

5.5.9 Expected Performance

Detection Limits

Table 5.5.25 and 5.5.26 summarizes 5σ detection limits of the IRC04 observing mode. These numbers are for 8 exposure cycles, i.e. a single pointing opportunity. Line detection limits are given for integrated line fluxes of an isolated line that can be treated as a point source (by aperture photometry technique at the line position).

Continuum detection limits for point source (slitless or with Np) are per pixel in the direction of dispersion. In other words, they are the flux that provides a $S/N = 5$ signal after being integrated over the pixels along the spatial direction of one row in the spectral dispersion direction. Averaging over the dispersion direction can improve the detection limits with a cost of spectral resolution.

On the other hand, continuum detection limits for diffuse source (with slit) are given per pixel. Integrating over the slit length can improve the sensitivity. If you integrate the spectrum over 0.8 arcmin (about 33 pix), the NP detection limits at the Ecliptic pole can be $0.26/\sqrt{(33)} = 0.045$ [MJy/sr].

These numbers are for the monotonic limit at the wavelength band center. The spectral response functions (RSRF; Figures 5.2.3, 5.2.4, 5.2.6) have to be taken into account for the limits at other wavelengths. Moreover, the spectral resolution changes as a function of wavelength in the case of NP, the prism dispersion element, and this also has to be considered for any detailed estimate of the performance. In this case, the resolution is approximately about 1/4 of the center value (at $3.5\ \mu\text{m}$) at $2\ \mu\text{m}$ and about twice at $5\ \mu\text{m}$.

Table 5.5.25: Line Detection Limits for IRC04

Camera	Element	λ_{center} (μm)	Position	Point Source		Diffuse Source	
				(10 ⁻¹⁷ W m ⁻²)			
				Pole	Plane	Pole	Plane
NIR	NP	3.5	Nc	0.18	0.26	—	—
	NP	3.5	Ns	—	—	0.13	0.13
	NG	3.6	Np	0.22	0.27	—	—
	NG	3.6	Ns/Nh	—	—	0.19	0.19
MIR-S	SG1	6.6	Nc	1.3	1.8	—	—
	SG1	6.6	Ns	—	—	0.92	0.94
	SG2	10.6	Nc	1.3	2.0	—	—
	SG2	10.6	Ns	—	—	0.63	0.68
MIR-L	LG1			— N/A —			
	LG2	20.2	Lc	2.2	3.9	—	—
	LG2	20.2	Ls	—	—	0.92	1.1

Table 5.5.26: Continuum Detection Limits for IRC04

Camera	Element	λ_{center} (μm)	Position	Point Source (mJy)		Diffuse Source (MJy/sr)	
				Pole	Plane	Pole	Plane
NIR	NP	3.5	Nc	0.05	0.08	—	—
	NP	3.5	Ns	—	—	0.26	0.27
	NG	3.6	Np	0.48	0.60	—	—
	NG	3.6	Ns/Nh	—	—	2.8	2.8
MIR-S	SG1	6.6	Nc	1.8	2.5	—	—
	SG1	6.6	Ns	—	—	3.8	3.9
	SG2	10.6	Nc	2.0	3.3	—	—
	SG2	10.6	Ns	—	—	3.5	3.9
MIR-L	LG1			— N/A —			
	LG2	20.2	Lc	5.5	9.8	—	—
	LG2	20.2	Ls	—	—	7.0	8.4

Saturation Limits

Table 5.5.27: Saturation Limits for IRC04

Band		Line limit (10^{-14} W/m $^{-2}$)	Continuum limit	
			Point source (Jy)	Diffuse source (GJy/sr)
NIR	NP	7.4	2.2	15
	NG	11	24	160
MIR-S	SG1	55	76	230
	SG2	48	77	270
MIR-L	LG1		— N/A —	
	LG2	91	220	680