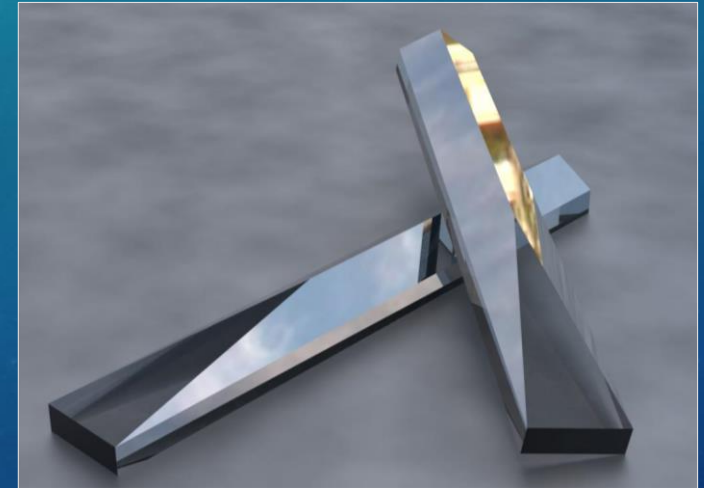


TOWARDS THE AUTOMATIC ALIGNMENT PROCEDURE OF THE INGOT WFS

AN UPDATE ON
LAB ACTIVITIES



Davide Greggio - INAF Osservatorio Astronomico di Padova

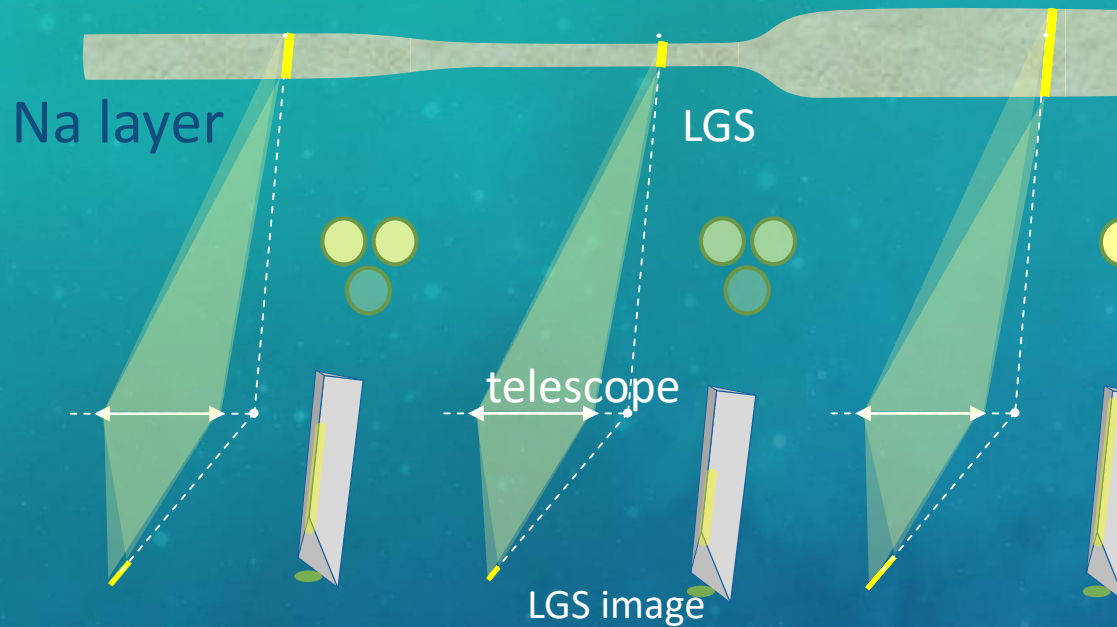


LABORATORIO
NAZIONALE
ADONI
OTTICA
ADATTIVA



Elisa Portaluri, Simone Di Filippo, Valentina Viotto, Roberto Ragazzoni, Carmelo Arcidiacono, Kalyan K. Radhakrishnan S., Maria Bergomi, Jacopo Farinato, and Demetrio Magrin

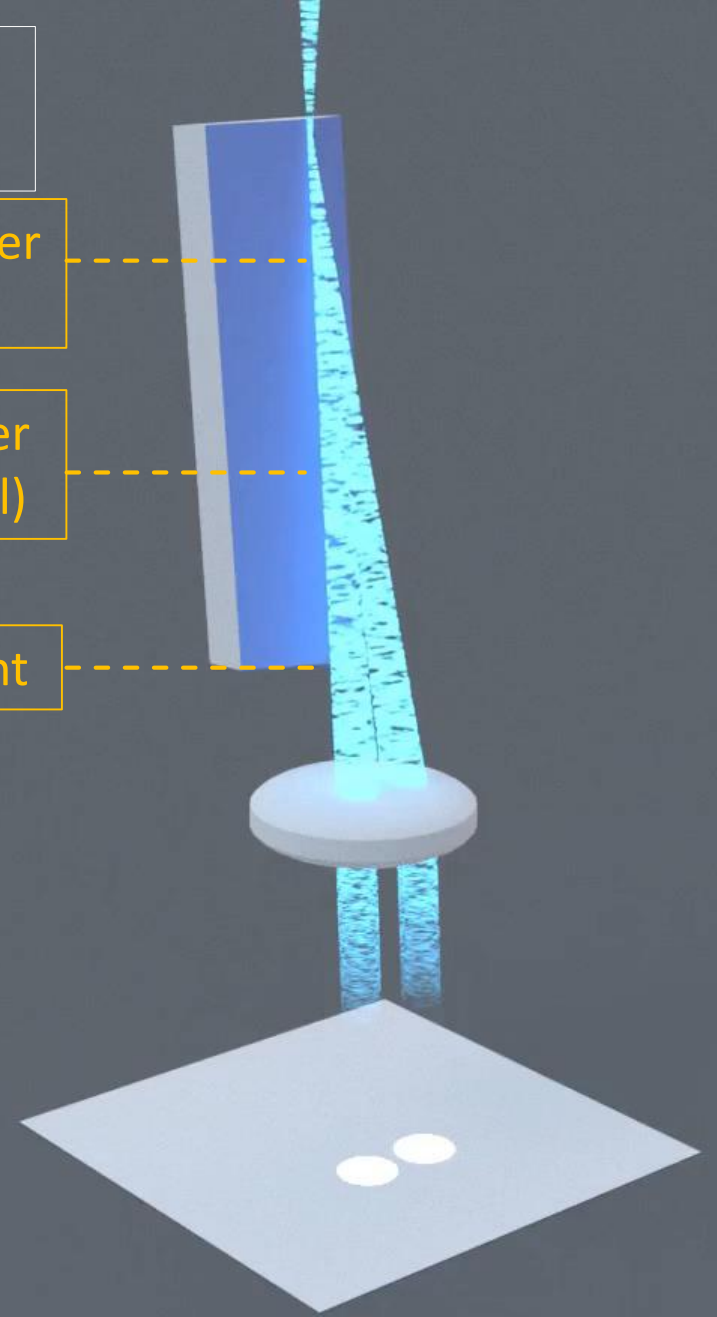
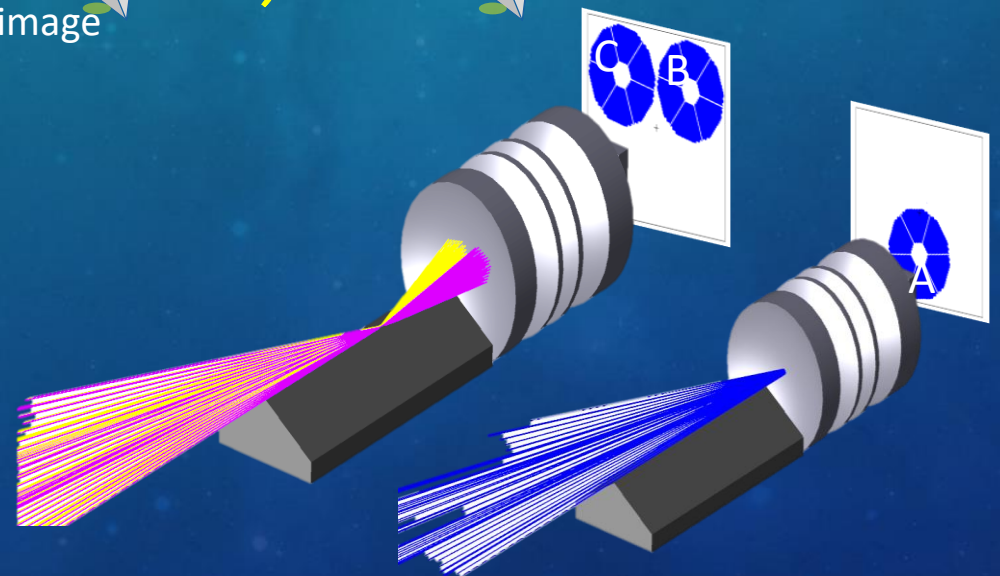
INGOT SUPER QUICK SUMMARY



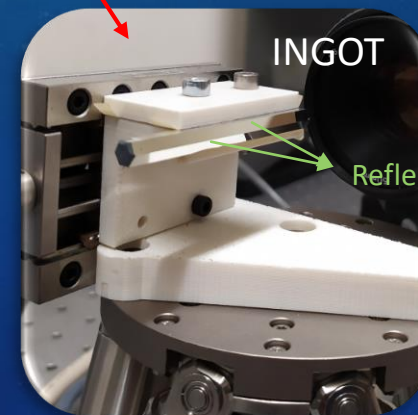
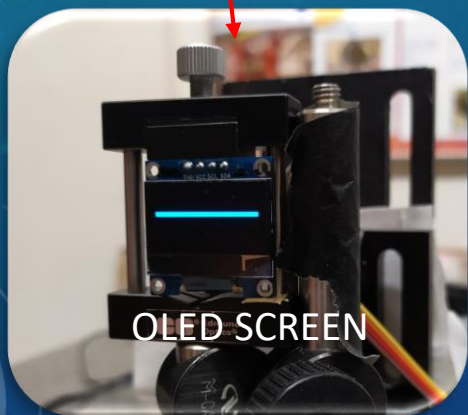
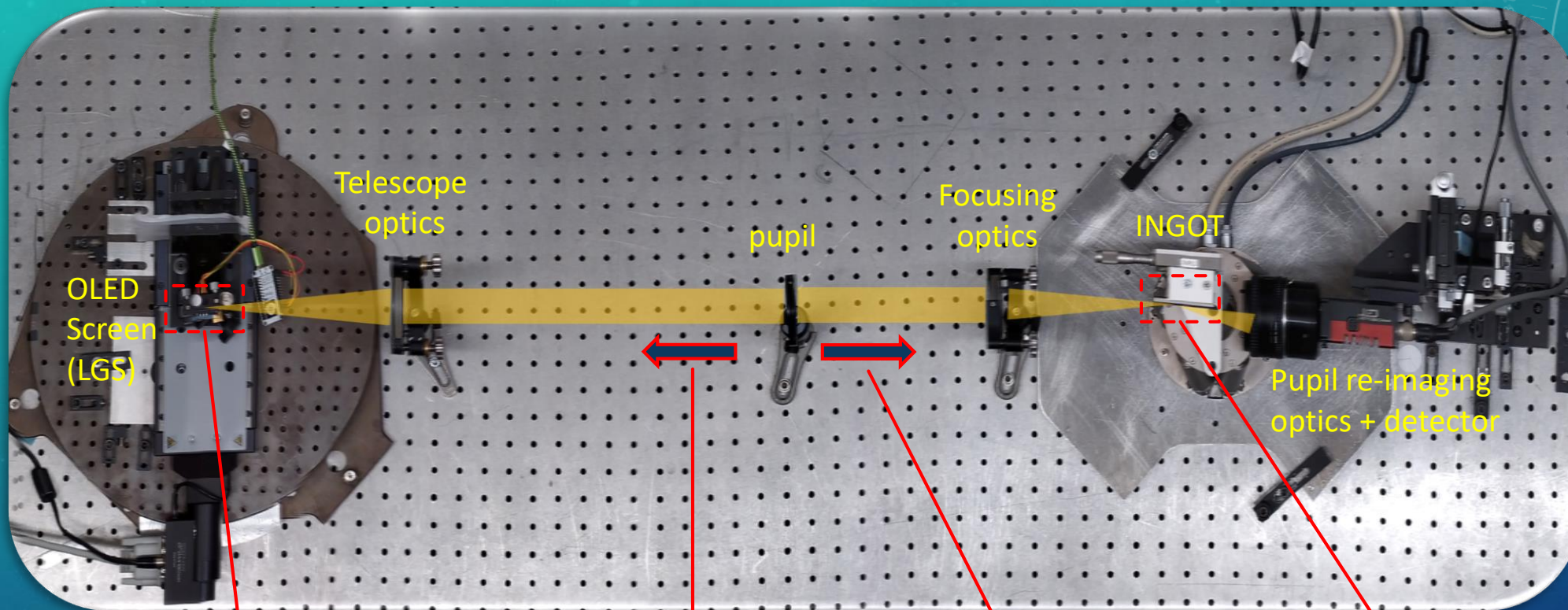
Higher "highest" Na layer
(longest Na & zenith)

Lower "highest" Na layer
(shortest Na & lowest el)

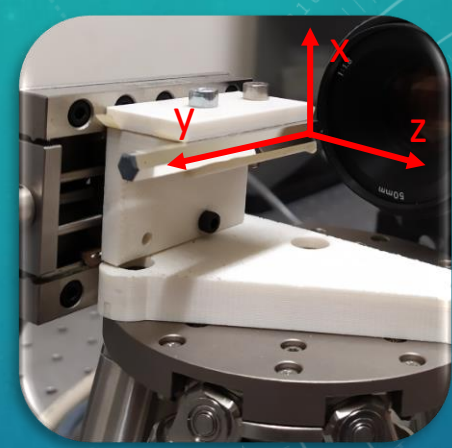
Lowest Na layer point



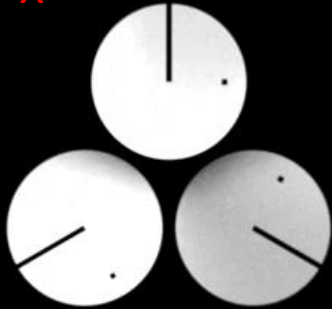
LABORATORY SETUP



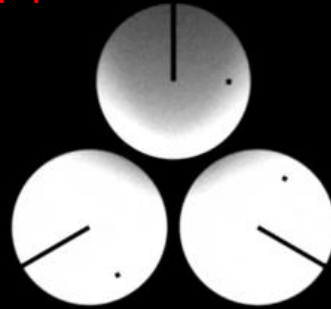
DEGREES OF FREEDOM



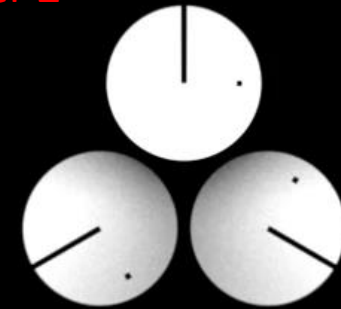
Decenter X



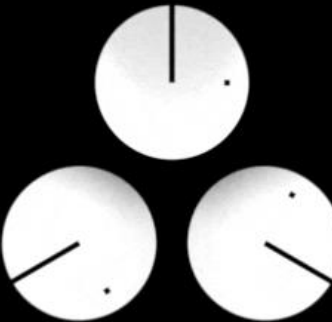
Decenter Y



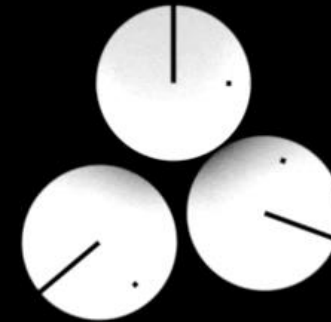
Decenter Z



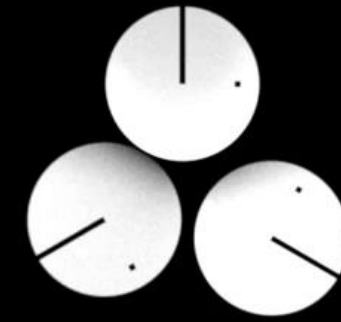
Tilt X



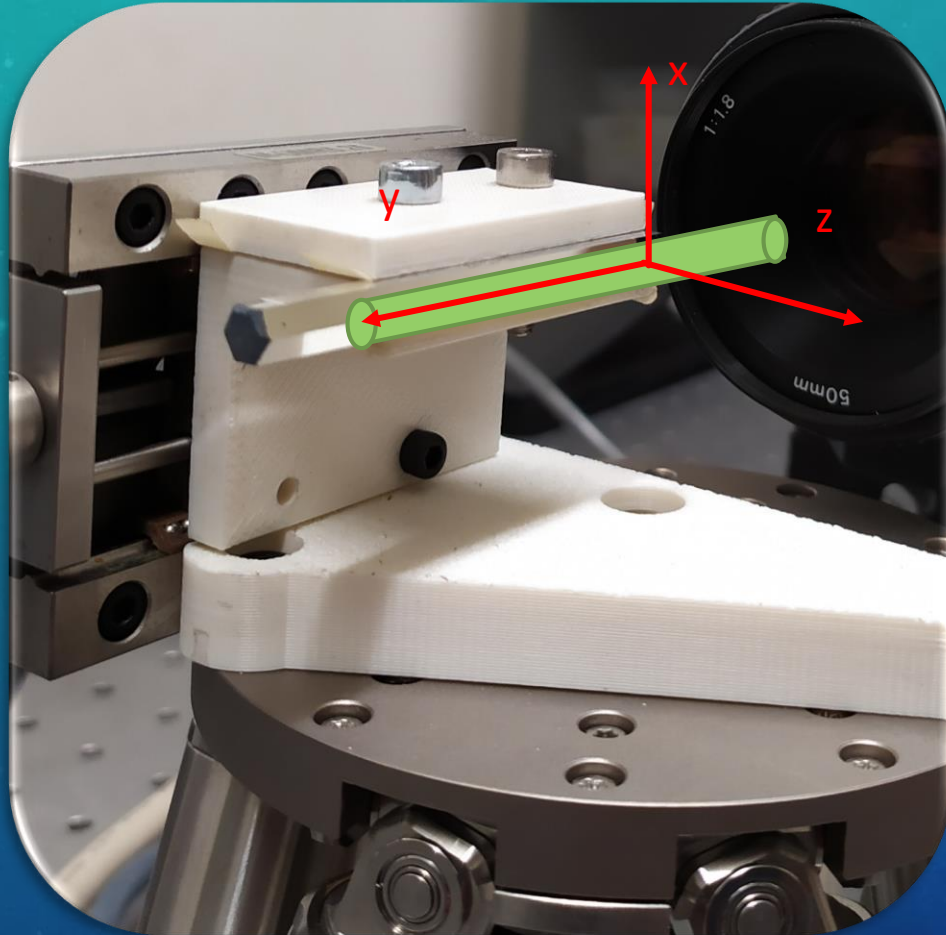
Tilt Y



Tilt Z



DEGREES OF FREEDOM

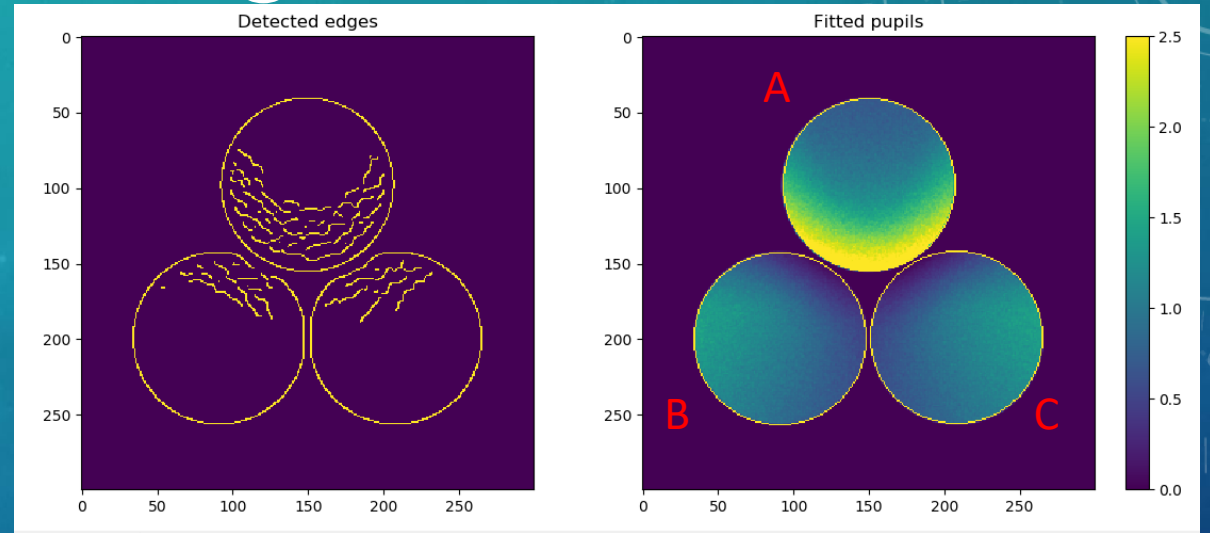


The LGS is approx a cylinder: a rotation around Y has negligible effect on the signal due to rotational symmetry!

CALCULATION OF SIGNALS

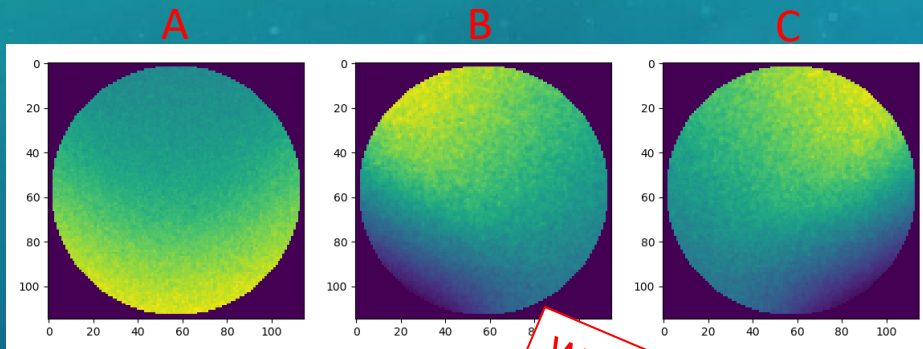
1

PUPILS DETECTION



2

PUPIL EXTRACTION + (Rotation, flipping)



WE WILL TEST ALSO OTHER
WAYS TO CALCULATE SIGNALS

SIGNALS

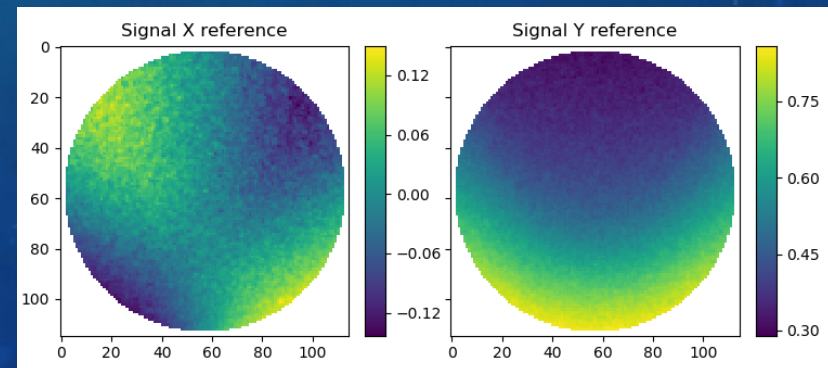
$$S_x = \frac{B - C}{A + B + C} - \frac{B_{static} - C_{static}}{A_{static} + B_{static} + C_{static}}$$

$$S_y = \frac{A}{A + B + C} - \frac{A_{static}}{A_{static} + B_{static} + C_{static}}$$

*static pupil is the one without errors (reference slope)

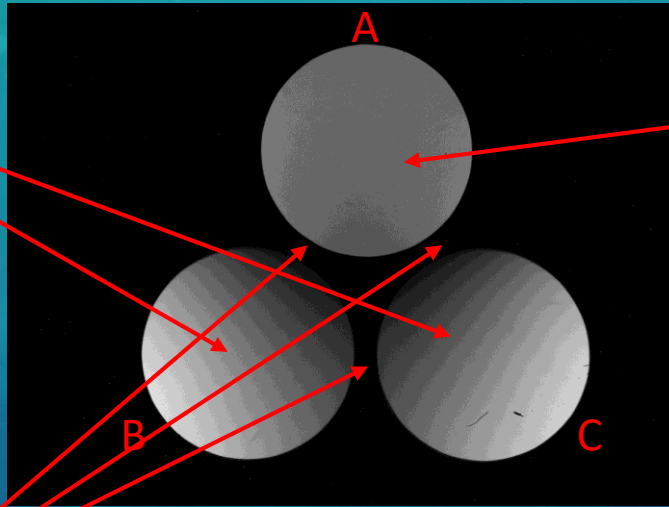
3

SIGNAL CALCULATION



FIRST ALIGNMENT (REFERENCE FOR SLOPE CALCULATION)

Flux within pupils
(Flux B = Flux C)



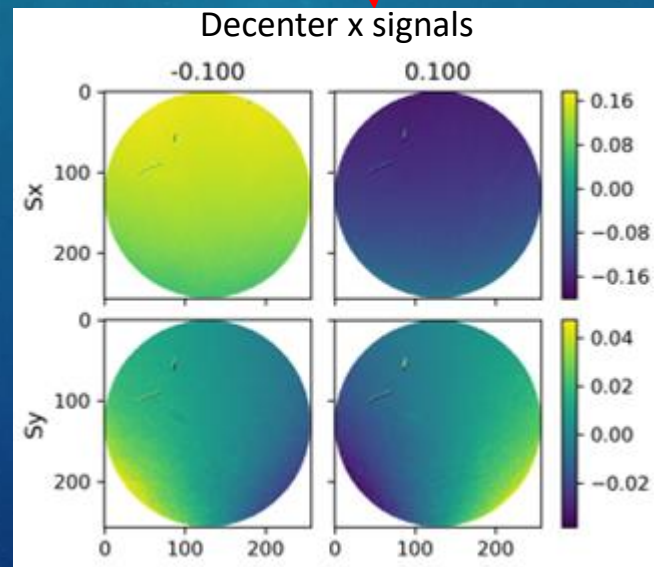
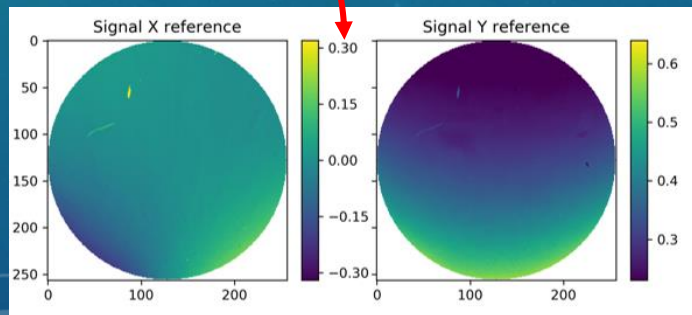
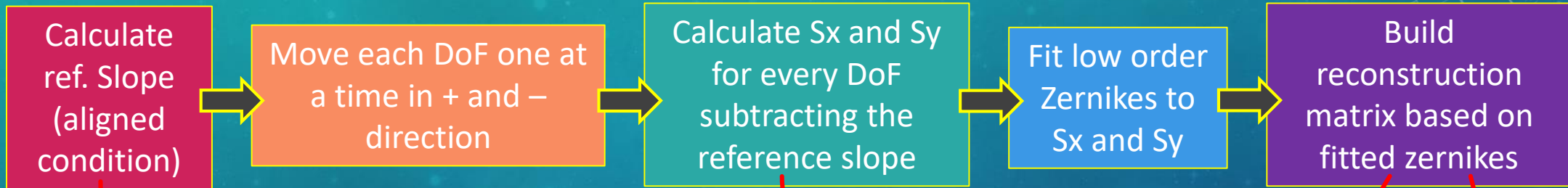
Flux A?
Still under investigation...

Distance between pupils
(distance AB = distance AC
= distance BC)



Remove defocus
(appears as a gradient
in the signal Sx)

ALIGNMENT CALIBRATION



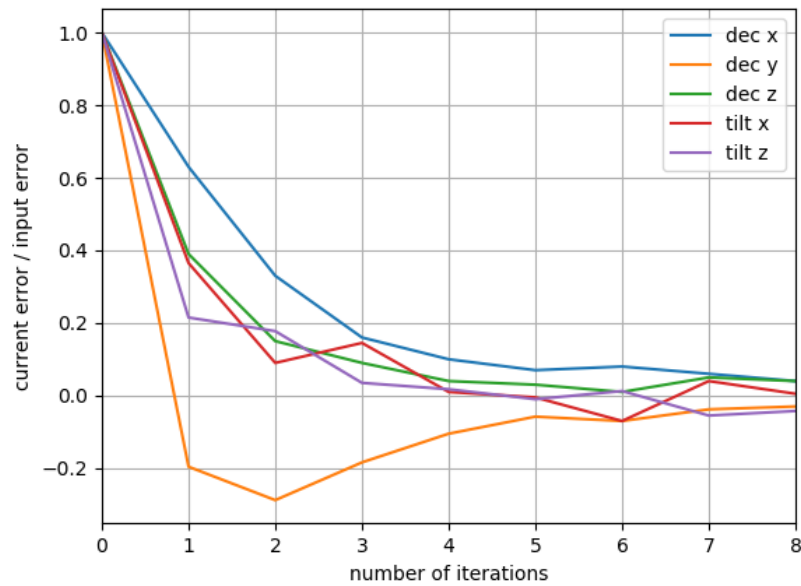
LAB
RECONSTRUCTION
MATRIX

SYNTHETIC
RECONSTRUCTION
MATRIX
(ray-tracing simulations)

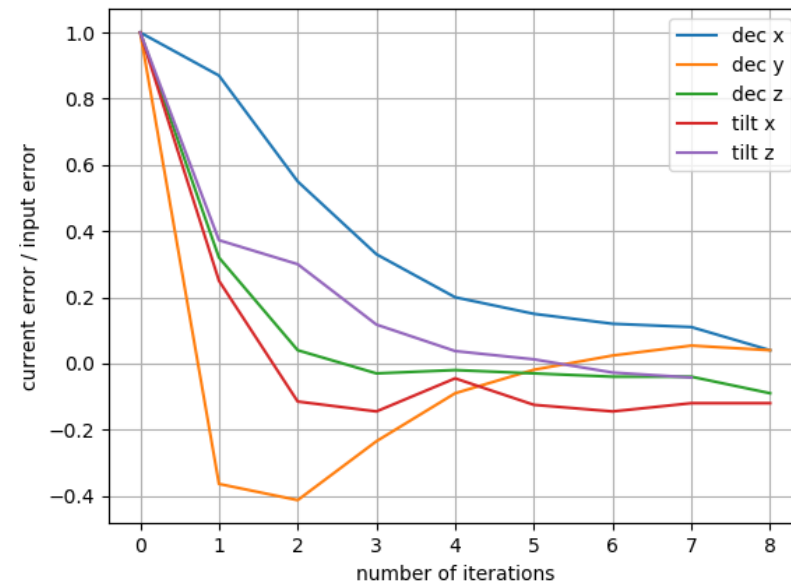
ALIGNMENT LOOP CONVERGENCE

Convergence for a random input misalignment

LAB INTERACTION MATRIX



SYNTHETIC INTERACTION MATRIX



CONCLUSIONS AND FUTURE

- We have developed an automatable alignment procedure for the ingot
- We are fully automating the procedure (hexapod and camera remote control) for a statistical analysis of the alignment loop

Add aberrations:

- Static aberration (sensitivity study, check simulation results)
- Dynamic aberrations (closing the loop with evolving turbulence)