

**INFORMATION ONLY**

**CALIBRATION PROCEDURE  
FOR THE  
ION AND ELECTRON SPECTROMETER (IES)  
PROTOFLIGHT MODEL (PFM) UNIT**

September 2001

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Prepared by Raymond Goldstein



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# CALIBRATION PROCEDURE FOR THE ION AND ELECTRON SPECTROMETER (IES) PROTOFLIGHT MODEL (PFM) UNIT

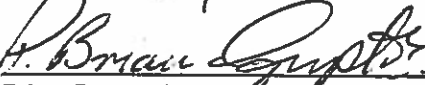
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### TABLE OF CONTENTS

|  |    |
|--|----|
| CALIBRATION PROCEDURE .....                              | 1  |
| 1 SCOPE, OBJECTIVES, AND DESCRIPTION .....               | 1  |
| 2 APPLICABLE DOCUMENTS AND STANDARDS .....               | 1  |
| 3 ABBREVIATIONS .....                                    | 2  |
| 4 TEST DOCUMENTATION AND REPORTING .....                 | 2  |
| 4.1 TEST RESULTS .....                                   | 2  |
| 4.2 NONCONFORMANCES AND PROBLEM/FAILURE REPORTS .....    | 2  |
| 4.3 CHANGES TO TEST PROCEDURES .....                     | 2  |
| 4.3.1 <i>Minor Changes</i> .....                         | 2  |
| 4.3.2 <i>Major Changes</i> .....                         | 3  |
| 5 TEST PERSONNEL .....                                   | 3  |
| 6 TEST TOLERANCES .....                                  | 3  |
| 7 CLEANLINESS AND CONTAMINATION CONTROL .....            | 3  |
| 8 TEST EQUIPMENT .....                                   | 3  |
| 8.1 CALIBRATION REQUIREMENTS .....                       | 3  |
| 8.2 REQUIRED TEST EQUIPMENT .....                        | 3  |
| 9 TEST OVERVIEW AND SETUP .....                          | 4  |
| 9.1 TEST OVERVIEW .....                                  | 4  |
| 9.1.1 <i>Environmental Conditions Monitoring</i> .....   | 5  |
| 9.2 TEST SET UP .....                                    | 5  |
| 10 TEST PROCEDURE .....                                  | 5  |
| 10.1 PUMPDOWN .....                                      | 6  |
| 10.2 IES PFM FUNCTIONAL PROCEDURE .....                  | 7  |
| 10.3 HIGH VOLTAGE CHECKOUT PROCEDURE .....               | 7  |
| 10.4 INITIALIZE CALIBRATION .....                        | 8  |
| 10.5 N <sup>+</sup> BEAM AT 2 KEV .....                  | 9  |
| 10.5.1 <i>Full ESA Sweep</i> .....                       | 9  |
| 10.5.2 <i>Ion MCP gain test</i> .....                    | 10 |
| 10.6 ELECTRON BEAM AT 1 KEV .....                        | 10 |
| 10.6.1 <i>Full ESA Sweep</i> .....                       | 11 |
| 10.6.2 <i>Electron MCP test</i> .....                    | 11 |
| 10.7 FLIGHT SOFTWARE TEST .....                          | 11 |
| 10.8 RETURN TO SCI6 SOFTWARE .....                       | 12 |
| 10.8.1 <i>ESA Sweep with INNER Scan</i> .....            | 12 |
| 10.8.2 <i>ESA Sweep with OUTER Scan</i> .....            | 12 |
| 10.8.3 <i>End of 1 keV electron beam</i> .....           | 13 |
| 10.8.4 <i>ESA Sweep with Inner angle Scan</i> .....      | 13 |
| 10.8.5 <i>ESA Sweep with INNER and OUTER Scans</i> ..... | 14 |
| 10.9 N <sup>+</sup> BEAM AT 21 KEV .....                 | 14 |
| 10.9.1 <i>Full ESA Sweep</i> .....                       | 15 |
| 10.9.2 <i>ESA Sweep and ELEVATION Scan</i> .....         | 15 |

Calibration Procedure for the IES PFM Unit

|         |  |    |
|---------|--|----|
| 10.9.3  | DEF scan for high energy beam.....                             | 16 |
| 10.9.4  | Perform the following DEF scans.....                           | 16 |
| 10.9.5  | End 21 keV N <sup>+</sup> Beam.....                            | 17 |
| 10.10   | N <sup>+</sup> BEAM AT 500 EV.....                             | 17 |
| 10.10.1 | Full ESA Sweep.....  | 17 |
| 10.10.2 | Linear ESA sweep and DEF sweep.....                            | 18 |
| 10.10.3 | Perform Sweeps and Scans as follows:.....                      | 18 |
| 10.10.4 | End 500 eV N <sup>+</sup> Beam.....                            | 18 |
| 10.11   | ELECTRON BEAM AT 1 KEV AND N <sup>+</sup> BEAM AT 2 KEV.....   | 18 |
| 10.11.1 | Full ESA Sweep.....  | 19 |
| 10.11.2 | ESA Sweep with INNER Scan.....                                 | 20 |
| 10.11.3 | End of calibration tests. Turn off electron and ion beams..... | 21 |
| 10.12   | ARCHIVE DATA.....  | 21 |
| 10.13   | COMMENTS:.....   | 21 |
| 10.14   | CLOSURE:.....  | 21 |
| 11      | RECORDED FILE LOG.....   | 22 |
| 12      | MCP TEST LOG.....  | 23 |

**REVISION NOTICE**

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## 1 Scope, Objectives, and Description

This document is the calibration procedure for the IES Proto-Flight Model (PFM) instrument being developed by Southwest Research Institute (SwRI) for the European Space Agency Rosetta Project under contract number JPL-960549. This procedure is used to obtain ion and electron calibration data for the instrument.

## 2 Applicable Documents and Standards

The following documents and standards shown form a part of the document to the extent specified. If a revision number is not shown, then it is the issue in effect on the date of this document. In the event of a conflict between this document and the contents of one of the documents and standards listed below, the order of precedence is the contract, this document, European Space Agency documents, then Military and SwRI documents.

### European Space Agency

|                      |                                      |
|----------------------|--------------------------------------|
| RO-EST-RS-3001/EID-A | Experiment Interface Document Part A |
| RO-EST-RS-3001/EID-B | Experiment Interface Document Part B |
| RO-EST-RS-3001/EID-B | Experiment Interface Document Part C |

### Military Documents

|                          |   |
|--------------------------|---|
| MIL-STD-810E<br>Notice 2 | Environmental Test Methods and Engineering Guidelines |
| MIL-STD-831              | Preparation of Test Reports 28 Aug 1963               |
| MIL-STD-45662A           | Calibration System Requirements                       |

### SwRI

|                 |  |
|-----------------|--|
| OP-5-15-101     | Document Control   |
| OP-9-15-101     | Calibration Control  |
| OP-9-30-104     | Calibration System   |
| OP-16-15-301    | ESD Control  |
| QAP-12-1        | Nonconformance Control   |
| QAP-12-2        | Failure Reporting, Analysis, and Corrective Action System      |
| QAP-14-1        | Corrective Action Control                                      |
| PAIP-97-15-8182 | Performance Assurance Implementation Plan                      |
| 8182-ISIES-01   | Instrument Specification for the Ion and Electron Spectrometer |
| 8182-FTPFM-02   | Functional Test Procedure for IES PFM Unit                     |
| 8182-HVPFM-01   | High-Voltage Checkout Procedure for IES PFM Unit               |
| XXXX            | Cleanliness Requirements for High Vacuum Applications          |
| Software        | IES PFM flight Software, Sci6 software                         |

|                    |                                |
|--------------------|--------------------------------|
| FRA-2X1-2/EGPS-2X1 | Electron Beam Equipment Manual |
|--------------------|--------------------------------|

### 3 Abbreviations

|      |                               |
|------|-------------------------------|
| DEF  | Deflection                    |
| ESA  | Electrostatic Analyzer        |
| IES  | Ion and Electron Spectrometer |
| MCP  | Microchannel Plate            |
| QA   | Quality Assurance             |
| SwRI | Southwest Research Institute  |
| UUT  | Unit Under Test               |

### 4 Test Documentation and Reporting

#### 4.1 Test Results

Test data will be logged on the GSE computer, and/or recorded directly on this procedure or on a test-computer printout attached to this procedure in Appendix A. Mark the front page of this procedure "As-Run Test Report" or similar. Submit "As-Run" procedure to Document Control for file. All log files are to be captured at the end of this test on 3 1/2" diskettes, properly labeled and submitted to document control.

During the course of running the calibration procedure, test data shall be kept under the following directory names on their respective machines:

D:\DATA\FM\090501FMCAL\GSEOSRaw – Raw Link Packet data recorded by GSEOS  
D:\DATA\FM\090501FMCAL\IESViewData – ASCII comma-delimited files generated by LabVIEW  
D:\DATA\FM\090501FMCAL\SCRIPTS – Command log script files used by this procedure

Whenever new record files are created by IESVIEW, they shall be logged in the table in Section 11. Execute each of the test cases contained in Section 10 of this document. Write test observations in the OBSERVED RESULTS column. Whenever possible, obtain a hardcopy printout of test results. Annotate those results with the procedure number, test case number, and date and time the test was executed. Mark in the PASS/FAIL column whether the observed result matches the expected result as a pass or fail.

#### 4.2 Nonconformances and Problem/Failure Reports

Nonconformances and problems/failures encountered during the execution of this test shall be dispositioned in the manner prescribed by QAP-12-1 and QAP-12-2.

#### 4.3 Changes to Test Procedures

Changes to this test procedure may be made in response to last minute changes in test requirements or to correct errors in the test procedure identified after the test has started. Changes are defined as minor or major changes dependent upon how much the procedure is changed. Changes should be made in red ink in the procedure with appropriate initials, dates and stamps annotated in the right hand margin.

##### 4.3.1 Minor Changes

Minor changes are defined as those changes that will not significantly change the actual test procedure or affect the results of the test. Such changes as equipment model number changes or corrections of procedural errors are minor changes. The test conductor may make minor changes with the concurrence of the project manager and the cognizant QA engineer. Changes must be initialed and dated by the test conductor, the project manager and receive a QA stamp or initial and date after approval.

**Calibration Procedure for the IES PFM Unit****4.3.2 Major Changes**

Major changes are defined as those changes that will significantly change the actual test procedure or affect the test results. Changes to procedure to reduce schedule impact, changes as the result of test failure closeouts, or changes in the scope of the test (temperature, dwell time, etc.) are defined as major changes. Major changes must be initiated by the project manager and receive a QA stamp or initial after approval.

**5 TEST PERSONNEL**

Test personnel will include a test conductor and technicians as needed to support the testing. The test engineer or project manager shall notify QA of the test schedule so that QA may monitor test activities and results.

**6 TEST TOLERANCES**

The following tolerances will be observed in making measurements for the test:

|         |    |
|---------|----|
| Voltage | 1% |
| Current | 3% |

**7 CLEANLINESS AND CONTAMINATION CONTROL**

The UUT shall be handled in a class 10,000, or better, clean environment. For transportation and operation in a non-clean room environment, the unit will be wrapped in conductive wrap except for the mounting feet areas and connectors. The aperture cover will be in place to minimize contamination in the sensor assembly at all times unless otherwise directed by the governing procedure.

The areas in and around the calibration chamber are considered contamination sensitive and must be protected from incompatible materials such as hydrocarbons, hydroscopic materials, and body detritus. Procedures are established and shall be enforced to prevent contamination.

Refer to the document "DOP-8-15-405 Cleanliness Requirements for High Vacuum Applications" for cleanliness procedures.

The only gas allowed for use as backfill shall be nitrogen in purity levels of 99.995% (zero grade) or 99.999% (preferred). Any gas used as backfill must be certified for contamination levels of less than 0.5ppm hydrocarbons.

**8 TEST EQUIPMENT****8.1 CALIBRATION REQUIREMENTS**

All equipment used to make measurements during the execution of this procedure shall have current calibration certifications. The date of the last calibration and the due date for the next calibration shall be clearly marked on the test equipment. Requirements for calibration are specified in SwRI documents OP-9-30-104.

**8.2 Required Test Equipment**

1. Power Supplies to provide +5, -5, +12, -12 V
2. Digital multimeter (Calibration Required)
3. SwRI PIU Power Simulator (or equivalent)
4. SwRI PIU Interface Simulator



Calibration Procedure for the IES PFM Unit

5. Laptop PC running the Rosetta Spacecraft Simulator and the IES GSE
6. IES GSE/Thermal Vac Cable SwRI P/N: 81822600

| Equipment Identification | Serial Number | Next Cal. Due Date |
|--------------------------|---------------|--------------------|
| Fluke 87 multimeter      | 69210760      | 7/3/02             |
| Fluke 8062A multimeter   | 6441013       | 9/21/01            |
| Fluke 79 multimeter      | 59830236      | 8/8/02             |
| Fluke 79 multimeter      | 67840799      | 7/20/02            |
| Lambda supply            | 003209        |                    |
| Keeco supply             | 37190         |                    |
| Agilent supply           | 37461096      |                    |
| Tektronix TxT            | B011399       |                    |

**9 Test Overview and Setup**

**9.1 Test Overview**

This test is designed to characterize the performance of the instrument. This is accomplished by using the SwRI calibration system and performing the following tests. (Note that the list is approximately in priority order, but regarding test of the flight software, it should be run prior to step 8 if at any time it is likely that no more than a few hours remain before IES must be removed from the chamber.)

1. Use Sci6 software
2. N<sup>+</sup> beam set to 2 keV
3. Full ESA sweep, no angle scans
4. Ion MCP gain test
5. Electron beam set at 1 keV
6. Full ESA sweep, no angle scans
7. Electron MCP gain test
8. Here or earlier if short of time load flight software, run full ESA sweep and limited DEF sweep
9. Return to Sci6 software
10. ESA and DEF sweep with inner angle scan
11. ESA and DEF sweep with inner and outer angle scan
12. Return to N<sup>+</sup> beam, at 2 keV
13. ESA and DEF sweep with inner angle scan
14. ESA and DEF sweep with inner and outer angle scan
15. Set N<sup>+</sup> beam to 21 keV
16. ESA and DEF sweep with inner and outer angle scan
17. Set N<sup>+</sup> beam to 500 eV
18. ESA and DEF sweep with inner and outer angle scan
19. Set both N<sup>+</sup> and e beams
20. Full ESA sweep at 3 fixed inner angles
21. ESA and DEF sweep for one position of step 18.

## Calibration Procedure for the IES PFM Unit

### 9.1.1 Environmental Conditions Monitoring

Pressure and temperature shall be recorded automatically by the calibration chamber system once every minute. A residual gas content measurement shall be taken once every 12 hrs.

### 9.2 Test Set up

- CG3
- a) Verify that the test area meets the cleanliness requirements for this instrument.
  - b) Verify that there is sufficient N<sub>2</sub> to complete this test.
  - c) Set the +5V power supply current limit to .25A
  - d) Set the -5, +12, and -12 V power supply limits to 0.150 A
  - e) Verify that the power supplies are off.
  - f) Connect the PIU power simulator to the 28V power supply.
  - g) Power up the PIU power simulator and verify the following voltages

+5V : V= 5.18 V<sub>dc</sub>  
 -5V : V= -5.008 V<sub>dc</sub>  
 +12V : V= 12.02 V<sub>dc</sub>  
 -12V : V= -12.03 V<sub>dc</sub>

- h) Power off the PIU power simulator
- i) Install the Unit Under Test (UUT) in the calibration chamber as shown in Figure 1.
- j) Cable up the UUT.
- k) QA Verify test setup per Figure 2.
- l) Verify that the V/8 only plug is installed.
- m) Verify that the freedom of motion with the test cables connected is sufficient to complete this test.
- CG3 n) Perform IES PFM functional test procedure, 8182-FTP FM-02. *FTP COPY #72*

Pass :  Fail: \_\_\_\_\_  
 Time: ~~00:45~~:00 Date: 9/18/01  
01:00:00 2  
CG3 CG3

## 10 Test Procedure

INNER rotation limits: -115° to +225°  
 OUTER rotation limits: -55° to +55°

Calibration Procedure for the IES PFM Unit

10.1 Pumpdown

- \_\_\_\_\_ a) Close Chamber and begin pumping the chamber down to a pressure  $< 1 \times 10^{-7}$  Torr.
- \_\_\_\_\_ b) Record the time and date when the chamber has stabilized at a pressure  $< 1 \times 10^{-7}$  Torr.

Time : 14 : 52 : 00      Date : 21 Sep 01

- \_\_\_\_\_ c) Allow the unit to pump for at least 24 hrs from the time recorded in 10.1.b.

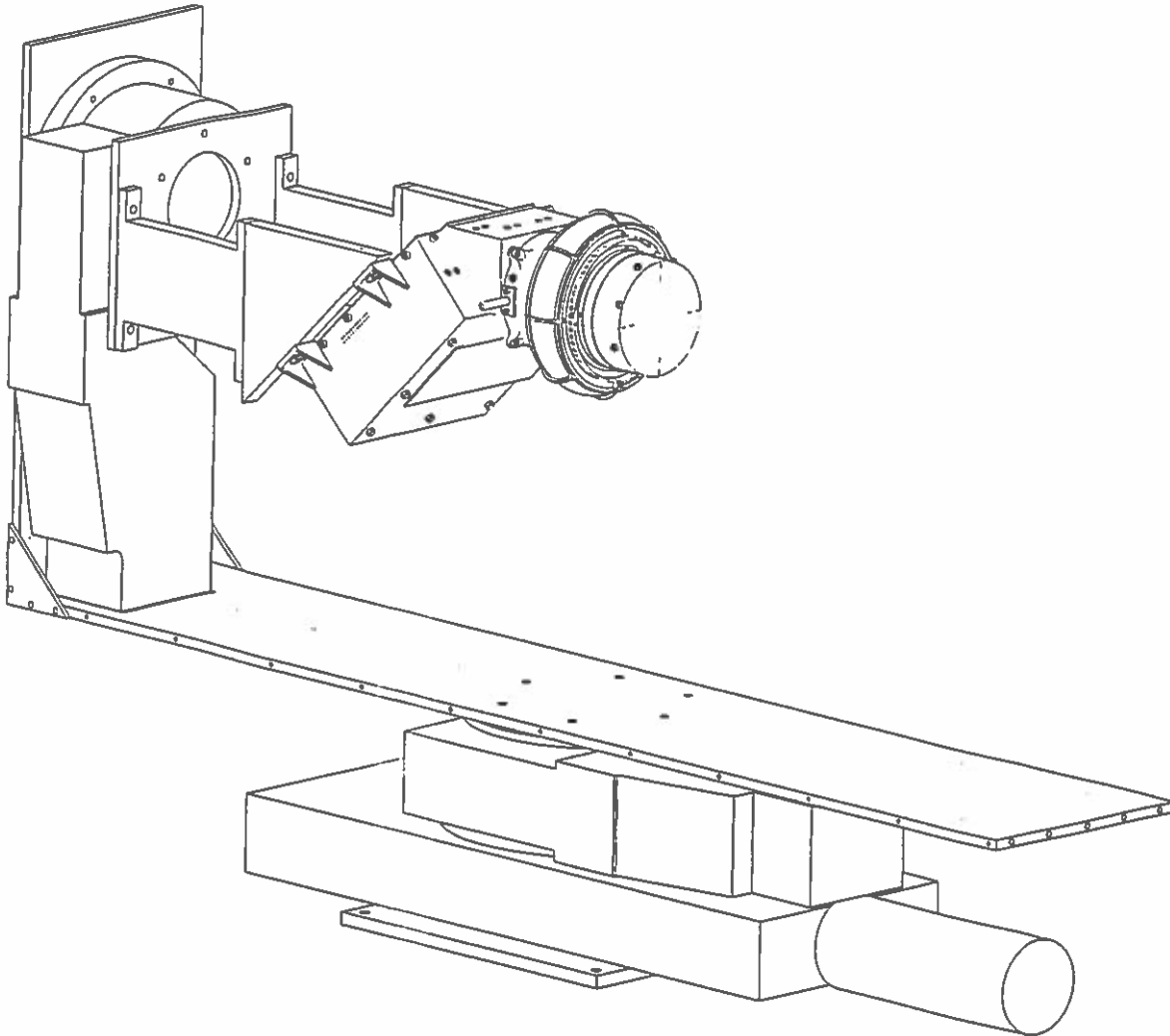


Figure 1. IES Installation in Calibration Chamber

Calibration Procedure for the IES PFM Unit

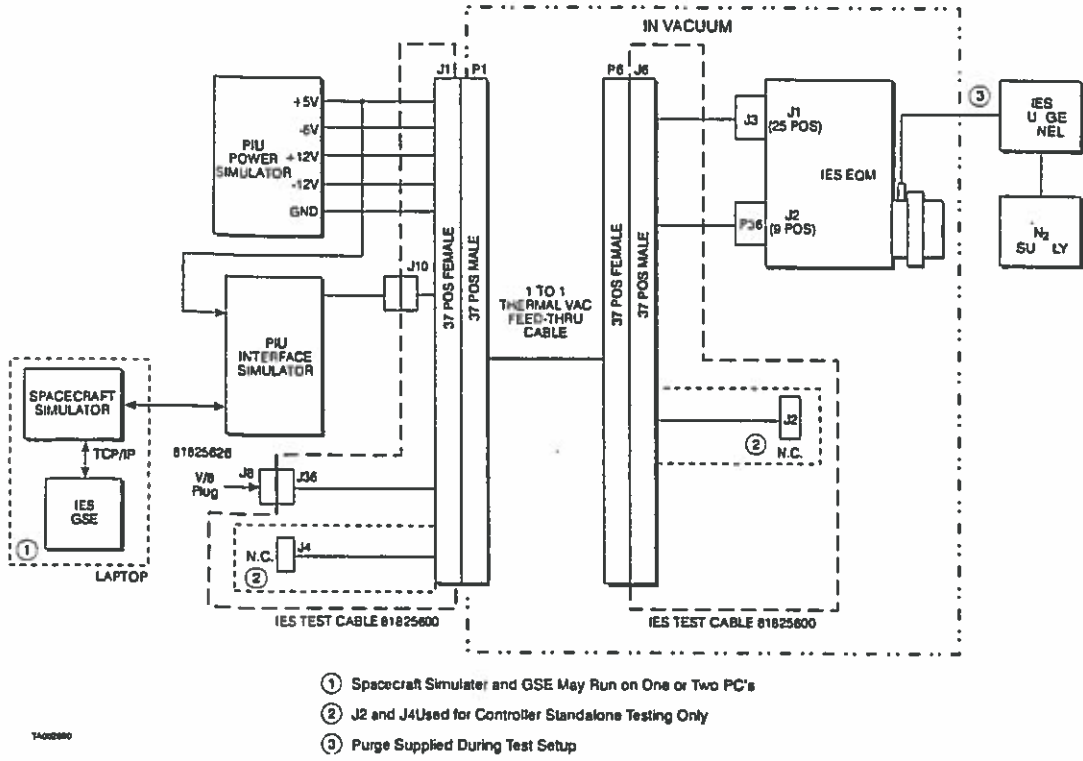


Figure 2. IES Test Setup

10.2 IES PFM Functional Procedure

Caution : Verify that the V/8 Plug is installed.

off a) Record the time and date and pressure when the functional test is started.

Time : 06 : 35 : 00 Date : 9 / 4 / 01

Pressure : 1.5 v. 10<sup>-5</sup> torr

off b) Perform IES PFM functional test procedure, 8182-FTPFM-02. copy # 73

Pass : ✓ Fail: \_\_\_\_\_

Time : 0 : 6 : 40 Date : 9 / 4 / 01

10.3 High Voltage Checkout Procedure

off a) Record the time and date and pressure when the High Voltage Checkout Procedure is started.

Time : 07 : 00 : 00 Date : 9 / 4 / 01

Calibration Procedure for the IES PFM Unit

Pressure : 1.5 x 10<sup>-7</sup> torr

C93 b) Perform IES High-Voltage Checkout procedure, 8182-HVPFM-01. copy #13

Pass : \_\_\_\_\_ Fail:

Time: 8:00:00 Date: 9/4/01

*Run 8182-FIP FM-02 after failure; Test Passed; copy #79  
Allowed the instrument to pump under vacuum in an additional  
day. Run 8182-FIP FM-02 copy #75, again test passed  
Run 8182-HV FM-01. Test Passed. Reverse calibration.*

10.4 Initialize Calibration

It is assumed that as a result of running 8182-HVPFM-01, the voltages should be at the following settings so that the calibration procedure can proceed with Section 10.5: (The MCP operating voltages may need to be changed later as a result of the gain tests of Section 10.5.2)

- ELC MCP: 2500 V
- ION MCP: -2500 V
- MCP ENABLED
- ESA: 0 V
- ESA ENABLED
- DEF: 0 V
- DEF ENABLED

→  
on  
BACK

If there are breaks in the calibration schedule and the instrument is turned off, the following steps shall be run from 8182-HVPFM-01 for subsequent high-voltage turn-on:

4.1, 4.2, 8.1.1-8.1.6, 8.2.1-8.2.3, 8.3.1, 8.4.1.

*Note that it is anticipated that the state of the calibration system will require each angular position move to be performed manually, one step at a time. Most of the data will be collected using the SCI6 instrument software, which means that any voltage sweep scripts must also be run manually at each position. As a result, it is recommended that a separate data file be written for each position after the system has settled to its new position. Observe the motion and be sure the system has settled before recording data. The following is a suggestion for a file naming convention:*

TEEEOOOIIII SDHHmm.dat, where

- T = l for ion, e for electron, or b if both are measured simultaneously
- EEE = beam energy (in in hundreds of Volts)
- OOOO = OUTER angle position (=instrument azimuth angle), with p for positive or n for negative angle as the first entry of the four places
- IIII = INNER angle position (=instrument elevation angle), with p for positive or n for negative angle as the first entry of the four places
- S = ESA sweep status, i.e. f=full sweep, p=partial sweep, n=no sweep
- D DEF sweep status, i.e. f=full sweep, p=partial sweep, n=no sweep

Calibration Procedure for the IES PFM Unit

HHmm = hour :minute time stamp imposed by the computer

A log shall be kept of all data files written. An example of a Table representing such a log is shown in Section 11.

10.5 N<sup>+</sup> Beam at 2 keV

Purpose: Set up 2keV N<sup>+</sup> beam according to the following table:

| Source | Type           | Energy | Current |
|--------|----------------|--------|---------|
| ELC    | None           | N/A    | N/A     |
| ION    | N <sup>+</sup> | 2 keV  | 0.8 pA  |

Procedure:

- \_\_\_\_\_ a) Make sure gate valve is closed
- \_\_\_\_\_ b) Deploy Faraday cup (FC)
- \_\_\_\_\_ c) Set up N<sup>+</sup> beam in DP source
- \_\_\_\_\_ d) Turn beam on at 1 kV U<sub>float</sub> + 1 kV U<sub>extraction</sub> = 2 keV beam and center the FC. Set x-raster to 15 V and y-raster to 30.2 V.
- \_\_\_\_\_ e) Total ion current should not exceed 0.8 pA
- \_\_\_\_\_ f) Go to beam stability mode
- \_\_\_\_\_ g) Verify that beam is steady for 10 minutes before proceeding
- \_\_\_\_\_ h) If beam current is below 0.5 pA, extend MCP sensor and record cts/sec reading (efficiency measurement)
- \_\_\_\_\_ i) Retract FC
- \_\_\_\_\_ j) Turn off IES high voltages
- \_\_\_\_\_ k) Open gate valve to chamber
- \_\_\_\_\_ l) Observe pressure increase in chamber
- \_\_\_\_\_ m) Wait until chamber pressure returns at least to <math>5 \times 10^{-7}</math> Torr range.
- \_\_\_\_\_ n) Ramp up high voltages per Section 10.4

10.5.1 Full ESA Sweep

Purpose: Determine satisfactory operation of ESA and ion detector.

Expected Result: Should obtain an energy profile of the beam centered around 2 keV.

Procedure

- \_\_\_\_\_ a) Orient IES at instrument 0-degree OUTER and INNER at such angle such that the ion beam will be centered on ion channel 15.
- \_\_\_\_\_ b) Create SCI6 data File: 10200000p022fnhmm.dat to record IES output data.
- \_\_\_\_\_ c) Run full ESA sweep by executing script file: 12alln.spt.  
This script file uses the following parameters for ESA:

*Replaced by hand-written Appendix*  
*[Signature]*

Calibration Procedure for the IES PFM Unit

| Parameter         | Description                              | Start | End      | Step Size | No. Steps | Time per Step |              |
|-------------------|--|-------|----------|-----------|-----------|---------------|--------------|
| ESA               | Full exponential sweep with 8 bkgd steps | 0 V   | 1,667 kV | Exp       | 256       | 2 s           |              |
| DEF               | Fixed at 0 V                             | 0 V   | 0 V      | N/A       | N/A       | N/A           |              |
| INNER             | Fixed at 22.5°                           | 22.5° | 22.5°    | N/A       | N/A       | N/A           |              |
| OUTER             | 0°                                       | 0°    | 0°       | N/A       | N/A       | N/A           |              |
| <b>TOTAL TIME</b> |  |       |          |           |           | <b>hh:mm</b>  | <b>00:09</b> |

\_\_\_\_\_ a) Record the date and time sweep is completed.  
Date: \_\_\_\_/\_\_\_\_/\_\_\_\_  
Time: \_\_\_\_:\_\_\_\_:\_\_\_\_

10.5.2 Ion MCP gain test.

Purpose: Determine proper operating voltage for the ion MCP.  
Expected Result: Should obtain a gain curve of the ion MCP.

Procedure:

- \_\_\_\_\_ a) Maintain position of IES as in previous procedure.
- \_\_\_\_\_ b) Set ESA voltage to the center of the peak measured in the previous procedure.
- \_\_\_\_\_ c) Create SCI6 data Files: I20ISM.dat to record IES output data (where angle "I" is the inner angle, "S" is the fixed ESA voltage, and "M" is the MCP voltage.)
- \_\_\_\_\_ d) Beginning at -2500 V, step the MCP voltage not to exceed -2800 V in 20 V increments, pausing 2 minutes at each step.
- \_\_\_\_\_ e) Record information for each file in the Table illustrated in Section 12, MCP Test Table.
- \_\_\_\_\_ f) From the results of this test, determine the appropriate ion MCP operating voltage and perform all additional calibrations with this value.

Record the value of the new operating voltage: \_\_\_\_\_

End of ion test

\_\_\_\_\_ a) Turn off ion beam.

10.6 Electron Beam at 1 keV

Purpose: Set up 1 keV electron beam according to the following table:

| Source | Type | Energy | Current |
|--------|------|--------|---------|
| ELC    | ELC  | 1 keV  | 0.8 pA  |
| ION    | None | N/A    | N/A     |

Procedure:

\_\_\_\_\_ a) develop electron beam at 1 keV using procedure in electron beam manual, FRA-2X1-2/EGPS-2X1

*See Appendix*  
*RA*

Calibration Procedure for the IES PFM Unit

Note that since there is no detector monitoring the electron beam intensity it is important to proceed slowly, starting with low intensity until there is assurance that the countrate in IES does not exceed 100 kHz in any channel.

10.6.1 Full ESA Sweep

Purpose: Determine satisfactory operation of ESA and electron detector.

Expected Result: Should obtain an energy profile of the beam centered around 1 keV.

Procedure:

- \_\_\_\_\_ a) Orient IES at instrument 0-degree OUTER and the INNER angle such that the electron beam is centered on sector 12.
- \_\_\_\_\_ b) Create SCI6 data File: e010000p011fnhhmm.dat to record IES output data.
- \_\_\_\_\_ c) Run full ESA sweep by executing script file: e1alln.spt.  
This script file uses the following parameters for ESA:

| Parameter         | Description                              | Start  | End      | Step Size | No. Steps | Time per Step |       |
|-------------------|--|--------|----------|-----------|-----------|---------------|-------|
| ESA               | Full exponential sweep with 8 bkgd steps | 0 V    | 1.667 kV | Exp       | 256       | 5 s           |       |
| DEF               | Fixed at 0 V                             | 0 V    | 0 V      | N/A       | N/A       | N/A           |       |
| INNER             | 11.25°                                   | 11.25° | 11.25°   | 11.25°    | N/A       | N/A           |       |
| OUTER             | Fixed at 0°                              | 0°     | 0°       | N/A       | N/A       | N/A           |       |
| <b>TOTAL TIME</b> |  |        |          |           |           | hh:mm         | 00:21 |

- \_\_\_\_\_ d) Record the date and time sweep is completed.  
Date: \_\_\_/\_\_\_/\_\_\_  
Time: \_\_\_:\_\_\_:\_\_\_

10.6.2 Electron MCP test.

Purpose: Determine proper operating voltage for the electron MCP.

Expected Result: Should obtain a gain curve of the electron MCP.

Procedure:

- \_\_\_\_\_ a) Maintain orientation of IES as in the previous procedure.
- \_\_\_\_\_ b) Set ESA voltage to the center of the peak measured in the previous procedure.
- \_\_\_\_\_ c) Create SCI6 data Files: e1225ISM.dat to record IES output data (where angle "I" is the inner angle, "S" is the fixed ESA voltage, and "M" is the MCP voltage.)
- \_\_\_\_\_ d) Beginning at 2500 V, step the MCP not to exceed 2800 V in 20 V increments, pausing 2 minutes at each step.
- \_\_\_\_\_ e) Record information for each file in the Table illustrated in Section 12, MCP Test Table.
- \_\_\_\_\_ f) From the results of this test, determine the appropriate ion MCP operating voltage and perform all additional calibrations with this value.

10.7 Flight software test

Purpose: To verify proper functioning of the flight software during beam stimulation.

Expected result: Satisfactory operation of software.

*See Appendix  
RH*



Calibration Procedure for the IES PFM Unit

Procedure (Note: Either John Hanley or Charles Zinsmeyer must be present for this procedure)

- \_\_\_\_\_ a) Record data in file TBD
- \_\_\_\_\_ b) Start up flight software in IES.
- \_\_\_\_\_ c) Run as for section 10.8.1 but for a single INNER angle position.
- \_\_\_\_\_ d) Record the date and time run is completed.

Date: \_\_\_\_\_  
Time: \_\_\_\_\_ Pass \_\_\_\_\_ Fail \_\_\_\_\_

10.8 Return to SCI6 software

10.8.1 ESA Sweep with INNER Scan

Purpose: Determine satisfactory operation of as many anode and electronics strings as possible.

Expected Result: Should result in INNER profile of the beam.

Procedure:

- \_\_\_\_\_ a) Orient IES at instrument 0-degree OUTER and 0-degree INNER.
- \_\_\_\_\_ b) Set up calibration system scanner using the parameters in the following table.
- \_\_\_\_\_ c) Create SCI6 data files: e0100000IIIIpp.dat to record IES output data.
- \_\_\_\_\_ d) Run ESA sweep with INNER scan by executing script file: e1na.spt.  
This script file uses the following parameters:

| Parameter         | Description                        | Start  | End    | Step Size | No. Steps | Time per Step |      |
|-------------------|------------------------------------|--------|--------|-----------|-----------|---------------|------|
| ESA               | Linear sweep centered around 1 keV | 75 V   | 100 V  | 1.2 V     | 20        | 22s           |      |
| DEF               | Sweep                              | +/-25V | +/-25V | 5V        | 11        | 2 s           |      |
| INNER             | Scan over allowable range          | -115°  | +221°  | 6°        | 57        | 7.7m          |      |
| OUTER             | Fixed at 0°                        | 0°     | 0°     | N/A       | N/A       | N/A           |      |
| <b>TOTAL TIME</b> |                                    |        |        |           |           | hh:mm         | 7:32 |

- \_\_\_\_\_ a) Record the date and time sweep is completed.

Date: \_\_\_\_/\_\_\_\_/\_\_\_\_  
Time: \_\_\_\_:\_\_\_\_:\_\_\_\_

10.8.2 ESA Sweep with OUTER Scan

Purpose: Determine satisfactory operation of ESA and OUTER scan.

Expected Result: Should result in OUTER profile of the beam.

Procedure:

- \_\_\_\_\_ a) Orient IES at instrument -50-degree OUTER and -115-degree INNER.
- \_\_\_\_\_ b) Set up calibration system scanner using the parameters in the following table.
- \_\_\_\_\_ c) Create SCI6 data file: e0100000IIIIpphmm.dat to record IES output data.
- \_\_\_\_\_ d) Run ESA and DEF sweeps with both angle scans by executing script file: e1nl.spt.

*See Appendix*  
*PLT*

Calibration Procedure for the IES PFM Unit

This script file uses the following parameters:

| Parameter         | Description                        | Start    | End      | Step Size | No. Steps | Time per Step |              |
|-------------------|------------------------------------|----------|----------|-----------|-----------|---------------|--------------|
| ESA               | Linear sweep centered around 1 keV | 75 V     | 100 V    | 2.5 V     | 11        | 22 s          |              |
| DEF               | Sweep                              | +/- 25 V | +/- 25 V | 5V        | 11        | 2s            |              |
| INNER             | Scan                               | -115°    | +221°    | 24°       | 29        | 5m            |              |
| OUTER             | Scan                               | -50°     | +50°     | 10°       | 11        | 3h            |              |
| <b>TOTAL TIME</b> |                                    |          |          |           |           | <b>hh:mm</b>  | <b>21:26</b> |

\_\_\_\_\_ e) Record the date and time sweep is completed.  
Date: \_\_\_\_/\_\_\_\_/\_\_\_\_  
Time: \_\_\_\_:\_\_\_\_:\_\_\_\_

10.8.3 End of 1 keV electron beam

\_\_\_\_\_ e) Turn off 1 keV electron beam.

Turn on 2 keV N<sup>+</sup> beam.

10.8.4 ESA Sweep with Inner angle Scan

Purpose: Determine satisfactory operation of as many anode and electronics strings as possible.

Expected Result: Should result in INNER angle profile of the beam.

Procedure:

- \_\_\_\_\_ a) Orient IES at instrument 0-degree OUTER and -115-degree INNER.
- \_\_\_\_\_ b) Set up calibration system scanner using the parameters in the following table.
- \_\_\_\_\_ c) Create SCI6 data files: i0200000i111pp.dat for each position of the INNER angle "I" to record IES output data.
- \_\_\_\_\_ d) Run ESA sweep with INNER scan by executing script file: i2na.spt.  
(Note that 10° steps are used over the coarse sectors while 1° steps are used for the fine ones.)

This script file uses the following parameters:

| Parameter         | Description                        | Start  | End    | Step Size | No. Steps | Time per Step |                   |
|-------------------|------------------------------------|--------|--------|-----------|-----------|---------------|-------------------|
| ESA               | Linear sweep centered around 2 keV | 151V   | 199V   | 2.4 V     | 21        | 42s           |                   |
| DEF               | Sweep                              | +/-50V | -/+50V | 5 V       | 21        | 2s            |                   |
| INNER             | Scan over allowable range          | -115°  | +221°  | 10°/1°    | 32/45     | 42m           |                   |
| OUTER             | Fixed at 0                         | 0°     | 0°     | N/A       | N/A       | N/A           |                   |
| <b>TOTAL TIME</b> |                                    |        |        |           |           | <b>hh:mm</b>  | <b>7:21/11:16</b> |

*See Appendix  
RA*

Calibration Procedure for the IES PFM Unit

\_\_\_\_\_ e) Record the date and time sweep is completed.

Date: \_\_\_\_/\_\_\_\_/\_\_\_\_  
Time: \_\_\_\_:\_\_\_\_:\_\_\_\_

10.8.5 ESA Sweep with INNER and OUTER Scans

Purpose: Determine satisfactory operation of ESA and both INNER and OUTER scan.

Expected Result: Should result in OUTER profile of the beam.

Procedure:

- \_\_\_\_\_ a) Orient IES at instrument 0-degree OUTER and 0-degree INNER.
- \_\_\_\_\_ b) Set up calibration system scanner using the parameters in the following table.
- \_\_\_\_\_ c) Create SCI6 data file: **i20lpp.dat** to record IES output data.
- \_\_\_\_\_ d) Run ESA and DEF sweeps with INNER and OUTER scans by executing script file: **i2nl.spt**.  
This script file uses the following parameters:

| Parameter         | Description                        | Start   | End     | Step Size | No. Steps | Time per Step |
|-------------------|------------------------------------|---------|---------|-----------|-----------|---------------|
| ESA               | Linear sweep centered around 2 keV | 151 V   | 199 V   | 4.8 V     | 11        | 42 s          |
| DEF               | Sweep                              | +/-50 V | +/-50 V | 5 V       | 21        | 2s            |
| INNER             | Scan                               | -115°   | +221°   | 24°       | 15        | 7.7m          |
| OUTER             | Scan                               | -50°    | +50°    | 10°       | 11        | 4/2.4h        |
| <b>TOTAL TIME</b> |                                    |         |         |           |           | <b>21.2h</b>  |

\_\_\_\_\_ e) Record the date and time sweep is completed.

Date: \_\_\_\_/\_\_\_\_/\_\_\_\_  
Time: \_\_\_\_:\_\_\_\_:\_\_\_\_

Turn off 2 keV N<sup>+</sup> beam

10.9 N<sup>+</sup> Beam at 21 keV

Purpose: Set up 21 keV N<sup>+</sup> beam according to the following table:

| Source | Type           | Energy | Current |
|--------|----------------|--------|---------|
| ELC    | N/A            | N/A    | N/A     |
| ION    | N <sup>+</sup> | 21 keV | 0.8 pA  |

Procedure:

- \_\_\_\_\_ a) Set IES DEF and ESA voltages to zero.
- \_\_\_\_\_ b) Deploy Faraday cup (FC)
- \_\_\_\_\_ c) Set up N<sup>+</sup> beam in DP source
- \_\_\_\_\_ d) Turn beam on at 20 kV  $U_{float} + 1 \text{ kV } U_{extraction} = 21 \text{ keV}$  beam and center the FC. Set x-raster to 15 V and y-raster to 30.2 V.
- \_\_\_\_\_ e) Total ion current should not exceed 0.8 pA
- \_\_\_\_\_ f) Go to beam stability mode
- \_\_\_\_\_ g) Verify that beam is steady for 10 minutes before proceeding

*See Appendix*  
*PS*

Calibration Procedure for the IES PFM Unit

- \_\_\_\_\_ h) If beam current is below 0.5 pA, extend MCP sensor and record cts/sec reading  
\_\_\_\_\_ (efficiency measurement)
- \_\_\_\_\_ i) Retract FC

10.9.1 Full ESA Sweep

Purpose: Determine satisfactory operation of optics and ion detectors with a high energy beam.

Expected Result: Should obtain an energy profile of the beam centered around 21 keV.

Procedure:

- \_\_\_\_\_ a) Orient IES at instrument 0-degree OUTER and at an INNER angle such that the beam is centered on channel 15.
- \_\_\_\_\_ b) Create SCI6 data File: `i2100000p022fn.dat` to record IES output data.
- \_\_\_\_\_ c) Run full ESA sweep by executing script file: `i21alln.spt`.  
This script file uses the following parameters for ESA:

| Parameter         | Description                              | Start | End      | Step Size | No. Steps | Time per Step |              |
|-------------------|--|-------|----------|-----------|-----------|---------------|--------------|
| ESA               | Full exponential sweep with 8 bkgd steps | 0 V   | 1.667 kV | Exp       | 256       | 2 s           |              |
| DEF               | Fixed at 0 V                             | 0 V   | 0 V      | N/A       | N/A       | N/A           |              |
| INNER             | Fixed at 22.5°                           | 22.5° | 22.5°    | N/A       | N/A       | N/A           |              |
| OUTER             | Fixed at 0°                              | 0°    | 0°       | N/A       | N/A       | N/A           |              |
| <b>TOTAL TIME</b> |  |       |          |           |           | <b>hh:mm</b>  | <b>00:09</b> |

- \_\_\_\_\_ d) Record the date and time sweep is completed.  
Date: \_\_\_\_/\_\_\_\_/\_\_\_\_  
Time: \_\_\_\_:\_\_\_\_:\_\_\_\_

10.9.2 ESA Sweep and ELEVATION Scan

Purpose: Determine satisfactory operation of as many anode and electronics strings as possible.

Expected Result: Should result in ELEVATION profile of the beam.

Procedure:

- \_\_\_\_\_ a) Orient IES at INNER = -115°, OUTER = 0°.
- \_\_\_\_\_ b) Set up calibration system scanner using the parameters in the following table.
- \_\_\_\_\_ c) Create SCI6 data file: `i21000000000pnhhmm.dat` to record IES output data.
- \_\_\_\_\_ d) Run ESA sweep with ELEVATION scan by executing script file: `i21na.spt`.  
This script file uses the following parameters:

*See Appendix*  
*AB*

Calibration Procedure for the IES PFM Unit

| Parameter         | Description                         | Start  | End    | Step Size | No. Steps | Time per Step |       |
|-------------------|-------------------------------------|--------|--------|-----------|-----------|---------------|-------|
| ESA               | Linear sweep centered around 21 keV | 1367 V | 1667 V | 20 V      | 16        | 2 s           |       |
| DEF               | Fixed at 0 V                        | 0 V    | 0 V    | N/A       | N/A       | N/A           |       |
| INNER             | Scan over allowable range           | -115°  | +175°  | 10°       | 30        | 100 s         |       |
| INNER             | Scan over allowable range           | +175°  | +221°  | 1°        | 46        |               |       |
| OUTER             | Fixed at 0°                         | 0°     | 0°     | N/A       | N/A       | N/A           |       |
| <b>TOTAL TIME</b> |                                     |        |        |           |           | hh:mm         | 01:00 |

\_\_\_\_\_ e) Record the date and time sweep is completed.

Date: \_\_\_\_/\_\_\_\_/\_\_\_\_  
Time: \_\_\_\_:\_\_\_\_:\_\_\_\_

10.9.3 DEF scan for high energy beam

Procedure:

- \_\_\_\_\_ a) Orient IES at instrument to INNER angle +22.5°.
- \_\_\_\_\_ b) Set up calibration system scanner using the parameters in the following table.
- \_\_\_\_\_ c) Create SCI6 data file: i2100000p025pn.dat to record IES output data.
- \_\_\_\_\_ d) Run ESA and DEF sweeps by executing script file: i21n.spt.
- \_\_\_\_\_ e) This script file uses the following parameters:

| Parameter         | Description                         | Start  | End     | Step Size | No. Steps | Time per Step |       |
|-------------------|-------------------------------------|--------|---------|-----------|-----------|---------------|-------|
| ESA               | Linear sweep centered around 21 keV | 1575 V | 1667 V  | 20 V      | 16        | 200s s        |       |
| DEF               | Sweep                               | +/-1kV | +/-1k V | 50V       | 41        | 2s            |       |
| INNER             | Fixed                               | 22.5°  | 22.5°   | N/A       | N/A       | N/A           |       |
| OUTER             | Fixed at 0°                         | 0°     | 0°      | N/A       | N/A       | N/A           |       |
| <b>TOTAL TIME</b> |                                     |        |         |           |           | hh:mm         | 00:40 |

10.9.4 Perform the following DEF scans

| OUTER angle | DEF scan range (V) | Step size (V) |
|-------------|--------------------|---------------|
| -45°        | +/-3280: 3330      | 5             |
| +/-37.5°    | +/-3280: 3330      | 5             |
| +/-30°      | +/-3280: 3330      | 5             |
| +/-22.5°    | +/-3280: 3330      | 5             |
| +/-15°      | +/-2175: 2225      | 5             |
| +/-7.5°     | +/-1075: 1125      | 5             |
| 0°          | +/-25: -/+25       | 5             |

*See Appendix*  
*RA*

Calibration Procedure for the IES PFM Unit

10.9.5 End 21 keV N<sup>+</sup> Beam

- \_\_\_\_\_ a) Turn off 21 keV N<sup>+</sup> beam.

10.10 N<sup>+</sup> Beam at 500 eV

Purpose: Set up 500 eV N<sup>+</sup> beam according to the following table:

| Source | Type           | Energy | Current |
|--------|----------------|--------|---------|
| ELC    | N/A            | N/A    | N/A     |
| ION    | N <sup>+</sup> | 500 eV | 0.8 pA  |

Procedure:

- \_\_\_\_\_ a) Set ESA and DEF voltages to zero.
- \_\_\_\_\_ b) Deploy Faraday cup (FC)
- \_\_\_\_\_ c) Set up 500<sup>+</sup> beam in DP source
- \_\_\_\_\_ d) Total ion current should not exceed 0.8 pA
- \_\_\_\_\_ e) Go to beam stability mode
- \_\_\_\_\_ f) Verify that beam is steady for 10 minutes before proceeding
- \_\_\_\_\_ g) If beam current is below 0.5 pA, extend MCP sensor and record cts/sec reading  
\_\_\_\_\_ (efficiency measurement)
- \_\_\_\_\_ h) Retract FC

10.10.1 Full ESA Sweep

Purpose: Determine satisfactory operation of ESA and ion detector.

Expected Result: Should obtain an energy profile of the beam centered around 500 eV.

Procedure:

- \_\_\_\_\_ a) Orient IES at instrument 0-degree OUTER and 0-degree INNER.
- \_\_\_\_\_ b) Create SCI6 data File: `ip00500000000if00fn.dat` to record IES output data.
- \_\_\_\_\_ c) Run full ESA sweep by executing script file: `i21alln.spt`.  
This script file uses the following parameters for ESA:

| Parameter | Description                              | Start | End      | Step Size         | No. Steps    | Time per Step |
|-----------|--|-------|----------|-------------------|--------------|---------------|
| ESA       | Full/exponential sweep with 8 bkgd steps | 0 V   | 1.667 kV | Exp               | 256          | 2 s           |
| DEF       | Fixed at 0 V                             | 0 V   | 0 V      | N/A               | N/A          | N/A           |
| INNER     | Fixed at 0°                              | 0°    | 0°       | N/A               | N/A          | N/A           |
| OUTER     | Fixed at 0°                              | 0°    | 0°       | N/A               | N/A          | N/A           |
|           |  |       |          | <b>TOTAL TIME</b> | <b>hh:mm</b> | <b>00:09</b>  |

*See Appendix  
Rh*

Calibration Procedure for the IES PFM Unit

\_\_\_\_\_d) Record the date and time sweep is completed.

Date: \_\_\_\_/\_\_\_\_/\_\_\_\_  
Time: \_\_\_\_:\_\_\_\_:\_\_\_\_

10.10.2 Linear ESA sweep and DEF sweep.

Purpose: Determine satisfactory operation of ESA and ion detector.

Expected Result: Should obtain a higher resolution energy profile of the beam centered around 500 eV and deflector profiles.

Procedure:

- \_\_\_\_\_a) Create SCI6 data File: i0050000IIIIIfOlpn.dat to record IES output data.
- \_\_\_\_\_b) Run ESA and DEF sweeps with limited INNER scan by executing script file:1500na.spt.
- \_\_\_\_\_c) This script file uses the following parameters for ESA:

| Parameter         | Description                | Start    | End      | Step Size | No. Steps | Time per Step |       |
|-------------------|----------------------------|----------|----------|-----------|-----------|---------------|-------|
| ESA               | Linear sweep around 500 eV | 38 V     | 46 V     | 1 V       | 9         | 100 s         |       |
| DEF               | Sweep                      | +/-100 V | +/-100 V | 5 V       | 21        | 2 s           |       |
| INNER             | Scan over range            | -115°    | +175°    | 10°       | 18        | 13 m          |       |
| INNER             | Scan over range            | +175°    | +221°    | 1°        | 47        |               |       |
| OUTER             | Fixed at 0°                | 0°       | 0°       | N/A       | N/A       | N/A           |       |
| <b>TOTAL TIME</b> |                            |          |          |           |           | hh:mm         | 08:00 |

10.10.3 Perform Sweeps and Scans as follows:

| OUTER Angle | DEF range (V) | step size (V) |
|-------------|---------------|---------------|
| -45°        | 150-200       | 5             |
| -30°        | 80-130        | 5             |
| -15°        | 25 : 75       | 5             |
| 0°          | -25 : +25     | 5             |

10.10.4 End 500 eV N<sup>+</sup> Beam

\_\_\_\_\_e) Turn off 500 eV N<sup>+</sup> Beam.

10.11 Electron Beam at 1 keV and N<sup>+</sup> Beam at 2 keV

Purpose: Set up 1 keV electron beam and 2 keV N<sup>+</sup> beam according to the following table:

## Calibration Procedure for the IES PFM Unit

| Source | Type           | Energy | Current |
|--------|----------------|--------|---------|
| ELC    | ELC            | 1 keV  | 0.8 pA  |
| ION    | N <sup>+</sup> | 2 keV  | 0.8 pA  |

### Procedure:

#### N<sup>+</sup> beam:

- \_\_\_\_\_ a) Set ESA voltage to zero
- \_\_\_\_\_ b) Deploy Faraday cup (FC)
- \_\_\_\_\_ c) Set up N<sup>+</sup> beam in DP source
- \_\_\_\_\_ d) Turn beam on at 1 kV U<sub>float</sub> + 1 kV U<sub>extraction</sub> = 2 keV beam and center the FC. Set x-raster to 15 V and y-raster to 30.2 V.
- \_\_\_\_\_ e) Total ion current should not exceed 0.8 pA
- \_\_\_\_\_ f) Go to beam stability mode
- \_\_\_\_\_ g) Verify that beam is steady for 10 minutes before proceeding
- \_\_\_\_\_ h) Retract FC

#### Electron beam:

- \_\_\_\_\_ a) Run electron beam up to 1 keV using procedure in electron beam manual, FRA-2X1-2/EGPS-2X1

### 10.11.1 Full ESA Sweep

**Purpose:** Determine satisfactory operation of ESA and ion and electron detectors stimulated simultaneously.

**Expected Result:** Should obtain an energy profile of the electron beam centered around 1 keV and of the ion beam around 2 keV.

#### Procedure:

- \_\_\_\_\_ a) Orient IES at instrument 0-degree OUTER and 0-degree INNER.
- \_\_\_\_\_ b) Create SCI6 data File: **e1i200fn.dat** to record IES output data.
- \_\_\_\_\_ c) Run full ESA sweep by executing script file: **e1i1alln.spt**.  
This script file uses the following parameters for ESA:

| Parameter         | Description                             | Start | End       | Step Size | No. Steps | Time per Step |       |
|-------------------|---|-------|-----------|-----------|-----------|---------------|-------|
| ESA               | Full exponential scan with 8 bkgd steps | 0 eV  | 1.667 keV | Exp       | 256       | 2 s           |       |
| DEF               | Fixed at 0°                             | 0°    | 0°        | N/A       | N/A       | N/A           |       |
| INNER             | Fixed at 0                              | 0°    | 0°        | N/A       | N/A       | N/A           |       |
| OUTER             | Fixed at 0°                             | 0°    | 0°        | N/A       | N/A       | N/A           |       |
| <b>TOTAL TIME</b> |   |       |           |           |           | hh:mm         | 00:21 |

- \_\_\_\_\_ d) Record the date and time sweep is completed.

Date: \_\_\_/\_\_\_/\_\_\_  
Time: \_\_\_:\_\_\_:\_\_\_

*See Appendix*  
*PLH*



## Calibration Procedure for the IES PFM Unit

### 10.11.2 ESA Sweep with INNER Scan

**Purpose:** Determine satisfactory operation of as many anode and electronics strings as possible.

**Expected Result:** Should result in INNER profile of the beam.

**Procedure:**

- \_\_\_\_\_ a) Orient IES at instrument 0-degree OUTER and 0-degree INNER.
- \_\_\_\_\_ b) Set up calibration system scanner using the parameters in the following table.
- \_\_\_\_\_ c) Create SCI6 data file: **b01200.dat** to record IES output data.
- \_\_\_\_\_ d) Run ESA sweep with INNER scan by executing script file: **e111na.spt**.  
This script file uses the following parameters:

Calibration Procedure for the IES PFM Unit

| Parameter         | Description                       | Start | End   | Step Size | No. Steps | Time per Step |       |
|-------------------|-----------------------------------|-------|-------|-----------|-----------|---------------|-------|
| ESA               | Linear sweep covering 1 and 2 keV | 50 V  | 202 V | 4 V       | 8         | 2 s           |       |
| DEF               | 0V                                | 0V    | 0V    | 0V        | N/A       | N/A           |       |
| INNER             | Scan over range                   | -115° | +175° | 5°        | 59        | 100 s         |       |
|                   | Scan over range                   | +175° | +221° | 2°        | 24        |               |       |
| OUTER             | Fixed at 0°                       | 0°    | 0°    | N/A       | N/A       | N/A           |       |
| <b>TOTAL TIME</b> |                                   |       |       |           |           | hh:mm         | 01:00 |

\_\_\_\_\_ e) Record the date and time sweep is completed.

Date: \_\_\_\_/\_\_\_\_/\_\_\_\_  
Time: \_\_\_\_:\_\_\_\_:\_\_\_\_

10.11.3 End of calibration tests. Turn off electron and ion beams.

- \_\_\_\_\_ a) Turn off 2 keV N<sup>+</sup> beam.
- \_\_\_\_\_ b) Turn off 1 keV electron beam.

*See Appendix*

10.12 Archive Data

When calibration is complete, all the files in the D:\data\FM subdirectories from each of the machines shall be copied and written to a CD-ROM.

10.13 Comments:

10.14 Closure:

IES PI Signature \_\_\_\_\_

IES Project manager Signature \_\_\_\_\_

IES QA Signature \_\_\_\_\_

11 Recorded File Log

| Date    | Time  | Filename   | Faraday Cup | ESA range | DEF range | Comments | Section Executed |
|---------|-------|------------|-------------|-----------|-----------|----------|------------------|
| 10/1/99 | 14:00 | TEOISD.dat | 0.5 pA      |           |           |          | 10.5.2           |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |
|         |       |            |             |           |           |          |                  |

*See Appendix*  
*PA*

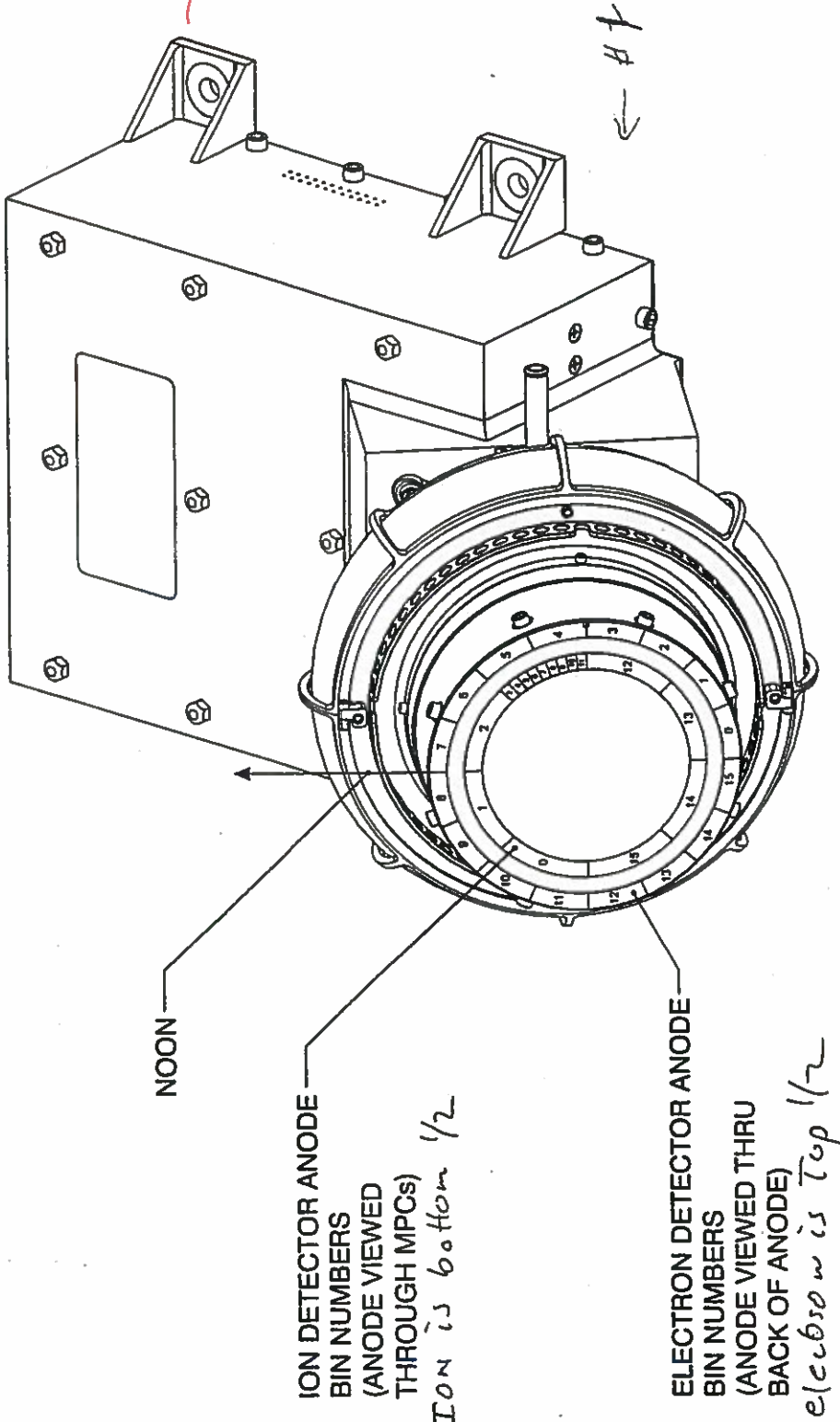
12 MCP Test Log

| Date | Time | Filename | Ion<br>MCP V | Electron<br>MCP V | i sector/Counts | e Sector/Counts | Comments |
|------|------|----------|--------------|-------------------|-----------------|-----------------|----------|
|      |      |          | -2500        |                   |                 |                 |          |
|      |      |          | -2520        |                   |                 |                 |          |
|      |      |          | -2540        |                   |                 |                 |          |
|      |      |          | -2560        |                   |                 |                 |          |
|      |      |          | -2580        |                   |                 |                 |          |
|      |      |          | -2600        |                   |                 |                 |          |
|      |      |          | -2620        |                   |                 |                 |          |
|      |      |          | -2640        |                   |                 |                 |          |
|      |      |          | -2660        |                   |                 |                 |          |
|      |      |          | -2680        |                   |                 |                 |          |
|      |      |          | -2700        |                   |                 |                 |          |
|      |      |          |              | 2500              |                 |                 |          |
|      |      |          |              | 2520              |                 |                 |          |
|      |      |          |              | 2540              |                 |                 |          |
|      |      |          |              | 2560              |                 |                 |          |
|      |      |          |              | 2580              |                 |                 |          |
|      |      |          |              | 2600              |                 |                 |          |
|      |      |          |              | 2620              |                 |                 |          |
|      |      |          |              | 2640              |                 |                 |          |
|      |      |          |              | 2660              |                 |                 |          |
|      |      |          |              | 2680              |                 |                 |          |
|      |      |          |              | 2700              |                 |                 |          |

*See Appendix*

*RA*

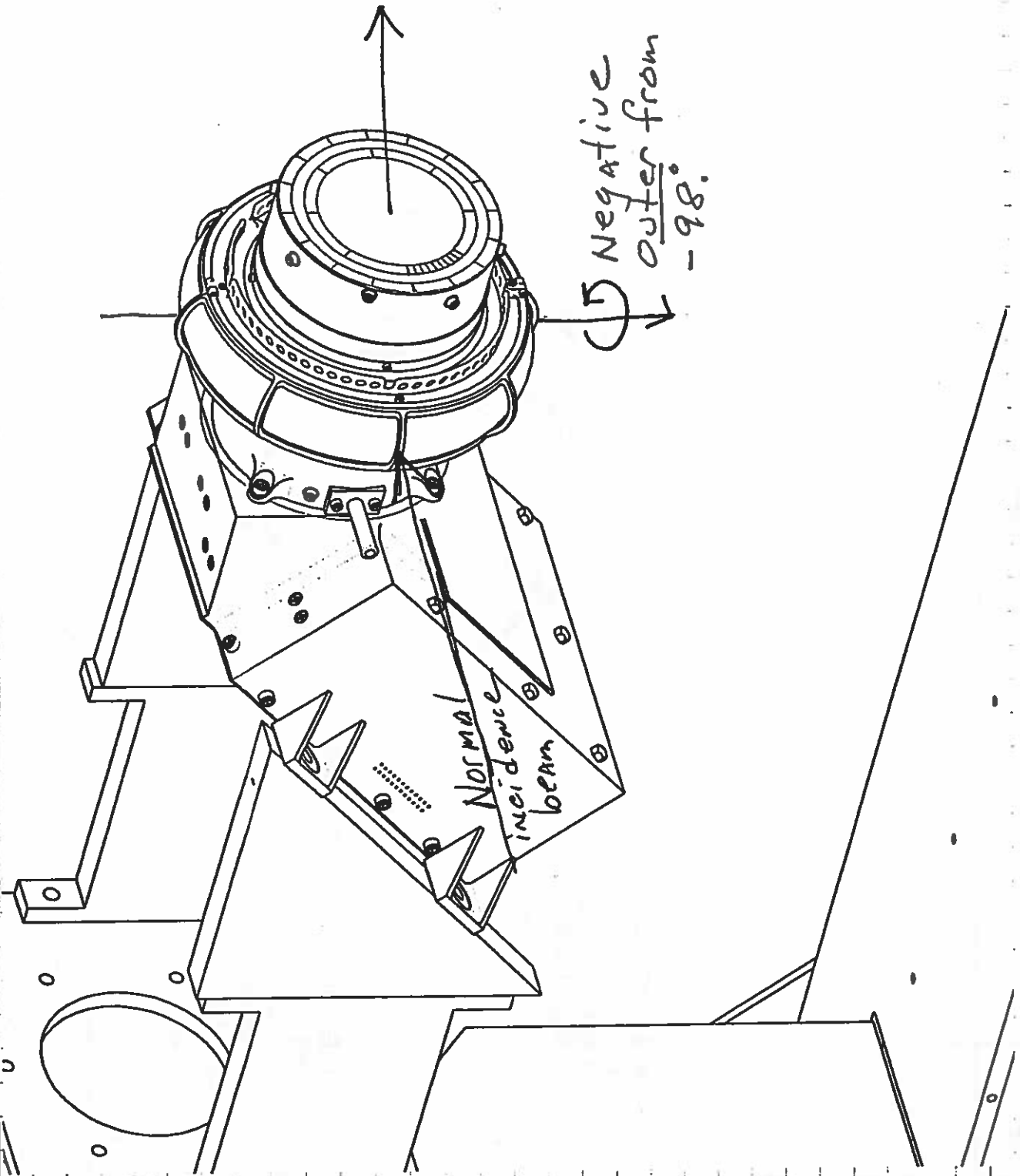
*Appendix*



T4002506b

# IES Cal Setup:

Outer; Nominal zero =  $-98^\circ$  from home



From previous pages:

Outer

When outer is more negative than  $-95^\circ$ ,  
beam will come from box direction (below).

When outer is more positive than  $-95^\circ$ ,  
beam will come from direction away  
from box.

Inner

Sept. 6, 2001

1224 PM EDT  
2 KeV D<sup>+</sup> beam. Only run on FSA script.  
170V → 200V X 2V steps

INNER +30: ~~ipkevtscf20.0030.0dpp~~  
↳ Bin 15.

1324 PM EDT  
Working on a variant of 10.8.3 in cat procedure  
Go to INNER = +45 (Bin 15/14 intersection)

File name - i2kev0.0045.0dpp  
START STEP Num  
Def. Sweep: -26 5V 11  
FSA 170 21.5 21

END 1324 PM EDT  
BEG 1326  
INNER → +44; Repeat ~~above~~ above sweep.  
File name - i2kev0.0044.0dpp

END 1335  
BEG 1336  
INNER → +42 Repeat above  
FILENAME → i2kev0.0042.0dpp

END 1344  
BEG 1346  
INNER → +40 Repeat above  
FILENAME → i2kev0.0040.0dpp

END 1354  
BEG 1355  
INNER → +38 Repeat above  
FILENAME → i2kev0.0038.0dpp

END 1404  
BEG 1413  
INNER → +46 Repeat above  
FILENAME → i2kev0.0046.0dpp



6 Sep 6. 0276

1415 At this point, pressure =  $5.0 \times 10^{-7}$  T. Excursion to  $5.3 \times 10^{-7}$  T. Now decide we can operate at pressure up to  $5.0 \times 10^{-7}$  T (NO MOTION) or  $6.0 \times 10^{-7}$  T (MAX MOTION). (cup)

REC 1415 INNER  $\rightarrow +48^\circ$  Repeat above  
END 1423 FILENAME  $\rightarrow$  i2kevo.0048.0dpp

REC 1426 INNER  $\rightarrow +50^\circ$  Repeat above  
END 1435 FILENAME  $\rightarrow$  i2kevo.0050.0dpp

End of Experiment

Summary: Carbide intersection between B14 & B15 looks like  $\sim +43.5^\circ$ . ~~FWHM  $\sim 5^\circ$~~  width  $\sim 5^\circ$ .

REC 1450 Move to INNER =  $+43.5^\circ$   
OUTER =  $+15^\circ$

Set ESA to  $-184$  V

Scan Deflection:  $+144 \rightarrow +200$ , 21 steps, 5.8 V each

END 1451 Saw peak near  $-190$  to  $-195$  according to GSE monitor  
BUT  $+190$  to  $+195$  according to script command.

1457  $43.5^\circ$  Inner VESA =  $-170 \rightarrow -200$ , 21 steps, 1.5 V ea  
 $15.0^\circ$  Outer VDEF =  $+180 \rightarrow +210$ ,  
FILE =

Rec 1515  
ALB 1515

ESA  $170$  V  $\rightarrow$   $200$  V, 21 steps

DEF  $5^\circ \rightarrow 25^\circ$ , 11 steps

Filename ~~i2kevo.0043.5dpp~~ i2kevo.defscan.15.0d43.5dpp  
Stoppin' in DEF was too coarse.

OUT  $\swarrow$   
 $\searrow$

Note: When we did DEF scan, we noted that the DEF value reported on the GSE was negative. This is an error in GSE conversion table that needs to be fixed.

DEF → inner scan (faster)  
 ESA → outer scan

(12.5-17.5)

IES CWL

6 Sep 6 (Cont.)

BEG = ? ESA: 170 → 200, 1.5V steps, 21 steps  
 DEF: 12.5-17.5, 0.25° steps, 17 steps

END = 1530 Filename: 2keV Def scan 10deg - 20deg 15.0D 43.5D PP

Still, DEF peaks

BEG = ? ESA: 170-200, 1.5V steps, 21 steps  
 DEF: 12.5-17.5, 0.25° steps, 17 steps

END = 1551 Filename: 2keV DEF scan 12.5deg 17.5deg 15.0D 43.5D PP

BEG = ? ESA: 170-200, 1.5V steps, 21 steps  
 DEF: 170-210, 2.5V steps, 17 steps

END = 1610xt Filename: 2keV DEF scan 12.5deg 17.5deg 15.0D 43.5D PP  
 2keV DEF scan 170 210V 15.0D 43.5D PP

BEG = 1625 ESA: (2keV) 170-200, 1.5V steps, 21 steps  
 DEF: (+30°) 340-420, 5V steps, 17 steps

END = 1440 Filename: 2keV Def scan 340 420 V 30.0 D 43.5D PP

BEG = ? ESA: (2keV) 170-200, 1.5V steps, 21 steps  
 DEF: (+45°) 510-630, 7.5V steps, 17 steps

END = 1705 Filename: 2keV Def scan 510 630V 45.0D 43.5D PP

BEG = 1712 ESA: (2keV) 170-200, 1.5V steps, 21 steps  
 DEF: (-15°) -210 - -170, 2.5V steps, 17 steps

END = 1728 Filename: 2keV Def scan -210 -170V -15.0 D 43.5D PP

BEG = 1735 ESA: (2keV) 170-200, 1.5V steps, 21 steps  
 DEF: (-30°) -420 - -340, 5V steps, 17 steps

END = 1751 Filename: 2keV Def scan -420 -390V -30.0 D 43.5D PP

BEG = 1758 ESA: (2keV) 170-200, 1.5V steps, 21 steps  
 DEF: (-45°) -638 - -502, 9.5V steps, 17 steps

END = 1805 Filename: 2keV Def scan -638 -502V -45.0D 43.5D PP

} aborted  
 can't find  
 beam

Tried ESA 184V, scanned DEF -453 - -509V at  
 outer angle of 40° and didn't find beam

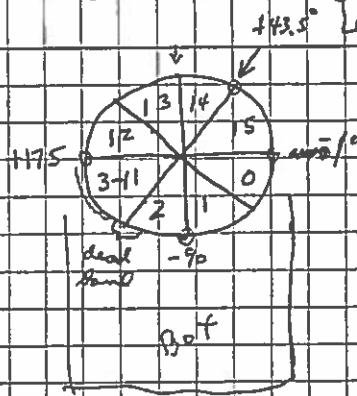
Tried ESA 184V, scanned DEF -420 - -340V, at  
 outer angle of 30° and found count rates lower than  
 before (200 cps) consistent with previous sweep.

THE CAL

$V_{ref} \approx 70E$   
 $V_{y keV}$



6 SEPT 29 01



+225 polar angle (inner)  
-115 limits

azimuth angle (outer) limit 50°  
at 0° go +15V to locate 0

locate polar angle boundaries  
do diff. scan at every other bdy

Electron channel 11 noisy (50-100 c/s)

- Trial -15° scan and got  $> 800$  c/s
- Conclude that max. outer is somewhere between -30° and -40° perhaps because of beam distortion or beam boundary. Raster at max. beam diam. of 15 cm.
- Moving to outer of 0° and sectors 0/15.
- Keystroke error on angle mechanism causes s/w latch-up. Contacted Newport Customer Support.
- Controller back on line, registered inner at 43.5° by equalizing channels 14 and 15

1918 • Move to 0° (-43.5° offset from 43.5°) on inner.

- 43.5° = -6° on controller
- channel 0/15 bdy occurs at -50.5° on controller
- $\therefore$  channel 14/15 bdy is 43.5° away from 0/15 bdy and 0/15 bdy is at -1°.

1928 Note - Inner angle data circularized starting here - see note on Page  
 BEG= ESA: (2keV) 170-200, 1.5V steps 21 steps (about  
 ENDF DEF: (0°)  
 Filename: 2keV.Dofscan V 0.0D-1.0D PP)

Note: Electron channel 11 counts drop to 10-20 c/s (1930)  
 Electron " " " go back up (1935)  
 " " " " drop again (1936)

Another controller glitch. Had to power off to stop scan.  
Re-zeroed. Now 0/15 def is at  $-24.1^\circ$  on controller.

1950

Test scan: ESA: 184V

1. DEF:  $-10$  to  $+10$  V2. DEF:  $-15$  to  $+15$  V3. DEF:  $-15$  to  $+30$  V (zero response at  $-15$  and  $20$  V)Conclude that offset is  $1^\circ$  or less.Offset =  $0^\circ$ Inner =  $-24.1^\circ \rightarrow -1.0^\circ$  in previous reference frame.

BEG: 2013

ESA: (2keV)

170-200

1.5V steps

21 steps

END: 2026

DEF: ( $0^\circ$ ) $-20$  to  $+20$ 

17 steps

Filename:

2keVDefscan -20 20 V 0.0D -1.0D PP

2005

Lost contact with instrument. Power cycle.

2012

Instr. back on line.

BEG: 2048

ESA: (2keV)

170-200

1.5V steps

21 steps

END: 2110

DEF: ( $15^\circ$ )

170-210

2.5V steps

17 steps

Filename:

2keVDefscan 170 210 V 15.0D -1.0D PP

2032

Lost contact with instrument

2045

Instr. back on line

BEG: 2115

ESA: (2keV)

170-200

1.5V steps

21 steps

END: 2125

DEF: ( $30^\circ$ )

340-420

5V steps

17 steps

Filename:

2keVDefscan 340 420 V 30.0D -1.0D PP

BEG: 2140

ESA: (2keV)

170-200

1.5V steps

21 steps

END: 2148

DEF: ( $40^\circ$ )

540-660

17 steps

Filename:

2keVDefscan 540 660 V 45.0D -1.0D PP

Note: Ran  $40^\circ$  instead of  $45^\circ$  because flukes were too low at  $45^\circ$ .

IES CAL

02429.01.103

6 Sep 83 01

BEG: 2155 ESA: (2keV) 170-200 1.5V steps 21 steps  
 END: 2212 DEF (-15°) -210 -170 17 steps  
 Filename: 2keVdefscan -210 -170V -15.0D -1.0D PP

Burda out; Pollock in @ 2200 HRS

Move outer to -30° Do exploratory scan with:

$V_{ESA} = -184$ ,  $-450 \leq V_{DEF} \leq -320$  53 steps (5V each)  
 Saw weak (50 Hz max) peak in CH 15, and much weaker  
 (factor of 10) peak in CH 0.

BEG: 2221 ESA: (2keV) 170-200 1.5V steps 21 steps  
 END: 2234 DEF (-30°) -420 -340 5V steps 17 steps  
 Filename: 2keVdefscan -420 -340V -30.0D -1.0D PP

Again - CH 15 ~ factor of 10 larger peaks than CH 0.

Move to OUTER = -40°, INNER = -1°

BEG: 2240 ESA (2keV) 170-200 1.5V steps, 21 steps  
 DEF (-40°) -660 -540 7.5V steps, 17 steps  
 END: 2253 FILENAME: 2keVdefscan -660 -540V -40.0D -1.0D PP

At beginning of sequence we saw spike ~ 30 Hz in  
 Ion bin 140 saw  
 Saw nothing but noise on this scan. Not sure why.

\* Set up exploratory scan: No file

$V_{ESA}$ : None -184V  
 $-700 \leq V_{DEF} \leq -500$ , 5V steps, 41 steps.  
 Saw noise only.

\* ~~Move outer to -30°~~ ~~Pollock 2400~~  
 \* Move inner to -29.1° (-6°)  
 Set up exploratory scan:

$V_{ESA}$ : -184  
 $-700 \leq V_{DEF} \leq -500$ , 5V steps, 41 steps  
 Saw peak (17 Hz) in CH 0

\* Same, but at INNER = -29.1° (+5°)  
 Saw 17 Hz peak near -535 / def → over

From Above

6 Sept. - 17 Sept.

Remember - we are shooting into blind spot.

This messes up our transmission in ways difficult to understand.

Move outer  $\rightarrow$  0 degMove inner  $\rightarrow$  +6 deg

REF: 2329

VESA (2keV) 170-200 1.5V ST 21 ST

VDEF (0°) -20+20 2.5V ST 17 ST

END: 2330

FILENAME: 2KEVDEFSCAN-20\_20V0.OD6.ODPP

Need to see -30  $\rightarrow$  +10 on VDEFLECT.

REF 2333

VESA (2keV) 170-200 1.5V ST 21 ST

VDEF (0°) -30  $\rightarrow$  +10 2.5V ST 17 ST

END 2336

2KEVDEFSCAN-30\_10V0.OD6.ODPP

Saw Cook peaks, but they bumped up against the +10V rail, especially at large ESA voltages. Repeat now with -30  $\rightarrow$  +30, 25 scans.

REF 2349

VESA (2keV) 170-200 1.5V ST 21 ST

LOG  $\rightarrow$  9/07VDEF (0°) -30  $\rightarrow$  +30 2.5V ST 25 ST

NO 0068

FILENAME 2KEVDEFSCAN-30\_30V0.OD6.ODPP

At VESA = -170, VDEF peak extends from -25  $\rightarrow$  <sup>range</sup> ~~0~~ to +5

Change script file from VDEFLECT=25 ST to VDEFLECT=17 ST

Move ~~the~~ INNER to +6°

REF 0013

VESA (2keV) 170-200 1.5V ST 21 ST

END 0024

VDEF (0°) -30 30 ~~2.5V ST~~ 17 ST

FILENAME: 2KEVDEFSCAN-30\_30V0.OD4.ODPP

REF 0028

Move inner to +2°

VESA (2keV) 170-200 1.5V ST 21 ST

END 0041

VDEF (0°) -30 30 3.75V ST 17 ST

FILENAME 2KEVDEFSCAN-30\_30V0.OD2.ODPP

# TES CAL

9/2/01 (cont) 33

Move INNER to 0°

|                  |             |                               |          |       |
|------------------|-------------|-------------------------------|----------|-------|
| BEG 0043         | VESA (2keV) | 170 - 200                     | 1.5V ST  | 21 ST |
| END 0044<br>0056 | VDEF (0°)   | -30 → 30                      | 3.75V ST | 17 ST |
|                  | FILE        | 2keV/DEFSCAN-30_30V0.0D0.0D?? |          |       |

Move INNER to -2°

|          |             |                                |          |       |
|----------|-------------|--------------------------------|----------|-------|
| BEG 0100 | VESA (2keV) | 170 - 200                      | 1.5V ST  | 21 ST |
| END 0113 | VDEF (0°)   | -30 → 30                       | 3.75V ST | 17 ST |
|          | FILE        | 2keV/DEFSCAN-30_30V0.0D-2.0D?? |          |       |

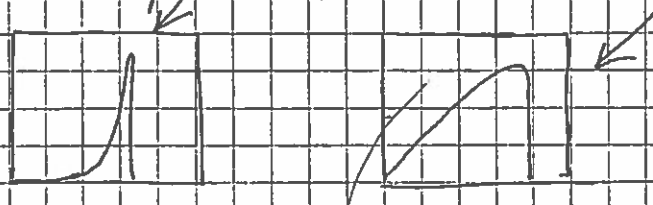
Move INNER to -4°

|          |             |                                |          |       |
|----------|-------------|--------------------------------|----------|-------|
| BEG 0114 | VESA (2keV) | 170 - 200                      | 1.5V ST  | 21 ST |
| END 0127 | VDEF (0°)   | -30 → 30                       | 3.75V ST | 17 ST |
|          | FILE        | 2keV/DEFSCAN-30_30V0.0D-4.0D?? |          |       |

Note: Surprisingly, ~~VESA~~ counts at VESA = -170 already very high (> 100/sample), compare to other angles. Speculate that this is due to severe energy straggling due to grazing incidence scattering by low webbed VANE between Bin 15 & 0 (on Bin 0 side).

Spectrum upstream of Vane

DOWNSTREAM



|          |                   |                                |           |         |       |
|----------|-------------------|--------------------------------|-----------|---------|-------|
| BEG 0131 | Move INNER to -6° | VESA (2keV)                    | 170 - 200 | 1.5V ST | 21 ST |
| END 0144 | VDEF (0°)         | -30 → 30                       | 3.75V ST  | 17 ST   |       |
|          | FILE              | 2keV/DEFSCAN-30_30V0.0D-6.0D?? |           |         |       |

Note See similar effect at this angle as described above at -4°. Worried about this. Don't understand. Maybe coating is different on two sides of vane?!

OVER

7 Sep 01 (cont)

REF: 0145 Move INNER to -80  
 END: 0158 VESA (2keV) 170-200 1.5V ST 21 ST  
 VDEF (09) -30 30 375V ST 17 ST  
 FILE = 2keVDEFSCAN-30.30V0.0D-6.00PP

Now, same problem at low end. Will execute, a success extended at low end.

REF: 0200 Keep inner at -80  
 END: 0213 VESA (2keV) 130-210 4V ST 21 ST  
 VDEF (09) -30 30 375V ST 17 ST  
 FILE = 2keVWIDEDEFSCAN-30.30V0.0D-6.00PP

Turn on at low end is sudden

158V → ~ 20 CTS  
 162V → ~ 50 CTS  
 166V → ~ 500 CTS  
 170V → ~ 1200 CTS

Now move to new INNER: Tubers etalon between bins 1 & 2.

Move INNER to -85, VESA to -184 VDEF = 0

| INNER: | CH1 CTS                 | CH2 CTS                 |
|--------|-------------------------|-------------------------|
| -85    | 596, 619, 551, 544, 543 | 5, 4, 3, 2, 5           |
| -86    | 462, 461, 496, 532, 620 | 5, 5, 4, 6              |
| -87    | 57, 56, 615, 640, 528   | 10, 9, 4, 6, 9          |
| -88    | 323, 314, 352, 394, 401 | 11, 11, 12, 22, 22      |
| -89    | 247, 279, 240, 294, 259 | 21, 17, 23, 22, 25      |
| -90    | 105, 115, 111, 103, 101 | 8, 8, 13, 7, 7          |
| -91    | 114, 111, 117, 136, 125 | 18, 17, 25, 23, 13      |
| -92    | 10, 11, 9, 10, 17       | 7, 8, 6, 4, 2           |
| -93    | 8, 8, 5, 7, 5           | 21, 17, 15, 23, 19      |
| -94    | 2, 0, 0, 1, 1           | 4, 3, 8, 3, 5           |
| -95    | 13, 3, 9, 4, 5          | 212, 199, 212, 183, 191 |
| -96    | 10, 4, 4, 6, 4          | 363, 376, 354, 346, 378 |
| -97    | 4, 2, 6, 6, 6           | 412, 307, 378, 372, 411 |
| -98    | 4, 5, 8, 3, 2           | 448, 408, 468, 463, 450 |
| -85    | 494, 532, 465, 515, 553 | 4, 5, 5, 5, 8           |

no. 50  
 6000  
 930  
 CH1  
 CH2  
 number of bins  
 5000



# IES CAL

Sept 17 (2015)

BEG: 0257  
 END: 1510  
 INNER = -85  
 VESA (2keV) 170-200 1.5V ST 21 ST  
 VDEF (0°) -30, 30 3.75V ST 17 ST  
 FILE 2keV/DEFSCAN-30.30V0.0D-85.0DPP

Note: Bumping badly up against the edge of pass band in deflection at high end of VESA pass band

Therefore, we will expand our deflection sweep from -30,30 to ~~30~~ -35,35. We will remain 17 step sweep.

BEG: 0312  
 END: 0325  
 INNER = -85  
 VESA (2keV) 170-200 1.5V ST 20 ST  
 VDEF (0°) -35, 35 4.375V ST 17 ST  
 FILE 2keV/DEFSCAN-35.35V0.0D-85.0DPP

BEG: 0340  
 END: 0354  
 INNER = -87  
 VESA (2keV) 170-200 1.5V ST 21 ST  
 VDEF (0°) -35, 35 4.375V ST 17 ST  
 FILE 2keV/DEFSCAN-35.35V0.0D-87.0DPP

BEG: 0340  
 END: 0353  
 INNER = -89  
 VESA (2keV) 170-200 1.5V ST 21 ST  
 VDEF (0°) -35, 35 4.375V ST 17 ST  
 FILE 2keV/DEFSCAN-35.35V0.0D-89.0DPP

BEG: 0524  
 END:  
 INNER = -91  
 VESA (2keV) 170-200 1.5V ST 21 ST  
 VDEF (0°) -35, 35 4.375V ST 17 ST  
 FILE 2keV/DEFSCAN-35.35V0.0D-91.0DPP

- Issues
- ① Motion types - Fix: Type TB? System will report error & self-fix if possible. Otherwise cycle power required when cycle power:
    - A) ~~3MO~~ "3MO" ⇒ green LED for 3
    - B) "4MO" ⇒ green LED for 4
  - ② Electrons, CH it noisy all night (~100 p/samp) variable
  - ③ Problems near edges. Specular reflection w/ energy degradation

④ GSE Lockups. Twice during evening - Crowbar power off. Mike McEllan prefers:

a) Install V/S plug, then power off - OR

b) Just cycle PC, no inst power off

⑤ Bumping up against top end of VDEF sweep (+35V) at top end of ESA sweep

2/17/01  
Ham

New Skoff notes McCoun, Zinswiler, Brooker

1) Complete point edge scans:  
-93, -95, -97, -99, -101 Tuner

4:10 -93° 2 keV DEFSCAN35\_35V 0.000-93.00pp  
Def -35 to 35 V 17 steps  
ESA 170 to 200 V 21 steps

$P = 4.3 \times 10^{-7} \text{ Torr}$

4:18 -95° inner 2 keV Defscan -35-35V 0.000-95.00pp  
Def -35 to 35 V 17 step  
ESA 170 to 200 V 21 step  
Outer 0° } (\* reset previously - results find zeros  
Inner -95° }

4:38 -97° inner 2 keV Defscan -35-35V 0.000-97.00pp

Def -35 to 35 V 17 step  
ESA 170 to 200 V 21 step  
Outer 0° } (\*  
Inner -95° }

~~7:50 c/s, n=6, 2~~

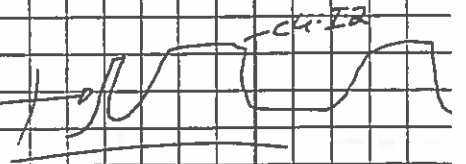
4:52 -99° inner i 2 kev Defscan -35 35v 0.0d -99

Def -35 to 35 17 step  
ESA 170 to 200V 21 step  
Outer 0°

0506 -101° inner i 2 kev Defscan -35 35v 0.0d -101

~~0506~~ Def -35 to 35 17 steps  
ESA 170 to 200 21 steps  
Outer

strange narrow peak on 1<sup>st</sup> reflector scan  
2-3 pts wide



~05:24 i 2 kev Defscan 540-660V 40.0d -93.0d pp  
-93° Inner  
+40 Outer

ESA 170 to 200V 21 steps  
Def 540 to 660V 17 steps

$P = 4.3 \times 10^{-7}$  (only up from  $4.2 \times 10^{-7}$  before turn)

Abort Script Deflector scan Plot large angle (closes range)

05:34 -0 HV<sup>+</sup> down, restart GSE (GSE latchup recovery)

~~05:34~~ { repeat but with Def 520-680 21 steps  
also set Inner to -91° to better split counts  
i 2 kev Def scan 520 680v 40.0d -92.5 dpp  
92.5

05:43 -92.5 Inner  
+40 Outer

ESA 170 to 200V 21 steps  
Def 520 to 680V 21 steps

06:00  $P = 4.2 \times 10^{-7}$

06:02 -92.5 Inner i 2 kev Defscan 260-340v 20.0d -92.5 dpp  
+20 Outer  
ESA 170 to 200V 21 steps  
Def 260 to 340V 21 steps

$P = 4.3 \times 10^{-7}$  just turning

9/7/01

0619

 $4.2 \times 10^{-7}$  TOuter  $-20^\circ$ Inner  $-92.5^\circ$ 

ESA 170 to 260V 21 steps

Def  $-260$  to  $-340$ V 21 steps

0622

i 2 keV Defscan  $-260$   $-340$ V  $-20.0$ d  $-92.5$ dppOuter  $-70^\circ$ Inner  $-92.5^\circ$ 

ESA 170 to 260V 21 steps

Def  $-520$  to  $-680$  21 steps

0642

i 2 keV Defscan  $-520$   $-680$ V  $-40.0$ d  $-92.5$ dpp

0646

Electron N uniscants took major drop from  $10^3$ - $100^3$   
down to a few/s

no apparent correlation w/ anything changing

0657

rise in E11 counts from 2-3 up to  $10^3$ - $100^3$ 

no change in Pressure, SES counts, etc

Looking for Angle zerosturn inner to present zero P to  $4.4 \times 10^7$ turn inner to  $+92^\circ$  (manual turn) error  $42.2^\circ$  not  $98^\circ$ \* homed inner stage then turn  $42.2^\circ$  and reset zeros  
Angles ok after thislooks like there may have been an accumulated error  
in outer stagelast relay before re zero on home was  $97.001$ But should have been  $98^\circ$ Angles from P291 to here suspect  $\sim 1^\circ$ 

07:23

Angles NOW RESETP =  $4.6 \times 10^7$  (lots of tuning)

HV<sup>s</sup> off, turn off IES

RGA scan

Burn Backup of cal data thus far

0820 Restarting Cal  $P = 4.3 \times 10^{-7}$   
 next topic - the high res sectors  
~~reprogram IES, ~~turn off HV~~~~

Turn inner to +175°,  $P = 4.7 \times 10^{-7}$  T

0823 Bringing instrument + HV<sup>s</sup>  
 $4.3 \times 10^{-7}$

826 ~~184~~ 184 V on ESA

+152° inner & is - center of ch 12

Burn is much more stable than yesterday so we decided to take a scan across the center of a large mode (#12)

Inner +152°

Outer 0°

ESA 170 to 200V 21 steps

Def -35 to +35 V 17 steps

0832 i 0 KeV Defscan -35 35V ~~170.0d~~ 152.0dpp

more symmetric peaks than near edges of channels

setting up to run similar scans each 2° of inner (polar) angle starting at 176°

for all ESA 170V to 200V in 21 steps  
 Def -35V to 35V in 17 steps  
 Outer 0°

$P = 4.2 \times 10^{-7}$

|                        | Start time    | Inner              | File name                    |           |
|------------------------|---------------|--------------------|------------------------------|-----------|
|                        | 08:47         | 176°               | i 0 KeV Defscan -35 35V 0.0d | 176.0 dpp |
| adnt                   | 09:03         | 178°               | "                            | 178.0 "   |
|                        | 09:04         | <del>176</del> 177 | "                            | 177.0 "   |
| Repl. vol. 10.0 to 1.0 | 09:19         | 178° 178           | "                            | 178.0 "   |
|                        | 09:35         | <del>176</del> 177 | "                            | 179.0 "   |
|                        | 09:47         | 180                | "                            | 180.0 "   |
|                        | see next page | 181                | "                            | 181.0 "   |

40

9/7/01

10:00  $P = 4.0 \times 10^{-7}$ View and read  
of CH10

| Start time | inner | Filename                |           |
|------------|-------|-------------------------|-----------|
| 10:01      | 181   | i2kevDefscan-35_35v0.0d | 181.0 dpp |
| 10:15      | 182   |                         | 182.0     |
| 10:30      | 183   |                         | 183.0     |
| 10:45      | 184   |                         | 184.0     |
| 10:58      | 185   |                         | 185.0     |
| 11:14      | 186   |                         | 186.0     |
| 11:30      | 187   |                         | 187.0     |

Note 187° is the center of CH10:  
counts from 9 and 11 are exactly split  
moving to 2° steps  
±

|       |     |                         |       |
|-------|-----|-------------------------|-------|
| 11:44 | 189 | i2kevDefscan-35_35v0.0d | 189.0 |
| 11:59 | 191 | i2kevDefscan-35_35v0.0d | 191.0 |
| 12:14 | 193 | i2kevDefscan-35_35v0.0d | 193.0 |
| 12:28 | 195 |                         | 195.0 |

Note 189 is boundary of CH 819

|       |     |  |       |
|-------|-----|--|-------|
| 12:42 | 198 |  | 198.0 |
| 13:01 | 199 |  | 199.0 |
|       | 204 |  |       |
| 13:33 | 209 |  |       |

Special test - HV off

1348 Background noise test - "iBkgNoiseTest0.0d 209.0dpp"  
inner 209°  
outer 0°

HV ± 8 connector in

1351 ~~1351~~ 430V on MCPs - NO NOISE!  
1352 Pull out disable connector  
HV → 2500  
noise counts back e #11 ~ 80 Hz (10-100 Hz)  
others < 10 Hz

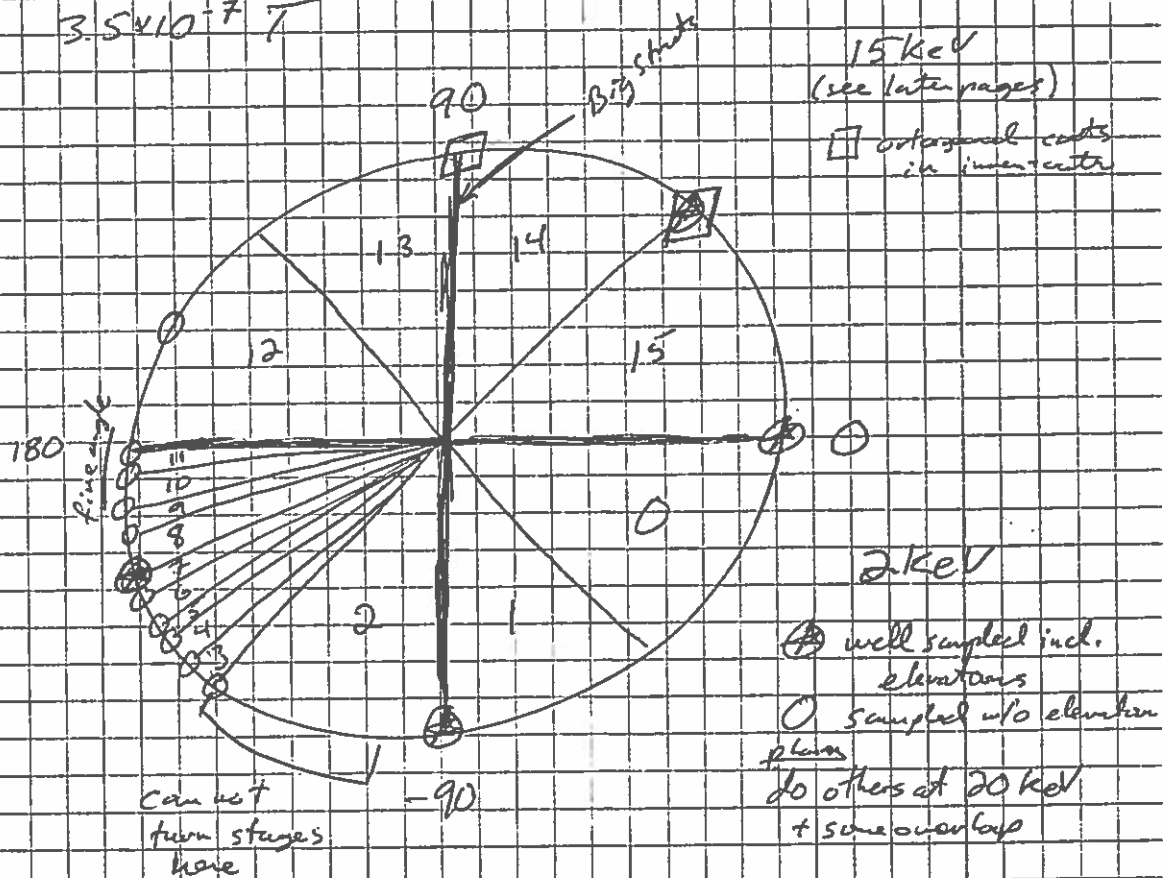
Mike's # 684 2467

|          | Start time | inner $\angle$ | Filename                         |
|----------|------------|----------------|----------------------------------|
| P-<br>10 | 13:57      | 214°           | i2kvDefscan-35-35v0.0d 214.0 dpp |
|          | 14:15      | 219°           | 219                              |
|          | ~14:30     | 224°           | 224                              |

Now we do scans at different Outer (Az) angles  
 set inner to 199° 47-8 boundary

| Start time                | Outer $\angle$ | Filename                                  | 40.0d  |
|---------------------------|----------------|---|--------|
| 14:52                     | 40°            | i2kvDefscan 520-680v 199.0 dpp            |        |
| <del>15:02</del><br>15:02 | 20°            | i2kvDefscan <del>260</del> 340v 199.0 dpp | 20.0d  |
| 15:41                     | -20°           | i2kvDefscan -260-340v 199.0 dpp           | -20.0d |
| 16:00                     | -40°           | i2kvDefscan -520-680v 199.0 dpp           | -40.0d |

16:15  $3.5 \times 10^{-7}$  T



① Going to a 20 KeV beam. We will go first to  $\theta = \phi$ .  $I = +43.5^\circ$ . Could be in D BSA sweeps at  $+40 \rightarrow +47$ , 15 STEPS,  $0.5^\circ/\text{STEP}$ .

$$V_{BSA} \approx \frac{20 \text{ KeV}}{10.9 \text{ KeV/KV}} \approx 1834 \pm 183$$

$$1850 \pm 200$$

|             |      |      |      |       |
|-------------|------|------|------|-------|
| $V_{BSA}$ : | MIN  | MAX  | STOP | STEPS |
|             | 1650 | 2050 | 10   | 31    |

$$\text{Time: } 15 \text{ angles} \times 31 \text{ } V_{BSA} \times 26 \text{ / Acq.} = 20 \text{ min} + \text{OH}$$

② Above gives center ( $I_0$ )

I need to go to  $I_0, I_0 \pm 2, I_0 \pm 4$   
 O need to go to  $0, \pm 7.5, \pm 15, \pm 22.5$   
 $V_{BSA}$ : 21 steps sweep:

No. Can't fully sample 20 KeV beam  
 MAX energy is  $1667 \times 10.9 = 18.2 \text{ KeV}$

$\therefore$  Use 15 KeV beam, rather than 20 KeV.

① Same as above ( $I = 46, 47, 0.5, 15$ )

$$V_{BSA} = 1250, 1500, 10, 26$$

$$\text{Time: } 15 \times 2 \times 26 + \text{OH} = 13 \text{ min} + \text{OH}$$

No. Above gives  
 2050 steps

$I_0$

②  $I_0, I_0 \pm 2, I_0 \pm 4$   
 $0, \pm 10, \pm 20, \pm 30$   
 $V_{BSA}$ : 1250, 1500, 15, 21  
 $V_{DSB}$ :



08

1827: V/8 plug installed. ~~±43.2V~~ on MOD'S.  $V_{ESA} = V_{DEF} = 0$

Open Flight tube gate valve for 65 KeV beam  
 At 2 pA ± 1.5 pA Pressure goes from  $1.5 \times 10^{-7}$   
 to  $2.8 \times 10^{-7}$

1829 V/8 removed, background nominal

Outer mode to 0.0°  
 Inner mode to +43°

| I    | <del>10</del> | I    | 14                      | 15                      |
|------|---------------|------|-------------------------|-------------------------|
| 48   |               | 48   | 733, 728, 772, 729, 791 | 18, 22, 26, 25, 36      |
| 47.5 |               | 47.5 | 713, 703, 728, 785, 700 | 41, 42, 34, 39, 49      |
| 47   |               | 47   | 741, 737, 285, 286, 292 | 64, 21, 27, 76, 55      |
| 46.5 |               | 46.5 | 999, 958, 803, 869, 828 | 152, 134, 159, 149, 134 |
| 46   |               | 46   | 796, 796, 764, 945, 846 | 216, 226, 225, 242, 202 |
| 45.5 |               | 45.5 | 886, 886, 894, 843, 876 | 345, 338, 353, 339, 324 |
| 45   |               | 45   | 808, 823, 761, 792, 727 | 409, 500, 494, 455, 485 |
| 44.5 |               | 44.5 | 830, 813, 801, 792, 797 | 621, 588, 610, 581, 620 |
| 44   |               | 44   | 593, 647, 627, 614, 642 | 569, 613, 595, 589, 663 |
| 43.5 |               | 43.5 | 562, 528, 557, 529, 551 | 572, 638, 672, 628, 638 |
| 43   |               | 43   | 333, 348, 357, 372, 338 | 531, 553, 519, 507, 583 |
| 42.5 |               | 42.5 | 302, 334, 312, 318, 299 | 492, 529, 501, 500, 580 |
| 42   |               | 42   | 232, 225, 225, 224, 218 | 561, 508, 501, 511, 588 |
| 41.5 |               | 41.5 | 156, 168, 184, 156, 165 | 448, 495, 530, 519, 527 |
| 41   |               | 41   | 112, 118, 117, 121, 101 | 538, 548, 522, 543, 524 |
| 40.5 |               | 40.5 | 74, 69, 68, 80, 67, 82  | 540, 518, 482, 513, 489 |
| 40   |               | 40   | 32, 23, 40, 42, 47      | 462, 492, 485, 484, 487 |
| 39.5 |               | 39.5 | 39, 30, 33, 29, 19      | 552, 487, 525, 511, 508 |
| 39   |               | 39   | 18, 16, 23, 15, 25      | 563, 589, 576, 601, 578 |
| 48   |               | 48   | 565, 544, 559, 550, 588 | 30, 26, 29, 25, 30      |

Call to 43.5

END 1917

BEV: 1932

END: 1945

INNER = +43.5°, OUTER = 0  
 $V_{ESA}(15KV) = 1275, 1475, 10, 21$   
 $V_{DEF}(0°) = -350, 350, 48, 75, 17$   
 FILE = 15KV ESA1275 1475 DEF0AN-350 350 0.00 43.50 PP

7 SEPT 01 → 8 SEPT 01

REG: 1950  
 END: 2003  
 INNER = +47.5; OUTER =  $\phi$   
 $V_{ESA} (15 \text{ keV}) = 1225, 1475, 12.5, 21$   
 $V_{DEF} (0^\circ) = -250, 250, 31.25, 17$   
 FILE: 15keV ESA 1225 1475 DEFSCAN-250 250V 0.00 47.5 DPP

REG: 2007  
 END: 2018  
 $I = +45.5; O = \phi$   
 $V_{ESA} (15 \text{ keV}) = 1225, 1475, 12.5, 21$   
 $V_{DEF} (0^\circ) = -250, 250, 31.25, 17$   
 FILE: 15keV ESA 1225 1475 DEFSCAN-250 250V 0.00 45.5 DPP

REG: 2021  
 END: 2032  
 INNER = +41.5;  $O = \phi$   
 $V_{ESA} (15 \text{ keV}) = 1225, 1475, 12.5, 21$   
 $V_{DEF} (0^\circ) = -250, 250, 31.25, 17$   
 FILE: 15keV ESA 1225 1475 DEFSCAN-250 250V 0.00 41.5 DPP

at 01 → At 2032, lost filament on ion source.  
 This shuts us down!

at 01

0207 Finally got arc after replacing filament and having lots of trouble striking arc.

Install  $1/8$ . Open gabe value.  $P_{current} = 2.7 \times 10^{-7}$

0209 Open gabe value all nominal.

$I = +41.5; O = \phi$ , Beam energy = 15 keV.

No meaning for signal on Faraday cup

Set  $V_{ESA} = 1250$ , no counts

1275, no counts

1300, no "

1325 counts drift up from a few to  $> 100$ , then drift down to a few again. Unstable.

Deploy Faraday cup. No meaningful signal.

0231  $V_{ESA}$  to 1350. Beam seems to be more stable.

0235 Beam drops out. Beam gone.

Set  $V_{ESA}$  to 0.0.

0248 Seems that we have a beam.  
 Extract Faraday cup.  
 Parameter =  $1.6 \times 10^{-7}$  T.  
 Install V/S plug  
 Open flighted tube gate valve  $P \rightarrow 2.5 \times 10^{-7}$  T  
 V/S plug out. ACK

0250  $V_{ESA} = 1250$ : No counts  
 $V_{ESA} = 1275$ : Maybe a few counts  
 $V_{ESA} = 1300$ : Maybe a few counts  
 $V_{ESA} = 1325$ : Got  $\sim 100$  c/samp @ 14' 60 cts/samp @ 14'

0256 Beam monitors appear stable.  
 $V_{ESA} \rightarrow 1350$   
 Reduce beam flux COUNT RATE  $1000 \rightarrow 600$  cts/samp  
 $V_{ESA} \rightarrow 1375$ : COUNT RATE  $570$  cts/samp

Will now set up to repeat experiment. In progress  
 when filament broke (2021  $\rightarrow$  2032, 7 SEPT) will  
 place a "2" after "Defscan" in file name.

BEG: 0304 ~~Beam~~  
 END: 0311  
 INNER = +41.5 outer = 0  
 $V_{ESA}$  (15 keV) = 1225, 1475, 12.5, 21  
 $V_{DEF}$  ( $0^\circ$ ) = -250, 250, 31.25, 17  
 File name = 15keVESA12251475DEFSCAN2-250250V0.0D415DPP

$V_{ESA} = 1375$ :  $650$  cts/samp

BEG: 0320  
 END: 0333  
 INNER  $\rightarrow$  +39.5 outer  
 $V_{ESA}$  (15 keV) = 1225, 1475, 12.5, 21  
 $V_{DEF}$  ( $0^\circ$ ) = -250, 250, 31.25, 17  
 File name = 15keVESA12251475DEFSCAN-250250V0D39.5DPP

$V_{ESA} = 1375$ :  $900$  cts/samp

BEG: 0342  
 END: 0355  
 MOVE OUTER to -30  
 INNER = +39.5  
 Outer = -30  
 $V_{ESA}$  (15 keV) 1225, 1475, 12.5, 21  
 $V_{DEF}$  ( $-30^\circ$ ) -33.33 -2800 33.31.25, 17  
 File name = 15keVESA12251475DEFSCAN-3333-2800V-30D39.5DPP

0359

Move OUTER TO -15°

BEG: 0404  
15keV

INNER = +39.5° OUTER = -15°

ESA = 1225, 1475, 12.5 21

END:

VDEF (-15°) = -1665 - 1350 ~ 20.0 17

IF

FILENAME = 15KEVESA1225\_1475DEFSCAN-1665-1350V-15.00-29.50PP

SHIFT CHANGE → McComas, Piepgrus, Booker

04:02  
2/9/01

Plan to finish 14-15 IF

+43.5 ± 30 ± 15

± 30 ± 3333 to ± 2700

± 15 ± 1665 to ± 1350

1225 to 1475

} Def 17 steps

} ESA 21 steps

$P = 3 \times 10^{-7} T$

04:13

15keV ESA 1225\_1475DEFSCAN-1665-1350V-15.00-29.50PP

Inner +43.5°

Outer ~~15°~~ -15°

ESA 1225 to 1475 21 steps

Def -1665 to -1350 17 steps

move outer to -30°

04:37

15keV ESA 1225\_1475Defscan-3333\_-2700V-30.00-39.50PP

move to inner to +15°

04:55

15keV ESA 1225\_1475Defscan 1350\_1665V 15.0d-39.50PP

move outer to +30°

05:13

15keV ESA 1225\_1475Defscan 2700 3333V 30.0d-39.50PP

\* all e- channels very quiet 0-2 c/s  
even ch #11 now quiet - similar to rest

moving on to ch 13-14 IF ~ 90° inner

move outer to 0°

move inner to 90°

1-D scan in ESA

peak at -1370 ESA

inner to 92°

very little response at 89° bar in the way?!

ch 13 down at 90°

ch 14 " " 88°

88, 89, 90, 86, 92 scans

outer = 0.0°  
 ESA = 1225 to 1475V  
 Def = -250 to 250V

| Start time | inner | File name   |
|------------|-------|---|
| 05:49      | 86°   | i15kev ESA 1225_1475 Def scan -250_250v 0.0d 86.0d pp |
| 06:03      | 88°   | " " " " " " 88.0d pp                                  |
| 06:17      | 89°   | " " " " " " 89.0d pp                                  |
| 06:30      | 90°   | " " " " " " 90.0d pp                                  |
| 06:44      | 92°   | " " " " " " 92.0d pp                                  |

Notes: This is a strange edge between channels

- 1) at 88° ch #15 showed substantial counts as well as 13+14
- 2) at 89° beam almost disappears even though it's clearly the change in angle between 13+14  
 - could this be obscuration by the grid structure?  
 seems unlikely for at least (large aperture)
- 3) 90° looks much more normal than 89° so decided to do deflection cut there

inner = 90°

Start time outer File name

|                           |      |   |
|---------------------------|------|---|
| 07:00                     | 30°  | i15kev ESA 1225_1475 Def scan 2700_3333v 30.0d 90.0d pp |
| 07:15                     | 15°  | " " " " " " 1350_1665v 15.0d "                          |
| <del>07:30</del><br>07:38 | -15° | " " " " " " -1665_-1350v -15.0d "                       |
| 7:51                      | -30° | " " " " " " -3333_-2700v -30.0d "                       |

almost no peaks in -30° run turned to 0° outer, 1370V

~652 ch 11 e<sup>-</sup> had small burst of noise again

Moving on to Ch 12-13 IF

set ESA to ~1370V

inner ~135°

outer 0°

edge at 134.9° (#5 match) = inner L.

| Start time | Inner  | Filename                                      |
|------------|--------|---|
| 08:16      | 134.9° | 15keVESA1225_1475DefScan-250_250v0ad134.9clpp |
| 08:30      | 130.9  | " 130.9                                       |
| 08:44      | 132.9  | " 132.9                                       |
| 08:58      | 136.9  | " 136.9                                       |
| 09:12      | 138.9  | " 138.9                                       |

09:25 Close Gate valve in Beamline  
check HV - still 15KV  
start down HV in IES

need to change de-ionized water in source

~9:45 last control of position on inner  
cycled power on cathode  
re kunch  
turned -42.2°  
rezeroed  
OK

$$P = 1.3 \times 10^{-7}$$

operating value  $P \rightarrow 2.3 \times 10^{-7}$

Beam back stable at 15KV N<sup>+</sup>

Special test - full polar scan

File: i15kev ESA 1370 POLESCAN 0.0V<sup>def</sup> 0.0d 0.0dpp  
 ↑ note: this actually changes w/ time

outer = 0.0°  
 inner scans full range in 0.5° steps every 10s  
 def = 0.0V  
 ESA = 1370eV

| Inner L        | Start time (from computer taking file) |              |
|----------------|--|--------------|
| START -115     | 10:37:00                               |              |
| -100           | 10:38:00                               |              |
| -80            | 10:44:50                               |              |
| -60            | 10:51:30                               |              |
| -40            | 10:58:10                               |              |
| -20            | 11:05:00                               |              |
| -10            | 11:08:20                               |              |
| 0              | 11:11:50                               |              |
| 20             | 11:18:30                               | 30 11:21:50  |
| 40             | 11:25:10                               | 50 11:28:30  |
| 60             | 11:31:40                               | 70 11:35:00  |
| 80             | 11:38:20                               | 90 11:41:40  |
| 100            | 11:45:00                               | 110 11:48:20 |
| 120            | 11:51:40                               | 130 11:55:10 |
| 140            | 11:58:40                               | 150 12:02:00 |
| 160            | 12:05:20                               | 170 12:08:40 |
| 180            | 12:12:00                               | 190 12:15:20 |
| * 200          | 12:18:40                               | 210 12:22:00 |
| 220            | 12:25:20                               |              |
| <del>230</del> |  |              |
| END 224        | 12:26:50                               |              |

\* AT 195 started seeing "BIT ERROR", POSITION DISPLAY NO LONGER 0.5 OR 0.0 PURE DECIMAL. PROBLEM WITH NEWPORT UMC/D.

12:27

$$P = 2.6 \times 10^{-7} \text{ T}$$

scanning inner L fast (nominal rate)

$$ESA = 1370 \text{ V}$$

$$Def = 0.0 \text{ V}$$

$$Outer = 0^\circ$$

inner scanned  $\frac{1}{3}$

12:32

i 15 keV esa 1370 polescan 2 - 0.0V def 0.0d 0.0dpp

$$224.1 \rightarrow 180 \rightarrow 135 \rightarrow 90 \rightarrow 45 \rightarrow 0$$

$$\rightarrow -45 \rightarrow -90 \rightarrow -115$$

$$P = 2.6 \times 10^{-7} \text{ T}$$

12:42

i 15 keV esa 1370 polescan 3 - 0.0V def 0.0d 0.0dpp

Same as above, but -115  $\rightarrow$  224.1 ~~steps~~  
continuous ~~rotation~~

$$P = 2.7 \times 10^{-7} \text{ T}$$

~~i 15 keV~~

12:49

i 15 keV esa 1370 polescan 4 - 0.0V def 0.0d 0.0dpp

$$P = 2.7 \times 10^{-7} \text{ T}$$

These 4 need to be plotted ASAP

12:55

Inst front shutdown

$\rightarrow$

V/8 plug in

remove before starting IES

Cycled Vac system to install  $e^-$  source

w/ ~~rip~~ ~ ripple and skirt bellows

Had to install in previous port in order  
to use outer rotation to approximate  
elevation angle



1453  $3.0 \times 10^{-9} T$   
 1527  $7.7 \times 10^{-7} T$

9/9/01 1750:  $5.8 \times 10^{-8} \text{ Von}$

Try electrons w/ new setup

Center =  $0^\circ$   
 X-axis =  $+11.25^\circ$  (ch 5)

1.19 A on source, 70-90 V sweep  
 10 V on grid

Moved to  $+33.75^\circ$  ch 6

Can DEF scan w/ ESA @ 82V

plates ~ -35 V on ion side of DEF (-16 kV)

(Source: 1.15 A, 0.89 V)

electron MCP gain test: 2500  $\rightarrow$  2580 V no apparent change although source has a slight continuous drift upward. ch 6 reading ~ 8500 Hz.

Find center of sector

| Def Scan              | DEF              | ESA             | Notes   |
|-----------------------|------------------|-----------------|---------|
| Def Scan 0.00-115 dpp | DEF: -20 - -50 V | ESA: 70 - 90 V  | ch 15/0 |
| Def Scan 2            | DEF: 85 - 100 V  |                 |         |
| -109°                 | DEF: -20 - -55 V | ESA: 75 - 100 V | ch 15   |
| -103°                 | DEF: -15 - -50 V |                 | ch 4    |
| Def scan 2 -103°      | DEF: -15 - -55 V |                 |         |
| Def m36 -103°         | DEF: -36 V       | ESA: 75 - 100 V |         |
| -50.5°                | DEF: -15 - -55 V | ESA: 75 - 100 V | ch 1    |
| -58°                  | DEF: -15 - -55 V | ESA: 70 - 100 V | ch 2    |

|                             |      |         |                 |             |
|-----------------------------|------|---------|-----------------|-------------|
|                             |      | +35.5°  | ESA: 70-100V    | ch 3        |
|                             |      |         | DEF: -15 - -55V |             |
|                             | 2205 | -13.0°  | ESA: 70-100V    | ch 4        |
|                             |      | +19.5°  | "               | ch 5        |
|                             |      | +32.0°  | "               | ch 6        |
| 5.6 x 10 <sup>-8</sup> Torr | 2249 | +54.5°  | "               | ch 7        |
|                             |      | +77.0°  | "               | ch 8        |
|                             |      | +99.5°  | "               | ch 9        |
|                             |      | +122.0° | "               | ch 10 + 18° |

should be ch 10  
but 8 also lights up. X-talk?

5.5 x 10<sup>-8</sup> Torr    2330    +144.5°    ESA & DEF as above    ch 11  
 ch 8 shows up again  
 almost identical slope as ch 10

|         |                    |       |
|---------|--------------------|-------|
| +167°   | ESA & DEF as above | ch 12 |
| +189.5° | "                  | ch 13 |
| +212.0° | "                  | ch 14 |

+32° beam stability (beam stability of 36 to 82)

(0.93V 1.4A : kind of e-beam)  
 grid = 0

+32° inner +10° outer 1keV def 50-50

" -10° outer 1keV def 10-80

9/10/01 outer = 0°

inner = -112°

0/05

6.0 x 10<sup>-8</sup> Torr

Fold slope of sectors 1keV def 15.55 to 70-100

-90°

1+1

-67.5°

1+2

-45°

2+3

-45.5°

$-23.0^\circ$  3+4 but too much of 3  
 unequal sensitivities?  
 0246:  $6.2 \times 10^8$   $-22.5^\circ$  3+4  
 $0^\circ$  } ← ~~scribble~~  
 $-0.5^\circ$  } 4+5  
 $+22.0^\circ$  } 5+6  
 $+21.0^\circ$  } also shows itself here.  
~~scribble~~  
 $+23.0^\circ$   
 $+22.5^\circ$

Sept. 10, 2001 (Burch, Piepgras, Young)

0428 CDT scan for anode 5/6 boundary FSA 70-190V 21 steps  
 Def -15-55V 21 steps  
 Outer  $0^\circ$   
 Inner  $22.5^\circ$

0450 Repeat scan for anode 5/6 with inner at  $23.0^\circ$

~~0520~~ Repeat scan for anode 5/6

0530 Look for anode 6/7 inner  $45.0^\circ$

~~0601~~  
~~0600~~ Run scan for anode 6/7 with inner at  $45^\circ$

0620 Look for anode 7/8 with (inner at  $68.2^\circ$ )

0728 Run scan for anode 7/8 with inner at  $68.2^\circ$ .

~~07~~ Look for anode 8/9 peak inner at  $90.2^\circ$

0750 Run scan for anode 8/9 with inner at  $90.2^\circ$

0800 Look for anode 9/10 peak at inner  $112.9^\circ$

0807 Run scan for anode 9/10 with inner at  $112.9^\circ$   
 Drawing that run channel 8 counts about as high as 9 & 10.

Note: Channel 0 seems to be picking up crosstalk signals from other channels (6 or 7?). Need to check data to find out which ones they are. It's at a much lower level (for 7%) than channel 8 (~80%).

0820 Look for anode 10/11 ~~no~~ peak at inner 136.4°

0829 Run scan for anode 10/11 with inner at 136.4°  
During this run there are significant counts on anode 8.  
Anode 8 seems to follow anode 10.

Inner angle not optimum  
Look for anode 10/11 again peak at inner 135.6°

0848 Run scan for anode 10/11 with inner at ~~135.6~~ 135.6°

0858 Look for anode 11/12 peak at inner 157.9°

0908 Run scan for anode 11/12 with inner at 157.9°

0927 Look for anode 12/13 peak at 182°

0942 Run scan for anode 12/13 with inner at 182°

0955 Look for anode 13/14 peak at 203.6°

1000 Run scan for anode 13/14 with inner at 203.6°

1020 Checking for cross-talk in channel 0

Try inner of 45°, then 55°  
Channel 0 seems to pick up counts from channel 14  
This cross-talk is very low, a few percent at most

file

1215 inner scan

9/10/81 Do detailed study of ion chans. 2 & 14

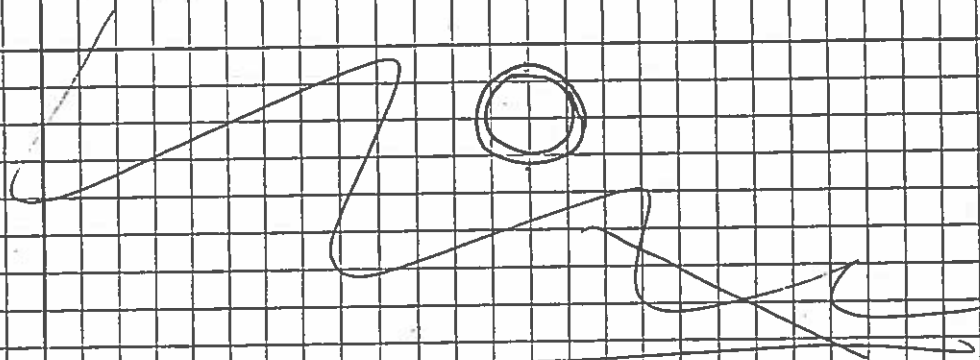
1630

2keV NFI

2.0 x 10<sup>7</sup> cm  
w/ gate pulse  
open

Outer 0° inner +65° run ESA acceptor field  
beam on 'ch 14: peak -155V 183V

Keep ESA @ 183V try DEF scan -250V +250V  
2keV @ 183V def. 30° @ 183V



Same, but +15° Outer → no counts  
 increase DEF to ±100V → no counts  
 " " ±200+300V → no counts

+15° Outer !

Back to +15° outer peak ~ +185V  
 DEF 150-250V

+30° DEF: 300-500V

-15° DEF: -150:-250V

-30° DEF: -300:-500V

18:56  
 2.5x10<sup>-7</sup>

Go to -115° inner (ch 2) 0° outer  
 ESA max @ 180V

(electron noise ~ 10-40 cps)

DEF scan: ±35V

Outer +15° DEF: 150-250V

Outer +30° DEF: 300-500V

Outer -15° DEF: -150:-250V

Outer -30° DEF: -300:-500V

19:48  
 2.4x10<sup>-7</sup>

To ch 1: -67.5° inner 0° outer  
 ESA: 140-200 Peak 183V  
 DEF: 35-35 w/ ESA=103

Outer +15° DEF: 150-250V

Outer:  $-15^\circ$  DEF:  $-150$ ;  $-250$

Inner:  $-22.5^\circ$  CH  $\emptyset$  ESA:  $140-200$  V max @  $185$  V

Outer  $0^\circ$

DEF  $35-35$

Outer  $+15^\circ$  DEF  $150-250$  V

Outer  $-15^\circ$  DEF:  $-150$ ;  $-250$  V

20:26

$2.2 \times 10^7$  Ton

Inner  $+12.5^\circ$  (CH 13) Outer  $0^\circ$

ESA:  $140-200$  V max @  $182$  V

DEF scan  $35-35$

Outer  $+15^\circ$  DEF:  $150-250$  V

Outer  $-15^\circ$  DEF:  $-150$ ;  $-250$  V

Inner  $192.5^\circ$  (CH 9) Outer  $0^\circ$

ESA:  $140-200$  V max @  $180$  V

DEF scan:  $35-35$

Outer  $+15^\circ$  DEF:  $150-250$  V

Outer  $-15^\circ$  DEF:  $-150$ ;  $-250$  V

21:22

(500 eV / V)

$2.8 \times 10^7$  Ton

Inner  $154.5^\circ$  (CH 12) Outer  $0^\circ$

ESA scan  $25-60$  V Max @  $45$  V

DEF scan  $40$ ;  $+20$  V

Outer  $+15^\circ$  DEF scan  $38-64$  V

Outer  $+30^\circ$  DEF scan  $76-128$  V

Outer  $-15^\circ$  DEF scan  $-38$ ;  $-64$  V

Outer  $-30^\circ$  DEF scan  $-76$ ;  $-128$  V

Inner  $112.5^\circ$  (CH 9) Outer  $0^\circ$

ESA scan  $25-60$  V Max @  $45$  V

DEF scan  $-20$ ;  $20$  V

Outer  $+15^\circ$  DEF scan  $38-64$  V

Outer  $+30^\circ$  DEF scan  $76-128$  V

Outer  $-15^\circ$  DEF scan  $-38$ ;  $-64$  V

Outer  $-30^\circ$  DEF scan  $-76$ ;  $-128$  V

Inner  $+65^\circ$  (CH 14) Outer  $0^\circ$

ESA scan  $25-60$  V Max @ max @  $47$  V

DEF scan  $-20$ ;  $20$  V

Outer  $+15^\circ$  DEF scan  $38-64$  V

Outer  $+30^\circ$  DEF scan  $76-128$  V

23:02  
 $2.8 \times 10^{-7}$   
 outer  $-15^\circ$  Def scan  $-38$ :  $-64$   
 outer  $-30^\circ$  Def scan  $-76$ :  $-128$

outer  $0^\circ$  ESA  $47$  V DEF  $0$  V  $180$  Hz  
 $+1^\circ$  " " " "  $40$  Hz  
 $+2^\circ$  " " " "  $2$  Hz  
 $-1^\circ$  " " " "  $25$  Hz  
 $-2^\circ$  " " " "  $2$  Hz  
 $0^\circ$  " " " "  $135$  Hz

ESA:  $35-60$  V DEF:  $-20$  to  $20$  V

2337 Shut down  $2.8 \times 10^{-7}$  Torr

9/12/01 Run flight software HeVE,  $2$  kV V  
 Outer  $0^\circ$   
 Inner  $0^\circ$   
 $0850$   
 $6 \times 10^{-8}$   
 Need to fit display software

Back to Sci 6. Do Outer (azimuth) vs Def.

Outer  $-45^\circ$  Inner  $+65^\circ$   
 Def  $-588$  V ESA scan  $170-200$  V  
 (Repeat w/ 41 steps) ESA max  $\sim 18/102$  V

1126  
 $2.3 \times 10^{-7}$   
 ESA =  $182$  DEF  $-630$ :  $-1180$  V (2 V steps)

outer  $-43^\circ$  DEF  $-630$ :  $-374$  V (file)  
 $-41^\circ$  "  
 $-39^\circ$  "  
 $-37^\circ$  "  
 $-35^\circ$  "  
 $-33^\circ$  "  
 $-31^\circ$  "  
 $-30^\circ$  " out of @  $374$   
 $-30^\circ$   $-440$ :  $-1849$  V

best position: Axis 3:  $65^\circ$  Axis 4:  $-31^\circ$

Testing Flight Software ~ 1300 ~

1527-1628  
2.3 x 10<sup>-7</sup>

Back to Slide

redo  
(473)

Inner 0° Outer -31° ESA=182V, DEF: -440: -184

1630  
2.4 x 10<sup>-7</sup>

|      |   |  |
|------|---|--|
| -29° | " |  |
| -27° | " |  |
| -25° | " |  |
| -23° | " |  |
| -21° | " |  |
| -19° | " |  |

num of way  
ESA →

|      |       |            |
|------|-------|------------|
| -17° | (184) | -400: -184 |
| -17° | 182   | -300: -44  |
| -15° | "     | "          |
| -13° | "     | "          |
| -11° | "     | "          |
| -9°  | "     | "          |
| -7°  | "     | "          |
| -5°  | "     | "          |

1803  
2.4 x 10<sup>-7</sup>

|     |  |                         |
|-----|--|-------------------------|
| -3° |  | -50: +206V (offset -50) |
| -1° |  | "                       |
| 0°  |  | "                       |
| +1° |  | "                       |
| +3° |  | "                       |



|      |                      |
|------|----------------------|
| +5°  | DEF-50: +206V        |
| +7°  | "                    |
| +9°  | "                    |
| +11° | "                    |
| +13° | "                    |
| +15° | DEF-120: +376        |
| +17° | "                    |
| +19° | "                    |
| +21° | "                    |
| +23° | "                    |
| +25° | "                    |
| +27° | "                    |
| +29° | 390-606V             |
| +31° | "                    |
| +33° | "                    |
| +35° | "                    |
| +37° | "                    |
| +39° | 380-636V             |
| +41° | "                    |
| +43° | "                    |
| +45° | 400-656              |
| +45° | ESA 170-200 DEF 580V |

60

-45° ESA: 170-200V DEF: -580V

2040

$7.4 \times 10^{-7}$

2044

IES ~~FD~~

