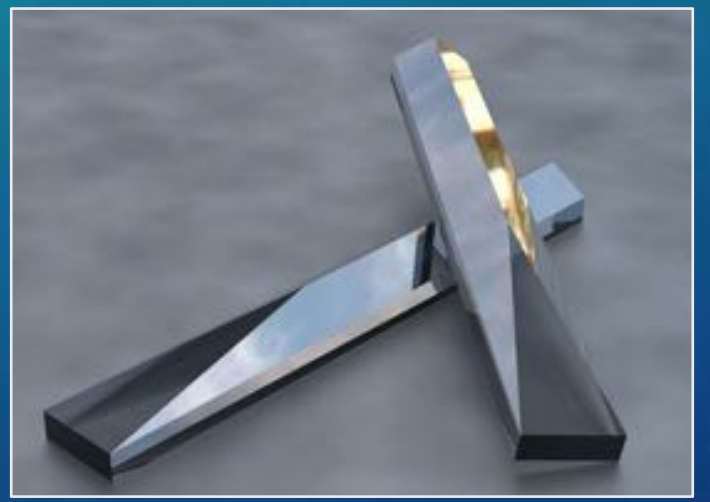
THE INGOT WFS ON LARGE TELESCOPES

THE PROJECT AND FIRST SIMULATIONS

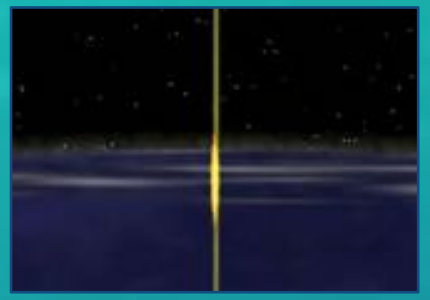


Elisa Portaluri - INAF Osservatorio Astronomico d'Abruzzo

Davide Greggio, Valentina Viotto, Roberto Ragazzoni, Carmelo Arcidiacono, Kalyan Radhakrishnan, Maria Bergomi, Simone Di Filippo, Jacopo Farinato, and Demetrio Magrin

ELISA.PORTALURI@INAF.IT

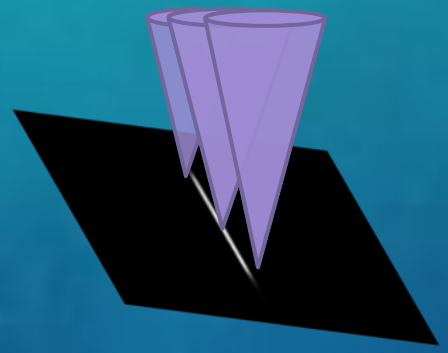
WHY ANOTHER WFS…?

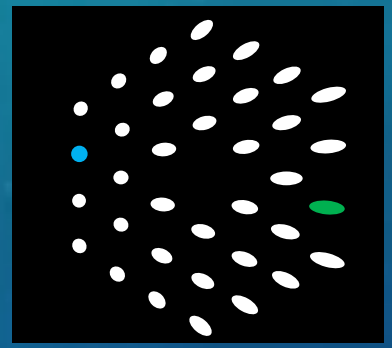


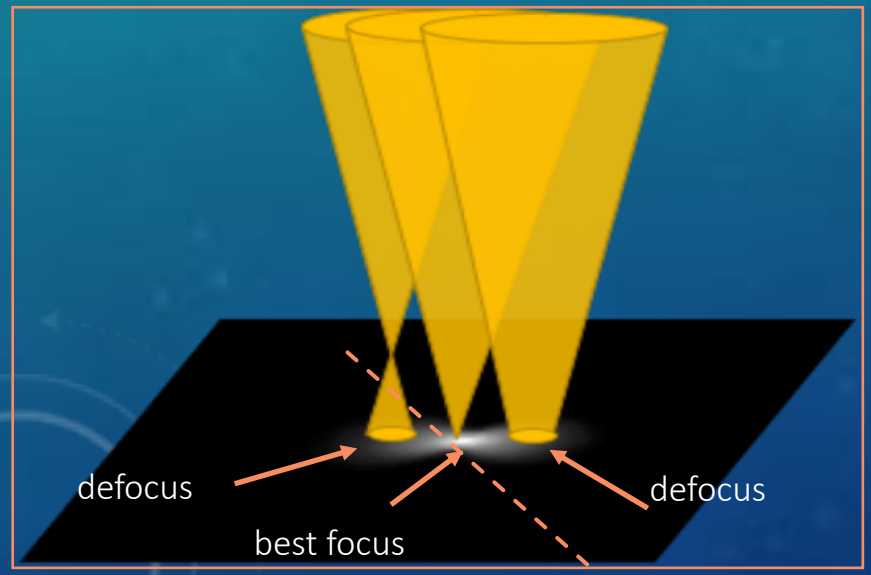
LGSs are NOT point-like source,
but some CIGARS in the sky
located at a FINITE distance!!!

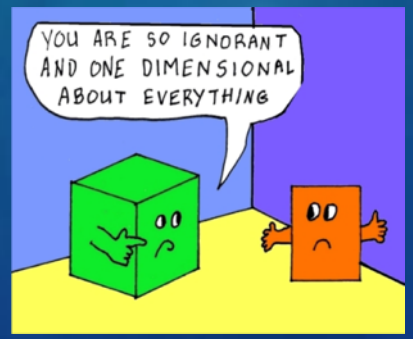
To avoid spot truncation
(on a S-H WFS focal plane)
due to the elongation

GEOMETRY IS IMPORTANT
They focus on a 3D VOLUME,
not just on a plane!!!



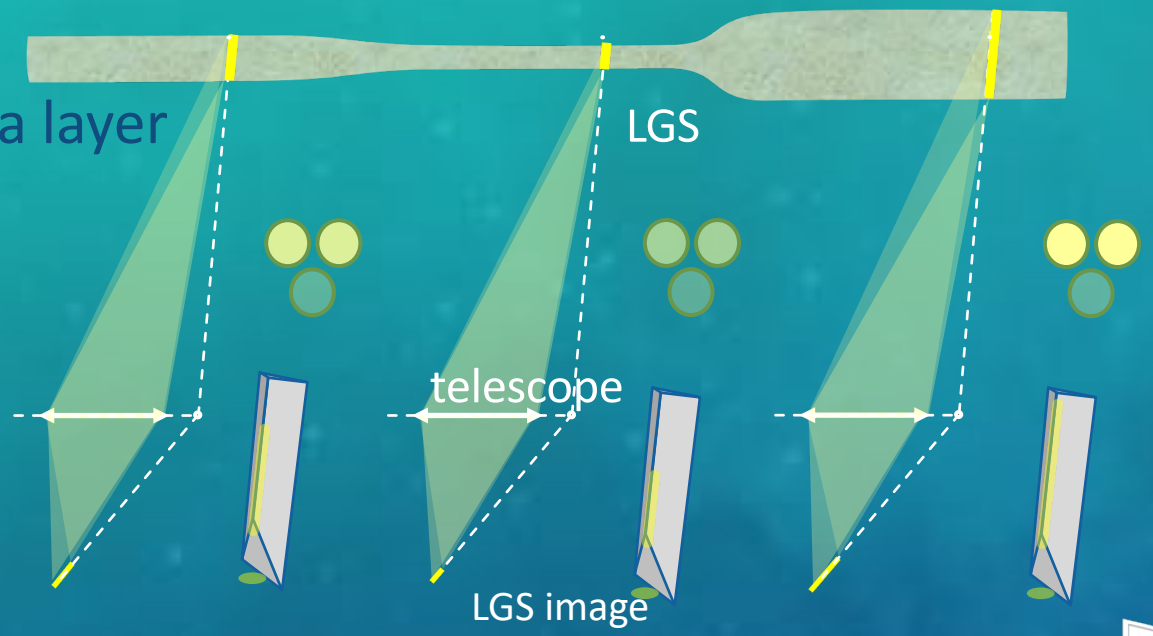






They are
MONOCHROMATIC!!!

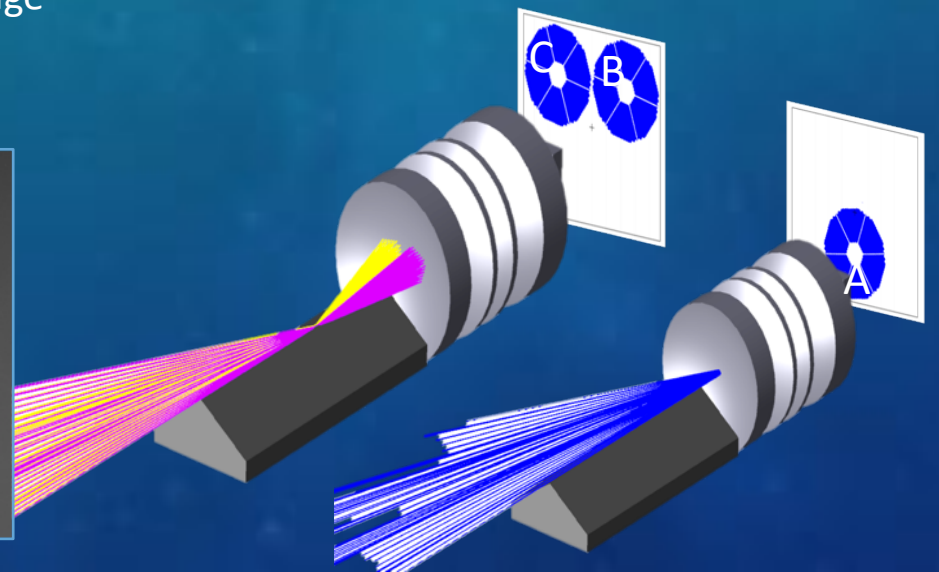
INGOT SPECS: A «SIMPLE» REFLECTING ROOF

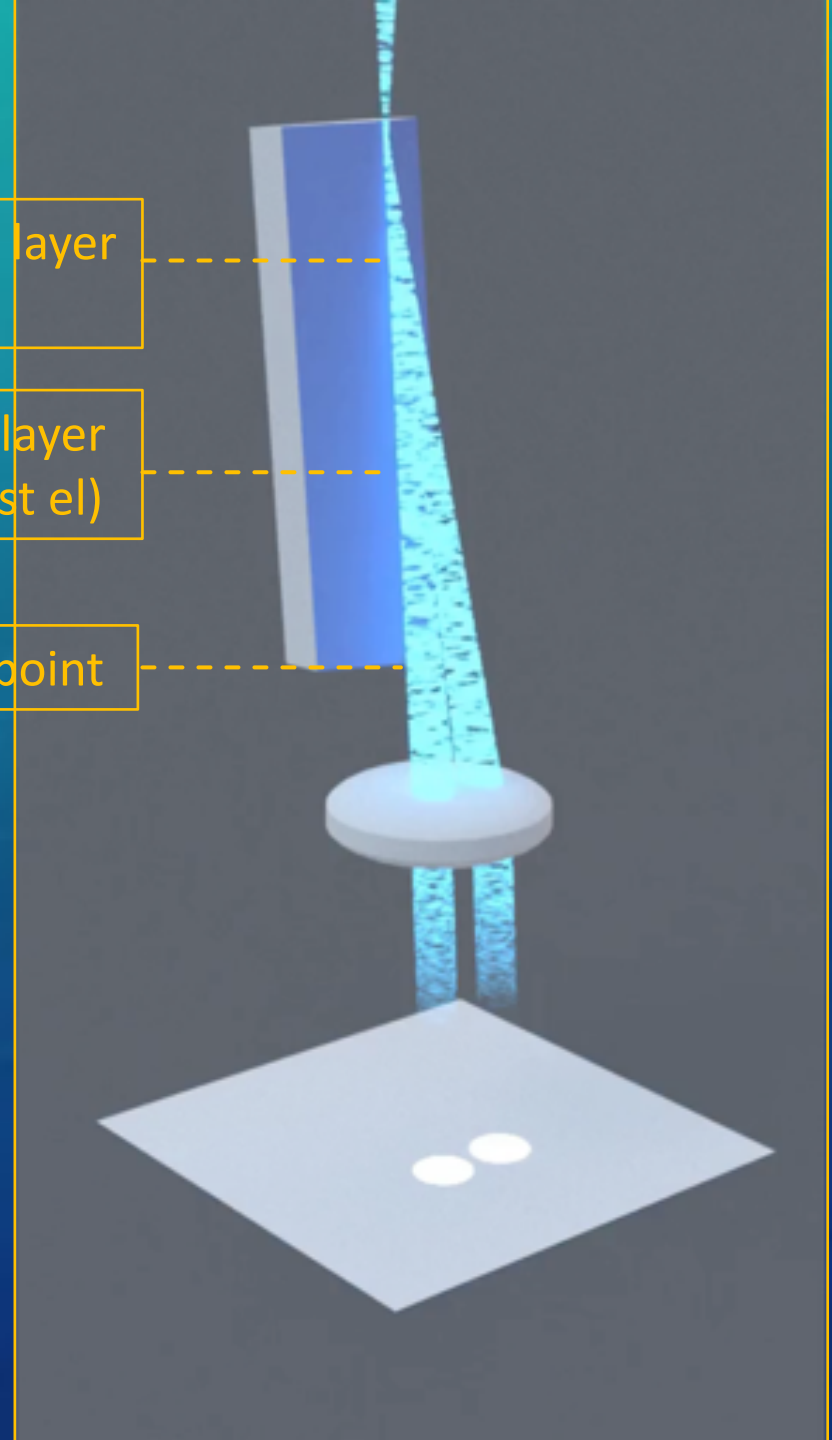


Higher “highest” Na layer
(longest Na & zenit)

Lower “highest” Na layer
(shortest Na & lowest el)

Lowest Na layer point





FROM THE CONCEPT TO THE ACTIVITIES

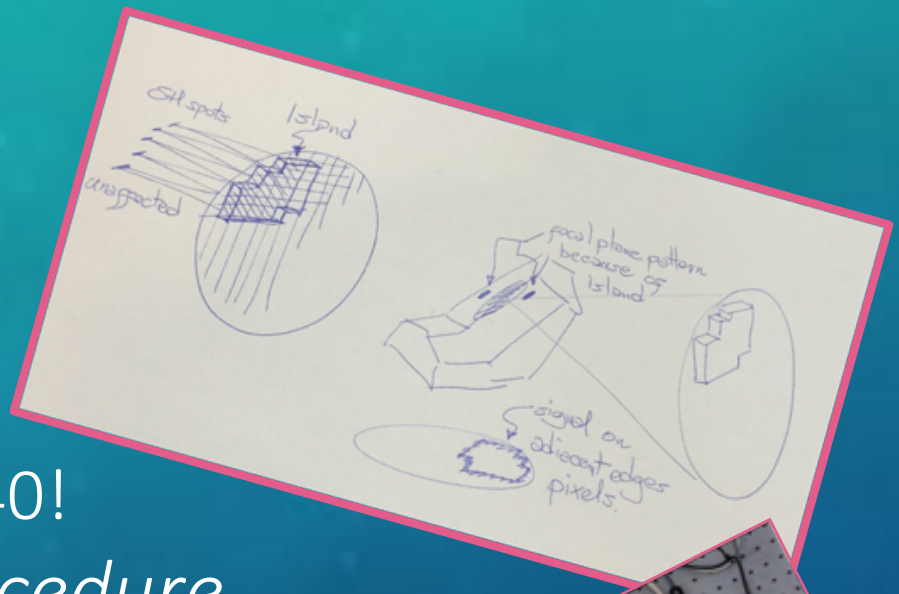
1 - OPTICAL DESIGN

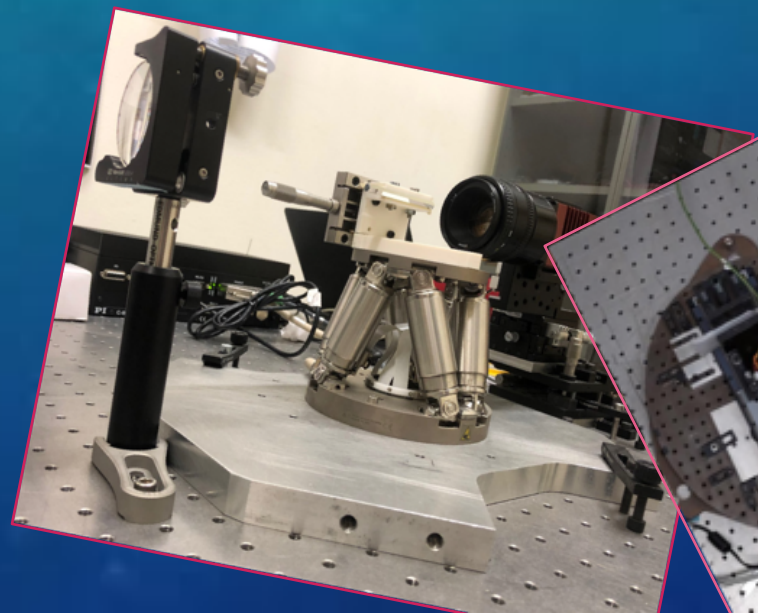
2a - FIRST LAB TESTS @ INAF- OAPD

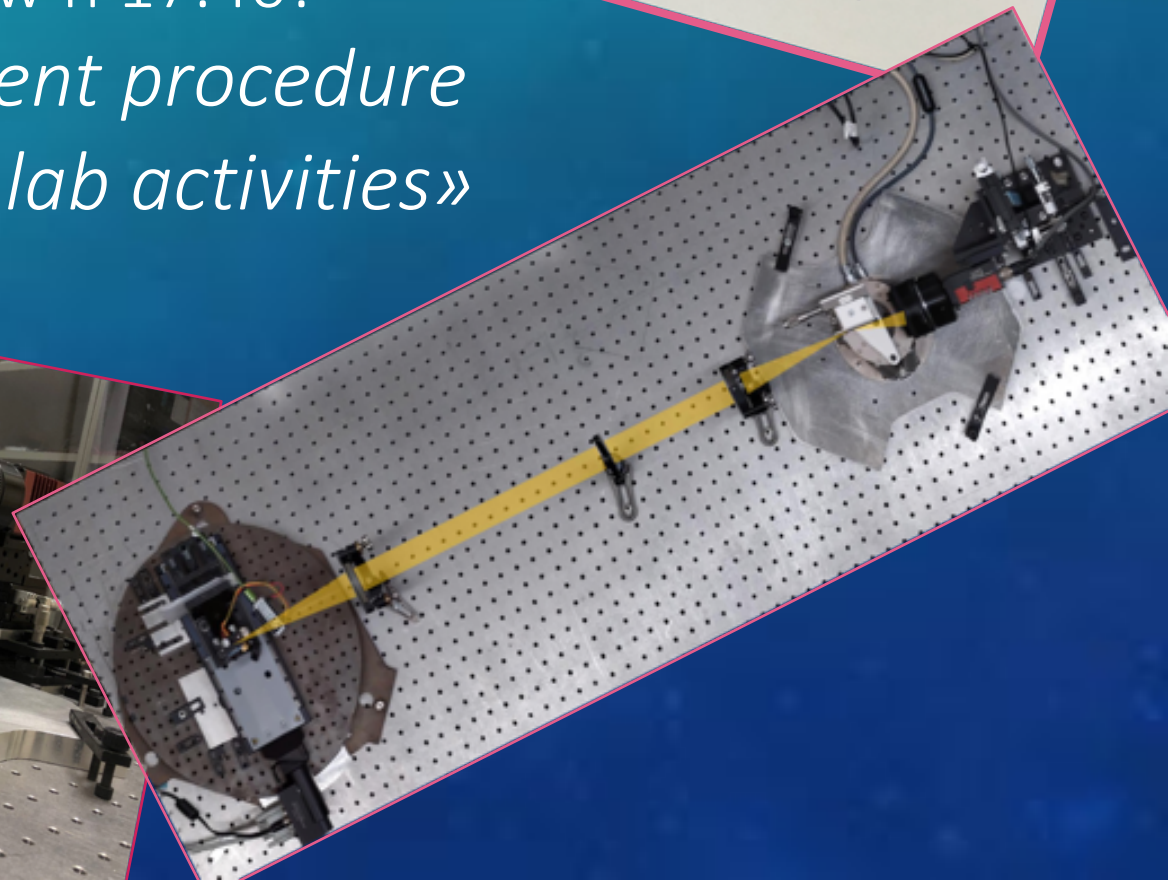
→ see Davide Greggio's talk Tomorrow h 17.40!

«Towards the automatic alignment procedure of the ingot WFS - an update on lab activities»

2b - E2E SIMULATIONS







E2E SIMULATIONS

INPUT DATASET

INPUT:
- C_n^2 profile
- Seeing value
- Spectrum Type

Compute layers? (flag)

YES

Generate atmospheric layers

NO

INPUT:
- Atmospheric layers

INPUT:
- LLT and LGS pos.

Compute LGSs asterism

Compute Na density? (flag)

YES

INPUT:
- Sampling
- Min-max h

Generate Na density uniform profile

NO

INPUT:
- Na profile

Compute point-like sources positions

INPUT:
- XY size of LGS cigar
- LGS sampling

Reconstruction

Ingot signal computation

INPUT:
- Pupil sampling
- Pupil geometry

Tomographic inputs:
e.g. 35 layers atmosphere

Pupils through Ingot (illumination)

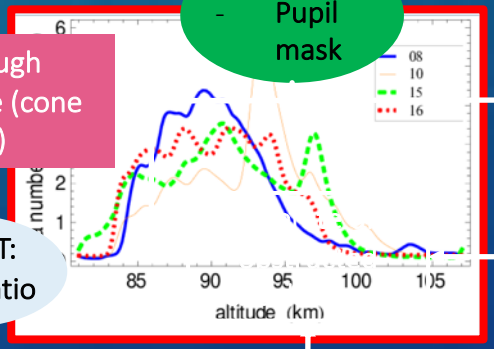
INPUT:
- Ingot parameters

System's inputs: e.g.
Telescope and launcher characteristics

WF through atmosphere (cone effect)

INPUT:
- F-ratio

INPUT:
- Pupil mask



LGS i...
NA profile ...ng

INPUT:
- D
- sampling

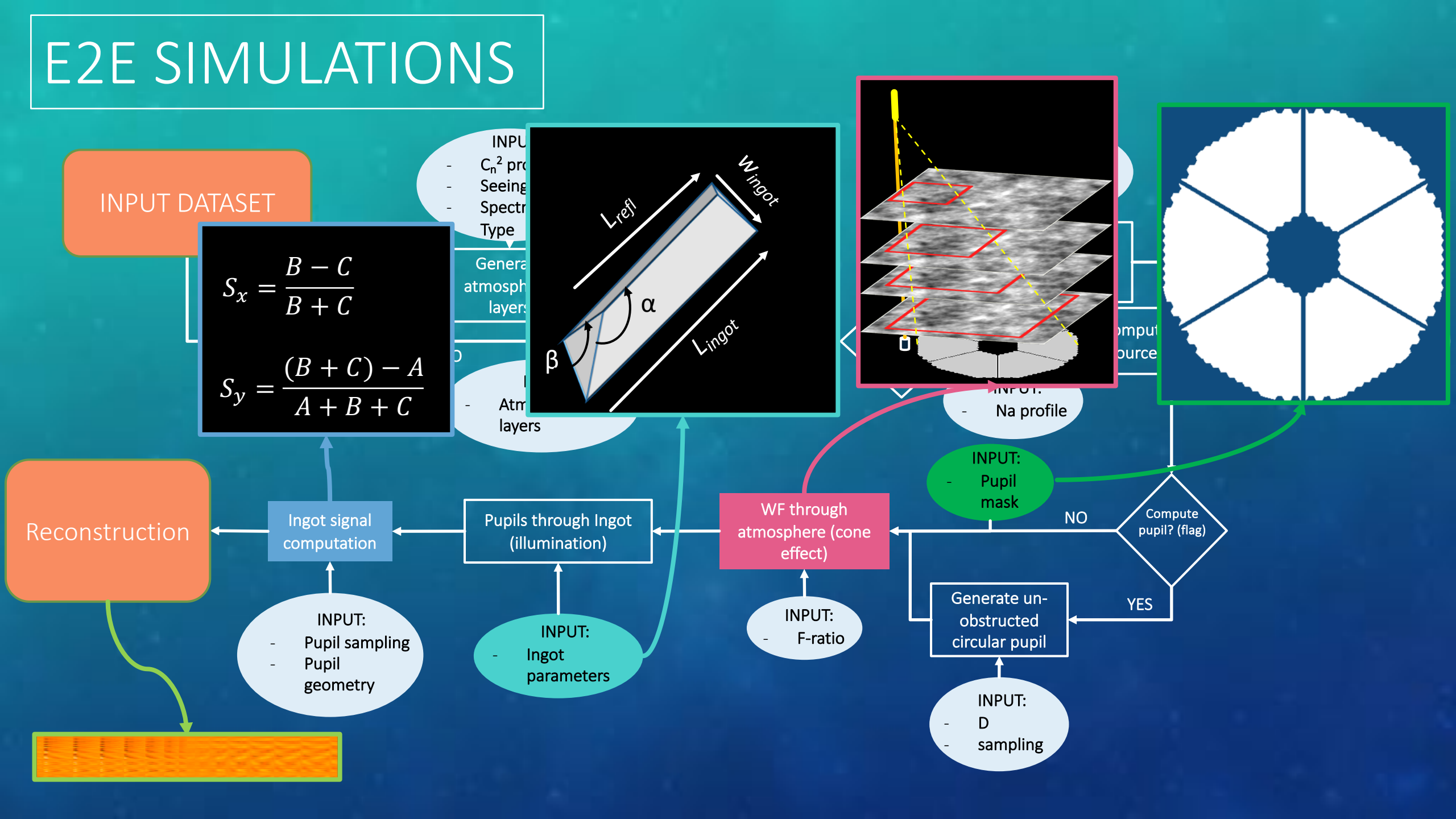
Compute pupil? (flag)

YES

LGS source

P1

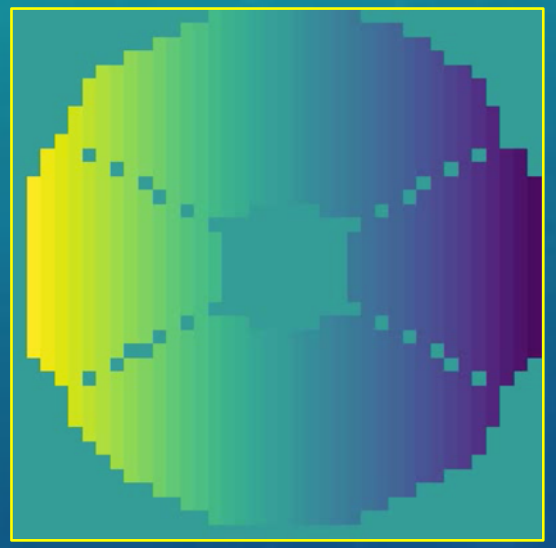
E2E SIMULATIONS



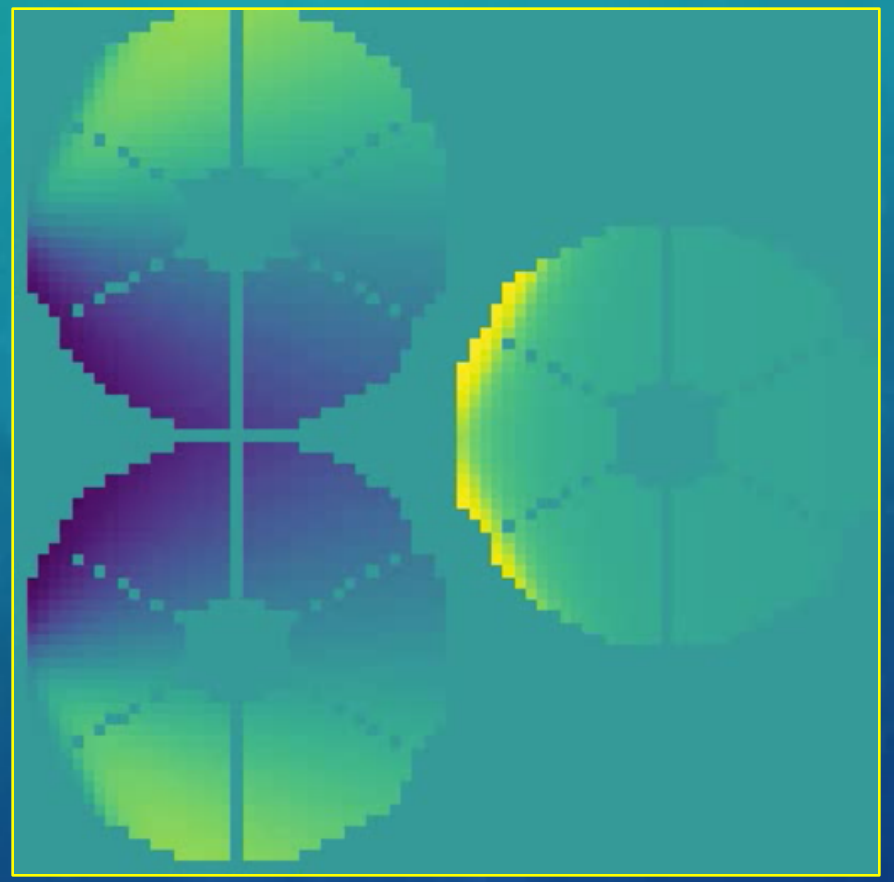
E2E SIMULATIONS

STARTING RECONSTRUCTION LOOPS

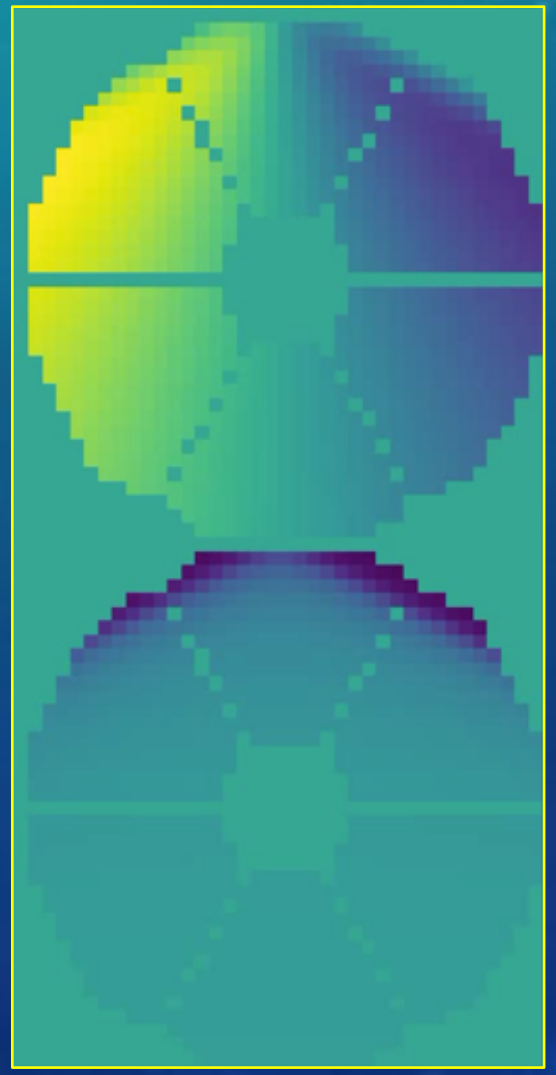
100 Zernike modes



Corresponding pupils



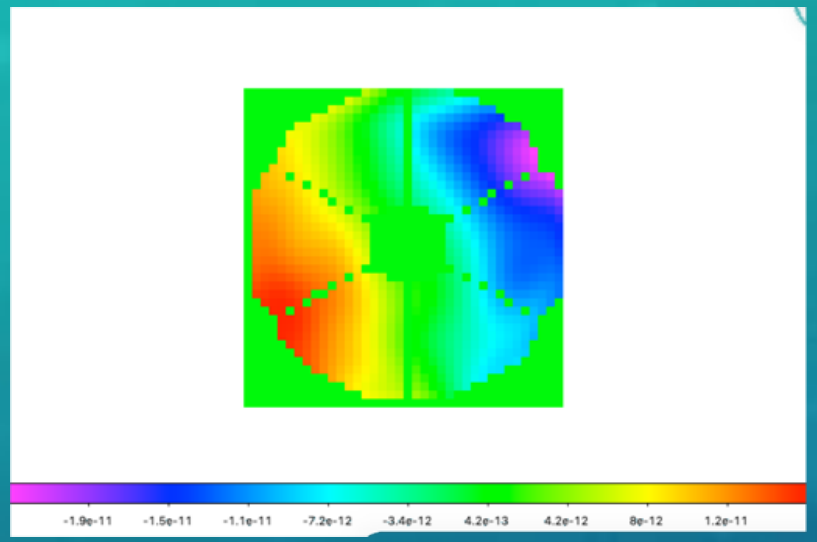
Measured signals



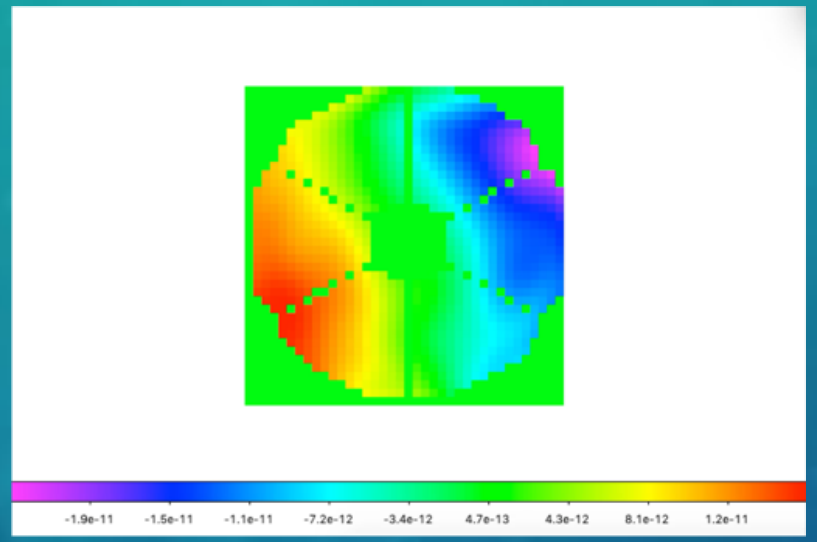
RECONSTRUCTION: CLOSED LOOP

Frozen turbulence!!!

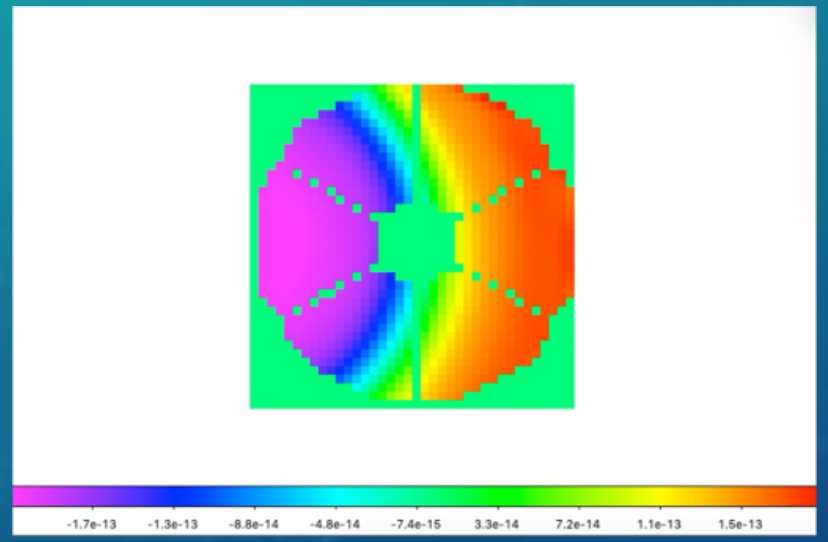
SAME Input WF



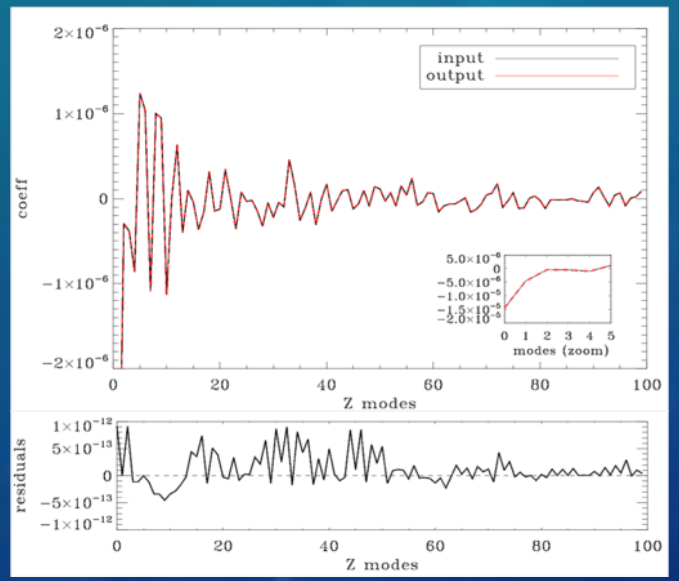
Reconstructed WF

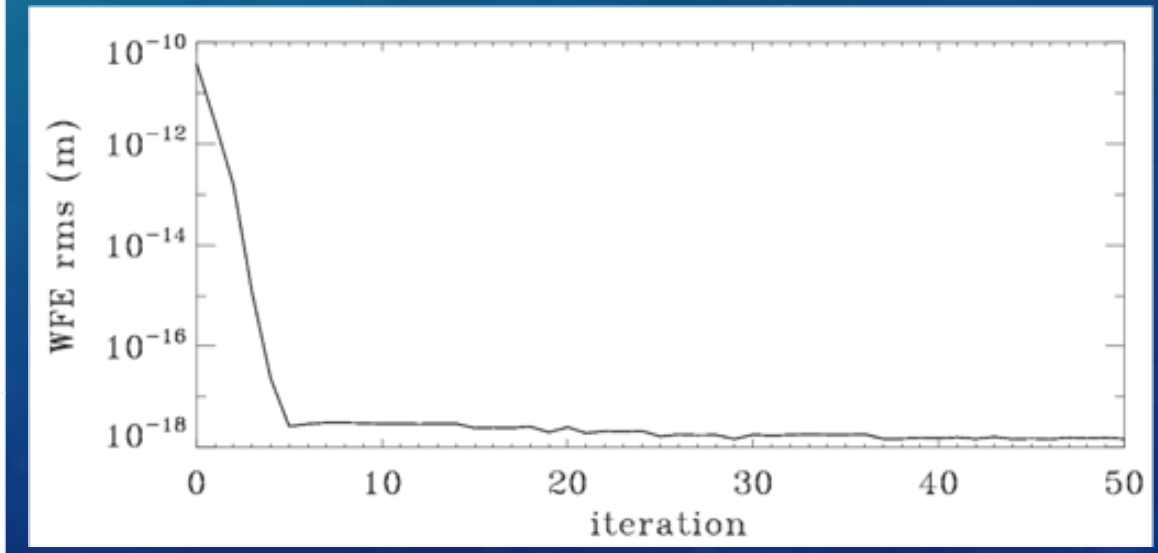


Residuals (changing scale!)



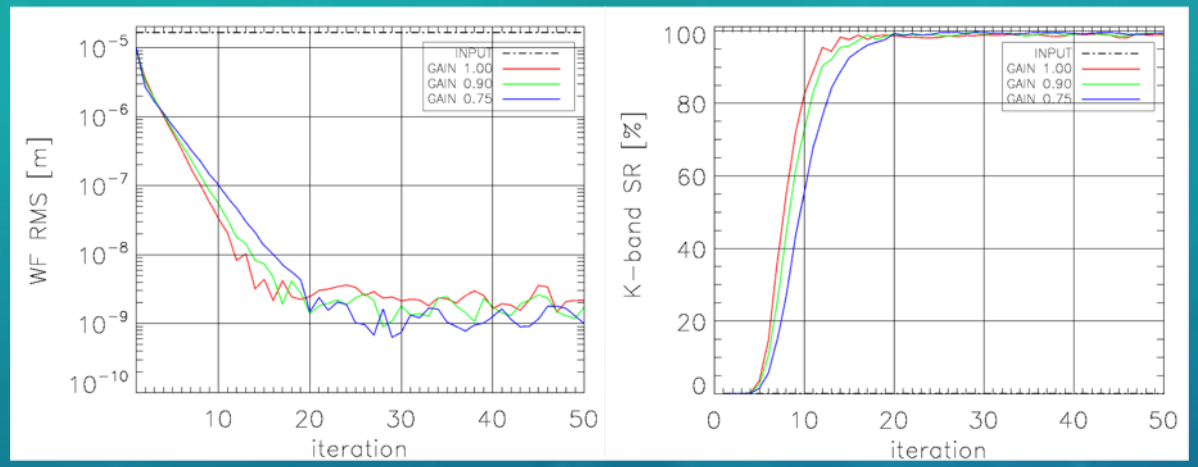
Comparison between input and output coefficients



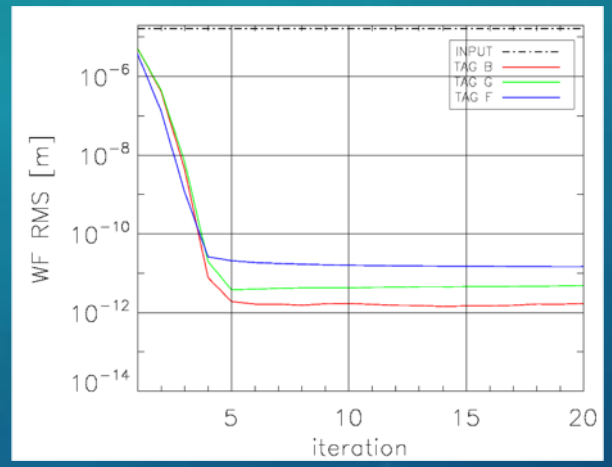


TESTING SOME INPUT PARAMETERS

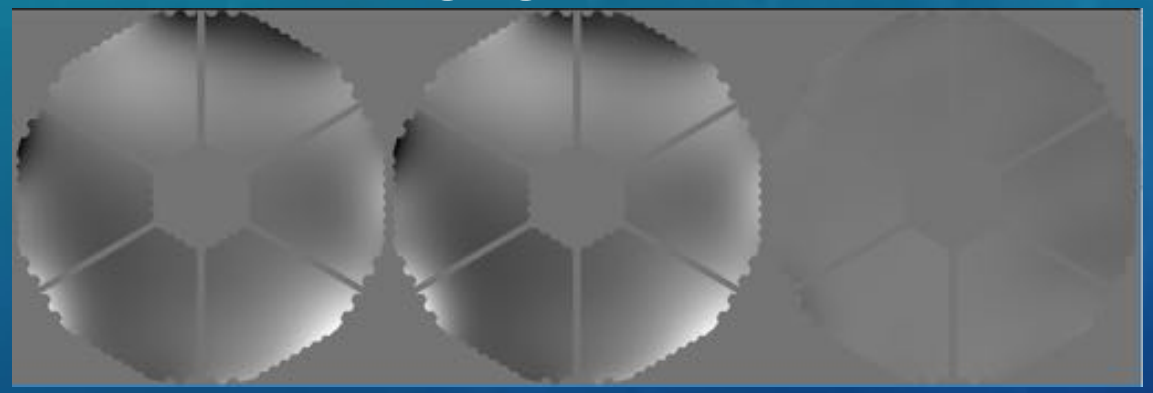
Different gain



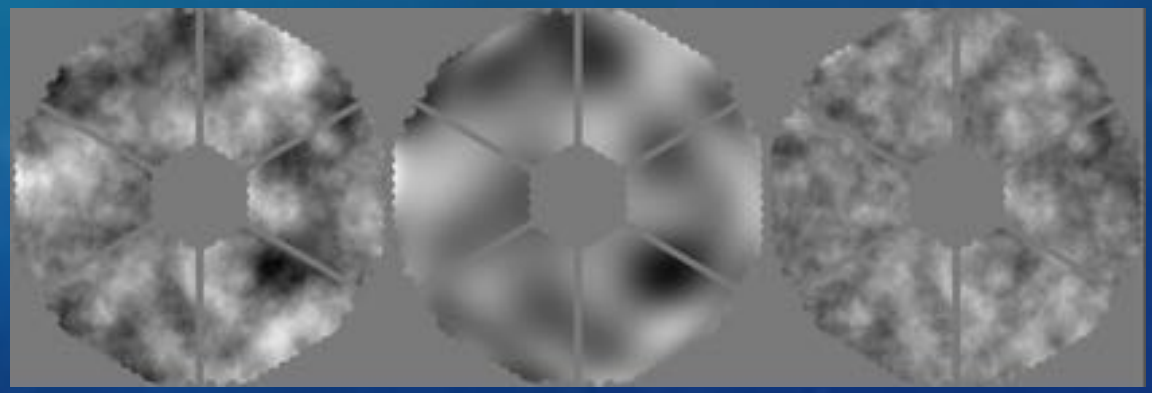
Different source sampling



Changing resolution



First results with a full turbulence



CONCLUSIONS AND FUTURE

- We have built an E2E simulator to test the performance of the I-WFS in the ELT configuration.
- We have demonstrated that we were able to close the loop and perform a good reconstruction of the wavefront at least for a static turbulence.
- We are improving the simulations changing the input parameters as **resolution, sampling, number of modes and dynamical disturbance** to have a full description of the performance. This is going parallel with the need of speed-up the code.
- We will compare the results with those obtained using SH-WFS and with those obtained in the lab.