

HIRDLS

TR-OXF-262

HIGH RESOLUTION DYNAMICS LIMB SOUNDER

Originator: C. Hepplewhite

Date: 7th Aug 00

Subject/Title:	In-Flight Calibrator (IFC) Thermal Vacuum Test Report <i>TO BE APPENDED TO RAL REPORT AV-99-111-TK</i>
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Description/Summary/Contents:

This document is a supplemental report of the In-Flight Calibrator (IFC) sub-system thermal vacuum testing. It supplements the report provided by the facility operators, and covers IFC specific performance issues.

Keywords:

Reviewed/Approved by:			
Date (yy-mm-dd):			

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 - 3.1 PRT-A; 3.2 PRT-B, 3.3 A-side voltage monitor; 3.4 B-side voltage monitor, 3.5 Ref-resistor temperature. (All data in telemetry counts).
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5. Taken 7/Jul/00 11:23 to 8/Jul/00 14:26 GMT - LPT for last two cycles.
 - 5.1 PRT-A; 5.2 PRT-B, 5.3 A-side voltage monitor; 5.4 B-side voltage monitor, 5.5 Ref-resistor temperature. (All data in telemetry counts).

1. Introduction

this document is the supplemental report to the In-Flight Calibrator (IFC) sub-system thermal -vacuum testing. This is in addition to the report RD1 provided by the facility operators and covers IFC specific issues of performance by examination of the data obtained.

1.1 References

RD1

2. Equipment & Facility

The IFC thermal vacuum test was performed at the Rutherford Appleton Laboratory, SSD AIV facility, vacuum chamber 2. It was conducted over the period 3rd to 8th July 2000.

The Facility manager was Mr. Graham Toplis. The IFC was operated by Dr. Hepplewhite, Mr. D. Peters & Mr. S. Graham (GSFC).

Standard procedures were followed with regard to preparation of the facility for use with space grade hardware and the handling of the IFC was conducted in accordance with flight approved PA procedures.

2.1 Hardware Flow

3. Summary of Data

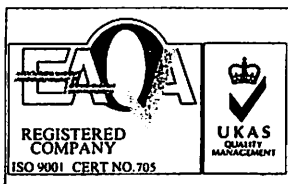
4. Review

		Side -A Telemetry Monitors								Side - B Telemetry Monitors								Notes
		Time	+15V_mon	-15V_mon	+5V_mon	Rref_Temp	PRT_1	PRT_2	PRT_3	Time	+15V_mon	-15V_mon	+5V_mon	Rref_Temp	PRT_1	PRT_2	PRT_3	
Thermal-Vacuum	(3 - 8/Jul/00)																	
First LPT (ready to go)	(3/Jul/00)	11:27	E8	EA	DE	7E	AFC0	ABCB	A7D8	11:27	E9	EA	E0	80	AFC4	ABCD	A7DD	BEU+U15+TV-Cable+IFCBB-1
Telemetry readings																		
LPT @ 1st Max Op Temp	(4/Jul/00)	12:00	E9	E9	DD	39	AFC3	ABCE	A7DB	12:00	EA	E9	E0	39	AFC9	ABD1	A7E3	
Telemetry readings																		
HCW response test	Input	12:12	00	n/a	20	40	80	FF	n/a	12:12	00	n/a	20	40	80	FF	n/a	
Voltage measured			+0.26		2.12	3.99	7.73	14.92			+0.30		2.17	4.03	7.77	14.93		
LPT @ 1st Min Op Temp	(4/Jul/00)	20:00	E9	E9	E0	FF	AFB4	ABC1	A7D0	20:00	EA	EA	E0	FF	AFC1	ABCA	A7D9	
Telemetry readings																		
HCW response test	Input	20:16	00	0F	20	40	80	FF	00	20:16	00	0F	20	40	80	FF	00	
Voltage measured			+0.23	1.11	2.09	3.97	7.7	14.96	+0.24		+0.28	1.08	2.15	4	7.74	14.96	+0.28	
Hot-St & LPT Max-Min Op Temp	(5/Jul/00)	7:07	E9	E2	DD	2D	AF7F	ABD1	A7DC	7:07	EA	E3	E0	2C	AFBB	ABD3	A7E4	
Telemetry readings																		
HCW response test	Input	7:22	00	0F	20	40	80	FF	00	7:22	00	0F	20	40	80	FF	00	
Voltage measured			+0.26	1.13	2.12	3.99	7.7	14.91			+0.3	1.12	2.16	4.02	7.75	14.92	+0.3	
Telemetry readings		9:50	EA	E9	D6	8E	AF8E	ABCA	A7D8	9:50	EC	EA	D7	8B	AFC5	ABCF	A7DE	
Cold-St & LPT Min-Max Op	(6/Jul/00)	20:33	EA	E8	DB	FF	AFAA	ABB7	A7C6	20:33	EA	E9	DC	FF	AFBB	ABC6	A7D4	
Telemetry readings																		
HCW response test	Input	21:26	00	0F	20	40	80	FF	00	21:26	00	0F	20	40	80	FF	00	
Voltage measured			+0.24	1.13	2.11	3.98	7.71	14.97	+0.24		+0.28	1.11	2.15	4.02	7.75	14.97	+0.29	
Telemetry readings		23:45	E9	E8	D8	4A	AF8E	ABC9	A7D7	23:45	EA	E9	D8	4B	AFC5	ABCD	A7DD	
LPT @ ambient	(8/Jul/00)	10:26	EA	DE	DD	86	B006	B04B	B056	10:26	EA	E0	E0	86	B04F	A8A9	A057	BEU+U15+TV-cable+IFCBB
Telemetry readings																		
LPT @ 2nd Min Op Temp	(7/Jul/00)	11:25	EA	EA	DB	FF	9280	92BE	92B9	11:25	EA	EA	DC	FF	92D0	92B5	92B3	
Telemetry readings																		
IFCBB Heater run full power for 70 mins		12:53								12:53								See TC-OXF-265
LPT @ 2nd Max Op Temp	(7/Jul/00)	19:30	E9	E9	D9	36	C0A8	C0F1	C108	19:30	EA	EA	D9	36	C0F9	C0E2	C0FC	
Telemetry readings																		
IFCBB Heater run full power for 4 mins		19:24								19:24								
LPT @ 3rd Min-Op Temp	(8/Jul/00)	5:00																
Telemetry readings																		
LPT @ 3rd Max-Op Temp	(8/Jul/00)																	
Telemetry readings																		

**SST DEPARTMENT
AIV FACILITY**

HIRDLS – In Flight Calibrator

**Thermal Vacuum Test
REPORT No: AIV-99-111-TVC**



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Annex A – Equipment Used.

Annex B – PreTest Data.

Annex C – Test Data

Annex D - Photographs

1) **Test Item Description**

Test 1: Black Body Electronics Unit (BEU) and Black Body Simulator
Test2: Black Body Electronics Unit (BEU) and Black Body (IFCBB)

2) **Test Specification**

The following specification was taken from Oxford University Doc No: SP-OXF-223

REQUIREMENT	TEMPERATURE
Maximum Operating	46°C
Minimum Operating	-9°C
Maximum Survival	60°C
Minimum Survival	-52°C
Maximum Rate of Change	20°C/Hr
Tolerances	+1°C –1°C
REQUIREMENT	DURATION
Soak Time	4 Hr
REQUIREMENT	PRESSURE
Maximum Pressure	<1.0E-5 mBar

3) **Test Objectives**

The objective was to test the HIRDLS In-Flight Calibrator to the levels set out in Oxford University Doc No: SP-OXF-223

4) Test Summary

Pumpdown 1

Parameter	Date	Time	Shroud/Plate Temperature	Pressure MBar
Pumpdown Initiated	03/07/2000	13:15		
Start Thermal Cycling	04/07/2000	07:45	22.6 / 22.2°C	4.7 E-6
Finish Thermal Cycling	06/07/2000	05:30	14.3 / 13.4°C	3.4 E-7
Letup Initiated	06/07/2000	09:30	19.8 / 18.6°C	1.2 E-6
Maximum Pressure At	04/07/2000	09:00	50.4 / 50.9°C	2.1 E-5
Minimum Pressure At	05/07/2000	17:25	-54.3 / -54.3°C	2.6 E-7

Pumpdown 2

Parameter	Date	Time	Shroud/Plate Temperature	Pressure MBar
Pumpdown Initiated	06/07/2000	11:35		
Start Thermal Cycling	07/07/2000	08:05	22.3 / 21.9°C	2.0 E-6
Finish Thermal Cycling	08/07/2000	17:10	23.7 / 22.0°C	1.2 E-6
Letup Initiated	08/07/2000	17:15	26.9 / 26°C	1.0 E-6
Maximum Pressure At	07/07/2000	19:00	42.3 / 42.6°C	2.2 E-5
Minimum Pressure At	08/07/2000	05:00	-17.7 / -18.0°C	1.3 E-7

5) Test Item Mounting and Sensor Details

The Receivers were mounted on a thermally controlled plate within the chamber, see photos in Annex D for details.

PRT No.	Position	Function
PRT01	Top of Black Body Electronics Unit	Monitor (Control)
PRT02	Top of Black Body Electronics Unit (2)	Monitor
PRT03	LHS of Black Body Electronics Unit	Monitor
PRT04	RHS of Black Body Electronics Unit	Monitor
PRT05	Front of Black Body Electronics Unit	Monitor
PRT06 (Test 1)	Top of Black Body Simulator	Monitor
PRT06 (Test 2)	Black Body (IFCBB) Connector Backshell	Monitor

6) Comments

Previous to the test being performed the chamber was run through a representative profile and a TQCM Baseline obtained. The data for these tests are included in Annex B.

Temperature Vs Time plots show a full test Profile in Annex C. More detailed temperatures and TQCM data obtained during the test are also included.

It can be seen from the thermal plots that the transition from Min survival to Max Operating temps was interrupted and held at -9°C (Cold Start). This was due to problems with the instrument EGSE.

7) Cleanliness

Test Type	Cleanliness	Status	Peaks	Figures
Pre Test Calibration	Satisfactory	Normal		
Thermal Testing (Pump 1)	High 91 peak (Toluene)	Normal	18, 28, 32 & 91	Annex B
Thermal Testing (Pump 2)	High 91 peak (Toluene)	Normal	18, 28, 32 & 91	Annex C

8) Conclusion

A Thermal Vacuum Test was successfully performed on the HIRDLS – In Flight Calibrator by Cycling the Thermal Shroud and one cold plate.

Reporting Officer



Date

18-7-00

Facility Manager



Date

18/7/00

Annex A – Equipment Used

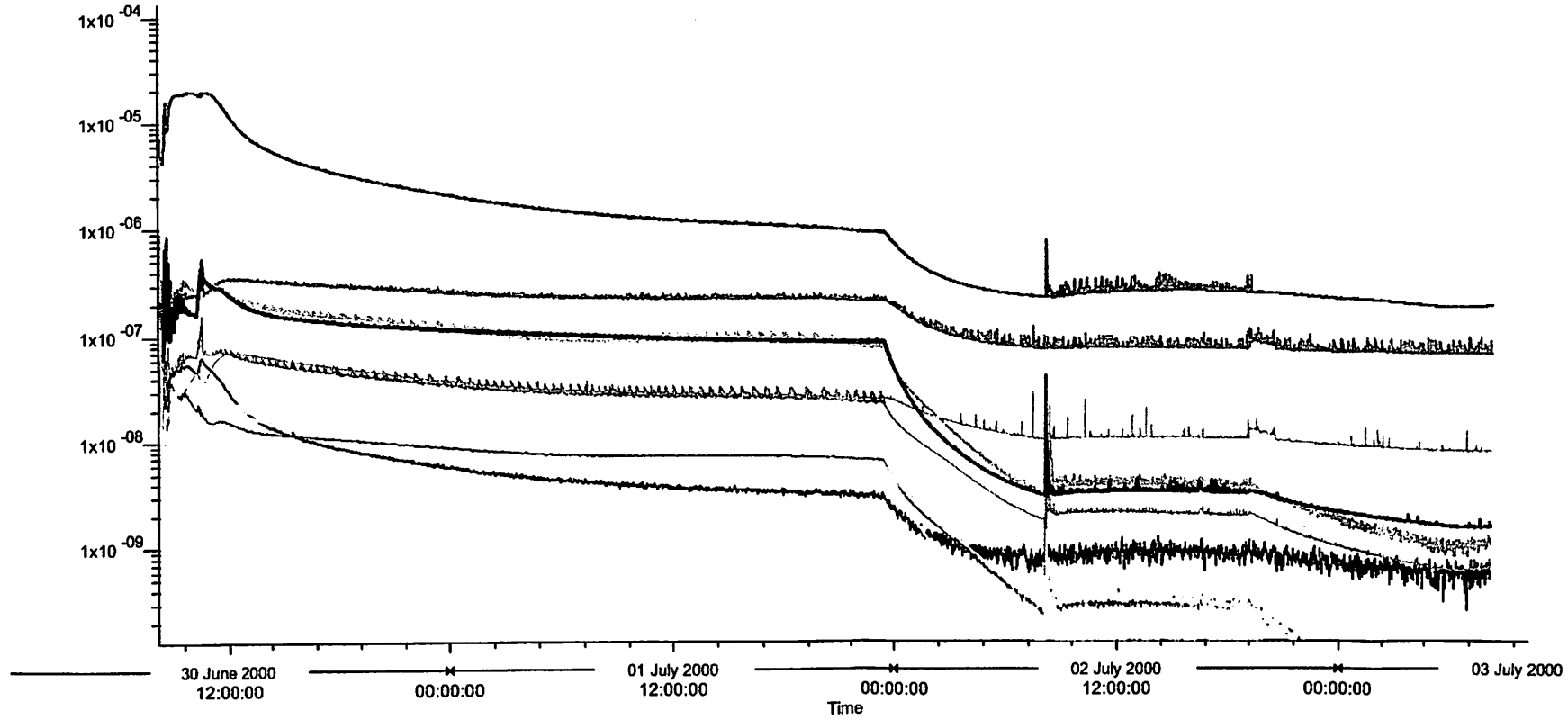
EQUIPMENT USED

Equipment	Manufacturer	Type	Calibration Date	Certificate No	Comments
Mass Spectrometer 0-100 AMU	Spectra Metrics	Microvision Plus (MQH1)	28/01/2000	NA	Calibrated by OEM
Vacuum gauges	Balzers	TPG300 Pirani/Penning	NA	NA	
Monitoring PRT's	TC LTD	PT100 Class A	29 June 2000	NA	In house Calibration
Temperature Controller	Eurotherm	PC 3000	29 June 2000	NA	In house Calibration
Thermal Sentry	Eurotherm	Eurotherm 92	29 June 2000	NA	In House Calibration
Data acquisition system	Measurement Systems	Datascan Modules	29 June 2000	NA	In house Calibration
Calibrator	Beamax	TC 303	30/05/2000	16394	Absolute Calibration Ltd

[illegible]

AIV-99-111-TVC Pretest Mass Trend

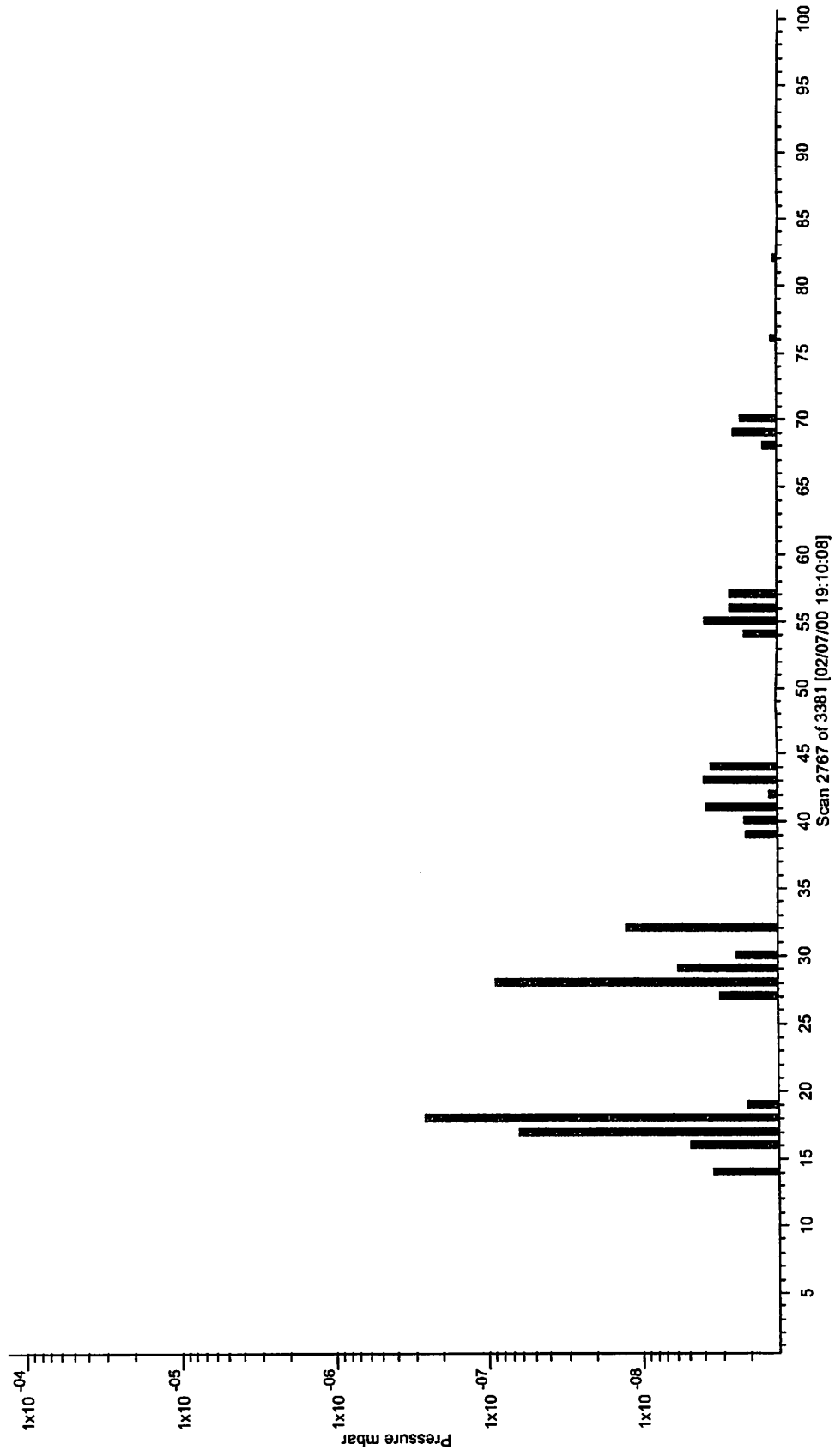
Chamber 2



20 - Neon : From 6.47×10^{-8} To 5.09×10^{-10}
 18 - Water : From 7.22×10^{-8} To 1.93×10^{-7}
 28 - Nitrogen : From 4.14×10^{-7} To 6.83×10^{-8}
 32 - Oxygen : From 5.42×10^{-8} To 8.19×10^{-9}
 Hydrocarbon : From 8.99×10^{-7} To 1.06×10^{-9}
 4 - Helium : From -1.63×10^{-11} To -2.30×10^{-11}

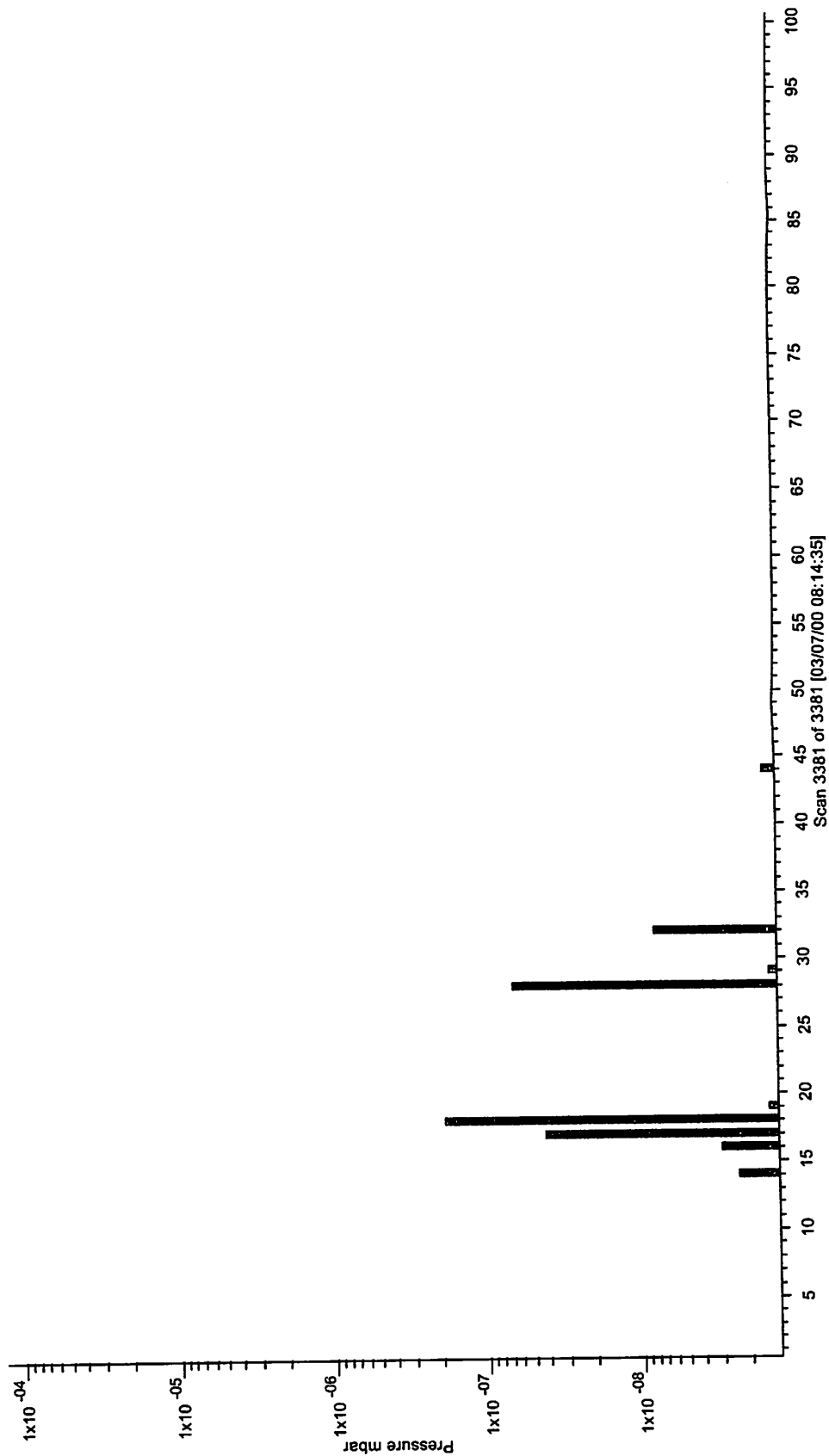
91 - Toluene : From 3.12×10^{-8} To 1.99×10^{-11}
 39 - Hydrocarbon : From 1.16×10^{-7} To 6.42×10^{-10}
 44 - Carbon dioxide : From 2.15×10^{-7} To 1.55×10^{-9}
 60 - Hydrocarbon : From 1.97×10^{-8} To -5.09×10^{-12}
 73 - Hydrocarbon : From 1.18×10^{-7} To -3.74×10^{-11}

AIV-99-111-TVC Pretest Mass Barchart at end of Bake



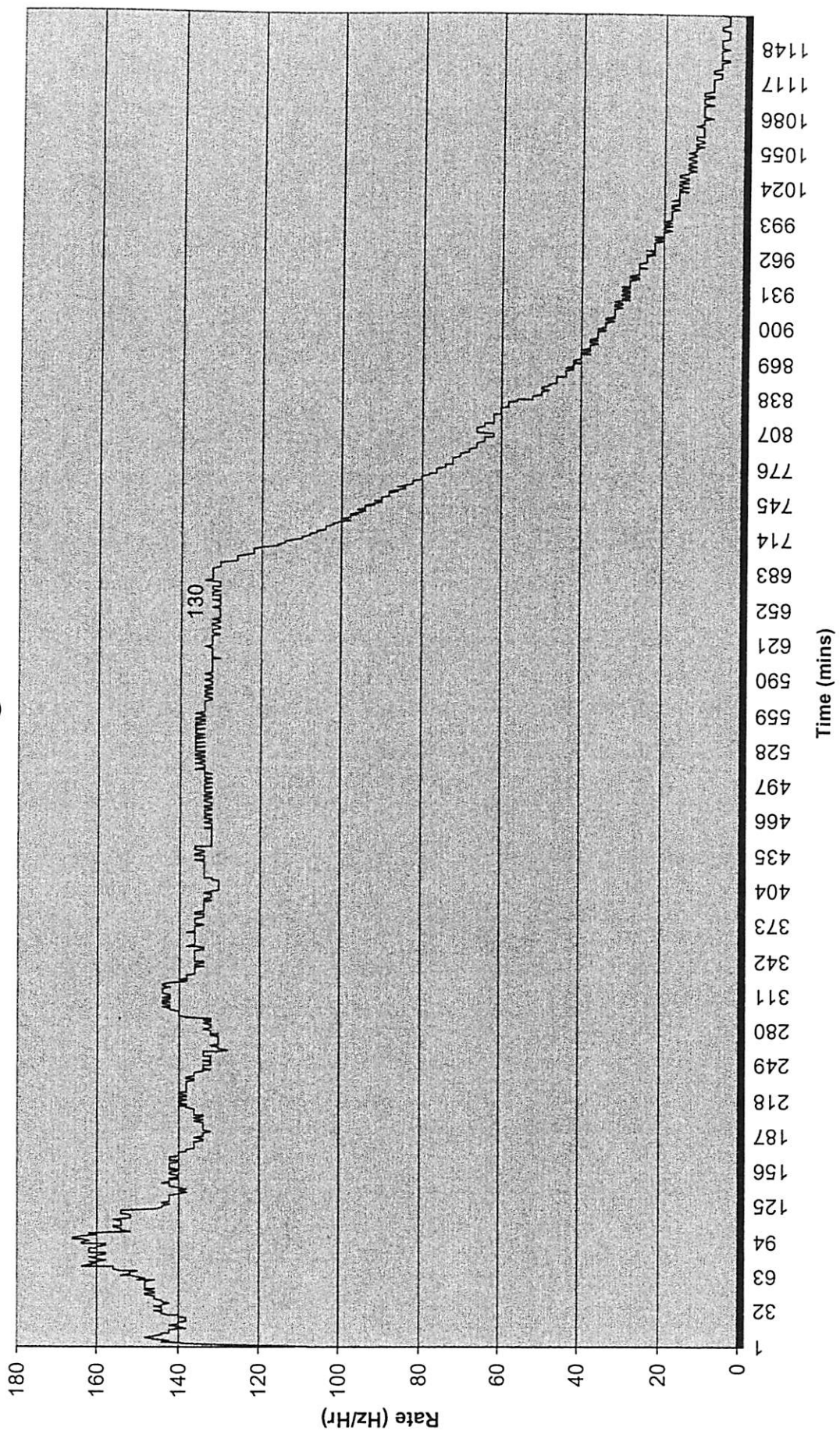
Ion source configuration: Standard Electron Energy
Detector: Faraday
Accuracy: 8
Instrument serial number: LM76-01399007

AIV-99-111-TVC Pretest Mass Barchart at Letup



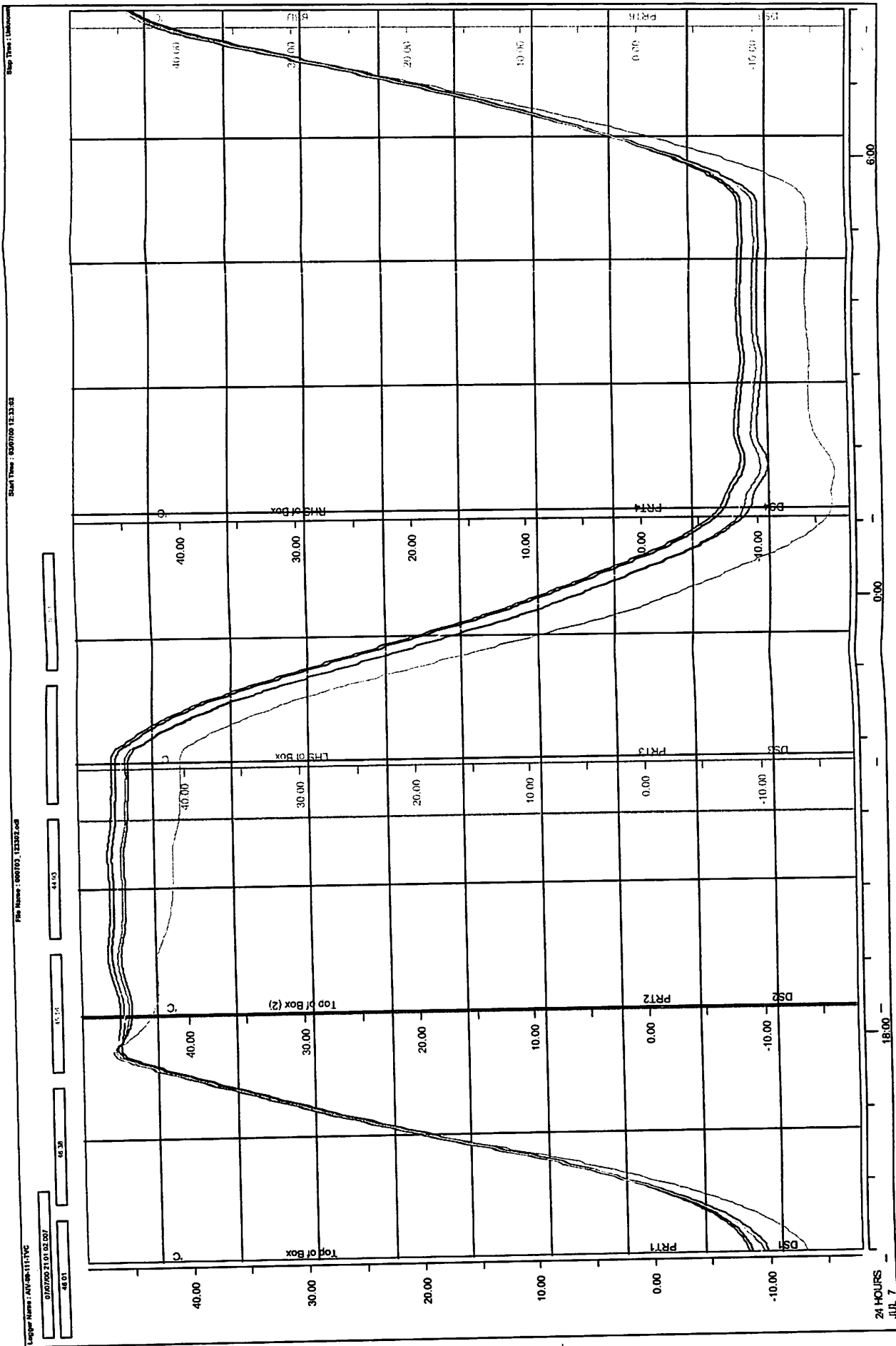
Ion source configuration: Standard Electron Energy
 Detector: Faraday
 Accuracy: 8
 Instrument serial number: LM76-01399007

Chamber Baseline @ 46°C



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AIV-99-111-TVC Typical Hot Temperature

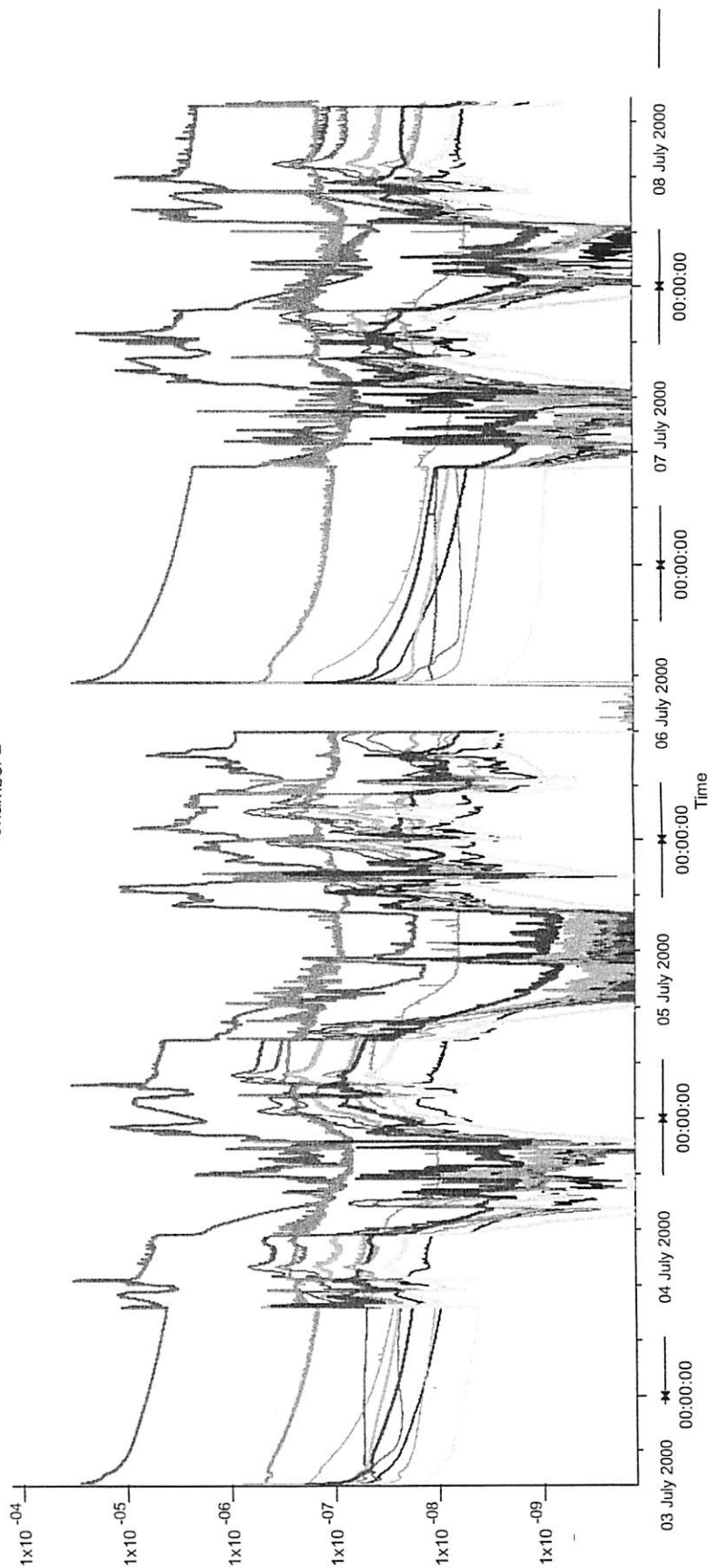


AIV-99-111-TVC Typical Cold Temperature



AIV-99-111-TVC Mass Trend (Full Test)

Chamber 2

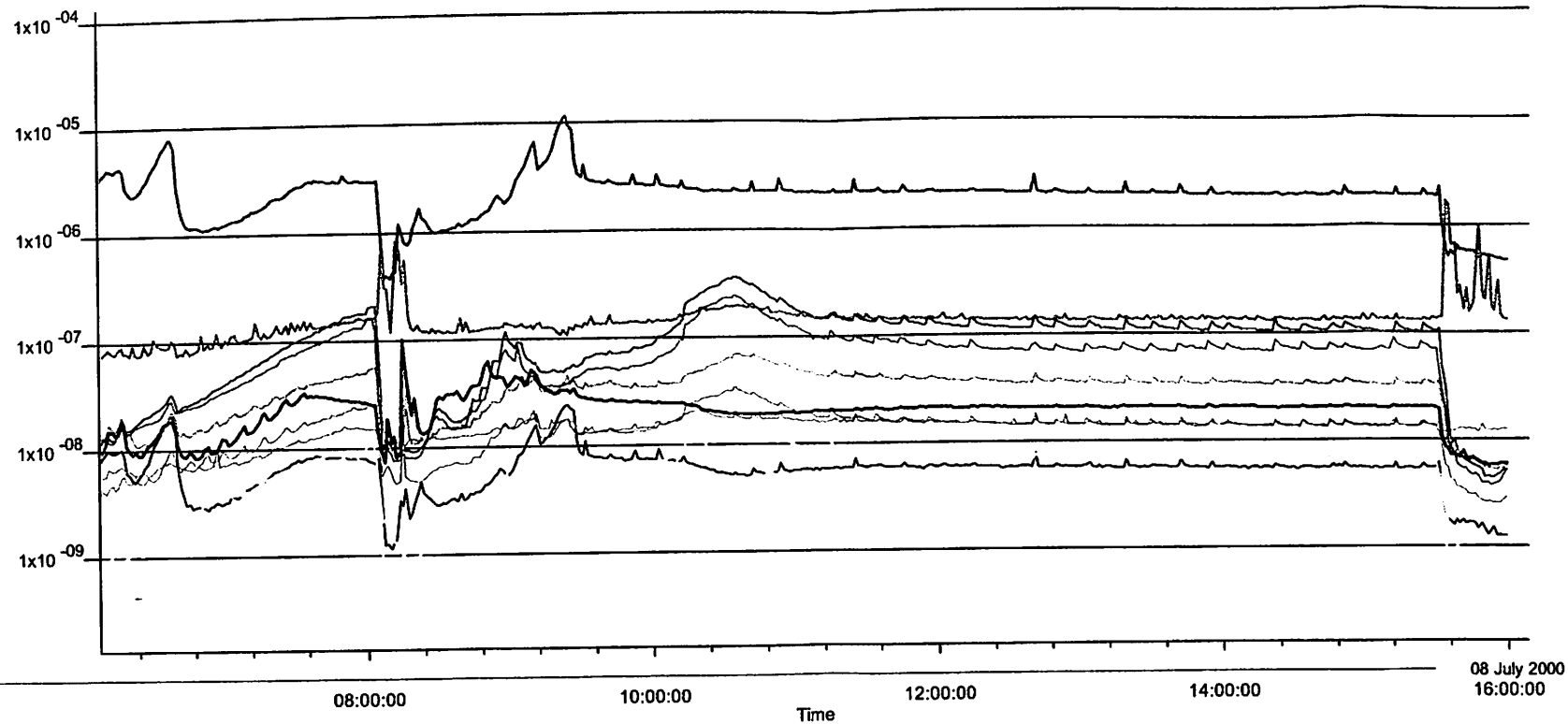


4 - Helium : From -1.39e-011 To -8.34e-012
 91 - Toluene : From 9.41e-008 To 5.18e-009
 39 - Hydrocarbon : From 7.57e-008 To 2.86e-009
 44 - Carbon dioxide : From 2.03e-007 To 5.99e-009
 60 - Hydrocarbon : From 1.51e-008 To 5.58e-010
 73 - Hydrocarbon : From 8.53e-008 To 7.53e-010

20 - Neon : From 5.00e-008 To 1.22e-009
 90 : From 1.50e-007 To 6.01e-009
 18 - Water : From 2.06e-005 To 4.67e-007
 28 - Nitrogen : From 7.85e-007 To 1.31e-007
 32 - Oxygen : From 2.07e-007 To 1.24e-008
 43 - Hydrocarbon : From 5.11e-007 To 5.55e-009

AIV-99-111-TVC Mass Trend (Final Hot Soak)

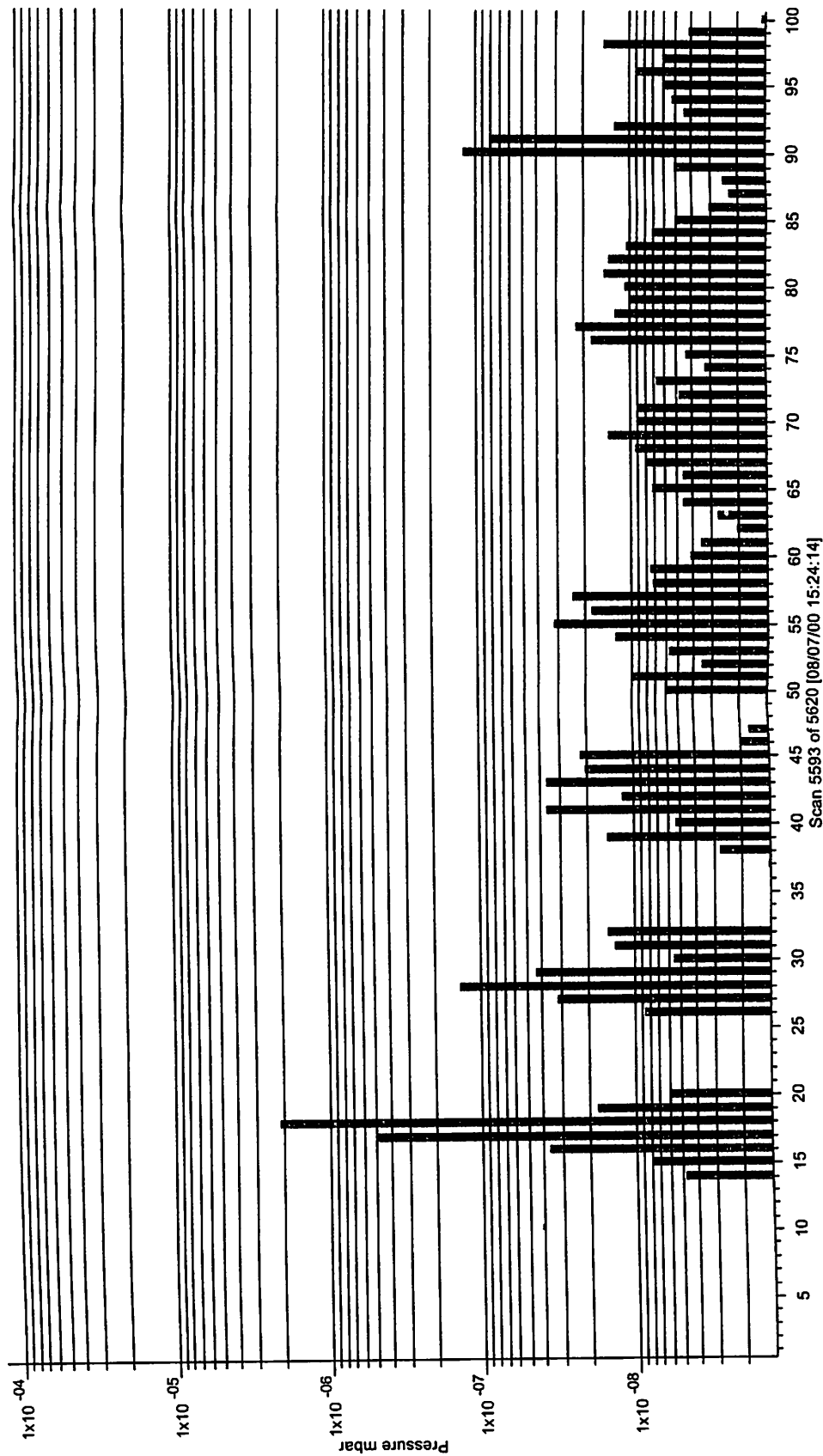
Chamber 2



20 - Neon : From 7.58×10^{-9} To 1.22×10^{-9}
 90 : From 8.63×10^{-9} To 6.01×10^{-9}
 18 - Water : From 3.23×10^{-6} To 4.67×10^{-7}
 28 - Nitrogen : From 7.99×10^{-8} To 1.31×10^{-7}
 32 - Oxygen : From 5.56×10^{-9} To 1.24×10^{-8}
 43 - Hydrocarbon : From 1.29×10^{-8} To 5.55×10^{-9}

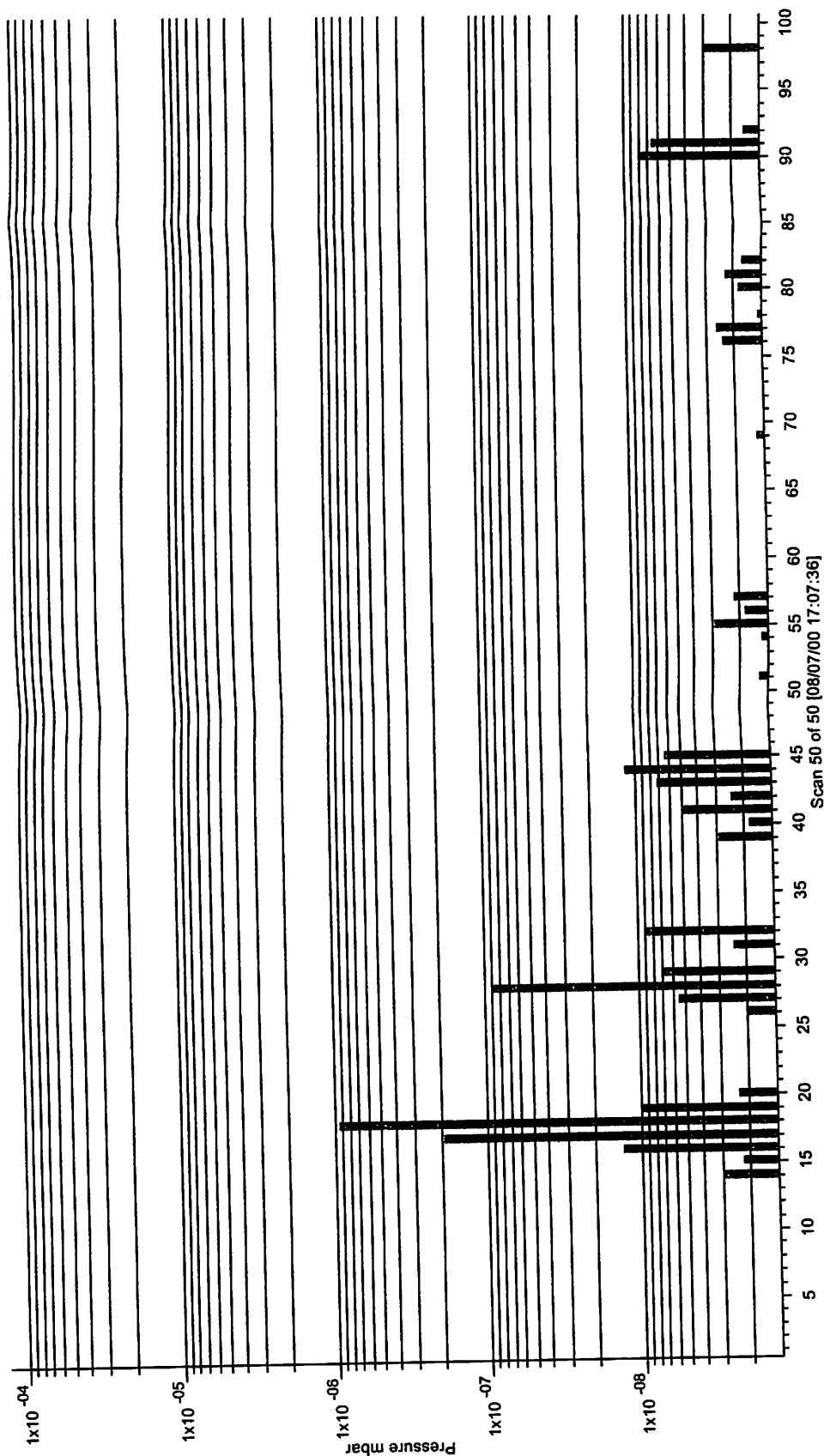
4 - Helium : From -2.62×10^{-11} To -8.34×10^{-12}
 91 - Toluene : From 8.12×10^{-9} To 5.18×10^{-9}
 39 - Hydrocarbon : From 3.50×10^{-9} To 2.86×10^{-9}
 44 - Carbon dioxide : From 1.15×10^{-8} To 5.99×10^{-9}
 60 - Hydrocarbon : From 6.52×10^{-10} To 5.58×10^{-10}
 73 - Hydrocarbon : From 8.49×10^{-10} To 7.53×10^{-10}

AIV-99-111-TVC Mass Barchart at end of Hot Last Soak



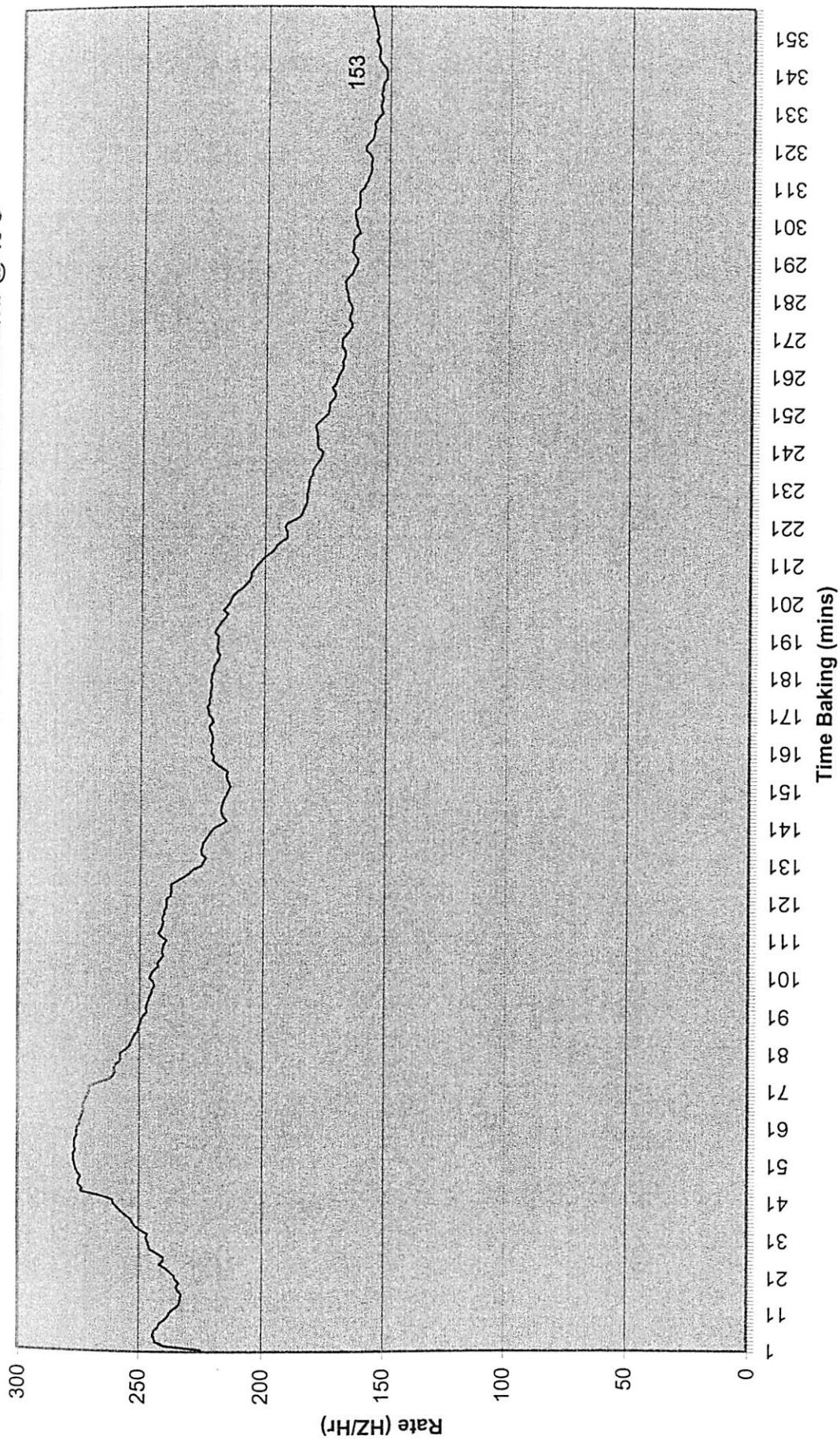
Ion source configuration: Standard Electron Energy
 Detector: Faraday
 Accuracy: 8
 Instrument serial number: LM76-01399007

AIV-99-111-TVC Mass Barchart at Letup

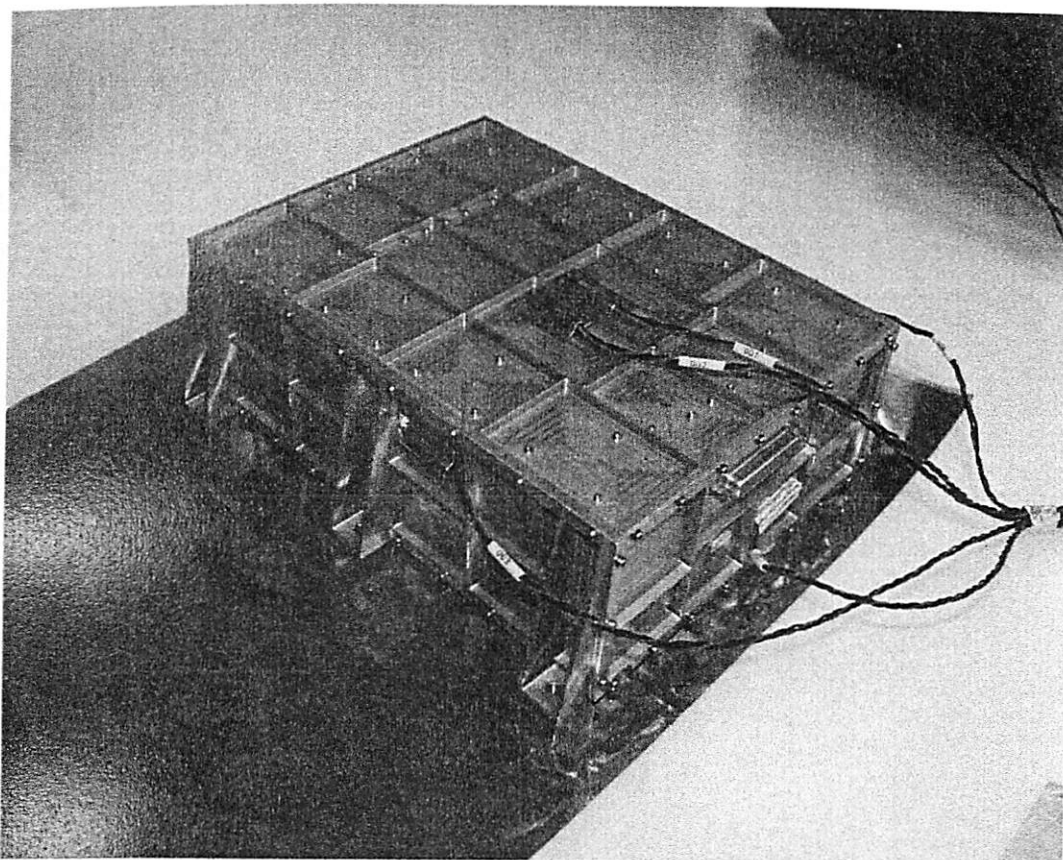


Ion source configuration: Standard Electron Energy
 Detector: Faraday
 Accuracy: 8
 Instrument serial number: LM76-01399007

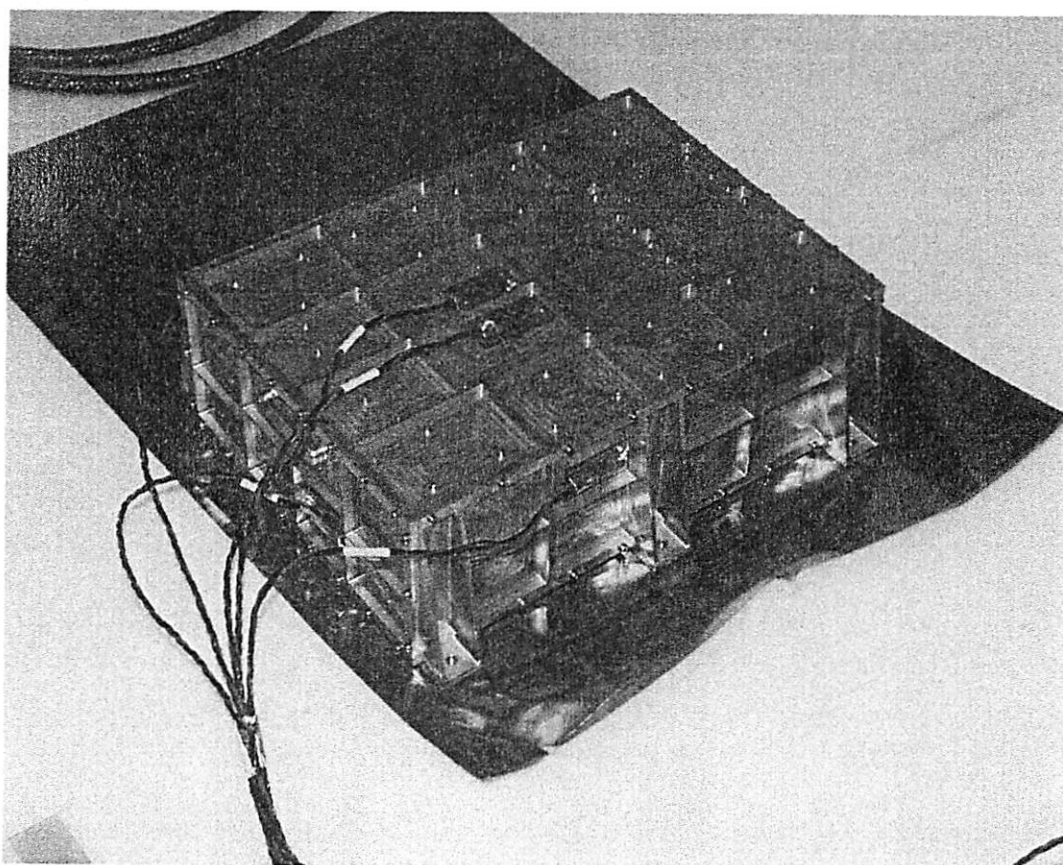
AIV-99-111-TVC IFC TQCM Data at 46°C/-20°C over 7 hours. Chamber baseline 130Hz/Hr @ 46°C



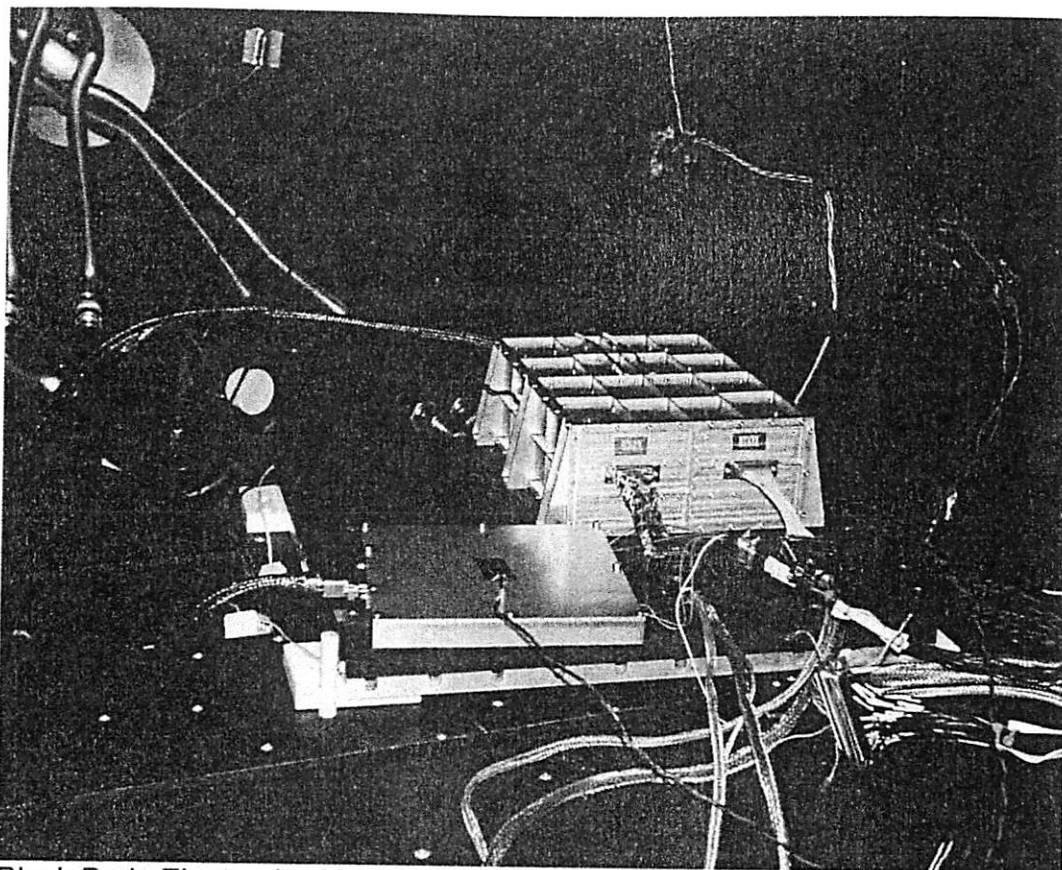
Annex D - Photographs



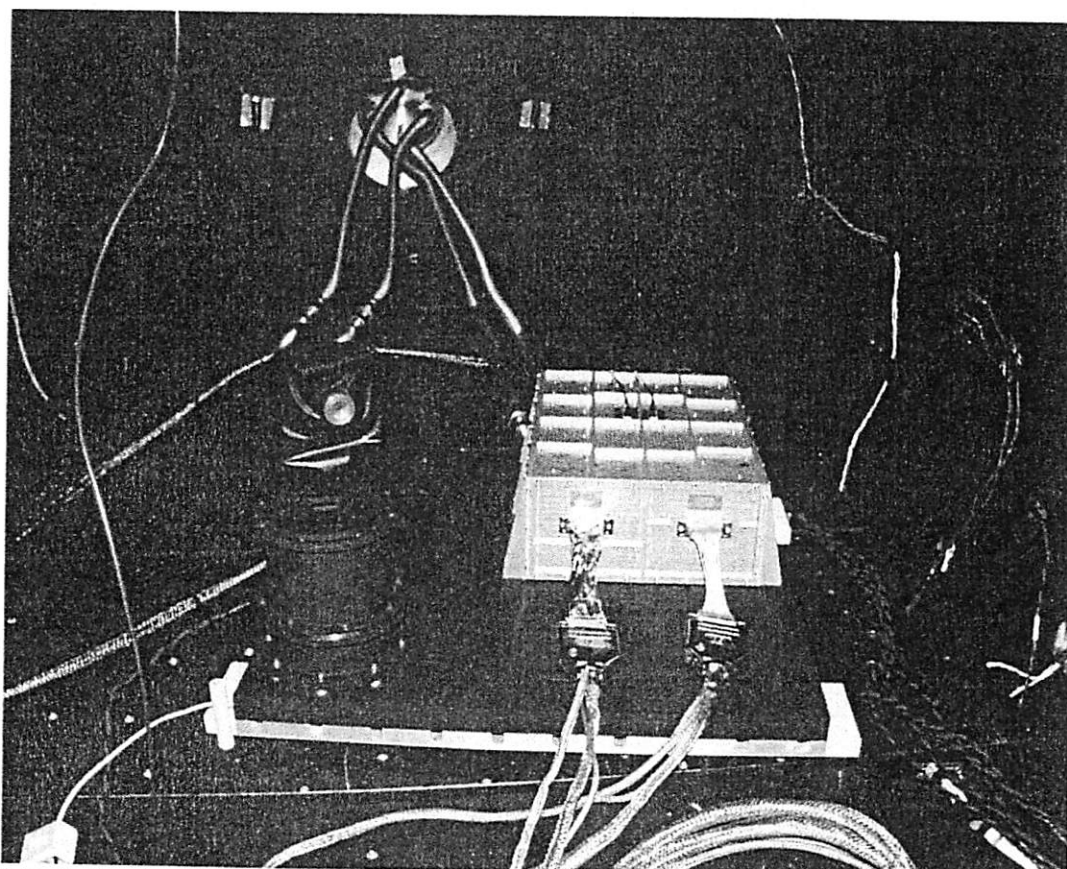
Sensor locations on Black Body Electronics Unit (BEU)



Sensor locations on Black Body Electronics Unit (BEU)



Black Body Electronics Unit (BEU) and Black Body Simulator in Chamber



Black Body Electronics Unit (BEU) and Black Body Simulator (IFCBB) in Chamber