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

September 2001

SwRI Project 15-8182

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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 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 _" 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*090501*FMCAL\GSEOSRaw – Raw Link Packet data recorded by GSEOS
D:\DATA\FM*090501*FMCAL\IESViewData – ASCII comma-delimited files generated by LabVIEW
D:\DATA\FM*090501*FMCAL\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.

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 initialed 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 pcleanliness 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

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 Y062A multimeter	6481013	9/21/01
Fluke 79 multimeter	59830236	8/8/02
Fluke 79 multimeter	67840199	7/20/02
Lambda Supply	C03209	
Kepco supply	37190	
Agilent Supply	37461096	
Tektronix TyT	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^+ 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^+ 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^+ beam to 21 keV
16. ESA and DEF sweep with inner and outer angle scan
17. Set N^+ beam to 500 eV
18. ESA and DEF sweep with inner and outer angle scan
19. Set both N^+ and e beams
20. Full ESA sweep at 3 fixed inner angles
21. ESA and DEF sweep for one position of step 18.

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

CJ3 a) Verify that the test area meets the cleanliness requirements for this instrument.

____ b) Verify that there is sufficient N_2 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_{dc}
-5V : V= -5.008 V_{dc}
+12V : V= 12.02 V_{dc}
-12V : V= -12.03 V_{dc}

____ 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.

CJ3 n) Perform IES PFM functional test procedure, 8182-FTPFM-02. FTP copy #72

Pass : ✓ Fail: ____

Time: ~~09~~ : ~~45~~ : 00 Date: 9 / ~~8~~ 2 / 01
01:00:00 CJ3 CJ3

10 Test Procedure

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

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 : 2 / Sep / 01

_____c) Allow the unit to pump for at least 24 hrs from the time recorded in 10.1.b.

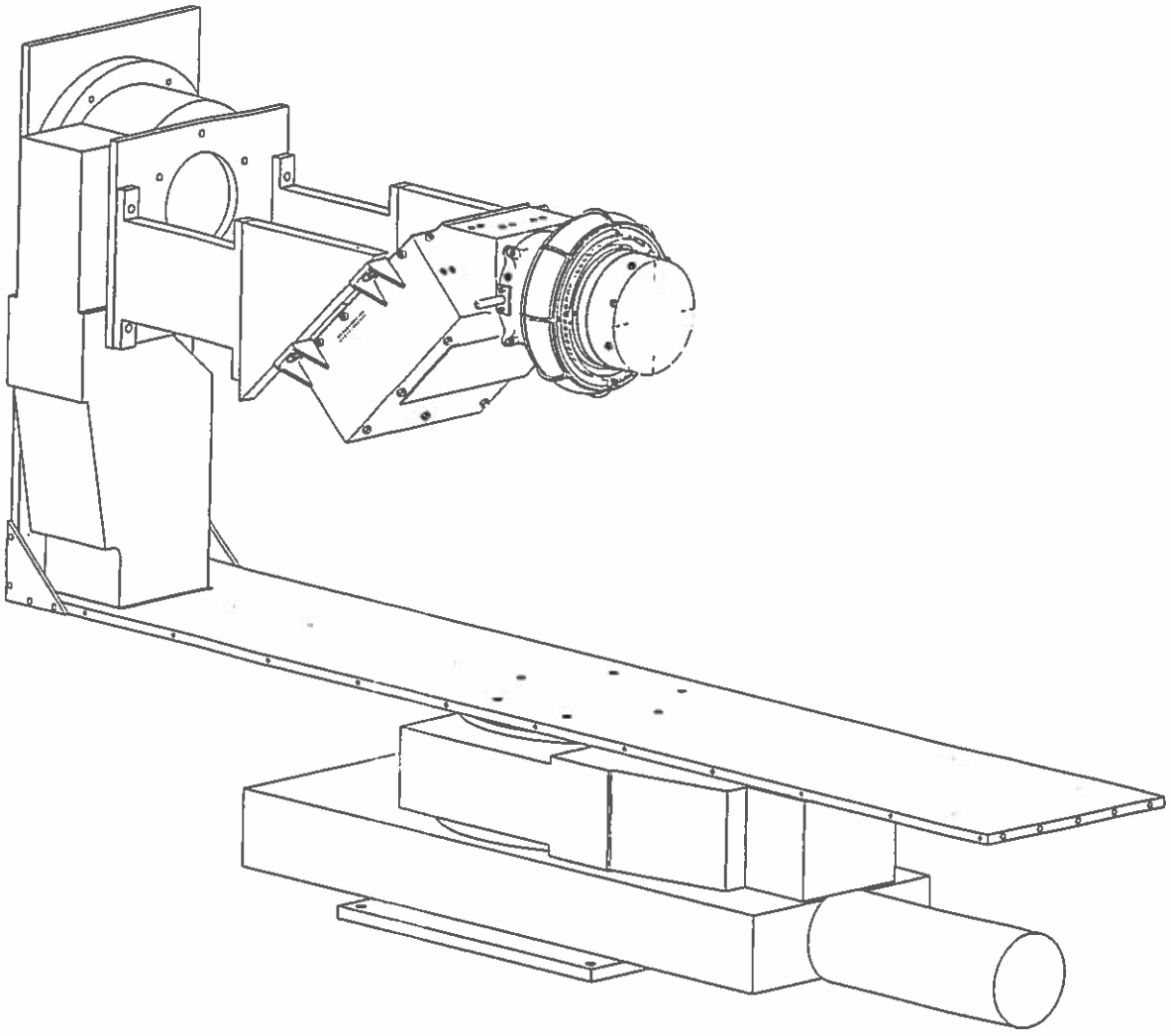


Figure 1. IES Installation in Calibration Chamber

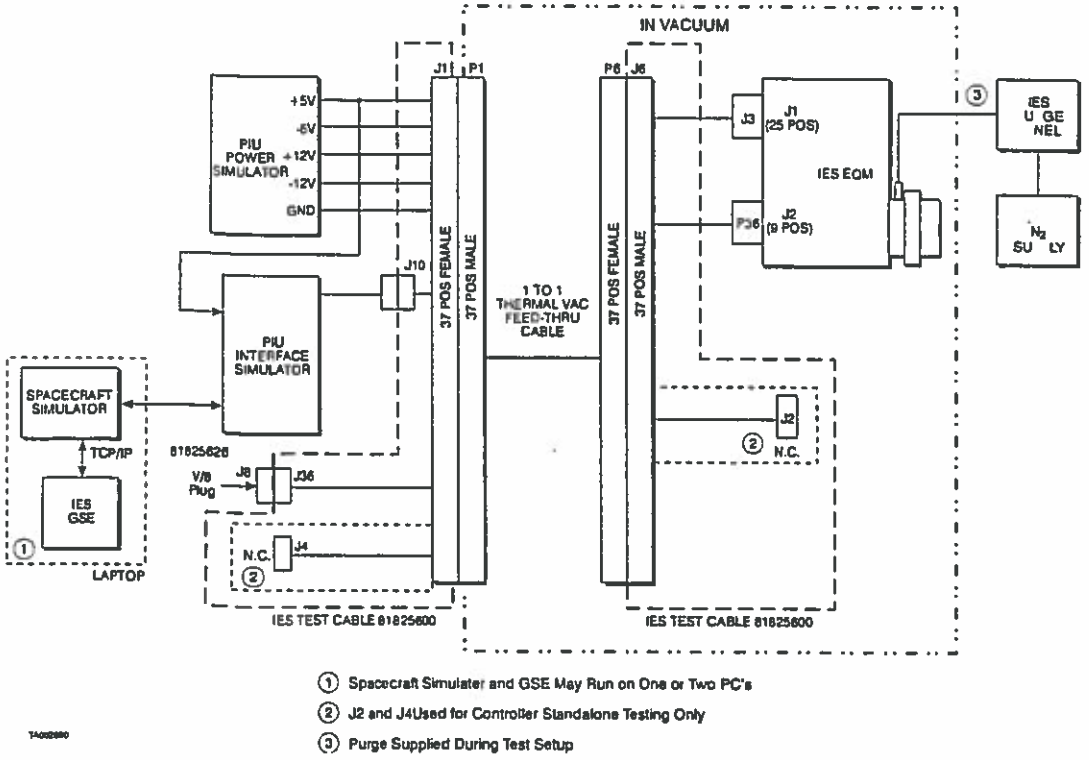


Figure 2. IES Test Setup

10.2 IES PFM Functional Procedure

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

DJ 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 x 10^-7 Torr

DJ 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

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

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

Pressure : 1.5 x10⁻⁷ torr

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

Pass :_____ Fail: ✓

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

Ran 8182-FTP FM-02 after failure; Test PASSED, COPY #79 Allowed the Instrument To Pump under Vacuum for one additional day. Ran 8182-FTP FM-02 copy #75, again test passed Ran 8182-HVFM-01. Test Passed Resume calibration. → on Back

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

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:*

TEEEOOOOIIIISDHHmm.dat, where

T = I 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

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^+ Beam at 2 keV

Purpose: Set up 2keV N^+ beam according to the following table:

Source	Type	Energy	Current
ELC	None	N/A	N/A
ION	N^+	2 keV	0.8 pA

Procedure:

_____a) Make sure gate valve is closed
_____b) Deploy Faraday cup (FC)
_____c) Set up N^+ beam in DP source
_____d) Turn beam on at 1 kV U_{float} + 1 kV $U_{extraction}$ = 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 $<5x10^{-7}$ 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: **i0200000p022fnhhmm.dat** to record IES output data.
_____c) Run full ESA sweep by executing script file: **i2alln.spt.**
This script file uses the following parameters for ESA:

Replaced by hand-written Appendix

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
			TOTAL TIME		hh:mm	00:09

_____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 1keV 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

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
			TOTAL TIME 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
RL

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
			TOTAL TIME		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: **e010OOOOIIIIpphhmm.dat** to record IES output data.
_____d) Run ESA and DEF sweeps with both angle scans by executing script file: **e1nI.spt.**

See Appendix

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
			TOTAL TIME hh:mm			21:26

_____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^+ 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: **I0200000IIIIIpp.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
			TOTAL TIME hh:mm			7:21/11:16

See Appendix

_____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: **i20ipp.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
			TOTAL TIME			21.2h

_____e) Record the date and time sweep is completed.
Date: _____/_____/_____
Time: ____:_____:_____

Turn off 2 keV N^+ beam

10.9 N^+ Beam at 21 keV

Purpose: Set up 21 keV N^+ beam according to the following table:

Source	Type	Energy	Current
ELC	N/A	N/A	N/A
ION	N^+	21 keV	0.8 pA

Procedure:
_____a) Set IES DEF and ESA voltages to zero.
_____b) Deploy Faraday cup (FC)
_____c) Set up N^+ beam in DP source
_____d) Turn beam on at 20 kV U_{float} + 1 kV $U_{extraction}$ = 21 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

_____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
			TOTAL TIME		hh:mm	00:09

_____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: **i2100000OOOOpnhhmm.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

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
			TOTAL TIME		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
			TOTAL TIME		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

10.9.5 End 21 keV N^+ Beam

_____a) Turn off 21 keV N^+ beam.

10.10 N^+ Beam at 500 eV

Purpose: Set up 500 eV N^+ beam according to the following table:

Source	Type	Energy	Current
ELC	N/A	N/A	N/A
ION	N^+	500 eV	0.8 pA

Procedure:

_____a) Set ESA and DEF voltages to zero.
_____b) Deploy Faraday cup (FC)
_____c) Set up 500$^+$ 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: **ip00500000000lf00fn.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
			TOTAL TIME		hh:mm	00:09

See Appendix
RK

_____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: **i0050000IIIIfOIpn.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
			TOTAL TIME		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^+ Beam

_____e) Turn off 500 eV N^+ Beam.

10.11 Electron Beam at 1 keV and N^+ Beam at 2 keV

Purpose: Set up 1 keV electron beam and 2 keV N^+ beam according to the following table:

Source	Type	Energy	Current
ELC	ELC	1 keV	0.8 pA
ION	N^+	2 keV	0.8 pA

Procedure:

N^+ beam:

_____a) Set ESA voltage to zero
_____b) Deploy Faraday cup (FC)
_____c) Set up N^+ beam in DP source
_____d) Turn beam on at 1 kV U_{float} + 1 kV $U_{extraction}$ = 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 kV	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
			TOTAL TIME hh:mm			00:21

_____d) Record the date and time sweep is completed.
Date: _____/_____/_____
Time: _____:_____

See Appendix

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: **b0120O.dat** to record IES output data.
_____d) Run ESA sweep with INNER scan by executing script file: **e1i1na.spt.**
This script file uses the following parameters:

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
			TOTAL TIME		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^+ beam.
_____b) Turn off 1 keV electron beam.

See Appendix PB

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_____

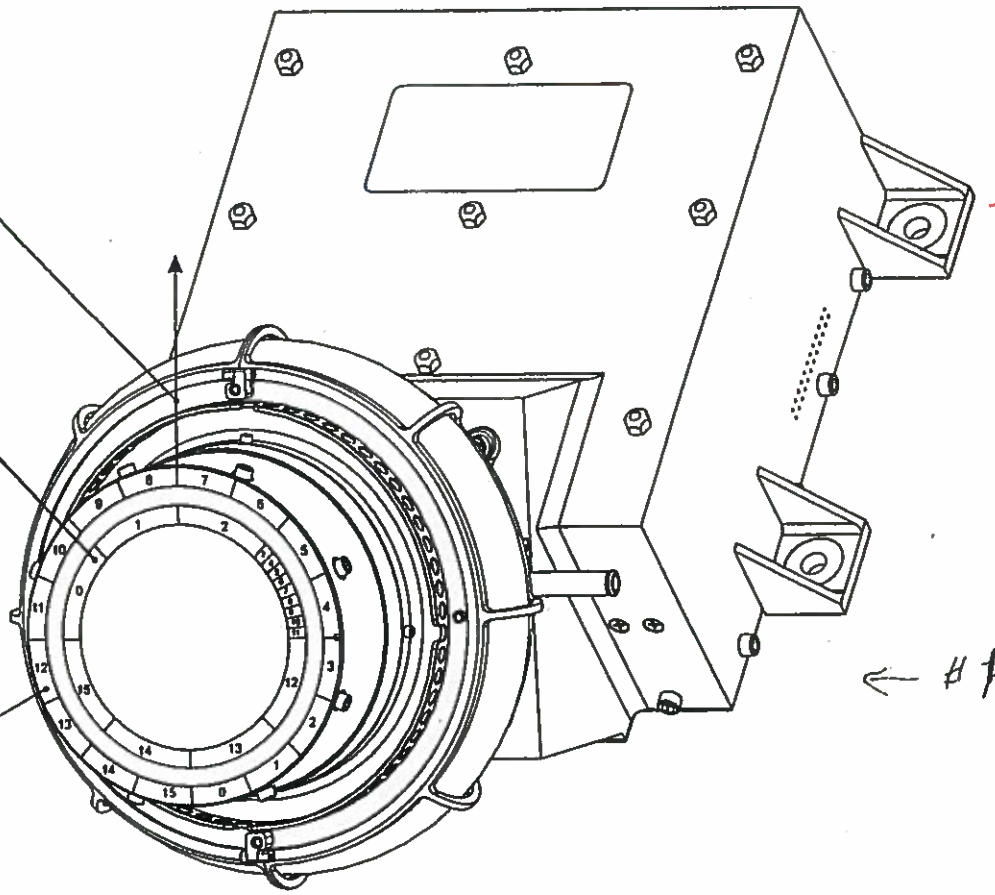
11 Recorded File Log

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 B

12 MCP Test Log

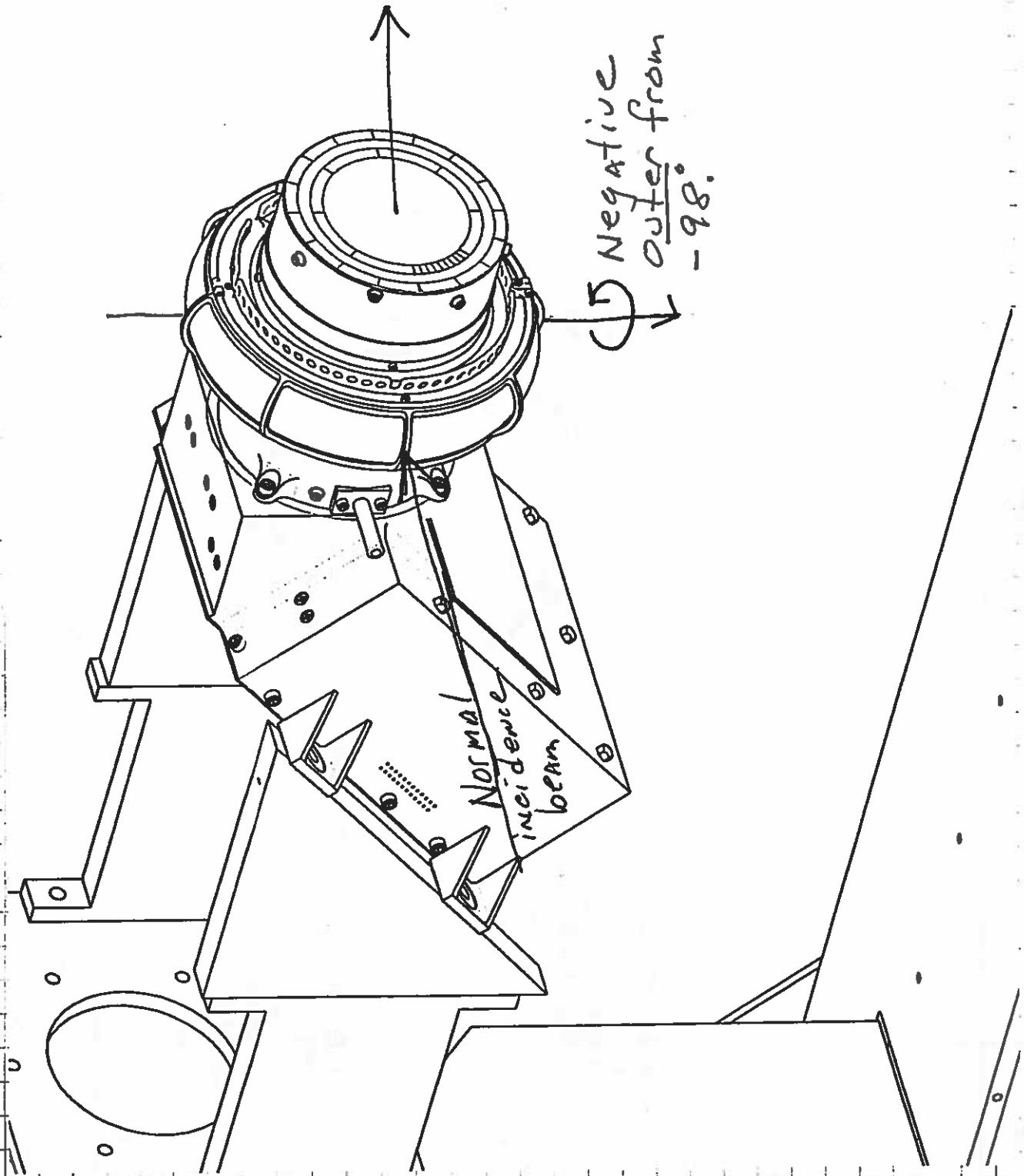
Date	Time	Filename	Ion MCP V	Electron MCP V	i sector/Counts	e Sector/Counts	Comments
			-2500				
			-2520				
			-2540				
			-2560				
			-2580				
			-2600				
			-2620				
			-2640				
			-2660				
			-2680		See Appendix		
			-2700				
				2500			
				2520			
				2540			
				2560			
				2580			
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


NOON
ION DETECTOR ANODE BIN NUMBERS (ANODE VIEWED THROUGH MPCs)
Ion is bottom 1/2
ELECTRON DETECTOR ANODE BIN NUMBERS (ANODE VIEWED THRU BACK OF ANODE)
electron is Top 1/2
TA002586b

Appendix B

IFS Cal Setup:

Outer: Nominal zero = -98° from home



From previous page:

OUTER When outer is more negative than $-98°$, beam will come from box direction (down). When outer is more positive than $-78°$, beam will come from direction away from box.

INNER

Sep. 6, 2001

1224 PM CDT
2 keV N+ beam. D1 / run on ESA script.

170V → 200V x 2V steps

Inner +30°: ~~i2keVTEST2 0.0D30.0DPP~~
↳ Bin 15

Beg 1317 CDT + Working on a variant of 10.8.3 in cal procedure
Go to INNER = +45 (Bin 15/14 intersection)

Filename = i2keV0.0D45.0dpp

	START	STEP	Num
Def. sweep:	-26	5V	11
ESA	170	~~2~~ 1.5	21

END 1324 CDT

BEG 1326 INNER → +44 ; Repeat ~~above~~ above test.
Filename = i2keV0.0D44.0dpp

END 1335

BEG 1336 INNER → +42 Repeat above
FILENAME → i2keV0.0D42.0dpp

END 1344

BEG 1346 INNER → +40 Repeat above
FILENAME → i2keV0.0D40.0dpp

END 1354

BEG 1355 INNER → +38 Repeat above
FILENAME → i2keV0.0D38.0dpp.
END 1404

BEG: ?? INNER → +46 Repeat above
END: 1413 FILENAME → i2keV0.0D46.0dpp

6 Sep 6 0276

1445 At this point pressure = 5.0×10^{-5} T. Excursion to 5.3×10^{-5} T. Now decide we can operate at pressure up to 5.5×10^{-5} T (NO MOTION) or 6.0×10^{-5} T (MAX MOTION). (Up).

BEG 1445 INNER → +48°, Repeat above
END 1423 FILEname → i2kev0.0048.0dpp

BEG 1426 INNER → +50° Repeat above
END 1435 FILEname → i2kev0.0050.0dpp

End of Experiment

Summarize: Cowboid intersection between 0144 & 0315 looks like ~+43.5°. ~~Fuzzy~~ ~5°. width ~5°.

BEG 1450 Move to INNER = +43.5°
OUTER = +15°
Set ESA to -184 V
Scan Deflection: +144 → +200, 21 STEPS, 5.5 V each
END 1451 Saw peak near -190 to -195 According to GSE monitor
BUT +190 to +195 According to sampD command.

1457 43.5° Inner $V_{ESA} = -170 \rightarrow 200$, 21 steps, 1.5 V ea
15.0° Outer $V_{DEF} = +180 \rightarrow +210$,
FILE=

Begin Analysis

ESA 170 V → 200 V, 21 steps
DEF 5° → 25°, 11 steps
Filename ~~i2kev15.00~~ i2kevDefScan.15.0d43.5dpp
Stopping in DEF was too coarse.

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.

OV

DEF → inner scan (faster)
ESA → outer scan (slower) (12.5–17.5)

IES CAL

6 Sep 6 (Cont.)

Beg = ?
End = 1530
ESA: 170 → 200, 1.5 V 56 eps, 21 56 eps
DEF
Filename: 2KeV Def Scan 10dg_20dg 15.0D43.5DPP

Still, DEF peaks

BEG ?
FWD: 1551
ESA: 170-200, 1.5V 56 eps, 21 56 eps
Def. 12.5°-17.5°, 0.25° 56 eps, 21 56 eps
FILEName: 2KeV DEF Scan 12.5dg_17.5dg 15.0D43.5DPP

BEG ?
END: 1610 OUT
ESA: 170-200, 1.5V 56 eps, 21 56 eps
DEF: 170-210, 2.5V 56 eps, 17 56 eps
Filename: ~~2KeV DEF Scan 12.5dg 17.5dg 15.0D 43.5DPP~~
2KeV DEF Scan 170 210 V 15.0D 43.5DPP

DEG = 1625
END = 1440
ESA: (2keV) 170-200, 1.5V steps, 21 steps
DEF: (+30°) 340-420, 5 V steps, 17 steps
Filename: 2KeV Defscan 340_420 V 30.0 D 43.5D PP

BEG = ?
END = 1705
ESA: (2keV) 170-200, 1.5V steps, 21 steps
DEF: (+45°) 510-630, 7.5V steps, 17 steps
Filename: 2keV Defscan 510_630V 45.0D 43.5DPP

BEG = 1712
END = 1728
ESA: (2keV) 170-200, 1.5V steps, 21 steps
DEF: (-15°) -210--170, 2.5V steps, 17 steps
Filename: 2 KeV Defscan -210_-170V -15.0 D 43.5D PP

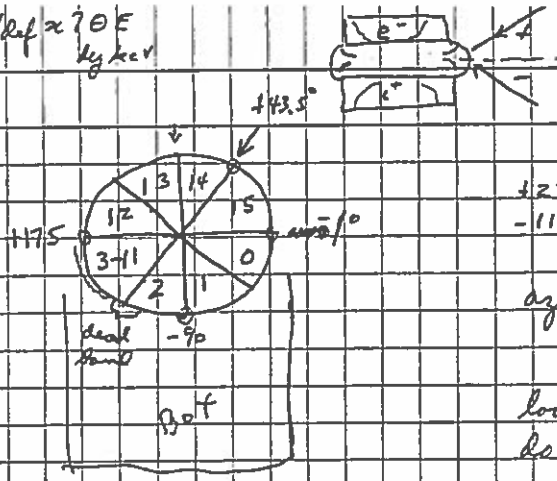
BEG = 1735
END = 1751
ESA: (2 KeV) 170-200, 1.5 V steps, 21 steps
DEF: (-30°) -420--340, 5 V steps, 17 steps
Filename: 2 KeV Defscan -420_-390 V -30.0 D 43.5 D PP

BEG = 1758
END = 1805
ESA: (2keV) 170-200
DEF: (-45°) -638--502, 8.5V steps, 17 steps
Filename: 2 KeV Defscan -638_-502V -45.0D 43.5D PP
} aborted. Can't find beam

Tried ESA 184V, scanned DEF -453--560V at outer angle of -40° and didn't find beam

Tried ESA 184V, scanned DEF -420--340 V, at outer angle of -30° and found count rates ~~[illegible]~~ consistent with previous sweep.

IES CAL Vref = 10 E key ker 6 SEPT 2001



±225 } polar angle (inner) limits
-115 }

azimuthal angle (outer) limit 50°
at 0° go ±15 V to locate 0

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

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

- Tried -15° scan and got >300 c/s
- Concluded that max. outer is somewhere between -30° and -40° perhaps because of beam obstruction or beam bending. Reset at max. beam diam. of 10 cm.
- Moving to outer of 0° and sectors 0/15.
- Keystroke error on angle mechanism caused 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 Eq occurs at -50.5° on controller
- ∴ channel 14/15 Eq is 44.5° away from 0/15 Eq and 0/15 Eq is at -1°.

1928 Note - Inner angle data uncalibrated starting here - see note on Page above

ESA: (2 keV) 170-200, 1.5 V steps 21 steps
BEG= DEF: (0°)
END= Filename: 2 keV Defscan V 0.00 - 1.00 PP

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

30 TESCAL 6 SEPT 01

Another controller glitch. Had to power off to stop scan.
Re-zeroed. Now 6/15 Adj is at -24.1° on controller.

1950 Test beam: ESA: 184V
1. DEF: -10 to +10 V.
2. DEF: -15 to +15 V.
3. DEF: -15 to +30 V (Zero response at -15V and 20V)
Conclude that offset is 1° or less.

Outer = 0°
Inner = -24.1° → -1.0° in previous reference frame.

BEG: 2013 ESA: (2keV) 170-200, 1.5V steps 21 steps
END: 2026 DEF: (0°) -20 - +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°) 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, 1.5 V steps 21 steps
DEF: (30°) 340-420, 5 V steps 17 steps
END: 2125 Filename: 2KeVDefscan 340 _ 420V 30.0D -1.0D PP

BEG: 2140 ESA: (2keV) 170-200, 1.5V steps 21 steps
END: 2148 DEF: (40°) 540-660, 17 steps
Filename: 2KeVDefscan 540 _ 660 V 45.0D -1.0D PP

Note: Ran 40° instead of 45° because fluxes were too low at 45°.

IES CAL   02429.01.103   6 Sept 31 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 AP

Burch out, Pollock in @ 2200 HRS

Move outer to -30°. Do exploratory scan with:

$V_{ESA} = -184$, $-450 \leq V_{DEF} \leq -320$, 53 steps (2.5V 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
DEF (-30°) -420 - -340 5V steps, 17 steps
END: 2234 | Filename: 2keVdefscan-420 -340V-30.0D-1.0DPP

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-1.0DPP
At beginning of sequence, we saw sporadic ~30 Hz in ion bin 14 ~~ ~~
Saw nothing but noise on this scan. Not sure why.

* Set up exploratory scan: No file

V_{ESA}: ~~ ~~ -184V
$-700 \leq V_{DEF} \leq -500$, 5V steps, 41 steps.
Saw noise only!

* ~~Move OUTER to -35° ...~~
* 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 V def ⟶ over

IES CAL

From Above — 6 Sept.–7 Sept.

Remember - we are shooting into blind spot. This messes up our transmission in ways difficult to unstress & unto.

Move outer → 0 deg
Move inner → +6 deg

BEG: 2329	VESA (2KeV)	170-200	1.5V ST,	21 ST
END: ABORT 2330	VDEF (0°)	-20+20	2.5V ST,	17 ST
	Filename:	2KeVDEFSCAN+20_20V0.0D6.0DPP		

Need to see -30 → +10 on VDEFLECT.

BEG 2333	VESA (2KeV)	170-200	1.5V ST	21 ST
	VDEF (@0°)	-30 → +10	2.5V ST	17 ST
END 2336		2KeVDEFSCAN-30_10V0.0D6.0DPP		

Saw Good peaks, but they bumped up against the +10V rail, especially at large ESA voltages! Repeat now with -30 → +30, 125 scans.

BEG 2349	VESA (2KeV)	170-200	1.5V ST	21 ST
9/06 → 9/07	VDEF (0°)	-30 → +30	2.5V ST	25 ST
END 0008	FILENAME	2KeVDEFSCAN-30_30V0.0D6.0DPP		

At VESA = -170, VDEF peak exhaust from -25 → ~~Range~~ 0 to +5

Change Script file from VDEFL=25 ST to VDEFL=17.5T
Move INNER to +4°

BEG 0013	VESA (2KeV)	170-200	1.5V ST	21 ST
END 0024	VDEF (0°)	-30 30	~~3.5~~ 3.75V ST	17 ST
	FILENAME:	2KeVDEFSCAN-30_30V0.0D4.0DPP		

BEG 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_30V0.0D2.0DPP		

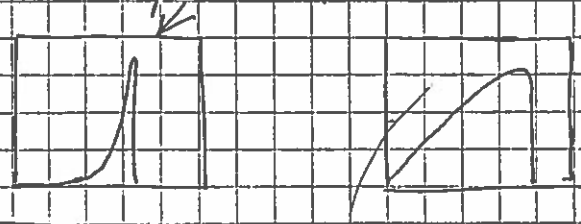
Move INNER to 0°

BEG 0043	VESA (2KeV)	170 - 200	1.5V ST	21 ST
END 0056	VDEF (0°)	-30 -> 30	3.75V ST	17 ST
	FILE	2KeVDEFSCAN-30_30V0.0D0.0DPP		

BEG 0100	Move INNER TO -2°			
END 0113	VESA (2KeV)	170 - 200	1.5V ST	21 ST
	VDEF (0°)	-30 -> 30	3.75V ST	17 ST
	FILE	2KeVDEFSCAN-30_30V0.0D-2.0DPP		

	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	2KeVDEFSCAN-30_30V0.0D-4.0DPP		

Note: Surprisingly, ~~Beam~~ counts at VESA = -170 already very high (>1000/sample), compared to other angles. Speculate that this is due to severe energy straggling due to grazing incidence scattering off webbed vanes between Bin 15 & 0? (on Bin 0 side).



BEG 0131	Move INNER to -6°			
END 0144	VESA (2KeV)	170-200	1.5V ST	21 ST
	VDEF (0°)	-30 30	3.75V ST	17 ST
	FILE	2KeVDEFSCAN-30_30V0.0D-6.0DPP		

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

IES CAL

7 Sept 01 (cont)

BEG: 0145
END: 0158

Move Inner to −8°

VESA (2keV)	170 − 200	1.5V ST	21 ST
VDEF (0°)	−30, 30	.375V ST	17 ST

File = 2keVDEFSCAN-30_30V0.0D-6.0DPP

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

BEG: 0200
END: 0213

Keep inner at −8°

VESA (2keV)	130 − 210	4V ST	21 ST
VDEF (0°)	−30, 30	.375V ST	17 ST

FILE = 2keVWIDEDEFSCAN-30_30V0.0D-6.0DPP

Turn on at low end is sudden

158V → ~0 CTS
162V → ~50 CTS
166V → ~500 CTS
170V → ~1200 CTS

Now move to new INNER: Interaction between bars 1 & 2.

Move INNER to −85, ESA to −184 VDEF = 0

INNER:	CH1 CTS	CH2 CTS
−85	596, 619, 551, 564, 643	5, 4, 3, 2, 5
−86	462, 461, 496, 532, 620	5, 5, 4, 6, 1
−87	571, 561, 615, 640, 528	10, 5, 4, 6, 9
−88	323, 314, 352, 344, 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, 27, 25, 23, 13
−92	10, 11, 9, 10, 17	7, 8, 6, 4, 2
−93	8, 8, 5, 7, 5	21, 27, 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, 367, 378, 372, 411
−98	4, 5, 8, 3, 2	448, 408, 468, 443, 450
−85	494, 532, 485, 515, 563	4, 5, 5, 6, 8

~92.5° better

CAK 93° center of CH1 turn-on

CH2

IES CAL

Sept 17 (035)

BEG 0257
END 0310

INNER = -85
VESA (2KeV) 130-200, 1.5V ST, 21 ST
VDEF (0°) -30, 30, 3.75V ST, 17 ST
FILE 2KeVDEFSCAN-30.30V0.0D-85.0DPP

Note: Bumping badly up against the edge of PASS band in Deflection V, at high end of ESA pass band.

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

BEG: 0317
END 0325
INNER = -85°
VESA (2KeV) 170-200 1.5V ST 21 ST
VDEF (0°) -35, 35 4.375 V ST 17 ST
FILE 2KeVDEFSCAN-35_35V0.0D-85.0DPP

BEG: 0326
END: 0334
INNER = -87°
VESA (2KeV) 170-200 1.5V ST 21 ST
VDEF (0°) -35, 35 4.375V ST 17 ST
FILE 2KeVDEFSCAN-35_35V0.0D-87.0DPP

BEG 0340
END 0353
INNER = -89
VESA (2KeV) 170-200 1.5V ST 21 ST
VDEF (0°) -35, 35 4.375 V ST 17 ST
FILE 2KeVDEFSCAN-35_35V0.0D-89.0DPP

BEG: 0354
END:
INNER = -91
VESA (2KeV) 170-200 1.5V ST 21 ST
VDEF (0°) -35, 35 4.375 V ST 17 ST
FILE 2KeVDEFSCAN-35_35V0.0D-91.0DPP return

Issues ① Motion types - Fix: Type TB?? System will reboot & self-fix if possible. Otherwise cycle power required. When cycle power:
A) "3 MO" ⇒ green LED for 3
B) "4 MO" ⇒ green LED for 4

② Electrons, CH1 is noisy all night (~100 C/samp) variable

③ Problems near edges. Specular reflection w/ energy degradation

IES CAL (CONT)

9/7/01

④ GSE lockups. Twice during evening - Crowbar power off. Mike McLellan prefers:

a) Install V/I plug, then power off -

OR

B) Just cycle PC, no inst turn off

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

9/7/01 4am New Shift arrives McComas, Zirzweier, Booker

1) Complete present edge measurements:
-93, -95, -97, -99, -101 Inner

410 -93° 2 keV DEFSCAN35_35V 0.0d-93.0dpp
Def -35 to 35 V 17 steps
ESA 170 to 200 V 21 steps

P = 4.3x10^{-7} Torr

4:18 (4:23) -95° inner ; 2 keV Defscan -35_35v 0.0d-95.0dpp

Def -35 to 35 V 17 step
ESA 170 to 200 21 step
Outer 0° } (*) reset previously - need to find zeros
Inner -95° }

4:38 -97° inner ; 2 keV Defscan -35_35v 0.0d -97.0dpp

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

~~~400 c/s, w=2~~
~~~

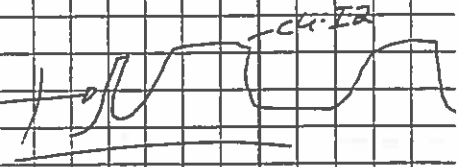
4:52 -99° inner i 2kev Defscan -35_35v 0.0d -99

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

0506 -101° inner i 2kev Defscan -35_35v 0.0d -101

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

Strange narrow peak on 1st deflectorscan



2-3 pts wide

~05:24 i 2kev Defscan 540_660V 40.0d -93.0dpp
-93° Inner
+40 Outer
ESA 170 to 200 V 21 steps
Def 540 to 660V 17 steps

P = 4.3 x10⁻⁷ T (only up from 4.2x10⁻⁷ before turn)

Abort Script Deflectorscan don't change energies (causes resets)
0534 -0 HV's down, restart GSE (GSE latchup recovery)
repeat but with Def 520-680 21 steps
also set Inner to -91° to better split counts
i 2kev Defscan 520_680v 40.0d -92.5dpp
0543 -92.5° Inner
+40° Outer
ESA 170 to 200V 21 steps
Def 520 to 680V 21 steps
06:00 P = 4.2 x10⁻⁷
-92.5° Inner i 2kev Defscan 260_340v 20.0d -92.5dpp
06:02 +20° Outer
ESA 170 to 200V 21 steps
Def 260 to 340V 21 steps

P = 4.3 x10⁻⁷ post turning

9/7/01

0619 4.2×10^{-7} T

Outer -20°
Inner -92.5°
ESA 170 to 260 V 21 steps
Def -260 to -340 V 21 steps

0622 i 2keV Defscan -260 -340 V -20.0 d -92.5 dpp

Outer -40°
Inner -92.5°
ESA 170 to 260 V 21 steps
Def -520 to -680 21 steps

0642 i 2keV Defscan -520 -680 V -40.0 d -92.5 dPA

0646 Electron N increments took major drop from 10^5-10^3 down to a few/s
no apparent correlation w/ anything changing

0657 rise in EN counts from 2-3 up to 10^5-10^3
no change in Pressure, IES counts, etc

Looking for Angle zeros

turn inner to present zero P to 4.4×10^{-7}
~~turn inner to +98° (normal home) error 42.2° not 98°~~
★ homed inner stage then turn 42.2° not correct zeros
Angles ok after #3

looks like there may have been an accumulated error in outer stage
looks like before re-zero on home was 97.00°
But should have been 98°

Angles from PZA to here suspect ~ 1°

0723 Angles NOW RESET

$P = 4.6 \times 10^{-7}$ (lots of firing)

HV's off, turn off IES
RGA scan
Beam Backup of calculations thus far

~08:20 Restarting Cal P = 4.3 x 10⁻⁷
next topic - the highest sectors
~~[illegible]~~

Turn inner to +175°, P = 4.4 x 10⁻⁷ T

0823 Bring up instrument + HV's
4.3 x 10⁻⁷

8|26 ~~[illegible]~~ 184 V on ESA

+152° Inner Ais ~ center of ch 17
Beam is much more stable than yesterday so we decided to take a scan around the center of a large anode (#17)

Inner +152°
Outer 0°
ESA 170 to 200 V 21 steps
Def -35 to +35 V 17 steps
0832 i 2 KeV Defscan -35_35v ~~[illegible]~~ 0.0d 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 170 V to 200 V in 21 steps
Def -35 V to 35 V in 17 steps
Outer 0°

P = 4.2 x 10⁻⁷

Start time	Inner	Filename	
08:47	176°	i 2 KeV Defscan -35_35v 0.0d	178.0 dpp
about 09:02	178°	"	178.0
09:04	~~[illegible]~~ 177		177.0
Replaced 160 HV 09:19	~~[illegible]~~ 178		178.0
09:35	~~[illegible]~~ 179		179.0
09:47	180		180.0
see next page	181		181.0

40

9/7/01

10:00 $P = 4.0 \times 10^{-7}$

Vertical scan of Ch 10

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 Ch 10: counts from Quad II are exactly split moving to 2° steps

11:44	189	i2kevDefscan-35_35v 0.0d	189.0
11:59	191	i2kevDefScan-35_35v 0.0d	191.0
12:14	193	i2kevDefScan-35_35v 0.0d	193.0
12:28	195		195.0
~~Note 189.: boundary of Ch 8 & 9~~			
12:42	197		197.0
13:01	199		199.0
	204		
13:33	209		

Special test - HV off

13 48 Background noise test - "IBKg NoiseTest 0.0d 209.0dpp"
inner 209°
outer 0°

HV ÷8 connector in

13 51 ~~4300 V~~ 4300 V on MCPs - NO NOISE!

13 52 Pull out double connector
HV → 2500
noise counts back @ HV ~ 80 Hz (10-100 Hz)
others ≤ 10 Hz

Mike's # 684 2467

Start time	inner ∠	Filename
13:54	214°	i2kVDefscan-35_35v0.0d214.0dpp
14:15	219°	219
~1430	224°	224

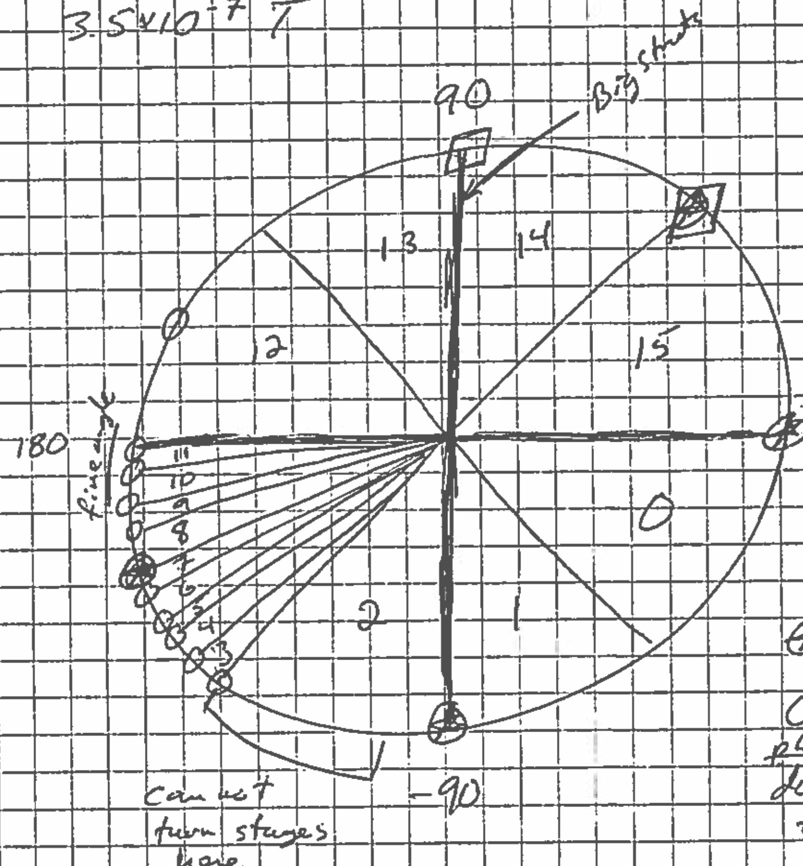
P: 3.6×10^{4}

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

Start time	Outer ∠	Filename
14:52	40°	i2kVDefscan520_680v 40.0d 199.0dpp
~~[illegible]~~ 1522	20°	i2kvDefscan ~~220~~ ~~260~~ 260_340v 20.0d 199.0dpp
1541	-20°	i2kvDefscan-260_-340v -20.0d 199.0dpp
16:00	-40°	i2kvDefscan -520_-680v -40.0d 199.0dpp

16:15 3.5×10^{-7} T

15 keV
(see later pages)



□ orthogonal cuts in inner-outer

2keV

⊛ well sampled incl. elevations
○ sampled w/o elevation

plans
do others at 20 keV
+ some overlap

42 IES CAL 9/7/01

① Going to a 20 KeV beam. We will go first to ϕ, θ: $\theta = \phi$; $I = +43.5°$. Conduct 3D IESA sweep:
θ: $+40 \rightarrow +47$, 15 steps, 0.5°/step.

V_{IESA}: $\sim \frac{20\,KeV}{10.9\,KeV/KV} \simeq 1834 \pm 183$

1850 ± 200.

V_{IESA}: 1650, 2050, 10, 31 steps.
(1650 MIN, 2050 MAX, 10 STEP, ~~44~~ 31 STEPS.)

Time: 15 angles x 31 V_{IESA} x 2s / Acq.
$= 20$ min + OH

② Above gives center (I_0).
I Need to go to I_0, $I_0 \pm 2$, $I_0 \pm 4$
θ Need to go to 0, ± 7.5, ± 15, ± 22.5
V_{ESA}: 21 Step sweep:

① No. Can't fully sample 20 KeV beam.
MAX energy is $1667 \times 10.9 = 18.2$ KeV
(min, max, step, number)
∴ Use 15 KeV beam, rather than 20 KeV.

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

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

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

No Beam / Fixes

I_0

② I: I_0, $I_0 \pm 2$, $I_0 \pm 4$
θ: 0, ± 10, ± 20, ± 30
V_{ESA}: 1250, 1500 (MIN, MAX), 21
V_{DEA}:

~~28~~

1827: V/8 plug installed. ±432V (~~±43~~) on MCP's. $V_{ESA} = V_{DEF} = 0$

Open flight tube gate valve for 15 KeV beam at 2 pA ± 1.5 pA. Pressure goes from 1.5×10^{-7} to 2.8×10^{-7}.

1829 V/8 removed. Background nominal

Outer moved to 0.0°
Inner moved to +47°

I	~~HHS~~	I	14	15
~~+47~~	~~166~~ 10	48	733, 728, 772, 777, 791	18, 22, 26, 25, 36
+46.5		47.5	713, 703, 728, 785, 700	44, 42, 34, 39, 49
~~+46~~		47	741, 737, 785, 786, 792	64, 71, 77, 76, 55
+45.5		46.5	999, 958, 803, 889, 828	152, 134, 150, 147, 134
~~+45~~		46	796, 796, 764, 945, 846	216, 226, 229, 242, 202
+44.5		45.5	886, 896, 894, 843, 876	345, 338, 353, 339, 324
~~+44~~		45	808, 823, 761, 772, 727	449, 500, 494, 455, 485
+43.5		44.5	830, 813, 801, 772, 797	621, 583, 619, 581, 620
~~+43~~		44	593, 640, 627, 614, 642	569, 613, 595, 589, 663
~~+42.5~~		43.5	562, 528, 557, 529, 552	572, 638, 672, 628, 638
		43	333, 348, 357, 372, 338	531, 553, 517, 509, 583
		42.5	302, 334, 312, 318, 299	492, 529, 501, 500, 580
		42	232, 225, 227, 224, 218	501, 528, 501, 511, 548
		41.5	158, 168, 184, 156, 165	488, 495, 530, 517, 527
		41	112, 118, 117, 121, 101	538, 548, 522, 543, 524
		40.5	74, 69, 68, 80, 67, ~~82~~	540, 518, 482, 512, 429
		40	32, 33, 40, 42, 47,	462, 492, 485, 494, 487
		39.5	39, 30, 33, 29, 19	552, 487, 525, 511, 508
		39	18, 16, 23, 15, 25	563, 589, 576, 601, 558
		48	565, 574, 559, 550, 588	30, 26, 29, 25, 30

Call I_0 43.5

END 1917

BEG. 1932 — END. 1946

INNER = +43.5°, OUTER = 0
V_{ESA} (15 kV) = 1275, 1475, 10, 21
V_{DEF} (0°) = -350, 350, 43.75, 17
FILE = 15keV ESA1275 1475 DEFSCAN-350 350 V 0.0 D 43.5 DPP

IES CAL

7 SEPT 01 —> 8 SEPT 01

BEG: 1950
END: 2003

INNER = +41.5 ;	OUTER = 0
V_{ESA} (15 KeV) =	1225, 1475, 12.5, 21
V_{DEF} (0°) =	-250, 250, 31.25, 17
FILE:	15KeV ESA 1225 1475 DEFSCAN -250 250 V0.0 D 41.5 DPP

BEG: 2007
END: 2018

I = +45.5 ;	O = 0
V_{ESA} (15 KeV) =	1225, 1475, 12.5, 21
V_{DEF} (0°) =	-250, 250, 3.125, 17
FILE	15KeV ESA 1225 1475 DEFSCAN -250 250 V0.0 D 45.5 DPP

BEG: 2021
END: 2032

Inner = +41.5 ,	O = 0
V_{ESA} (15 KeV) =	1225, 1475, 12.5, 21
V_{DEF} (0°) =	-250, 250, 31.25, 17
FILE:	15KeV ESA 1225 1475 DEFSCAN -250 250 V0.0 D 41.5 DPP

9/8/01 => At 2032, lost filament on ion source. This shuts us down!!

9/8/01

0207 Finally got Arc after replacing filament and having 1800 of trouble shooting Arc.
Install V/G. Open gate valve. $P_{CHAMBER} = 2.7 \times 10^{-7}$.

0209 Open gate valve All nominal.
I = +41.5°, O = 0°, Beam energy = 15KeV.
No meaningful signal on Faraday cup
Set V_{ESA} = 1250, NO counts
1275, NO counts
1300, NO "
1325 counts drift up from a few 60 > 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.

0247 Seems that we have a beam.
Retract Faraday cup.
$P_{chamber} = 1.6 \times 10^{-7}$ T.
Install V/S plug.
Open flight tube gate valve $P \rightarrow 2.5 \times 10^{-7}$ T
V/S plug out. OK

0250 $V_{ESA} = 1250$: No counts
$V_{ESA} = 1275$: Maybe a few counts
$V_{ESA} = 1300$: Maybe a few counts
$V_{ESA} = 1325$: GA ~100 cts/samp CH14; 60 cts/samp CH 14.

0256 Beam monitors appear stable.
$V_{ESA} \rightarrow 1350$
Reduce beam flux Count rate 1000 → 600 CH15 cts/samp
$V_{ESA} \rightarrow 1375$: Count rate 570 cts/samp

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

650 cts/samp

BEG: 0304 Beam
Inner = +41.5, outer = 0
END: 0314 V_{ESA} (15 KeV) = 1225, 1475, 12.5, 21
V_{DEF} (0°) = -250, 250, 31.25, 17
Filename = 15KeVESA1225_1475DEFSCAN2-250_250V0.0D41.5DPP

$V_{ESA} = 1375$; 600 cts/samp

900

BEG: 0320 Inner → +39.5, outer
END: 0333 V_{ESA} (15 KeV) = 1225, 1475, 12.5, 21
V_{DEF} (0°) = -250, 250, 31.25, 17
File name = 15KeVESA1225_1475DEFSCAN-250_250V0.0D39.5DPP

$V_{ESA} = 1375$: 900 cts/samp
Move outer to -30
BEG: 0342 Inner = +39.5°
END: 0355 Outer = -30°
V_{ESA} (15 KeV) 1225, 1475, 12.5, 21
V_{DEF} (-30°) -3333, -2500, 33.3, 25, 17
File name = 15KeVESA1225_1475DEFSCAN-3333_-2500V-30.0D39.5DPP

8 Sept. 01 ESA QAC

0359 Move OUTER TO -15°

BEG: 0404 15KeV | INNER = +39.5° OUTER = -15°
V_{ESA} = 1225, 1475, 12.5, 21
END: V_{DEF} (-15°) = -1665, -1350, ~20.0, 17
FileName = 15KeVESA1225_1475DEFSCAN-1665-1350V-15.0D-39.5PP

SHIFT CHANGE → McComas, Piepgrass, Booker

0411 8/8/01 Plan to finish 14-15 IF

+43.5	±30	±15	
±30	±3333 to ±2700	} Def	17 steps
±15	±1665 to ±1350		
	1225 to 1475	} ESA	21 steps

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

04:13 15KeV ESA 1225_1475 DEFSCAN-1665_-1350V-15.0D-~~43.5~~ 39.5PP
Inner +43.5°
Outer ~~+30.0~~ -15°
ESA 1225 to 1475 21 steps
Def -1665 to -1350 17 steps

move outer to -30°
04:37 15KeV ESA 1225_1475 Defscan -3333_-2700V -30.0D-~~43.5~~ 39.5PP

move outer to +15°
04:55 15KeV ESA 1225_1475 Defscan 1350_1665V 15.0D-~~43.5~~ 39.5PP

move outer to +30°
05:13 15KeV ESA 1225_1475 Defscan 2700_3333V 30.0D-~~43.5~~ 39.5PP

★ 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 1475 v
Def = -250 to 250 v

start time	inner	filename	
05:49	86°	15kev ESA 1225_1475 Defscan -250_250v 0.0d	86.0 dpp
06:03	88°	"	88.0 dpp
06:17	89°	"	89.0 dpp
06:30	90°	"	90.0 dpp
06:44	92°	"	92.0 dpp

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 a telescope (large aperture)
3) 90° looks much more normal than 89° so decided to do deflection cut there

~652 ch 11 e⁻s had small burst of noise again

inner = 90°

Start time	outer	Filename		
0700	30°	15kevESA1225_1475 Defscan 2700_3333v 30.0d	90.0 dpp	
0715	15°	"	1350_1665v 15.0d	"
~~0730~~ 0736	-15°	"	-1665_-1350v -15.0d	"
751	-30°	"	-3333_-2700v -30.0d	"

almost no peaks in -30° scan
turned to 0° outer, 1370 v

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 L	Filename	
08:16	134.9°	15kV ESA 1225_1475 Defscan -250_250 v0.0d 134.9dpp	
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
shut down HV in IES

need to change deionized water in source

~9:45 last central aft position on inner
cycled power on controller
re homed
marked -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$^+$

Special test - full polar scan

File: i15kev ESA 1370 POLESCAN 0.0v def 0.0d 0.0dpp
↑ note: this actually changes w time

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

~~Time~~ Inner ∠	start time (from computer taking file)
START -115	10:32:00
-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
40	11:25:10
60	11:31:40
80	11:38:20
100	11:45:00
120	11:51:40
140	11:58:40
160	12:05:20
180	12:12:00
* 200	12:18:40
220	12:25:20
END 224	12:26:50

30	11:21:50
50	11:28:30
70	11:35:00
90	11:41:40
110	11:48:20
130	11:55:10
150	12:02:00
170	12:08:40
190	12:15:20
210	12:22:00

* AT -195 STARTED SEEING "BIT ERROR", POSITION DISPLAY NO LONGER 0.5 OR 0.0 RATE DECIMAL. PROTOCOL WITH NEWPORT UMC/D.

12:27 $P = 2.6 \times 10^{-7}$ T

Scanning inner 6 foot (nominal width)

ESA = 1370 V
Def = 0.0 V
Outer = 0°
inner scanned 3x

12:32 i 15 keV esa 1370 polescan 2_0.0v def 0.0 d 0.0 dpp

224.1 → 180 → 135 → 90 → 45 → 0
→ -45 → -90 → -115

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

12:42 i 15 keV esa 1370 polescan 3_0.0v def 0.0 d 0.0 dpp

Same as above, 6 at -115 → 224 [illegible]

Contents as above

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

i [illegible]

12:49 i 15 keV esa 1370 polescan 4_0.0v def 0.0 d 0.0 dpp

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

These 4 need to be plotted ASAP

10 55 Instrument shutdown

V/8 plug in

remove before starting IES

Cycled Vac system to install e- source
w/ ~ 1' nipple and shutdellens

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

1453	3.0×10^{-6} T
1527	7.7×10^{-7} T

9/9/01 1750: 5.8×10^{-8} Torr

RA Try electrons w/ new setup

Outer = 0°

Inner = +11.25° (ch 5)

1.19 A on source, 70-90 V sweep

10 V on grid

Moved to +33.75° ch 6

Ran DEF scan w/ ESA @ 82 V

plasma ~ +35 V on ion side of DEF (~16 kHz)

(Source: 1.15 A, 0.88 V)

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

Find center of sector

61 kV Def Scan 0.0d -115 dpp — Inside

DEF: -20 - -50 V — ch 1&16

ESA 70 - 90 V

ESA: 85 - 100 V

Def Scan 2

-109° DEF: -20 - -55 V — ch 15&16

ESA 75 - 100 V

-103° DEF: -15 - -50 V — ch 4

Def scan 2 -103° DEF: +15 - -55 V

Def n 36 -103° DEF: +36 V

ESA: 75 - 100 V

-50.5° DEF: -15 : -55 V — ch 1

ESA: 75 - 100 V

-58° ESA: 70 - 100 V — ch 2

DEF: +15 : -55 V

		−35.5°	ESA: 70 - 100 V	ch 3
			DEF: −15 : −55 V	
	2205	−13.0°	ESA: 70 - 100 V	ch 4
			DEF: −15 - −55 V	
		+19.5°	"	ch 5
		+32.0°	"	ch 6
5.6×10⁻⁹ Torr	2249	+54.5°	"	ch 7
		+77.0°	"	ch 8
		+99.5°	"	ch 9
		+122.0°	"	ch 10 + 8?

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

5.5×10⁻⁹ Torr	2330	+144.5°	ESA & DEF as above	ch 11

ch 8 shows up again

almost identical shape as ch 10 <

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

+32° Beam stability (keV beam table df 36 sa 82

(0.93 V 1.1 A ; Kimball e-beam)
grid = 0

+32° inner / +10° outer 1 keV def 50 50

" +10° outer 1 kV def 100 80

9/10/01 outer = 0°
inner = −112°

0105 6.0×10⁻⁸ Torr

Find edges of sectors

1 keV def 15 55 sa 70 100

+113° } ϕ +15

−90°

−67.5° ϕ +1

−45° 1+2

−45.5° } 2+3

-27.0°

0246 ; 6.2×10⁷ -22.5°

0°
-0.5°

+22.0°
+21.0°
~~+20.0°~~
+23.0°
+22.5°

3+4 but too much of 3
unequal sensitivities?

3 + 4

4+5

5+6
Also shows stuff here.

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

0428 CDT	Scan for anode 5/6 boundary	ESA 70-100V 21 steps Def -15-55 V 21 steps Outer 0° Inner 22.5°
0450	Repeat scan for anode 5/6	with inner at 23.0°
~~0530~~	~~Repeat scan for anode 6/7~~	
0530	Look for anode 6/7	inner 45.0°
0601	Run scan for anode 6/7	with inner at 45°
0620	Look for anode 7/8	(inner at 68.2°)
0728	Run scan for anode 7/8	with inner at 68.2°
	Look for anode 8/9	peak inner at 90.2°
0750	Run scan for anode 8/9	with inner at 90.2°
0800	Look for anode 9/10	peak at inner 112.9°
0807	Run scan for anode 9/10	with inner at 112.9°

During this 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 look data to find out which ones they are. It's at a much lower level (~7%) than channel 8 (~80%).

0820 Look for anode 10/11 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°

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 7.
This cross talk is very low, a few percent at most

1215 file Inner Scan

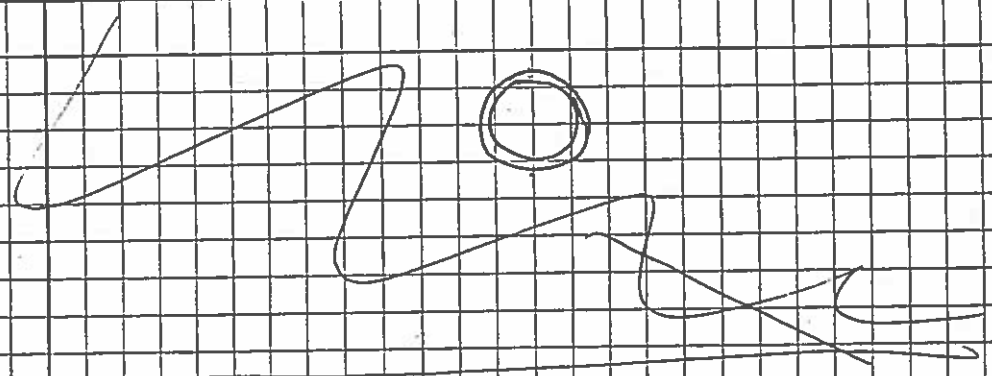
9/10/01 1630 Do detailed study of ion chan's. 2 + 14

2 keV N+

2.0×10^{-7} torr w/ gate valve open

Outer 0° Inner +65° ran ESA sweep to find beam on ch 14: peak ~~155 V~~ 183 V

Keep ESA @ 183 V try DEF scan ~~+35~~ ± 35 V
2 keV esa 183 def ± 35 p185



Same, but +15° Outer → no counts
increase DEF to ±150V → no counts
" ±200, ±300V → no counts

+5° Outer ?

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

+30° DEF: 300 - 500 V

-15° DEF: -150 : -250 V

-30° DEF: -300 : -500 V

18:56
2.5x10⁻⁷ Back to +115° inner (ch 2) 0° outer
ESA max @ 180 V

(echan 11 noisy: ~10-40 cts)

DEF scan: ±35 V

Outer +15° DEF: 150 - 250 V

Outer +30° DEF: 300 - 500 V

Outer -15° DEF: -150 : -250 V

Outer -30° DEF: -300 : -500 V

To ch 1 : -67.5° inner 0° outer
19:48
2.44x10⁻⁷ ESA: 140 - 200 Peak @ 183 V
DEF: 35 - 35 V / ESA = 163
Outer +15° DEF: 150 - 250 V

Outer: +15° DEF: +150: +250

Inner: +22.5° ch Ø ESA: 140-200V max @ 185V
Outer 0°
DEF 35-35

Outer +15° DEF 150-250V
Outer -15° DEF: -150: -250V

20:26
2.7X10⁻⁷Torr Inner +112.5° (ch 13) Outer 0°
ESA: 140-200 max @ 182V
DEF scan 35-35
Outer +15° DEF: 150-250V
Outer -15° DEF: -150: -250V

Inner 192.5° (ch 9) Outer 0°
ESA: 140-200 max @ 180V
DEF scan: 35-35
Outer +15° DEF: 150-250V
Outer -15° DEF: -150: -250V

21:22 500eV N2
2.8X10⁻⁷Torr Inner 157.5° (ch 12) Outer 0°
ESA scan 25-80V max @ 45V
DEF scan -20 -+20V
Outer +15° DEF scan 38-64V
Outer +30° DEF scan 76-128V
Outer -15° DEF scan -38: -64V
Outer -30° DEF scan -76: -128V

Inner 112.5° (ch 8) Outer 0°
ESA scan 25-60V Max @ 45V
DEF scan -20: 20V
Outer +15° DEF scan 38-64V
Outer +30° DEF scan 76-128V
Outer -15° DEF scan -38: -64
Outer -30° DEF scan -76: -128V

Inner +65° (ch 14) Outer 0°
ESA scan 25-60V Max @ max @ 47V
DEF scan -20: 20V
Outer +15° DEF scan 38-64V
Outer +30° DEF scan 76-128V

outer +15° Def scan -38 : -64 V
23:02 outer -30° Def scan -76 : -128
2.8x10⁻⁷

outer 0° ESA 47 V DEF 0 V
+1°
+2°
-1°
-2°
0°

140 Hz
40
2
25
2
135

ESA: 35-60 V DEF: -20-+20 V

2337 Shut down 2.8 x 10⁻⁷ Torr

9/12/01 Run flight software the VE 24 V NT
Outer: 60°
0850 Inner: 0°
6x10⁻⁸ Need to fix display software

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

Outer -45° Inner @ +65°
Def -580 V ESA scan 170-200 V
(Repeat w/ 41 steps) ESA max ~ 181/182 V

1126
2.3x10⁻⁷

ESA = 182 DEF -630 : -1181 V (2 V steps)

outer -43° DEF -630 : -374 V Table
-41° "
-39° "
-37° "
-35° "
-33° "
-31° " cut off @ -374
-34° -440 : -184 V

last position: Axis 3: 65° Axis 4: -31°

Testing Flight Software ~1300 –

1527–1626
2.3×10^{-7}

Back to Sci 6

redo (1625) Inner 0° Outer -31° ESA=182 V, DEF: -440 : -184

1630
2.4×10^{-7}

-29° "
-27° "
-25° "
-23° "
-21° "
-19° "
-17° (184) -400 : -144

min of warm ESA →

-17° 182 -300 : -44
-15° " "
-13° " "
-11° " "
-9° " "
-7° " "
-5° " "

1803
2.4×10^{-7}

-3° -90 : +206 V (ctr @ -50)
-1° "
0° "
+1° "
+3° "

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

-45° ESA: 170-200V DEF: -580V

2040

7.4 x 10^7

2044 IES