AGENDA FOR THE LIGO INTEGRATION MEETING

9 February 1995

Facilities

0900 - 0930

- Ground motion measurements at the sites
- Foundation motions and alignment

Beam Tube

0930 - 1030

- QT Status & Baffle design issues
- Tube motion analysis
- Beam tube scattering measurements & baffle material options
- Synopsis of the Baffle Review Meeting

BREAK

1030 -1045

Vacuum Equipment

1045 - 1115

- Deferral of getter pump procurement for initial interferometer
- Procurement status & update

Detector

1130 - 1245

- Length control modeling

- IFO configuration definition

Lisa Sievers
Mike Gamble
Charts only
no oral presentation
~~Larry Jones~~
Mike Gamble
Rai Weiss
Albert Lazzarini

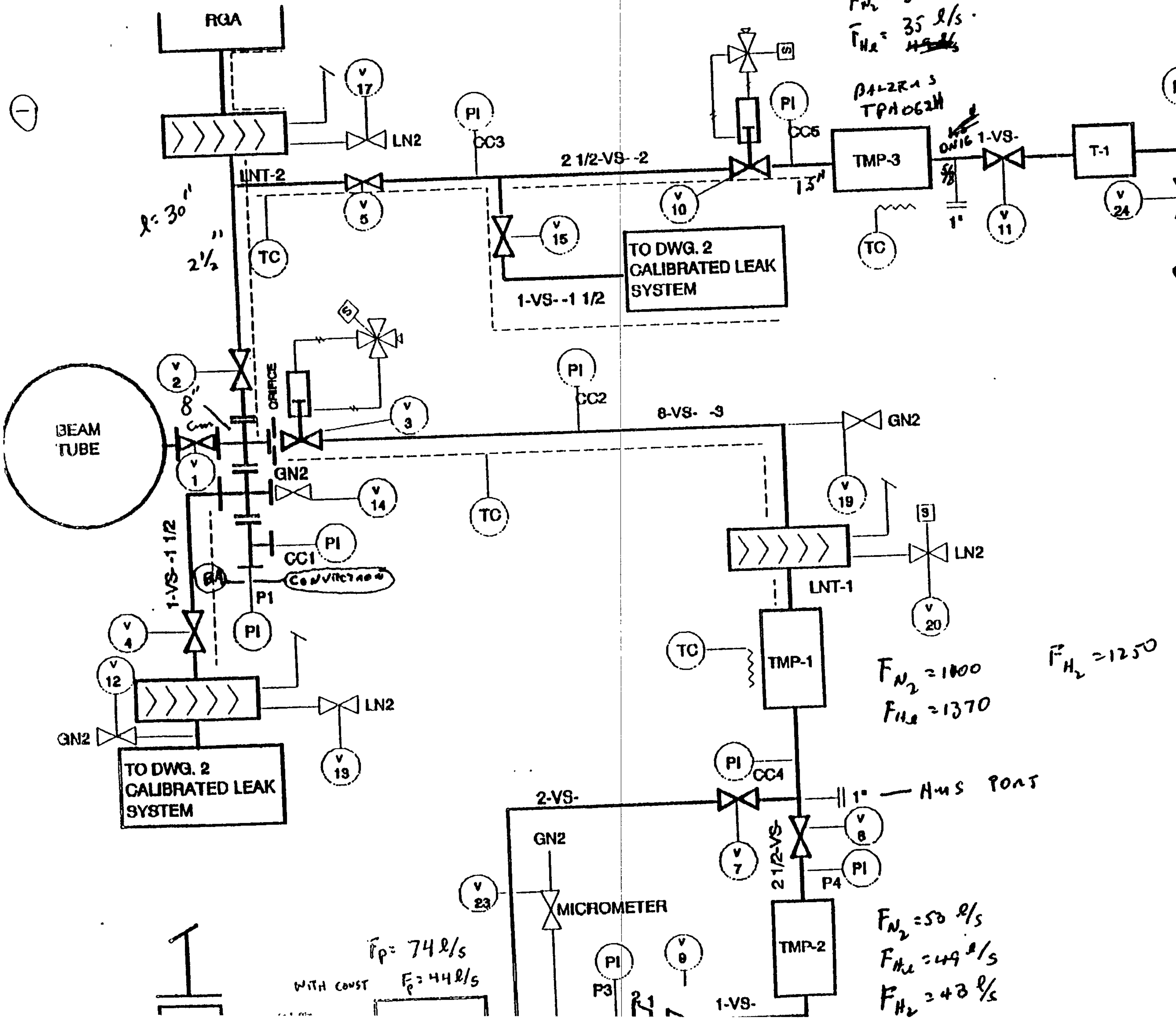
Mike Zucker
John Worden

Lisa Sievers
Jordan Camp
Dave Redding (JPL)
Yaron Hefetz

INTMTG 2/7/95

G950127-00-B

①



F_{N_2} = 30 l/s
F_{H_2} = 34 l/s
F_{He} = 35 l/s

BALZERS TPH062H

ONIG

5/8

13"

1"

l = 30"

2½"

8"

CONVECTRON

1" — HMS PORT

F_{N_2} = 1000
F_{He} = 1370

F_{H_2} = 1250

F_{N_2} = 50 l/s
F_{He} = 49 l/s
F_{H_2} = 43 l/s

F_p = 74 l/s

WITH CONST F_p = 44 l/s

VOLUMES
V1→V3 V4→V2 26.2L
V3→TMP1 32.8L
V2→V6 INCL RGA 3.6L
V5→TMP3 1.6L
V4→V15 10L

6500

He on ~~[illegible]~~ TUBE

4.7 X10^{-10} cc-atm/sec

ALL LEAKS IN CC-ATM/SEC

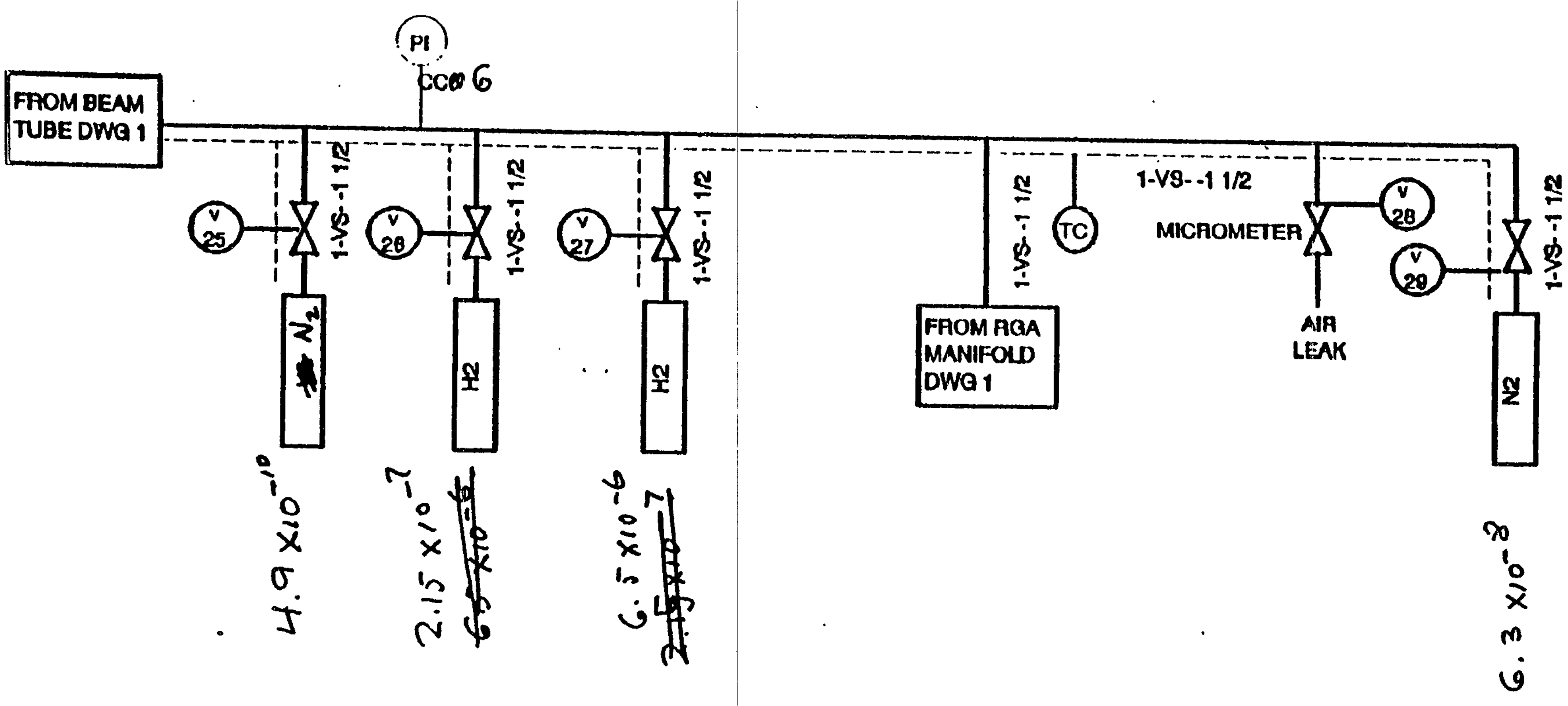
BEAM TUBE AREA

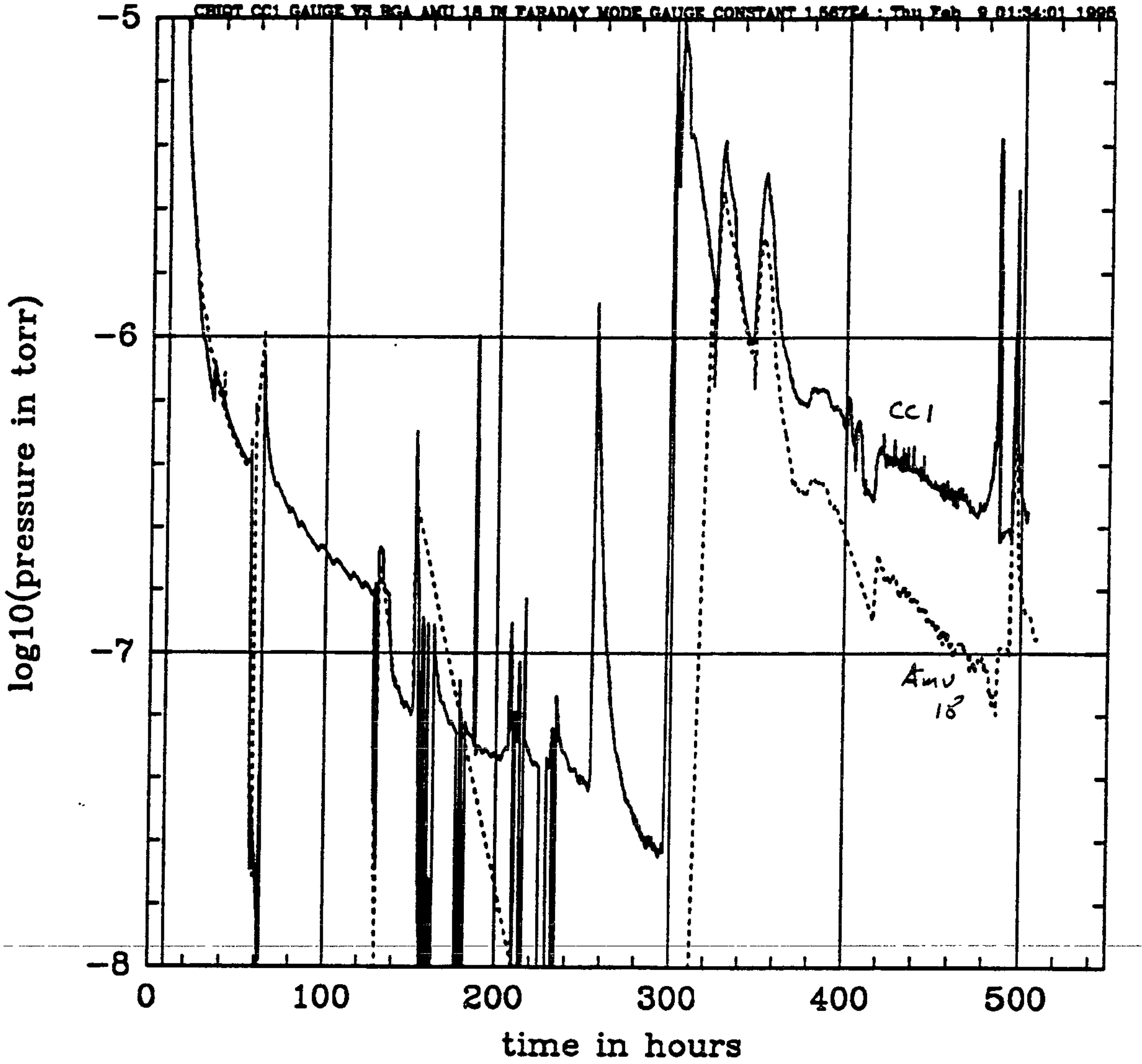
1.71 x10^6 cm^2

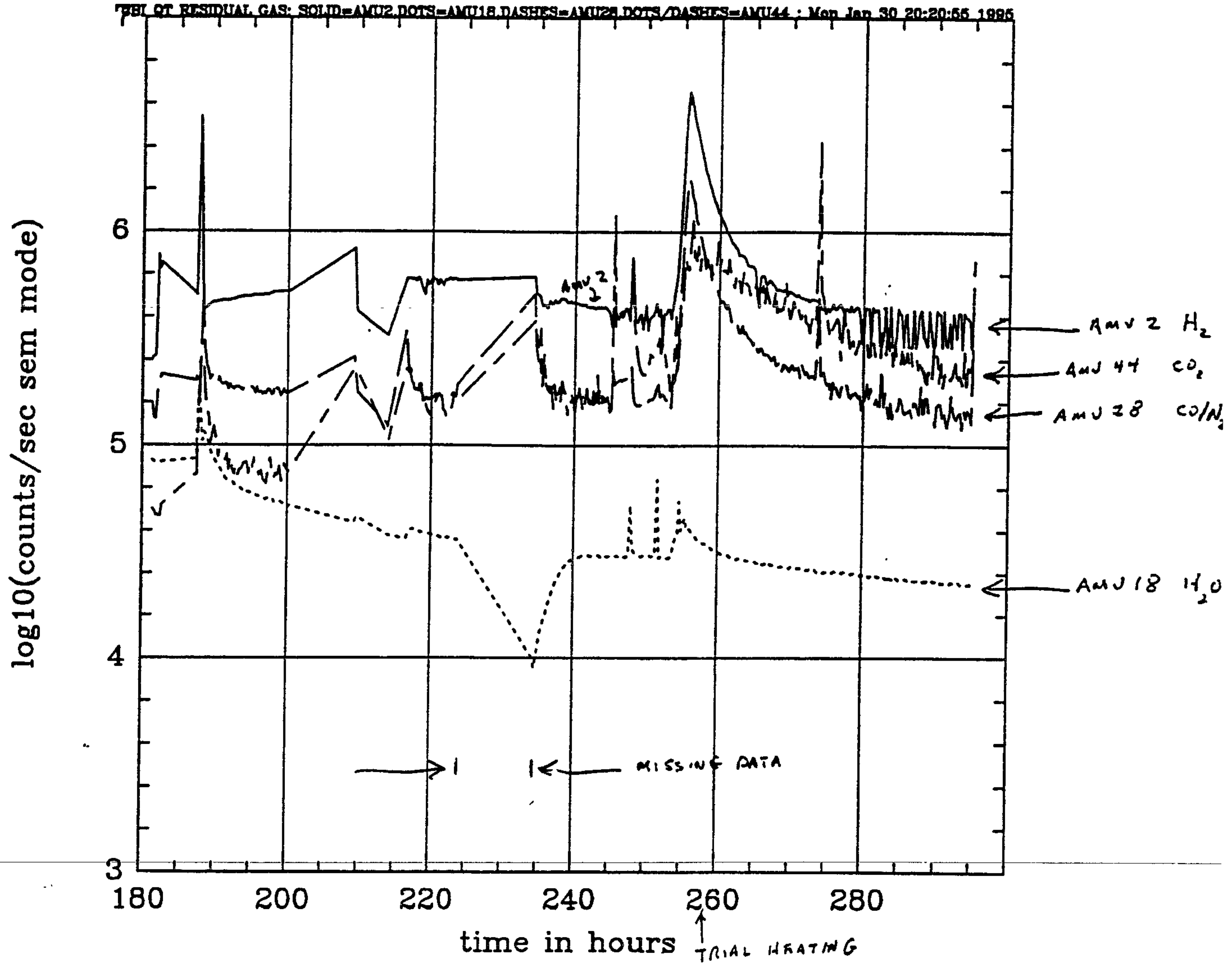
BEAM TUBE VOLUME

5.124 x 10^4 liter

~~[illegible] S_{H_2} = 85 [illegible]~~




CBUOT CC1 GAUGE VS RGA AMU 18 IN FARADAY MODE GAUGE CONSTANT 1.567E4 : Thu Feb 9 01:34:01 1995
log10(pressure in torr)
−5
−6
−7
−8
time in hours
0
100
200
300
400
500
CC1
Amu
18

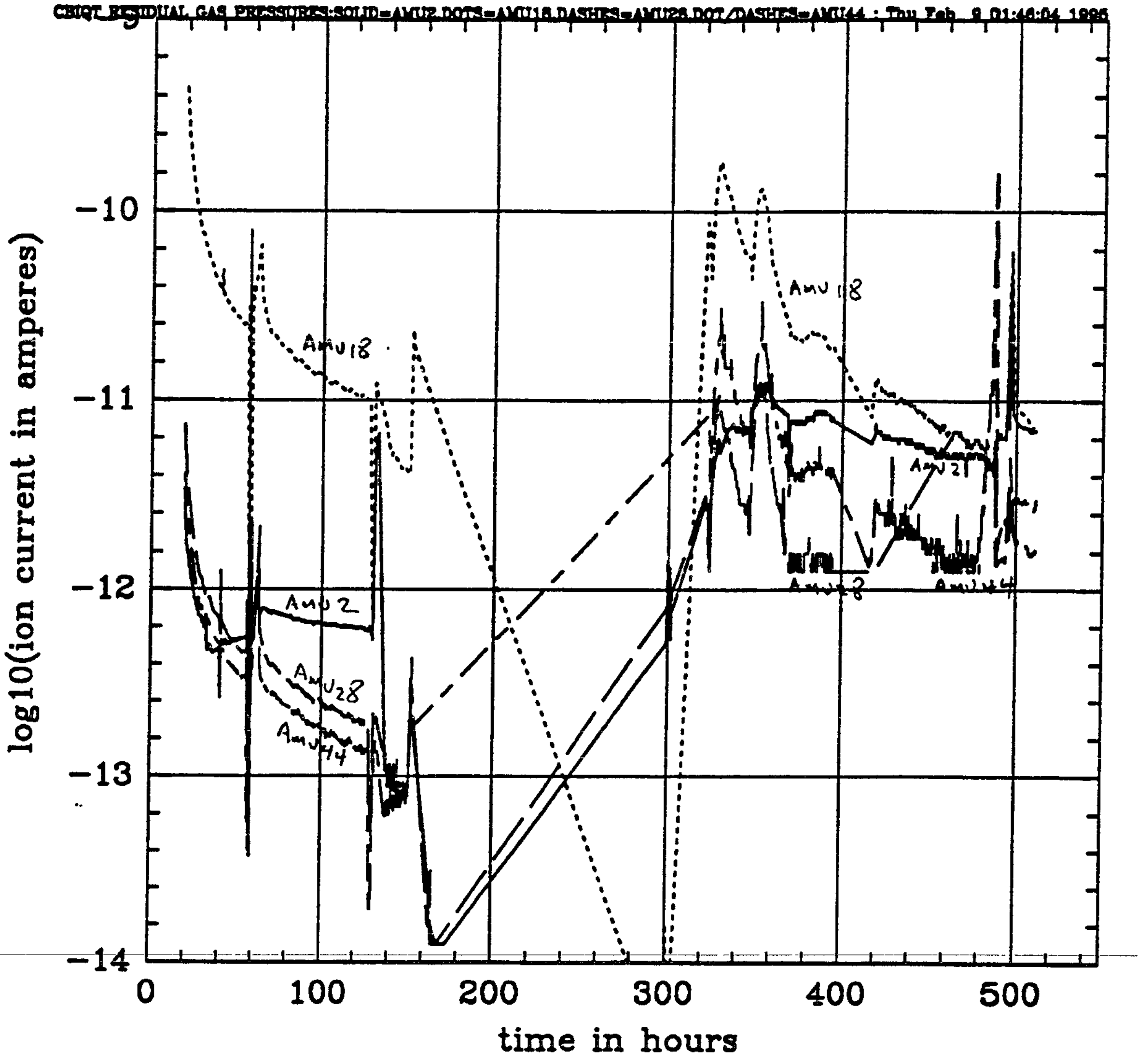


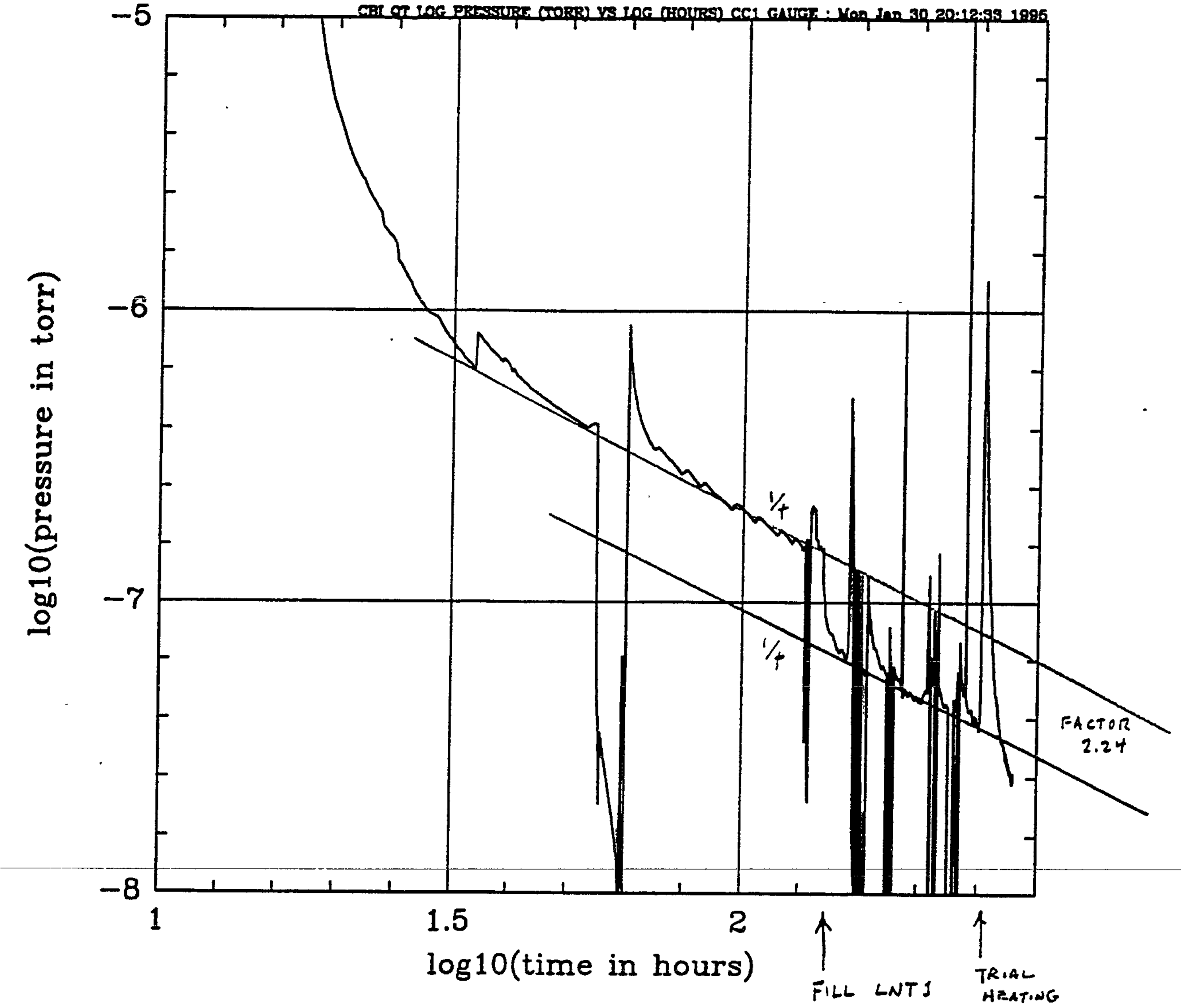
COUNTER /SEM MODE   LNT1, LNT2 AT 77°K

COUNTER GAUGE CONSTANTS
torr/count/sec

H_2	3.2×10^{-15}
N_2	1.5×10^{-15} (?)

NOTE: CC GAUGES ON


CBIQT_RESIDUAL GAS PRESSURES:SOLID=AMU2,DOTS=AMU18,DASHES=AMU28,DOT/DASHES=AMU44 : Thu Feb 9 01:46:04 1995
log10(ion current in amperes)
-10
-11
-12
-13
-14
0
100
200
300
400
500
time in hours
AMU18
AMU 18
AMU 2
AMU 2
AMU28
AMU44
AMU 28
AMU 44



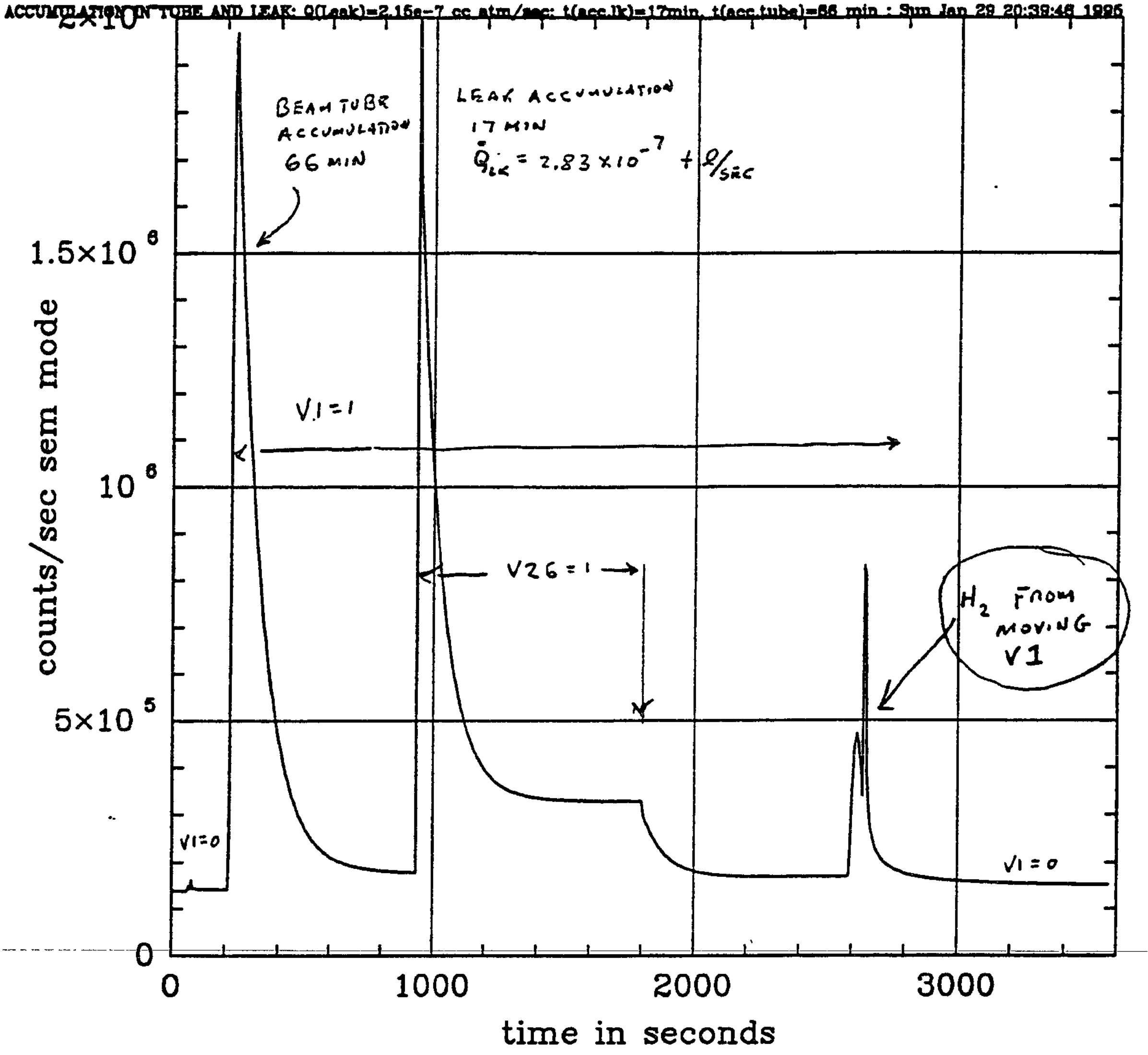
WATER OUTGASSING

$$J_{H_2O}(t) = \frac{1.15 \times 10^{-8}}{t\,(\text{hours})}$$ torr liters/sec cm²

USING F_{H_2O} = 311 ± 10 liters/sec

F_{H_2O} = 696 ± 23 liters/sec LNT1 AT 77°K

N QT HYDROGEN ACCUMULATION IN TUBE AND LEAK: Q(Leak)=2.16e-7 cc atm/sec: t(acc.lk)=17min, t(acc.tube)=66 min : Sun Jan 29 20:38:48 1995



HYDROGEN MEASUREMENT: LNT1, LNT2 AT 77°K
RGA COUNTER MODE
CC GAUGES OFF

RESULTS:

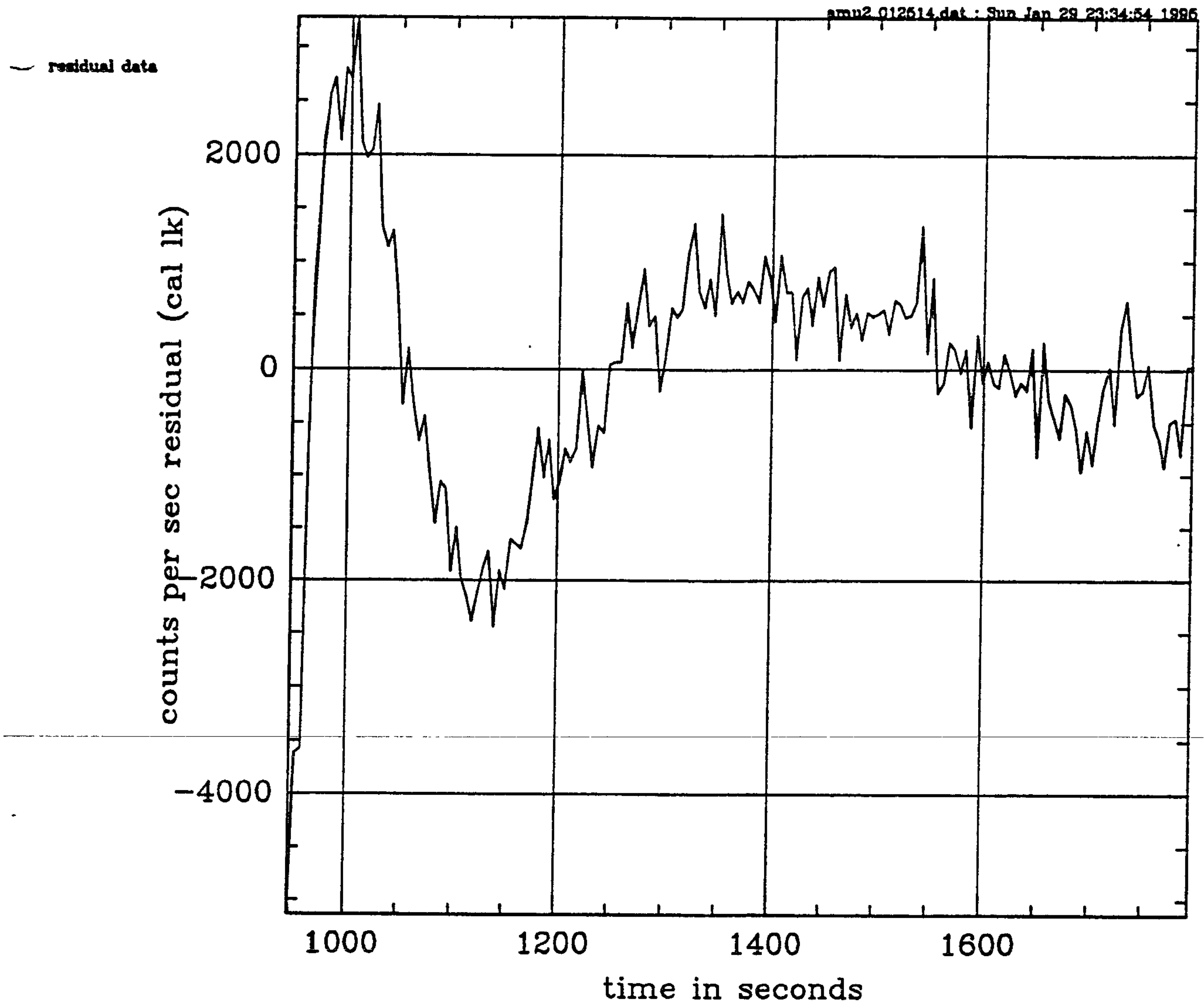
H_2 PUMPING SPEED 611 ± 5 liters/sec $\tau_{H_2} = 84$ sec

$J(H_2)_{TUBE} = 5.1 \pm .3 \times 10^{-14}$ torr liters/sec cm² TRANSIENT

$= 3.8 \pm 1. \times 10^{-14}$ STEADY STATE

H_2 GAUGE CONSTANT 3.1×10^{-15} TORR/COUNT/sec TRANSIENT
2.7×10^{-15} STEADY STATE

amu2-012514.ps


residual data
amu2.012514.dat : Sun Jan 29 23:34:54 1995
counts per sec residual (cal lk)
2000
0
-2000
-4000
1000
1200
1400
1600
time in seconds

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LIGO

LIGO Beam Tube Vibration Study

(Dynamic Response of the Tube to the Hanford Site Ambient Vibration Spectrum)

Presented at the

LIGO Integration Meeting, 9 February 1995

by

M. Gamble of the LIGO DETECTOR GROUP

OBJECTIVE

Determine the response of the LIGO beam tube to the standard LIGO input spectrum (Hanford site ambient spectrum) and infer the transfer function matrix elements, as functions of frequency, describing the support hardware .

METHOD

A general purpose finite element code used to determine the response of tube extension and bending modes (using 3D, kirchoff beam elements) and tube ovalization modes (using thin, isoparametric shell elements) supported by grounded hardware (modeled using 2D spring elements).

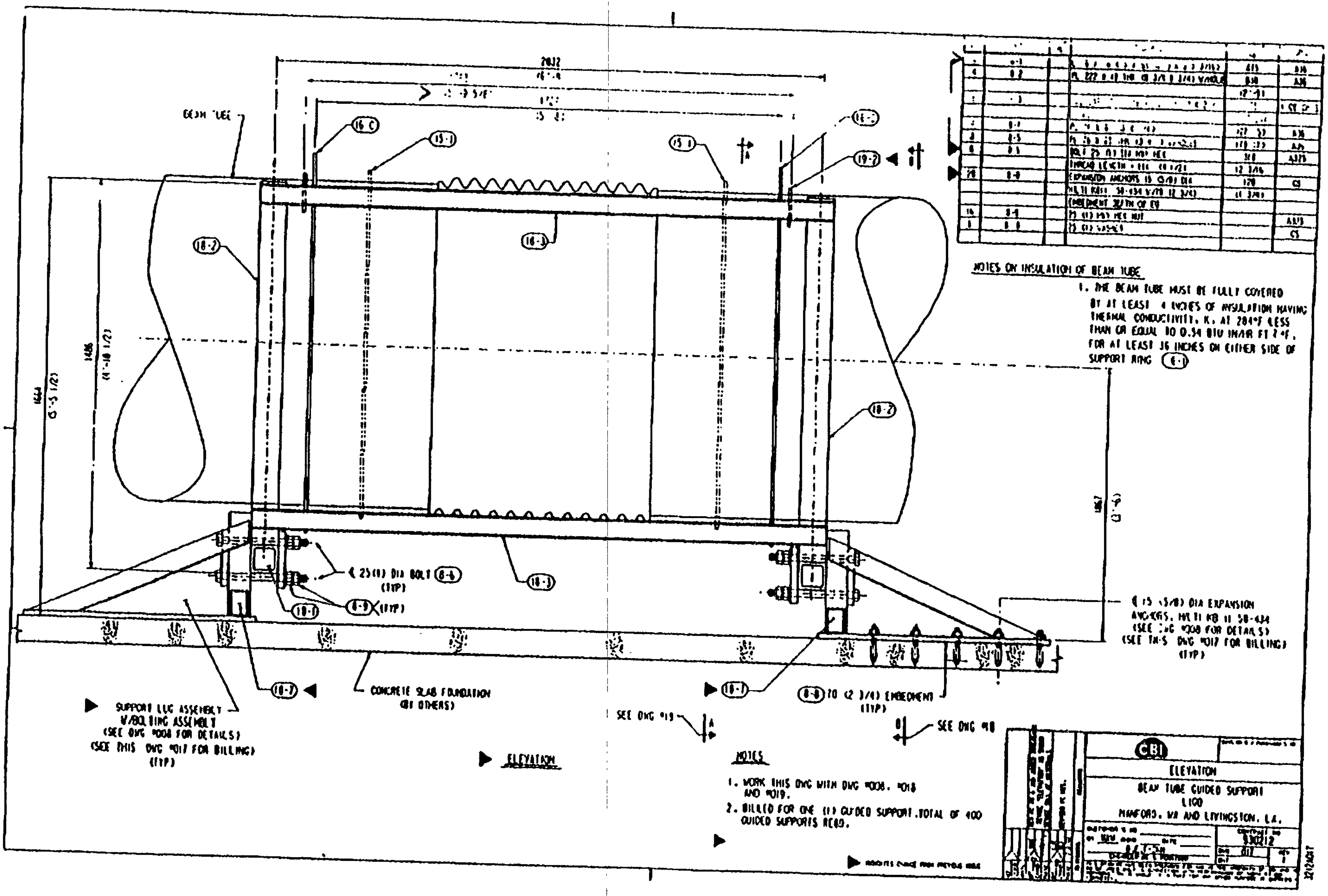
ASSUMPTIONS

- Neglect the effects of soil / structure interactions (apply input PSD directly to the support hardware base nodes).

- The tube's vibrational behavior can be characterized by modeling only 2 rigid pipe supports and a single guided pipe support located at an arbitrary bellows.

- Diagonal matrix elements are much larger than off diagonal elements.

- Small strains and linear / elastic materials.



	8-1		[illegible]	415	A36
4	8-2		PL 222 X 41 THK (8 3/4 X 1 3/4) VARIOUS	838	A36
				(2'-9)	
	8-3		[illegible]		[illegible]
	8-4		[illegible]	[illegible]	A36
4	8-5		PL [illegible]	170 (3)	A36
8	8-6		BOLT 25 (1) DIA HVY HEX	318	A325
			THREAD LENGTH [illegible]	12 3/16	
28	8-8		EXPANSION ANCHORS 15 (5/8) DIA	170	CS
			HILTI KB II 58-434 W/70 (2 3/4)	(1 3/4)	
			EMBEDMENT DEPTH OF EA		
16	8-9		25 (1) HVY HEX NUT		A325
8	8-10		25 (1) WASHER		CS

NOTES ON INSULATION OF BEAM TUBE

1. THE BEAM TUBE MUST BE FULLY COVERED BY AT LEAST 4 INCHES OF INSULATION HAVING THERMAL CONDUCTIVITY, K, AT 284°F LESS THAN OR EQUAL TO 0.34 BTU IN/HR FT ² °F, FOR AT LEAST 36 INCHES ON EITHER SIDE OF SUPPORT RING (6-1)

Ⓔ 25 (1) DIA BOLT (8-6) (TYP)

Ⓔ 15 (5/8) DIA EXPANSION ANCHORS, HILTI KB II 58-434 (SEE DWG #008 FOR DETAILS) (SEE THIS DWG #017 FOR BILLING) (TYP)

(8-8) TO (2 3/4) EMBEDMENT (TYP)

CONCRETE SLAB FOUNDATION (BY OTHERS)

▶ SUPPORT LUG ASSEMBLY W/BOLTING ASSEMBLY (SEE DWG #008 FOR DETAILS) (SEE THIS DWG #017 FOR BILLING) (TYP)

SEE DWG #19

SEE DWG #18

▶ ELEVATION

NOTES

1. WORK THIS DWG WITH DWG #008, #018 AND #019.
2. BILLED FOR ONE (1) GUIDED SUPPORT. TOTAL OF 400 GUIDED SUPPORTS REQD.

▶ INDICATES CHANGE FROM PREVIOUS ISSUE

CBI

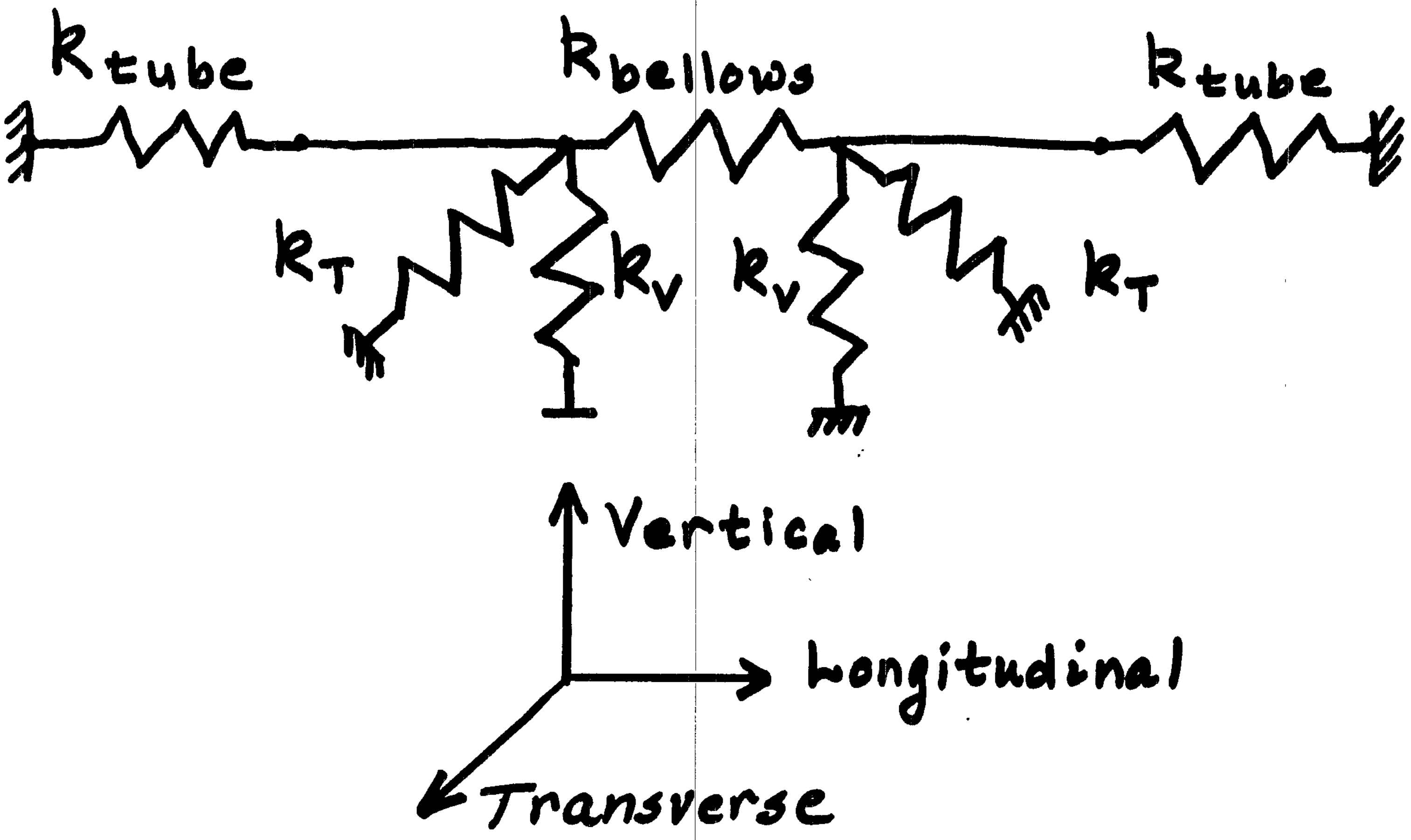
ELEVATION

BEAM TUBE GUIDED SUPPORT
LIGO
HANFORD, WA AND LIVINGSTON, LA.

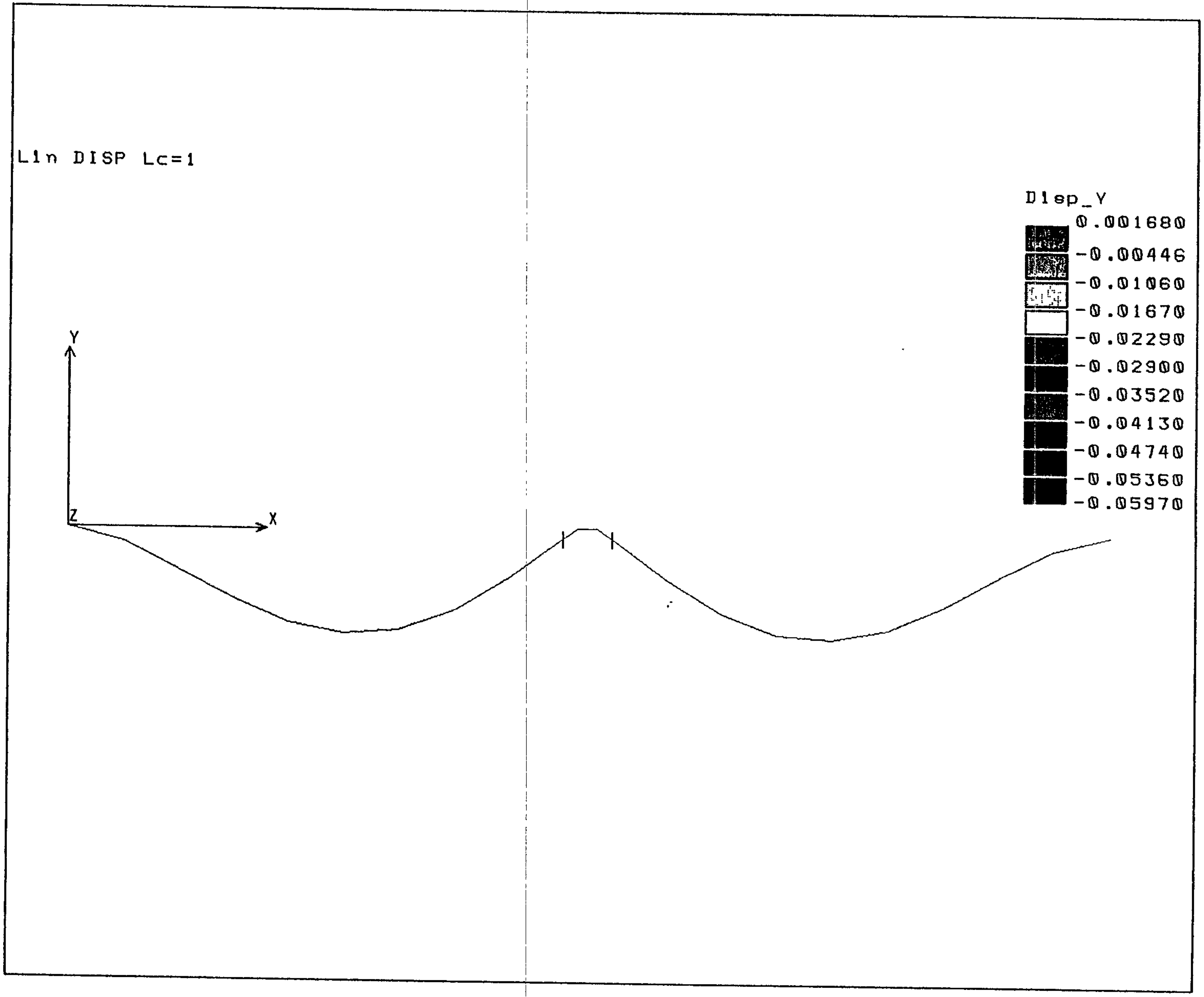
CONTRACT NO 930212
DWG 017
REV 1

3212A017

3D Finite Element Model Schematic



0.06in = 1.5 mm


Lin DISP Lc=1
Y
Z
X
Disp_Y
0.001680
-0.00446
-0.01060
-0.01670
-0.02290
-0.02900
-0.03520
-0.04130
-0.04740
-0.05360
-0.05970

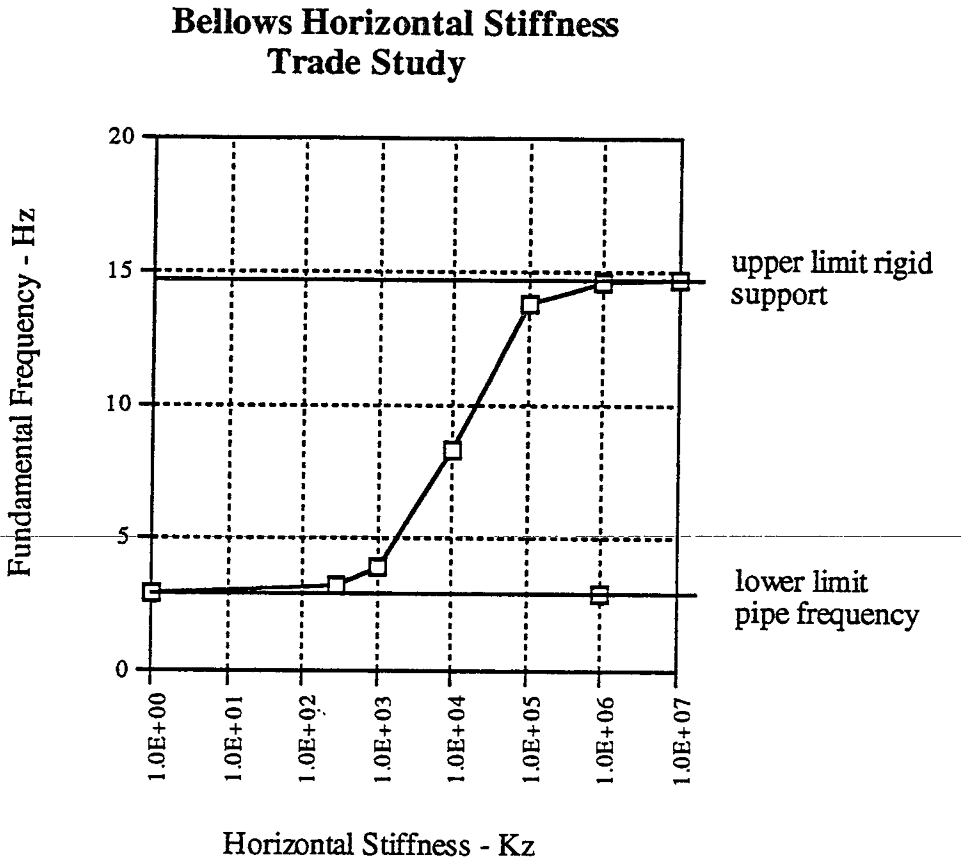
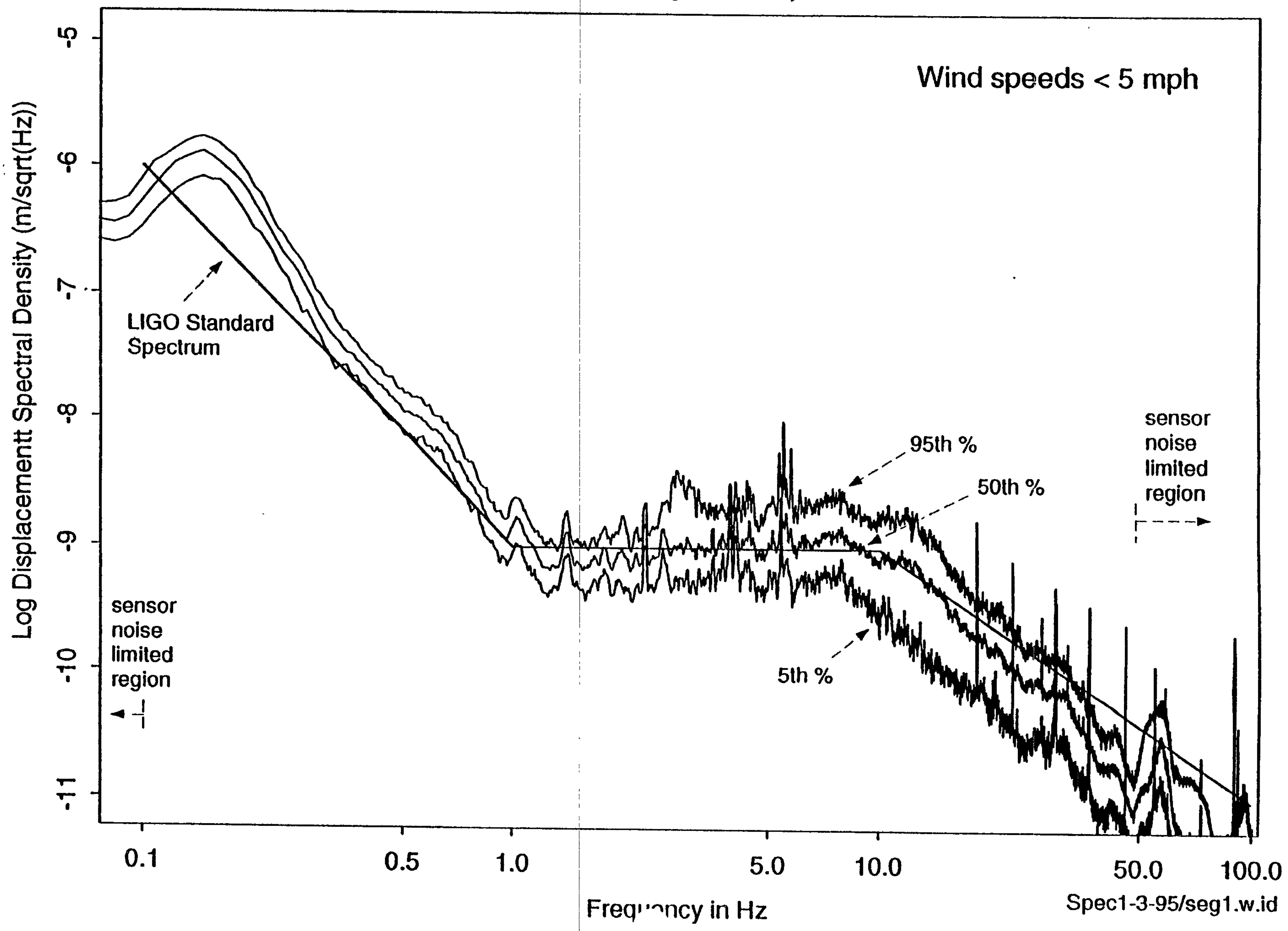

Bellows Horizontal Stiffness
Trade Study
Fundamental Frequency - Hz
20
15
10
5
0
upper limit rigid support
lower limit pipe frequency
1.0E+00
1.0E+01
1.0E+02
1.0E+03
1.0E+04
1.0E+05
1.0E+06
1.0E+07
Horizontal Stiffness - Kz

Fig 3

Hanford Corner Station SW Arm Axis, Morning Traffic December 13,1994
(Preliminary Data)



INPUT / OUTPUT QUANTITIES

INPUT POWER SPECTRUM

- Hanford site ambient ground spectrum
- Displacement power
- Standard power units [m^2/Hz]

TRANSFER FUNCTION

- RELATIVE frequency response function, H(f)
- Plotted values are $/H(f)/^2$

OUTPUT POWER SPECTRA

- RELATIVE displacement power { $Szz(f) = Syy(f) - Sxx(f)$ }
- ABSOLUTE displacement power { $Syy(f) = /H(f)/^2\ Sxx\ (f)$ }
- "Linearized" units [$m/Hz^{1/2}$]

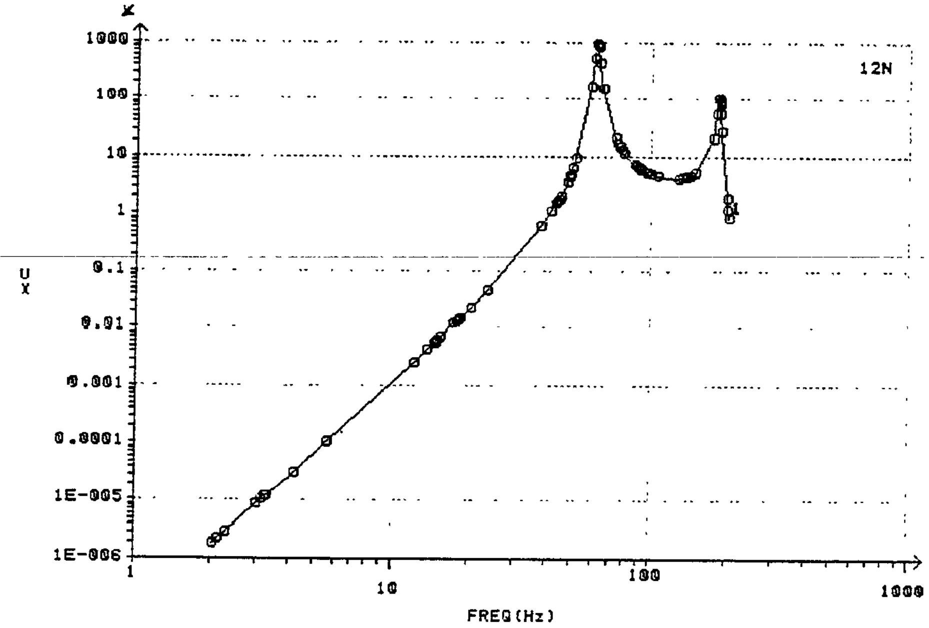
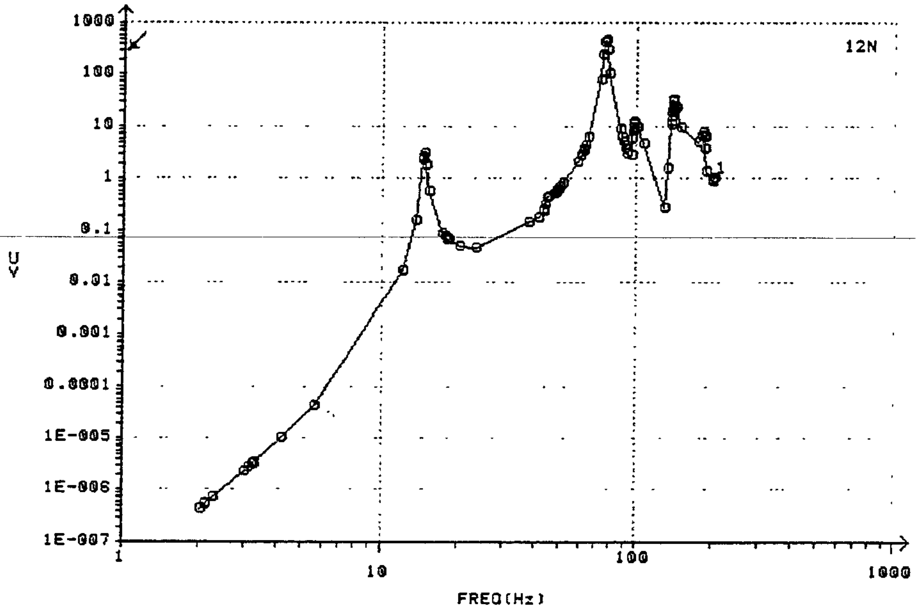

1000
100
10
1
0.1
0.01
0.001
0.0001
1E-005
1E-006
U
X
12N
1
10
100
1000
FREQ(Hz)

Figure 8X



1000
100
10
1
0.1
0.01
0.001
0.0001
1E-005
1E-006
1E-007
U
Y
12N
1
1
10
100
1000
FREQ(Hz)

Fig 84

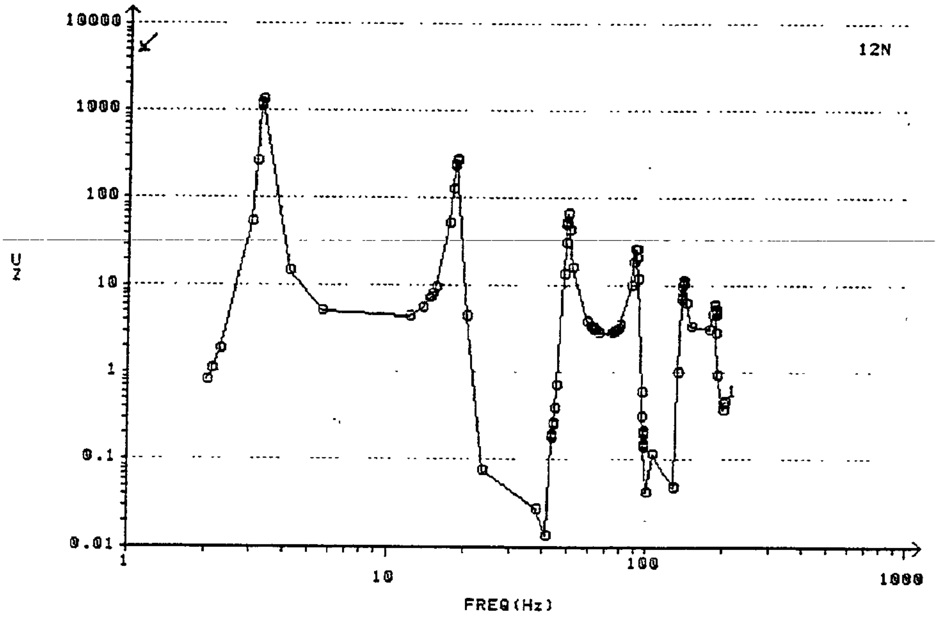
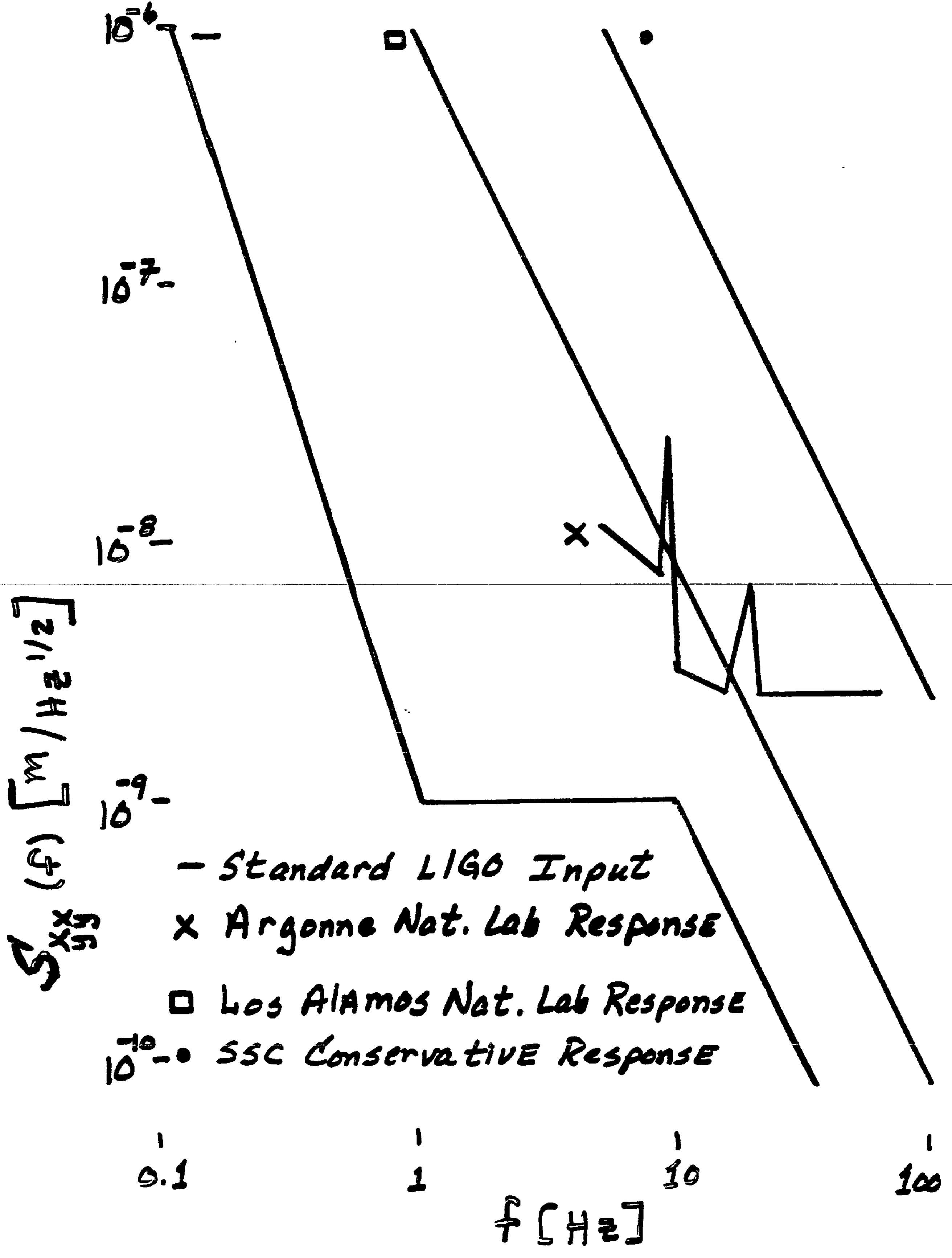
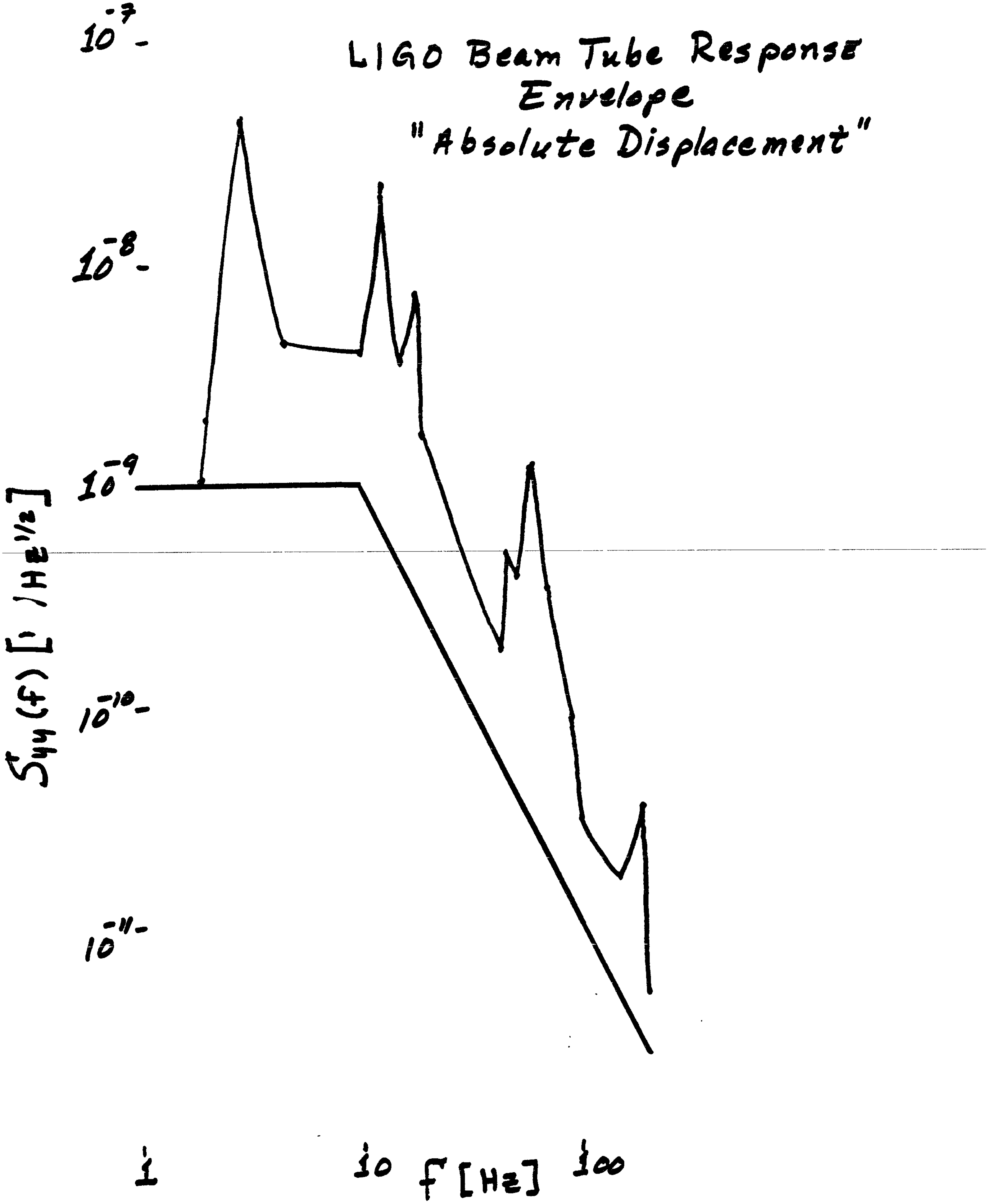


Figure 82

PSD COMPARISON





LIGO Beam Tube Response
Envelope
"Absolute Displacement"

RESULTS

- The gravity-induced deflection of the tube was well modeled by CBI and has a magnitude of approximately 0.0015 m.

- The fundamental mode of vibration of the tube is a strong function of the lateral stiffness of the guided tube support and has a magnitude of approximately 3.2 Hz, when modeled as described by CBI mechanical drawings. The second mode of vibration agrees with CBI calculations and has a magnitude of approximately 14 Hz.

- Gain factors for the tube / support system reach a maximum of approximately 30 in the longitudinal, transverse, and vertical directions. The system is generally stiffest in the longitudinal direction and most flexible in the transverse direction.

- The frequency of the tube's first ovalization mode is approximately 35 Hz and demonstrates little participatory mass.

- Beam tube responses are well above the input PSD at frequencies below 20 Hz. Large peaks, also well above the input PSD, are found near 60 Hz, within the LIGO operations bandwidth.

CONCLUSIONS and RECOMMENDATIONS

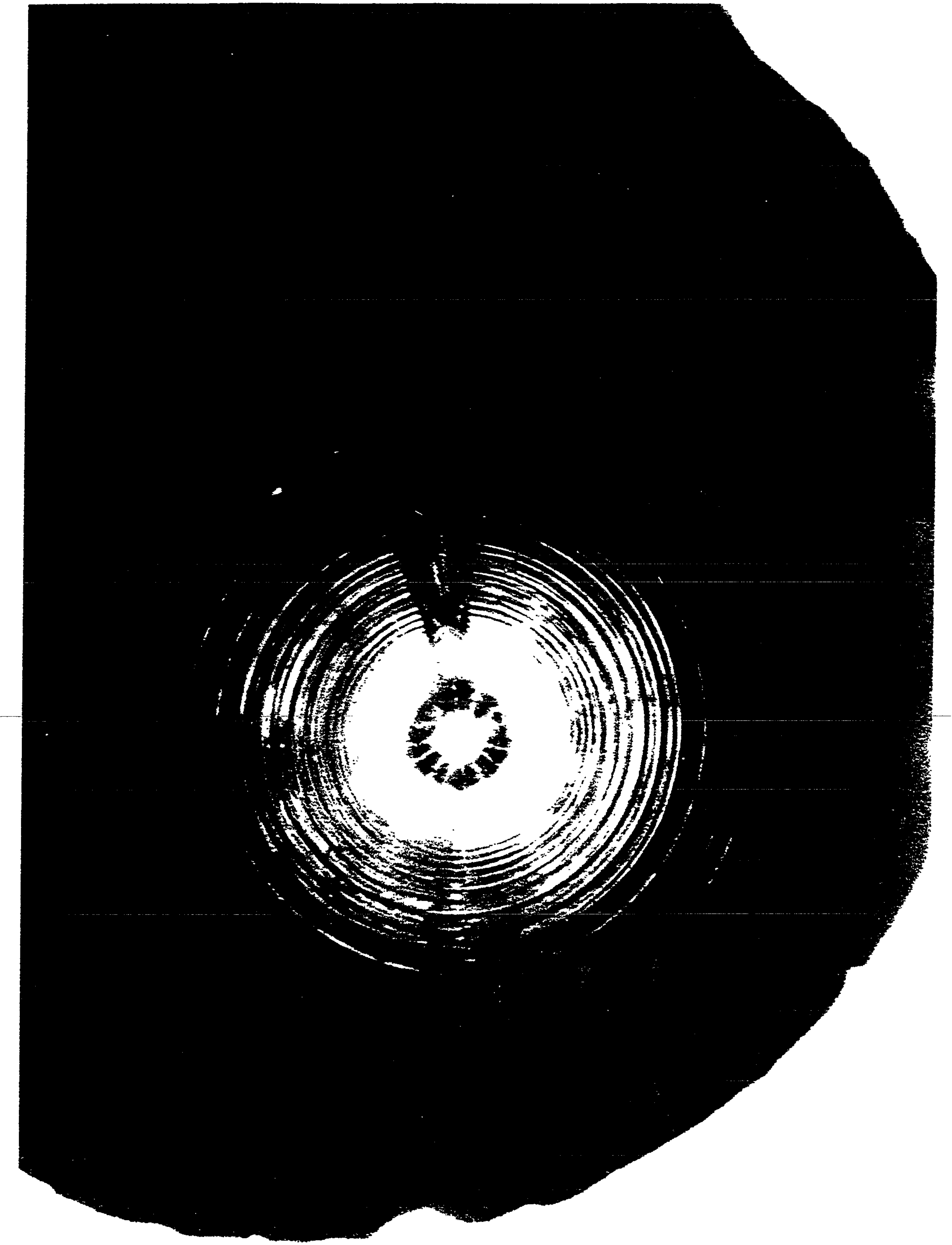
- The LIGO beam tube, as currently envisioned, will undergo large vibration-induced deflections within the gravity wave observation bandwidth.

- The response estimates provided today neglect other sources of motion enhancement such as soil / structure resonance, acoustic noise sources, and baffle / tube motion enhancement,

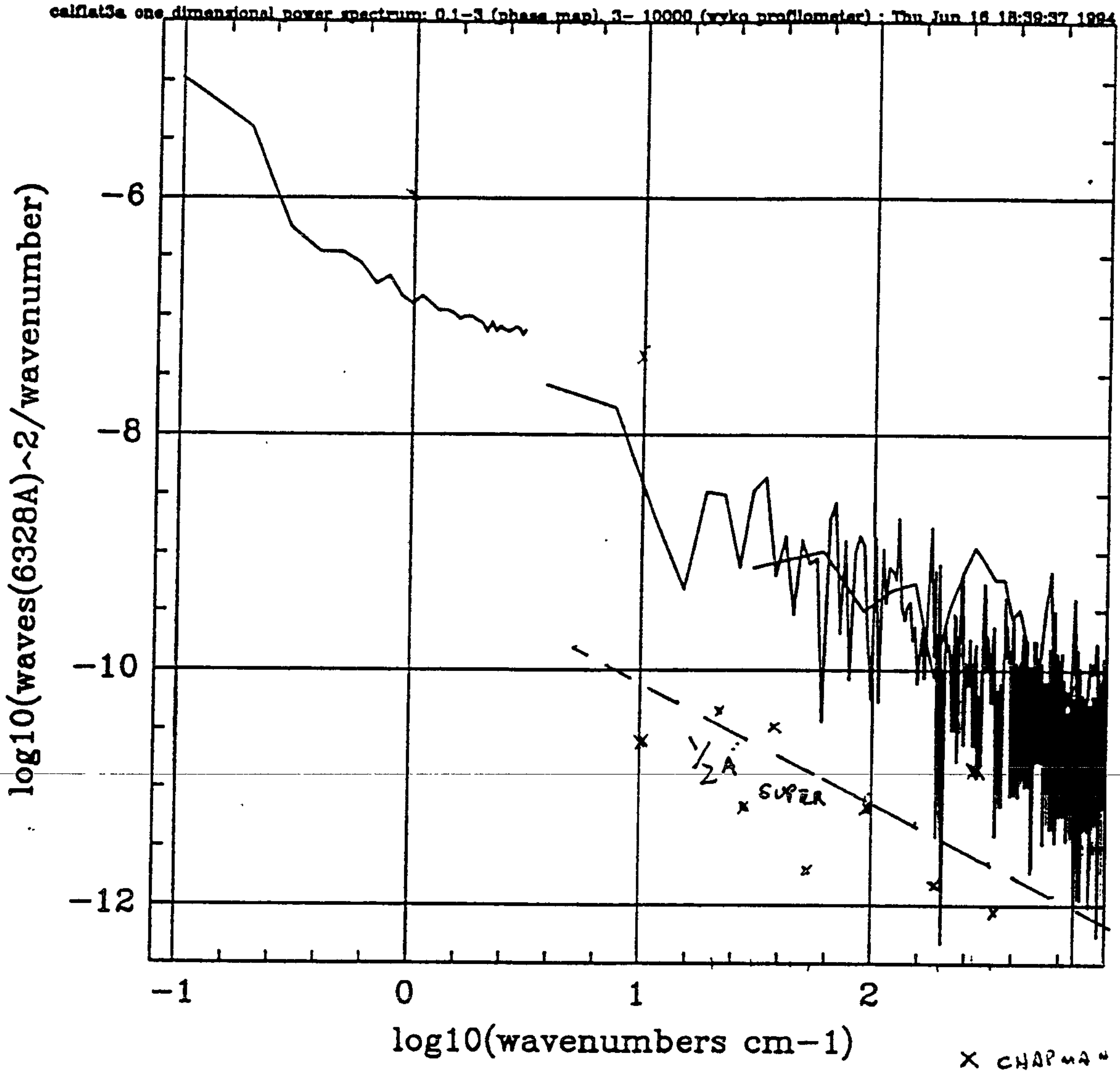
- As a minimum, the current guided support design should be reconsidered and potentially stiffened in the transverse direction.

- Visco-elastic material should be considered for the interfaces of the support hardware and their mating surfaces fixed to the ground.

- An estimate of the response behavior of the baffle, excited by the beam tube, using an accurate shell model of the tube, should be executed.



calflat3a one dimensional power spectrum: 0.1–3 (phase map), 3– 10000 (wyko profilometer) : Thu Jun 16 18:39:37 1994



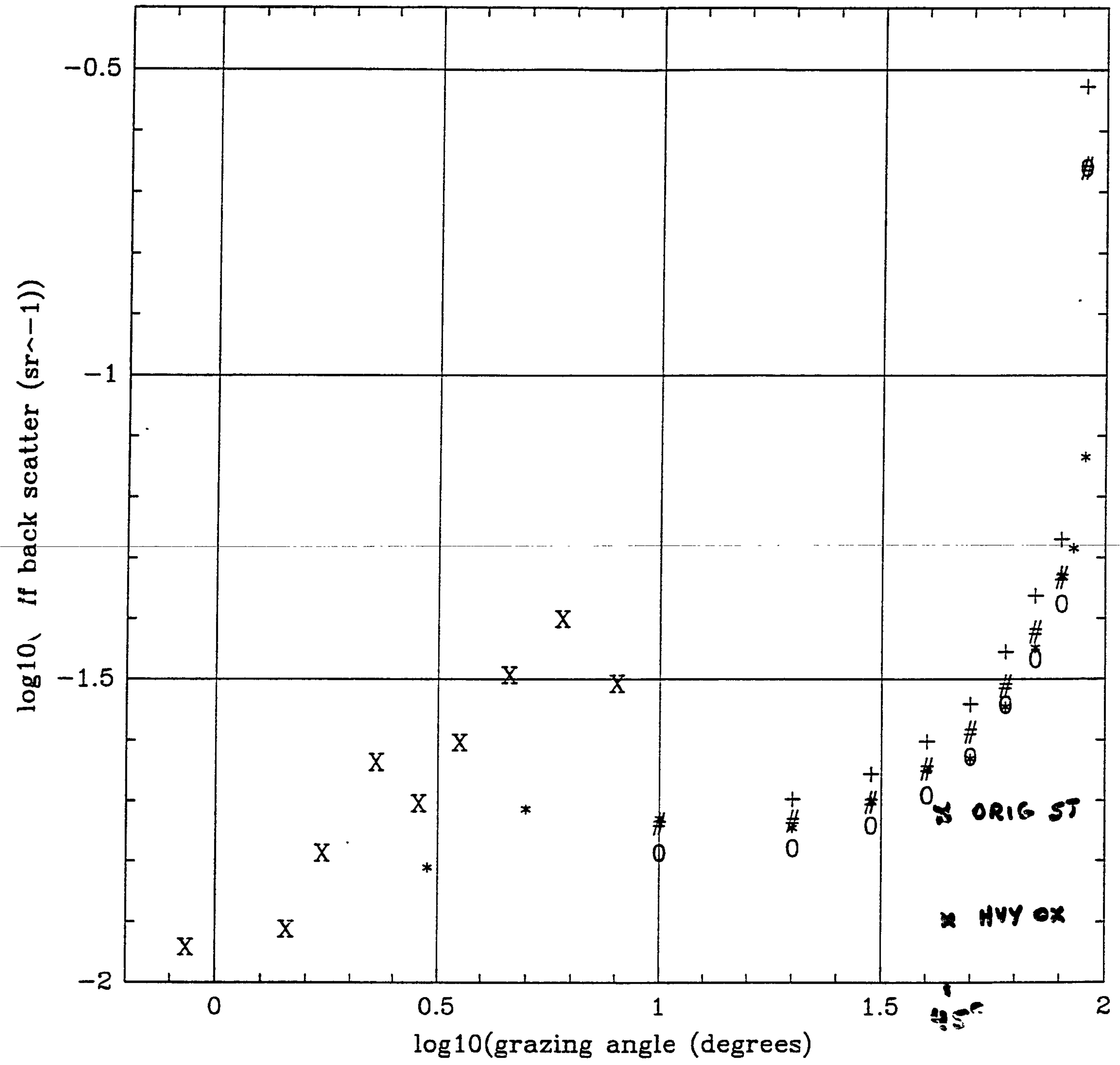
X CHAPMAN MEASUREMENT

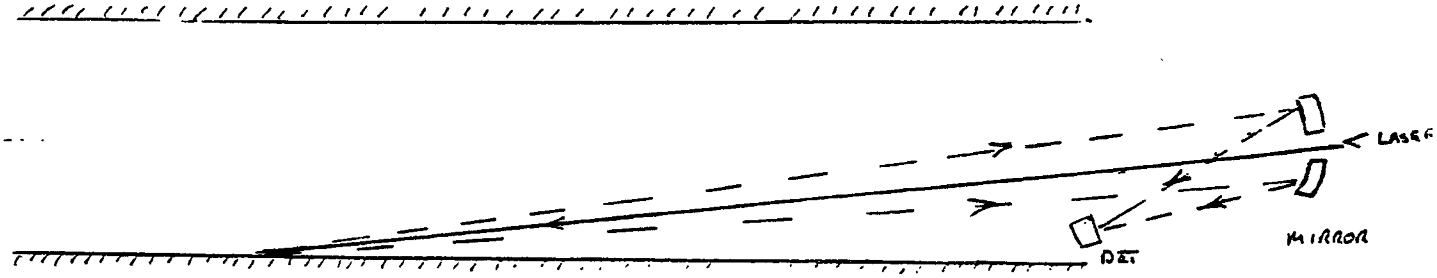
GO SMALL FLAT

0.34 A°

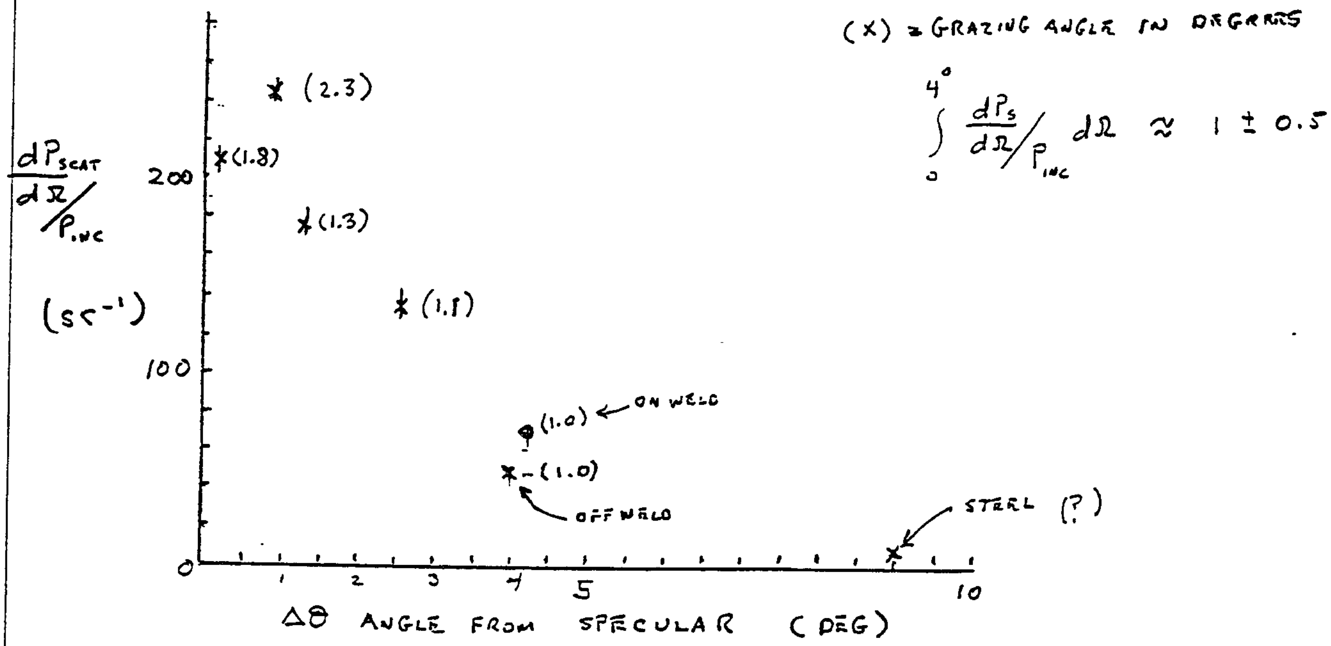
calflat3

differential back scatter vs grazing angle STEEL:12.5m=*,25m=0,30m=#,35m=+; TUBE = X : Wed Jan 4 00:59:48 1995

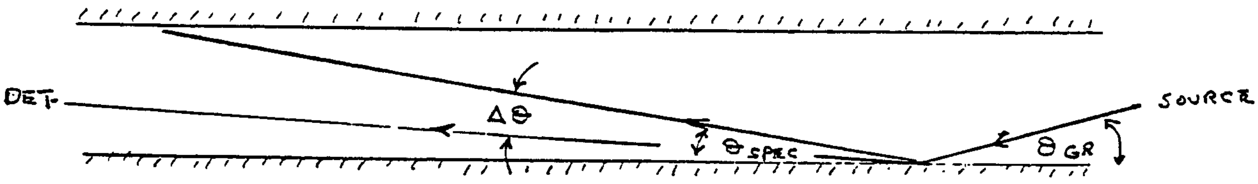




FORWARD SCATTERING FROM BEAM TUBE
PRELIMINARY DATA 1/04/95



$$\int_0^{4^\circ} \frac{dP_s}{d\Omega} / P_{INC} \, d\Omega \approx 1 \pm 0.5$$

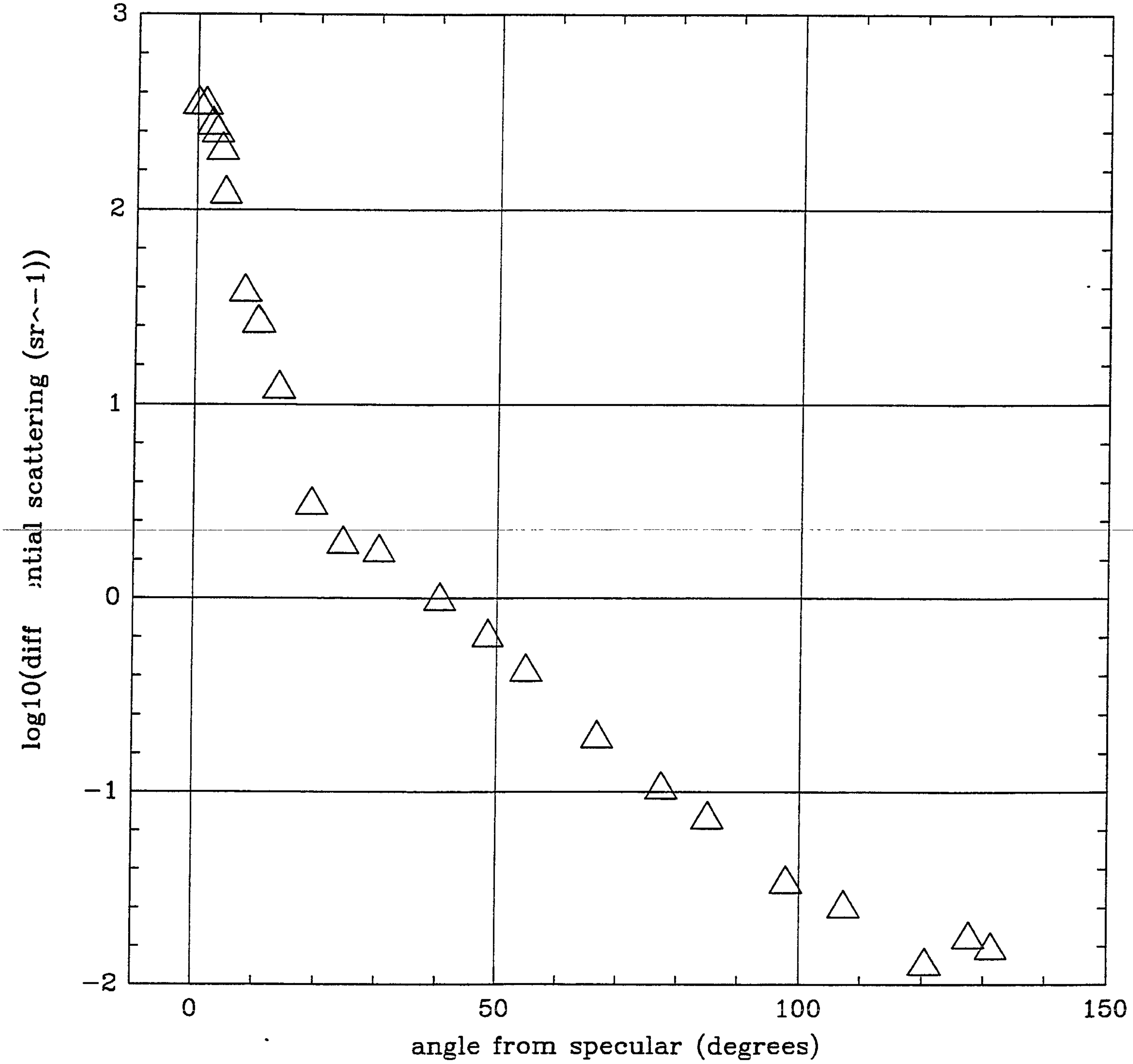


LASER
BEAM DIVERGENCE (FULL ANGLE) 1.65×10^{-3} RADIANS

NEED TO MAKE FURTHER MEASUREMENTS
1) $\Delta\theta > 5$ ON STEEL SAMPLE

2) TOTAL SCATTER

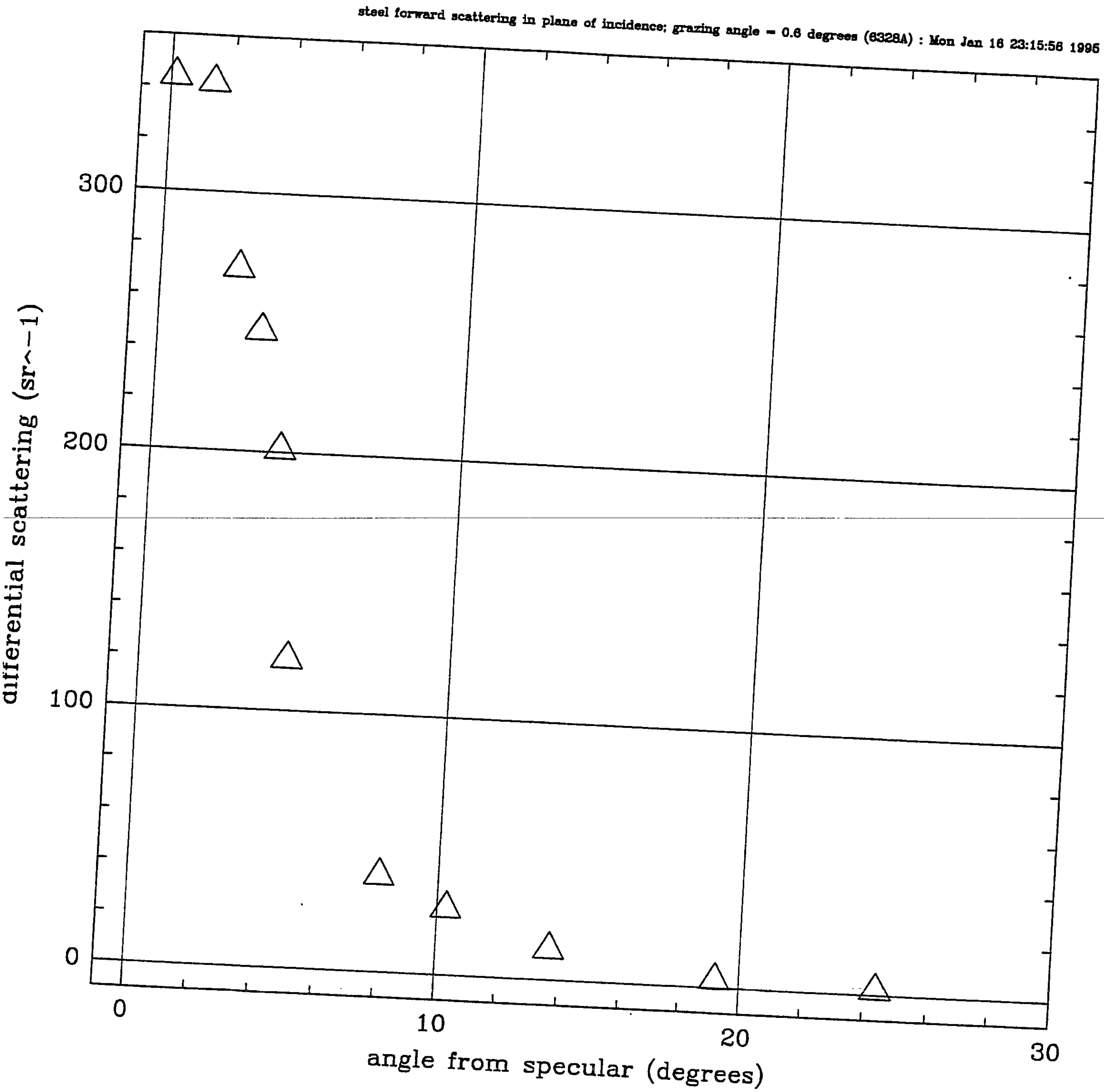
3) LOSS

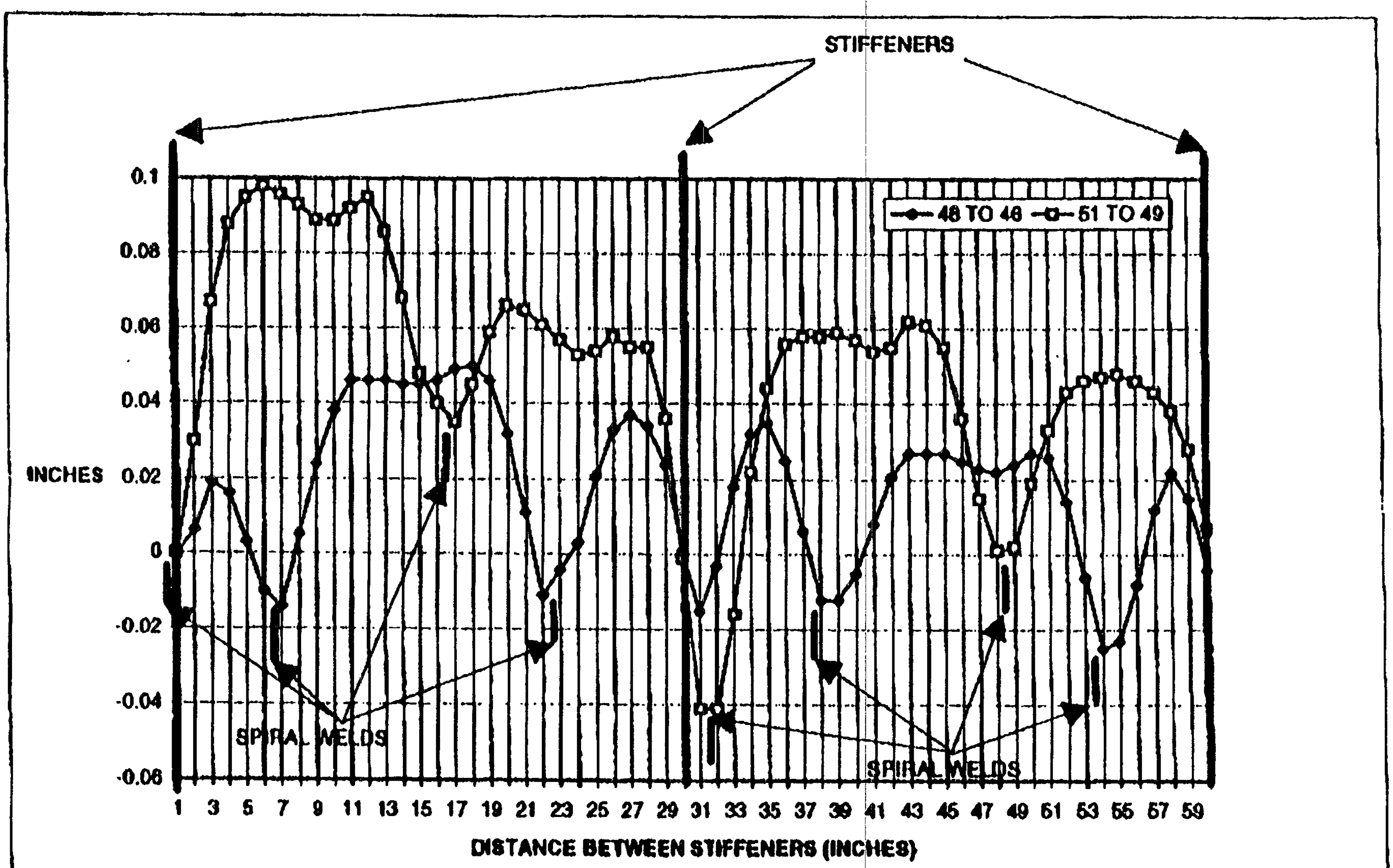


steel forward scattering in plane of incidence; grazing angle = 0.6 degrees (6328A) : Mon Jan 16 23:19:42 1995

DISK/FORWARDSCAT5.PS

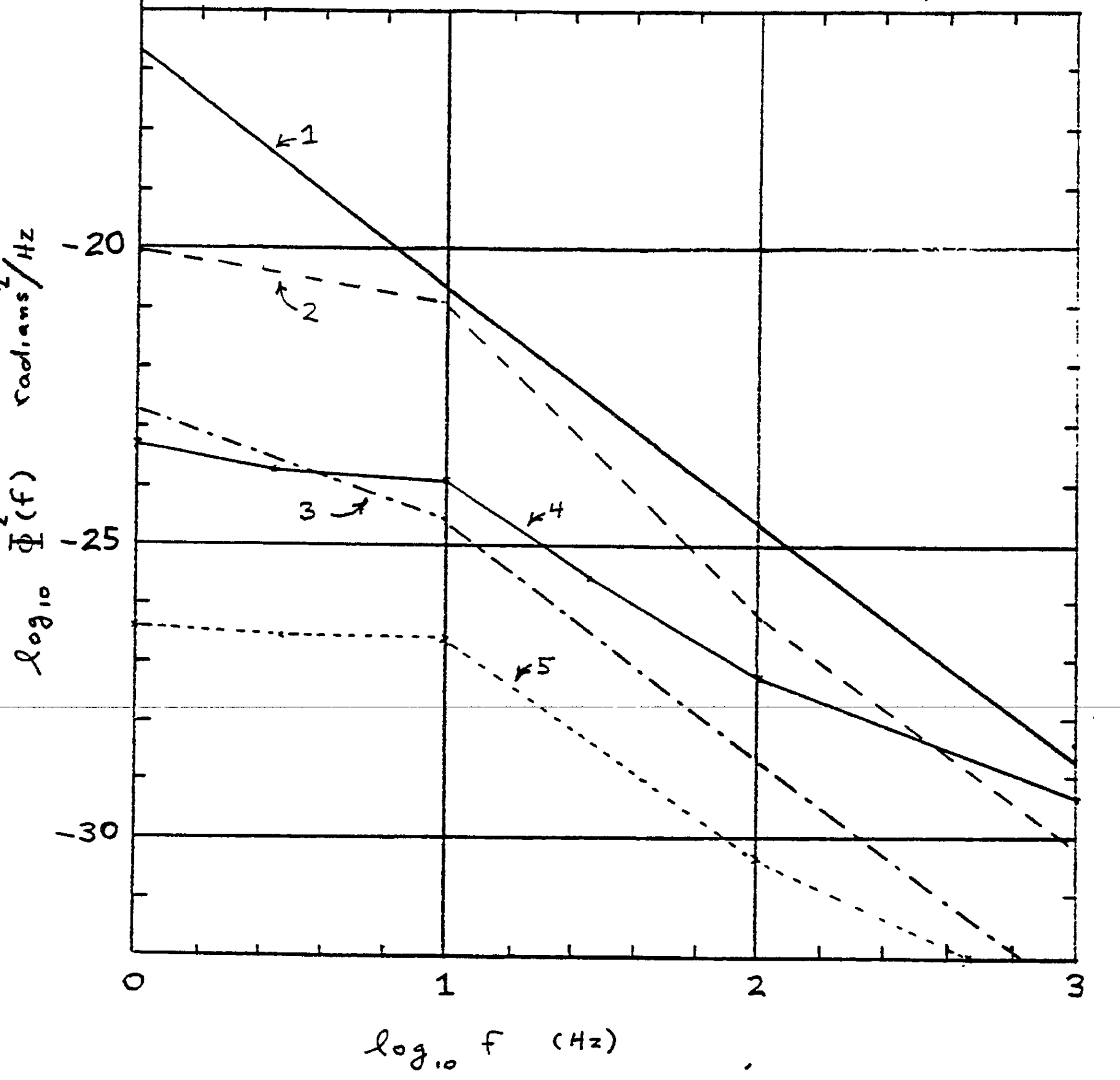
steel forward scattering in plane of incidence; grazing angle = 0.6 degrees (6328A) : Mon Jan 16 23:15:56 1995





PROFILE BEAM TUBE SURFACE BETWEEN STIFFENERS

DEC 29, 1994



PHASE NOISE FROM BRO STRAY LIGHT ANALYSIS

1 1/10 (AMPLITUDE) SQL 10^6 gms 4 Km

2 ALL PATHS, CAVITY MIRROR RECOMBINATION $f_0 = 10$ Hz

3 NO BACKSCATTER PATHS, CAVITY RECOMBINATION $f_0 = 10$ Hz

4 ALL PATHS, DETECTOR RECOMBINATION

5 NO BACKSCATTER PATHS, DETECTOR RECOMB.

$\left.\right\} \frac{\sigma_{SENS}}{SENS} \sim 10^{-3}$

BAFFLE AND STEEL SURFACE DIFFERENTIAL SCATTERING

$$\frac{\frac{dP_{SCAT}(\theta)}{d\Omega}}{P} = 1.25 \times 10^{-2} \cos\theta \quad sr^{-1}$$

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BAFFLE REVIEW MEETING

SOURCES OF SCATTERED-LIGHT INDUCED PHASE NOISE

Phase Noise Contribution	Source(s)	Comments
$\left(\frac{1}{P}\frac{dP}{d\Omega}\right)_\pi$ (backscatter)	Baffle materials - BRDFs Tube wall - BRDF	Use diffuse (black) materials Use absorptive (black) glass (VIRGO) Avoid glints (handling/fabrication) Baffle to avoid seeing walls
$\left(\frac{1}{P}\frac{dP}{d\Omega}\right)_0$ (forward scatter)	Tube wall - BRDF	Baffle to avoid seeing walls
$\left(\frac{1}{P}\frac{dP}{d\Omega}\right)_0$ (diffraction)	Edges	Reduce number of baffles by appropriate baffle spacing Reduce coherence effects by serrating & randomizing serration amplitudes
A[f]	Beam tube/baffle motion amplification	Preliminary effect indicates amplifications up to 30x possible. - Shell model for beam tube; radial motions - Rod model; translational motions
$\sigma_{recombination}$	Mirror surface roughness at high ν [cm^{-1}]	Address coating and polishing techniques - Future effort not immediately addressable

BAFFLE REVIEW MEETING

- MEETING WAS SPONSORED BY CALTECH (CHAIRED BY STAN WHITCOMB, ORGANIZED BY KIP THORNE) ON FRIDAY, SATURDAY 6,7 JANUARY.
- ATTENDED BY:
  - LIGO
    - BARRY BARISH, VLADIMIR BRAGINSKY, RON DREVER, EANNA FLANNIGAN, MIKE GAMBLE, LARRY JONES, ALBERT LAZZARINI, GARY SANDERS, RICK SAVAGE, GERRY-STAPFER, ROBBIE VOGT, RAI WEISS, JOHN WORDEN, HIRO YAMAMOTO
  - VIRGO
    - JEAN-YVES VINET
  - GEO
    - WALTER WINKLER
  - BREAULT RESEARCH ORGANIZATION -- CONSULTANT
    - BOB BREAULT
  - US NAVAL SURFACE WEAPONS CENTER, CHINA LAKE -- CONSULTANT
    - HAL BENNETT

BAFFLE REVIEW MEETING

VIRGO BAFFLE AND BEAM TUBE CONCEPTUAL DESIGN

- BEAM TUBE WILL BE EITHER LIGO-LIKE, STRAIGHT TUBE OR OF A CORRUGATED DESIGN, WITH CORRUGATIONS HAVING 90 cm PITCH, 25 mm AMPLITUDE
  - BOTH CONCEPTS BEING EVALUATED
- BAFFLES ARE MADE OF BLACK GLASS IN A TRUNCATED-CONE (45°) PLUS CYLINDRICAL HOOP CONFIGURATION
  - 3 REFLECTIONS OFF (AR COATED) ABSORPTIVE GLASS PROVIDE $T \cong 2-3\times10^{-7}$
  - DIRECT BACKSCATTER IS VERY LOW DUE SURFACE FINISH OF THE GLASS: $BRDF \approx 1\times10^{-6}$
  - NO SERRATIONS ARE PLANNED [AT THIS TIME]
  - BAFFLE HOOPS ARE PLANNED TO BE INCLINED TO OPTICAL AXIS $\theta \approx 10°$
- BAFFLE SPACING WILL BE A GEOMETRIC PROGRESSION: $z_n = z_0\,(1.15)^n$
- BAFFLE DESIGN TO BE COMPLETED BY MARCH 1995; DECISION ON DESIGN BY APRIL 1995;
- UNRESOLVED ISSUES:
  - INSERTION OF BAFFLES INTO TUBES NOT YET ADDRESSED;
  - BAFFLES EDGES WILL NEED TO BE TAPERED TO KNIFE-LIKE CHARACTERISTIC TO REDUCE GLINTS
  - NEED TO SERRATE BAFFLES TO BE ADDRESSED

BAFFLE REVIEW MEETING

GEO BAFFLE AND BEAM TUBE CONCEPTUAL DESIGN

- **BEAM TUBE NEEDS TO BE 1/2 LIGO/VIRGO DIAMETER**
- **BAFFLES ARE OF A CONFIGURATION SIMILAR TO VIRGO:**
  - **CONE ANGLE IS** 26° **-- 5 REFLECTIONS REQUIRED TO EXIT VERTEX OF CYLINDER-CONE**
  - **TWO SUCH LIGHT TRAPS AT EACH BAFFLE, ARRAGNED BACK-TO-BACK (LOOKING AT OPPOSITE MIRRORS)**
  - **BAFFLE HEIGHT IS 3 cm; BAFFLE IS SPACING LINEAR, 6 m**
  - **MATERIAL EITHER POLISHED STAINLESS STEEL OR BLACK-GLASS COATED SS**
  - **DIRECT BACKSCATTER IS VERY LOW DUE SURFACE FINISH OF THE STEEL/GLASS:** $BRDF \approx 1\times10^{-6}$
  - **ISSUE OF SERRATIONS WAS NOT ADDRESSED [YET]**

- **BAFFLE DESIGN IS VERY PRELIMINARY**

BAFFLE REVIEW MEETING

LIGO <u>BASELINE</u> BAFFLE DESIGN

- BAFFLES ARE MADE OF A SINGLE BENT SHEET INCLINED AT ANGLE OF 55° AWAY FROM NEAREST TEST MASS -- PROJECTION ALONG THE RADIAL DIRECTION IS 6 cm
- BAFFLE HAS SAME OPTICAL PROPERTIES AS BEAM TUBE (OXIDIZED) STAINLESS STEEL
- REGULAR SERRATIONS ALONG THE EDGE ARE PRODUCED BY COMPUTER CONTROLLED WATERJET CUTTING -- 2 mm DEPTH, ALONG RADIAL DIRECTION; UNIFORM IN PERIOD AND AMPLITUDE
- BAFFLE DIAMETER IS SLIGHTLY OVERSIZED TO PROVIDE A "SPRING LOADED" PRESS FIT
- BAFFLE INSERTED WITH A HELICAL BIAS OF ≅ 30 cm/TURN, WITH ≅ 30° OVERLAP
- BAFFLES ARE UNIFORMLY SPACED ALONG TUBE FROM END TO MID-POINT; BEYOND MID-POINT, THE SEQUENCE IS REVERSED:

$0 < l < 100$ m; NO BAFFLING

$100\text{ m} < L < 250\text{ m}$; BAFFLES EVERY 7 m, EVERY 3rd IS AT A BEAM TUBE SUPPORT

$250\text{ m} < L <$ MID-POINT; BAFFLES EVERY 21 m, LOCATED AT SUPPORTS

BAFFLE REVIEW MEETING

OUTCOME OF THE REVIEW

- LIGO IS NOT READY TO FREEZE BAFFLE DESIGN(!)
- THE BEAM TUBE BACKSCATTER, MEASURED BY RAI, WAS MUCH HIGHER THAN WAS ORIGINALLY ASSUMED IN THE BAFFLING ANALYSIS AND DESIGN.

  BRDF FOR NEAR GRAZING INCIDENCE (1-2 °) WAS ≅100x GREATER THAN EXPECTED

  BACKSCATTER FROM TUBE SURFACE IS THE LARGEST SOURCE OF PHASE NOISE IN THE PRESENT BASELINE DESIGN.
- THE BEAM TUBE FORWARD SCATTER WAS MEASURED TO BE MORE BENIGN THAN WAS ORIGINALLY ASSUMED.

  THERE IS NO WELL-DEFINED SPECULAR COMPONENT, BUT RATHER, A BROAD MAXIMUM ALONG THE SPECULAR DIRECTION, WITH $\theta_{rms} \cong 3°$.
- MIKE GAMBLE'S PRELIMINARY ANALYSIS OF COUPLING OF GROUND MOTION TO THE BEAM TUBE WALL INDICATES AMPLIFICATIONS AS GREAT AS 30x MAY OCCUR AT STRUCTURAL RESONANCES, WITH TYPICAL AMPLIFICATIONS OF 2x OFF RESONANCE IN 50 - 200 Hz BAND:

  ANALYSIS WAS FOR A ROD MODEL OF THE BEAM TUBE -- NO SHELL DOFs.

  LARGEST AMPLIFICATION IS TRANSVERSE TO THE BEAM AXIS, IN THE PLANE PARALLEL TO THE GROUND -- AFFECTS DIFFRACTION CONTRIBUTION.

  AMPLIFICATION TRACED TO THE DESIGN OF THE GUIDED SUPPORT AT EXPANSION JOINTS

BAFFLE REVIEW MEETING

- A NUMBER OF MODIFICATIONS TO THE LIGO BAFFLE DESIGN WERE PROPOSED:

  TIGHTEN DESIGN GOAL TO PROVIDE FOR A LIMITING CONTRIBUTION TO THE DETECTOR NOISE FLOOR CORRESPONDING TO 0.1 SQL FOR A 1-TON TEST MASS

  REPLACE BARE OXIDIZED STAINLESS STEEL MATERIAL WITH A DIFFUSIVE/ABSORPTIVE COATING TO REDUCE BACKSCATTER

  BAFFLE THE 1st 100 m OF THE BEAM TUBE

  REMOVE UNNEEDED BAFFLES FROM NEAR MID-STATION TO REDUCE DIFFRACTING EDGES

    - USE SPACING SEQUENCE CORRESPONDING TO GEOMETRICAL PROGRESSION RATHER THAN LINEAR ONE -- VIRGO APPROACH

  FURTHER REDUCE DIFFRACTION BY RANDOMIZING SERRATION AMPLITUDES BY ±0.5 mm

  PLACE BAFFLES AT OR NEAR FIXED BEAM TUBE SUPPORTS TO REDUCE STRUCTURAL AMPLIFICATION OF GROUND MOTION

  CONSIDER BETTER FASTENING METHOD FOR BAFFLE WITHIN TUBE

- ADDITIONAL MEASUREMENTS AND CALCULATIONS ARE NEEDED:

  FOLD RAI's BEAM TUBE BRDF MEASUREMENTS INTO FORWARD PROPAGATION OF SCATTERED LIGHT

  REDO MONTE CARLO ANALYSIS WITH MEASURED SCATTERING DISTRIBUTIONS

  COMPLETE THE STRUCTURAL ANALYSIS OF BEAM TUBE MOTION AMPLIFICATION

BAFFLE REVIEW MEETING

LIGO ACTIONS RESULTING FROM THE RECOMMENDATIONS OF THE BAFFLE REVIEW MEETING

- A REVIEW OF OUR SCHEDULE INDICATES WE HAVE UNTIL DECEMBER 1995 TO PRODUCE A FINAL BAFFLING DESIGN
- LIGO WILL COMPLETE THE SCATTERING ANALYSIS:
  - COMPLETE THE FORWARD PROPAGATION ANALYSIS
  - COMPLETE BRDF ANALYSIS (DONE)
  - REFINE THE BAFFLE MOTION ESTIMATE
  - UPDATE PERFORMANCE CURVES AND SAFETY MARGIN ESTIMATES
- LIGO CONTRACTED BREAULT RESEARCH ORGANIZATION (BRO) TO PROVIDE A LIST OF CANDIDATE DIFFUSE AND/OR ABSORPTIVE MATERIALS WITH THE LEVEL OF OPTICAL PERFORMANCE REQUIRED FOR THE BAFFLES
- LIGO WILL SELECT TWO CANDIDATE COATINGS;
  - FIRST CANDIDATE (i.e., BEST OPTICAL PERFORMER) IS EXPECTED TO BE AN ORGANIC DYE-BASED MATERIAL, WHICH WILL BE EVALUATED FOR CONTAMINATION EFFECTS ON OPTICS;
  - SECOND CANDIDATE WILL BE THE BEST INORGANIC MATERIAL
- BOTH MATERIALS WILL BE EVALUATED FOR OUTGASSING CHARACTERISTICS

BAFFLE REVIEW MEETING

LIGO ACTIONS RESULTING FROM THE RECOMMENDATIONS OF THE BAFFLE REVIEW MEETING (continued)

- LIGO WILL WORK (WITHIN THE SCHEDULE CONSTRAINTS -- 3-4 MONTH SETUP TIME; 3-4 MONTH RINGDOWN TESTING) TO SET UP A RINGDOWN FACILITY AND TO TEST THE ORGANIC DYE-BASED CANDIDATE FOR CONTAMINATION OF OPTICS AT THE LEVEL REQUIRED BY LIGO:

  IF THE RINGDOWN TESTING FALLS BEHIND SCHEDULE... OR

  THE ORGANIC DYE-BASED CANDIDATE FAILS THE RINGDOWN TESTS... OR

  IF THE RESULTS ARE INCONCLUSIVE...

  BAFFLE COATING SELECTION WILL DEFAULT TO THE BACK-UP MATERIAL

- LIGO WILL PURSUE, IN PARALLEL, THE MECHANICAL DESIGN OF THE MODIFIED BAFFLES TO INCLUDE:

  MOUNTING CONCEPTS

  SERRATION DESIGN

  BAFFLE CONFIGURATION AND FABRICATION

  THOSE ASPECTS OF DESIGN THAT ARE NOT DEPENDENT ON COATING AND COATING PROCESS SELECTION WILL BE CARRIED FORWARD, MAINTAINING THE OPTION TO SELECT EITHER COATING MATERIAL AND PROCESS - FINAL DESIGN WILL AWAIT MATERIAL SELECTION