

GRADUATE AERONAUTICAL LABORATORIES CALIFORNIA INSTITUTE OF TECHNOLOGY

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Electre Experiments in T5

by

Bernard Rousset & Philippe Adam

Firestone Flight Sciences Laboratory

Guggenheim Aeronautical Laboratory

Karman Laboratory of Fluid Mechanics and Jet Propulsion

Pasadena

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Graduate Aeronautical Laboratories
California Institute of Technology
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Abstract

A series of 18 shots was conducted on the DLR's Electre model in Caltech's T5 hypervelocity shock tunnel facility. The model was instrumented for both pressure and heat flux measurements. It was tested at low and high enthalpies with air, argon, nitrogen and hydrogen for test gases. The trends observed in the preliminary data seem to agree quite well with results of the numerical simulations. Problems have been identified and proposed solutions should improve the quality and efficiency of future testing under similar conditions.

Acknowledgments

The authors would like to thank the entire T5 team for their help during the Electre tests; in particular, Eric Cummings for his help with the optics, Jacques Bélanger with the SURF computations and Patrick Germain as well as Simon Sanderson with the instrumentation and data acquisition. Thanks also to Bahram Valiferdowsi for putting up with all of us and to our dynamic tunnel engineers Jean-Paul Davis, Patrick Lemieux and Ruppi Meffert.

Special thanks go to Dr Hans Hornung for supervising this project as well as providing advice and support.

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1. Introduction

The Electre experiment conducted a few years ago consisted in obtaining real flight data from a sphero-conical re-entry capsule. The recent development of several hypervelocity facilities around the world now makes it possible to simulate in the laboratory the same conditions encountered by the capsule on its trajectory back to Earth thereby allowing direct comparison between flight, numerical and wind tunnel data.

One such facility, the T5 free piston shock tunnel located at Caltech's Graduate Aeronautical Laboratories in Pasadena, California, is particularly well suited to study part of this trajectory since it can achieve very high enthalpy flows including ones where dissociation occurs in the free stream and where significant nonequilibrium effects may be present. A scaled model of Electre was therefore designed and built by the DLR to be tested in T5.

The Electre model was instrumented with transducers and thermocouples to document the pressure and heat flux. A total of eighteen runs were made in T5 with varying conditions. Different enthalpies were considered as well as different test gases yielding a wide range of results for comparison not only with existing flight data and numerical simulations but also with future results from other "hot" hypersonics facilities such as the ONERA impulse facility F4 and the DLR free piston shock tunnel HEG.

2. The T5 Hypervelocity Shock Tunnel Facility

2.1 The T5 Hypervelocity Shock Tunnel

Free-piston shock tunnels such as T5 are capable of generating very high enthalpy flows at high densities (Figure 2.1). This is particularly useful to simulate real gas effects, i.e. the chemical nonequilibrium effects, that occur during the re-entry of vehicles through planetary atmospheres (Hornung [1992]). Typical examples include the Space Shuttle and its return to Earth or in the following case, Hermes and in particular Electre.

The method by which the free-piston technique reaches high enthalpies at high densities is to compress a monatomic driver gas - usually a He/Ar mixture - adiabatically to a desired diaphragm burst pressure P_4 . This is achieved using high pressure air in a secondary reservoir (2R) to push a reusable 120 kg piston down the compression tube (CT). As the piston accelerates along down the CT, there is a shift in center of mass which is compensated by a recoil of the CT, shock tube (ST), and the attached nozzle. The secondary air reservoir (2R) recoils in the opposite direction under the acceleration of the thrust of the outflowing air which drives the

piston down the CT. The test section and dump tank (DT) remain stationary. A sketch of T5 detailing these major parts is shown in Figure 2.2.

2.2 Typical Run Conditions

In typical shots, with burst pressures ranging from 30 MPa to 120 MPa, the nozzle reservoir pressure (P_0) can be made to vary from 13 MPa to 80 MPa, and the enthalpy (h_0) from 3 MJ/kg to 22 MJ/kg. Furthermore, one can use different throats (14 mm, 20mm, 30mm in diameter) in order to match other parameters such as the density. The typical testing time is of the order of 4 ms, while the “steady” window is about 1 ms.

2.3 Data Acquisition System and Instrumentation

The data acquisition system consists of several DSP A/D channels and amplifiers controlled by software run on a Sun SPARCstation computer. Data is first stored during the test in transient recorders before being downloaded to the computer’s hard drive. Trigger generators, threshold detectors and counters are also used to determine the beginning of the sampling time, the speed of the shock down the ST and to synchronize the flow visualization equipment.

Pictures are taken with a 4in x 5in camera on black and white film. The test section is illuminated by a pulsed laser and the image focused by a series of filters, lenses and mirrors on the photographic plate. Finite and infinite fringe differential interferometry is usually the technique of choice to visualize the flow (Smeets *et.al.*[1973]).

3. The Electre Model and its Instrumentation

3.1 Model Description

The Electre model tested in T5 consisted in a sphero-conical body built and instrumented entirely by the DLR. The model came in two halves, the lower one outfitted with pressure transducers and the upper one with thermocouples for heat flux measurements (Figure 3.1). Securing the two pieces together is done through the top half by a series of six screws that extend into the lower half. The holes through which these screws are inserted are then filled with a silicone rubber sealant and smoothed until flush with the model.

The back of the assembled model is attached to a cylindrical sting mounted inside the test section. The sting’s position can be adjusted axially with respect to the window depending on the location one wishes to visualize. Pictures of the test section setup are shown in Figures 3.2 and 3.3. It should also be noted that the

sting is hollow and carries the wires from the model's gages and thermocouples to the bottom of the test section where additional connectors are linked to the data acquisition system. The cables are totally enclosed in a copper tube to shield them against the hostile environment and electrical noise.

3.2 Instrumentation

The pressure instrumentation installed by the DLR inside Electre consisted of three different types of transducers. At the tip of the model, close to the stagnation point, a Kistler gage was used followed by one high pressure Kulite gage. The seven remaining transducers were Kulites with lower pressure range. The heat transfer instrumentation consisted of twelve chromel-constantan Medtherm thermocouples also installed by the DLR.

The pressure transducers were connected to existing T5 amplifiers and the gain controlled through the data acquisition software. However, it should be noted that the gain varied depending on the type of transducer and whether the shot involved high reservoir pressures or not. The thermocouples were supplied by the DLR with their own amplifiers and the gain was set externally with respect to the software.

4. Test Conditions

A total of 18 shots - numbered 609 to 626 and including 613 where the diaphragm did not burst - were conducted. Three different throats were used and six different conditions considered (Table 4.1).

CONDITION	1	2	3	4	5	6
Stagnation Pressure P_0 (MPa)	18	18	18	60	60	60
Stagnation Enthaply h_0 (MJ/kg)	11	11	20	11	11	21
Stagnation Temperature T_0 (K)	6225	6225	8675	6550	6550	9275
Throat Diameter (mm)	20	14	20	30	20	20
Freestream Temperature T_∞ (K)	1210	980	1710	1650	1360	2080
Freestream Pressure P_∞ (kPa)	3.01	1.21	2.65	28.6	10.3	9.91
Freestream Density ρ_∞ (kg/m ³)	0.0081	0.0040	0.0045	0.0590	0.0260	0.0150
Freestream Velocity v_∞ (m/s)	4090	4090	5620	4170	4230	5690
Freestream Mach no. M_∞	5.84	6.37	6.32	5.29	5.86	6.10

Table 4.1 - Electre Test Conditions

Conditions 1, 2 and 3 were tested in order to match points on the re-entry curve, and compare with similar tests in other high enthalpy facilities such as the ONERA F4 160MW impulse tunnel and the DLR's HEG free piston shock tunnel (Walpot *et.al.*[1993]). Conditions 4, 5 and 6 were tested in order to study the chemical nonequilibrium effects. Also, higher densities allowed better pictures to be taken.

Condition 1 (runs 609, 610, 611, and 612) and condition 5 (runs 618, 620, and 621) were repeated, with the same setup and same test gas, in order to check the repeatability of T5. It should be noted that only for run 612 was the model moved upstream by 3.5 cm. Conditions 1 and 5 were tested with different gases: nitrogen in order to compare with air and to reduce computation time when simulating these conditions numerically, argon in order to compare with a perfect monatomic gas.

Table 4.2 gives a detailed listing of the run conditions.

CONDITION							
	1	2	3	4	5	6	Test Gas
Shot 609	***						Air
Shot 610	***						Air
Shot 611	***						Air
Shot 612	***						Air
Shot 613			***				Air
Shot 614			***				Air
Shot 615		***					Air
Shot 616				***			Air
Shot 617				***			Air
Shot 618					***		Air
Shot 619						***	Air
Shot 620					***		Air
Shot 621					***		Air
Shot 622					***		N ₂
Shot 623	***						N ₂
Shot 624	***						Ar
Shot 625	***						Ar

Table 4.2 - T5 Shot Conditions and Test Gases

Hydrogen was tested in run 626, as a diatomic non-reacting gas with the 20 mm throat diameter nozzle.

5. Test Results

During this series of shots, the three main objectives set by DLR were reached. The repeatability of the T5 facility was successfully checked; the data obtained from the traces of the different captors on the Electre model seemed to agree quite well with the numerical simulation; and photos, showing the detailed shock, were taken with a satisfactory resolution.

5.1 The T5 Facility

5.1.1 T5 Measurements, Data and Parameters

The principal parameters measured in T5, useful for studying the results, are the burst pressure P_4 , the nozzle reservoir pressure P_0 , the shock speed v_s , and the ST recoil. A good first approximation of the reservoir enthalpy h_0 is given by the square of the shock speed v_s .

The burst pressure P_4 is derived from the two “ P_4 traces”, North and South, taken by two PCB transducers, sampled at 1 point every $32 \mu s$. In order to get a reasonable value, and to remove the high frequency noise, the traces are smoothed out over 31 pts. This means that every point is averaged with the 15 previous ones and the 15 following ones. The corresponding time window is 0.960 ms. The maxima are then taken, and averaged together to get $P_{4,avg}$. An example is shown in Figure 5.1 .

The nozzle reservoir pressure P_0 is also computed from two traces, North and South, taken by PCB transducers, but this time sampled at 200 kHz (same sampling as the test section data). The traces are smoothed out over 19 pts to remove the high frequency noise - the time window is 0.090 ms. Time windows for the overshoot, the steady period, and the decreasing period, are carefully established for a given condition and remain the same for all runs of a given enthalpy. Averages are then taken over the entire steady period. Usually, this period lasts around 1 ms for low enthalpy runs, to 0.5 ms for high enthalpy ones. Once again, the two averages (North and South) are averaged together to get $P_{0,avg}$.

The shock speed v_s is derived from 4 traces, given by 3 PCBs placed along the ST, and one nozzle reservoir pressure trace. The shock is caught by the sudden rise in the pressure and the time is recorded. Note that the trigger is exactly the same for all the traces because it is given by the same box. Knowing the exact distance between the transducers, three speeds are derived. Only the middle one is used as a parameter, corresponding to the averaged shock speed along the ST.

The CT recoil (which is also the ST and Nozzle recoil) is given by a LVDT and recorded in each shot.

These parameters are given for each shot in table 5.1.

Shot	Cond.	Burst Pres. (MPa)			Res. Pres.(MPa)			v_s (m/s)	h_0 (MJ/kg)	Test Gas
		$P_{4,N}$	$P_{4,S}$	$P_{4,avg}$	$P_{0,N}$	$P_{0,S}$	$P_{0,avg}$			
609	1	33.7	32.2	32.9	19.2	16.4	17.8	3.28	10.8	Air
610	1	33.5	32.2	32.8	18.1	16.6	17.3	3.45	11.9	Air
611	1	33.4	32.1	32.7	17.6	16.5	17.0	3.35	11.2	Air
612	1	33.4	32.1	32.7	18.2	17.0	17.6	3.43	11.8	Air
613	3	No Data - Diaphragm did not burst								
614	3	34.5	32.9	33.7	19.8	19.1	19.4	4.72	22.3	Air
615	2	32.9	31.5	32.2	20.2	19.4	19.8	3.51	12.3	Air
616	4	82.4	81.2	81.8	57.2	57.3	57.3	3.30	10.9	Air
617	4	88.4	88.1	88.3	55.3	55.1	55.2	3.33	11.1	Air
618	5	93.4	92.9	93.2	58.2	57.5	57.8	3.33	11.1	Air
619	6	92.7	91.4	92.0	58.5	58.9	58.7	4.48	20.1	Air
620	5	86.7	86.4	86.5	51.7	50.9	51.3	3.26	10.6	Air
621	5	90.9	89.5	90.2	59.9	58.9	59.4	3.37	11.4	Air
622	5	88.9	88.0	88.4	58.9	57.8	58.4	3.37	11.4	N_2
623	1	32.3	31.0	31.7	18.9	16.5	17.7	3.49	12.2	N_2
624	1	32.2	30.8	31.5	24.1	21.5	22.8	2.48	6.15	Ar
625	1	34.3	32.9	33.6	24.0	21.6	22.8	2.48	6.15	Ar

Table 5.1 - T5 Parameters (Shots 609-625)

5.1.2 T5 Repeatability

One main concern for the DLR during these runs, was to check the repeatability of a given condition, especially in T5.

T5 repeatability was checked on two different conditions. Condition 1 is referred to as “Low-Pressure Low-Enthalpy”; while condition 5 is referred to as “Mid-Pressure, Low-Enthalpy”. Note that condition 6 is “Mid-Pressure, High-Enthalpy”. For both conditions, the kind of diaphragm, filling pressures, test gas (air), nozzle (20 mm), and position of the model in the test section, were kept the same, except for run 612 where the model was moved downstream by 3.5cm. Nevertheless, the T5 parameters should remain the same.

Therefore, for condition 1, parameters from runs 609, 610, 611, and 612, were

used; for condition 5, runs 618, 620, and 621.

Then, in order to better understand the quality of the repeatability and to lower the effect of run 620 where the burst pressure was slightly weaker (and therefore the nozzle reservoir pressure), runs 619 and 622 were added to the previous ones to create the condition “5/6”. Note that run 619 differs from the original condition 5 by its enthalpy only (21 MJ/kg instead of 11 MJ/kg), and run 622 by the test gas only (N_2 instead of Air). In both cases, the burst pressure and therefore the nozzle stagnation pressure should be the same, and as verified, are indeed.

As can be verified on Table 5.2, the repeatability of the T5 facility is quite good. The standard deviation of all parameters is lower than 8%. For the shock speed, it even goes down to 2% or 3%, implying a deviation of the order of 5% for the enthalpy. One can also check that the averaged parameters are quite close to the desired ones.

Cond.	Test Gas	Burst Pressure			Reservoir Pressure			Shock Speed		
		P_4 (MPa)	st.dev. (MPa)	(%)	P_0 (MPa)	st.dev. (MPa)	(%)	v_s (m/s)	st.dev. (m/s)	(%)
1	Air	32.8	0.096	0.3	17.4	0.35	2.0	3.88	0.078	2.3
5	Air	90.0	3.4	3.7	56.2	4.3	7.6	3.32	0.056	1.7
5 & 6	Air & N_2	90.1	2.7	3.0	57.1	3.3	5.8	-	-	-

Table 5.2 - Pressure and Speed Deviations

Finally, it should be noted that run 624 (condition 1 with Argon) was also repeated in run 625, with perfect repeatability even though the burst pressures were slightly different. This repeated shot was needed to improve the quality of the photo.

5.2 Electre Data

Even though no statistics have been derived from Electre’s data, preliminary conclusions can be drawn from the traces, graphs, and superimposed plots. It is possible to establish a “time window” of steady flow, thereby enabling averages to be computed and compared with numerical simulations.

5.2.1 Pressure Traces and Data

Electre’s pressure traces are probably the most difficult data to interpret. In fact, several problems were observed including high amplitude high frequency noise,

damping, and insufficient thermal protection. It was also impossible during the runs to improve the existing connections inside the model.

Several of the pressure traces are very noisy. Some loose, or even bad, connections are thought to be responsible. This problem can easily be solved by carefully smoothing out the traces, i.e. by not taking too many points and thus adding artificial damping. 31 pts, i.e. a smooth box of 0.150 ms, seems to be enough.

On the Kulite traces, slow response proved to be a problem as well. It is thought to be due to the various transducer access holes at the surface of the Electre model. As a result of this damping, no overshoot is visible, and the steady period appears later and for a shorter time. Therefore, it is necessary to be careful, especially when selecting the time window to determine the averages.

Thermal protection appears insufficient for the Kistler transducer, since the traces show “negative” pressures. This may be due to the thermal dilatation of the crystal inside the instrument.

Nevertheless, it is possible to establish averages, and thus plot points which, at first glance, seem to match quite well the numerically computed trends.

Some kinks appear on the curve. Run 612, where the model has been moved axially, showed that these kinks move with the model and are therefore not an effect of the nozzle flow.

5.2.2 Heat Transfer Traces and Data

The temperature traces, obtained from the Medtherms, exhibit only the high frequency noise problem. But overall, they can be used directly. They are smoothed “naturally” by the indirect method. This consists in first obtaining the “integrated heat”, and then differentiating in order to get the “heat transfer rate” (Germain *et.al.* [1993]). An overshoot is noticeable on the traces as well as a decrease followed by a steady period.

5.3 Alternate Test Gases

The main purpose of tests in a facility like T5 is to simulate the real gas effects at conditions equivalent to those during the re-entry of spacecraft. Therefore, it is natural to use Air as a test gas. However, it might also be useful to try other gases for the sake of comparison.

N₂ was tested under conditions 1 and 5 (runs 622 and 623), in order to show that there are few differences with Air. As far as T5 is concerned, the operating parameters remain the same (within the computed deviation margin). As to the Electre data, it seems that the small differences are in the error margin, both for pressures and heat fluxes. Direct superpositions have been plotted (Figure 5.1), but nondimensionalizing the data would probably be more appropriate for comparing.

This superposition is particularly useful in enabling the use of N_2 in numerical simulations instead of Air. Indeed, N_2 involves fewer chemical reactions and therefore less CPU time.

Argon was tested under condition 1 (runs 624 and 625) in order to compare with a “perfect” gas with no reactions. The T5 parameters and the Electre model were slightly modified to accomodate the lower speed at this condition. This also increased the response time in the pressure traces. Run 624 was repeated in order to get a better photo, and to verify the presence of shock waves. In fact, the nozzle used was not designed for such a gas, and therefore produces shocks waves that kink the bare shock. Since a monatomic gas takes the nozzle extremely far away from the design point, the T5 team expressed reservations about performing this test. Instead, the following additional test with hydrogen, which behaves like a perfect diatomic gas at the condition used, was preferred.

A last shot was therefore tested with H_2 to try another perfect gas. This was the first H_2 shot in T5. The tunnel operating parameters were therefore totally unknown, and the results could not be directly compared with the other condition. The measured results are tabulated below (Table 5.3).

Burst Pressure $P_{4,avg} = 86.6$ MPa
Nozzle Reservoir Pressure $P_{0,avg} = 46.8$ MPa
Shock Speed $v_s = 7.5$ km/s
Enthalpy $h_0 = 56.25$ MJ/kg

Table 5.3 Hydrogen Shot Parameters

The enthalpy of this shot turned out to be larger than expected, and there may have been some vibrational excitation present. The response time of the pressure gauges was adequate in this run.

5.4 Photos

A photo was taken for each run. It allows one to visualize the detached shock, the stand off distance between the shock and nose of the model and, in the argon runs, the kinks. The first photos (runs 609 and 610) were taken using finite fringes interferometry. Infinite fringe interferometry was then used for runs 611 to 621, in order to get a higher resolution. Since there is always a double image, the fringes were rotated by 90° to get vertical image shift instead of horizontal one, starting after run 621 thereby allowing more accurate measurements of the stand off distance.

6. Conclusions and Recommendations

6.1 Conclusions

Based on this first analysis, it can be concluded that this series of shots with the Electre model was successful. On one hand, the repeatability of the T5 facility has been demonstrated within acceptable limits for several conditions. On the other hand, preliminary reduction of Electre's data showed that pressure distributions and heat transfer rates on the model seem to agree quite well with the numerical trends. Some of the conditions (low density shots) have been tested in order to check numerical simulations, compare data with other hypersonic facilities, and most importantly understand the phenomena occurring during the re-entry of a shuttle such as Hermes. The other conditions (higher density shots), using different gases, help in better understanding chemical nonequilibrium effects. The photos enable not only the visualization of the general shape of the detached shock, but also perturbations due to Electre's shape, or shock waves coming from the nozzle exit, which may explain kinks in the curves.

6.2 Recommendations

The authors would like to suggest some recommendations, should additional experiments with the Electre model be performed, in order to improve the quality of the data.

6.2.1 Damping in the Pressure Traces

The protection of the Kistler and Kulite transducers has been well designed, as far as avoiding soot and direct thermal contact are concerned. However, it is believed that these small holes and reservoirs are the main reason for the noticeable damping in the traces. This method of draining one reservoir into the other seems to increase the response time unduely. The authors believe that these holes are the cause of the damping, based on the results of the *Argon* and H_2 runs. Improving the design of these spaces, in particular by increasing the hole sizes may be necessary.

6.2.2 Thermal Protection on the Kistler

The insufficient thermal protection appears clearly on the Kistler traces, showing up as negative pressures. A fine film of silicon on the transducer's exposed surface, as is usually done in T5, is necessary. A 0.5mm thick layer seems to be adequate without damping the pressures. This kind of protection, which also protects from soot, may be extended to the Kulites as well, for better results. This was actually done after shot 617, and improved the situation.

6.2.3 Accessibility

Accessibility to the instrumentation inside the model also proved to be a problem and should be improved. Whenever the transducers and thermocouples had to be checked in between shots because of possible faulty connections, the DLR experimentalist, Mr. Shuichi Ueda, had to take the model apart thereby stalling the tests for extended periods of time varying from several hours to a whole day. In each case, all the 3m long cables had to be disconnected and the setup (cable pipes, mounting sting, model) undone.

Therefore, the main recommendation the DLR experimentalist and the authors have expressed, is to free the model from the mounting part, and especially from the cables. Connectors such as microdots could be used near the exit of the model to remedy the problem

6.2.4 Communication

Even though communication was quite good between the DLR and T5 groups during the preparation of these tests, it was difficult to get into all the details and recommendations by fax. In the future, it would be more efficient to visit the facility before the final design of such an experiment.

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Figures

Figure 2.1 T5 Performance Envelope

Figure 2.2 Sketch of the T5 Hypervelocity Shock Tunnel

Figure 3.1 Electre Model and Instrumentation

Figure 3.2 Test Section Setup

Figure 3.3 Test Section Setup (Closeup View)

Figure 5.1 Burst Pressure Traces and Smoothed Curves

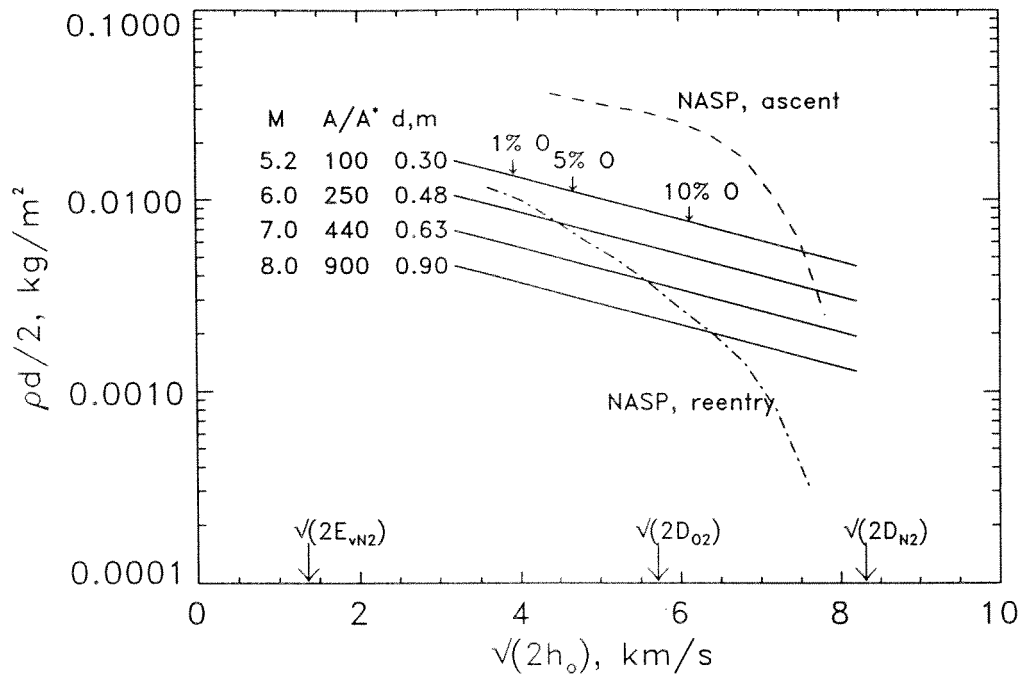


Figure 2.1 T5 Performance Envelope

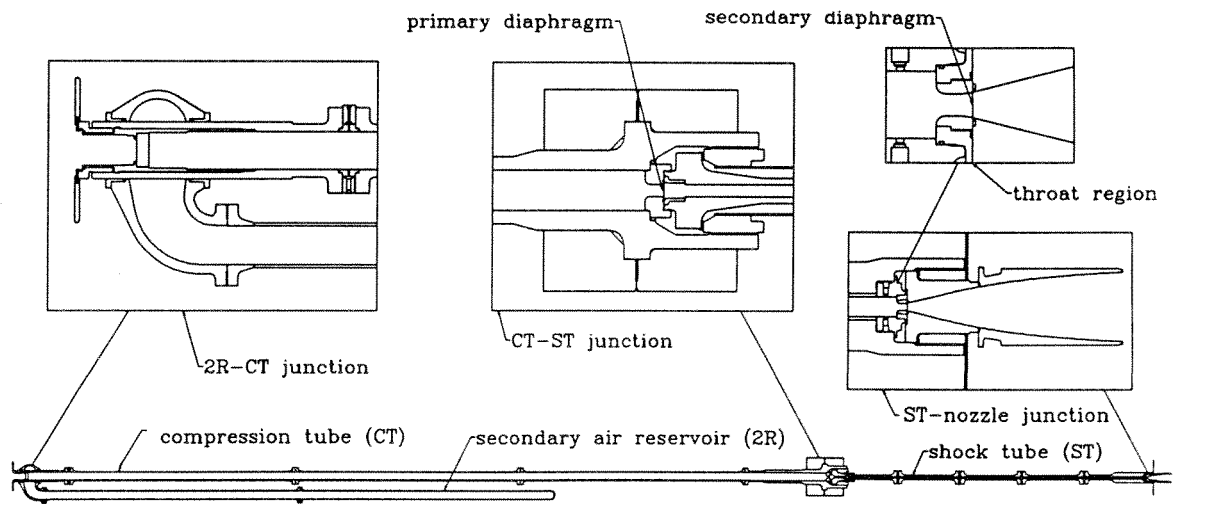


Figure 2.2 Sketch of the T5 Hypervelocity Shock Tunnel

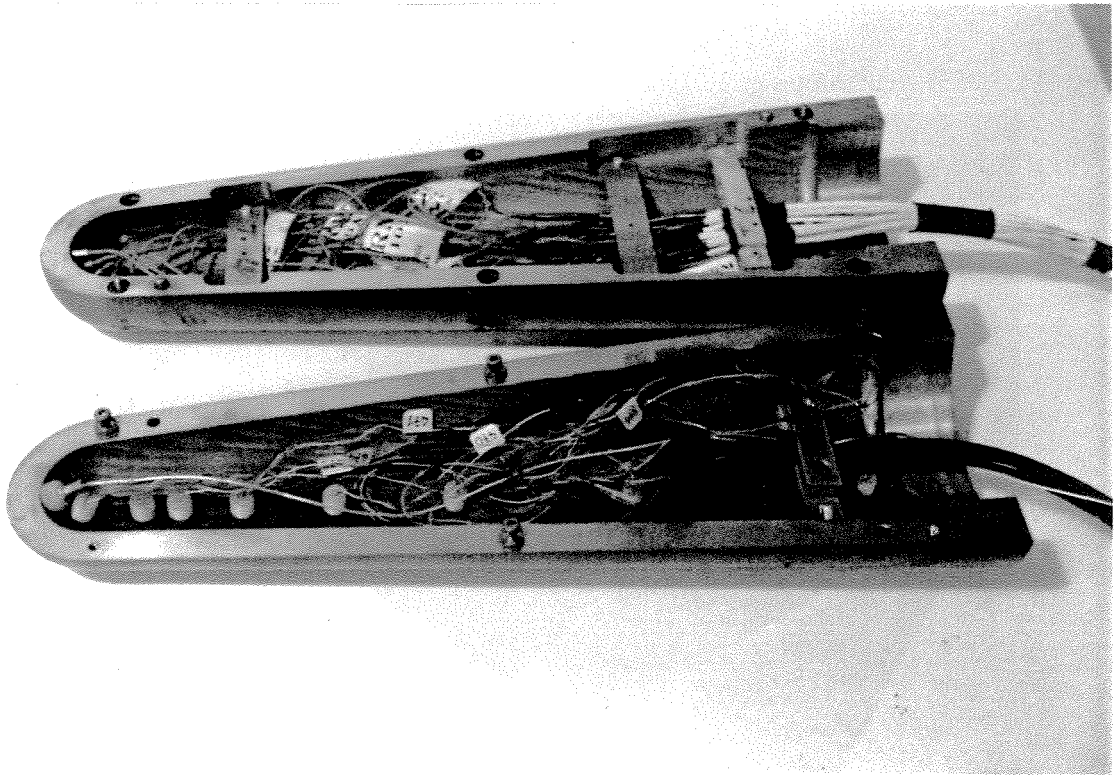


Figure 3.1 Electre Model and Instrumentation

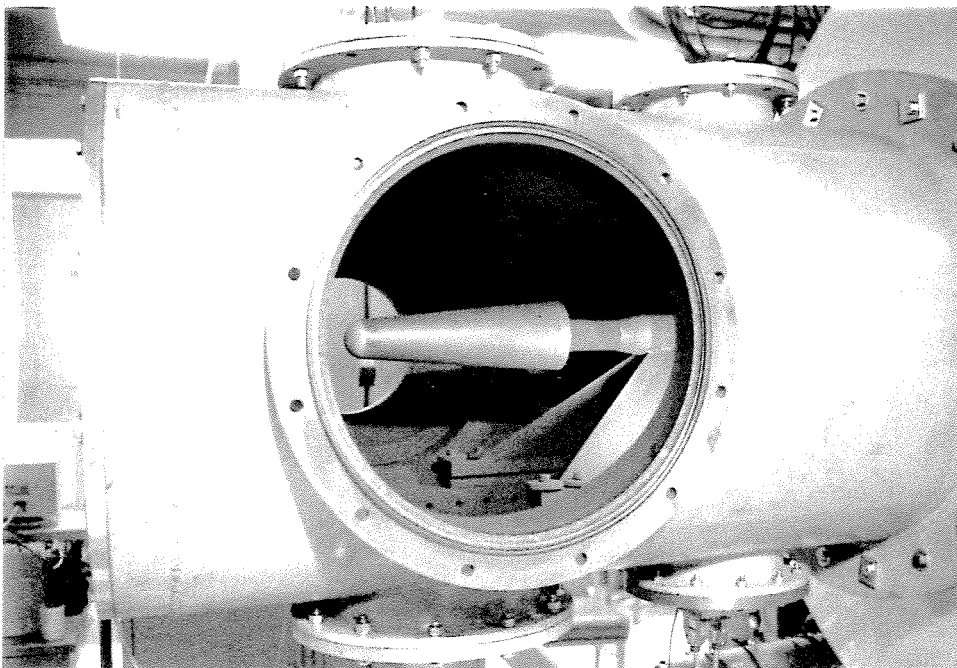


Figure 3.2 Test Section Setup

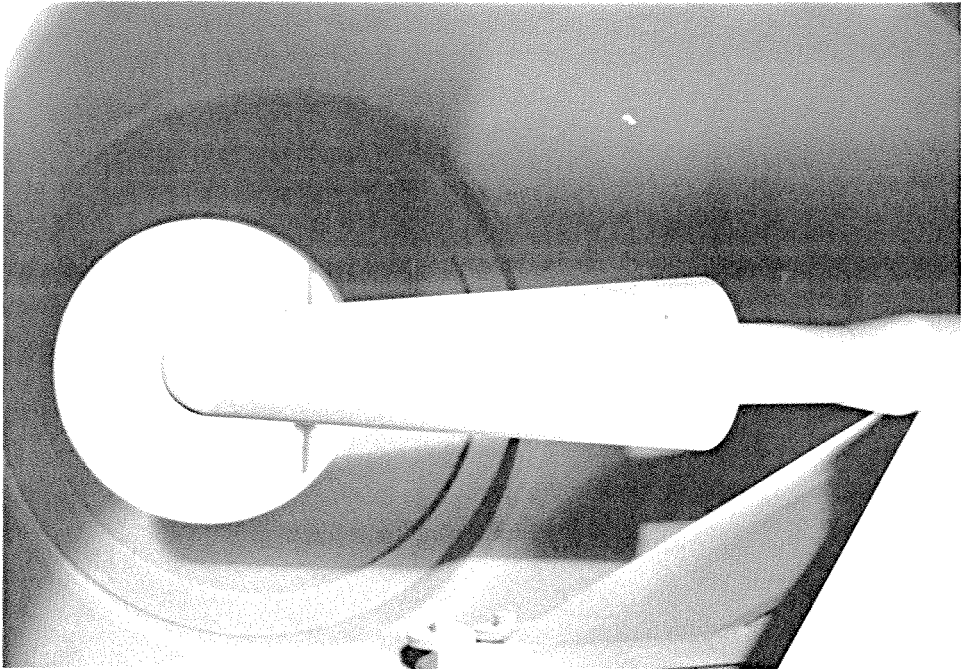


Figure 3.3 Test Section Setup (Closeup View)

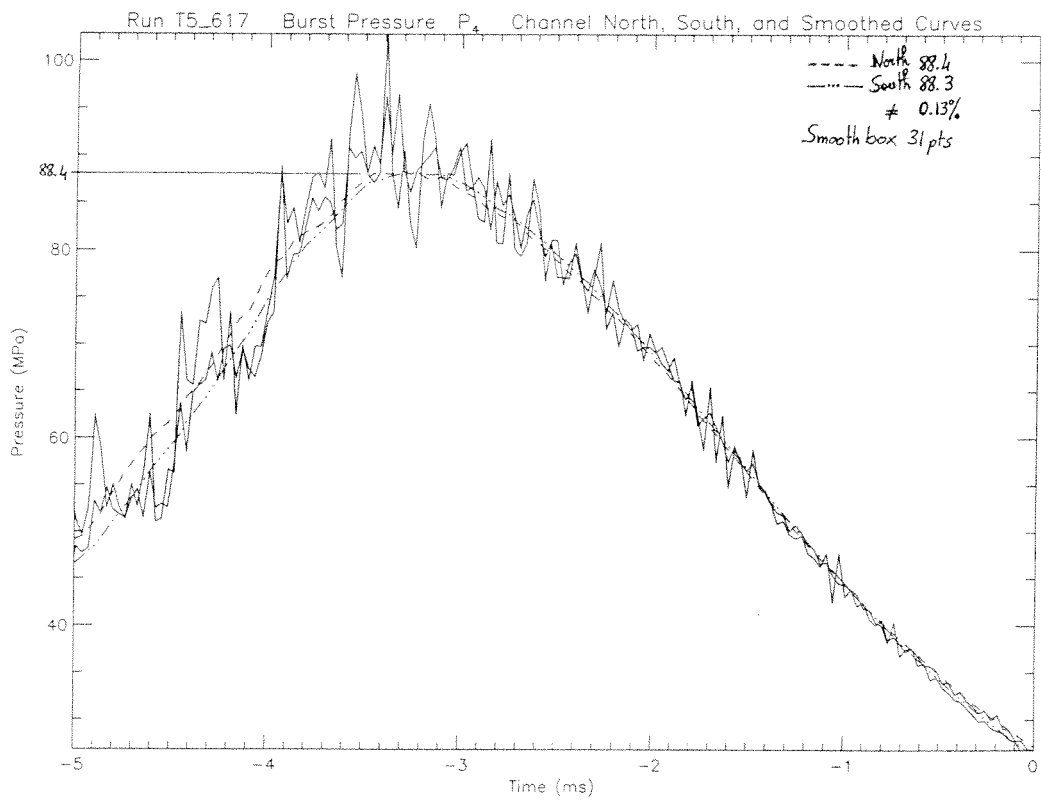
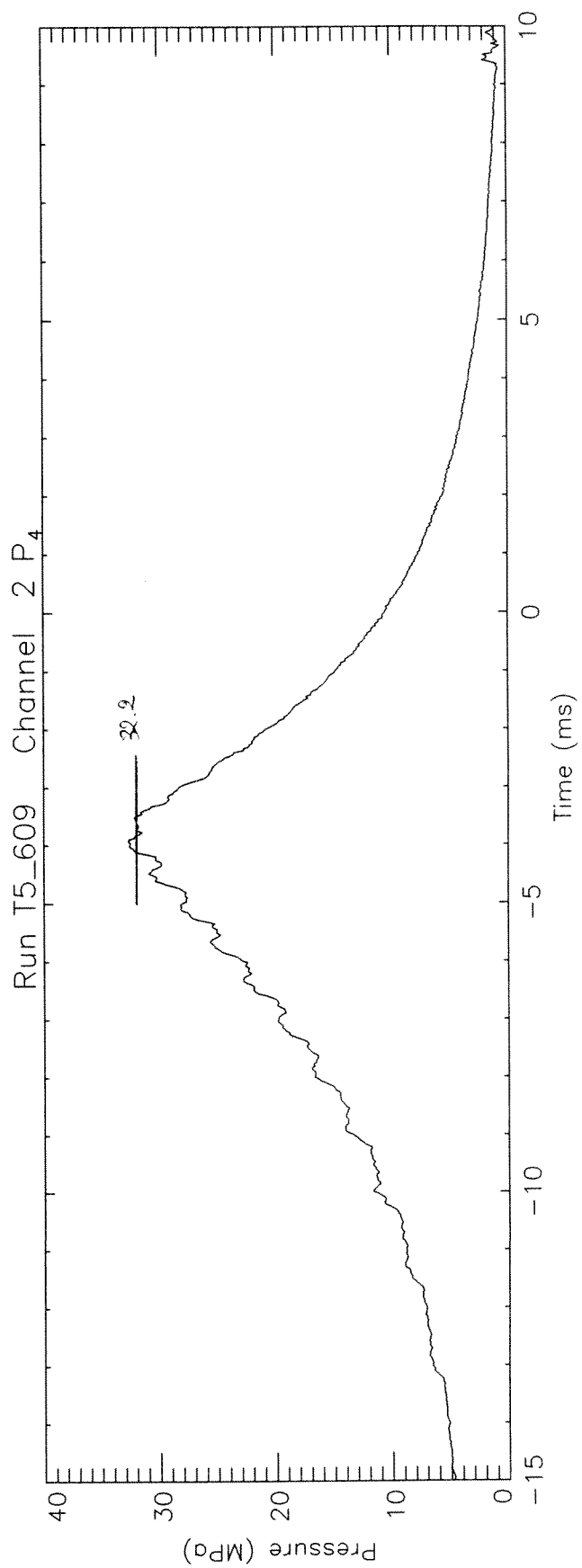
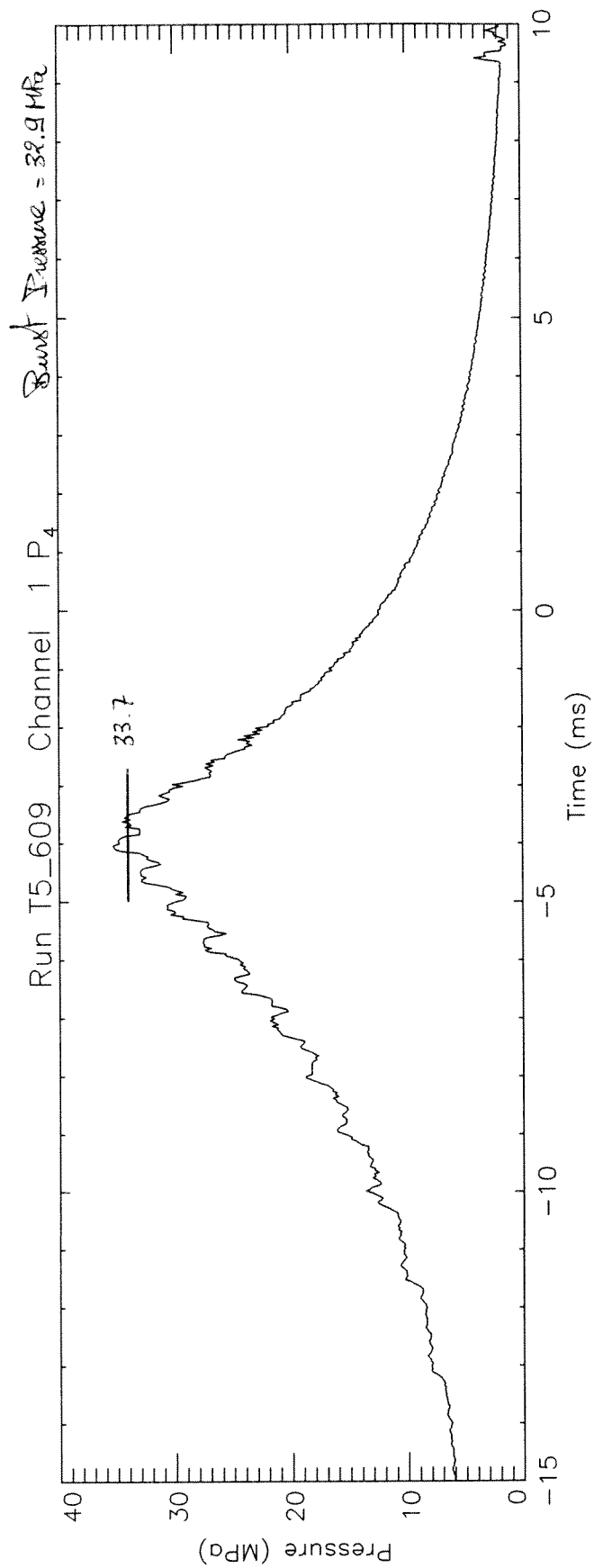
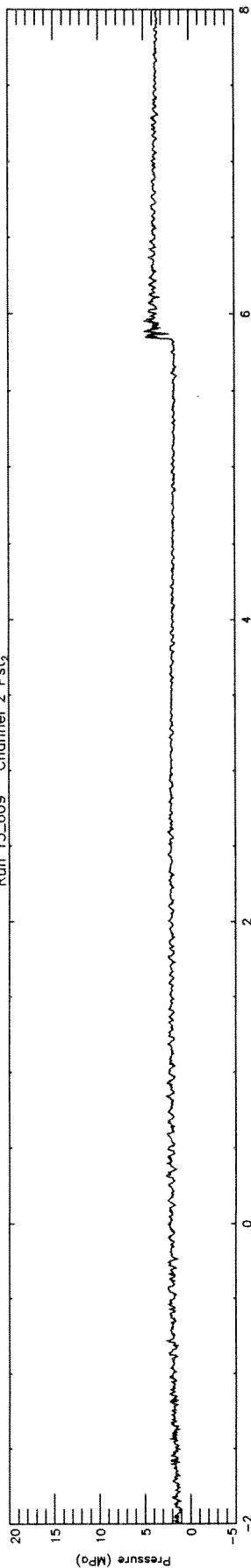


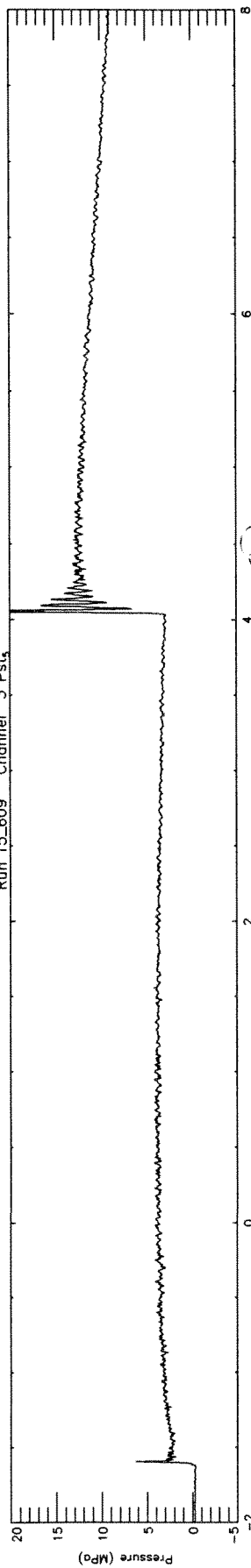
Figure 5.1 Burst Pressure Traces and Smoothed Curves

Shot Traces and Data

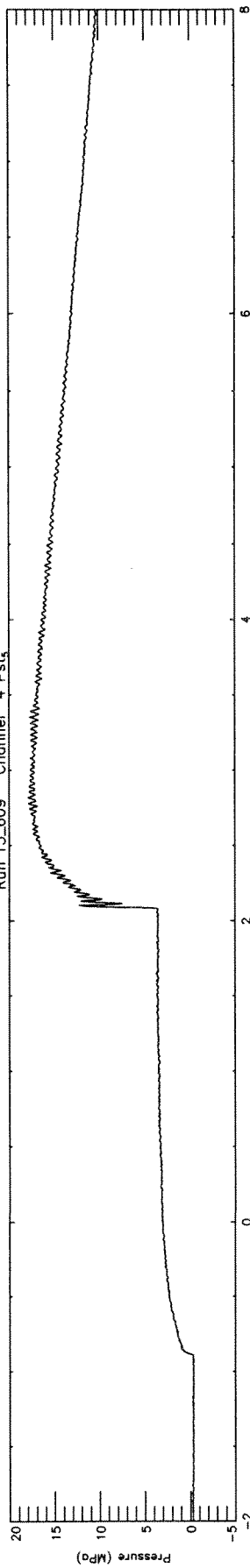




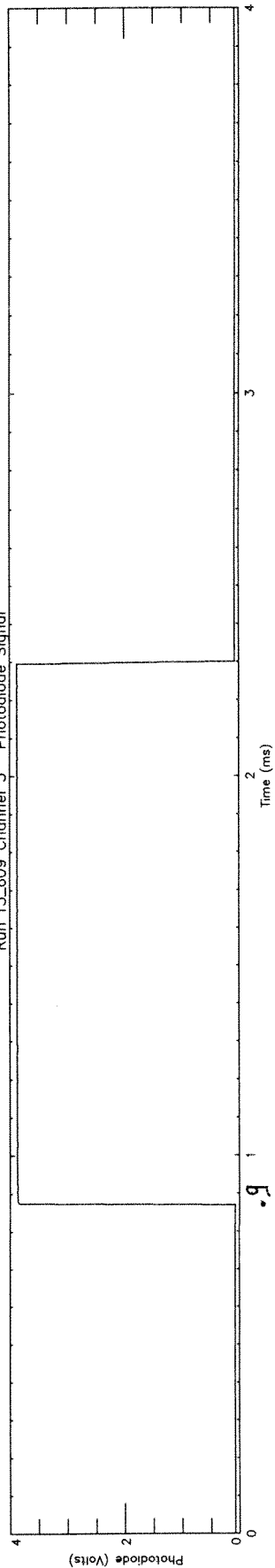
Shock Speed between sta.2 and sta.3 in km/s : 3.51

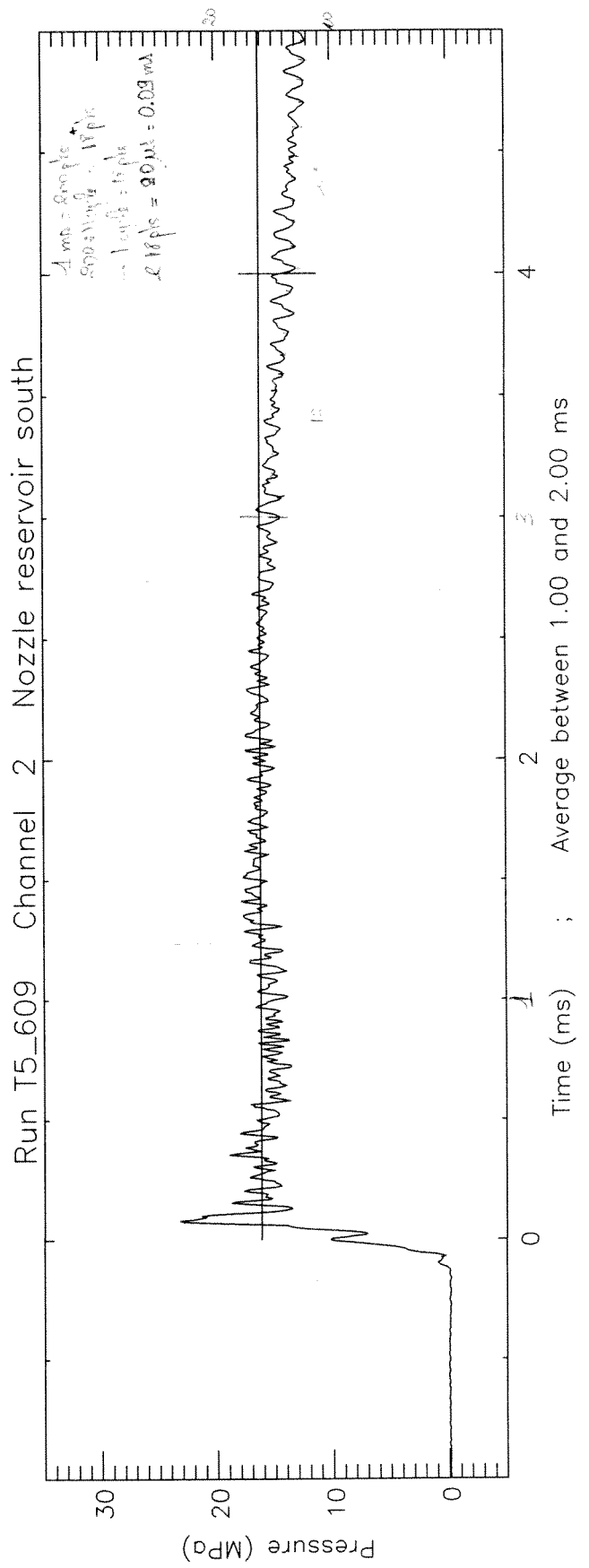
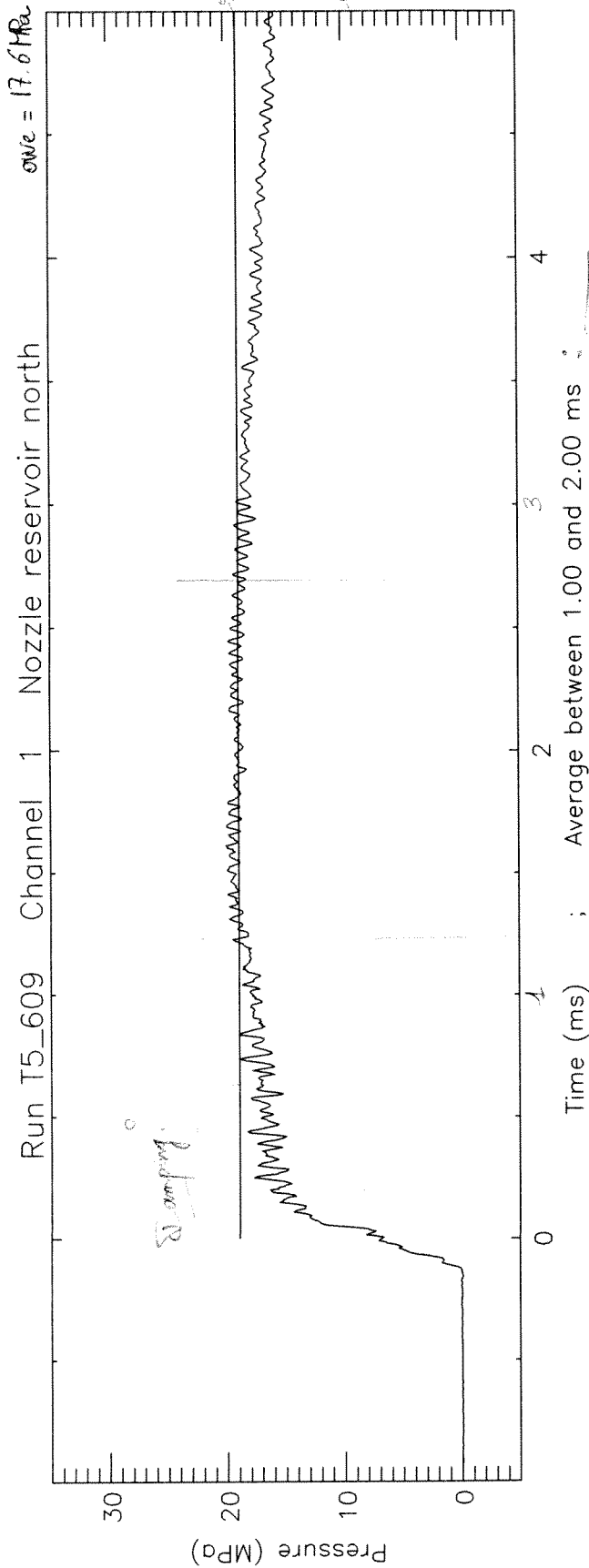


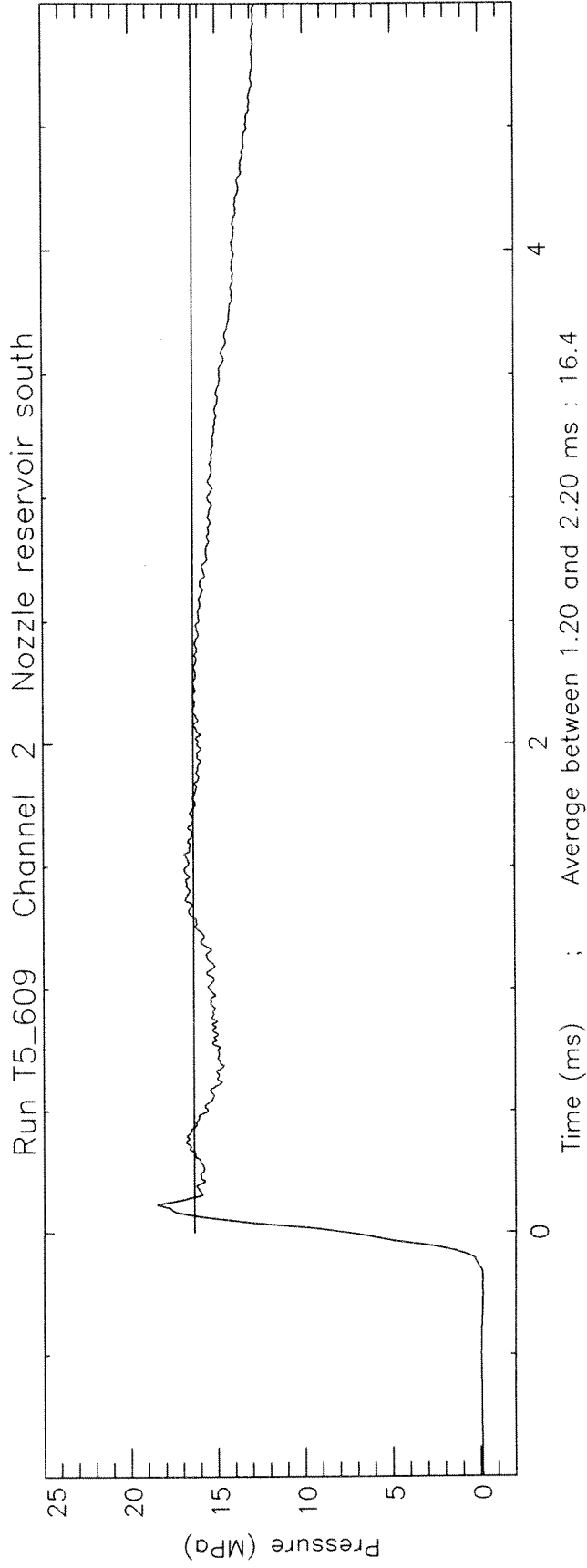
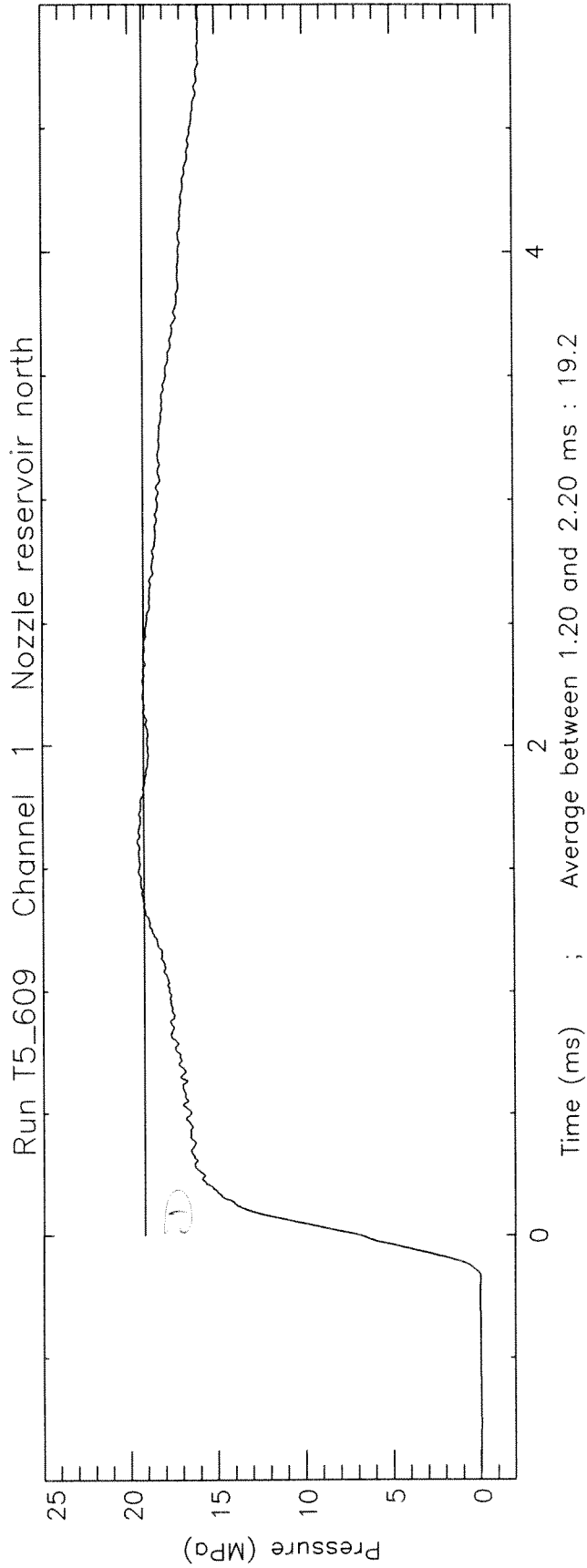
Shock Speed between sta.3 and sta.4 in km/s (3.28)

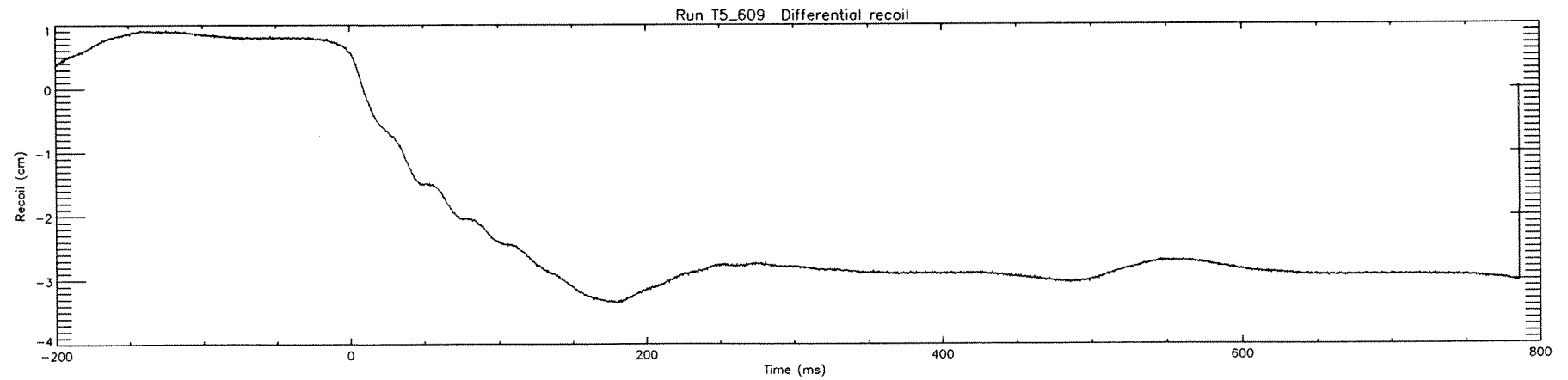
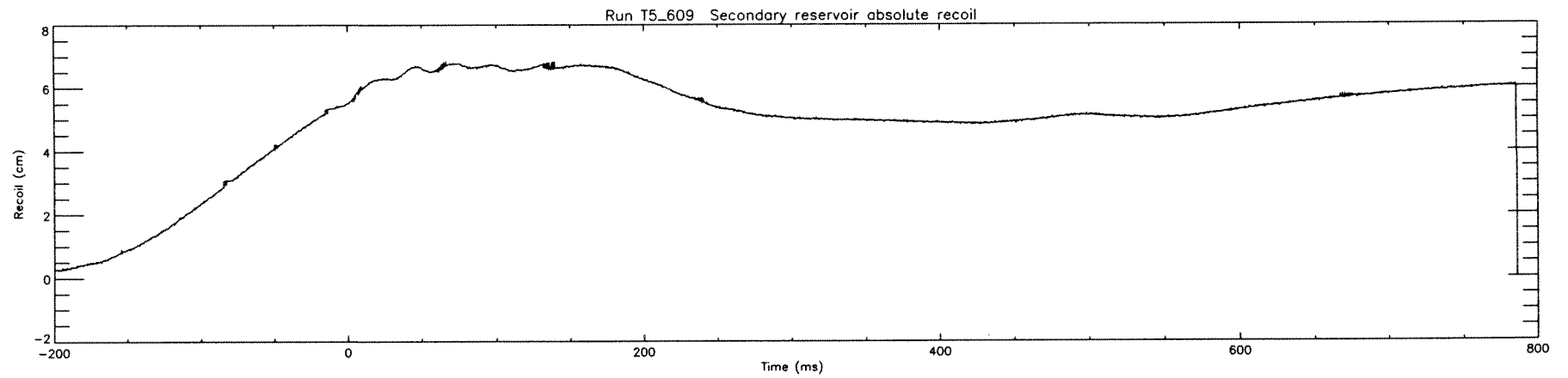
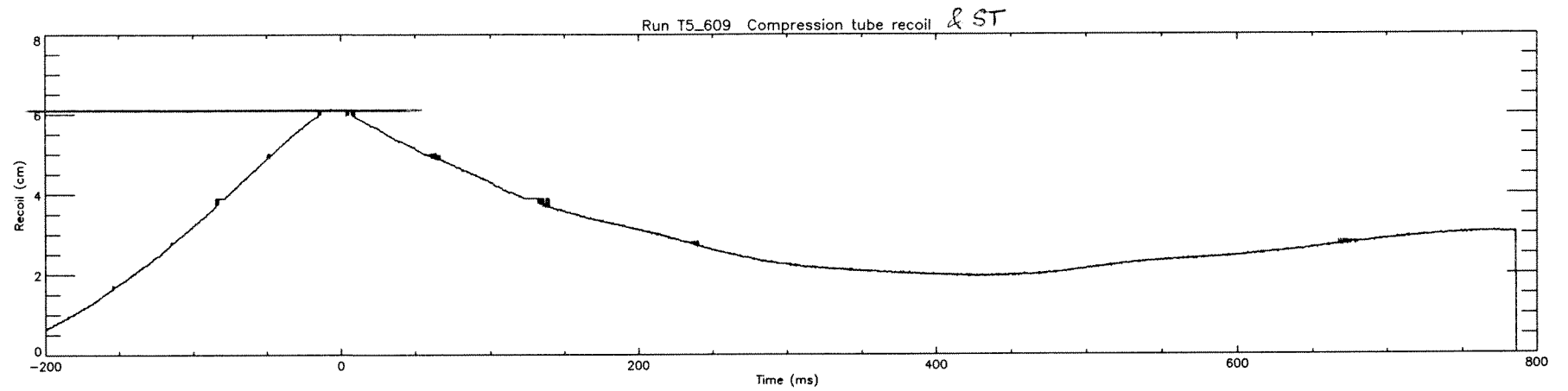


Shock Speed between sta.4 and nozzle in km/s : 3.02

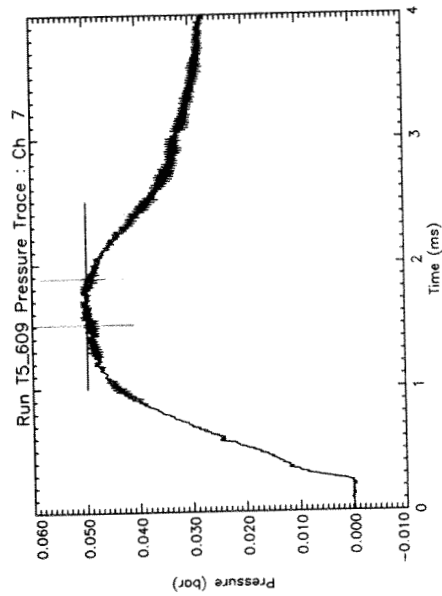
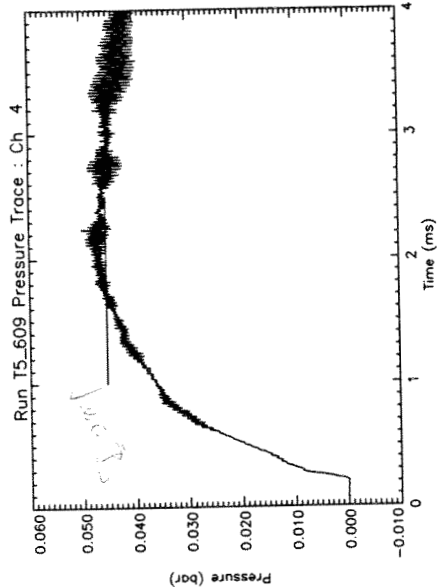
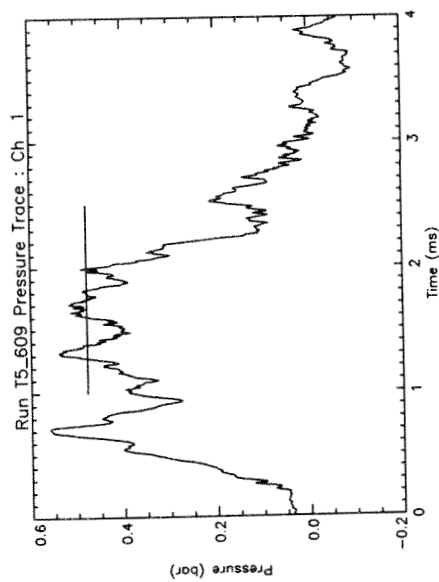
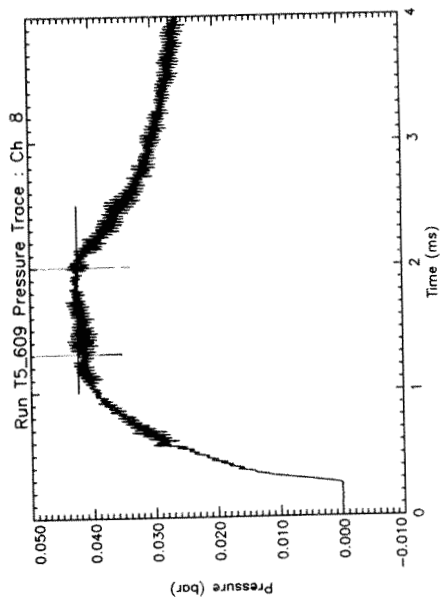
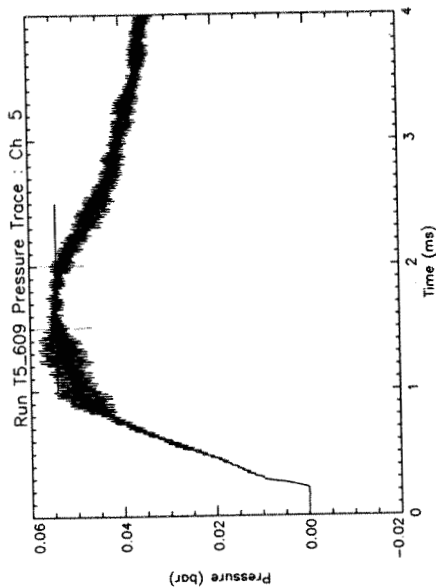
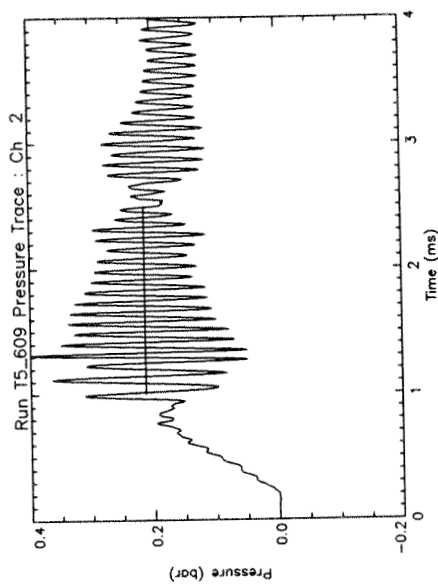
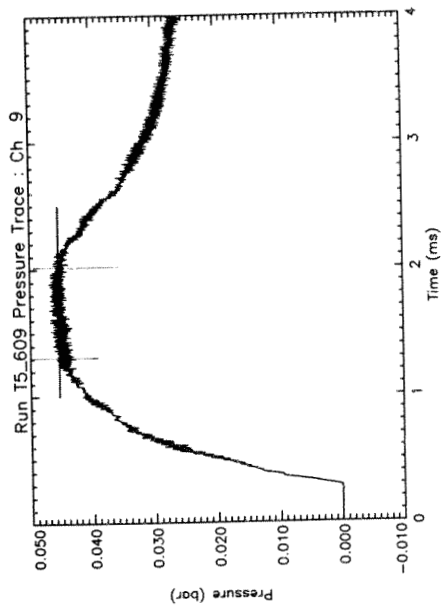
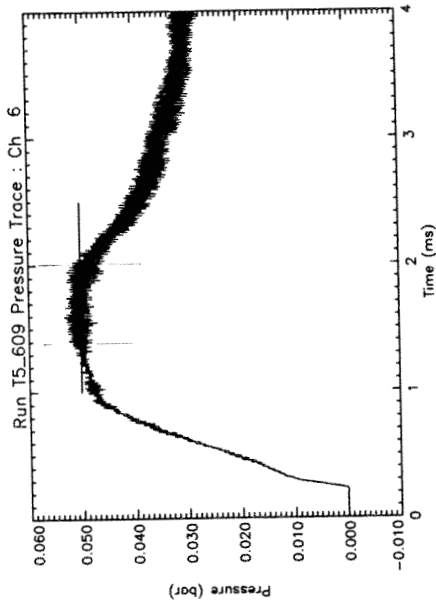
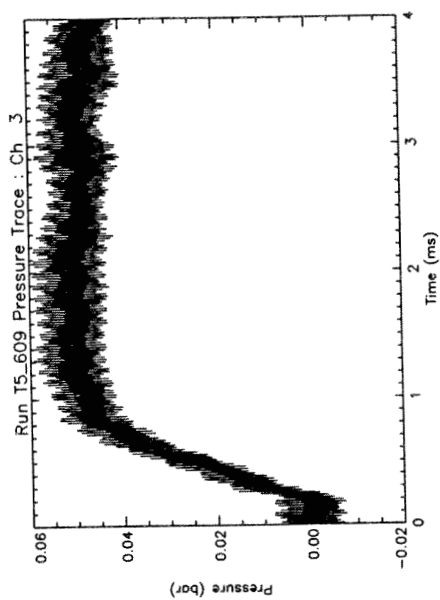




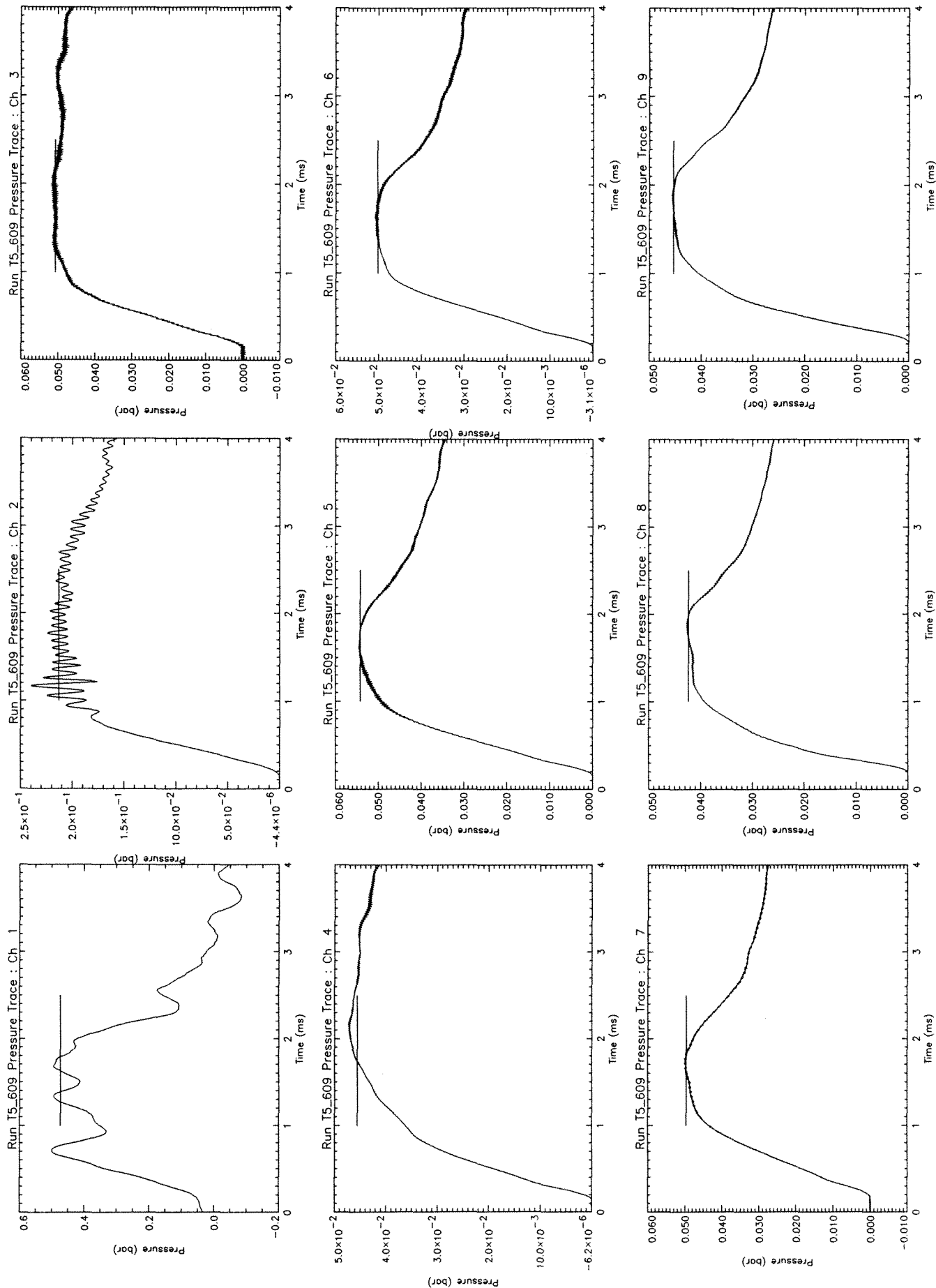


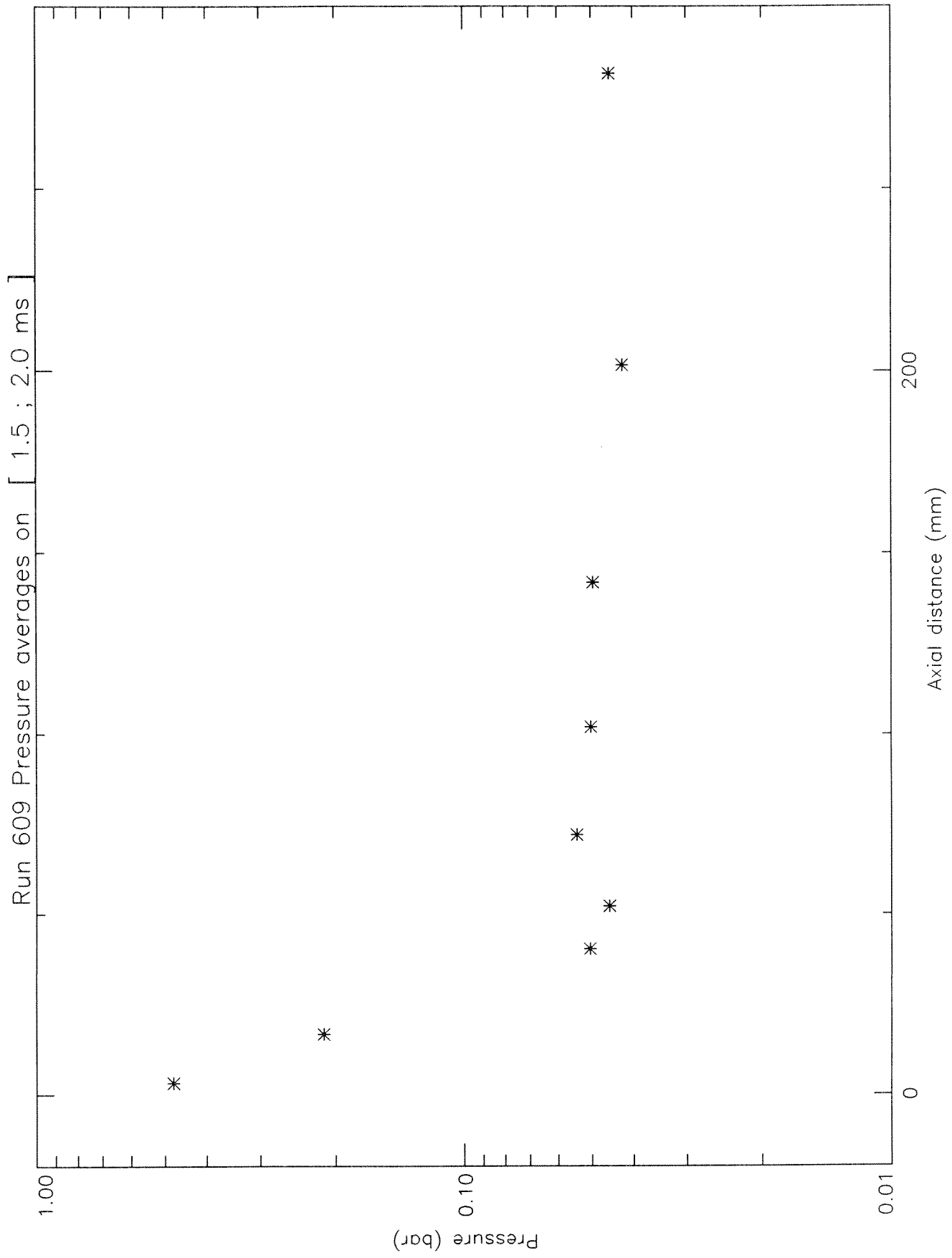


Run 15_200

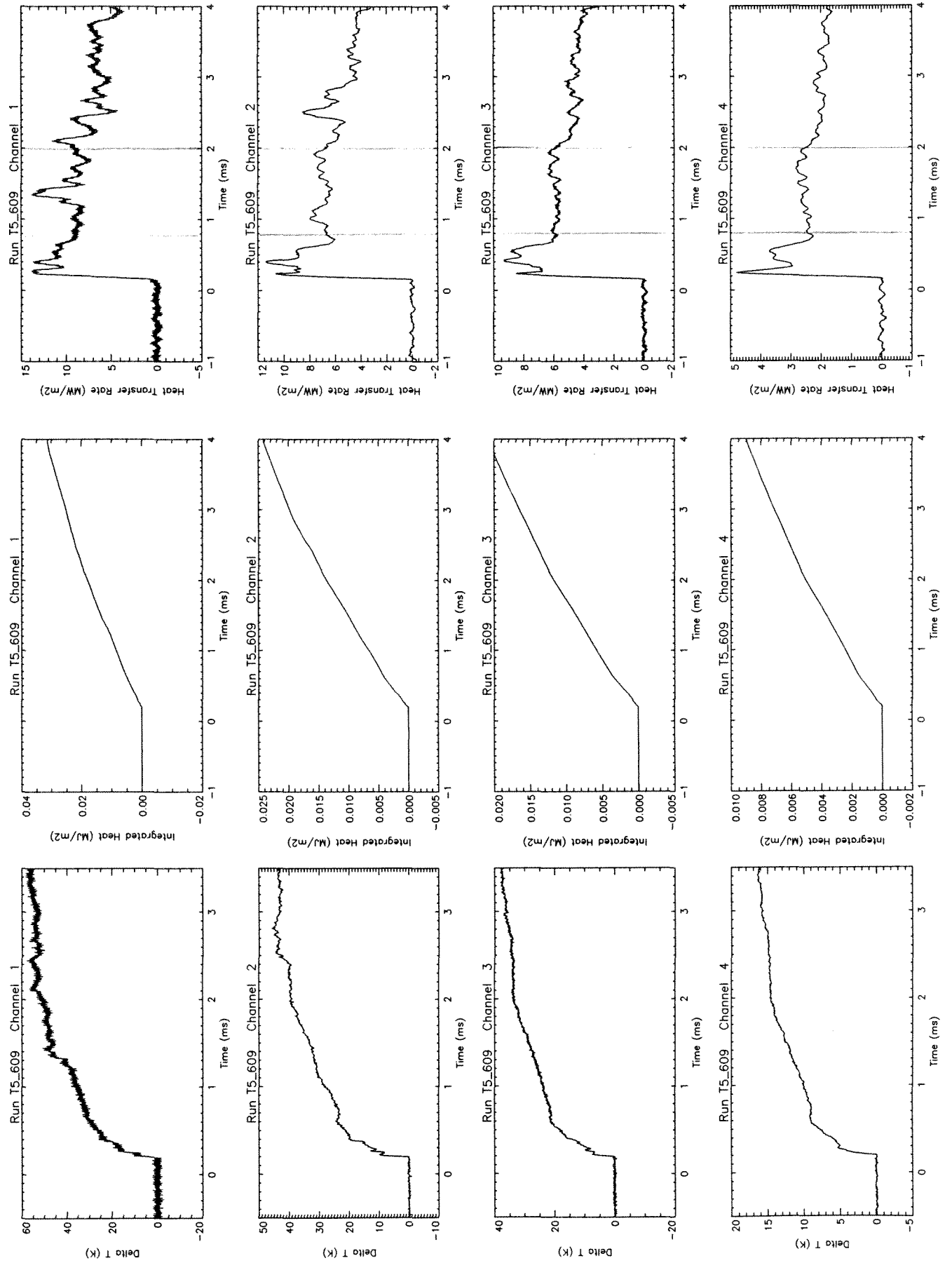


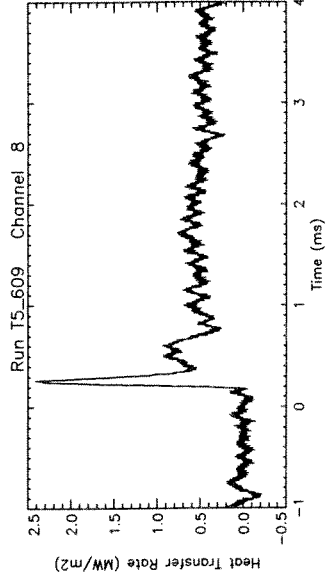
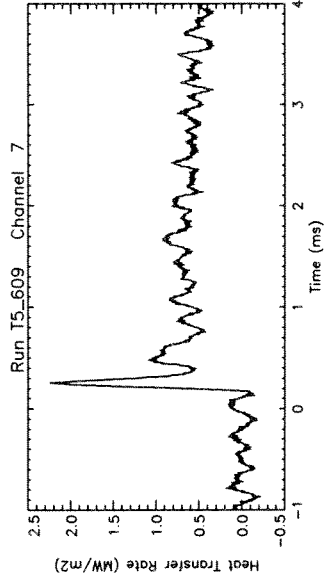
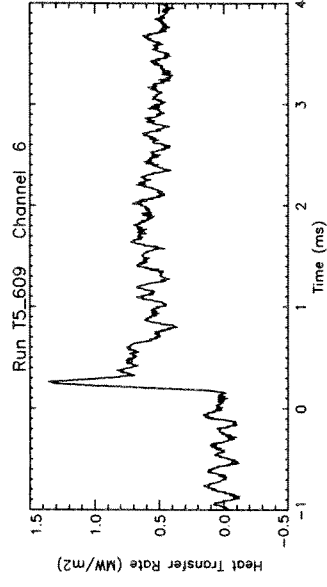
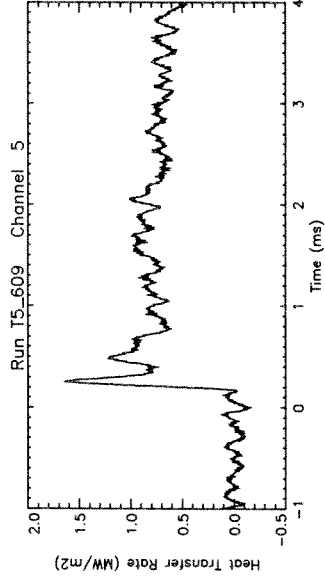
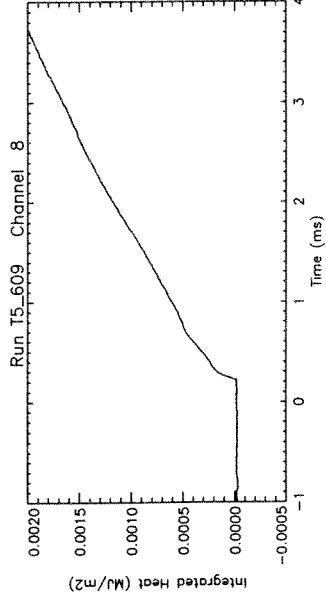
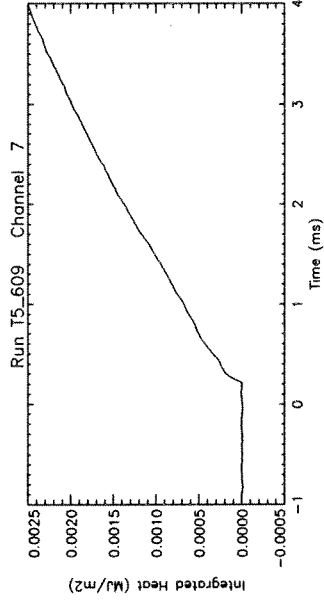
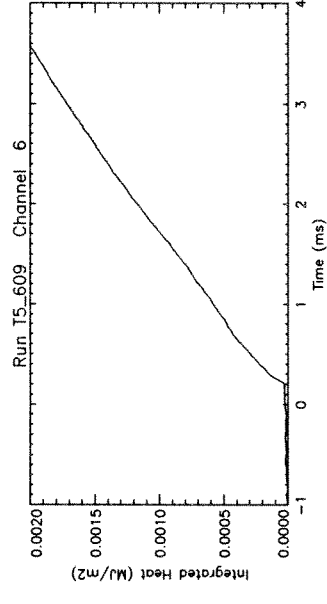
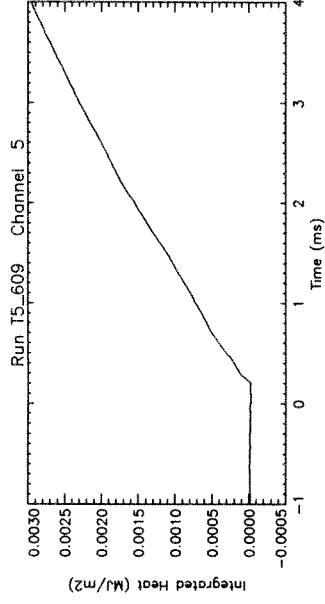
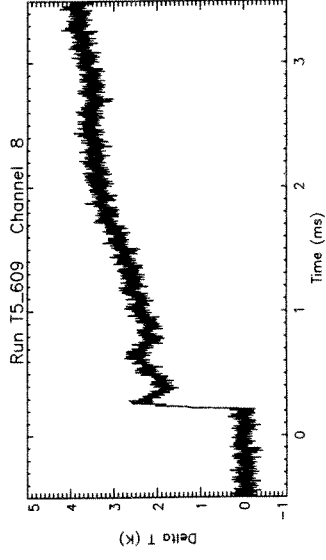
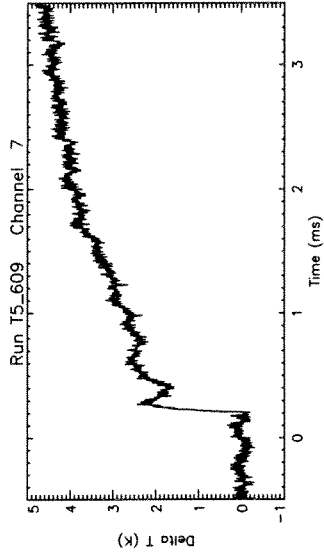
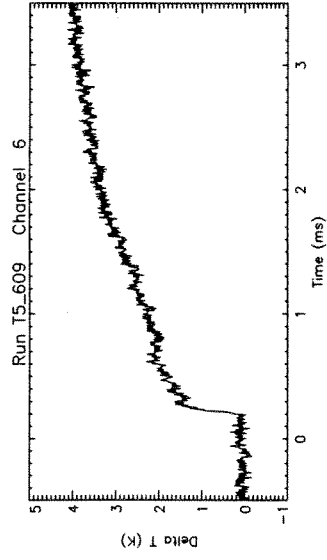
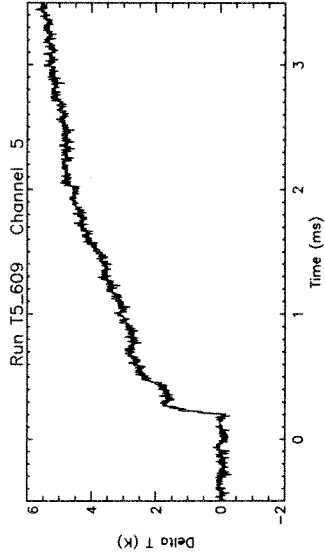
box 31

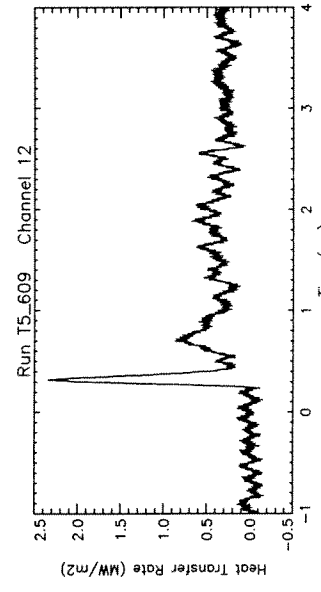
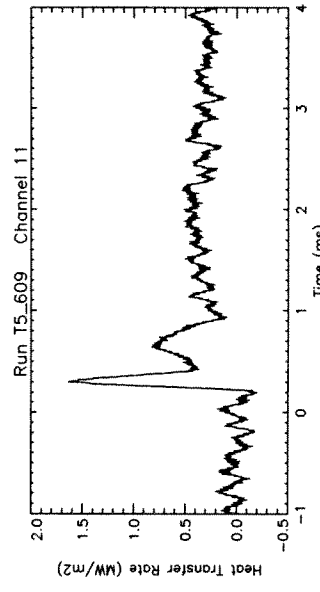
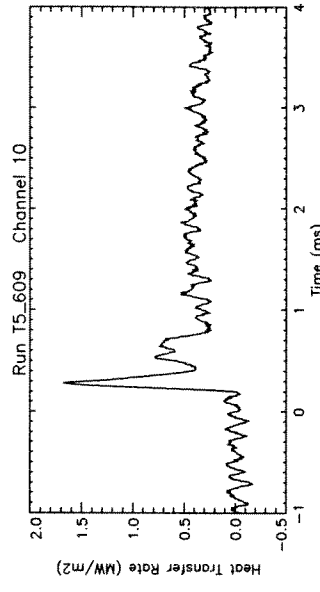
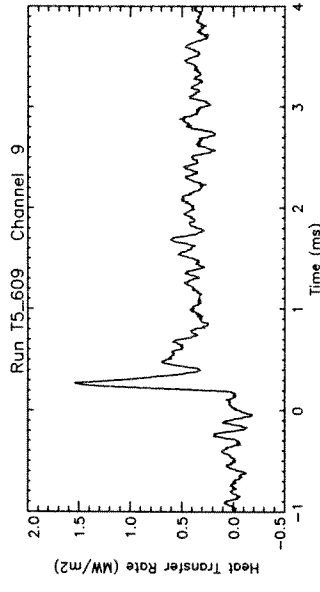
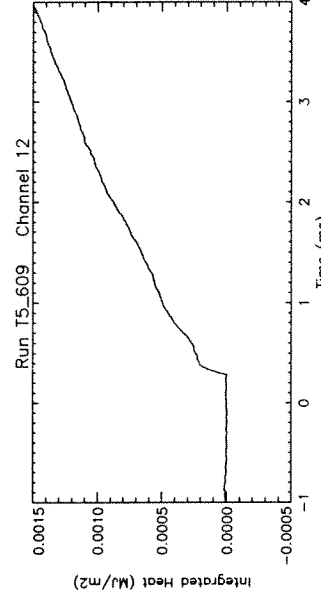
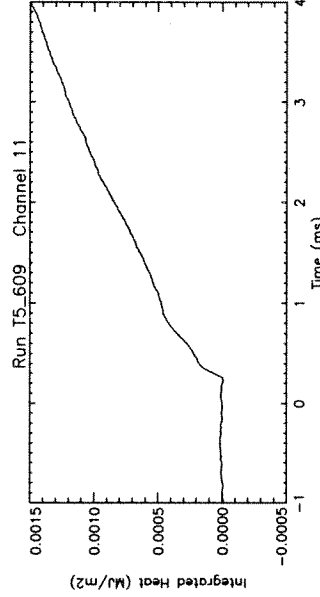
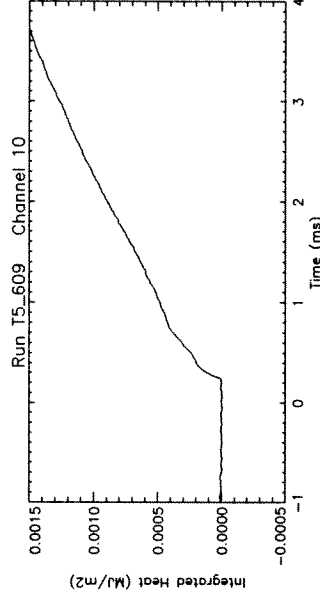
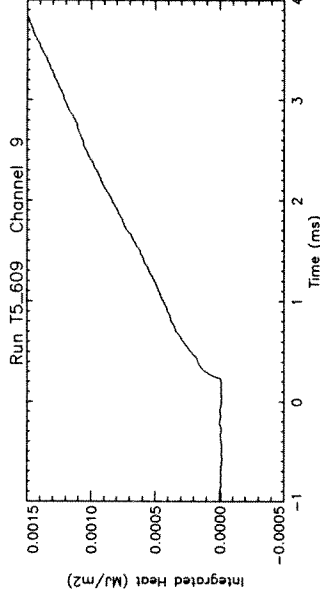
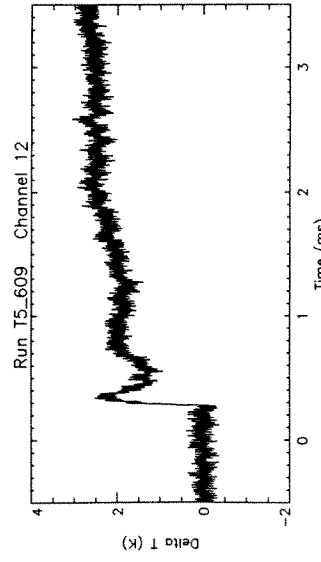
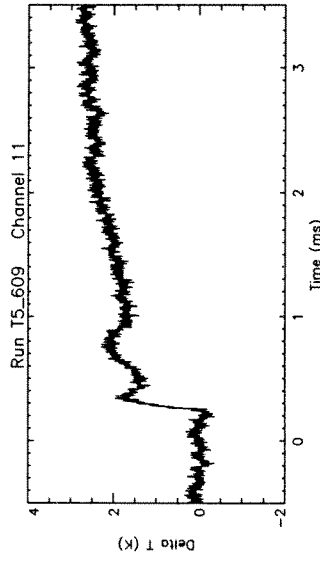
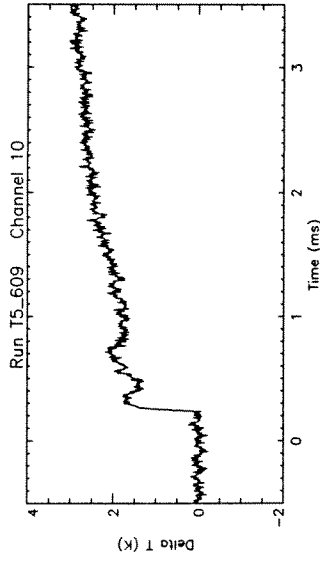
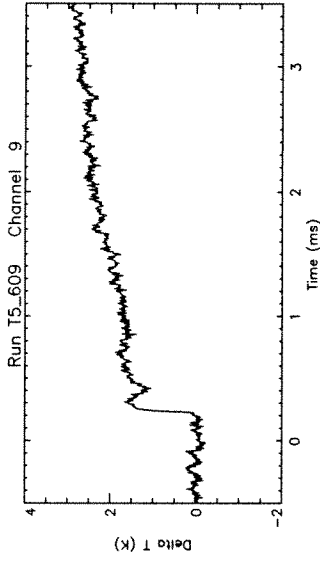


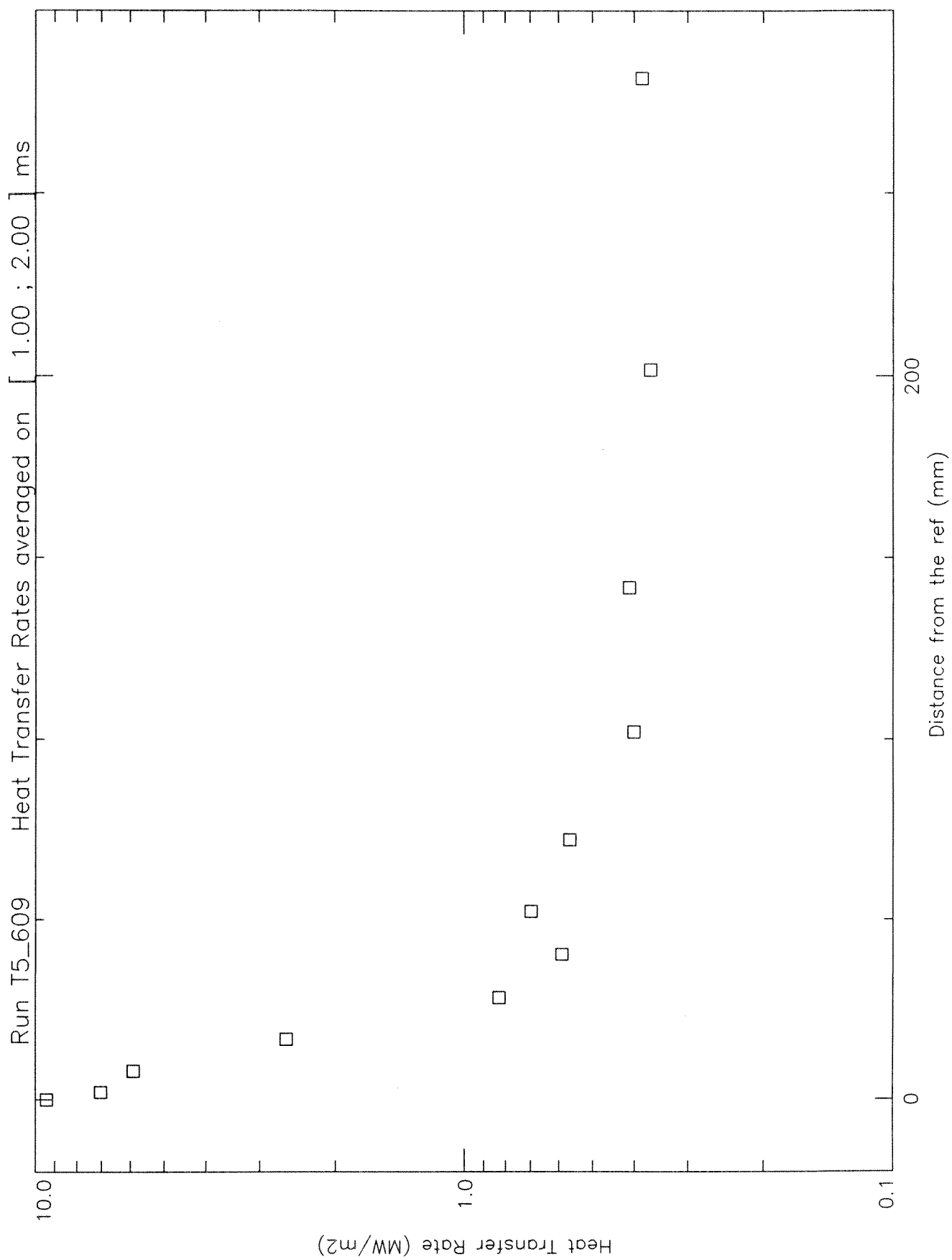


Dec 09 / 118 ms









Run # 609

Pressure averages around 1.75 +/- 0.25 ms

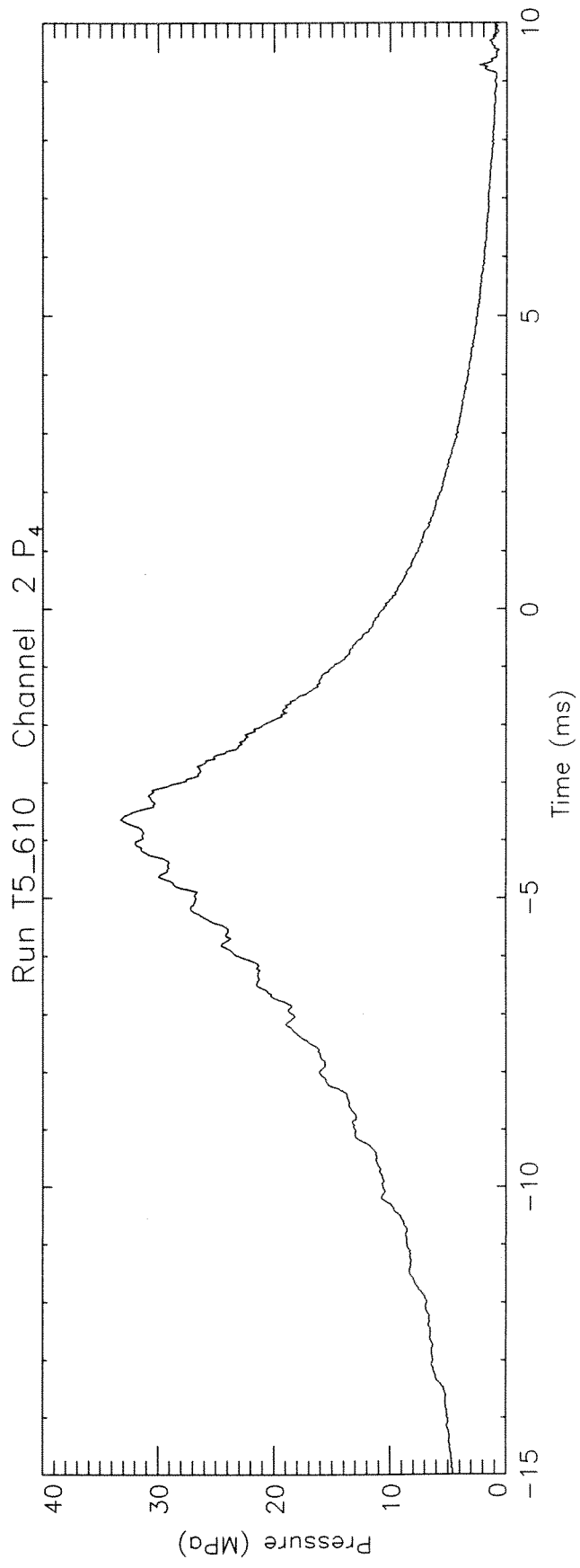
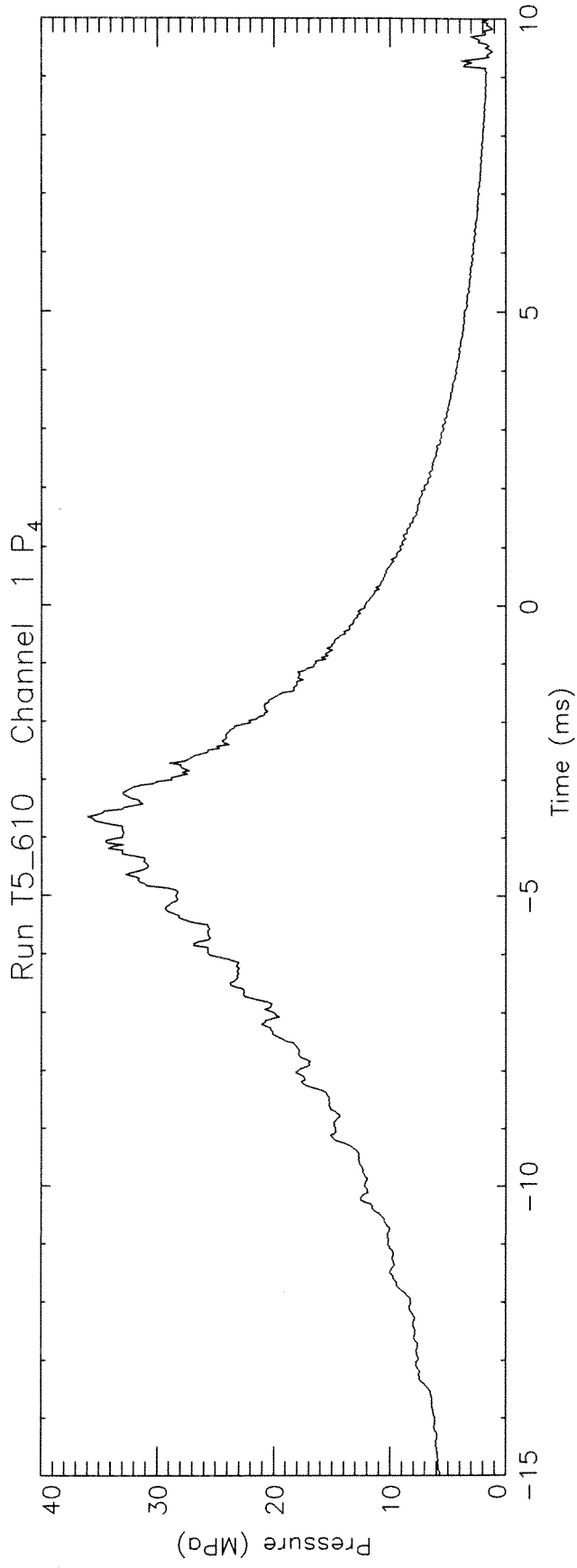
Smooth box = 2.

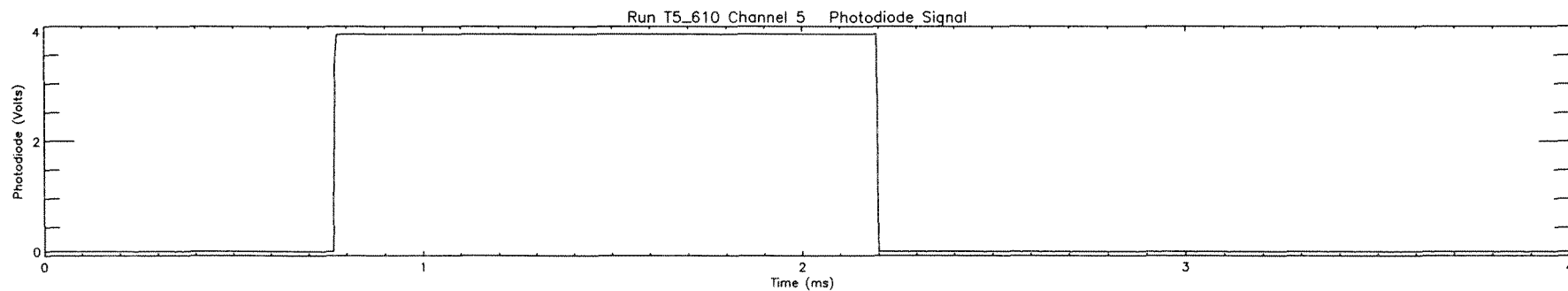
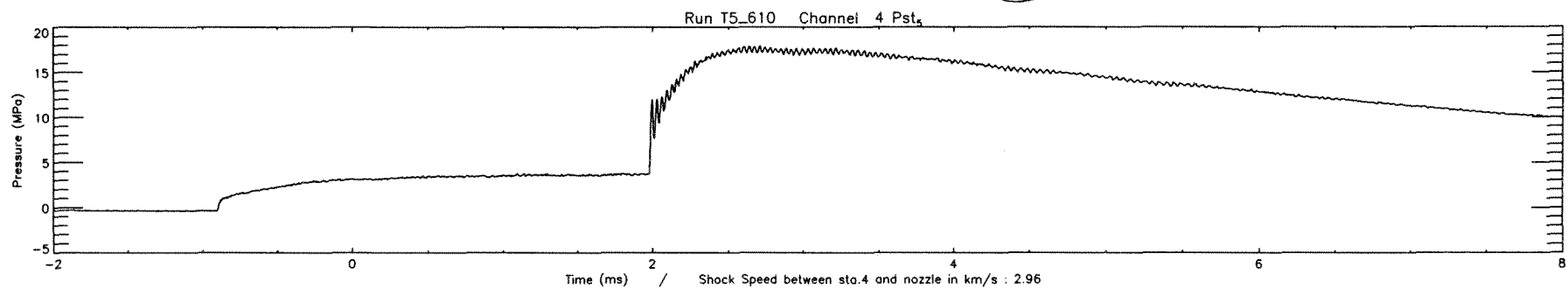
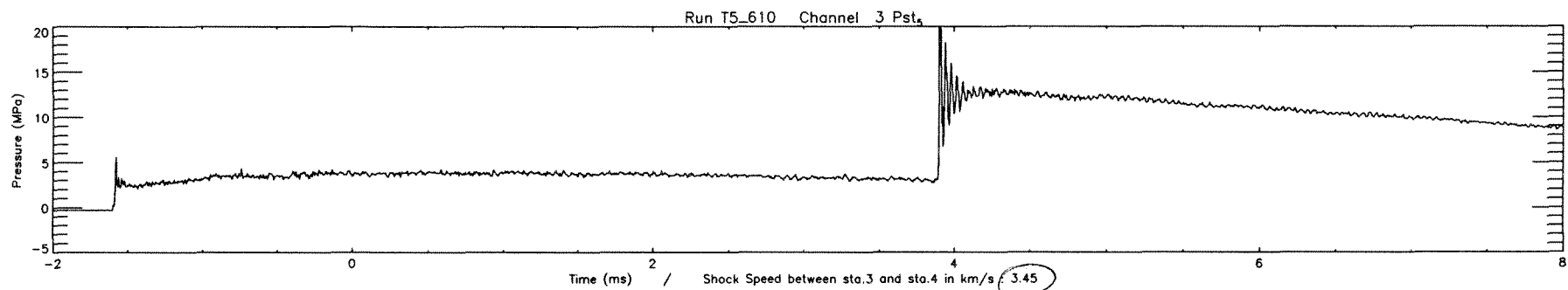
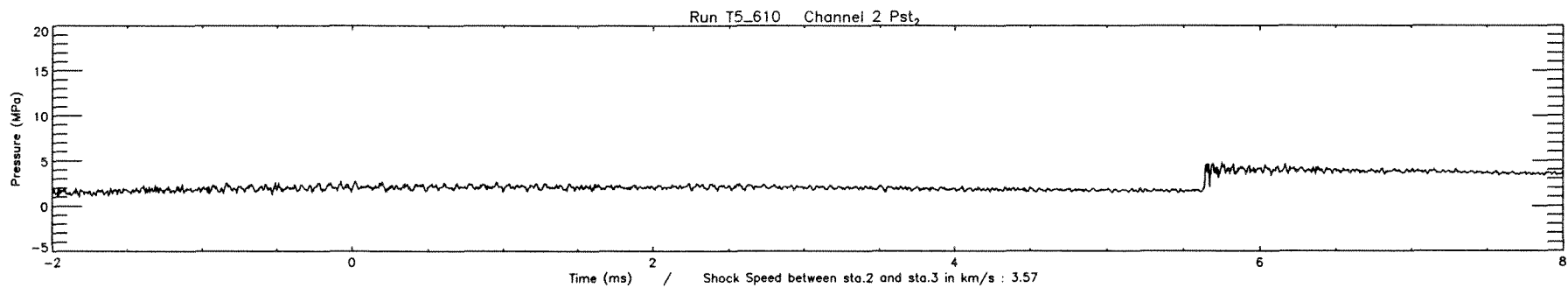
DA1	:	0.4782
DA2	:	0.2134
DA3	:	0.0506
DA4	:	0.0455
DA5	:	0.0543
DA6	:	0.0503
DA7	:	0.0497
DA8	:	0.0424
DA9	:	0.0454

Run # 609

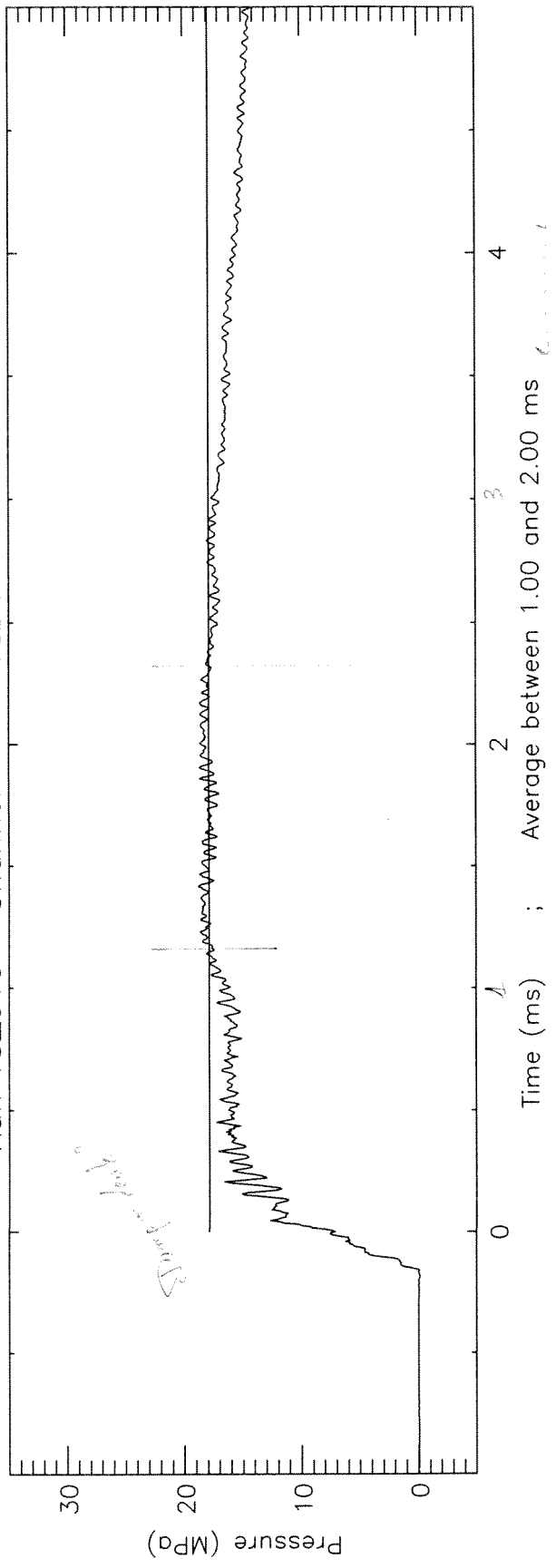
Heat Transfer Rates (in MW/m²)
averaged around 1.50 +/- 0.50 ms

MT 1 :	9.4115
MT 2 :	7.0303
MT 3 :	5.9004
MT 4 :	2.6029
MT 5 :	0.8286
MT 6 :	0.5906
MT 7 :	0.6977
MT 8 :	0.5658
MT 9 :	0.4004
MT10 :	0.4108
MT11 :	0.3667
MT12 :	0.3833

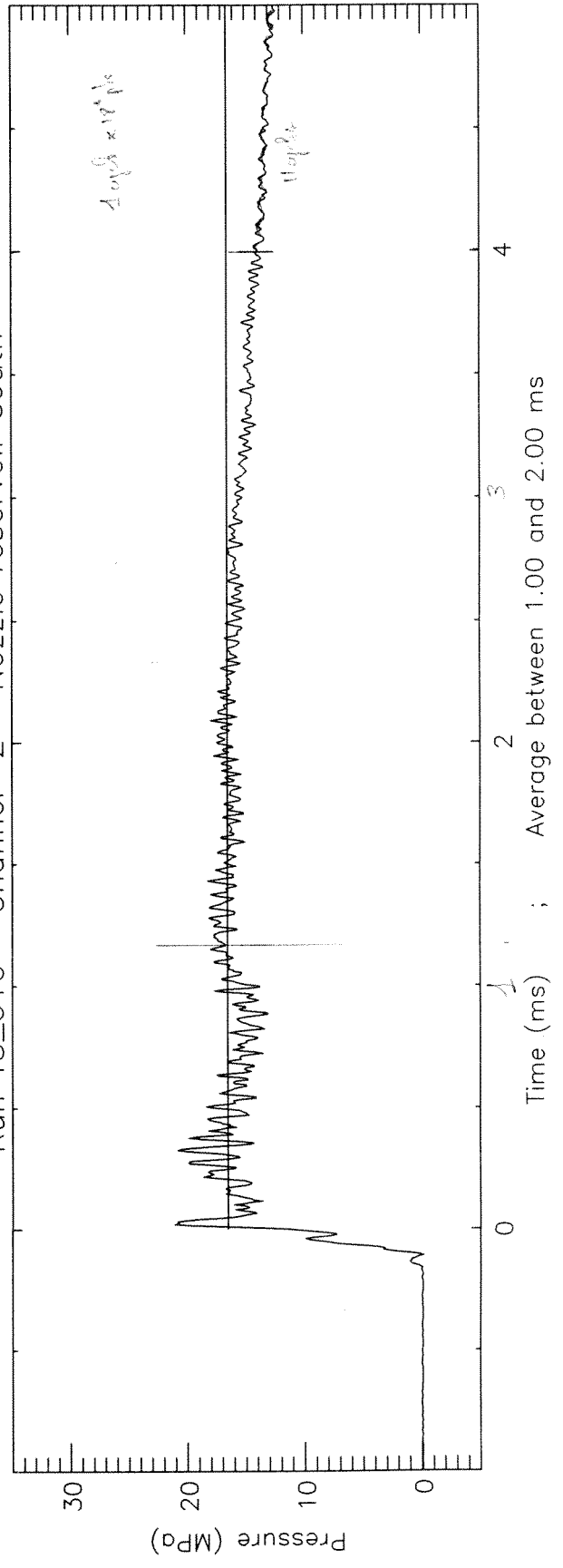




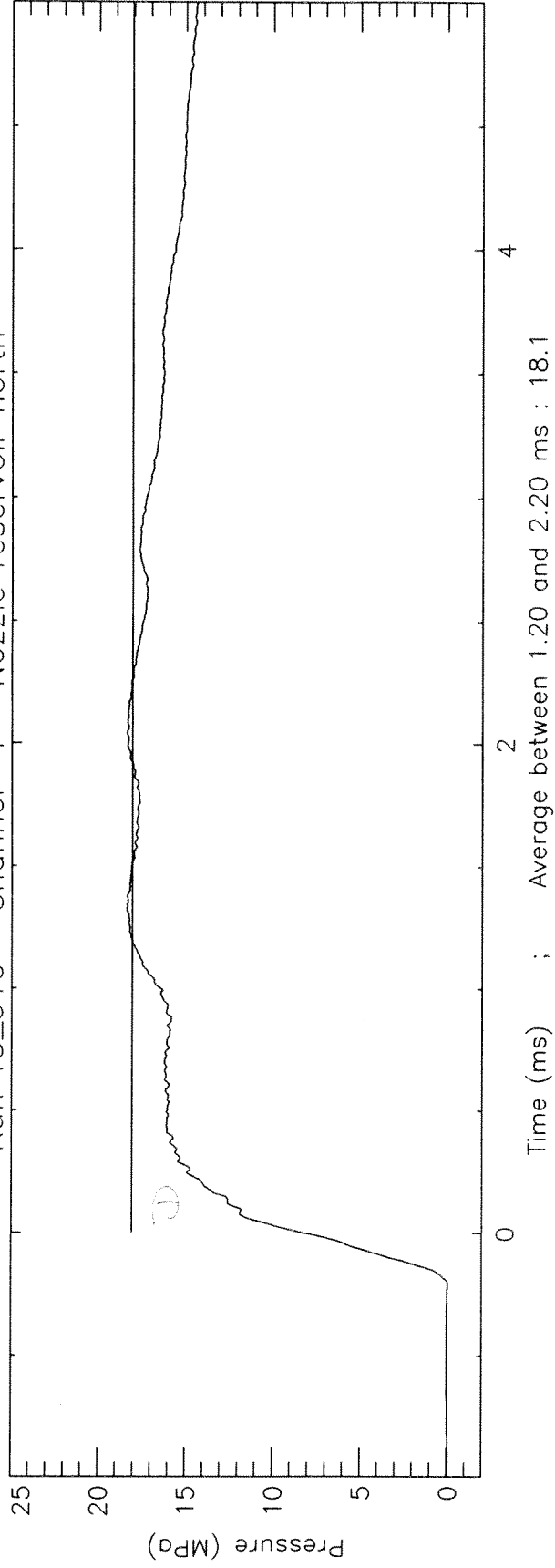
Run T5_610 Channel 1 Nozzle reservoir north



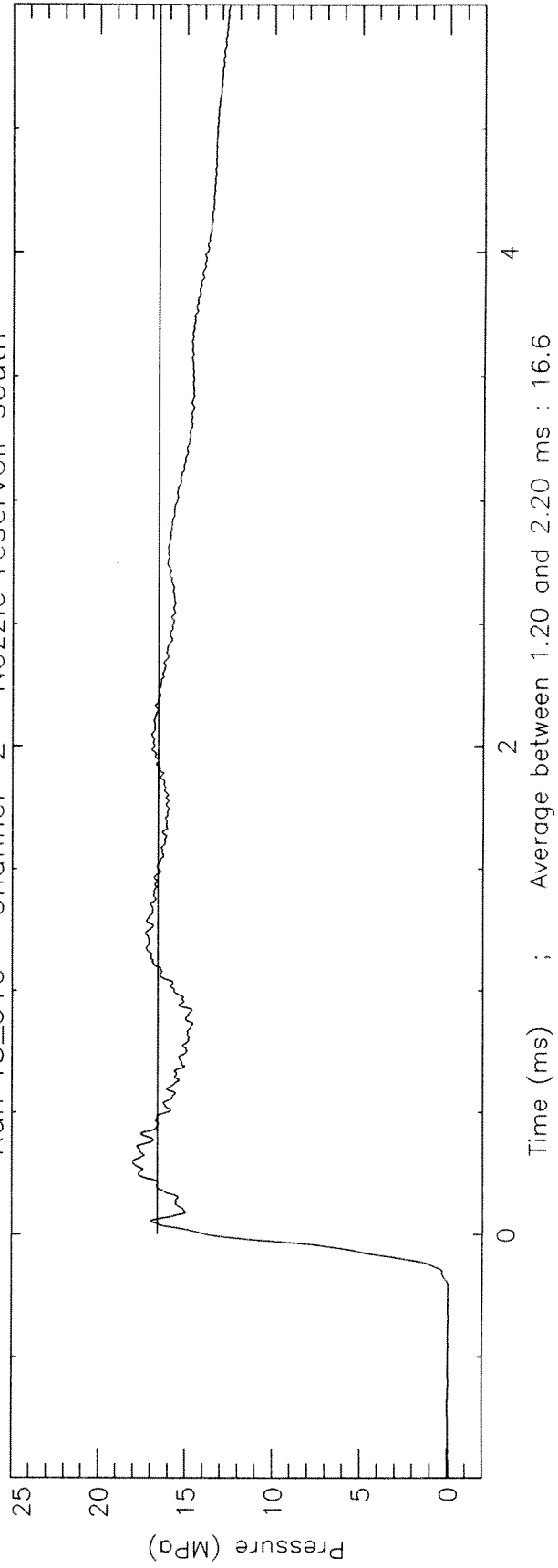
Run T5_610 Channel 2 Nozzle reservoir south

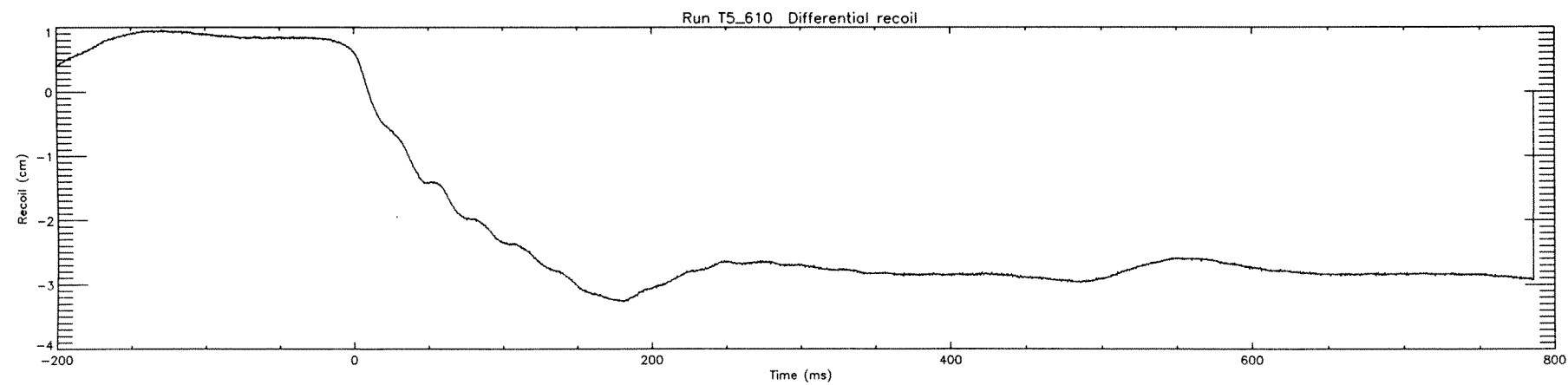
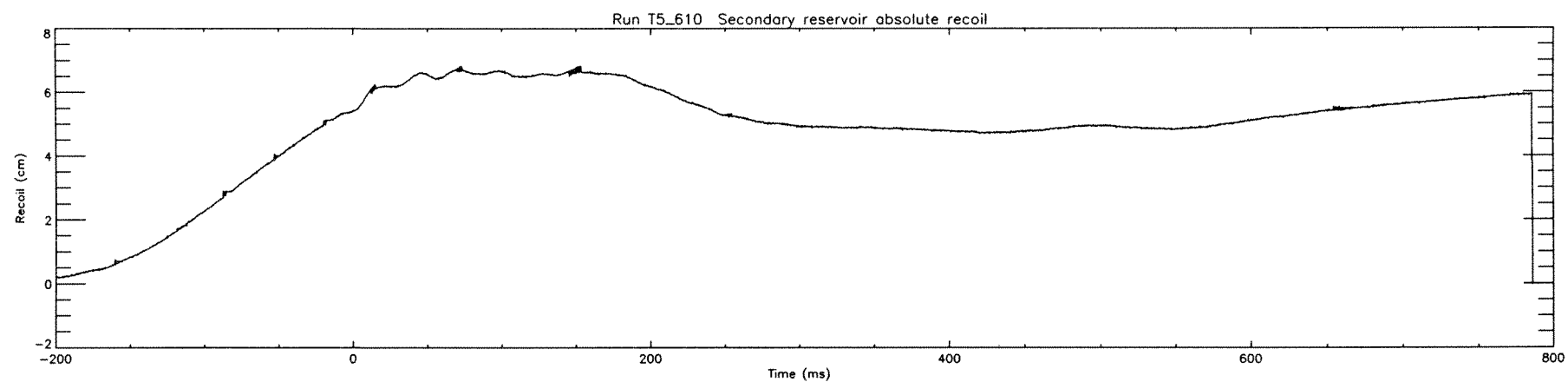
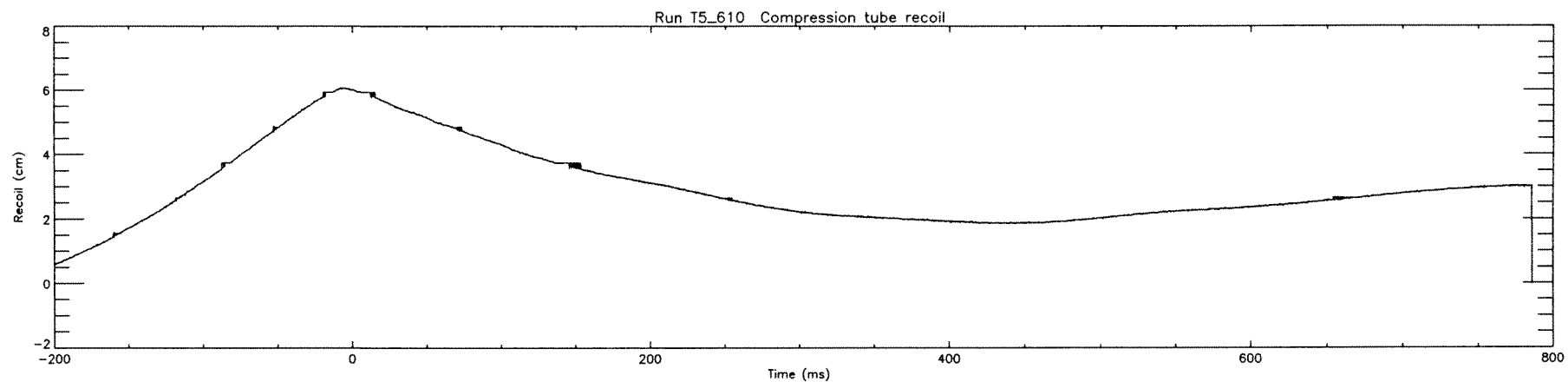


Run T5_610 Channel 1 Nozzle reservoir north

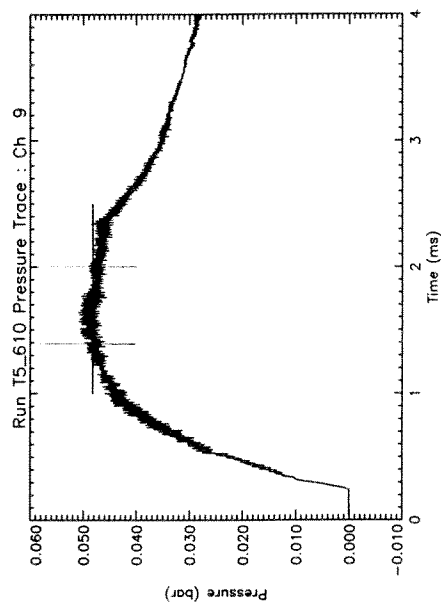
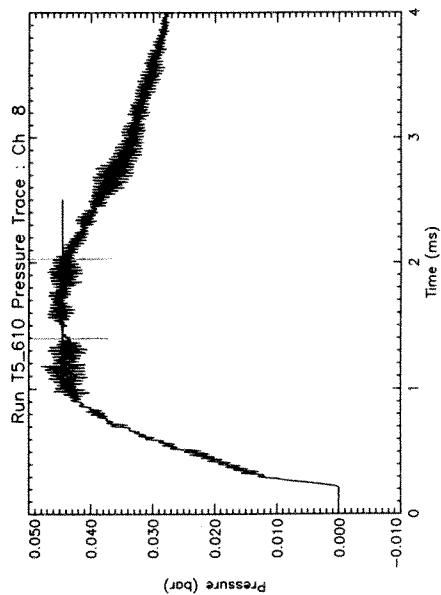
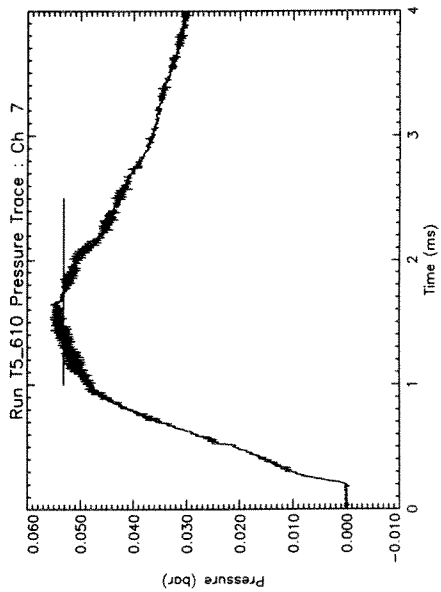
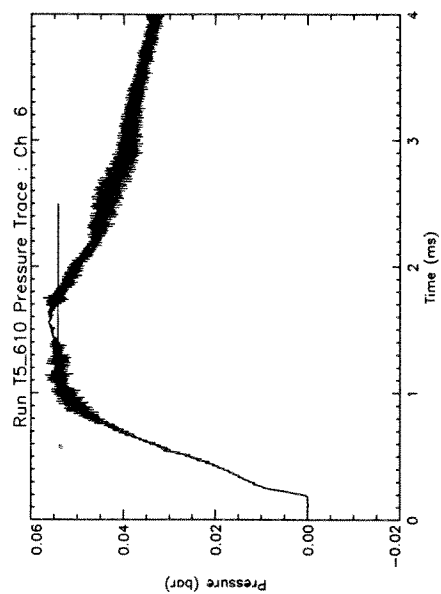
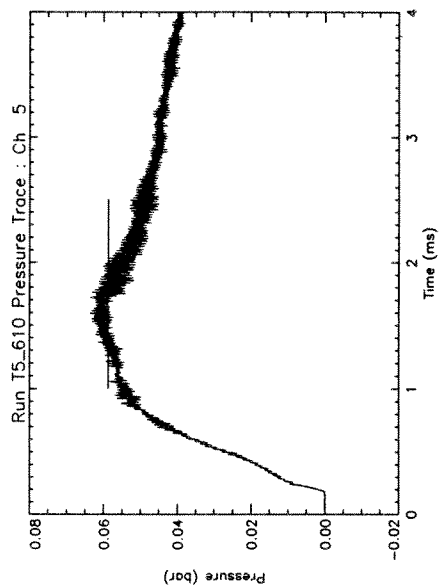
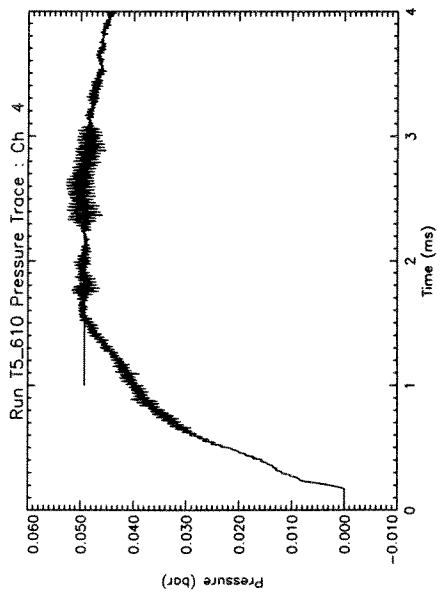
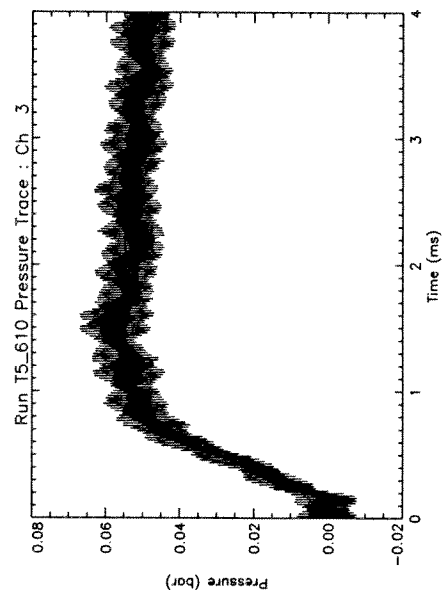
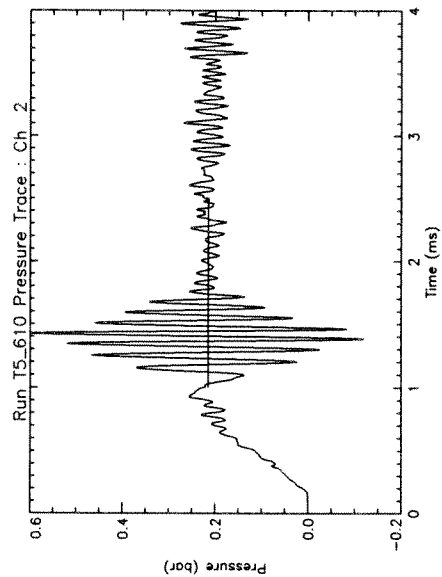
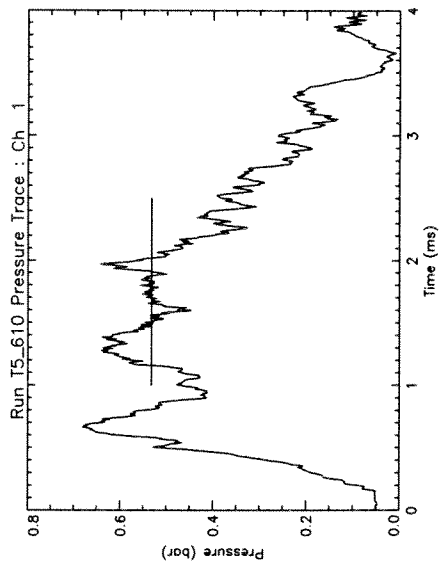


Run T5_610 Channel 2 Nozzle reservoir south

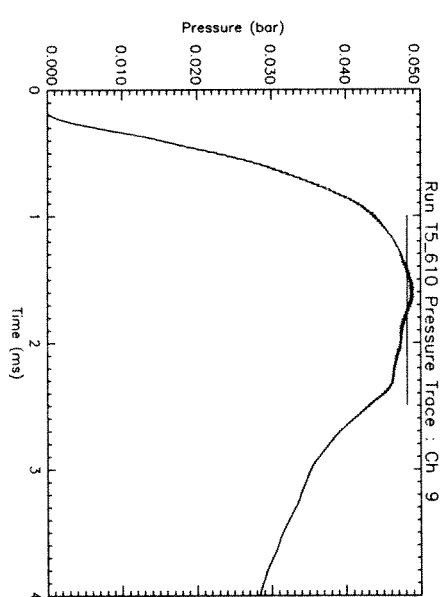
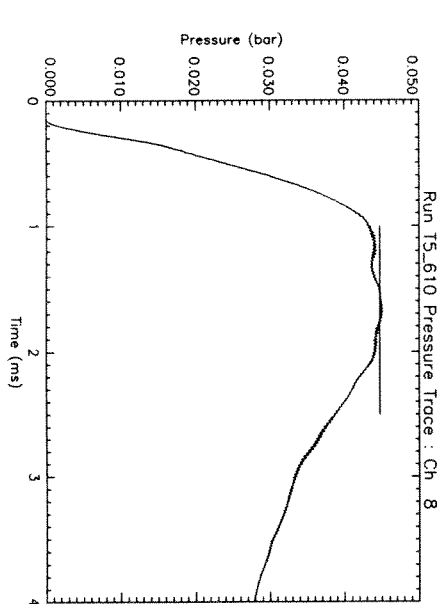
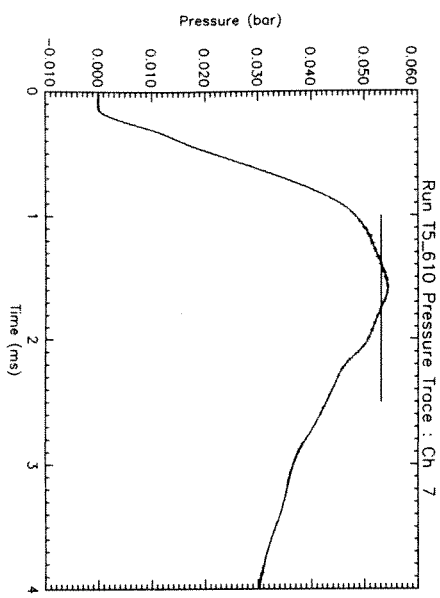
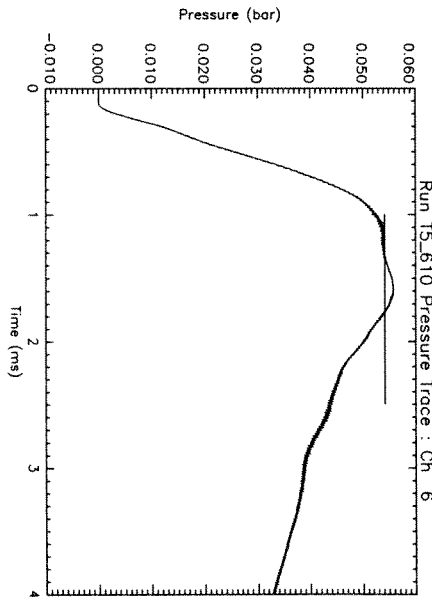
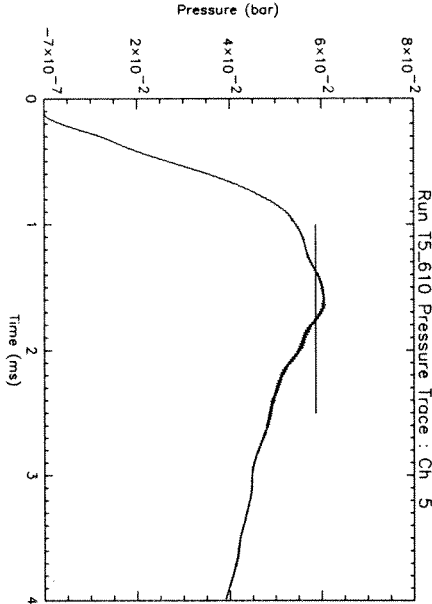
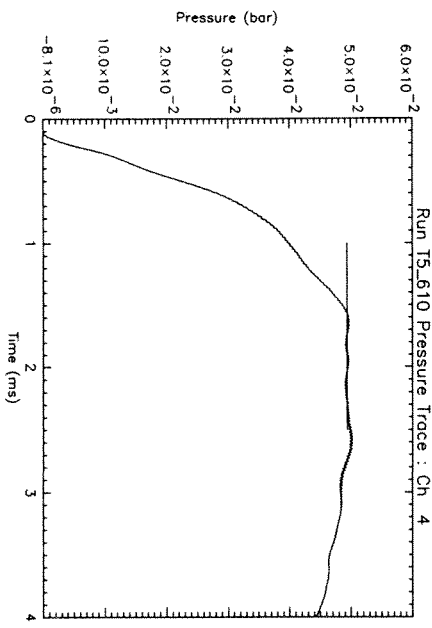
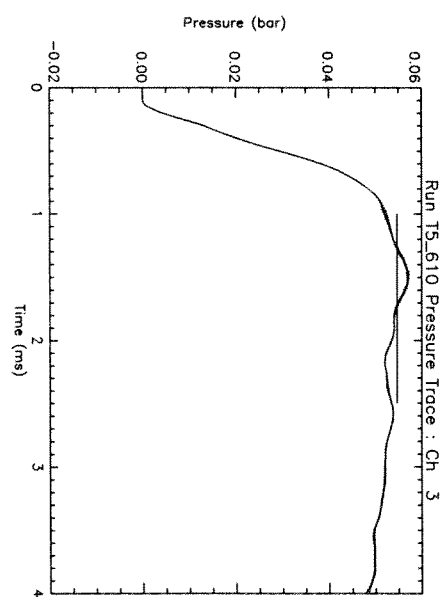
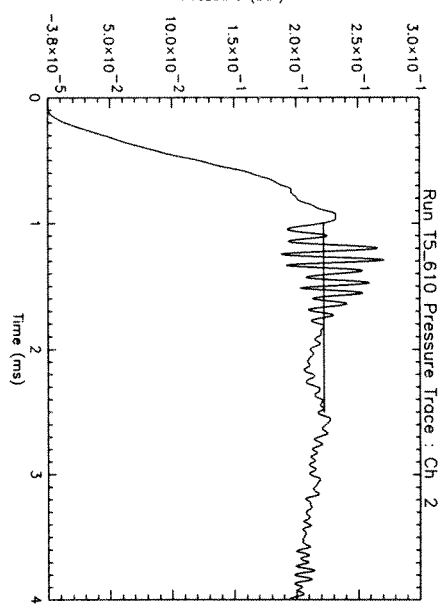
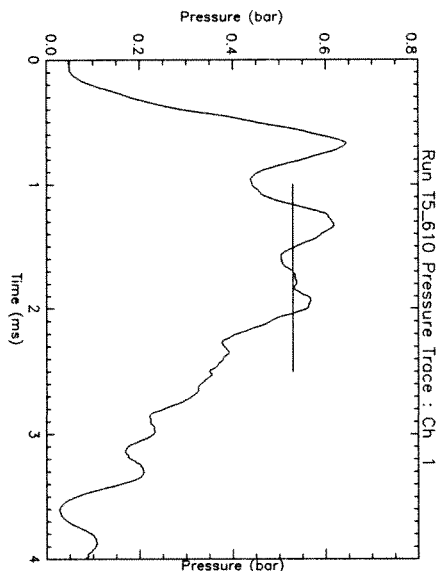


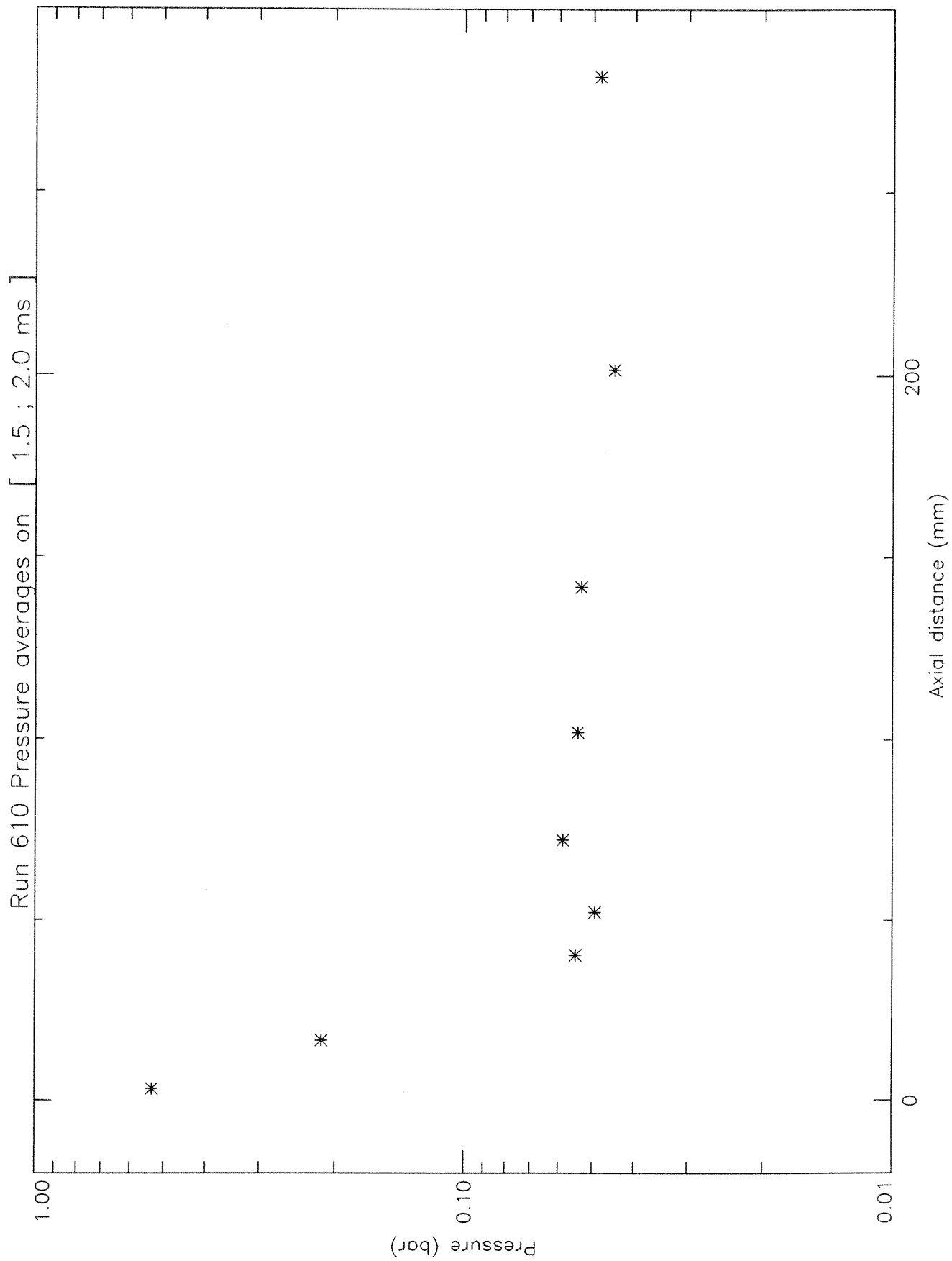


15.205

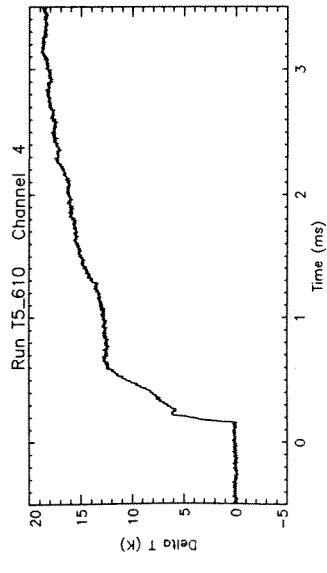
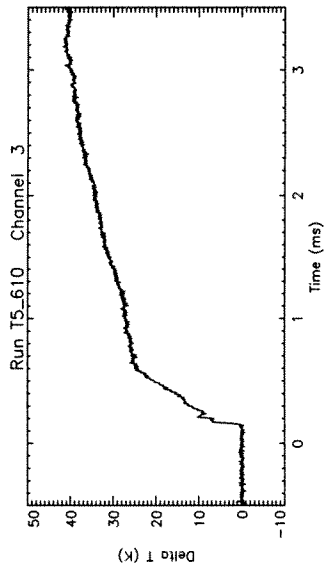
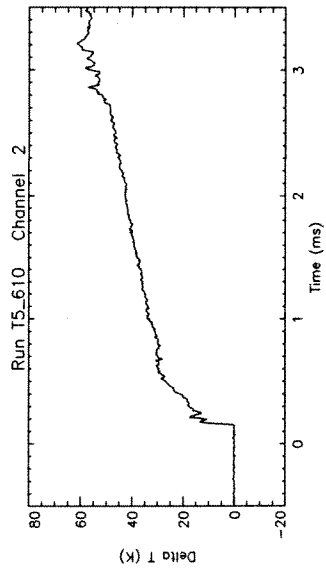
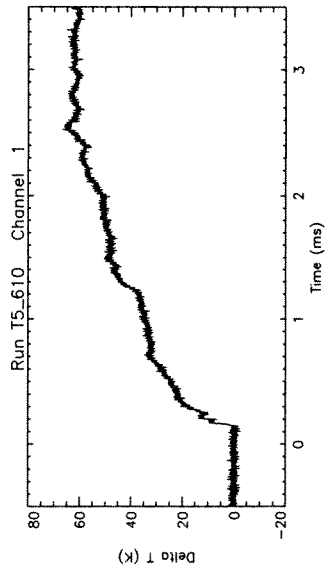
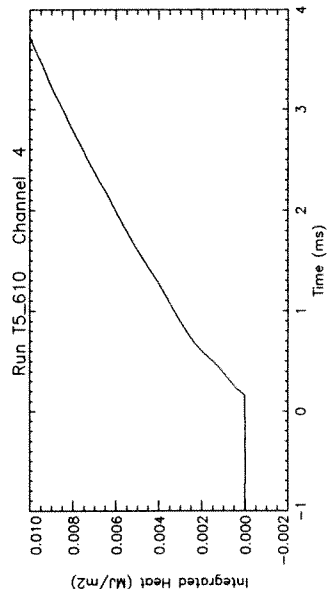
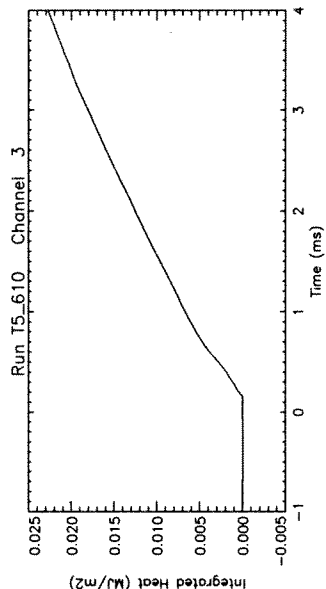
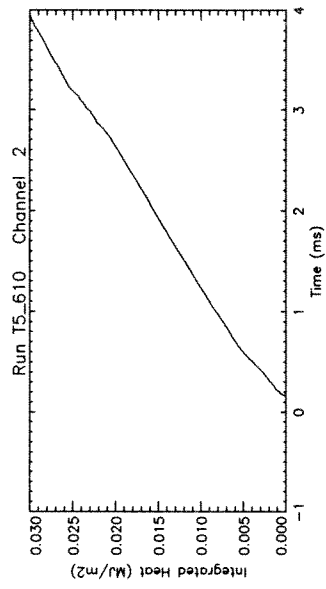
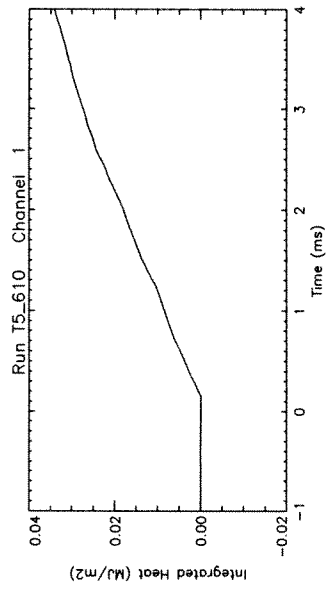
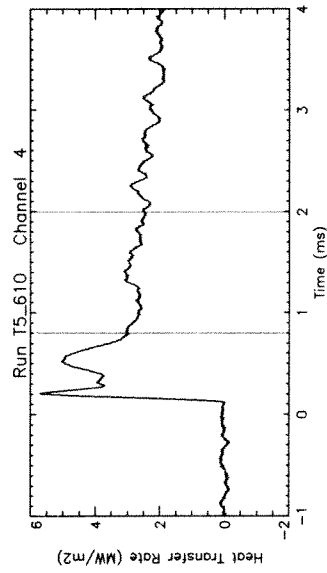
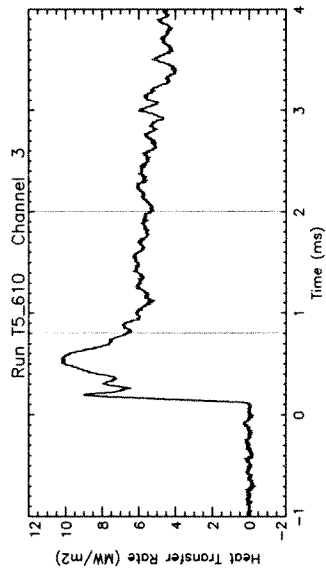
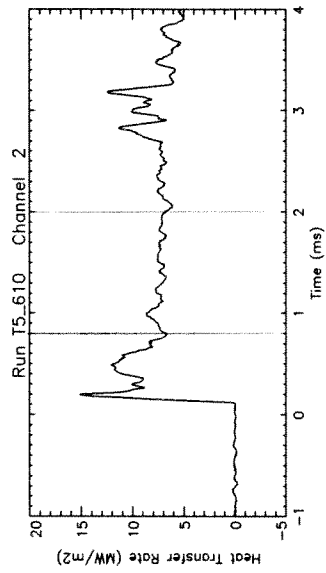
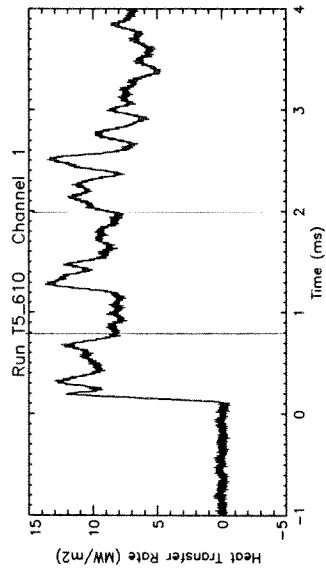


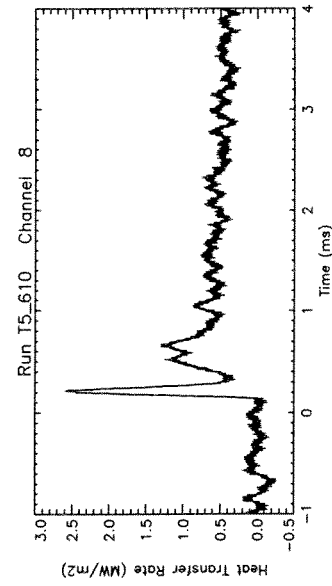
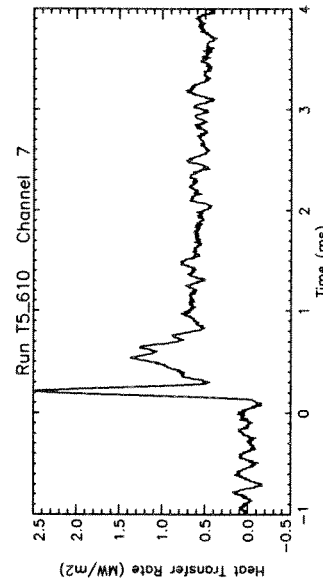
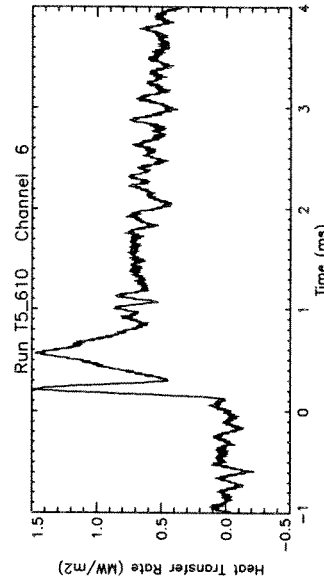
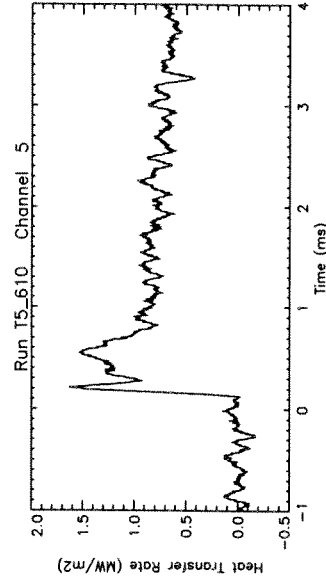
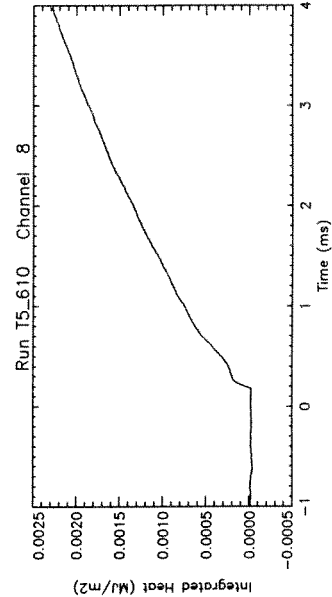
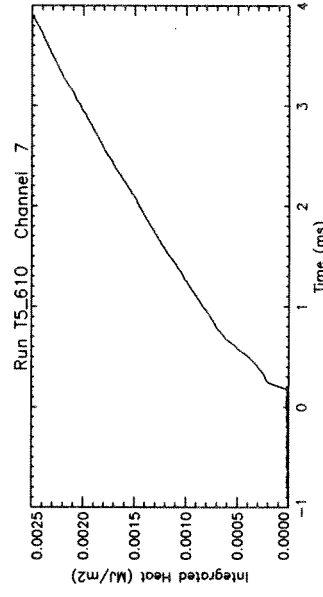
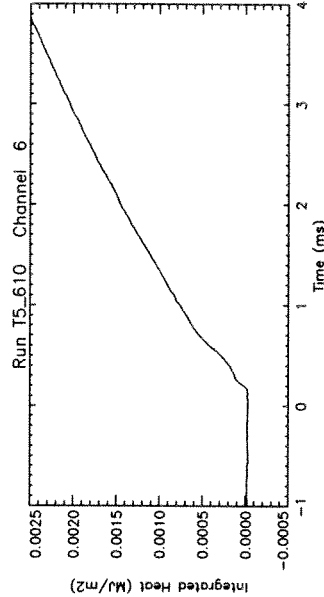
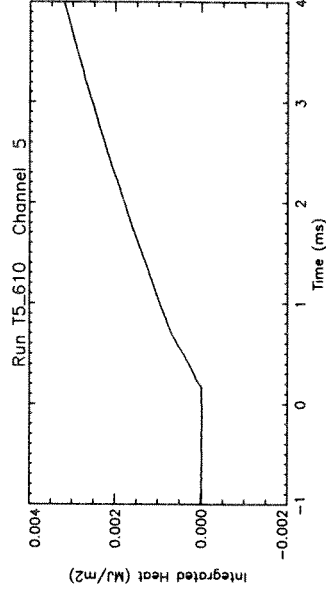
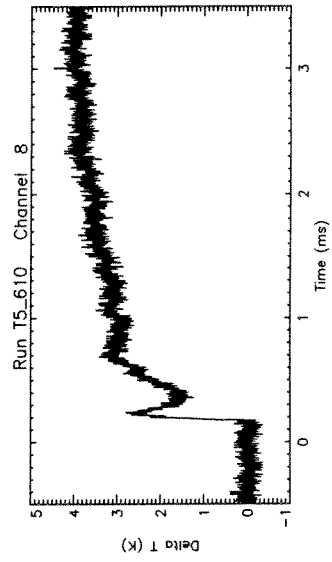
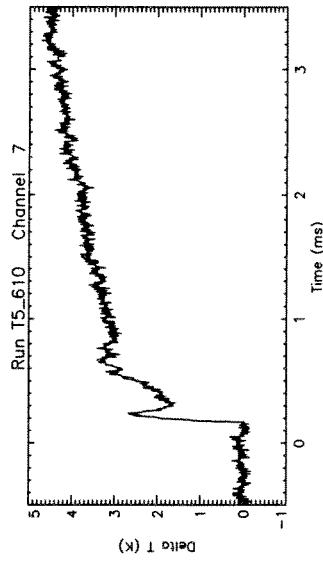
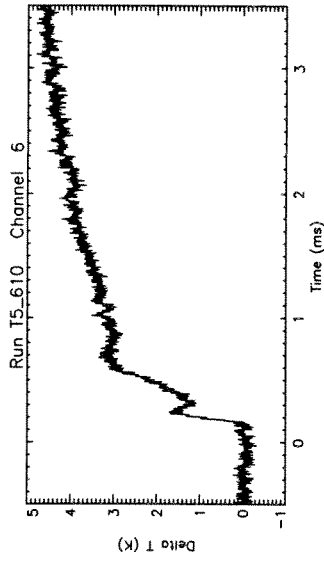
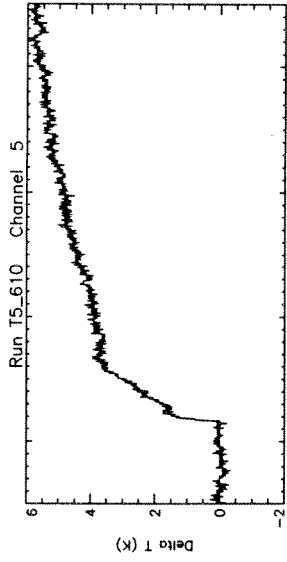
Box: 31

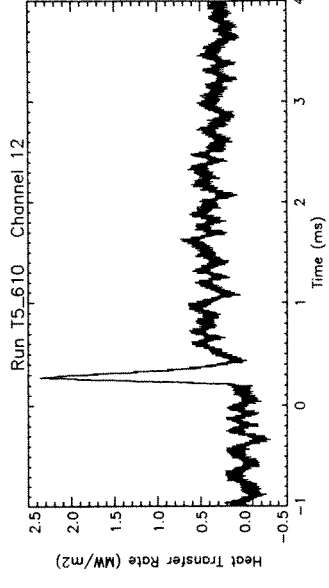
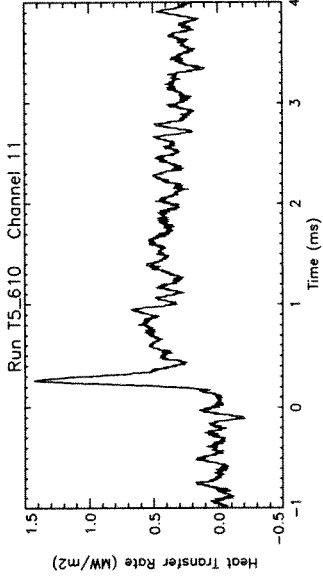
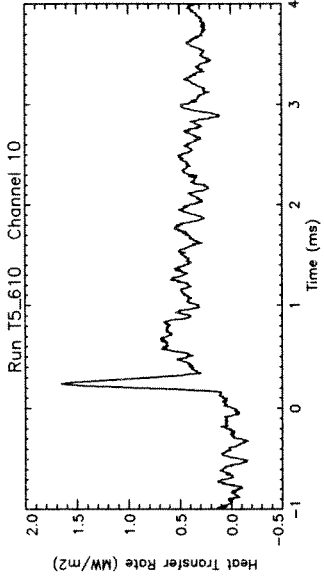
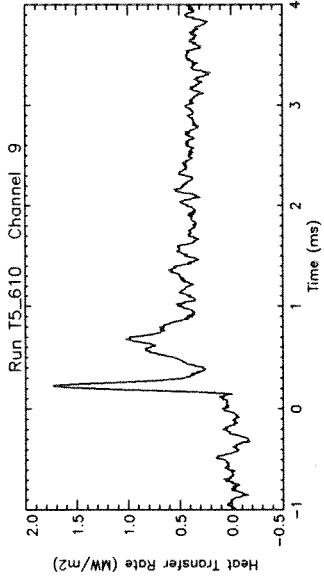
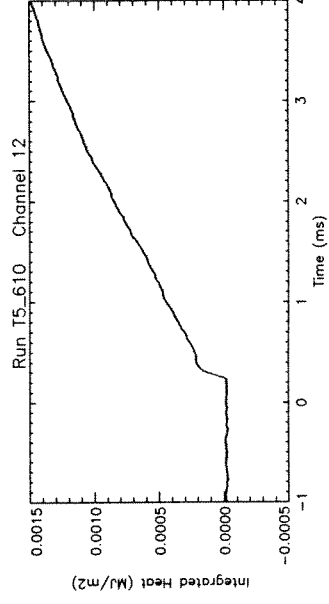
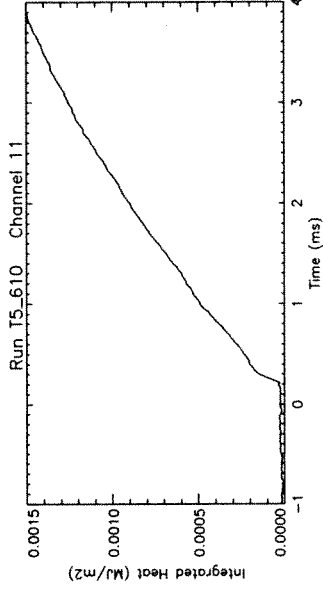
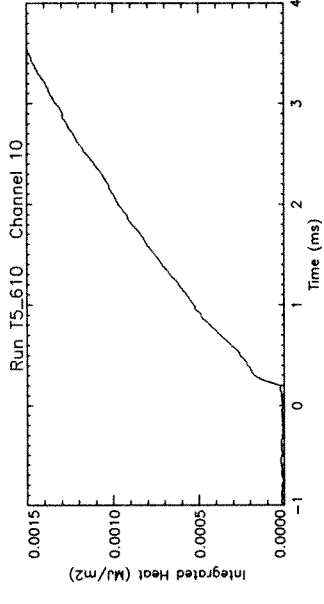
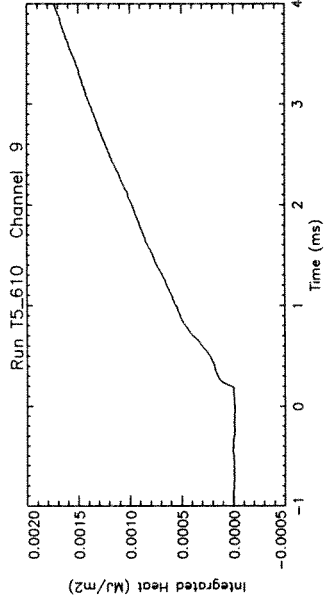
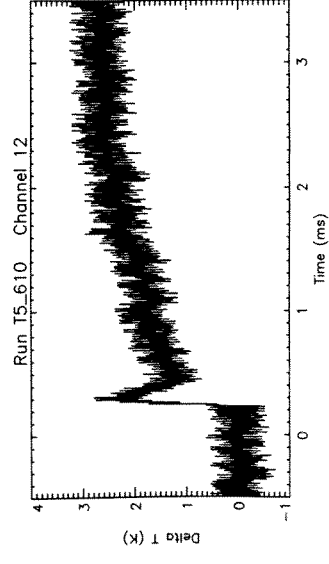
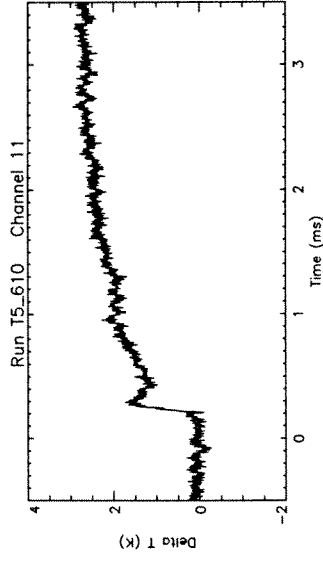
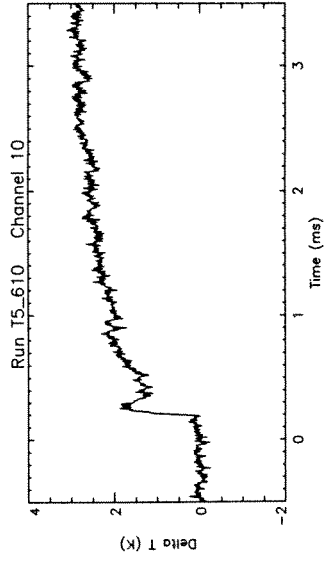
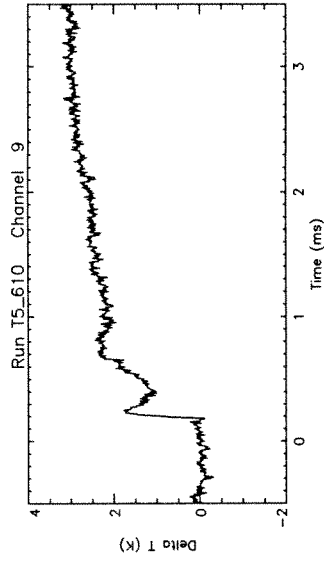


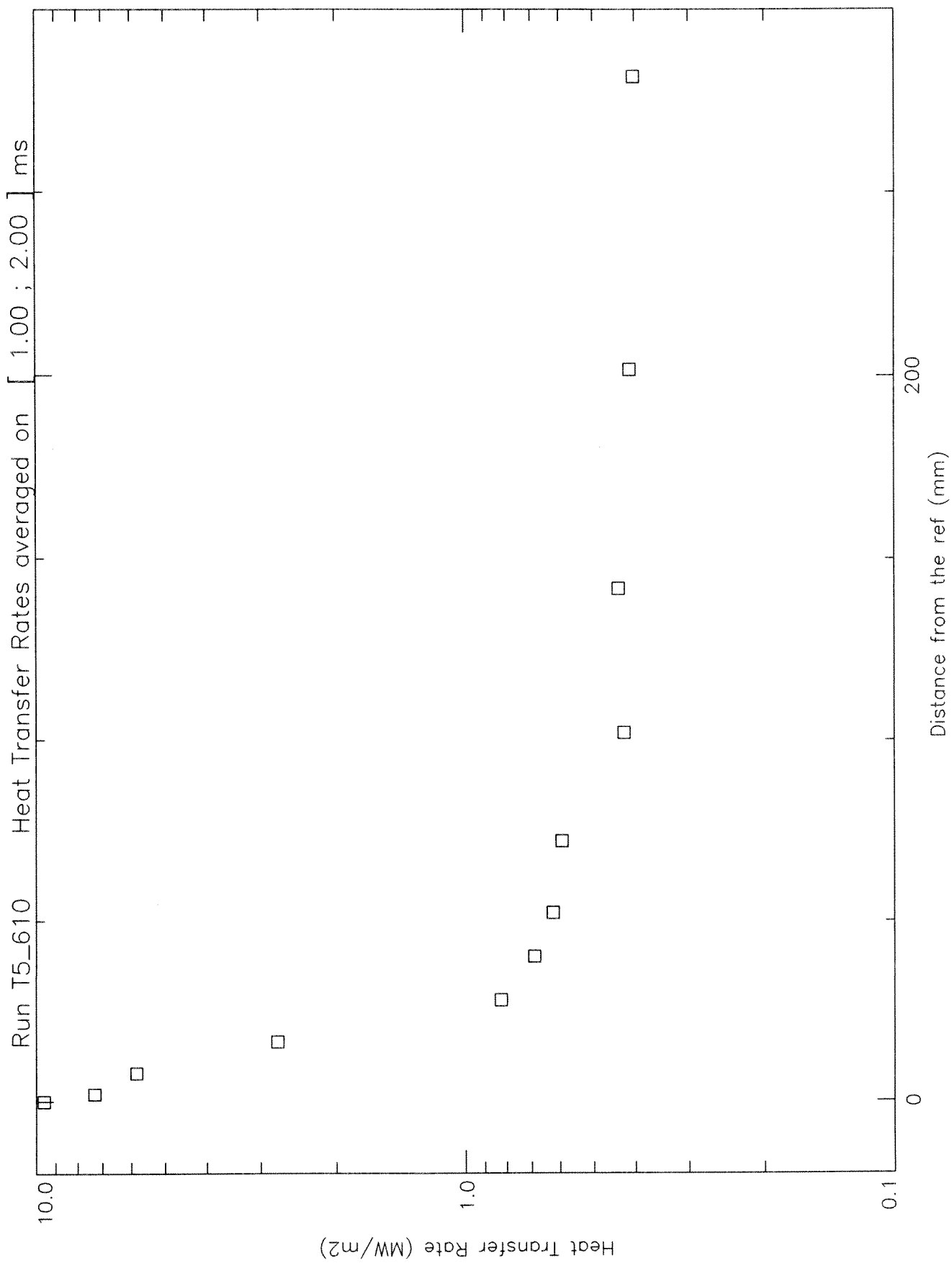


Run 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100









Run # 610

Pressure averages around 1.75 +/- 0.25 ms

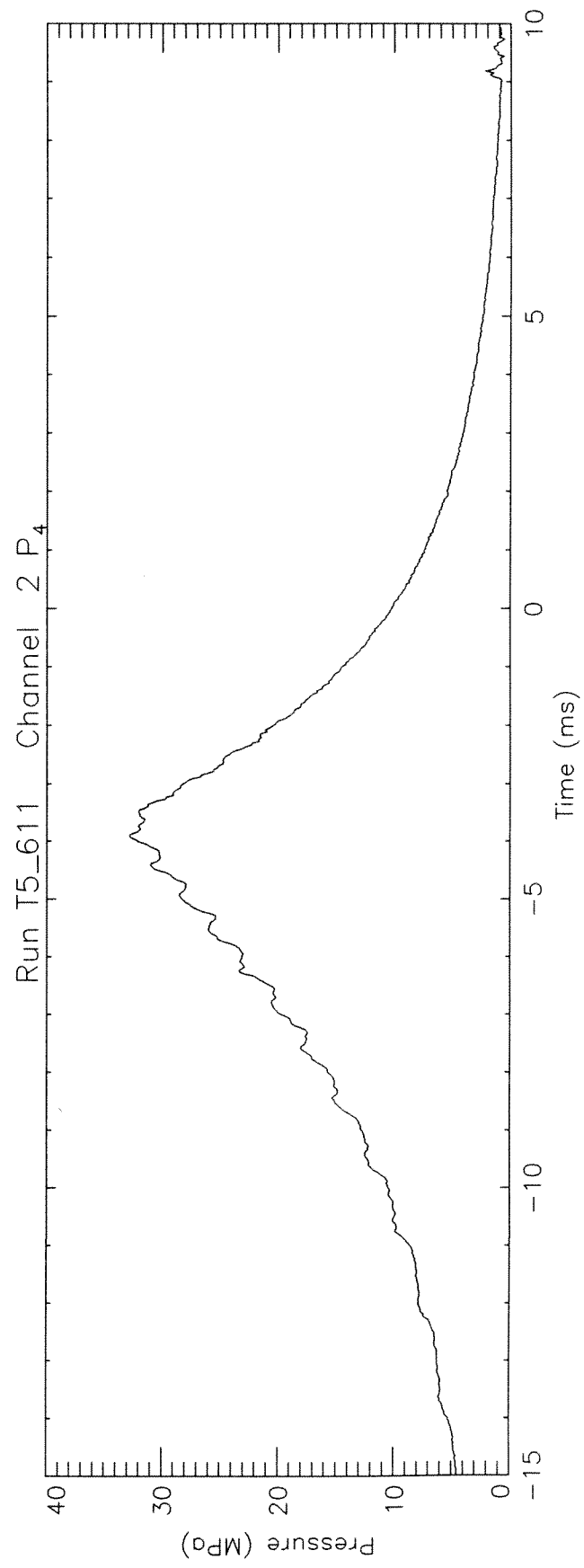
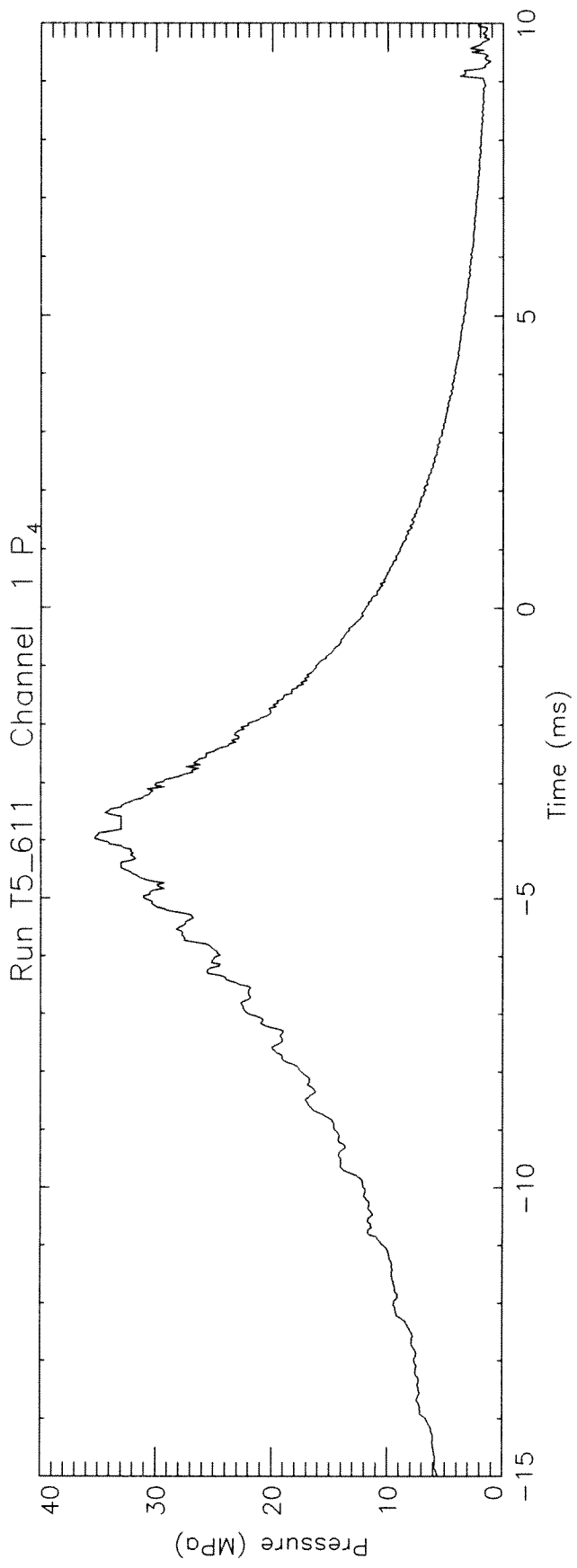
Smooth box = 2.

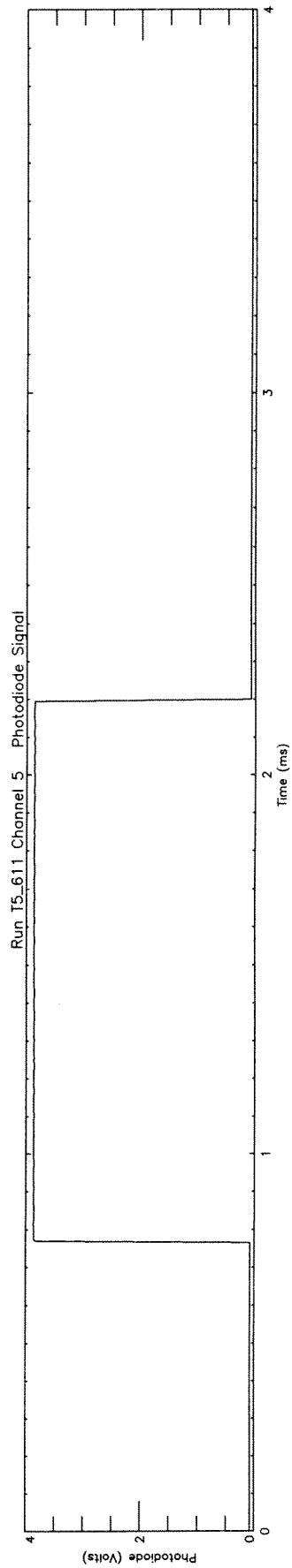
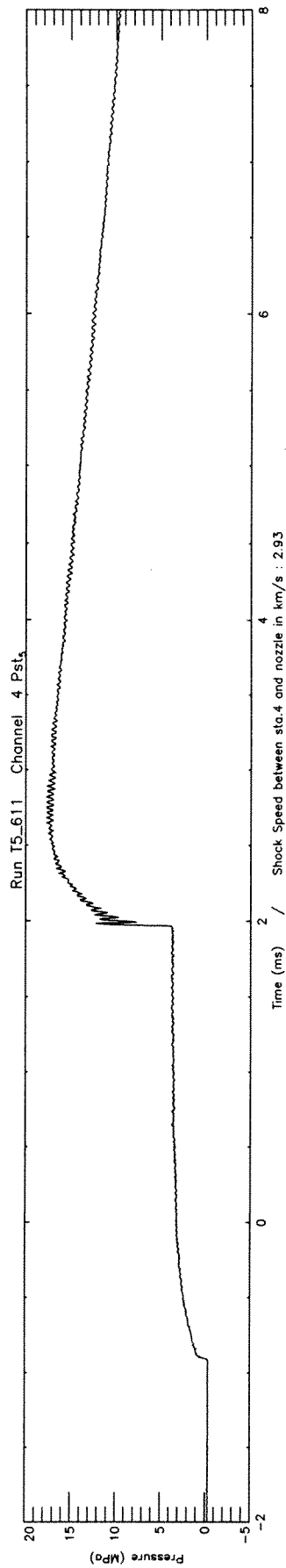
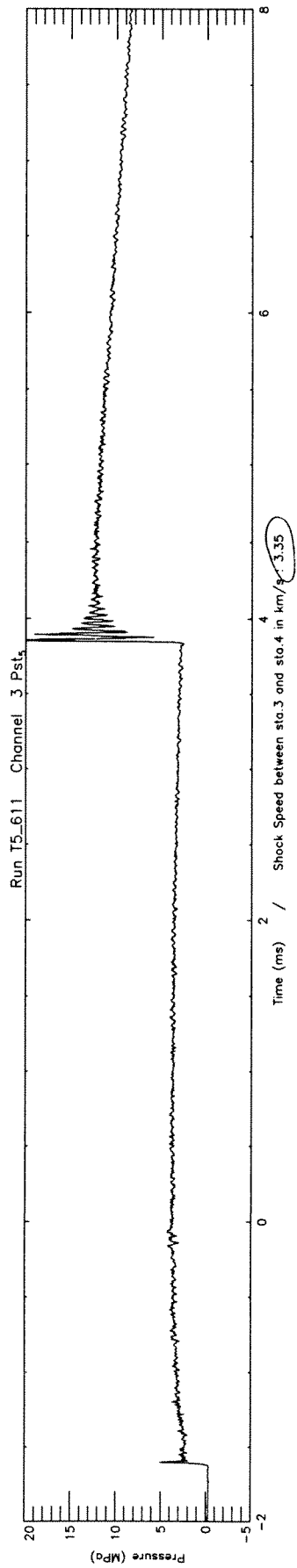
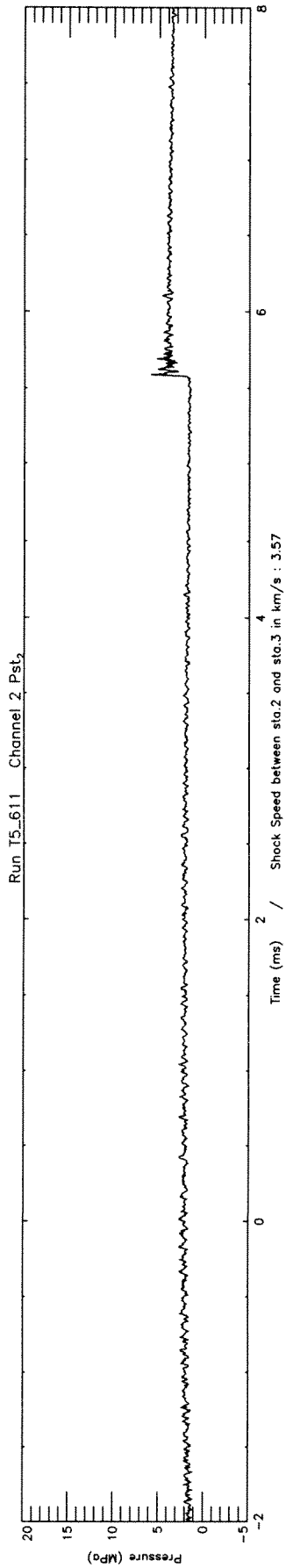
DA1	:	0.5320
DA2	:	0.2147
DA3	:	0.0548
DA4	:	0.0494
DA5	:	0.0587
DA6	:	0.0542
DA7	:	0.0532
DA8	:	0.0447
DA9	:	0.0482

Run # 610

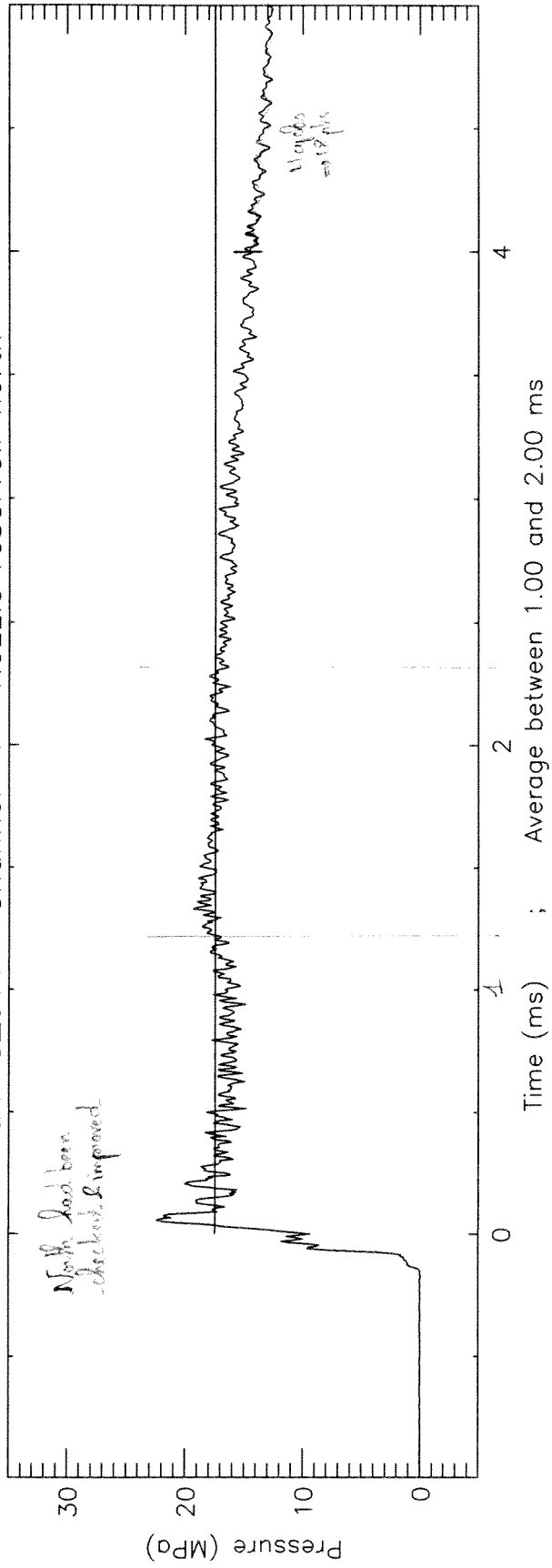
Heat Transfer Rates (in MW/m²)
averaged around 1.50 +/- 0.50 ms

MT 1 :	9.5847
MT 2 :	7.3051
MT 3 :	5.8301
MT 4 :	2.7389
MT 5 :	0.8249
MT 6 :	0.6901
MT 7 :	0.6240
MT 8 :	0.5943
MT 9 :	0.4248
MT10 :	0.4376
MT11 :	0.4114
MT12 :	0.4022

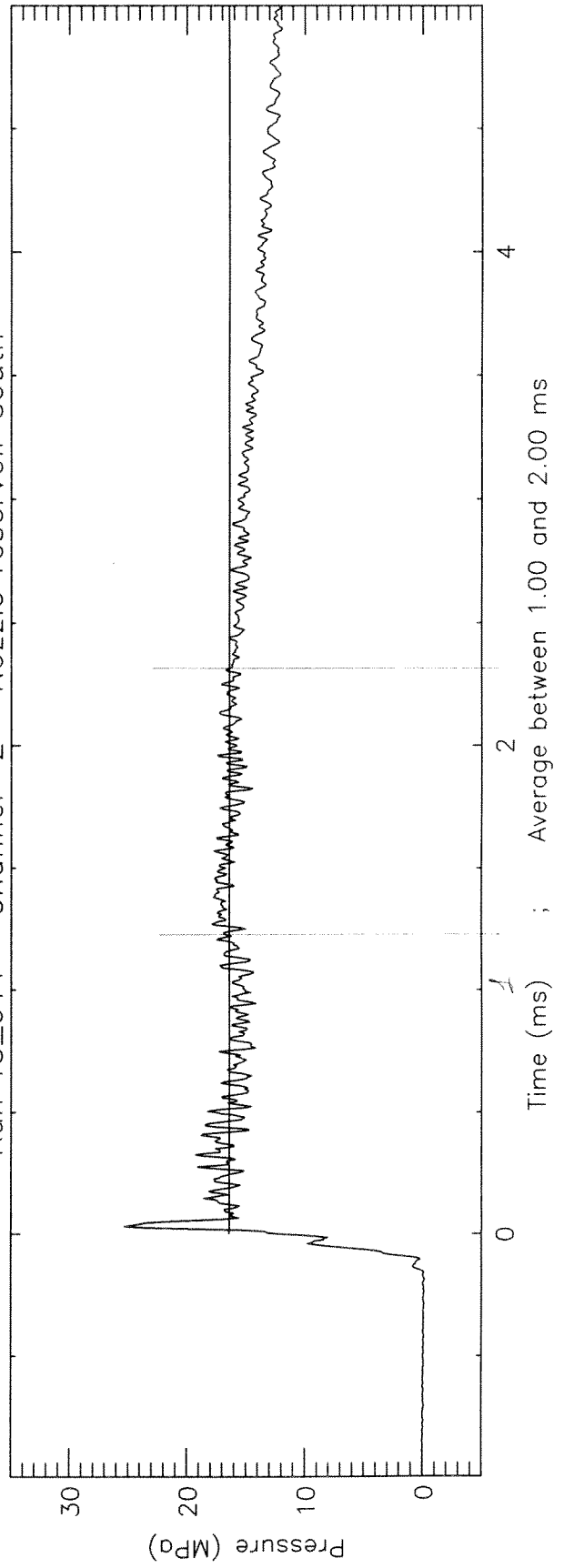




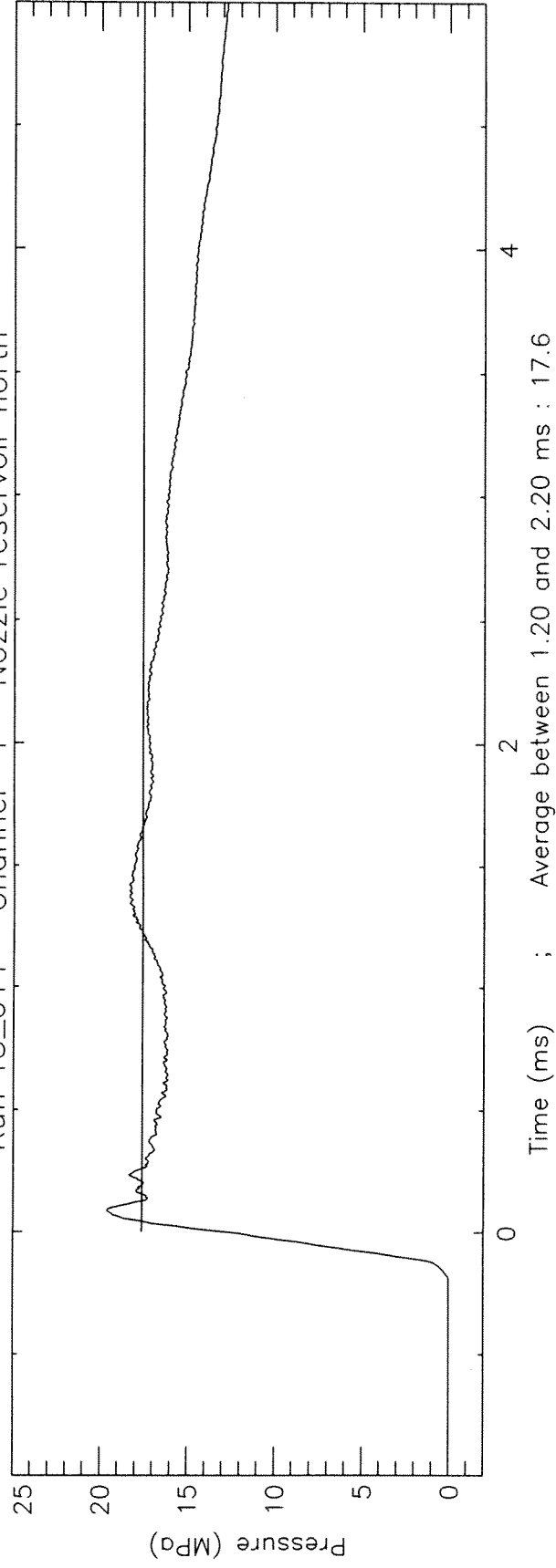
Run T5_611 Channel 1 Nozzle reservoir north



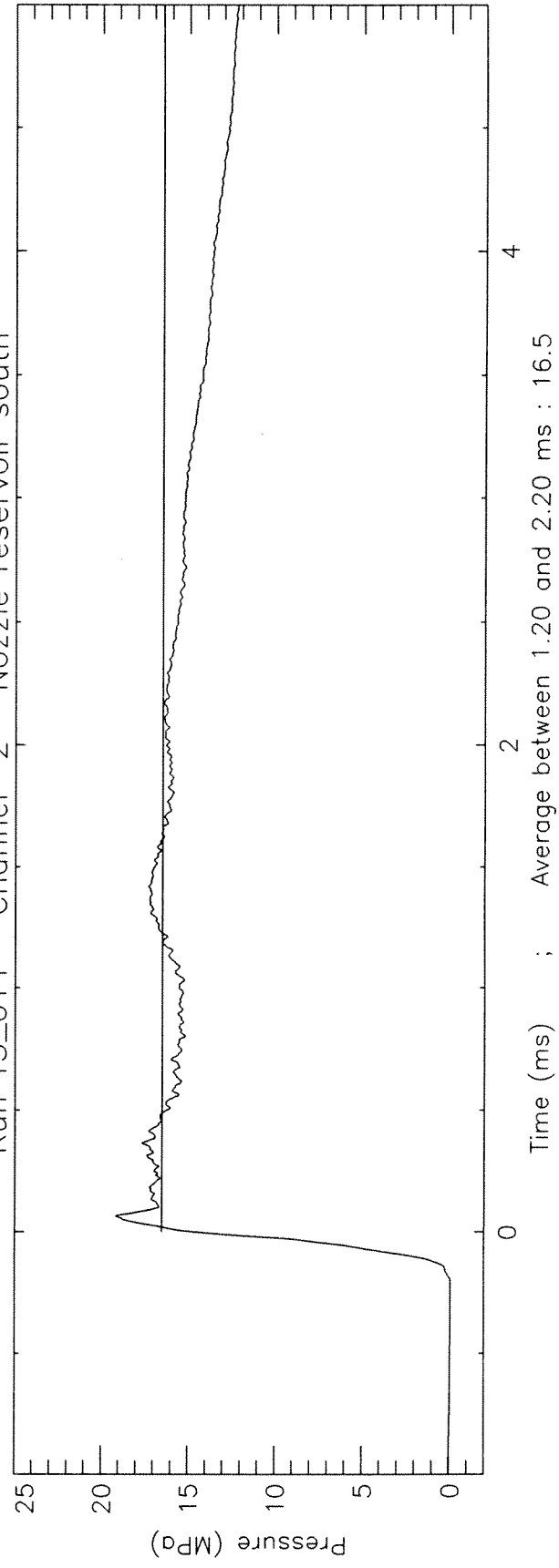
Run T5_611 Channel 2 Nozzle reservoir south



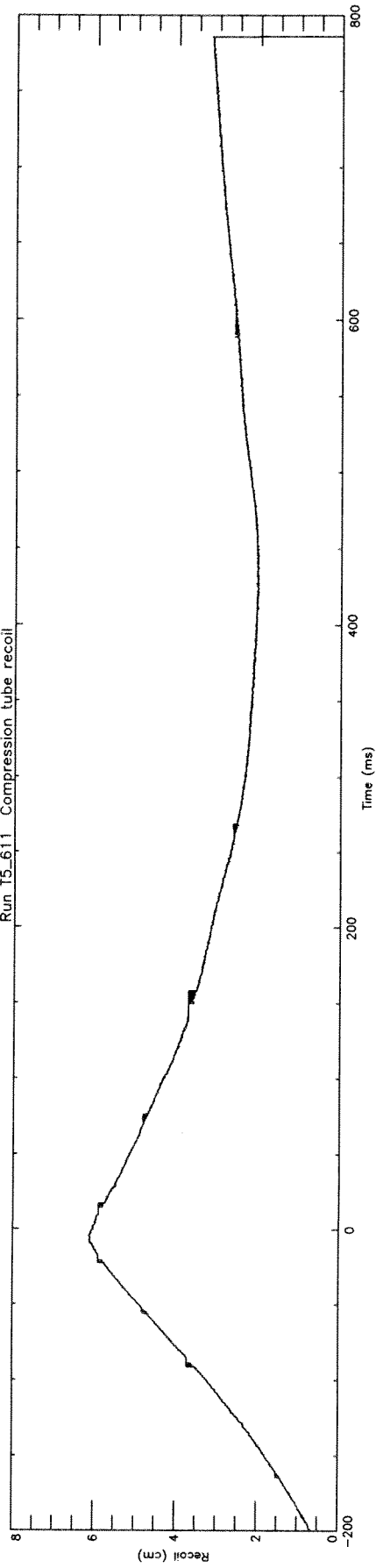
Run T5_611 Channel 1 Nozzle reservoir north



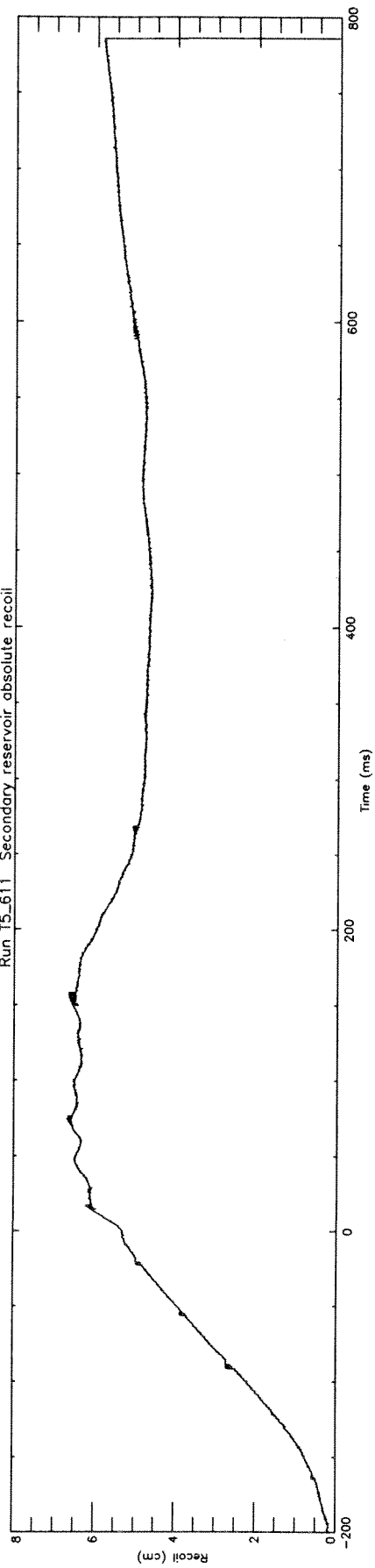
Run T5_611 Channel 2 Nozzle reservoir south



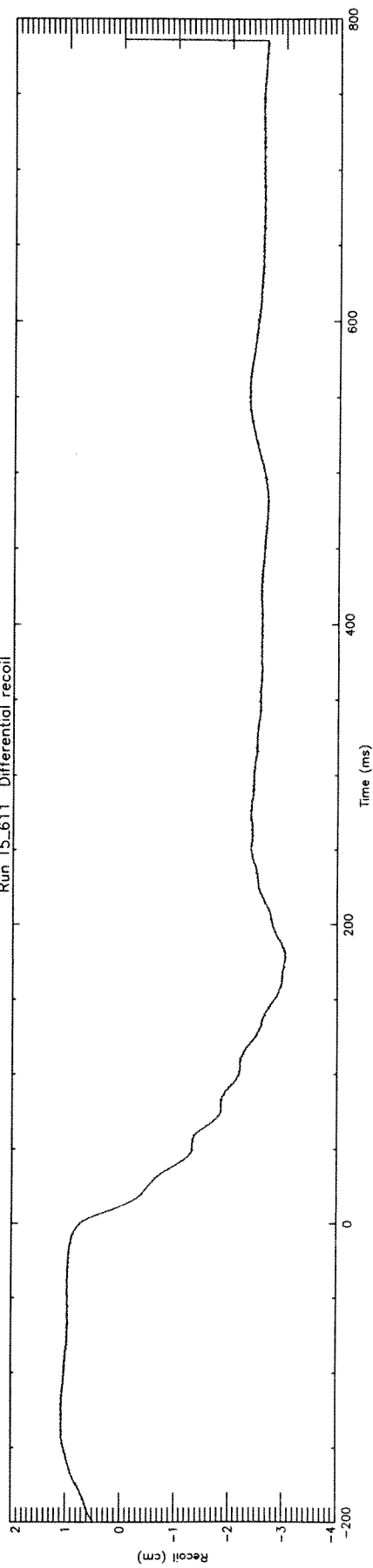
Run T5_611 Compression tube recoil



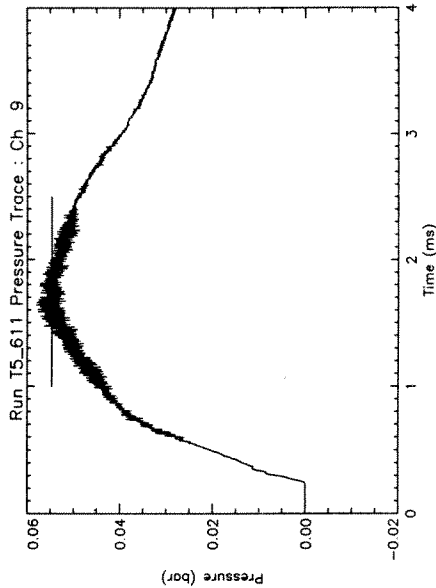
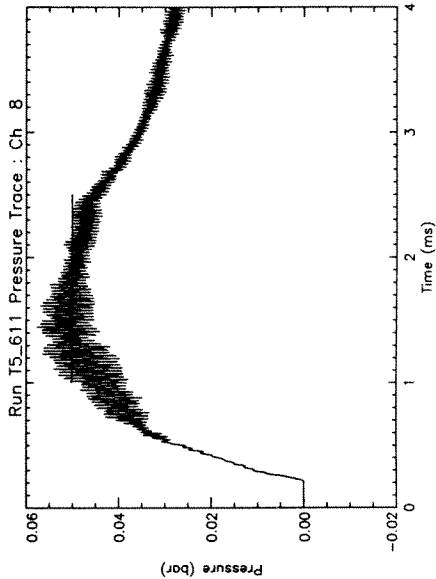
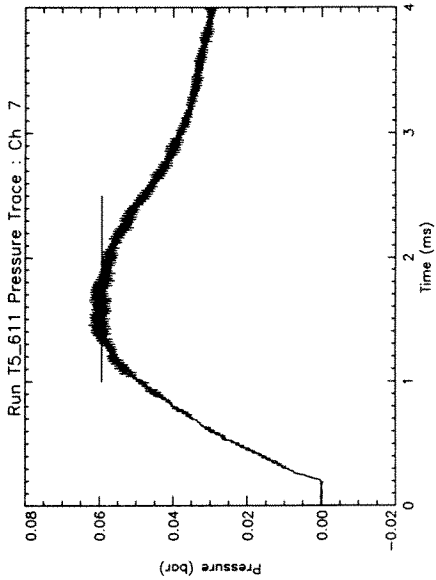
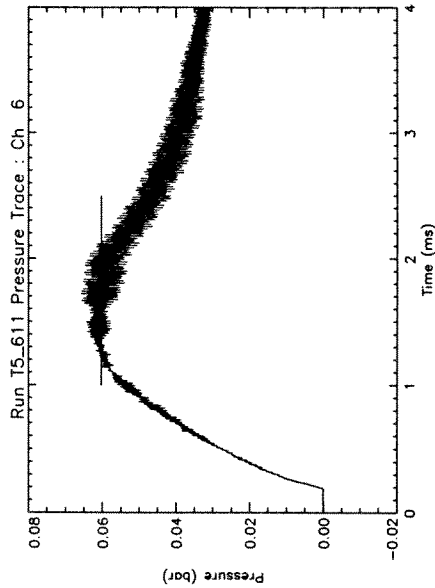
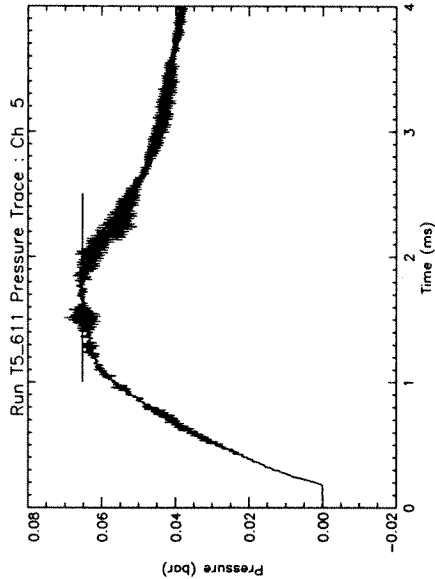
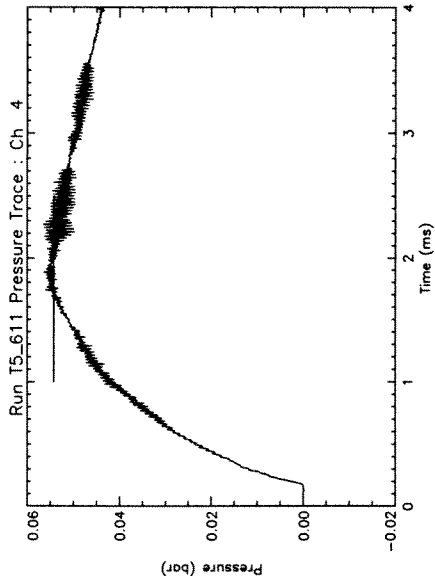
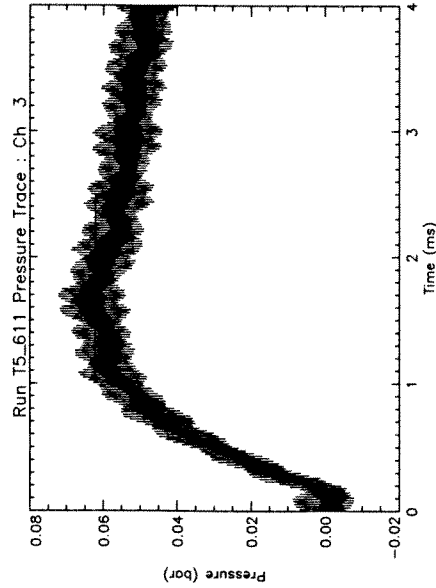
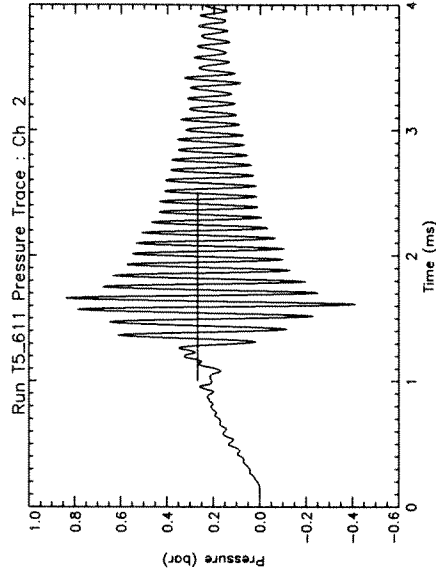
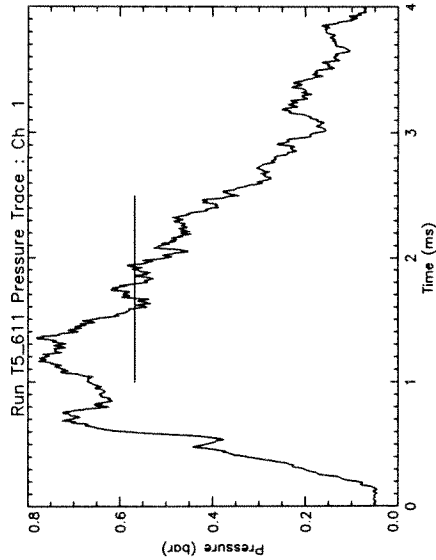
Run T5_611 Secondary reservoir absolute recoil

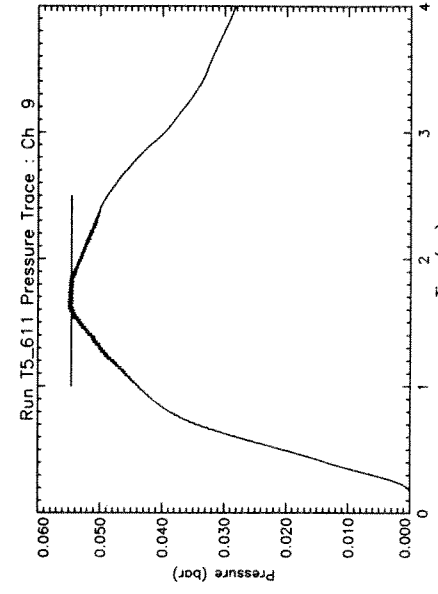
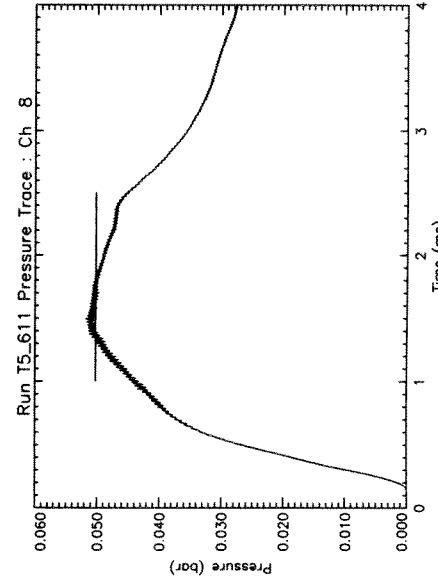
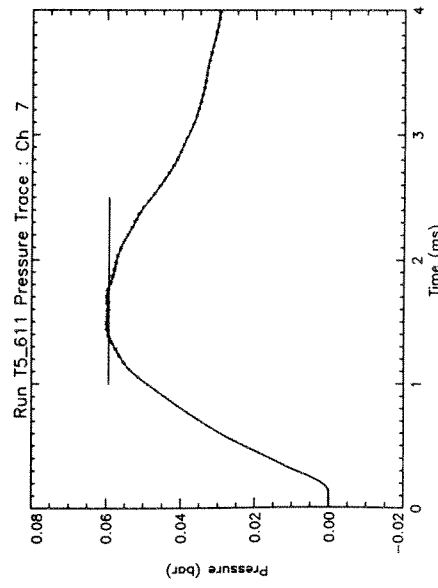
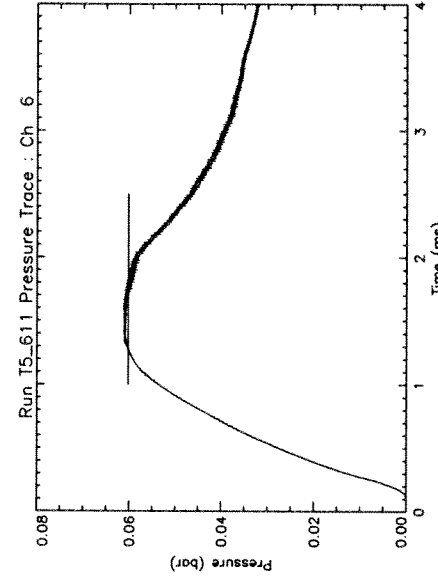
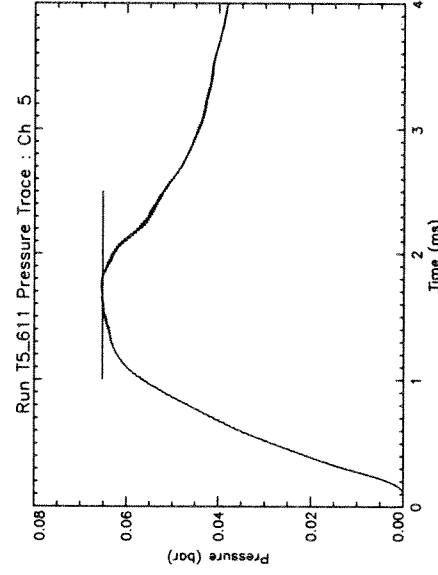
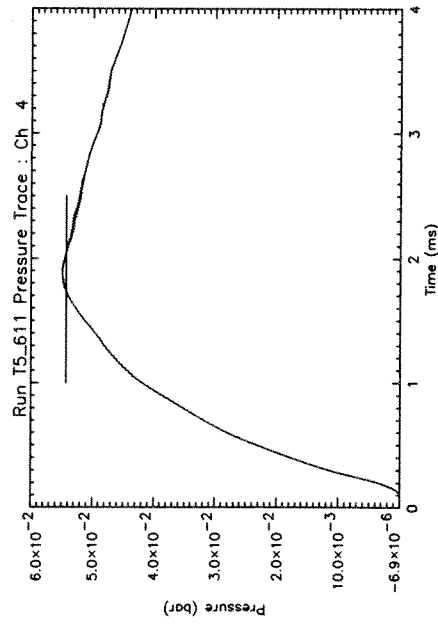
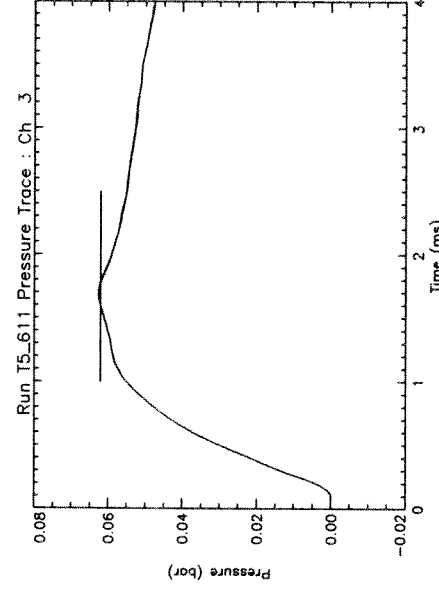
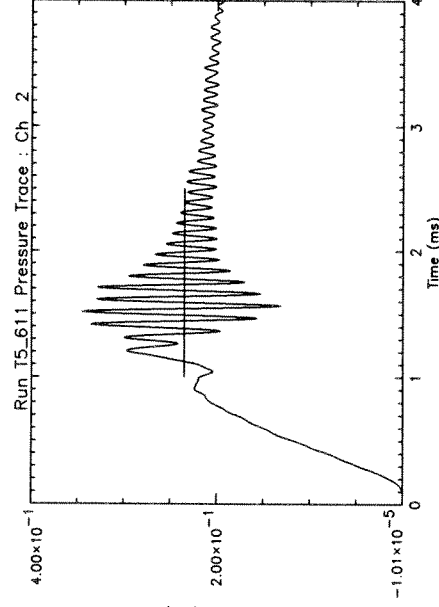
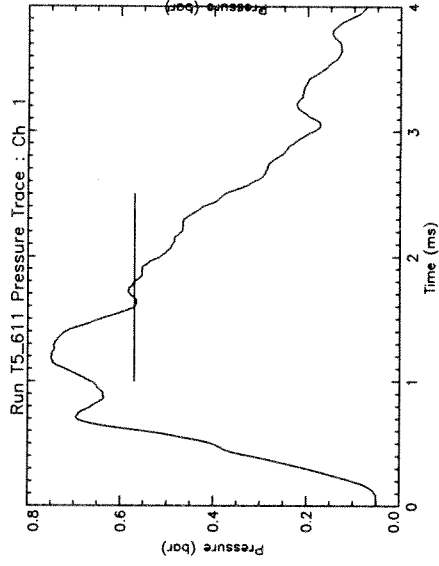


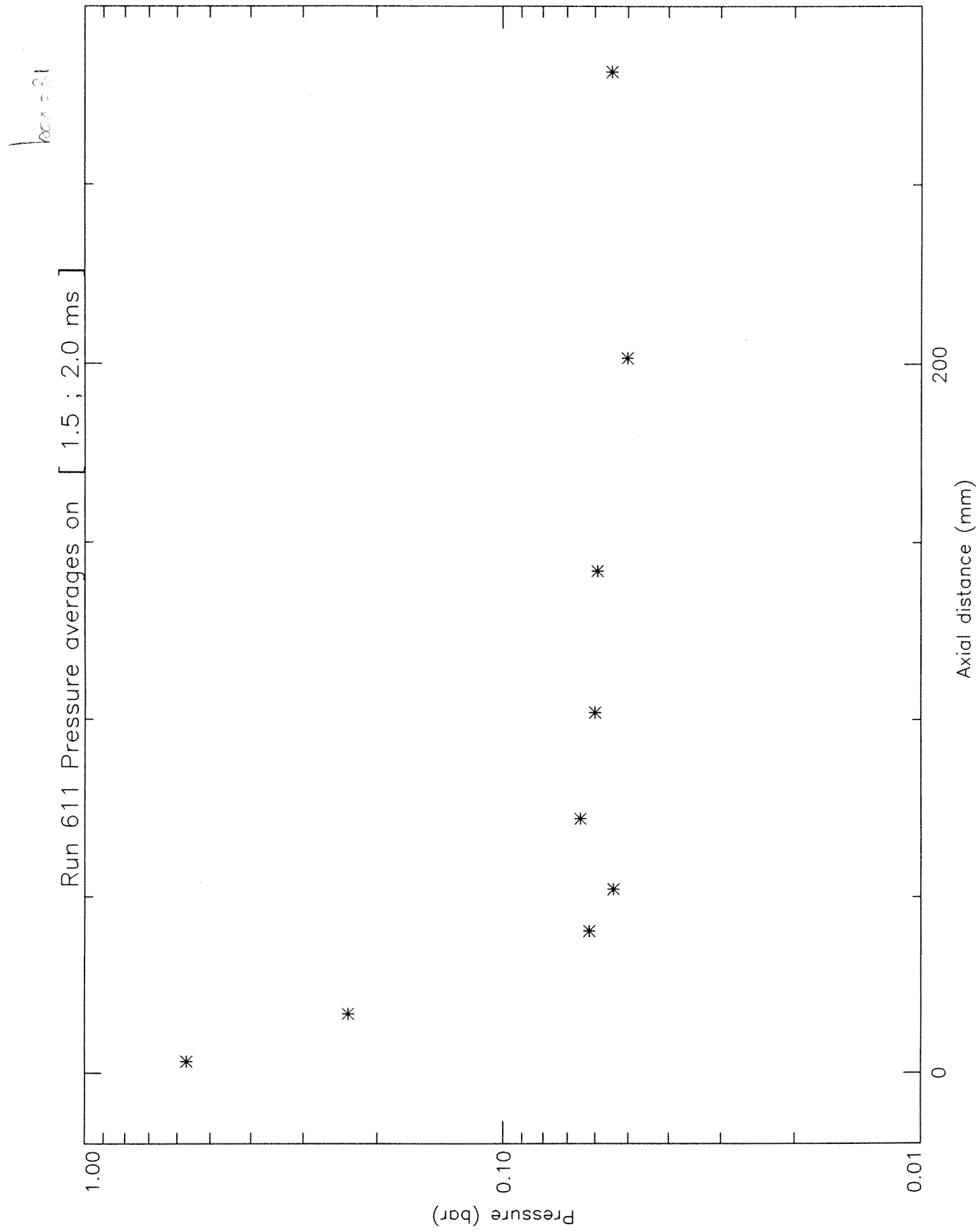
Run T5_611 Differential recoil



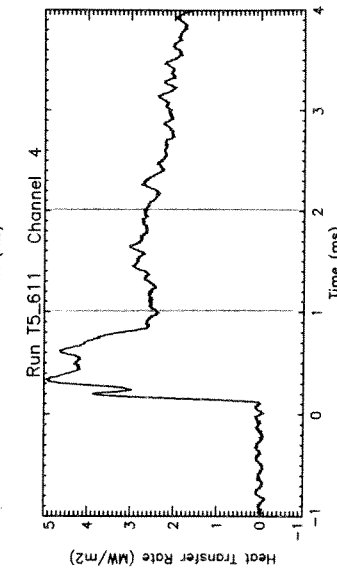
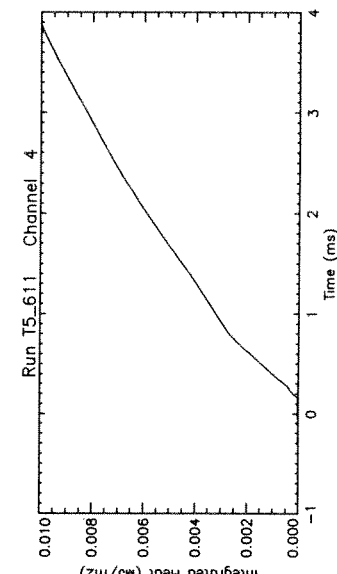
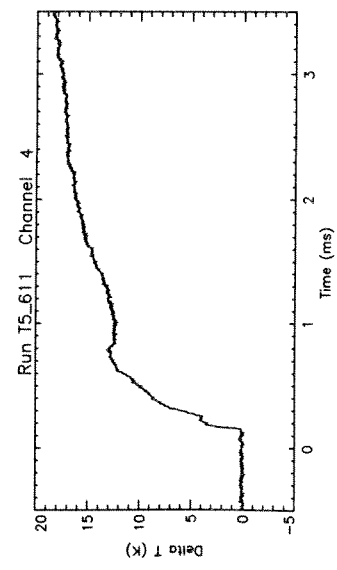
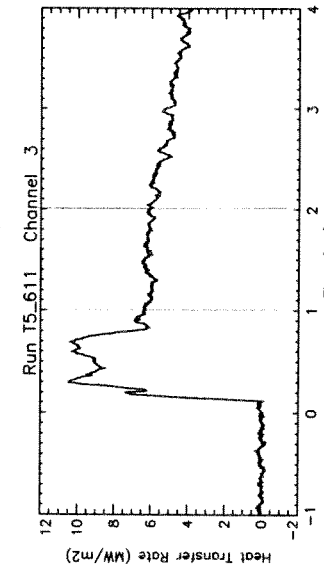
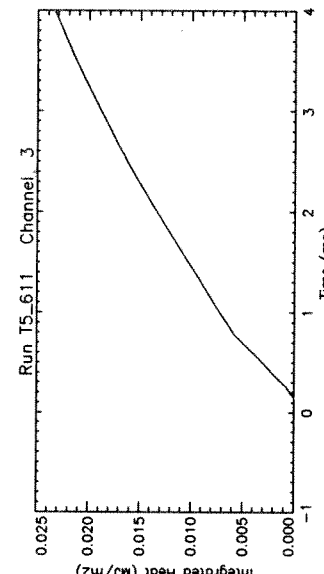
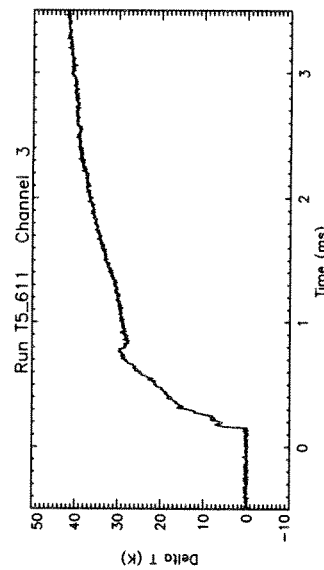
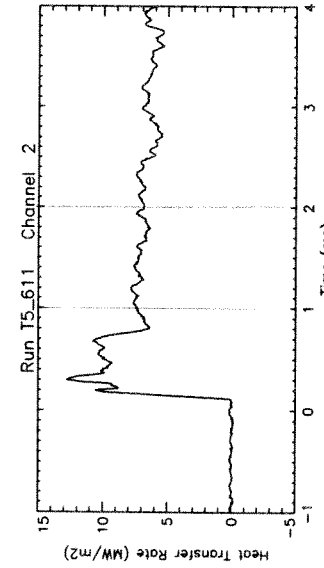
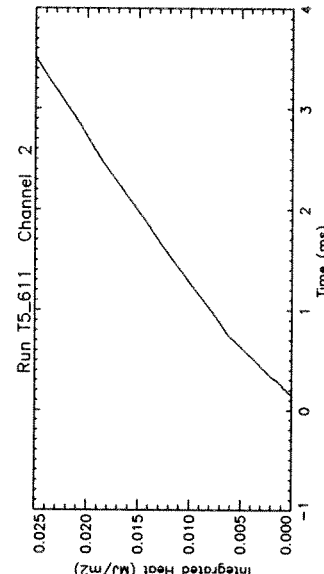
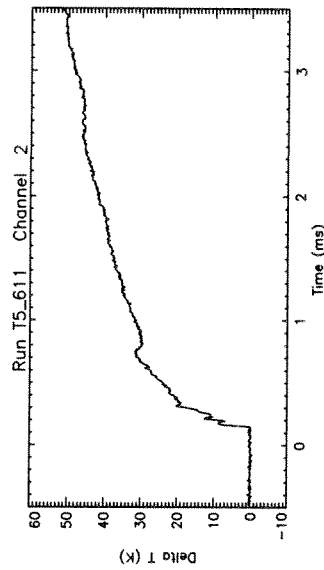
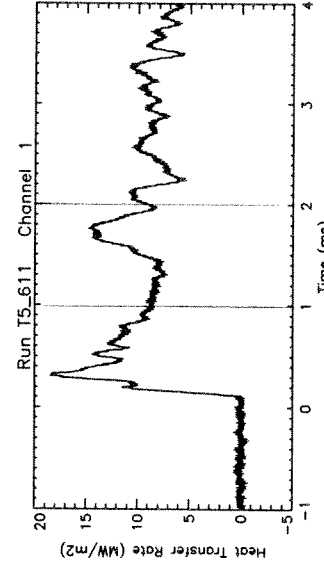
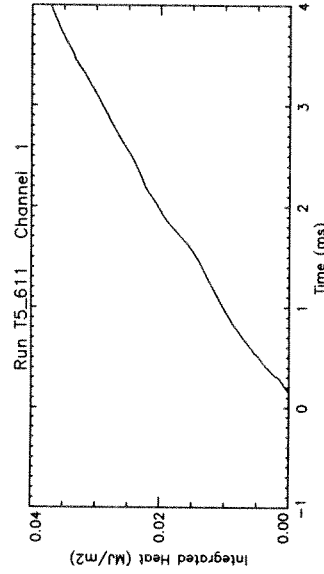
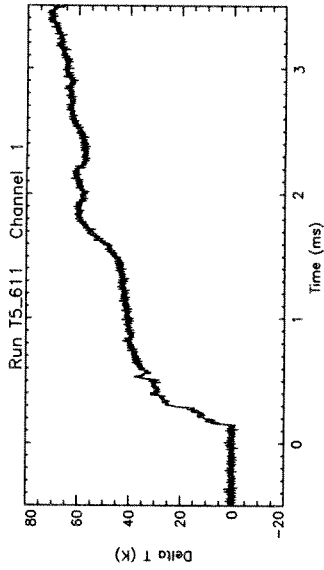
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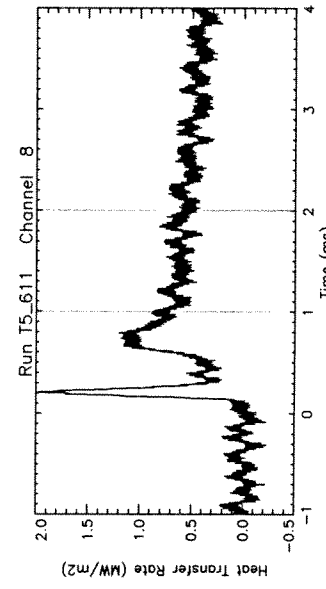
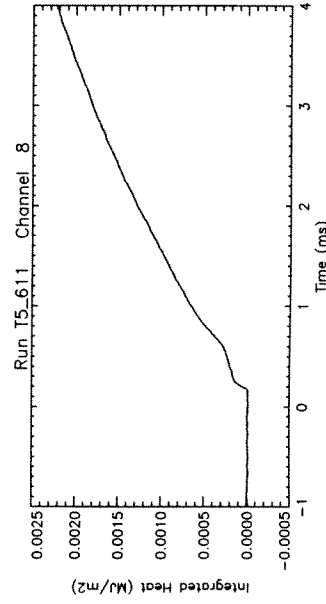
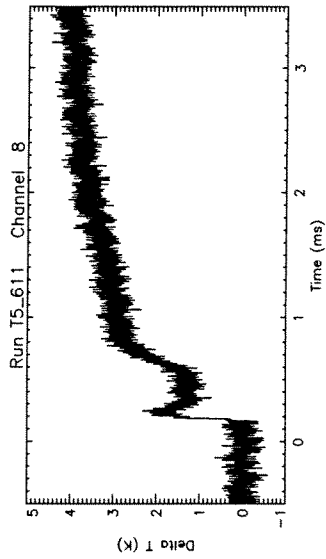
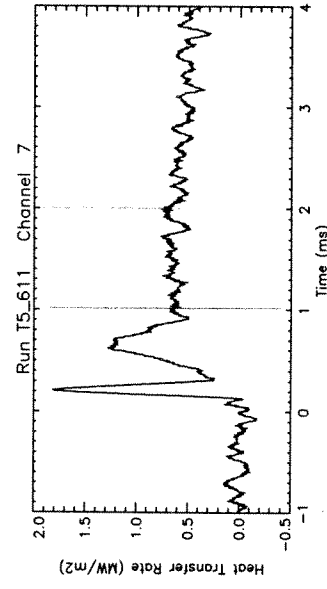
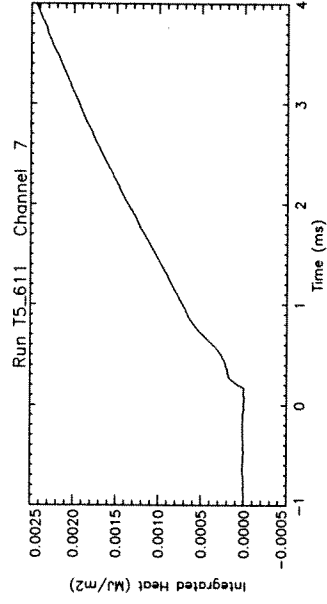
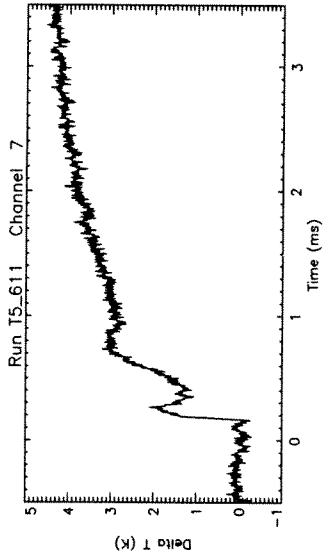
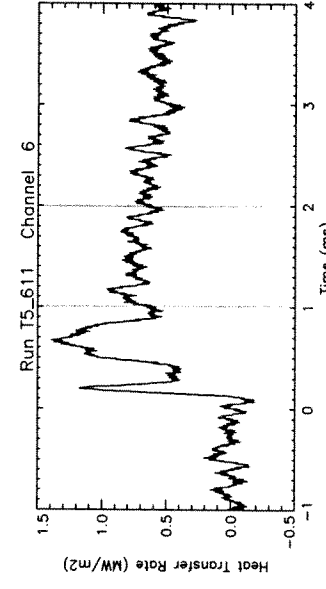
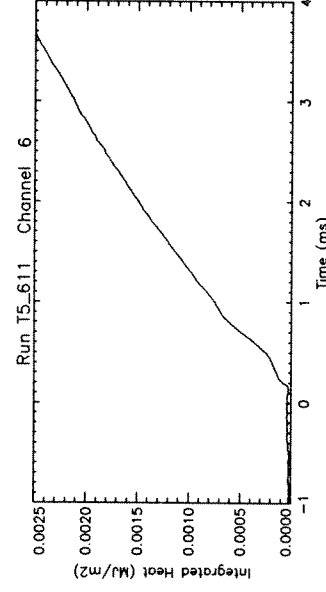
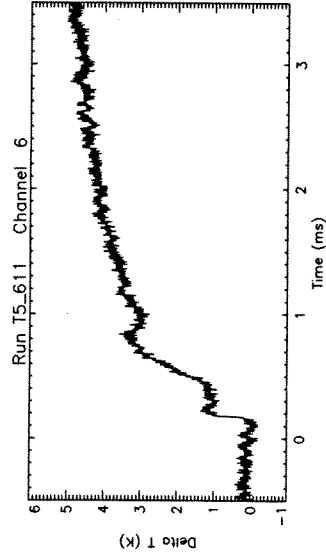
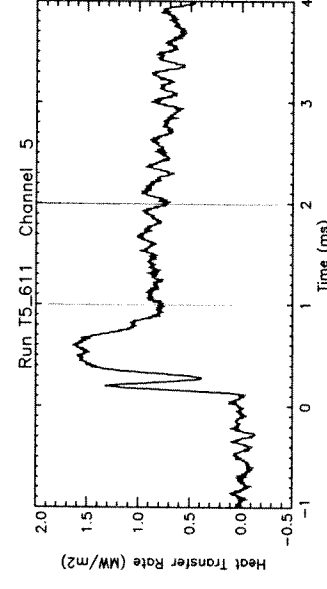
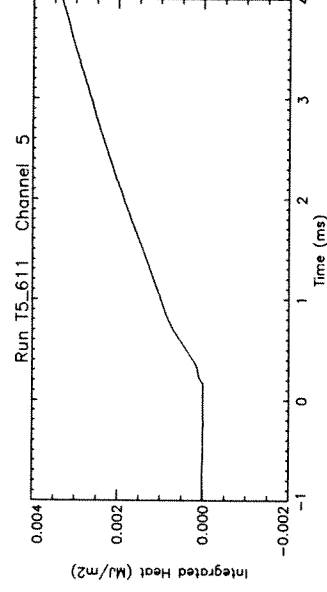
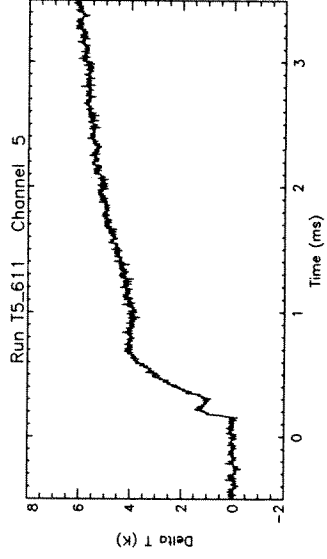


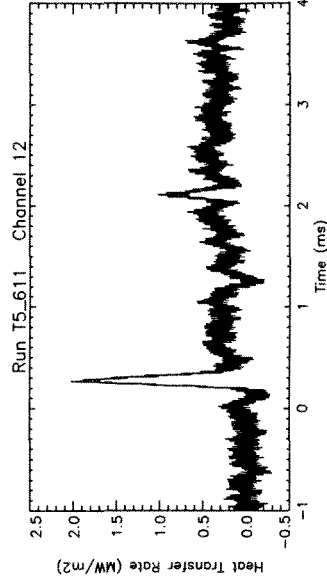
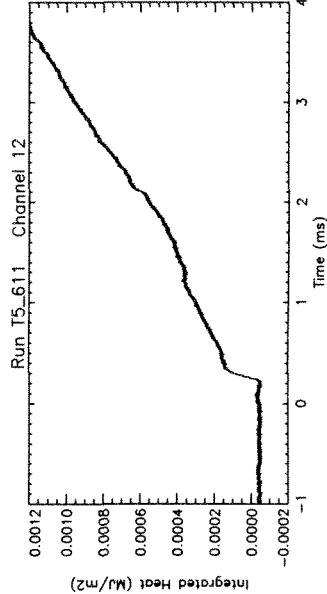
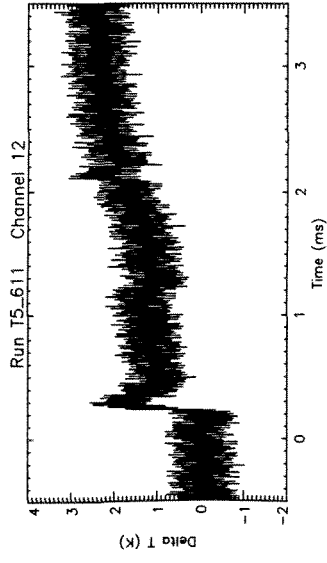
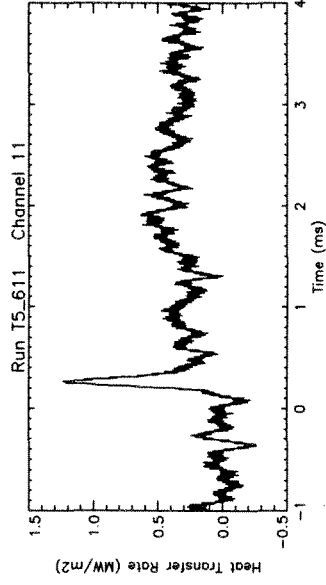
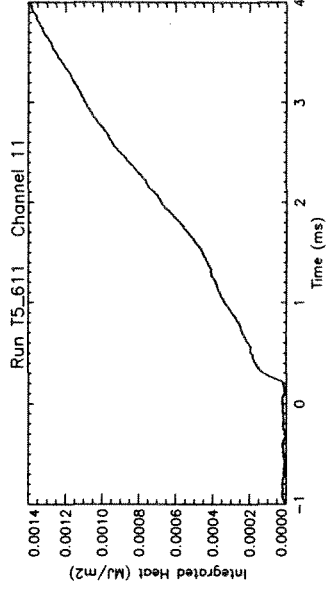
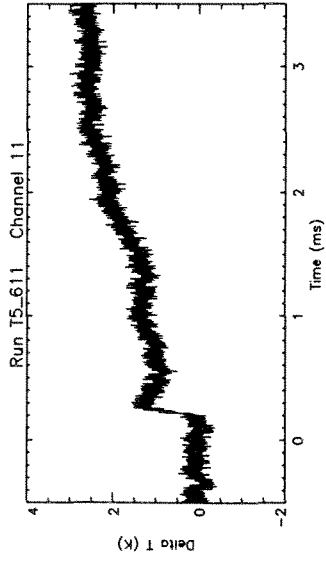
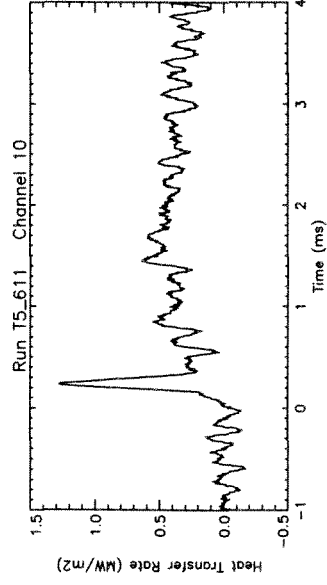
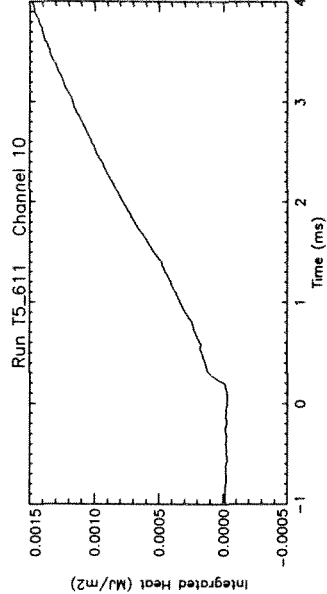
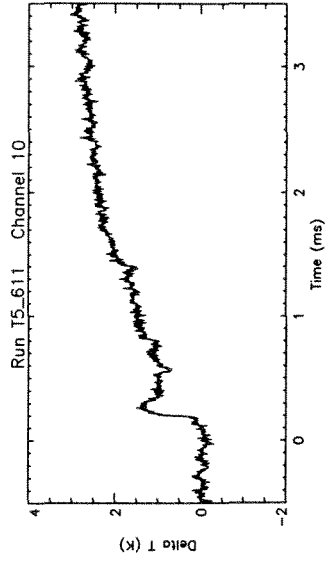
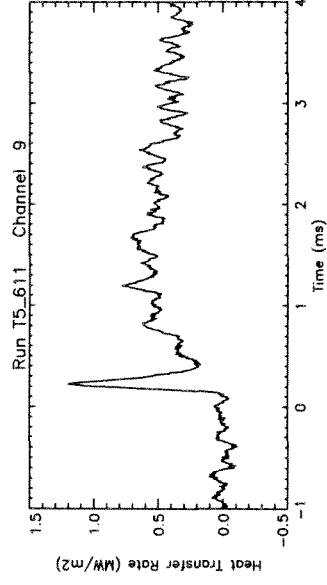
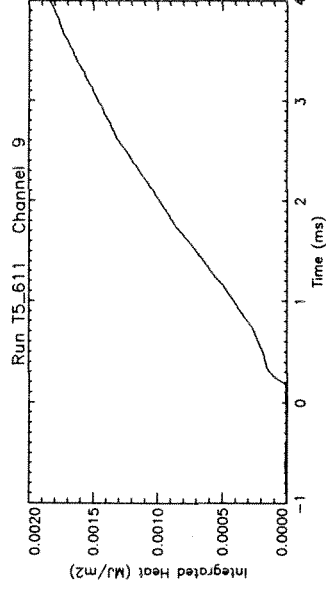
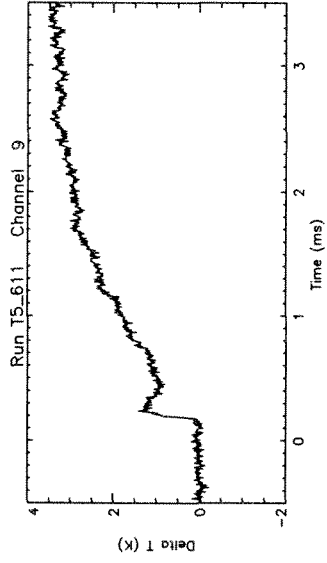


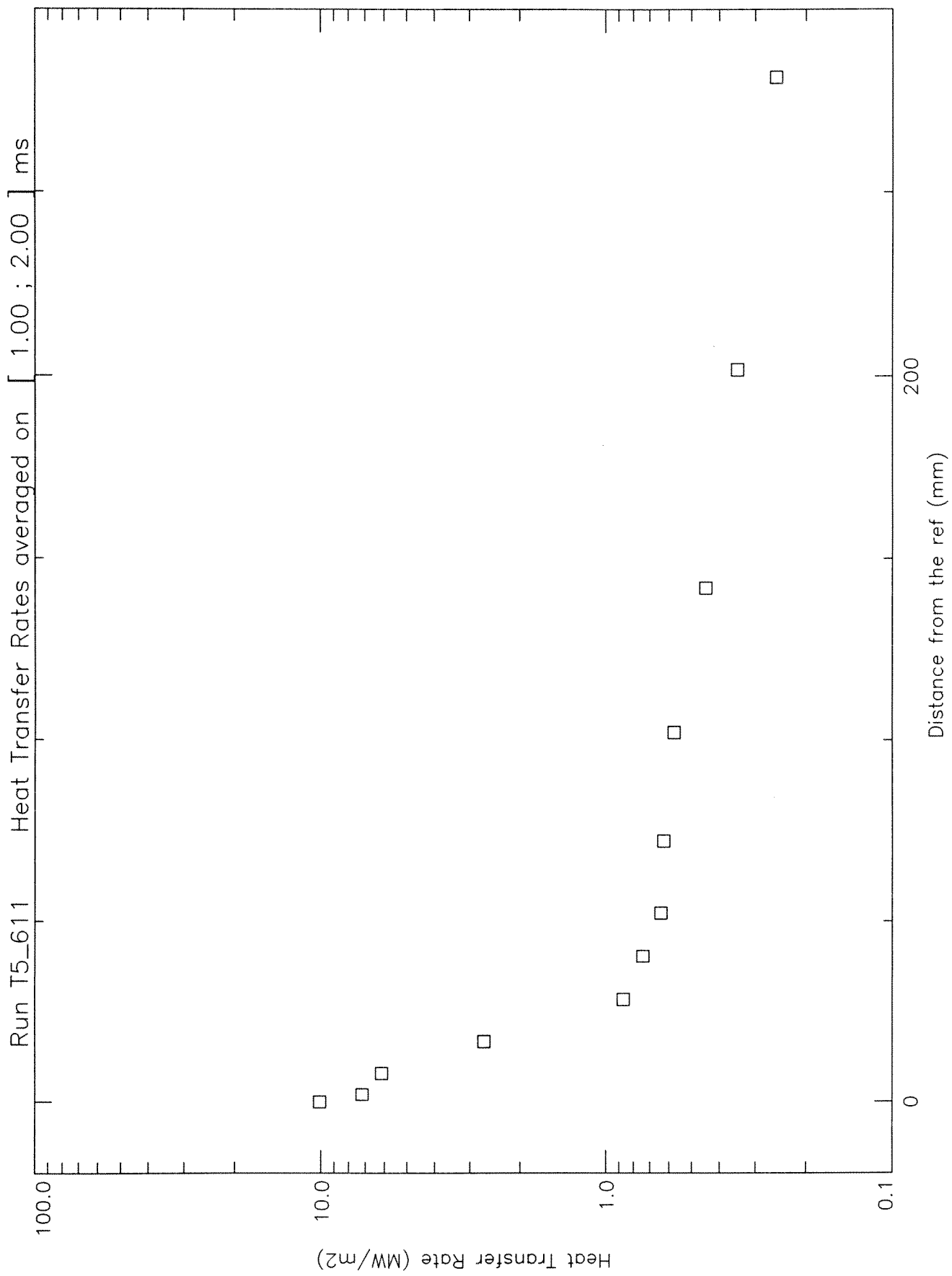


one of 9/12/601
7/1/8.01









Run # 611

Pressure averages around 1.75 +/- 0.25 ms

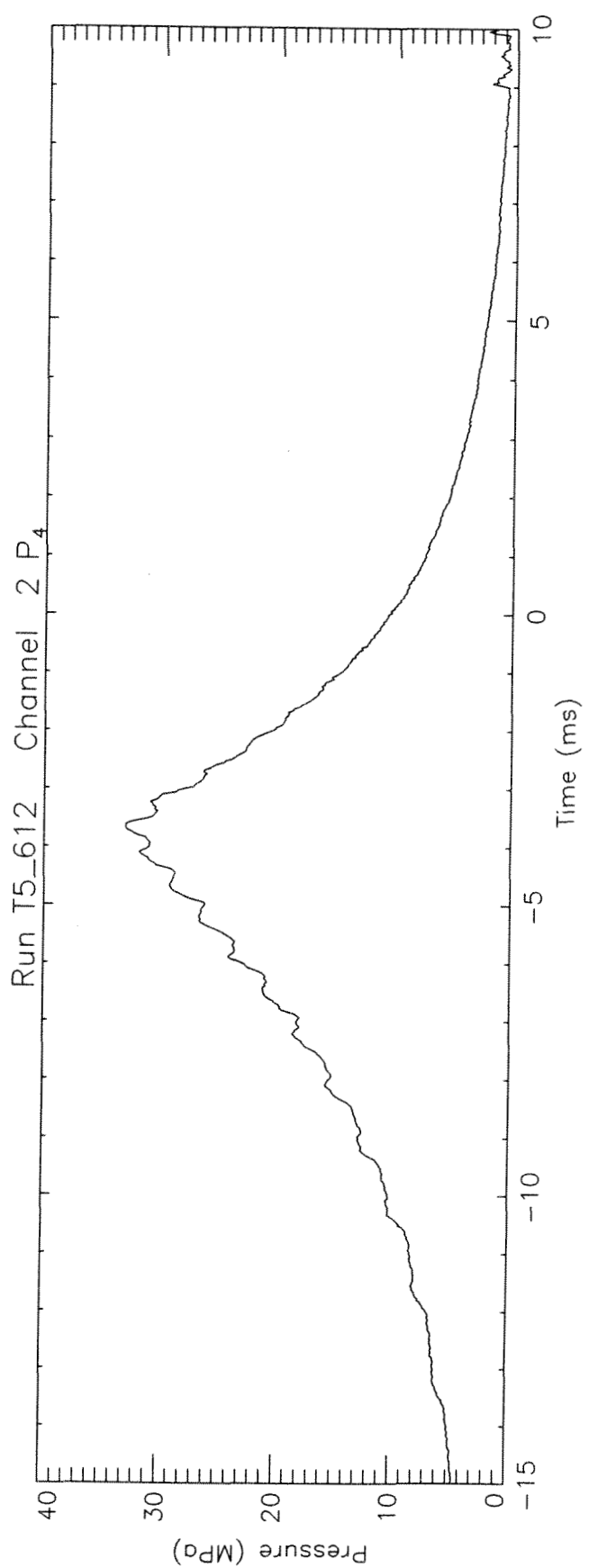
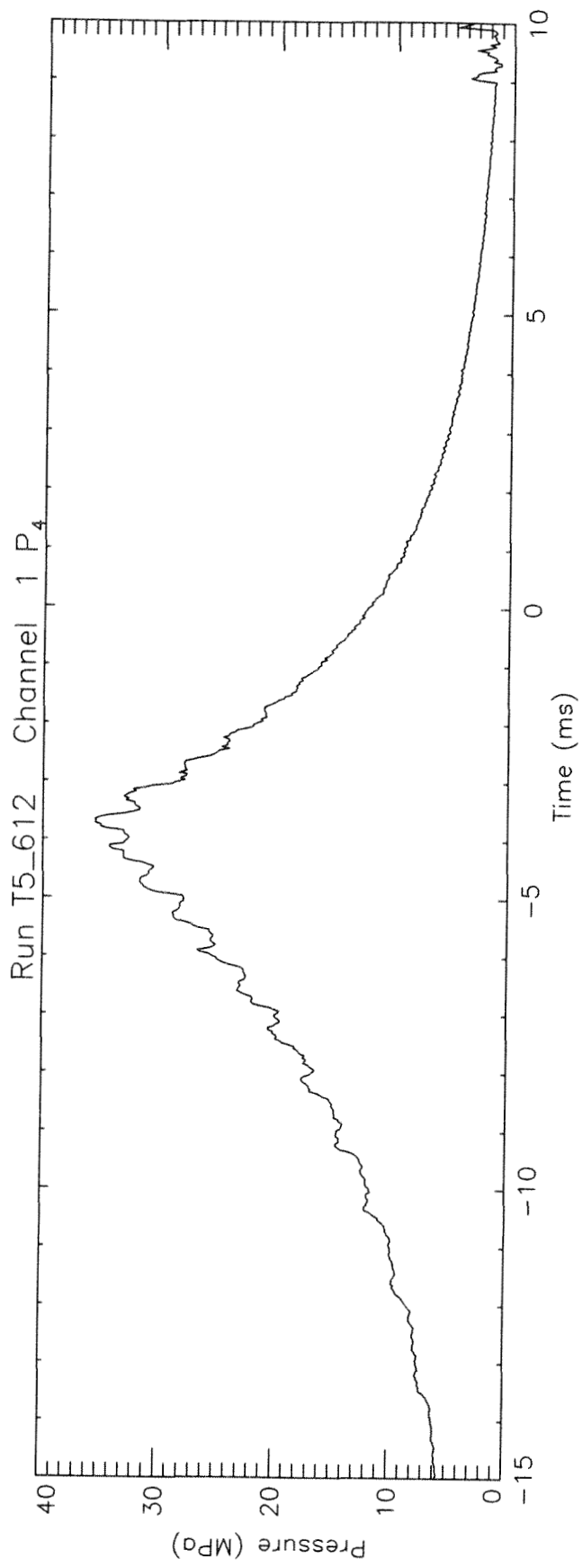
Smooth box = 2.

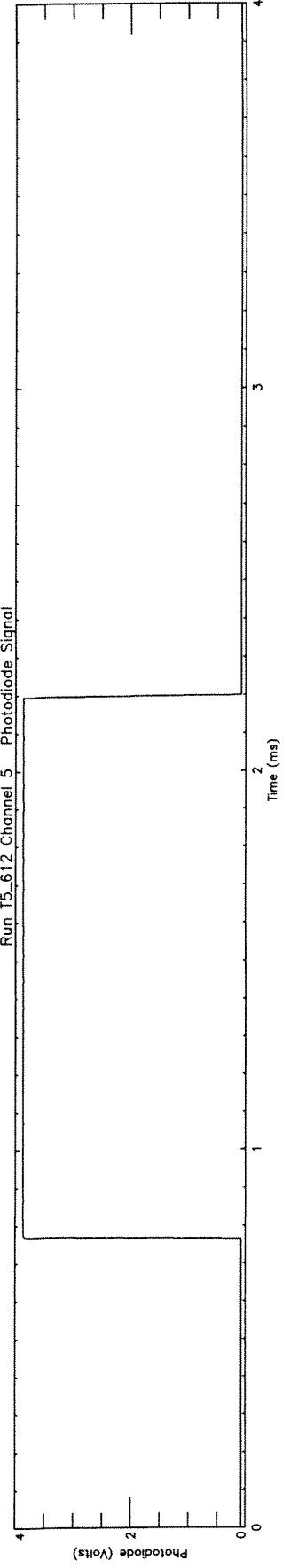
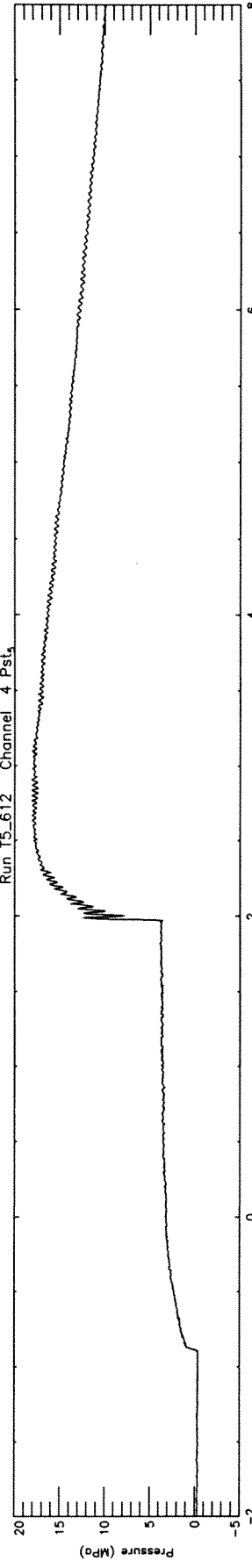
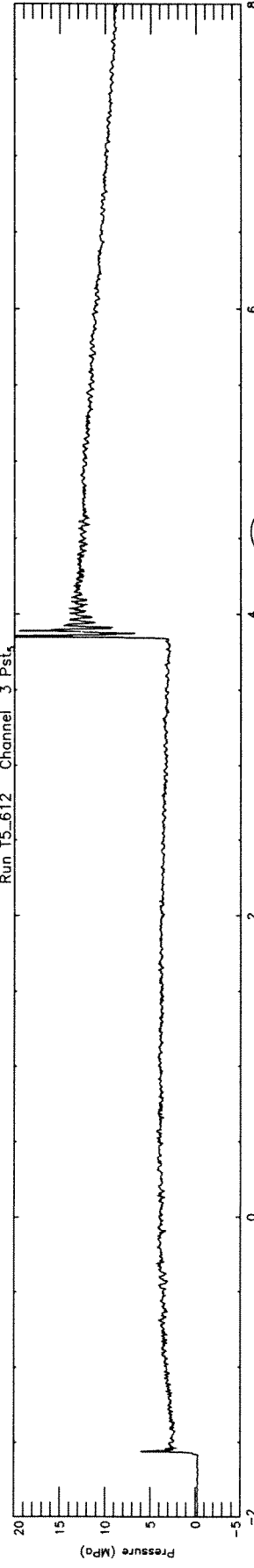
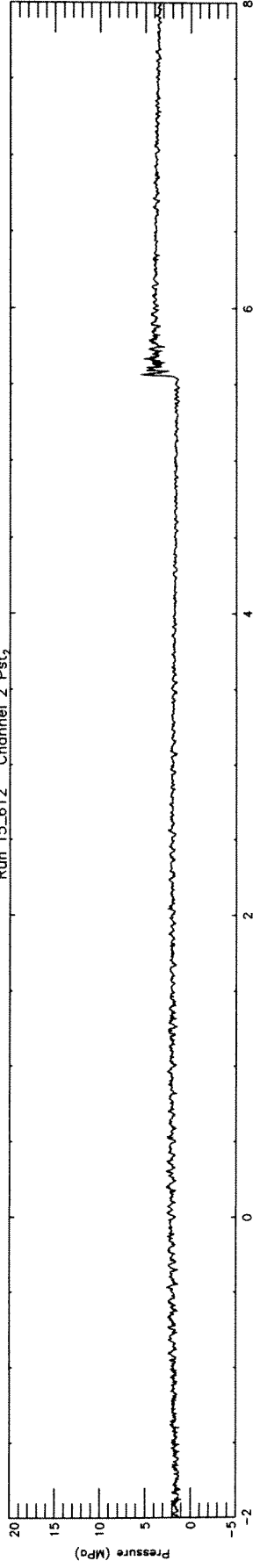
DA1	:	0.5680
DA2	:	0.2684
DA3	:	0.0622
DA4	:	0.0542
DA5	:	0.0653
DA6	:	0.0603
DA7	:	0.0593
DA8	:	0.0501
DA9	:	0.0547

Run # 611

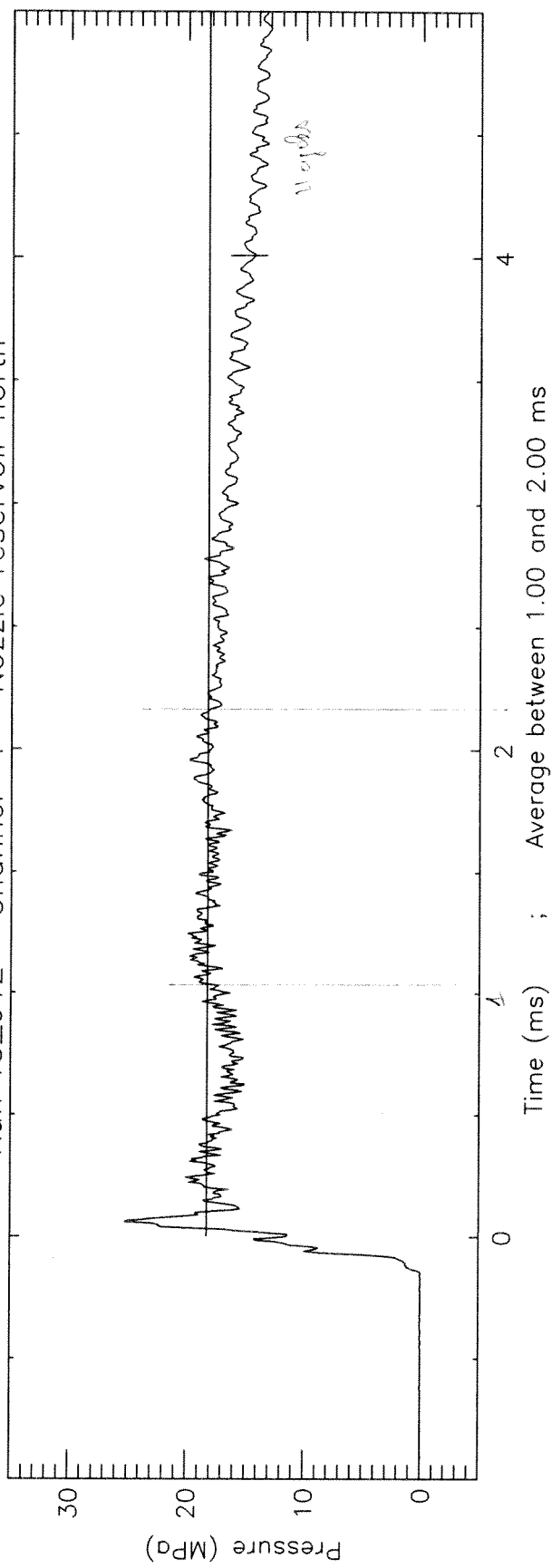
Heat Transfer Rates (in MW/m²)
averaged around 1.50 +/- 0.50 ms

MT 1 :	10.0977
MT 2 :	7.1817
MT 3 :	6.1368
MT 4 :	2.6845
MT 5 :	0.8678
MT 6 :	0.7413
MT 7 :	0.6417
MT 8 :	0.6277
MT 9 :	0.5759
MT10 :	0.4466
MT11 :	0.3465
MT12 :	0.2541

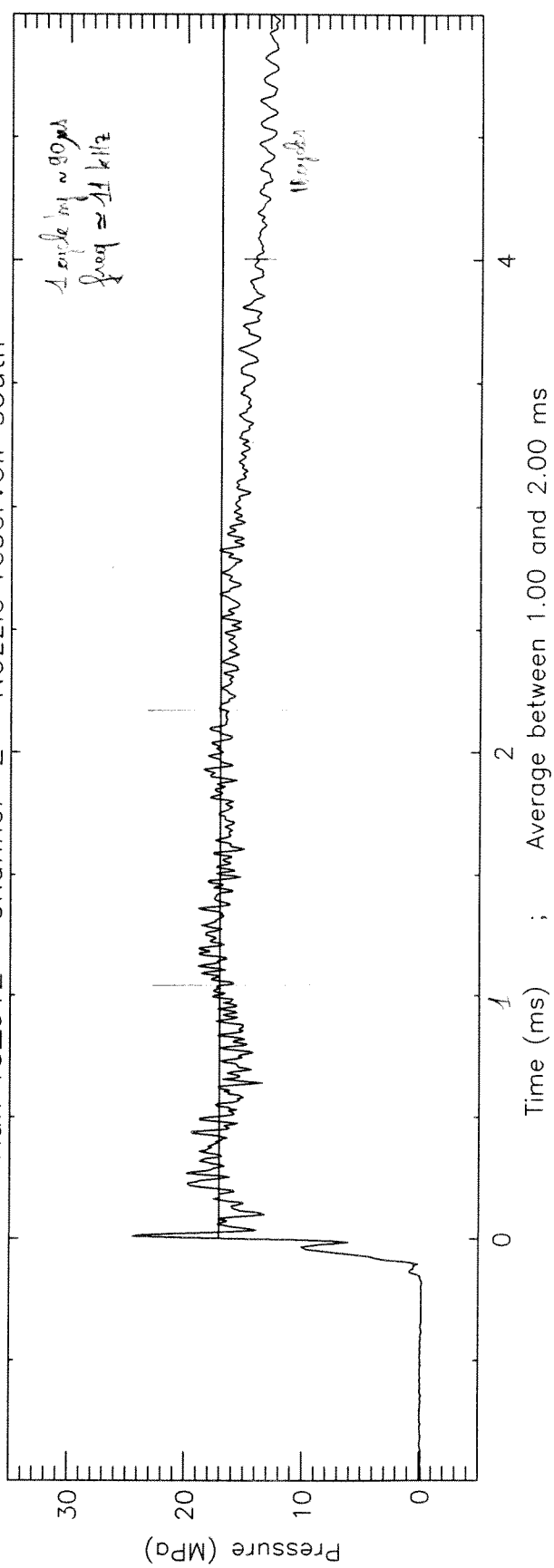




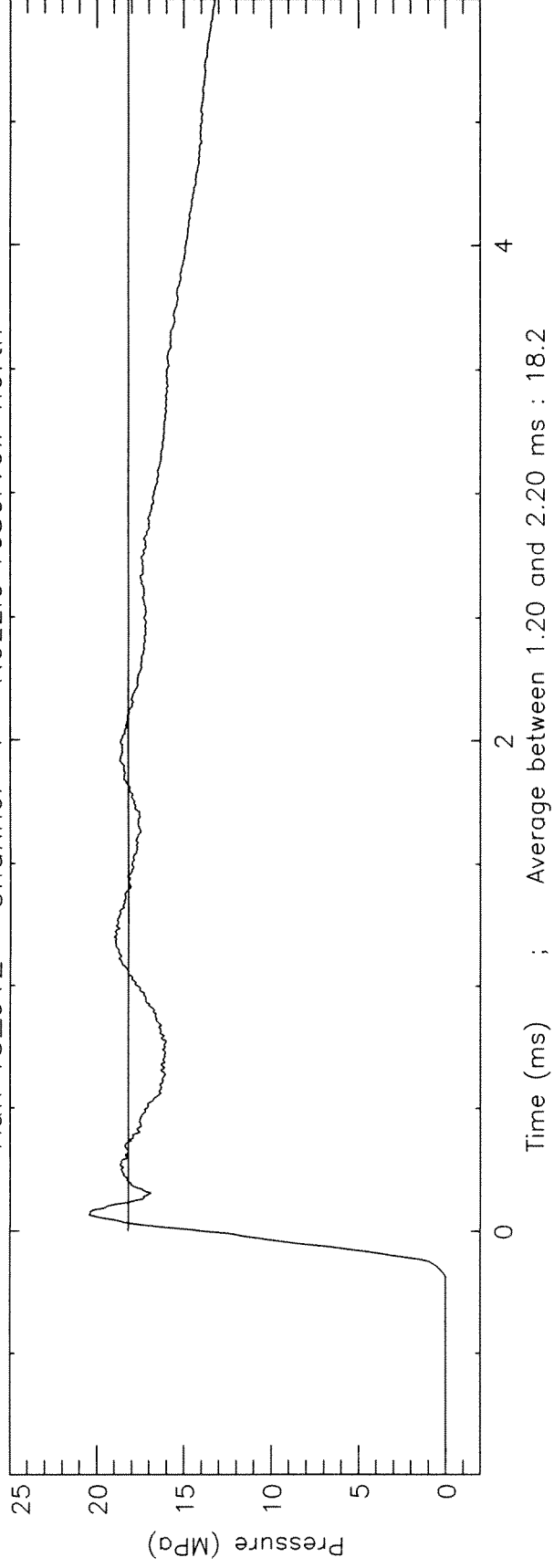
Run T5_612 Channel 1 Nozzle reservoir north



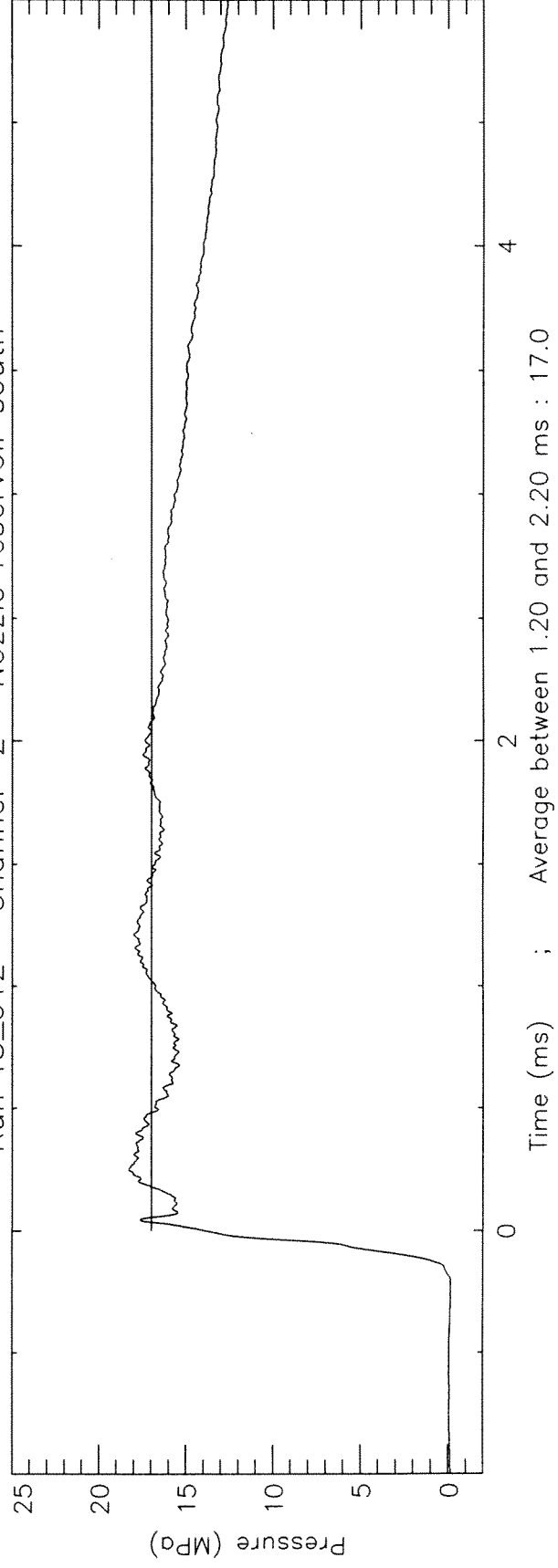
Run T5_612 Channel 2 Nozzle reservoir south

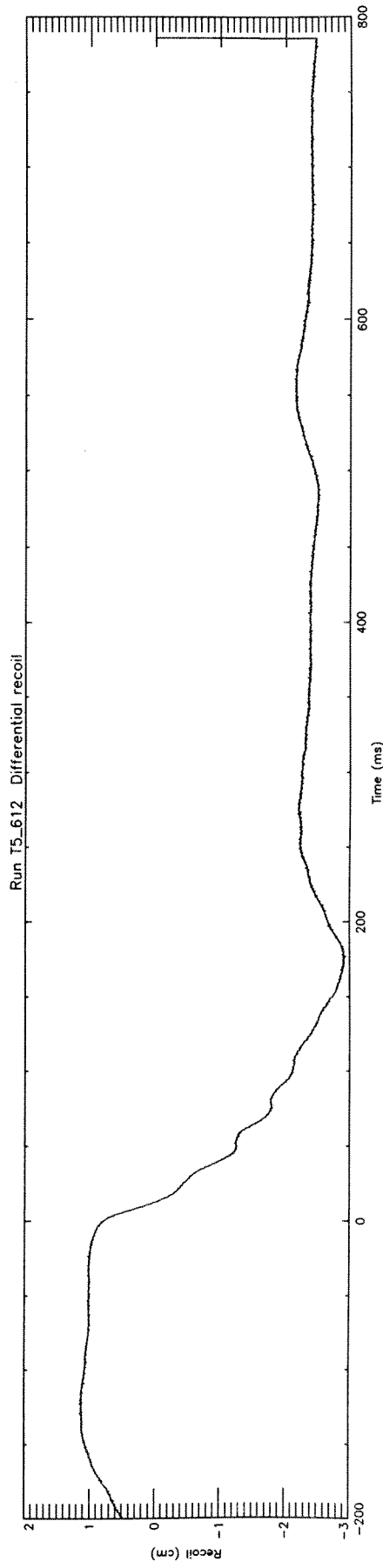
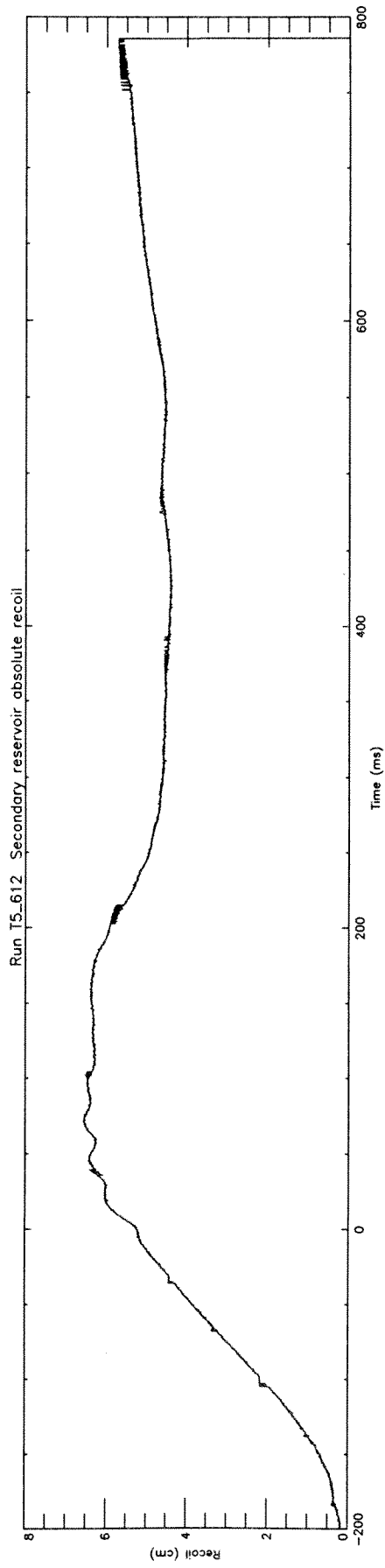
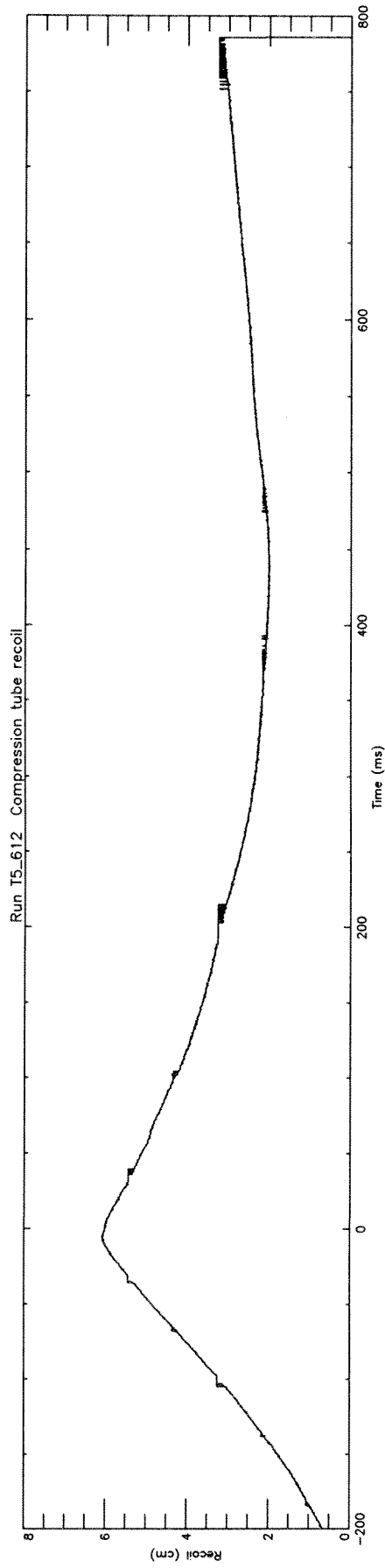


Run T5_612 Channel 1 Nozzle reservoir north

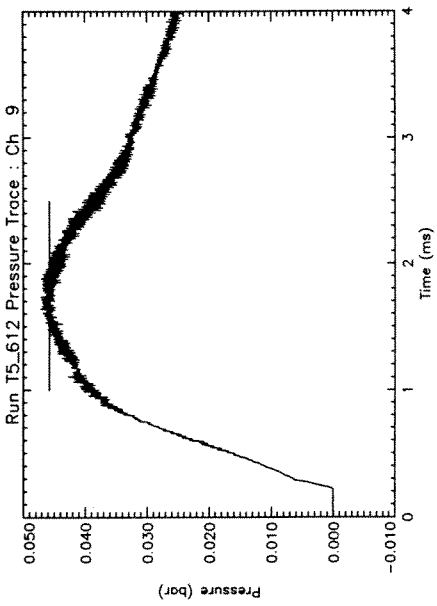
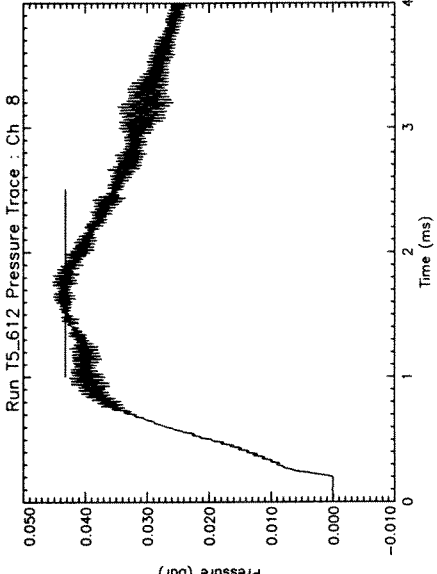
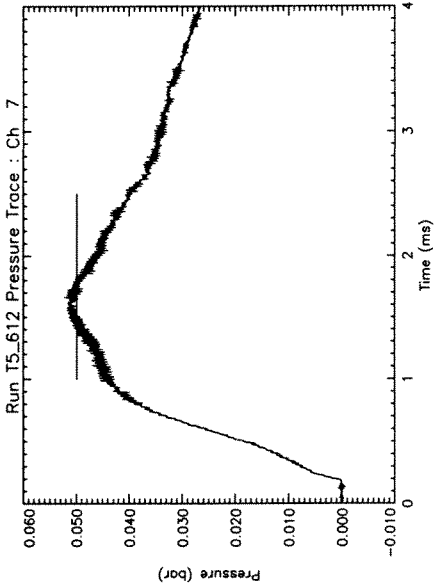
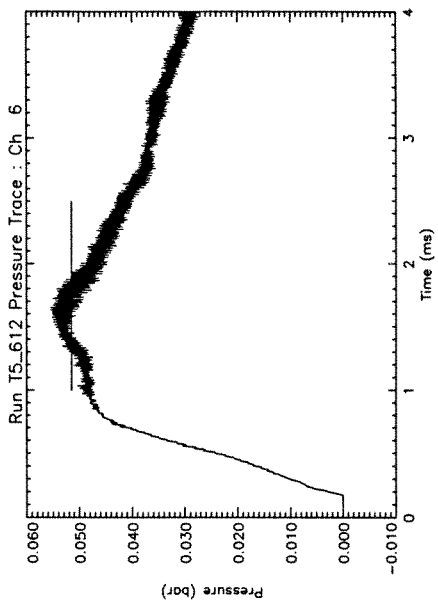
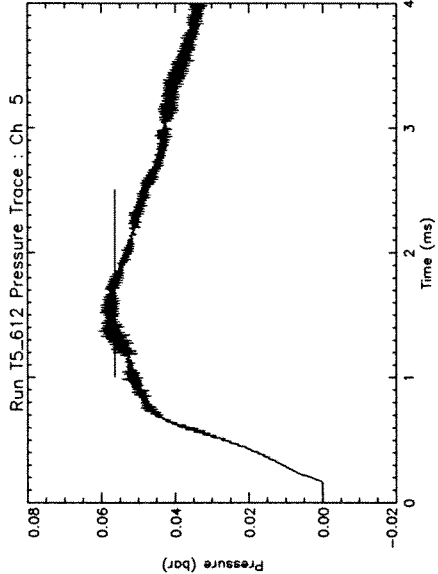
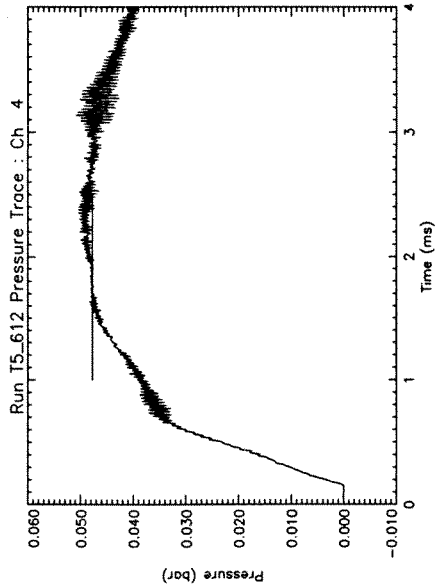
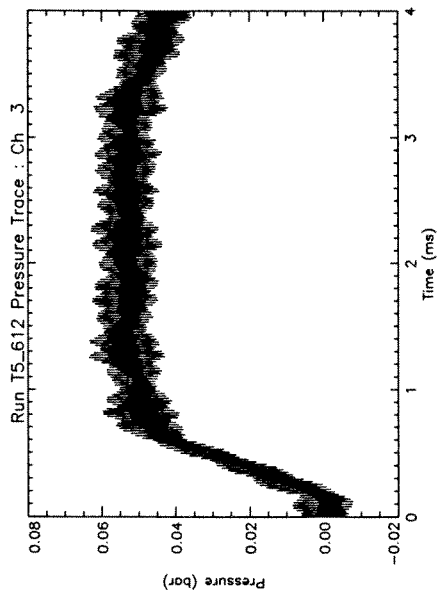
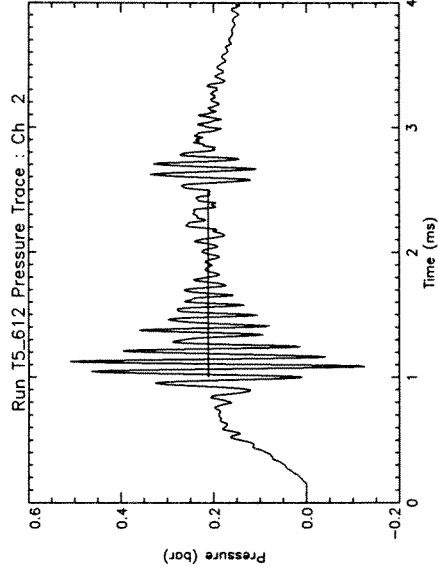
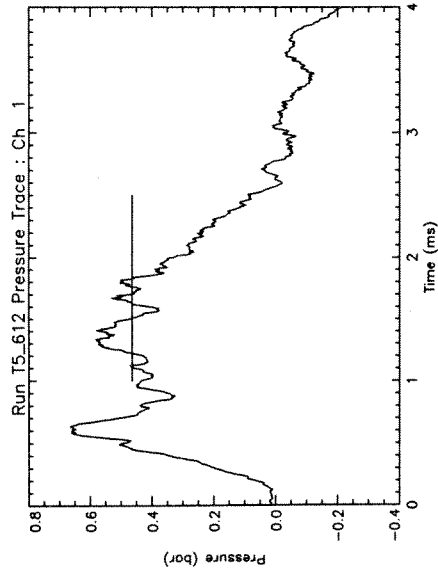


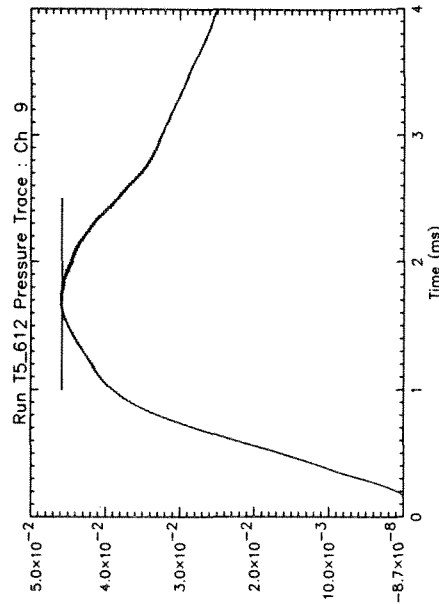
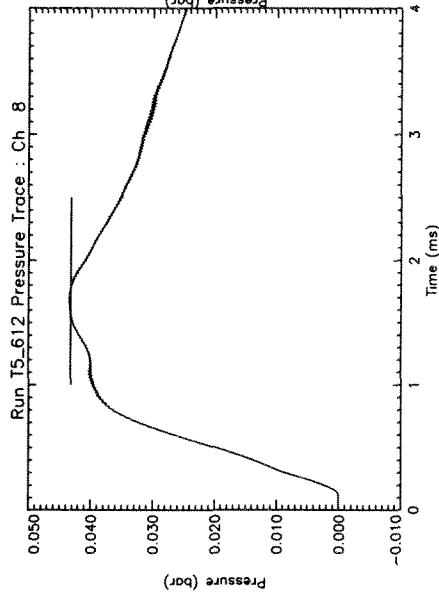
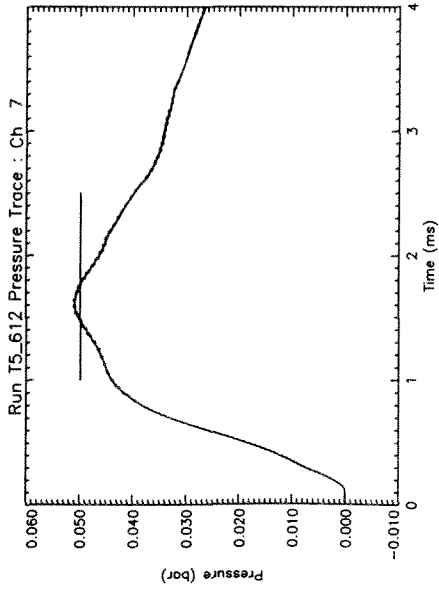
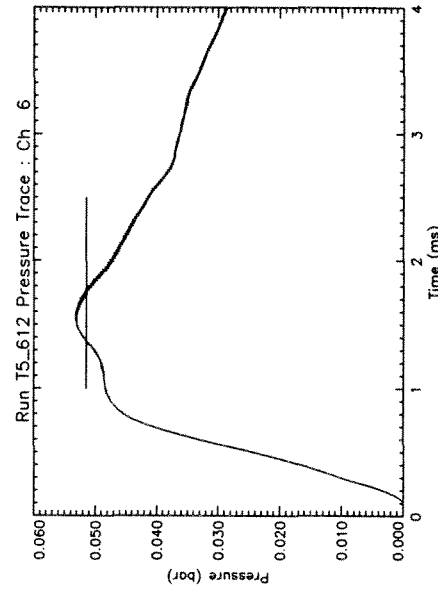
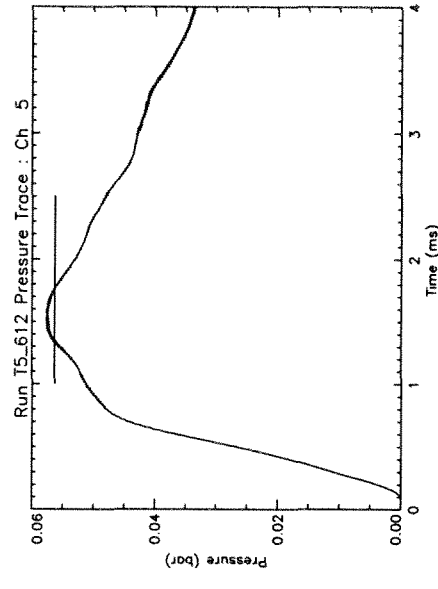
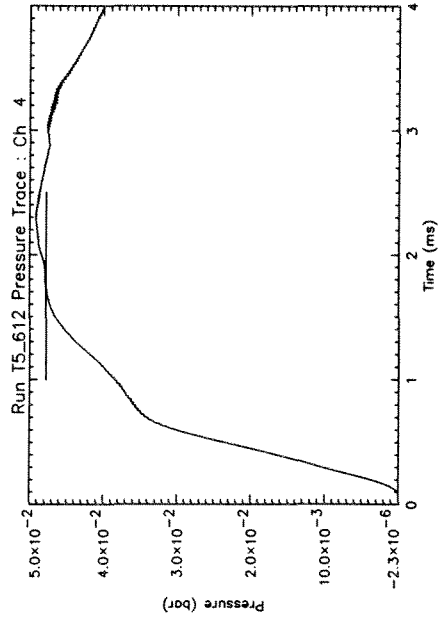
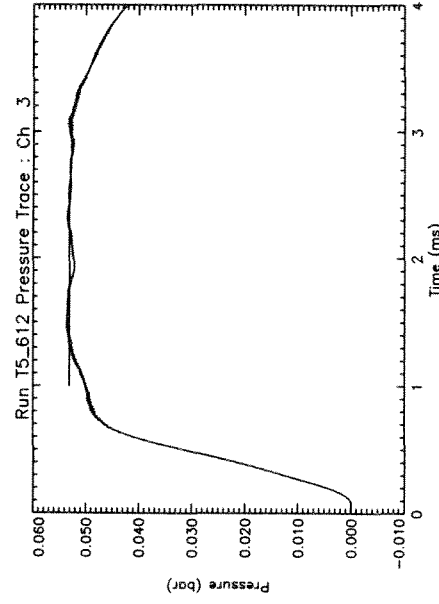
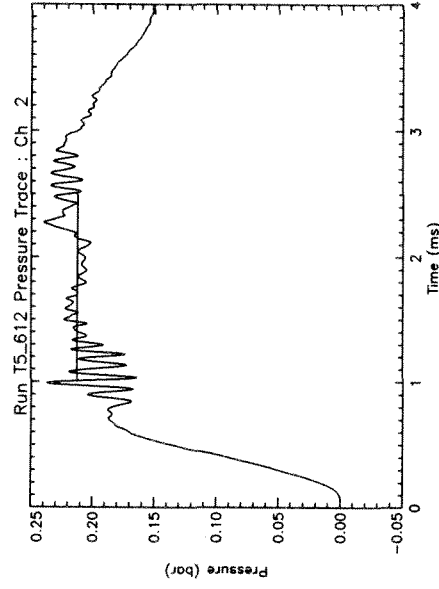
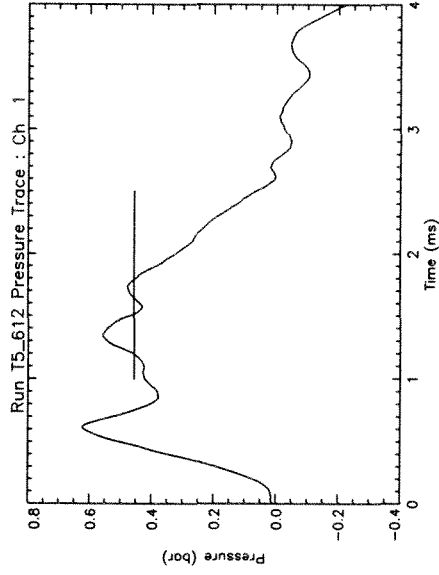
Run T5_612 Channel 2 Nozzle reservoir south

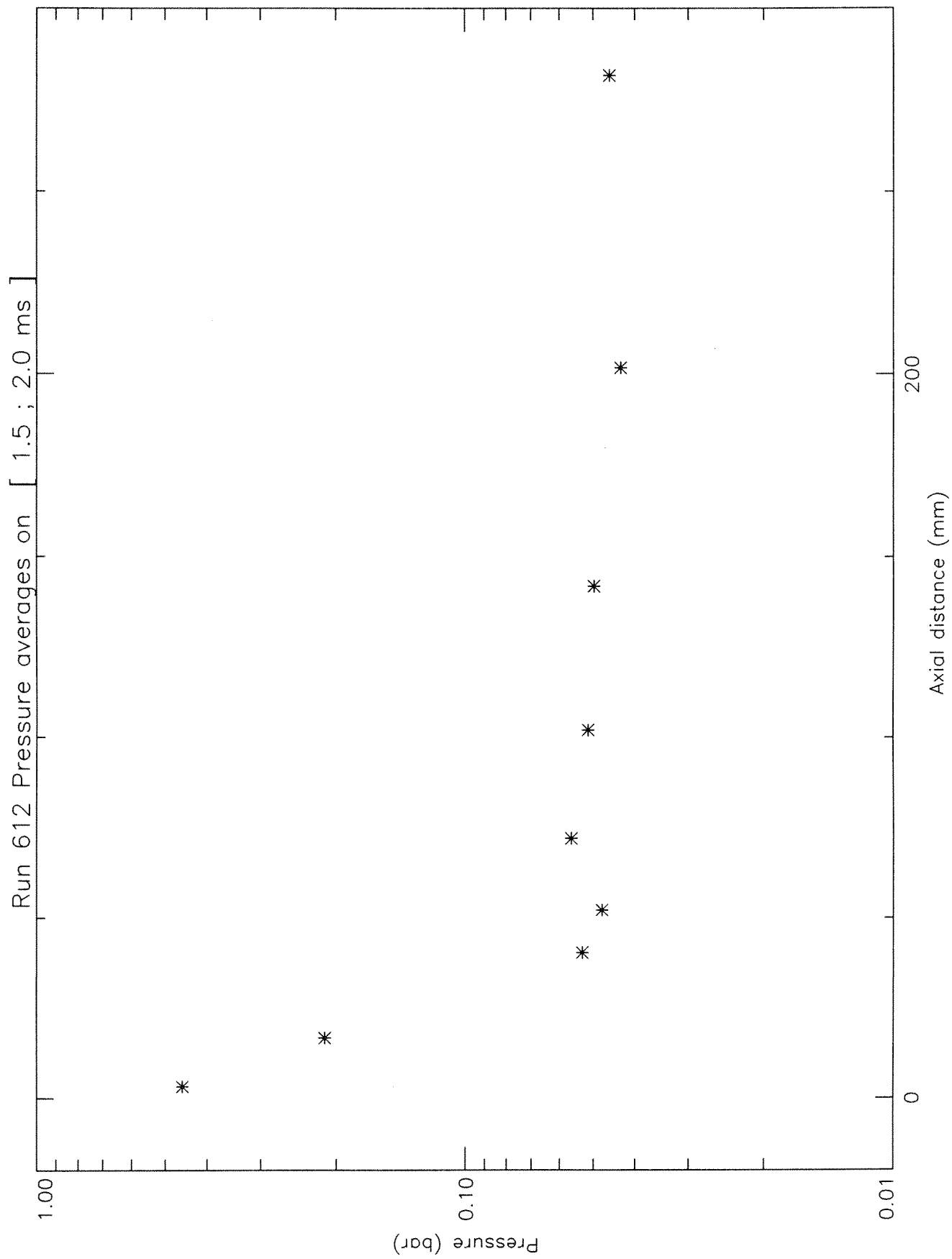




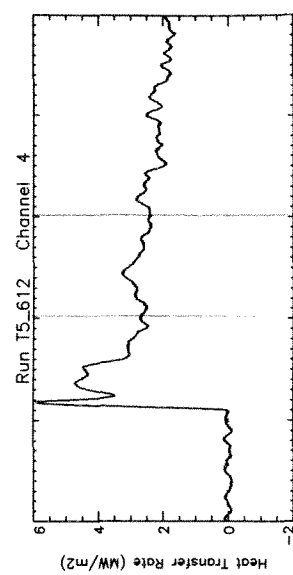
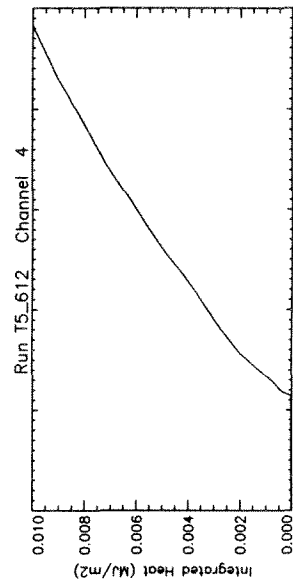
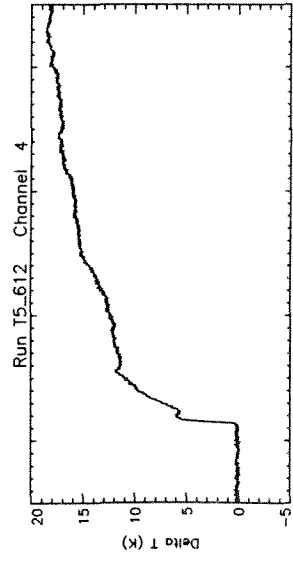
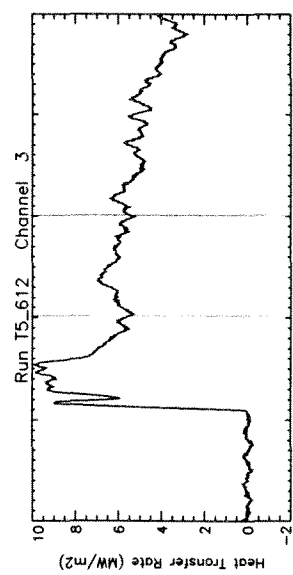
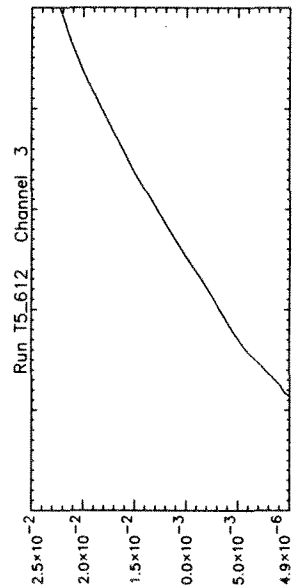
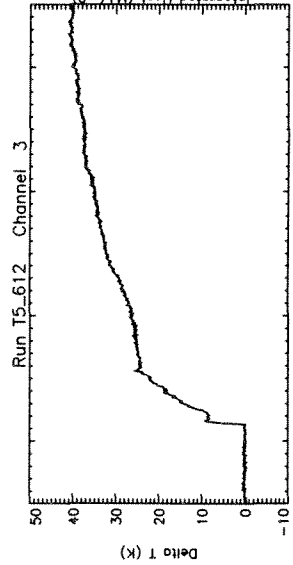
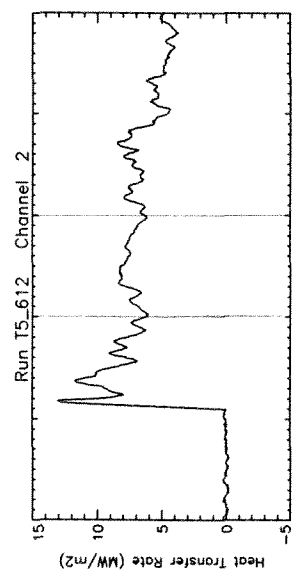
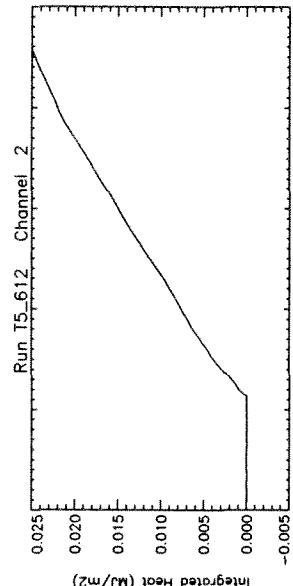
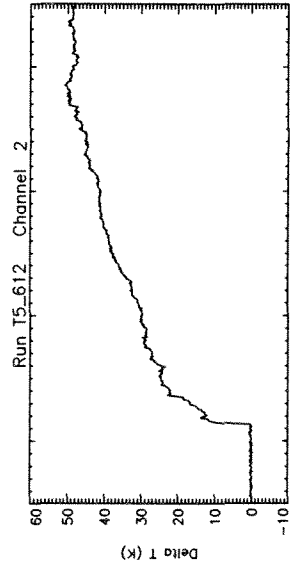
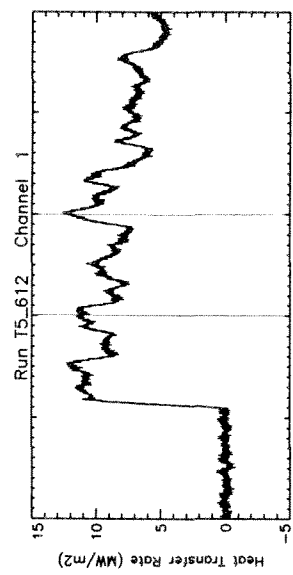
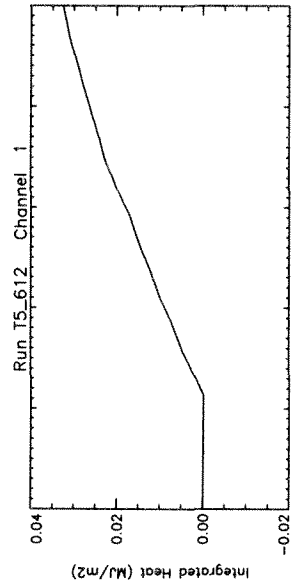
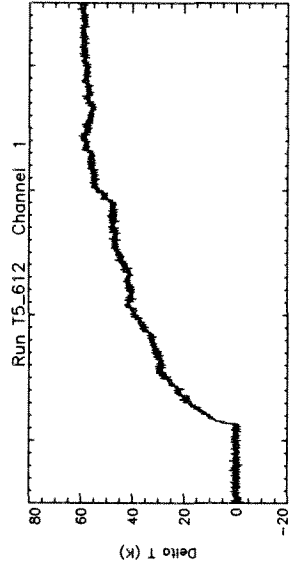
11.5.2017

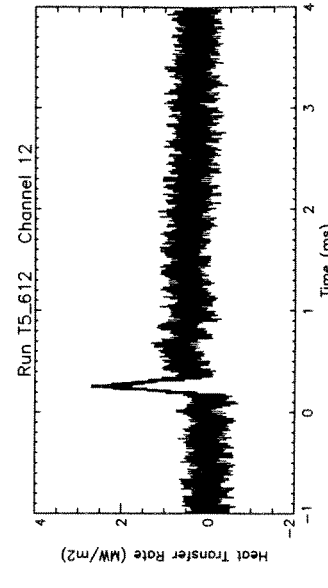
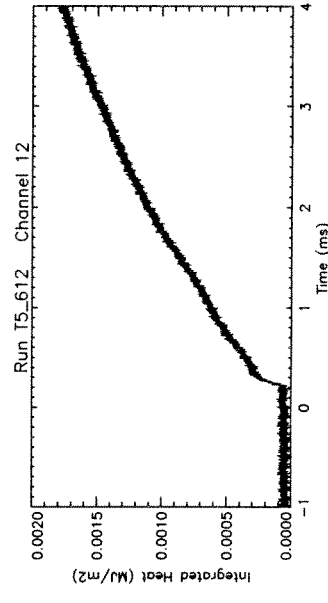
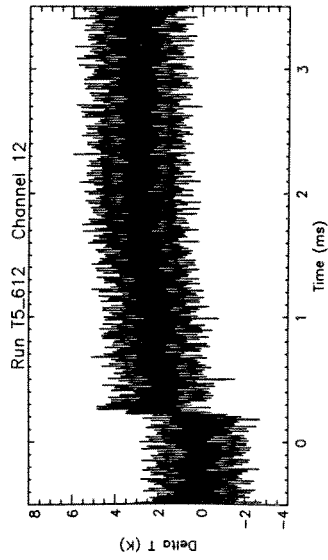
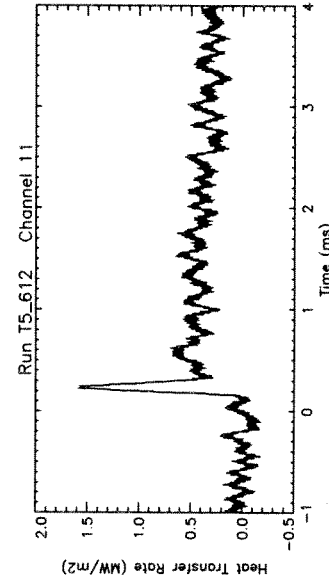
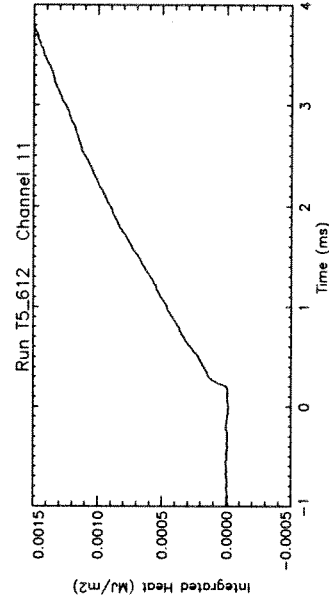
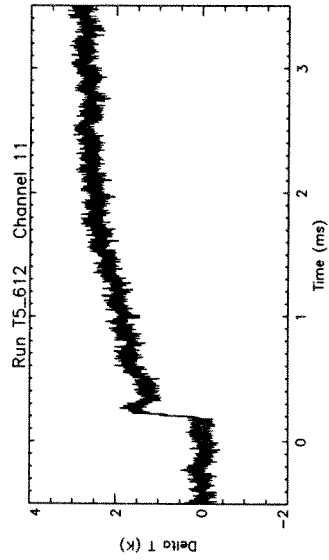
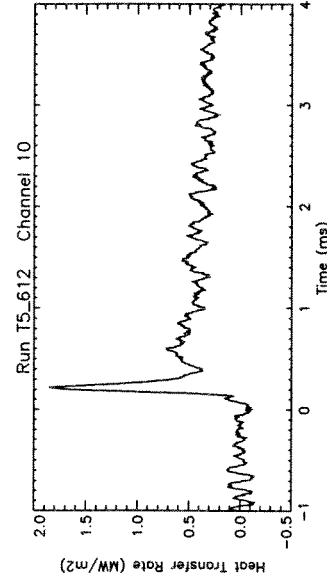
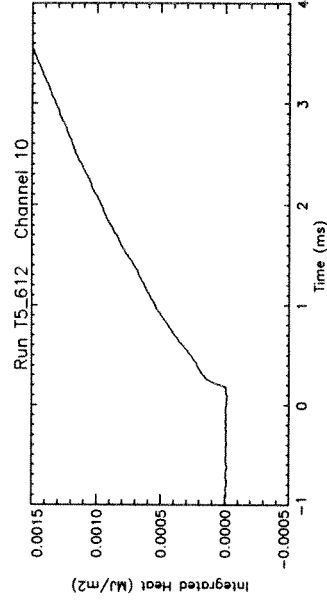
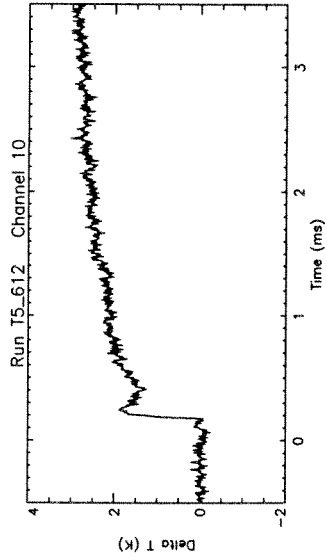
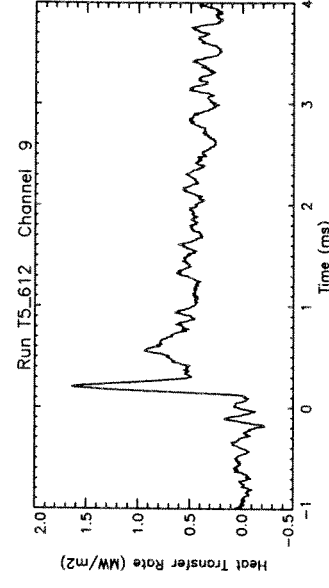
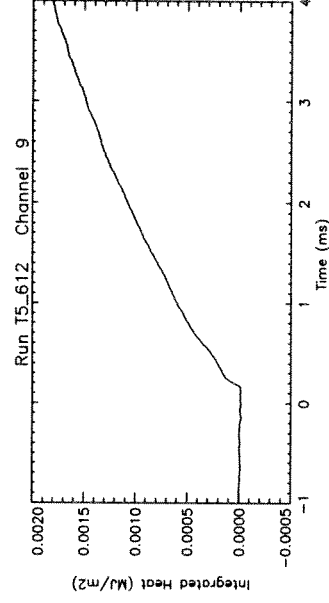
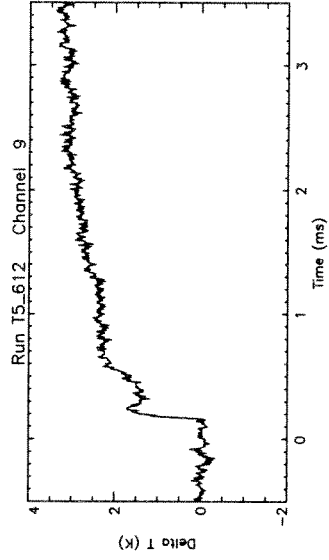


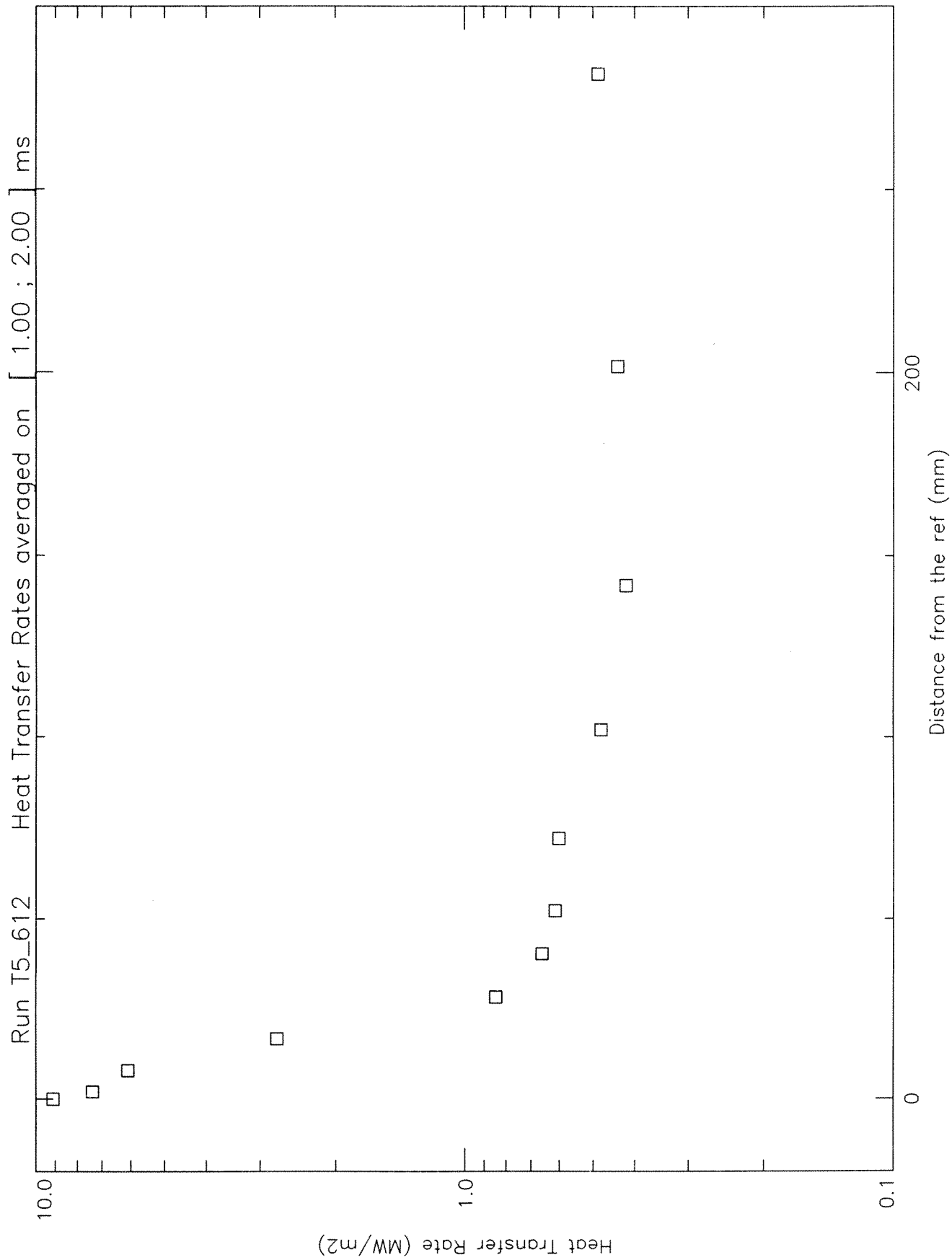




Exp. 15.612 - 15.612







Run # 612

Pressure averages around 1.75 +/- 0.25 ms

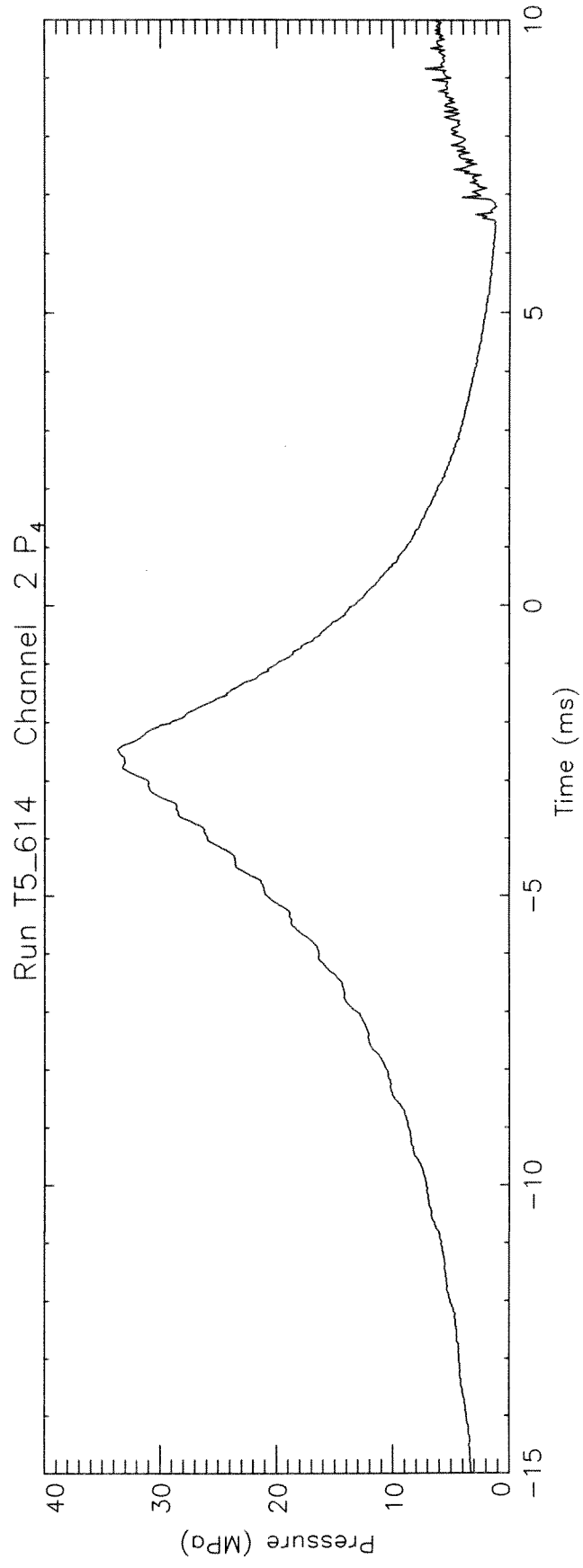
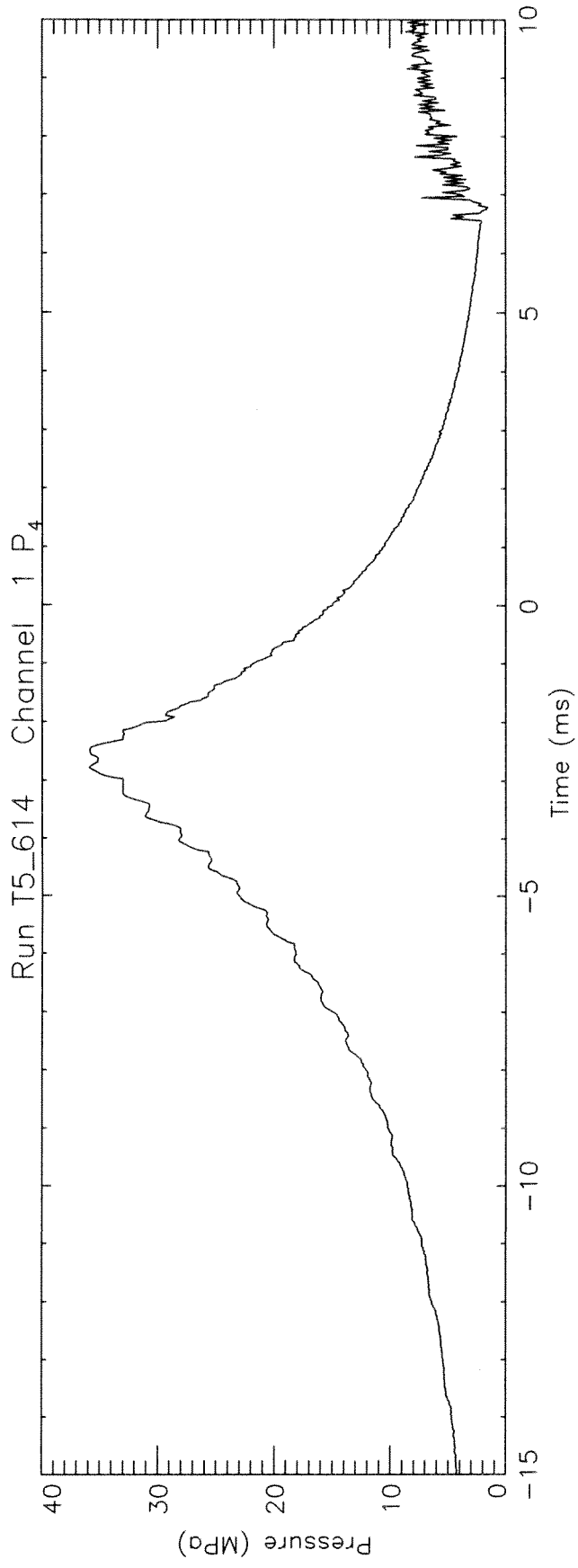
Smooth box = 2.

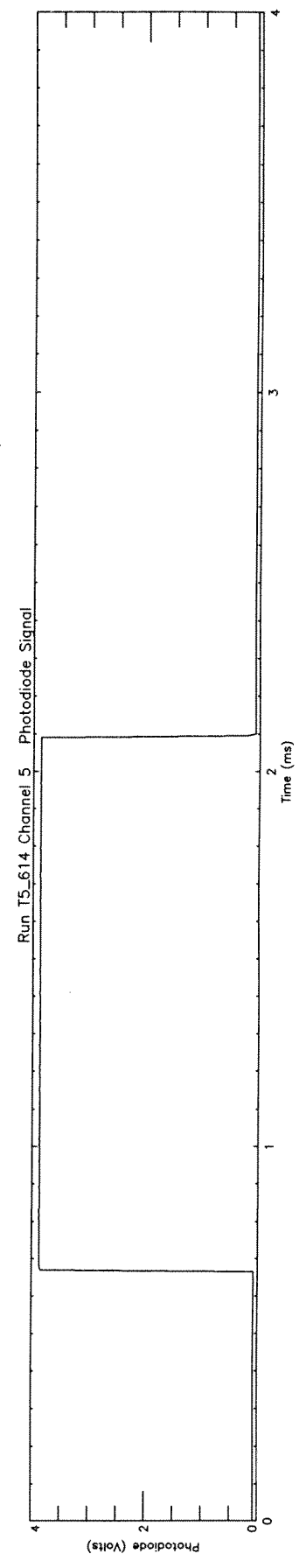
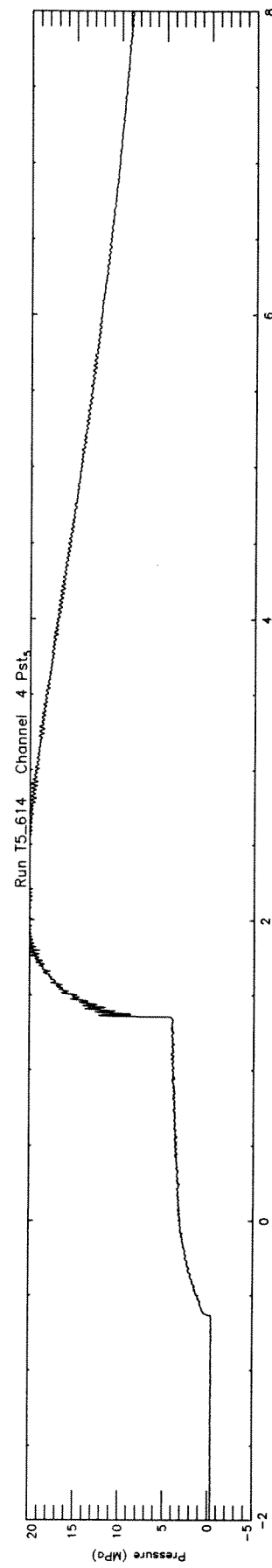
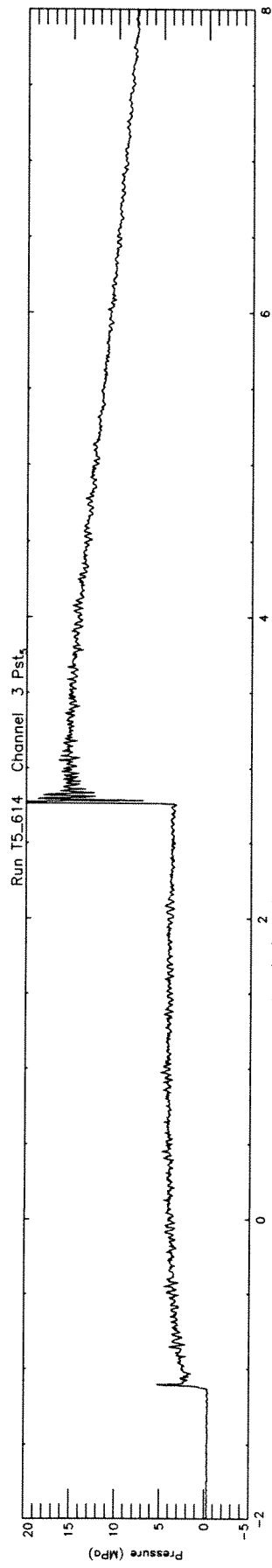
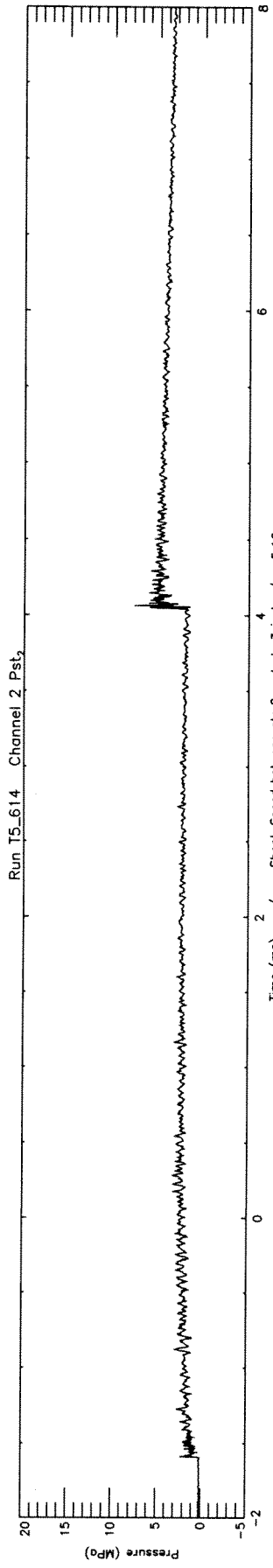
DA1	:	0.4647
DA2	:	0.2119
DA3	:	0.0531
DA4	:	0.0478
DA5	:	0.0564
DA6	:	0.0515
DA7	:	0.0499
DA8	:	0.0432
DA9	:	0.0458

Run # 612

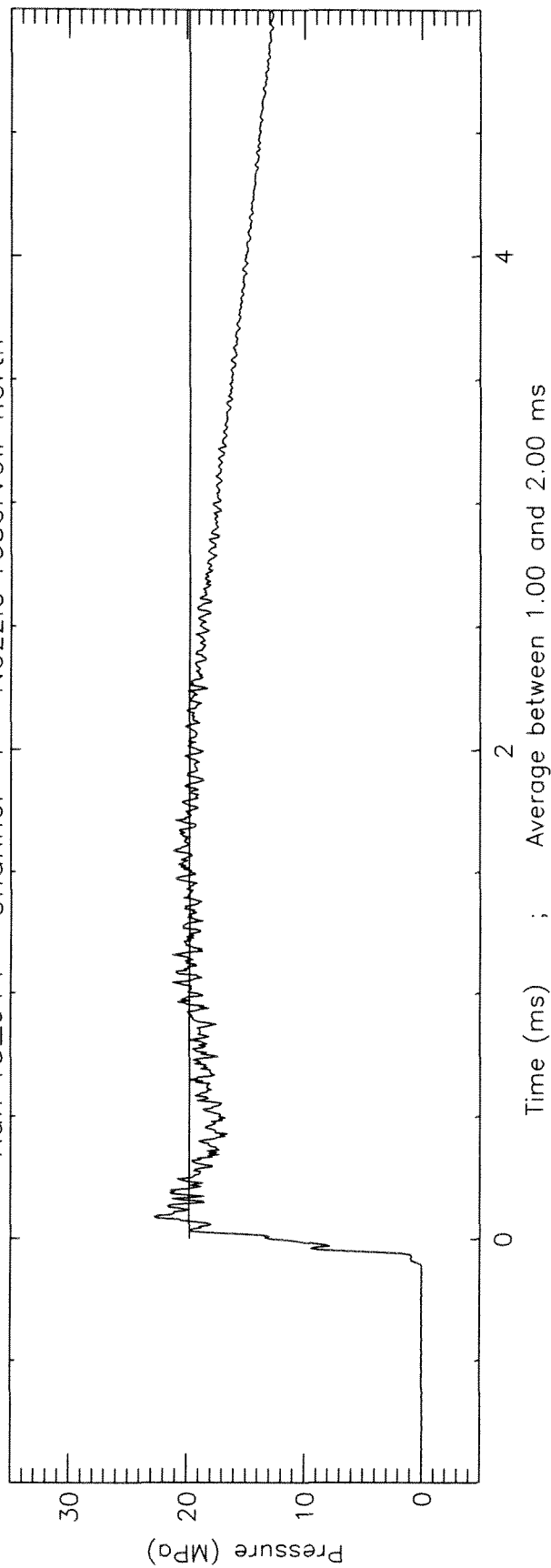
Heat Transfer Rates (in MW/m²)
averaged around 1.50 +/- 0.50 ms

MT 1 :	9.1111
MT 2 :	7.3654
MT 3 :	6.0908
MT 4 :	2.7426
MT 5 :	0.8450
MT 6 :	0.6600
MT 7 :	0.6151
MT 8 :	0.6025
MT 9 :	0.4797
MT10 :	0.4190
MT11 :	0.4384
MT12 :	0.4864

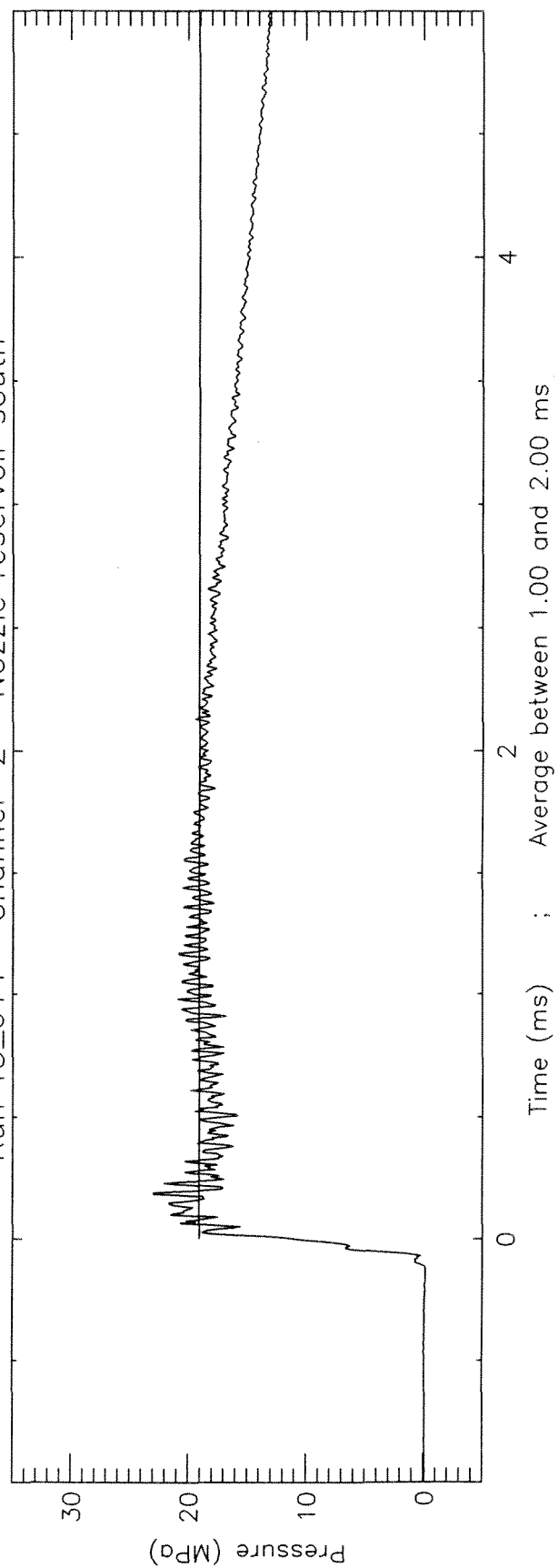




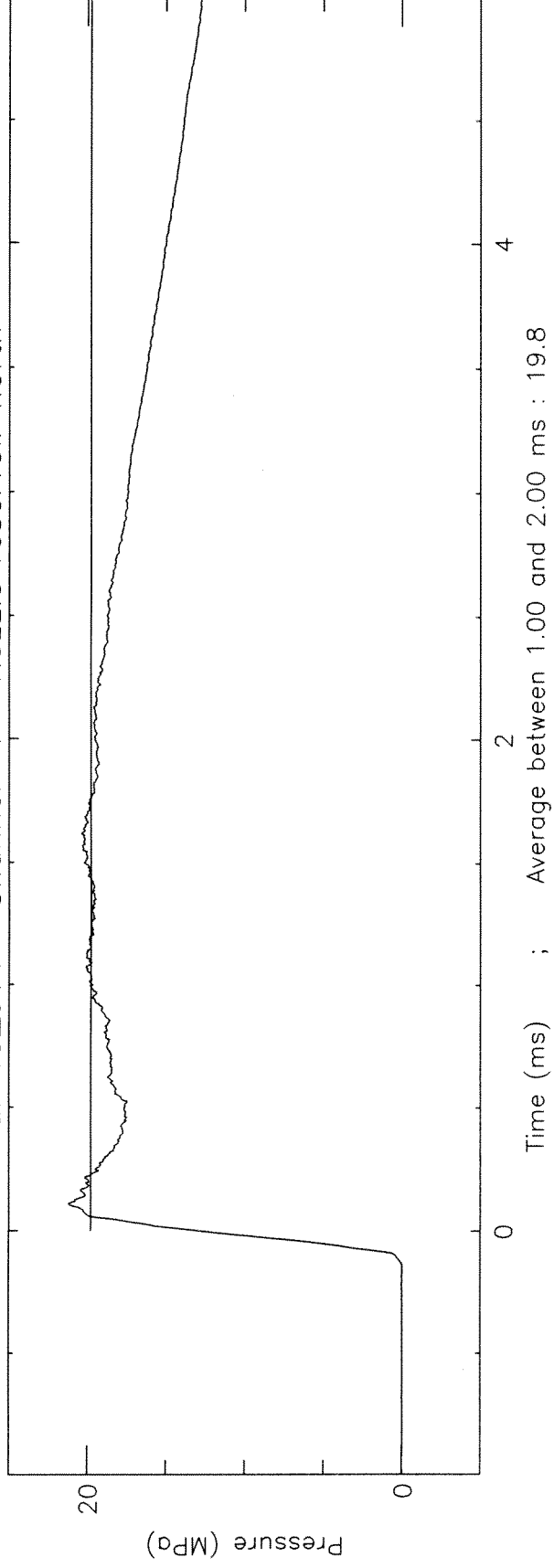
Run T5_614 Channel 1 Nozzle reservoir north



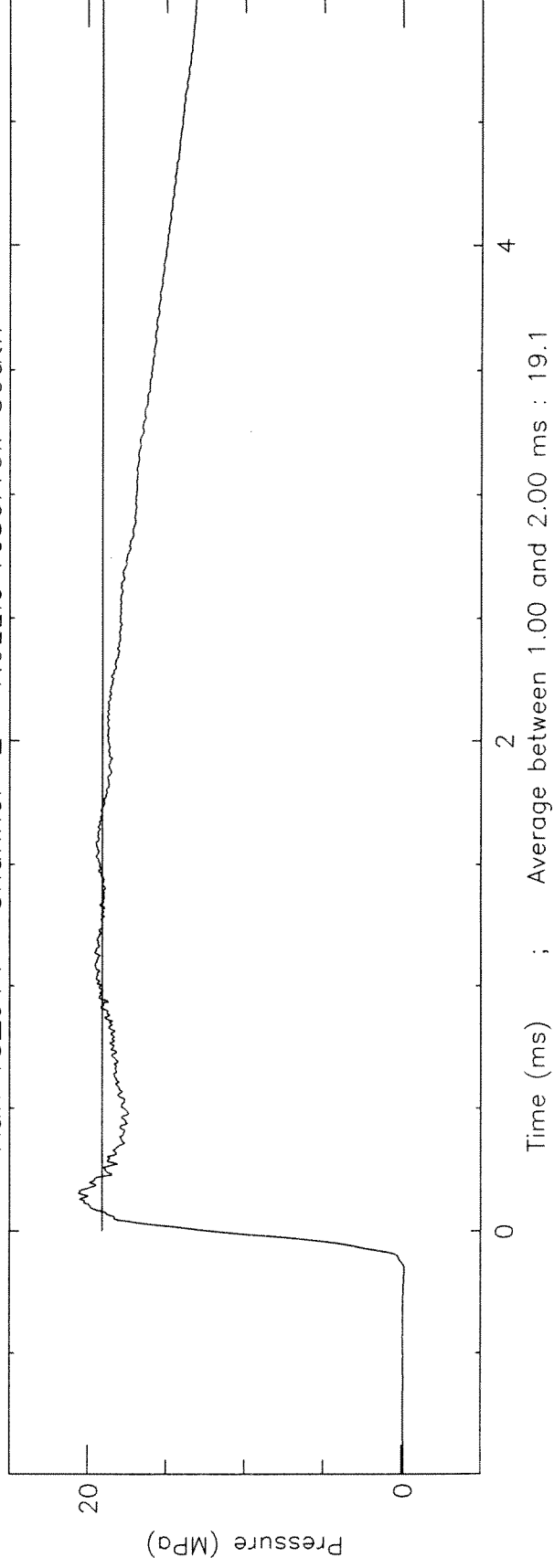
Run T5_614 Channel 2 Nozzle reservoir south

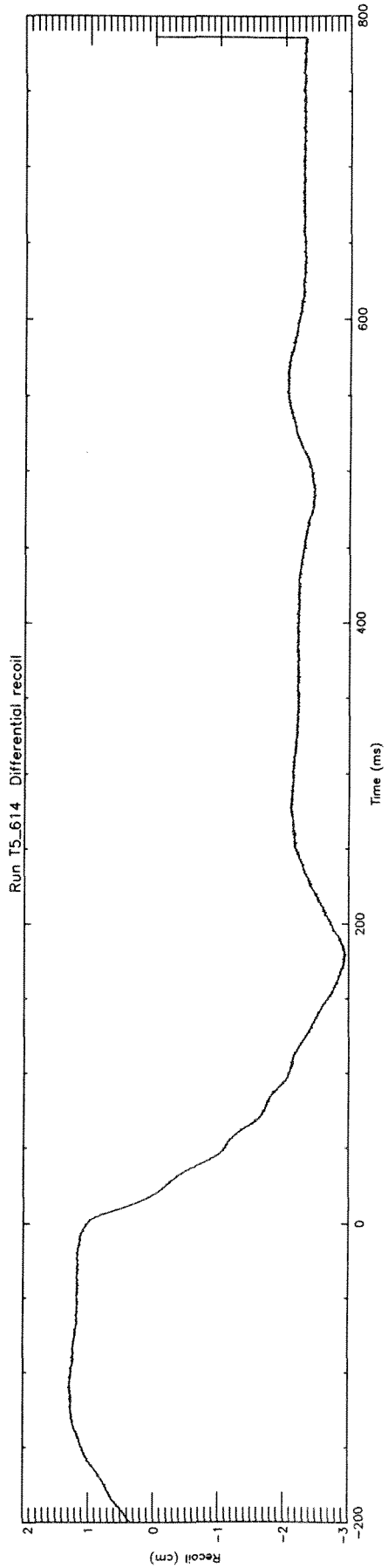
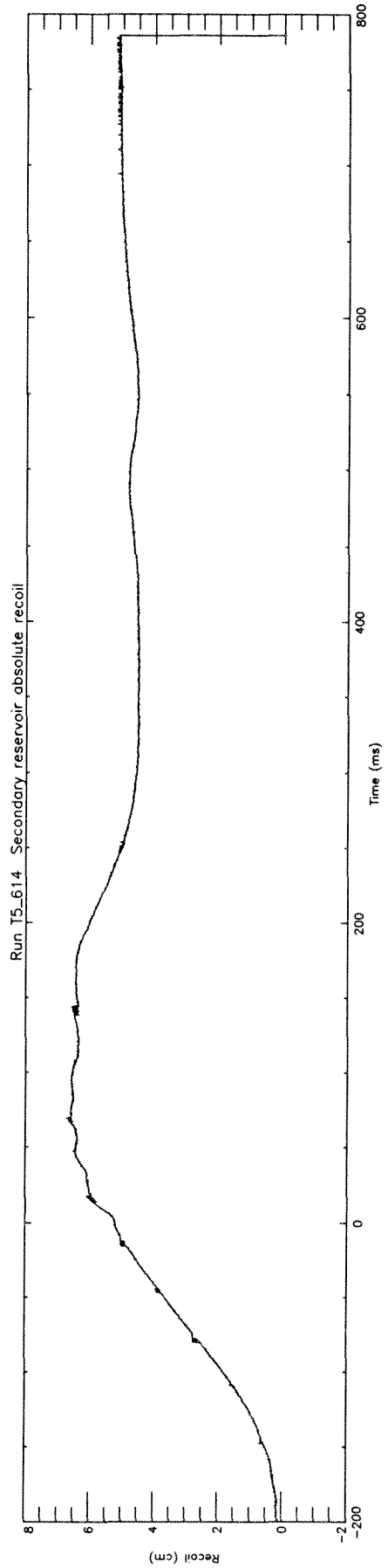
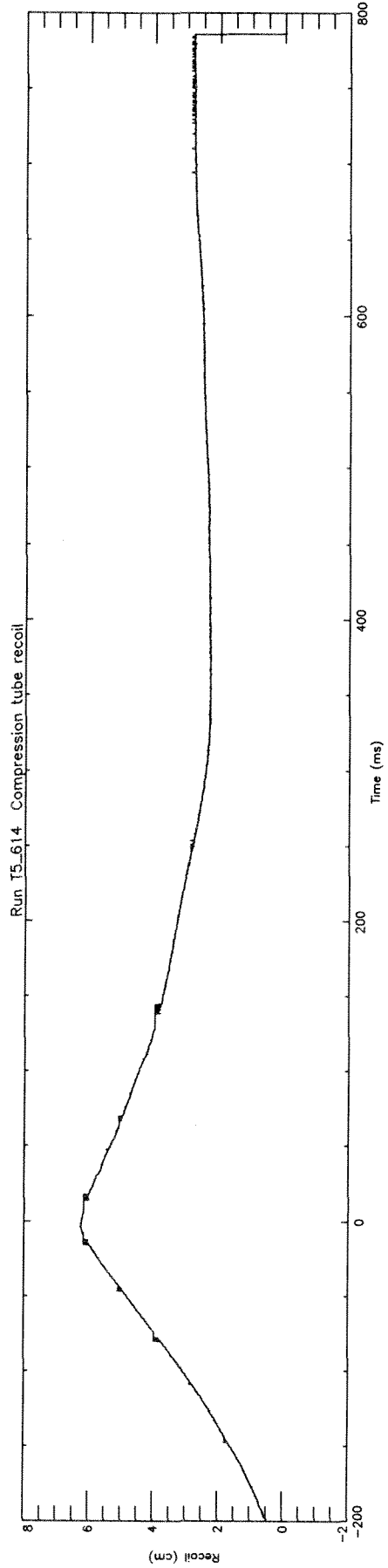


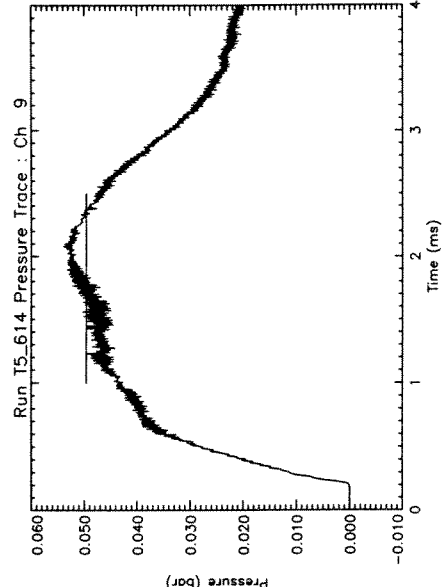
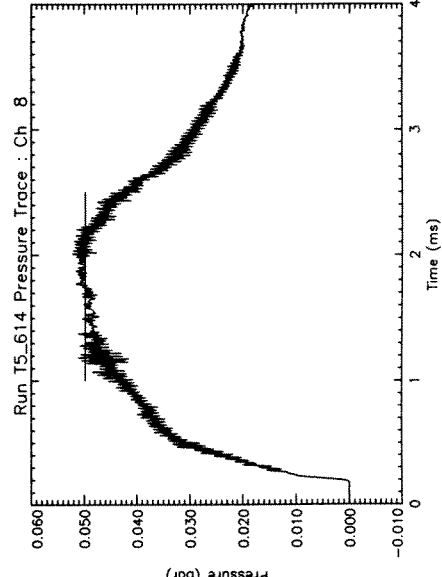
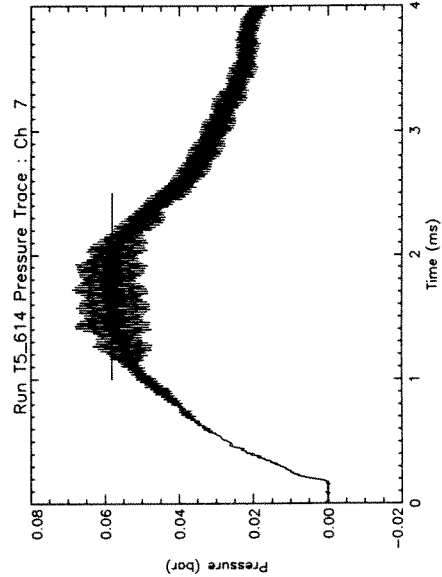
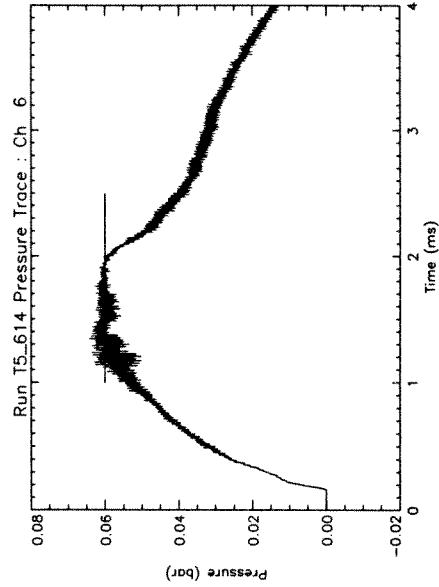
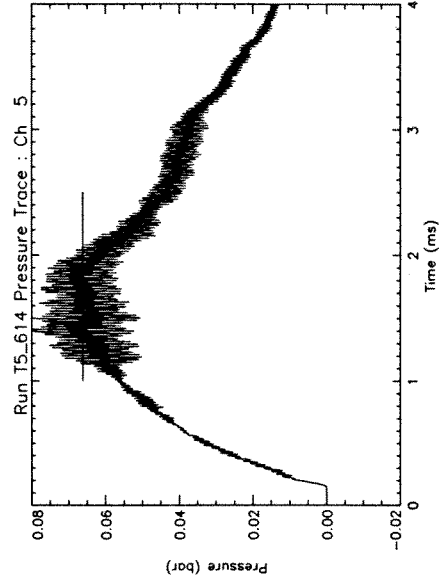
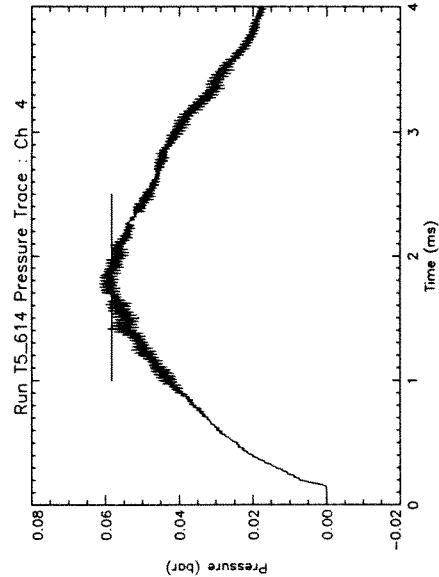
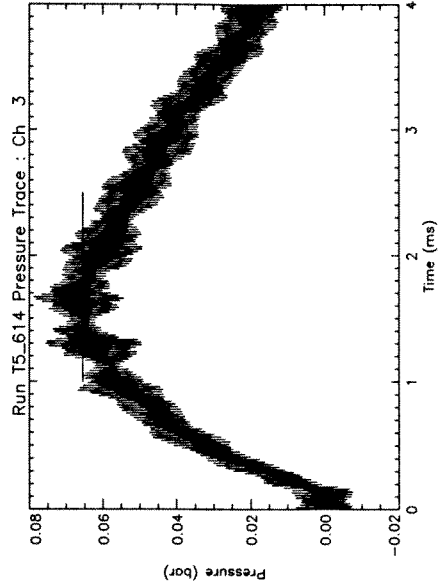
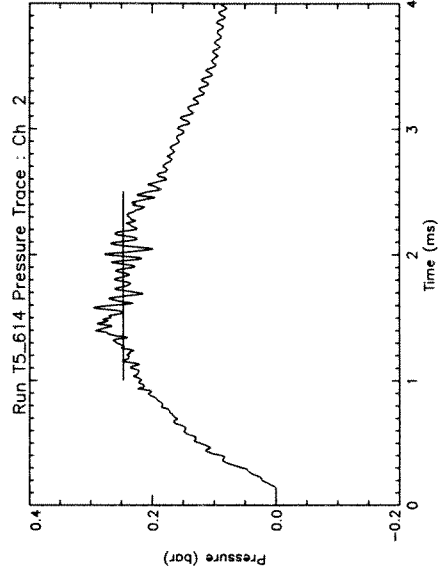
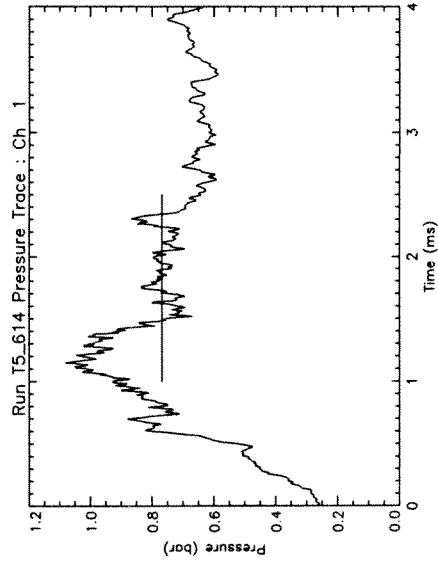
Run T5_614 Channel 1 Nozzle reservoir north

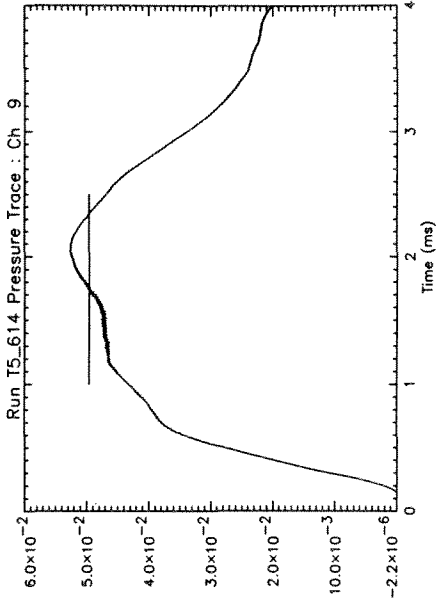
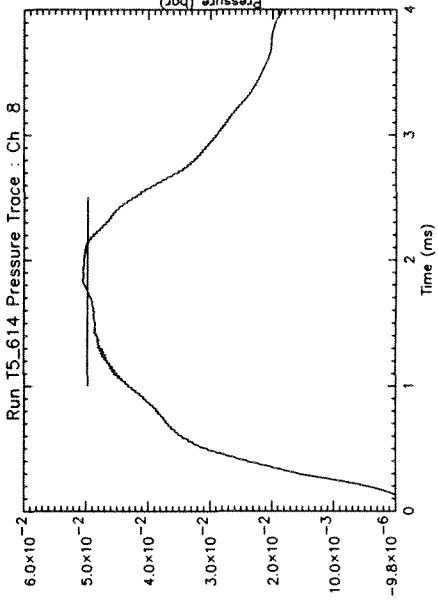
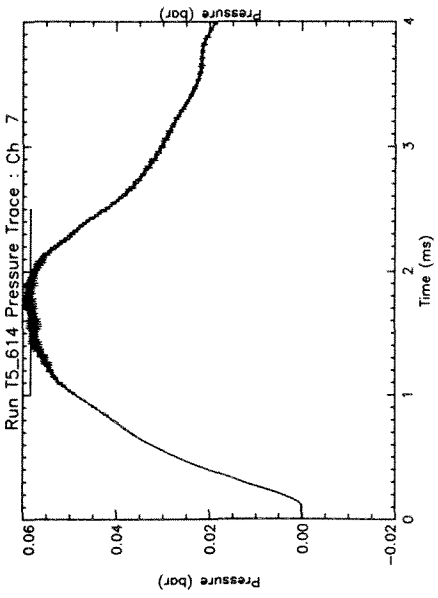
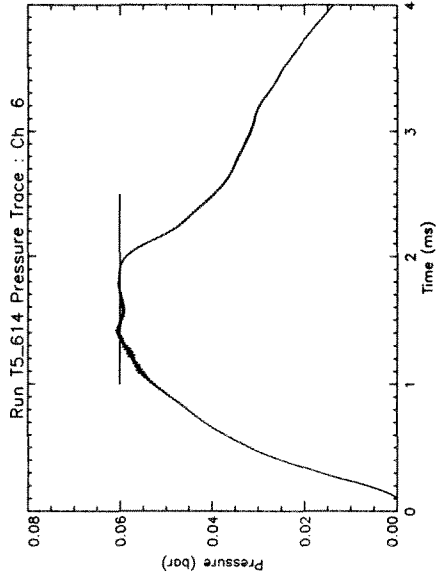
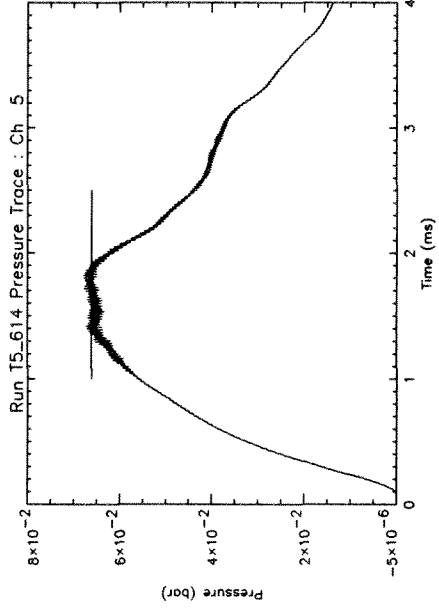
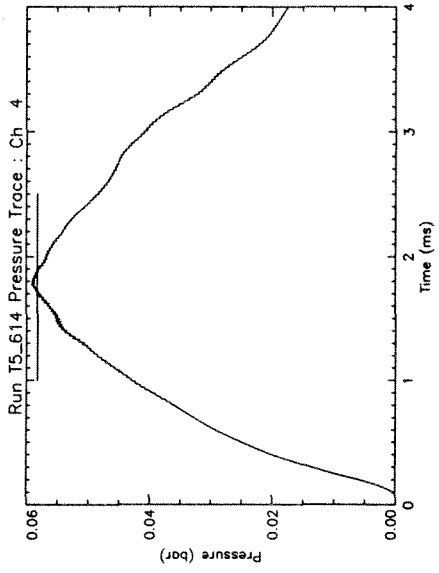
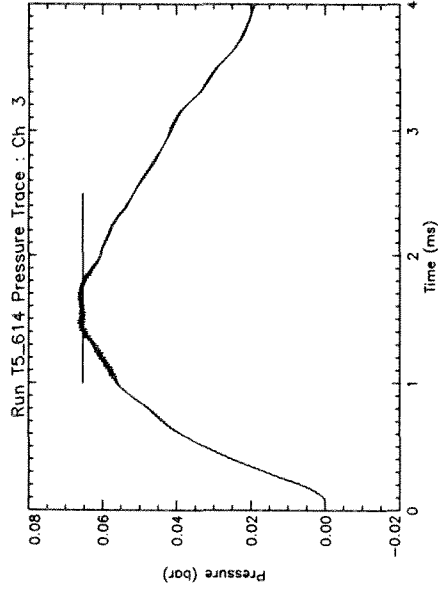
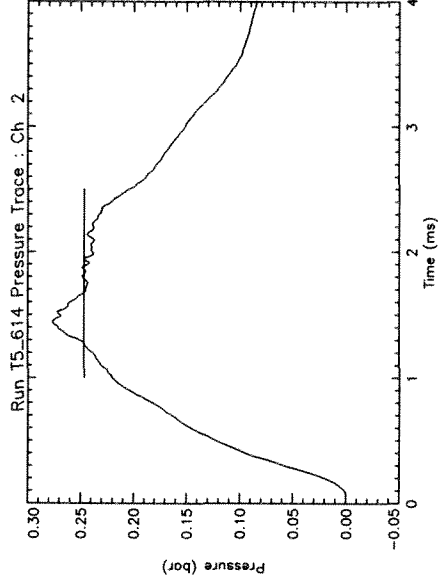
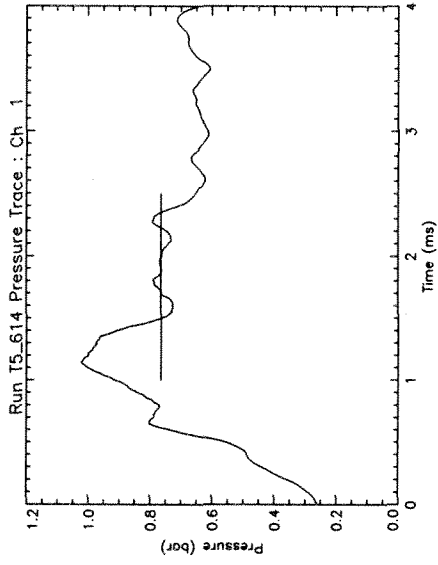


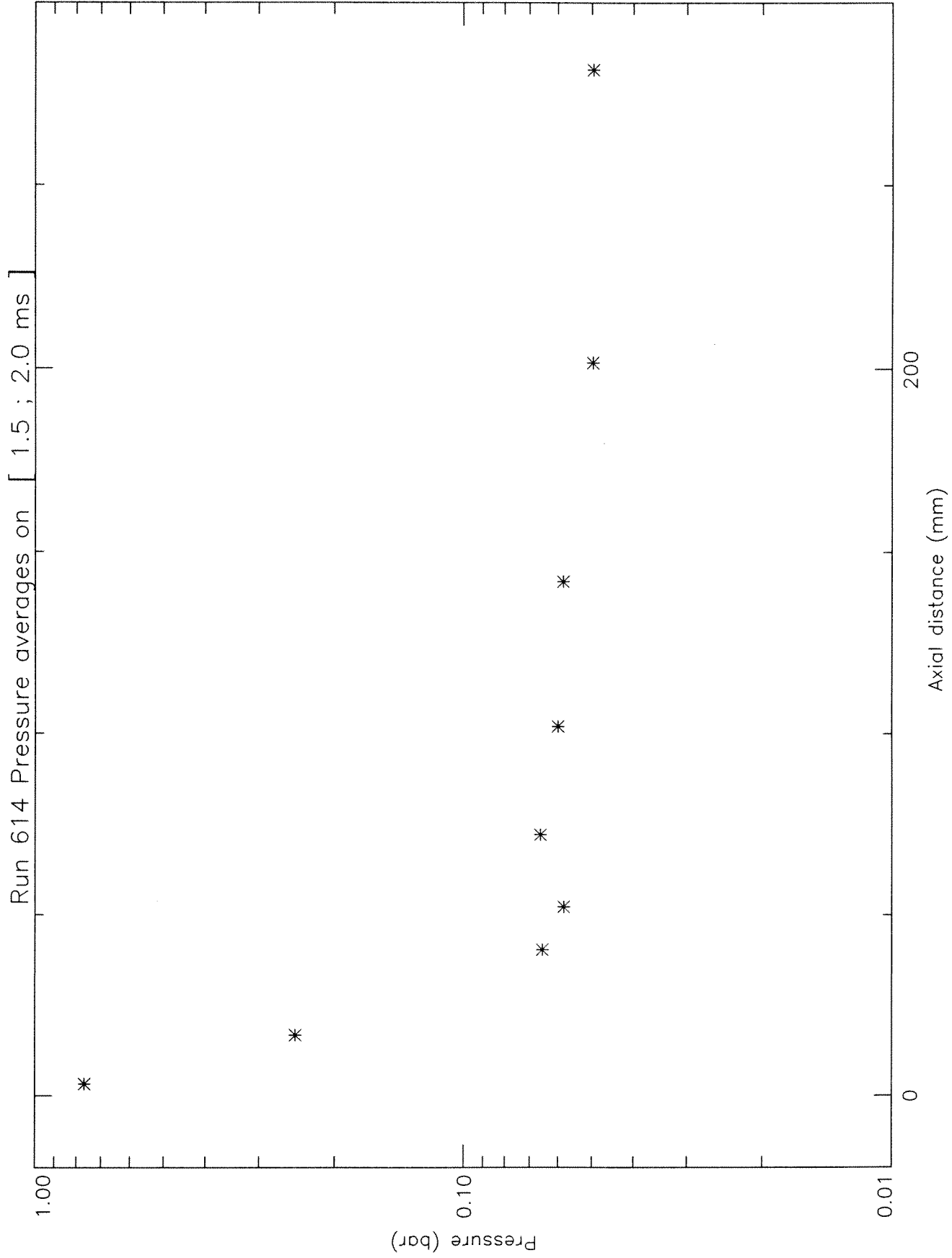
Run T5_614 Channel 2 Nozzle reservoir south



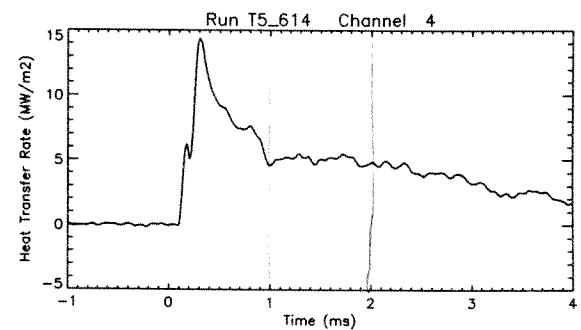
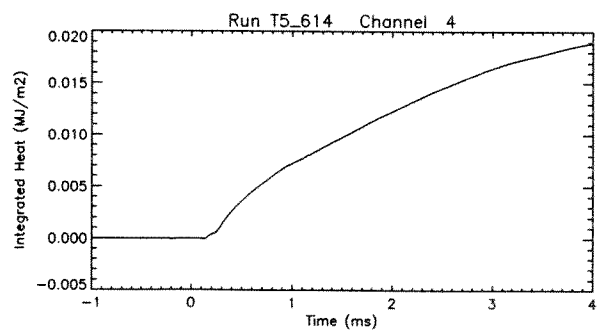
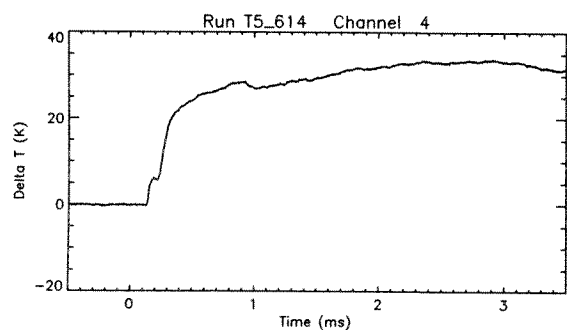
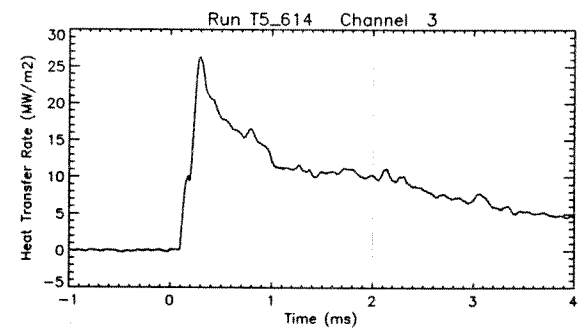
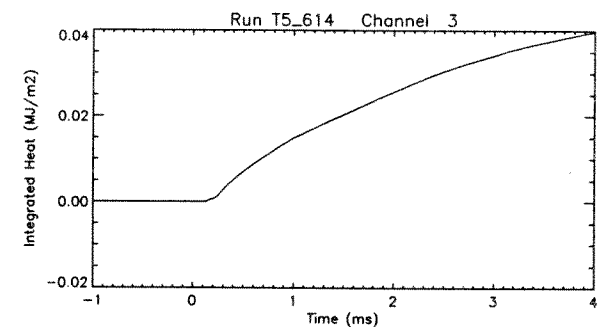
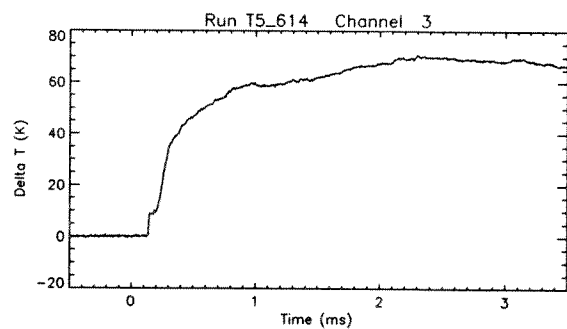
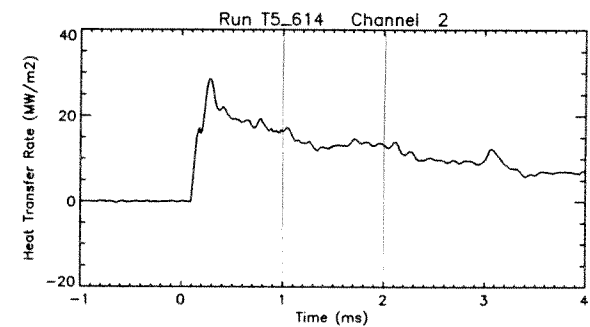
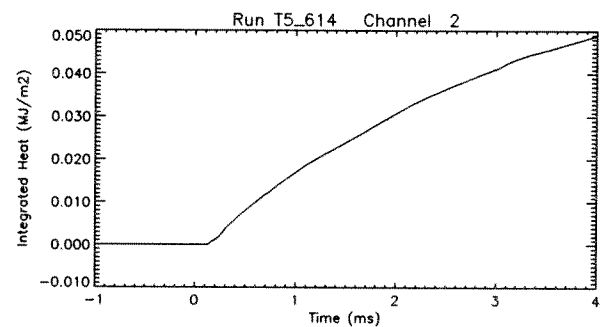
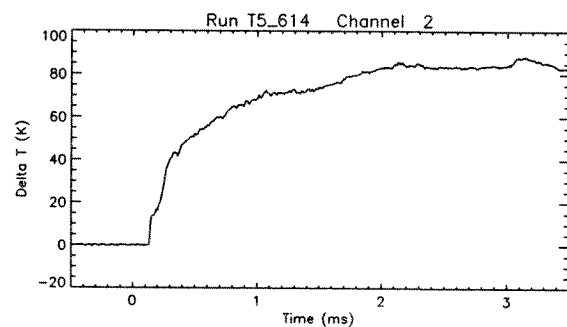
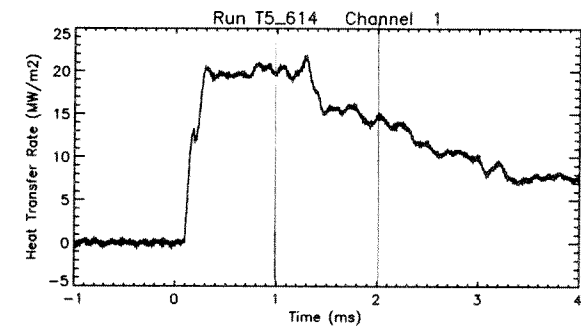
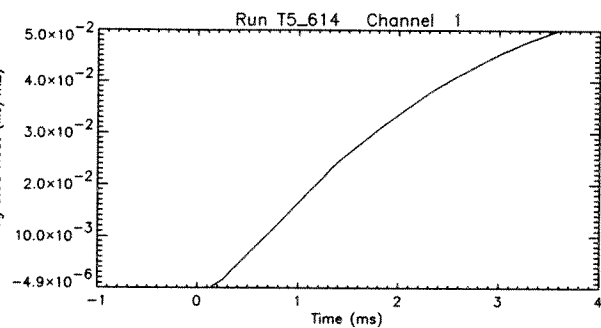
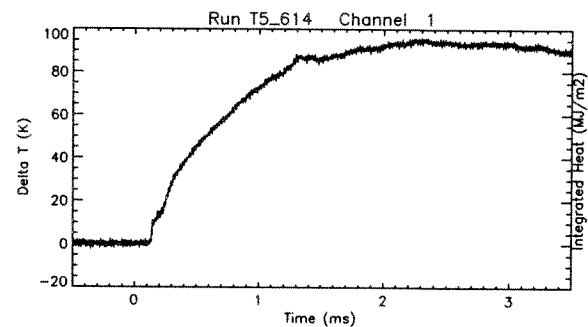


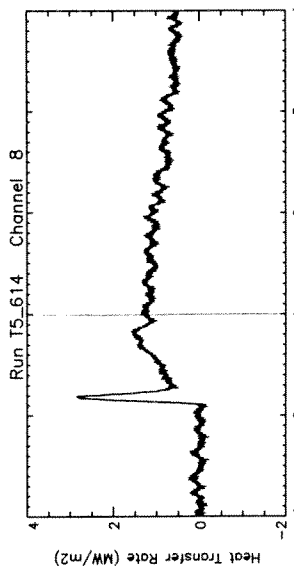
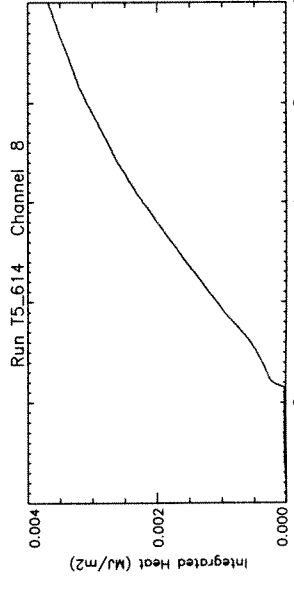
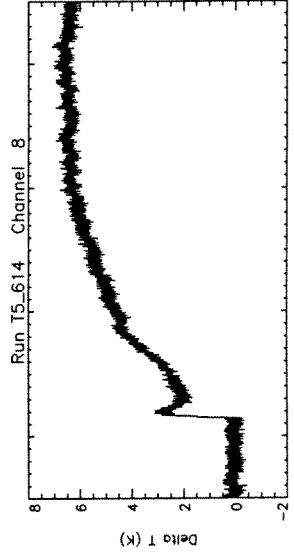
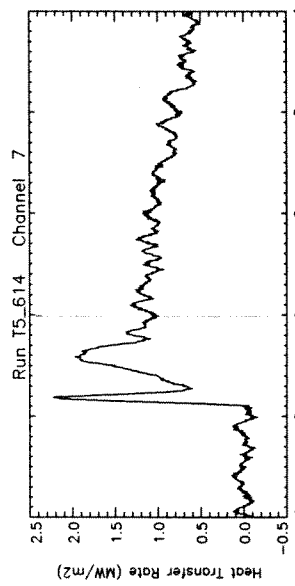
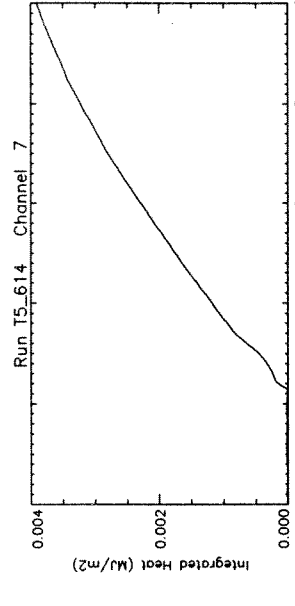
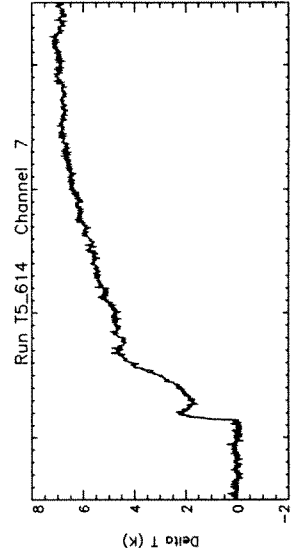
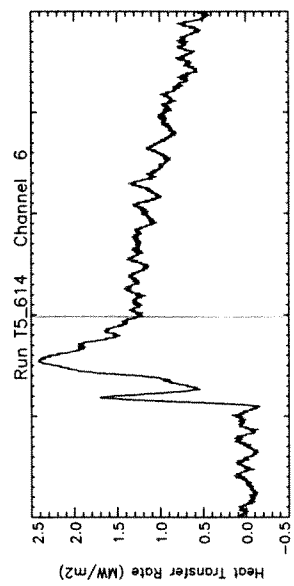
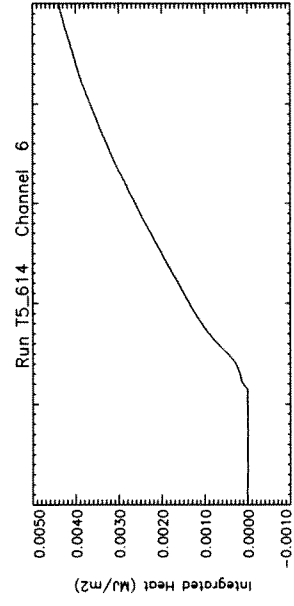
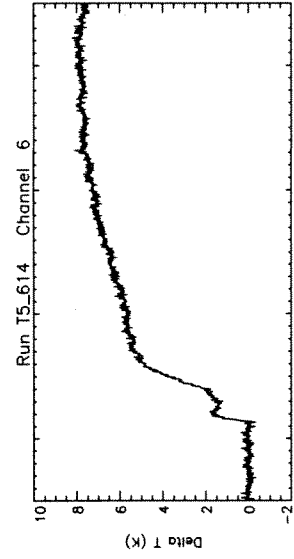
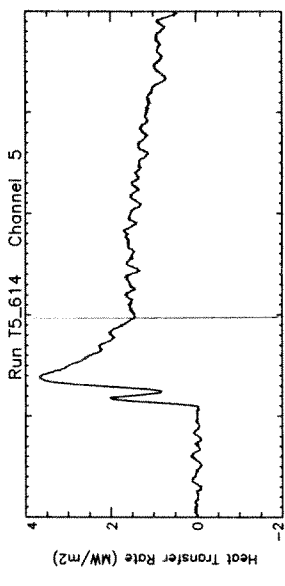
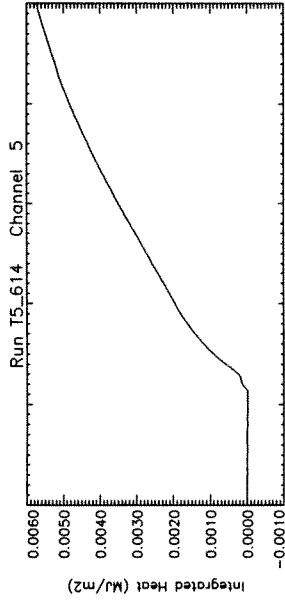
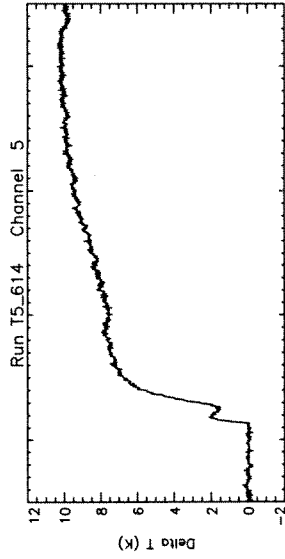


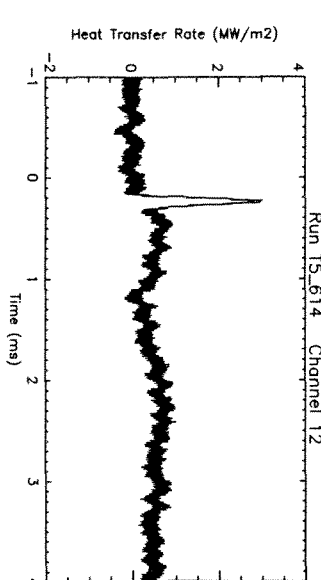
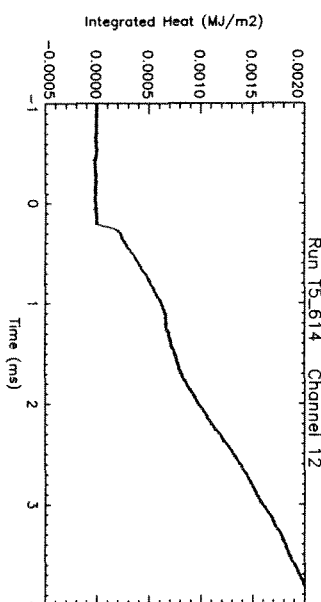
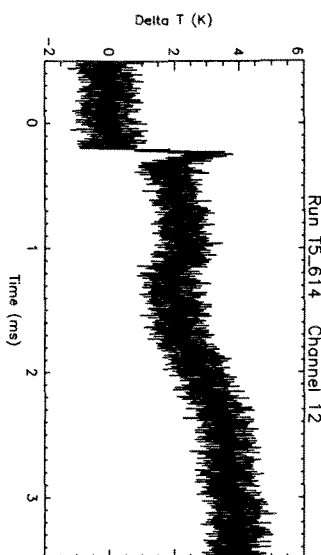
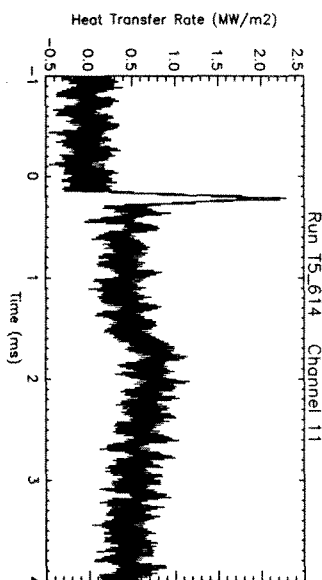
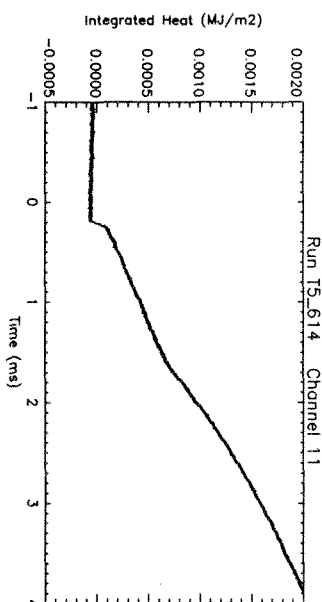
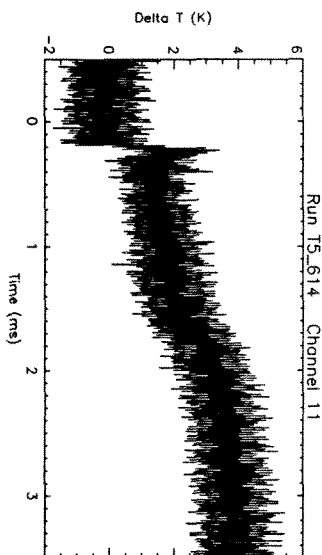
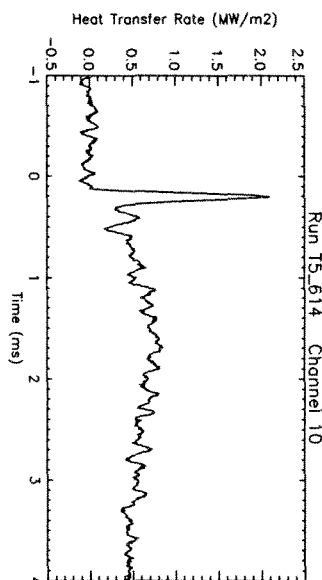
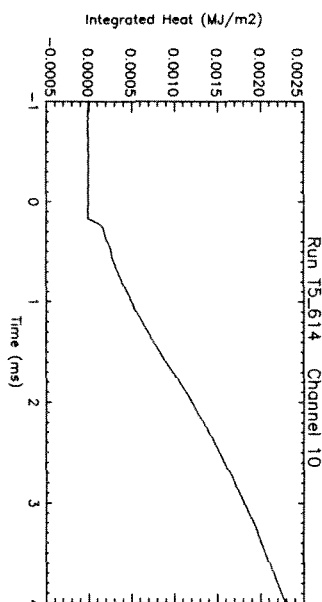
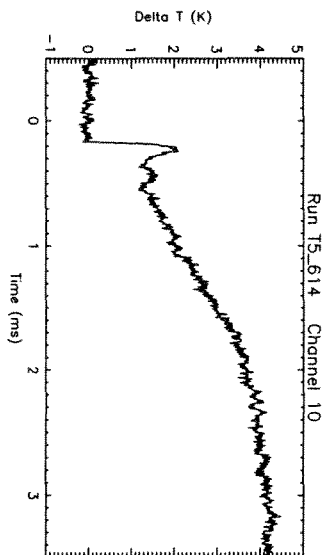
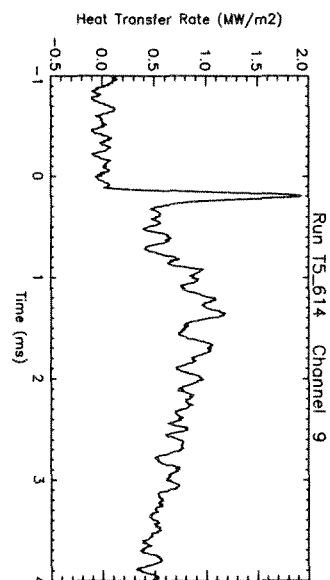
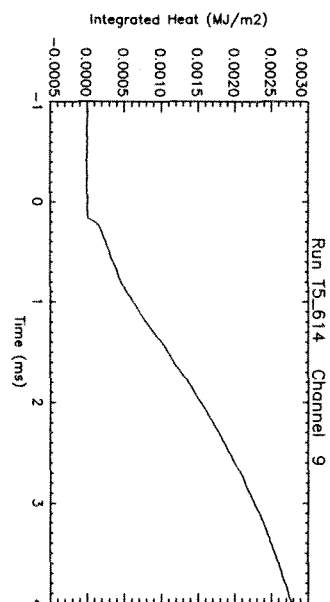
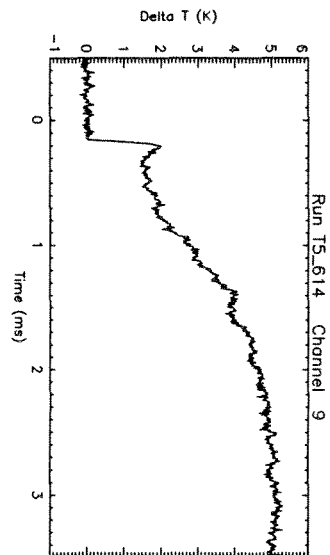


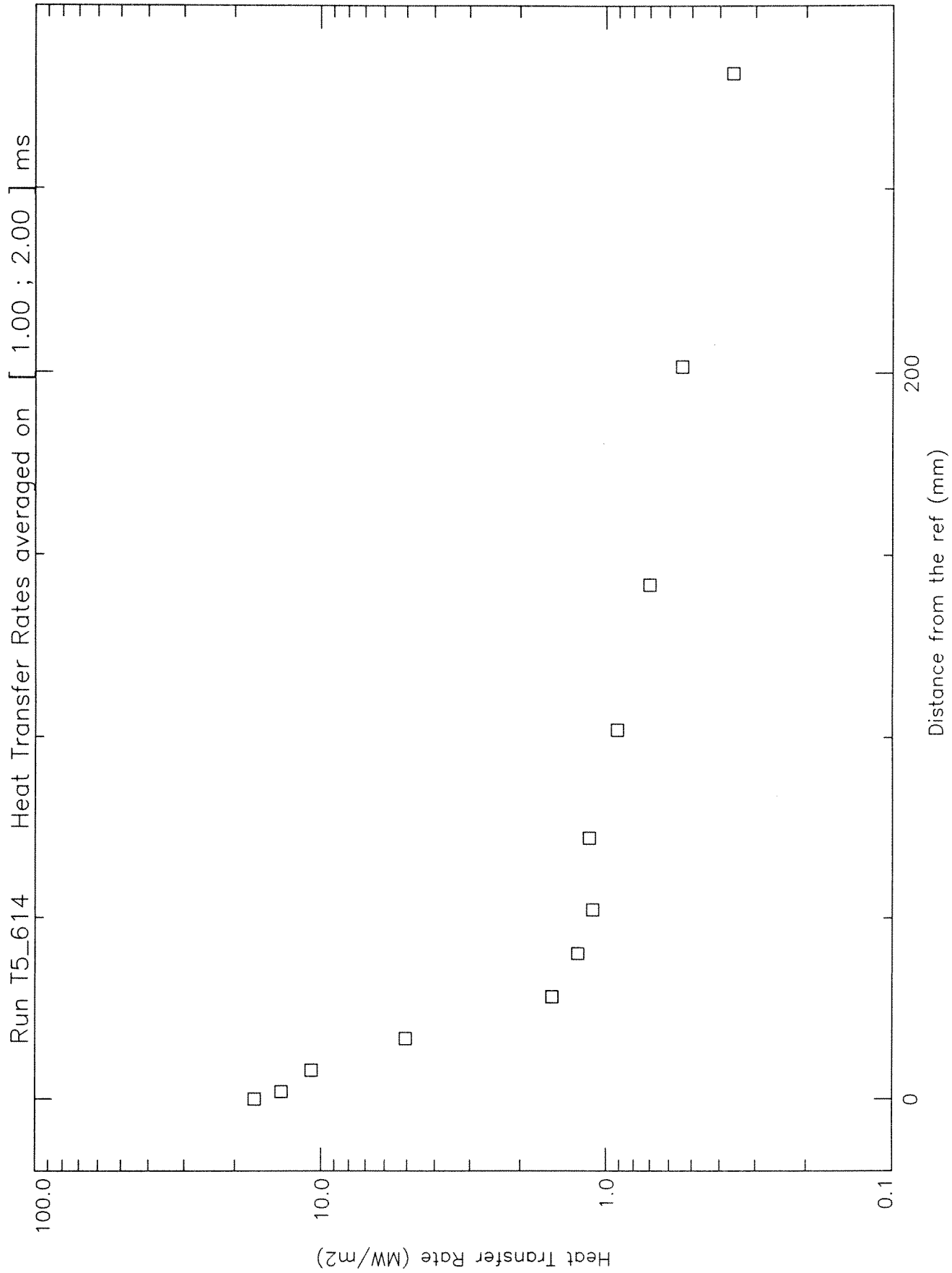


type on [11.5] bit









Run # 614

Pressure averages around 1.75 +/- 0.25 ms

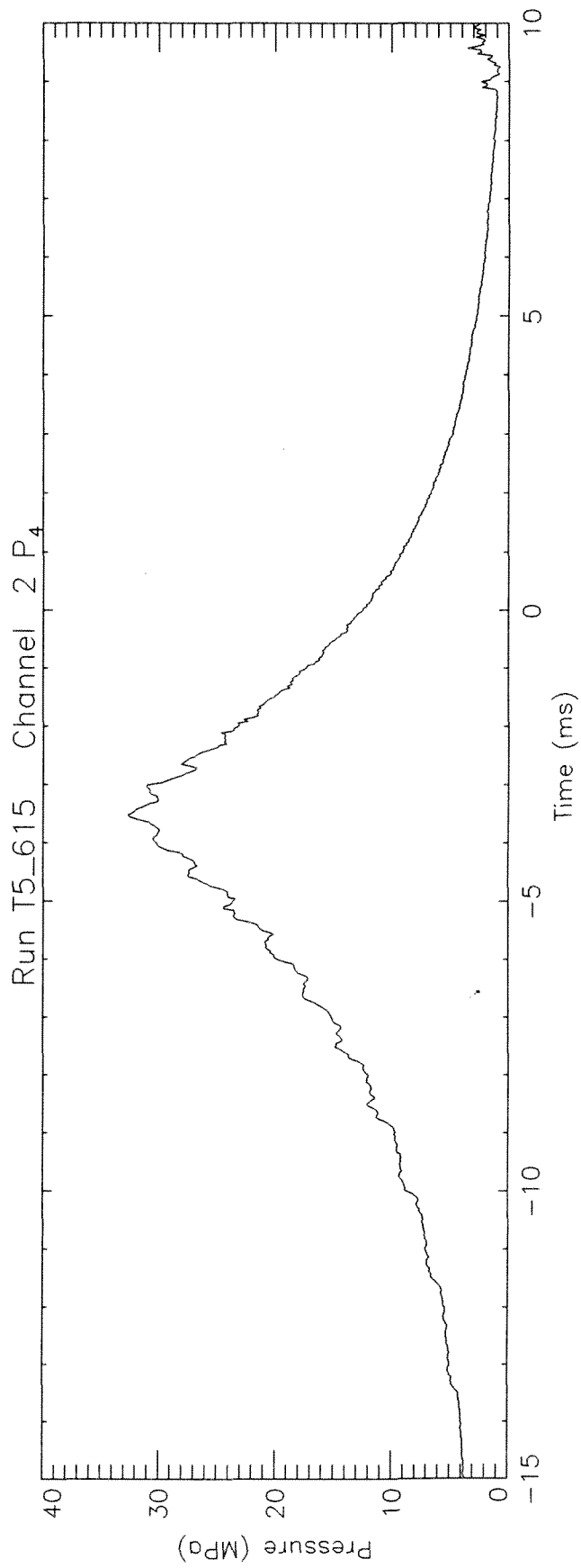
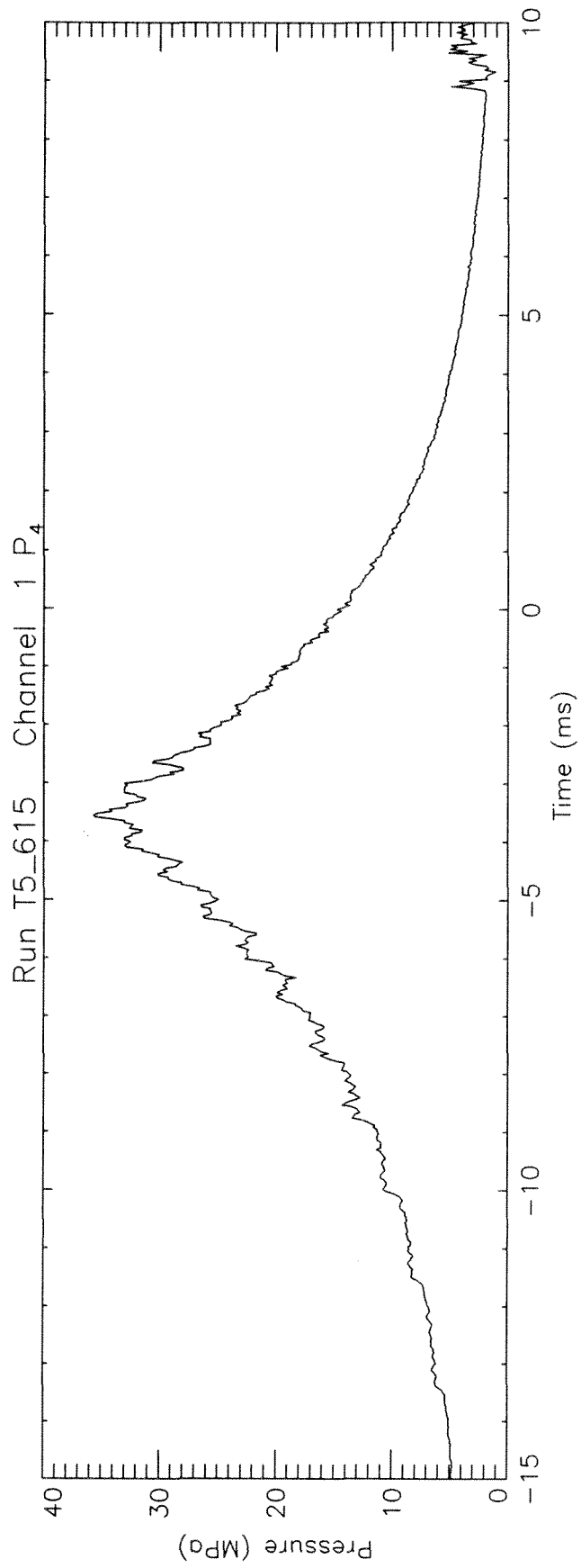
Smooth box = 2.

DA1	:	0.7679
DA2	:	0.2470
DA3	:	0.0654
DA4	:	0.0583
DA5	:	0.0661
DA6	:	0.0601
DA7	:	0.0581
DA8	:	0.0498
DA9	:	0.0496

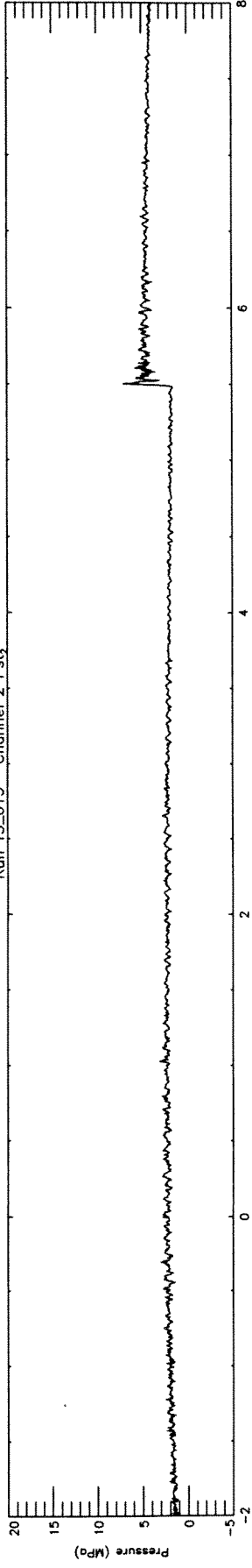
Run # 614

Heat Transfer Rates (in MW/m²)
averaged around 1.50 +/- 0.50 ms

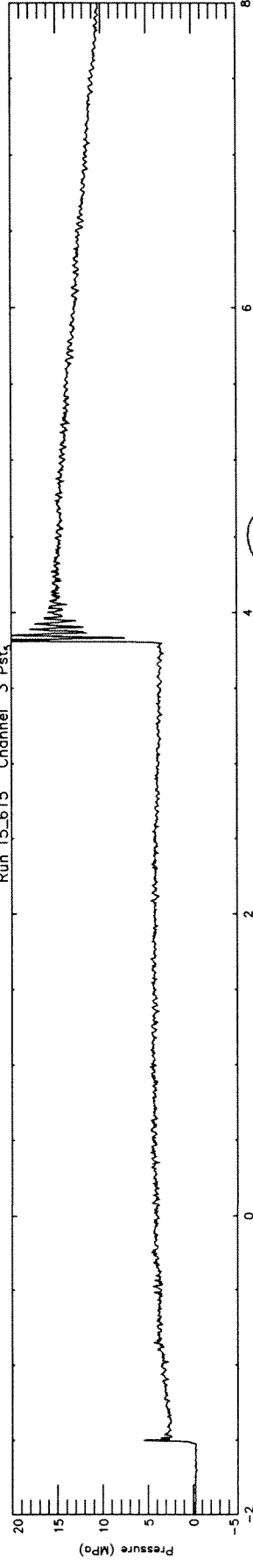
MT 1 :	17.0583
MT 2 :	13.7560
MT 3 :	10.8106
MT 4 :	5.0573
MT 5 :	1.5436
MT 6 :	1.2572
MT 7 :	1.1131
MT 8 :	1.1454
MT 9 :	0.9128
MT10 :	0.7039
MT11 :	0.5417
MT12 :	0.3605



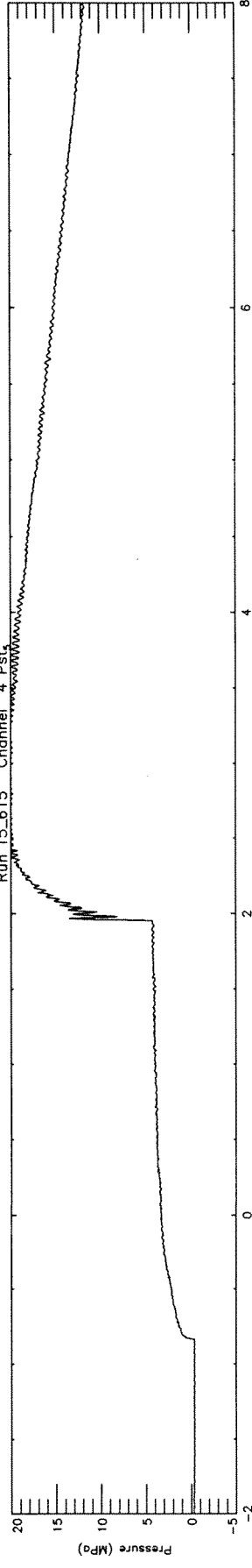
Run T5_615 Channel 2 Pst.



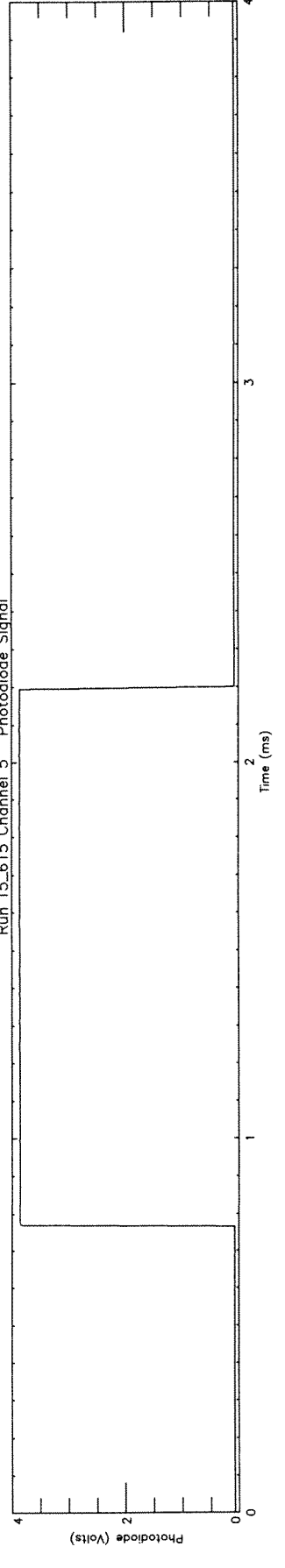
Run T5_615 Channel 3 Pst.



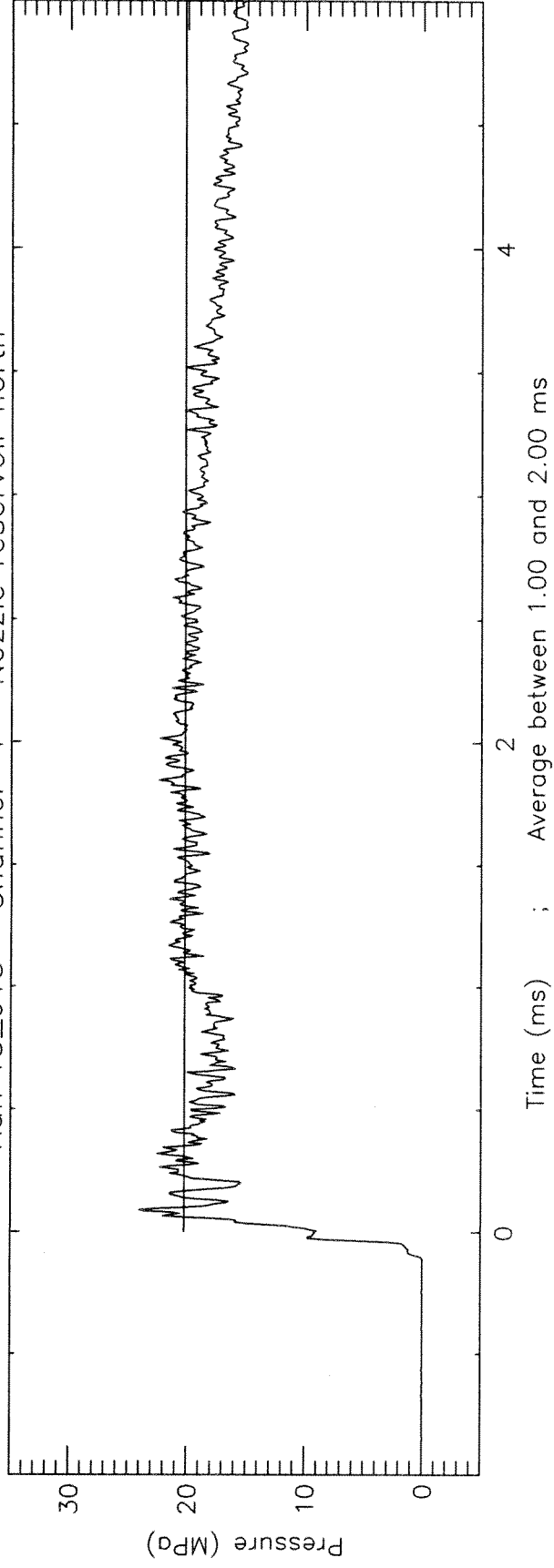
Run T5_615 Channel 4 Pst.



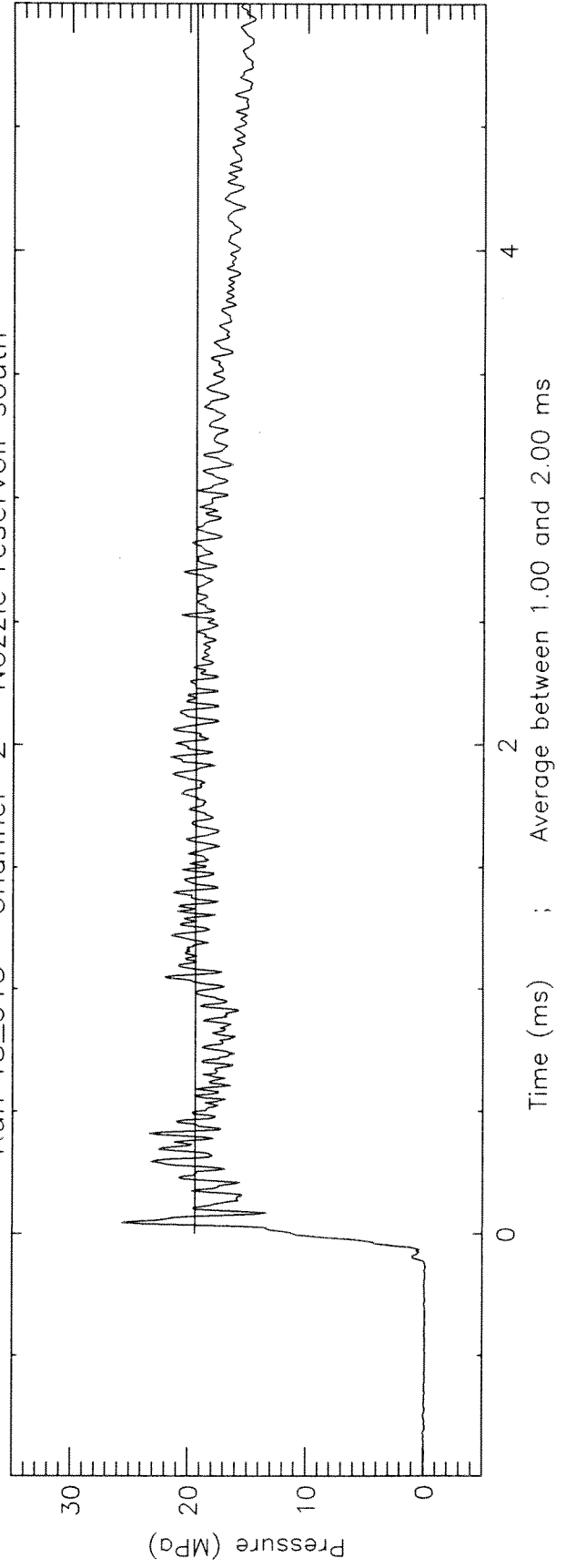
Run T5_615 Channel 5 Photodiode Signal



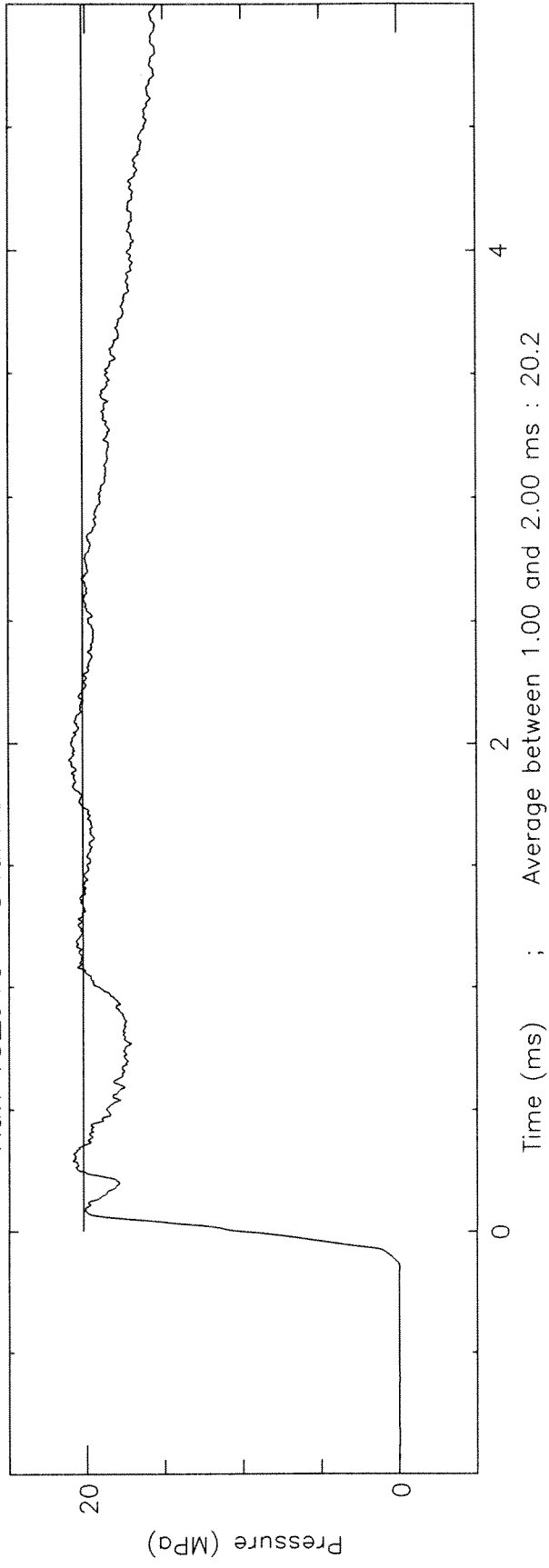
Run T5_615 Channel 1 Nozzle reservoir north



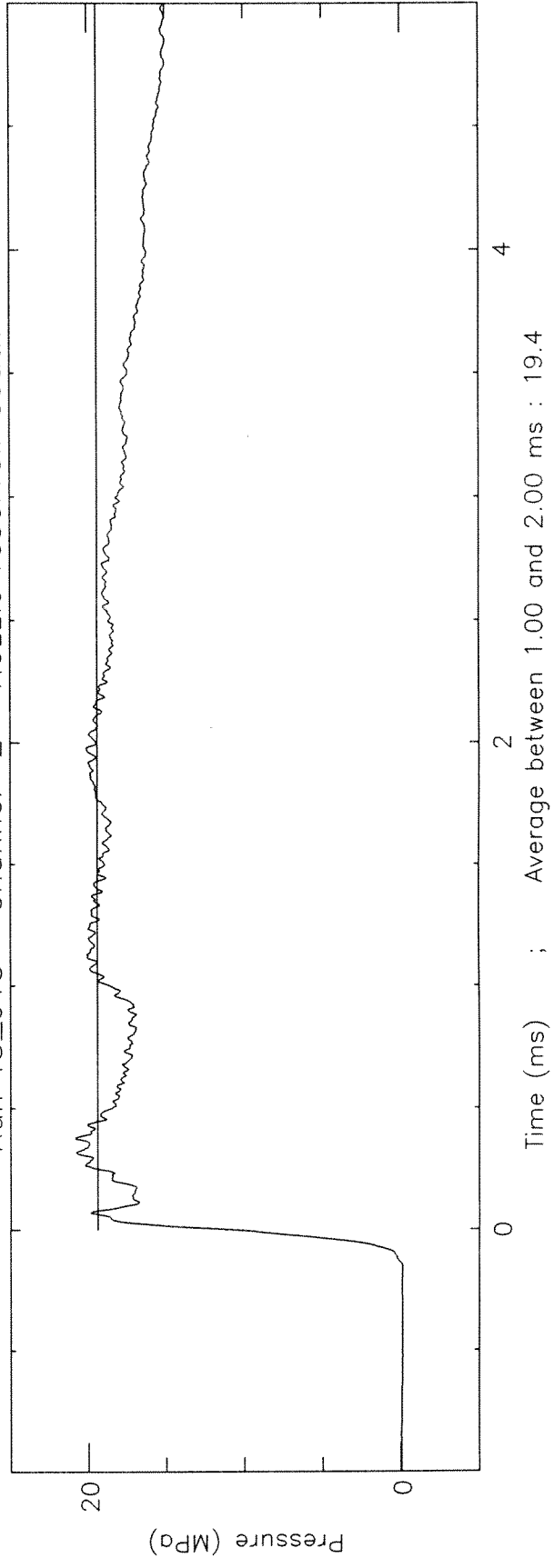
Run T5_615 Channel 2 Nozzle reservoir south

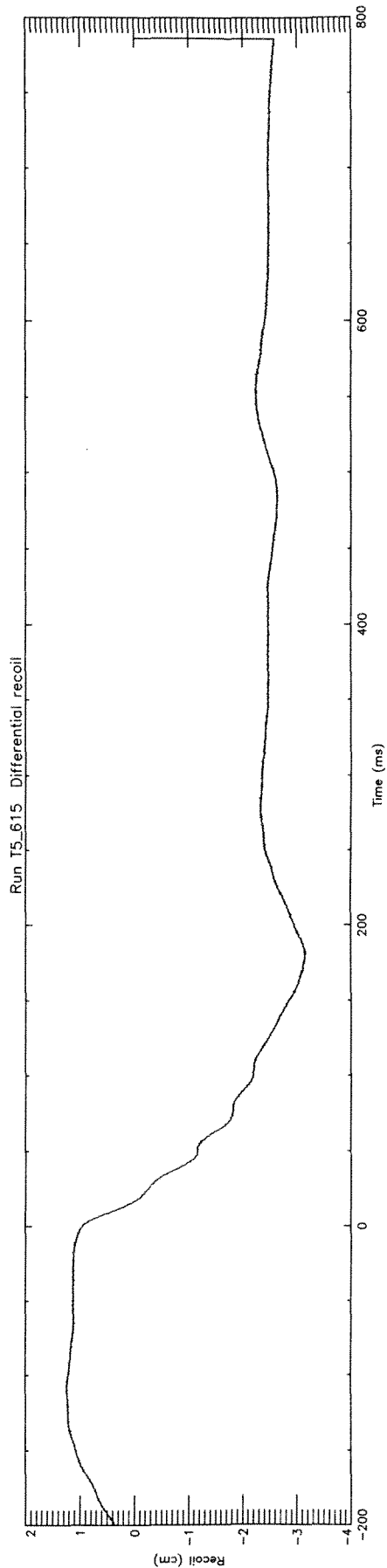
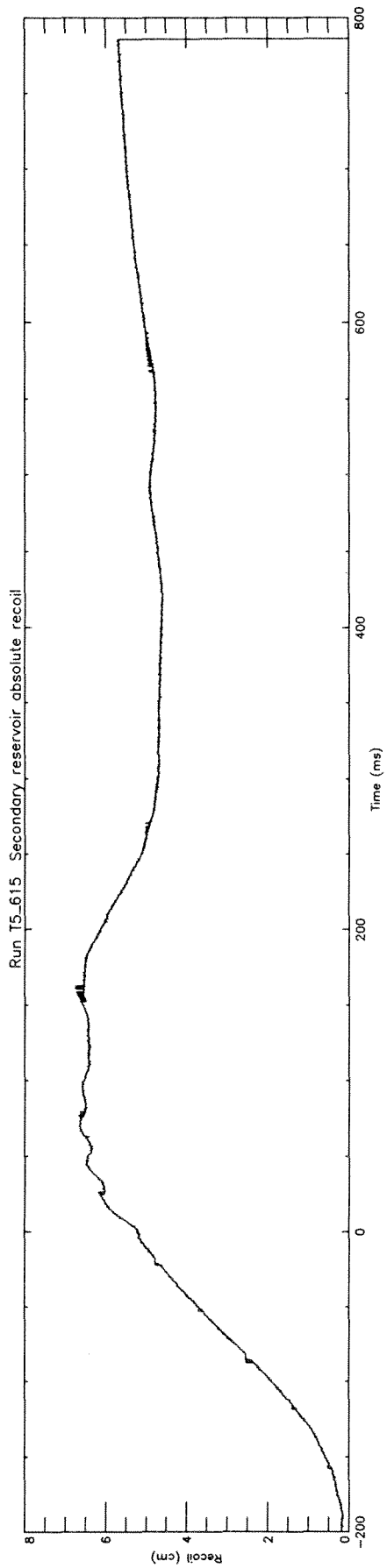
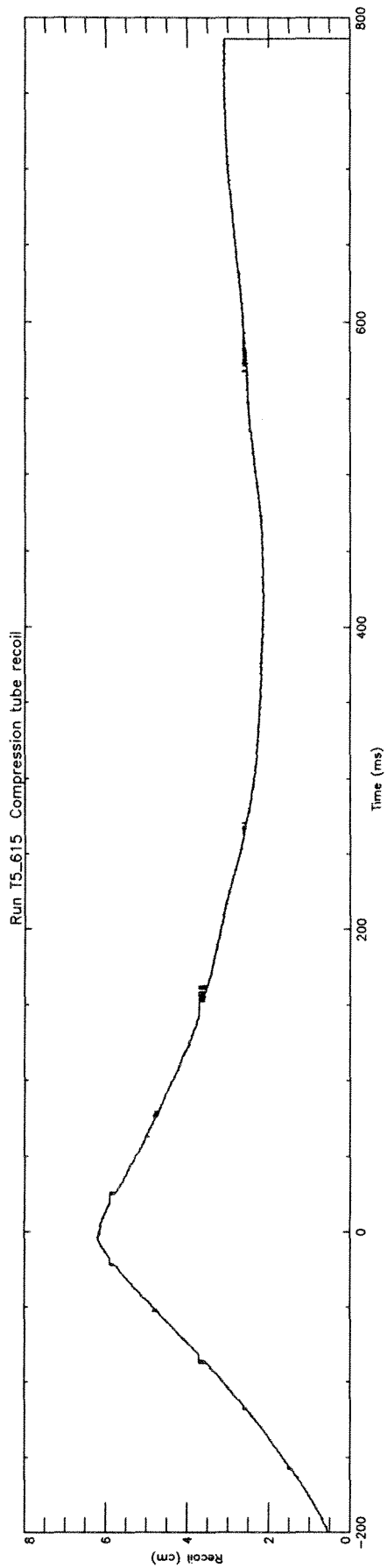


Run T5_615 Channel 1 Nozzle reservoir north

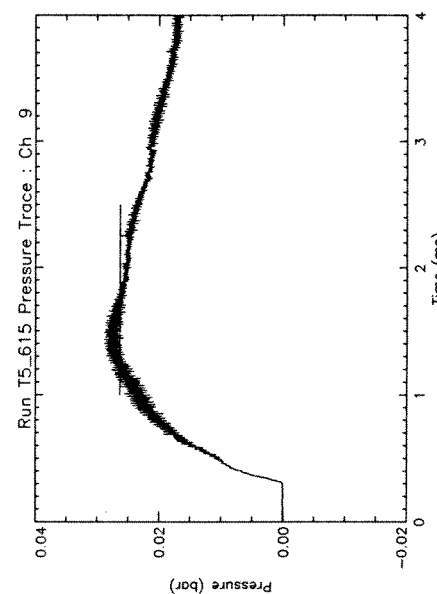
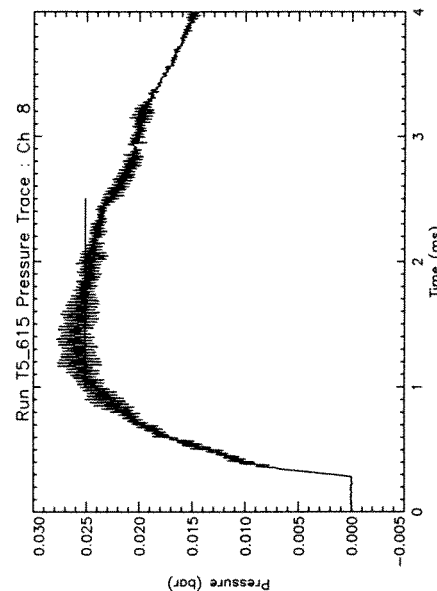
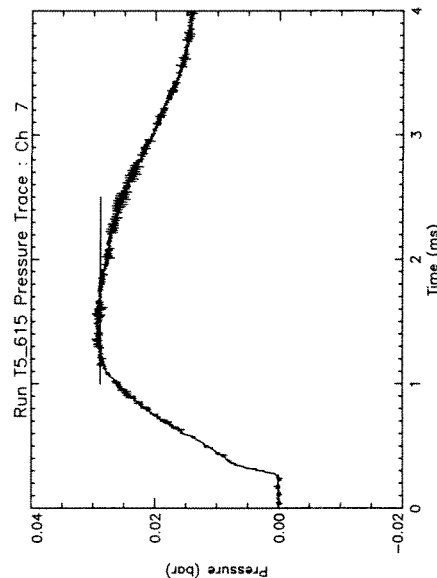
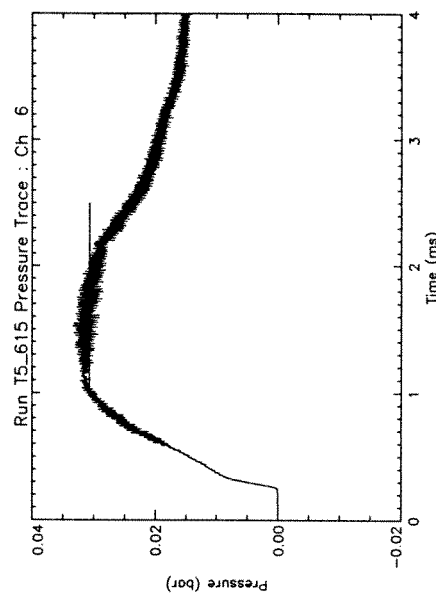
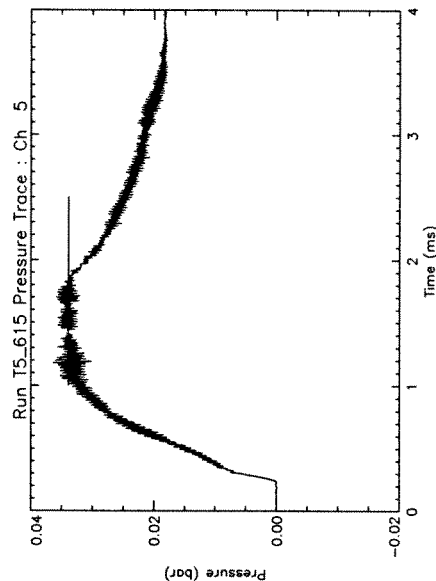
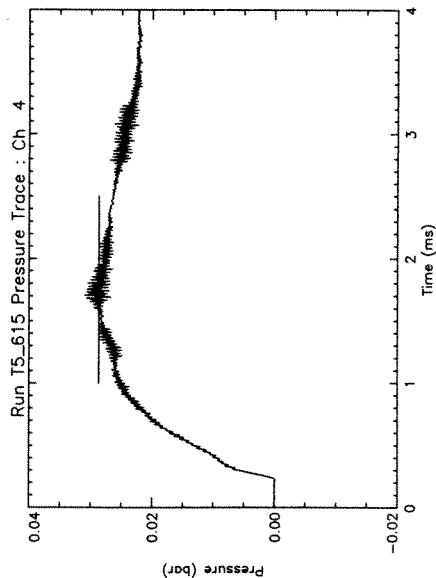
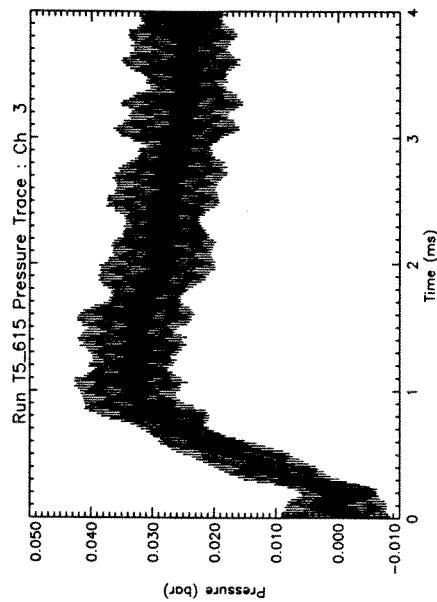
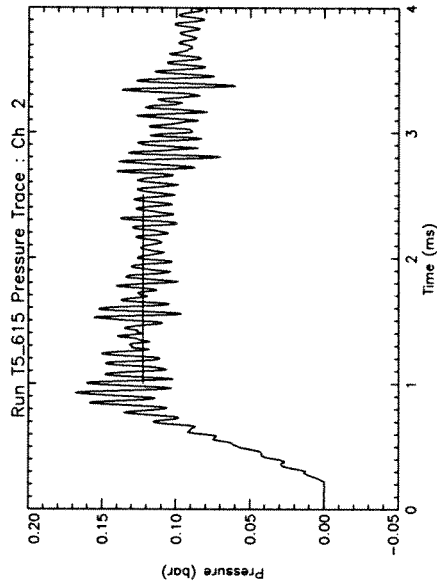
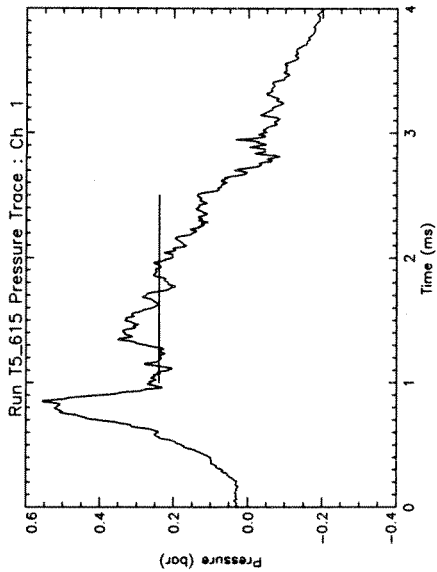


Run T5_615 Channel 2 Nozzle reservoir south

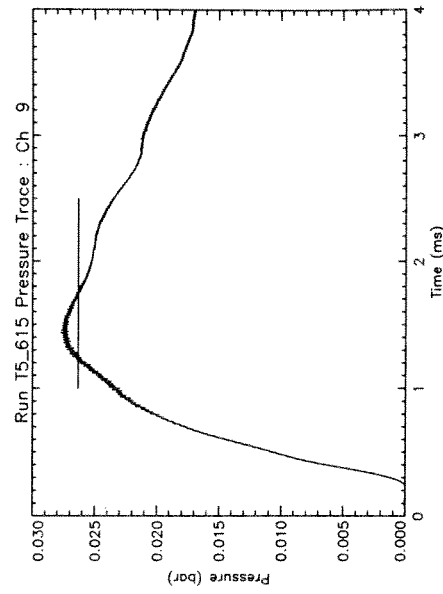
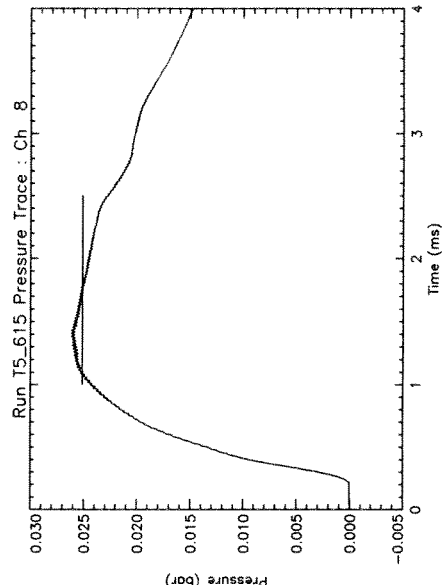
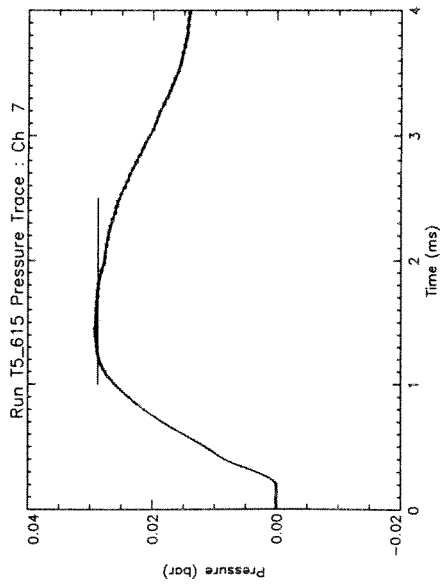
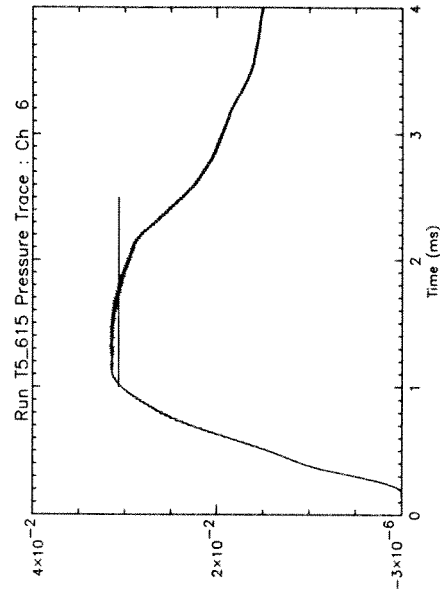
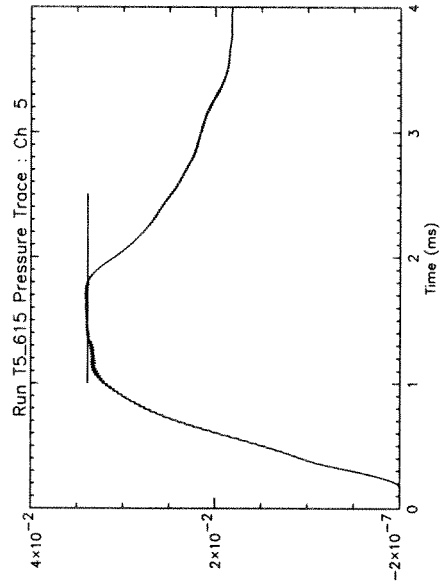
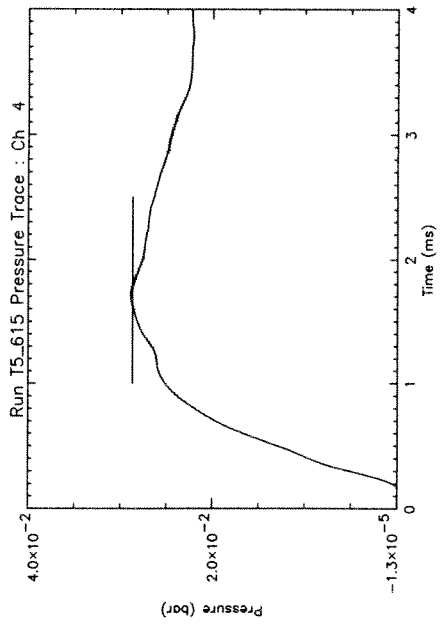
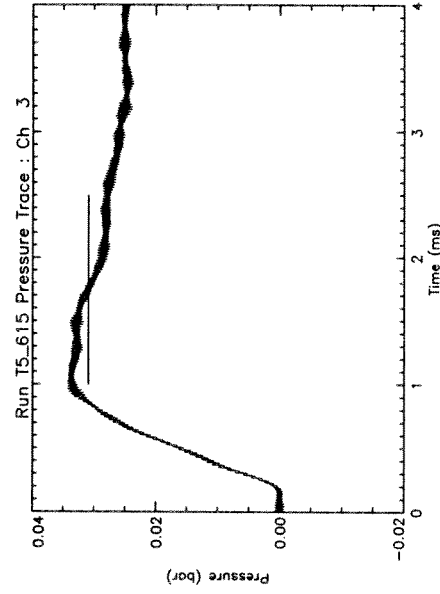
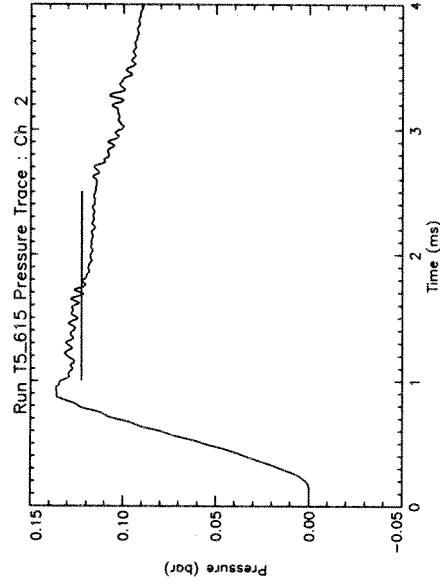
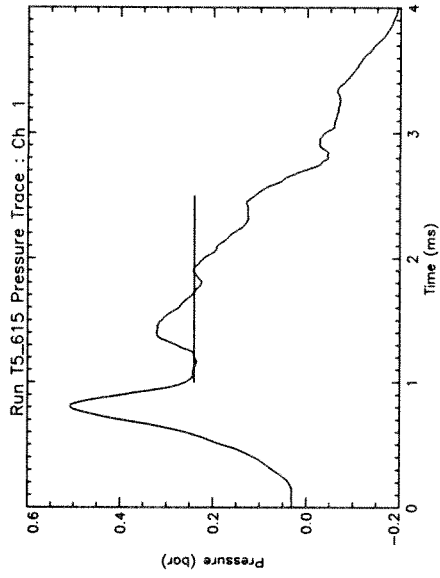


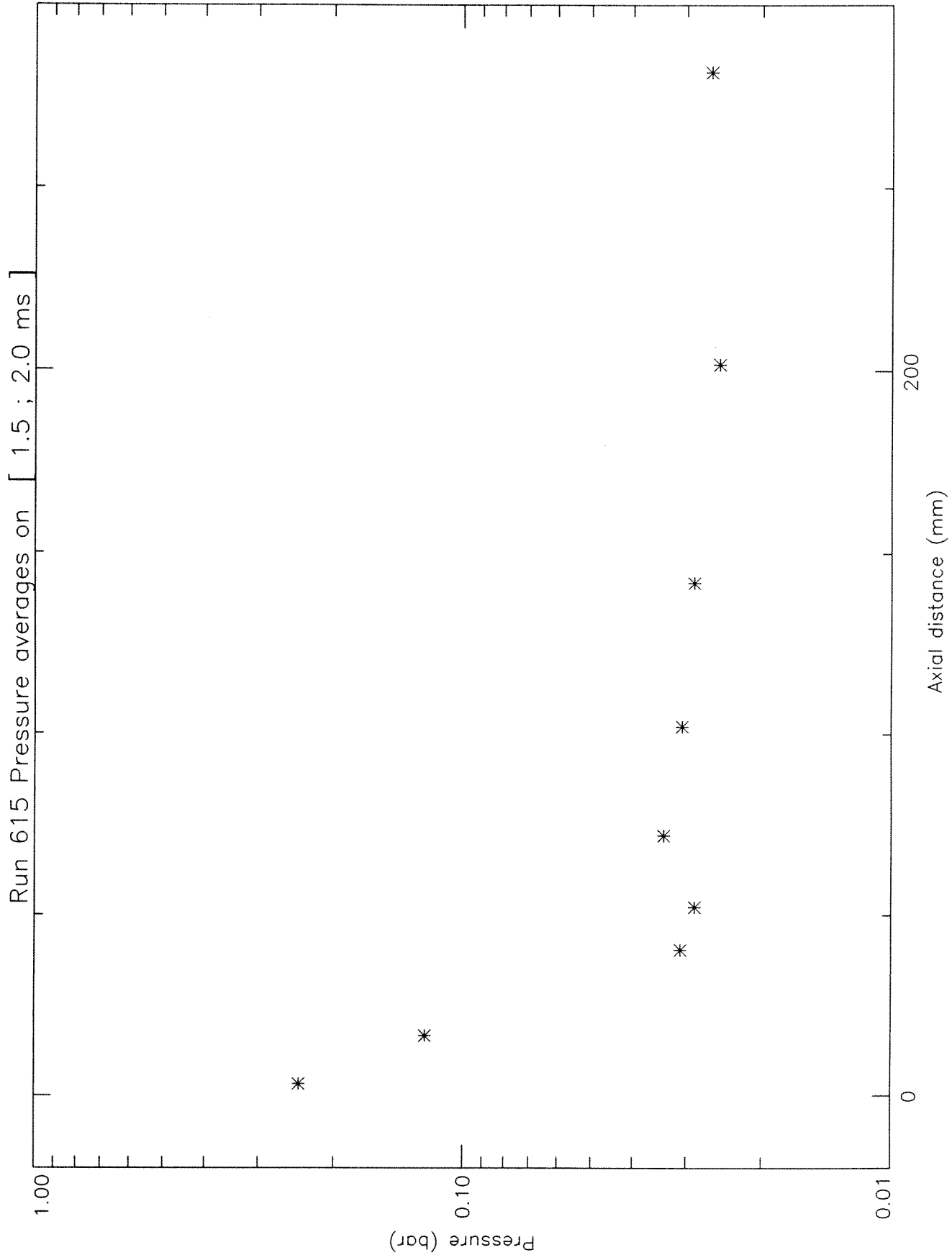


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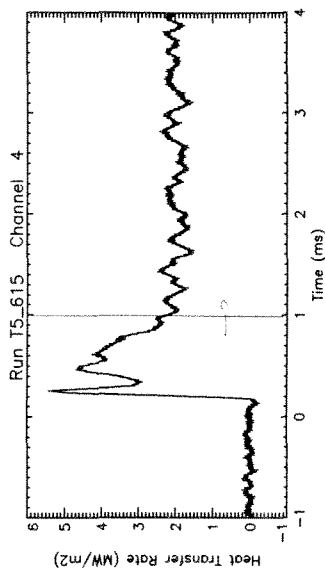
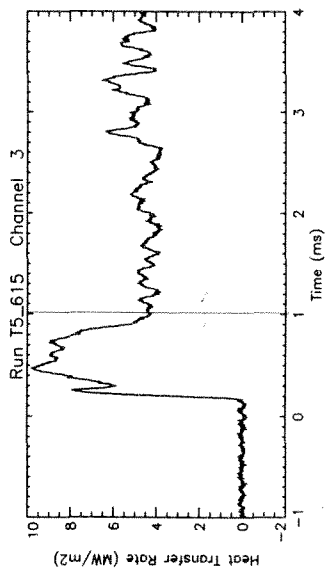
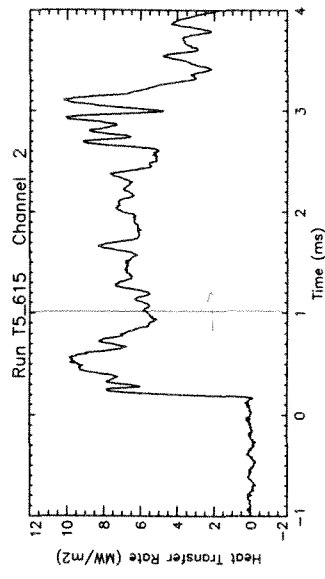
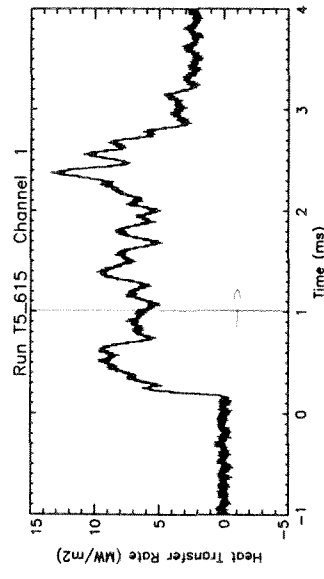
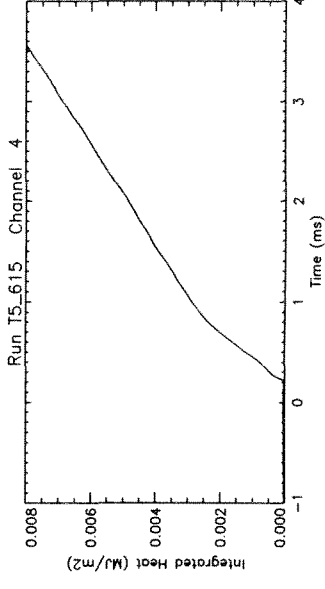
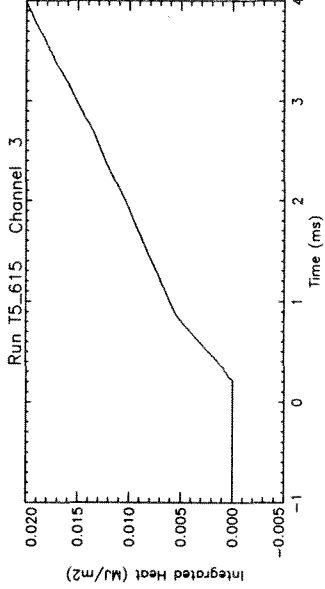
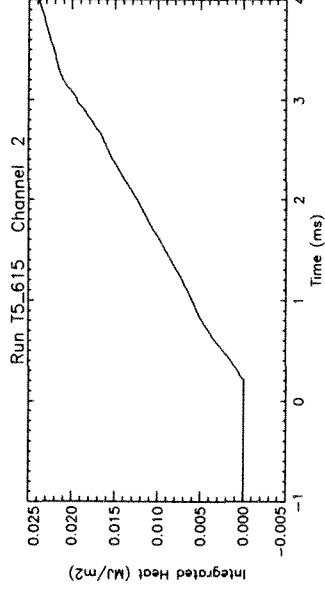
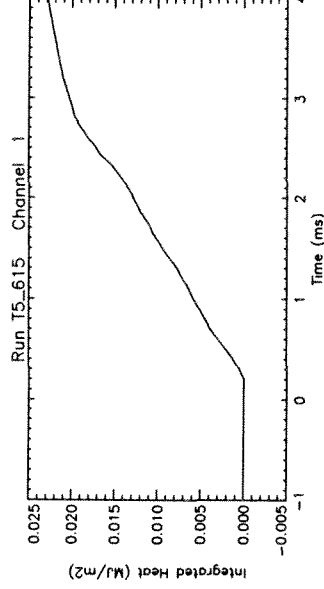
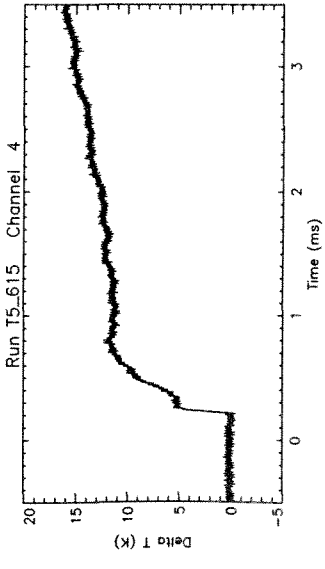
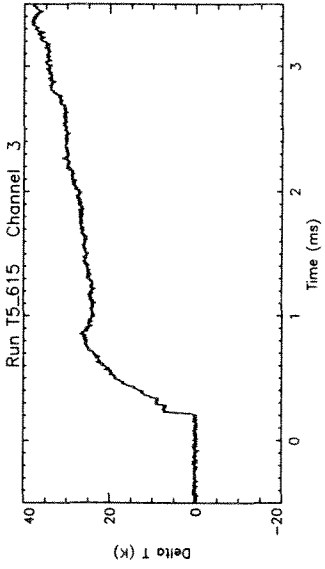
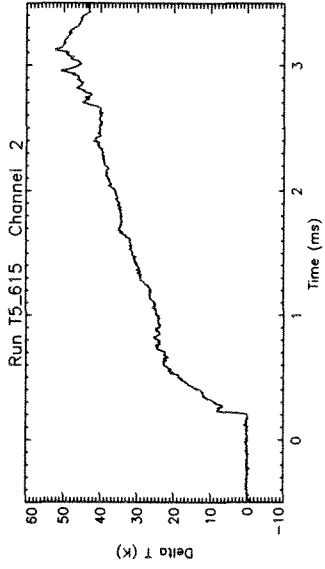
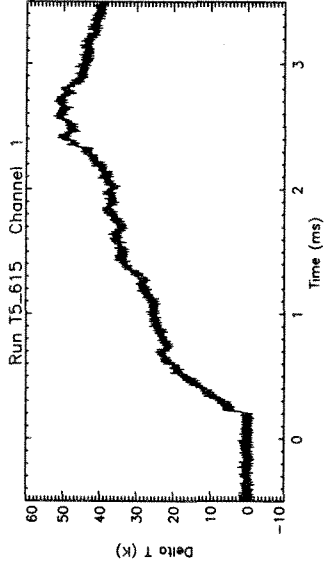


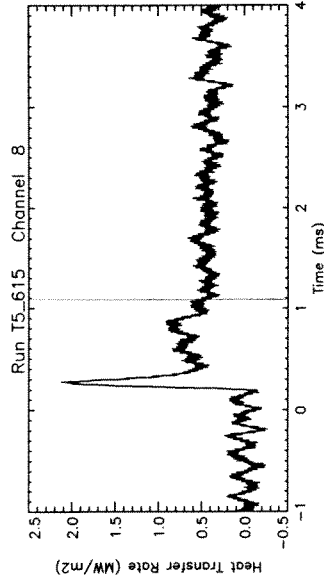
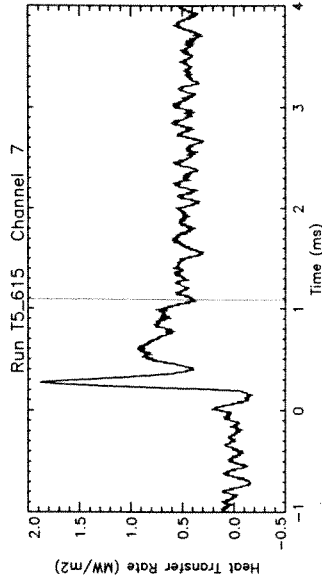
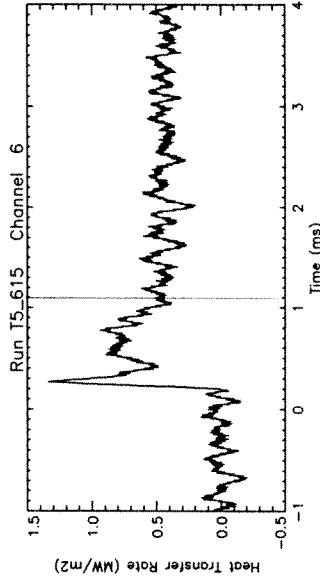
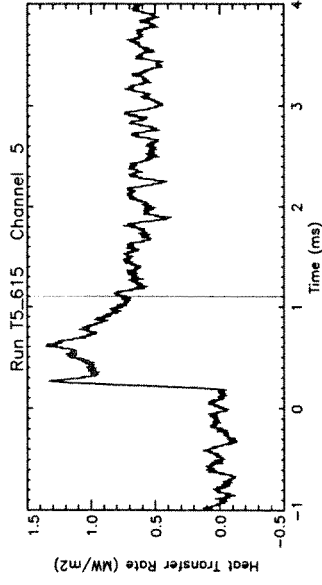
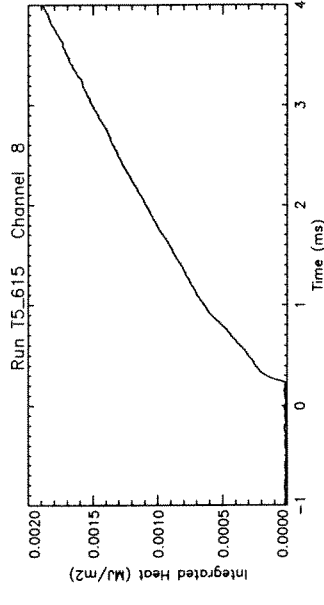
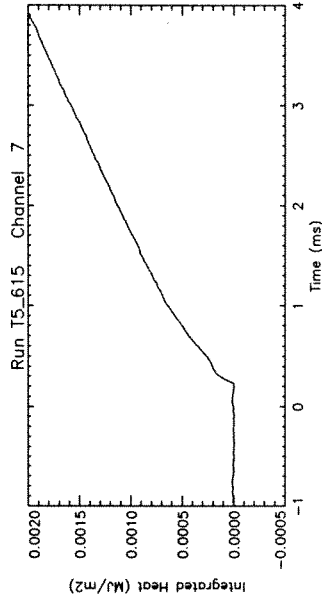
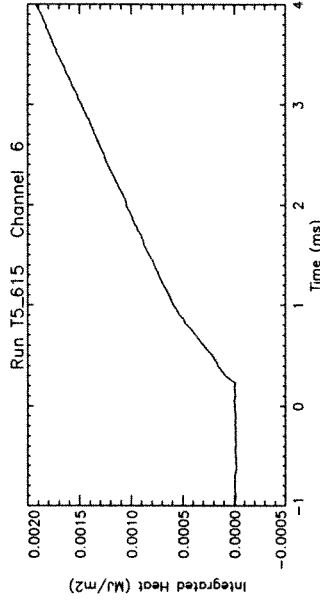
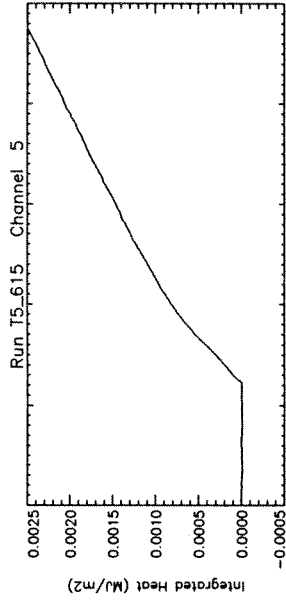
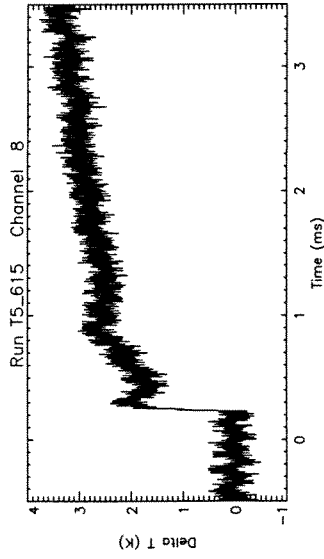
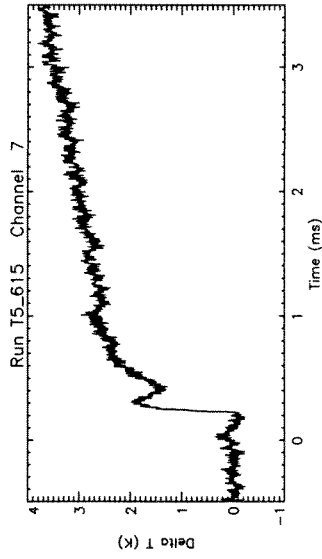
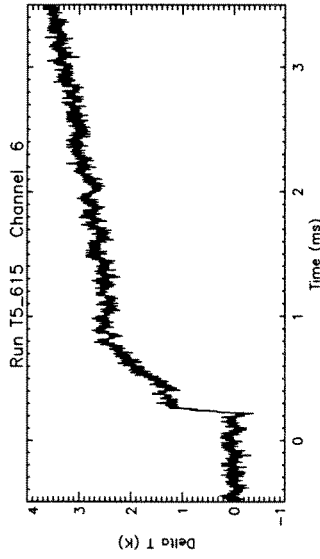
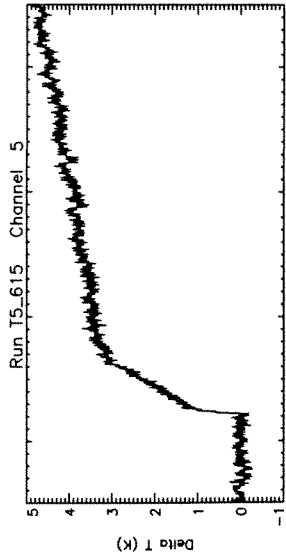
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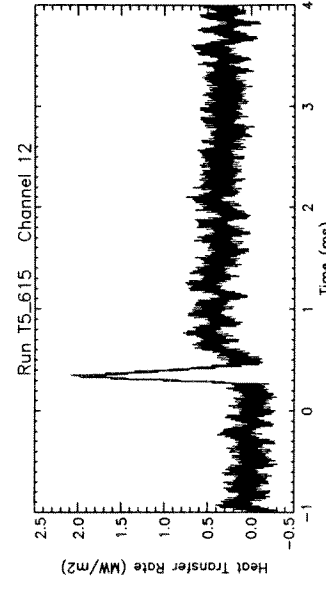
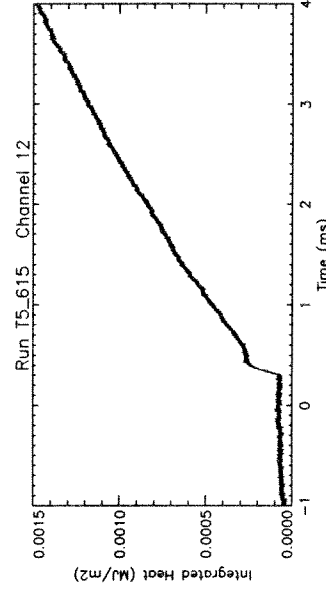
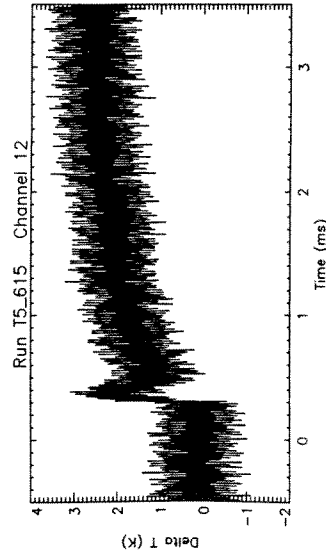
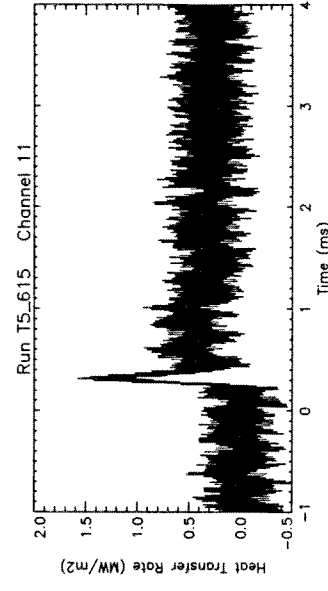
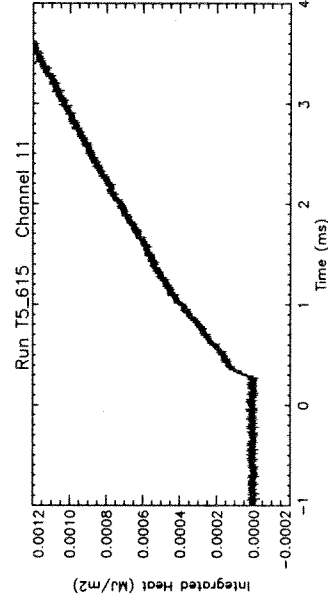
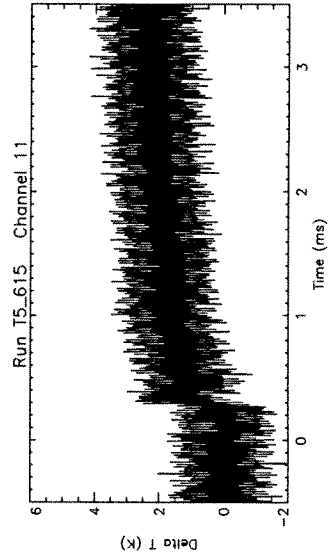
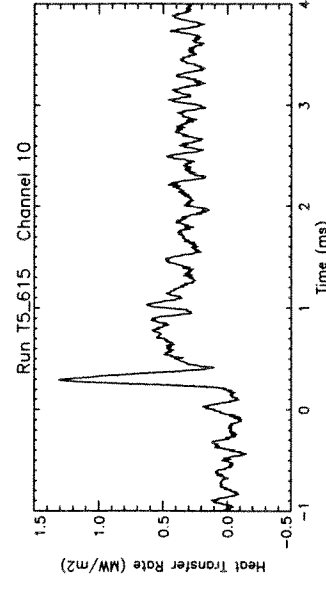
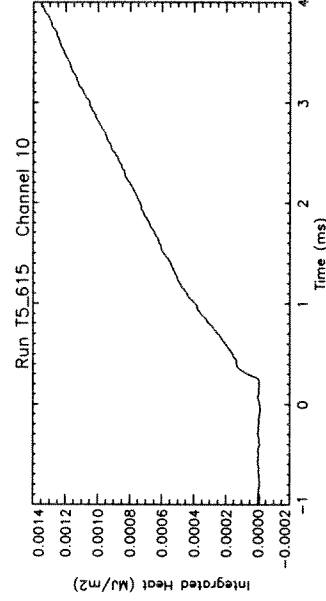
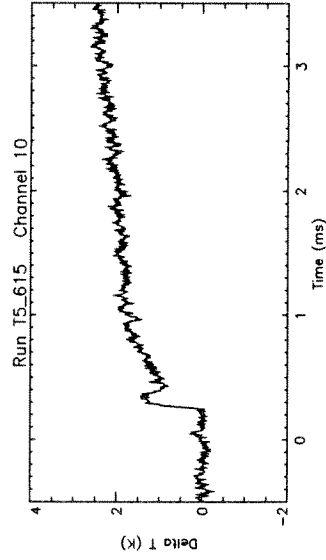
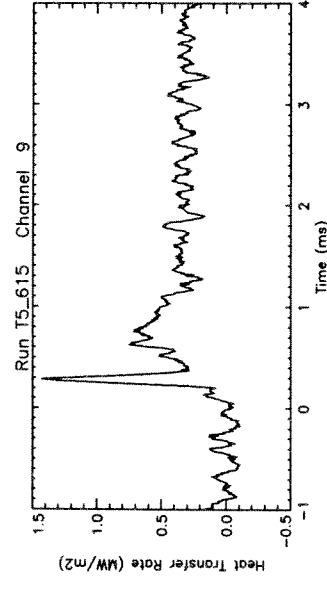
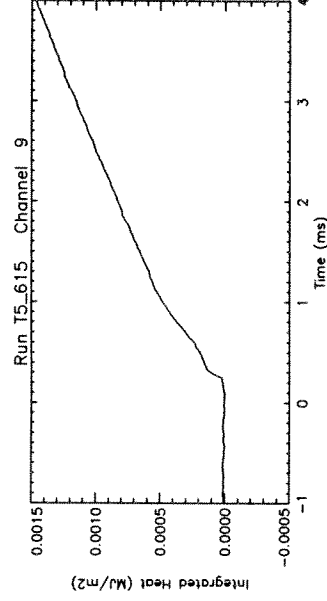
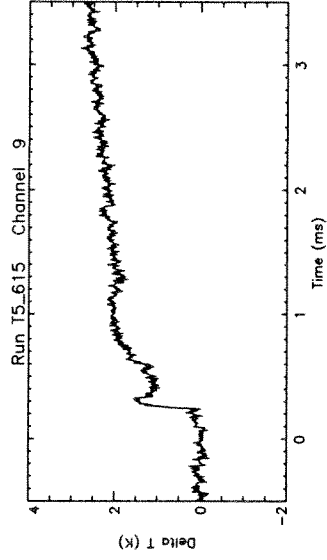


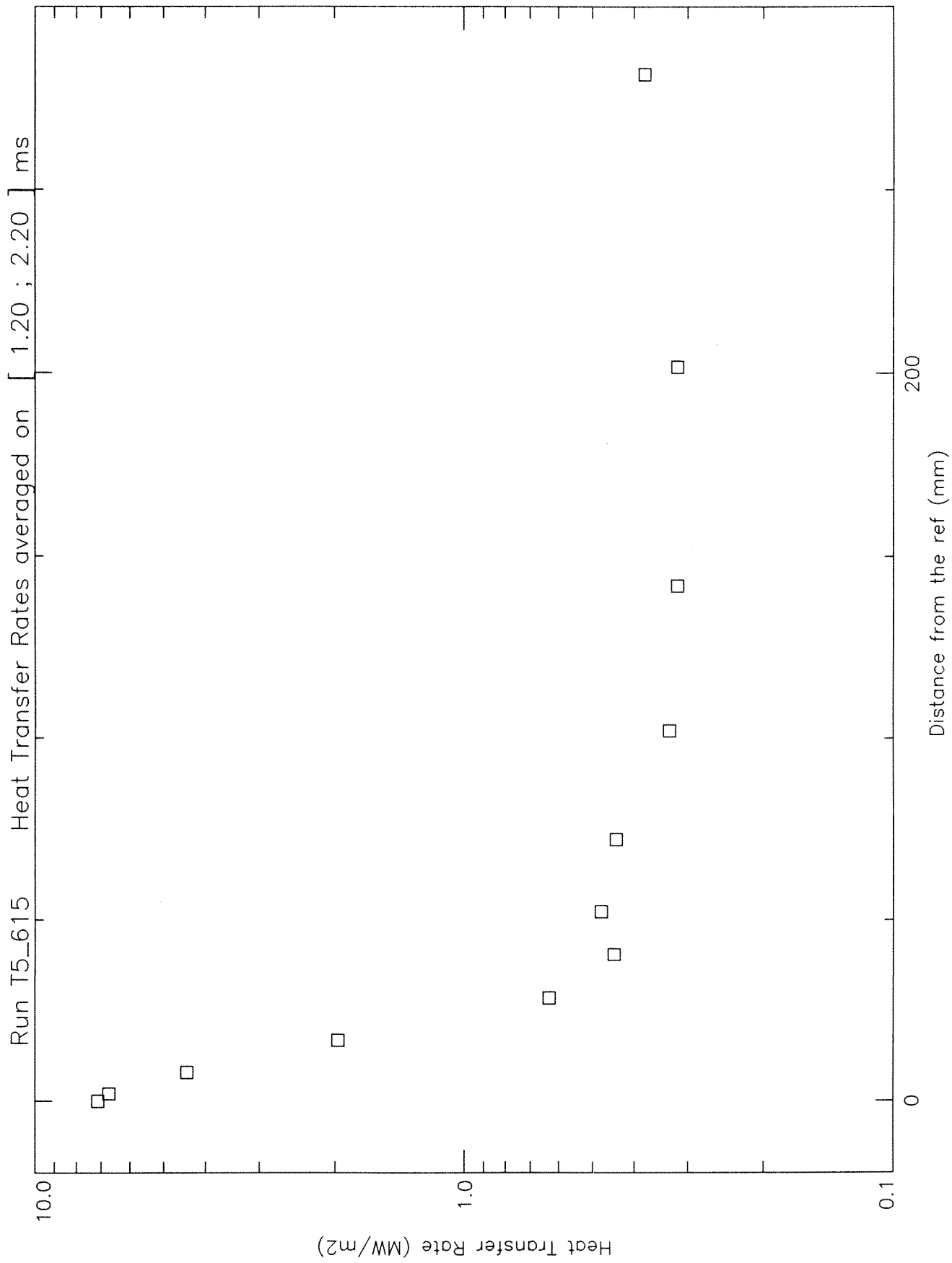


ave on 100/007ms









Run # 615

Pressure averages around 1.75 +/- 0.25 ms

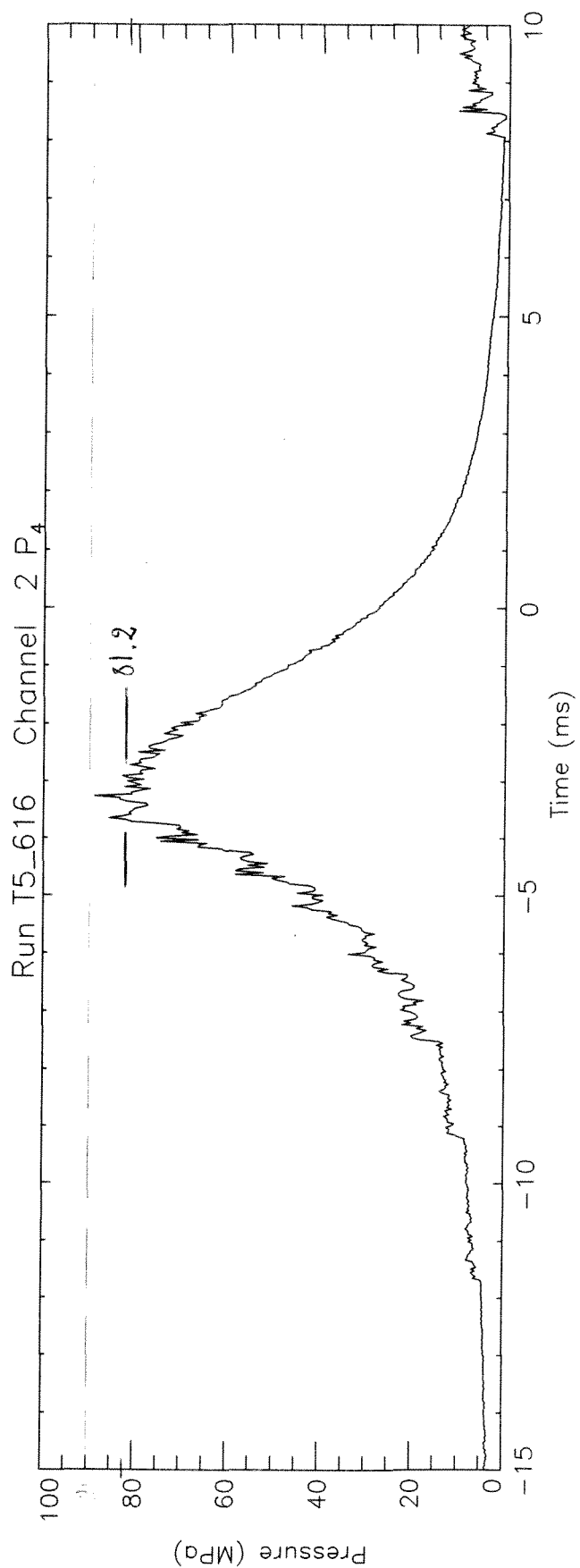
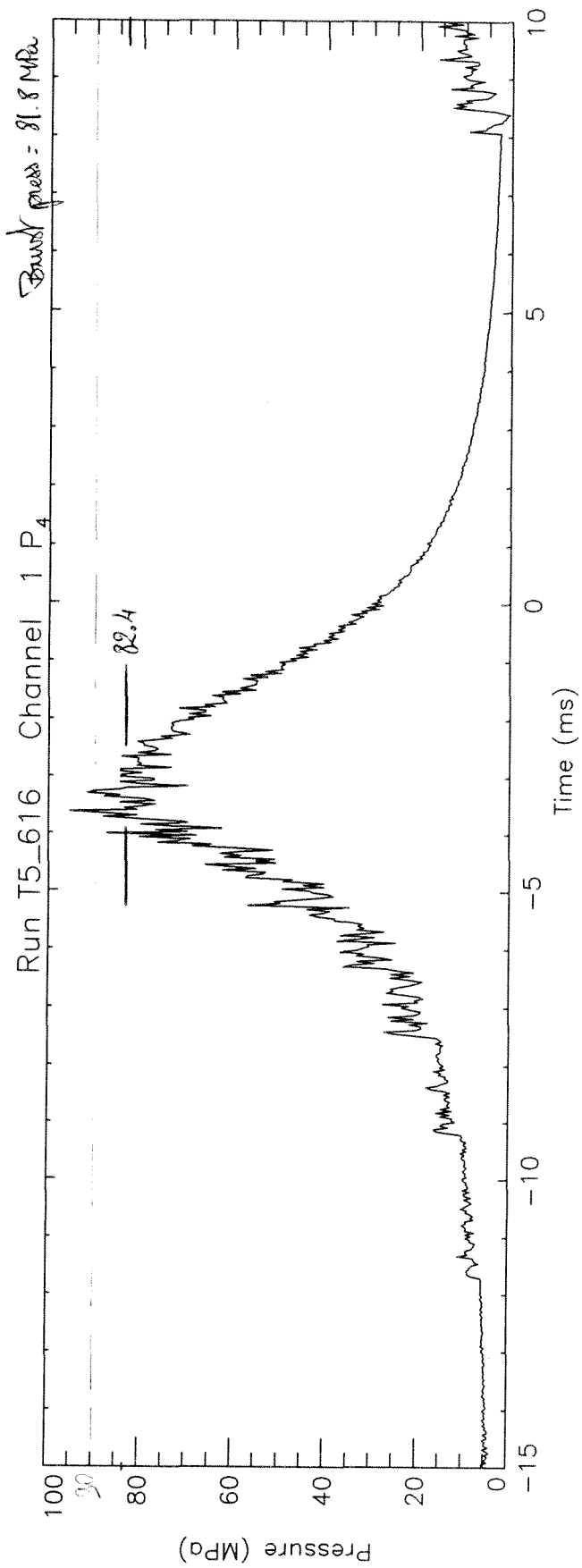
Smooth box = 2.

DA1	:	0.2398
DA2	:	0.1222
DA3	:	0.0310
DA4	:	0.0287
DA5	:	0.0339
DA6	:	0.0307
DA7	:	0.0288
DA8	:	0.0251
DA9	:	0.0263

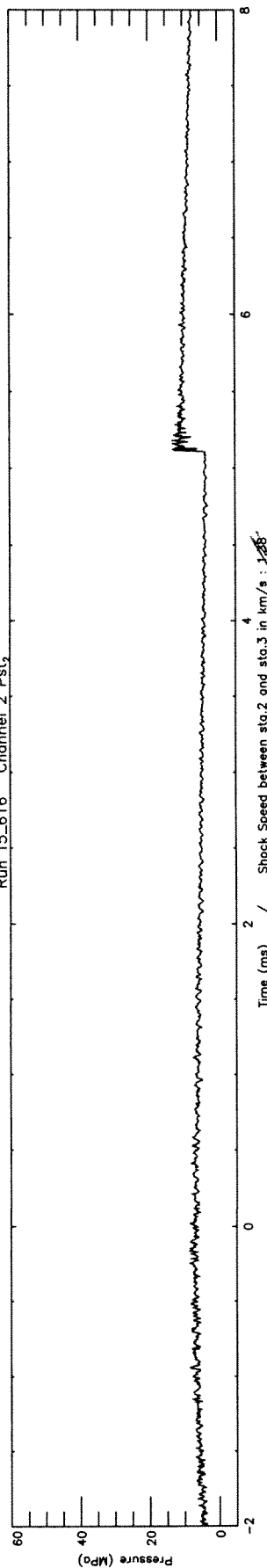
Run # 615

Heat Transfer Rates (in MW/m²)
averaged around 1.70 +/- 0.50 ms

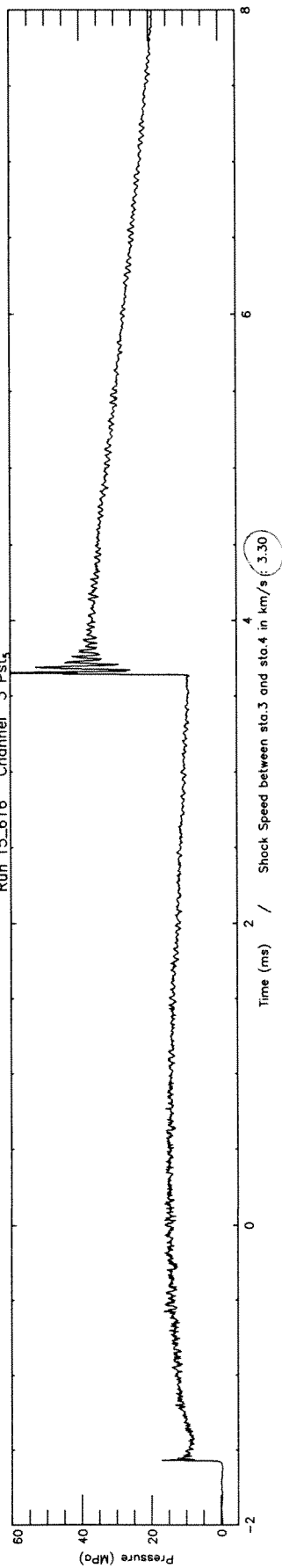
MT 1 :	7.1272
MT 2 :	6.7133
MT 3 :	4.4206
MT 4 :	1.9702
MT 5 :	0.6321
MT 6 :	0.4454
MT 7 :	0.4778
MT 8 :	0.4406
MT 9 :	0.3311
MT10 :	0.3172
MT11 :	0.3171
MT12 :	0.3779



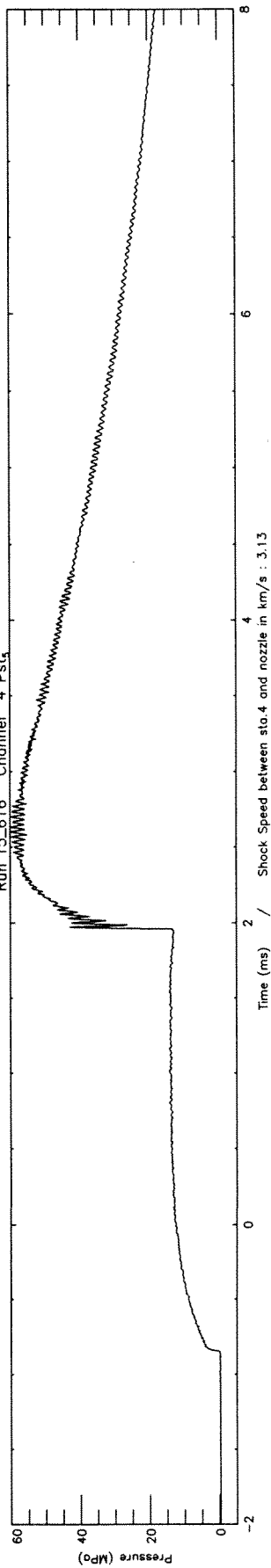
Run T5_616 Channel 2 Pst₂



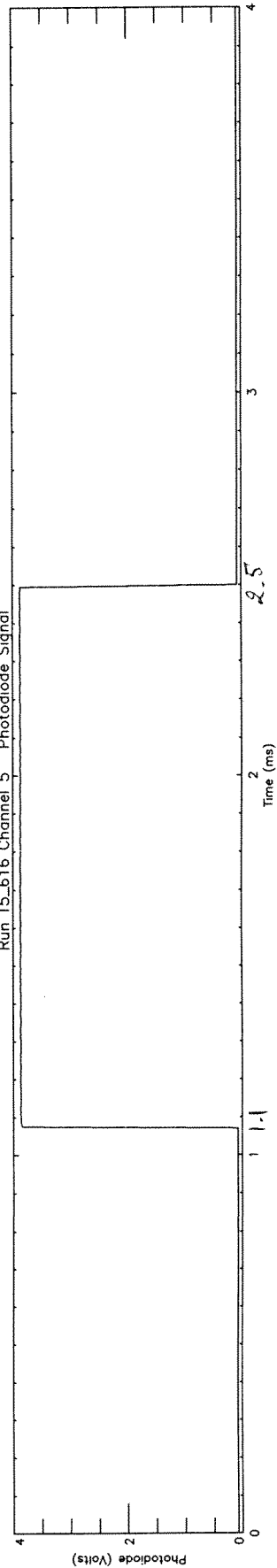
Run T5_616 Channel 3 Pst₃



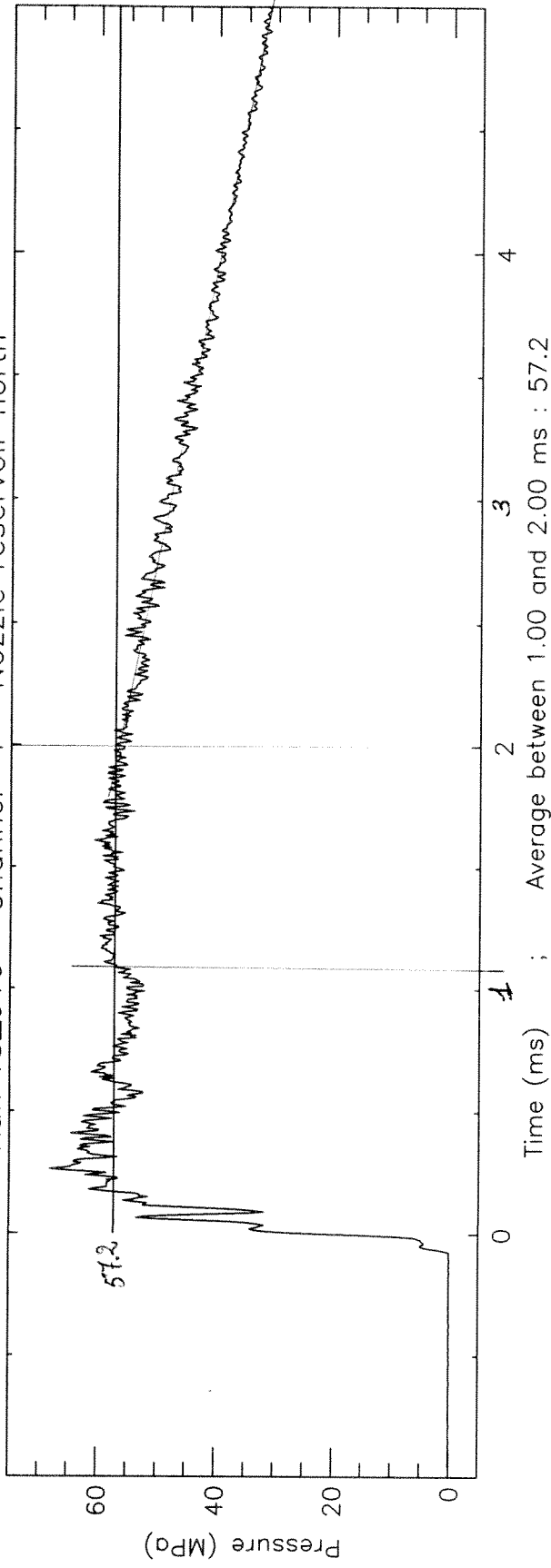
Run T5_616 Channel 4 Pst₄



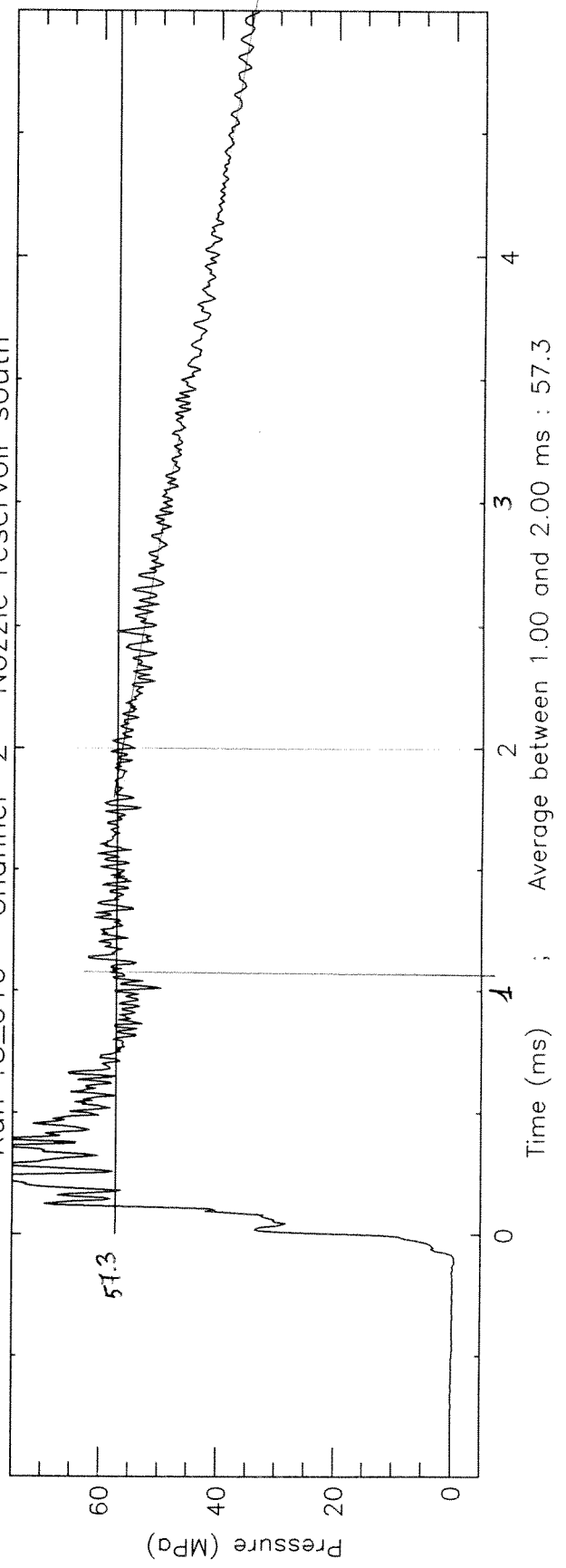
Run T5_616 Channel 5 Photodiode Signal

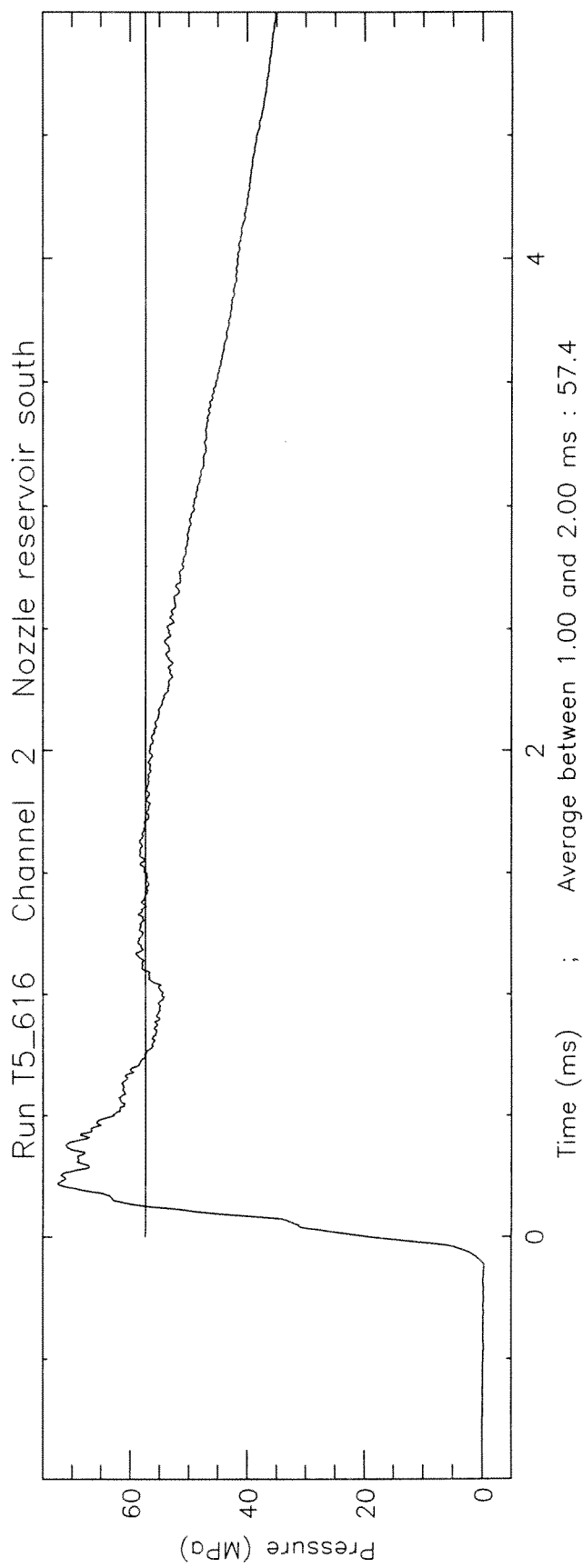
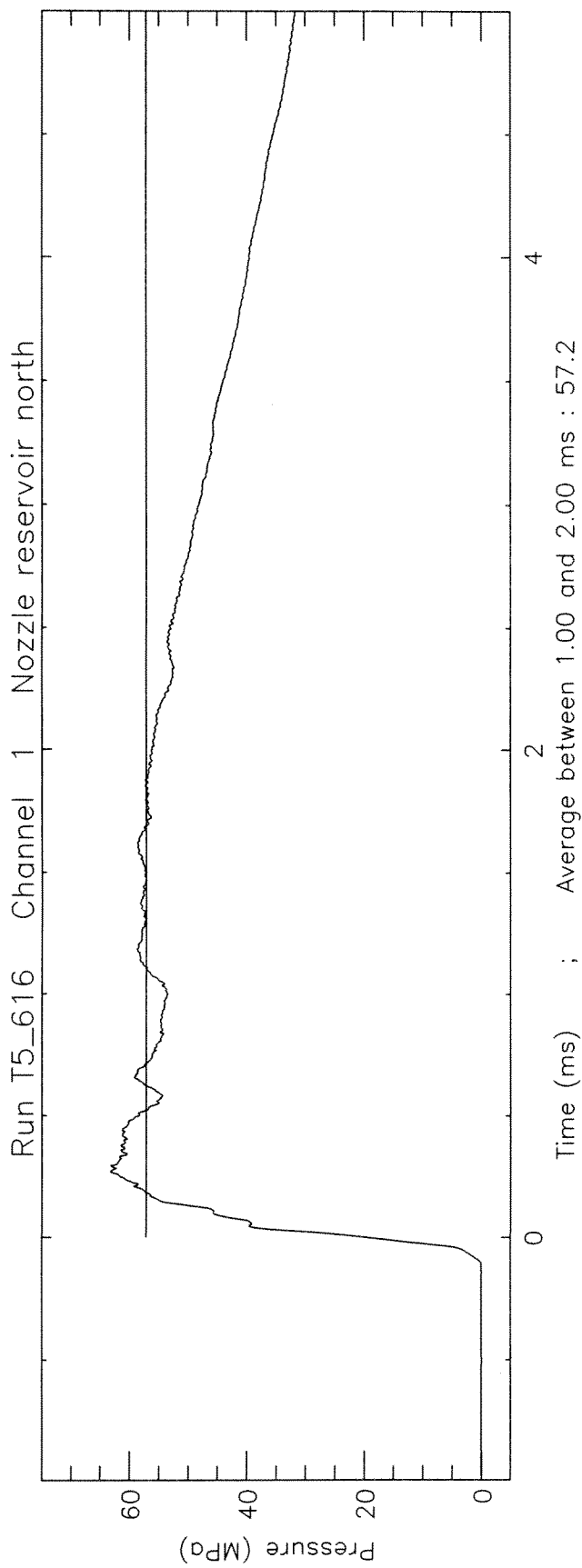


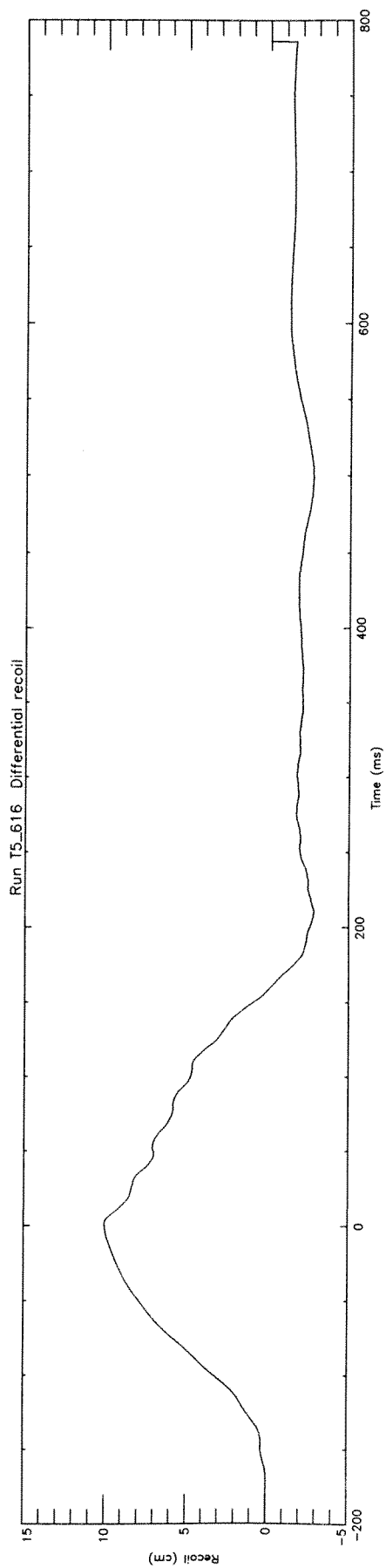
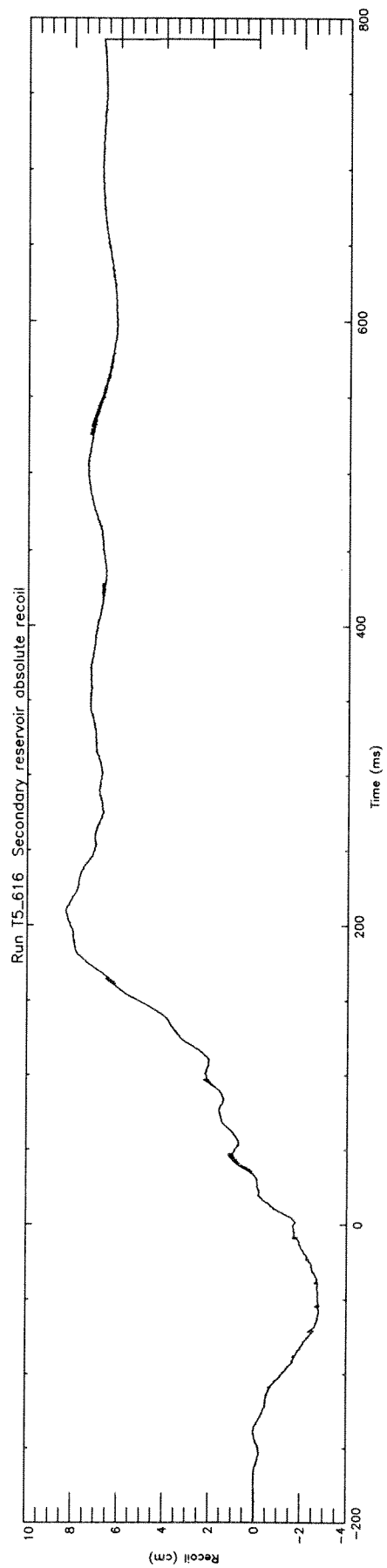
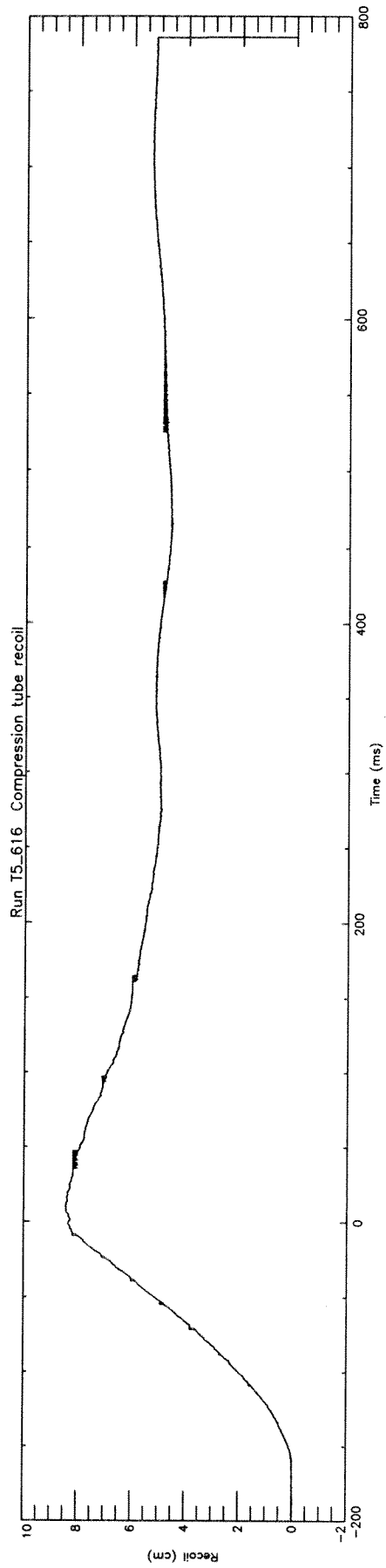
Run T5_616 Channel 1 Nozzle reservoir north



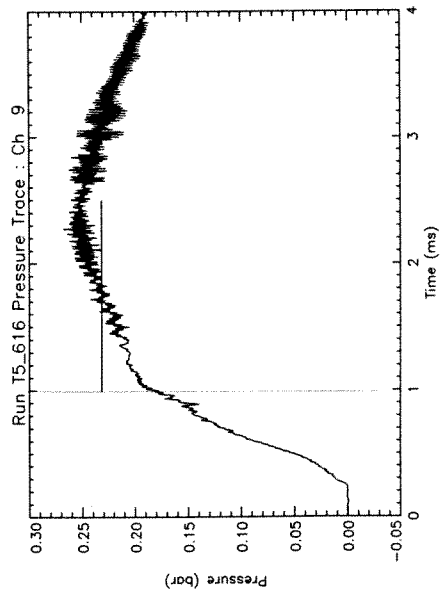
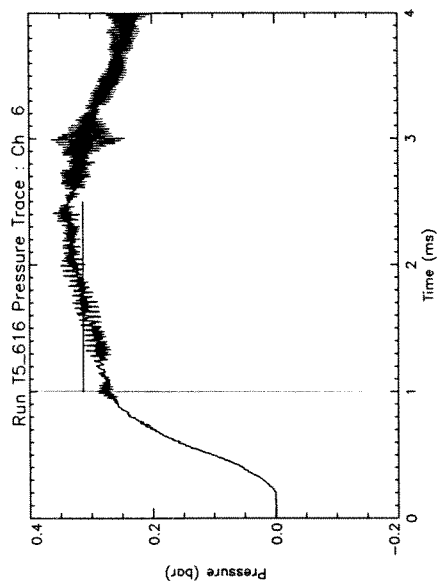
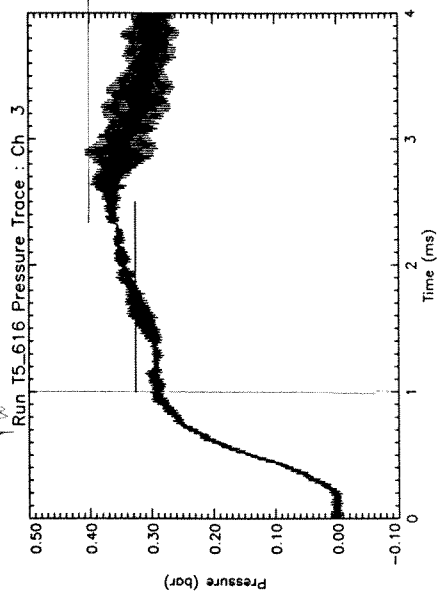
Run T5_616 Channel 2 Nozzle reservoir south



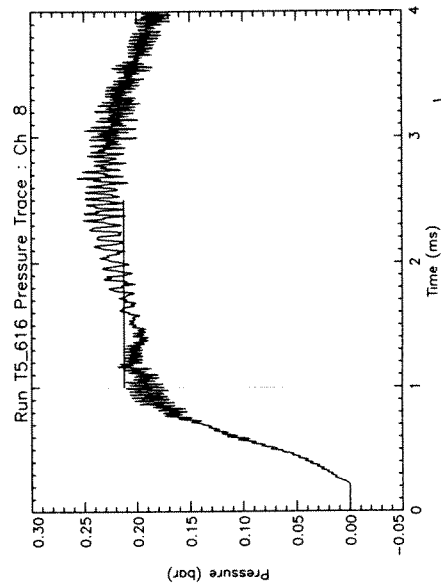
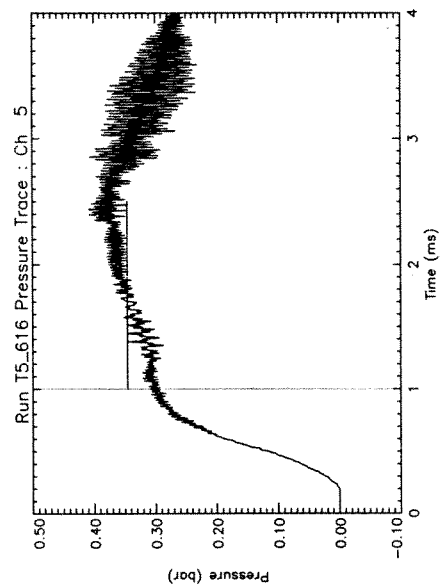
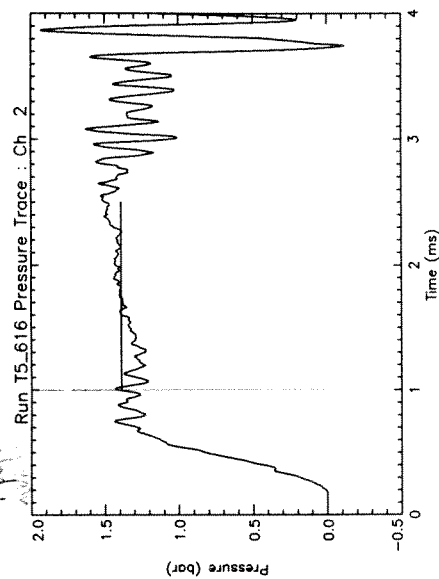




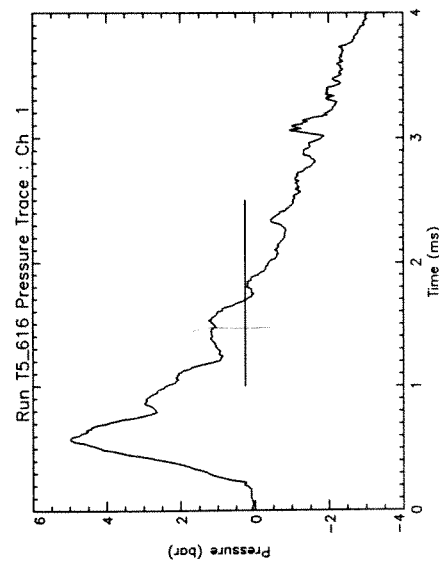
Did you



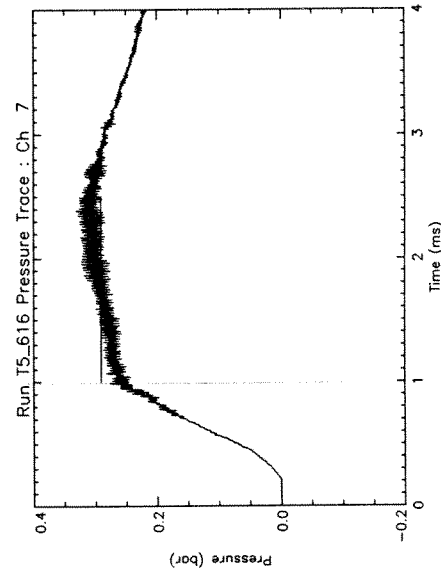
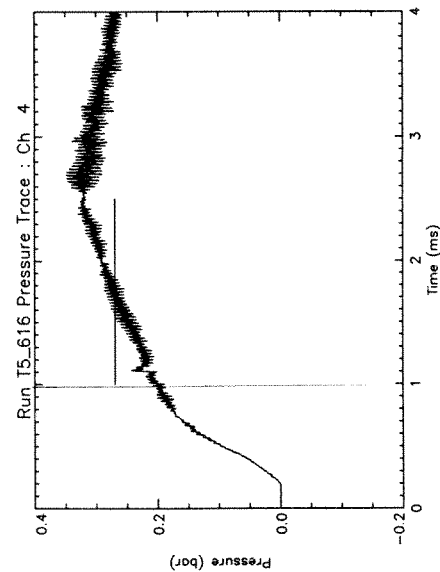
Max = 1.7 bar
V₁ = 0.001 m³

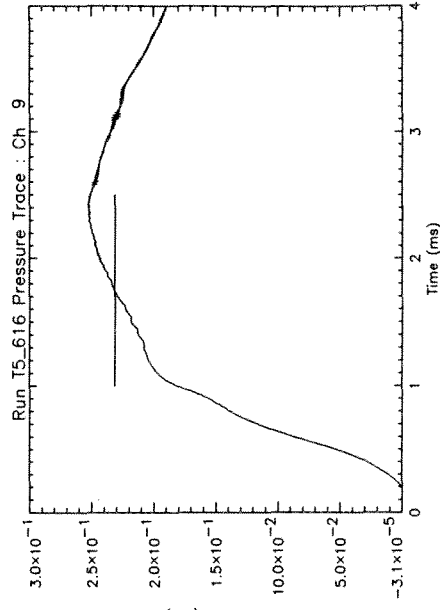
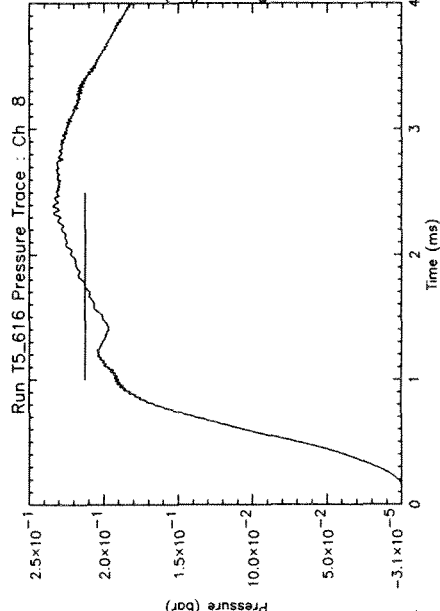
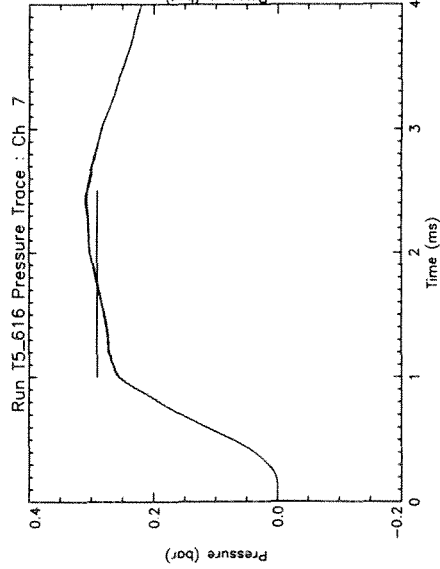
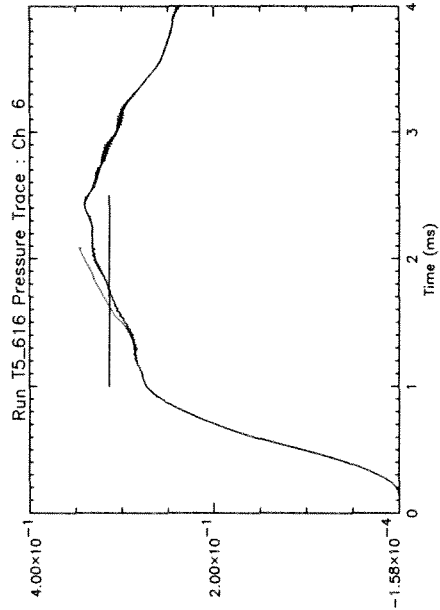
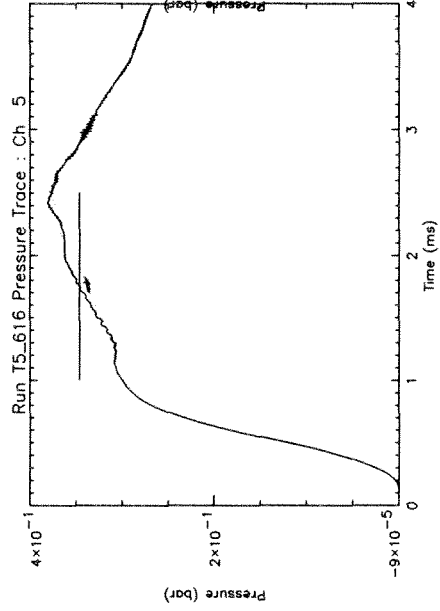
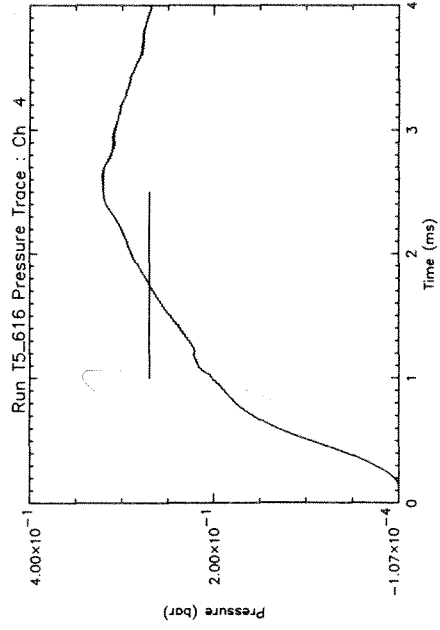
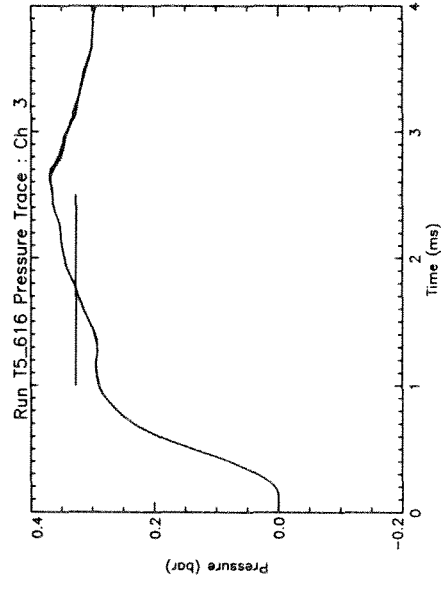
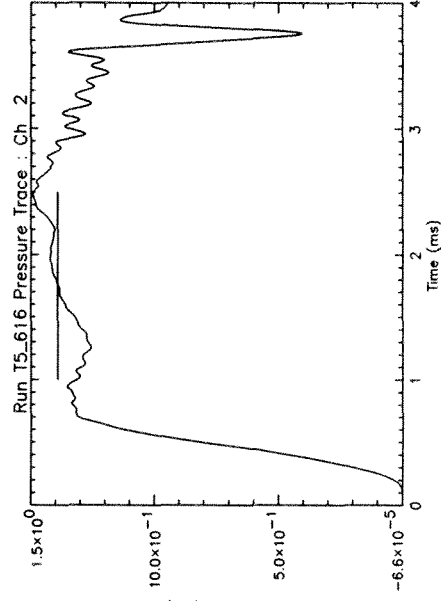
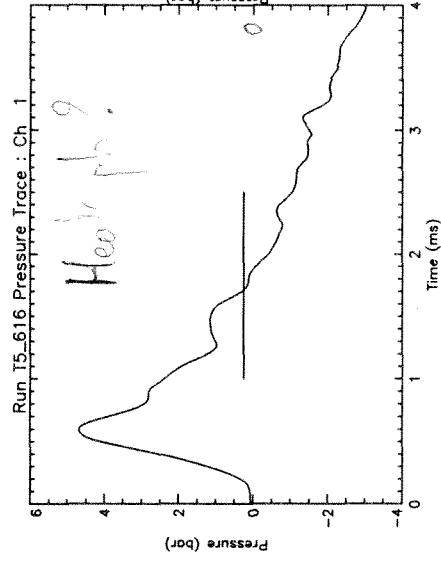


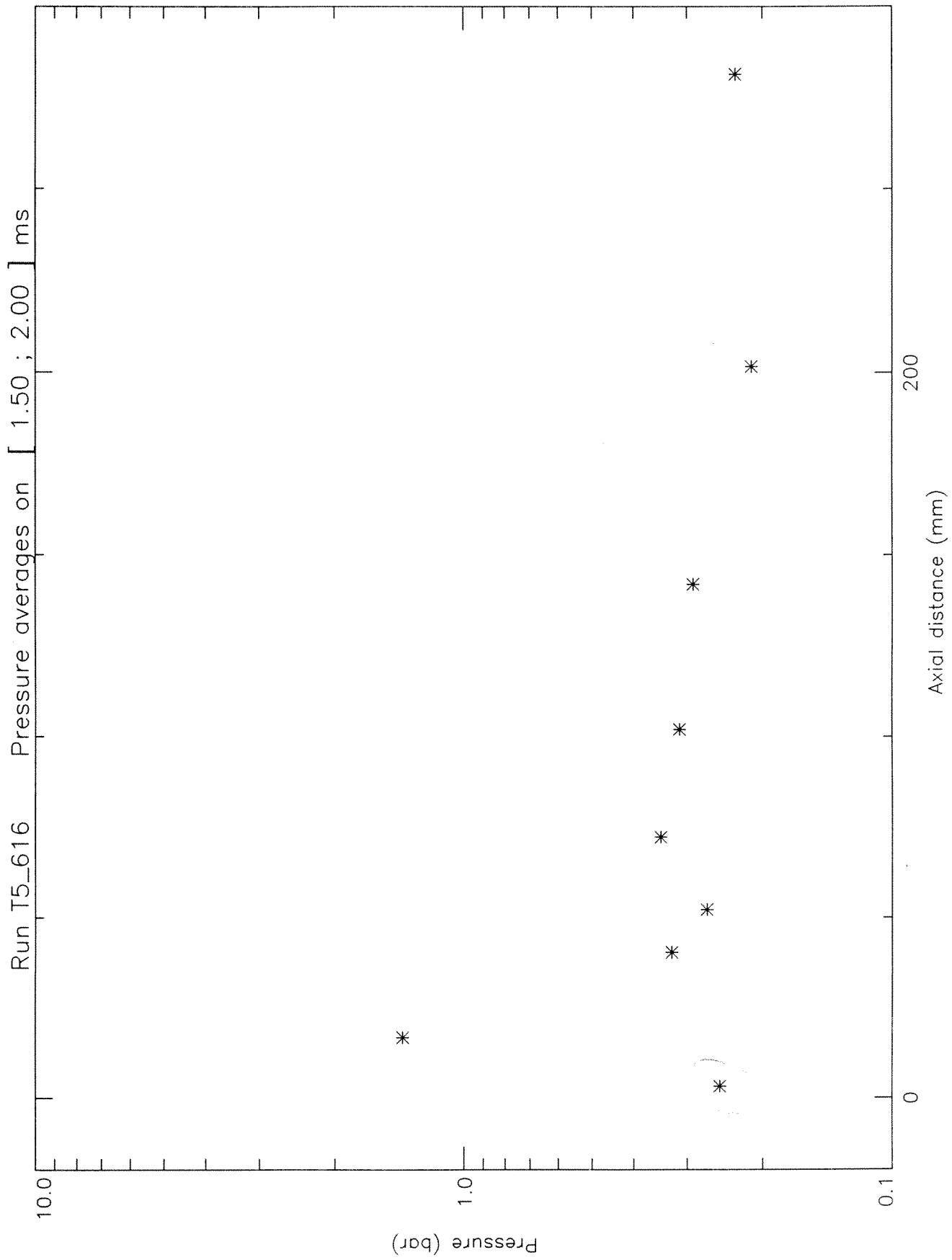
Time (ms)



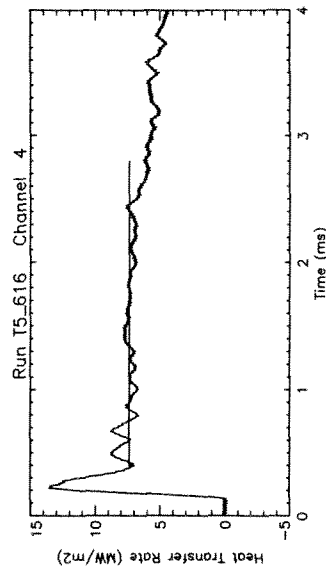
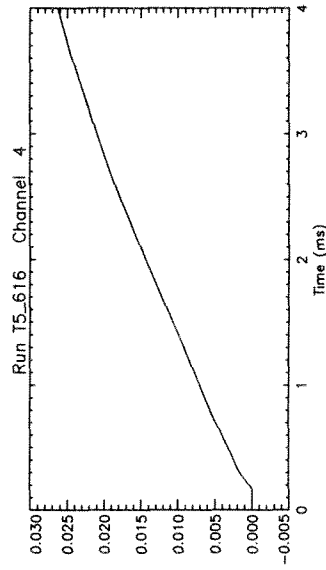
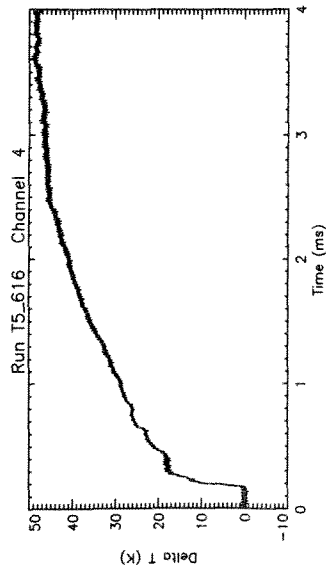
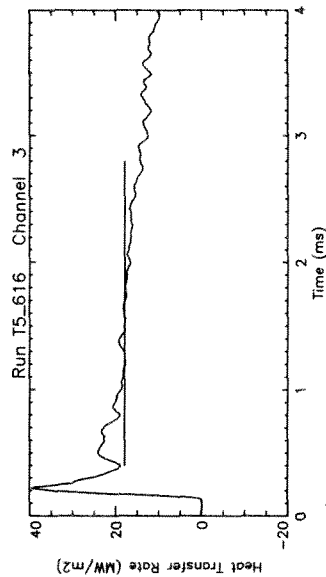
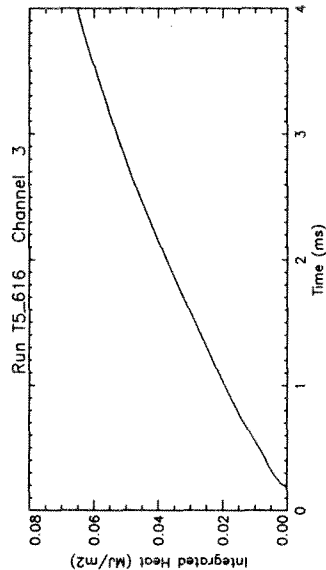
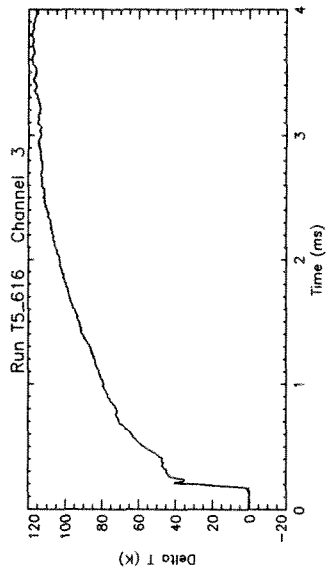
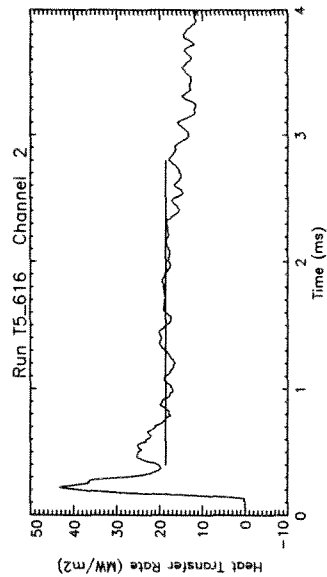
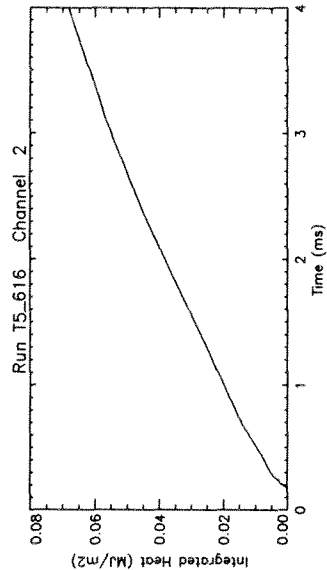
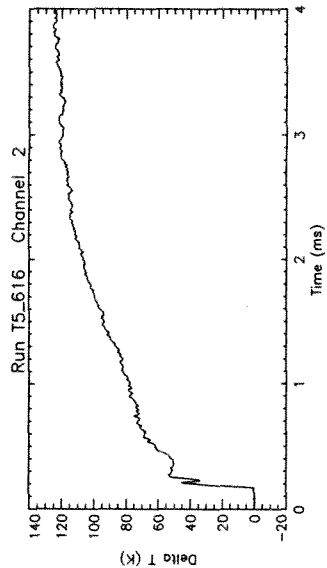
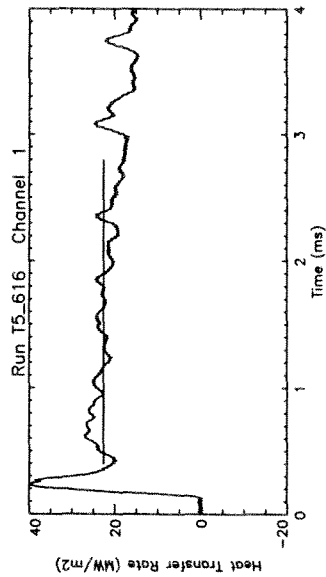
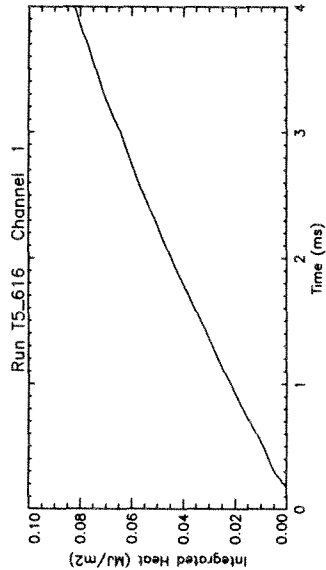
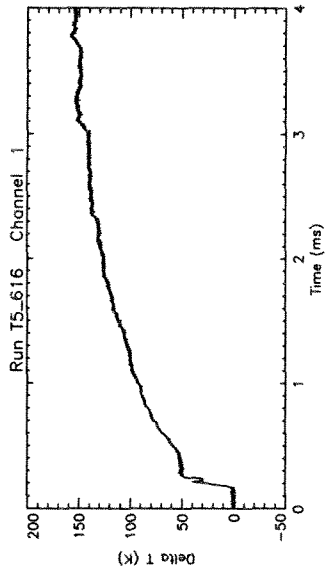
17

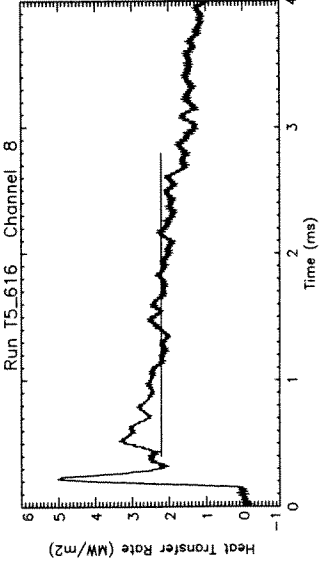
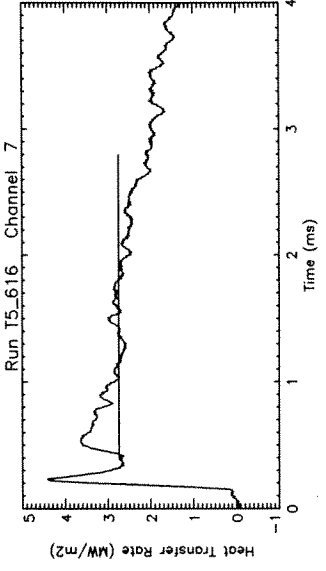
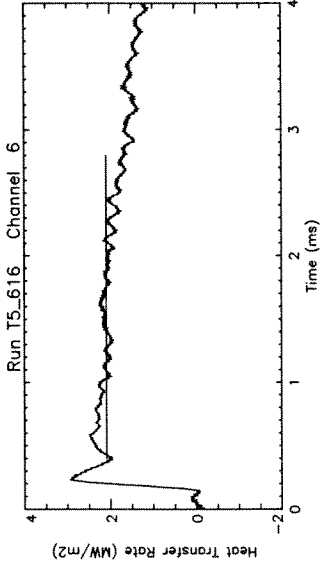
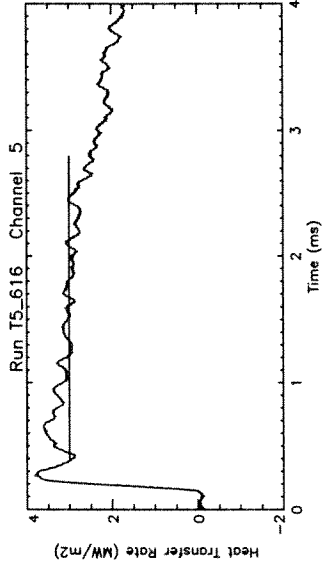
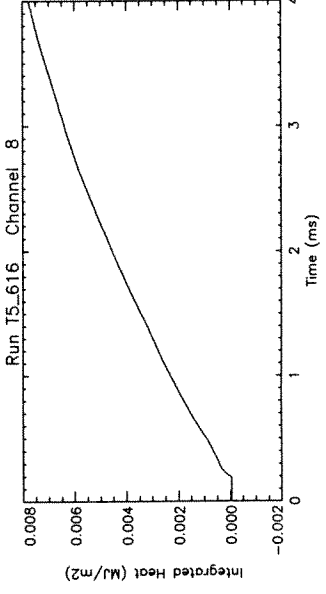
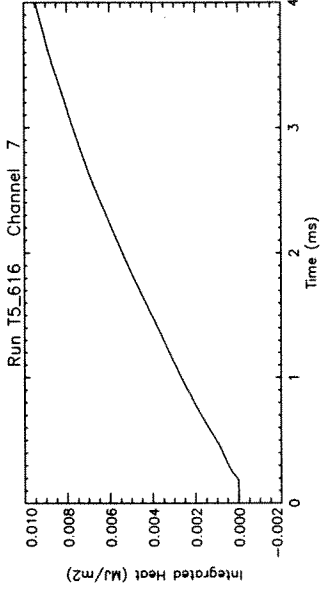
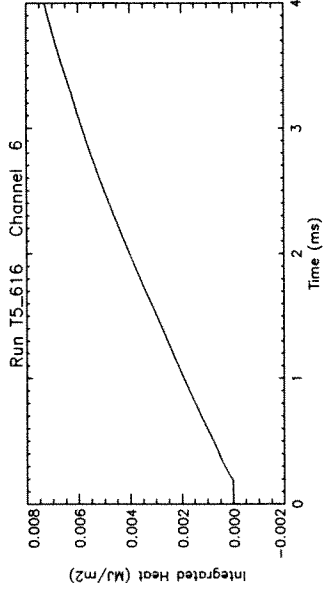
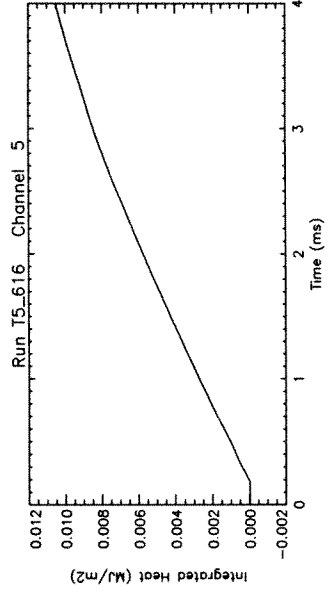
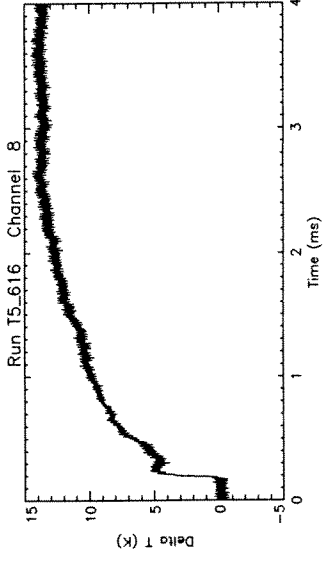
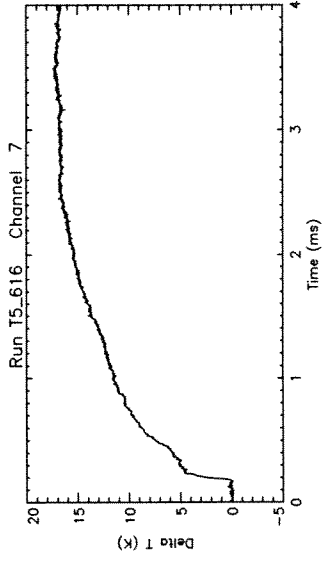
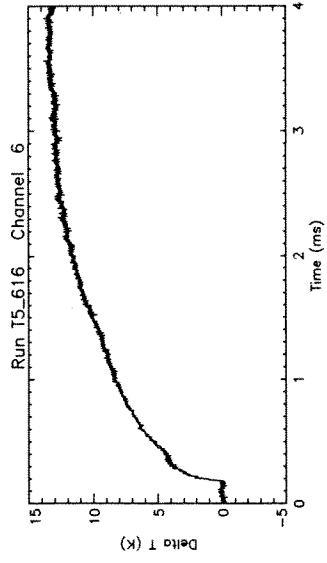
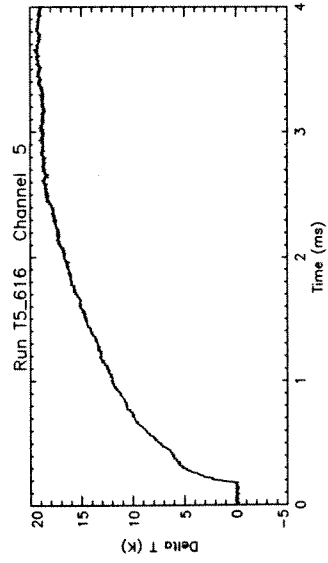


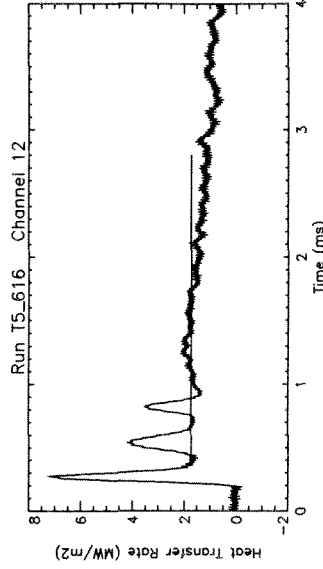
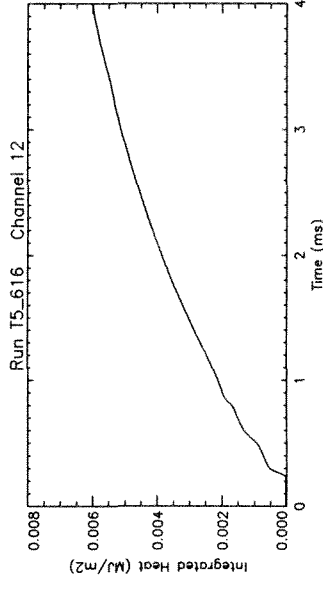
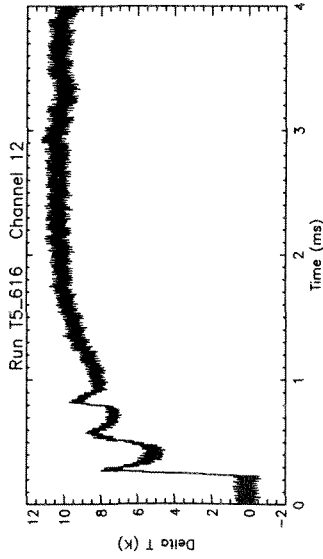
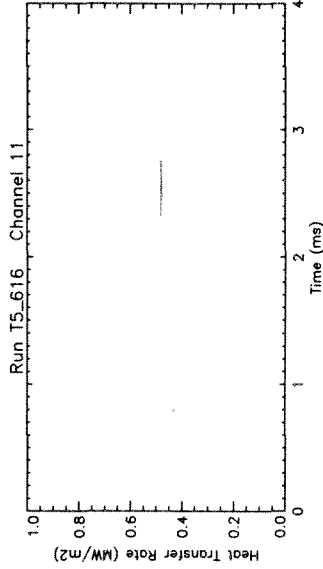
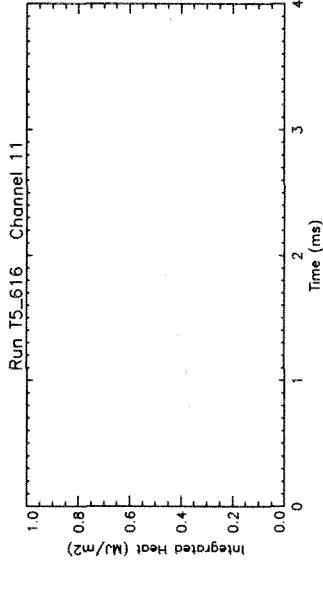
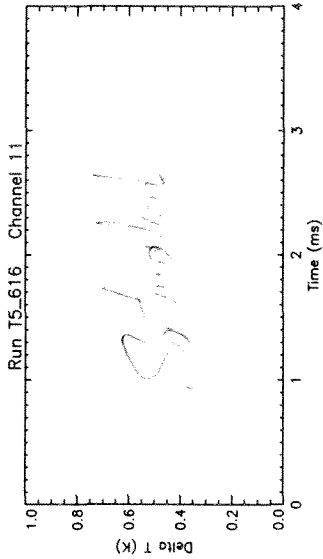
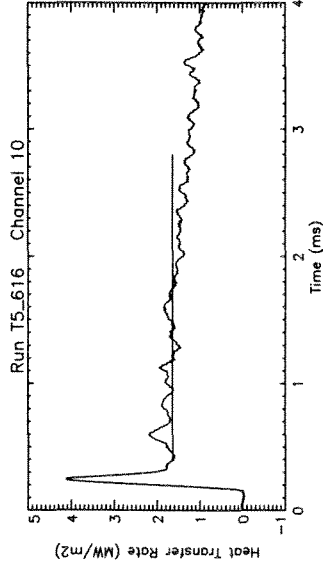
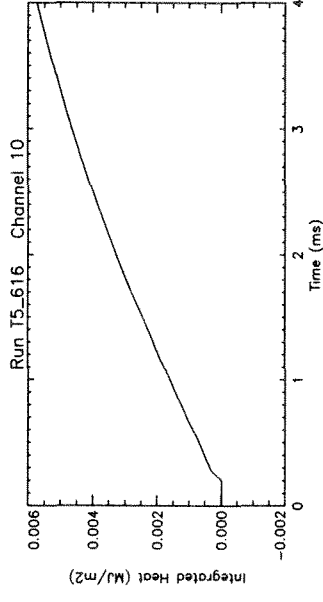
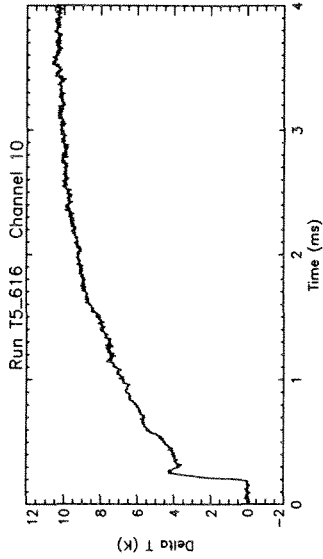
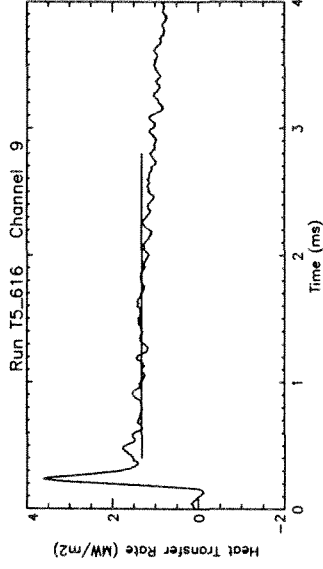
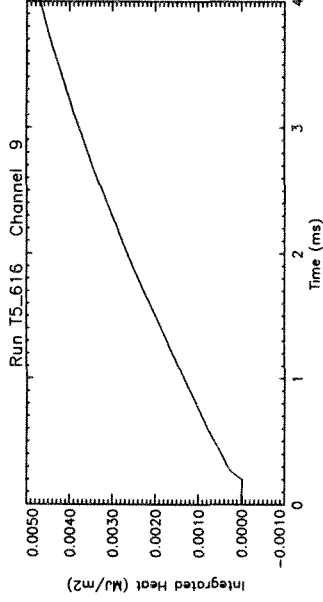
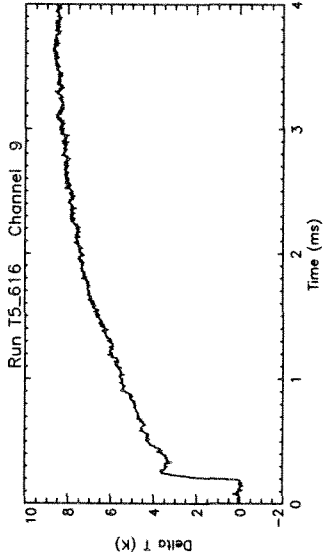


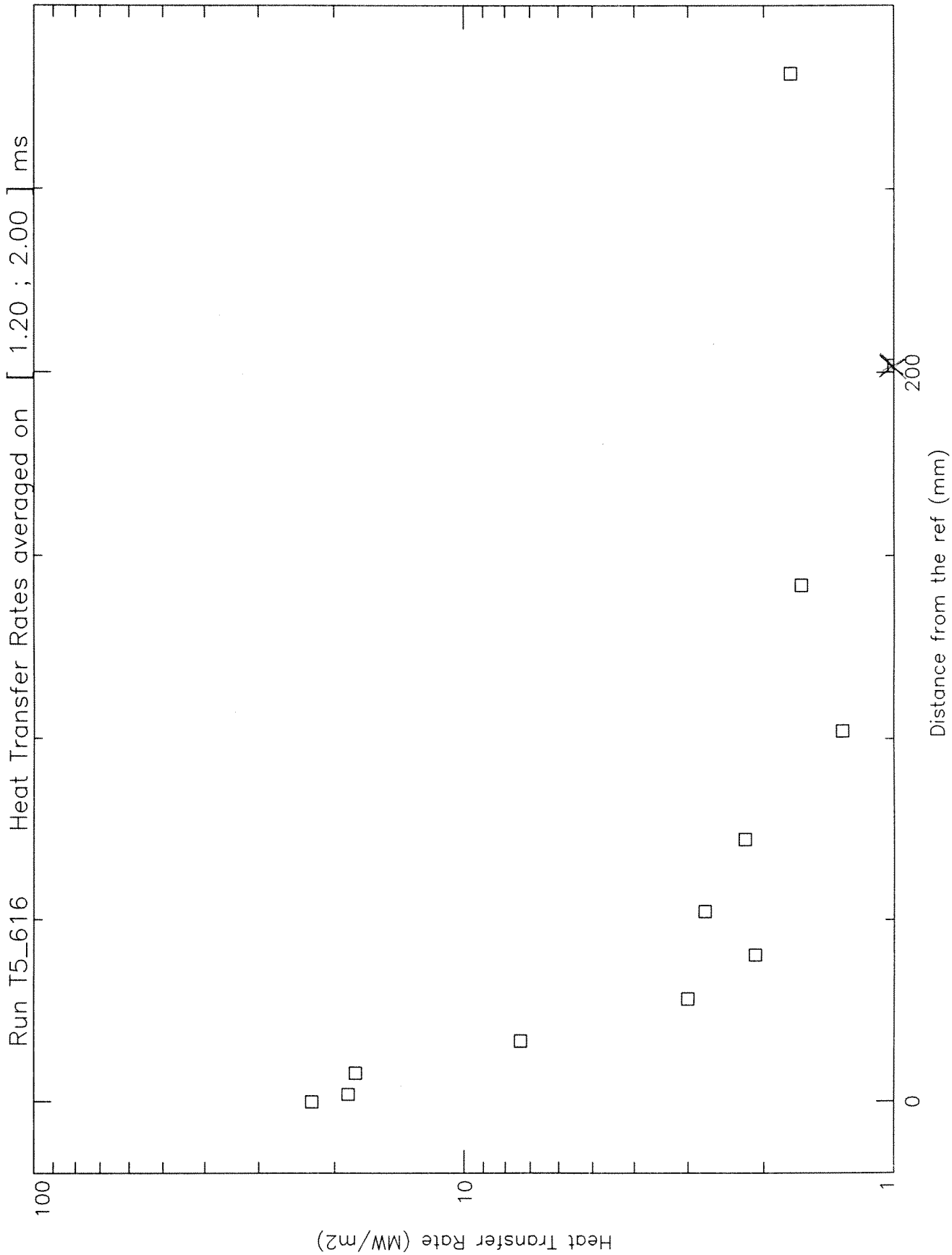


all on [1.9; 9 ms]









Run # 616

Pressure averages around 1.75 ± 0.25 ms

Smooth box = 2.

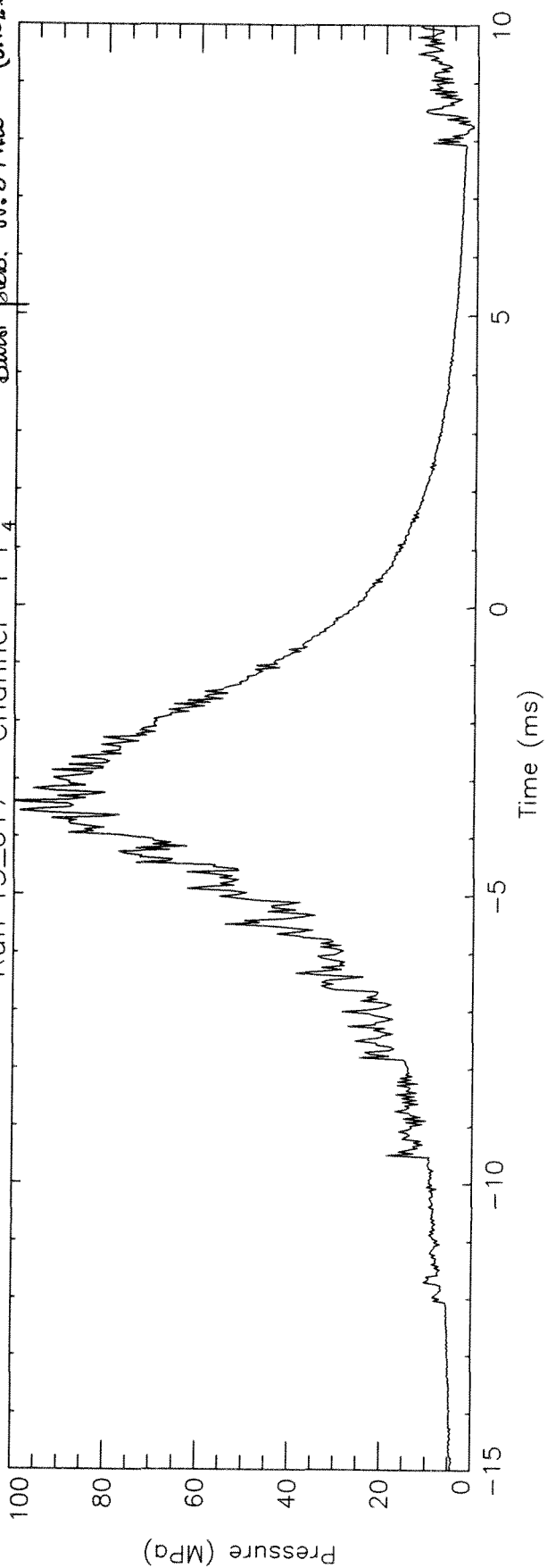
DA1	:	0.2518
DA2	:	1.3900
DA3	:	0.3260
DA4	:	0.2696
DA5	:	0.3455
DA6	:	0.3126
DA7	:	0.2907
DA8	:	0.2124
DA9	:	0.2314

Run # 616

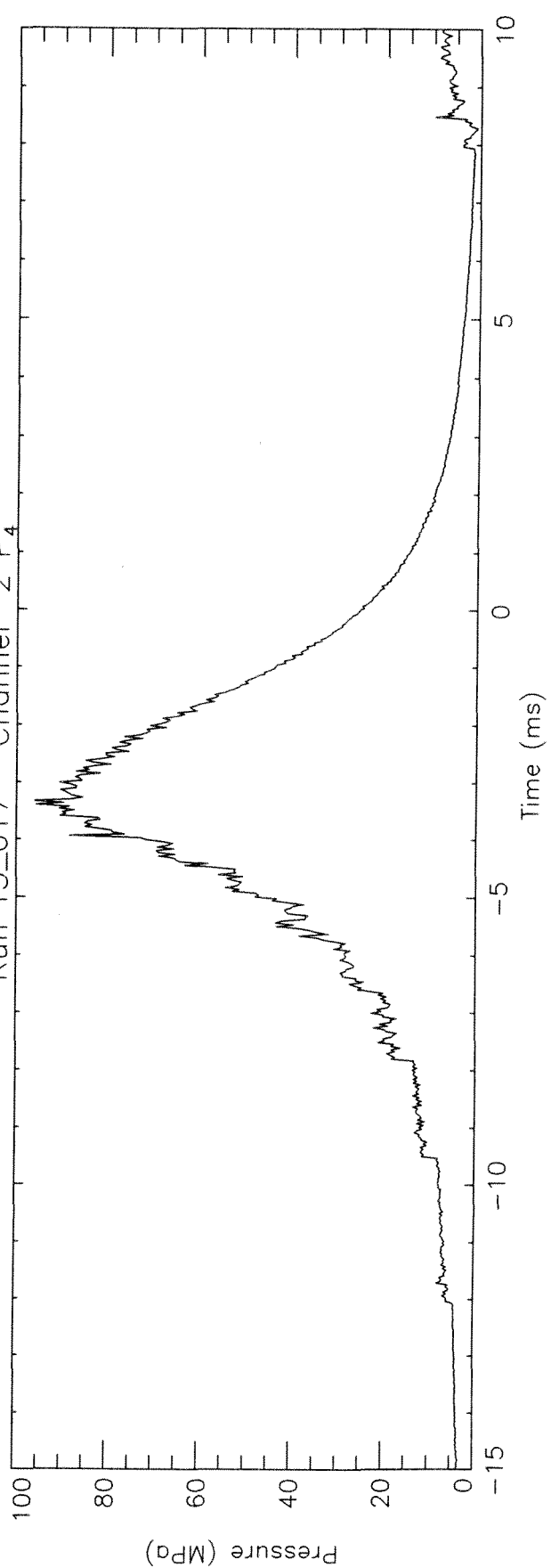
Heat Transfer Rates (in MW/m²)
averaged around 1.60 +/- 0.40 ms

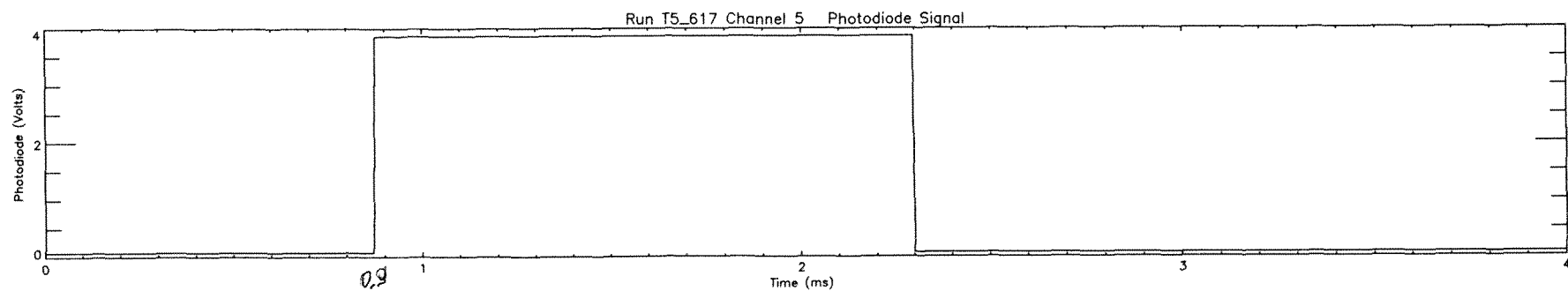
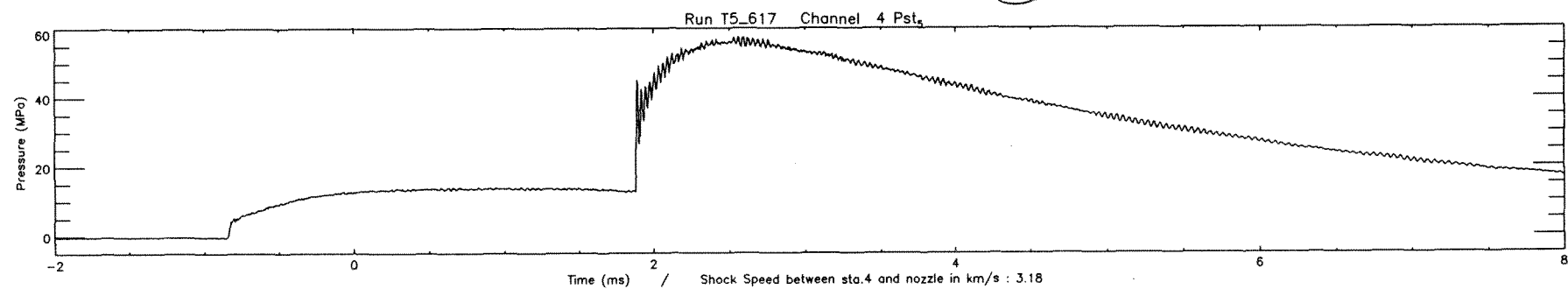
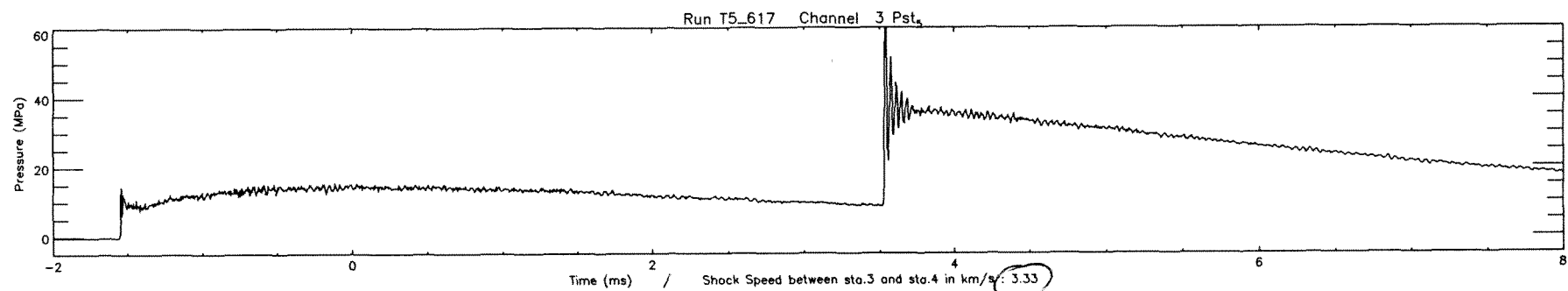
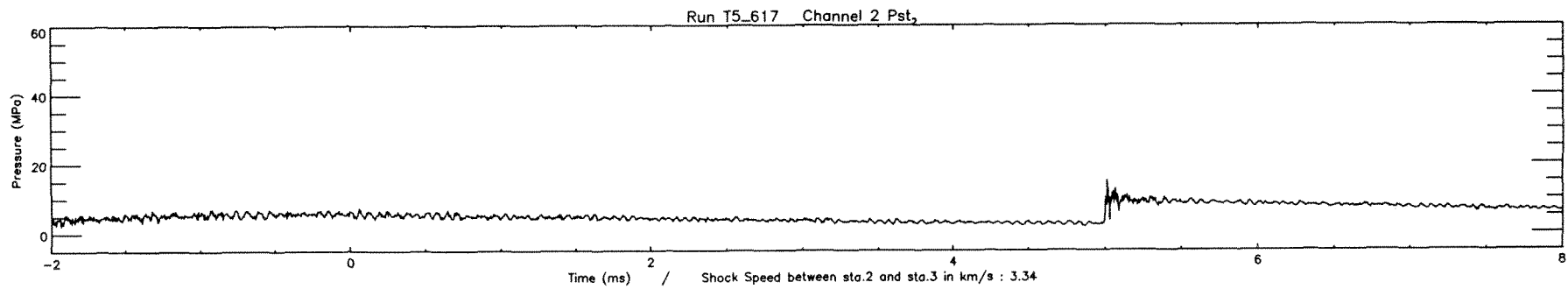
MT 1 :	22.6015
MT 2 :	18.6161
MT 3 :	17.8927
MT 4 :	7.3761
MT 5 :	3.0095
MT 6 :	2.0989
MT 7 :	2.7418
MT 8 :	2.2134
MT 9 :	1.3159
MT10 :	1.6393
MT11 :	0.0000
MT12 :	1.7338

Run T5_617 Channel 1 P₄ Burst press: 88.3 MPa (0.13% diff)

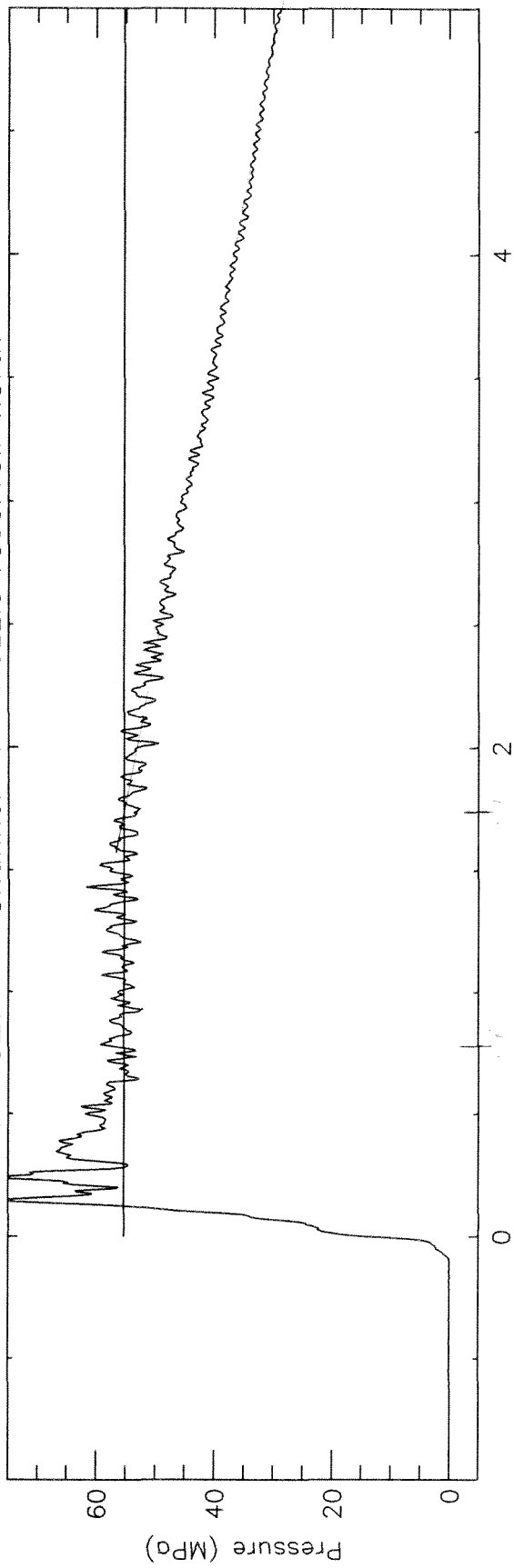


Run T5_617 Channel 2 P₄

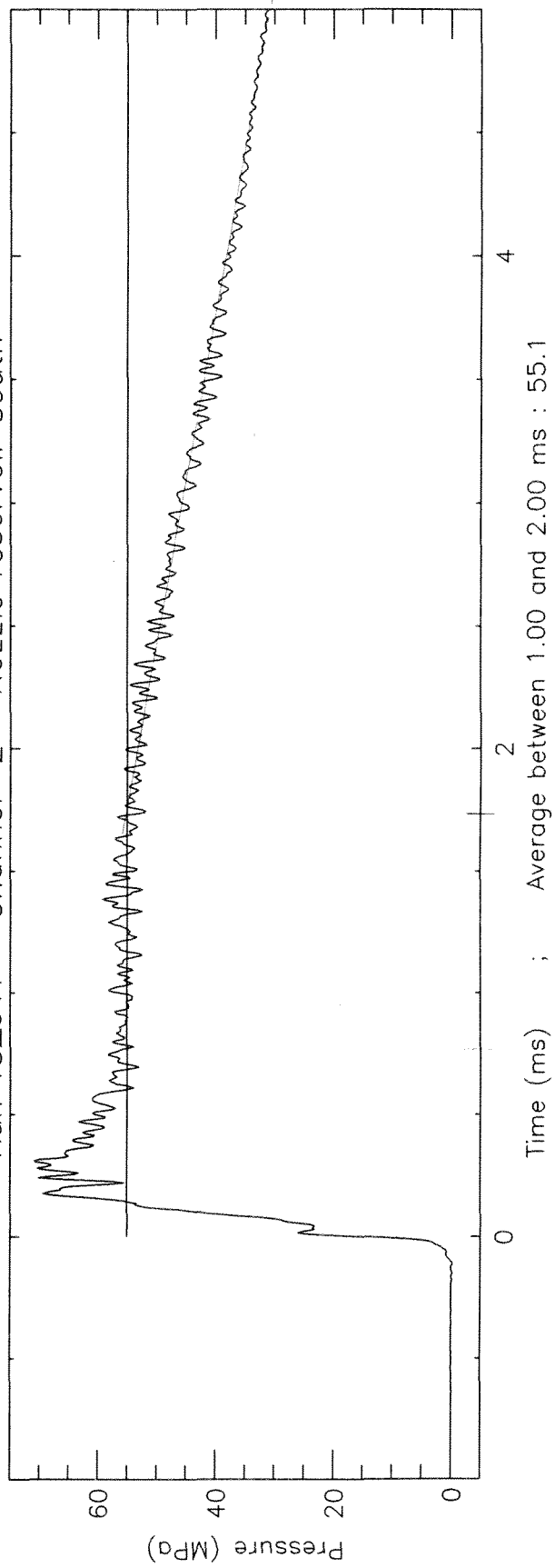




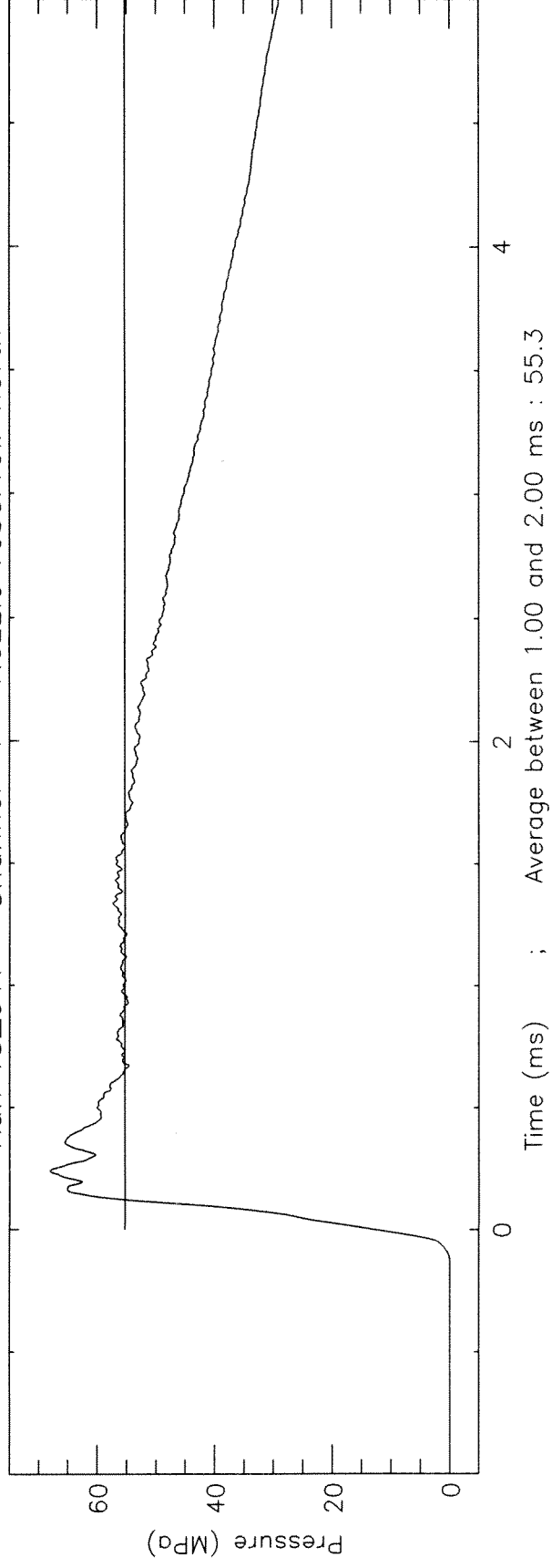
Run T5_617 Channel 1 Nozzle reservoir north



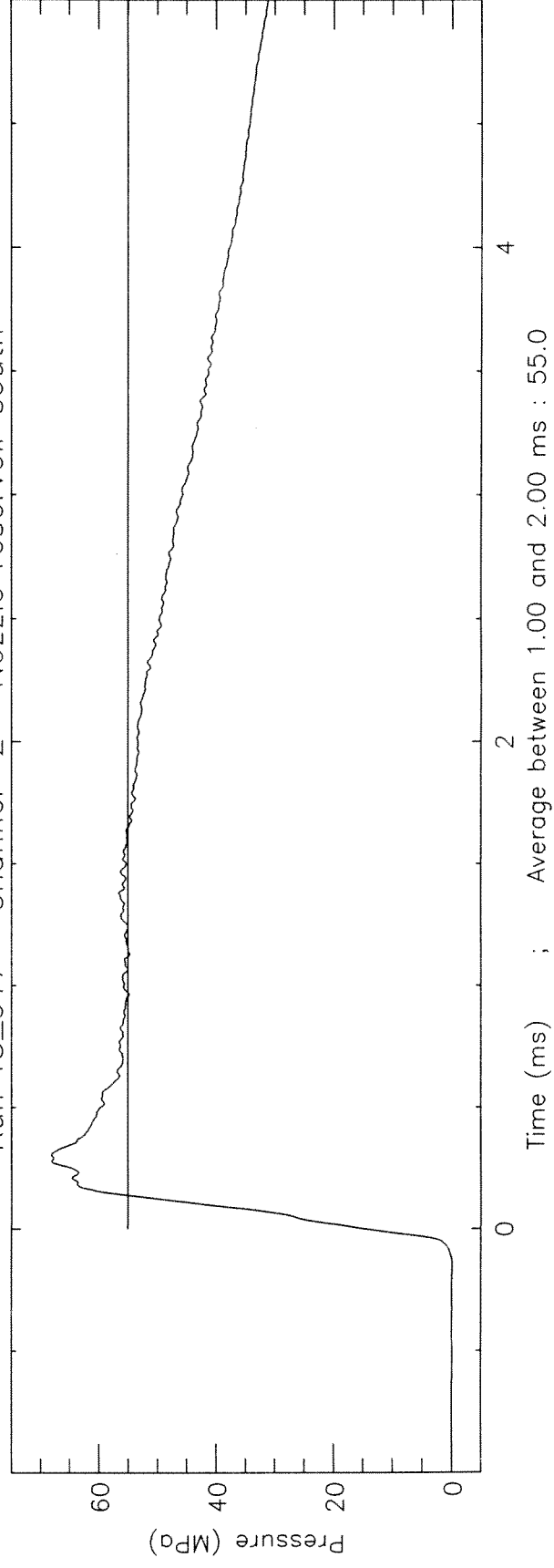
Run T5_617 Channel 2 Nozzle reservoir south

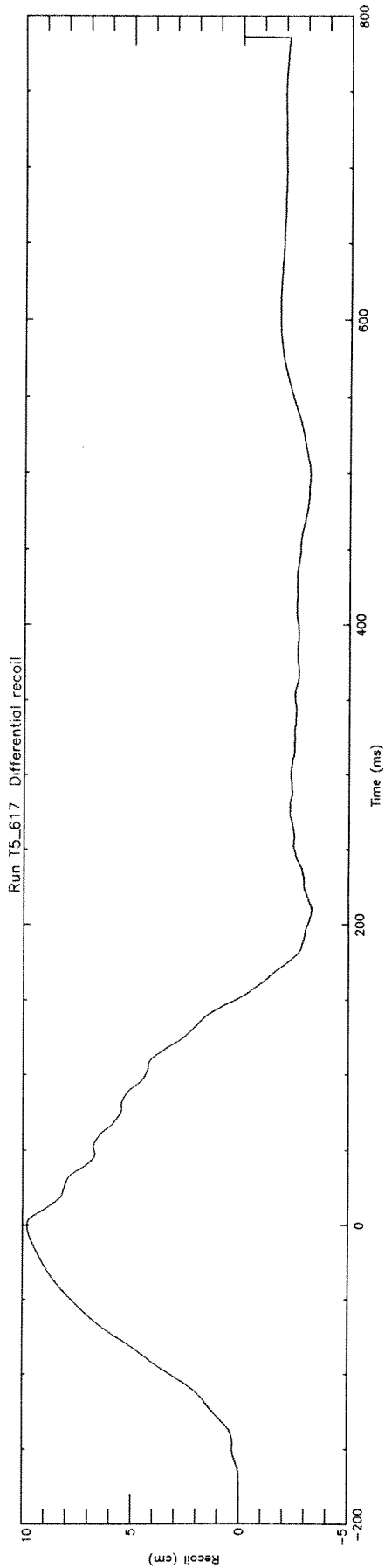
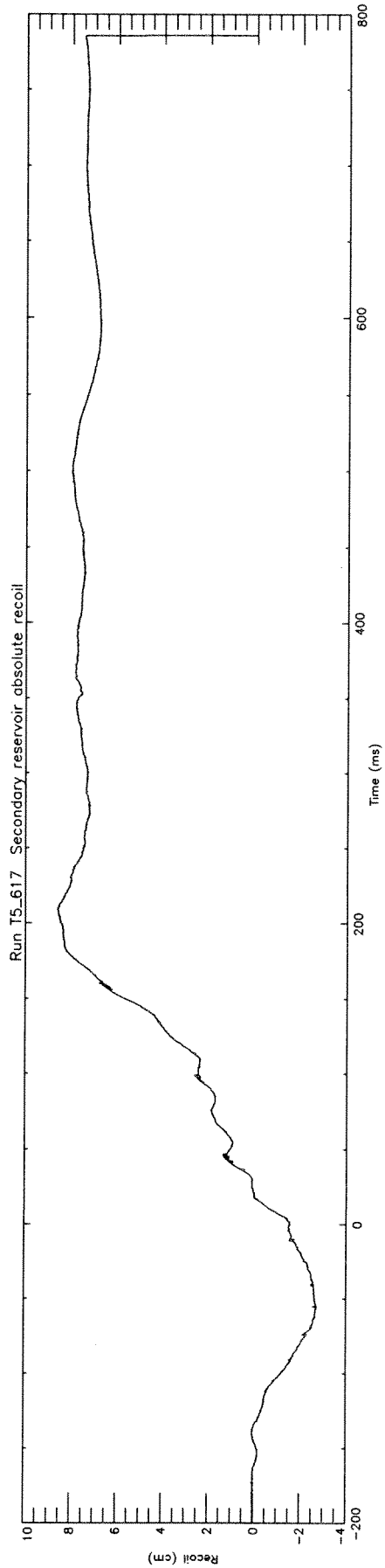
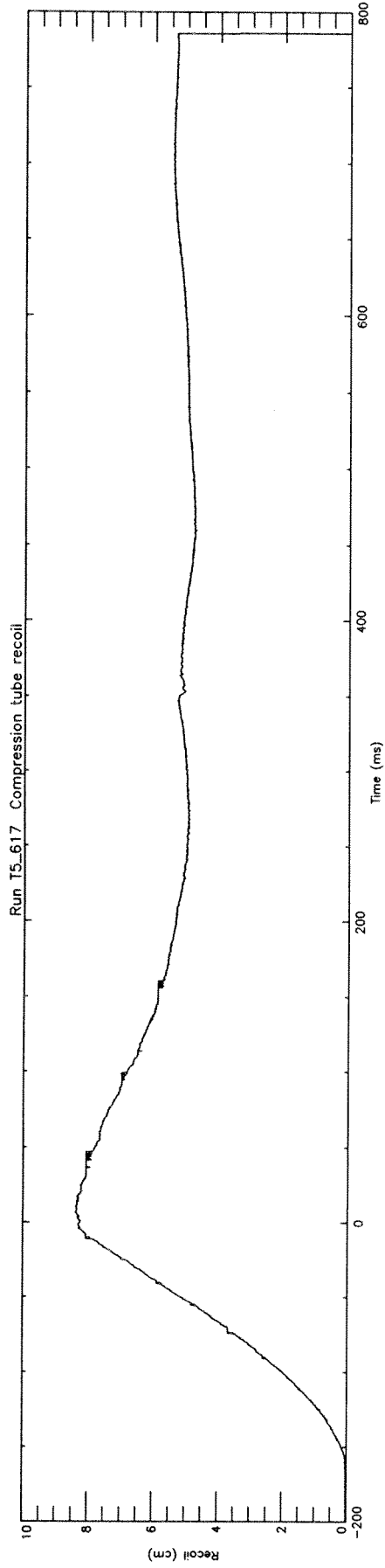


Run T5_617 Channel 1 Nozzle reservoir north

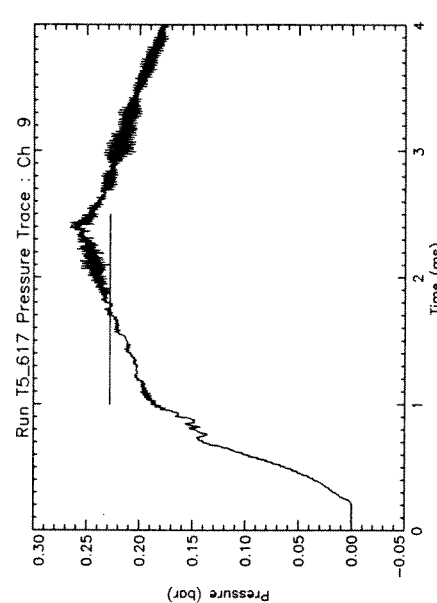
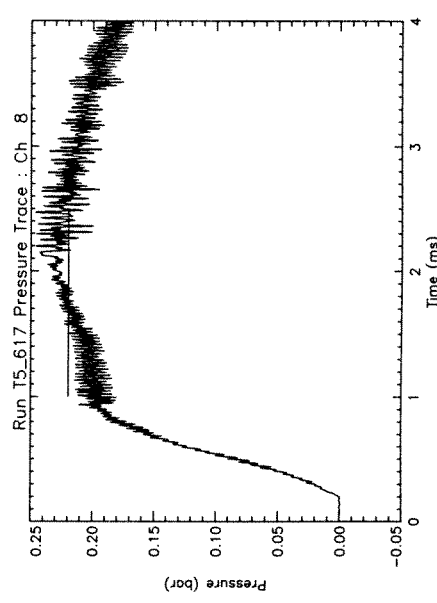
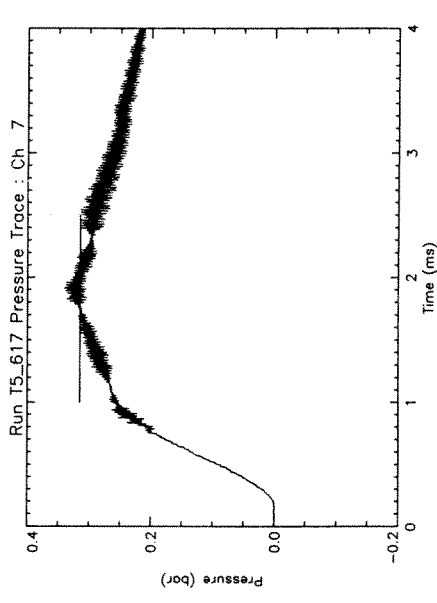
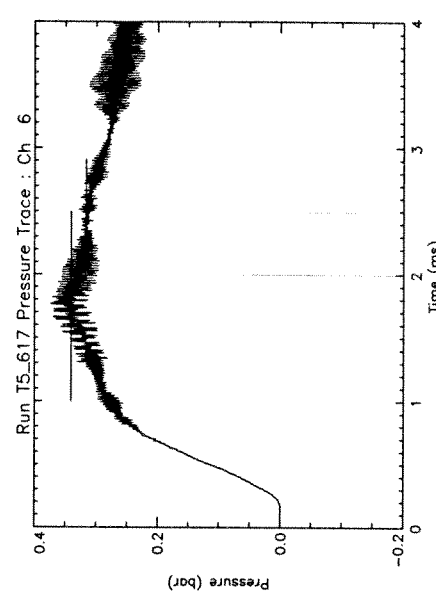
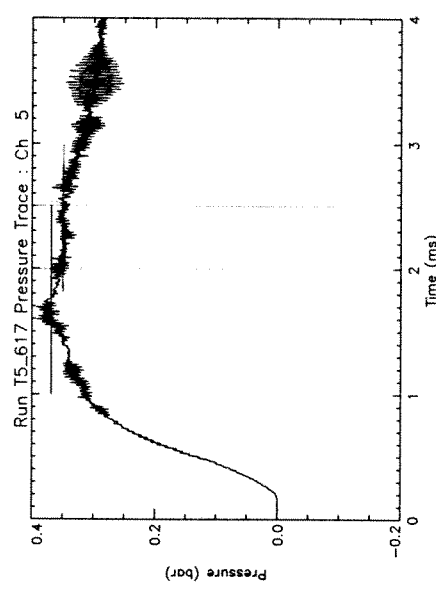
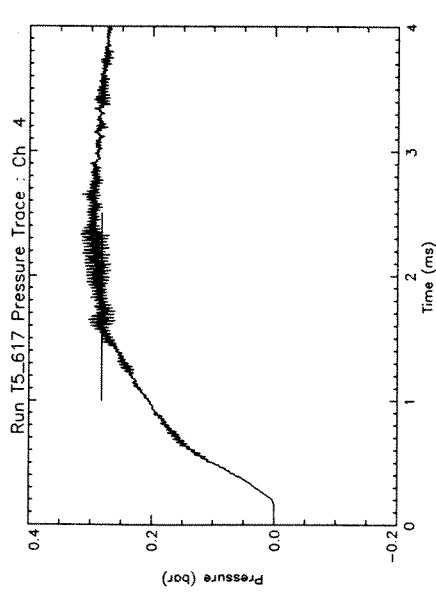
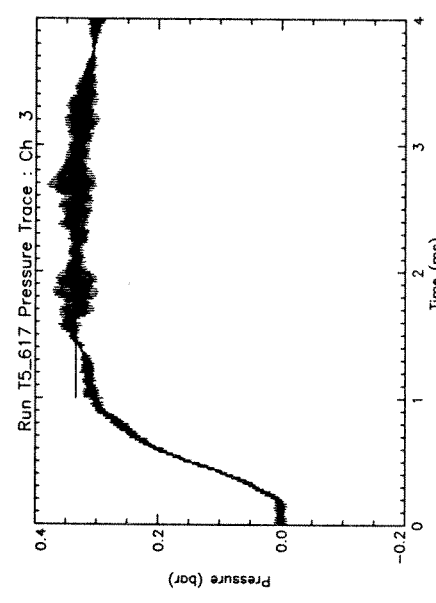
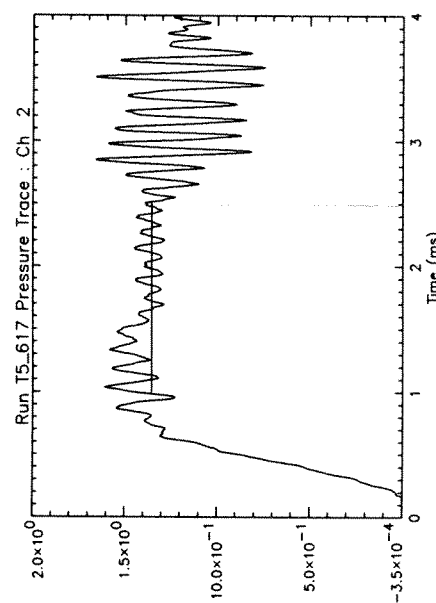
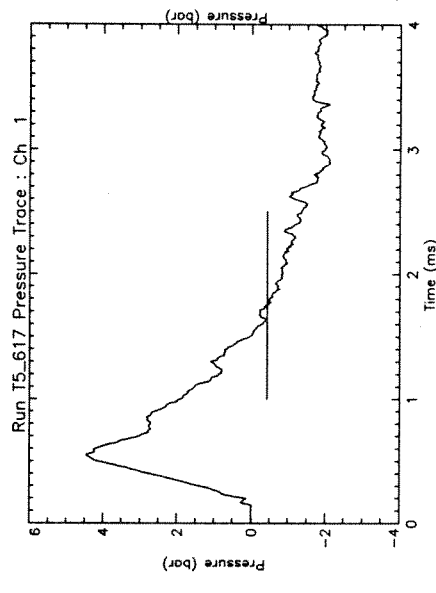


Run T5_617 Channel 2 Nozzle reservoir south

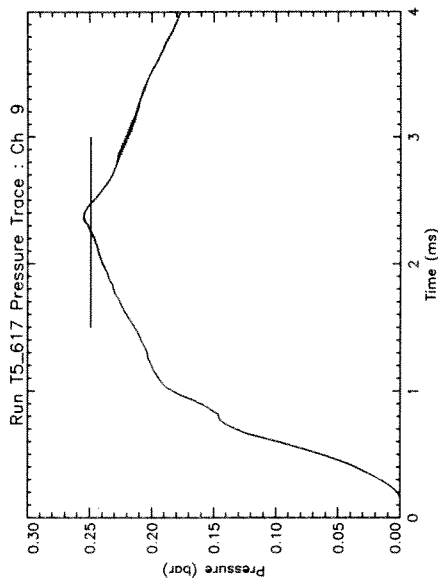
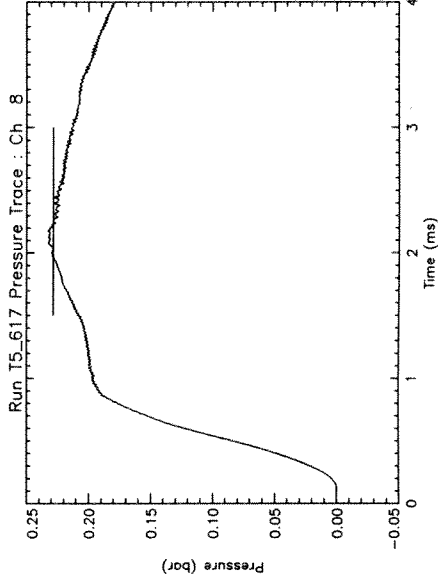
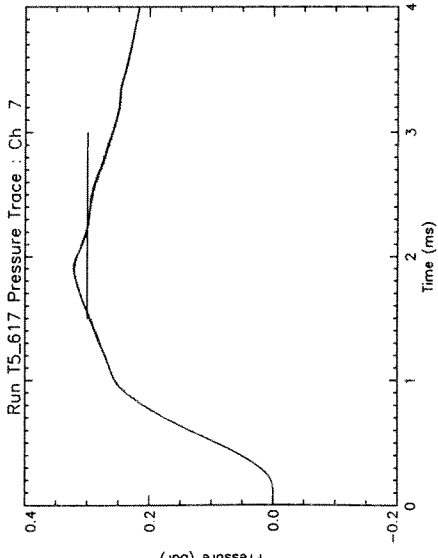
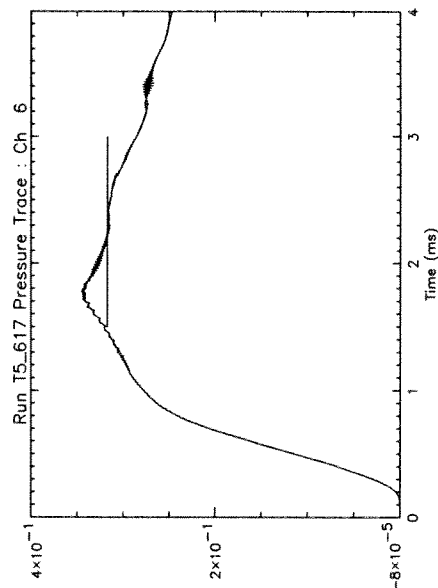
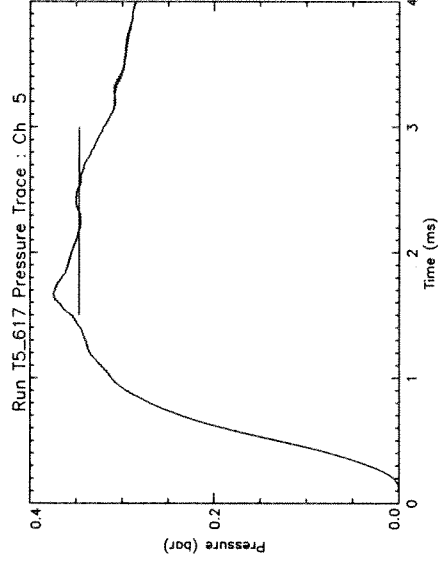
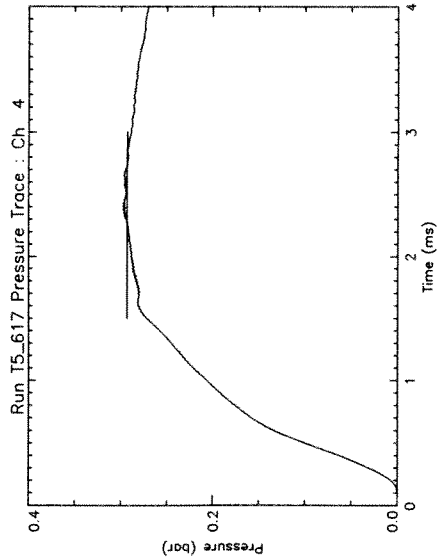
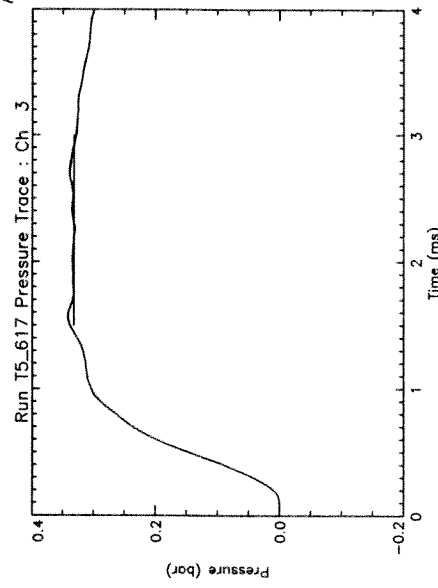
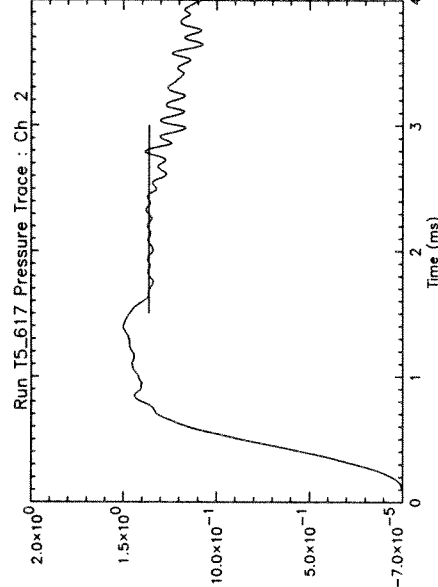
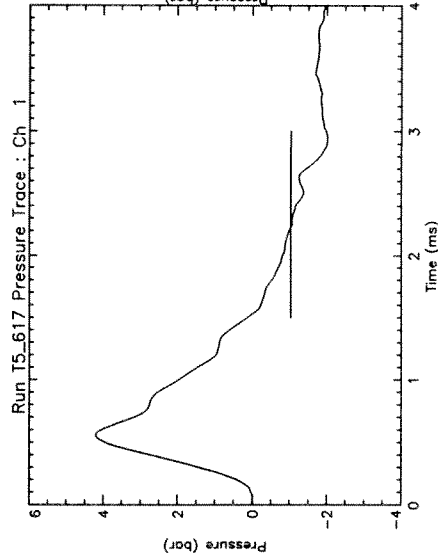




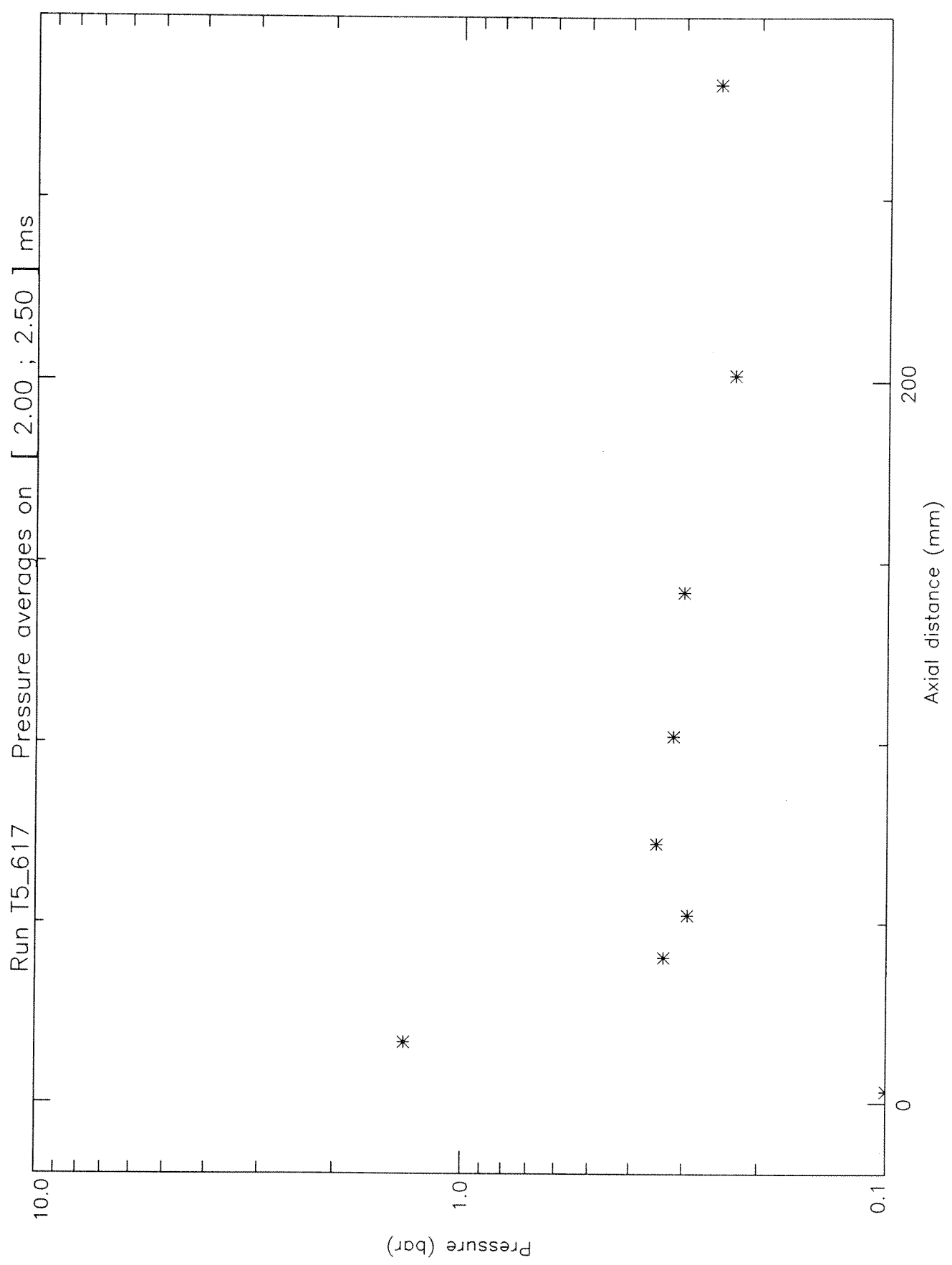
date on [1.5/2.0] min box2



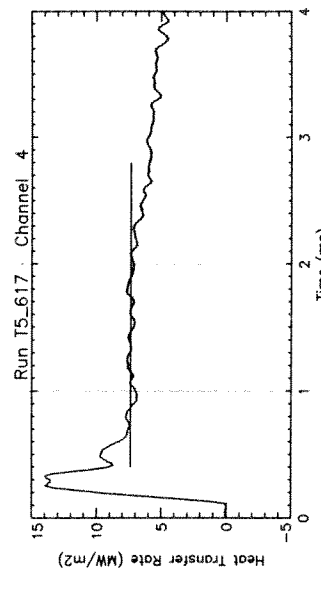
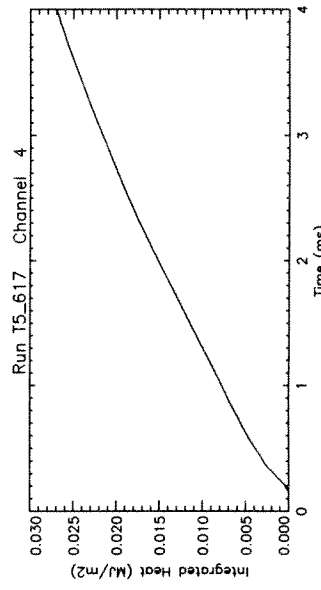
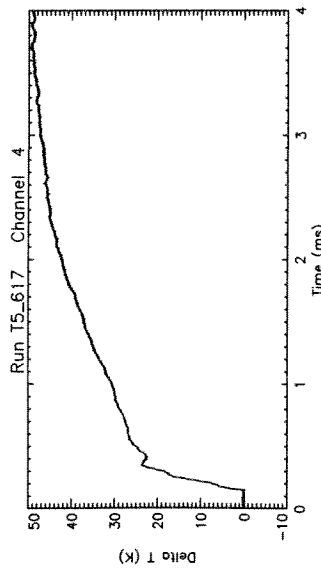
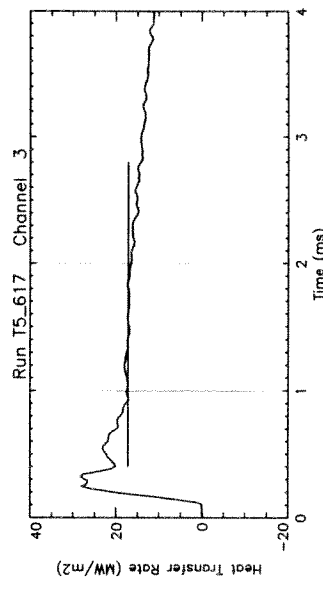
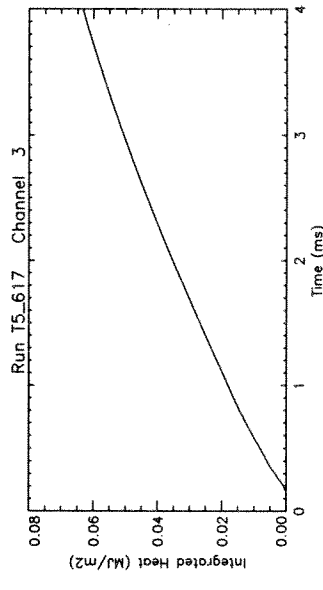
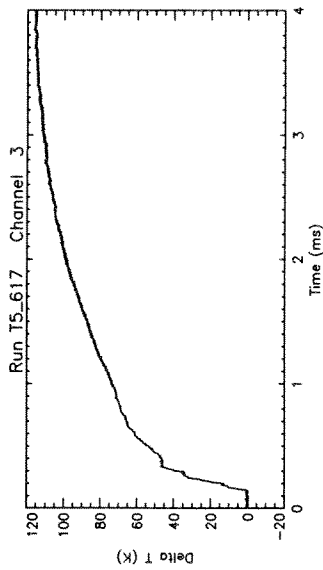
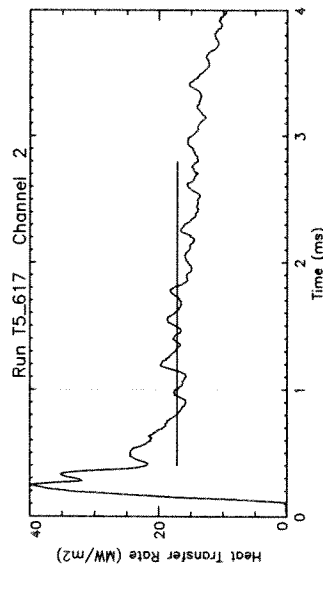
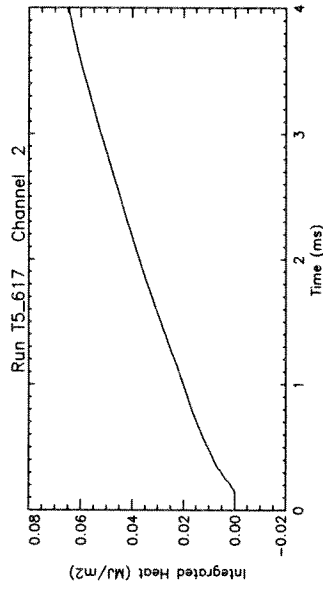
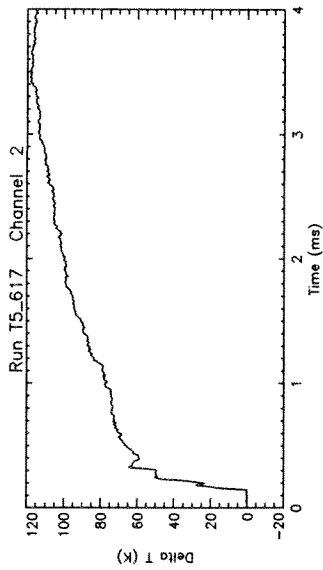
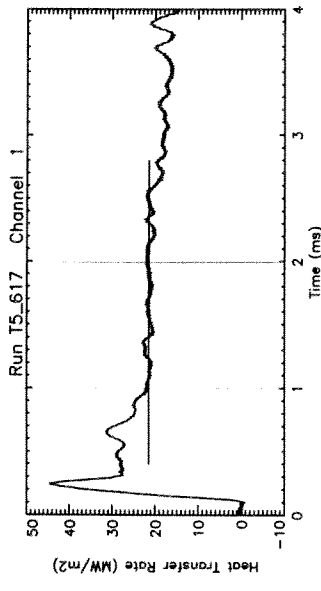
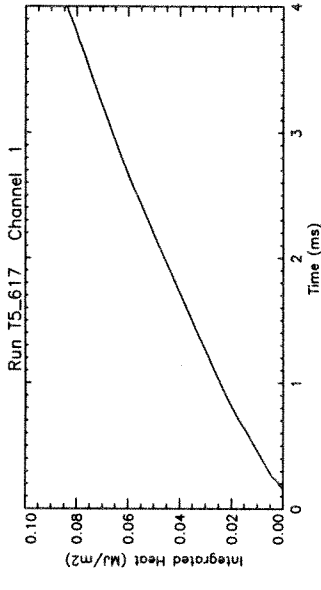
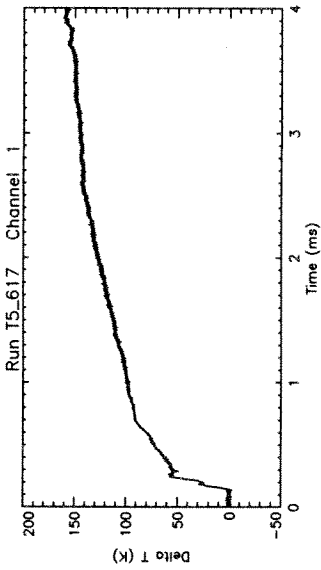
box 31

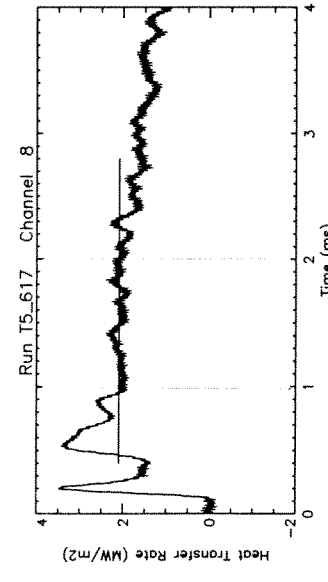
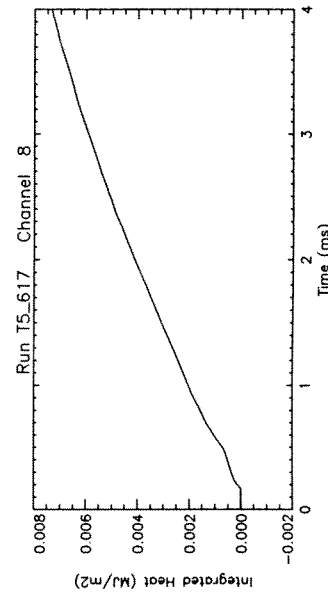
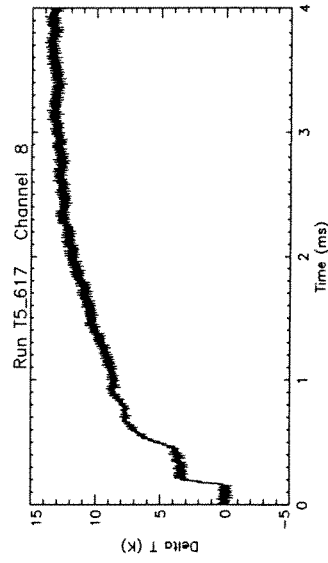
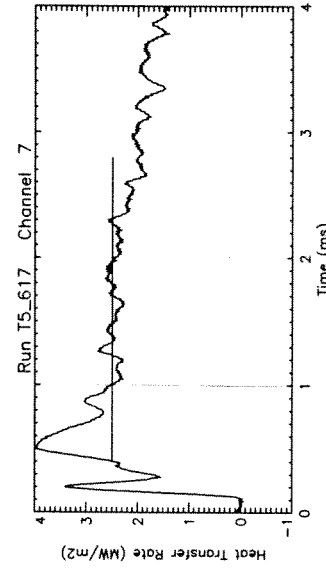
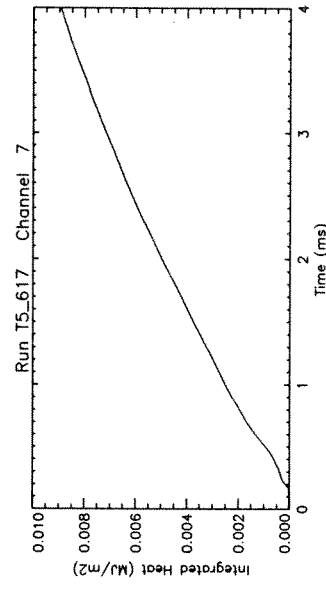
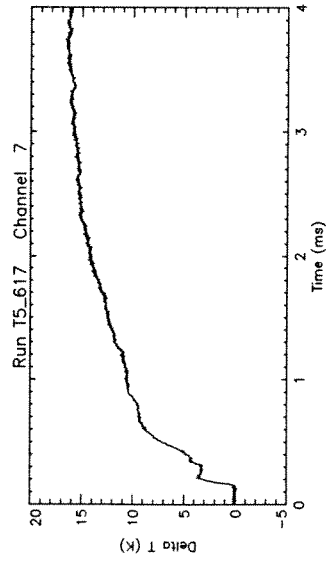
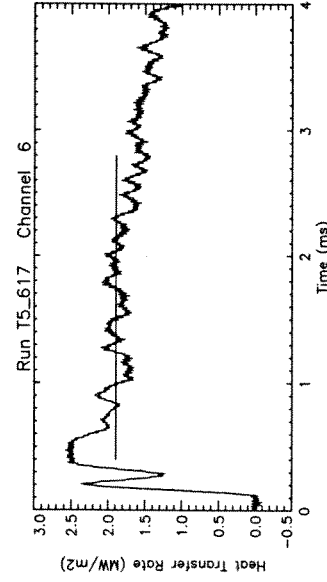
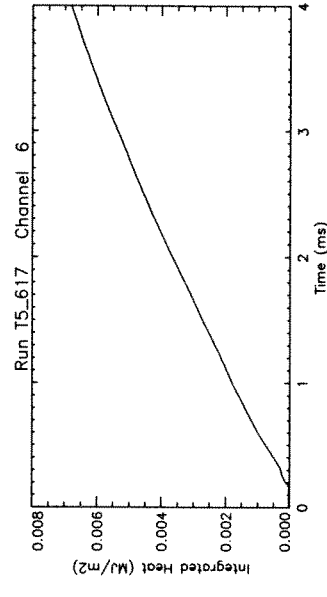
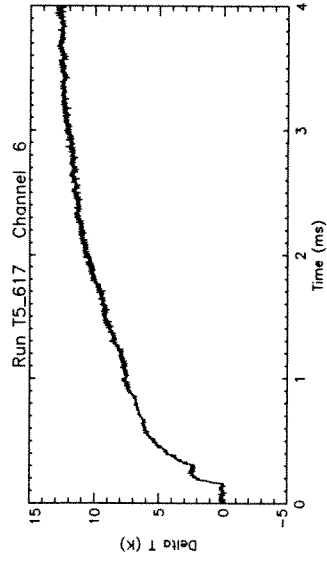
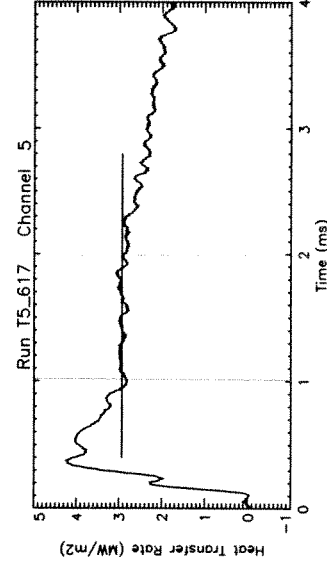
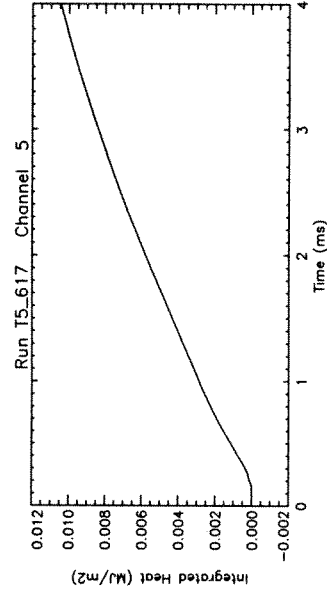
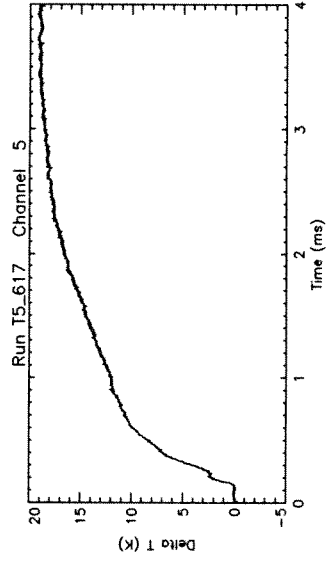


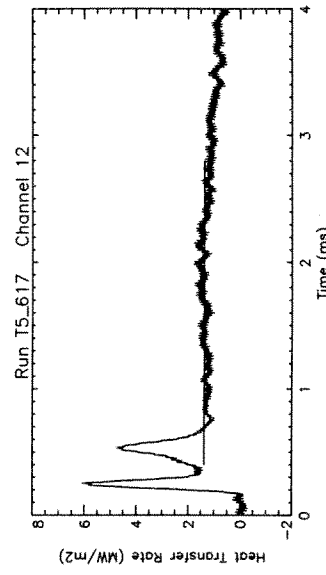
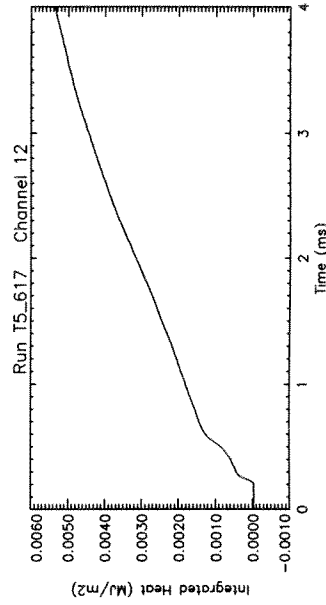
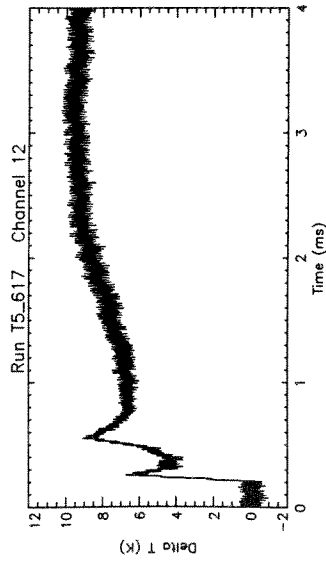
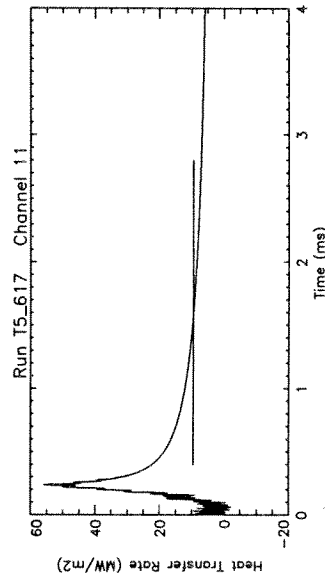
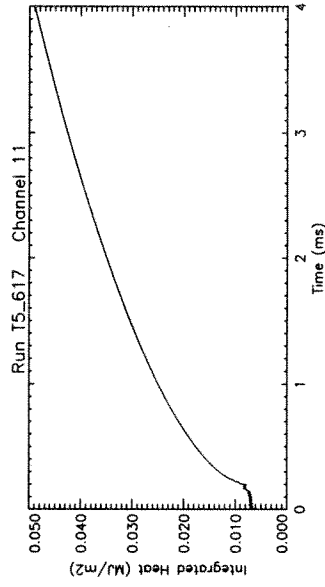
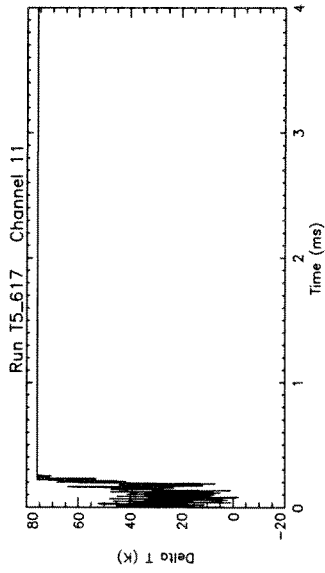
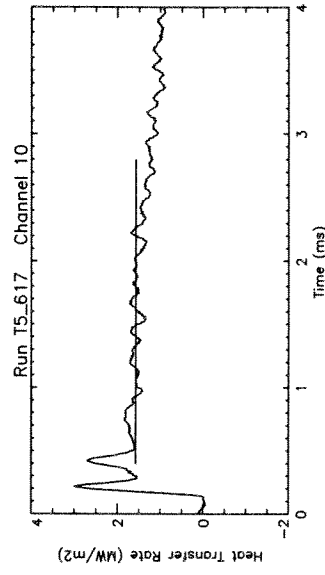
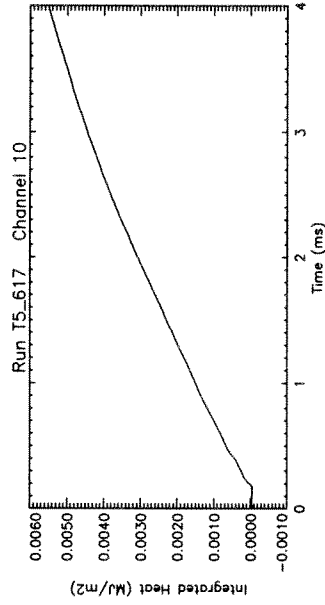
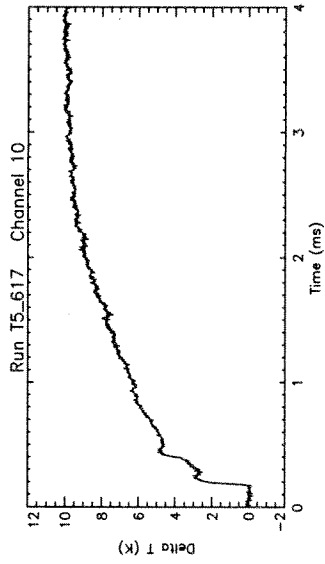
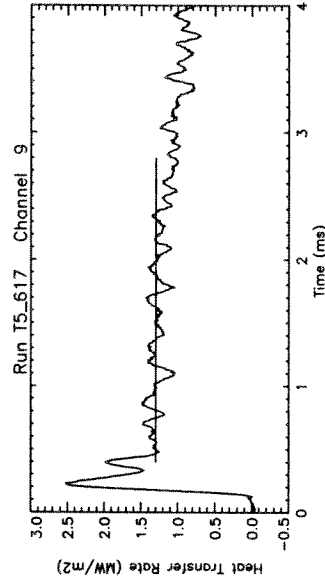
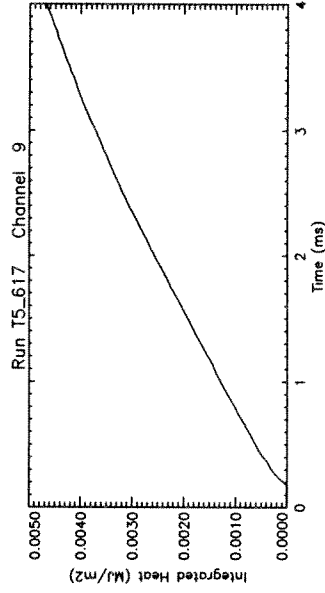
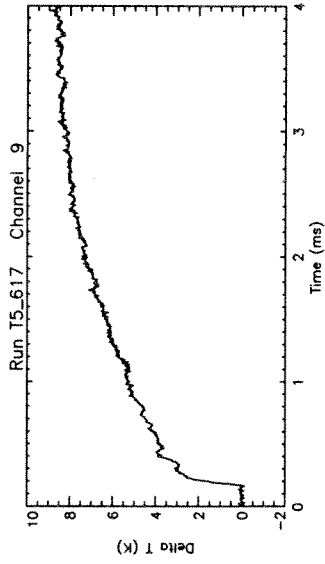
Run 31

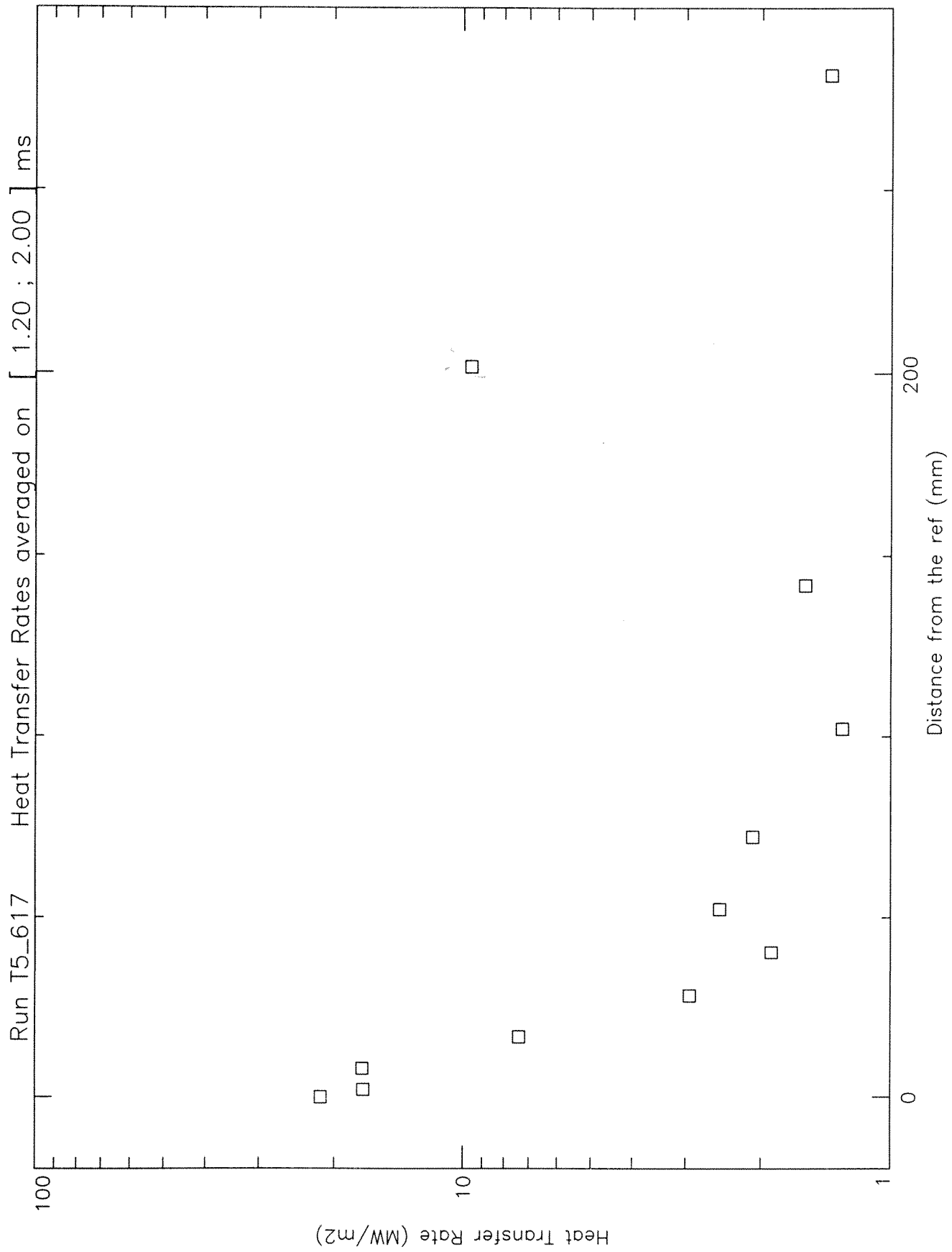


0.5 ms } 1.0/2.0] m.









Run # 617

Pressure averages around 2.25 +/- 0.25 ms

Smooth box = 2.

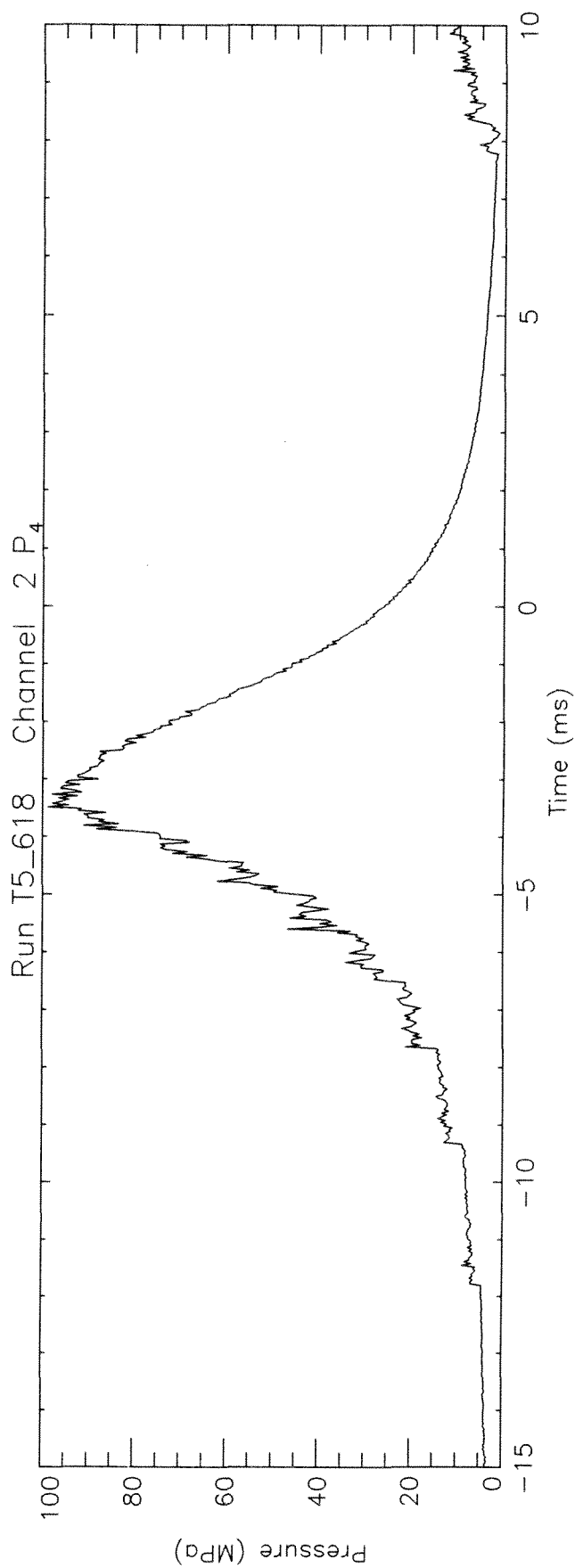
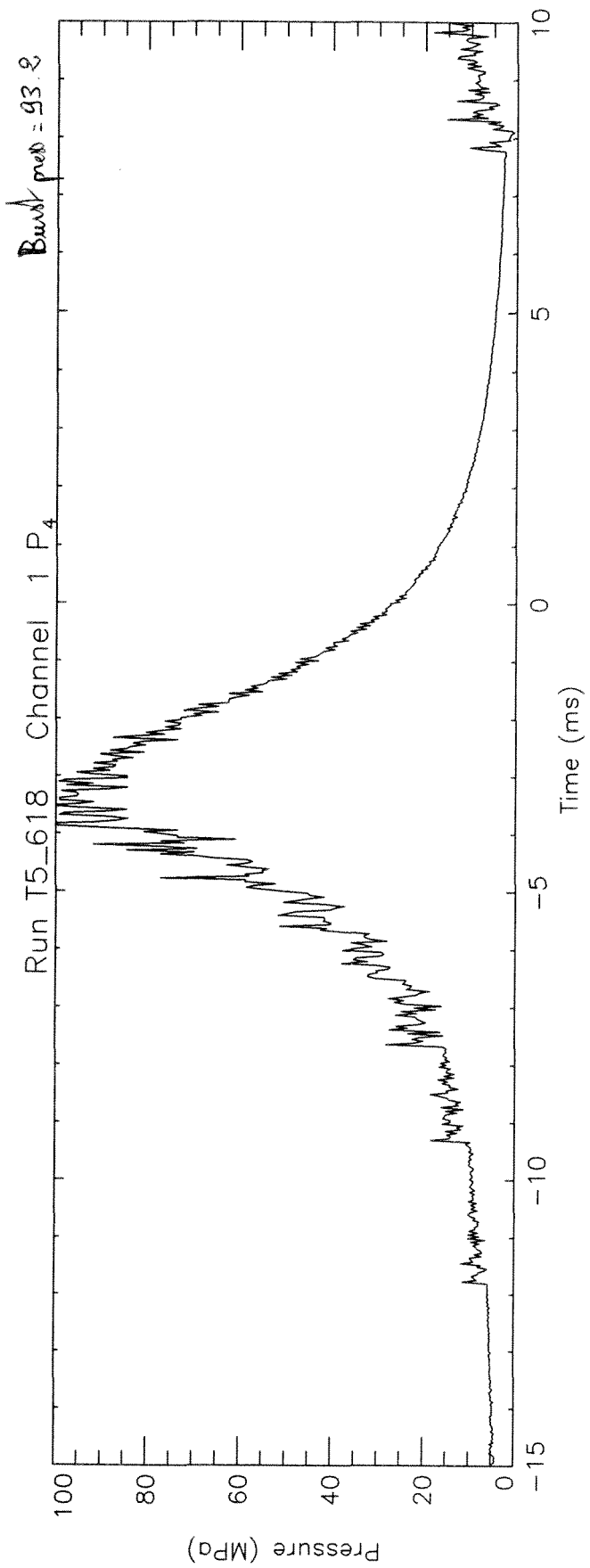
on [2.0; 2.5] ms
in order to be on the "plateau"

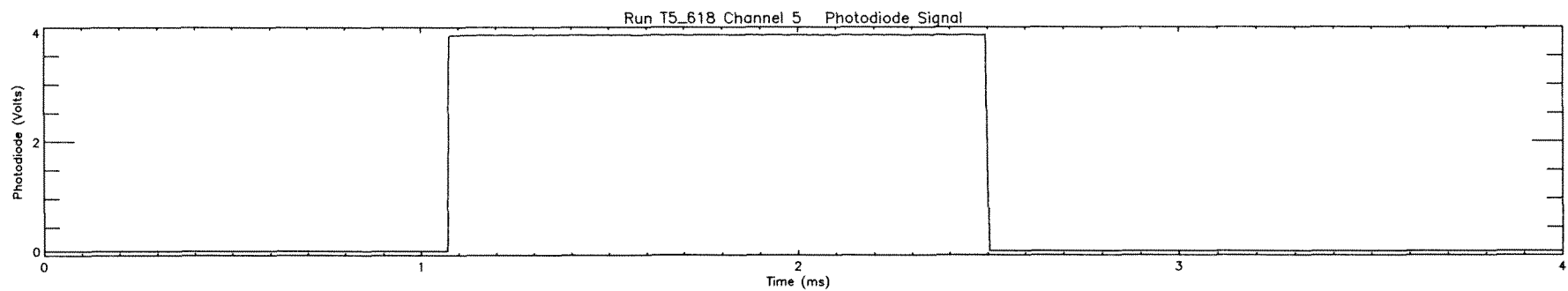
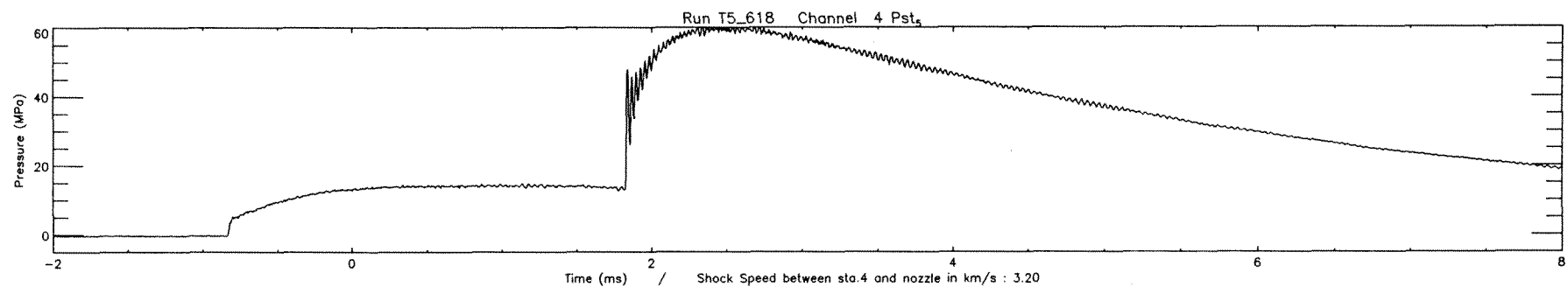
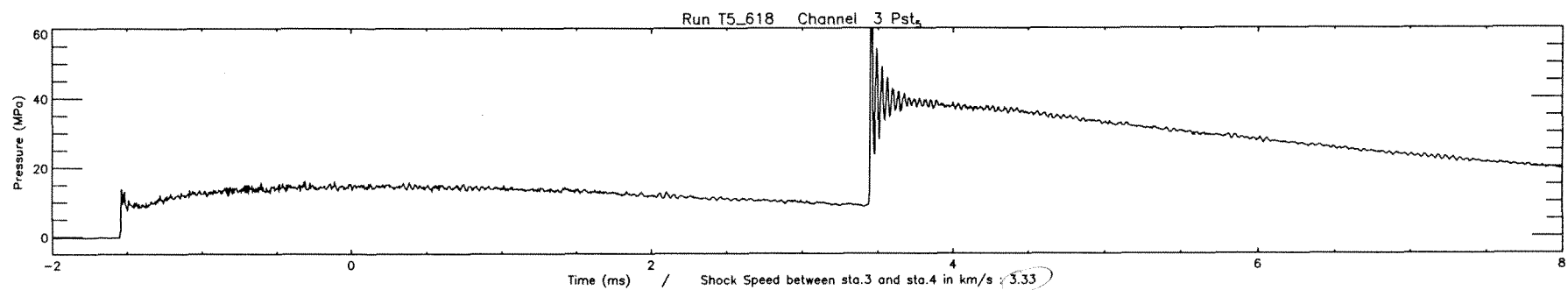
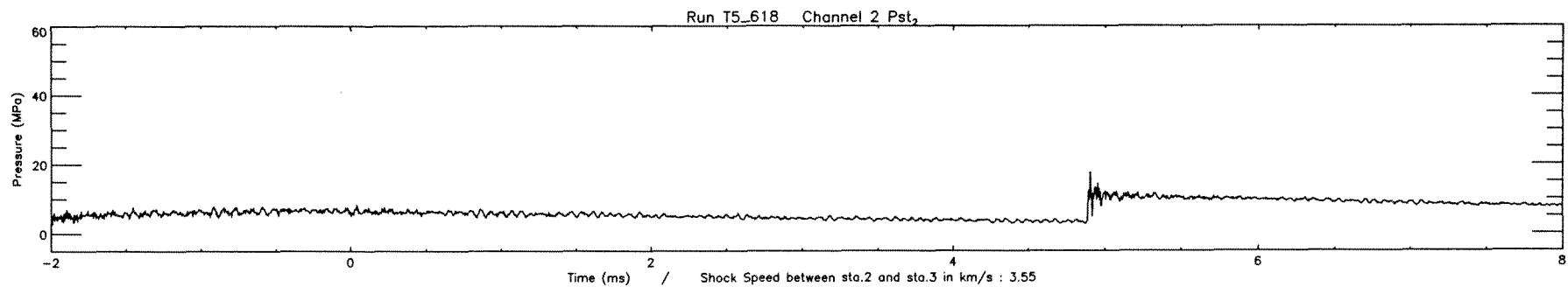
DA1 : *****
DA2 : 1.3649
DA3 : 0.3329
DA4 : 0.2933
DA5 : 0.3461
DA6 : 0.3163
DA7 : 0.2997
DA8 : 0.2291
DA9 : 0.2492

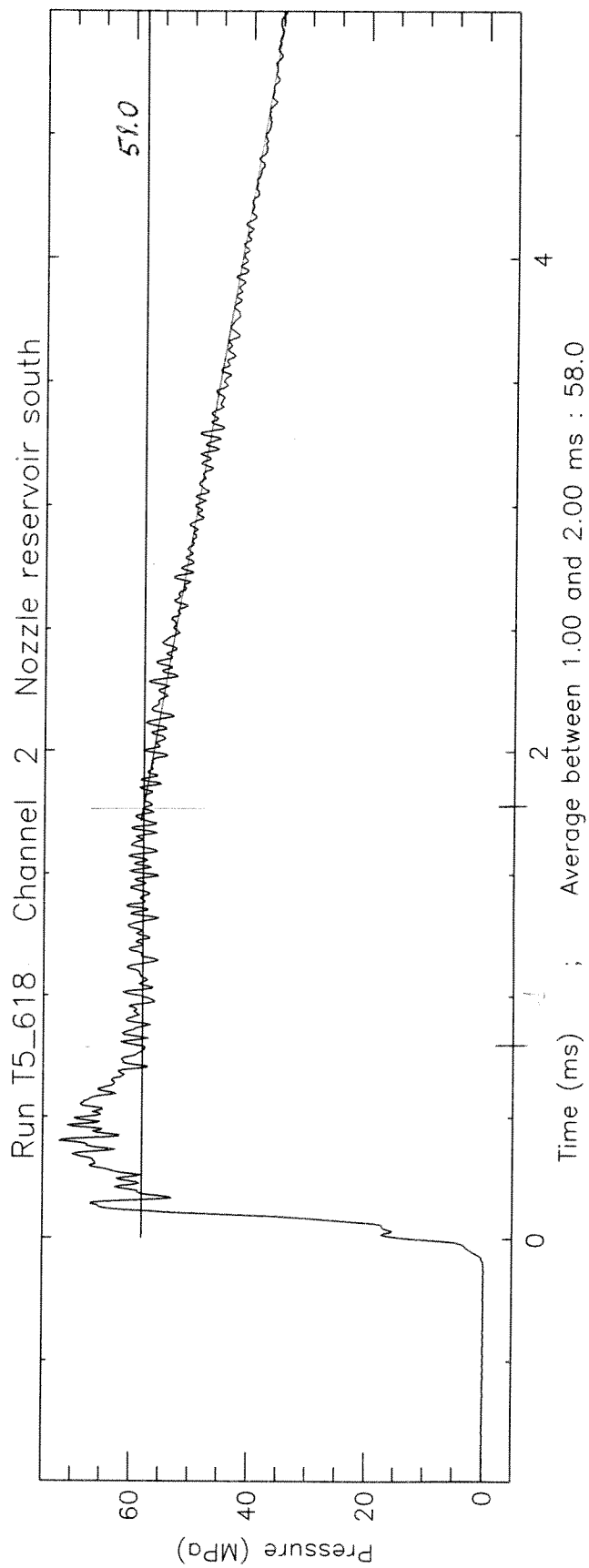
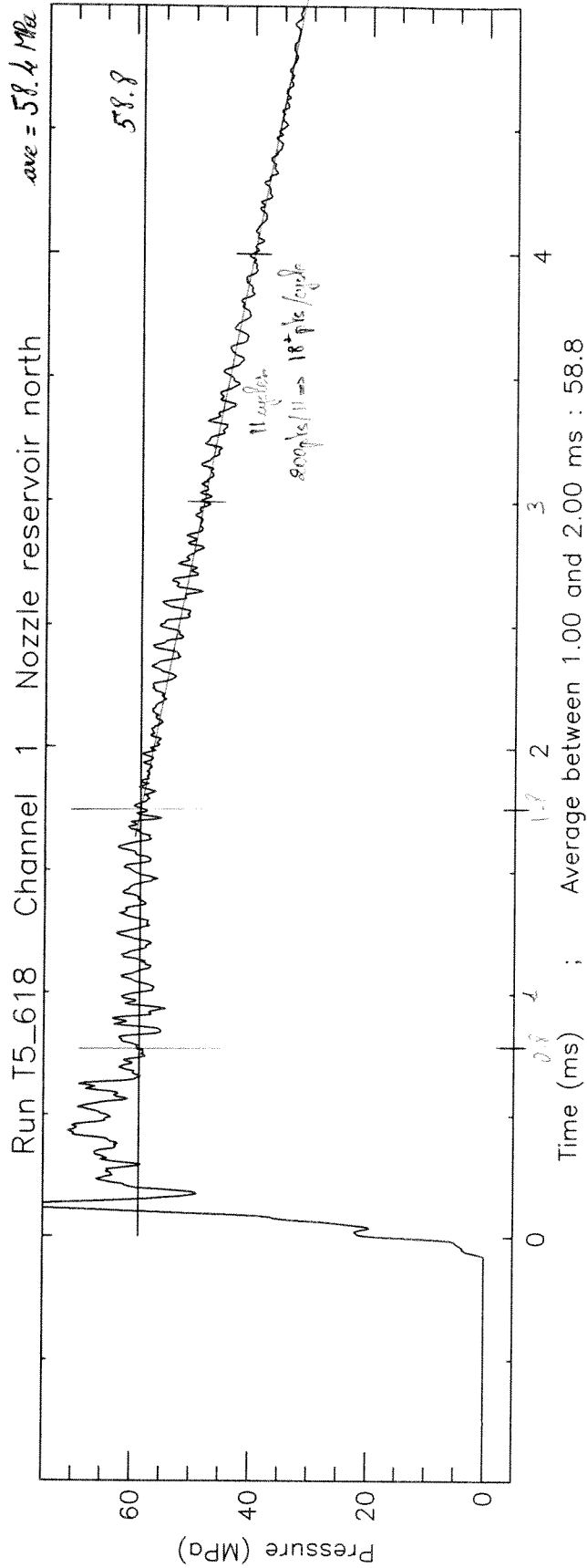
Run # 617

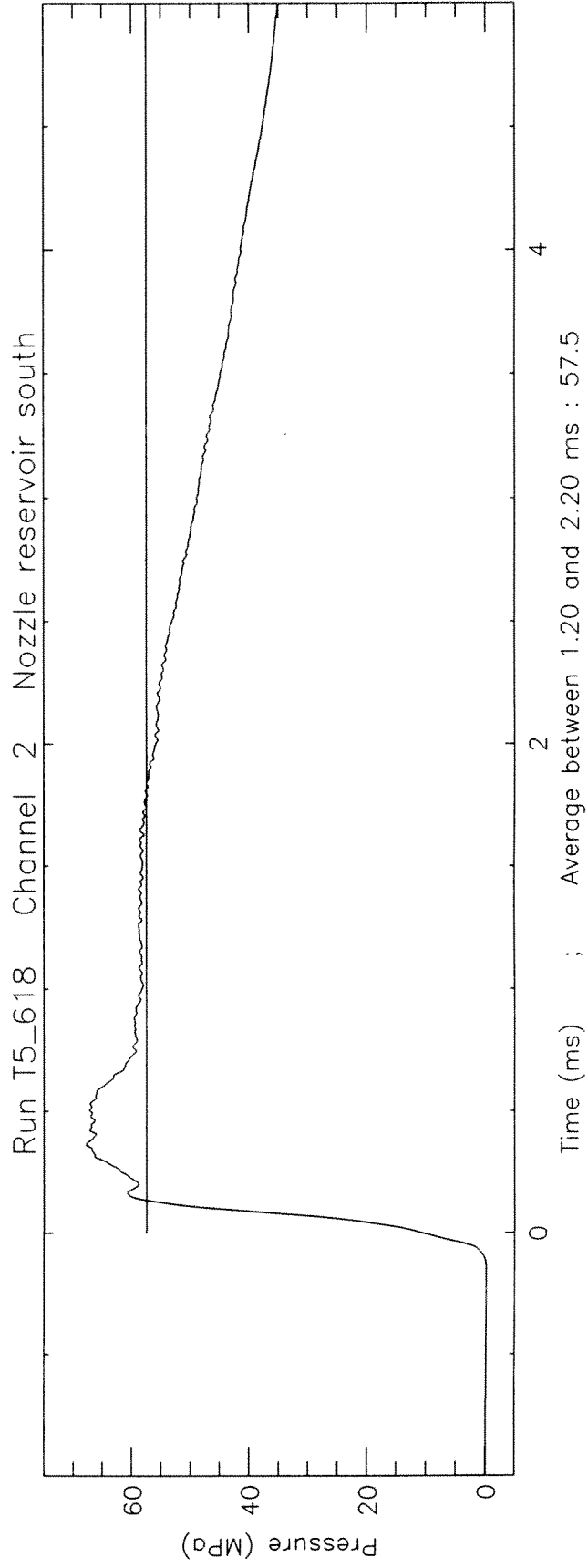
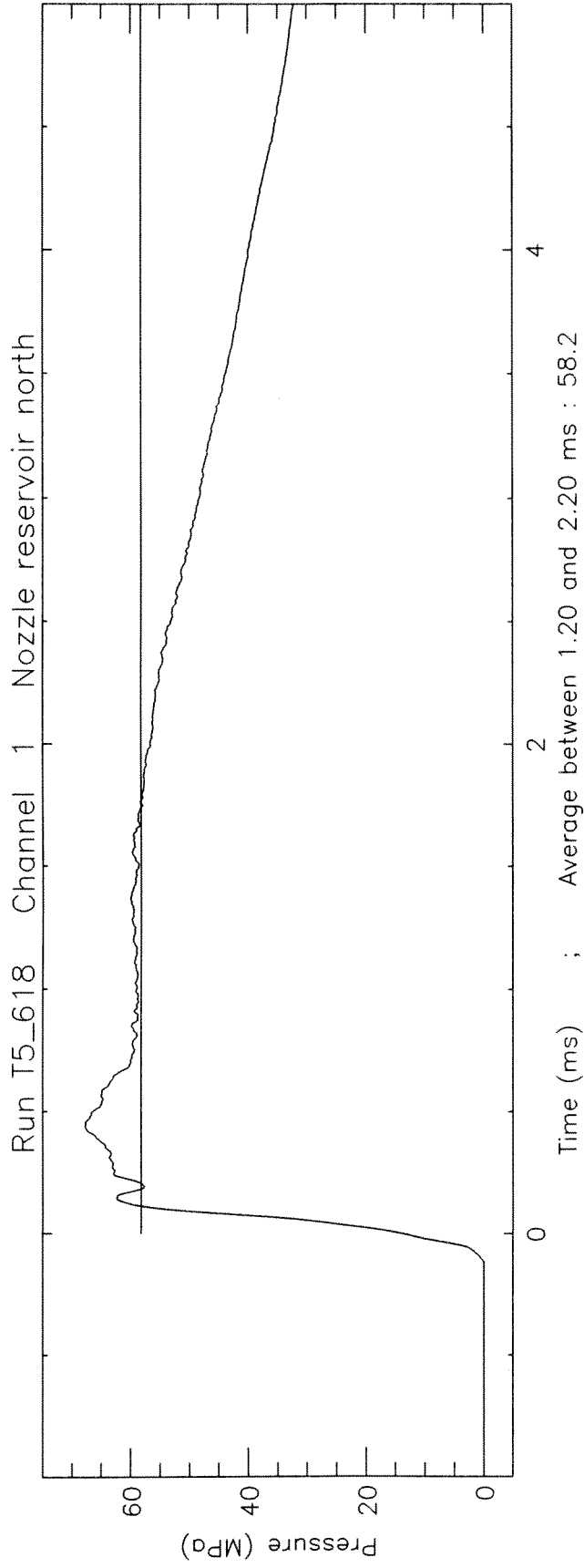
Heat Transfer Rates (in MW/m²)
averaged around 1.60 +/- 0.40 ms

MT 1 :	21.5223
MT 2 :	17.1368
MT 3 :	17.1994
MT 4 :	7.3810
MT 5 :	2.9346
MT 6 :	1.8938
MT 7 :	2.4979
MT 8 :	2.0952
MT 9 :	1.2949
MT10 :	1.5814
MT11 :	9.5845
MT12 :	1.3851

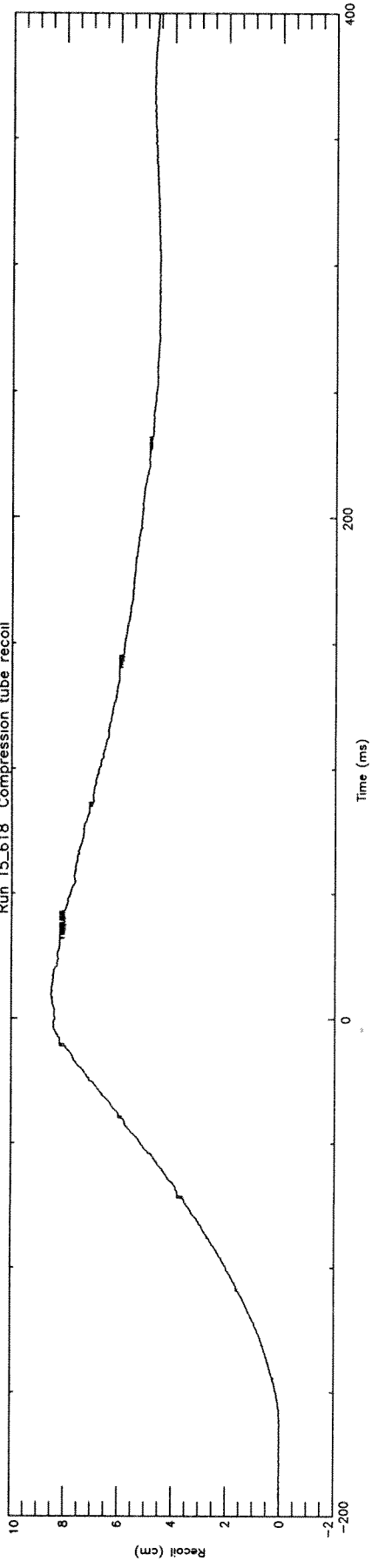




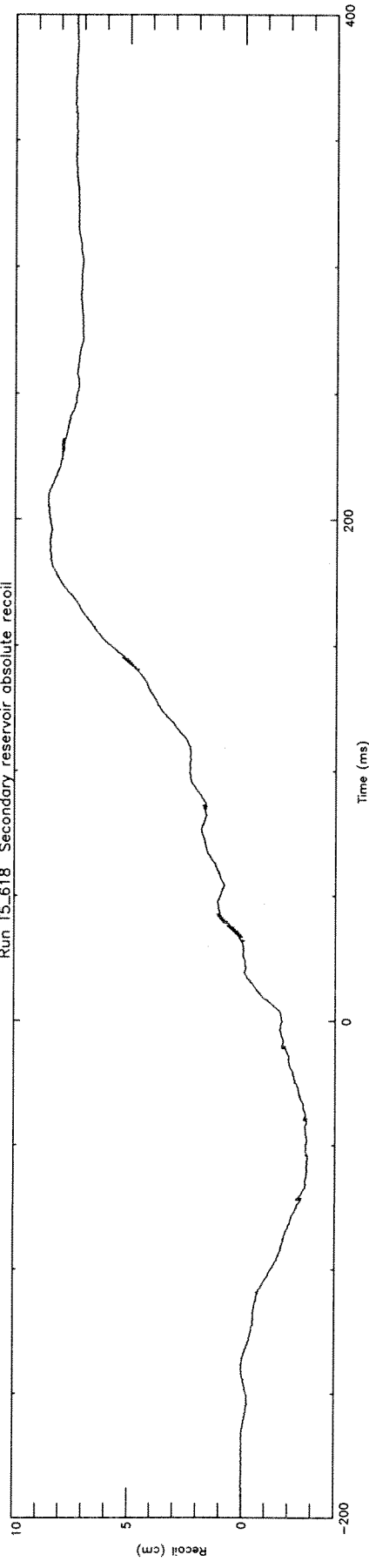




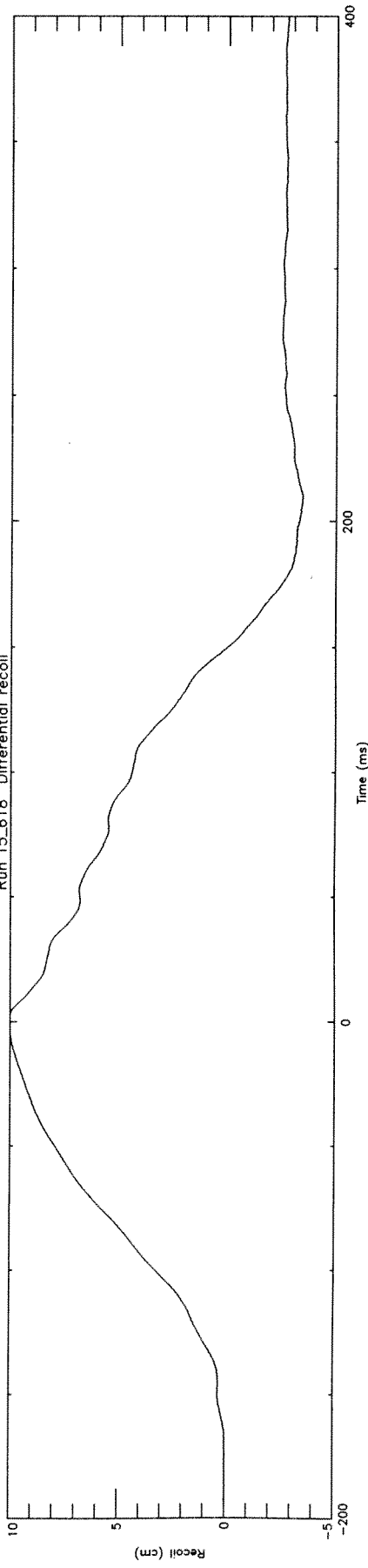
Run T5_618 Compression tube recoil



Run T5_618 Secondary reservoir absolute recoil

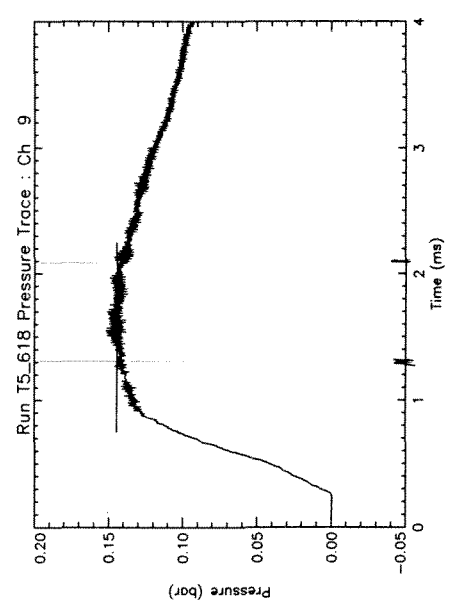
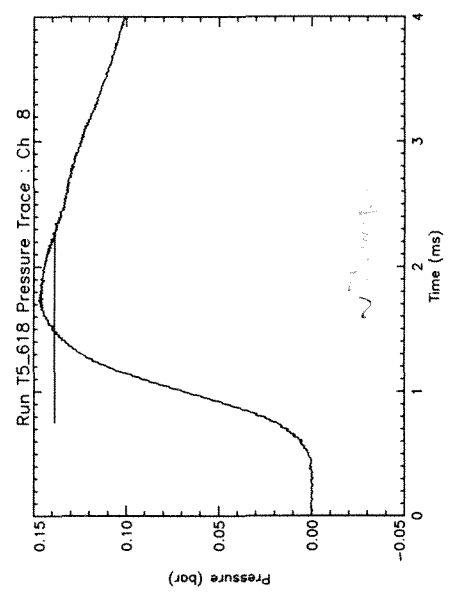
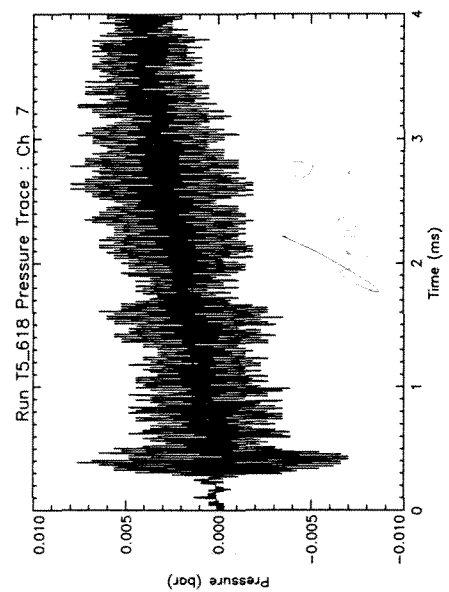
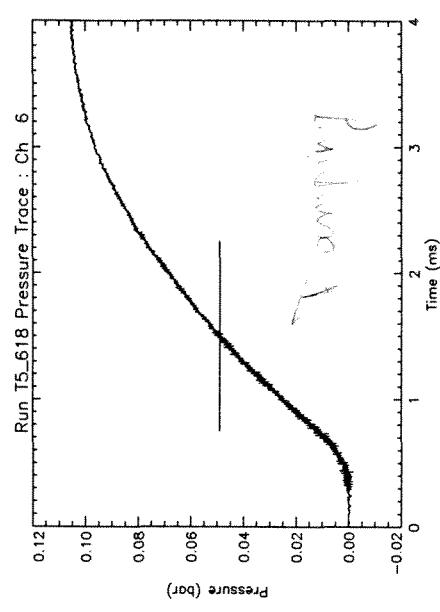
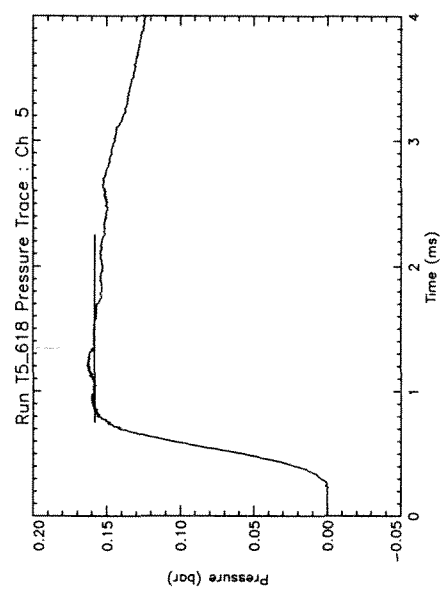
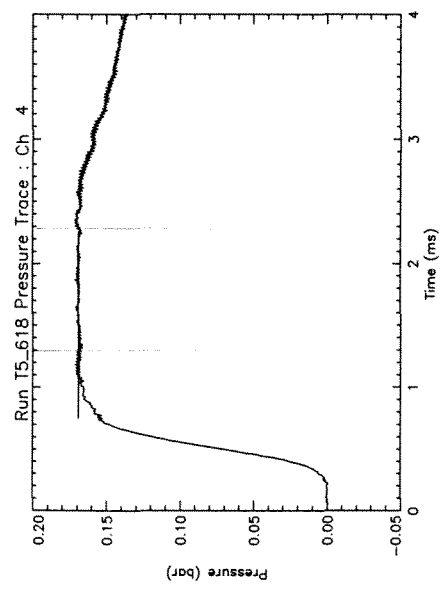
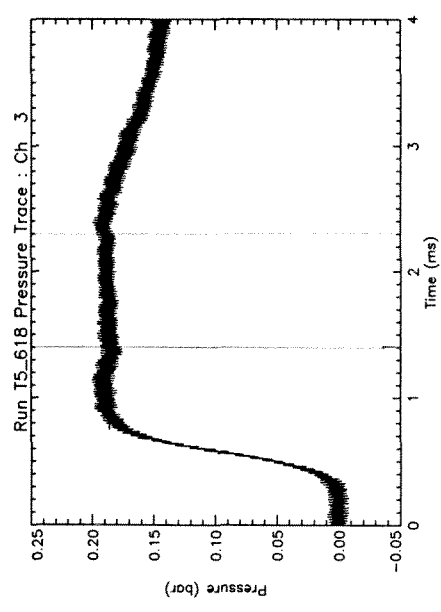
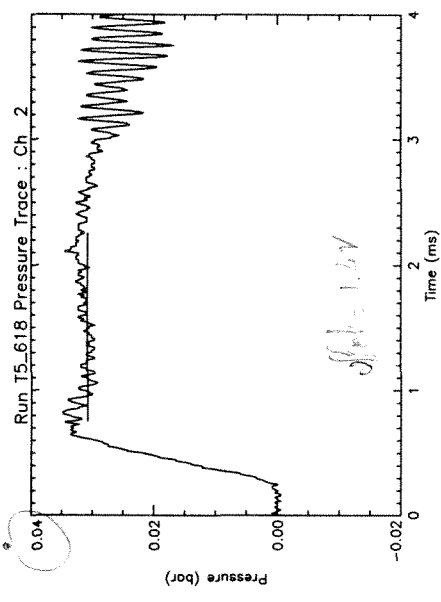
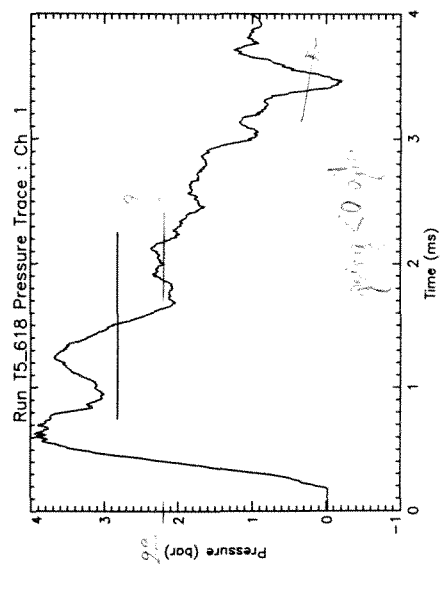


Run T5_618 Differential recoil



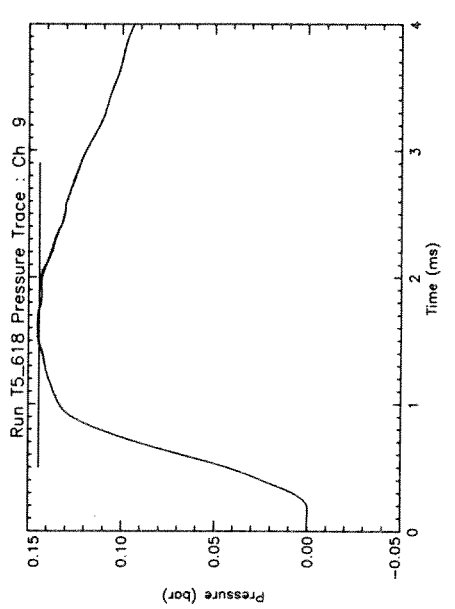
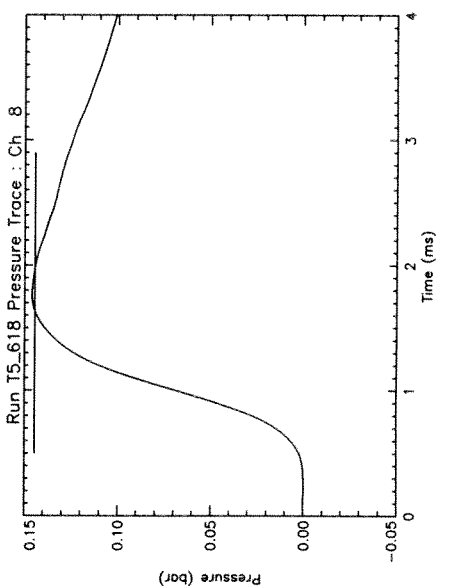
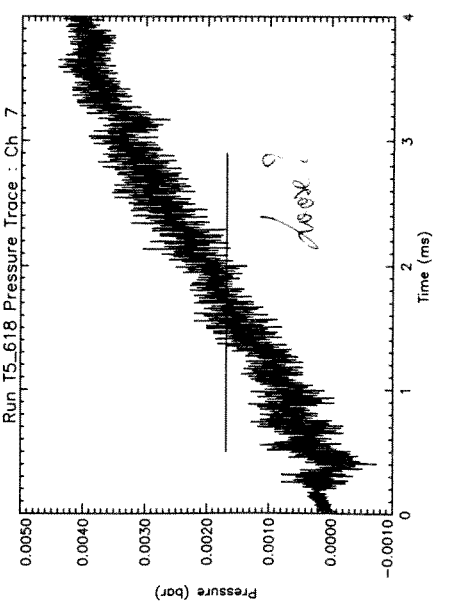
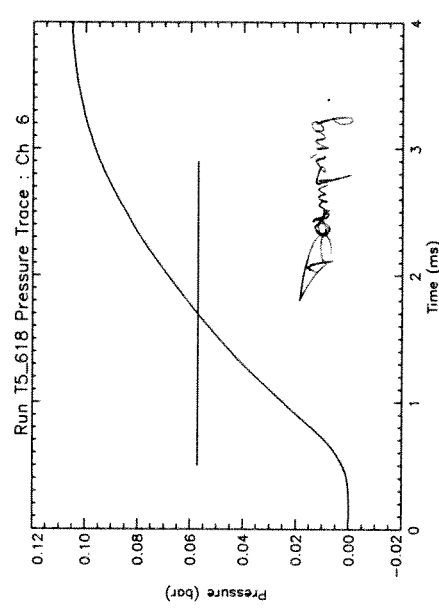
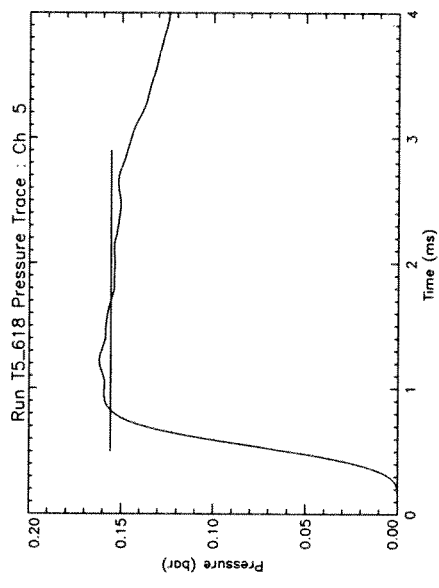
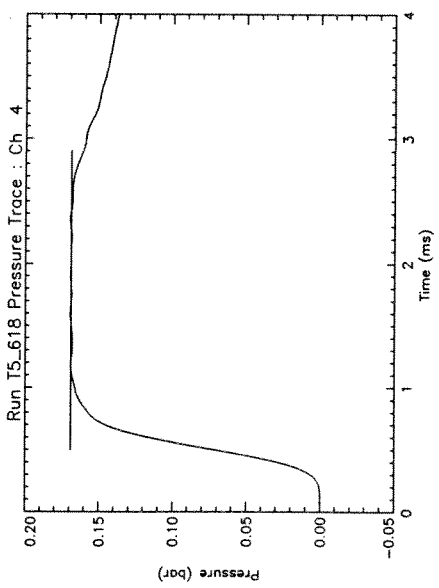
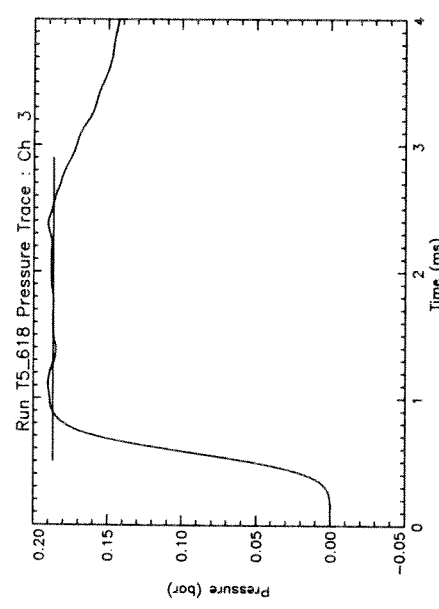
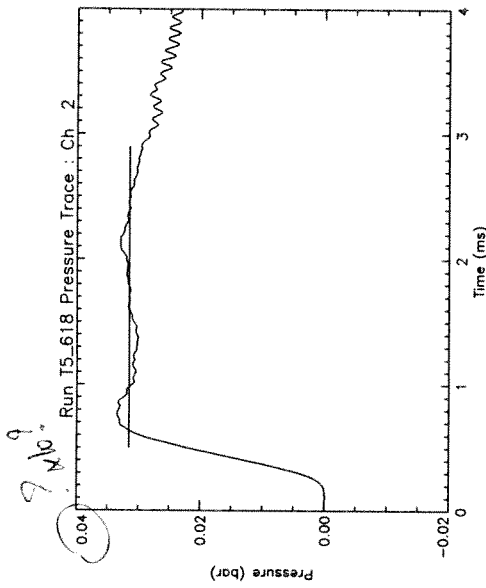
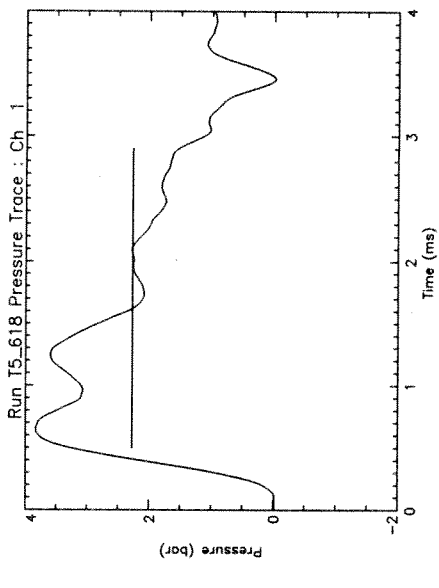
Box = 2

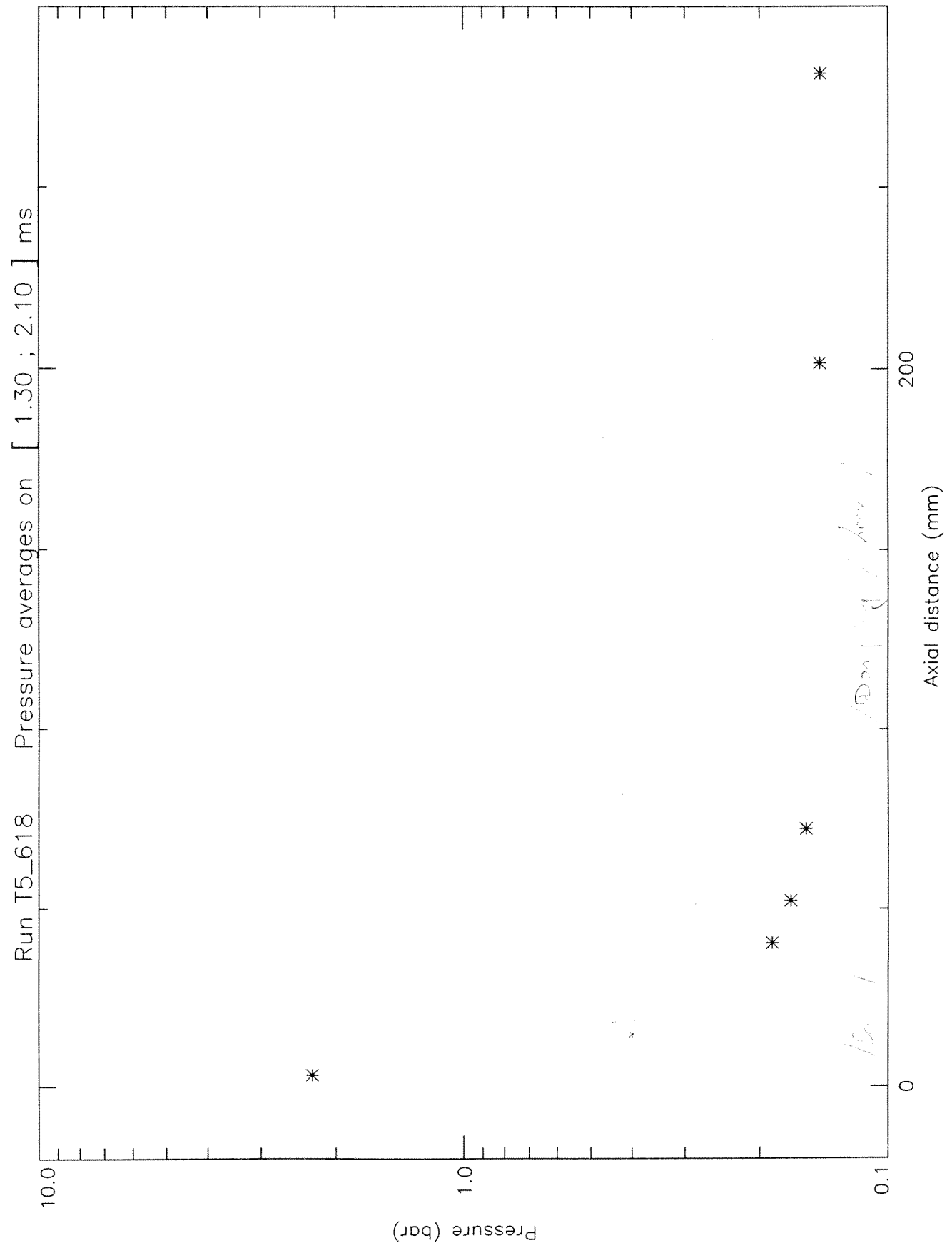
one on [1.95, .75] ms



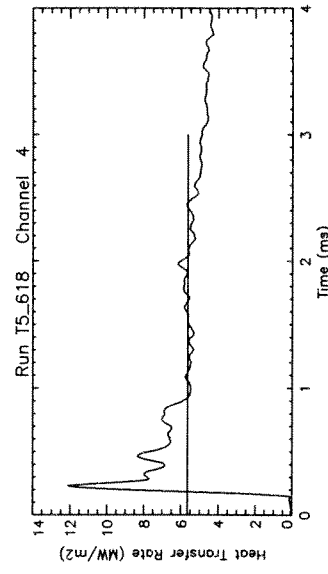
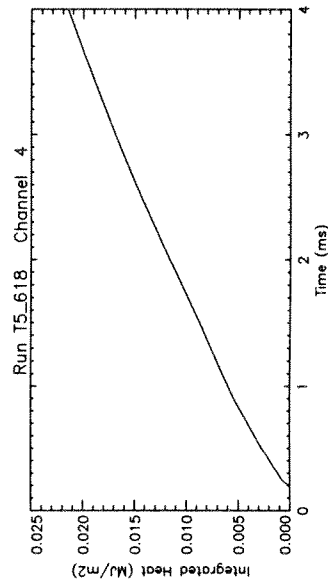
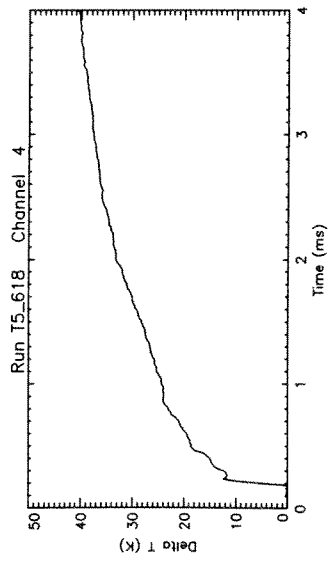
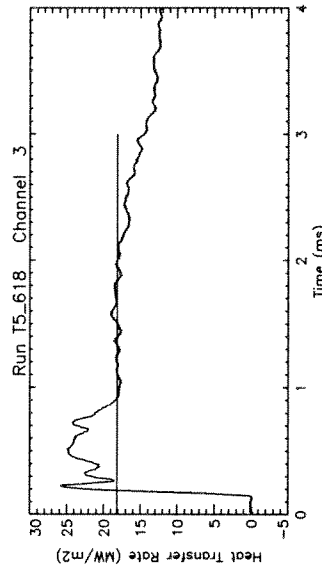
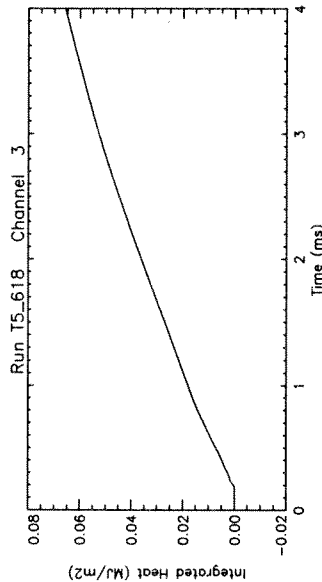
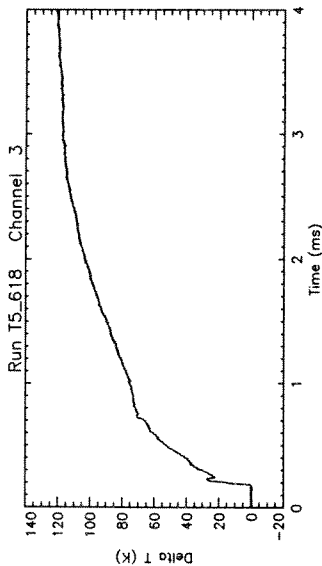
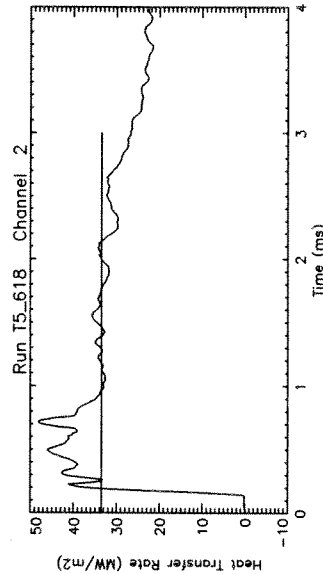
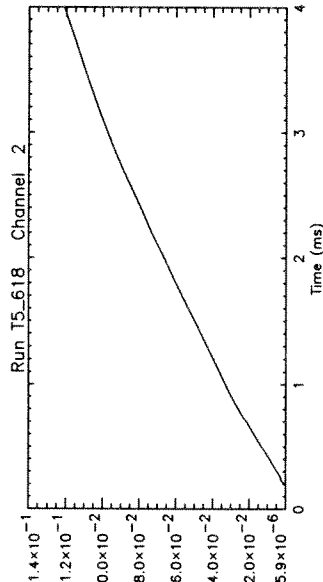
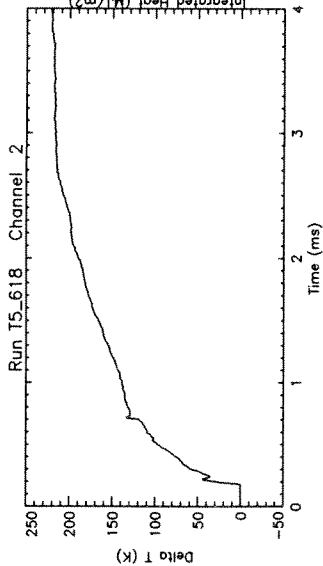
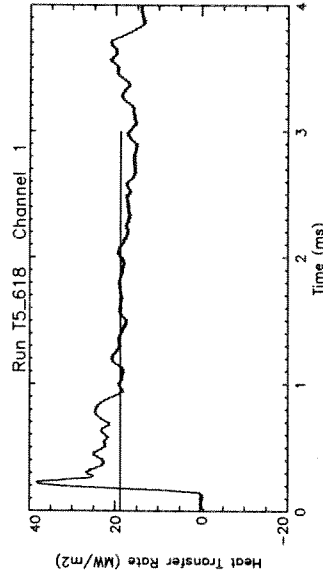
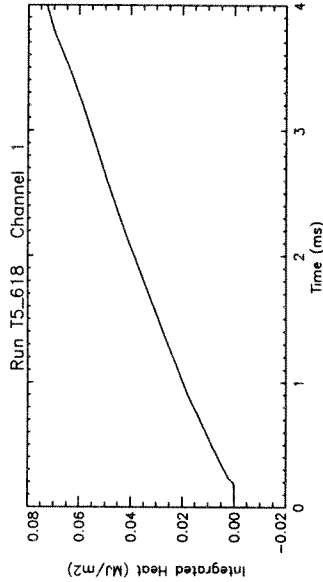
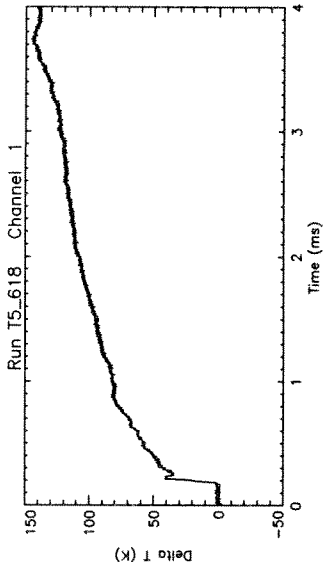
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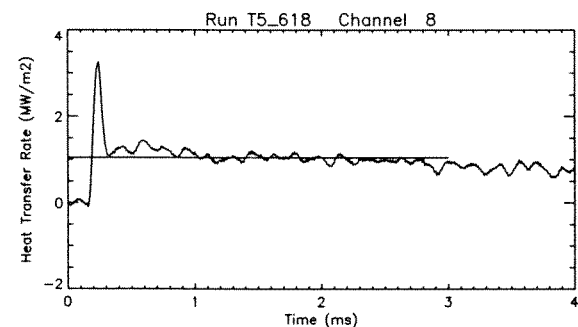
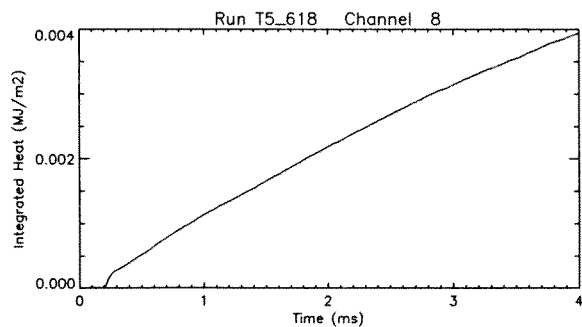
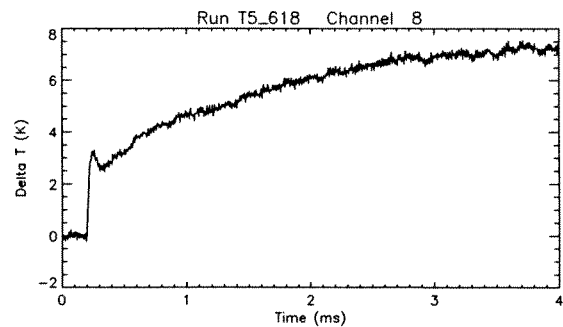
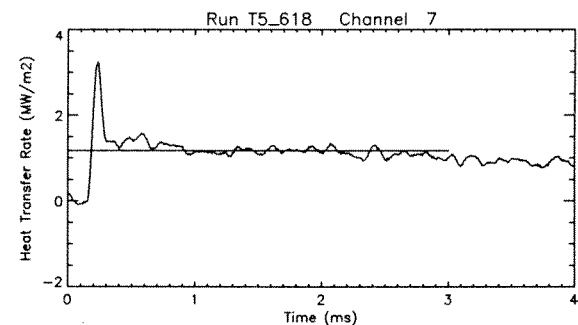
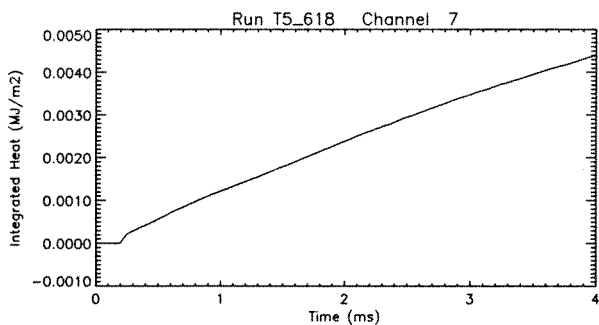
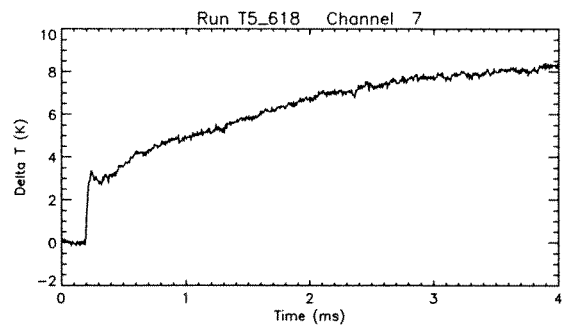
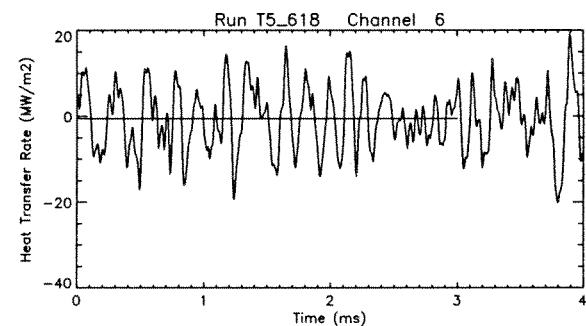
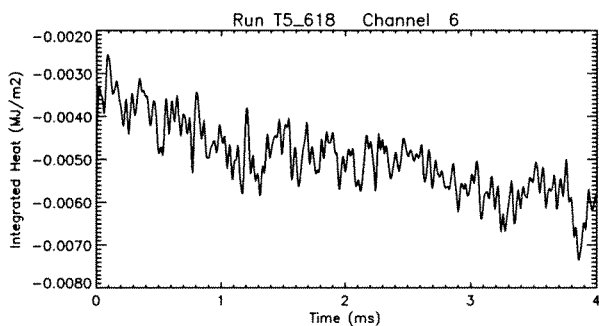
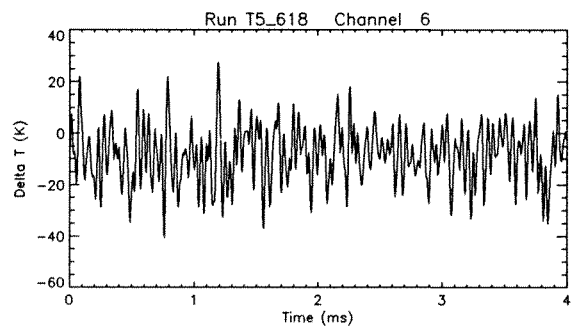
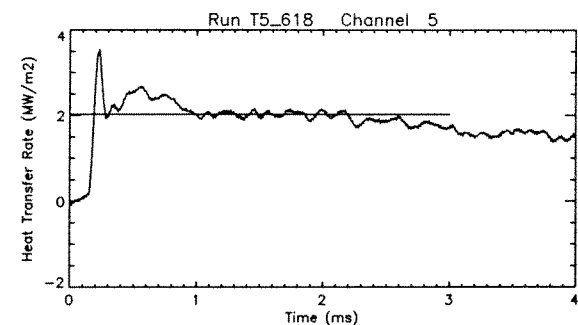
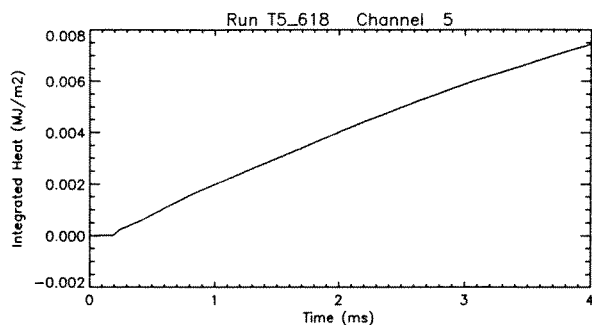
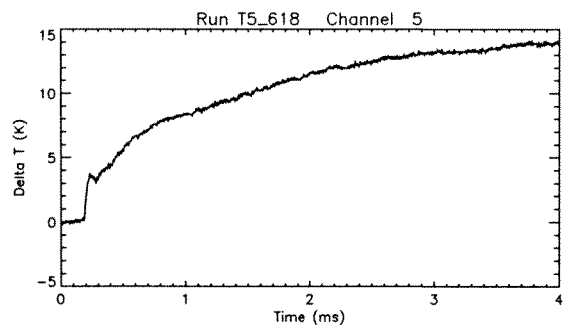
ave en [1.30; 2.60]

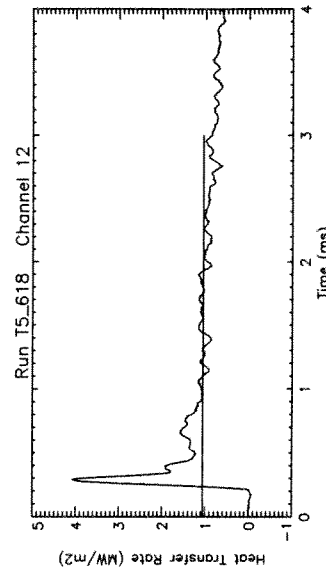
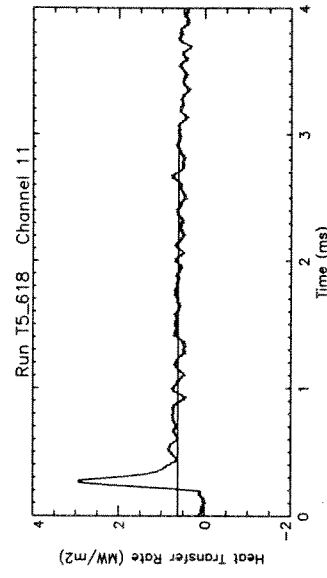
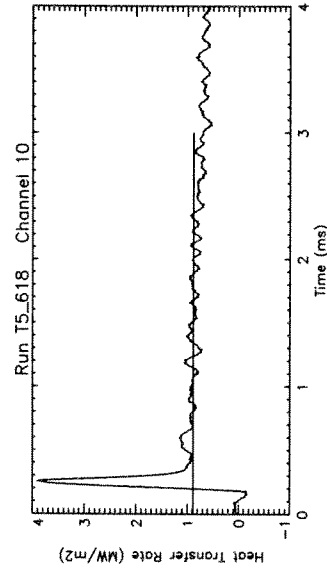
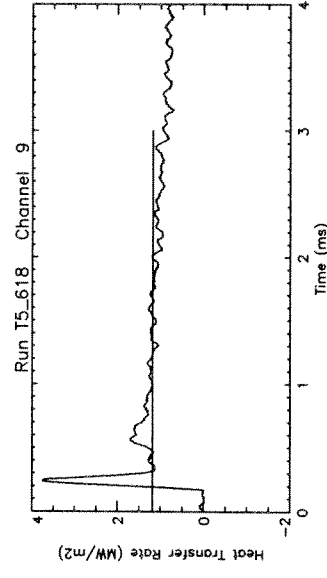
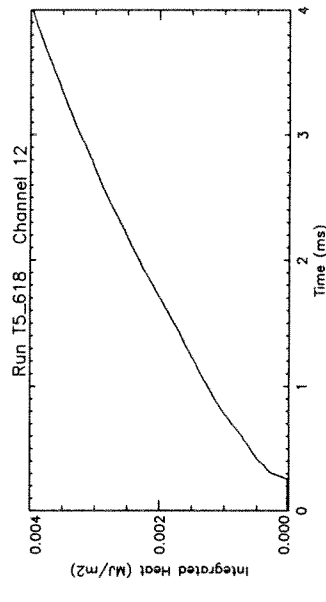
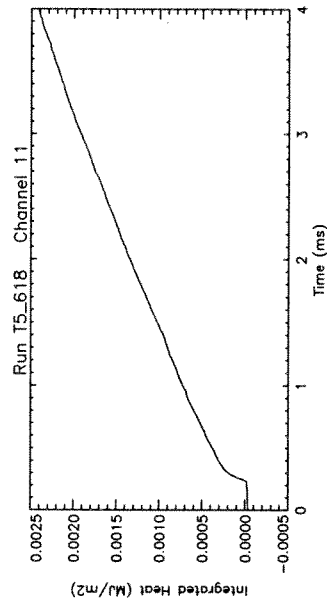
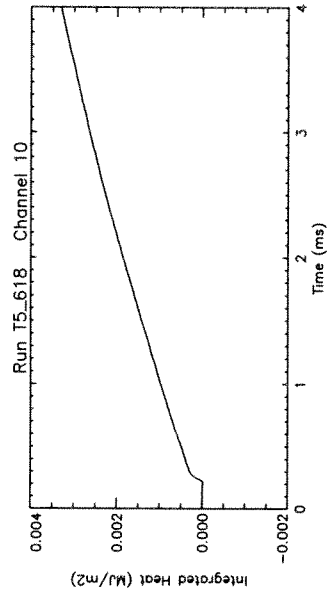
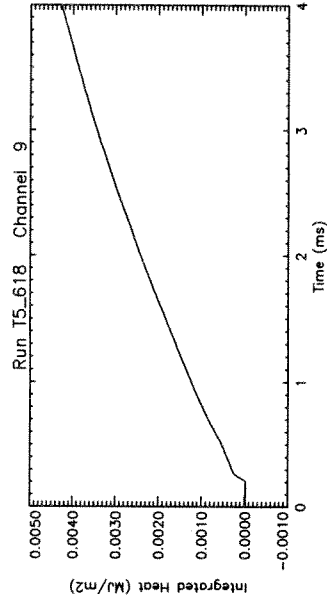
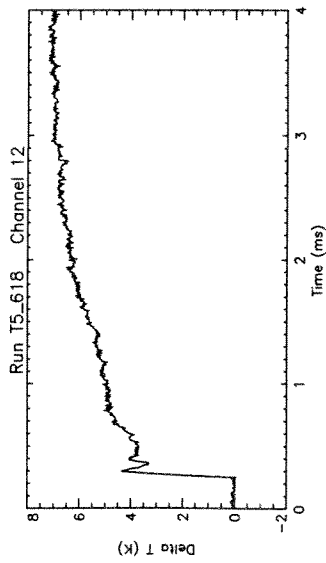
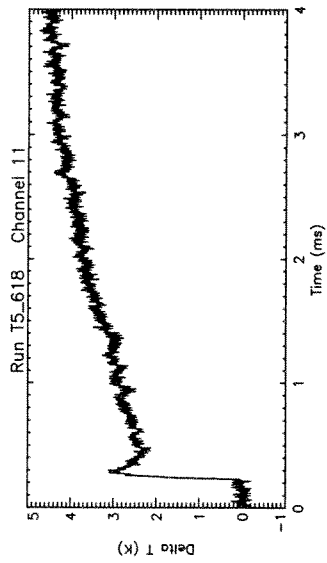
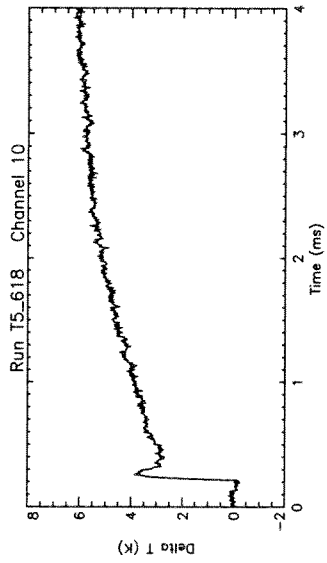
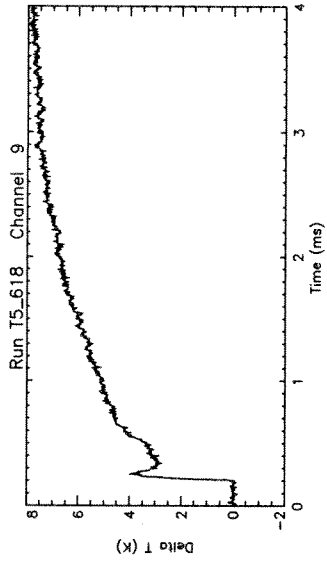


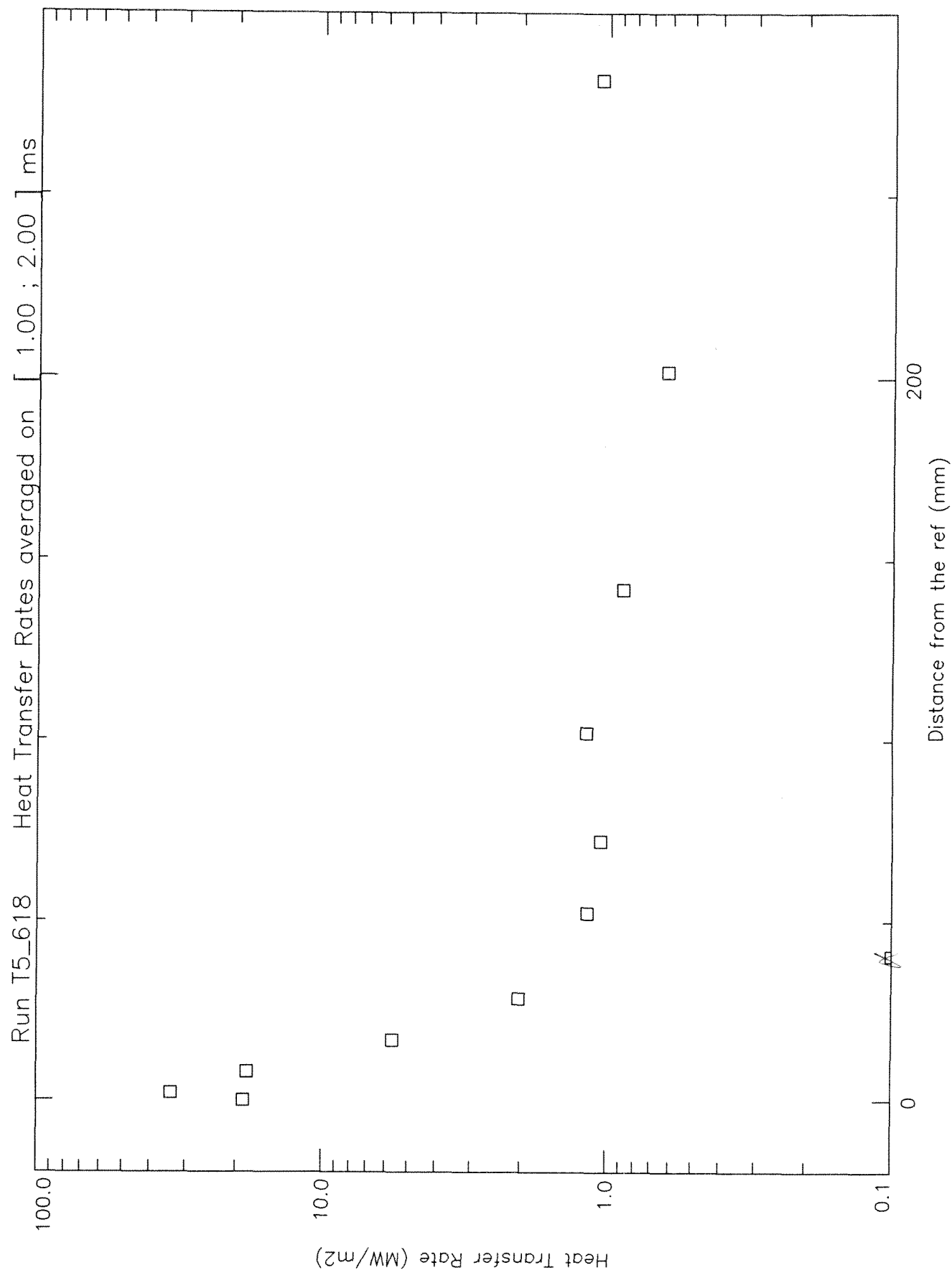


QMC on [1.0 2] mK









Run # 618

Pressure averages around 1.70 +/- 0.40 ms

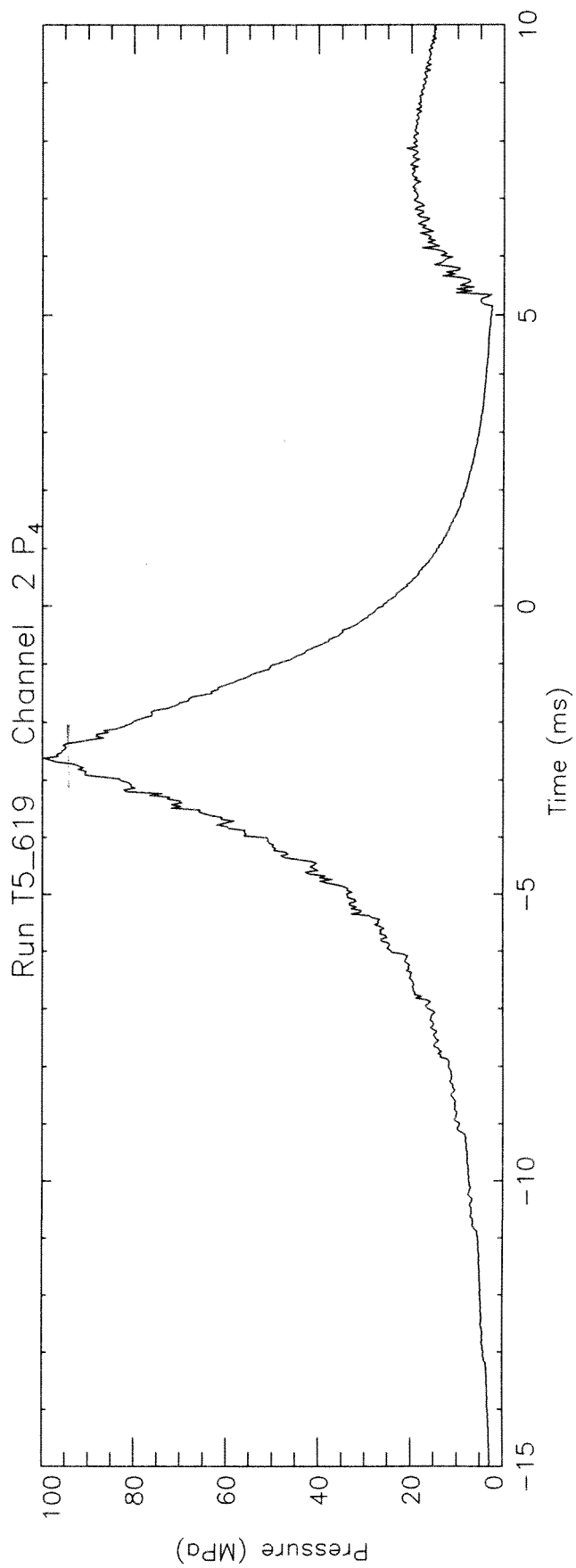
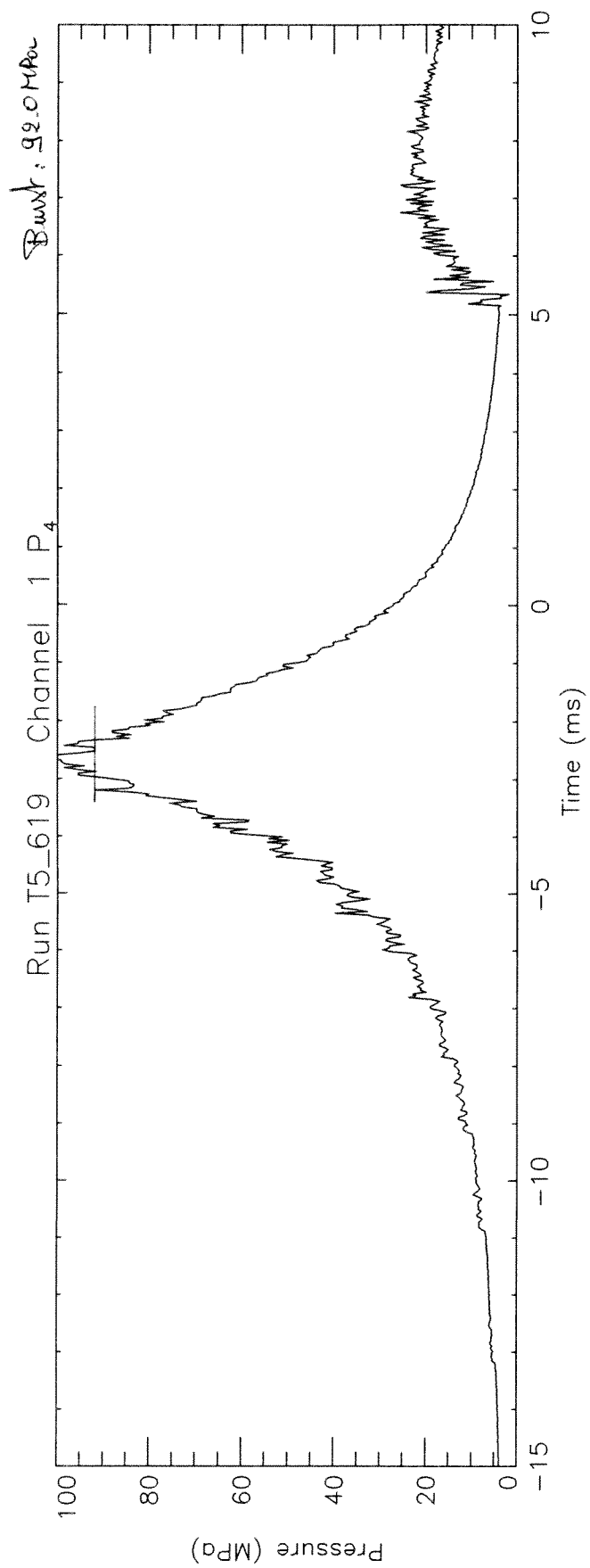
Smooth box = 2.

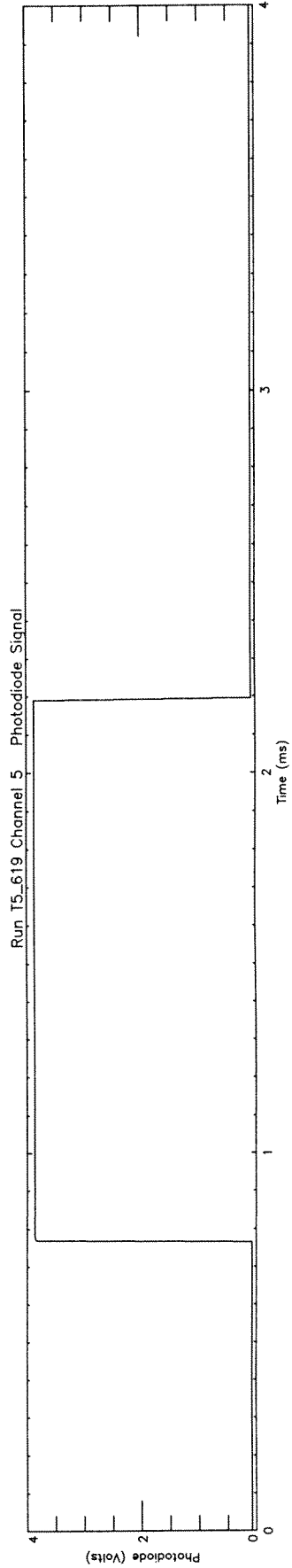
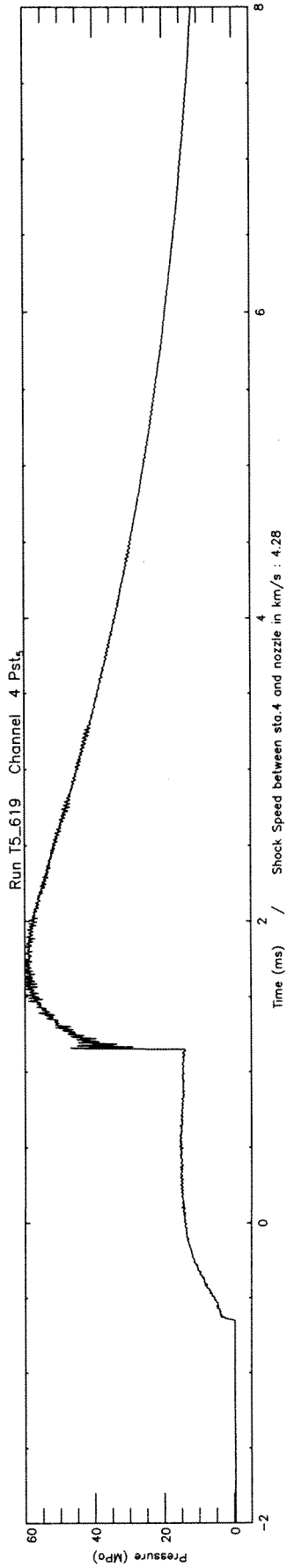
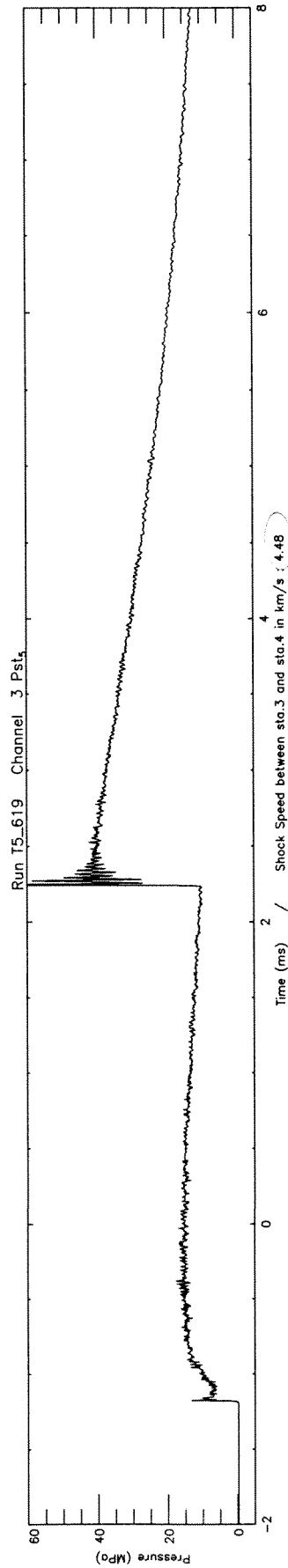
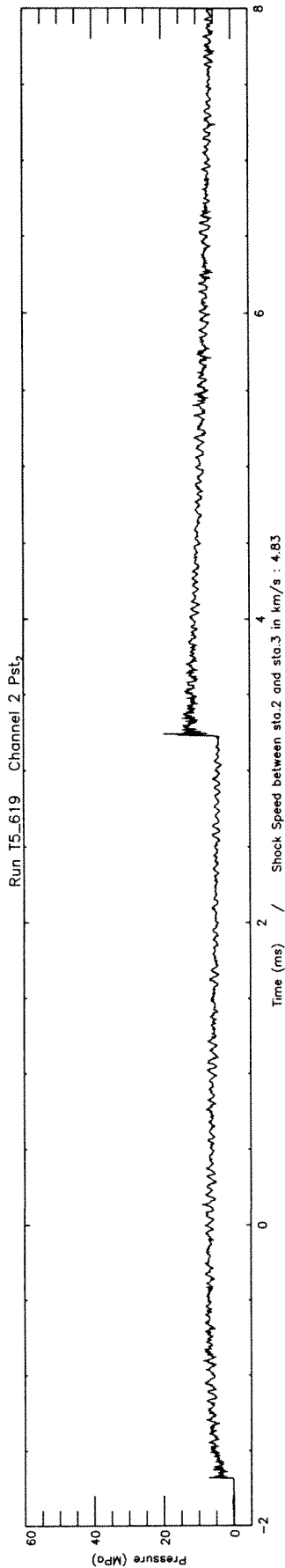
DA1	:	2.2581
DA2	:	0.0315
DA3	:	0.1870
DA4	:	0.1691
DA5	:	0.1557
DA6	:	0.0573
DA7	:	0.0017
DA8	:	0.1447
DA9	:	0.1442

Run # 618

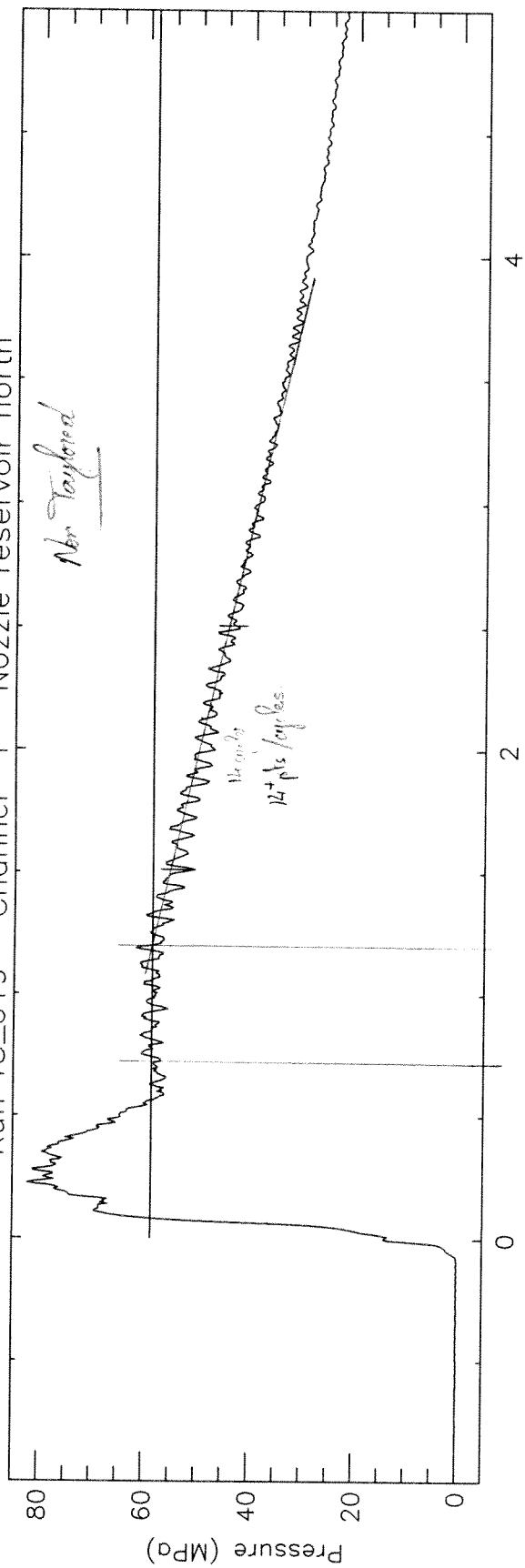
Heat Transfer Rates (in MW/m²)
averaged around 1.50 +/- 0.50 ms

MT 1 :	18.7767
MT 2 :	33.5617
MT 3 :	18.1876
MT 4 :	5.6462
MT 5 :	2.0254
MT 6 :	-0.5211
MT 7 :	1.1680
MT 8 :	1.0509
MT 9 :	1.1823
MT10 :	0.8826
MT11 :	0.6195
MT12 :	1.0610

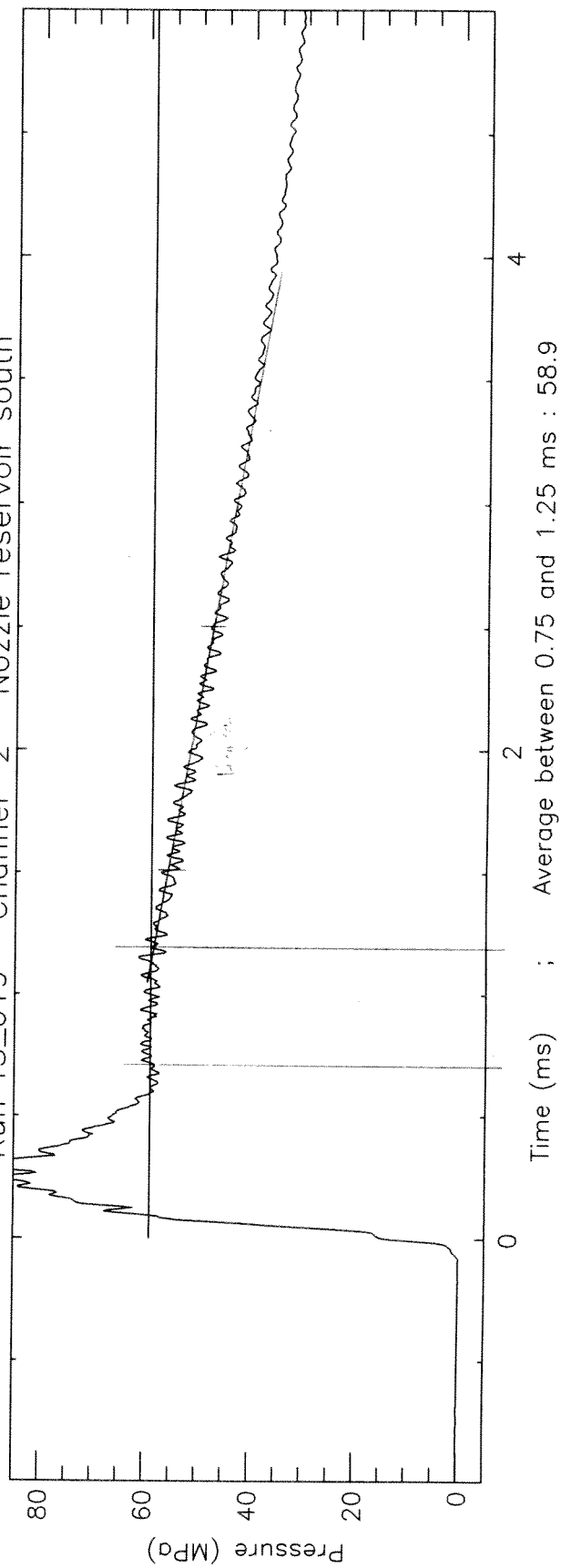


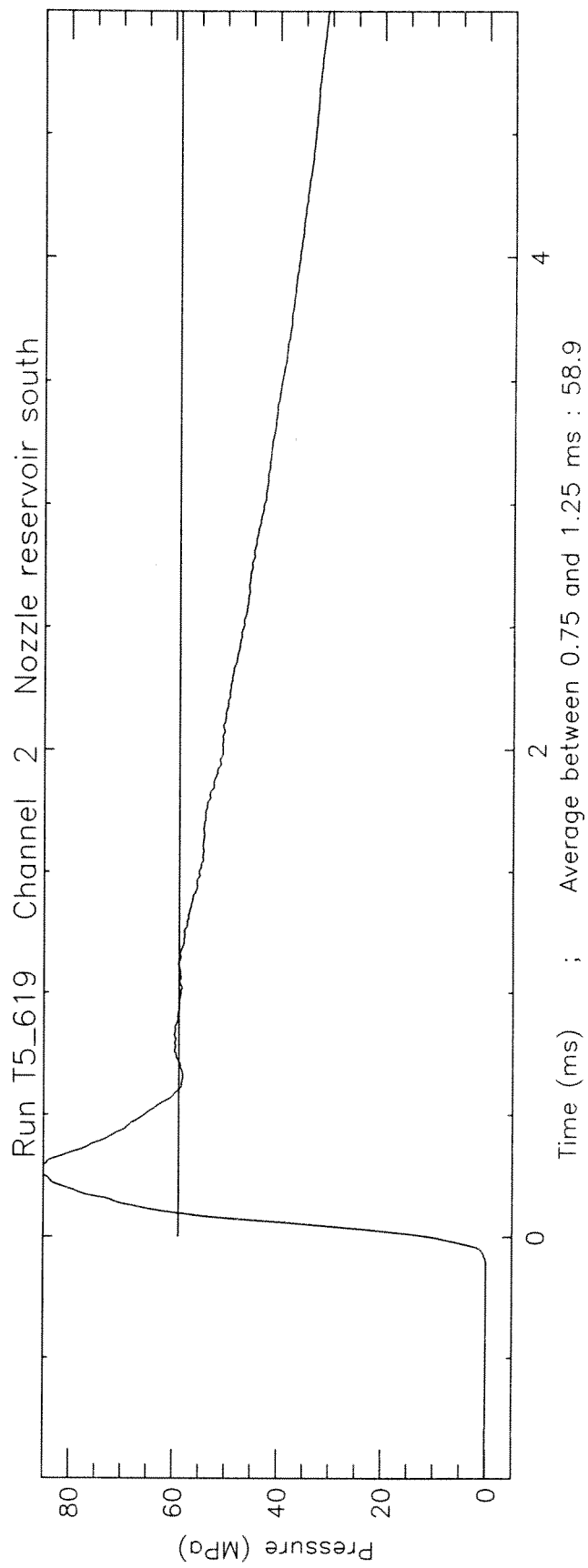
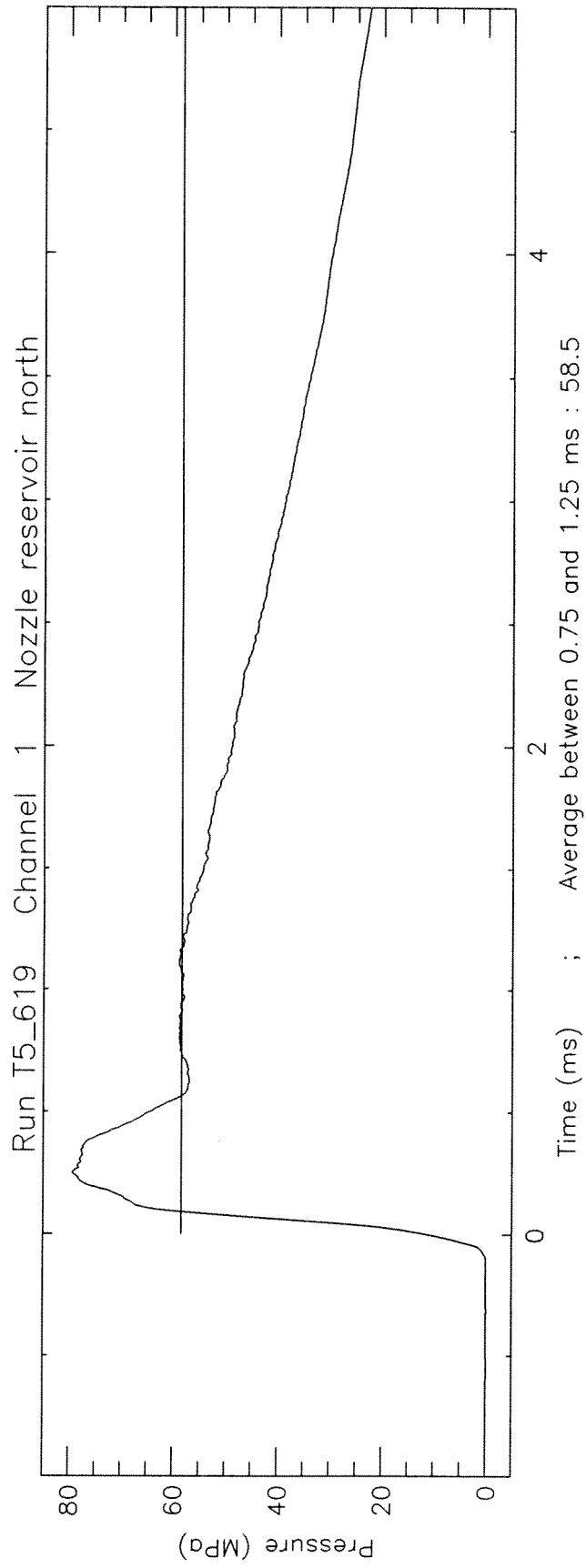


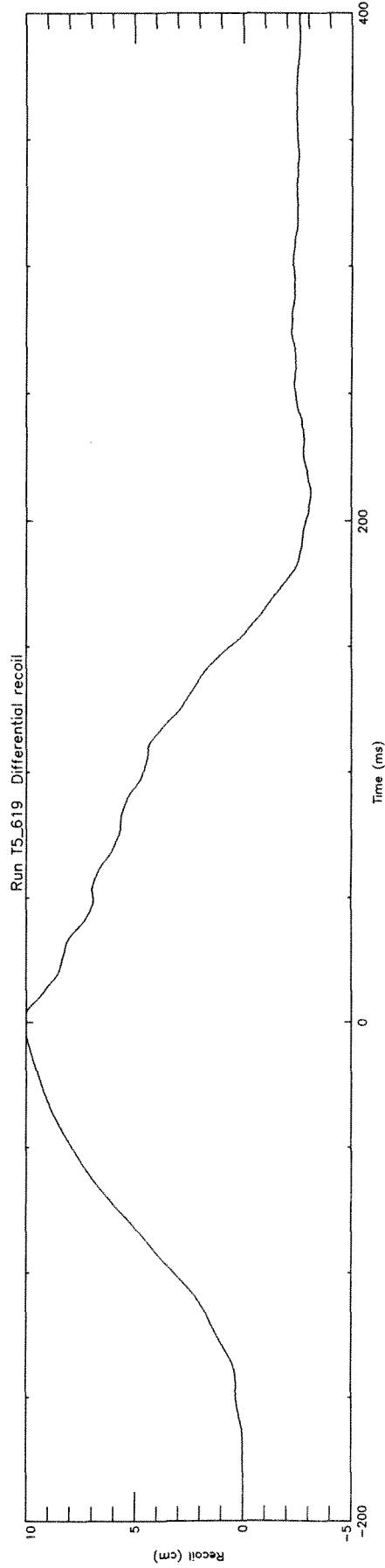
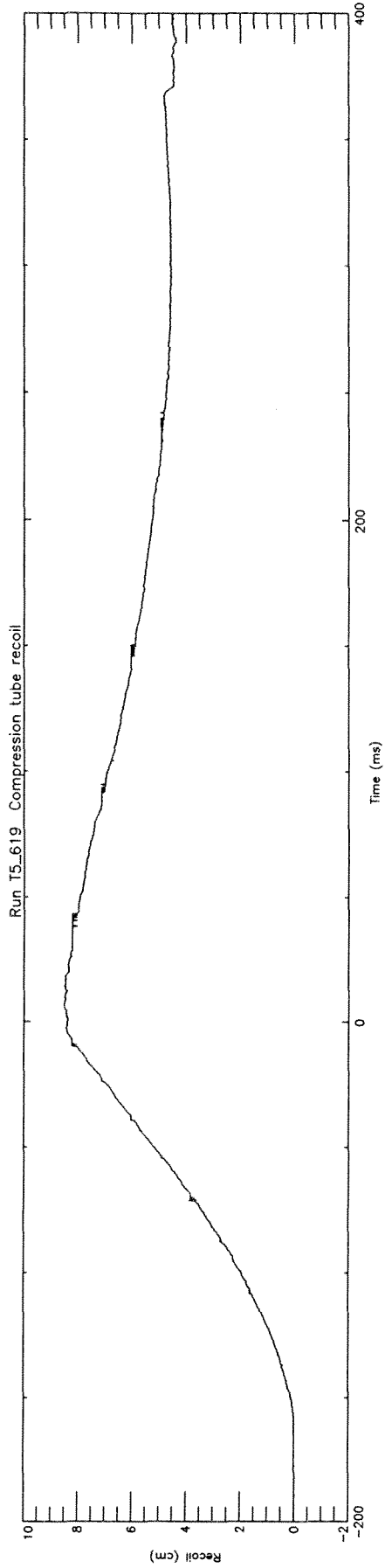
Run T5_619 Channel 1 Nozzle reservoir north

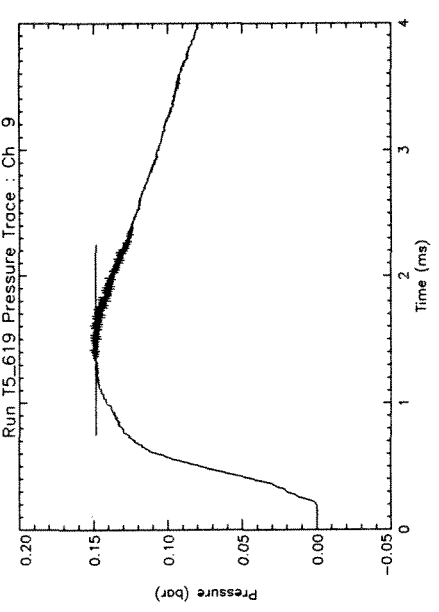
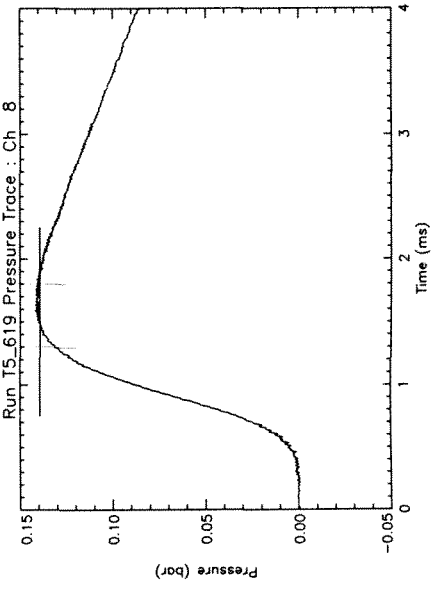
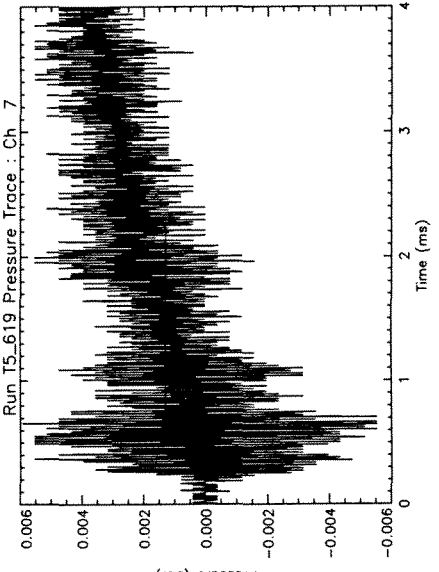
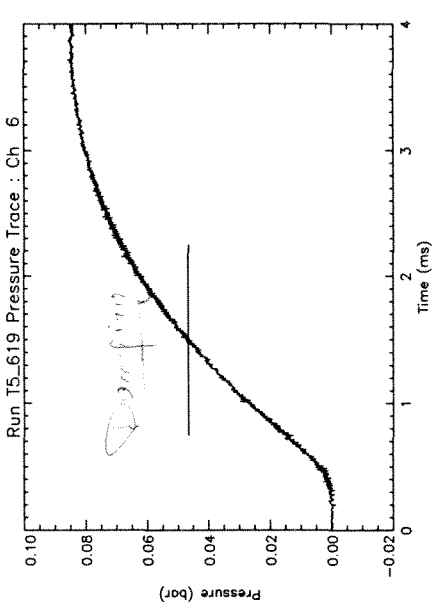
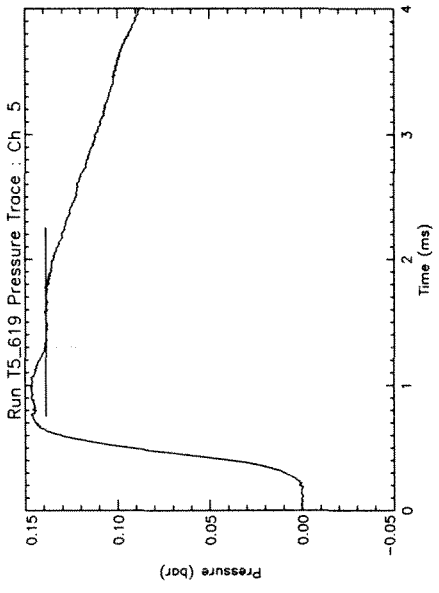
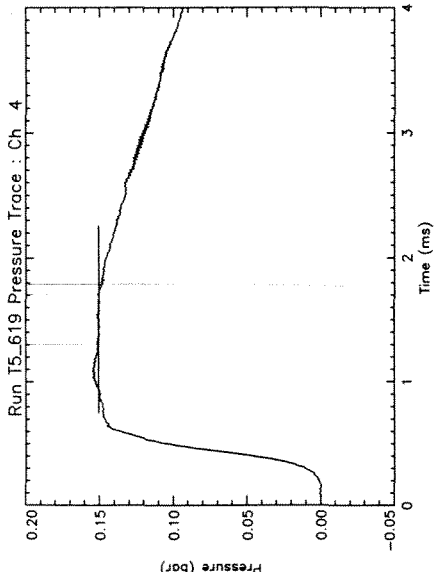
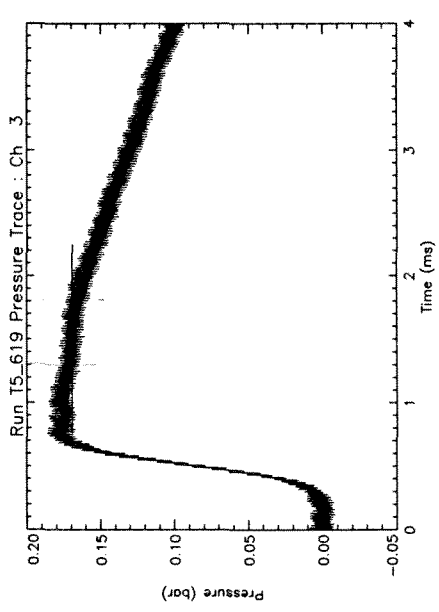
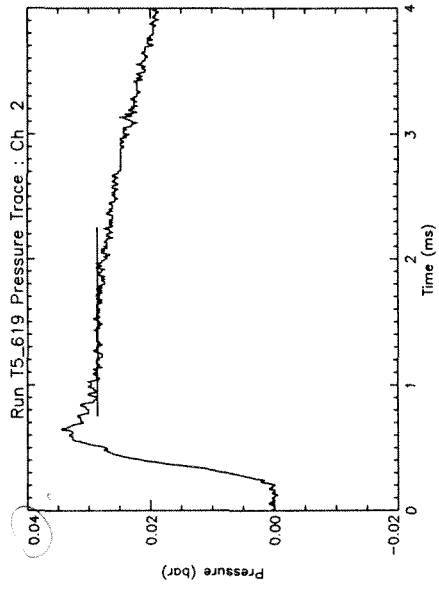
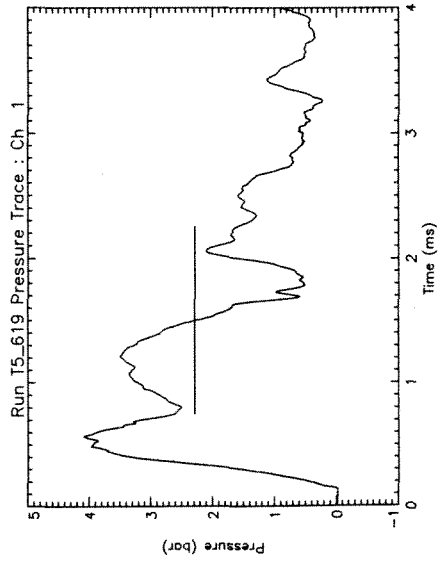


Run T5_619 Channel 2 Nozzle reservoir south



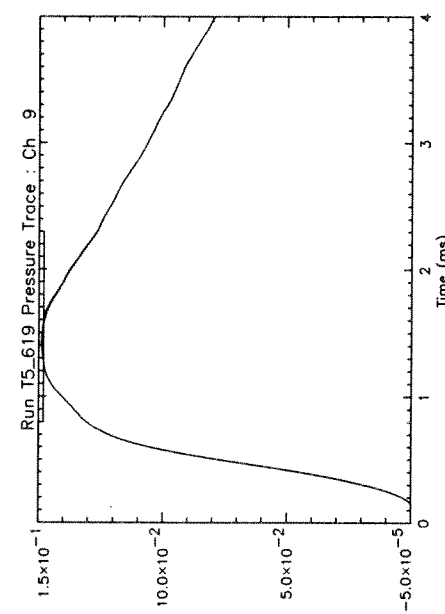
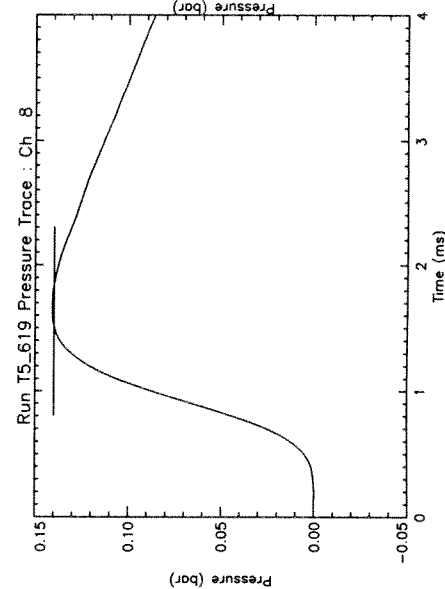
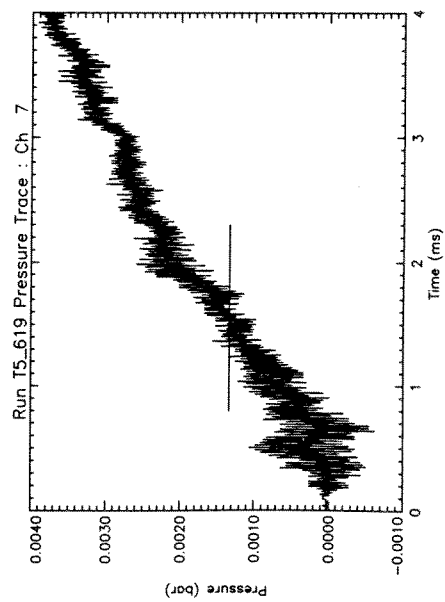
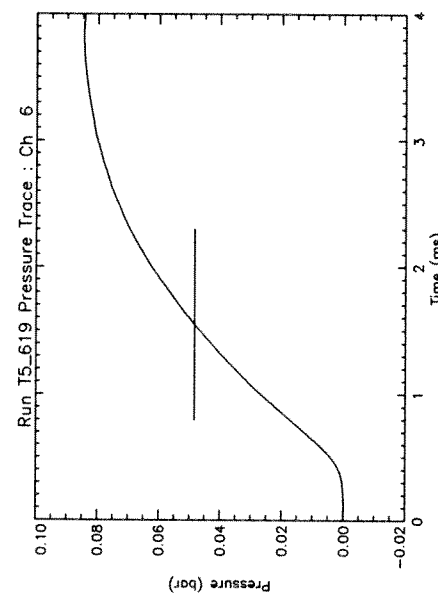
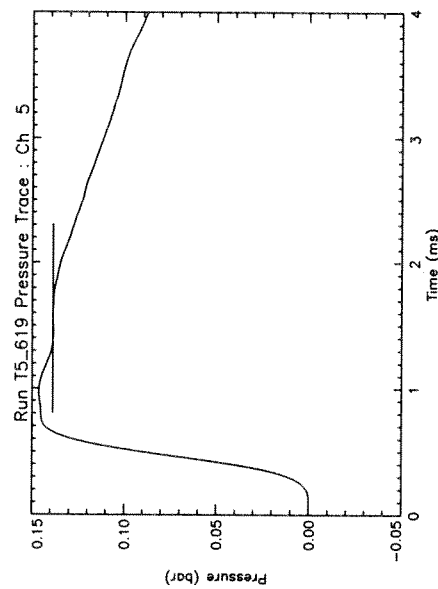
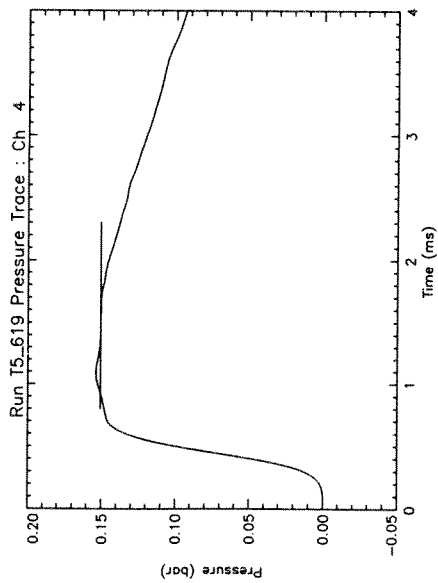
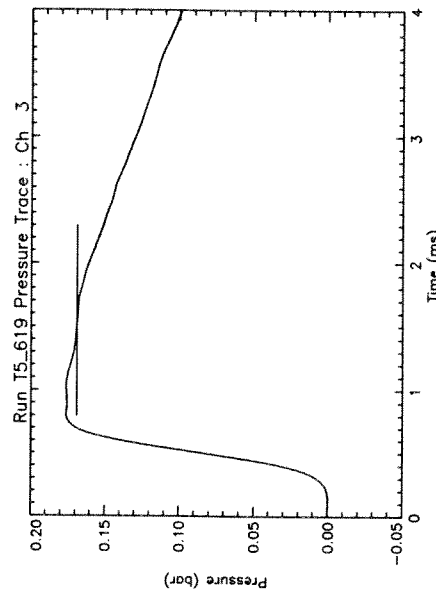
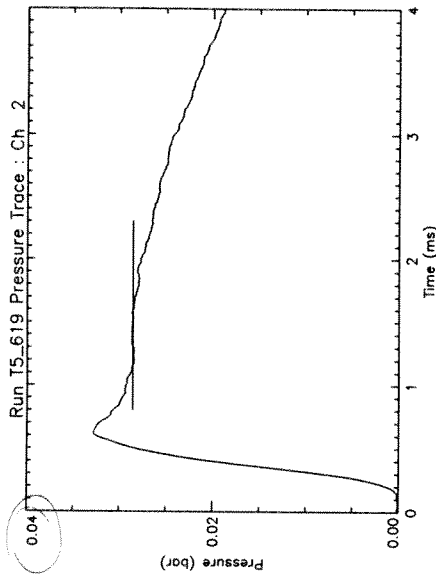
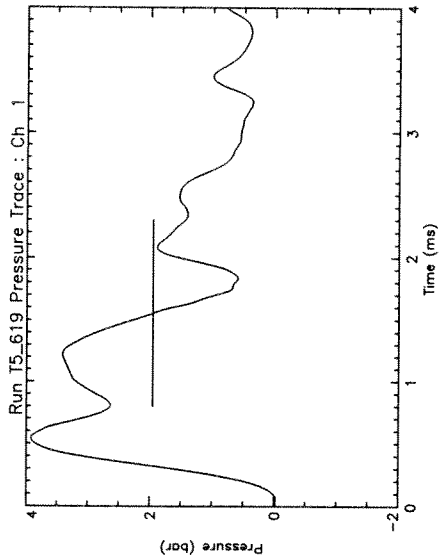


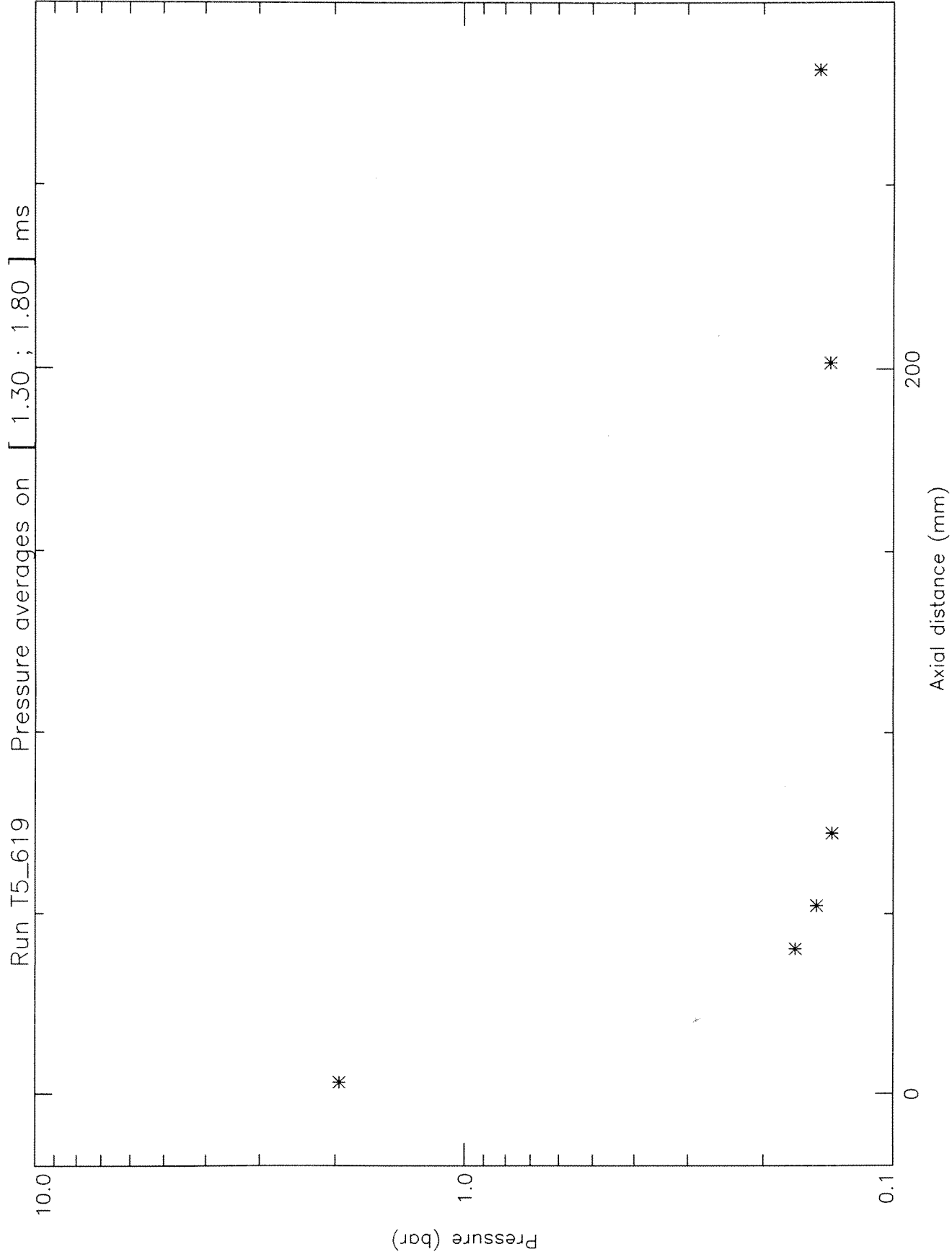




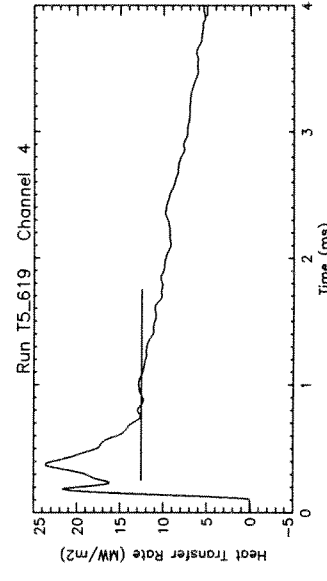
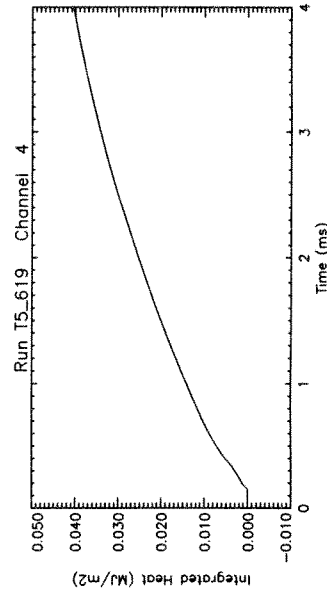
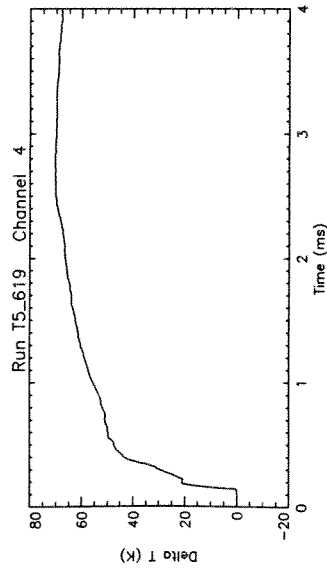
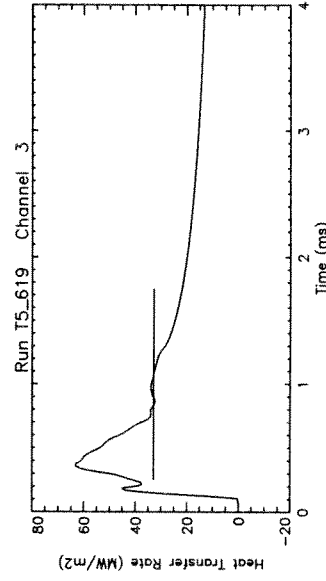
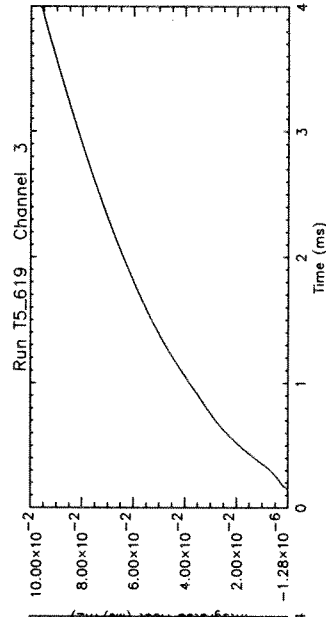
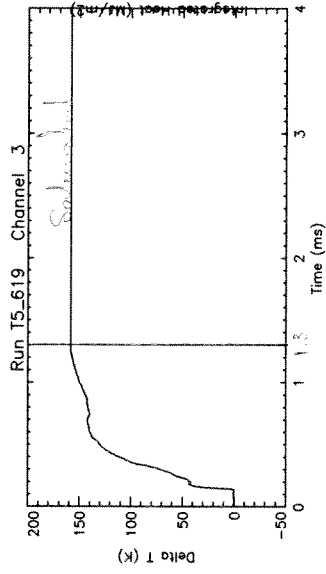
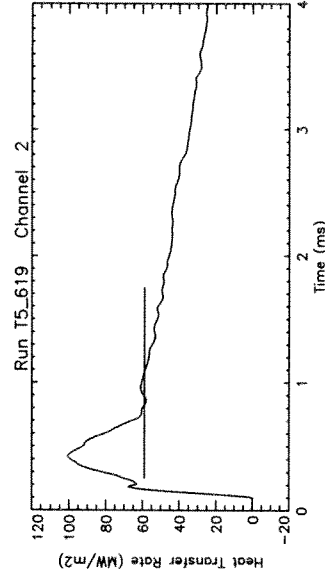
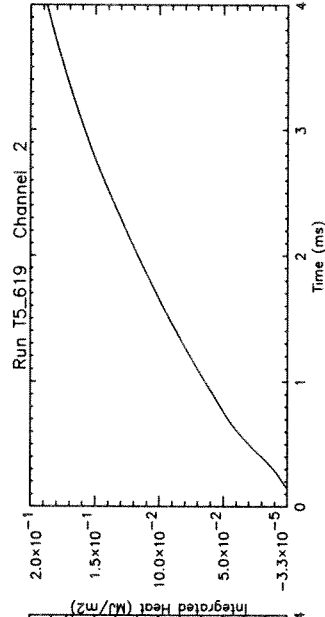
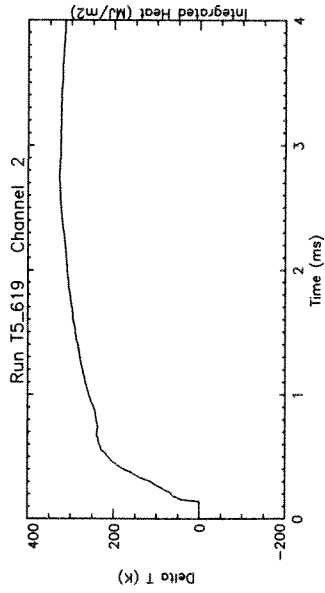
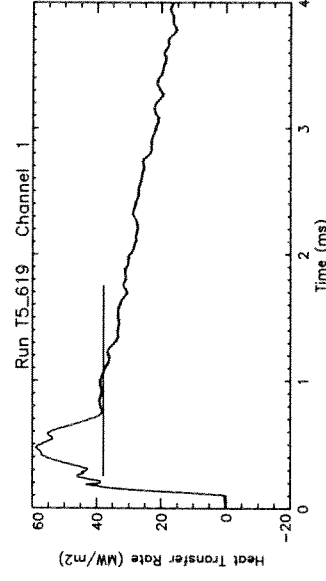
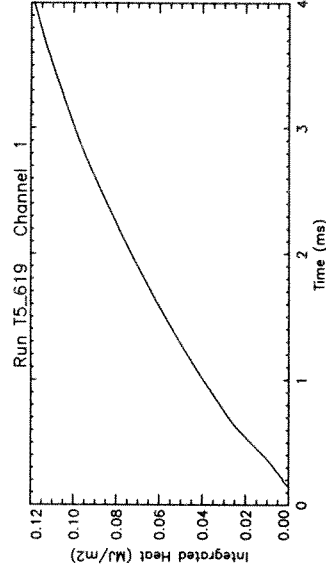
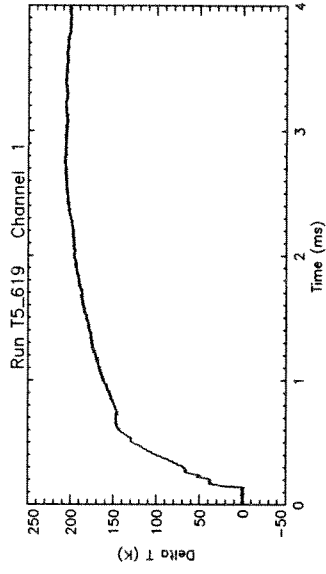
one [1.5, 1.25] m2
Age = 9

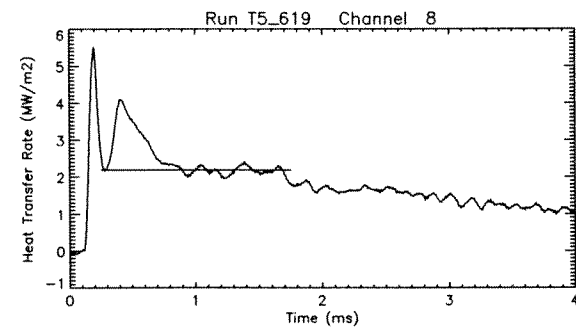
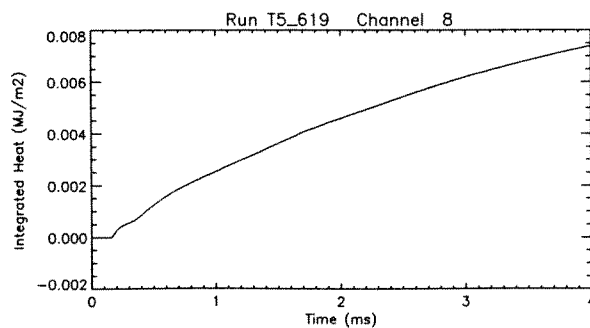
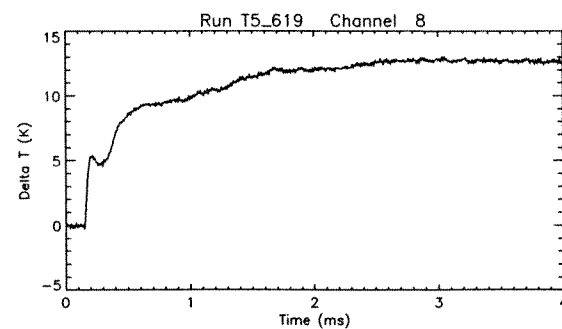
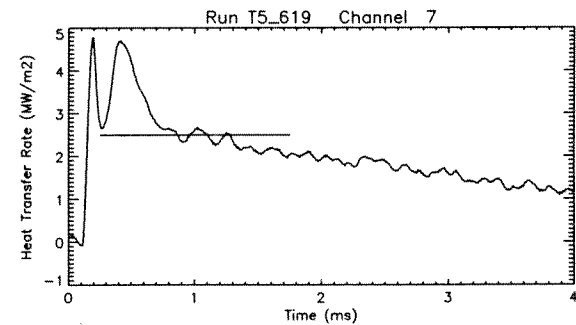
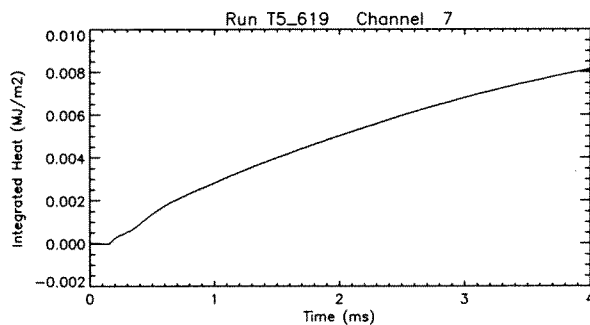
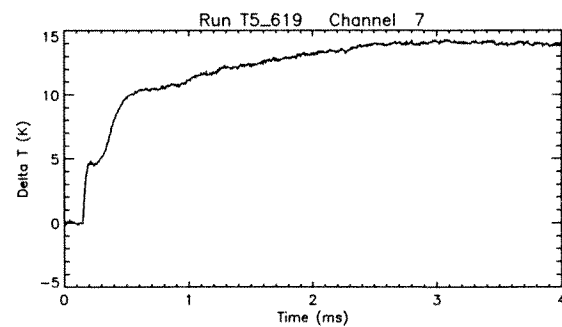
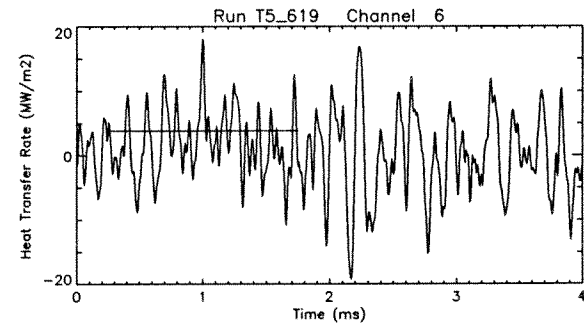
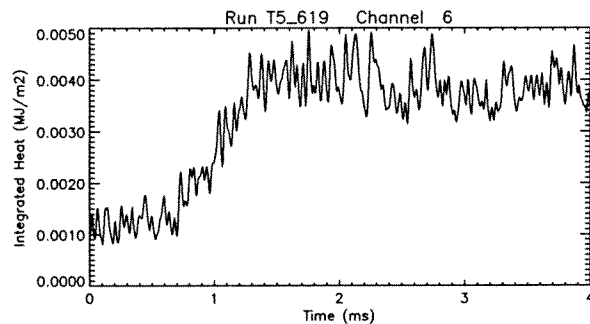
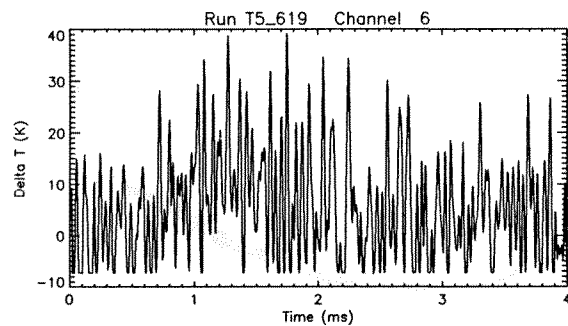
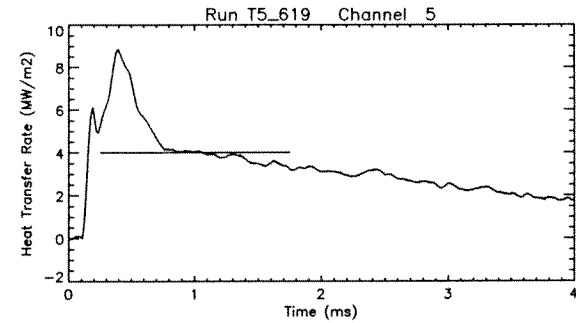
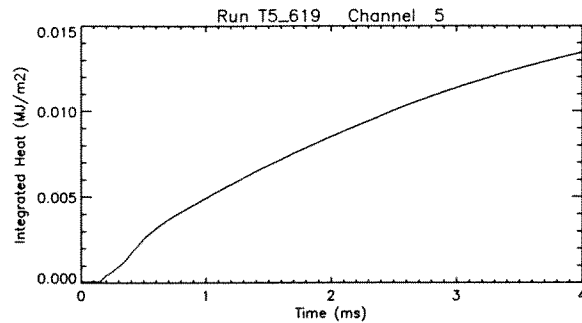
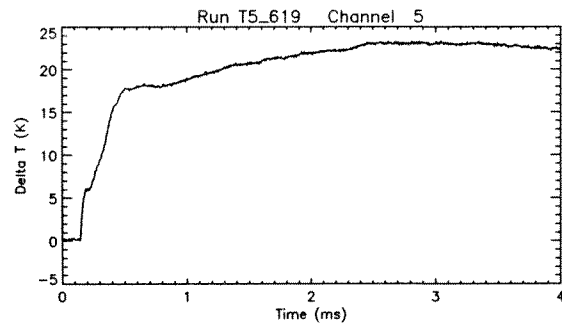
box = 31

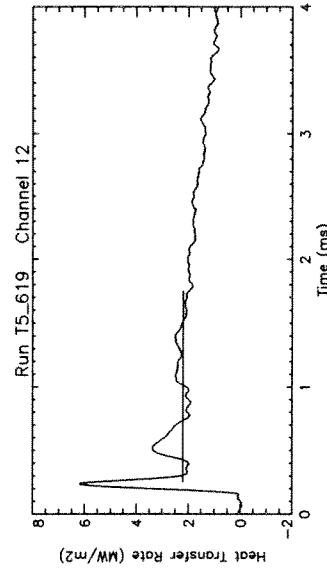
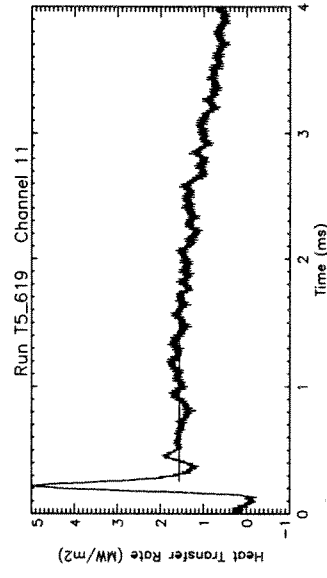
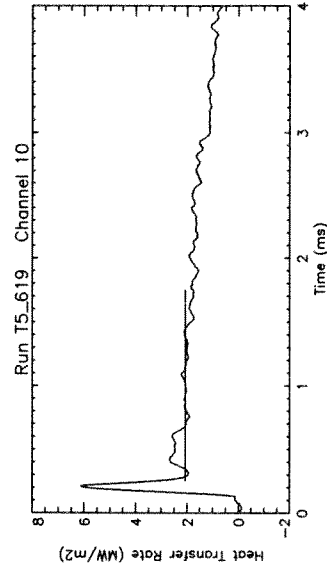
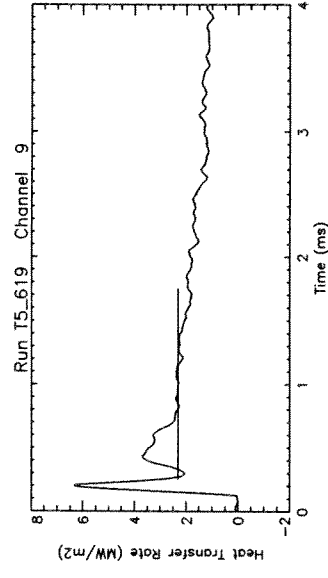
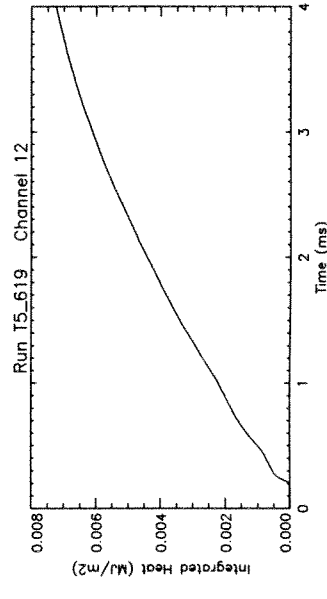
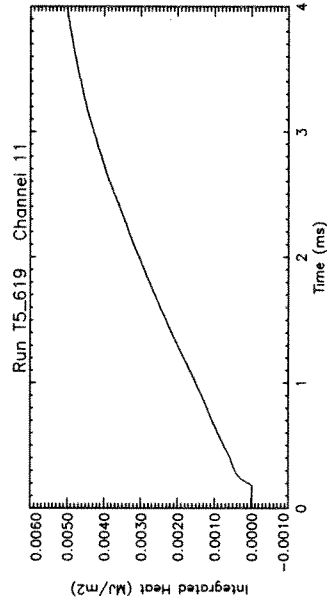
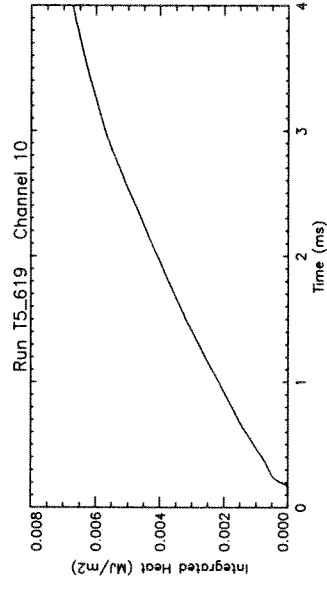
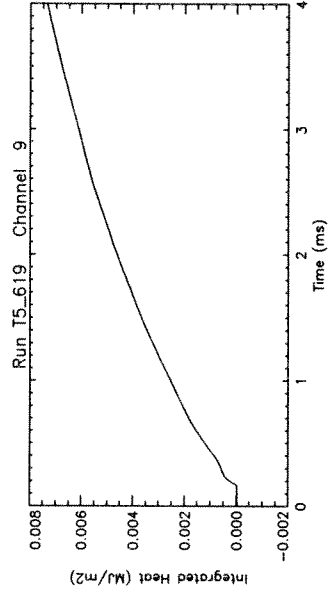
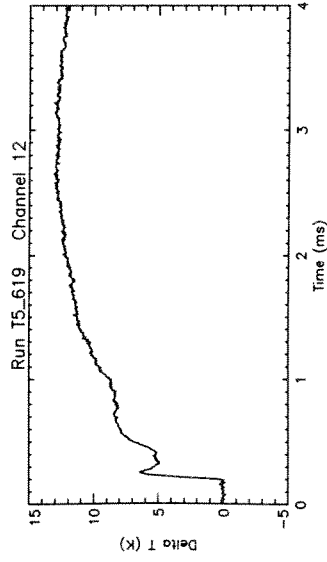
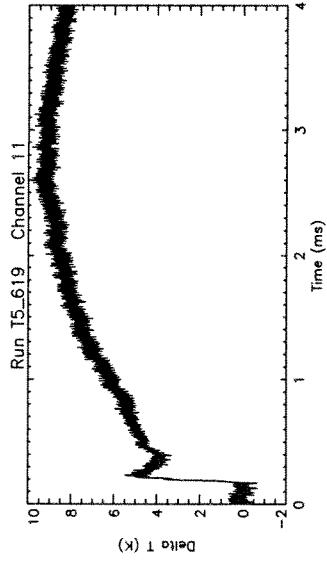
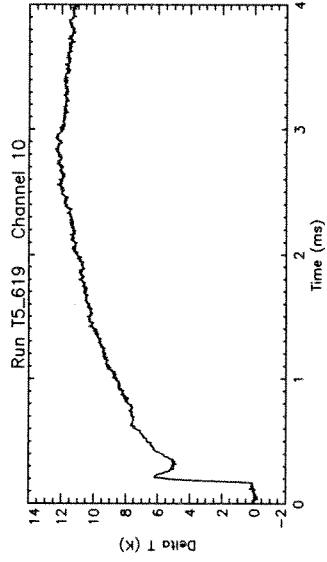
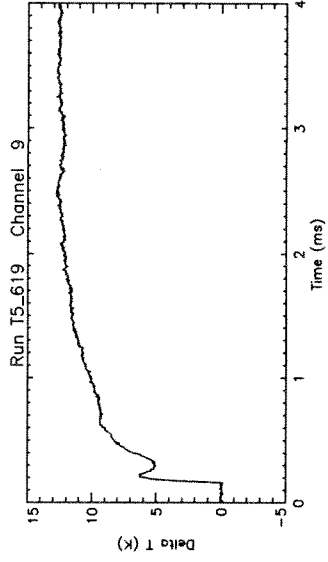


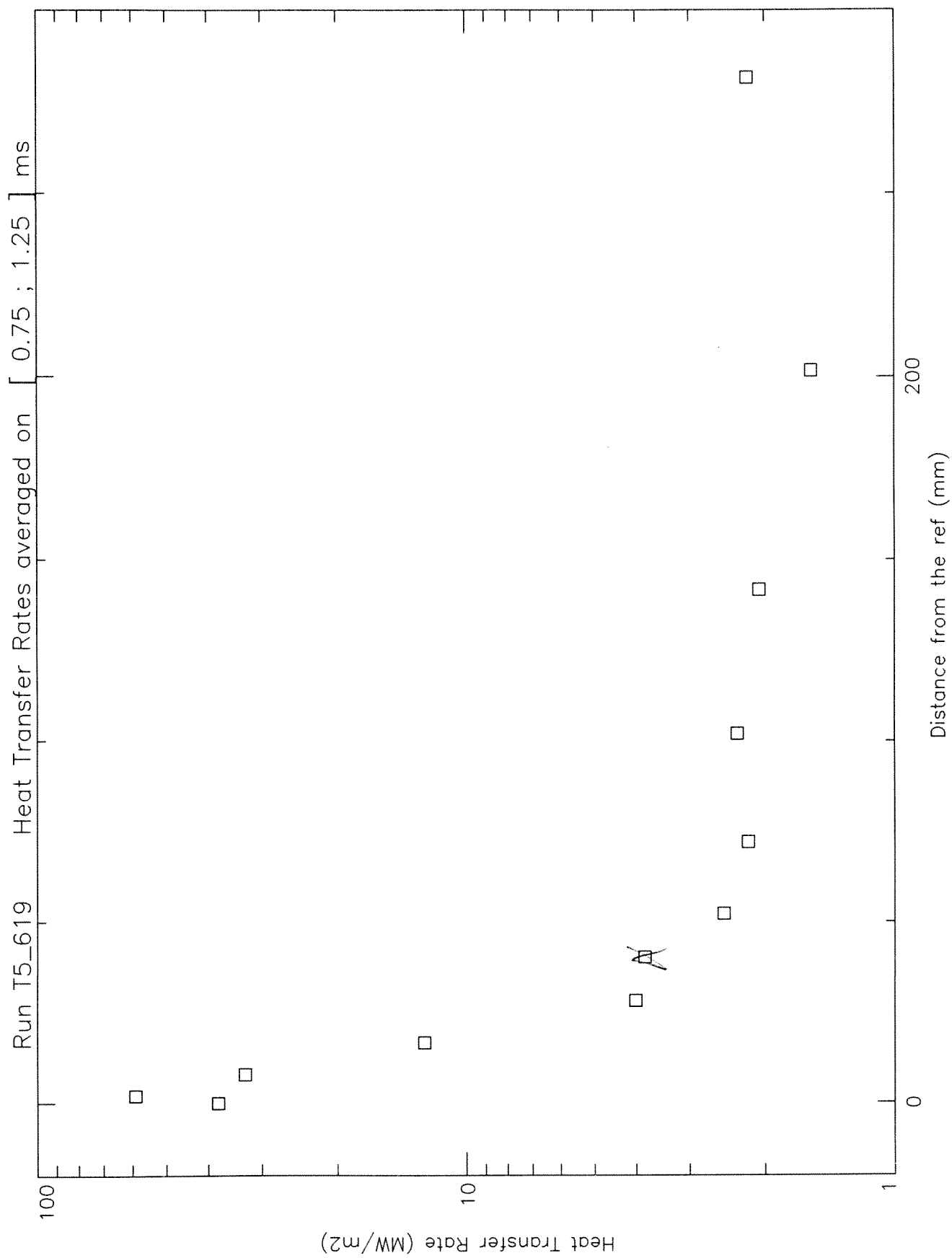


ONE OF 1075; 1.95









Run # 619

Pressure averages around 1.55 +/- 0.25 ms

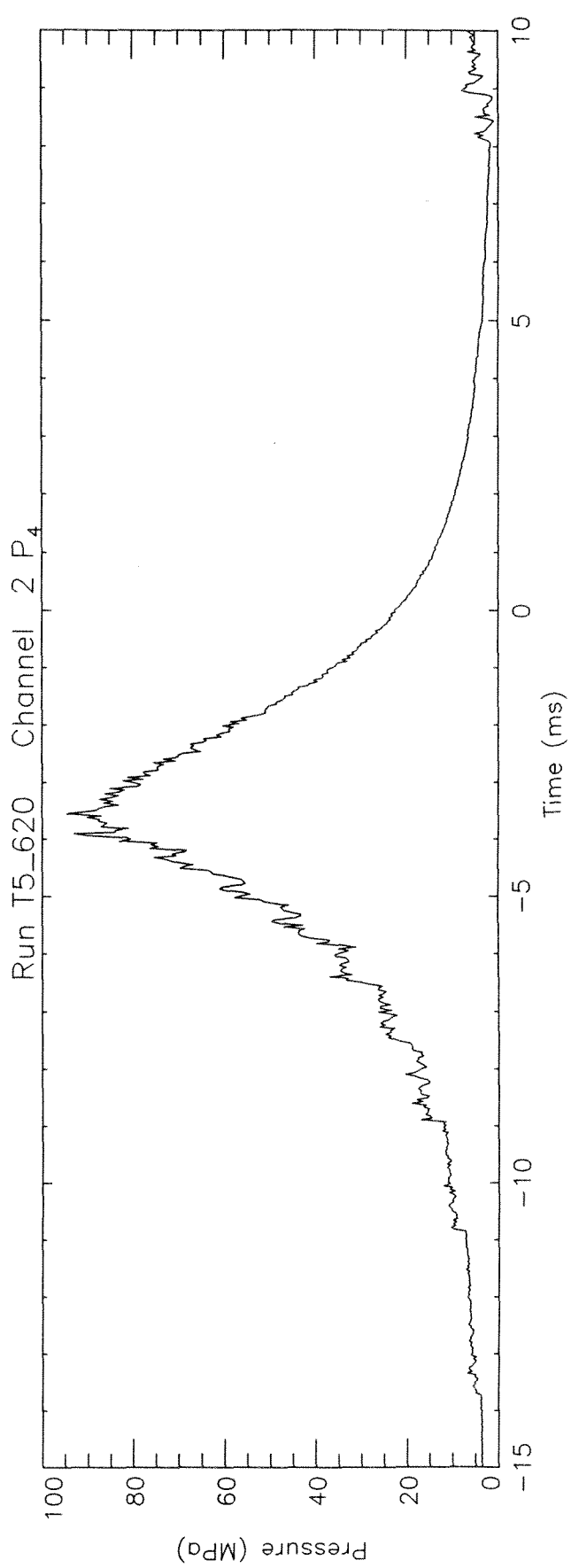
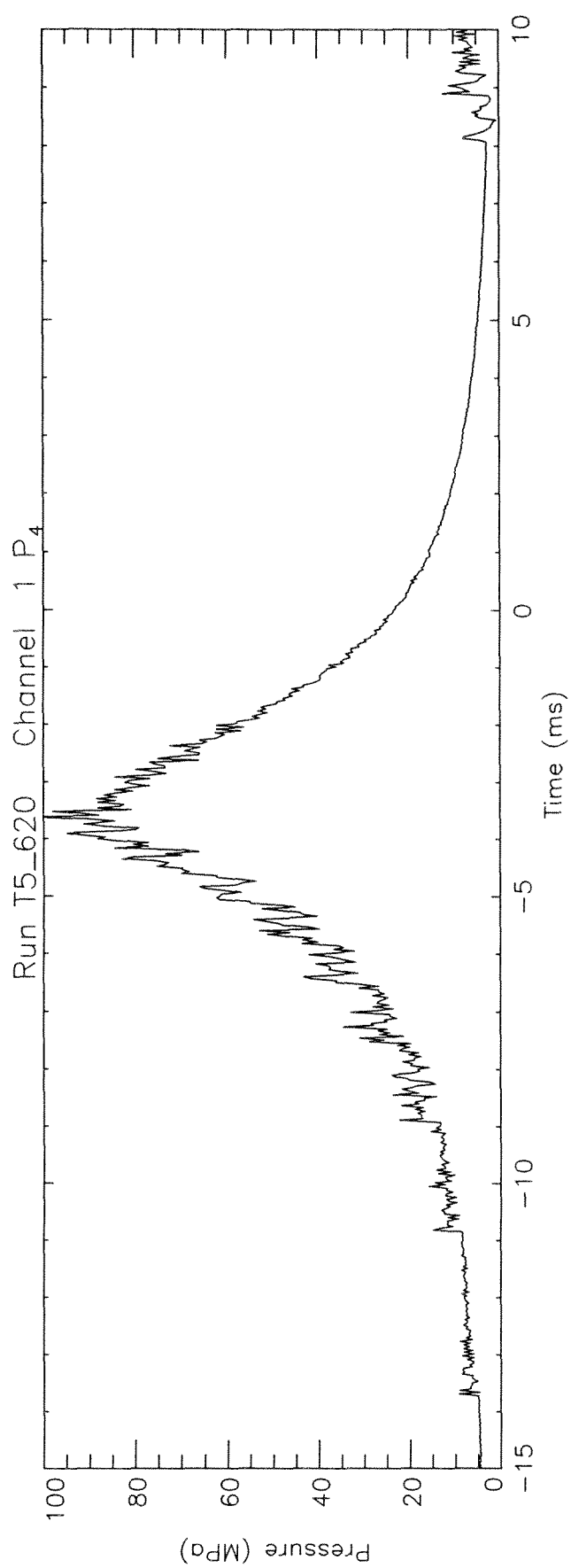
Smooth box = 2.

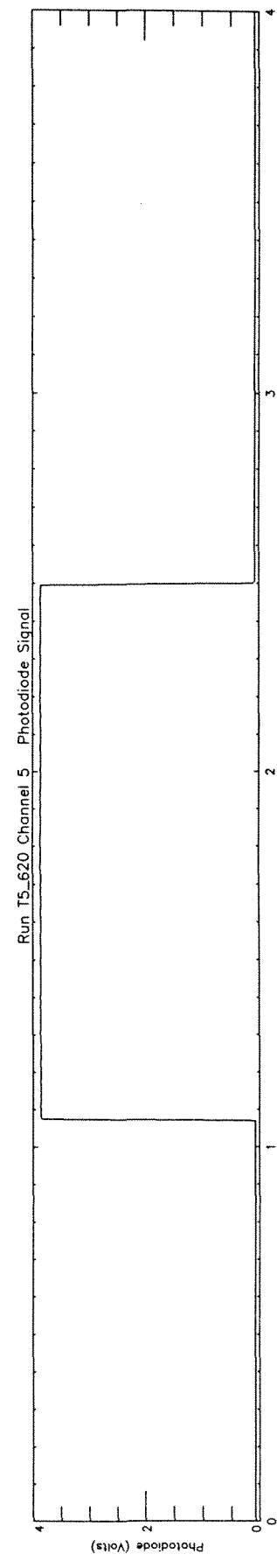
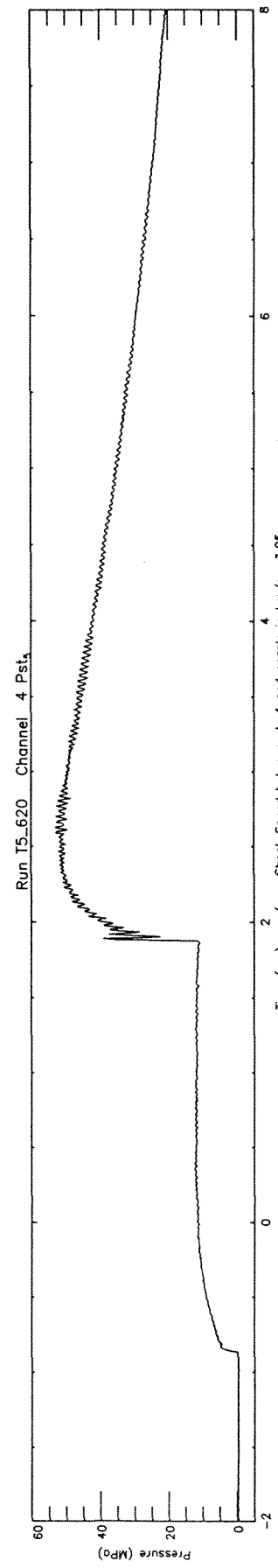
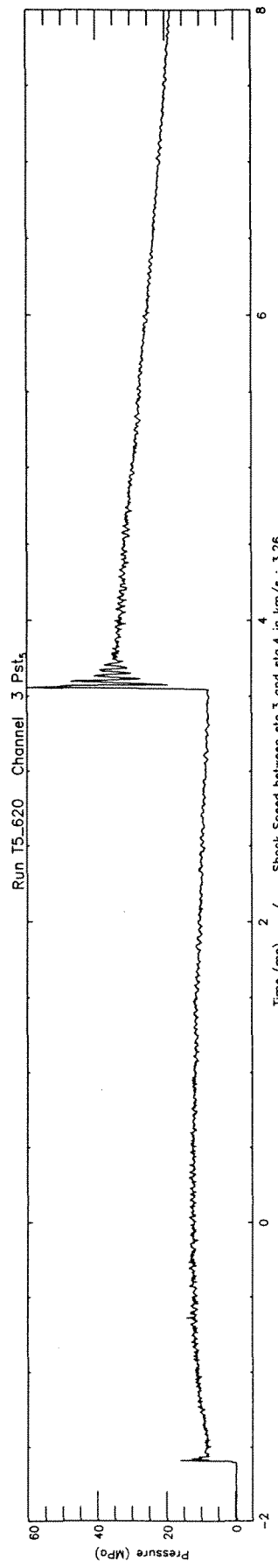
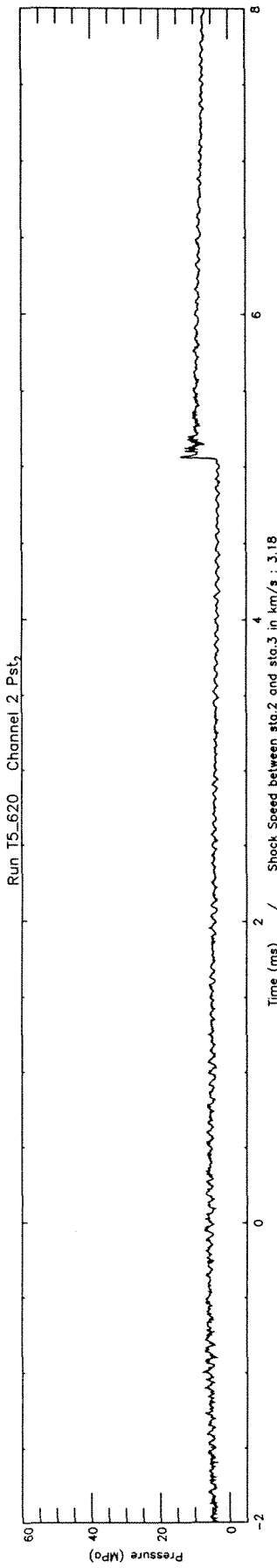
DA1	:	1.9832
DA2	:	0.0285
DA3	:	0.1685
DA4	:	0.1505
DA5	:	0.1386
DA6	:	0.0484
DA7	:	0.0014
DA8	:	0.1401
DA9	:	0.1481

Run # 619

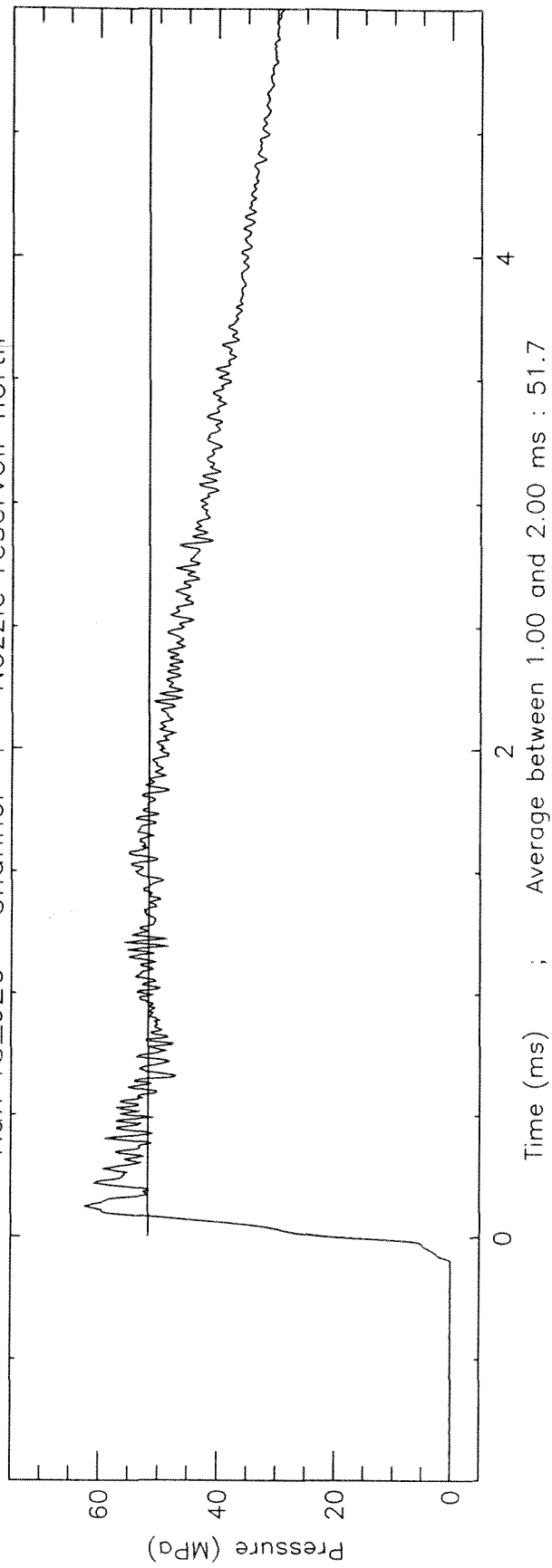
Heat Transfer Rates (in MW/m²)
averaged around 1.00 +/- 0.25 ms

MT 1 :	37.9285
MT 2 :	59.0297
MT 3 :	32.8253
MT 4 :	12.5310
MT 5 :	4.0074
MT 6 :	3.8202
MT 7 :	2.4940
MT 8 :	2.1878
MT 9 :	2.3183
MT10 :	2.0622
MT11 :	1.5604
MT12 :	2.1969

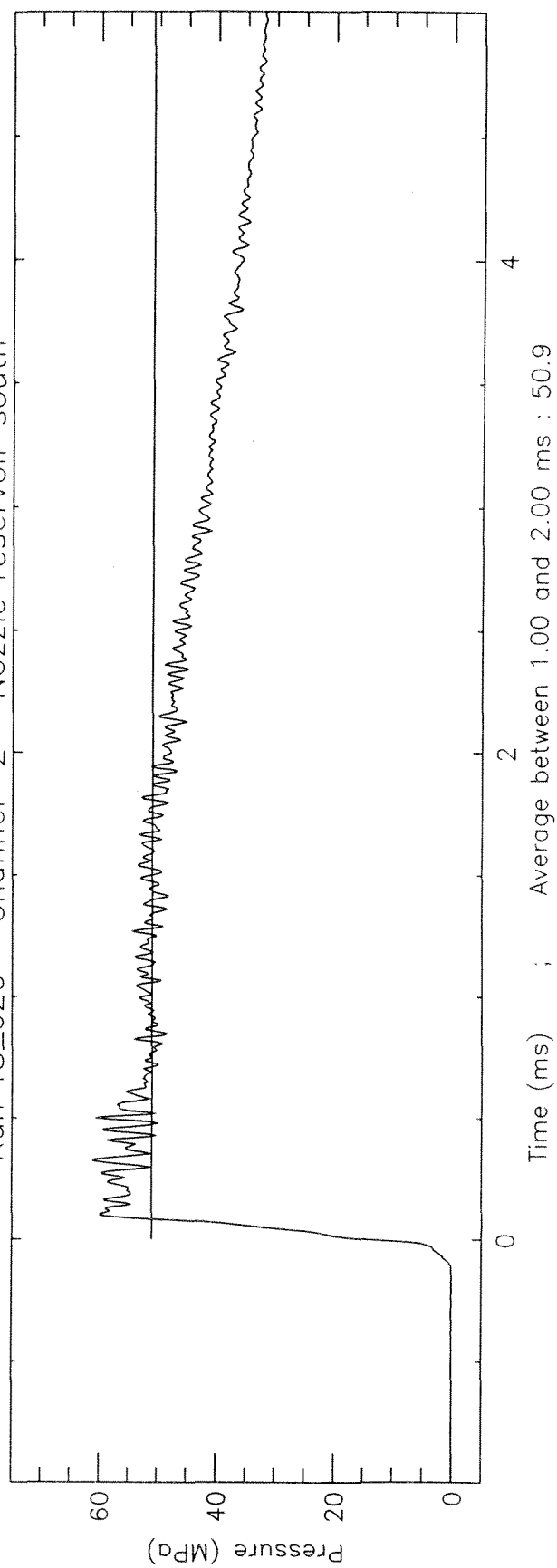




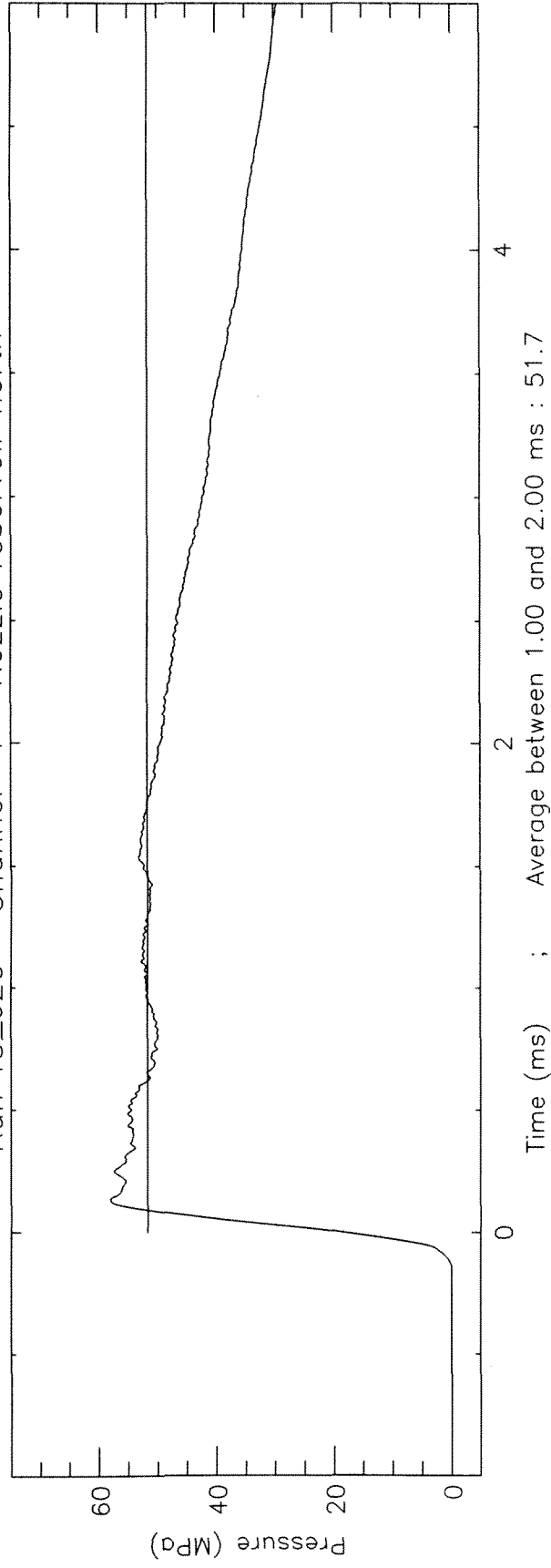
Run T5_620 Channel 1 Nozzle reservoir north



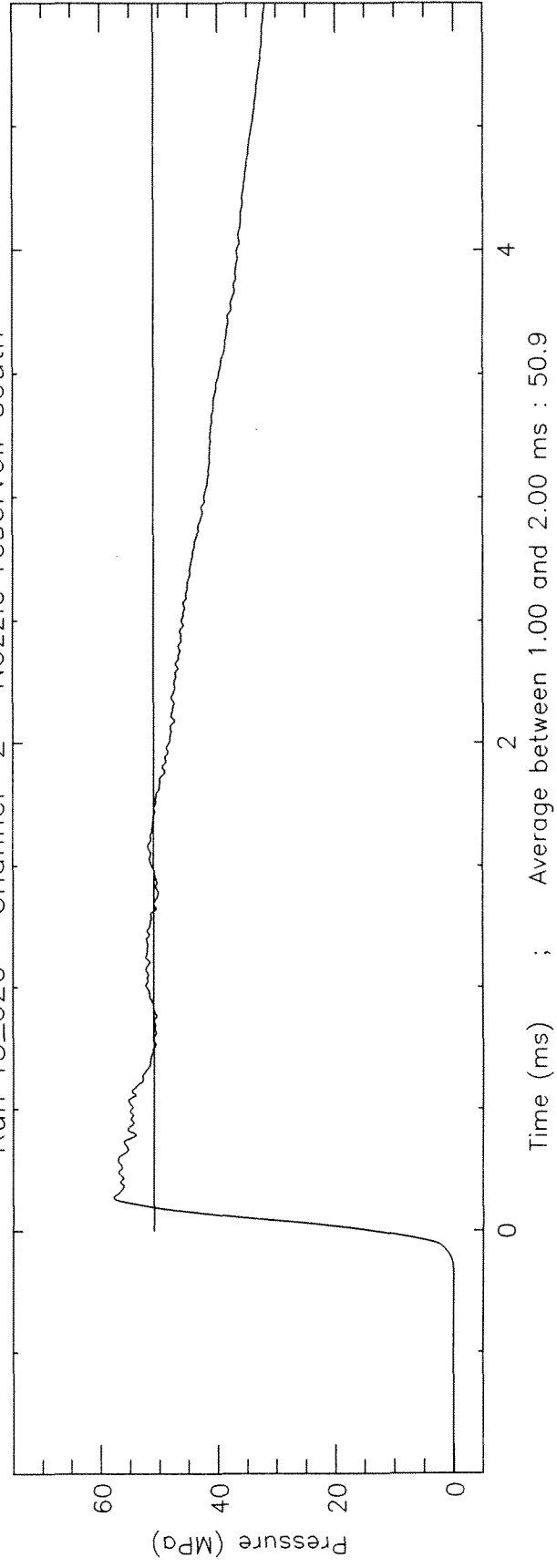
Run T5_620 Channel 2 Nozzle reservoir south

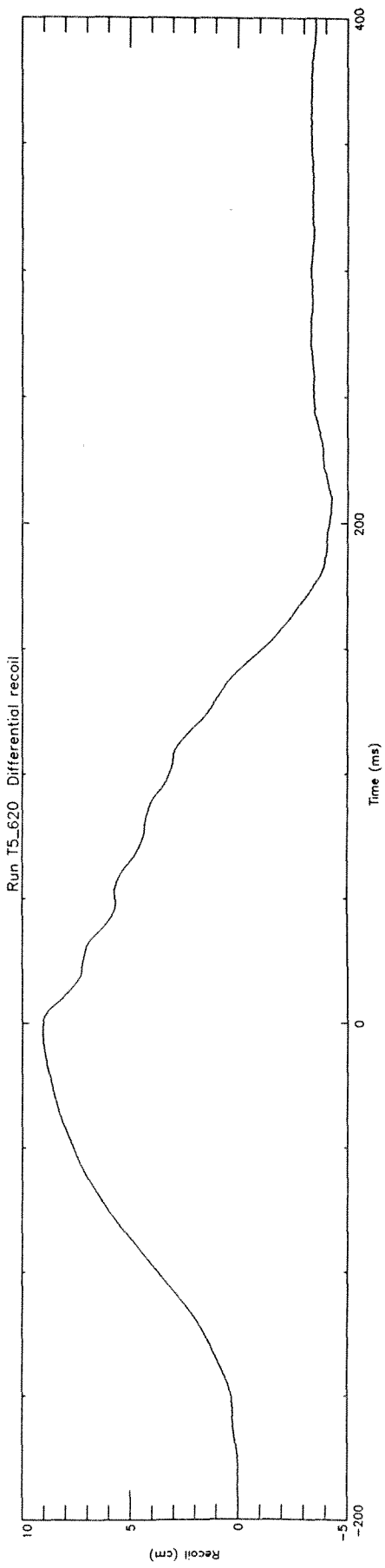
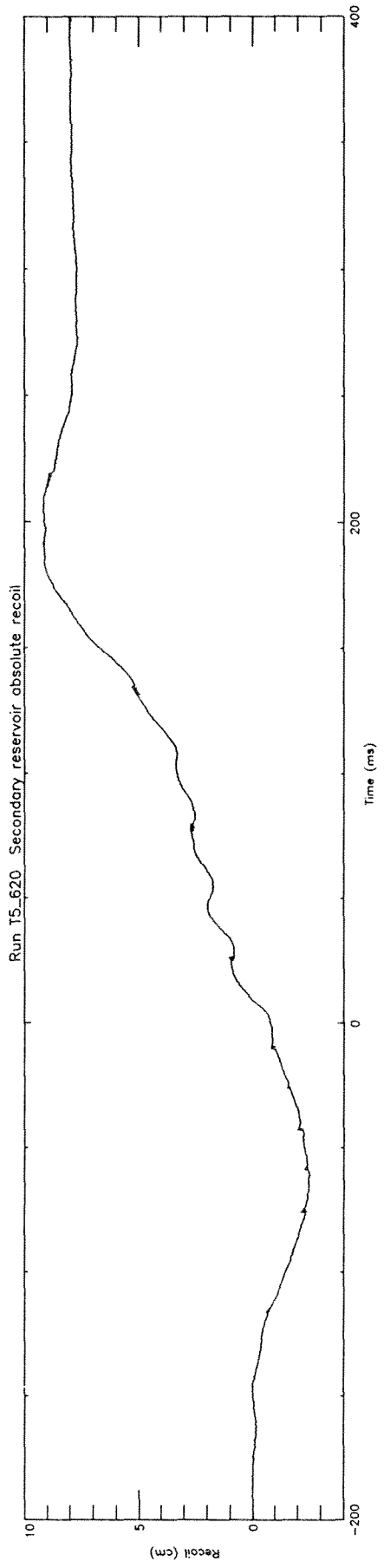
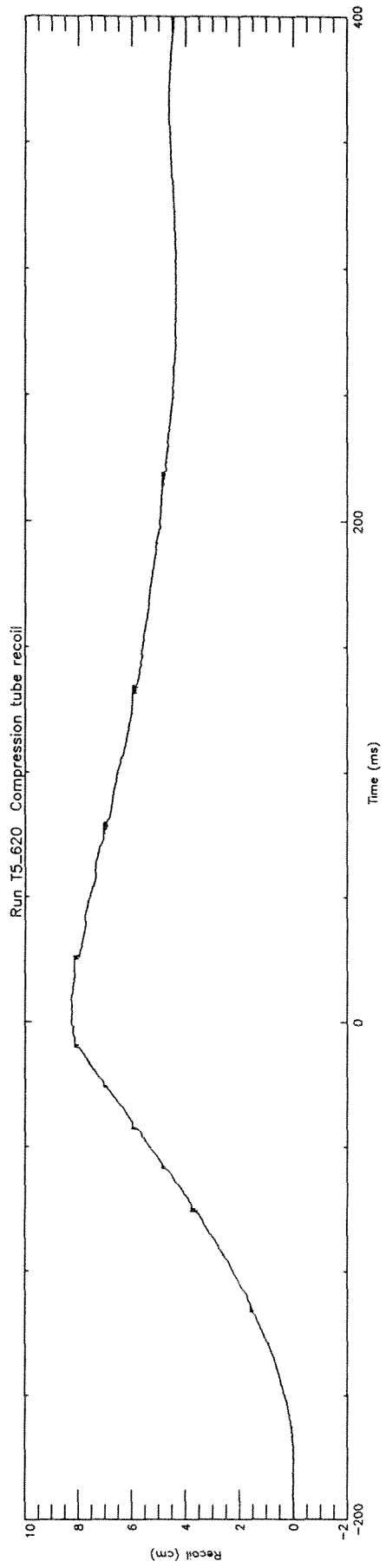


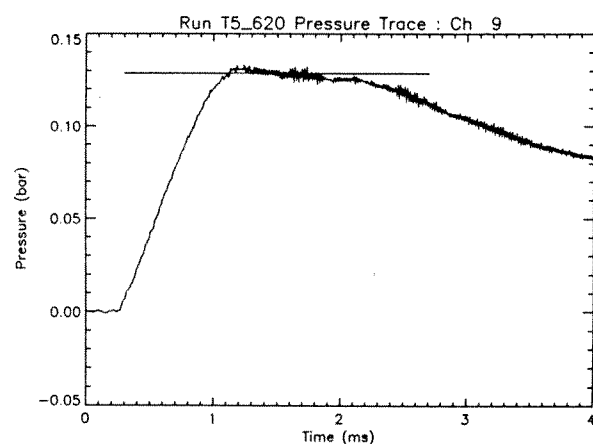
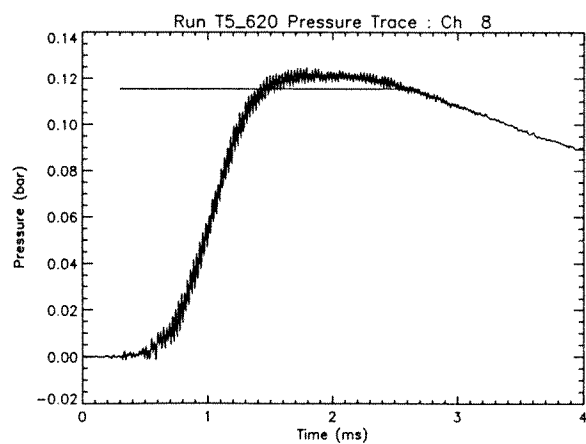
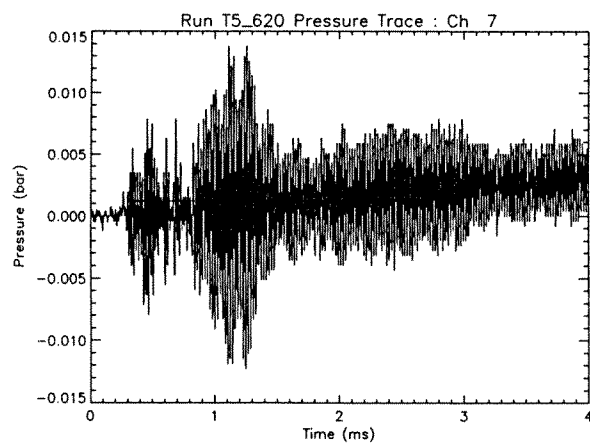
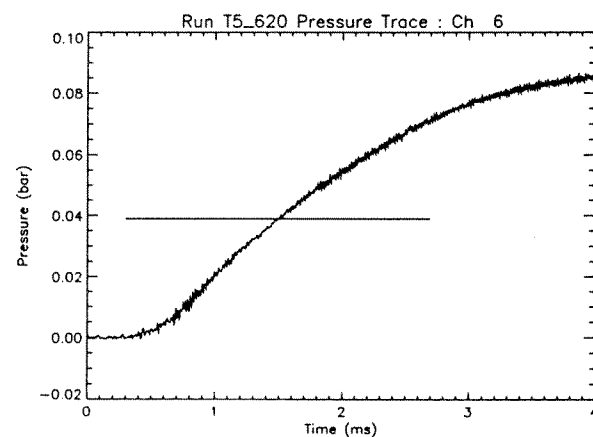
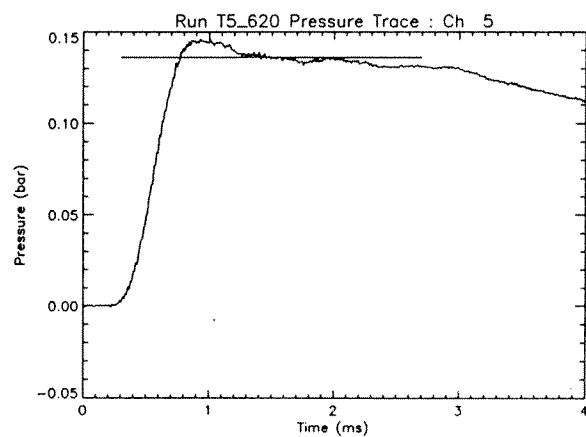
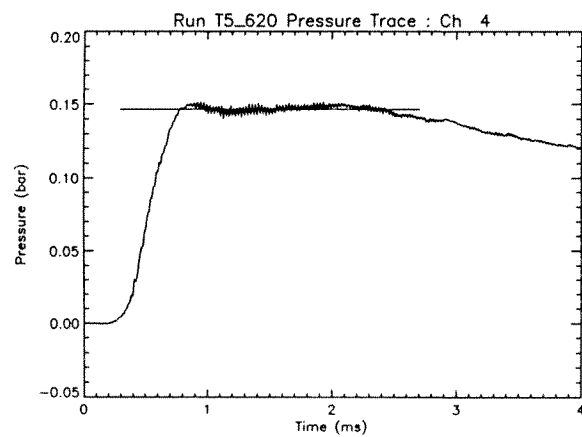
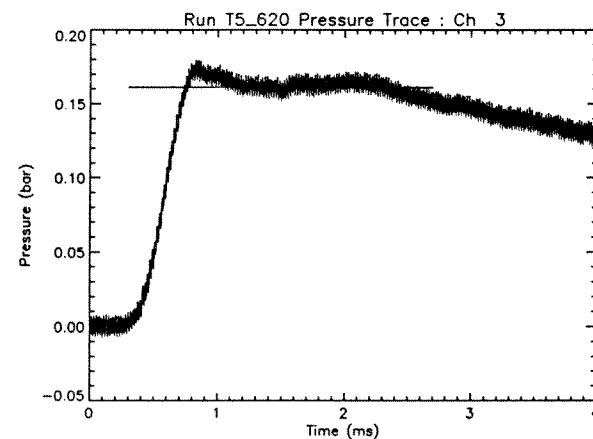
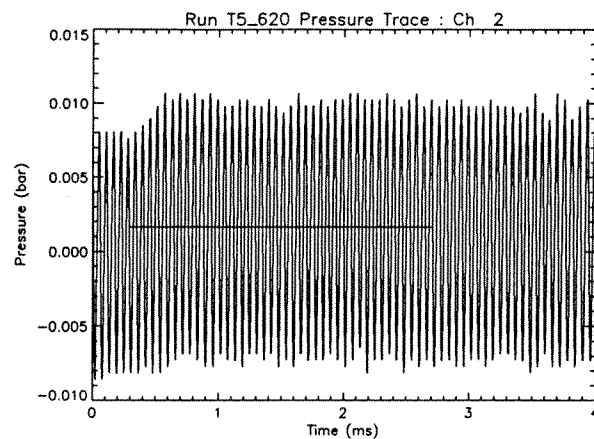
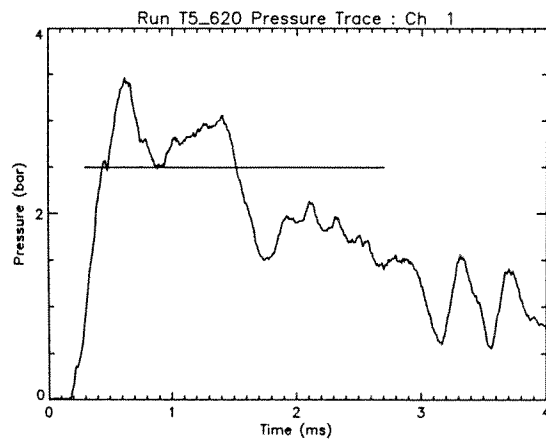
Run T5_620 Channel 1 Nozzle reservoir north

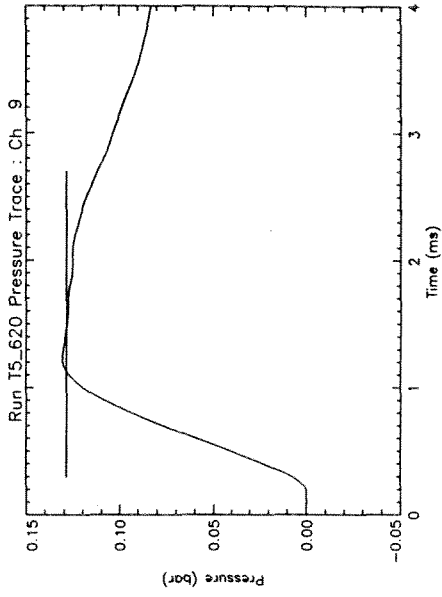
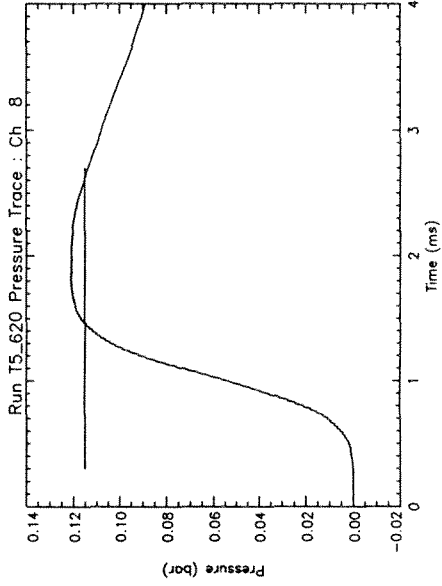
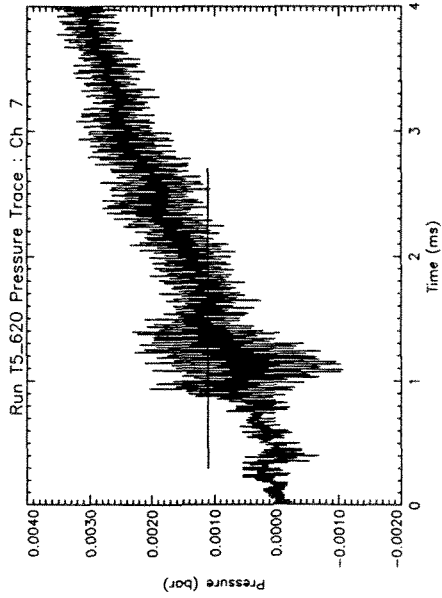
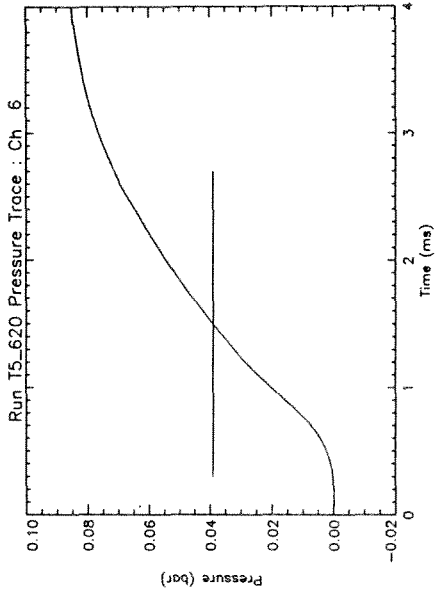
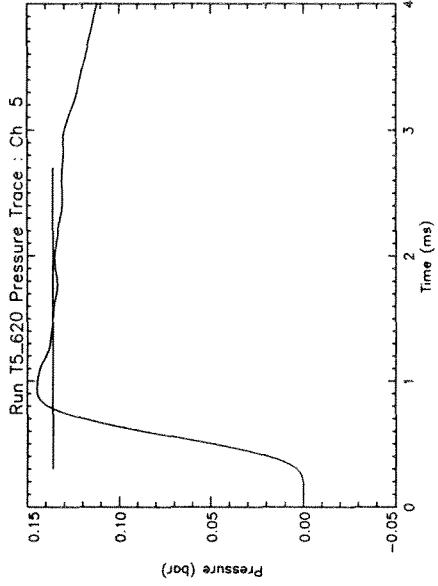
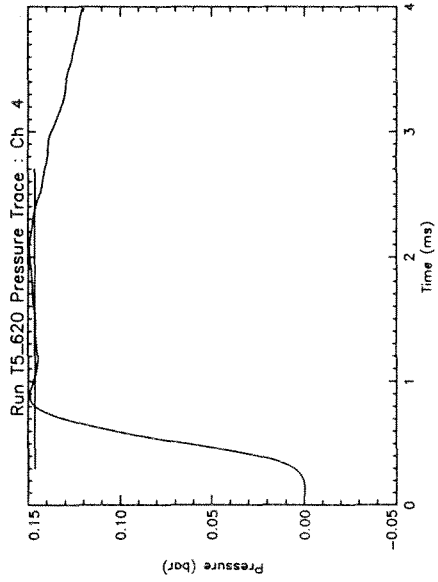
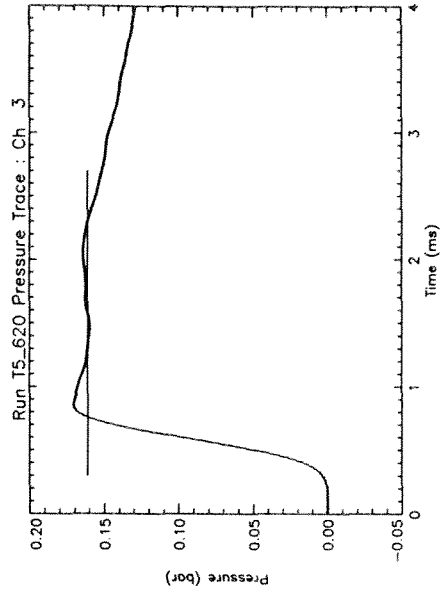
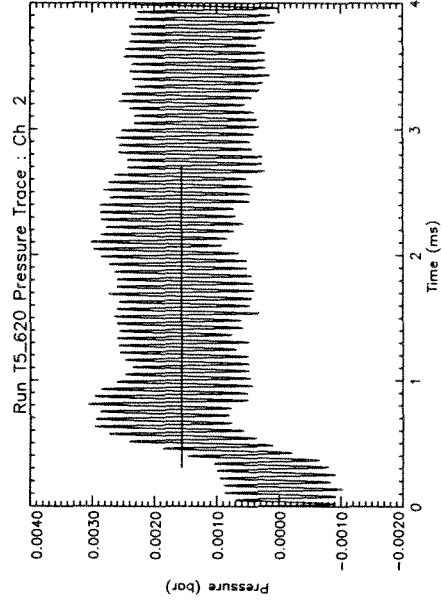
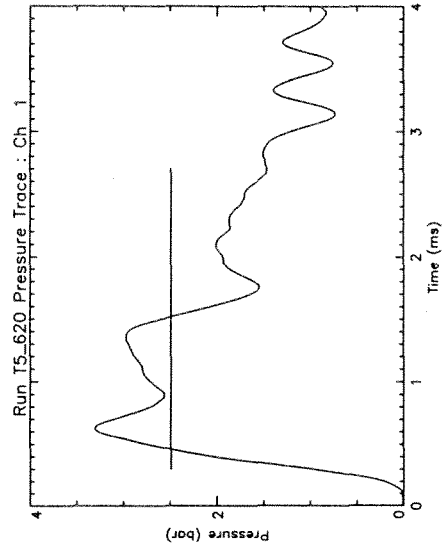


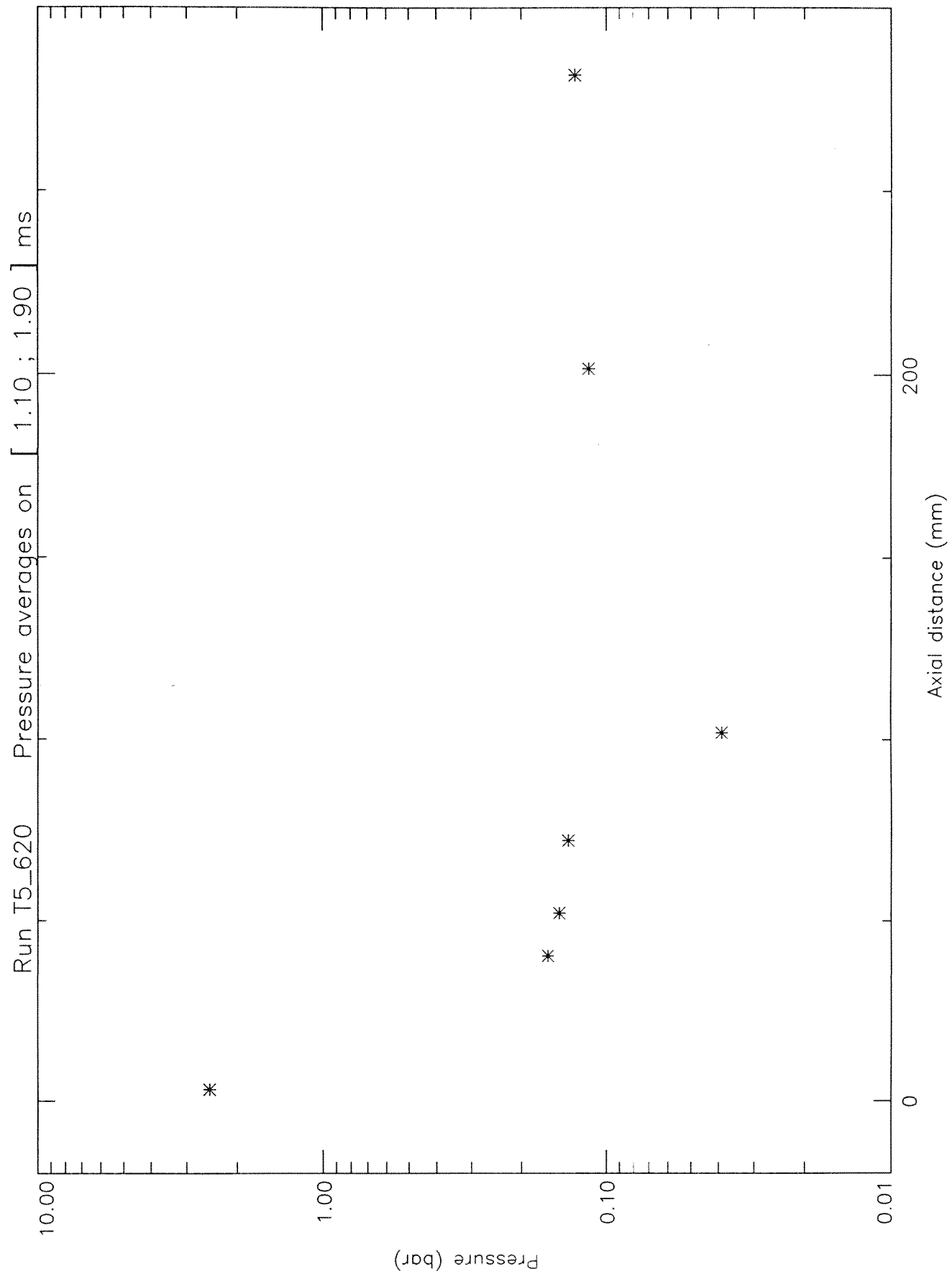
Run T5_620 Channel 2 Nozzle reservoir south

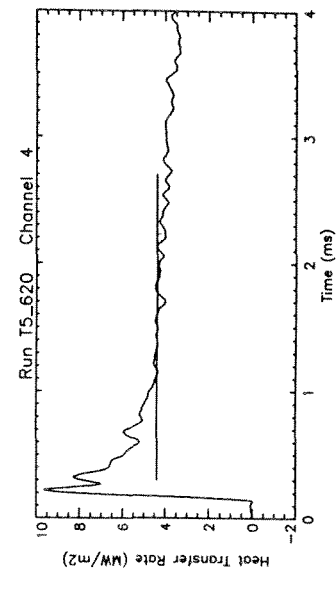
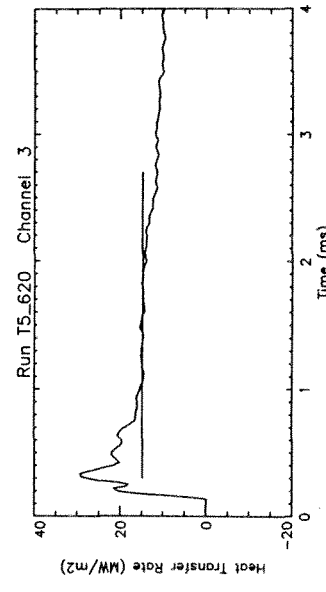
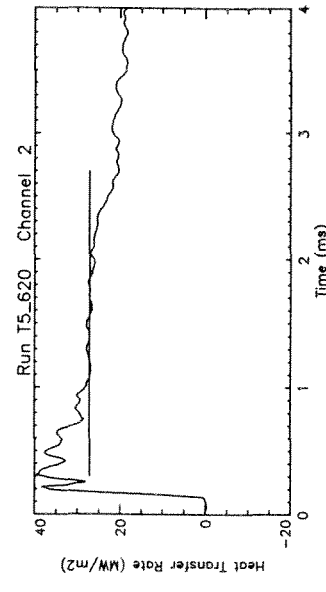
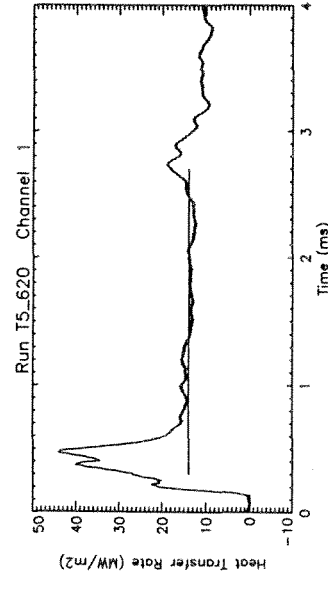
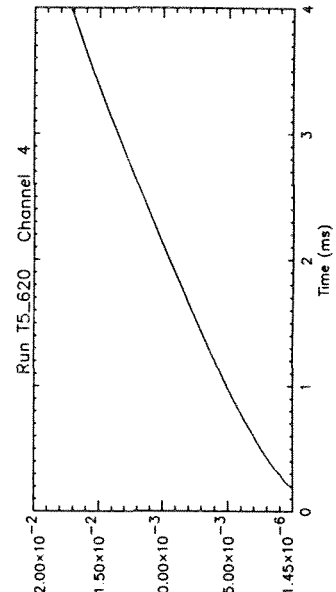
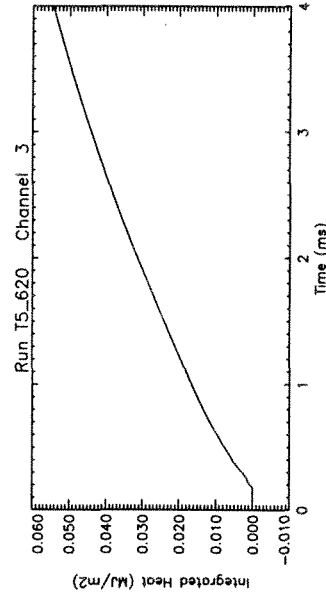
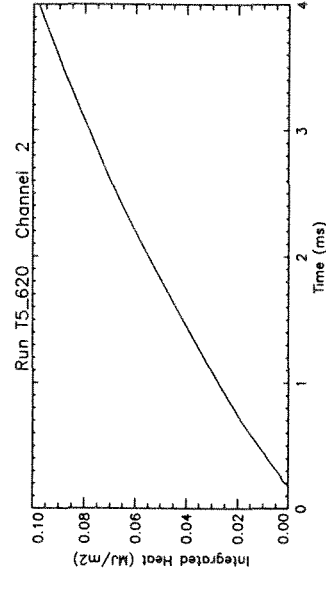
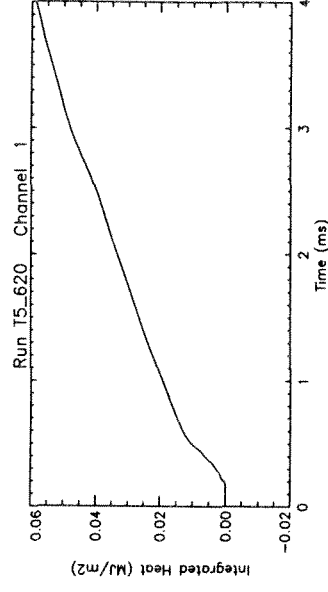
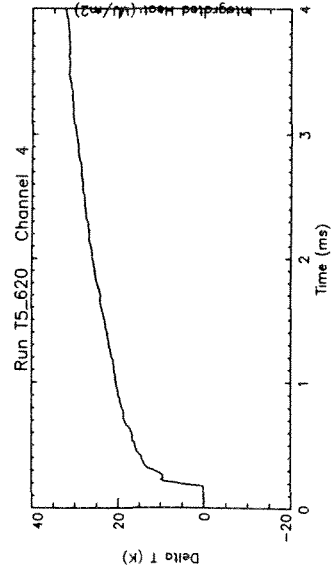
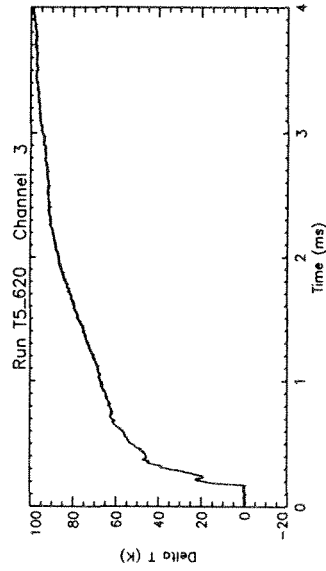
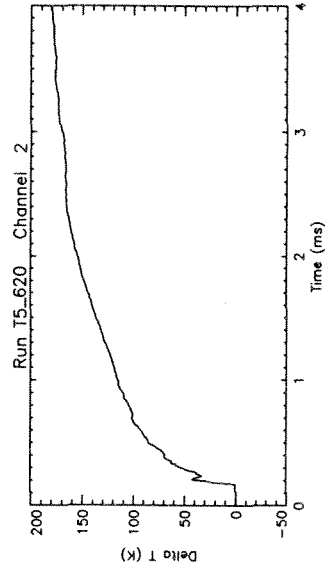
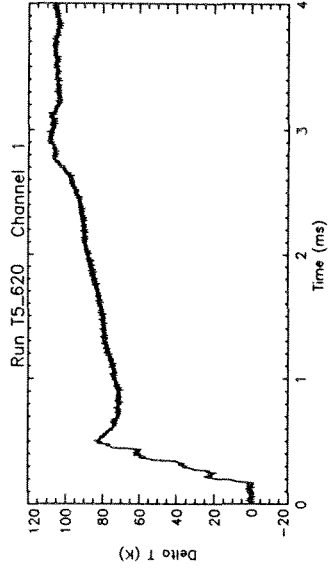


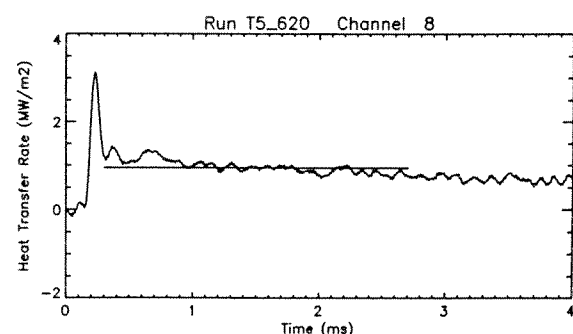
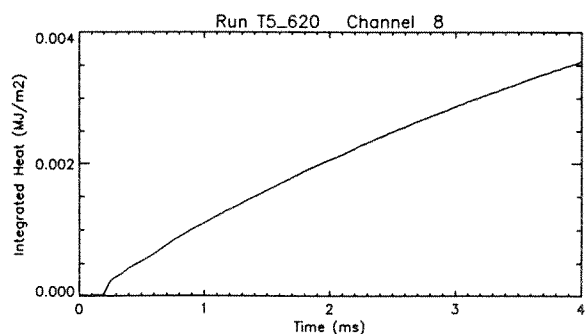
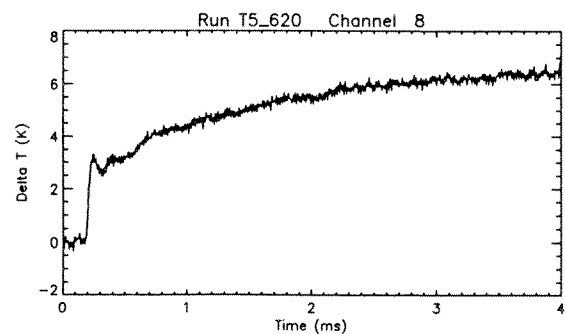
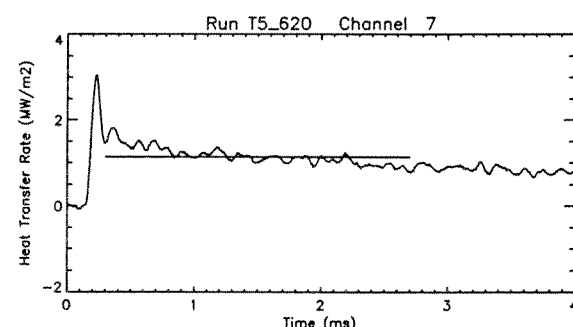
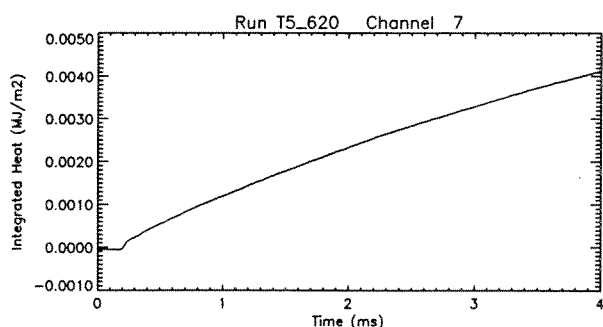
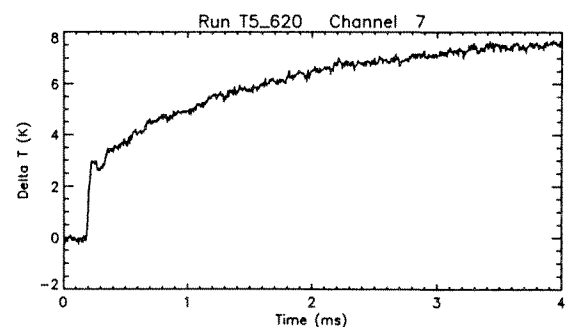
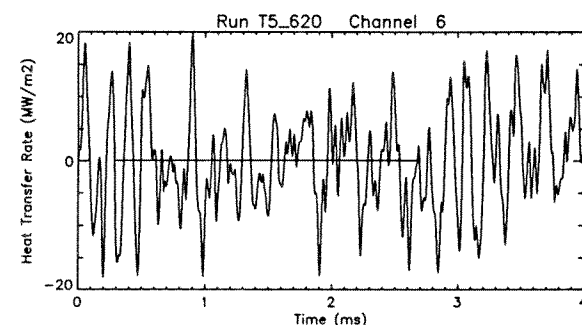
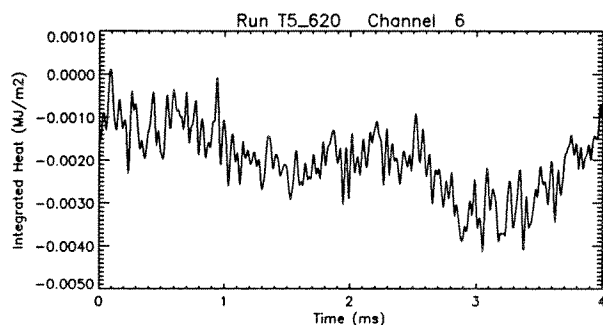
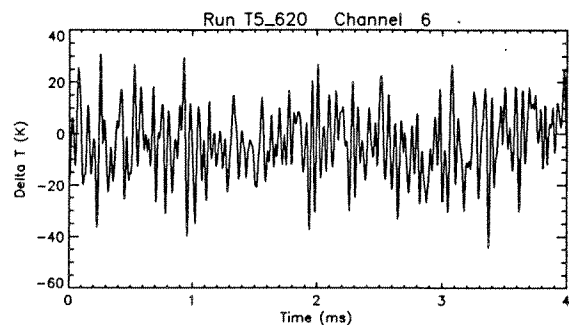
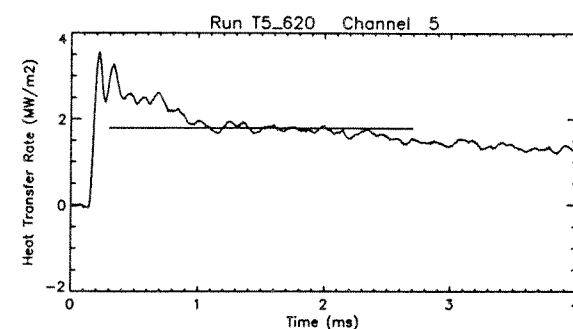
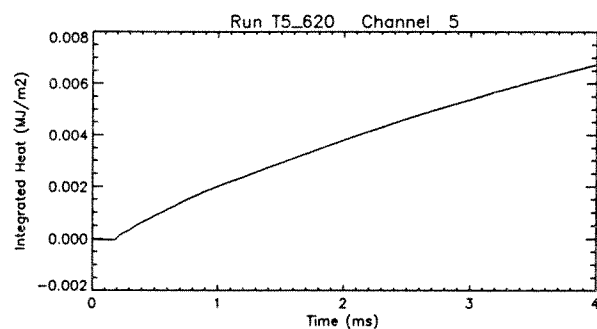
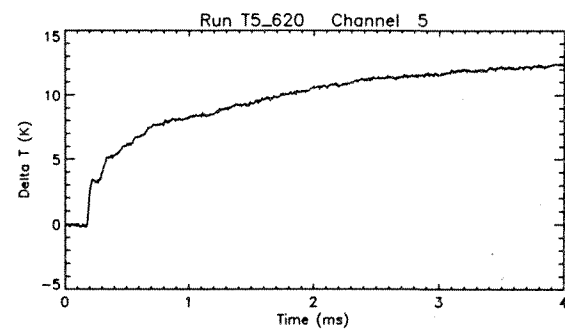


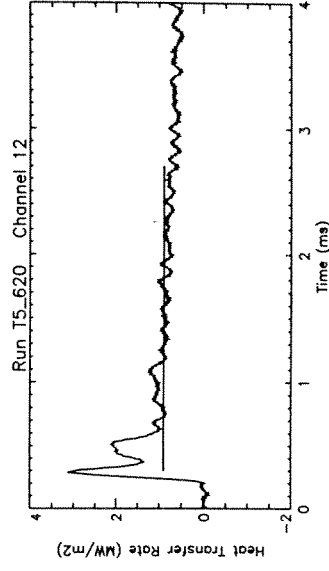
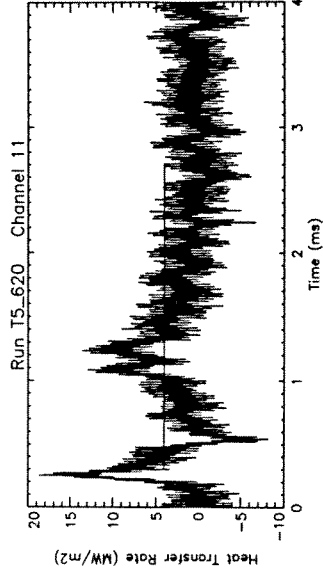
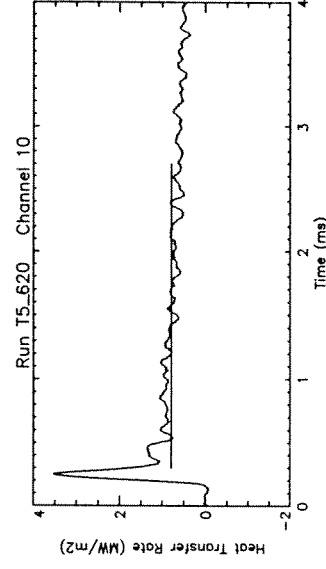
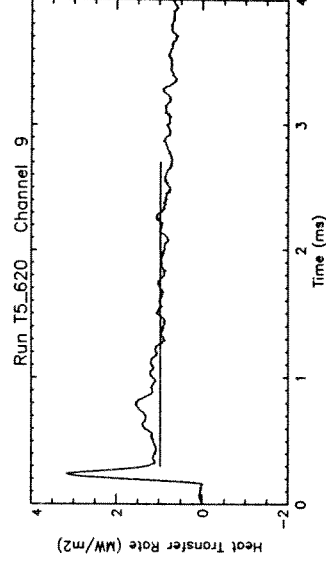
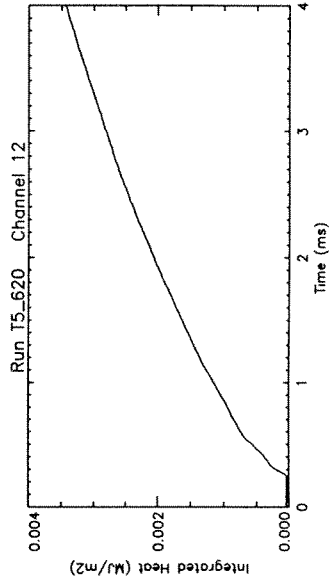
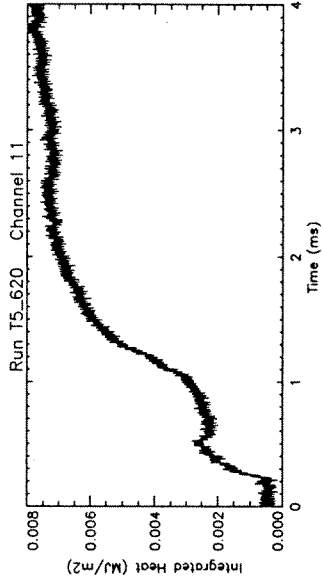
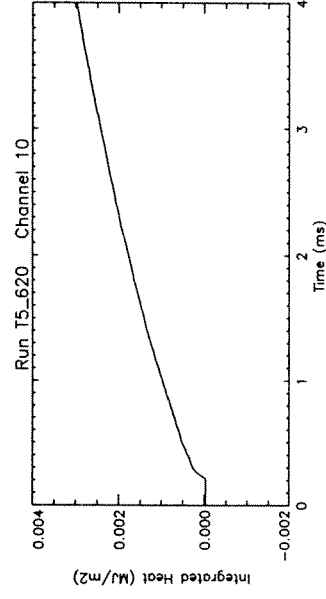
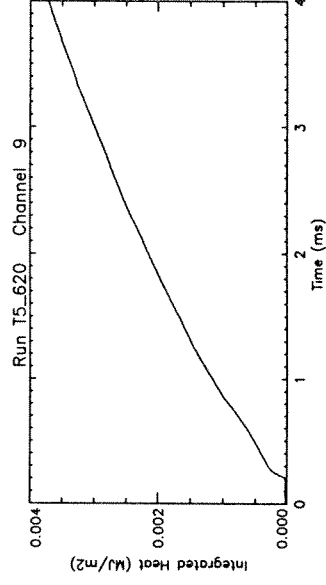
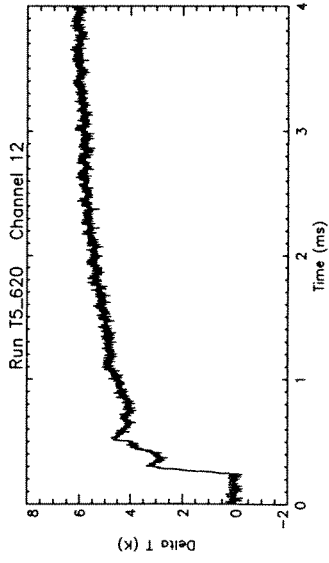
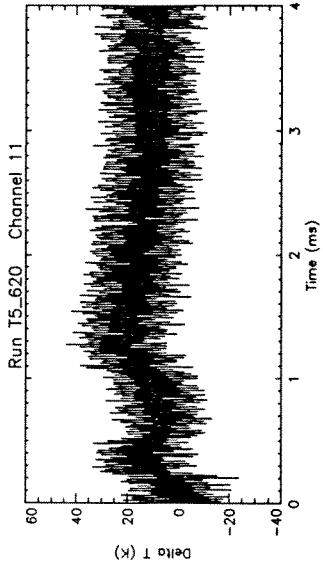
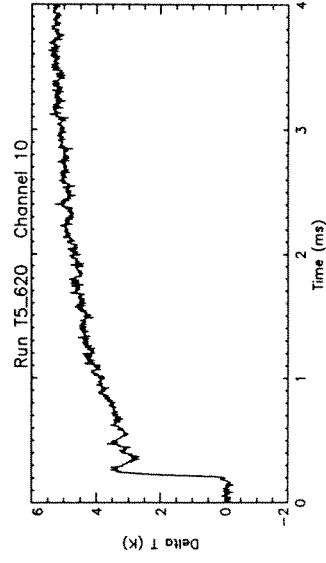
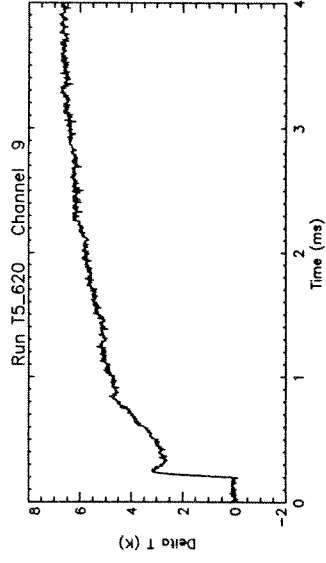


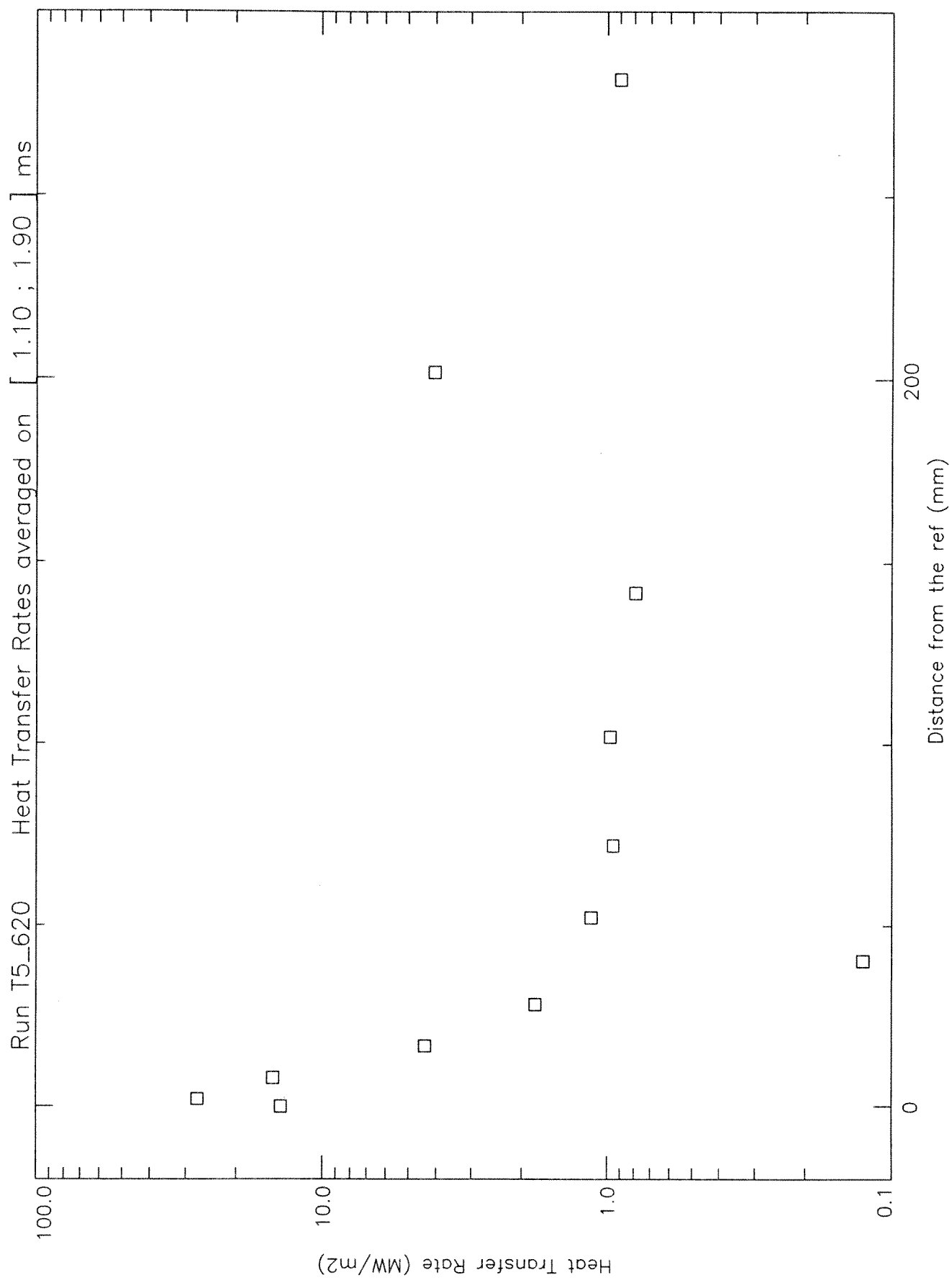












Run # 620

Pressure averages around 1.50 +/- 0.40 ms

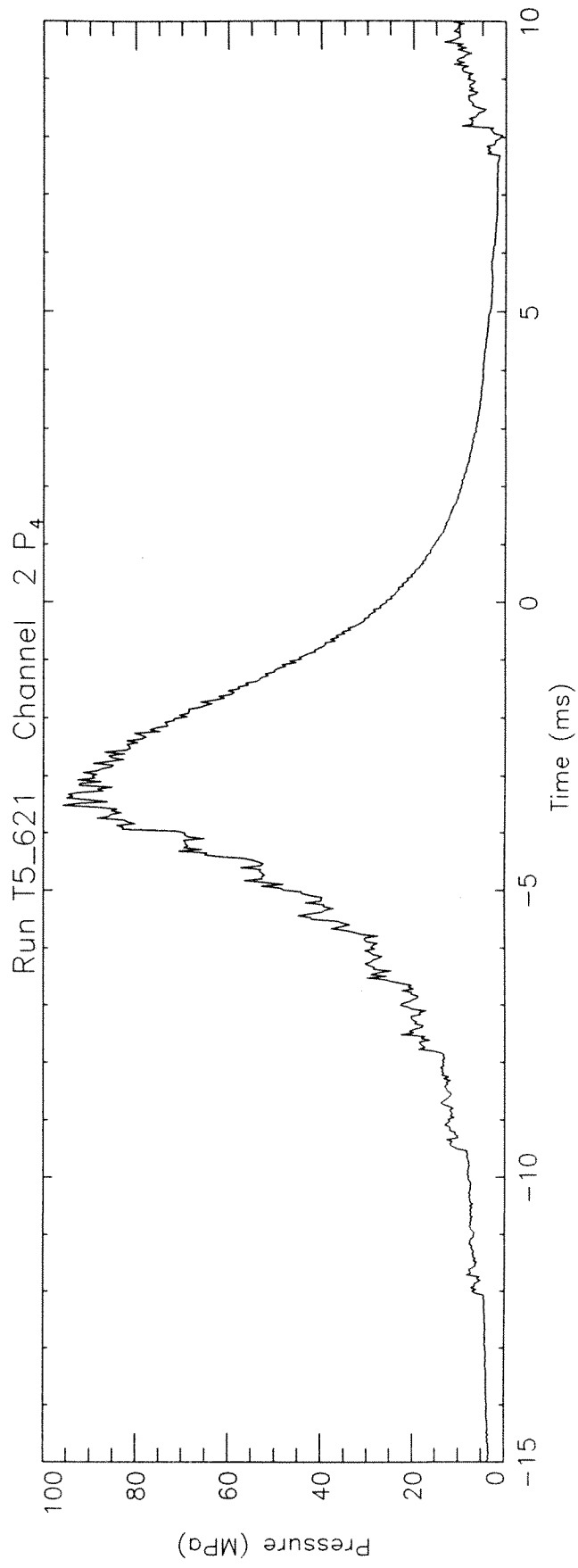
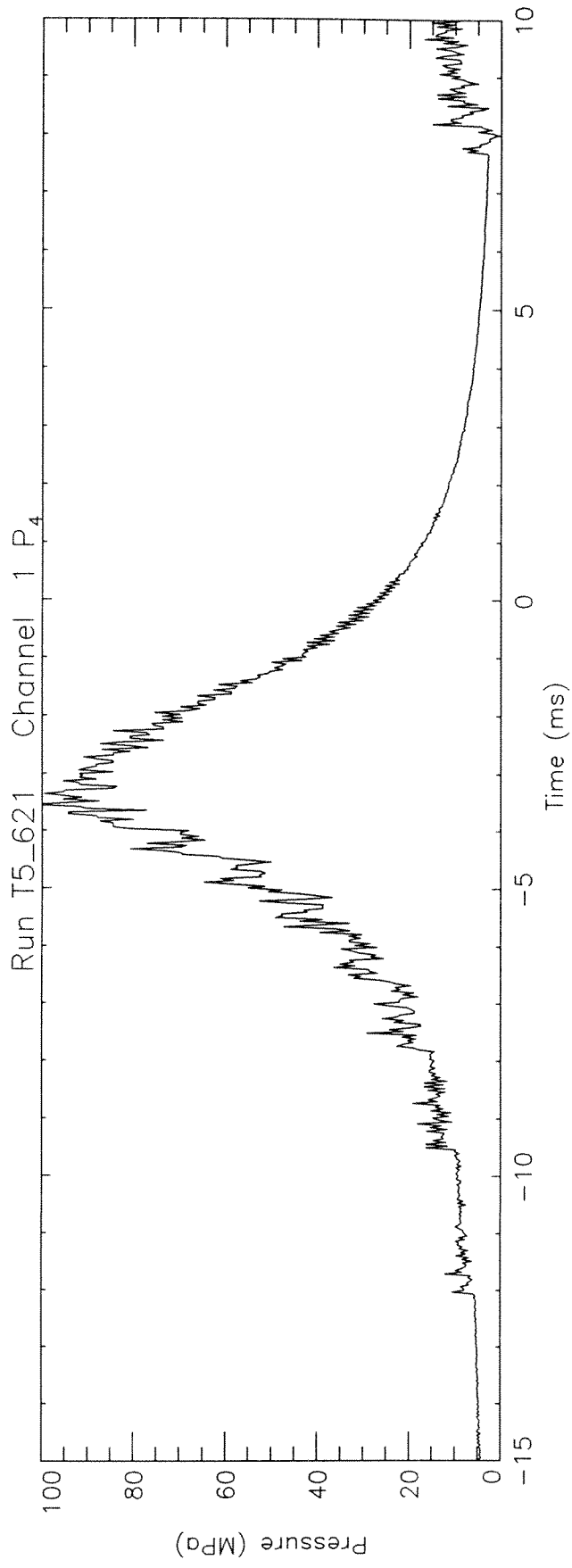
Smooth box = 2.

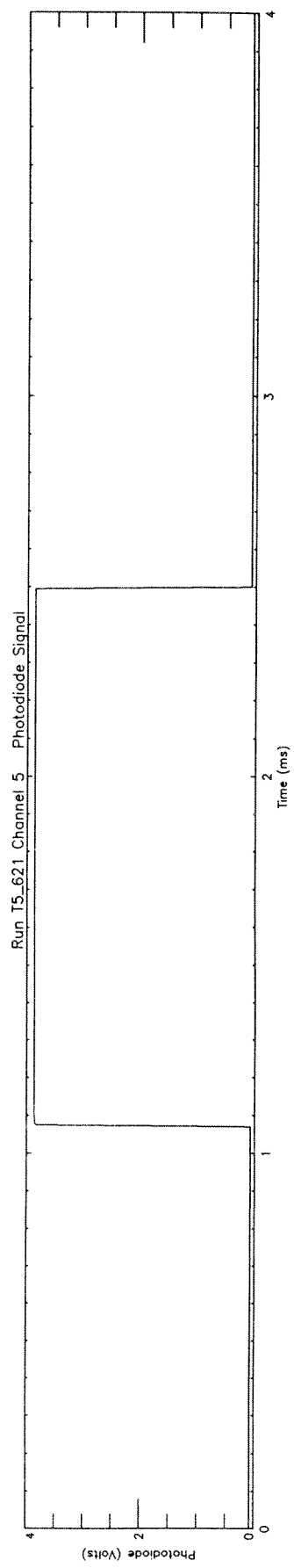
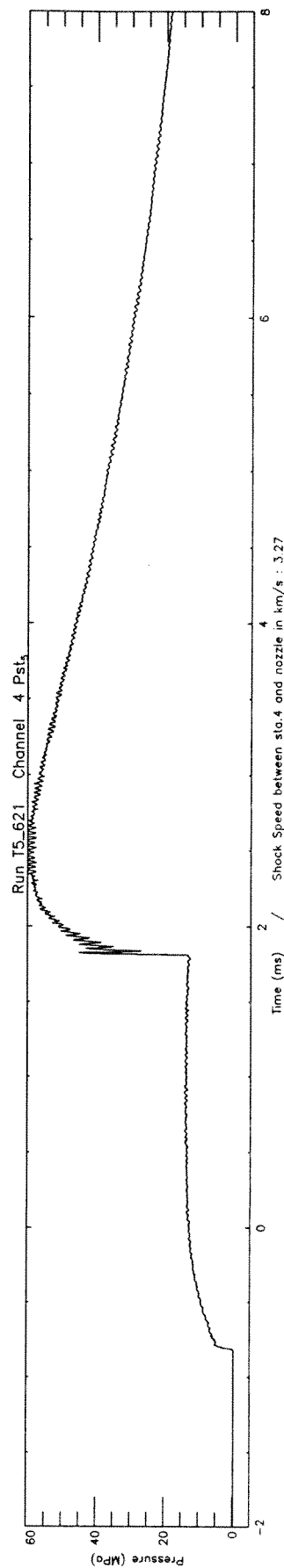
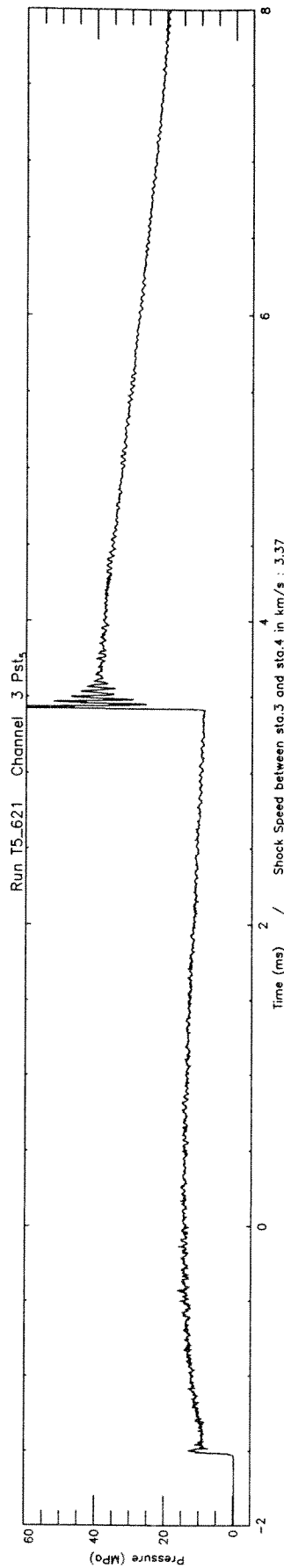
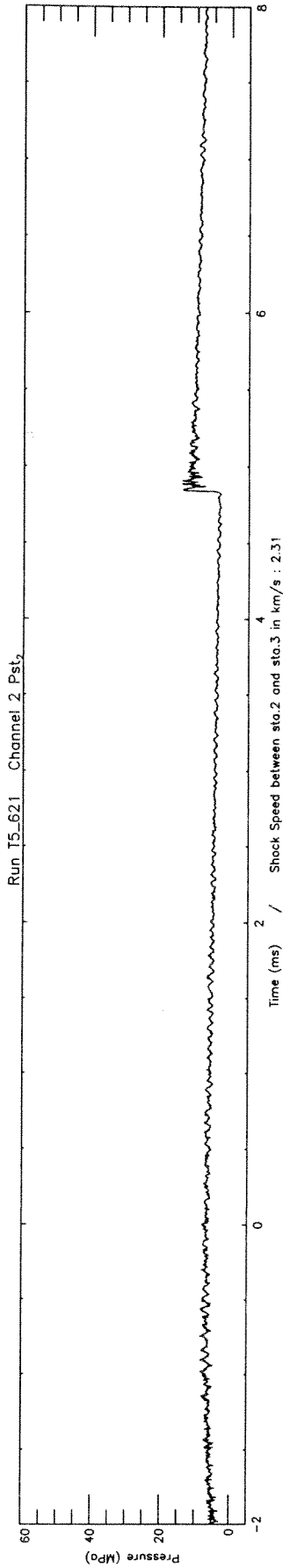
DA1	:	2.4961
DA2	:	0.0017
DA3	:	0.1609
DA4	:	0.1464
DA5	:	0.1361
DA6	:	0.0389
DA7	:	0.0012
DA8	:	0.1154
DA9	:	0.1287

Run # 620

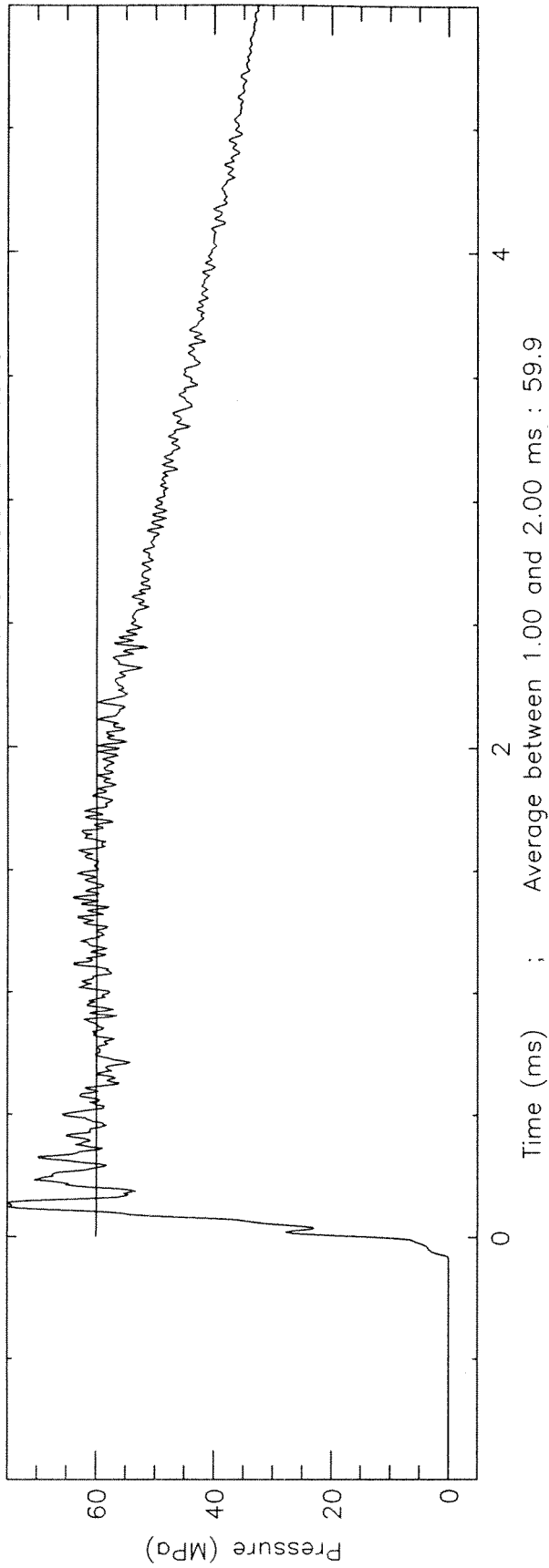
Heat Transfer Rates (in MW/m²)
averaged around 1.50 +/- 0.40 ms

MT 1 :	13.9682
MT 2 :	27.2896
MT 3 :	14.8942
MT 4 :	4.3815
MT 5 :	1.7855
MT 6 :	0.1259
MT 7 :	1.1372
MT 8 :	0.9505
MT 9 :	0.9746
MT10 :	0.7899
MT11 :	4.0489
MT12 :	0.8978

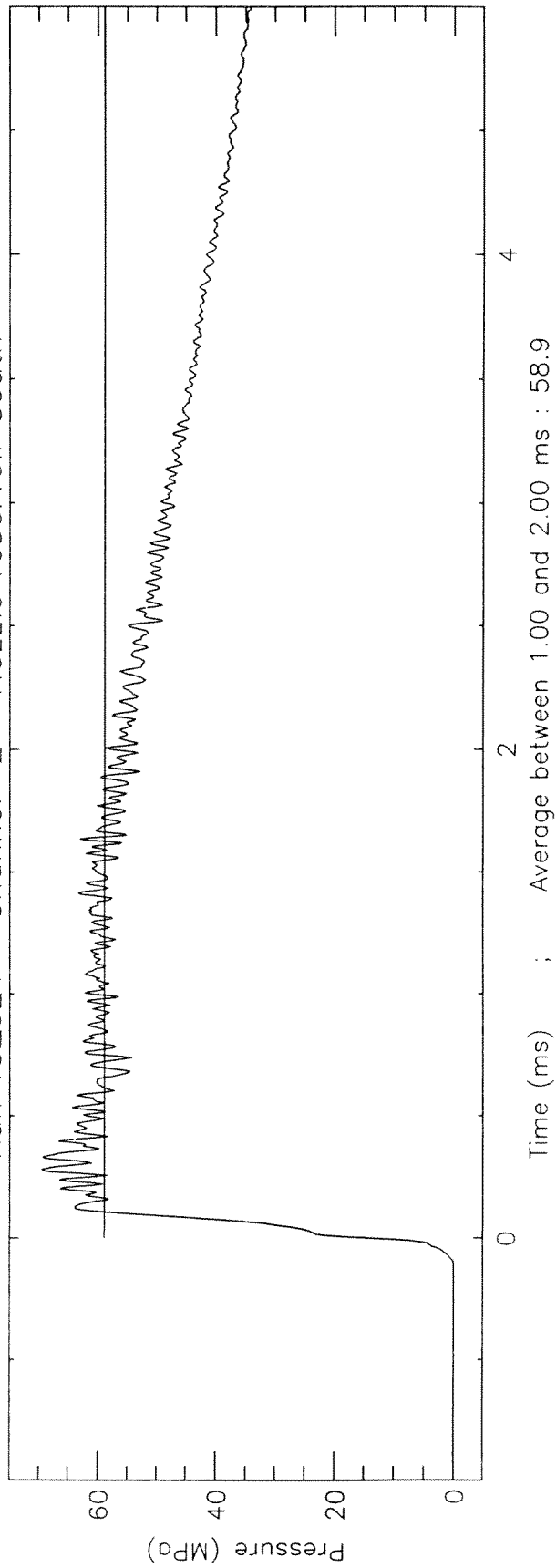




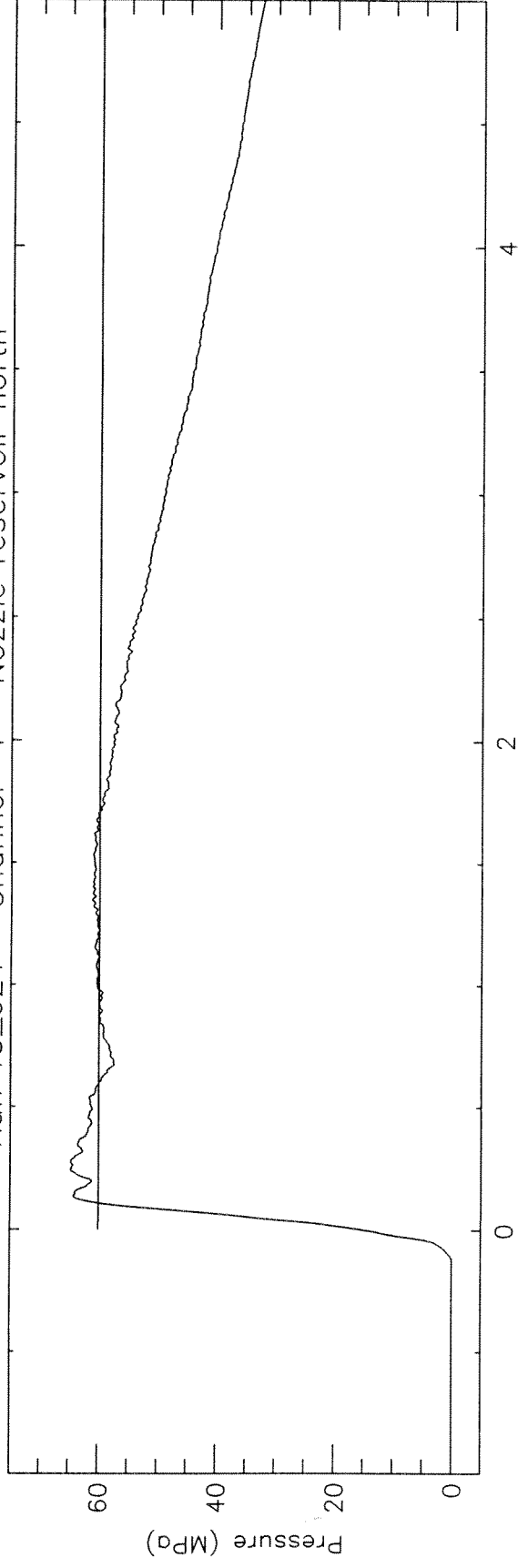
Run T5_621 Channel 1 Nozzle reservoir north



Run T5_621 Channel 2 Nozzle reservoir south

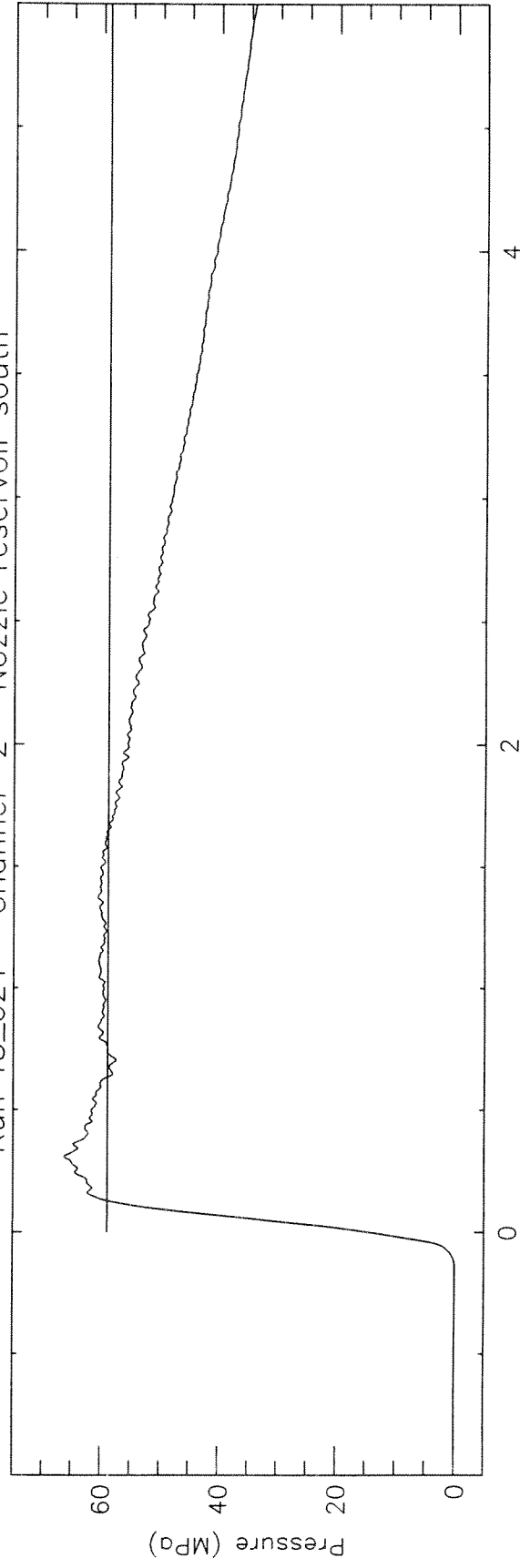


Run T5_621 Channel 1 Nozzle reservoir north

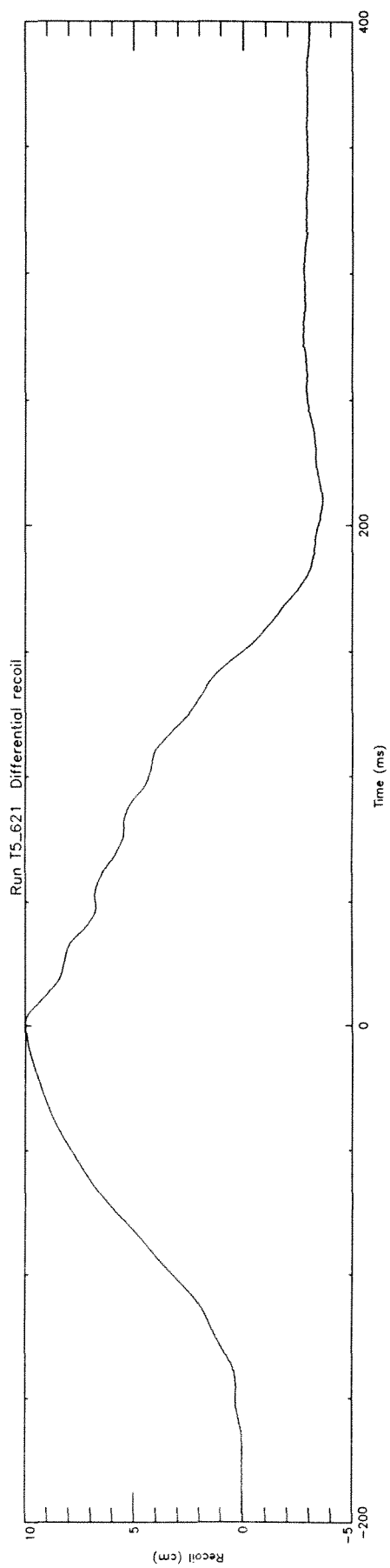
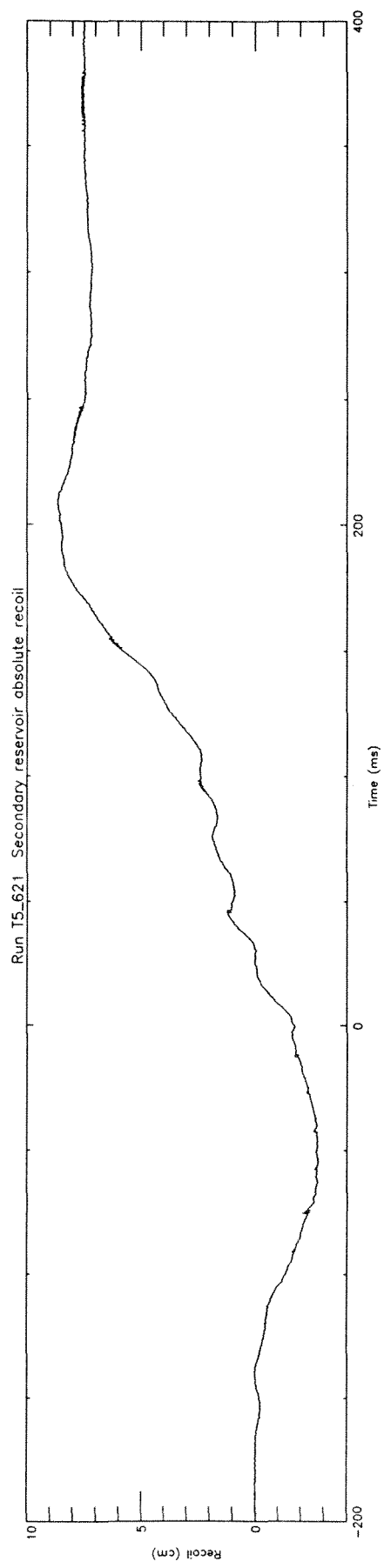
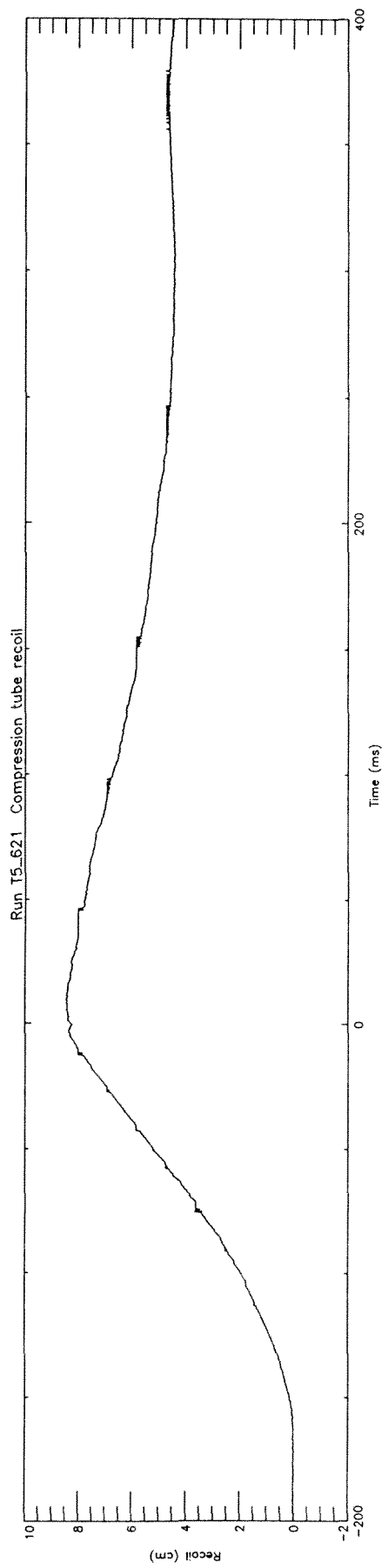


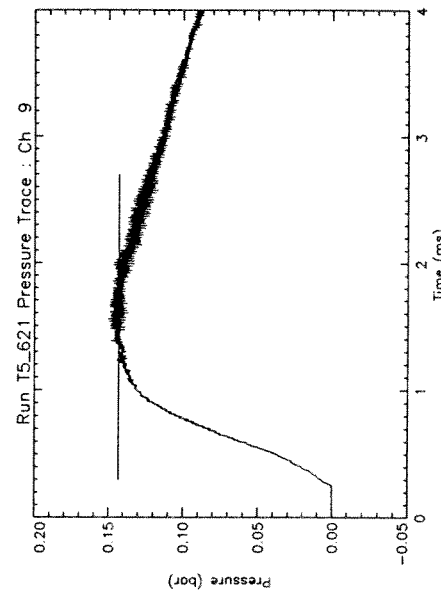
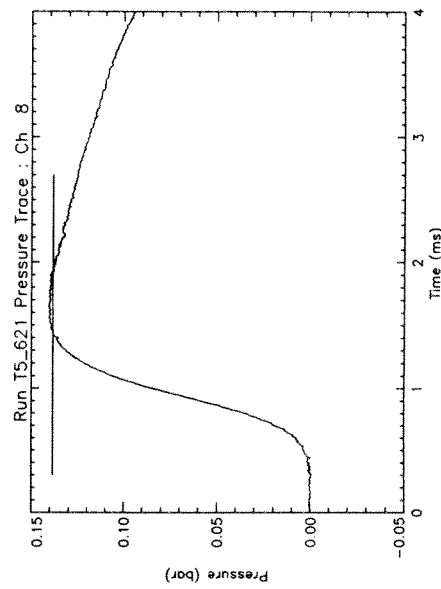
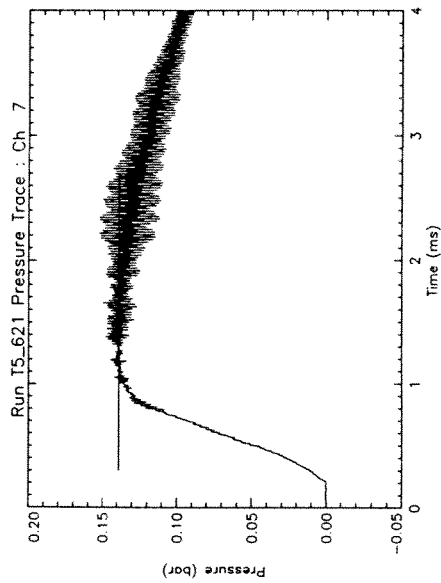
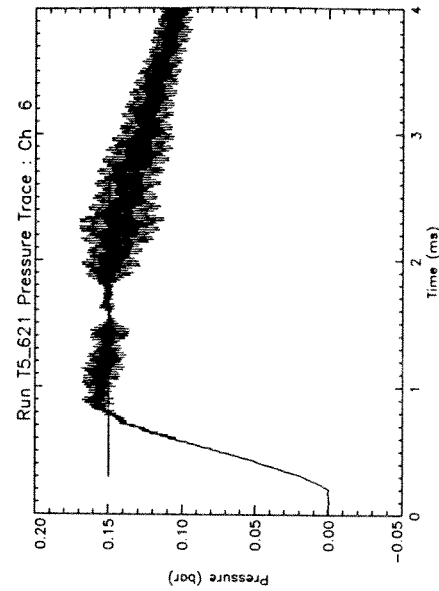
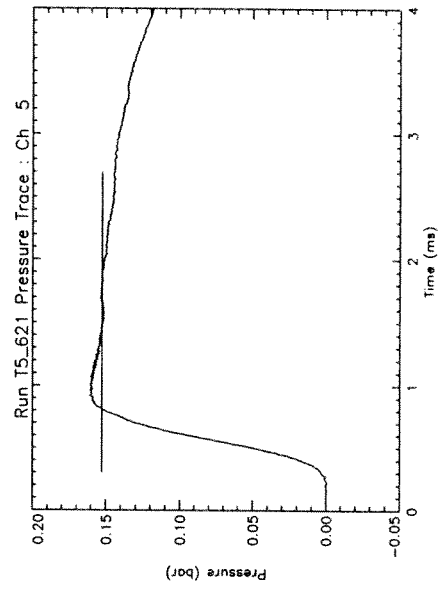
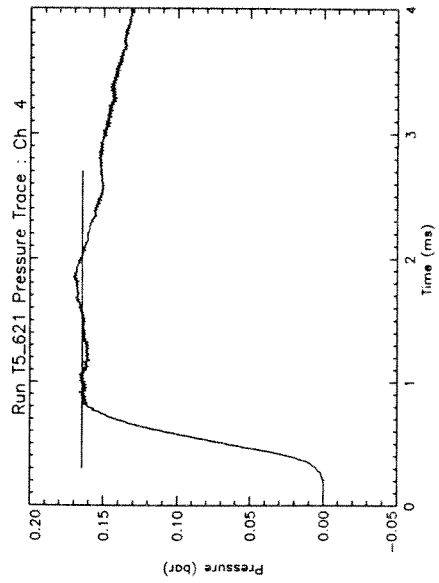
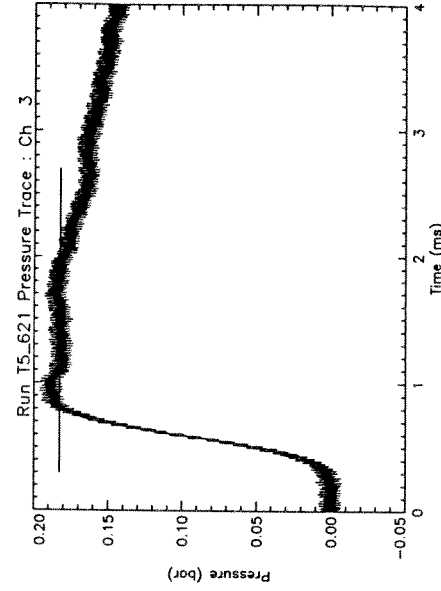
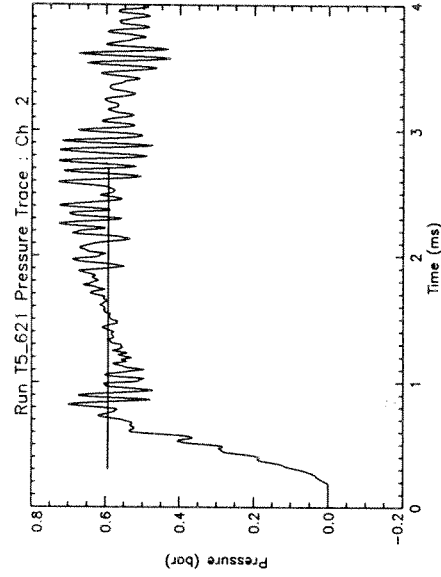
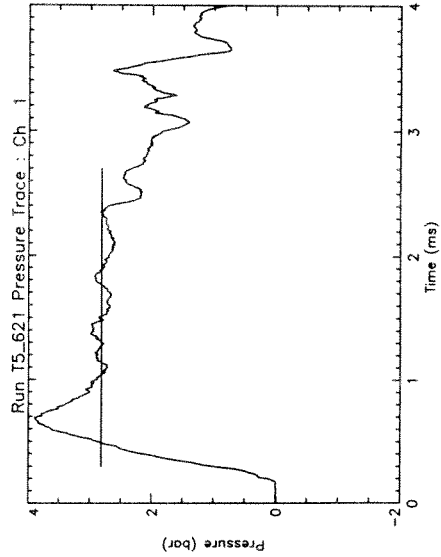
Time (ms) ; Average between 1.00 and 2.00 ms : 59.9

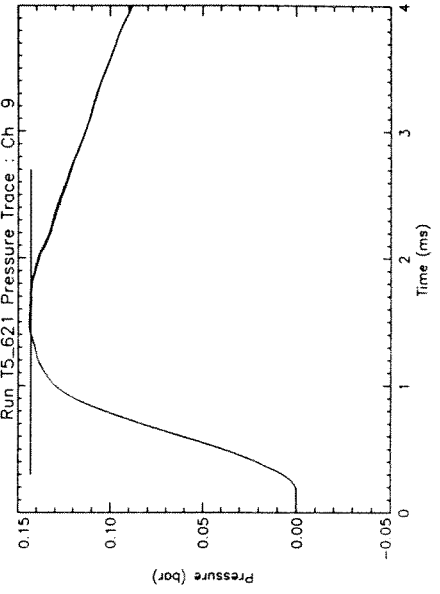
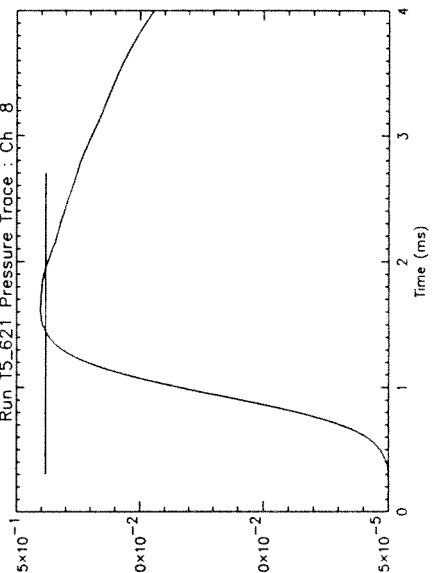
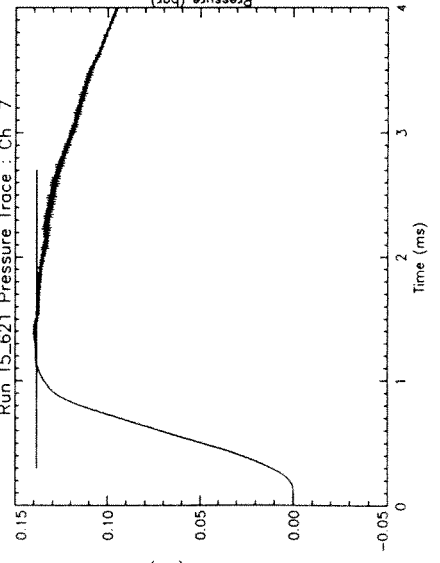
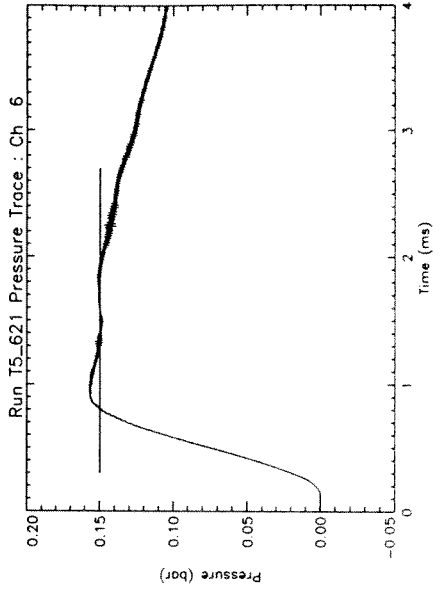
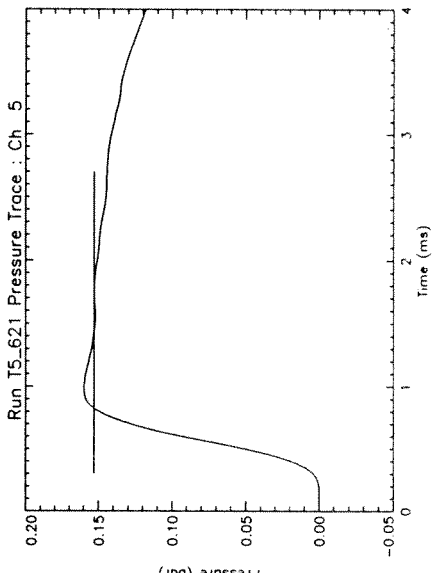
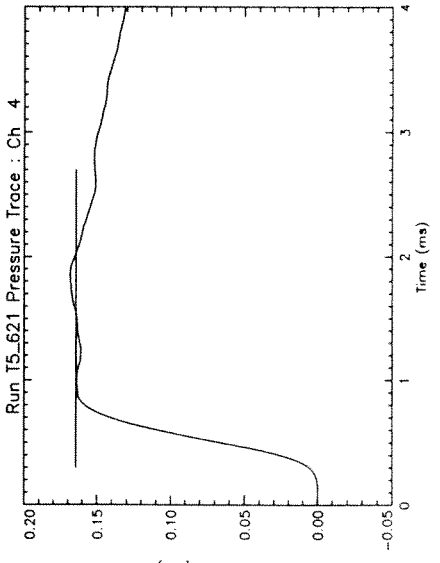
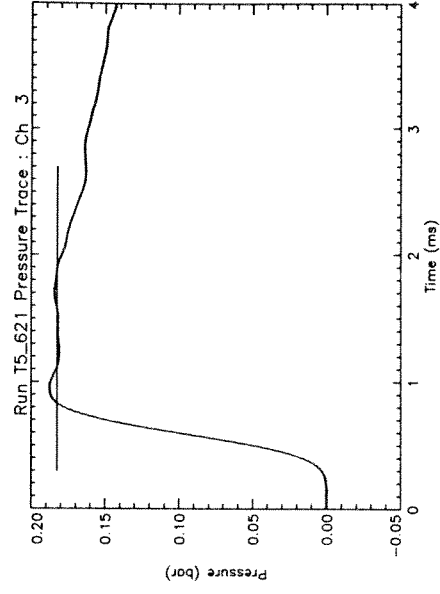
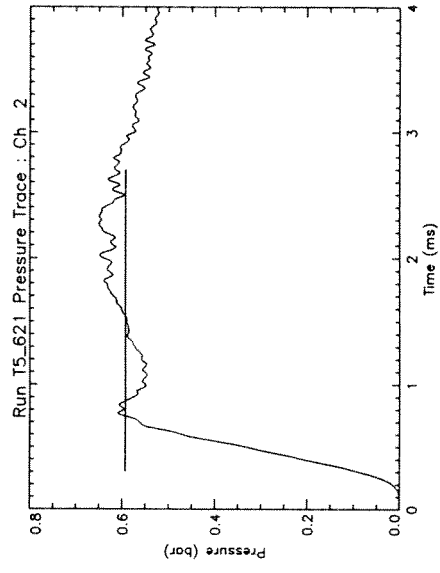
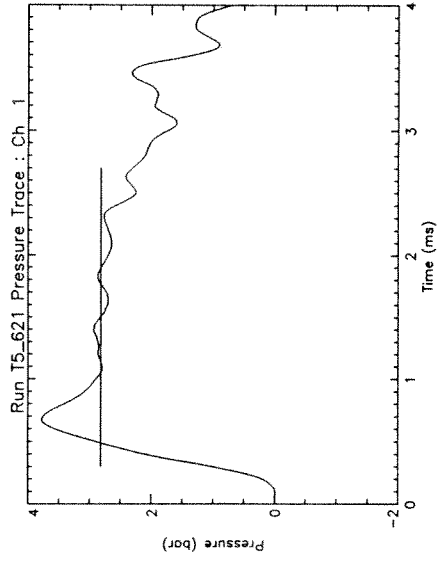
Run T5_621 Channel 2 Nozzle reservoir south

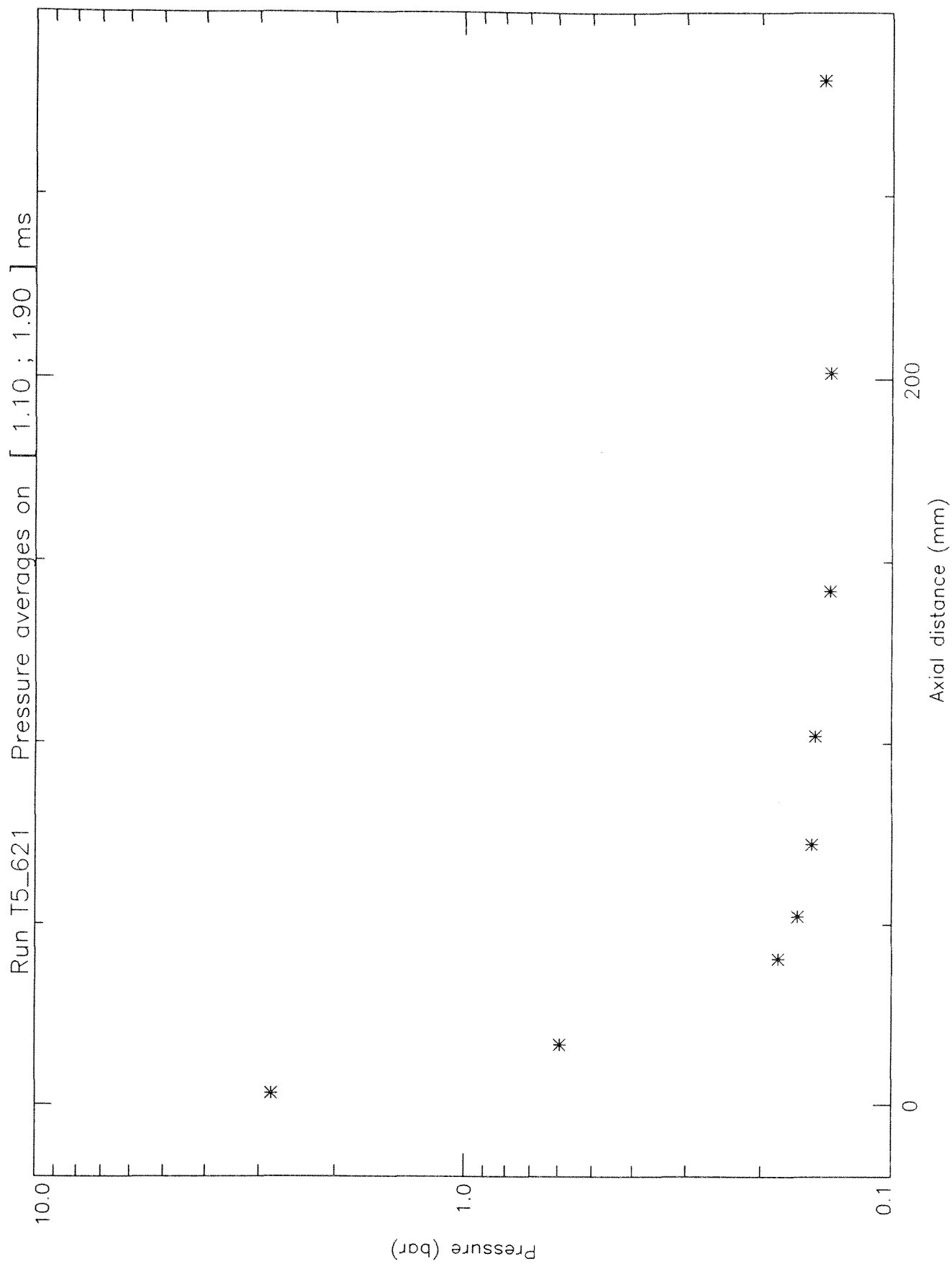


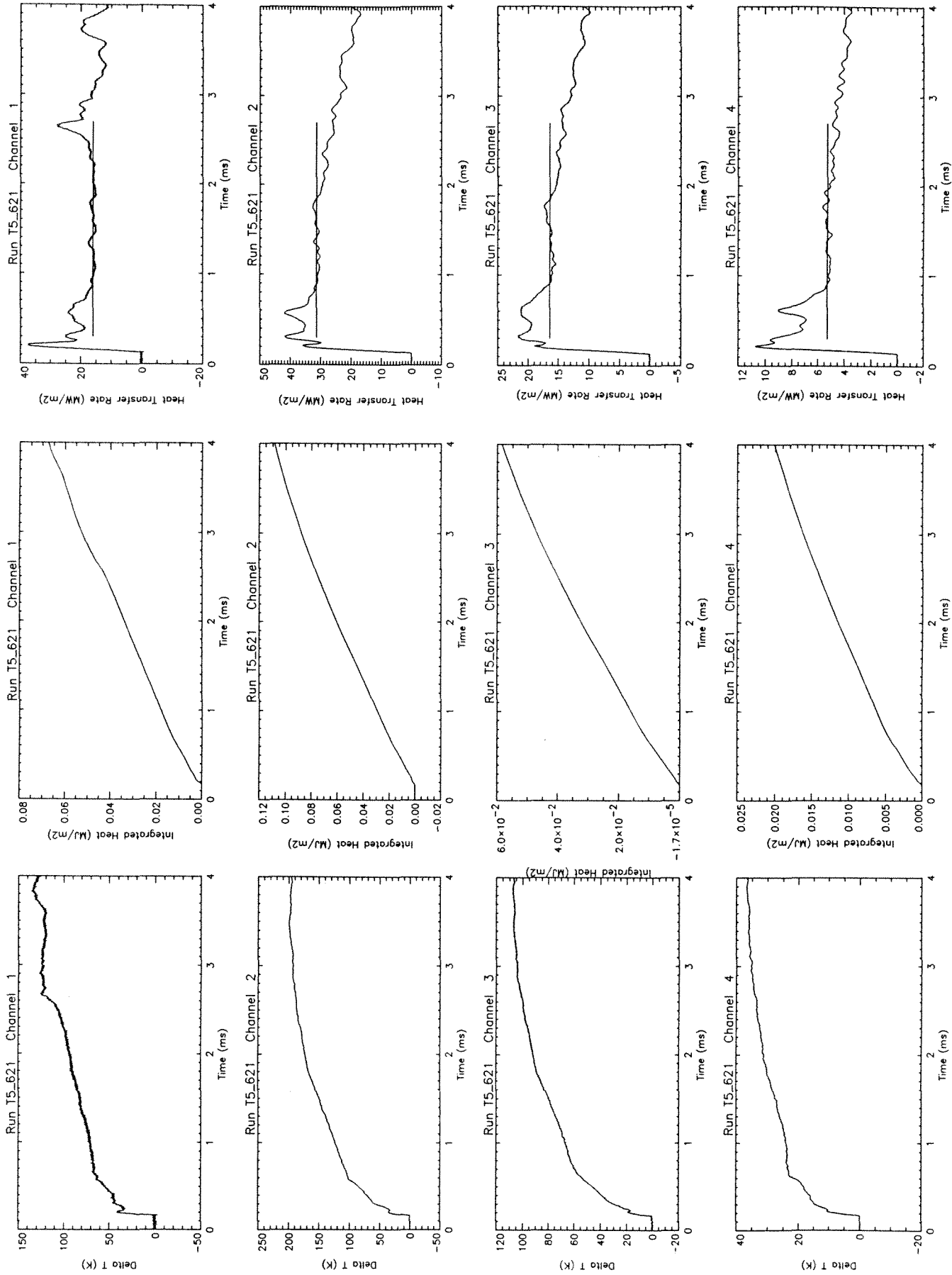
Time (ms) ; Average between 1.00 and 2.00 ms : 58.9

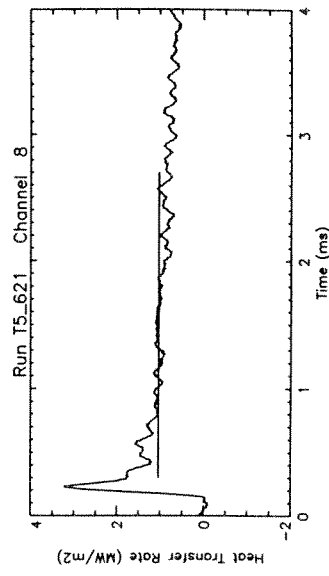
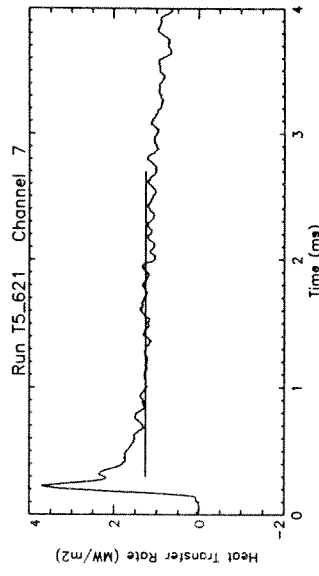
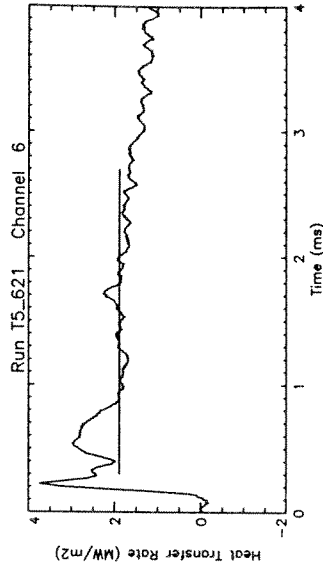
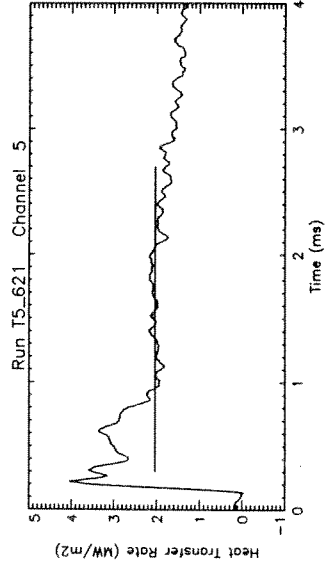
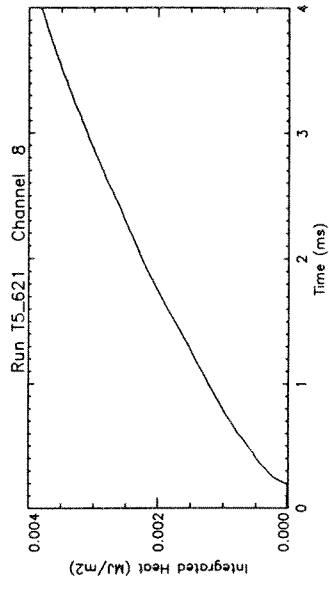
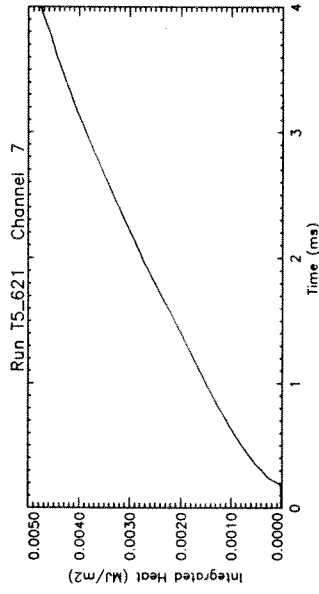
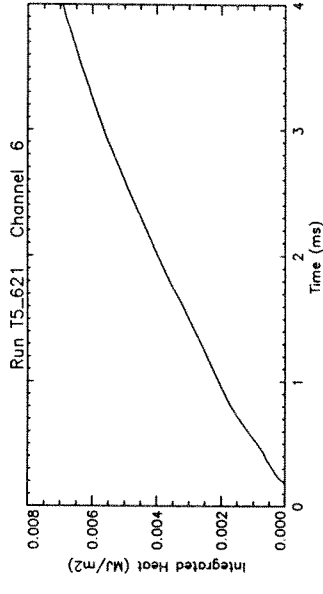
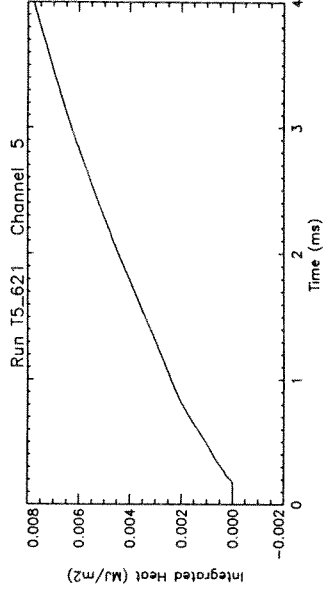
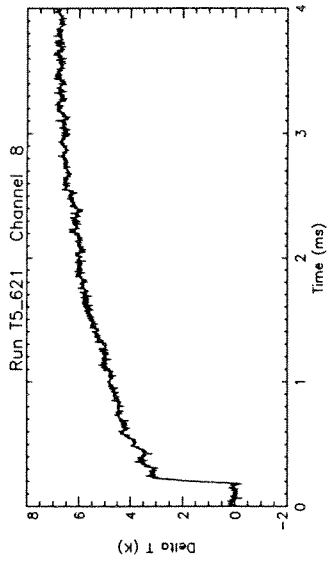
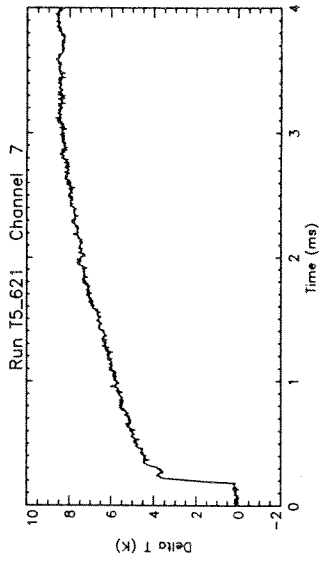
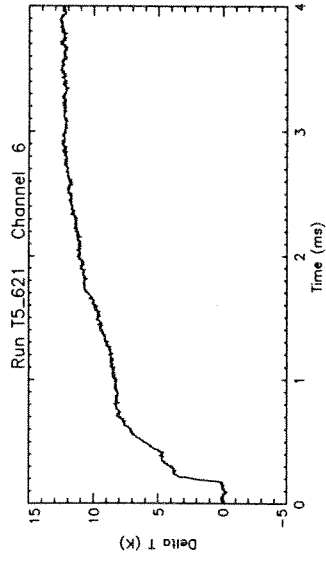
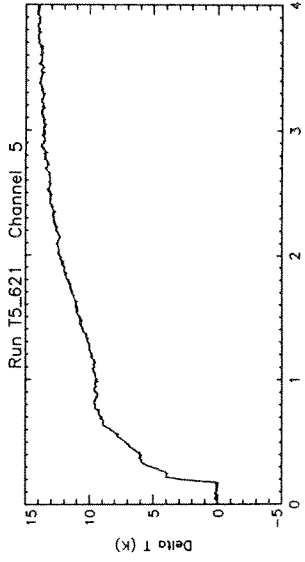


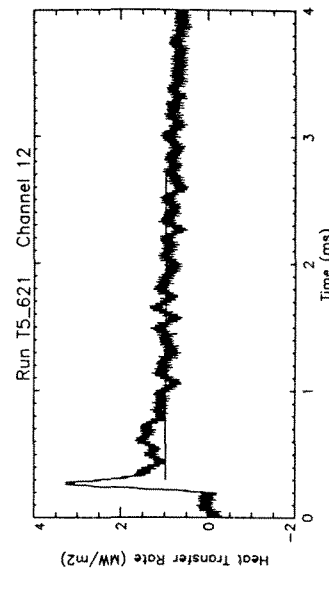
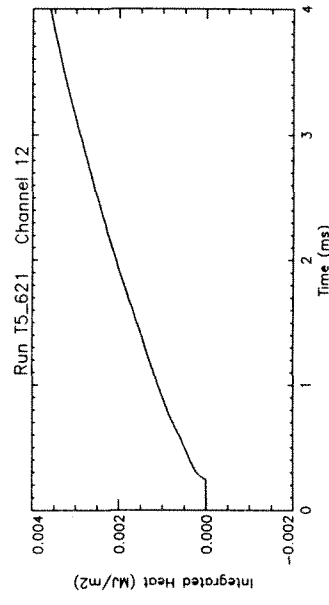
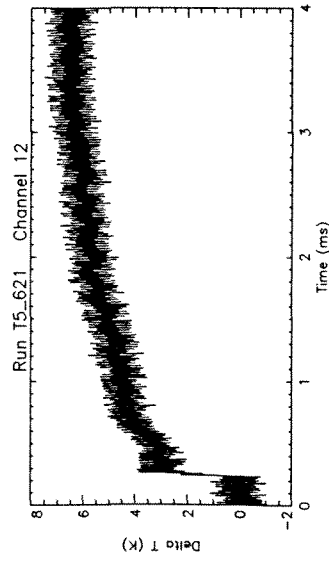
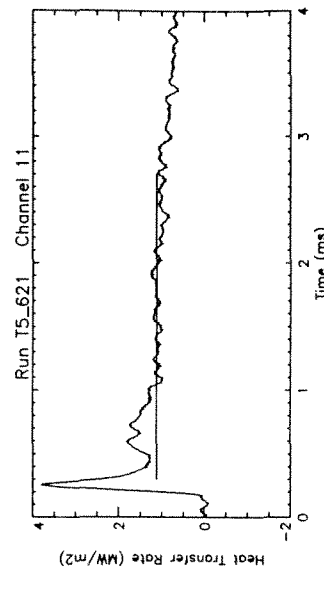
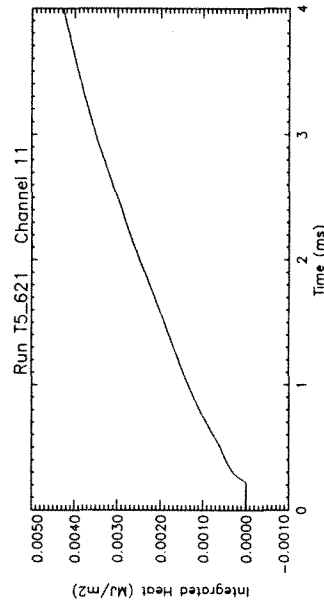
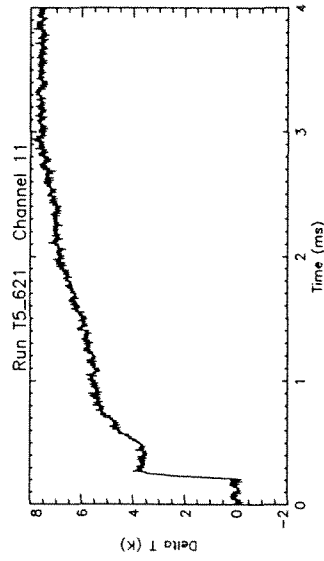
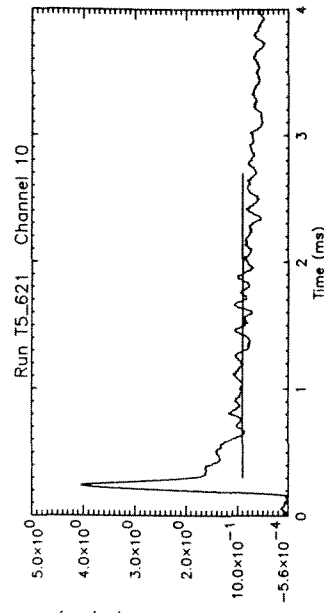
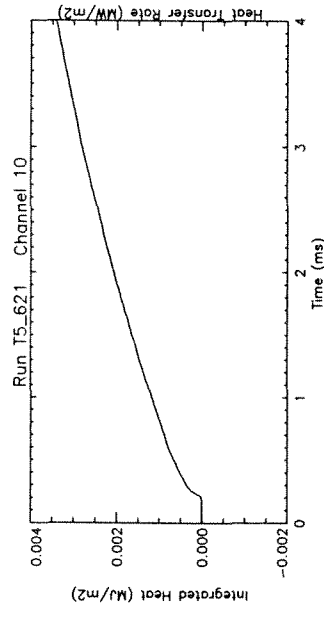
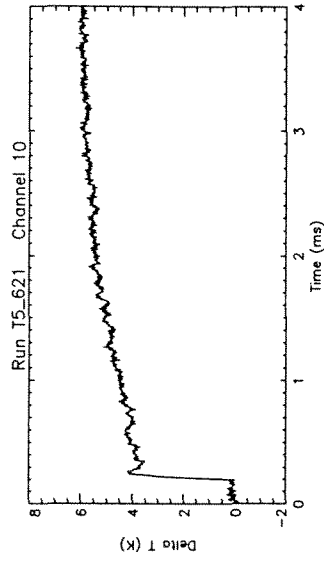
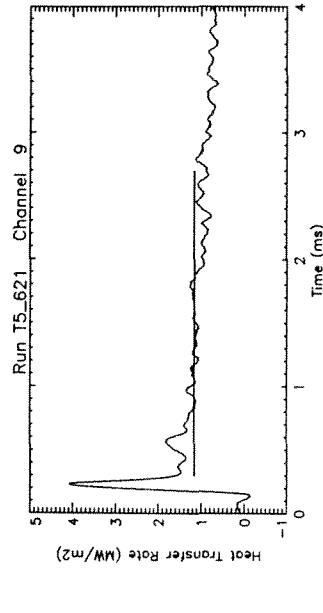
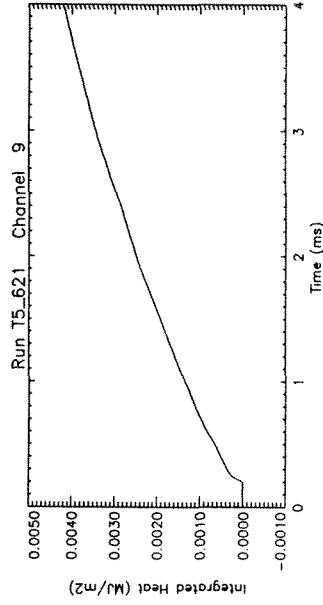
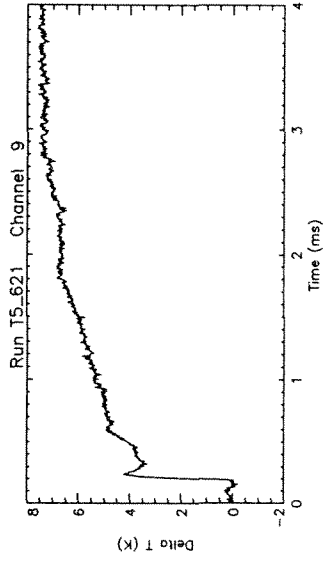


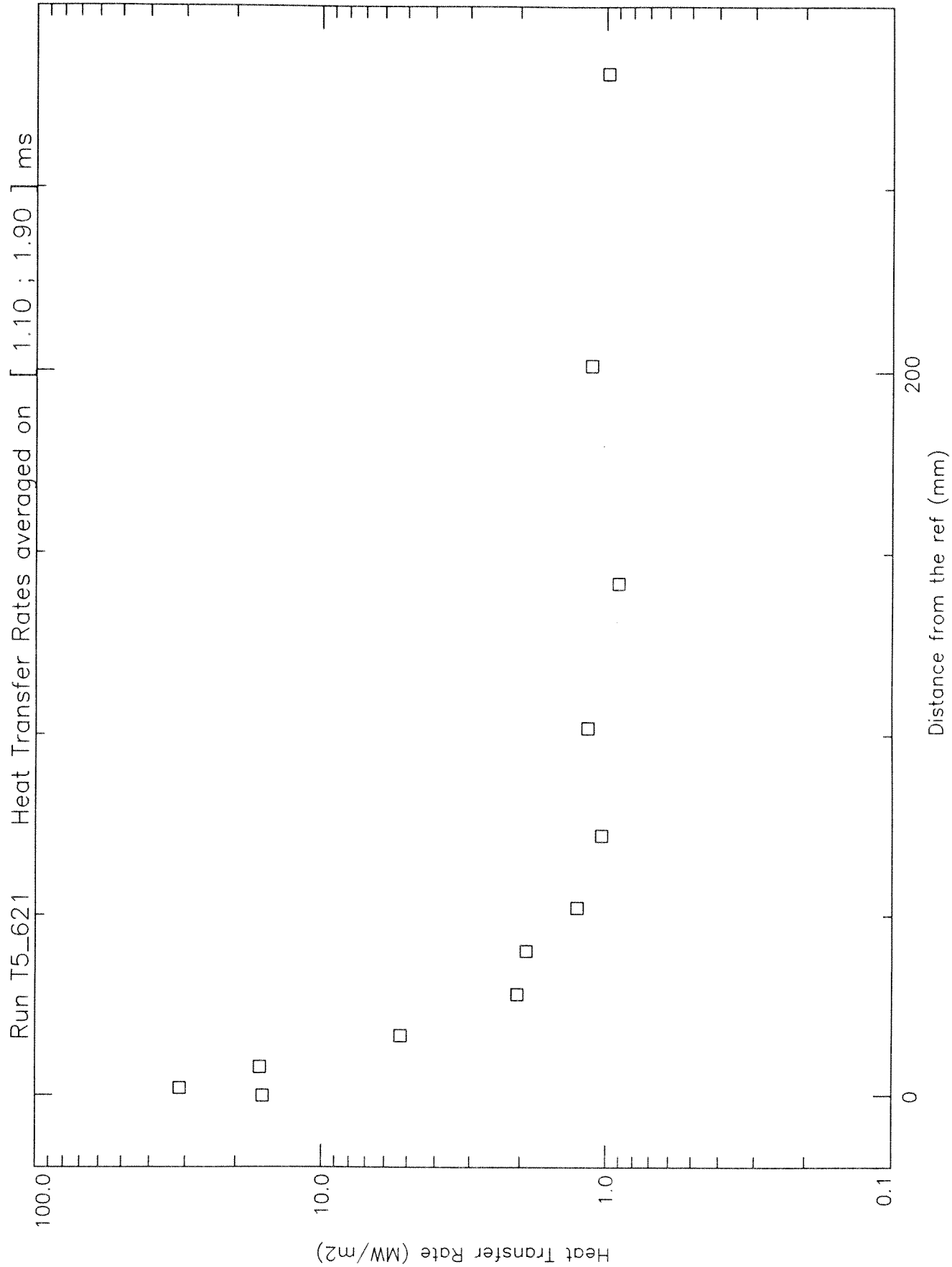












Run # 621

Pressure averages around 1.50 +/- 0.40 ms

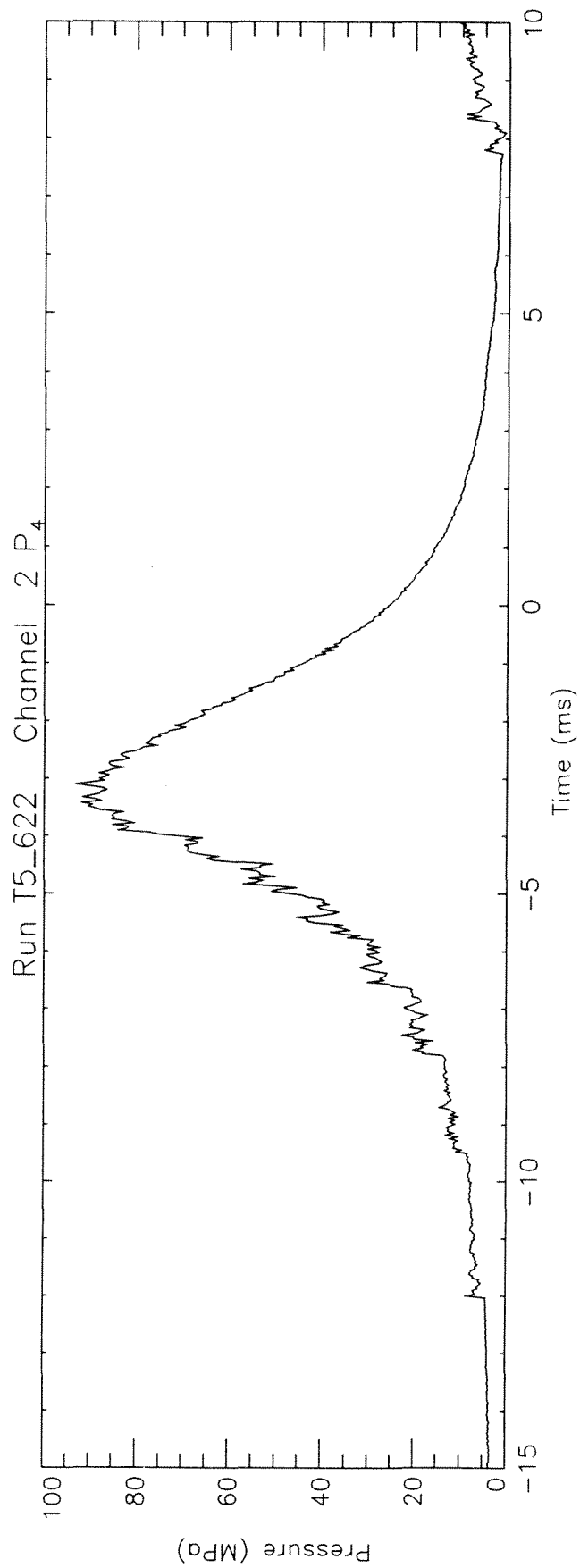
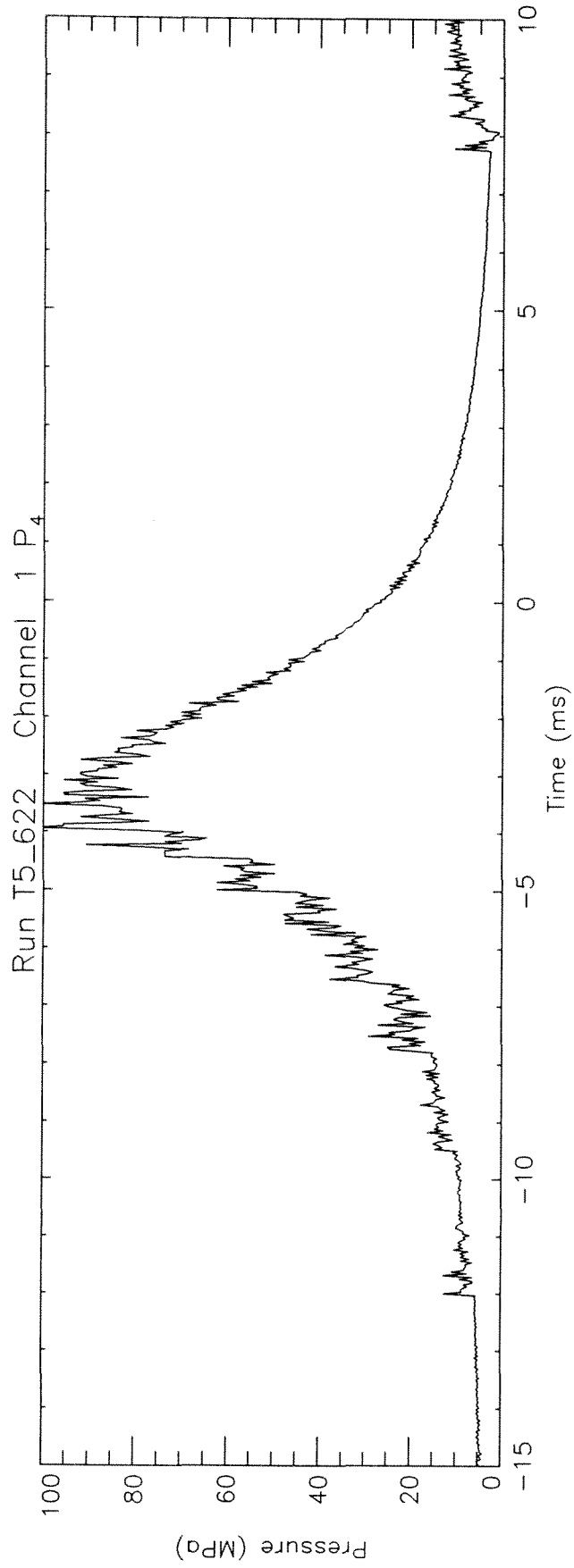
Smooth box = 2.

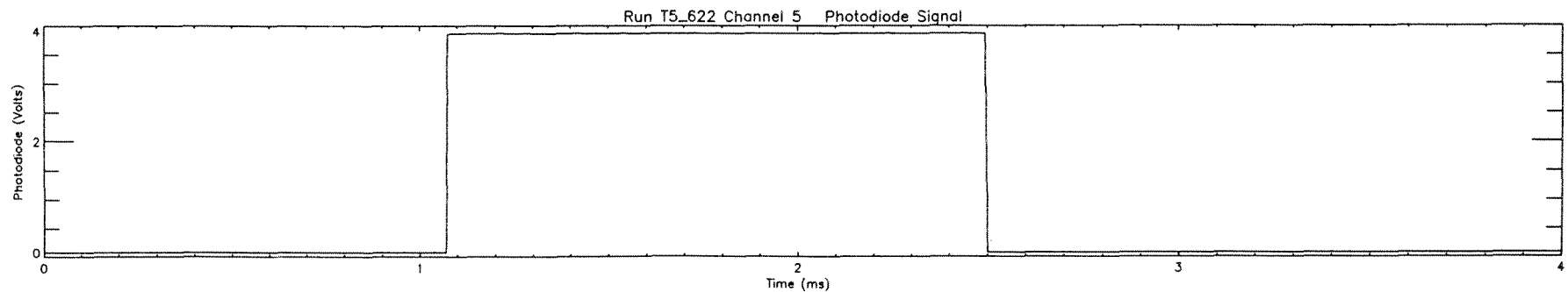
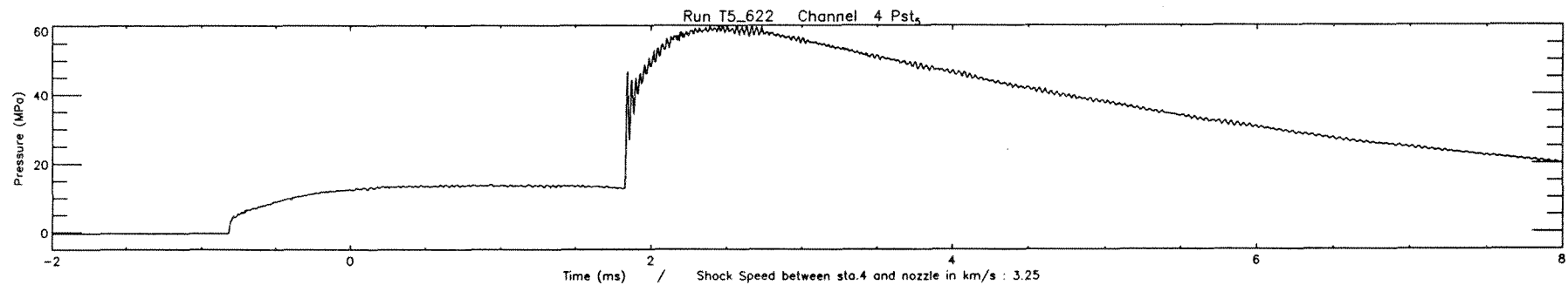
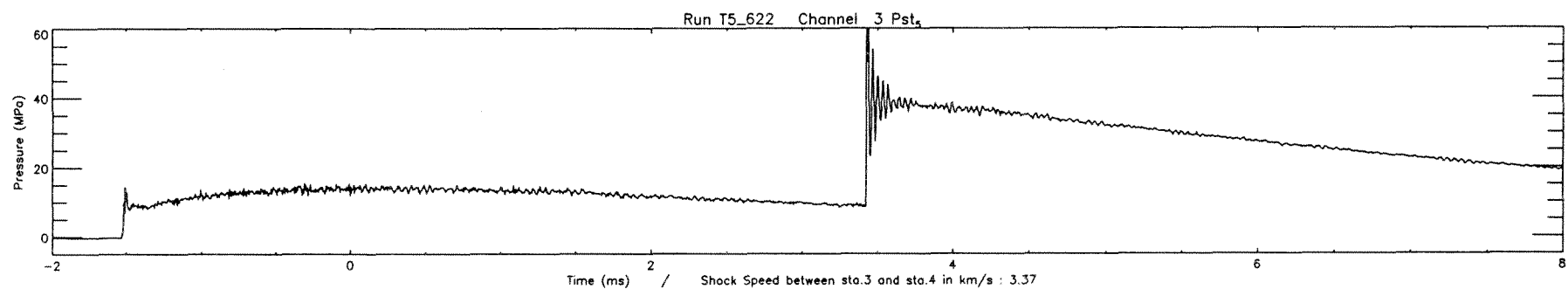
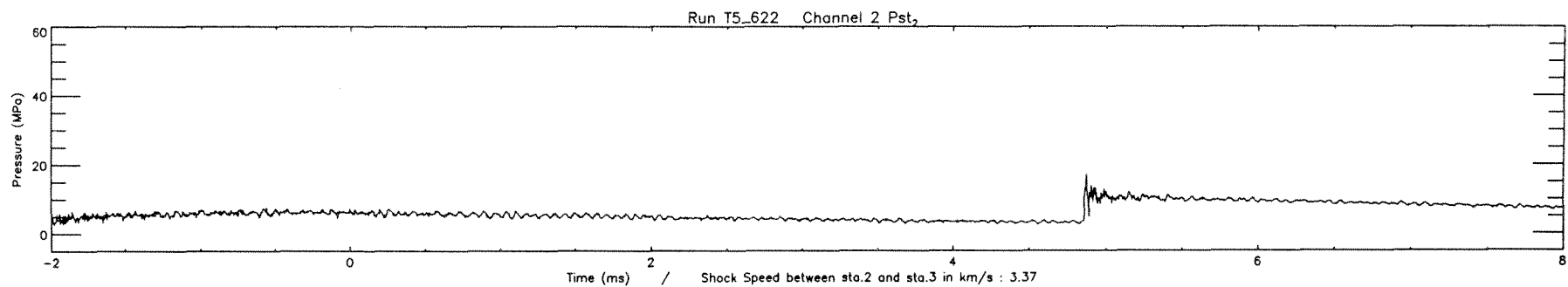
DA1	:	2.8118
DA2	:	0.5939
DA3	:	0.1826
DA4	:	0.1643
DA5	:	0.1528
DA6	:	0.1498
DA7	:	0.1388
DA8	:	0.1384
DA9	:	0.1432

Run # 621

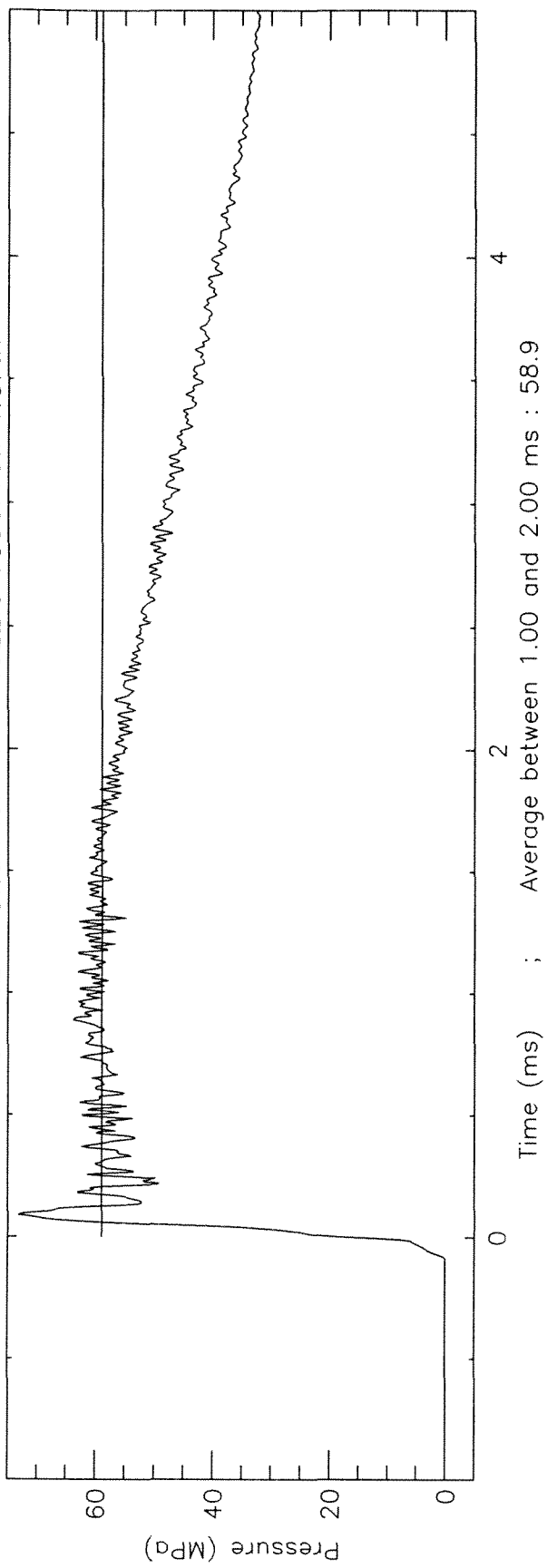
Heat Transfer Rates (in MW/m²)
averaged around 1.50 +/- 0.40 ms

MT 1 :	16.0264
MT 2 :	31.3618
MT 3 :	16.4206
MT 4 :	5.2709
MT 5 :	2.0426
MT 6 :	1.8981
MT 7 :	1.2594
MT 8 :	1.0352
MT 9 :	1.1576
MT10 :	0.8993
MT11 :	1.1259
MT12 :	0.9839

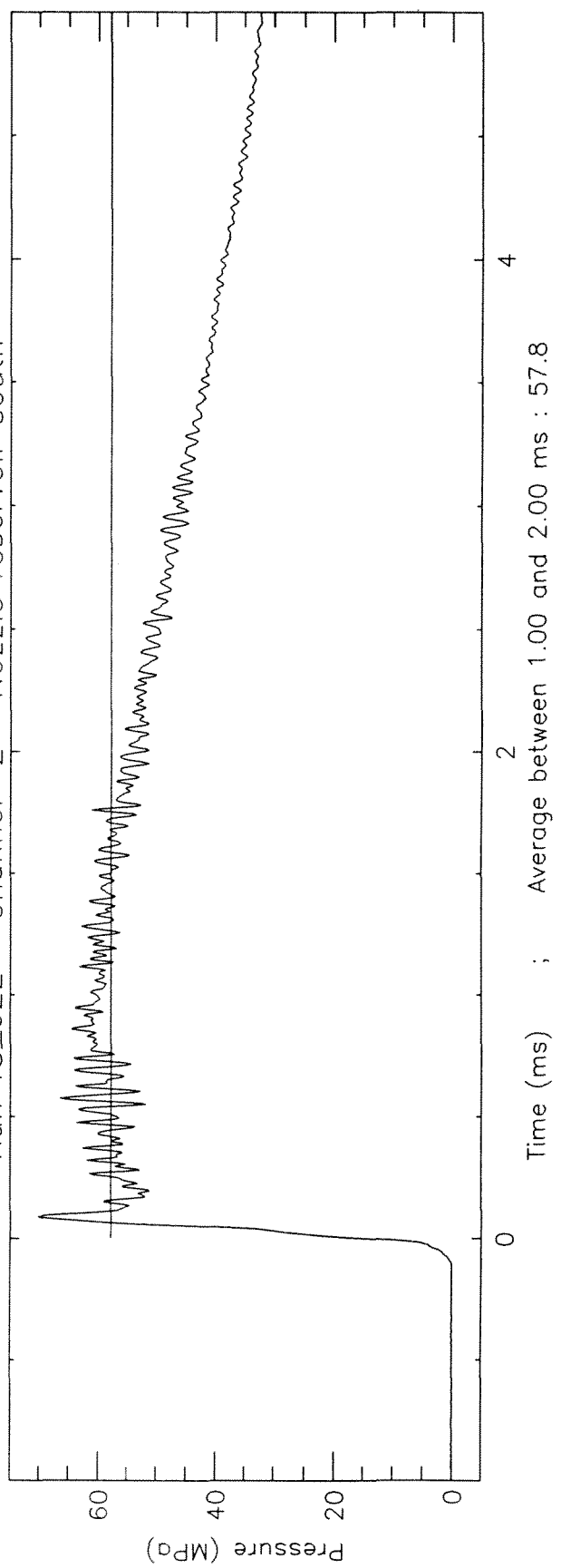




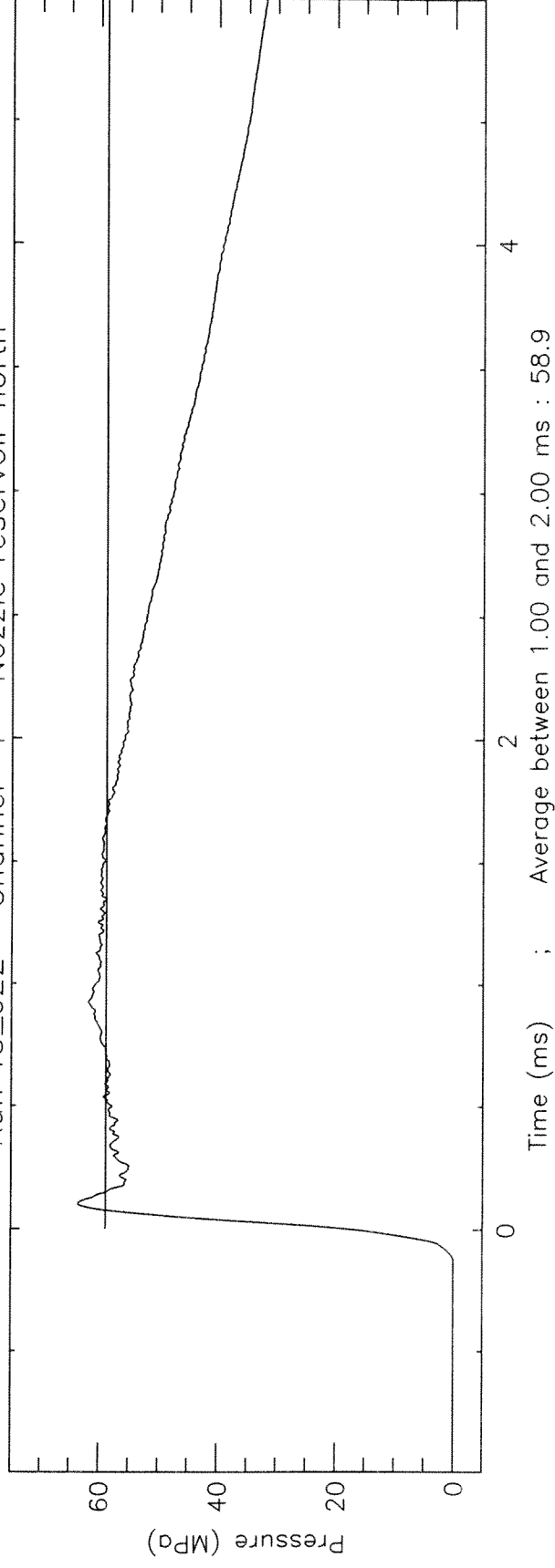
Run T5_622 Channel 1 Nozzle reservoir north



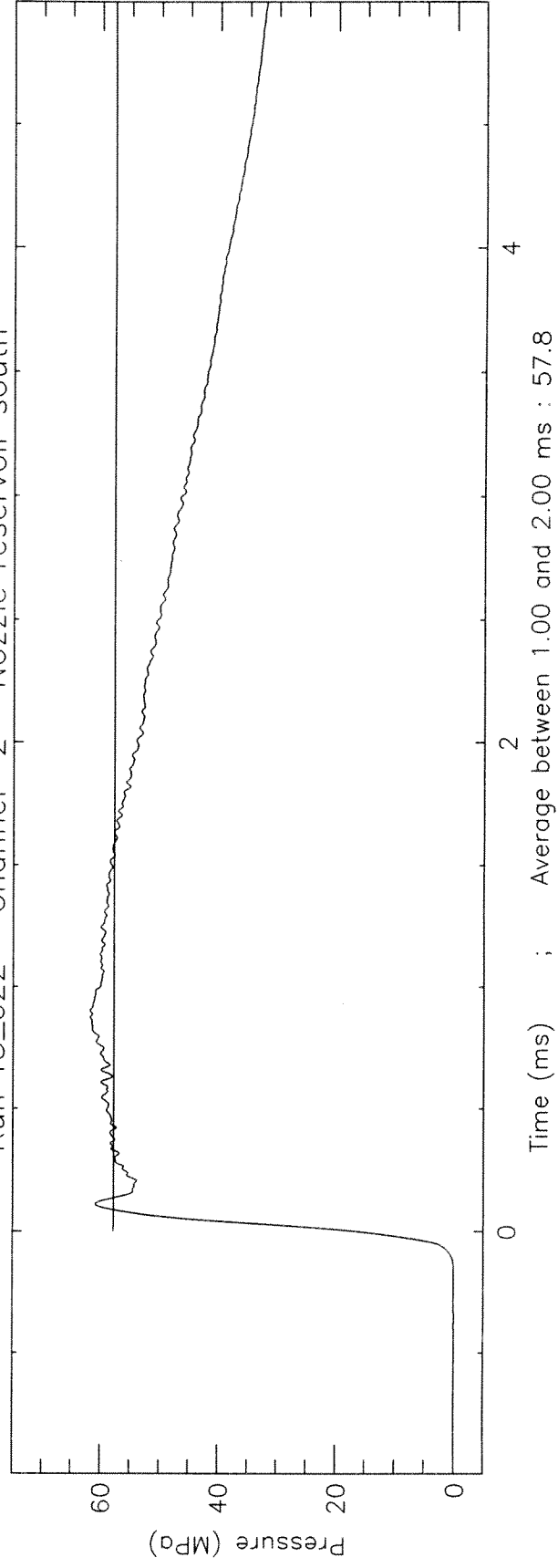
Run T5_622 Channel 2 Nozzle reservoir south

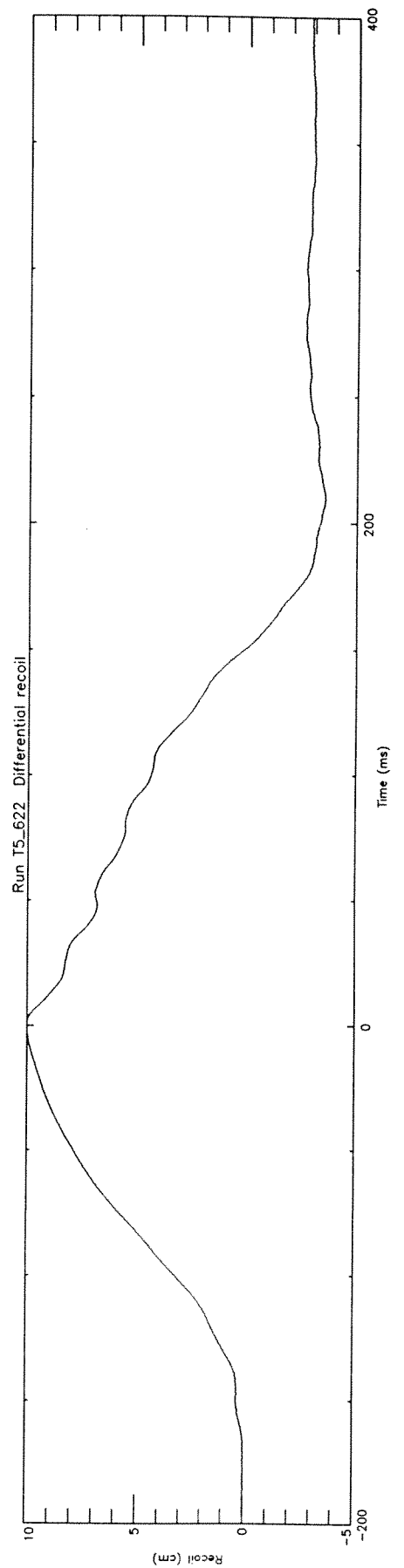
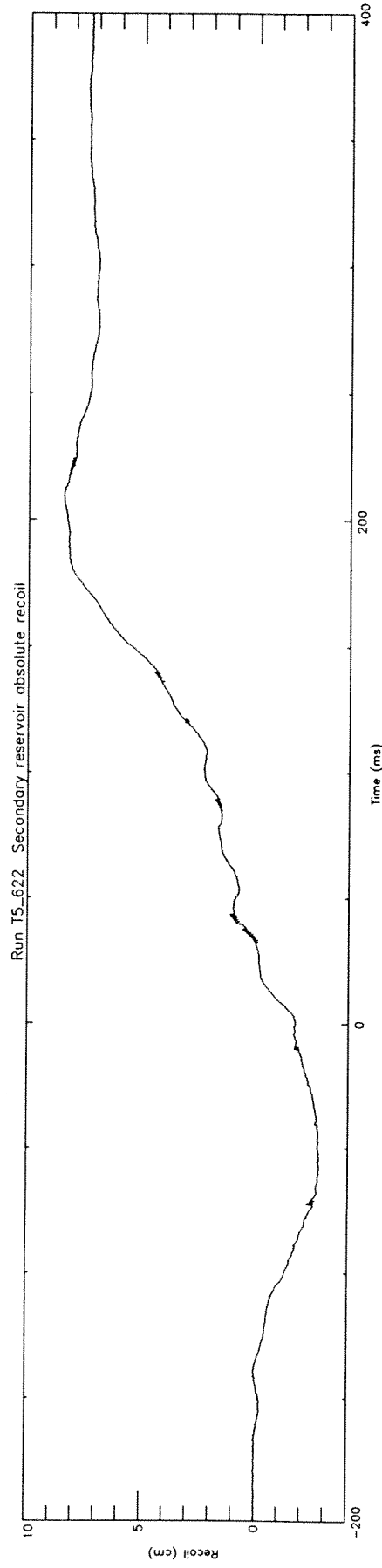
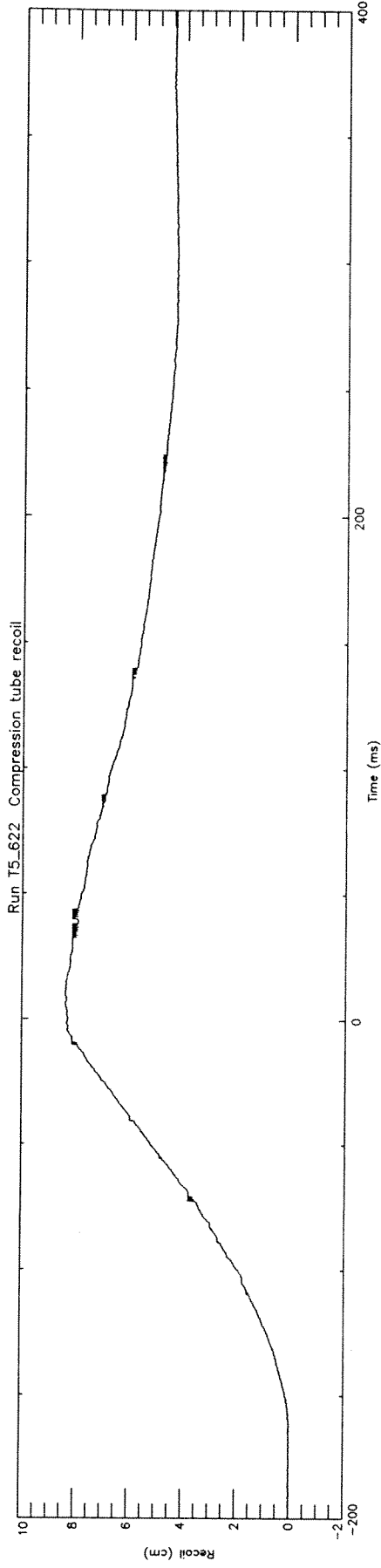


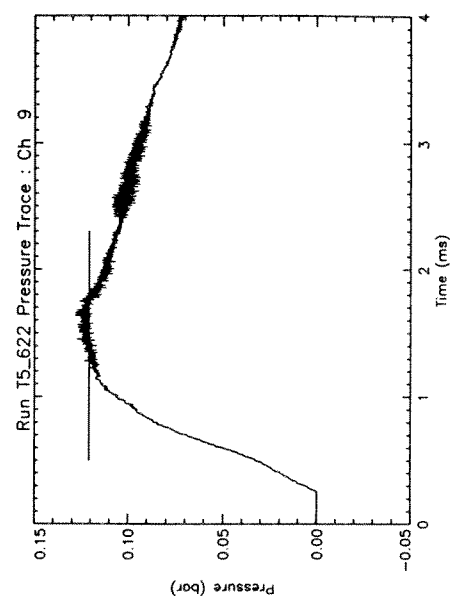
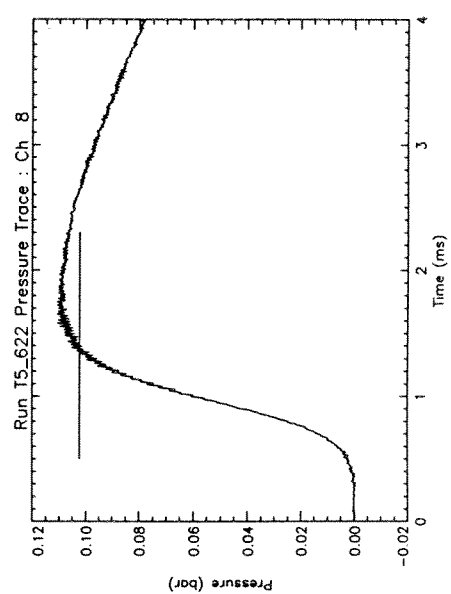
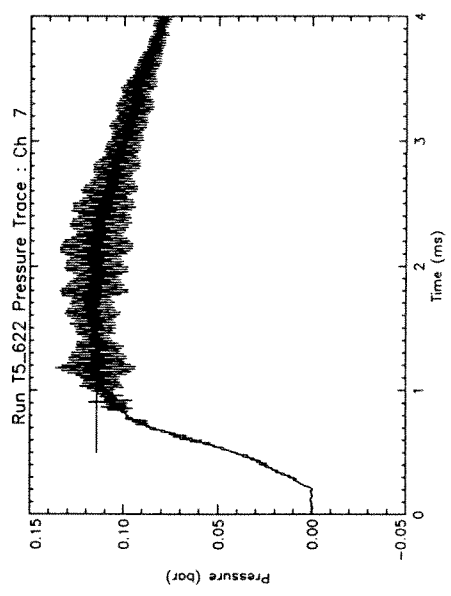
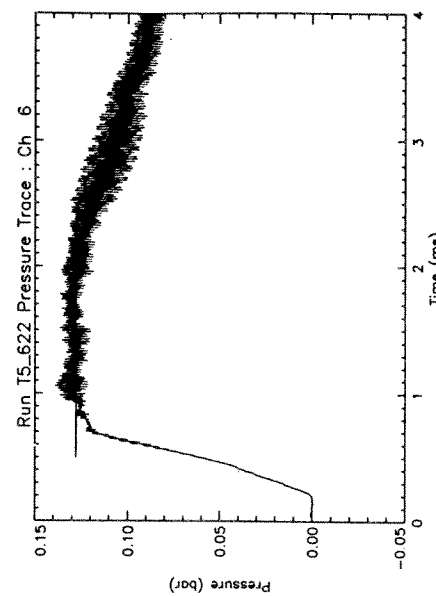
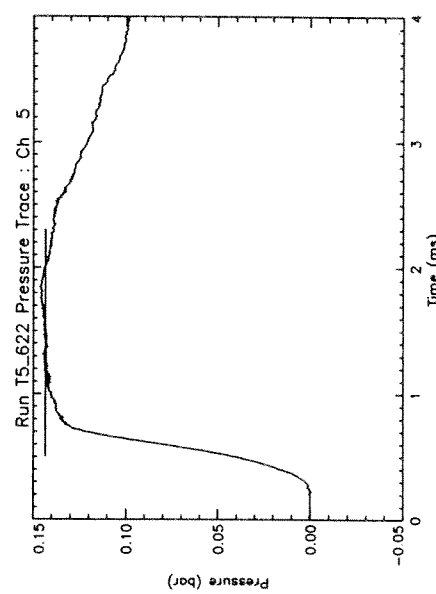
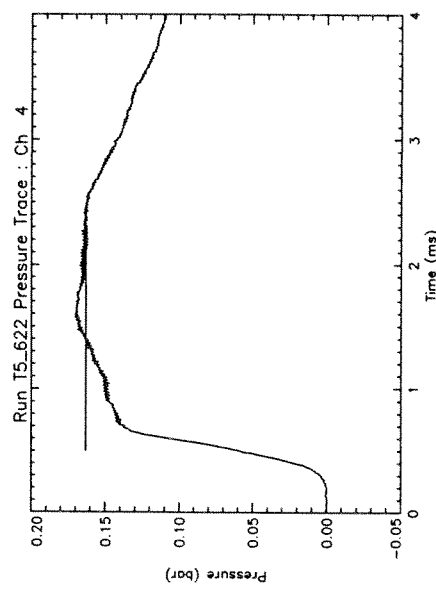
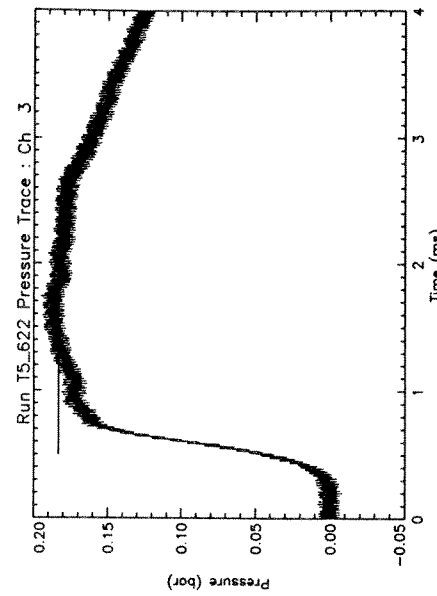
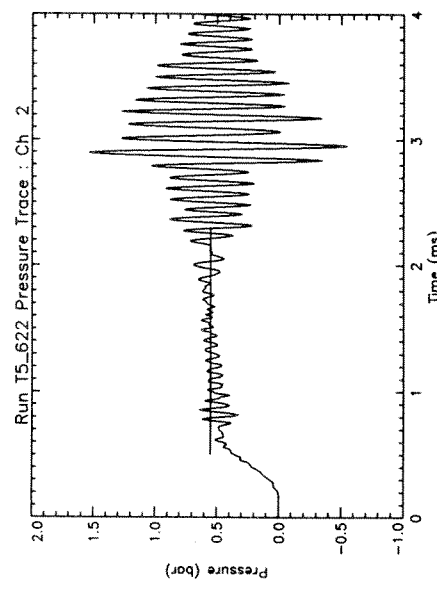
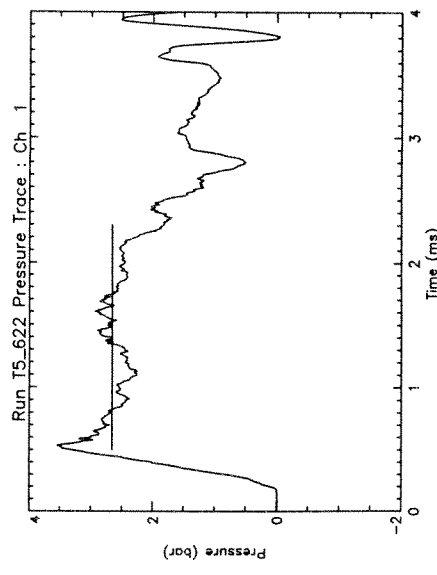
Run T5_622 Channel 1 Nozzle reservoir north

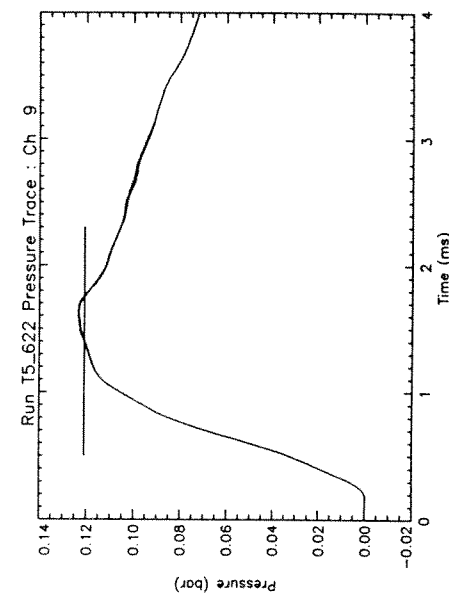
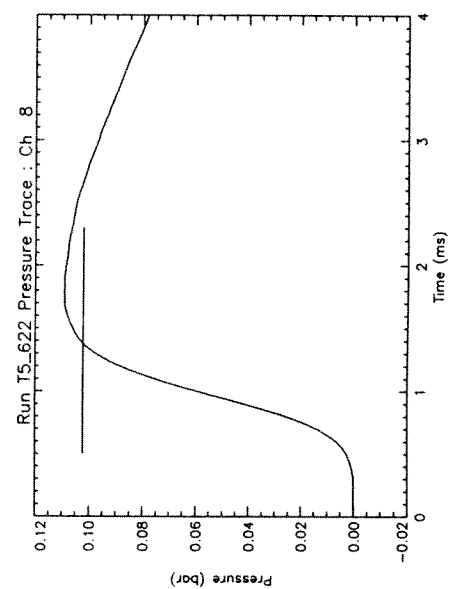
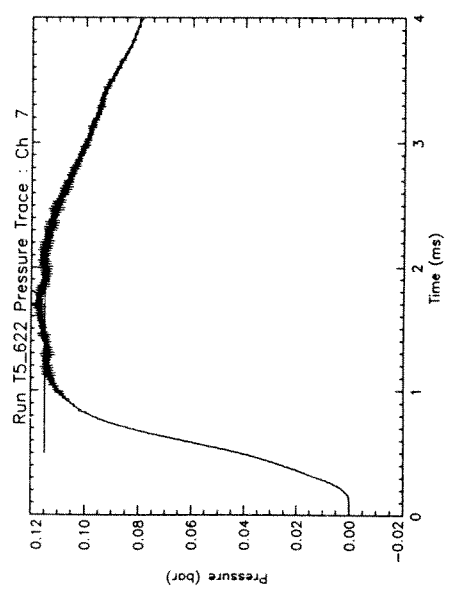
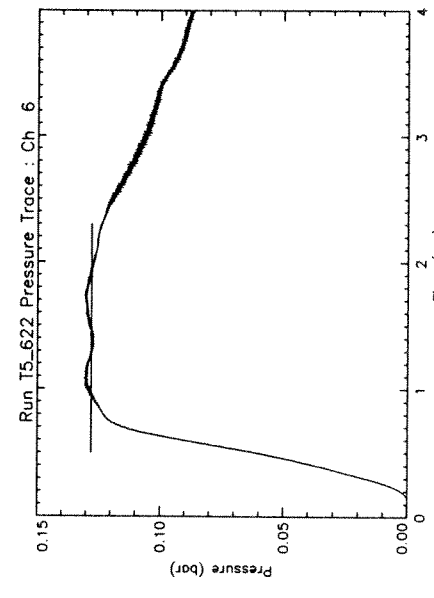
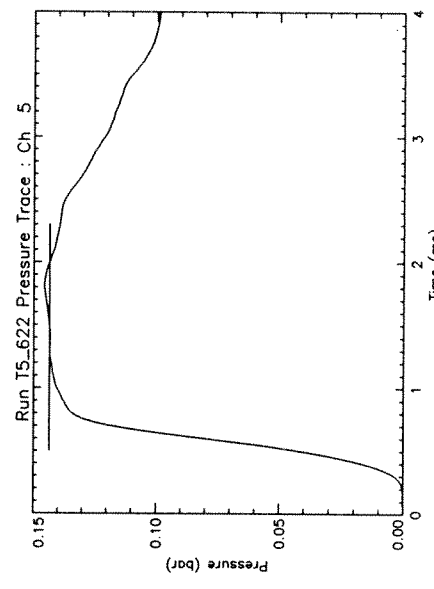
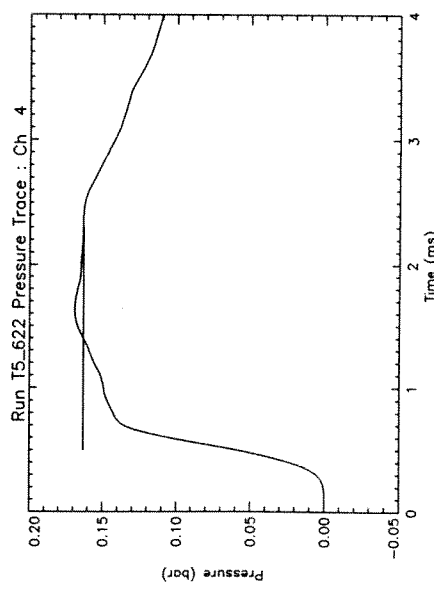
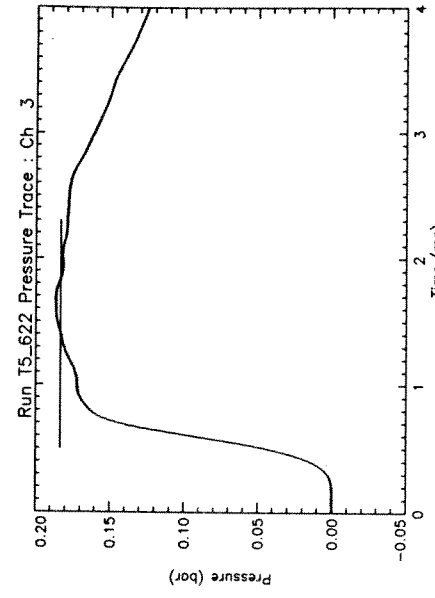
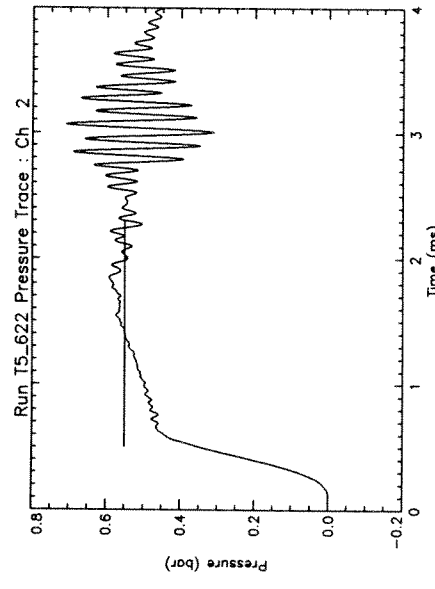
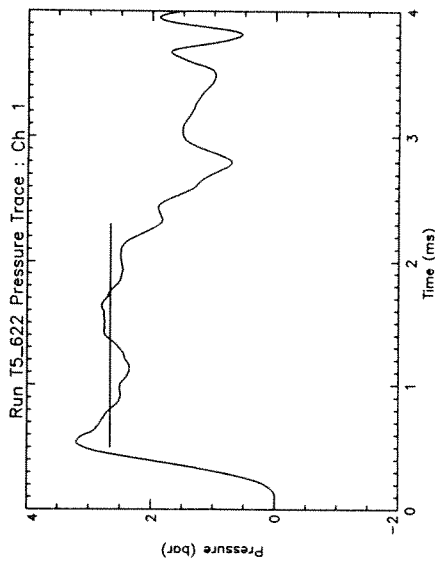


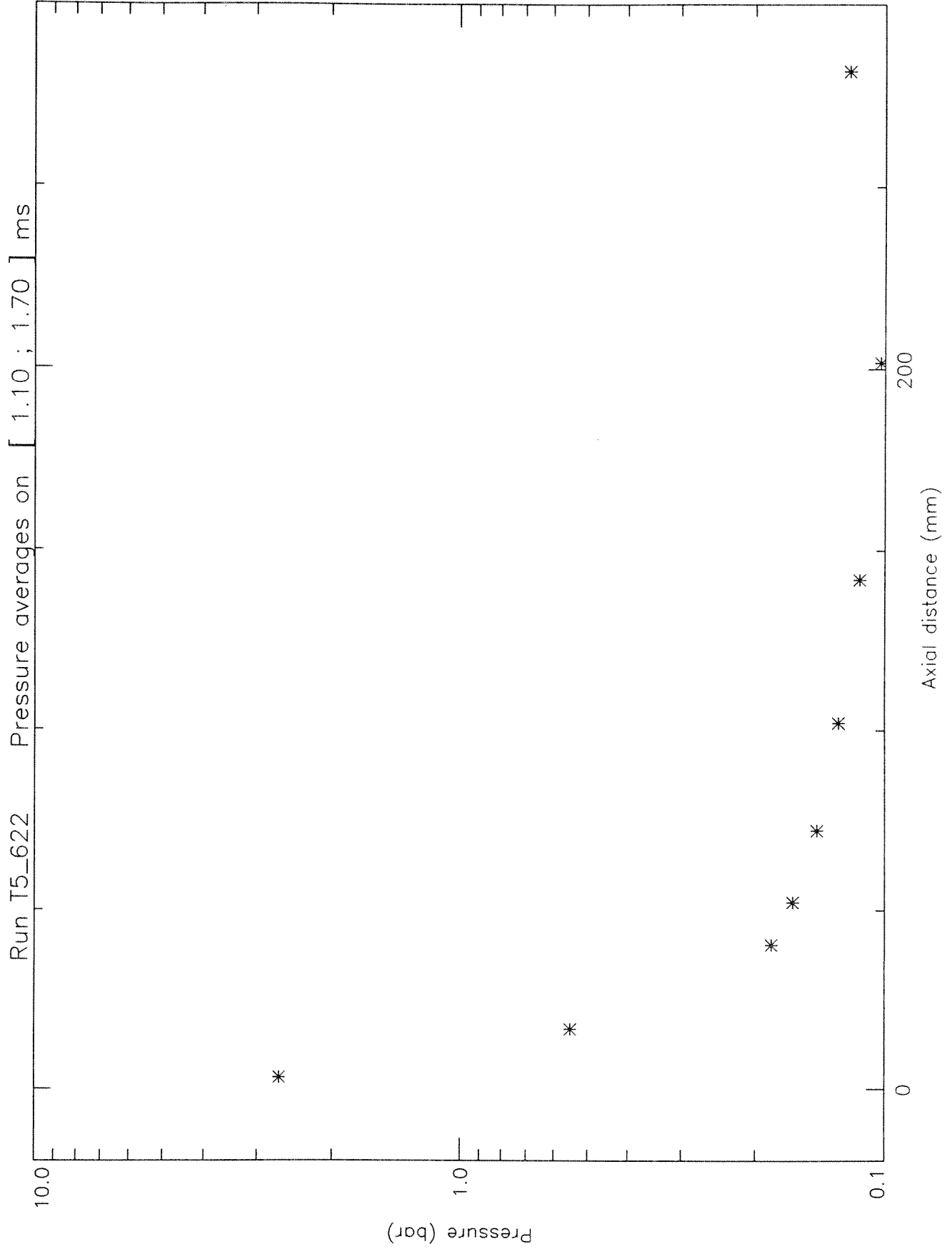
Run T5_622 Channel 2 Nozzle reservoir south

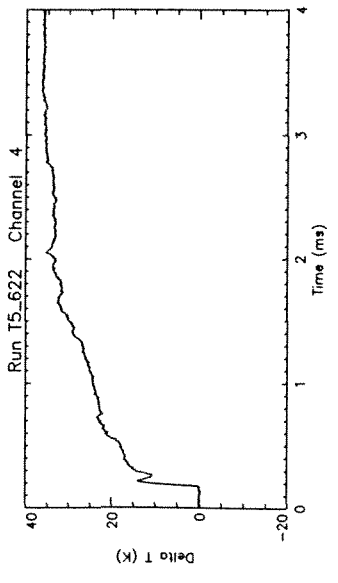
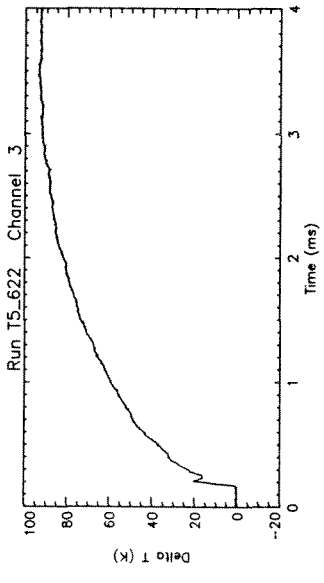
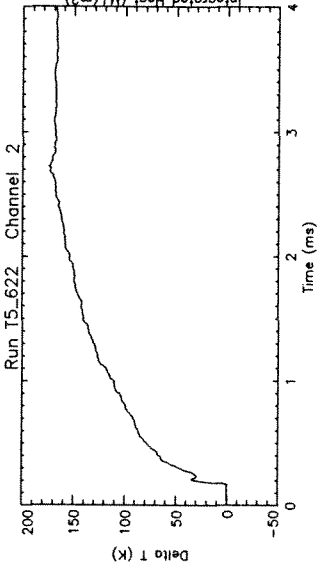
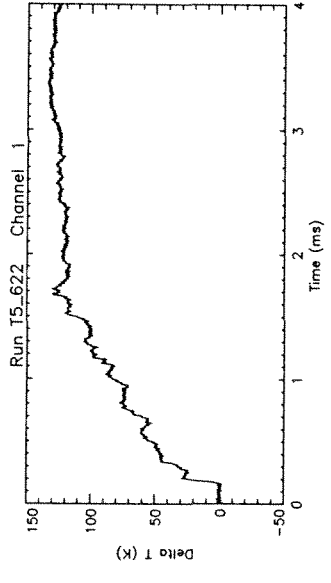
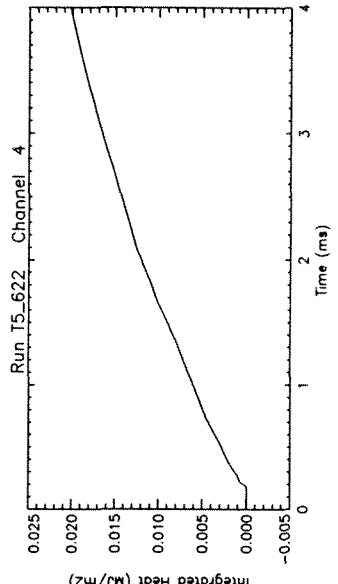
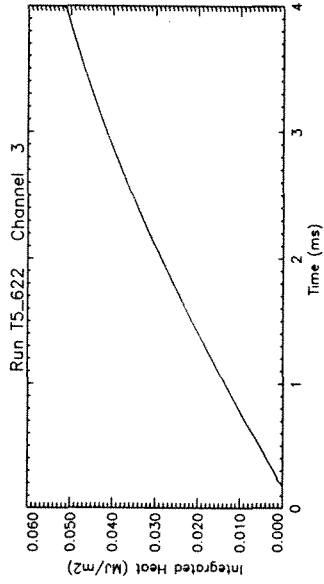
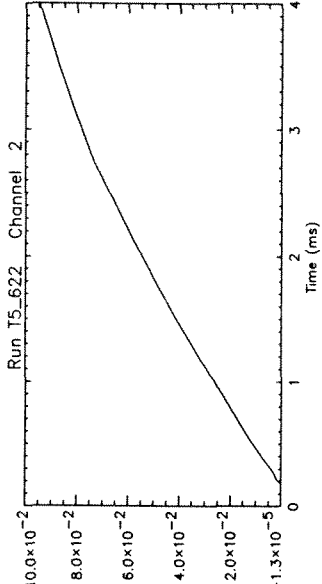
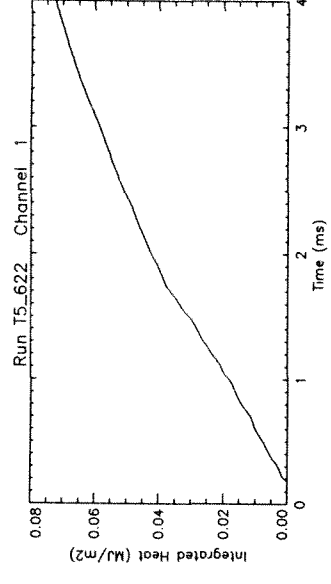
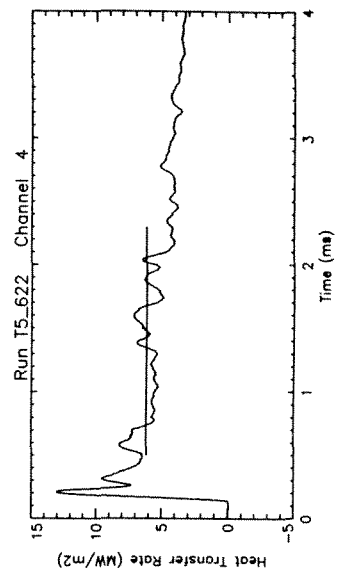
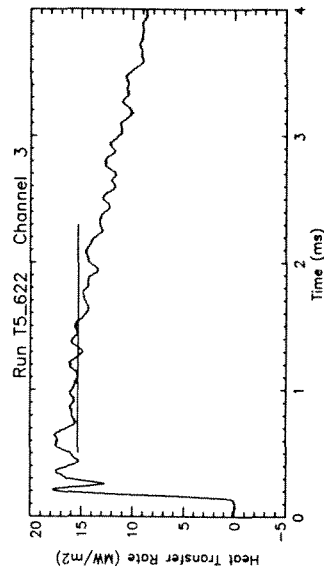
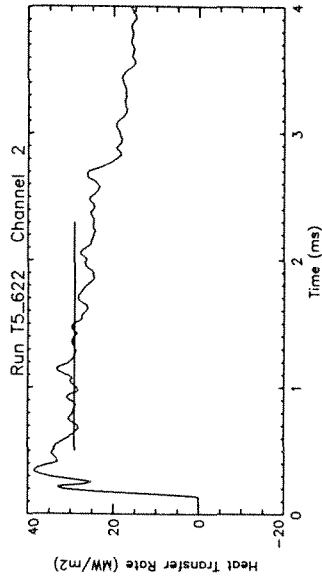
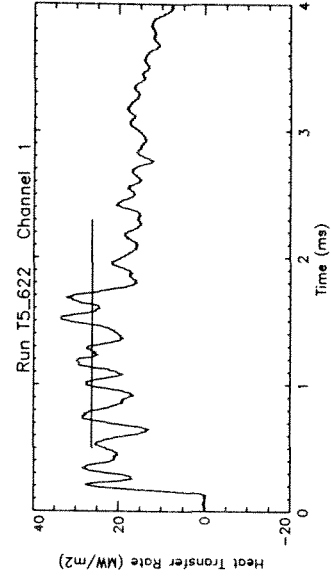


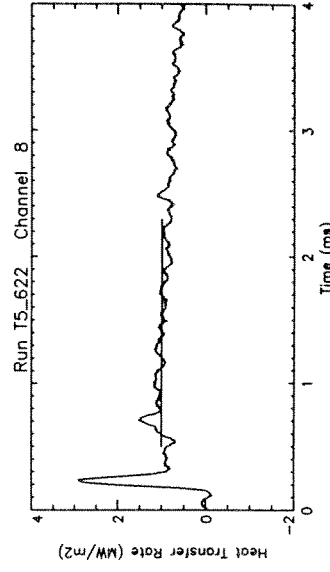
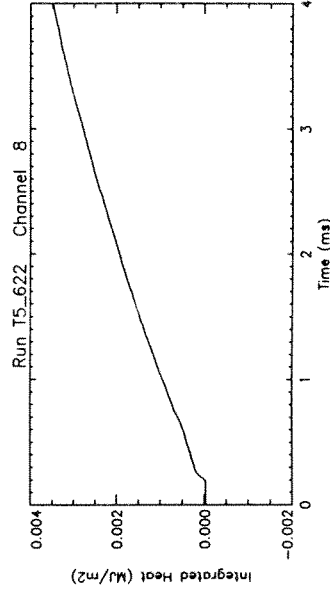
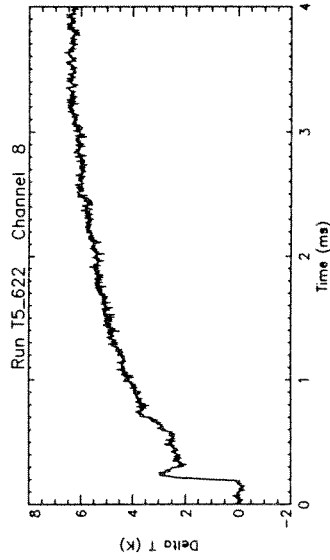
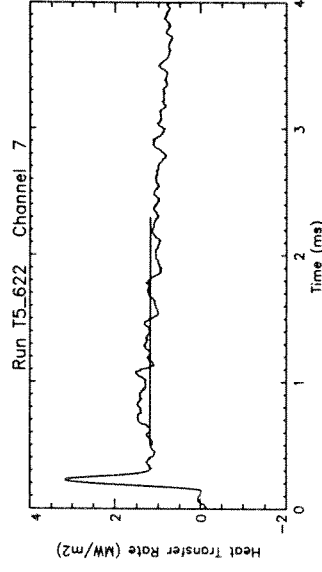
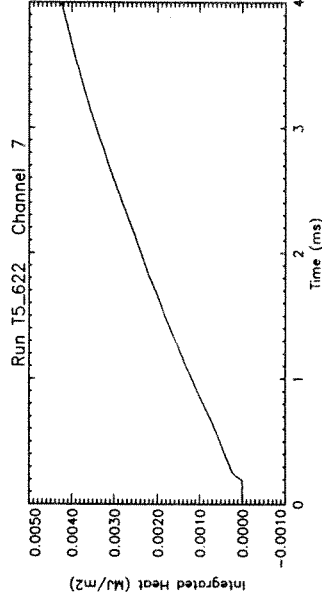
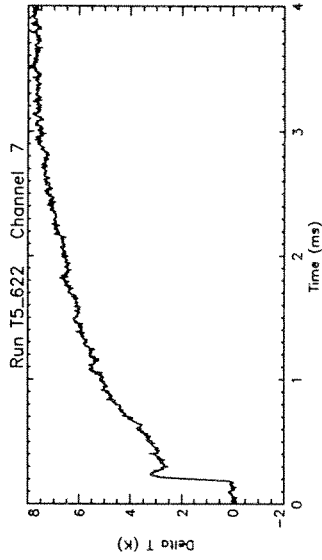
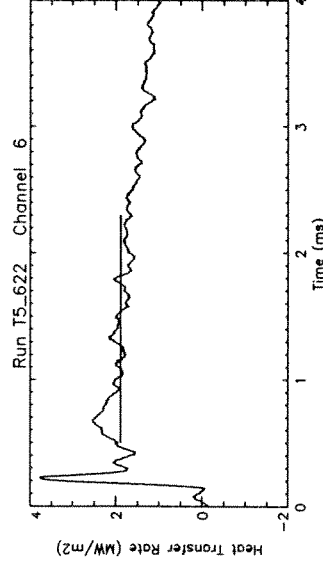
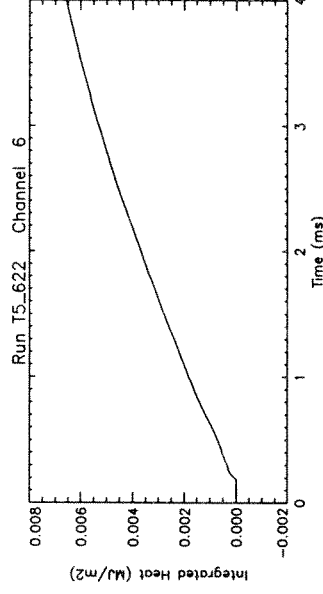
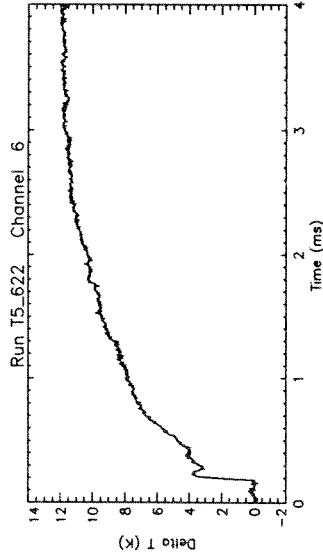
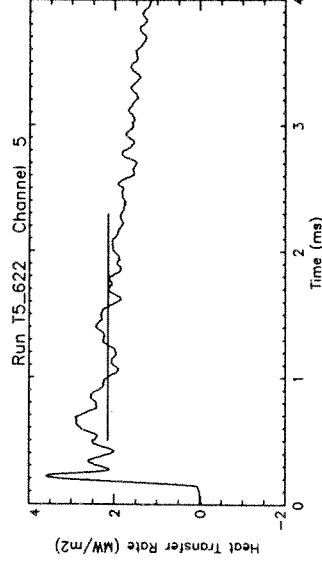
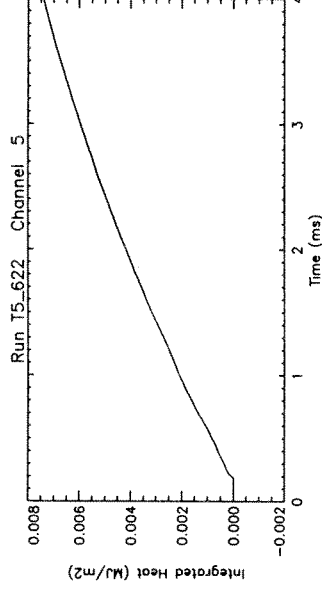
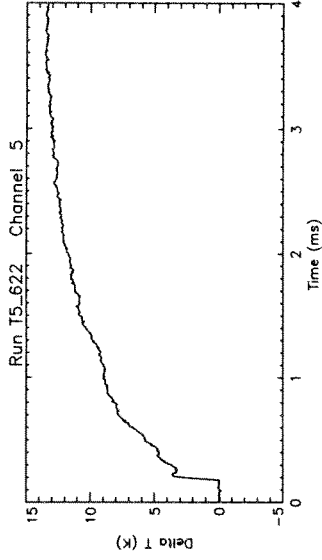


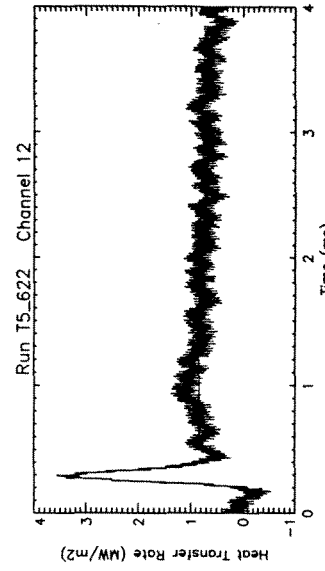
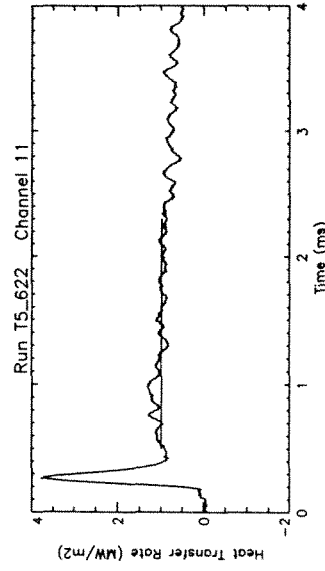
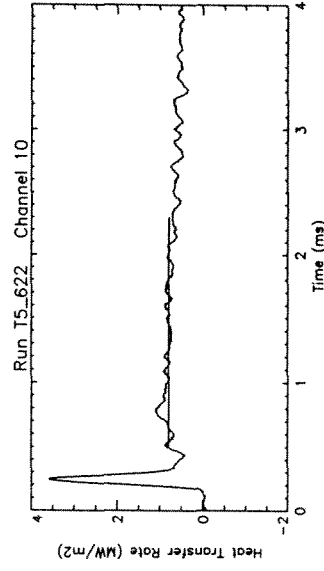
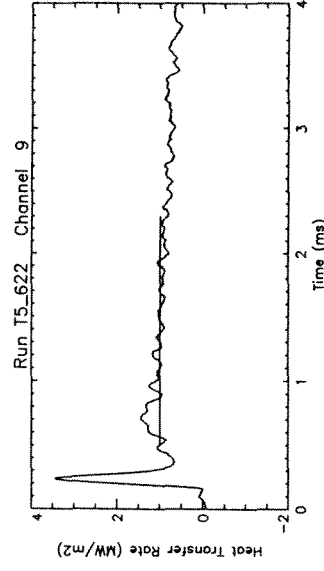
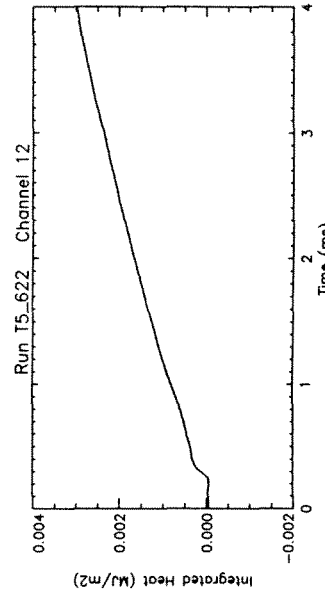
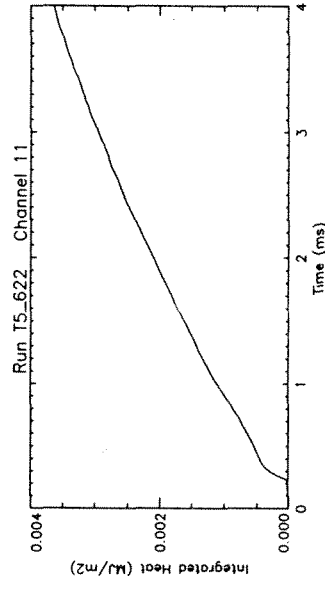
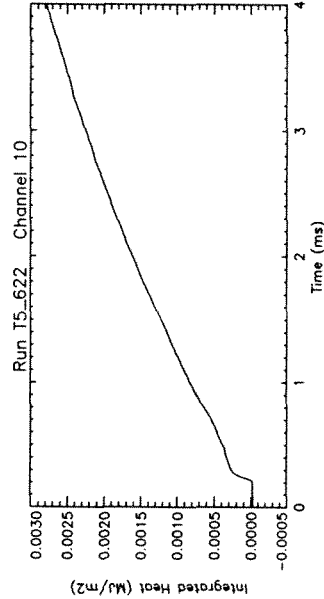
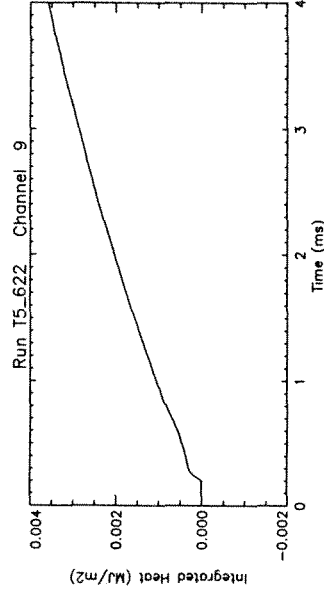
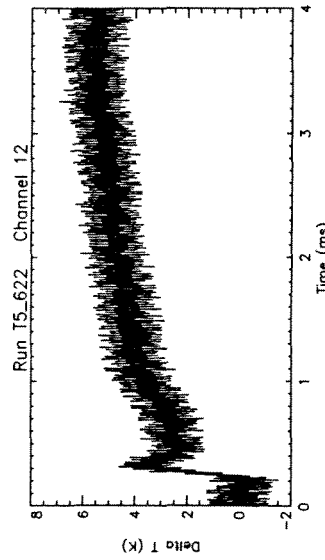
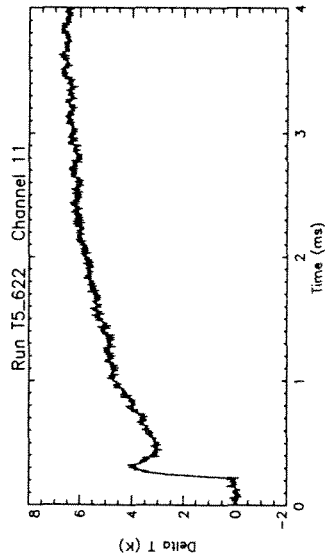
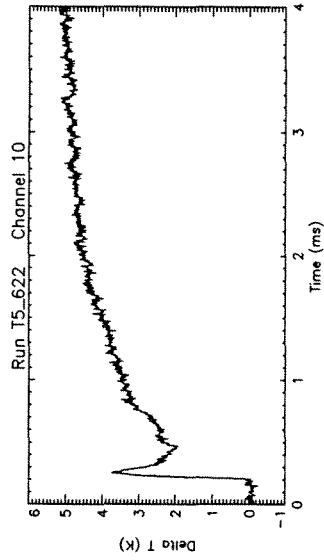
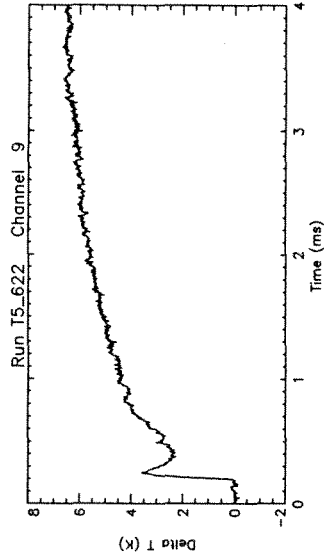


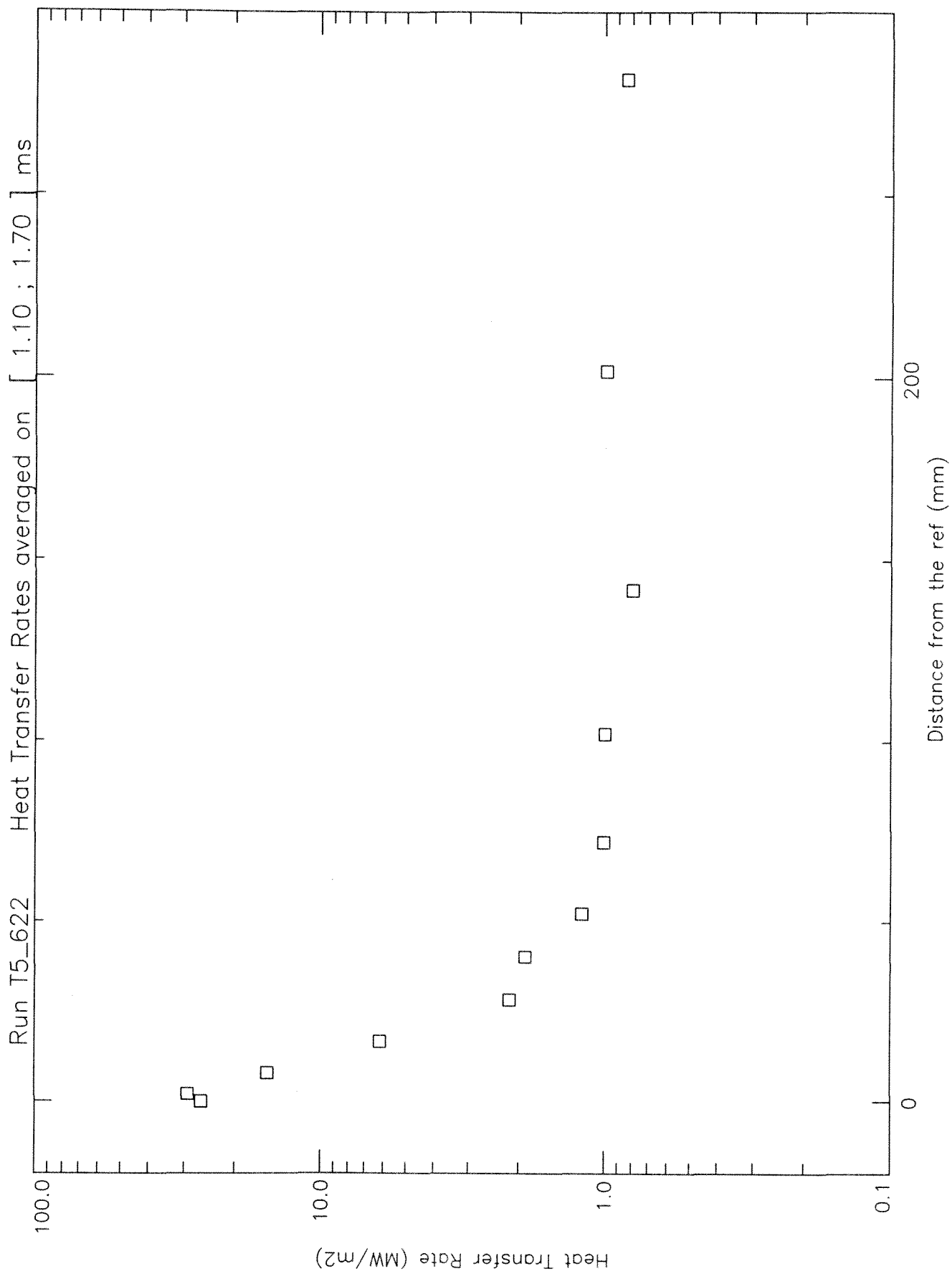












Run # 622

Pressure averages around 1.40 +/- 0.30 ms

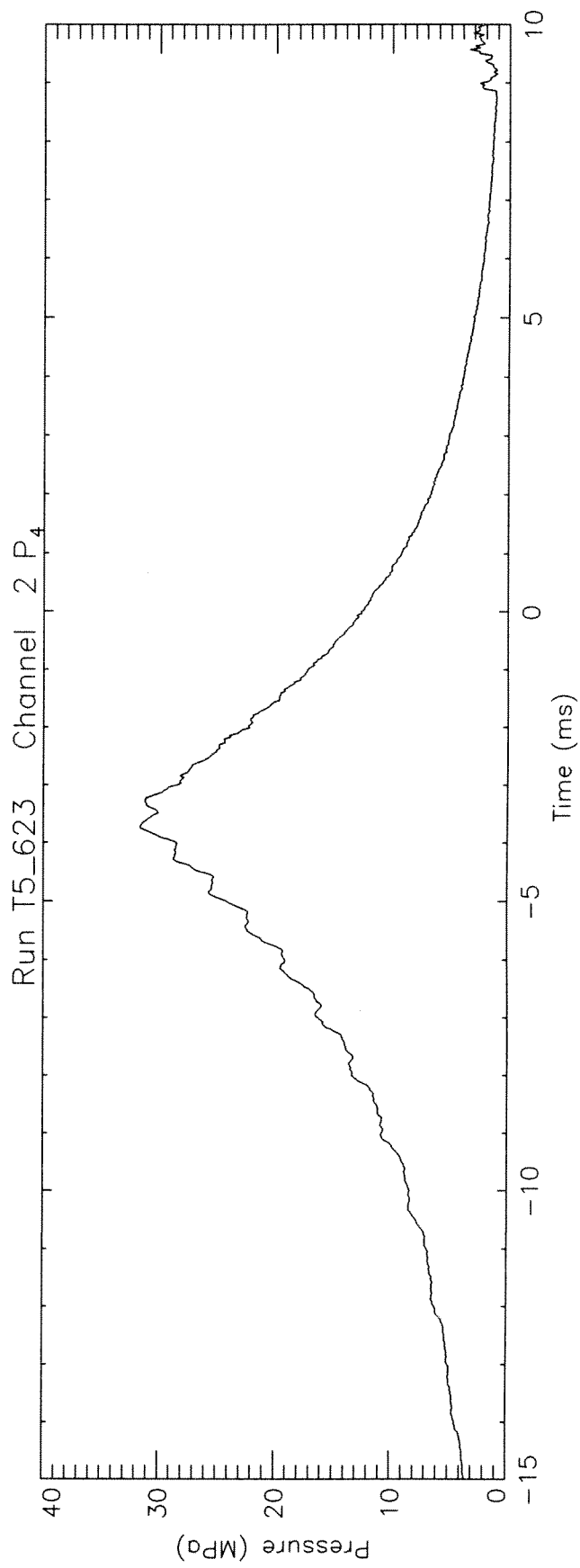
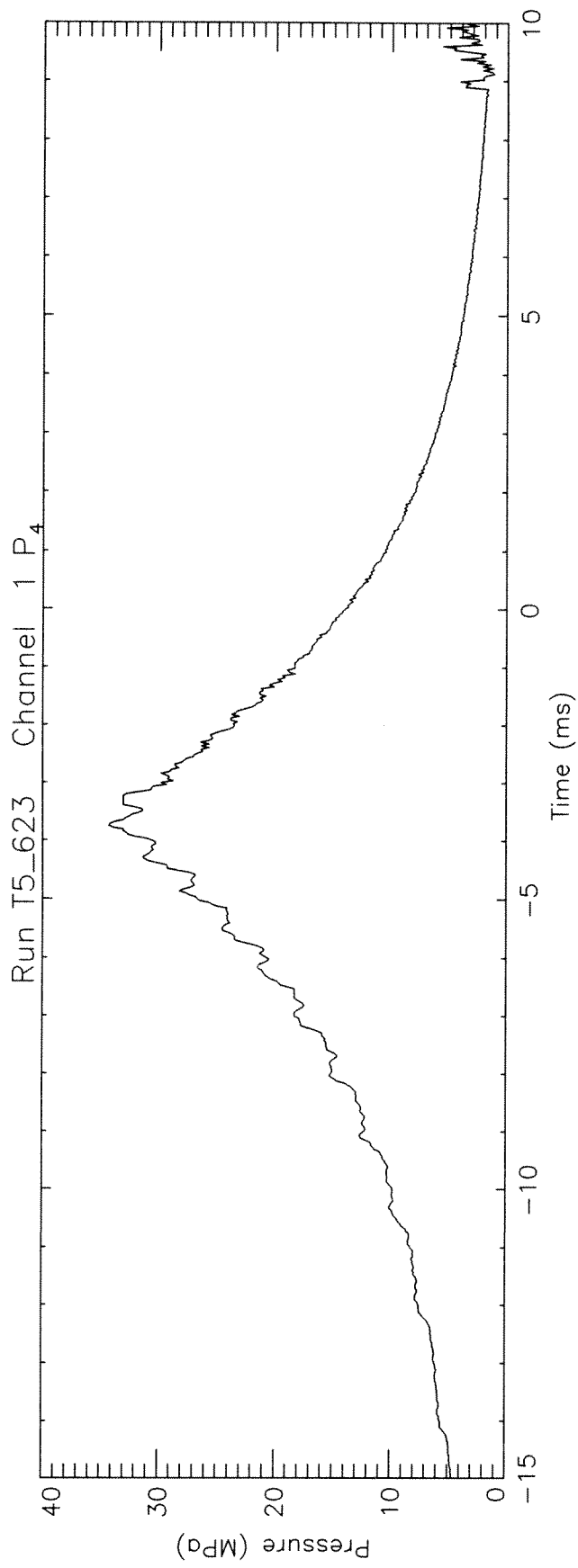
Smooth box = 2.

DA1	:	2.6566
DA2	:	0.5490
DA3	:	0.1832
DA4	:	0.1632
DA5	:	0.1435
DA6	:	0.1278
DA7	:	0.1143
DA8	:	0.1023
DA9	:	0.1208

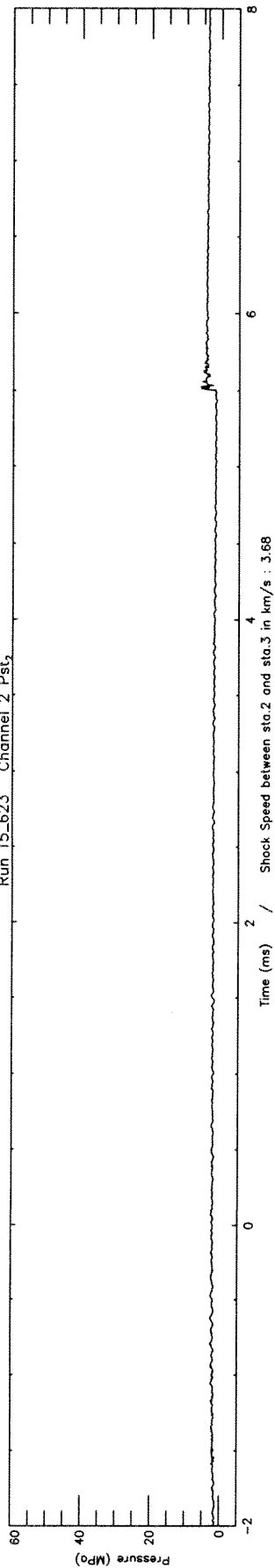
Run # 622

Heat Transfer Rates (in MW/m²)
averaged around 1.40 +/- 0.30 ms

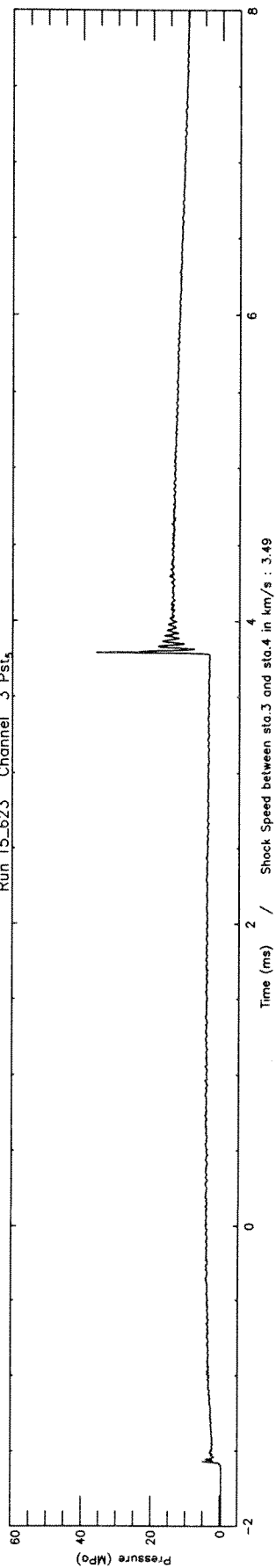
MT 1 :	26.1964
MT 2 :	29.1350
MT 3 :	15.3295
MT 4 :	6.1587
MT 5 :	2.1548
MT 6 :	1.8968
MT 7 :	1.1968
MT 8 :	1.0066
MT 9 :	0.9969
MT10 :	0.7928
MT11 :	0.9870
MT12 :	0.8356



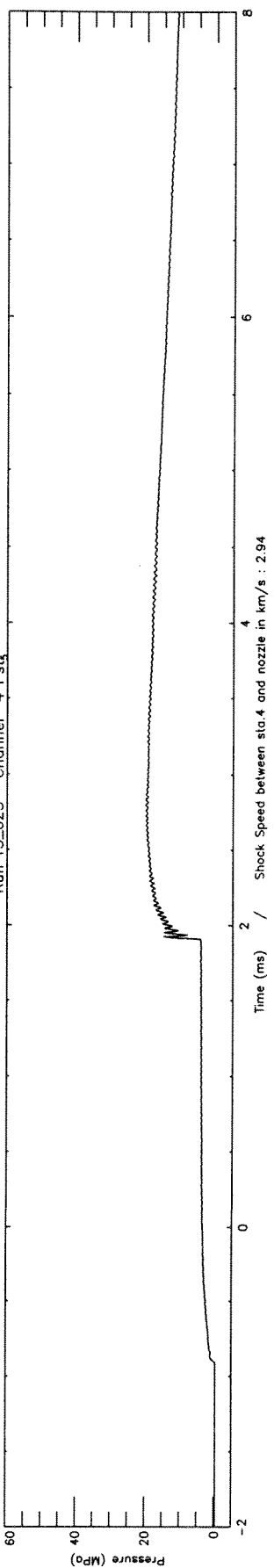
Run T5_623 Channel 2 Pst₂



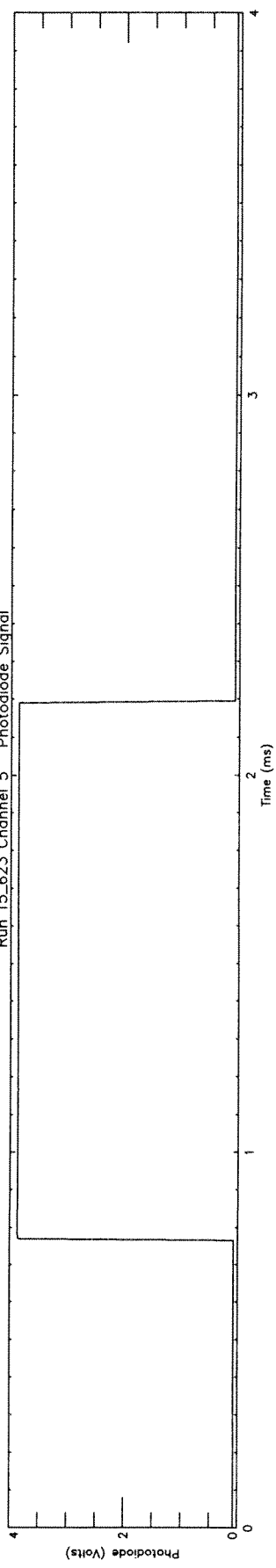
Run T5_623 Channel 3 Pst₃



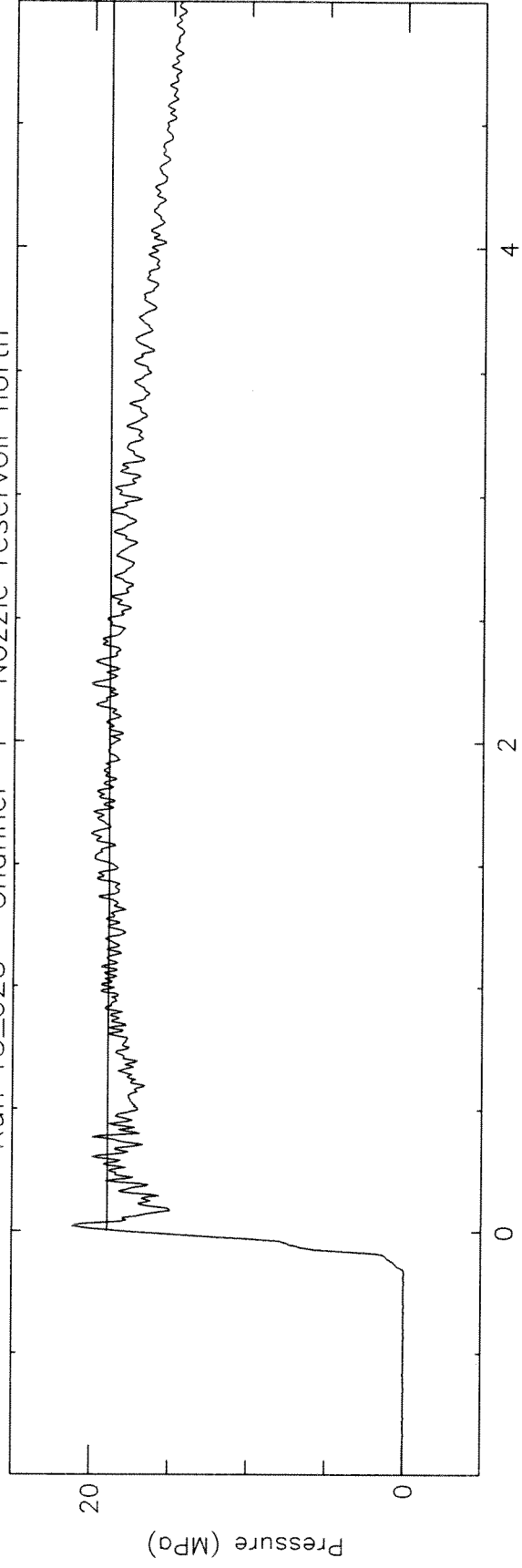
Run T5_623 Channel 4 Pst₄



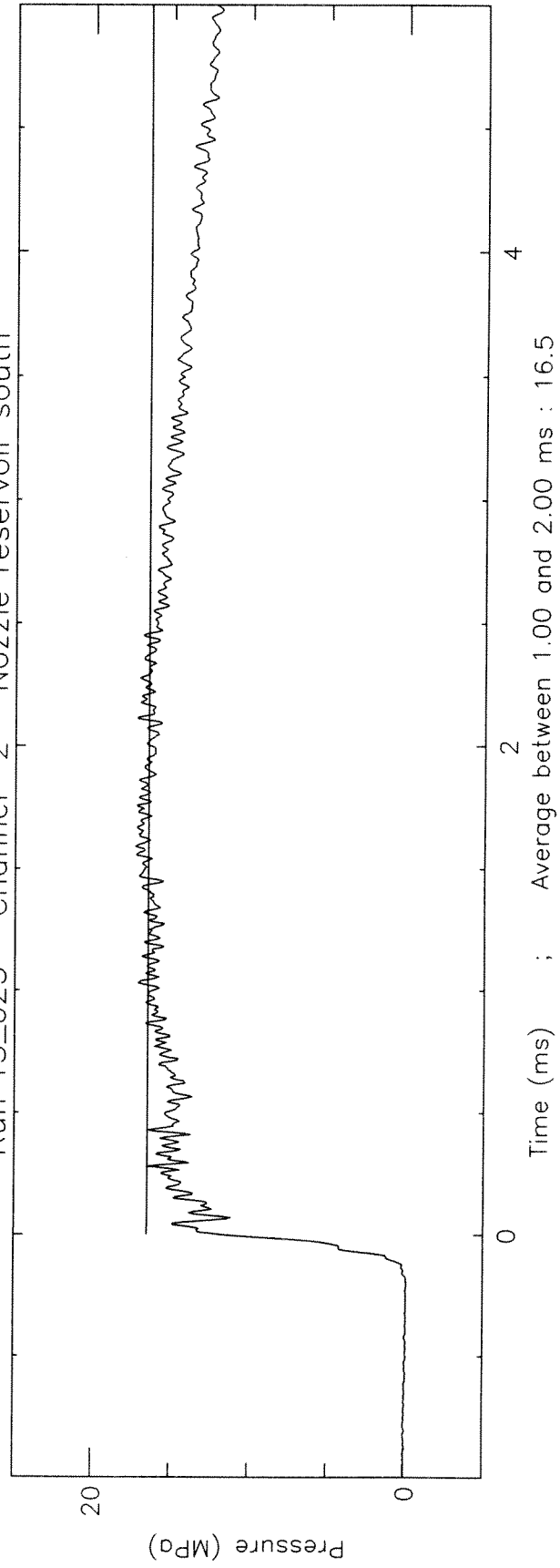
Run T5_623 Channel 5 Photodiode Signal



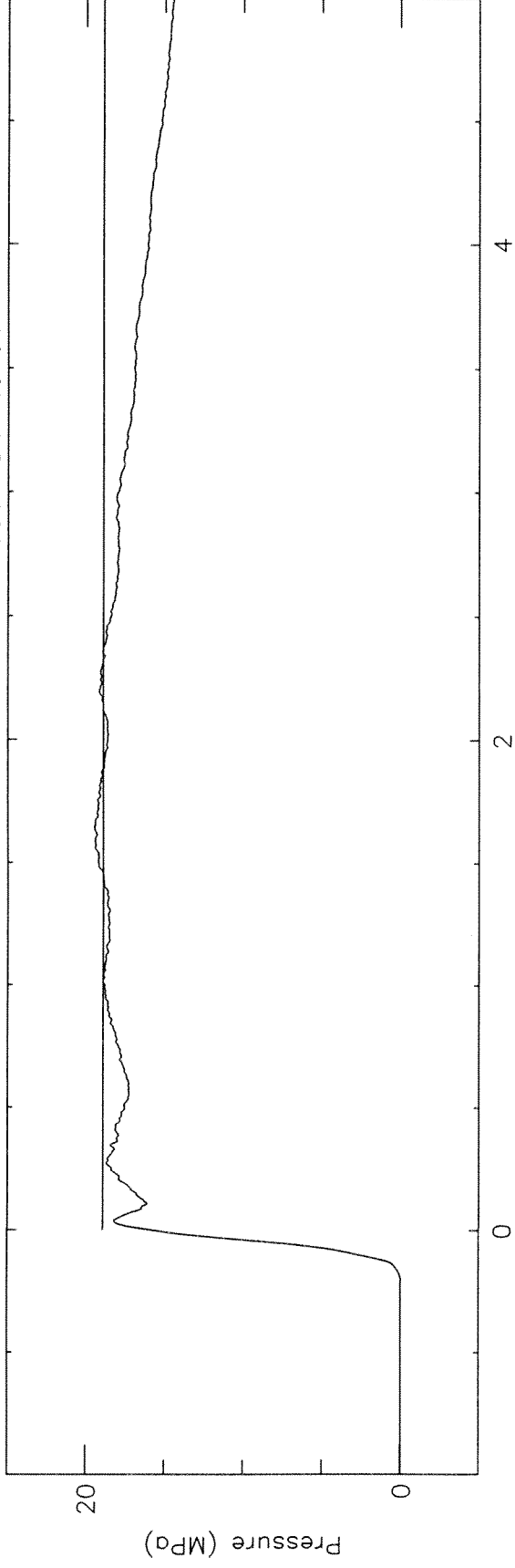
Run T5_623 Channel 1 Nozzle reservoir north



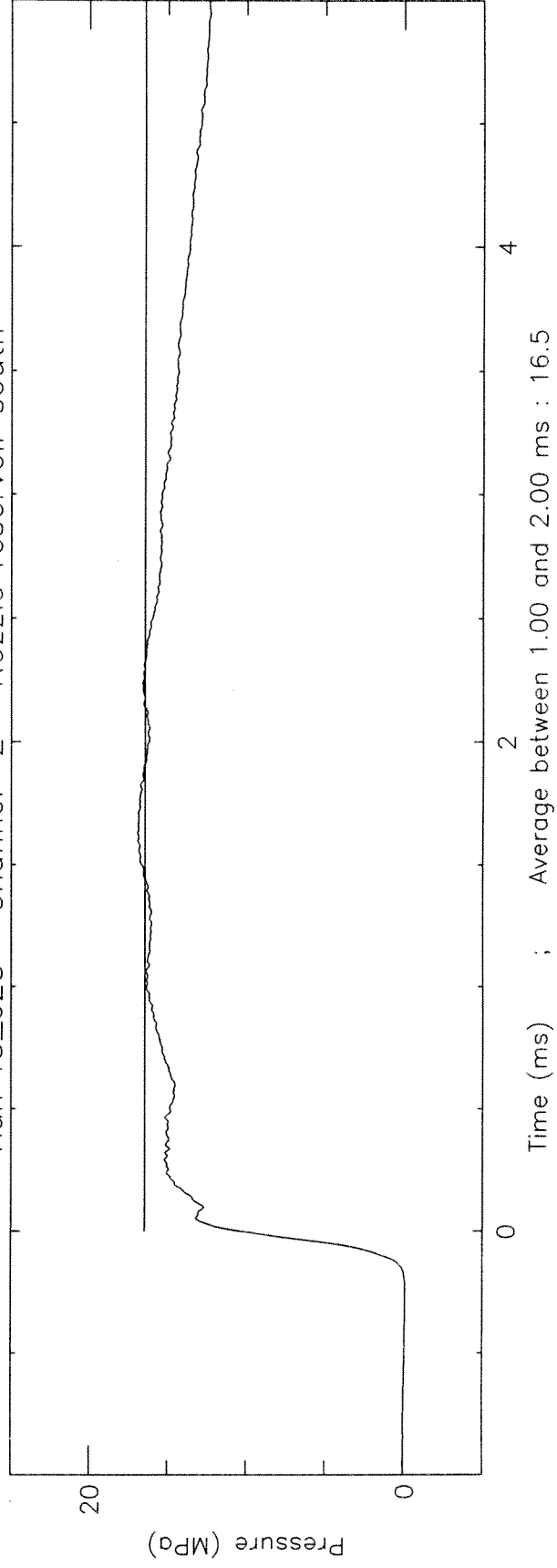
Run T5_623 Channel 2 Nozzle reservoir south

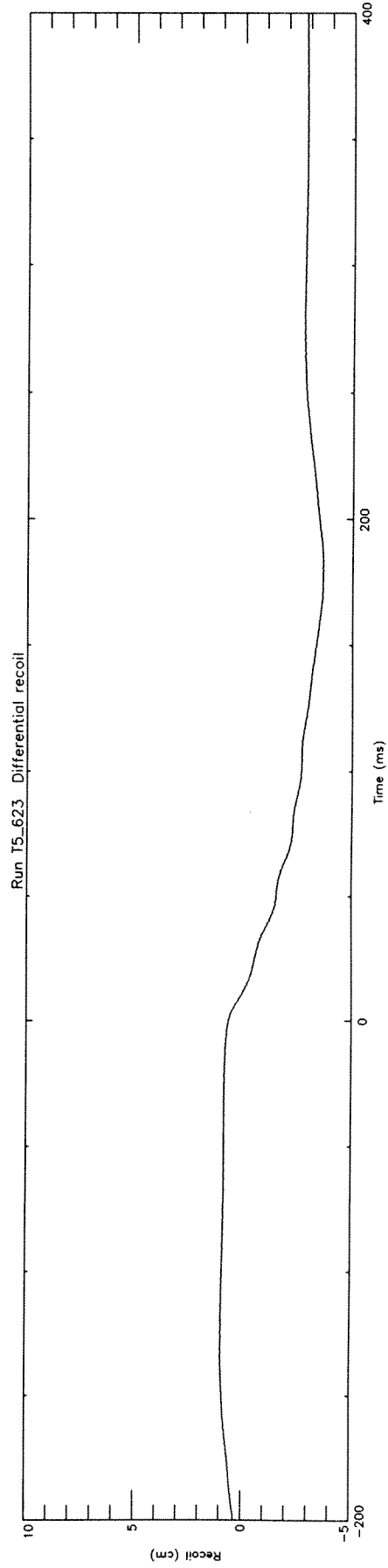
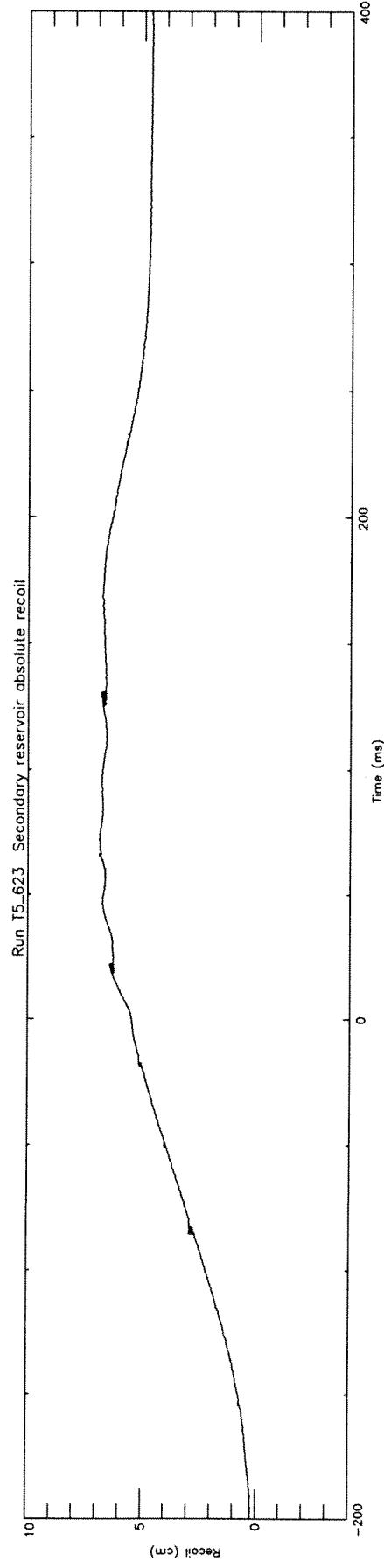
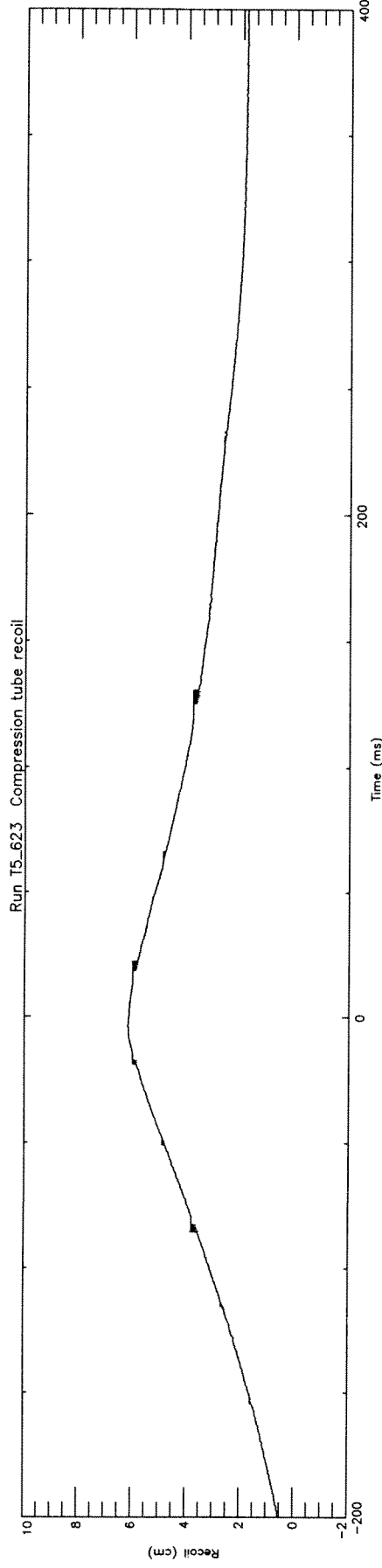


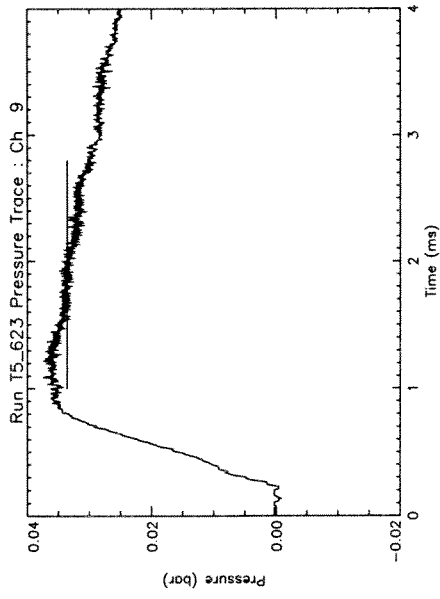
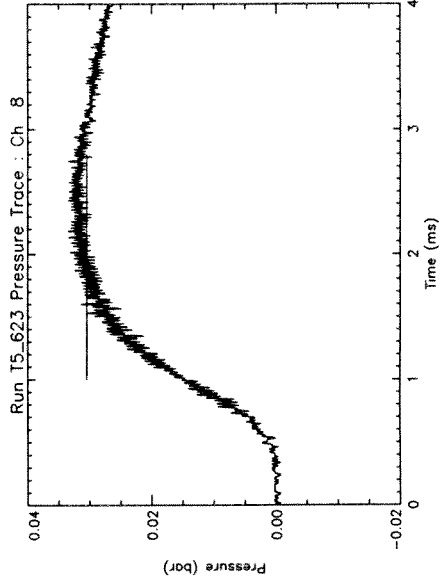
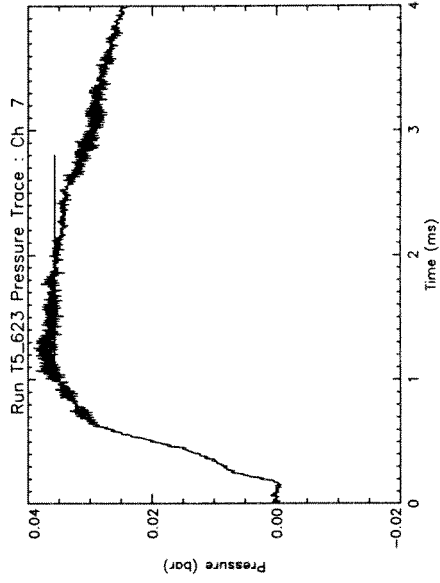
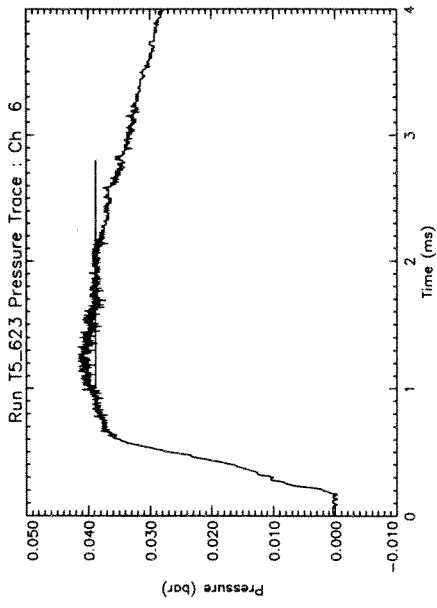
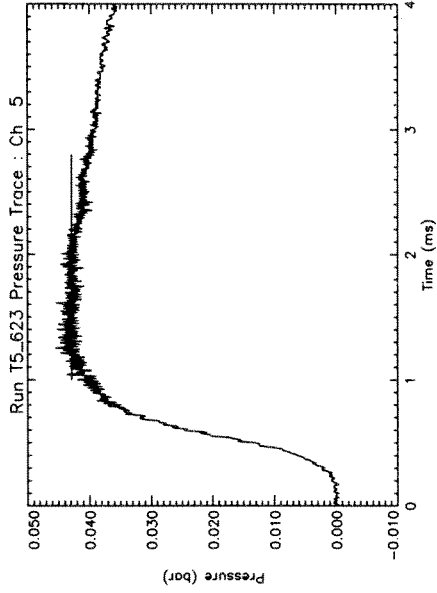
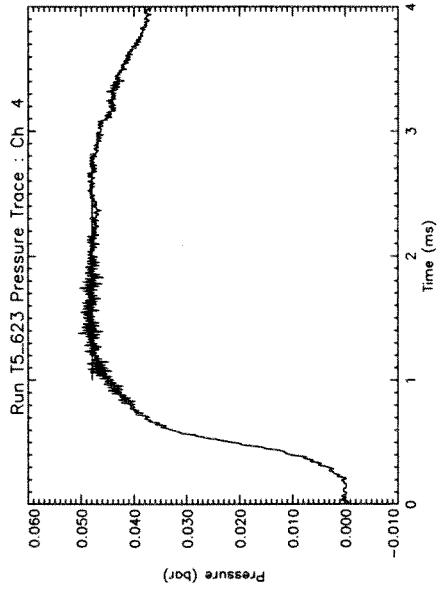
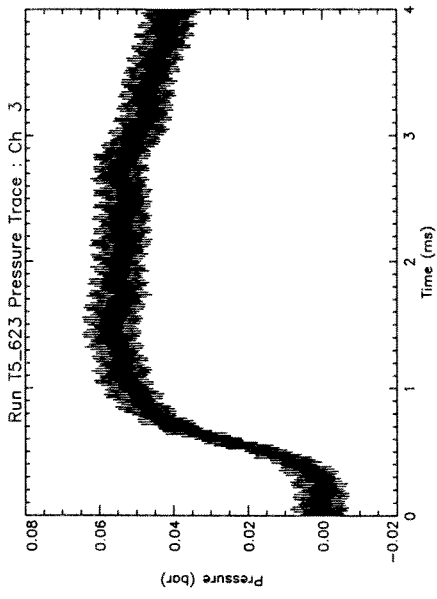
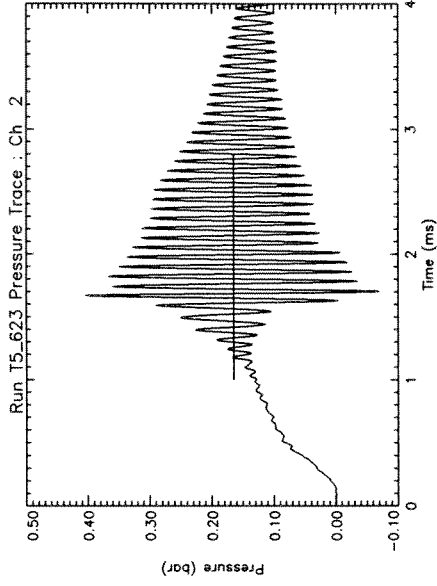
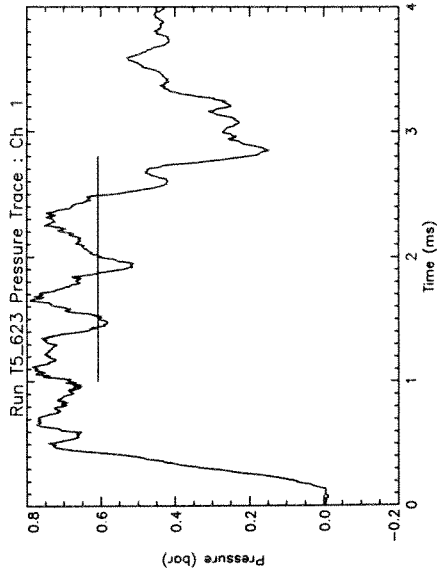
Run T5_623 Channel 1 Nozzle reservoir north

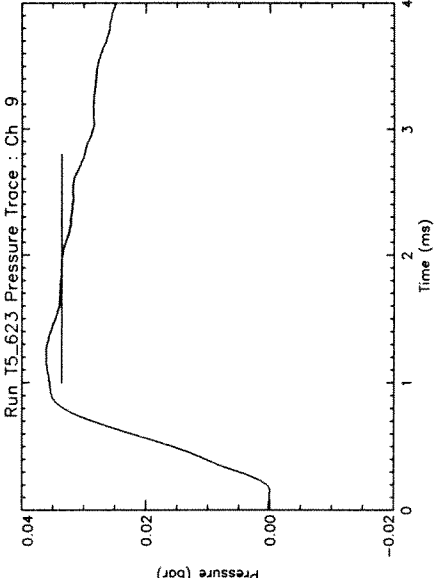
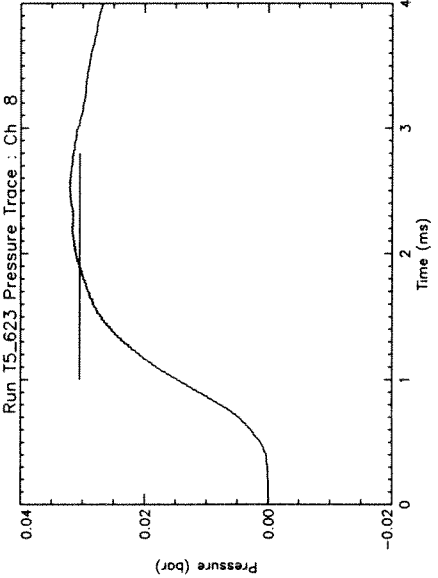
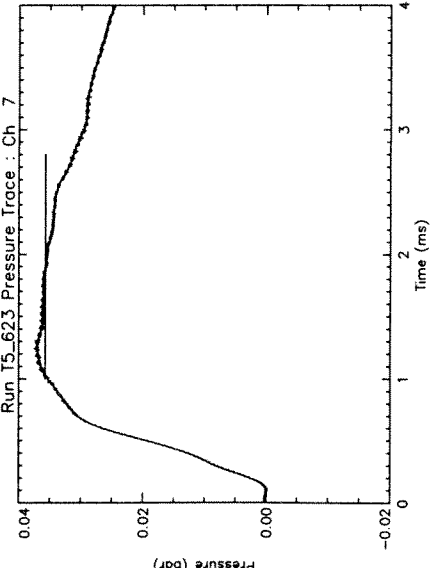
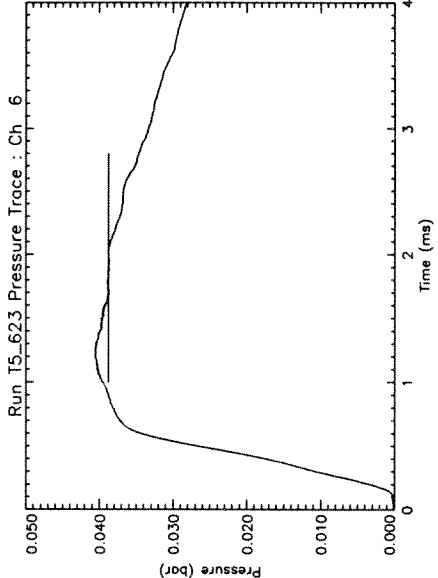
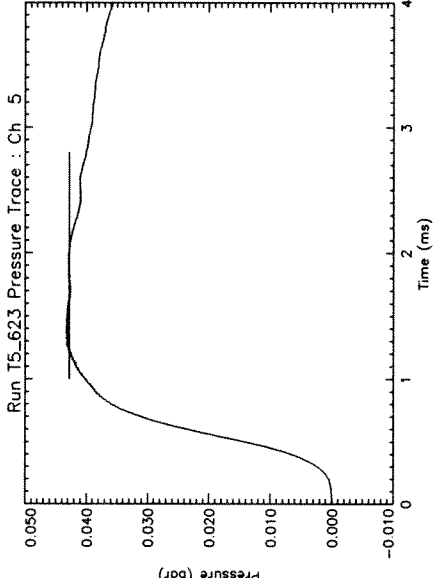
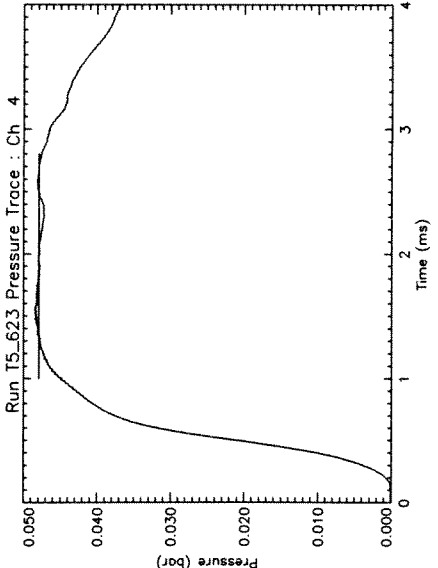
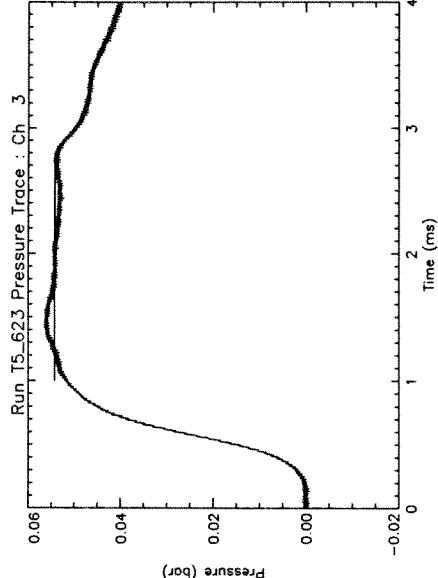
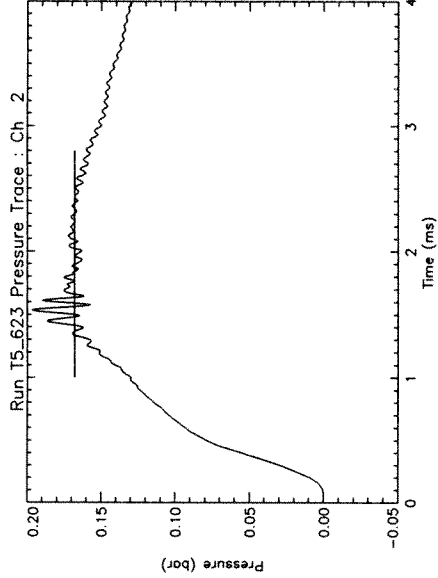
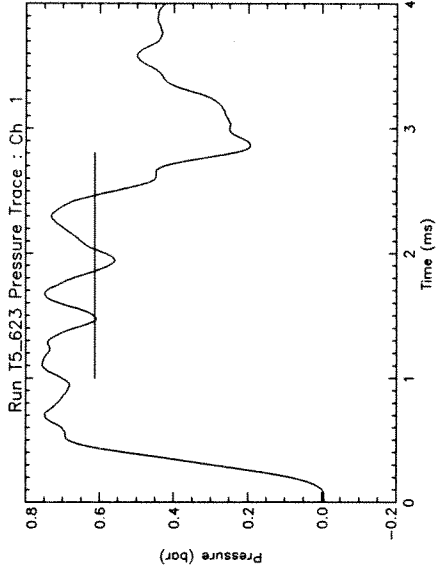


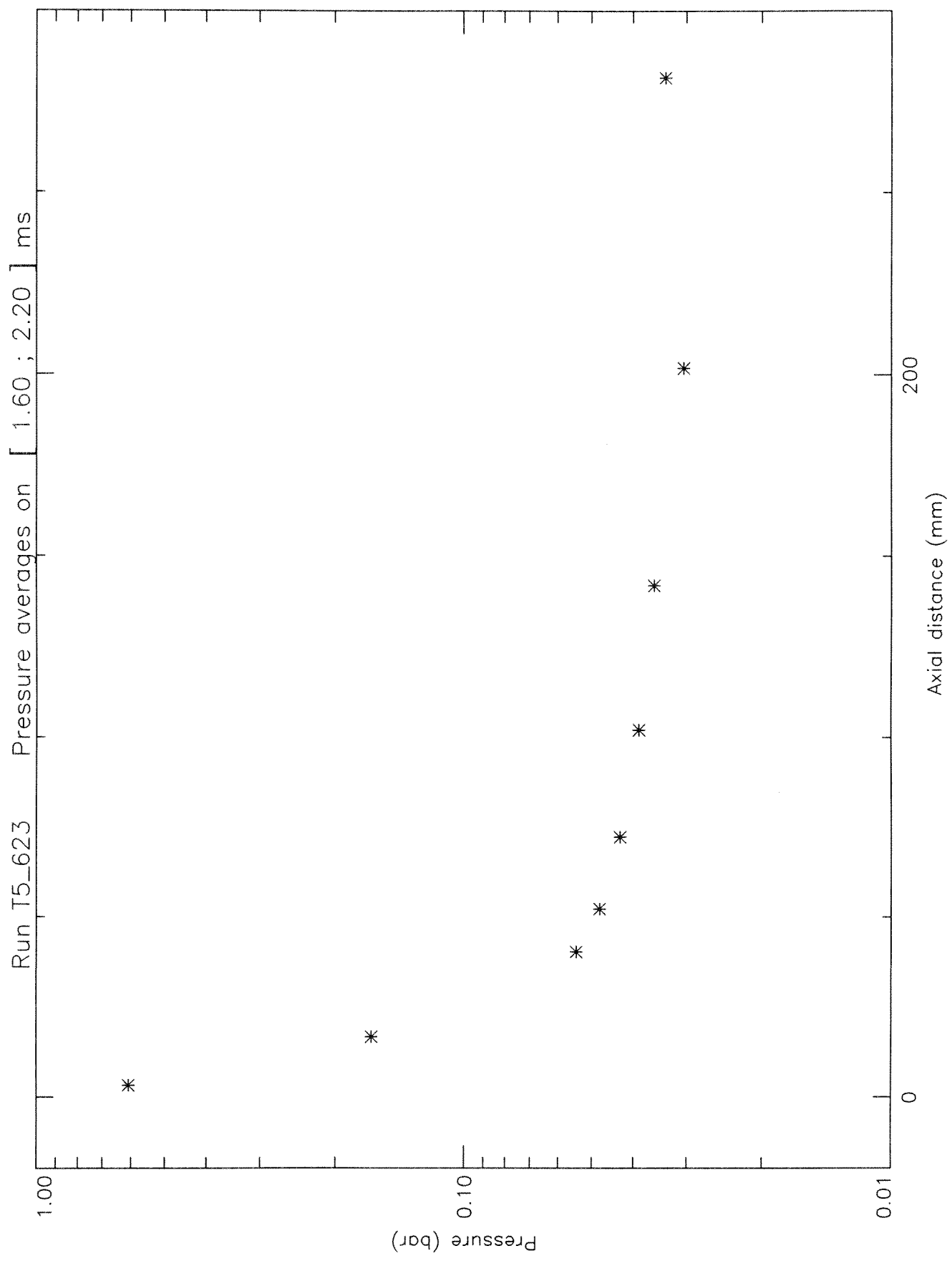
Run T5_623 Channel 2 Nozzle reservoir south

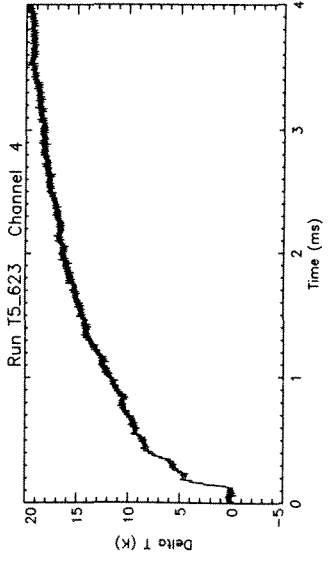
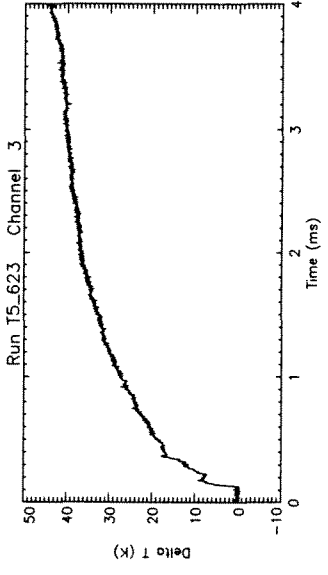
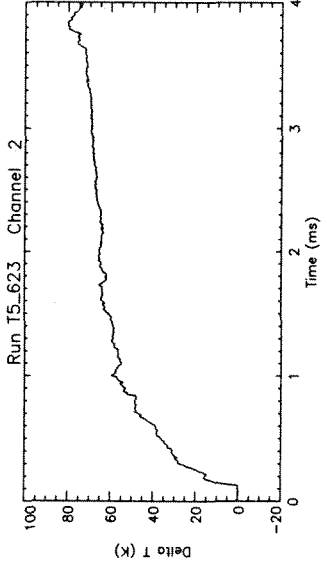
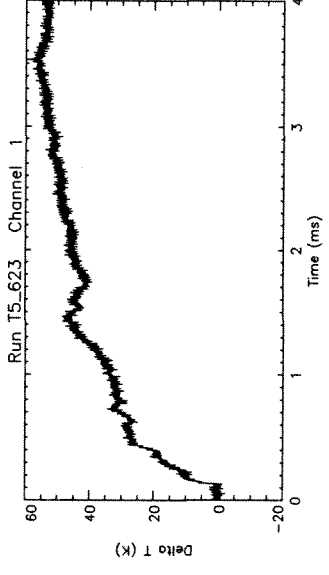
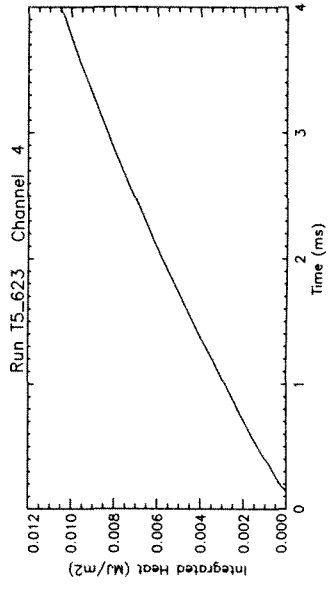
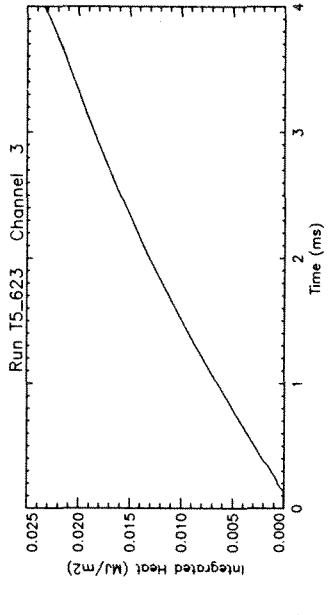
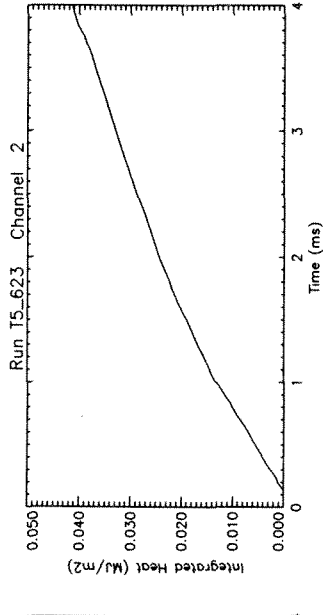
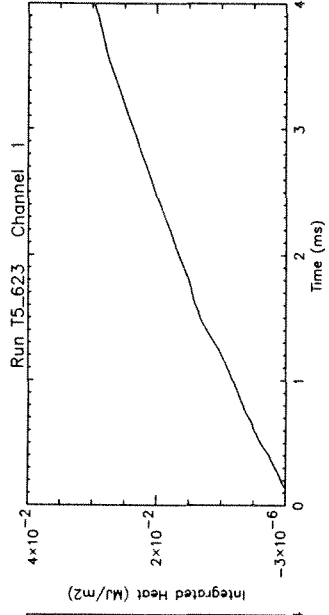
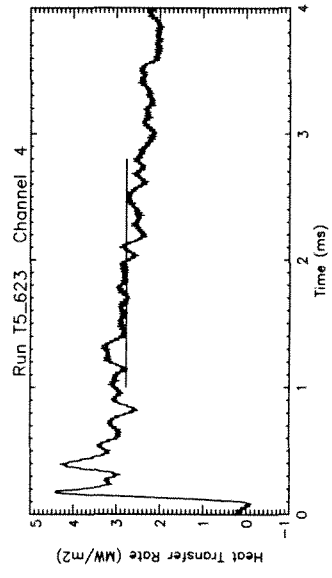
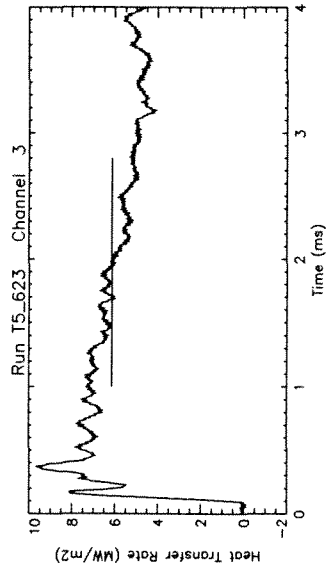
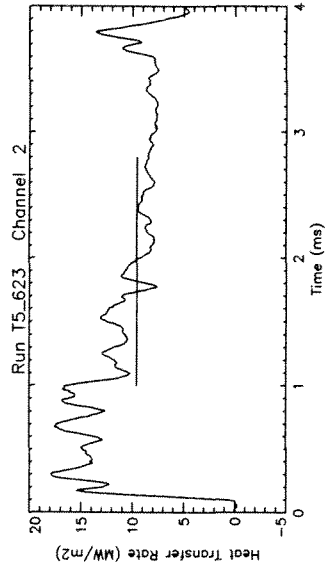
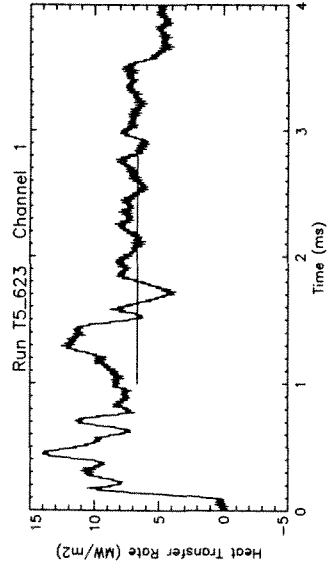


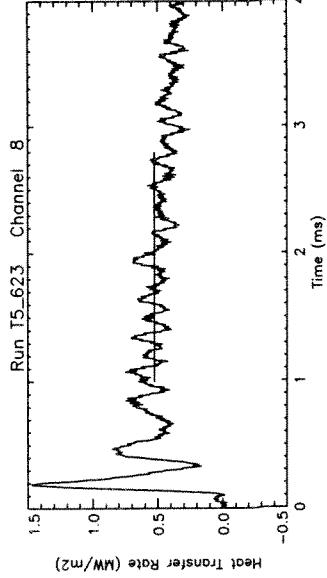
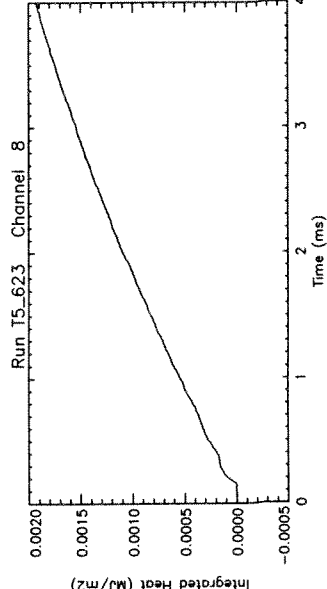
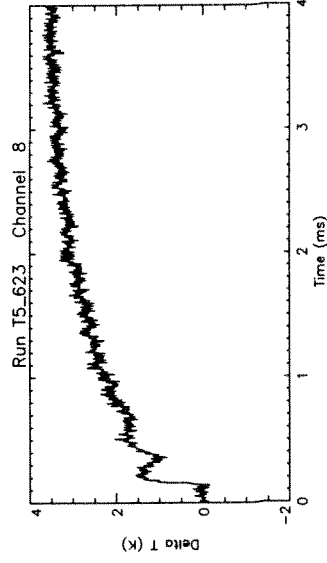
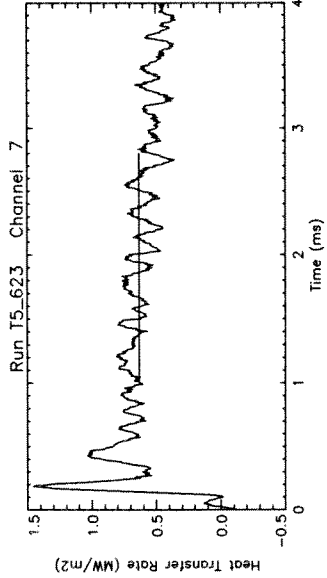
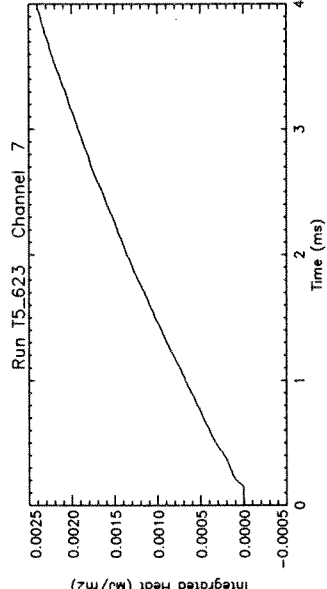
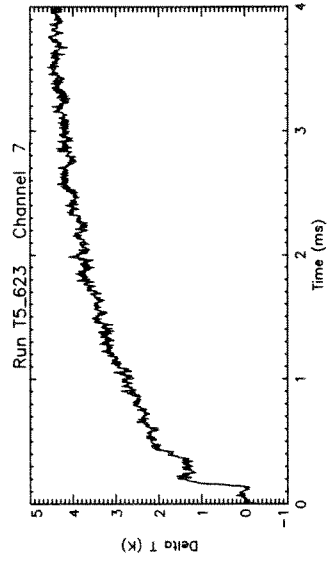
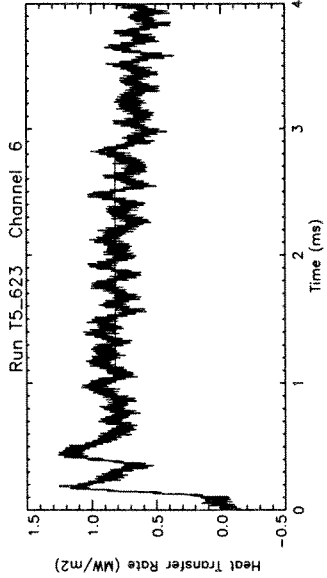
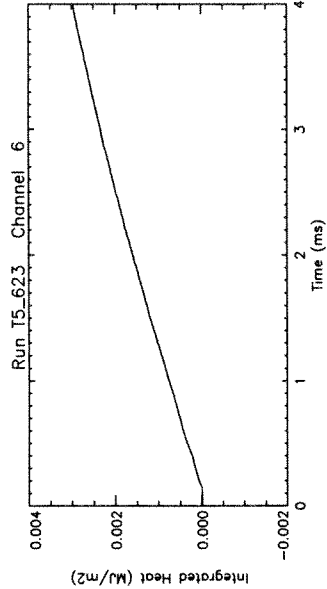
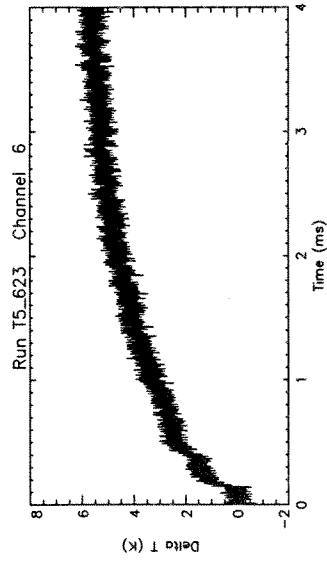
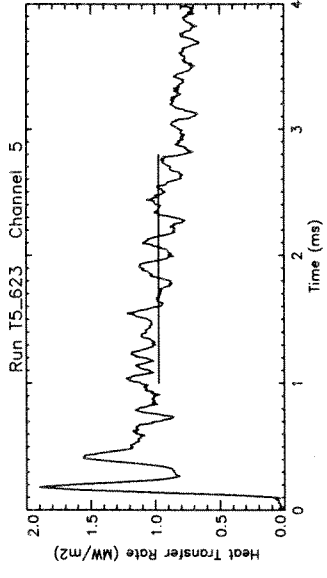
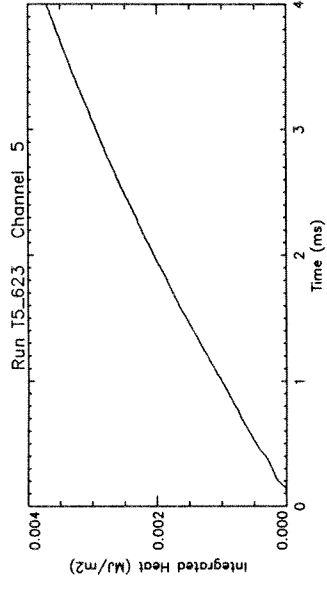
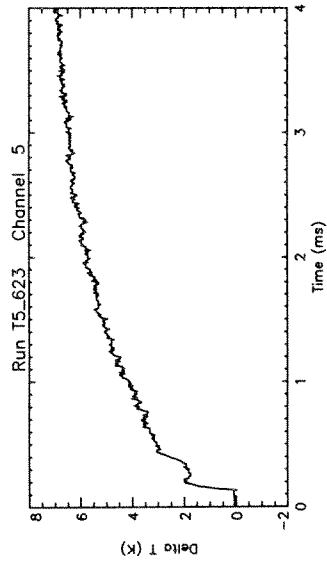


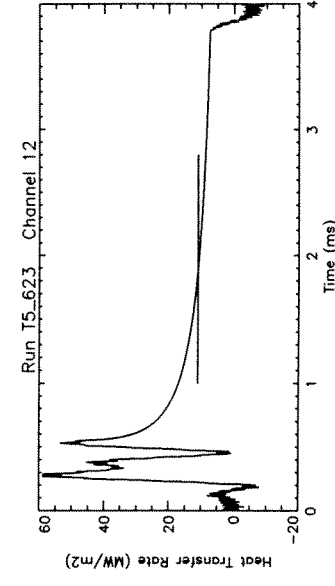
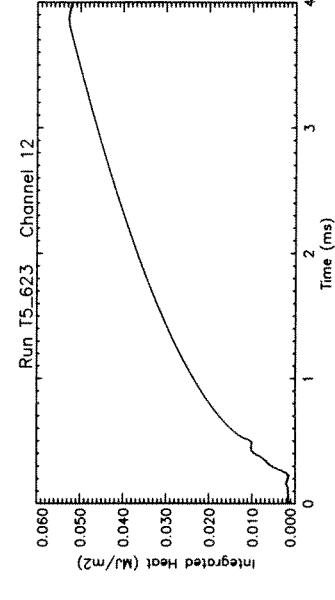
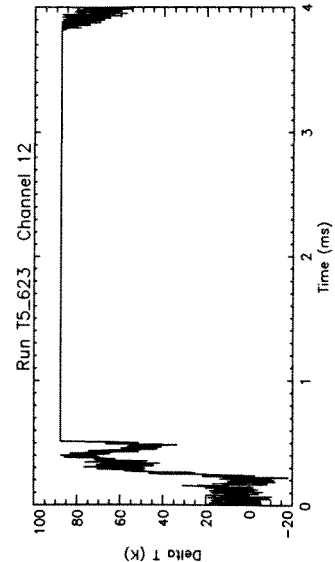
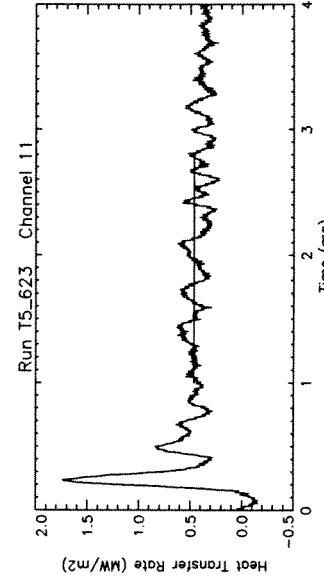
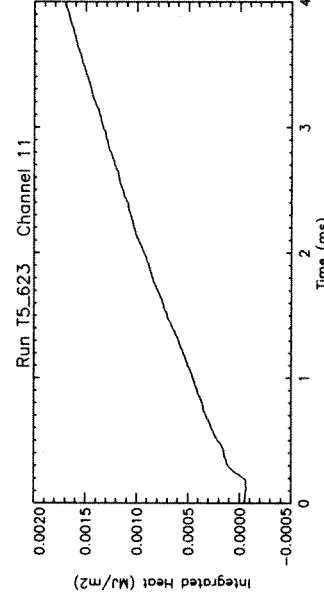
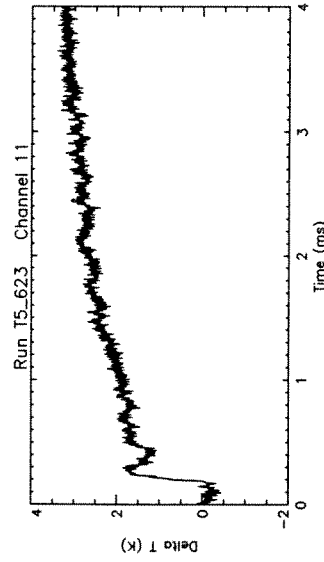
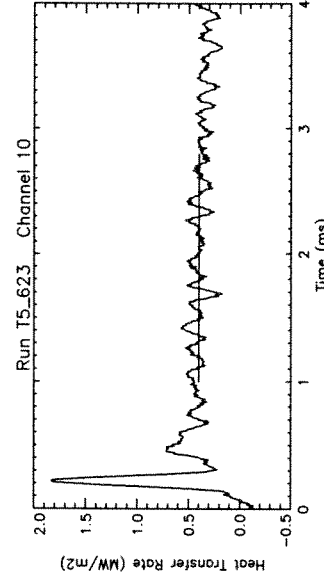
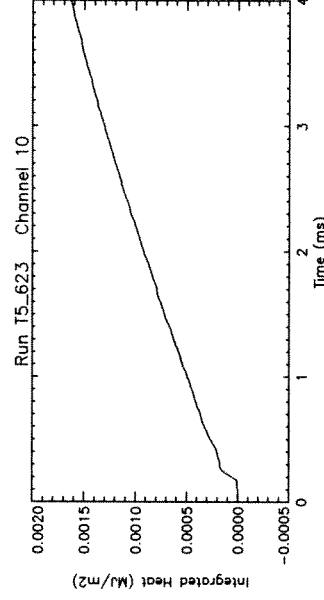
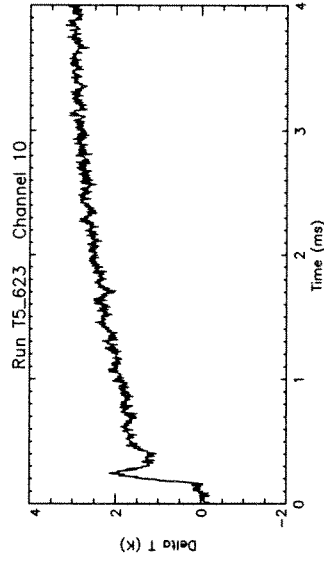
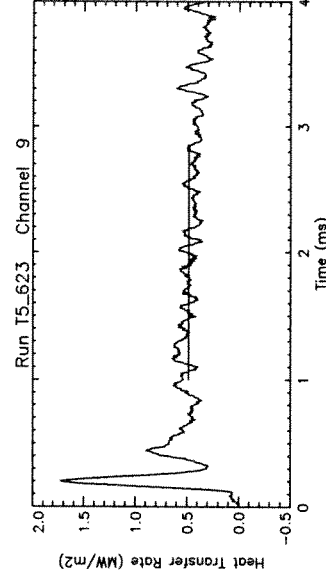
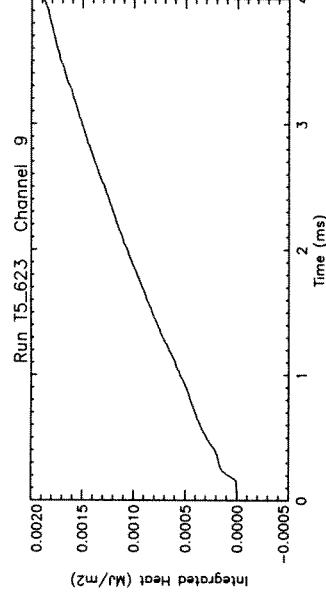
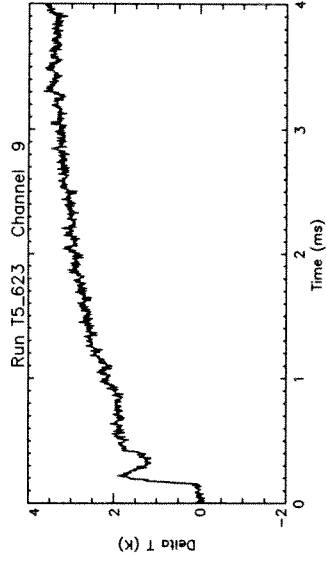


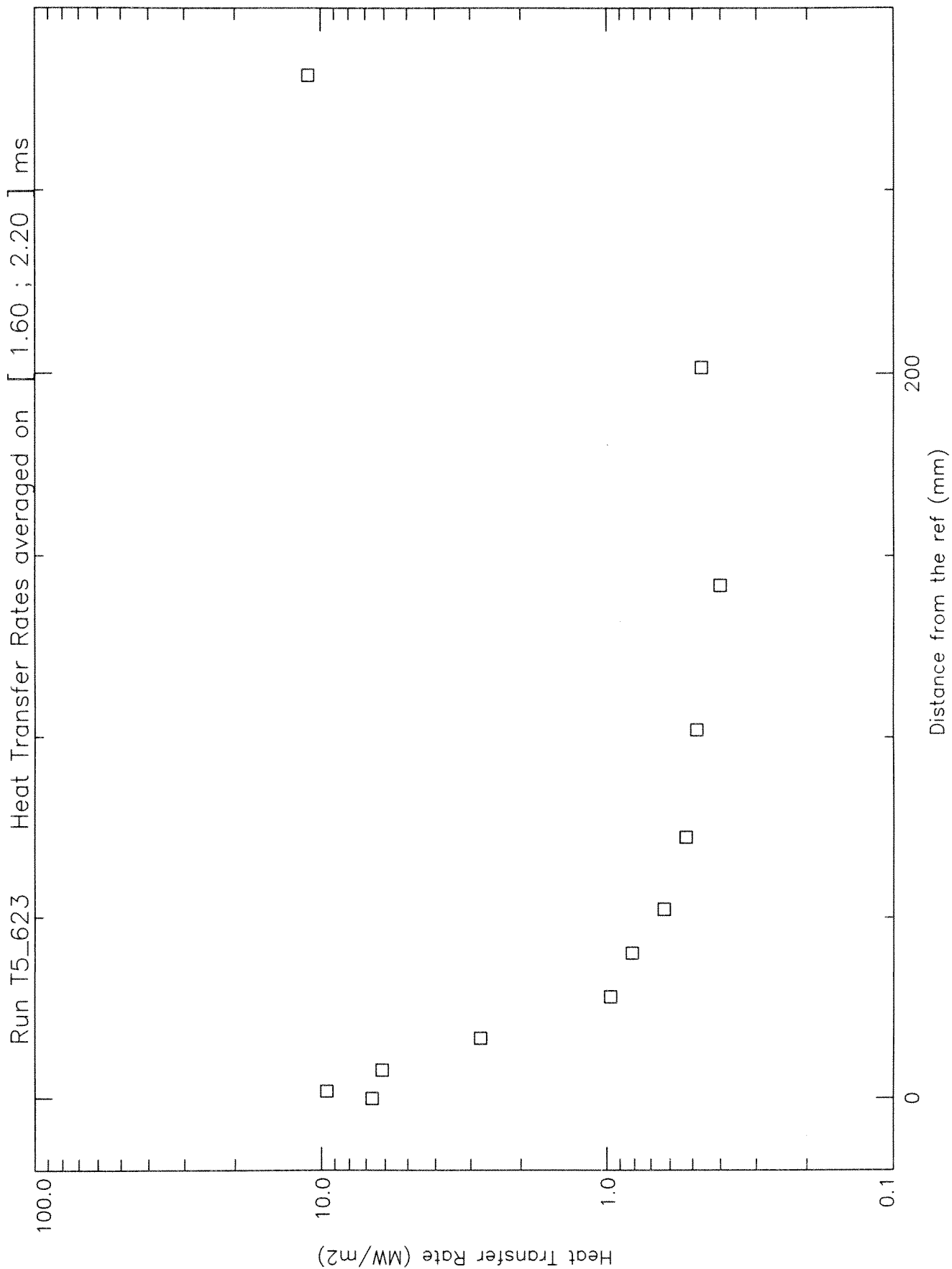












Run # 623

Pressure averages around 1.90 +/- 0.30 ms

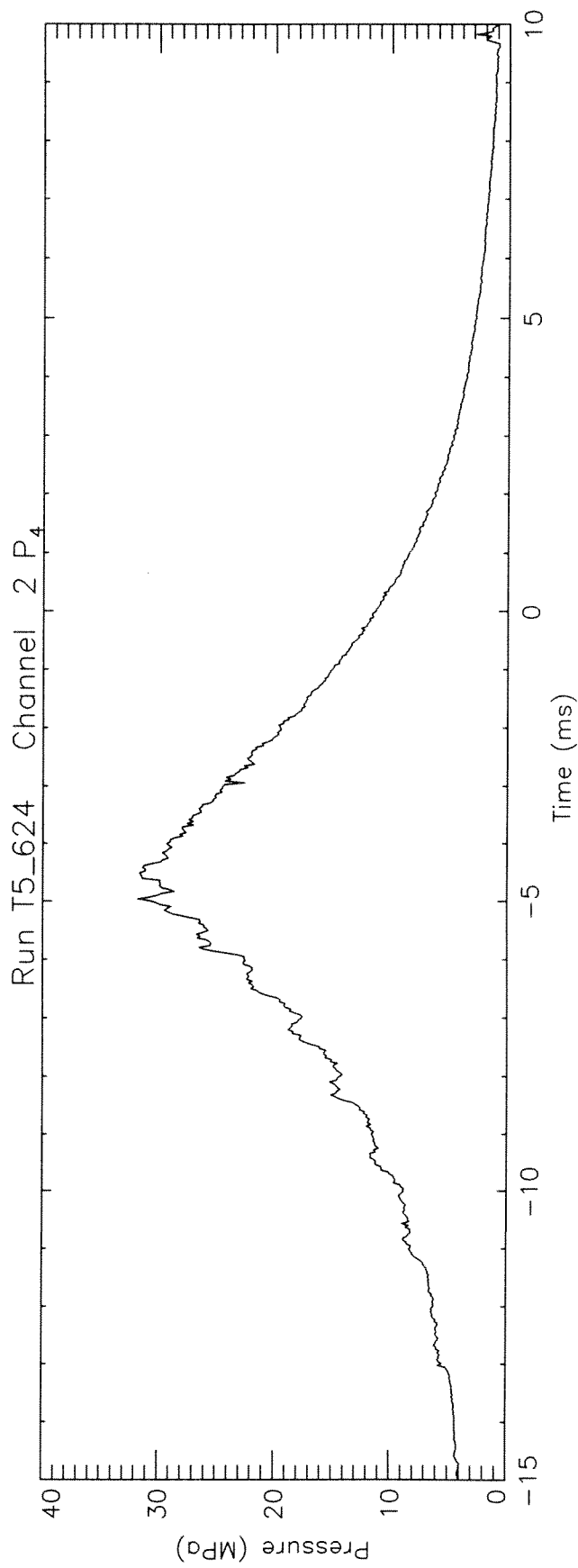
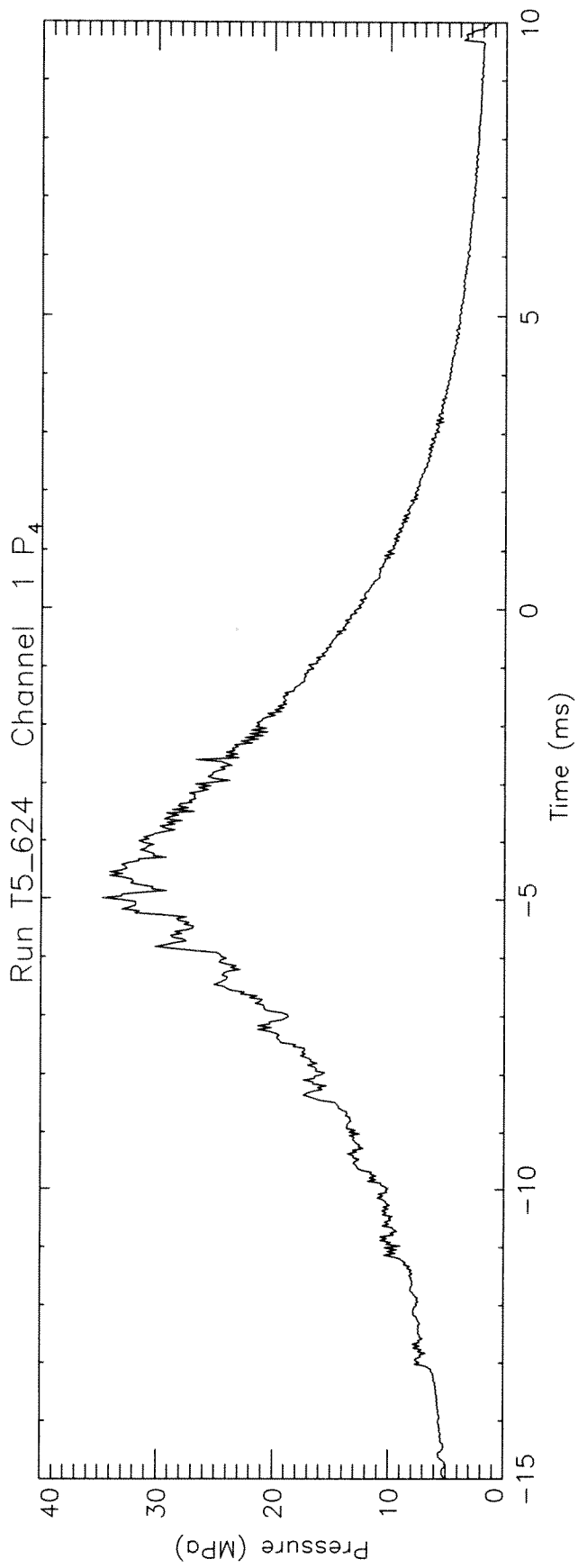
Smooth box = 2.

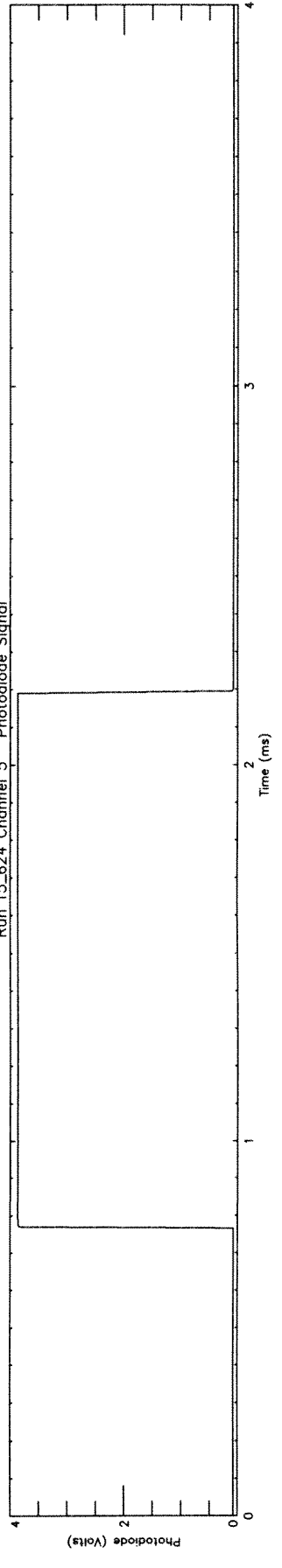
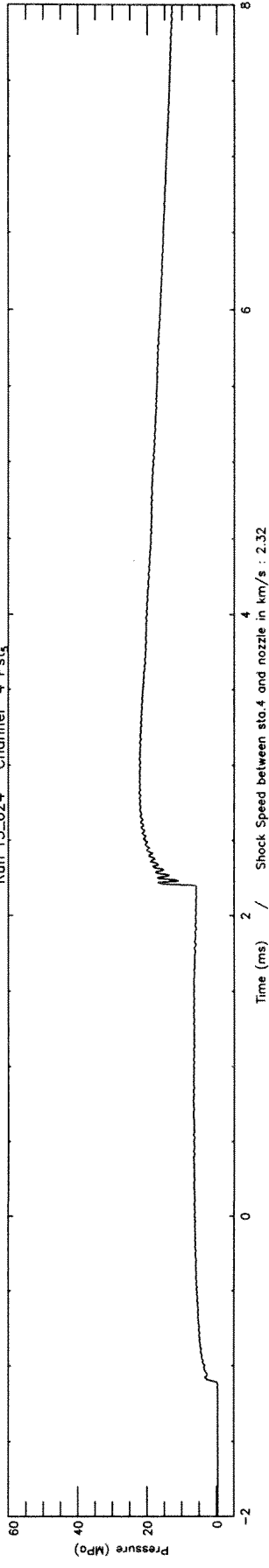
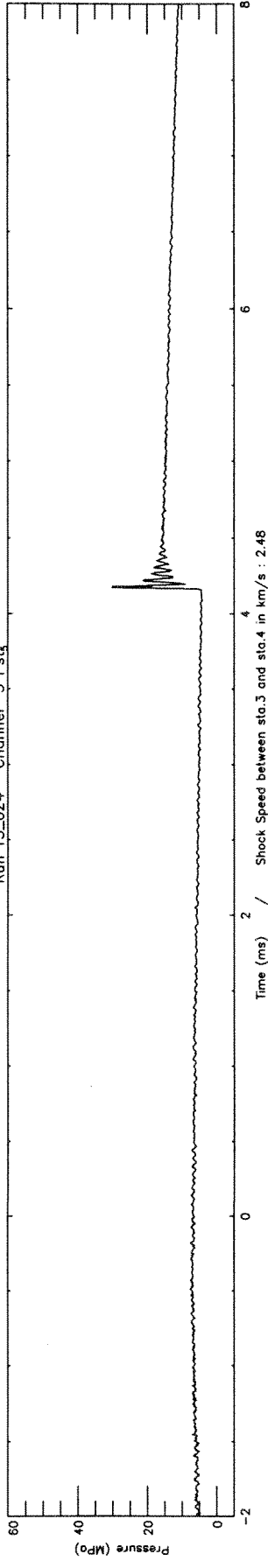
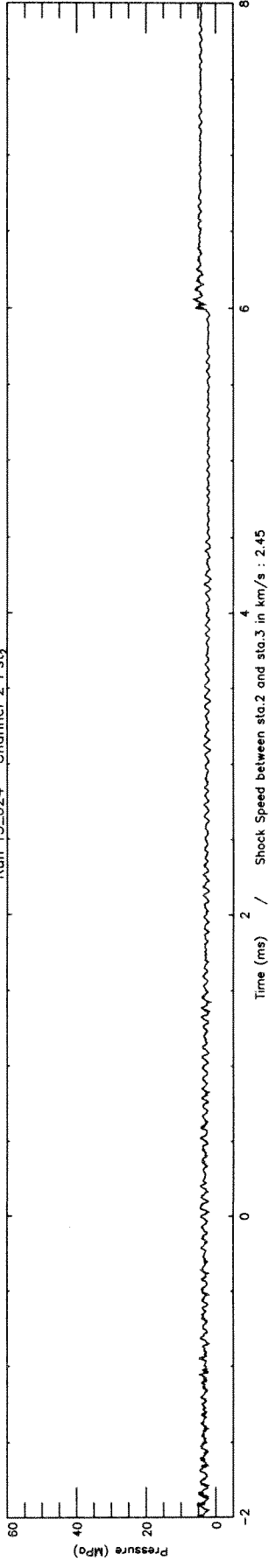
DA1	:	0.6079
DA2	:	0.1647
DA3	:	0.0544
DA4	:	0.0479
DA5	:	0.0429
DA6	:	0.0388
DA7	:	0.0357
DA8	:	0.0305
DA9	:	0.0336

Run # 623

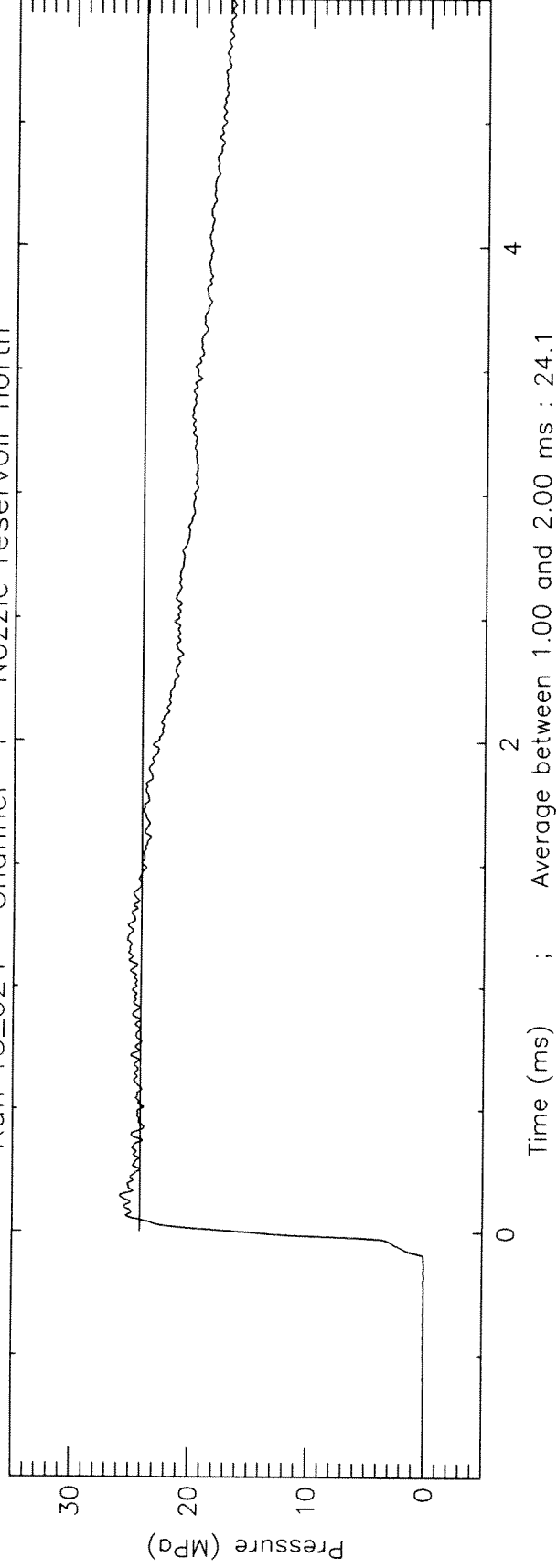
Heat Transfer Rates (in MW/m²)
averaged around 1.90 +/- 0.30 ms

MT 1 :	6.6626
MT 2 :	9.5827
MT 3 :	6.1408
MT 4 :	2.7765
MT 5 :	0.9707
MT 6 :	0.8148
MT 7 :	0.6313
MT 8 :	0.5290
MT 9 :	0.4844
MT10 :	0.4016
MT11 :	0.4665
MT12 :	11.0721

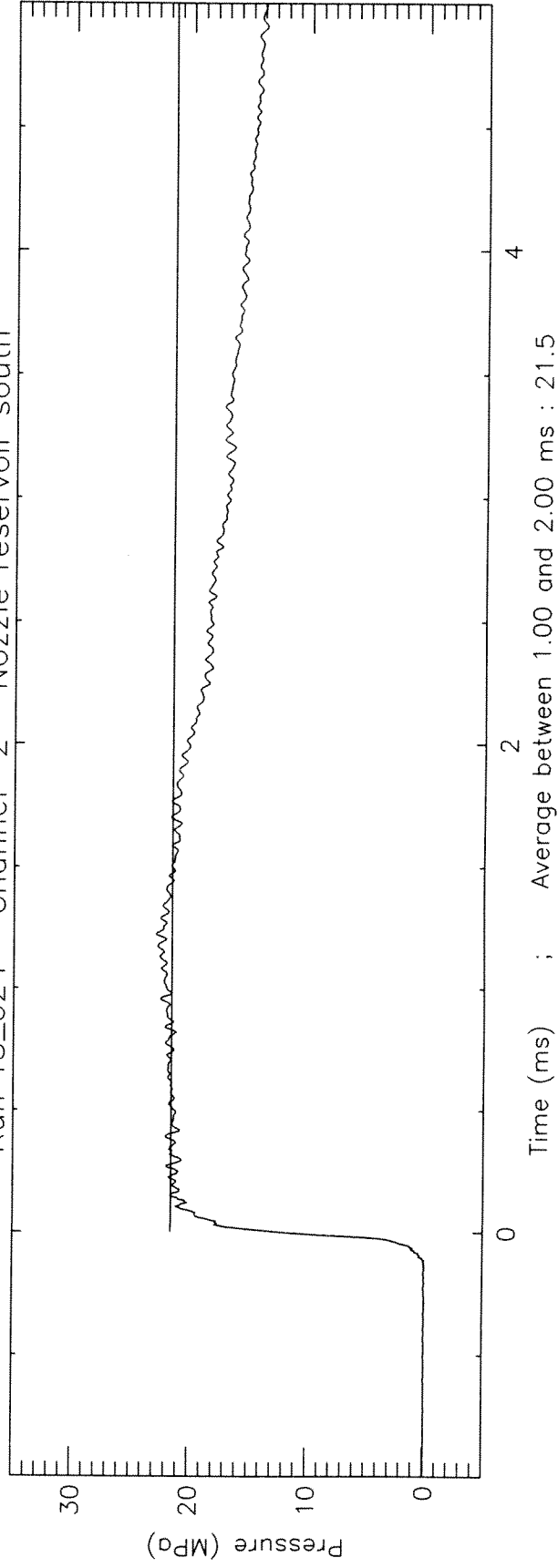




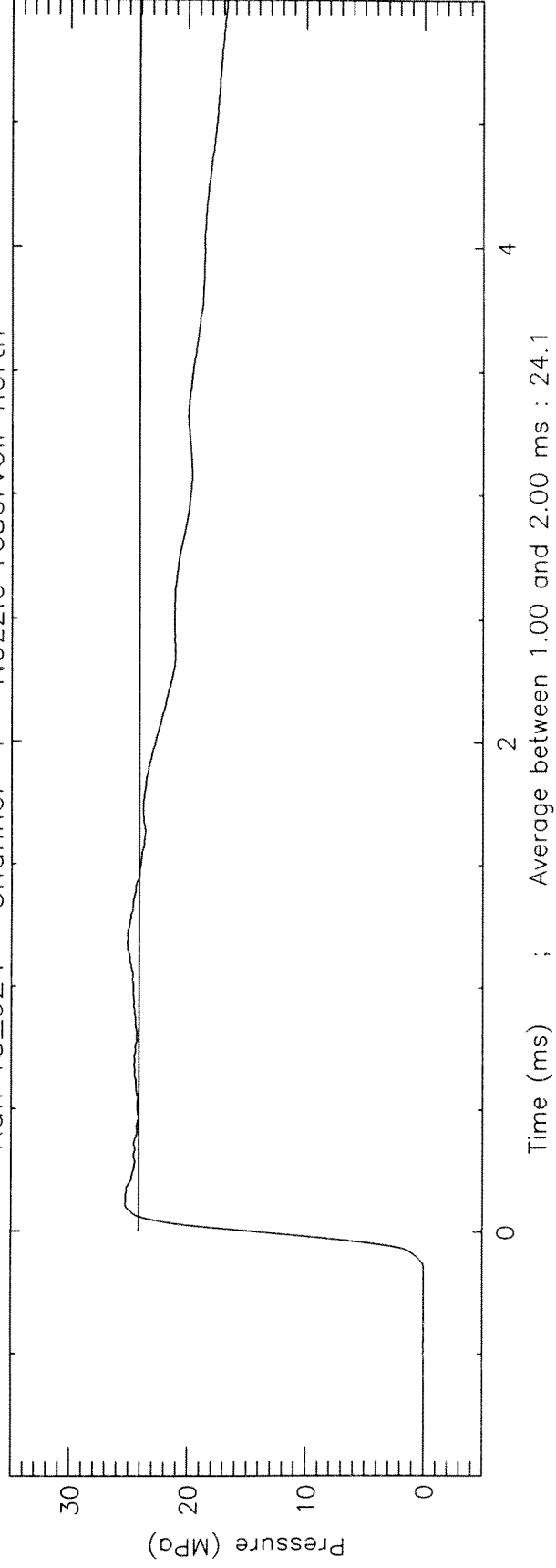
Run T5_624 Channel 1 Nozzle reservoir north



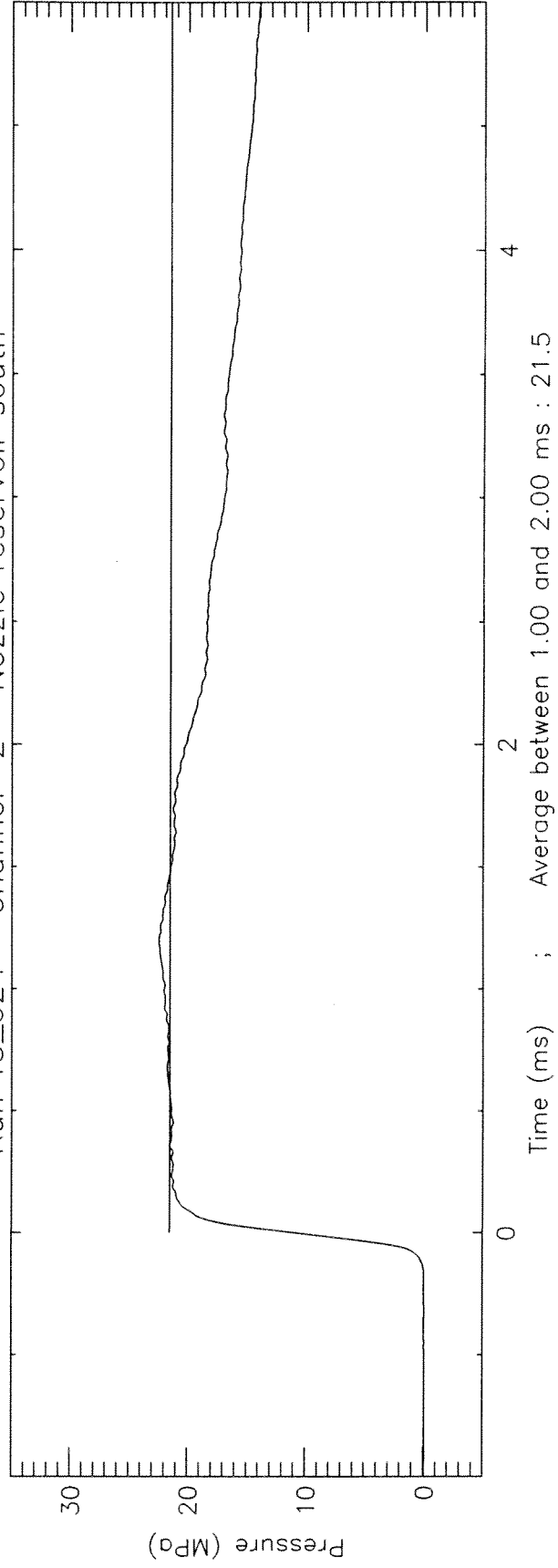
Run T5_624 Channel 2 Nozzle reservoir south

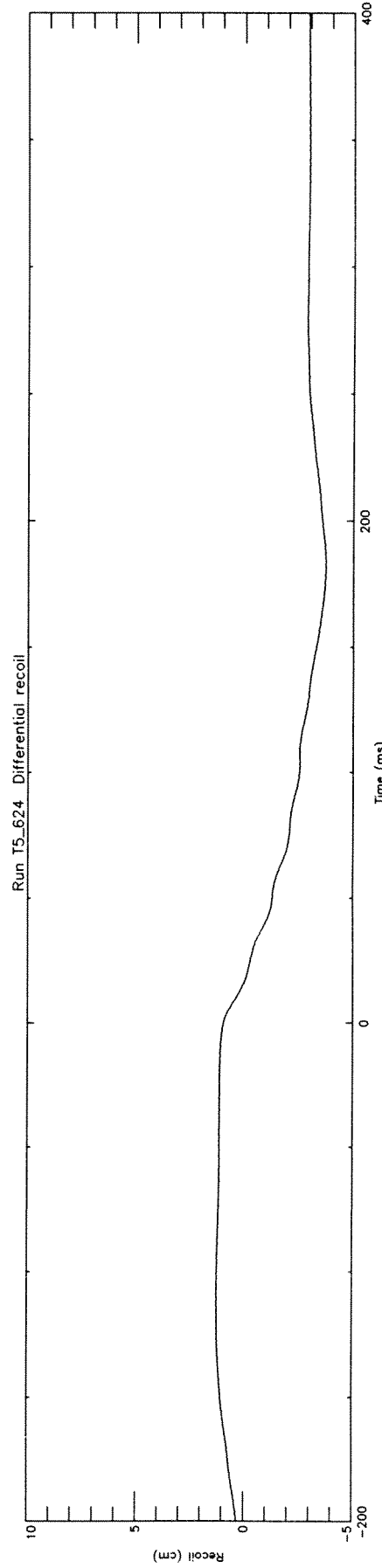
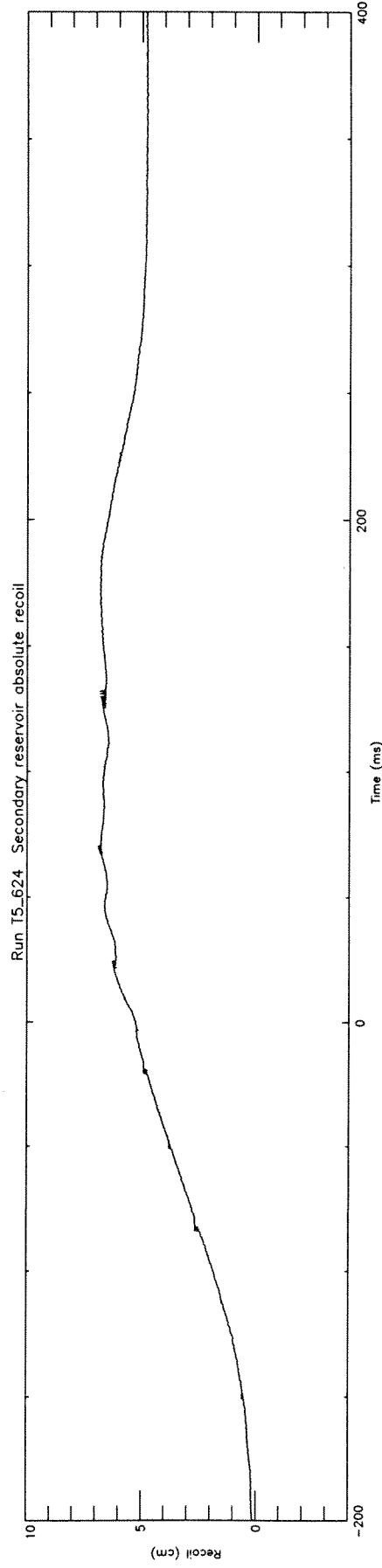
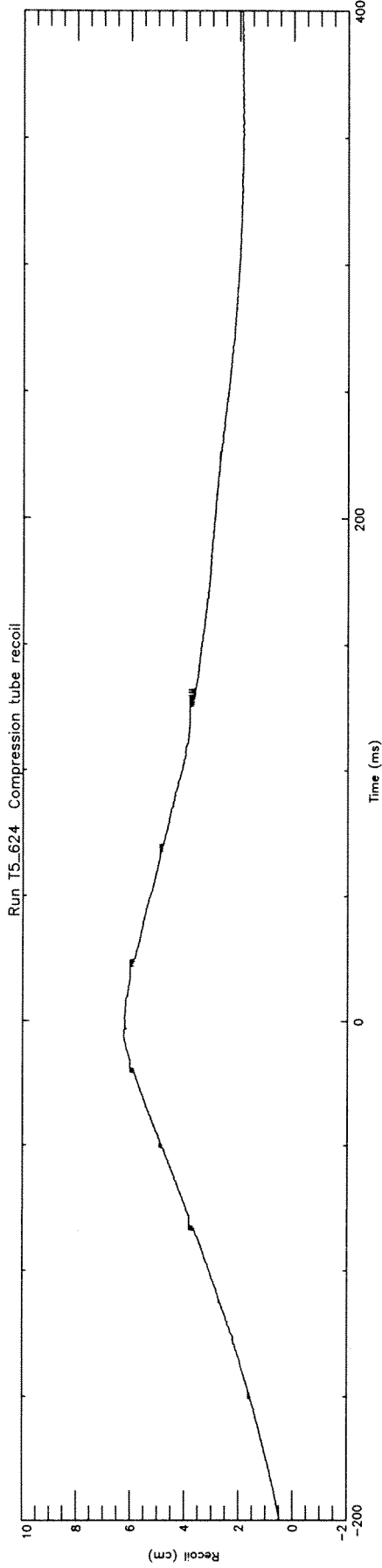


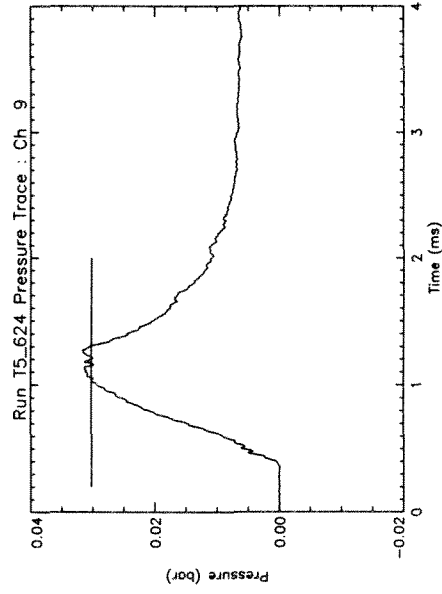
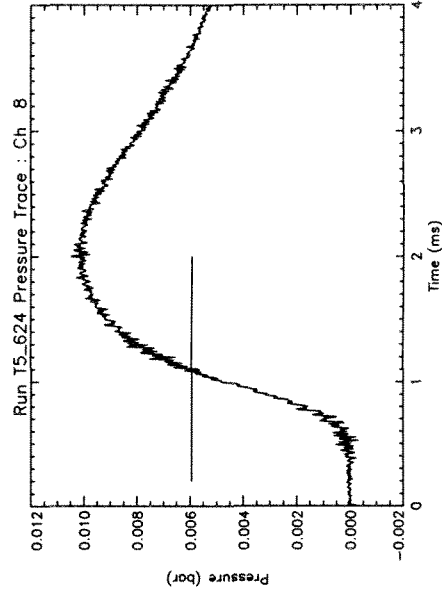
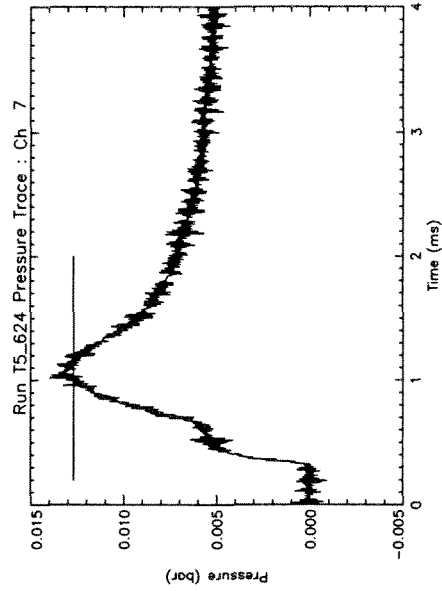
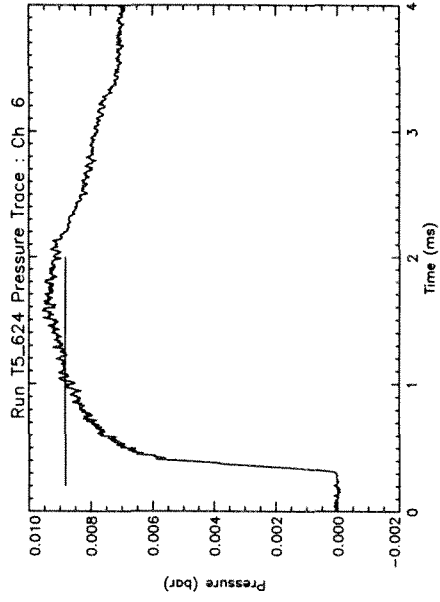
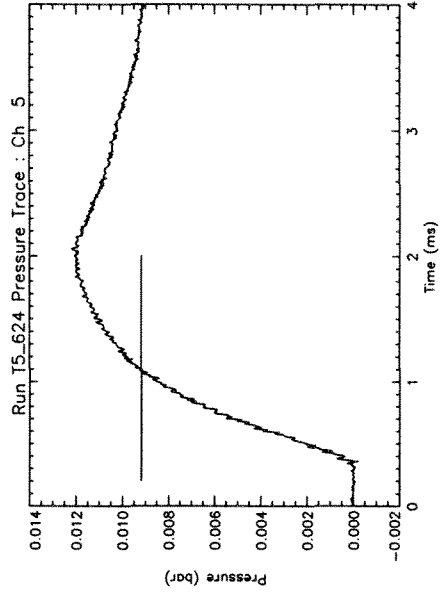
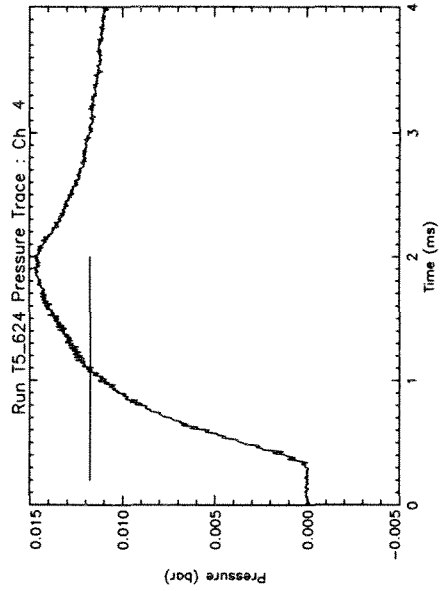
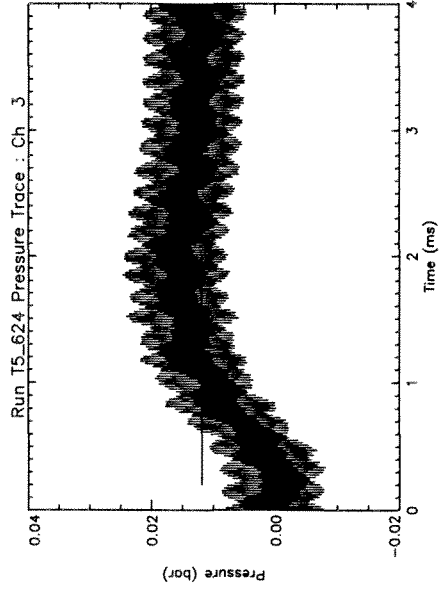
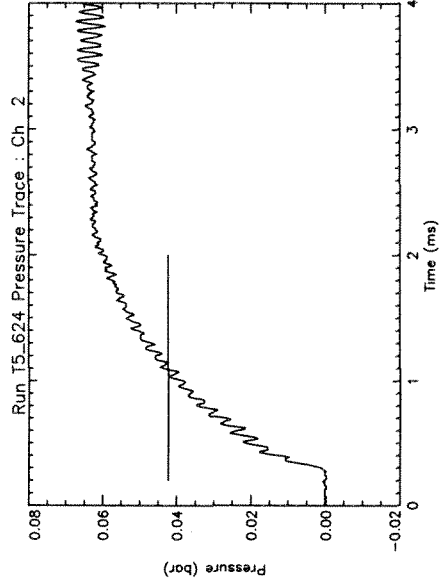
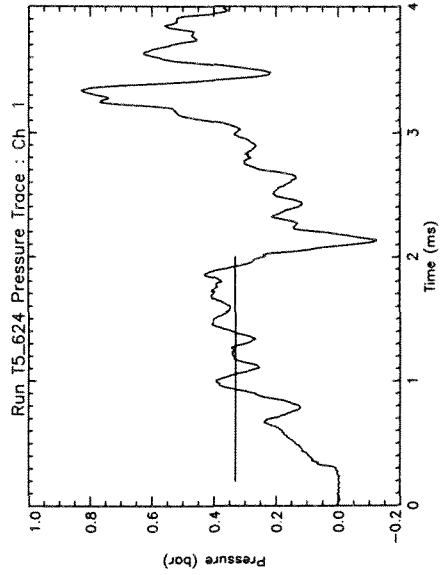
Run T5_624 Channel 1 Nozzle reservoir north

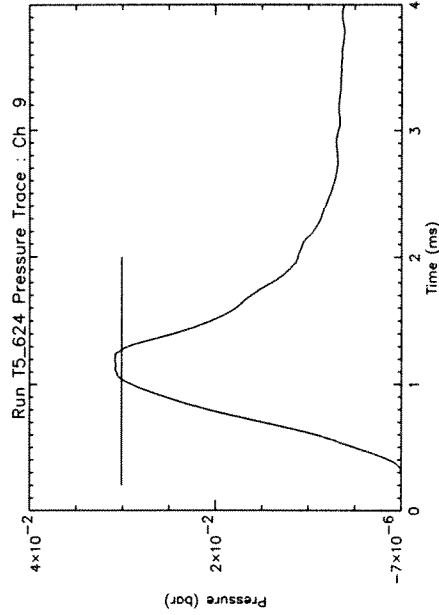
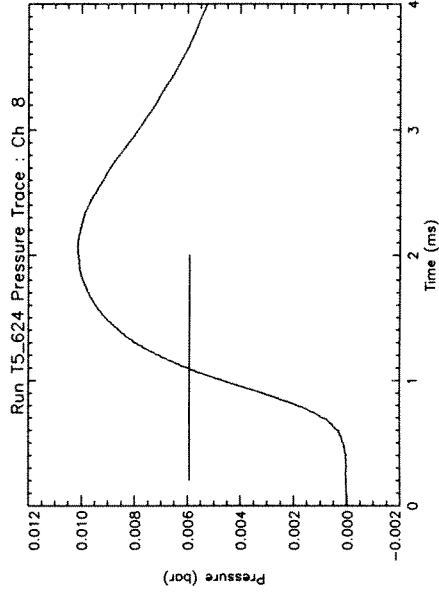
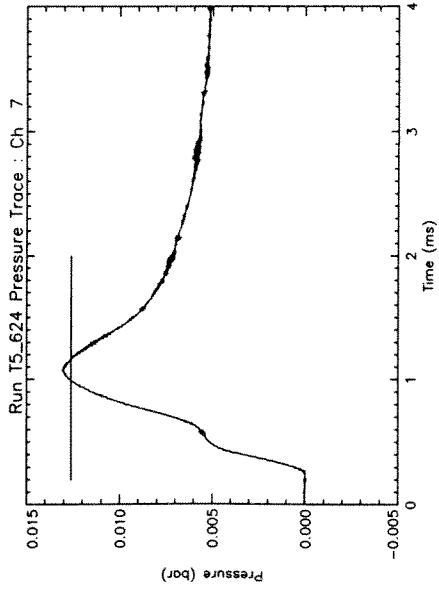
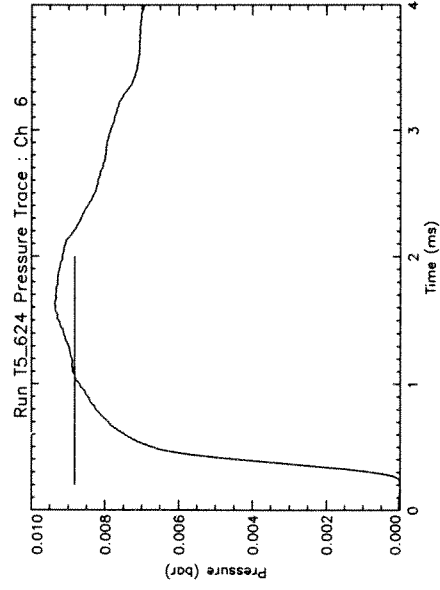
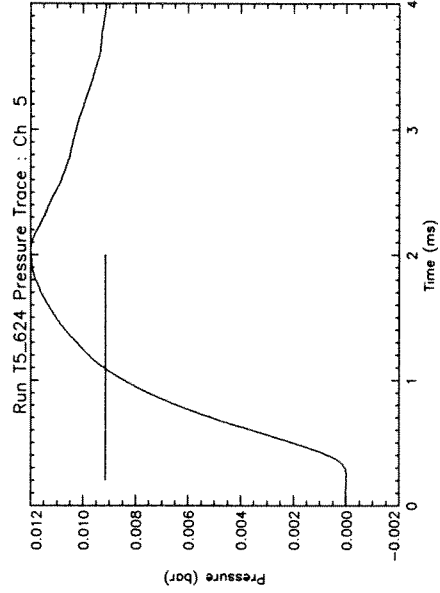
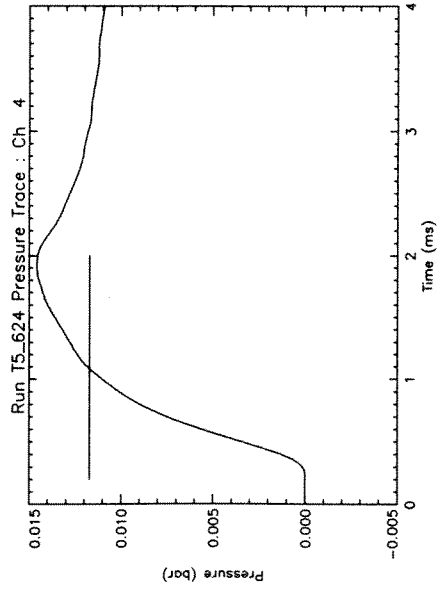
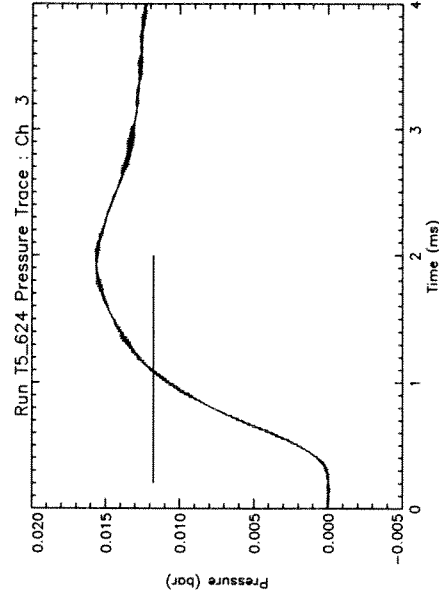
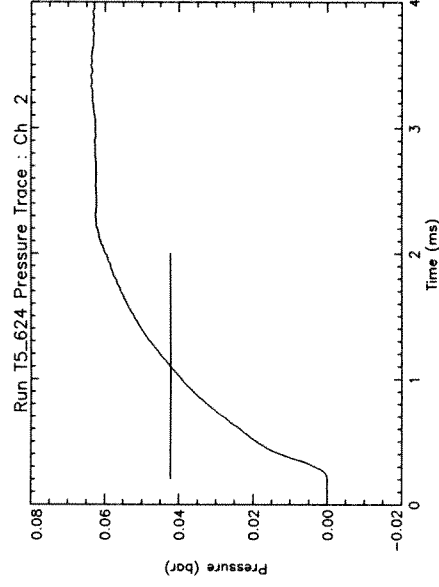
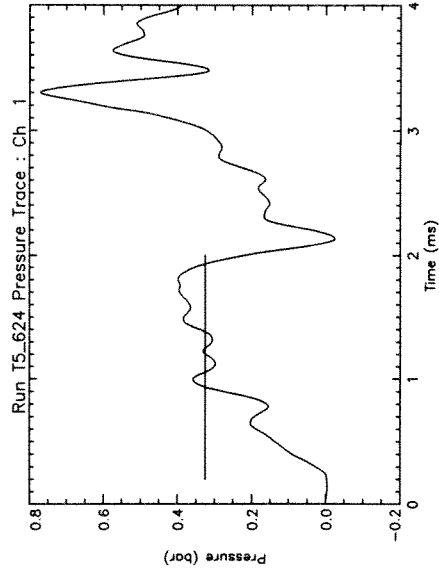


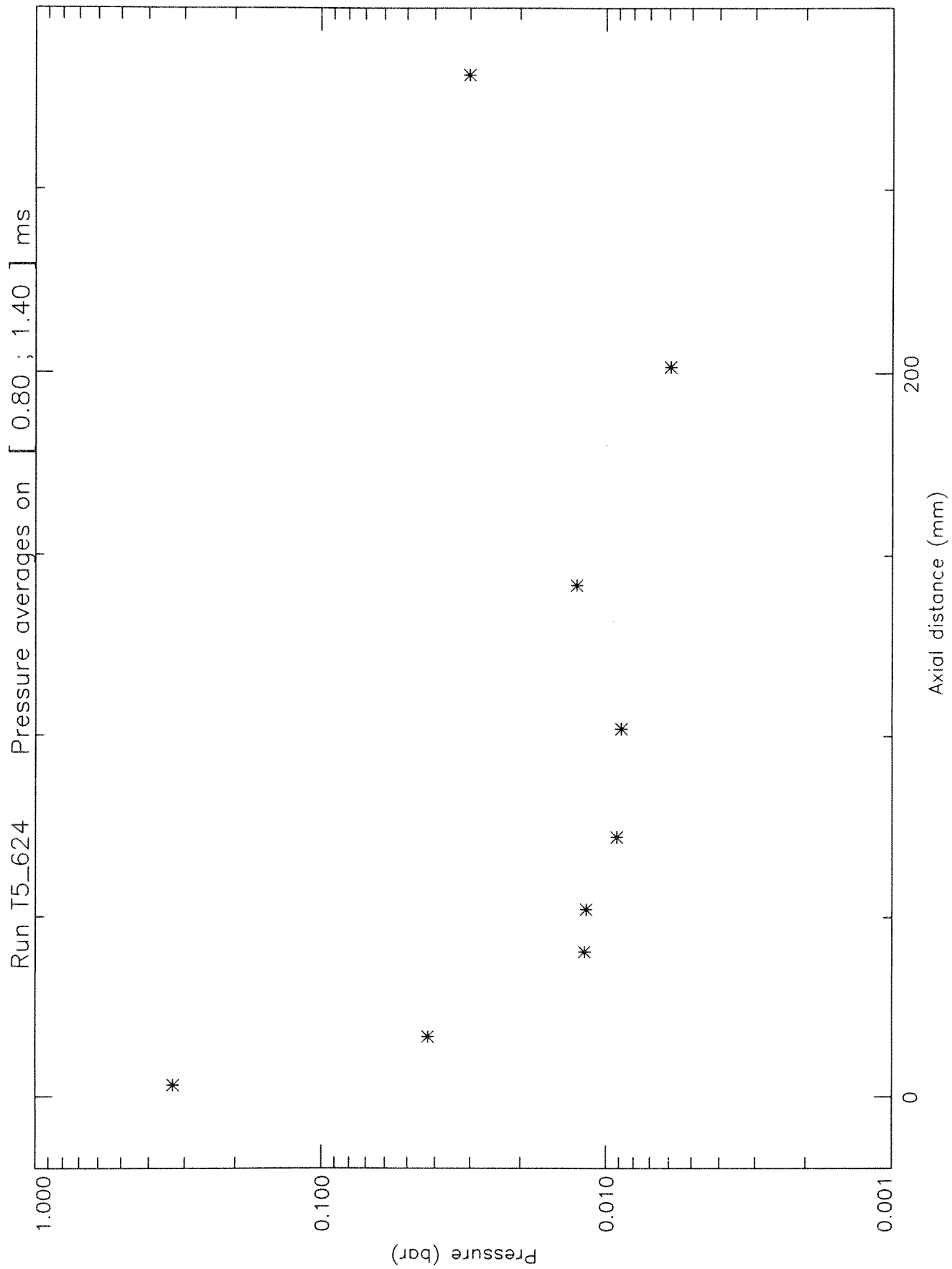
Run T5_624 Channel 2 Nozzle reservoir south

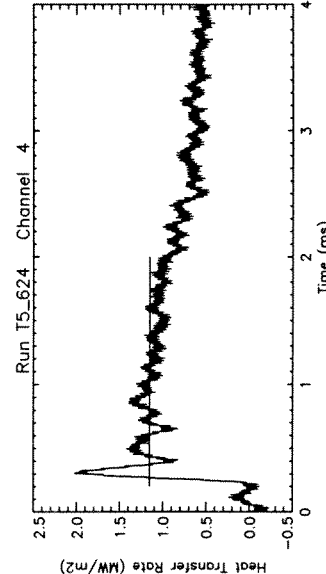
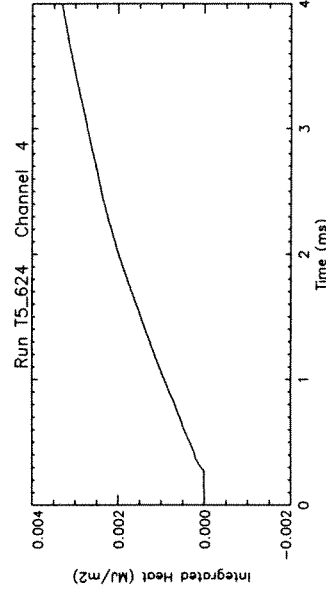
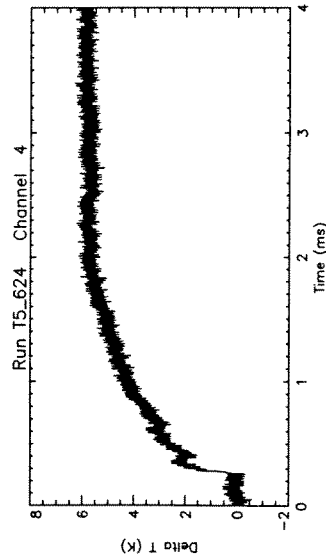
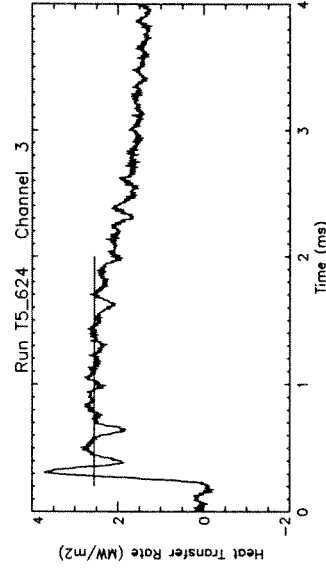
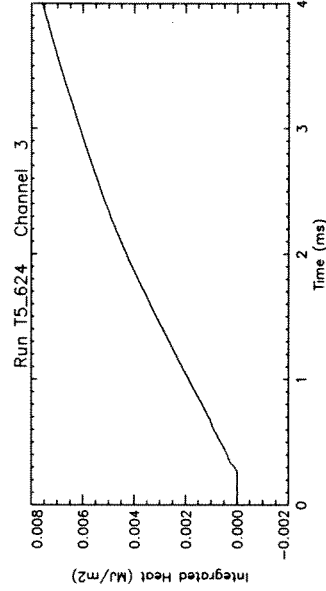
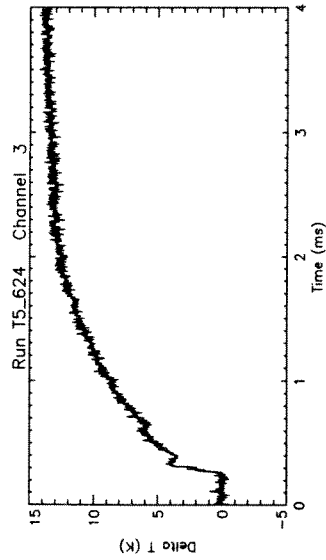
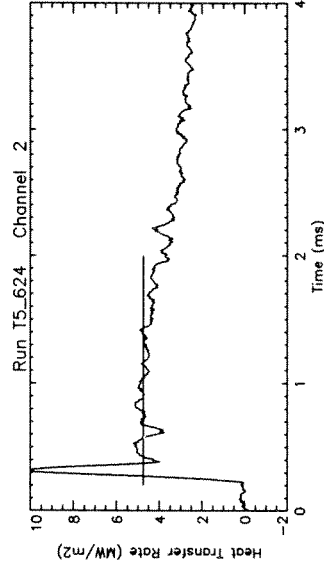
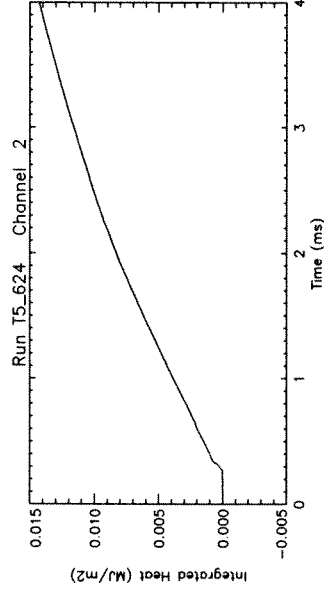
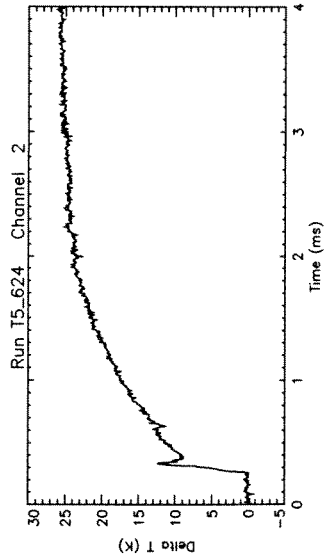
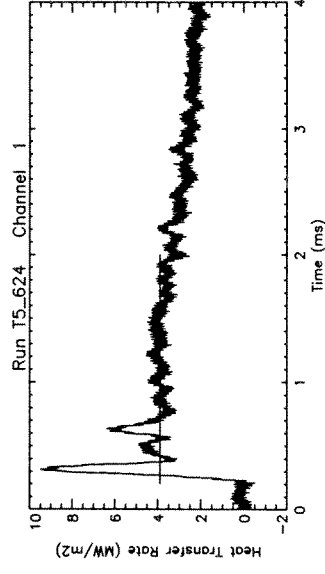
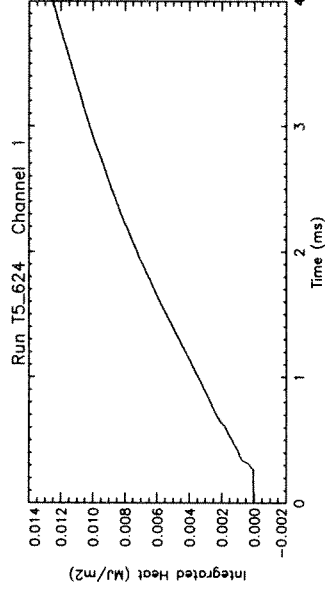
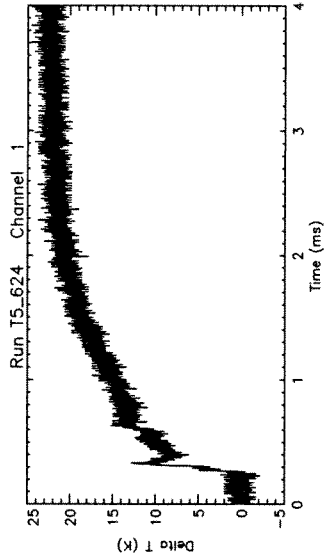


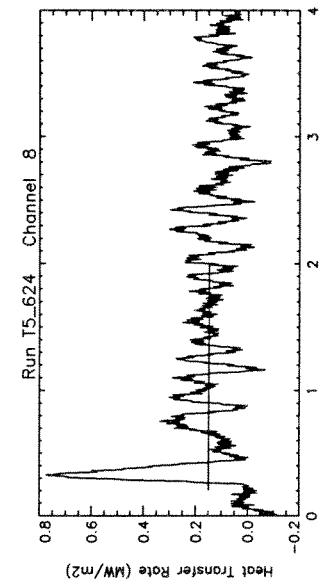
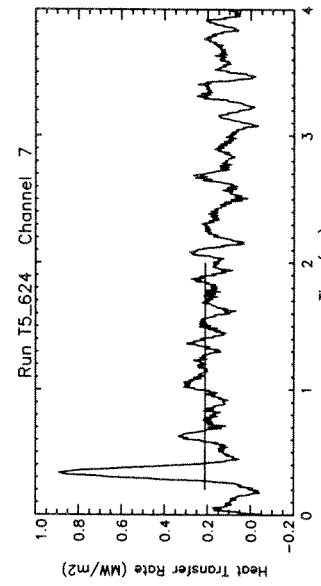
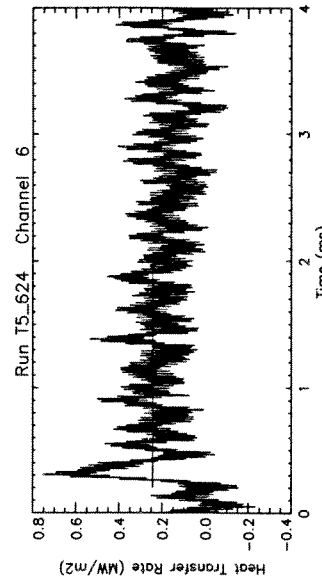
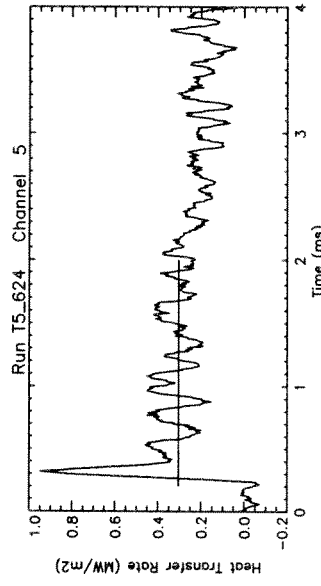
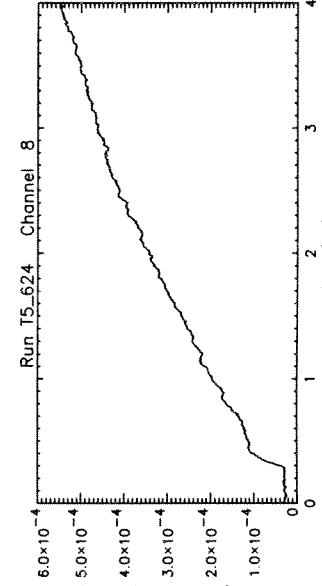
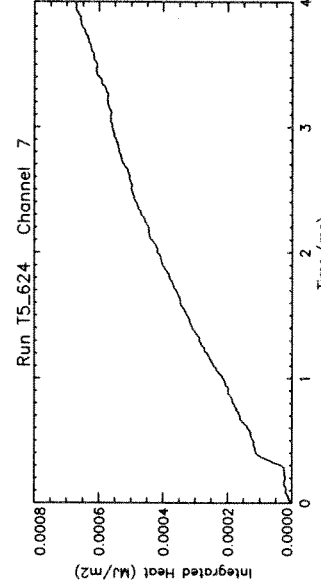
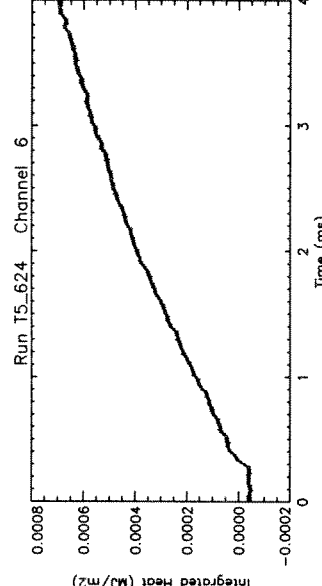
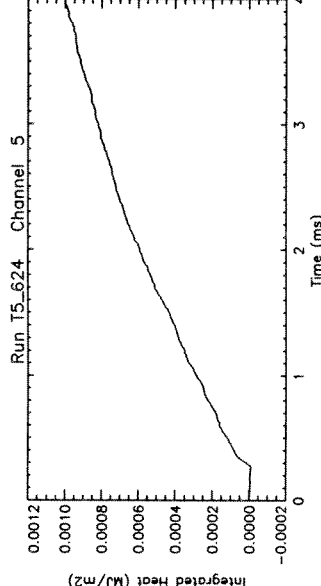
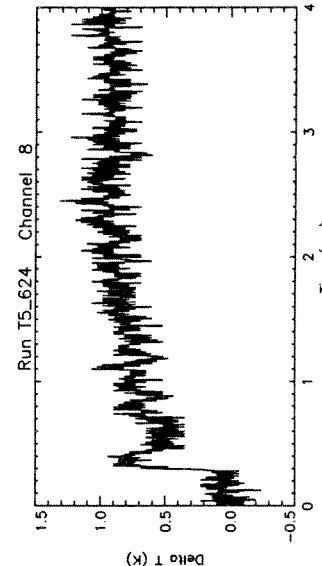
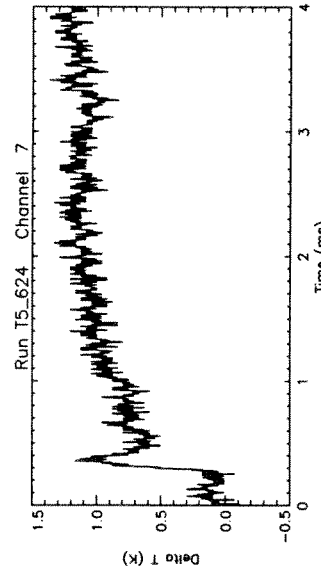
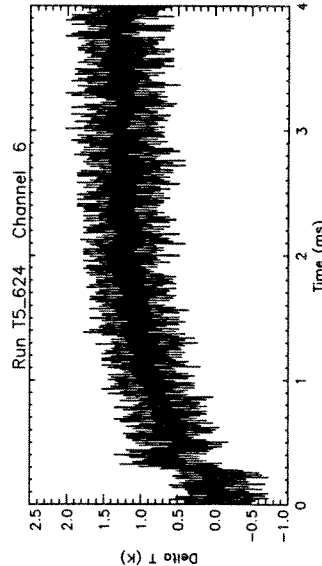
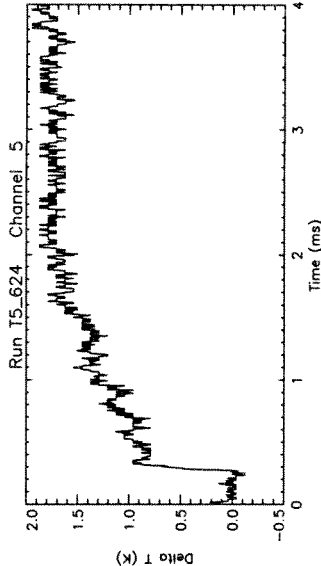


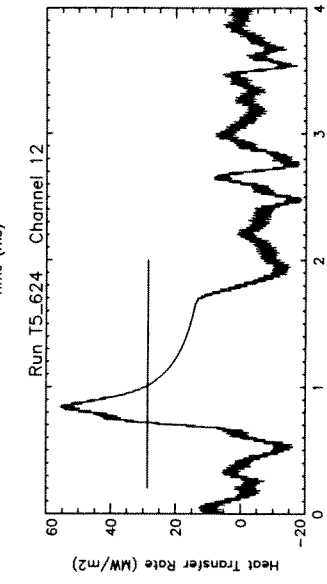
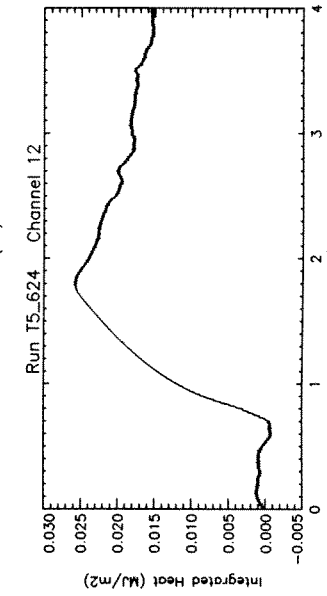
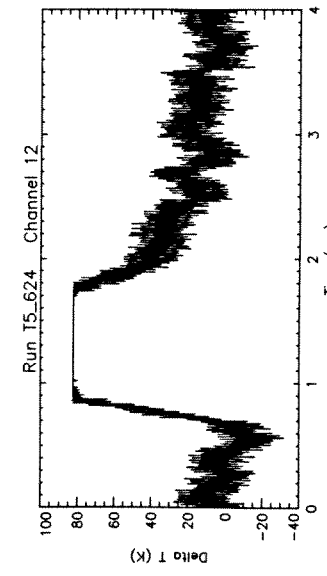
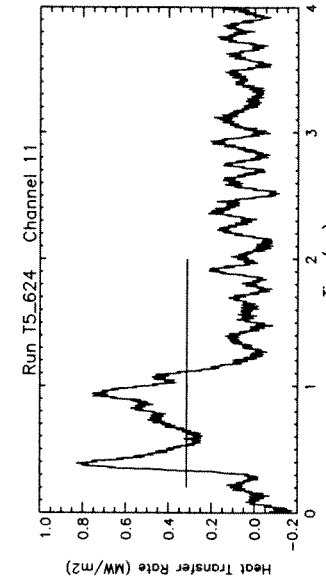
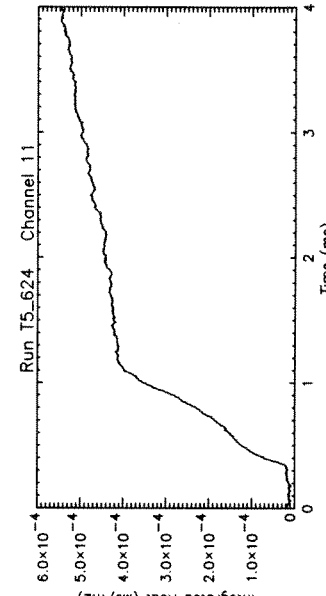
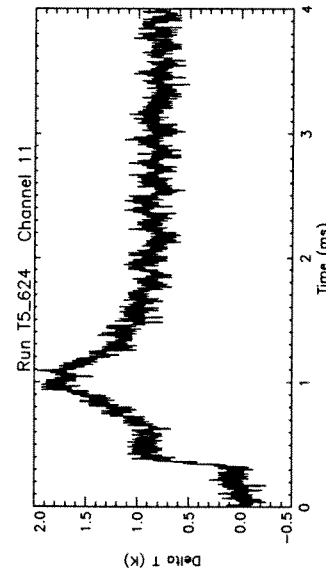
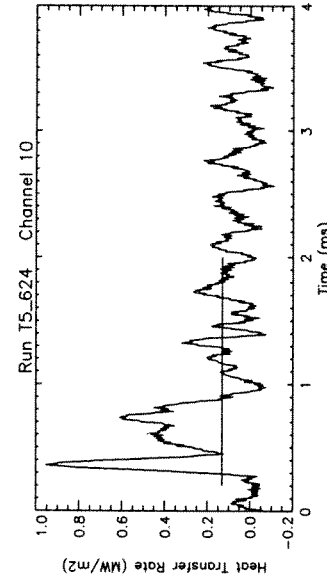
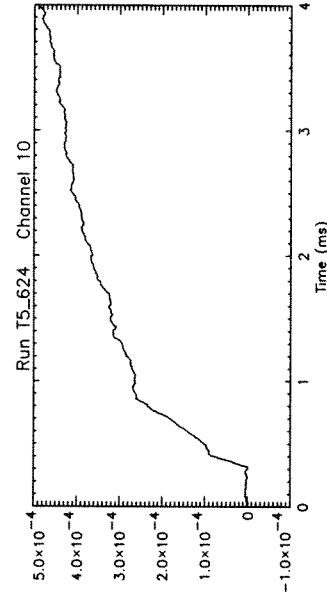
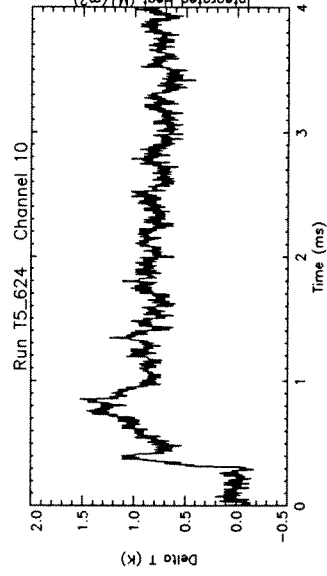
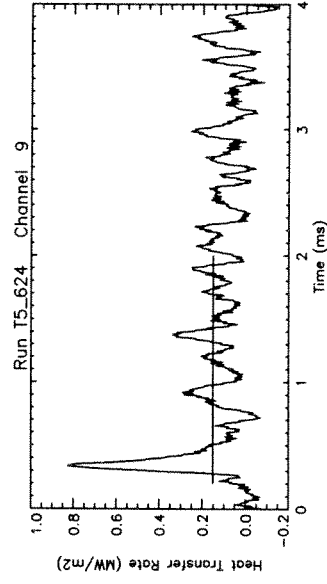
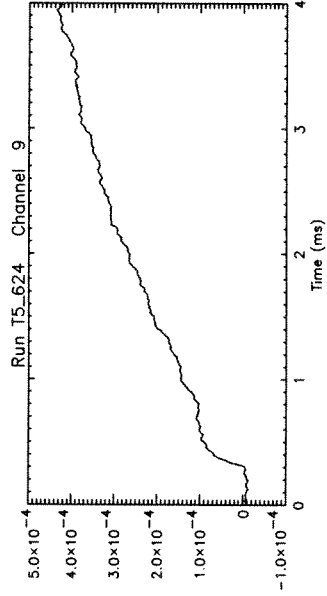
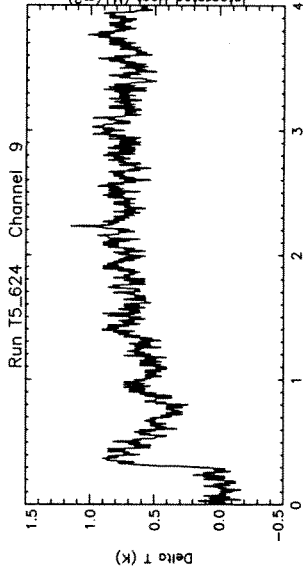


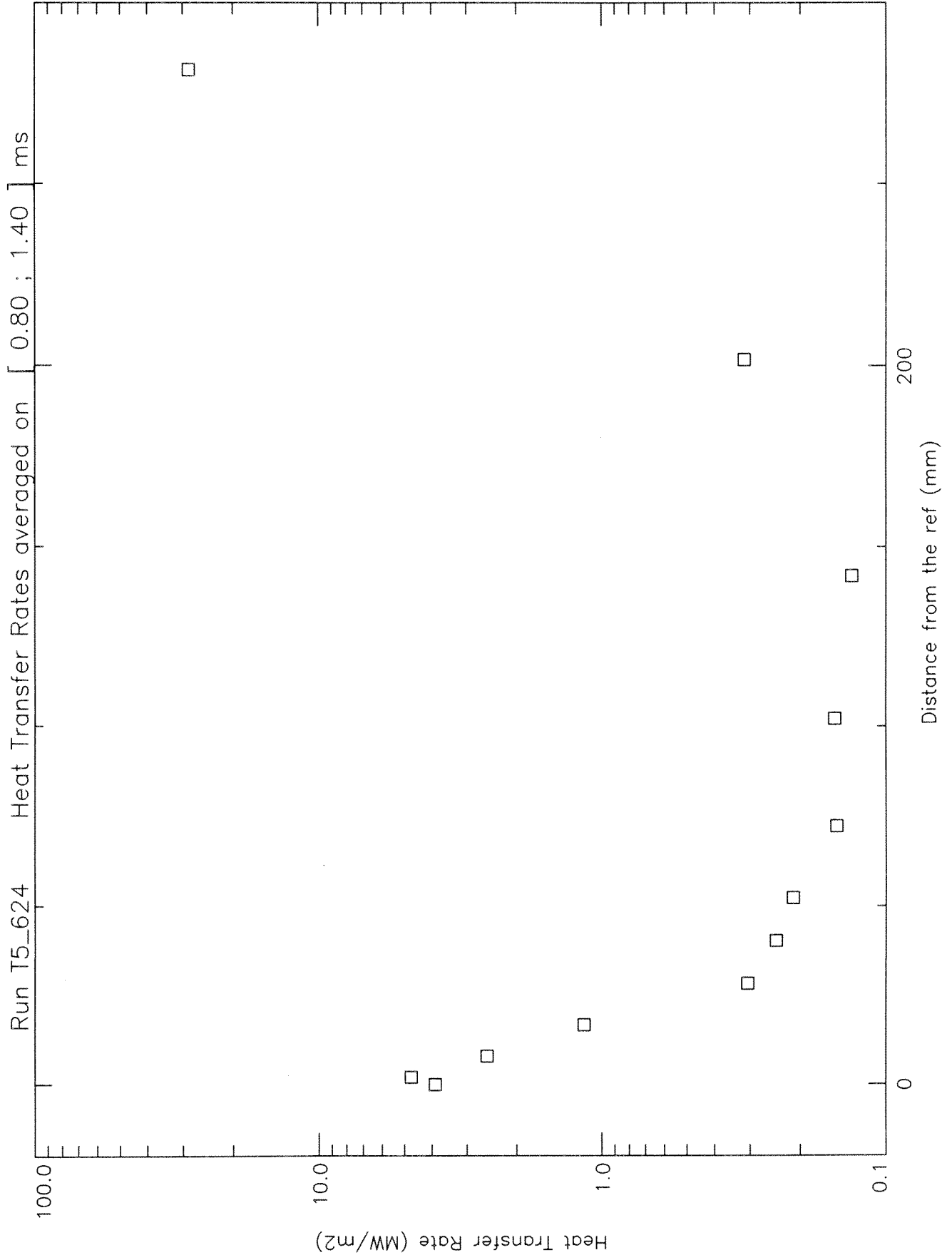












Run # 624

Pressure averages around 1.10 +/- 0.30 ms

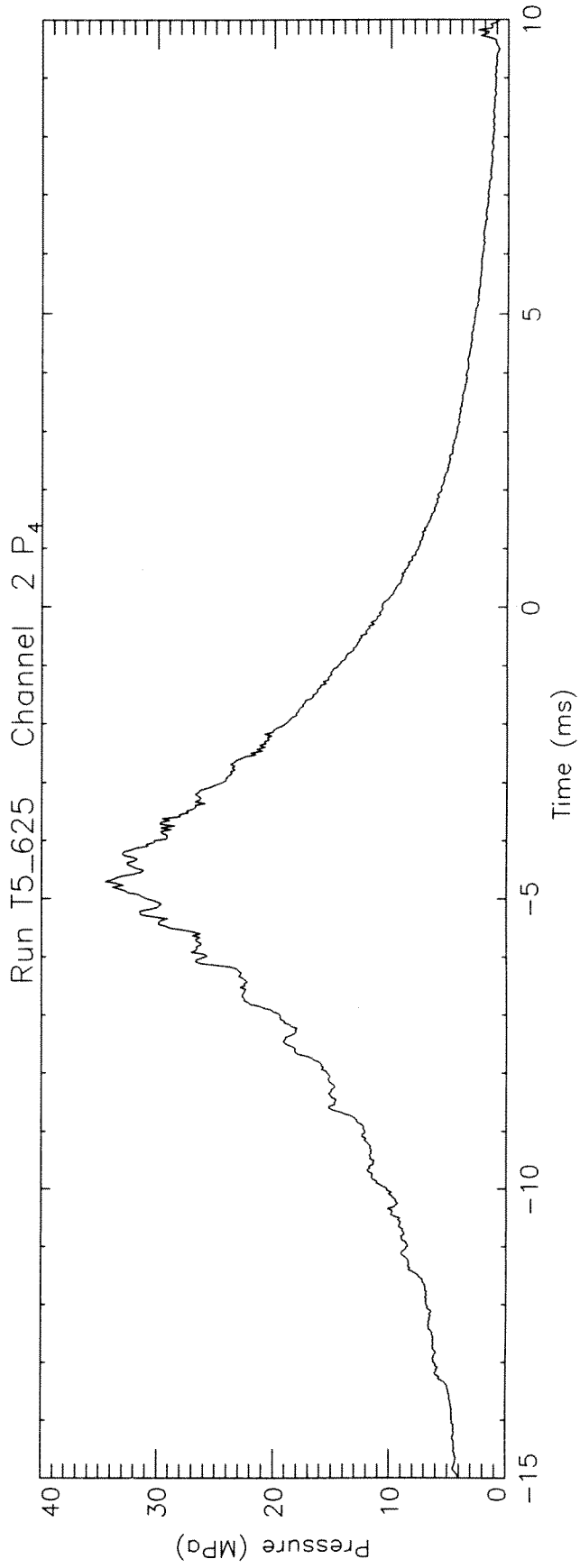
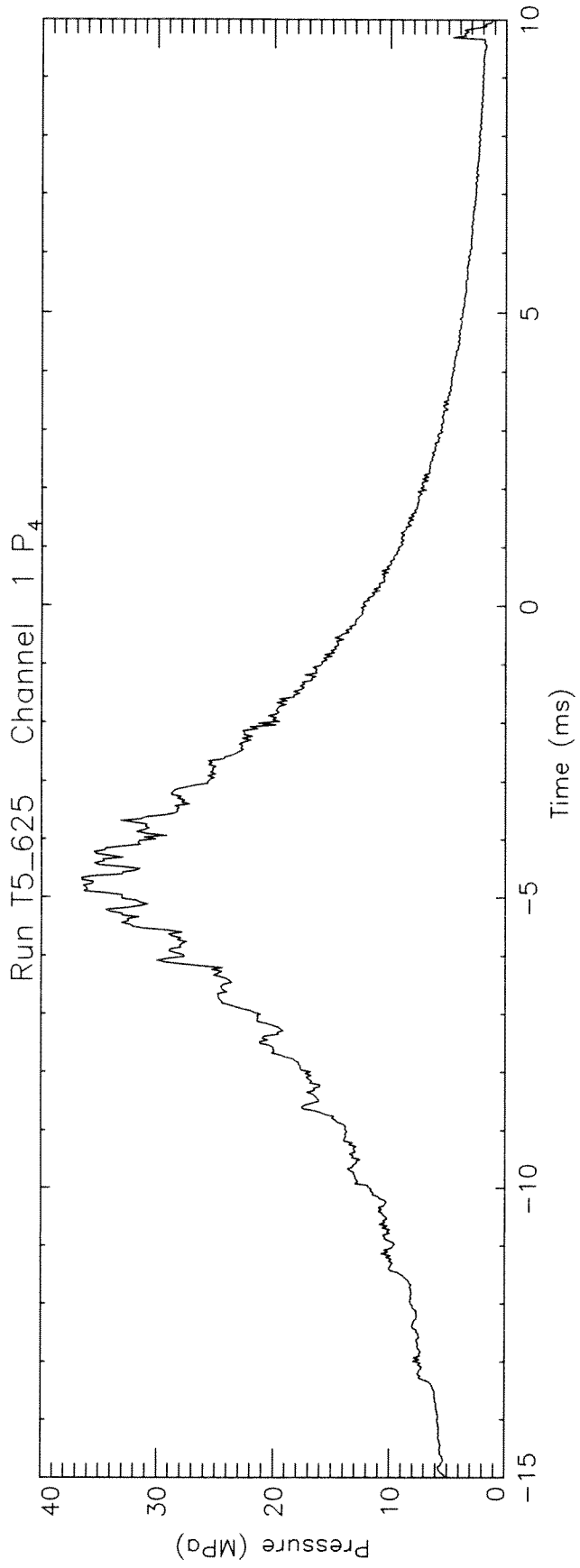
Smooth box = 2.

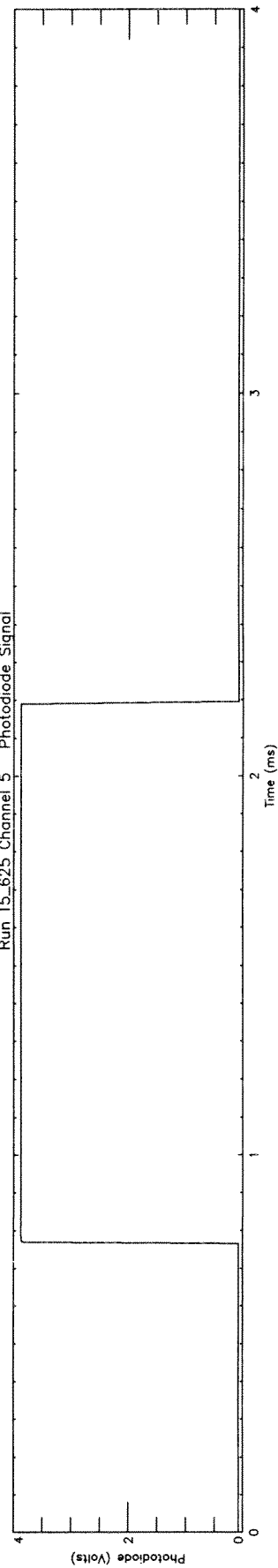
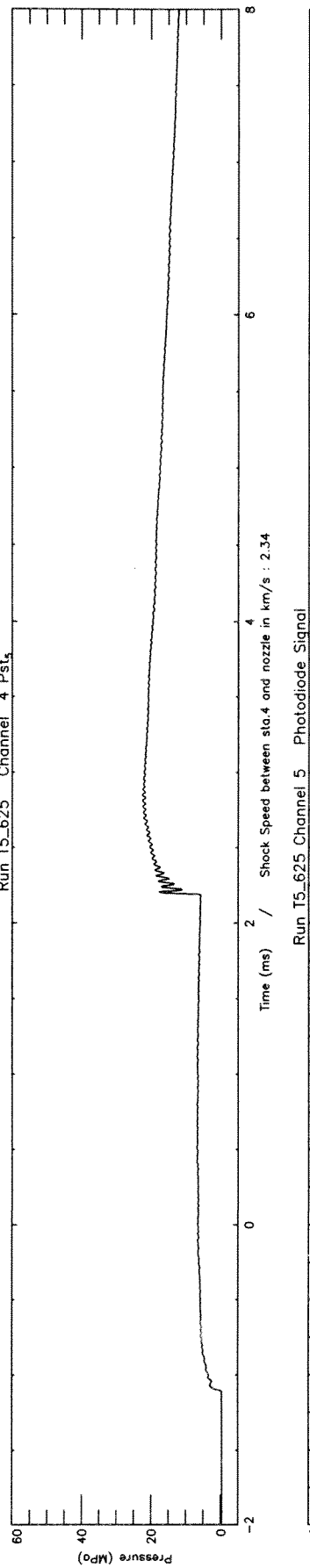
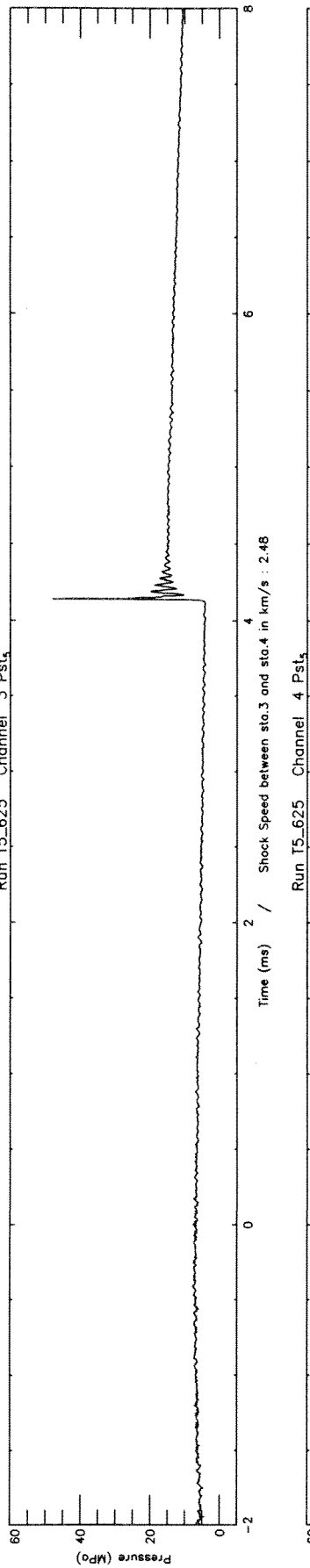
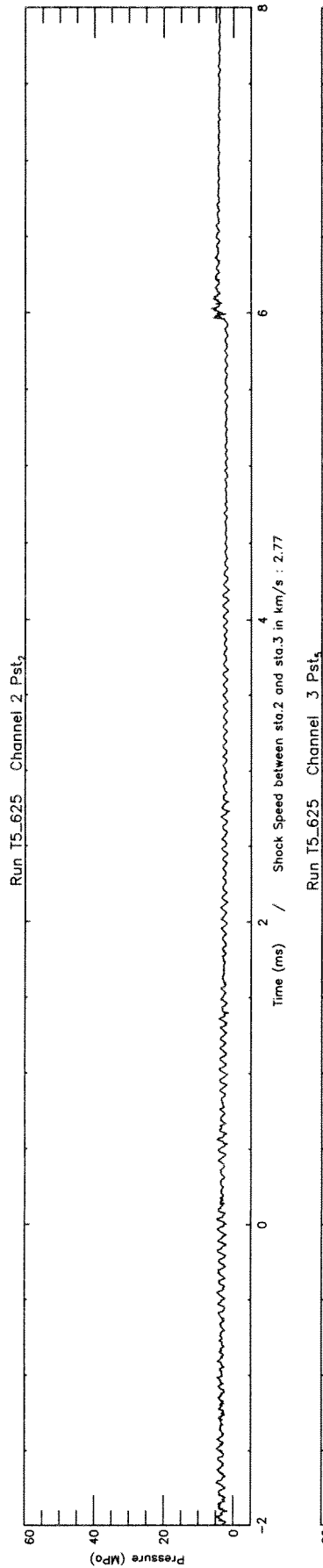
DA1	:	0.3299
DA2	:	0.0423
DA3	:	0.0119
DA4	:	0.0117
DA5	:	0.0092
DA6	:	0.0088
DA7	:	0.0127
DA8	:	0.0059
DA9	:	0.0302

Run # 624

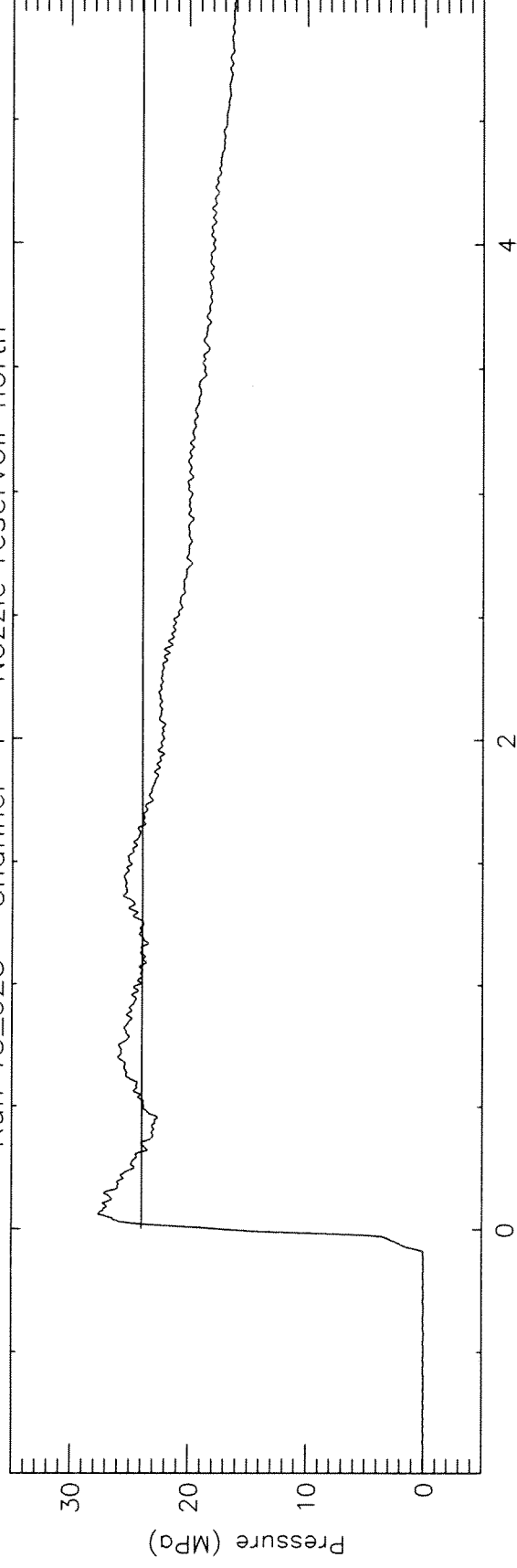
Heat Transfer Rates (in MW/m²)
averaged around 1.10 +/- 0.30 ms

MT 1 :	3.8943
MT 2 :	4.7392
MT 3 :	2.5508
MT 4 :	1.1543
MT 5 :	0.3051
MT 6 :	0.2431
MT 7 :	0.2116
MT 8 :	0.1491
MT 9 :	0.1512
MT10 :	0.1319
MT11 :	0.3143
MT12 :	28.5704

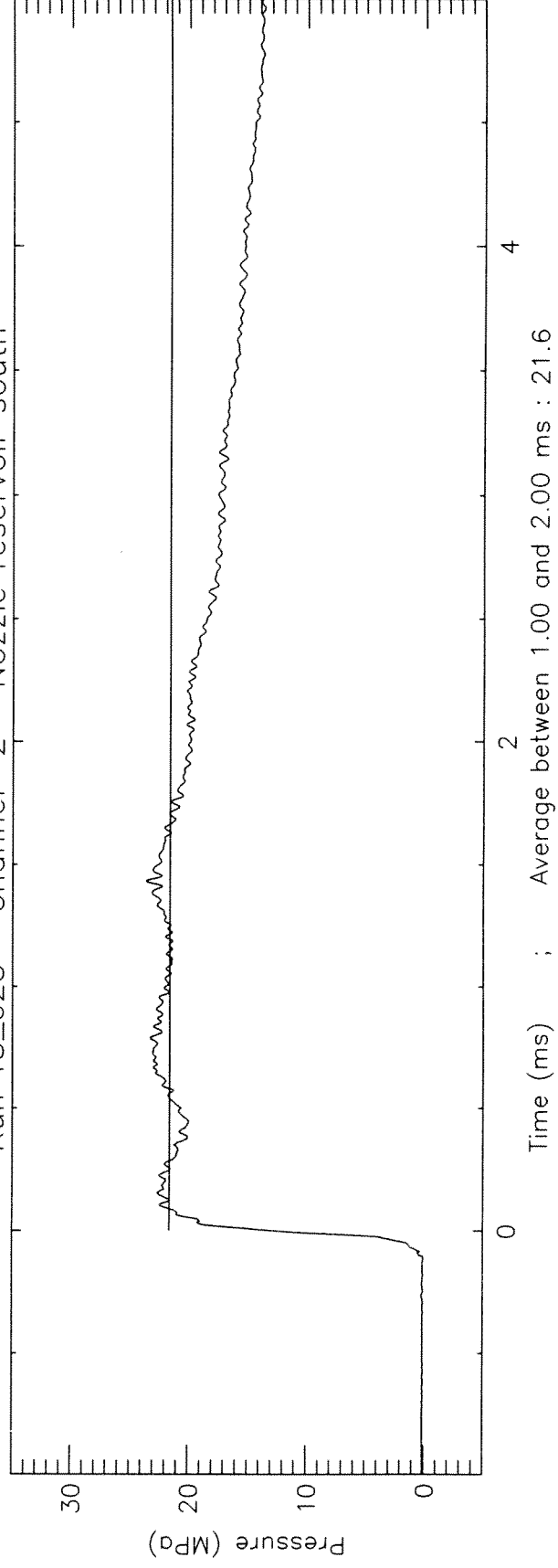




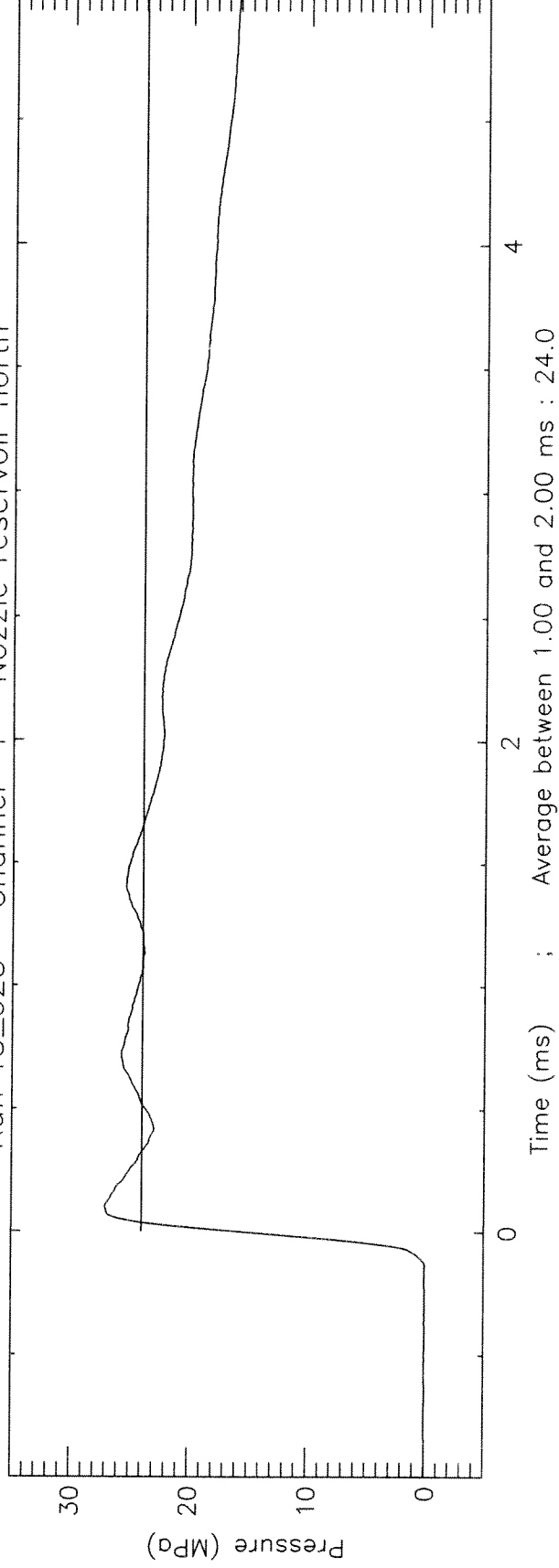
Run T5_625 Channel 1 Nozzle reservoir north



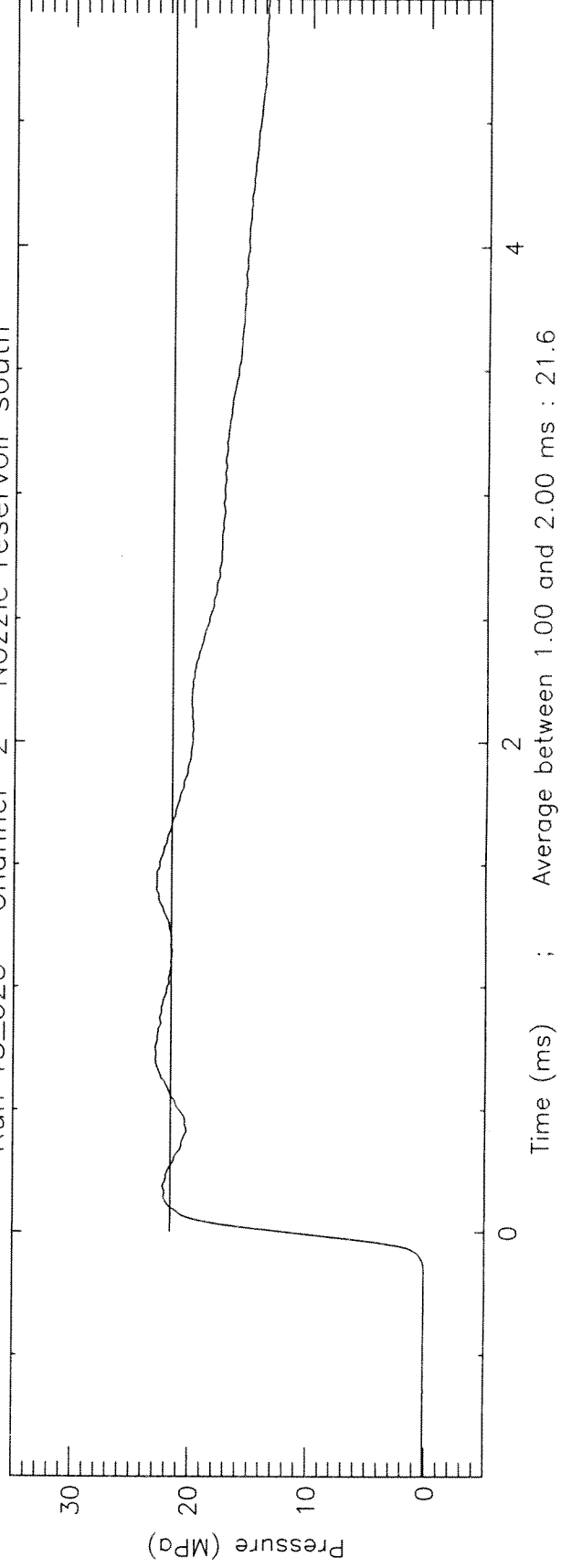
Run T5_625 Channel 2 Nozzle reservoir south



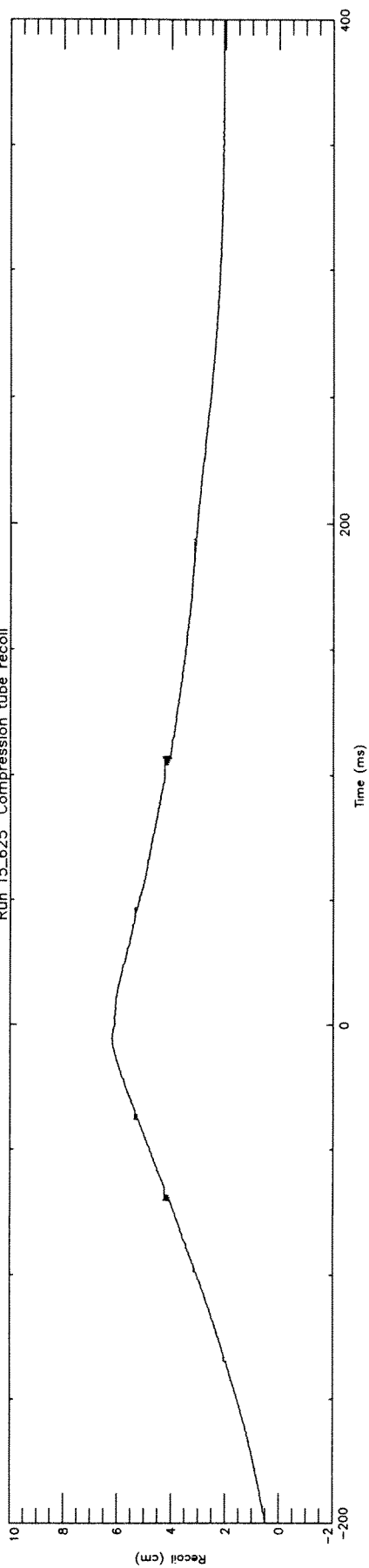
Run T5_625 Channel 1 Nozzle reservoir north



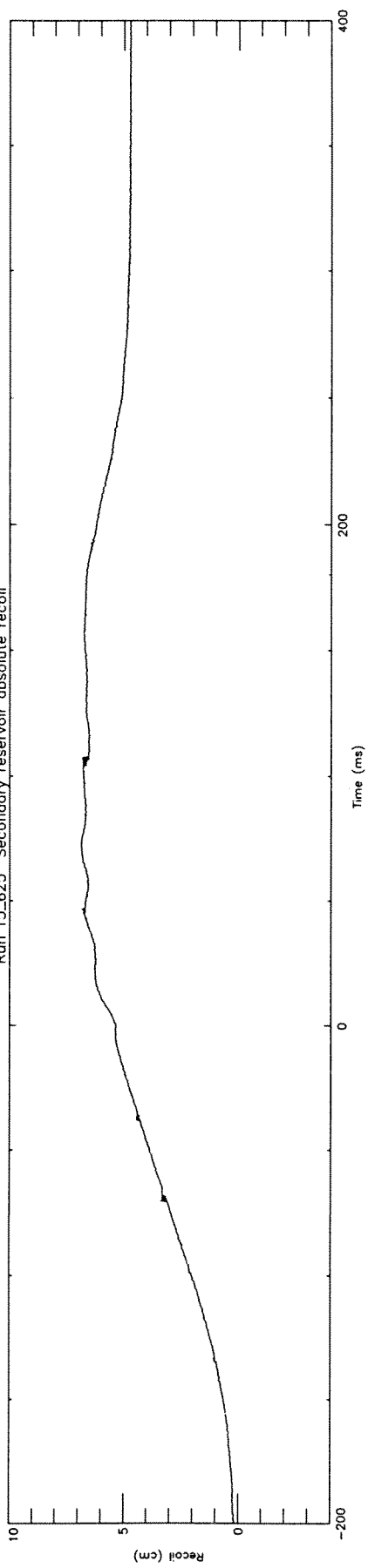
Run T5_625 Channel 2 Nozzle reservoir south



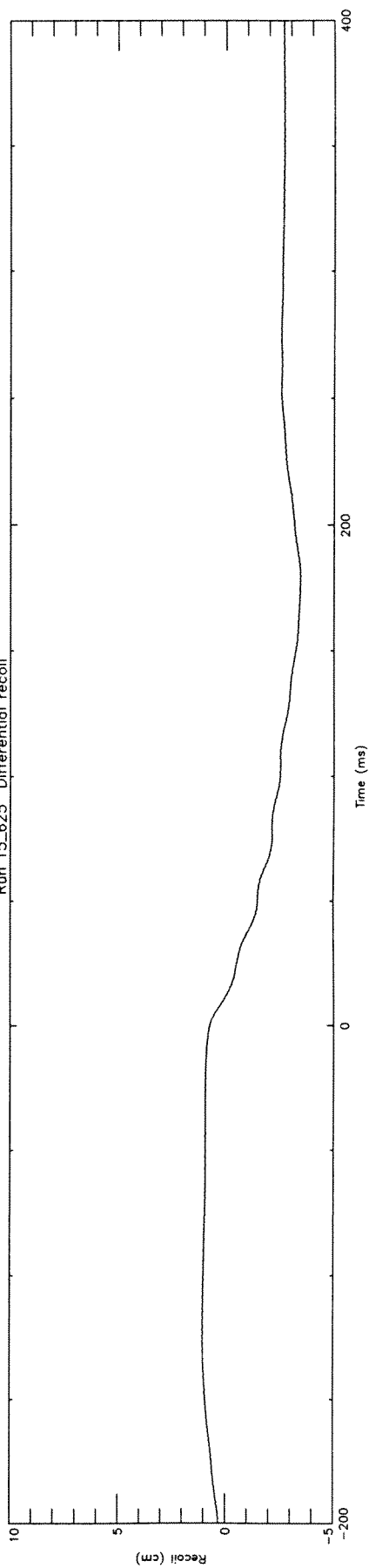
Run T5_625 Compression tube recoil

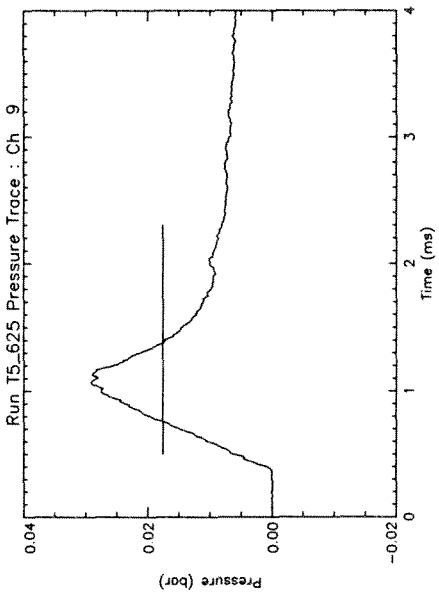
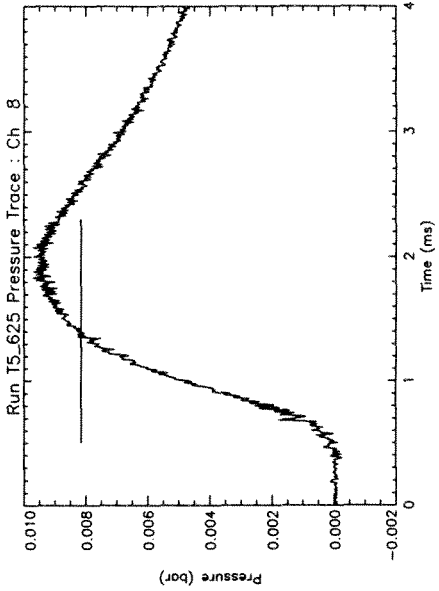
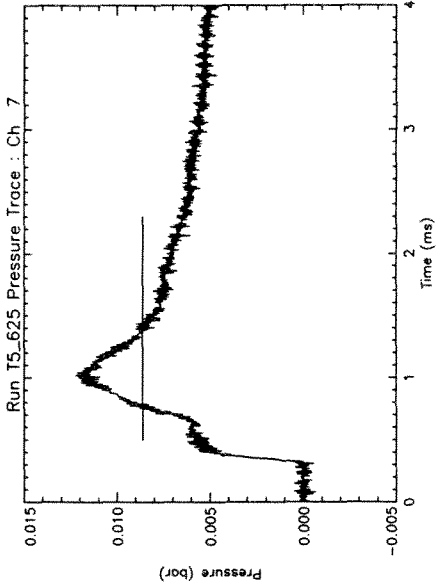
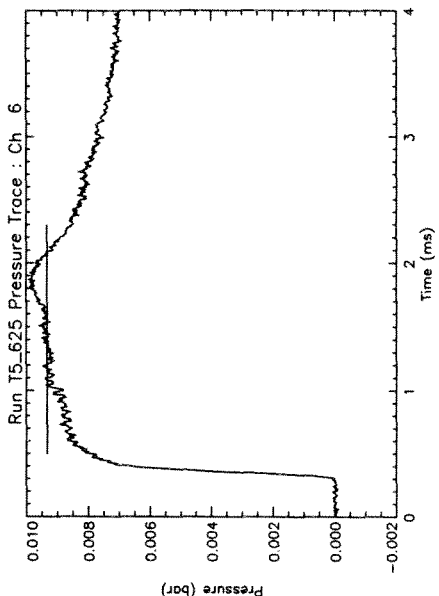
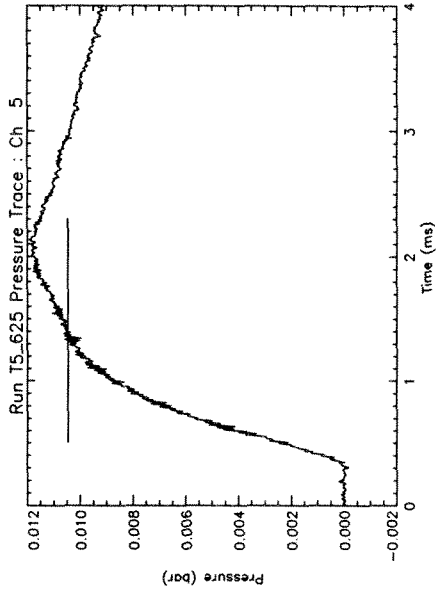
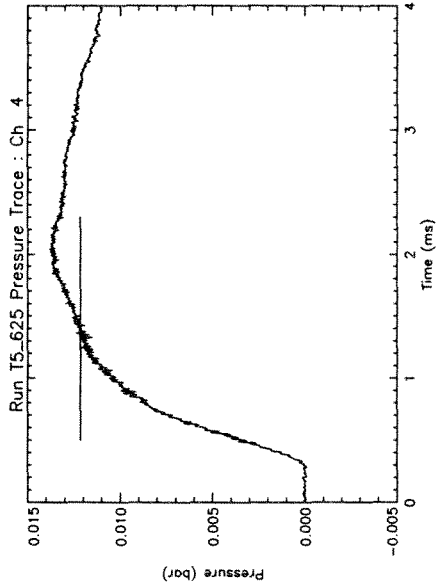
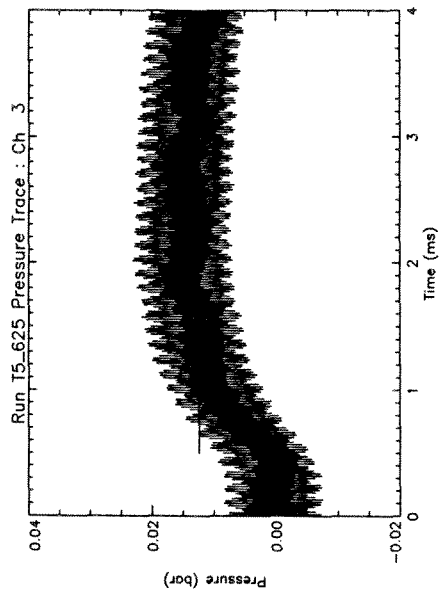
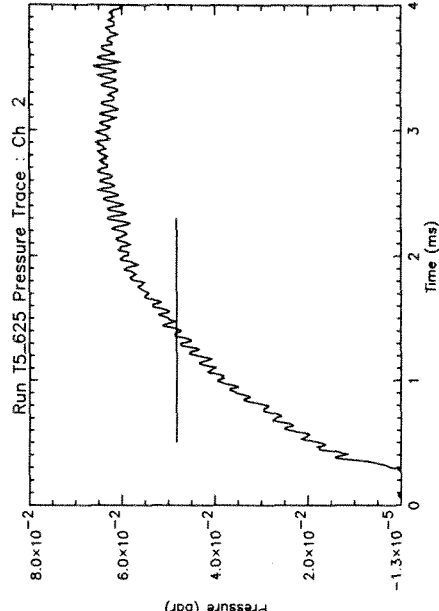
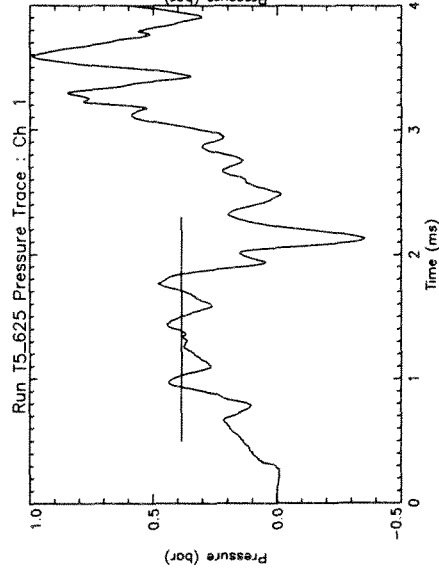


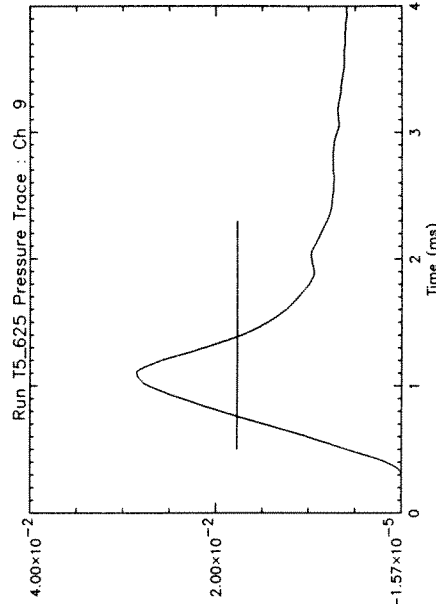
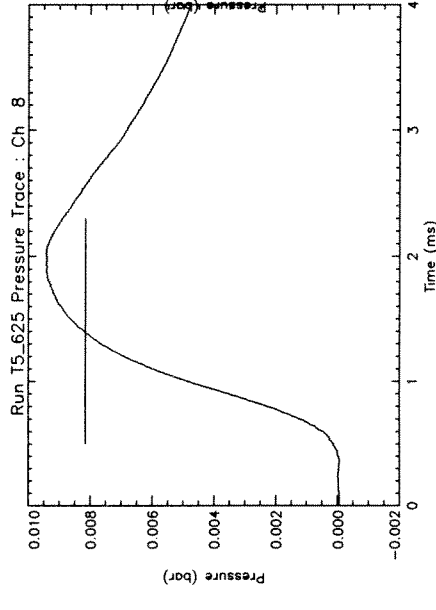
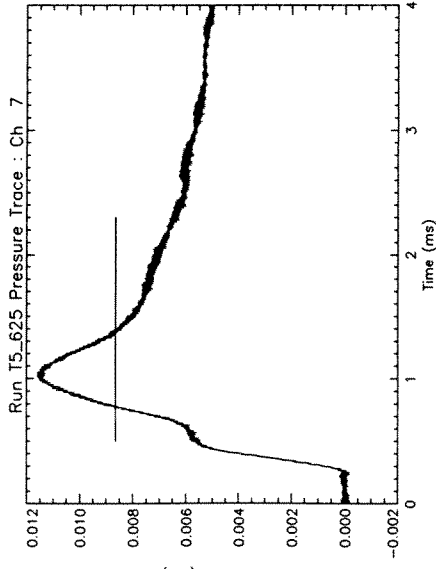
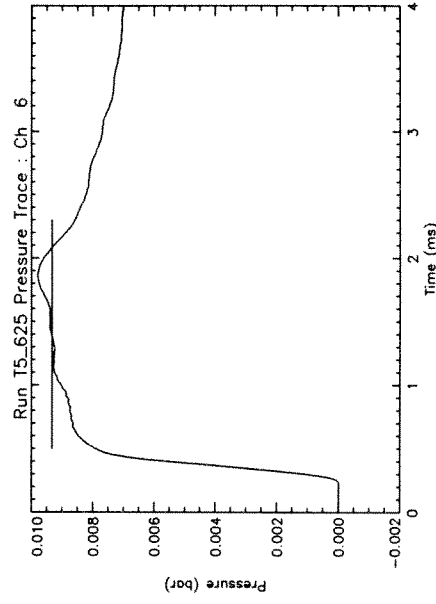
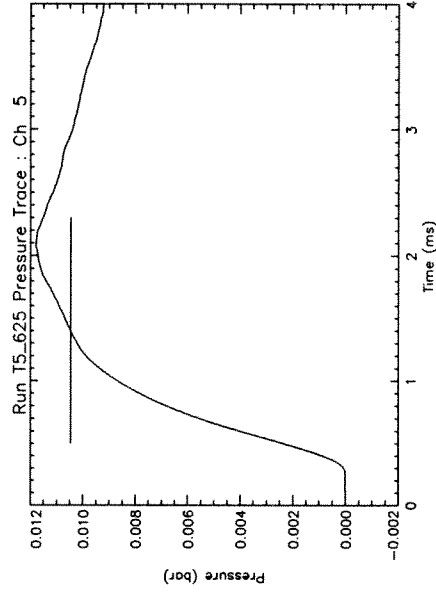
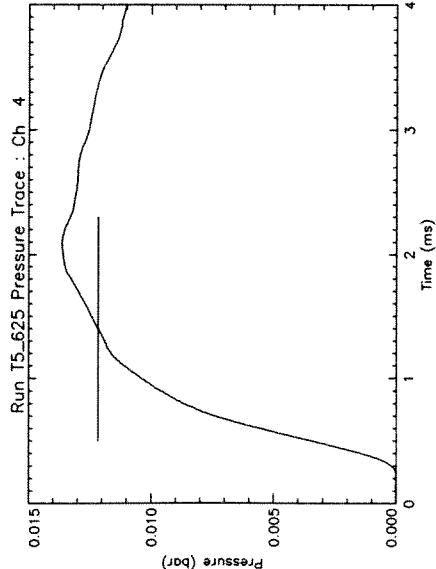
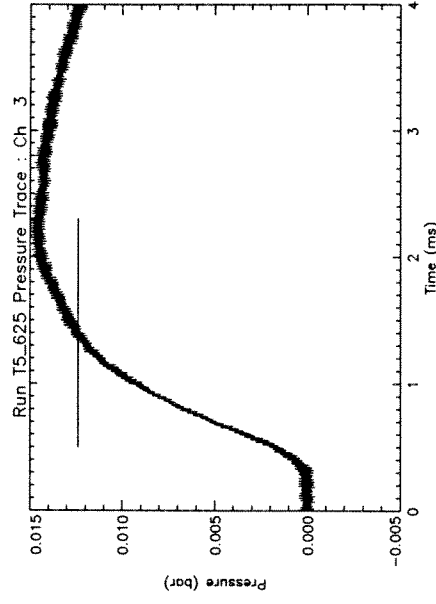
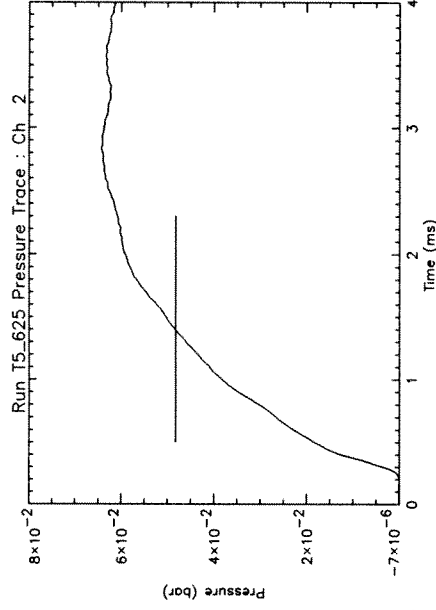
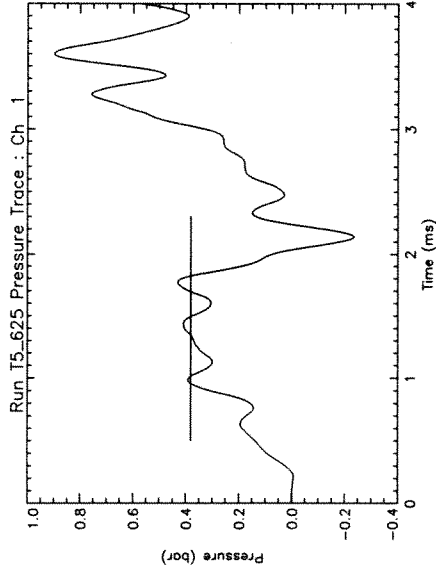
Run T5_625 Secondary reservoir absolute recoil

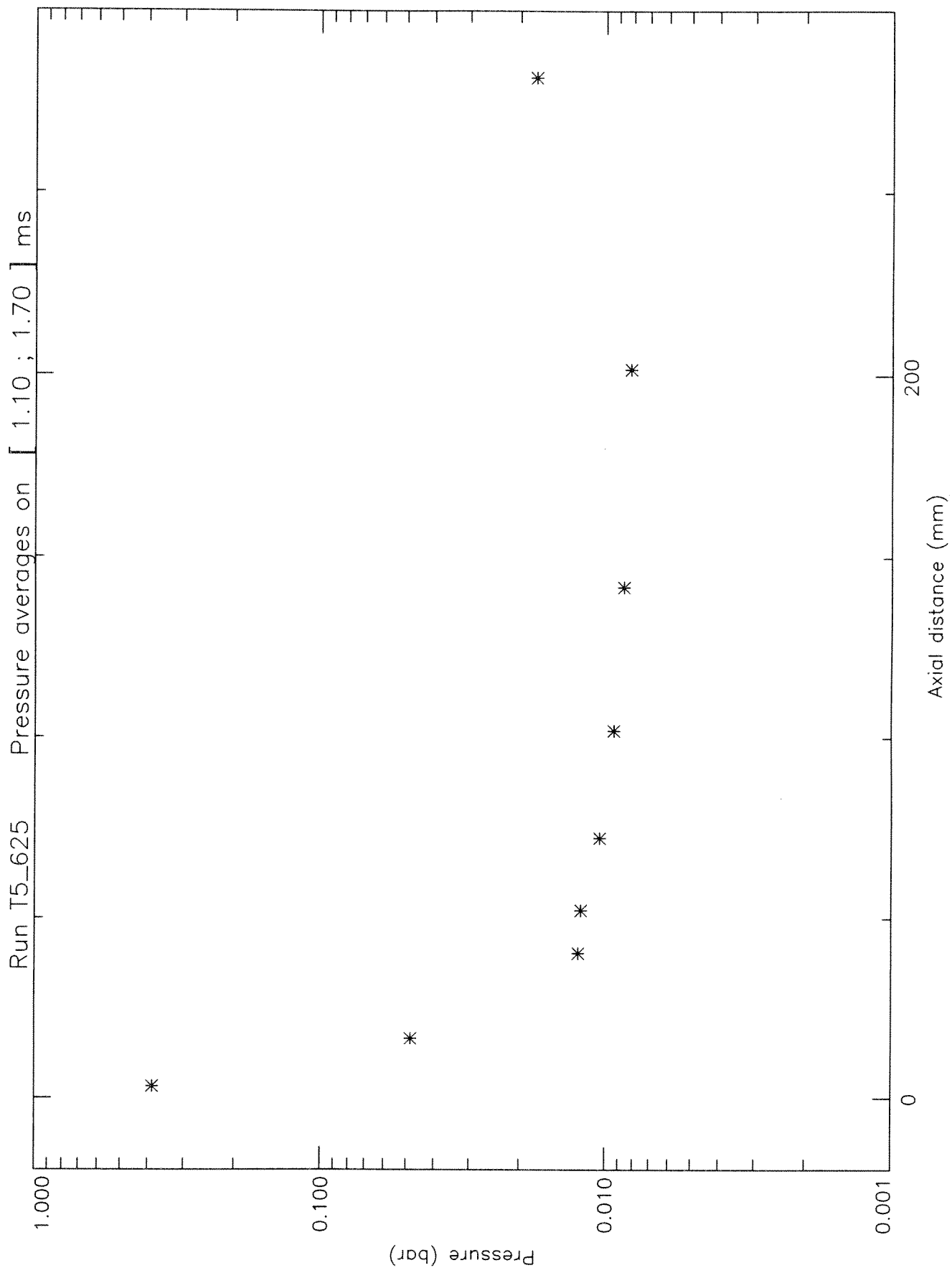


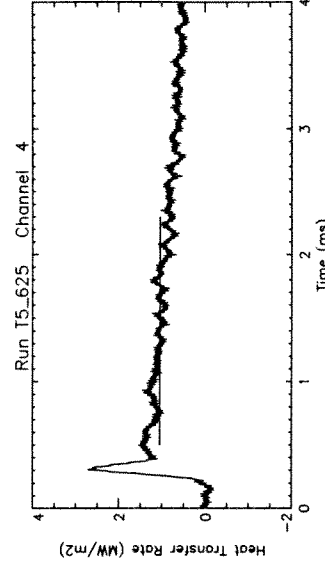
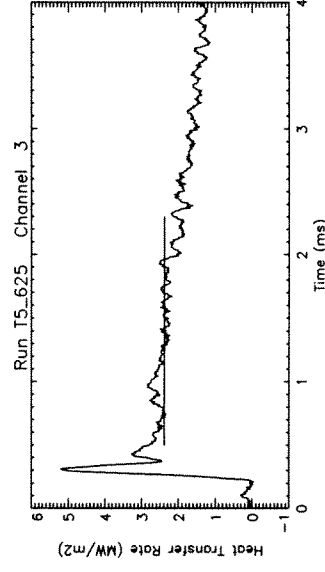
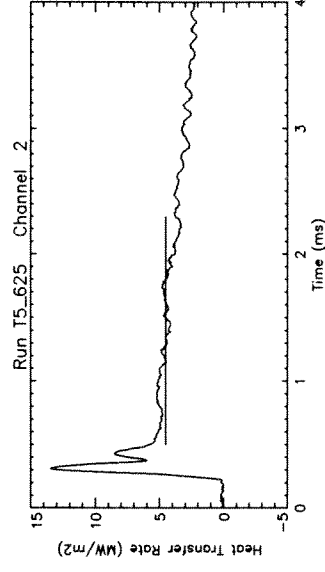
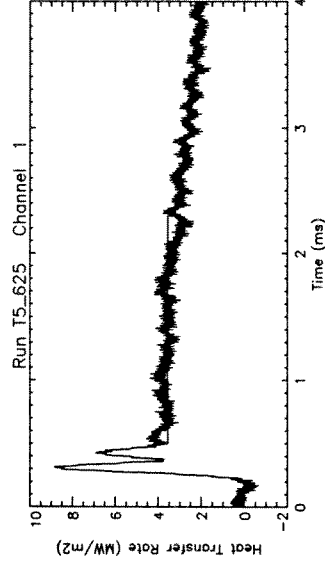
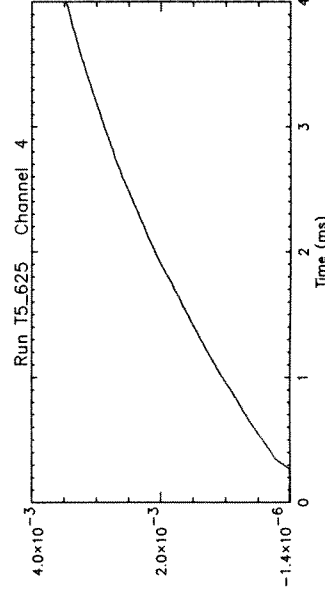
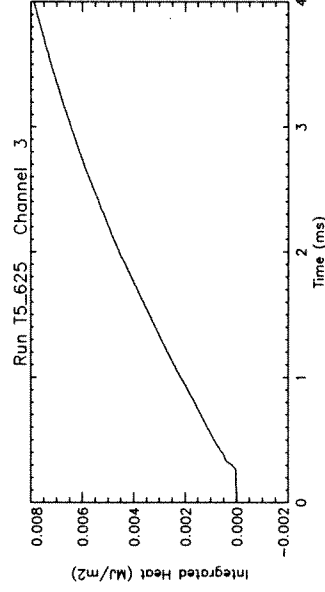
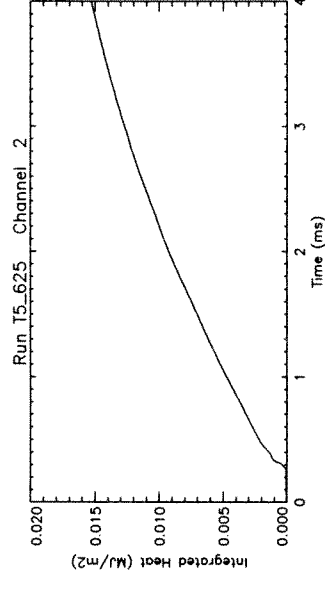
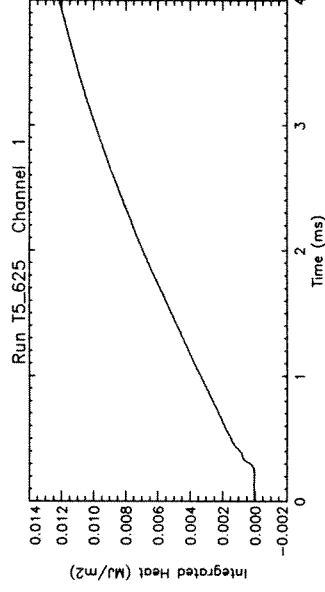
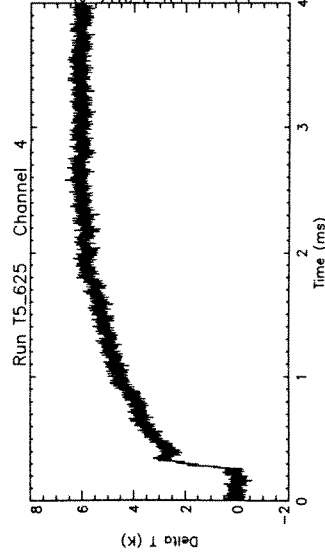
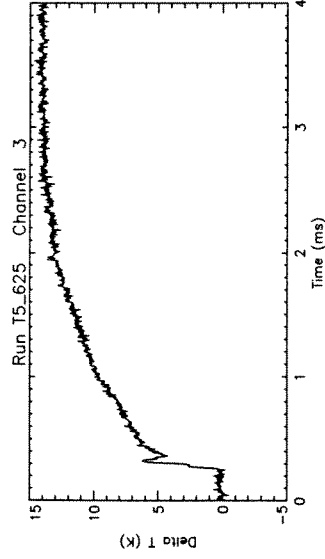
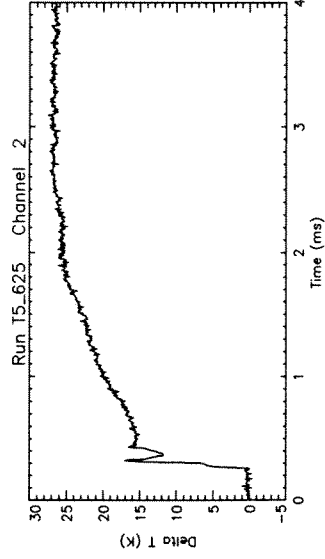
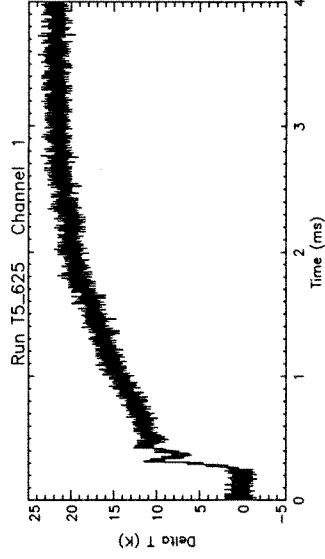
Run T5_625 Differential recoil

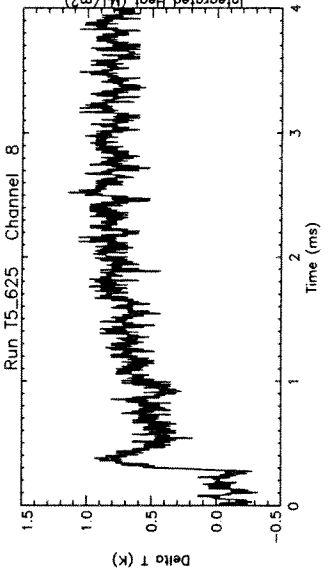
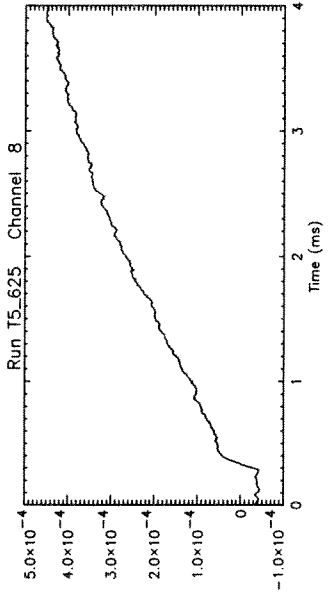
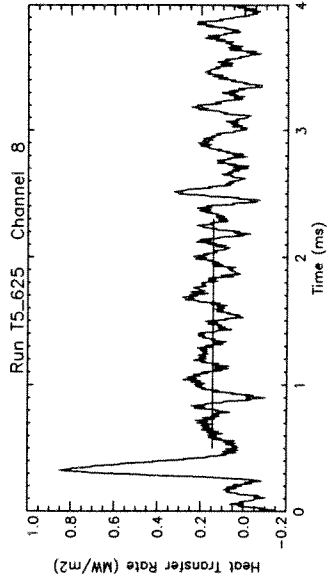
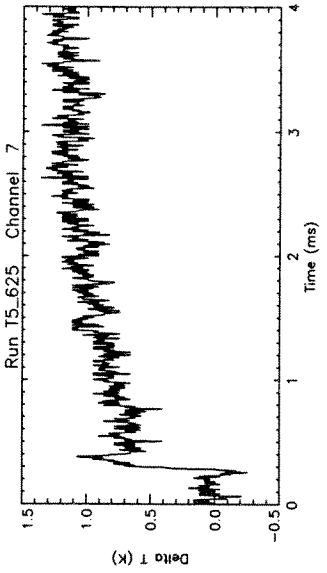
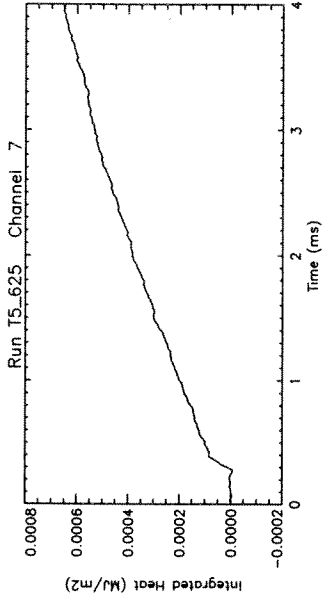
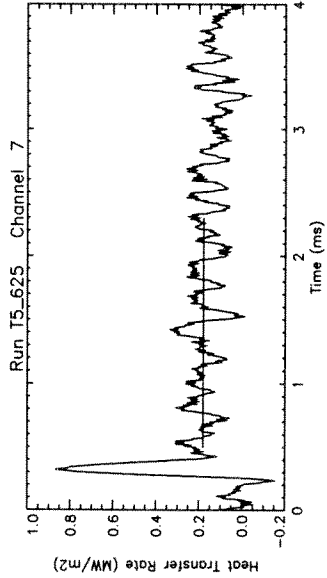
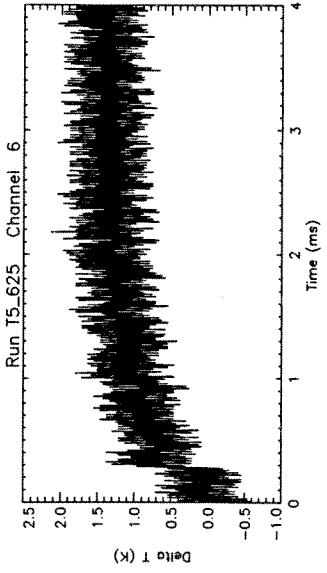
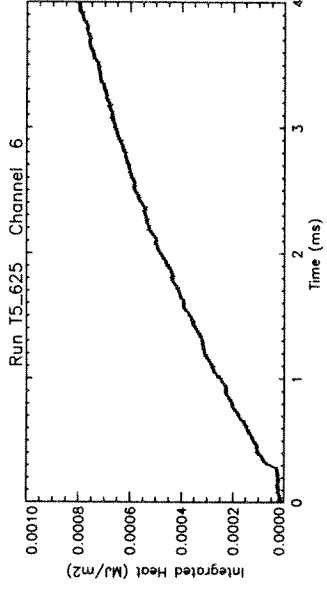
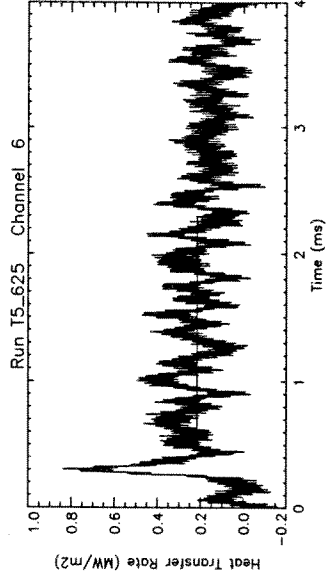
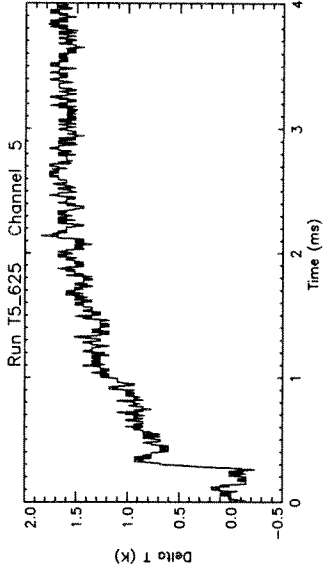
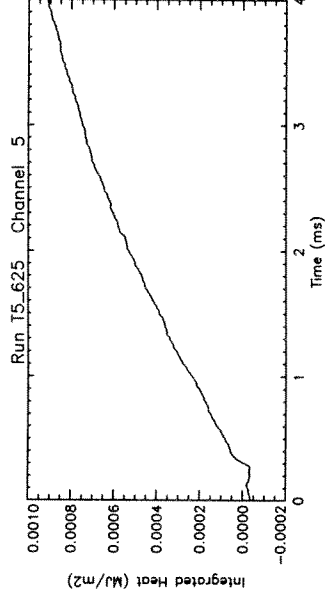
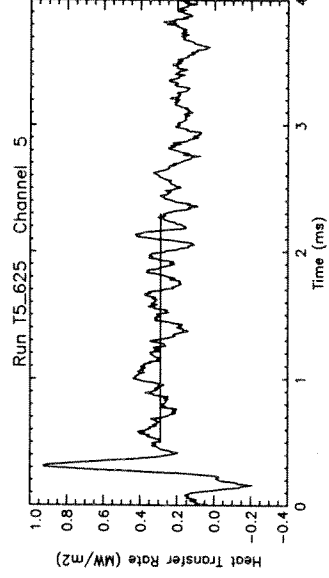


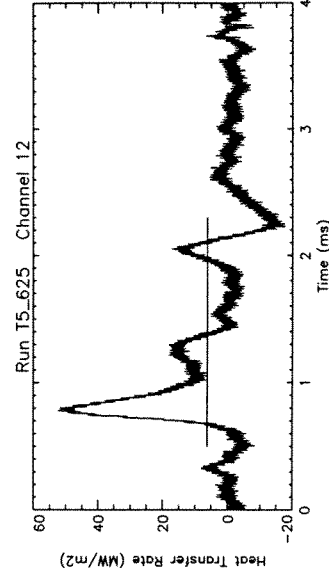
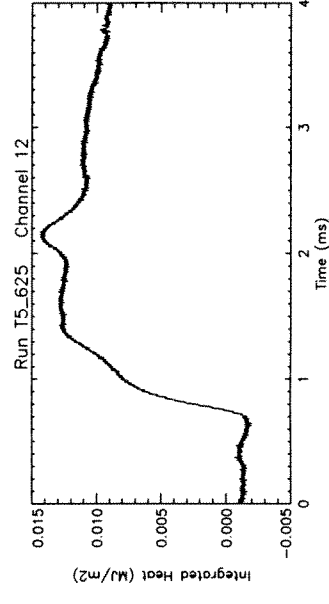
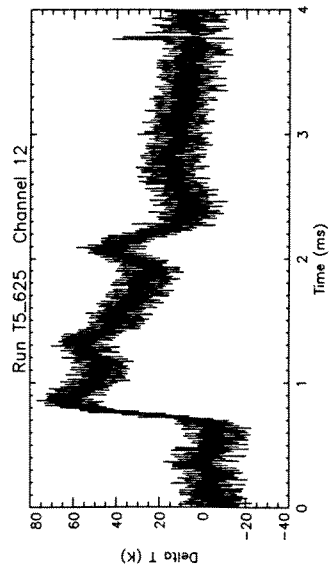
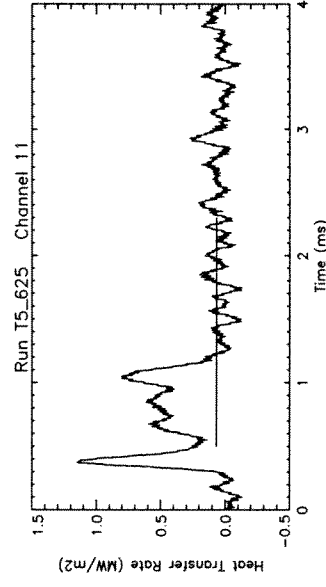
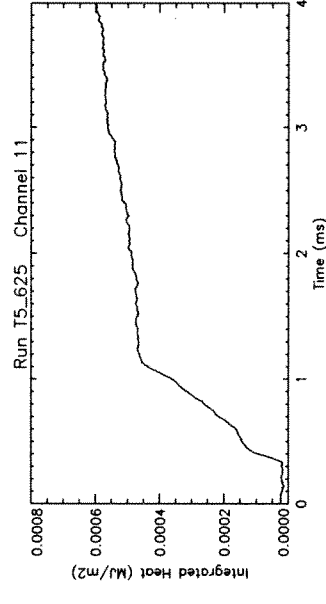
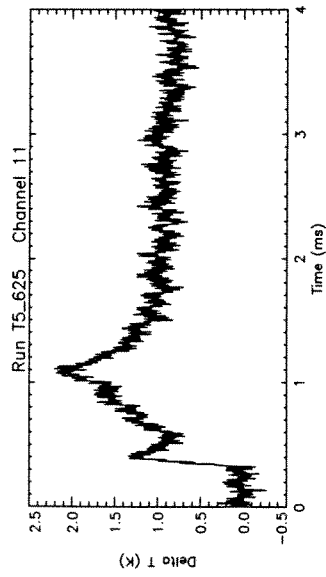
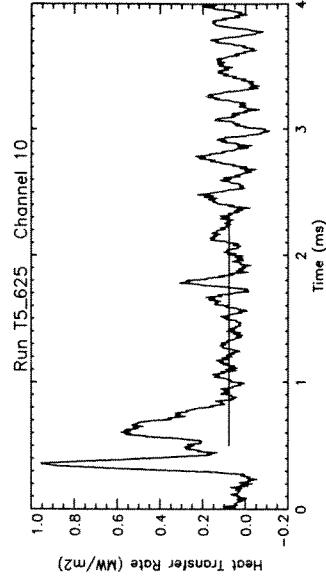
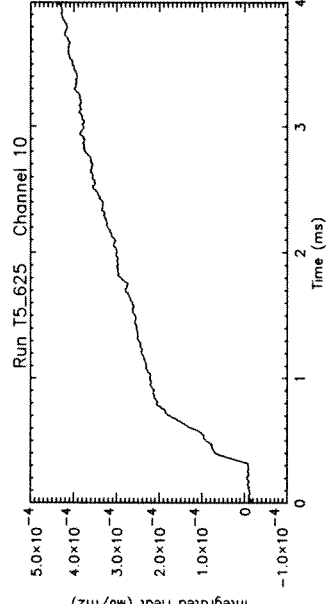
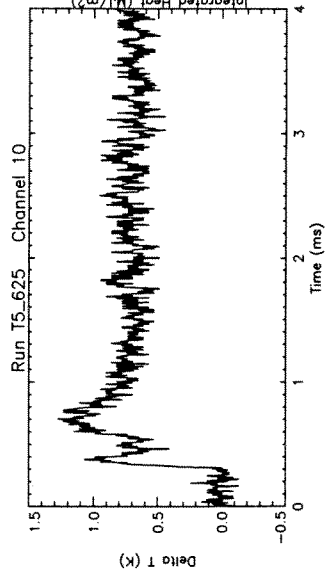
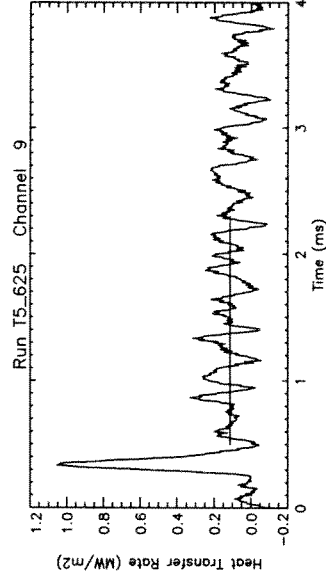
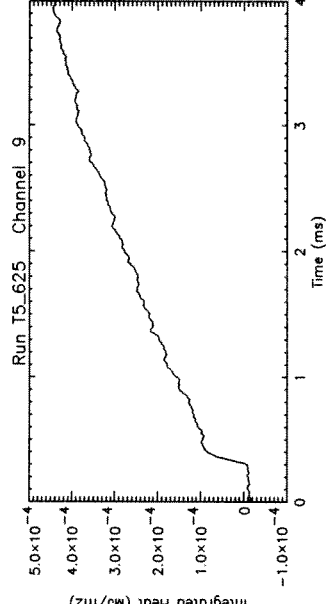
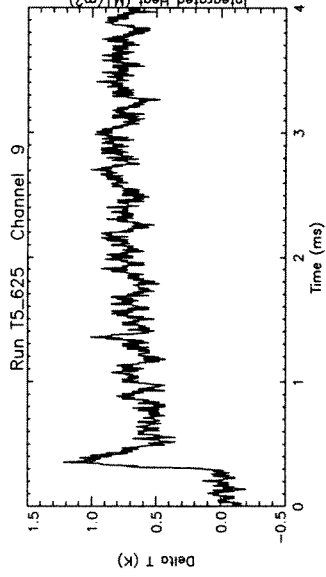


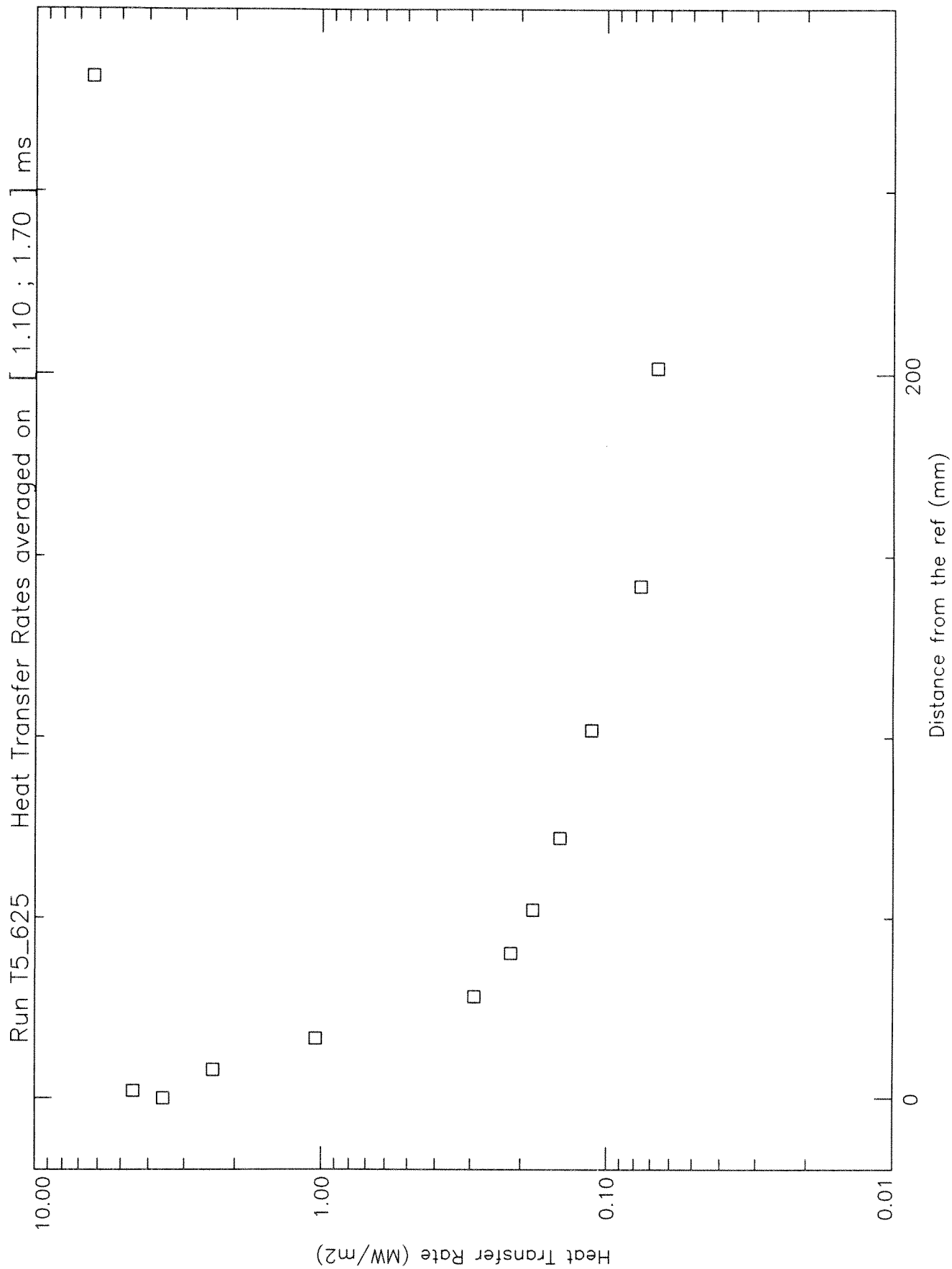












Run # 625

Pressure averages around 1.40 +/- 0.30 ms

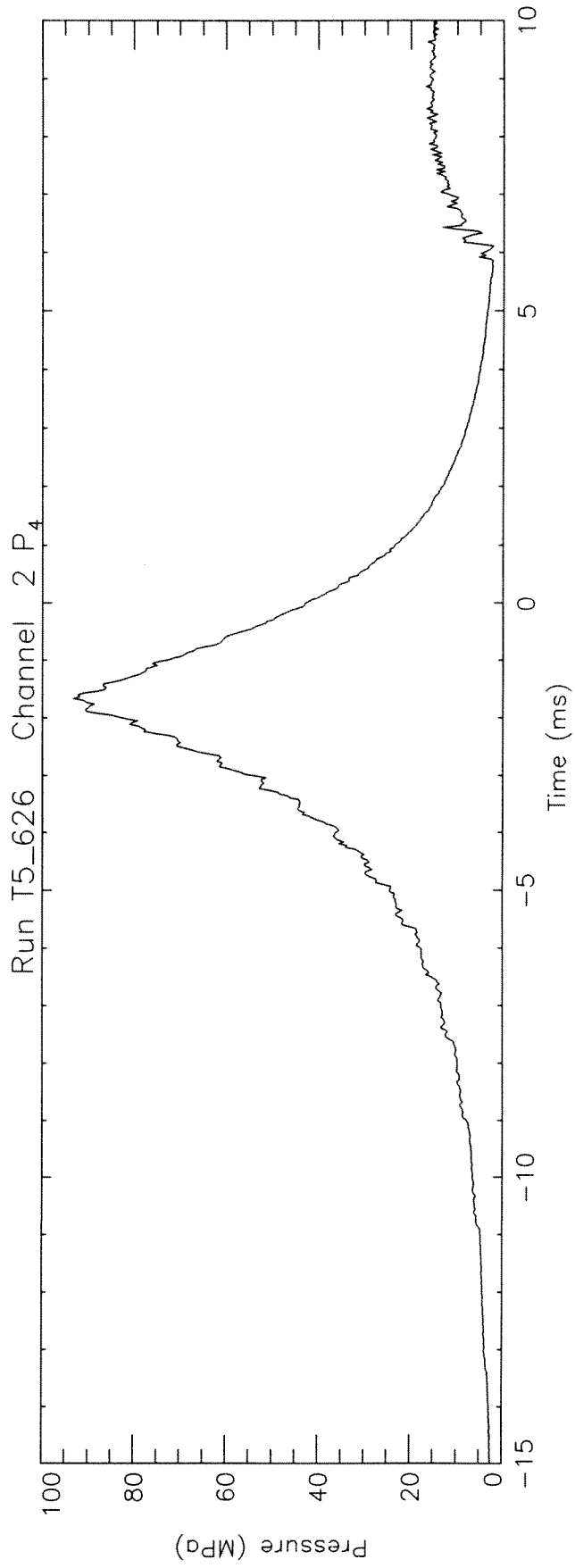
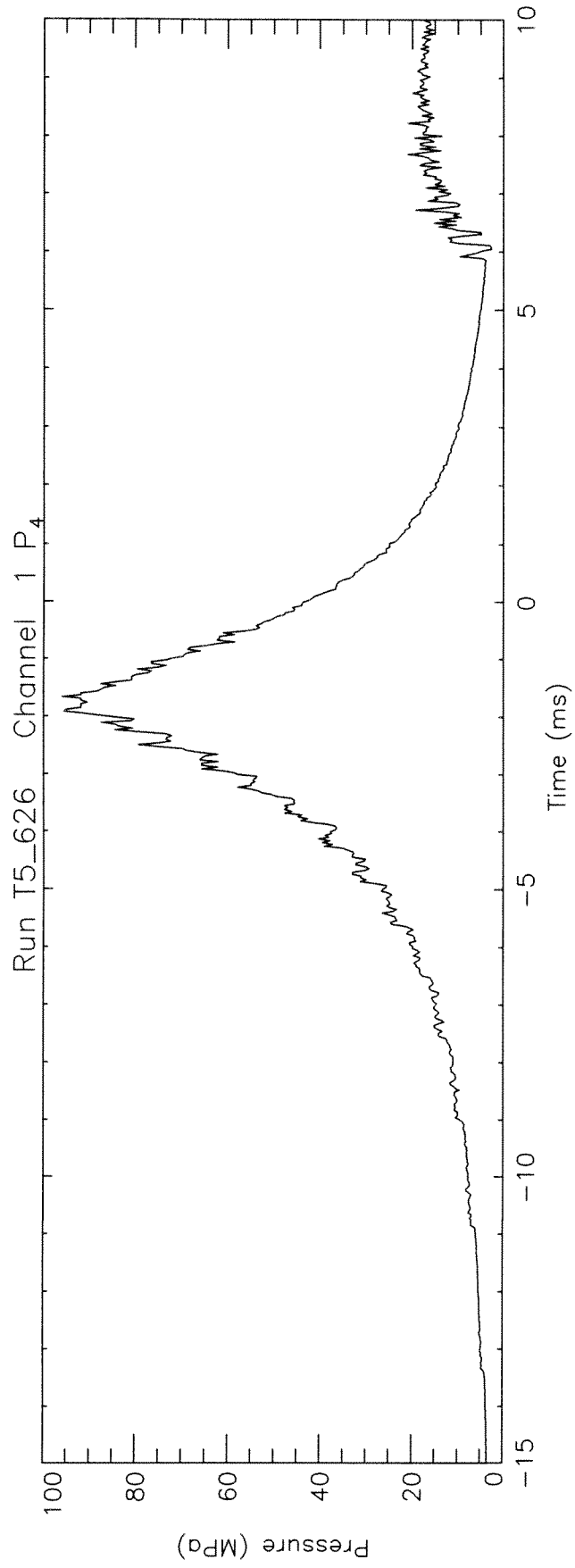
Smooth box = 2.

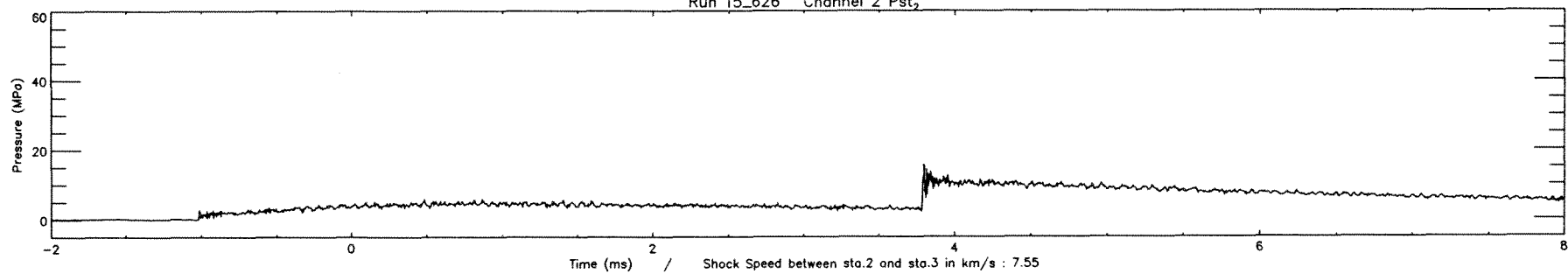
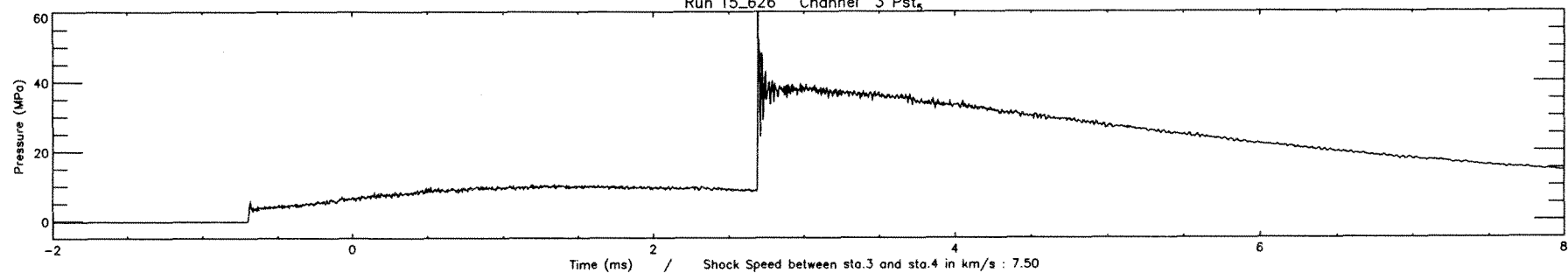
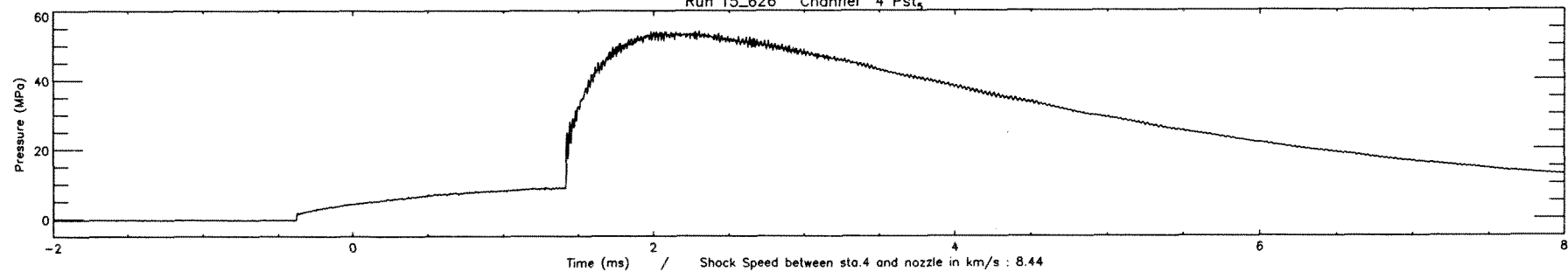
DA1	:	0.3853
DA2	:	0.0482
DA3	:	0.0124
DA4	:	0.0122
DA5	:	0.0105
DA6	:	0.0093
DA7	:	0.0086
DA8	:	0.0082
DA9	:	0.0176

Run # 625

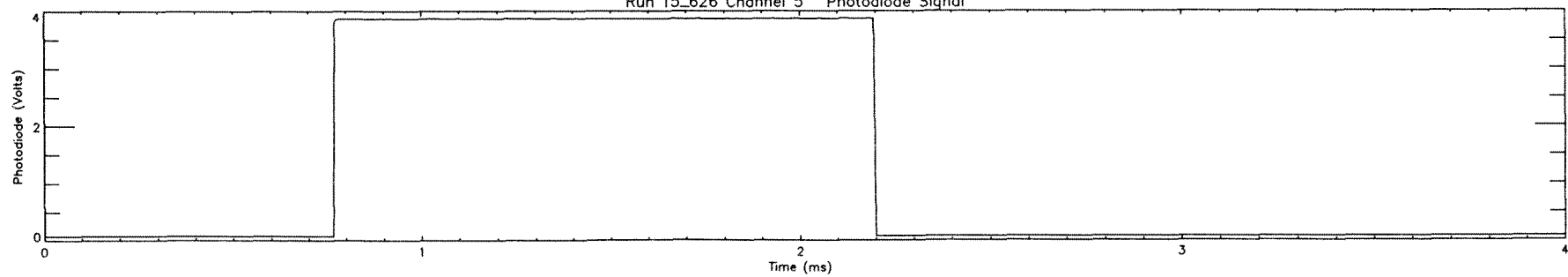
Heat Transfer Rates (in MW/m²)
averaged around 1.40 +/- 0.30 ms

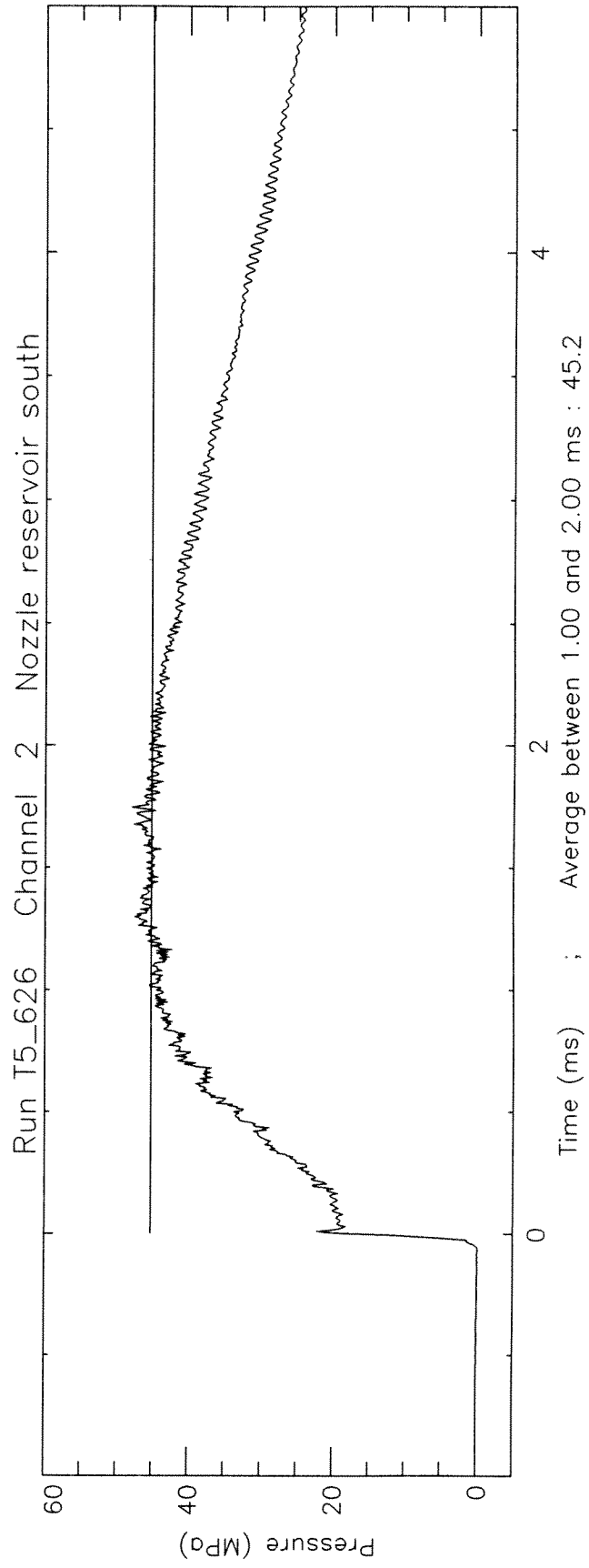
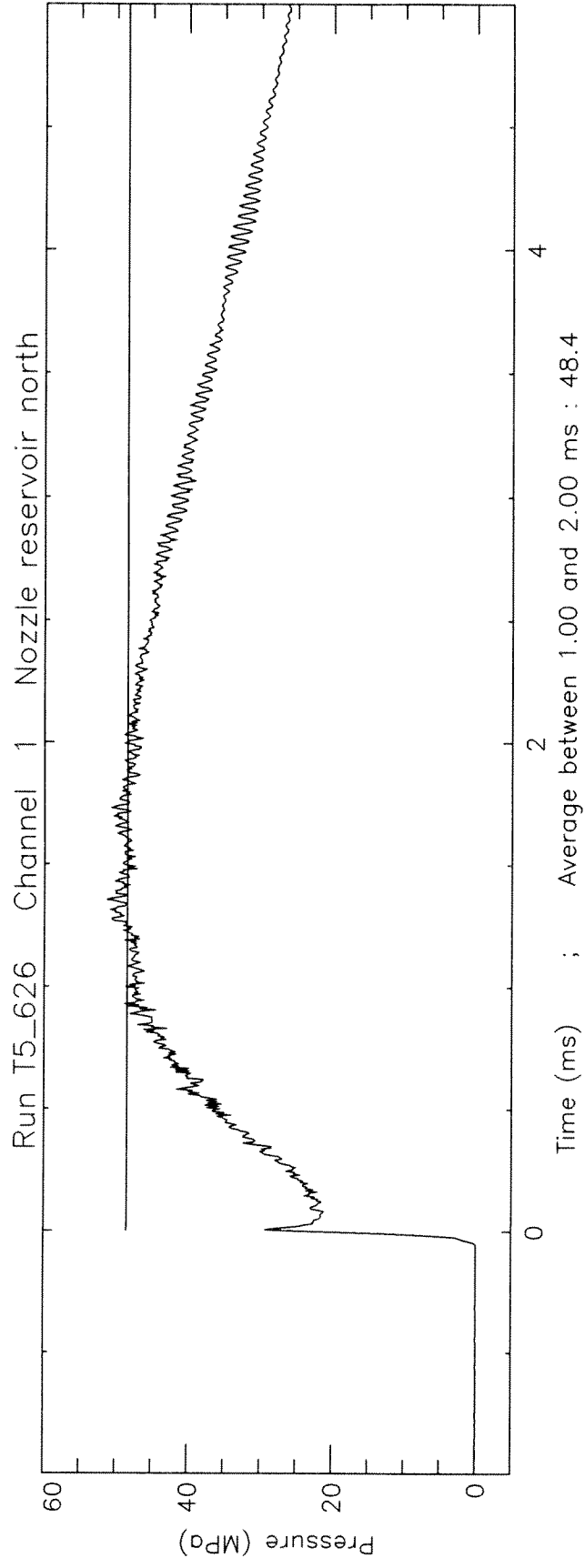
MT 1 :	3.5553
MT 2 :	4.5190
MT 3 :	2.3821
MT 4 :	1.0449
MT 5 :	0.2905
MT 6 :	0.2168
MT 7 :	0.1815
MT 8 :	0.1456
MT 9 :	0.1130
MT10 :	0.0760
MT11 :	0.0666
MT12 :	6.2891



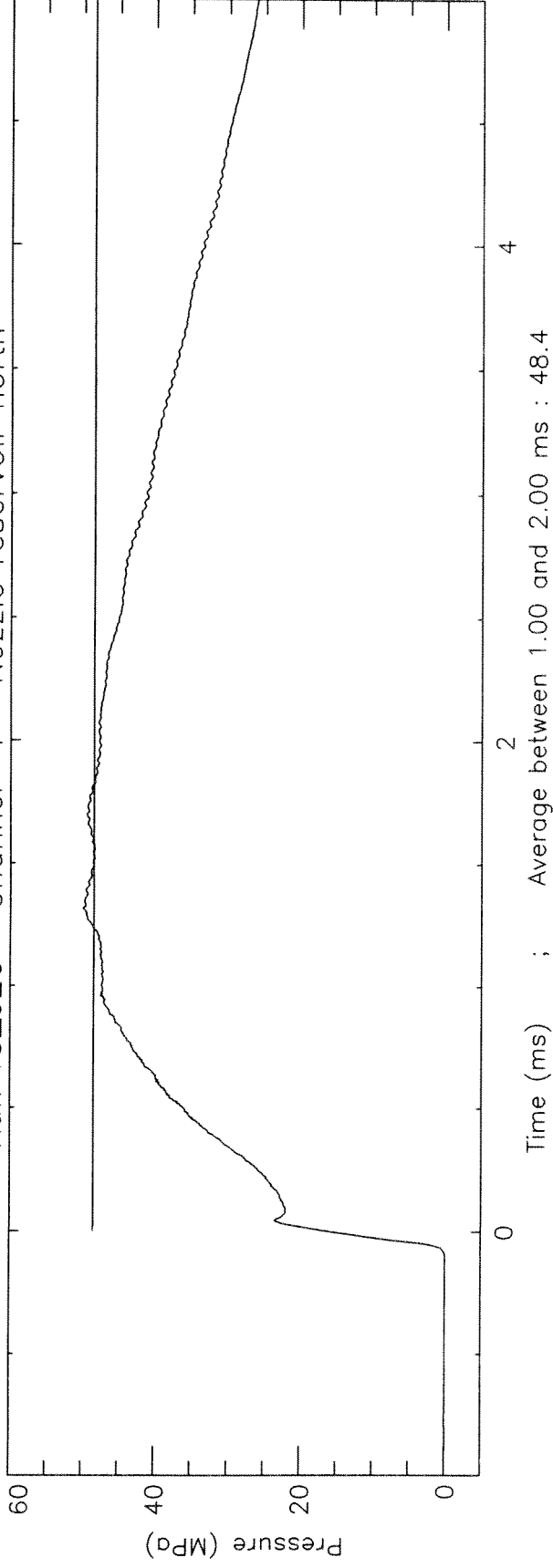
Run T5_626 Channel 2 Pst₂Run T5_626 Channel 3 Pst₃Run T5_626 Channel 4 Pst₄

Run T5_626 Channel 5 Photodiode Signal

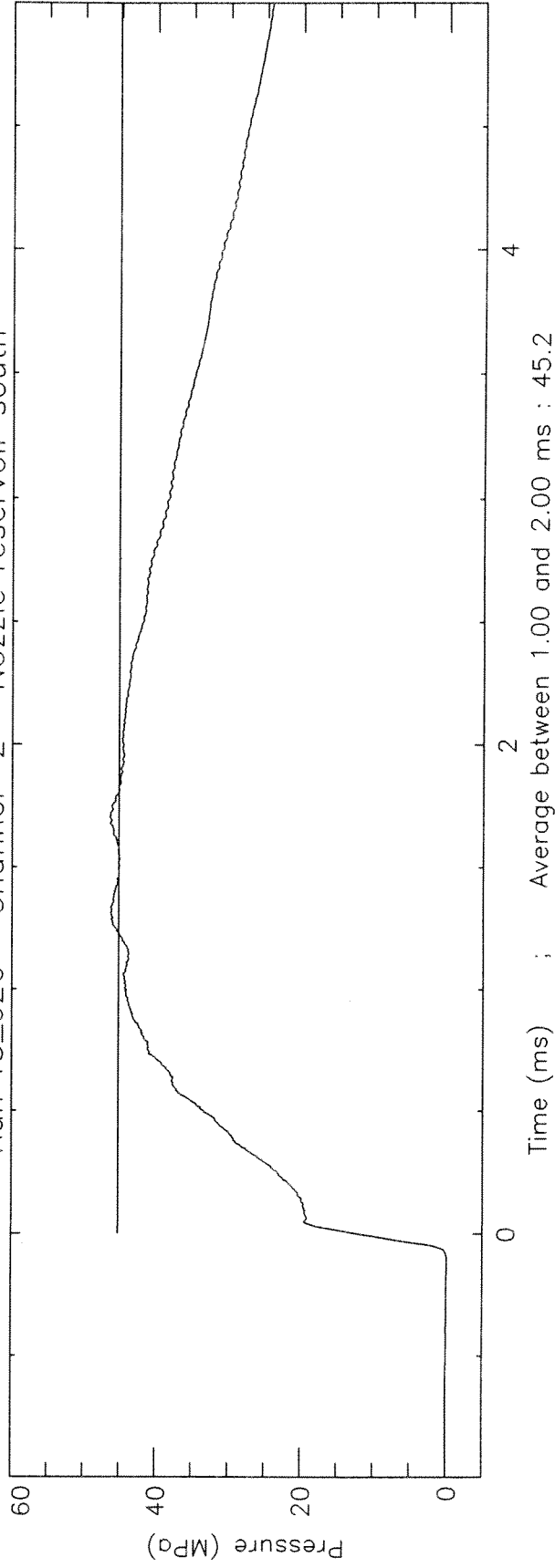


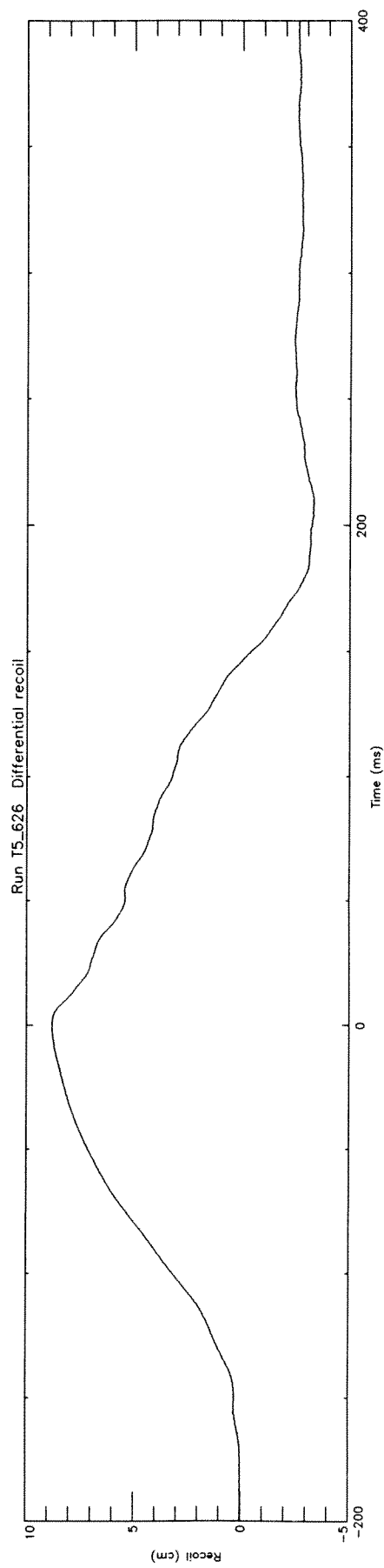
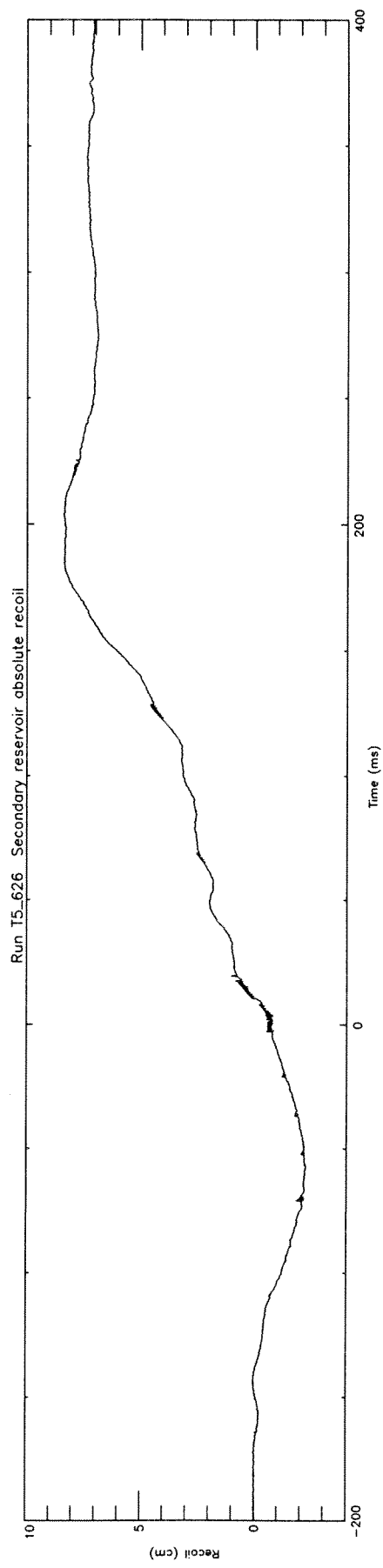
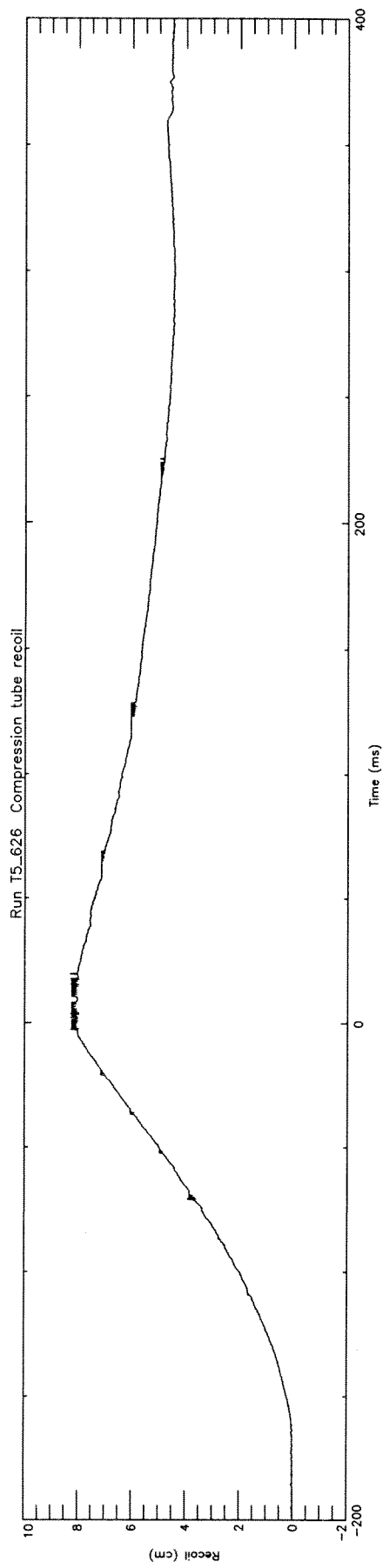


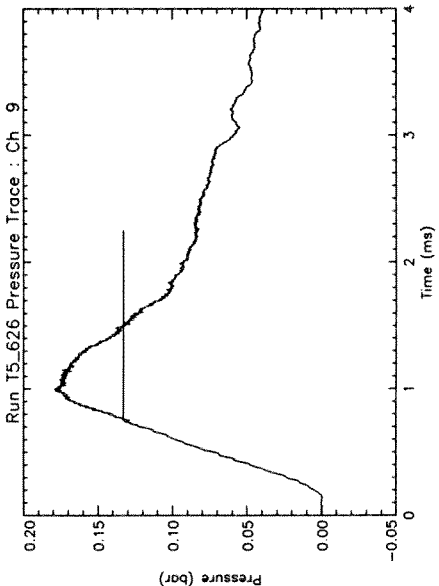
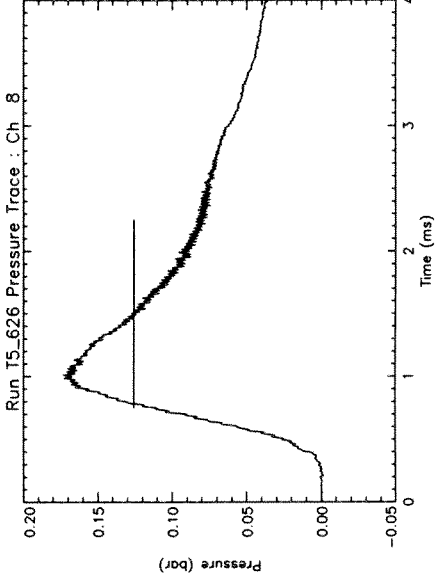
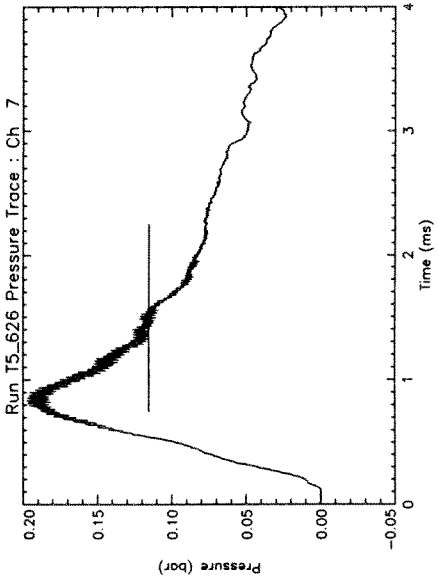
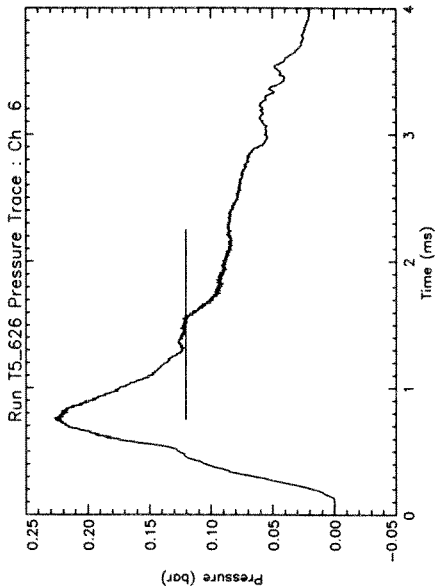
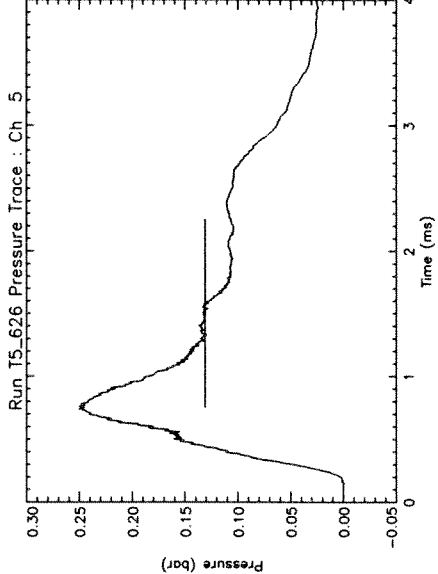
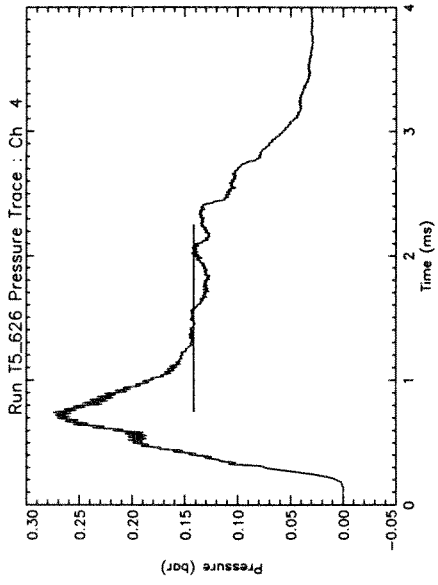
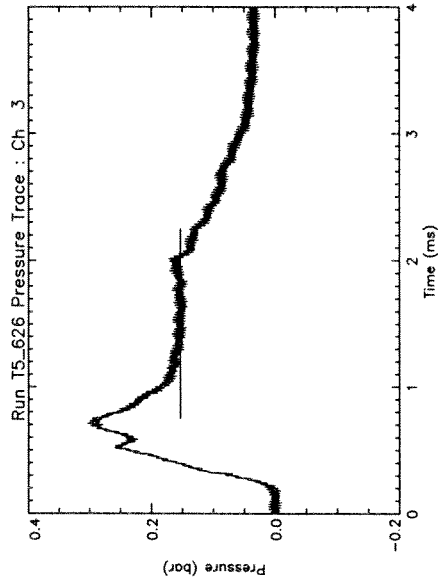
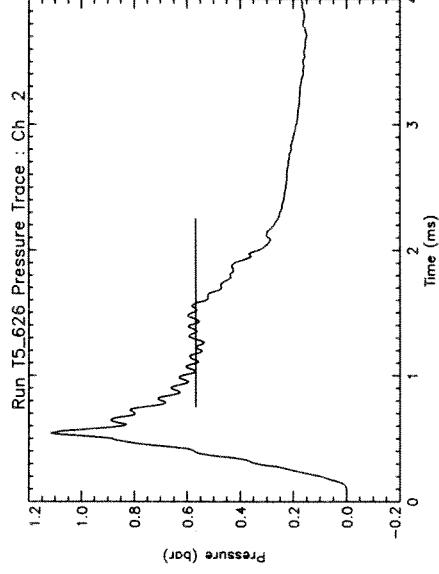
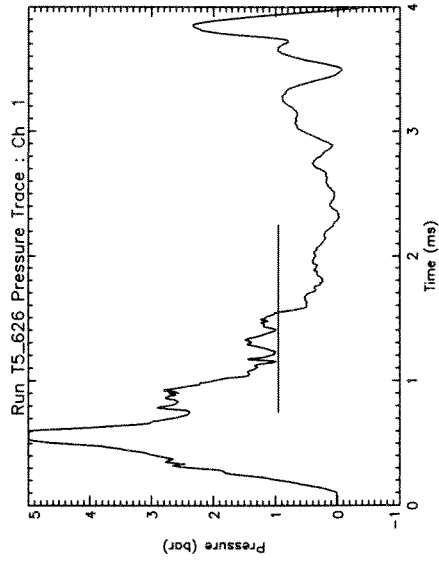
Run T5_626 Channel 1 Nozzle reservoir north

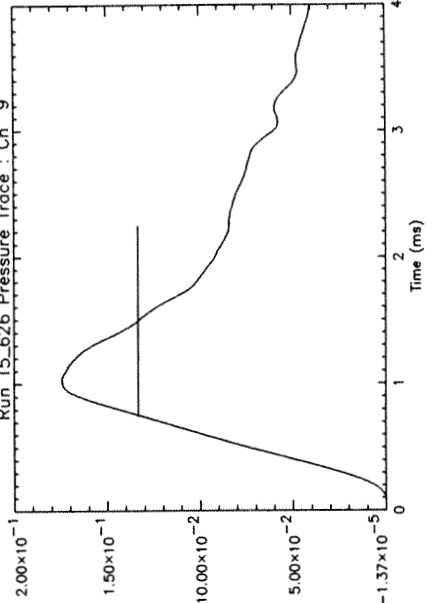
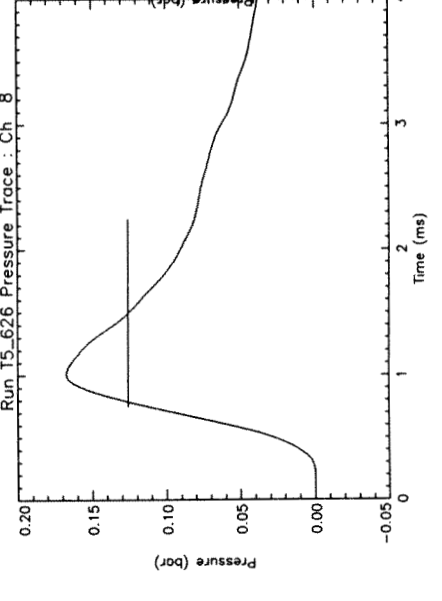
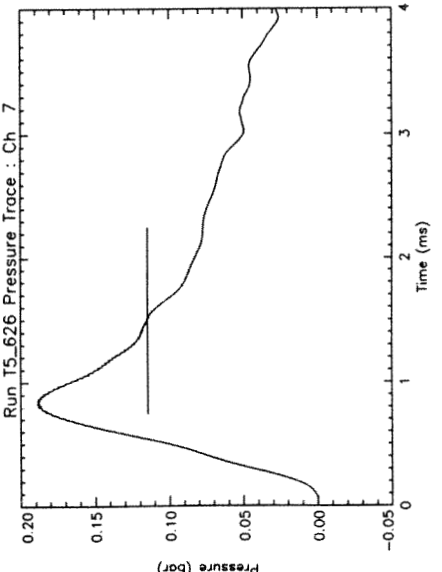
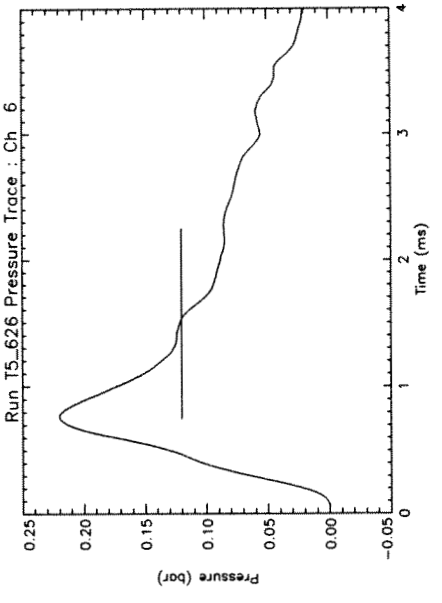
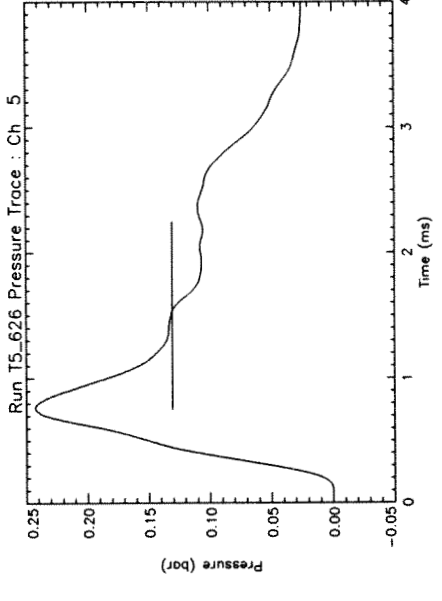
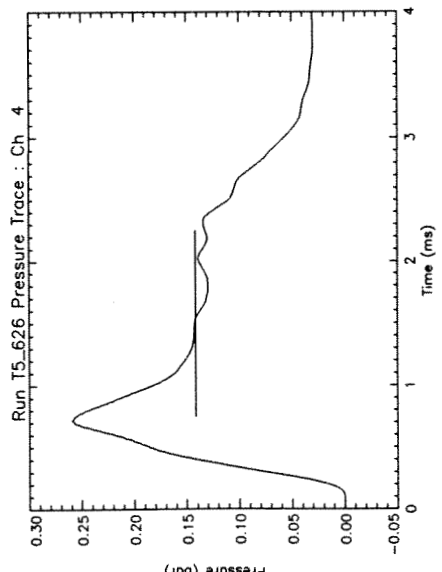
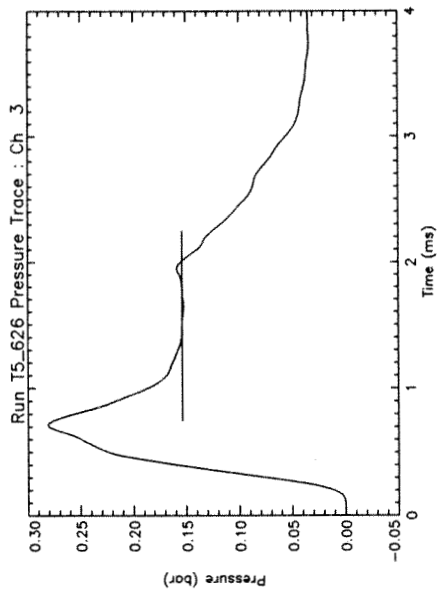
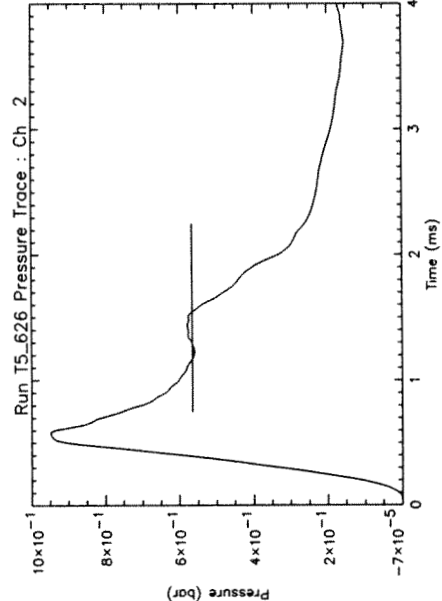
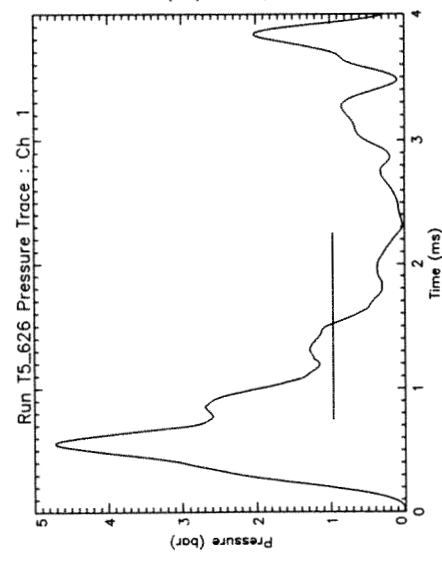


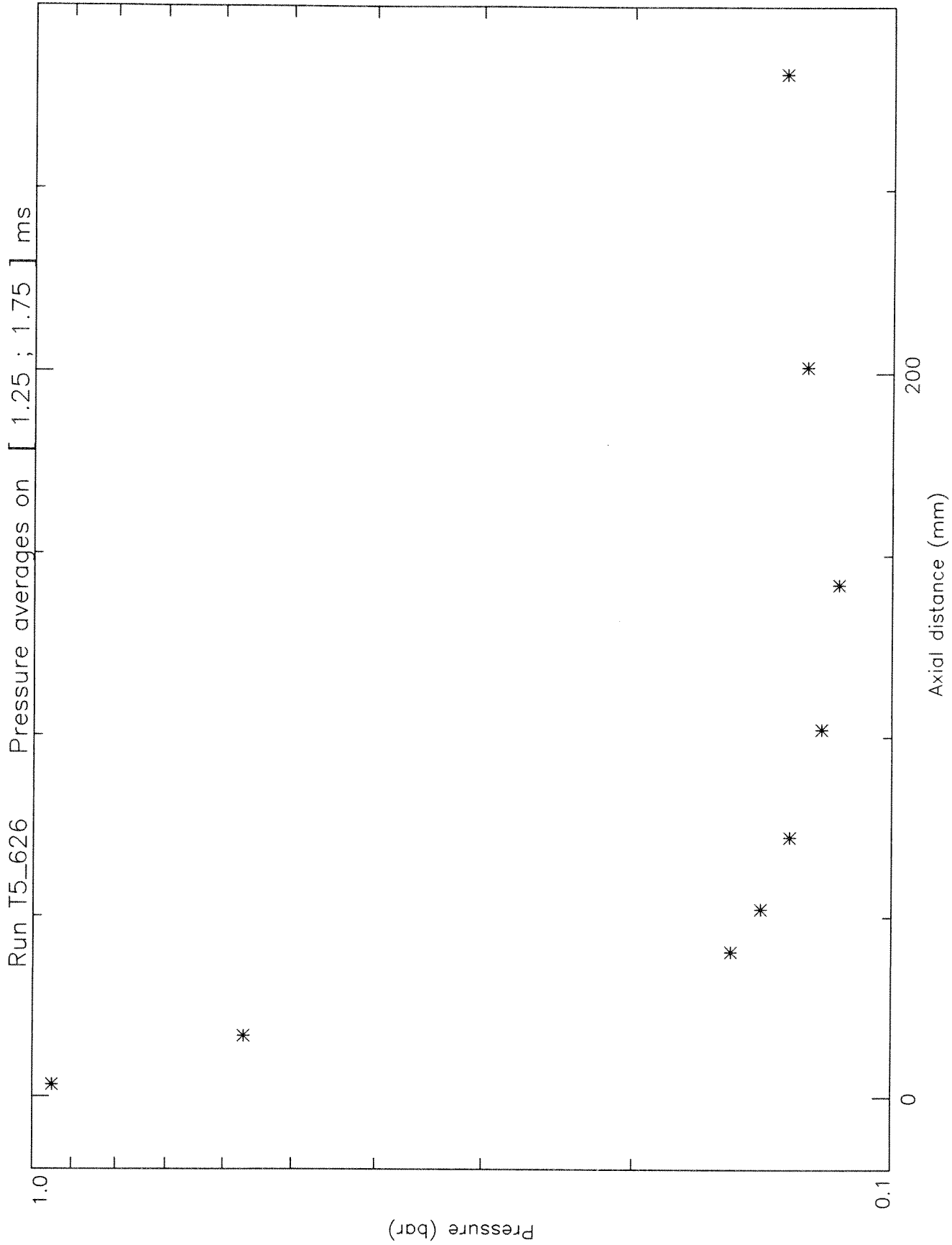
Run T5_626 Channel 2 Nozzle reservoir south

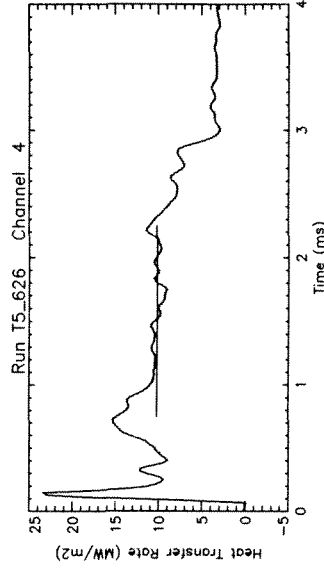
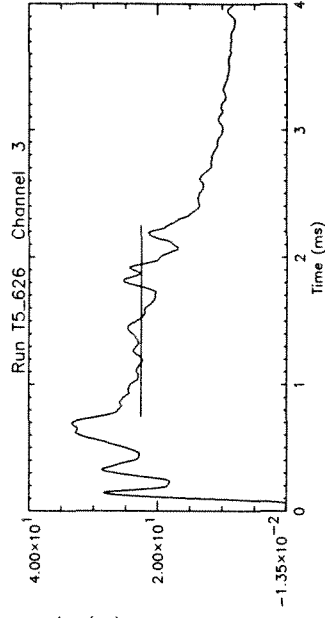
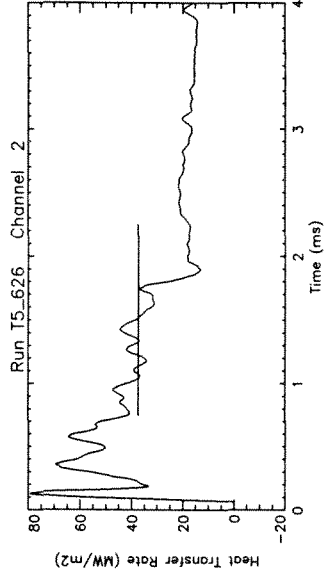
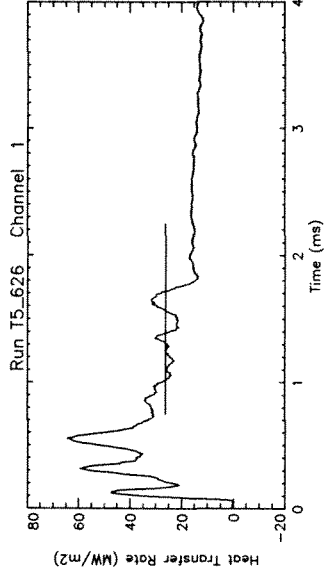
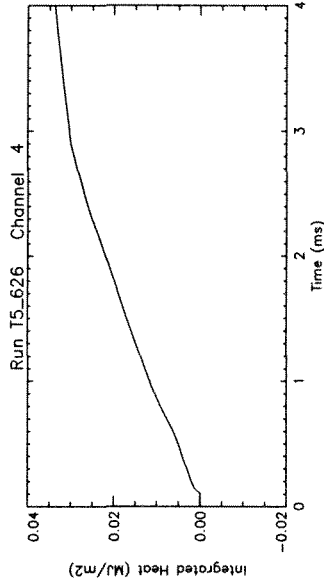
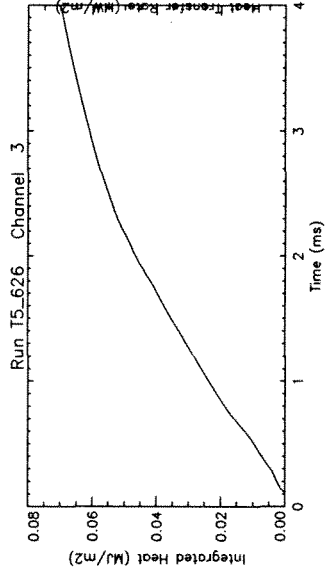
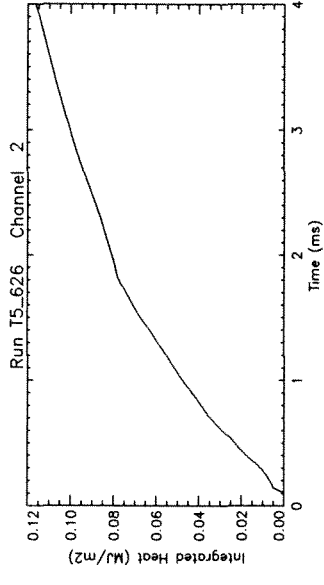
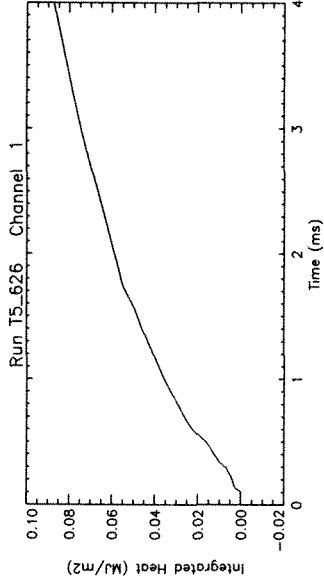
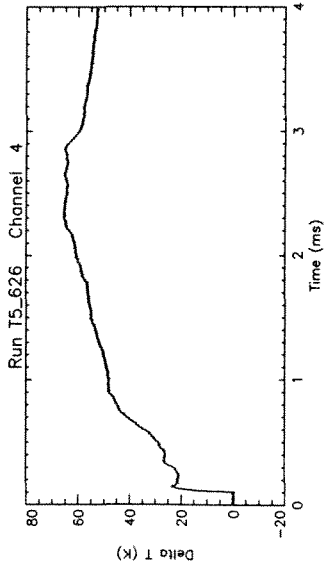
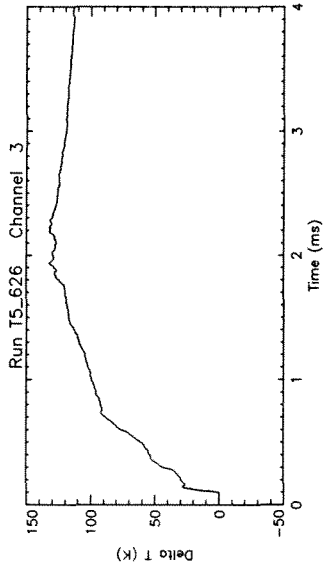
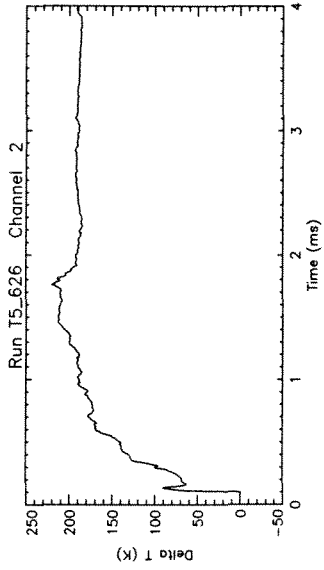
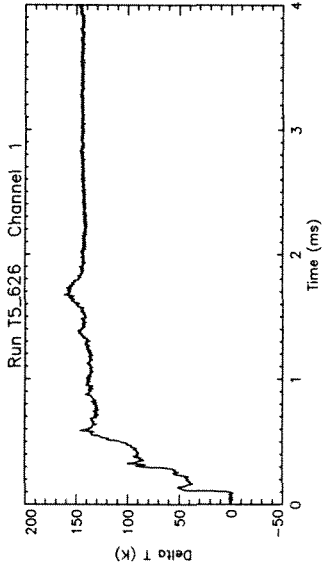


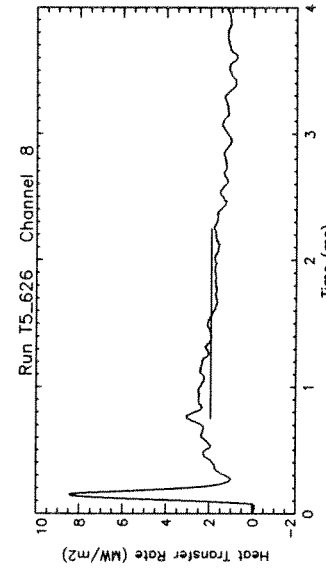
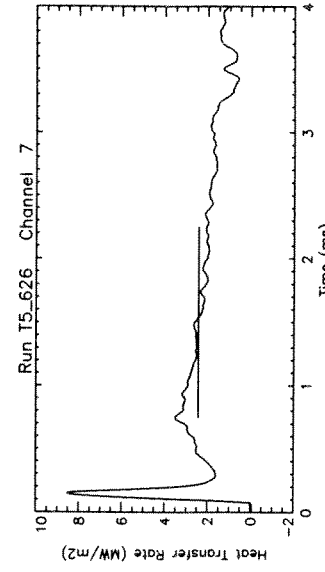
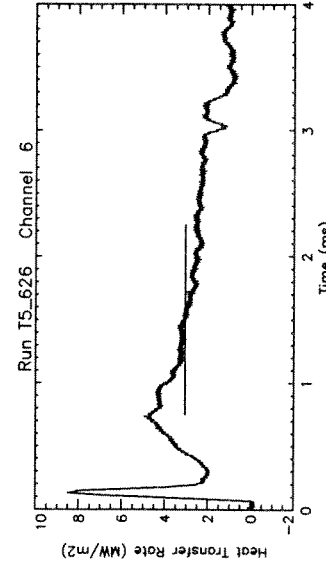
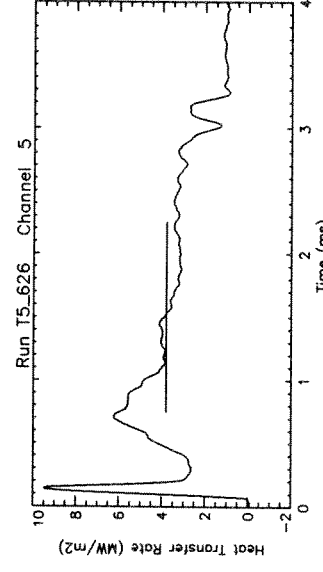
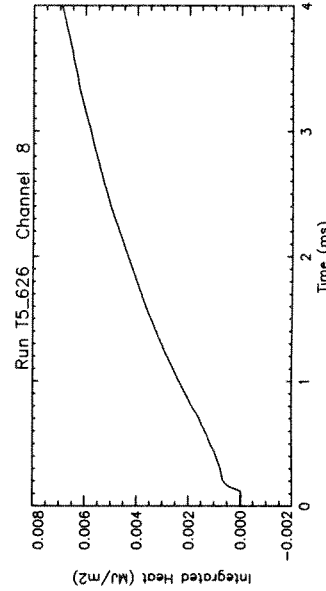
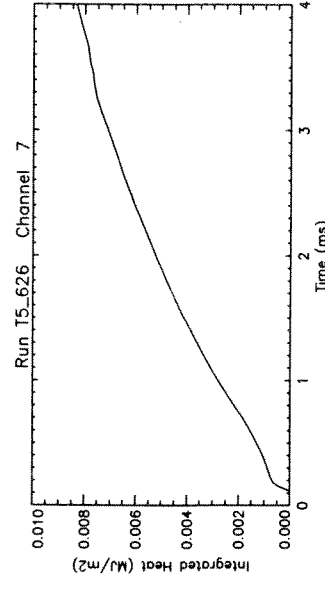
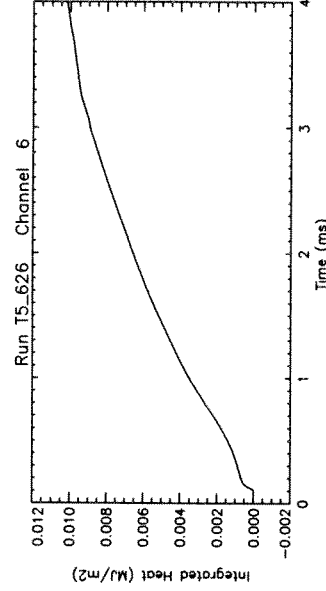
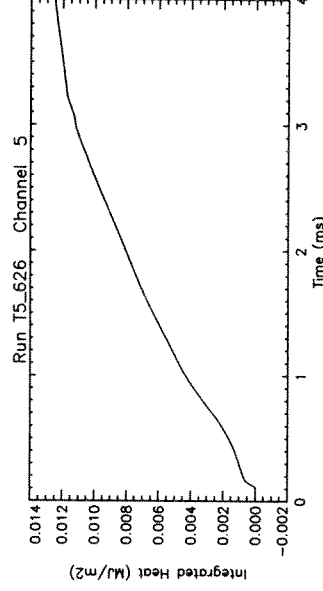
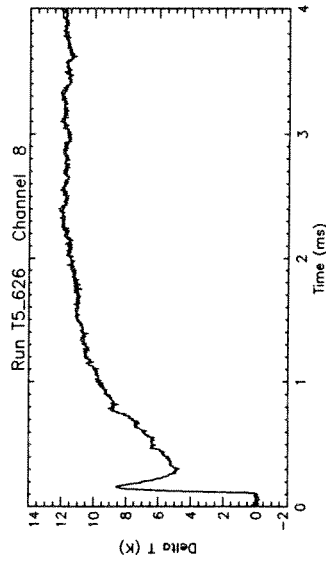
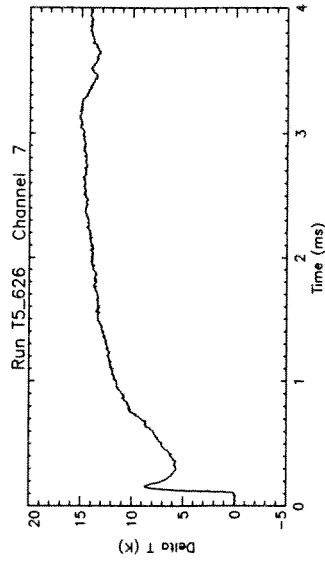
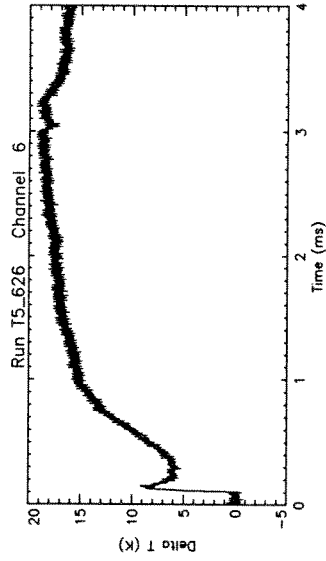
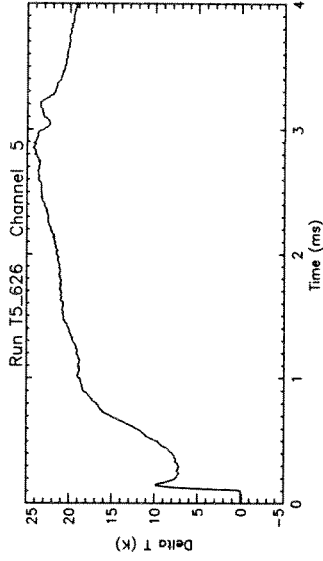


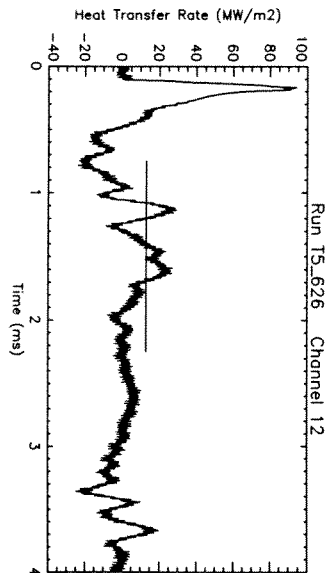
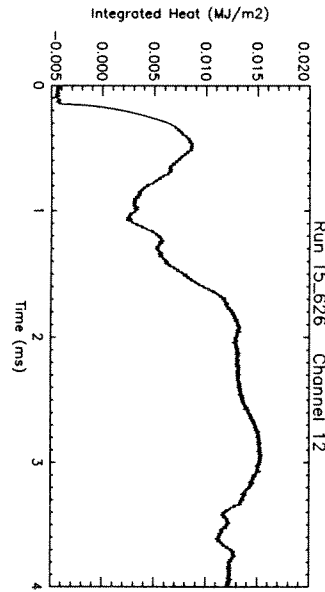
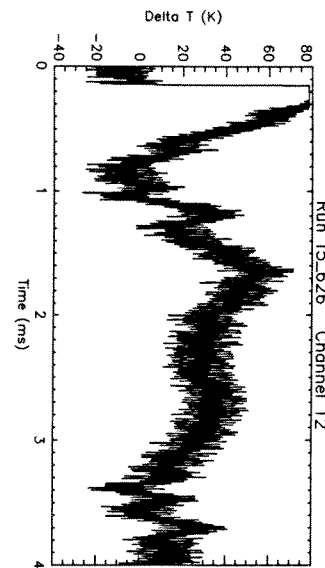
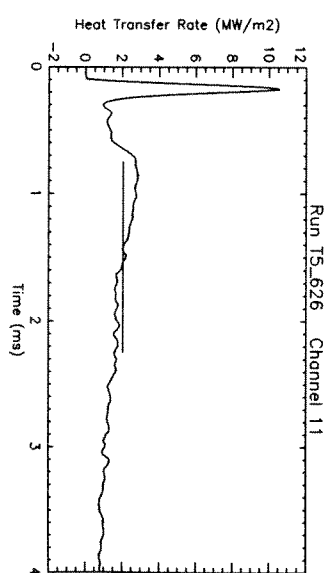
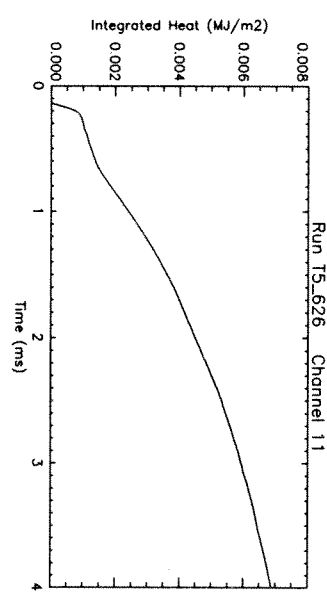
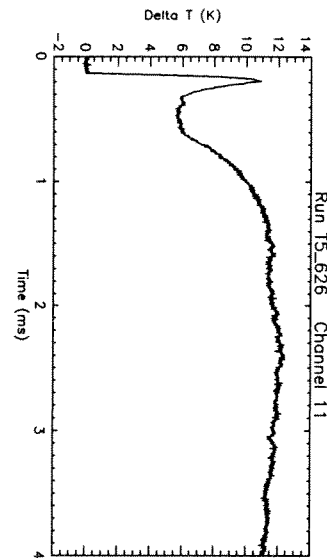
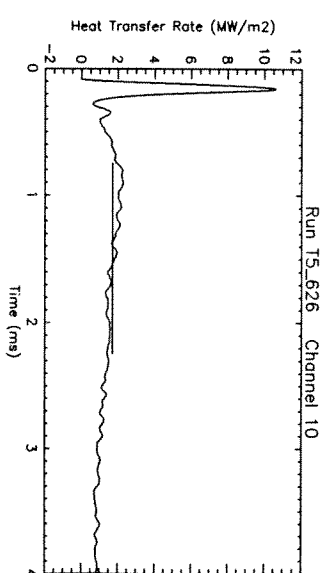
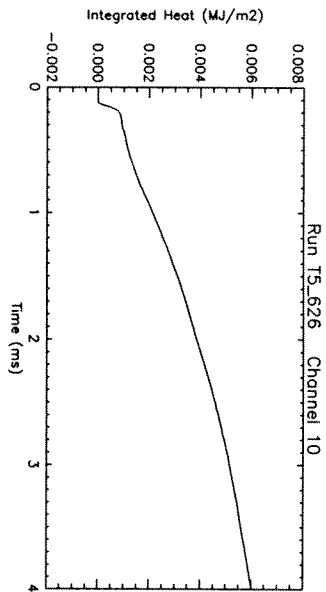
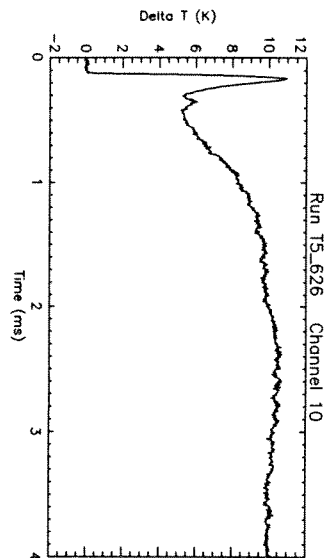
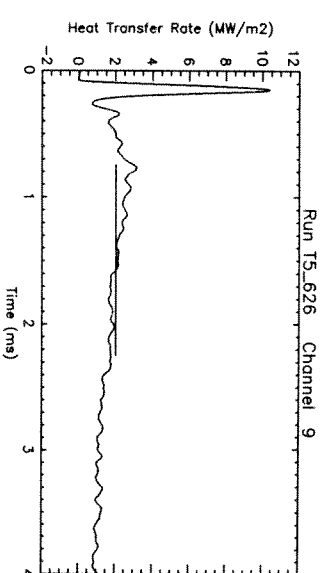
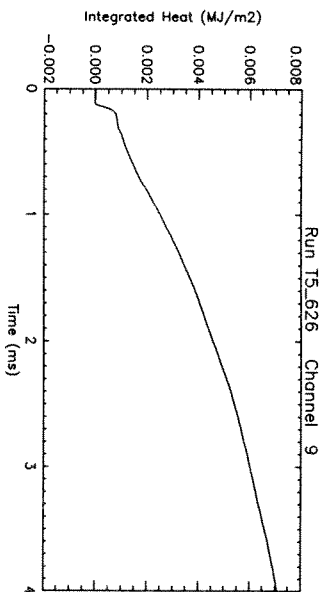
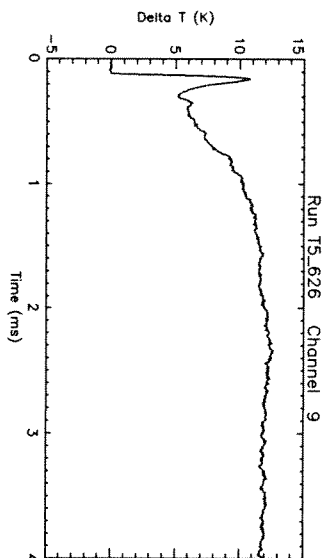


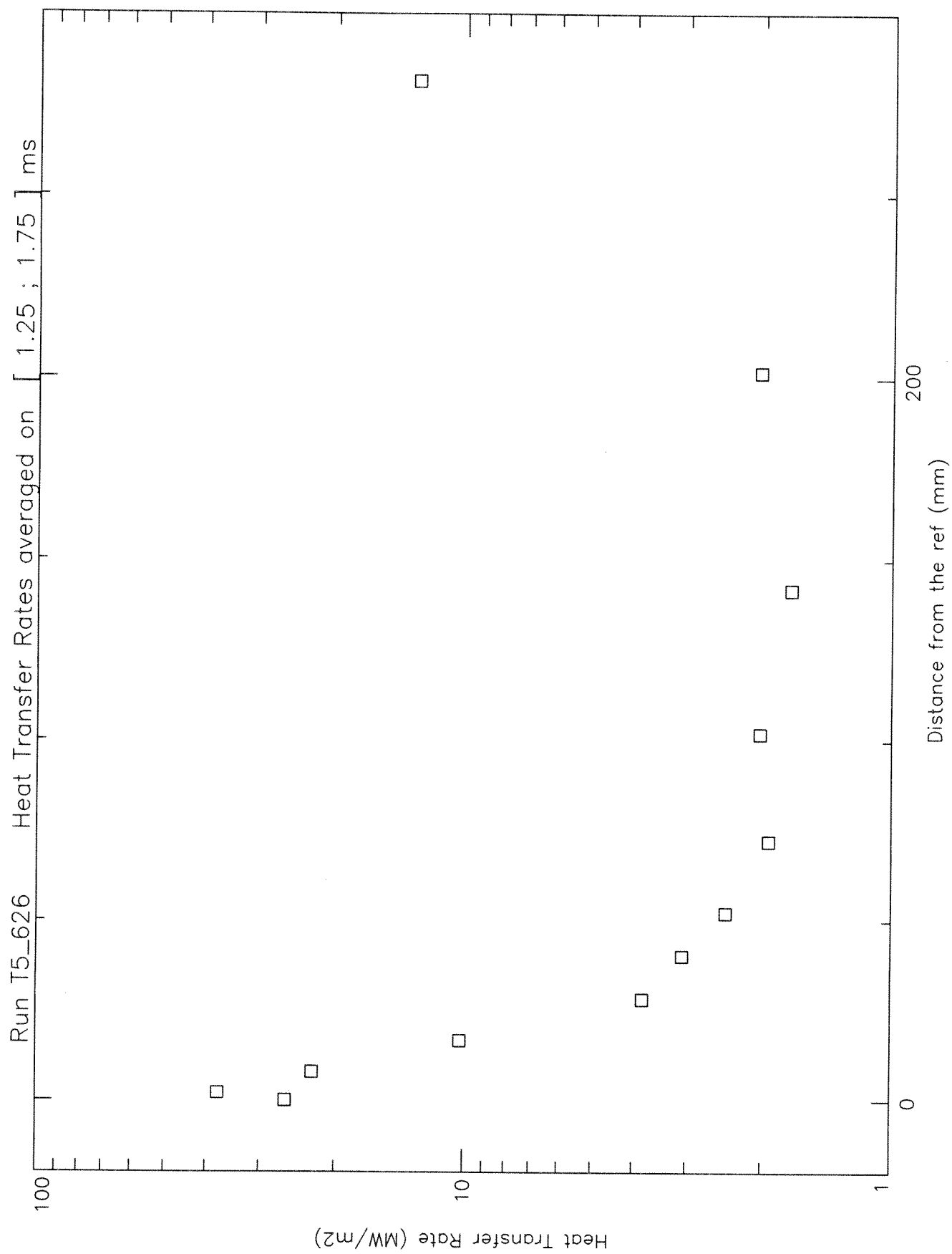












Run # 626

Pressure averages around 1.50 +/- 0.25 ms

Smooth box = 2.

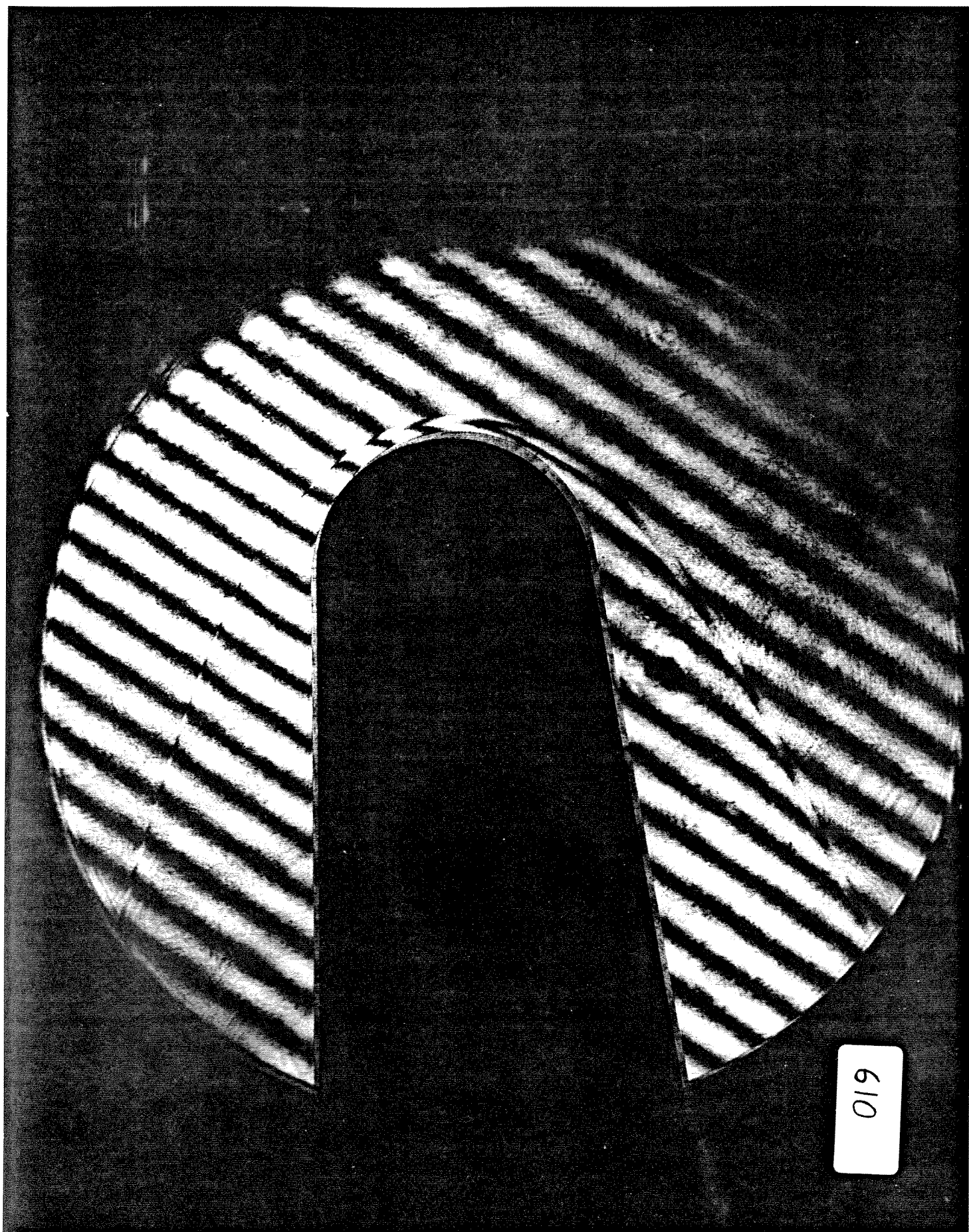
DA1	:	0.9486
DA2	:	0.5681
DA3	:	0.1535
DA4	:	0.1417
DA5	:	0.1312
DA6	:	0.1206
DA7	:	0.1152
DA8	:	0.1257
DA9	:	0.1330

Run # 626

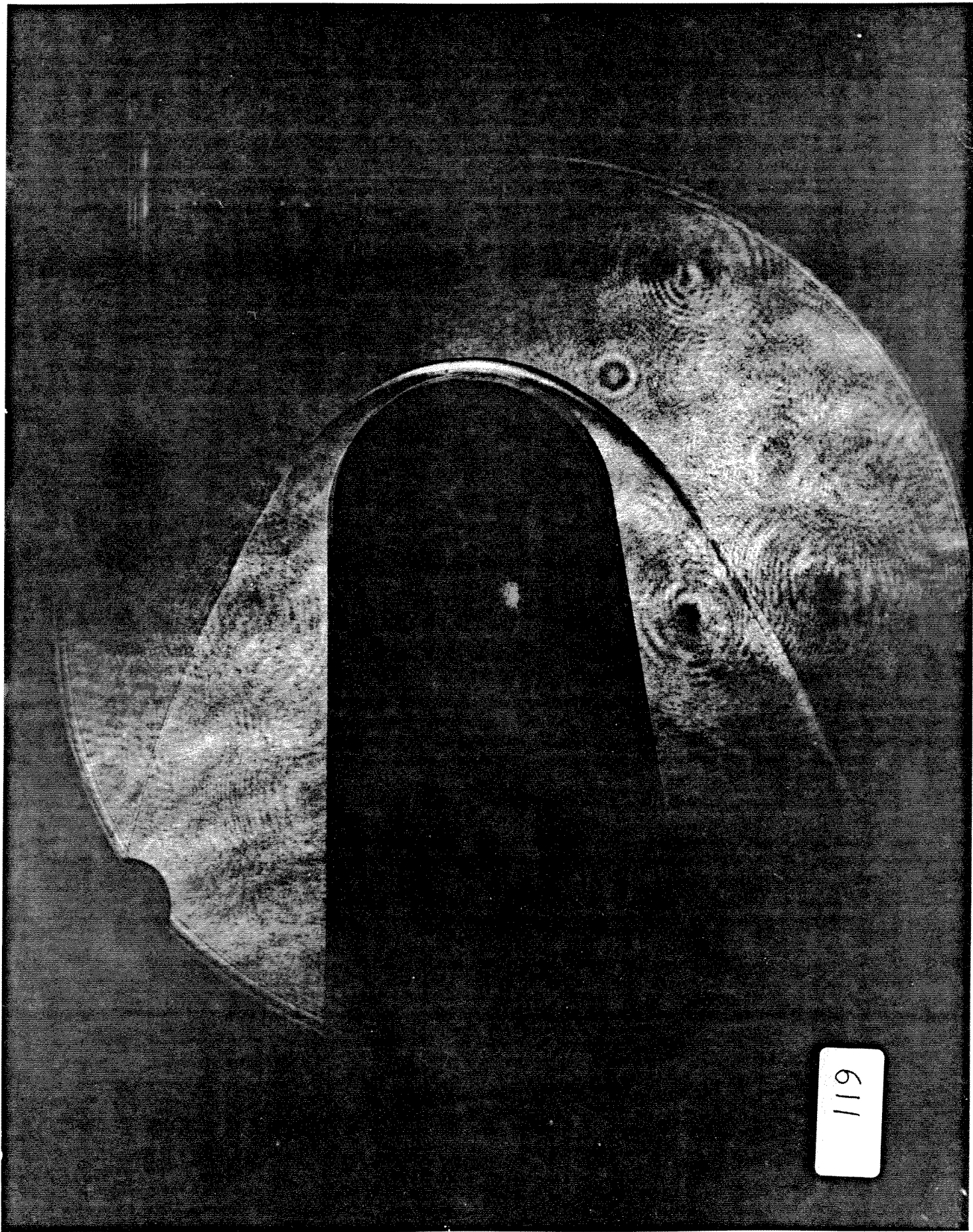
Heat Transfer Rates (in MW/m²)
averaged around 1.50 +/- 0.25 ms

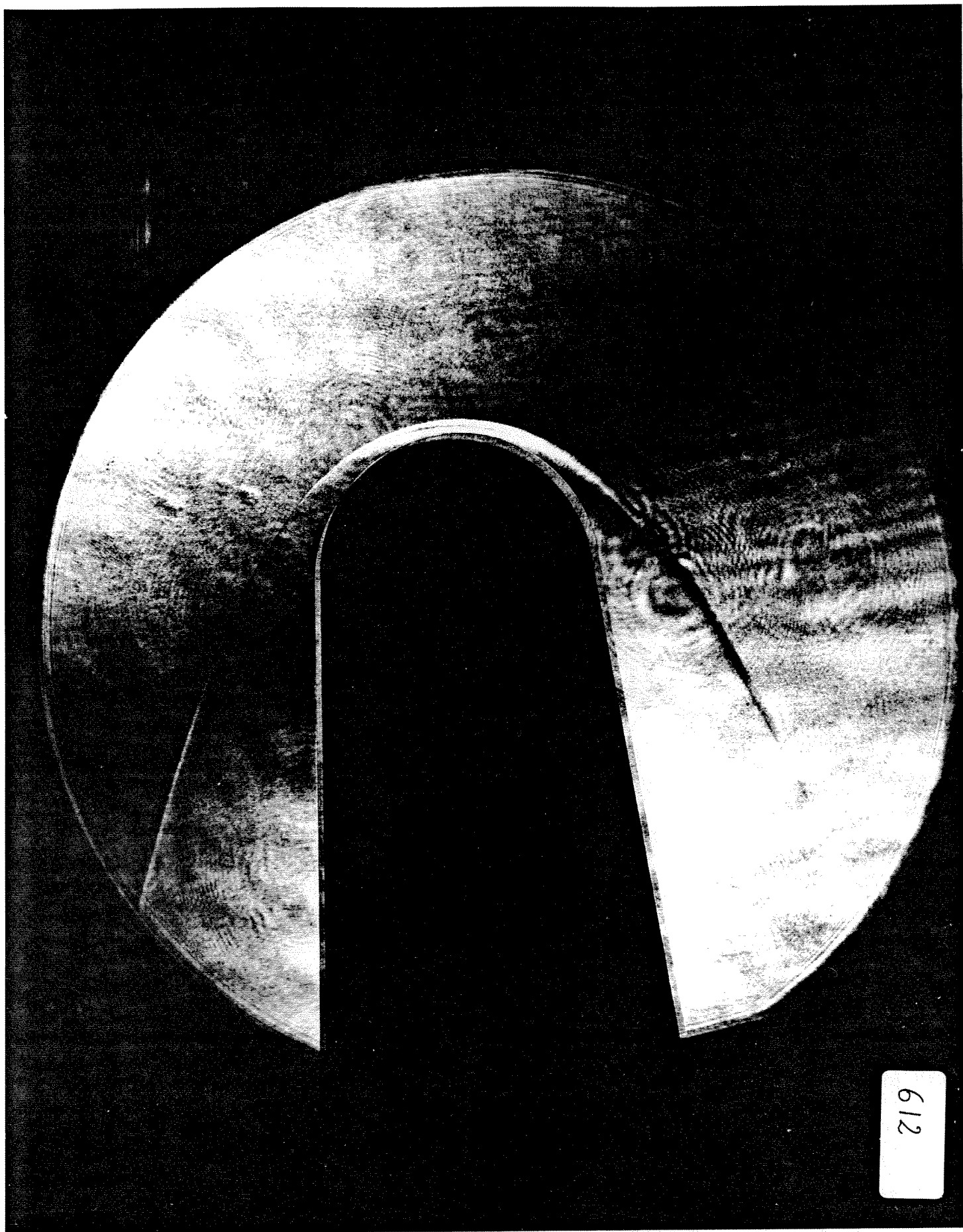
MT 1 :	26.0311
MT 2 :	37.4121
MT 3 :	22.5765
MT 4 :	10.1738
MT 5 :	3.7928
MT 6 :	3.0638
MT 7 :	2.4261
MT 8 :	1.9274
MT 9 :	2.0241
MT10 :	1.7172
MT11 :	2.0355
MT12 :	12.9702

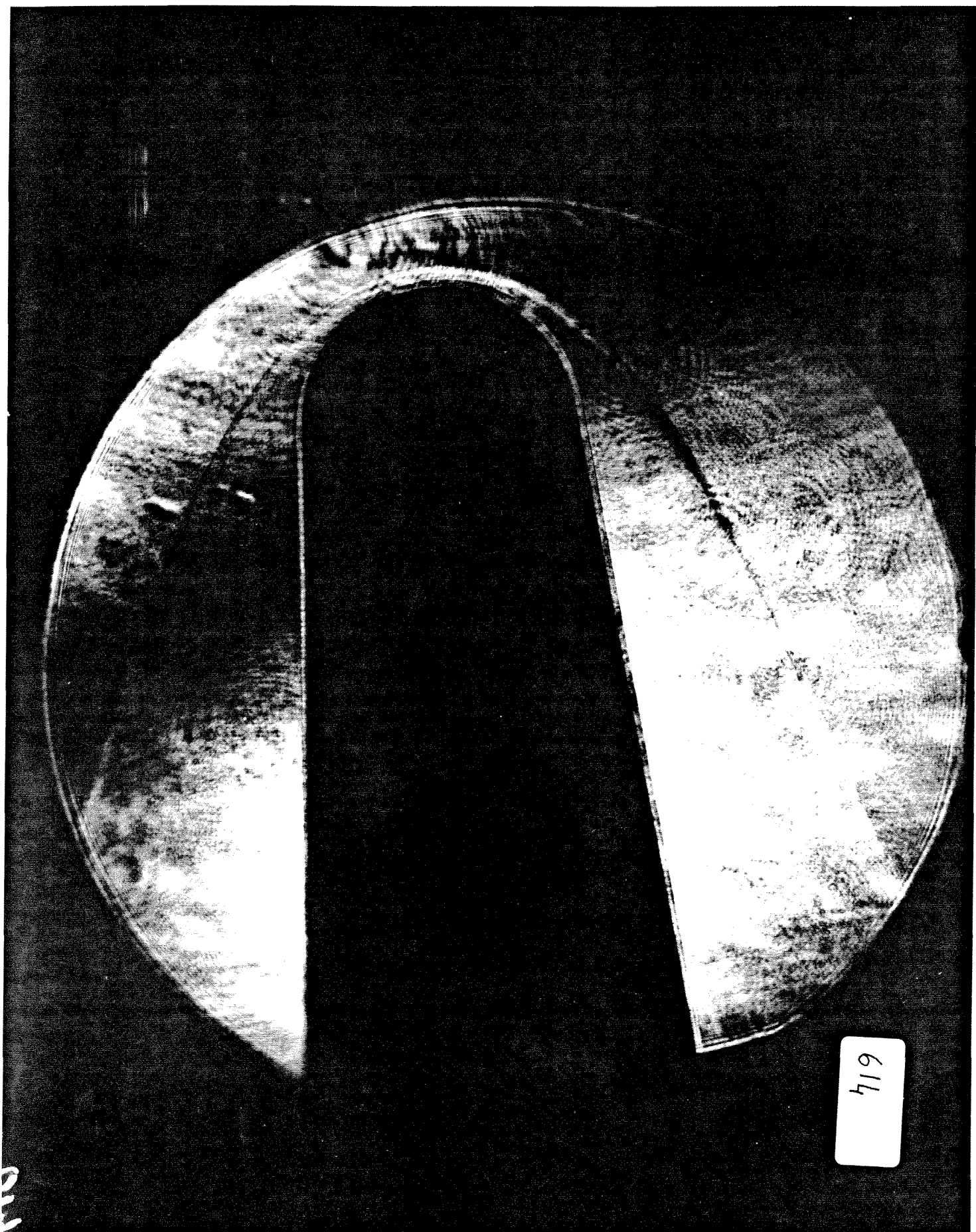
Shock Photos



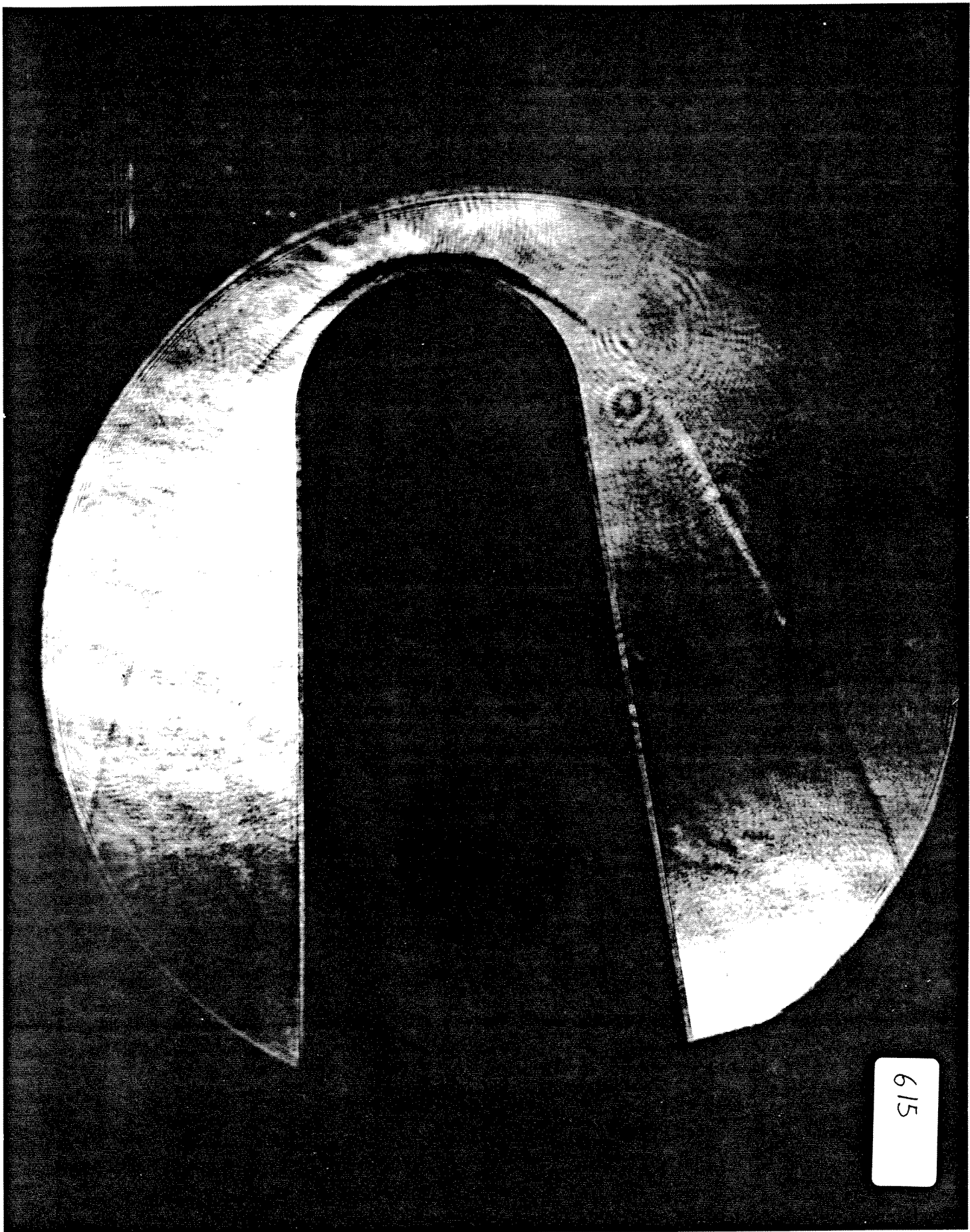
019



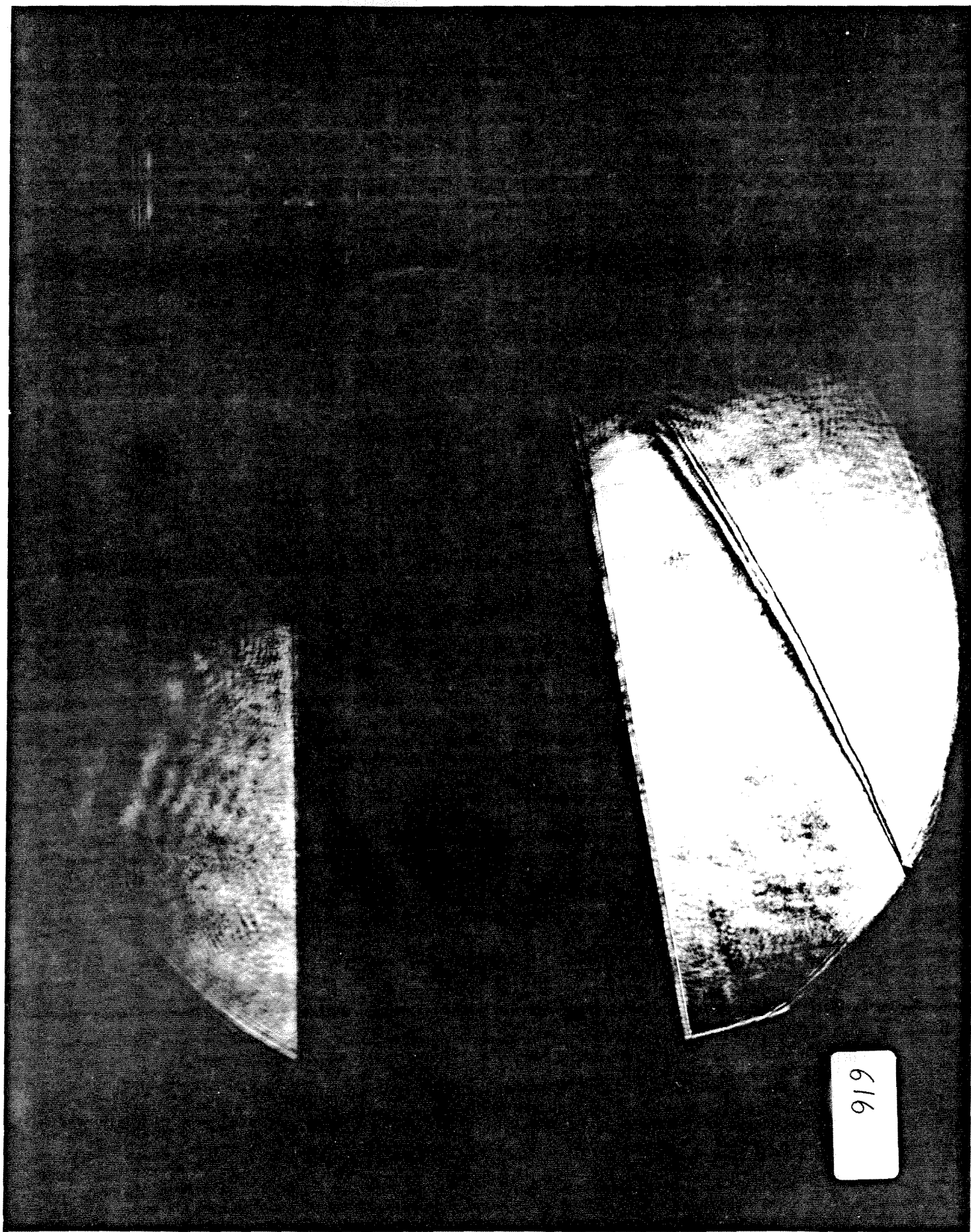




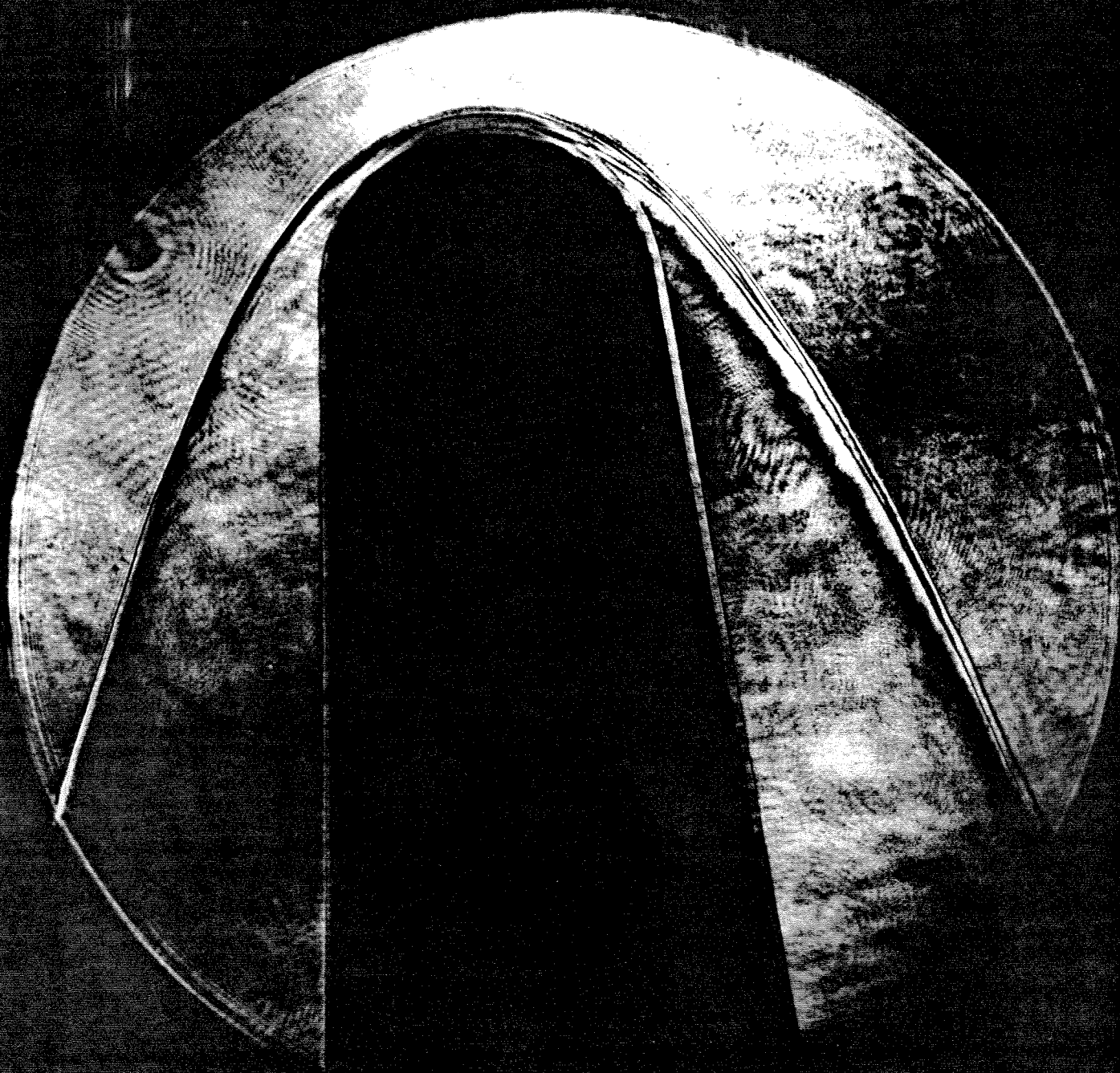
614



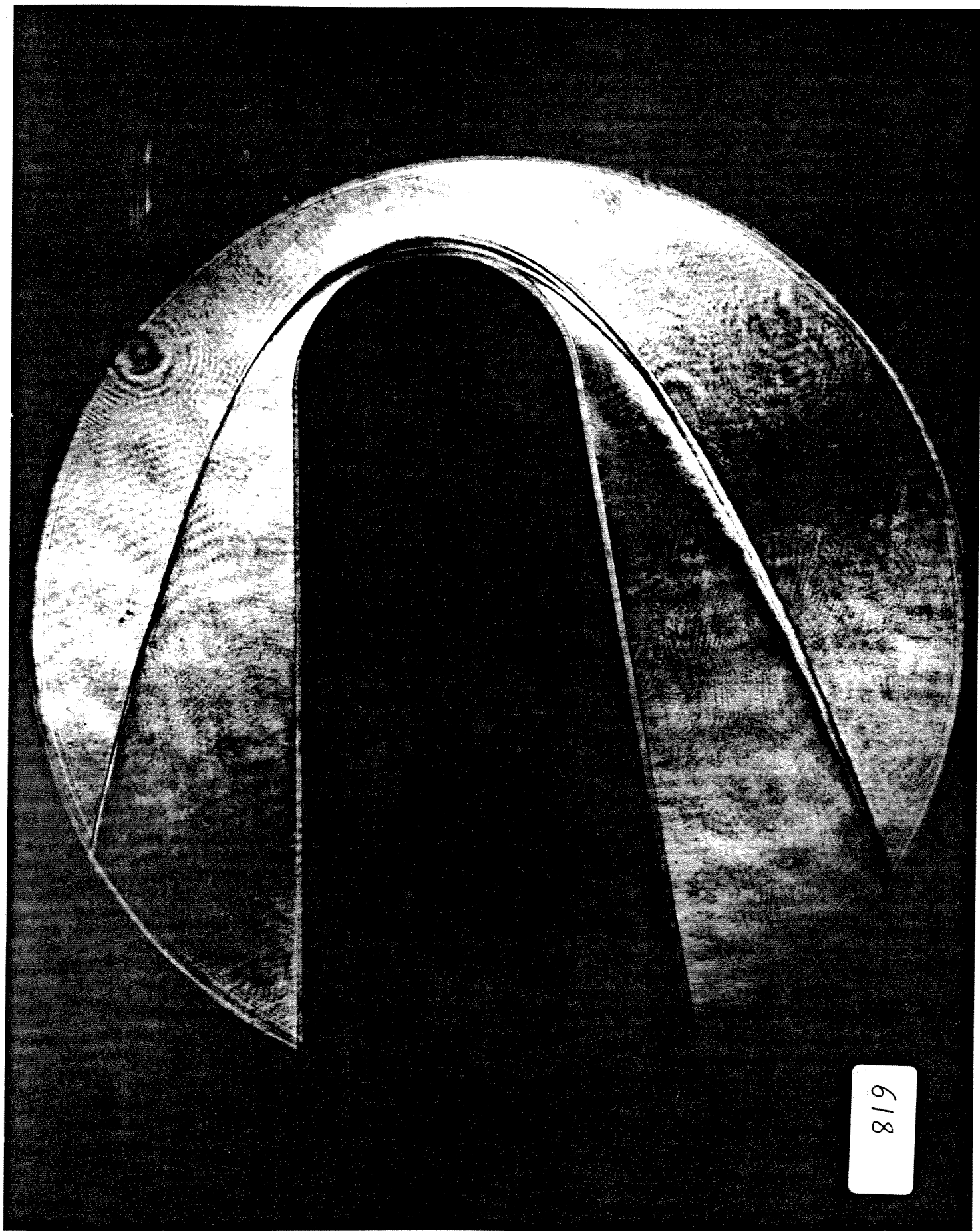
615

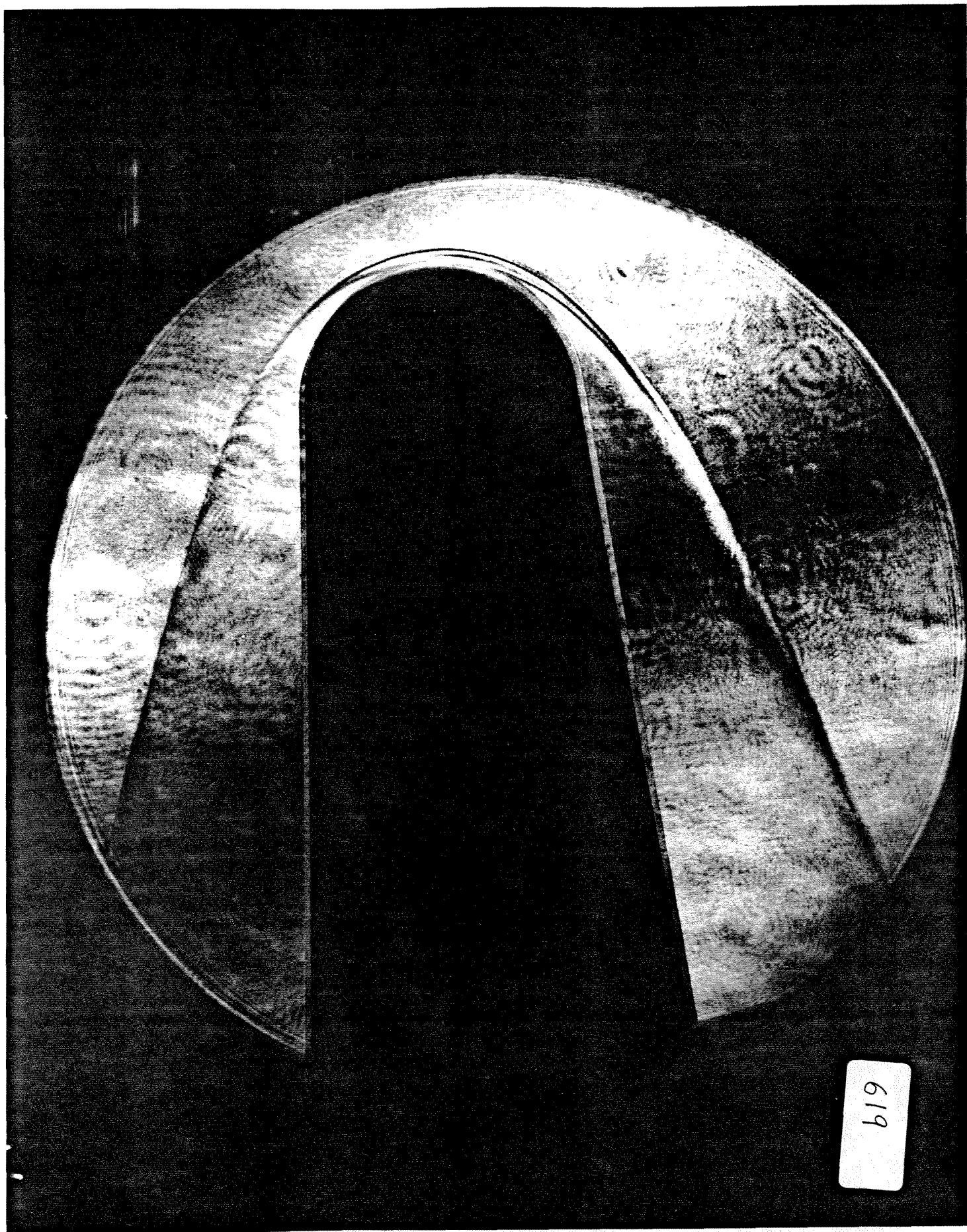


916

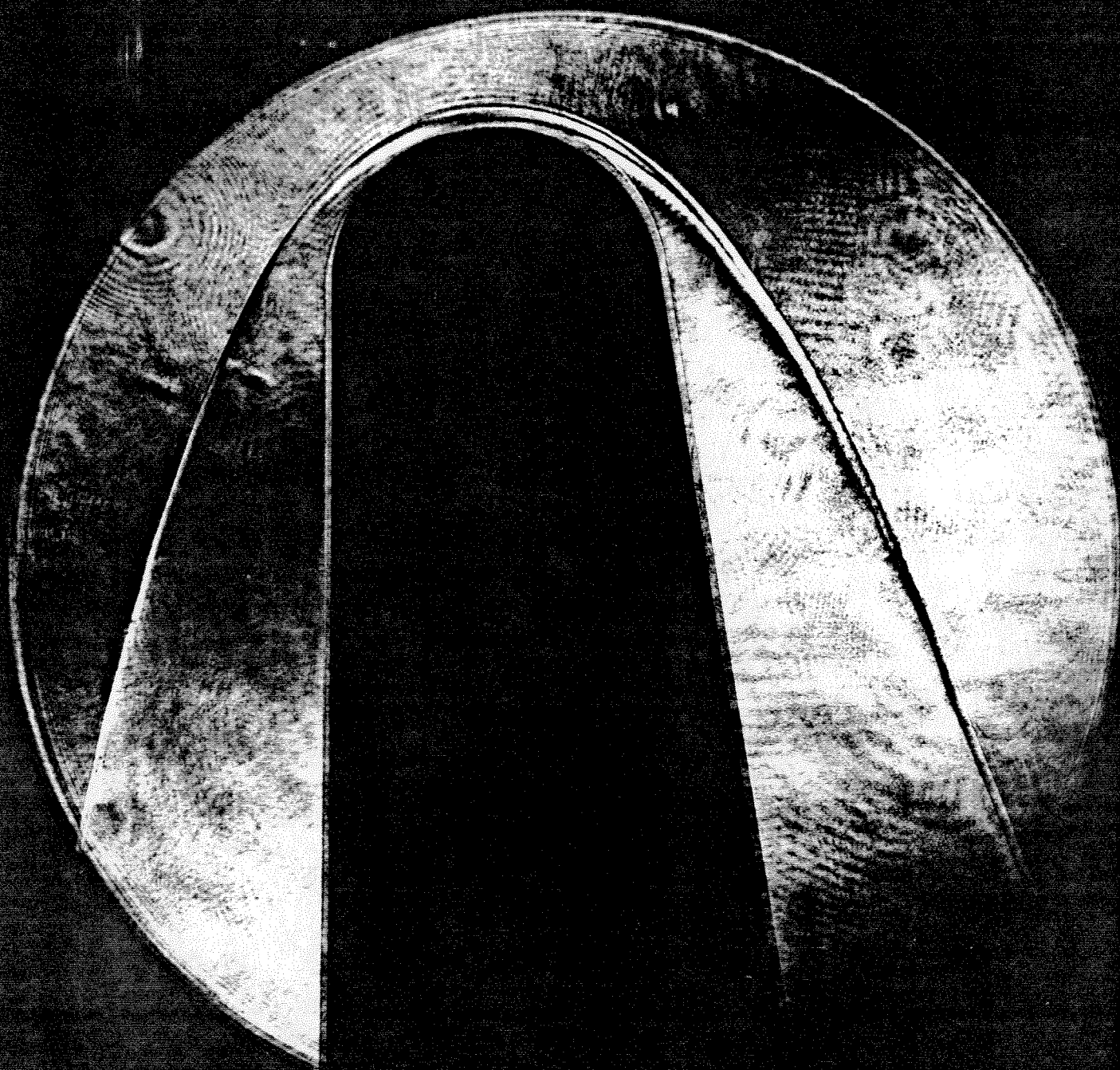


617

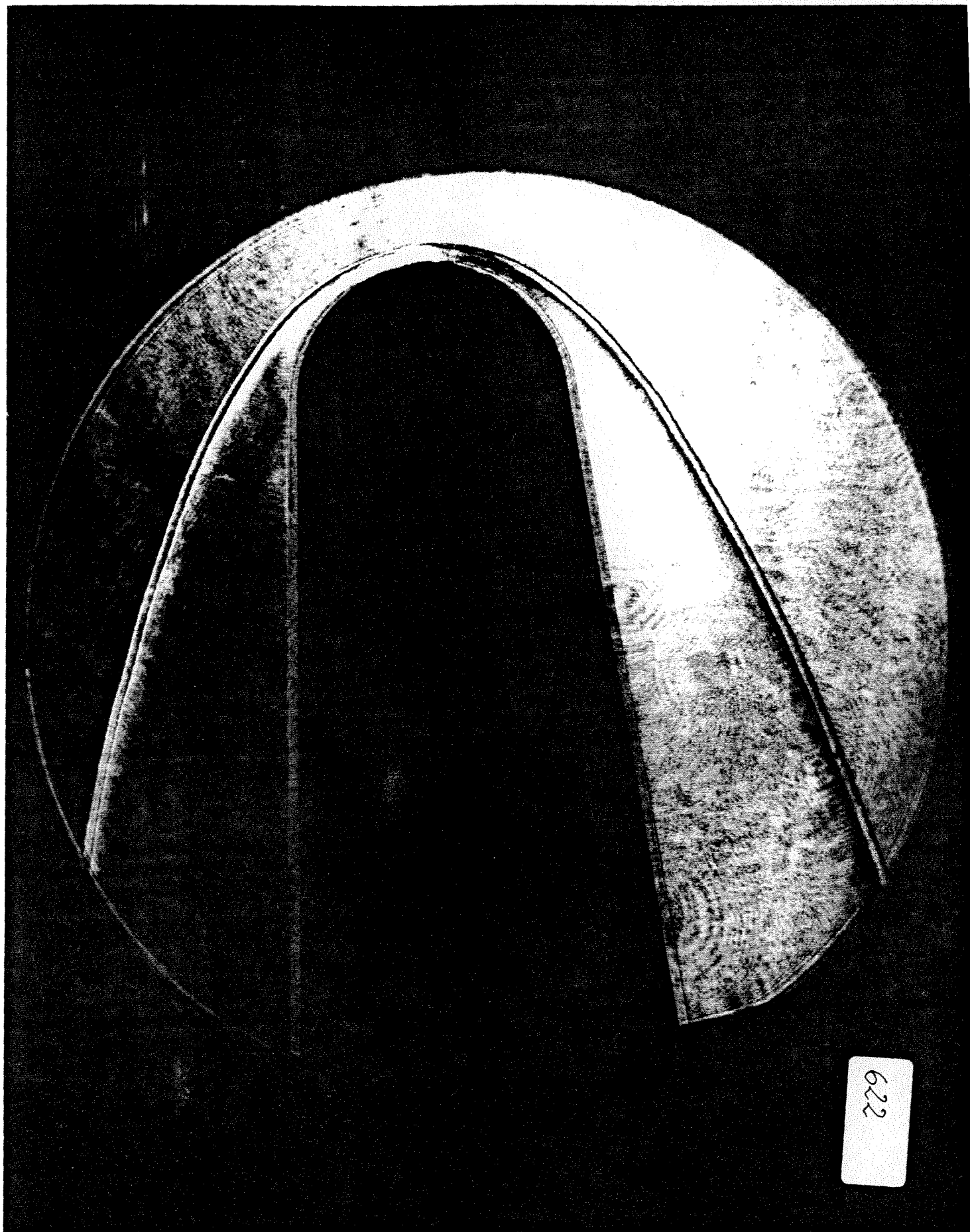


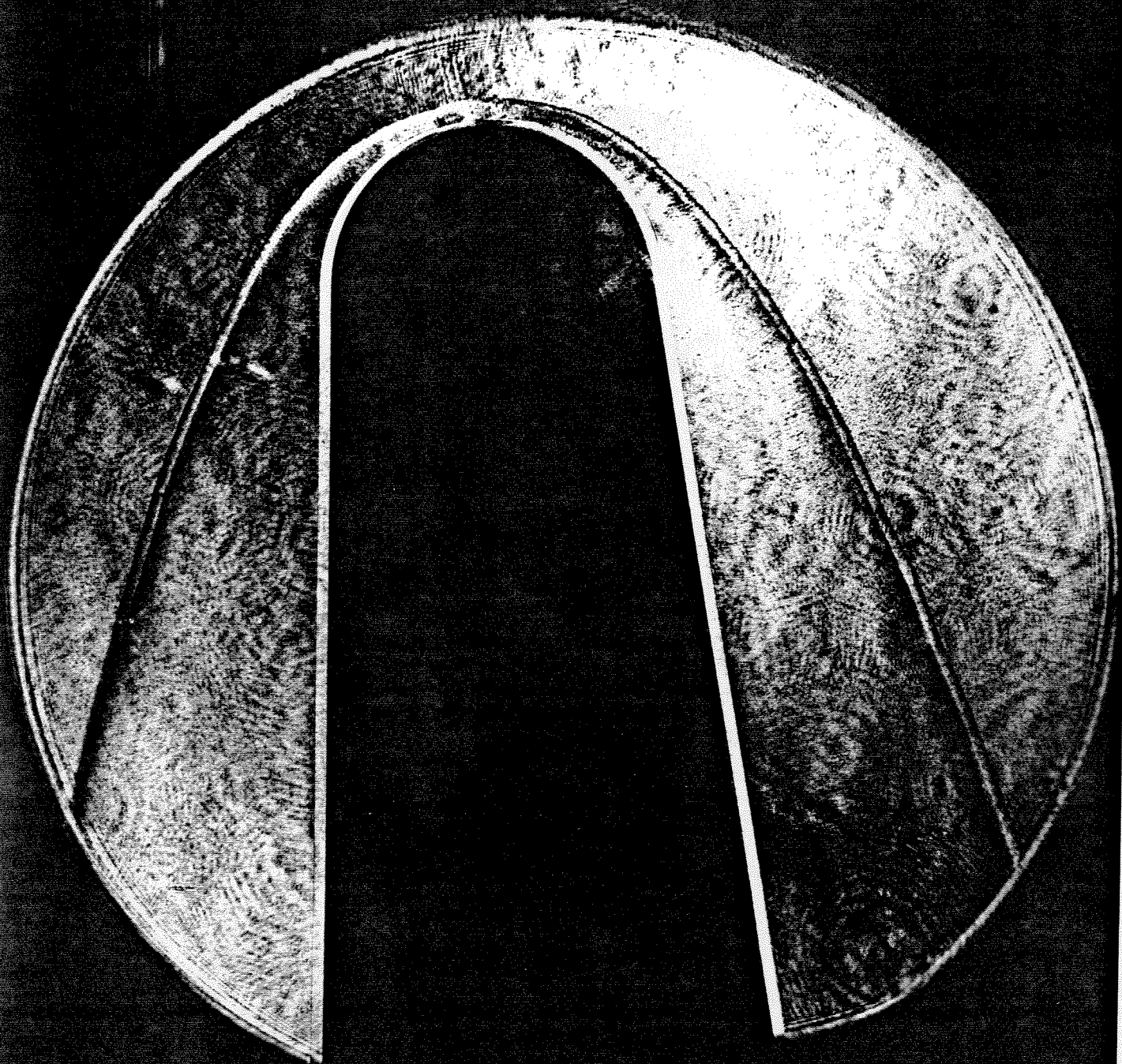






621

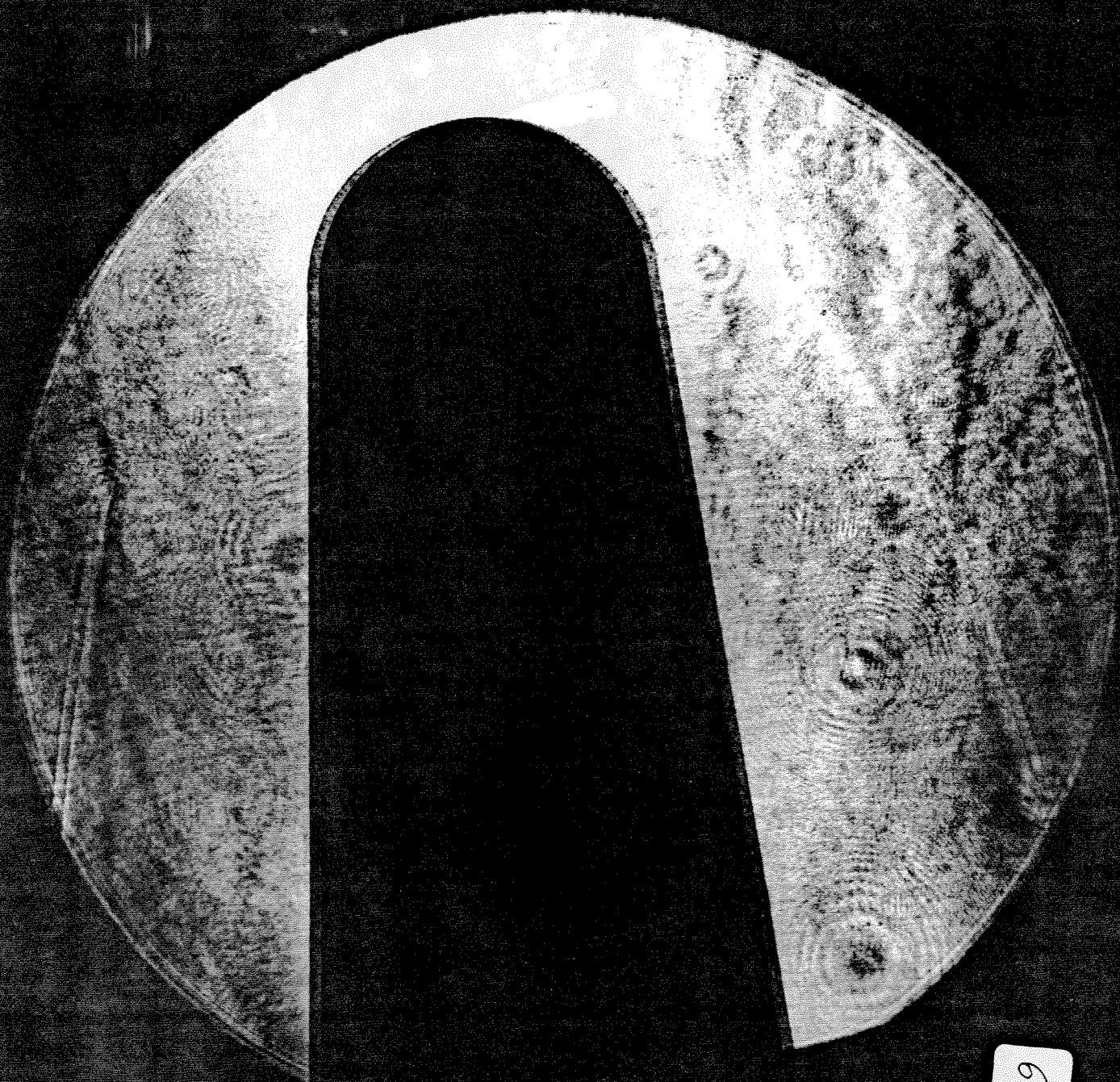




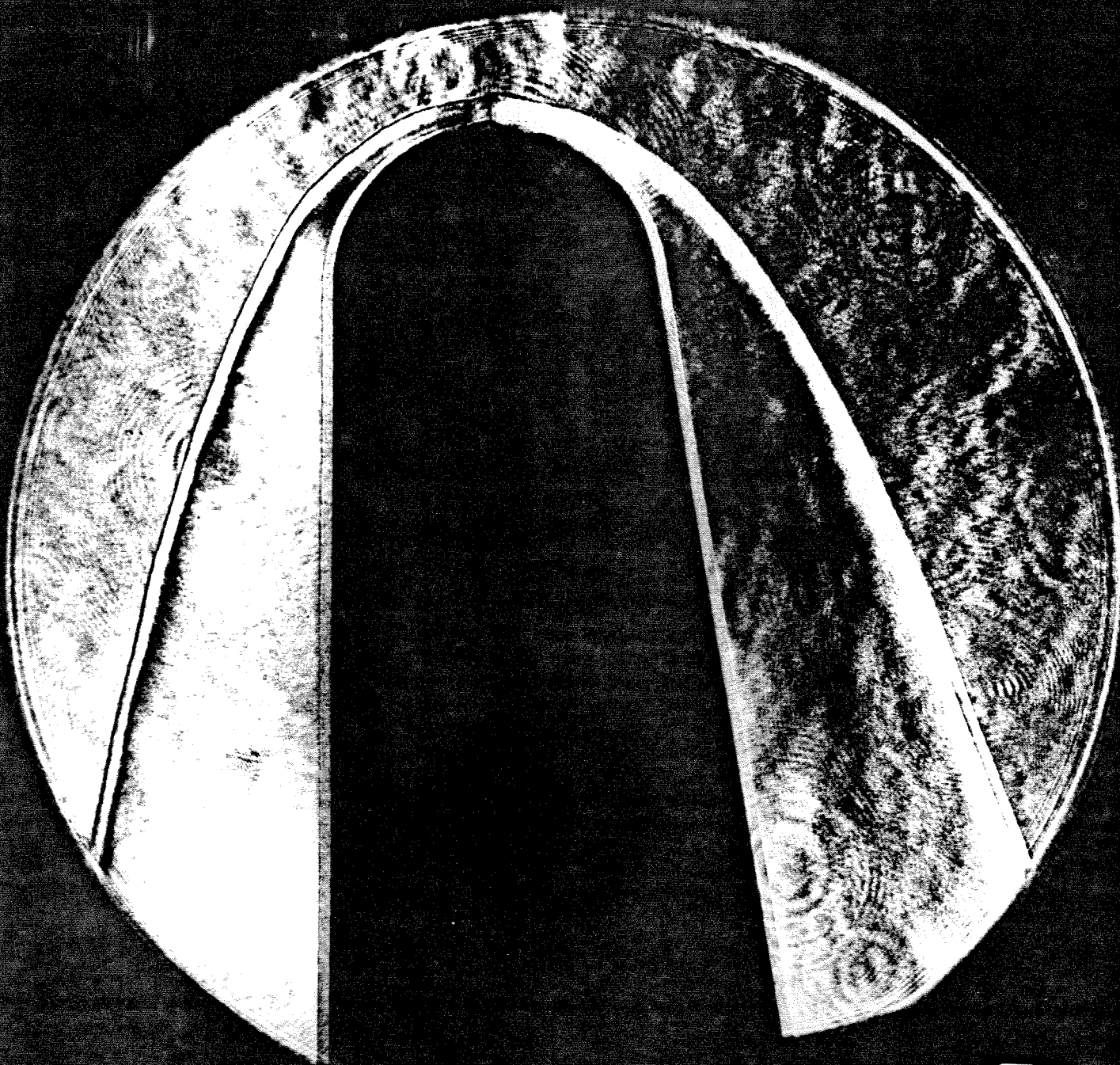
623



624



625



626

Checklists

Signature: GO9 E3A 2nd

[illegible]

[illegible]

T5 Checklist, Version 9, 1-5-93

Signature: Bob ESLA/HB

Operator in charge: BAHRAM V. Date: 8-24-93 Time: 3:00 Shot Number: 610
ESA # 3

[illegible]

T5 Checklist, Version 9, 1-5-93

Signature: Philippe H. Adams

Operator in charge: Philippe Adam Date: 08/26/93 Time: 2:00 Shot Number: 611

ESA # 4

[illegible]

T5 Checklist, Version 9, 1-5-93

Signature: _____

Operator in charge:

Date:

Time: 9:45

Shot Number

[illegible]

Action	Check	Signal
Press hand switch HS-C3 to confirm ST pressure	<input checked="" type="checkbox"/>	
Close V-14 (ST isolation)	<input checked="" type="checkbox"/>	
Close ZS-20 (DT vacuum isolation)	<input checked="" type="checkbox"/>	
Close V-8 (CT isolation)	<input checked="" type="checkbox"/>	
Close (ST gauges):		
SV-25A	<input checked="" type="checkbox"/>	
SV-25B	<input checked="" type="checkbox"/>	E, F
Close SV-29 (CT vacuum gauge)	<input checked="" type="checkbox"/>	G
Fill CT gas: <u>90% He</u> vacuum: <u>-96.5</u> kPa		
70 kPa setting: <u>-33.5</u> kPa		
thumbwheel: <u>-33.5</u> kPa		
value: <u>-33.5</u> kPa	<input checked="" type="checkbox"/>	
gas: <u>10% Ar</u> setting: <u>-26.5</u> kPa		
thumbwheel: <u>-26.5</u> kPa		
value: <u>-26.5</u> kPa	<input checked="" type="checkbox"/>	
Close V-11 (CT high pressure isolation valve)	<input checked="" type="checkbox"/>	H
Close V-7 (CT/2R vacuum)	<input checked="" type="checkbox"/>	
Close SV-23 (DT vacuum gauge)	<input checked="" type="checkbox"/>	I, J
Arm "T5 das" on DAS	<input checked="" type="checkbox"/>	
Instrumentation ready	<input checked="" type="checkbox"/>	
WARNING LIGHTS ON (P1).	<input checked="" type="checkbox"/>	
Verify the door is closed.	<input checked="" type="checkbox"/>	
Close SV-27 (2R vacuum gauge)	<input checked="" type="checkbox"/>	
2R Temperature before _____ °C		
Fill 2R gas: <u>Ar</u> setting: <u>380</u> psig	<input checked="" type="checkbox"/>	
thumbwheel: <u>380</u> psig		
value: <u>380</u> psig	<input checked="" type="checkbox"/>	
Isolate flex hose	<input checked="" type="checkbox"/>	
Confirm 2R pressure, Hand switch HS-C1	<input checked="" type="checkbox"/>	
Isolate 2R gauge	<input checked="" type="checkbox"/>	
Confirm isolation, Hand switch HS-28	<input checked="" type="checkbox"/>	K, L
Close SV-31 (PS vacuum gauge)	<input checked="" type="checkbox"/>	M
Confirm CT pressure, Hand switch HS-C2 value: <u>-26.7</u> kPa	<input checked="" type="checkbox"/>	N
Isolate CT gauge	<input checked="" type="checkbox"/>	
Confirm isolation, Hand switch HS-30	<input checked="" type="checkbox"/>	O
2R Temperature after <u>25.0</u> °C		
Close V-12 (2R vacuum)	<input checked="" type="checkbox"/>	P
Open V-13 to vent CT vacuum pump	<input checked="" type="checkbox"/>	
Turn off CT vacuum pump (next to pump)	<input checked="" type="checkbox"/>	
READY TO FIRE	<input checked="" type="checkbox"/>	
Chime for 5 seconds	<input checked="" type="checkbox"/>	
Press and hold down firing buttons.	<input checked="" type="checkbox"/>	
Time: <u>5:05</u>		

T5 Checklist, Version 9, 1-5-93

Signature:

Operator in charge:

Date: _____

Time: 10:30

Shot Number: 613

[illegible]

Action	Check	Signal
Press hand switch HS-C3 to confirm ST pressure	<input checked="" type="checkbox"/>	
Close V-14 (ST isolation)	<input checked="" type="checkbox"/>	
Close ZS-20 (DT vacuum isolation)	<input checked="" type="checkbox"/>	
Close V-8 (CT isolation)	<input checked="" type="checkbox"/>	
Close (ST gauges):		
SV-25A	<input checked="" type="checkbox"/>	
SV-25B	<input checked="" type="checkbox"/>	E, F
Close SV-29 (CT vacuum gauge)	<input checked="" type="checkbox"/>	G
Fill CT gas: <u>100%</u> <u>70 kPa</u> gas: <u> </u> vacuum: <u>-96.6</u> kPa setting: <u>70</u> kPa thumbwheel: <u>-26.6</u> kPa value: <u>-26.5</u> kPa setting: <u> </u> kPa thumbwheel: <u> </u> kPa value: <u> </u> kPa	<input checked="" type="checkbox"/>	
Close V-11 (CT high pressure isolation valve)	<input checked="" type="checkbox"/>	H
Close V-7 (CT/2R vacuum)	<input checked="" type="checkbox"/>	
Close SV-23 (DT vacuum gauge)	<input checked="" type="checkbox"/>	I, J
Arm "T5 das" on DAS	<input checked="" type="checkbox"/>	
Instrumentation ready	<input checked="" type="checkbox"/>	
WARNING LIGHTS ON (P1).	<input checked="" type="checkbox"/>	
Close SV-27 (2R vacuum gauge)	<input checked="" type="checkbox"/>	
2R Temperature before <u>22.2</u> °C		
Fill 2R gas: <u>air</u> setting: <u>360</u> psig thumbwheel: <u>360</u> psig value: <u>360</u> psig	<input checked="" type="checkbox"/>	
Isolate flex hose	<input checked="" type="checkbox"/>	
Confirm 2R pressure, Hand switch HS-C1	<input checked="" type="checkbox"/>	
Isolate 2R gauge	<input checked="" type="checkbox"/>	
Confirm isolation, Hand switch HS-28	<input checked="" type="checkbox"/>	K, L
Close SV-31 (PS vacuum gauge)	<input checked="" type="checkbox"/>	M
Confirm CT pressure, Hand switch HS-C2	<input checked="" type="checkbox"/>	N
value: <u>-26.5</u> kPa		
Isolate CT gauge	<input checked="" type="checkbox"/>	
Confirm isolation, Hand switch HS-30	<input checked="" type="checkbox"/>	O
2R Temperature after <u>23.2</u> °C		
Close V-12 (2R vacuum)	<input checked="" type="checkbox"/>	P
Open V-13 to vent CT vacuum pump	<input checked="" type="checkbox"/>	
Turn off CT vacuum pump (next to pump)	<input checked="" type="checkbox"/>	
READY TO FIRE	<input checked="" type="checkbox"/>	
Chime for 5 seconds	<input checked="" type="checkbox"/>	
Press and hold down firing buttons.	<input checked="" type="checkbox"/>	
Time: <u>10:40</u>		

Signature: E. B. C.

[illegible]

T5 Checklist, Version 9, 1-5-93

Signature: _____

Operator in charge:

Date: 8-27-93

Time: 5.5

Shot Number: 615

[illegible]

Action	Check	Signal
Press hand switch HS-C3 to confirm ST pressure	<input checked="" type="checkbox"/>	
Close V-14 (ST isolation)	<input checked="" type="checkbox"/>	
Close ZS-20 (DT vacuum isolation)	<input checked="" type="checkbox"/>	
Close V-8 (CT isolation)	<input checked="" type="checkbox"/>	
Close (ST gauges):		
SV-25A	<input checked="" type="checkbox"/>	
SV-25B	<input checked="" type="checkbox"/>	E, F
Close SV-29 (CT vacuum gauge)	<input checked="" type="checkbox"/>	G
Fill CT gas: <u>90% He</u> vacuum: <u>-96.5</u> kPa		
setting: <u>63</u> kPa		
thumbwheel: <u>-33.5</u> kPa		
value: <u>-33.5</u> kPa	<input checked="" type="checkbox"/>	
gas: <u>10% Ar</u> setting: <u>7</u> <u>-26.5</u> kPa		
thumbwheel: <u>-26.5</u> kPa		
value: <u>-26.5</u> kPa	<input checked="" type="checkbox"/>	
Close V-11 (CT high pressure isolation valve)	<input checked="" type="checkbox"/>	H
Close V-7 (CT/2R vacuum)	<input checked="" type="checkbox"/>	
Close SV-23 (DT vacuum gauge)	<input checked="" type="checkbox"/>	I, J
Arm "T5 das" on DAS	<input checked="" type="checkbox"/>	
Instrumentation ready	<input checked="" type="checkbox"/>	
WARNING LIGHTS ON (P1). Verify the door is closed.	<input checked="" type="checkbox"/>	
Close SV-27 (2R vacuum gauge)	<input checked="" type="checkbox"/>	
2R Temperature before <u>23.4</u> °C		
Fill 2R gas: <u>400</u> <u>XRF6</u> setting: <u>400</u> psig	<input checked="" type="checkbox"/>	
thumbwheel: <u>400</u> psig		
value: <u>400</u> psig	<input checked="" type="checkbox"/>	
Isolate flex hose	<input checked="" type="checkbox"/>	
Confirm 2R pressure, Hand switch HS-C1	<input checked="" type="checkbox"/>	
Isolate 2R gauge	<input checked="" type="checkbox"/>	
Confirm isolation, Hand switch HS-28	<input checked="" type="checkbox"/>	K, L
Close SV-31 (PS vacuum gauge)	<input checked="" type="checkbox"/>	M
Confirm CT pressure, Hand switch HS-C2 value: <u>-26.5</u> kPa	<input checked="" type="checkbox"/>	N
Isolate CT gauge	<input checked="" type="checkbox"/>	
Confirm isolation, Hand switch HS-30	<input checked="" type="checkbox"/>	O
2R Temperature after <u>24.7</u> °C		
Close V-12 (2R vacuum)	<input checked="" type="checkbox"/>	P
Open V-13 to vent CT vacuum pump	<input checked="" type="checkbox"/>	
Turn off CT vacuum pump (next to pump)	<input checked="" type="checkbox"/>	
READY TO FIRE Time: <u>4:00</u>	<input checked="" type="checkbox"/>	
Chime for 5 seconds	<input checked="" type="checkbox"/>	
Press and hold down firing buttons.	<input checked="" type="checkbox"/>	

T5 Checklist, Version 9, 1-5-93

Signature: _____

Operator in charge:

Date:

Time

Shot

626

[illegible]

Action	Check	Signal
Press hand switch HS-C3 to confirm ST pressure	<input checked="" type="checkbox"/>	
Close V-14 (ST isolation)	<input checked="" type="checkbox"/>	
Close ZS-20 (DT vacuum isolation)	<input checked="" type="checkbox"/>	
Close V-8 (CT isolation)	<input checked="" type="checkbox"/>	
Close (ST gauges):		
SV-25A	<input checked="" type="checkbox"/>	
SV-25B	<input checked="" type="checkbox"/>	E, F
Close SV-29 (CT vacuum gauge)	<input checked="" type="checkbox"/>	G
Fill CT gas: <u>85% He</u> vacuum: <u>-96.5</u> kPa setting: <u>2.1</u> kPa thumbwheel: <u>2.1</u> kPa value: <u>2.1</u> kPa gas: <u>15% Ar</u> setting: <u>19.5</u> kPa thumbwheel: <u>19.5</u> kPa value: <u>19.5</u> kPa <div style="border: 1px solid black; padding: 5px; display: inline-block;">116 kPa TOTAL</div>	<input checked="" type="checkbox"/>	
Close V-11 (CT high pressure isolation valve)	<input checked="" type="checkbox"/>	H
Close V-7 (CT/2R vacuum)	<input checked="" type="checkbox"/>	
Close SV-23 (DT vacuum gauge)	<input checked="" type="checkbox"/>	I, J
Arm "T5 das" on DAS	<input checked="" type="checkbox"/>	
Instrumentation ready	<input checked="" type="checkbox"/>	
WARNING LIGHTS ON (P1).	<input checked="" type="checkbox"/>	
Close SV-27 (2R vacuum gauge)	<input checked="" type="checkbox"/>	
2R Temperature before <u>22.5</u> °C		
Fill 2R gas: <u>Air</u> setting: <u>1110</u> psig thumbwheel: <u>1110</u> psig value: <u>1110</u> psig	<input checked="" type="checkbox"/>	
Isolate flex hose	<input checked="" type="checkbox"/>	
Confirm 2R pressure, Hand switch HS-C1	<input checked="" type="checkbox"/>	
Isolate 2R gauge	<input checked="" type="checkbox"/>	
Confirm isolation, Hand switch HS-28	<input checked="" type="checkbox"/>	K, L
Close SV-31 (PS vacuum gauge)	<input checked="" type="checkbox"/>	M
Confirm CT pressure, Hand switch HS-C2 value: <u>19.5</u> kPa	<input checked="" type="checkbox"/>	N
Isolate CT gauge	<input checked="" type="checkbox"/>	
Confirm isolation, Hand switch HS-30	<input checked="" type="checkbox"/>	O
2R Temperature after <u>25.2</u> °C		
Close V-12 (2R vacuum)	<input checked="" type="checkbox"/>	P
Open V-13 to vent CT vacuum pump	<input checked="" type="checkbox"/>	
Turn off CT vacuum pump (next to pump)	<input checked="" type="checkbox"/>	
READY TO FIRE	<input checked="" type="checkbox"/>	
Chime for 5 seconds	<input checked="" type="checkbox"/>	
Press and hold down firing buttons.	<input checked="" type="checkbox"/>	
Time: <u>12:20</u>		

T5 Checklist, Version 9, 1-5-93

/Signature:

Operator in charge:

Date:

Time:

Shot Number: 617

[illegible]

T5 Checklist, Version 9, 1-5-98

Signature:

Operator in charge:

Date:

Time: 8:30

Shot Number: 618

(Conditi^o 5)

[illegible]

T5 Checklist, Version 9, 1-5-93

Signature:

Operator in charge: Patrick Lemieux

Date: 9/3/08

Time: 2:40

Shot Number 619

(Cord. 1^o 6)

[illegible]

[illegible]

T5 Checklist, Version 9, 1-5-93

Signature: _____

Operator in charge: _____ Date: 09/02/93 Time: _____ Shot Number: 620
(Condition 5)

(Condition 5

[illegible]

T5 Checklist, Version 9, 1-5-93

Signature: _____

Operator in charge:

Date: _____

Time:

Shot Number 621

[illegible]

[illegible]

T5 Checklist, Version 9, 1-5-93

Signature: _____

Operator in charge: Patrick Leveilleux Date: 09/03/93 Time: _____ Shot Number: 622
(Condition 5)

[illegible]

T5 Checklist, Version 9, 1-5-93

Signature: _____

Operator in charge:

Date:

09/07/93

Time: 1:30

2 Shot Number 623

(condition 1)

[illegible]

Action	Check	Signal
Press hand switch HS-C3 to confirm ST pressure	<input checked="" type="checkbox"/>	
Close V-14 (ST isolation)	<input checked="" type="checkbox"/>	
Close ZS-20 (DT vacuum isolation)	<input checked="" type="checkbox"/>	
Close V-8 (CT isolation)	<input checked="" type="checkbox"/>	
Close (ST gauges):		
SV-25A	<input checked="" type="checkbox"/>	
SV-25B	<input checked="" type="checkbox"/>	E, F
Close SV-29 (CT vacuum gauge)	<input checked="" type="checkbox"/>	G
Fill CT gas: <u>90% He</u> vacuum: <u>-96.5</u> kPa setting: <u>63</u> kPa thumbwheel: <u>-33.5</u> kPa value: <u>-33.5</u> kPa <div style="border: 1px solid black; padding: 2px; display: inline-block;">70 kPa</div> gas: <u>10% Ar</u> setting: <u>70</u> kPa thumbwheel: <u>-26.5</u> kPa value: <u>-26.5</u> kPa	<input checked="" type="checkbox"/>	
Close V-11 (CT high pressure isolation valve)	<input checked="" type="checkbox"/>	H
Close V-7 (CT/2R vacuum)	<input checked="" type="checkbox"/>	
Close SV-23 (DT vacuum gauge)	<input checked="" type="checkbox"/>	I, J
Arm "T5 das" on DAS	<input checked="" type="checkbox"/>	
Instrumentation ready	<input checked="" type="checkbox"/>	
WARNING LIGHTS ON (P1).	<input checked="" type="checkbox"/>	
Close SV-27 (2R vacuum gauge)	<input checked="" type="checkbox"/>	
2R Temperature before <u>2</u> °C		
Fill 2R gas: <u>Air</u> setting: <u>380</u> psig	<input checked="" type="checkbox"/>	
thumbwheel: <u>380</u> psig		
value: <u>380</u> psig	<input checked="" type="checkbox"/>	
Isolate flex hose	<input checked="" type="checkbox"/>	
Confirm 2R pressure, Hand switch HS-C1	<input checked="" type="checkbox"/>	
Isolate 2R gauge	<input checked="" type="checkbox"/>	
Confirm isolation, Hand switch HS-28	<input checked="" type="checkbox"/>	K, L
Close SV-31 (PS vacuum gauge)	<input checked="" type="checkbox"/>	M
Confirm CT pressure, Hand switch HS-C2 value: <u>-26.5</u> kPa	<input checked="" type="checkbox"/>	N
Isolate CT gauge	<input checked="" type="checkbox"/>	
Confirm isolation, Hand switch HS-30	<input checked="" type="checkbox"/>	O
2R Temperature after <u>24.6</u> °C		
Close V-12 (2R vacuum)	<input checked="" type="checkbox"/>	P
Open V-13 to vent CT vacuum pump	<input checked="" type="checkbox"/>	
Turn off CT vacuum pump (next to pump)	<input checked="" type="checkbox"/>	
READY TO FIRE	<input checked="" type="checkbox"/>	
Chime for 5 seconds	<input checked="" type="checkbox"/>	
Press and hold down firing buttons.	<input checked="" type="checkbox"/>	
Time: <u>2:00</u>		

Signature: _____

Date:

Time:

Shot Number 624

(Condition 1)

[illegible]

Action	Check	Signal
Press hand switch HS-C3 to confirm ST pressure	<input checked="" type="checkbox"/>	
Close V-14 (ST isolation)	<input checked="" type="checkbox"/>	
Close ZS-20 (DT vacuum isolation)	<input checked="" type="checkbox"/>	
Close V-8 (CT isolation)	<input checked="" type="checkbox"/>	
Close (ST gauges):		
SV-25A	<input checked="" type="checkbox"/>	
SV-25B	<input checked="" type="checkbox"/>	E, F
Close SV-29 (CT vacuum gauge)	<input checked="" type="checkbox"/>	G
Fill CT gas: <u>85% He</u> vacuum: <u>-96.5</u> kPa		
setting: <u>59.5</u> kPa		
thumbwheel: <u>-32.0</u> kPa		
value: <u>-32.0</u> kPa	<input checked="" type="checkbox"/>	
gas: <u>15% Ar</u> setting: <u>70.0</u> kPa		
thumbwheel: <u>-26.5</u> kPa		
value: <u>-26.5</u> kPa	<input checked="" type="checkbox"/>	
Close V-11 (CT high pressure isolation valve)	<input checked="" type="checkbox"/>	H
Close V-7 (CT/2R vacuum)	<input checked="" type="checkbox"/>	
Close SV-23 (DT vacuum gauge)	<input checked="" type="checkbox"/>	I, J
Arm "T5 das" on DAS	<input checked="" type="checkbox"/>	
Instrumentation ready	<input checked="" type="checkbox"/>	
WARNING LIGHTS ON (P1).	<input checked="" type="checkbox"/>	
Close SV-27 (2R vacuum gauge)	<input checked="" type="checkbox"/>	
2R Temperature before <u>24.4</u> °C		
Fill 2R gas: <u>Air</u> setting: <u>400</u> psig	<input checked="" type="checkbox"/>	
thumbwheel: <u>400</u> psig		
value: <u>400</u> psig	<input checked="" type="checkbox"/>	
Isolate flex hose	<input checked="" type="checkbox"/>	
Confirm 2R pressure, Hand switch HS-C1	<input checked="" type="checkbox"/>	
Isolate 2R gauge	<input checked="" type="checkbox"/>	
Confirm isolation, Hand switch HS-28	<input checked="" type="checkbox"/>	K, L
Close SV-31 (PS vacuum gauge)	<input checked="" type="checkbox"/>	M
Confirm CT pressure, Hand switch HS-C2	<input checked="" type="checkbox"/>	N
value: <u>-26.5</u> kPa		
Isolate CT gauge	<input checked="" type="checkbox"/>	
Confirm isolation, Hand switch HS-30	<input checked="" type="checkbox"/>	O
2R Temperature after <u>25.1</u> °C		
Close V-12 (2R vacuum)	<input checked="" type="checkbox"/>	P
Open V-13 to vent CT vacuum pump	<input checked="" type="checkbox"/>	
Turn off CT vacuum pump (next to pump)	<input checked="" type="checkbox"/>	
READY TO FIRE	<input checked="" type="checkbox"/>	
Chime for 5 seconds	<input checked="" type="checkbox"/>	
Press and hold down firing buttons.	<input checked="" type="checkbox"/>	
Time: <u>4:40</u>		

T5 Checklist, Version 9, 1-5-93

Signature: _____

Operator in charge: _____

Date: 09/08/93

Time: 10:10

Shot Number: 625

(Repeat of 6)

[illegible]

[illegible]

T5 Checklist, Version 9, 1-5-93

Signature:

Operator in charge:

Date:

Time:

Shot Number:

[illegible]

Action	Check	Signal
Press hand switch HS-C3 to confirm ST pressure	<input checked="" type="checkbox"/>	
Close V-14 (ST isolation)	<input checked="" type="checkbox"/>	
Close ZS-20 (DT vacuum isolation)	<input checked="" type="checkbox"/>	
Close V-8 (CT isolation)	<input checked="" type="checkbox"/>	
Close (ST gauges):		
SV-25A	<input checked="" type="checkbox"/>	
SV-25B	<input checked="" type="checkbox"/>	E, F
Close SV-29 (CT vacuum gauge)	<input checked="" type="checkbox"/>	G
Fill CT gas: <u>85% He</u> vacuum: <u>-96.5</u> kPa		
setting: <u>59.5</u> kPa		
thumbwheel: <u>-37</u> kPa		
value: <u>-37</u> kPa	<input checked="" type="checkbox"/>	
gas: <u>15% Ar</u> setting: <u>70.0</u> kPa		
thumbwheel: <u>-26.5</u> kPa		
value: <u>-26.5</u> kPa	<input checked="" type="checkbox"/>	
Close V-11 (CT high pressure isolation valve)	<input checked="" type="checkbox"/>	H
Close V-7 (CT/2R vacuum)	<input checked="" type="checkbox"/>	
Close SV-23 (DT vacuum gauge)	<input checked="" type="checkbox"/>	I, J
Arm "T5 das" on DAS	<input checked="" type="checkbox"/>	
Instrumentation ready	<input checked="" type="checkbox"/>	
WARNING LIGHTS ON (P1).	<input checked="" type="checkbox"/>	
Close SV-27 (2R vacuum gauge)	<input checked="" type="checkbox"/>	
2R Temperature before <u>22.0</u> °C		
Fill 2R gas: <u>Air</u> setting: <u>400</u> psig	<input checked="" type="checkbox"/>	
thumbwheel: <u>400</u> psig		
value: <u>400</u> psig	<input checked="" type="checkbox"/>	
Isolate flex hose	<input checked="" type="checkbox"/>	
Confirm 2R pressure, Hand switch HS-C1	<input checked="" type="checkbox"/>	
Isolate 2R gauge	<input checked="" type="checkbox"/>	
Confirm isolation, Hand switch HS-28	<input checked="" type="checkbox"/>	K, L
Close SV-31 (PS vacuum gauge)	<input checked="" type="checkbox"/>	M
Confirm CT pressure, Hand switch HS-C2 value: <u>-26.3</u> kPa	<input checked="" type="checkbox"/>	N
Isolate CT gauge	<input checked="" type="checkbox"/>	
Confirm isolation, Hand switch HS-30	<input checked="" type="checkbox"/>	O
2R Temperature after <u>22.7</u> °C		
Close V-12 (2R vacuum)	<input checked="" type="checkbox"/>	P
Open V-13 to vent CT vacuum pump	<input checked="" type="checkbox"/>	
Turn off CT vacuum pump (next to pump)	<input checked="" type="checkbox"/>	
READY TO FIRE Time: <u>10:30</u>	<input checked="" type="checkbox"/>	
Chime for 5 seconds	<input checked="" type="checkbox"/>	
Press and hold down firing buttons.	<input checked="" type="checkbox"/>	

T5 Checklist, Version 9, 1-5-93

Signature: *John Paul D*Operator in charge: S. DavisDate: 09/08/93Time: 10:10Shot Number: 625

(Repeat of 6)

Action	Check	Signal
Diaphragm Material: <u>SS 304</u> Thickness: <u>180</u> Type: <u>Star 4</u> Expected burst pressure: <u>32</u> MPa		
Open door to compressor room, turn on fan Turn on all vacuum pumps Wait at least 15 minutes.	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	
Position tunnel correctly LVDT1: setting: <u>2500</u> , value: <u>?</u> LVDT2: setting: <u>480</u> , value: <u>?</u>	<input type="checkbox"/> <input type="checkbox"/>	A
Center ST frame	<input checked="" type="checkbox"/>	B
Position DT	<input checked="" type="checkbox"/>	C
Close ZS-4 (Emergency vent) HV-6A HV-6B (Firing) Open V-7 (CT/2R Vacuum) V-8 (CT Vacuum) V-11 (High pressure CT isolation) V-12 (2R Vacuum) Open vacuum gauge valves: SV-24 (DT) SV-25A (ST) SV-25B (ST) SV-23 (DT) SV-26 (ST) SV-29 (CT) SV-27 (2R) SV-31 (PS)	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	D
Close 2R pressure isolation valve (near P1) Check vacuum levels	2R vacuum: <u>atm</u> mm Hg DT: <u>0.25</u> mm Hg ST: <u>0.10</u> mm Hg CT: <u>0.08</u> mm Hg 2R: <u>atm</u> mm Hg PS: <u>0.08</u> mm Hg	
Disconnect nozzle support trolley Isolate ST vacuum (V-17) Isolate ST vacuum gauge (SV-26) Fill ST gas: <u>Argon</u> setting: <u>80</u> kPa thumbwheel: <u>1600</u> value: <u>1602</u>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	

Action	Check	Signal
Press hand switch HS-C3 to confirm ST pressure	<input checked="" type="checkbox"/>	E, F
Close V-14 (ST isolation)	<input checked="" type="checkbox"/>	
Close ZS-20 (DT vacuum isolation) - <u>Leave pump on!</u> and leave	<input checked="" type="checkbox"/>	
Close V-8 (CT isolation)	<input checked="" type="checkbox"/>	
Close (ST gauges):	<input checked="" type="checkbox"/>	
SV-25A	<input checked="" type="checkbox"/>	
SV-25B	<input checked="" type="checkbox"/>	
Close SV-29 (CT vacuum gauge)	<input checked="" type="checkbox"/>	G
Fill CT gas: <u>100 % He</u> vacuum: <u>-96.0 kPa</u>	<input checked="" type="checkbox"/>	H
<u>116 kPa</u> setting: <u>116 kPa</u>		
thumbwheel: <u>20.0 kPa</u>		
value: <u>20.0 kPa</u>		
gas: _____		
setting: _____ kPa		
thumbwheel: _____ kPa	<input checked="" type="checkbox"/>	I, J
value: _____ kPa	<input checked="" type="checkbox"/>	
Close V-11 (CT high pressure isolation valve)	<input checked="" type="checkbox"/>	K, L
Close V-7 (CT/2R vacuum)	<input checked="" type="checkbox"/>	
Close SV-23 (DT vacuum gauge)	<input checked="" type="checkbox"/>	M
Arm "T5 das" on DAS	<input checked="" type="checkbox"/>	
Instrumentation ready	<input checked="" type="checkbox"/>	N
WARNING LIGHTS ON (P1). Verify the door is closed.	<input checked="" type="checkbox"/>	
Close SV-27 (2R vacuum gauge)	<input checked="" type="checkbox"/>	O
2R Temperature before <u>23.2 °C</u>	<input checked="" type="checkbox"/>	
Fill 2R gas: <u>Air</u> setting: <u>1000 psig</u>	<input checked="" type="checkbox"/>	P
thumbwheel: <u>1000 psig</u>	<input checked="" type="checkbox"/>	
value: <u>1000 psig</u>	<input checked="" type="checkbox"/>	P
Isolate flex hose	<input checked="" type="checkbox"/>	
Confirm 2R pressure, Hand switch HS-C1	<input checked="" type="checkbox"/>	P
Isolate 2R gauge	<input checked="" type="checkbox"/>	
Confirm isolation, Hand switch HS-28	<input checked="" type="checkbox"/>	P
Close SV-31 (PS vacuum gauge)	<input checked="" type="checkbox"/>	
Confirm CT pressure, Hand switch HS-C2 value: <u>20.0 kPa</u>	<input checked="" type="checkbox"/>	P
Isolate CT gauge	<input checked="" type="checkbox"/>	
Confirm isolation, Hand switch HS-30	<input checked="" type="checkbox"/>	P
2R Temperature after <u>25.9 °C</u>	<input checked="" type="checkbox"/>	
Close V-12 (2R vacuum)	<input checked="" type="checkbox"/>	P
Open V-13 to vent CT vacuum pump	<input checked="" type="checkbox"/>	
Turn off CT vacuum pump (next to pump)	<input checked="" type="checkbox"/>	P
READY TO FIRE Time: <u>12:45</u>	<input checked="" type="checkbox"/>	
Chime for 5 seconds	<input checked="" type="checkbox"/>	P
Press and hold down firing buttons.	<input checked="" type="checkbox"/>	

IMPORTANT : post-shot, open HS-20 only

