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SCIENCE INSTITUTE

EXPANDING THE FRONTIERS OF SPACE ASTRONOMY

## NIRSpec status update



James Muzerolle Page (*Branch manager*), on behalf of the NIRSpec team

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# Operations

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- the instrument continues to perform extremely well, with no significant anomalies
- target acquisition in cycle 1
  - WATA (as of July 2023): 205/221 visits successful; most failures due to coord errors or guide star issues
  - MSATA (as of July 2023): 125/130 visits successful
  - working on improvements to WATA algorithm (background sub, noise correction)
- MSA electrical shorts
  - random incidence, frequency seems to be declining with time (6 shorts masked in cycle 1, 1 since Feb.)
  - many are transient (7 identified during cycle 1), not masked as impact/recurrence unclear
  - implemented new process for shorts detection & masking, greatly improves efficiency
- IFU reference point adjustment
  - revised SIAF and instrument model to take out ~0.2" offset in the IFU reference point, confirmed by point source observations taken in July
  - obs with WATA can now proceed with expected positional accuracy



## Calibration: Reference files, Cycle 1 data analysis

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- recent reference file updates
  - revised darks & masks to mitigate issues with bad pixels (excessive “NaNs”)
  - in-flight flux calibration for FS+G140M/F100LP (no data obtained in Comm)
  - revised instrument model for IFU pointing adjustment, should improve WCS in pipeline products
  - MSA operability
- reference file updates coming soon
  - detector-level files (darks, biases, bad pixels) based on cycle 1 data
  - FS pathloss, based on cycle 1 data & in-flight PSF
  - MOS pathloss, based on in-flight PSF
  - barshadow correction for extended-source obs with MOS
  - improved flux calibration (ensemble of standards, MOS FOV)
- other ongoing studies
  - wavelength accuracy for offset point sources
  - instrument model recheck (particularly GWA tilt calibration)
  - LSF characterization for all modes



## Calibration: Pipeline work, documentation

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- recent pipeline updates & fixes
  - FS/BOTS: data taken with subarrays now include a correlated noise correction using unilluminated pixels
  - IFU: new outlier detection algorithm with significantly improved performance (significantly fewer false positives, eliminating “holes” in combined cubes)
  - all: various bug fixes (account for bad reference pixels, pathloss interpolation, flux conservation for point sources in IFU cubes)
- pipeline updates coming soon or under investigation
  - FS/MOS: developed an alternative method for extraction aperture centering, which should greatly improve the automated 1D extraction performance and mitigate the need for manual intervention
  - FS/MOS: investigating outlier detection improvements
  - all modes: investigating “NSClean” algorithm for improved correlated noise correction, feasibility for including automated mask creation in the pipeline
- documentation updates
  - pipeline demo notebooks for IFU obs available soon, examples for other modes coming later
  - working on new “Calibration Methodology” JDoX page for a thorough user-centric description of all steps used in the pipeline for flux & wavelength calibration

A deep blue and purple nebula with wispy, ethereal clouds of gas and dust. The background is a dense field of stars, many of which are bright blue, creating a sparkling effect against the dark cosmic backdrop. The overall scene is a vast, beautiful representation of outer space.

**backup slides**

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# The Great NIRSpec Branch

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# NIRSpec overview

near-infrared spectroscopy with wavelength coverage 0.6 – 5.3 microns, resolving powers  $\sim 100, 1000, 2700$ , available in 4 modes

Mode	Target Type	Corresponding Aperture
Fixed slit spectroscopy	Single objects	0.2" x 3.2" slits (3) 0.4" x 3.65" slit
Bright Object Time Series	Exoplanet host stars	1.6" x 1.6" aperture
Integral-field spectroscopy	Moderately extended objects	3.0" x 3.0" IFU with 0.1" square spaxels
Multi-object spectroscopy (MOS)	Rich fields or extended objects	Selectable from $\sim 250,000$ 0.2" x 0.46" micro-shutters

built for ESA by Airbus Defense and Space, with microshutter assembly (MSA) and detector subsystem provided by NASA/GSFC

