

# Filters for the F-TOUs

Alexis Brandeker  
Stockholm Observatory

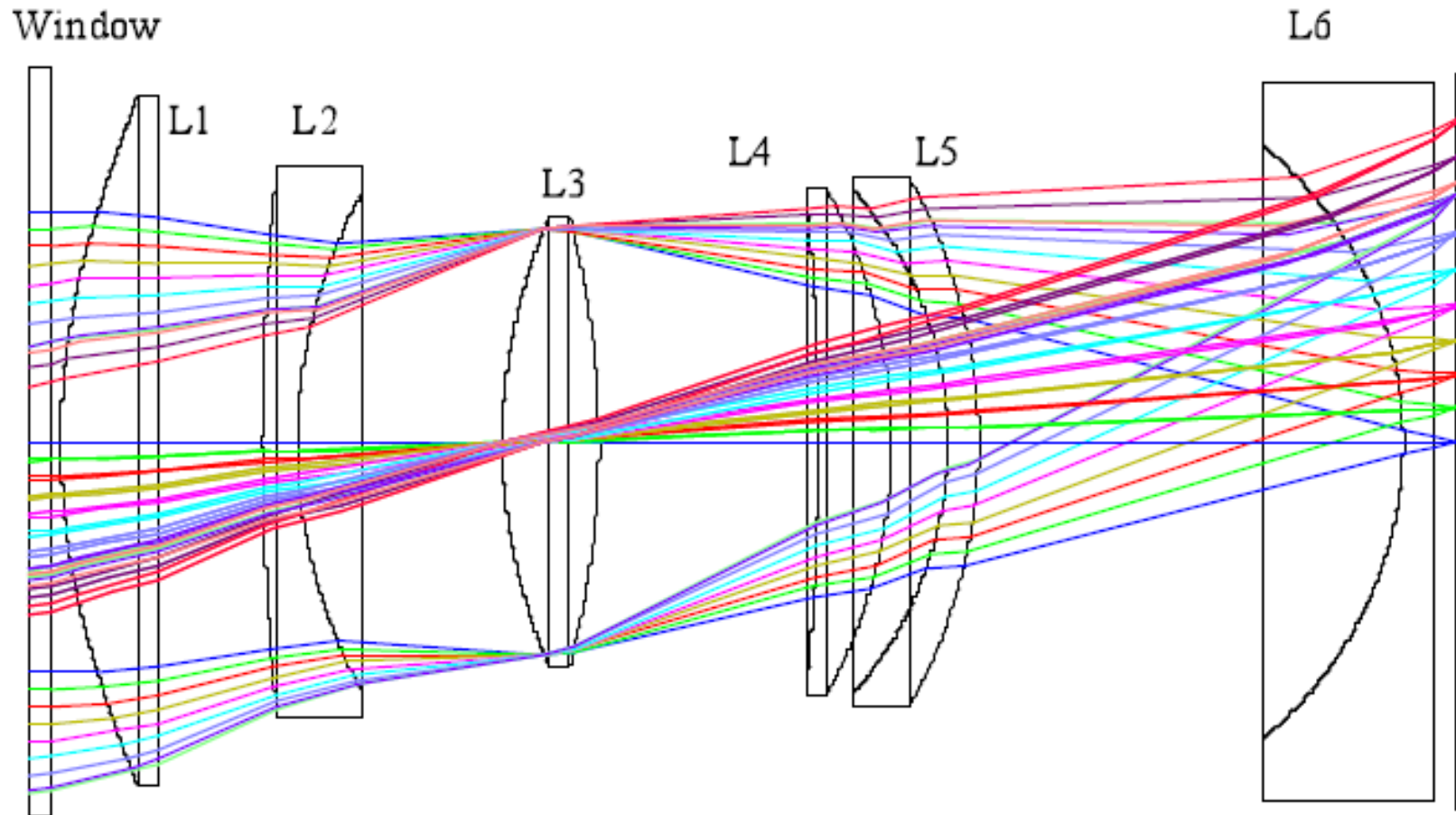
# F-TOU

- 2 F-TOU; one “red”, one “blue”
- 2.5s cadence (instead of 25s)
- Bright stars,  $V=4-8$  mag (instead of  $V>8$  mag)
- Mainly asteroseismology

# Requirements

- *The effective spectral range of the two fast telescopes optics shall be separated so that the photoelectron flux integrated in the common wavelength range represents less than 10 % of the total photoelectron flux.*
- *In the colour discrimination, less than 50% of the photo-electron flux is allowed to be lost due to this broad-band spectroscopy.*

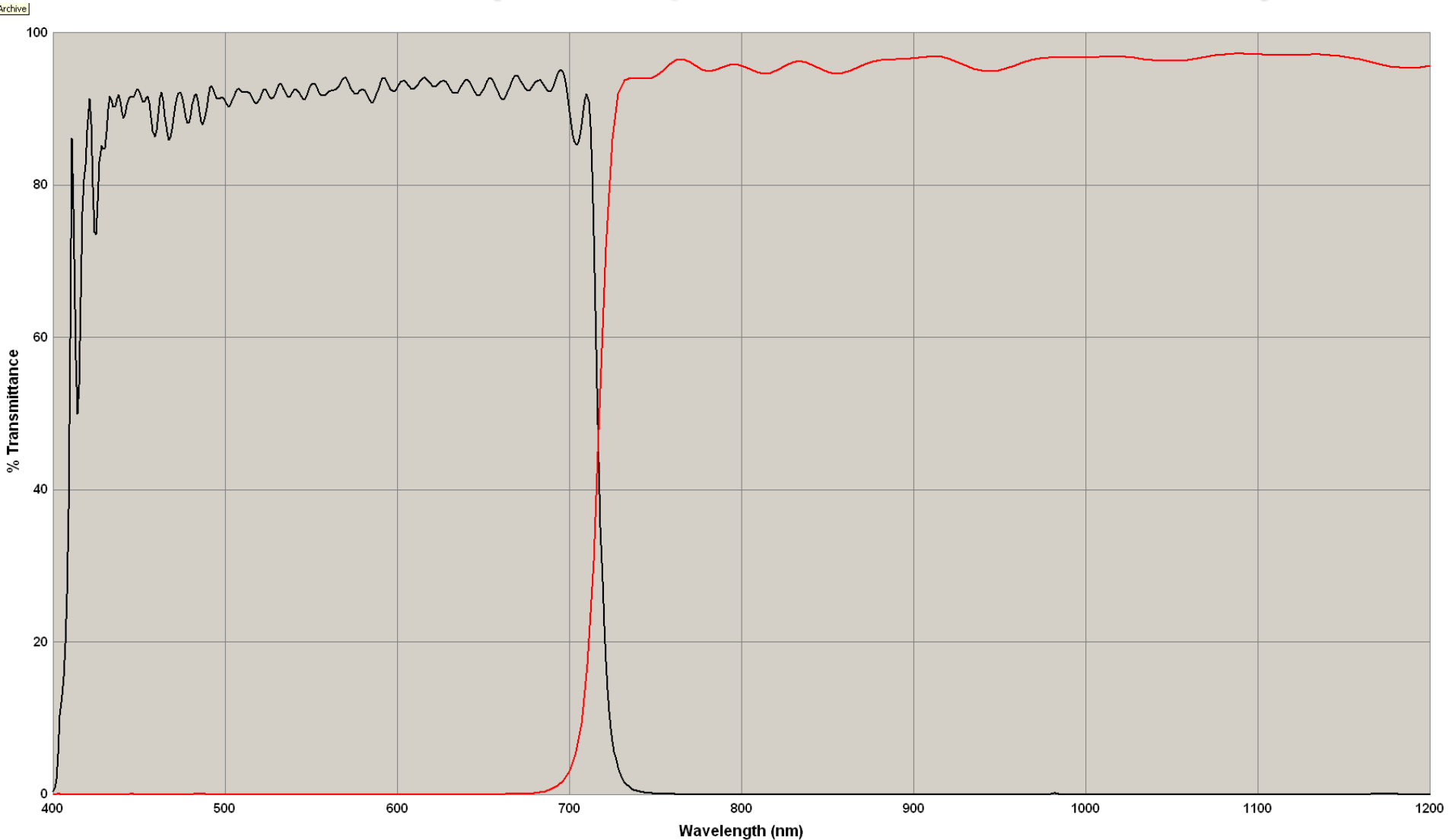
# Placement of filters: entrance window



# Placement of filters: entrance window

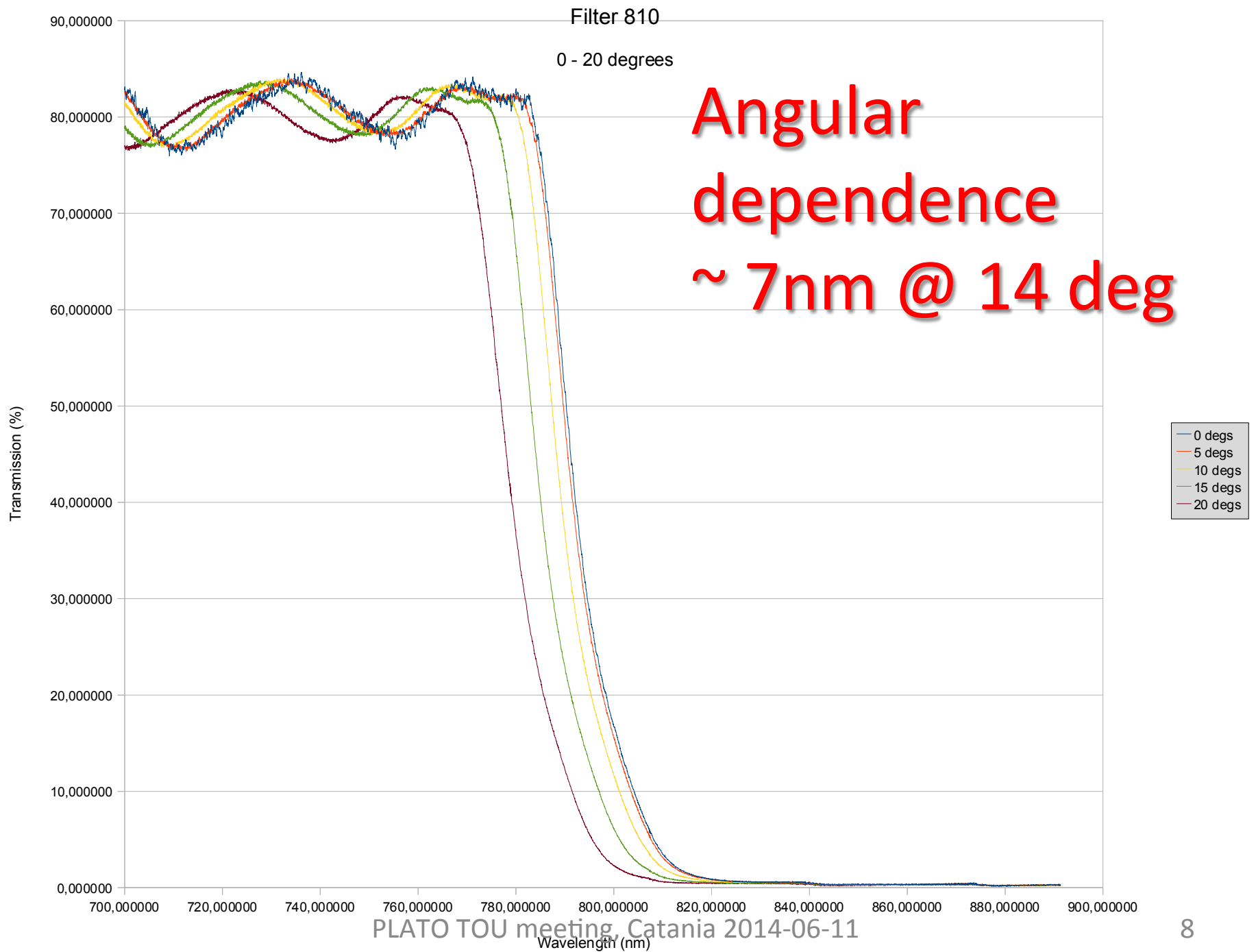
- Advantages:
  - F-TOUs mechanically identical to normal TOU
  - Parallel beam
  - Curved entrance window may limit cut/on wavelength shift
- Disadvantages:
  - Big filter diameter
  - Exposed to space

# 720 nm (50% ph e<sup>-</sup> each for Sun)



# Filters

- Manufacturer *Spectrogon* has previous experience producing filters for space (ISOcam, ROSETTA, MIRI)
- $\text{TiO}_2$  and  $\text{SiO}_2$  layers on BK7-G18 substrate
- Transmission >85%
- Chromatic shift is measured to be 6-7 nm for 14 deg off axis (for flat filter)
- Filters about 196 mm diameter – up to 225mm possible.





# Substrate

- 26 (!) substrates needed for manufacturing
  - 16 BK7-G18 for production filters (5+3 reserve)
  - 10 n-BK7 for process tuning
- Specifications (?)
  - Thickness: **6 mm**, diameter 196 mm
  - Flatness: 50 nm peak-to-valley
  - Scratch/dig: 40/20
  - Inclusions:  $10^{-3} \text{ mm}^3/\text{cm}^3$

# Coating

- Cut-on/off wavelength: 720 nm
- Cut-on/off slope: from 5% to 80% in 50nm
- Mean transmission 85% (up to 1100 nm)

# Testing

- Transmission 360—1100 nm (by manufacturer)
  - Room temperature for full-size filters
  - 150—290 K for small filter
- Optical quality verification (by manufacturer)
- Cooling test 290 K → 150 K to verify curvature specification ( $R > 10 \text{ m?}$ ) and no peeling of coatings (full-size engineering filters; by us)