Pointing model and mirror alignment system

Lessons learnt from ASTRI and strategies for SST

Simone Iovenitti

SST's AIV SW meeting (link)

Milan, Feb 19-20 2024
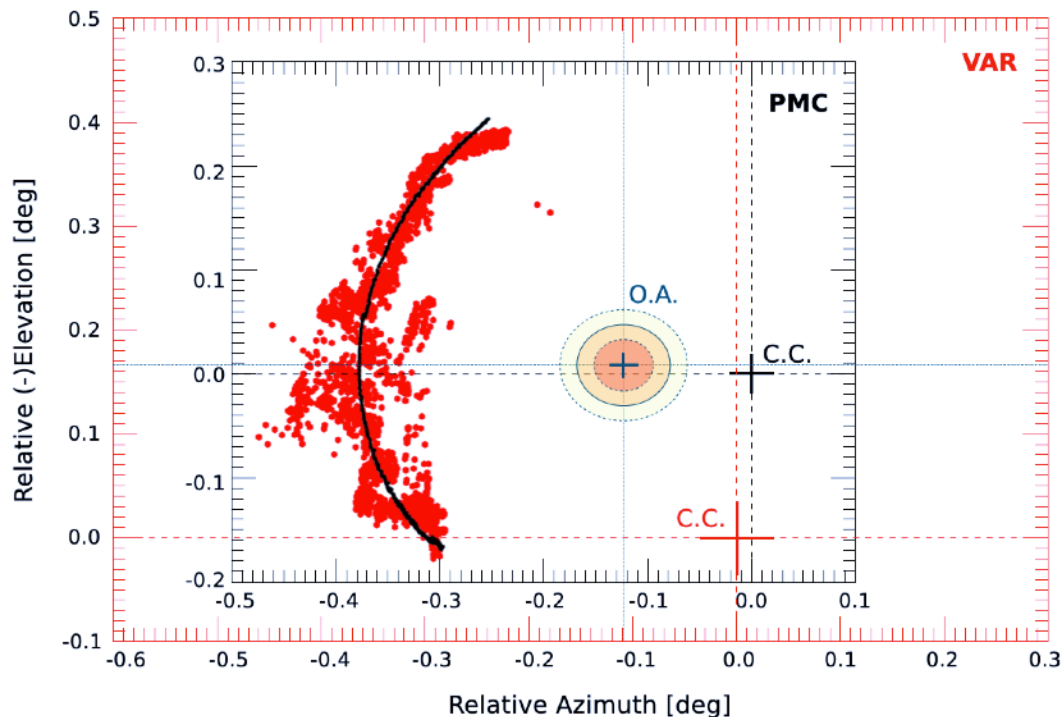
Pt.1) TELESCOPE POINTING MODEL

Pt.2) MIRROR ALIGNMENT SYSTEM

Real-case study: ASTRI-Horn (RUN1631)

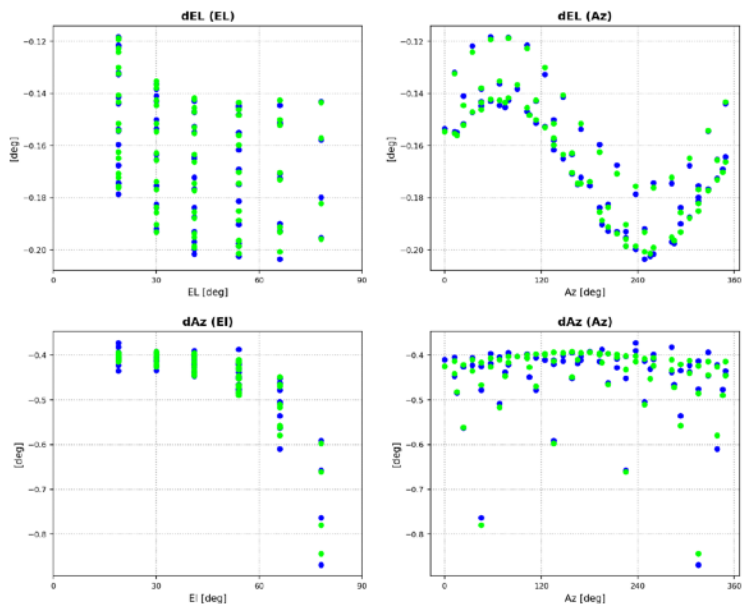Very good tracking precision, but low pointing accuracy.
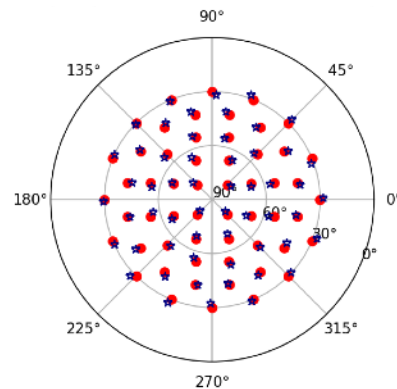

First problem:
PMC alignment.

Second problem:
ASTRICam alignment.

TPOINT - The algorithm

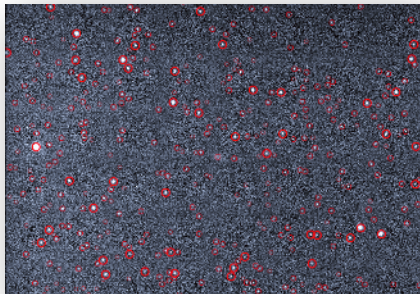Provide a set of parameters for the correction of pointing offsets.

- Python version (S.Iovenitti) on the AIV workstation
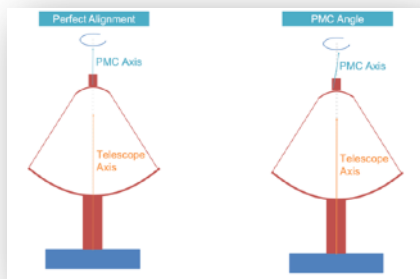- Java version (G.Tosti) implemented in the eng. GUI

Which instrument to use, PMC OPTICAM or SSTCAM?

TPOINT - PMC

Instrument dedicated to the monitoring of the pointing accuracy.

Astrometry of the PMC (see S. Germani contribution)

- arcsec level resolution
- implements astrometry.net
- adequate for the pointing calibration

Need for assessment (i.e. alignment verification)

- pointing at the local zenith
- rotating in azimuth
- PMC axis aligned with telescope axis.

TPOINT - OPTICam

OPTICam is the instrument dedicated to the PSF composition and optimisation.

- The focal spot **is created in the center** by the MAS (see later)

- What if that position is not aligned with telescope optical axis?
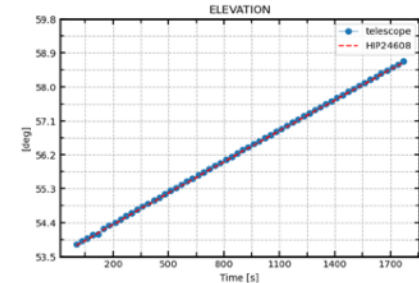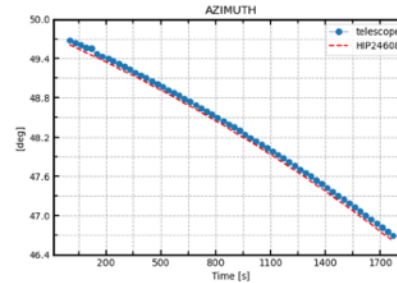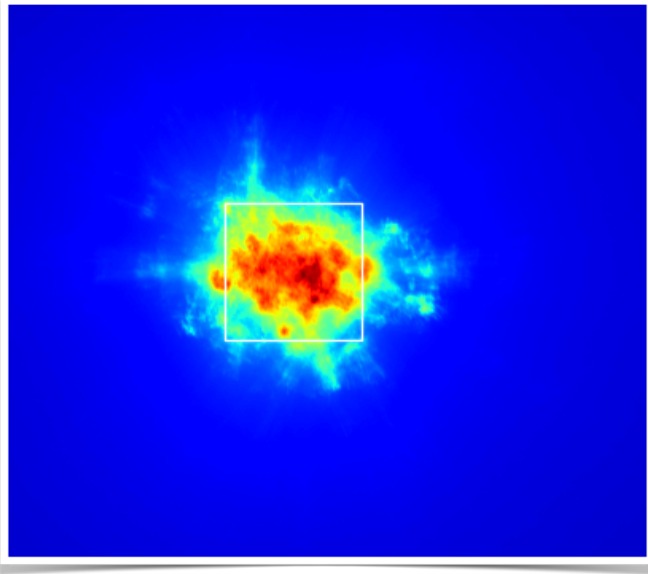
Measure and characterise any eventual offset

TPOINT - SSTCam

Assessment of camera alignment DURING AIV with different strategies

- standard astrometry of the focal plane
- long circular acquisition (in tracking mode or, better, in staring mode at the celestial pole)
- long straight acquisition

At least for the characterisation of any eventual offset!
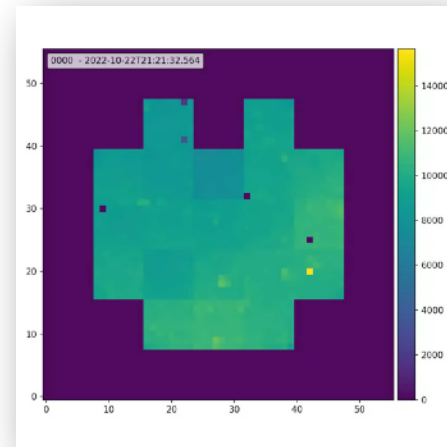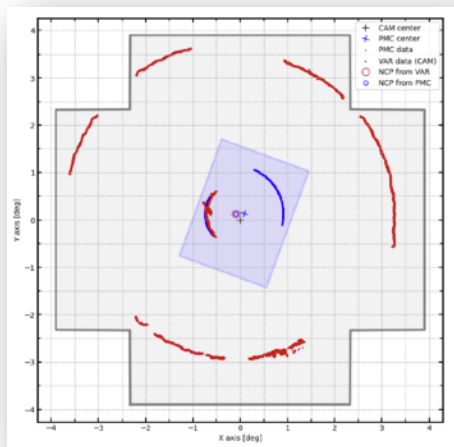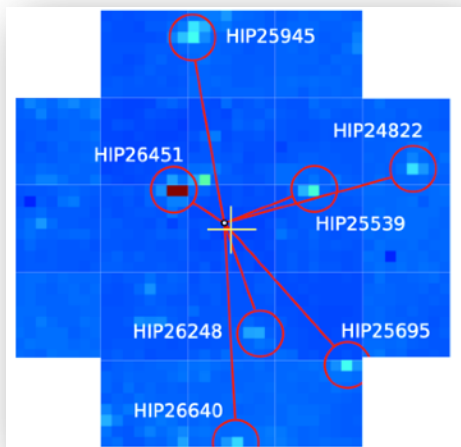
Full pointing calibration procedure

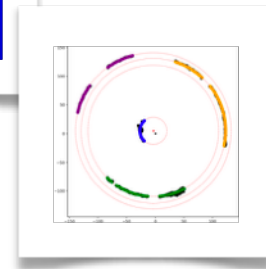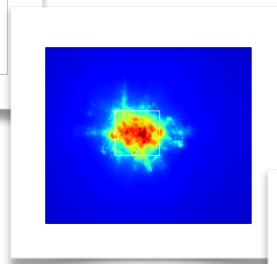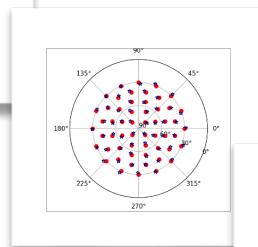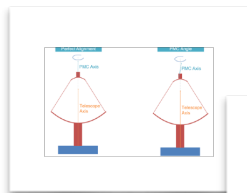**To be fulfilled in different moments (suggestion):**

✓ • PMC assessment

✓ • TPOINT w PMC

✓ • Pointing verification (or update) w OPTICam
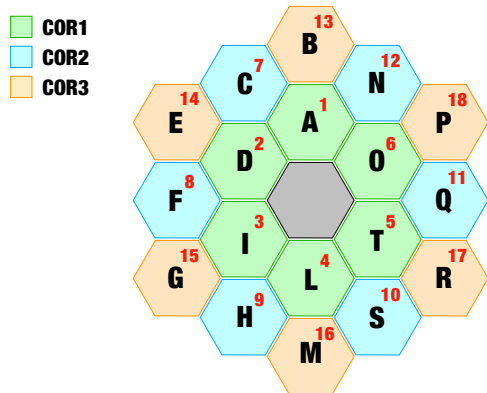
✓ • Pointing verification (or update) w SSTCam

Pt.1) TELESCOPE POINTING MODEL

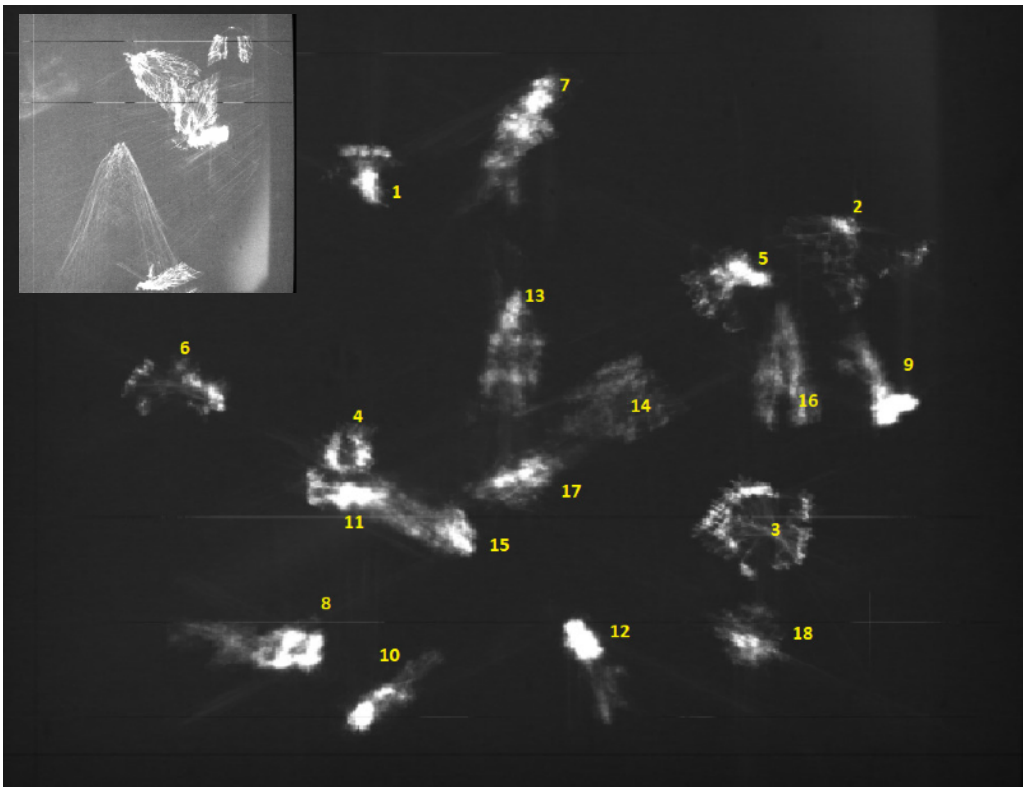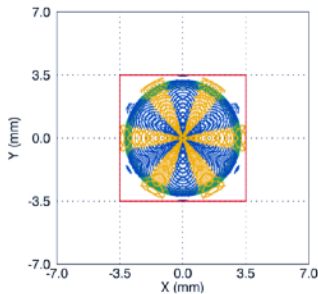# Pt.2) MIRROR ALIGNMENT SYSTEM

Recognizing segments

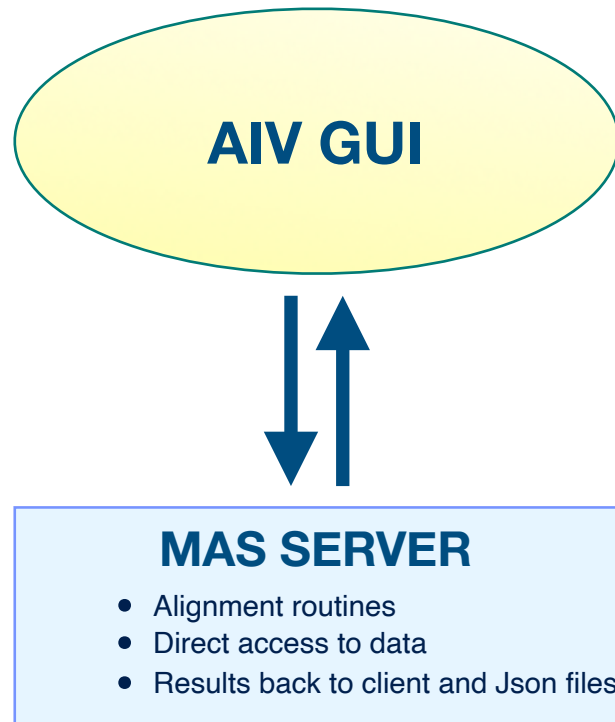Front view of the dish in park position:

PSF composition by design:

Mirror Alignment Software (MAS)

This software actually constitutes an independent component

- ✔ • Installed on the OPTICam computer

- ✔ • Controlled by a dedicated opc-ua server

- ✔ • Tested with ASTRI images and simulations

AIV GUI

MAS SERVER
- Alignment routines
- Direct access to data
- Results back to client and Json files

MAS STRATEGY

The goal is align the mirror segments, possibly **with a full automatic procedure** controlled by the MAS server.
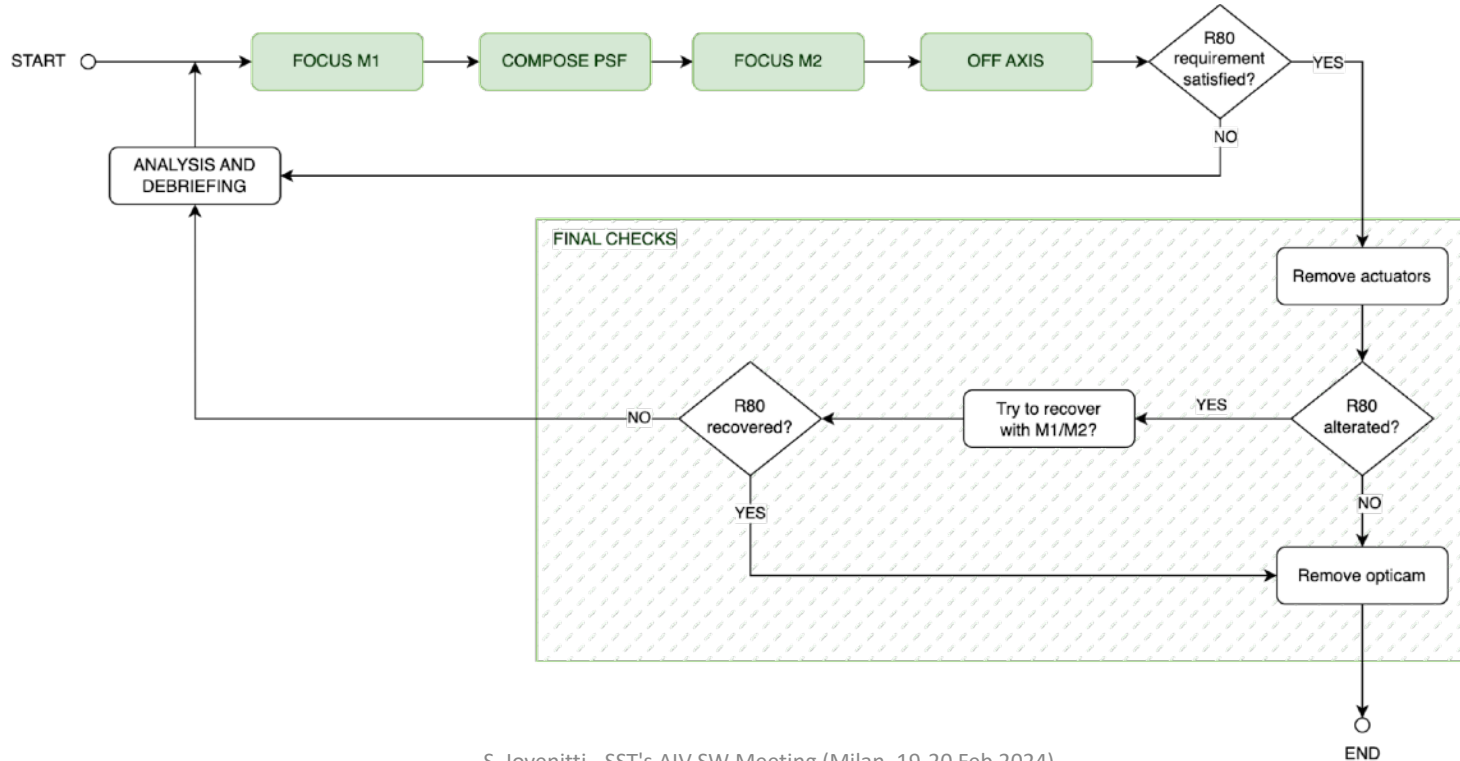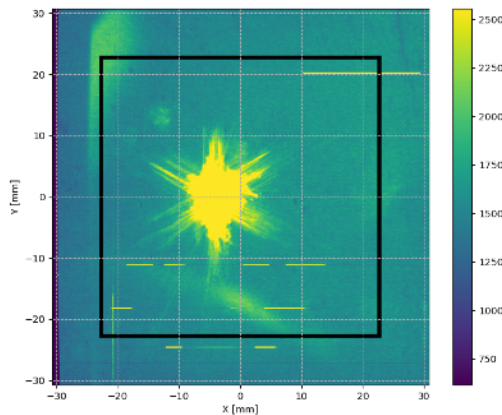
MAS ROUTINES

Besides several utilities, the MAS implements three fundamental routines, each one with specific inputs and outputs.
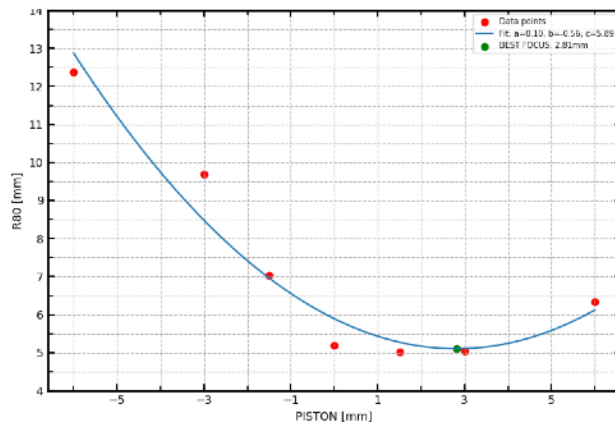
Centroid and Size

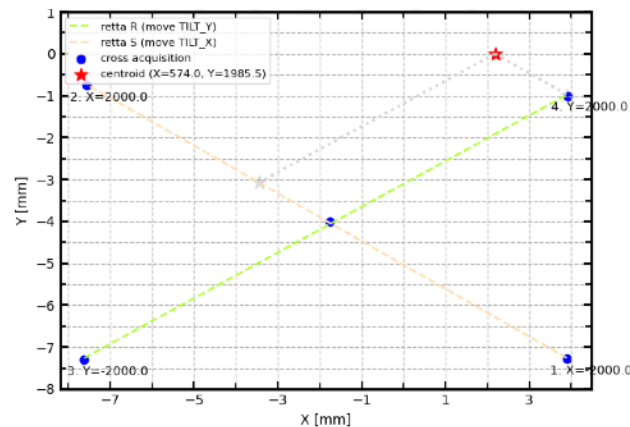Considering, flat-field, stray-light, same **ray-tracing** routines.

Best focus of a segment

Moving each mirror in **piston** we will find its best position along the z axis

Best position of a segment

provide the final TILT_X TILT_Y values for the correct **PSF composition**.

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