NIRCam Team

Not pictured: Dan Lewis, Malcolm Ferry, Chuck Clark & honorary team members Tony Sohn and Nestor Espinoza
NIRCam serves as the primary wavefront monitor instrument.

NIRCam has four science modes:
• Imaging with 29 filters
• Wide Field Slitless Spectroscopy
• Time Series photometry and spectroscopy
• Coronagraphic Imaging with variety of Lyot stops

All modes exceed requirements!
Sensitivity & EE are Excellent

Results from P330-E

- Observed Throughput/ETC Throughput
- Wavelength (microns)
- 30% Limit

SCA-to-SCA response

b1 vs. a4

b3 vs. a2
Astrometry

Field Distortion is Excellent

- Standard deviation of residuals wrt Gaia typically 0.08 – 0.15 pixels (2-8 mas)
- Standard deviation of binned residuals wrt Gaia typically 0.015-0.025 pixels (0.4-1 mas)
- For B2, B3, B4: residual systematic pixel scale change (0.15 pixels, 4.5 mas)

Absolute Astrometry in progress

- Pipeline (assign_wcs) uses alignment info from both PRD/SIAF and CRDS. Refinements needed.

Analysis by A. Rest, T. Sohn, V. Platais, E. Egami, M. Correnti, B. Hilbert, A. Canipe, B. Sunnquist J. Leisenring, C. Willmer, and J. Girard
Testing various smoothing/masking strategies to avoid scattered light (e.g. wisps), striping, outlier, etc. effects while still capturing as much flat field variation as possible in the new reference files.
Running these new reference files through the JWST pipeline, and measuring image quality and photometric improvement.
Horizontal stripes and 1/f noise correction

Various filtering algorithms being developed and tested. In progress
Very rare features: Claws & Wisps

Claw & wisp analysis: Mario Gennaro, Ben Sunnquist, Martha Boyer, Marcia Rieke, John Stansberry, Christopher Willmer
Claws and Wisps mitigation strategies

**Wisps** result from off-axis light bouncing off the top secondary mirror support and entering into the aft-optics-system (AOS) mask. Wisps can be subtracted using a universal wisp template by scaling the strength to match the observed wisps.

**Claws** are caused by a very bright source far from the NIRCam FOV, whose light enters directly into the AOS mask. Claws can be prevented by avoiding placing very bright stars in an avoidance zone.

Optical modeling by Scott Rohrbach
WFSS Sensitivity is Excellent

Measured sensitivities exceed the pre-flight ETC predictions by a significant margin

Measured NIRCam/Grism sensitivities are ~20-40% higher than the pre-flight ETC predictions for much of the 2.5-5 \( \mu m \) range and as much as ~50-60% higher in the red end.

WFSS Core Analysis Team: Eiichi Egami, Nor Pirzkal, Fengwu Sun, Jarron Leisenring, Everett Schlawin
Hunting for Ice with NIRCam

<table>
<thead>
<tr>
<th>Requirement</th>
<th>5-sigma upper limit</th>
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<tbody>
<tr>
<td>Water ice on the OTE</td>
<td>&lt; 130 Å layer</td>
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<tr>
<td>NVR in NIRCam</td>
<td>&lt; 2800 Å layer</td>
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</tbody>
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Analysis by Jarron Leisenring, Everett Schlawin, Nor Pirzkal, Tom Greene, Randy Kimble
NIRCam WFSS

• New field dependent WFSS files delivered
• Based on module A/B Grism R/C Cross filters F444W/F322W2 traces and dispersions
• Field dependence valid for a large fraction of the FOV (more observations needed to fully calibrate)
• New sensitivities estimates.
• Out of Field Imaging dither offsets adjusted. Improved overlap between imaging and the WFSS observations.

From Nor Pirzkal
Wide Field Slitless Surveying

Serendipitous detection of a line-emitting galaxy at z=4.39

Only a 386 sec exposure!
NIRCam Grism Time Series

- Mode uses a grism in the LW channel for a spectrum and a weak lens in the SW channel for monitoring
- Commissioning test observed a transit of HATP-14
Excellent Grism TS Performance

Noise Floor Requirement
• Initial analysis gives a standard deviation of 91 ppm at R=100, below our 100 ppm requirement.
• The median transit depth is 6670 ppm, consistent with TESS’s depth of 6520 +/- 170 ppm, expected to be constant across all wavelengths due to the planet’s high surface gravity.

Settling
• The SW detector settling time is ~11min
• The LW detector settling time is near-instantaneous
Coronagraph Pupil Shift

- Observed PSF reproduced w/ Lyot stop offsets in WebbPSF
- Direction corresponds to a ~3% Mod-A LW pupil wheel offset

Jarron Leisenring, Julien Girard, Armin Rest, Mario Gennaro, Bryan Hilbert, Doug Kelly
Contrast Performance is Excellent

HD 114174 B

5σ contrast readiness criterion

Jens Kammerer
Julien Girard
Jarron Leisenring
Summary

1) All NIRCam modes exceed requirements

2) Commissioning data being analyzed, e.g.
   • Absolute astrometry
   • Absolute photometry/zero points
   • Flat fields
   • Detector features
   • Reference files & pipeline

3) PIs may be contacted as needed regarding
   - Increased sensitivity => saturation
   - possible presence of scattered light
   - WFSS geometry