

**GRAVITY PROBE B
 PROCEDURE FOR
 PAYLOAD VERIFICATION**

***(PTP) TELESCOPE TELEMETRY AND
 OPTICAL POWER SETUP PROCEDURE***

Procedure No. **P0555 Rev. A** (for payload verification II)

10 May 2001

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Authority to redline this document (make minor changes during execution of this procedure): Ted Acworth or Rob Bernier

Level of QA required during performance of this procedure:

- Stanford QA Representative
 Government QA Representative

All redlines must be approved by QA

**Gravity Probe B
Telescope Telemetry Setup Procedure**

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Revision Record:

Rev	Rev Date	ECO #	Summary Description
-	10 may 99		Ted Acworth Wrote original procedure
A	10 May 01	1268	Ted Acworth incorporated redlines from payload verification I, changed format to conform to new Pdoc format

Acronyms and Abbreviations:

Acronym / Abbreviation	Meaning
AS3	Artificial Star # 3
TRE	Telescope Readout Electronics
TRE-GSE	Ground Support Equipment rack for reading telescope telemetry
SMD, dewar	Science Mission Dewar
QA	Quality Assurance
GPB, GP-B	Gravity Probe B
CC, cc	Cube corner
AXP, AXN, etc.	TRE-GSE telescope telemetry readout channels
I _x , I _y , etc.	TRE-GSE telescope telemetry slope values in amps
Θ _x , Θ _y , etc.	Angle theta of AS3 beam relative to AS3 or the telescope
Fe	Optical power in W/m ²
Active duty slope	TRE-GSE telemetry ramp values that lie between the beginning of the ramp and the end of the ramp where the signal is saturated
p-p, p-v	Peak-to-peak is the same as peak-to-valley
SF	Scale factor
Boresight	The optical axis of the telescope
Reticle	The mirror placed on and facing away from the telescope, used to establish an optical reference angle between AS3 and the telescope
Probe	The science mission assembly containing the gyroscopes and telescope, inserted into the SMD space vehicle

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A Scope

Artificial star 3 (AS3) is an instrument used to evaluate the Gravity Probe B (GPB) flight telescope when installed in the spacecraft science mission dewar (SMD). AS3 is capable of projecting a beam of artificial starlight into the telescope, and actuating the beam through a range of calibrated angles relative to the telescope boresight axis. The purpose of this test instrument is to provide data used in the calibration confidence check of the telescope after integration.

Specifically, this procedure details hardware connection to the TRE-GSE, setting gain mode and gain of the TRE-GSE, adjusting optical power of the AS3 beam, tuning the AS3 jitter compensation system to function at a given AS3 optical power

This procedure	<input type="checkbox"/> Does	<input checked="" type="checkbox"/> Does not	provide formal verification of GP-B requirements.
This procedure	<input type="checkbox"/> Does	<input checked="" type="checkbox"/> Does not	include restraints or restrictions for the payload.

B Verification/ Success Criteria

- B.1 **AS3 is used to perform system level confidence tests of the GPB probe containing telescope #3 during the payload verification tests.**

C Constraints and Restrictions

n/a

D Configuration Requirements

- D.1 **The FIST lab area must be seismically and thermally "quiet." Air conditioning, pumps, etc. may need to be turned off as required. Any mechanical noise sources that adversely affect the test will be sought out and shut down with the permission of the Payload Test Director. Temperature in the FIST area should be kept at a stable room temperature.**
- D.2 **Floor plan detailing the positioning of AS3 test equipment in the FIST OPS**
- D.2.1 Roll-in access to a floor area, of 4 ft x 5 ft minimum, for staging is required, accessible by the overhead crane to lift the star module onto the probe flange.
- D.2.2 The control station requires floor space area of 10 ft x 6 ft minimum, and must be within 24 ft of the probe flange for cabling to reach. A 4 ft x 3 ft space directly next to the dewar and on the floor level is required to set up the vacuum pump.
- D.2.3 The flange area of the dewar must be clear out to a radius of at least 4 ft, extending up to the crane on the ceiling, and continuing down at least two feet below the plane of the dewar flange

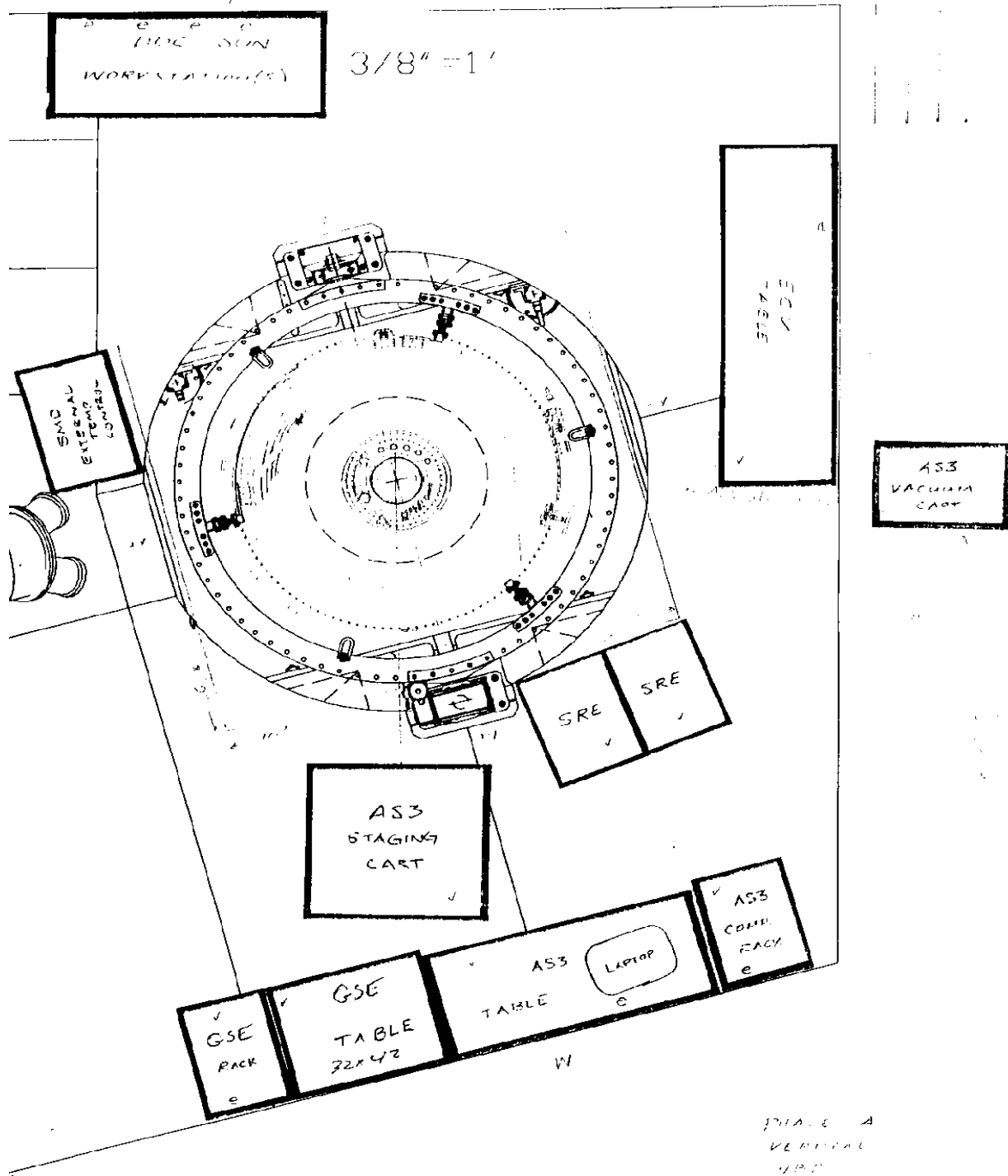
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- D.3 **AS3 operations, once AS3 is installed onto the Probe flange, will be removed from the immediate vicinity of the dewar. Operations will involve the AS3 operators sitting at the AS3 control station and operating optical devices inside the AS3 vacuum chamber**
- D.4 **Three standard 110 VAC and one 3 phase 208 VAC are required to power AS3 and the vacuum pump respectively. Of three 110 VAC lines, one must be on the circuit specially grounded to the probe.**
- D.5 **Three Ethernet drops must be available for communications – two for AS3 and one for the TRE-GSE.**
- D.6 **The TRE-GSE group is responsible for installing the TRE-GSE readout equipment before the AS3 procedures may begin. The TRE-GSE group will position the TRE-GSE test rack within 12 feet of the AS3 control station (see floor plan) and assure that the TRE-GSE test rack correctly reads out telescope telemetry for AS3 tests to proceed. The AS3 group will provide 9 BNC coax cables and connect these to the TRE-GSE during the AS3 alignment procedure.**
- D.7 **The Artificial Star 3 assembly with window #4 adapter plate will be bolted to the probe flange. Umbilicals will trail off the star module down to the control station and pump.**

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E Hardware Required

E.1 Cabling list between AS3 star module and control rack station. (clockwise from accessory cable)

Accessory A
 Accessory B
 Video coax 1
 Video coax 2
 Video coax 3
 Video coax 4
 Motor 1
 Motor 2
 Motor 3
 Motor 4
 Motor 5
 Quad Cells
 Vacuum hose for AS3 vacuum bell
 Vacuum pressure sensor 1
 Vacuum pressure sensor 2
 Thermistor coax 1
 Thermistor coax 2
 Thermistor coax 3
 Thermistor coax 4
 Jitter A
 Jitter B
 Jitter C
 Laser power
 N₂ hose for window #4 purge, 20 foot length, 3/8 inch diameter
 Vacuum hose for Window #4/AS3 window vacuum volume

E.2 Cabling list between AS3 control rack and TRE-GSE control rack

Quantity 9 of 20 foot coax with male BNC connectors on both ends

E.3 Equipment requiring formal periodic calibration

Manufacturer	Model	Serial Number	Calibr. Exp. Date
Newport Optical Power Meter	1830-C	1604	11 May 02
Newport Optical Power Meter Detector Head (quantity 2)	818-SL	7761 and 7844	11 May 02
Fluke multimeter "GPB SMD"	85	66500192	16 Nov 01
Torque wrench for tightening flange mount bolts	DA175M and DA130M	STU-0031 and STU- 0030	OK to use FIST OPS wrench
Torque wrench (FIST OPS property in bonded storage)		000191	28 Nov 01

E.4 Special AS3 test equipment

Description	Part No.	Rev. no.	Serial No.
AS3 star module	25567	A	none
500 bomb cart for AS3 star module	none	none	none

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AS3 mounted to bomb cart using three legs setup for on-cart optical transmissibility tests (tabs for holding condenser lens under the AS3 star module)	none	none	none
AS3 star module mounting flange		none	none
Torque wrench for tightening flange mount bolts	DA175M	none	STU-0031
Torque wrench for tightening flange mount bolts	DA130M	none	STU-0030
10.75 inch Diameter Mylar sheet for the bottom of the AS3 mounting flange			
N ₂ cylinder with valve	none	none	none
AS3 control rack including AS3-PC computer and other instruments	none	none	none
AS3 control station including: 5x video monitors and 2 switch boxes AS3-HR1510 computer, computer monitor, keyboard and mouse AS3-PC computer monitor, keyboard, mouse, and trackball	none	none	none
AS3 vacuum pumping cart:			
Vacuum pump for AS3 vacuum bell	none	none	none
220V power cord	none	none	none
20 feet of QF 50 vacuum hose	none	none	none
Vacuum pump for Window #4/AS3 window vacuum volume (available in FIST OPS)	none	none	none
30 feet of 3/8 inch diameter vacuum hose with QF 10 fittings	none	none	none
mechanical toolbox	none	none	none
1/4 inch socket adapter to 5/32 Allen. Note, due to limitation on space, max 1.100 in long.	none	none	none
Allen wrench, 5/32 (in)	none	none	none
6 inch Caliper	none	none	none
electrical toolbox	none	none	none
optics toolbox	none	none	none
AS3 Payload Verification test notebook	none	none	none

E.5 Tools

Description	No. Req'd
AS3 Mechanical Toolbox inventoried	1
AS3 Electrical Toolbox inventoried	1
AS3 Optics Toolbox inventoried	1

Toolbox content lists are contained in a separate document titled "AS3 tools list."

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E.6 Computers and software:

Computer	Name	Model	Software Vendor	Software Name	Version No
WinTel	AS3-PC	Industrial PC 133 MHz NT	National Instruments and other	Lab View and other	5.0.1
WinTel	AS3-HR1510	Adsys	Various support software		

E.7 Expendables

Description	Quantity
Optics cleaning supplies	1 bag
JAZ [®] disks	4
Blank CD-R disks	20
Video camera and media	1
Still Camera and media	1

F Software Required

F.1 Test Support Software

Version control is implemented using a system where the program file name is followed by an F and a date of last modification, in year month day format. For example, "2D Scale Factor_F_990630.vi" would be the version of "2D Scale Factor_F.vi" last modified on 30 June 1999

Test Software Name	Version No.	QA
Get Theta_F.vi	F_990707	
Manual Control Module_F.vi	F_990722	
Null_Both_Spots_F.vi	F_990806	
Record Motor Positions_F.VI	F_990809	
Restore Motor Positions_F.vi	F_990717	
Spot_Calibration_F.vi	F_990727	
Spot Nuller_F.vi	F_990716	
Trackball Module_F.vi	F_990809	
View Telescope Spot_F.vi	F_990717	

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G Procedures Required

Procedure Name	Procedure No.
AS3 adapter flange fit check procedure	P0514
Installation procedure	P0500 Rev A
Alignment procedure	P0501 Rev A
Transmissibility test procedure	P0502 Rev B
Focus, scale factor, and strehl ratio test procedure	P0503 Rev B
Removal procedure	P0504 Rev A
Removing the vacuum cover while the star is mounted to the probe and accessing internal optics	P0347 Operation order
Telescope telemetry setup procedure	P0555

H Equipment Pretest Requirements

Equipment	Serial No.	Test Required	Proc. No.	Test Performed	
				Date	By
AS3 star module	none	Reconfirm beam center positions for 1 cm cc, 6" cc, and sliding aperture motor encoders 1 cm cc = _____ ticks 6" cc = _____ ticks sliding ap= _____ ticks	None – performed by E. Acworth and R. Bernier in AS3 lab	May 01	E. Acworth and R. Bernier
AS3 star module	none	internal optics aligned, 1 cm and 6" beams collimated, covered and evacuated, and mounted to transport cart.	P0501	day before test	E. Acworth and R. Bernier
AS3 star module	none	Vacuum system leak tested	None – performed by E. Acworth and R. Bernier in AS3 lab	Jun. 97	E. Acworth and R. Bernier
AS3 star module	none	Vacuum structure and shackle (for crane hook connection) tested to 2x load with chamber at atmospheric and evacuated	None – performed by E. Acworth and R. Bernier in AS3 lab	8 Oct. 97	E. Acworth and R. Bernier
AS3 star module	none	Window #4 space vacuum leak check	None – performed by E. Acworth and R. Bernier in AS3 lab	TBD	TBD
AS3 test wedge	none	Wedge angle calibration	None – Read R. Bernier's lab notebook #7 page 72	21 Feb 01	R. Bernier

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AS3 transmissibility	none	Transmissibility calibration	None – performed by E. Acworth and R. Bernier in AS3 lab	22Jun99	E. Acworth

I Personnel Requirements

The test director for this procedure is Ted Acworth

This test to be conducted only by certified personnel: Ted Acworth and Rob Bernier.

A TRE-GSE group representative will be available during all AS3 procedures to monitor the TRE-GSE functionality. Ted Acworth and Rob Bernier have authority to request the presence of a TRE-GSE group representative at any time during the AS3 procedures.

Quality Assurance shall be conducted on a formal basis to approved and released procedures. The QA program office shall be notified of the start of this procedure. A Quality Assurance Representative, designated by Dorrene Ross shall be present during the procedure and shall review any discrepancies noted and approve their disposition. Upon completion of this procedure, the QA Program Engineer, Dorrene Ross or her designate, nominally R. Leese, will certify her concurrence that the effort was performed and accomplished in accordance with the prescribed instructions by signing and dating in the designated place(s) in the document. Discrepancies will be recorder in a D-log or as a DR per Quality Plan P0108.

J Safety Requirements

J.1 Dewar safety

- J.1.1 During the time that this test is in operation personnel will discharge built up static electricity appropriately. Refer to P0476
- J.1.2 During the tests no magnetic tools will be allowed to come in contact with the probe
- J.1.3 Don't bump the probe unnecessarily
- J.1.4 When handling tools or objects above the dewar, special care is to be taken so as not to drop them onto the dewar or equipment. An absolute minimum of tools is to be used above the dewar (torque wrench for tightening adapter flange to sunshield flange)

J.2 Installation and removal procedures

- J.2.1 The lifting operation should be QC'd by the Payload Verification Test Director (Mike Taber) who will direct the lifting of AS3 over the SMD
- J.2.2 Harv Moskowitz's presence will be necessary during lifting for safety assurance
- J.2.3 Personnel should not be present beneath the AS3 star module during lifting operations
- J.2.4 When pushing the control rack make sure that it doesn't topple over.
- J.2.5 When maneuvering the AS3 star module be careful not to allow the accelerations to

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exceed 2 G to avoid shock

J.3 Electrical mating and demating of AS3 hardware connectors

- J.3.1 Place cable connector A only into socket A, etc.
- J.3.2 Strain relieve all cables
- J.3.3 Connection and disconnection shall be performed only by Ted Acworth or Rob Bernier, and only when the equipment involved is in a powered-down state (unless otherwise noted)
- J.3.4 Connectors shall be inspected for contamination and for bent, damaged, or recessed pins prior to mating.

K General Instructions

K.1 Red-line authority

- K.1.1 Redlines may be initiated by Ted Acworth or Rob Bernier. Authority to red-line (make minor changes during execution) this procedure is given solely to the TD or his designate and shall be approved by the QA Representative. Additionally, approval by the Hardware Manager shall be required, if in the judgement of the TD or QA Representative, the experiment functionality may be affected.

K.2 Any nonconformance or test anomaly should be reported by a Discrepancy Report. Refer to the Quality Plan, P0108, for guidance. Do not alter or break test configuration if a test failure occurs; notify quality assurance.

K.3 Only the following persons have the authority to exit/terminate this test or perform a retest: Ted Acworth or Rob Bernier

L References and Applicable Documents

Tool list

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M Operations

Hardware connection:

M.1 Connect 9 BNC cables from the TRE-GSE rack to the AS3-PC NIDAQ card breakout terminal box in the following order (for these cables it's OK to connect while both the TRE-GSE and the AS3-PC are powered on) :

- M.1.1 TRE-GSE ATC Strobe -> AS3 Trigger
- M.1.2 TRE-GSE Panel A XPSIGHI -> AS3 CH0
- M.1.3 TRE-GSE Panel A XNSIGHI -> AS3 CH1 (CH0-CH1=XA)
- M.1.4 TRE-GSE Panel A YPSIGHI -> AS3 CH2
- M.1.5 TRE-GSE Panel A YNSIGHI -> AS3 CH3 (CH2-CH3=YA)
- M.1.6 TRE-GSE Panel B XPSIGHI -> AS3 CH4
- M.1.7 TRE-GSE Panel B XNSIGHI -> AS3 CH5 (CH4-CH5=XB)
- M.1.8 TRE-GSE Panel B YPSIGHI -> AS3 CH6
- M.1.9 TRE-GSE Panel B YNSIGHI -> AS3 CH7 (CH6-CH7=YB)

Normal (flight) gain mode setup:

M.2 Prepare AS3 optical power for payload telescope normal (flight) gain mode readout

- M.2.1 TRE-GSE personnel: set telescope readout to normal gain mode, with minimum gain following the charge locked loop (maximum allowable light in normal gain mode)
- M.2.2 Set AS3 optical power to 0.5 mW
- M.2.3 Null AS3 beam to reticle
- M.2.4 (optional) Observe return spot calibration curve without annular filter in beam
 - M.2.4.1 Extend 150 mm cube corner into beam center position
 - M.2.4.2 Run "Spot Calibraion_F.vi" using 150 mm cube corner as xscan motor to observe return spot calibration curve
 - M.2.4.2.1 Slope of calibration curve = _____
 - M.2.4.3 Run "SnagIlt.exe" to capture the "Spot Calibraion_F.vi" window and save an image to file
 - M.2.4.3.1 File name: _____
- M.2.5 Position the annular filter to the center of the AS3 beam

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- M.2.5.1 Run "ManualControlModule_F.vi" and extend 1cm cc translator to 800,000 ticks
- M.2.6 (optional) Check that annular filter is in center position of beam
 - M.2.6.1 Set AS3 optical power to 2.0 mW
 - M.2.6.2 Extend 150 mm cube corner into beam center position.
 - M.2.6.3 Run "Spot Calibraion_F.vi" using 150 mm cube corner as xscan motor to compare return spot calibration curve to curve taken in M.2.4.2
 - M.2.6.3.1 Slope of calibration curve = _____
 - M.2.6.4 Run "Snaglt.exe" to capture the "Spot Calibraion_F.vi" window and save an image to file
 - M.2.6.4.1 File name: _____
- M.2.7 Observe 8 channels of slope estimation. Decrease AS3 optical power until fastest slope has a period of 0.05 sec or longer
 - M.2.7.1 Run "View Telescope Spot_F.vi"
- M.2.8 Set slope estimation timing to capture about the first half of the active duty slopes
- M.2.9 Null AS3 beam to telescope boresight
- M.2.10 Observe 8 channels of slope estimation. Decrease AS3 optical power until fastest slope has a period of 0.05 sec or longer
 - M.2.10.1 Active duty period of fastest slope = _____ msec
 - M.2.10.2 AS3 optical power setting _____ mW
- M.2.11 Set slope estimation timing to capture about the first half of the active duty slopes
 - M.2.11.1 Slope capture Start = _____ sec
 - M.2.11.2 Slope capture End = _____ sec

Completed by: _____

Date/time: _____

QA witness: _____

M.3 Check telescope telemetry readout into AS3-PC

- M.3.1 Run "Record Motor Positions_F.vi" to record positions of motors (specifically acquisition mount)
 - M.3.1.1 File name: Motor Positions_____
- M.3.2 Run Labview program "View Telescope Spot_F.vi version F". Choose "Payload Telescope" setting of "Payload Telescope Selection" switch.
- M.3.3 Null to boresight
- M.3.4 Run "Trackball Module_F.vi" and steer 150 mm beam to each of four telescope readout quadrants. In each quadrant check:
 - M.3.4.1 Check to see that the active duty slopes are accurately captured in each of

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four quadrants (with the slope estimation timing settings entered). Modify optical power or timings if necessary.

NOTE:

If timing is not set correctly to capture active duty slopes over the entire scan field, science test data will be inaccurate. If timing ever includes saturated data points, slope estimation will be incorrect!

- M.3.4.2 Check for sign error on "View Telescope Spot_F.vi" in each of four quadrants
- M.3.4.3 Identify direction and polarity of telescope readout for light beam entering probe from X+, X-, Y+, and Y- axes directions
 - M.3.4.3.1 For AS3 beam exiting star module downwards (-Z) and steering toward the X+ axis, TRE reads out direction _____
 - M.3.4.3.2 For AS3 beam exiting star module downwards (-Z) and steering toward the X- axis, TRE reads out direction _____
 - M.3.4.3.3 For AS3 beam exiting star module downwards (-Z) and steering toward the Y+ axis, TRE reads out direction _____
 - M.3.4.3.4 For AS3 beam exiting star module downwards (-Z) and steering toward the Y- axis, TRE reads out direction _____
- M.3.5 Final settings for 8 channels of slope estimation.
 - M.3.5.1 Active duty period of fastest slope = _____ msec
 - M.3.5.2 AS3 optical power setting _____ mW
 - M.3.5.3 Multiply by _____ (ND 2 filter transmissibility) = _____ nW
 - M.3.5.4 Multiply by _____ (AS3 transmissibility) = _____ nW = optical power leaving AS3
 - M.3.5.5 Slope capture Start = _____ sec
 - M.3.5.6 Slope capture End = _____ sec
- M.3.6 Run "Restore Motor Positions_F.vi" with file name in M.3.1.1 to restore motor positions to those before this test section

Completed by: _____
Date/time: _____
QA witness: _____

Low gain mode setup:

M.4 Preparing AS3 optical power for payload telescope low gain mode readout

- M.4.1 TRE-GSE personnel: set telescope readout to low gain mode, to accept highest

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possible light level

- M.4.1.1 It is assumed that the detector balancing procedure as described in P0487 has been completed.
- M.4.1.2 These steps must be performed for each axis to be placed in low gain mode.
- M.4.1.3 Set the CLAMP command for the axis to 0000h.
- M.4.1.4 Set the control word to 1040h if not using local closed loop temperature control or 10C0h if local closed loop temperature control had been enabled. [Bit 6 enables the lo-gain mode, bit 7 enables local closed loop temperature mode.]
- M.4.1.5 Set the gain to the desired value by changing the BIAS Command. The left most nibbles control the gain. The lowest gain setting would be when BIAS is 0000h.
- M.4.1.6 Adjust the CLAMP value to avoid saturation of the output waveform and was done in P0487. [Clamp values in lo-gain mode are likely to be between 0000h and 0505h.]
- M.4.2 Turn off jitter compensation system
- M.4.3 Run Labview "Record Motor Positions_F.vi Version F" to record positions of motors
 - M.4.3.1 File name: Motor Positions_____
- M.4.4 **(saturation method)**
 - M.4.4.1 Set AS3 optical power readout to 0.5 mW
 - M.4.4.2 Null AS3 beam normal to telescope reticle
 - M.4.4.3 Run Labview Program "View Telescope Spot_F.vi Version F" with "Payload Telescope" setting of Telescope Selection switch
 - M.4.4.4 Observe 8 channels of slope estimation. Decrease AS3 optical power until fastest slope has an active duty period of 0.02 sec or longer.
 - M.4.4.4.1 AS3 optical power setting _____ mW
 - M.4.4.4.2 Active duty period of fastest slope = _____ msec
 - M.4.4.5 Set slope estimation timing to capture about the first half of the active duty slopes
- M.4.5 Set direction signs and gains for automatic nulling with Payload Telescope telemetry
 - M.4.5.1 Run LabView program "Spot Nuller_F.vi" Version F with "acq->payload telescope" setting. Assure nulling converges
 - M.4.5.1.1 Open LabView program "Spot Nuller singleiteration_F.vi" Version F and adjust "acq->payload telescope" settings
 - M.4.5.2 Run LabView program "Spot Nuller_F.vi" Version F with "ff->payload telescope" setting. Assure nulling converges
 - M.4.5.3 Run LabView program "Null Both Spots_F.vi" Version F with with "ff-

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>payload telescope” and “ffc->source” settings. Assure nulling converges

M.4.5.4 Null to boresight

M.4.5.4.1 Run LabView program “Null Both Spots_F.vi” Version F with with “ff->payload telescope” and “ffc->source” settings.

M.4.5.5 Observe 8 channels of slope estimation. Further decrease AS3 optical power until fastest slope has a period of 0.02 sec or longer. (with all slopes equal to 0.02 sec at boresight, fastest slope when telescope spot falls completely to far field will be equal to 0.01 sec, the minimum allowable)

M.4.5.6 Active duty period of fastest slope = _____ msec

M.4.5.7 AS3 optical power setting _____ mW

M.4.6 Set slope estimation timing to capture about the first half of the active duty slopes

M.4.6.1 Slope capture Start = _____ sec

M.4.6.2 Slope capture End = _____ sec

Completed by: _____

Date/time: _____

QA witness: _____

M.4.7 Set up jitter compensation system for functionality at this AS3 optical power setting and return spot diameter. If jitter compensation system will function with less light, then decrease light level to minimum required. If jitter system will not function with this light level, then the saturation method failed – go to M.4.8 below

M.4.7.1 AS3 optical power setting _____ mW

M.4.7.2 Minimize return spot diameter

M.4.7.2.1 Slope value = _____

M.4.7.3 Turn on jitter compensation system

M.4.7.4 If jitter compensation system will run with this light level, then light level is finalized. Continue with the next step below. If there is not enough light to give acceptable signal-to-noise ratio then go to M.4.8 below

M.4.7.5 Adjust loop gain until controller goes unstable

M.4.7.5.1 Loop gain (LG) at which controller goes unstable = _____

M.4.7.6 Measure and graph p-p jitter amplitude vs. loop gain at 10 loop gain values around the LG value: 0, 0.1 LG, 0.2 LG, ..., 0.9 LG, and just less than LG

M.4.7.6.1 P-p jitter at 0 loop gain = _____ arcsec

M.4.7.6.2 P-p jitter at 0.1 LG = _____ arcsec

M.4.7.6.3 P-p jitter at 0.2 LG = _____ arcsec

M.4.7.6.4 P-p jitter at 0.3 LG = _____ arcsec

M.4.7.6.5 P-p jitter at 0.4 LG = _____ arcsec

M.4.7.6.6 P-p jitter at 0.5 LG = _____ arcsec

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- M.4.7.6.7 P-p jitter at 0.6 LG = _____ arcsec
- M.4.7.6.8 P-p jitter at 0.7 LG = _____ arcsec
- M.4.7.6.9 P-p jitter at 0.8 LG = _____ arcsec
- M.4.7.6.10 P-p jitter at 0.9 LG = _____ arcsec
- M.4.7.6.11 P-p jitter at just less than LG = _____ arcsec
- M.4.7.7 Set jitter compensation to operate at loop gain setting with minimum p-p jitter

GO / NO GO: _____
Completed by: _____
Date/time: _____
QA witness: _____

M.4.8 If NO GO above (annular filter method)

- M.4.8.1 Position the annular filter to the center of the AS3 beam
 - M.4.8.1.1 Run "ManualControlModule_F.vi" and extend 1cm cc translator to 800,000 ticks
- M.4.8.2 Set AS3 optical power to 0.80 mW (Verify That This Doesn't Saturate)
- M.4.8.3 Observe 8 channels of slope estimation. Decrease AS3 optical power until fastest slope has a period of 0.02 sec or longer.
- M.4.8.4 Set slope estimation timing to capture about the first half of the active duty slopes
- M.4.8.5 Null AS3 beam to telescope boresight
- M.4.8.6 Observe 8 channels of slope estimation. Decrease AS3 optical power until fastest slope has a period of 0.02 sec or longer. (with all slopes equal to 0.02 sec at boresight, fastest slope when telescope spot falls completely to far field will be equal to 0.01 sec, the minimum allowable)
 - M.4.8.6.1 AS3 optical power setting _____ mW
 - M.4.8.6.2 Active duty period of fastest slope = _____ msec
- M.4.8.7 Set slope estimation timing to capture about the first half of the active duty slopes

Completed by: _____
Date/time: _____
QA witness: _____

- M.4.8.8 Set up jitter compensation system for functionality at this AS3 optical power setting and return spot diameter. If jitter compensation system will function with less light, then decrease light level to minimum required.
 - M.4.8.8.1 AS3 optical power setting _____ mW

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M.4.8.8.2 Minimize return spot diameter

M.4.8.8.2.1 Slope value = _____

M.4.8.8.3 Turn on jitter compensation system

M.4.8.8.4 Adjust loop gain until controller goes unstable

M.4.8.8.4.1 Loop gain (LG) at which controller goes unstable
= _____

Jitter Files:

Amp: _____ File Name: _____

Amp: _____ FileName: _____

Amp: _____ FileName: _____

Amp: _____ FileName: _____

Amp: _____ FileName: _____

Amp: _____ FileName: _____

Amp: _____ FileName: _____

Amp: _____ FileName: _____

Amp: _____ FileName: _____

Amp: _____ FileName: _____

M.4.8.8.5 Measure and graph p-p jitter amplitude vs. loop gain for loop gain values of 0, 0.1 LG, 0.2 LG, ..., 0.9 LG, and just less than LG

M.4.8.8.6 Set jitter compensation to operate at loop gain setting with minimum p-p jitter

GO / NO GO: _____

Completed by: _____

Date/time: _____

QA witness: _____

M.5 Turn off jitter system

M.6 Check telescope telemetry readout into AS3-PC

M.6.1 Run "Record Motor Positions_F.vi" to record positions of motors (specifically acquisition mount)

M.6.1.1 File name: Motor Positions _____

M.6.2 Run Labview program "View Telescope Spot_F.vi version F". Choose "Payload Telescope" setting of "Payload Telescope Selection" switch.

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- M.6.3 Run "Trackball Module_F.vi" and steer 150 mm beam to each of four telescope readout quadrants.
 - M.6.3.1 Check to see that the active duty slopes are accurately captured in each of four quadrants (with the slope estimation timing settings entered). Modify optical power or timings if necessary.

NOTE:

If timing is not set correctly to capture active duty slopes over the entire scan field, science test data will be inaccurate. If timing ever includes saturated data points, slope estimation will be incorrect!

- M.6.3.2 Check for sign error on "View Telescope Spot_F.vi" in each of four quadrants
- M.6.4 Final settings for 8 channels of slope estimation.
 - M.6.4.1 Active duty period of fastest slope = _____ msec
 - M.6.4.2 AS3 optical power setting _____ mW
 - M.6.4.3 Multiply by _____ (ND 2 filter transmissibility) = _____ nW
 - M.6.4.4 Multiply by _____ (AS3 transmissibility) = _____ nW = optical power leaving AS3
 - M.6.4.5 Slope capture Start = _____ sec
 - M.6.4.6 Slope capture End = _____ sec
- M.6.5 Check direction signs and gains for automatic nulling with Payload Telescope telemetry
 - M.6.5.1 Run LabView program "Spot Nuller_F.vi" Version F with "acq->payload telescope" setting. Assure nulling converges
 - M.6.5.1.1 Open LabView program "Spot Nuller singleiteration_F.vi" Version F and adjust "acq->payload telescope" settings
 - M.6.5.2 Run LabView program "Spot Nuller_F.vi" Version F with "ff->payload telescope" setting. Assure nulling converges
 - M.6.5.2.1 Open LabView program "Spot Nuller singleiteration_F.vi" Version F and adjust "ff->payload telescope" settings
 - M.6.5.3 Run LabView program "Null Both_F.vi" Version F with with "ff->payload telescope" and "ffc->source" settings. Assure nulling converges
- M.6.6 Null to boresight
 - M.6.6.1 Run LabView program "Null Both_F.vi" Version F with with "ff->payload telescope" and "ffc->source" settings.
- M.6.7 Run "Restore Motor Positions_F.vi" with file name in M.3.1.1 to restore motor positions to those before this test section

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Completed by: _____
Date/time: _____
QA witness: _____

N Procedure Completion.

Completed by: _____
Witnessed by: _____
Date: _____
Time: _____

Quality Manager _____ Date _____
Payload Test Director _____ Date _____