

PAUL SCHERRER INSTITUT



Estia  
Estia



EUROPEAN  
SPALLATION  
SOURCE



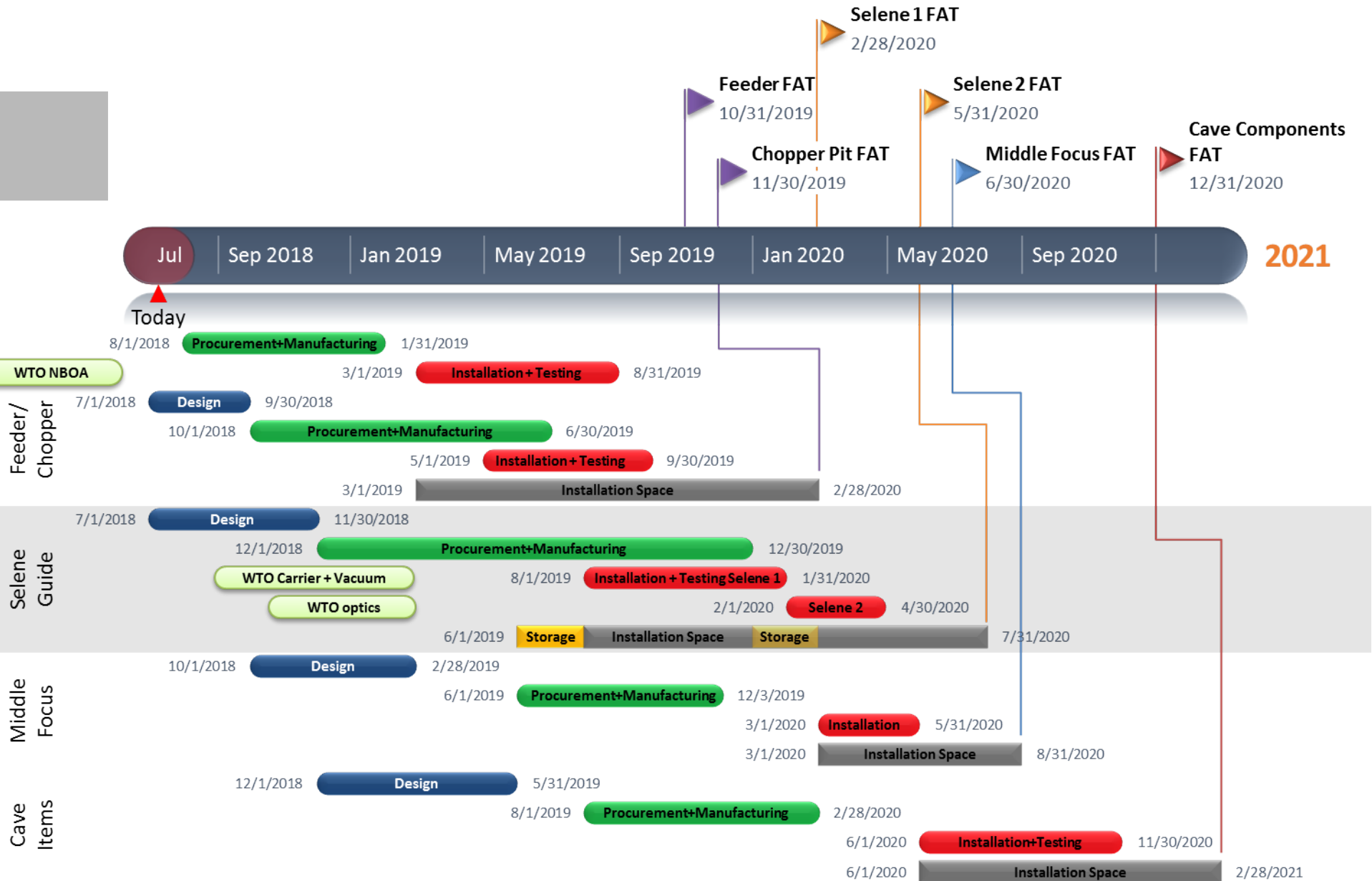
Artur Glavic / Sven Schütz :: Paul Scherrer Institut

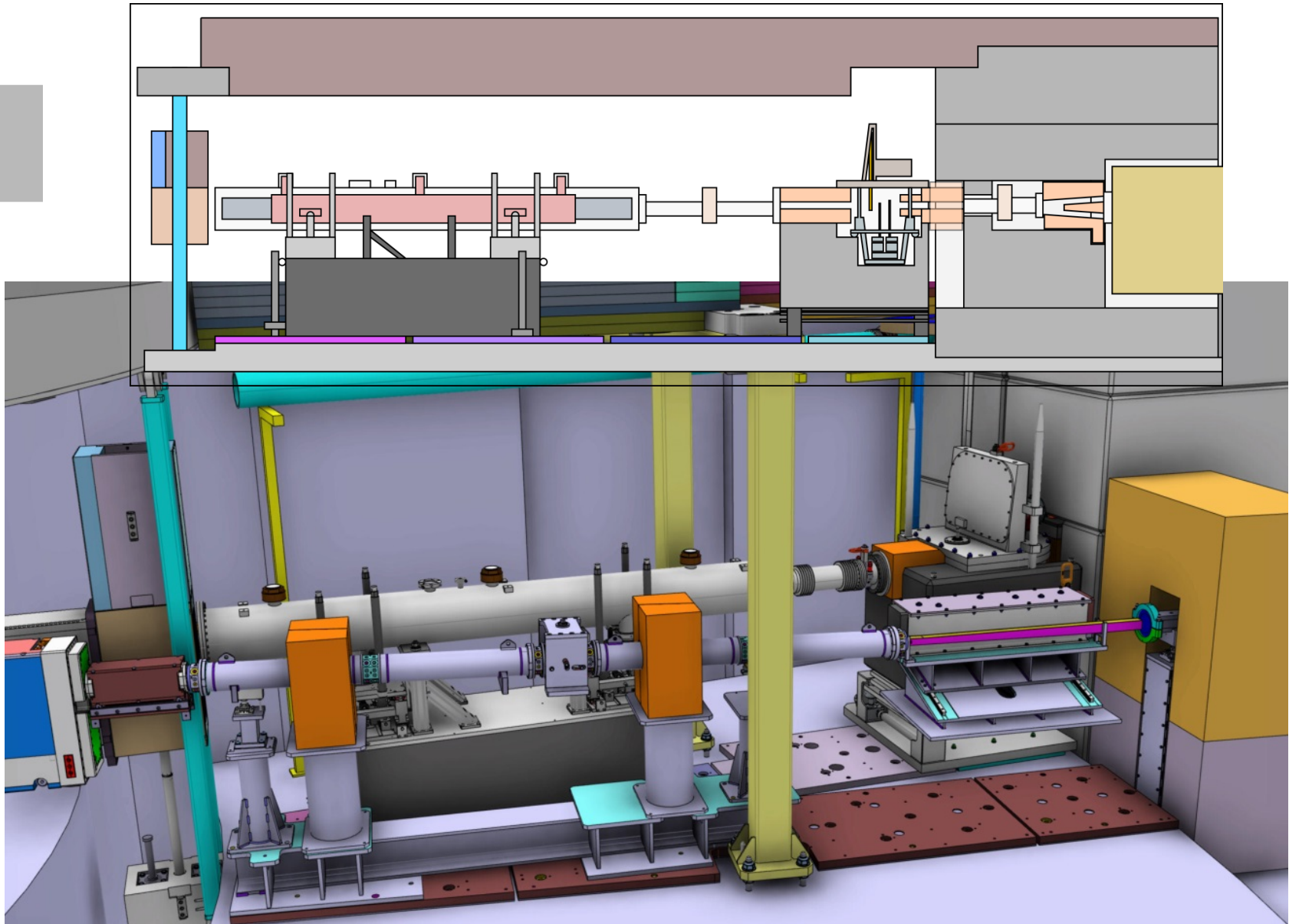
# Updates from Estia

Large Scale Structures instrument class session

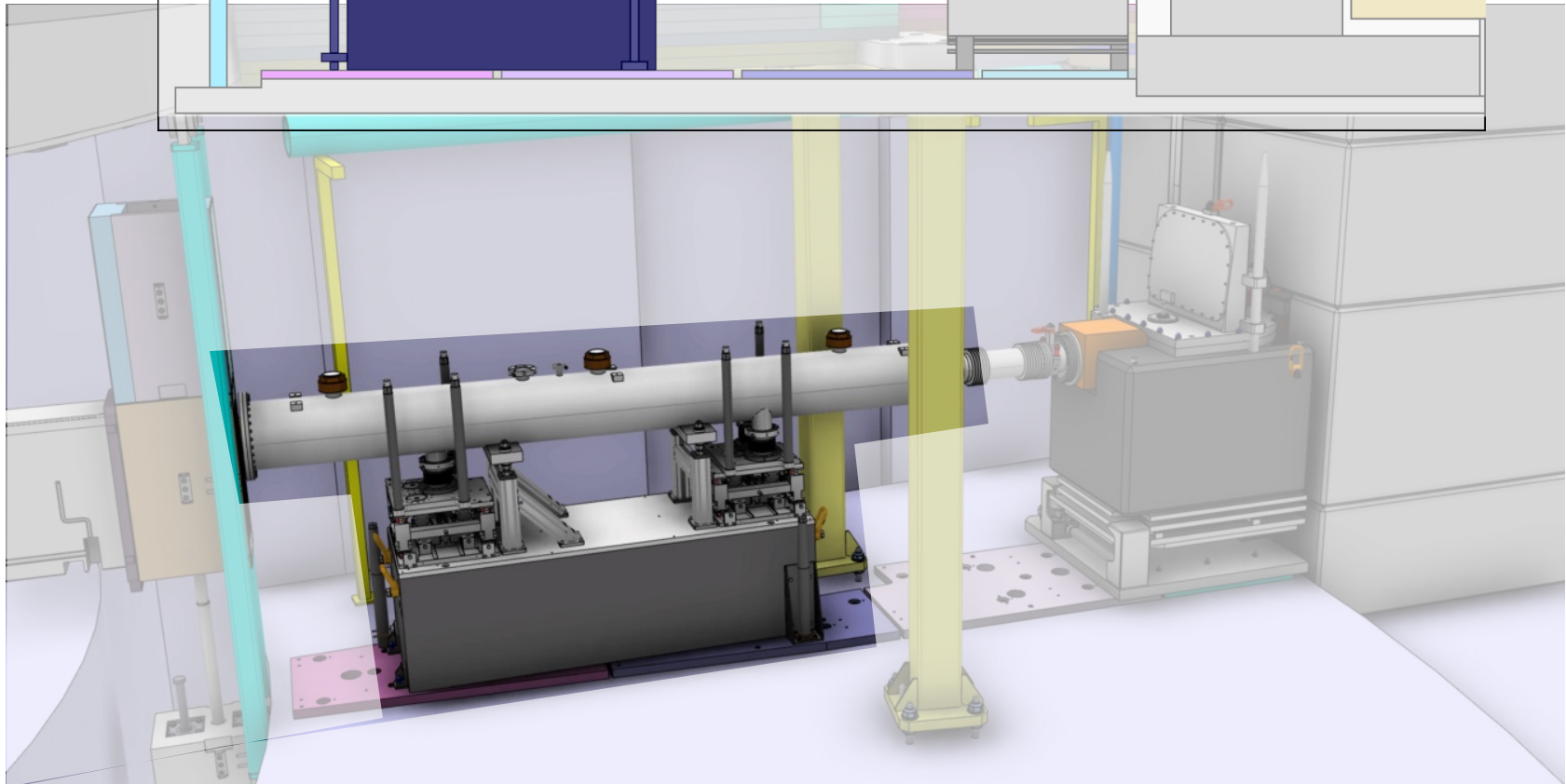
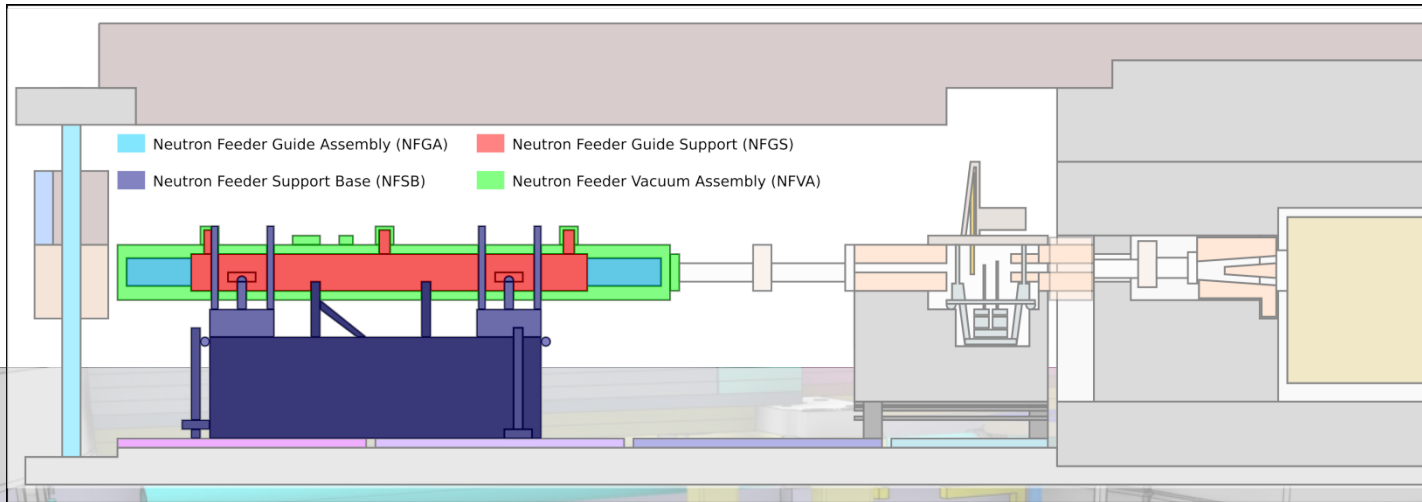
11.09.2018 – ESS Lund

- Design and procurement schedule
- In-bunker feeder
- Chopper and Virtual Source
- Selene Guide
- Shielding Calculations

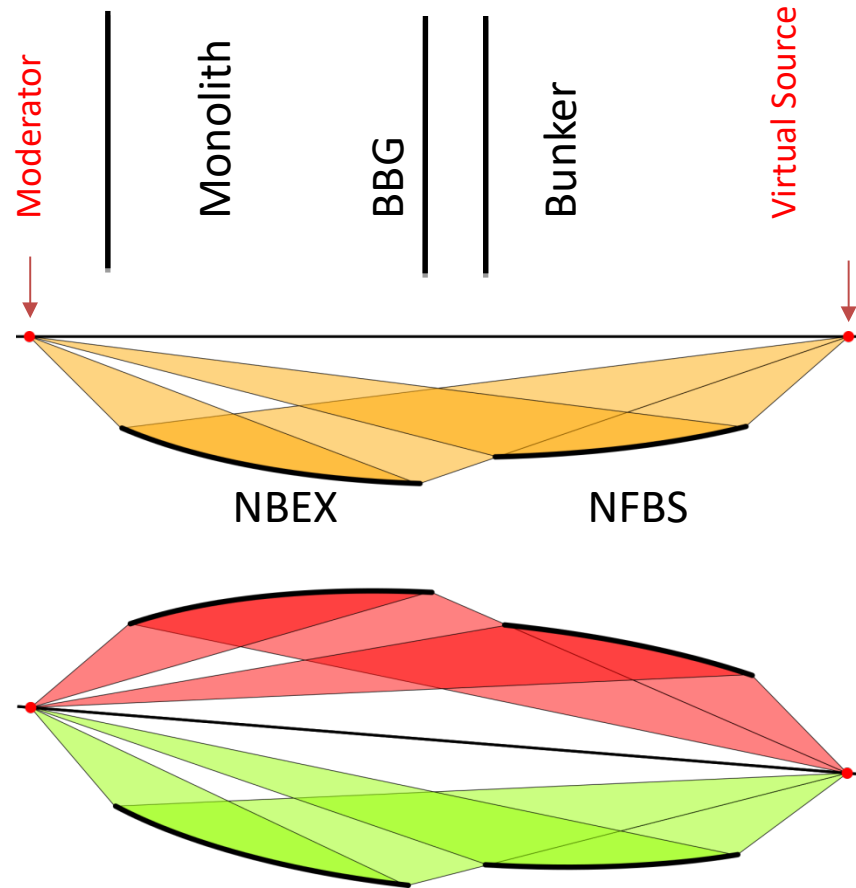




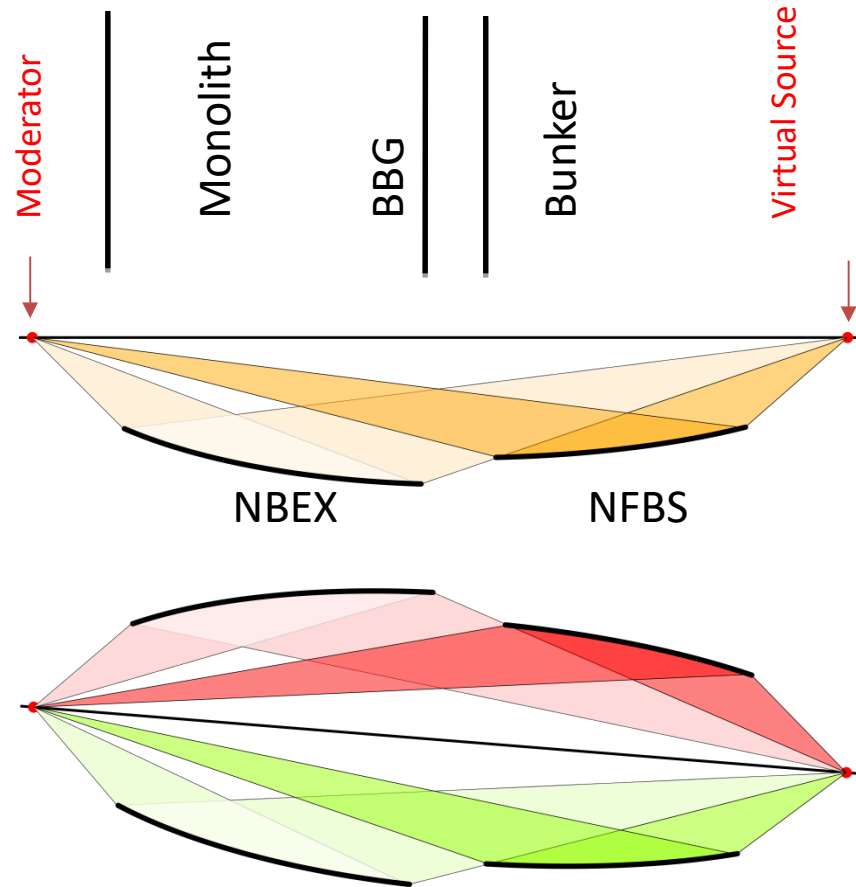
# Sub-TG3 Systems



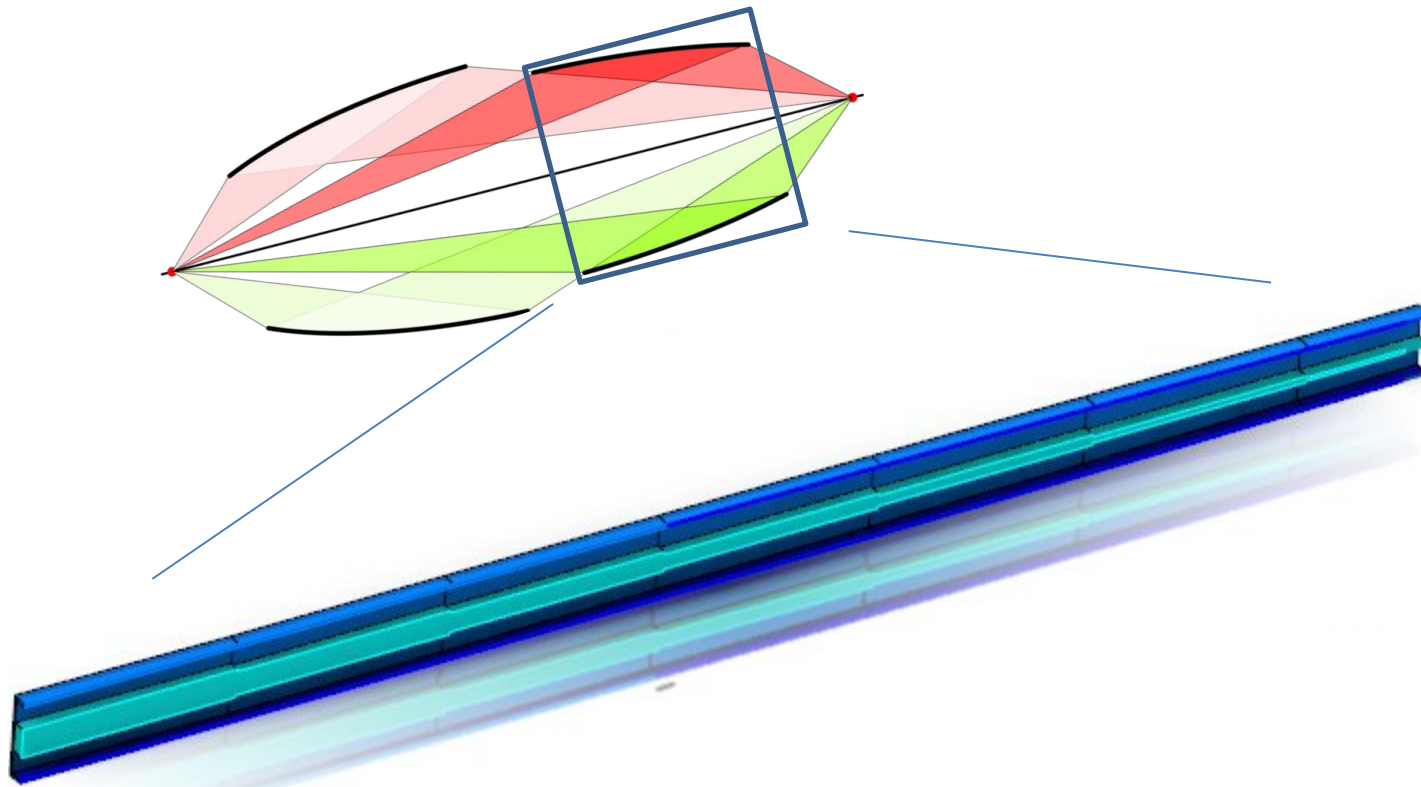
# Required Functionalities



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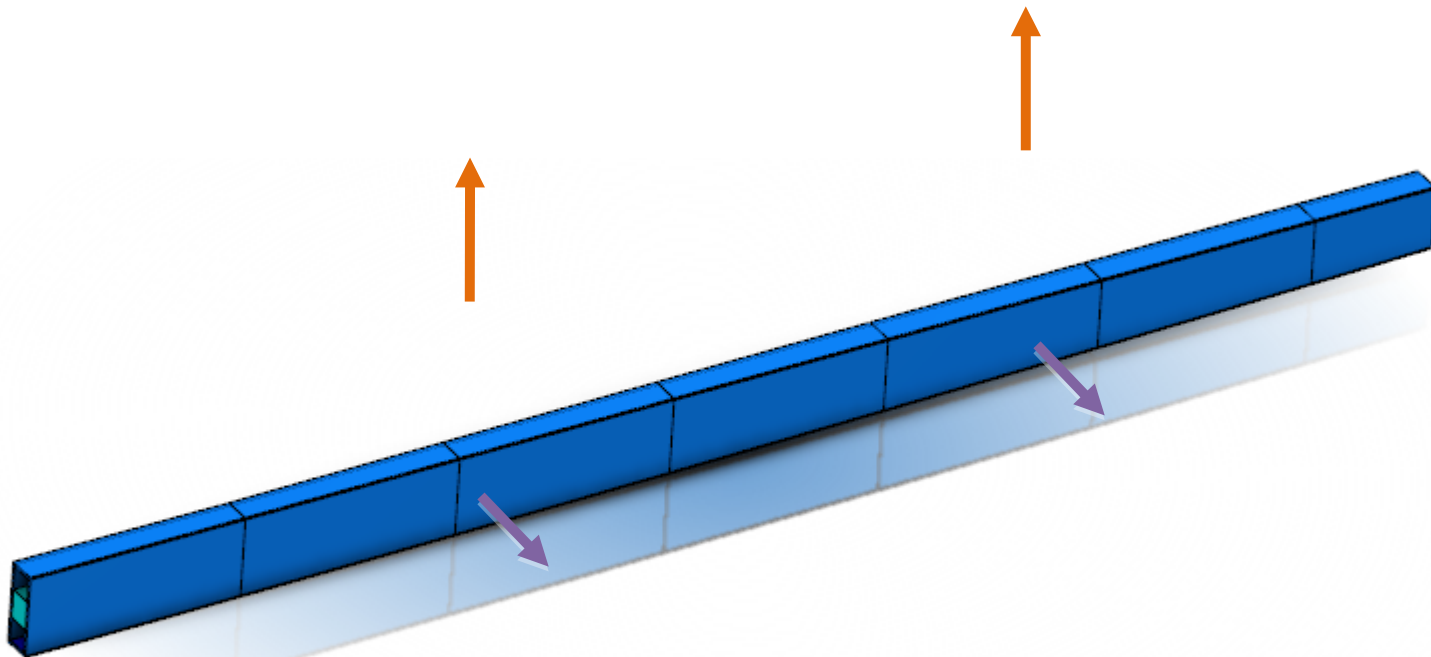


- NFGA - Neutron Feeder Guide Assembly
  - Neutron guide
  - Heavy collimation shielding

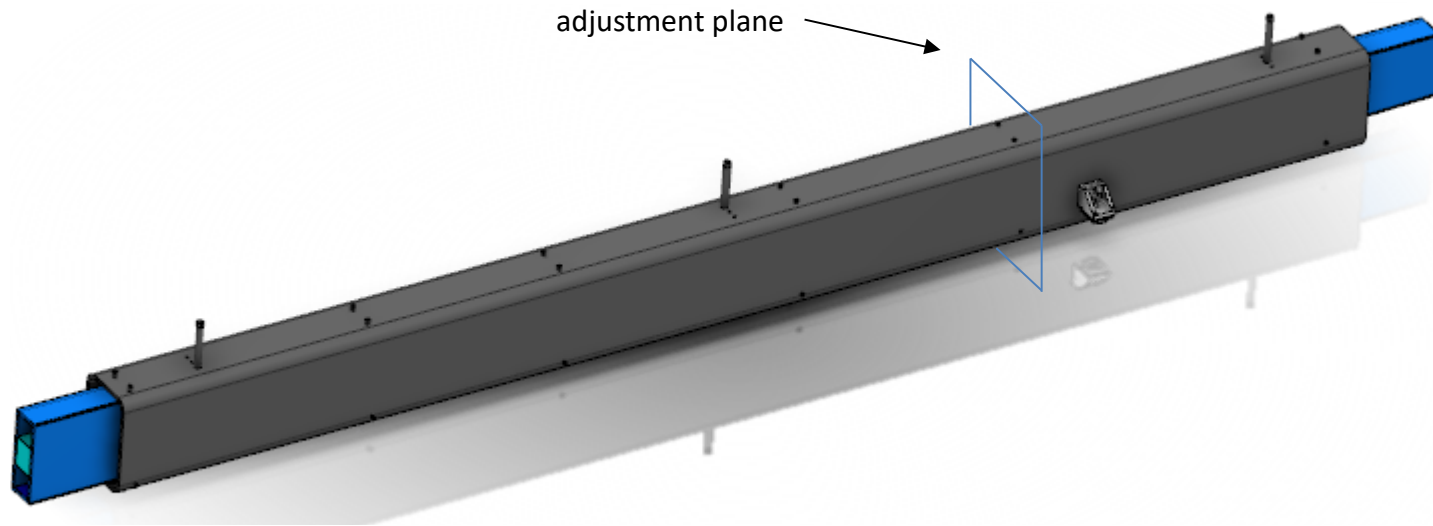
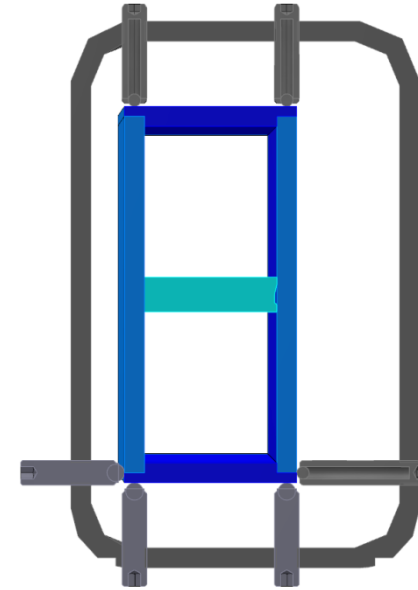


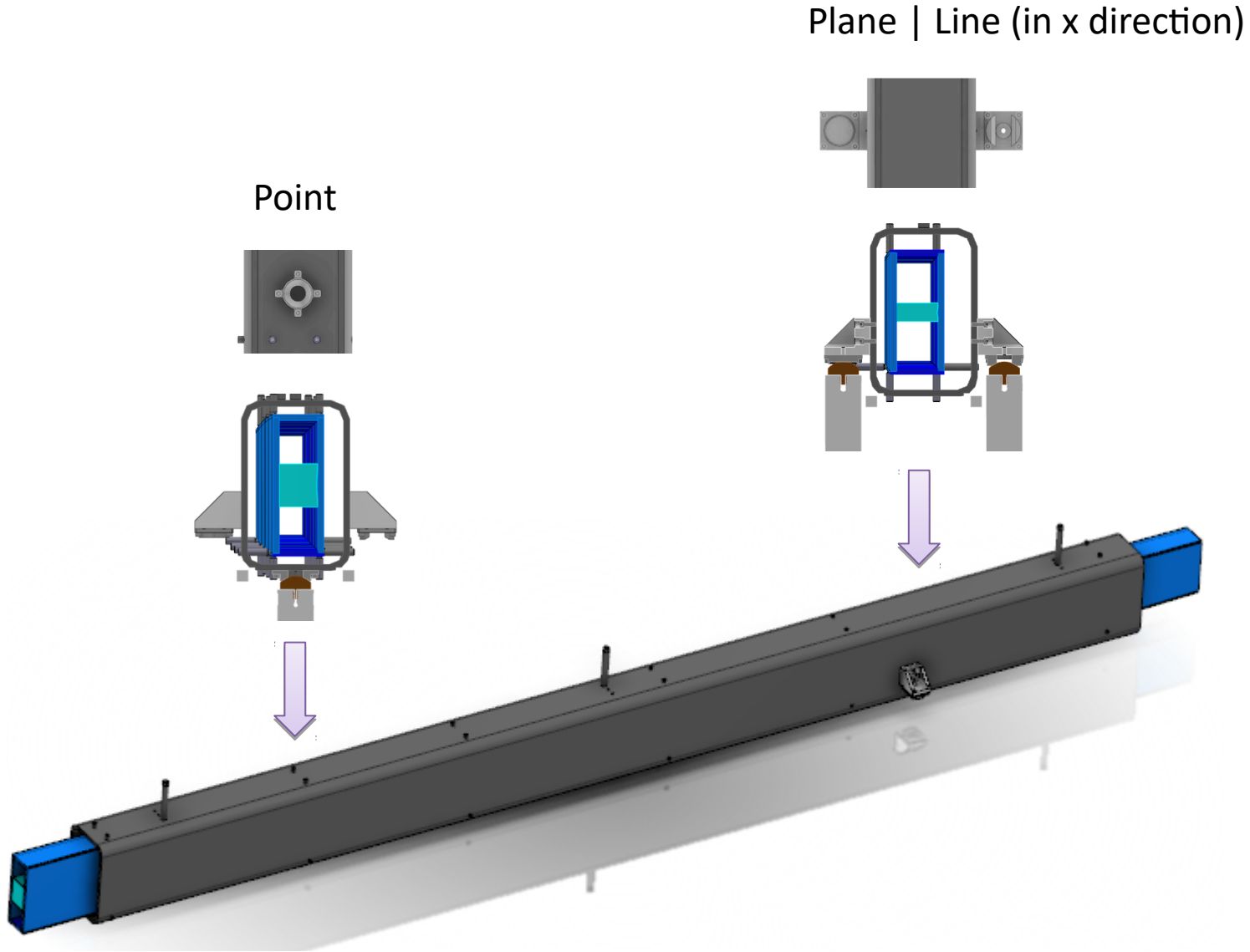


- NFGA - Neutron Feeder Guide Assembly
  - Neutron guide
  - Heavy collimation shielding
- Alignment tolerance:  $\pm 0.05$

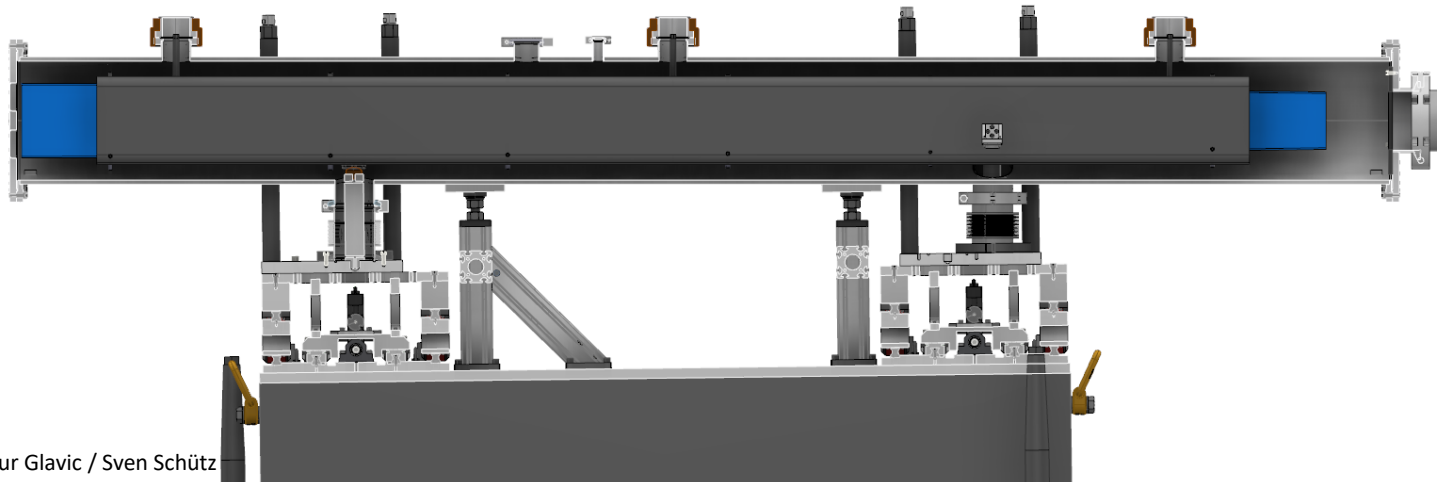
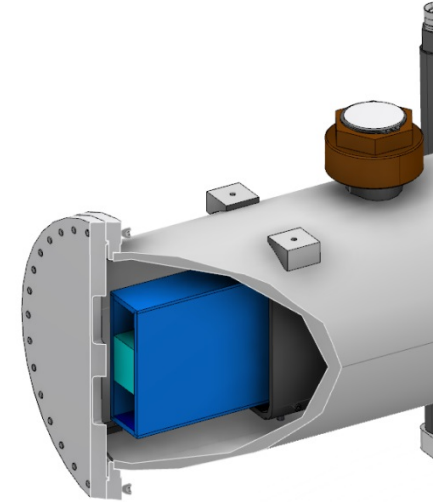


- 6 adjustment planes
  - 3 x screws with fixed balls
  - 3 x screws with spring loaded balls
- 3 x pins to place fiducials

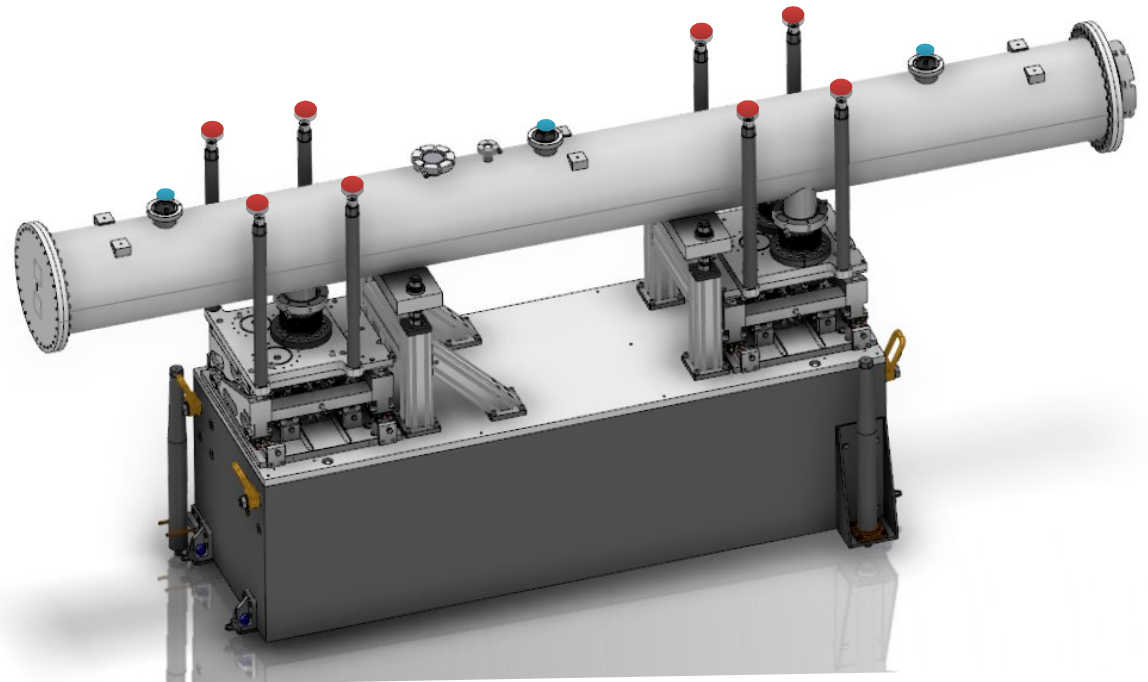
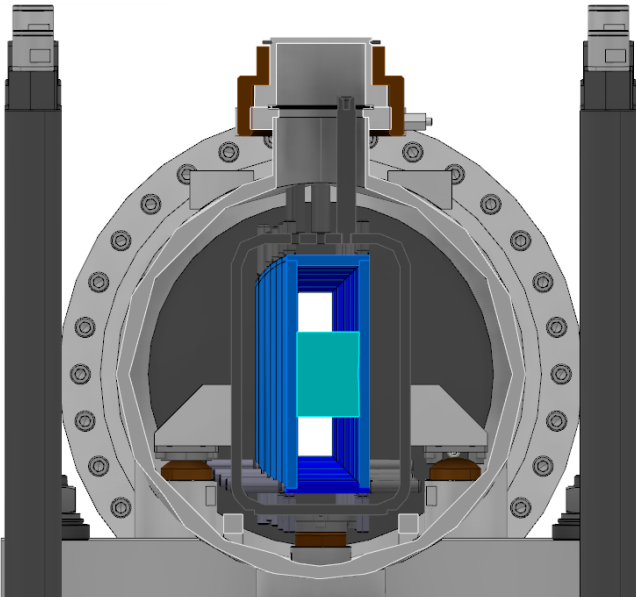




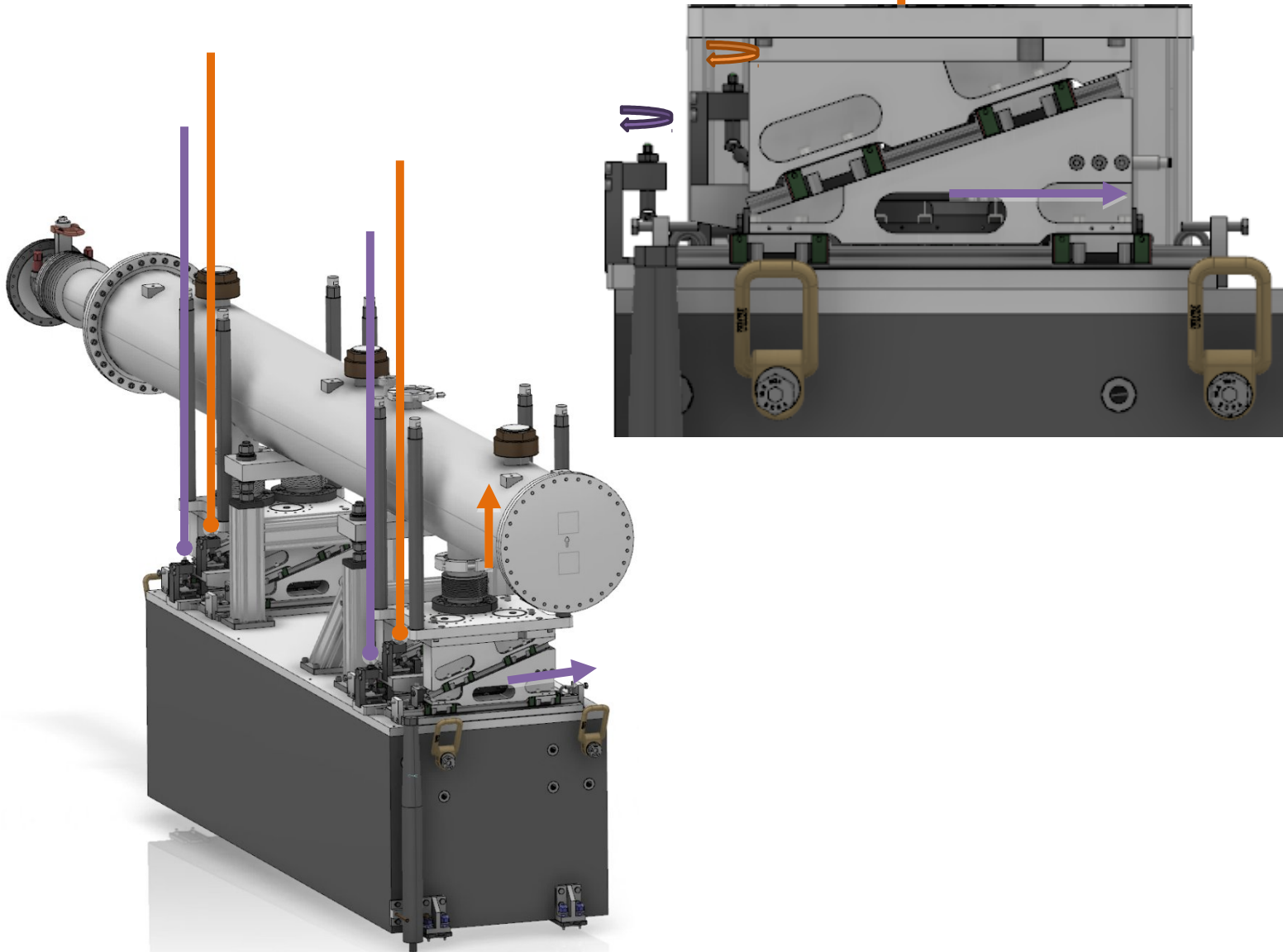
- Up- and Downstream flange are mounted
- Upstream window prevents the collision of the Guide and the BBG in case of an earth quake

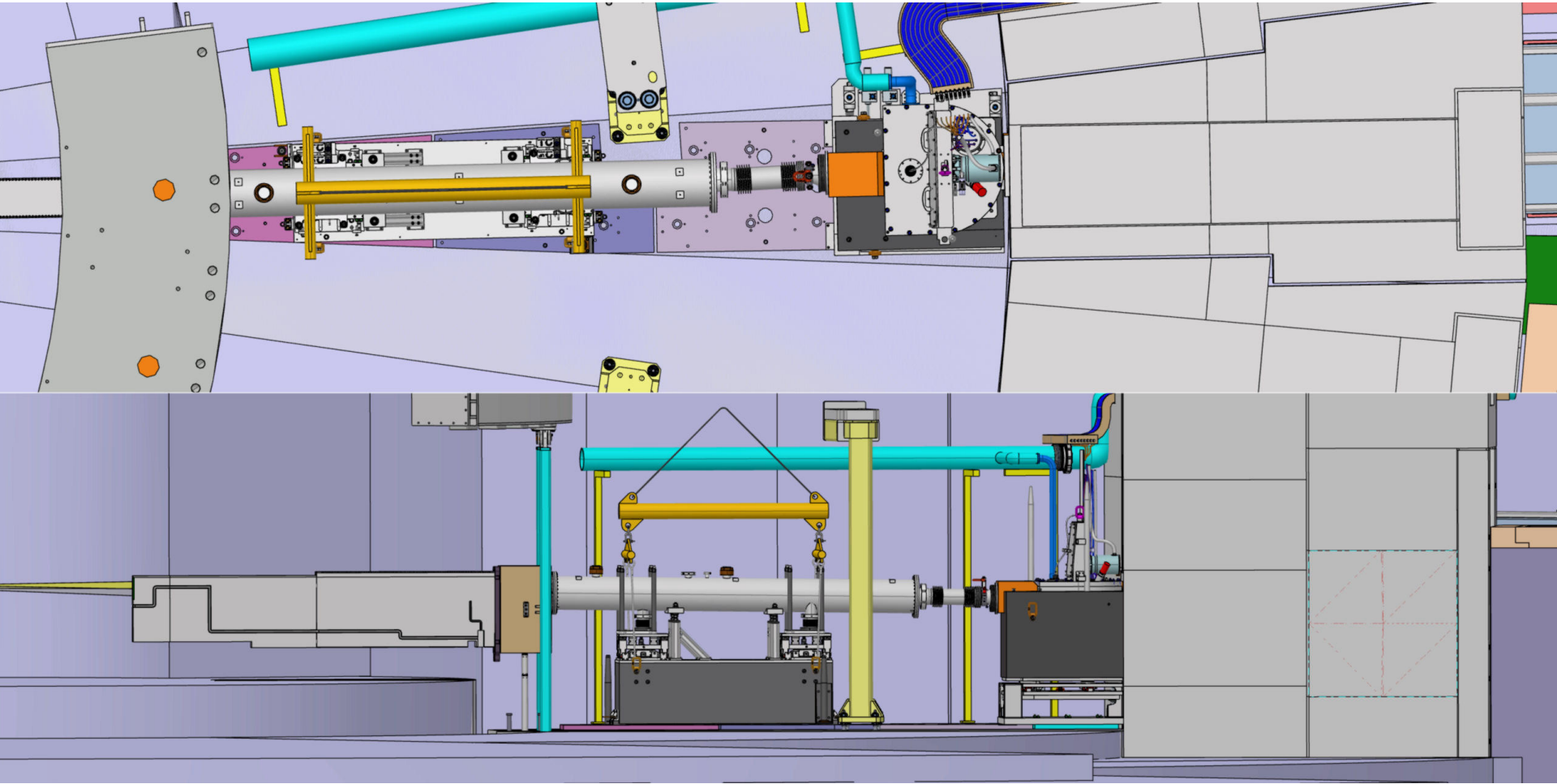


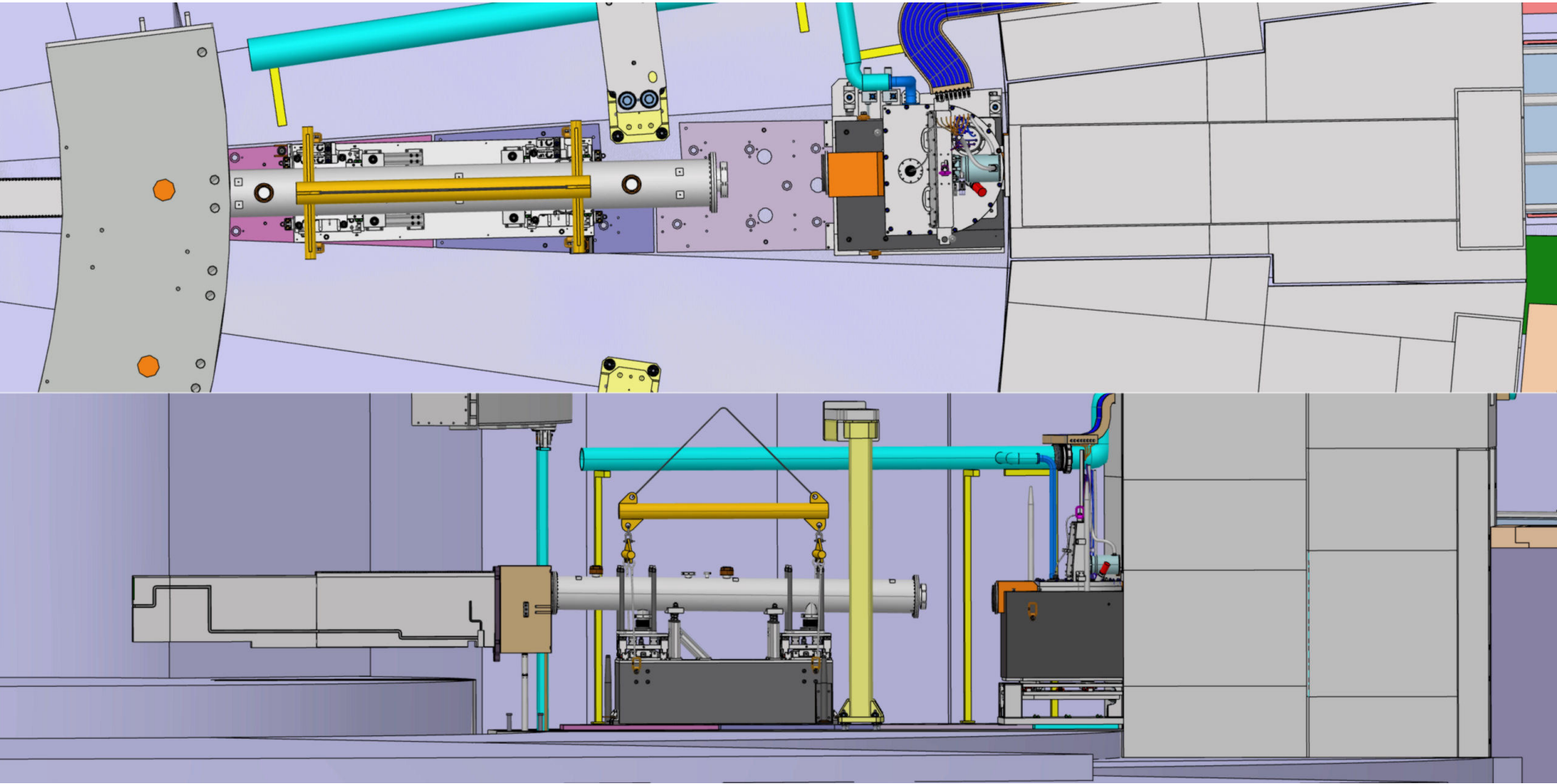
- **External survey points**
  - Top access → no preparations
- **Internal survey points**
  - Vacuum must be broken
  - RH vacuum sealing removal



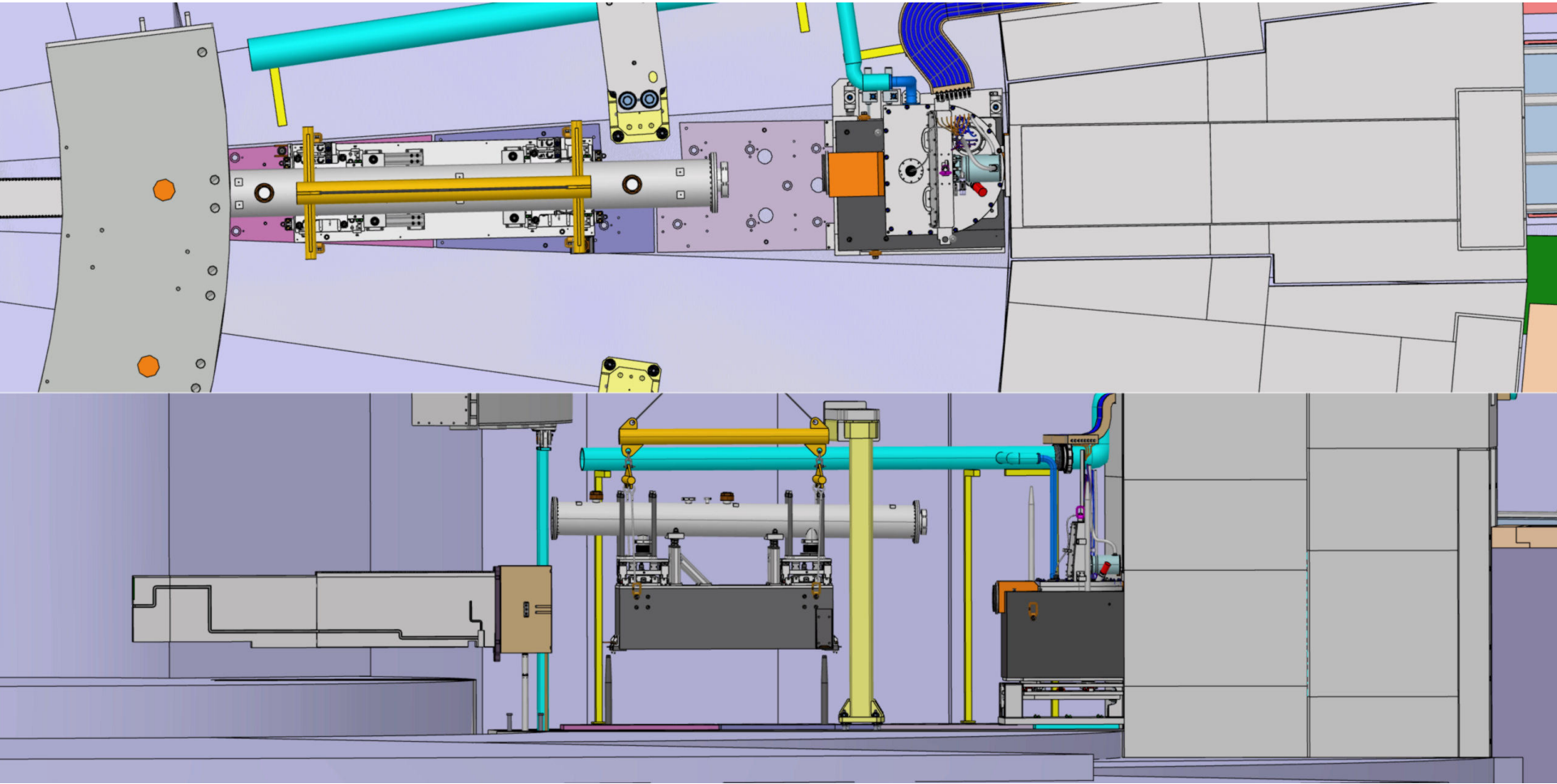
# NFSB – RH alignment system

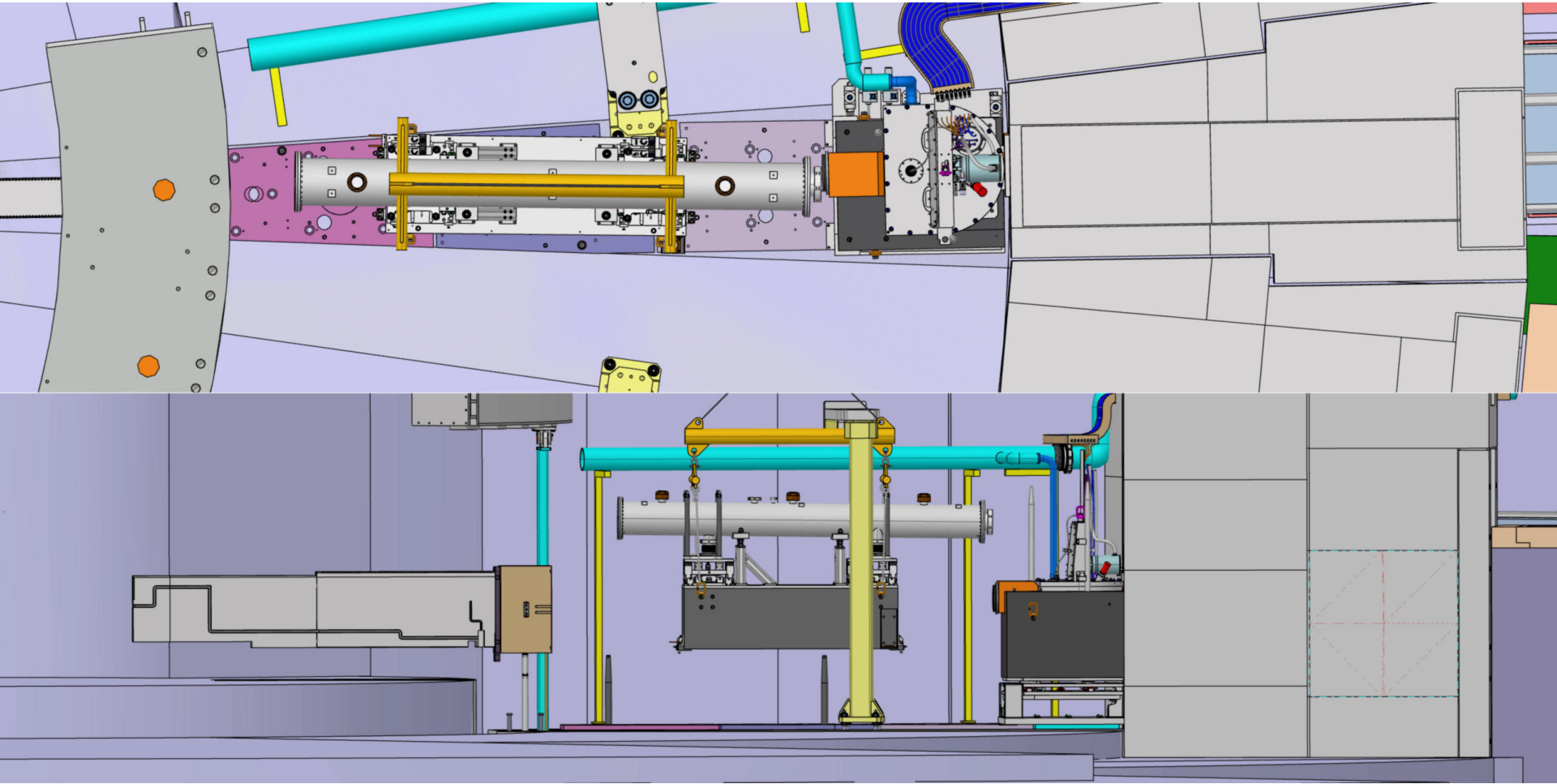


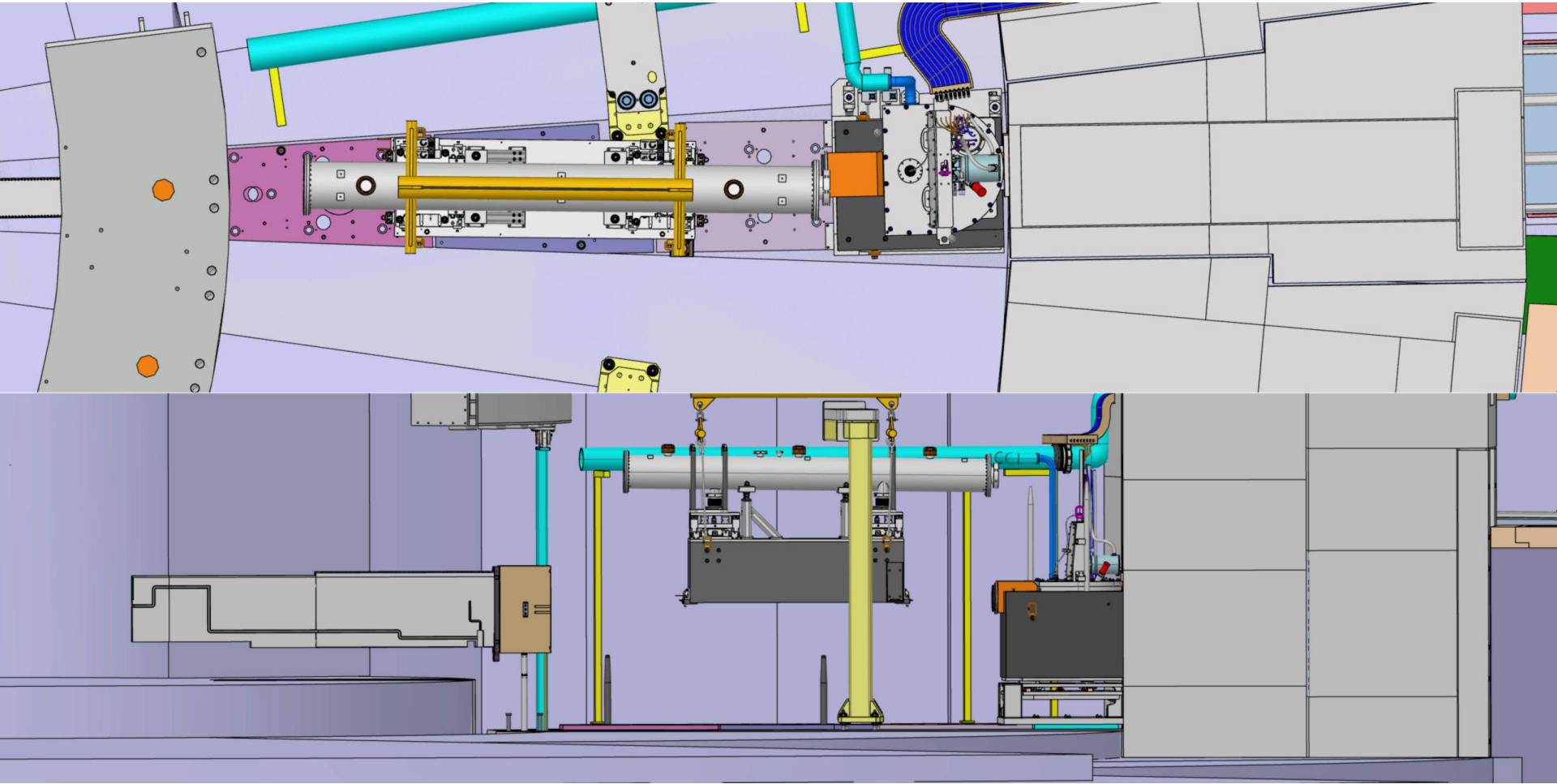


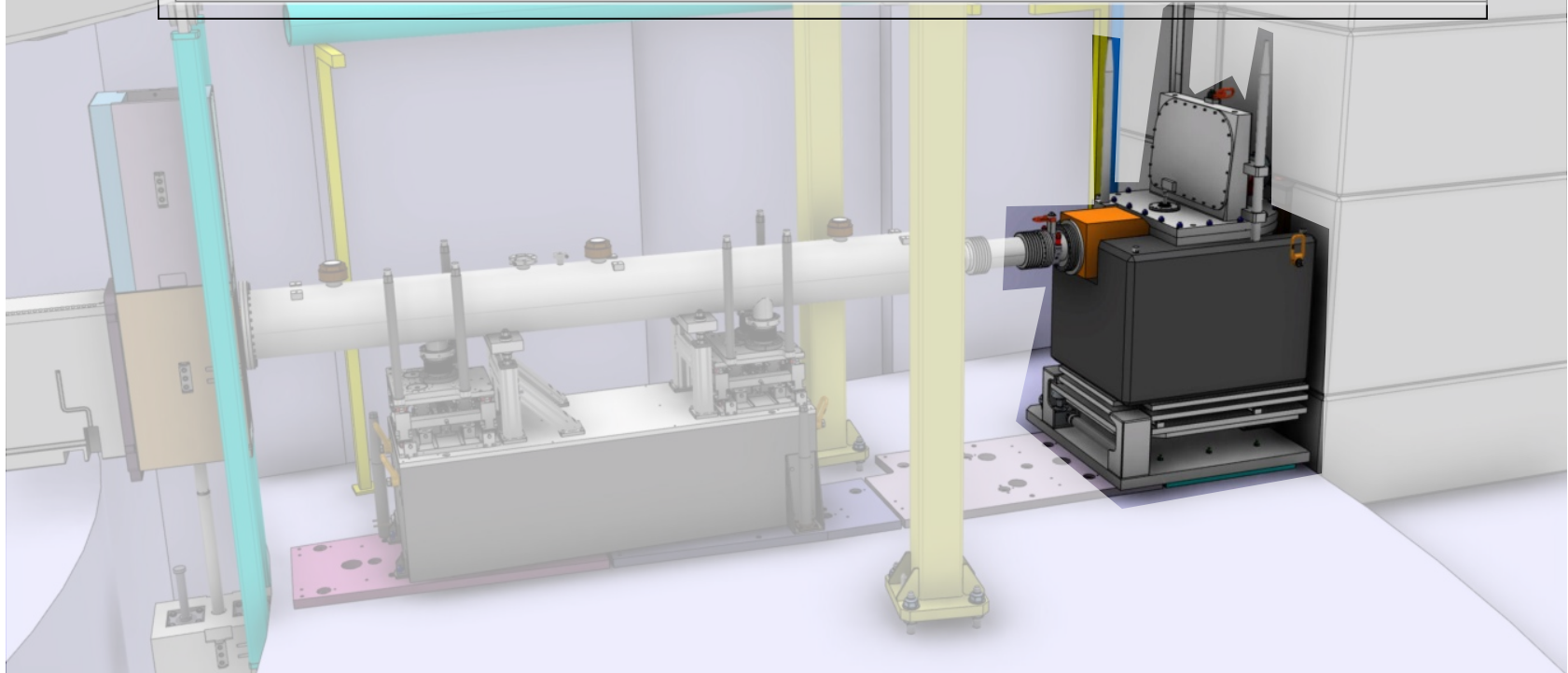
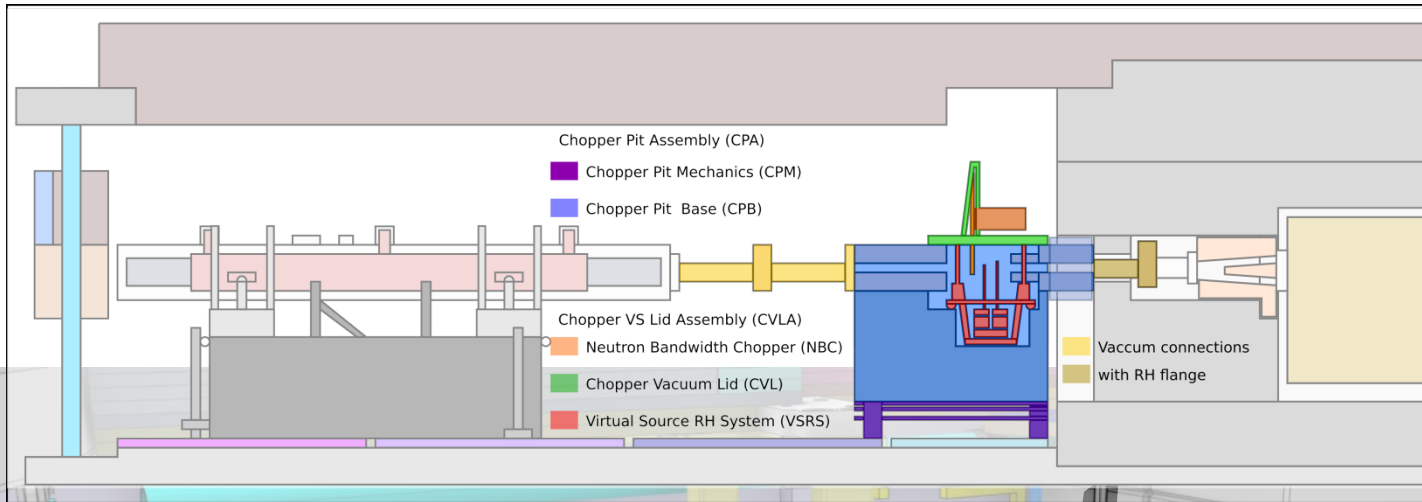




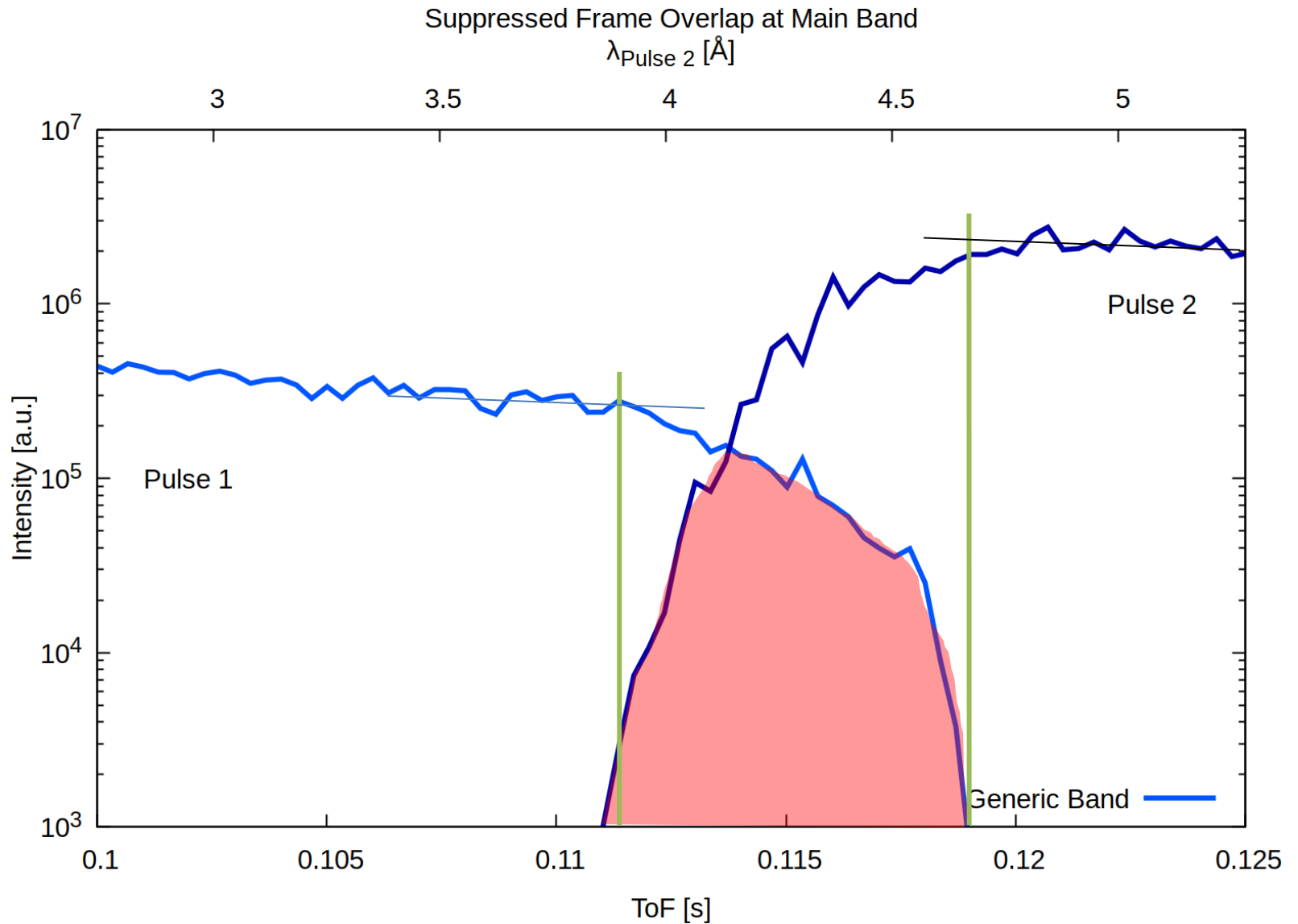






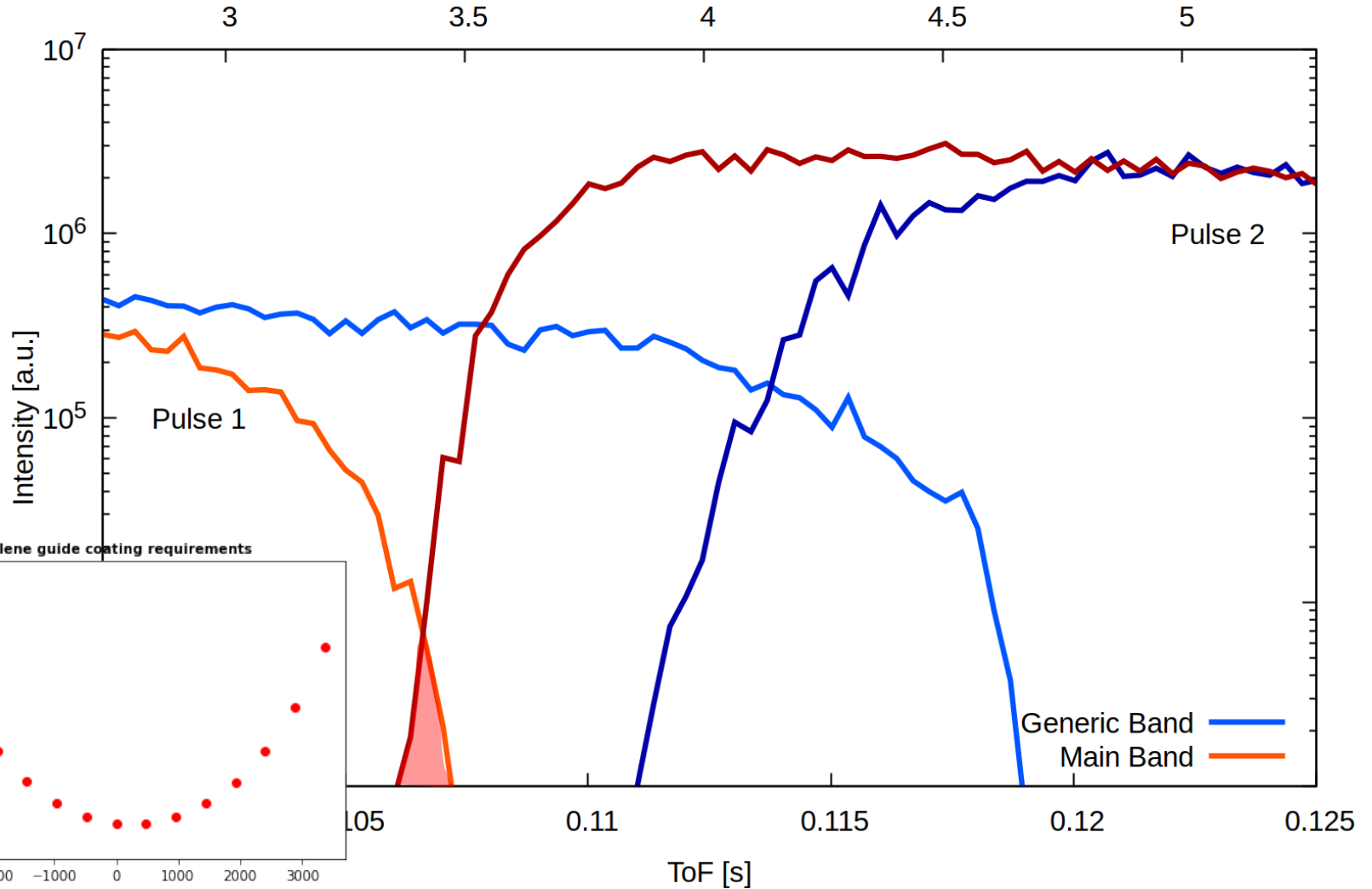


# Bandwidth Chopper



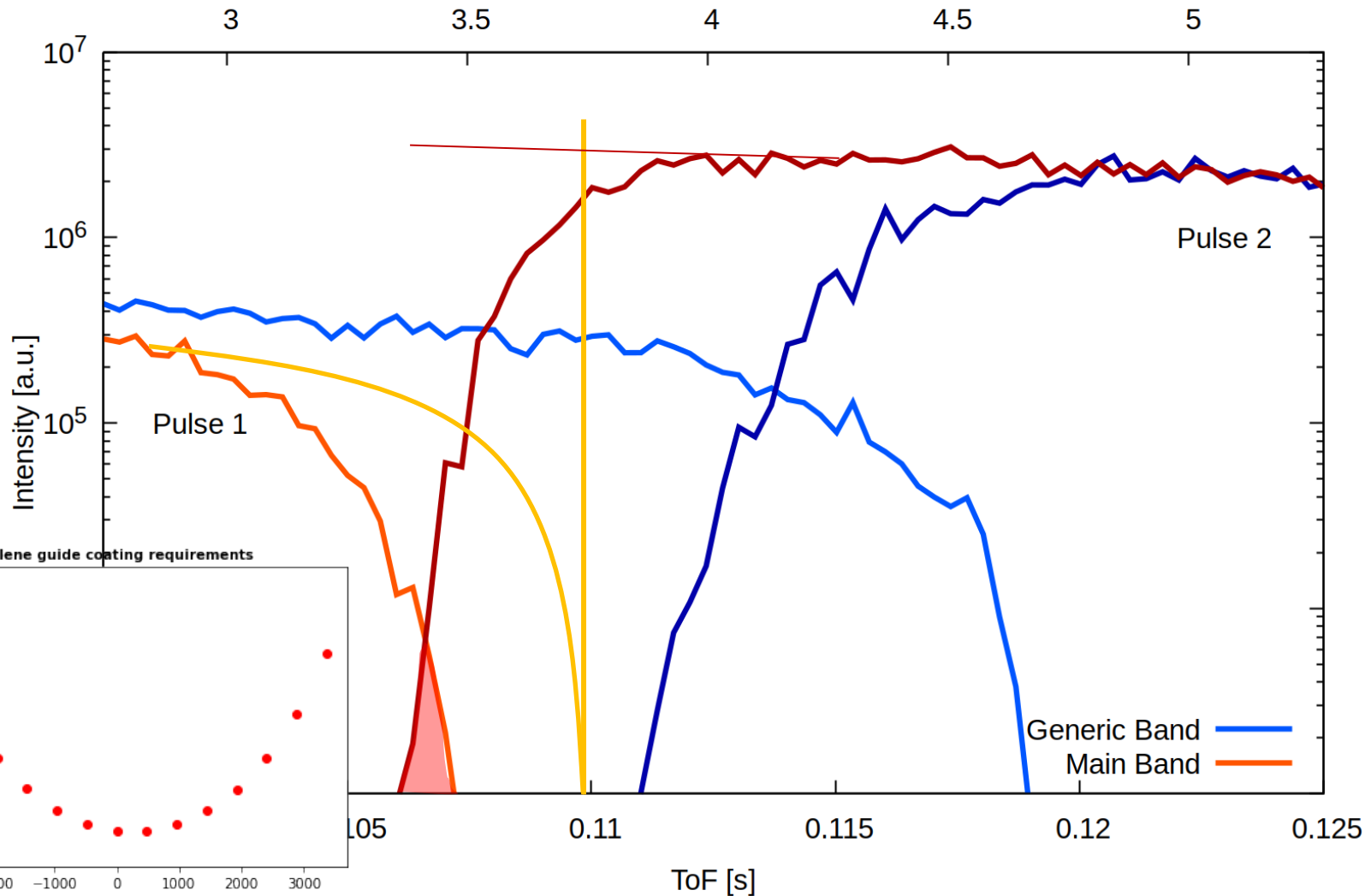
Suppressed Frame Overlap at Main Band

$\lambda_{\text{Pulse 2}} [\text{\AA}]$



Suppressed Frame Overlap at Main Band

$\lambda_{\text{Pulse 2}} [\text{\AA}]$



## Spindle

Manufacturer: SKF

Type: HT120g5

Running Frequencies: 14/3, 7 and 14 Hz

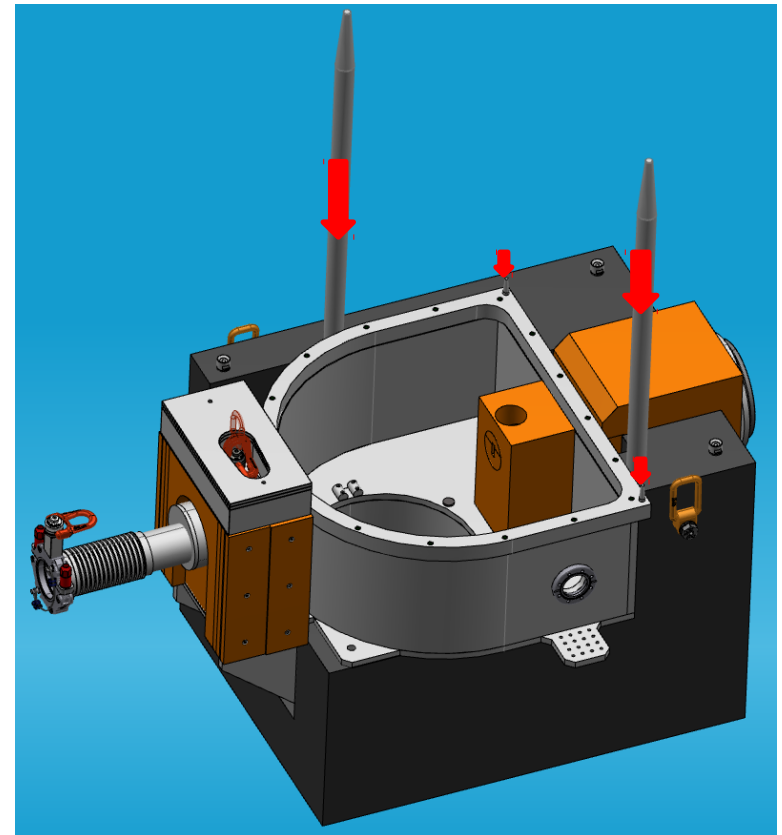
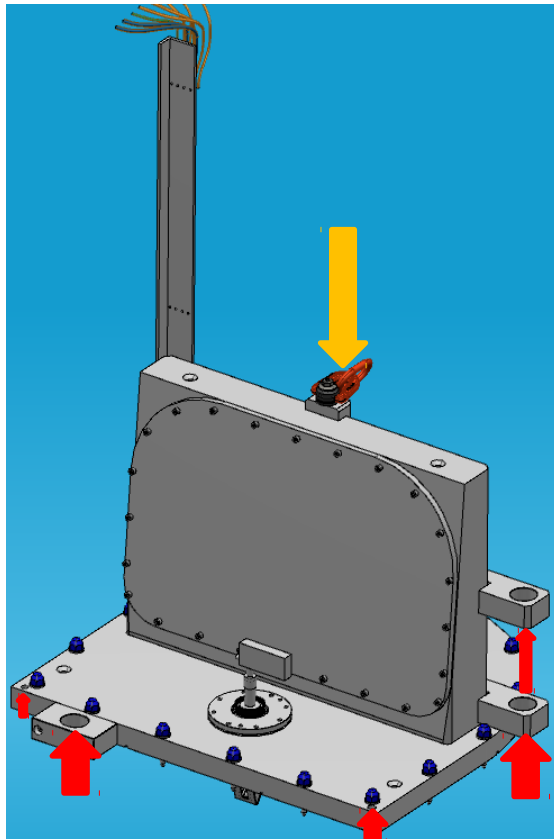


Would like to pool  
procurement with  
Denmark, other offers  
welcome

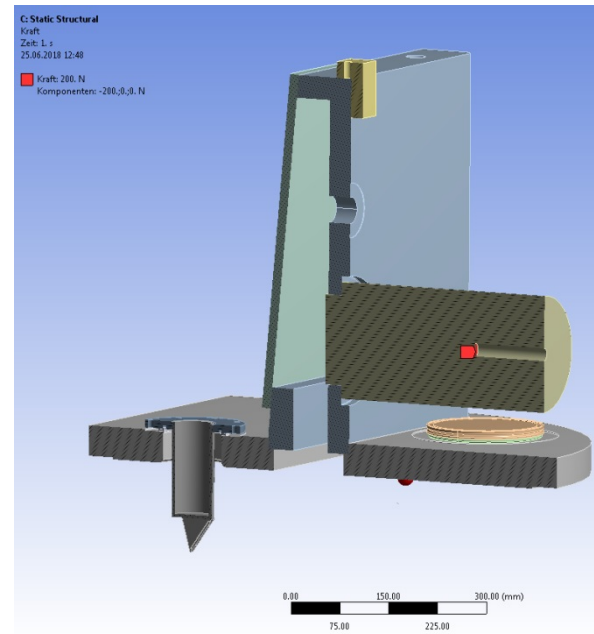
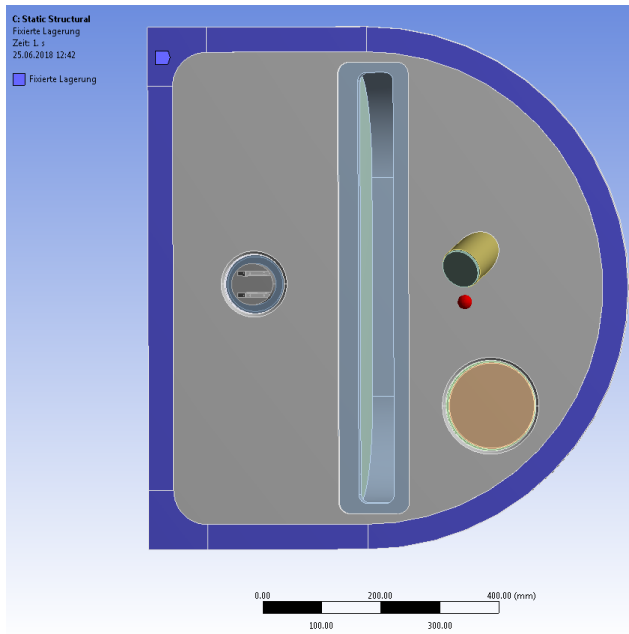


## Housing – RH Lifting & Positioning

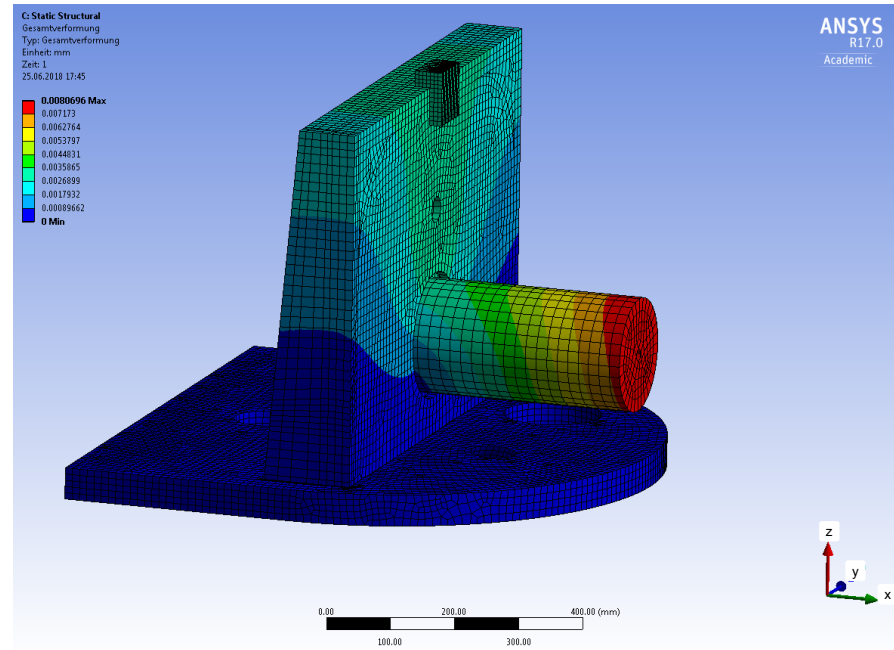
- Fixed position for crane hook
- Standard hook
- Poles allow 3.5° tilt => no jamming

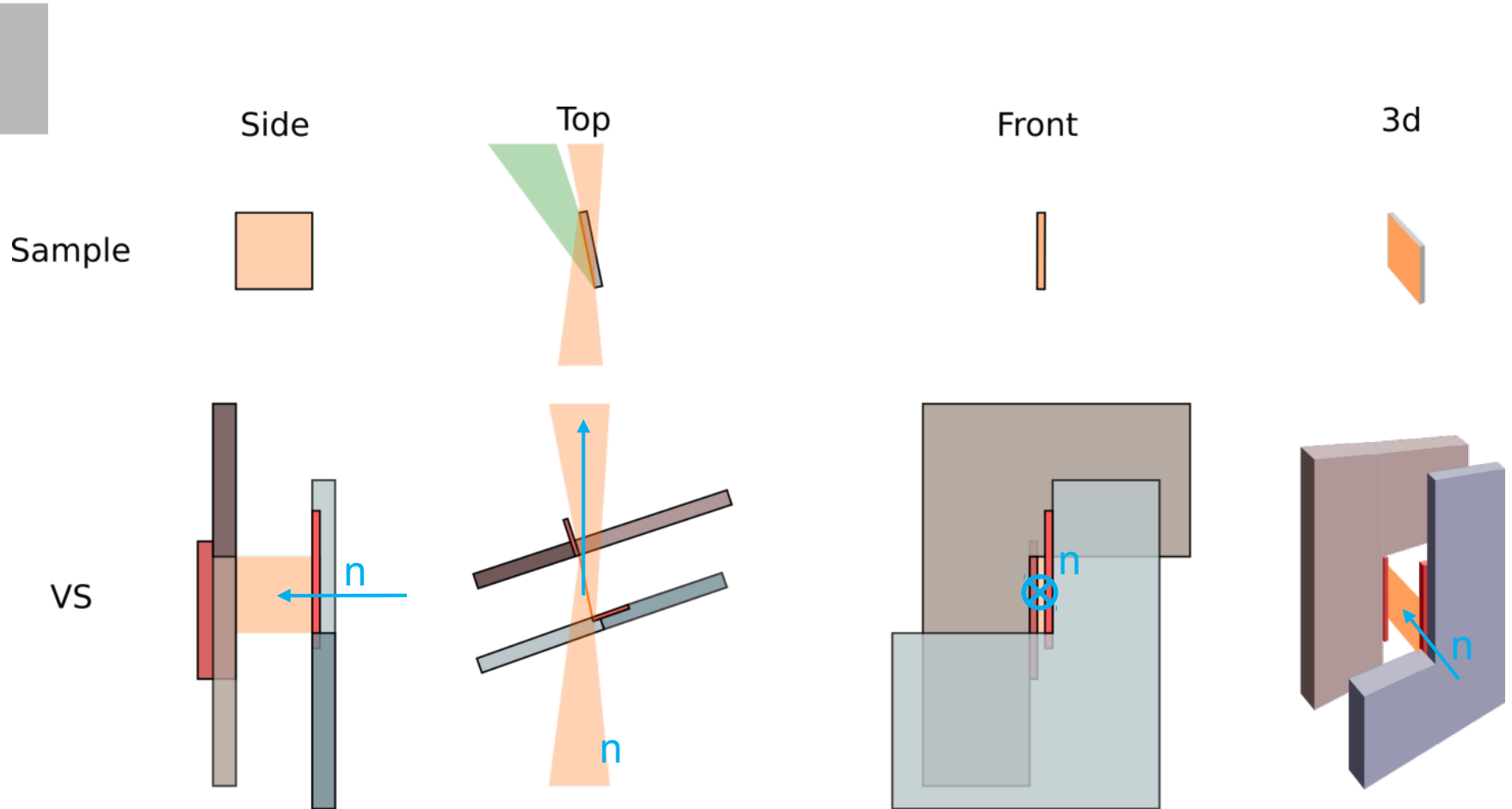


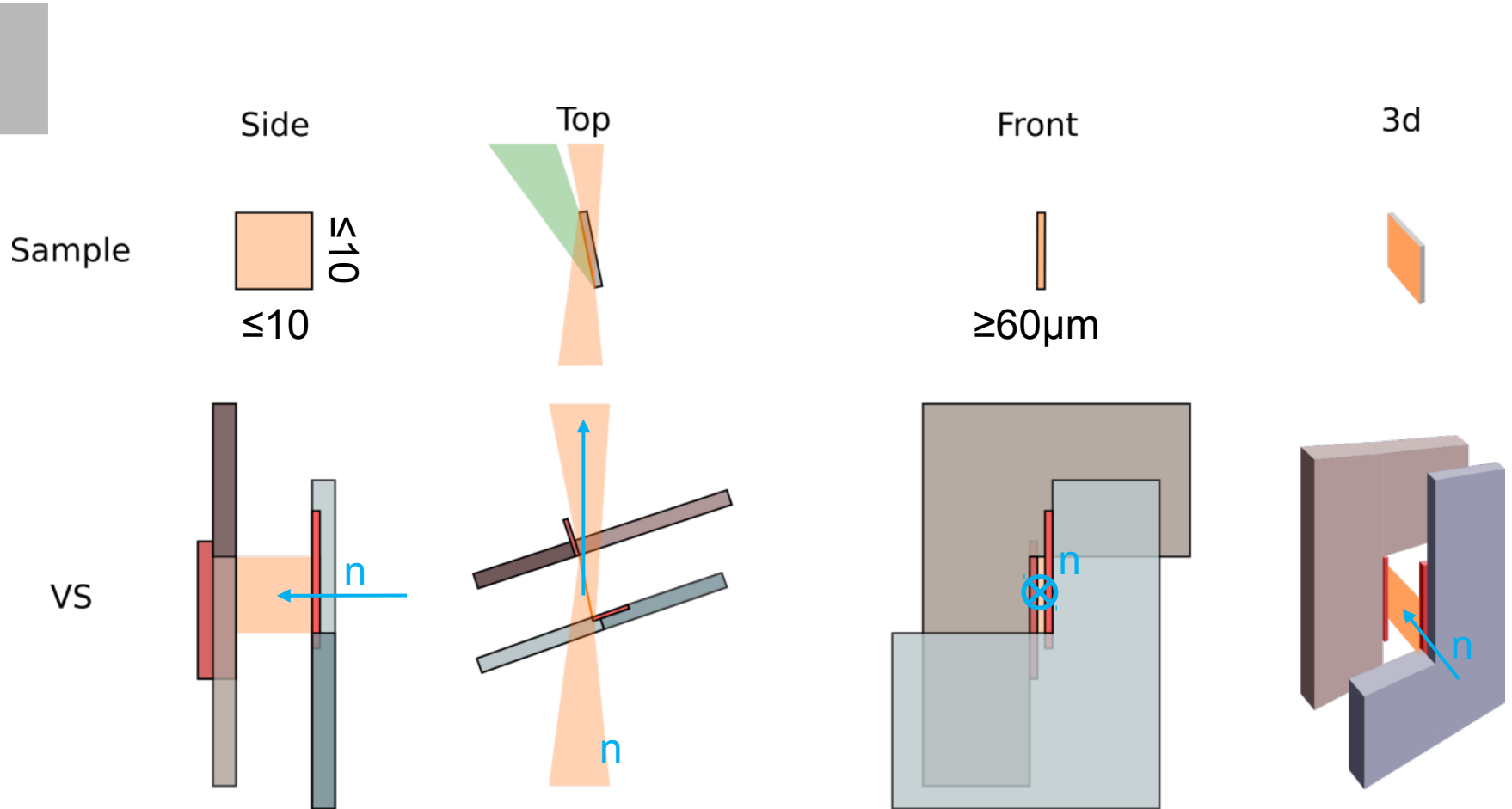
- Fixed mounting of the CVLA
- Force applied 120mm from backside



Force Direction	Total Deformation [μm]
X (+/-)	2.8
Y (+/-)	5.6
Z (+/-)	8



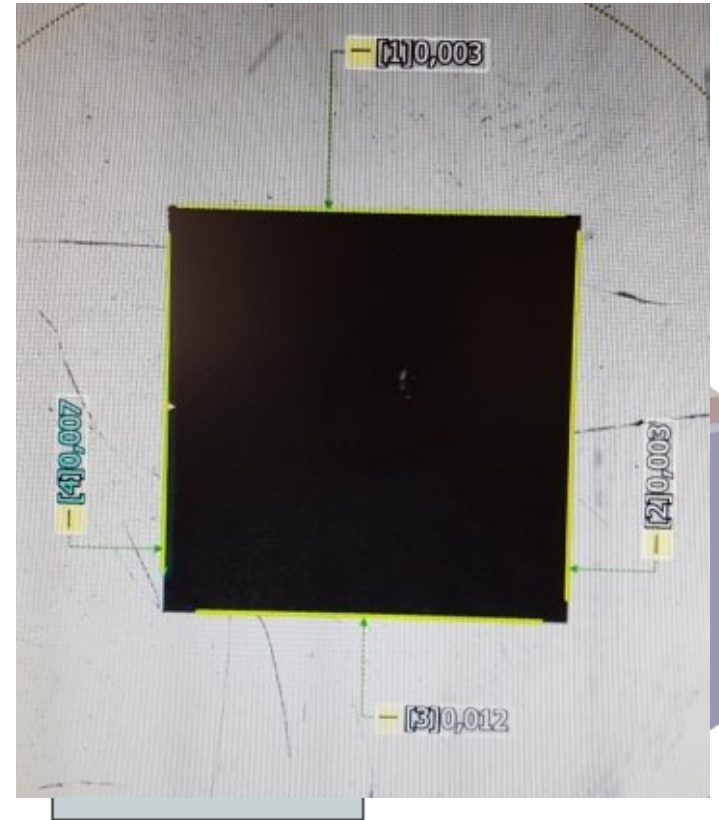
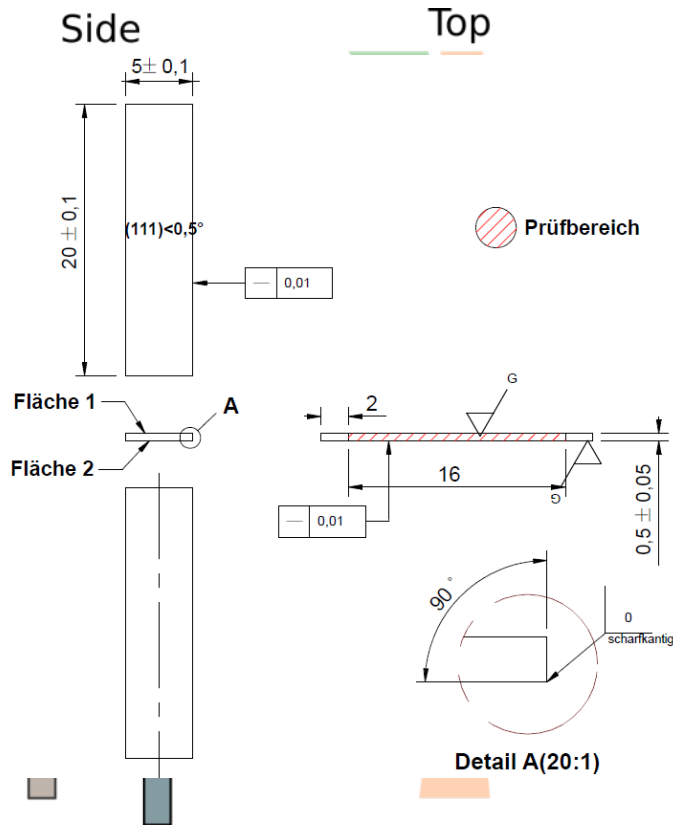




=> Vertical edge straightness of  $10\mu\text{m}$  over  $10\text{mm}$

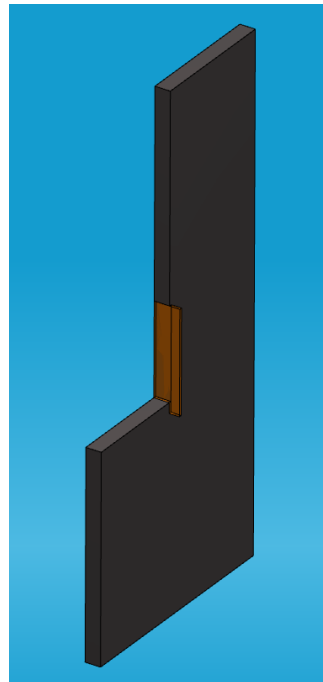
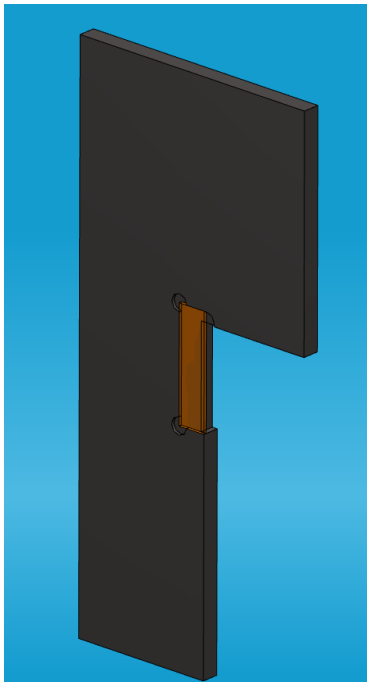
Sample

VS

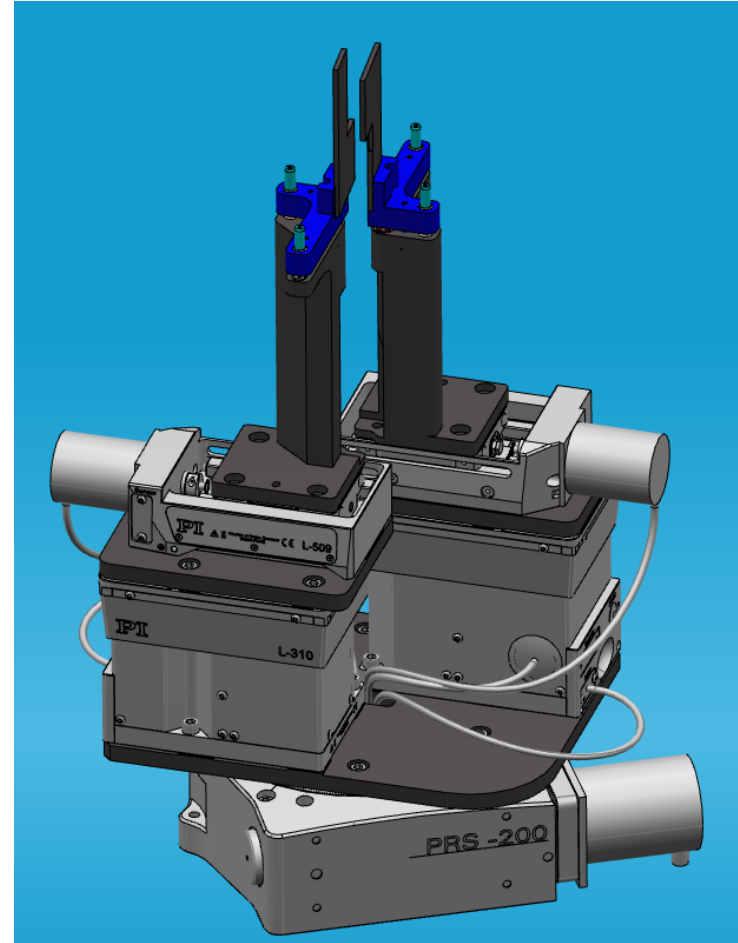
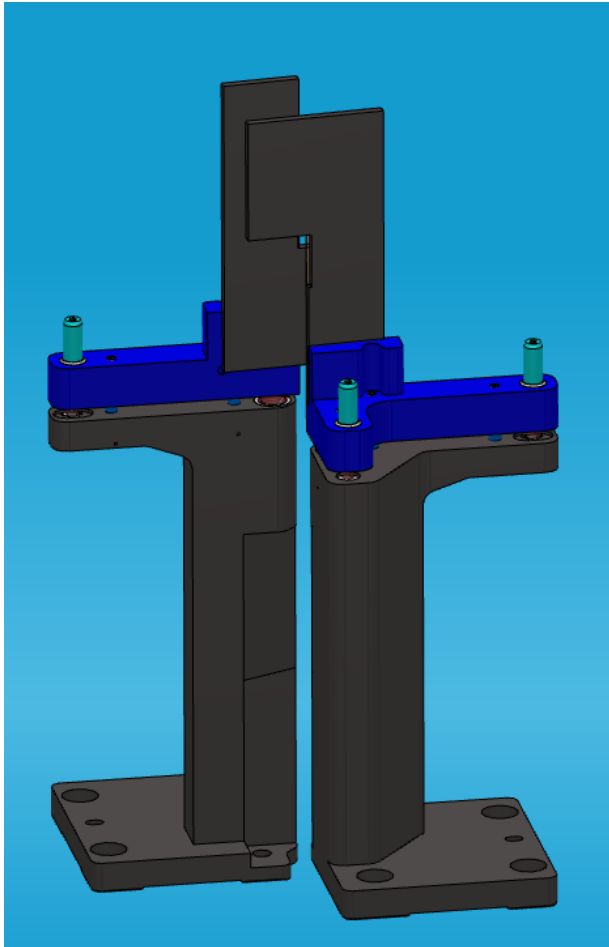


## Blades – Geometry & Material

- sintered B4C
- vertical edges GGG ( $\text{Gd}_3\text{Ga}_5\text{O}_{12}$ ) single crystals
- The straightness edges within 10  $\mu\text{m}$



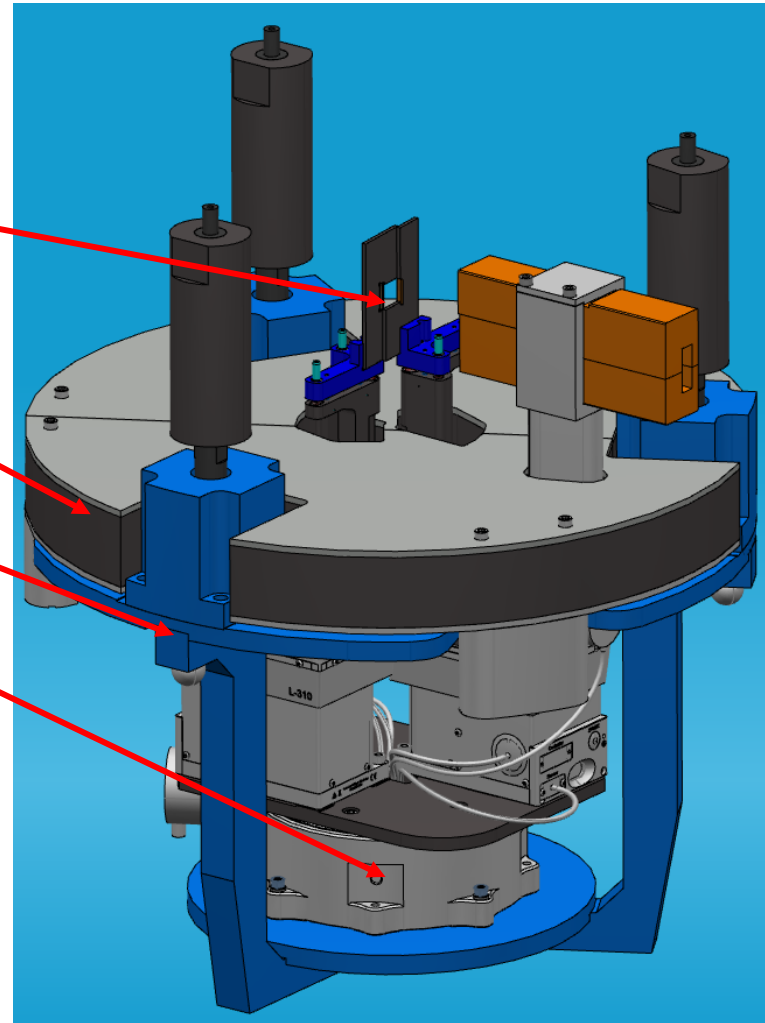
## Blade-System



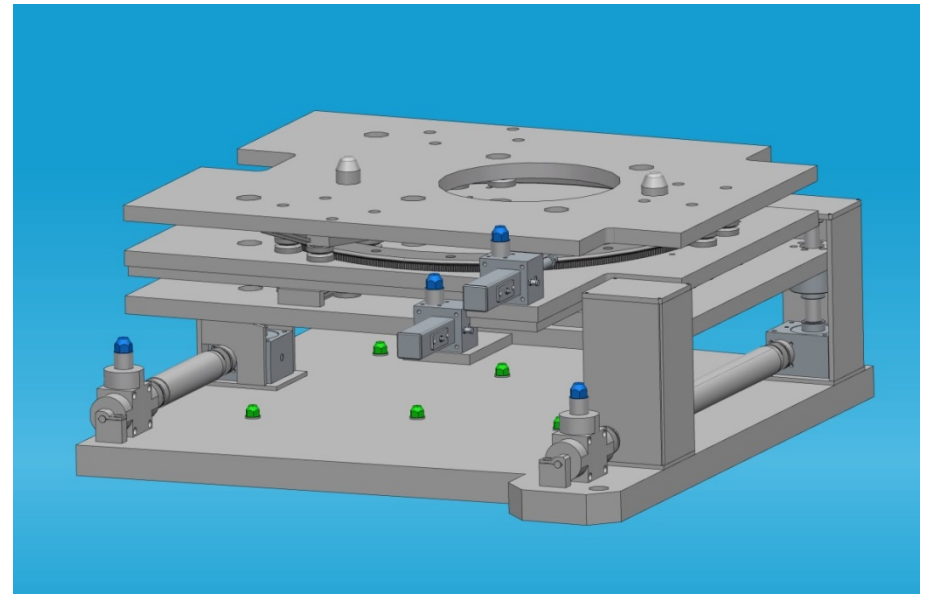
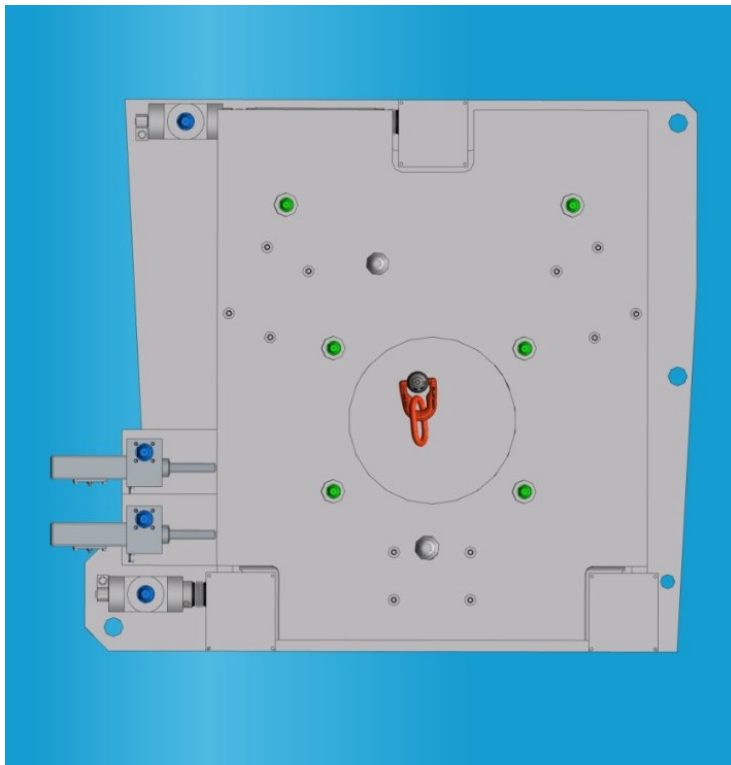


## Complete Assembly

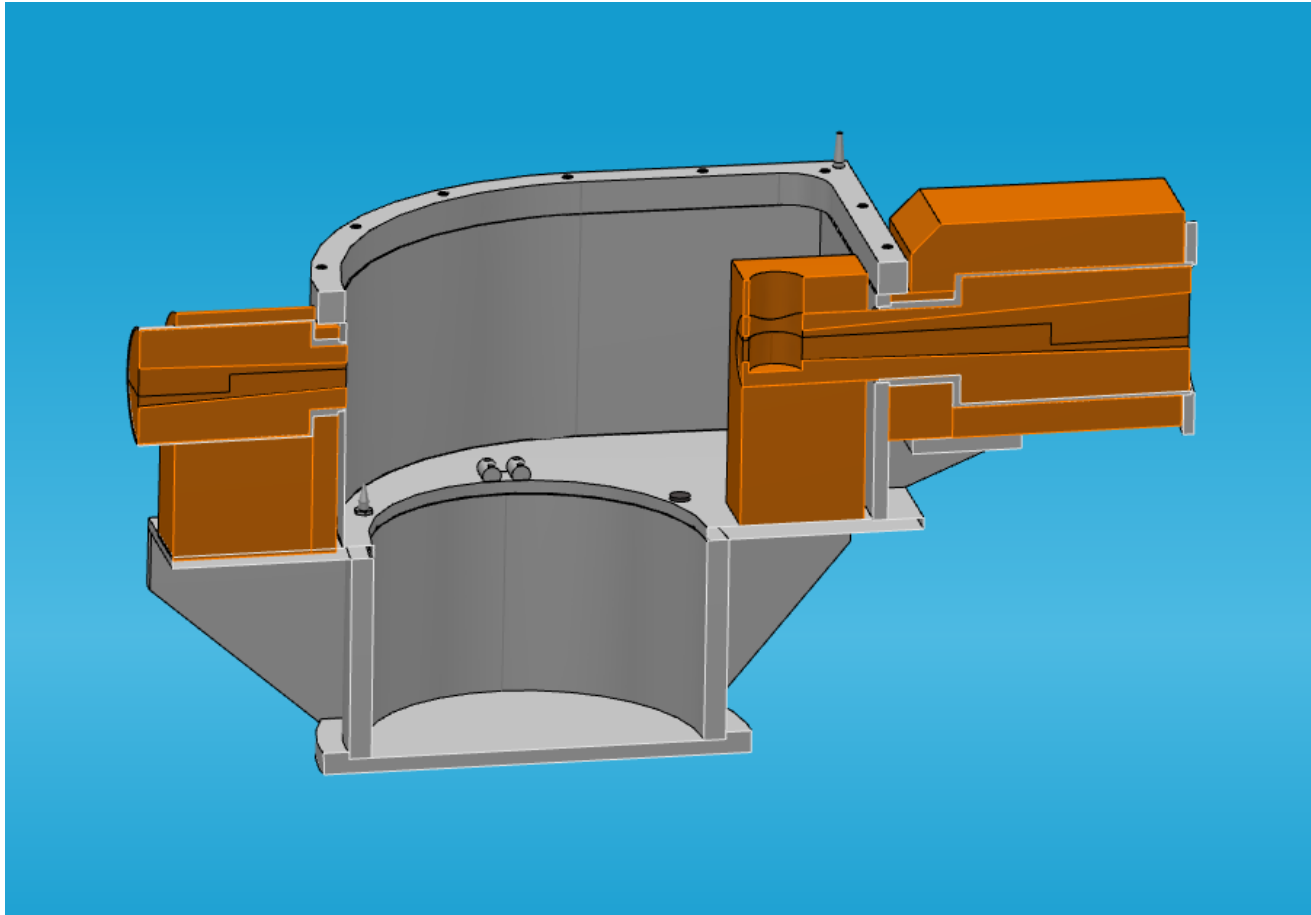
- Blade-system
- Shielding
- Carrier
- Stages



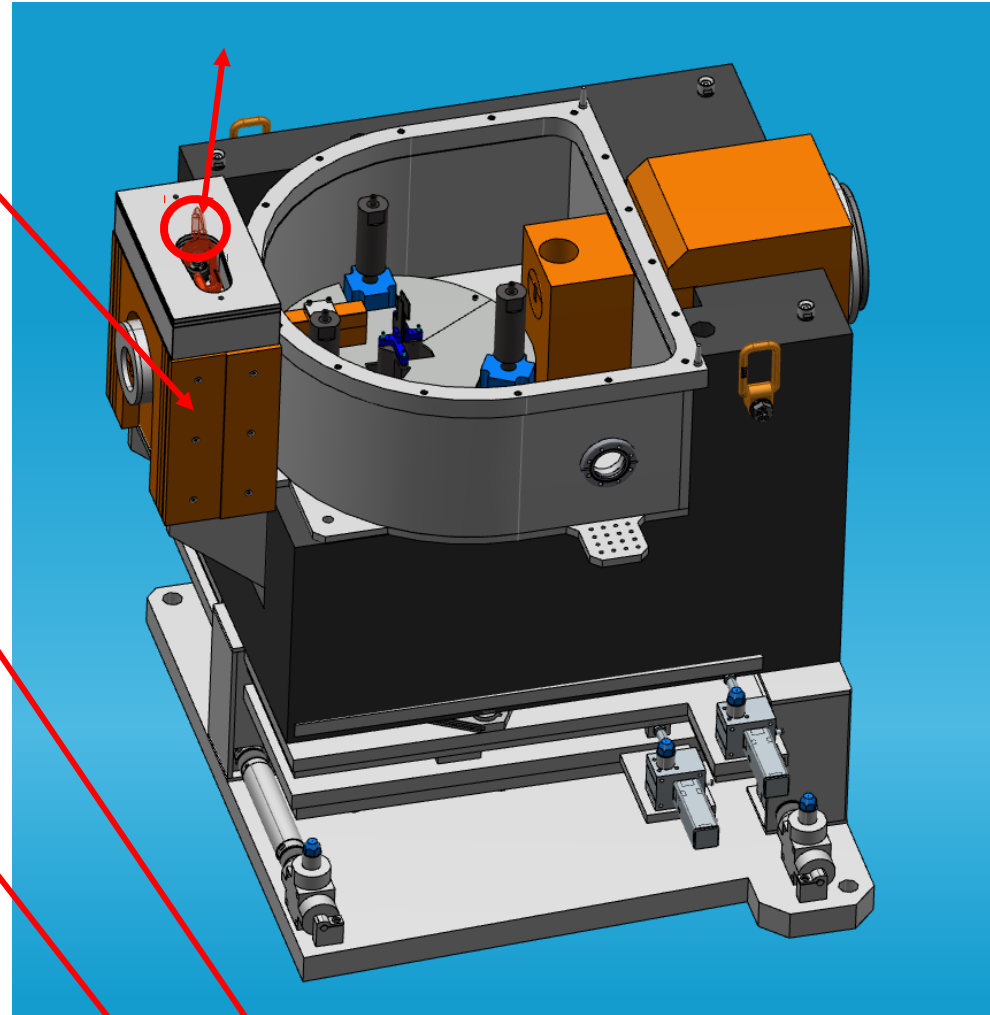
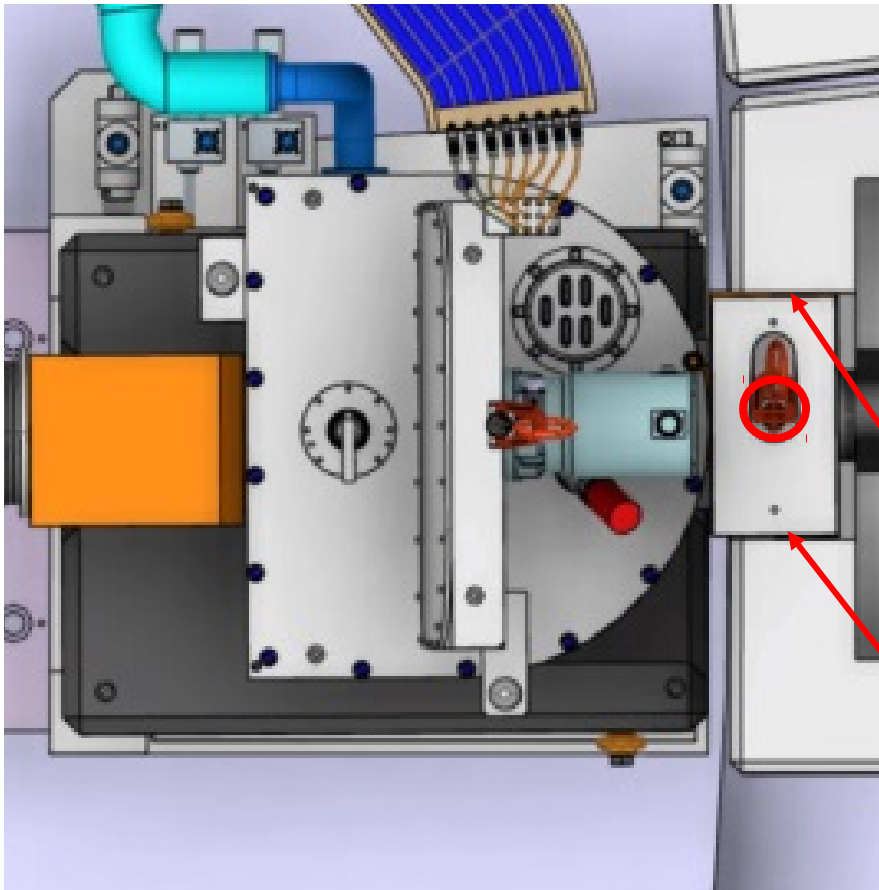
## Extracting and release of fixation



# Collimator 1 & 2



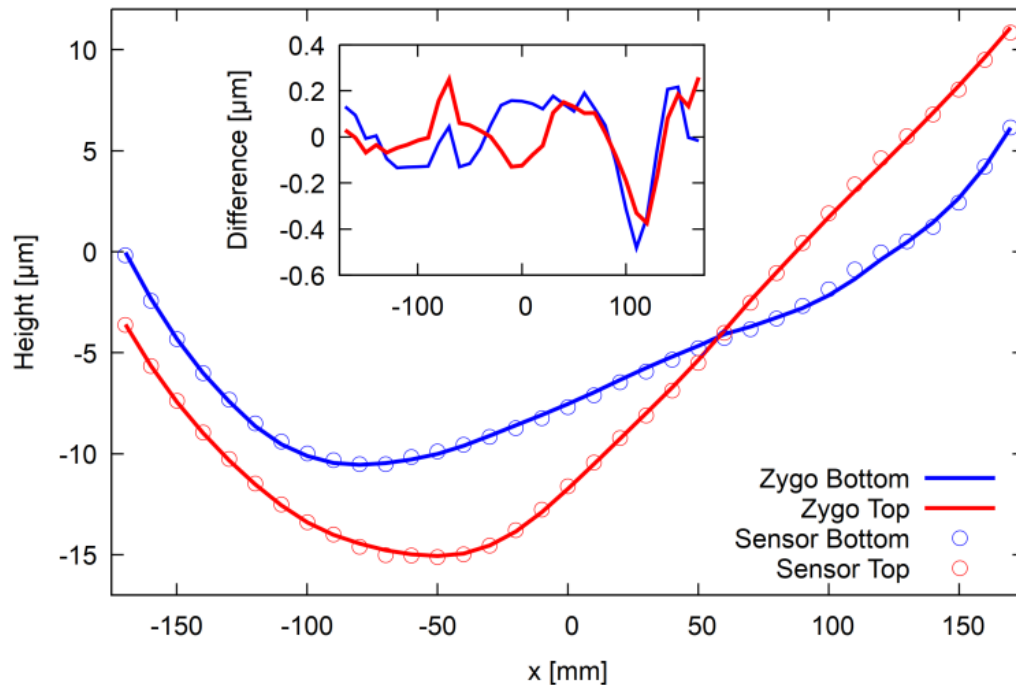
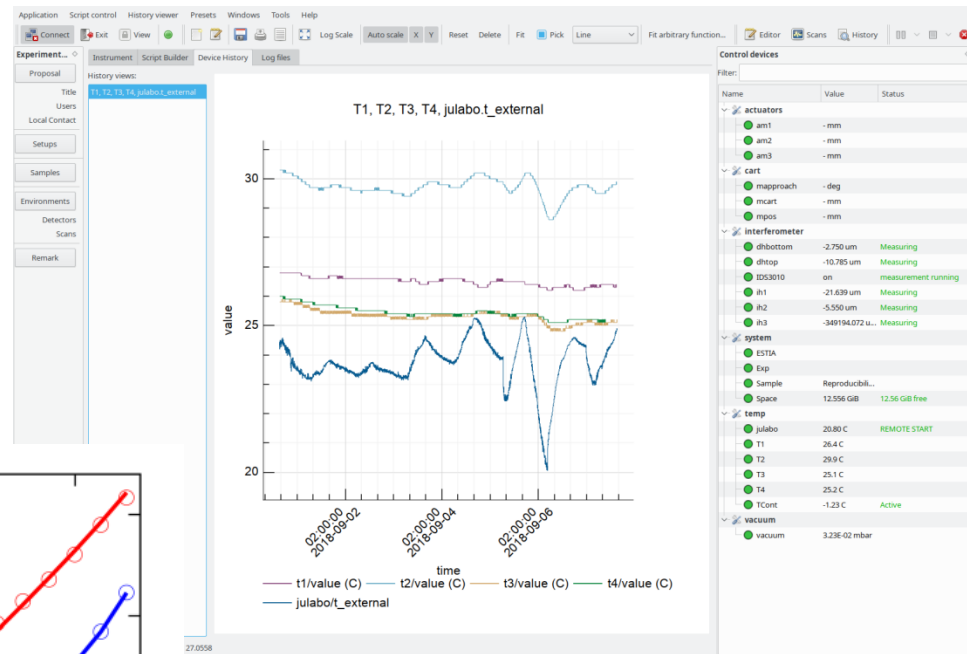
Shimming  
sides+top



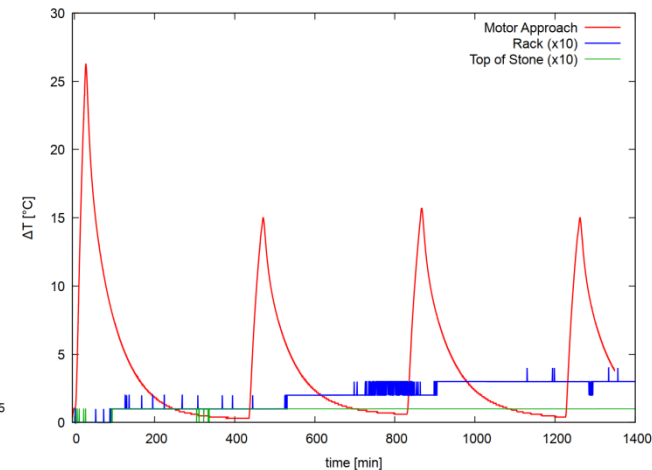
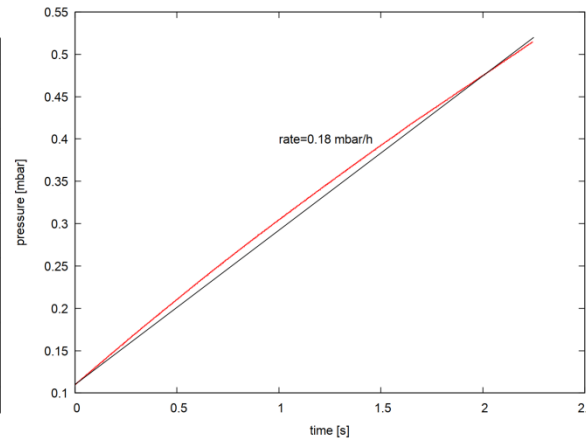
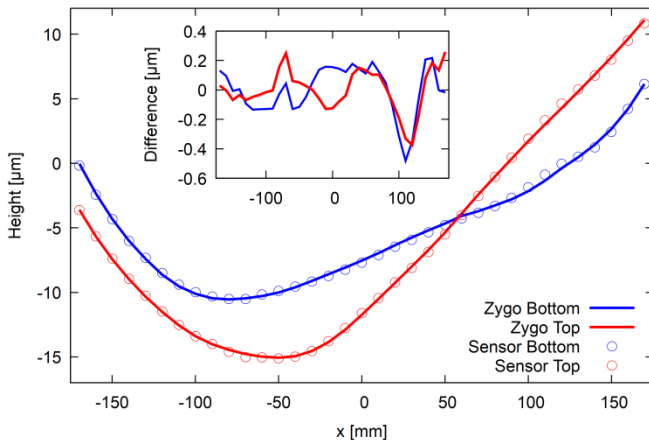
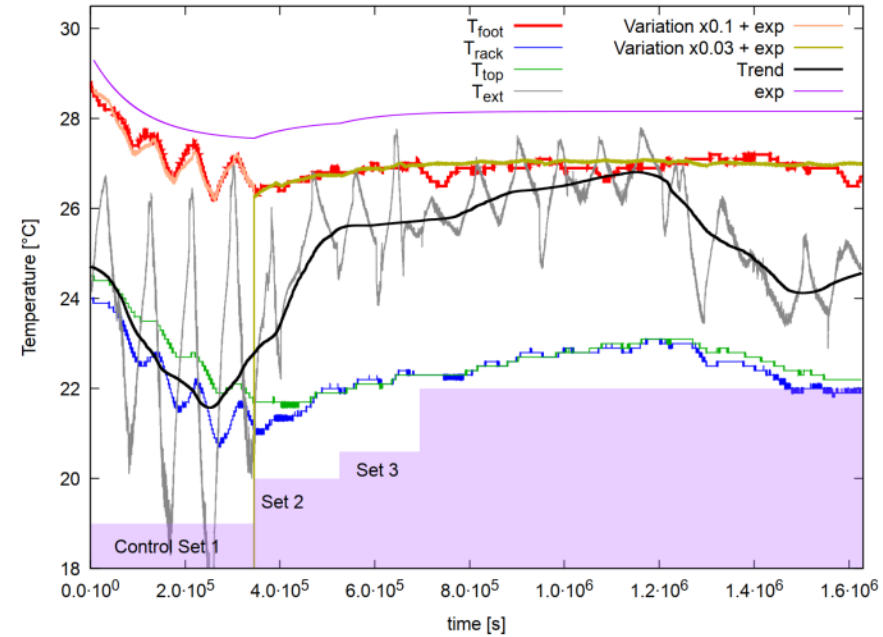
~1 mm residual gap

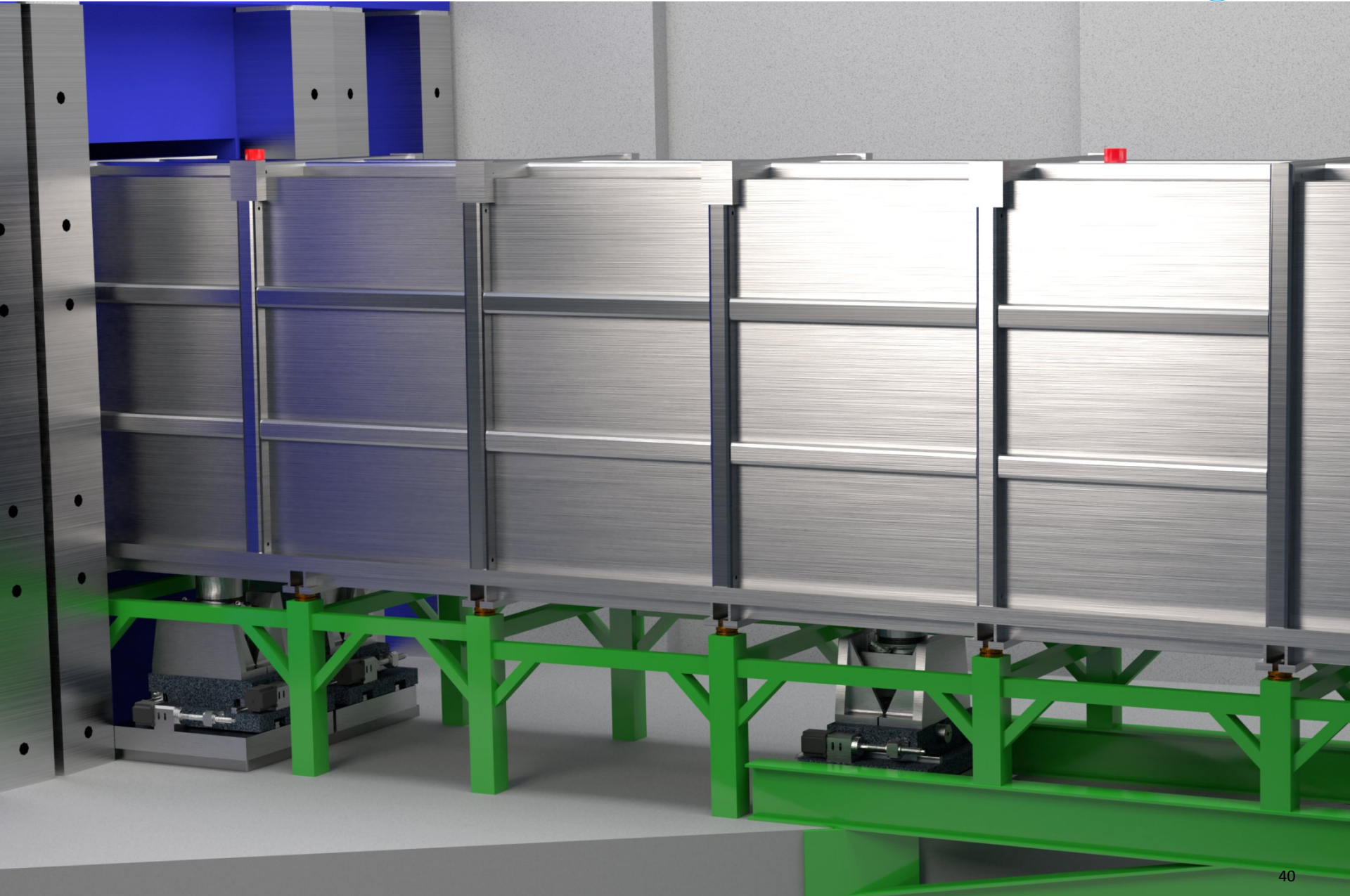


- Tests running w/ Beckhoff+EPICS+NICOS
- Measurement promising (ultimately up to 0.1 $\mu$ m precision?)

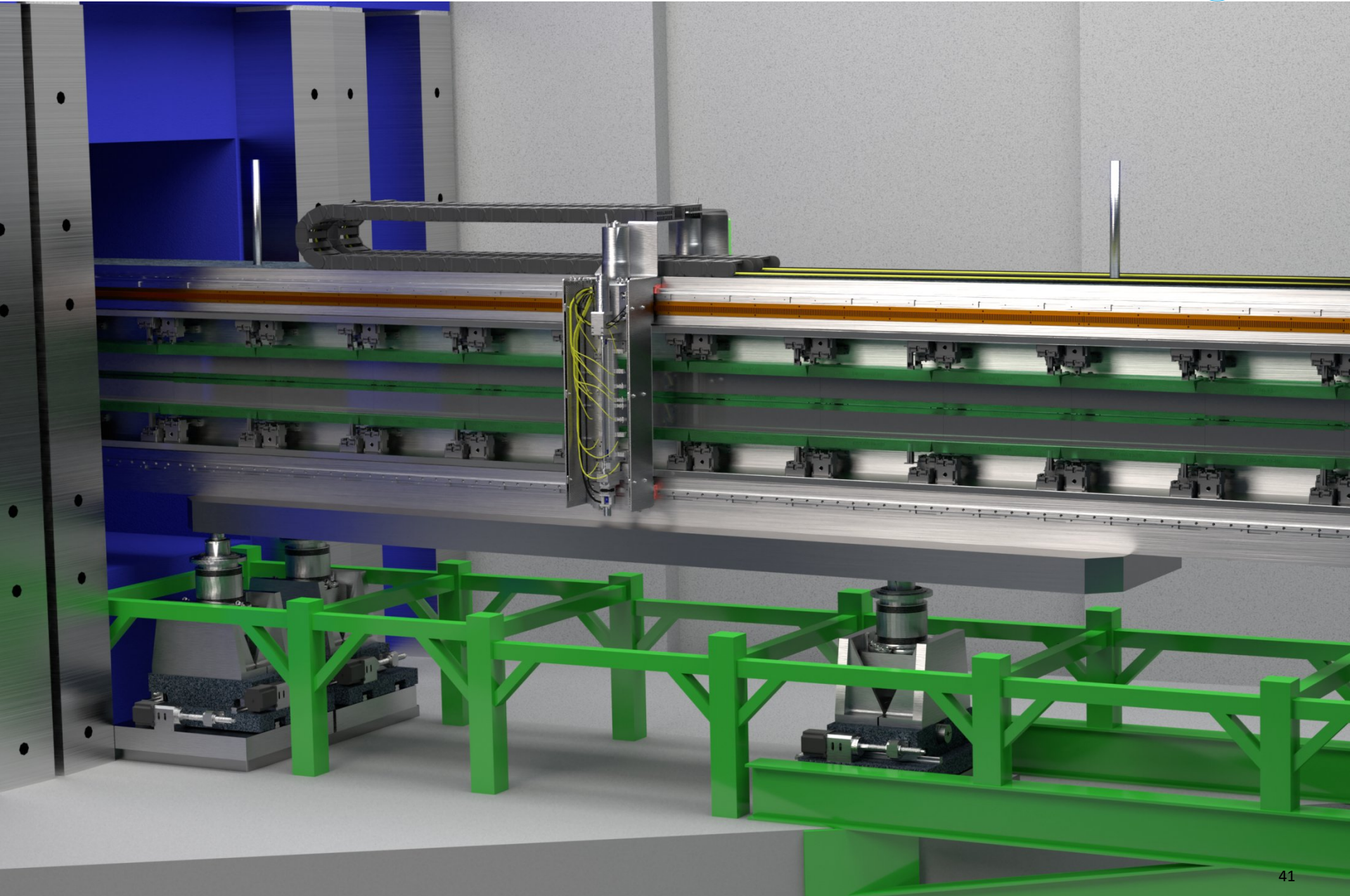


- Tests running w/ Beckhoff+EPICS+NICOS
- Measurement promising (ultimately up to 0.1 $\mu\text{m}$  precision?)
- Vacuum OK, limited outgassing
- Needed reflecting surfaces to reduce radiative heating
- Motor heating is an issue

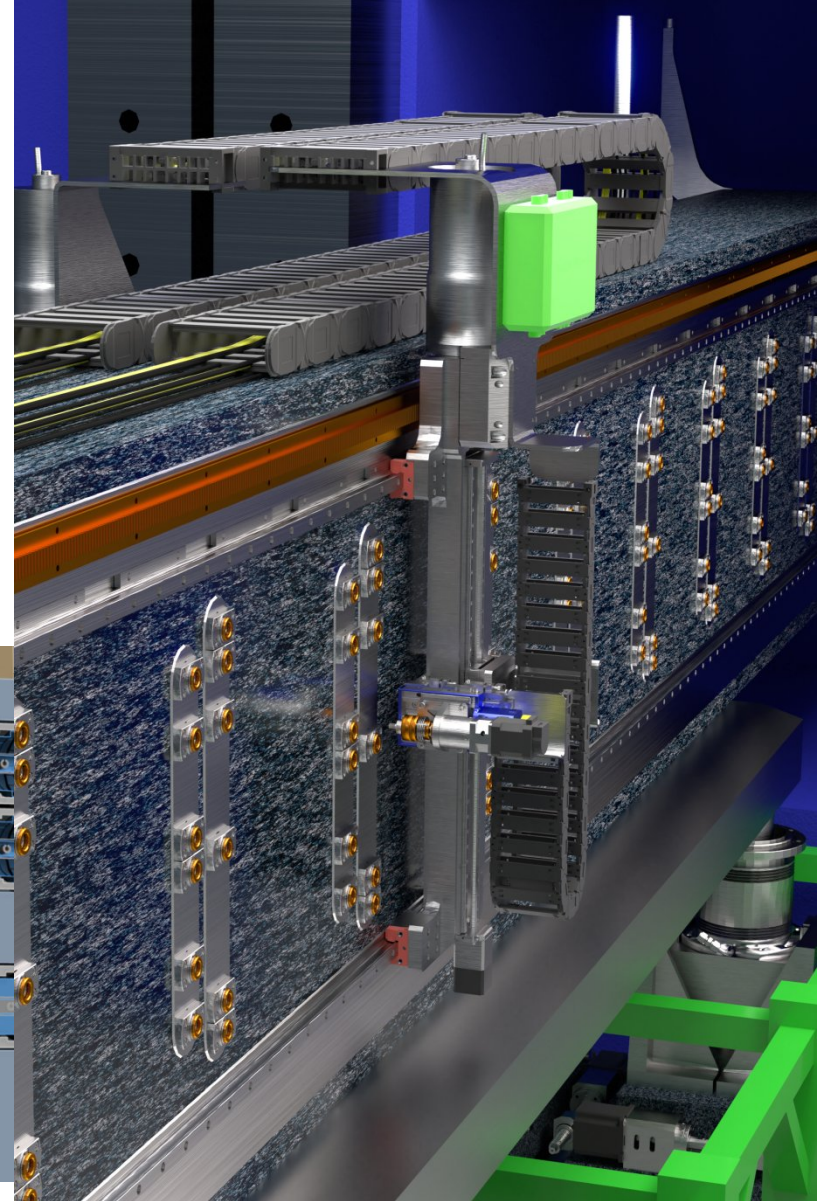
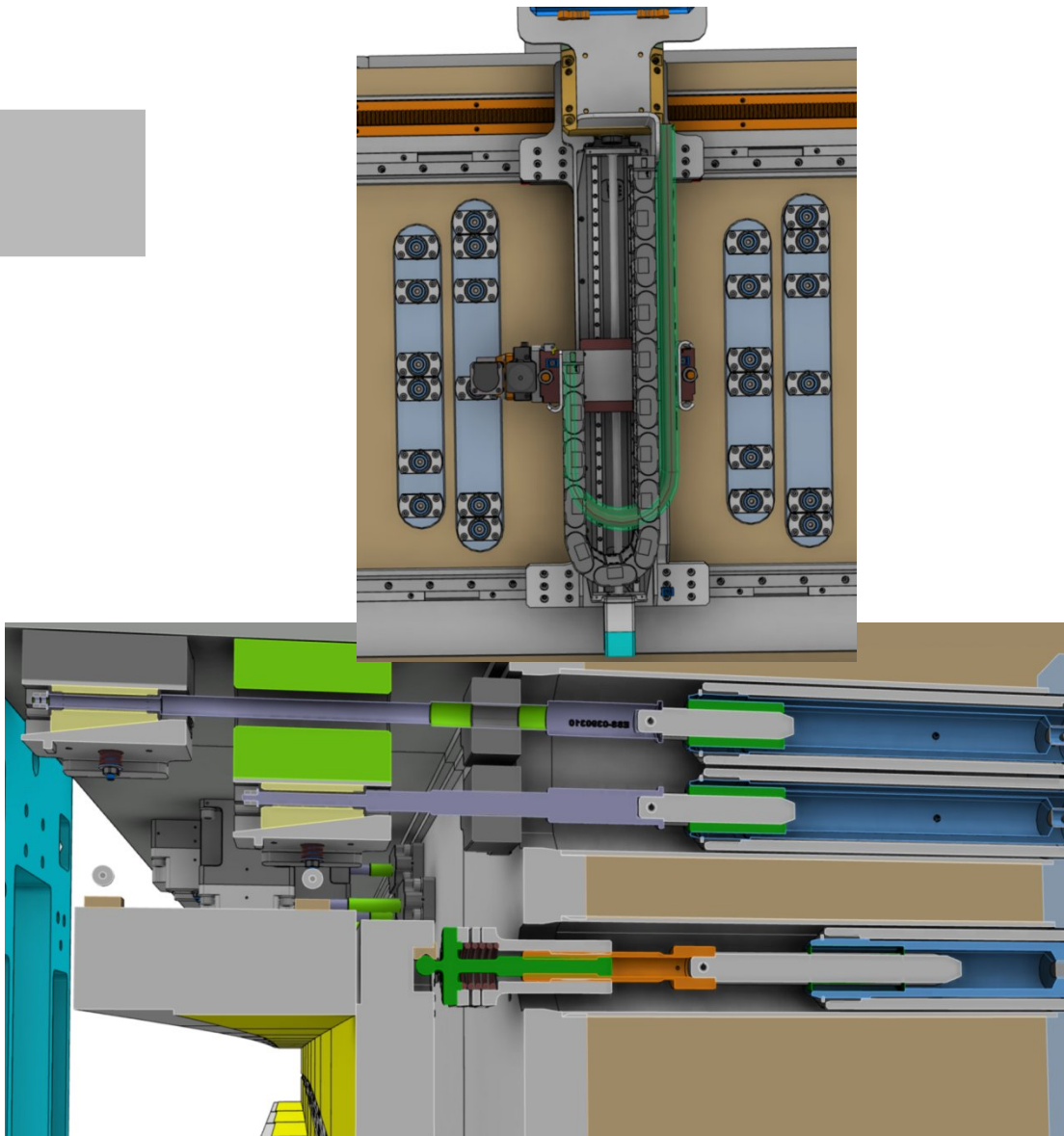


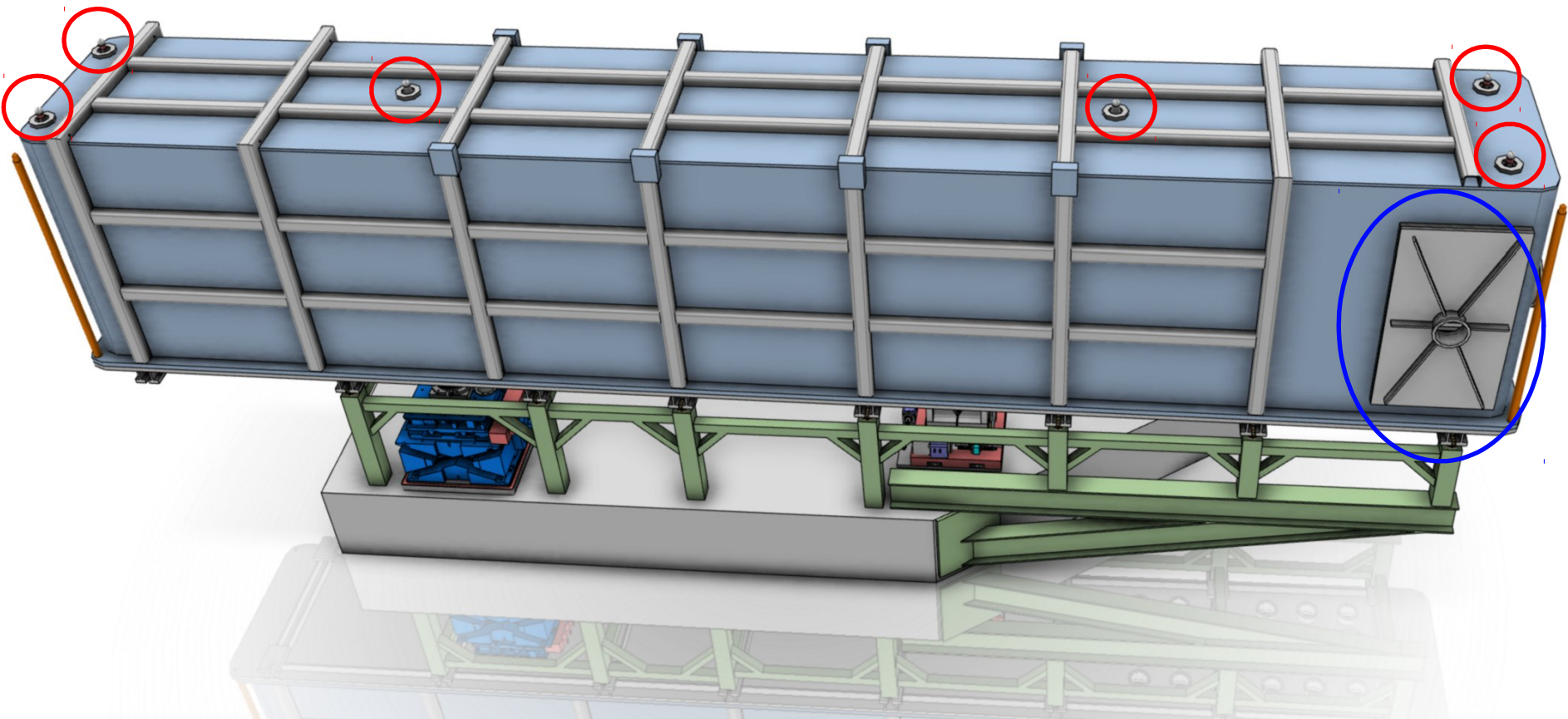






# Selene Guide





## 2-tiers:

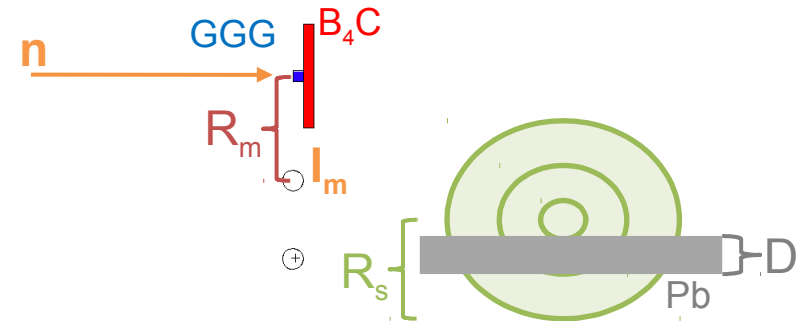
- McStas thermal n  
=> MCNP  $\gamma$   
=> analytic distance & attenuation
- Full MCNP  
=> dose at stages (n,  $\gamma$ , p,  $\pi$ ,  $\alpha$ )  
=> high energy
- Life: 200 days @ 5 MW x 20 years

## Results:

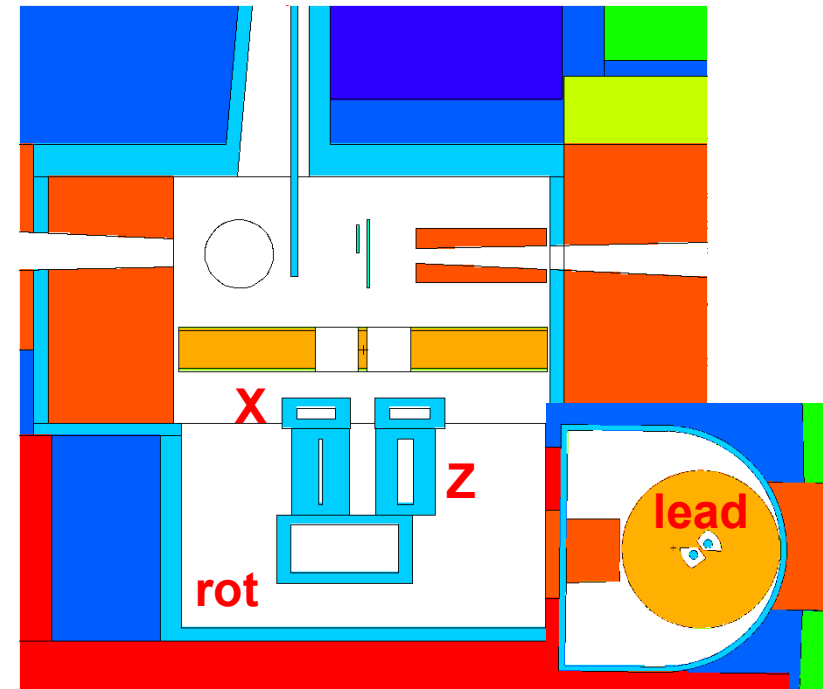
- X-stages: 0.06 rad/h + 0.4 rad/h  
=> **430 Grey life dose**
- Z-stages: 0.09 rad/h + 0.3 rad/h  
=> 325 Grey life dose
- rot-stage: 0.1 rad/h + 0.1 rad/h  
=> 190 Grey life dose

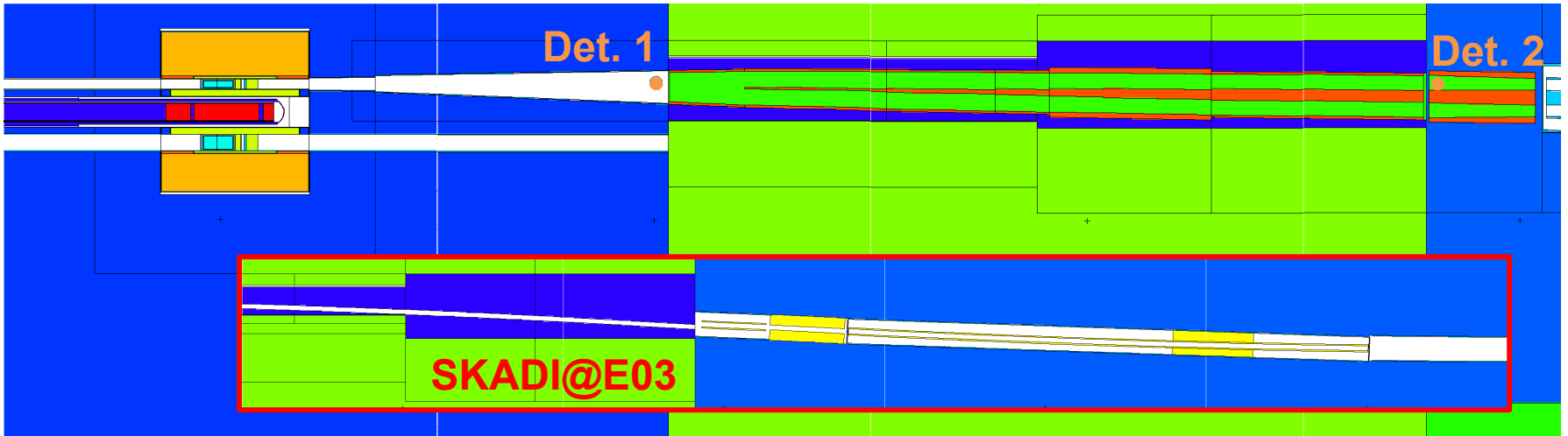
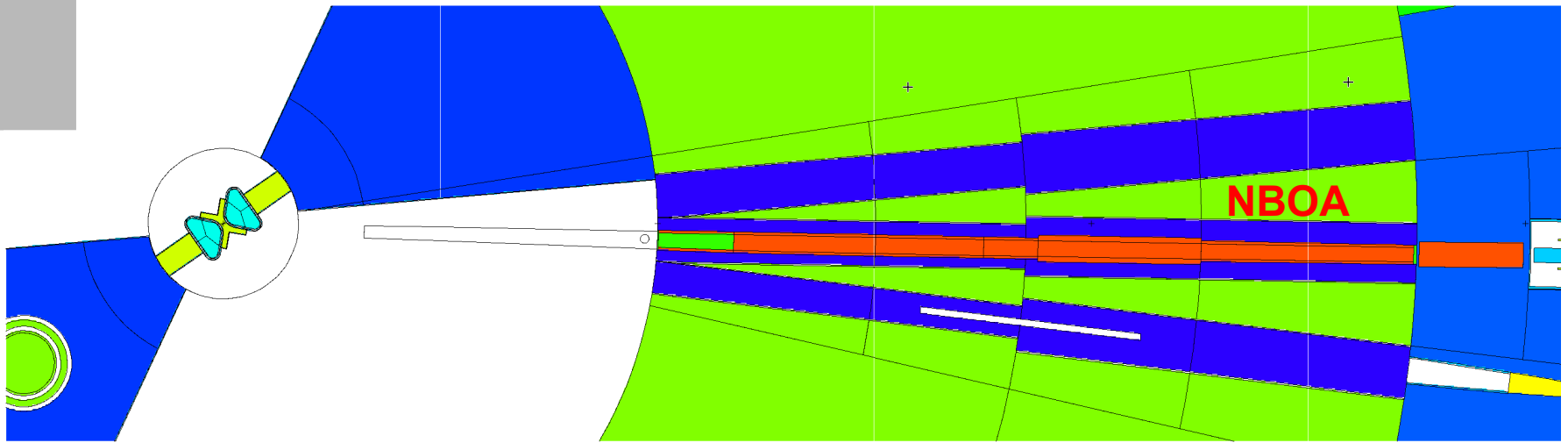
## Comparison, no lead shielding:

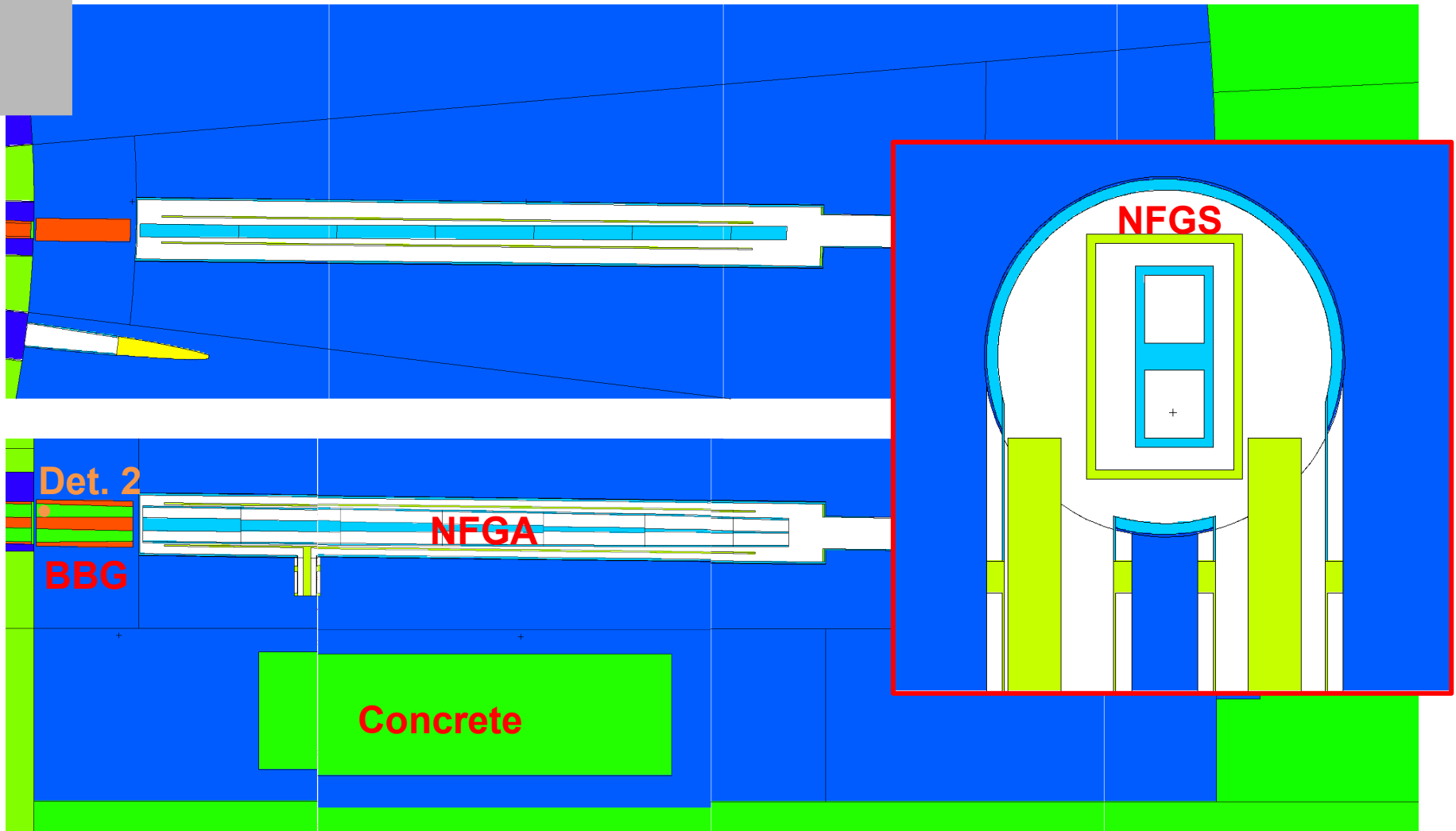
- 17'000 Grey life dose from gammas

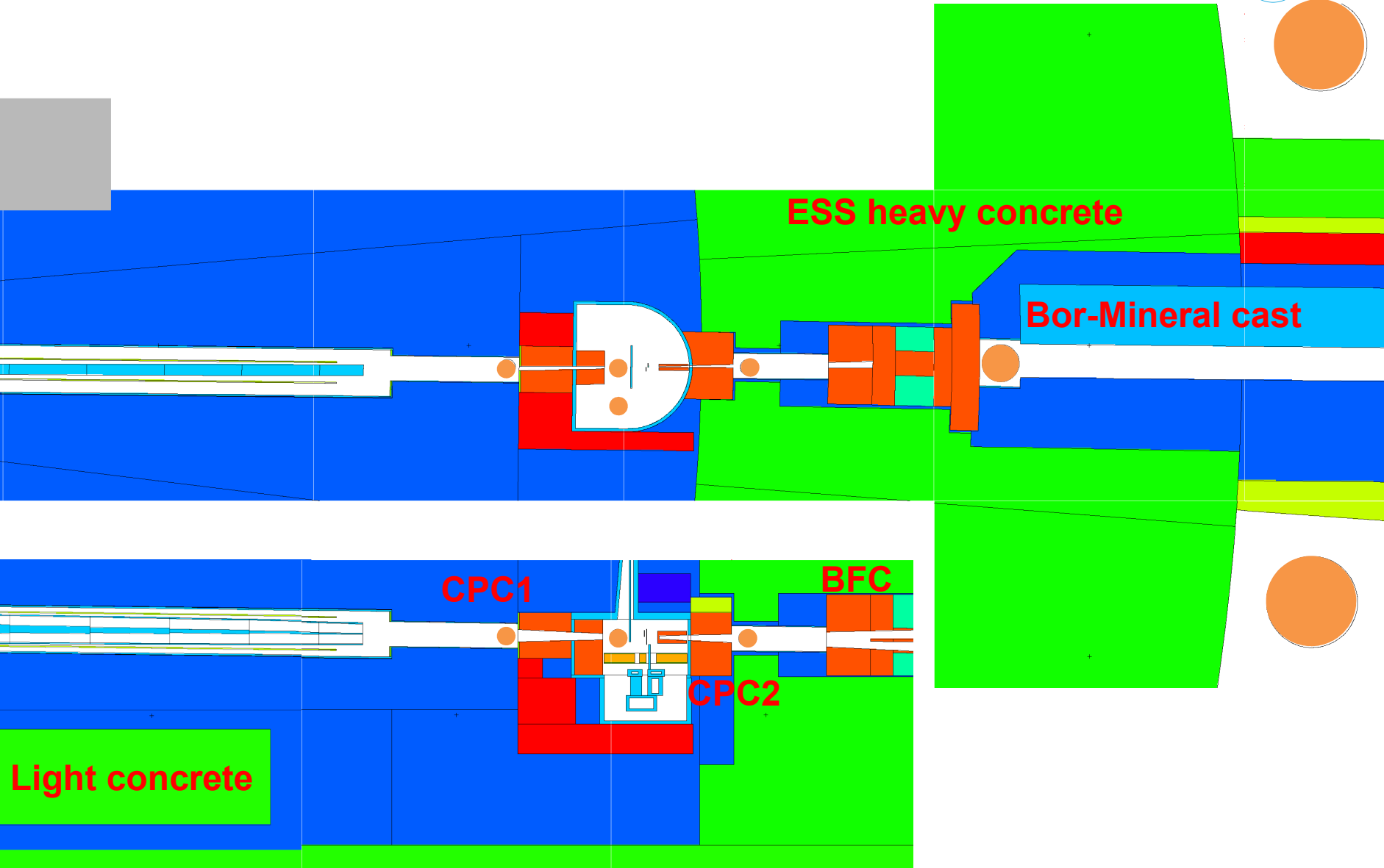


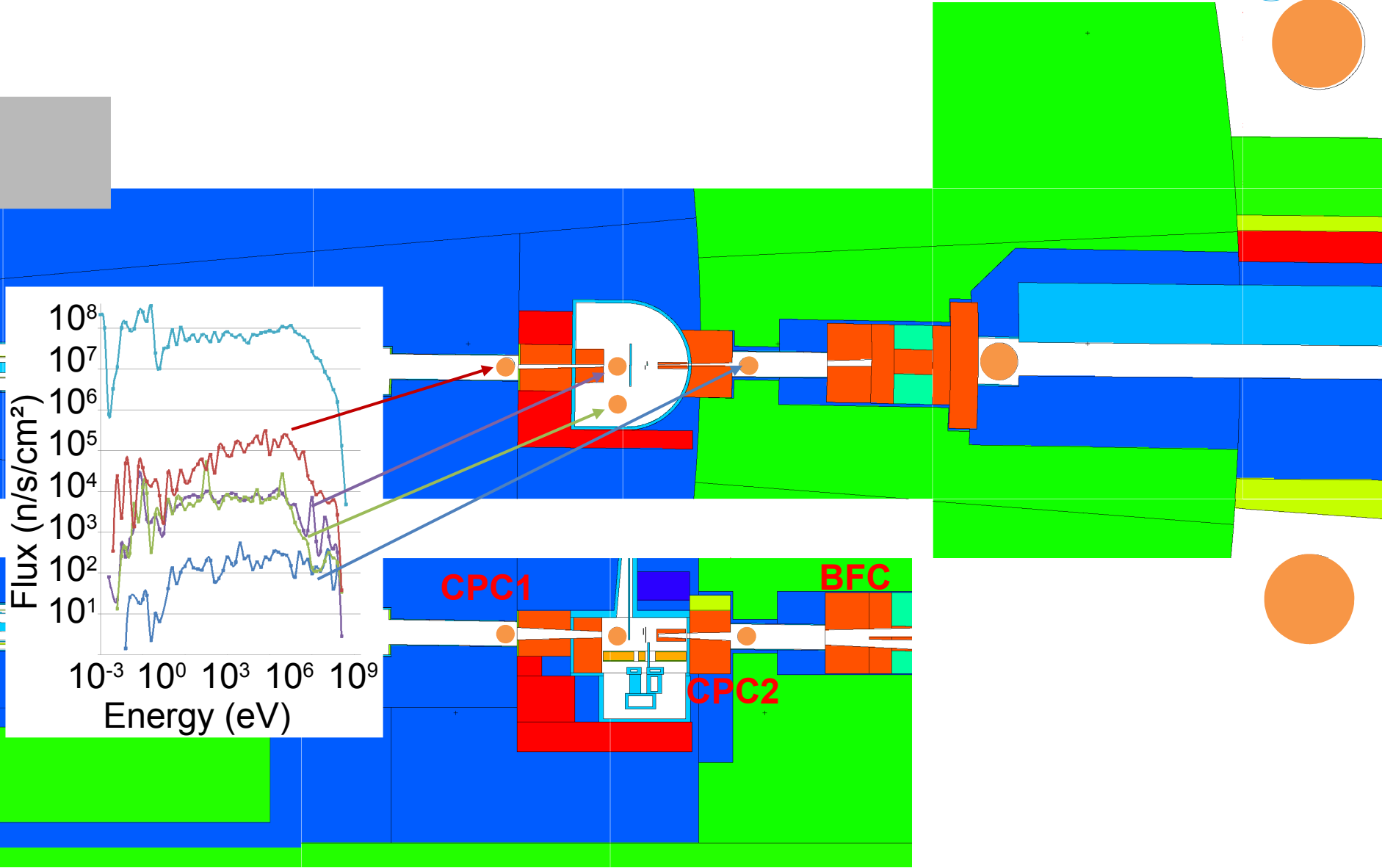
$$\circ \text{ Dose} = \left(\frac{R_s}{R_m}\right)^2 \cdot I_m \cdot e^{-\mu(E)D}$$



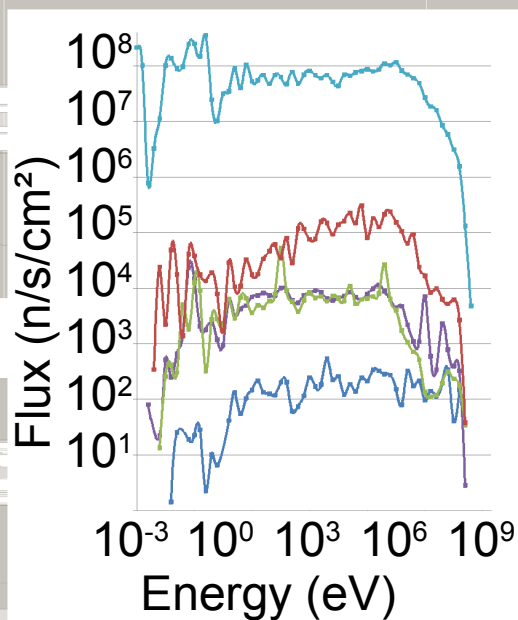
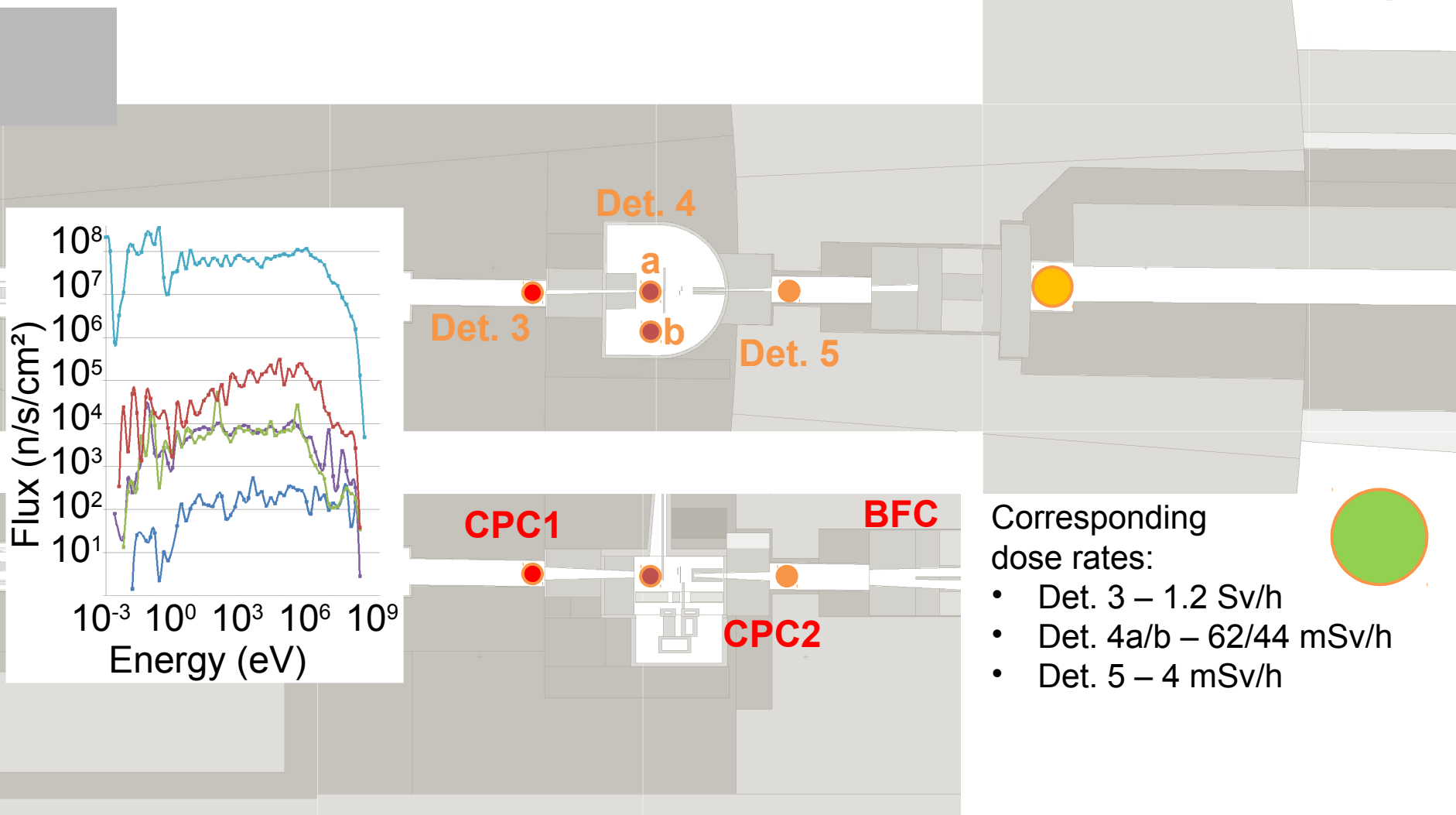
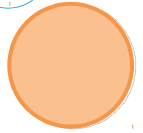






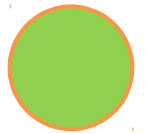


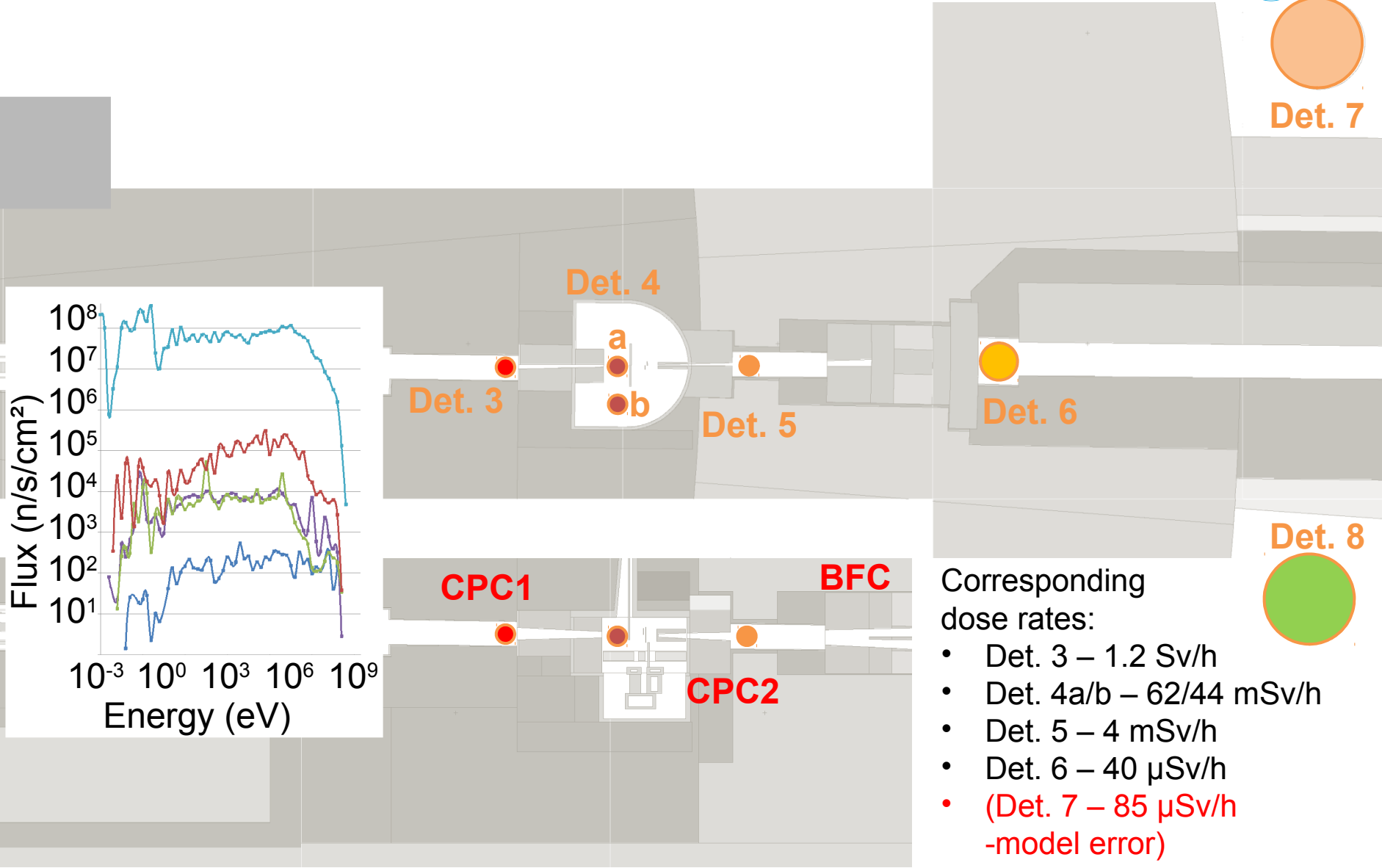




Corresponding dose rates:

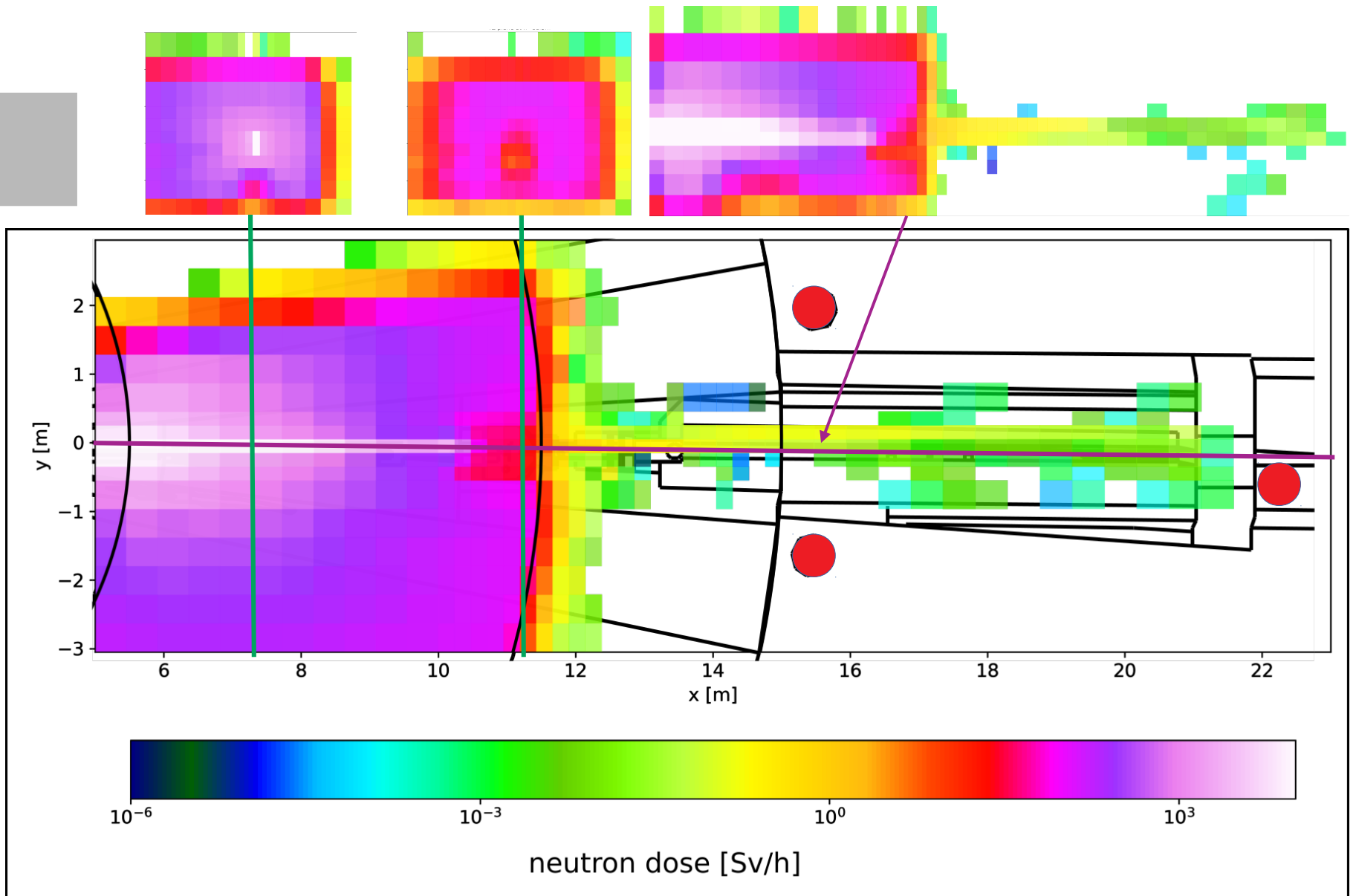
- Det. 3 – 1.2 Sv/h
- Det. 4a/b – 62/44 mSv/h
- Det. 5 – 4 mSv/h





Corresponding dose rates:

- Det. 3 – 1.2 Sv/h
- Det. 4a/b – 62/44 mSv/h
- Det. 5 – 4 mSv/h
- Det. 6 – 40 μSv/h
- (Det. 7 – 85 μSv/h -model error)
- (Det. 8 – 0.2 μSv/h)



# Ἑστία Estia

Ἑστία/Hestia:

- Greek goddess of the hearth (Latin "focus")
- Firstborn of the Olympian gods
- 1<sup>st</sup> ESS reflectometer

Thanks to everybody involved  
making this progress possible



Estia

# Questions?



Uwe Filges

Jochen  
Stahn



Federico Rojas



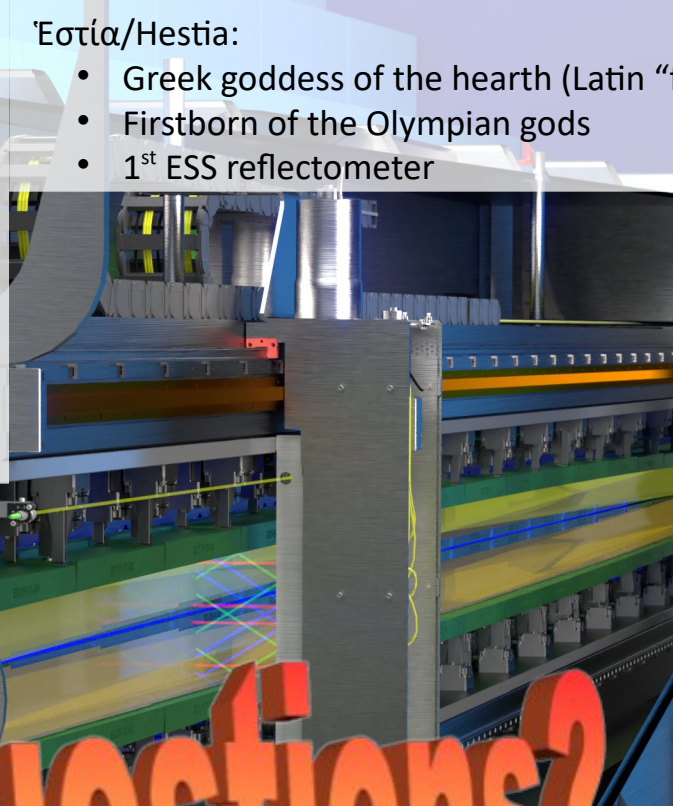
Peter  
Heimgartner



Katharina  
Liefert

Elisa  
Maslowski

Fabian  
Cortesi



Artur Glavic

Sven Schütz