A testing facility for AO on-sky demonstrations at the Copernico's Telescope within the LABORATORIO NAZIONALE ADONI OTTICA ADATTIVA framework

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On behalf of

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Testing facility for AO on-sky demonstrations

Facility for ON-SKY testing - Copernico TEL

Accessible to the AO community

Testing of critical sub-sytems/components/prototypes of innovative concepts

Coude' focus → AO Laboratory

PROJECT STATUS

Optical Design	✅
Mechanical Design	✅
Procurement Optics & Mounts	✅
Test: characterization of Optics & Mounts & Mechanics	✅
Integration	WiP
Laboratory @ Coude'	✅

Refurbishment of optical train Coude' focus

Workbench ON-SKY

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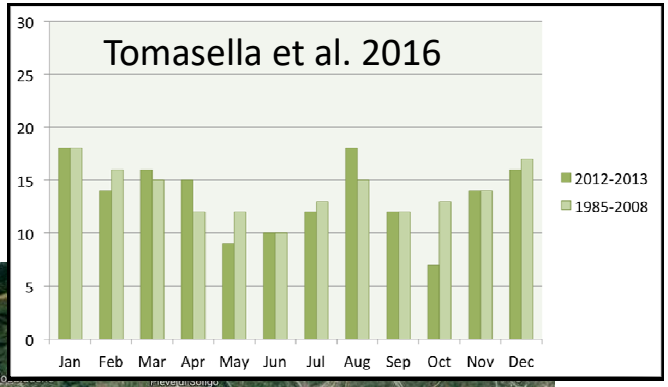
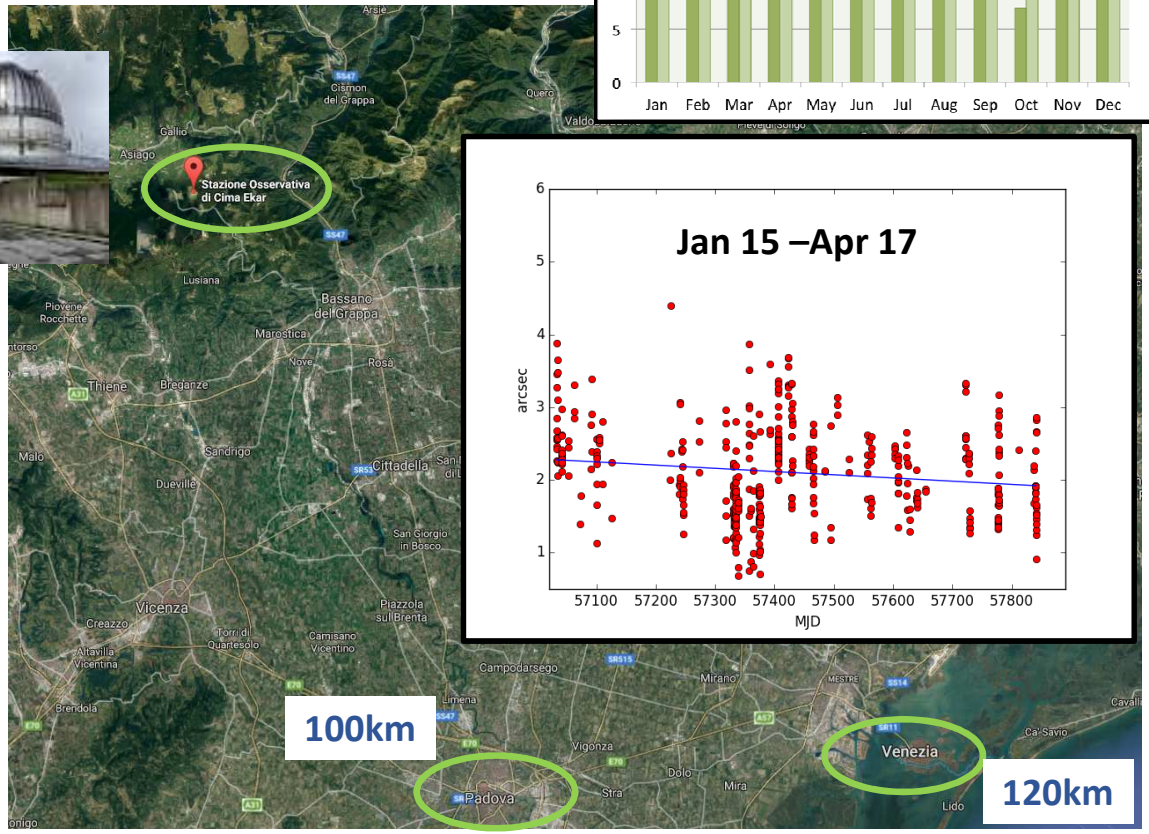
COPERNICO TELESCOPE Asiago





Diam 1.82m
Focal length 16.38m
F/9
Foci: Cassegrain, 2 Nasmyth, Coude’

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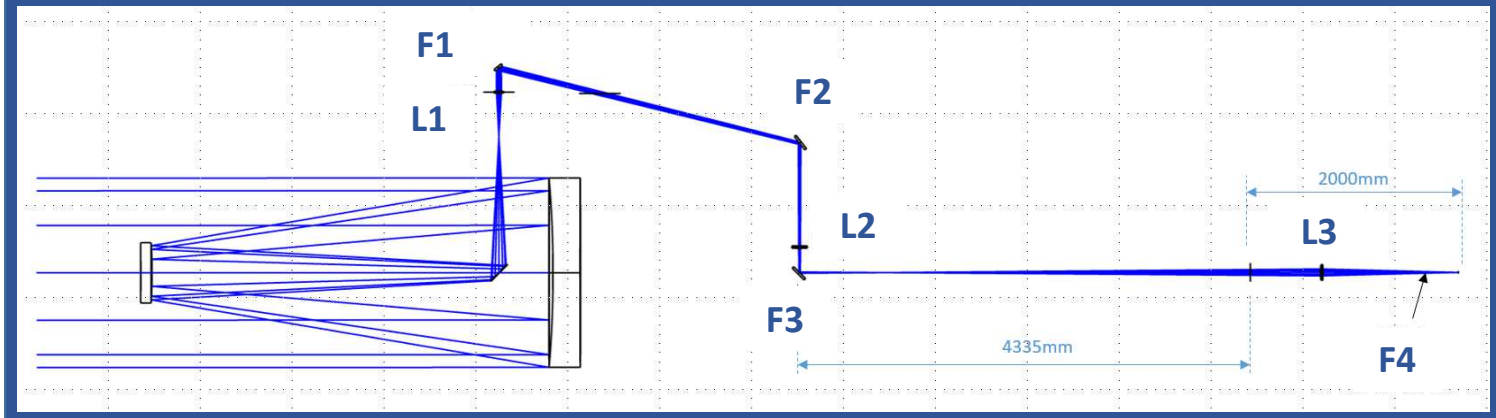
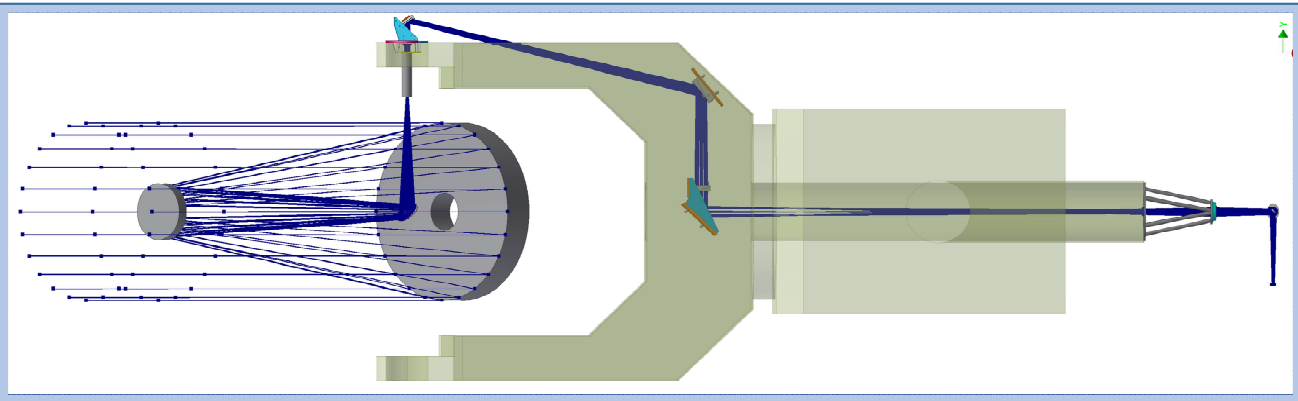
HW - DESIGN



OPTICAL Design



MECHANICAL Design

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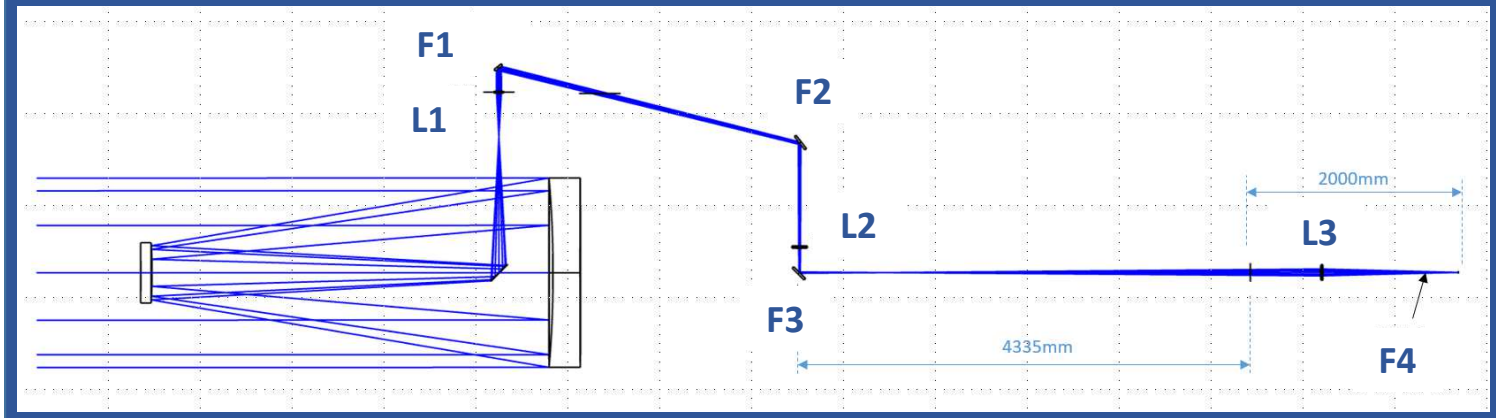
OPTICAL DESIGN



Lenses L1, L2, L3
Mirrors F1, F2, F3. F4

F/19.5 TELECENTRIC
FoV ≈ 2.4 arcmin

Scale ≈ 6 arcsec/mm

L1 - F1

Component		Dimension mm	Weight kg
L1	L1 lens	Ø 75 t = 17.05/12.84	Lens: 0.18 Mount: 1.32
	L1 mount + interface ring	Ø 76.2 5.75x3.00x6.20	Ring: 0.10 TOT: 1.60
F1	F1 mirror	Ø 76.2 t = 19.10	Mirror: 0.18 Mount: 1.32
	F1 mount + interface ring	Ø 76.2 5.75x3.00x6.25	Ring: 0.10 TOT: 1.98

F2- L2 – F3

Component		Dimension mm	Weight kg
F2	F2 mirror	Ø 203.2 t = 25.00	Mirror: 1.80 Mount: 13
	F2 mount	Ø 203.2 304.80x152.40x292.10	TOT: 14.8
L2	L2 lens	Ø 150 t = 23.27/20.30	Lens: 1.15 Mount: 3.7
	L2 mount	Ø 152.4 203.2x152.4x203.2	TOT: 4.85
F3	F3 mirror	Ø 203.2 t = 25.00	Mirror: 1.8 Mount: 13
	F3 mount	Ø 203.2 304.8x152.4x292.1	TOT: 14.8

L3 – F4

Component		Dimension mm	Weight kg
L3	L3 lens	Ø 150 t = 24.63/18.7	Lente: 0.14 Montatura: -
	L3 mount	Custom	
F4	F4 mirror	Ø 100 t = 15	Specchio: 0.24 Montatura: 1.56
	F4 mount	101.6	TOT: 1.8

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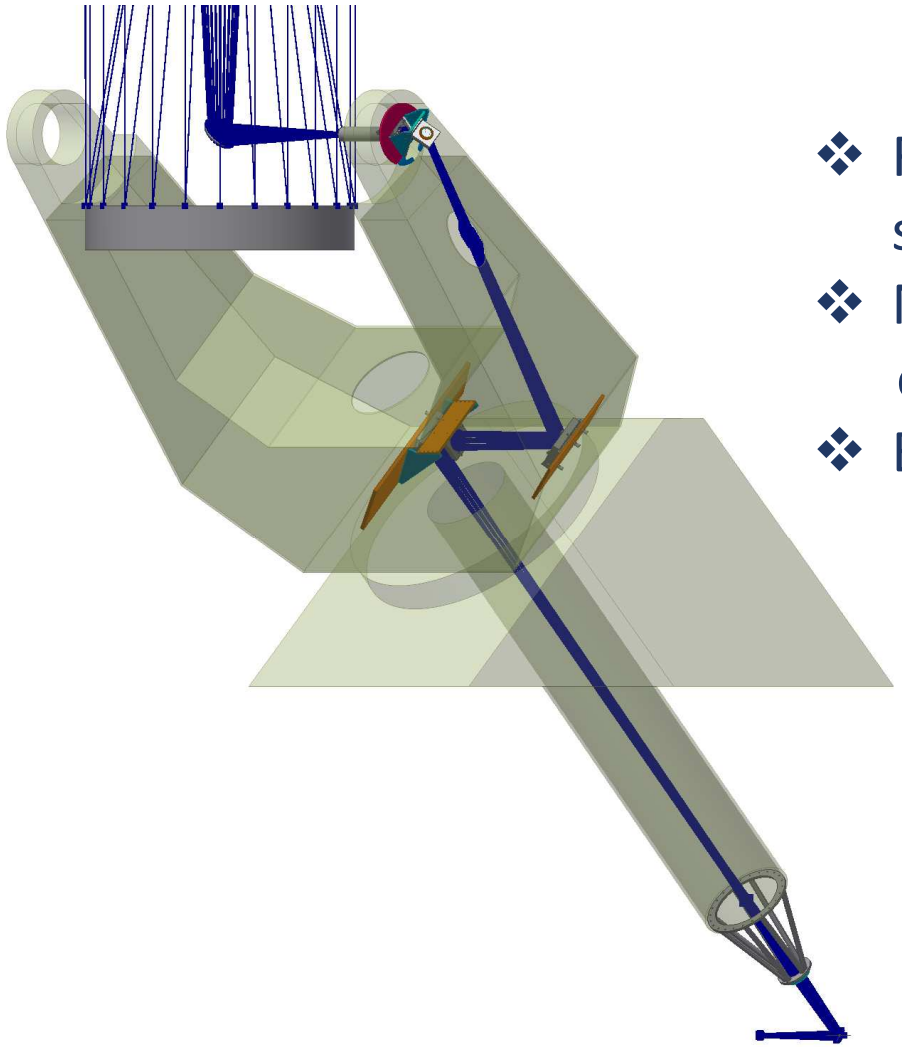

MECHANICAL DESIGN

- Fittable to the pre-existing structure
- Not alteration the performance of the telescope
- Existing interfaces

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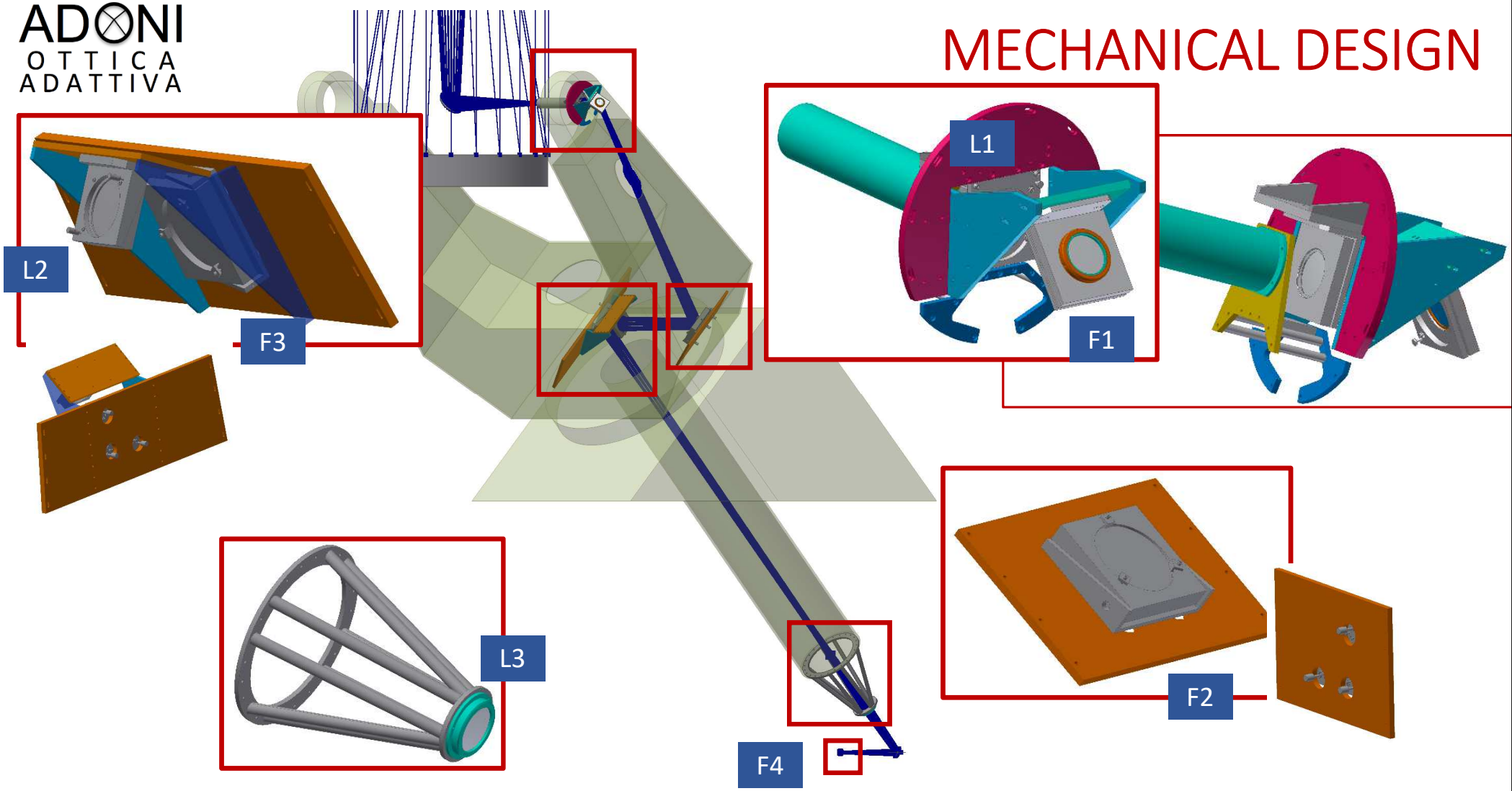
MECHANICAL DESIGN



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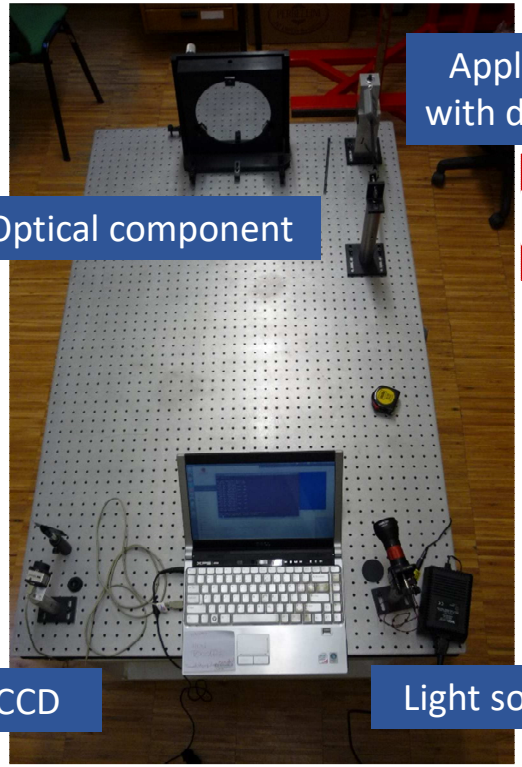
Optics & Mounts Characterization: FLEXURE TEST

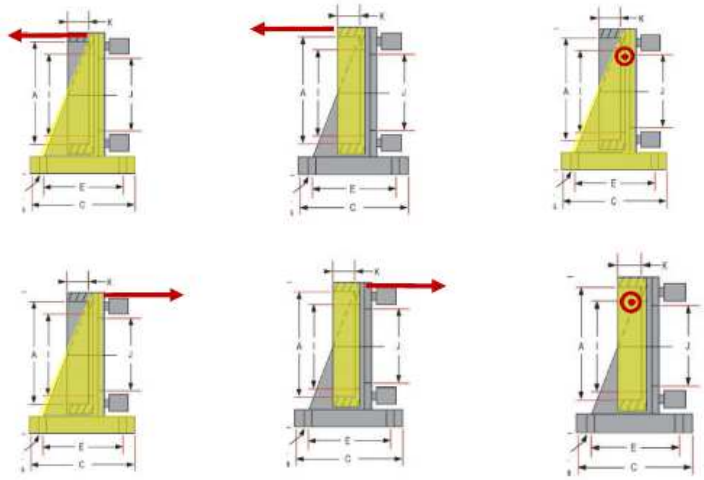
Simulating gravity



Applied tension with dinamometer

1 kg | 2 kg | 5 kg | 10 kg | 15 kg

- Coude' Focus redirects the beam, no matter where the telescope is pointing, to a fixed place in a lower lever → gravity invariant.
- Opto-mechanical components inside fork → subject to TEL movement
- Characterize flexures



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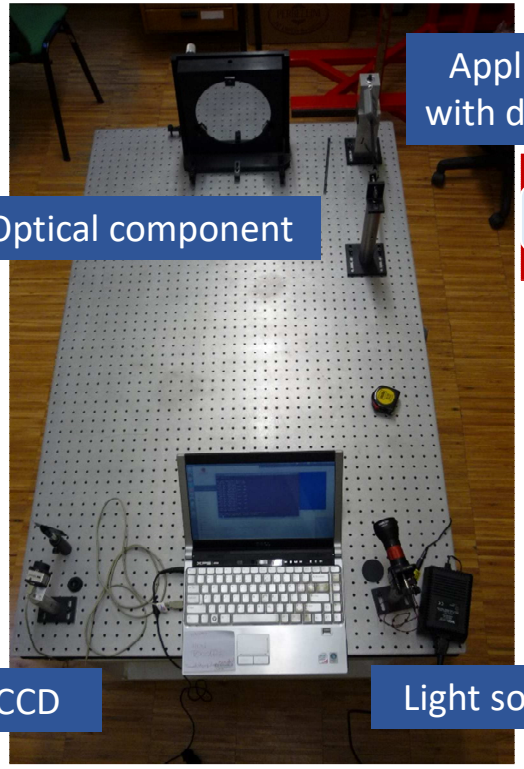
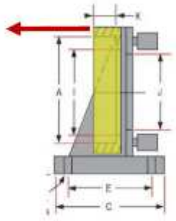
Optics & Mounts Characterization: FLEXURE TEST Mount 8”

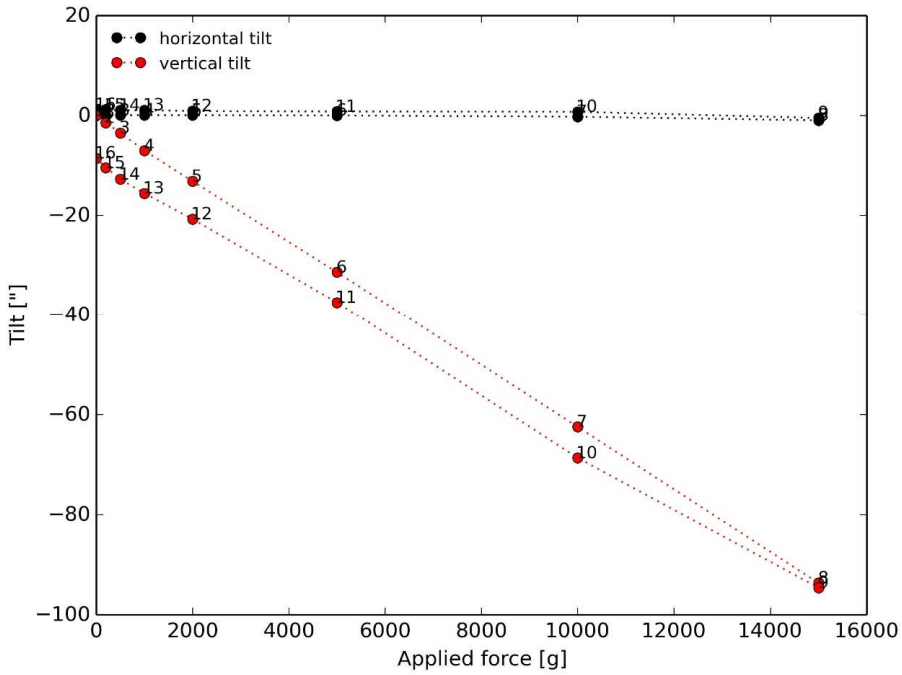
Simulating gravity



Applied tension with dinamometer

1 kg | 2 kg | 5 kg | 10 kg | 15 kg





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Optics & Mounts Characterization: FLEXURE TEST

All Mounts

Mount	Optic	Dim	Total displacement on optic [°]	Max radial displacement on focal plane ["]
L1	Lens	3"	0.1166	0.31
F1	Mirror	3"	0.1166	27.04
F2	Mirror	8"	0.038	4.64
L2	Lens	6"	0.0175	0.014
F3	Mirror	6"	0.038	2.93
L3	Lens	8"	TBD	TBD

Radial displacement on Focal Plane MC(10000) = 27.54"
40% FoV

Worst case

Reinforced mounts

Mount	Optic	Dim	Total displacement on optic [°]	Max radial displacement on focal plane ["]
L1	Lens	3"	0.0119	0.03
F1	Mirror	3"	0.0119	2.77
F2	Mirror	8"	0.038	4.64
L2	Lens	6"	0.0175	0.014
F3	Mirror	6"	0.038	2.93
L3	Lens	8"	TBD	TBD

Radial displacement MC(10000) = 7.6"
10.5% FoV

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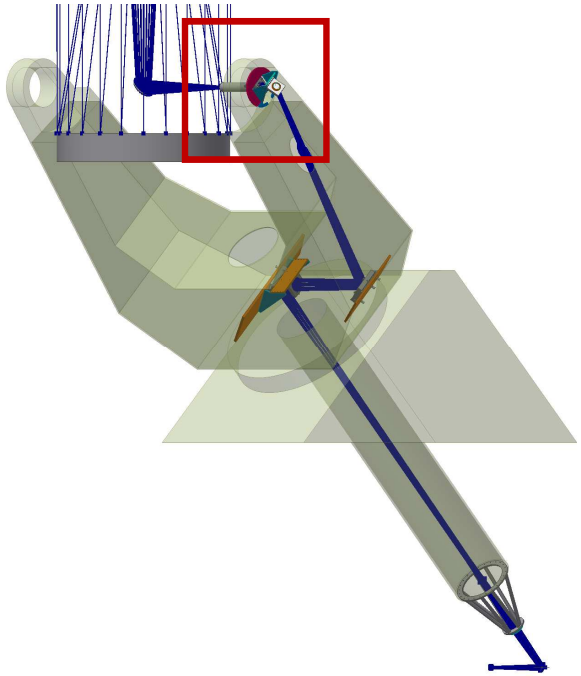
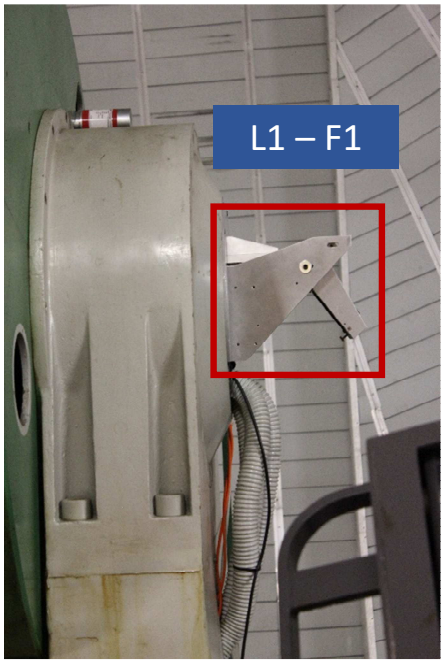
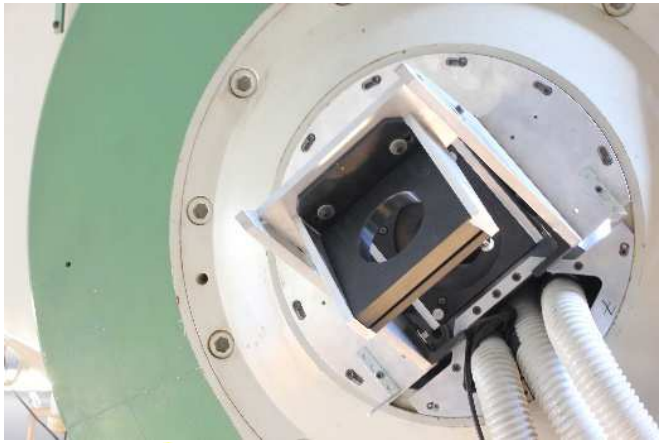
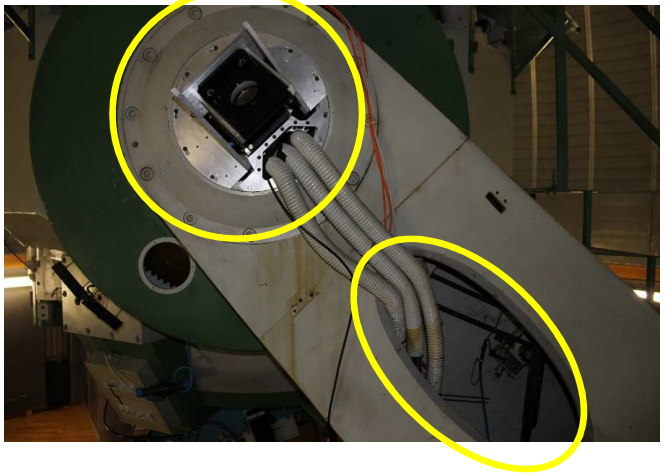
INTEGRATION – First steps

L1-F1 within Nasmyth West side









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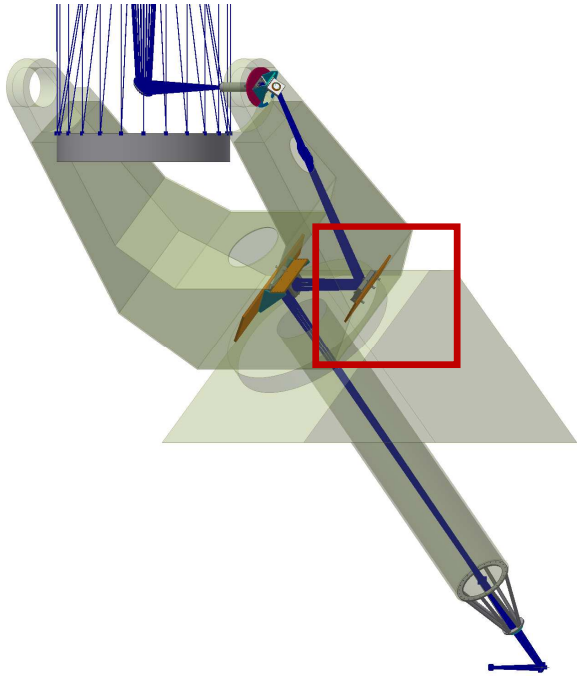
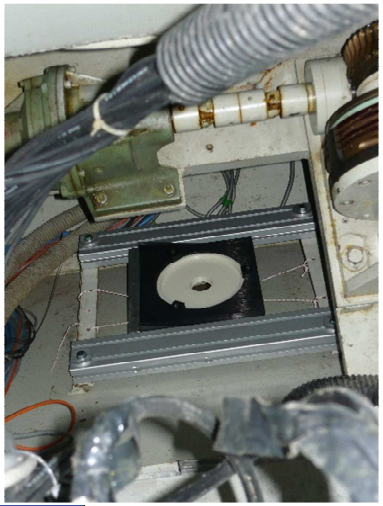
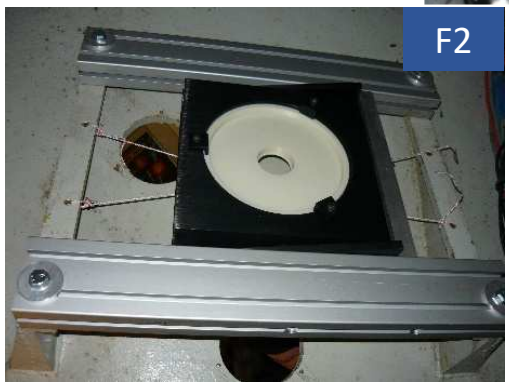
INTEGRATION – First steps

F2 within the fork







F2

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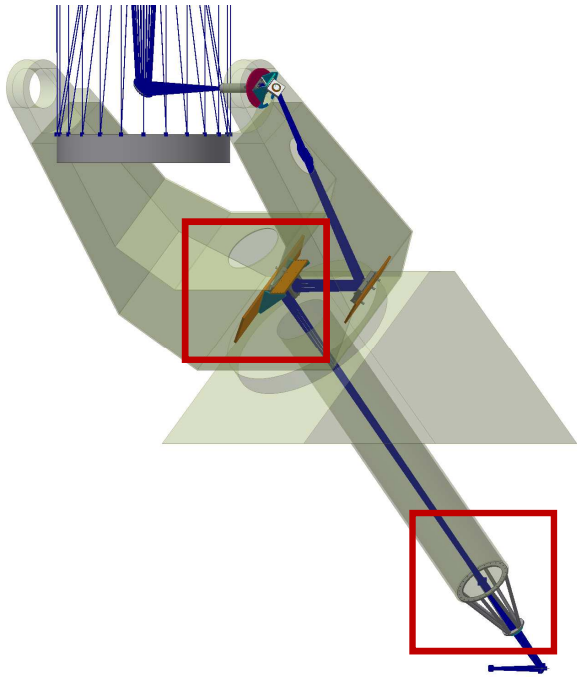
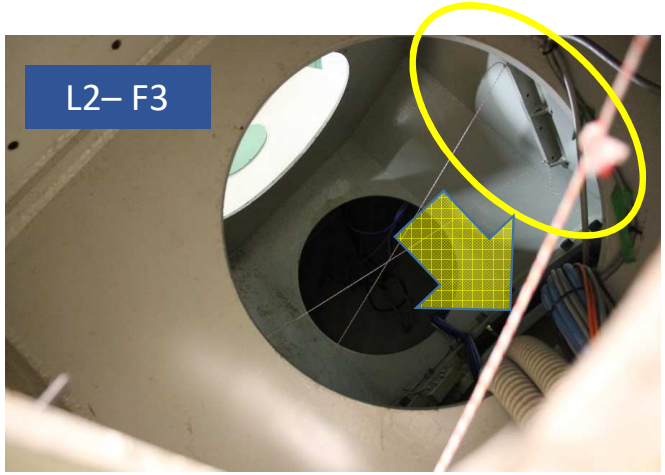
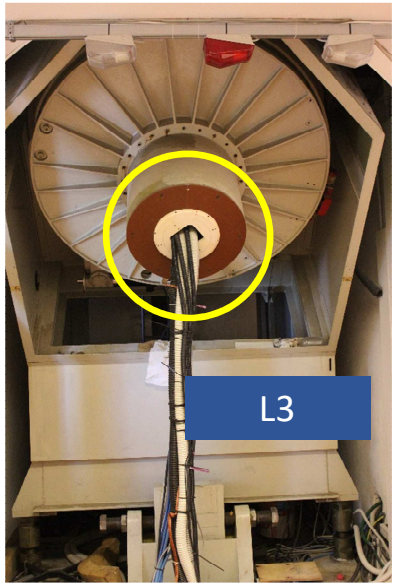
INTEGRATION – Next



L2-F3 within the fork
L3 outside

Mechanics under construction





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THE AO TEST BENCH @ COUDE' ROOM

Closed/dedicated area
Light tight room/dimming lights
Thermically insulated
Web connection
Optical table

COUDE' FOCUS

TELECENTRIC BEAM
F/19.5
FoV ≈ 2.4 arcmin

Room 4x5m^2
Optical table 2400x1200mm
Pneumatic legs
Optical axis @ 15 cm height

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CONCLUSIONS

- A common user bench for direct ON-SKY testing – permanent facility
- Opportunity for AO community
- Versatile / telecentric beam for AO multi-purpose instrumentation
- Easy to reach site
- Coudé focus always accessible (switch in 10 min)
- Next step: installation of last 3 opto-mechanical mounts