MECHANICAL DESIGN OF MIRAS INFRARED MICROSPECTROSCOPY BEAM LINE AT ALBA

ALBA Synchrotron Light Source, Engineering division, Transversal section

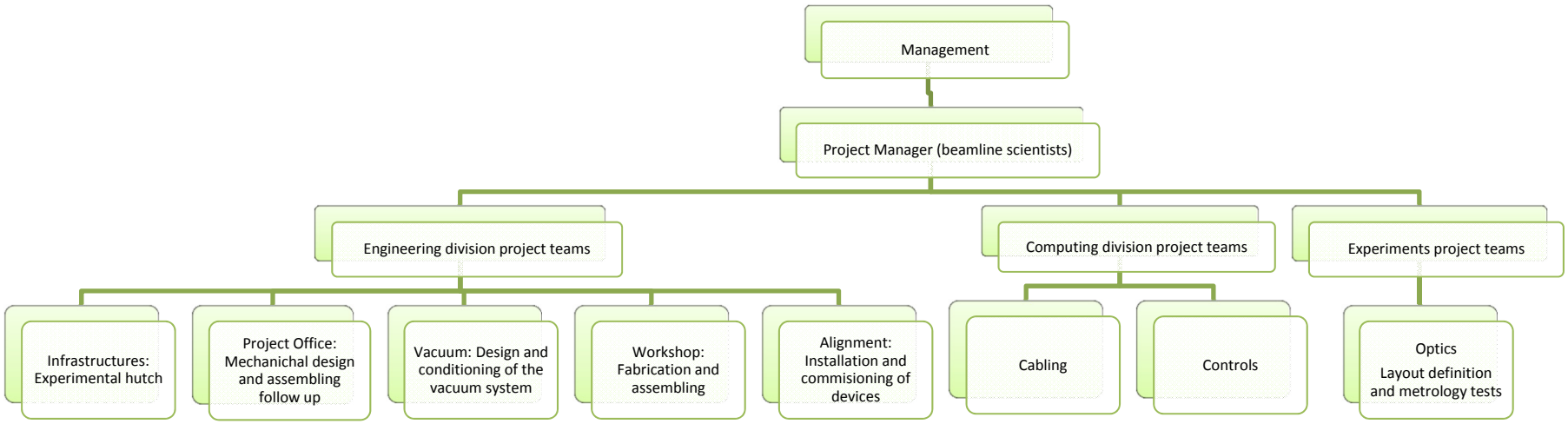
Llibert Ribó, Igors Sics, Josep Nicolas Artur Gevoryan, Alejandro Crisol, Carles Colldelram, Liudmila Nikitina, Raquel Monge, Marcos Quispe

Summary

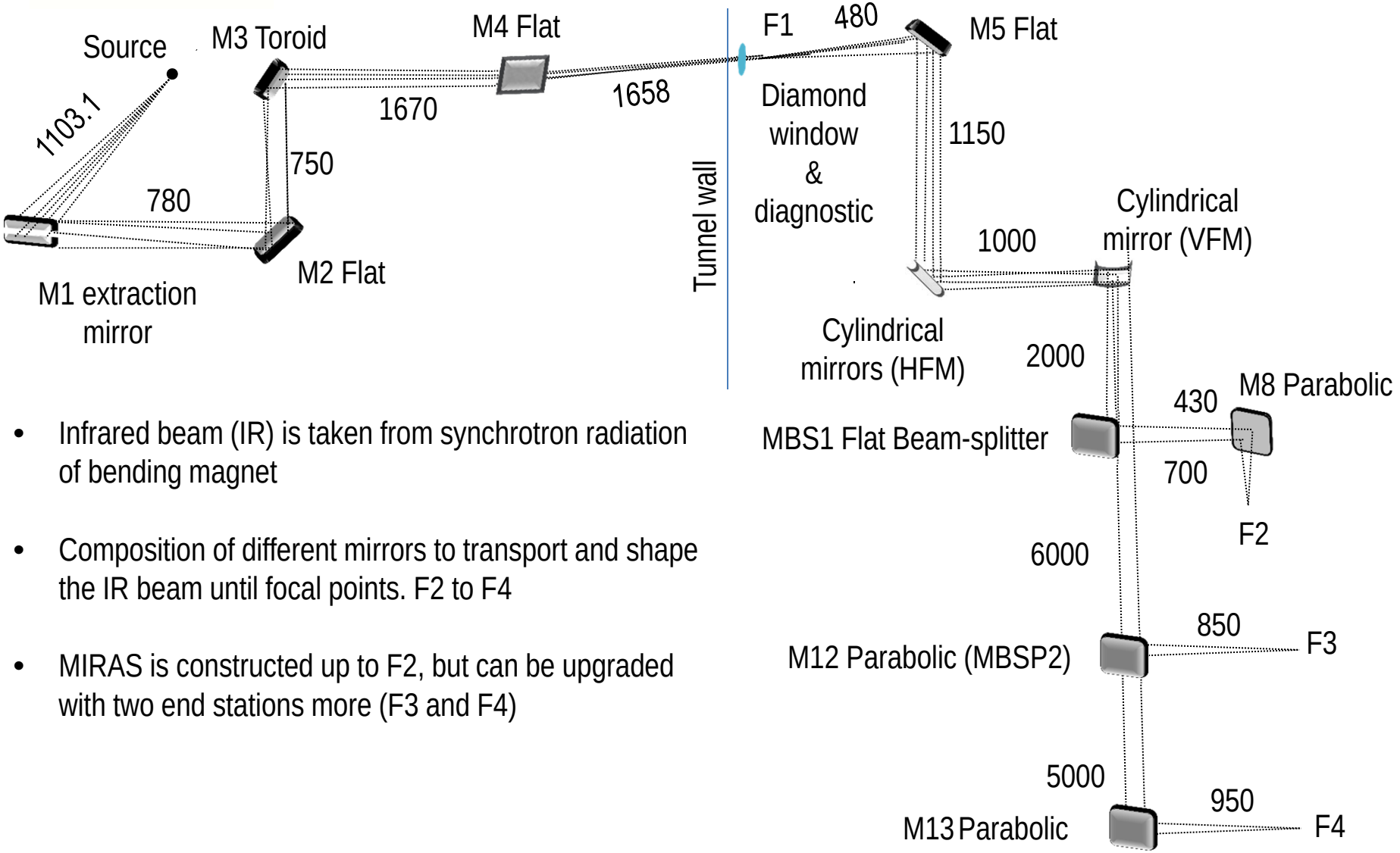
- *Schedule*
- *Layout / Overall view*
- *Extraction Mirror M1*
- *Transport mirrors*
- *Front end inside tunnel*
- *Beamline outside tunnel*
- *Installation*
- *Commissioning*

schedule

- Project starts on 2013 First design and first layout definition 2014. Strong collaboration and advice from Soleil
- First beam observed early 2016
- First friendly users Spring 2016. First official user October 2016
- Taken by ALBA as an in house project. Different teams from all divisions are asked to provide different work packages

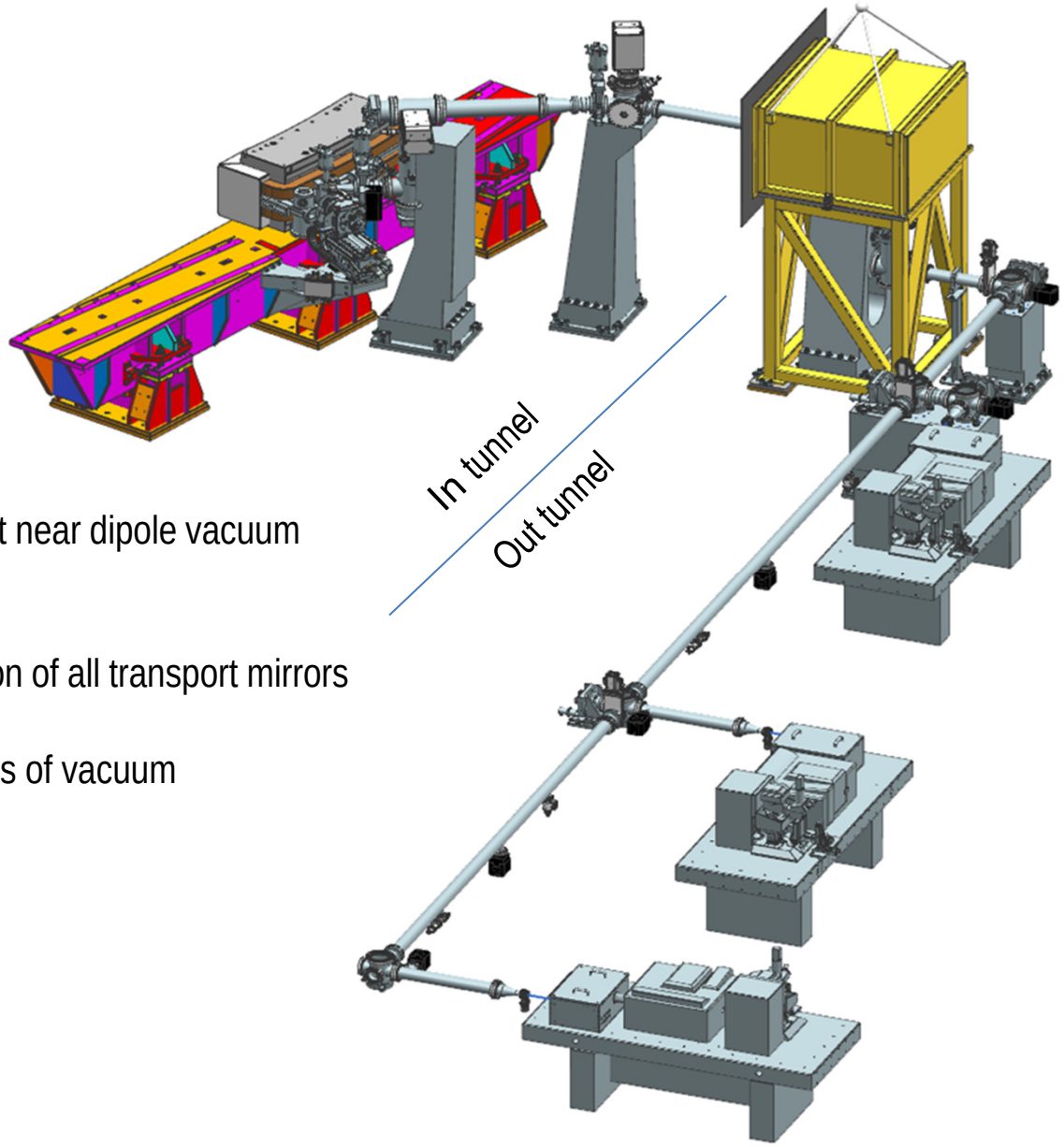


Layout



- Infrared beam (IR) is taken from synchrotron radiation of bending magnet
- Composition of different mirrors to transport and shape the IR beam until focal points. F2 to F4
- MIRAS is constructed up to F2, but can be upgraded with two end stations more (F3 and F4)

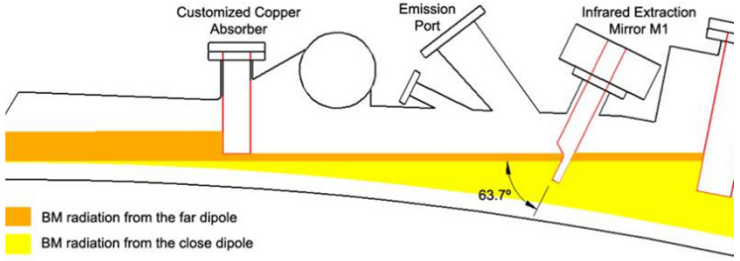
Overall view

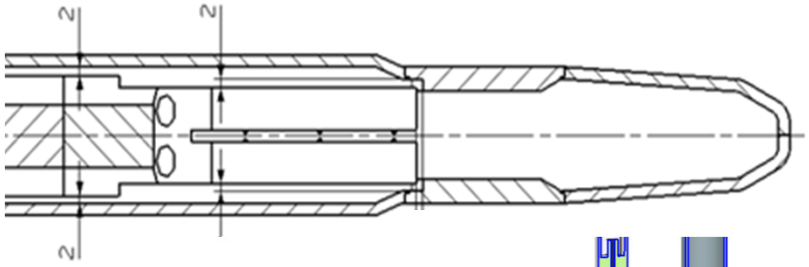


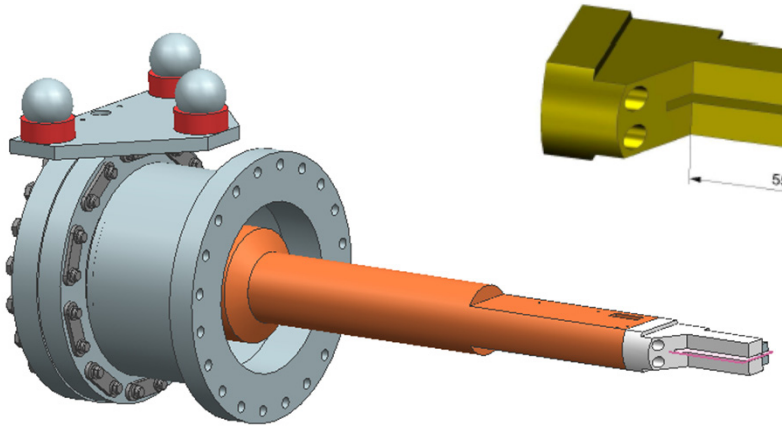
- Extraction mirror mechanism just near dipole vacuum chamber
- Mechanisms to adjust the position of all transport mirrors
- Vacuum system. 2 different levels of vacuum
- Supports and pedestals
- Small lead hutch
- End stations

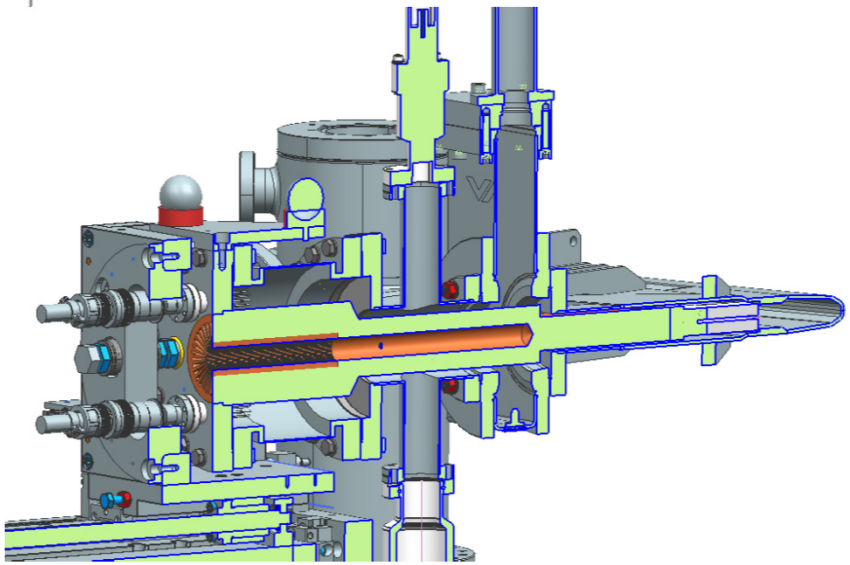
Extraction Mirror M1.

- M1 takes IR from far and close Bending magnets,
- U shaped 2 parts separated by a 3 mm slot
- Optimized optical surface, very tight clearances with the dipole chamber (2 mm)
- UHV compatible Thermocouples array to adjust the mirror height in respect to the orbit plane
- 2 thermocouples to measure temperature body
- Cooper Arm to position the mirror inside dipole chamber heat dissipation with no use of water cooling.
- Temperature at mirror body expected at 400 mA of 63ºC (see M.Quispe contribution TUPE11)









M1 positioner design.

Insertion / extraction:

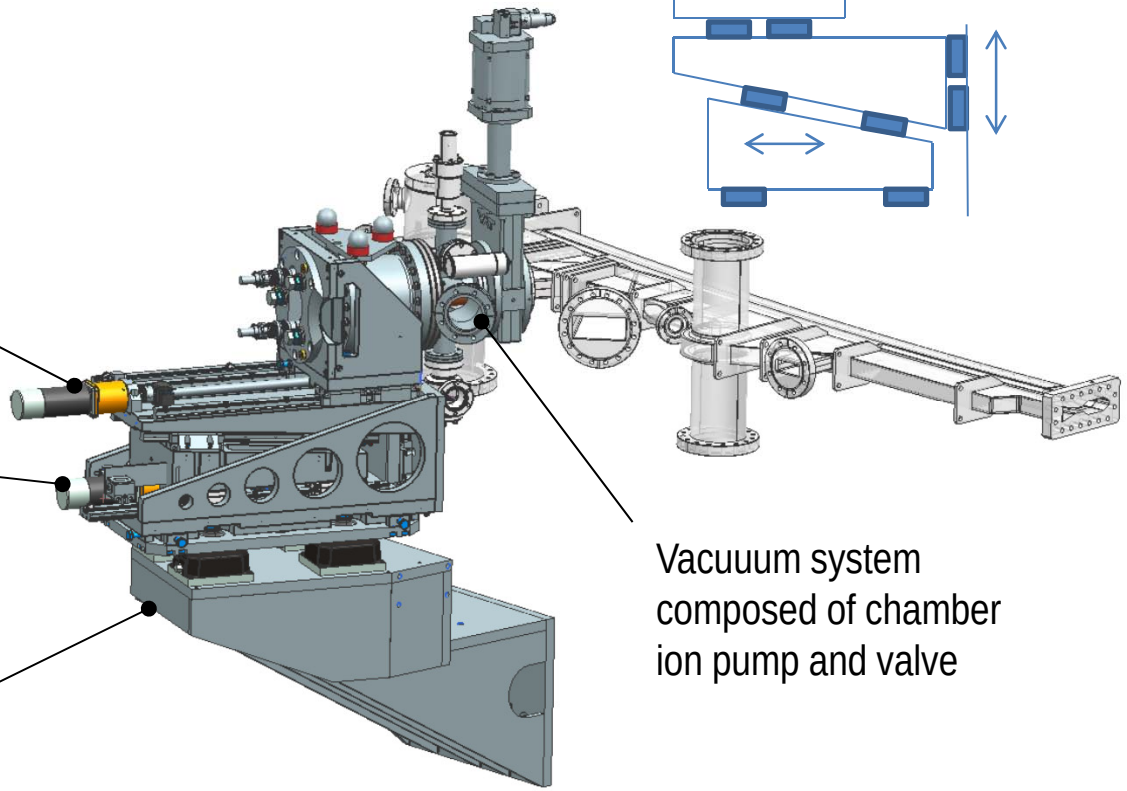
- Motorized horitzontal long spindle
- Cooper arm guided
- Range 300 mm

Vertical movement: M1 positioning

- Based on wedgemount system
- Very short range +/- 1 mm

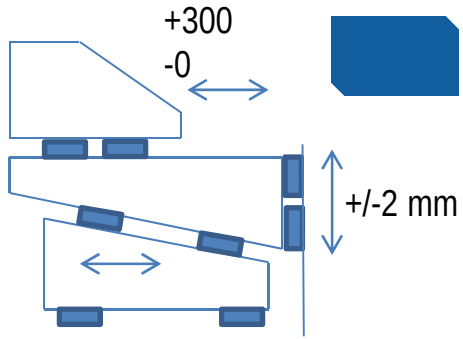
Both movements are encoded to record the position

All attached to guirder by steel interface



Vacuuum system composed of chamber ion pump and valve

M1 positioner design.



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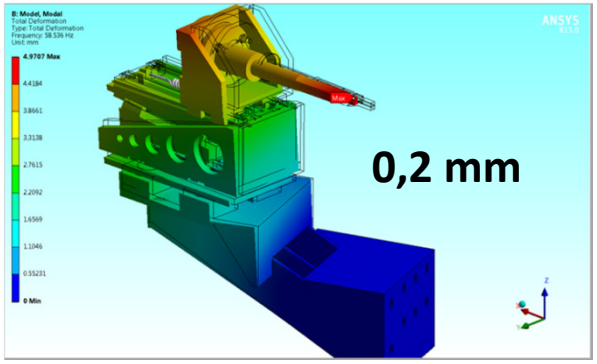
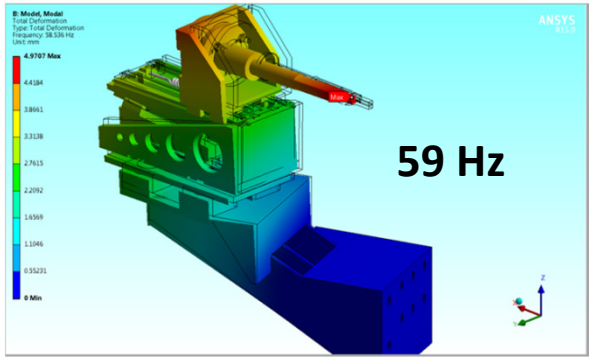
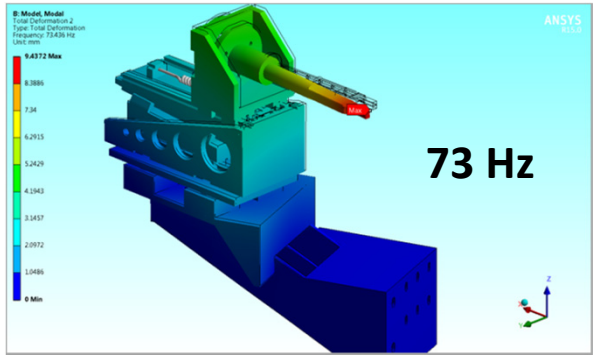
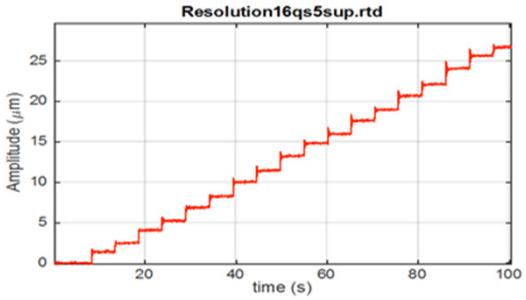
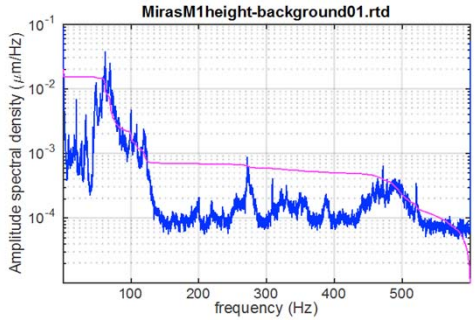


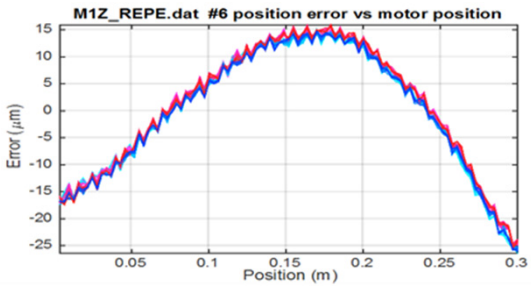


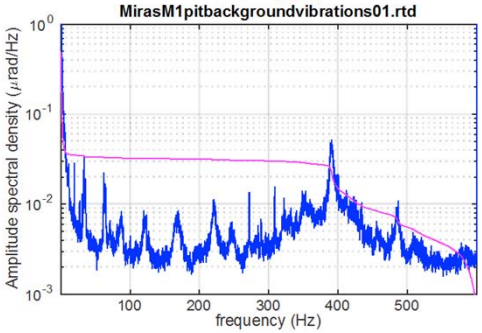


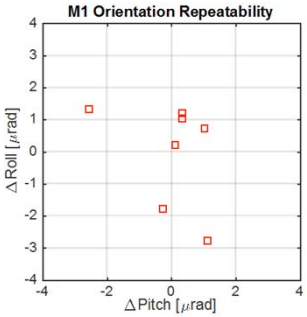
M1 positioner performance.



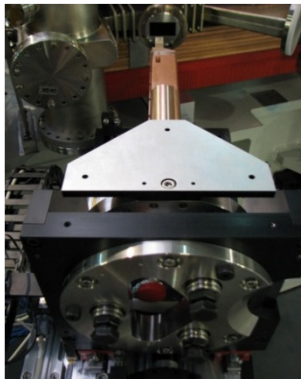


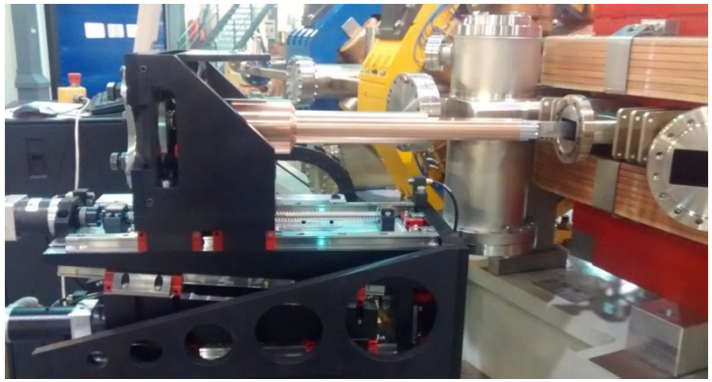






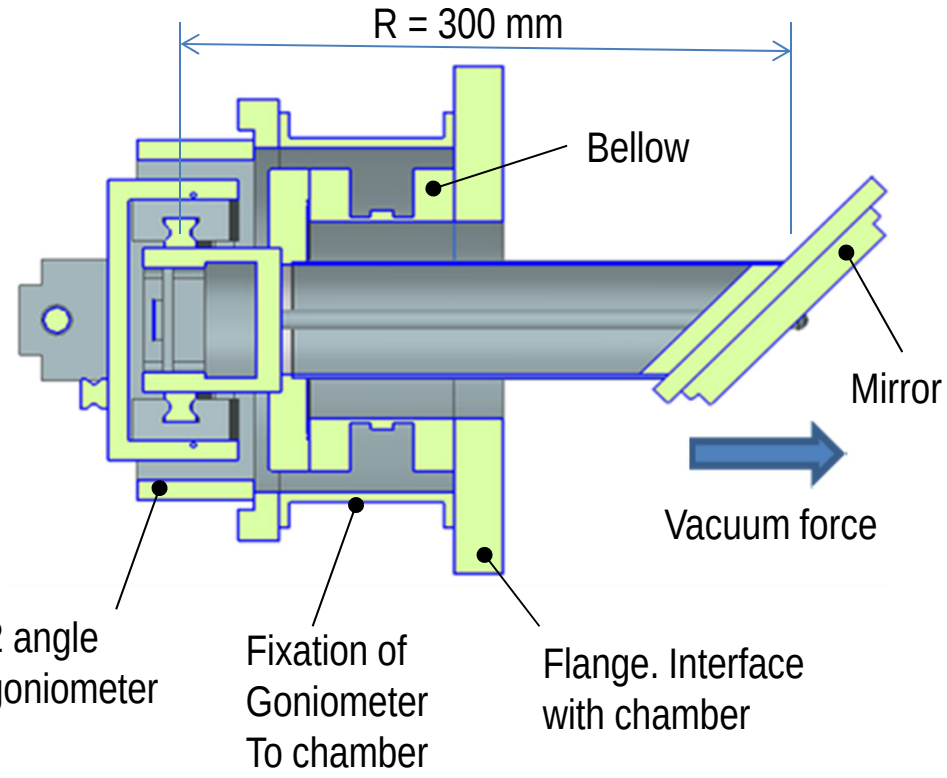
- Resolution of longitudinal movement spot after 4 full steps → 1,6 µm/ 4 steps
- Deviation 15 µm in respect to actuator theoretical position
- Repeatability 1,1 µm
- M1 Orientation repeatability after in / out between 3 and 4 µrad
- Height background: 27 nm at 61 Hz
- Pitch background 400 Hz

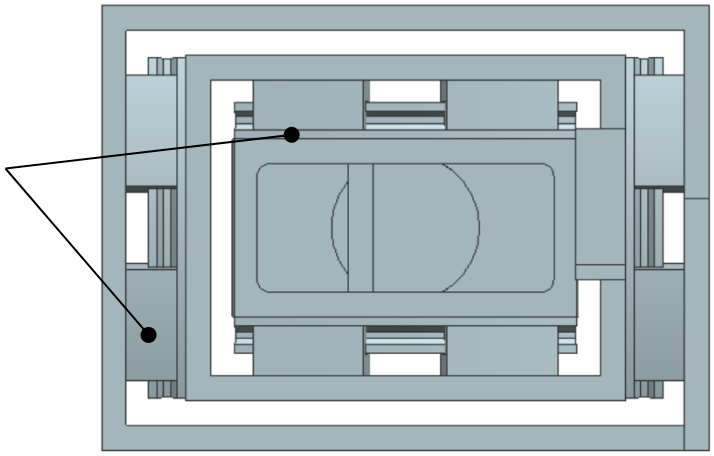


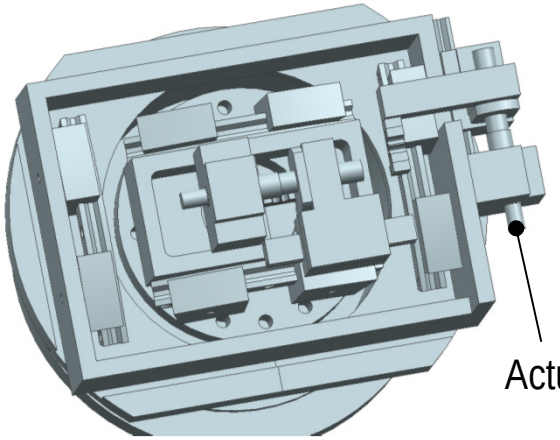


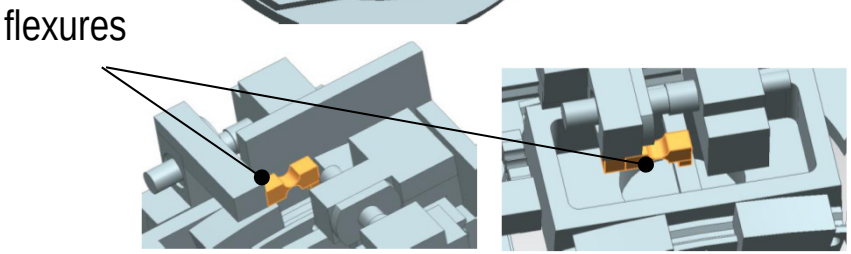
Transport mirror mechanism.

Range	± 9.07 mrad	± 1 º
Resolution	15 µrad	$9 \cdot 10^{-4}$ º
Accuracy	0.25 mrad	0.014 º
Repeatability	32 µrad	$2 \cdot 10^{-4}$ º









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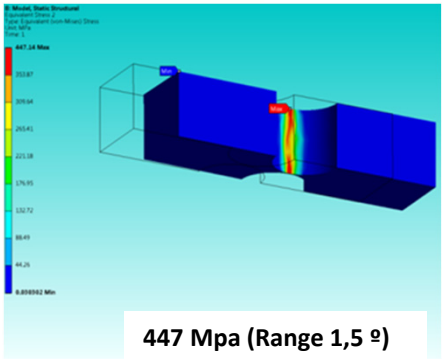
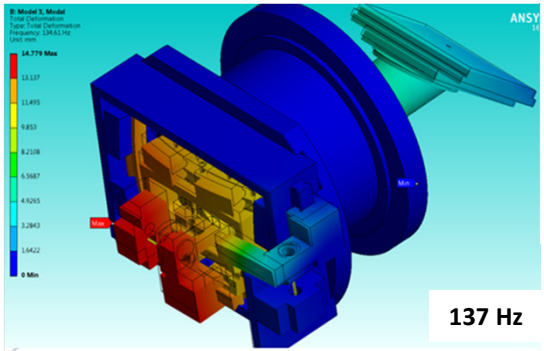
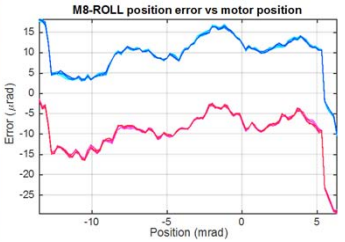
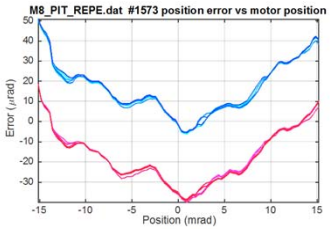


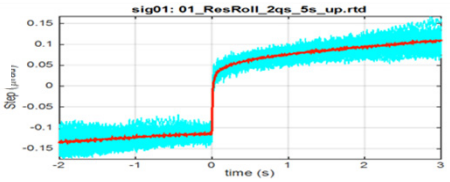
447 Mpa (Range 1,5 º)



137 Hz

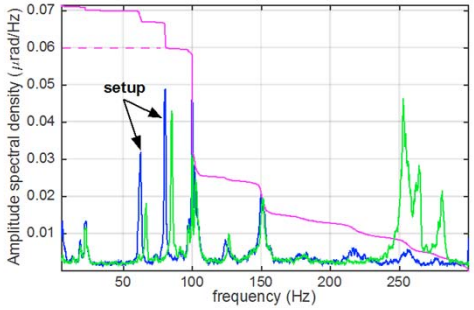






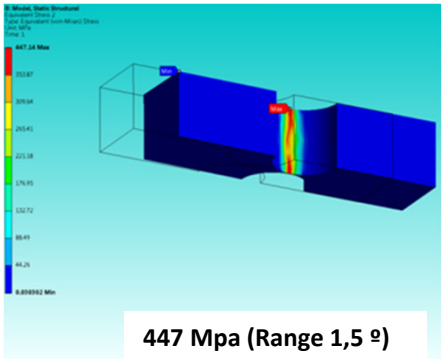
TEST	UNE-EN ISO 6892
L.Elástico/Y.Strenth ReH MPa	Resistencia/Tensile R_m MPa
820	1001
825	1018

ure = RT (RT = Temperatura Ambien



- 0.16 μrad /half step
- Accuracy open loop 57,2μrad
- Peak resonance 98 Hz amplitude 0,06 μrad

Transport mirror mechanism.



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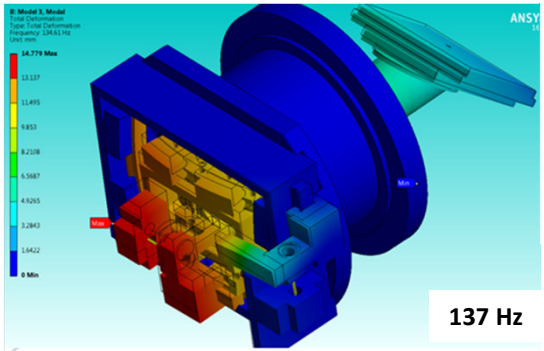

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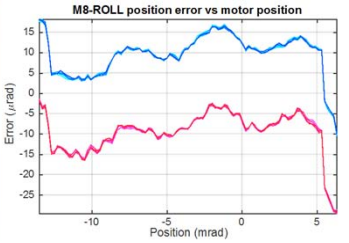

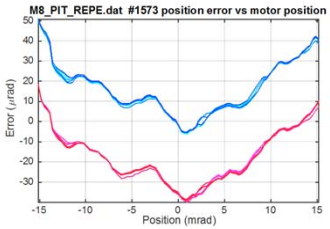

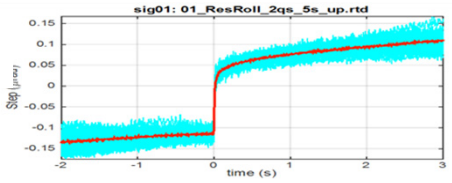

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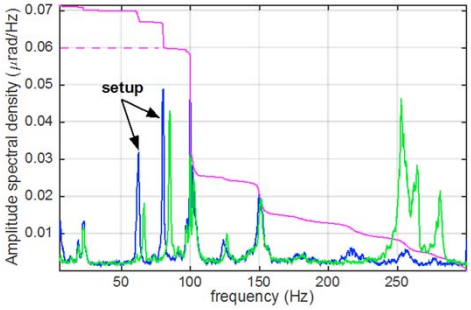

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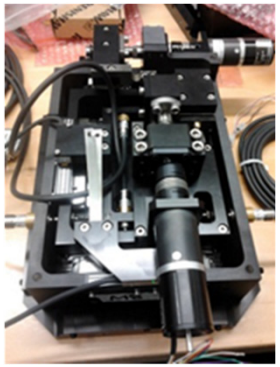
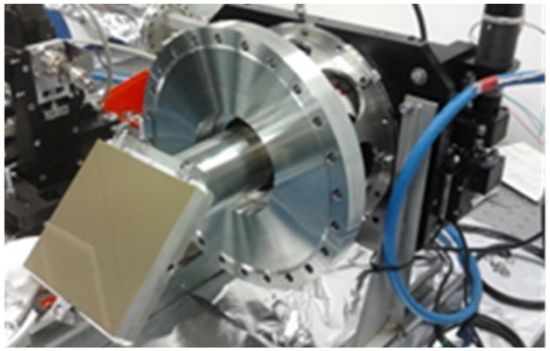
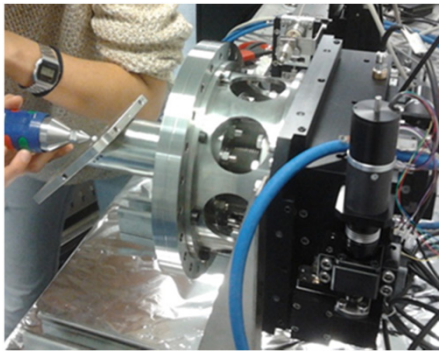
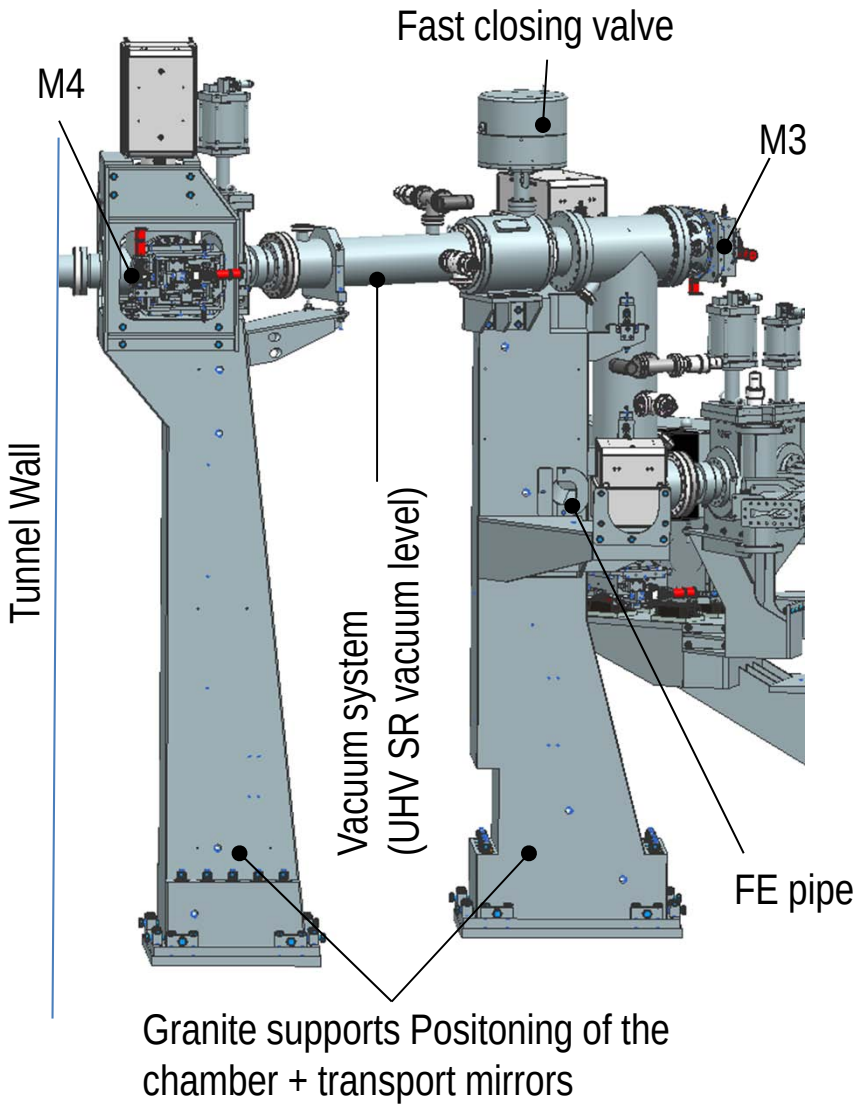






Front end Inside Tunnel



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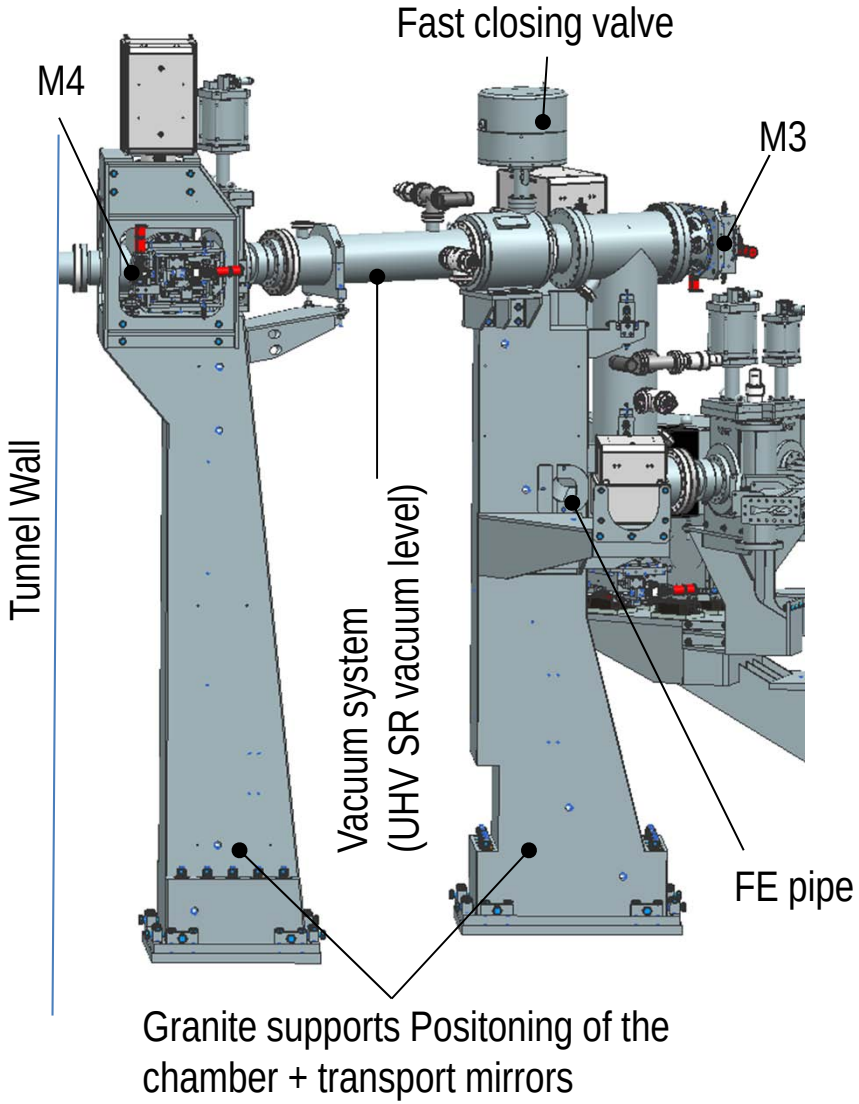

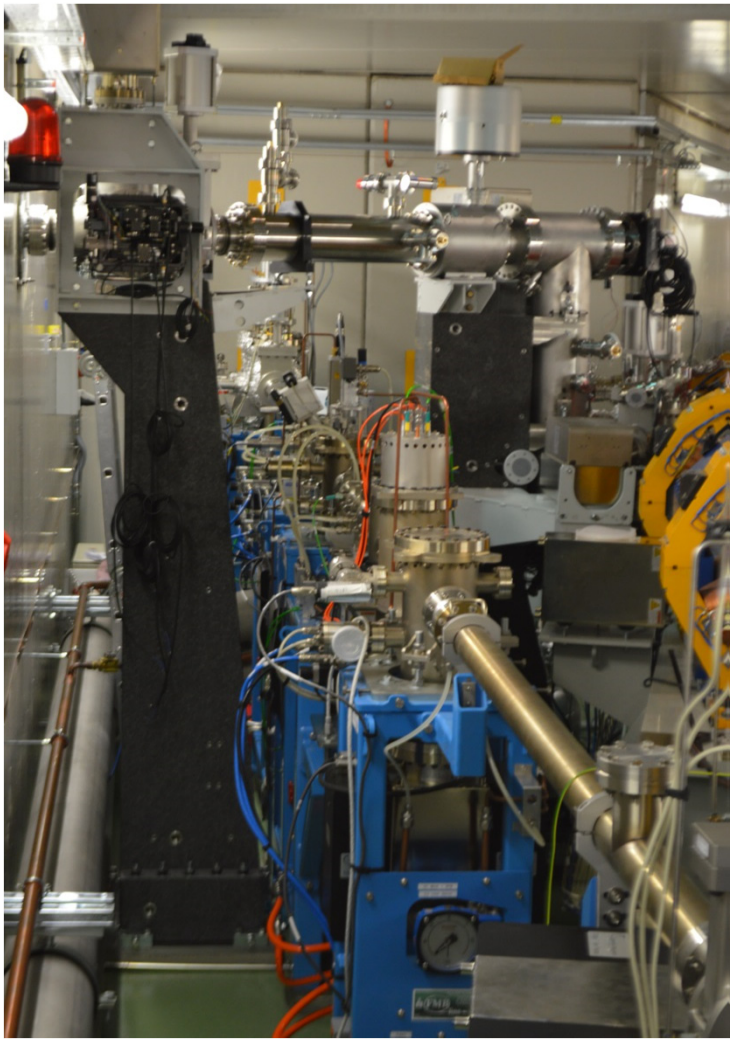

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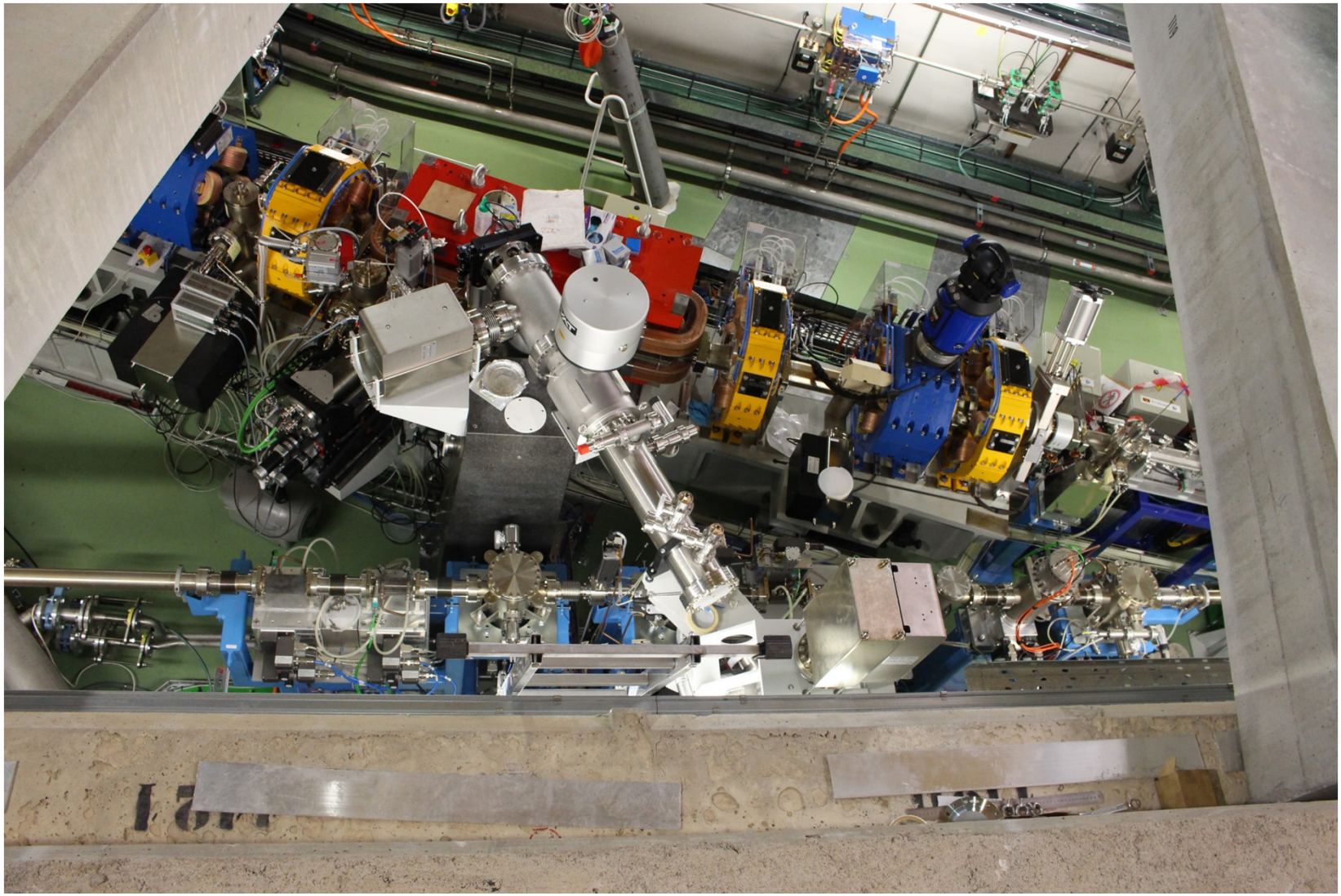
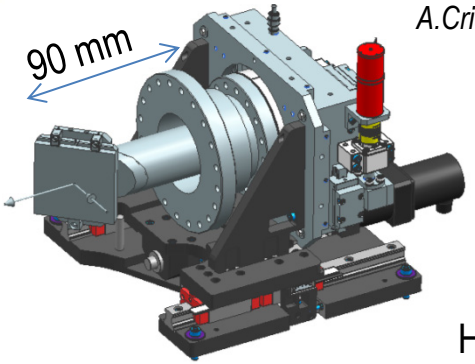


Beamline outside tunnel



A.Crisol

To F3 / F4
Upgrade end
stations

End
station/
F2

MBSP1

High Vacuum
system

CVD / F1

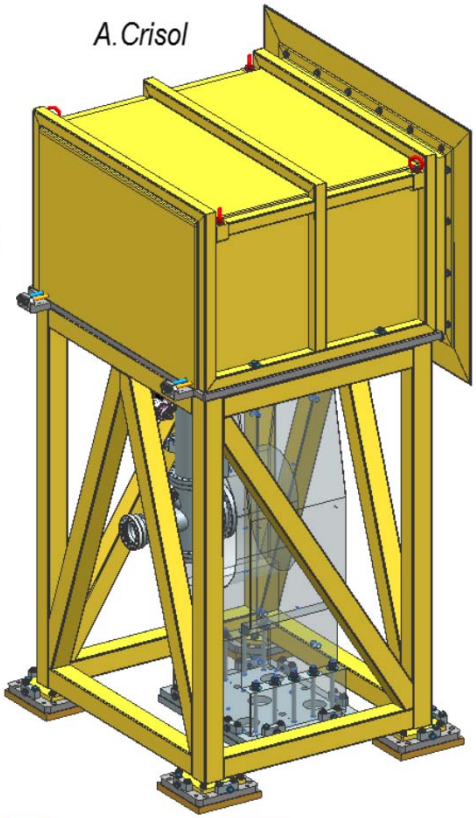
M5

M7

M6

M7

Granite blocks



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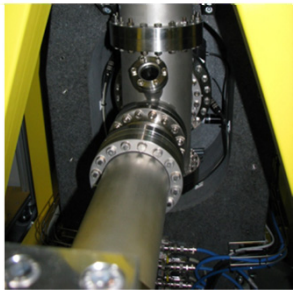
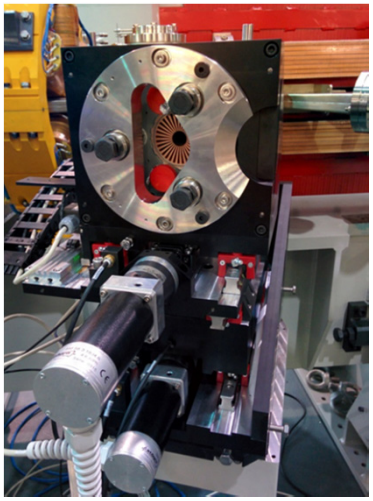
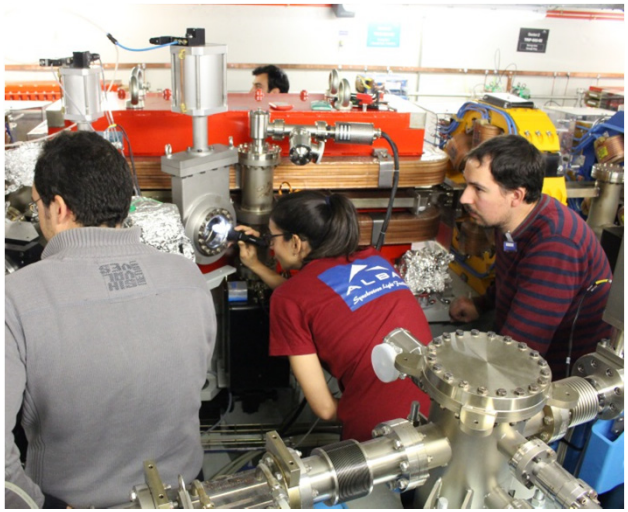
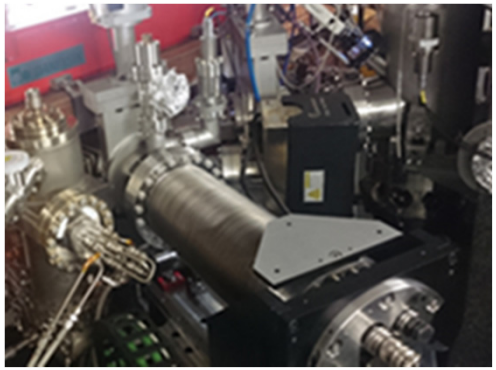


Installation







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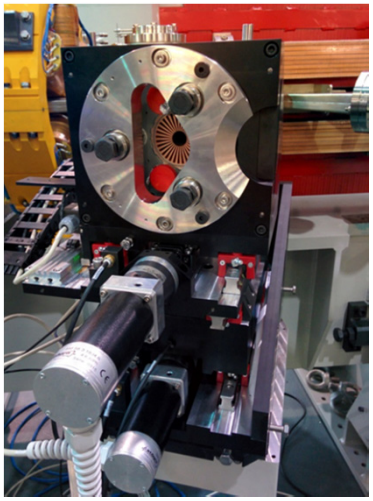
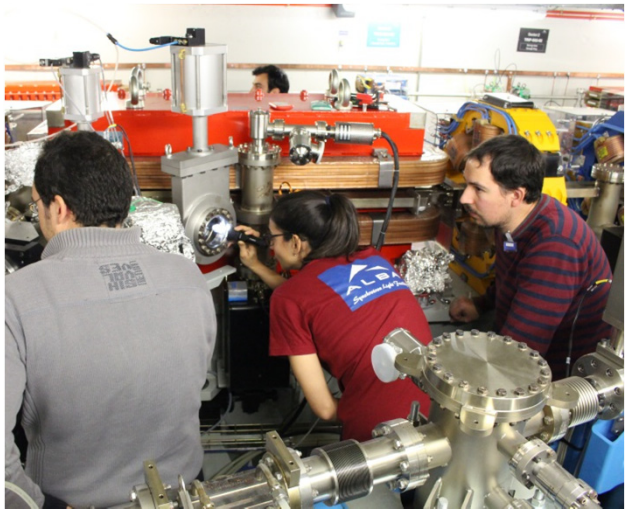
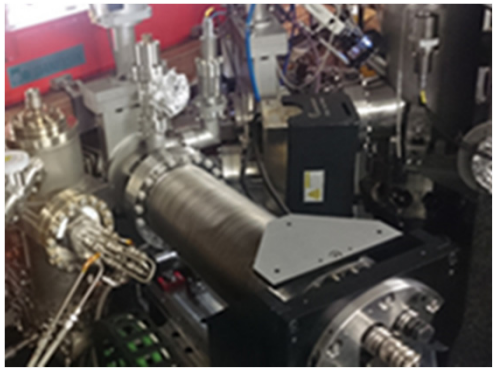
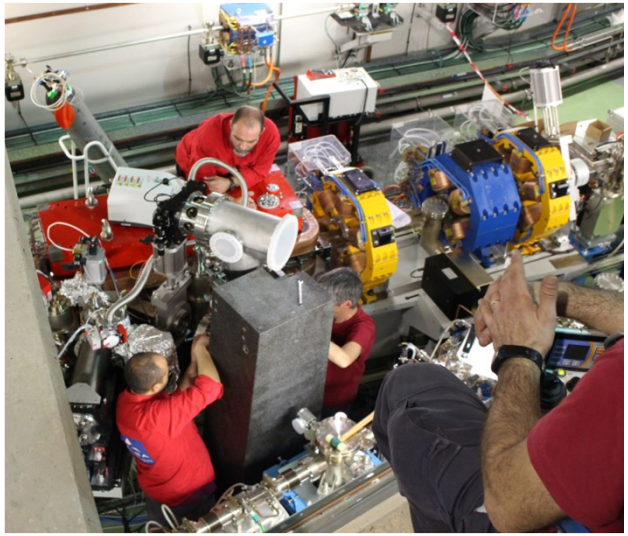
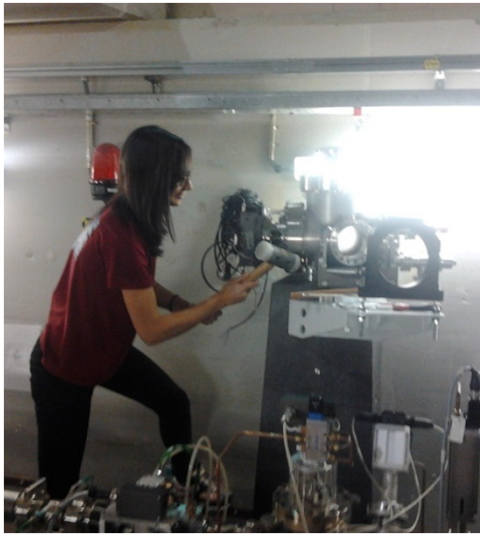
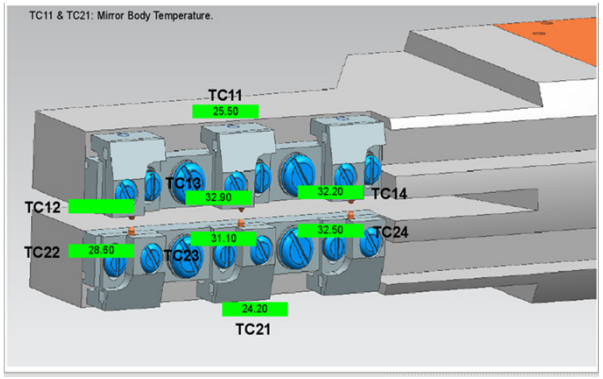
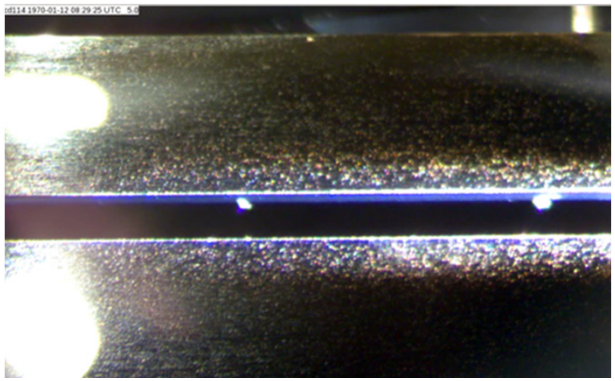



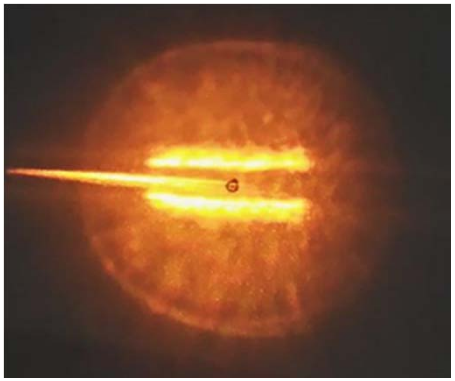





Commissioning



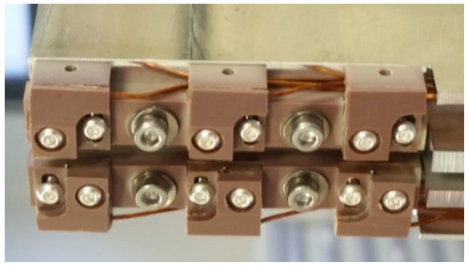




- Beam current 130 mA
- Temperatures on M1 slot between 28ºC and 32,5ºC
- Temperature mirror body 25,5ºC → simulations OK (See M. Quispe Report TUPE11)

Next steps

- First installed type K thermocouples were affected by synchrotron radiation generating a pressure increase in S02
- There were replaced by other type of thermocouples UHV compatible and radiation resistive → provisional solution
- PEEK supports seems to be degraded due to the radiation
- Definitive solution → thermocouples covered by stainless steel and ALUMINA supports



Liudmila Nikitina, Raquel Monge, Arthur Gevorgyan
Alejandro Crisol, Carles Colldelram, Gabriel Peña
Karim Maimouni, Jose Ferrer, Jordi Navarro
Ibraheem Youssef, Josep Nicolas
Marta Llonch,Jon Ladrera
Paul Dumas and Gary Ellis
Domingo Alloza
Igors Sics

Thanks to all of you for your attention