Polarimeter in NIR with CRIRES+

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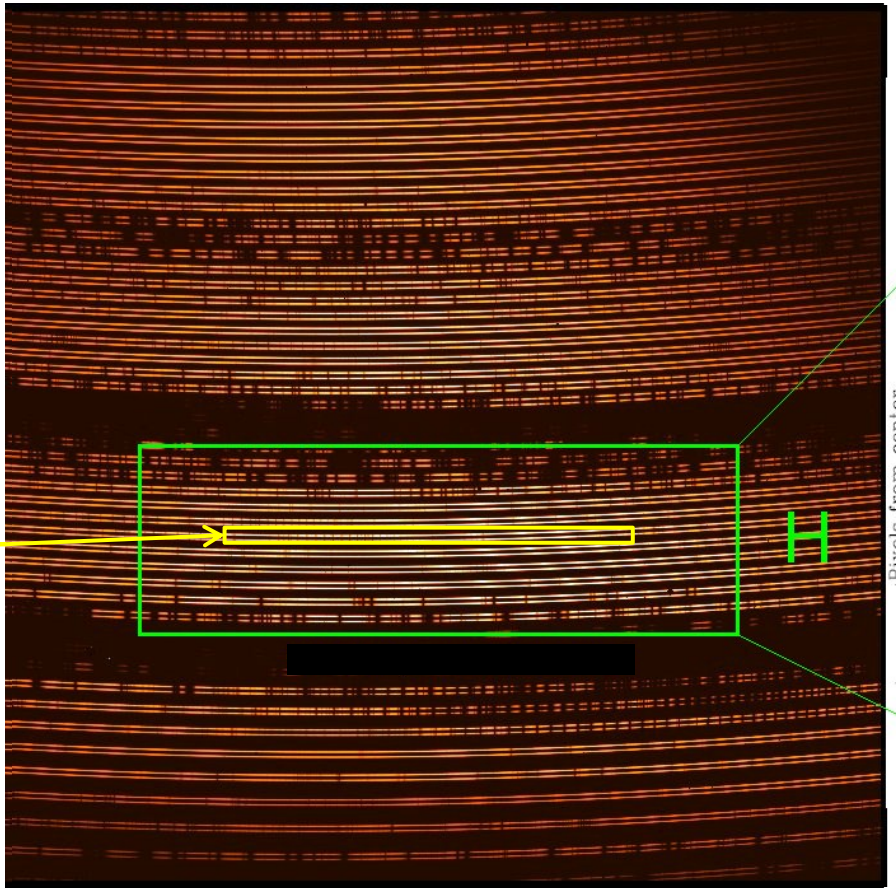
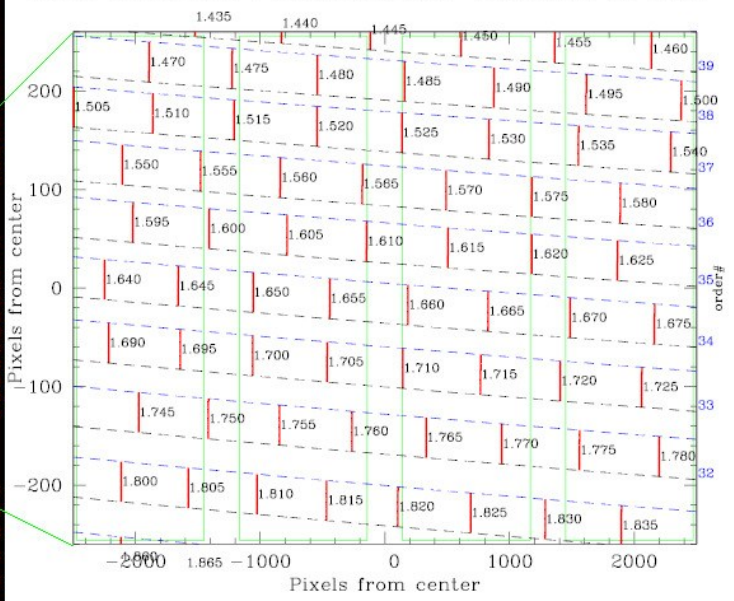
Upgrade of the ESO VLT NIR HR spectrometer

CRIRES coverage in one exposure



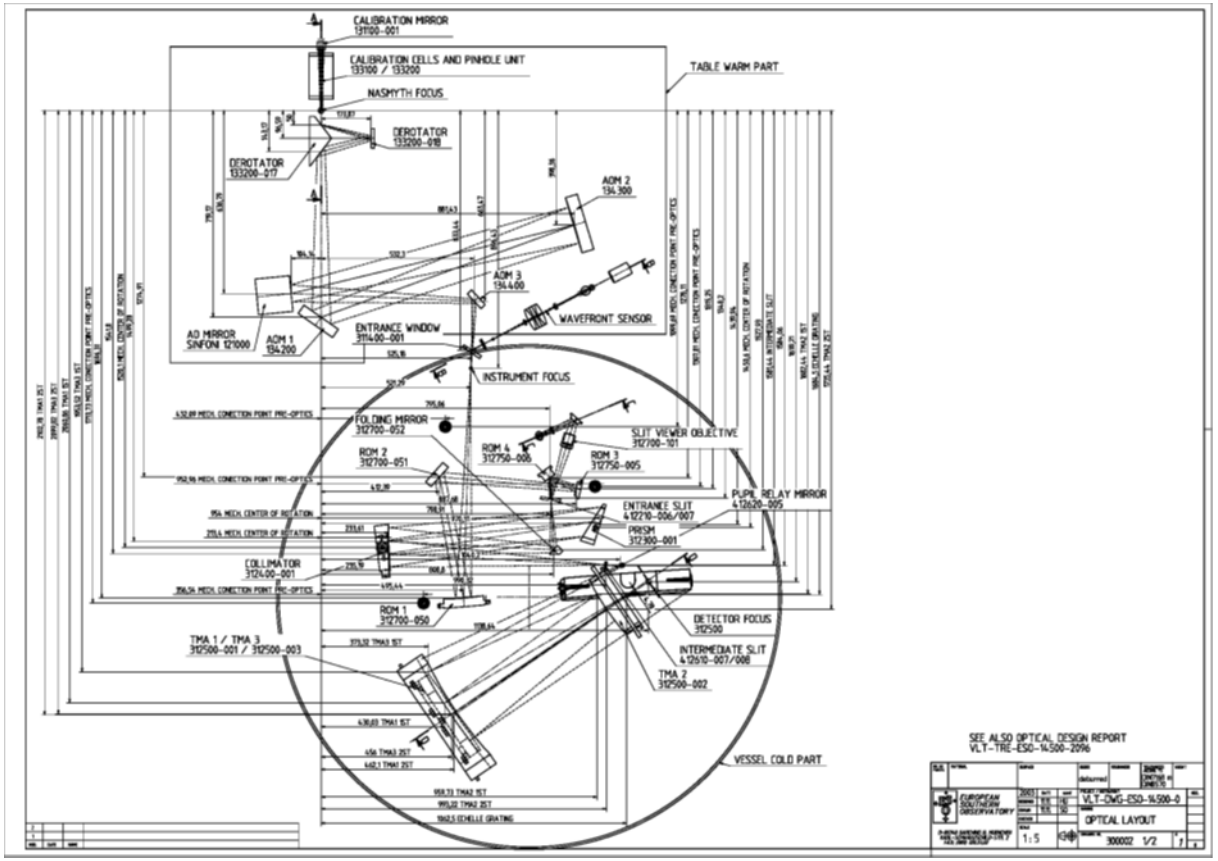
H–band 76% spectral range in 1 exposure



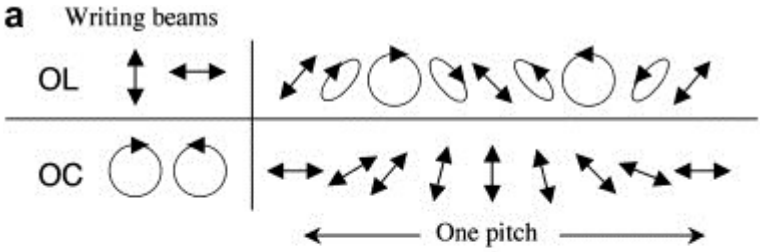
Placing polarimeter in CRIRES+

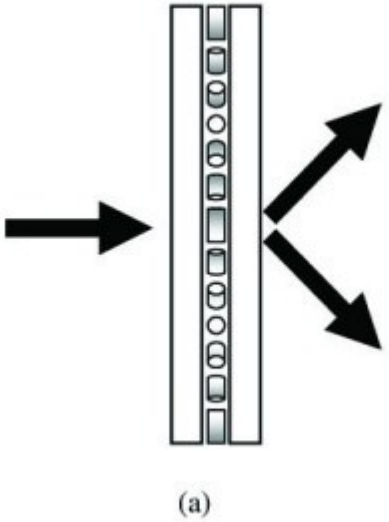
Complication: CRIRES – NIR, AO - visible

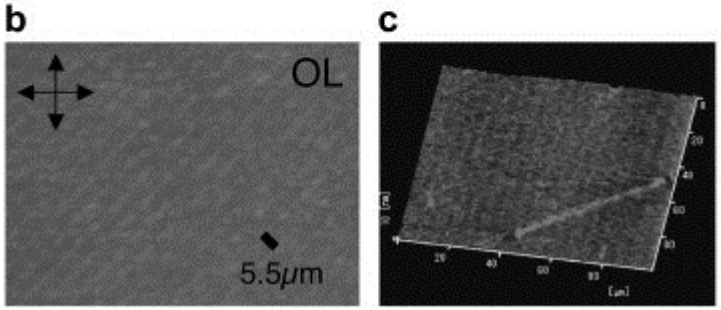
(1) Crystal Savart plates or (2) Polarizing gratings

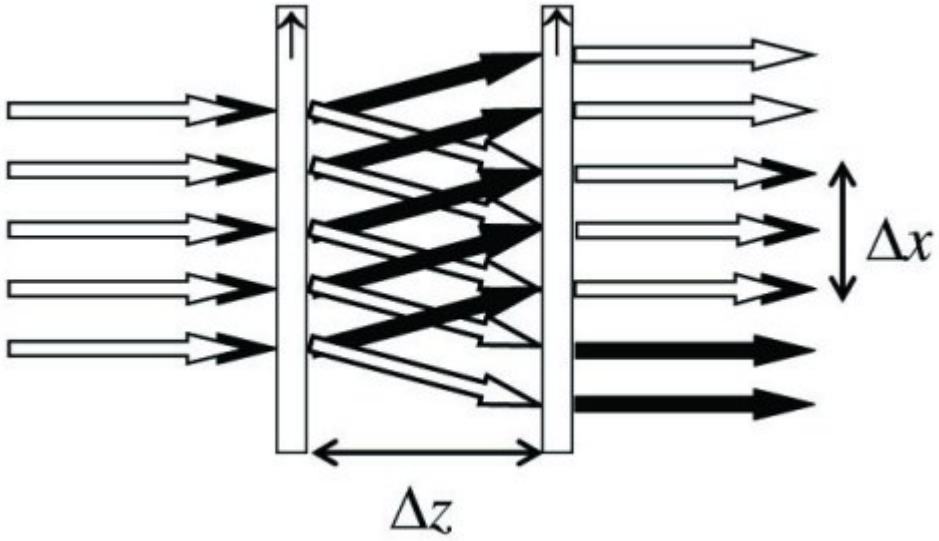


Polarizing gratings

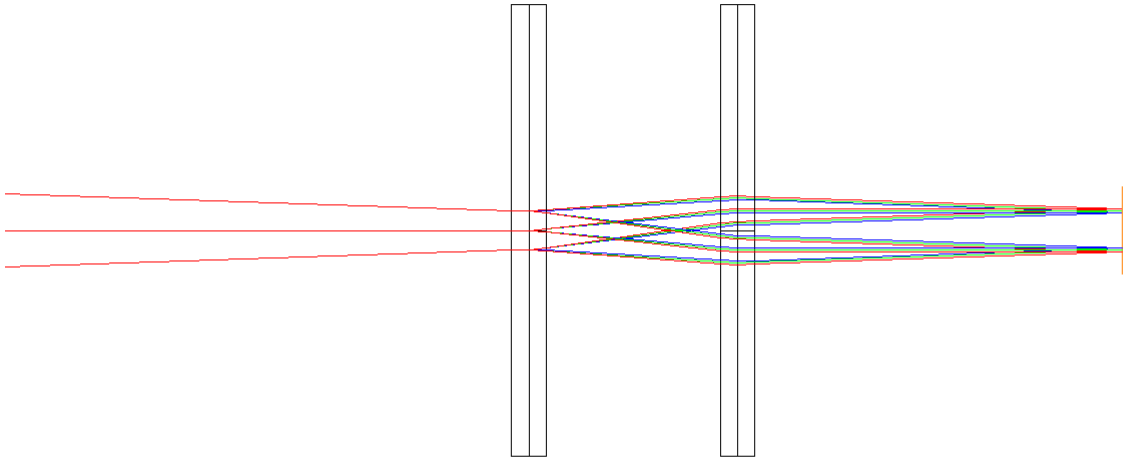


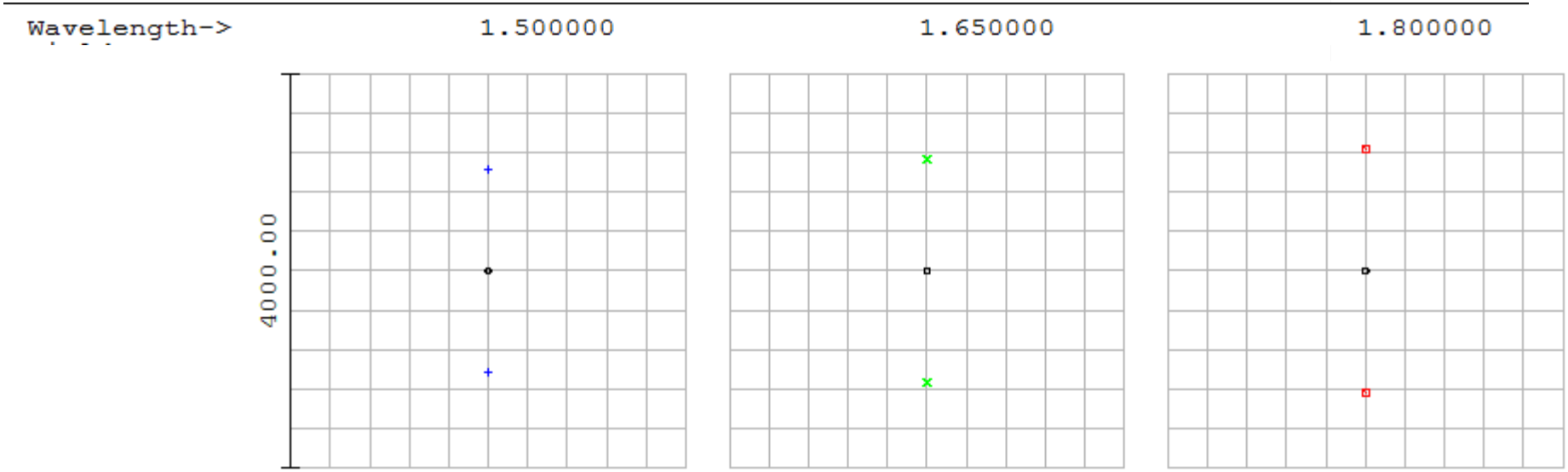




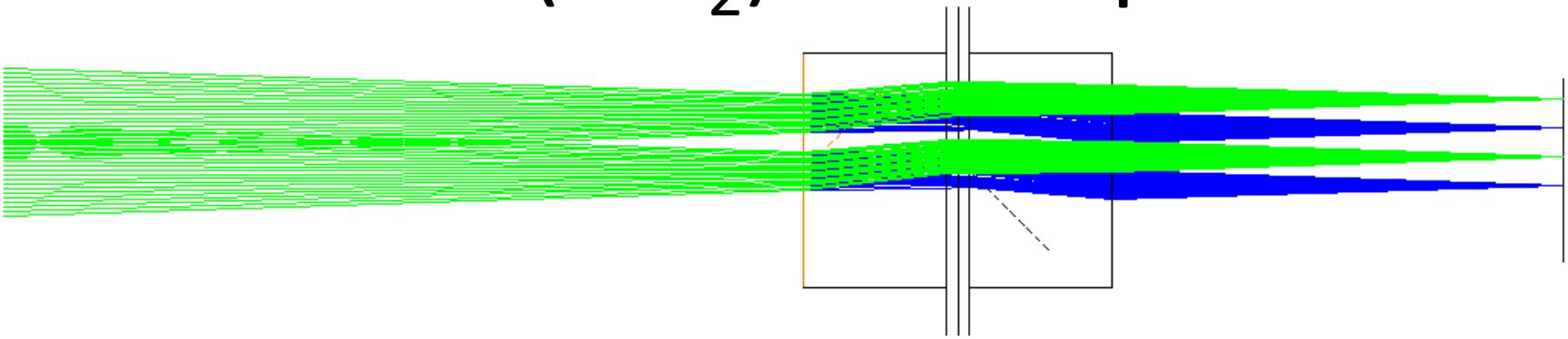


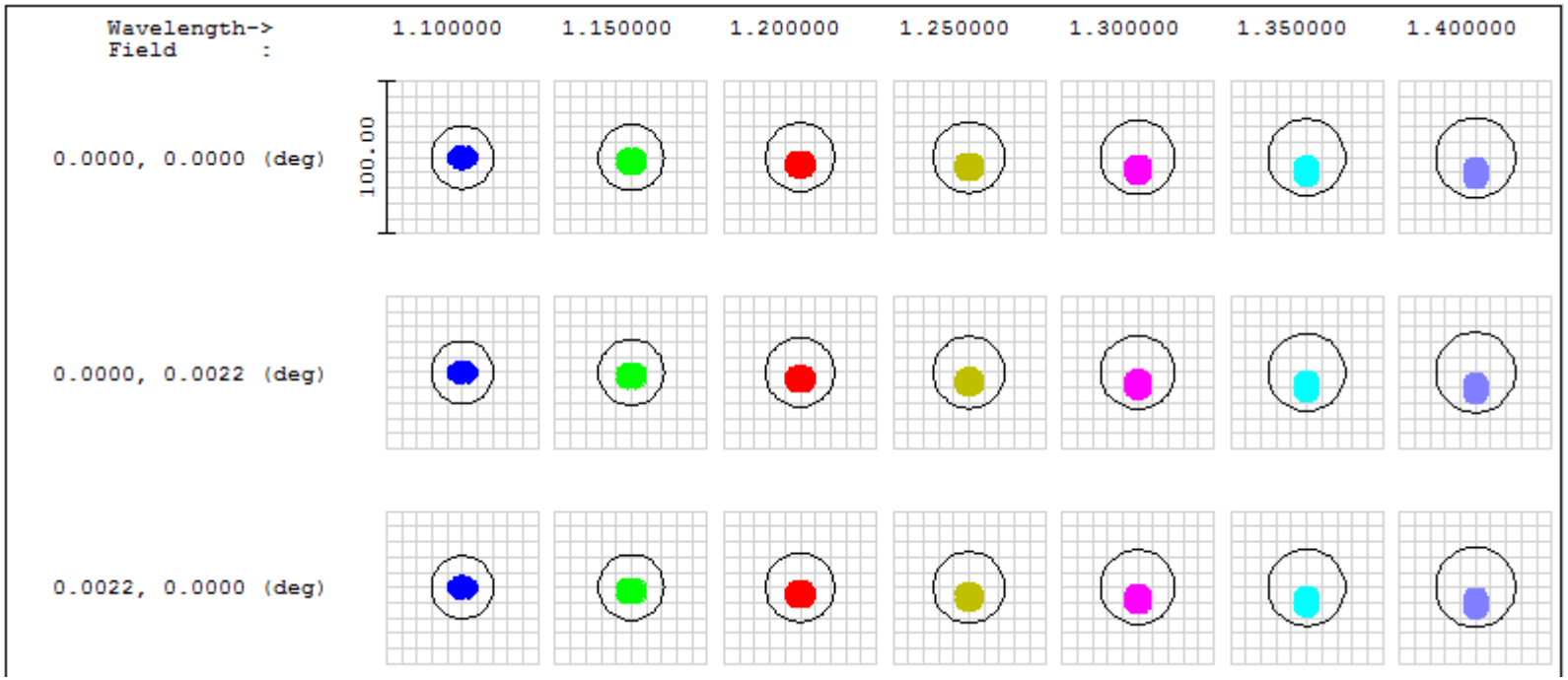
PG beam displacer



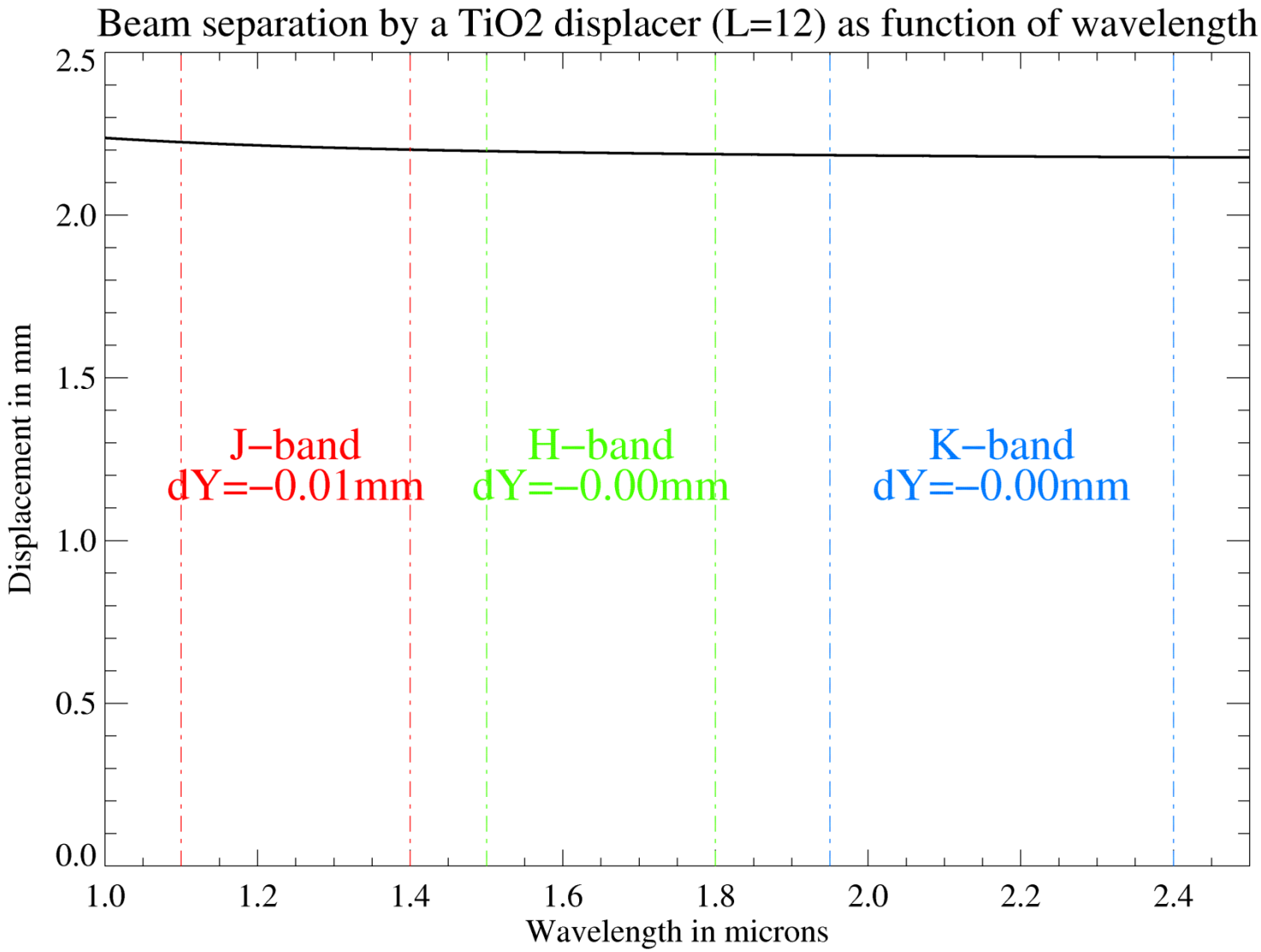


Rutile (TiO_2) beam splitter





Crystal plate chromatisim



Calibrations

Polarimeter is initially characterized in a lab.

Spectropolarimetry needs standard calibrations:

- Flat fields;
- Wavelengths calibrations.

Polarization observations use beam switching.

NIR observations use nodding and jitter for removing the background.

The two polarized images of spectral orders must be traced separately (chromatism).

Outstanding questions:
Instrumental polarization

- VLT tertiary mirror introduces linear polarization. For CRIRES+ measuring Stokes *V* should see little instrumental polarization.
- How do we *measure* this?
- Why modelling does not offer a comparable accuracy?
- Instrumental polarization introduced by AO

Outstanding questions:
Broad-band polarization

- (Irrelevant to CRIRES+)
- Can a spectropolarimeter be calibrated well enough to measure broad-band linear polarization?
- Overlap between broad-band polarization standards and spectropolarimetric standards
- Can one e.g. use instrumental polarization as a calibration source for a spectropolarimeter?

Outstanding questions

- Difference in focus between the K-band and the optical (CRIRES and AO) *AO can handle this*
- PG for 0.5-2.5 microns
  - Transmission of the PG
  - Polarization extinction
- Scattering
- Efficiently combining a PG and a QWP
- Availability of the TiO2 crystals in the right size and quality (16×25×25mm)
- Mechanical design (QWP rotation: Piezo motor?)