



2778 - Imaging Spectroscopy of the Coldest Imaged Exoplanet and a Low-Mass Accreting Protoplanet

Cycle: 2, Proposal Category: GTO

INVESTIGATORS

| <i>Name</i> | <i>Institution</i> |
|--------------------------------------|--|
| Dr. Marshall Perrin (PI) | Space Telescope Science Institute |
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| Isabel Rebollido (CoI) (ESA Member) | Centro de Astrobiologia (CSIC/INTA) Inst. Nac. de Tec. Aero. |
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| Kadin Worthen (CoI) | Space Telescope Science Institute |
| Dr. Matt Mountain (CoI) | Space Telescope Science Institute |

OBSERVATIONS

| <i>Folder</i> | <i>Observation</i> | <i>Label</i> | <i>Observing Template</i> | <i>Science Target</i> |
|---------------|--------------------|----------------------------|---------------------------|-----------------------|
| GJ 504 | | | | |
| | 1 | NIRSpec GJ 504 b - Ro II 1 | NIRSpec IFU Spectroscopy | (1) GJ-504-B |

| <i>Folder</i> | <i>Observation</i> | <i>Label</i> | <i>Observing Template</i> | <i>Science Target</i> |
|---------------|--------------------|----------------------------|-------------------------------------|-----------------------|
| | 2 | NIRSpec GJ 504 b - Ro II 2 | NIRSpec IFU Spectroscopy | (1) GJ-504-B |
| Delorme 1 | | | | |
| | 3 | MIRI MRS on Delorme 1 AB b | MIRI Medium Resolution Spectroscopy | (2) DELORME-1-AB-B |

ABSTRACT

This program will conduct JWST imaging spectroscopy of two directly-imaged substellar companions at the current frontiers of our knowledge of exoplanetary systems.

GJ 504 b is the directly-imaged exoplanet with the coldest known atmosphere, $T \sim 550$ K. Its faintness and extreme redness places its spectroscopic characterization beyond the ability of the largest ground-based telescopes. NIRSpec IFU spectroscopy from 2.9-5.3 microns at $R \sim 3000$ (F295LP/G395H mode) will be used to characterize its atmospheric composition. This observation is technically highly challenging, pushing NIRSpec spectroscopy toward higher contrast ($1e-5$ contrast) at smaller separations, but also high reward, as it will yield spectra of an exoplanet atmosphere at much lower temperatures than accessible with transiting or other imaged exoplanets.

Delorme 1 AB b is the lowest mass accreting companion yet discovered. Recent ground-based spectra reveal NIR hydrogen lines consistent with a planetary accretion shock. The wide separation and relatively favorable contrast ratio to the M dwarf binary host stars (2 arcsec, K delta mag 3.8) make this target uniquely favorable for spectroscopic characterization of the circumplanetary dust. MIRI MRS spectroscopy from 5-20 microns will be used to investigate the thermal emission from and composition of the circumplanetary disk.

OBSERVING DESCRIPTION

This program will conduct JWST imaging spectroscopy of two directly-imaged substellar companions at the current frontiers of our knowledge of exoplanetary systems.

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Delorme 1 AB b is the lowest mass accreting companion yet discovered. Recent ground-based spectra reveal NIR hydrogen lines consistent with a

planetary accretion shock. MIRI MRS spectroscopy from 5-20 microns will be used to investigate the thermal emission from and composition of the circumplanetary disk.

Technical Description:

****GJ 504 with NIRSpec:****

The F290LP filter is selected to observe around the peak of the planet's thermal emission at 4-5 microns. NIRSpec's highest spectral resolution is used, for both more detailed atmospheric diagnostics and because the higher resolution will help disentangle the planet flux from the stellar PSF halo during data processing.

Given the faintness of the target relative to the stellar PSF halo, we optimize observing strategy based on what we currently believe optimal to achieve high contrast with the NIRSpec IFU. We will know more after the cycle 1 GTO program 1414 which is designed to test these strategies, and it is possible (perhaps likely) that we may revise some of the technical choices here once the results of that program are known in early 2023. We describe here our current understanding of best practices at this time.

PA constraint:

We set an absolute roll constraint to position the bright six-fold diffraction spikes away from the companion. There are a few possible roll ranges which meet this constraint so this constraint can be adjusted if necessary to ease scheduling. The available V3PA ranges for this target are roughly 108 to 136 (May to July scheduling window) and 270 to 297 (Jan to Feb scheduling window). Desirable V3PA ranges are near 105 or 285, which would put the diffraction spikes as far as possible from the faint companion. We select 285 ± 6 , which is near the center of the Jan/Feb scheduling window and results in a scheduling window 1 month long.

If it is desired to schedule this observation during the May/July window instead, the absolute V3PA constraint range should be changed to V3PA=108-120 deg. This is slightly less optimal, but acceptable.

We also will obtain two observations at slightly different telescope rolls back to back for angular differential imaging type analyses. The desired offset is around 10 deg, but we'd like as much as possible on the date of scheduling.

Timing constraint (SEQ NON-INT):

The two visits are specified as a non-interruptible sequence to ensure they happen close in time (thus will have consistent PSFs). Furthermore this will ensure a precisely consistent position of NIRSpec's grating wheel between the observations (i.e. the wheel will not move in between these observations), for maximum reproducibility of the wavelength calibration and PSF properties in the datacube.

Exposure Settings and SNR:

We use a 9-position cycling dither pattern to optimally sample NIRSpec's undersampled PSF. The very bright star will be located outside the field of view (fully outside the NIRSpec IFU entrance aperture, so its bright PSF core will not reach the detector to saturate it).

The chosen exposure settings will reach SNR ~20-40 per spectral channel on the companion, across the spectral range 4-5 microns, with lower SNR at the shorter wavelengths at which the companion is fainter. That is computed for the ideal case of the companion without the stellar PSF halo, so sets an upper limit per each of the two rolls. The integration settings follow NIRSpec recommended best practices, e.g. NIRSIRS2RAPID mode with a single moderately-long integration (NGROUPS=32; 480 s) per dither position

We omit a dedicated background observation, and will instead measure the background using data within the science cubes. The background will be dominated by the stellar PSF halo, which we will model and calibrate out during data reduction using the spectral information within the cube. The actual astrophysical sky background is very low at these wavelengths (near JWST's minimum) and is not a limiting factor.

No target acquisition is required; JWST's absolute pointing accuracy after FGS guide star acquisition suffices.

Delorme 1 with MIRI MRS:

The observing strategy and goal SNR is based on the ERS observation 1386:14 of VHS 1256 b, which is a roughly similar case of observing a substellar companion at moderate contrasts (a few magnitudes at several arcsec) from an M dwarf host star.

A complete MRS spectrum will be obtained using all three sub-bands within the IFU channels. As this target is somewhat brighter than VHS 1256 b, slightly shorter exposure times are used. These will reach SNR from 15 to 5 per wavelength bin across channels 1 and 2 (5 to 15 microns), decreasing to SNR~3 per wavelength by end of channel 3. See ETC workbook 123352. The integration settings follow MIRI recommended best practices, e.g. FASTR1 mode with ~100 groups.

Similar to that ERS observation 1386:14, the 4-point dither pattern optimized for point sources is used. Based on the experience in that ERS program, we omit a dedicated background observation, and will instead measure the background using an offset region within the science cubes.

No target acquisition is required; JWST's absolute pointing accuracy after FGS guide star acquisition suffices.

Proposal 2778 - Targets - Imaging Spectroscopy of the Coldest Imaged Exoplanet and a Low-Mass Accreting Protoplanet

| # | Name | Target Coordinates | Targ. Coord. Corrections | Miscellaneous |
|---|--------------------|---|---|---------------|
| (1) | GJ-504-B | RA: 13 16 46.0439 (199.1918496d) Dec: +09 25 31.67 (9.42546d) Equinox: J2000 | Proper Motion RA: -336.66 mas/yr Proper Motion Dec: 190.58 mas/yr Parallax: 0.057" Epoch of Position: 2015.5 | |
| <p><i>Comments: This is a substellar companion to a high proper motion star. The coordinates given here are the predicted position of the **companion in 2024**, specified in the Gaia DR2 frame and epoch, including the measured stellar proper motion.</i></p> <p><i>The **star** GJ 504 has the ICRS coordinates 13 16 46.1635 +09 25 29.92 at epoch 2015.5 (Gaia DR2). As of mid cycle 2 at epoch 2024.0, the offset position of the companion relative to the star is computed to be: Separation = 2490.953 ± 11.931 mas, PA = 314.763 ± 0.256 deg The computed ICRS coordinates here specify that offset position in the ICRS frame, including the proper motion of the star.</i></p> <p><i>Category=Star Description=[Exoplanet Systems, Exoplanets, Substellar companions] Extended=NO</i></p> | | | | |
| (2) | DELORME-1-AB-B | RA: 01 03 35.7300 (15.8988750d) Dec: -55 15 55.36 (-55.26538d) Equinox: J2000 | Proper Motion RA: 100.2 mas/yr Proper Motion Dec: -47.2 mas/yr Parallax: 0.02118" Epoch of Position: 2015.5 | |
| <p><i>Comments: This is a substellar companion to a high proper motion star. The coordinates given here are the predicted position of the **companion in 2024**, specified in the Gaia DR2 frame and epoch, including the measured stellar proper motion.</i></p> <p><i>The binary star Delorme 1 AB has the ICRS coordinates 01 03 35.836 -55 15 56.97 at epoch 2015.5 (Gaia DR2). As of mid cycle 2 at epoch 2024.0, the offset position of the companion relative to the star is computed to be: Separation = 1816.195 +/- 15.4561 mas, PA = 334.116 +/- 0.069 deg The computed ICRS coordinates here specify that offset position in the ICRS frame, including the proper motion of the star.</i></p> <p><i>Category=Star Description=[Circumstellar disks, Exoplanet Systems, Exoplanets, Substellar companions] Extended=NO</i></p> | | | | |
| (3) | GJ-504-STAR | RA: 13 16 46.1635 (199.1923479d) Dec: +09 25 29.92 (9.42498d) Equinox: J2000 | Proper Motion RA: -336.66 mas/yr Proper Motion Dec: 190.58 mas/yr Parallax: 0.057" Epoch of Position: 2015.5 | |
| <p><i>Comments: This is the host star itself, a high proper motion star.</i></p> <p><i>This target is intentionally NOT USED DIRECTLY in this proposal, but is present for visualization & cross checking purposes relative to the offset companion.</i></p> <p><i>Category=Star Description=[Exoplanet Systems, Exoplanets, Substellar companions] Extended=NO</i></p> | | | | |
| (4) | DELORME-1-AB-STARS | RA: 01 03 35.8360 (15.8993167d) Dec: -55 15 56.97 (-55.26583d) Equinox: J2000 | Proper Motion RA: 100.2 mas/yr Proper Motion Dec: -47.2 mas/yr Parallax: 0.02118" Epoch of Position: 2015.5 | |
| <p><i>Comments: This is the host star binary itself, a high proper motion star system. (Here we simplify and treat the 0.25" close binary as a single object)</i></p> <p><i>This target is intentionally NOT USED DIRECTLY in this proposal, but is present for visualization & cross checking purposes relative to the offset companion.</i></p> <p><i>Category=Star Description=[Circumstellar disks, Exoplanet Systems, Exoplanets, Substellar companions] Extended=NO</i></p> | | | | |

Fixed Targets

Proposal 2778 - Observation 1 - Imaging Spectroscopy of the Coldest Imaged Exoplanet and a Low-Mass Accreting Protoplanet

Mon Jun 26 16:02:32 GMT 2023

| | | | | | | | | | | | | |
|--------------------------|--|-----------------------|--|-------------------|-------------------------|---|-------------------------|----------------|----------------------|---------------------------|----------------------------|-------------------------|
| Observation | Proposal 2778, Observation 1: NIRSpec GJ 504 b - Roll 1 Diagnostic Status: Warning Observing Template: NIRSpec IFU Spectroscopy | | | | | | | | | | | |
| Diagnostics | (Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (NIRSpec GJ 504 b - Roll 1 (Obs 1)) Informational (Form): The Visit Planner and Spike may produce different schedulability results. (Visit 1:1) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements. | | | | | | | | | | | |
| Fixed Targets | # | Name | Target Coordinates | | | Targ. Coord. Corrections | | | Miscellaneous | | | |
| | (1) | GJ-504-B | RA: 13 16 46.0439 (199.1918496d) Dec: +09 25 31.67 (9.42546d) Equinox: J2000 | | | Proper Motion RA: -336.66 mas/yr Proper Motion Dec: 190.58 mas/yr Parallax: 0.057" Epoch of Position: 2015.5 | | | | | | |
| | <i>Comments: This is a substellar companion to a high proper motion star. The coordinates given here are the predicted position of the **companion in 2024**, specified in the Gaia DR2 frame and epoch, including the measured stellar proper motion.</i> <i>The **star** GJ 504 has the ICRS coordinates 13 16 46.1635 +09 25 29.92 at epoch 2015.5 (Gaia DR2). As of mid cycle 2 at epoch 2024.0, the offset position of the companion relative to the star is computed to be: Separation = 2490.953 ± 11.931 mas, PA = 314.763 ± 0.256 deg The computed ICRS coordinates here specify that offset position in the ICRS frame, including the proper motion of the star. Category=Star Description=[Exoplanet Systems, Exoplanets, Substellar companions] Extended=NO</i> | | | | | | | | | | | |
| Template | TA Method | | | | | | | | | | | |
| | NONE | | | | | | | | | | | |
| Dithers | # | Dither Type | | Size | Starting Point | | Number of Points | Points | | | | |
| | 1 | CYCLING | | MEDIUM | 1 | | 9 | | | | | |
| Spectral Elements | # | Grating/Filter | Readout Pattern | Groups/Int | Integrations/Exp | Leakcal | Dither | Autocal | Total Dithers | Total Integrations | Total Exposure Time | ETC Wkbk.Calc ID |
| | 1 | G395H/F290LP | NRSIRS2RAPID | 32 | 1 | false | true | NONE | 9 | 9 | 4332.9 | |

Proposal 2778 - Observation 1 - Imaging Spectroscopy of the Coldest Imaged Exoplanet and a Low-Mass Accreting Protoplanet

Special Requirements

Aperture PA Range 57.97253418 to 69.97253418 Degrees (V3 279.0 to 291.0)

Sequence Observations 1, 2, Non-interruptible

Aperture PA Offset 1 from 2 by 10 to 14 Degrees (Same offsets in V3)

Proposal 2778 - Observation 2 - Imaging Spectroscopy of the Coldest Imaged Exoplanet and a Low-Mass Accreting Protoplanet

Mon Jun 26 16:02:32 GMT 2023

| | | | | | | | | | | | | |
|--------------------------|---|-----------------------|--|-------------------|-------------------------|---|-------------------------|----------------|----------------------|---------------------------|----------------------------|-------------------------|
| Observation | <p>Proposal 2778, Observation 2: NIRSpec GJ 504 b - Roll 2</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRSpec IFU Spectroscopy</p> | | | | | | | | | | | |
| Diagnostics | <p>(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.</p> <p>(NIRSpec GJ 504 b - Roll 2 (Obs 2)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.</p> <p>(Visit 2:1) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements.</p> | | | | | | | | | | | |
| Fixed Targets | # | Name | Target Coordinates | | | Targ. Coord. Corrections | | | Miscellaneous | | | |
| | (1) | GJ-504-B | RA: 13 16 46.0439 (199.1918496d) Dec: +09 25 31.67 (9.42546d) Equinox: J2000 | | | Proper Motion RA: -336.66 mas/yr Proper Motion Dec: 190.58 mas/yr Parallax: 0.057" Epoch of Position: 2015.5 | | | | | | |
| | <p><i>Comments: This is a substellar companion to a high proper motion star. The coordinates given here are the predicted position of the **companion in 2024**, specified in the Gaia DR2 frame and epoch, including the measured stellar proper motion.</i></p> <p><i>The **star** GJ 504 has the ICRS coordinates 13 16 46.1635 +09 25 29.92 at epoch 2015.5 (Gaia DR2).</i></p> <p><i>As of mid cycle 2 at epoch 2024.0, the offset position of the companion relative to the star is computed to be:</i></p> <p><i>Separation = 2490.953 ± 11.931 mas, PA = 314.763 ± 0.256 deg</i></p> <p><i>The computed ICRS coordinates here specify that offset position in the ICRS frame, including the proper motion of the star.</i></p> <p><i>Category=Star</i></p> <p><i>Description=[Exoplanet Systems, Exoplanets, Substellar companions]</i></p> <p><i>Extended=NO</i></p> | | | | | | | | | | | |
| Template | <p>TA Method</p> <p>NONE</p> | | | | | | | | | | | |
| Dithers | # | Dither Type | | Size | Starting Point | | Number of Points | Points | | | | |
| | 1 | CYCLING | | MEDIUM | 1 | | 9 | | | | | |
| Spectral Elements | # | Grating/Filter | Readout Pattern | Groups/Int | Integrations/Exp | Leakcal | Dither | Autocal | Total Dithers | Total Integrations | Total Exposure Time | ETC Wkbk.Calc ID |
| | 1 | G395H/F290LP | NRSIRS2RAPID | 32 | 1 | false | true | NONE | 9 | 9 | 4332.9 | |

Proposal 2778 - Observation 2 - Imaging Spectroscopy of the Coldest Imaged Exoplanet and a Low-Mass Accreting Protoplanet

Special Requirements

Sequence Observations 1, 2, Non-interruptible
Aperture PA Offset 1 from 2 by 10 to 14 Degrees (Same offsets in V3)

Proposal 2778 - Observation 3 - Imaging Spectroscopy of the Coldest Imaged Exoplanet and a Low-Mass Accreting Protoplanet

Mon Jun 26 16:02:32 GMT 2023

| Observation | Proposal 2778, Observation 3: MIRI MRS on Delorme 1 AB b Diagnostic Status: Warning Observing Template: MIRI Medium Resolution Spectroscopy <i>Comments: No dedicated background observation is needed; the target is a point source (well, a couple point sources), and background will be subtracted from offset regions within the science cube. This follows the approach adopted for the ERS 1386 observations of VHS 1256 b.</i> | | | | | | | | | | | | | | |
|----------------------|--|---|--|-------------------------|--------------------------|-------------------------|---------|----------------|---|--|---------|--|--|--|--|
| Diagnostics | (Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. | | | | | | | | | | | | | | |
| Fixed Targets | <table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(2)</td> <td>DELORME-1-AB-B</td> <td>RA: 01 03 35.7300 (15.8988750d) Dec: -55 15 55.36 (-55.26538d) Equinox: J2000</td> <td>Proper Motion RA: 100.2 mas/yr Proper Motion Dec: -47.2 mas/yr Parallax: 0.02118" Epoch of Position: 2015.5</td> <td></td> </tr> </tbody> </table> <p><i>Comments: This is a substellar companion to a high proper motion star. The coordinates given here are the predicted position of the **companion in 2024**, specified in the Gaia DR2 frame and epoch, including the measured stellar proper motion.</i></p> <p><i>The binary star Delorme 1 AB has the ICRS coordinates 01 03 35.836 -55 15 56.97 at epoch 2015.5 (Gaia DR2). As of mid cycle 2 at epoch 2024.0, the offset position of the companion relative to the star is computed to be: Separation = 1816.195 +/- 15.4561 mas, PA = 334.116 +/- 0.069 deg The computed ICRS coordinates here specify that offset position in the ICRS frame, including the proper motion of the star. Category=Star Description=[Circumstellar disks, Exoplanet Systems, Exoplanets, Substellar companions] Extended=NO</i></p> | # | Name | Target Coordinates | Targ. Coord. Corrections | Miscellaneous | (2) | DELORME-1-AB-B | RA: 01 03 35.7300 (15.8988750d) Dec: -55 15 55.36 (-55.26538d) Equinox: J2000 | Proper Motion RA: 100.2 mas/yr Proper Motion Dec: -47.2 mas/yr Parallax: 0.02118" Epoch of Position: 2015.5 | | | | | |
| # | Name | Target Coordinates | Targ. Coord. Corrections | Miscellaneous | | | | | | | | | | | |
| (2) | DELORME-1-AB-B | RA: 01 03 35.7300 (15.8988750d) Dec: -55 15 55.36 (-55.26538d) Equinox: J2000 | Proper Motion RA: 100.2 mas/yr Proper Motion Dec: -47.2 mas/yr Parallax: 0.02118" Epoch of Position: 2015.5 | | | | | | | | | | | | |
| Acquisition | <table border="1"> <thead> <tr> <th>#</th> <th>Target</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>NONE</td> </tr> </tbody> </table> | # | Target | 1 | NONE | | | | | | | | | | |
| # | Target | | | | | | | | | | | | | | |
| 1 | NONE | | | | | | | | | | | | | | |
| Template | <table border="1"> <thead> <tr> <th>AcqFilter</th> <th>Primary Channel</th> <th>Simultaneous Imaging</th> <th>Imager Subarray</th> <th>Grating Wheel Direction</th> </tr> </thead> <tbody> <tr> <td>FND</td> <td>ALL</td> <td>YES</td> <td>FULL</td> <td>NEUTRAL</td> </tr> </tbody> </table> | AcqFilter | Primary Channel | Simultaneous Imaging | Imager Subarray | Grating Wheel Direction | FND | ALL | YES | FULL | NEUTRAL | | | | |
| AcqFilter | Primary Channel | Simultaneous Imaging | Imager Subarray | Grating Wheel Direction | | | | | | | | | | | |
| FND | ALL | YES | FULL | NEUTRAL | | | | | | | | | | | |
| Dithers | <table border="1"> <thead> <tr> <th>#</th> <th>Dither Type</th> <th>Optimized For</th> <th>Direction</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>4-Point</td> <td>POINT SOURCE</td> <td>NEGATIVE</td> </tr> </tbody> </table> | # | Dither Type | Optimized For | Direction | 1 | 4-Point | POINT SOURCE | NEGATIVE | | | | | | |
| # | Dither Type | Optimized For | Direction | | | | | | | | | | | | |
| 1 | 4-Point | POINT SOURCE | NEGATIVE | | | | | | | | | | | | |

Proposal 2778 - Observation 3 - Imaging Spectroscopy of the Coldest Imaged Exoplanet and a Low-Mass Accreting Protoplanet

| Spectral Elements | # | Wavelength Range | Detector | Filter | Readout Pattern | Groups/Int | Integrations/Exp | Exposures/Dith | Dither | Total Dithers | Total Integrations | Total Exposure Time | ETC Wkbk.Calc ID |
|-------------------|---|------------------|----------|--------|-----------------|------------|------------------|----------------|----------|---------------|--------------------|---------------------|------------------|
| | 1 | | IMAGER | F770W | FASTR1 | 5 | 1 | 1 | Dither 1 | 4 | 4 | 55.501 | 94000 |
| | 1 | LONG(C) | MRSLONG | | FASTR1 | 100 | 1 | 1 | Dither 1 | 4 | 4 | 1110.016 | 94000 |
| | 1 | LONG(C) | MRSSHORT | | FASTR1 | 100 | 1 | 1 | Dither 1 | 4 | 4 | 1110.016 | 94000 |
| | 2 | | IMAGER | F770W | FASTR1 | 5 | 1 | 1 | Dither 1 | 4 | 4 | 55.501 | 94000 |
| | 2 | MEDIUM(B) | MRSLONG | | FASTR1 | 100 | 1 | 1 | Dither 1 | 4 | 4 | 1110.016 | 94000 |
| | 2 | MEDIUM(B) | MRSSHORT | | FASTR1 | 100 | 1 | 1 | Dither 1 | 4 | 4 | 1110.016 | 94000 |
| | 3 | | IMAGER | F770W | FASTR1 | 5 | 1 | 1 | Dither 1 | 4 | 4 | 55.501 | 94000 |
| | 3 | SHORT(A) | MRSLONG | | FASTR1 | 100 | 1 | 1 | Dither 1 | 4 | 4 | 1110.016 | 94000 |
| | 3 | SHORT(A) | MRSSHORT | | FASTR1 | 100 | 1 | 1 | Dither 1 | 4 | 4 | 1110.016 | 94000 |