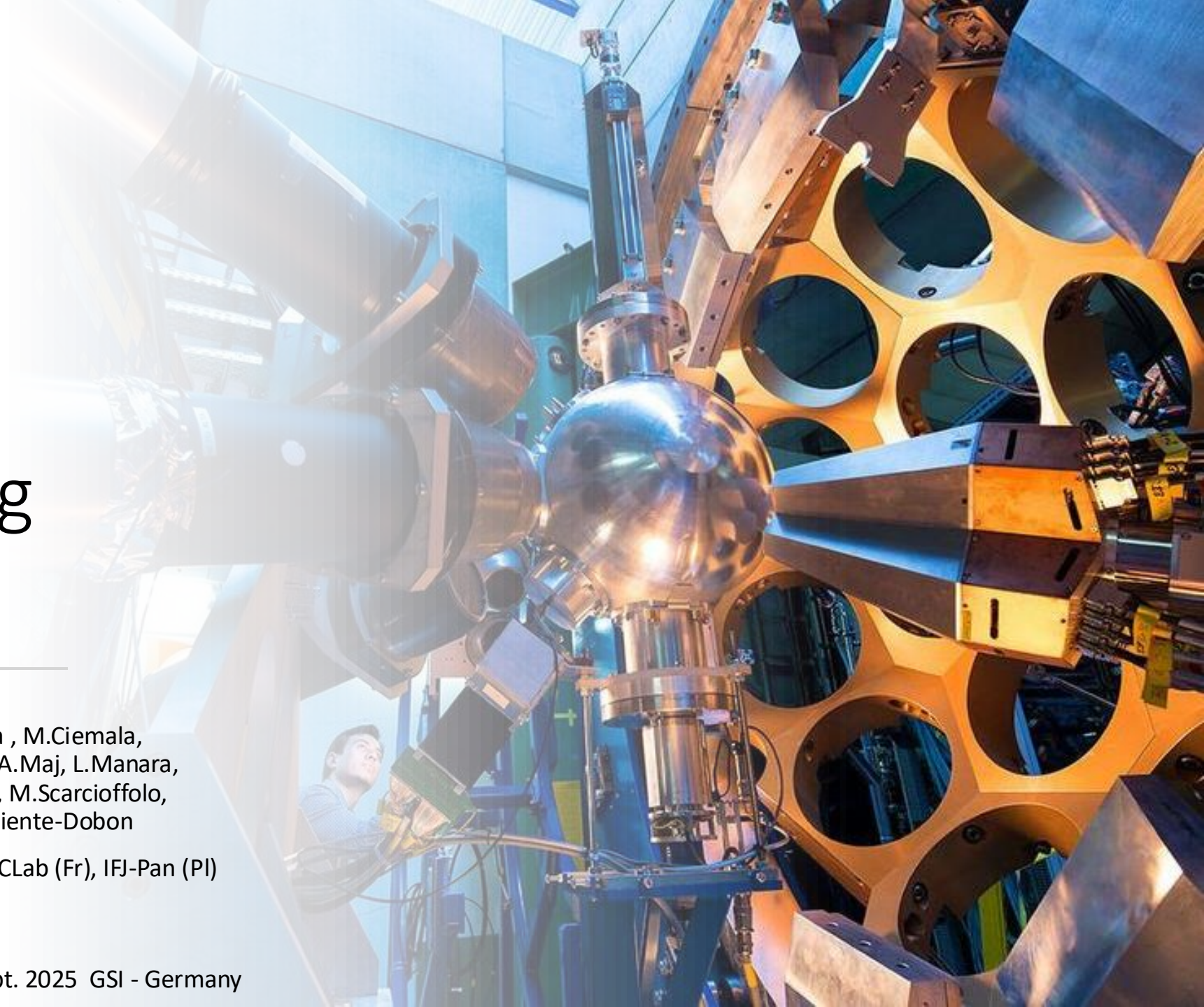
AGATA Zero-Deg Updates

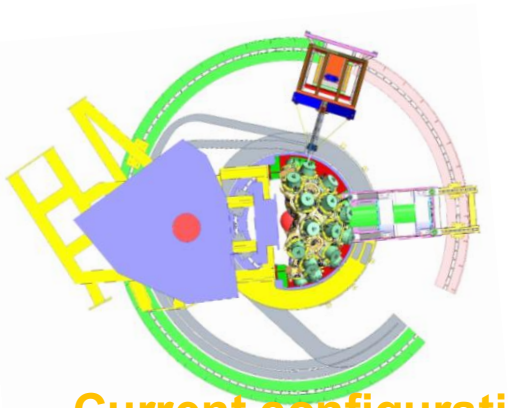
G.Benzoni, M.Benettoni, M.Bolognesi, F.Camera , M.Ciemala, S.Coelli, T.Druillole, C.Le Gaillard, F. Galtarossa, A.Maj, L.Manara, I.Matea, R.Menegazzo, L.Ramina, M.Rampazzo, M.Scarcioffolo, D.Scarpa, R.Smith, B. Sowicki, F.Veronese, J.J.Valiente-Dobon

INFN-Mi, INFN-Pd, INFN-LNL, Daresbury (UK), IJCLab (Fr), IFJ-Pan (Pl)

The 25th AGATA week and ACC meeting 15–19 sept. 2025 GSI - Germany

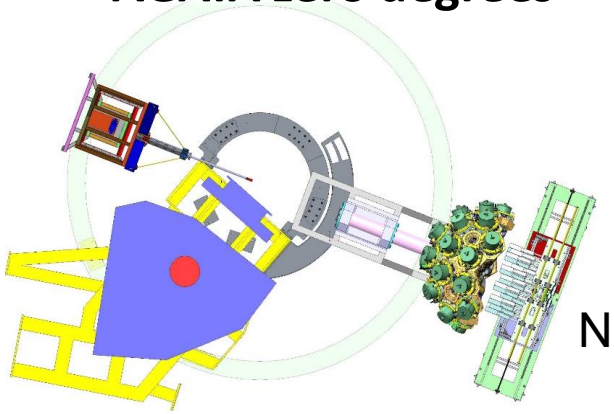


AGATA Zero-Deg Configuration



Current configuration

AGATA zero degrees



NEDA

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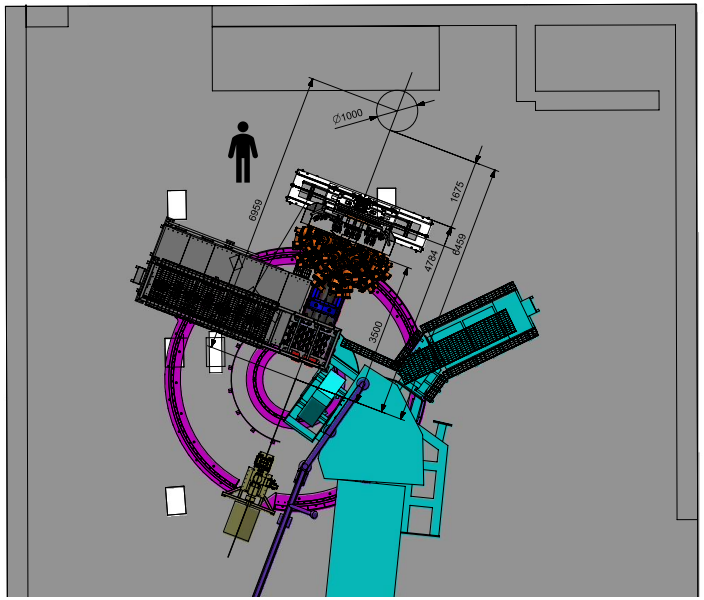

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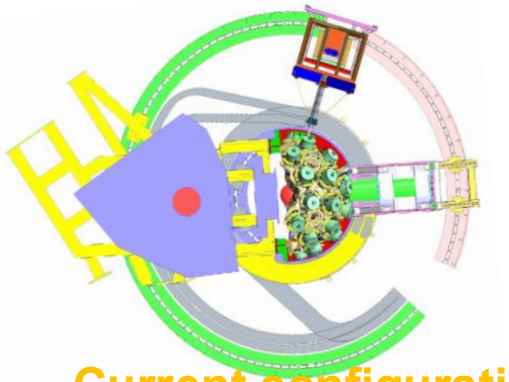

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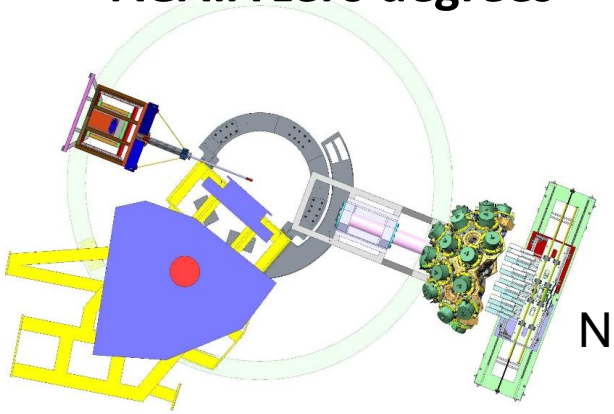

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  - Move shaft and honeycomb
  - New support for shaft
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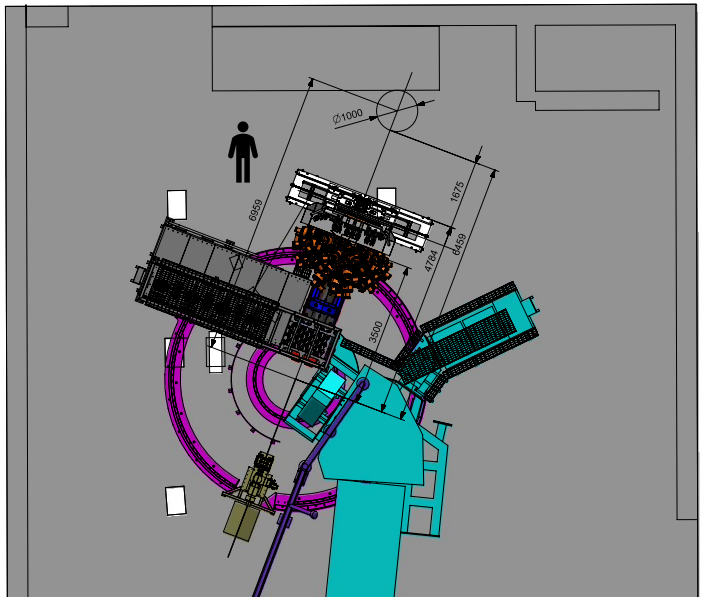
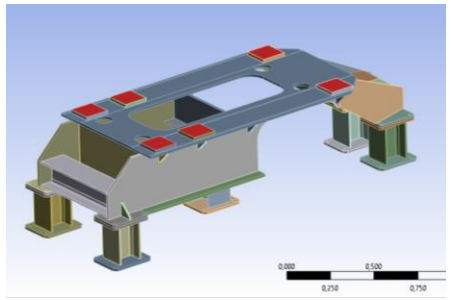
  - Create new reaction chamber
  - Extend the beamline towards new beamdump
  - Ancillary detectors support

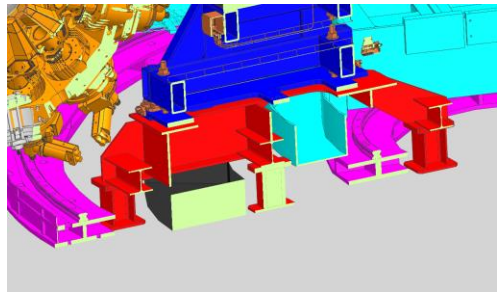


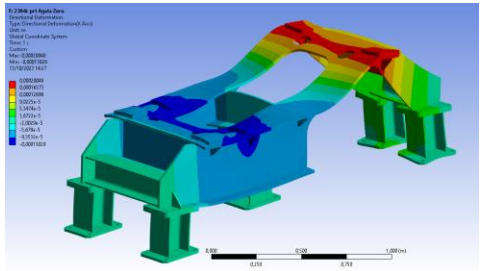
AGATA Zero-Deg Configuration: New support for shaft

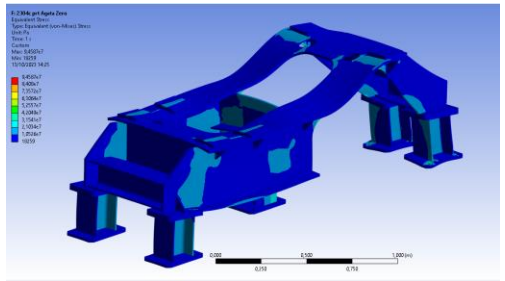
AGATA will be moved in new position, and the shaft will be placed on a newly designed support:

- Lean over the rails that allow PRISMA rotation and cabling





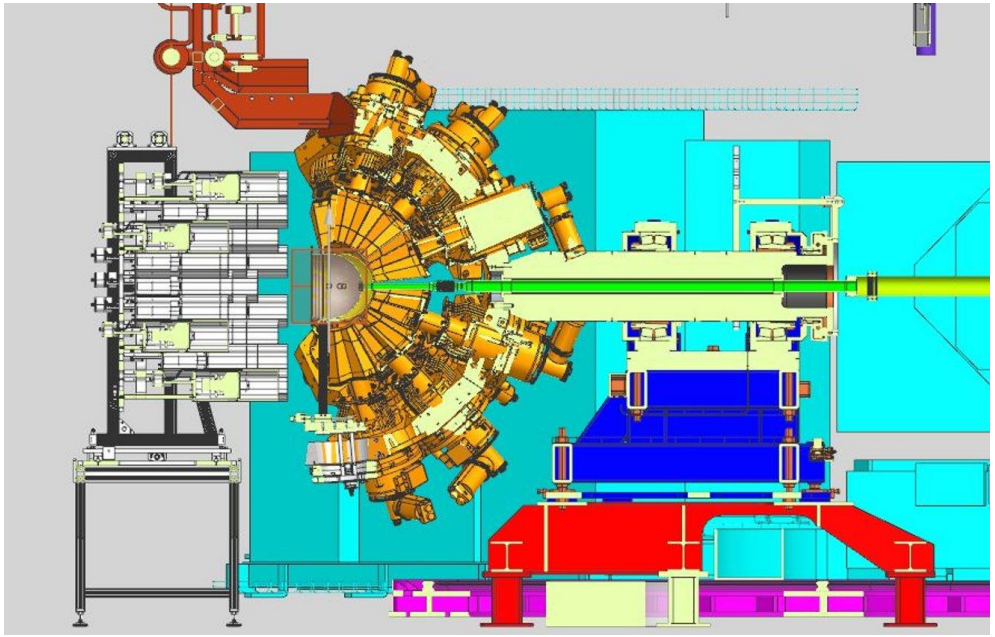




Deformation analysis performed assuming a weight of 10 tons (10^5 N)
Deformations are not uniform on the surface:

- 0.2 mm on the back
- 0.13 mm to the front

==> possible rotation that can be compensated shimming



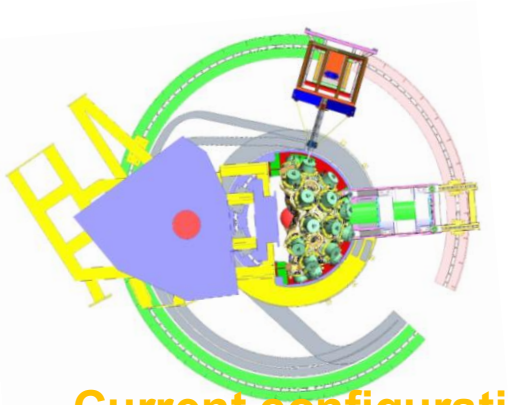
In this new position AGATA will:

- Rotate around its axis for intervention on detectors
- NOT translate along the beam axis to approach target position

NB: PRISMA will be frozen at 110 deg

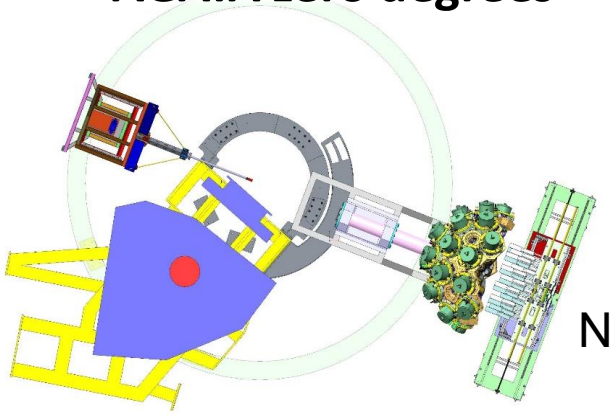
==> elements have been purchased and system ready to be installed

AGATA Zero-Deg Configuration



Current configuration

AGATA zero degrees



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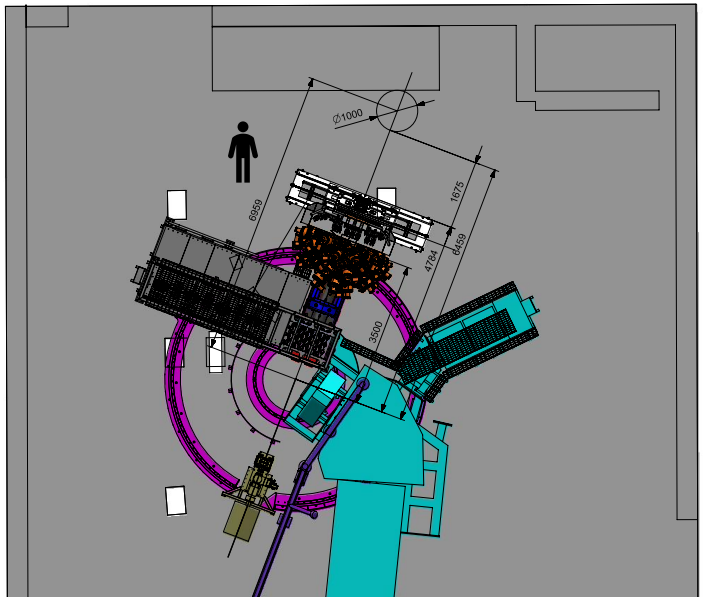
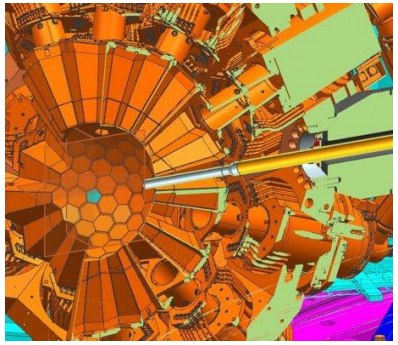
  - Extend the beamline towards new beamdump
  - Ancillary detectors support

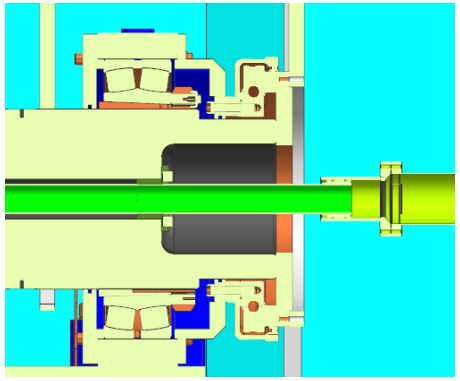


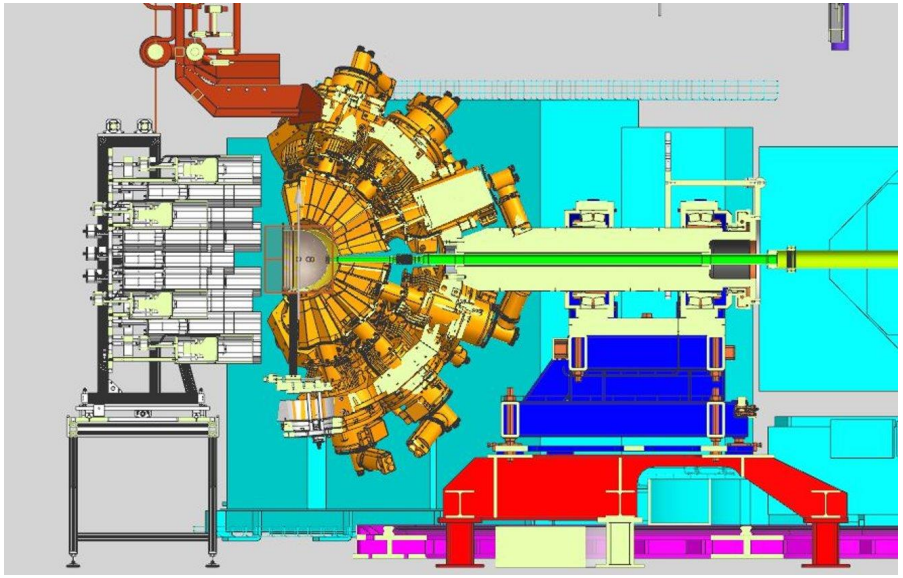
AGATA Zero-Deg Configuration

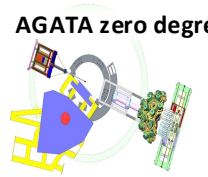
- Beam line goes through the shafts and is connected to the shell of the chamber
- Beamline diameter 55 mm, narrowing down to 33.4 mm at chamber entrance

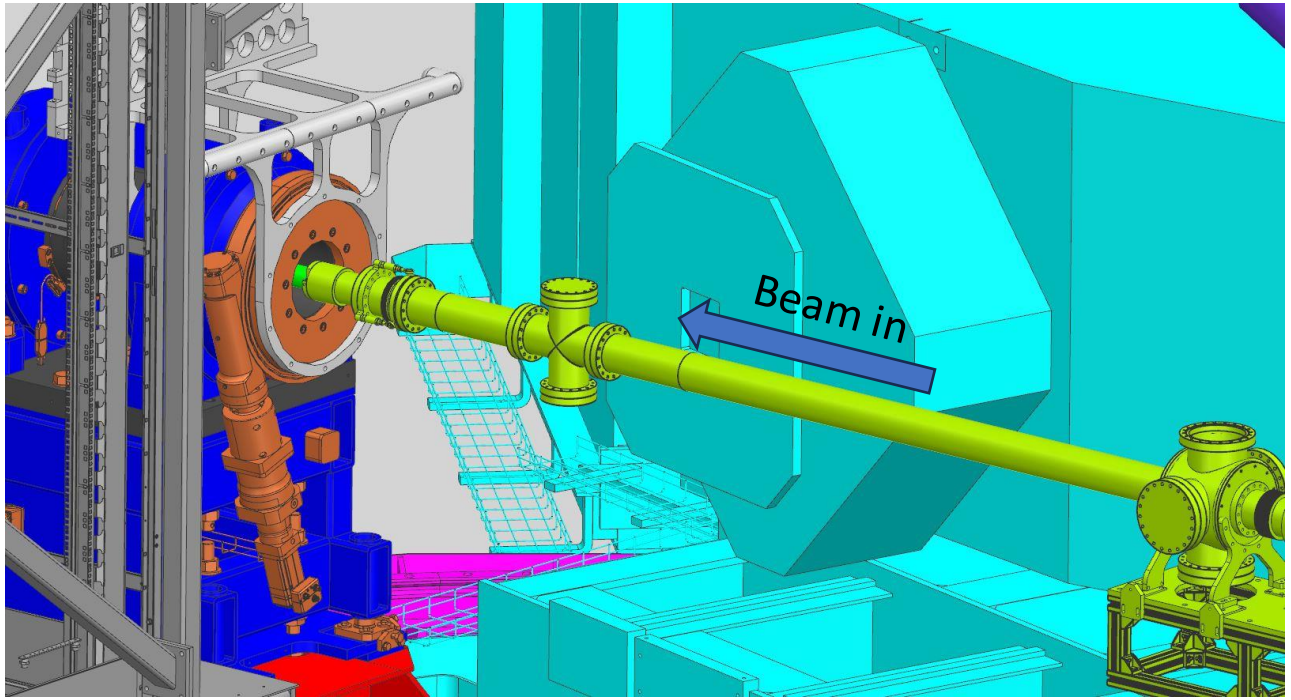


Telescopic movement of the beamline to change detectors-target distance working in high-efficiency configuration: continuous range from 0 (nominal) to - 55 mm (high eff.)

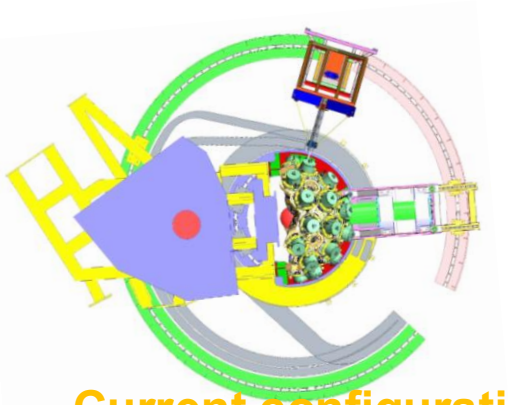






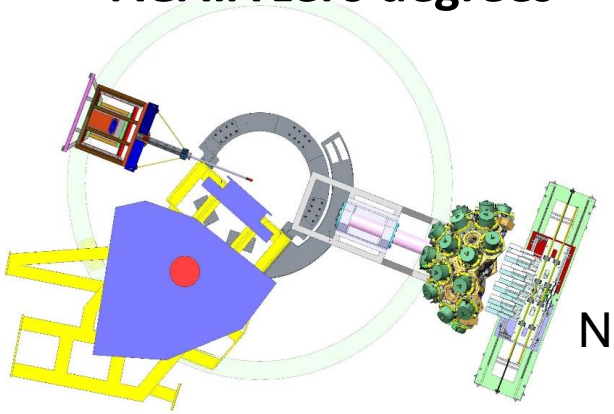


AGATA Zero-Deg Configuration



Current configuration

AGATA zero degrees



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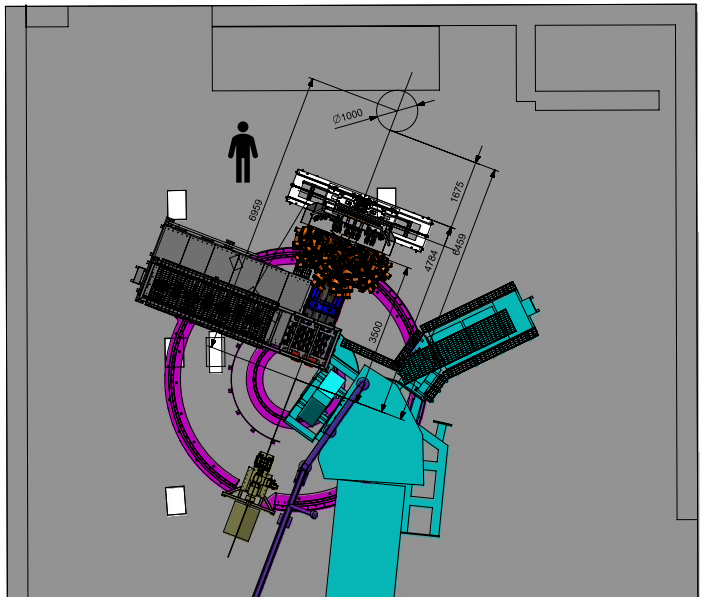
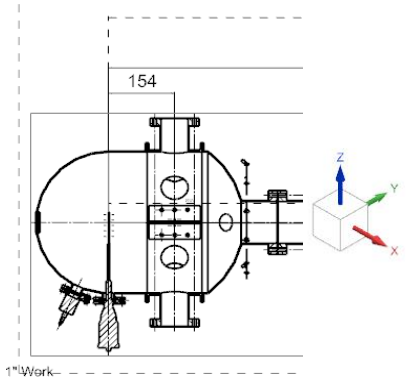
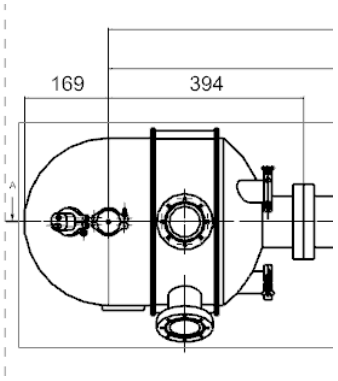


AGATA Zero-Deg Configuration: multi-purpose chamber

Upstream Shell:

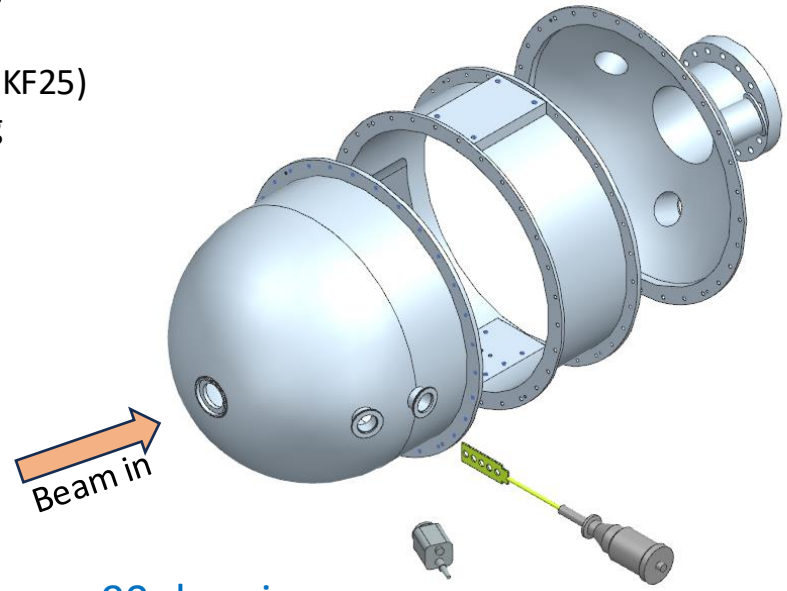
- 2 mm Al thickness; 170 mm radius
- Target holder (KF25)
- Videocamera for beam centering (KF25)
  Flattening towards the 90 deg ring
- (outside AGATA view)





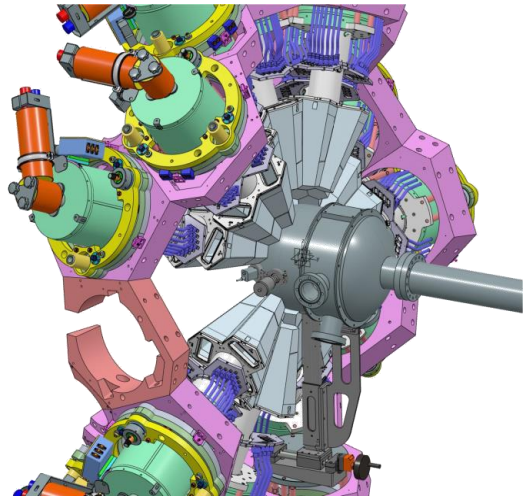
Downstream shell:

- 4 Viewports KF40
- Connecting flange to beamline CF100

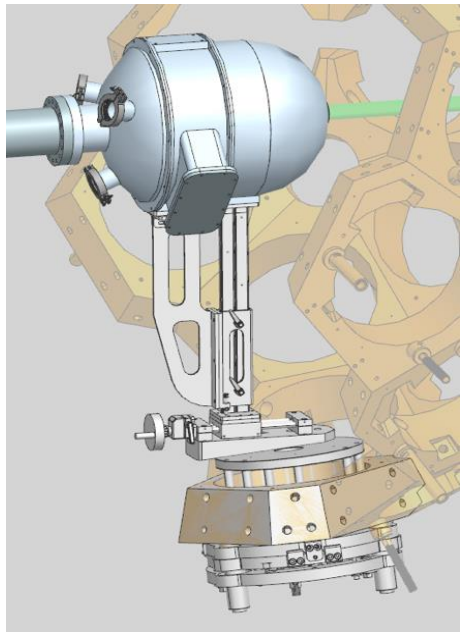


90 deg ring:

- Outside AGATA view, 5 mm Al thickness
- large flange for services in lower hemisphere (detectors' signals and power cables)
- Gauge monitor
- Inserts with blind holes for ancillary detectors holding structures

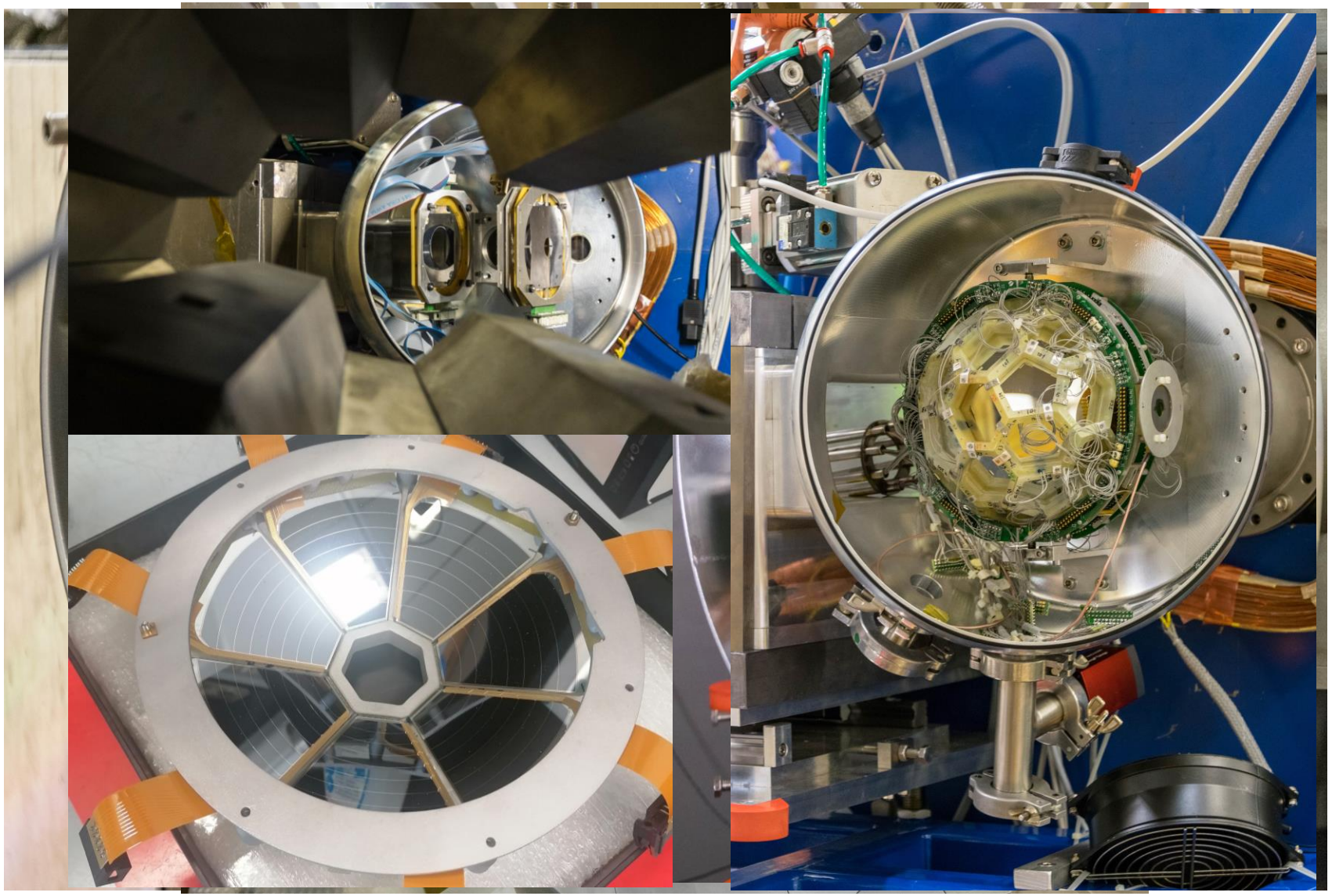


Support on flange:
3D centering regulations



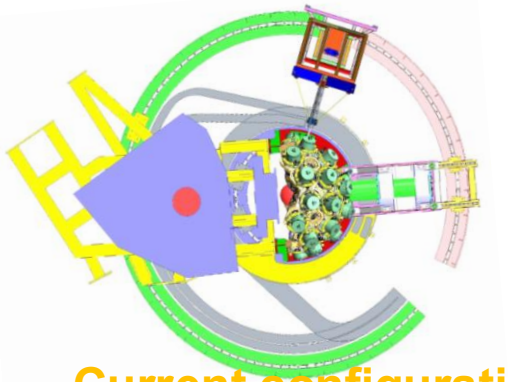
AGATA Zero-Deg Configuration: multi-purpose chamber: A wealth of Complementary detectors

1. Heavy ions:
   - ~~PRISMA~~
   - SPIDER
   - DANTE
   - OSCAR
2. Light charged particles:
   - SPIDER
   - EUCLIDES
   - SAURON
   - AGATRACE
3. Lifetimes
   - Plungers
4. Scintillators
   - $LaBr_3(Ce)$
   - PARIS
   - NEDA



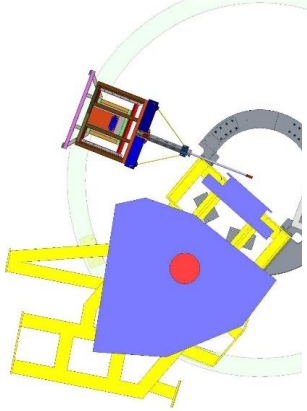
Courtesy of M. Balogh, A. Goasduff

AGATA Zero-Deg Configuration



Current configuration

AGATA zero degrees



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  - **Extend the beamline towards new beam-dump**
  - **External ancillary detectors support**

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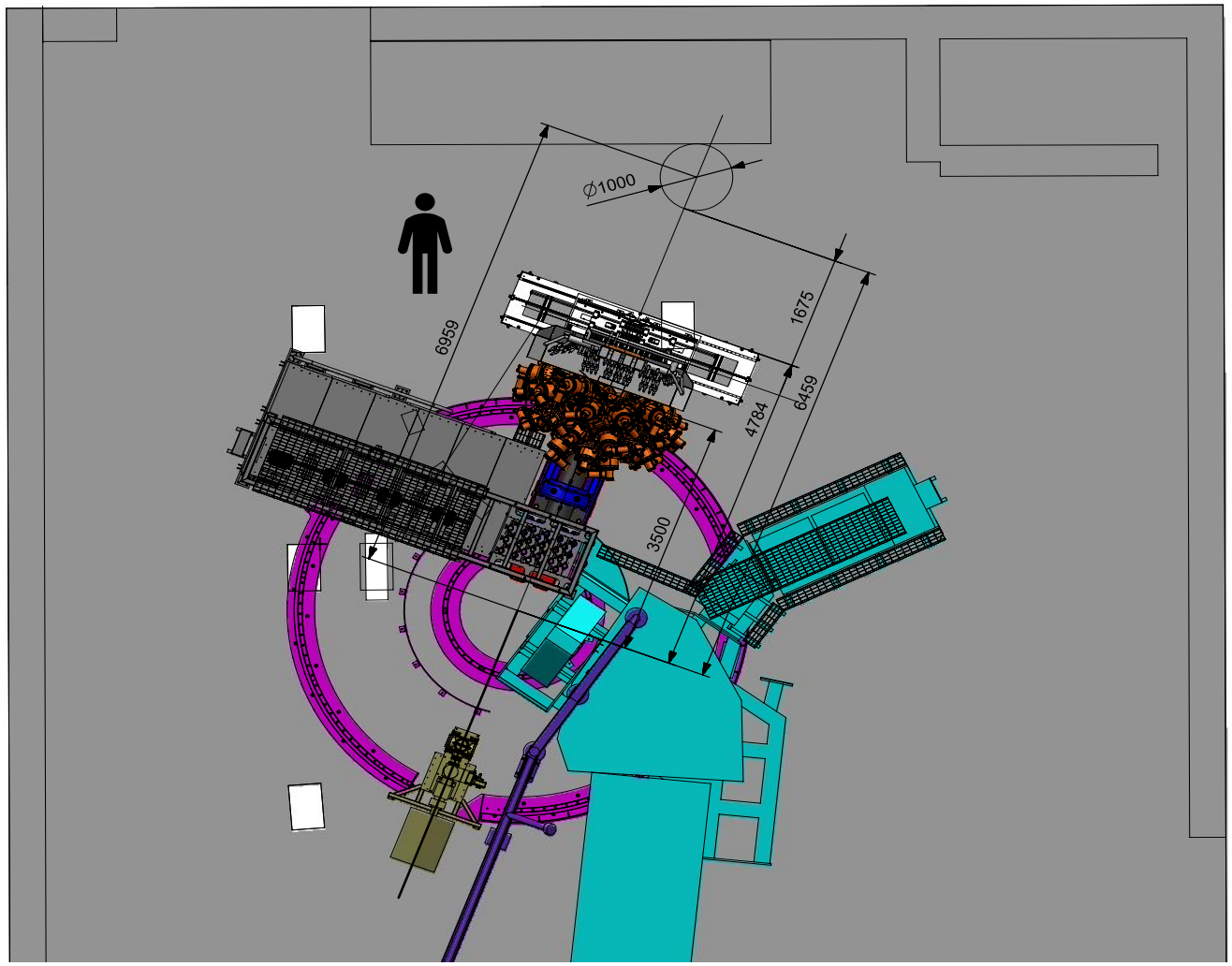
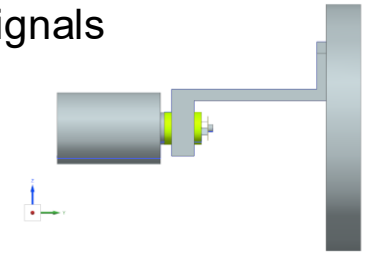
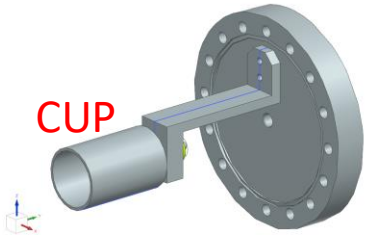


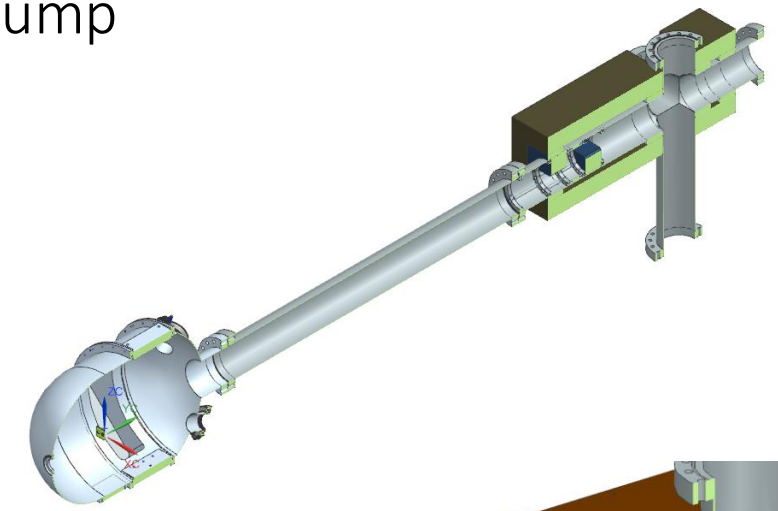
AGATA Zero-Deg Configuration: downstream and beam dump

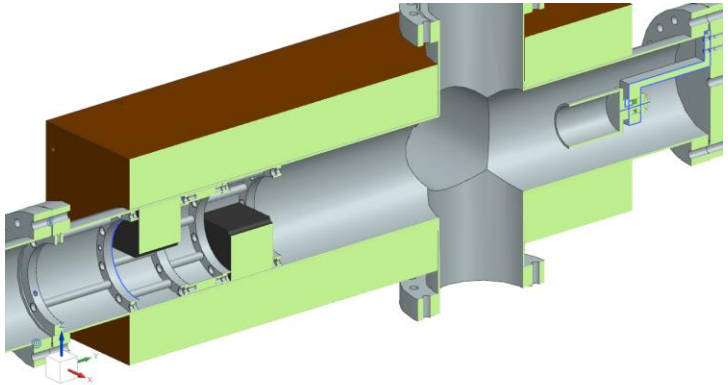
Details of the beam-dump chamber:

- It is a 4-way cross to allow location of a pumping system
- Beam-dump cup located on end flange
- Feedthroughs for signals
- PEEK insulation

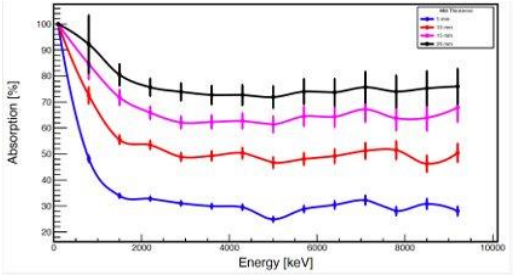


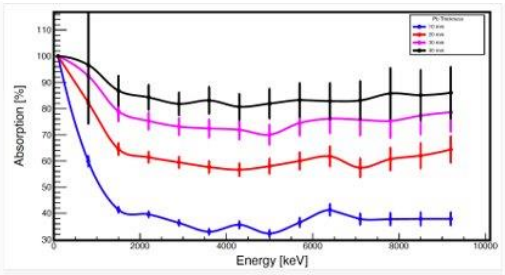


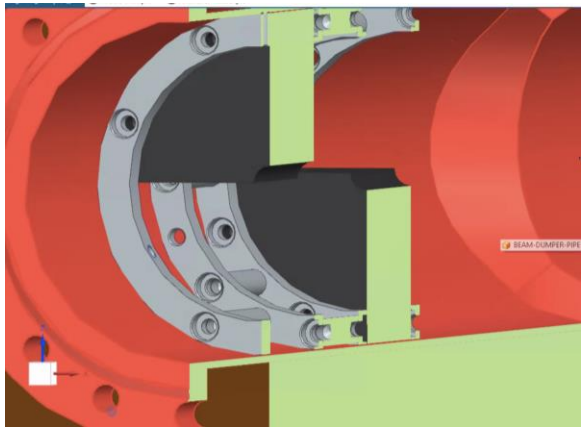




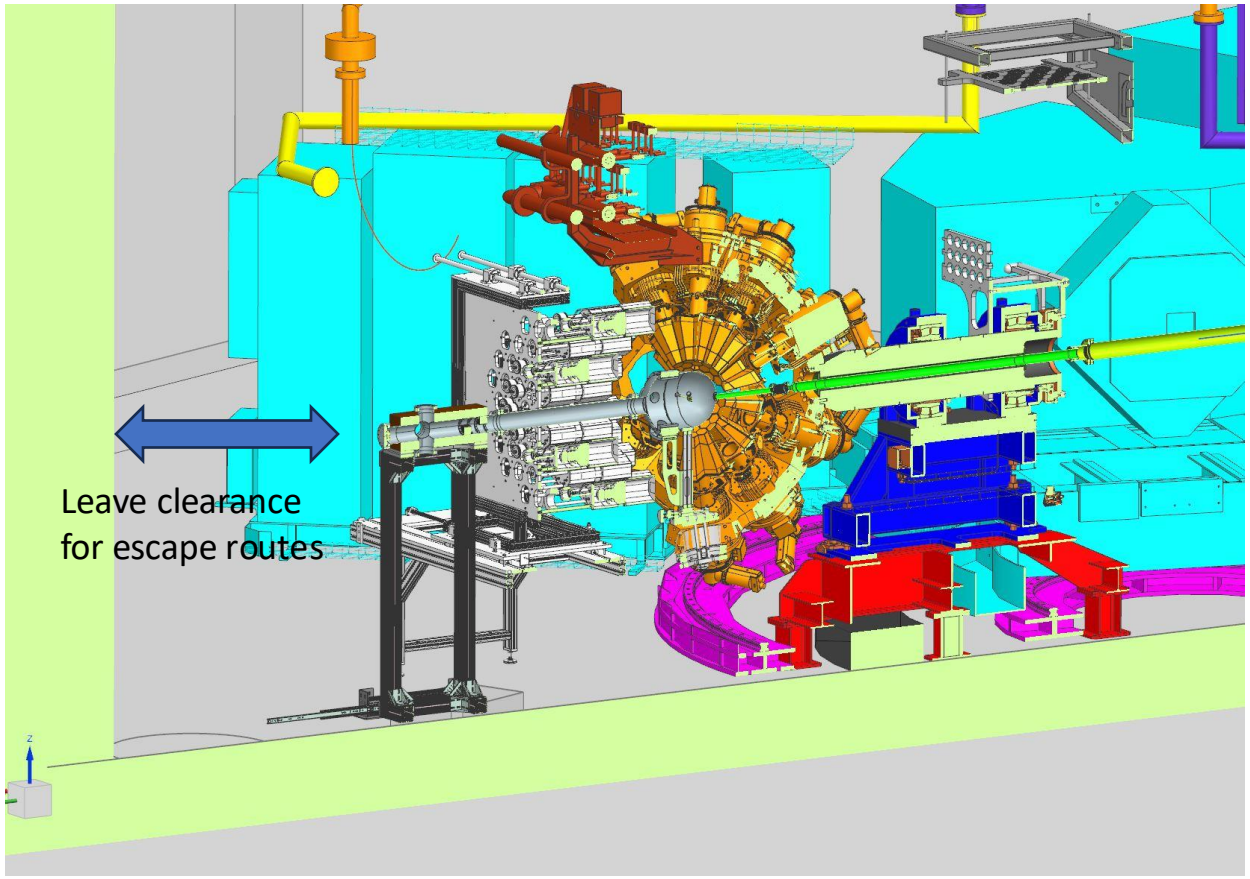
- End-flange closed using flat Viton CF o-ring for easy removal
- Shielding:
  - Externally 50 mm Pb
  - Internally at the entrance of the chamber, two blocks of W alloy to shield from backward scattering radiation
  - W blocks are detached to help vacuum and have a hole (10 mm) to allow beam entering.
  - Absorbs approx. 98% or radiation up to 4-5 MeV



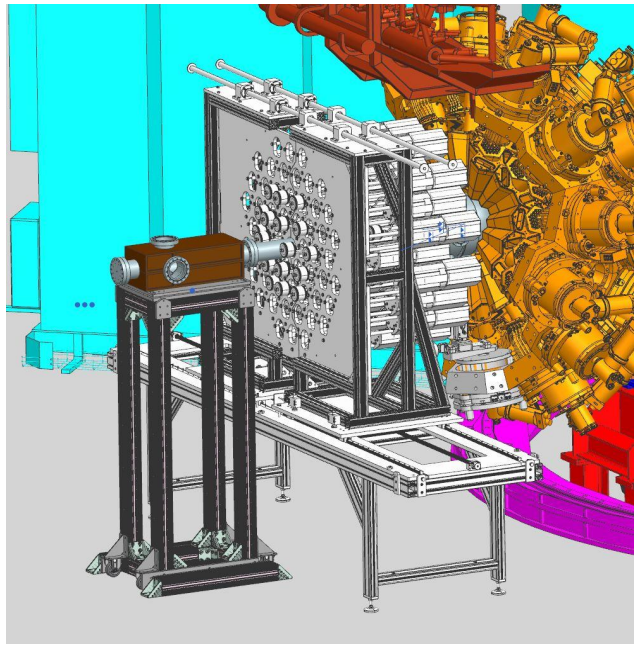




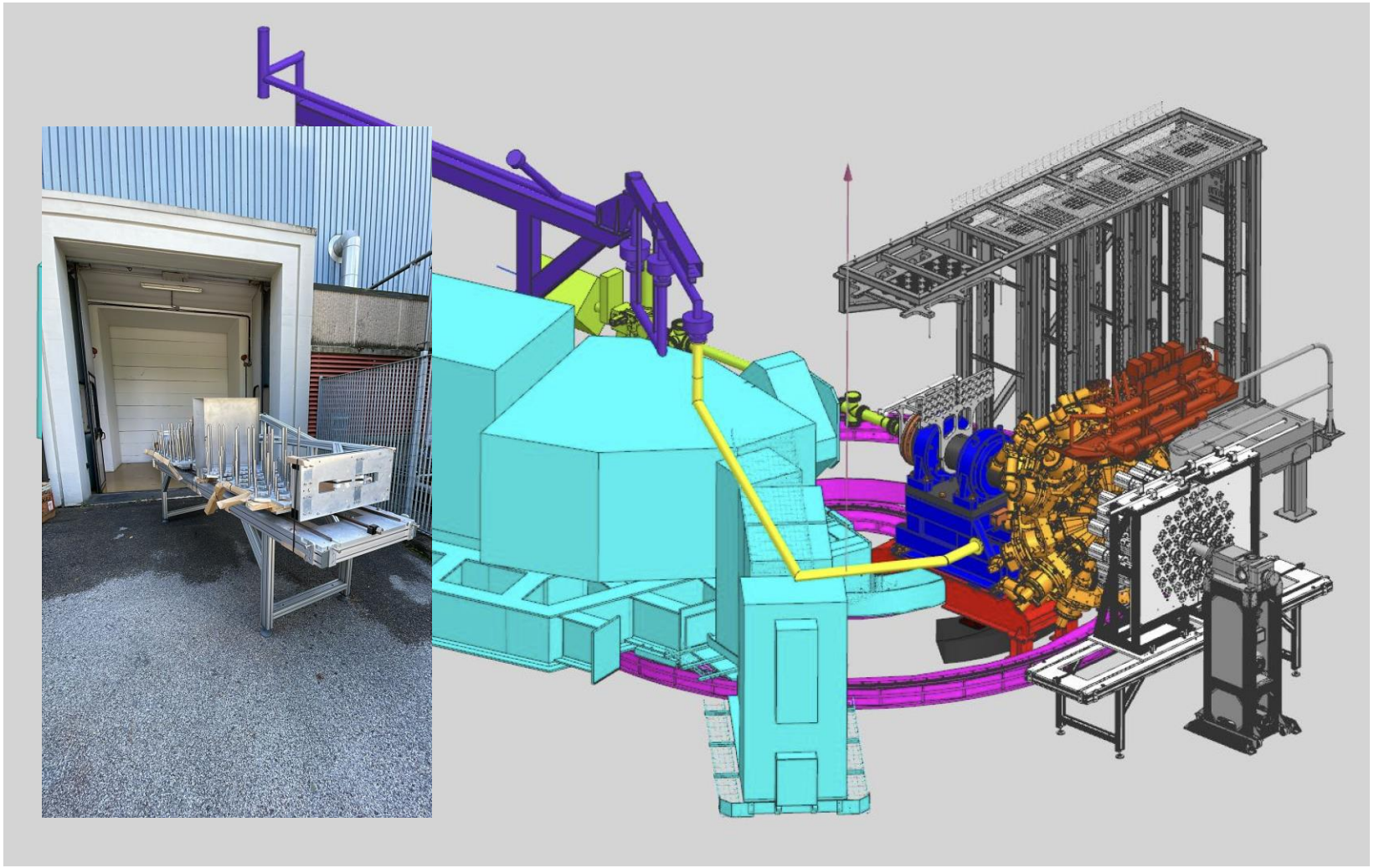
AGATA Zero-Deg Configuration: downstream and beam dump



- Beam-dump support structure will be moved along its axis towards or away from the scattering chamber to allow opening operations in the chamber
- The beam-dump will also guide the movement of the telescopic upstream beam line for high-efficiency configuration
- Diameter of the beamline 100 mm (CF100 standard), just one middle element between chamber and beam-dump



Zero degree campaign “bulky” ancillaries



NEDA Neutron Detector Array

- 54 liquid scintillator cells
- 50 cm from the target
- Neutron discimination:
  - PSA
  - Time of flight
- Digital electronics compatible with AGATA
- DAQ integration is on-going

J.J. Valiente Dobón, Nucl. Inst. Meth. A **927** (2019) 81

Courtesy A.Goasduff

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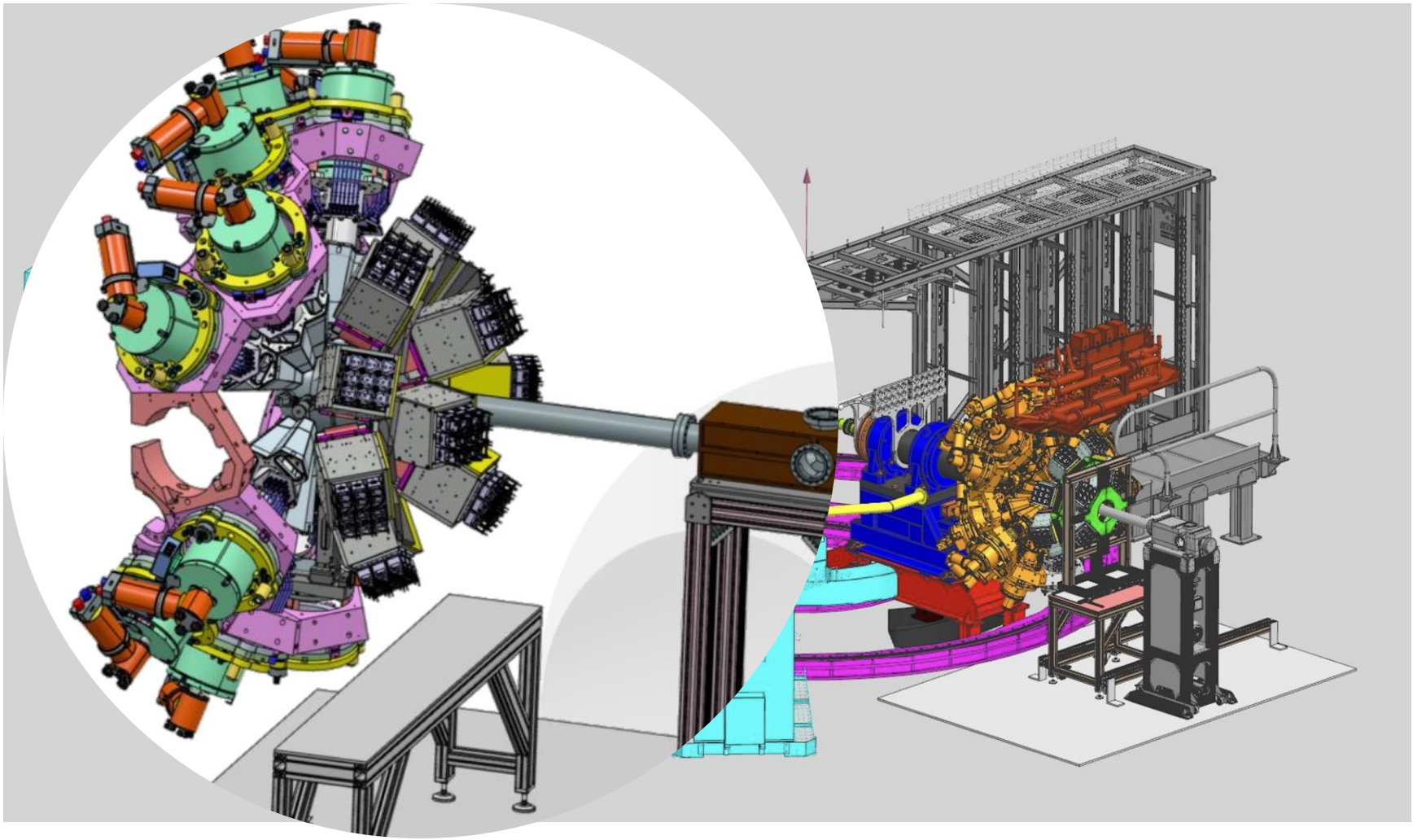
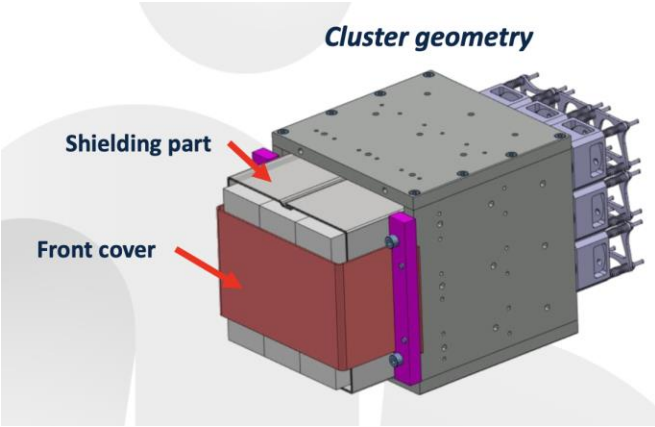


PARIS phoswich array

- 10 cluster made of 9 phoswiches
- 2 rings at forward angles:
  - 6 clusters at 60 degrees
  - 4 clusters at 15 degrees
- Same electronics than present $LaBr_3$ – fully integrated



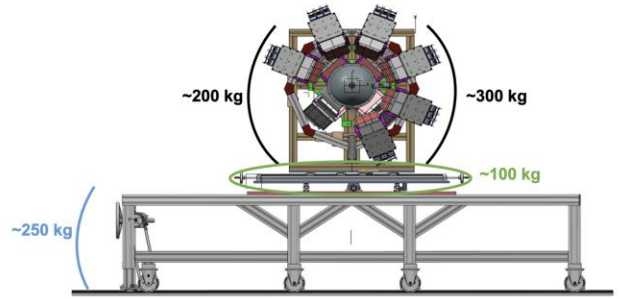
http://paris.ifj.edu.pl

Courtesy A.Goasduff

Work to create a common support table for NEDA and PARIS

- Very heavy equipment (~1 ton)
- Movable on rails to allow access to AGATA detectors
- Opening in halfs for quick access to AGATA scattering chamber

Weight of the all structure



Total : 850kg

IJCLab Irène Joliot-Curie Laboratoire de Physique des 2 Infinis

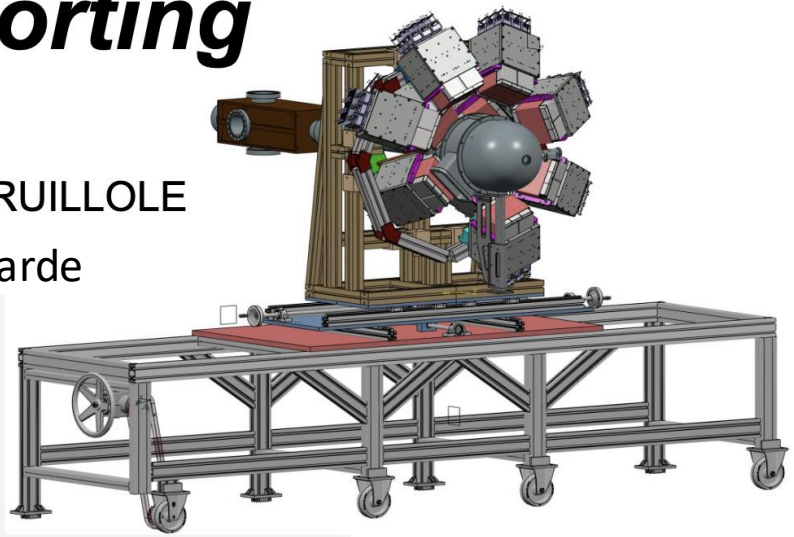
PARIS@LEGNARO

PARIS's supporting structure

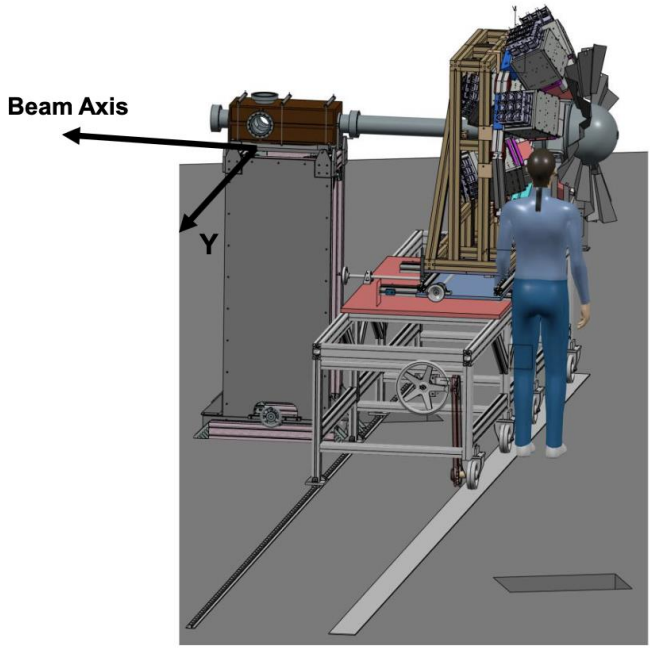
Thomas DRUILLOLE

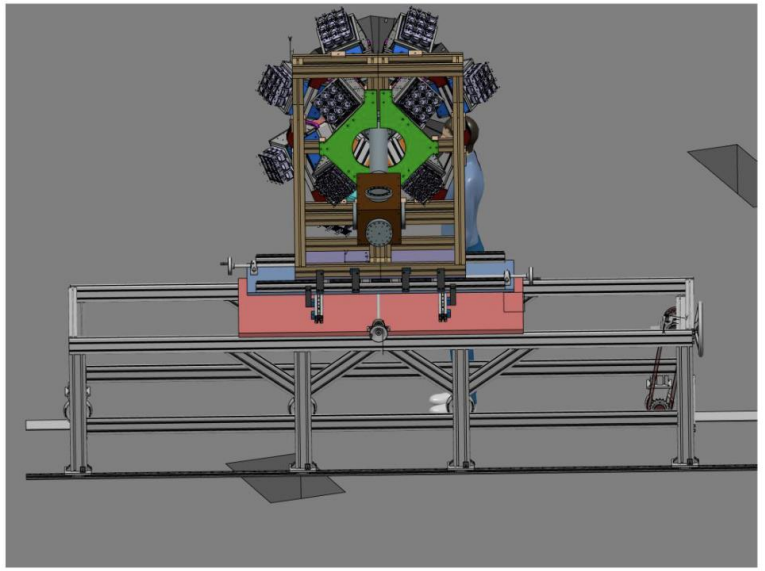
Christine Le Gaillarde

Iolanda Matea



Global view PARIS





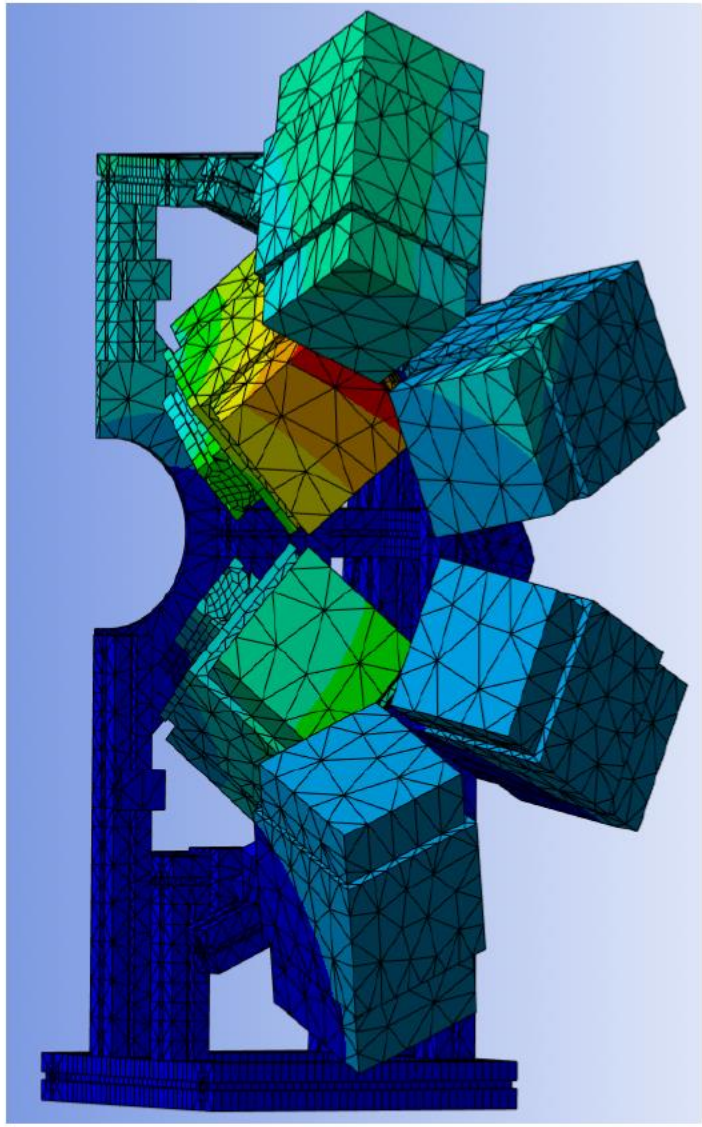
The majority of the elements of the supporting structure are made in aluminium or are aluminium profiles (AP)

- 10 cluster made of 9 phoswiches
- 2 rings at forward angles:
  - 6 clusters at 60 degrees
  - 4 clusters at 15 degrees
  - Average distance Ta-Phoswich 300 mm

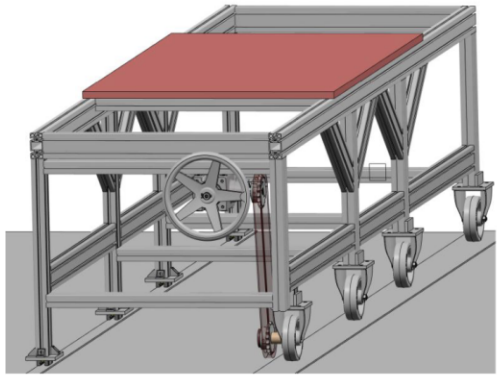
Possibility to access the chamber even when PARIS is in working position

Stress evaluation shows deformations below 0.4 mm

Deformation



Wheels side



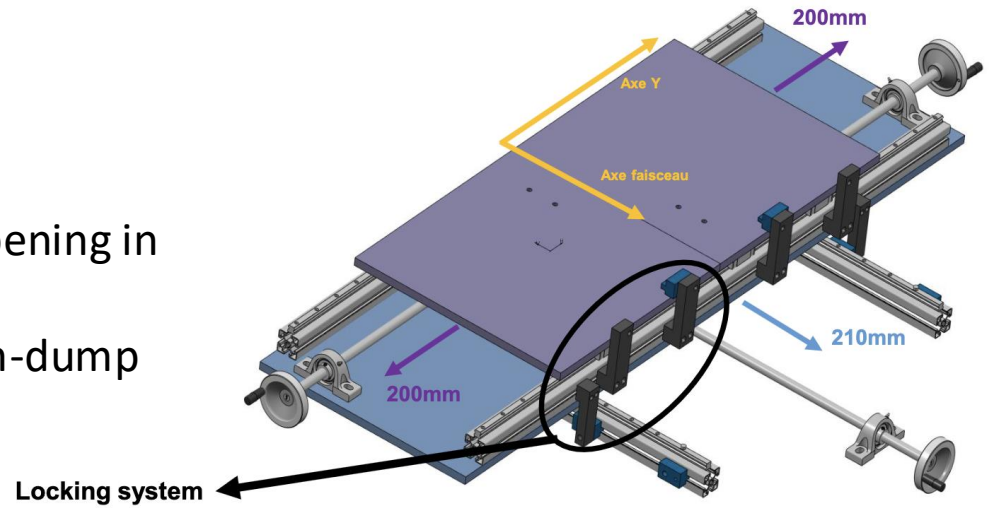
- 1 steering wheel
- 1 angular box
- 2 gears
- 1 chain

- ~6
- 1st

Support table moving on wheels but guided by rails
➔ Reproducibility of positioning and manoeuvrability
➔ Movement guided by pulley and hand wheel

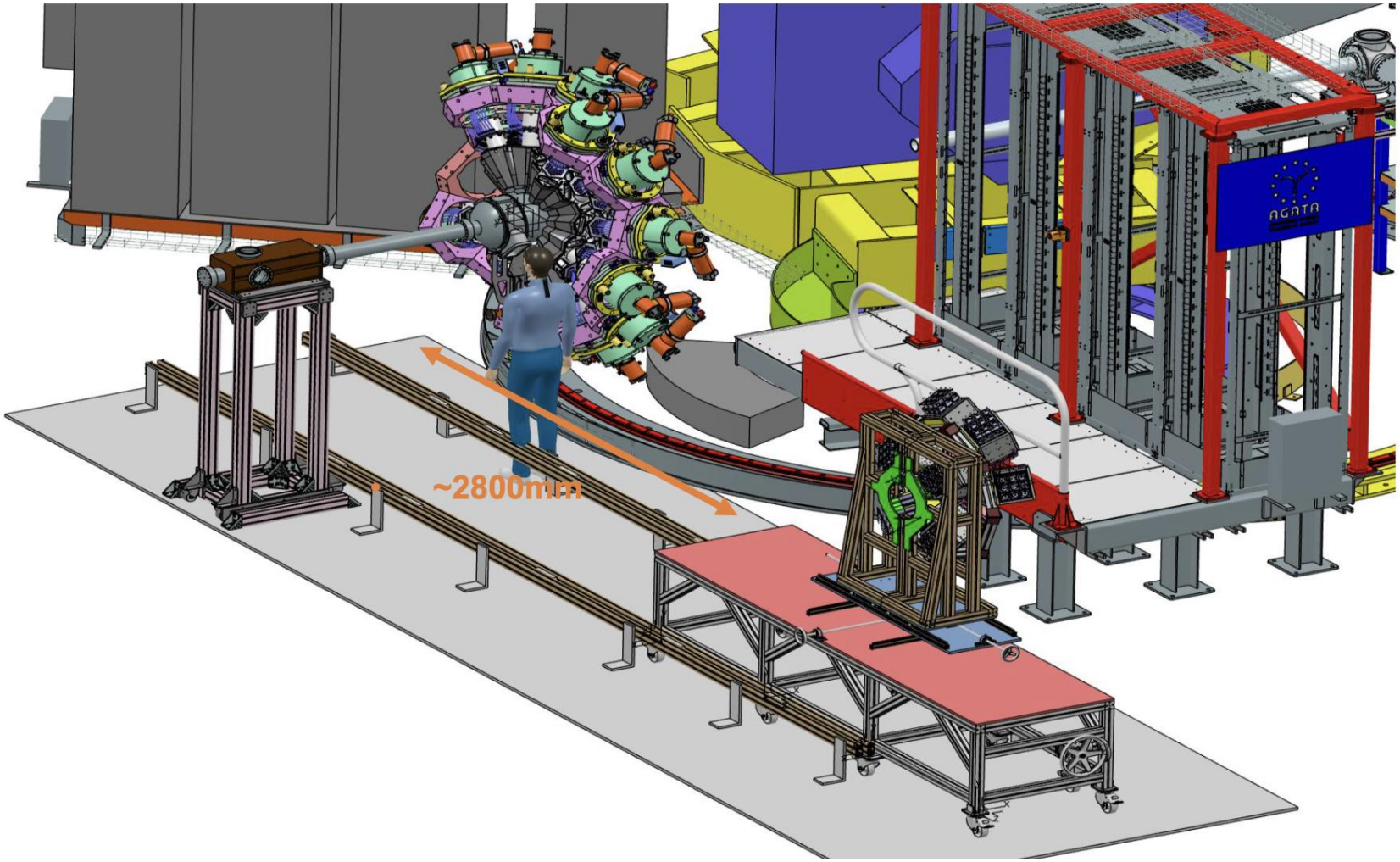
Global view of the mobile structure

Blue and viole plates are made in aluminium



-PARIS support structure (wall) placed on table opening in the middle
-Table is also translating backwards towards beam-dump chamber to allow opening of scattering chamber

Global view with PARIS in garage position



AGATA Zero-deg Configuration: Conclusions

- New position and new support for shaft+honeycomb designed and procured, ready for mounting

- Solutions for beamline – scattering chamber – beam-dump
  - ➔ designed consolidated
  - ➔ elements procured
  - ➔ pre-assembly in fall 2025

- Capability to host various ancillary detectors and new targets
  - ➔ opportunities for new physics campaigns

- PARIS and NEDA integration finalized, tendering for elements started

- **Time required to complete the new configuration: ~<6 months**

AGATA zero degrees