DWG NO. 564419 | SH 1 | REV –

APPLICATION			REVISIONS			
PART NO.	NEXT ASSY	USED ON	REV	DESCRIPTION	DATE	APPROVED
		IN0112A	–	INITIAL RELEASE	03/03/04	W. ANDERSON

AS RUN Redline

⚠ 12, 13, 15, 16, 17, 24, 30, 14, 19, 29, 28 CB 4/25/03

Note: All stepscalling for UDT photometer are N/A since the photometer was out of the facility for the test. The spheres were calibrated using an ASD spectrophotometer on a later date
DLH 4/23/03

CO23382 OP 790

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

REVISION STATUS OF SHEETS

DRAWING TYPE (PER MIL-T 31000)	
CONCEPT. DES.	
DEVELOP. DES.	
PRODUCT	
COMMERCIAL	

UNLESS OTHERWISE SPECIFIED

BREAK SHARP EDGES –

INTERPRET DRAWING PER MIL-STD-100 AND PRODUCT STANDARD 25030

SURFACE TEXTURE EXCEPT AS NOTED 125 √

DIMENSIONS ARE IN INCHES TOLERANCES

.XX	.XXX	X°
±.03	±.010	±1°

LAYOUT NO.

Ball Aerospace & Technologies Corp.
P.O. Box 1062
Boulder, ~~CO~~ 80306

APPROVED	DATE	APPROVED	DATE
THERMAL N/A		PREP BY Donald Hampton	03/01/27
STRL ANAL N/A		RESP ENGR Donald Hampton	03/01/27
MASS PROP N/A		I&T L. Hunter	03/01/28
MATL & PRCS N/A		Optics James Baer	
SAFETY N/A		FIT/FUNC CHK N/A	
QA John King	03/01/28	FIT/FUNC ANAL N/A	
LOGISTICS N/A		SYSTEMS Marty Huisjen	03/01/27
		RELIABILITY N/A	

High Resolution Instrument (HRI) Performance Test Procedure

SIZE	CAGE CODE	DWG NO.	REV
A	13993	564419	–
SCALE NONE		WT NA	SHEET 1 OF 36

CONTRACT NO.

A6356 BR228144A1 BR 228-f 7/15/02

GODDARD SPACE FLIGHT CENTER

GSFC STI PUBLIC DISCLOSURE EXPORT CONTROL CHECKLIST

Title: Deep Impact - Integration and Test Instrument - Document No: 564419

Instructions – This checklist is used for the disclosures of STI, and ITAR or EAR controlled information.

For STI (scientific and technical information) disclosures subject to NPG 2200.2 (Guidelines for Documentation, Approval, and Dissemination of STI), this checklist should be forwarded with the NASA Form 1676 (NASA Scientific and Technical Document Availability Authorization (DAA)). For all other ITAR (International Traffic in Arms Regulations, 22 CFR 120-130) and EAR (Export Administration Regulations, 15 CFR 730-774) disclosures, this checklist should be forwarded with a copy of the information to the GSFC Export Control Office for review/approval. Completion of this checklist should minimize delays in approving most requests.

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Generally, the export of information pertaining to the design, development, production, manufacture, assembly, operation, repair, testing, maintenance or modification of defense articles (e.g., space flight hardware, ground tracking systems, launch vehicles to include sounding rockets and meteorological rockets, radiation hardened hardware and associated hardware and engineering units for these items) are controlled by the State Department under the ITAR. The export of information with respect to ground based sensors, detectors, high-speed computers, and "dual use" (military/commercial) technology items are controlled by the Commerce Department under the EAR. A complete listing of items covered by the ITAR and the EAR can be accessed at http://export.gsfc.nasa.gov. If the information intended for release falls within the above categories but fits into one or more of the following exemptions, the information may be released.

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If your information is already in the public domain in its entirety through a non-NASA medium and/or through a NASA release previously approved by any NASA Export Control Office, the information is exempt. If the information falls into this category, you may attest that you are using this exemption by signing below.

Print Name and Code	Signature	Date

EXEMPTION II – Scientific data

If your information pertains exclusively to the release of scientific data (e.g., data pertaining to studies of clouds, soil, vegetation, oceans, planets, stars, galaxies and the universe) without the disclosure of information pertaining to articles controlled by the ITAR or EAR, such as flight instruments, high-speed computers, or launch vehicles, the information is exempt. If the information falls into this category, you may attest that you are using this exemption by signing below.

Print Name and Code	Signature	Date

GODDARD SPACE FLIGHT CENTER

GSFC STI PUBLIC DISCLOSURE EXPORT CONTROL CHECKLIST *CONTINUED*

EXEMPTION III – General purpose information

If your information falls into the ITAR or EAR areas of concern as referenced above, but is offered at a general purpose or high level (e.g., poster briefs and overviews) where no detailed technical information (e.g., design, development, production, or manufacturing) pertaining to ITAR or EAR controlled items is offered, the information is exempt. If the information falls into this category you may attest that you are using this exemption by signing below.

Print Name and Code	Signature	Date
Edwin J Grayzeck 690.1	Edwin J Grayzeck	**Sept 28, 2005**

EXEMPTION IV – Software safety and assurance methodologies

If your information pertains exclusively to the release of software safety and assurance methodologies or studies, without disclosing information pertaining to articles controlled by the ITAR or EAR, the information is exempt. If the information falls into this category, you may attest that you are using this exemption by signing below.

Print Name and Code	Signature	Date

REQUEST FOR ITAR 125.4(b)(13) EXEMPTION – Technical data

If your information is not satisfied by the exemptions stated above, the information might be releasable using exemption 125.4(b)(13) of the ITAR. This exemption allows the release of ITAR controlled information into the public domain and does not require that the information be published in order to qualify. Use of this exemption is afforded only to agencies of the Federal Government. The GSFC Export Control Office will approve this exemption only after receiving assurance that such a release is a responsible action. The following guideline has been established regarding the use of this authority: The information may not offer specific insight into the design, development, production, or manufacture of an identified ITAR controlled item (reference paragraph 2 above) in sufficient detail (by itself or in conjunction with other information in the public domain) to allow potential adversaries to replicate the item, or exploit or defeat controlled U.S. technologies. All signatures of approval on NASA Form 1676 (and in the signature blocks below) expressly indicate concurrence with the responsible use of this exemption when it is requested. If you determine that you have met these criteria, you may attest your determination by signing below, and the GSFC Export Control Office will offer favorable consideration toward approving your request under this special exemption.

Print Name and Code	Signature	Date

If a NASA Form 1676 does not accompany this request, use of this exemption requires approval from a Branch-level or higher management official.

Print Name and Code	Signature	Date

The GSFC Export Control Office ☑ approves ☐ does not approve this exemption/request. 9/28/05 AM

Center Export Administrator (CEA)	Signature	Date
Thomas A. Weisz, Code ~~232~~ 234	Thomas A. Weisz	9/28/05

If your STI, ITAR, or EAR disclosure does not satisfy any of the above exemptions, please contact the GSFC Export Control Office for further clarification on the releasability of your information under the ITAR or EAR.

GSFC 25-49 (2/03) BACK

CONTENTS

1 SCOPE

This procedure describes the steps to be performed to test the throughput performance of the visible portion of the High Resolution Instrument (HRI) for Deep Impact. These tests will be performed as part of the overall Thermal Vacuum test described in Test Procedure 564426. Focus and boresight measurements are governed by Test Procedure 564422.

2 APPLICABLE DOCUMENTS

The following documents form a part of this procedure to the extent specified herein. Unless a specific issue or revision is listed, these documents shall be of the latest issue or revisions in effect at the time of the test. In the event of a conflict between this procedure and the reference documents, the contents of this procedure shall govern.

2.1 Deep Impact Program Documents / Drawings

559700	Instrument Platform Assembly
559699	High Resolution Instrument (HRI)
564303	Instrument Electronics Assembly, HRI
564307-500	Pre-Amp Clock Bias Assembly (HRI)
564422	Instrument Platform Alignment Procedure
564426	Instrument Platform Thermal Vacuum Procedure
564506	CSTOL: DI HRI VIS Single Mode Dark Imaging
564507	CSTOL: DI HRI VIS Single Mode Light Imaging
576688	CSTOL: DI HRI VIS Three Frame Set Imaging
576689	CSTOL: DI HRI VIS Five Frame Set Imaging
574498	CSTOL: DI HRI Power On
574499	CSTOL: DI HRI Power Off

574495	CSTOL: DI HRI IR Detector Multiple Mode Calibration
575086	CSTOL: DI HRI IR Detector Single Mode Calibration
576690	CSTOL: DI HRI IR Stimulator DAC Select

3 TEST CONDITIONS AND REQUIREMENTS

3.1 Precautions

Failure to follow the procedures contained in this document, as well as SPS 1930 and SPS 3096, may result in damage to flight hardware.

3.1.1 ESDS Equipment. (If Applicable)

The test specimen contains electrostatic-discharge sensitive (ESDS) devices that may be exposed at the electrical interfaces. Therefore, it shall be handled per MIL-STD-1686 Class 1, as implemented by SPS 120211. The test specimen, the test operator (using wrist straps), and related electrical test equipment shall be connected to a common ground before any electrical connecting or disconnecting operations, and during the use of any electrical test equipment probes. The following requirements are important:

A. All personnel within 1 meter of the Instrument or Electronics, and all related test equipment shall be connected to a common ground at all time.
B. An ionizing blower shall be in place and operating whenever static generators such as nylon sheeting or paper are within one meter of exposed electrical interfaces.
C. Under no circumstances shall connections be made to the unit under test while power is applied.
D. Test cables and equipment shall have all pins shorted to equal potential (or ground) prior to being connected to ESDS hardware. This requirement shall be met by using shorting devices on applicable connectors prior to mating.

3.1.2 Proof Load Certification

All equipment to be used for flight hardware lifts shall have current proof load certification. If certification paperwork does not exist, or is out of date, proof load testing must be performed, using a technique appropriate for the device in question. Immediately prior to use, each such device shall be visually inspected for damage. Any hardware exhibiting cracks, or any cable having parted strands, or any similar defects, shall be disposed of and replaced or documented on an MDR, regardless of its state of certification.

3.1.3 General Precautions for Connectors:

A. Connector savers shall be used on all flight hardware electrical connectors as specified in the Deep Impact Connector Guidelines.
B. Flight hardware electrical connectors shall be capped with ESD approved covers when they are not in use, to minimize contamination, and to prevent damage from electrostatic discharge.
C. Before mating any connector, examine the connector to assure that there is no interference or visible contaminants at the pin or socket interface. Notify QA if connectors exhibit any problems.

D. Extreme care shall be exercised should connectors need to be probed at any time, and the following precautions taken:
- The probing pin shall be a mating pin or socket that is insulated to prevent shorting.
- The probing pin shall be gold plated, or of a non-marring smooth surface.

3.2 Safety Requirements

In accordance with the Reliability, Parts and System Safety Handbook SP0031A-014, the System Safety Engineer or his delegate has final authority over safety provisions contained in this procedure, and in controlling any hazardous conditions which may arise during any operations performed in accordance with this procedure.

3.2.1 Responsibility for Safety.

All personnel are responsible for maintaining a safe work environment. The Test Conductor or cognizant operator shall assure that appropriate safe practices are implemented during these operations, and that operations are performed in a proper order.

3.2.2 Test Readiness Reviews

Prior to the commencement of any activities detailed in this document, and again at each shift change, the Test Conductor or cognizant operator shall conduct a pre-test briefing. Also, immediately prior to each hazardous sequence of operations, the Test Conductor or cognizant operator shall conduct a pre-task briefing. Both the pre-test and pre-task briefings shall include a discussion of:

A. Test sequence, objectives, and equipment.
B. Nature and location of the specific hazards to be encountered.
C. Hazard controls, including protective equipment, safety boundaries, personnel access, etc.
D. Limitations on concurrent activity.
E. Emergency instructions and response, and, when the situation warrants, the availability of emergency shutdown procedures.

3.2.3 Caution and Warning Notations

In this procedure follow these definitions:

- **Caution**: Operational step, etc., which if not adhered to or observed could result in damage to the equipment;
- **Warning**: Operational step, etc., when not adhered to or observed, could result in loss of life, personal injury, or exposure.

3.2.4 Mechanically Assisted Lift Hazard

Severe damage to personnel and flight hardware may result if lifting fixtures are excessively loaded. Lifting hardware shall never be used in a configuration that may apply loads greater than the working load that is clearly marked on each piece of lifting hardware. Never use lifting hardware that is not marked with a working load and proof test date. A properly certified crane operator shall control the lift.

3.3 Cleanliness And Environment

Except as provided herein, these operations shall be conducted in a Class 10,000 or better clean area as defined in FED-STD-209B, and as implemented by BATC process standard BPS 21.04. Cleanliness of the test units shall be established and maintained per BATC specification SPS 2780.

Standard laboratory conditions of atmospheric temperature (18 to 28°C), pressure (520 to 810 torr), and relative humidity (25 to 70 percent) are acceptable for the operations defined herein.

3.4 Controlled Redline Procedures

BATC DEEP IMPACT test procedure change control shall be implemented in compliance with DEEP IMPACT QWI.

A. Any testing of flight hardware shall be required to be done in accordance with a test procedure that has been formally released prior to the start of the applicable test. This means that test procedures must be released through BATC Engineering Document Control prior to use.

B. Once the test procedure is released, it may be changed in compliance with WI Test.4.3.005 Controlled Redline Test Procedure. Such changes may also be made during the test.

C. Such changes must be approved by the following personnel:
Minor Changes: Test Engineer and Quality Engineer.
Major Changes: Test Engineer, Quality Engineer and Responsible Design Engineer and/or Systems Engineer (As determined by QE)

D. The "AS-RUN COPY" of the test procedure containing such changes is controlled by the Test Engineer.

E. Subsequent to completion of the applicable test, but before final buyoff of that test in the applicable Certification Log, the redline changes to the "AS- RUN COPY" test procedure shall be incorporated in a formal revision of the test procedure. (Note: At the discretion of the program the final Spacecraft Integration procedures may not be updated.)

3.5 Software Configuration

Prior to beginning any DEEP IMPACT instrument/spacecraft level test, the revision of all flight software and test software shall be recorded. The listing will include the software version numbers, tables and database version numbers. If any software is revised during the testing, record the revision information required identifying the software configuration used during each test operation.

4 QUALITY ASSURANCE PROVISIONS / TEST MANAGEMENT RESPONSIBILITIES

4.1 Quality Assurance Provisions

QA provisions operative during activities defined in this procedure are derived from the DEEP IMPACT Product Assurance (PA) Plan and the DEEP IMPACT Quality Work Instructions (QWI) document. These provisions, summarized below, identify the interfaces between QA and test personnel.

A. The PEQA shall be notified, in advance, of performance of any activities described in this procedure. A QA Inspector shall be assigned to monitor those activities as is deemed necessary or appropriate, in accordance with the QWI. When required, QA shall notify the customer and/or government representatives, who may, at their option, monitor or witness the activity. The PEQA shall attend the "Ready-to-Test" meeting with assigned QA personnel, to assure QA support during the test, and to address and resolve outstanding QA items.

B. The PEQA shall assure that the proper "as-run copy" of this procedure document has been prepared, and that the required Cert Log is in proper order. When all pre-test conditions have been met, the PEQA shall complete the "Ready-to-Test" entry in the applicable Cert Log.

C. During testing, the PEQA shall approve, **prior to its implementation**, any major changes to the test procedure involving actual testing deviation, test set-up, measurement methodology, or tolerance changes, along with the cognizant design engineer and the Test Conductor.

D. Test Support provided by the QA Inspector shall be as follows:

- Verify that calibration is current for test and measuring equipment in accordance with QSP 11.1 " Selection, Maintenance, and Control of Inspection, Measuring, and Test Equipment".
- Verify that applicable lifting and handling GSE has been properly proof tested and tagged.
- Assure that the proper change control practices are applied as described in section 3.4, which implements the applicable provisions of QSP 4.4 Design Changes.
- Assist in assuring that the precautionary and safety requirements stated in sections 3.1 and 3.2 are met.
- Assist in the inspection of test setups prior to application of power to a test specimen, and prior to any mechanism-assisted lifts or moves.
- Prepare quality assurance test documents as applicable. In the Action Item List of the Certification Log, document any discrepancies or non-conformances noted during or after testing, and immediately notify the PEQA.

E. At completion of the test, the PEQA/Inspector shall perform the following:

- Review all test data for completeness, and to verify that all measurements are within tolerances.
- Assure that the resulting test data fulfills the test requirements of the end item.

- Verify completion of any related action items and disposition of any related MDR's in the test Cert Log.

F. Upon the occurrence of a test anomaly (any event that deviates from the planned procedures, exceeds normal variations, or generates unexpected data), operation of the test article shall be stopped immediately. All other test conditions and parameters shall be maintained (except as those conditions that may pose an immediate hazard). The Inspector and the Test Conductor shall review the anomaly. Minor, non-destructive, investigative troubleshooting that will not change the failure mode of the article under test, may be conducted by the Test Conductor, with PEQA concurrence. All troubleshooting shall be performed in accordance with QSP 13.1 Control of Nonconforming Product and WI PA.13.1.004 Test Anomaly Work Sheet (TAWS). If the anomaly is found to result from human error or test equipment problems that have not affected the test article, corrective action shall be taken and testing may continue. The PEQA will check the "continue test" box, the approval box, and sign the TAWS along with the Responsible Engineer.

G. If a test anomaly cannot be resolved as described above, the PEQA shall be notified, and an appropriate entry shall be made in the Action Item List (AIL) portion of the Certification Log. The PEQA shall prepare a Material Discrepancy Report (MDR) and convene the Material Review Board (MRB) for action as specified in WI PA.13.1.002 "Completion of Material_Discrepancy Report". The MRB convened to resolve an anomaly that occurred during testing shall include a representative of the project test group. Testing of the failed item shall then not continue without prior authorization from the MRB.

4.2 Test Management Responsibilities

4.2.1 Integration And Test Manager

The Integration and Test Manager shall have responsibility for the following:

a. Delegate responsibility to conduct the SIM Alignment and Test Procedure or portions of this procedure to qualified personnel.

b. Release of the Alignment and Test Procedure.

c. Release of all required procedures, drawings, E.O.'s and other documents.

d. Approve exceptions to requirements of this procedure, including facility ambient requirements.

e. Availability and certification of required GSE.

f. Approval on the final completion of the SIM Alignment and Test Procedure

4.2.2 Test Conductor

The test conductor (T/C) as delegated by the Integration and Test Manager is assigned shift responsibility for the following:

a. Verify that required flight hardware and GSE are available and certified for integration and alignment as described in this procedure.

b. Verify that GSE and other test equipment is available and calibrated where applicable and that calibration will not expire during performance of this procedure.

c. Verify that required documentation is released, correct and complete. Documentation will include:
   - A copy of the latest revision of the Integration and Alignment Procedure
   - The Certification Log for the Instrument
   - The Assembly drawing for the FPA integration to the Telescope Assembly
   - All necessary prints, E.O.'s and other documents

d. Verify that setup, integration and alignment are in accordance with the requirements of this procedure, including facility ambient conditions. Setup shall be verified by an independent observer and recorded in the Certification Log.

e. Collect, identify and store all raw data generated during the procedure. Data storage will be in the program SER files and referenced in the Certification Log.

f. Responsible for sign off, on completion, all integration and alignment process steps, torque values and / or other measured and recorded values as specified in this procedure in the Certification Log. The person who performed the operation shall perform sign off.

g. Conduct the integration and alignment in a safe manner.

h. Notify the Integration and Test Manager and QA monitor or PEQA if out of tolerance conditions occur. Flag out of tolerance conditions in the Certification Log.

i. Supervise the troubleshooting and rework as required.

j. Maintain a record in the Certification Log of all action items and ensure that all items are closed prior to final sign-off of the Certification Log.

k. Notify the Integration and Test Manager and QA monitor or PEQA of completion of this procedure for data review and sign-off in the certification log.

The test conductor has the authority to change, in writing, the sequence of events of this procedure, during the conduct of this procedure, to facilitate availability of certain test equipment, flight hardware or personnel. The T/C is responsible for certifying that such deviations do not jeopardize the intent or the data integrity of this procedure.

The test conductor has the authority to substitute equivalent test equipment for those items called out in Section 6 of this procedure. The T/C is responsible for certifying that the substituted items are up-to-date in terms of their certification and that these substitutions do not jeopardizing the intent nor the data integrity of this procedure.

5 TEST DESCRIPTION

This procedure describes four tests, which will be run at different thermal conditions, as specified in the Instrument Platform Thermal Vacuum Test Procedure, 564426.

1) A set of CCD dark current measurements taken as the CCD cools down to its operating temperature
2) An *optional* test is a set of images of a bright spot followed immediately by images taken without the bright spot to determine the level of latent charge remaining in the CCD. This will be done in coordination with steps in the alignment and focus test procedure 564422
3) Throughput calibration using an integrating sphere. This is used to establish a calibration (using both the previous sphere calibration, and a reference photodiode), establish system flatfield images, determine system linearity, and test system gain using the gain-variance technique.
4) A verification that fixes to the IR spectrometer to take care of detector ghosting as well as long wavelength saturation on the nucleus are working. The tests includes a repeat of short wavelength flatfield images using the integrating sphere through the fused silica window.

6 TEST ARTICLE CONFIGURATION

The HRI shall be configured as described in the as-run copy of 564426, Instrument Platform Thermal Vacuum Procedure, including the ITOC test stations and associated computers

7 REQUIRED TEST EQUIPMENT

- 65" LabSphere integrating sphere system including sphere, calibrated lamp and lamp controllers
- Optical Test Station #2
- CW light source with fiber-optic feed
- ND filters (ZnSe substrate) and holder(s)
- Tungsten lamp and power supply
- SIRTF blackbody source
- Ar and Kr pen-ray lamps with power supply
- Calibrated photodiode and amplifier
- Gas Cell, with fill tubes and tube clamps, CO and NH4 gas cylinders
- Sun Workstation with DIVe analysis software installed

8 TEST PROCEDURES

Inspect all electrical and mechanical setup ✓

Confirm that last functional test shows that system is operating properly 2/26/03

Confirm that QA has given OK to test in Cert Log ✓

For each section below, if not explicitly stated, use the following CSTOL procedures to turn instrument electronics power on and off:

Power ON: TP574498
Power OFF: TP574499

When powering electronics on or off, notify the personnel monitoring the chamber thermal conditions so they can compensate for change in power.

8.1 Dark Current Measurements During CCD Cooldown

The cooldown of the HRI CCD offers a unique opportunity to measure the CCD dark current vs. temperature for a range of temperatures expected in flight. During the steps to cool the CCD specified in Test Procedure 564426, conduct the following steps as needed to gather images.

1. Cover the window(s) of the TV chamber with either dark cloth or Al foil (or both) to greatly reduce stray light ✓
2. Power on the HRI instrument electronics using CSTOL script TP574498. Alert test operator that instrument electronics are powered on. ✓
3. Start the HRI VIS Single Mode Dark CSTOL script, TP574506 (Single Mode Dark) ✓
4. Repeat the following steps as needed.

a) Record the current CCD temperature in the image log, as measured by the test temperature monitor ✓

b) Use Figure 8-1 below to determine the approximate integration delay time needed to produce at least 5 DN of signal at the measured CCD temperature ✓

c) Collect two to four (2 – 4) MODE 1 images with 0 msec integration delay ✓

d) Collect two to four (2 – 4) MODE 1 images with the integration delay calculated in the previous step, using CSTOL script TP574506 (shutter closed) ✓

e) Using DIVe (or other analysis tool) determine the dark current by measuring average signals in the image area and the serial overclocked region (columns 0-7 or 1015-1023) ✓

f) At the discretion of the test conductor, take images of other modes (2-9) during cooldown using same integration delay time calculations

5. Power down instrument electronics using CSTOL script TP574499, and alert test operator that instrument electronics are powered off.

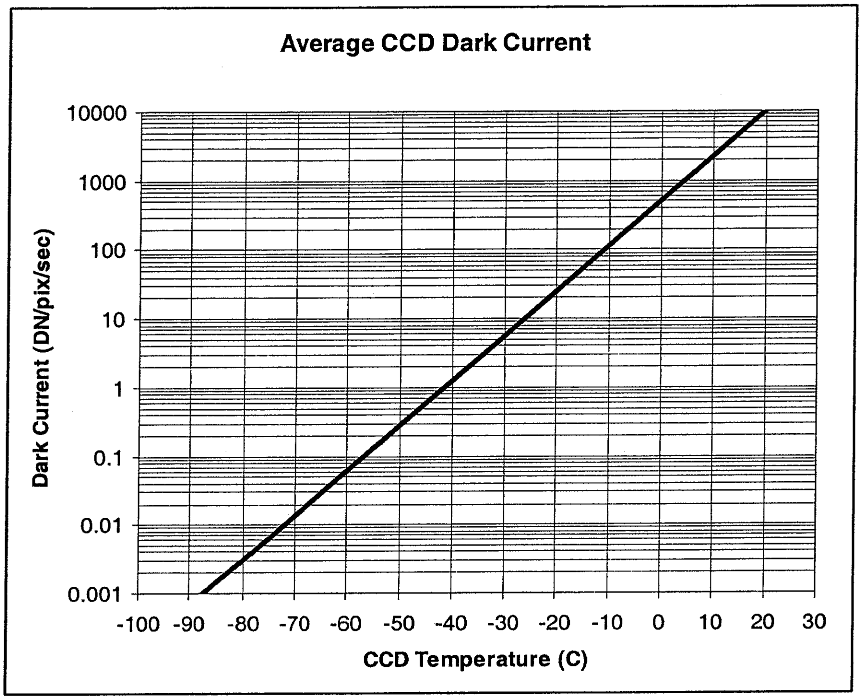


Figure 8-1 Average Dark Current For Deep Impact CCDs.

8.2 Latent Image Test (Optional)

1. During alignment testing of HRI using optical test station #2 and at the discretion of test director and systems engineering, perform the following reduce iris to ~1mm hole
2. ~~Place the knife edge target in the target stage of optical test station #2~~ DLH 3/1/03 CB 4/25/03
3. Remove the end of the fiber optic feed from the flash lamp and insert in the CW lamp
4. Collect 4 MODE 1 images, 100 msec integration delay, using CSTOL script TP574507
5. Collect 4 MODE 6 images, 4 msec integration delay, using CSTOL script TP574507
6. Turn on CW lamp and place diffuser behind knife edge target with the fiber optic feed shining through an ND-2 filter and onto the diffuser
7. Collect MODE 1 image, 100 msec integration delay, using CSTOL script TP574507 and use DIVe to determine the signal level of the lit portion of the ~~knife edge target~~ iris DLH 3/1/03 CB 4/25/03

8. Adjust the output of the CW lamp and repeat the previous step until the average signal in the lit portion is not saturated ✓
9. Remove the filter
10. Using CSTOL script TP574507, set up to collect a series of 16 MODE 1 images with 100 msec integration delay and follow the steps below. Image count can be found in the Detector Ops telemetry window with mnemonic **IIIDOVISEXCC**
    a. Place a light block in front of the chamber window ✓
    b. Start the image sequence ✓
    c. When the image count reaches 2 remove the light block ✓
    d. When the image count reaches 6 replace the light block and let the sequence finish ✓
11. Examine the images using DIVe and determine that there are at least 3 images with a saturated CW lamp filament image. If not repeat the image sequence and light block steps above ✓ LD DLH 3/1/03 CS 4/25/03
12. Repeat Step 9 with ~~64~~ 16 MODE 6 images, ~~4~~ 4900 msec integration delay, blocking up to 8, open for 32, blocked for the remainder
13. With the same light setup as in step 8, collect 4 MODE 1 images with 10 sec integration delays using CSTOL script TP574506, single mode dark to test the shutter blocking. N/A – will do @ sphere test DLH 3/5/03

8.3 HRI Flatfield Source Imaging

A calculation predicting the signal level for HRI-VIS with the clear filter viewing the 65" integrating sphere with a single lamp at its calibrated current, shows that for 0 msec integration delay (effectively 8.5 msec exposure for a flatfield) the CCD will be at 1/3 full well. Photometer readings will be collected on sheets labeled Instrument Platform Calibration Photometer Worksheet included in the Appendix. Make as many copies as needed. This will be shortened to "Photometer Worksheet" in the procedure steps.

8.3.1 Cold Dark Measurements

When the HRI structure and the HRI electronics have reached their expected operating temperature, as defined in test procedure 564426, conduct the following steps.

1. Record CCD temperature as read from the test temperature monitor 179.5K (from telemetry)
2. If not already on, power on the instrument electronics using CSTOL procedure TP576702 ✓
3. Ensure that all chamber windows are covered with dark cloth or Al foil (or both) ✓
4. Start CSTOL procedure TP574506 (Single Mode Dark) ✓

5. Collect sixteen to thirty-two (16 – 32) image in each of 9 MODEs with the minimum integration delay time (0 msec for modes 1, 2, 3, 5 and 9; 4 msec for modes 4, 6, 7 and 8) ✓
6. Determine minimum exposure time to produce at least 5 DN of signal from dark current, either from Figure 8-1 or from extrapolated data from section 8.1, or use a maximum exposure time of 8 minutes ✓
7. Collect two to eight (2 – 8) images in each of 9 MODEs with integration delay equal to the exposure time calculated in the previous step ✓
8. Power down instrument electronics using CSTOL script TP576703, and alert test operator that instrument electronics are powered off. ✓
9. Record CCD temperature as read from the test temperature monitor 179.5K from telemetry

8.3.2 Installing the Integrating Sphere

1. Place the front aperture of the 65" LabSphere integrating sphere in front of the chamber window so that the center matches the HRI boresight outside the chamber within 1 inch. The approximate location of each component is shown in Figure 8-2 ✓
2. Lift the Rambo thermal vacuum chamber clean tent over the top of the sphere, making sure to leave clearance for the fan on top of the sphere N/A use hole in dent
3. Move the 20" flat mirror on Optical Test Station #2 so that there is a clear path between the thermal vacuum chamber window and the integrating sphere aperture ✓

Use theodolite sight to center on telescope boresight, then rotate 180° & measure center on sphere
DLH 3/5/03
CB 4/25/03

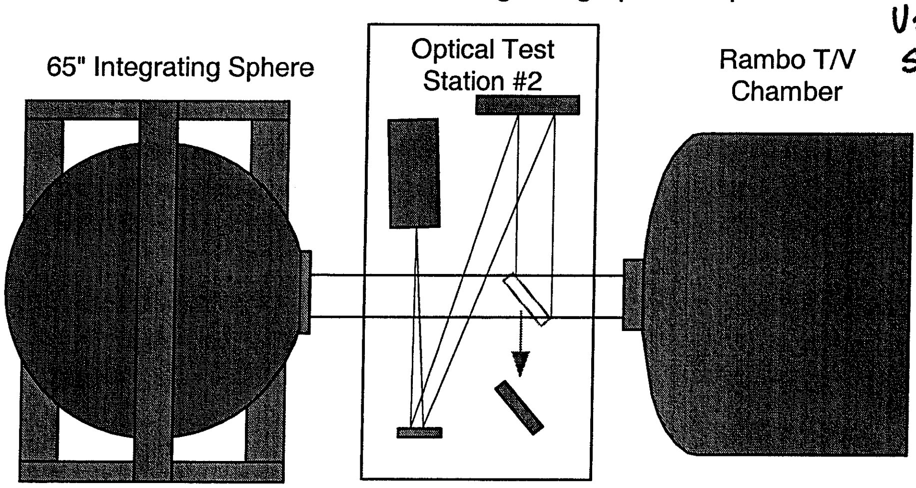


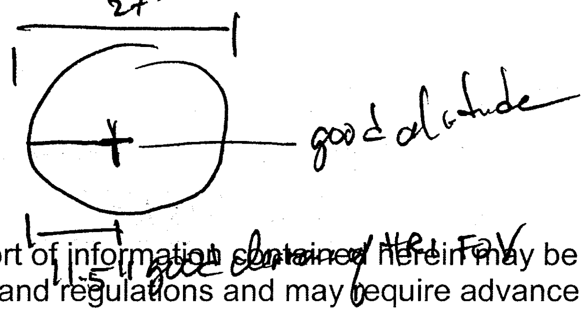
Figure 8-2 Integrating Sphere Mechanical Setup

2. Turn on the LabSphere controller and verify that the integrating sphere diode is operational ✓

over for geometry →

Used theodolite sight to align along HRC Boresight, rotate 180

sight on sphere.



lifted tent into groove behind aperture.

DLH
3/5/03

8.3.3 Ambient signals

1. Record CCD temperature as read from the test temperature monitor 179.25K
2. If not already on, power on the HRI electronics using CSTOL script TP564~~700~~ ~~98~~ 98
3. Cover the vacuum chamber window with black cloth or Al foil (or both)
4. Collect eight to sixteen (8-16) images in all MODEs with the minimum integration delay (0 msec for MODEs 1, 2, 3, 5 and 9, 4 msec for others) using CSTOL script TP574506 for bias frame measurements ✓
5. Remove cover from vacuum chamber window, and confirm that integrating sphere lamp is not on ✓
6. Note the lighting conditions in the FT-1 T/V chamber area. It is highly recommended that overhead lights above the sphere be turned off, and that this test be conducted after sunset so that the skylights do not introduce variable illumination. Use dark cloth or dark baffles as needed to reduce ambient light Lights out – after 7pm ✓
7. Collect eight images in MODE 1 with ~~1~~ 10 sec integration delay using CSTOL script TP574506 as dark images ✓
8. Collect eight to sixteen (8 – (16)) images in all MODEs with ~~1~~ 10 sec integration delay using CSTOL script TP574507 as an ambient light level reading. ~~N/A – not needed~~ STET DLH 3/5/03
9. Move to each filter and collect ~~eight (8)~~ 16 images in MODE 1 using CSTOL 10 sec script TP574507 ✓
10. Install the calibrated photodiode (UDT) in front of the integrating sphere N/A see sphere calibration DLH 3/5/03
11. Use a Photometer Worksheet to collect ambient photometer measurements with "Lighting Conditions" labeled "Ambient" ✓
12. Record CCD temperature as read from the test temperature monitor 179.9K

CB 4/25/03 ⚠ DLH 5 places 3/2/03

8.3.4 Source Measurements

1. Turn on the calibrated quartz halogen lamp (controller E) in the LabSphere integrating sphere to the calibrated current level of 6.00 amps and allow at least 30 minutes to stabilize ✓
2. Record the lamp run time from LabSphere controller at power on 117:03:45 on 19:02 3/6/03; 113:21:58 on 20:00 3/5/03
3. Record the integrating sphere lamp stabilized current 6.00 and voltage 23.96 24.08
4. Use a Photometer Worksheet to collect photometer measurements of the integrating sphere with "Lighting Conditions" labeled "Lamp with UDT and Window" N/A no UDT
5. Cover the "Rambo" chamber window with black cloth or low reflectivity material ✓ DLH 3/5/03

6. Use a Photometer Worksheet to collect photometer measurements of the integrating sphere with "Lighting Conditions" labeled "Lamp with UDT, Window Covered"
7. Remove the UDT calibrated photodiode

NA no UDT 3/5/03 DLH

8. Use a Photometer Worksheet to collect photometer measurements of the integrating sphere with "Lighting Conditions" labeled "Lamp without UDT, Window Covered" ✓
9. Remove the dark cloth from chamber window ✓
10. Use a Photometer Worksheet to collect photometer measurements of the integrating sphere with "Lighting Conditions" labeled "Lamp no UDT with Window" ✓

8.3.5 Clear Filter Measurements

CCD temp 179.5K

1. Verify that the HRI filter wheel is set at position 1 (Clear Filter). If not move to position 1 by issuing OASIS command "`CMD IMF VIS_FW_ABS WITH FILTER_NUM 1`" and confirm position by reading Mechanism telemetry page ✓
2. Collect a MODE 1 image using CSTOL script TP574507 with 0 msec integration delay and analyze in real-time using DIVe for uniformity and to determine a charge collection rate – 0 msec is approximately 8.5 msec exposure for a flatfield source ✓
3. Use Table 8-1 below to spread up to 20 integration delay times from 0 msec to that needed to produce 120% of the nominal CCD full well (450,000 e-, 15,000 DN) ✓
4. For each integration delay entered in Table 8-1 collect eight to twenty-four (8 – 24) MODE 1 images using CSTOL script TP574507 (single mode light) ✓
5. Collect sixteen ~~(16)~~ 8 MODE 2, 3, 5 and 9 images using CSTOL script TP574507 with an integration delay at the midpoint of the delays listed in Table 8-1 ✓

Δ DLH 3 places 3/2/03

6. Collect sixteen ~~(16)~~ 8 MODE 4, 6, 7, and 8 images using CSTOL script TP574507 with 4 msec integration delay (minimum for these modes). ✓

CS 4/25/03

7. Move the HRI filter wheel to position 6 by issuing OASIS command "`CMD IMF VIS_FW_ABS WITH FILTER_NUM 6`" and confirm positions by reading from mechanism telemetry page ✓
8. For each integration delay entered in Table 8-1 collect eight to twenty-four (8 – 24) MODE 1 images using CSTOL script TP574507 (single mode light) ✓
9. Collect ~~sixteen (16)~~ 8 MODE 2, 3, 5 and 9 images using CSTOL script TP574507 with an integration delay at the midpoint of the delays listed in Table 8-1

10. Collect ~~sixteen (16)~~ 8 MODE 4, 6, 7, and 8 images using CSTOL script TP574507 with 4 msec integration delay (minimum for these modes) Δ DLH 3/12/03 CB 4/25/03

11. Collect eight (8) MODE 1 images using CSTOL script TP574506 with 0 msec integration delay ✓

12. Collect eight (8) MODE 1 images using CSTOL script TP574506 with 2x the longest (100 sec) integration delay listed in Table 8-1 for a shutter blocking test

Filter 1 **Table 8-1 Clear Filter Exposure Times** Filter 6

#	T_exp (msec)	% Full Well	#	T_exp (msec)	% Full Well
1	0		12	0	
2	5		13	5	
3	15		14	15	
4	35		15	35	
5	45		16	45	
6	50		17		
7	55		18		
8	60		19		
9	65		20		
10	70		21		
11	80		22		

8.3.6 Bandpass Filter Measurements

1. For two of the 100 nm bandpass filters, 2 & 7, perform the following steps
   a. Move the filter wheel to the next filter positions by issuing the OASIS command "`CMD IMF VIS_FW_ABS WITH FILTER_NUM N`" where `N` is the desired filter position ✓
   b. Collect a MODE 1 image with 10 msec integration delay using CSTOL script TP574507 and analyze in real time using DIVe to find the average signal level. ✓
   c. Use Table 8-2 below to spread ~~20~~ 5 to 25 integration delay times from 0 msec to that needed to produce 120% of the nominal CCD full well (450,000 e-, 15,000 DN) ✓ Δ DLH 3/5/03 CB 4/25/03
   d. Record CCD temperature as read from the test temperature monitor 180.51 K from TLM
   e. For each integration delay entered in the table collect eight to twenty-four (8 – 24) MODE 1 images using CSTOL script TP574507 (single mode light) ✓
   f. Collect ~~sixteen (16)~~ 8 images of MODEs 2 through 9 CSTOL script TP574507 with an integration delay at the midpoint of the delays listed in Table 8-2 ✓ Δ DLH 3/5/03 CB 4/25/03

filter 2 1600
filter 7 150

0 10 20 30 40 50 60
3.9 3.95 4 4.15 4.2 4.25 4.3 x 10^4

g. Use a Photometer Worksheet to collect photometer measurements of the integrating sphere with "Lighting Conditions" labeled "Lamp with Window, no UDT" ✓

h. Record the integrating sphere lamp stabilized current 6.00 and voltage NA DLH 3/6/03

i. Record CCD temperature as read from the test temperature monitor 180.6 K from TLM ✓

Table 8-2 100 nm Bandpass Filter Integration Delay Times

#	Filter 2 T_delay (msec)	Filter 7 T_delay (msec)	#	Filter 2 T_delay (msec)	Filter 7 T_delay (msec)
1	100	0	15		
2	200	15	16		
3	400	75	17		
4	1600	150	18		
5	1900	200	19		
6			20		
7			21		
8			22		
9			23		
10			24		
11			25		
12			26		
13			27		
14			28		

2. For the remaining bandpass filters, 3, 4, 5, 8 & 9 perform the following steps
   a. Move the filter wheel to the next filter position by issuing the OASIS command "`CMD IMF VIS_FW_ABS WITH FILTER_NUM N`", where `N` is the desired filter position ✓
   b. Record a MODE 1 image using CSTOL script TP574507, with 10 msec integration delay. ✓
   c. Use DIVe to determine the average signal level and determine the integration delay time needed to produce 120% of the nominal CCD full well (450,000 e-, 15,000 DN). ✓
   d. Use Table 8-3 to spread up to 12 integration delay times from 0 msec to that needed to produce 120% of the nominal CCD full well (450,000 e-, 15,000 DN). ✓
   e. Record CCD temperature as read from the test temperature monitor filter 3 180.6; 4 180.8; 5-9 181.0 all from TLM
   f. Use a Photometer Worksheet to collect photometer measurements of the integrating sphere with "Lighting Conditions" labeled "Lamp with Window, no UDT" ✓

g. For each integration delay entered in Table 8-3 collect eight to twenty-four (8 – 24) MODE 1 images using CSTOL script TP574507 (single mode light) Δ DLH 3/6/03

h. Collect ~~sixteen (16)~~ 8 images of MODEs 2 through 9 CSTOL script TP574507 with an integration delay at the midpoint of the delays listed in Table 8-2 4/25/03

i. Use a Photometer Worksheet to collect photometer measurements of the integrating sphere with "Lighting Conditions" labeled "Lamp with Window, no UDT"

j. Record the integrating sphere lamp stabilized current 6.00 and voltage N/A 3/5/03

k. Record CCD temperature as read from the test temperature monitor 181 K from TLM

Table 8-3 Remaining 100 nm Bandpass Filter Integration Delay Times

#	Filter 3 T_delay (msec)	Filter 4 T_delay (msec)		Filter 5 T_delay (msec)	Filter 8 T_delay (msec)	Filter 9 T_delay (msec)
1	~~0~~ 15	0	90ea	15	5	5
2	40	15	90ea	35	20	20
3	180	55	90ea	170	95	90
4	350	200	25ea	340	200	190
5	450	600		430	250	240
6		1000				
7		2000				
8		6000				
9		12000				
10		16000				
11		20000				
12						
13						
14						

8.3.7 Source Verification

With the single calibrated lamp powered on at the integrating sphere, perform the following steps

1. Re-install the UDT calibrated photodiode at the aperture of the integrating sphere at the same place as previously installed
2. Use a Photometer Worksheet to collect photometer measurements of the integrating sphere with "Lighting Conditions" labeled "Lamp with UDT and Window"

N/A no UDT DLH 3/5/03

3. Remove the UDT photometer
4. Use a Photometer Worksheet to collect photometer measurements of the integrating sphere with "Lighting Conditions" labeled "Lamp with Window, no UDT" ✓

5. Record the integrating sphere lamp stabilized current 6.000 6.006 and voltage 23.96 24.08

8.3.8 Lamp Power Off

1. Turn off power to lamp C using either UVS-2000 software control or from the front panel of the Labsphere Lamp power supply ✓
2. Record lamp run time from LabSphere controller at power off 0117:03:45 0120:57:48 2346 3/05/2003 22:58 3/6/2003 24.08V
3. Use a Photometer Worksheet to collect Labsphere photometer measurements of the integrating sphere with "Lighting Conditions" labeled "Ambient, no UDT" ✓

8.4 Visible Stimulator Test

To test the operation of the LED that will be used as a visible stimulator conduct the following steps

1. Mask all thermal vacuum chamber windows with dark cloth or Al foil (or both) ✓
2. Confirm that the beamsplitter decontamination heater circuit is connected to 35 V power supply ✓
3. Disconnect leads to the beamsplitter decon. heater circuit and set up power supply to provide 28 V, and turn off power supply ✓
4. Reconnect the beamsplitter decon. heater circuit leads to the power supply ✓
5. If not already on, power on the HRI instrument electronics using CSTOL script TP574498 N/A
6. Collect four MODE 1 images with 100 msec integration delay, using CSTOL script TP574506 (Single Mode Dark) ✓
7. Turn on power supply ✓
8. Collect four MODE 1 images with 100 msec integration delay, using CSTOL script TP574506 ✓ 4 sec delay between images
9. Turn off power supply ✓
10. Repeat steps 1 through 8 with the power supply set to 26V and 35V ✓
11. Turn off HRI instrument electronics using CSTOL script TP574499 – N/A

9 IR SPECTROMETER TESTS

The following steps are designed to confirm that the two modifications to the IR spectrometer – a baffle at the detector, and a filter at the slit – have removed ghosting in the detector and reduced the long wavelength flux so that a warm comet does not saturate. Also included are flatfields at short wavelengths and re-confirming the spectral alignment. There are three sections corresponding to three optical support equipment conditions.

9.1 IR Tests Using Optical Test Station 2

9.1.1 IR Short Wavelength Spectral Dispersion Validation

1. Place the krypton (Kr) pen-ray lamp at focus of optical test station #2 with the long axis of the lamp in the vertical direction ✓
2. Collect 8 MODE 4 IR images using CSTOL script TP575086 ✓
3. Turn on pen-ray lamp ✓
4. Collect 8 MODE 4 IR images using CSTOL script TP575086 ✓
5. Examine images for uniformity and signal. Adjust pointing with 20" flat mirror, and add ND filters to the optical path, as needed, to bring signal > 500 DN ✓ ND1
6. Turn off pen-ray lamp ✓
7. Collect 8 MODE 4 IR images using CSTOL script TP575086 ✓
8. Repeat all steps in this sub-section with the argon (Ar) pen-ray lamp ✓

9.1.2 IR Boresight With Respect to CCD.

1. Select knife-edge target and install it at focus of collimator, with edge in the cross-slit orientation ✓
2. Position the target at best focus of HRI system as determined from HRI-VIS focus measurement ✓
3. Block the illumination source ✓
4. Collect 4 MODE 4 IR darks using CSTOL script TP575086 ✓
5. Unblock the illumination source ✓
6. Collect 4 MODE 4 IR images using CSTOL script TP575086 ✓
7. Examine images using DIVe to determine position of illumination on IR detector ✓
8. Adjust position of knife-edge in the along-slit direction to center the edge of the knife-edge illumination on the IR detector ✓
9. Repeat steps 6-8 as needed to center the edge of the knife-edge on the IR detector. ✓
10. Collect 4 MODE 1 visible images using CSTOL script TP574507. ✓
11. Examine images using DIVe to verify knife-edge location and orientation.
12. Rotate knife-edge to a 45-degree orientation with respect to the IR slit. ✓
13. Collect 4 MODE 4 IR images using CSTOL script TP575086. ✓

14. Examine images using DIVe to determine position of illumination on the IR detector.
15. Adjust position of knife-edge in across-slit direction to center edge of knife-edge illumination on IR detector.
16. Repeat steps 13-15 as needed to center edge of knife-edge on the IR detector.
17. Collect 4 MODE 1 visible images using CSTOL script TP574507.
18. Examine images using DIVe to verify knife-edge location and orientation.
19. Rotate knife-edge to more closely align the edge with the direction of the IR slit.
20. Repeat steps 13-15 as needed to center edge of knife-edge on detector.
21. Collect 4 MODE 1 visible images using CSTOL script TP574507.
22. Examine images using DIVe to verify knife-edge location and orientation.

Boresight determination is complete when the edge of the knife-edge is nearly aligned with the IR slit.

9.1.3 IR to CCD Co-Focus

1. Rotate the knife-edge target to place edge in cross-slit orientation.
2. Position target at best focus of HRI system as determined from HRI-VIS focus measurement
3. Block the illumination source
4. Collect 4 MODE 4 IR darks using CSTOL script TP575086
5. Unblock the illumination source
6. Collect 4 MODE 4 IR images using CSTOL script TP575086
7. Examine images using DIVe to determine position of illumination on IR detector.
8. Adjust position of knife-edge in along-slit direction to center the edge of the knife-edge illumination on the IR detector.
9. Repeat steps 6-8 as needed to center the edge of the knife-edge on the IR detector.
10. Collect 4 MODE 1 visible images using CSTOL script TP574507.
11. Examine images using DIVe to verify knife-edge location and orientation.
12. Use Klinger stage to move to –5.0 mm with respect to best focus position (approach from negative side)
13. Collect 4 MODE 4 IR images using CSTOL script TP575086.
14. Collect 4 MODE 1 visible images using CSTOL script TP574507.
15. Increment position of focus by +0.500 mm.

16. Repeat steps 13-15 until IR and visible images have been taken from –5.000 mm to 5.000 mm with respect to focus, in 0.500 mm increments. ✓ +2.5
17. Review images using DIVe to verify appropriate data was taken. Plot edge width vs. Klinger focus axis position. Report if a minimum in edge width was found during the focus sweep.
18. Restore focus to best focus position, approaching from negative side.
19. Move the knife-edge in the along-slit direction until the edge is at a position 7/8 of the height of the IR detector (approximately row 512-64 = 448).
20. Block illumination source.
21. Collect 4 MODE 4 IR darks using CSTOL script TP575086.
22. Unblock illumination source.
23. Collect 4 MODE 4 IR images using CSTOL script TP575086.
24. Examine images using DIVe to determine position of illumination on IR detector.
25. Collect 4 MODE 1 visible images using CSTOL script TP574507.
26. Examine images using DIVe to verify knife-edge location and orientation.
27. Repeat steps 12-18 to obtain through-focus images.
28. Move the knife-edge in the along-slit direction until the edge is at a position 1/8 of the height of the IR detector (approximately row 6+64 = 70).
29. Block illumination source.
30. Collect 4 MODE 4 IR darks using CSTOL script TP575086.
31. Unblock illumination source.
32. Collect 4 MODE 4 IR images using CSTOL script TP575086.
33. Examine images using DIVe to determine position of illumination on IR detector.
34. Collect 4 MODE 1 visible images using CSTOL script TP574507.
35. Examine images using DIVe to verify knife-edge location and orientation.
36. Repeat steps 12-18 to obtain through-focus images.
37. Analyze data using DIVe or other tools to determine best focus of IR spectrometer with respect to HRI-VIS.

Adjust focus step size and/or focus range and repeat procedure to refine focus determination.

NA only @ center DLH 3/6/03

9.1.4 IR Mid Wavelength Imaging

1. Install tungsten (W) lamp to illuminate spectralon diffuser at a distance of about 12 inches ✓

2. Remove any targets from interferometer stage ✓
3. Adjust stages and 20" turn mirror until interferometer stage is centered on IR slit, as determined in section 9.1.2 ✓
4. Collect 16 MODE 4 images using CSTOL script TP575086 ✓
5. Turn on W lamp to 15 A and allow to stabilize for 10 minutes
6. Use baffles to block any direct lamp sources onto collimator mirrors
7. Collect 4 MODE 4 images using CSTOL script TP575086
8. Examine images for uniformity and saturation — ND 1.0
9. If images are saturated install ND filters between the lamp and the spectralon diffuser until the signal is unsaturated. If images are unsaturated skip to step 11and continue
10. Block light between lamp and ND filter and collect images in all MODEs using CSTOL script TP574495 4 △1 DLH 3/3/03 CB 4/25/03
11. Unblock light and collect images in ~~all~~ MODE~~s~~ using CSTOL script TP574495 8 each

9.1.5 IR Spectrometer Along-Slit Scale

Using the W lamp and diffuser setup from Section 9.1.2, perform the following

1. Place the Air Force Test Target at the focus of test station #2 ✓
2. Move the focus stage of test station #2 to the best focus for IR as determined from Section 9.1.4 ✓
3. Block the light between the W lamp and the spectralon diffuser ✓ lamp off
4. Collect 2 MODE 4 images using CSTOL script TP575086 ✓
5. Un-block the W lamp ✓
6. Collect 2 MODE 4 images using CSTOL script TP575086 ✓
7. Collect a MODE 1 visible image with 100 msec integration delay using CSTOL script TP574507 ✓
8. Examine the differenced IR images and the VIS for contrast and signal level. Adjust the setup and VIS integration delay as appropriate to produce good contrast and alignment. Note VIS integration delay to use 100 msec. ✓
9. Block the light between the W lamp and the spectralon diffuser ✓
10. Collect a MODE 1 VIS image, with integration delay determined above, using CSTOL script TP474507 ✓
11. Collect images in ~~all~~ 4 IR MODE~~s~~ using CSTOL script TP574495 ✓ △1 DLH 3/10/03 CB 4/25/03

12. Un-block the W lamp ✓ 4 Δ DLH 3/10/03 CB 4/25/03
13. Collect images in ~~all~~ IR MODE~~s~~ 4 using CSTOL script TP574495
14. Collect a MODE 1 VIS image, with integration delay determined above, using CSTOL script TP474507 ✓
15. Adjust the 20" fold flat in test station #2 to move the image along the slit by 170 pixels (0.83 mrad) ✓
16. Repeat steps 9 through 14 ✓
17. Adjust the 20" fold flat in test station #2 to move the image along the slit, in the opposite direction, by 340 pixels (1.67 mrad) – 170 pixels away from the center in the opposite direction as step 15 ✓
18. Repeat steps 9 through 14 ✓

9.1.6 IR Slit Filter Glint and Scatter Tests ✓

1. Set the test station to the best IR focus as determined in section 9.1.3
2. Place the knife edge test target in the test station fixture so that the knife edge is horizontal (cross-slit) ✓
3. Set up the W lamp and spectralon diffuser as in section 9.1.4 to produce images that are not saturated ✓
4. Collect 4 MODE 4 images of the test setup without the W lamp power on using CSTOL script TP575086 ✓
5. IF not already on, turn on the W lamp to 15A and allow 10 minutes to stabilize ✓
6. Collect 1 MODE 4 image and determine current knife-edge position ✓
7. Adjust the test station configuration to place knife-edge a few rows below the "top" edge of the slit filter ✓
8. Determine motion needed to cause knife-edge to cross the slit filter position in at least five different positions ✓
9. For each position collect 4 MODE 4 images with the W lamp blocked, and 4 MODE 4 images with the W lamp illuminating the knife-edge using CSTOL script TP575086 ✓
10. Adjust the test station configuration to place the knife-edge a few rows below the "bottom" edge of the slit filter ✓
11. Repeat steps 8 & 9 ✓

12. Rotate the knife edge approximately 180 degrees and repeat steps 7 to 11 above ✓
13. Install the 10 um pinhole at the focus of the optical test station
14. Place a block between the W lamp and the spetralon diffuser
15. Collect 4 MODE 4 images using CSTOL script TP575086
16. Remove block and ND filters from between W lamp and diffuser
17. Collect 4 MODE 4 images
18. Adjust test station until pinhole image is seen in the spectrometer slit
19. Examine differenced images for signal level and adjust W lamp to diffuser spacing until signal is at least 1/2 of saturation, or W lamp is as close as possible to diffuser
20. Repeat scans across both the top and bottom edges of the slit filter with at least 5 positions at each edge, collecting 4 MODE 4 images at each position

N/A not needed DLH 3/6/03

9.1.7 Long Wavelength Imaging (optional)

1. Securely place the SIRTF blackbody near the focus of optical test station #2, in front of the interferometer target stage ✓ — in front of Fused Si window
2. Turn on the SIRTF blackbody and set dial to 250 , and wait 15 minutes for blackbody to stabilize ✓
3. Place a block in front of the blackbody and collect 16 MODE 4 images using CSTOL script TP575086 ✓
4. Remove the block and collect 16 MODE 4 images using CSTOL script TP575086 ✓

9.2 IR Short Wavelength Flatfield Imaging, Using Integrating Sphere

While the large integrating sphere is operational for the HRI visible flatfield calibration, perform the following steps with the IR detector to gain flatfield images in the IR spectrometer

1. Record the integrating sphere lamp stabilized current 6.00 and voltage N/A DLH 3/10/03
2. Install UDT photometer at its previous position (section 8.3.4)
3. Use a Photometer Worksheet to collect photometer readings, with "Lighting Conditions" labeled "IR, Lamp, UDT and window"
4. Remove UDT photometer

N/A no UDT DLH 3/10/03

5. Use a Photometer Worksheet to collect a photometer reading, with "Lighting Conditions" labeled "IR, Lamp, Window, no UDT" ✓
6. Cover the chamber windows with dark cloth or Al foil (or both) — move to view shroud
7. Collect 2 MODE 4 images using CSTOL script TP575086 IR Single Mode ✓

8. Uncover the 16” fused silica window ✓
9. Collect 2 MODE 4 images using CSTOL script TP575086 IR Single Mode / 3 layers of Al screen & 2 photographers screens
10. Examine the differenced images in DIVe for uniformity and peak signal. If these images are unsaturated skip to step 15 below. If signal is saturated in the first 600 columns place several layers of stainless steel screen over the aperture of the integrating sphere and repeat the previous three steps until the first 600 columns are unsaturated.
11. Install UDT photometer at its previous position N/A no UDT
12. Use a Photometer Worksheet to collect photometer readings, with “Lighting Conditions” labeled “IR with screen, Lamp, UDT and window” DLH 3/6/03
13. Remove UDT photometer
14. Use a Photometer Worksheet to collect a photometer reading, with “Lighting Conditions” labeled “IR with screen, Lamp, Window, no UDT” ✓
15. Cover the chamber windows with dark cloth or Al foil (or both) N/A done step 6 & 7
16. Collect 8 images in all MODEs using CSTOL script TP574495
17. Uncover the 16” fused silica window
18. Collect 8 images in all MODEs using CSTOL script TP5774495 ✓
19. Install UDT photometer at its previous position
20. Use a Photometer Worksheet to collect photometer readings, with “Lighting Conditions” labeled “IR, Lamp, UDT and window” N/A no UDT
21. Remove UDT photometer
22. Use a Photometer Worksheet to collect a photometer reading, with “Lighting Conditions” labeled “IR, Lamp, Window, no UDT”

9.3 IR Tests Using ZnSe Window on Chamber Side Port

9.3.1 IR Baffle and Filter Verification

1. Move the HRI and the 5” cryo flat slide table so that there is a clear view of the HRI telescope aperture from the ZnSe window on the side port of the “Rambo” T/V chamber. The view should be the same altitude as the secondary obscuration but to one side or the other. Note which side of secondary obscuration is being illuminated West. ✓

2. Cover the ZnSe window with Al foil or place flat mirror within 1 cm of surface of ZnSe window and collect ~~12~~ 4 MODE ~~6~~ 4 IR FPA images using CSTOL script TP575086. Examine images for uniformity and signal level & 8 mode 1 △1 DLH 3/6/03
3. Collect 4 MODE 4 images using CSTOL script TP575086 ✓
4. Turn on SIRTF blackbody and set dial to ~~250~~ 350, wait for 15 minutes to stabilize CB 4/25/03
5. Place SIRTF blackbody in front of ZnSe window
6. Collect 4 MODE 4 images using CSTOL script TP575086 ✓
7. Examine images using DIVe with previous images as dark frames. ✓
   a. Examine signal level at long wavelength inside and outside of the slit filter ✓
   b. Examine short wavelength end of region outside of the slit filter for ghost images
8. Place mask with filter holder and astronomy M filter in front of SIRTF blackbody ✓
9. Collect 4 MODE 4 images using CSTOL script TP575086 ✓
10. Examine images using DIVe with previous images as dark frames. ✓
    a. Examine signal level at long wavelength inside and outside of the slit filter
    b. Examine short wavelength end of region outside of the slit filter for ghost images
11. Move the Instrument Platform slide table until the fold mirror is looking into the other side of the HRI aperture from Step 1. Note which side of secondary obscuration is being illuminated EAST ✓
12. Repeat steps 5 to 10 ✓

9.3.2 IR Long Wavelength Flatfield Images (optional)

1. Place the gold plated diffuse target on the line of sight through the ZnSe to the spectrometer, as determined above MAA
2. Determine a method of mounting the SIRTF blackbody to illuminate the gold target while not directly illuminating the ZnSe window ✓
3. Remove the SIRTF blackbody from the setup and collect 2 MODE 4 images using CSTOL script TP575086 ✓
4. Place the SIRTF blackbody in the setup, turn it on and set dial to 350 ✓
5. Wait 10 minutes for blackbody to stabilize, and lower dial setting if it starts to smoke. Record final dial setting 350
6. Collect 2 MODE 4 images ✓

7. Examine differenced images for saturation. If images are saturated adjust the setup to place the SIRTF blackbody farther from the gold diffuser and repeat the imaging with and without the SIRTF blackbody in the setup until the image is not saturated ✓ Δ DLH 3/6/03
8. Place the SIRTF blackbody in the setup and collect 16 images in ~~all modes~~ MODE 4 using CSTOL script TP574495 ✓
9. Remove the SIRTF blackbody and collect 16 images in ~~all modes~~ MODE 4 using CSTOL script TP574495 ✓ CB 4/25/03

9.3.3 IR Middle Wavelength Crossover Flats

1. Using the same gold diffuser as in 9.3.3 remove the SIRTF BB from the setup and place the W lamp in the setup to illuminate the gold diffuser ✓ ~~[illegible] all modes~~ STET DLH 3/7/03
2. With the W lamp off collect 2 MODE 4 images using CSTOL script TP575086 ✓
3. Turn on the W lamp to 15 A and allow 10 minutes to stabilize ✓
4. Collect 2 MODE 4 images using the same CSTOL script ✓
5. Examine the differenced images for saturation. If the images are saturated adjust the setup to move the W lamp farther from the gold diffuser, or add ND filters and repeat the imaging with and without the illuminating the gold diffuser (using a light block) until the images are not saturated ✓ → Lamp off Δ DLH 3/7/03 CB 4/25/03
6. Block the W lamp and collect 16 images in all modes using CSTOL script TP575086 ✓
7. Unblock the W lamp and collect 16 images in all modes using the same script ✓

9.3.4 Long Wavelength Dispersion Verification

1. Fill gas cell with gaseous N2 and place in front of SIRTF blackbody ✓
2. Collect 16 MODE 4 images using CSTOL script TP575086 ✓
3. Examine images for signal at expected 4.7 um column. If signal is saturated, reduce the setting on the SIRTF blackbody and repeat images until it is within scale. Note final blackbody setting ~~[illegible]~~ 250. ✓
4. Fill gas cell with carbon monoxide mixture by following the steps in 564451, section 11 "The Gas Cell" ✓
5. Place gas cell in front of SIRTF blackbody ✓
6. Collect 16 MODE 4 images using CSTOL script TP575086 ✓
7. Use DIVe to examine differenced images for CO absorption feature ✓ DLH 3/7/03
8. At discretion of test director, repeat steps 1 to 7 for ~~NH4~~ Methane BB @ 300 ✓

9.3.5 Short Wavelength Dispersion Verification (optional)

9.3.5.1 Kr

1. Place the Kr pen-ray lamp as close to the ZnSe window ✓
2. With the Kr lamp off, collect 2 MODE 4 images using CSTOL script TP575086 ✓ Δ DLH 3/6/03
3. Turn on the Kr lamp and collect 2 MODE 4 images using the same script – hold flat mirror behind lamp to increase signal CS 4/25/03
4. Examine the differenced images for spectral lines ✓
5. If spectral lines are present and are saturating, adjust distance of Kr lamp to ZnSe window, moving along the ZnSe window to spectrometer slit axis until most or all the spectral lines are unsaturated and skip to step 7 ✓
6. If there are no lines present proceed to the Ar lamp ✓
7. Collect 16 images in all MODEs using CSTOL script TP574495 ✓
8. Turn off the Kr lamp and collect 16 images in all MODEs using the same CSTOL script ✓

9.3.5.2 Ar

Follow the same steps as Kr, replace the Kr pen-ray lamp with Ar ✓

9.3.6 Variable Delay From Previous Image

1. While the HRI is not viewing the 16” fused silica window perform the following steps ✓
2. Cover the chamber windows, especially the ZnSe window with Al Foil and black cloth ✓
3. Run CSTOL script TP579115 (variable delay between images) with first set as MODE 1 and the second set as MODE 1 with the following incremental pauses (seconds):
   0 ✓, 4 ✓, 8 ✓, 12 ✓, 18 ✓, 24 ✓, 60 ✓
4. Run CSTOL script TP579115 (variable delay between images) with first set as MODE 2 and the second set as MODE 1 with the following incremental pauses (seconds):
   0 ✓, 4 ✓, 8 ✓, 12 ✓, 18 ✓, 24 ✓, 60 ✓
5. Run CSTOL script TP579115 (variable delay between images) with first set as MODE 3 and the second set as MODE 3 with the following incremental pauses (seconds):
   0 ✓, 4 ✓, 8 ✓, 12 ✓, 18 ✓, 24 ✓, 60 ✓
6. Examine these sets for to determine offset change between last image of first set and the first image of the second set. Determine if any more delay times are needed and collect as needed, recording on a separate sheet and attaching to this procedure ✓

7. Run CSTOL script TP579115 (variable delay between images) with first set as MODE 1 and the second set as MODE 2 with the following incremental pauses (seconds): 0 ✓, 60 ✓, 120 ✓
8. Run CSTOL script TP579115 (variable delay between images) with first set as MODE 1 and the second set as MODE 3 with the following incremental pauses (seconds): 0 ✓, 60 ✓, 120 ✓
9. Run CSTOL script TP579115 (variable delay between images) with first set as MODE 3 and the second set as MODE 2 with the following incremental pauses (seconds): 0 ✓, 60 ✓, 120 ✓
10. At the discretion of the test conductor, while performing flatfield calibration on the MRI uncover the ZnSe window and repeat one or all of the sets called out above.

9.3.7 IR Stimulator Tests

9.3.7.1 Stimulator response and setpoint determination

No Signal transfer to TAWS INST-038 DLH 3/7/03

1. Record these items before the test:
   a. STIM DAC transfer function in mA/bit: ________(4.0)
   b. STIM DAC offset current in mA (x00 current) ________(0)
   c. Current corresponding to xFF ________(1000 mA)
   d. Default STIM setting, ______ (x60)
   e. Do not exceed value ______(xB3) The circuit has been changed since TV2 and this value MUST be observed.
2. Block both vacuum chamber windows
3. Confirm from telemetry that the STIM is OFF: IHFDOIRDCS = x00 ✓
4. Collect ~~2~~ 8 frames of MODE 4 data using CSTOL script TP575086, with ExpID = 1. Record the file name I030306_122118 I030307_151949
5. Command the STIM to its default setting using the CSTOL procedure TP576690.
6. Collect 2 frames of MODE 4 data using CSTOL script TP575086 x60 up to XB3
7. Record the amplitude of the polystyrene absorption depth near column 770 in a well-illuminated row of the image, in DN 0
8. If the polystyrene line is > 1500 DN, then the default DAC setting is too high. Decrease the DAC by x10 and repeat steps 5-7.

9. If the polystyrene line is < 500 DN, then the default DAC setting is too low. Increase the DAC by x10 and repeat steps 4-6 until the signal is in the specified range, or the "do not exceed" DAC setting is reached. Do not exceed the "do not exceed" value listed above.
10. Interpolate the DAC setting, if necessary, to give a polystyrene line > 500 and < 1500 DN. This will be the default STIM DAC setting for all subsequent measurements. Write the DAC value here ______Command this value using the CSTOL procedure TP576690
11. Collect 8 frames of data from all 6 modes using CSTOL procedure TP574495, with ExpID = 48
12. Command the STIM to x00 using the CSTOL procedure TP576690 ✓
13. Confirm from telemetry that the STIM is OFF: IHFDOIRDCS = x00 __00__
14. Collect 8 frames of data from all 6 modes using CSTOL procedure TP574495

Table 9-1: Stimulator Response

Stim DAC, hex	Line strength, DN

9.3.7.2 Stimulator Line Stability N/A See note in previous section DLH 3/7/03

Repeat this Section each day when HRI SIM bench and IR detector are near operating temperature

Record these items before the test:

Default STIM setting, ______
Do not exceed value _______(xB3)

1. Block both vacuum chamber windows
2. Confirm from telemetry that the STIM is OFF: IHFDOIRDCS = x00 ______

3. Collect 2 frames of mode 4 data as per Section 10.4.1, with ExpID = 1. Record the file name ______________________
4. Command the STIM to its default setting using the CSTOL procedure TP576690.
5. Collect 2 frames of mode 4 data using CSTOL script TP575086
6. Record the amplitude of the polystyrene line near column 770 in a well-illuminated row of the image, in DN _____. Verify that this line is between 500 and 1500 DN ______
7. Collect 8 frames of data from all 6 using CSTOL script TP574495, with ExpID = 48.
8. Terminate the CSTOL data collection procedure
9. Record the final ExpID______and file name _________________for this Section. N/A
10. Command the STIM to x00 using the CSTOL procedure TP576690
11. Confirm from telemetry that the STIM is OFF: IHFDOIRDCS = x00 ______

10 DATA PRODUCTS & WORKSHEETS

The following table lists the calibration products and the associated procedure and section where the data are collected to produce the needed results

Product	Document	Section	Comments
Plate Scale	575084	8.1	Survey point source with theodolite
IFOV	575084	8.1	
FOV	575084 & 564446	8.1	1008 active pixels x IFOV
PSF	575084	8.2	Knife Edge and/or Pinhole Tests
MTF	575084	8.2	"
Noise	564421	8.3.2	Gain Variance
Readout Smear	564421	8.4	Latent Image Tests
Gain	564421	8.3	Gain Variance. Each Quad independently
Linearity	564421	8.3	Gain Variance
Flat Field	564421	8.3	
Bad Pixel Maps	564421	8.2 & 8.3	Hot and Dead pixels
Radiometric	564421	8.3	Calibrated lamp and sphere
Stellar Radiometry MSSR 5.2.13.2-4			Combine Radiometric and PSF results

Instrument Platform Calibration Photometer Worksheet

Procedure & Section 564419 8.3.3 Instrument HRI
Date & Time 7:22pm 2003/03/05
Lighting Conditions Ambient window no UDT
Sphere ~~UDT~~ Photometer
Readings

Average Reading ______

Labsphere Photometer 27" apeture sphere, x10⁻¹¹ amps ~~foot-lamberts~~.
Readings

2.55	2.49	2.49	2.51	2.49
2.52	2.50	2.49	2.51	2.51

Average Reading ______
Comments

Procedure & Section 564419 8.3.~~3~~4 step 9 Instrument HRI
Date & Time 8:34pm 2003/03/05
Lighting Conditions Lamp E ~~off~~ on for 30 minutes - no UDT
~~UDT~~ Photometer
Readings

Average Reading ______

Labsphere Photometer 27" aperture Labsphere, x10⁻⁵ amps ~~foot-lamberts~~
Readings

1.5838	1.5844	1.5843	1.5844	1.5844
1.5845	1.5836	1.5835	1.5836	1.5844

Average Reading ______
Comments

Lamp without UDT, window covered

Instrument Platform Calibration Photometer Worksheet

Procedure & Section 564419 8-3-4 Instrument HRI
Date & Time Mar 5 2003 21:05
Lighting Conditions Lamp E window no UDT
~~UDT Photometer~~
Readings

Average Reading

Labsphere Photometer
Readings x10-5 Amps

1.5822	1.5818	1.5818	1.5821	1.5809
1.5811	1.5807	1.5822	1.5816	1.5817

Average Reading
Comments

Procedure & Section Instrument HRI
Date & Time 2003 Mar 5 21:30
Lighting Conditions Lamp E Window No UDT
~~UDT Photometer~~
Readings

Average Reading

Labsphere Photometer
Readings x10-5 ~~foot lamberts~~ Amps

1.5819	1.5814	1.5815	1.5806	1.5807
1.5823	1.5813	1.5812	1.5804	1.5806

Average Reading
Comments 2003 Mar 5, 21:58 Lamp No UDT

after filter 2

1.5811, 1.5817, 1.5808, 1.5809, 1.5809
1.5798 1.580 1.5822, 1.5799, 1.5811

Instrument Platform Calibration Photometer Worksheet

Procedure & Section: 564419
Instrument: HRI
Date & Time: Mar 5 2003 22:12
Lighting Conditions: ~~Dark~~ Lamp E, Window no UDT
~~UDT Photometer Readings~~

~~Average Reading~~

Labsphere Photometer Readings X10-5 Amp

After filter 3

1.5806	1.5792	1.5808	1.5811	1.5806
1.5811	1.5799	1.5816	1.5804	1.5800

Average Reading

Comments: X10-5 Amp 22:40

During filter 4

1.5799, 1.578, 1.5789, 1.5796, 1.5801,
1.5792, 1.5796, 1.5794, 1.5814, 1.5806

Procedure & Section: 564419
Instrument: HRI
Date & Time: Mar 5 2003 23:31
Lighting Conditions:
~~UDT Photometer Readings~~

~~Average Reading~~

After Filter 4

Labsphere Photometer Readings X10-5 Amp

1.5801	1.5786	1.5782	1.5788	1.5783
1.5787	1.5804	1.5789	1.579	1.5801

Average Reading

Comments: X10-11 ~~X10-5~~ Amp 23:57

Ambient

2.4, 2.48, 2.38, 2.34, 2.33, 2.32, 2.37,
2.37, 2.37, 2.34

Instrument Platform Calibration Photometer Worksheet

Procedure & Section 564419 Instrument HRI
Date & Time 6 Mar 2003, 1901
Lighting Conditions Ambient window no UDT (Lightsoot 7pm)
UDT Photometer
Readings

Average Reading

Labsphere Photometer
Readings x10⁻¹¹ Amps

3.65	4.03	3.91	3.8	3.89
3.66	3.87	3.14	3.65	3.9

Average Reading
Comments x10⁻⁵ Amps 1932, 6 Mar 2003

1.5876, 1.5876, 1.5871, 1.5864, 1.5865,
1.5875, 1.5877, 1.5885, 1.5877, 1.5867

Lamp on window no UDT 30 min on

Procedure & Section Instrument HRI
Date & Time Mar 6 '03 20:30
Lighting Conditions Lamp window no UDT
UDT Photometer
Readings

Average Reading

Labsphere Photometer
Readings x10⁻⁵

Before flt 8

1.582	1.582	1.5818	1.5825	1.583
1.5823	1.5823	1.5822	1.5831	1.5830

Average Reading
Comments x10⁻⁵ Amps 2056, 6 Mar 2003

After filter 9

1.5813, 1.5817, 1.5824, 1.5814, 1.5813,
1.5811, 1.5809, 1.5809, 1.5813, 1.5813.

Instrument Platform Calibration Photometer Worksheet

Procedure & Section: 564419 Instrument: HRI
Date & Time: Mar 6 '03 22:50
Lighting Conditions: Lamp E Ballscreen on sphere Photographer screens in front of cylinder
UDT Photometer: NO UDT
Readings

Average Reading: ______

Labsphere Photometer Readings x10^-5 Amps

1.7837	1.7836	1.7837	1.7833	1.7834
1.7841	1.7839	1.7837	1.7837	1.7841

Average Reading: ______

Comments:

Ballscreens clipped directly to front of sphere
see pictures for photographer screens.

Procedure & Section: 564419 Instrument: HRI
Date & Time: 22:55
Lighting Conditions: Lamp E Photographer screens in front of chamber
UDT Photometer: NO UDT
Readings

Average Reading: ______

Labsphere Photometer Readings x10^-5 A

1.579	1.580	1.5791	1.5807	1.5796
1.5798	1.5791	1.5796	1.579	1.5791

Average Reading: ______

Comments:

Instrument Platform Calibration Photometer Worksheet

Procedure & Section 564419 Instrument HRI
Date & Time Mar 6 2003
Lighting Conditions Ambient - post turn off - Screens on aperture
~~UDT~~ Photometer NO UDT
Readings

Average Reading ______

Labsphere Photometer ______
Readings x10^-12 A

6.8	6.6	6.4	6.8	7.0
7.1	6.9	6.9	7.1	6.6

Average Reading ______
Comments

Procedure & Section ______ Instrument ______
Date & Time ______
Lighting Conditions ______
UDT Photometer ______
Readings

Average Reading ______

Labsphere Photometer ______
Readings

Average Reading ______
Comments

Ball Aerospace & Technologies Corp. P.O. Box 1062 Boulder, CO 80306	SIZE A	CAGE CODE 13993	DWG. NO. 564419	REV –
	Operator: DLH 3/6/03			SHEET 35F

Equipment List

Labsphore Integrating Sphere system Control SC5500 P117050

Labsphore Halogen Lamp Power Supply LPS-200-H P117039 "E"

65" Labsphore integrating Sphere

65" sphere internal diode AS-00805-000 SAA-4

Astronomy M filter OCLI PO DN600284

Tungsten Lamp Optronic Labs OL550 S/N IR-489

ORIEL Penray lamp power supply Model 6045 11/2001

Kr Penray lamp ORIEL 66015284

AR Penray lamp ORIEL 66642617

ND filters Reynard Corp C-ND ~~2.5~~ 1.0-ZnSe 1.0
C-ND 2.0-ZnSe 2.0