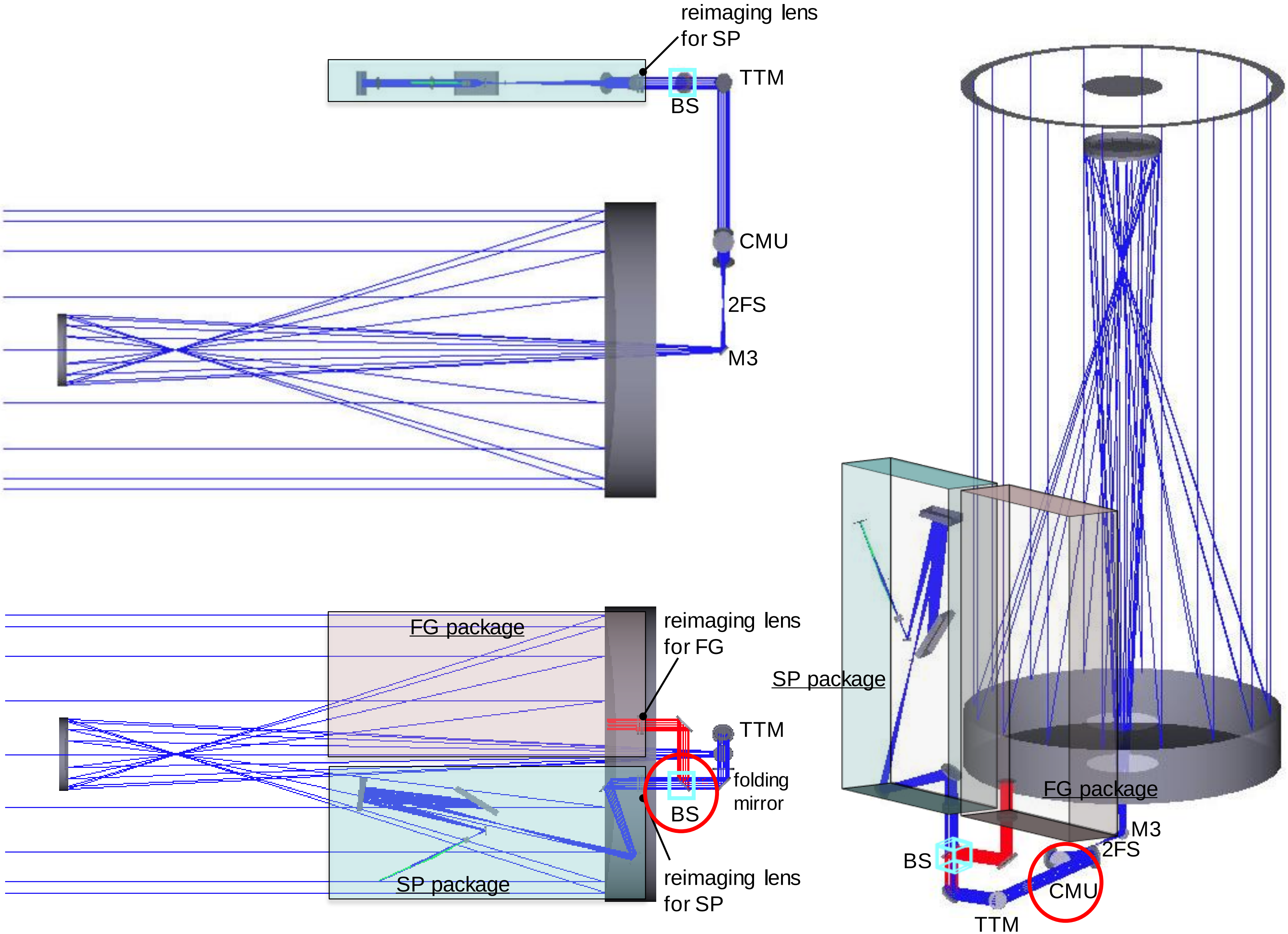
Technical Prospect for 280nm Observations with SUVIT

Y. Suematsu (NAOJ)

Glass and Coating Material

Big jump in designing optics from 388-1100 nm to 280-1100 nm band, because transmitting material in UV (< 350 nm) is limited.

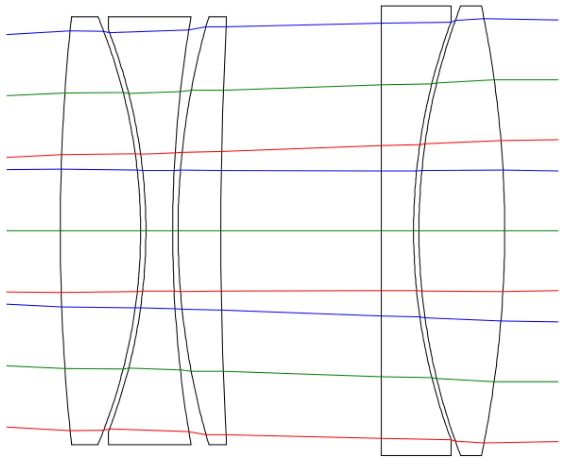
Glass: Silica, CaF_2, (LiF)


reimaging lens
for SP
TTM
BS
CMU
2FS
M3
FG package
reimaging lens
for FG
TTM
folding
mirror
BS
reimaging lens
for SP
SP package
SP package
FG package
M3
2FS
BS
CMU
TTM

Collimator Unit in Telescope Assembly

388-1100 nm

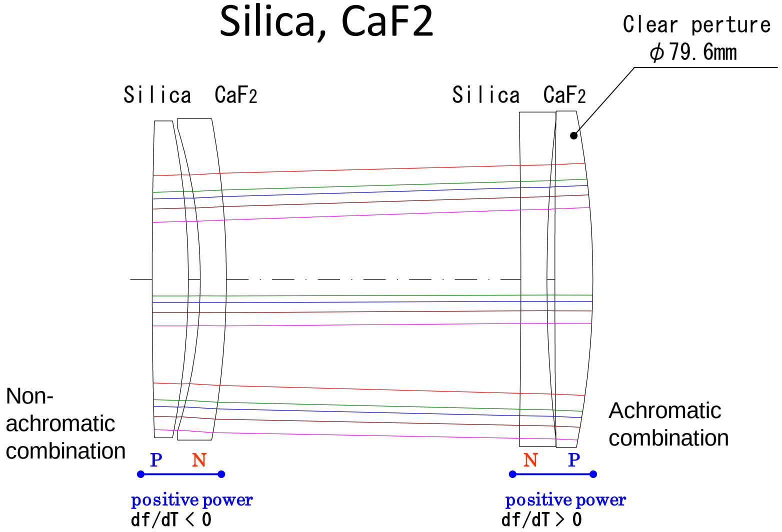
S-BSM2, S-LHA64, S-BAH27



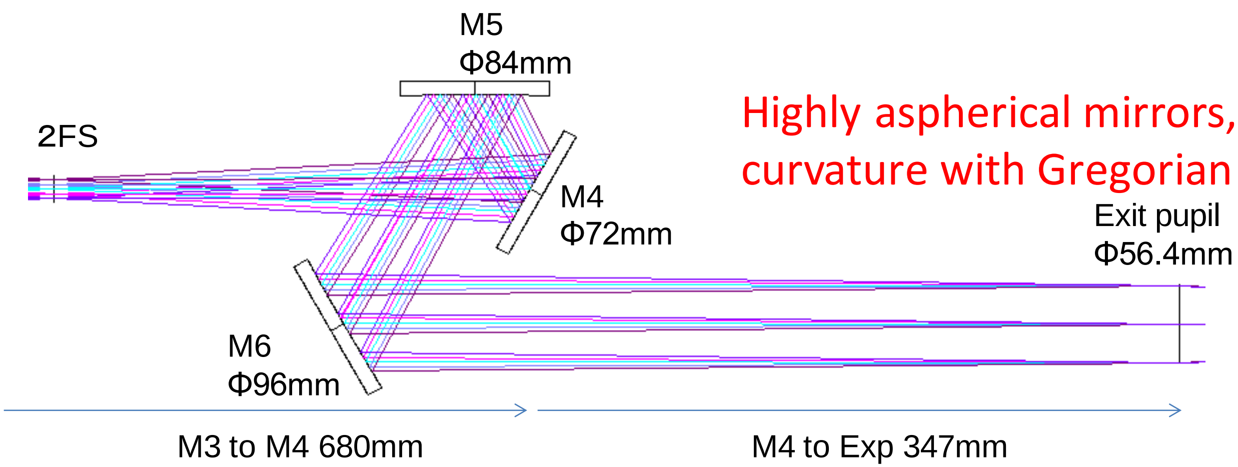
Athermal, Apochromatic

280-1100 nm

Silica, CaF2

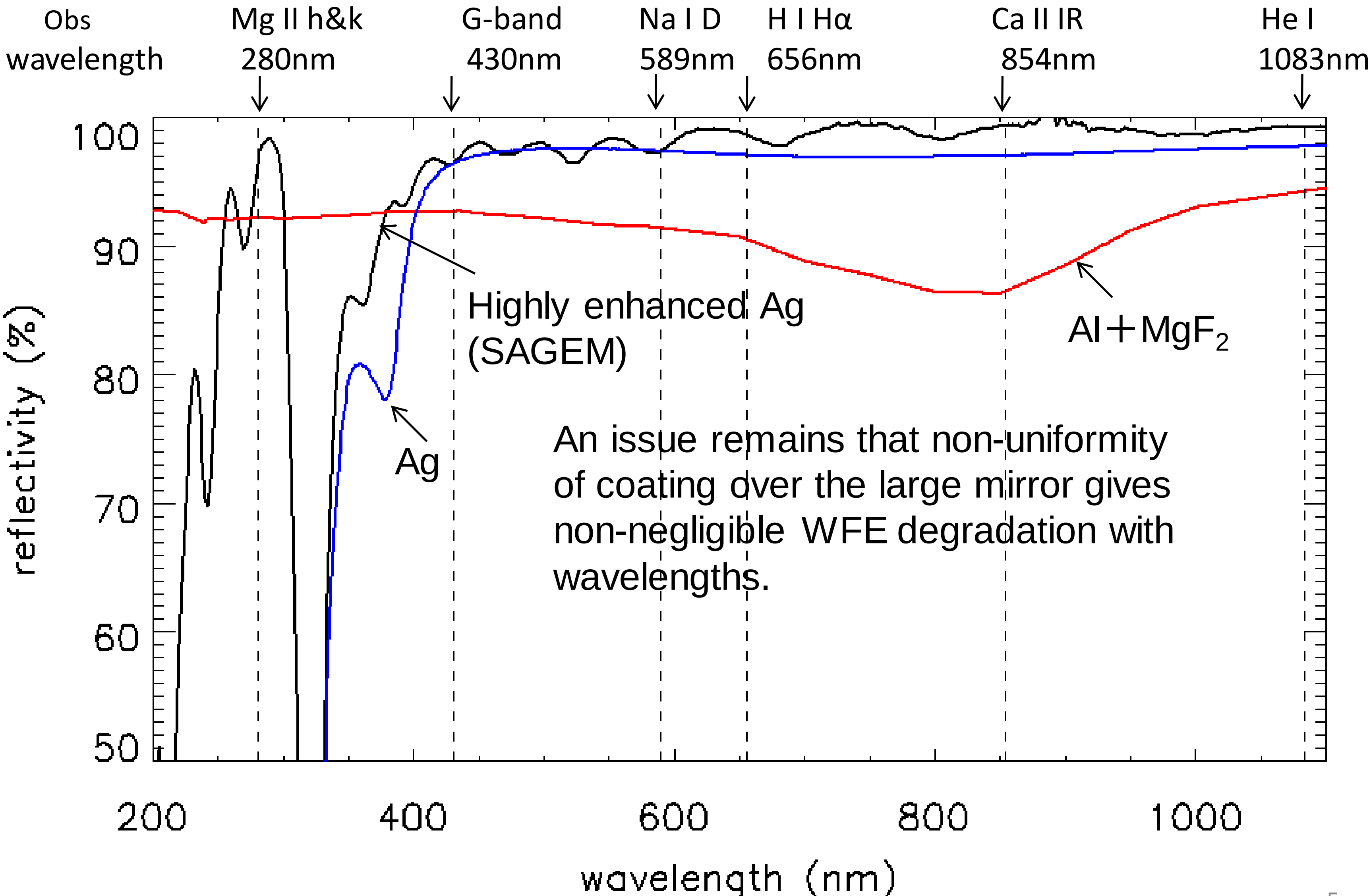


Athermal but not achromatic (△f～50mm)



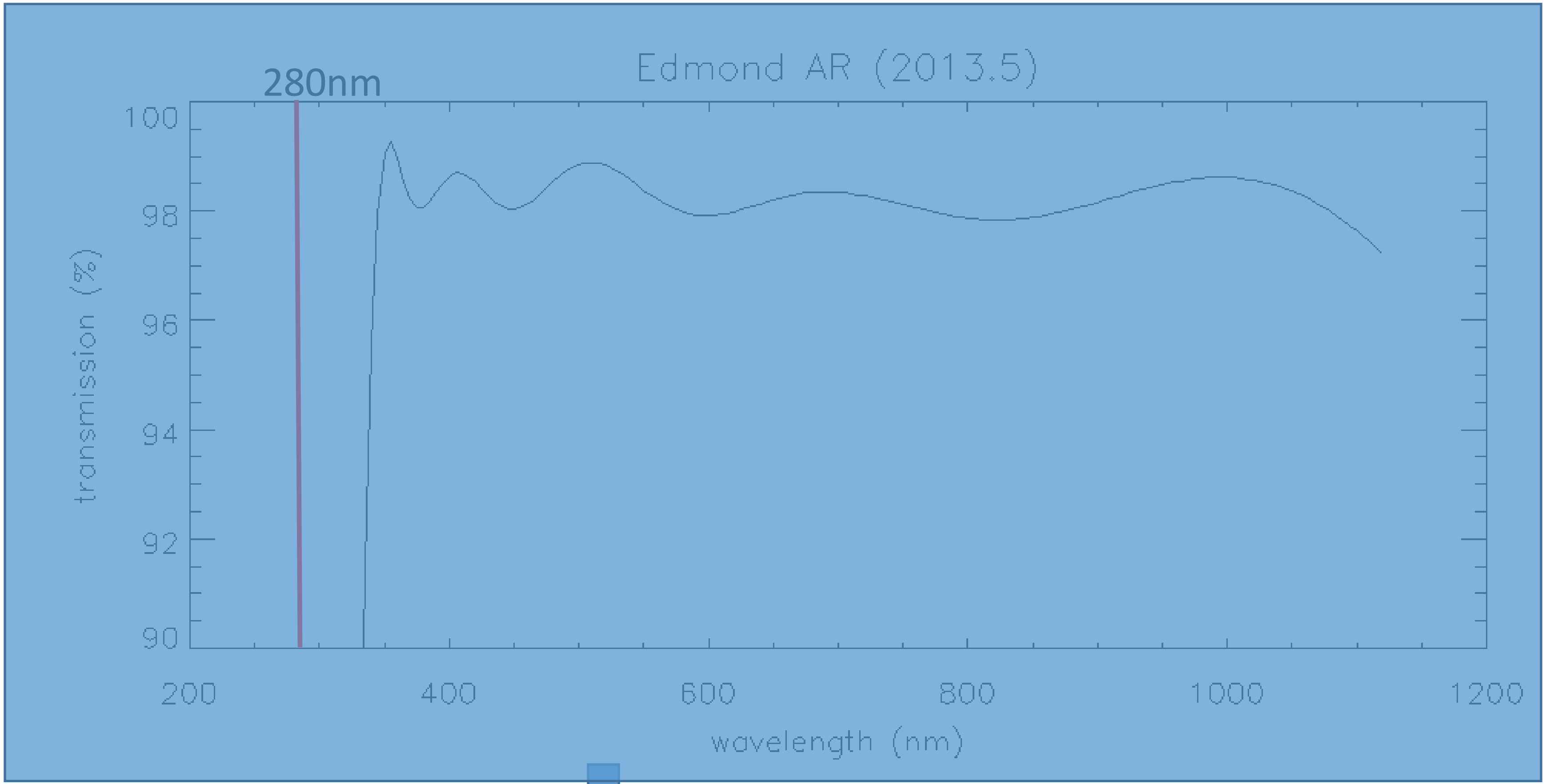
Highly aspherical mirrors, field curvature with Gregorian

Mirror Coating



Design of AR Coating

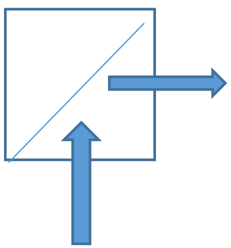
For 350 nm – 10830 nm

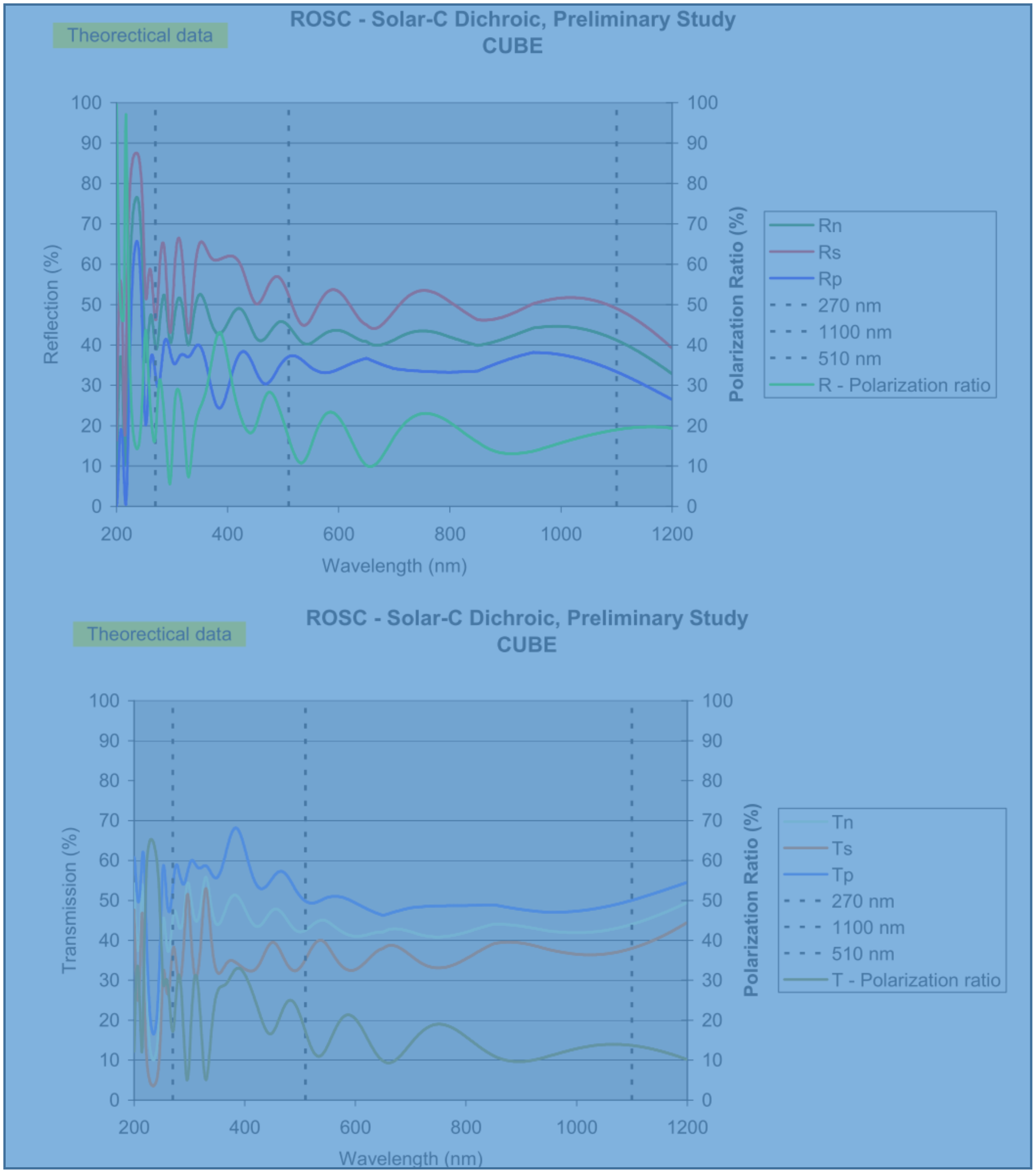


For 280 nm – 10830 nm ?

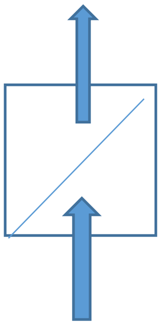
Design of Beam Splitter Coating

Reflection



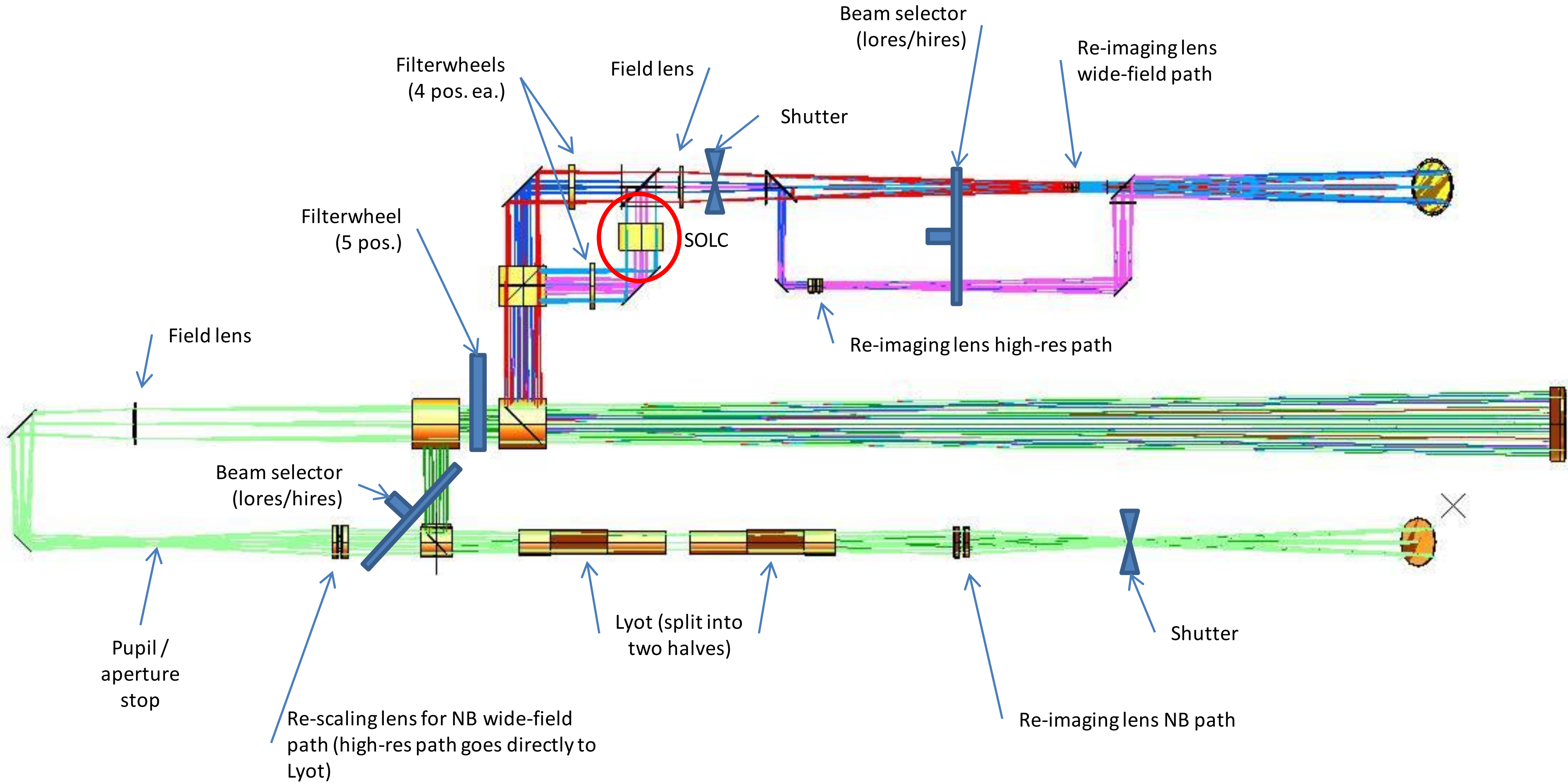


Transmission

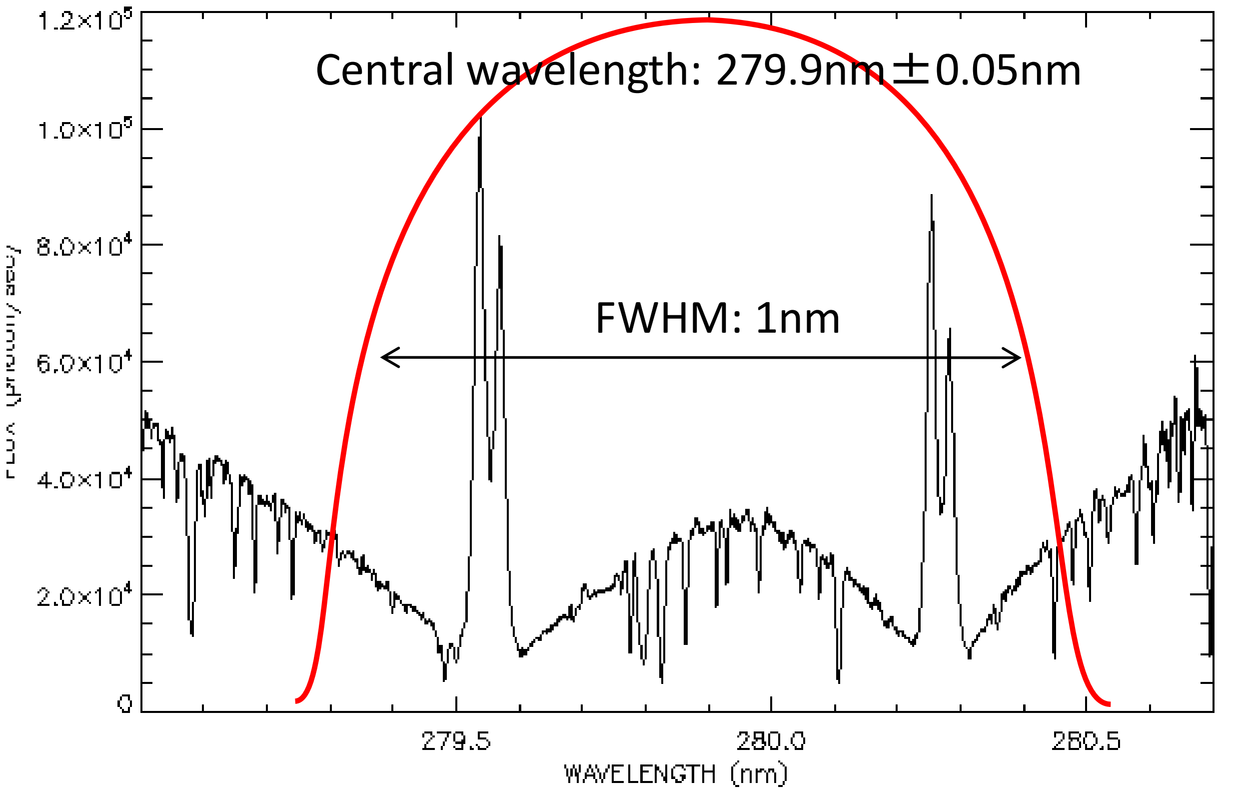


Filtergraph

280nm Broadband Imager, FG Design by LMSAL



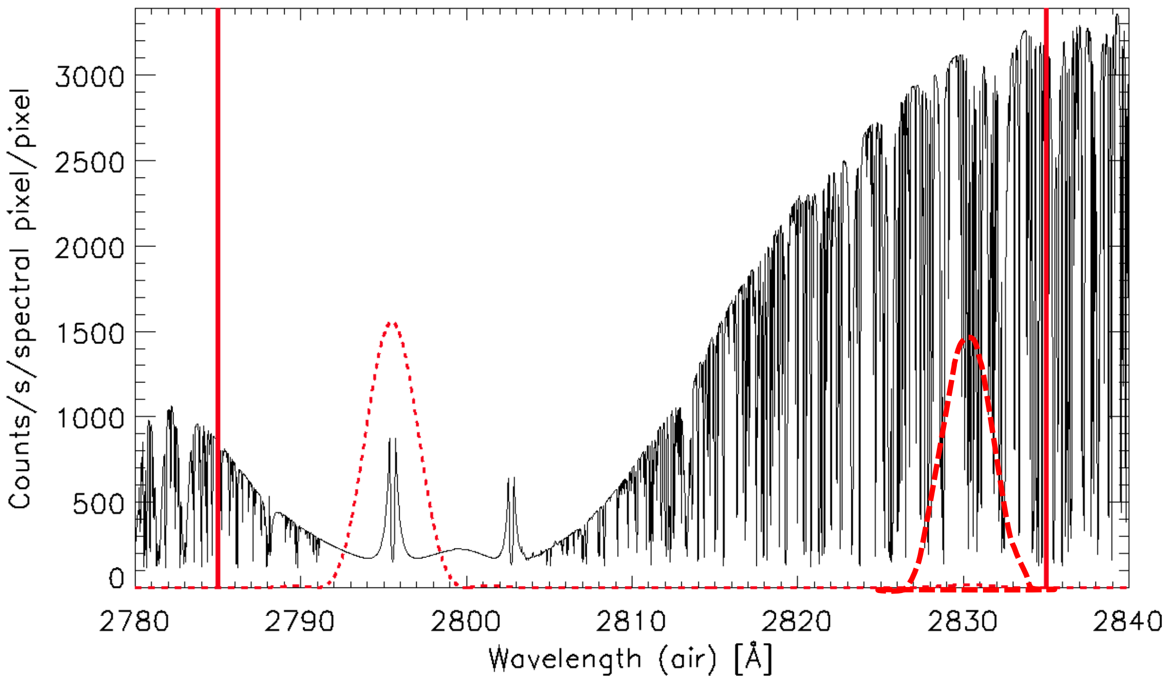
Interference filter for 280 nm band



Transmission：>10% (TBD)

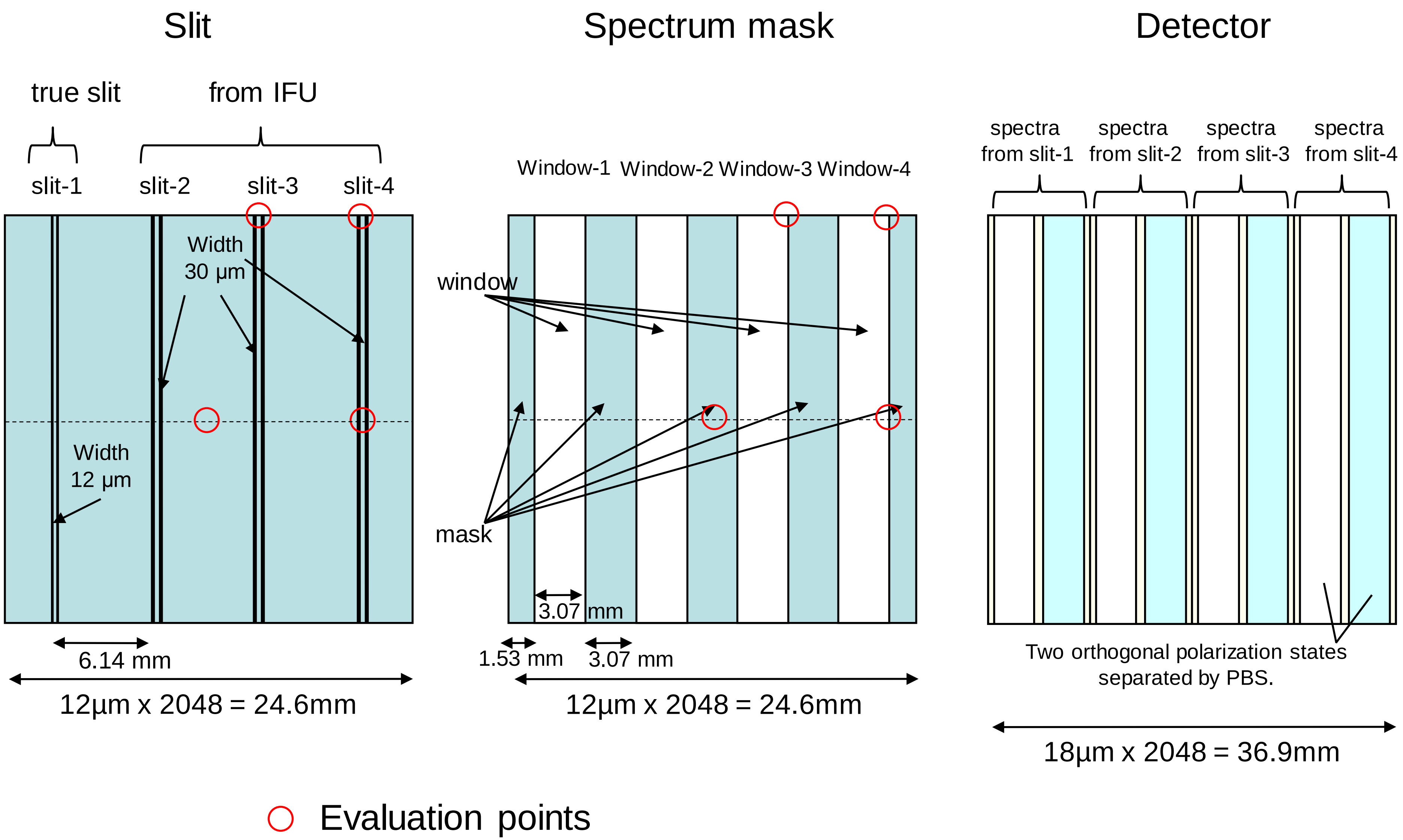
IRIS Solc Filter

- Filter design strategy
  - Solc filters have multiple orders, or peaks, separated by the Free Spectral Range (FSR). Using a single filter, can place one peak at the Mg II K-line core (λ_0 = 2796 Å) and the next peak at the +1 order (λ_0 + FSR = 2830Å).
  - Design plate thickness to achieve FSR = 34 Å.
  - Design number of plates to achieve FWHM < 4 Å.
  - Design plate angles to control sidelobe amplitudes.
  - Choose orders using an upstream 2-cavity interference filter which has a FWHM given by approximately FSR/2 (~15 Å). Such filters are easily manufactured.

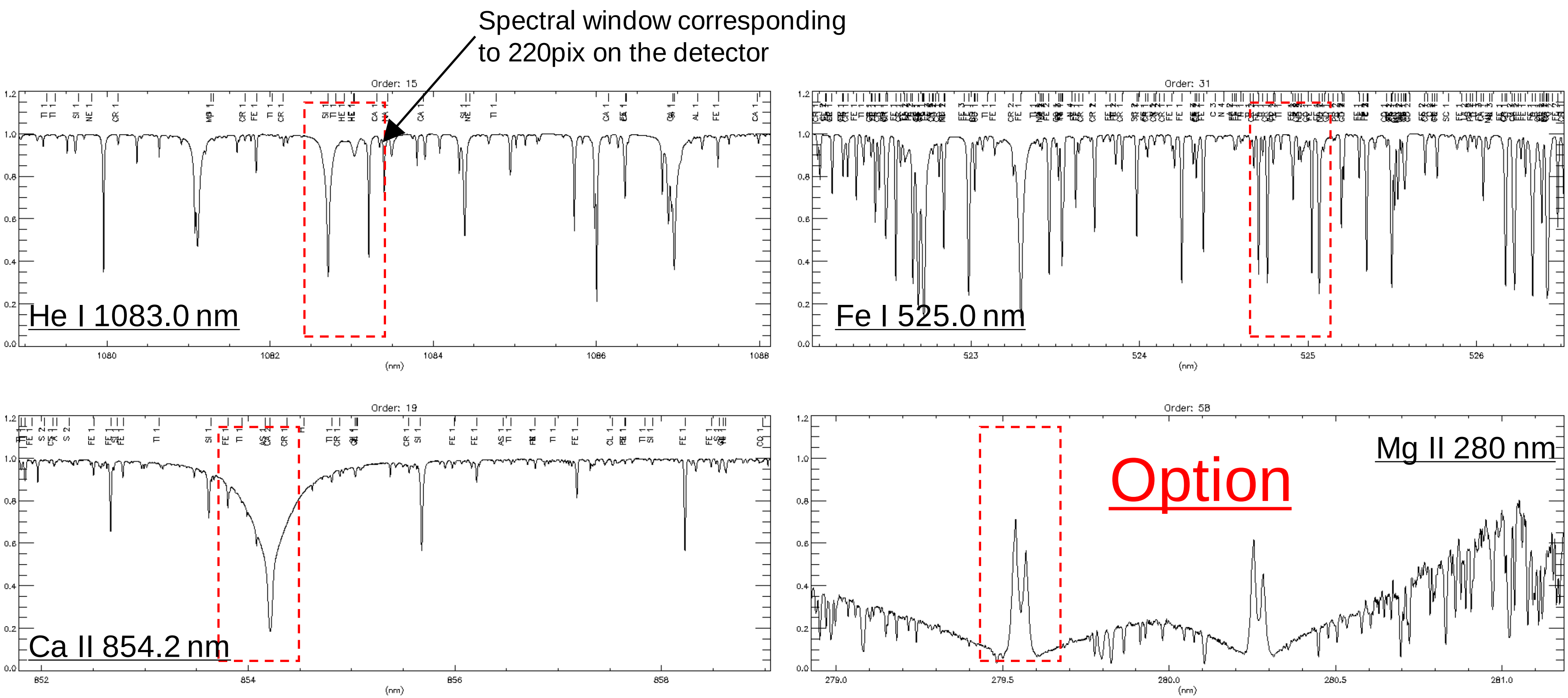


Filtergraph

4-slit configuration for a slit and IFU

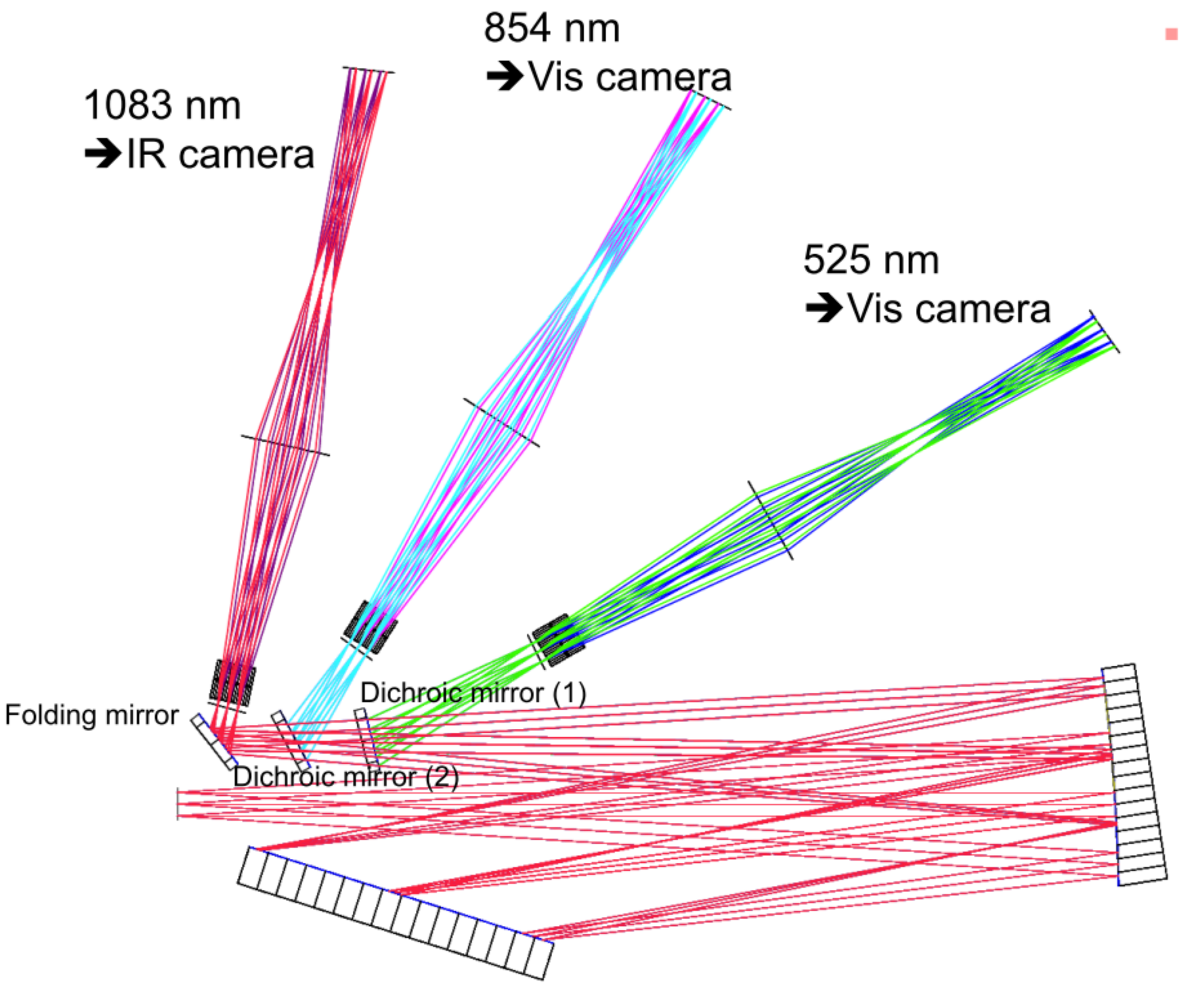


Spectral Bands for SP



	Order	Sampling	# of pixels	Wavelength range
He I 1083.0 nm	15	45.2 mÅ	220 pixels	1082.50 – 1083.49 nm (0.99 nm)
Ca II 854.2 nm	19	35.6 mÅ	220 pixels	853.72 – 854.50 nm (0.78 nm)
Fe I 525.0 nm	31	21.9 mÅ	220 pixels	524.65 – 525.13 nm (0.48 nm)
Mg II 280 nm		11.7 mÅ	220 pixels	279.43 – 280.69 nm (0.26 nm)

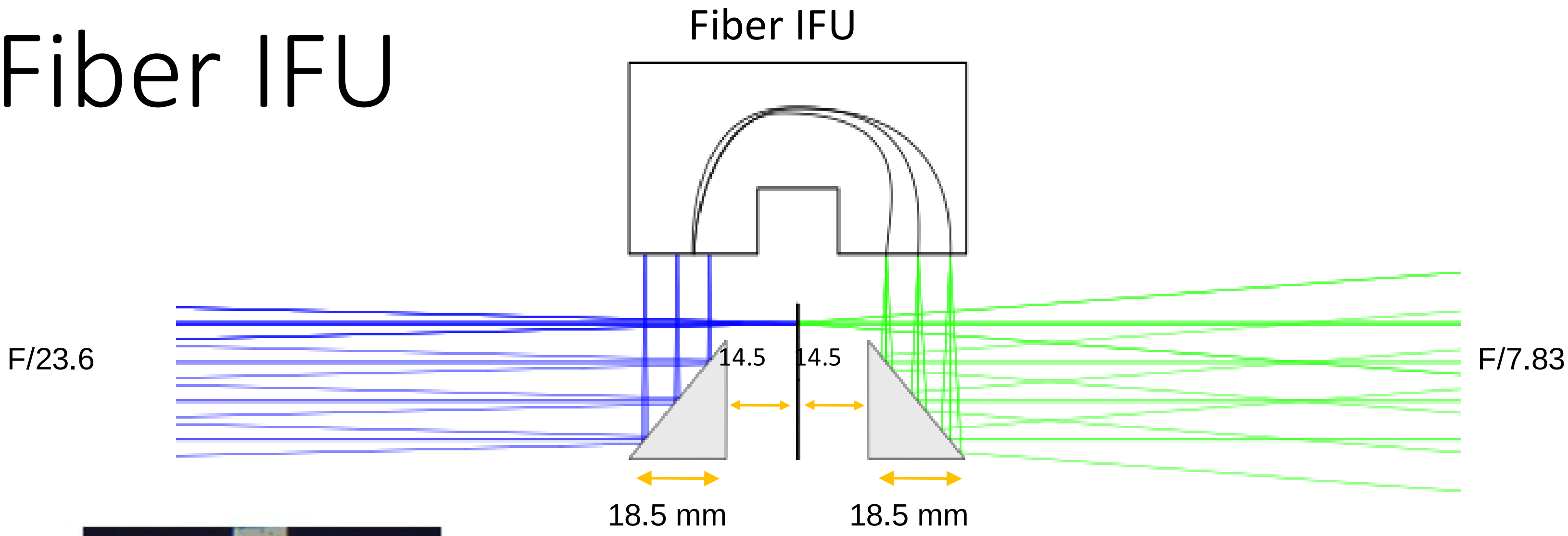
Three Cameras

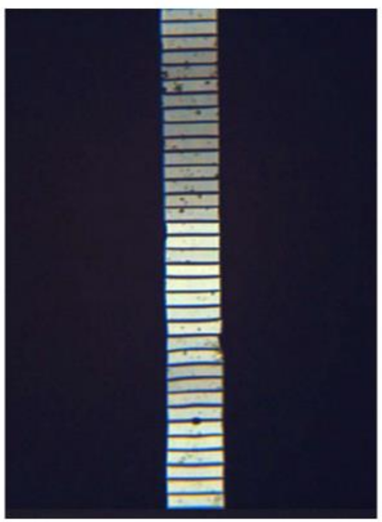


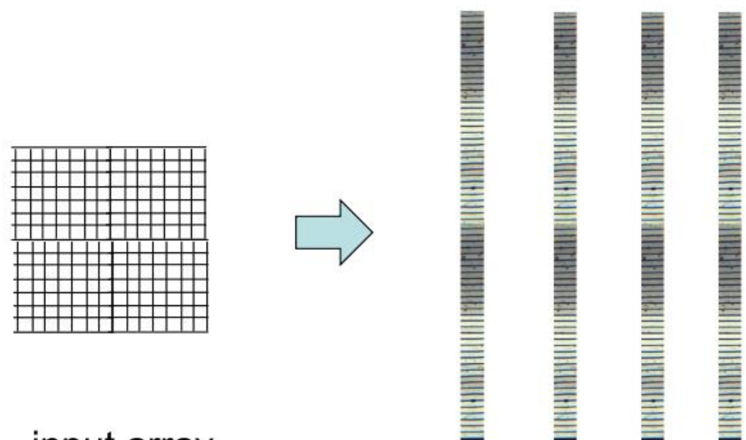
- Advantages
  - Simultaneous obs of the three spectrum lines.
  - No need of the filter wheel.
  - The tilt adjust mechanism of the grating can be simpler.
  - The PBS consisting of the calcite blocks can be optimized at each wavelength.
  - Optical design of the relay optics becomes easy because there is no chromatic aberration at each optical path.

- Disadvantages
  - Three cameras are necessary (resources).
  - Three optical paths are necessary (fabrication and alignment, resources).

Fiber IFU





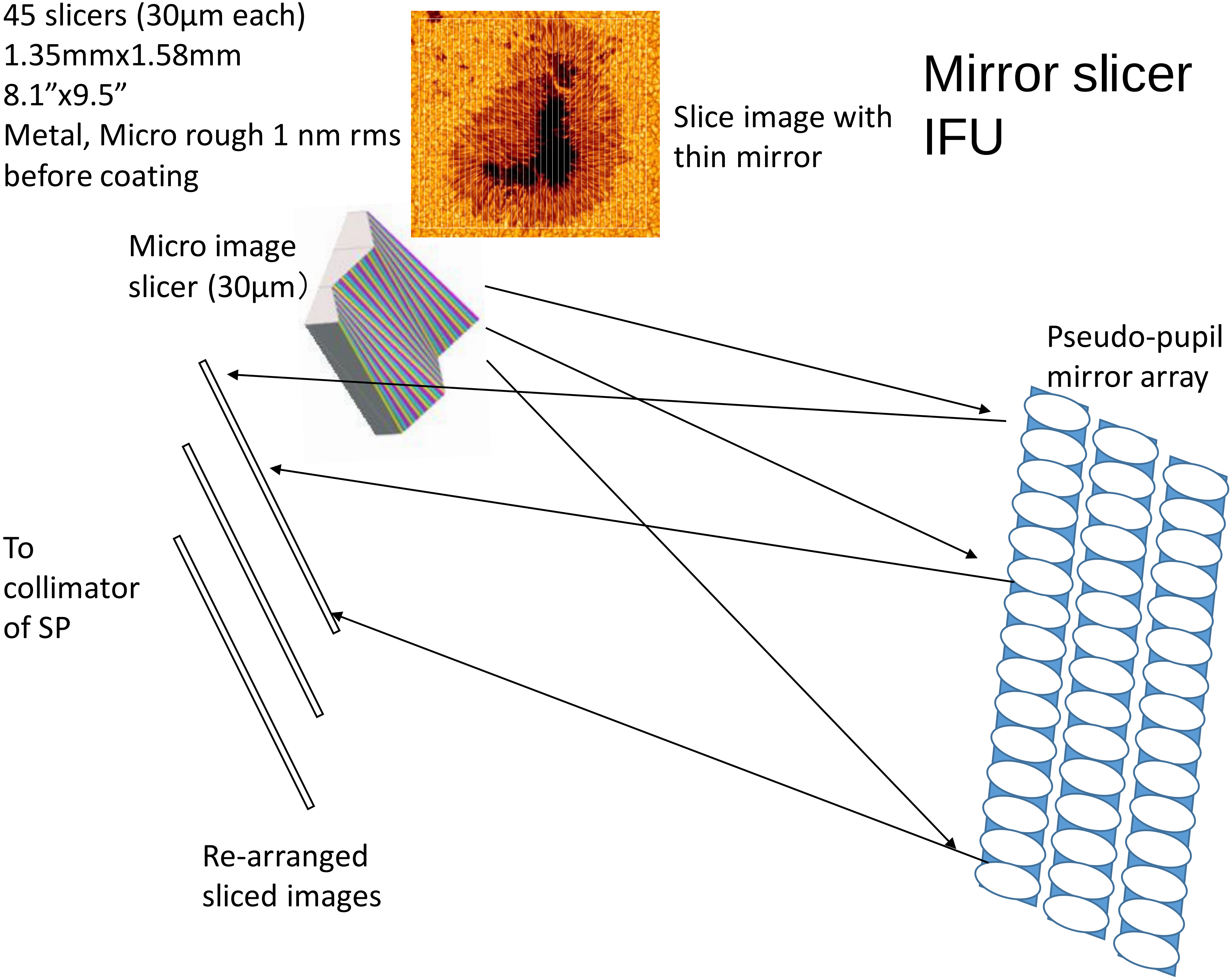


input array

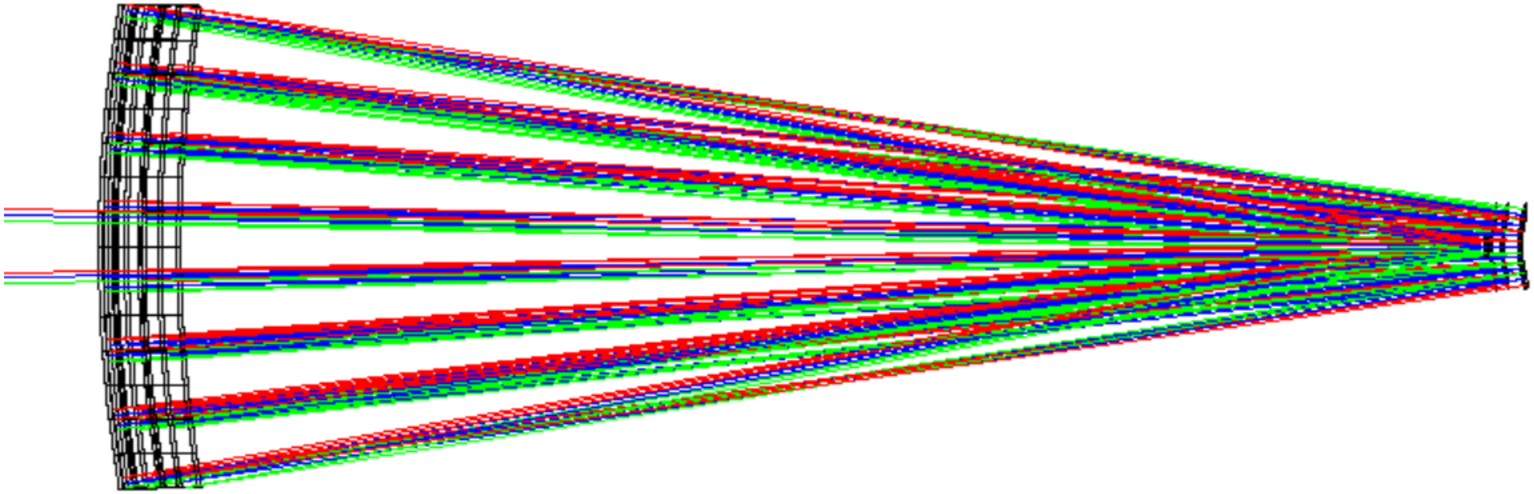
output array

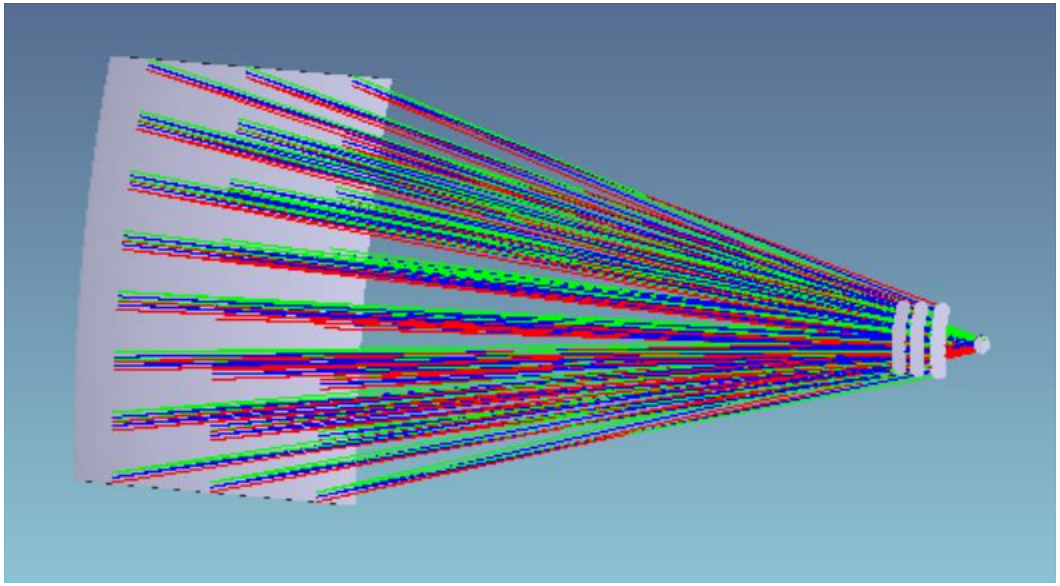
- Fiber ribbon developed by Collimated Holes (Inc., CHI) with H. Lin (Hawaii Univ.)
- Size of the elemental fiber 10μm x 40μm. → 10μm x 30μm
- Material: Bolosilicate Glass → Not transmit 280 nm
- Polarization maintaining (to be verified)

Mirror slicer IFU

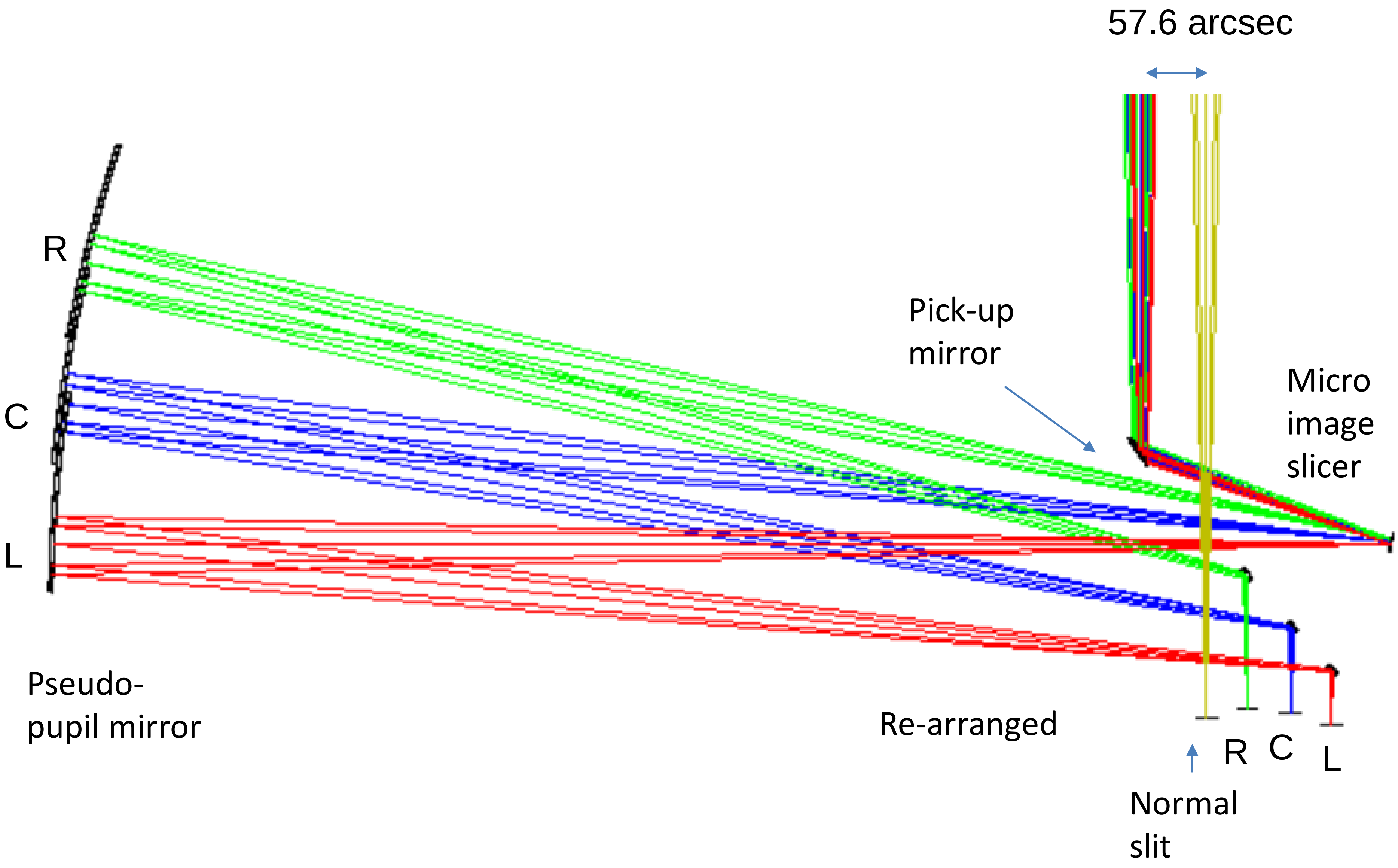


Pseudo- Pupil Mirror Array （3x7 only）



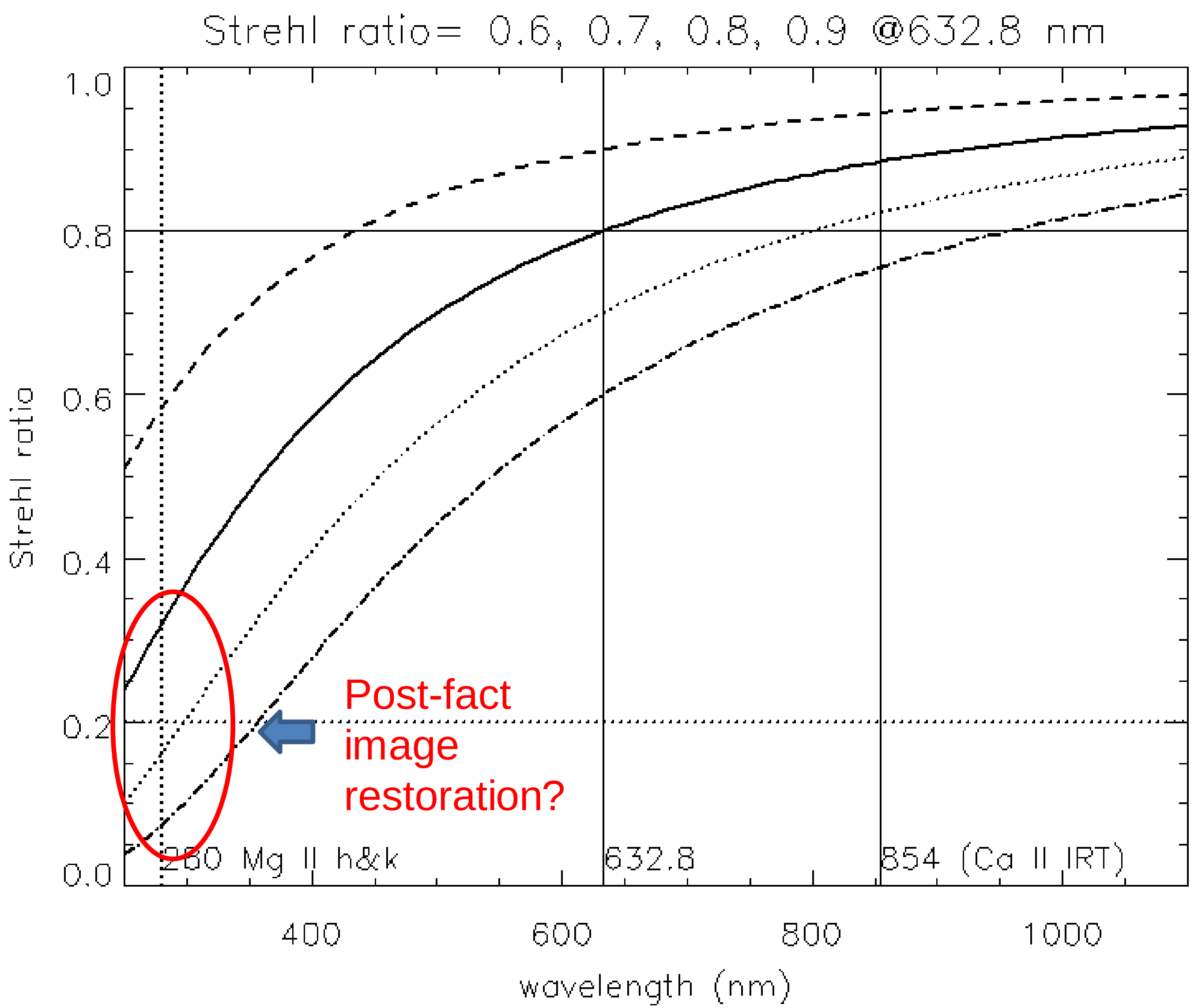


For SOLAR-C SP



Wavelength dependence of image quality

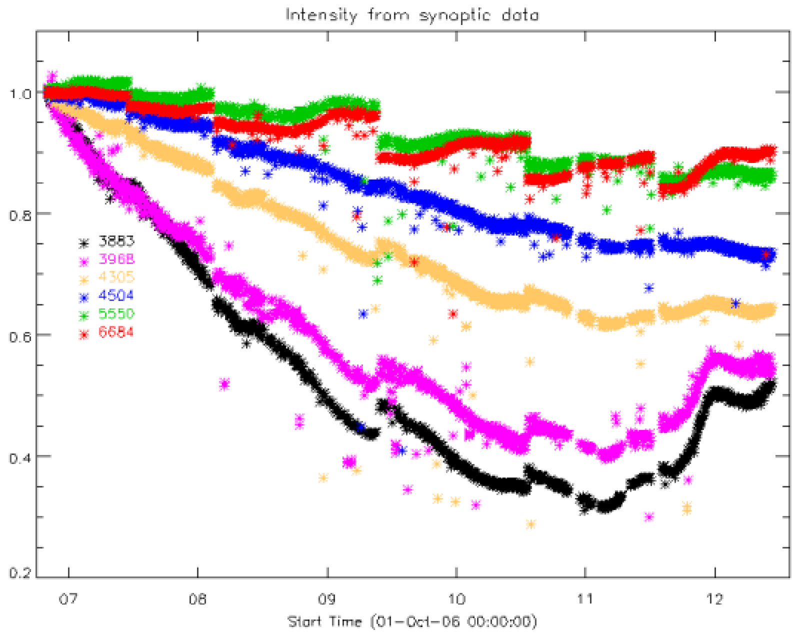
Strehl ratio = $\exp[-(2\pi \text{ rms-WFE}/\lambda)^2]$



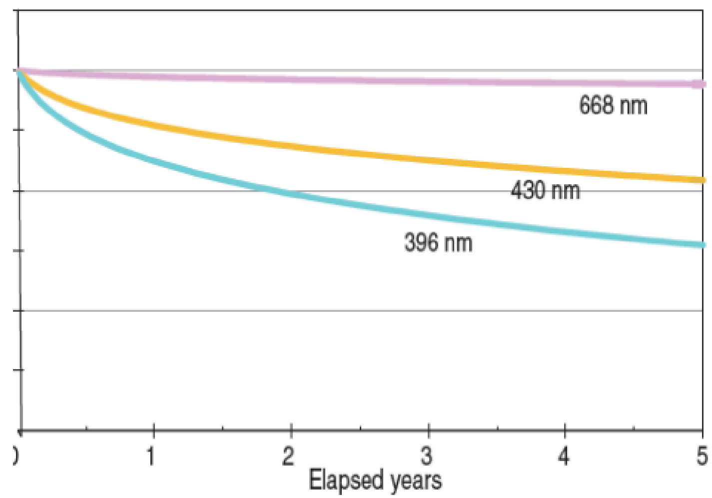
Severe Contamination Control Necessary

request much sever contamination control than Hinode case

SOT throughput (real)



SOT contamination model



We do not understand exactly the cause of degradation of SOT throughtput.

→ Need further experiments for Solar-C!

Summary

To realize 280 nm observations (scientifically useful)

- Many issues to be solved exist in coatings

- 2D Spectroscopy
  is not possible with Filtergraph
  (only broadband imager)
  needs dedicated spectrograph for 280 nm band
  with high speed slit scan and/or mirror IFU