DWG NO. 564421 | SH 1 | REV –

APPLICATION			REVISIONS			
PART NO.	NEXT ASSY	USED ON	REV	DESCRIPTION	DATE	APPROVED
		IN0112A	–	INITIAL RELEASE	03/01/28	W. ANDERSON

AS RUN

1-28-03 thru 1-30-03

LD p 14, 16, 17
DLH 2/19/03
2003/02/19

564430 Section 8.2 b)

CO 23379 OP 350

REVISION	–	–	–	–	–											DRAWING TYPE (PER MIL-T 31000)	
SHEET	16	17	18	19	20											CONCEPT. DES.	
REVISION	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	DEVELOP. DES.	
SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	PRODUCT	
																COMMERCIAL	

REVISION STATUS OF SHEETS

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		STD CHK N/A	
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	

Impactor Targeting Sensor (ITS) Performance Test Procedure

SIZE	CAGE CODE	DWG NO.	REV
A	13993	564421	–

CONTRACT NO.

SCALE NONE | WT NA | SHEET 1 OF

GODDARD SPACE FLIGHT CENTER

GSFC STI PUBLIC DISCLOSURE EXPORT CONTROL CHECKLIST

Title: Deep Impact - Integration and Test Instrument - Document No: 564421

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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Print Name and Code	Signature	Date

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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*

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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.

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

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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

Thomas A. Weisz, Code 232	Thomas A. Weisz	9/28/04
Center Export Administrator (CEA)	Signature	Date

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.

CONTENTS

1 SCOPE

This procedure describes the steps to be performed to test the throughput performance of the Impactor Targeting Sensor (ITS) for Deep Impact. These tests will be performed as part of the overall Thermal Vacuum test described in Test Procedure 564430. Focus and boresight measurements are made at room temperature and are governed by Test Procedure 575084.

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

559697	ITS Instrument
564305	ITS Instrument Electronics
564307	ITS Pre-Amp Clock Bias Assembly
575084	ITS Instrument Alignment Procedure
564430	ITS Thermal Vacuum Procedure
564423	CSTOL: DI ITS Single Mode Dark Imaging
564427	CSTOL: DI ITS Single Mode Light Imaging
564428	CSTOL: DI ITS Three Frame Set Imaging
564431	CSTOL: DI ITS Five Frame Set Imaging
576702	CSTOL: DI ITS Power On
576703	CSTOL: DI ITS Power Off

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, one of which is optional and can be run at the discretion of the Test Conductor.

1) A set of dark images taken as the CCD is cooled from ambient temperature to the final operating temperature as specified in Test Procedure 564430.
2) A set of dark images taken when the CCD is at the operating temperature.
3) The third test is a set of images taken while viewing an integrating sphere. This is used to establish a calibration (using both the previous sphere calibration, and a reference photodiode), determine system linearity, and test system gain using the gain-variance

technique. A variable attenuator that varies source intensity but does not affect the spectrum will be used to bring the sphere intensity to a level that will support 20 to 25 exposure times across the dynamic range of the CCD system.

4) The final, *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.

6 TEST ARTICLE CONFIGURATION

The ITS shall be configured as described in the as-run copy of 564430, ITS Thermal Vacuum Procedure

7 REQUIRED TEST EQUIPMENT

- 24 inch LabSphere integrating sphere system including sphere, calibrated lamp and lamp controllers, P118394
- Calibrated photodiode
- Tungsten lamp and power supply
- 2 to 3 inch diameter lens, ND filters and hardware to mount each

8 TEST PROCEDURES

Inspect all electrical and mechanical setup ✓

Confirm that last functional test shows that system is operating properly 1/28/03 +60°C

Confirm that QA has given OK to test in Cert Log C023379 OP520

8.1 Dark Current Measurements During CCD Cooldown

The cooldown of the ITS 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 564430, conduct the following steps as needed to gather images.

1. Cover the window of the TV chamber with either dark cloth or Al foil (or both) to greatly reduce stray light ✓
2. Power on the ITS instrument electronics using CSTOL script TP576702. Alert test operator that instrument electronics are powered on. ✓ 12:46 pm 28V
3. Start the ITS VIS Single Mode Dark CSTOL script, TP564423 ✓ IF @ −13.2°C
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 TP564423 (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 TP576703, and alert test operator that instrument electronics are powered off.

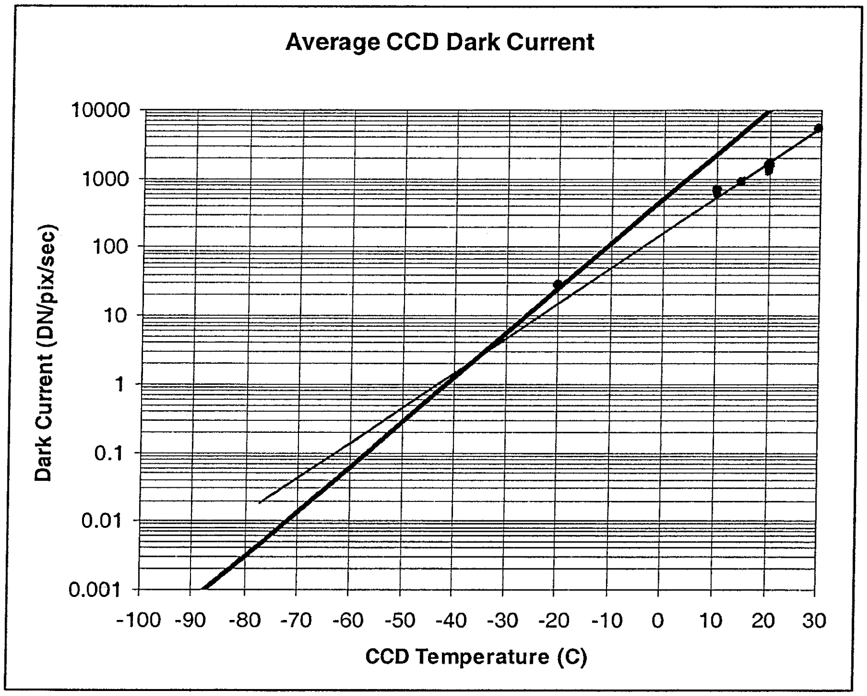

Figure 8-1 Average Dark Current For Deep Impact CCDs.

8.2 Cold Dark Image Measurements

When the ITS and ITS electronics have reached their expected operating temperature, as defined in test procedure 564430, conduct the following steps.

1. If not already on, power on the instrument electronics using CSTOL procedure TP576702
2. Start CSTOL procedure TP564423 (Single Mode Dark)

3. 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)
4. 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
5. Collect sixteen to thirty-two (16 – 32) images in each of 9 MODEs with integration delay equal to the exposure time calculated in the previous step
6. Power down instrument electronics using CSTOL script TP576703, and alert test operator that instrument electronics are powered off.

8.3 Flat Field Source Imaging

Tests at room temperature indicated that the un-attenuated quartz-halogen source feeding the 24" LabSphere will saturate the CCD for very short exposure times. Thus the calibration and linearity tests require that the variable aperture (attenuator), which is part of the LabSphere, will need to be used to bring the source to a level that will allow for on-scale imaging. The following steps allow a determination of the final source intensity used to calibrate the ITS, compared to the un-attenuated source intensity.

8.3.1 Installing the Integrating Sphere

1. Place the front aperture of the 24 inch LabSphere integrating sphere in front of the chamber window so that the centers match within 0.5 inches. Leave enough room between the sphere and the window to place the calibrated photodiode (approximately 6 inches). The approximate locations of each component is shown in Figure 8-2.

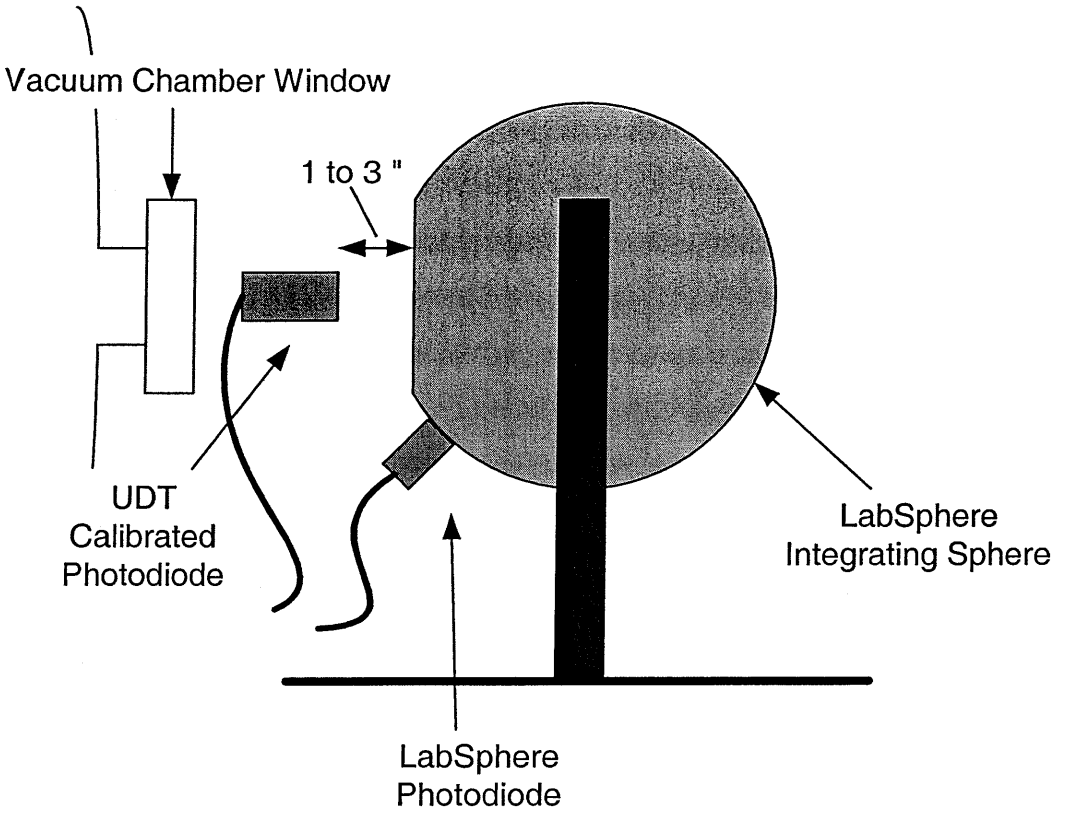

Figure 8-2 Integrating Sphere Mechanical Setup

2. Connect COM port of a PC computer with LabSphere USS-2000V software to LabSphere control module (Model VAC-1000, port VA 1) using serial cable to null modem cable.
3. Start USS-2000V software on laptop ✓
4. Turn on Labsphere control module, interface module and lamp power supply C ✓
5. Confirm that variable aperture (VA) control is working
6. Set the VA to 255 (full open) for the next tests.

8.3.2 Setting and Measuring Source

8.3.2.1 Ambient signals

1. Record CCD temperature as read from the test temperature monitor 1/30/03 T4 -45.8 T5 -46.0 TLM 13422
2. If not already on, power on ITS IE using CSTOL script TP564702 ✓
3. Cover vacuum chamber window with black cloth or Al foil (or both) ✓ foil only
4. Collect four (4) images in all MODEs with 10 sec integration delay using CSTOL script TP564423 as dark current measurement ~~VR-47~~ ✓

5. Collect eight to sixteen (8-16) images in all MODEs with the minimum integration delay using CSTOL script TP564423 for bias frame measurements ✓ 2003/02/19
6. Remove cover from vacuum chamber window 5 ΔDLH 1/30/03
7. Collect eight to sixteen (8 – 16) images in all MODEs with 1 sec integration delay using CSTOL script TP564427 as an ambient light level reading ✓
8. 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 black cloth over sphere & chamber
9. Set the LabSphere diode display to measure current, and adjust the range until the LSB shows some variation 0.00 on 20mA
10. Collect 10 current readings from the ~~LabSphere~~ UDT photodiode mA on 2μA scale

0.213	0.218	0.217	0.213	0.211
0.207	0.198	0.193	0.196	0.190

11. Calculate the average LabSphere diode current reading: 0.210
12. Set the UDT photodiode display to measure current, and adjust the range until the LSB shows some variation
13. Collect 10 current readings from the ~~UDT photodiode~~ Labsphere — x10-7 A

0.091	0.092	0.092	0.090	0.092
0.089	0.091	0.091	0.091	0.090

14. Calculate the average UDT diode current reading: 0.090
15. Record CCD temperature as read from the test temperature monitor TA -43.6 T5 -43.8 TLM 13313

8.3.2.2 Source Measurements

1. Turn on the calibrated quartz halogen lamp (controller C) in the LabSphere integrating sphere to the calibrated current level of 6.250 amps and allow at least 30 minutes to stabilize. Record which lamp is used EHLS-100-75R, and the stabilized current 6.250A 10:24 on
2. Collect 10 current readings from the UDT calibrated photodiode 10:55

2.99 mA				

3. Calculate and record average diode current reading here 2.99mA
4. Collect 10 current readings from the LabSphere photodiode

1.028 X10^{-6}				

5. Calculate and record average diode current reading here 1.028 X10^{-6} A
6. Cover the Ball 8 chamber window with black cloth or low reflectivity material (DLH blue coat)
7. Repeat Steps 2 through 5 UDT 2.99mA Labsphere 1.024 X10^{-6}
8. Remove the UDT calibrated photodiode
9. Repeat Steps 4 and 5 Labsphere 1.021 X10^{-6}
10. Set the variable attenuator to fully closed by entering 0 in the USS-2000V "VA" field Labsp 0.009 X10^{-6}
11. Set the variable attenuator to 15 ~~–~~ 20
12. Collect MODE 1 images using CSTOL script TP564427 and analyze in real time using DIVe to find an integration delay that produces images with signal level that is between 4000 and 5000 DN above the serial overclocked region signal (full well is ~14000 DN)
13. If the integration delay calculated is less than 50 msec reduce the source signal by decreasing the value of the variable attenuator, collecting images until the integration delay is greater than 50 msec Final VA = 18
14. Record the integration delay 360 and average signal level from one quadrant 5452 91
15. Use Table 8-1 below to spread 20 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)
16. Install the UDT calibrated photodiode Labsphere from 0.155, 0.157, 0.157, 0.156 X10^{-7}
17. Collect 10 current readings from the UDT calibrated photodiode

18.07(5) @ 20μA		17.8 @ 20μA	0.015mA @2mA	

18. Calculate and record average diode current reading here _____
19. Collect 10 current readings from the LabSphere photodiode X10^{-7} A

0.155	0.157	0.157	0.156	0.157
0.157	0.155	0.155	0.157	0.156

20. Calculate and record average diode current reading here _____
21. Cover the Ball 8 chamber window with black cloth or low reflectivity material
22. Repeat Steps 17 through 20 UDT 18.05 @20μA 17.8@20μA 0.015@2mA Labsphere 0.155, 0.156, 0.156, 0.155, 0.156 (X10^{-7})

→ UDT down to 17.99 on 20μA

23. Remove the UDT calibrated photodiode

24. Repeat Steps 19 and 20 ✓ Labsph 0.154 0.155, 0.157, 0.156, 0.157
0.155 0.156, 0.155, 0.154, 0.157

8.3.2.3 Instrument Flatfield Measurements

△ remove black cloth from window DLH 1/30/03 03/02/09

Do not adjust the variable attenuator at any point in this section

T4 -41.685 T5 -41.9

1. Record CCD temperature as read from the test temperature monitor TLM 13216
2. For each integration delay entered in Table 8-1 collect eight to twenty-four (8 – 24) MODE 1 images using CSTOL script TP564427 (single mode light)
3. Collect sixteen (16) MODE 2, 3, 5 and 9 images using CSTOL script TP564427 with an integration delay at the midpoint of the delays listed in Table 8-1 300 ms & 700ms
4. Collect sixteen (16) MODE 4, 6, 7, and 8 images using CSTOL script TP564427 with 4 msec integration delay (minimum for these modes).
5. Insert the UDT calibrated photodiode at the aperture of the integrating sphere at the same place as previously installed
6. Repeat steps 17 through 20 from Section 8.3.2.2 Labsph 0.153, 0.156, 0.153, 0.155, 0.153, 0.154, 0.156 0.154, ~~0.155~~
7. Record CCD temperature as read from the test temperature monitor ~~T4 -40.96~~ T5 -41.21 TLM 13179
8. Power off ITS instrument electronics, using CSTOL script TP564703, at discretion of test conductor

UDT 18.01@20μA
17.7@200μA
0.015@2mA

Table 8-1

#	T_exp (msec)	% Full Well	#	T_exp (msec)	% Full Well
1	0		15	400	
2	1		16	500	
3	2		17	600	
4	3		18	700	
5	4		19	800	
6	5		20	900	
7	8		21	950	
8	10		22	1000	
9	20		23	1020	
10	~~50~~ 30		24	1040	
11	~~100~~ 50		25	1060	
12	~~200~~ 100		26	1080	
13	200		27	1100	
14	300		28	1300	

8.3.2.4 Source confirmation

1. Return variable attenuator to full open, 255, using USS-2000V software ✓
2. Repeat steps 17 through 20 from Section 8.3.2.2 UDT 2.88 mA (20mA scale) 029 mA (200mA scale)

⚠ Cross calibrate to Kailey's measurement — OVER

Labsphere 1.025 x10^{-6} A

8.4 Latent Image Tests (Optional – At Discretion of Test Conductor)

8.4.1 Optical Setup

1. Set up the 2 to 3 inch lens in front of chamber window ✓
2. Place tungsten (W) lamp behind the lens at the approximate focal length of the lens
3. Place ND filter holder mount directly in front of W lamp, but do not place ND filter
4. If not already on, power on ITS instrument electronics using CSTOL script TP564702 and alert T/V chamber operator that instrument electronics power is on ✓
5. Turn on W lamp power supply to 12 A N/A
6. Collect one MODE 1 image using CSTOL script TP564427 ✓
7. Examine the image using DIVe for position and "sharpness" of image ✓
8. Repeat images and adjustment of lamp and lens position in order to place the image of the lamp filament near the center of the CCD and close to focus. Use ND filters as required. ND3 600msec

8.4.2 Data Collection

N/A

1. Adjust W lamp current to ~~15 A~~ output. This should severely saturate the CCD.
2. Place ND filters in front of W lamp, and collect MODE 1 images with 100 msec integration delay using CSTOL script TP576435 until the attenuation is sufficient to produce an image of the W lamp filament that is not saturated
3. Determine the set of ND filters that would result in 30,000 to 50,000 DN in ~~100~~ 600 msec integration delay (so the image will not bleed into storage area while shutter is closing)
4. Place this set of ND filters in front of the W lamp
5. Using CSTOL script TP564427, 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

6. Examine the images using DIVe and determine that there are at least 3 images with a saturated W lamp filament image. If not repeat the image sequence and light block steps above ✓
7. Power off the ITS instrument electronics using CSTOL script TP576703 and alert T/V chamber operator that instrument electronics power is off. 23:39

9 DATA PRODUCTS

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

The following sets of images will be produced for each subsection of section 8

Subsection	Mode	# Images	Comments
8.1	1 (1-9)	40 to 160	Based on HRI SIM test Aug. 25, 2002
8.2	1-9	288 to 576	Dark and light
8.3.1	N/A	N/A	Setup
8.3.2.1	1-9	144 to 288	Dark
8.3.2.2	1	10	
8.3.2.3	1-9	528	Source
8.4	1	32	Latent Image
	Total	1042 to 1594	

Equipment List

Photodiode	UDT model 221	S/N 17862		Cal Report 20025	M26379
Log dynamic range Amp	Melles Griot	S/N 812		NO BATC cal	Last cal 09/10/01 By Melles Griot
Labsphere 24" integrating sphere				P118394	See cal report
Labsphere	Integrating sphere system control	SC-5500		P118387	See cal report
Labsphere	Variable attenuator control	VAC1000		P118392	See cal report
Labsphere	Halogen Lamp Power supply	LPS-045H		P118389	See cal report

Deep Impact

Procedure 564421 Date Jan 30 '03 Operator Hampton

ITS Dark Current & calibration

Image Log

Filename Prefix I030130_ - 2911

Filename	Mode V(IS) I(R)	Exp. ID	Mechanical Setup X	Y	Z	Comments
		Power on		8:35	43	T4 T5 TLM
084609	V1	2000				0 sec -47.2 -47.4 13482
093359	V1					10 sec -47.17 -47.4 13480
093500	V1					10 sec 4 for Idk — window comend
093551	V2					~~10 sec~~ 0msec 8 for bias T4(-45.54)
093749	V3					0msec 8 for bias
093909	V3					0msec 8 bias — corrupt
094054	V3					0msec 8 " — corrupt
		Power off				— corrupt out of disk space!
095158	V3					
095250	V4					0ms bias OK
095342	V5					4ms bias 8 each
095431	V6					0ms bias
095517	V7					4msec bias
095544	V8					4msec
095609	V9					4msec
						0ms T4 -44.63 T5 -44.84
095955	V1					window on comend
100115	V2					5sec ambient 8 each
100224	V3					5sec T4 -44.42 T5 -44.6
100335	V4					5sec TLM 13346
100932	V5					"
101222	V6					" T4 -44.08 T5 -44.3
101326	V7					" TLM 13329
101443	V8					"
101646	V9					"
						" T4 -43.78 T5 -44.00
						TLM 13320

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Procedure 564421 ITS Calibration

Deep Impact

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Image Log

Filename Prefix I030130_

Filename	Mode V(IS) I(R)	Exp. ID	Mechanical Setup X	Y	Z	Comments
110749	V1					50msec VA=20
110905						500msec VA=20 ~9000 DN
111115						500msec VA=18
114030						560msec VA=18
120501						1050ms VA=18 - from noon
120657						1200 ms
						Start Imeas / Electronics ~31°C
121740						Texp(ms) N TA TS TLM
122048		5000				0 16 -41.58 -41.82 13229
122340		5001				0 24 No shutter TP564427
122513		02				1 16 -41.50 -41.75 13208 - shutter
122754		03				2 16 -41.48 -41.72 13205
122920		04				3 16 -41.44 -41.68 13200
123100		05				4 16 -41.42 -41.66 ~~13202~~ Wapped!
123245		06				4 16 -41.40 -41.64 13217
123507		07				5 16 -41.37 -41.62 13200
123744		08				8 16 -41.34 -41.58 13195
123929		09				10 16 -41.3 -41.55 13194
124136		10				20 16 -41.28 -41.52 13194
124315		11				30 16 -41.25 -41.49 13192
124455		12				50 16 -41.24 -41.48 13194
124635		13				100 16 -41.22 -41.46 13192
124839		14				200 12 -41.20 -41.44 13192
125014		15 ~~15 16~~				300 12 -41.18 -41.42 13191
125209		~~16~~ 16				400 12 -41.16 -41.41 13193
125344		17				500 12 -41.14 -41.39 13184
125455		18				600 8 -41.13 -41.37 13185
125630		19				700 8 -41.12 -41.36 13183
125716		20				800 8 -41.10 -41.35 13191
						900 8 -41.10 -41.34 13183

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Export or re-export of information contained herein may be subject to restrictions and requirements of U.S. export laws and regulations and may require advance authorization from the U.S. government

Procedure 564421 **Deep Impact** Date Jan 30 '03 Operator Hampton **Image Log** Filename Prefix I030130-

Filename	Mode V(IS) I(R)	Exp. ID	Mechanical Setup X	Y	Z	Comments
		~~5021~~				Temp (ms) N T4 T5 TLM
125902		5021				950 8 -41.08 -41.33 13191
130008		5022				1000 8 -41.08 -41.32 13183 BG light pwrup?
130146						1020 8 -41.06 -41.31 13180
130244						1040 8 -41.06 -41.30 13182
130419						1060 8 -41.05 -41.29 13181
130528		5026				1080 8 -41.04 -41.29 13181
130722						1100 8 -41.03 -41.28 13190
130825						1300 8 -41.03 -41.27 13180
131226	V2					300 16 -41.01 -41.26 13179
131323	V3					300 16 -41.01 -41-26
131411	V5					300 16 -41.00 -41.26 13180
131549	V9					300 16 -41.00 -41.25 13180
131730	V2					700 16 -40.99 -41.24 13178
131825	V3					700 16 " " "
131903	V5					700 16 " -41.23 13178
131951	V9					700 8 " " "
132113	V4					4 16 -40.97 -41.22 13179
132148	V6					4 16
132208	V7					4 16
132234	V8					4 16
155033	V1					700ms 2 -40.86 -41.11 13172
155228						cover body main lamp
~~171059~~ 171059	V1					50.0 sec 2
~~1740~~ 171146						10.0 sec 2 Idk -39.7 -39.94 13114
171429						100ms 2 image of mglight (wot)
171642						" 1 "
173029						" 1 "

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Procedure 564421 **Deep Impact** Date Jan 30 '03 Operator Hampton **Image Log** Filename Prefix IC3013a

Filename	Mode V(IS) I(R)	Exp. ID	Mechanical Setup X	Y	Z	Comments
173502						100 1 ND2
173827						50ms 1 ND3
174041						50ms 2 turns forward focus
174143						50ms 1 turn back Sign start
174250						50ms 1 more back
174440						50ms 1 more back
174655						4 2 more back
174826						4 2 more back
174922						2 more back 4000DN
175117						175ms just under sat.
175510						400ms
175656						600ms
180032						600ms Latent 16
180222						7 -38.84 -39.09 13072
181010						75 more 1mm S
181150						75 1 more mm S
182001						600ms Latent 16
		~~1~~				
182815		1				1 sec 427 no "stim"
182853		2				28V on header cacut.
183205		3				30V on structure
183737		4				75ms center? - wrong procedure
184146		1				Cam window 10sec shutter closed
184259		2				open wind 10sec shutter closed - Lap-
		~~1~~				-38.04
184924	V1	7000				75 2 each
184958	V5	01				~~75~~
185015	V1	02				75
185036	~~V2~~	03				~~75~~ walk
	~~V1~~	04				~~75~~

Operator Hampton Date

IIS 030.

Procedure 564421 **Deep Impact** Date Jan 30 '03 Operator Hampton **Image Log** Filename Prefix I030130_

Filename	Mode V(IS) I(R)	Exp. ID	Mechanical Setup X	Y	Z	Comments
185351	VI	7005				75
185407	VI					4
185420	VI					75
185443	VI					4
185457	VI					75
195943	VI	8000				Idk
200044	VI	01				0 msec 2 Forgot Tem
200843	VI	02				20 sec 2
200931	VI	03				0 msec 2
203827	VI	04				20 sec 2 -31.9 -32.09 12719
						100ms Sphm VA=25 -shutter closed -no dark dent
204014	VI	8005				1 100ms Sphm VA=25
204203		8006				1 100ms VA=30
						Start anoth Image ~ -#34
204753		8007				4 dark no shutter 0 msec -33.8 -34.2
						Idelay N T4 T5 TLM
204929		8008				0 4 -33.8 -34.2 12816
205047		09				1 4 -33.6 -34.2 12815
205048						2 4 -33.8 -34.1 12812
205123						3 4 -33.8 -34.1 12816
205158						4 4 -33.7 -34.1 12812
205316						10 4 -33.6 -34.0 12807
205443						20 4 -33.6 -33.9 12804
205525						40 4 -33.6 -33.9 12803
205410						100 4 -33.4 -33.8 12798
205705						200 4 -33.4 -33.7 12793
205756						300 2 -33.3 -33.6 12790
205841						400 2 -33.2 -33.6 12788

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Procedure 564421 **Deep Impact** Date Jan 30 '03 Operator Hampton **Image Log** Filename Prefix I030130_

Filename	Mode V(IS) I(R)	Exp. ID	Mechanical Setup X	Y	Z	T delay	N	Comments T4	T5	TLM
205927	V1					~~500~~450	2	-33.2	-33.5	12783
210005						500	2	-33.1	-33.4	12780
210055						550	2	-33	-33.3	12782
211354						600	2	-31.14	-31.4	12680
211439						650	2	-31.0	-31.2	12674
211509						700	2	-30.9	-31.2	12669
211552						750	2	-30.8	-31.05	12660
						Labsphere = 0.217 x 10^-7 A				
211658		~~9000~~				Idk				
211921		9000				0 msec	2	-30.2	-30.4	12632
215328		01				10 sec	2	-30.1	-30.3	12628
215405		02				0	2	-22.5	-22.7	12256
220455		03				10 sec	2	-22.4	-22.6	12248
220537		04				0	2	-20.0	-20.2	12133
221549		05				10 sec	2	-19.9	-20.1	12128
221649		06				0	2	-17.8	-17.9	12025
223043		07				10 sec	2	-17.6	-17.8	12019
223125		08				0	2	-15.0	-15.28	11895
224703		09				10 sec	2	-14.94	-15.16	11891
224803						0	2	-12.38	-12.6	11768
230555						10 sec	2	-12.3	-12.6	11766
230758						0	2	-9.8	-10.1	
232659						10 sec	2	-9.6	-9.93	11517
232753						0	2	-7.503	-7.82	11530
						10 sec	2	-7.4	-7.7	11540
		Power off 23:39				STEP ALIVE = 53,682 sec (!)				