EO Level1 – Lessons learnt

GOMOS pointing accuracy

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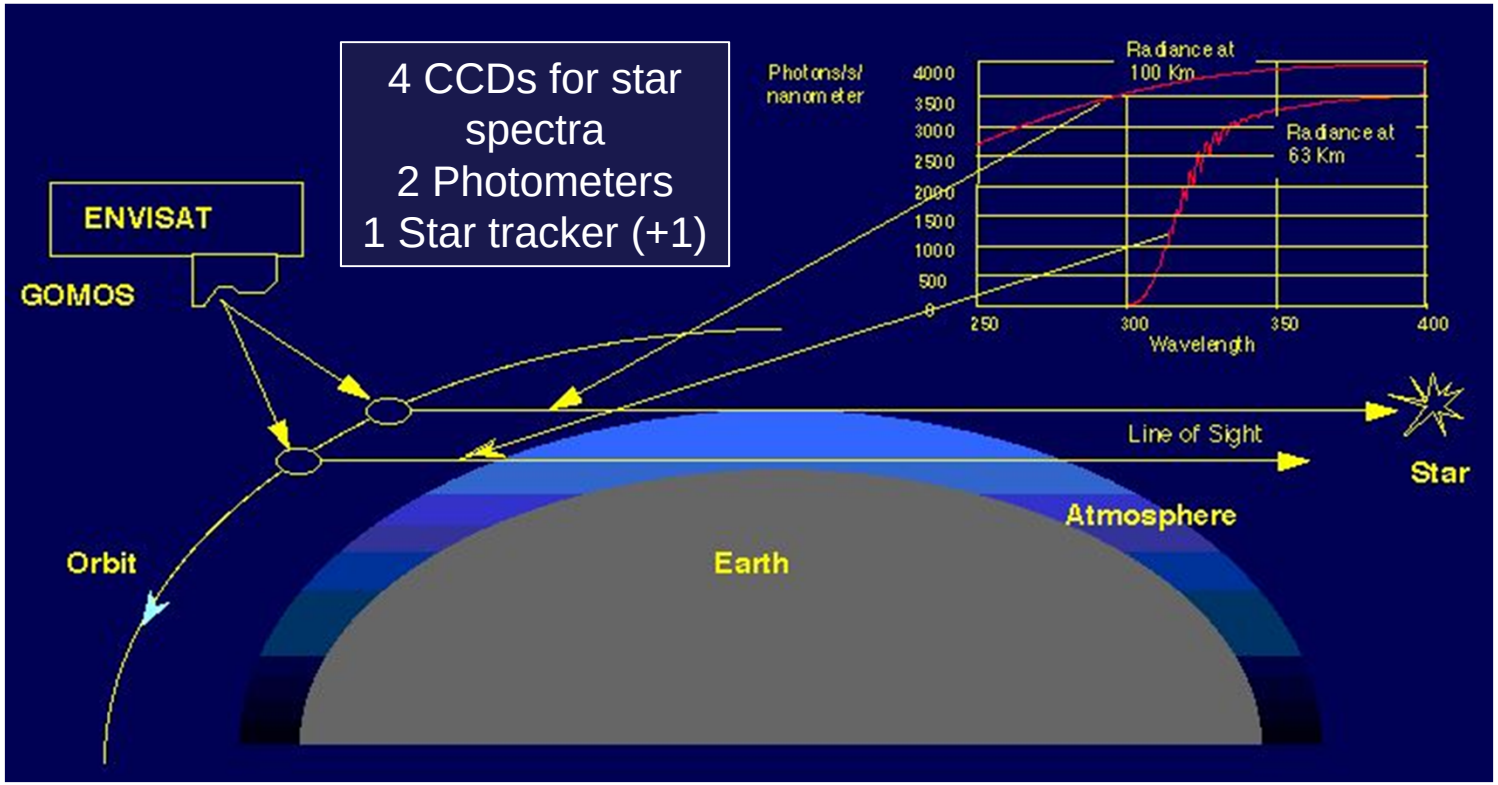
ESRIN

GOMOS
Global Ozone Monitoring by Occultation of Stars

- GOMOS instrument measures star spectra during star set (30-40 stars per orbit – night/day illumination).
- First spectra outside atmosphere are used to compute a "reference star spectrum".
- Following spectra are used to compute transmission spectra and error bars (from an error model).
- Transmission and error spectra are send from L1 to L2 to retrieve species densities as well as tangent point characteristics.

GOMOS
Global Ozone Monitoring by Occultation of Stars

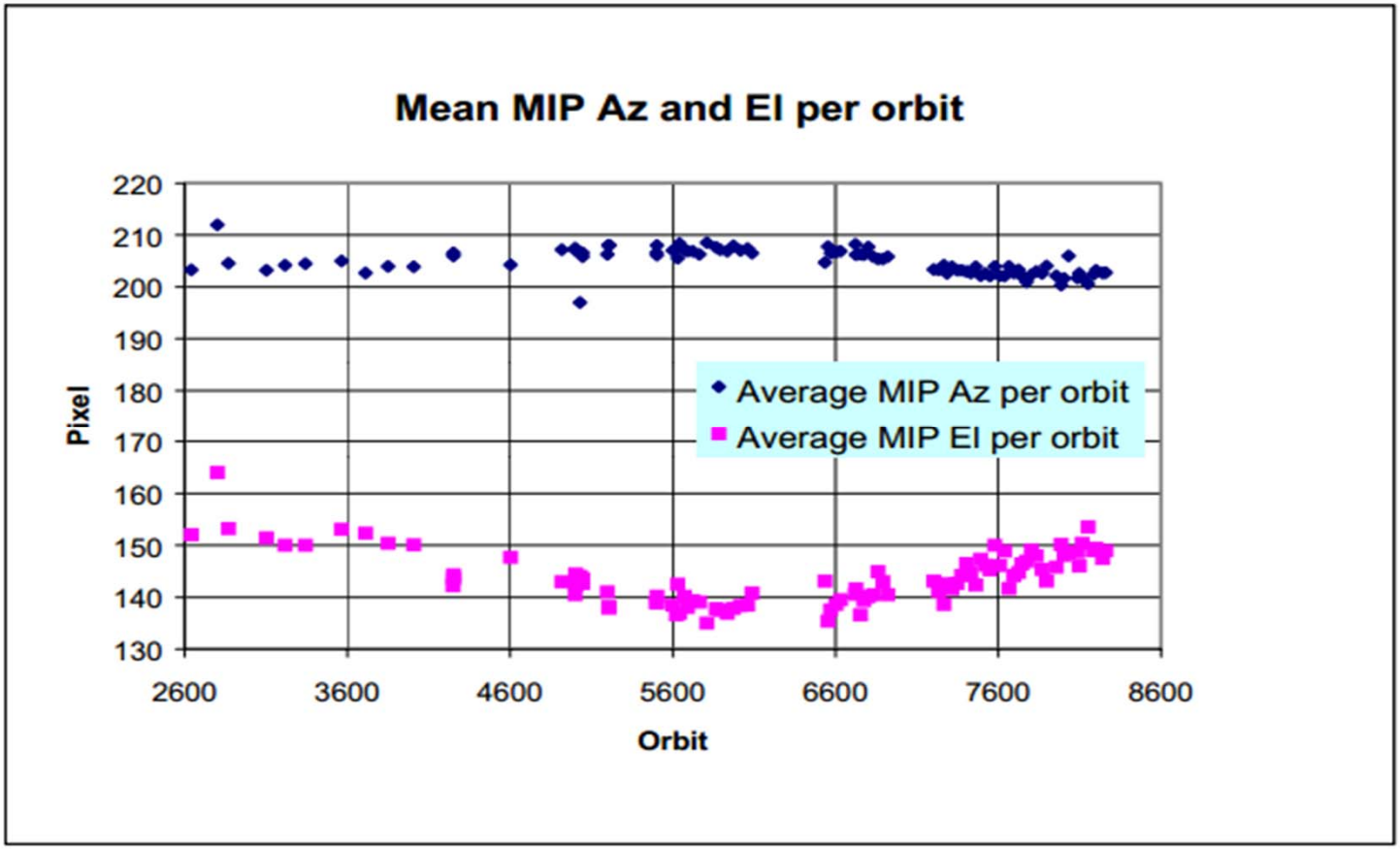
GOMOS was programmed regularly to reach *rendez-vous* points with stars (seen outside the atmosphere): time, pointing angle and initial velocity. Then, the star is centered in the GOMOS telescope and tracked until the bottom of the atmosphere where the star is lost while its spectrum is measured (dt=0.5s).



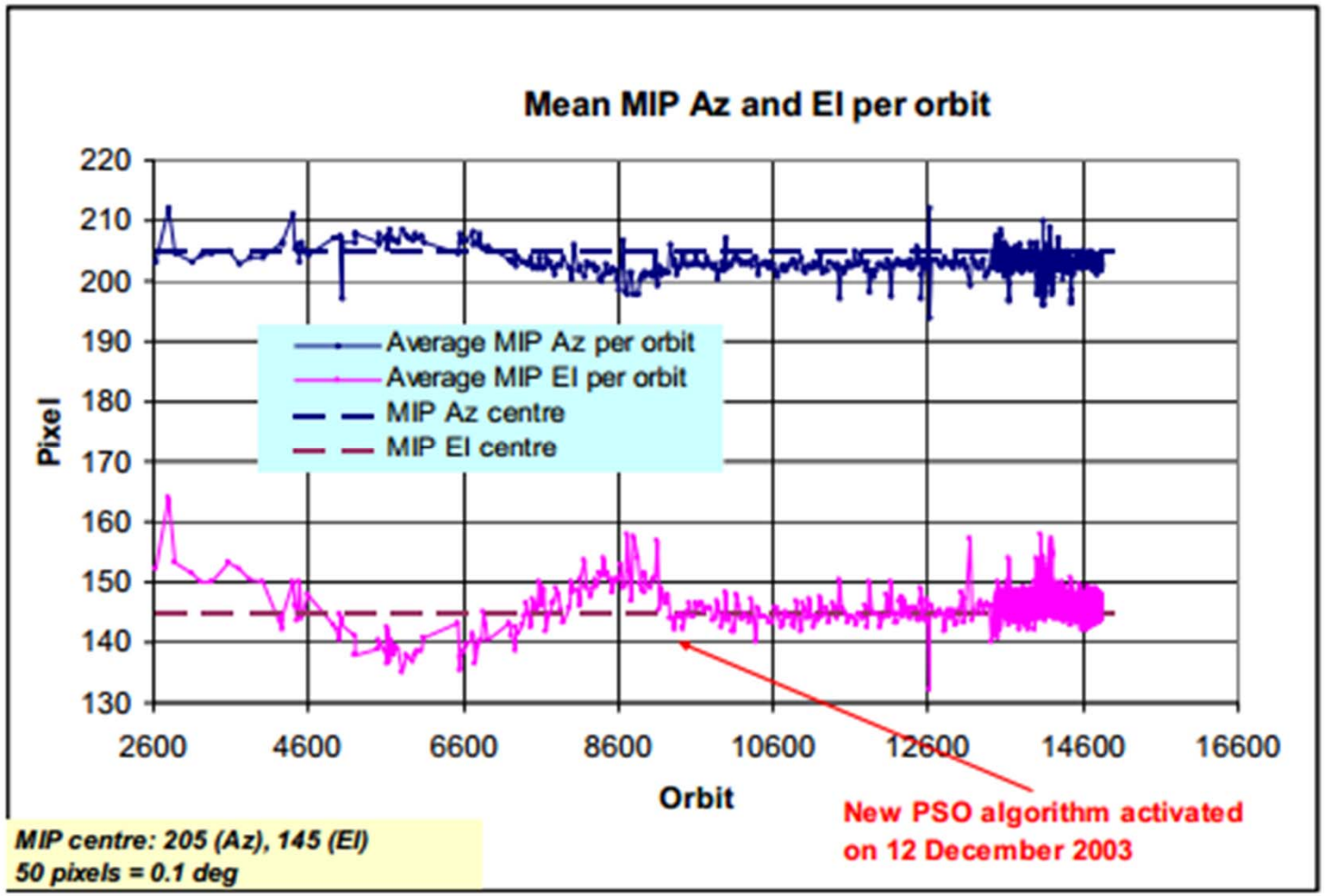
GOMOS MIP in 2002-2003

The MIP (Most Illuminated Pixel) is the star position on the SATU CCD in detection mode

The variation in MIP positions seems to be seasonal and it is an indicator of deviations from expected ENVISAT platform attitude.

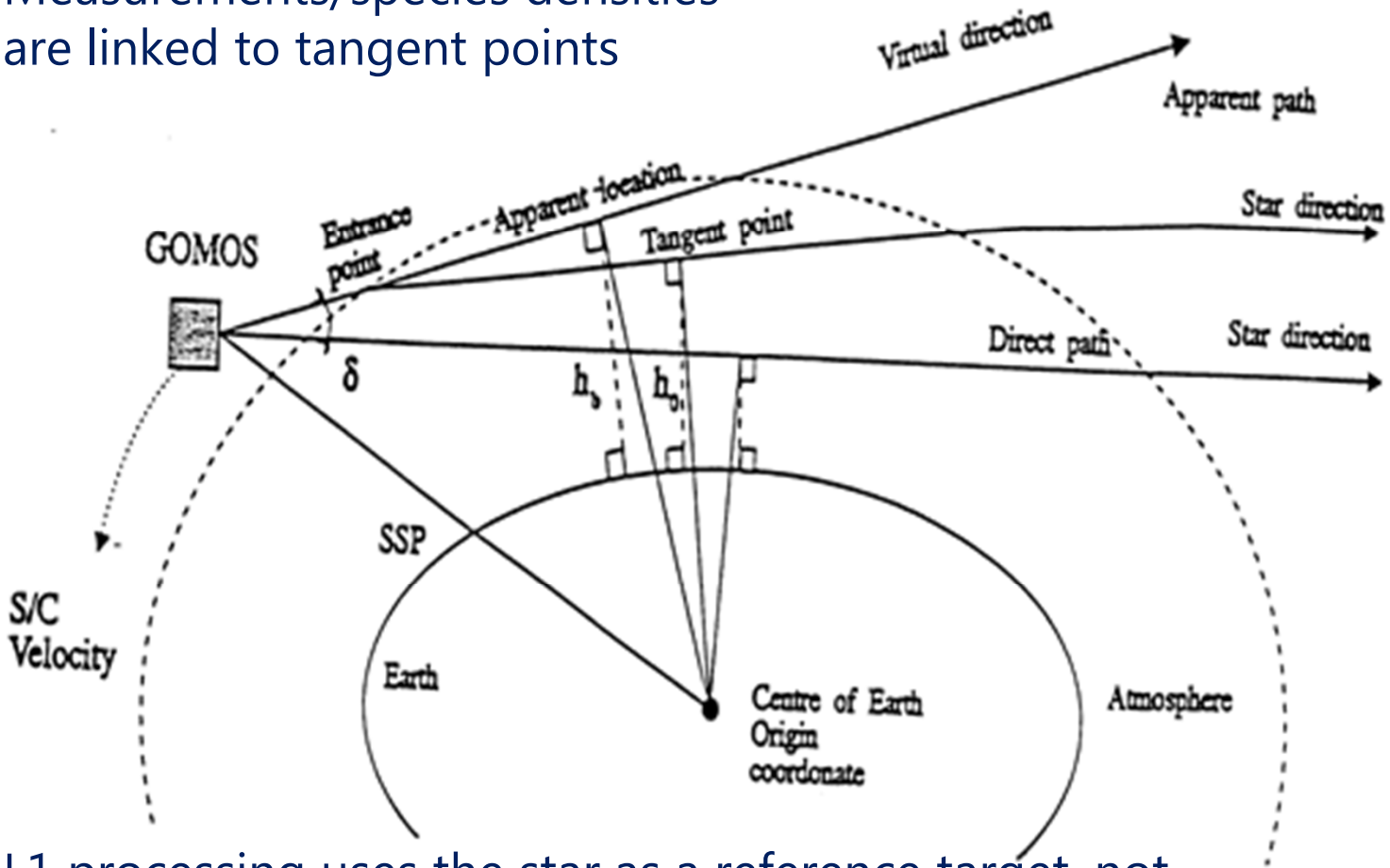


GOMOS MIP in 2002-2003



GOMOS
Tangent point definition

- Measurements/species densities are linked to tangent points



- L1 processing uses the star as a reference target, not pointing information provided by the sensor

GOMOS
Global Ozone Monitoring by Occultation of Stars

GOMOS needs an accurate platform position and attitude knowledge to have a correct RV time with the stars !

The tracking is performed thanks to a star tracker.

RV altitude
120 km

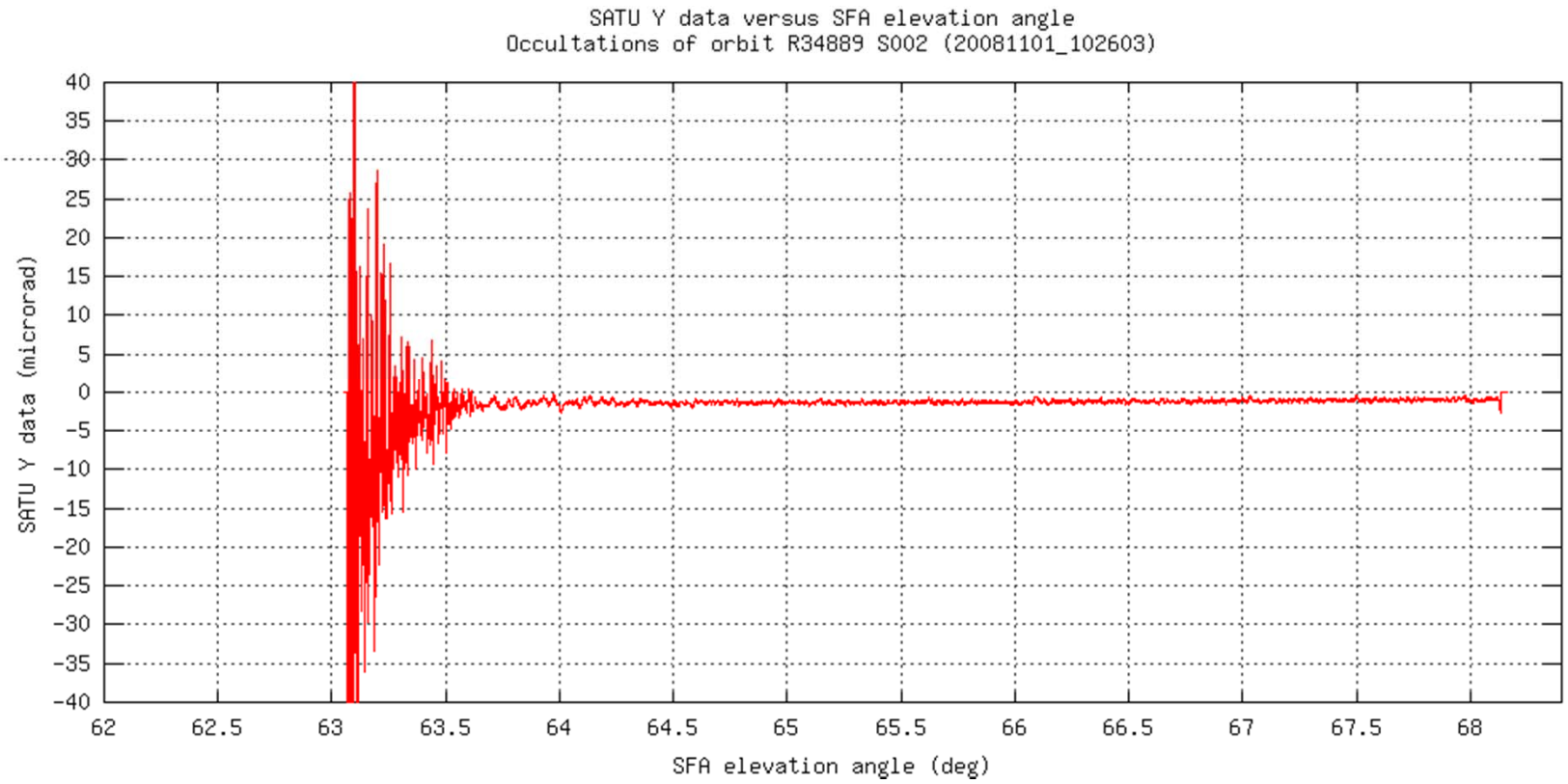
Star tracker output is used to correct the mirror velocity i.e. to accelerate or slow down the relative movement of the star image.

Vertical velocity is *almost* constant as a function of the observation azimuth angle.

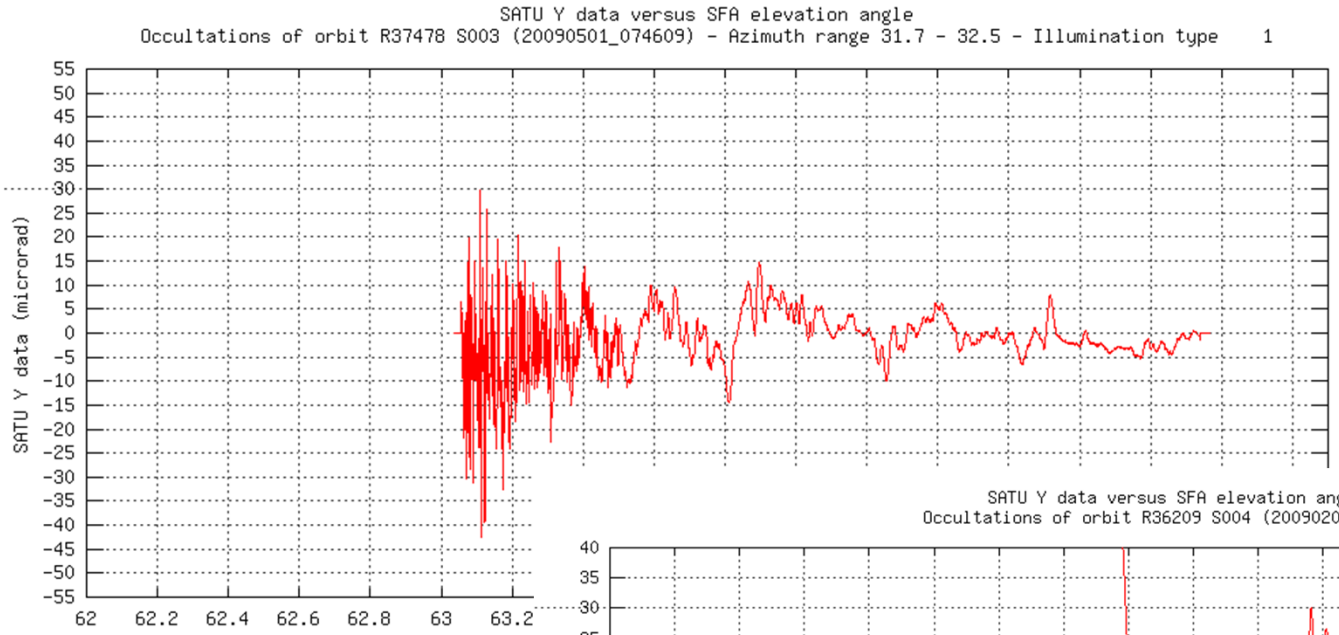
Chromatic refraction (at low altitude) leads to smaller vertical velocity.

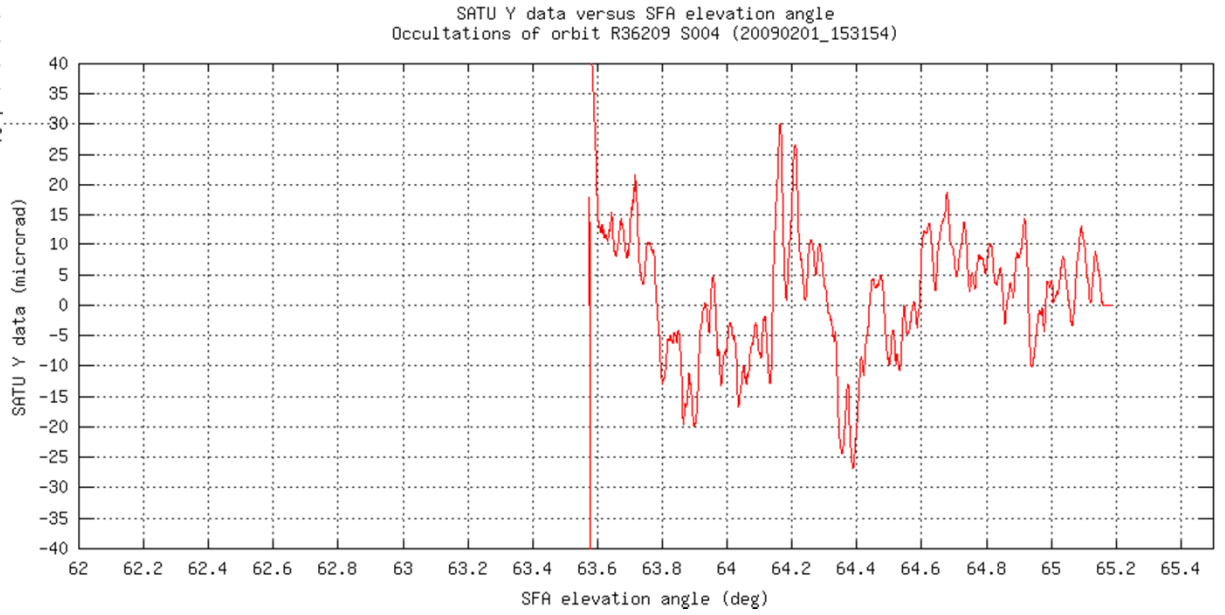
SATU-Y data versus altitude
Nominal sensor behavior

SATU-Y output: difference between the expected and "real" star location

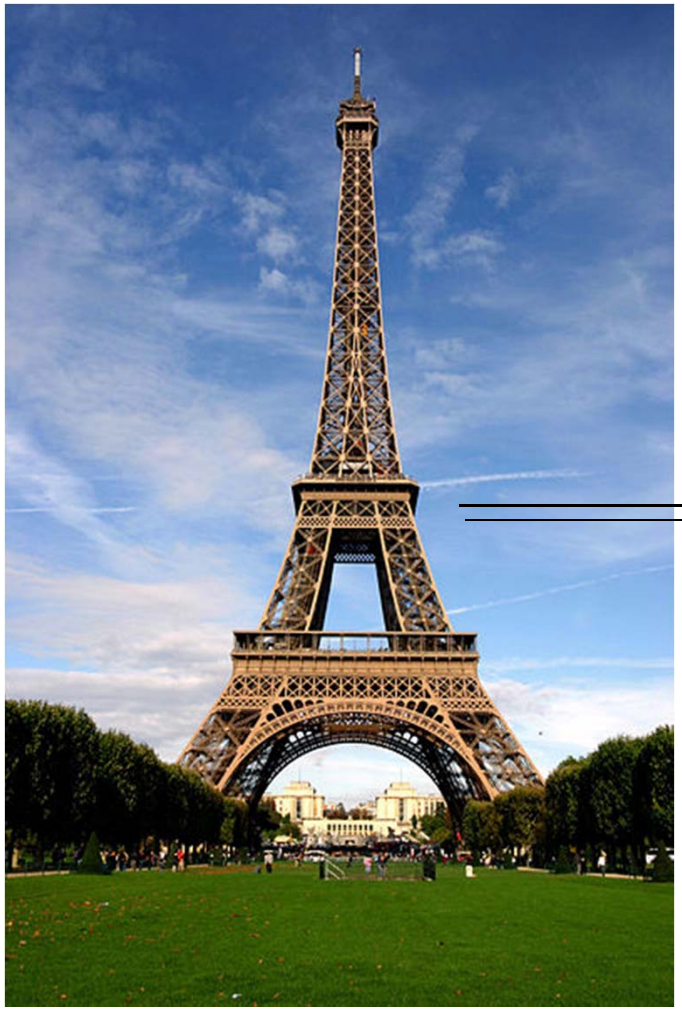


SATU-Y data versus altitude During anomaly





SATU-Y data versus altitude
2 µrad ?



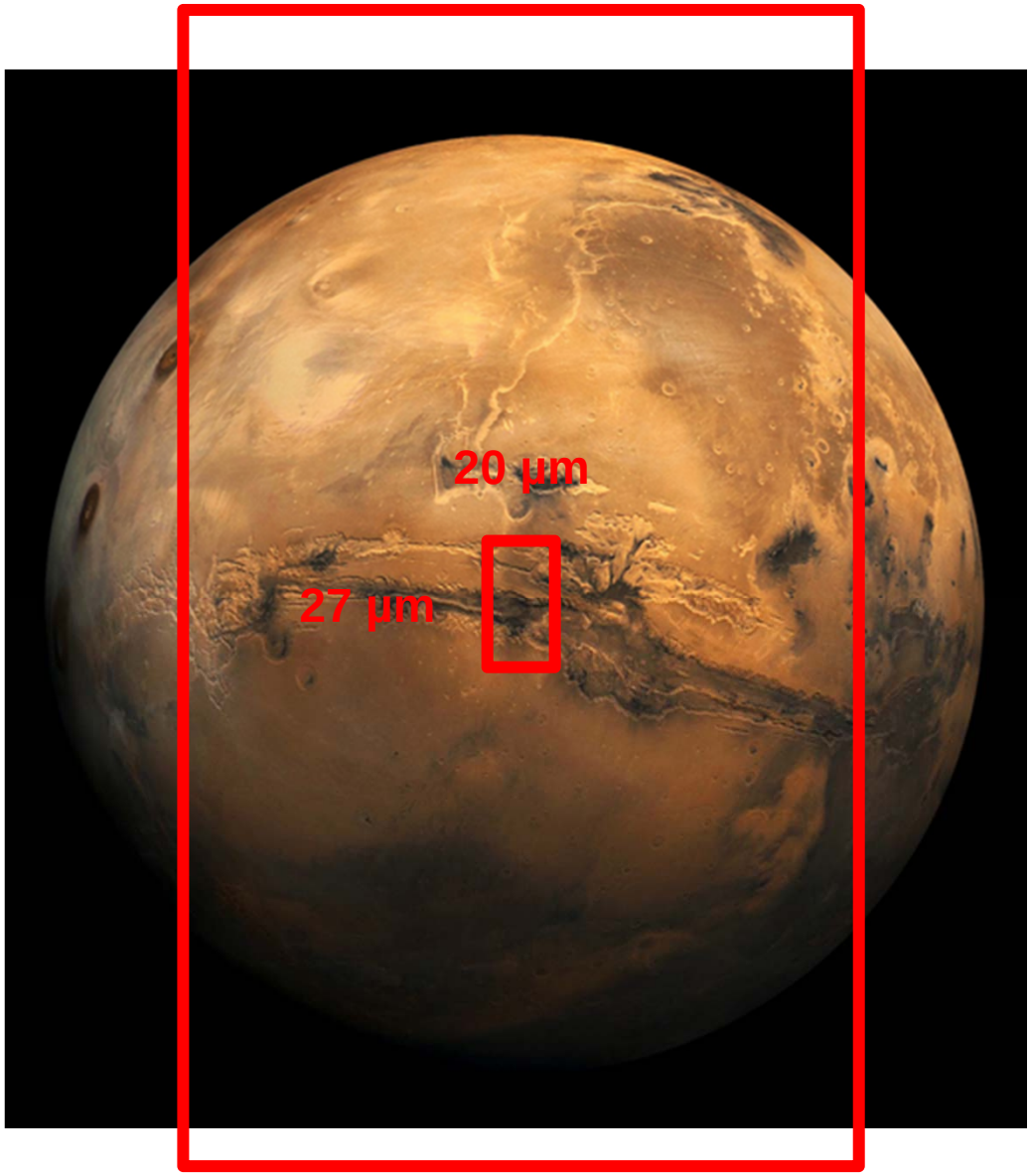
Observed GOMOS pointing variation (before scintillation)

2 µrad as seen from Roma

3 m


Mars

Projection of a GOMOS pixel and of the slit width on the Mars surface

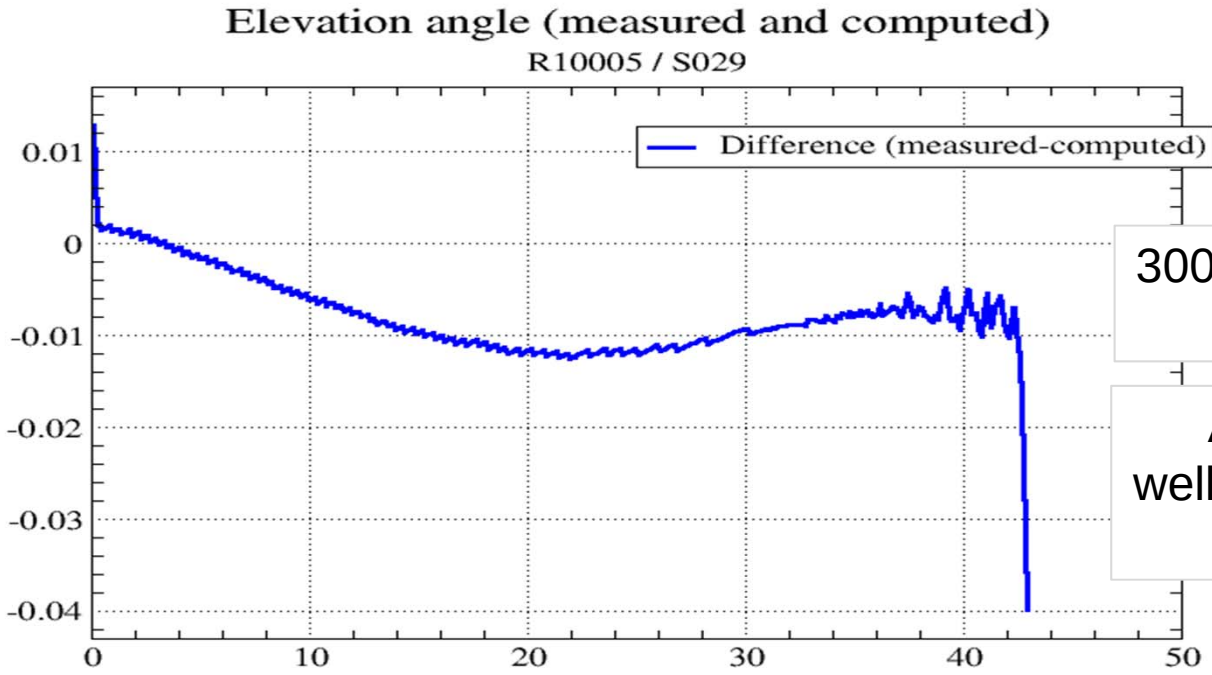


Theoritical vs measured angles

L1 processing: absolute pointing accuracy of GOMOS: only rely on Envisat position knowledge (which is well known) + star location (heliocentric).

If expected attitude is not correct : GOMOS misses the *rendez-vous* with the star ! Only required by the Mission Planning

A posteriori: GOMOS star tracker + SFM measured pointing angles provides information. We can compare the theoretical and measured angles.



300 m at 3000 km distance

Actually not fully well-understand source of difference

Tangent point altitude accuracy vs altitude

TGP altitude is computed thanks to 3D density grids (ECMWF) using a ray tracing model.

ECMWF error bar (fn of altitude) is used to determine the error in altitude accuracy at the TGP.

Error of 100 m at 20 km due to air density error.

Is not linked to the Envisat attitude knowledge

Total error: mostly pointing error linked to air density knowledge

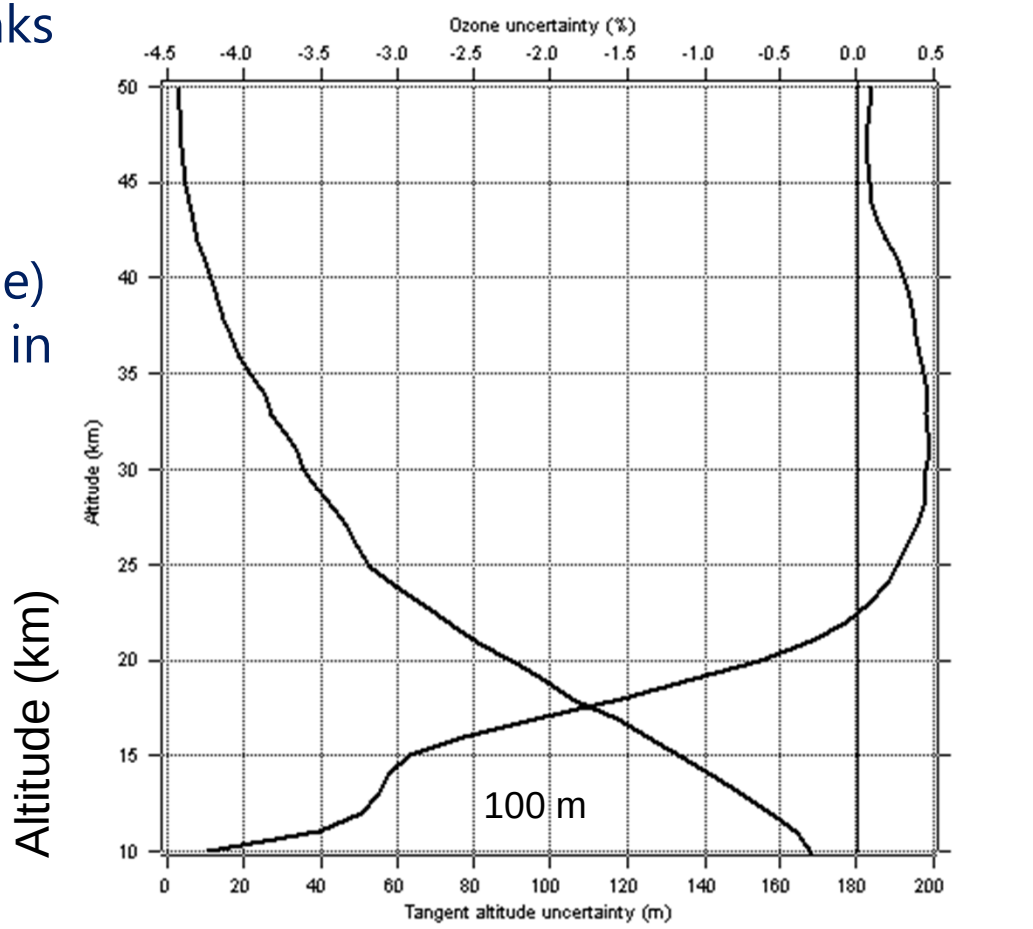


Figure 1: Uncertainty on tangent altitude (dashed line, bottom scale) and on ozone concentration (solid line top scale) due o uncertainties on refraction angle.

Altitude (km)

TGP altitude accuracy (m)

Thanks for you attention.

Thanks for the nice dinner…

Any question ?

L1 lesson-learnt animation