

Filtergraph calibration for the Polarimetric and Helioseismic Imager

Carlos DOMINGUEZ-TAGLE, Thierry APOURCHAUX, Jean-Jacques FOURMOND, Anne PHILIPPON, Jean-Christophe LE CLECH, Mehdi BOUZIT, Claudia RUIZ DE GALARRETA, Institut d'Astrophysique Spatiale, Université Paris Sud, France
Veronique BOMMIER, Regis LE COGUEN, Daniel CRUSSAIRE, Jean-Marie MALHERBE Observatoire de Paris, LESIA, France

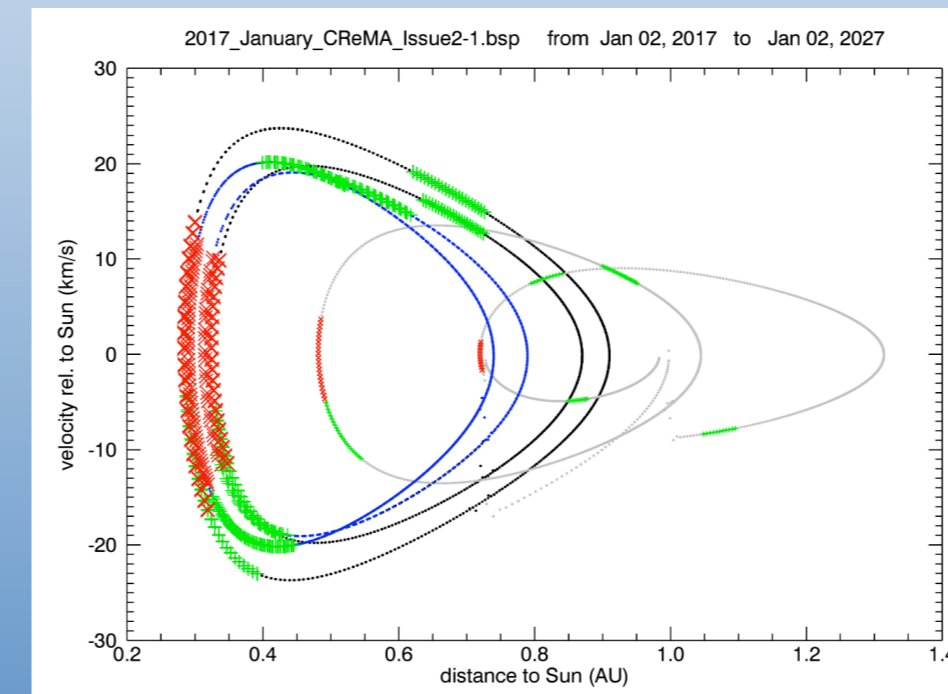
Solar Orbiter

- ESA's Cosmic Vision 2015-2025
- Central question of heliophysics:
 - *How the Sun creates and controls the heliosphere?*
- In-situ and remote-sensing instruments
- Launch: January 2017
- Nominal mission: 2022

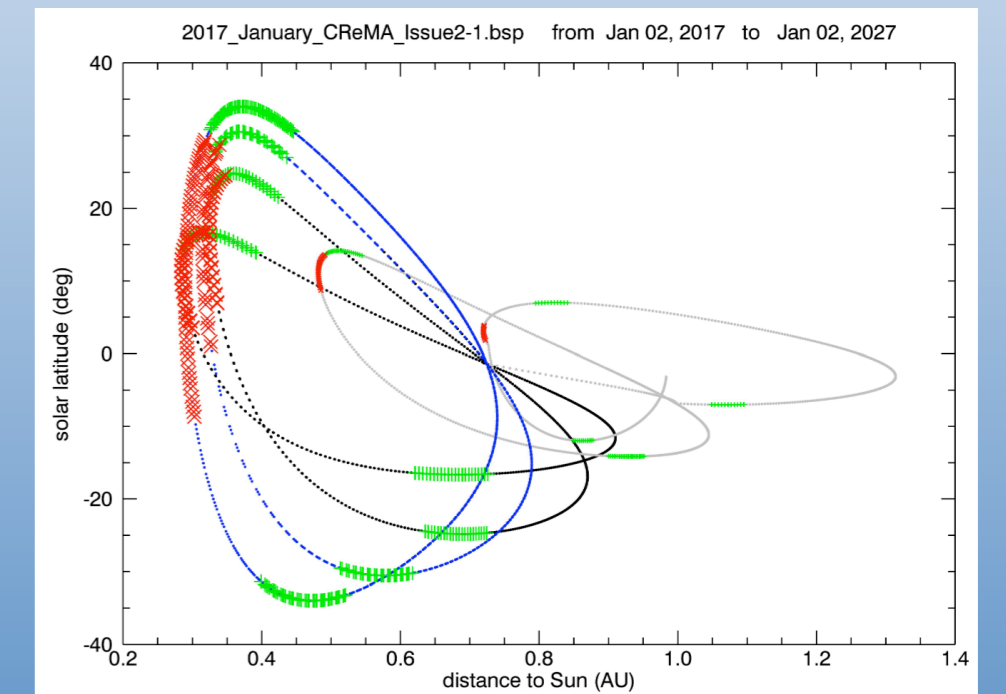


Mission orbit

- Launch trajectory combined with Earth and Venus gravity assist maneuvers
- Nominal orbit with 168 days period

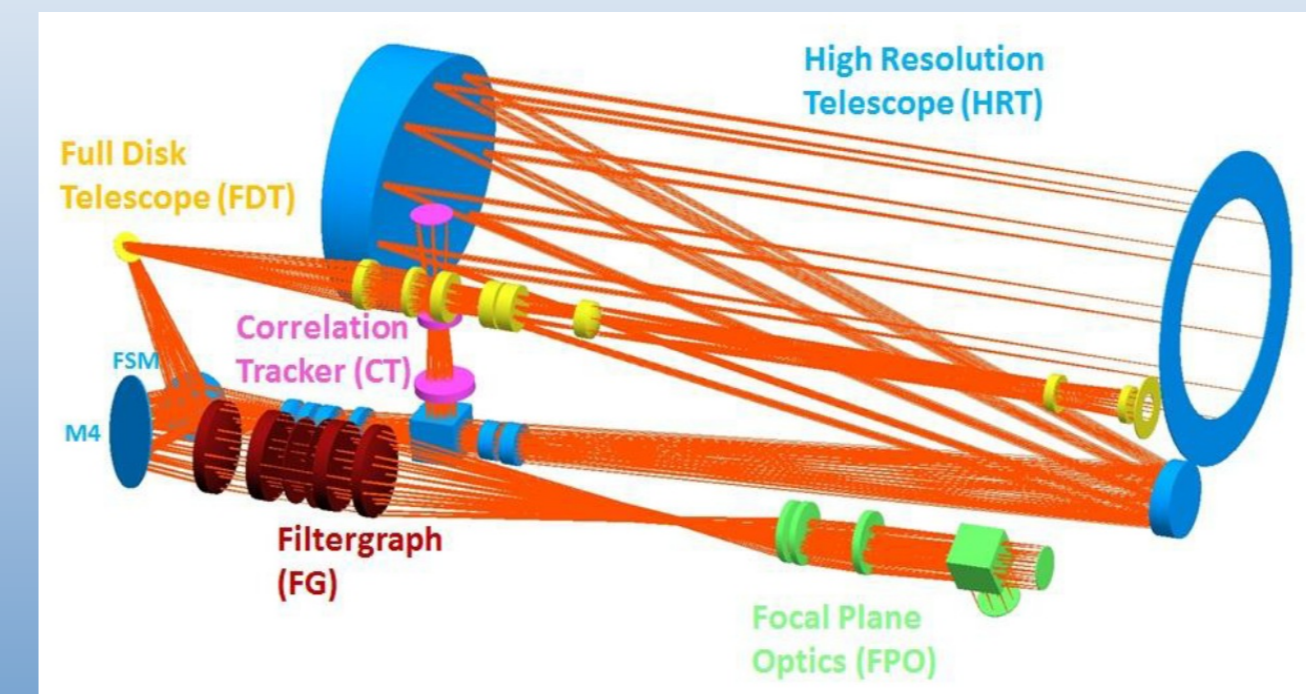
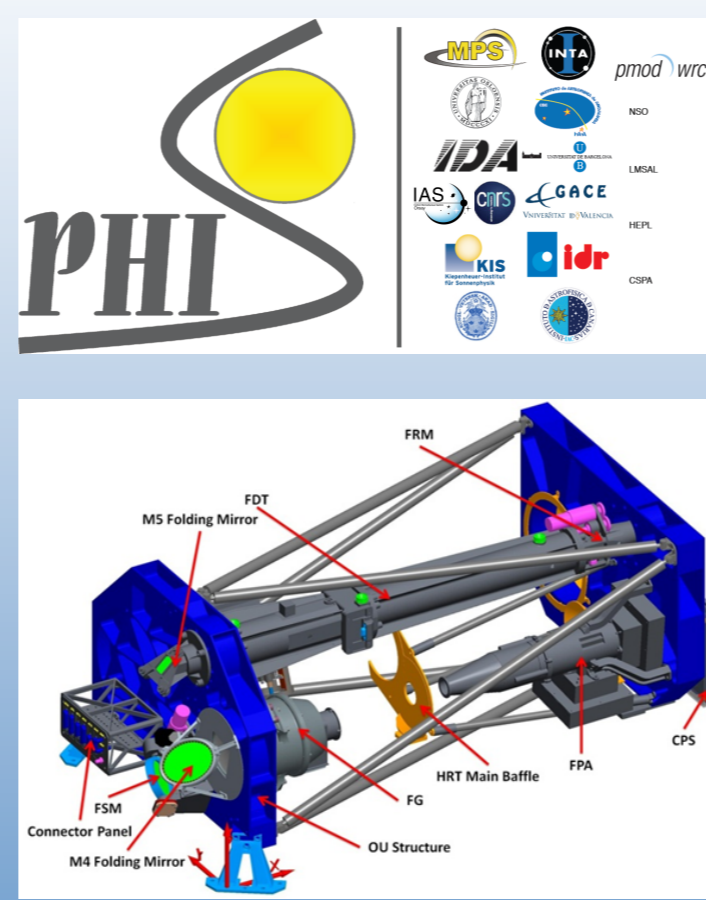


- Min. Sun dist.: 0.284 AU
- Higher latitudes 36.1° (ext).
- Max. rel velocity: 25.8 km/s



The Polarimetric and Helioseismic Imager

- High-resolution and full-disk measurements
- Doppler- and Zeeman-effects in the photospheric FeI 6173 Å absorption line
 - Intensity
 - Magnetic field
 - Line-of-sight velocity

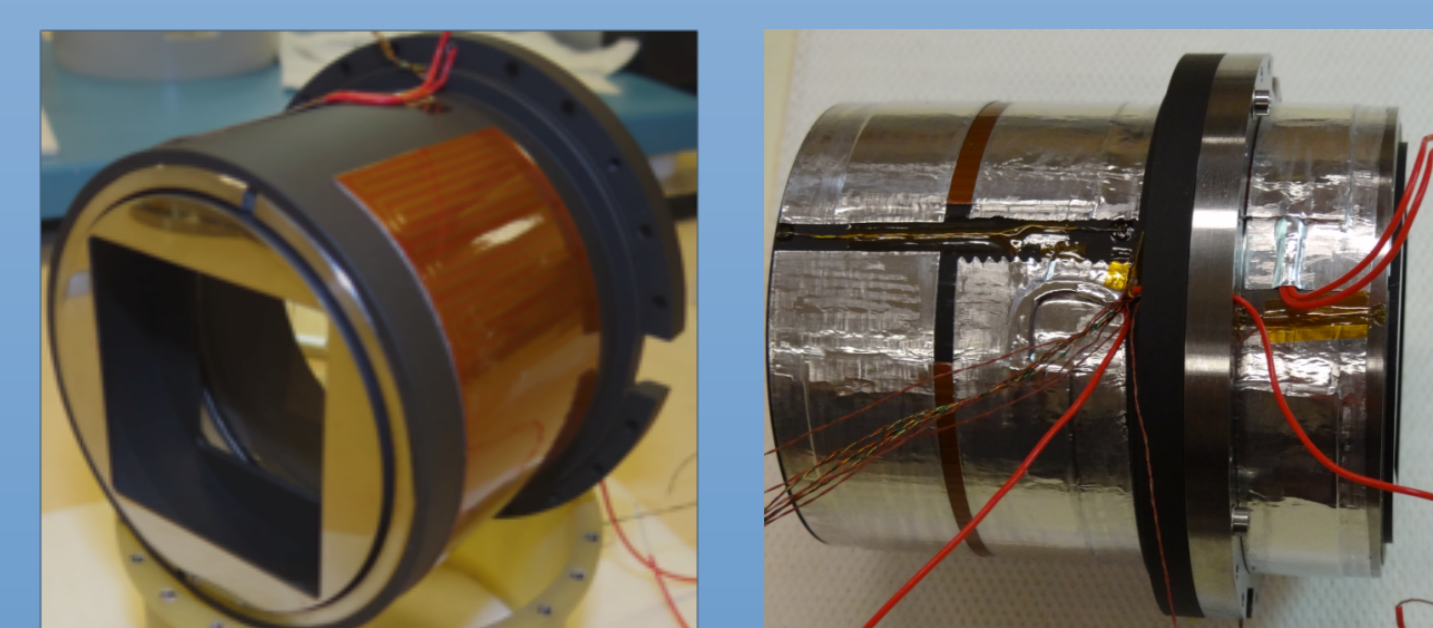
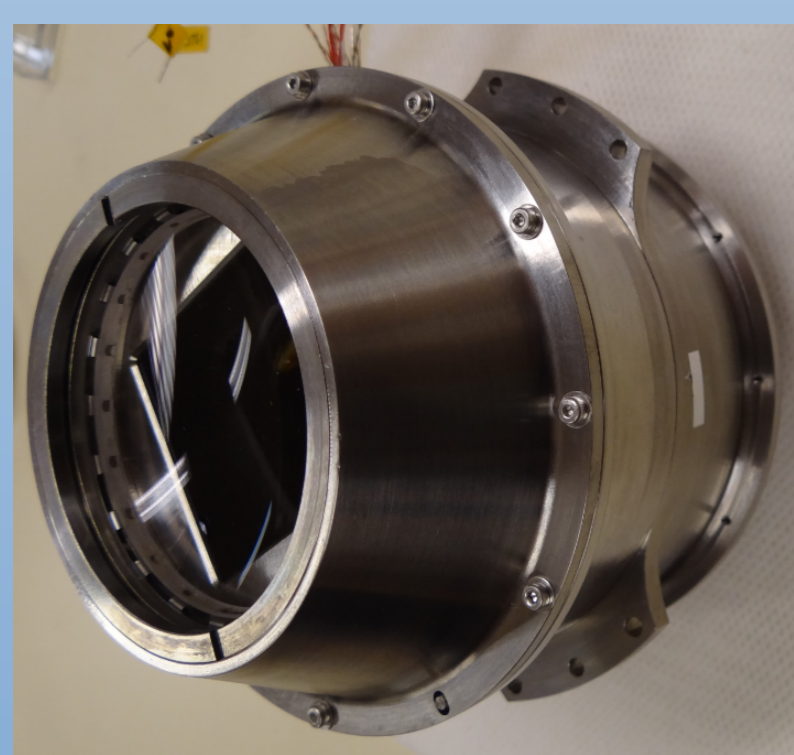
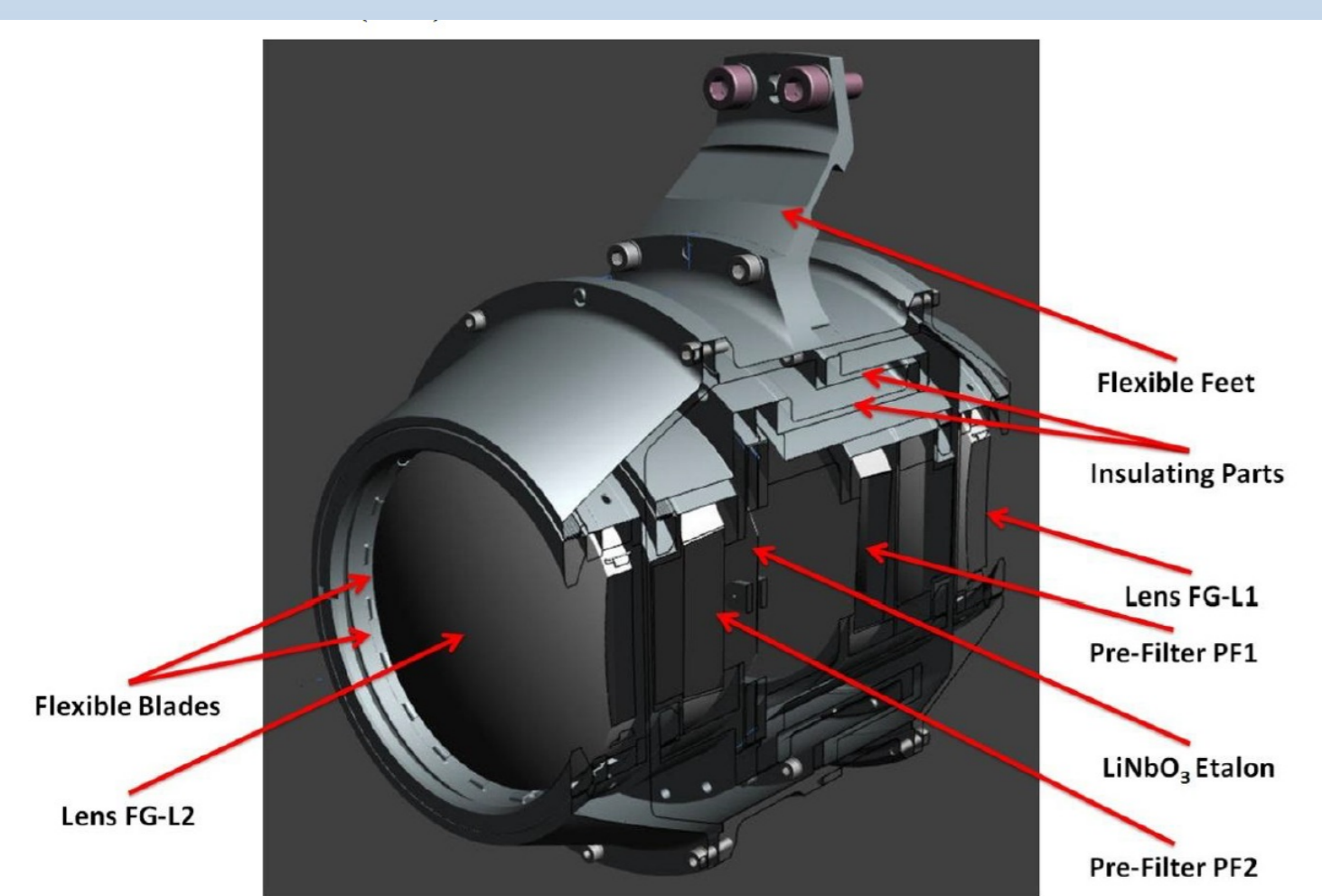
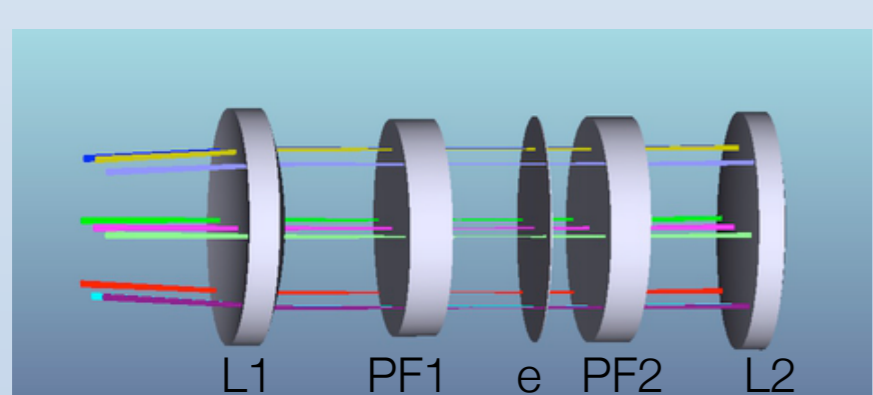


PHI - Optical diagram

- HRT as oblique reflector
- FDT as refractor
- Polarization module
- Image stabilization system
- Narrow-band filter (**Filtergraph**)
- 2k APS detectors

Filtergraph

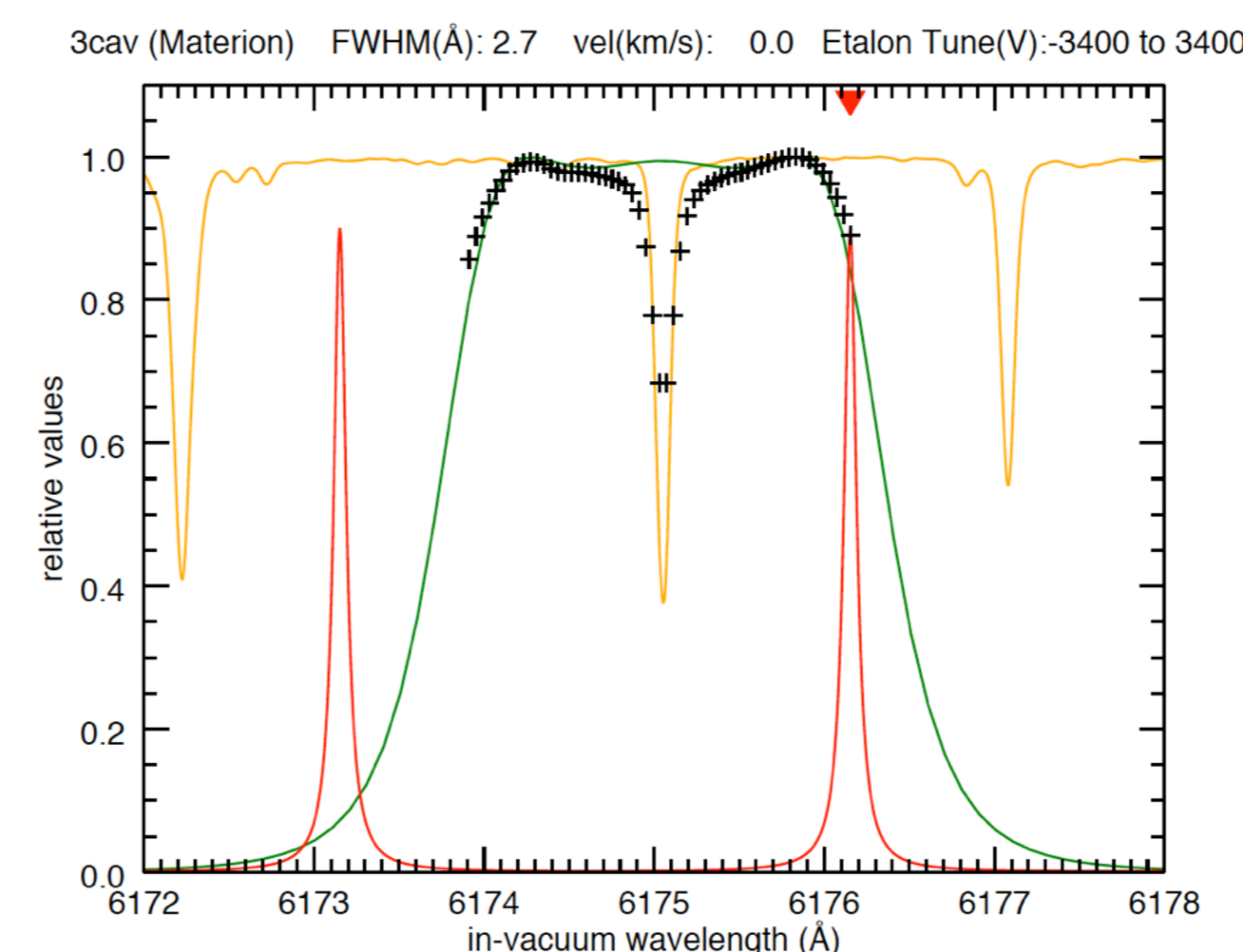
- Lenses (L1, L2)
- Fabry-Perot etalon (LiNbO3)
- Prefilter:
 - PF1 - narrow passband
 - PF2 - blocker
- *Oven, heaters, thermal sensors, insulating supports, lenses support, etc*



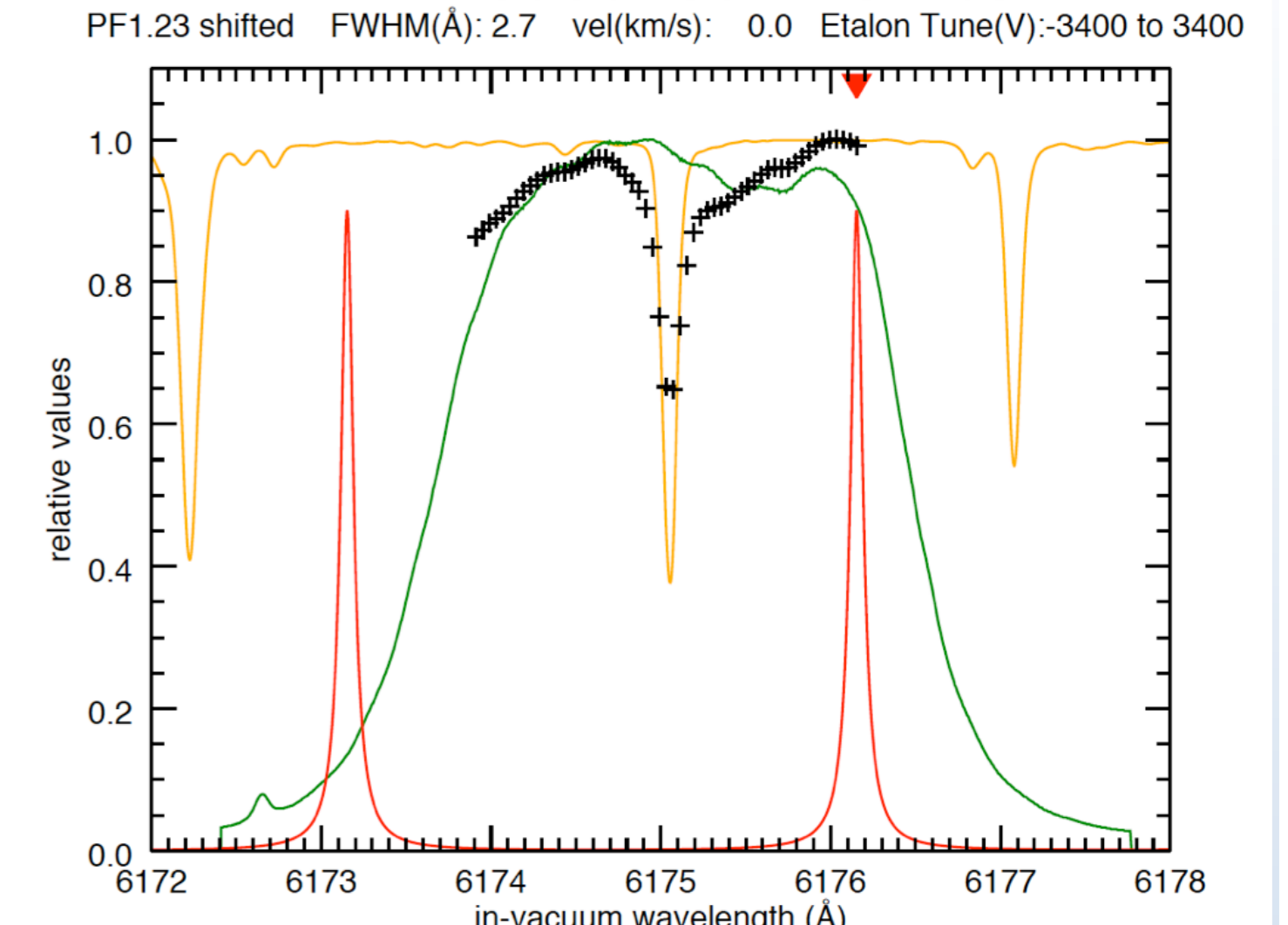
Filtergraph scan

- **Solar spectra: continuum with absorption lines. FeI 6173 Å (center)**
- **Etalon passband: 0.1 Å**
- **PF1 passband: 2.7 Å**

Simulated Prefilter

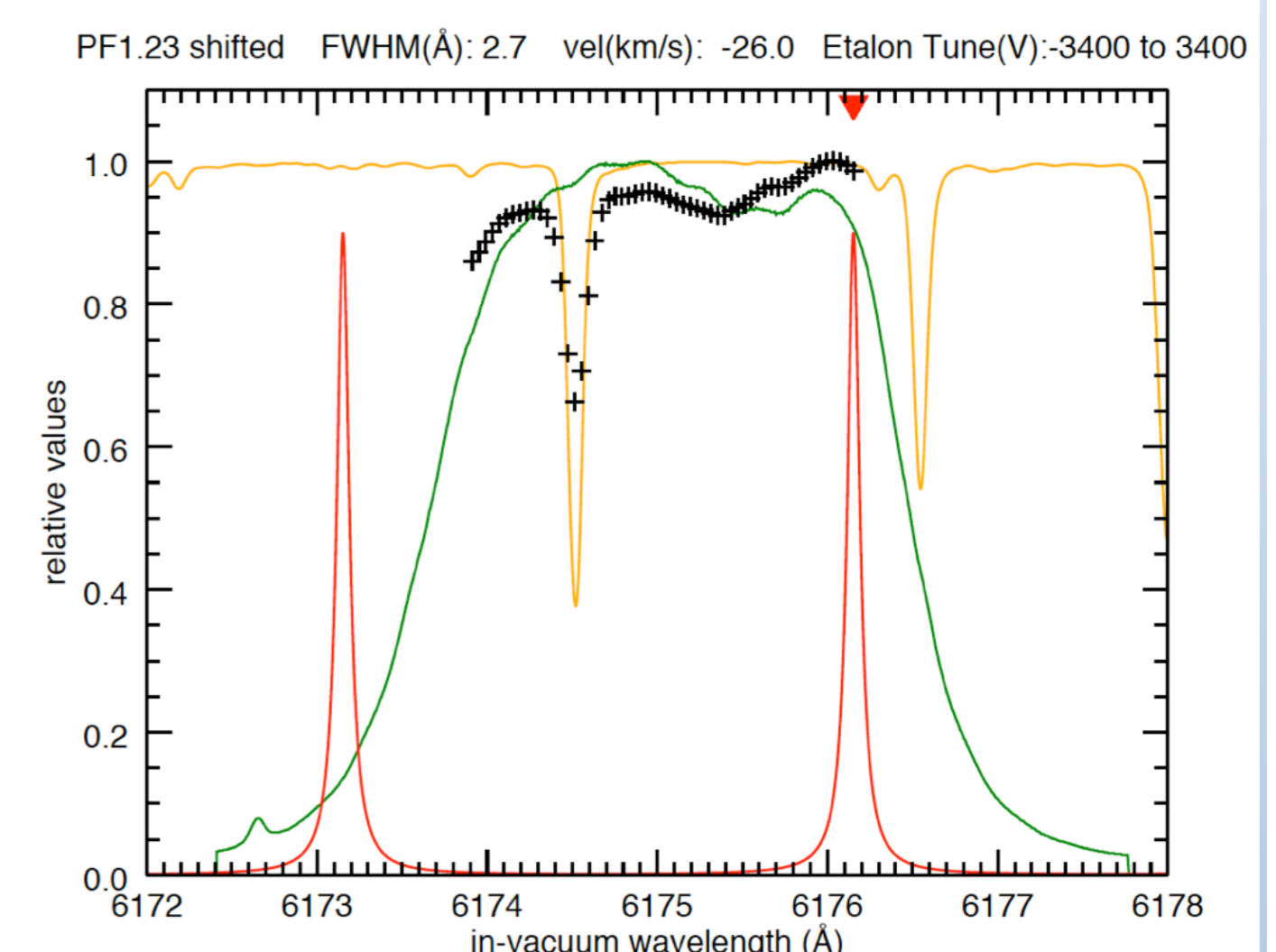
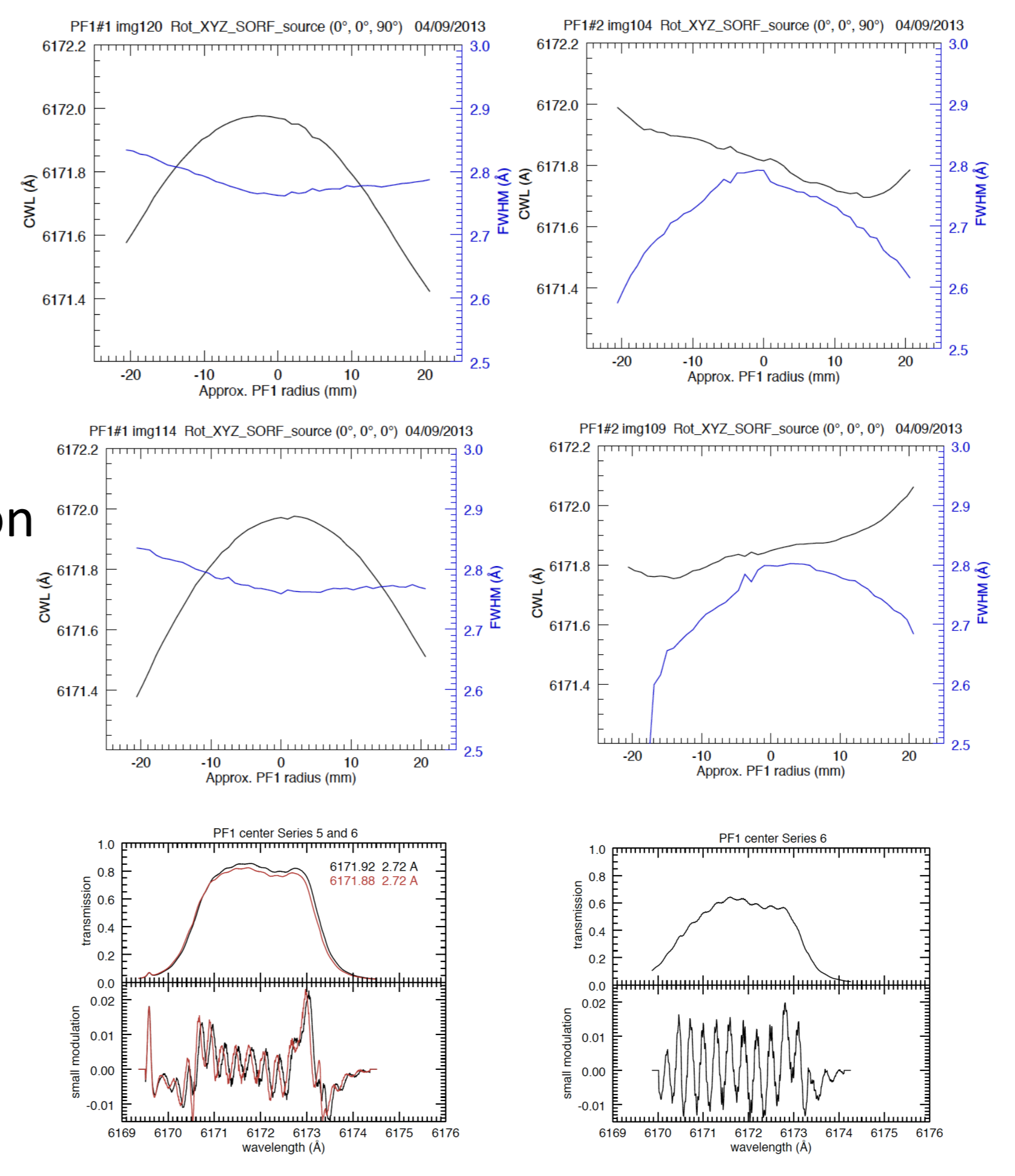


Measured Prefilter



Prefilter measurements

- High resolution spectra
- Profile measured to 0.06% (1-sigma error)
- CWL and FWHM variation across the filter surface
- Diff. to theoretical 3-cav filter: ±6%
- Small modulation (0.3 Å period) due to AR coatings



La Station, IAS
10000-class clean room
Monochromator
R=15000



Test Plan

Component	Tests
PF1	Transmission profile, thermal gradients, AOI and temperature sensitivities
PF2	Transmission profile
Etalon	Transmission profile, thermal gradients, AOI, temperature and high voltage sensitivities
Assembled FG	Transmission profile, thermal gradients, alignment, thermo-elastic stability and operation life



Observatoire de Meudon



Tour Solaire

Spectrograph
R=300000
f/75

