



VUV divertor Spectrometer for JT-60SA: status of the project

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WPSA General Meeting May 2022 (remote)

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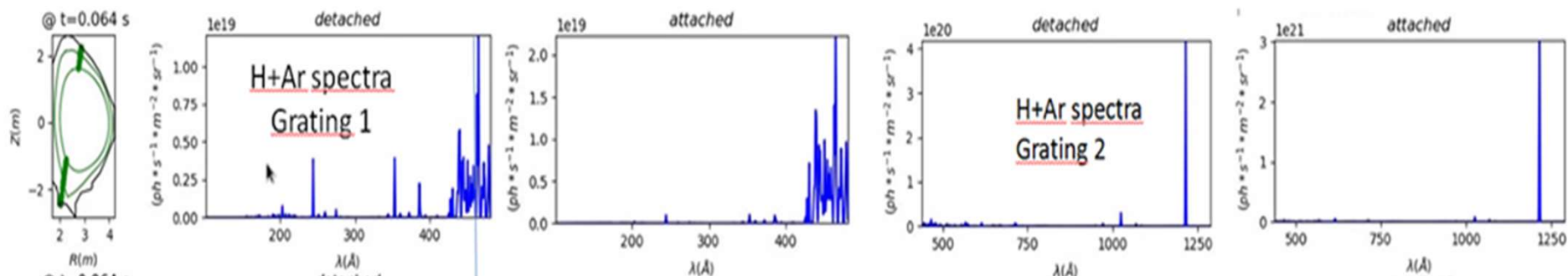


This work has been carried out within the framework of the EUROfusion Consortium and has received funding from the Euratom research and training programme 2014-2018 and 2019-2020 under grant agreement No 633053. The views and opinions expressed herein do not necessarily reflect those of the European Commission.

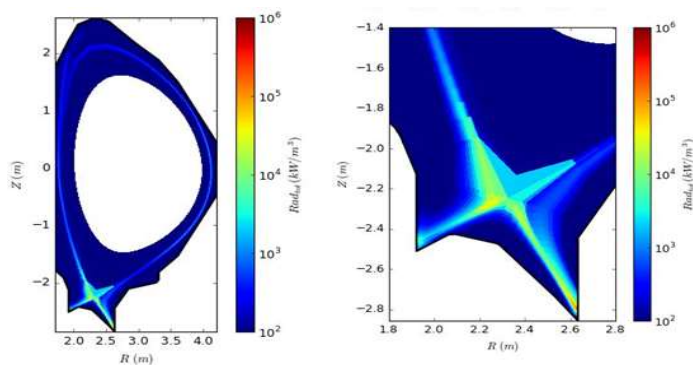
Scientific scope



- Monitor the space-resolved emission @ Inner/X point/ Outer divertor



(Sample of) Synthetic version of the spectra from one LOS in Ar doped case (scenario 2)



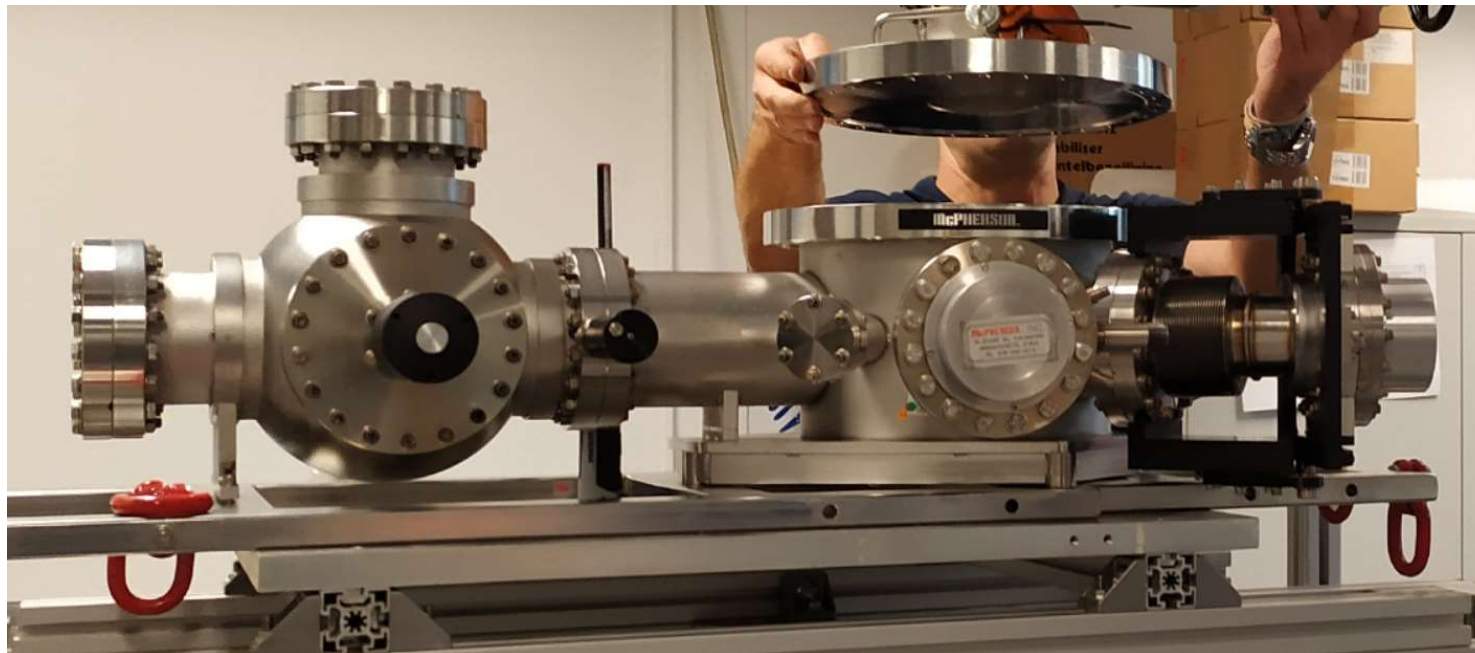
Soledge simulations of JT-60SA scenario#2

Carraro et al., *Simulation of the VUV spectral emission from the JT-60SA divertor*
 47th EPS Conf 2021
<http://ocs.ciemat.es/EPS2021ABS/pdf/P4.1005.pdf>

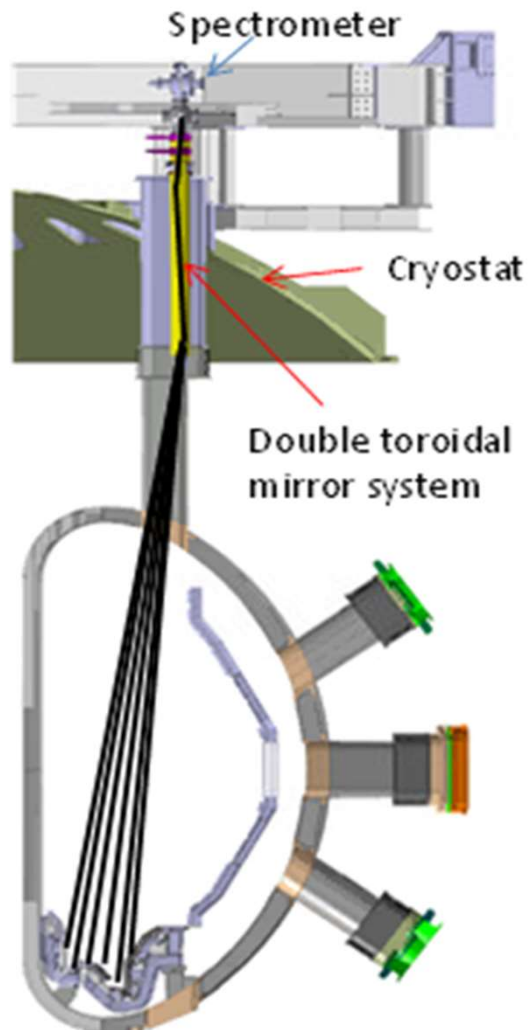
Spectrometer



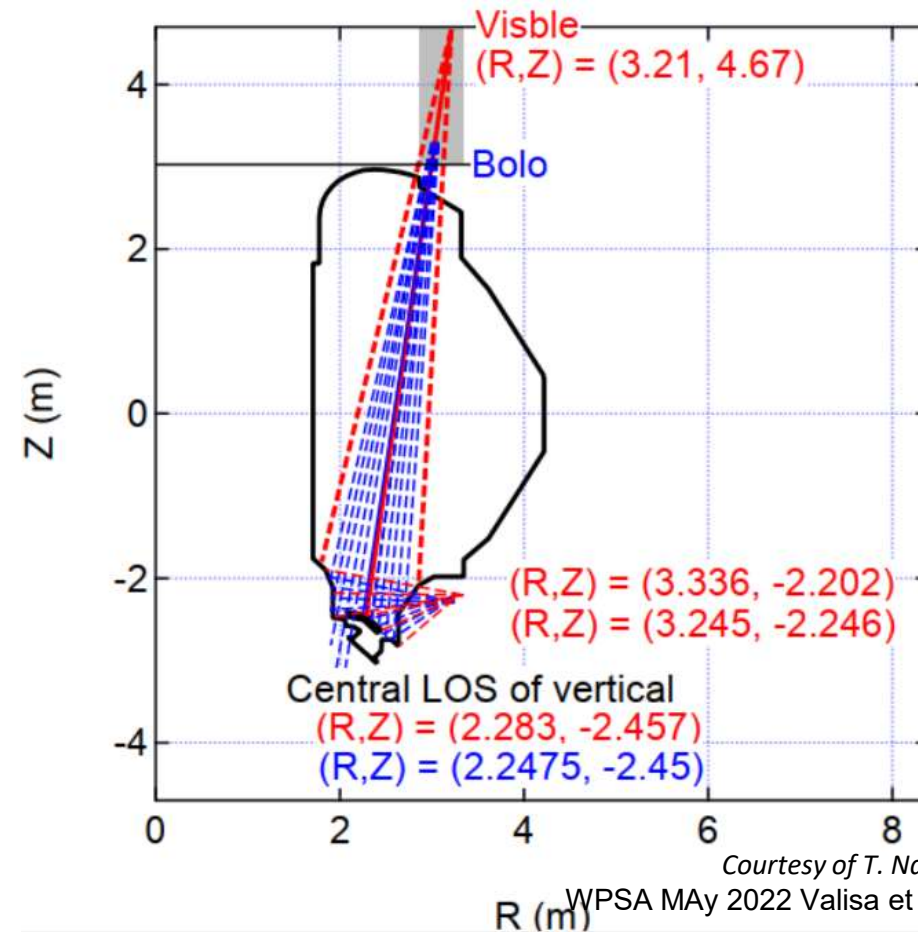
- Model 251 McPherson Dual Spectrometer , to be transported from Julich to Frascati in June , together with XUV calibration source
- Gratings , Detectors and pumping system to be refurbished
- Front sphere to be filled with relay upper mirror with remote adjustment.



Layout



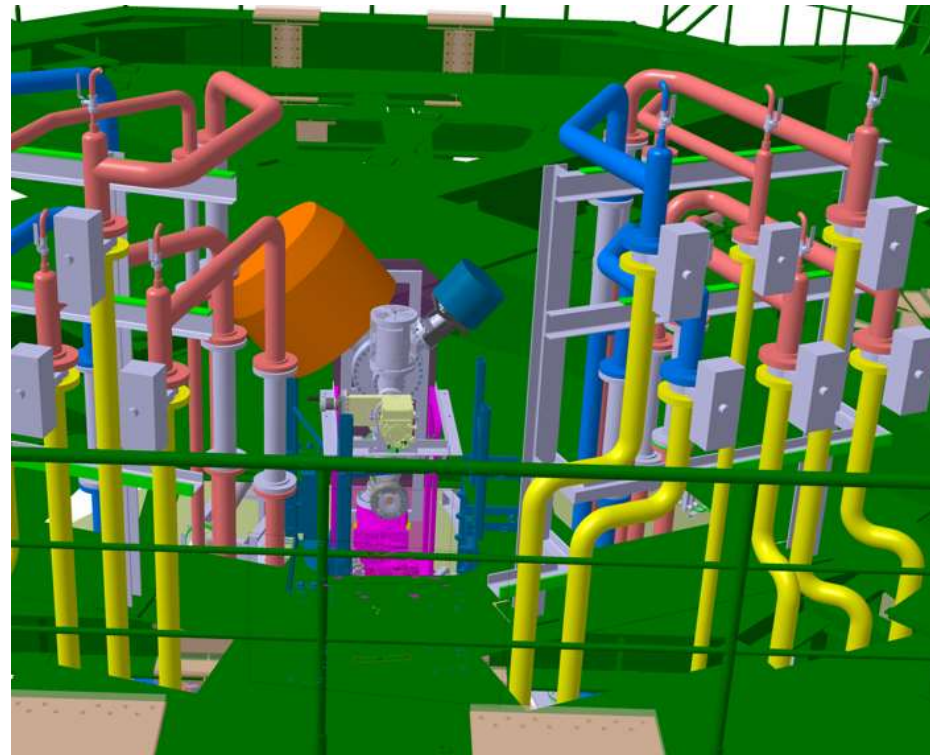
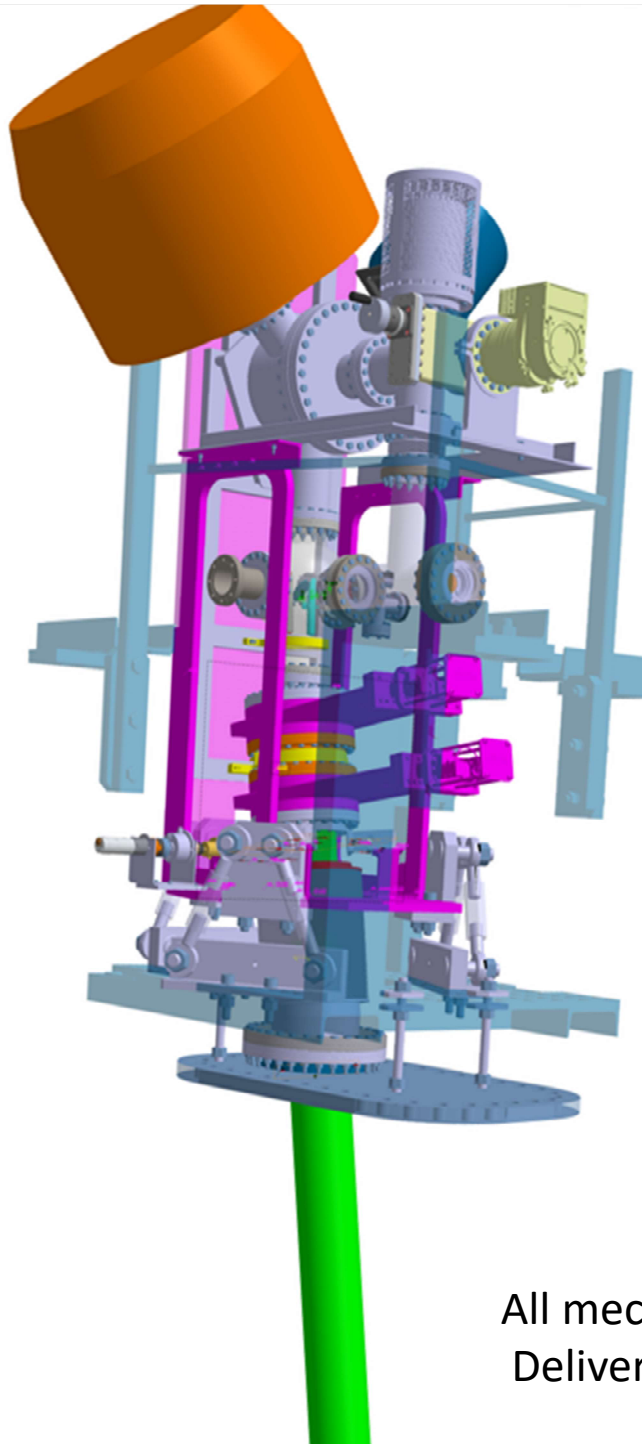
Good overlap of VUV VIS and bolometer LOS important for physics studies



Courtesy of T. Nakano

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Layout



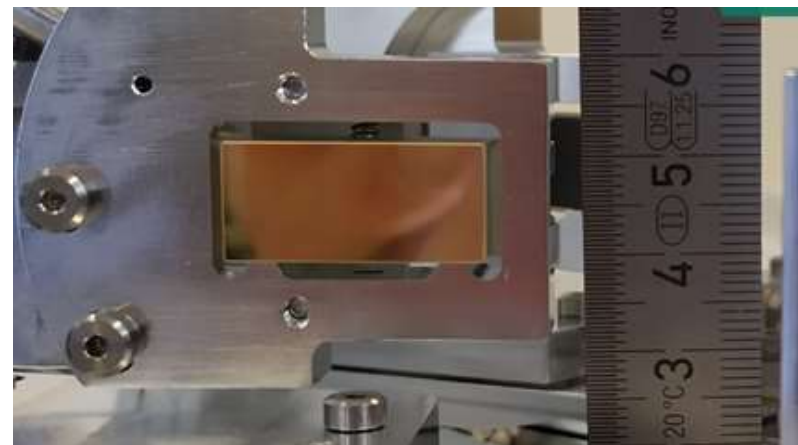
All mechanical components to be manufactured in IAP.
Delivery expected in August.

Gratings



- Holographic gratings, specially designed to cover the specific wavelength range and fit the spectrometer (*W Biel*)
 - 10 – 48 and 44 - 125 (nm) (with overlap for cross calibration)
 - Resolution of around 1 Ang.

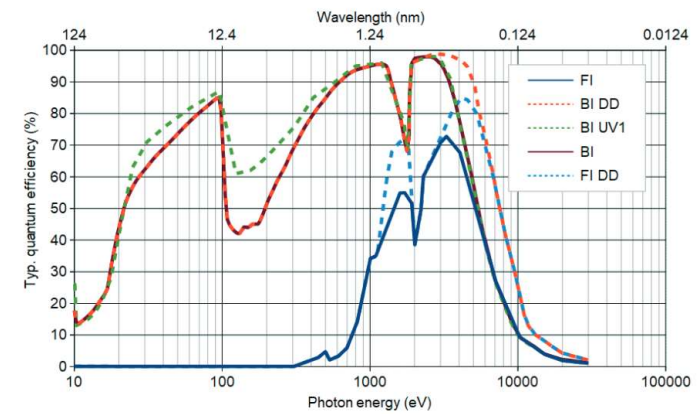
- Manufacturing ongoing at Zeiss (D)- Blanks ready in mid May



Detectors



- 2D CCD detectors
- Ordered by IPPLM (Andor- 2EV Sensor)



Sensitivity

Collection Optics



2 upper mirrors

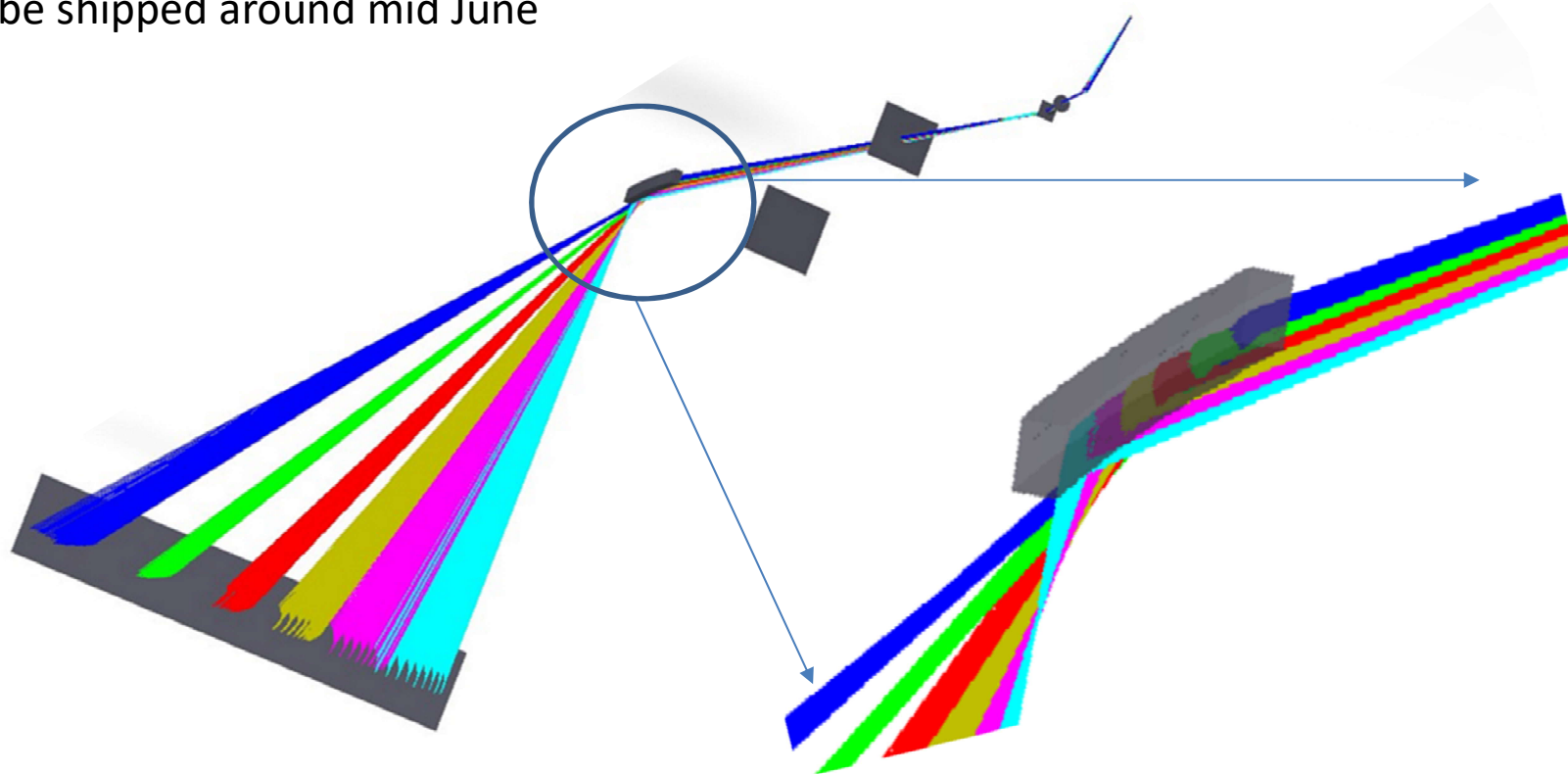
2 lower mirrors

Au coated toroidal mirrors , based on Zerodur substrates

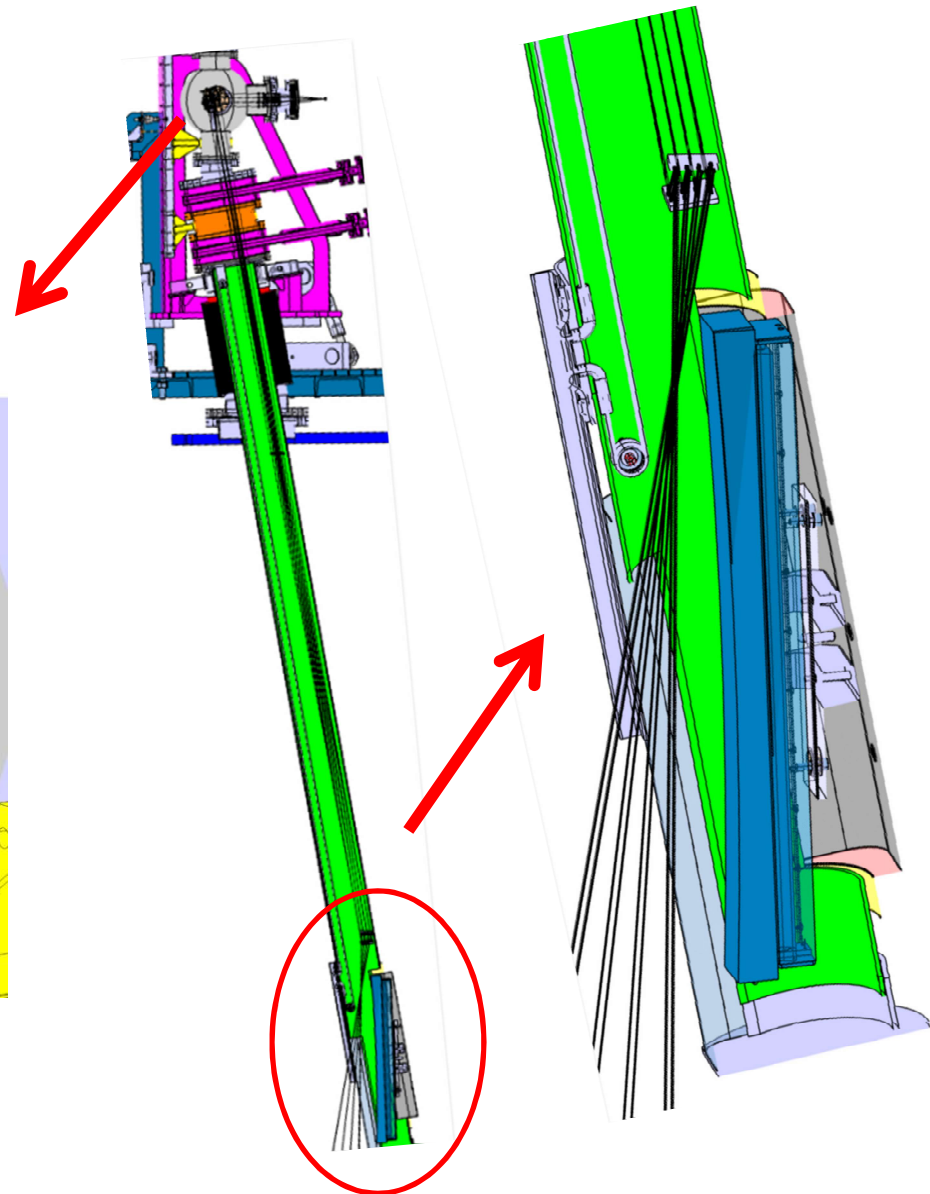
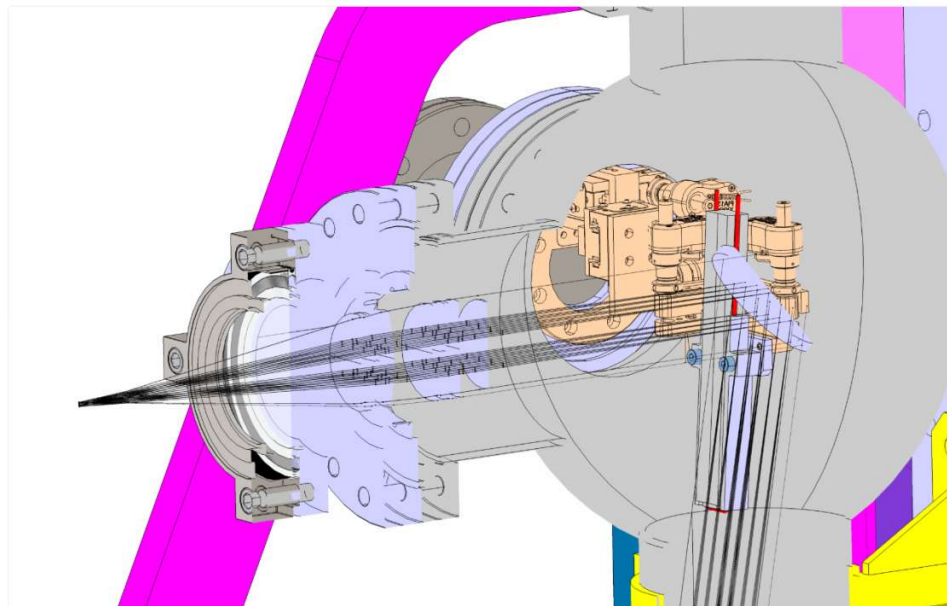
Bulk manufactured in Japan by IK-Technology. Au (Cr interlayer) coating being deposited.

Small samples manufactured in parallel for tests (thermal cycles and surface quality)

To be shipped around mid June



Periscope for alignment



Pumping system



Getter pumps , insensitive to magnetic fields

+ back up turbo pump to be used offline ,periodically, for

- 1) Pumping noble gases (every 2 -3 days)
- 2) Regeneration (period depends on number of discharges)

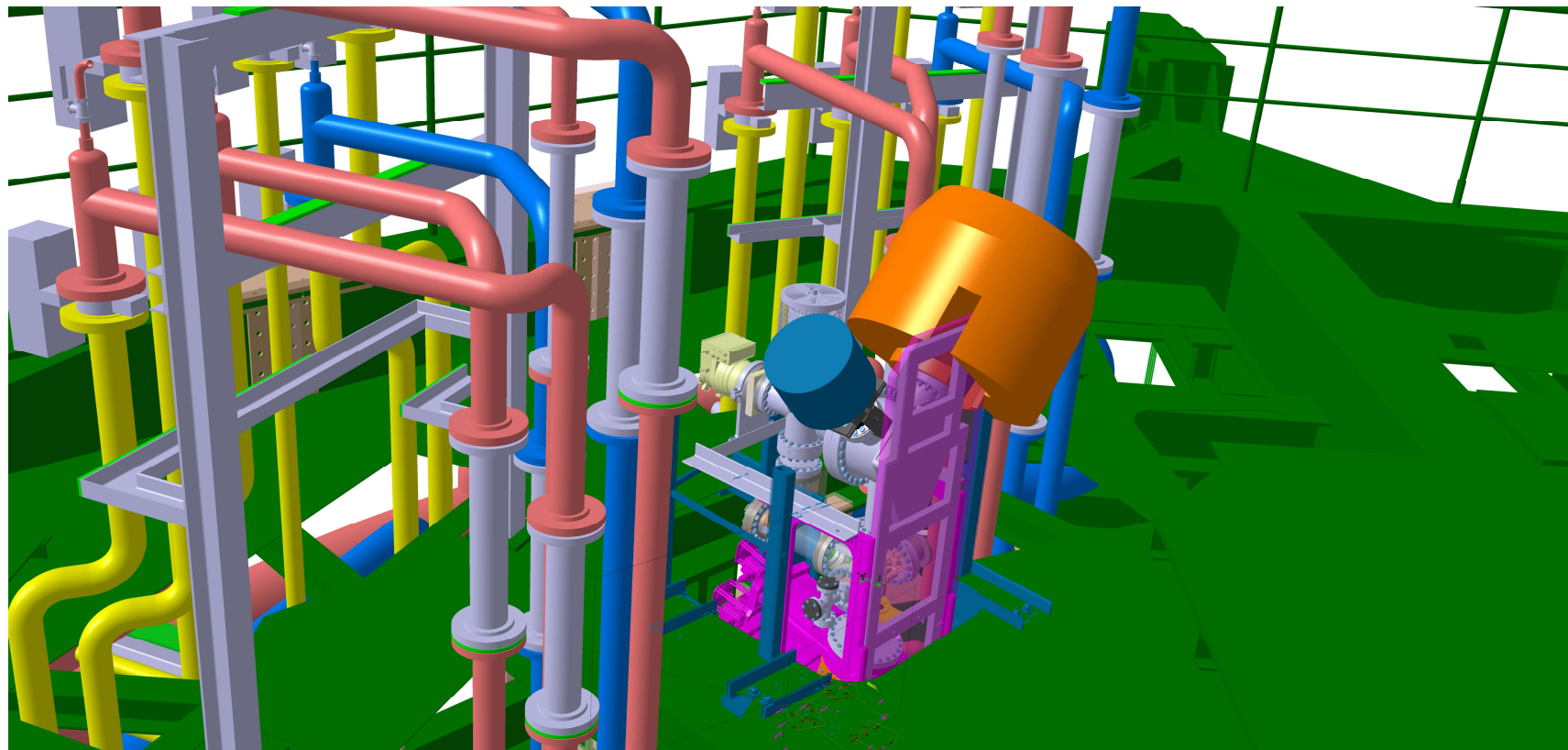
To be ordered by IPPLM

Vacuum control designed by CRFX- components ready to be ordered

Radiation screening



- Possible radiation shield designed (Borated Polyethylene + Lead)
- Jet solution (few cm of SS) as alternative being considered





- Ancillary equipment (computers for acquisition , optical links , vacuum control, piezo motors control for alignment etc being purchased)
- Procurement Agreement and installation procedure ready
- Space in Frascati ready for hosting spectrometer and assembly operations

Summary



- All of components expected to converge in Frascati for assembly in September
- Tests in October



Thanks

Alignment procedure



- Coarse alignment : mechanical , based on fiducial points on top of the machine
- Fine alignment:
 - Laser footprint on the divertor through the zero order
 - Periscope to monitor the position.
 - Upper mirror with remote control

NB If,as expected , the interior of the machine were too dark to show the position of the laser spots → use the initial frames of a plasma pulse.