ESO
European Organisation for Astronomical Research in the Southern Hemisphere

Application of the X-shooter Physical Model to Quality control Processing and Flexure Analysis

A different kind of science with X-shooter

Paul Bristow (ESO)

With support from Andrea Modigliani, Sabine Moehler, Joël Vernet & Florian Kerber (ESO) and Paolo Goldoni, Frédéric Royer & Régis Haigron (APC-SAp/CEA)

X-shooter 2010 – Como – 19th October 2010

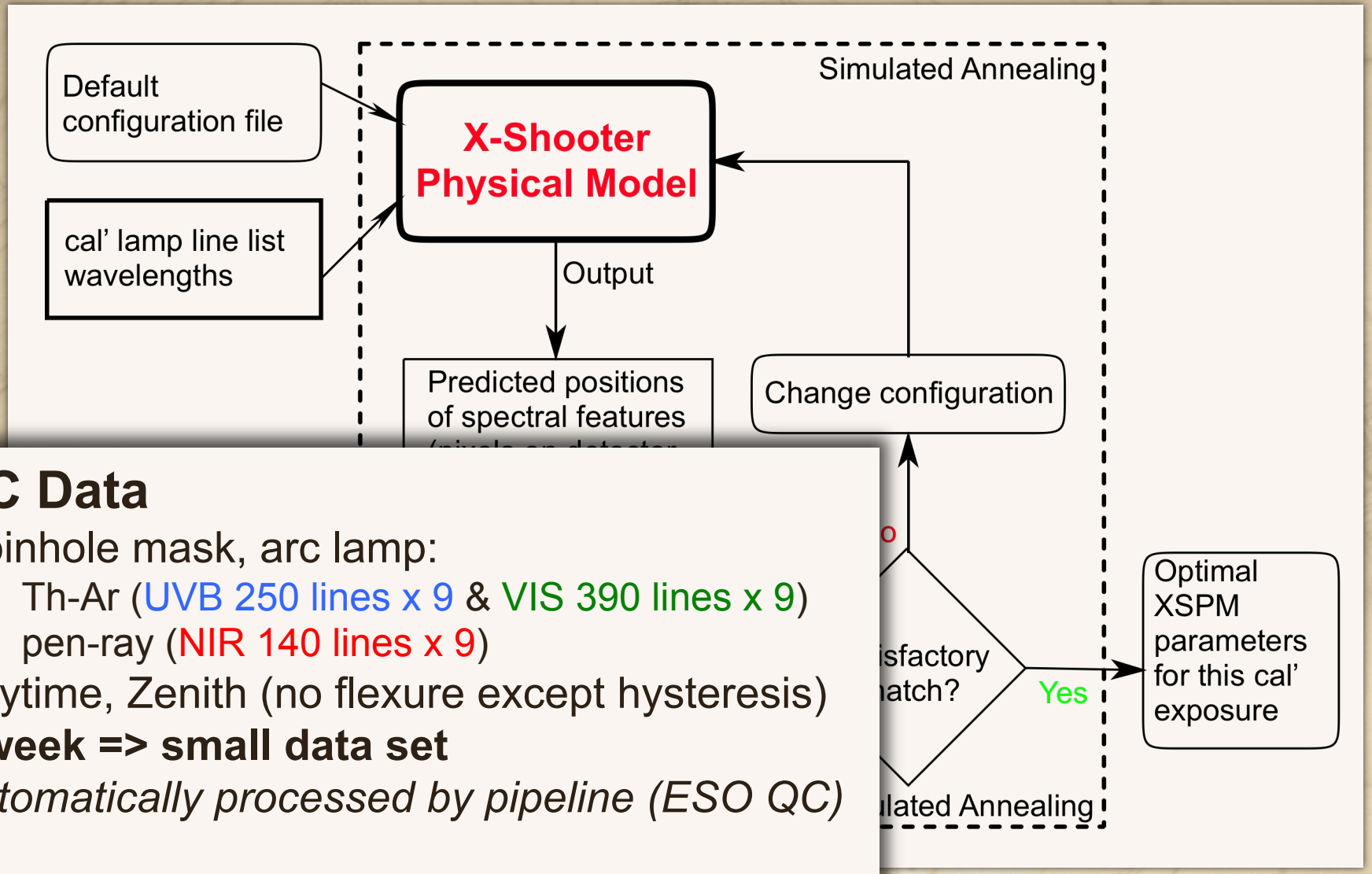
ESO
European Organisation for Astronomical Research in the Southern Hemisphere

The "Physical Model"

- Simplified ray trace of spectrograph optics
- Maps $p_s, \lambda \mapsto x, y$
- Poly coeffs replaced by parameters describing optical components:
  - Relative orientations
  - Relative positions
  - physical properties (grating constant or focal length)
- Specific parameter configuration for each arm
- Parameters can be optimised to match calibration data
- Instrument monitoring
- Further uses and details? - *Afternoon session!*

ESO
European Organisation for Astronomical Research in the Southern Hemisphere

Physical Model Optimisation



QC Data

9 pinhole mask, arc lamp:

Th-Ar (UVB 250 lines x 9 & VIS 390 lines x 9)

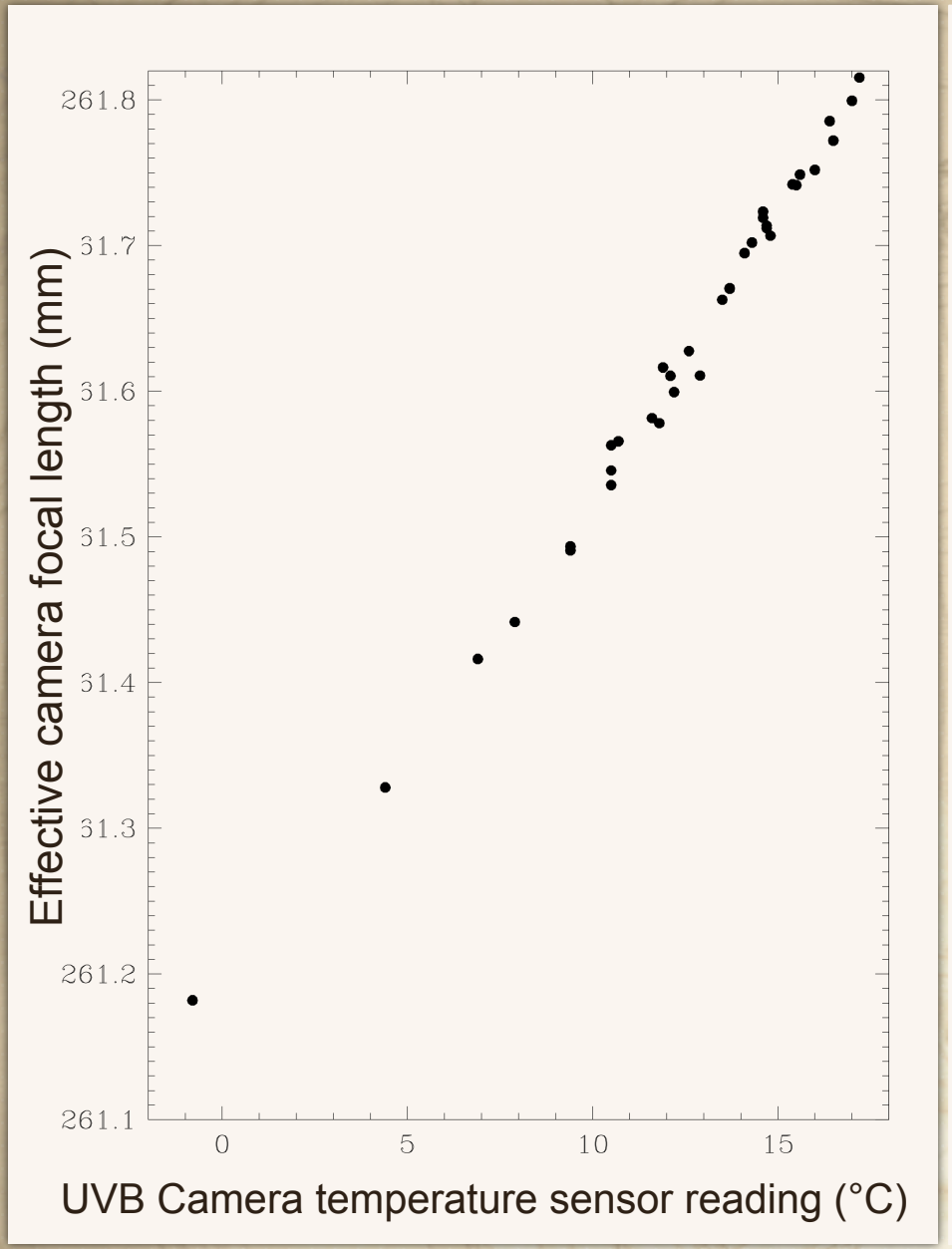
pen-ray (NIR 140 lines x 9)

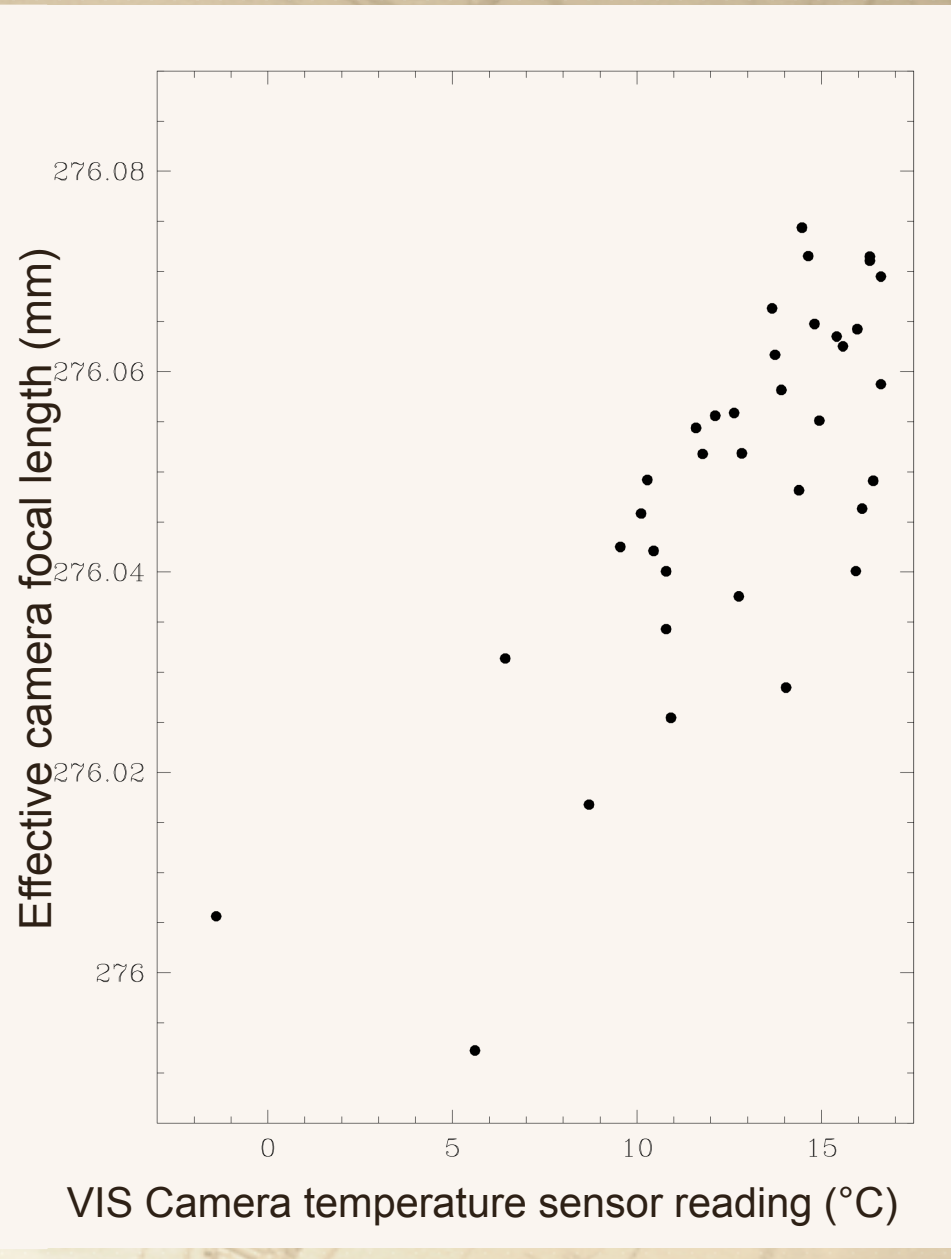
Daytime, Zenith (no flexure except hysteresis)

1/week => small data set

Automatically processed by pipeline (ESO QC)

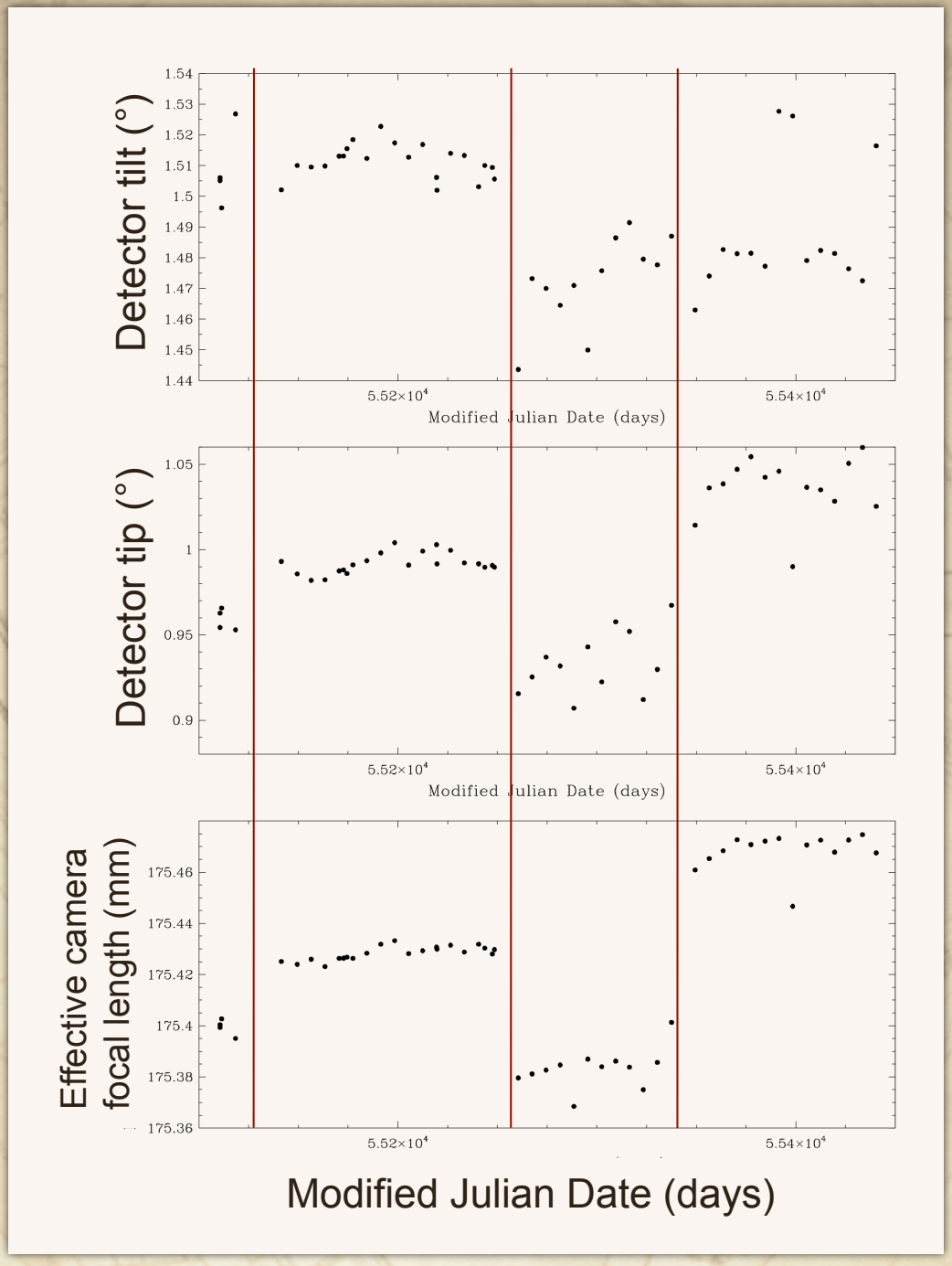
ESO
European Organisation for Astronomical Research in the Southern Hemisphere





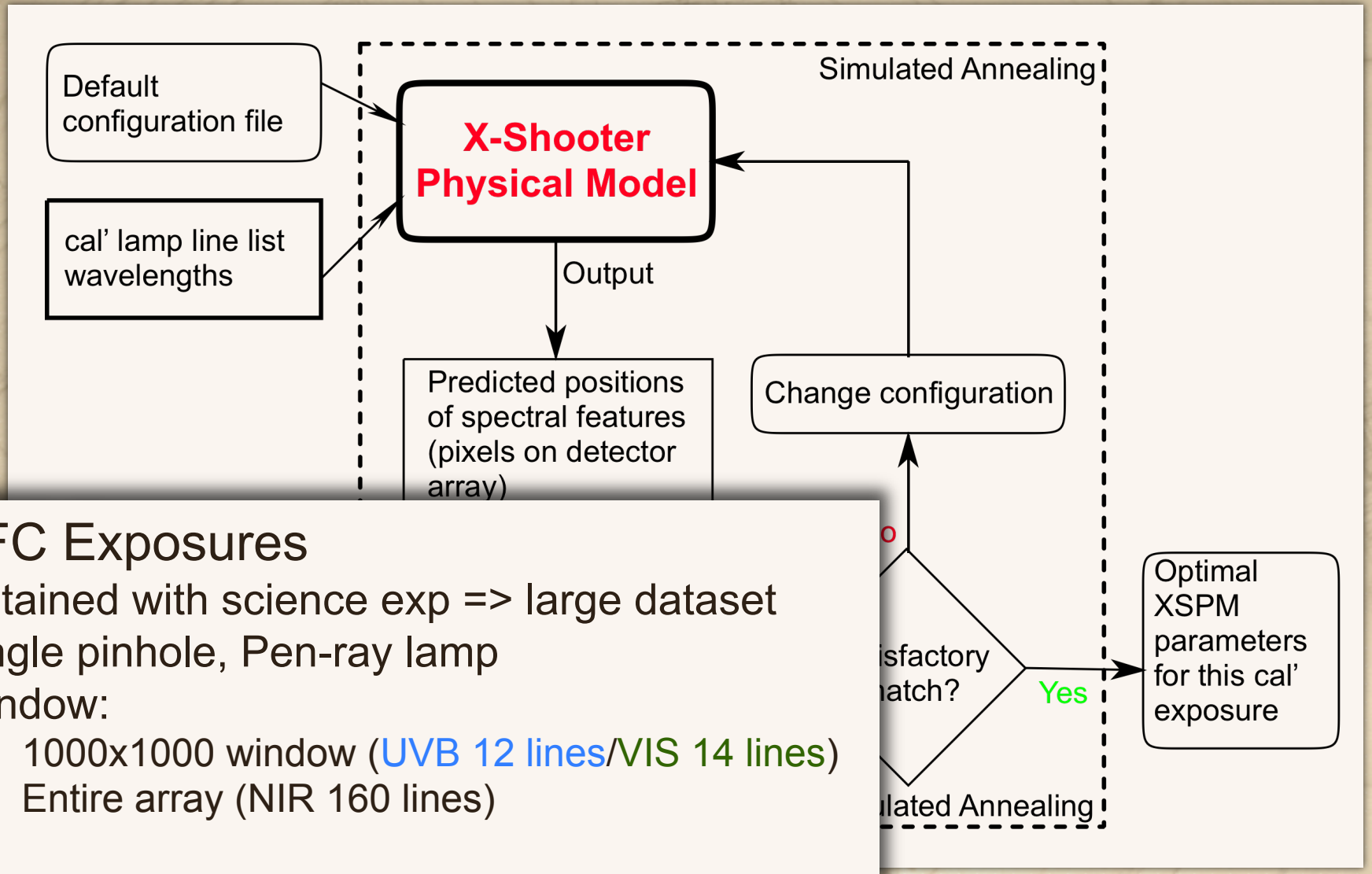
ESO

European Organisation for Astronomical Research in the Southern Hemisphere



ESO
European Organisation for Astronomical Research in the Southern Hemisphere

Physical Model Optimisation



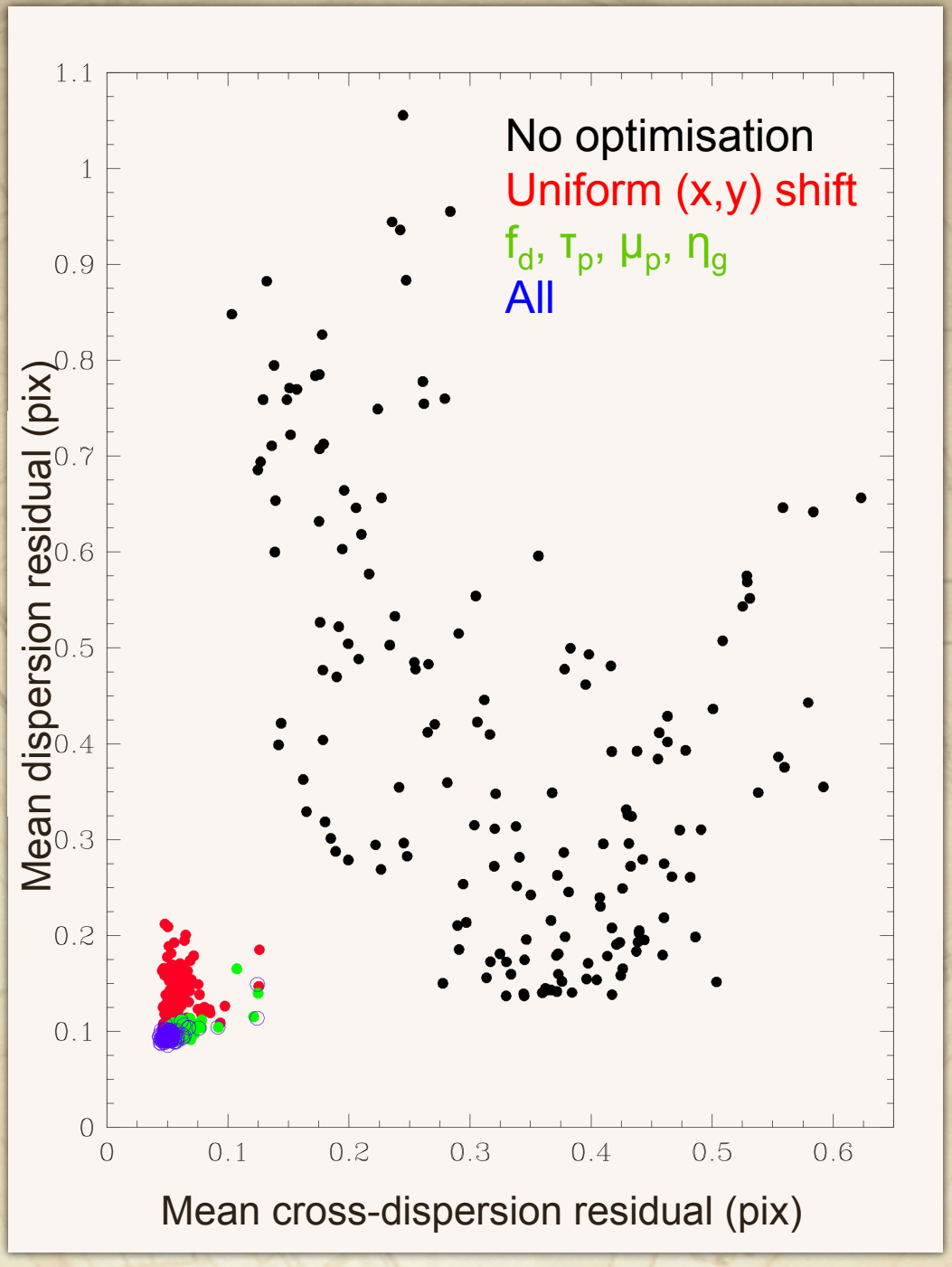
AFC Exposures

Obtained with science exp => large dataset

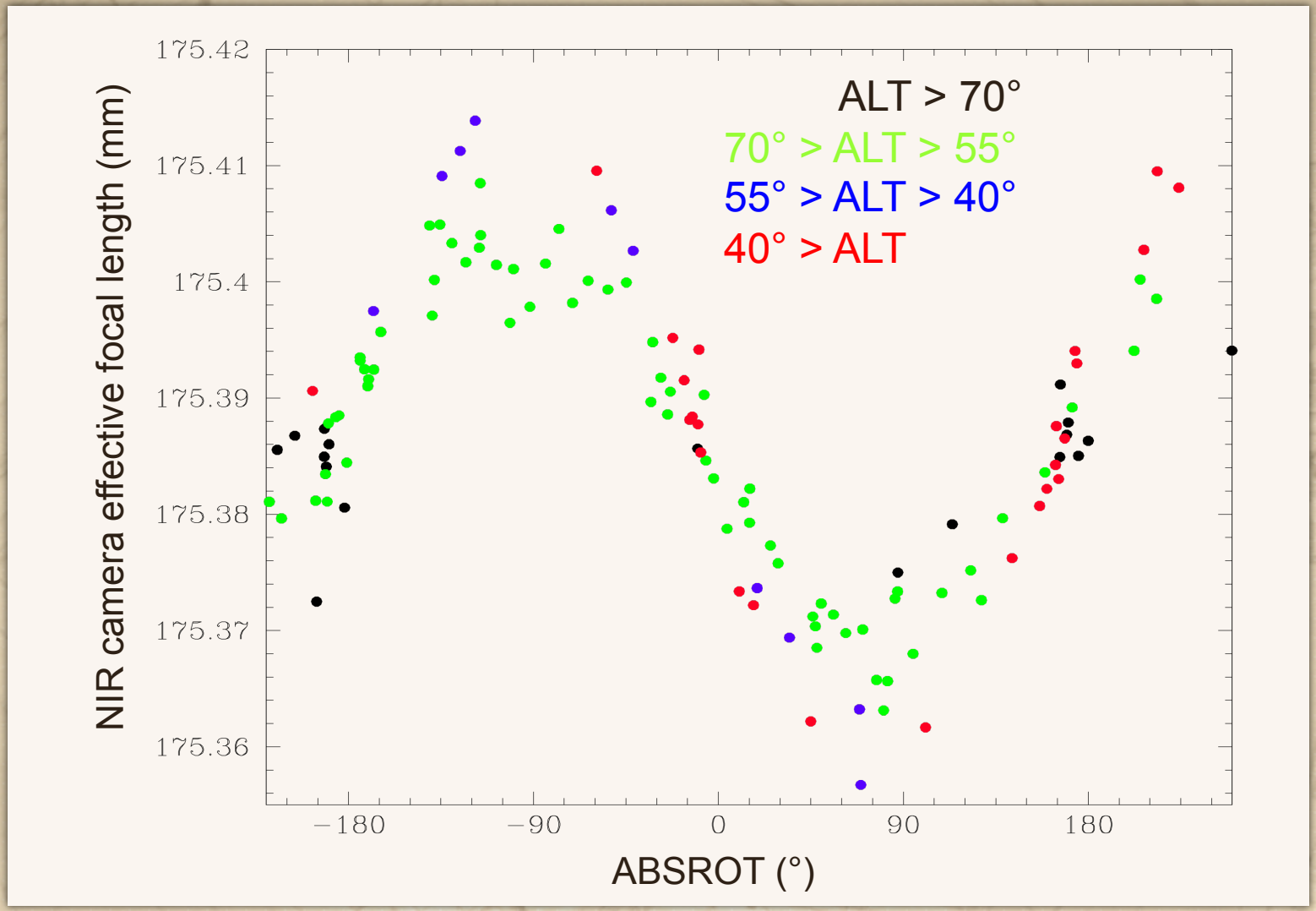
Single pinhole, Pen-ray lamp

Window:

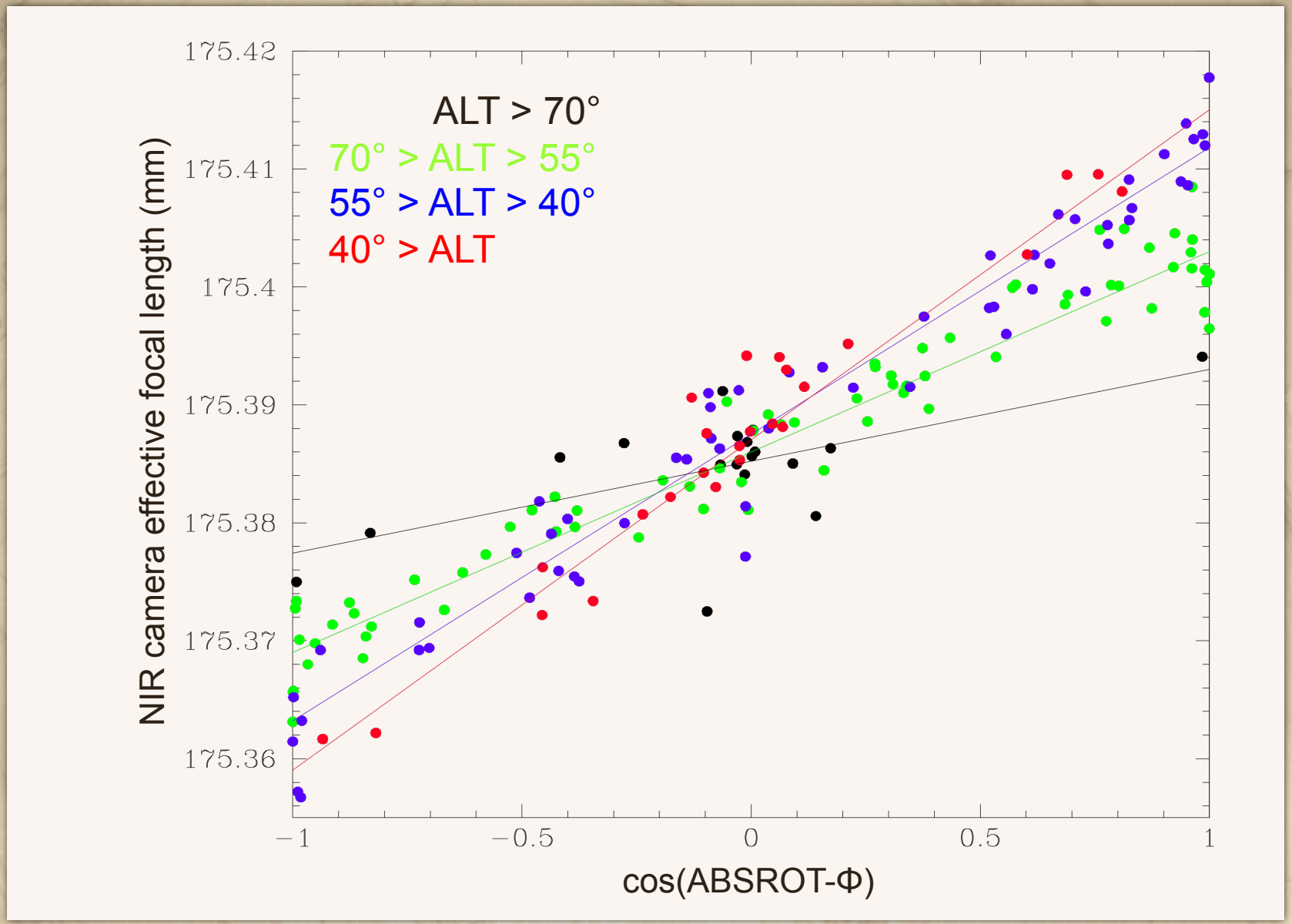
- 1000x1000 window (UVB 12 lines/VIS 14 lines)
- Entire array (NIR 160 lines)

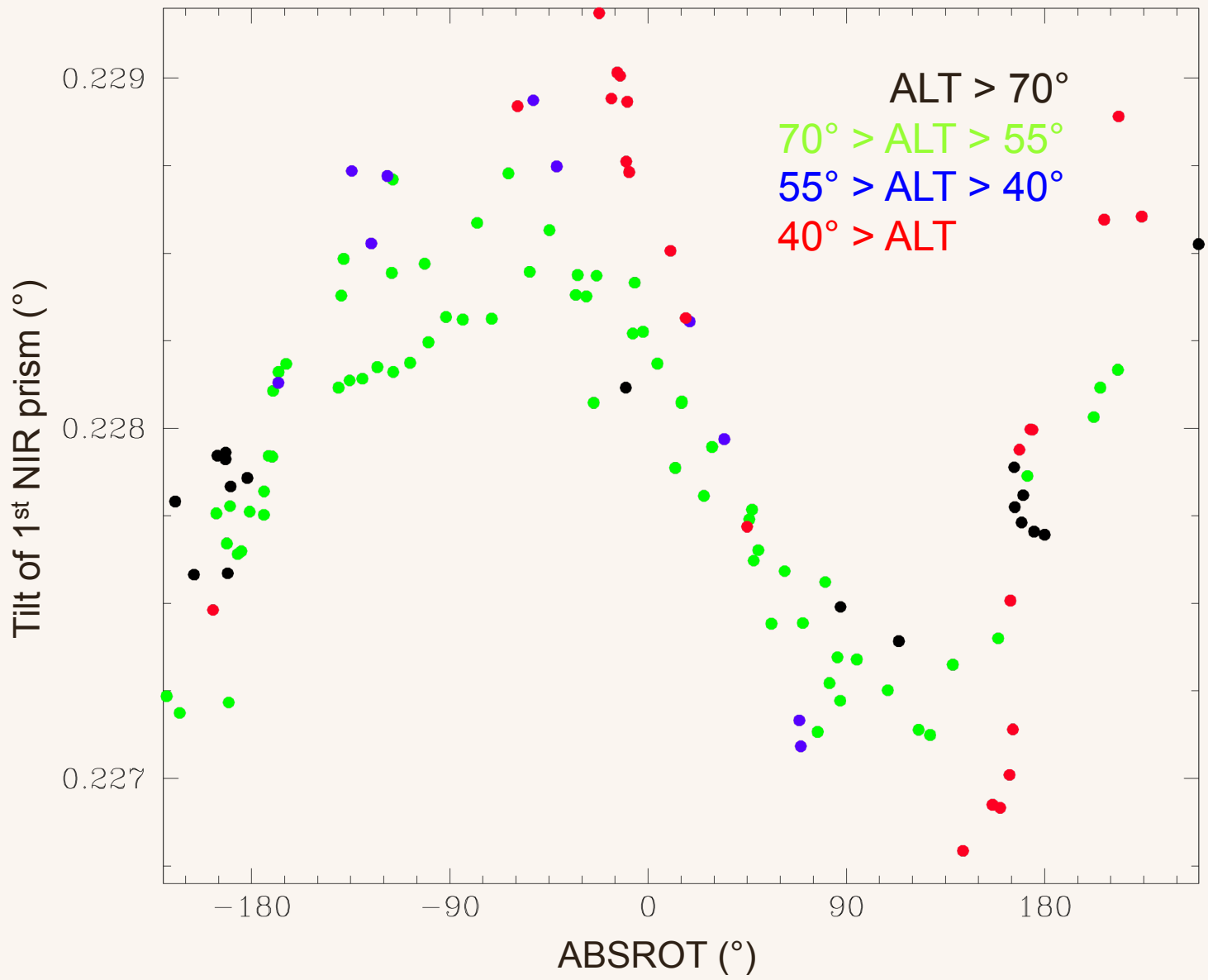


ESO
European Organisation for Astronomical Research in the Southern Hemisphere



ESO
European Organisation for Astronomical Research in the Southern Hemisphere




ALT > 70°
70° > ALT > 55°
55° > ALT > 40°
40° > ALT
0.229
0.228
0.227
Tilt of 1st NIR prism (°)
−180
−90
0
90
180
ABSROT (°)

ESO
European Organisation for Astronomical Research in the Southern Hemisphere

Conclusions

- This method gives an insight into the behaviour of physical components of X-shooter:
  - Dependency upon environmental conditions
  - Sudden changes
  - Flexure
- Degeneracy is a major consideration
- Physical interpretation should be treated with caution.