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OLS #20

F18

ACCEPTANCE TEST REPORT
VOLUME I OF IV
SUMMARY AND SPECIFICATION REQUIREMENTS

(CDRL 039A2)

Contract F04701-88-C-0118

Prepared For

UNITED STATES AIR FORCE
Headquarters, Space Division
Los Angeles, California

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1.0 INTRODUCTION

The OLS #20 Acceptance Test Report contains the technical data pertinent to the OLS #20 AVE system. This document is intended to present the Acceptance Test data in terms of the requirements of the Prime Item Development Specification (S-DMSP-886) and Interface Specification (ICD-88802).

Test results and data have been reviewed and verified by Westinghouse Electric Corporation and USAF representatives. System performance data, test histories, data summaries and system analyses are included in this report. In addition, a complete set of system log books are on file at the contractor's facility and are available for review. The Test History is in log book K42358-- and K42586--.

This Acceptance Test Report consists of 4 volumes as follows:

BVS 2815	OLS #20 Summary and Specification Requirements
BVS 2816	OLS #20 Acceptance Vibration Report
BVS 2817	OLS #20 Alignment & Synchronization Curves
BVS 2818	OLS #20 Weight & Center of Gravity

1.1 Summary of OLS 20 System - Specific Parameters

OLS software Program = OLSP03.FS & OLSE03.FS

Gain Constants and Sensor Switch Points

P(0) = 7.375 dB
P(1) = ~~49.75 dB~~ 51.00 dB
P(2) = 0.00 dB
P(3) = 29.625 dB
S(1) = 59.875 dB
S(2) = 22.00 dB
S(3) = 33.625 dB

(These may change during Early Orbit Calibration.)

PMT HV EST (A532) = 2.746 volts \pm .250V

Cone Cooler S/N 033 with T detector S/N 4114

T Cold Patch EST (A549) curve - see Table next page.

T Cold Patch EST Voltage = 2.493 \pm .200V

TGAIN Left = 7
Right = 7
Both = 7

TLEVEL vs MI temperature range - see second page following for table

VDGA constant for PMTCAL = (0440)₈

Encoder Simulator Bias Constant Prime= -33 Redundant= -31

Encoder Simulator Separation Constant Prime= 2 Redundant= 3

T COLD PATCH TEMP vs. EST VOLTS
CONE COOLER S/N 033
T DETECTOR S/N 4114

<u>T (deg k)</u>	<u>EST (Volts)</u>
98.0	5.577
99.0	5.201
100.0	4.852
101.0	4.528
102.0	4.227
103.0	3.949
104.0	3.690
105.0	3.450
106.0	3.228
107.0	3.021
108.0	2.829
109.0	2.651
110.0	2.486
111.0	2.332
112.0	2.189
113.0	2.056
114.0	1.932
115.0	1.817
116.0	1.710
117.0	1.610
118.0	1.517
119.0	1.430
120.0	1.349
121.0	1.274
122.0	1.203
123.0	1.137
124.0	1.075
125.0	1.018

OLS #20
 TLEVEL VS M1 TEMPERATURE RANGE
 T DETECTOR S/N 4114

<u>TL</u>	<u>M1 TEMP(°C)</u>	
1111	-28.502°	to -22.933°
1110	-22.933°	-17.363°
1101	-17.363°	-11.794°
1100	-11.794°	-6.225°
1011	-6.225°	-0.655°
1010	-0.655°	4.914°
1001	4.914°	10.483°
1000	10.483°	16.053°
0111	16.053°	21.622°
0110	21.622°	27.191°
0101	27.191°	32.761°
0100	32.761°	38.330°
0011	38.330°	43.899°
0010	43.899°	49.469°
0001	49.469°	55.038°
0000	55.038°	60.607°

TLEVEL command changes should be uplinked to the OLS as a function of M1 temperature to maximize T Channel output accuracy.

1.2 Specification Pass-Fail Summary

The following sections of this Acceptance Test Report contain the test results as they pertain to the Development Specification requirements. Each Test Report paragraph heading is followed by the corresponding Segment Spec paragraph number in parentheses.

The table on the following page summarizes the OLS #20 pass-fail status vs. Development Spec. paragraph number.

DEVELOPMENT SPEC. PARAGRAPH NUMBER	PASS	FAIL
3.2.1.1.1.1 Infrared Spectrum	x	
3.2.1.1.1.2 Vis-Day Spectrum	x	
3.2.1.1.1.3 Vis-Night Spectrum	x	
3.2.1.1.1.4 Snow Cloud Optics	x	
3.2.1.1.2.1 Fine Geometric Resolution - HRD	x	
3.2.1.1.2.1 Fine Geometric Resolution - T	x	
3.2.1.1.2.2 Smooth Geometric Resolution - HRD	x	
3.2.1.1.2.2 Smooth Geometric Resolution - T	x	
3.2.1.1.2.2 Smooth Geometric Resolution - PMT	x	
3.2.1.1.2.3 Data Sampling	x	
3.2.1.1.3.1 Along Track Geometric Accuracy	x	
3.2.1.1.3.2-4 Along Scan Geometric Accuracy	x	
3.2.1.1.4.1.a T Channel Radiometric Accuracy Repeatability	x	
3.2.1.1.4.1b T Channel Radiometric Accuracy - Stability	x	
3.2.1.1.4.1c T Channel Radiometric Accuracy - Fixed	x	
3.2.1.1.4.2 Daytime Radiometric Accuracy	x	
3.2.1.1.4.3 Nighttime Radiometric Accuracy	x	
3.2.1.1.4.5.1 Terminator Location	x	
3.2.1.1.4.5.3 Maximum Gain Settings	x	
3.2.1.1.4.5.4 Commandable T-Channel Gain	x	

DEVELOPMENT SPEC. PARAGRAPH NUMBER	PASS	FAIL
3.2.1.1.4.5.5 Commandable T-Channel Level	x	
3.2.1.1.4.6.2/3 A/D Conversions & Algorithms	x	
3.2.1.1.5 Radiometric Resolution	x	
3.2.1.1.6.1 T Channel Noise	x	
3.2.1.1.6.2 L Channel Noise (Day)	x	
3.2.1.1.6.3 L Channel Noise (Night)	x	
3.2.1.1.6.4 Dark Current	x	
3.2.1.1.6.5 Stability	x	
3.2.1.1.6.6 Along-Track Noise Integration	x	
3.2.1.1.6.7 Glare Suppression	x	
3.2.1.1.8 Scan Angle	x	
3.2.1.1.9 Data Collection Rate	x	
3.2.1.2 Data Management	x	
3.2.1.3.1 28V Power	x	
3.2.1.3.2 5V Power	x	
3.2.2.1 Total Mass	x	
3.2.2.2 Component Mass	x	
3.2.2.3 Cable Harness Mass	x	
3.2.2.4 Dimensional Limits	x	
3.2.7 Survivability	x	
3.3 Design Features	x	
20.2 Environment	x	
5.1 Shipping & Storage	x	
INTERFACE SPEC PARAGRAPH NUMBER		
3.2.3 Alignment	x	

1.3 Summary of OLS #20 Testing

04/20/94 Start system test
Short T Preamp and coax cables and 9RA5255H27 cable
9 SSS and PSU board assemblies need 1302 op amp part
change

04/24/94 Completed system adjustment

04/27/94 Stopped test for 1302 part replacement

06/14/94 Resumed testing less coax cables and configuration
check

06/16/94 Blown PSU fuse - AM 20-7

06/30/94 Start CONFIGURATION tests

07/17/94 Completed ambient adjustments and CONFIG tests

07/18/94 SPS Vibration - 10V Current Dropouts - AM 20-20

07/19/94 OSU, SPU, PSU Vibration

07/20/94 SSS Vibration, SPS Re-Vibration

08/03/94 TF glitch investigation - AM 20-15

08/04/94 Ambient test completed - Installed in TV chamber

08/09/94 TV pumpdown, purge and bakeout

08/12/94 Started TV Adjustment testing

08/13/94 T patch heater not on, aborted TV run

08/14/94 Reset PSU board cold patch temperature pot

08/15/94 Installed flight coax cables

08/16/94 TV pumpdown, purge and bakeout

08/20/94 T channel would not adjust-beamsplitter in backwards
AM 20-29 - aborted TV run

08/26/94 Blue Room T channel investigation

09/02/94 SSS in TV - T channel investigation vacuum run

09/09/94 TV tests complete - warm-up and vent

09/18/94 OLS 21 PSU (SN 5016) failed vibration (AM 20-31).
Transferred to OLS 20. SN 5015 transferred to OLS
21.

10/03/94 PSU SN 5016 vibrated in 3 axes

01/06/95 Started post beamsplitter repair ambient tests

01/13/95 SSS 3 axis vibration per BVS 2804

01/14/95 Special PMT power monitored vibration per BVS 2804

01/19/95 Completed ambient post vib tests - Moved to TV
chamber

1.3 Summary of OLS #20 Testing (Continued)

01/25/95 TV pumpdown, purge and bakeout
01/30/95 Could not adjust T right bias - pot adjustment tool
- aborted
01/31/95 Repaired T pot adjustment tool
02/01/95 TV pumpdown, purge and bakeout
02/08/95 T channel adjustments and performance tests
completed
02/09/95 Cold Soak testing
02/10/95 Hot Soak testing
02/11/95 TV adjustment tests complete - Warm-up and vent
02/13/95 Installed 1 HRD shim (total now 3)
Adjusted MT1 and MT2 for optimum T channel focus -
AM20-34
Removed T channel pot adjustment tool
Installed flight 9RA5255H27 cable
02/15/95 BB3BYPASS signal missing - AM 20-35
Defective drive transistor on SPS Red/Black board
repaired
03/01/95 Repaired SPS installed in TV chamber
03/03/95 TV pumpdown, purge and bakeout
03/06/95 Started Hot Limit T Reference testing
03/07/95 ETC preset problem - test equipment connector -
aborted TV
03/09/95 TV chamber warm and vent
Repaired TCP connector - ETC preset now OK
TV pumpdown, purge and bakeout
03/14/95 Completed Hot Limit T Reference testing
03/15/95 Completed Cold Soak #1 testing
03/17/95 Completed Hot Soak #1 testing
03/19/95 Completed Cold Soak #2 testing
03/21/95 Completed Hot Soak #2 testing
03/29/95 Completed Cold Limit testing
T channel End-Of-Scan (EOS) problem AM 20-42
04/03/95 Completed Hot Limit testing
04/04/95 TV chamber warm and vent

1.3 Summary of OLS #20 Testing (Continued)

- 04/04/95 Adjusted M4' and M4" mirror for optimum T channel contiguous coverage
Adjusted HRD gain pot 1A8R26 for optimum across scan balance
TV pumpdown, purge and bakeout
- 04/08/95 Complete T channel Hot Limit T Reference verification
- 04/09/95 Completed Hot Soak repeat
- 04/10/95 TV chamber warm and vent
Transported all units to Blue Room
- 04/12/95 Final OLS 20 testing completed

1.4 Configuration and Serialized Assemblies

The configuration listing on the following pages includes the current configuration of OLS #20 as of 04-29-95.

DESCRIPTION	ASSEMBLY NO.	REV.	S/N
Key Drawing	536R500G09	BA	5015
<u>SSS Assembly</u>	<u>693R700G05</u>	AK	5015
W/D	693R662G02	D	-
Cable Assy	633R781G01	A	-
Cable Assy	633R782G01	-	-
Cable Assy	633R783G01	-	-
Cable Assy	633R784G01	-	-
Cable Assy	633R785G01	A	-
Cable Assy	432R240G01	B	-
Cable Assy	644R199G01	B	-
Cable	682R189G01	G	001
Cable	693R692G02	J	004
<u>Heat Cont</u>	633R053G17	M	5047
Electronics	633R052G05	M	5047
<u>Heat Cont</u>	633R053G18	M	5048
Electronics	633R052G05	AM	5048
<u>Heat Cont</u>	633R053G19	M	5049
Electronics	633R052G05	AM	5049
<u>Heat Cont</u>	633R053G20	M	5050
Electronics	633R052G05	AM	5050
<u>OSC</u>	623R765G09	AV	5015
IMC LEAD	623R909G01	C	-
Spring Assy	522R210G01	A	-
Spring Assy	522R210G01	A	-
Spring Assy	522R210G01	A	-
Spring Assy	522R210G01	A	-
<u>Mot Assy</u>	623R894G01	B	5015

DESCRIPTION	ASSEMBLY NO.	REV.	S/N
<u>IMC/M3</u>	623R858G01	F	5016
Assy	522R222G01	B	1011
Assy	522R223G01	D	1011
Assy	522R222G01	B	1013
Assy	522R223G01	D	1013
Assy	522R302G01	A	-
<u>Rel Assy</u>	640R701G02	G	5015
<u>R/M EST Assy</u>	644R088G02	J	-
<u>ENPA Assy</u>	682R215G09	Y	5015
Cir. Card	682R167G08	Y	5016
Cir. Card	682R112G07	AC	5015
Cir. Card	682R110G07	AD	5017
<u>AUXENCODER</u>	682R300G05	J	5015
Cir. Card	682R149G05	J	5016
Cir. Card	682R151G05	J	5016
<u>SP Assy #1</u>	623R771G01	C	A1015
Flat Spring	522R118H01	B	A1015
<u>SP Assy #2</u>	623R772G01	D	A1016
Flat Spring	522R118H01	B	A1016
<u>SP Assy #3</u>	623R773G01	C	A1017
Flat Spring	522R118H01	B	A1017
<u>SP Assy #4</u>	623R774G01	C	A1018
Flat Spring	522R118H01	B	A1018

<u>DESCRIPTION</u>	<u>ASSEMBLY NO.</u>	<u>REV.</u>	<u>S/N</u>
<u>Z Tunnel</u>	758R836G01	B	5016
H.V. Wire	540R582G06	B	-
Tunnel Frame	758R832G01	A	-
Insulator	758R834G01	-	-
Z Tunnel	758R837G01	B	5015
H.V. Wire	540R582G04	B	-
Tunnel Frame	758R833G01	A	-
Insulator	758R835G01	-	-
Strip	540R593G01	-	-
Strip	540R593G02	-	-
<u>T-Clamp Assy</u>	623R821G02	L	-
<u>AUXENCODER</u>	640R846G06	U	5015
Cir Card	640R825G06	P	5017
Cir Card	640R844G06	U	5017
<u>T-CAL Source</u>	623R920G01	C	5015
<u>HRD Elect</u>	693R663G03	F	5005
FILT Assy	693R661G01	-	-
Cir Card	623R758G04	W	0015
Cir Card	623R506G07	AF	0015
<u>SOL ASSY</u>	758R620G03	N	5008
Cable	758R693G01	D	-
<u>T Channel</u>	765R048G03	K	5009
Cir Card	762R539G03	M	5005
Mod Assy	623R727G01	C	5030
Mod Assy	623R727G01	C	5031
<u>VDGA</u>	644R150G07	P	5015
Cir Card	644R152G05	AB	5015

<u>DESCRIPTION</u>	<u>ASSEMBLY NO.</u>	<u>REV.</u>	<u>S/N</u>
Cir Card	644R153G05	AA	5016
Cir Card	644R127G07	AD	5016
<u>Post Amp</u>	644R220G10	T	5015
Cir Card	644R228G08	BA	5012
<u>EST/LMD Assy</u>	644R219G04	E	5015
Cir Card	758R142G03	M	0017
<u>PMT Assy</u>	644R909G07	AC	0017
A1	644R903G04	AC	0017
A2	644R907G02	T	0018
A3	644R807G04	R	5014
A4	644R905G03	L	0016
A5	644R935G06	Y	5017
A7	536R916G01	F	5016
Tube A6	640R920G02	J	0028
<u>Rel Assy</u>	640R381G02	K	5015
<u>R/M EST Assy</u>	640R753G02	J	5016
<u>Z-THERM</u>	758R779G01	B	5016
H.V. Wire	540R582G02	B	-
Blanket	758R807G01	-	-
Frame	758R830G01	A	-
<u>Z-Therm</u>	758R781G01	B	5016
H.V. Wire	540R582G03	B	-
Frame	758R829G01	C	-
Blanket	758R808G01	-	-
<u>RAD Housing</u>	765R158G01	B	-
<u>BLNKT Assy</u>	522R276G02	J	-
Deployable	640R320G01	A	5016

<u>DESCRIPTION</u>	<u>ASSEMBLY NO.</u>	<u>REV.</u>	<u>S/N</u>
<u>Pad Assy</u>	640R332G01	-	-
<u>Mirror Assy</u>	536R188G01	A	5015
Mount DOU	540R565G01	-	-
<u>Plate Assy</u>	540R568G01	A	5016
Strip	540R569G01	B	-
Insulator	758R985G01	-	-
ORA	693R619H01	B	004
<u>ENC 1A14</u>	688R705H01	E	018
<u>RAD Cooler</u>	9RA5216H02	M	033
<u>TH BLKT Kit</u>	661R660G01	A	5016
<u>GSSB</u>	765R061G01	A	-
<u>GSSA</u>	758R943G01	B	5016
<u>SPS</u>	<u>775R150G03</u>	AH	5015
WD	775R151G01	H	-
BUS BAR	640R714G03	U	5014
BUS BAR	640R714G02	U	5016
MAT PL	712R003G02	W	135485-001
Cable J4	640R941G09	R	-
Cable J5	640R941G04	R	-
Cable J6	640R937G01	H	-
Cable J15	640R941G03	R	-
Cable J19	640R930G04	K	-
Cable J20	640R930G02	K	-
Cable J21	640R941G05	R	-

DESCRIPTION	ASSEMBLY NO.	REV.	S/N
Cable J22	640R941G01	R	-
Cable J23	640R943G03	L	-
Cable J24	640R942G04	N	-
Cable J25	640R930G01	K	-
Cable J26	640R941G06	R	-
Cable J27	644R346G01	H	-
Cable J30	640R944G02	J	-
Cable J31	640R942G06	N	-
COAX J7-14	640R913G01	T	-
<u>R/B Assy</u>	693R864G02	B	5004
MOTH BRD	644R081G04	T	002
Cable P4-34	644R235G01	M	134911-004
Cable J2-3	644R236G01	K	-
Cable J4-P7	765R056G02	E	-
2A1A1	765R626G02	B	5008
2A1A2	785R005G03	C	5010
2A1A3	693R808G02	F	5006
<u>R/B Assy</u>	644R665G07	AP	5027
MOTH BRD	644R081G01	T	129534-002
Cable	644R235G01	M	-
Cable	644R236G01	K	-
Cable	765R056G02	E	-
2A2A1	765R626G02	B	5007
2A2A2	785R005G03	C	5009
2A21A3	765R623G02	E	5004
2A102	775R073G02	M	5007
2A302	775R073G02	M	5008

DESCRIPTION	ASSEMBLY NO.	REV.	S/N
2A104	775R071G02	F	5007
2A304	775R071G02	F	5008
2A106	775R075G03	K	5007
2A306	775R075G03	K	5008
2A107	775R055G03	J	5005
2A307	775R055G03	J	5008
2A108	775R054G02	M	5007
2A308	775R054G02	M	5004
2A122	775R020G02	F	5007
2A322	775R020G02	F	5008
2A123	775R021G02	C	5007
2A323	775R021G02	C	5008
2A124	775R022G02	C	5007
2A324	775R022G02	C	5008
2A125	775R008G03	G	5007
2A325	775R008G03	G	5008
2A127	775R014G03	AC	5001
2A327	775R014G03	AC	5008
2A128	775R023G02	B	5007
3A328	775R023G02	B	5008
2A129	775R024G03	F	5007
2A329	775R024G03	F	5008
2A130	775R025G02	C	5007
2A330	775R025G02	C	5008
2A131	775R026G02	D	5007
2A331	775R026G02	D	5008
2A132	775R015G03	J	5008

DESCRIPTION	ASSEMBLY NO.	REV.	S/N
2A332	775R015G03	J	5007
2A133	775R016G03	K	5007
2A333	775R016G03	K	5008
2A134	775R027G02	C	5007
2A334	775R027G02	C	5008
2A135	775R028G02	C	5007
2A335	775R028G02	C	5009
2A136	775R052G02	G	5007
2A336	775R052G02	G	5008
2A137	775R053G03	J	5007
2A337	775R053G03	J	5008
2A138	775R009G02	B	5007
2A338	775R009G02	B	5008
2A201	775R029G02	B	5007
2A202	775R029G02	B	5008
2A203	775R001G02	N	5009
2A204	775R001G02	N	5008
2A205	775R017G03	K	5007
2A206	775R017G03	K	5008
2A207	775R002G02	L	5007
2A208	775R002G02	L	5008
2A209	775R003G03	K	5001
2A210	775R003G03	K	5008
2A211	775R030G03	C	5007
2A212	775R030G03	C	5008
2A213	775R034G02	F	5007
2A214	775R034G02	F	5010

DESCRIPTION	ASSEMBLY NO.	REV.	S/N
2A215	775R031G03	D	5007
2A216	775R031G03	D	5008
2A217	775R004G02	D	5007
2A218	775R004G02	D	5008
2A219	775R005G02	C	5007
2A220	775R005G02	C	5008
2A221	775R006G02	B	5006
2A222	775R006G02	B	5008
2A223	775R010G03	E	5006
2A224	775R010G03	E	5008
2A227	775R032G02	B	5007
2A232	775R032G02	B	5008
2A228	775R007G02	C	5007
2A233	775R007G02	C	5008
2A229	775R018G02	B	5009
2A234	775R018G02	B	5008
2A230	775R019G02	C	5007
2A235	775R019G02	C	5008
2A231	775R033G02	D	5007
2A236	775R033G02	D	5008
2A237	775R011G04	G	5007
2A240	775R011G04	G	5008
2A238	775R012G02	L	5007
2A241	775R012G03	L	5008
2A239	775R013G03	M	5007
2A242	775R013G03	M	5008
<u>SPU</u>	<u>775R140G03</u>	R	5015

DESCRIPTION	ASSEMBLY NO.	REV.	S/N
W/D	758R605G02	B	-
BUS BAR	640R912G01	N	5015
MOTH BRD	640R927G04	AD	134611-002
Cable J1	640R942G05	N	-
Cable J2	640R942G02	N	-
Cable J3	640R941G07	R	-
Cable J4	640R941G02	R	-
Cable J5	640R942G03	N	-
Cable J6	640R937G01	H	-
Cable J7	640R941G08	R	-
Cable J8	640R943G02	L	-
Cable J9	640R943G01	L	-
3A103	775R042G02	D	5007
3A203	775R042G02	D	5008
3A104	775R043G04	G	5007
3A204	775R043G04	G	5008
3A105	775R040G04	G	5007
3A205	775R040G04	G	5008
3A106	775R041G02	B	5007
3A206	775R041G02	B	5008
3A107	775R035G02	G	5007
3A207	775R035G02	G	5008
3A108	775R044G03	D	5007
3A208	775R044G03	D	5008
3A109	775R036G02	D	5007
3A209	775R036G02	D	5008
3A110	775R037G02	D	5007
3A210	775R037G02	D	5008

DESCRIPTION	ASSEMBLY NO.	REV.	S/N
3A111	775R045G04	D	5007
3A211	775R045G04	D	5008
3A112	775R046G02	C	5007
3A212	775R046G02	C	5008
3A113	775R047G02	C	5007
3A213	775R047G02	C	5008
3A114	775R038G02	F	5007
3A214	775R038G02	F	5008
3A116	775R039G02	B	5007
3A216	775R039G02	B	5008
3A116	775R048G02	E	5007
3A216	775R048G02	E	5008
<u>OSU</u>	<u>693R770G02</u>	K	5015
MOTHER BRD	522R783G04	L	134809-002
Cable	644R134G01	M	-
Cable	644R134G02	M	-
11A1	775R049G02	F	5004
11A2	775R050G02	G	5004
BOT Cover	644R047G04	AB	5015
Top Cover	693R778G02	E	5015
<u>PSU</u>	<u>758R050G08</u>	BG	5016
Wiring Doc	690R898G01	V	-
MOTH BRD	765R397G01	A	134646-002
Matrix Plate	765R396G01	B	128283-002
Cable J1	758R607G01	D	-
Cable J9	644R164G01	M	-
Cable J10	644R165G01	M	-

DESCRIPTION	ASSEMBLY NO.	REV.	S/N
Cable J12	644R166G01	M	-
RFI	690R891G01	B	5015
REG COMP	682R089G03	T	5013
12A3	756R609G02	F	5017
12A101	781R982G02	D	5005
12A102	765R571G04	H	5016
12A103	765R575G04	J	5017
12A104	688R489G05	K	5016
12A105	688R491G05	T	5031
12A106	688R491G05	T	5030
12A107	688R493G05	N	5030
12A108	688R493G05	N	5031
12A109	640R998G06	N	5031
12A110	640R998G06	N	5032
12A112	688R481G05	P	5033
12A113	775R051G02	B	5005
12A114	688R481G05	P	5034
12A115	644R864G05	J	5016
12A117	756R593G02	J	5009
12A201	682R381G04	F	5016
12A202	693R711G02	B	5016
12A203	644R078G04	T	5016
12A204	688R502G04	H	5016
12A205	688R499G04	G	5031
12A206	688R499G04	G	5032
12A207	688R503G04	F	5016
12A208	644R069G04	W	5016

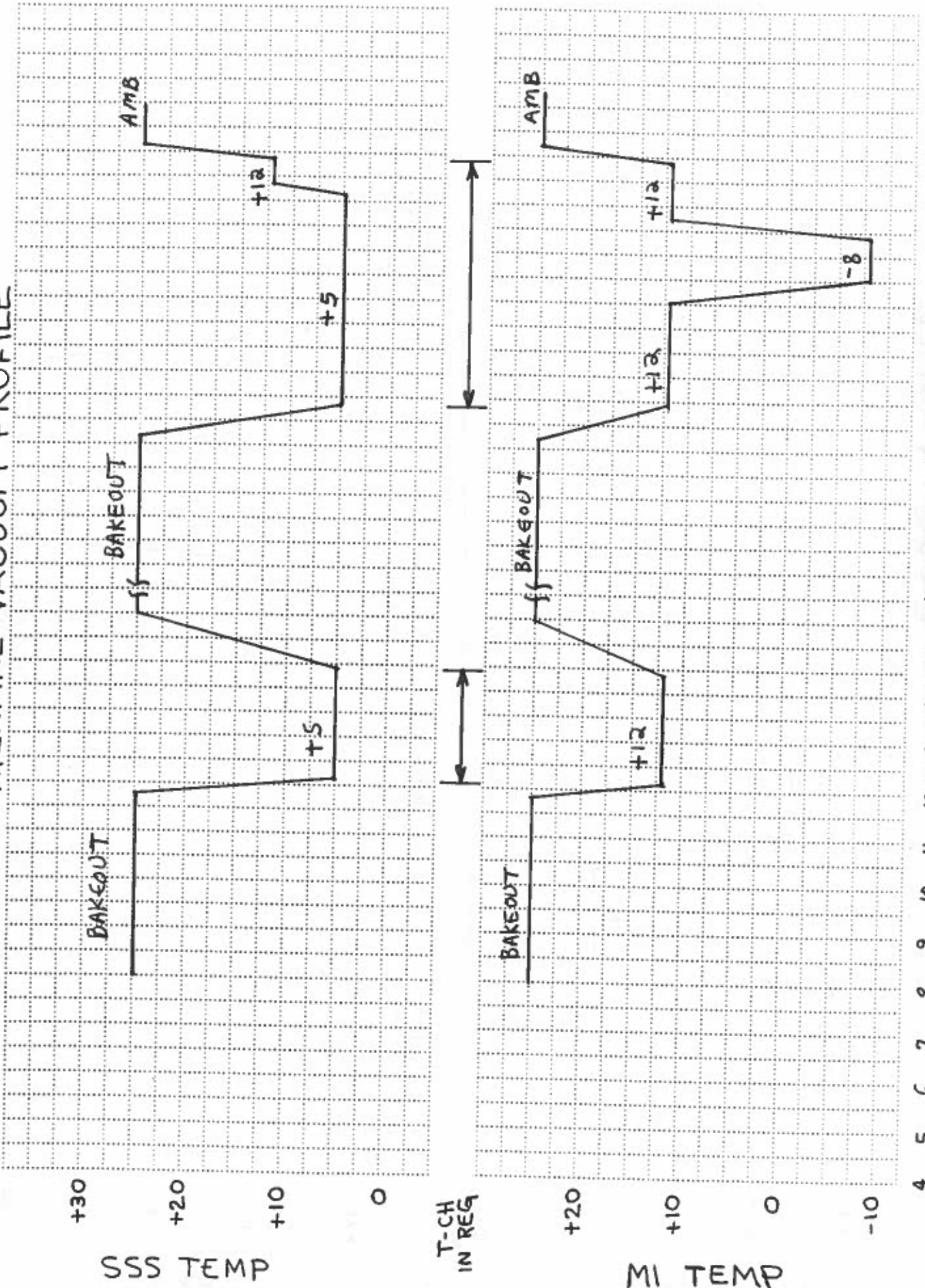
DESCRIPTION	ASSEMBLY NO.	REV.	S/N
12A209	688R505G04	F	5016
12A210	688R504G04	F	5016
12A211	688R500G04	F	5017
12A212	688R495G04	J	5032
12A213	688R495G04	J	5033
12A214	688R497G04	H	5016
Cable	9RA5255H26	AK	012
Cable	9RA5255H19	AK	005
Cable	9RA5255H20	AK	003
Cable	9RA5255H21	AK	006
Cable	9RA5255H22	AK	005
Cable	9RA5255H27	AK	002
Cable	9RA5255H24	AK	005
Cable	9RA5255H25	AK	005
Cable	9RA8118G01	H	-
Cable Coax	644R327G10	K	503R
Cable Coax	644R327G02	K	502R
Cable Coax	644R327G09	K	501R
Cable Coax	644R327G05	K	504
Cable Coax	644R327G06	K	521
Cable Coax	644R328G09	G	510R
Cable Coax	644R328G10	G	511R
Cable Coax	644R328G03	G	508R
Cable Coax	644R328G04	G	509R
Cable Coax	644R328G07	G	506R
Cable Coax	644R328G08	G	507R
Cable Coax	644R329G18	N	514R
Cable Coax	644R329G02	N	513R

DESCRIPTION	ASSEMBLY NO.	REV.	S/N
Cable Coax	644R329G17	N	512R
Cable Coax	644R329G20	N	517R
Cable Coax	644R329G07	N	516R
Cable Coax	644R329G19	N	515R
Cable Coax	644R329G11	N	518
Cable Coax	644R329G12	N	519
Cable Coax	644R329G13	N	520
Tape Recorder	688R461H02	H	068
Tape Recorder	688R461H02	H	069
Tape Recorder	688R461H02	H	070
Tape Recorder	688R461H02	H	071

1.5 Thermal Vacuum Profiles

The OLS #20 AVE underwent a series of Thermal Vacuum Tests. The profiles on the next pages represent the history of pumpdowns, SSS temperature and MI temperatures experienced by the OLS #20 AVE.

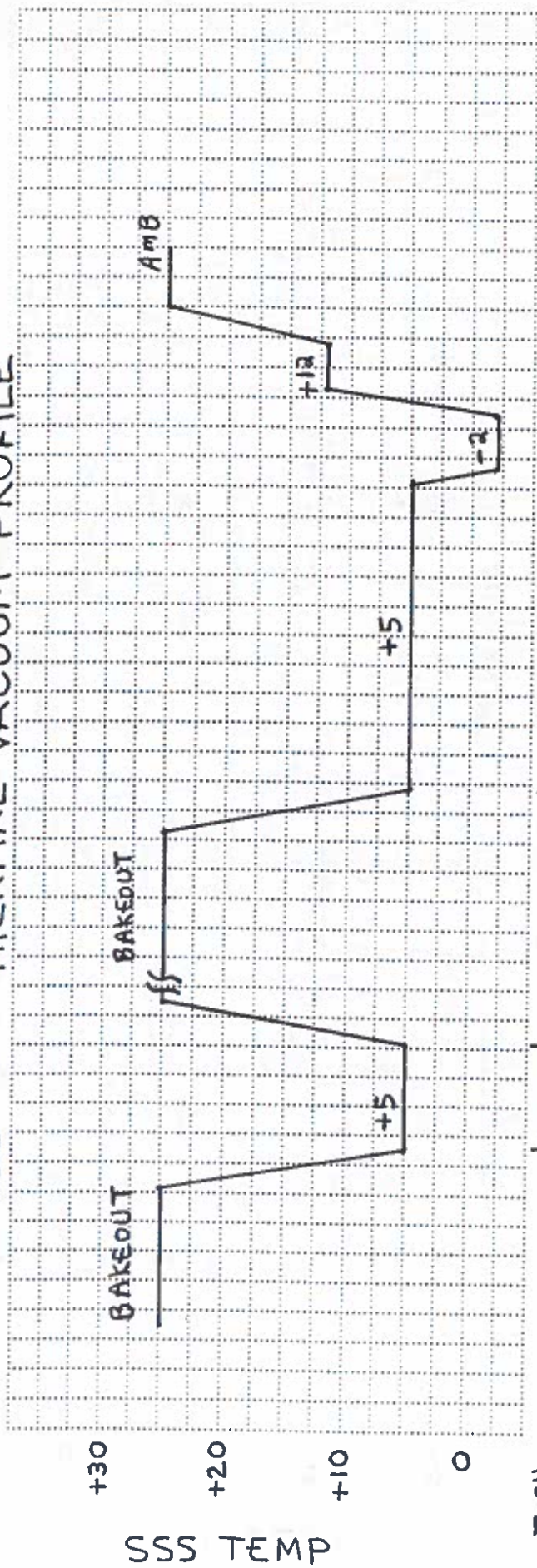
OLS #20 THERMAL VACUUM PROFILE



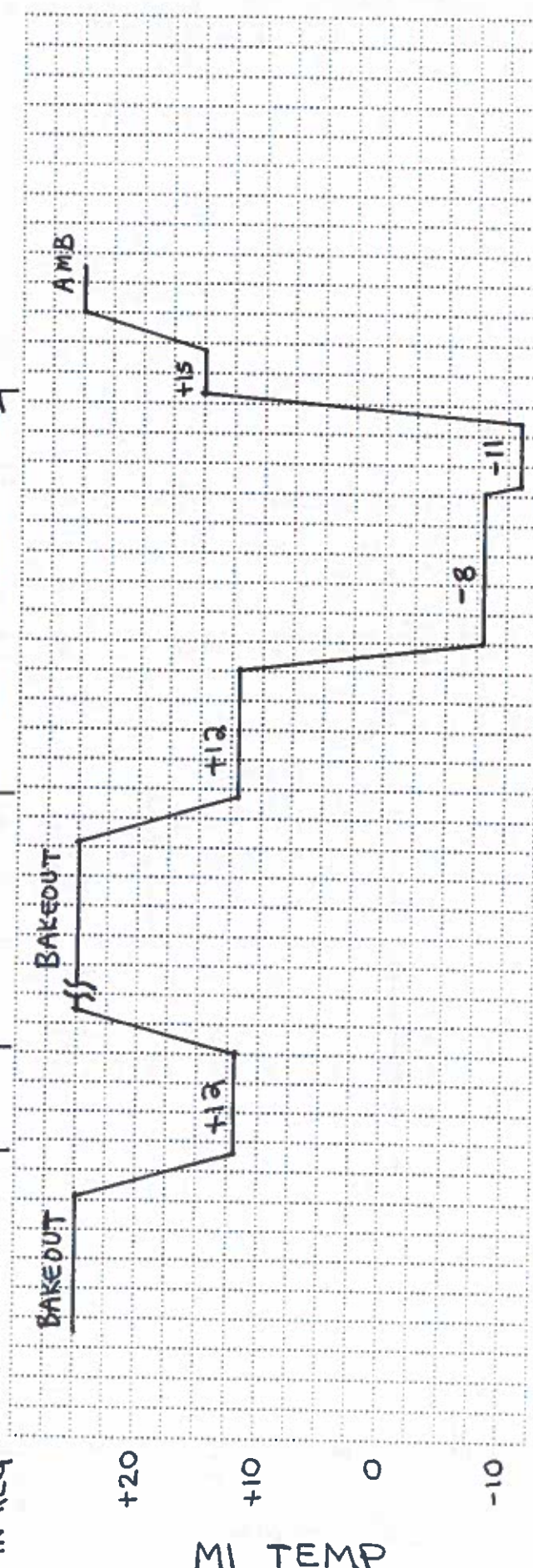
1-27

AUGUST 94

OLS #20 THERMAL VACUUM PROFILE



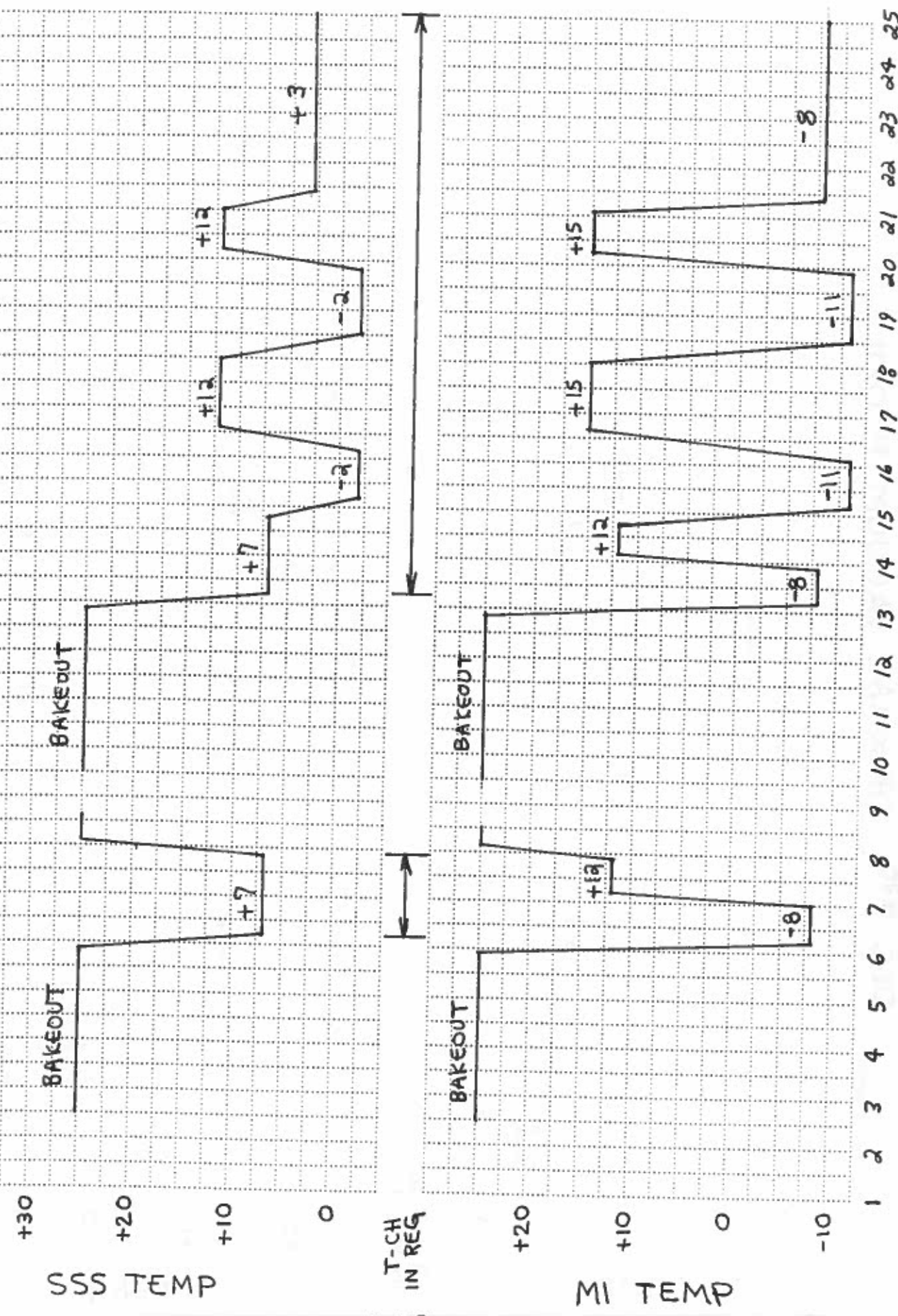
T-CH IN REG



JANUARY 95

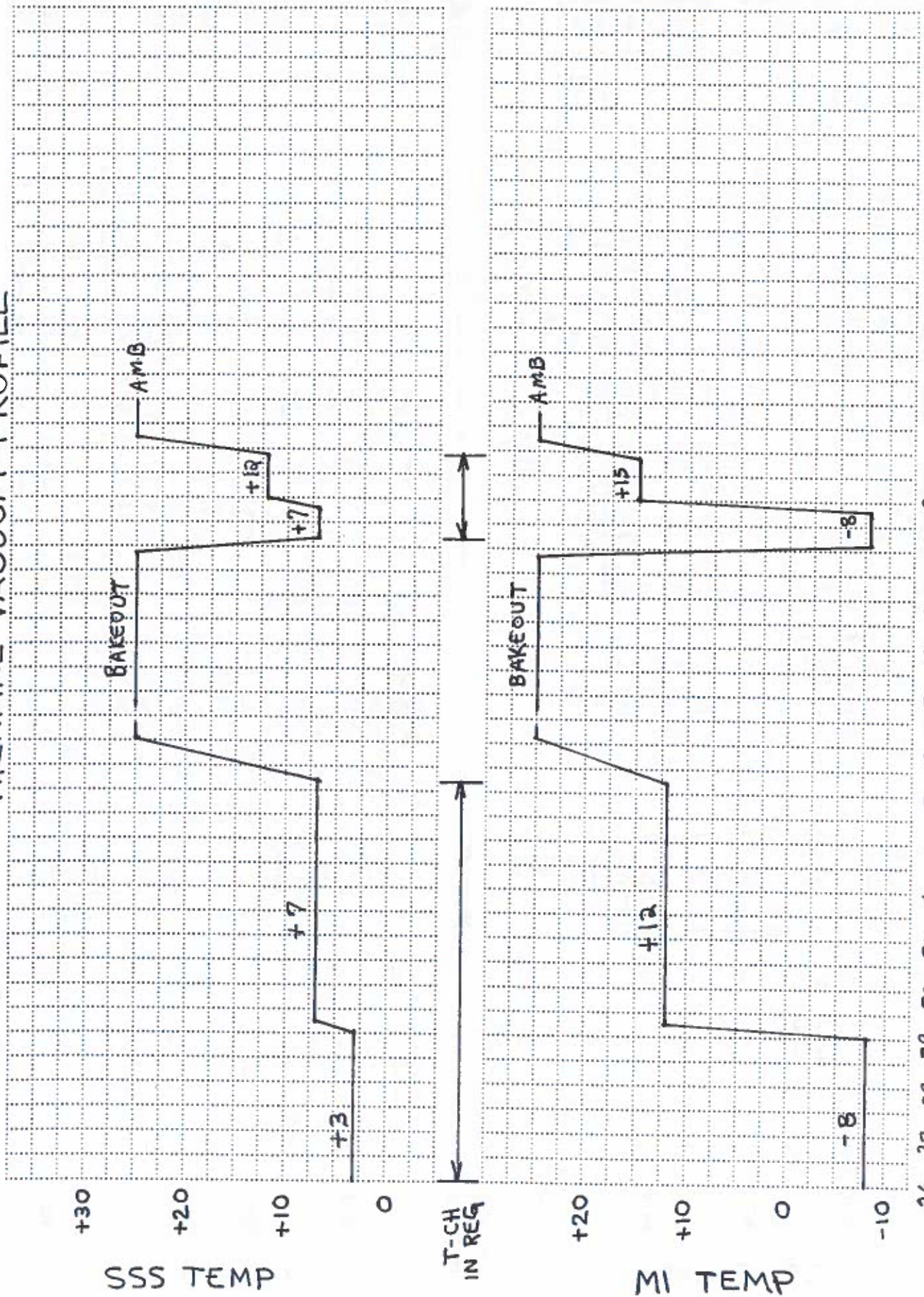
FEBRUARY 95

OLS #20 THERMAL VACUUM PROFILE



MARCH 95

OLS #20 THERMAL VACUUM PROFILE



1.6 Test History Calendar

The test history calendar is a capsule look at the day-to-day progress of the OLS #20 AVE throughout its testing period at WEC.

UNIT OLS #20

TEST HISTORY

DATE APR ' 94

2	1					
9	8	7	6	5	4	3
16	15	14	13	12	11	10
23	22	21	20	19	18	17
30	29	28	27	26	25	24

4x5x1
4x2x1
4x6x1
4x7x1
4x9x1

4x13
4x3x1
APC 3PT

4x1x1
4x1x2
4x4x1

20 Connected
up system
7x1

27 No Testing
1302 part
replacement

26 6x2x1
6x3x1

25 AHSF7PT
APC 7PT

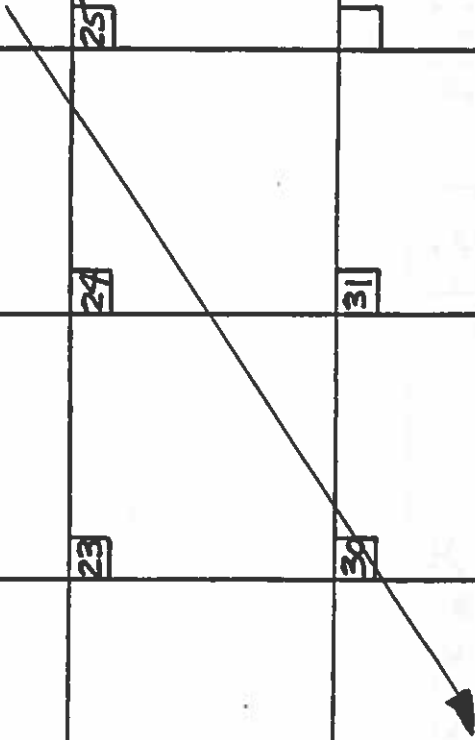
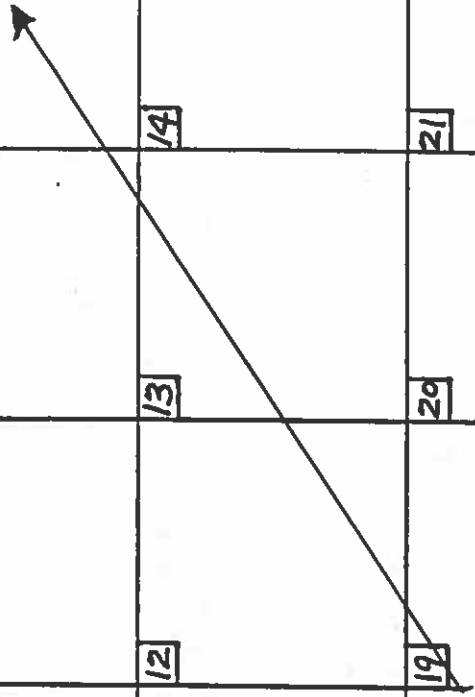
24 4x10x1
6x6x2
6x5x1



UNIT OLS #20 TEST HISTORY DATE MAY '94

11	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

No Testing



1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20
21	22	23	24
25	26	27	28

No Testing

No Testing

No Testing

No Testing

18

4x4x1
6x2x1
6x5x1

No Testing

17

12A3F8 &
F13 fuses
blown
6x5x1

25

OATIF
calibration
check
6x3x1
6x3x2
6x3x3

24

AHSFB1IPT
6x4x3A
Funct Tests
Config
Tests

23

MPA1IPT
AHSF3PTI
AHC1IPT
6x2x4
6x2x1

22

MPA1IPT
APC3PT
4x5x1

21

4x4x1
6x2x1
6x5x1
OLS #20 PSU
installed
MHC1IPT

20

6x8x2
6x11x1
6x11x2
6x11x3

30

Funct Tests
Config
Tests

29

APC1IPT
Funct Tests

28

6x11x4
Funct Tests

27

6x7x2
6x9

UNIT OLS #20

TEST HISTORY

DATE JUL '94

31	Config Tests					1	Config Tests	2	6x10 Config Tests
3	Config Tests	4	No Tests	5	Config Tests	6	Config Tests	7	Config Tests
10	Config Tests 9x1x2	11	Funct Tests 9x1x4 9x1x5	12	9x1x3	13	SIMFLT Funct Tests	14	9x1x6 Funct Tests
17	Funct Tests	18	SPS Vib 10 V current drop-outs OSU, SPU, PSU x axis Vib	19	OSU, SPU, PSU Y&Z axis Vib	20	SSS Vib ReVib of SPS	21	No Tests
24	No Tests	25	Funct Tests	26	AHSF7PT AHSF3PTI AHSFB9PT Funct Tests MHA7PT 6x2x1 6x2x4	27	MPA7PT 6x4x3A APC7PT 6x3x1 6x6x2 9x1x4 AHSF7PT 6x7x2	28	7x5 7x8 Funct Tests
								29	Funct Tests 9x1x1 Config Tests
								22	No Tests
								15	Funct Tests Config Tests
								8	Config Tests APC11PT
								9	Config Tests 9x1x1
								16	Funct Tests
								23	No Tests
								30	Config Tests

UNIT OLS #20

TEST HISTORY

DATE AUG '94

	<p>1] Config Tests</p>	<p>2] Config Tests TF glitch noted</p>	<p>3] Config Tests T/s glitch</p>	<p>4] Installed System in TV Chamber</p>	<p>5] AHSF7PT MHA7PT 6x5x1 PMT removed HOTTEST PMT reinstalled</p>	<p>6] SIMFLT</p>
<p>7] 6x3x1 6x6x2 6x3x4 6x3x5 Funct Tests</p>	<p>8] Funct Tests AHSF7PT 6x2x2 6x7x2 6x7x1 7x9 7x10 7x11 7x13 6x9 End Bell Closed @ 2225</p>	<p>9] AMOS.TP Bake-out</p>	<p>10] KEVAN.TP Bake-out</p>	<p>11] KEVAN.TP Bake-out</p>	<p>12] 7x7 4x13 Funct Tests</p>	<p>13] APC7PT MHC7PT 6x5x1 4x9x1 AHSF7PT 6x2x2 MPA7PT 6x3x1 6x3x4 6x6x2 6x9 6x3x5 T Patch Heater not coming ON</p>
<p>14] Funct Tests Chamber Warm-up @ 1100</p>	<p>15] Door open @ 1200 4x6x1 7x3 7x11 Funct Tests 7x0</p>	<p>16] Pumpdown</p>	<p>17] Bake-out</p>	<p>18] Bake-out</p>	<p>19] 7x7 6x3x4 6x2x2</p>	<p>20] AHSF7PT AHSFB9PT 6x7x1 4x8x1 T Gain low TIZIT2318</p>
<p>21] TIZIT2318 6x2x4 ASV310</p>	<p>22] TIZIT229B ASV290 TIZIT227B MTC7PT ASV270 6x5x2 ATSF7PT 6x3x3 MI to -8 7x12</p>	<p>23] MI - -8 TIZIT221A ASV 210, 310 MI back to +12 ASV 210, 310</p>	<p>24] TIZIT221A SSS to +12 TIZIT221A ASV 210, 310 Began Chamber warm-up</p>	<p>25] Door Open Check T-detector bias currents 6x2x2 SSS to Blue Room</p>	<p>26] T/s T-Ch</p>	<p>27] →</p>
<p>28] →</p>	<p>29] →</p>	<p>30] →</p>	<p>31] →</p>			

UNIT OLS #20

TEST HISTORY

DATE SEP '94

				<p>1 Reinstalled SSS in TV Chamber 4x6x1 7x3, 7x11 7x2, 7x9 7x10</p>	<p>2 6x2x2 AHSF7PT 6x4x3A 6x3x3 Pumpdown @ 0740</p>	<p>3 Bake-out</p>
<p>4 Bake-out</p>	<p>5 Bake-out 7x7</p>	<p>6 6x2x2 4x8x1 T Gain still low TZIT2310 ASV 210 310 ASV 240</p>	<p>7 ATSF7PT MI to -8 ASV 210 MI to -4 ASV 210 MI to 0 ASV 210</p>	<p>8 MI to -8 ASV 210 TZIT231A 6x5x1 6x2x2 MHC7PT 6x3x3 ASV 310 ASV 210 IMC off Begun Warm-up</p>	<p>9 Removed SSS for T/S</p>	<p>10</p>
<p>11</p>	<p>12</p>	<p>13</p>	<p>14</p>	<p>15</p>	<p>16</p>	<p>17</p>
<p>18</p>	<p>19</p>	<p>20</p>	<p>21</p>	<p>22</p>	<p>23</p>	<p>24</p>
<p>25</p>	<p>26</p>	<p>27</p>	<p>28</p>	<p>29</p>	<p>30</p>	<p>T-Oh T/S</p>

TEST HISTORY

UNIT OLS # 20

DATE OCT '94

30	31								
2	3 PSU 4/15/96 vibration 3 axis	4	5	6	7	8			
9	10	11	12	13	14	15			
16	17	18	19	20	21	22			
23	24	25	26	27	28	29			

UNIT OLS #20 TEST HISTORY DATE Nov '94

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26	27	28	29	30
	DHS Supporting TIA Test			
	DHS Supporting TIA Test			

UNIT OLS #20

TEST HISTORY

DATE JAN '95

11	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

					Began Post-beamsplitter repair test	No Tests
No Tests	7x1 4x1x1 4x1x2	4x5x1 6x2x1 6x3x2 AHSF3PTI	MHC11PT MPA11PT AHC11PT 6x4x3A 7x8 4x6x1 6x7x1 6x7x2 APC11PT	SIMFLT	SSS 3 axis Vib BVS 2804	SSS 3 axis vib BVS 2804
No Tests	Cabled in up SSS in Blue Rm Funct Tests	Funct Tests 6x4x3A 6x6x2 AHSF3PTI AHSF7PT	APC7PT MHA7PT MPA7PT 7x5 6x2x1 6x3x1 6x7x2 7x8	Moved to POL	Funct Tests	No Tests
No Tests	Funct Tests	AHSF7PT 6x3x4 6x3x5 MHA7PT 6x5x1 4x11x1 Funct Tests 6x2x2 6x3x1 6x7x1 6x7x2 6x6x2	SIMFLT Funct Tests 6x9 7x9 ASH-HALF-WATT 7x10 7x13 7x3 Pumpdown @1600	Bake-out	Bake-out 7x7 4x13	
AHSF7PT 4x9x1 AHSFB9PT 6x5x1 Funct Tests MHC7PT	4x8x1 Can't adjust T-Rgt bias to Gain Chamber Warm-up @1300	T-Pet drive Tool gears were removed & cleaned 7x11 Pumpdown @1800				

UNIT OLS #20

TEST HISTORY

DATE FEB '95

<p>5 6x3x3 ATSF7PT MTC7PT 6x5x2 6x2x2 6x2x5 6x3x1 6x3x5 6x6x2</p>	<p>6 6x7x3 MI to -8 Funct Tests MI = -8 @ 1700 4x8x3</p>	<p>7 6x2x4 ASV210 G T121T231A AHSF7PT T123T229A T125T227A ASV270 TOCRM3A MTC7PT MHC7PT</p>	<p>8 ATSF7PT 6x5x1 6x5x2 Funct Tests</p>	<p>9 T123T231A To @ 18 Soak @ 0205 9x1x3 6x10 6x2x2 T121T231B SIMFLT</p>	<p>10 To H/T Soak @ 0516 9x1x6 T121T231B 6x2x2 SIMFLT 6x10</p>	<p>11 Chamber Warm-up</p>	<p>12 No Tests</p>	<p>13 Opened End Bell removed T-pot tool installed 1 HRD shim BB'S installed</p>	<p>14 No Tests BB3 BYPASS Problem</p>	<p>15 No Tests</p>	<p>16 No Tests</p>	<p>17 T/S BB3 BYPASS Funct Tests</p>	<p>18 No Tests</p>	<p>19 No Tests</p>	<p>20 No Tests</p>	<p>21 Funct Tests AHSF7PT SPS removed for T/S Blown Transistor on Red/Black Board</p>	<p>22 SPS Repair</p>	<p>23 No Tests</p>	<p>24 No Tests</p>	<p>25 No Tests</p>	<p>26 No Tests</p>	<p>27 No Tests</p>	<p>28 No Tests</p>	<p>29 No Tests</p>	<p>30 No Tests</p>	<p>31 No Tests</p>	<p>32 No Tests</p>	<p>33 No Tests</p>	<p>34 No Tests</p>	<p>35 No Tests</p>	<p>36 No Tests</p>	<p>37 No Tests</p>	<p>38 No Tests</p>	<p>39 No Tests</p>
---	--	--	--	--	--	-----------------------------------	------------------------	--	---	------------------------	------------------------	--	------------------------	------------------------	------------------------	---	--------------------------	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------

UNIT OLS #20

TEST HISTORY

DATE MAR '95

				1 Installed SPS in Chamber	2 Funct Tests 6x2x2 6x5x1 ASH-HALF-WATT 7x9 7x10 Pumpdown @ 1250	3 Bake-out	4 Bake-out
5 Bake-out	6 7x7 @ +7/-8 Funct Tests 6x2x3A TDCRM29 ATSF7PT	7 T12IT231G 6x5x2 6x5x1 MTC7PT Funct Tests T12IT221S Mi to +12 ETC Problem	8 6x2x3A TDCRM29 ATSF7PT 6x5x2 MTC7PT 6x5x1 Chamber Warmup	9 End Bell open T/S ETC Preset problem Pumpdown @ 1725	10 Bake-out	11 Bake-out	
12 Bake-out 7x7	13 @ +7/-8 6x2x3A TDCRM29 T12IT231G T12IT221S	14 @ +7/+12 6x2x3A TDCRM29 T12IT231H To Cold Soak #/	15 Funct Tests SIMFLT T12IT231B 6x2x2	16 Funct Tests To Hot Soak #/ 6x2x2 T12IT231B	17 SIMFLT Funct Tests	18 To Cold Soak #2 7X4A SIMFLT	
19 T12IT231B Funct Tests	20 To Hot Soak #2 9x1x6 T12IT231B SIMFLT	21 Funct Tests To Cold Limits 9x1x3	22 6x2x3A T12IT231B ASV 210 310 SIMFLT	23 T123T229B AHSF3PTI 6x2x4 6x2x5 T125T227B ASV 270 Funct Tests T119T220B TDCRM3B 6x2x2	24 9x1x3 Funct Tests AHC11PT	25 Funct Tests APC11PT	
26 Funct Tests 9x1x4 9x1x1 ATC11PT	27 6x11x1 6x3x4 6x3x5 6x3x3 MHC11PT AHSFB9PT MPA11PT	28 6x7x3 6x3x1 MTC11PT 6x11x2 6x11x3 6x11x4 6x10 Funct Tests	29 6x6x1 6x6x2 6x6x3 6x9 6x7x1 9x1x2 To Hot Limits 7x4B 9x1x2 Funct Tests	30 SIMFLT Funct Tests 6x2x3A T12IT231B ASV 210 310 AHSF3PTI	31 AHC7PT T123T229B 6x2x4 6x3x5 6x2x5 MHC7PT Funct Tests T125T227B ASV 270 6x7x3		

UNIT OLS #20

TEST HISTORY

DATE APR '95

1	T119T220B TDC-RM3B ATS7PT 6x3x3 9x1x6 AHSFB9PT APC-7PT 6x2x2 MPA3PT																	
2	9x1x4 6x3x4 6x3x1 6x11x1 6x11x2 6x11x3 6x11x4	3	6x10 6x6x1 6x6x2 6x6x3 9x1x1 Funcy Tests Chamber Warm-up	4	opened End Bell Adjusted M4's Adjusted M4's 6x2x2 6x7x1 Pump @ 2100	5	Bake-out	6	Bake-out	7	Bake-out	8	7x7 6x2x2 6x7x1 @+7/-8 T121T231B 6x7x3 to Hot Soak	15				
9	T121T231B 6x2x2 SIMFLT Chamber Warm-up	10	opened End Bell Moved system to Blue Rm.	11	AHSFIPT	12	7x5 6x2x1 6x7x1 6x7x2	13		14								
16		17		18		19		20		21		22						
23		24		25		26		27		28		29						

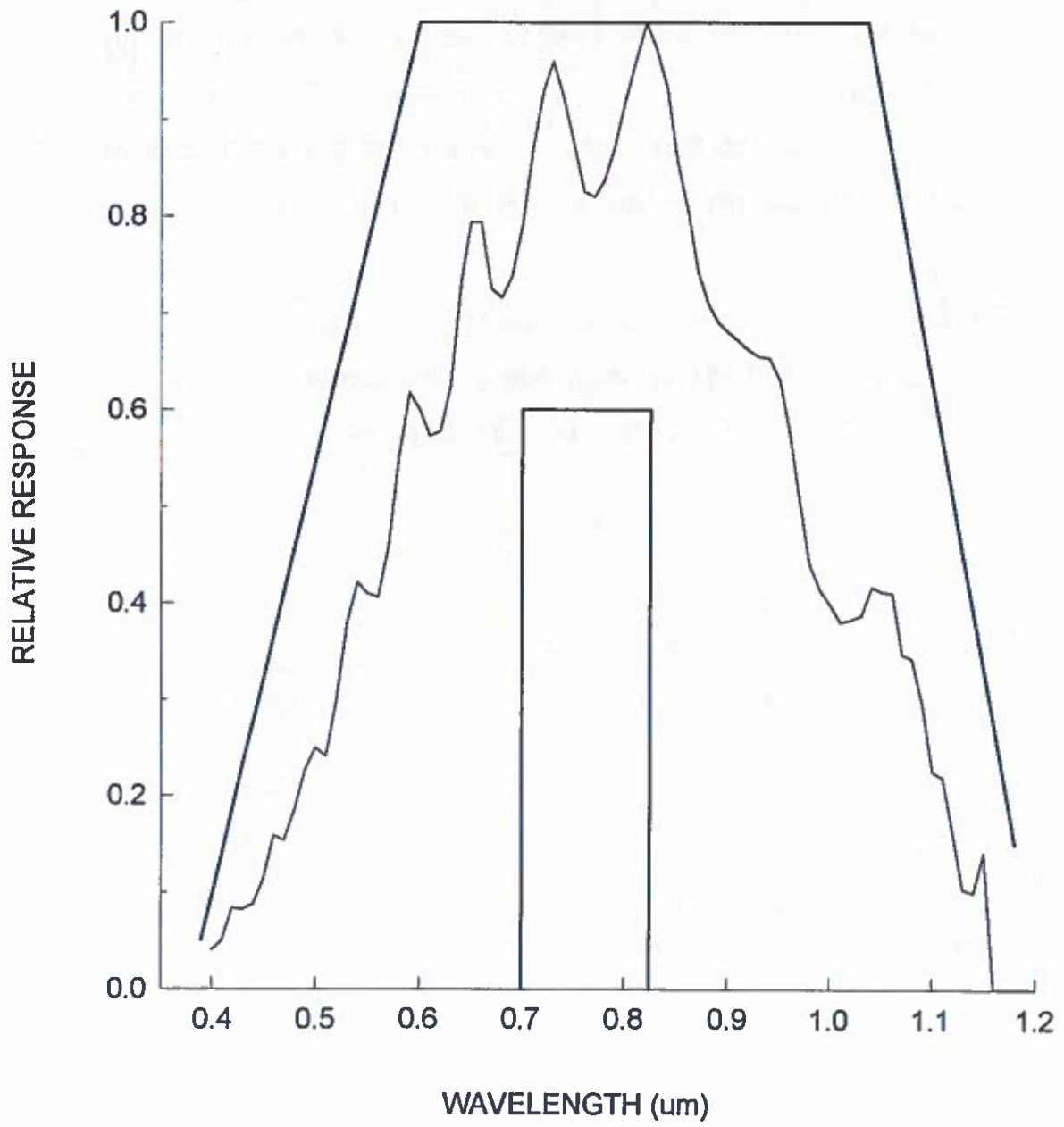
2.0 DEVELOPMENT SPECIFICATION REQUIREMENTS

2.1 Spectra (3.2.1.1.1.1, 3.1.1.1.2, 3.1.1.1.3)

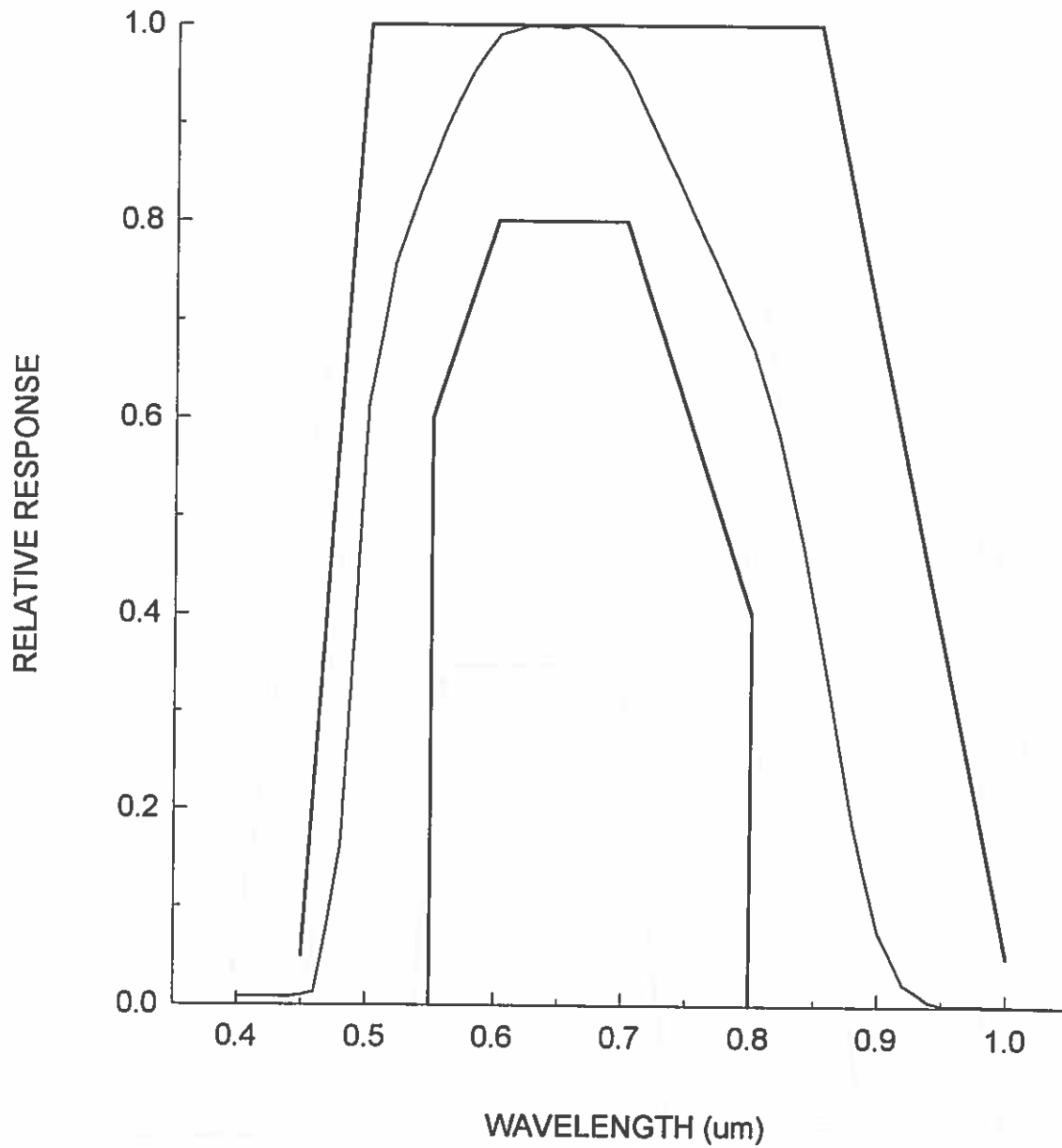
The OLS #20 Channel spectral responses are calculated by computer programs (GAINSET for L Channel and TGAIN for T channel) utilizing vendor spectral response data for the detectors, mirror and lens transmissivities/ reflectivities, and solar & lunar spectral radiance.

As calculated by these programs, the OLS #20 T channel, L Day and L Nite spectral responses are within specification.

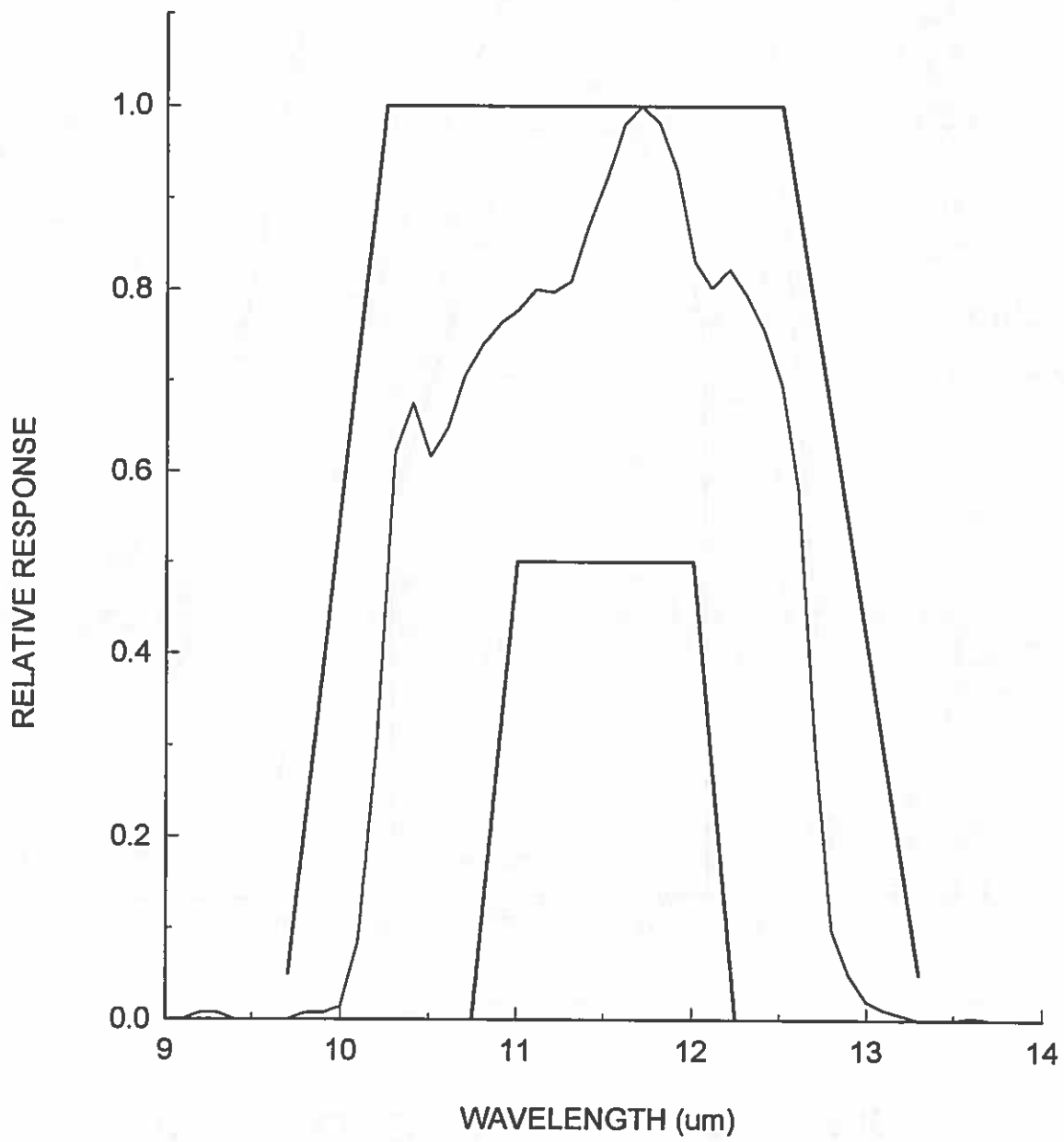
ATTACHMENTS: OLS #20 HRD Channel Spectral Response.
OLS #20 PMT Channel Spectral Response.
OLS #20 T Channel Spectral Response.



OLS20 VISIBLE DAY SPECTRUM



OLS20 VISIBLE NIGHTTIME SPECTRUM



OLS20 T CHANNEL SPECTRUM

2.2 GEOMETRIC RESOLUTION

2.2.1 Fine Geometric Resolution - Infrared (3.2.1.1.2.1)

The TF Surface Resolution Parameter (SRP) is within the development specification limits.

The STS Computer programs calculate and plot the Fine Primary SRP, and the T Right & Left Fallback modes. In addition, all Specification required modes are tabulated and presented. The designations on the graphs are defined as follows:

TF T Fine Electronics

TS T Smooth Electronics

2.2.1.1 Baseline (Orbit Nominal)

Effective with OLS18 the nominal environment is no longer part of OLS testing.

2.2 Geometric Resolution (Cont'd)

2.2.1 Fine Geometric Resolution, Infrared (Cont'd.) (3.2.1.1.2.1)

2.2.1.2 Acceptance - Vibration

Effective with OLS 18 previbration testing is no longer done on the T channel. The T channel is accepted by similarity to OLS's 12 thru 17 contingent on all other alignment/synchronization and MTF data being in spec and typical of the performance of prior OLS units.

2.2 Geometric Resolution (Cont'd)

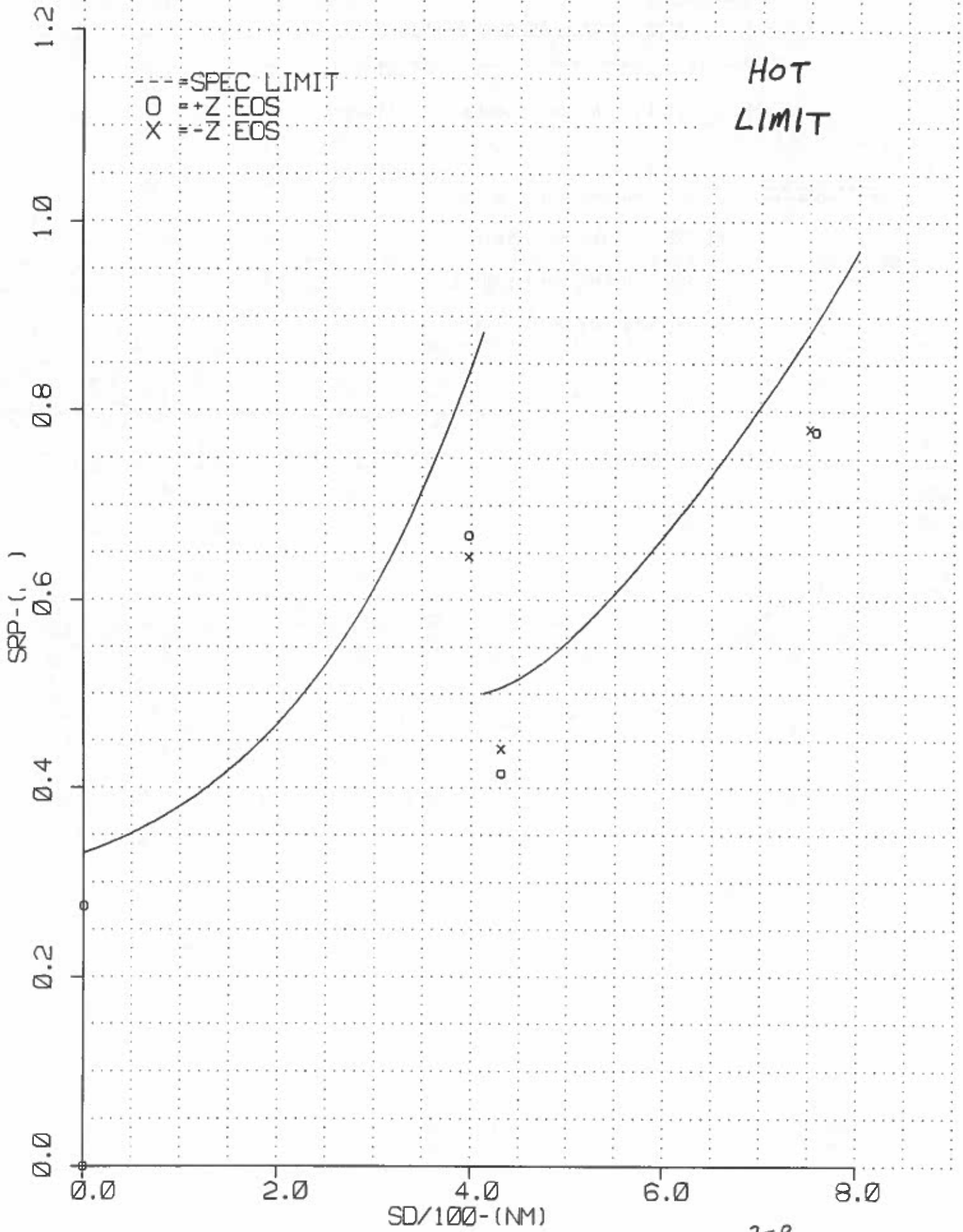
2.2.1 Fine Geometric Resolution, Infrared (Cont'd) (3.2.1.1.2.1)

2.2.1.3 Acceptance - Thermal Vacuum

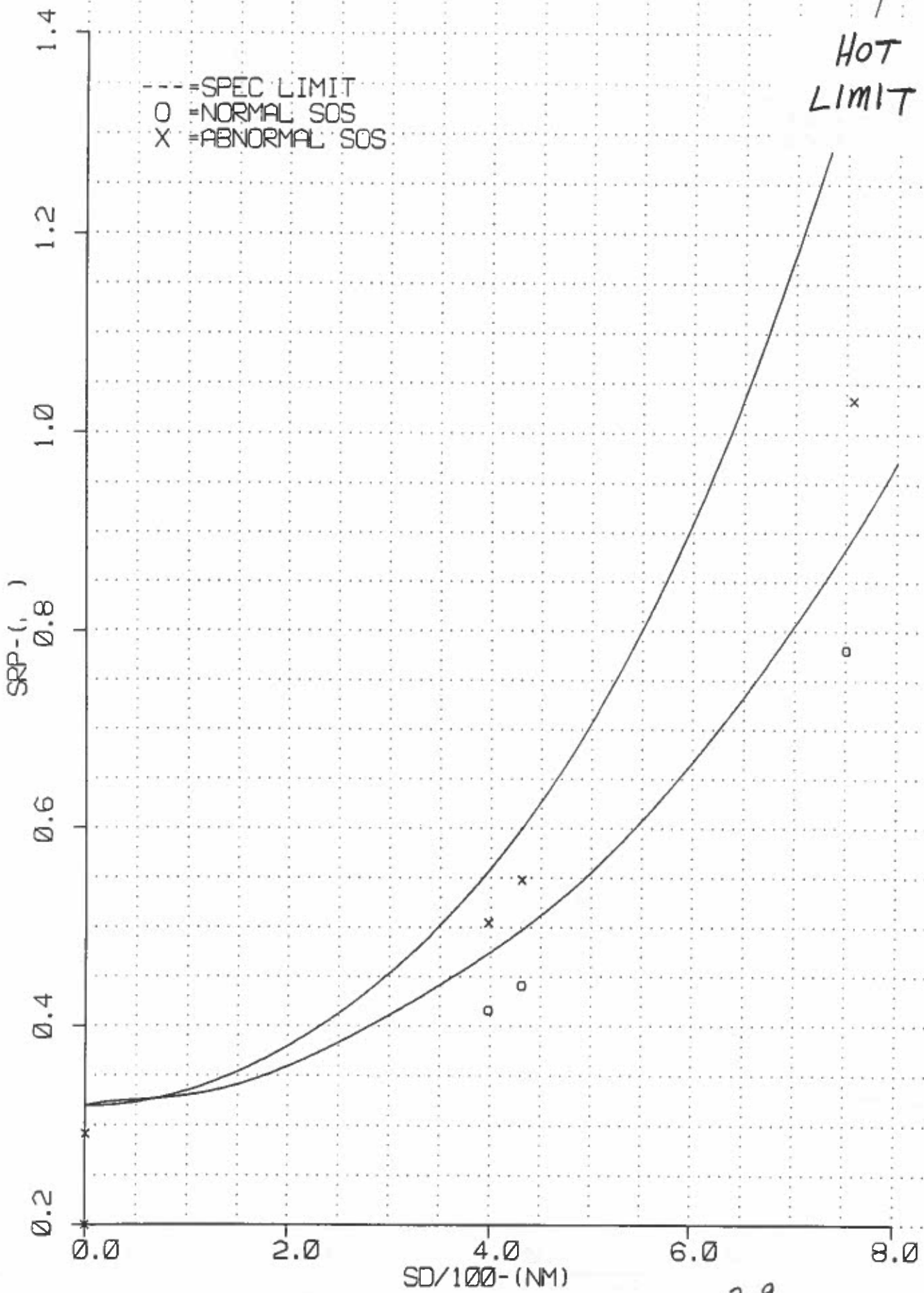
The attached TF SRP curves and tables demonstrate in-spec performance at the thermal vacuum test limits.

ATTACHMENTS: TF SRP Curves Hot Limits
TF SRP Tables Hot Limits
TF SRP Curves Cold Limits
TF SRP Tables Cold Limits

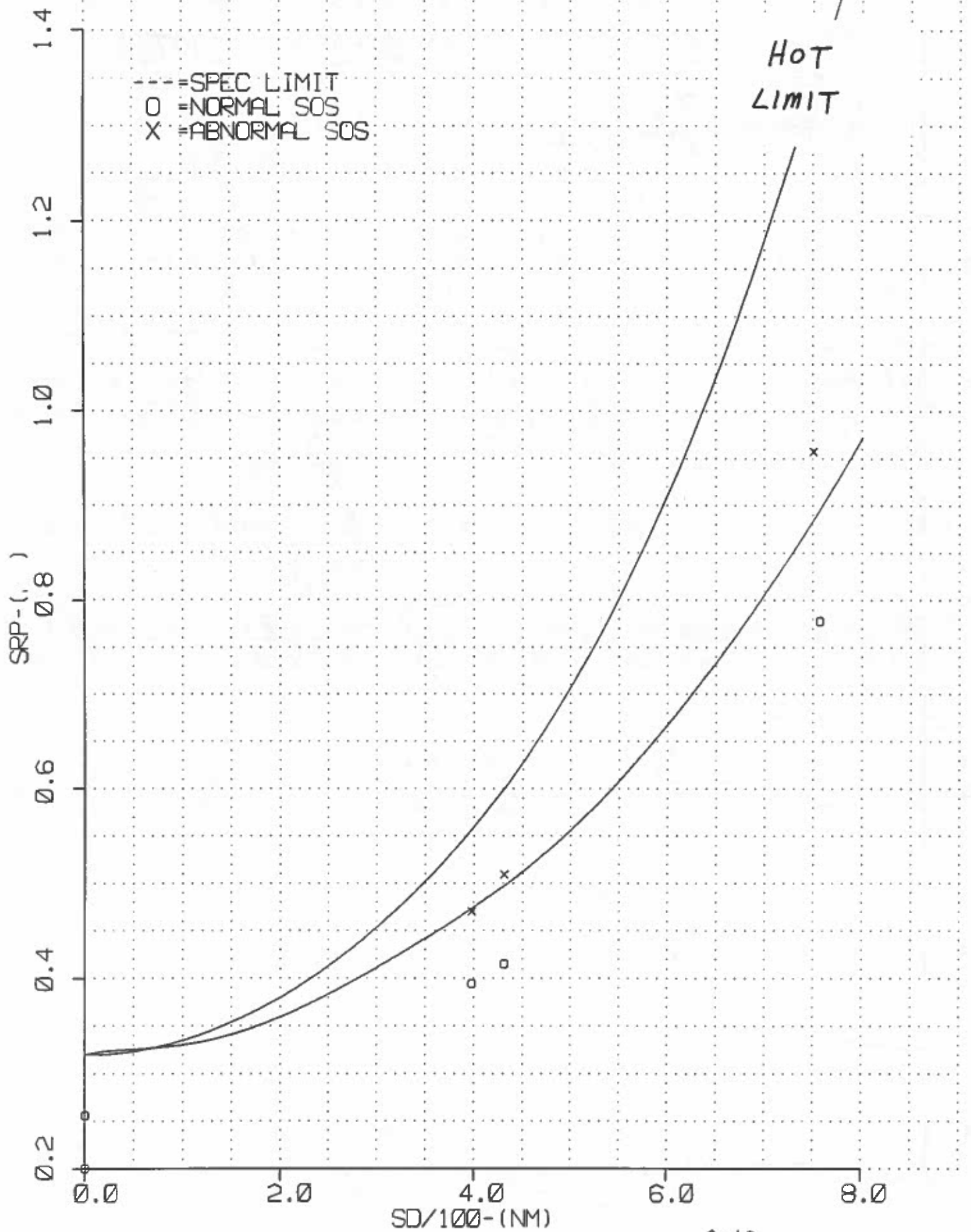
SYSTEM 20, SRP TF NORMAL, SSS=7, M1=12, DATE:41



SYSTEM 20, SRP TF L FBAK, SSS=7, M1=12, DATE:41



SYSTEM 20, SRP TF R FBAK, SSS=7, M1=12, DATE:41



T, COMPLETE, SRP (NM)

FLT. NO. = 20 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 41

SEG	SUR. DIST. (NM)	TFP	TFB	TSP	TSB
LFT	-750.	0.781	0.767	1.760	1.756
MID	-750.	1.323	0.000	1.876	1.872
RGT	-750.	0.957	0.950	1.769	1.765
LFT	0.	0.000	0.000	0.000	0.000
MID	0.	0.000	0.000	0.000	0.000
RGT	0.	0.000	0.000	0.000	0.000
LFT	-431.	0.441	0.430	1.477	1.474
MID	-431.	0.641	0.000	1.504	1.501
RGT	-431.	0.509	0.495	1.484	1.480
LFT	-398.	0.416	0.407	1.422	1.419
MID	-398.	0.646	0.633	1.441	1.438
RGT	-398.	0.470	0.458	1.424	1.421
LFT	0.	0.000	0.000	0.000	0.000
MID	0.	0.000	0.000	0.000	0.000
RGT	0.	0.000	0.000	0.000	0.000
LFT	0.	0.291	0.285	0.979	0.976
MID	0.	0.275	0.269	0.978	0.976
RGT	0.	0.256	0.251	0.976	0.974
LFT	0.	0.000	0.000	0.000	0.000
MID	0.	0.000	0.000	0.000	0.000
RGT	0.	0.000	0.000	0.000	0.000
LFT	398.	0.504	0.489	1.425	1.421
MID	398.	0.668	0.657	1.439	1.435
RGT	398.	0.394	0.386	1.414	1.411
LFT	431.	0.548	0.531	1.485	1.482
MID	431.	0.677	0.000	1.504	1.501
RGT	431.	0.415	0.406	1.467	1.463
LFT	0.	0.000	0.000	0.000	0.000
MID	0.	0.000	0.000	0.000	0.000
RGT	0.	0.000	0.000	0.000	0.000
LFT	757.	1.033	1.025	1.796	1.792
MID	757.	1.662	0.000	1.993	1.990
RGT	757.	0.778	0.764	1.733	1.729

T, COMPLETE, SRP RATIO

SEG	SUR. DIST. (NM)	TFP	TFB	TSP	TSB
LFT	-750.	0.883	0.867	0.783	0.781
MID	-750.	0.000	0.000	0.834	0.832
RGT	-750.	0.714	0.709	0.787	0.785
LFT	0.	0.000	0.000	0.000	0.000
MID	0.	0.000	0.000	0.000	0.000
RGT	0.	0.000	0.000	0.000	0.000
LFT	-431.	0.887	0.866	0.923	0.921
MID	-431.	0.000	0.000	0.939	0.937
RGT	-431.	0.849	0.825	0.927	0.925
LFT	-398.	0.878	0.859	0.927	0.925
MID	-398.	0.769	0.754	0.939	0.937
RGT	-398.	0.844	0.822	0.928	0.926
LFT	0.	0.000	0.000	0.000	0.000
MID	0.	0.000	0.000	0.000	0.000
RGT	0.	0.000	0.000	0.000	0.000
LFT	0.	0.911	0.889	0.932	0.930
MID	0.	0.830	0.812	0.932	0.930
RGT	0.	0.800	0.783	0.930	0.927
LFT	0.	0.000	0.000	0.000	0.000
MID	0.	0.000	0.000	0.000	0.000
RGT	0.	0.000	0.000	0.000	0.000
LFT	398.	0.906	0.879	0.929	0.927
MID	398.	0.796	0.783	0.938	0.936
RGT	398.	0.833	0.817	0.922	0.920
LFT	431.	0.913	0.885	0.928	0.925
MID	431.	0.000	0.000	0.939	0.937
RGT	431.	0.834	0.816	0.916	0.914
LFT	0.	0.000	0.000	0.000	0.000
MID	0.	0.000	0.000	0.000	0.000
RGT	0.	0.000	0.000	0.000	0.000
LFT	757.	0.759	0.753	0.795	0.793
MID	757.	0.000	0.000	0.882	0.880
RGT	757.	0.869	0.853	0.767	0.765

TF, LEFT, PRIMARY

FLT. NO. = 20 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 41

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-750.	0.781	0.883
0.	0.000	0.000
-431.	0.441	0.887
-398.	0.416	0.878
0.	0.000	0.000
0.	0.291	0.911
0.	0.000	0.000
398.	0.504	0.906
431.	0.548	0.913
0.	0.000	0.000
757.	1.033	0.759

TF, LEFT, BACKUP

FLT. NO. = 20 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 41

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-750.	0.767	0.867
0.	0.000	0.000
-431.	0.430	0.866
-398.	0.407	0.859
0.	0.000	0.000
0.	0.285	0.889
0.	0.000	0.000
398.	0.489	0.879
431.	0.531	0.885
0.	0.000	0.000
757.	1.025	0.753

TF, RIGHT, PRIMARY

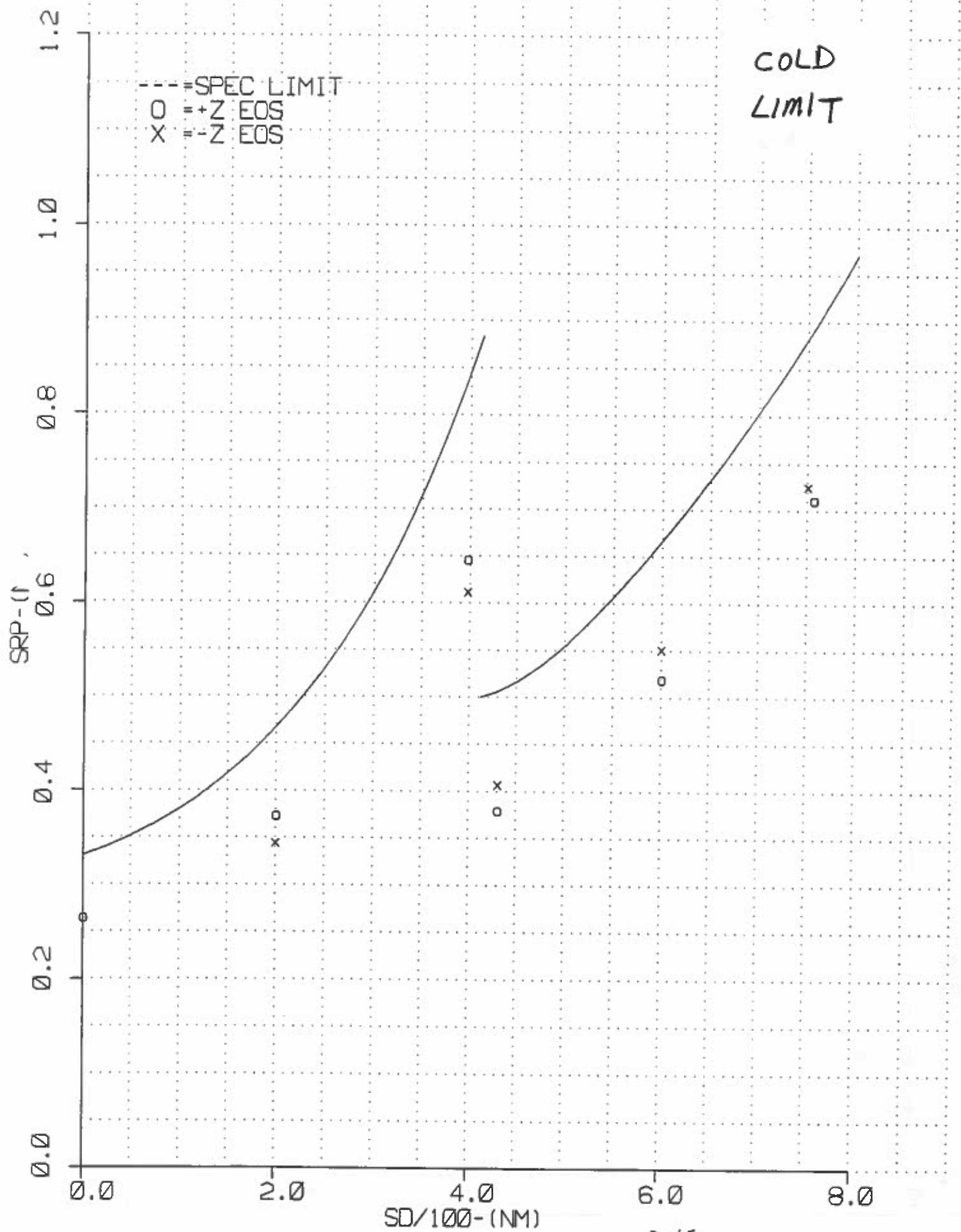
FLT. NO. = 20 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 41

SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-750.	0.957	0.714
0.	0.000	0.000
-431.	0.509	0.849
-398.	0.470	0.844
0.	0.000	0.000
0.	0.256	0.800
0.	0.000	0.000
398.	0.394	0.833
431.	0.415	0.834
0.	0.000	0.000
757.	0.778	0.869

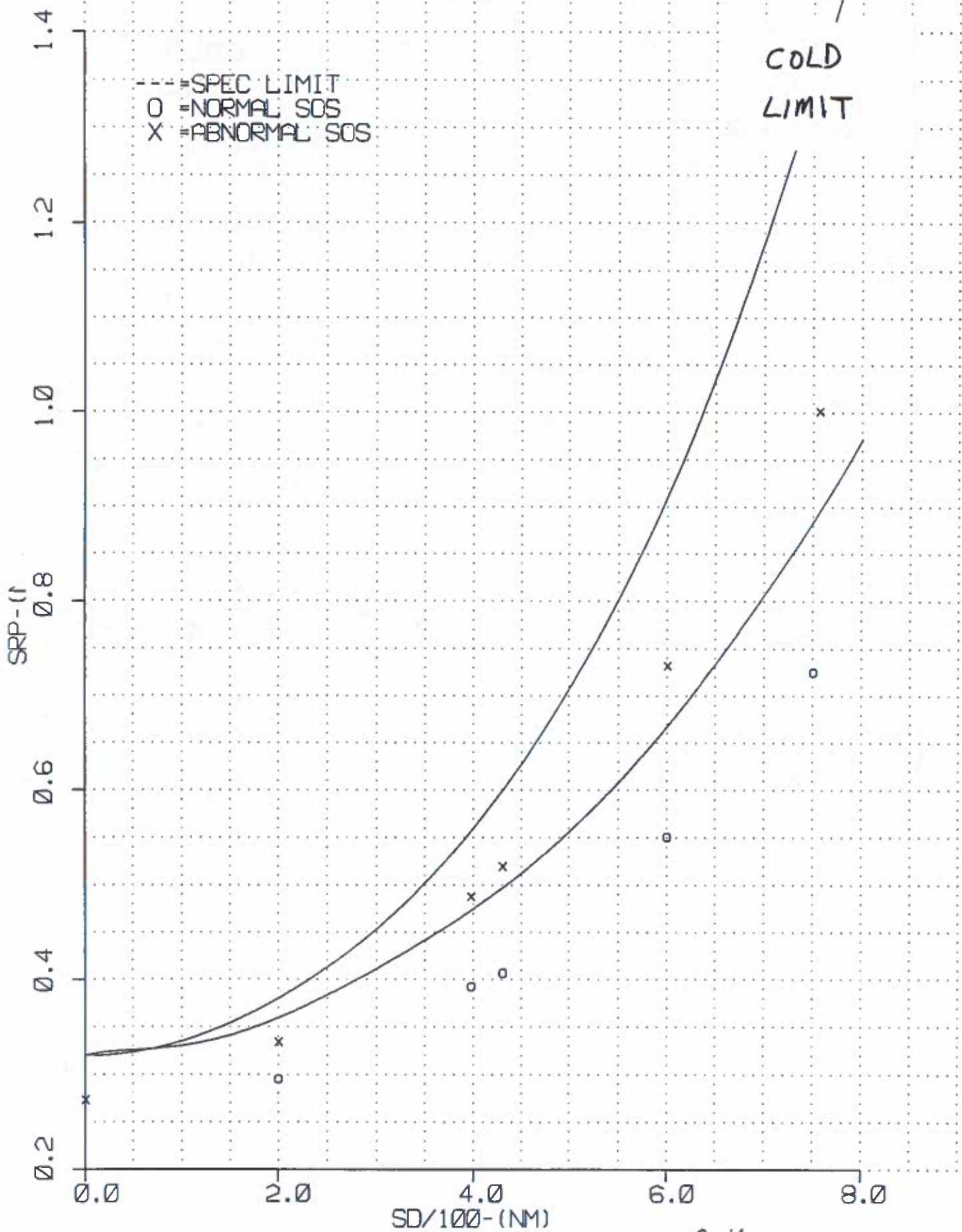
TF RIGHT, BACKUP

FLT. NO. = 20 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 41

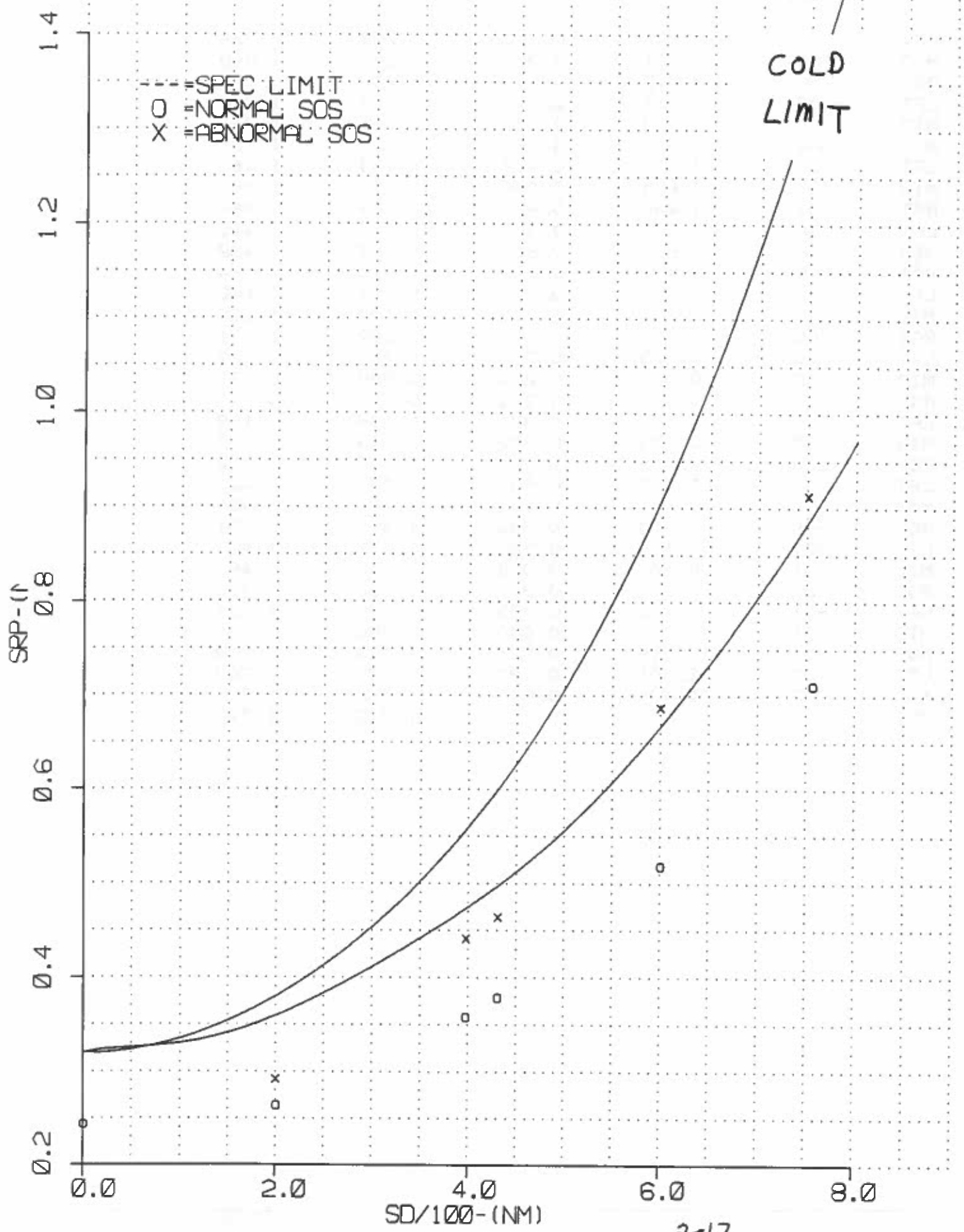
SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-750.	0.950	0.709
0.	0.000	0.000
-431.	0.495	0.825
-398.	0.458	0.822
0.	0.000	0.000
0.	0.251	0.783
0.	0.000	0.000
398.	0.386	0.817
431.	0.406	0.816
0.	0.000	0.000
757.	0.764	0.853



SYSTEM 20, SRP TF L FBAK, SSS=3, M1=-8, DATE:328



SYSTEM 20 , SRP TF R FBAK , SSS=3 , M1= -8 , DATE:328



T, COMPLETE, SRP (NM)

FLT. NO. = 20 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 328

SEG	SUR. DIST. (NM)	TFP	TFB	TSP	TSB
LFT	-750.	0.725	0.720	1.734	1.734
MID	-750.	1.251	0.000	1.841	1.842
RGT	-750.	0.913	0.910	1.745	1.745
LFT	-600.	0.551	0.548	1.720	1.720
MID	-600.	1.000	0.000	1.792	1.793
RGT	-600.	0.687	0.682	1.730	1.731
LFT	-431.	0.407	0.404	1.465	1.465
MID	-431.	0.605	0.000	1.490	1.491
RGT	-431.	0.464	0.461	1.469	1.469
LFT	-398.	0.392	0.389	1.411	1.410
MID	-398.	0.611	0.614	1.432	1.432
RGT	-398.	0.441	0.438	1.415	1.414
LFT	-200.	0.295	0.293	1.102	1.102
MID	-200.	0.344	0.341	1.105	1.105
RGT	-200.	0.292	0.290	1.102	1.101
LFT	0.	0.273	0.271	0.977	0.977
MID	0.	0.264	0.262	0.980	0.979
RGT	0.	0.243	0.242	0.973	0.973
LFT	200.	0.334	0.331	1.109	1.109
MID	200.	0.373	0.372	1.113	1.113
RGT	200.	0.263	0.262	1.102	1.102
LFT	398.	0.488	0.487	1.421	1.421
MID	398.	0.645	0.648	1.431	1.431
RGT	398.	0.358	0.356	1.401	1.401
LFT	431.	0.520	0.520	1.479	1.479
MID	431.	0.657	0.000	1.493	1.493
RGT	431.	0.379	0.377	1.460	1.460
LFT	601.	0.732	0.735	1.729	1.728
MID	601.	1.044	0.000	1.790	1.790
RGT	601.	0.518	0.515	1.708	1.708
LFT	757.	1.001	0.997	1.783	1.783
MID	757.	1.629	0.000	1.968	1.971
RGT	757.	0.710	0.714	1.712	1.712

T, COMPLETE, SRP RATIO

SEG	SUR. DIST. (NM)	TFP	TFB	TSP	TSB
LFT	-750.	0.819	0.814	0.771	0.771
MID	-750.	0.000	0.000	0.819	0.819
RGT	-750.	0.681	0.679	0.776	0.776
LFT	-600.	0.826	0.821	0.873	0.874
MID	-600.	0.000	0.000	0.910	0.911
RGT	-600.	0.755	0.750	0.879	0.879
LFT	-431.	0.818	0.813	0.915	0.915
MID	-431.	0.000	0.000	0.931	0.931
RGT	-431.	0.773	0.769	0.917	0.917
LFT	-398.	0.829	0.822	0.920	0.919
MID	-398.	0.728	0.732	0.933	0.933
RGT	-398.	0.791	0.786	0.922	0.922
LFT	-200.	0.821	0.816	0.919	0.919
MID	-200.	0.737	0.731	0.922	0.921
RGT	-200.	0.768	0.765	0.919	0.919
LFT	0.	0.853	0.846	0.931	0.931
MID	0.	0.797	0.792	0.933	0.933
RGT	0.	0.760	0.757	0.927	0.927
LFT	200.	0.879	0.870	0.924	0.924
MID	200.	0.798	0.795	0.928	0.928
RGT	200.	0.733	0.729	0.919	0.918
LFT	398.	0.876	0.875	0.927	0.927
MID	398.	0.769	0.772	0.933	0.933
RGT	398.	0.756	0.753	0.914	0.914
LFT	431.	0.866	0.867	0.923	0.923
MID	431.	0.000	0.000	0.932	0.932
RGT	431.	0.761	0.758	0.912	0.912
LFT	601.	0.803	0.807	0.877	0.877
MID	601.	0.000	0.000	0.908	0.909
RGT	601.	0.776	0.770	0.867	0.866
LFT	757.	0.736	0.732	0.789	0.789
MID	757.	0.000	0.000	0.871	0.872
RGT	757.	0.794	0.797	0.757	0.757

IF, LEFT, PRIMARY

FLT. NO. = 20 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 328

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-750.	0.725	0.819
-600.	0.551	0.826
-431.	0.407	0.818
-398.	0.392	0.829
-200.	0.295	0.821
0.	0.273	0.853
200.	0.334	0.879
398.	0.488	0.876
431.	0.520	0.866
601.	0.732	0.803
757.	1.001	0.736

TF, LEFT, BACKUP

FLT. NO. = 20 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 328

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-750.	0.720	0.814
-600.	0.548	0.821
-431.	0.404	0.813
-398.	0.389	0.822
-200.	0.293	0.816
0.	0.271	0.846
200.	0.331	0.870
398.	0.487	0.875
431.	0.520	0.867
601.	0.735	0.807
757.	0.997	0.732

TF, RIGHT, PRIMARY

FLT. NO. = 20 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 328

SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-750.	0.913	0.681
-600.	0.687	0.755
-431.	0.464	0.773
-398.	0.441	0.791
-200.	0.292	0.768
0.	0.243	0.760
200.	0.263	0.733
398.	0.358	0.756
431.	0.379	0.761
601.	0.518	0.776
757.	0.710	0.794

TF RIGHT, BACKUP

FLT. NO. = 20 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 328

SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-750.	0.910	0.679
-600.	0.682	0.750
-431.	0.461	0.769
-398.	0.438	0.786
-200.	0.290	0.765
0.	0.242	0.757
200.	0.262	0.729
398.	0.356	0.753
431.	0.377	0.758
601.	0.515	0.770
757.	0.714	0.797

2.2 Geometric Resolution (Cont'd)

2.2.2 Fine Geometric Resolution - Daytime Visual (3.2.1.1.2.1)

2.2.2.1 Baseline (Orbit Nominal)

Effective with OLS 18 the nominal environment is no longer part of OLS testing.

2.2 Geometric Resolution (Cont'd)

2.2.2 Fine Geometric Resolution - Daytime Visual (Cont'd)

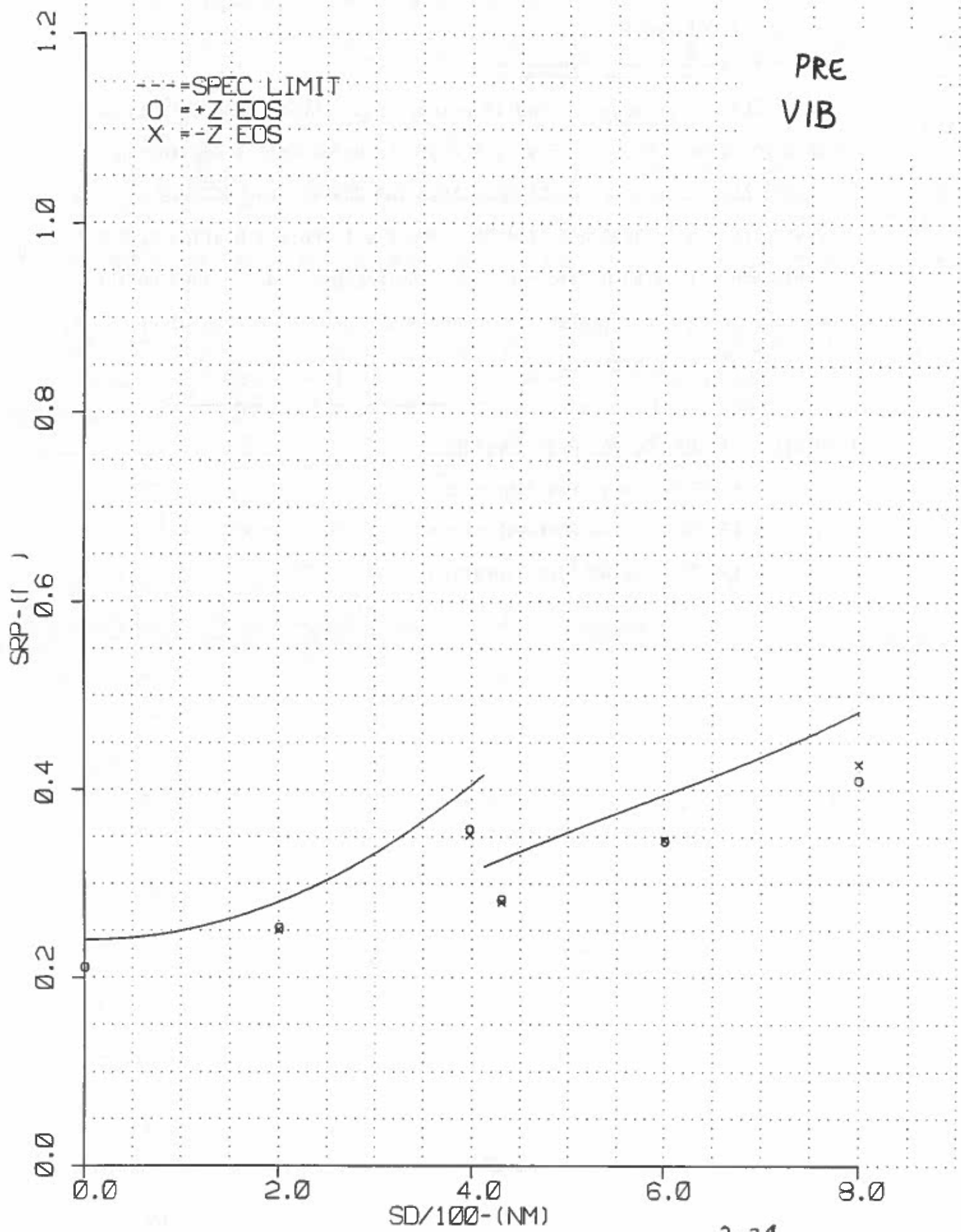
(3.2.1.1.2.1)

2.2.2.2 Acceptance - Vibration

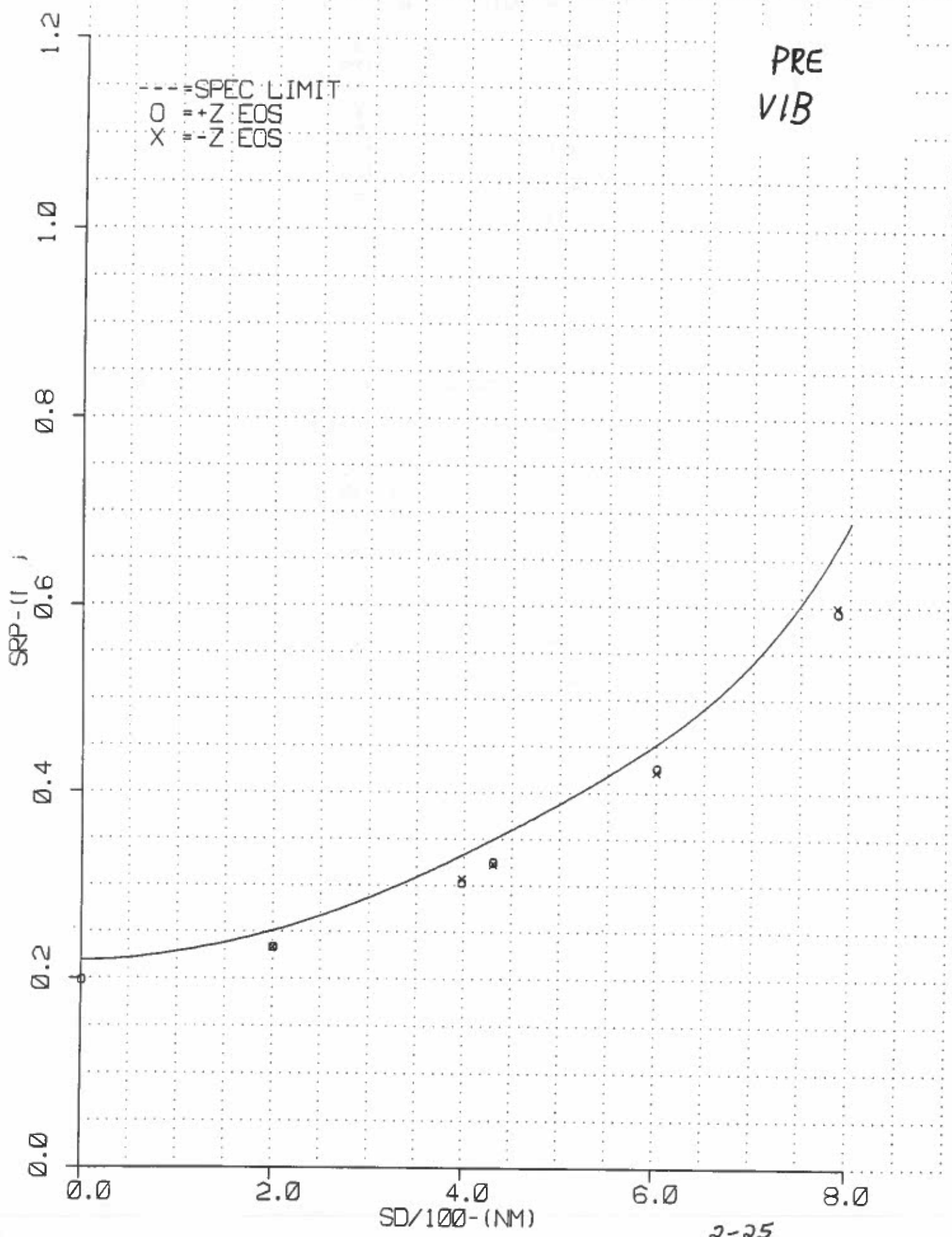
OLS #20 underwent Acceptance-level SSS vibration on July 19 and July 20, 1994. Because of a rework of the Relay Optics due to the incorrect mounting of the beamsplitter (AM 20-29), the SSS was revibrated on 1/13/95 and 1/14/95. The Pre-to-Post Vibration SRP performance is within Specification requirements and is shown on the attached curves and tables. No changes in SRP performance occurred as a result of vibration.

ATTACHMENTS: LF SRP Curves Pre-Vibration
LF SRP Tables Pre-Vibration
LF SRP Curves Post-Vibration
LF SRP Tables Post-Vibration

SYSTEM 20 , SRP LF NORMAL , SSS=23 , M1=23 , DATE:620



PRE
VIB



LF, DAY, NORMAL, PRIMARY

FLT. NO. = 20 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 620

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	0.427	0.884
-600.	0.347	0.879
-431.	0.280	0.859
-398.	0.352	0.873
-200.	0.250	0.893
0.	0.211	0.878
200.	0.253	0.900
398.	0.358	0.887
431.	0.283	0.866
601.	0.346	0.876
800.	0.410	0.849

LF, DAY, NORMAL, BACKUP

FLT. NO. = 20 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 620

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	0.427	0.885
-600.	0.345	0.875
-431.	0.280	0.857
-398.	0.352	0.872
-200.	0.249	0.889
0.	0.210	0.873
200.	0.252	0.897
398.	0.357	0.886
431.	0.282	0.864
601.	0.344	0.872
800.	0.410	0.848

LF, DAY, FALLBACK, PRIMARY

FLT. NO. = 20 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 620

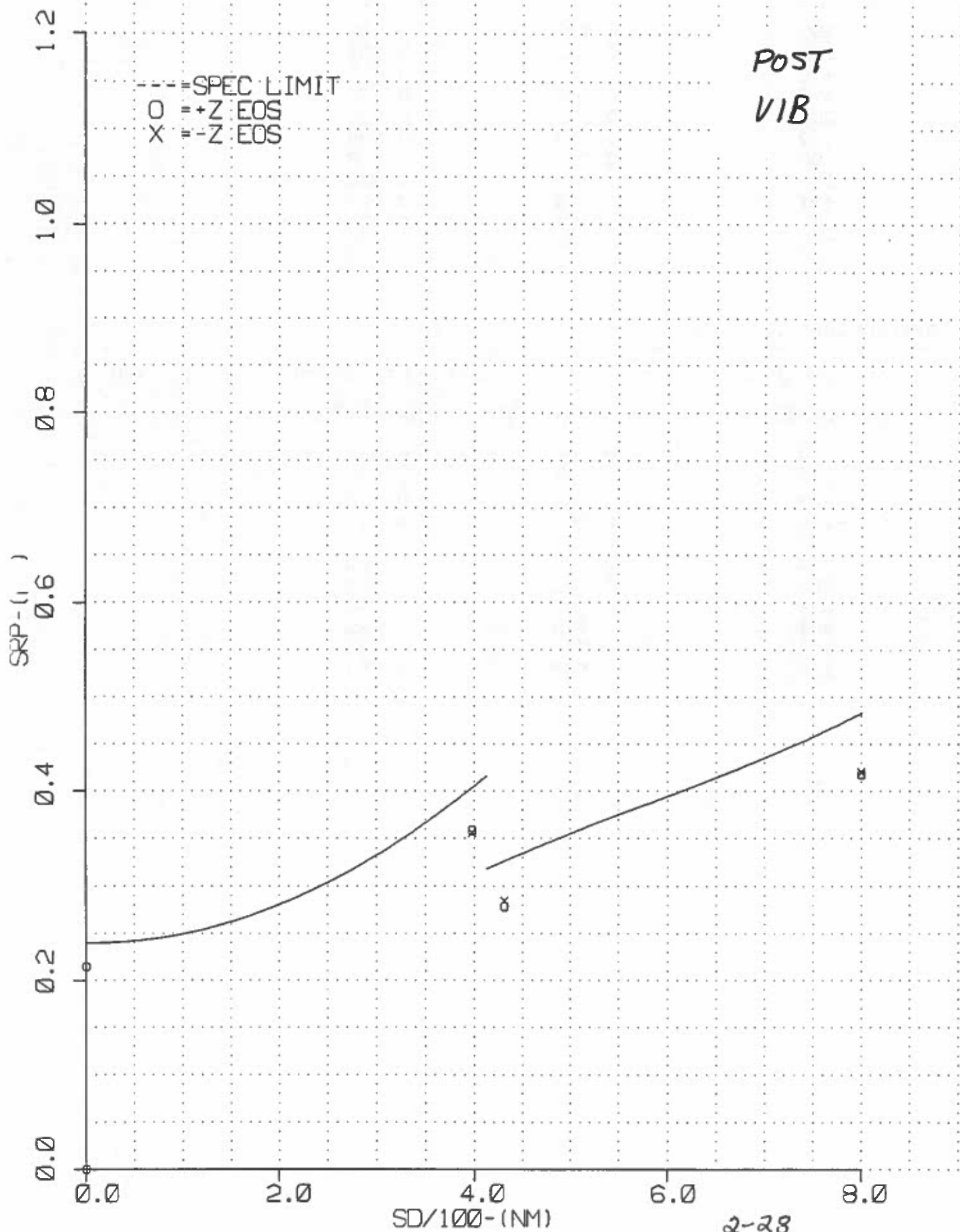
SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-787.	0.599	0.902
-600.	0.422	0.934
-431.	0.323	0.923
-398.	0.307	0.922
-200.	0.233	0.929
0.	0.198	0.904
200.	0.233	0.929
398.	0.303	0.910
431.	0.325	0.928
601.	0.426	0.941
788.	0.594	0.892

LF, DAY, FALLBACK, BACKUP

FLT. NO. = 20 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 620

SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-787.	0.599	0.901
-600.	0.421	0.932
-431.	0.321	0.918
-398.	0.305	0.917
-200.	0.232	0.924
0.	0.197	0.900
200.	0.232	0.924
398.	0.301	0.906
431.	0.323	0.923
601.	0.425	0.940
788.	0.593	0.891

SYSTEM 20., SRP LF. NORMAL, SSS=23., M1=23., DATE:726



LF, DAY, NORMAL, PRIMARY

FLT. NO. = 20 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 726

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	0.420	0.870
0.	0.000	0.000
-431.	0.284	0.872
-398.	0.356	0.882
0.	0.000	0.000
0.	0.214	0.894
0.	0.000	0.000
398.	0.358	0.888
431.	0.278	0.852
0.	0.000	0.000
800.	0.417	0.865

LF, DAY, NORMAL, BACKUP

FLT. NO. = 20 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 726

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	0.420	0.870
0.	0.000	0.000
-431.	0.283	0.868
-398.	0.356	0.881
0.	0.000	0.000
0.	0.213	0.887
0.	0.000	0.000
398.	0.358	0.887
431.	0.277	0.850
0.	0.000	0.000
800.	0.418	0.865

2.2 Geometric Resolution (Cont'd)

2.2.2 Fine Geometric Resolution - Daytime Visual (Cont'd)

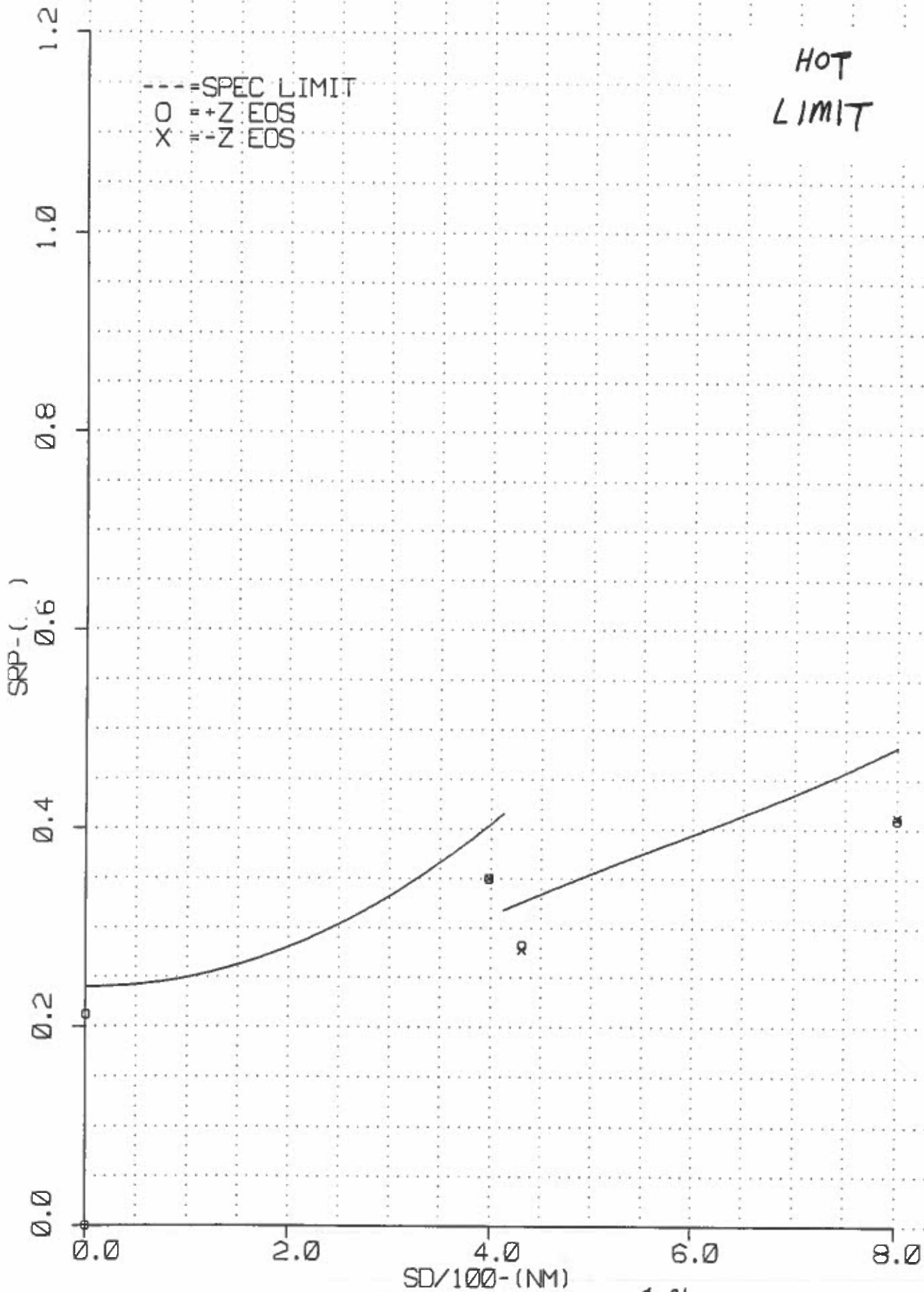
(3.2.1.1.2.1)

2.2.2.3 Acceptance - Thermal Vacuum

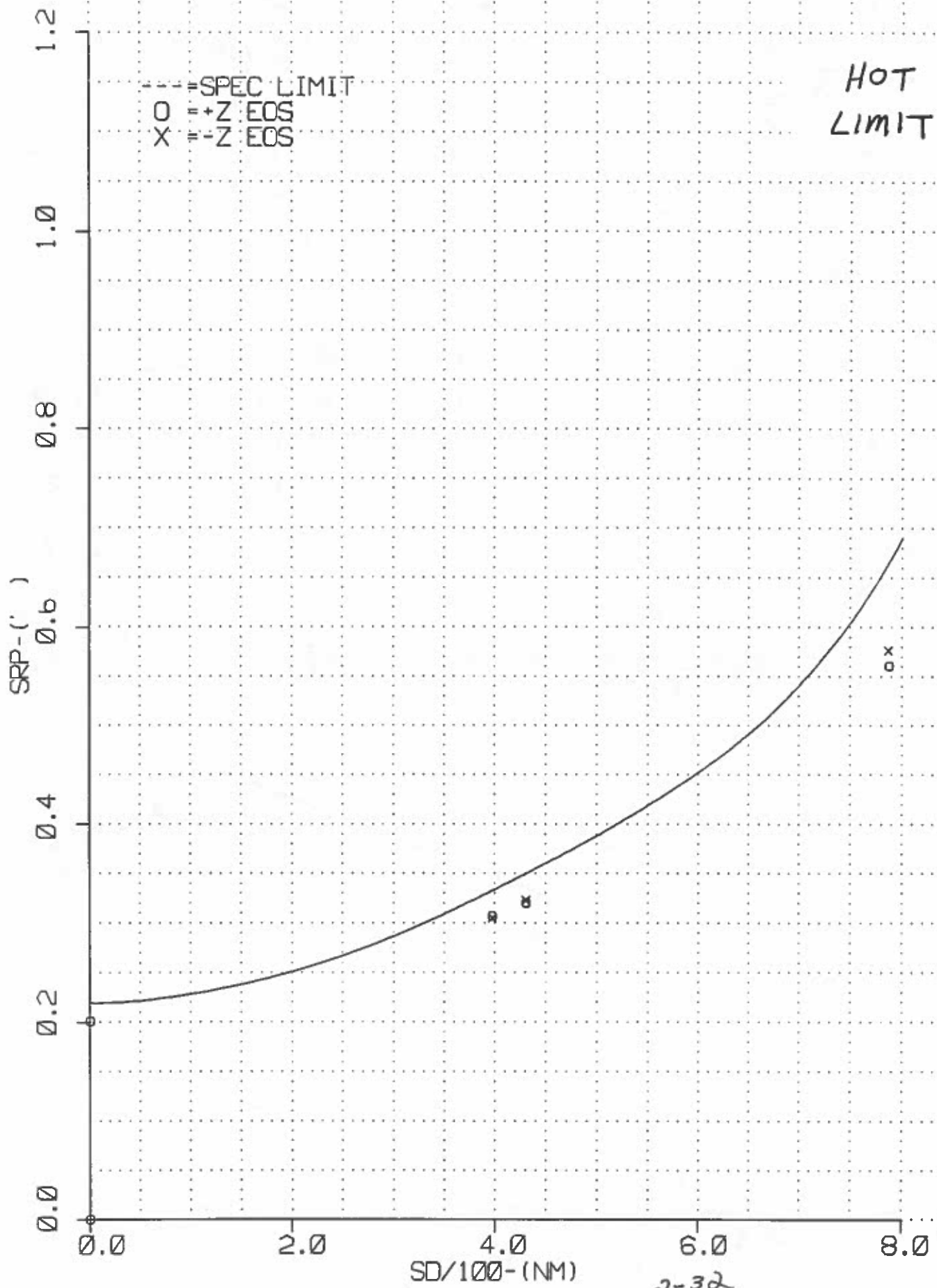
OLS #20 LF SRP is within the specification limits in both
Primary and Redundant configurations.

ATTACHMENTS: LF SRP Curve Hot Limit
LF SRP Tables Hot Limit
LF SRP Curves Cold Limit
LF SRP Tables Cold Limit

SYSTEM 20, SRP LF NORMAL, SSS=7, M1=12, DATE:331



SYSTEM 20 , SRP LF FBACK , SSS=7 , M1=12 , DATE:331



LF, DAY, NORMAL, PRIMARY

FLT. NO. = 20 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 331

SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-800.	0.412	0.853
0.	0.000	0.000
-431.	0.278	0.852
-398.	0.350	0.867
0.	0.000	0.000
0.	0.212	0.883
0.	0.000	0.000
398.	0.350	0.867
431.	0.282	0.865
0.	0.000	0.000
800.	0.409	0.847

LF, DAY, NORMAL, BACKUP

FLT. NO. = 20 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 331

SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-800.	0.402	0.832
0.	0.000	0.000
-431.	0.273	0.837
-398.	0.342	0.849
0.	0.000	0.000
0.	0.207	0.863
0.	0.000	0.000
398.	0.342	0.848
431.	0.277	0.849
0.	0.000	0.000
800.	0.399	0.826

LF, DAY, FALLBACK, PRIMARY

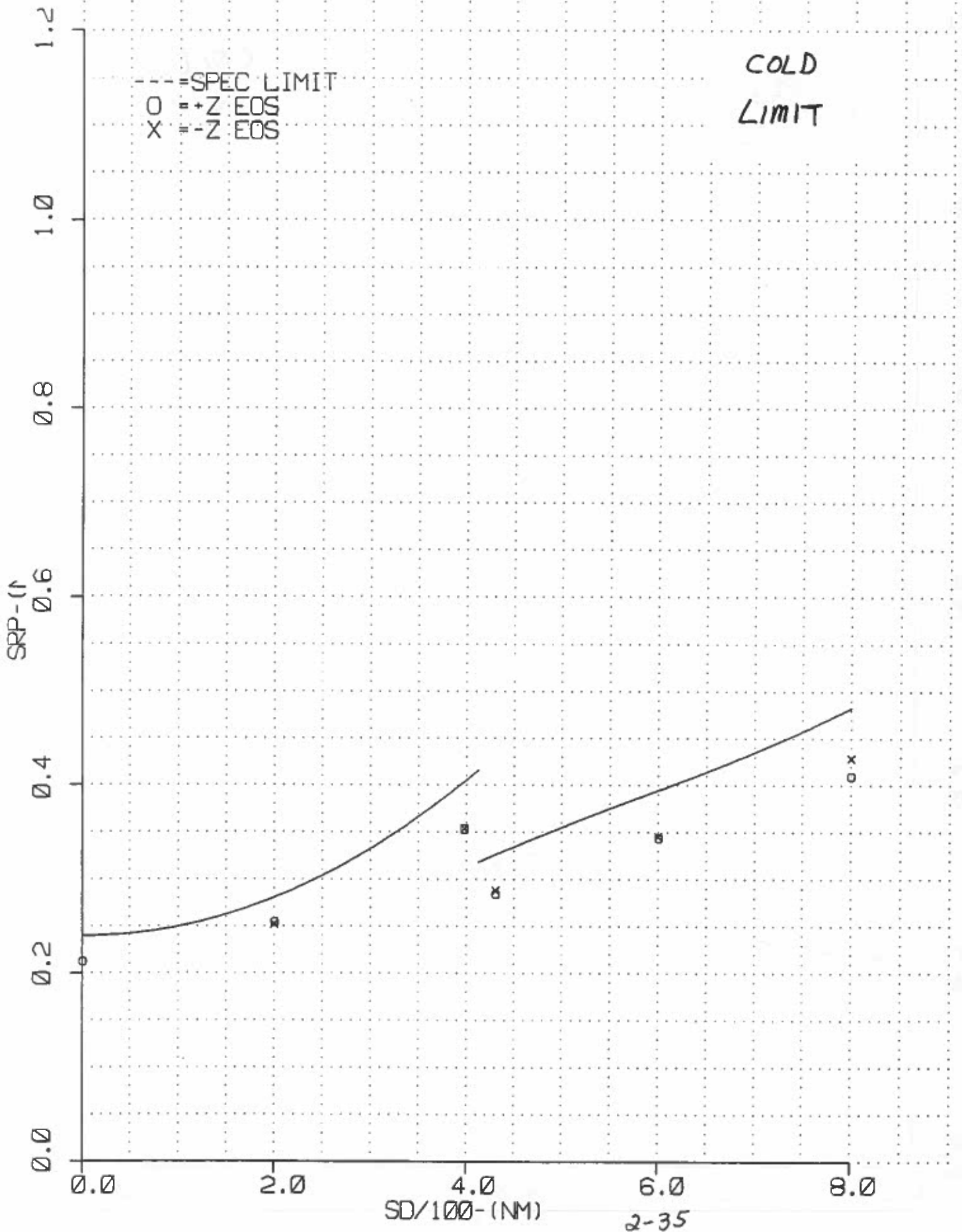
FLT. NO. = 20 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 331

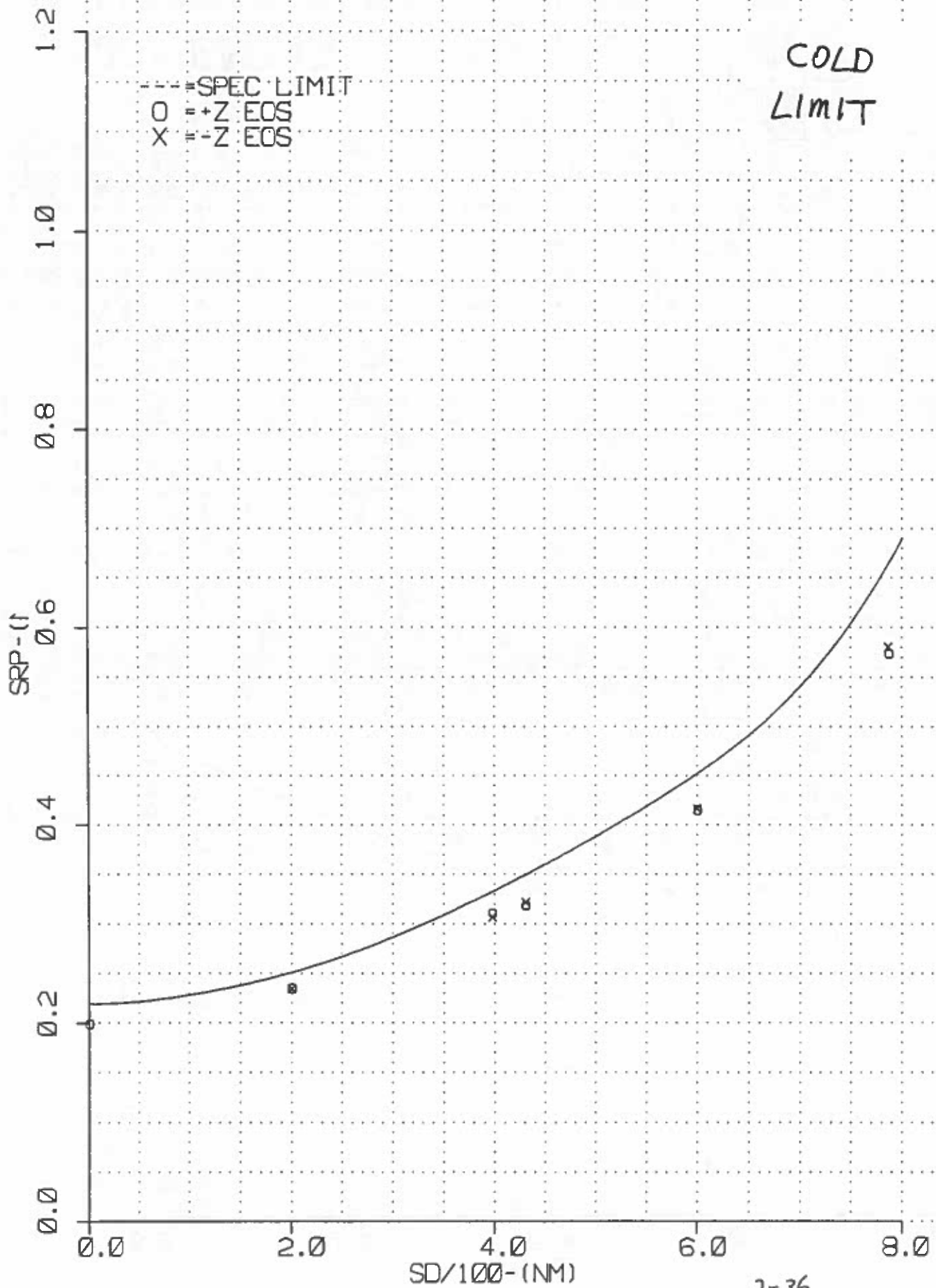
SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-787.	0.576	0.868
0.	0.000	0.000
-431.	0.322	0.921
-398.	0.305	0.916
0.	0.000	0.000
0.	0.201	0.917
0.	0.000	0.000
398.	0.307	0.923
431.	0.320	0.915
0.	0.000	0.000
788.	0.561	0.842

LF, DAY, FALLBACK, BACKUP

FLT. NO. = 20 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 331

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-787.	0.568	0.855
0.	0.000	0.000
-431.	0.314	0.899
-398.	0.297	0.894
0.	0.000	0.000
0.	0.196	0.896
0.	0.000	0.000
398.	0.299	0.901
431.	0.312	0.892
0.	0.000	0.000
788.	0.552	0.829





LF, DAY, NORMAL, PRIMARY

FLT. NO. = 20 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 327

SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-800.	0.429	0.888
-600.	0.345	0.876
-431.	0.287	0.981
-398.	0.354	0.876
-200.	0.252	0.899
0.	0.212	0.884
200.	0.254	0.905
398.	0.353	0.875
431.	0.284	0.871
601.	0.344	0.871
800.	0.410	0.848

LF, DAY, NORMAL, BACKUP

FLT. NO. = 20 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 327

SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-800.	0.418	0.867
-600.	0.337	0.855
-431.	0.291	0.861
-398.	0.345	0.856
-200.	0.246	0.877
0.	0.207	0.863
200.	0.248	0.883
398.	0.345	0.855
431.	0.278	0.852
601.	0.336	0.851
800.	0.399	0.827

LF, DAY, FALLBACK, PRIMARY

FLT. NO. = 20 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 327

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-787.	0.580	0.874
-600.	0.417	0.922
-431.	0.322	0.920
-398.	0.307	0.922
-200.	0.234	0.934
0.	0.199	0.907
200.	0.235	0.935
398.	0.311	0.935
431.	0.318	0.910
601.	0.415	0.916
788.	0.573	0.861

LF, DAY, FALLBACK, BACKUP

FLT. NO. = 20 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 327

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-787.	0.571	0.860
-600.	0.405	0.897
-431.	0.313	0.895
-398.	0.299	0.898
-200.	0.228	0.909
0.	0.194	0.884
200.	0.229	0.911
398.	0.302	0.909
431.	0.310	0.886
601.	0.403	0.891
788.	0.564	0.848

2.2 Geometric Resolution (Cont'd)

2.2.3 Smoothed Geometric Resolution - Infrared (3.2.1.1.2.2)

2.2.3.1 Baseline (Orbit Nominal)

Effective with OLS 18 the nominal environment is no longer part of OLS testing.

2.2 Geometric Resolution (Cont'd)

2.2.3 Smoothed Geometric Resolution - Infrared (Cont'd)

(3.2.1.1.2.2)

2.2.3.2 Acceptance - Vibration

Effective with OLS 18 previbration testing is no longer done on the T channel. The T channel is accepted by similarity to OLS's 12 thru 17 contingent on all other alignment/synchronization and MTF data being in spec and typical of the performance of prior OLS units.

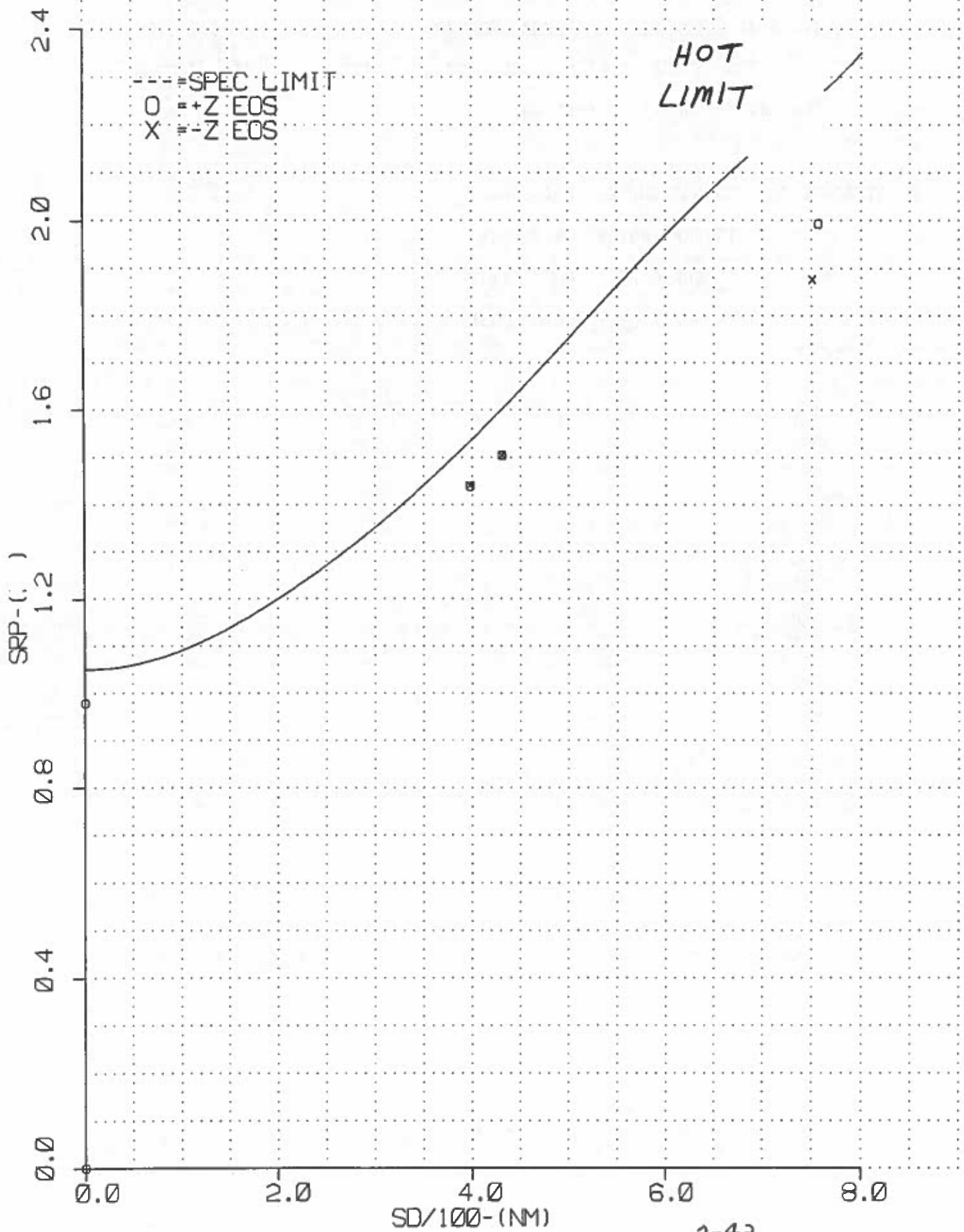
2.2 Geometric Resolution (Cont'd)

2.2.3 Smoothed Geometric Resolution - Infrared (3.2.1.1.2.2)

2.2.3.3 Acceptance - Thermal Vacuum

The TS SRP is within spec for the extremes of hot and cold Thermal Vacuum limit testing.

ATTACHMENTS: TS SRP Curve Hot Limits
TS SRP Tables Hot Limits
TS SRP Curve Cold Limits
TS SRP Tables Cold Limits



TS, MID, PRIMARY

FLT. NO. = 20 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 41

SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-750.	1.876	0.834
0.	0.000	0.000
-431.	1.504	0.939
-398.	1.441	0.939
0.	0.000	0.000
0.	0.978	0.932
0.	0.000	0.000
398.	1.439	0.938
431.	1.504	0.939
0.	0.000	0.000
757.	1.993	0.882

TS, MID, BACKUP

FLT. NO. = 20 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 41

SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-750.	1.872	0.832
0.	0.000	0.000
-431.	1.501	0.937
-398.	1.438	0.937
0.	0.000	0.000
0.	0.976	0.930
0.	0.000	0.000
398.	1.435	0.936
431.	1.501	0.937
0.	0.000	0.000
757.	1.990	0.880

TS, MID, PRIMARY

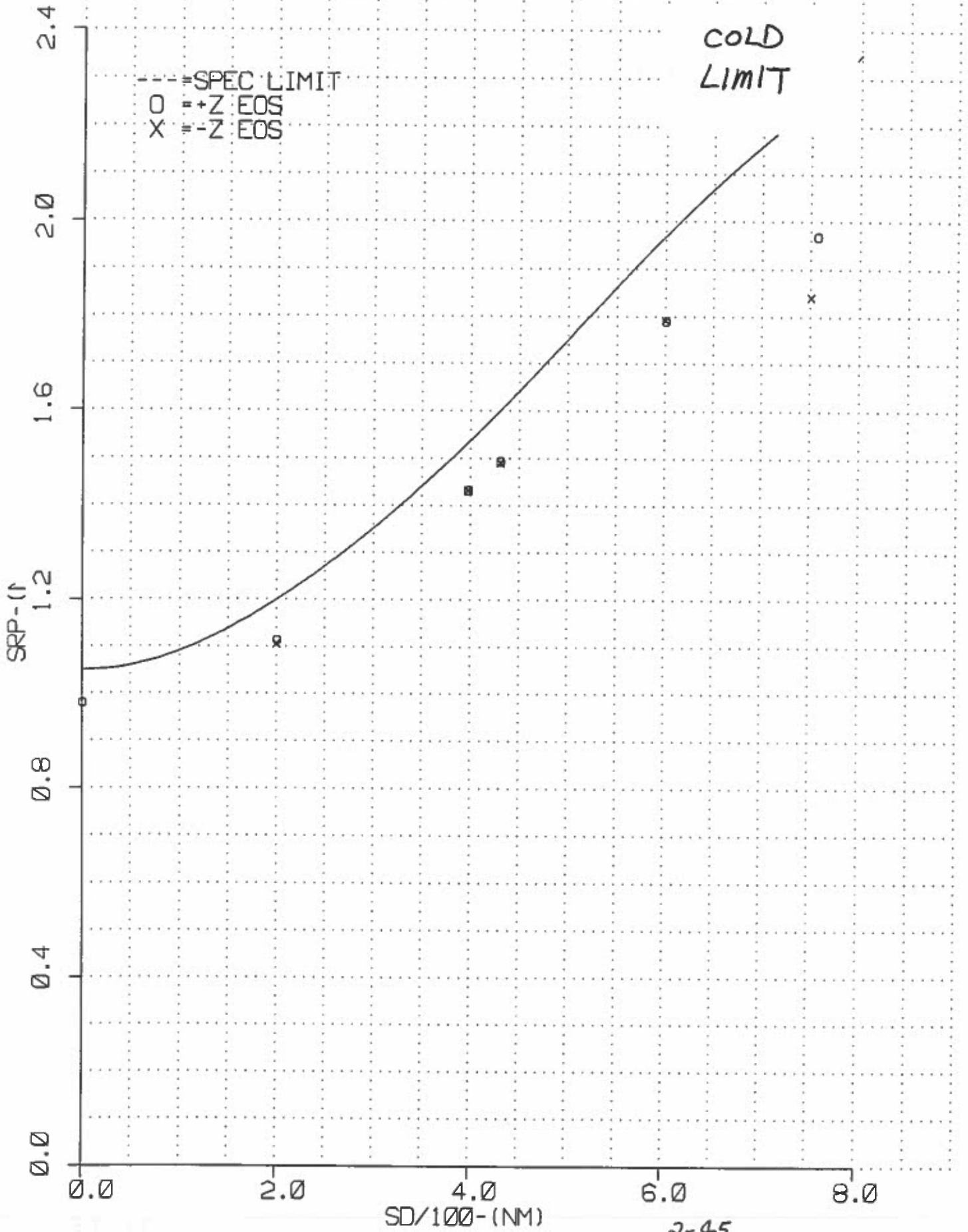
FLT. NO. = 20 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 328

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-750.	1.841	0.819
-600.	1.792	0.910
-431.	1.490	0.931
-398.	1.432	0.933
-200.	1.105	0.922
0.	0.980	0.933
200.	1.113	0.928
398.	1.431	0.933
431.	1.493	0.932
601.	1.790	0.908
757.	1.968	0.871

TS, MID, BACKUP

FLT. NO. = 20 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 328

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-750.	1.842	0.819
-600.	1.793	0.911
-431.	1.491	0.931
-398.	1.432	0.933
-200.	1.105	0.921
0.	0.979	0.933
200.	1.113	0.928
398.	1.431	0.933
431.	1.493	0.932
601.	1.790	0.909
757.	1.971	0.872



2.2 Geometric Resolution (Cont'd)

2.2.4 Smoothed Geometric Resolution - Daytime Visual (3.2.1.1.2.2)

2.2.4.1 Baseline (Orbit Nominal)

Effective with OLS 18 the nominal environment is no longer part of OLS testing.

2.2 Geometric Resolution (Cont'd)

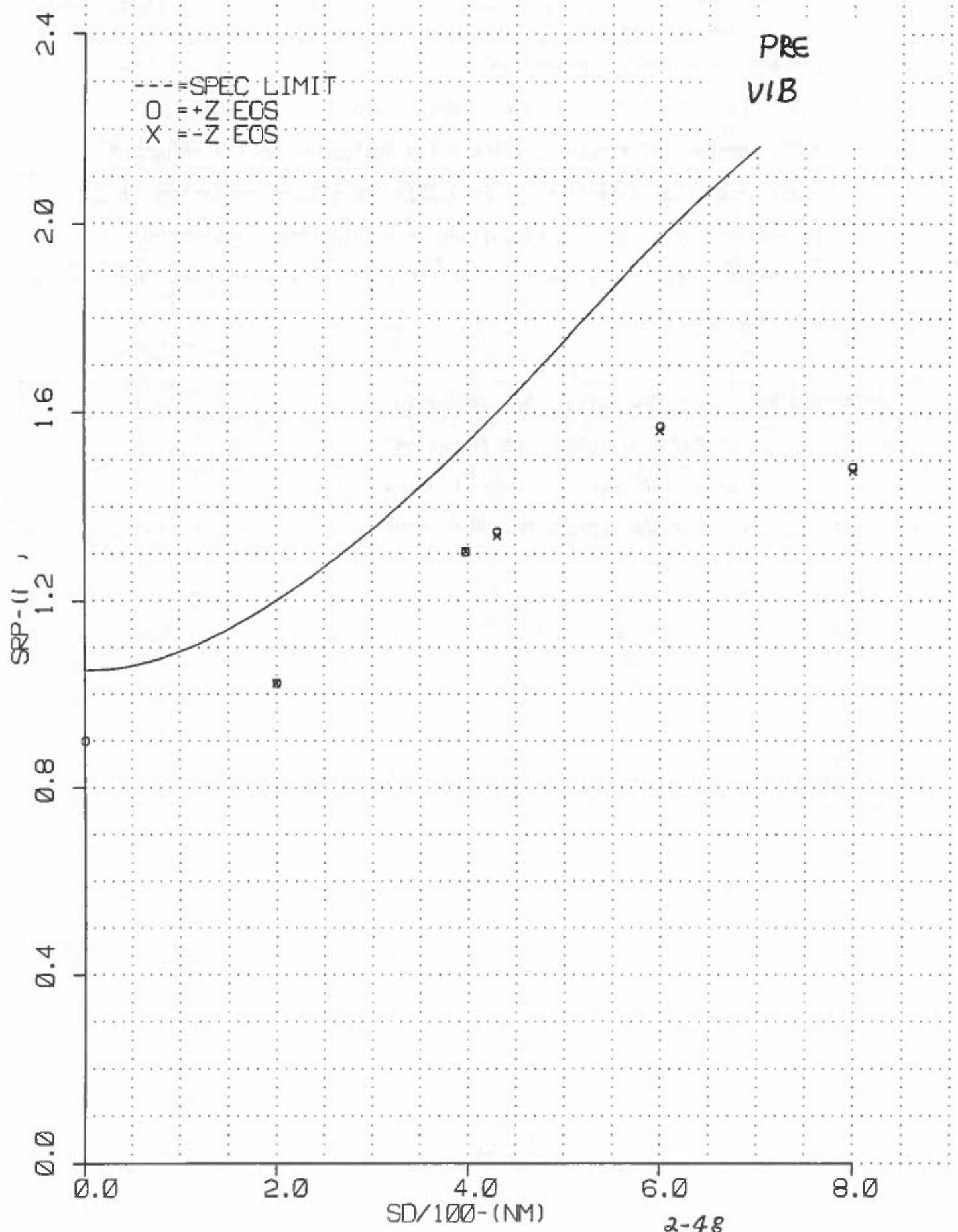
2.2.4 Smoothed Geometric Resolution - Daytime Visual (Cont'd)

(3.2.1.1.2.2)

2.2.4.2 Acceptance - Vibration

The OLS #20 SSS underwent vibrations on July 19 and July 20, 1994. Because of a rework of the Relay Optics due to the incorrect mounting of the beamsplitter (AM 20-29), the SSS was revibrated on 1/13/95 and 1/14/95. The LS Day SRP is within specification both before and after SSS vibration. No vibration-related changes in SRP were observed.

ATTACHMENTS: LS Day SRP Curve Pre-Vibration
LS Day SRP Tables Pre-Vibration
LS Day SRP Curve Post-Vibration
LS Day SRP Table Post-Vibration



LS, DAY, NORMAL, PRIMARY

FLT. NO. = 20 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 620

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	1. 476	0. 628
-600.	1. 562	0. 793
-431.	1. 339	0. 836
-398.	1. 305	0. 851
-200.	1. 023	0. 853
0.	0. 899	0. 856
200.	1. 022	0. 852
398.	1. 304	0. 850
431.	1. 347	0. 841
601.	1. 569	0. 796
800.	1. 485	0. 632

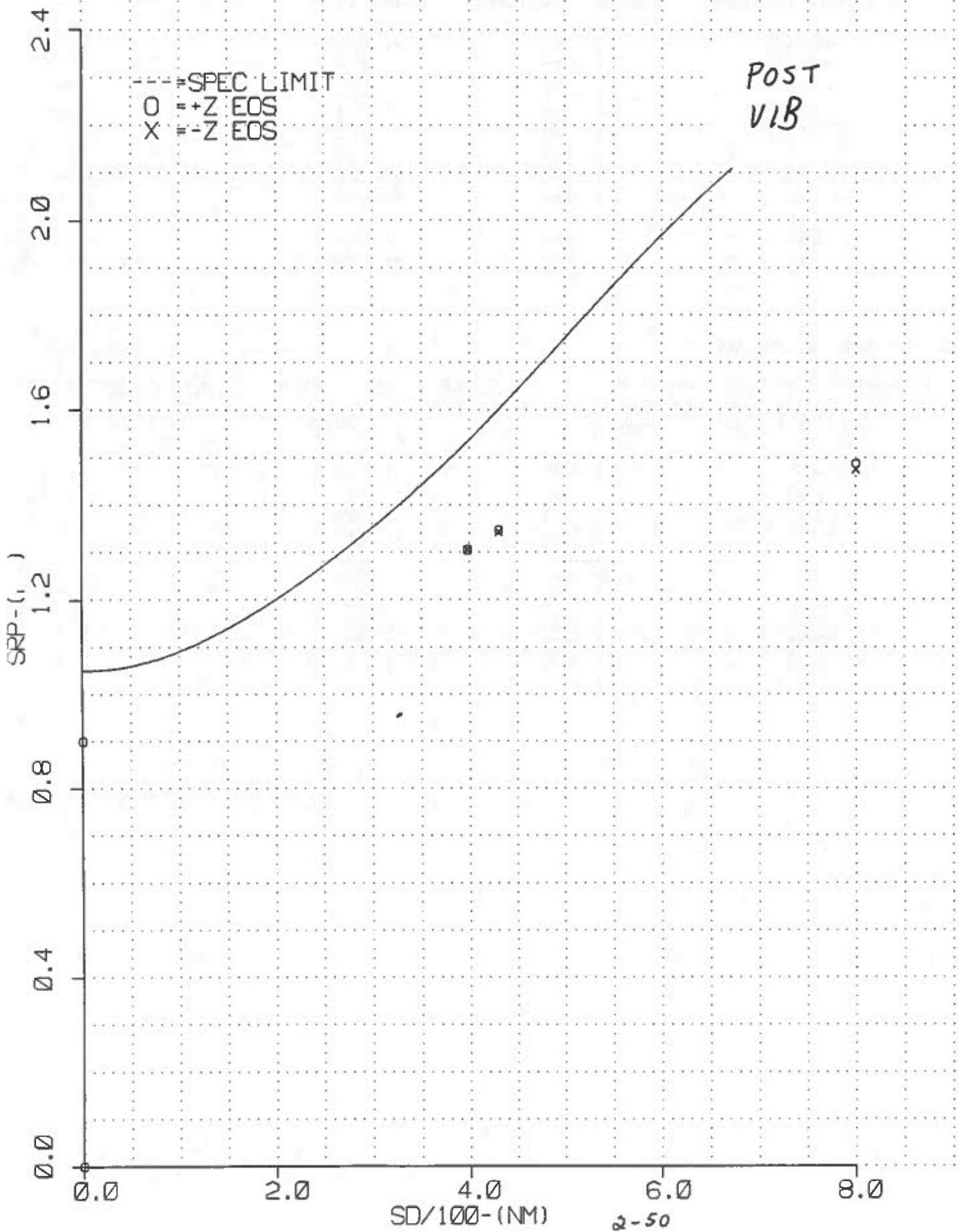
LS, DAY, NORMAL, BACKUP

FLT. NO. = 20 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 620

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	1. 475	0. 628
-600.	1. 560	0. 792
-431.	1. 337	0. 835
-398.	1. 303	0. 850
-200.	1. 021	0. 852
0.	0. 898	0. 855
200.	1. 021	0. 851
398.	1. 303	0. 849
431.	1. 345	0. 840
601.	1. 568	0. 796
800.	1. 483	0. 631

SYSTEM 20 , SRP LS DAY/TS = NORM

SSS=23 , MI=23 , DATE:726



LS, DAY, NORMAL, PRIMARY

FLT. NO. = 20 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 726

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	1.475	0.628
0.	0.000	0.000
-431.	1.342	0.838
-398.	1.305	0.851
0.	0.000	0.000
0.	0.900	0.857
0.	0.000	0.000
398.	1.305	0.851
431.	1.346	0.840
0.	0.000	0.000
800.	1.487	0.633

LS, DAY, NORMAL, BACKUP

FLT. NO. = 20 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 726

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	1.473	0.627
0.	0.000	0.000
-431.	1.340	0.837
-398.	1.303	0.850
0.	0.000	0.000
0.	0.898	0.856
0.	0.000	0.000
398.	1.303	0.850
431.	1.344	0.839
0.	0.000	0.000
800.	1.485	0.632

2.2 Geometric Resolution (Cont'd)

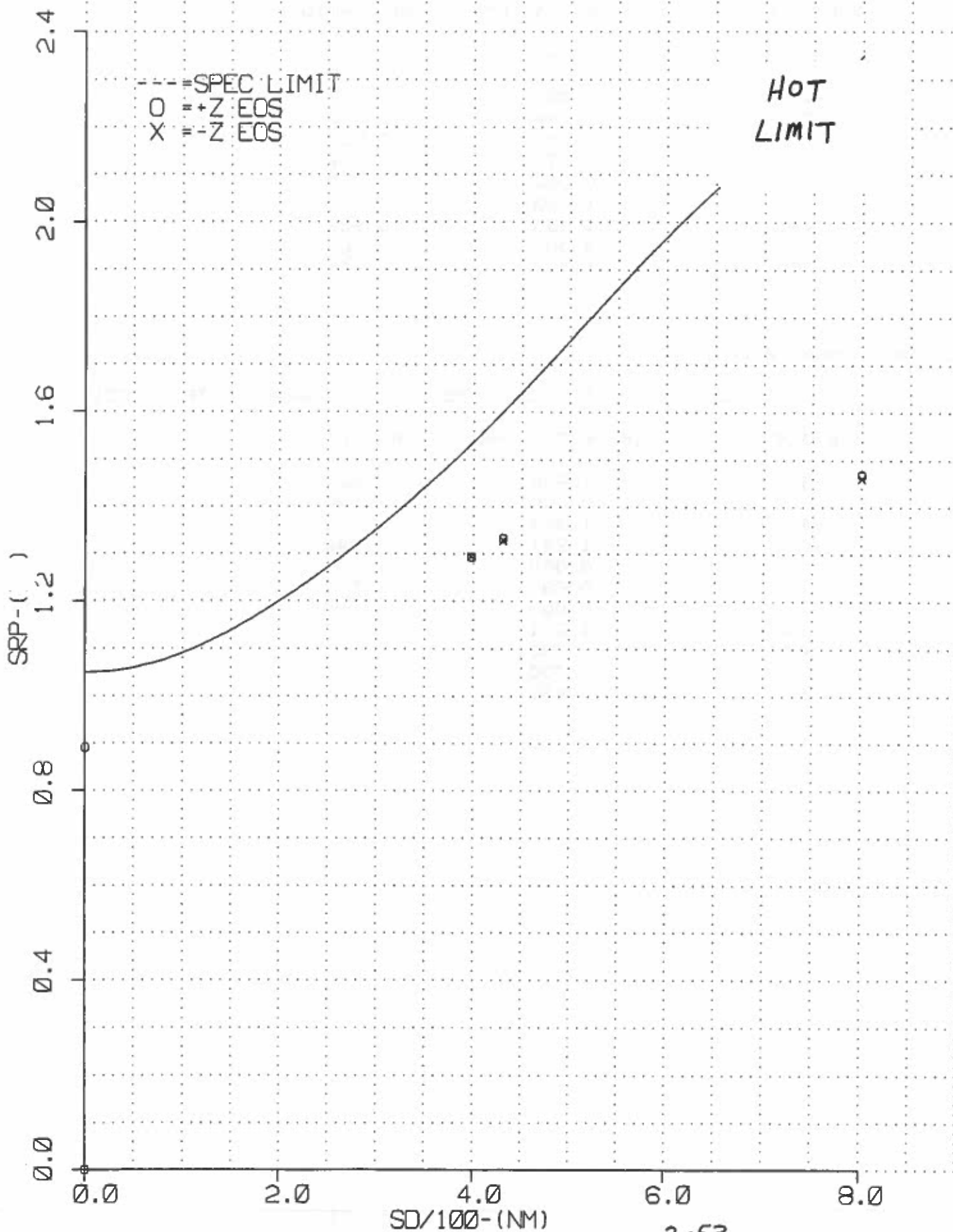
2.2.4 Smoothed Geometric Resolution - Daytime Visual (Cont'd)

(3.2.1.1.2.2)

2.2.4.3 Acceptance - Thermal Vacuum

The LS Day SRP is within specification allowance over the entire range of temperatures.

ATTACHMENTS: LS Day SRP Curve Hot Limits
LS Day SRP Tables Hot Limits
LS Day SRP Curve Cold Limits
LS Day SRP Tables Cold Limits



LS, DAY, NORMAL, PRIMARY

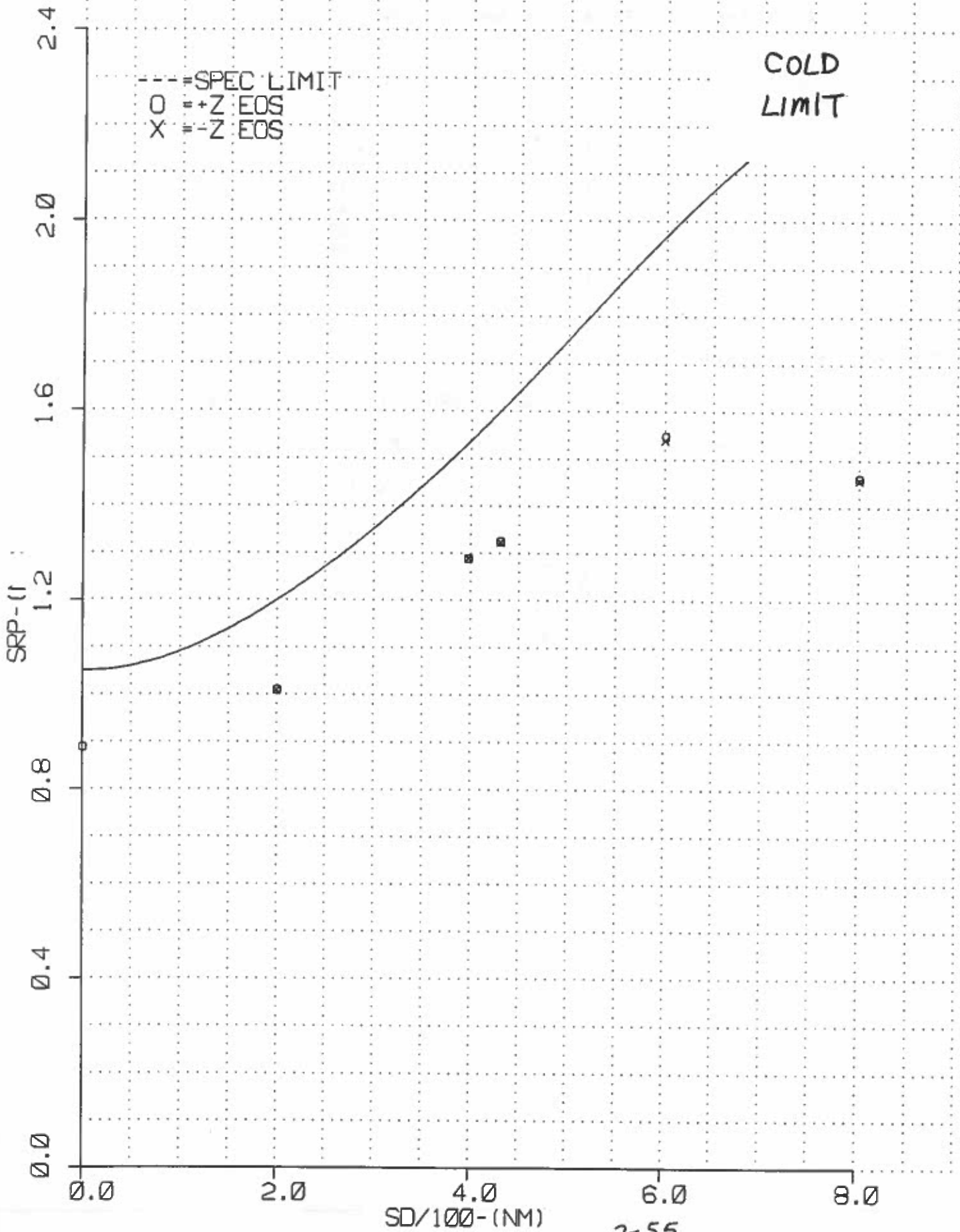
FLT. NO. = 20 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 331

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	1.461	0.622
0.	0.000	0.000
-431.	1.328	0.829
-398.	1.294	0.843
0.	0.000	0.000
0.	0.891	0.848
0.	0.000	0.000
398.	1.293	0.843
431.	1.333	0.832
0.	0.000	0.000
800.	1.468	0.625

LS, DAY, NORMAL, BACKUP

FLT. NO. = 20 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 331

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	1.458	0.621
0.	0.000	0.000
-431.	1.325	0.828
-398.	1.291	0.842
0.	0.000	0.000
0.	0.889	0.847
0.	0.000	0.000
398.	1.291	0.842
431.	1.330	0.830
0.	0.000	0.000
800.	1.465	0.624



LS, DAY, NORMAL, PRIMARY

FLT. NO. = 20 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 327

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	1.457	0.620
-600.	1.540	0.782
-431.	1.323	0.826
-398.	1.289	0.840
-200.	1.009	0.841
0.	0.889	0.846
200.	1.010	0.842
398.	1.288	0.840
431.	1.325	0.827
601.	1.547	0.785
800.	1.460	0.621

LS, DAY, NORMAL, BACKUP

FLT. NO. = 20 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 327

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	1.456	0.620
-600.	1.538	0.781
-431.	1.322	0.826
-398.	1.288	0.840
-200.	1.008	0.841
0.	0.888	0.845
200.	1.009	0.841
398.	1.287	0.840
431.	1.324	0.827
601.	1.546	0.784
800.	1.459	0.621

2.2 Geometric Resolution (Cont'd)

2.2.5 Smoothed Geometric Resolution - Nighttime Visual (3.2.1.1.2.2)

LS Night SRP routinely is deliberately adjusted to be close to spec limit during system integration in order to optimize PMT signal-to-noise ratio, at the expense of SRP margin.

2.2.5.1 Baseline (Orbit Nominal)

Effective with OLS 18 the nominal environment is no longer part of OLS testing.

2.2 Geometric Resolution (Cont'd)

2.2.5 Smoothed Geometric Resolution - Nighttime

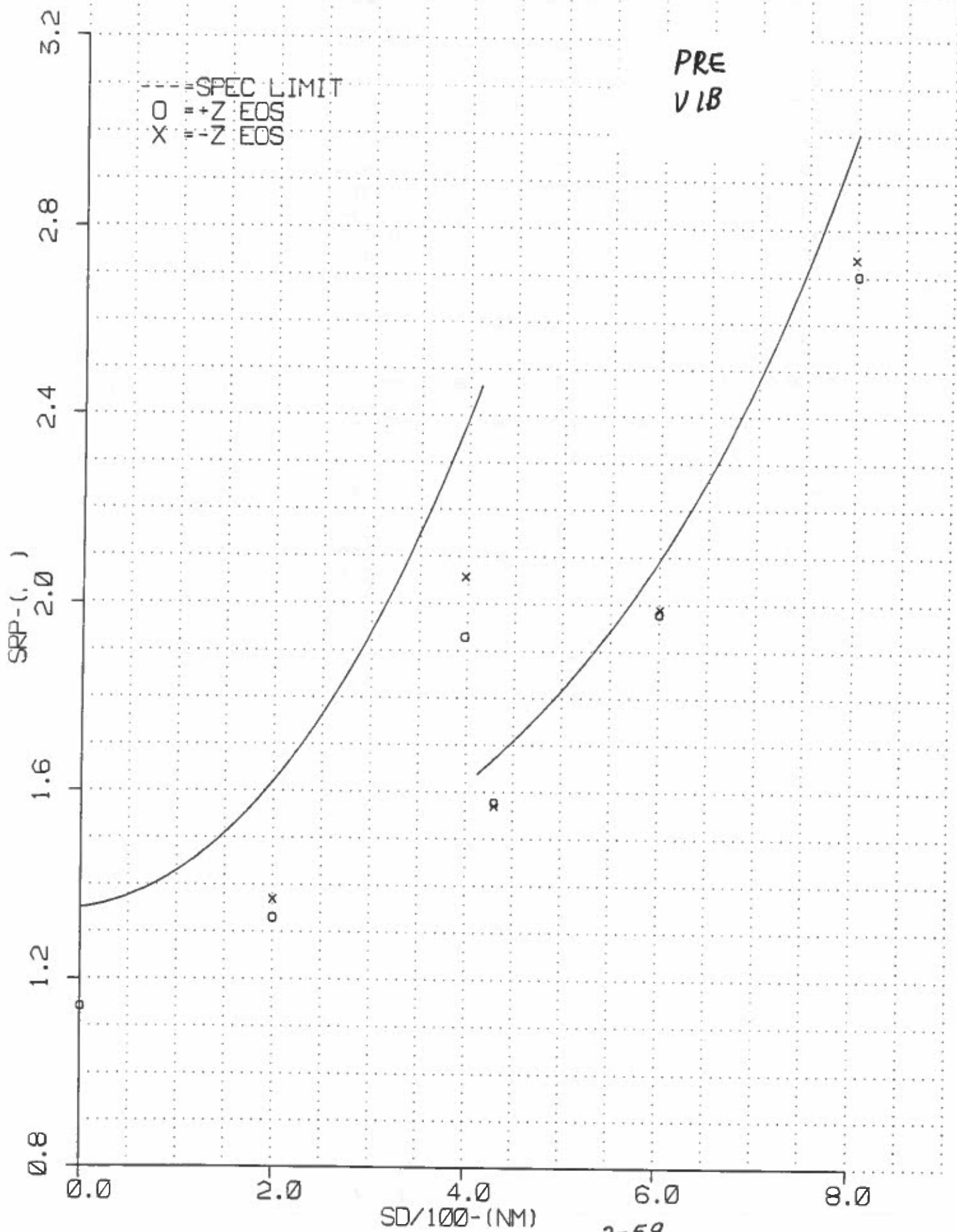
Visual (Cont'd) (3.1.2.2)

2.2.5.2 Acceptance - Vibration

The LS Night SRP is within specification before and after SSS vibration. No vibration-induced changes in SRP were observed.

ATTACHMENTS: LS Night SRP Curve Pre-Vibration
LS Night SRP Tables Pre-Vibration
LS Night SRP Curve Post-Vibration
LS Night SRP Tables Post-Vibration

SYSTEM 20 , SRP LS NITE , SSS=23 , M1=23 , DATE:621



LS, NITE, NORMAL, PRIMARY

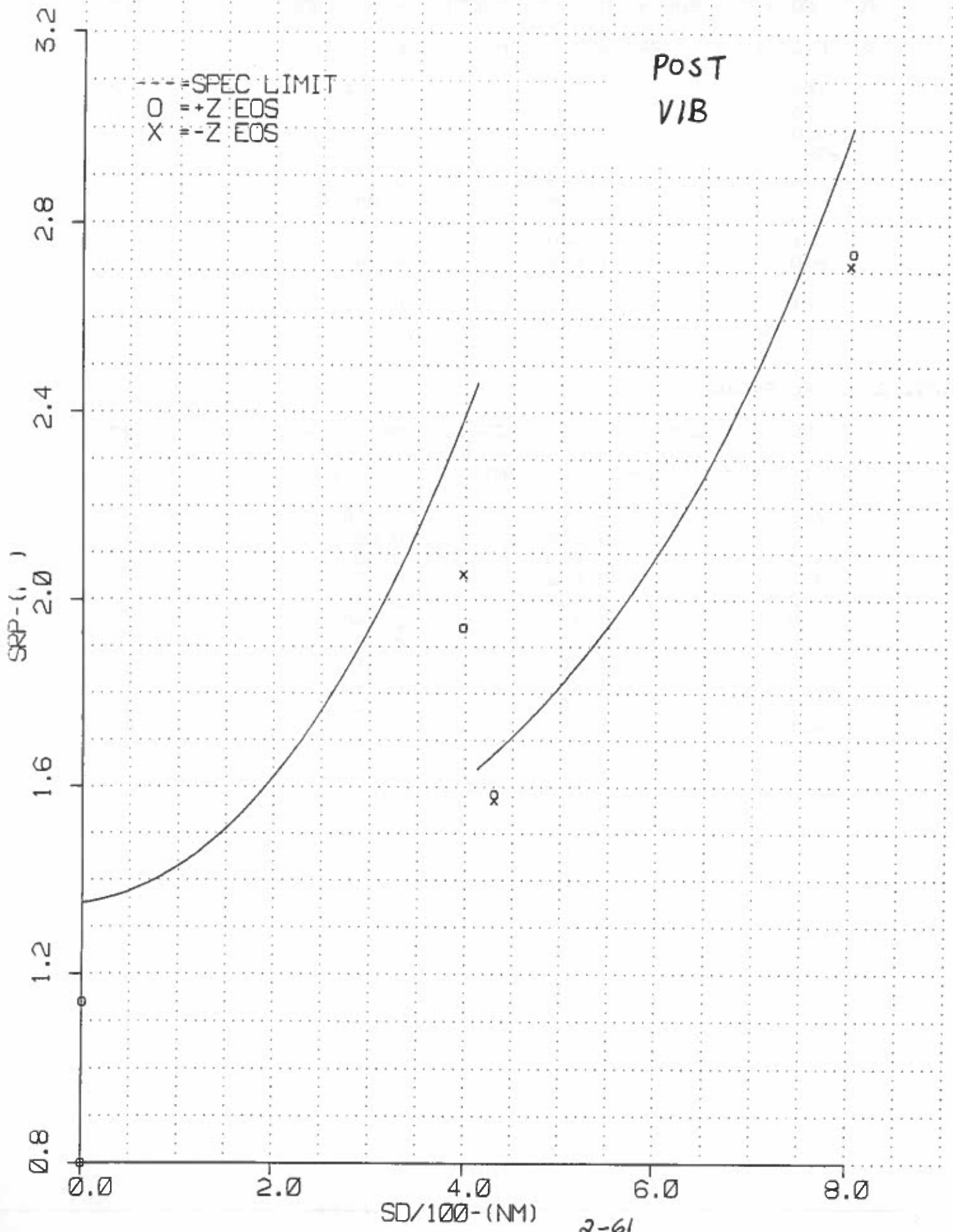
FLT. NO. = 20 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 621

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-799.	2.737	0.914
-601.	1.989	0.949
-430.	1.570	0.939
-397.	2.057	0.863
-200.	1.369	0.844
0.	1.141	0.845
200.	1.330	0.820
397.	1.929	0.810
430.	1.577	0.944
600.	1.979	0.945
801.	2.702	0.899

LS, NITE, NORMAL, BACKUP

FLT. NO. = 20 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 621

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-799.	2.719	0.908
-601.	1.978	0.944
-430.	1.563	0.935
-397.	2.044	0.858
-200.	1.362	0.840
0.	1.136	0.841
200.	1.323	0.816
397.	1.918	0.805
430.	1.570	0.940
600.	1.969	0.940
801.	2.684	0.892



LS, NITE, NORMAL, PRIMARY

FLT. NO. = 20 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 727

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-799.	2.712	0.906
0.	0.000	0.000
-430.	1.572	0.941
-397.	2.054	0.862
0.	0.000	0.000
0.	1.140	0.844
0.	0.000	0.000
397.	1.940	0.814
430.	1.584	0.948
0.	0.000	0.000
801.	2.738	0.910

LS, NITE, NORMAL, BACKUP

FLT. NO. = 20 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 727

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-799.	2.694	0.900
0.	0.000	0.000
-430.	1.565	0.936
-397.	2.042	0.857
0.	0.000	0.000
0.	1.134	0.840
0.	0.000	0.000
397.	1.929	0.810
430.	1.577	0.943
0.	0.000	0.000
801.	2.720	0.904

2.2 Geometric Resolution (Cont'd)

2.2.5 Smoothed Geometric Resolution - Nighttime

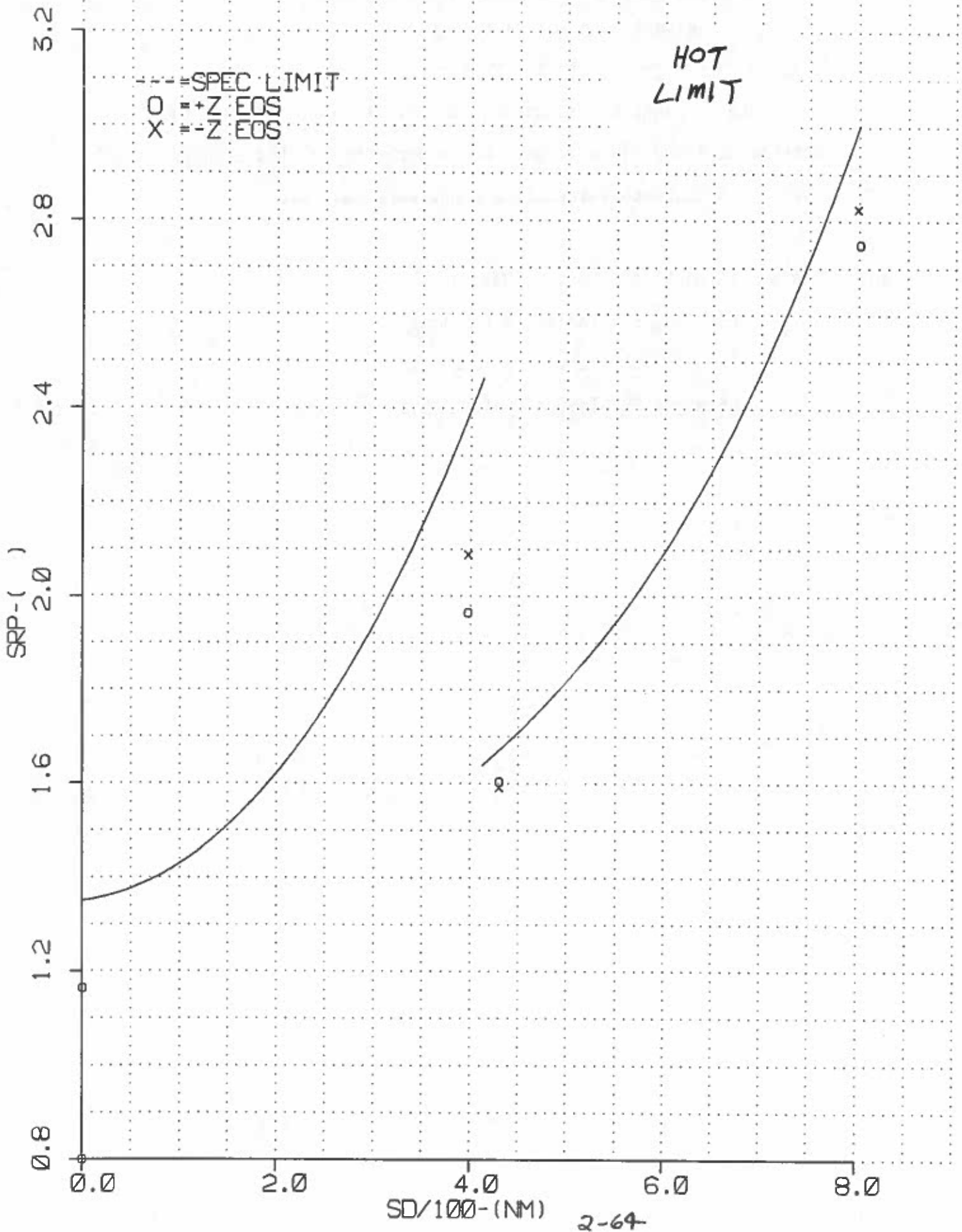
Visual (Cont'd) (3.1.2.2)

2.2.5.3 Acceptance - Thermal Vacuum

The LS Night SRP is within specification limits over the Acceptance temperature range. No temperature-related changes in SRP over the Acceptance temperature range were observed.

ATTACHMENTS: LS Night SRP Curve Hot Limits
LS Night SRP Tables Hot Limits
LS Night SRP Curve Cold Limits
LS Night SRP Tables Cold Limits

SYSTEM 20 , SRP LS NITE , SSS=7 , M1=12 , DATE:41



LS, NITE, NORMAL, PRIMARY

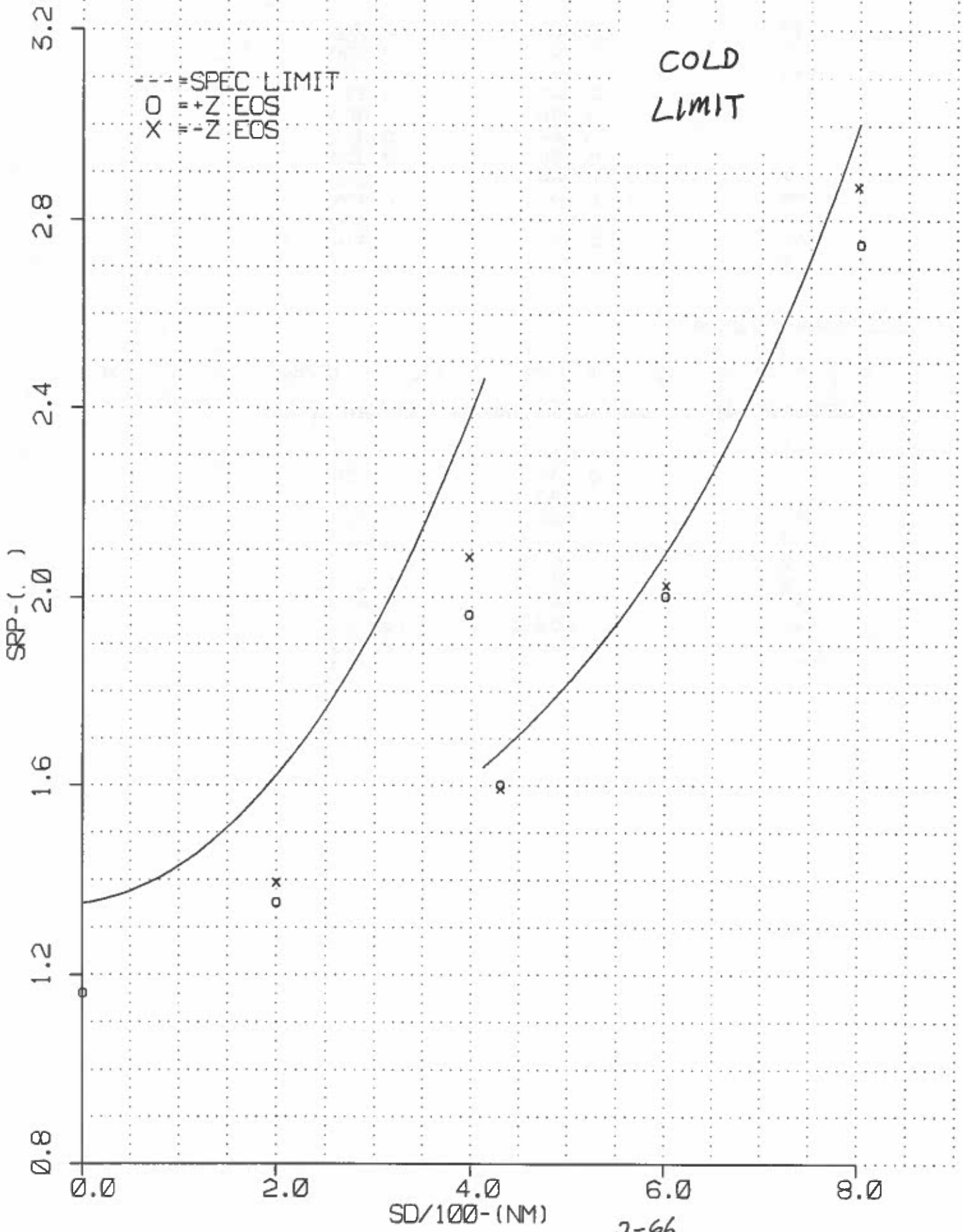
FLT. NO. = 20 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 41

SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-799.	2.826	0.944
0.	0.000	0.000
-430.	1.591	0.952
-397.	2.088	0.877
0.	0.000	0.000
0.	1.164	0.862
0.	0.000	0.000
397.	1.964	0.825
430.	1.603	0.959
0.	0.000	0.000
801.	2.750	0.914

LS, NITE, NORMAL, BACKUP

FLT. NO. = 20 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 41

SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-799.	2.820	0.942
0.	0.000	0.000
-430.	1.590	0.952
-397.	2.084	0.875
0.	0.000	0.000
0.	1.162	0.861
0.	0.000	0.000
397.	1.960	0.823
430.	1.602	0.959
0.	0.000	0.000
801.	2.745	0.913



LS, NITE, NORMAL, PRIMARY

FLT. NO. = 20 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 327

SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-799.	2.870	0.959
-601.	2.025	0.966
-430.	1.592	0.953
-397.	2.085	0.875
-200.	1.394	0.860
0.	1.161	0.860
200.	1.352	0.834
397.	1.962	0.824
430.	1.601	0.958
600.	2.003	0.956
801.	2.749	0.914

LS, NITE, NORMAL, BACKUP

FLT. NO. = 20 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 327

SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-799.	2.866	0.957
-601.	2.022	0.965
-430.	1.591	0.952
-397.	2.080	0.873
-200.	1.391	0.858
0.	1.160	0.859
200.	1.350	0.833
397.	1.958	0.822
430.	1.600	0.957
600.	2.000	0.955
801.	2.744	0.912

2.2 Geometric Resolution (Cont'd)

2.2.6 Data Sampling (3.2.1.1.2.3)

The sampling frequency ratios for all modes of the 5D-3 OLS satisfy the specification requirements. The calculations are contained in the 5D-3 OLS System Summary Report. The results are summarized below. The worst-case sampling frequency ratio for each mode is given.

<u>MODE</u>	<u>SAMPLING FREQ. RATIO</u> (Spec: > 2.4)
LF Day - Normal	2.58
LF Day - Fallback	2.61
LS & TS Day - Normal	2.50
LS Night - Normal	2.66
TF - Normal	3.44
TF Fallback - Normal Side of scan	3.28
TF Fallback - Abnormal Side of Scan	3.28

2.3 Geometric Accuracy (3.2.1.1.3.1 thru 3.2.1.1.3.4)

The alignment and synchronization of the SSS determine the Geometric Accuracy. Geometric accuracy is specified in 3 categories (Repeatability, Stability & Fixed Errors). Within these categories, accuracy is further specified for Along Track, Along Scan (Stored Data), Along Scan (Direct Data), and Along Scan (with digital delphi generation, i.e., the Encoder Simulator locked mode).

There was an observed shift in alignment between the extremes of M1 temperature of -8°C and $+12^{\circ}\text{C}$ on the order of 0.15 milliradians or less for all channels. There was also an observed shift in synchronization in all modes in OLS #20 of approximately 0.2 milliradians or less between M1 temperature extremes of -8°C and $+12^{\circ}$.

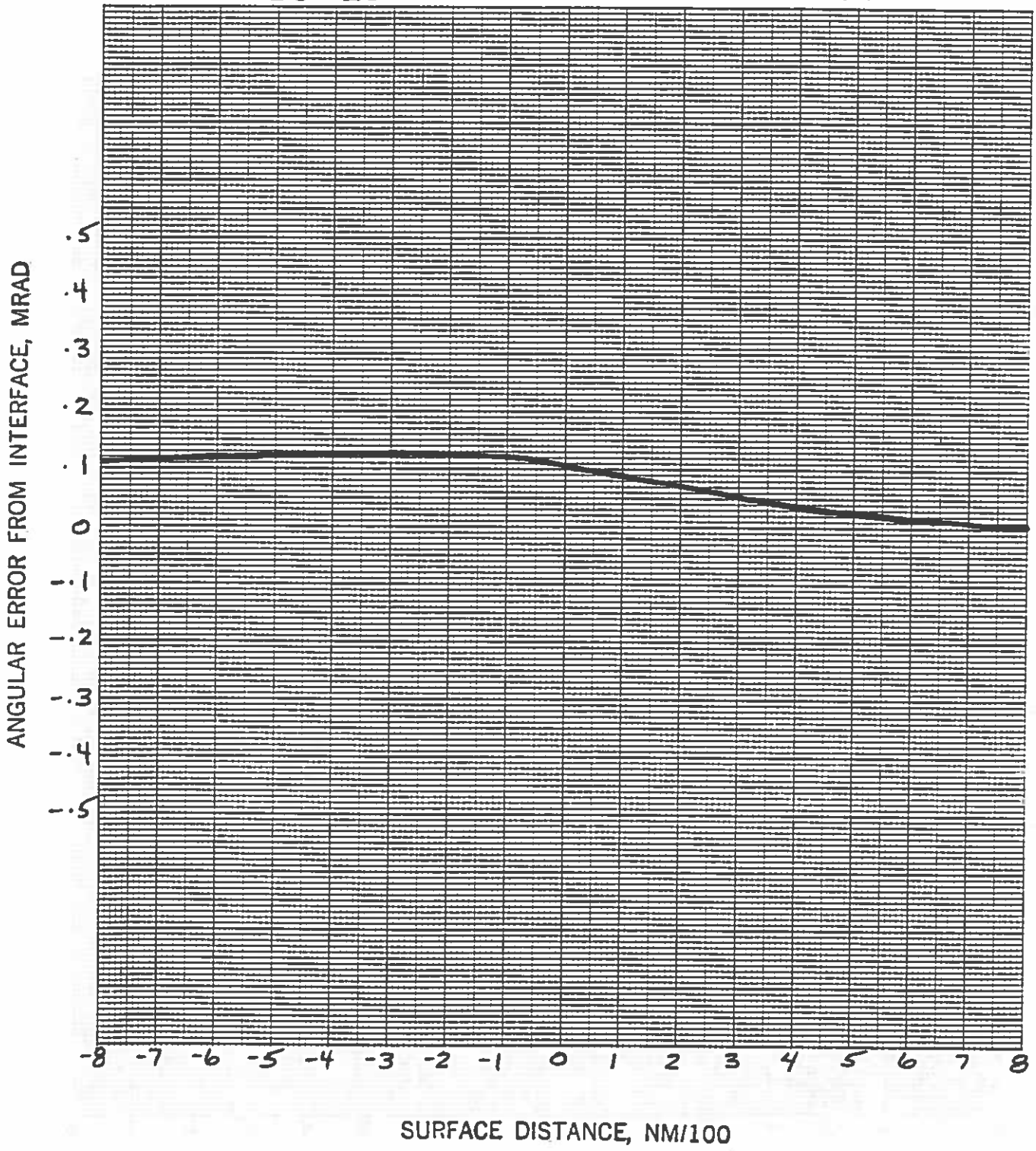
The Repeatability error is calculated using the rms difference of the measured alignment/synchronization (as a function of the variation of M1 temperature on orbit) from the hot-to-cold average values of alignment/ synchronization. The total Repeatability contribution for synchronization is determined by rss'ing the wow-flutter error (as measured in test 6x11.ST) and the jitter error (which was negligible on OLS #20) with the repeatability shift between the Hot and Cold Limits.

The Primary Alignment Reference Axes (REFPLN) are calculated in a computer program using HRD & T channel Alignment and Sync data from several tests. The data determine a best-fit alignment with respect to the Interface Mounting Axes. The REFPLN Alignment and REFPLN Synchronization curves are included here. The remainder of the Alignment and Synchronization data for the OLS #20 SSS are in BVS 2809, Vol. III of this Acceptance Test Report.

The 5D-3 System has a Fallback mode utilizing an encoder control track and Encoder Simulator. The spec limits and measured results are shown in Table 2.3-2.

ATTACHMENTS: OLS #20 REFPLN ALIGNMENT
OLS #20 REFPLN SYNCHRONIZATION
OLS #20 ALIGN/SYNC vs SPEC, Table 2.3-1
OLS #20 Encoder Simulator Sync, Table 2.3-2

OLS #20 REFPLN ALIGNMENT



OLS #20 REFPLN SYNCHRONIZATION

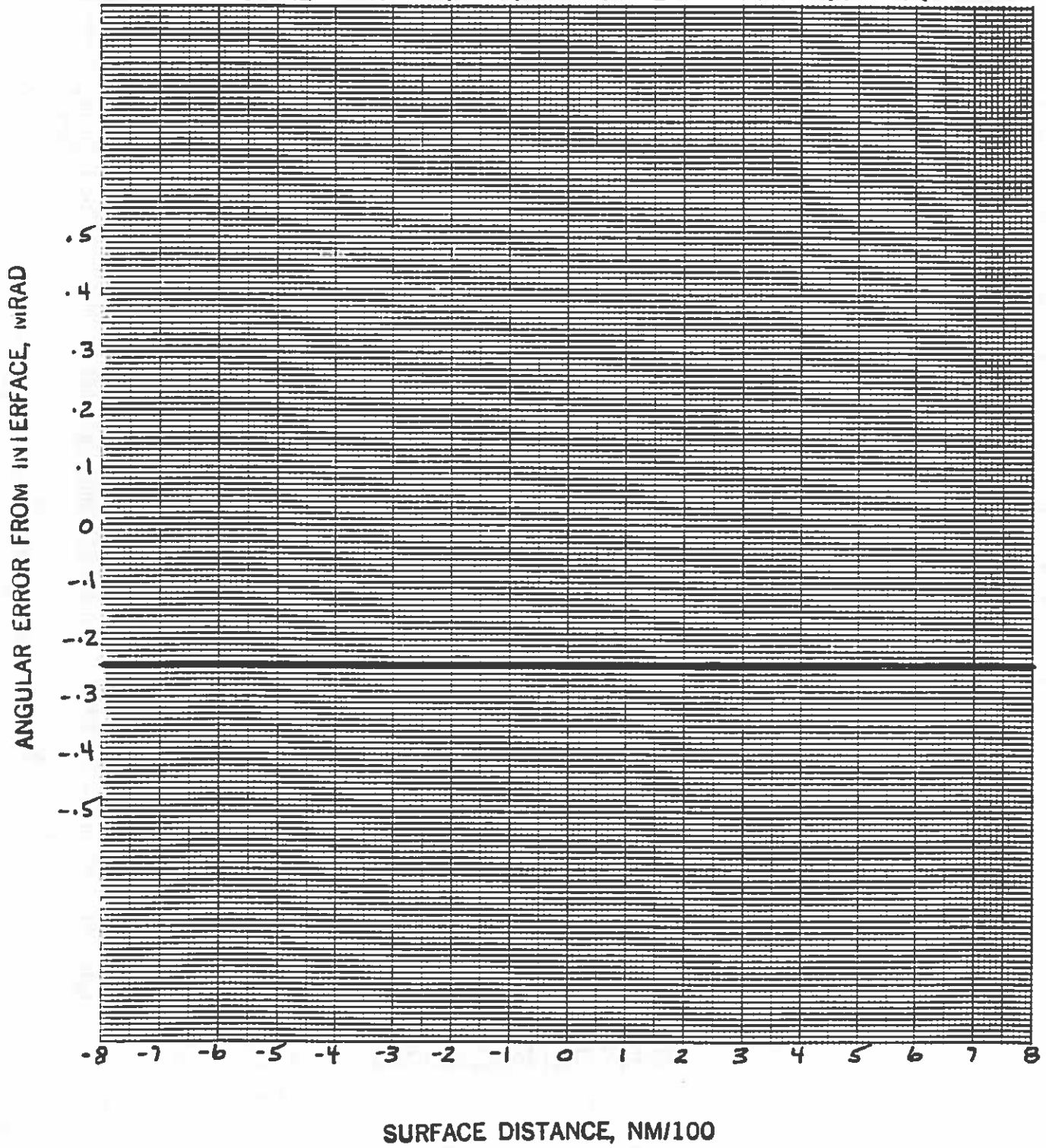


Table 2.3-1

OLS #20 ALIGN/SYNC vs. SPEC
all numbers in milliradians

	<u>HRD</u>	<u>T</u>	<u>PMT</u>
<u>FIXED - Delta between "REFPLN"</u>			
<u>& Optic Hot - Cold Average</u>			
AT SPEC	0.45	0.70	0.60
Measured (worst-case)	0.15	0.21	0.36
AS STORED SPEC	0.80	0.80	1.90
Measured (worst-case)	0.21	0.45	0.77
AS DIRECT FINE SPEC	0.80	0.80	1.90
Measured (worst-case)	0.21*	0.45*	N/A
AS DIRECT SMOOTH SPEC	0.80	0.80	1.90
Measured (worst-case)	0.21*	0.45*	0.96
<u>STABILITY - Delta Between Pre & Post - Vibration</u>			
AT SPEC	0.50	0.55	0.55
Measured (worst-case)	0.07	0.09**	0.20
AS STORED SPEC	0.20	0.25	0.25
Measured (worst-case)	0.05	0.12**	0.10
AS DIRECT FINE SPEC	0.20	0.25	0.25
Measured (worst-case)	0.05*	0.12**	N/A
AS DIRECT SMOOTH SPEC	0.20	0.25	0.25
Measured (worst-case)	0.05*	0.12**	0.10
<u>REPEATABILITY - Delta between TV Hot & Cold Limits</u>			
AT SPEC	0.20	0.22	0.20
Measured (rms)	0.02	0.03	0.05
AS STORED SPEC	0.30	0.30	0.30
Measured (rms)	0.09	0.09	0.14
AS DIRECT FINE SPEC	0.50	0.50	0.50
Measured (rms)	0.08	0.09*	N/A
AS DIRECT SMOOTH SPEC	2.00	2.00	2.00
Measured (rms)	0.11	0.09*	0.08
<u>TOTAL -</u>			
AT SPEC	1.00	1.30	1.20
Calculated	0.22	0.30	0.57
AS STORED SPEC	1.16	1.19	1.20
Calculated	0.31	0.60	0.94
AS DIRECT FINE SPEC	1.34	1.36	2.46
Calculated	0.30	0.60	N/A
AS DIRECT SMOOTH SPEC	2.81	2.82	3.92
Calculated	0.33	0.60	1.09

N/A = not applicable * = Inferred from AS Stored number.

** Average of OLS #12 thru OLS #17

Table 2.3-2
OLS #20 ALONG-SCAN GEOMETRIC ACCURACY WITH ENCODER SIMULATOR

	<u>Stored</u>	<u>Direct Fine</u>	<u>Direct Smooth</u>
Repeatability-Spec, mrad	1.0	1.1	2.2
Measured	0.07	0.06	0.09
Stability - Spec, mrad	0.50	0.50	0.50
Measured	0.20	0.20*	0.20*
Fixed - Spec, mrad	10.0	10.0	10.0
Measured	1.04	1.04*	1.04*
Total - Spec, mrad	11.1	11.2	12.3
Calculated	1.25	1.25	1.26

*Inferred from stored number

2.4 RADIOMETRIC ACCURACY

2.4.1 T Channel Radiometric Accuracy (3.2.1.1.4.1 a,b,c)

The overall one sigma accuracy of the OLS #20 T Channel DC response is 0.74°K compared to a 1.1°K spec and therefore OLS #20 does meet this specification requirement.

Table 2.4.1-1 presents the overall summary of performance, which is discussed more fully in sections 2.4.1.1, 2.4.1.2 and 2.4.1.3.

ATTACHMENTS:

Table 2.4.1-1	Overall Contributors
Table 2.4.1-2	210° to 310°K Best Straight Line Calibrations
Table 2.4.1-3	T DC Response Compilation of Test Runs
Table 2.4.1-4	BSL Equation T Right, Run #9
Table 2.4.1-5	BSL Equation T Mid, Run #9
Table 2.4.1-6	BSL Equation T Left, Run #9
Figure 2.4.1-1	T DC Response Plots, Run #1 - Primary
Figure 2.4.1-2	T DC Response Plots, Run #1 - Redundant
Figure 2.4.1-3	T DC Response Plots, Run #8 - Primary
Figure 2.4.1-4	T DC Response Plots, Run #8 - Redundant
Figure 2.4.1-5	T DC Response Plots, Run #9 - Primary
Figure 2.4.1-6	T DC Response Plots, Run #9 - Redundant

TABLE 2.4.1-1

OLS #20OVERALL CONTRIBUTORS TO T-CHANNEL RADIOMETRIC ACCURACY

<u>SPECIFICATION PARA. 3.1.4.1</u>	<u>RMS DEVIATION (°K)</u>	<u>SPECIFICATION MAX ONE SIGMA ERROR (°K)</u>
a) Repeatability (<1 day)	0.26	0.42
b) Stability (>1 day)	0.61	0.80
c) Fixed Deviations	0.32	0.60
TOTAL (RSS) ACCURACY	<u>0.74</u>	<u>1.10</u>

Discussion of T DC Response Test and Overview

The measurement of T DC Response is accomplished in the thermal vacuum chamber because the T detector must be cooled to its operating temperature of near 110°K. Two controlled blackbody targets variable in temperature over the dynamic range of 190°K to 310°K provide the absolute infrared radiance reference. The temperature of each target is measured by five thermocouples which have been calibrated against a precision platinum resistance temperature standard. The five thermocouples provide target temperature gradient information to indicate target stability as well as the capability to average the five for the reference target temperature. T Channel DC Response consists of comparing the average target temperature to the channel output voltage at the input to the A/D converters for several target temperatures.

Nine vacuum runs were made on OLS #20. The T DC Response data from vacuum runs (1 through 9) is compiled in Table 2.4.1-2 and -3, which show the equipment temperature environments and characteristics of each run. The column headed "Data Points" indicates how many target temperatures were in that run. The characteristics of the response itself are indicated in three columns each for T LFT, T MID and T RGT. The compared channel response to target temperature results in a difference for each data point. This difference is corrected for M1 Temperature so that all data for a given run reflect the same M1 temperature and the expected shaper circuit difference is subtracted. In this form the difference data for a given run should ideally be a linear function vs. target temperature. A linear least-squares fit to the corrected data is used to determine the equation of the best straight line (BSL). In Table 2.4.1-2 the slope error, the 210°K ordinate and the RMS data fit values for these different BSL's are listed in the columns headed Slope, Ordinate at 210°K, and RMS Dev.

In order to distinguish between gain and bias type effects caused by environment, the 310°K value that results when the 210°K BSL value is forced to zero difference is also calculated. Table 2.4.1-3 shows the pre-shaper % gain Difference from Nominal, the Bias Diff. from Nominal (at 190°K) where the pre-shaper Gain is forced to nominal, and the M1 temperature coefficient (K factor); in three columns each for TRGT, TMID and TLEFT.

Tables 2.4.1-4, -5 and -6 show the STS computer processed and gain compensated T DC Response Data of the final "Hot Limit" Run (Run #9) for TRGT, TMID, and TLEFT respectively. The fourth line down in the body of the Best Straight Line Equation, "RMS Deviation", is the RMS error (for 210°K to 310°K) of the data points fitted to the best straight line. "FP" is T Fine Primary; "FB" is T Fine, Backup (Redundant); "SP" is T Smoothed, Primary; "SB" is T Smoothed, Backup (redundant). The SP and SB are not used for T Right Only or for T Left Only in the Primary or Redundant normal modes; these are utilized only in the Fallback (slightly degraded) modes of operation. SP and SB are applicable to T Mid in normal Primary or Redundant modes.

Runs 8 and 9 together indicate the changes which accompany operation over the foreoptics cold-to-warm temperature range as indicated by M1 temperature.

Runs 4 and 5 or 6 and 7 together indicate the magnitude of the variation over the extremes of SSS temperature, (+12° to -2°C); when compared to the +7°C SSS run pairs with the corresponding M1 temperatures, (Runs 8 and 9, respectively). However, changes between these runs are not only due to SSS temperature differences. The PSU, which contains the shaper networks was varied in temperature along with the SSS, from a low of -1.2°C to a high of +36.7°C.

Figures 2.4.1-1 through 2.4.1-6 inclusive show, for Run No. 1 along with No. 8 and No. 9, (respectively), the test data points for Targets 1 and 2 and the BSL plots for Right, Mid, and Left. (No BSL data plot was obtained for Runs 2 through 7).

The OLS #20 average M1 coefficient (coupling factor) measured for the Hot Limit run (#9) was 0.184°K at 210°K scene per 1°C temperature change of M1. The lower the M1 coefficient value, the better the performance. The T Clamp leakage was $+0.200\%$ T LEFT and $+0.177\%$ RIGHT.

The BSL differences (from Table 2.4.1-4,5 and 6) between Fine Primary and Fine Backup are small, the largest being 0.06°K for T Rgt, at the 210°K end. In the Smooth Primary and Backup modes, T Lft differs by 0.07°K (at 310°K).

The difference between T LEFT and T RIGHT segments calibration (from Tables 2.4.1.3-3 and 4) is 0.84°K worst-case, vs. a spec limit of 1.0°K .

TABLE 2.4.1-2
OLS #20

210° TO 310°K BEST STRAIGHT LINE CALCULATIONS

DATE	RUN#	R/L TG	TL	# OF DATA POINTS	TEMPERATURE °C			T RIGHT			T MID			T LEFT			COMMENTS
					SSS	MI	PSU	SLOPE	ORD. @ 210°	RMS DEV	SLOPE	ORD. @ 210°	RMS DEV	SLOPE	ORD. @ 210°	RMS DEV	
02/07/95	1	6/6	13	6	5.5	-8.2	22.4	-0.0057	0.84	0.17	-0.0116	1.26	0.13	-0.0009	0.61	0.19	T VAC ADJ
VACUUM BREAK																	
03/13/95	2	6/6	13	2	7.2	-7.9	31.7	-0.0086	0.45	0.00	-0.0138	0.91	0.00	-0.0010	0.05	0.00	COLD OPTICS LIMIT
03/14/95	3	7/7	9	2	6.7	12.3	31.8	-0.0039	0.08	0.00	-0.0129	1.03	0.00	-0.0010	0.28	0.00	HOT OPTICS LIMIT
03/15/95	4	7/7	13	2	-1.6	-10.6	-1.2	0.0028	0.73	0.00	-0.0001	1.02	0.00	0.0129	0.34	0.00	COLD SOAK #1
03/16/95	5	7/7	9	2	12.3	15.1	36.4	-0.0086	0.27	0.00	-0.0176	1.22	0.00	-0.0048	0.42	0.00	HOT SOAK #1
03/19/95	6	7/7	13	2	-1.6	-10.8	-1.2	0.0017	0.71	0.00	-0.0016	1.07	0.00	0.0119	0.33	0.00	COLD SOAK #2
03/20/95	7	7/7	9	2	11.6	15.5	36.7	-0.0088	0.22	0.00	-0.0176	1.17	0.00	-0.0059	0.42	0.00	HOT SOAK #2
03/23/95	8	7/7	13	8	3.7	-8.1	2.4	-0.0003	0.94	0.23	-0.0035	1.24	0.19	0.0101	0.51	0.27	COLD LIMIT
03/30/95	9	7/7	9	8	6.7	12.3	31.8	-0.0067	0.46	0.19	-0.0153	1.28	0.10	-0.0032	0.63	0.18	HOT LIMIT

TABLE 2.4.1-3
OLS #20
T DC RESPONSE COMPILATION OF TEST RUNS

DATE	RUN #	R/L TG	TL	# OF DATA POINTS	TEMPERATURE °C			T RIGHT			T MID			T LEFT			COMMENTS
					SSS	HI	PSU	% GAIN DIFF. FROM NOM.	BIAS DIFF. FROM NOM.	K FACTOR	% GAIN DIFF. FROM NOM.	BIAS DIFF. FROM NOM.	K FACTOR	% GAIN DIFF. FROM NOM.	BIAS DIFF. FROM NOM.	K FACTOR	
02/07/95	1	6/6	13	6	5.5	-8.2	22.4	-0.03	1.24	.178	-0.50	1.65	.206	0.46	1.12	.222	TVAC ADJ
VACUUM BREAK																	
03/13/95	2	6/6	13	2	7.2	-7.9	31.7	-0.85	0.28	.165	-1.18	0.83	.190	-0.10	0.02	.196	COLD OPTICS LIMIT
03/14/95	3	7/7	9	2	6.7	12.3	31.8	-0.50	-0.11	.165	-0.92	1.13	.190	0.13	0.48	.196	HOT OPTICS LIMIT
03/15/95	4	7/7	13	2	-1.6	-10.6	-1.2	1.13	1.48	.165	0.98	1.86	.190	2.25	1.27	.196	COLD SOAK #1
03/16/95	5	7/7	9	2	12.3	15.1	36.4	-1.02	-0.11	.165	-1.43	1.13	.190	-0.31	0.47	.196	HOT SOAK #1
03/19/95	6	7/7	13	2	-1.6	-10.8	-1.2	0.94	1.39	.165	0.80	1.87	.190	2.08	1.19	.196	COLD SOAK #2
03/20/95	7	7/7	9	2	11.6	15.5	36.7	-1.09	-0.21	.165	-1.48	1.03	.190	-0.48	0.39	.196	HOT SOAK #2
03/23/95	8	7/7	13	8	3.7	-8.1	2.4	0.95	1.78	.165	0.68	2.12	.190	2.00	1.56	.196	COLD LIMIT
03/30/95	9	7/7	9	8	6.7	12.3	31.8	-0.55	0.44	.165	-1.04	1.45	.190	0.13	0.98	.196	HOT LIMIT

TABLE 2.4.1-4

OLS NUMBER 20

T RGT DATA OF 03/30/95

SSS AT 6.7°C

M1 AT 12.3°C

PSU TEMP = 31.8°C

M1 Coefficient =0.165 K/oC

T GAIN = 7

T LEVEL = 9

V2 <T Clamp> = 1.91406

K9 <TL Step Size> = 0.919172

BEST STRAIGHT LINE EQUATION

	FP	(Δ)	FB	SP	(Δ)	SB
BSL SLOPE	-0.0067	-	-0.0066	-0.0065	-	-0.0067
BSL AT 190K<K>	0.59	(.06)	0.53	0.61	(.04)	0.57
BSL AT 210K<K>	0.46	(.06)	0.40	0.48	(.04)	0.44
BSL AT 310K<K>	-0.21	(.05)	-0.26	-0.17	(.07)	-0.24
RMS DEVIATION<K>	0.19	-	0.18	0.19	-	0.18
BSL AT 310K; 190 AT OV<K>	-0.40	-	-0.42	-0.36	-	-0.42
% CHANGE FROM NOM GAIN	-0.55	-	-0.59	-0.50	-	-0.58
BIAS DIFF FROM NORMAL 190K<K>	0.44	-	0.33	0.49	-	0.39

TABLE 2.4.1-5

OLS NUMBER 20

T MID DATA OF 03/30/95

SSS AT 6.7°C

M1 AT 12.2°C

PSU TEMP = 31.8°C

M1 Coefficient = -0.190 K/oC

T GAIN = 0

T LEVEL = 9

V2 <T Clamp> = 1.89575

K9 <TL Step Size> = .919172

BEST STRAIGHT LINE EQUATION

	FP	(Δ)	FB	SP	(Δ)	SB
BSL SLOPE	-0.0153	-	-0.0154	-0.0153	-	-0.0154
BSL AT 190K<K>	1.58	(.03)	1.55	1.60	(.05)	1.55
BSL AT 210K<K>	1.28	(.04)	1.24	1.29	(.05)	1.24
BSL AT 310K<K>	-0.26	(.04)	-0.30	-0.24	(.06)	-0.30
RMS DEVIATION<K>	0.10	-	0.09	0.10	-	0.09
BSL AT 310K; 190 AT 0V<K>	-0.75	-	-0.79	-0.74	-	-0.79
% CHANGE FROM NOM GAIN	-1.04	-	-1.08	-1.02	-	-1.09
BIAS DIFF FROM NORMAL 190K<K>	1.45	-	1.38	1.49	-	1.38

TABLE 2.4.1-6

OLS NUMBER 20

T LFT DATA OF 03/30/95

SSS AT 6.7°C

M1 AT 12.2°C

PSU TEMP = 31.8°C

M1 Coefficient = .196°K/C

T GAIN = 7

T LEVEL =9

V2 <T Clamp> = 1.87744

K9 <TL Step Size> = .919172

BEST STRAIGHT LINE EQUATION

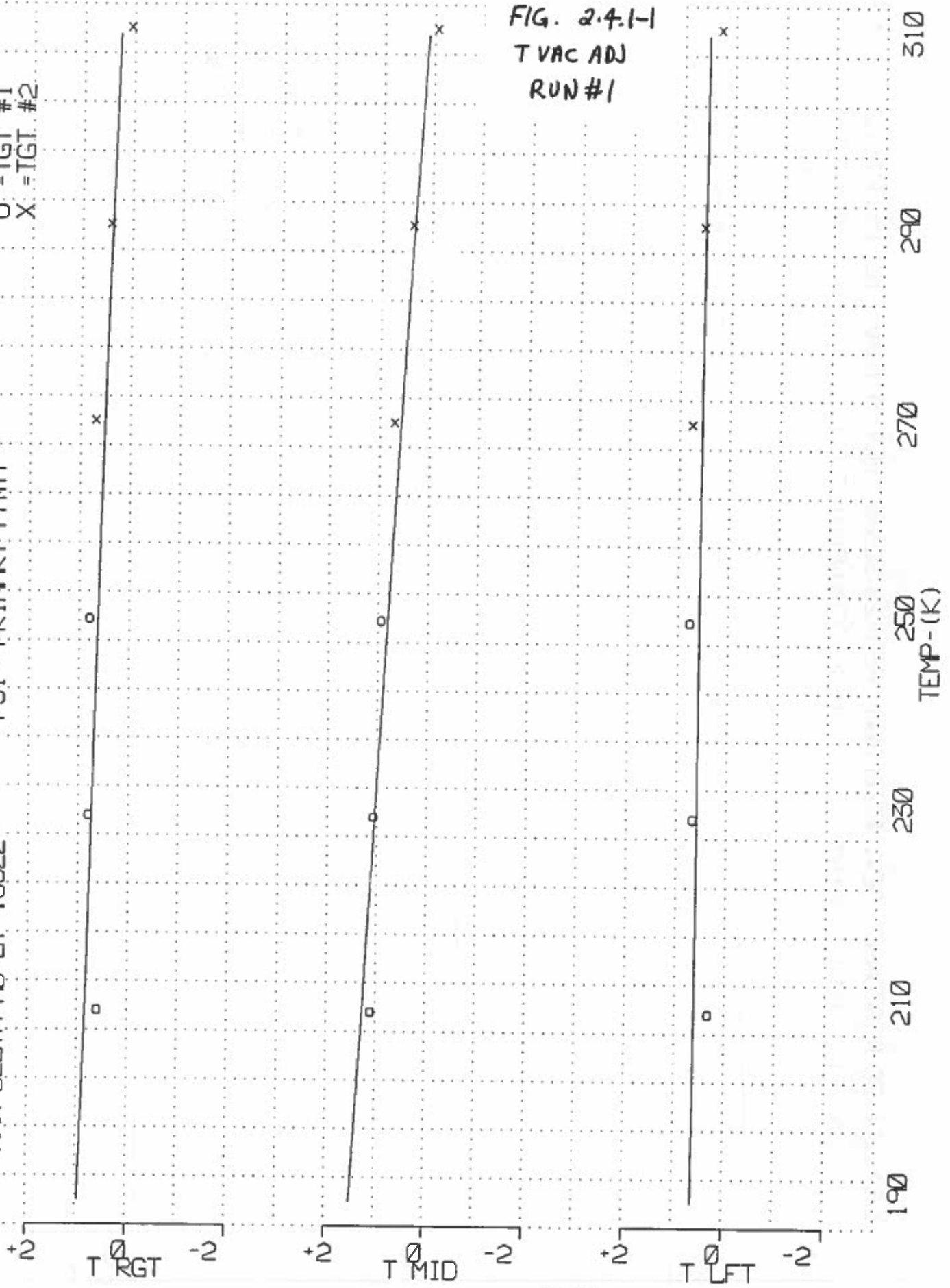
	FP	(Δ)	FB	SP	(Δ)	SB
BSL SLOPE	-0.0032	-	-0.0030	-0.0029	-	-0.0030
BSL AT 190K<K>	0.69	(.03)	0.66	0.70	(.02)	0.68
BSL AT 210K<K>	0.63	(.03)	0.60	0.65	(.03)	0.62
BSL AT 310K<K>	0.31	(.01)	0.30	0.36	(.04)	0.32
RMS DEVIATION<K>	0.18	-	0.18	0.18	-	0.17
BSL AT 310K;						
190 AT OV<K>	0.10	-	0.10	0.14	-	0.12
% CHANGE FROM						
NOM GAIN	0.13	-	0.14	0.20	-	0.16
BIAS DIFF FROM						
NORMAL 190K<K>	0.98	-	0.95	1.04	-	0.98

OLS# 20 T DC RESPONSE: DEV. FROM NOM PSU=23 SSS=5 M1=-8 TG=6 TL=13 DATE:2 / 7 / 95

MAX DELTA MD-LT .6522 PSI - PRIMARY PATH

O = IGT #1
X = IGT #2

FIG. 2.4.1-1
TVAC ADJ
RUN #1



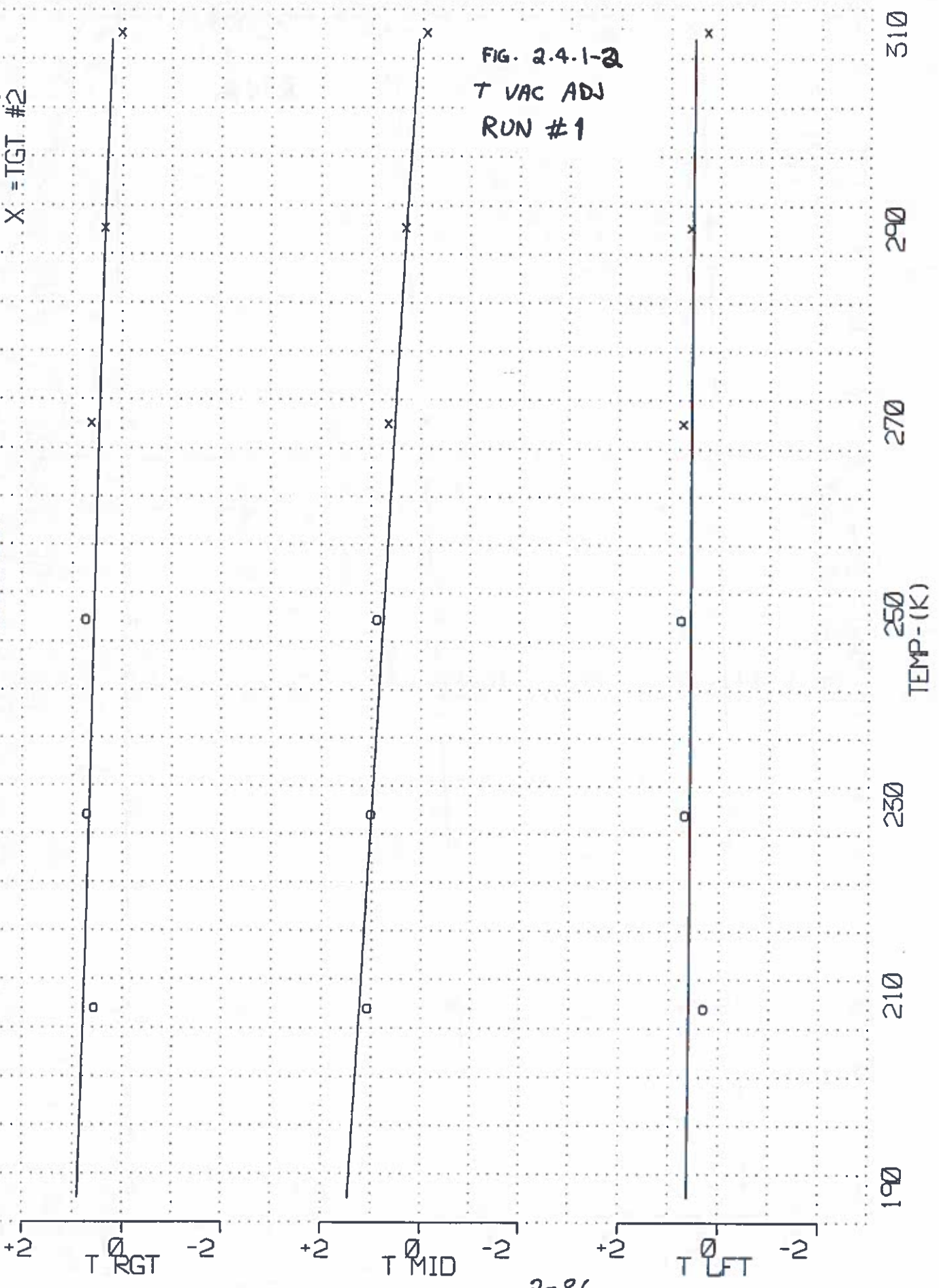
OLS# 20 T DC RESPONSE: DEV. FROM NOM PSU=23 SSS=5 M1=-8 TG=6 TL=13 DATE:2 /7 /95

O = TGT #1
X = TGT #2

PS2- REDUNDANT PATH

MAX DELTA MD-LT .6197

FIG. 2.4.1-2
T VAC ADJ
RUN #1



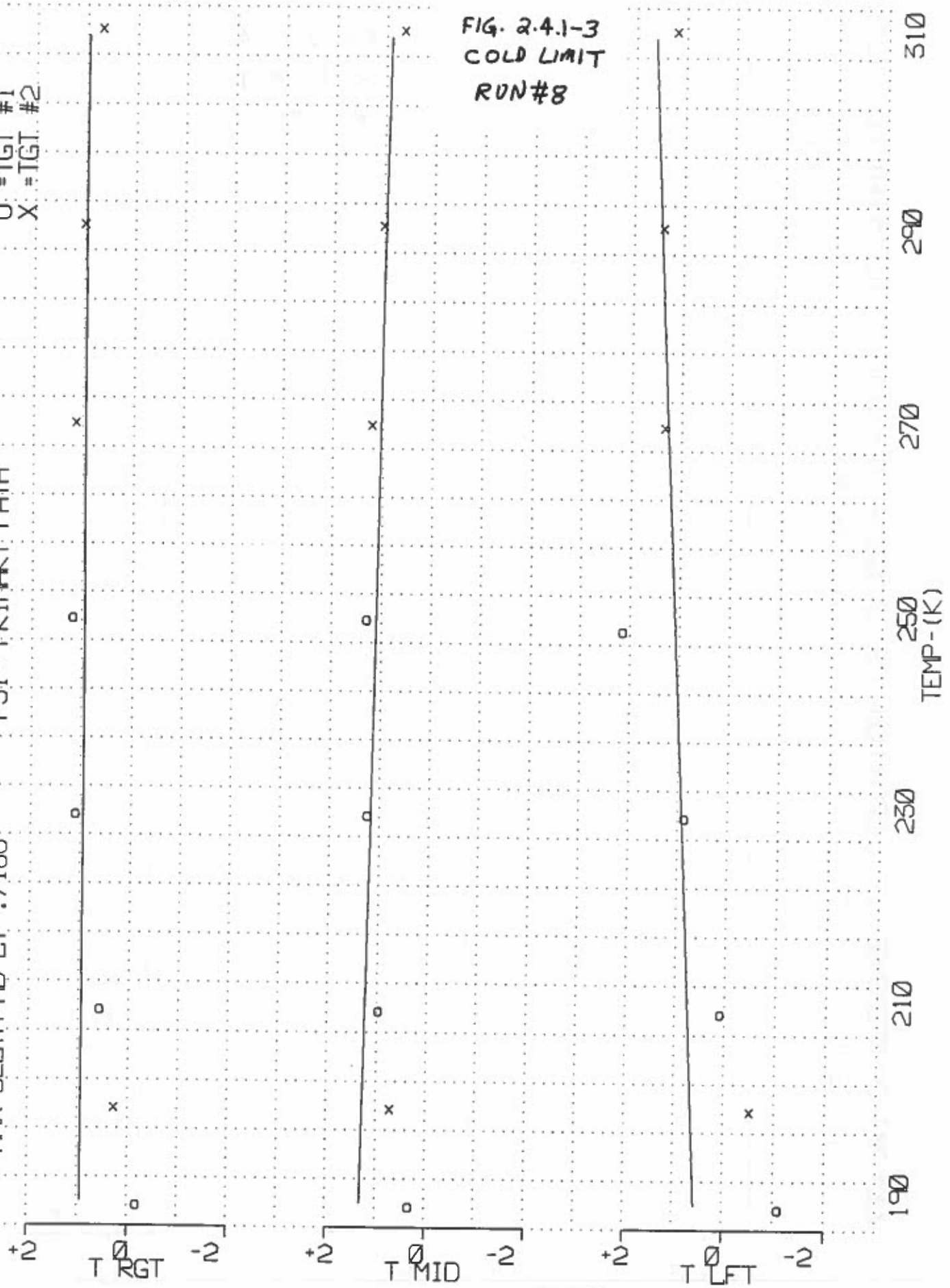
OLS# 20 T DC RESPONSE: DEV. FROM NOM PSU=3 SSS=4 M1=-8 TG=7 TL=13 DATE: 5 /22/95

PS1 - PRIMARY PATH

MAX DELTA MD-LT .7168

O = TGT #1
X = TGT #2

FIG. 2.4.1-3
COLD LIMIT
RUN#8



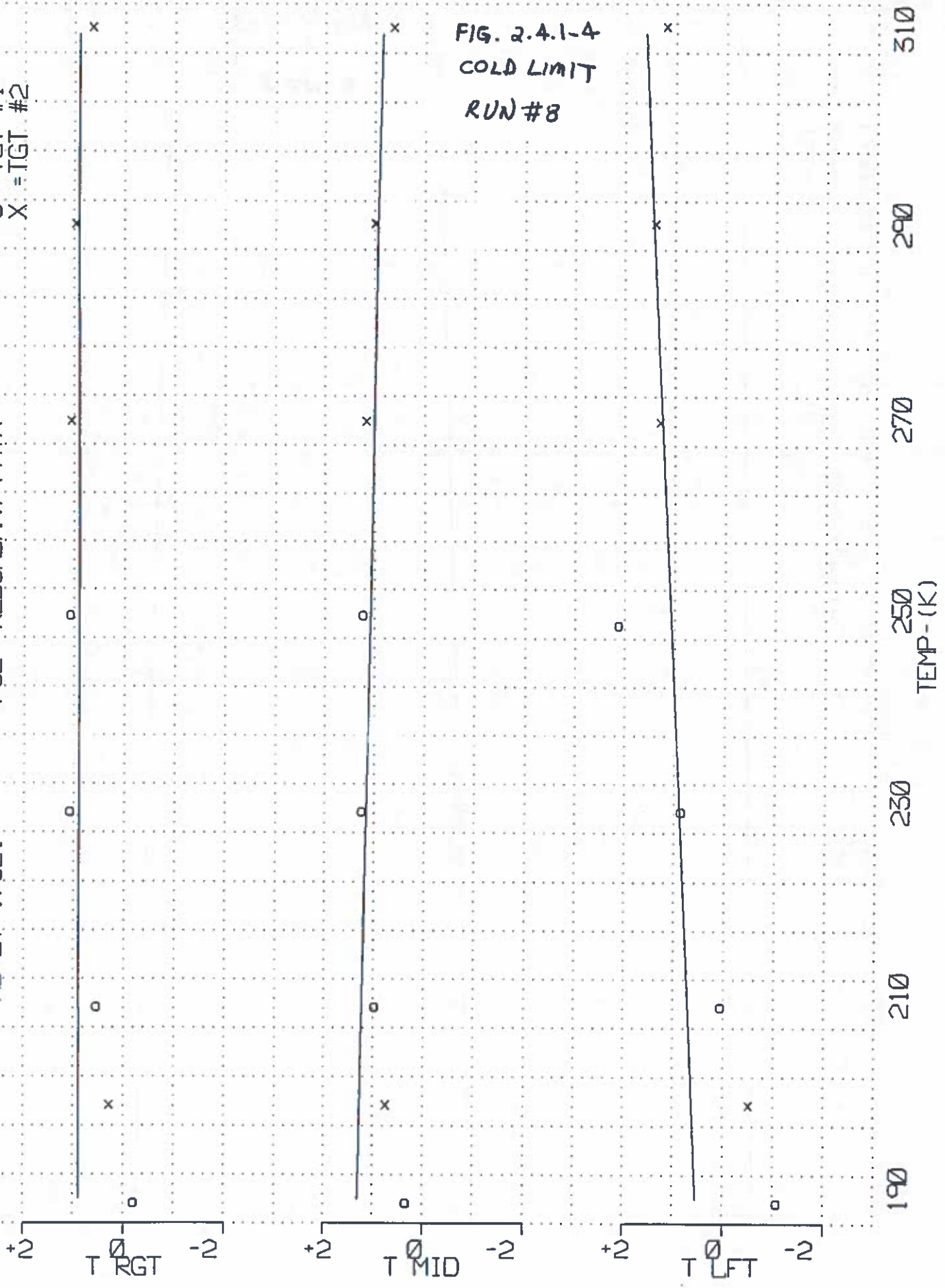
OLS# 20 T DC RESPONSE: DEV. FROM NOM PSU=3 SSS=4 M1=-8 TG=7 TL=13 DATE: 3 /22/95

MAX DELTA MD-LT: .7521

PS2- REDUNDANT PATH

O = TGT #1

X = TGT #2



OLS# 20 T DC RESPONSE: DEV. FROM NOM PSU=32 SSS=7 M1=12 TG=7 TL=9 DATE:3 /30/95

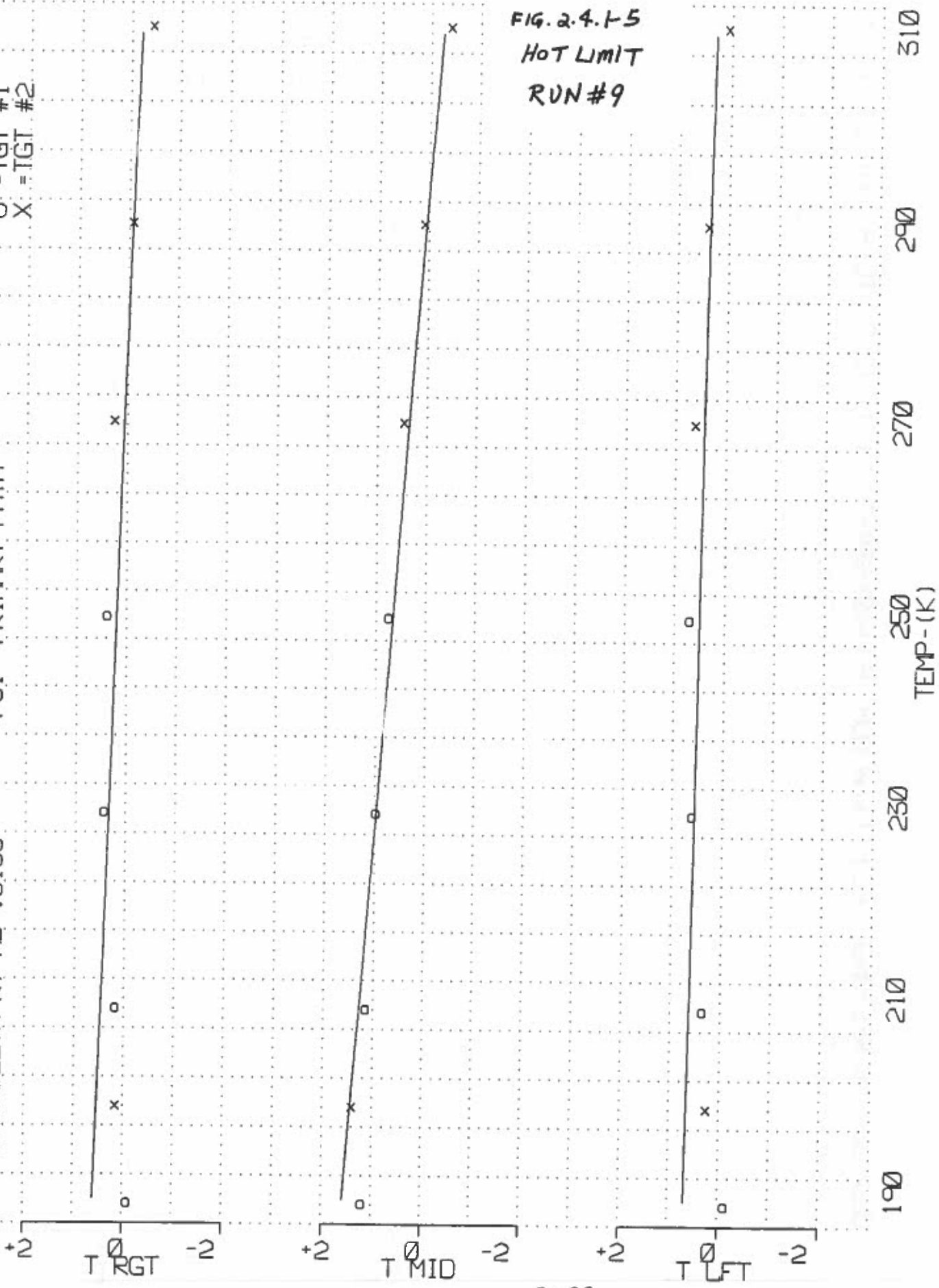
PS1 - PRIMARY PATH

MAX DELTA RT-MD .8155

O = TGT #1

X = TGT #2

FIG. 2.4.1-5
HOT LIMIT
RUN #9



OLS# 20 T DC RESPONSE: DEV. FROM NOM PSU=32 SSS=7 M1=12 TG=7 TL=9 DATE:3 /30/95

O = TGT #1
X = TGT #2

PS2- REDUNDANT PATH

MAX DELTA RT-MD .8264

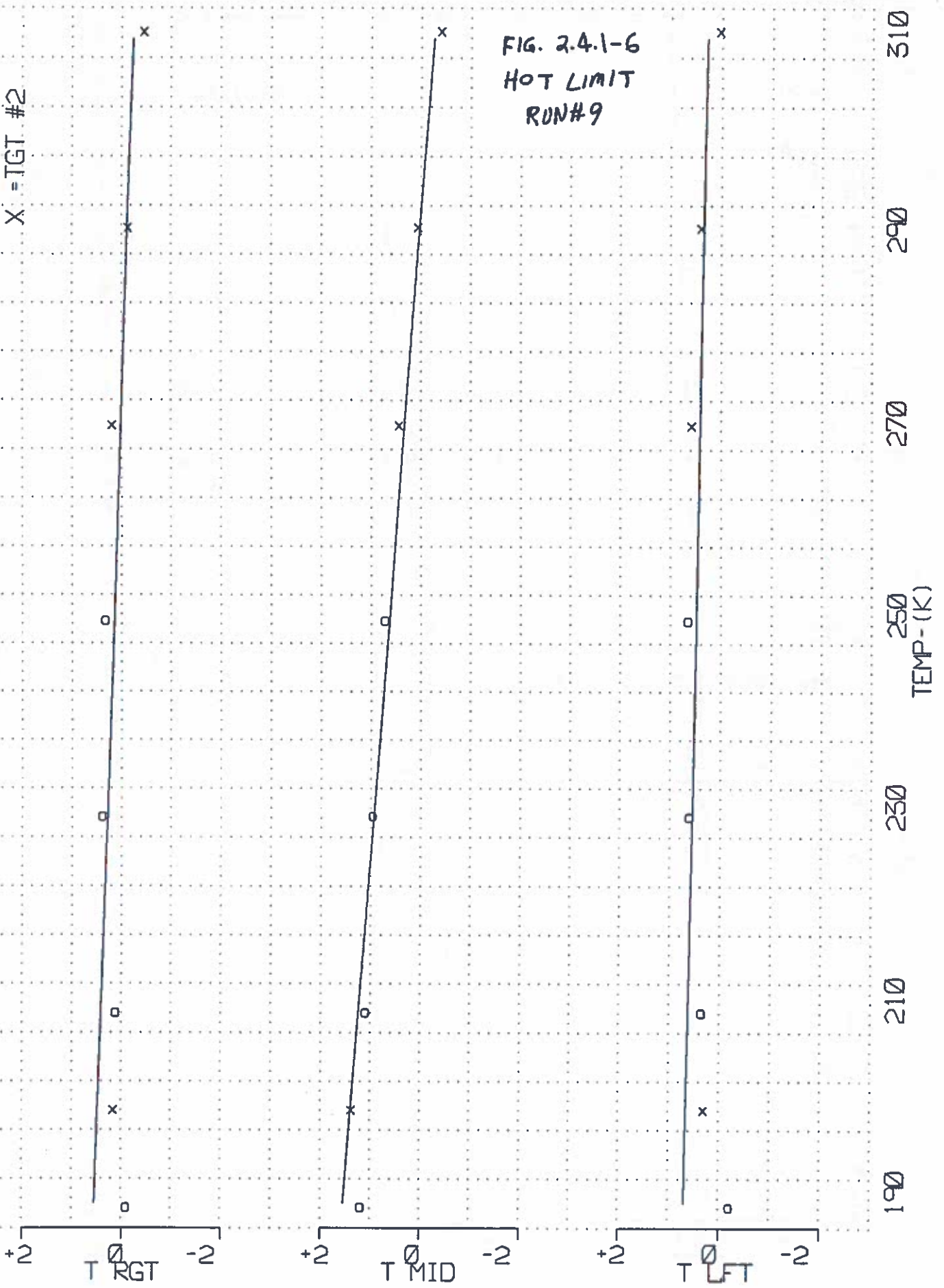


FIG. 2.4.1-6
HOT LIMIT
RUN#9

2.4 RADIOMETRIC ACCURACY

2.4.1 T Channel Radiometric Accuracy (Cont'd)

2.4.1.1 Repeatability (3.2.1.1.4.1a)

The 1 sigma Repeatability of T Channel DC Response is 0.26°K compared to a 0.42°K one sigma specification maximum and therefore OLS #20 does meet this specification requirements.

ATTACHMENTS

Table 2.4.1.1-1 Repeatability Contributors

Table 2.4.1.1-2 Gain and Bias Variations with Temperature Change

Table 2.4.1.1-3 Target Crosstalk, T Clamp Leakage Data

TABLE 2.4.1.1-1

OLS #20

REPEATABILITY CONTRIBUTORS SUMMARY

<u>ERROR SOURCE</u>	<u>ONE SIGMA ERROR (K°)</u>
1. Diurnal M1 Temperature Change (4°C)	
A. Quantization of T Level Command	0.17
B. Inability to Compensate Actual Effect Exactly	0.06*
2. Temperature Change PSU ± 4.5°C, SSS ± 1°C	
A. Effect due to Gain Change	0.05*
B. Effect due to Bias Change	0.07*
3. T Clamp Shaper Compensation	0.08
4. T Clamp Leakage	<u>0.15*</u>
TOTAL RSS REPEATABILITY ERROR (°K)	0.26
SPECIFICATION LIMIT, °K, ONE SIGMA	0.42 MAXIMUM

*FROM TEST DATA (REDUCED)

Discussion of Repeatability Calculations

1. Diurnal M1 Temperature Change

A. The effects of M1 temperature (more properly the foreoptics temperature) are a Repeatability error source. The foreoptics thermal time constant is short enough to permit significant diurnal temperature variations. The ability to compensate for foreoptics temperature using the T Level command greatly reduces this error but does not eliminate it. Although calculations enabling ground compensation smaller than the quantization of the T Level command are possible, it is herein assumed that they will not generally be made. Therefore an error is ascribed due to the T Level quantization as follows:

$$\begin{aligned}
& 0.294^{\circ}\text{K RMS T Level Cmd. Quantization Error at } 210^{\circ}\text{K } (1.02^{\circ} \times 1/\sqrt{12}) \\
\times & 0.564 \quad \text{RMS Temperature Linearity Effects over } 210\text{-}310^{\circ}\text{K dynamic range} \\
= & 0.17^{\circ}\text{K RMS error}
\end{aligned}$$

B. The fact that foreoptics temperature effect cannot be accurately predicted by the single monitor of M1 temperature means that in times of sharp transition the ability to compensate is impaired. It has been assumed that this error may be represented by a 1°C lag in M1 temperature during the 1/3 of the orbit that sharp transistions occur. Therefore the inability to compensate the actual effect is ascribed the following error:

$$\begin{aligned}
& 1^{\circ}\text{C} \quad \text{Lag in M1 Temperature} \\
\times & 1/\sqrt{3} \quad \text{RMS Over total orbit} \\
\times & 0.184 \quad \text{T Left T Mid T Right average sensitivity coefficient of} \\
& \quad \text{video at 210K to M1 temperature change for OLS #20 (K} \\
& \quad \text{factor)} \\
\times & 0.564 \quad \text{Temperature Linearity Effects over dynamic range.} \\
= & 0.060^{\circ}\text{K RMS error}
\end{aligned}$$

Discussion of Repeatability Calculations

Total T channel gain change with temperature may be broken down into two components as follows:

$$\text{Total Gain } \Delta = [(\text{PSU } \Delta T) \times P_G] + [(\text{SSS } \Delta T) \times S_G]$$

where: P_G = PSU coefficient of gain, % per °C.
 S_G = SSS coefficient of gain, % per °C.

Similarly for bias changes with temperature:

$$\text{Total Bias } \Delta = [(\text{PSU } \Delta T) \times P_B] + [(\text{SSS } \Delta T) \times S_B]$$

where: P_B = PSU coefficient of bias, °K per °C.
 S_B = SSS coefficient of bias, °K per °C.

Data from two pairs of runs designated A and B, were used to solve these equations simultaneously:

$$\begin{aligned} \text{Gain } \Delta, \text{ Run A} &= G_A = (T_{PA})(P_G) + (T_{SA})(S_G) \\ \text{Gain } \Delta, \text{ Run B} &= G_B = (T_{PB})(P_G) + (T_{SB})(S_G) \\ \text{Bias } \Delta, \text{ Run A} &= B_A = (T_{PA})(P_B) + (T_{SA})(S_B) \\ \text{Bias } \Delta, \text{ Run B} &= B_B = (T_{PB})(P_B) + (T_{SB})(S_B) \end{aligned}$$

where: G = Total Gain change over temperature
 B = Total Bias change over temperature
 T_P = PSU Temperature change
 T_S = SSS Temperature change

Solved simultaneously for the temperature sensitivity factors, these equations can be reduced to the following:

$$S_G = \frac{(T_{PA})(G_B) - (T_{PB})(G_A)}{(T_{PA})(T_{SB}) - (T_{PB})(T_{SA})}$$

$$P_G = \frac{G_A - (T_{SA})(S_G)}{T_{PA}}$$

$$S_B = \frac{(T_{PA})(B_B) - (T_{PB})(B_A)}{(T_{PA})(T_{SB}) - (T_{PB})(T_{SA})}$$

$$P_B = \frac{B_A - (T_{SA})(S_B)}{T_{PA}}$$

2. SSS and PSU Temperature Change: Effect On Gain Change

The effects of SSS and PSU temperature change on gains were determined from parametric analysis of the four runs in Table 2.4.1.1-2. Solving simultaneous equations yielded sensitivity coefficients of gain change for both SSS and PSU temperature change. Temperature data from 5D-2 systems indicates that the worst case SSS temperature variations are 1°C while worst case PSU temperature variations are 4.5°C. Using the worst-case factors yields:

$$\begin{aligned} S_G &= -0.060 \text{ Gain change per degree SSS change} \\ &\quad \times 1^\circ \text{ temperature change} \\ &\quad \times .31^\circ \text{K RMS over 210K to 310K range} \\ &\quad \times 1/\sqrt{3} \text{ for uniform temperature distribution} \\ &= -0.011 \end{aligned}$$

$$\begin{aligned} P_G &= -0.065 \text{ Gain change per degree PSU change} \\ &\quad \times 4.5^\circ \text{ temperature change} \\ &\quad \times .31^\circ \text{K RMS over 210K to 310K range} \\ &\quad \times 1/\sqrt{3} \text{ for uniform temperature distribution} \\ &= -0.052 \end{aligned}$$

RSS'ing these two contributors yields 0.053 degree total.

3. SSS and PSU Temperature Change, Effect On Bias Change

From Table 2.4.1.1-2:

$$\begin{aligned} S_B &= -0.093 \text{ deg Bias change per degree SSS change} \\ &\quad \times 1^\circ \text{ temperature change} \\ &\quad \times 0.564 \text{ RMS Temperature Linearization Effects, 210K to 310K} \\ &\quad \times 1/\sqrt{3} \text{ for uniform temperature distribution} \\ &= -0.030 \end{aligned}$$

$$\begin{aligned} P_B &= -0.043 \text{ deg Bias change per degree PSU change} \\ &\quad \times 4.5^\circ \text{ temperature change} \\ &\quad \times 0.564 \text{ RMS Temperature Linearization Effects, 210K to 310K} \\ &\quad \times 1/\sqrt{3} \text{ for uniform temperature distribution} \\ &= -0.063 \end{aligned}$$

RSS'ing these two contributors yields 0.070 degree total.

4. T Clamp Shaper Compensation

The SSS temperature changes throughout each orbit are expected to cause a one sigma error of 0.146°K at 210K due to the compensation for T clamp temperature variation from 228K to 253K. This times the 0.564 RMS Temperature Linearization Effect over the dynamic range equals 0.08°K RMS error.

5. T Clamp Leakage

An along scan variation (ASV) effect may be caused by some of the scene radiance being viewed at the time of T clamp during the overscan period getting into the reference T Clamp value. This can happen if the T detector sensitivity extends slightly beyond the boundaries of M4' during the clamp time. The test performed for leakage is to view one target at 210°K during active scan while the other target (which is at the T Clamp angle) is varied over the 210° to 310°K dynamic range. This data is presented in Table 2.4.1.1-3. The effect on the response to the active scan target is attributed to the T clamp optical leakage.

Using the OLS #20 T data from Table 2.4.1.1-3, the T clamp leakage contribution can be calculated as follows:

$$\begin{aligned} \text{T clamp leakage ratio (LR)} &= 100\% \times \Delta T \times \frac{\frac{\partial P}{\Delta T} \cdot 215}{\Delta P} \\ &= \Delta T \times .50552\% \end{aligned}$$

This calculation is performed in the MODE 4 data reduction of T121T221S. The ratio calculated is:

0.200% T LEFT

0.177% T RIGHT

The peak error from T clamp leakage (due to the 310° background) can be calculated as follows:

$$\begin{aligned}
 \text{peak error} &= LR \times \Delta N \times \left(\frac{\partial P^{-1}}{\Delta T_{210}} \right)^{-1} \\
 &= \Delta T \times \frac{\Delta N}{\Delta P} \times \frac{\frac{\partial P}{\Delta T_{215}}}{\Delta T_{210}} \\
 &= \Delta T \times 0.8156 \times 1.0788 \\
 &= \Delta T \times 0.880
 \end{aligned}$$

where:

$$\begin{aligned}
 \Delta P &= \text{Difference in radiance between 210° and 310°K} \\
 &= 16.742 \text{ E-4 w cm}^{-2} \text{ sr}^{-1} @ 310^\circ\text{K} \\
 &\quad - \underline{2.3468\text{E-4 w cm}^{-2} \text{ sr}^{-1} @ 210^\circ\text{K}} \\
 &= 14.395\text{E-4 w cm}^{-2} \text{ sr}^{-1}
 \end{aligned}$$

$$\begin{aligned}
 \text{and: } \Delta N &= \text{Difference in radiance between 240° and 310°K} \\
 &= 16.742 \text{ E-4 w cm}^{-2} \text{ sr}^{-1} @ 310^\circ\text{K} \\
 &\quad - \underline{5.001 \text{ E-4 w cm}^{-2} \text{ sr}^{-1} @ 240^\circ\text{K}} \\
 &= 11.741 \text{ E-4 w cm}^{-2} \text{ sr}^{-1}
 \end{aligned}$$

$$\frac{\partial P}{\Delta T_{210}} = \text{slope of radiance curve at 210°K} = 6.7452 \text{ E-6}$$

$$\frac{\partial P}{\Delta T_{215}} = \text{slope of radiance curve at 215°K} = 7.415 \text{ E-6}$$

ΔT = measured change in response to 210° target as the background is varied from 210° to 310°K.

RMS ERROR = PEAK ERROR
 x 0.7605 for RMS distribution of leakage radiance over dynamic range.
 x 0.564 RMS Temperature Linearization Effect

FROM MODE 4 Data reduction:

$$\begin{aligned}
 \text{Calculated RMS leakage error} &= 0.170^\circ\text{K T LEFT} \\
 &= 0.151^\circ\text{K T RIGHT}
 \end{aligned}$$

The worst-case contribution to repeatability error by T-clamp leakage is therefore
 0.151°K RMS.

TABLE 2.4.1.1-2

OLS #20

GAIN AND BIAS VARIATIONS WITH TEMPERATURE CHANGE
(M1 TEMP CORRECTED TO +12°C OR -8°C)

	SSS TEMP	PSU TEMP	T RGT		T MID		T LFT		
			% GAIN DELTA (%)	BIAS CHG. @ 190°K (°K)	% GAIN DELTA (%)	BIAS CHG. @ 190°K (°K)	% GAIN DELTA (%)	BIAS CHG. @ 190°K (°K)	
M1 = -8°C (Run A)									
	RUN 2 COLD OPTICS	7.2	31.7	-0.85	0.28	-1.18	0.83	-0.1	0.02
	RUN 8 COLD LIMIT	3.7	2.4	0.95	1.78	0.68	2.12	2	1.56
M1 = +12°C (Run B)									
	RUN 2- RUN 8	3.5 T _{SA}	29.3 T _{PA}	1.8 G _A	-1.5 B _A	-1.86 G _A	-1.29 B _A	-2.1 G _A	-1.54 B _A
	RUN 7 HOT SOAK #2	11.6	36.7	-1.09	-0.21	-1.48	1.03	-0.48	0.39
M1 = +12°C (Run B)									
	RUN 9 HOT LIMIT	6.7	31.8	-0.55	0.44	-1.04	1.45	0.13	0.98
	RUN 7- RUN 9	4.9 T _{SB}	4.9 T _{PB}	-0.54 G _B	-0.65 B _B	-0.44 G _B	-0.42 B _B	-0.61 G _B	-0.59 B _B
Calculated Sensitivity Factors			SSS: S _G S _B	{%/C {K/C	-0.0554	-0.0299	-0.0473	-0.0600*	-0.0771
			PSU: P _G P _B	{%/C {K/C	0.0548	-0.0599	-0.0384	-0.0645*	-0.0434*

*WORST CASE VALUES

TABLE 2.4.1.1-3
 OLS #20
 TARGET CROSSTALK, T CLAMP LEAKAGE DATA*

SSS = +7°
 M1 = -8°

	T RIGHT	T MID	T CPL	T CPR	T LEFT	
T1 210° [T2 @ 310°] (T121T231G)	0.45	0.91	0.11	1.22	0.04	03/13/95
Difference, ΔT	0.18	0.16	0.39	0.35	0.20	
T1 210° [T2 @ 210°]	0.63	1.07	0.50	1.57	0.24	03/13/95
Worst Case Data From T121T221S.ST Mode 4 Data Reduction: T clamp leakage ratio is 0.200% 0.177% Peak leakage error at 210°K is 0.347°K 0.308°K RMS leakage error at 210°K is 0.170°K 0.151°K						

*Data is FP Deviation in °K

2.4 Radiometric Accuracy

2.4.1 T Channel Radiometric Accuracy (Cont'd)

2.4.1.2 Stability (3.2.1.1.4.1b)

The T Channel Radiometric Accuracy (Stability) analysis in the OLS 5D-3 System Summary Report Paragraph 3.5.1.2, predicts 0.61°K 1 sigma error in stability compared to the 0.8°K maximum specification requirement. This calculation is applicable to all 5D-3 systems with 190-310°K total range.

ATTACHMENTS

Table 2.4.1.2-1 Stability Contributors Summary

Table 2.4.1.2-2 Change in BSL 210°, 310°K Points Between Runs

Table 2.4.1.2-3 Change in 210°, 310° Output Deviation From Nominal (°K) between Power Supply 1 and Power Supply 2

TABLE 2.4.1.2-1

STABILITY CONTRIBUTORS SUMMARY

		<u>ONE SIGMA ERROR (°K)</u>
1.	<u>Shaped Bias</u>	
a)	Open Loop Mirror Emissivity	0.1
b)	T Clamp Shaper Compensation - Temperature	0.23
	- Age	<u>0.17</u>
	RSS Total	0.30°K
	X RMS Temperature Linearization Effect = RMS Shaped Bias Errors	0.564
		0.17°K
2.	<u>Bias</u>	
a)	Preshaper Gain - Inner Stage Temperature	0.28
	- Bias Current	0.24
	- Amplifiers	0.22
b)	Post Shaper DC Drift	<u>0.12</u>
	RSS Total = RMS Bias Error	0.45°K
3.	<u>Gain</u>	
	Postshaper Gain Changes - Amplifier over the 210-310K range, °K RMS Error	<u>0.38</u>
	<u>TOTAL RSS Stability Error (Total Dynamic Range)</u>	0.61
	Stability Error Specification (°K, 1 Sigma)	0.80 Maximum

Discussion of Stability Errors

The experimentally derived RMS change of the BSL(s) between runs was calculated to be 0.06°K, 0.05°K and 0.07°K for TRGT, TMID and TLEFT respectively. The two runs used were Run #5 and run #7. The results verify the analytical estimate of the stability over time intervals greater than one day. This data is tabulated in Table 2.4.1.2-2.

As an additional check of stability, the Fine-Primary outputs of the three segments as a deviation from nominal (°K) at 210° and 310° were compared using power supply 1 data of T121T231B.ST and power supply 2 data of 6X2X3A.ST. (Both from Run #9). This data is tabulated in Table 2.4.1.2-3. The deltas were calculated and RMS'd over the temperature range. The results are comparable to the "Change Between Runs" data.

TABLE 2.4.1.2-2

OLS #20

CHANGE IN BSL 210, 310K POINTS BETWEEN RUNS

SSS = 12°C, MI = 15°C

	TG R/L	TL	T RGT		T MID		T LFT	
			210	310	210	310	210	310
T121T231B 03/16/95	7/7	9	0.27	-0.59	1.23	-0.54	0.42	-0.07
T121T231B 03/20/95	7/7	9	0.23	-0.66	1.18	-0.59	0.42	-0.17
Change Between Runs			0.04	0.07	0.05	0.05	0.00	0.10
RMS Change			0.06°K		0.05°K		0.07°K	

TABLE 2.4.1.2-3

OLS #20

T CHANNEL DC RESPONSE

DIFFERENCE BETWEEN POWER SUPPLIES 1 and 2

From Hot Limit (Run #9), SSS = +7°C, MI = +12°C

	RIGHT		MID		LEFT	
	TGT-1 210°K	TGT-2 310°K	TGT-1 210°	TGT-2 310°	TGT-1 210°	TGT-2 310°
FP DEV [K] Power Supply 1 T121T231B 03/30/95	0.18	-0.43	1.16	-0.40	0.37	0.07
FP DEV [K] Power Supply 2 6X2X3A 03/30/95	0.26	-0.42	1.19	-0.36	0.45	0.15
Change °K	0.08	0.01	0.03	0.04	0.08	0.08
RMS °K	0.06		0.04		0.08	

2.4 RADIOMETRIC ACCURACY

2.4.1 T Channel Radiometric Accuracy (Cont'd)

2.4.1.3 Fixed Deviations (3.2.1.1.4.1c)

The Fixed deviations for OLS #20 are 0.32°K, 1 sigma, compared to the 0.6°K specification maximum. The calibratable portion of the fixed deviations is 0.23°K RMS compared to the 0.4°K RMS specification maximum. The Fixed deviation calibration for separate detector segments is 0.84°K (worst case) compared to the 1°K spec. maximum. The maximum along scan variation was 0.18°K RMS for TF (Right) and 0.12°K RMS for TS compared to the 0.2°K RMS specification maximum.

ATTACHMENTS

Table 2.4.1.3-1	Fixed Deviations Contributors
Table 2.4.1.3-2	T Shaper Error Tabulation
Table 2.4.1.3-3	BSL Calibration Equations
Table 2.4.1.3-4	Fixed Deviation Calibration Differences for Separate Segments
Table 2.4.1.3-5	Along Scan Variation (265° to 310°K) within a Separate Segments
Table 2.4.1.3-6	Cone (Inner Stage) Patch Temp EST
Table 2.4.1.3-7	Cone Cooler Outer Stage Temp EST
Figure 2.4.1.3-1	5D3 Nominal Shaper Curve
Figure 2.4.1.3-2	Along Scan Variation, T Right, M1 = 12°C
Figure 2.4.1.3-3	Along Scan Variation, T Mid, M1 = 12°C
Figure 2.4.1.3-4	Along Scan Variation, T Left, M1 = 12°C
Figure 2.4.1.3-5	Along Scan Variation, T Right, M1 = -8°C
Figure 2.4.1.3-6	Along Scan Variation, T MID, M1 = -8°C
Figure 2.4.1.3-7	Along Scan Variation, T Left, M1 = -8°C
Figure 2.4.1.3-8	Along Scan Variation, T Auto M1 = 12°C
Figure 2.4.1.3-9	Along Scan Variation, T Auto M1 = -8°C

TABLE 2.4.1.3-1

OLS #20

FIXED DEVIATION CONTRIBUTORS

<u>DEVIATION SOURCE</u>	<u>ONE SIGMA ERROR (°K)</u>
1. Foreoptics Mirror Emissivity	0.10*
2. T Clamp Shaper Compensation	0.09
3. Transfer Function	
A. Non-Linearity	0.23* 0.4°K Spec Max
B. Shaper Components Variation	0.10
C. Detector Spectrum Variation (included in 3A)	-
4. Test Targets	
A. Temperature	0.10
B. Emissivity	0.10
C. Repeatability	<u>0.03*</u>
TOTAL (RSS) FIXED DEVIATION	0.32
FIXED DEV. SPECIFICATION LIMIT, °K ONE SIGMA	0.60 Maximum
* FROM TEST DATA ANALYSIS	

	<u>DATA</u>	<u>SPEC MAX</u>
5. Fixed Deviation BSL Calibrations Match for Separate Segments (Worst Case)	0.84	1.0°K
6. Along Scan Variations within a segment (265° to 310°K) Worst Case	0.18°K RMS	0.2°K RMS

Discussion of Fixed Deviation Tests and Calculations

1. Foreoptics Mirror Emissivity

The foreoptics mirror emissivity is a source of Fixed deviations as well as of Repeatability and Stability deviations. The correction in operation is made on M1 temperature only; whereas the entire foreoptics causes the offset phenomena. The ground calibration is made in the thermal vacuum chamber, where M1 is cooled radiatively via a cold tunnel, which fills the M1 view beyond the optical field of view of the system. Thus the foreoptics temperature distribution in the chamber differs somewhat from operation in space, especially in that M2 is colder in the chamber. It is not possible to determine accurately this effect based upon present knowledge. It is therefore assumed that it is equivalent to a 1°C difference in M1 temperature, or about 0.184°K at 210° using the actual OLS #20 M1 coefficient (K factor). The RMS Temperature Linearization Effect, 0.564, transforms this to a 0.10°K RMS contribution to fixed deviation.

2. T Clamp Shaper Compensation

The T Clamp shaper compensation contribution arises as follows. If the T Clamp emissivity were initially only 0.98 rather than the 0.995 used to calculate the compensation for T Clamp temperature, the error at 242°K would be 0.70°K. Although this error would be compensated for when the T channel adjustments were made, a change in T Clamp temperature to 256°K or 230°K would result in an error of 0.78°K, producing an uncompensated error of 0.08°K. Over the dynamic range this is equivalent to 0.09°K RMS.

3. Transfer Function

- A. The departure of the T channel radiometric transfer function from a linear relationship is not an error as such because it is known and compensation can be made for it. However, this type of deviation is included within the constraints of the Fixed deviation portion of the T channel radiometric accuracy spec. The nominal T Channel non-linear transfer function (shaper) error is tabulated in Table 2.4.1.3-2 and plotted in Figure 2.4.1.3-1. The nominal shaper error is 0.13°K RMS. This calculation is made with the 5D-3 shaper, which is also used on OLS #20. The worst-case reduced test data (from Tables 2.4.1-4,5 & 6) RMS Deviations of the points from the BSL for OLS #20, are 0.19°K for T Right (Fine Primary and Backup), 0.10°K for T MID (Fine Primary and Backup) and 0.18°K for T Left (Fine Primary Backup and Smooth). The analytic value, (0.13°K RMS) and the worst-case test value of 0.19°K are RSS'ed to become 0.23°K RMS for this Fixed deviation source versus the 0.4°K maximum spec allowance for the calibrateable portion of the Fixed deviations.
- B. Departure of shaper components from design nominal values may cause additional peak errors of 0.25°K and are assigned a one sigma error of 0.1°K. These deviations would not be included in the measured deviation, because the data points are not close enough together to adequately detect them.
- C. The T detector spectrum difference from unit to unit is included in the calibration data and is therefore included in 3A, the non-linearity of transfer function.

4. Test Targets

The deviation of the reference test target indicated blackbody temperature from absolute is the result of contributions from three Fixed deviation sources.

A. The measurement of the averaged target temperature using the 5 thermocouples immersed in the target baseplate is subject to the accuracy of the PQL/Block V Thermocouple Acquisition and Control System calibrated per procedure MCS0116801B. A review of the calibration procedure and the equipment used has led to ascribing 0.1°K RMS to these sources.

B. The actual effective blackbody temperature of the target also deviates from that measured because of differing emissivity from that assumed and because the "true" radiant temperature differs from the measured temperature using the thermocouples. The effective emissivity is a combination of true emissivity (which is better than 0.996 according to Eppley) and reflectance of up to 0.004. An average emissivity of 0.998 is corrected for along with the thermocouple calibration. This source of deviation has been assigned 0.1°K RMS.

C. Actual measurements using OLS systems 12 thru 17 of the two Eppley IR Reference test targets over the 210° to 310°K range reveal small differences between the targets. Effective with OLS 18 and up these differences are no longer measured. The values measured for OLS 12 thru OLS 17 are averaged to obtain a value of 0.03°K RMS for this error source.

Fixed Deviation Calibrations for Separate Segments

The calibrations are represented by the best straight line (BSL) equations for the separate segments. The BSL deviation expressions (from ideal), in $y = mx + b$ form for the segments are tabulated in Table 2.4.1.3-3. In T Smooth the Right and Left detector segments are averaged and used across the entire scan line.

In order to determine the differences in calibrations for separate segments, (for comparison to the specification) the T Fine BSL deviation equations of Table 2.4.1.3-3 were evaluated at 210°K and 310°K. The 3 possible segment differences were then calculated. Also, the worst-case deviations between segments were taken from the Best Straight Line Plots (Figures 2.4.1-1 thru 2.4.1-6). These results are tabulated in Table 2.4.1.3-4. The calibration differences for separate segments are within the 1°K maximum spec throughout the dynamic range of 210 to 310K for OLS #20.

Along Scan Variation (265°K to 310°K) Within a Segment

The Along Scan Variation (ASV) in T DC Response is considered to be a Fixed deviation, since as a function of scan angle it does not vary as a function of time per se. Figures 2.4.1.3-2, 3, 4, 5, 6, 7, 8 and 9 show the deviations along-scan vs. surface distance (nmi/100) for T RGT, T MID, TLFT, and T AUTO. The vertical scale factor is 1.0°K per cm. Four figures are for $M1 = -8^{\circ}\text{C}$ and four are for $M1 = +12^{\circ}\text{C}$. The computer printed number to the right of each curve is the computed RMS deviation in millidegrees K for the associated ASV plot. the RMS ASV values are only printed for the target temperatures above 265°K, i.e., the 270° and 310°K plots.

The T DC response BSL calibrations are taken using test scan angles of -50° (-600nmi) for T LFT, $+50^\circ$ ($+600\text{nmi}$) for T RGT, and $+0^\circ$ (0 nmi) for T MID. OLS #20 has some ASV, but is within spec. The worst case (max) ASV RMS value within a segment for OLS #20 was 0.18°K and is entered in Table 2.4.1.3-5 to compare with the specification limit.

TABLE 2.4.1.3-2

T SHAPER ERROR LIST

The 190 to 310°K 5D3 T Shaper used for OLS #13 and up has 6 straight line segments of decreasing slope and 5 (inflections) diode break points. The significant features in the shaper curve are tabulated below:

<u>T</u> (°K)	<u>ERROR</u> (°K)	<u>REMARKS</u>
190	0	End point adjusted to be an Ideal Curve
195	-0.38	1st slope is parallel to Radiance (Smooth) Curve
201.5	0	
205	+0.26	1st diode cut-in
210	0	
215	-0.18	2nd slope is parallel to Radiance (Smooth) Curve
220.5	0	
224	+0.20	2nd diode cut-in
228.5	0	
235	-0.20	3rd slope is parallel to Radiance Curve
240.5	0	
245	+0.19	3rd diode cut-in
251.5	0	
257	-0.21	4th slope is parallel to Radiance Curve
263	0	
267	+0.165	4th diode cut-in
272	0	
279	-0.195	5th slope is parallel to Radiance Curve
284.5	0	
291	+0.16	5th diode cut-in
296	0	
303	-0.13	6th slope is parallel to Radiance Curve
310	+0.023	

The largest plus and minus errors in the 210K-310°K range are +0.20° and -0.21°K respectively.

The standard deviation = 0.13°K RMS over the 210° to 310°K dynamic range.

TABLE 2.4.1.3-3

OLS #20

BSL CALIBRATION EQUATIONS

(From Tables 2.4.1-4,5,6)

			EVALUATED	
			@ 210°	@ 310°
T FINE (Primary)				
T-Right:	Error = -0.0067 (T-190) + 0.59	(°K)	0.456	-0.214
T-Mid:	Error = -0.0153 (T-190) + 1.58	(°K)	1.274	-0.256
T-Left:	Error = -0.0032 (T-190) + 0.69	(°K)	0.626	0.306
T FINE (Redundant)				
T-Right:	Error = -0.0066 (T-190) + 0.53	(°K)	0.398	-0.262
T-Mid:	Error = -0.0154 (T-190) + 1.55	(°K)	1.242	-0.298
T-Left:	Error = -0.0030 (T-190) + 0.66	(°K)	0.600	0.300
T SMOOTH (Primary - SP MID)	Error = -0.0153 (T-190) + 1.60	(°K)	1.294	-0.236
T SMOOTH (Redundant - SB MID)	Error = -0.0154 (T-190) + 1.55	(°K)	1.242	-0.298

TABLE 2.4.1.3-4

OLS #20

FIXED DEVIATION CALIBRATION DIFFERENCES FOR SEPARATE SEGMENTS

Calculated from BSL Equations in Table 2.4.1.3-3:

	<u>DIFFERENCE AT 210°K (°K)</u>	<u>DIFFERENCE AT 310K (°K)</u>	<u>SPECIFICATION (MAX)</u>
<u>PRIMARY</u>			
T Mid to T Right	0.82	0.04	1°K
T Mid to T Left	0.65	0.56	1°K
T Right to T Left	0.17	0.52	1°K
<u>REDUNDANT</u>			
T Mid to T Right	0.84*	0.04	1°K
T Mid to T Left	0.64	0.60	1°K
T Right to T Left	0.21	0.56	1°K

Worst Case Differences from Best Straight Line
Plots (Figures 2.4.1-1 thru 2.4.1-6):

<u>RUN #</u>	<u>PRIMARY PATH</u>	<u>REDUNDANT PATH</u>	<u>SPEC. MAX.</u>
1	0.65 MID-LFT	0.62 MID-LFT	1°K
8	0.73 MID-LFT	0.74 MID-LFT	1°K
9	0.82 RGT-MID	0.83 RGT-MID	1°K

*WORST-CASE DATA

TABLE 2.4.1.3-5

OLS #20

ALONG SCAN VARIATION (265°K to 310°K) WITHIN A SEGMENT

(From ASV Graphs)

	ONE SIGMA	SPEC
<u>T-FINE</u>	<u>ERROR (°K RMS)</u>	<u>LIMIT (°K RMS)</u>
T-Left Segment	0.08	0.2
T-Mid (Sum) Segment	0.12	0.2
T-Right Segment	0.18	0.2
 <u>T-SMOOTH</u>		
T-Sum	0.12	0.2

TABLE 2.4.1.3-6

CONE COOLER S/N 033

THERMISTOR S/N KC-60

OLS-20

CONE (INNER STAGE) PATCH TEMP. EST

<u>TEMPERATURE °K</u>	<u>PATCH EST. VOLTS</u>
98	5.577
99	5.201
100	4.852
101	4.528
102	4.227
103	3.949
104	3.690
105	3.450
106	3.228
107	3.021
108	2.829
109	2.651
110	2.486
111	2.332
112	2.189
113	2.056
114	1.932
115	1.817
116	1.710
117	1.610
118	1.517
119	1.430
120	1.349
121	1.274
122	1.203
123	1.137
124	1.075
125	1.018

TABLE 2.4.1.3-7

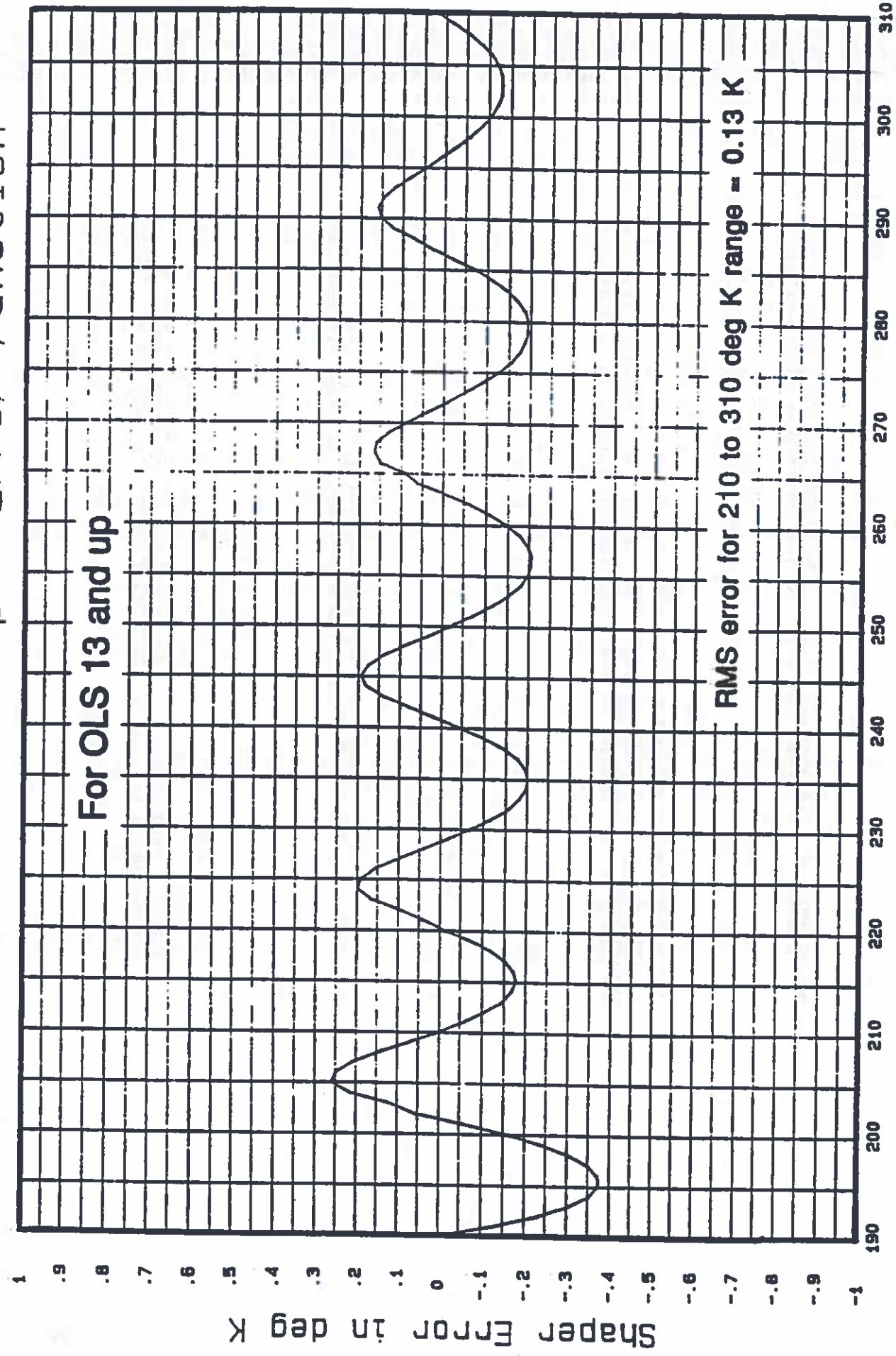
CONE COOLER OUTER STAGE TEMP EST

OLS #20

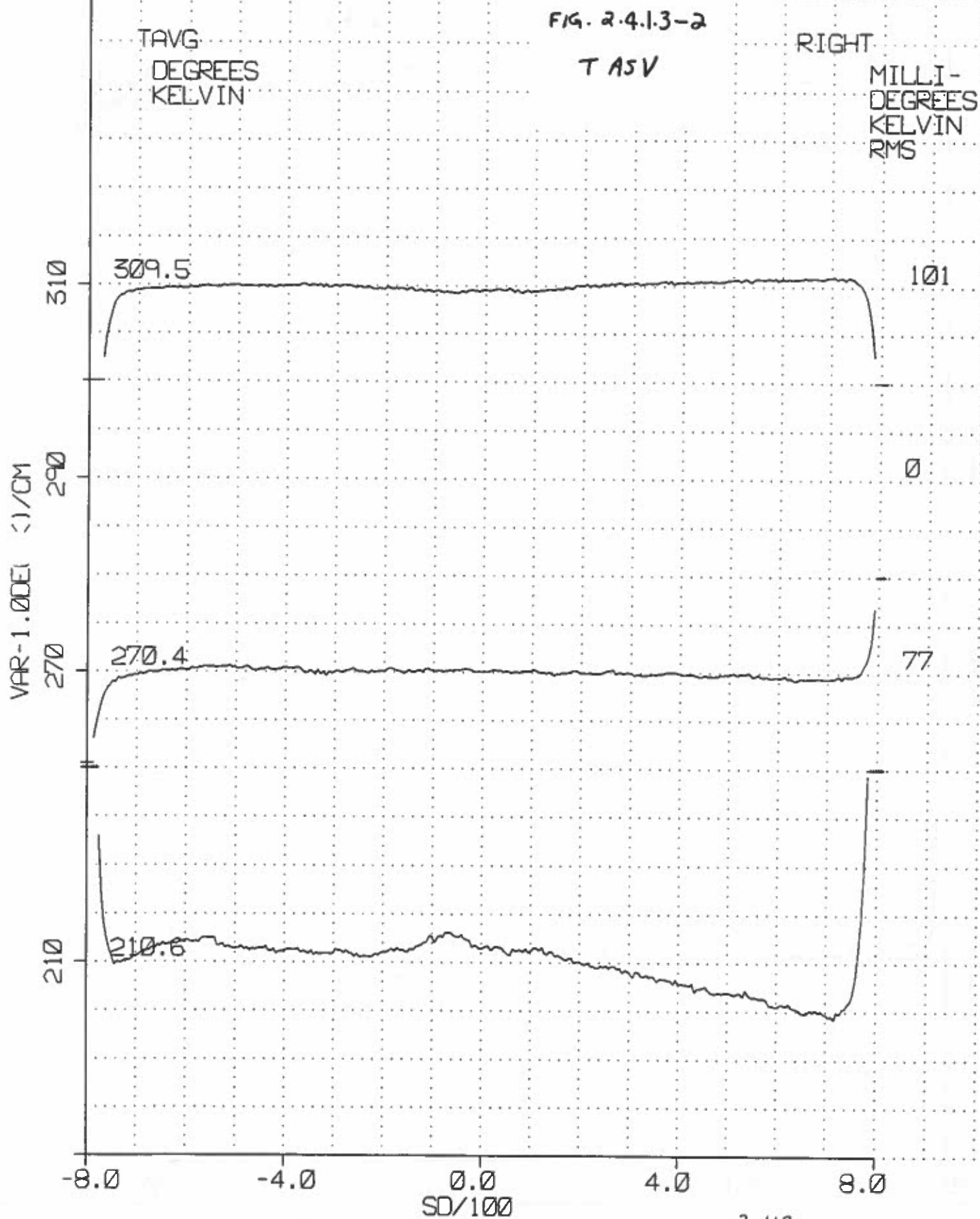
T CONE TEMP EST (EST #33)

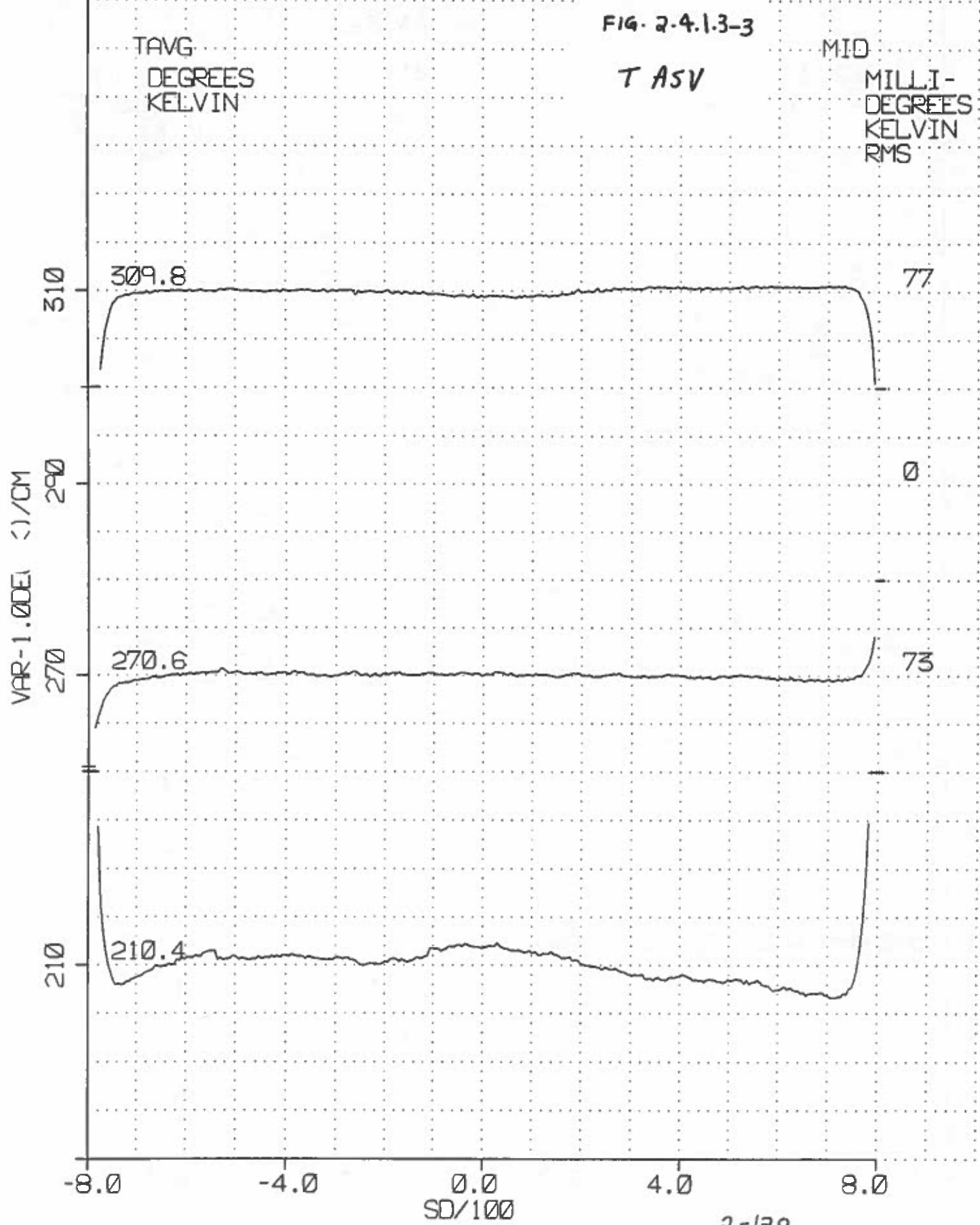
<u>T (DEG K)</u>	<u>EST VOLTS</u>	<u>T (DEG K)</u>	<u>EST VOLTS</u>
158	4.8221	194	4.1282
159	4.8181	196	4.0328
160	4.8136	198	3.93
161	4.8088	200	3.8195
162	4.8035	202	3.7016
163	4.7978	204	3.5769
164	4.7915	206	3.4468
165	4.7848	208	3.3115
166	4.7775	210	3.1719
167	4.7695	212	3.0292
168	4.7609	214	2.8844
169	4.7515	216	2.7386
170	4.7414	218	2.5924
171	4.7306	220	2.4475
172	4.7188	222	2.305
173	4.7063	224	2.1659
174	4.6926	226	2.0302
175	4.678	228	1.8995
176	4.6622	230	1.7735
177	4.6454	235	1.4832
178	4.6273	240	1.2308
179	4.608	245	1.0159
180	4.5874	250	0.8359
181	4.5654	255	0.6873
182	4.5418	260	0.5650
183	4.517	265	0.4653
184	4.4904	270	0.3842
185	4.4622	275	0.3182
186	4.4323	280	0.2646
187	4.4008	285	0.2207
188	4.3673	290	0.1852
189	4.3322	295	0.1560
190	4.2951	300	0.1320
192	4.2156	305	0.1123

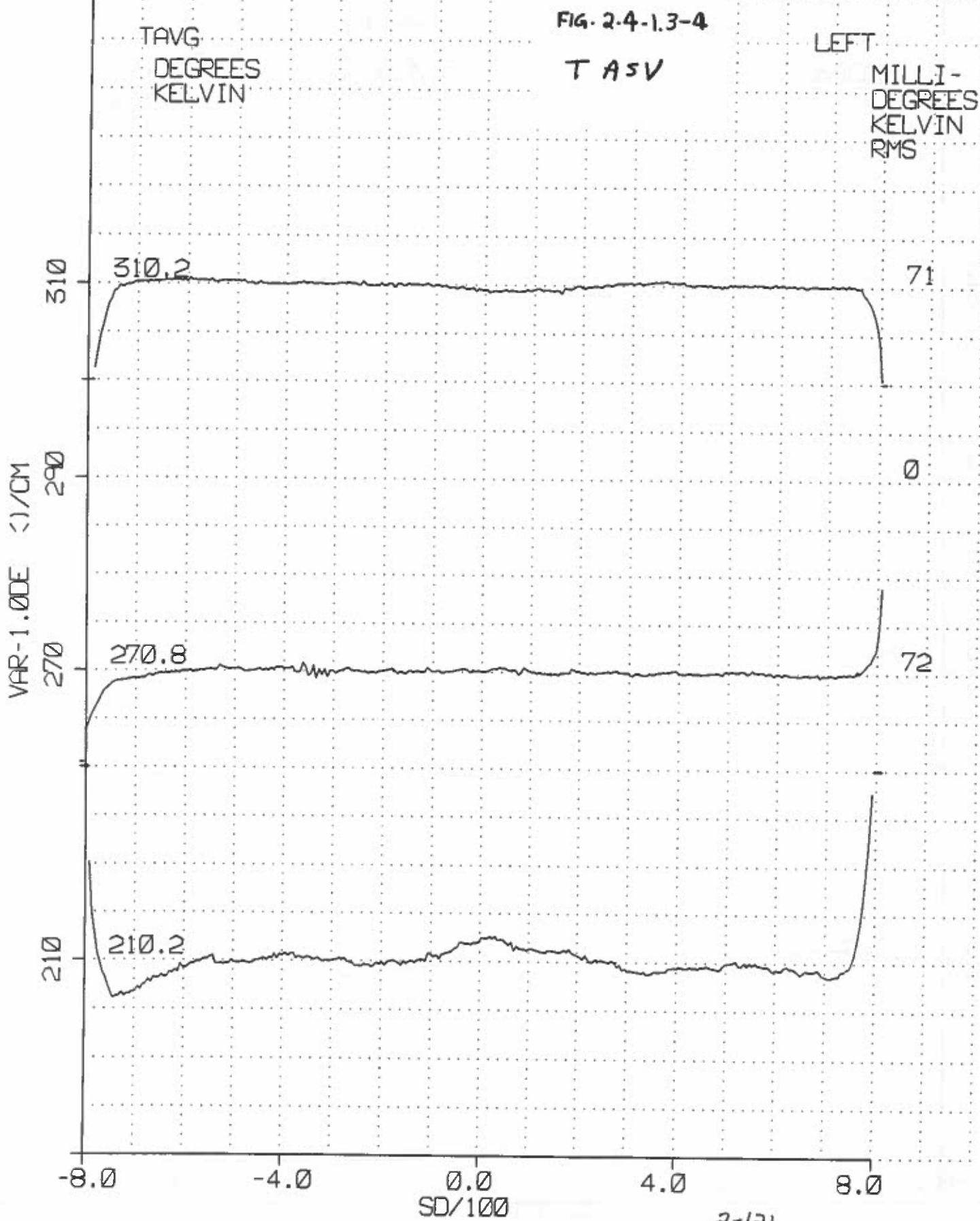
5D--3 Nominal Shaper Error Function



Temperature in deg K
FIGURE 2.4.1.3-1







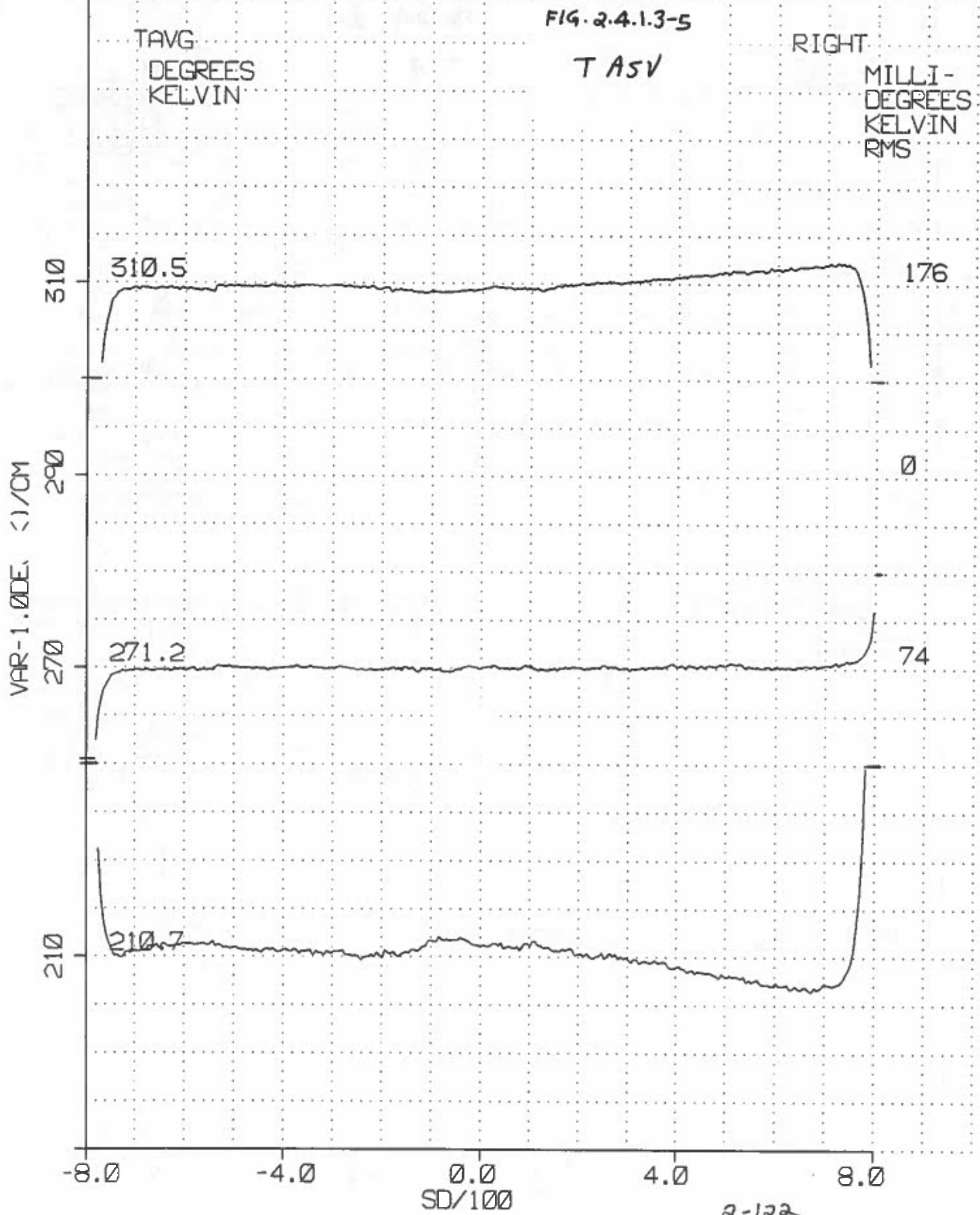
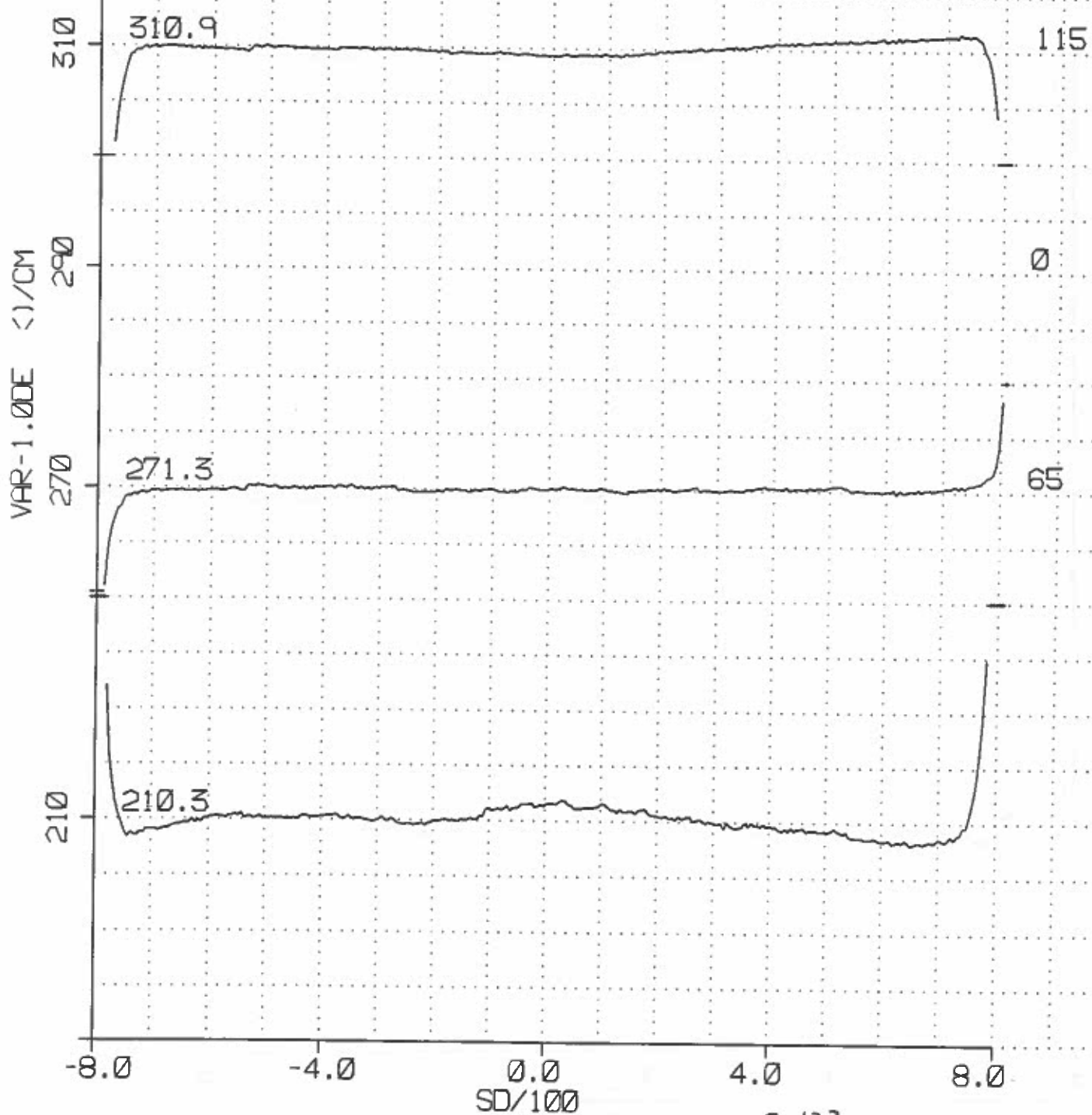


FIG. 2.4.1.3-6

TASV

TAVG
DEGREES
KELVIN

MID
MILLI-
DEGREES
KELVIN
RMS



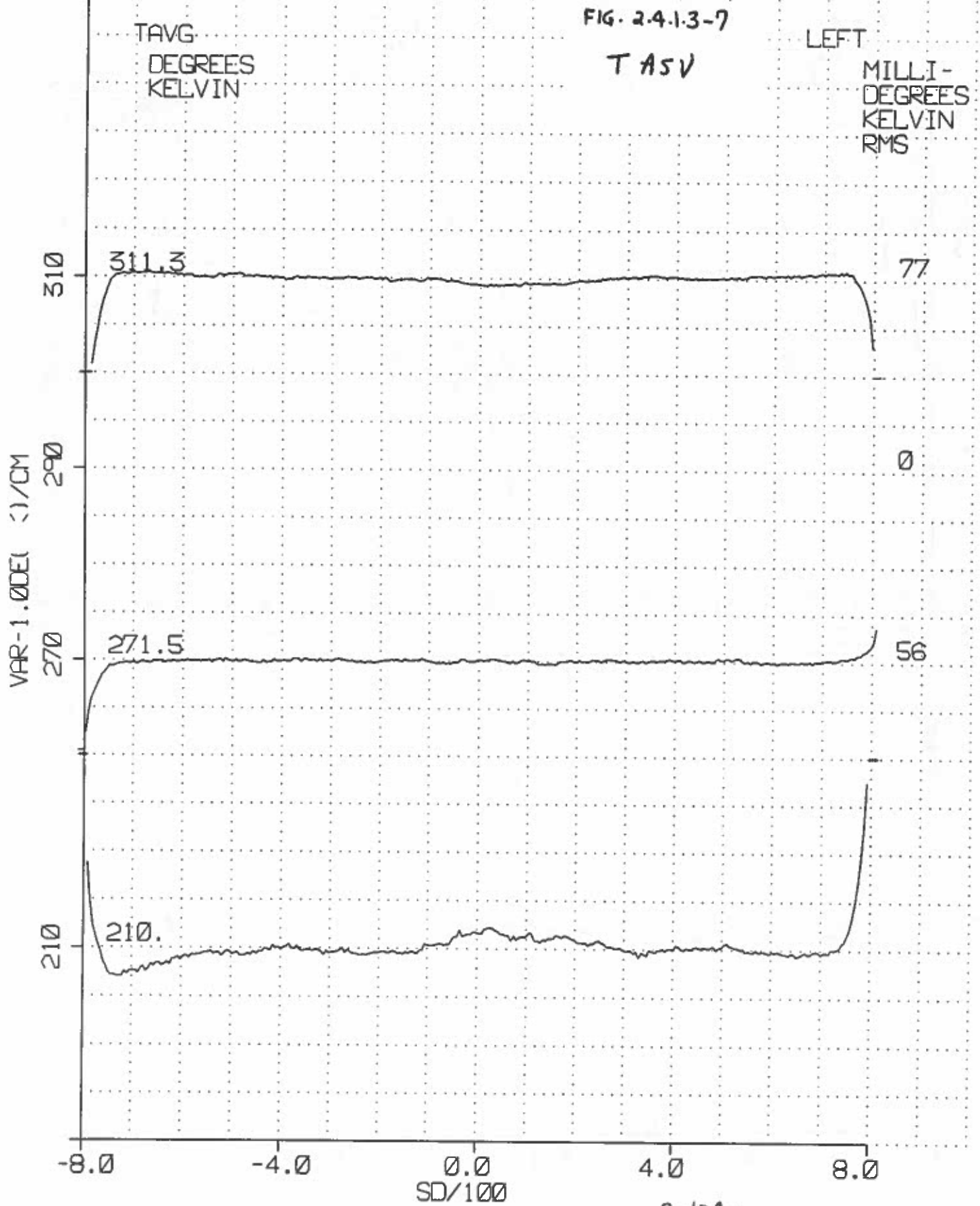


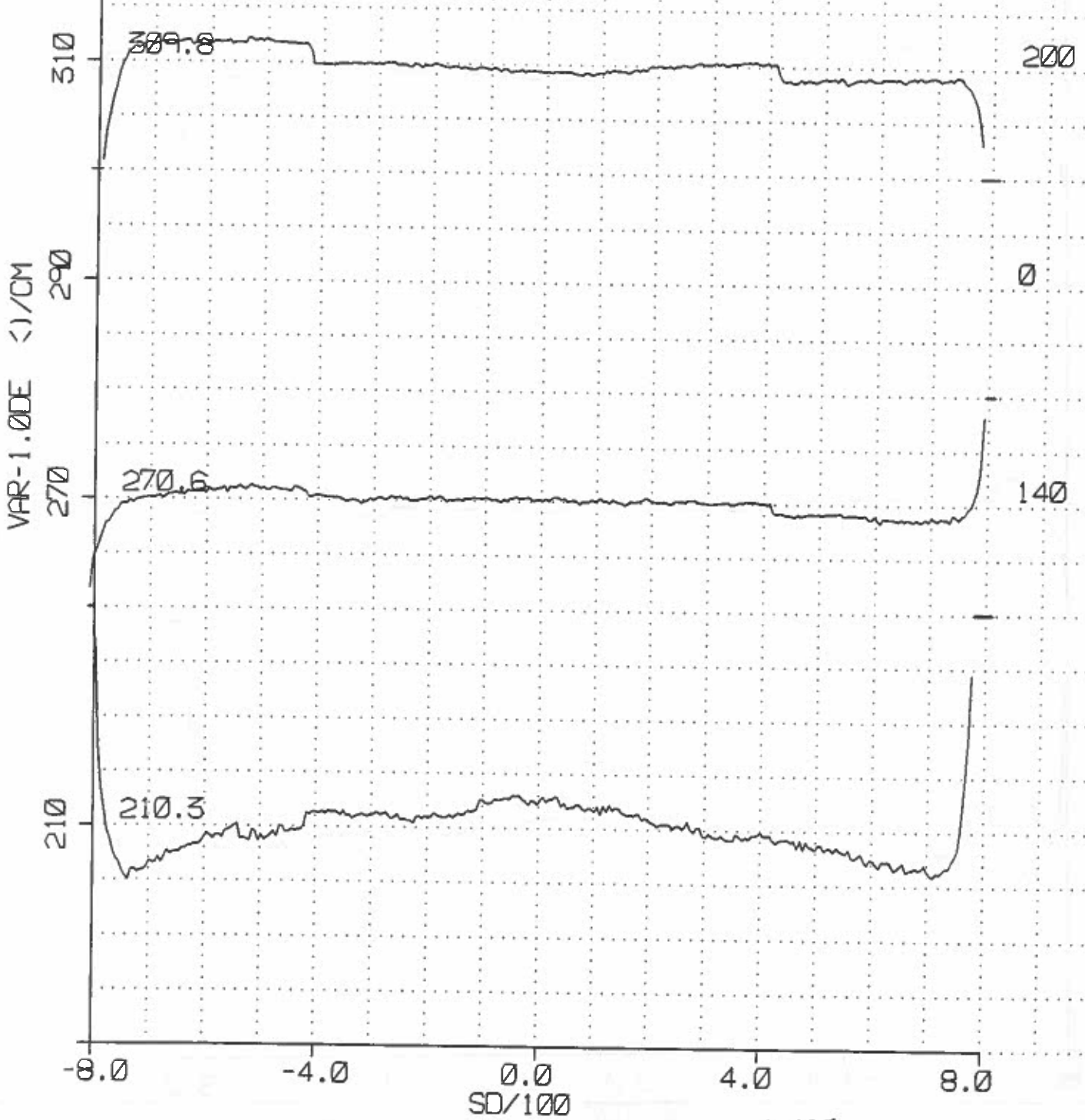
FIG. 2.4.1.3-8

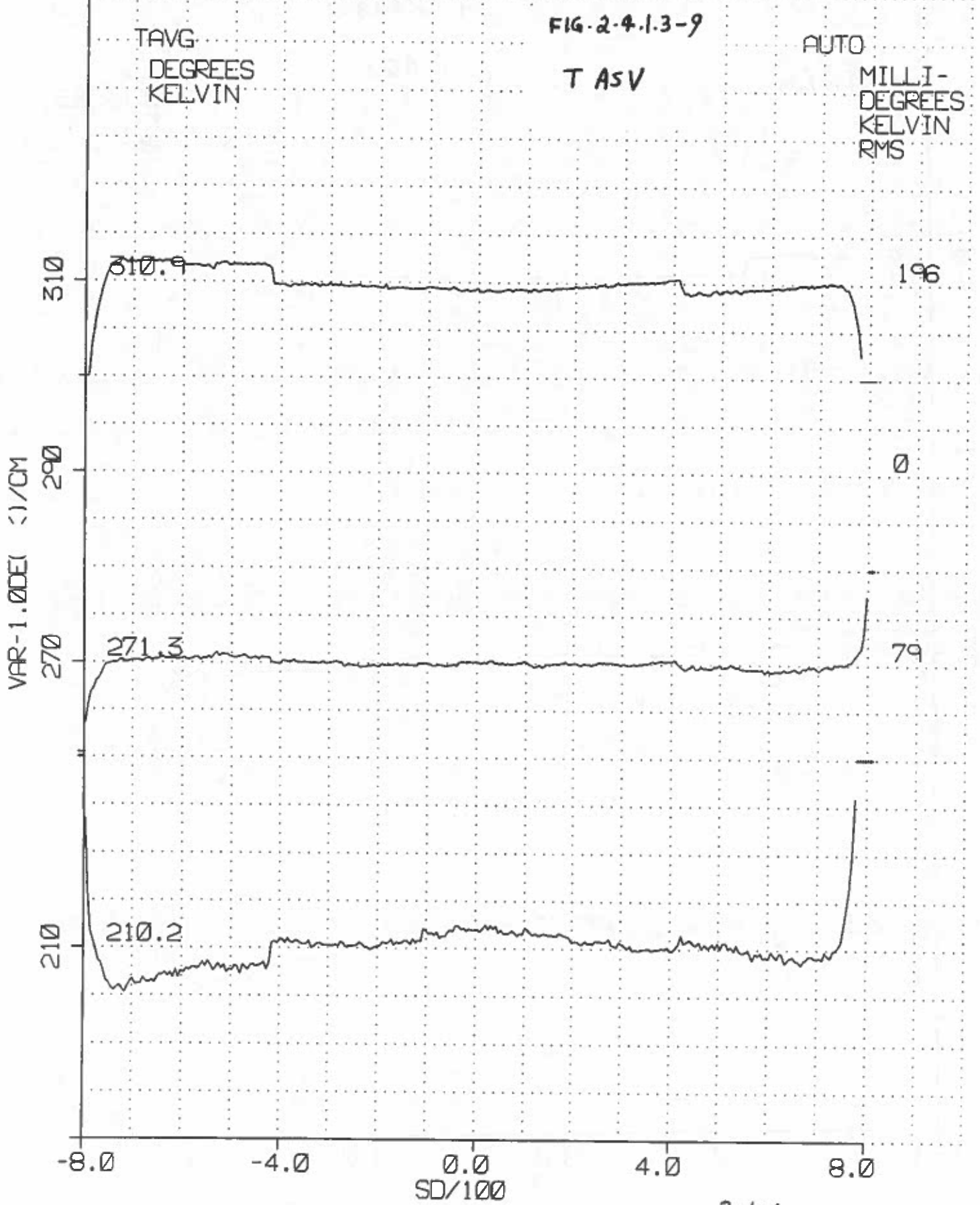
T ASV

AUTO

TAVG
DEGREES
KELVIN

MILLI-
DEGREES
KELVIN
RMS





2.4 Radiometric Accuracy (Cont'd)

2.4.2 Daytime Radiometric Accuracy (3.2.1.1.4.2)

OLS #20 achieved the 7% absolute radiance requirement by setting the HRD channel gain as shown on the L channel DC Response plot, using the calibrated light source (VULS).

The analysis of the calibration accuracy and the L-Day channel stability show within-specification performance. The gain ratios (PMH/PML, PML/HRD, and PMH/HRD) were measured using the VULS during Acceptance Test in test 6x2x1.ST, and vary less than 0.54% from the average of the ratios. The gain ratios measured in test 6x2x2.ST using a less accurate test method show greater variation.

The plot of L DC Response contains the calculated sensor switch points, $S(x)$, and relative gains $P(x)$, which are stored in the OLS Constants Memory page zero, locations 39H through 3FH. $P(2)$ and $S(2)$ represent the bypass of the PMT 1/9 mode, which is not usually implemented on orbit.

Two factors must be taken into account in modifying the nominal value of $P(0)$ for OLS 20. The addition of shims to the HRD/Preamp interface caused an additional 0.21 dB loss in signal output.

OLS #20 exhibited a 1.13dB drop in transmission from room temperature to +5°C. Thus $P(0)$ must be reset to $6.0 \text{ (nom)} + 1.13 + 0.21 = 7.375 \text{ dB}$. Rounding off to the nearest 1/8 dB gives 7.375 dB as the new setting for $P(0)$.

P1 is derived using the PMT LO/HRD average gain value of 48.21 dB with a compensation for the HRD Loss and PMT Gain Ratios with temperature from the test data as plotted in figure 2.4.2-2 and converted to dB of 1.13 dB and 0.46 dB, respectively. The P1 value is $48.21 + 1.13 + 0.46 = 49.80$ db (rounded to nearest 1/8th dB = 49.75).

Since the PMT 1/9 mode is currently unused, P2=0dB. P3 is given the PMT HI/LO average gain ratio of 29.59 dB or 29.625 dB after rounding.

ATTACHMENT: OLS #20 L Channel DC Response Plot
Table 2.4.2-1 OLS #20 DC Response Stability
Table 2.4.2-2 OLS #20 PMT/HRD DC Response vs. SSS Temp.

OLS20 L CHANNEL DC RESPONSE

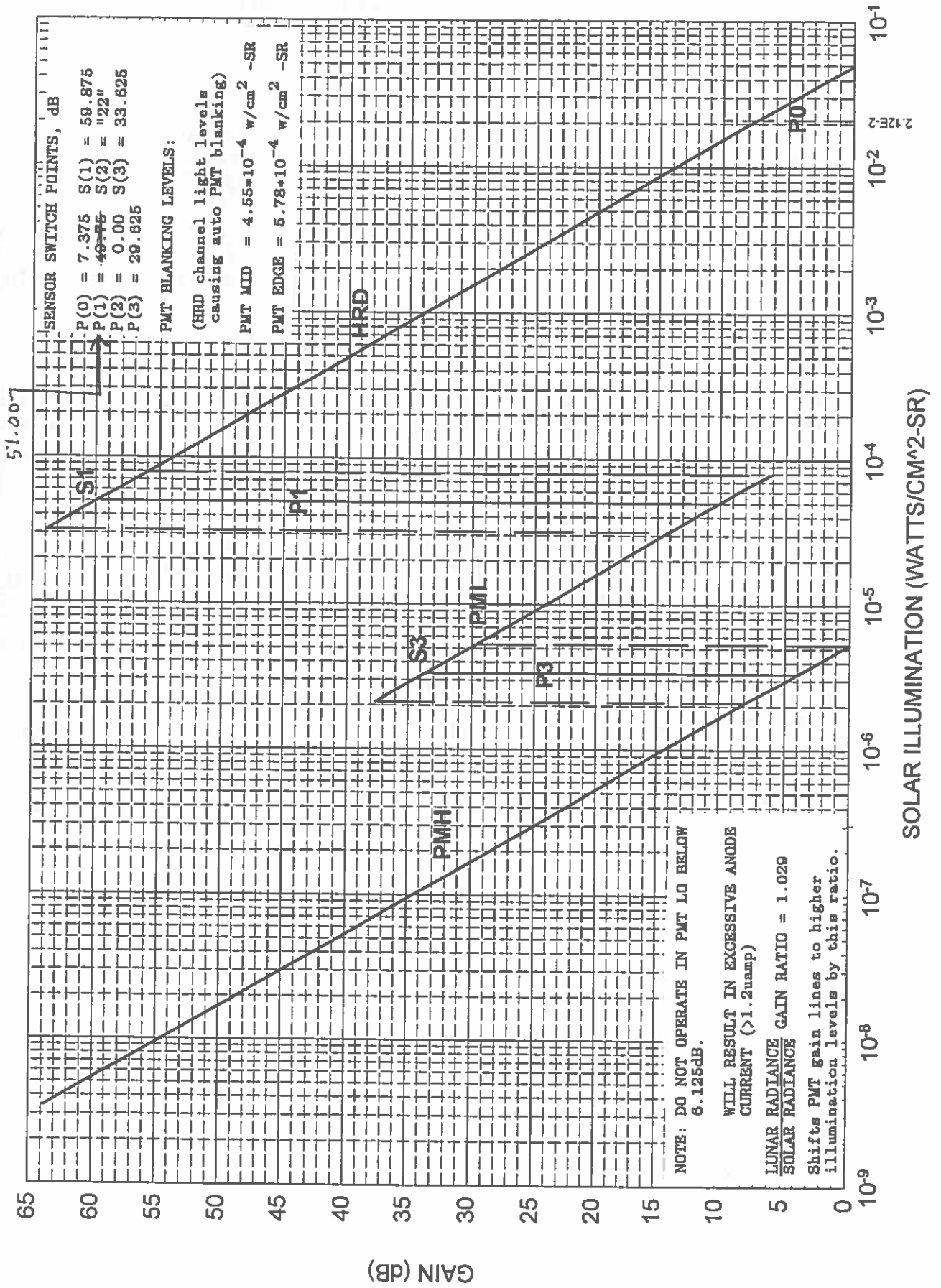


Table 2.4.2-1

OLS #20 L DC Response Stability

Stability vs. Time (6x2x1.ST data using VULS)

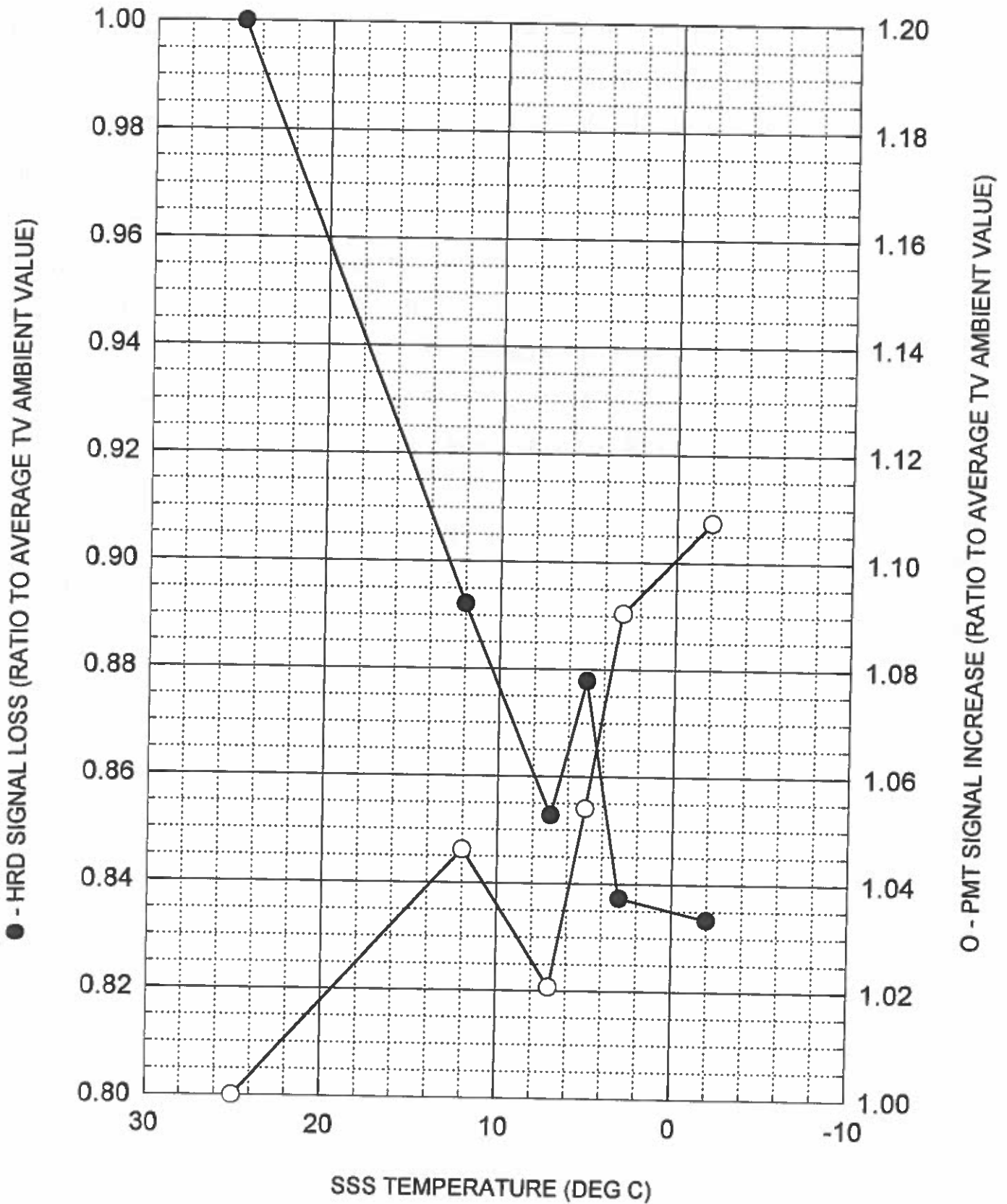
<u>DATE</u>	<u>PMT HI</u> <u>PMT LO</u> dB	<u>PMT LO</u> <u>HRD</u> dB	<u>PMT HI</u> <u>HRD</u> dB
01/10/95	29.58	48.01	77.59
01/18/95	29.60	48.16	77.76
04/12/95	29.60	48.47	78.07
Average	29.59	48.21	77.81
(Direct Multiple)	(30.18)	(257.43)	(7768.43)

Stability vs. Temperature (6x2x2.ST data using half sphere source)

<u>DATE</u>	<u>ENVIRONMENT</u>	<u>PMT HI</u> <u>PMT LO</u> dB	<u>PMT LO</u> <u>HRD</u> dB	<u>PMT HI</u> <u>HRD</u> dB
01/24/95	TVAC Amb	29.53	37.71	67.24
03/02/95	TVAC Amb	29.58	38.08	67.66
Average		29.56	37.90	67.45

<u>DATE</u>	<u>ENVIRONMENT</u>	<u>PMT HI</u> <u>PMT LO</u> dB	<u>PMT LO</u> <u>HRD</u> dB	<u>PMT HI</u> <u>HRD</u> dB
02/05/95	+5/+12	29.55	39.44	68.98
02/09/95	-2/-11	29.57	40.22	69.79
02/10/95	+12/+15	29.60	39.09	68.69
03/15/95	-2/-11	29.52	40.73	70.25
03/16/95	+12/+15	29.53	39.68	69.20
03/23/95	+3/-8	29.55	40.46	70.01
04/02/95	+5/+12	29.62	39.58	69.20
04/08/95	+7/-8	29.57	39.69	69.27
04/09/95	+12/+15	29.58	39.33	68.91
Average		29.57	39.80	69.37

TABLE 2.4.2-2 - PMT / HRD DC RESPONSE vs
SSS TEMPERATURE - OLS 20



2.4 Radiometric Accuracy, (Cont'd)

2.4.3 Nighttime Radiometric Accuracy (3.2.1.1.4.3)

The PMT accuracy is required to degrade by no more than 60% from its initial accuracy at time of Acceptance testing to end of 3 year orbital life.

The 5D-3 OLS System Summary Report indicates PMT channel stability to be within 25.7% over the mission life so that the PMT meets this specification requirement. The above figures do not include corrections utilizing on-board LED calibration. The PMT CAL LED is extremely stable, and has an essentially constant output over the mission life.

The DC response curve of the OLS #20 PMT is shown in the L Channel DC Response curve in paragraph 2.4.2.

ATTACHMENT: Table 2.4.3-1 PMT CAL Baseline data

(See para 2.4.2 attachment for L. Chan. DC Response curve)

TABLE 2.4.3-1

PMT CAL BASELINE DATA

The PMT Cal voltage EST is a monitor of PMT sensitivity and stability characteristics. In order to relate on-orbit measurement of PMT CAL to measurement during Acceptance Test, the following data are provided. PMT CAL Voltage (EST #40) and PMT BU (Back-up) CAL V (EST #41) are sampled 500 times in test 6x6x2.ST. The PMT Cal voltage EST output is tabulated below.

TABLE 2.4.3-1

PMT CAL BASELINE DATA

<u>DATE</u>	<u>SSS TEMP</u>	<u>OUTPUT VOLTAGE (mV)</u>	
		<u>PMT CAL V (EST #40)</u>	<u>PMT BU CAL V (EST #41)</u>
04-23-94	+25	2522	2518
07-15-94	+25	2538	2534
07-27-94	+25	2502	2496
08-07-94	+25	2471	2474
08-13-94	+5	2548	2556
01-17-95	+25	2496	2503
01-24-95	+25	2474	2472
02-05-95	+5	2536	2540
03-29-95	+3	2463	2469
04-02-95	+7	2453	2460
	AVERAGE	2500	2502
	Max change from AVERAGE	1.92%	2.16%

2.4 RADIOMETRIC ACCURACY, (Cont'd)

2.4.4 Gain Control Accuracy (3.1.4.4)

Along-Scan Gain Control (ASGC) accuracy is within the specification limit of 4dB of the smooth monotonic curve drawn through the nominal values of Gain Value versus Scene Solar Elevation (GVVSE), tabulated in para 3.2.1.1.1.4 of S-DMSP-886.

System Tests 5x6x3.ST and 5x6x6.ST exercise the ASGC function through various combinations of extremes of slope and bias adjustment; and measure channel output for a wide range of values. These are automatically compared against stored test limits which ensure spec compliance.

An analysis using the ASGC software algorithm showing 3.25dB maximum error is summarized in the System Summary Report paragraph 3.5.4.

ATTACHMENTS: None.

2.4 RADIOMETRIC ACCURACY, (Cont'd)

2.4.5 Gain Control Adjustability (3.2.1.1.4.4 et al)

The OLS #20 Gain Control Adjustability is similar to the 5D-1 systems. The OLS 5D-3 System Summary Report paragraph 3.5.5 contains the analysis required to demonstrate conformance with the specifications, with additional information below.

TERMINATOR LOCATION (3.1.4.5.1)

The GNC Command (an uplink command) has a sub mode (GNC 10 θ X) which allows the GVSSE bias (terminator location) to be adjusted by X degrees, where X is a 6-bit 2's complement word with an LSB of 0.5°. This results in the required range of + 15.5 degrees.

MAXIMUM GAIN SETTING (3.2.1.1.4.5.3)

The maximum ASGC gain is commandable. An operational value is determined in Early Orbit Calibrations. The value is stored in the Operational Constants Memory location page θ Address 44H (BCMAX). The ASGC function & performance are exercised in tests 5x6x3.ST & 5x6x6.ST

COMMANDABLE T-CHANNEL GAIN (3.2.1.1.4.5.4)

The T-Channel Commandable Gain is exercised in test 6x8x2.ST. The channel output is measured for the entire range of commandable gains. The T Channel Gain is required to have the capability of being varied by command to be between 164% and 174% of the established minimum gain value (0 dB).

The actual percentage of T GAIN change for OLS #20 was measured as 68.9% for T Right and 68.7% for T Left.

Each step of TGAIN is required to be between 0.9% and 2.5% above the preceding lower gain value. Measured gain steps on OLS #20 ranged from 1.62% to 1.92%, within specification.

COMMANDABLE T CHANNEL LEVEL (3.2.1.1.4.5.5)

The T Channel Commandable Level is also exercised in test 6x8x2.ST. The specification requires that TLEVEL be variable over at least a 14° range in steps of 1.1°K or less. Measured results for OLS 20 testing were 15.1° range with an average step size of 1.08°K; both within specification.

2.4 RADIOMETRIC ACCURACY, Cont'd

2.4.6 A/D Conversions & Algorithms (3.2.1.1.4.6.2 & 3.2.1.1.4.6.3)

S-DMSP-886 specifies that the Stored Smooth Algorithm accuracy with an ideal A/D shall be verified by analysis. OLS 5D-3 System Summary Report contains the analysis which shows that the LS % Full Scale Deviation does meet the specification. The results are summarized below:

<u>Mode</u>	<u>% Full Scale Deviation</u>	<u>Analysis</u>
LS	$\leq \pm 2.2\%$	-1.70%, +2.09%
TS	$\leq \pm 0.4\%$	$\pm 0.39\%$

The Actual A/D Conversion Radiometric Accuracy was measured in system test 6x10.ST. The worst-case results from the OLS #20 Thermal Vacuum runs are summarized below:

<u>A/D</u>	<u>BSL SLOPE (% DEV FROM IDEAL)</u>	<u>BSL OFFSET (% OF FULL SCALE)</u>	<u>RMS DEV FROM BSL (% OF FULL SCALE)</u>
SDF-L PRIM	-0.05	+0.06	0.06
RED	-0.15	-0.02	0.05
SDF-T PRIM	+0.31	-0.22	0.11
RED	-0.07	+0.02	0.14
RTD-FL PRIM	-0.12	-0.06	0.04
RED	-0.03	-0.04	0.04
RTD-FT PRIM	-0.18	-0.06	0.08
RED	-0.19	-0.12	0.07
SPEC	± 1.0	± 1.0	0.5
RTD-SL PRIM	-0.19	-0.06	0.03
RED	+0.01	-0.08	0.03
RTD-ST PRIM	-0.36	+0.04	0.08
RED	-0.22	+0.04	0.09
SDS-L PRIM	-0.09	+0.04	0.04
RED	-0.14	+0.10	0.06
SDS-T PRIM	-0.14	-0.20	0.05
RED	-0.18	-0.16	0.06
SPEC	± 0.5	± 0.5	0.25

2.5 RADIOMETRIC RESOLUTION (3.2.1.1.5 et al.)

S-DMSP-886 apportions the Radiometric Resolution verification between Test and Analysis.

The Fine and Direct Smoothed Radiometric Resolution (para. 3.2.1.1.5.1), as well as the Stored Smoothed A/D Converter Error (para. 3.2.1.1.5.2), were measured in System Test 6x10.ST during the OLS #20 vacuum runs and are tabulated below:

A/D		PEAK DEV FROM BSL (% OF FULL SCALE)	SPEC
SDF-L	PRIM	-0.09	±0.8%
	RED	-0.08	
SDF-T	PRIM	-0.21	±0.8%
	RED	+0.26	
RTD-FL	PRIM	-0.09	±0.8%
	RED	+0.08	
RTD-FT	PRIM	+0.16	±0.8%
	RED	+0.16	
RTD-SL	PRIM	+0.05	±0.25%
	RED	-0.05	
RTD-ST	PRIM	+0.16	±0.25%
	RED	-0.19	
SDS-L	PRIM	+0.07	±0.5%
	RED	-0.14	
SDS-T	PRIM	-0.10	±0.5%
	RED	-0.11	

The Stored Smoothed Algorithms Resolution with Ideal A/D (para. 3.2.1.1.5.2.1) are verified by Analysis in OLS 5D-3 System Summary Report, and are summarized in Table 2.5.1.

TABLE 2.5-1

Stored Smoothed Algorithms
Resolution With Ideal A/D

<u>ITEM</u>	<u>SPEC</u>	<u>ACTUAL</u>
Accuracy		
LS Algorithm	<±2.2%	-1.70% +2.09%
TS Algorithm	<±0.4%	±0.39%
Resolution		
LS Algorithm	<1.6%	1.57%
TS Algorithm		
Population 1 Density Quantization	25% <0.8%	25% 0.78%
Population 2 Density Quantization	75% <0.4%	75% 0.39%
Population Distribtution	Uniform	Uniform
Quantization Capability	0.4%	0.4%

2.6 NOISE

2.6.1 T Channel Noise (3.2.1.1.6.1)

The T Channel noise equivalent temperature difference (NETD) is specified between 210K and 310K, although the T channel responsivity extends down to 190K.

The NETD is measured during T Channel DC response tests in the Thermal Vacuum Chamber.

The Channel views a stable blackbody target at 210K (worst-case noise). The channel output is sampled & the noise (std. deviation) of 2000 samples is converted to NETD using the following formula:

$$\text{NETD} = [\text{Avg Noise in Volts} * 24 \text{ } ^\circ/\text{Volt}] * 1.074 \text{ (the shaper slope correction)}$$

The OLS #20 NETD is in-spec. The average noise in the T Right segment is 9.4% larger than in the T Left segment.

SPEC	<u>TF</u>	<u>TS</u>	<u>TS Fallback</u>
Worst-Case Measured NETD	2.2°K	0.90°K	1.3°K
Worst-Case Average NETD	0.637°K	0.254°K	0.363°K
	0.607°K	0.250°K	0.329°K

ATTACHMENT: Table 2.6.1-1 OLS #20 NETD

Table 2.6.1-1

OLS #20 PRIMARY SIDE NETD										
DATE	TG				Noise mV					
	SSS	MI	R/L	TL	FINE RGT	SMOOTH RGT	FINE MID	SMOOTH MID	FINE LFT	SMOOTH LFT
02/04/95	3	12	6/6	3	23.61	12.22	16.22	9.60	23.59	12.89
02/09/95	5	-8	6/6	13	24.19	12.42	16.50	9.50	24.04	13.04
02/10/95	12	15	6/6	9	22.24	12.07	15.50	9.41	22.10	11.88
03/07/95	8	-8	6/6	13	21.98	11.40	15.73	9.44	23.68	12.67
03/13/95	7	-8	6/6	13	22.91	12.10	15.13	9.25	23.61	13.23
03/14/95	7	12	6/6	9	22.13	11.90	15.37	9.23	22.09	11.65
03/14/95	7	12	7/7	9	23.00	12.90	15.72	9.85	24.22	12.67
03/15/95	-2	-11	7/7	13	23.97	12.71	16.67	9.69	24.52	14.09*
03/16/95	12	15	7/7	9	22.64	12.24	15.52	9.40	2.656	11.99
03/19/95	-2	-11	7/7	13	23.52	13.15*	16.78*	9.74	24.70*	14.10
03/20/95	12	15	7/7	9	22.68	12.14	15.83	9.36	22.67	12.27
03/22/95	3	-8	7/7	13	23.38	12.69	16.02	9.47	24.13	12.70
03/30/95	7	12	7/7	9	24.34*	12.80	16.26	9.58	23.25	12.32
AVERAGE NETD					23.12	12.37	15.94	9.50	23.48	12.73
					0.555	0.297	0.383	0.228	0.564	0.306
NETD Correction for Shaper Slope**					0.596	0.319	0.411	0.245	0.605	0.328

* Worst Case Measured

** Shaper Slope Correction Factor = 1.074

Table 2.6.1-1

OLS #20 REDUNDANT SIDE NETD										
DATE	TG				Noise mV					
	SSS	MI	R/L	TL	FINE RGT	SMOOTH RGT	FINE MID	SMOOTH MID	FINE LFT	SMOOTH LFT
03/06/95	7	-8	6/6	13	23.80	12.23	16.49	9.86	23.98	12.73
03/13/95	7	-8	6/6	13	23.26	12.23	15.38	9.76	23.98	13.75
03/14/95	7	12	6/6	9	21.98	11.99	15.11	9.28	22.26	11.71
03/22/95	7	-8	7/7	13	23.19	12.30	16.06	9.86*	24.00	12.87
03/30/95	7	12	7/7	9	23.49	12.61	15.34	9.85	23.41	12.10
AVERAGE NETD					23.06	12.19	15.76	9.69	23.56	12.77
					0.553	0.293	0.378	0.233	0.565	0.306
NETD Correction for Shaper Slope**					0.594	0.314	0.406	0.250	0.607	0.329
Worst Case Corrected NETD					0.627	0.339	0.433	0.254	0.637	0.363

* Worst Case Measured

**Shaper Slope Correction Factor = 1.074

2.6 NOISE (Cont'd)

2.6.2 L-Channel Noise (Day) (3.2.1.1.6.2)

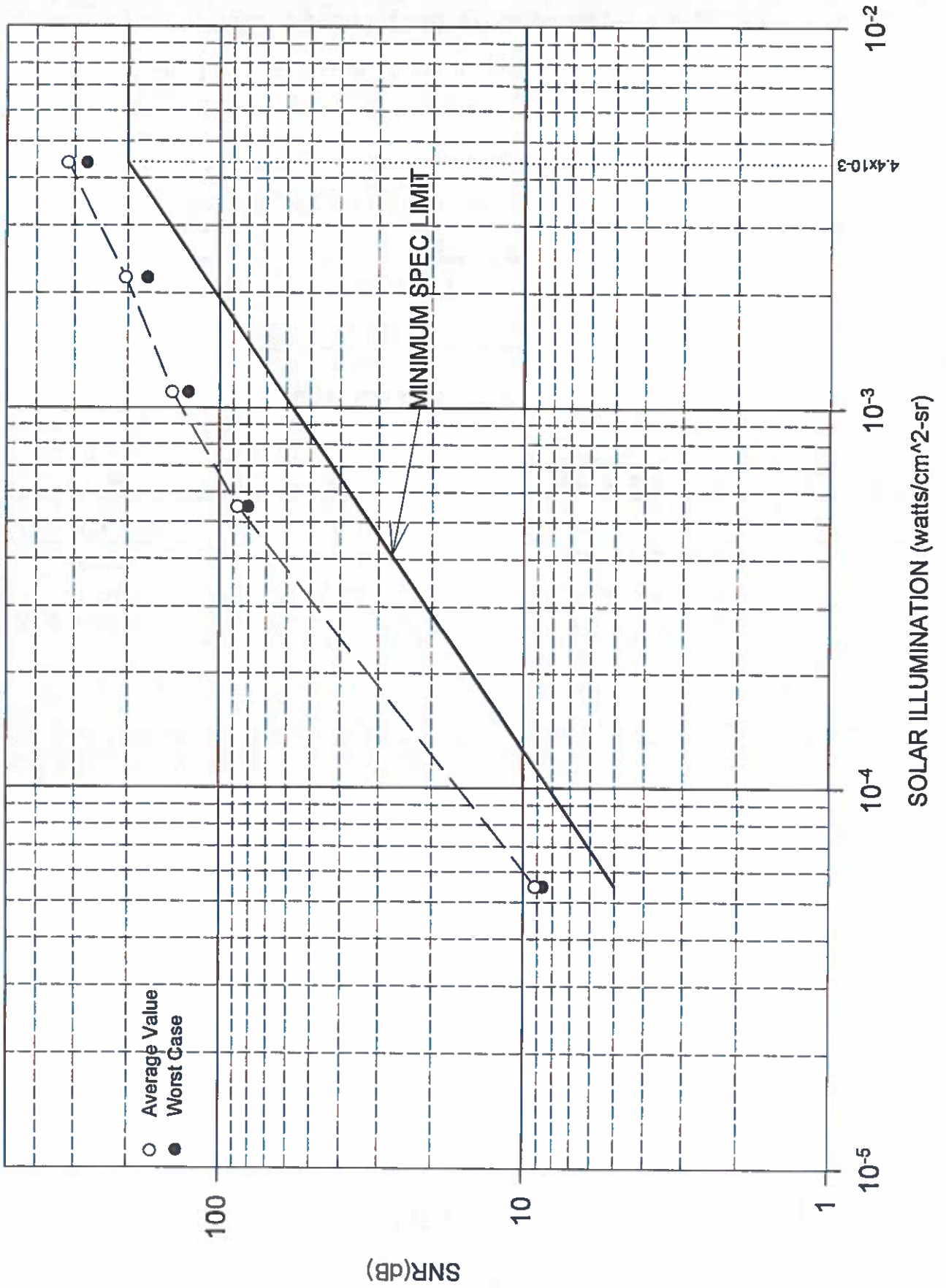
The L Channel Noise is measured using the calibrated Variable Uniform Light Source (VULS). Dark noise is measured in test 6x3x1.ST and shot noise is measured in 6x3x5.ST.

The OLS #20 HRD is in-spec for the entire range of illumination. In summary:

<u>SNR</u>			
<u>LIGHT LEVEL</u>	<u>SPEC</u>	<u>WORST CASE MEASURED</u>	<u>AVERAGE</u>
5.5×10^{-5}	5	8.6	9.1
5.5×10^{-4}	34.8	80.6	87.2
1.1×10^{-3}	62.3	126.5	143.1
2.2×10^{-3}	112	172.5	202.9
4.4×10^{-3}	200	271.8	315.4

ATTACHMENT: OLS #20 HRD Channel SNR Graph

OLS 20 HRD CHANNEL SNR



SNR(DB)

2-144

2.6 NOISE (Cont'd)

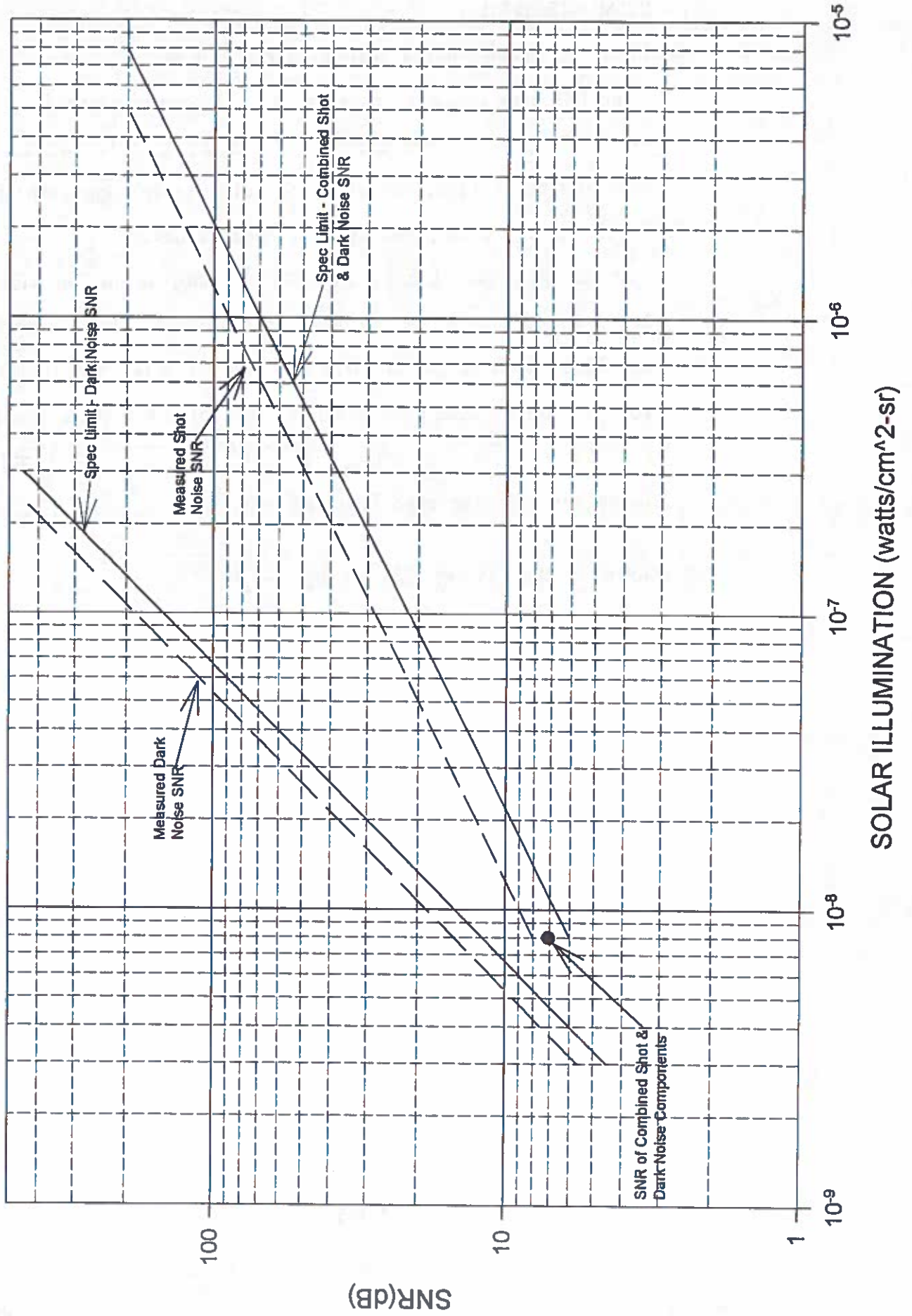
2.6.3 L Channel Noise (Night) 3.2.1.1.6.3)

The PMT dark noise is measured in all environments in Tests 6x3x1.ST, 6x3x2.ST and 6x3x4.ST. The SNR is calculated from the measured noise (std. deviation of multiple voltage samples) vs. light level and compared against spec values.

The minimum (worst case) OLS #20 PMT Shot Noise SNR was 8.0 at 8.0×10^{-9} watts/cm²-sr. The worst case measured Dark Noise SNR was 15.0 which is better than the specification requirement of 12. The worst case combined PMT shot noise and dark noise SNR is 7.06 calculated as $SNR = 1 / \sqrt{1/(SNR \text{ dark})^2 + 1/(SNR \text{ shot})^2}$ which is better than the spec limit of 6.0..

ATTACHMENT: OLS #20 PMT channel SNR graph.

OLS20 PMT CHANNEL SNR



2.6 NOISE (Cont'd)

2.6.4 Dark Current (3.2.1.1.6.4)

The Dark Current (the PMT noise with no signal input) is determined from the graph of PMT SNR in paragraph 2.6.3. The Dark Noise SNR is calculated from data gathered during PMT Smoothed Noise measurements. These measurements are made in Test 6x3x1.ST during Thermal Vacuum testing. For OLS #20 the average Dark Noise SNR at 8×10^{-9} watts/cm²-SR is 18.4, or 32.6% of the noise corresponding to an SNR of 6. The MINIMUM Dark Noise SNR measured at 8×10^{-9} watts/cm²-SR was 15.0, or 40.0% of the noise corresponding to a SNR of 6. This is well within the spec requirement for the dark current to be 50% or less of the noise corresponding to an SNR of 6.00.

2.6 NOISE, (Cont'd)

2.6.5 Stability (3.2.1.1.6.5) (L - Channel (night))

The OLS 5D-3 System Summary Report contains the analysis for this spec requirement.

The loss in sensitivity after 3 years on orbit of the PMT channel will be < 23%. This would require 2.27dB change in VDGA gain to compensate and over 6dB of VDGA gain is available.

ATTACHMENT: None.

2.6 NOISE (Cont'd)

2.6.6 Along-Track Noise Integration (3.2..1.1.6.6)

OLS 5D-3 System Summary Report contains the analysis which concludes that the OLS 5D-3 algorithm is consistently above 0.6 times the SNR resulting from perfect integration with 8 bit A/D for T Channel; and above $1/\sqrt{2}$ times the SNR resulting from perfect integration with 6-bit A/D for L channel. Therefore, the Along-Track Noise Integration is in-spec.

ATTACHMENT: None.

2.6 NOISE, (Cont'd)

2.6.7 Glare Suppression (3.2.1.1.6.7)

OLS 5D-3 System Summary Report contains the analysis which verifies that the OLS does provide effective protection against solar glare for sun angles between 75° and 95°.

ATTACHMENTS: None.

2.7 SURVIVABILITY (3.2.7)

The OLS 5D-3 System Summary Report contains calculations of survivability. OLS testing has provided values of $A=42.0$ and $B=0.41$ for A and B as defined in BVS 2740. This BVS - Verification of Survivability Requirements - provides an unclassified reference for verification of the survivability requirements for OLS's 17 thru 21. Unitless OLS system test values will be provided in the System test and Verification Plan Volume IV - Verification Matrix and the Acceptance Test Report. These values will be referenced to classified reports published for OLS 12 thru 16 as an aid in the interpretation of the test results.

The survivability specification, paragraph 3.2.7 of S-DMSP-886, references classified requirements for OLS 17 thru 21 as identified in BVS 2104, Rev. A. Unitless test values "A" and "B" published in each System Test and Verification Plan Volume IV-Verification Matrix and in the Acceptance Test Report for OLS's 17 thru 21 support this requirement. Classified BVS 2353 published for OLS 12 thru 16 under contract F04701-83-C-0048 is used for reference to interpret the measured values for "A" and "B". Value "A" is to be interpreted as that requirement specified in paragraph 3.2.1 of BVS 2353. Value "B" is to be interpreted as that requirement specified in paragraph 3.3.1 of BVS 2353.

ATTACHMENTS: None.

2.8 SCAN ANGLE (3.2.1.1.8)

Tests 6x7x1.ST and 6x7x3.ST (End of Scan Vignette for HRD & T channels respectively) measure the delphi number at which 1% vignetting of scene begins to occur. The measured delphis enable calculation of the altitude needed to obtain contiguous coverage at the equator. The contiguous coverage requirement is based on the average of +Z and -Z scan angles.

For OLS #20, the following results were obtained:

<u>CHANNEL</u>	<u>DELPHI</u>	<u>SCAN ANGLE</u>	<u>CONTIGUOUS COVERAGE ABOVE:</u>	
+Z HRD	+991.0	+55.96°	427.34 n. mi.	428.16 avg.
-Z HRD	-989.5	-55.87°	428.97 n. mi.	
+Z T	+977.0	+55.17°	442.70 n. mi.	438.30 avg.
-Z T	-985.0	-55.62°	433.89 n. mi.	

Thus, both the HRD channel and the T channel meet the requirements for contiguous coverage above 440 naut. mi, since both channels will provide contiguous coverage for all altitudes above 438.30 naut. mi.

ATTACHMENTS: None.

2.9 DATA COLLECTION RATE (3.2.1.1.9)

OLS #20 does scan the field of view at the prescribed 11.88 +/- .12 Hz rate. This parameter is measured in Scanner Functional tests 5x12x1.ST (Primary Side) and 5x12x2.ST (Redundant Side).

The test results are summarized below for all TV tests:

<u>Date</u>	Frequency, Hz	
	<u>Primary</u>	<u>Redundant</u>
01-29-95 Optic Limit	11.91	11.91
03-06-95 Optic Limit	11.93	11.92
03-24-95 Cold Limit	11.92	11.92
04-01-95 Hot Limit	11.91	11.92

ATTACHMENTS: None.

2.10 POWER (3.2.1.3.1 and 3.2.1.3.2)

Both +28V and +5V power is measured and monitored continuously throughout all of the test sequence.

The power required in the eight Development-Spec-defined modes is tabulated below. The Development Spec Power Profile is measured in test 5x2x11.ST for modes 1 through 8 and 5x2x2.ST for mode 0.

10V power consumption is not tested. The current system test equipment is not capable of monitoring 10V power. Analysis of the components using S/C supplied 10V power indicates that 5D-3 10V power consumption is in spec.

S-DMSP-886 limits 28V power consumed for SSS thermal control to 23 watts maximum. SSS heater power consumption was not measured. Analysis of the heater resistances and tolerances indicates that 5D-3 SSS heater power consumption is in spec.

OLS #20 28V power consumption is in spec for all modes in the primary and redundant configurations. Fallback (dual power) configuration power consumption is also in spec. See the attached table for further details.

ATTACHMENTS: OLS #20 Power Profile

OLS #20 POWER PROFILE

SINGLE POWER			DUAL POWER	
28V MODE/LIMIT	TV COLD LIMIT 03-23-95	TV HOT LIMIT 03-29-95	28V LIMIT	**WORST CASE (CALCULATED)
0 88W	41	41	131W	60
1 105W	70	70	148W	89
2 116W	79	79	159W	98
3 125W	86	86	168W	105
4 157W	119	121	200W	140
5 167W	128	129	210W	148
6 198W	153	154	241W	173
7 207W	168	169	250W	188
8 218W	177	178	261W	197
5V MODE/LIMIT				
0 6.0W	3	4		
1 6.0W	4	4		
2 6.0W	4	4		
3 6.0W	4	4		
4 6.0W	3	4		
5 6.0W	4	4		
6 6.0W	4	4		
7 6.0W	4	4		
8 6.0W	4	4		

2.11 MASS

2.11.1 Total Mass (3.2.2-1)

The total weight of OLS #20 is 284.8 lbs. Therefore, the maximum weight specification of 300 lbs. is not exceeded.

2.11.2 Component Mass (3.2.2.2)

All Westinghouse furnished parts meet their center of gravity specification limits and their maximum specified weight allocation as shown in Table 2.11.1.

ATTACHMENT: Table 2.11.1 - OLS #20 Weight and Center-of-Gravity
Table

TABLE 2.11.1

WESTINGHOUSE FURNISHED PARTS SUPPLIED WITH OLS 20 SYSTEM
SUMMARY OF WEIGHT AND CENTER GRAVITY

UNIT	UNIT SER. NO.	\bar{X} (in)		\bar{Y} (in)		\bar{Z} (in)		WEIGHT (lbs)	
		SPEC	ACT	SPEC	ACT	SPEC	ACT	MAX* SPEC	ACT
SSS	5015	1.8±0.5	1.66	6.2±0.5	6.24	0.7±0.5	0.61	59.0	53.2
SPS	5015	3.0±0.5	2.98	13.0±0.5	12.68	8.6±0.8	8.53	65.0	59.0
SPU	5015	3.0±0.5	2.92	6.6±0.5	6.69	6.0±0.5	5.83	20.5	18.8
PSU	5016	2.8±0.5	2.77	7.0±0.5	6.69	7.2±0.5	7.04	29.0	26.3
OSU	5015	1.2±0.25	1.30	4.0±0.5	4.20	2.5±0.5	2.68	4.5	3.6
GSSA/DOC	5016	4.2±0.5	4.32	0.1±0.3	0.02	3.0±0.5	2.81	9.0	7.2
PR1	68	3.5±0.3	3.50	6.4±0.3	6.23	4.2±0.3	4.39	22.75	21.25
PR2	69	3.5±0.3	3.30	6.4±0.3	6.16	4.2±0.3	4.05	22.75	21.26
PR3	70	3.5±0.3	3.40	6.4±0.3	6.14	4.2±0.3	4.10	22.75	21.33
PR4	71	3.5±0.3	3.27	6.4±0.3	6.15	4.2±0.3	4.45	22.75	21.39
CABLES	(1)	-	-	-	-	-	-	40.0	31.6
								300	284.8

* S-DMSP-886 11 FEB 1993

(1) SERIAL NUMBERS ARE AS RECORDED ON DATA SHEET

2.12 COOLER TRANSIENT MARGIN (3.2.2.5)

The T channel cone cooler transient cooldown cooling capacity margin is tested by the file 7x7.ST. An external power supply provides 1/2 Watt of heating to the outer stage of the cooler during a normal cooldown. On OLS #20 cone cooler S/N 032 successfully reached its operating set-point with 1/2 watt of external power applied, demonstrating the required margin.

ATTACHMENTS: None

2.13 DESIGN FEATURES

The following design features of the 5D-3 OLS are addressed in the analyses. The analyses are contained in the OLS 5D-3 System Summary Report. The requirements of the Design Features are met or exceeded in each category.

<u>SUBJECT</u>	<u>SPEC. PARA.</u>
DESIGN INTERFACES	(3.1.2)
RELIABILITY	(3.2.3)
WEAROUT/CONSUMPTION	(3.2.3.3)
STORAGE	(3.2.3.4)
CONTAMINATION CONTROL	(3.2.3.5)
CORROSION OF METAL PARTS	(3.2.3.6)
MAINTAINABILITY	(3.2.4)
INTERCHANGEABILITY	(3.3.5)

ATTACHMENTS: None.

2.14 REDUNDANT AND FALLBACK SUBSYSTEMS (3.2.3.1 & 3.2.3.2)

Paragraph 3.2.3.1 of the development spec requires the OLS to incorporate the following redundant subsystems:

- (1) Along-Scan Gain Control
- (2) Main Bus Power Supplies
- (3) Data Processors
- (4) Memories
- (5) I/O Interfaces
 - a. Bus Controls
 - b. I/O Controls
 - c. S/C Interfaces
 - d. WOW/Flutter Signals/Clock Drivers
 - e. Drive Motor Controls
 - f. Sensor Controls
 - g. Gain Controls
 - h. Encoder Processors
- (6) Data Channels
 - a. Smooth Video Filters
 - b. Fine Video Filters
 - c. T-Channel Post Amplifiers
 - d. SDS Channel
 - e. SDF Channel
 - f. RTD Channel
 - g. Special Sensor Processors
 - h. Output Data Multiplexers
 - i. RDS Channel
- (7) Output Switching Unit Oscillator and Clock Circuits
- (8) Digital Tape Recorders - (Three of Four Required)

(9) Output Data Channels - (Three of Four Required)

Paragraph 3.2.3.2 requires the OLS to incorporate the following fallback subsystems:

- (1) IMC Shut-Off Mode.
- (2) HRD - Detector Single Segment Select, with associated electronics.
- (3) T-Detector Single Segment Select, with associated electronics.
- (4) Digital Generation of Delphi Scanner Clock.
- (5) PMT Shut-Off Mode

Redundant and fallback subsystems are verified by test during the normal test flow either by repetition of the relevant test on the alternate subsystem (in the case of a redundant subsystem) or by tests designed to verify the specific subsystem (in the case of a fallback subsystem). In each case, any out-of-specs or anomalies are reported as part of the relevant Test Report paragraph.

2.15 ENVIRONMENT

The following environmental requirements are addressed in analyses and are contained in the OLS 5D-3 System Summary Report. The Thermal Vacuum (except CHA), Random Vibration, and shock requirements are verified by the successful completion of the approved Test Procedure.

The 5D-3 Environmental requirements of the Development Specification are met or exceeded by the OLS #20 AVE.

<u>SUBJECT</u>	<u>SPEC. PARA</u>
GROUND ENVIRONMENT	20.2.1
LAUNCH ENVIRONMENT	20.2.2
THERMAL VACUUM (CHA)	20.2.2.1
ACCELERATION	20.2.2.5
CHARGED PARTICLE ENVIRONMENT	20.2.2.6
LAUNCH PRESSURE PROFILE	20.2.2.8
ACCOUSTIC FIELD	20.2.2.9
TRANSPORTATION & HANDLING ENVIRONMENT	20.2.3

ATTACHMENTS: None.

3.0 INTERFACE SPECIFICATION REQUIREMENTS

Electrical Interface parameters are measured in the OLS Detailed Electrical Test (T927989) and the OLS Special Sensor Detailed Electrical Test (T927992). These tests demonstrated conformance with all applicable Interface Specification requirements. The only Interface related system measurements that vary significantly from system to system are the SSS Alignment axes which are included here.

3.1 SSS ALIGNMENT AXES

The OLS #20 SSS Reference Plane axes are within the specification allowances. The results of system test and calculation are given below. The designations are those in Interface Spec ICD-88802, para. 3.2.3.2.

SECONDARY REFERENCE AXES TO PRIMARY AXES

$$X_{R-P} = 0.873 \text{ mrad} = 180 \text{ arc sec}$$

$$Y_{R-P} = 0.873 \text{ mrad} = 180 \text{ arc sec}$$

$$Z_{R-P} = 1.023 \text{ mrad} = 211 \text{ arc sec}$$

SECONDARY REFERENCES AXES TO MOUNTING (INTERFACE) AXES

$$X_{R-M} = 0.650 \text{ mrad} = 134 \text{ arc sec}$$

$$Y_{R-M} = 0.926 \text{ mrad} = 191 \text{ arc sec}$$

$$Z_{R-M} = 0.771 \text{ mrad} = 159 \text{ arc sec}$$

These are within the specification limits of 600 arc seconds. The Mounting (Interface) Axes to Primary axes are also calculated, using the computer program REFPLN and are given below:

$$X_{M-P} = 0.267 \text{ mrad} = 55 \text{ arc sec}$$

$$Y_{M-P} = 0.126 \text{ mrad} = 26 \text{ arc sec}$$

$$Z_{M-P} = 0.252 \text{ mrad} = 52 \text{ arc sec}$$

These are within the specification limits of 120 arc seconds.