



4467 - MSA Electrical Shorts Detection (ESD) (CAL-NRS-213)

Cycle: 2, Proposal Category: CAL/NIRSPEC

INVESTIGATORS

| <i>Name</i> | <i>Institution</i> |
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OBSERVATIONS

| <i>Folder</i> | <i>Observation</i> | <i>Label</i> | <i>Observing Template</i> | <i>Science Target</i> |
|------------------------------|--------------------|------------------------------------|-----------------------------|-----------------------|
| EXAMPLE - for reference only | | | | |
| | 1 | ESD - AllQs | NIRSpec MSA Short Detection | NONE |
| | 2 | Diagnostic exposures | NIRSpec Internal Lamp | NONE |
| Aug-2023-Q2-short | | | | |
| | 3 | MSA Short Detection | NIRSpec MSA Short Detection | NONE |
| | 4 | Follow-up exposures | NIRSpec Internal Lamp | NONE |
| Oct-2023-Q2-Q4-short | | | | |
| | 5 | Electrical Shorts Detection for Q4 | NIRSpec MSA Short Detection | NONE |
| | 6 | Diagnostic exposures for Q2 and Q4 | NIRSpec Internal Lamp | NONE |

ABSTRACT

MANDATORY CAVEAT: This calibration program may change in response to system developments and the final Cycle 2 science program.

Contingency program for MSA ESD. When a new MSA short appears, if it is detectable in telemetry, ESD should be executed on the relevant MSA

Quad in order to locate the short and mask the shutter row/column as necessary. After ESD, diagnostic exposures can also be executed to verify that all associated glow has also been removed.

OBSERVING DESCRIPTION

OBJECTIVE: The MSA control electronics (MCE) sporadically suffer electrical shorts, in which an unintended (and perhaps temporary) pathway bridges circuitry from a quadrant row or column (collectively known as a line) to the substrate or another line. When a new short appears, the affected line should be identified and then masked, adding a full quadrant line to a dedicated mask in the MCE, effectively removing all the shutters in that line (171 or 365) from operations (this cannot be overruled by an MSA user pattern). If the short causes an elevated quadrant current above the telemetry noise threshold (i.e. the short is seen in telemetry), then this Electrical Shorts Detection (ESD) should be executed: PID4467, CAL-NRS-213. (Otherwise, see the OSD in PID4468, CAL-NRS-214).

METHOD: The dedicated OSS script NRSMASKMAIN uses a block-tree algorithm to search for the location of the short within the affected quadrant (ESD is executed on one quadrant at a time). This search is entirely electrical with no mechanism moves involved. While the visit could be run as a slew parallel, such a long slew is unlikely to occur. The OSS script includes updating the mask onboard, thereby leaving the MSA with the new mask ready for science operations. Diagnostic dark exposures through the pair of CHKBD3x3-1 and CHK3x3-3 MSA patterns can be executed to verify that associated glow has disappeared.

JUSTIFICATION: Shorts may cause unsafe currents on the MCE, contaminate the NIRSpec detector output with bright thermal emission and/or result in unpredictable shutter behavior that could degrade science data. Furthermore, bright shorts may even contaminate NIRCcam detector output. Masking the location of known shorts is a reliable method to prevent the short reoccurring and mitigate symptoms.

CYCLE 1 CALIBRATION: The Cycle 1 contingency program (PID1490) included each execution of ESD as required. From July 2022 to May 2023, ESD was executed six times. Note that an algorithm update in OSS 8.7 (from June 2023) will increase the chance of detecting shorts by ESD ("nearest neighbor" shorts can be detected), so the expectation is for more shorts to be curable by ESD and fewer will require OSD.

TIMING CONSTRAINTS: We aim to execute ESD as soon as practical, generally early in the next uplinked OP package, or at least before the first MSA visit of that package. However, the criticality of masking a new short is complex, depending on its strength (is it dangerous to hardware, or how much of the detector is affected by the thermal emission?) and its location relative to upcoming patterns (a short will only manifest when there is a potential across the fault, so not all MSA patterns will "trigger" the short).

DURATION (total hours): For 1 quadrant, a successful ESD (locating/masking a short) takes ~2 hours. If ESD fails to detect any new shorts, it will only take ~15 minutes. [Both these values TBC once new nearest-neighbor NRSMASKMAIN is tested in June 2023]. The pair of CHKBD3x3 dark exposures have a charged time of 945s.

COMMENTS: Each ESD is an internal visit with no mechanism movements. It can be inserted as prime or, if there is a long slew available, as a slew parallel. The diagnostic darks can be inserted as a slew parallel.

Proposal 4467 - Observation 1 - MSA Electrical Shorts Detection (ESD) (CAL-NRS-213)

Wed Oct 25 21:00:28 GMT 2023

| Observation | <p>Proposal 4467, Observation 1: ESD - AllQs Diagnostic Status: Warning Observing Template: NIRSspec MSA Short Detection</p> | | | | | | | | | | | | | | | | | | | | | | |
|-----------------------------|--|--|-------------------------|-------------------------|-------------------------|---|------------|-----|------|---|------------|------|-------|---|------------|------|------|---|------------|------|-----|--|--|
| Diagnostics | <p>(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.</p> | | | | | | | | | | | | | | | | | | | | | | |
| Template | <p>Error Response PROCEED</p> | <p>Region Check STANDARD</p> | | | | | | | | | | | | | | | | | | | | | |
| Quadrant List | <table border="1"> <thead> <tr> <th>#</th> <th>Quadrant</th> <th>Threshold 171 Side (mA)</th> <th>Threshold 365 Side (mA)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Quadrant 1</td> <td>0.6</td> <td>0.62</td> </tr> <tr> <td>2</td> <td>Quadrant 2</td> <td>0.86</td> <td>0.885</td> </tr> <tr> <td>3</td> <td>Quadrant 3</td> <td>0.55</td> <td>0.55</td> </tr> <tr> <td>4</td> <td>Quadrant 4</td> <td>1.52</td> <td>0.8</td> </tr> </tbody> </table> | # | Quadrant | Threshold 171 Side (mA) | Threshold 365 Side (mA) | 1 | Quadrant 1 | 0.6 | 0.62 | 2 | Quadrant 2 | 0.86 | 0.885 | 3 | Quadrant 3 | 0.55 | 0.55 | 4 | Quadrant 4 | 1.52 | 0.8 | | |
| # | Quadrant | Threshold 171 Side (mA) | Threshold 365 Side (mA) | | | | | | | | | | | | | | | | | | | | |
| 1 | Quadrant 1 | 0.6 | 0.62 | | | | | | | | | | | | | | | | | | | | |
| 2 | Quadrant 2 | 0.86 | 0.885 | | | | | | | | | | | | | | | | | | | | |
| 3 | Quadrant 3 | 0.55 | 0.55 | | | | | | | | | | | | | | | | | | | | |
| 4 | Quadrant 4 | 1.52 | 0.8 | | | | | | | | | | | | | | | | | | | | |
| Special Requirements | <p>No Parallel Attachments Special Commanding MSA Short Detection</p> | | | | | | | | | | | | | | | | | | | | | | |

Proposal 4467 - Observation 2 - MSA Electrical Shorts Detection (ESD) (CAL-NRS-213)

Wed Oct 25 21:00:28 GMT 2023

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|-----------------------------|--|----------------|----------|------|-------------------|---------|-----------------|------------|------------------|--------------------|---------------------|------------------|
| Observation | <p>Proposal 4467, Observation 2: Diagnostic exposures</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRSpec Internal Lamp</p> | | | | | | | | | | | |
| Diagnostics | <p>(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.</p> | | | | | | | | | | | |
| Spectral Elements | # | Operating Mode | Subarray | Lamp | MSA Configuration | Grating | Readout Pattern | Groups/Int | Integrations/Exp | Total Integrations | Total Exposure Time | ETC Wkbk.Calc ID |
| | 1 | IMAGE | FULL | NONE | CHKBD3x3-1 | MIRROR | NRSIRS2RAPID | 5 | 1 | 1 | 87.533 | |
| | 2 | IMAGE | FULL | NONE | CHKBD3x3-3 | MIRROR | NRSIRS2RAPID | 5 | 1 | 1 | 87.533 | |
| Special Requirements | <p>No Parallel Attachments</p> | | | | | | | | | | | |

Proposal 4467 - Observation 3 - MSA Electrical Shorts Detection (ESD) (CAL-NRS-213)

Wed Oct 25 21:00:28 GMT 2023

| Observation | <p>Proposal 4467, Observation 3: MSA Short Detection</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRSspec MSA Short Detection</p> | | | | | | | | | | |
|-----------------------------|--|--|-------------------------|-------------------------|-------------------------|---|------------|------|-------|--|--|
| Diagnostics | <p>(Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.</p> | | | | | | | | | | |
| Template | <p>Error Response</p> <p>PROCEED</p> | <p>Region Check</p> <p>STANDARD</p> | | | | | | | | | |
| Quadrant List | <table border="1"> <thead> <tr> <th>#</th> <th>Quadrant</th> <th>Threshold 171 Side (mA)</th> <th>Threshold 365 Side (mA)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Quadrant 2</td> <td>0.86</td> <td>0.885</td> </tr> </tbody> </table> | # | Quadrant | Threshold 171 Side (mA) | Threshold 365 Side (mA) | 1 | Quadrant 2 | 0.86 | 0.885 | | |
| # | Quadrant | Threshold 171 Side (mA) | Threshold 365 Side (mA) | | | | | | | | |
| 1 | Quadrant 2 | 0.86 | 0.885 | | | | | | | | |
| Special Requirements | <p>No Parallel Attachments</p> <p>Special Commanding MSA Short Detection</p> | | | | | | | | | | |

Proposal 4467 - Observation 4 - MSA Electrical Shorts Detection (ESD) (CAL-NRS-213)

Wed Oct 25 21:00:28 GMT 2023

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|-----------------------------|---|-----------------------|-----------------|-------------|------------------------------------|----------------|------------------------|-------------------|-------------------------|---------------------------|----------------------------|-------------------------|
| Observation | <p>Proposal 4467, Observation 4: Follow-up exposures</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRSpec Internal Lamp</p> | | | | | | | | | | | |
| Diagnostics | <p>(Visit 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.</p> | | | | | | | | | | | |
| Spectral Elements | # | Operating Mode | Subarray | Lamp | MSA Configuration | Grating | Readout Pattern | Groups/Int | Integrations/Exp | Total Integrations | Total Exposure Time | ETC Wkbk.Calc ID |
| | 1 | IMAGE | FULL | NONE | CHKBD3x3-1 | MIRROR | NRSIRS2RAPID | 5 | 1 | 1 | 87.533 | |
| | 2 | IMAGE | FULL | NONE | CHKBD3x3-3 | MIRROR | NRSIRS2RAPID | 5 | 1 | 1 | 87.533 | |
| | 3 | IMAGE | FULL | NONE | duplicate of V0256100200101 (msa1) | MIRROR | NRSIRS2RAPID | 5 | 1 | 1 | 87.533 | |
| Special Requirements | <p>No Parallel Attachments DMS Priority HIGH</p> | | | | | | | | | | | |

Proposal 4467 - Observation 5 - MSA Electrical Shorts Detection (ESD) (CAL-NRS-213)

Wed Oct 25 21:00:28 GMT 2023

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|-----------------------------|---|--|---|--|
| Observation | <p>Proposal 4467, Observation 5: Electrical Shorts Detection for Q4</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRSspec MSA Short Detection</p> | | | |
| Diagnostics | <p>(Visit 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.</p> | | | |
| Template | <p>Error Response</p> <p>PROCEED</p> | <p>Region Check</p> <p>STANDARD</p> | | |
| Quadrant List | <p>#</p> <p>1</p> | <p>Quadrant</p> <p>Quadrant 4</p> | <p>Threshold 171 Side (mA)</p> <p>1.52</p> | <p>Threshold 365 Side (mA)</p> <p>0.8</p> |
| Special Requirements | <p>No Parallel Attachments Special Commanding MSA Short Detection</p> <p>6 After 5</p> | | | |

Proposal 4467 - Observation 6 - MSA Electrical Shorts Detection (ESD) (CAL-NRS-213)

Wed Oct 25 21:00:28 GMT 2023

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|-----------------------------|---|-----------------------|-----------------|-------------|------------------------------------|----------------|------------------------|-------------------|-------------------------|---------------------------|----------------------------|-------------------------|
| Observation | <p>Proposal 4467, Observation 6: Diagnostic exposures for Q2 and Q4</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRSpec Internal Lamp</p> | | | | | | | | | | | |
| Diagnostics | <p>(Visit 6:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.</p> | | | | | | | | | | | |
| Spectral Elements | # | Operating Mode | Subarray | Lamp | MSA Configuration | Grating | Readout Pattern | Groups/Int | Integrations/Exp | Total Integrations | Total Exposure Time | ETC Wkbk.Calc ID |
| | 1 | IMAGE | FULL | NONE | CHKBD3x3-1 | MIRROR | NRSIRS2RAPID | 5 | 1 | 1 | 87.533 | |
| | 2 | IMAGE | FULL | NONE | CHKBD3x3-3 | MIRROR | NRSIRS2RAPID | 5 | 1 | 1 | 87.533 | |
| | 3 | IMAGE | FULL | NONE | Duplicate of V032150010050 1 (p5g) | MIRROR | NRSIRS2RAPID | 5 | 1 | 1 | 87.533 | |
| | 4 | IMAGE | FULL | NONE | Duplicate of V032150010050 2 (p5p) | MIRROR | NRSIRS2RAPID | 5 | 1 | 1 | 87.533 | |
| | 5 | IMAGE | FULL | NONE | Duplicate of V030730120010 1 (c1) | MIRROR | NRSIRS2RAPID | 5 | 1 | 1 | 87.533 | |
| Special Requirements | <p>No Parallel Attachments</p> <p>DMS Priority HIGH</p> <p>6 After 5</p> | | | | | | | | | | | |