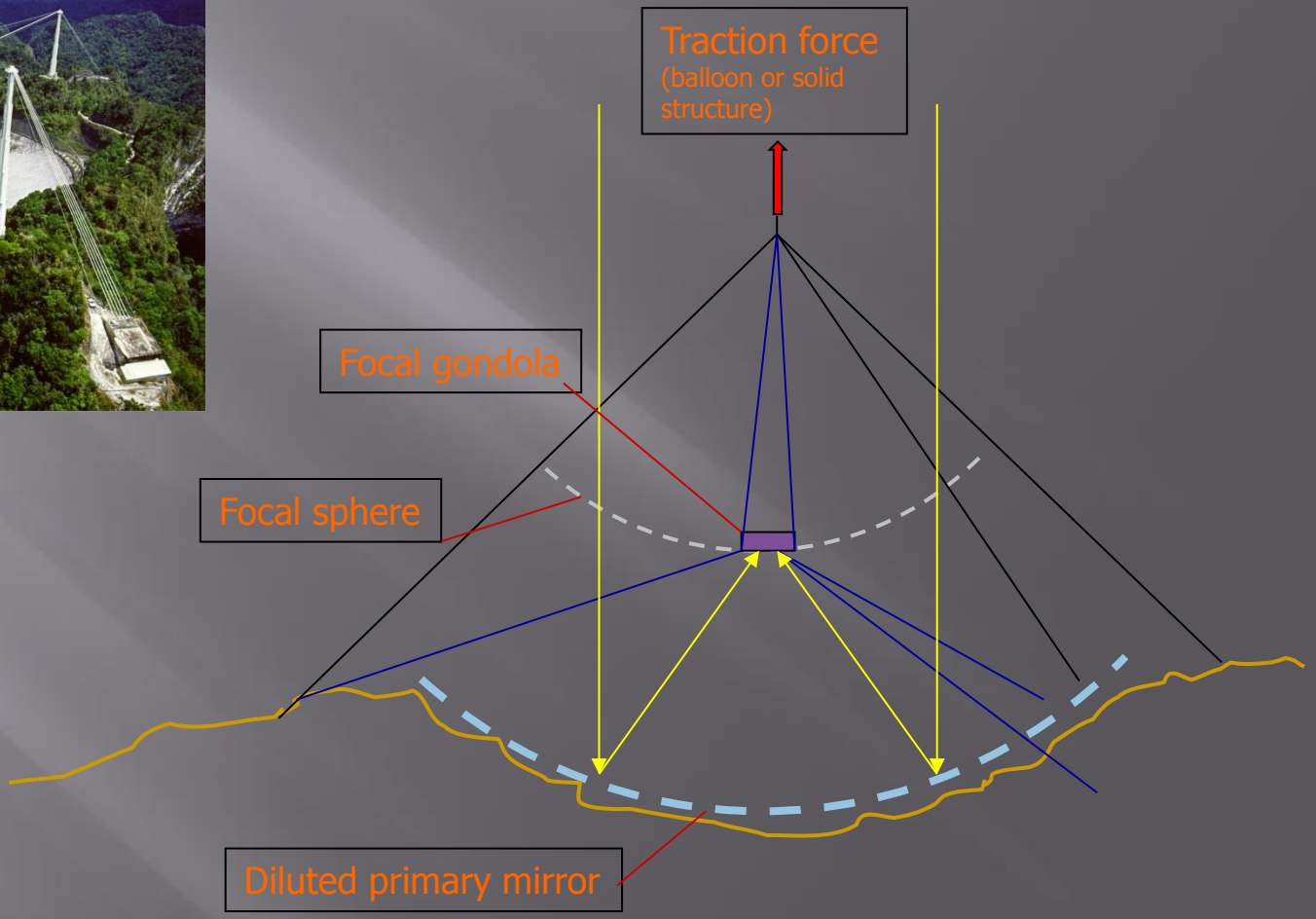
Opto-mechanical design of the Carlina interferometer

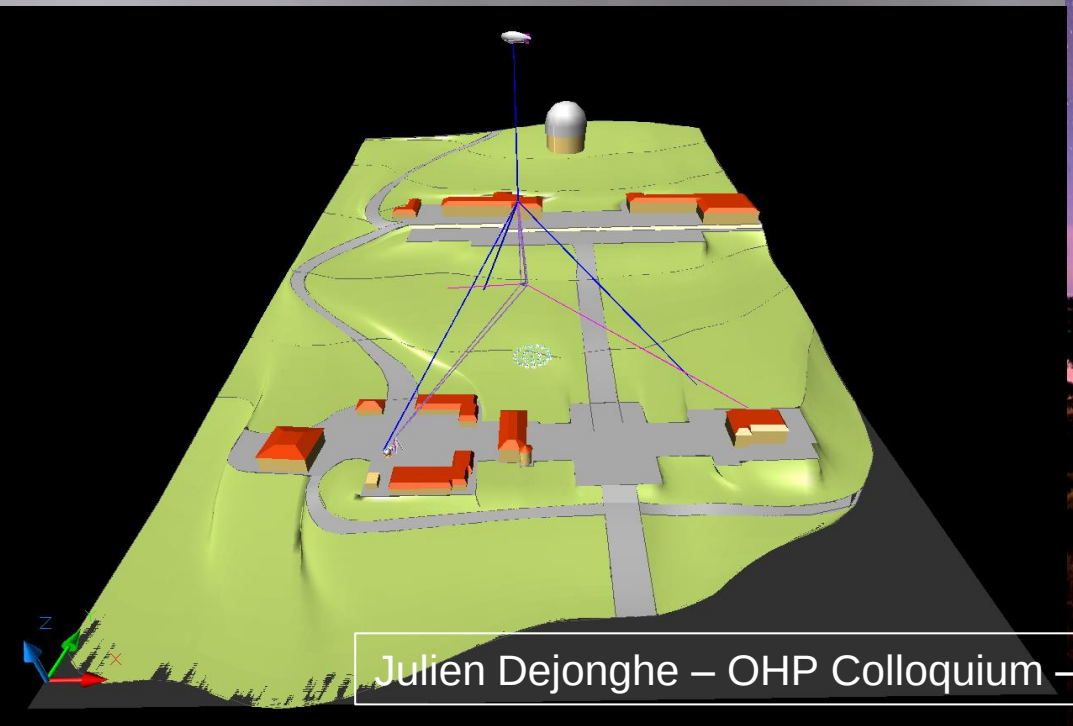
- Principle of the Carlina architecture
- The OHP prototype
  - Diluted primary mirror
  - A cable giant telescope
  - The focal gondola
- Conclusion

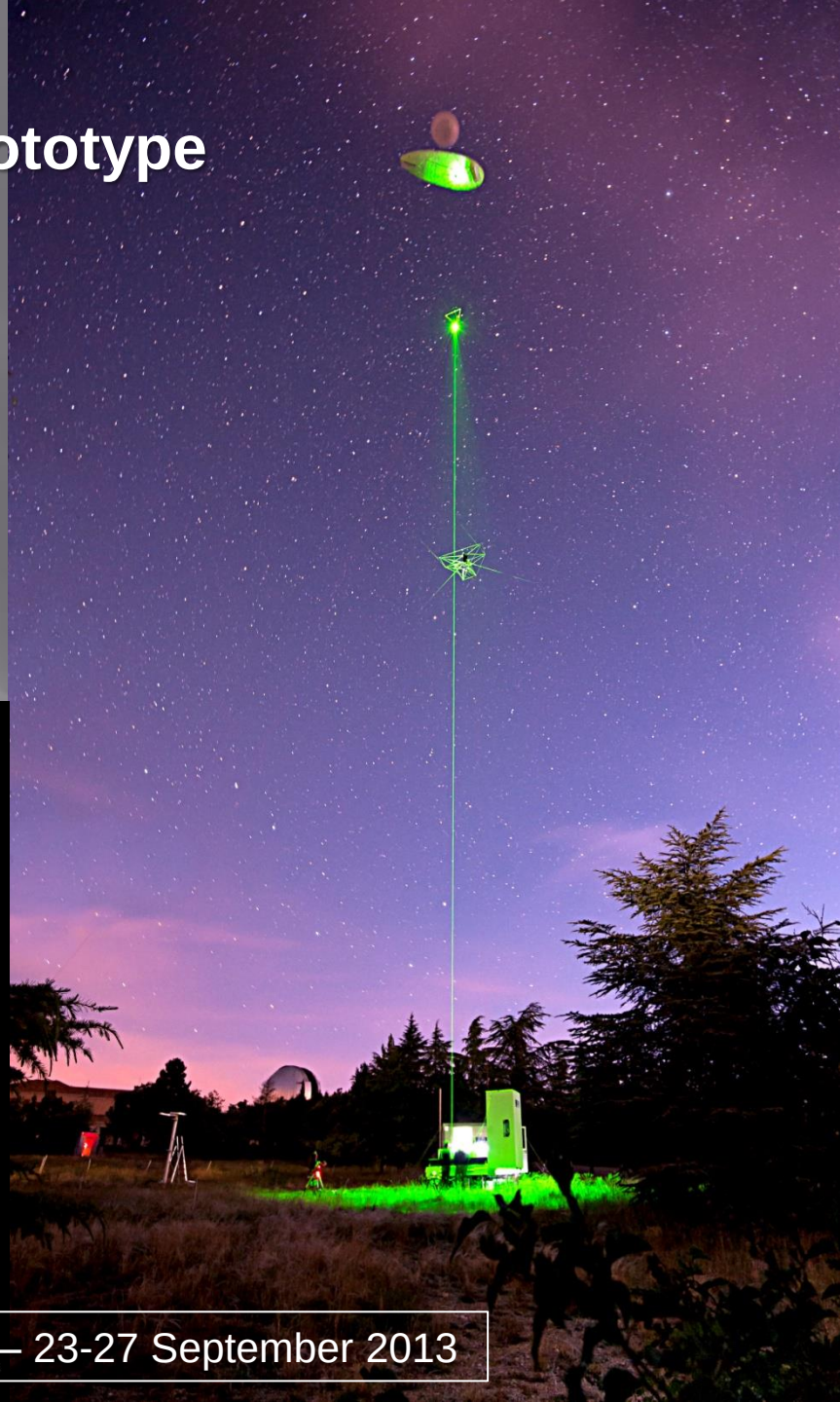
Principle and general architecture



The OHP Prototype

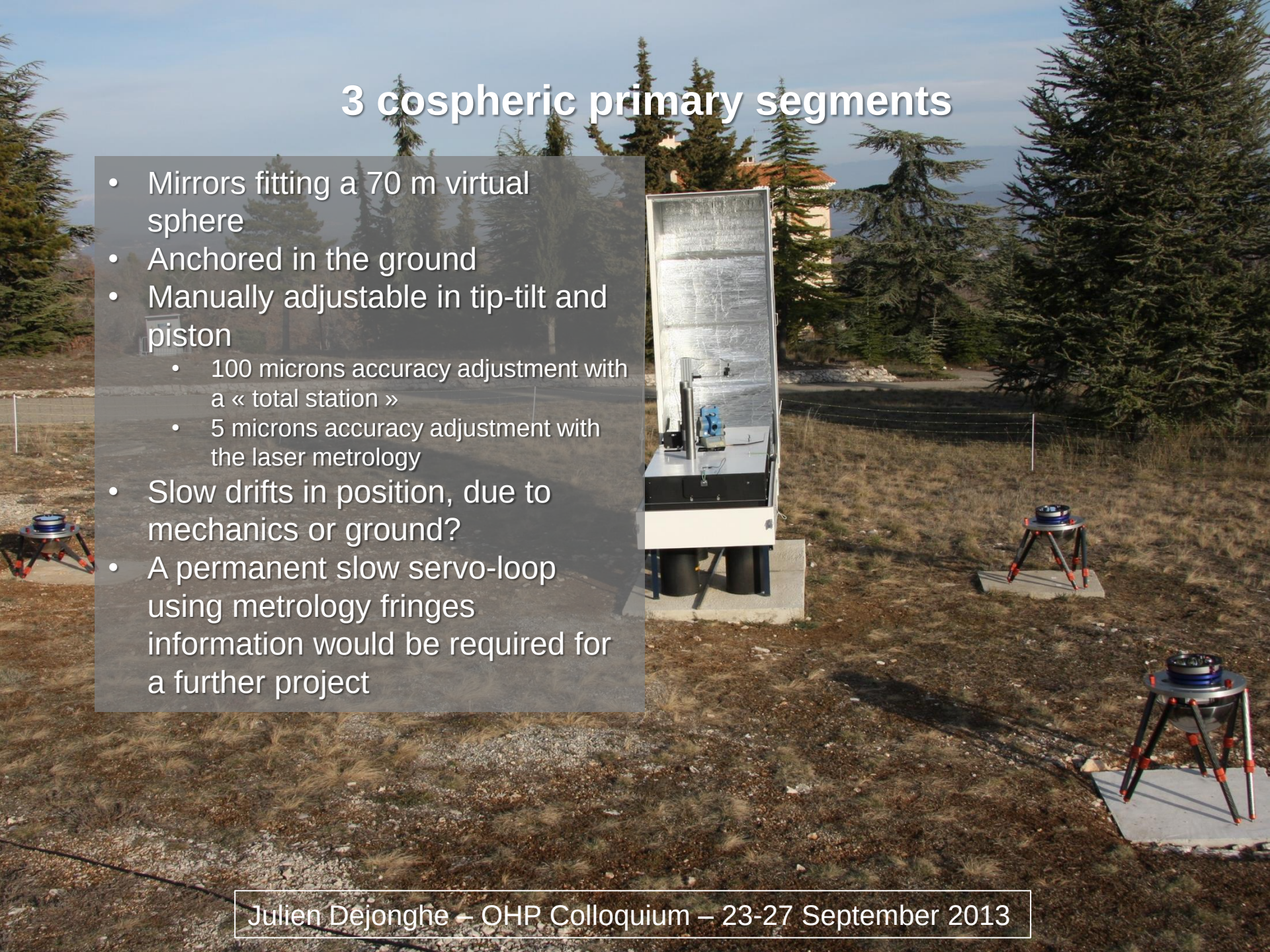
- Curvature radius of the primary sphere: 70 m
- Focal length: 35 m
- 5, 9 and 10,5 m baselines
- 3 primary segments anchored in the ground
- Laser metrology
- Stabilized cable tripod
- Focal gondola





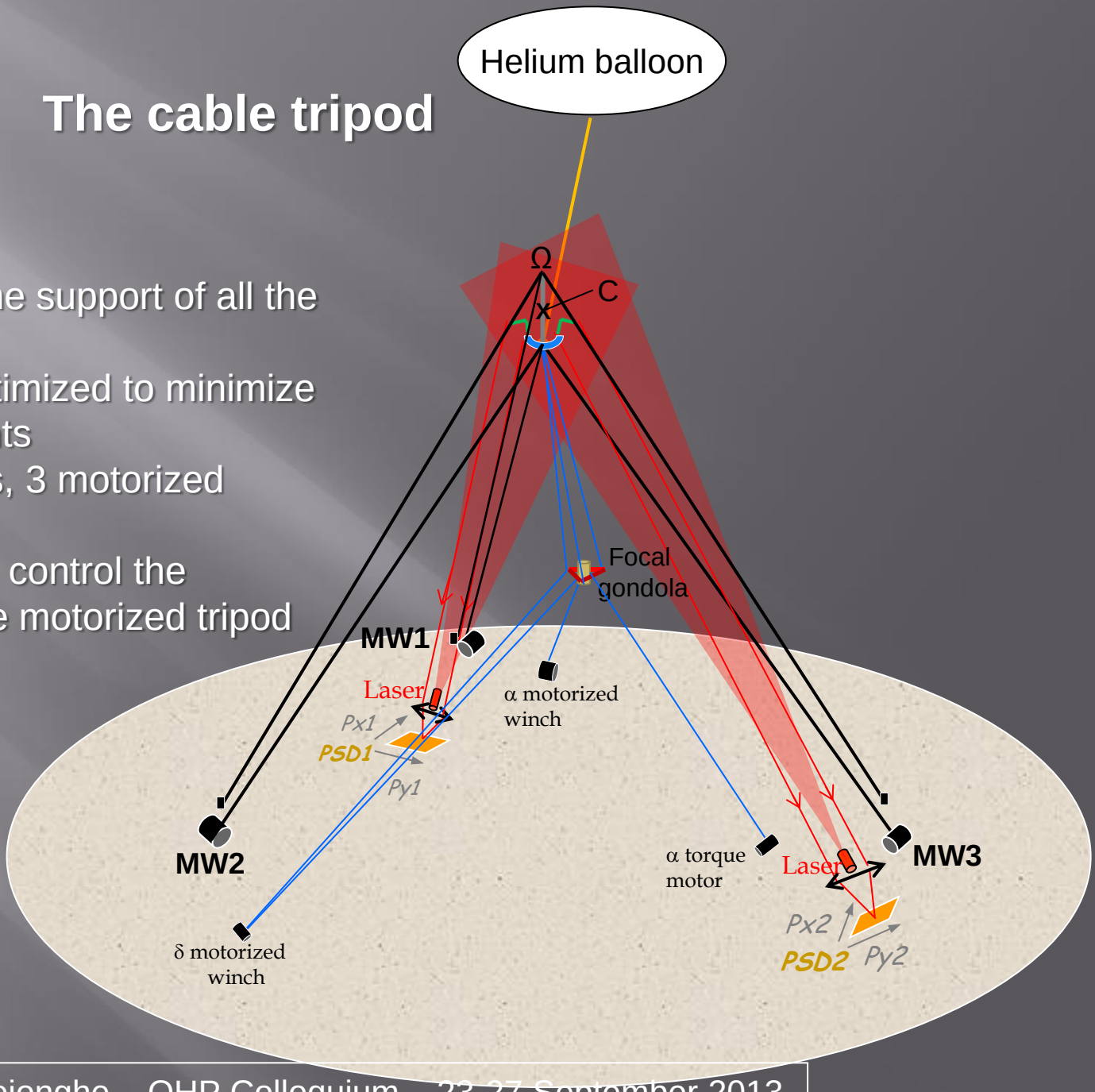
3 cospheric primary segments

- Mirrors fitting a 70 m virtual sphere
- Anchored in the ground
- Manually adjustable in tip-tilt and piston
  - 100 microns accuracy adjustment with a « total station »
  - 5 microns accuracy adjustment with the laser metrology
- Slow drifts in position, due to mechanics or ground?
- A permanent slow servo-loop using metrology fringes information would be required for a further project



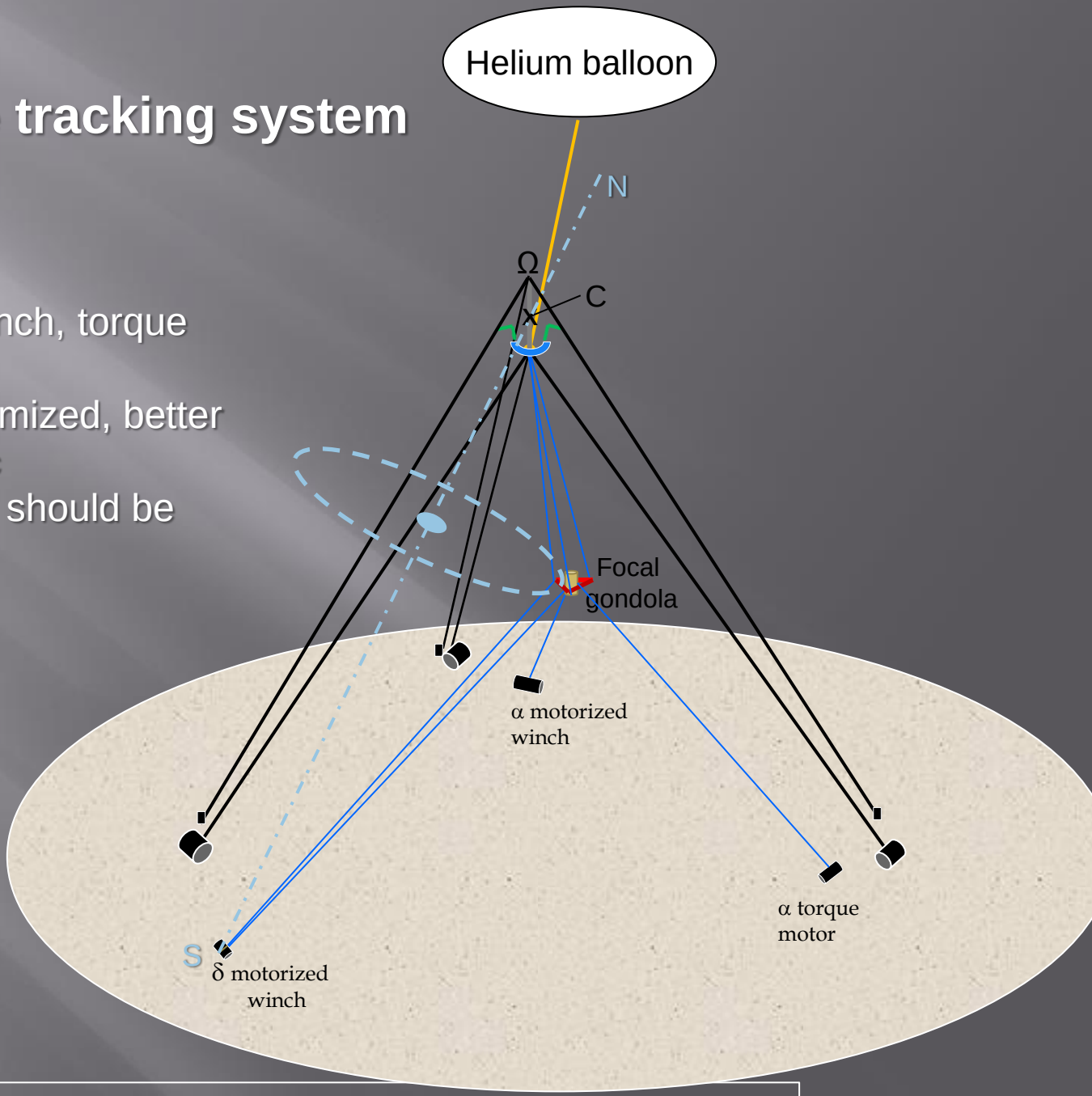
The cable tripod

- Constitutes the support of all the experiment
- Geometry optimized to minimize the movements
- 3 fixed cables, 3 motorized cables
- Servo-loop to control the position of the motorized tripod summit



The tracking system

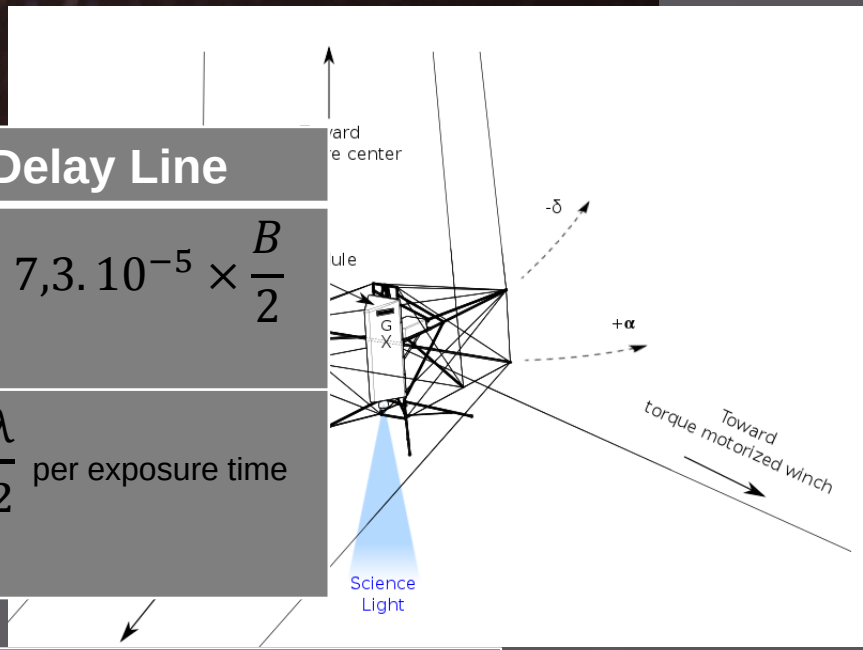
- Equatorial mount
- Alpha winch, delta winch, torque motor
- Torque motor not optimized, better results with an elastic
- A better torque motor should be developed



The focal gondola

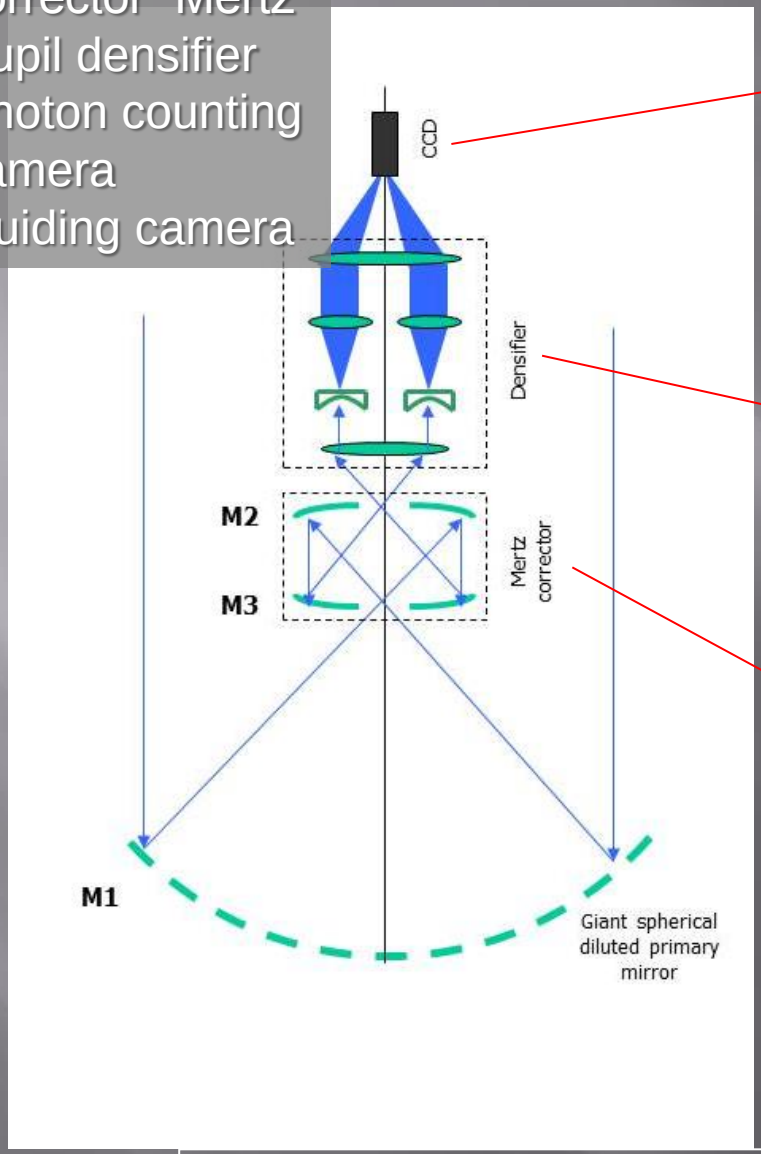
- Carbone structure
- Focal optics
- Attachments optimized to minimize yaw, pitch and roll

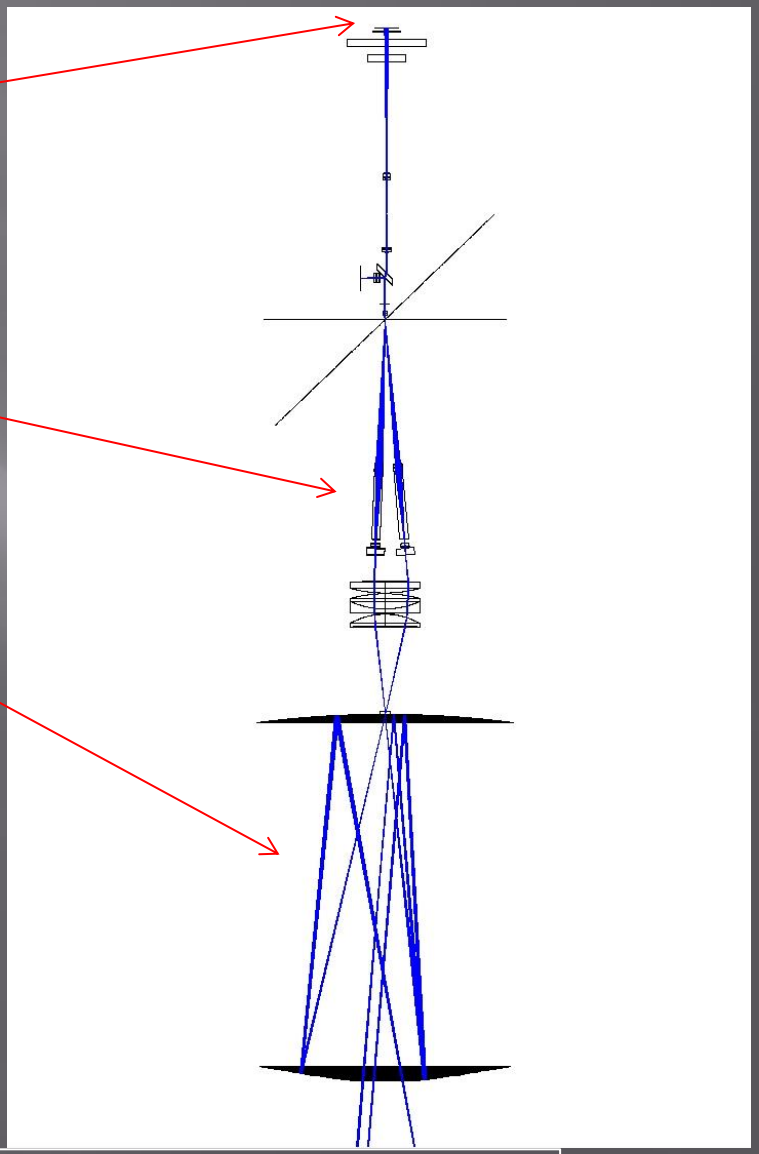
	Focal Gondola	Delay Line
Max speed (m/s)	$7{,}3.10^{-5} \times \frac{R}{2}$ $(7{,}3.10^{-5} \times 2B$ @F/2$)$	$7{,}3.10^{-5} \times \frac{B}{2}$
Max drift	$\lambda \frac{F}{B}$ per exposure time $(2\lambda$ @F/2$)$	$\frac{\lambda}{2}$ per exposure time



Focal optics

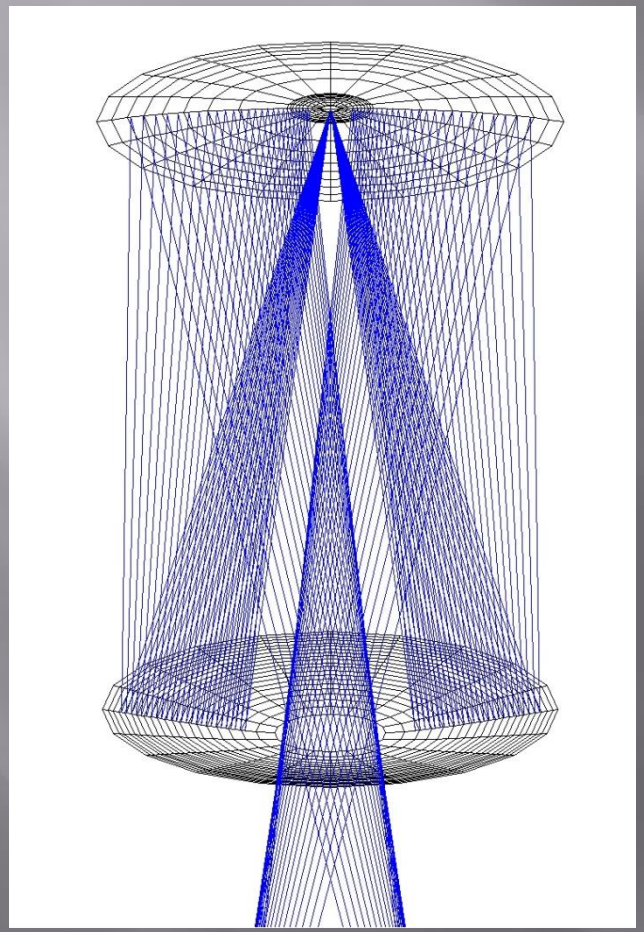
- Spherical aberration corrector “Mertz”
- Pupil densifier
- Photon counting camera
- Guiding camera





The Mertz corrector

- Two highly aspherical mirrors
- Guidance field: +/- 20 arcsec
- Science field: +/- 1 arcsec



PSF @ 0 arcsec

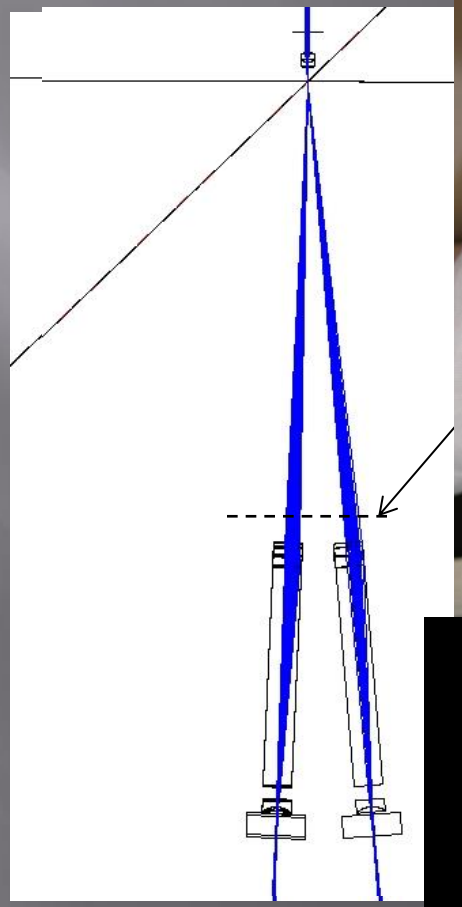
PSF @ 1 arcsec

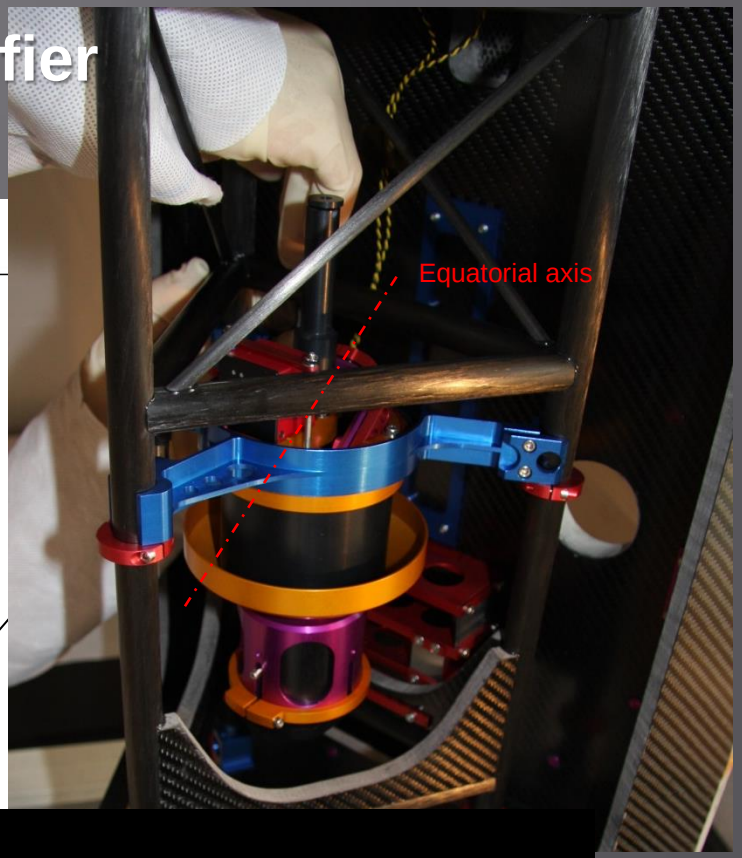
PSF @ 9 arcsec

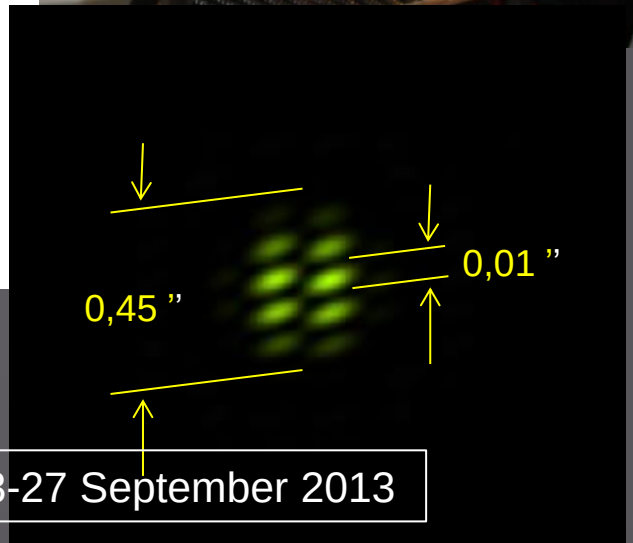
PSF @ 18 arcsec

The pupil densifier

- Destined to reduce the envelope size with regard to the fringes size
- Must follow the pupil movement within 0,1 mm
- Passively positioned with an equatorial mount
- Lab tests and laser sky tests successful, but guidance accuracy (0,1 arcsec) impossible to reach without fine motorized guiding system in the gondola

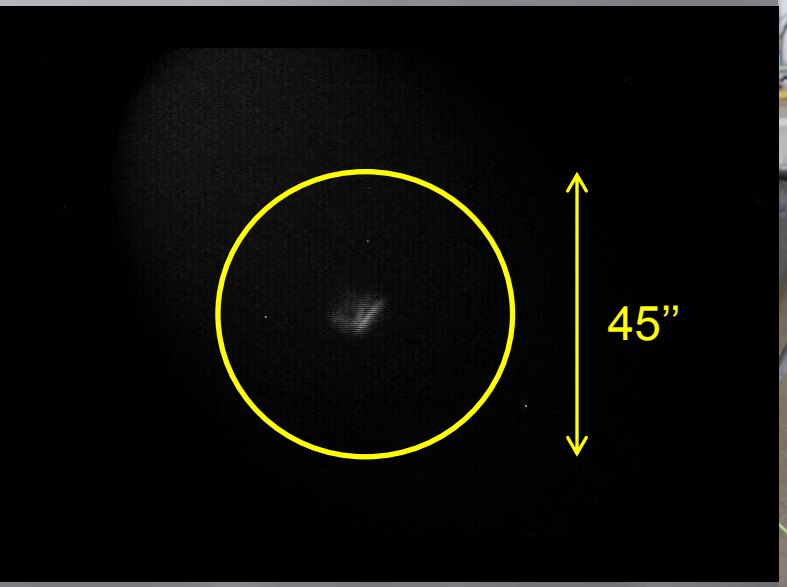




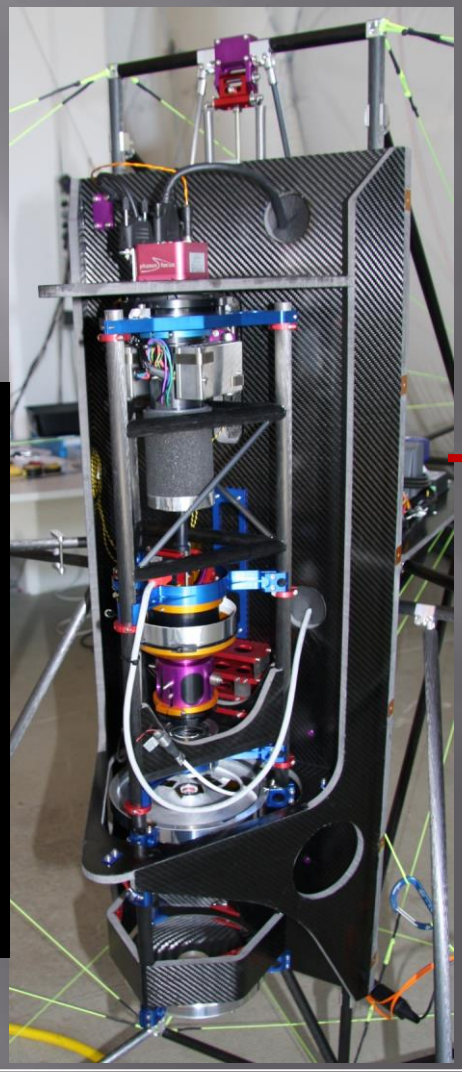


Fizeau version

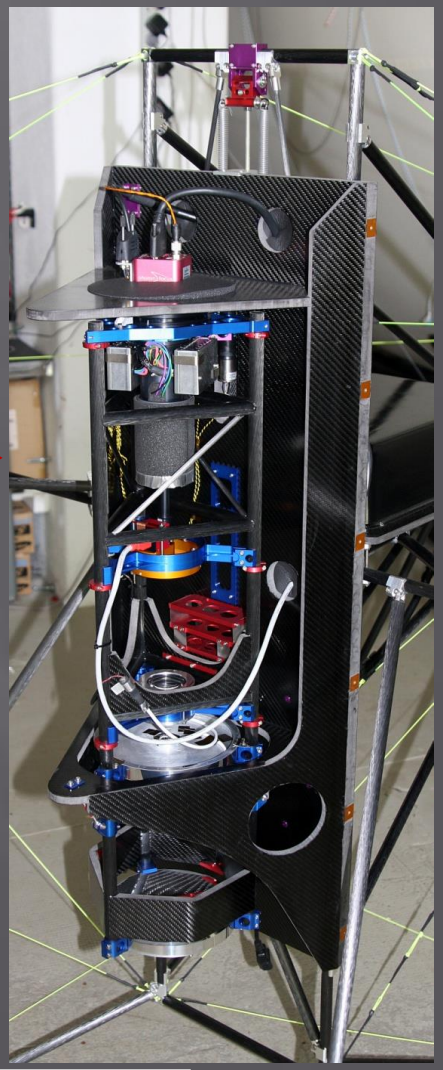
- Guidance tolerance released to +- 1 arcsec
- Good tracking results with very low wind
- Better performance expectable with fine motorized guiding system in the gondola



Densified mode
Science camera field : ±0.1” !!!



Fizeau mode
Science camera field ±1”



Conclusion

- Prototype complete since June 2012
- Good results with servo-loop, laser metrology and guiding
- All the system operates nominally
- Many others controls and servo-loops required for a further project (motors on primary segments, fine tracking system in the focal gondola, etc…)