# ICON FUV

#  turret rotation axis

# ICN-FUV-078

## REV - B

# 2015-September-16

As Run on: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date/Time

By: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Test Conductor

# Document Revision Record

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| --- | --- | --- | --- |
| **Rev.** | **Date** | **Description of Change** | **Approved By** |
| - | July 6, 2015 | Initial Draft Released |  |
|  | September 16, 2015 | Updates after calibration procedure discussion |  |
|  |  |  |  |

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**TBDs**

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| WRITTEN BY Harald Frey DATE 06/JULY/15APPROVALSENG : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DATE \_\_\_\_\_\_\_\_\_\_SCI (FUV) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (SM) DATE \_\_\_\_\_\_\_\_\_\_PM (FUV): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(CC) DATE \_\_\_\_\_\_\_\_\_\_P/L SE : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(SH) DATE \_\_\_\_\_\_\_\_\_\_PSE : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (ET) DATE \_\_\_\_\_\_\_\_\_\_QA: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(JF) DATE \_\_\_\_\_\_\_\_\_\_  | REVISIONS:B – September 15, 2015 |
| 1.0 OBJECTIVE, 2.0 APPLICATION, 3.0 DRAWINGS and DOCUMENTS, 4.0 REQUIRED PERSONNEL, 5.0 EQUIPMENT, 6.0 CONFIGURATION, 7.0 SAFETY, 8.0 PROCEDURES, 9.0 ANOMALIES. APPENDIX A: EMERGENCY SHUTDOWN and BACKOUT STEPS. |

1. Objective.

This procedure provides the steps to obtain the angle between the turret rotation and the FUV instrument optical axes. The general setup is similar to the measurement of the distortion map except that the turret is rotated and the MGSE compensates nominally for this rotation. If the turret rotation axis and the turret mirror are aligned per the design the resulting spot should always fall into the center of the image. This procedure will be used at CSL in Belgium with FUV in the 6.5 m vacuum chamber.

1. Application.

This procedure will be run once.

1. Drawings and Documents.

ICN-SYS-TBD ICON Contamination Control Plan

ICN-SYS-TBD ICON Purge Plan

1. Required Personnel.

The following personnel are required to be involved for this procedure:

1. Chris Scholz or representative, Quality Assurance
2. Ellen Taylor or Stu Harris, Project/Payload Systems Engineer
3. Cathy Chou or representative, FUV Instrument Lead
4. Stephen Mende or representative, FUV Instrument Scientist

Record assigned Test Conductor \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Record attending Test Personnel \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Only the Project Manager, Project Systems Engineer, Payload Systems Engineer, Assigned Test Conductor or Quality Assurance has the authority to make changes in this procedure during operation if the need arises. At least one of these individuals will be present during the full duration of operations.

1. Equipment.

Instrument GSE:

FUV GSE Hardware (Note Serial Number):

1. Keysight N6700B Power Supply \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. ICP Communications Emulator (CE) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. ITOS Machine, ITOS Version \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Engineering Model ICP (Foxtrot) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. SDL provided PC \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. Keithley \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Harnesses (in addition to Flight Instrument Harness):

1. FUVA- J31 FUV Camera A Data (SWC) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. FUVA- J32 FUV Camera A Power \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. FUVA- J33 FUV Camera A HV Power Supply \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. FUVA- J34 FUV Camera A HV Arming Plug \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. FUVB- J31 FUV Camera B Data (LWC) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. FUVB- J32 FUV Camera B Power \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. FUVB- J33 FUV Camera B HV Power Supply \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. FUVB- J34 FUV Camera B HV Arming Plug \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. FUV- J35 FUV Optics Interfaces \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
10. FUV- J36 FUV Turret Electronics \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
11. FUV- J37 FUV Turret Electronics Output \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
12. FUV- J38 FUV Turret Arming Plug \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
13. Configurations.

FUV is fully integrated. UV alignment is finished and all mirrors and grating are staked and in final positions. Communication is EM ICP to ITOS machine for power and commanding, data readout happens on SDL provided PC. Test plugs and equipment are installed:

* FUV SW Camera FULL HV Enabling Plug is installed
* FUV LW Camera FULL HV Enabling Plug is installed
* FUV Door Lift Assembly is installed (if necessary)
* FUV Turret Counterbalance is installed (if necessary)
* FUV Turret Arming Plug is installed
* Turret at 0 degrees with door opened

Figure 1: Schematic of test setup

Note deviations from above configuration: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Test Conductor Sign-Off on deviations: \_\_\_\_\_\_\_\_\_\_

1. Safety Precautions.

The FUV Instrument should be treated as ESD sensitive, and handled per the requirements listed in IVN-SYS-003 Environmental Requirements Document (ERD).

The FUV Instrument is contamination sensitive, and must be handled with appropriate care. At all times, the payload shall be handled per the requirements listed in ICN-SYS-006 ICON Contamination Control Plan.

All moving operations outside of a clean room will take place with the payload covered with anti-static bagging. The payload will be handled only by personnel wearing attire appropriate for a FED-STD-209 Class 100,000 cleanroom, including gloves. If the payload is double bagged, personnel will not need full cleanroom suits. However, gloves and wrist straps will be required.

The FUV Instruments must be under purge at all times. See ICN-SYS-TBD ICON Purge Plan for purge monitoring and safety precautions.

1. Procedures.
	1. Test Configuration
		1. FUV instrument installed in CSL vacuum chamber with door opened
		2. Proper movability of cradle confirmed
		3. Electric connection through feedthrough confirmed
		4. Communication between ICP and FUV confirmed
		5. Communication between FUV and SDL PC confirmed
		6. Verify Proper FUV Test Configuration

  FUV SW Camera FULL HV Enabling Plug is in

  FUV LW Camera FULL HV Enabling Plug is in

* + 1. Verify proper vacuum chamber pressure of <10^-3 Pa
		2. Start UV source
		3. Tune monochromator to 135.6 nm
		4. Characterize incoming beam with CSL photodiode
		5. Verify computer time is correct and note start time

Start time: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* + 1. Verify cover is open

FUV\_cover: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Required: OPENED

Sign off: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (TC initials required)

* 1. Note instrument temperatures for the record

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| FUV instrument | Temperature at begin of test | Temperature at end of test | OGSE/MGSE | Temperature at begin of test | Temperature at end of test |
| FUVS\_Temp1 |  |  |  |  |  |
| FUVS\_Temp2 |  |  |  |  |  |
| FUVS\_HV\_Temp |  |  |  |  |  |
| FUVL\_Temp1 |  |  |  |  |  |
| FUVL\_Temp2 |  |  |  |  |  |
| FUVL\_HV\_Temp |  |  |  |  |  |
| FUV\_TUR\_Temp |  |  |  |  |  |
| FUV\_OPT\_Temp |  |  |  |  |  |
| FUV\_IMG\_Temp |  |  |  |  |  |
| FUV\_GRAT\_Temp |  |  |  |  |  |

* 1. Instrument Payload Power On
		1.  Execute Section 8.9 in the FUV CPT (ICN-FUV-068) for ICP power on. Attach As-run paper procedure to the appendix. Note FUV CPT revision below:

FUV CPT Revision: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Sign off: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (TC initials required)

* 1. FUV Camera Power Control
		1.  Send script: **start FUV\_on** to power on FUV-Short Wave (SW) camera

Enter **SW** when prompted

* + 1.  Verify FUV A (SW) enable, current draw and data

FUV SW Enable \_\_\_\_\_\_\_\_\_\_\_ Required: ON

Keysight Current \_\_\_\_\_\_\_\_\_\_\_ Required: 530mA +/-10mA

fuv\_pwr\_imon \_\_\_\_\_\_\_\_\_\_\_ Required: 365 mA +/- 10mA

* + 1.  Verify FUV A (SW) Camera Ancillary Data

fuva\_temp1 (CCD) \_\_\_\_\_\_\_\_\_\_\_ Required: -20C to 48C

fuva\_temp2 (DIG) \_\_\_\_\_\_\_\_\_\_\_ Required: -20C to 48C

* + 1.  Send script: **start FUV\_on** to power on and initialize FUV-short wave and FUV-long wave cameras *(note: FUV B cannot be separately enabled)*

Enter **BOTH** when prompted

* + 1.  Verify FUV B (Long Wave) enable, current draw and data

FUV LW Enable \_\_\_\_\_\_\_\_\_\_\_ Required: ON

Keysight Current \_\_\_\_\_\_\_\_\_\_\_ Required: 570mA +/-10mA

fuv\_pwr\_imon \_\_\_\_\_\_\_\_\_\_\_ Required: 395mA +/- 10mA

* + 1.  Verify FUV B LW Camera Ancillary Data

fuvb\_temp1 (CCD) \_\_\_\_\_\_\_\_\_\_\_ Required: -20C to 48C

fuvb\_temp2 (DIG) \_\_\_\_\_\_\_\_\_\_\_ Required: -20C to 48C

* + 1.  Verify receipt of FUV APID 0xE1 (realtime) and 0xE2 (nominal) data
		2.  Set up SDL computer to collect 2x2 binned images (512x512 nominal pixel) and single left tap readout for Shortwave

 Frame Count = 100 (default)

 Binning = 2x2 (default)

 Verify X low = 0; X High = 535; Y low = 0; Y High = 514 (default)

 MS count = 120 ms (default)

* + 1.  Send script FUV\_TAKE\_PICTURE\_SW.PY to capture and store SW image on SDL computer. Make sure file\_type name is in pull down menu:

 STARTVIDEO 120

 COADD 100

 SAVEFILE file\_type 3

 Record filename \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* + 1.  Verify receipt of FUV SW data

* 1. FUV High Voltage (HV) On
		1.  Execute Section 8.13 in the FUV CPT (ICN-FUV-068) for FUV High Voltage setup. Attach As-run paper procedure to the appendix. Note FUV CPT Revision used below

FUV CPT Revision: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Sign-off \_\_\_\_\_\_\_\_\_\_\_ (TC initials required)

* 1. SW channel spot position determination
		1.  Verify Monochromator is set to 135.6 nm
		2.  Characterize incoming beam
		3.  Set up SDL computer to collect 2x2 binned images (512x512 nominal pixels) and single tap readout
		4.  Verify that turret is at nominal 0 degrees position
		5.  Verify that cradle is set to normal incidence 0 degrees
		6.  Send script: **FUV\_TAKE\_PICTURE\_SW.PY** to take an integrated picture of 100 frames of 120 msec exposure time and save on SDL PC with appropriate header information about time, number of frames, cradle position, wavelength, channel,
		7.  Verify appearance of a spot in the SW channel located at approximately the center of the image
		8.  Rotate turret in 5 degrees steps and move cradle to compensate for turret rotation. Repeat step 8.6.5 for each turret angle. Note the approximate pixel position of the spot center as the detailed analysis will be done later.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Turret angle** | **MGSE Angles** | **Angle alpha** | **Angle beta** | **Spot X-pixel position** | **Spot Y-pixel position** | **Spot counts** |
| 0 | 0/0 | 0 | 0 |  |  |  |
| +5 |  | 0 | 0 |  |  |  |
| +10 |  | 0 | 0 |  |  |  |
| +15 |  | 0 | 0 |  |  |  |
| +20 |  | 0 | 0 |  |  |  |
| +25 |  | 0 | 0 |  |  |  |
| +30 |  | 0 | 0 |  |  |  |
| -30 |  | 0 | 0 |  |  |  |
| -25 |  | 0 | 0 |  |  |  |
| -20 |  | 0 | 0 |  |  |  |
| -15 |  | 0 | 0 |  |  |  |
| -10 |  | 0 | 0 |  |  |  |
| -5 |  | 0 | 0 |  |  |  |
| 0 | 0/0 | 0 | 0 |  |  |  |
| 0 |  | +8 | 0 |  |  |  |
| +5 |  | +8 | 0 |  |  |  |
| +10 |  | +8 | 0 |  |  |  |
| +15 |  | +8 | 0 |  |  |  |
| +20 |  | +8 | 0 |  |  |  |
| +25 |  | +8 | 0 |  |  |  |
| +30 |  | +8 | 0 |  |  |  |
| -30 |  | +8 | 0 |  |  |  |
| -25 |  | +8 | 0 |  |  |  |
| -20 |  | +8 | 0 |  |  |  |
| -15 |  | +8 | 0 |  |  |  |
| -10 |  | +8 | 0 |  |  |  |
| -5 |  | +8 | 0 |  |  |  |
| 0 |  | +8 | 0 |  |  |  |
| 0 |  | 0 | +11 |  |  |  |
| +5 |  | 0 | +11 |  |  |  |
| +10 |  | 0 | +11 |  |  |  |
| +15 |  | 0 | +11 |  |  |  |
| +20 |  | 0 | +11 |  |  |  |
| +25 |  | 0 | +11 |  |  |  |
| +30 |  | 0 | +11 |  |  |  |
| -30 |  | 0 | +11 |  |  |  |
| -25 |  | 0 | +11 |  |  |  |
| -20 |  | 0 | +11 |  |  |  |
| -15 |  | 0 | +11 |  |  |  |
| -10 |  | 0 | +11 |  |  |  |
| -5 |  | 0 | +11 |  |  |  |
| 0 |  | 0 | +11 |  |  |  |
| 0 | 0/0 | 0 | 0 |  |  |  |

* 1. ITOS power down (this step may be skipped if the following calibration procedure will be run without interruption)
		1.  Record time of Instrument Power Off

 End of Test \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* + 1.  Start FUV\_OFF
		2.  Start icp\_off
		3.  Quit now in prompt
		4.  Foxtrot\_cleanup
1. Anomalies.

Note all anomalies that occurred during procedure:

1. Data Review.

QA Signoff: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

PSE Signoff: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_APPENDIX A: EMERGENCY SHUTDOWN and BACKOUT STEPS

FIRE:

[1] Stop the operation;

[2] Evacuate the area;

[3] Call 911.

EARTHQUAKE (highly unlikely in Belgium, but better have it in place):

[1] Stop the operation;

[2] Engage brakes on the spacecraft dolly;

[3] Evacuate the area.

VACUUM BREACH:

[1] Stop operations

[2] verify that automatic power off occurred else pull the power plug to FUV