



9271 - CAL-NRS-405: MSA Electrical Shorts Detection (ESD)

Cycle: 4, Proposal Category: CAL/NIRSPEC

INVESTIGATORS

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OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
2025-07 Q1 and Q3 shorts				
	1	MSA Short Detection (Q1 and Q3 only)	NIRSpec MSA Short Detection	NONE
	2	Follow-up exposures	NIRSpec Internal Lamp	NONE
2025-07 Q3 short redux				
	3	MSA Short Detection (Q3 only)	NIRSpec MSA Short Detection	NONE
	4	Follow-up exposures	NIRSpec Internal Lamp	NONE
2026-03 Q2 short				
	5	MSA Short Detection (Q2 only)	NIRSpec MSA Short Detection	NONE
	6	Follow-up exposures	NIRSpec Internal Lamp	NONE
2026-03 Q2 short: targeting 171 side				
	7	MSA Short Detection (Q2 only)	NIRSpec MSA Short Detection	NONE
	8	Follow-up exposures	NIRSpec Internal Lamp	NONE

ABSTRACT

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 quadrant 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.

This calibration program may change in response to system developments and the final Cycle 4 science program.

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: CAL-NRS-405. (Otherwise, see the OSD, CAL-NRS-406).

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. The OSS script includes updating the mask onboard, thereby leaving the MSA with the new mask in place for science operations. Follow-up dark exposures—using a pair of CHKBD3x3-1 and CHK3x3-3 MSA patterns and a duplicate of the MSA pattern in which the short appeared—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 NIRCам detector output. Masking the location of known shorts is a reliable method to prevent the short reoccurring and mitigate symptoms.

PREVIOUS CALIBRATIONS: Within the Cycle 1 general shorts detection contingency program (PID 1490), ESD was executed 8 times and found 3 shorts. Within the Cycle 2 ESD contingency program (PID 4467), ESD was run twice and found no shorts. Within the Cycle 3 ESD contingency program (PID 6649), ESD has not been run (as of this writing).

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): Execution of the new nearest-neighbor ESD with standard region checking for one quadrant in June 2023, which found and masked one short, took 30 minutes (0.5 hours). Execution of ESD for one quadrant in October 2023, which found no shorts, took 7 minutes (0.1 hours). A set of 3 follow-up dark exposures, comprised of two exposures using 3x3 checkerboard MSA patterns and one using a duplicate of the MSA pattern in which the short had appeared, would have a charged time of 1359 seconds (0.4 hours).

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 9271 - Observation 1 - CAL-NRS-405: MSA Electrical Shorts Detection (ESD)

Observation	Proposal 9271, Observation 1: MSA Short Detection (Q1 and Q3 only) Diagnostic Status: Warning Observing Template: NIRSpec MSA Short Detection			Wed Mar 11 18:00:30 GMT 2026
Diagnostics	(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.			
Template	Error Response		Region Check	
	PROCEED		STANDARD	
Quadrant List	#	Quadrant	Threshold 171 Side (mA)	Threshold 365 Side (mA)
	1	Quadrant 1	0.6	0.62
	2	Quadrant 3	0.55	0.485
Special Requirements	No Parallel Attachments Special Commanding MSA Short Detection Sequence Observations 1, 2, Non-interruptible			

Proposal 9271 - Observation 2 - CAL-NRS-405: MSA Electrical Shorts Detection (ESD)

Observation	Proposal 9271, Observation 2: Follow-up exposures Diagnostic Status: Warning Observing Template: NIRSpec Internal Lamp											Wed Mar 11 18:00:30 GMT 2026
Diagnostics	(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.											
Spectral Elements	#	Operating Mode	Subarray	Lamp	MSA Configuration	Grating	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID
	1	IMAGE	FULL	NONE	CHKBD1x1-1	MIRROR	NRSIRS2RAPID	5	1	1	87.533	
	2	IMAGE	FULL	NONE	CHKBD1x1-2	MIRROR	NRSIRS2RAPID	5	1	1	87.533	
Special Requirements	No Parallel Attachments DMS Priority HIGH Sequence Observations 1, 2, Non-interruptible											

Proposal 9271 - Observation 3 - CAL-NRS-405: MSA Electrical Shorts Detection (ESD)

Observation	Proposal 9271, Observation 3: MSA Short Detection (Q3 only) Diagnostic Status: Warning Observing Template: NIRSpec MSA Short Detection			Wed Mar 11 18:00:30 GMT 2026
Diagnostics	(Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.			
Template	Error Response		Region Check	
	PROCEED		STANDARD	
Quadrant List	#	Quadrant	Threshold 171 Side (mA)	Threshold 365 Side (mA)
	1	Quadrant 3	0.55	0.495
Special Requirements	No Parallel Attachments Special Commanding MSA Short Detection Sequence Observations 3, 4, Non-interruptible			

Proposal 9271 - Observation 4 - CAL-NRS-405: MSA Electrical Shorts Detection (ESD)

Observation	Proposal 9271, Observation 4: Follow-up exposures Diagnostic Status: Warning Observing Template: NIRSpec Internal Lamp											Wed Mar 11 18:00:30 GMT 2026
Diagnostics	(Visit 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.											
Spectral Elements	#	Operating Mode	Subarray	Lamp	MSA Configuration	Grating	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID
	1	IMAGE	FULL	NONE	CHKBD1x1-1	MIRROR	NRSIRS2RAPID	5	1	1	87.533	
	2	IMAGE	FULL	NONE	CHKBD1x1-2	MIRROR	NRSIRS2RAPID	5	1	1	87.533	
Special Requirements	No Parallel Attachments DMS Priority HIGH Sequence Observations 3, 4, Non-interruptible											

Proposal 9271 - Observation 5 - CAL-NRS-405: MSA Electrical Shorts Detection (ESD)

Observation	Proposal 9271, Observation 5: MSA Short Detection (Q2 only) Diagnostic Status: Warning Observing Template: NIRSpec MSA Short Detection			Wed Mar 11 18:00:30 GMT 2026
Diagnostics	(Visit 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.			
Template	Error Response		Region Check	
	PROCEED		STANDARD	
Quadrant List	#	Quadrant	Threshold 171 Side (mA)	Threshold 365 Side (mA)
	1	Quadrant 2	1.4	1.4
Special Requirements	No Parallel Attachments Special Commanding MSA Short Detection Sequence Observations 5, 6, Non-interruptible			

Proposal 9271 - Observation 6 - CAL-NRS-405: MSA Electrical Shorts Detection (ESD)

Observation	Proposal 9271, Observation 6: Follow-up exposures Diagnostic Status: Warning Observing Template: NIRSpec Internal Lamp											Wed Mar 11 18:00:30 GMT 2026
Diagnostics	(Visit 6:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.											
Spectral Elements	#	Operating Mode	Subarray	Lamp	MSA Configuration	Grating	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID
	1	IMAGE	FULL	NONE	CHKBD1x1-1	MIRROR	NRSIRS2RAPID	5	1	1	87.533	
	2	IMAGE	FULL	NONE	CHKBD1x1-2	MIRROR	NRSIRS2RAPID	5	1	1	87.533	
Special Requirements	No Parallel Attachments Sequence Observations 5, 6, Non-interruptible											

Proposal 9271 - Observation 7 - CAL-NRS-405: MSA Electrical Shorts Detection (ESD)

Observation	Proposal 9271, Observation 7: MSA Short Detection (Q2 only) Diagnostic Status: Warning Observing Template: NIRSpec MSA Short Detection			Wed Mar 11 18:00:30 GMT 2026
Diagnostics	(Visit 7:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.			
Template	Error Response		Region Check	
	PROCEED		STANDARD	
Quadrant List	#	Quadrant	Threshold 171 Side (mA)	Threshold 365 Side (mA)
	1	Quadrant 2	0.9	2.5
Special Requirements	No Parallel Attachments Special Commanding MSA Short Detection Sequence Observations 7, 8, Non-interruptible			

Proposal 9271 - Observation 8 - CAL-NRS-405: MSA Electrical Shorts Detection (ESD)

Observation	Proposal 9271, Observation 8: Follow-up exposures Diagnostic Status: Warning Observing Template: NIRSpec Internal Lamp											Wed Mar 11 18:00:30 GMT 2026
Diagnostics	(Visit 8:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.											
Spectral Elements	#	Operating Mode	Subarray	Lamp	MSA Configuration	Grating	Readout Pattern	Groups/Int	Integrations/Ex p	Total Integrations	Total Exposure Time	Optional ETC ID
	1	IMAGE	FULL	NONE	ALLOPEN	MIRROR	NRSIRS2RAPID	5	1	1	87.533	
	2	IMAGE	FULL	NONE	CHKBD1x1-1	MIRROR	NRSIRS2RAPID	5	1	1	87.533	
	3	IMAGE	FULL	NONE	CHKBD1x1-2	MIRROR	NRSIRS2RAPID	5	1	1	87.533	
Special Requirements	No Parallel Attachments Sequence Observations 7, 8, Non-interruptible											