
An Introduction to FORCAST
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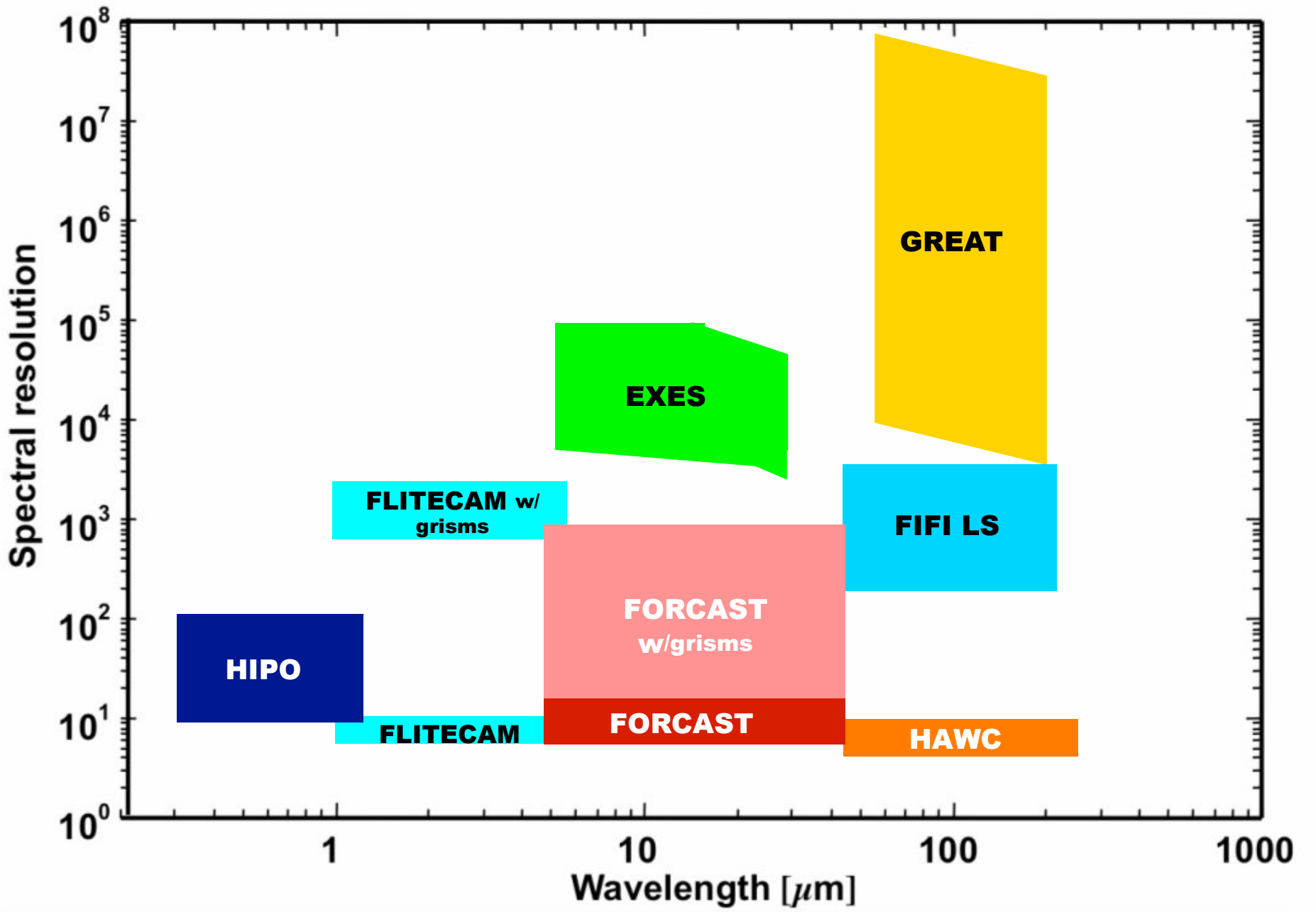
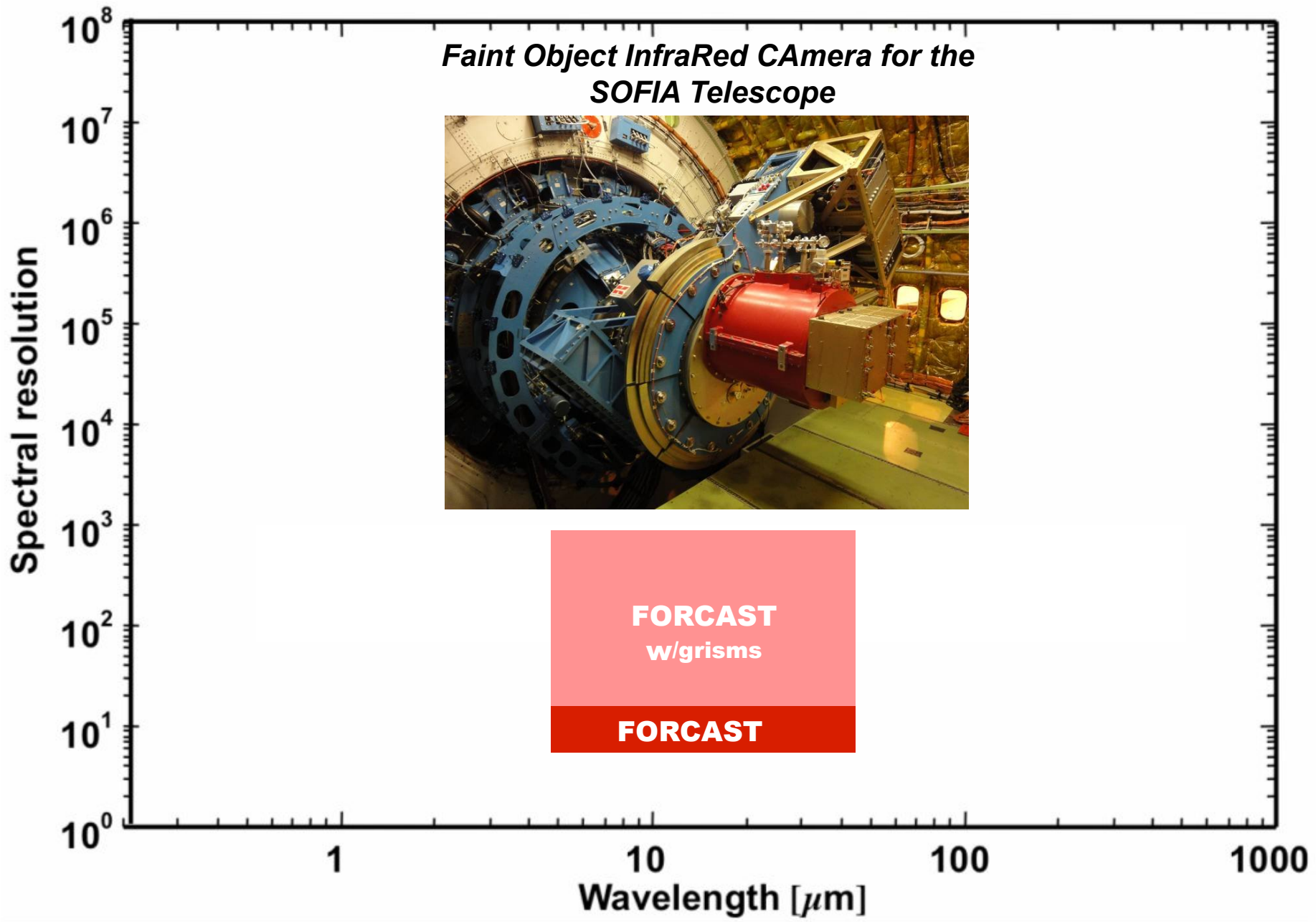
SOFIA Instrument Scientist

7 First Generation SOFIA Instruments



7 First Generation SOFIA Instruments



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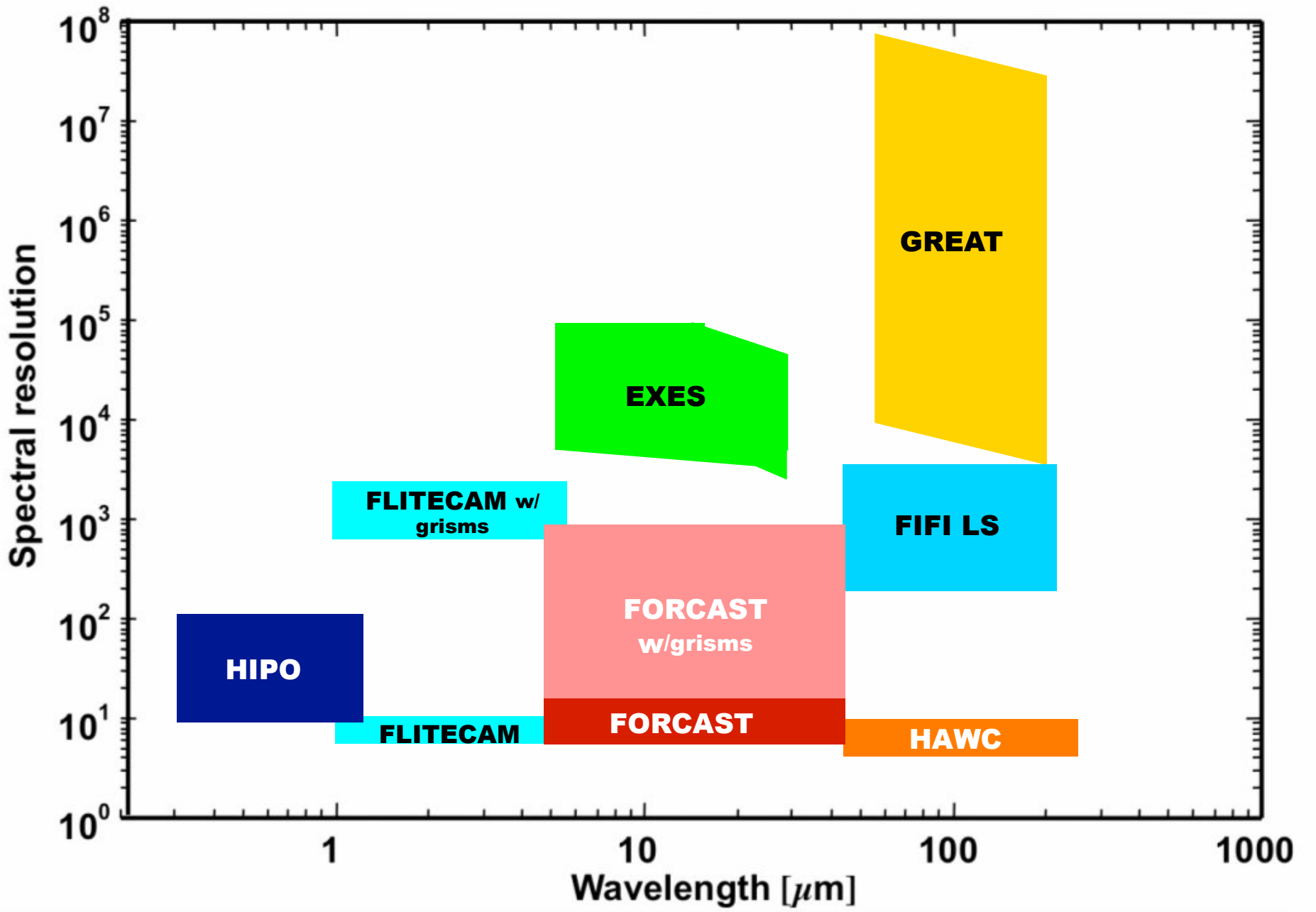
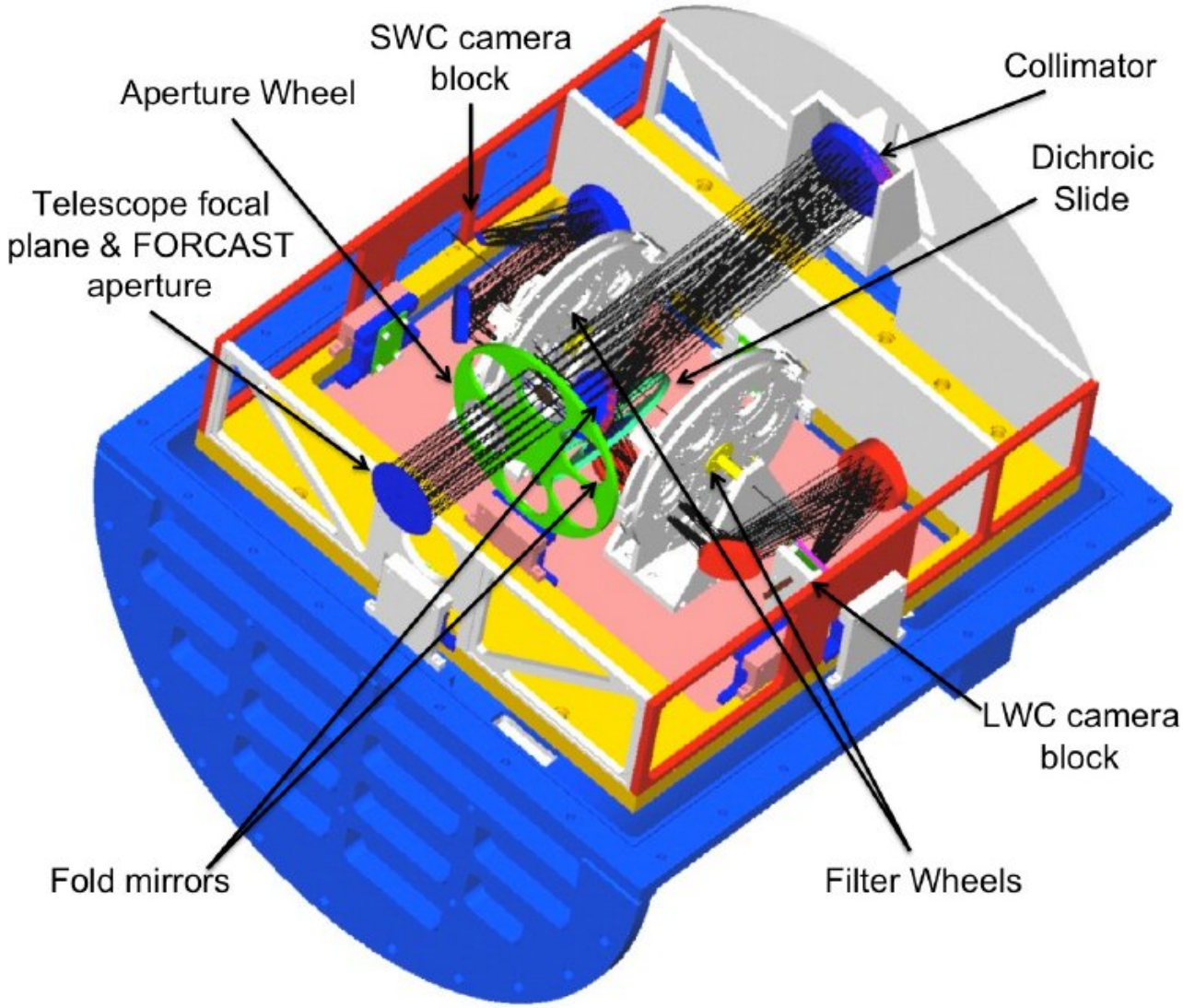


FORCAST DESIGN

Cryostat

- “Clam-shell” cryostat design
- Cooled with a dual liquid nitrogen and liquid helium can design
- Most optical elements near 77K, detectors at 4K
- Cryogen hold time: ~3 days

Optical Bench



- Window made of CsI (88% throughput from 0.6-40μm)
- Aperture wheel holds slits for spectroscopy
- Up to 10 filters or grisms can be used per channel

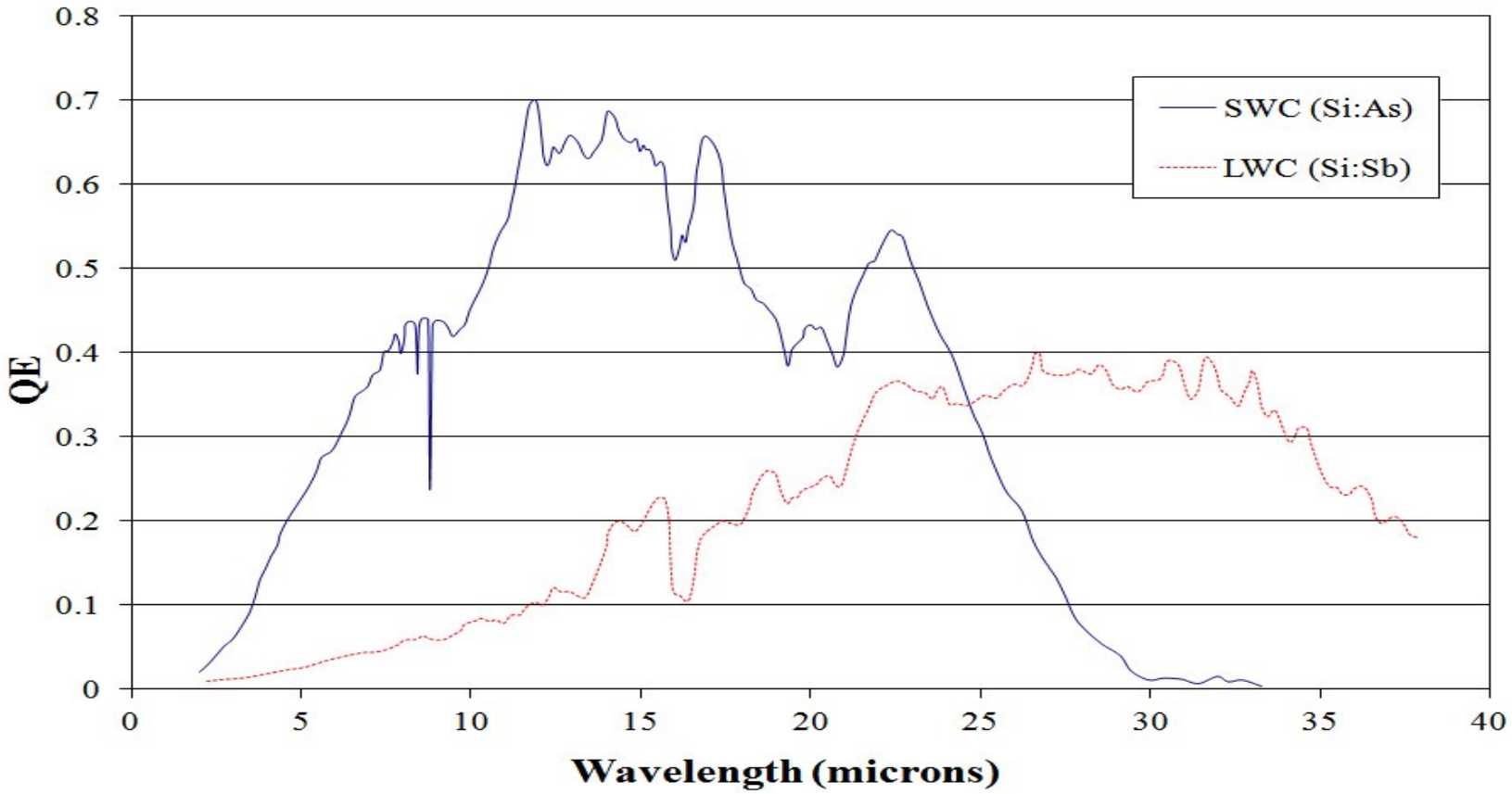
FORCAST (present) Arrays

SWC

- 256x256 pixel Si:As BIB array
- Optimized for 5-25 micron observations

LWC

- 256x256 pixel Si:Sb BIB array
- Optimized for 25-40 micron observations



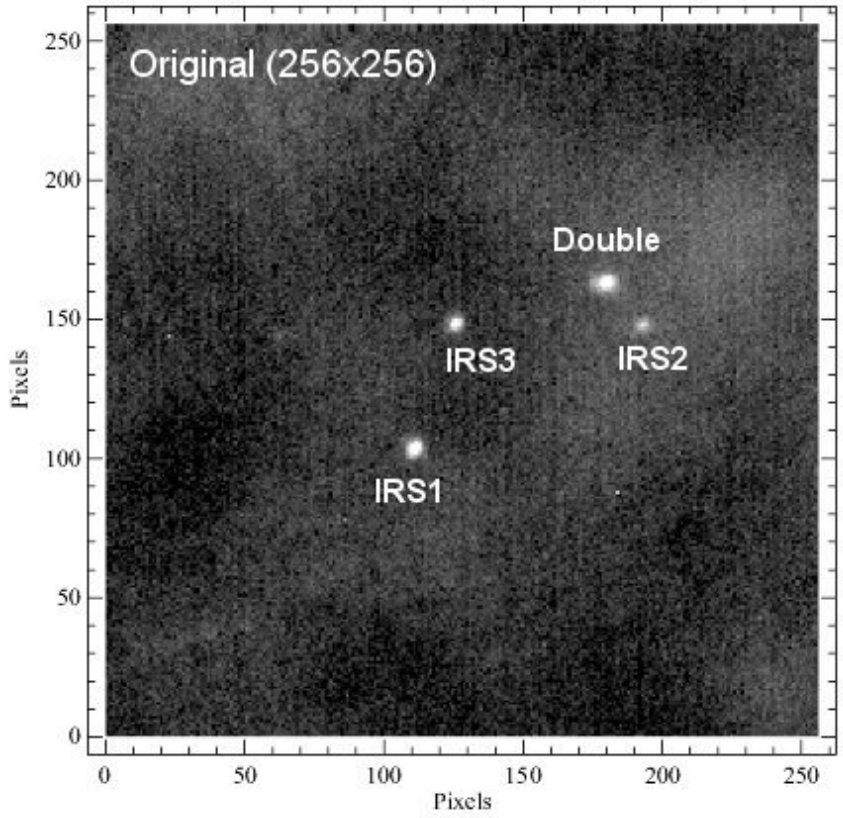
FORCAST (present) Arrays

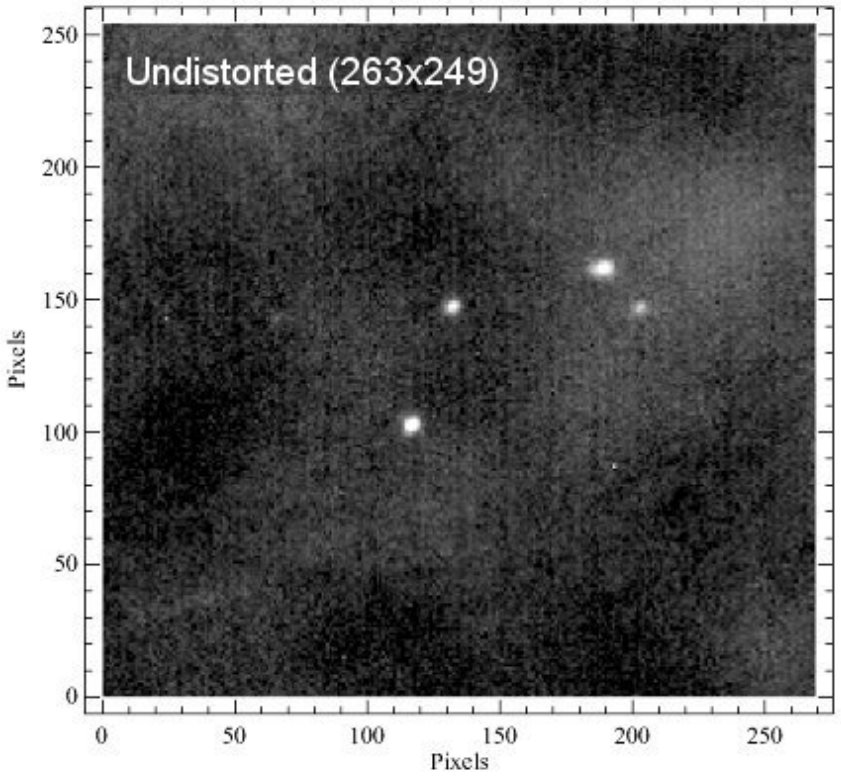
- Both arrays are 256x256 pixels, each 50μm square
- However, there is some internal optical distortion in FORCAST:

  Pixel scale (x) = 0.787″

  Pixel scale (y) = 0.745″
- Actual FoV is 201″x191″ (3.4′x3.2′), pixel scale is 0.768″ when rebinned

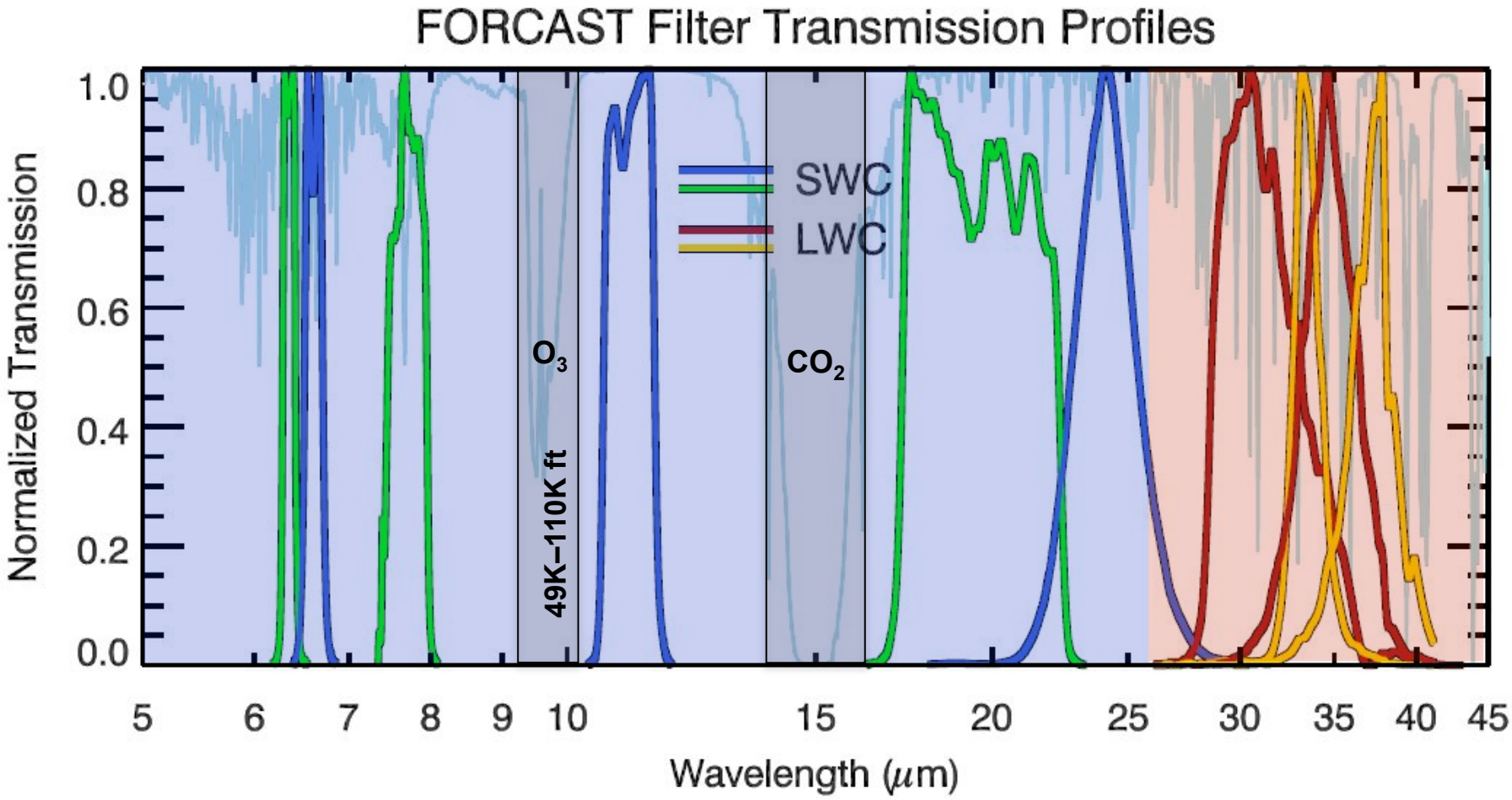
  Upgraded arrays 512^2 pixels- FoVs will likely be comparable (i.e. ~3'x~3')





IMAGING WITH FORCAST

Filters and Dichroic



- The dichroic is designed to transmit light at wavelengths greater than 25 microns, and reflect light less than 25 microns

Filters and Dichroic

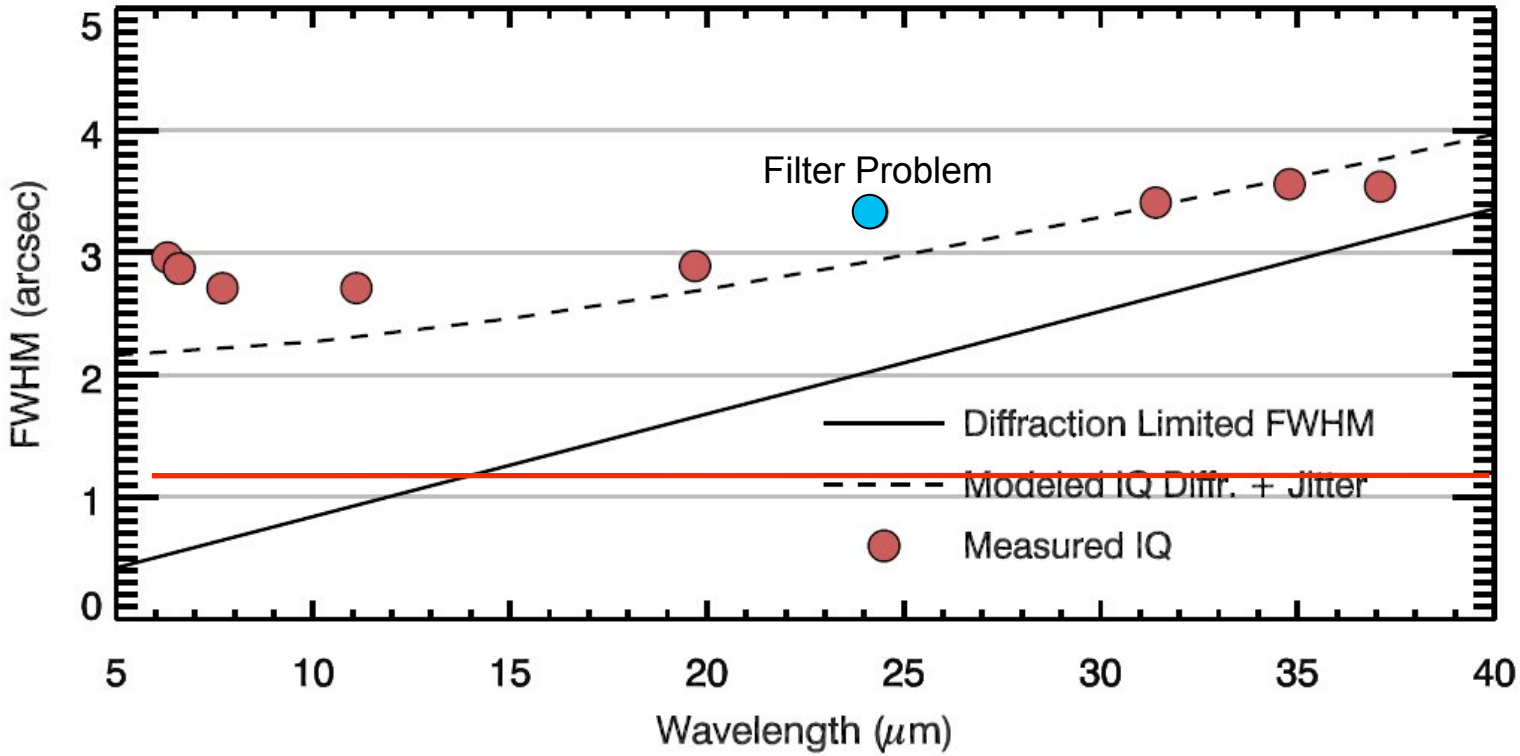
Channel	$\lambda_{\rm eff}$ (μm)	$\Delta\lambda$ (μm)	
SWC	6.4	0.14	
	6.6	0.24	~60%
	7.7	0.47	
	11.1	0.95	
	19.7	5.5	~85%
	24.2	2.9	
LWC	31.5	5.7	
	33.6	1.9	~40%
	34.8	3.8	
	37.1	3.3	

- Dual channel mode allows simultaneous imaging at two wavelengths
- However, there is decreased throughput compared to single channel mode

Filters and Dichroic

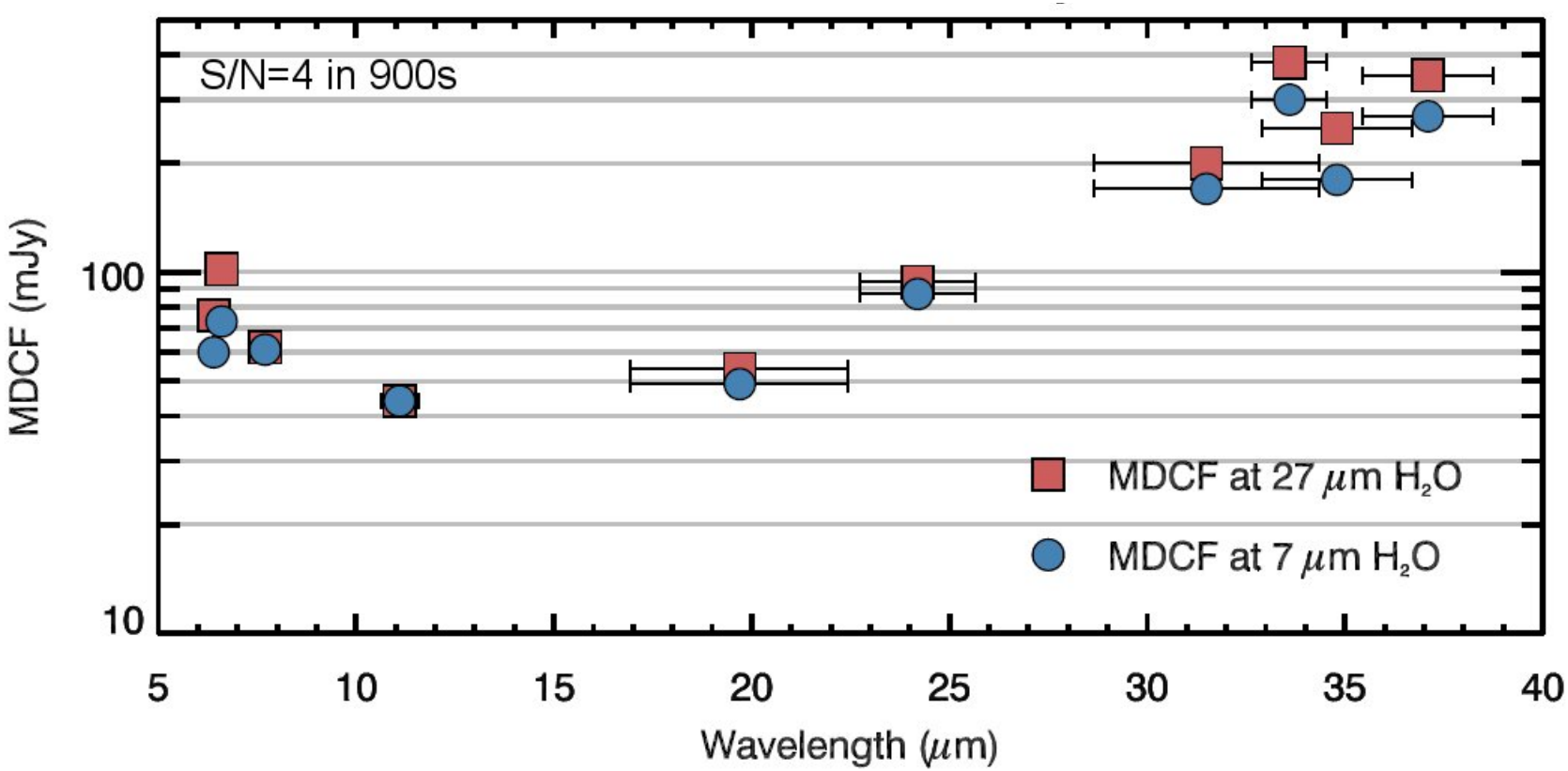
Channel	$\lambda_{\rm eff}$ (μm)	$\Delta\lambda$ (μm)	Spectral Features of Note
SWC	6.4	0.14	6.3μm PAH feature
	6.6	0.24	Continuum reference for PAH
	7.7	0.47	7.7μm PAH feature
	11.1	0.95	N-band substitute (11.3μm PAH)
	19.7	5.5	Q-band sub, Am. Silicate feature
	24.2	2.9	24.3μm [Ne V] line
LWC	31.5	5.7	
	33.6	1.9	33.5μm [S III] line
	34.8	3.8	Crystalline Silicate feature
	37.1	3.3	

Spatial Resolution



- Telescope jitter causes image quality at all wavelengths to degrade (chart shows 1.25” rms)
- Telescope jitter is expected to improve
- FORCAST is designed to be Nyquist sampled at greater than ~17 microns under diffraction-limit
- Further discussion of image quality will be presented in the next FORCAST talk

Imaging Sensitivity (present arrays)



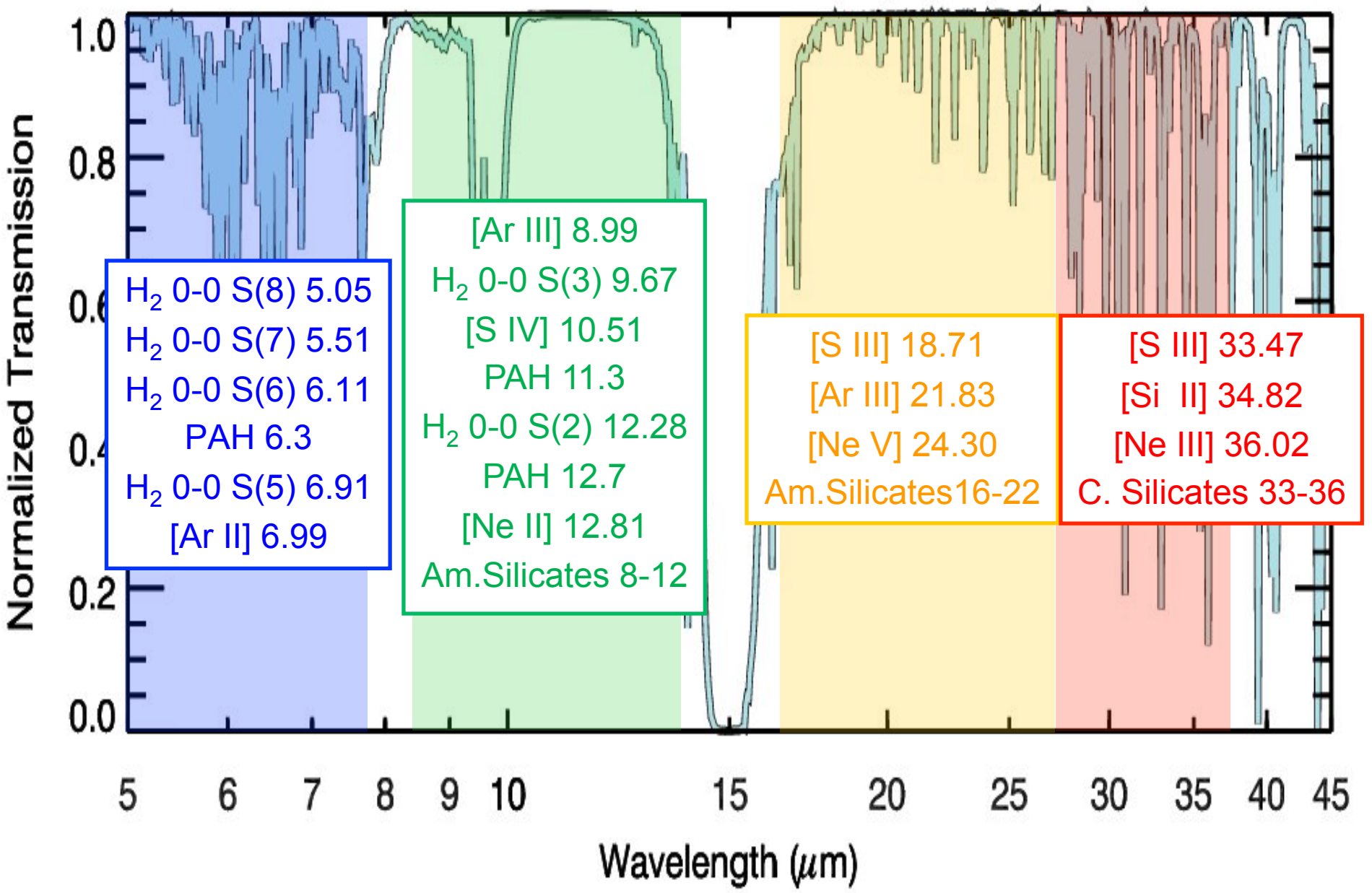
- S/N=4 in 900s, single channel mode (worse with dichroic)
- Altitude/water vapor affect sensitivity more in the LWC
- In preparing your FORCAST observations, you can use SITE, the online integration time estimator
- Additionally, there are substantial overheads that must be accounted for which depend on observing mode (see next FORCAST talk)

SPECTROSCOPY WITH FORCAST

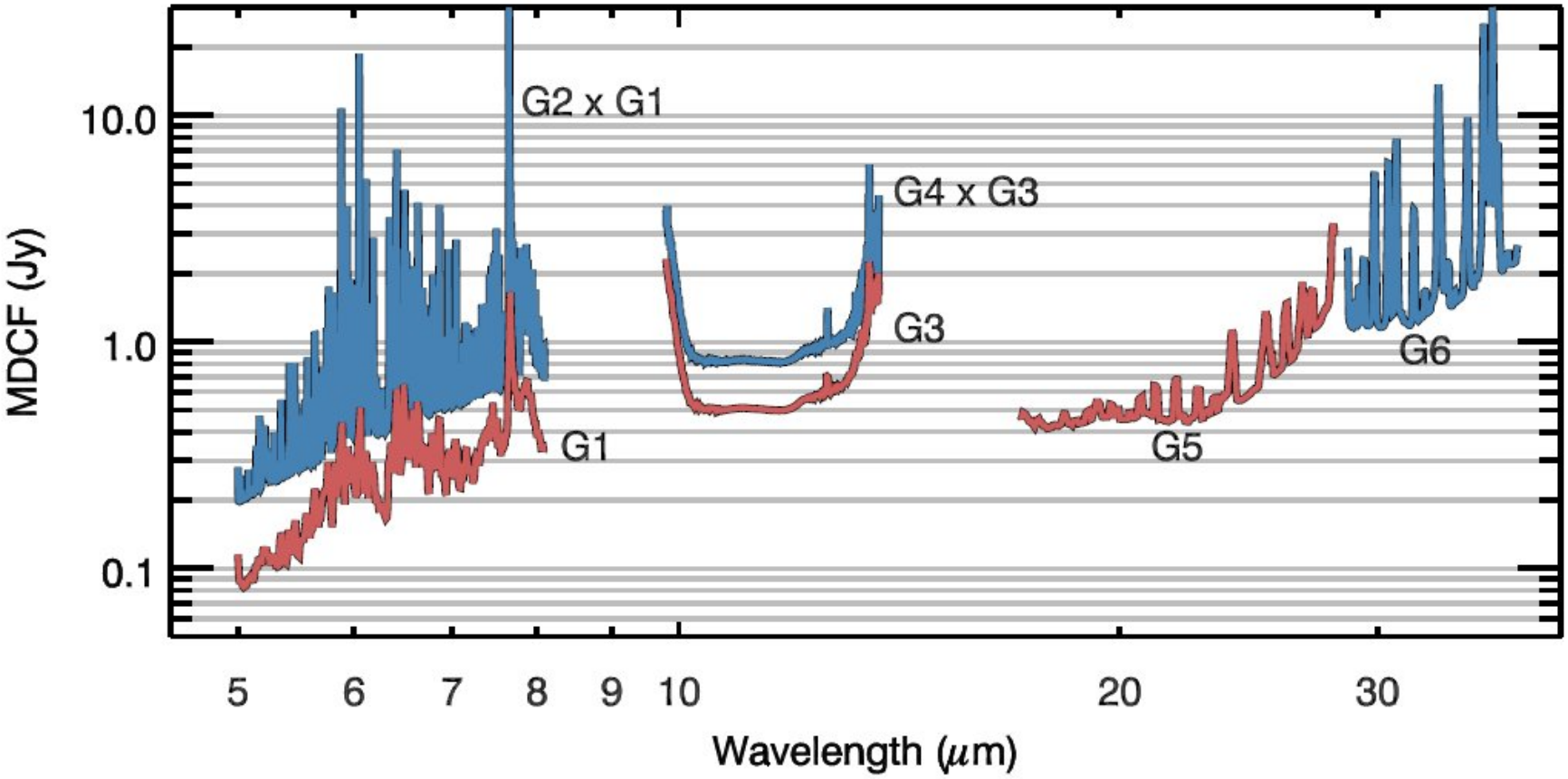
Grisms and Slits

Grism	Wavelength	Slit	Resolving Power
Long Slit Spectroscopy in the Short Wavelength Camera			
G1	4.7-7.8 μm	2.4"x191"	200
		4.7" x191"	100
G3	8.4-13.7 μm	2.4" x191"	300
		4.7" x191"	150
Cross Dispersed Spectroscopy in the Short Wavelength Camera			
G2xG1	4.7-7.8 μm	2.4"x11.2"	1200
G4xG3	8.4-13.7 μm	2.4"x11.2"	800
Long Slit Spectroscopy in the Long Wavelength Camera			
G5	17.6-27.7μm	2.4"x191"	140
		4.7" x191"	70
G6	28.7-37.1μm	2.4" x191"	220
		4.7" x191"	110

Spectral Features of Interest



Spectroscopic Sensitivity (present arrays)



- S/N=4 in 900s (7μm water vapor)
- In preparing your FORCAST spectroscopy observations, SITE will not be available for Cycle 1 CfP (a tutorial will be available)