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COMPASS:
Status update & Error breakdown

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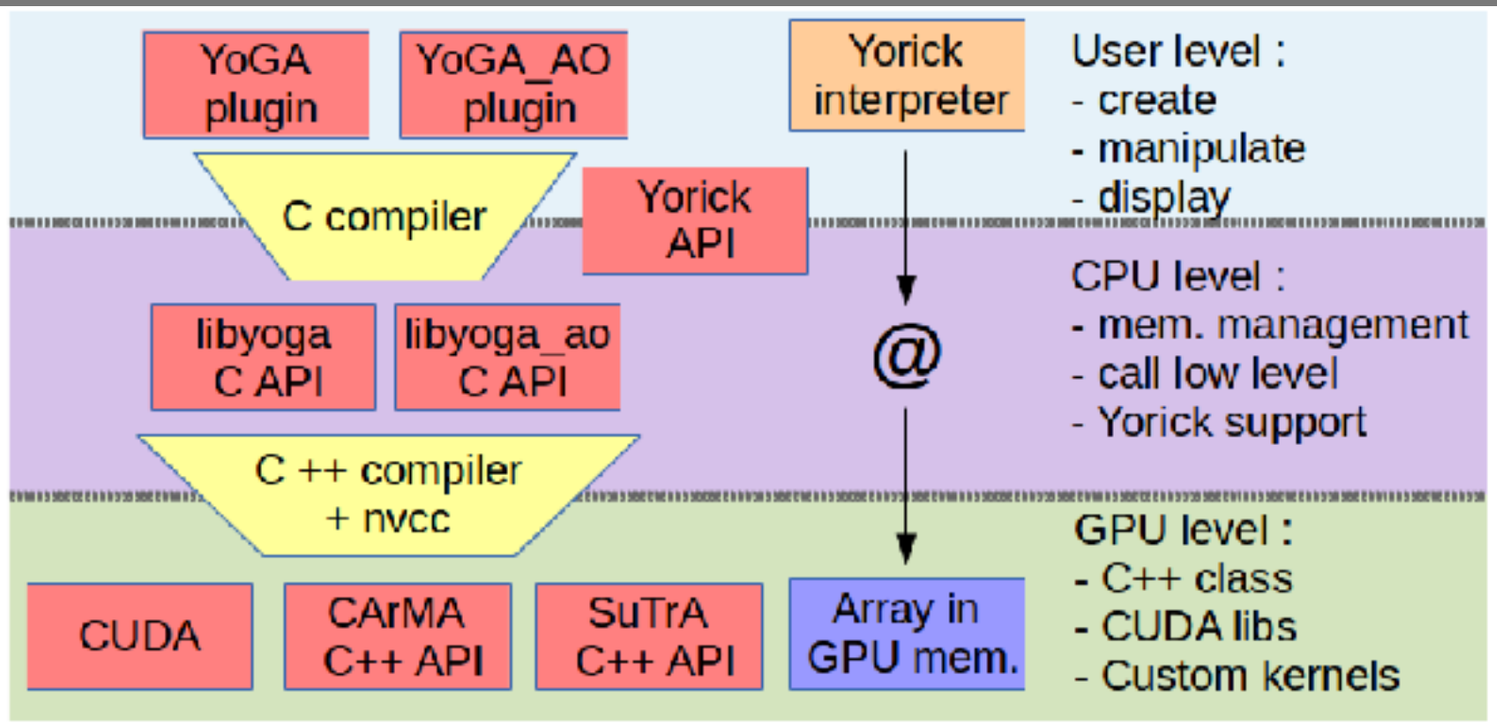
SUMMARY

- What is COMPASS ?
- Features & Performance
- ROKET: erROr breaKdown Estimation Tool
- Results
- Further developments

WHAT IS COMPASS ?

- COMPuting Platform for Adaptive opticS System
- End-to-end AO simulation platform
- GPU acceleration
- ELT scale

WHAT IS COMPASS ?



2 user interfaces:

Yorick: development stopped…

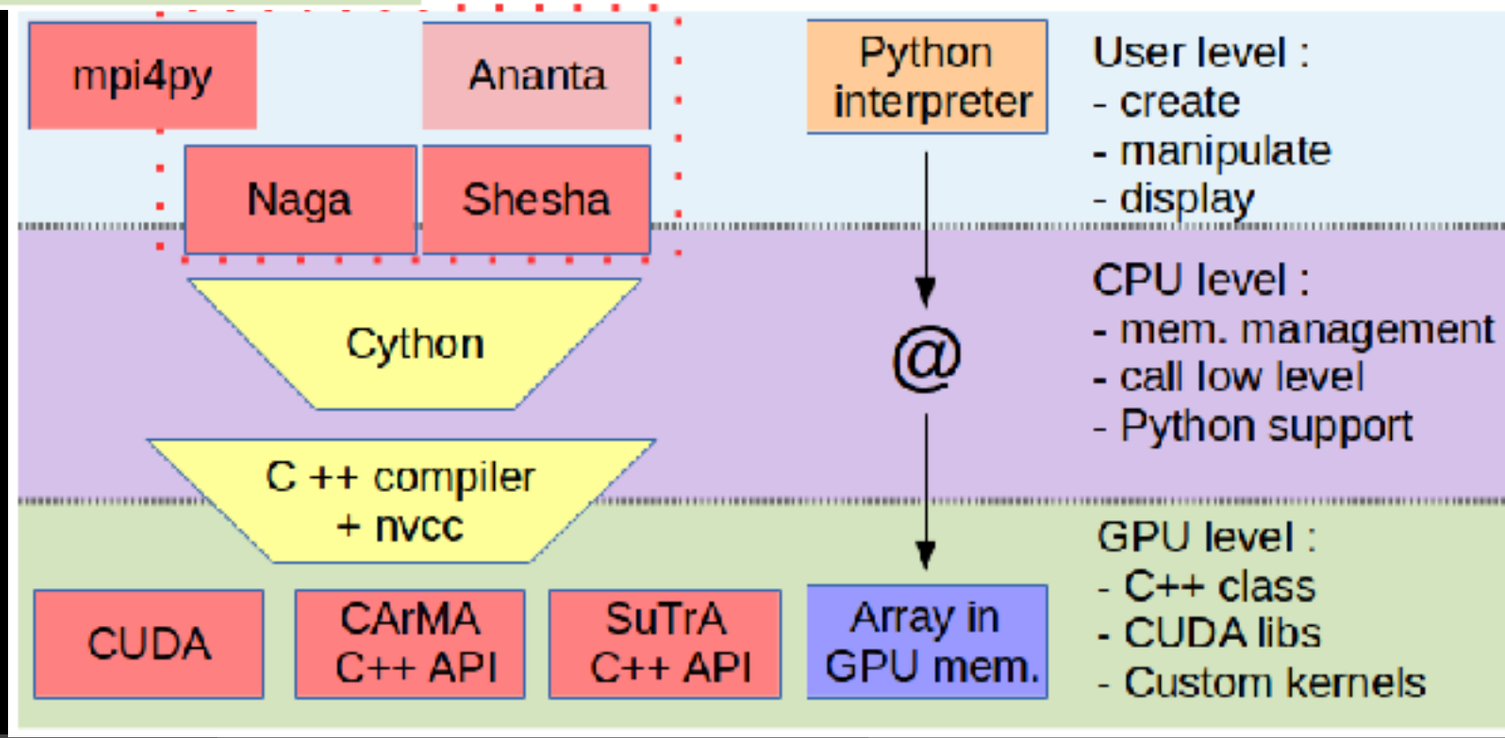
Python: …and translated in Python for long term maintenance plan

Main computations relies on GPU:

CArMA: C++ Api for Massively parallel Applications

SuTrA: Simulation Tool for Adaptive optics

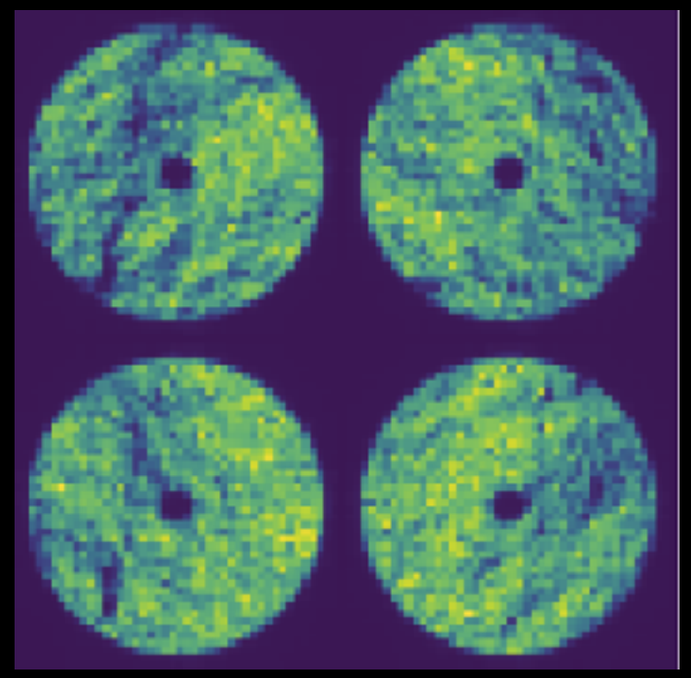
Use optimized libraries such as CUBLAS, CUFFT, MAGMA…

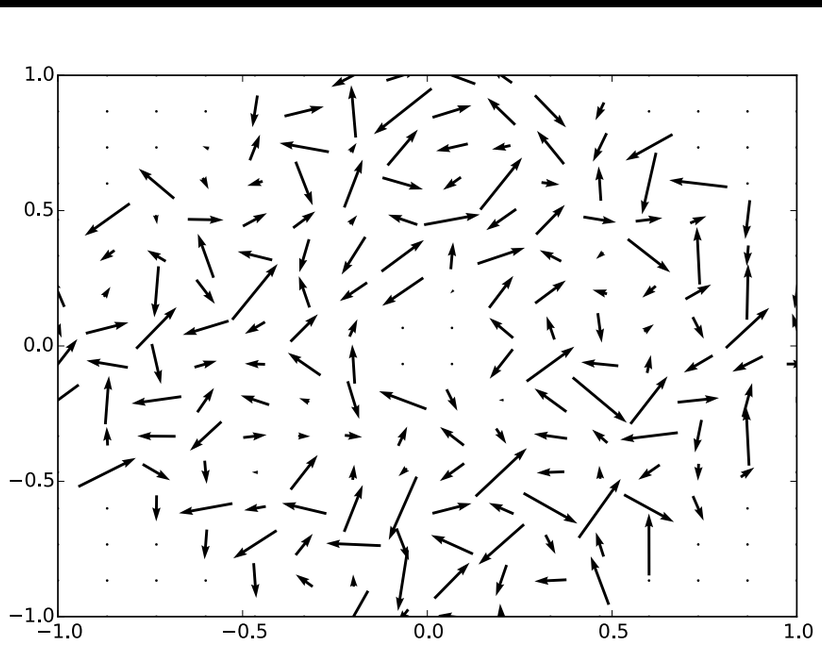


FEATURES

Wavefront Sensor models:

- ✦ Shack-Hartmann
- ✦ Pyramid
- ✦ Laser Guide Star





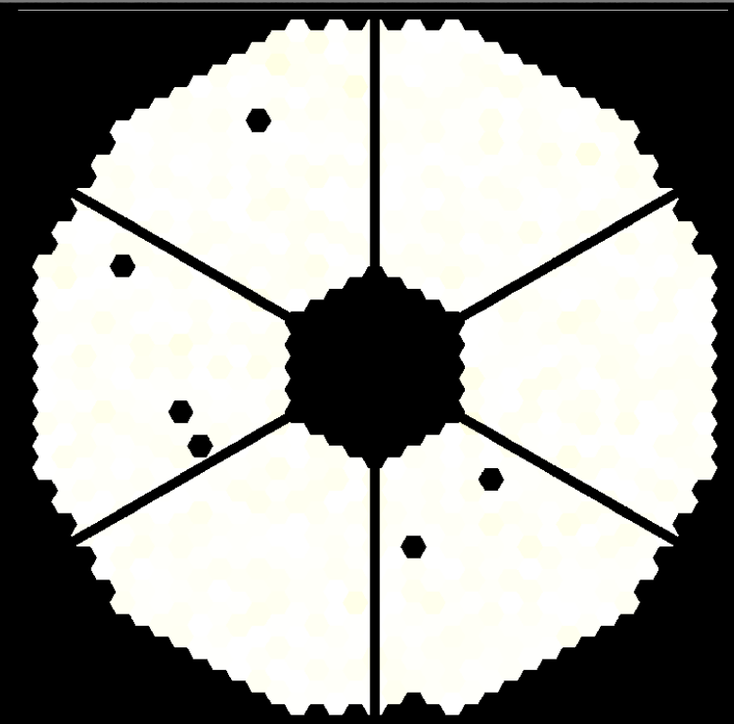
Centroiding methods:

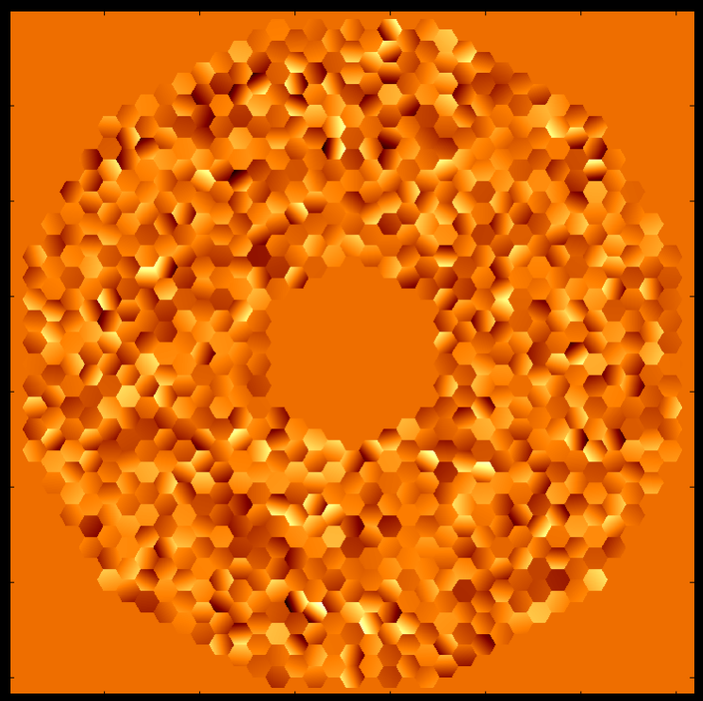
- ✦ Center of gravity (cog)
- ✦ Thresholded cog
- ✦ Weighted cog
- ✦ Brightest pixels
- ✦ Correlation

FEATURES

Controllers:

- ✦ Least square
- ✦ Modal optimization
- ✦ Minimum variance
- ✦ CuReD
- ✦ Projection

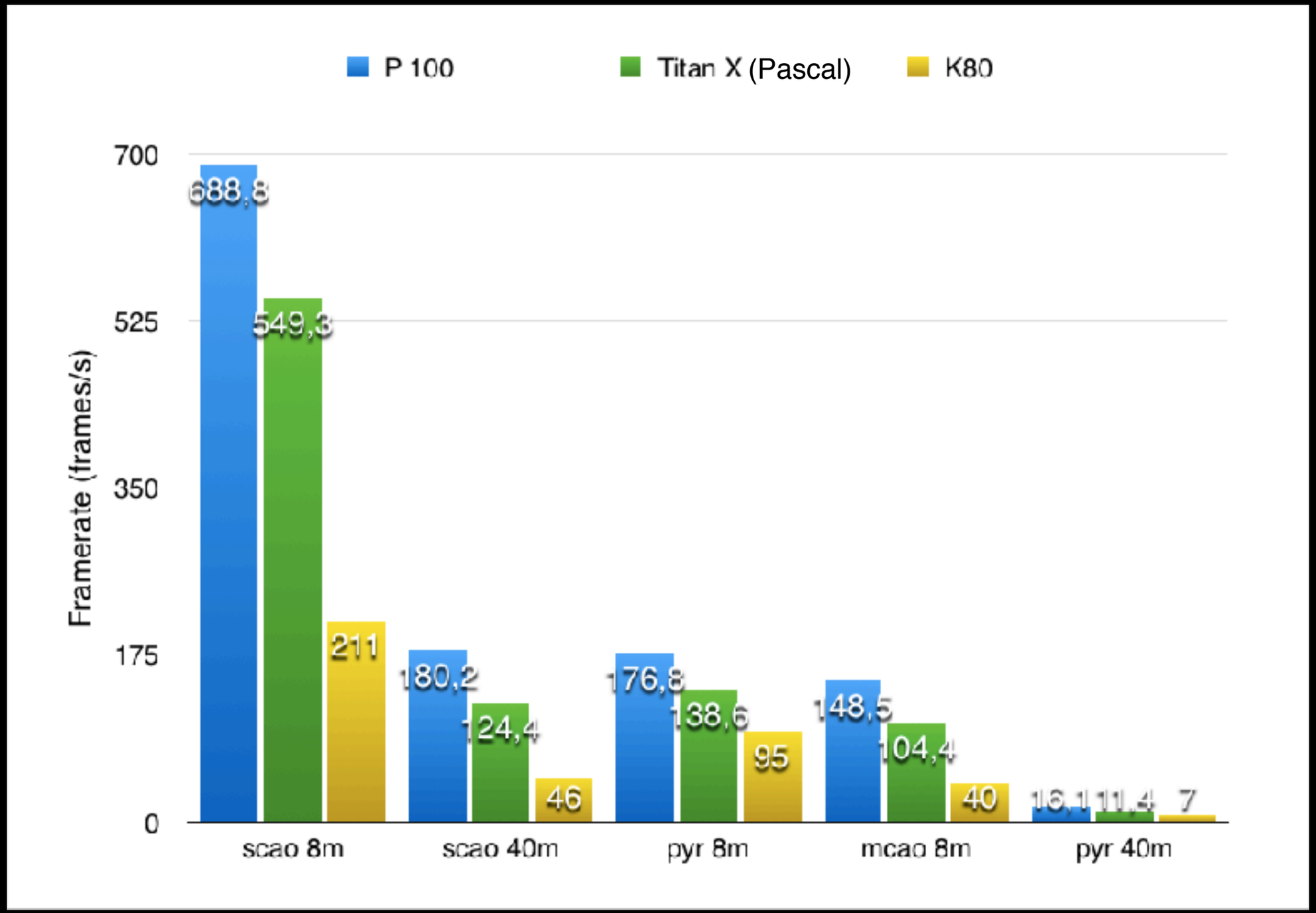




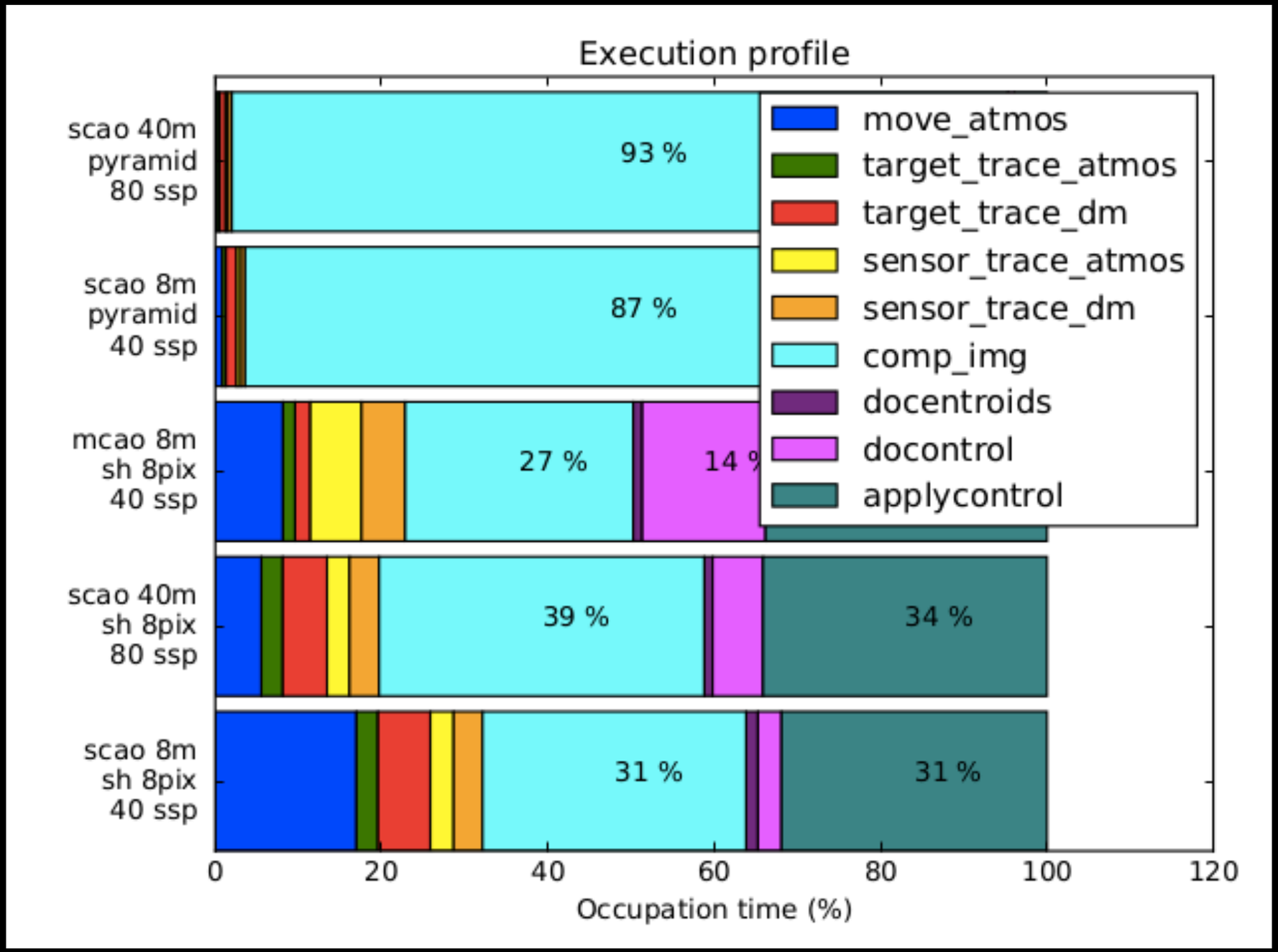
E-ELT:

- ✦ Hexagonal pupil
- ✦ Spiders
- ✦ Phase aberration
- ✦ M4 influence functions

PERFORMANCE



PERFORMANCE



DERIVING ERROR BREAKDOWN WITH COMPASS

Simulation tool

- Classical approaches aims to perform several simulation runs
- Operations between all those runs give an estimation
- ELT scale will be a problem…

ROKET

- erROr breaKdown Estimation Tool
- Give a full error breakdown as an output of a single simulation run
- Fully integrated in COMPASS

ROKET

Residual error contributors estimated by ROKET

- Anisoplanatism
- Temporal error
- Noise
- WFS non linearity
- Modes filtered
- Aliasing
- Fitting

ROKET

How does it work?

Example for the noise contribution:

- End-to-end simulation tool performs an iteration
- ROKET performs the same iteration after disabling noise
- Results are subtracted to isolate noise contributor
- Loop filter is applied to take into account the closed-loop

P-RECS

PSF reconstruction

- GPU module P-RECS
- Direct reconstruction from ROKET error buffers
- Classical « Vii functions » implementation

Performance

- Using Vii algorithm on an 8m case:
  - 2048x2048 PSF support
  - 1303 modes
- Reconstruction performed in 17s
  - x82 speed up vs CPU implementation

RESULTS

Bokeh demo !

PERSPECTIVES

Error breakdown study

Using ROKET to study contributors behavior:

Can we ignore some of those contributors?

Which conditions?

Correlations?

PSF reconstruction

Estimate the error breakdown from « real » AO loop datas

ROKET will be use to validate new approaches

Thank you !