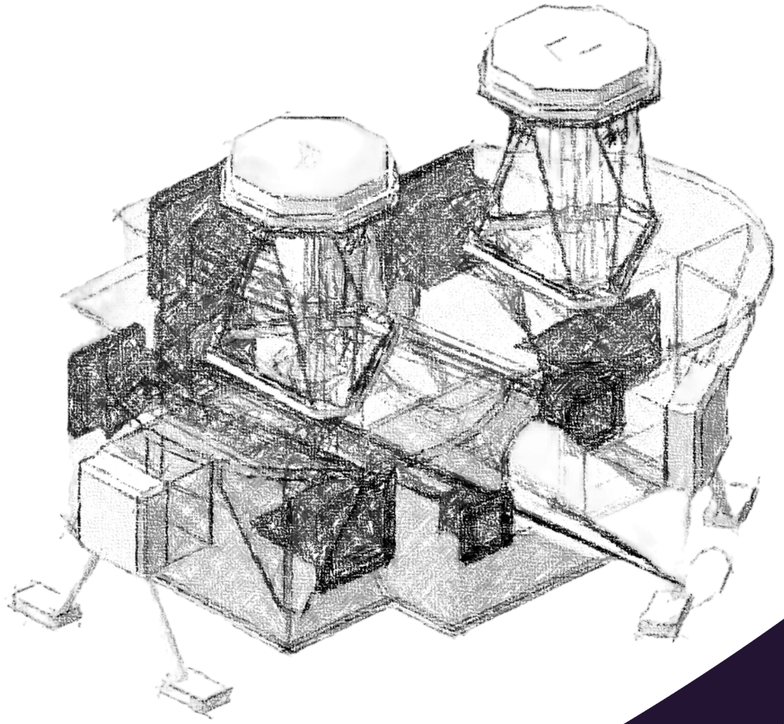
PRIMAger



Laure Ciesla,

D. Burgarella, M. Sauvage, E. Prieto, J. Baselmans,

W. Jellema, T. Maciaszek, and the PRIMAger team.

PRIMAger in a nutshell

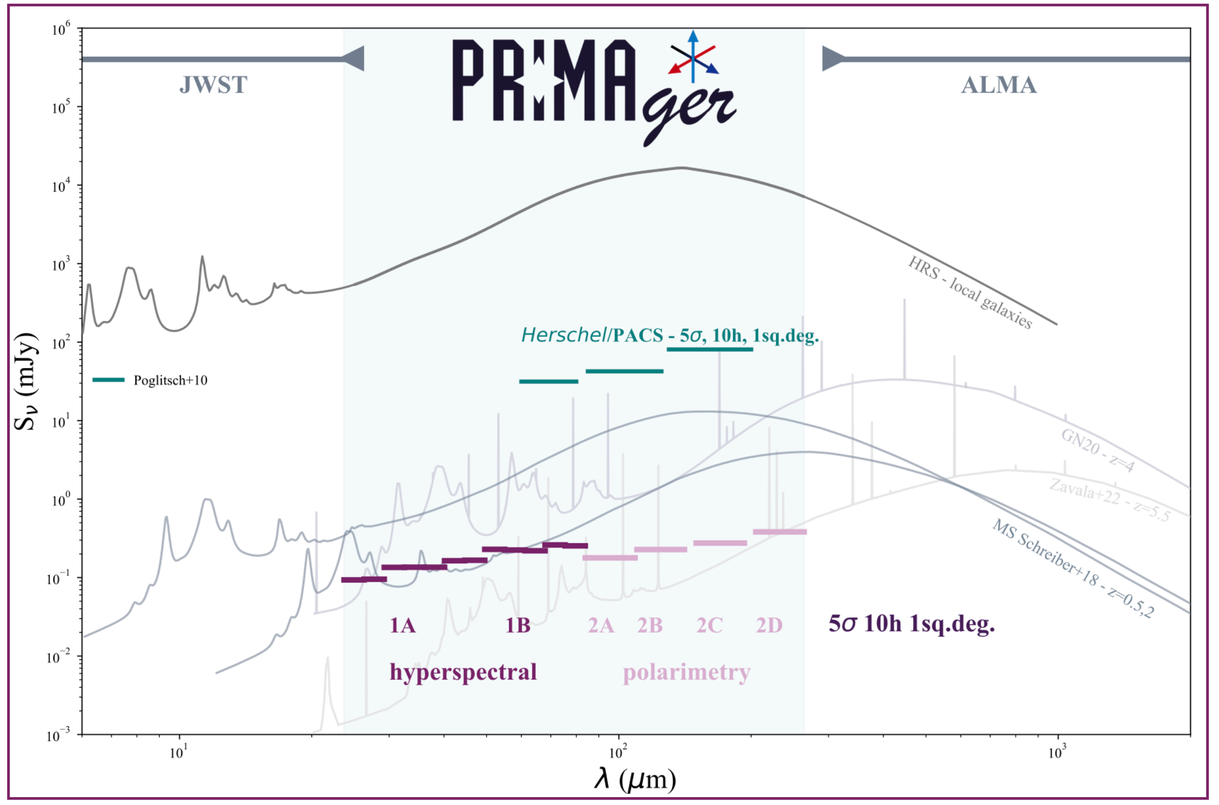
Far-infrared imager for mapping with two bands observed simultaneously

A **hyperspectral** band
25-80 microns
12 filters with R=10

- PAH properties
- Metallicities
- Redshift measurements
- AGN vs star formation
- Trans-neptunian objects
- …

- Dust grains properties
- Magnetic field in star-forming structures
- AGN dusty torus
- …

A **polarimeter**
80-264 microns
4 filters with R=4

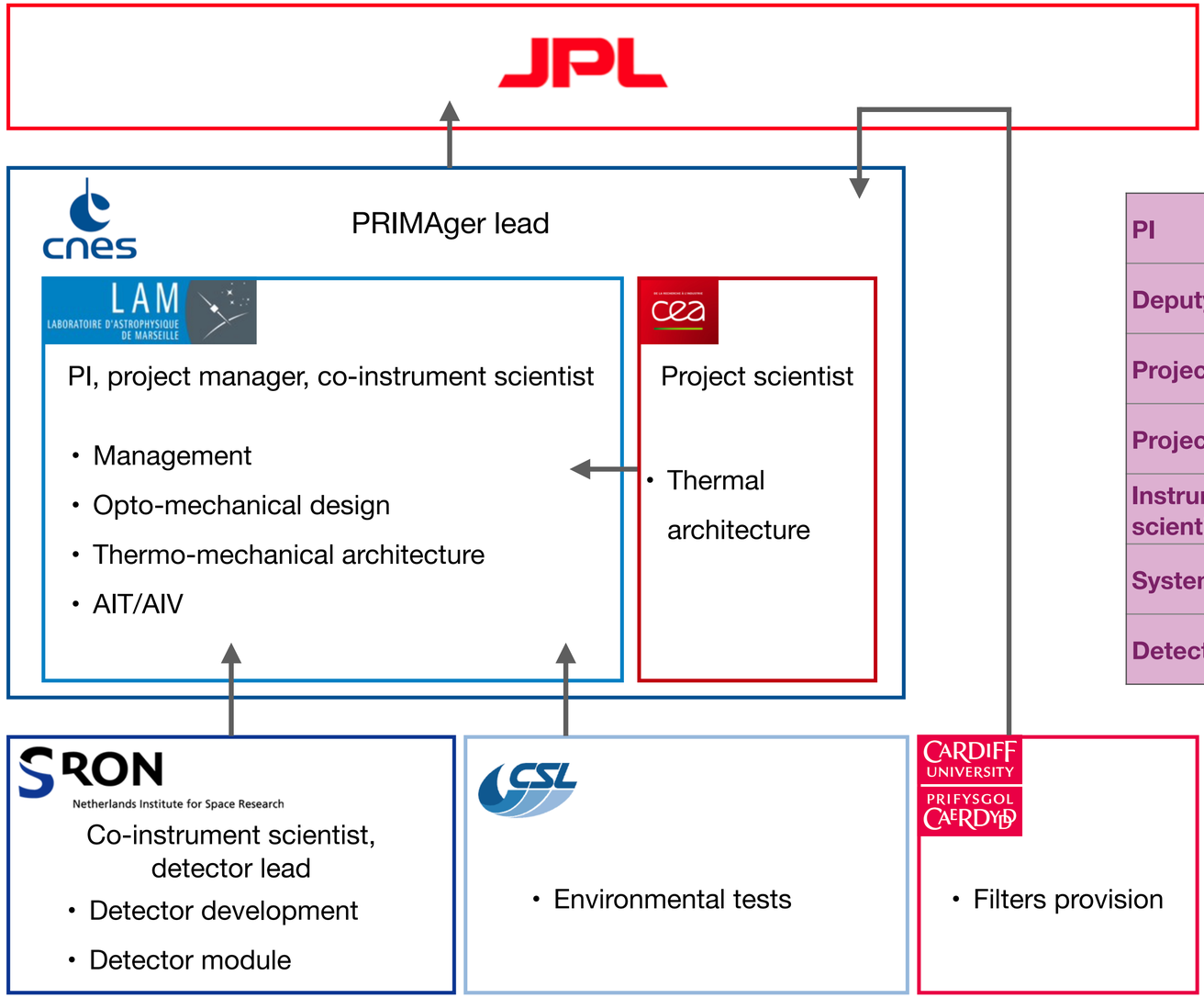


Aluminium based MKIDs cooled at ~100mK

Pipeline development collaboration to be organised in Europe.

Data archive at IPAC

Collaboration



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Project scientist	Marc Sauvage
Project manager	Eric Prieto
Instrument scientists	Laure Ciesla, Willem Jellema
System engineer	Willem Jellema
Detectors lead	Jochem Baselmans

Mapping strategy

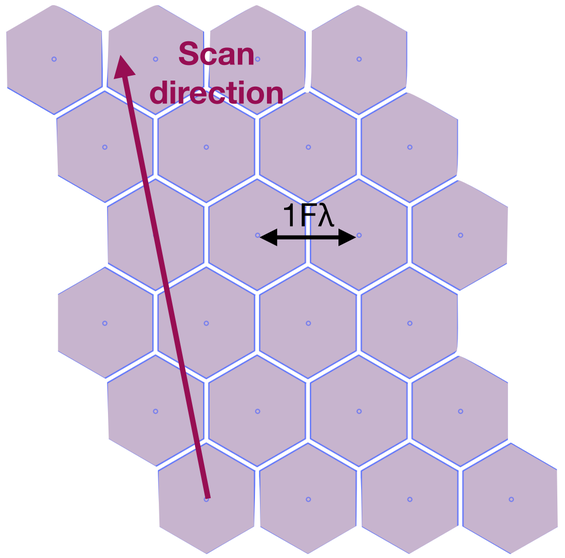
Simultaneous Hyperspectral and Polarimeter mapping

PRIMAger

Pixels with different functions co-exist in the focal plane.

Hyperspectral: pixels behind a linear variable filter; bandpass varies as a function of the position in the focal plane

Polarimeter: pixels select 3-4 different orientations of the linear polarisation

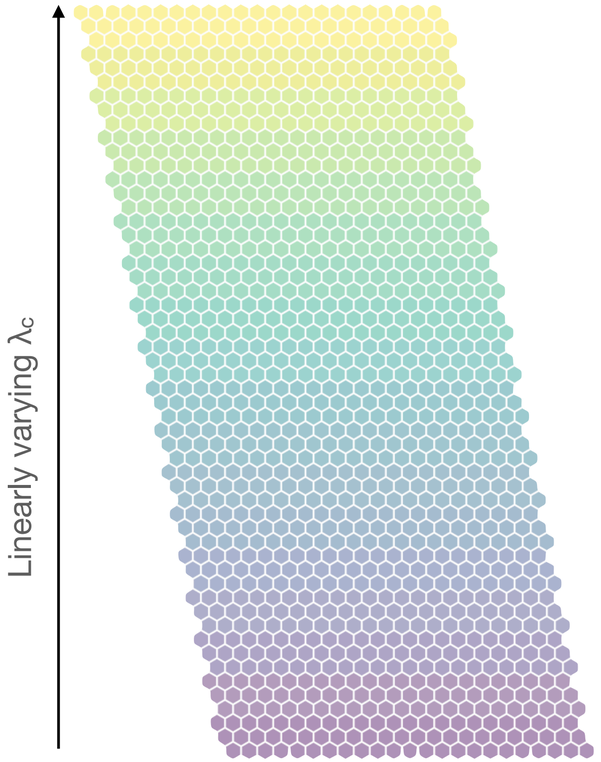


Instantaneous sky sampling is F.λ , ~1FWHM, below Nyquist.

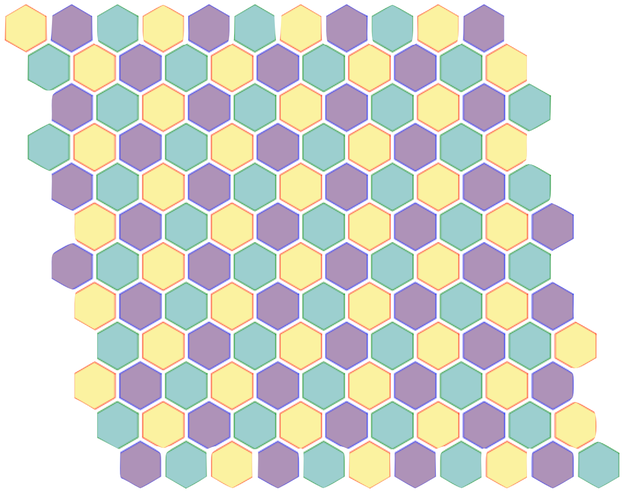
Hexagonal grid of pixels due to lenses.

Diamond-shaped focal plane for optimisation of coverage during scan.

Scan direction planed to recover complete spatial sampling



Band 1(A)
~3'x1.4'



Band 2(C)
~5'x4.5'

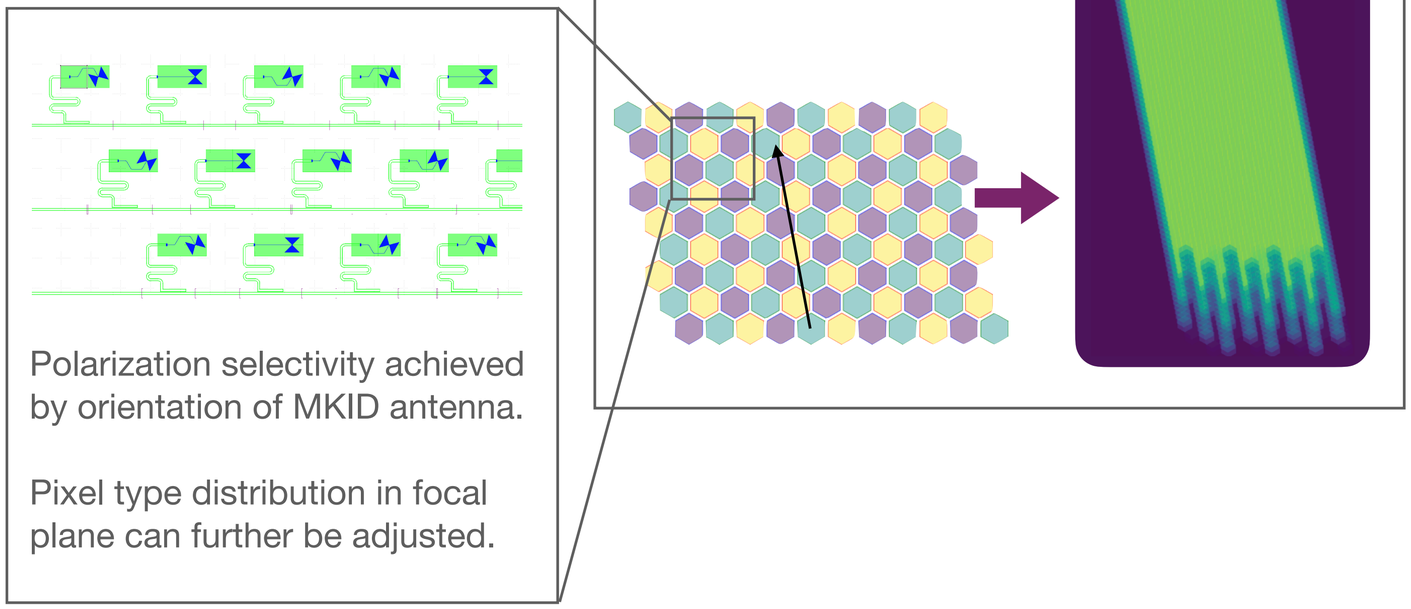
Focal planes are not shown to scale

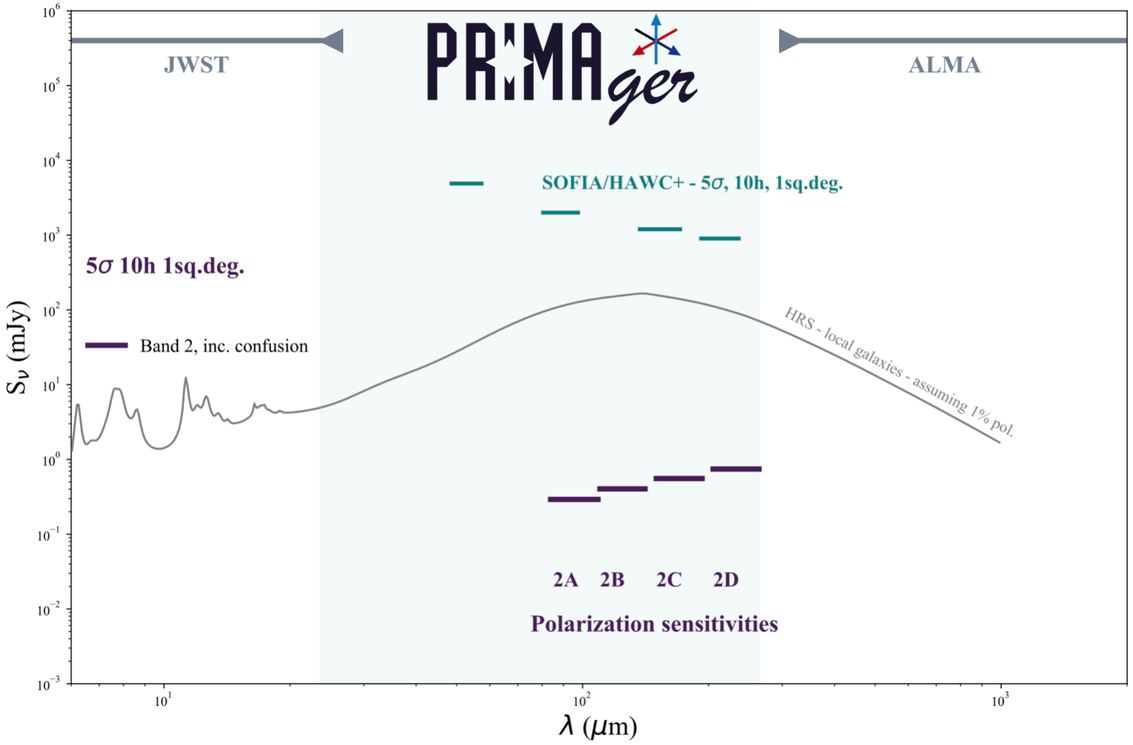
Polarization

PRIMAger

Pixels are sensitive to the linear polarisation angle. Baseline angle set (-60°, 0°, +60°).

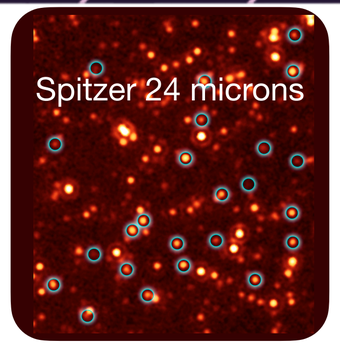
Adding a fourth angle (for redundancy) is under investigation.



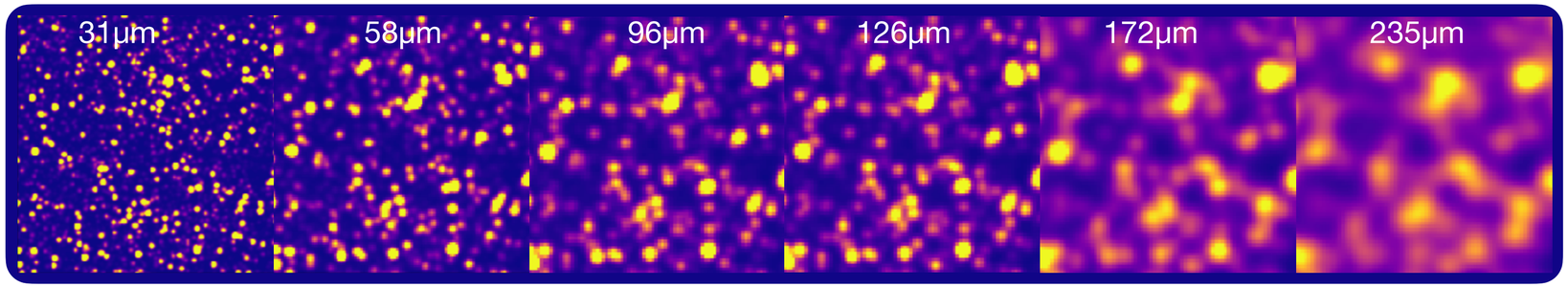


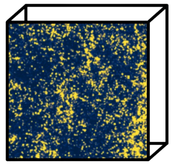
M. Sauvage, J. Baselmans

About confusion



Confusion, Béthermin+ PRIMAger technical note





SIDES

Beam sizes will be 3.6” FWHM at 25 microns; absolute positions for comparison to observations in other wavebands will be of order 4”

At z~2, in a flat Lambda CDM universe, 3.6” corresponds to 30 kpc.

Glenn et al. (JATIS): Extract photometry with high fidelity down to the beam sizes (FWHM) without bias

- Positional prior-based photometry for sources detected at shortest PRIMAger bands
- Positional and SED prior based photometry for catalogued sources detected at other wavelengths (optical/NIR/radio)
- Statistical studies, stacking, P(D), power-spectra, hierarchical modelling, etc.

	Band 1A	Band 1B	Band 2A	Band 2B	Band 2C	Band 2D
Band center (λ_c)	6 continuous filters 25-45 microns (linear-variable filters with spectral resolving power R = 10)	6 continuous filters 45-80 microns (linear-variable filters with spectral resolving power R = 10)	96 μm	126 μm	172 μm	235 μm
Band edges	25—45 μm	45—80μm	80—103μm	110-141μm	150-193μm	204-265μm
# of pixels	63x23	35x24	36x31	24x21	18x16	12x11
Pixel size	3.6”	6.3”	9.23”	13.3”	17.1”	24.0"
Band centre FWHM[a] (1.05 λ_c/D)	3.7” (4.3”)	6.6” (7.8”)	9.7” (11.3”)	13.2” (15.5”)	18.1” (21.2”)	24.7” (29.0”)
Point Source sensitivity (total power, I)	220 μJy	300 μJy	200 μJy	300 μJy	400 μJy	500 μJy
Point Source sensitivity in P = $(Q^2+U^2)^{1/2}$			300 μJy	400 μJy	550 μJy	700 μJy
Surface brightness sensitivity (total power, I)	1.1 MJy/sr	450 kJy/sr	150 kJy/sr	100 kJy/sr	80 kJy/sr	60 kJy/sr
Surface brightness sensitivity in P = $(Q^2+U^2)^{1/2}$			210 kJy/sr	150 kJy/sr	110 kJy/sr	80 kJy/sr
Estimates** of point source sensitivity including confusion (Extragalactic science cases)	240 μJy for the 6 filters	300, 320, 340, 370, 500, 610 μJy	800 μJy	3 mJy	10 mJy	13 mJy

Sensitivities are expressed for the 5σ level in a 1 square degree area mapped for 10hr *This is highly model dependent and may be changed in the future.

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System engineer	Willem Jellema
Detectors lead	Jochem Baselmans

Assumptions:

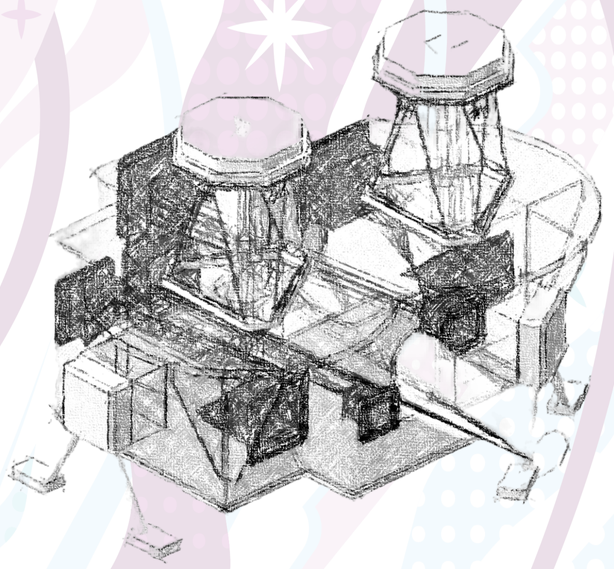
NEP is background dominated

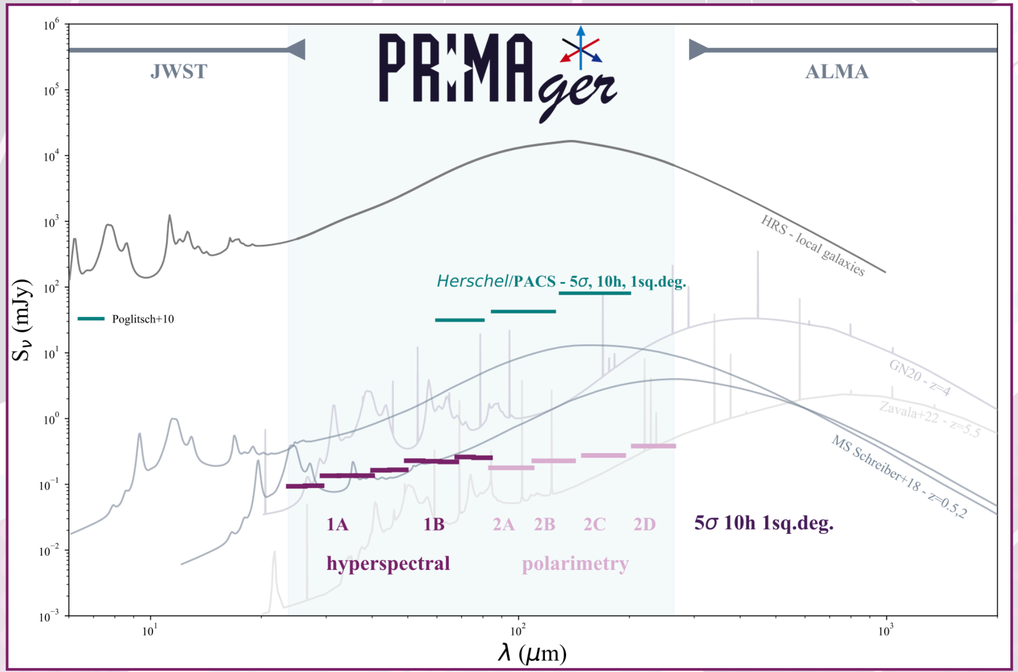
Telescope mirror temperature: 4.5 K

Mirror: ⌀2 m, 1.8 % areal obscuration

Background includes:

- Zodiacal light, ISM, CIB, CMB at location typical of **extragalactic deep fields**

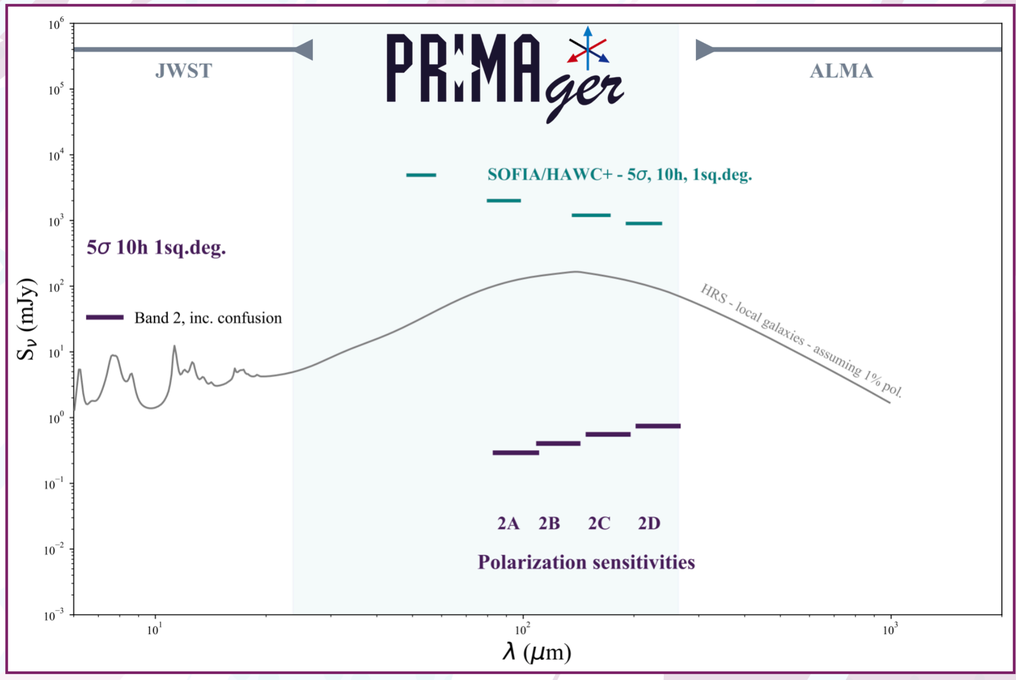


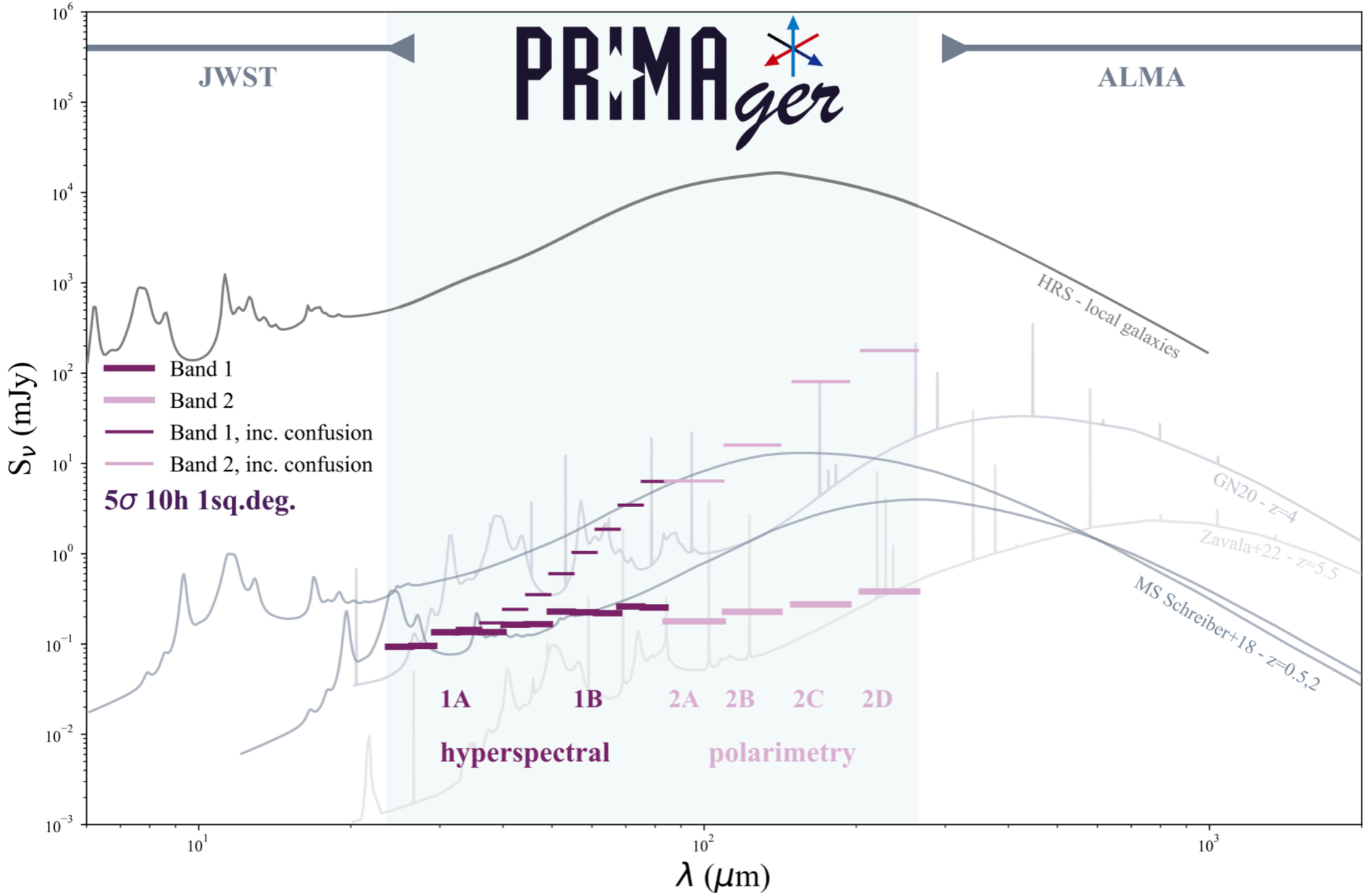


Hyperspectral imaging:
12 continuous filters between 25 and 80 microns with R=10

Imaging with polarimetry:
4 broad band filters with R=4 sensitive to 3 angles of polarization

The two bands will observe **simultaneously**, with all filters.




JWST
PRIMAger
ALMA
HRS - local galaxies
Band 1
Band 2
Band 1, inc. confusion
Band 2, inc. confusion
5σ 10h 1sq.deg.
GN20 - z=4
Zavala+22 - z=5.5
MS Schreiber+18 - z=0.5,2
1A
1B
2A
2B
2C
2D
hyperspectral
polarimetry
Sν (mJy)
λ (μm)

Great science to be done with PRIMAger!

The polarimetry capabilities of PRIMAger will unlock a new discovery space!

Thank you