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

Traction force
(balloon or solid structure)

Focal gondola

Focal sphere

Diluted primary mirror

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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

<table>
<thead>
<tr>
<th></th>
<th>Focal Gondola</th>
<th>Delay Line</th>
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<tbody>
<tr>
<td>Max speed (m/s)</td>
<td>(7.3 \times 10^{-5} \times \frac{R}{2})</td>
<td>(7.3 \times 10^{-5} \times \frac{B}{2})</td>
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<tr>
<td>(7.3 \times 10^{-5} \times 2B @F/2)</td>
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<tr>
<td>Max drift</td>
<td>(\lambda \frac{F}{B}) per exposure time</td>
<td>(\lambda \frac{B}{2}) per exposure time</td>
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<td>(2\lambda @F/2)</td>
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• Spherical aberration corrector “Mertz”
• Pupil densifier
• Photon counting camera
• Guiding camera

Focal optics
The Mertz corrector

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

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

Fizeau version

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...)

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