- "modern", user-friendly documentation system
  web-based, agile, searchable, integrated
- writing and publishing in Confluence
- schedule

Jennifer Lotz - STScI

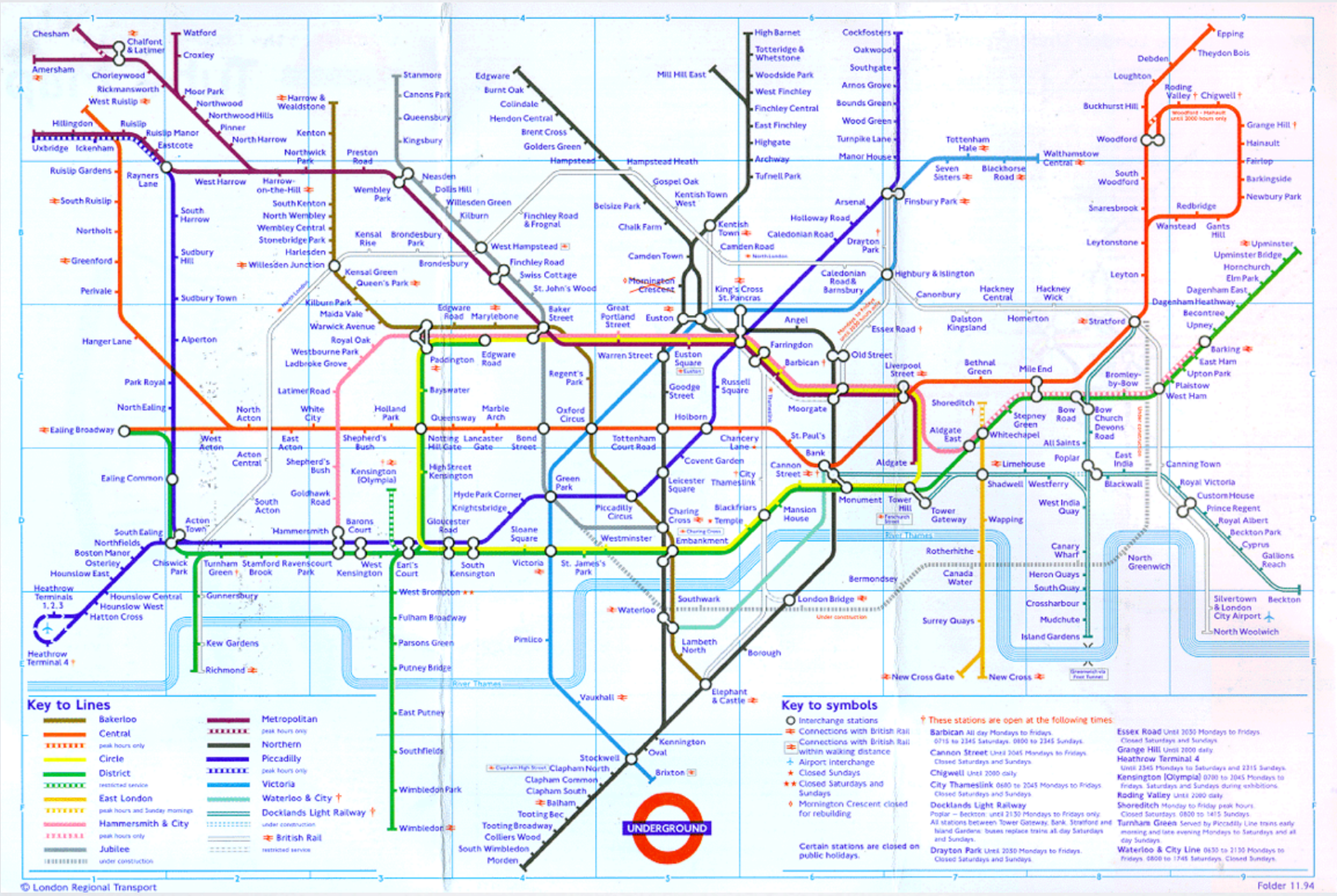
JDox team: Ori Fox, Shireen Gonzaga, Bill Blair, Bob Brown, Dan Coe, Ron Downes, Harry Ferguson, Alex Fullerton, Dean Hines, Amaya Moro-Martin, Karla Peterson, Tracy Beck, David Soderblom, Lou Strolger, Jeff Valenti, ITSD: Alex Yermolaev, Phil Grant, Paul Mulgrew

JDox goals:

- user-friendly, accurate, web-based JWST documentation
- "agile" process/infrastructure (easy to update)
- searchable via Google and internally
- heavily cross-linked across topics
- integrated with software tools (APT)
- to ensure a happy and well-informed JWST community

JDox philosophy:

documentation system is like public transportation with "hubs" and "lines" but not linear



JDox philosophy:

- "Every Page is Page One" -- wikipedia style articles.

- agile system: frequent updates, to be propagated automatically throughout the documentation system

- expert authors, reviewer approvals for publication; linked to public user forum/help desk

- PDFs created periodically for subsets of documentation ("MIRI instrument handbook", "Cycle 1 Call for Proposals")

Implementation

⇒ use Confluence (wiki) to write, review, and publish

jwst-docs.stsci.edu

STScI authors, reviewers: create & edit content articles, upload figures, provide comments, approve articles for publication

STScI editors: oversee reviews; editorial oversight; publish content

JWST users: search and read content; arrive via website, Google, or APT links. (no comments, no edits); can contribute to public user forum

jwst-docs.stsci.edu organization:

JWST Observatory and Instrumentation - background articles, "instrument handbooks"

JWST Observation Planning - APT, ETC, observing constraints, observing strategies (e.g. moving targets, spectroscopy)

JWST Data - calibration, pipeline, data analysis, archive

JWST Opportunities and Policies - call for proposals, duplication, science parallel policies, funding/grants

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JWST Observatory and Instrumentation

background, 'just the facts' articles on telescope and instruments; equivalent to instrument handbooks

- MIRI
- NIRCam
- NIRSpec
- NIRISS
- JWST Observatory (e.g. mirrors, WFS&C, FGS/guiding,)

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JWST Observatory and Instrumentation

background, 'just the facts' articles on telescope and instruments

MIRI

- "Landing Page" (hub with little content)
- Overview
- Observing Modes (Imaging, Corongraphy, LRS, MRS, TSO)
- Instrumentation/Hardware (Optics/Focal Plane, Detectors, Filters, Spectroscopic Elements, ..)
- Operations (Dithers, Target Acq., Parallels..)
- Predicted Performance (PSF, Backgrounds, Bright Source Limits, Sensitivity..)

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JWST Observatory and Instrumentation Documentation / Mid-Infrared Instrument, MIRI

MIRI Overview

The JWST Mid-Infrared Instrument (MIRI) provides imaging and spectroscopic observing modes from 4.9 to 28.8 µm.

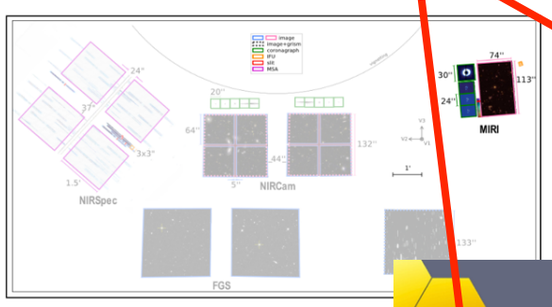
Introduction

The JWST Mid-Infrared Instrument (MIRI) provides imaging and spectroscopic observing modes from 4.9 to 28.8 µm (Wright et al. 2015, Rieke et al. 2015). These wavelengths can be utilized for studies including, but not limited to: direct imaging of young warm exoplanets and spectroscopy of their atmospheres; identification and characterization of the first galaxies at redshifts $z > 7$; and analysis of warm dust and molecular gas in young stars and proto-planetary disks.

To achieve these goals MIRI offers a very broad range of observing modes, including:

- imaging
- low-resolution slitted and slitless spectroscopy
- medium-resolution integral field unit (IFU) spectroscopy
- coronagraphy

Figure 1. JWST MIRI field of view in the telescope focal plane



MIRI

Mid-Infrared Instrument

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... / MIRI Observing Modes

MIRI Imaging

The imaging mode for JWST's Mid-Infrared Instrument (MIRI) offers nine broadband filters from 5.6 to 25.5 µm in a 74" × 113" FOV at 0.11"/pixel plate scale.

Introduction

For imaging, the MIRI Imager offers 9 broadband filters covering wavelengths from 5.6 to 25.5 µm over an unobstructed 74" × 113" field of view, and a detector plate scale of 0.11"/pixel (Bouchet et al. 2015). The MIRI imaging mode also supports the use of detector subarrays for bright targets, as well as a variety of dither patterns that could improve sampling at the shortest wavelengths, remove detector artifacts and cosmic-ray hits, and facilitate self-calibration. The Astronomer's Proposal Tool (APT) can be used to design mosaic observations to image larger fields.

This mode is not for coronagraphic imaging.

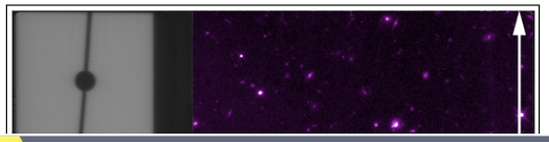
Basic performance

Imaging with MIRI is diffraction limited in all filters, with Strehl ratios in excess of 90%, although the detector plate scale of 0.11"/pixel slightly undersamples the PSF at the F560W band.

MIRI imaging sensitivity is background limited in all the imaging bands (unless one takes short integrations): natural background limited at wavelengths <11 µm and telescope background (primary mirror and sunshield) limited at wavelengths >11 µm.

Observers will be able to specify settings for 4 primary MIRI imaging parameters: (1) filters, (2) dithering pattern, (3) choice of subarray, and (4) detector read out modes and exposure time (via the number of frames and integrations).

Figure 1. The MIRI imaging FOV



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Mid-Infrared Instrument

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... / MIRI Observing Modes

MIRI Low-Resolution Spectroscopy

Low-resolution spectroscopy is an observing mode for JWST's Mid-Infrared Instrument (MIRI) that offers slit and slitless spectroscopy from 5 to 12 µm.

Introduction

The MIRI Low Resolution Spectrometer (LRS; Kendrew et al. 2015) offers both slit and slitless spectroscopy from 5 to 12 µm using a double prism mounted in the MIRI filter wheel, designed to provide a spectral resolving power of R = 40 at 5 µm and R = 160 at 10 µm for compact sources (<2"). The long-wavelength limit for this mode is determined by the combined throughput of the prisms and the slit mask, which drops off steeply from a peak of around 80% at 8–9 µm to just 25% at 12 µm. Point source sensitivity will be nearly a factor of 10× better when using the slit.

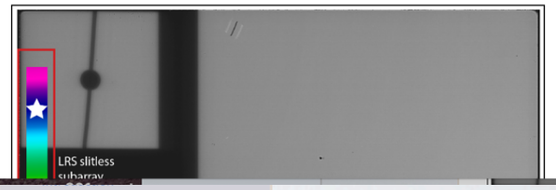
Users should ultimately use the Exposure Time Calculator for all sensitivity calculations.

Observers will be able to select parameters for 3 primary characteristics of the low-resolution spectroscopy mode: 1) presence of a slit, 2) dithering pattern, and 3) detector read out mode and exposure time (via the number of frames and integrations).

Slit vs. slitless spectroscopy

The LRS can be operated in slit (*FULL*) or slitless (*SLITLESSPRISM*) mode. Figure 1 shows the LRS focal plane layout on the MIRI imaging detector. The single slit is ~4.7" long (3.18 mm; 42.7 pixels) and ~0.51" wide (0.33 mm; 4.6 pixels). The nominal spectral range of 5–12 µm is dispersed over approximately ~370 pixels. (The bold italic font indicates these are parameters in APT observing templates.)

Figure 1. LRS slit and slitless spectra positions on MIRI imager focal plane



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MIRI Coronagraphic Imaging

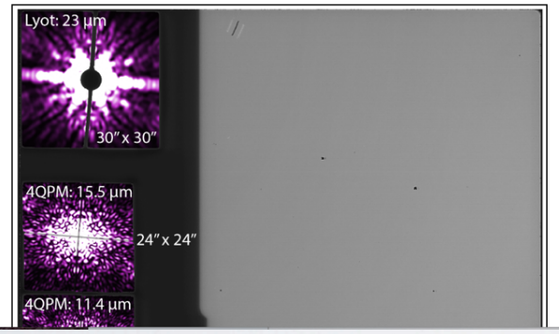
Coronagraphic imaging with JWST's Mid-Infrared Instrument (MIRI) provides high-contrast imaging in photometric bands from 10 to 23 µm, using a Lyot stop mask and three 4-quadrant phase masks (4QPM).

Introduction

The imaging channel on MIRI is equipped with 4 coronagraphs that provide high-contrast imaging capabilities covering photometric bands from 10 to 23 µm (Boccaletti et al. 2015). In addition to the classical Lyot Coronagraph (which provides an inner working angle (IWA) of ~3λ/D), MIRI also incorporates the 4-quadrant phase mask coronagraph technology (4QPM; Rouan et al., 2000) to provide the smallest possible IWA of ~1λ/D at 10 to 16 µm. The design offers a very small IWA in a stable environment. These advantages might be used for studying exoplanets and their circumstellar environments.

Each coronagraph is at a fixed position in MIRI's focal plane so that no mechanisms are used. The observer will have control over two primary variables for MIRI coronagraphy: 1) fixed filter-coronagraph pairs, and 2) exposure time (via the number of frames and integrations).

Figure 1. The MIRI coronagraphic imaging FOV



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... / MIRI Observing Modes

MIRI Medium-Resolution Spectroscopy

Medium-resolution spectroscopy is an observing mode for JWST's Mid-Infrared Instrument (MIRI) for obtaining spatial and spectral data between 4.9 and 28.8 µm over a FOV up to 7.7" × 7.7".

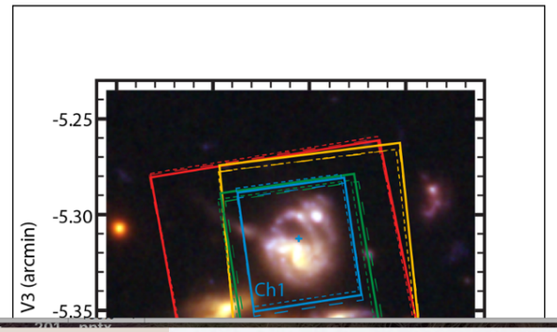
Introduction

The JWST MIRI Medium Resolution Spectrometer (MRS; Wells et al. 2015) will observe simultaneous spatial and spectral information between 4.9 and 28.8 µm over a contiguous field of view up to 7.7" × 7.7" in size. This is the only JWST configuration offering medium-resolution spectroscopy (with R from 1500 to 3500) longward of 4.9 µm.

MRS observations are carried out using a set of 4 integral field units (IFUs), each of which covers a different portion of the MIRI wavelength range. MRS IFUs split the field of view into spatial slices. Each slice produces a separate dispersed "long-slit" spectrum. Post-processing produces a 3-dimensional (2 spatial and one spectral dimension) data cube.

MRS operations have been designed to allow for efficient observations of point sources, compact sources, and fully extended sources. The observer will have control over 3 primary variables: (1) wavelength coverage, (2) dithering pattern, and (3) detector read out mode and exposure time (via the number of frames and integrations).

Figure 1. MRS focal plane



JWST Observatory and Instrumentation

publication timeline:

January 2017: instrument background articles, APT, ETC, proposal planning support, and GTO, ERS Call for Proposals

Summer/Fall 2017: science use cases, data calibration/pipeline descriptions, updates to JWST capabilities

Fall 2017: Cycle 1 GO Call for Proposals and supporting articles

2018 - : frequent updates through launch/commissioning/Cycle 1

jwst-docs.stsci.edu coming soon!