Sky tests of a 10-m baseline Carlina prototype

A new class of interferometers: the Diluted Telescopes

Plan

I. Introduction and goal of the experiment

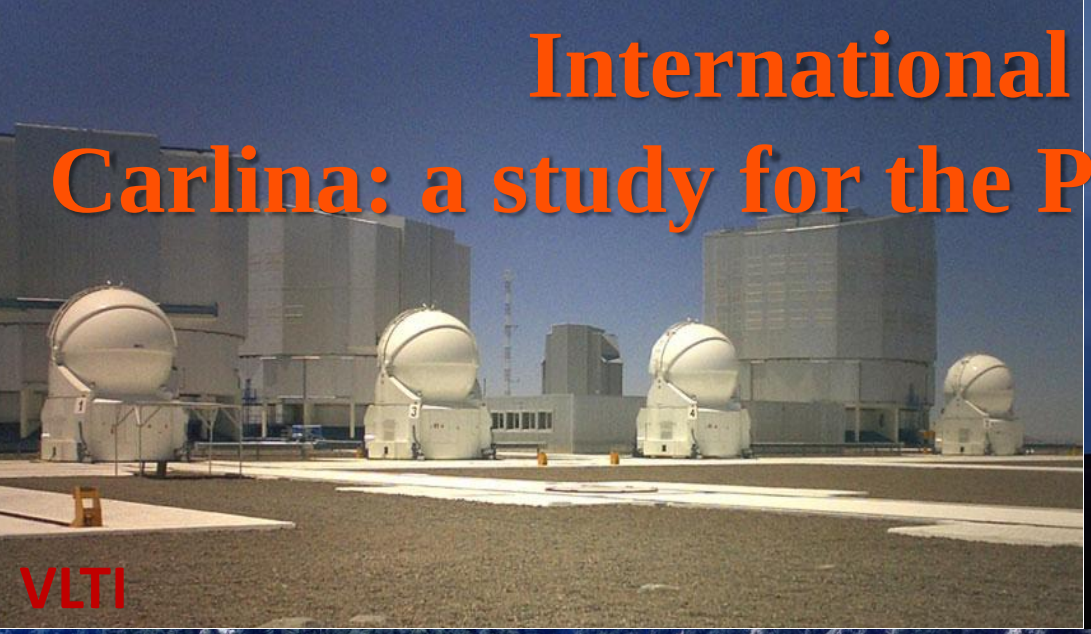
II. Primary mirrors coherencing

III. The Focal gondola

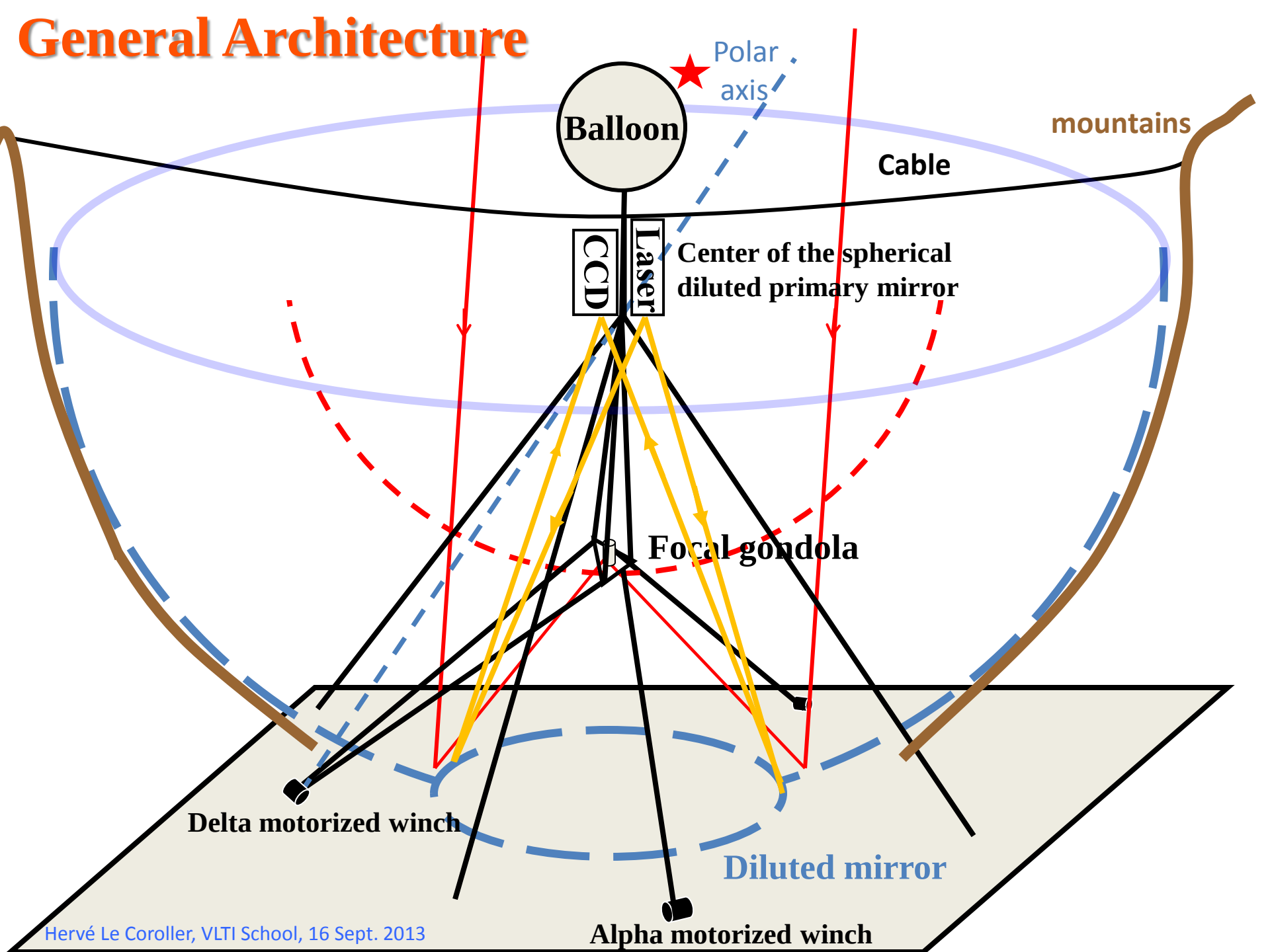
IV. Results and conclusions

International context

Carlina: a study for the Post-VLTI/E-ELT…



General Architecture



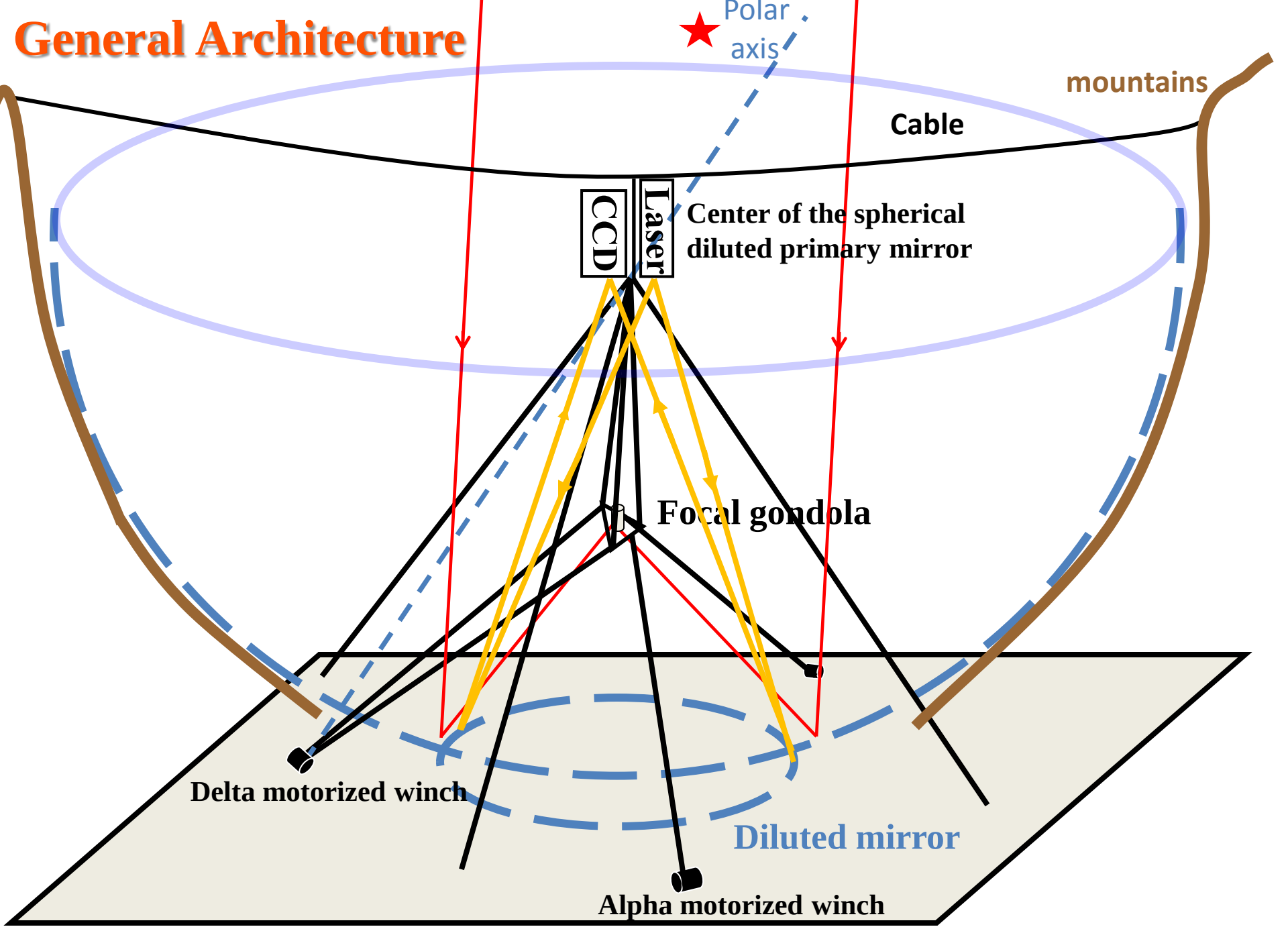
Goal of the Carlina experiment at Haute-Provence Observatory

I. Find the opto-mechanical solutions to stabilize the gondolas attached under cables, and to be able to record fringes ✓

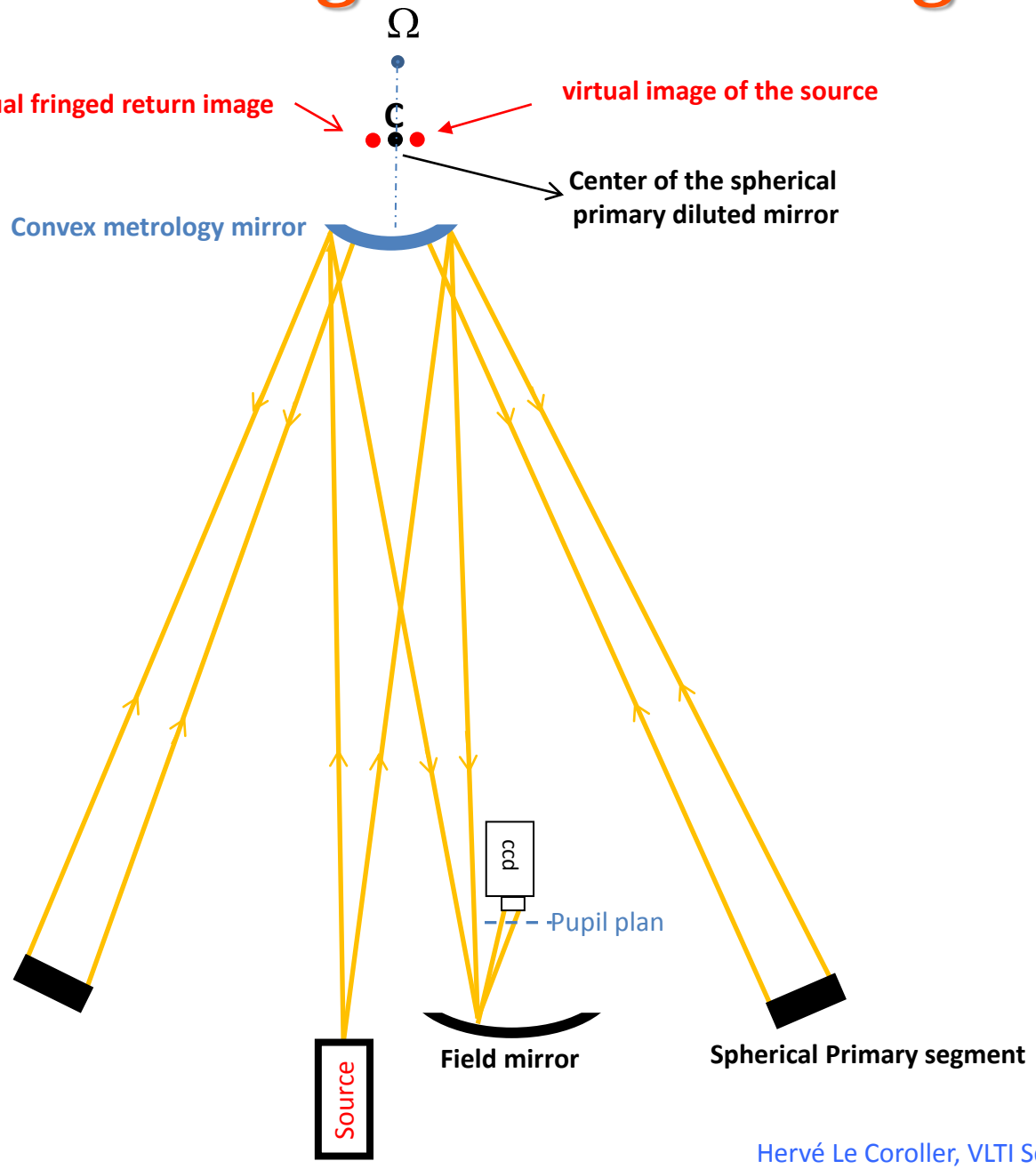
II. Measure in real condition the performances of the Carlina interferometer (sensibility, S/N of the visibilities, etc.)

II. Primary mirrors coherencing

General Architecture

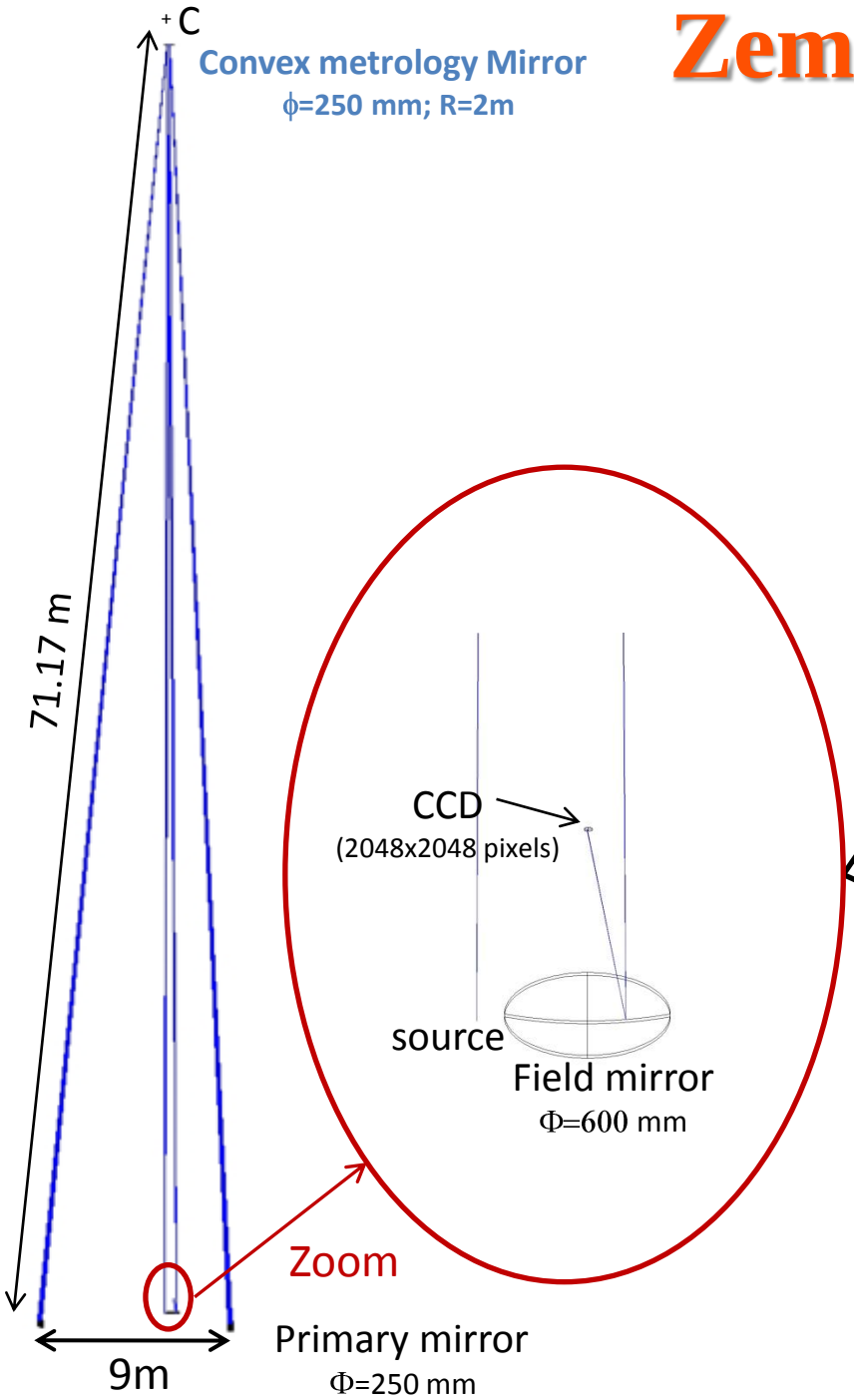


Drawing describing the coherencing technic



Opto-mechanical study of the OHP prototype

Zemax study



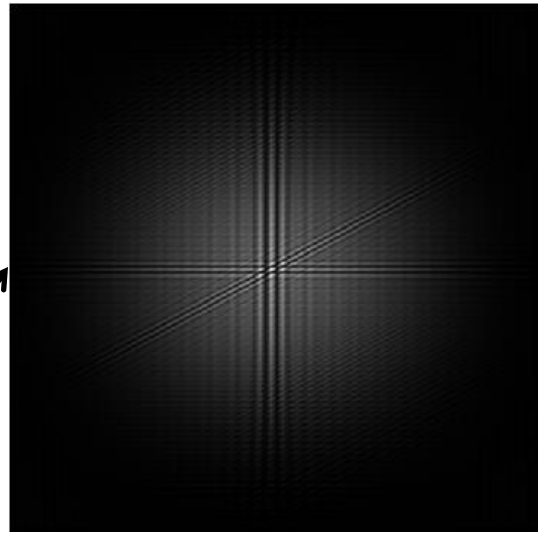
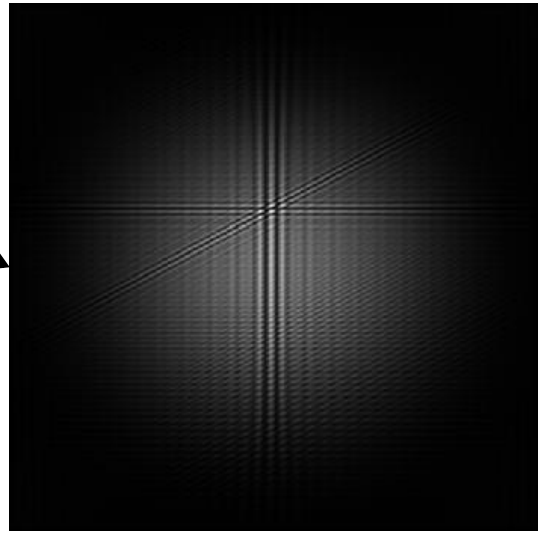


Image
without
piston error

Image
with
5 μm piston error

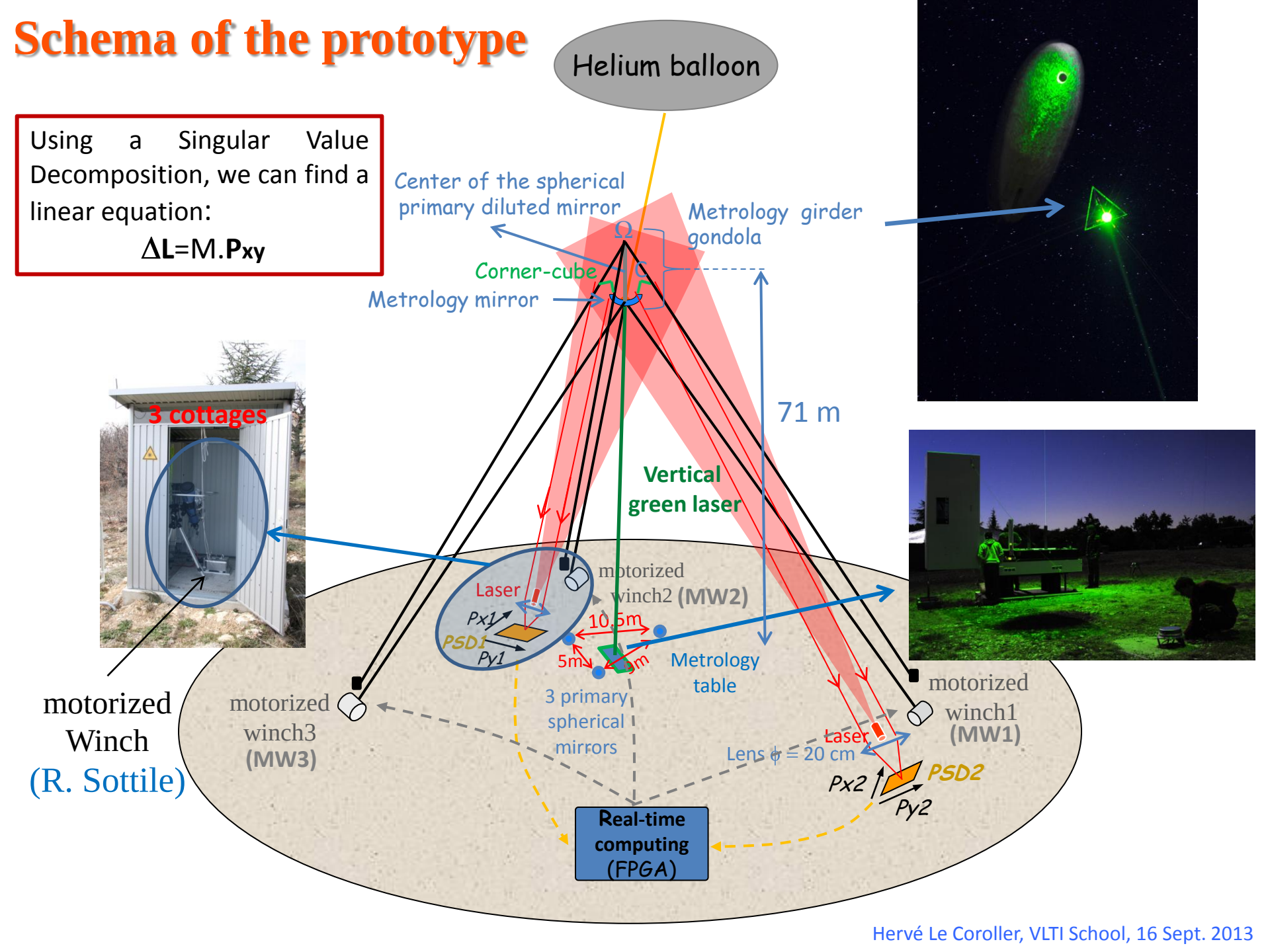


Julien Dejonghe study

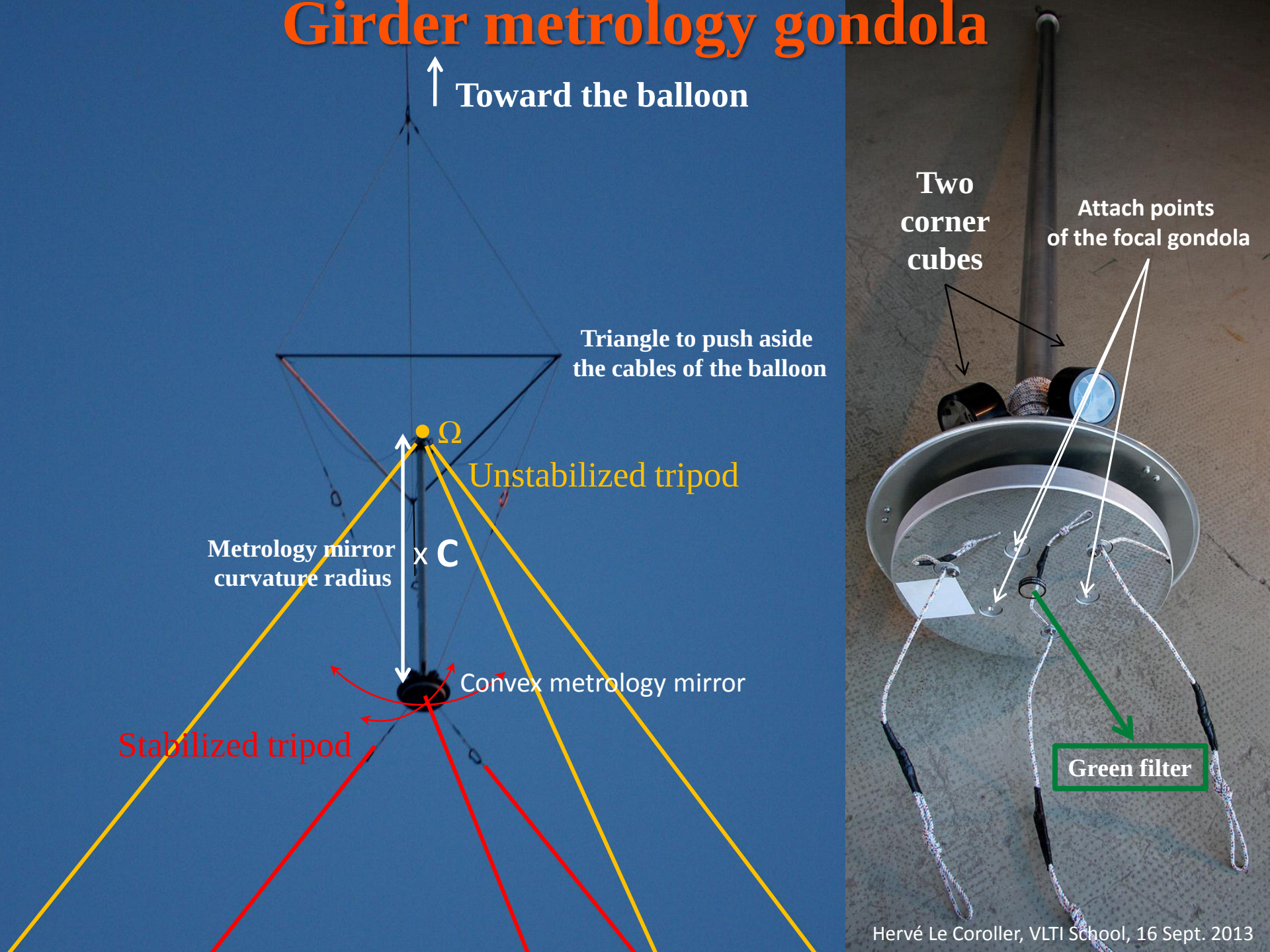
Schema of the prototype

Using a Singular Value Decomposition, we can find a linear equation:

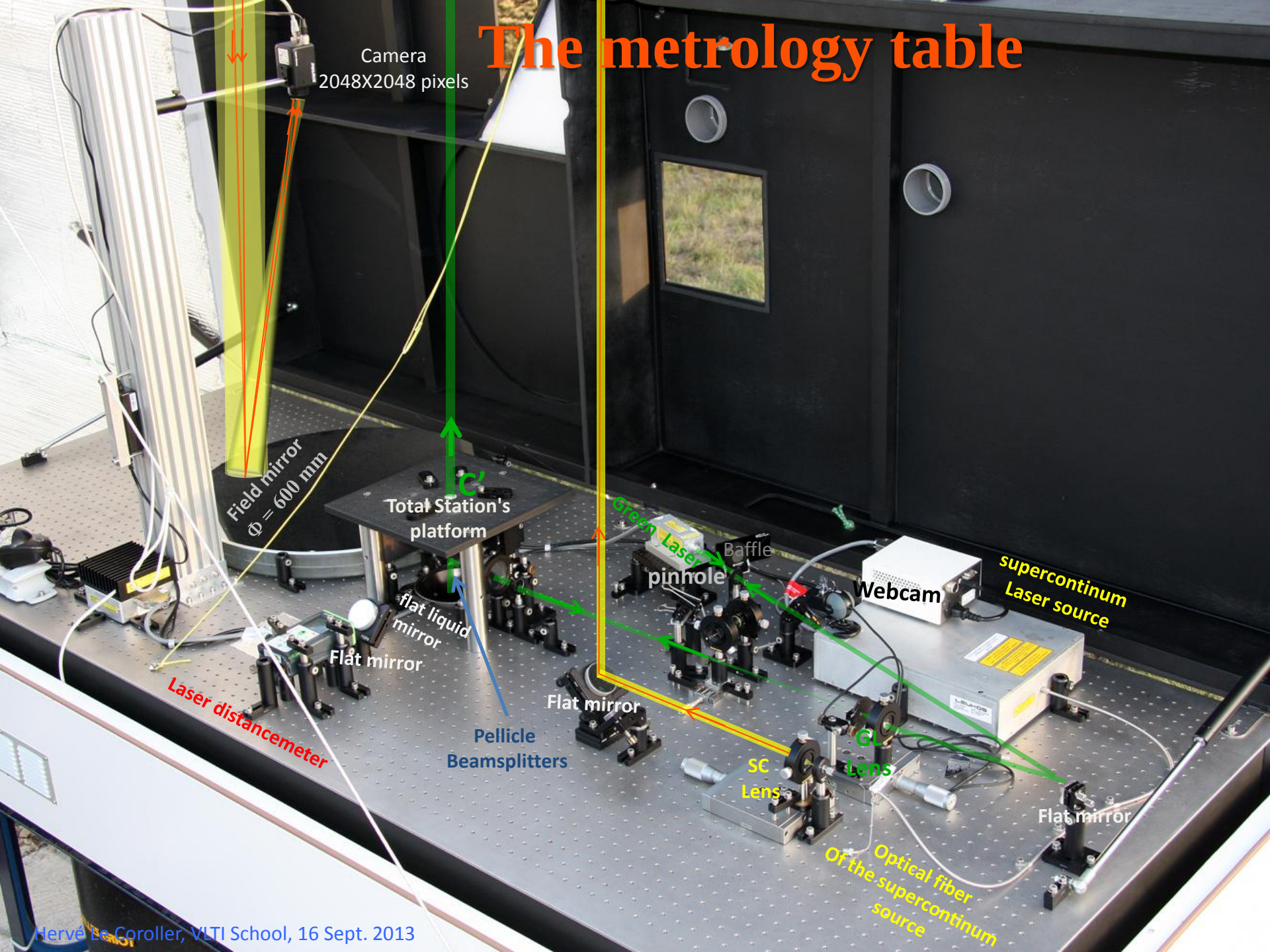
$$\Delta L = M.P_{xy}$$



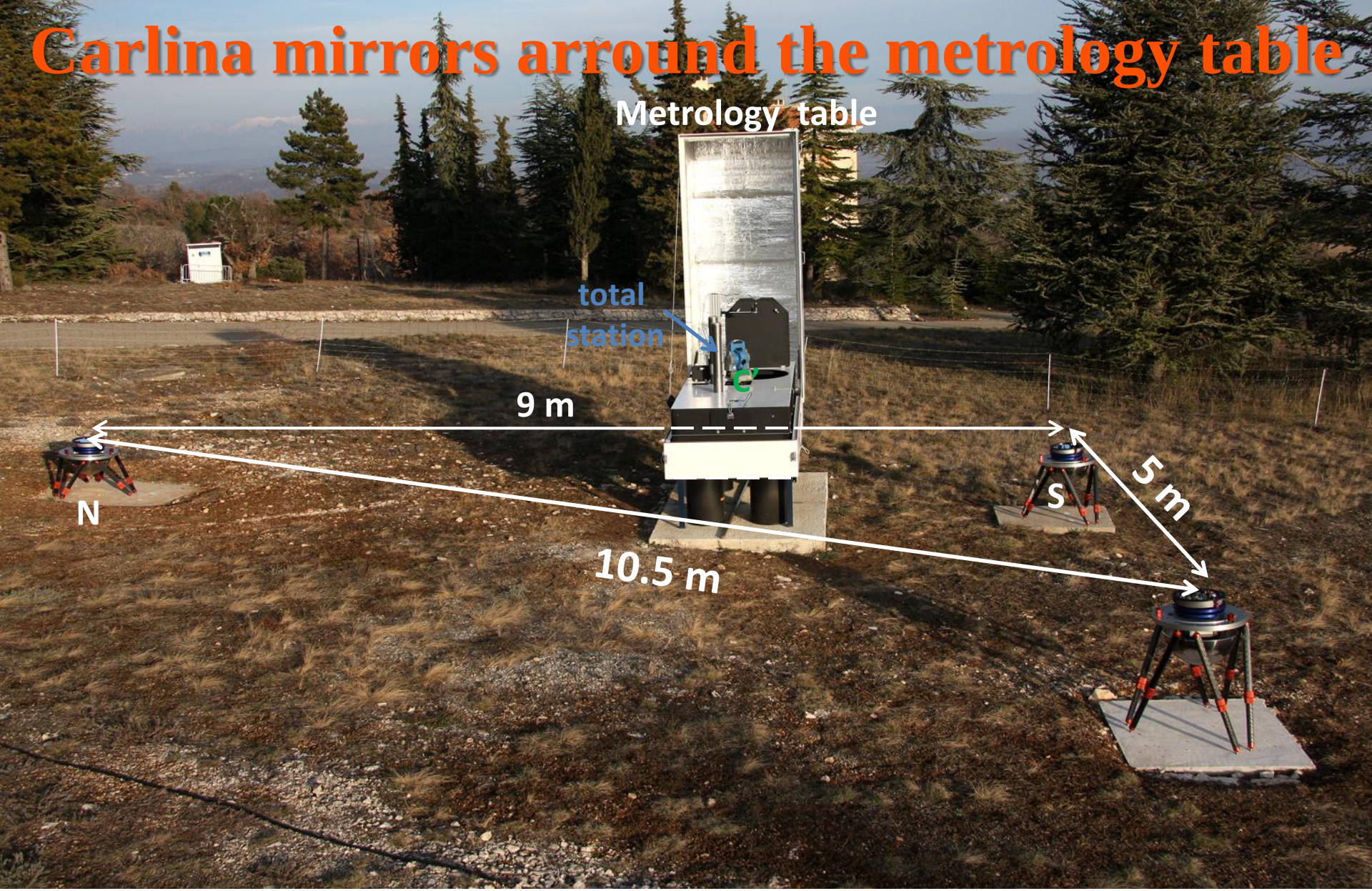
Girder metrology gondola



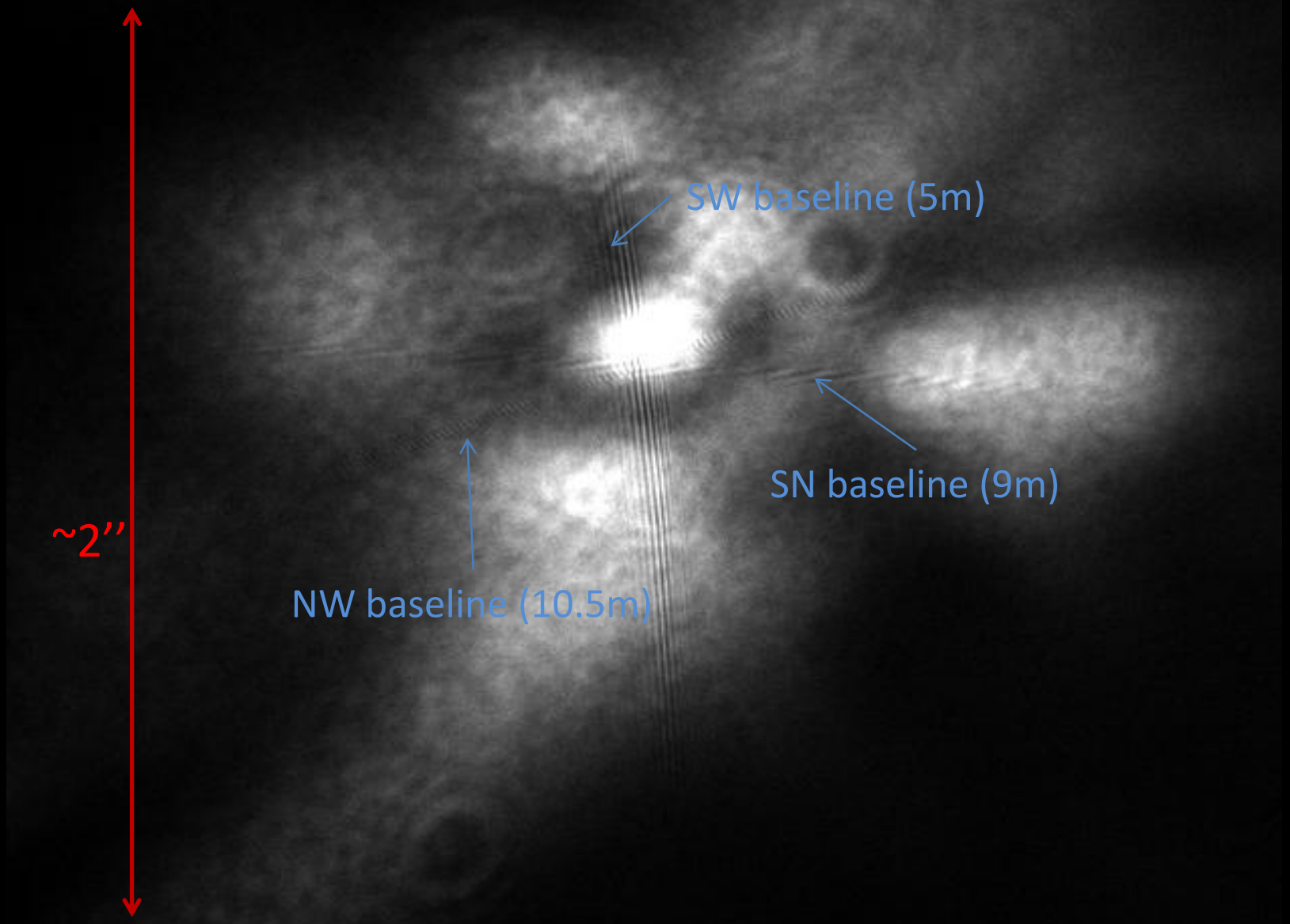
The metrology table



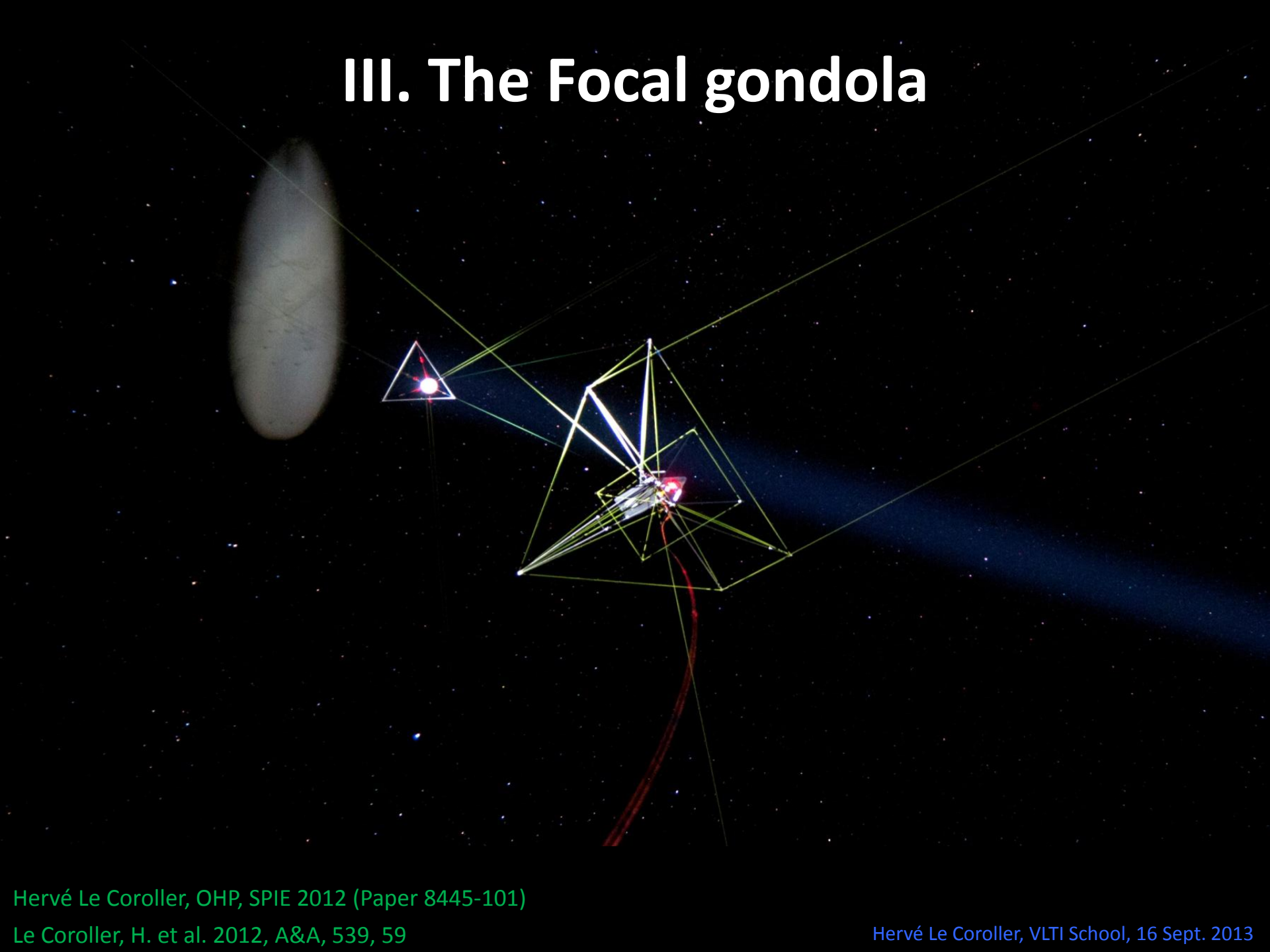
Carlina mirrors arround the metrology table



Metrology fringes



III. The Focal gondola



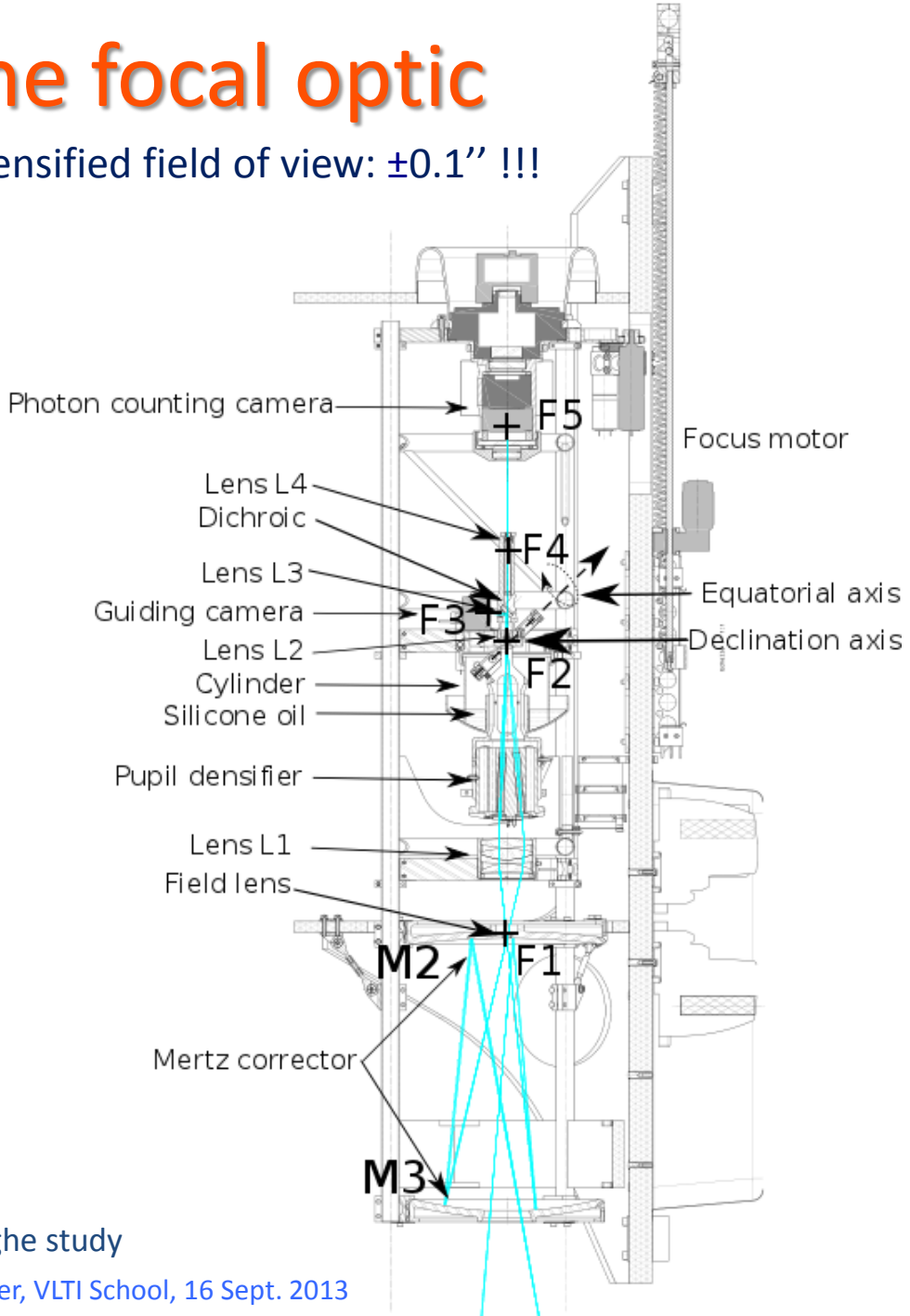
Hervé Le Coroller, OHP, SPIE 2012 (Paper 8445-101)

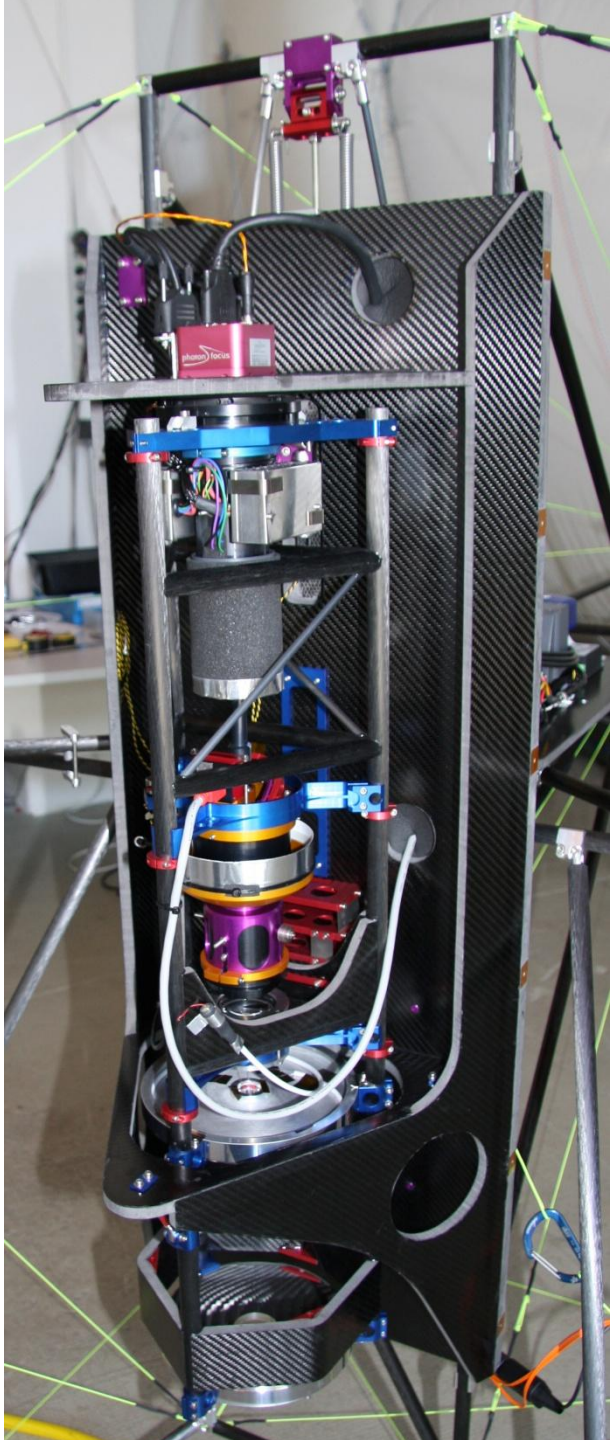
Le Coroller, H. et al. 2012, A&A, 539, 59

III. The focal gondola

The focal optic

Densified field of view: ±0.1'' !!!





Julien Dejonghe study

Densified mode

Science camera field : ±0.1’’ !!!

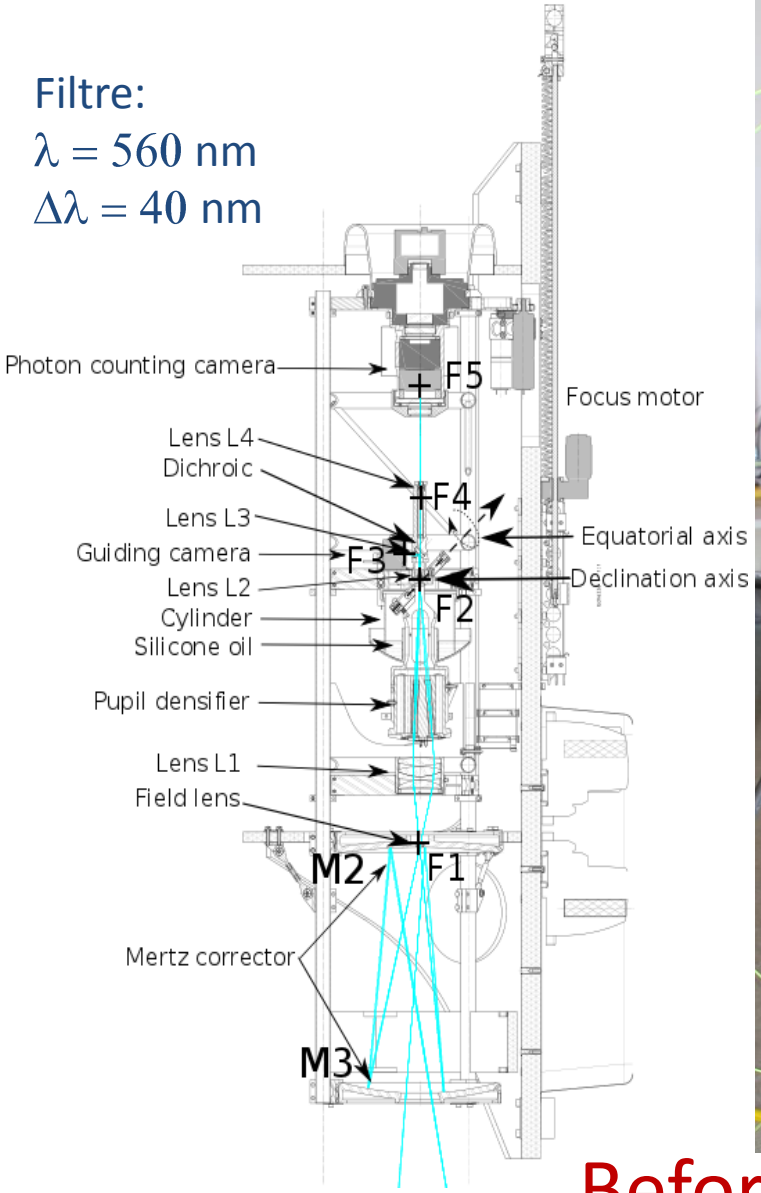
Fizeau mode

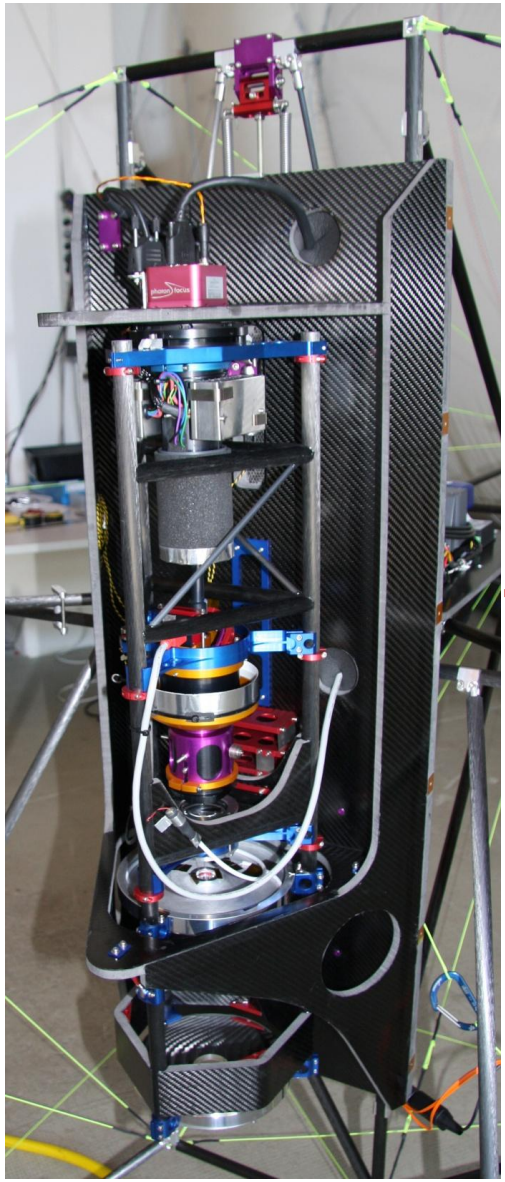
Science camera field ±1’’

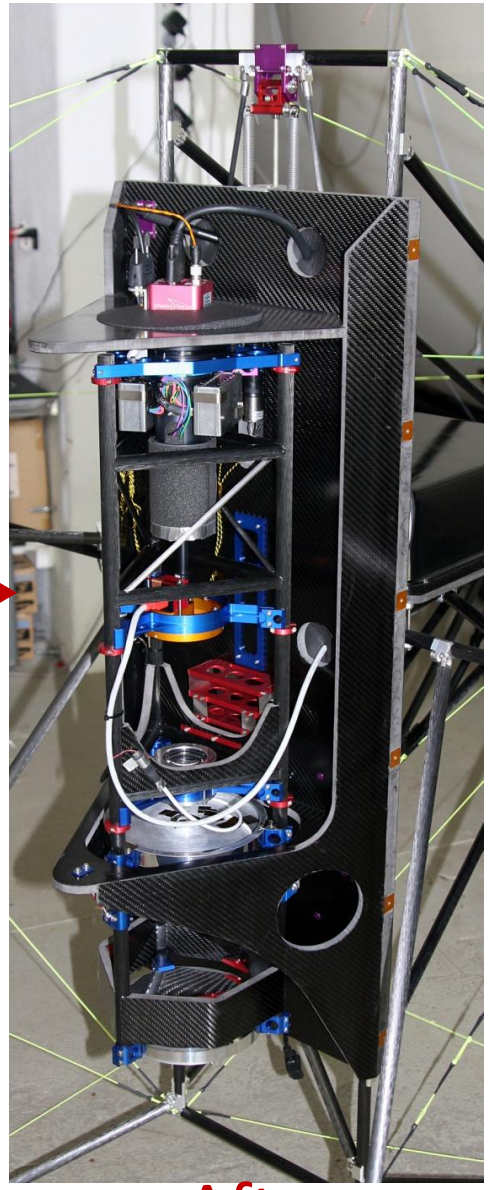
Filtre:

$\lambda = 560$ nm

$\Delta\lambda = 40$ nm

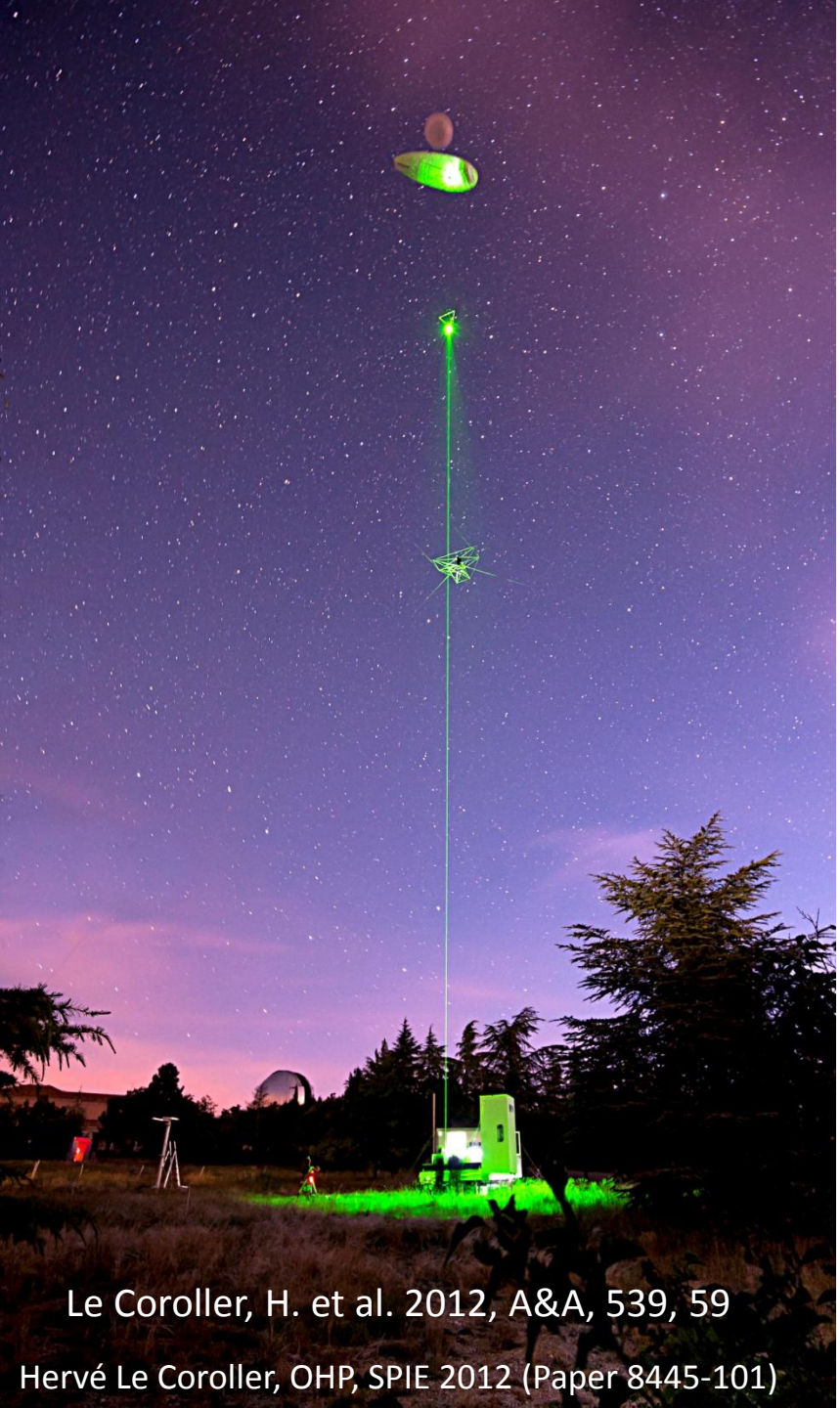






Before

After

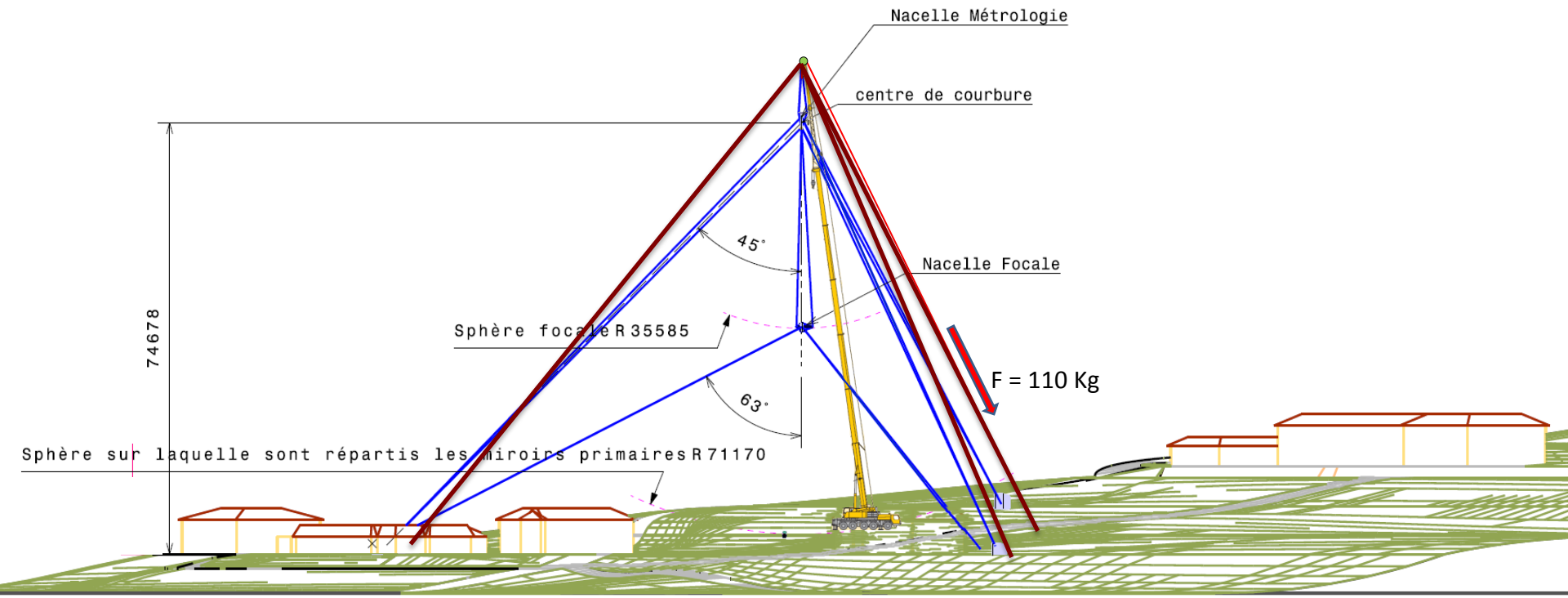


Le Coroller, H. et al. 2012, A&A, 539, 59

Hervé Le Coroller, OHP, SPIE 2012 (Paper 8445-101)

Difficult to observe again with 1-2 balloons !!

A Crane:
a heavy but stable solution
to replace the balloon !

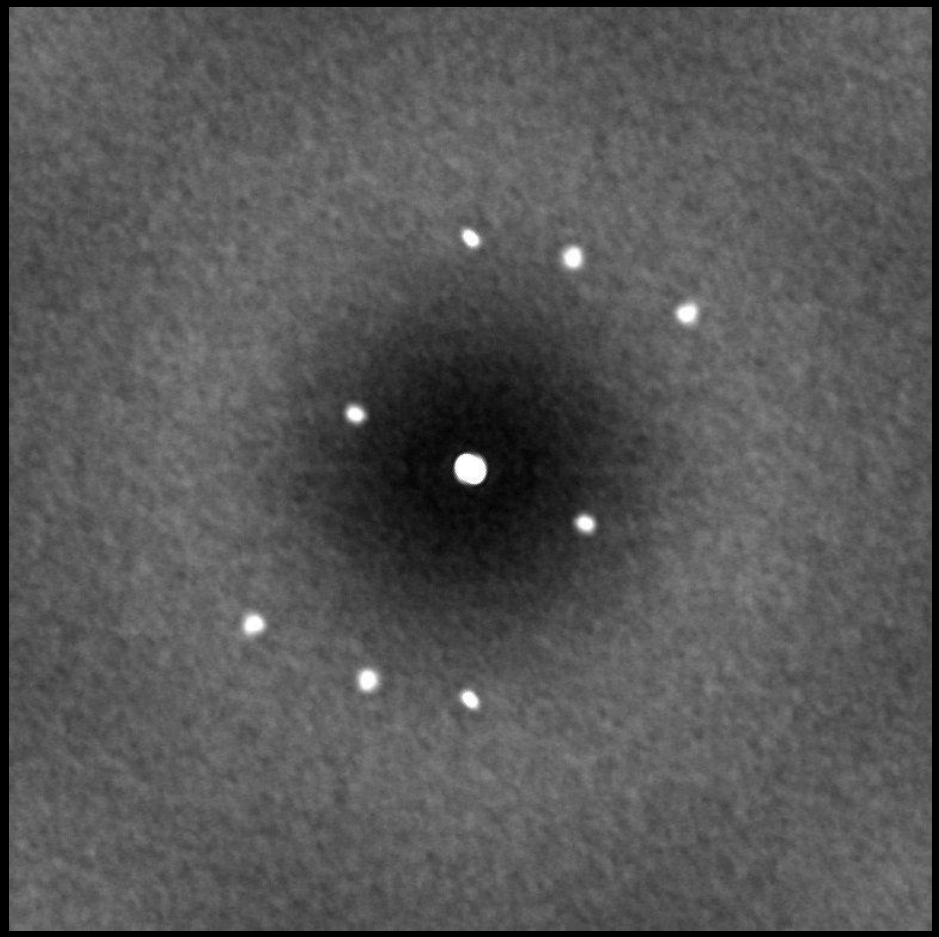


Carlina
with a Crane

IV. Results and conclusions

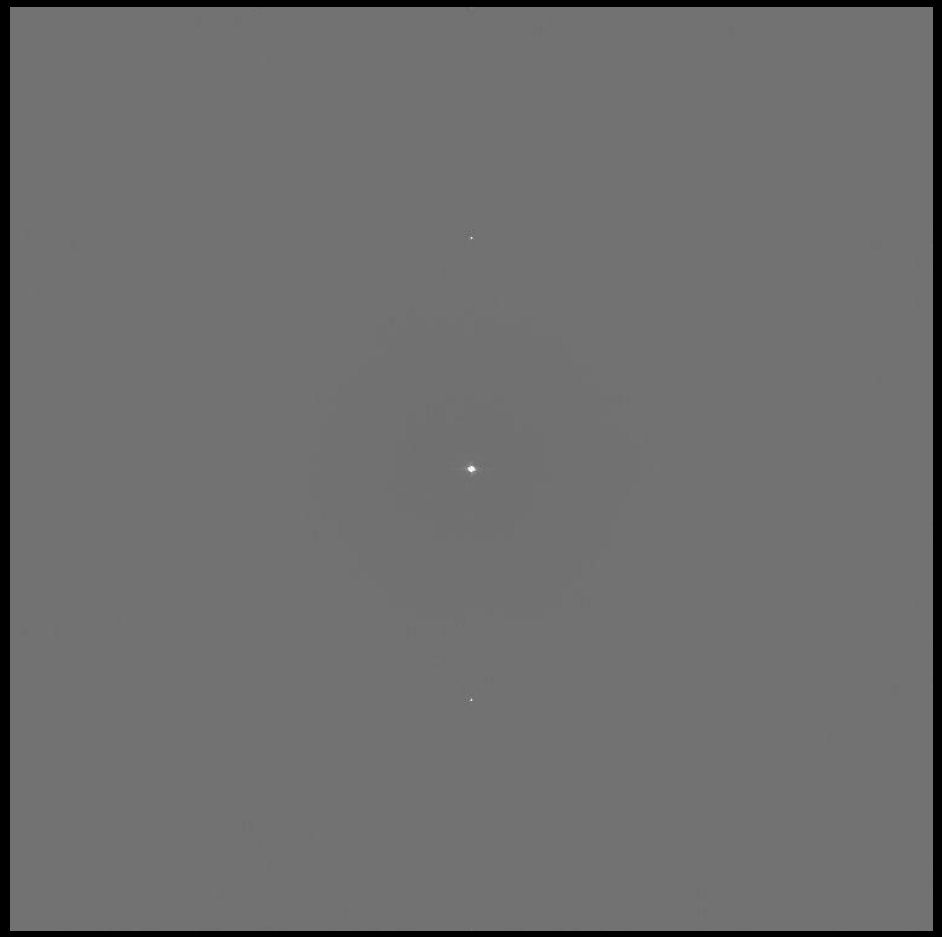
Observation

Power spectrum of a Fizeau recombination in laboratory



Power spectrum of a Fizeau recombination:

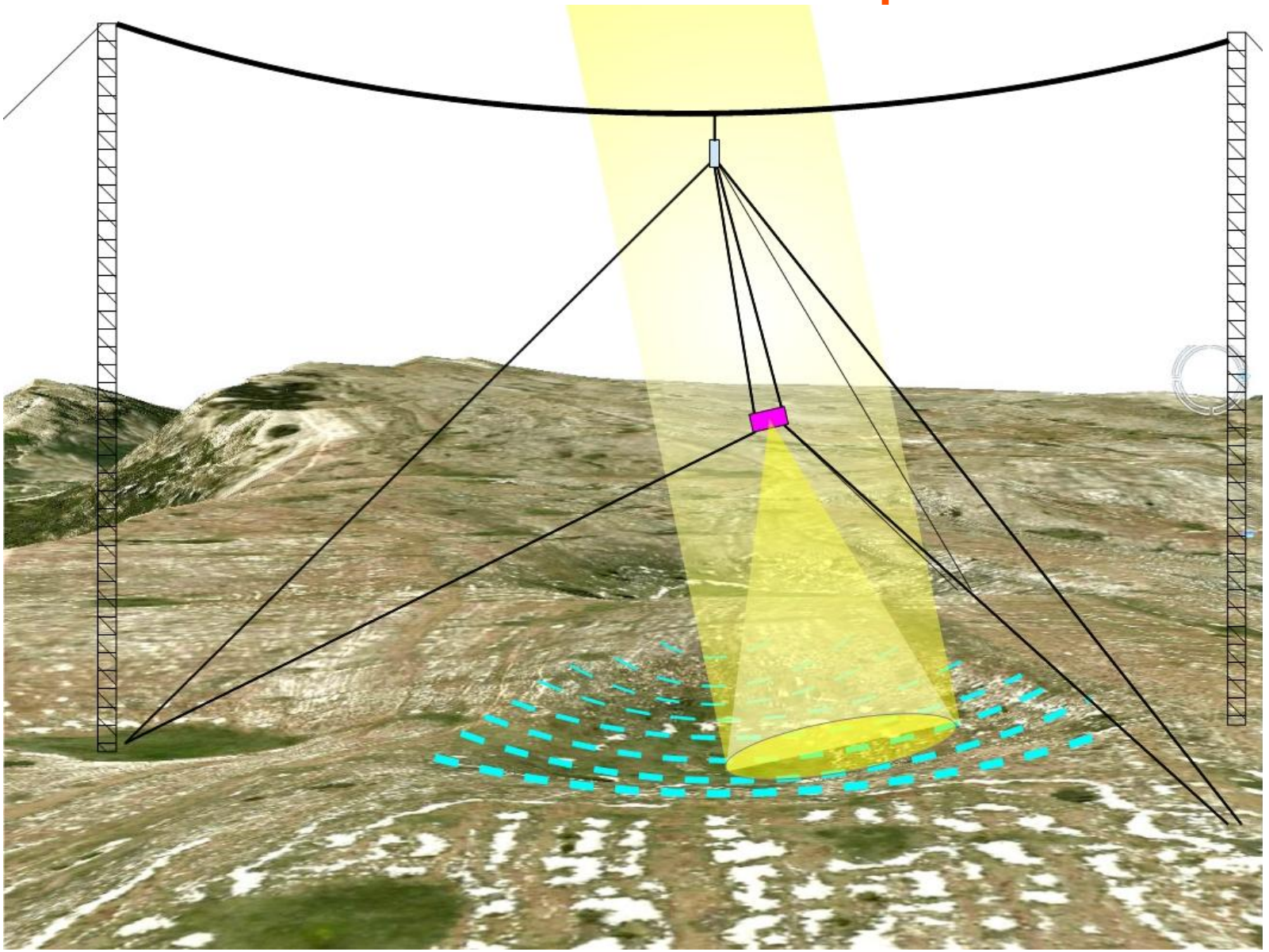
- Stars O AND mv **= 3.7**
- 1 baseline (5m)
-tracking 5 min (10 000 exposures of 5 ms)
- mean : 700 ph/exposure with $\Delta\lambda$=80nm ; λ=560 nm



Possible reasons that could explain why we didn't detect the fringes !

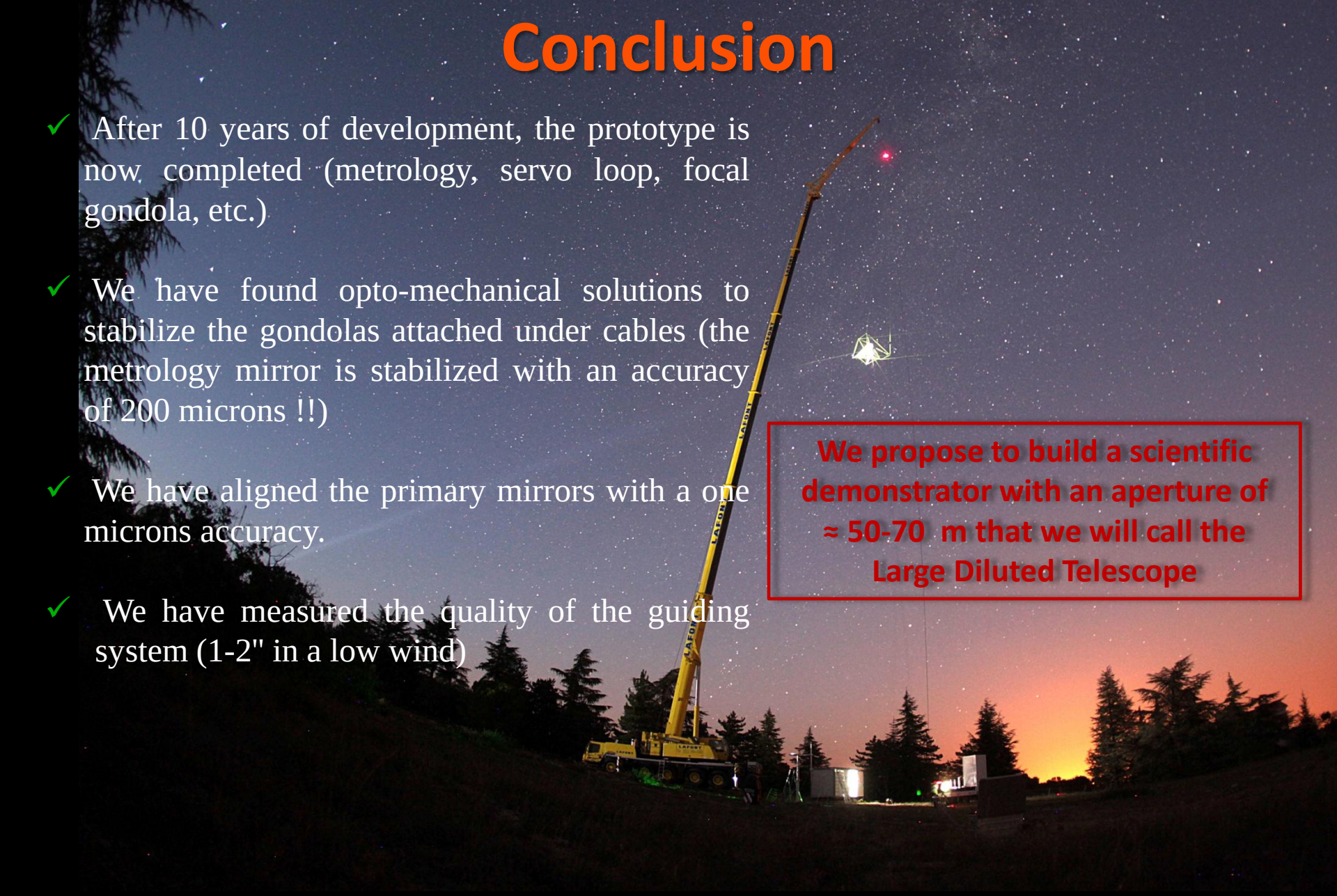
- Vibration of the cables transmitted to the focal optic.
- The bad atmospheric turbulence at OHP
- Our simple focal Fizeau recombiner not well adapted to the atmospheric turbulence
- Problem with the corrector of spherical aberation !?

Diluted Telescope



Conclusion

- ✓ After 10 years of development, the prototype is now completed (metrology, servo loop, focal gondola, etc.)
- ✓ We have found opto-mechanical solutions to stabilize the gondolas attached under cables (the metrology mirror is stabilized with an accuracy of 200 microns !!)
- ✓ We have aligned the primary mirrors with a one microns accuracy.
- ✓ We have measured the quality of the guiding system (1-2" in a low wind)



We propose to build a scientific demonstrator with an aperture of ≈ 50-70 m that we will call the Large Diluted Telescope

Le Coroller, H. et al. 2013, A&A, in preparation

Hervé Le Coroller, OHP, SPIE 2012 (Paper 8445-101)

Colloquium on the futur of the interferometry

I. Current Interferometers and future development for these facilities

II. Unique Science and technologies that will allow to design future interferometers with extremely high performances

III. Problem of sensitivity of interferometers and quality of the observables in interferometry

IV. Optimized beam combiners for present and future interferometers

V. Progress in data reduction and image reconstruction techniques

VI. Discussion on the future of interferometry (EII/ASHRA)