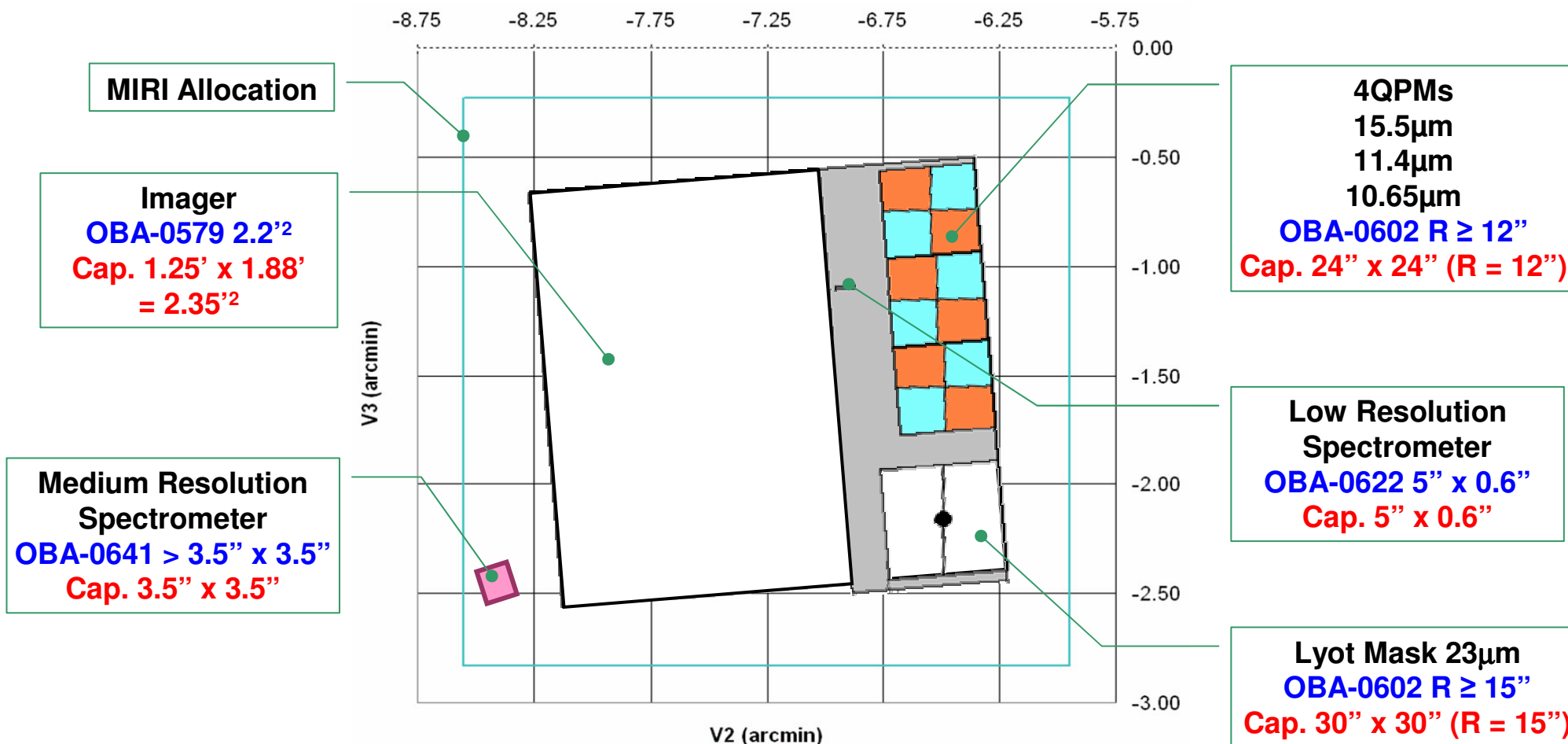




MIRI Fields of View (Requirement v Capability)



MIRI - Spatial Resolution and sampling



- JWST Delivered Image

Image dimension at 5 μm	arcseconds
Full Width at Half Maximum Intensity	0.18
Diameter of the 1st dark diffraction ring	0.48
Diameter enclosing 80% of the energy of a point source	0.63

- MIRIM

- Imager, Coronagraph and Low Resolution Spectrometer
- 0.11 arcseconds/pixel
- Nyquist sampled (OBA-0580) requirement at 7 μm , capability at 5.6 μm

- Medium Resolution Spectrometer

Channel Name	Spatial sample dimensions				FOV in a single integration			
	Across slice (Slice width) [arcsec]		Along slice (Pixel) [arcsec]		Across slice [arcsec]		Along slice [arcsec]	
1	0.18	<0.6	0.20	0.2	3.7	>3.5	3.7	>3.5
2	0.28	<0.9	0.20	± 0.03	4.5		4.7	
3	0.39	<1.4	0.25	<0.6	6.1		6.2	
4	0.64	<2.2	0.27		7.9		7.7	



MIRI - Spectral Coverage

Imager/Coronagraph

Name	Wavelength (μm)	Bandwidth (μm)
F560W	5.6	1.2
F770W	7.7	2.2
F1000W	10.0	2.0
F1130W	11.3	0.7
F1280W	12.8	2.4
F1500W	15.0	3.0
F1800W	18.0	3.0
F2100W	21.0	5.0
F2550W	25.5	4.0
F2550WR	25.5	4.0
F1065C	10.65	0.53
F1140C	11.4	0.57
F1550C	15.5	0.78
F2300C	23.0	4.6

- Low Resn. Spectrometer
5 to 10 μm, R = 100 at 7.5 μm

Medium Resolution Spectrometer

Sub-band	Wavelength Coverage [μm]	Spectral Resolving Power		Pixels per resolution element	
		(R = λ/Δλ)		Spectral (Rqmt >2)	Spatial
		Rqmt	Capability		
1A	4.9 - 5.8	> 2400	5180 - 6430	0.9 - 1.1	1.1 - 1.7
1B	5.6 - 6.7		4800 - 6600	0.9 - 1.2	1.2 - 1.6
1C	6.5 - 7.7		4770 - 6480	0.9 - 1.3	1.2 - 1.5
2A	7.5 - 8.8		2040 - 5590	1.1 - 3.1	1.2 - 1.7
2B	8.6 - 10.2		1770 - 5310	1.1 - 3.7	1.3 - 1.9
2C	10.0 - 11.8	> 1600	1600 - 5000	1.2 - 4.1	1.5 - 2.2
3A	11.5 - 13.6		3070 - 5900	1.0 - 2.1	1.6 - 2.0
3B	13.3 - 15.7		2390 - 5510	1.1 - 2.2	1.9 - 2.3
3C	15.3 - 18.1	> 800	2150 - 5040	1.2 - 2.5	2.2 - 2.6
4A	17.6 - 21.0		2190 - 2510	1.7 - 2.1	2.2 - 2.7
4B	20.5 - 24.5		1950 - 2210	1.9 - 2.4	2.6 - 4.0
4C	23.9 - 28.6		1860 - 1950	2.2 - 2.7	3.1 - 3.7

Waivers approved by MIRI Science Team (MIRI-RW-00009-ATC)
 “..the spectrometer is capable of doing the expected science programs with no significant compromise..”

APPENDIX D: MIRI SENSITIVITY MODEL RESULTS

Imager

	Wavelength [μm]	10- σ , 10000 sec [μJy]
B1	5.6	0.20
B2	7.7	0.28
B3	10.0	0.70
B4	15.0	1.80
B5	21.0	8.60
B6	25.5	29.00*
I1	11.3	1.80
I2	12.8	1.40
I3	18.0	4.30



* Assuming 512 x 512 subarray operation

Coronagraph

Wavelength [μm]	Radius of 10^4 Contrast [arcsec]	10- σ , 1000 sec [μJy]
10.65	1.10	20 (TBR)
11.40	1.20	27 (TBR)
15.50	1.65	60 (TBR)
23.00	5.00	200 (TBR)

Low Resolution Spectroscopy

Line flux ($10^{-20} \text{ W.m}^{-2}$)	Continuum
0.60 (TBR)	1.35 μJy (TBR)



Medium Resolution Spectroscopy

λ	$\lambda/\Delta\lambda$	# pixels	$10^{-20} \text{ W.m}^{-2}$
6.4	2400	4	1.20*
9.2	2400	6	1.00*
14.5	1600	8	1.20*
22.5	1200	18	6.00*



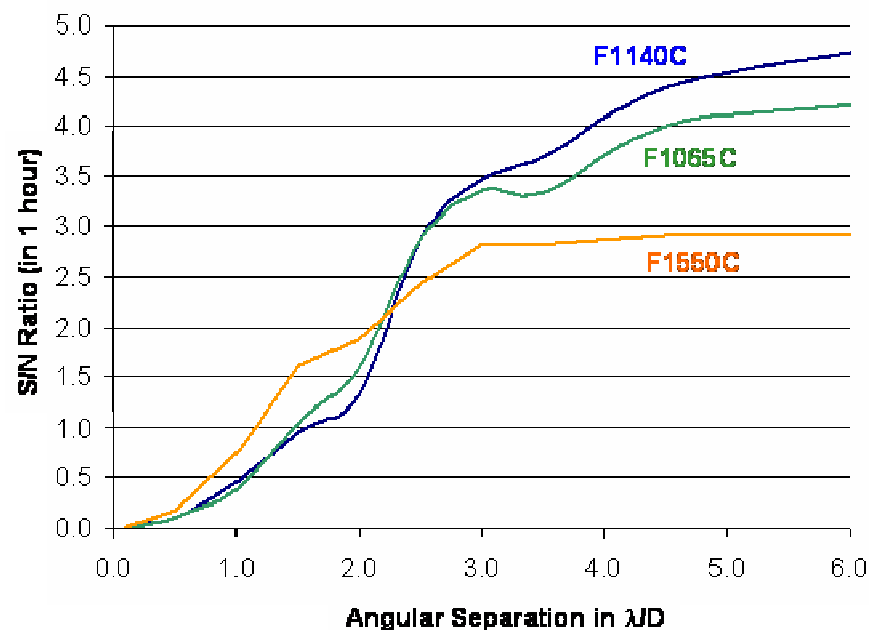
* For a point source centered in a $2.4\lambda/D$ wide slice. The indicated number of pixels are combined to the exact signal.

All sensitivity requirements are TBR awaiting completion of the collaborative facility background modelling with Ball Aerospace, and the entry of the resulting sensitivity requirements into higher-level project requirements to flow down to the MIRI FRD [AD 2].



Coronagraph Performance

- The sensitivity for detection of a faint target close to a bright star is a complicated function which is quantified by the coronagraph's contrast and rejection factor.
- Contrast and rejection are degraded/influenced by
 - Telescope/MIRI pupil alignment (shear and rotation) and defocus.
 - Telescope pointing jitter.
 - Bright star flux (determines residual image brightness).
 - Coronagraph transmission v radius
 - Sky and Telescope background flux.
- E.g. The S/N ratio in a 1 hour exposure for detection of a 100 microJansky point source close to a 0.1 Jansky star, using the three 4QPM coronagraphs.
 - Adapted from Boccaletti et al. ASR, 36, p1099





4QPM Coronagraph Performance

- **Performance modelled in the presence of**
 - 3.99 % ISIM to MIRIM pupil shear
 - 2 mm telescope defocus at the Imager focal plane
 - 7 milliarcseconds RMS telescope pointing jitter
- **Contrast gain of x10 assumed for point source calibration/subtraction.**
- **The modelling predicts that all requirements on contrast and rejection factor will be met or exceeded.**

Requirement	Rqt ID	Requirement Value (RD 2-9)	Capability (RD 2-15)
Contrast at I/D	OBA-1013	> 1,200	10,500
Contrast at 3I/D	OBA-1014	> 4,000	35,000
Contrast at 6I/D	OBA-1015	> 8,000	71,000
Rejection Factor	OBA-0604 OBA-0605 OBA-0606	> 30	200