Basic specs

Specification	Value
Spectral range	309 nm – 417 nm (80% coverage)

Design	• **SP**: Modified Czerny-Turner spectrograph with
	  • tunable low-order grating
	  • long-slit scan unit
	  • Full-Stokes, dual-beam polarimetry with rotating waveplate
	• **SJ**: synchronous slit-jaw imager, 325 nm continuum

Field of View	60“ x 19.0 Å – 31.5 Å (SP cameras) 60“ x 22” (SJ camera)
Pixel sampling	0.032“ x 9.67 – 15 .99 mÅ
Detectors	2 SP cameras (dual-beam polarimetric setup) 1 SJ camera (imaging only) Sensor type: Gpixel GSENSE400-BSI 2048 x 2048 pixels, 12 µm pitch Framerate: 46.9 fps (24 frames per PMU rotation)
Data rate	~ 600 MB/s (uncompressed: 880 MB/s)

Optical layout

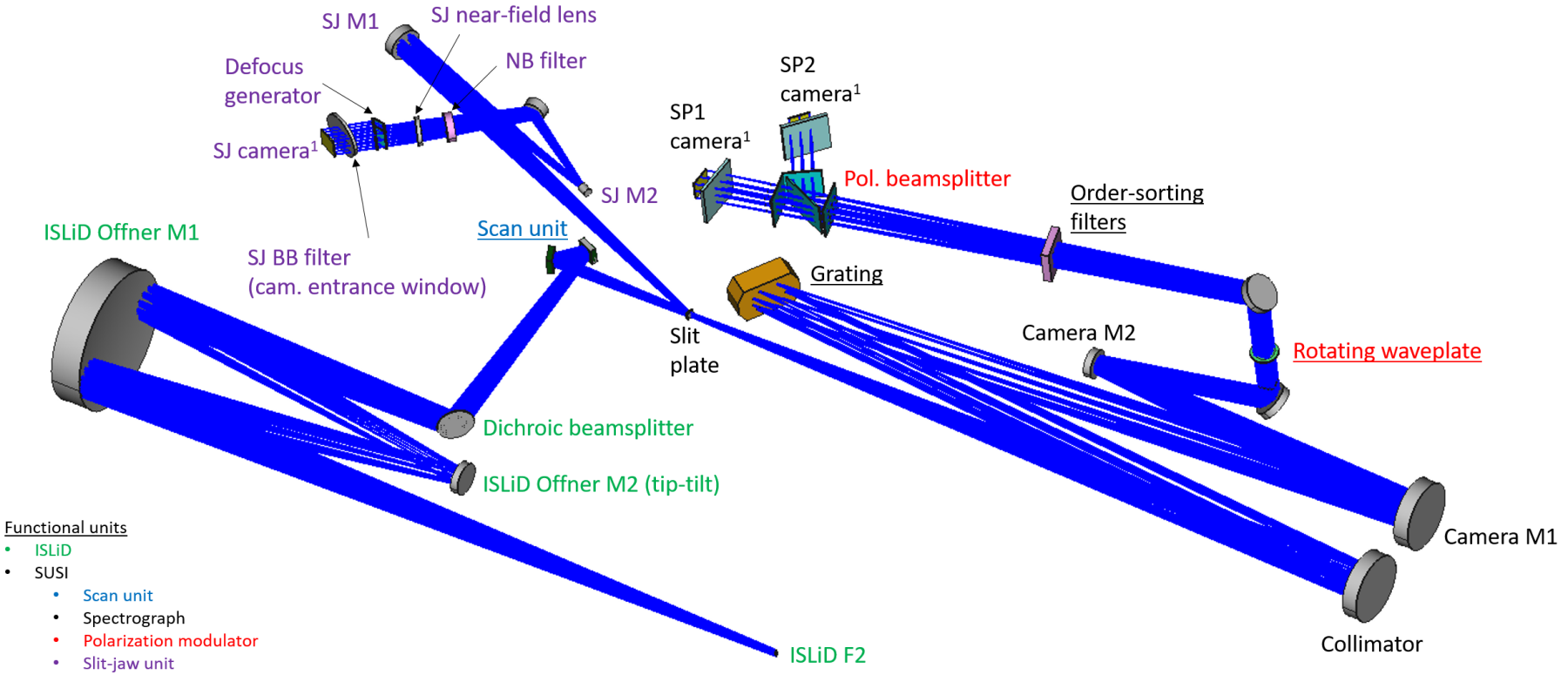

Fig. 1: SUSI optical layout

Basic working principle

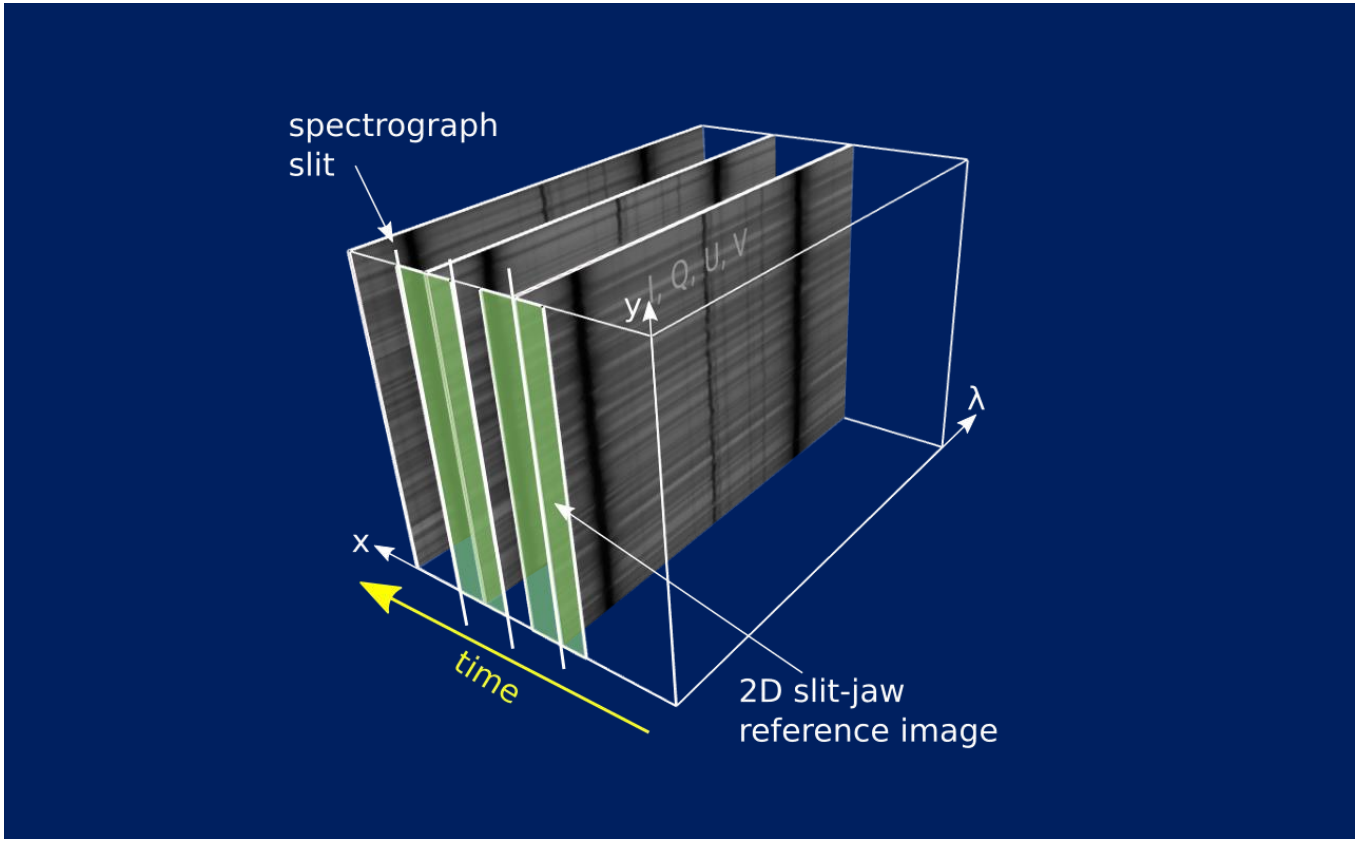

Fig. 2: SUSI basic working principle

Spectral sampling and window on camera

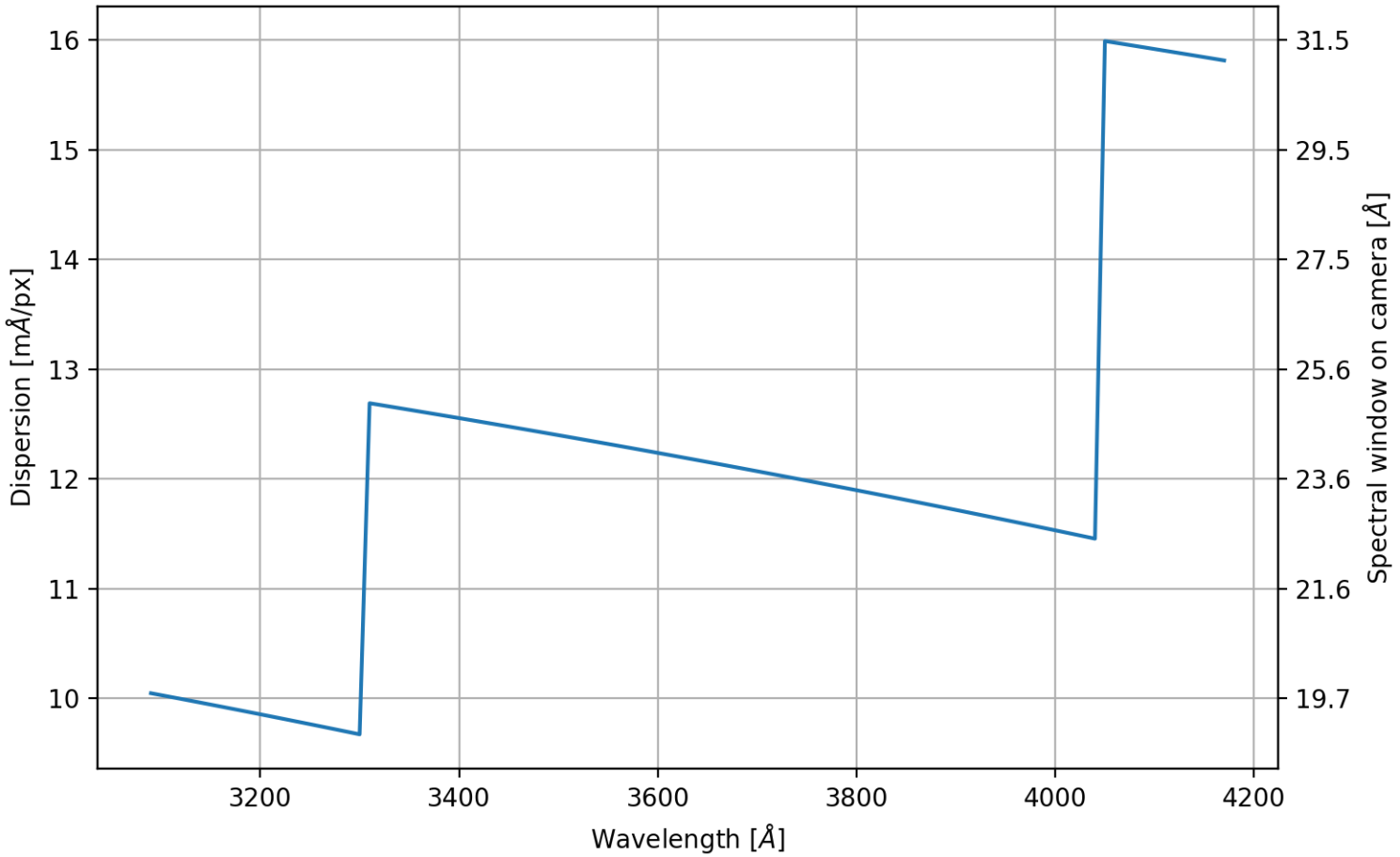

Fig. 3: Spectral sampling and spectral window on the SP cameras

Mechanical layout

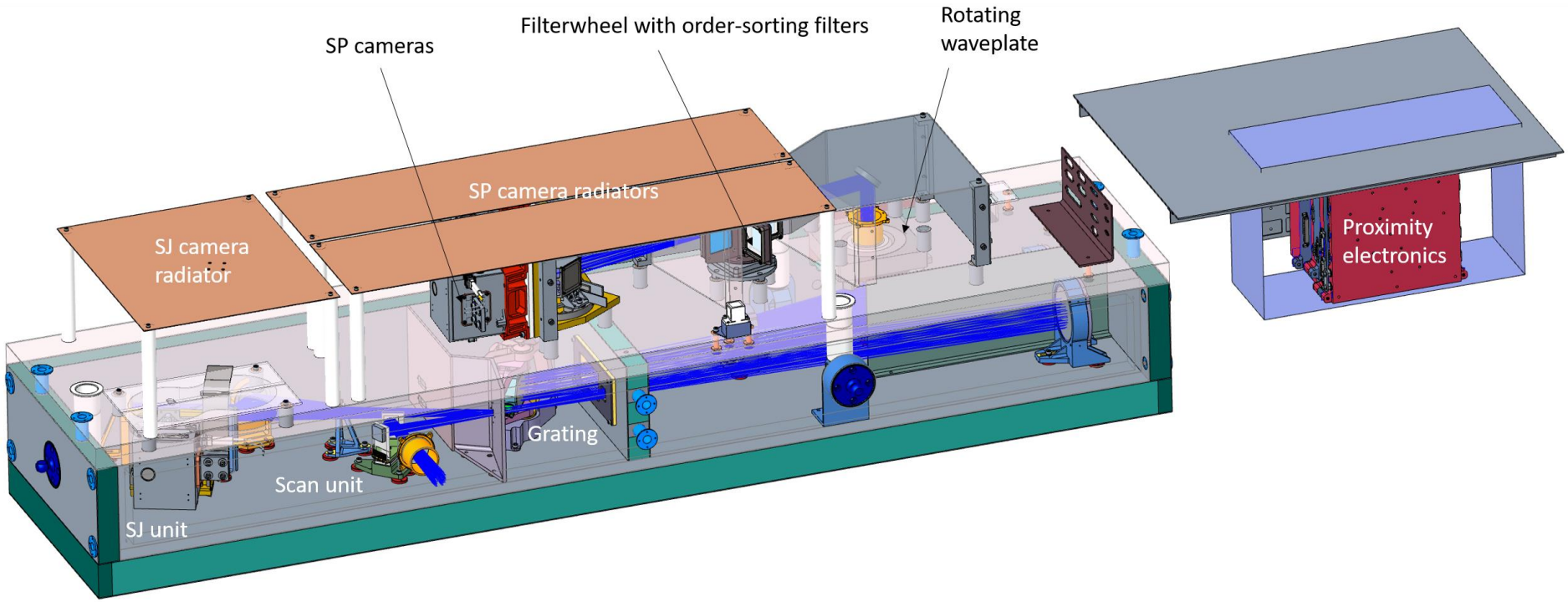

Fig. 4: Simplified CAD view, showing the basic mechanical design of SUSI.

Photon flux and prefilter passbands

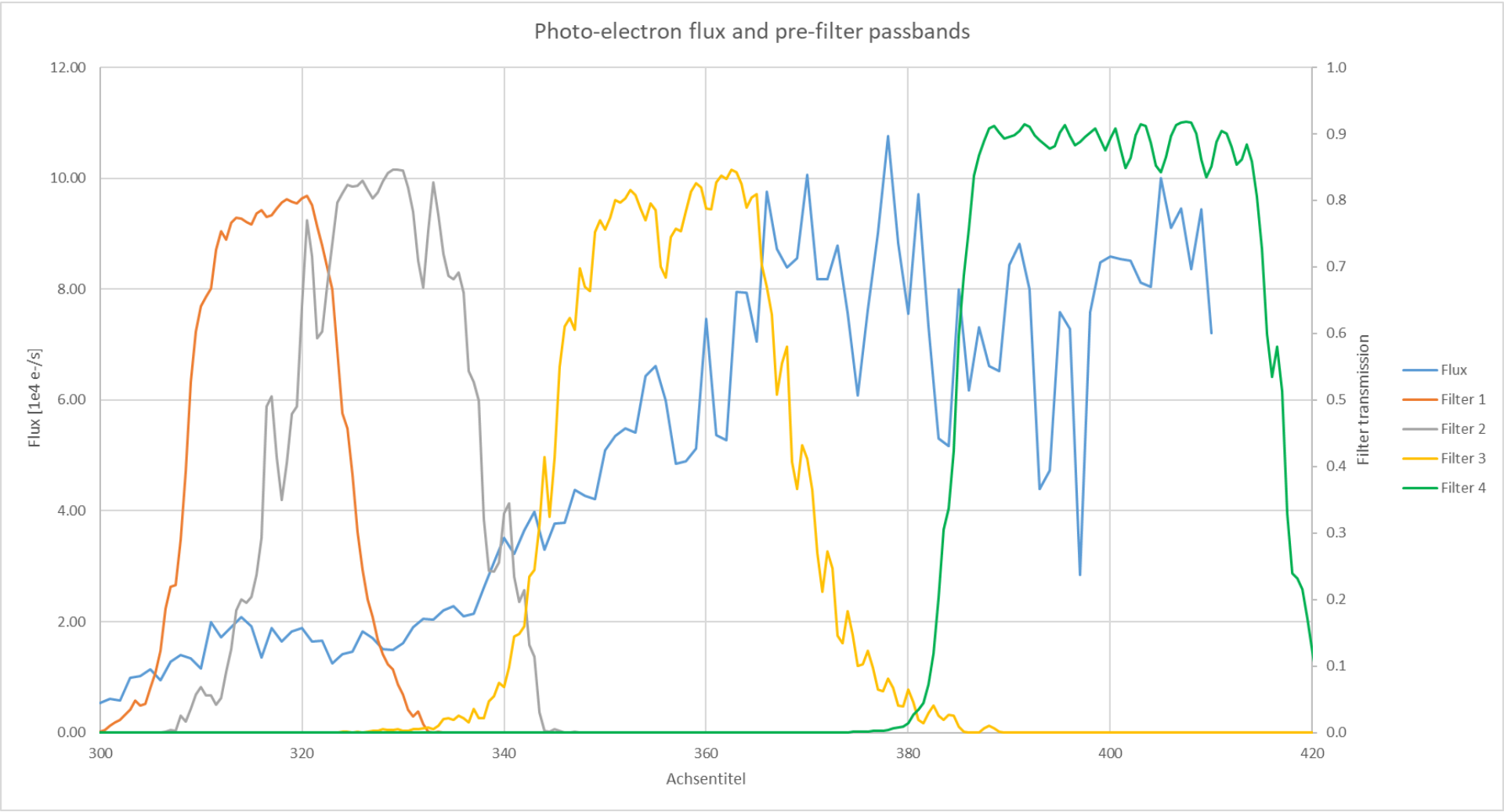

Fig. 5: Expected photon flux (w/o prefilters), and prefilter passbands

Polarimetric sensitivities after 1s integration

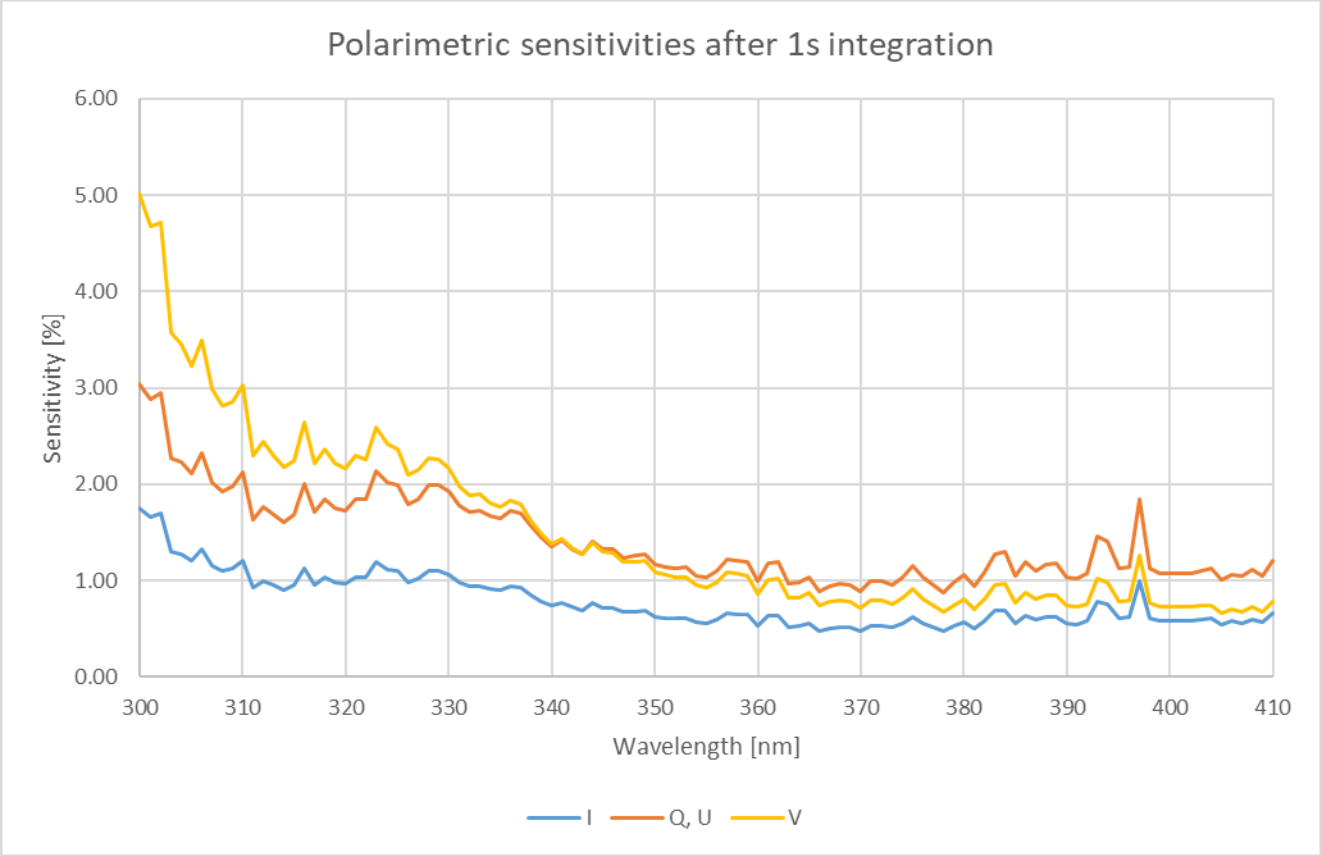

Fig. 6: Expected pol. sensitivities (w/o prefilters) after 1s integration and with intrinsic spatial and spectral sampling

SP order-sorting filters

Filter no.	Prioritized wavelengths [nm]	CWL [nm]	FWHM [nm]	Usable wavelength range [nm]
1	314	317	15.9	308.9 - 324.6
2	323	327	24.3	316.4 - 340.7
3	359	358	23.1	346.2 - 369.3
4	393.3, 396.8, 408	401	31.6	385.8 - 417.4

Criteria used for defining the usable wavelength range of each filter

1. Transmission > 0.5 * peak transmission
2. Integrated spectral straylight < 0.05%

Expected performance

Wavelength [nm]		314	323	359	400
Flux [10^4 e-/s]		1.0	1.0	4.0	5.4
Polarimetric efficiencies	ε_I	0.96	0.94	0.86	0.74
	ε_Q	0.54	0.52	0.46	0.40
	ε_U	0.54	0.53	0.47	0.41
	ε_V	0.40	0.43	0.53	0.59
	ε_{tot}	0.86	0.86	0.85	0.82
Intrinsic sampling	Spatio-temporal	0.03“/pix, 0.5s			
	Spectral [mÅ/pix]	9.6	9.5	11.9	11.2
Optimum spatio-temporal sampling for $\sigma = 2 \cdot 10^{-3}$	Photosphere (v = 7 km/s, line depth = 0.5)	0.12”/pix, 12s	0.15”/pix, 15s	0.08”/pix, 8s	0.08”/pix, 8s
	Chromosphere (v = 50 km/s, line depth = 0.1)	0.42”/pix, 6s	0.49”/pix, 7s	0.28”/pix, 4s	0.25”/pix, 3.5s

Expected polarimetric performance and optimum spatio-temporal sampling for 2 example science cases

Observation planning - Example

Obs. parameters to be specified

- SP mode: Full-Stokes
- Slit scanning range: 10“
- Slit scanning speed: **0.008“ / s**
- No. of scan repetitions: 1
- Central wavelength: 323 nm

How to compute the required scanning speed?

Requirements

R1: Pol. sensitivity < 0.2%, for all Stokes parameters

R2: Spatial sampling of 0.1“

Expected pol. sensitivity

At 323 nm, after 1s integration, and 0.03“/pixel sampling

	Slide 7	÷ prefilter transm.	
I	1.1%	$\sqrt{0.75}$	1.2%
Q, U	1.9%		2.0%
V	2.3%		2.4%

Integration time: $t = \left(\frac{2.4[\% \cdot s^{0.5}] \times 0.03["]}{0.2[\%] \times 0.1["]}\right)^2 \approx 13\ \mathrm{s}$

→ **Scanning speed:** 0.1“ / 13s = **0.008“ / s**