16531 - Cycle 29 ACS SBC Recovery from Anomalous Shutdown

Cycle: 29, Proposal Category: CAL/ACS
(Availability Mode: RESTRICTED)

**INVESTIGATORS**

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
<th>E-Mail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr. Thomas Wheeler (PI) (Contact)</td>
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</tr>
</tbody>
</table>

**VISITS**

<table>
<thead>
<tr>
<th>Visit</th>
<th>Targets used in Visit</th>
<th>Configurations used in Visit</th>
<th>Orbits Used</th>
<th>Last Orbit Planner Run</th>
<th>OP Current with Visit?</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>DARK</td>
<td>S/C</td>
<td>1</td>
<td>04-Jun-2021 17:00:37.0</td>
<td>yes</td>
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<tr>
<td>02</td>
<td>DARK</td>
<td>ACS/SBC S/C</td>
<td>1</td>
<td>04-Jun-2021 17:00:38.0</td>
<td>yes</td>
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<tr>
<td>03</td>
<td>DARK</td>
<td>ACS/SBC S/C</td>
<td>1</td>
<td>04-Jun-2021 17:00:38.0</td>
<td>yes</td>
</tr>
<tr>
<td>04</td>
<td>DARK DEUTERIUM</td>
<td>ACS/SBC S/C</td>
<td>1</td>
<td>04-Jun-2021 17:00:38.0</td>
<td>yes</td>
</tr>
</tbody>
</table>

4 Total Orbits Used

**ABSTRACT**

This proposal is designed to permit a safe and orderly recovery of the SBC (FUV MAMA) detector after an anomalous shutdown. This is accomplished by using slower-than-normal MCP high-voltage ramp-ups and diagnostics. Anomalous shutdowns can occur because of bright object violations, which trigger the Global Hardware Monitor or the Global Software Monitor. Anomalous shutdowns can also occur because of MAMA hardware anomalies or failures. The cause of the shutdown should be thoroughly investigated and understood prior to recovery. Twenty-four hour
wait intervals are required after each test for MCP gas desorption and data analysis. Event flag 2 is used to prevent inadvertent MAMA usage.

The recovery procedure consists of four separate tests (i.e. visits) to check the MAMA's health after an anomalous shutdown: 1) signal processing electronics check, 2) slow, high-voltage ramp-up to an intermediate voltage, 3) a slow high-voltage ramp-up to the nominal operating HV, and 4) fold analysis test. Each must be completed successfully before proceeding onto the next. During the two high-voltage ramp-ups, dark ACCUM exposures are taken. At high voltage, dark ACCUM exposures and diagnostics are taken. This proposal is based on Cycle 28 Proposal 16388. For additional MAMA recovery information, see STIS ISR 98-02R.

OBSERVING DESCRIPTION
The SBC (FUV MAMA) Recovery from Anomalous Shutdown consists of four tests (i.e. visits) where each must be successfully completed before the next. The visits are enabled for execution by the clearing of flag 2. The visits are:

1. Signal processing electronics check. This reduces amplifier thresholds to 0.28V and monitors the ORCOUNT rates. (MAMA HV is off during this procedure.)
2. Intermediate high-voltage ramp-up. The MAMA is ramped to an MCP voltage 300V below the nominal operating value. A dark ACCUM is taken during this partial ramp-up. Then a dark ACCUM is taken while W, X, Y, Z, OR, EV and VE counters are cycled and sampled.
3. Full high-voltage ramp-up. The MAMA is ramped to the nominal MCP voltage. A dark ACCUM is taken during this full ramp-up. Then a dark ACCUM is taken during which events counter is cycled through W, X, Y, Z, OR, EV, and VE counters are sampled.
4. Fold analysis test. The fold analysis provides a measurement of the distribution of charge cloud sizes incident upon the anode giving some measure of changes in the pulse height distribution of the MCP and, therefore, MCP gain. This is accomplished by disabling/enabling different combinations of decoder rows and columns.

For the Anomalous Shutdown tests to be executed, the following conditions have to have been met:
For visit 01: There was an anomalous MAMA HV shut down and the reason for the shutdown is understood. For this and visits 02 and 03, the ACS M3 fold mirror must be in the HRC position and the Cal Door must be in the Deployed position.
For visit 02: A minimum of 24 hours must have elapsed since the initial shutdown prior to beginning the intermediate HV ramp-up. For visits 02, 03, 24 hours are required for telemetry and data analysis.
This is not a requirement but it is desirable to have real-time engineering telemetry (MA return) during the execution of the first three visits.
Proposal 16531 - LV Signal Processing Test (01) - Cycle 29 ACS SBC Recovery from Anomalous Shutdown

Visit

Diagnostic Status: No Diagnostics

Scientific Instruments: S/C

Special Requirements: ON HOLD ; PARALLEL

Comments: Signal processing electronics checkout procedure. Goal: verify electronics. Must clear event flag 2 for the commanding to execute. Since no high voltage is involved, this visit may be scheduled within the 24 hour period following an anomalous HV shutdown. There are no images taken in this visit, only telemetry is required.

On Hold Comments: To be used only after an anomalous shutdown of the SBC high voltage.

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</thead>
<tbody>
<tr>
<td>1</td>
<td>LV On and Signal Processing Check</td>
<td>DARK</td>
<td>S/C, DATA, NONE</td>
<td>SAA CONTOUR 28; SPEC COM INSTR EJOPTLV_0; QASISTATES ACS SI WFHOPER WF HOPER</td>
<td>Same Alignment in LV Signal Processing Test (01)</td>
<td>1080.0 Secs (1080 Secs)</td>
<td>[I]</td>
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Comments: Switch on LV power supply and clean up after a possible MCE reset. Enable Software global monitor to values of Threshold = 77000 and Integration Period = 0.1 secs. Set amplifier threshold to default (0.48V). Collect a minimum of 30 telemetry points (OR counts). Set amplifier threshold to 0.28V. Collect a minimum of 30 telemetry points (OR Counts). Counts (W, X, Y, etc) are sampled by telemetry every 15 seconds for ACS.

| 2 | LV Off | DARK | S/C, DATA, NONE | SAA CONTOUR 28; SPEC COM INSTR RILVTOP | Same Alignment in LV Signal Processing Test (01) | 60.0 Secs (60 Secs) | [I] |

Comments: Transition from MAMA Low Voltage to WFHOPER.

| 3 | Set Flag 2 | DARK | S/C, DATA, NONE | SAA CONTOUR 28; SPEC COM INSTR EJFLAG2 | Same Alignment in LV Signal Processing Test (01) | 10.0 Secs (10 Secs) | [I] |

Comments: Set event flag 2. Prevents execution of the next scheduled visit without ground approval.

Orbit Structure

Orbit 1

Exp. 1

Unused Orbital Visibility = 3142

Exp. 2

Exp. 3

Occultation

Server Version: 20200619
### Proposal 16531 - Ramp to Intermediate HV (02) - Cycle 29 ACS SBC Recovery from Anomalous Shutdown

**Visit**

**Diagnostic Status:** Warning

**Scientific Instruments:** S/C, ACS/SBC

**Special Requirements:** AFTER 01 BY 1.0 D TO 30.0 D; ON HOLD; PARALLEL

**Comments:** Minimum wait of 24 hours following the anomalous shutdown. MAMA intermediate voltage checkout procedure. Goal: 1) Ramp MAMA to intermediate MCP voltage 2) Obtain dark image and dark count telemetry. Must clear event flag 2 for the commanding to execute.

**On Hold Comments:** To be used only after an anomalous shutdown of the SBC high voltage.

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**Diagnostics**

(Ramp to Intermediate HV (02)) Warning (Orbit Planner): MAXIMUM DURATION EXCEEDED FOR INTERNAL OR EARTH CALIB SU

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**Exposures**

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<tbody>
<tr>
<td>1</td>
<td>LV On</td>
<td>DARK</td>
<td>S/C, DATA, NONE</td>
<td>SAA CONTOUR 28; SPEC COM INSTR EJOPTILV_1; QASISTATES ACS SI WFMAHVON</td>
<td>Sequence 1-4 Non-Init in Ramp to Intermediate HV (02)</td>
<td>200 Secs (200 Secs)</td>
<td>[I]</td>
<td></td>
<td></td>
</tr>
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</table>

**Comments:** Switch on LV power supply and clean up after a possible MCE reset. Enable Software global monitor to values of Threshold = 100 and Integration Period = 0.1 secs. Enable SDF. Set amplifier threshold to default (0.48V). Event flag 2 must be cleared for this commanding to execute.

| 2 | Ramp HV to -2000/-100 | DARK | ACS/SBC, ACCUM, SBC DEF | SPEC COM INSTR EJLVTHV_1; NEW ALIGNMENT; QASISTATES ACS SI WFMAHVON | Sequence 1-4 Non-Init in Ramp to Intermediate HV (02) | 1980.0 Secs (1980 Secs) | [I] |

**Comments:** The MCP and Field Voltage partial Ramp-ups will be performed in stages. The ramp-up within a stage is by increments of 50V. The final MCP voltage will be -2000V, 300V shy of the nominal value of -2300V. The final Field Voltage will be -100V, rather than the nominal -1000V setting. Use the nominal yellow and red limits for ramping. At the end of each stage, reset the SGM to a Threshold = 100 and an Integration Period = 0.1 sec, and collect telemetry samples of Z Counts for 4 minutes. The ACS rate is 1 TLM sample/15 secs; 15 or 16 samples will be obtained. Stage 1 - MCP ramp-up (0 - 500V). Stage 2 - MCP ramp-up (500V - 1000V). Stage 3 - MCP ramp-up (1000V - 1500V). Stage 4 - MCP ramp-up (1500V - 2000V). Stage 5 - Field Voltage ramp-up (+28 - -100V).

| 3 | Dark and Cycle SGM | DARK | ACS/SBC, ACCUM, SBC DEF | SPEC COM INSTR EJHVDARK; NEW ALIGNMENT | Sequence 1-4 Non-Init in Ramp to Intermediate HV (02) | 720.0 Secs (720 Secs) | [I] |

**Comments:** Obtain a MAMA DARK while at 2000V. During the exposure, set Software Global Monitor to an SGM Threshold = 200 and an Integration Period = 0.1 secs. Collect a minimum of 5 samples of W, X, Y, Z, OR, EV, and VE events.

| 4 | HV and LV Off - Set Flag 2 | DARK | S/C, DATA, NONE | SAA CONTOUR 28; SPEC COM INSTR EJHVSTOP_1; NEW ALIGNMENT; QASISTATES ACS SI WFMAHVON WFHPHER | Sequence 1-4 Non-Init in Ramp to Intermediate HV (02) | 440.0 Secs (440 Secs) | [I] |

**Comments:** Ramp the Field and MCP High Voltage down from its intermediate value. Turn off the high voltage, then low voltage power. Set Event Flag 2
Proposal 16531 - Ramp to Full HV (03) - Cycle 29 ACS SBC Recovery from Anomalous Shutdown

**Visit**

**Proposal 16531, Ramp to Full HV (03)**

**Diagnostic Status:** Warning

**Scientific Instruments:** S/C, ACS/SBC

**Special Requirements:** AFTER 02 BY 1.0 D TO 30.0 D; ON HOLD; PARALLEL

**Comments:** Full HV ramp-up and checkout procedure. Goal: 1) Ramp MAMA to full MCP operating voltage. 2) Obtain a dark image and dark count telemetry. Must clear event flag 2 for the commanding to execute. Note this visit is normally followed immediately by the MAMA Fold Test, visit 4. The MAMA HV is left on and flag 2 is NOT set at the end of this visit.

**On Hold Comments:** To be used only after an anomalous shutdown of the SBC high voltage.

**Diagnostics**

(Ramp to Full HV (03)) Warning (Orbit Planner): MAXIMUM DURATION EXCEEDED FOR INTERNAL OR EARTH CALIB SU

**Exposures**

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</thead>
<tbody>
<tr>
<td>1</td>
<td>LV On</td>
<td>DARK</td>
<td>S/C, DATA, NONE</td>
<td>SPEC COM INSTR EJOPTLV_2; QASISTATES ACS SI WFHROPER WF MALVON</td>
<td>Sequence 1-3 Non-Init in Ramp to Full HV (03)</td>
<td>200 Secs (200 Secs)</td>
<td>[I]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Ramp HV to -2300/-1000</td>
<td>DARK</td>
<td>ACS/SBC, ACCUM, SBC DEF</td>
<td>SPEC COM INSTR EJLHVTHV_2; NEW ALIGNMENT ; QASISTATES ACS SI WFMAHVON W</td>
<td>Sequence 1-3 Non-Init in Ramp to Full HV (03)</td>
<td>3300.0 Secs (3300 Secs)</td>
<td>[I]</td>
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</tr>
<tr>
<td>3</td>
<td>Dark and Cycle SGM</td>
<td>DARK</td>
<td>ACS/SBC, ACCUM, SBC DEF</td>
<td>SPEC COM INSTR EJHVTHV, DARK; NEW ALIGNMENT</td>
<td>Sequence 1-3 Non-Init in Ramp to Full HV (03)</td>
<td>720.0 Secs (720 Secs)</td>
<td>[I]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Comments:**

1. **Switch on LV power supply and clean up after a possible MCE reset. Enable Software global monitor to values of Threshold = 100 and Integration Period = 0.1 secs. Enable SDF. Set amplifier threshold to default (0.48V). Event flag 2 must be cleared for this commanding to execute.
2. **The MCP and Field Voltage Ramp-ups will be performed in stages.** The ramp-up within a stage is by increments of 50V. Use the nominal yellow and red limits for ramping. At the end of each stage, reset the SGM to a Threshold = 100 and an Integration Period = 0.1 sec, and collect telemetry samples of Z Counts for 4 minutes. The ACS rate is 1 TLM sample/15 secs; 15 or 16 samples will be obtained. Stage 1 - MCP ramp-up (0 - 500V) Stage 2 - MCP ramp-up (500V - 1000V) Stage 3 - MCP ramp-up (1000V - 1500V) Stage 4 - MCP ramp-up (1500V - 2000V) Stage 5 - Field Voltage ramp-up (+28 - -100V) Stage 6 - MCP ramp-up (2000V - 2100V) Stage 7 - MCP ramp-up (2100V - 2200V) Stage 8 - Final MCP ramp-up (2200V - 2300V) Stage 9 - Field Voltage ramp-up (100V-1000V)
3. **Obtain a MAMA DARK while ramped up.** During the exposure, set Software Global Monitor to an SGM Threshold = 200 and an Integration Period = 0.1 secs. Collect a minimum of 5 samples of W, X, Y, Z, OR, EV, and VE events.
Orbit Structure

Orbit 1

Exp. 1
Unused Orbital Visibility = 3142

Exp. 2

Occultation

Exp. 3

Server Version: 20200619
<table>
<thead>
<tr>
<th>Visit</th>
<th>Proposal 16531, Fold Test (04)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Diagnostic Status: Warning</td>
</tr>
<tr>
<td></td>
<td>Scientific Instruments: S/C, ACS/SBC</td>
</tr>
<tr>
<td></td>
<td>Special Requirements: AFTER 03 BY 0.0 D TO 30.0 D; ON HOLD; PARALLEL</td>
</tr>
<tr>
<td></td>
<td>Comments: ACS MAMA fold analysis. Goal: verify performance of MCP. Since the Deterium lamp is turned on during exposure 1, the MAMA filter wheel should be initially set to blocking filter number 3 which is adjacent to F165LP used in exposure 2.</td>
</tr>
<tr>
<td></td>
<td>On Hold Comments: To be used only after an anomalous shutdown of the SBC high voltage.</td>
</tr>
</tbody>
</table>

| Diagnostics | (Fold Test (04)) Warning (Orbit Planner): MAXIMUM DURATION EXCEEDED FOR INTERNAL OR EARTH CALIB SU |
|----|-----------|-----------|------------------------|---------------|--------------|--------------|--------|----------------------------------|-------|
| 1  | Turn On D2 Lamp | DARK S/C, DATA, NONE | | | | | | SAA CONTOUR 28; Sequence 1-3 Non-Input in Fold Test (04) 300.0 Secs (500 Secs) | [I] |
|    |           |           |                        |               |              |             |        | [===>]                            |       |
|    |           |           |                        |               |              |             |        | [1]                              |       |
| Comments: | Patch soft safe table. Set Software Global monitor (SGM) SGM Threshold = 15000 SGM Integration period = 0.1 secs. Move SBC FW to BLOCK3. Disable TDF response. Turn on DEUTERIUM lamp. |
| 2  | D2 Expo   | DEUTERIUM | ACS/SBC, ACCUM, SBC    | F165LP        | QASISTATES ACS LAMP HOLD HOLD D | Sequence 1-3 Non-Input in Fold Test (04) 300.0 Secs (300 Secs) | [===>] |       |
|    |           |           |                        |               |              |             |        | [1]                              |       |
| Comments: | This is a DEUTERIUM lamp exposure. The lamp setup is performed by line 1. |
| 3  | Fold Test | DARK S/C, DATA, NONE | | | | | | SAA CONTOUR 28; Sequence 1-3 Non-Input in Fold Test (04) 3000.0 Secs (3000 Secs) | [===>] | [I] |
| Comments: | Move the fold mech to SBC. Set Software Global monitor (SGM Threshold = 130000 SGM Integration period = 1.0 secs. The TLM sample rate for ACS is one sample / 15 seconds. |
| (a) | Collect counter samples during flat field illumination | | | | | | | | |
| (b) | Disable MAMA Folds: C2, C3, C4, C5, C6, R2, R3, R4, R5, R6 |
| (c) | Conduct fold analysis: Collect 5 samples VE for following 19 combinations of MAMA folds: |
| (d) | Enable MAMA folds C2, C3, C4, C5, C6, R2, R3, R4, R5, R6 at completion of exposure |
| (e) | Check lamp stability by checking EV and VE. Collect 5 samples Valid Events (VE) |
| (f) | Turn off DEUTERIUM lamp |
| (g) | Collect event counter data for detector dark count rate |
| (h) | At completion of procedure reset SGM to nominal operating level |