

L799060

E990356-00-X  
E990358-00-X

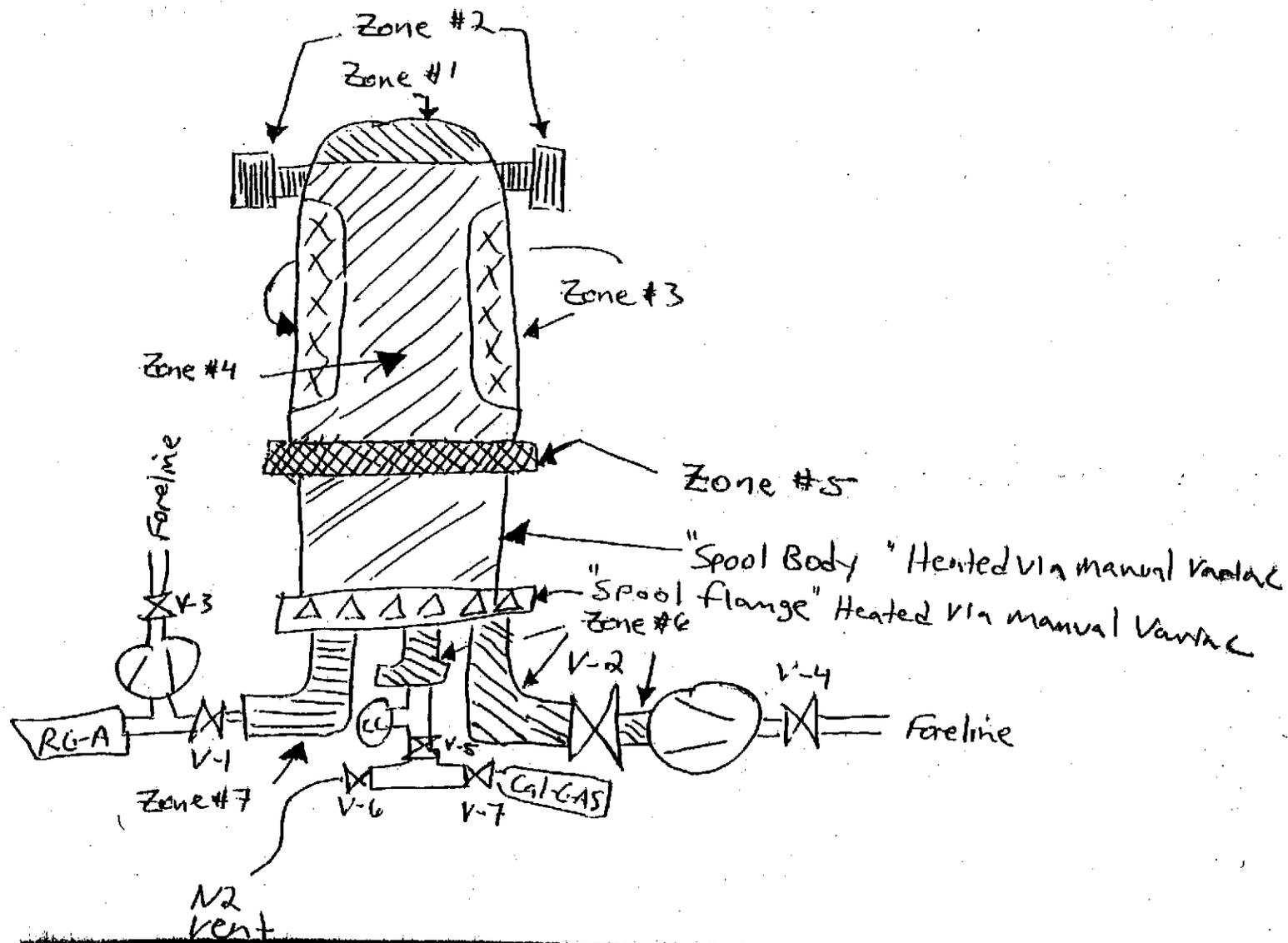
## Summary of LHO Vacuum Bake Oven A RGA Data Generation

The individual parts which comprise a "load" are cleaned as per-LIGO-E960022 or as allowed by waiver(s) and loaded into the bake oven. The oven is then pumped down through the main pump "arm" (through V-2, RGA arm is valved off at this point). A heating profile is programmed and baking of the system begins. A typical "heating profile" consists of ramping up to material type soak temperature, soaking for approximately 48 hours, ramping down to approximately 70C, soaking and then ramping down to near room temperature. While soaking at 70C, an RGA background scan is taken. V-1 is then opened and V-2 closed. Enough time is allowed for the system to come into pressure equilibrium and then an elevated load temperature RGA scan is taken. V-1 is then closed and V-2 opened. Following this elevated temperature scan, the load is ramped down to near room temperature and the baking portion of the process is complete. Throughout the baking, temperature data is taken to verify the actual temperatures in the various "heat zones" of the bake oven system.

Once at near room temperature, another RGA background (V-1 closed) scan is taken. Next, V-1 and the cal-gas are opened and V-2 closed. After a 30 minute pressure equilibration time, a "calibration" scan is taken. The calculated pressure of Argon (constituent of the "mixed" calibration gas) is determined using the leak rate of Argon and the pump speed of the RGA arm port as seen by the oven chamber and compared (ratio) to the maximum amp value measured for Argon in the calibration scan. This "torr/amp" ratio becomes the Calibration Factor for the given load, converting measured current to pressure.

Finally, the cal-gas is valved out and enough time is allotted to allow all traces of it to be pumped away. A "post-bake" scan is then taken. Approval of the post-bake scan is a collective "pass/fail" determination made by either Dennis Coyne (CalTech) or Stan Whitcomb (CalTech). The data collected during the "elevated temperature scan" is entered into a spreadsheet which then calculates what the outgassing rates of AMUs 41, 43, 53, 55 and 57 ought to be at room temperature. These calculations are used to determine the room temperature outgassing rates when the signals are below the RGA's sensitivity (noise floor).

Refer to the LHO Vacuum Bake Oven A logbook for the actual ordered events of the load # of interest.



# **LHO VACUUM BAKE OVEN A: CONTENTS LOAD #60**

## **PSL REFERENCE CAVITY ASSEMBLY**

**REFERENCE CAVITY CHAMBER SERIAL NUMBER D980716 (2ea)**

**REFERENCE CAVITY SUPPORT PLATES SERIAL NUMBER D980350-1-D  
(3ea)**

**REFERENCE CAVITY SUPPORT PLATES SERIAL NUMBER D980350-2-D  
(3ea)**

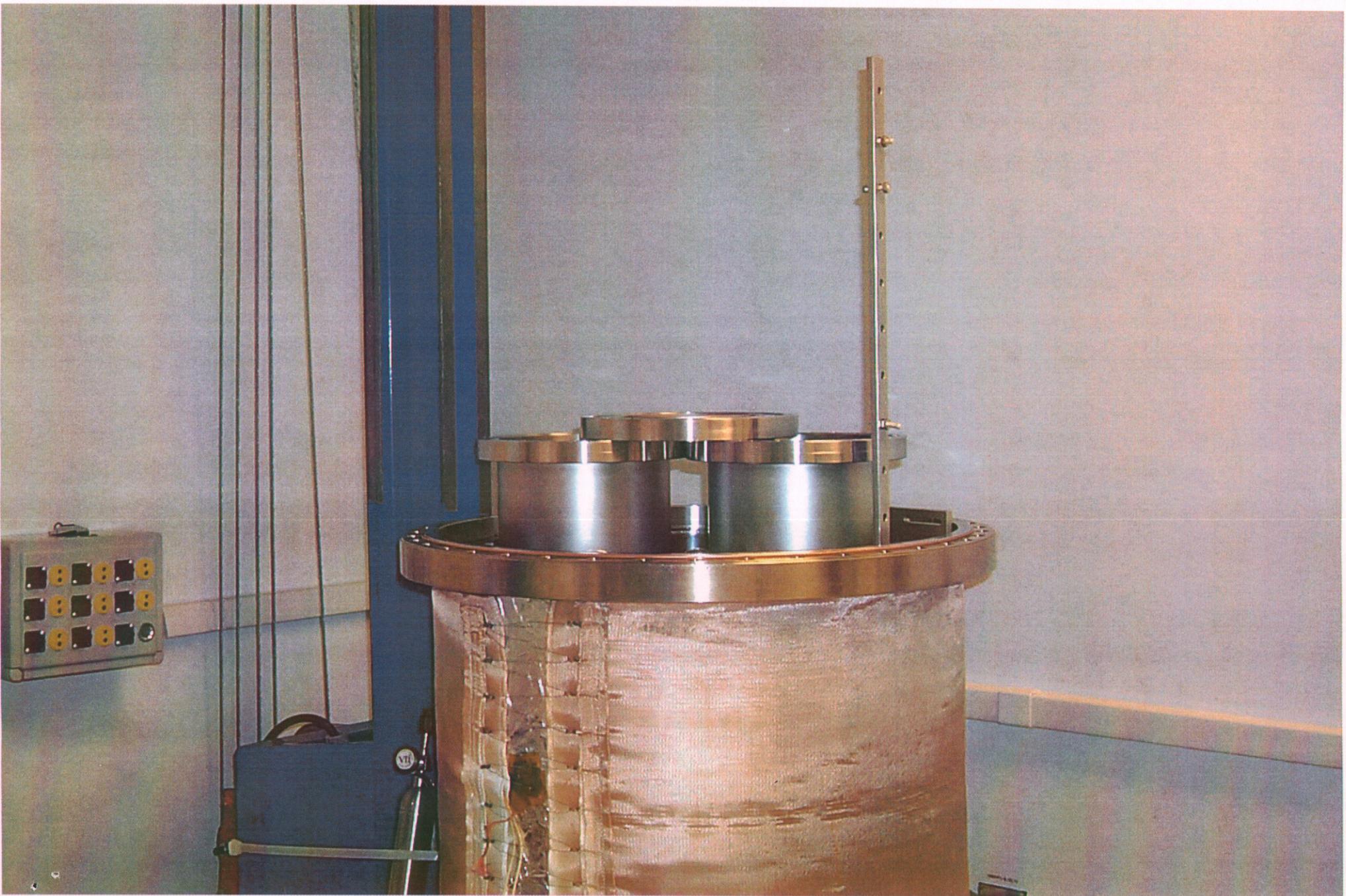
**REFERENCE CAVITY SUPPORT PLATES SERIAL NUMBER D980350-3-D  
(3ea)**

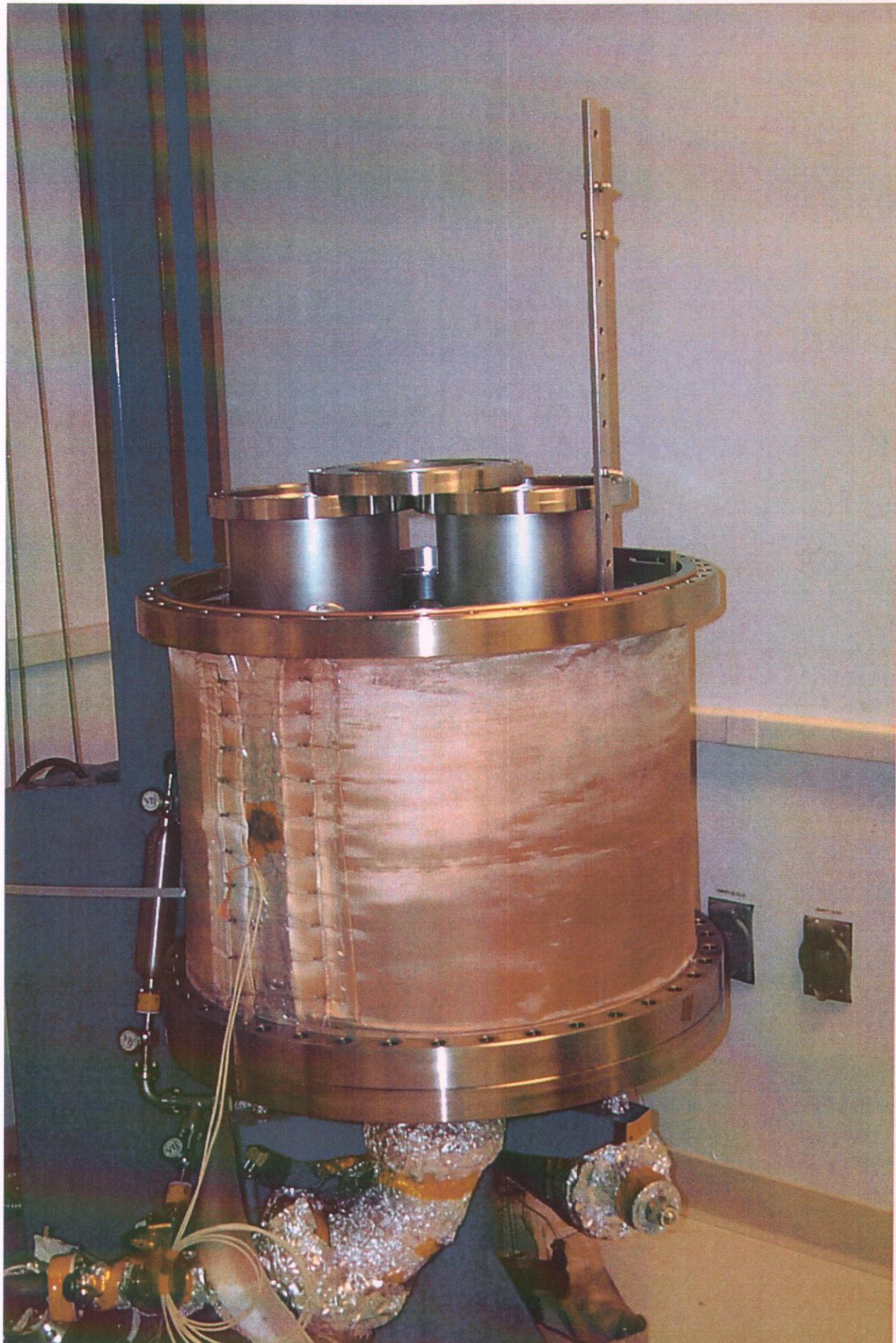
**REFERENCE CAVITY AR COATED VIEWPORT SERIAL NUMBER ZV-800  
(6ea)**

**REFERENCE CAVITY POSTS S.S. S/N N/A (8ea)**

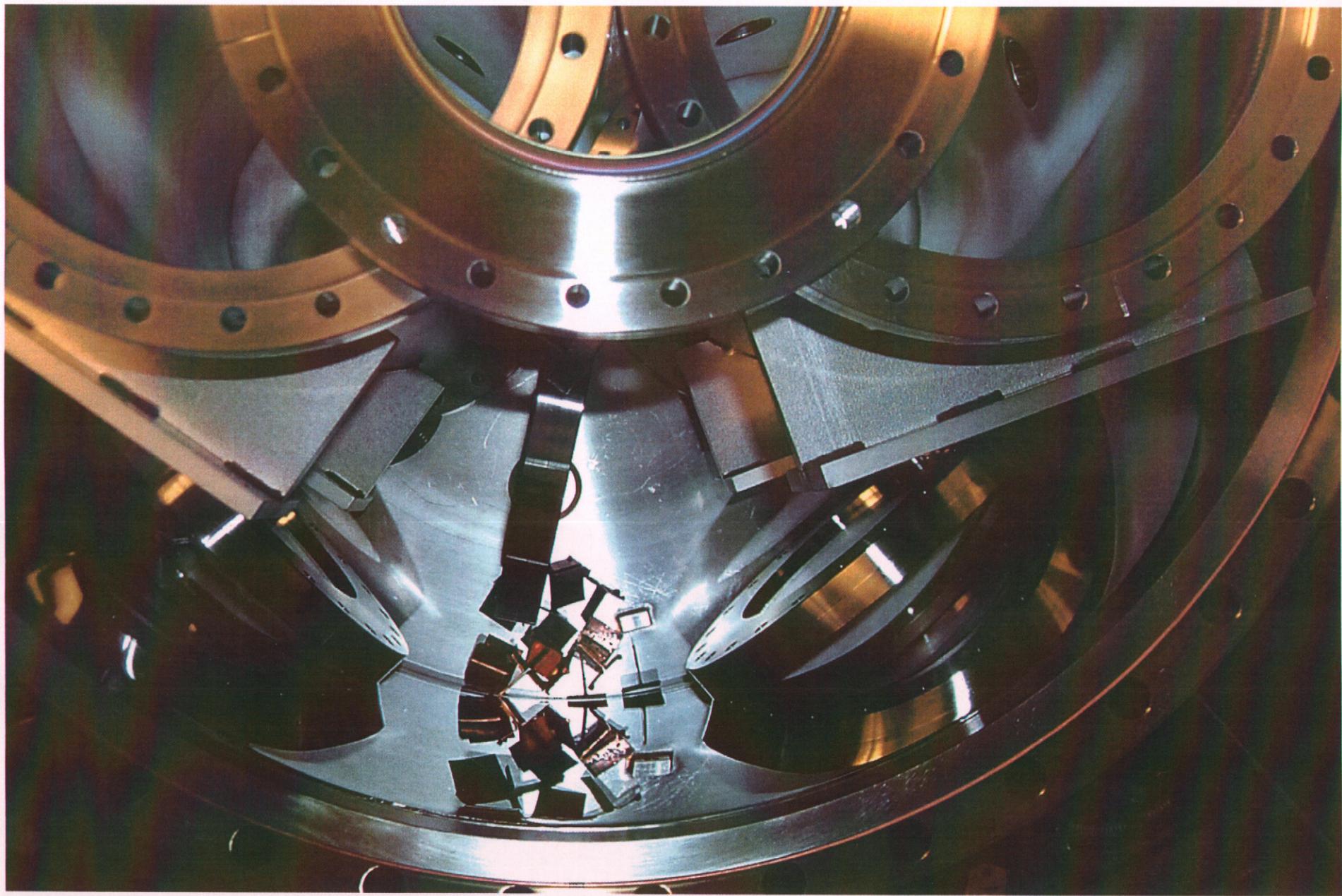
**S.S. CHANNEL DAMPERS S/N N/A (6ea)**

**CU DAMPERS S/N N/A (14ea)**

















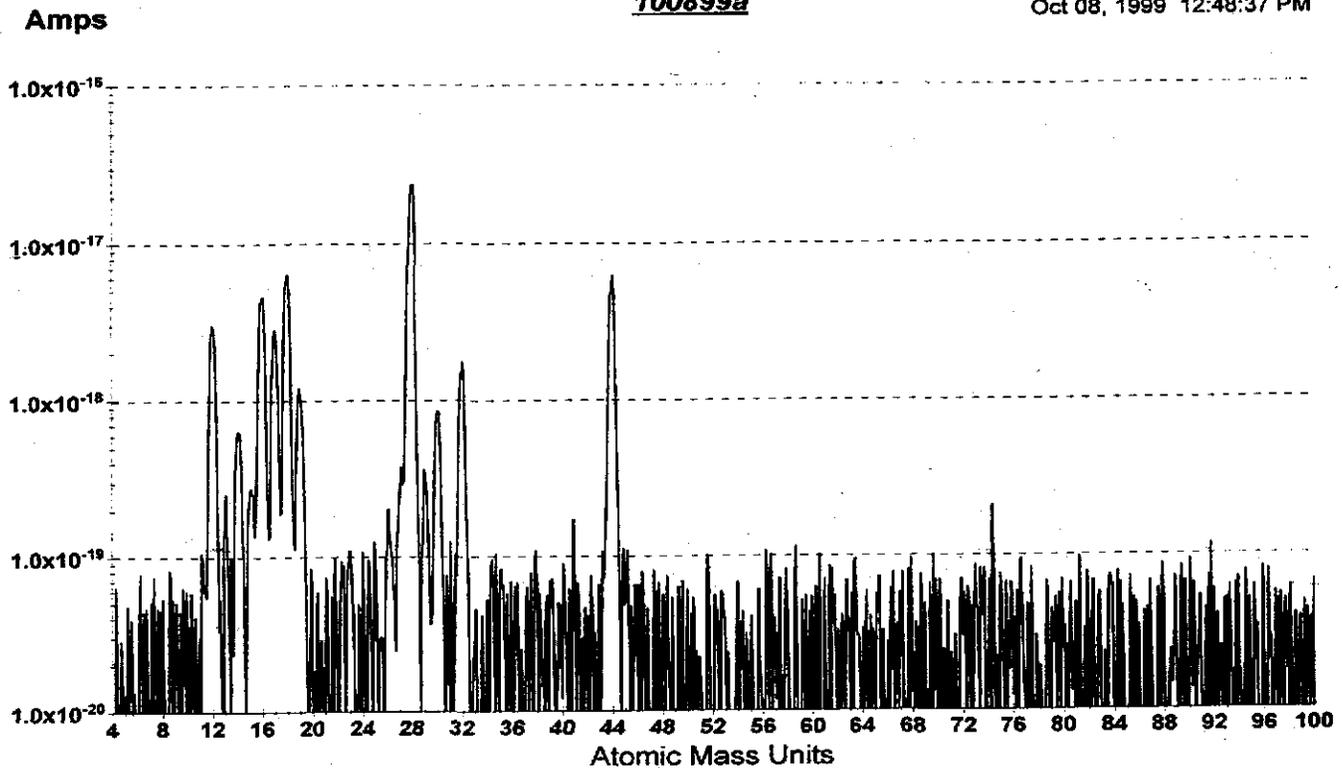


# LHO VACUUM BAKE OVEN A LOAD #60 ELEVATED TEMPERATURE BACKGROUND SCAN

V-1 Closed

100899a

Oct 08, 1999 12:48:37 PM



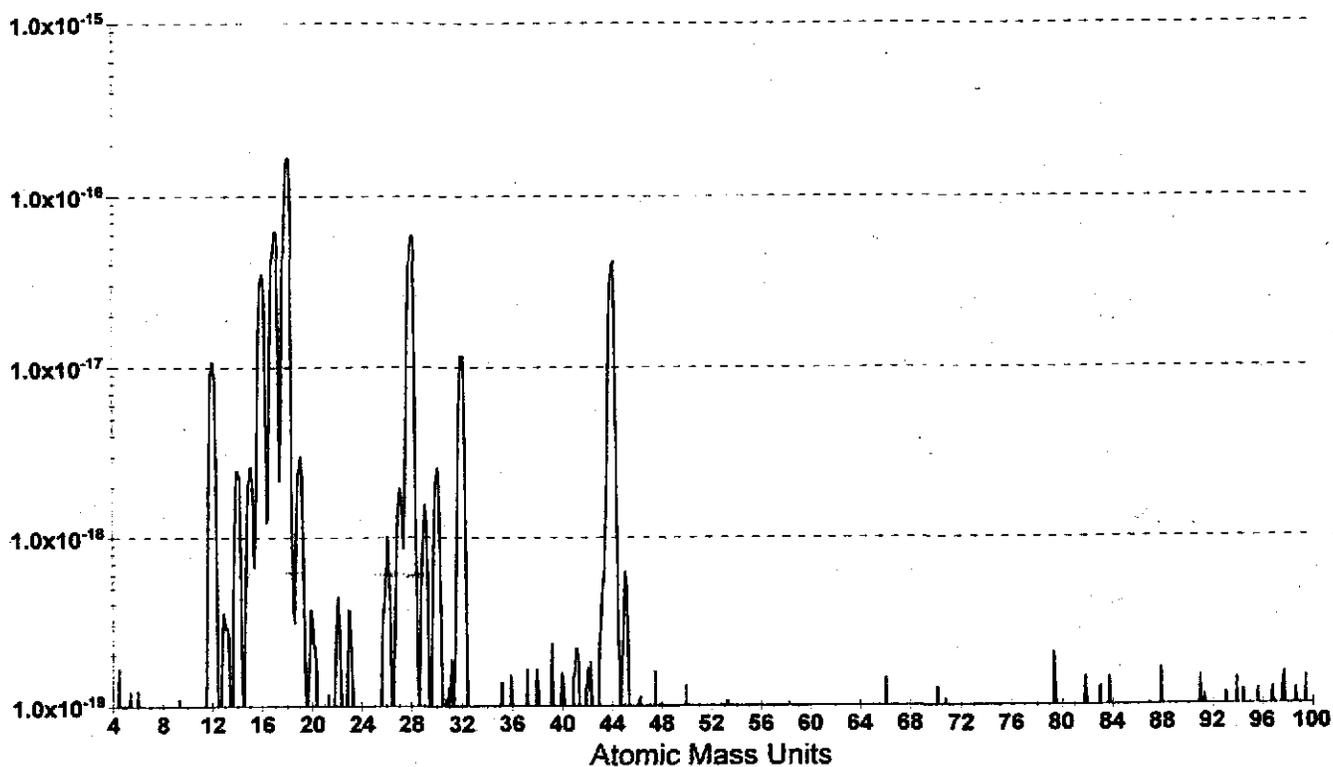
# LHO VACUUM BAKE OVEN A LOAD #60 ELEVATED TEMPERATURE SCAN

V-1 Open, Cal-Gas and V-2 Closed, 80°C

Amps

100899b

Oct 08, 1999 01:36:25 PM



## LHO Bake Oven A Load # 60

1<sup>st</sup> Order Desorption Outgassing Rate Estimates using  $Q_{low} = SP_{low} = SP_{high} [e^{-(E_s/kT_{high})}] / [e^{-(E_s/kT_{low})}]$

Number of units in bake load	Pump Speed (L/sec)	AMU	RGA background current (amps)	RGA current (amps) @ High Temp	Calibration Factor CF (torr/amps)	High Temp (K)	Low Temp (K)	Es/k	Extrapolated outgassing rate (torr*L/sec) @ T <sub>low</sub>
1	5	41	1.74E-19	2.16E-19	3.00E+07	not in equilibrium	2.96E+02	13000	#VALUE!
1	5	43	3.97E-19	2.78E-18	3.00E+07	not in equilibrium	2.96E+02	8000	#VALUE!
1	5	53	below noise	below noise	3.00E+07	not in equilibrium	2.96E+02	13000	#VALUE!
1	5	55	below noise	9.97E-20	3.00E+07	not in equilibrium	2.96E+02	15000	#VALUE!
1	5	57	below noise	9.74E-20	3.00E+07	not in equilibrium	2.96E+02	15000	#VALUE!

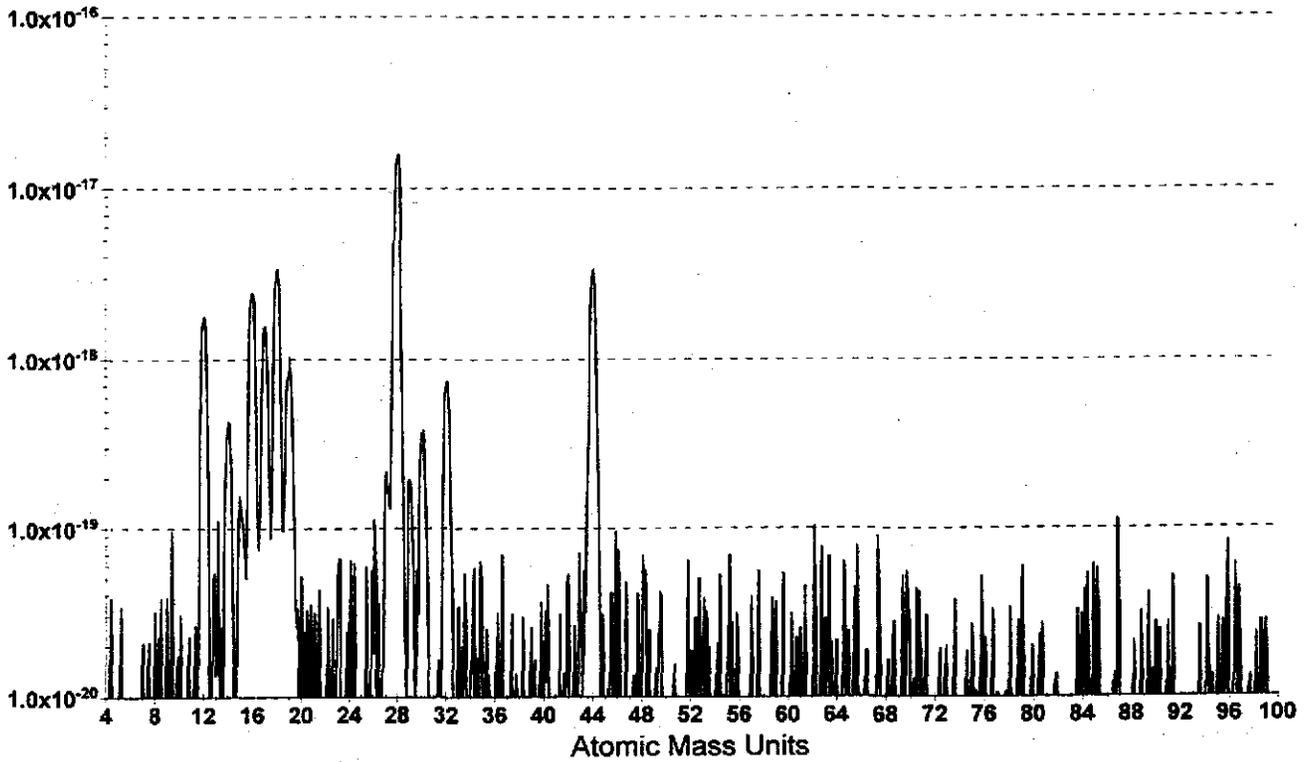
# LHO Vacuum Bake Oven A Load #60 RGA Background

V-1 closed, room temperature

Amps

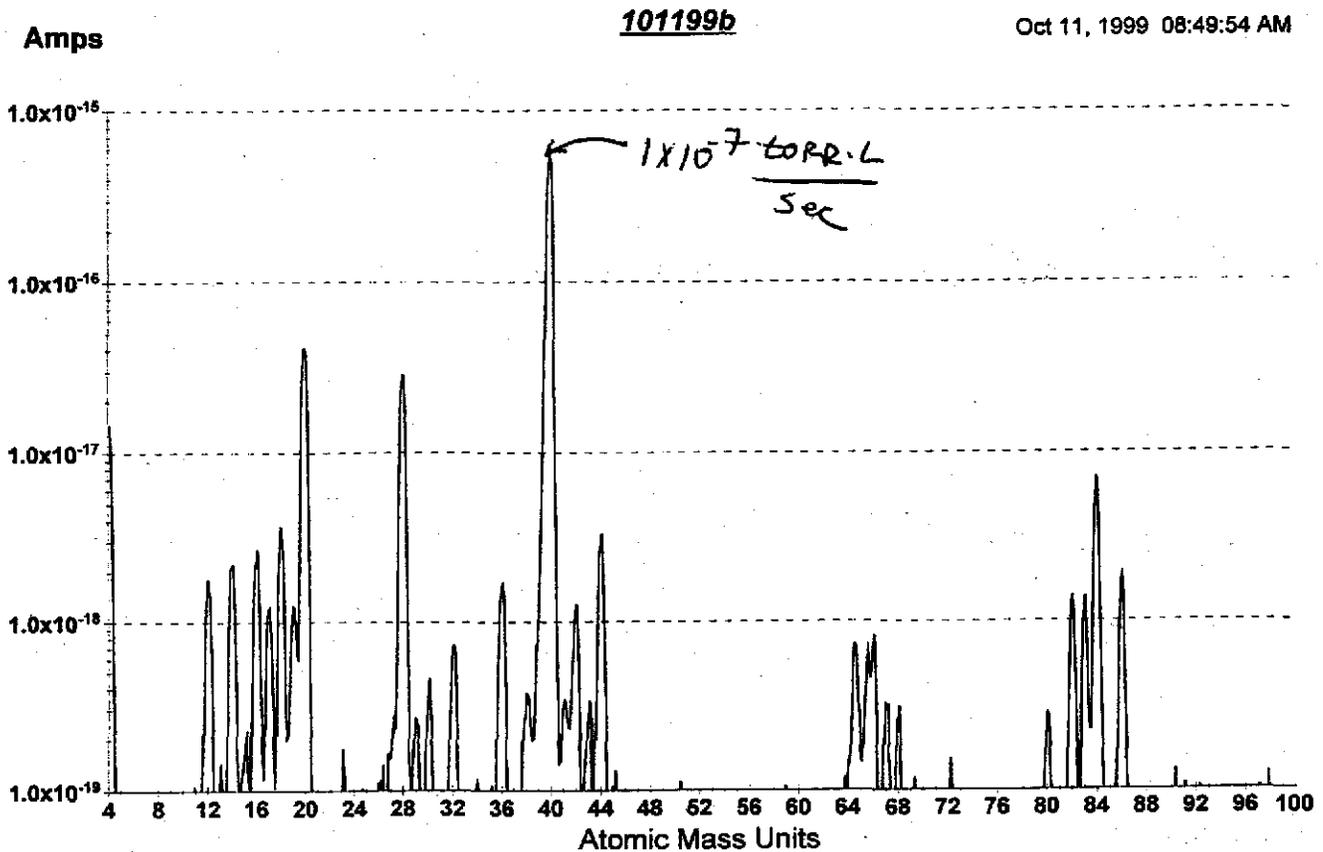
101199a

Oct 11, 1999 07:59:54 AM



# LHO Vacuum Bake Oven A Load #60 Calibration

V-1 and cal-gas open V-2 closed in pressure equilibrium at room temperature



CF defined as  $P_{(40)\text{calc}} / I_{(40)\text{meas}}$

$$P_{(40)\text{calc}} = (\text{leak rate}) / (\text{pump speed}) = (1.1 \text{e-}7 \text{ torr} \cdot \text{L} / \text{sec})(0.86) / (5 \text{ L} / \text{sec}) = 1.8 \text{e-}8 \text{ torr}$$

$$I_{(40)\text{meas}} = 5.3 \text{E-}16 \text{ amps} \quad (\text{taken from } 10119\text{b.asc})$$

$$\text{CF} = (1.8 \text{E-}8 \text{ torr}) / (5.3 \text{E-}16 \text{ amps}) = 3 \text{E}7 \text{ torr/amps}$$

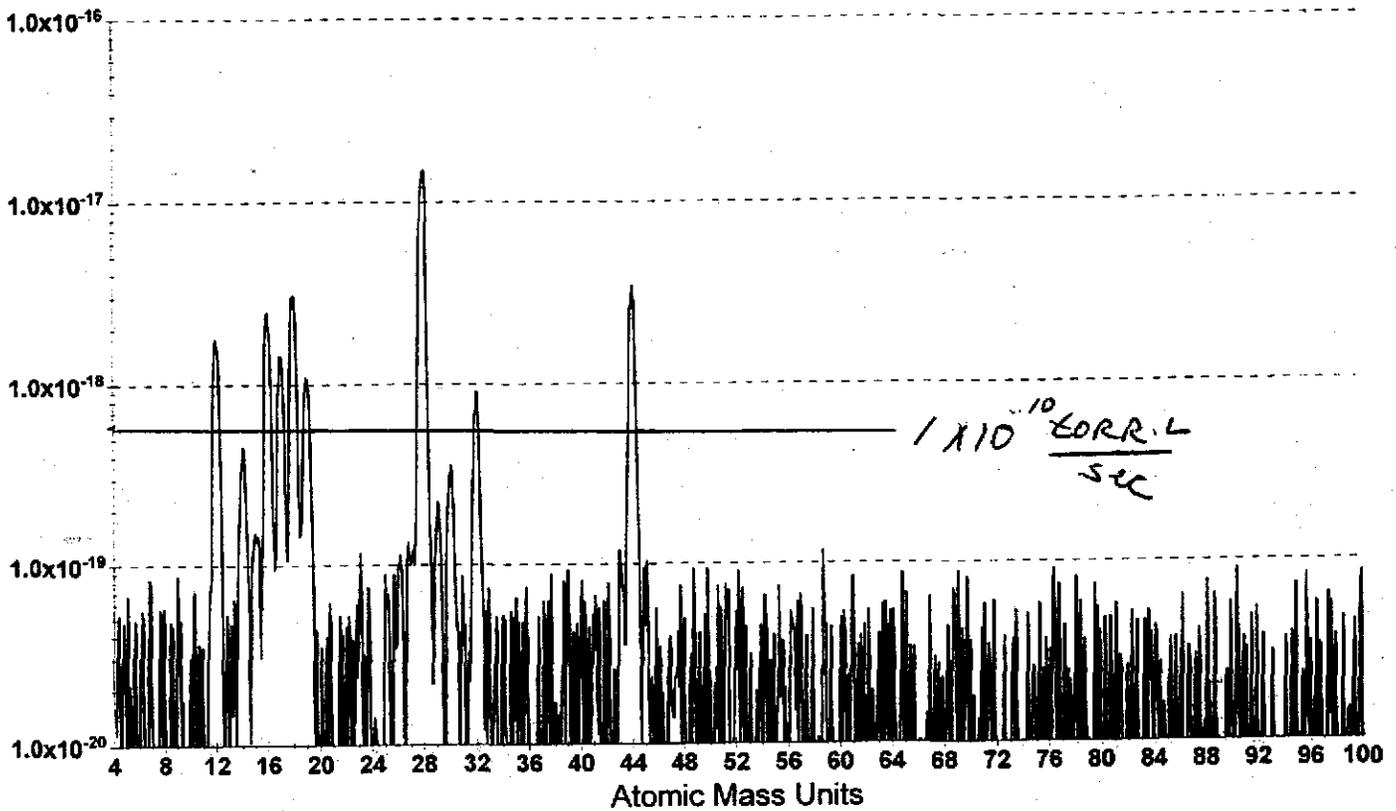
# LHO Vacuum Bake Oven A Load #60 Post-Bake Scan Room Temp.

V-1 open, Cal-Gas and V-2 Closed

101199c

Oct 11, 1999 09:54:27 AM

Amps



# LIGO PROCESS TRAVELER

*Original*  
*LHO/Cook*

DCC Number: E990358-00-X

Date Prepared: 9-28-99

Originator	Cognizant Engineer	Ext./Phone#	Account Number
J. Romie	Janeen Romie	#8445	5F518=LIGO.5F500 2.8, NSFLIGO.5F5000

Item	Dwg/Part Number	Rev	Part Description	Serial Number	Qty
1	D990484	02	<b>ALUMINUM PARTS</b> Rail, Little Beam Dumps	031 through 051	20

Used In (next higher assembly): Little Beam Dumps, D990490.

Vendor Name	PO/Contract Number
Spacecraft Specialist, Inc., Orange, CA	PO 1003714

**Data Package, Receiving/Inspection Remarks:**

Inspection Required Y/N	Visual Damage Y/N	Comments	Name/Initials	Date Comp.
Y	Y		J. Romie/JHR	9-99

**Process Flow:**

#	Operation	Start Date	Work Area	Instructions	Name/Initials	Date Comp.
1	Clean & Vacuum Bake per LIGO Vacuum Prep. Form		CIT	per E960022 for metal parts	Y. Kommemi S.E. J.C	10/1/99
2	Control Point		NA	Review/approve RGA scan # <i>354</i> <i>#65 SCAN 117990.2CA</i> <i>SEJ/11/10/99</i>	D. Coyne JC	10/5
3	Wrap & Tag vacuum clean parts per E960022-A		CIT	Wrap (UHV foil) and bag (CP Stat or equiv.) per E960022. Rails: 10 to LHO, 10 to LLO	Y. Kommemi Y.K.	10/5/99
4	Copy and File Traveler		N/A	Make 2 copies of the traveler File one copy with the DCC. Original goes with shipment to LHO, Attn: D. Cook. Send one copy with shipment to LLO, Attn: J. Kern.	Y. Kommemi Y.K.	10/5/99

*N.B.: A copy of this traveler must be submitted to the DCC each time the original is shipped with the associated part(s) and when the traveler has been completed.*

# LIGO PROCESS TRAVELER

DCC Number: E990358-00-X

#	Operation	Start Date	Work Area	Instructions	Name/Initials	Date Comp.
5	Pack and Ship		CIT	Pack parts as appropriate to prevent contamination and damage in shipment. Ship to LHO, Attn: Doug Cook, to be used in IO assembly. <u>Note: Ship original traveler with these parts.</u> Ship to LLO, Attn: Jonathan Kern, to be used in IO assembly. <u>NOTE: Ship copy of traveler with these parts.</u>	Y. Kommemi  Y.K.	10/15/99

END: Go to Traveler associated with next higher assembly processing

**Special Instructions (Handling/Packaging Constraints, Remarks, etc.) or Notes:**

RE MACHINED COMPONENTS. AND REBAKED @ LHO DCook

INSTRUMENT

1.2E-07 DISP SPEC

A

SCAN SPEC

A

10/ 5/99 9:10

VSA # 357

CHANNEL	MASS	DWELL	HI LIMIT	LO LIMIT	CALIBRATE	PRESSURE
1	40.	4.0 SEC	1.0E+00	1.0E-15	1.0E+00	4.009E-11
2	44.	4.0 SEC	1.0E+00	1.0E-15	1.0E+00	6.050E-10
3	20.	4.0 SEC	1.0E+00	1.0E-15	1.0E+00	1.463E-09
4	18.	4.0 SEC	1.0E+00	1.0E-15	1.0E+00	4.884E-09
5	12.	4.0 SEC	1.0E+00	1.0E-15	1.0E+00	1.645E-10
6	2.	4.0 SEC	1.0E+00	1.0E-15	1.0E+00	1.583E-00
7	64.	4.0 SEC	1.0E+00	1.0E-15	1.0E+00	1.931E-10
8	41.	4.0 SEC	1.0E+00	1.0E-15	1.0E+00	1.223E-10
9	43.	4.0 SEC	1.0E+00	1.0E-15	1.0E+00	9.633E-11
10	53.	4.0 SEC	1.0E+00	1.0E-15	1.0E+00	3.749E-11
11	55.	4.0 SEC	1.0E+00	1.0E-15	1.0E+00	5.467E-11
12	57.	4.0 SEC	1.0E+00	1.0E-15	1.0E+00	5.311E-11

$$\frac{\Sigma = 3.63E-10}{30}$$

$$= \frac{1.21E-11}{20}$$

$$6.05E-13 \times 40$$

$$\left. \begin{matrix} 2.42E-11 \text{ Rel} \\ \text{Unit} \end{matrix} \right\}$$

CHANNEL	12.	TAB HI	1.0E+00	ELEC CHR	9.960E-04	FIL RES	0.71
TAB MASS	57.	TAB LO	1.0E-15	EL ENERGY	-70.0	FIL VOLTS	2.2
TAB DWELL	4.0	TAB CALIB	1.0E+00	FOCUS	-20.0	FIL CHR	3.1
NO. SCANS	-1.	AUTO ZERO	ON	ELEC MULT	ON	FIL	ON

TOT PRES

1.2E-07 DISP SPEC

A

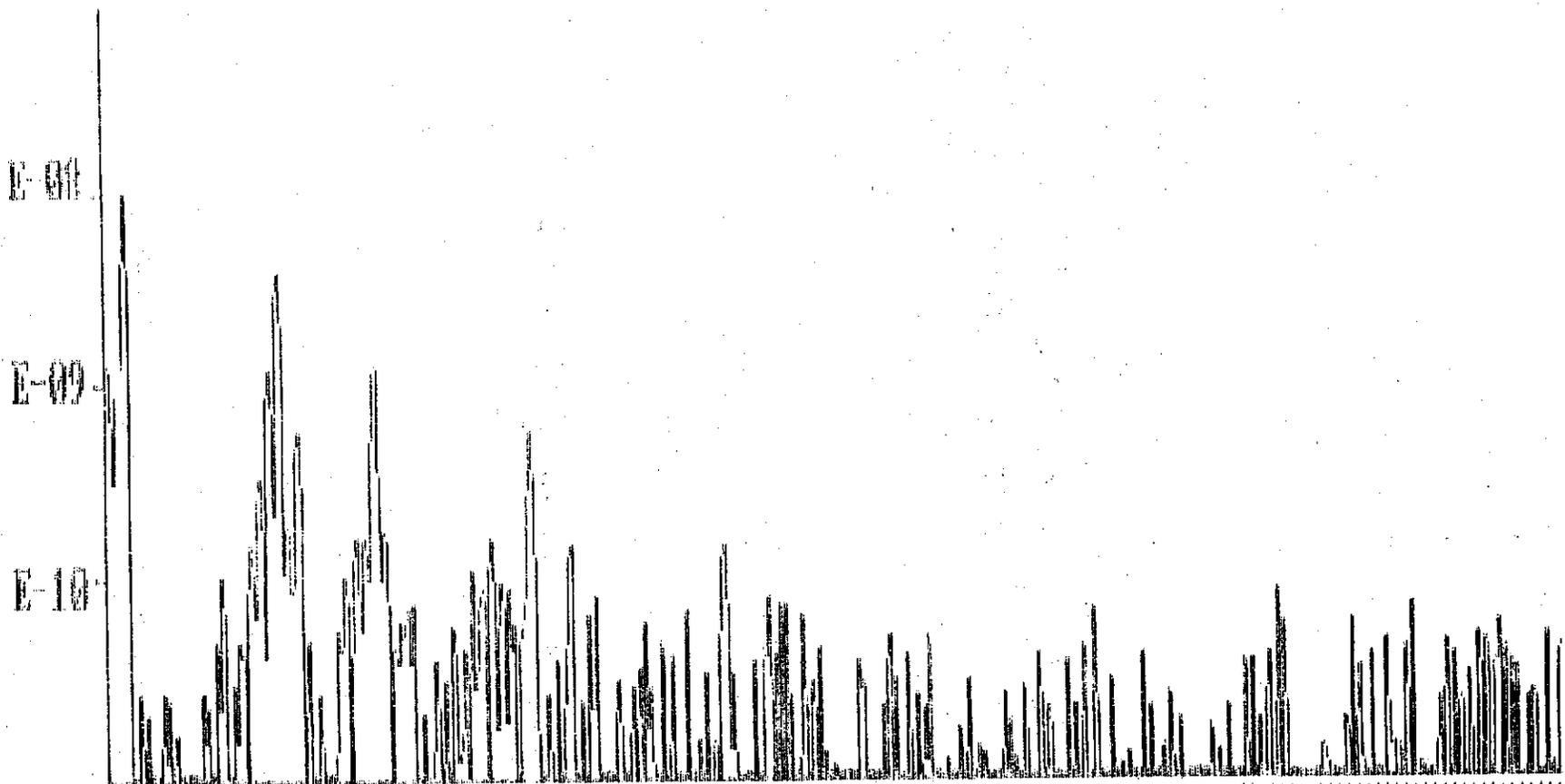
SCAN SPEC

A

10/ 5/99 8:52

1.0E-07

VCA #354



10

20

30

40

50

60

70

80

90

100

110

120

130

140

150

LO MASS

1. DWELL

2.0 SEC

ELEC CUR

9.986E-04

FIL RES

0.70

HI MASS

150. SCALE

4 DEC LOG

EL ENERGY

-70.0

FIL VOLTS

2.2

SAMP/AMU

4.

FOCUS

-20.0

FIL CUR

3.1

NO. SCANS

-1. AUTO ZERO

ON

ON

ON

FIL

ON

TOT PRES

1.4E-07 DISP SPEC

A

SCAN SPEC

A

10/5/99 8:56

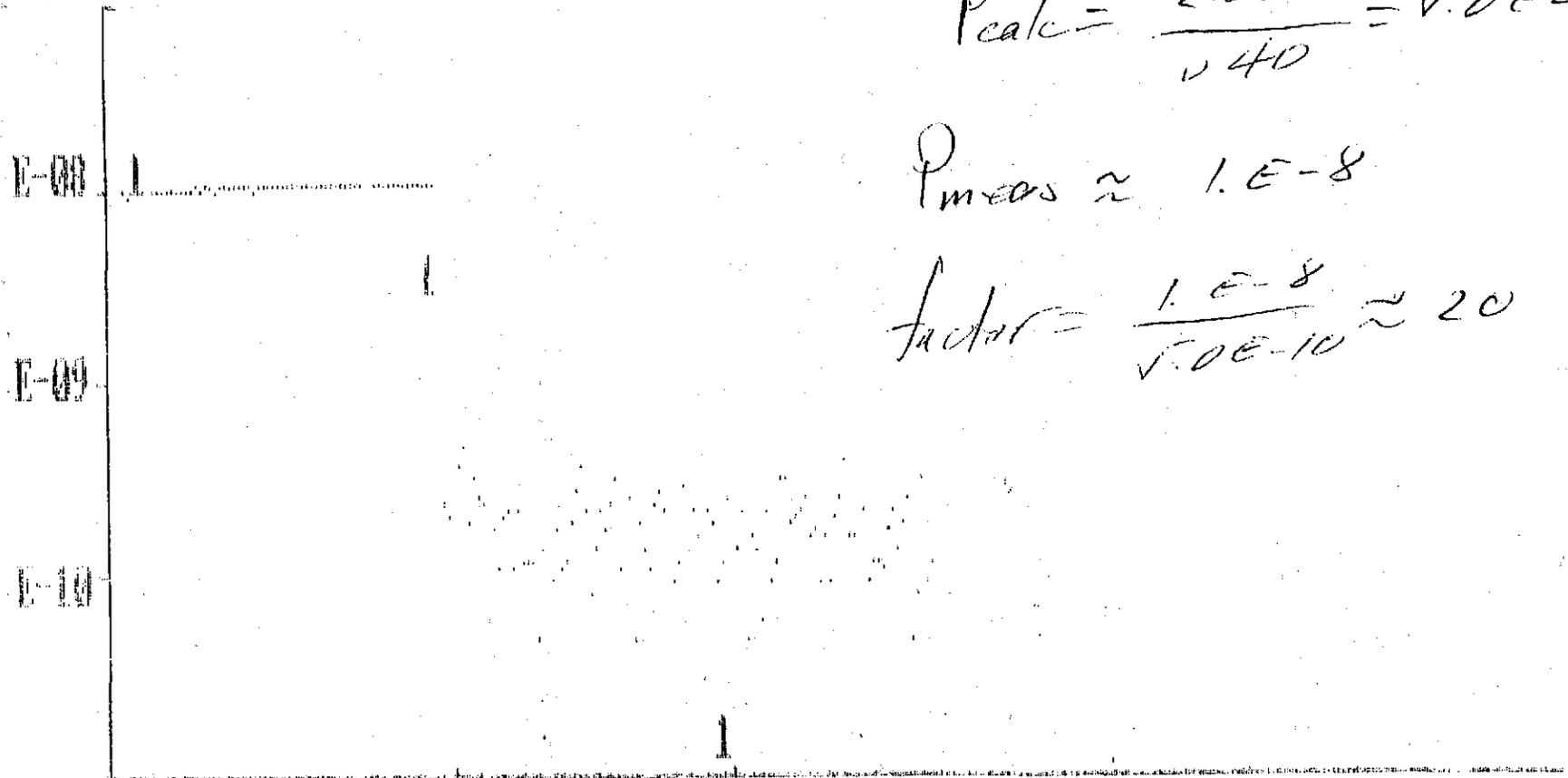
MINI. 0E-07

'USA' #354

$$Peak = \frac{2.0E-8}{\sqrt{40}} = 5.0E-10$$

$$P_{meas} \approx 1.E-8$$

$$factor = \frac{1.E-8}{5.0E-10} \approx 20$$



0.0	100.0	200.0	300.0	400.0	500.0
CHANNEL	1. FREQUENCY	2.260E+06	CAL MASS1	1. CAL MASS2	200.
TAB MASS	0. REF TIME	6.642	LO RES	4090. HI RES	2000.
TAB DWELL	120 NSEC	EMISSION	1.0E-03	LO POS	0.50
TOT. SENS	20.0	AMP CAL	7.0E+03	LO SENS	6.00
				HI SENS	8.00

LIGO VACUUM BAKE OVEN PROCEDURE AND CHECK LIST

Oven: A B C D VSA Load # 354 Date: 10, 1, 99

Load Contents: E990356, 358 (JMR) (24) stands LBD

Cap Torqued: \_\_\_\_\_ ft/lbs \_\_\_\_\_ ft/lbs (20) rails LBD \_\_\_\_\_ ft/lbs \_\_\_\_\_ ft/lbs

Metal vlv Open: Y N Vent vlv Closed: Y N TP on \_\_\_\_\_:\_\_\_\_\_ ; \_\_\_\_\_/\_\_\_\_\_  
 TP on \_\_\_\_\_:\_\_\_\_\_ ; \_\_\_\_\_/\_\_\_\_\_  
 TP on \_\_\_\_\_:\_\_\_\_\_ ; \_\_\_\_\_/\_\_\_\_\_  
 TP on \_\_\_\_\_:\_\_\_\_\_ ; \_\_\_\_\_/\_\_\_\_\_

Pressure: \_\_\_\_\_ Torr Date & Time: \_\_\_\_\_:\_\_\_\_\_

Pressure: \_\_\_\_\_ Torr Date & Time: \_\_\_\_\_:\_\_\_\_\_

NOTE: Do not turn heat on when pressure is above 5E-5 Torr.

(AUTO)/MANUAL; Heat on: \_\_\_\_\_:\_\_\_\_\_ ; \_\_\_\_\_/\_\_\_\_\_

RampTime: Oven: 3 Hrs, Pumpline: 3 Hrs

SoakTime: Oven: 48 Hrs, Pumpline: 48 Hrs

BAKE TEMPERATURE ('C');

Oven: 120 PumpLine: 200 TurboPump Heat On: Y N

TEMPERATURE: ('C');

	P-Line	End	Body	Cap	Date & Time	P(Torr)
1	_____					
2	_____					

TP Heat Off: Y N Temp Cont. sw Off: Y N Reset PROG off: Y N

DEGAS;

Fil On? Y N W/Dycor# \_\_\_\_\_ Date: \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_ Time On: \_\_\_\_\_:\_\_\_\_\_ Time Off: \_\_\_\_\_:\_\_\_\_\_  
 Date: \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_ Time On: \_\_\_\_\_:\_\_\_\_\_ Time Off: \_\_\_\_\_:\_\_\_\_\_  
 Date: \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_ Time On: \_\_\_\_\_:\_\_\_\_\_ Time Off: \_\_\_\_\_:\_\_\_\_\_  
 Date: \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_ Time On: \_\_\_\_\_:\_\_\_\_\_ Time Off: \_\_\_\_\_:\_\_\_\_\_

PURGE; N2 AIR

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

# LIGO PROCESS TRAVELER

DCC Number: **E990356-00-X**

Date Prepared: **9-27-99**

*original*  
*LHO/cook*

Originator

Cognizant Engineer

Ext./Phone#

Account Number

J. Romie	Janeen Romie	#8445	5F518=LIGO.5F500 2.8, NSFLIGO.5F5000
----------	--------------	-------	---

Item	Dwg/Part Number	Rev	Part Description	Serial Number	Qty
1	D990485	A	<b>ALUMINUM PARTS</b> Stand, Little Beam Dumps		24

Used In (next higher assembly): Little Beam Dumps, D990490.

Vendor Name

PO/Contract Number

Spacecraft Specialist, Inc., Orange, CA	PO 1003714
---	------------

**Data Package, Receiving/Inspection Remarks:**

Inspection Required Y/N	Visual Damage Y/N	Comments	Name/Initials	Date Comp.
Y	Y		J. Romie/JHR	9-27-99

**Process Flow:**

#	Operation	Start Date	Work Area	Instructions	Name/Initials	Date Comp.
1	Clean & Vacuum Bake per LIGO Vacuum Prep. Form		CIT	per E960022 for metal parts	<del>Y. Kommemi</del> S.E. J.C.	10/1/99
2	Control Point		NA	Review/approve RGA scan # <u>354</u> # <u>65</u> 111799C.RGA <u>11/18/99</u>	D. Coyne JC	10/5
3	Wrap & Tag vacuum clean parts per E960022-A		CIT	Wrap (UHV foil) and bag (CP Stat or equiv.) per E960022. Stands: 12 to LHO, 12 to LLO	Y. Kommemi Y.K.	10/5/99
4	Copy and File Traveler		N/A	Make 2 copies of the traveler File one copy with the DCC. Original goes with shipment to LHO, Attn: D. Cook. Send one copy with shipment to LLO, Attn: J. Kern.	Y. Kommemi Y.K.	10/5/99

*N.B.: A copy of this traveler must be submitted to the DCC each time the original is shipped with the associated part(s) and when the traveler has been completed.*

# LIGO PROCESS TRAVELER

DCC Number: E990356-00-X

#	Operation	Start Date	Work Area	Instructions	Name/Initials	Date Comp.
5	Pack and Ship		CIT	Pack parts as appropriate to prevent contamination and damage in shipment. Ship to LHO, Attn: Doug Cook, to be used in IO assembly. <u>Note: Ship original traveler with these parts.</u> Ship to LLO, Attn: Jonathan Kern, to be used in IO assembly. <u>NOTE: Ship copy of traveler with these parts.</u>	Y. Kommemi <i>Y. K.</i>	<i>10/1/99</i>

END: Go to Traveler associated with next higher assembly processing

**Special Instructions (Handling/Packaging Constraints, Remarks, etc.) or Notes:**

*RE MACHINED COMPONENTS AND RE BAKED @ LHO d Cook*

1.2E-07 DISP SPEC 0 | SCAN SPEC 0 | 10/ 5/99 9:10

VSA #27

CHANNEL	MASS	DMELL	HI LIMIT	LO LIMIT	CALIBRATE	PRESSURE
1	40.	4.0 SEC	1.0E+00	1.0E-15	1.0E+00	4.009E-11
2	44.	4.0 SEC	1.0E+00	1.0E-15	1.0E+00	6.050E-10
3	20.	4.0 SEC	1.0E+00	1.0E-15	1.0E+00	1.463E-09
4	10.	4.0 SEC	1.0E+00	1.0E-15	1.0E+00	4.884E-09
5	12.	4.0 SEC	1.0E+00	1.0E-15	1.0E+00	1.645E-10
6	2.	4.0 SEC	1.0E+00	1.0E-15	1.0E+00	1.583E-00
7	64.	4.0 SEC	1.0E+00	1.0E-15	1.0E+00	1.931E-10
8	41.	4.0 SEC	1.0E+00	1.0E-15	1.0E+00	1.223E-10
9	43.	4.0 SEC	1.0E+00	1.0E-15	1.0E+00	9.633E-11
10	53.	4.0 SEC	1.0E+00	1.0E-15	1.0E+00	3.749E-11
11	55.	4.0 SEC	1.0E+00	1.0E-15	1.0E+00	5.467E-11
12	57.	4.0 SEC	1.0E+00	1.0E-15	1.0E+00	5.311E-11

$$\frac{\sum = 3.63E-10}{30}$$

$$= 1.21E-11$$

$$\frac{\quad}{20}$$

$$6.05E-13 \times 40$$

$$\left. \begin{matrix} 2.42E-11 \\ \text{rel} \\ \text{unit} \end{matrix} \right\}$$

CHANNEL	12.	TAB HI	1.0E+00	ELEC CUR	9.960E-04	FIL RES	0.71
TAB MASS	57.	TAB LO	1.0E-15	EL. ENERGY	-70.0	FIL VOLTS	2.2
TAB DMELL	4.0	SEC TAB CALIB	1.0E+00	FOCUS	-20.0	FIL CUR	3.1
NO. SCANS	-1.	AUTO ZERO	ON	ELEC MULT	ON	FIL	ON

TOT PRES

1.2E-07

DISP SPEC

0

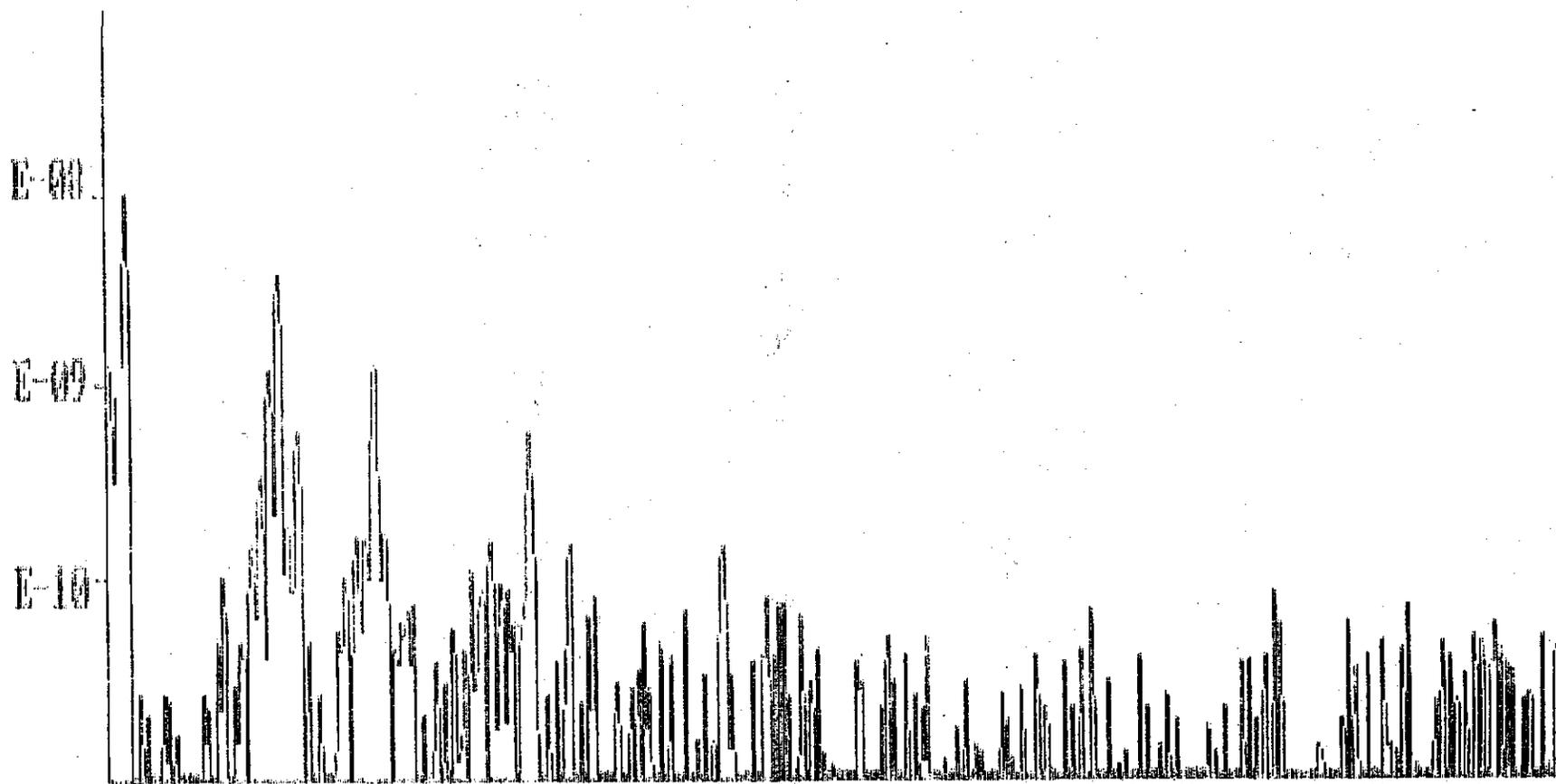
SCAN SPEC

0

10/ 5/99 8:52

1.0E-07

'VCA' # 354



LO MASS  
 HI MASS  
 SAMP/AMU  
 NO. SCANS

1. DWELL  
 150. SCALE  
 4.  
 -1. AUTO ZERO

2.0 SEC  
 4 DEC LOG  
 ELEC CUR  
 EL ENERGY  
 FOCUS

9.986E-04  
 -70.0  
 -20.0  
 ON

FIL RES  
 FIL VOLTS  
 FIL CUR  
 ON

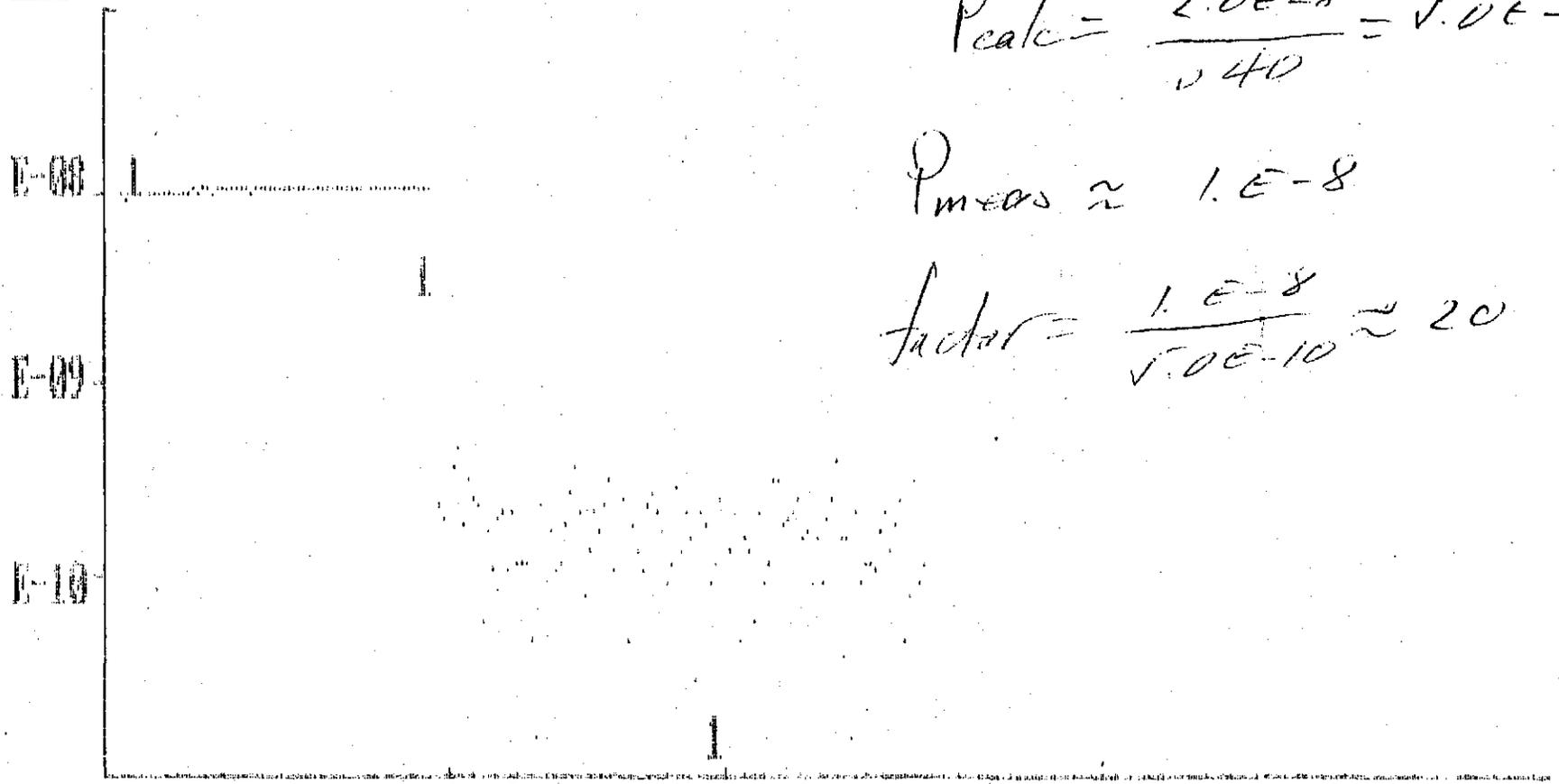
TOT PRES 1.4E-07 DISP SPEC A SCAN SPEC A 10/ 5/99 8:56

MINI. 0E-07 'USA' #3.4

$$P_{calc} = \frac{2.0E-8}{0.40} = 5.0E-10$$

$$P_{meas} \approx 1.E-8$$

$$factor = \frac{1.E-8}{5.0E-10} \approx 20$$



0.0	100.0	200.0	300.0	400.0	500.0
CHANNEL	1.	FREQUENCY	2.260E+06	CAL MASS1	1.
TAB MASS	0.	RF TUNE	6.642	LO RES	4098.
TAB DWELL	120	MSEC EMISSION	1.0E-03	LO POS	0.50
TOT. SENS	20.0	AMP CAL	7.0E+03	LO SENS	6.00
				HI RES	2000.
				HI POS	-3.00
				HI SENS	8.00

LIGO VACUUM BAKE OVEN PROCEDURE AND CHECK LIST

Oven: A B C D VSA Load # 354 Date: 10/1/99

Load Contents: E990356, 358 (JMR) (24) stands CRD

Cap Torqued: \_\_\_\_\_ ft/lbs \_\_\_\_\_ ft/lbs (20) rails ft/lbs \_\_\_\_\_ ft/lbs

Metal vlv Open: Y N Vent vlv Closed: Y N TP on \_\_\_\_\_:\_\_\_\_\_ : \_\_\_\_\_/\_\_\_\_\_  
TP on \_\_\_\_\_:\_\_\_\_\_ : \_\_\_\_\_/\_\_\_\_\_  
TP on \_\_\_\_\_:\_\_\_\_\_ : \_\_\_\_\_/\_\_\_\_\_  
TP on \_\_\_\_\_:\_\_\_\_\_ : \_\_\_\_\_/\_\_\_\_\_

Pressure: \_\_\_\_\_ Torr Date & Time: \_\_\_\_\_:\_\_\_\_\_

Pressure: \_\_\_\_\_ Torr Date & Time: \_\_\_\_\_:\_\_\_\_\_

NOTE: Do not turn heat on when pressure is above 5E-5 Torr.

(AUTO/MANUAL); Heat on: \_\_\_\_\_:\_\_\_\_\_ : \_\_\_\_\_/\_\_\_\_\_

RampTime: Oven: 3 Hrs, Pumpline: 3 Hrs

SoakTime: Oven: 48 Hrs, Pumpline: 48 Hrs

BAKE TEMPERATURE ('C');

Oven: 120 PumpLine: 200 TurboPump Heat On: Y N

TEMPERATURE: ('C');

	P-Line	End	Body	Cap	Date & Time	P(Torr)
1	_____	_____	_____	_____	_____	_____
2	_____	_____	_____	_____	_____	_____

TP Heat Off: Y N Temp Cont. sw Off: Y N Reset PROG off: Y N

DEGAS;

Fil On? Y N W/Dycor# \_\_\_\_\_ Date: \_\_\_/\_\_\_/\_\_\_ Time On: \_\_\_:\_\_\_:\_\_\_ Time Off: \_\_\_:\_\_\_:\_\_\_  
Date: \_\_\_/\_\_\_/\_\_\_ Time On: \_\_\_:\_\_\_:\_\_\_ Time Off: \_\_\_:\_\_\_:\_\_\_  
Date: \_\_\_/\_\_\_/\_\_\_ Time On: \_\_\_:\_\_\_:\_\_\_ Time Off: \_\_\_:\_\_\_:\_\_\_  
Date: \_\_\_/\_\_\_/\_\_\_ Time On: \_\_\_:\_\_\_:\_\_\_ Time Off: \_\_\_:\_\_\_:\_\_\_

PURGE; N2 AIR

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_