Science and Technology Facilities Council

ITRF - LhARA

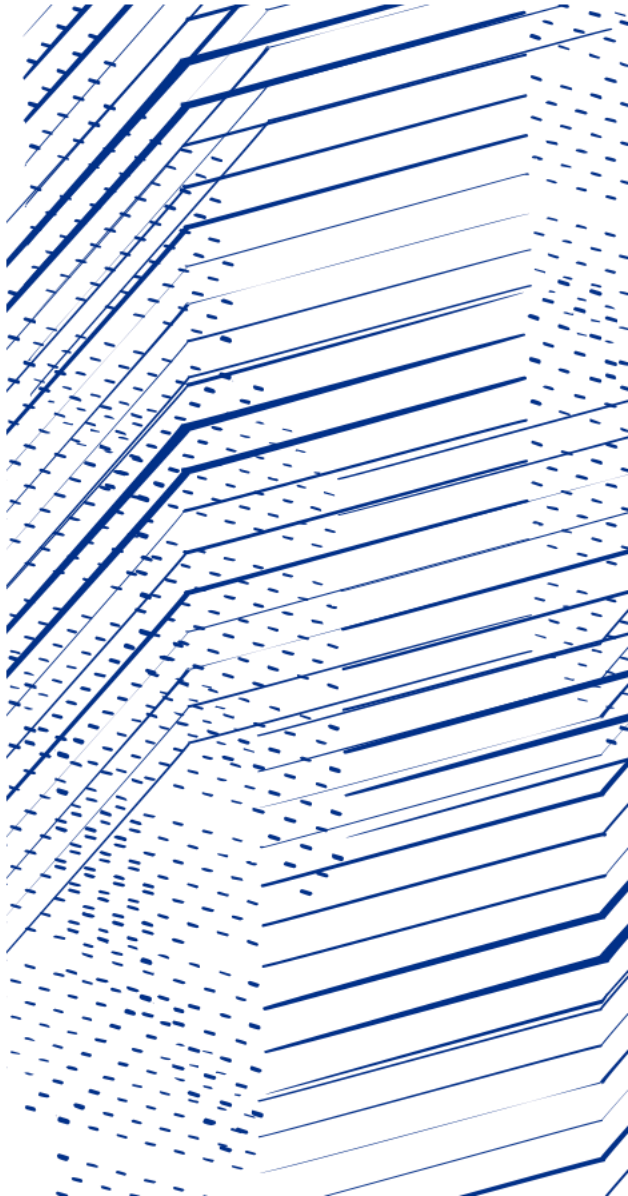
General Facility Infrastructure and Integration

ITRF WP2 & LhARA WP1.6

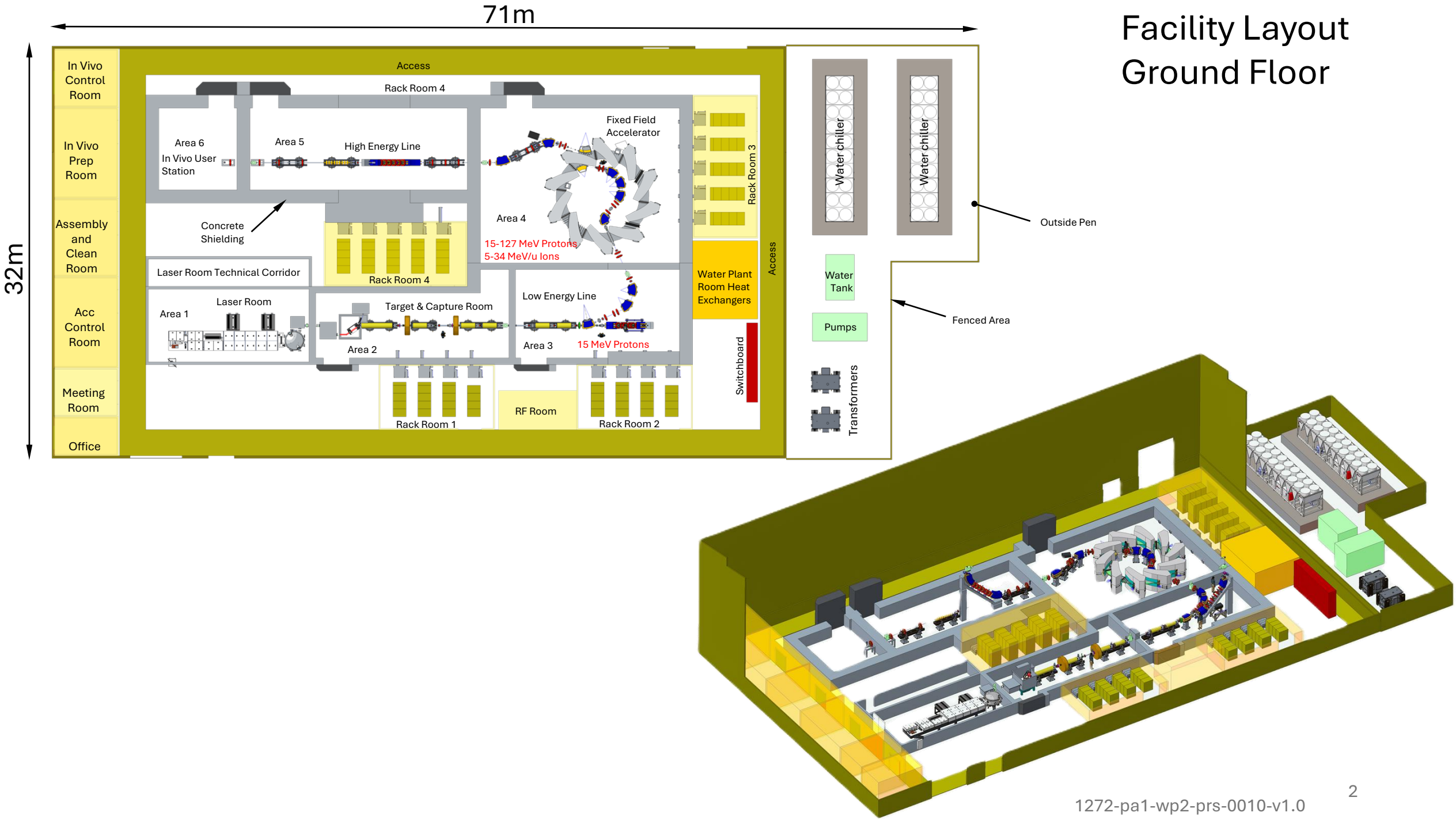
1272-pa1-wp2-prs-0010-v1.0-ITRF-24-month-design-review-WP6-infrastructure-2024-09-02

24 Month Design Review
2nd September 2024

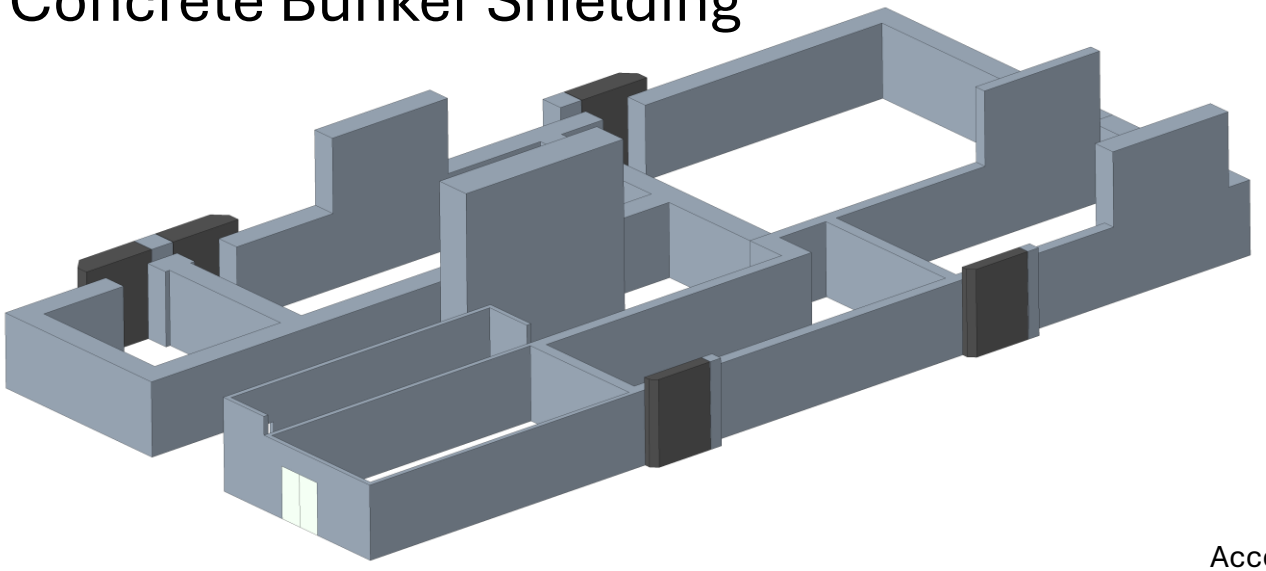
Clive Hill, UKRI-STFC-Daresbury Laboratory, On behalf of the team

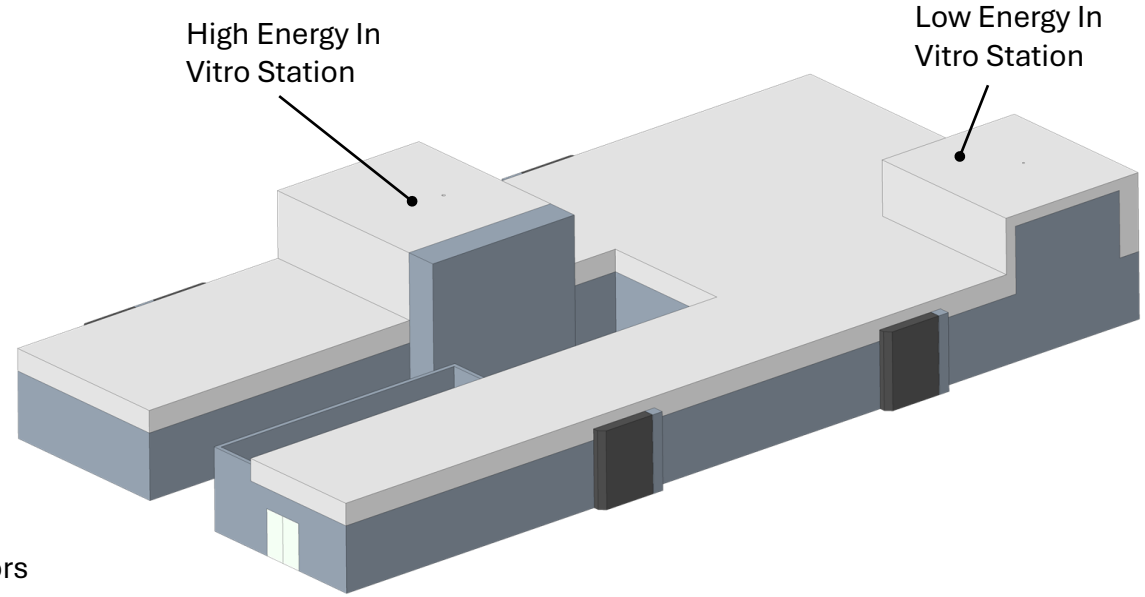


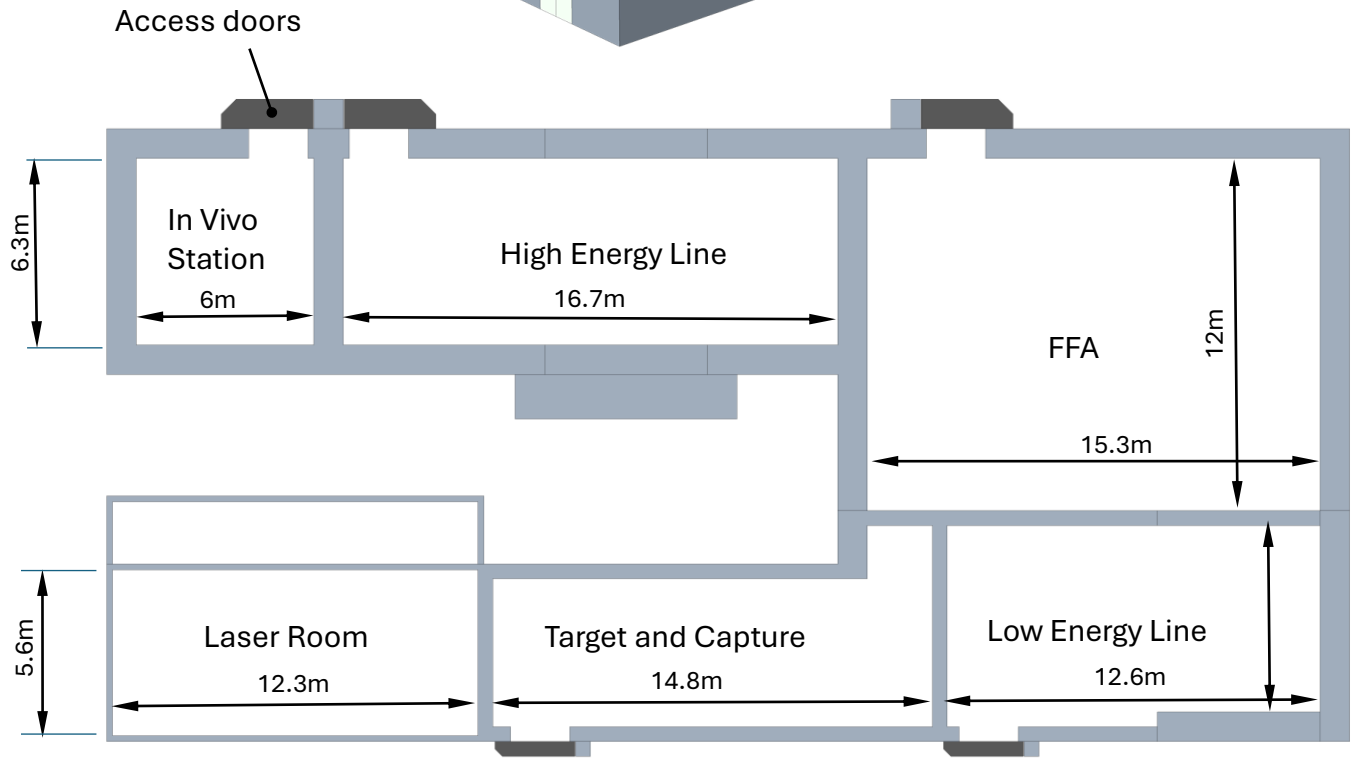
Facility Layout
Ground Floor



Concrete Bunker Shielding



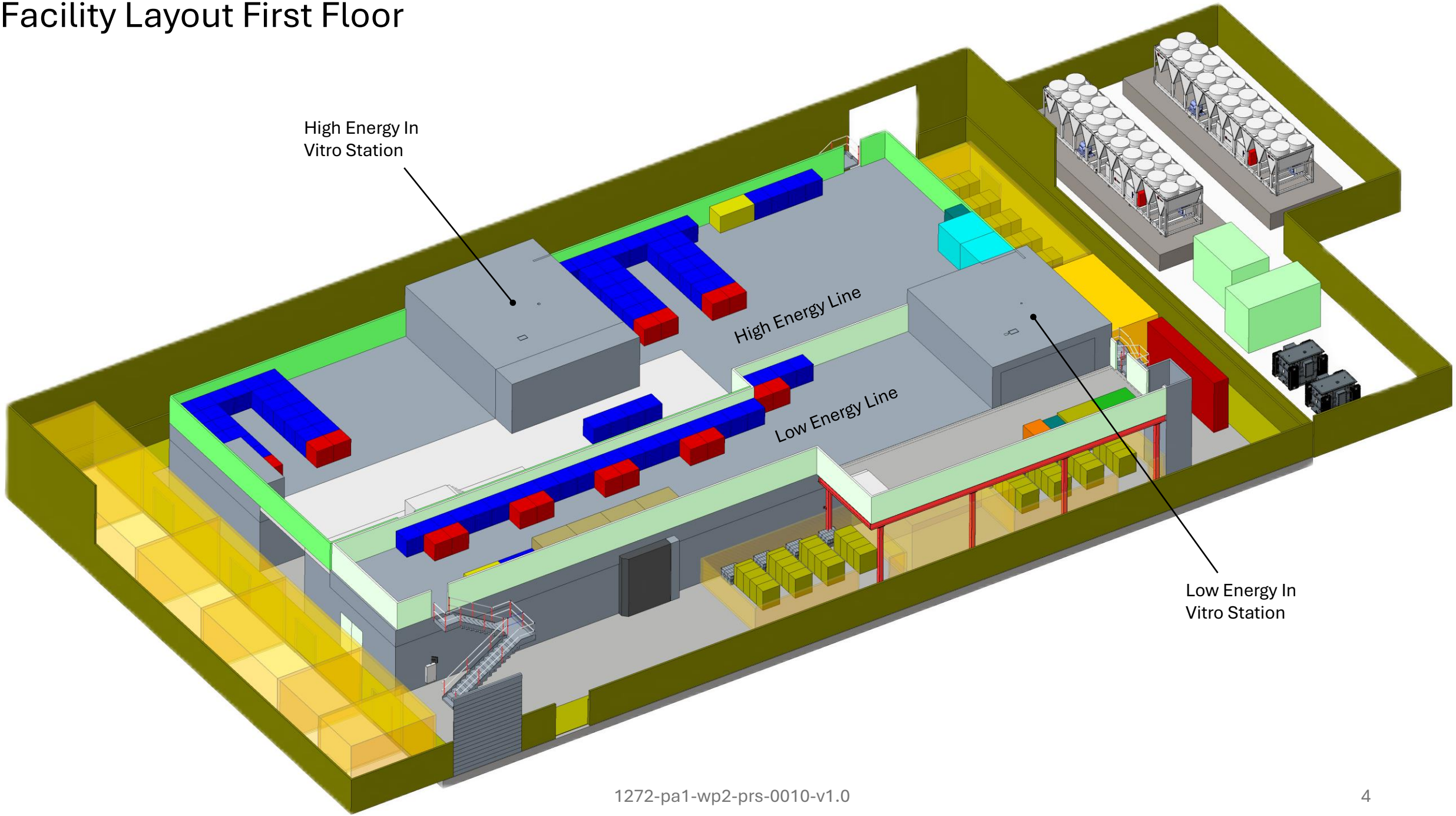




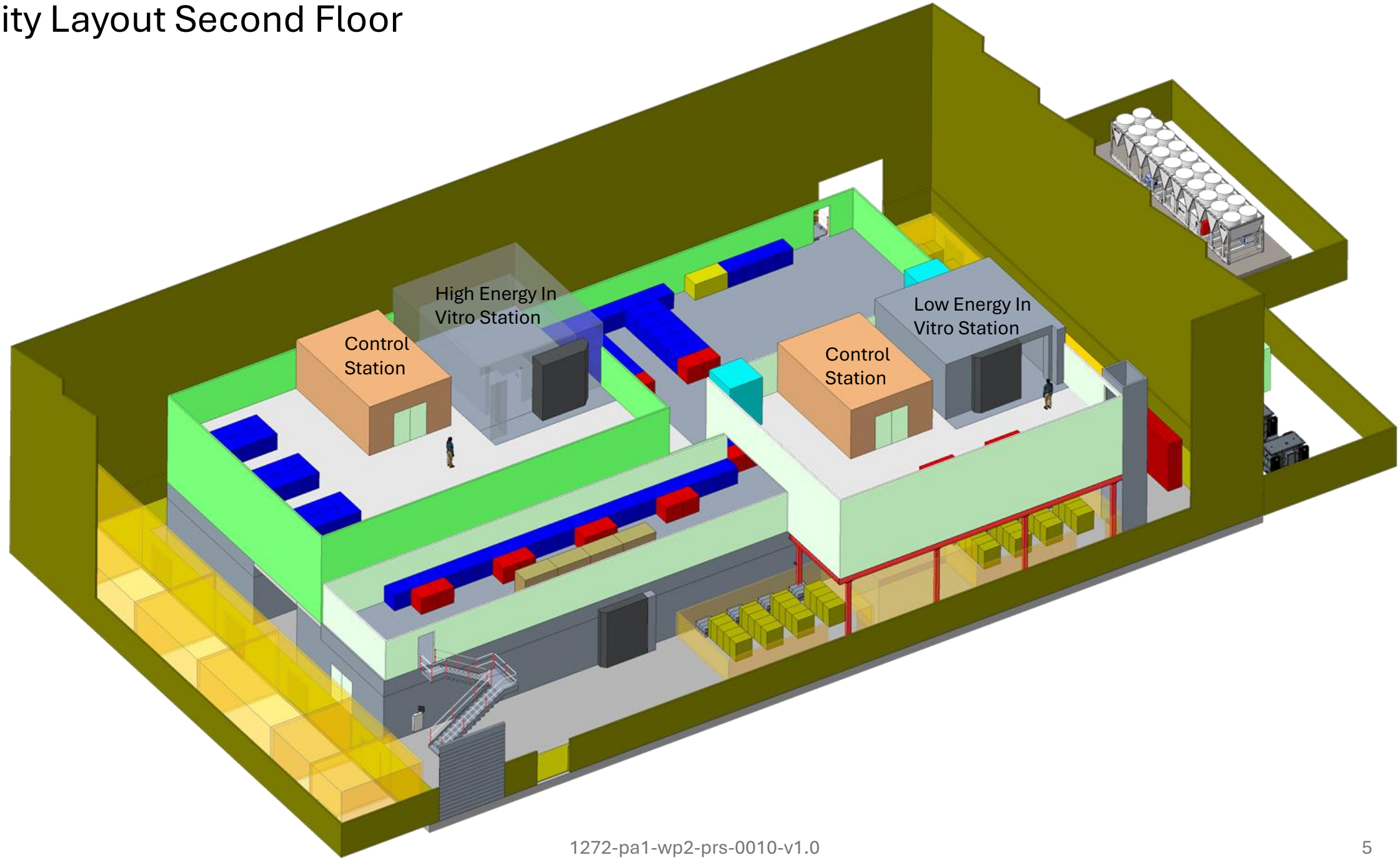
Concrete Shielding Thickness (Assumptions)

Target and Capture	0.5m
Low Energy Line	0.5m
FFA Area	1.0m
High Energy Line	1.0m
In Vivo Station	1.0m

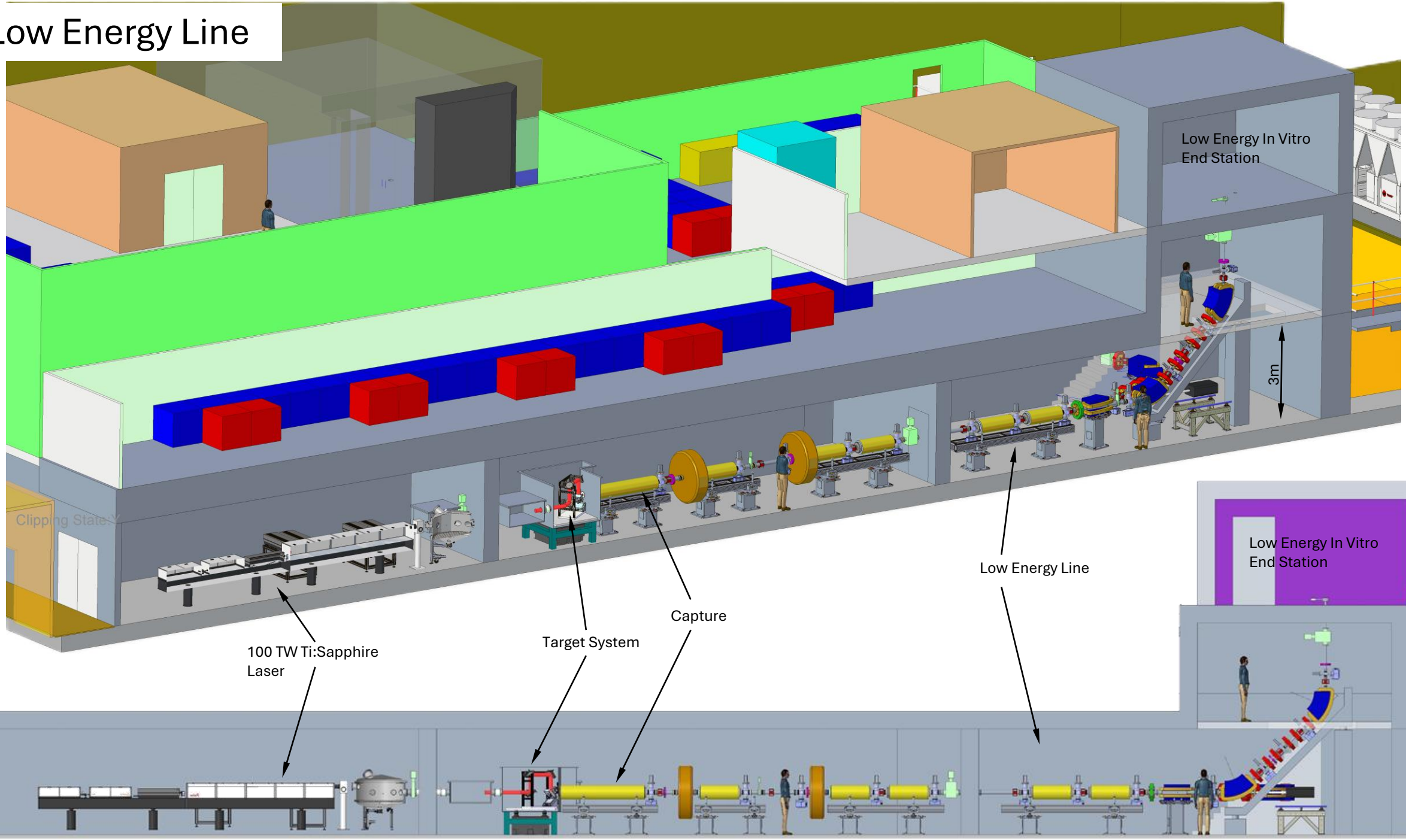
Facility Layout First Floor



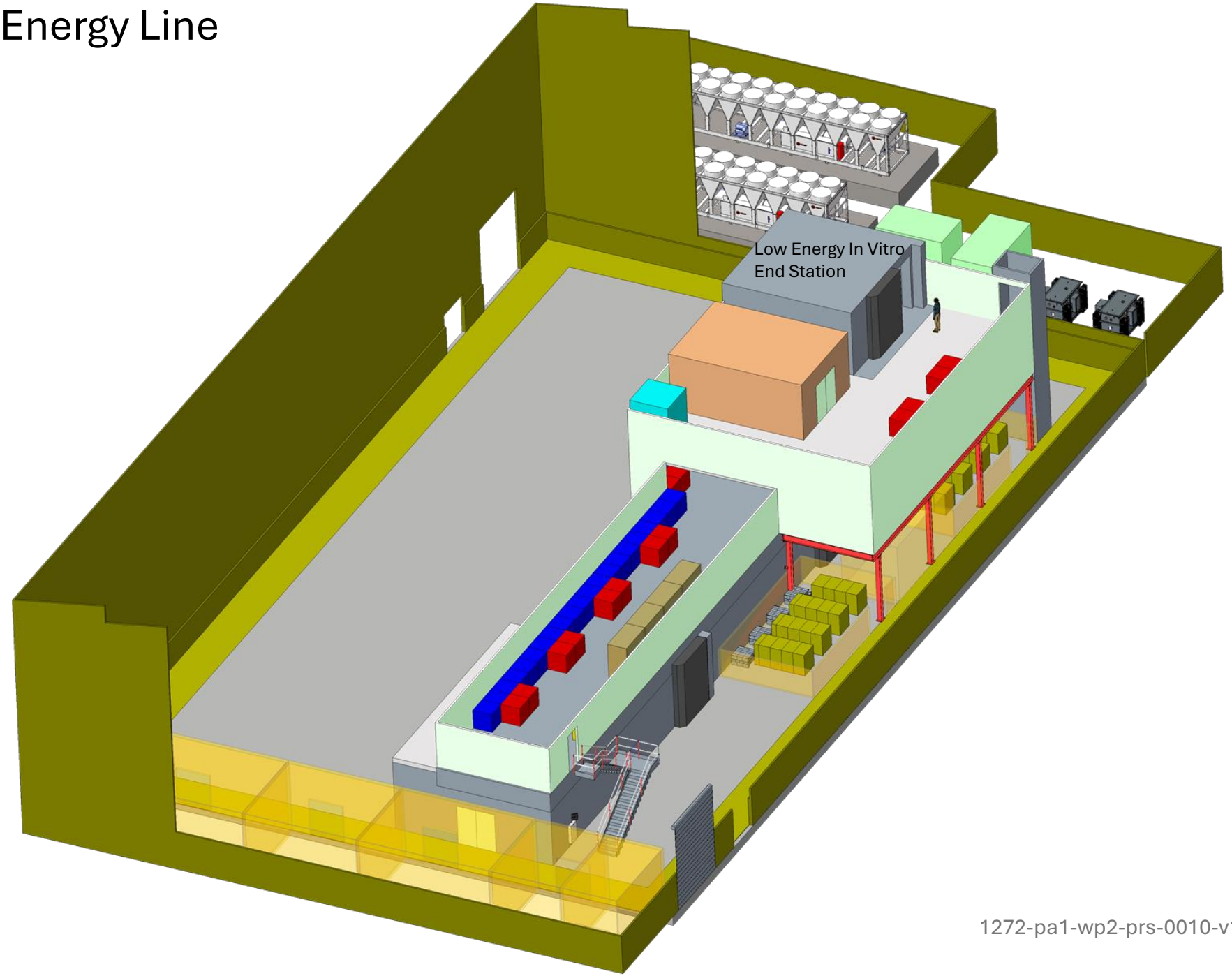
Facility Layout Second Floor



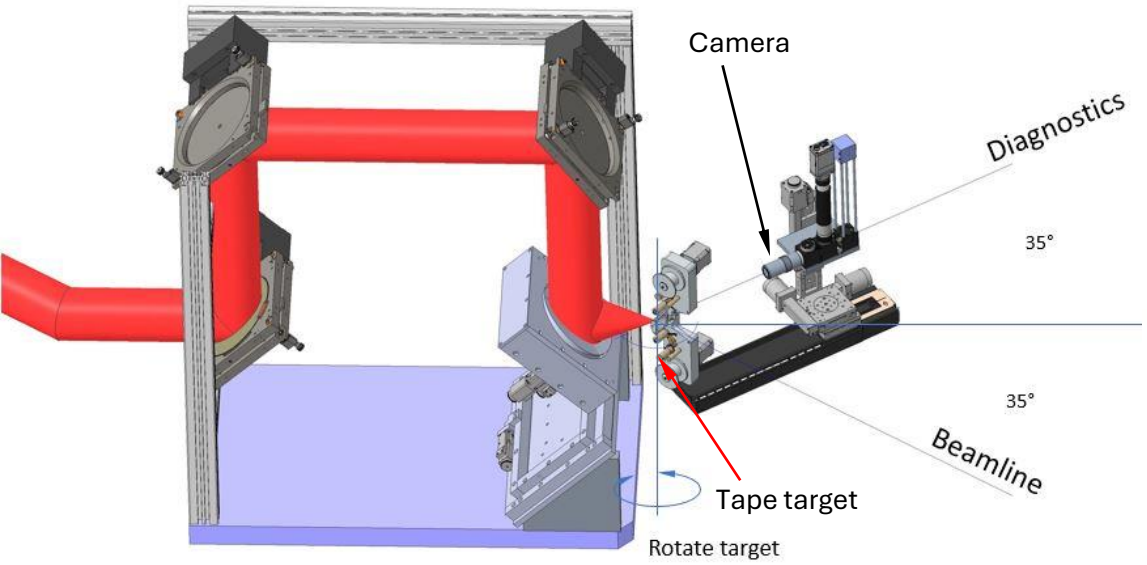
Low Energy Line

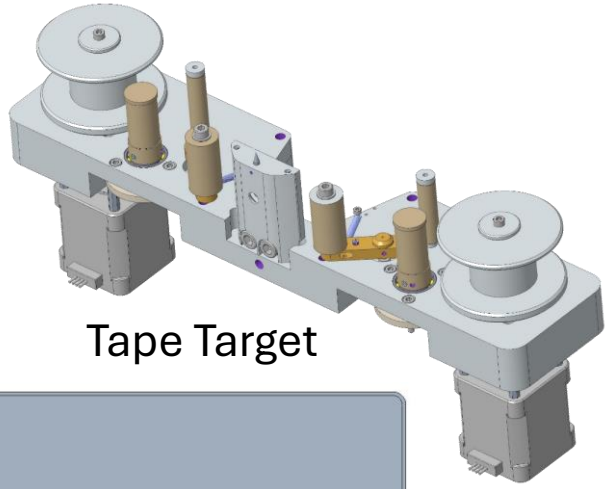


Stage 1 Low Energy Line

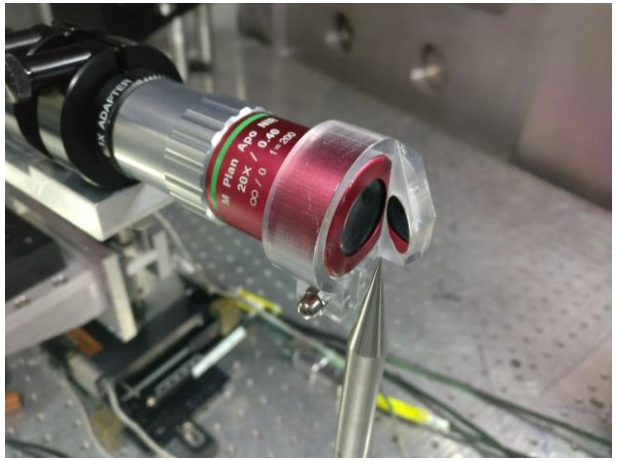


Tape Target



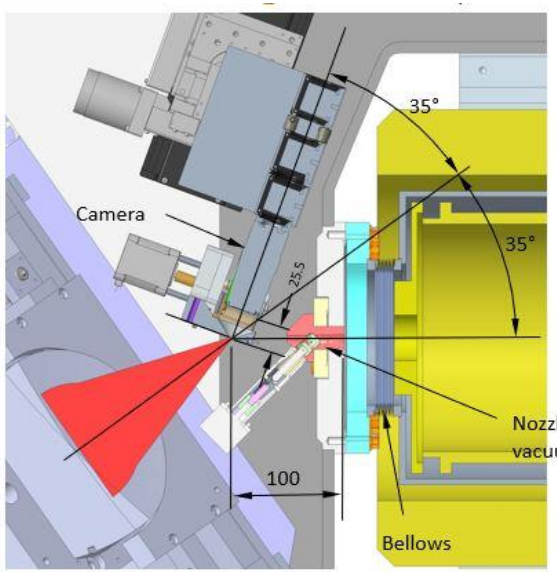


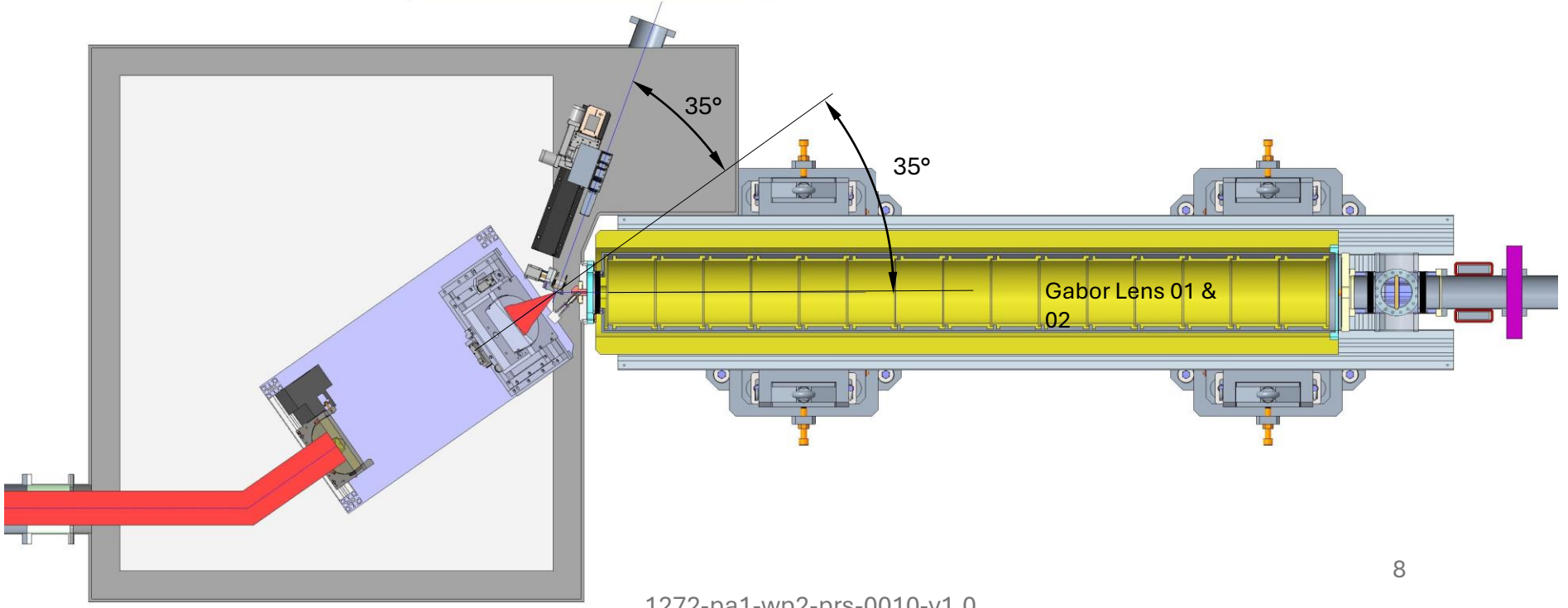
Tape Target



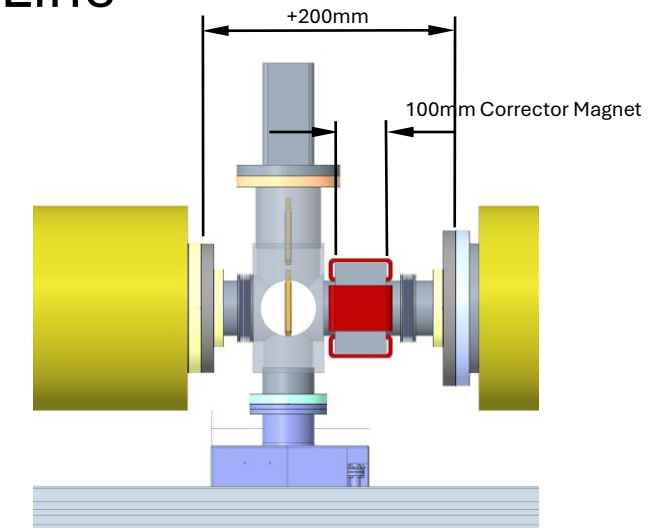
Diagnostics Camera

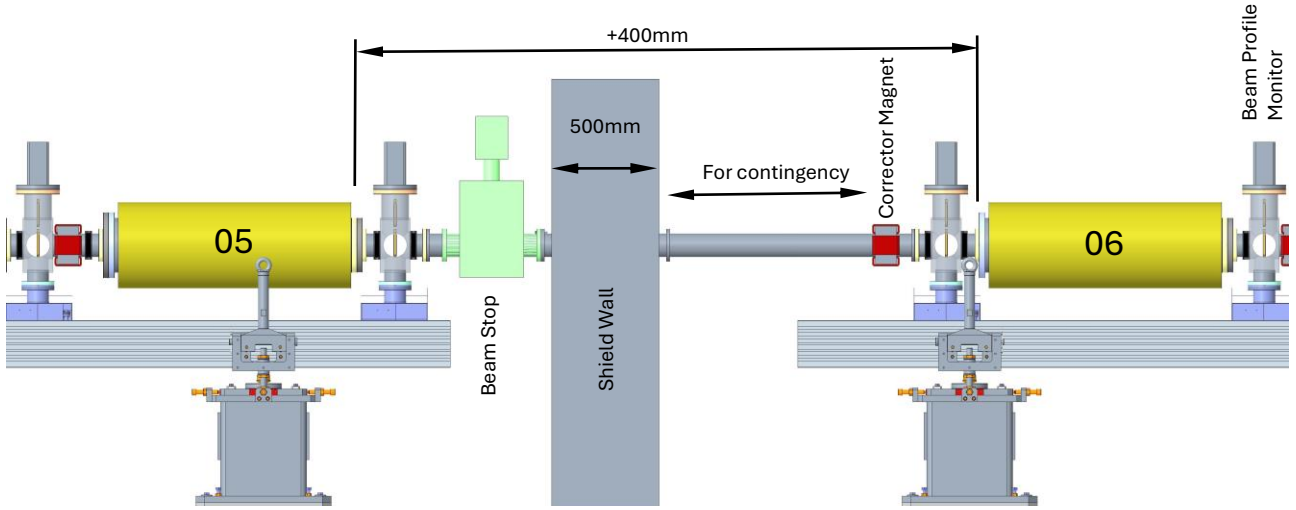
Diagnostics chamber

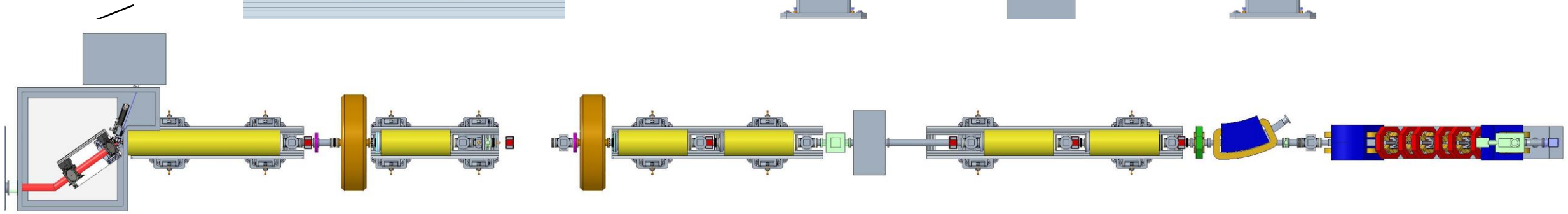


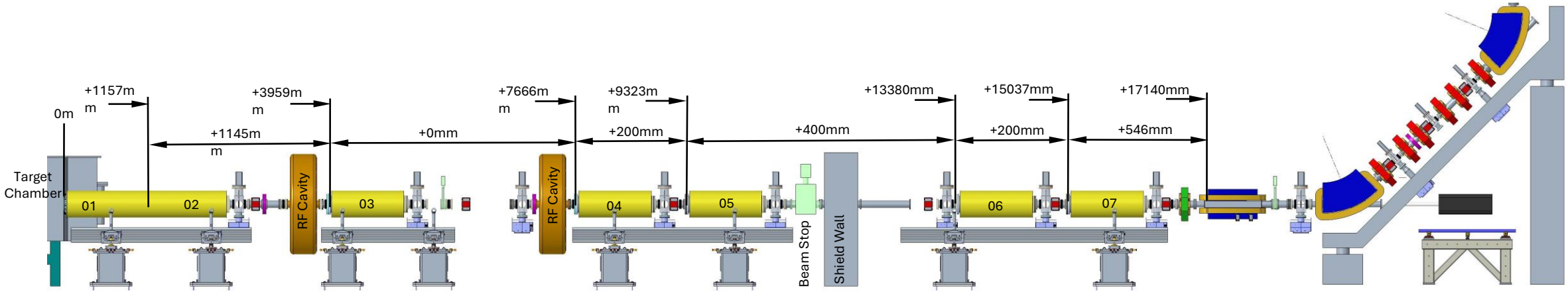


Low Energy Line

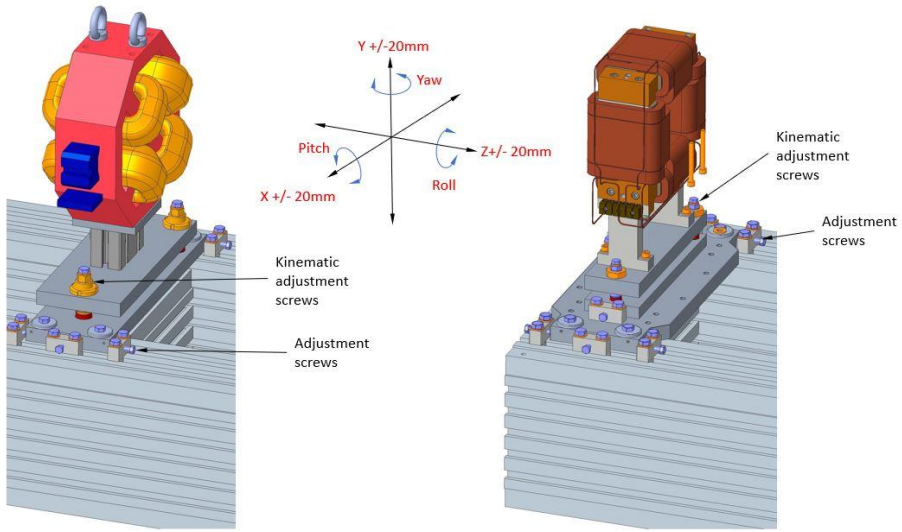


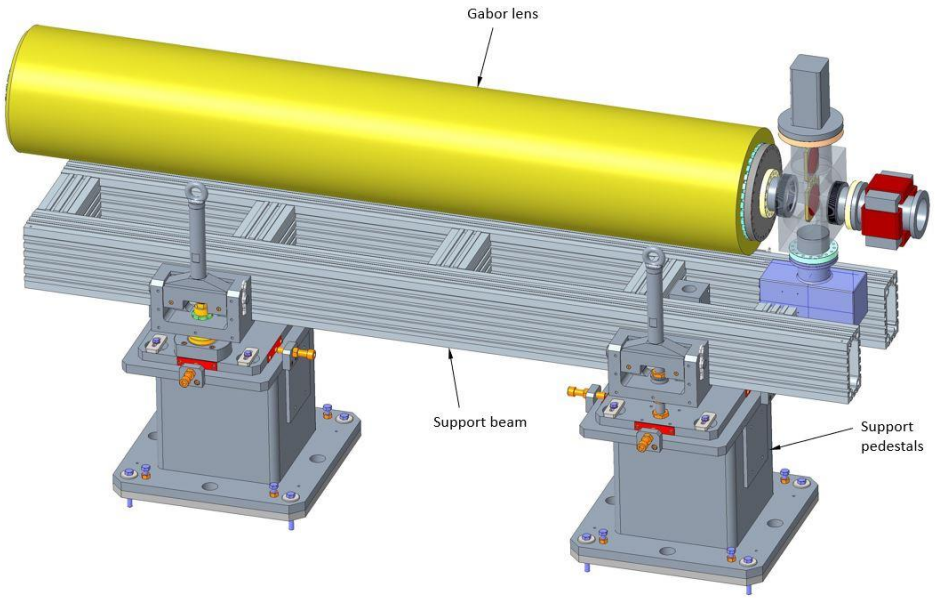


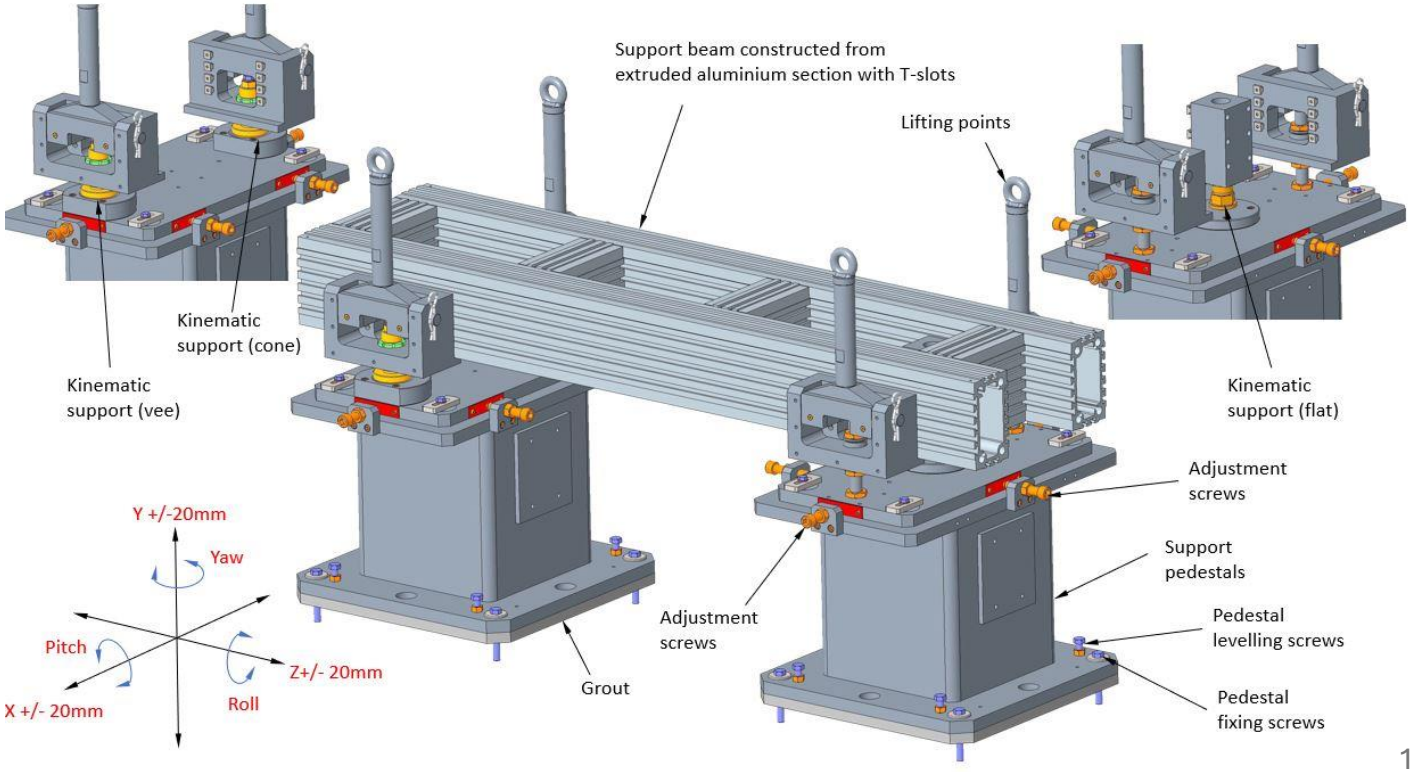


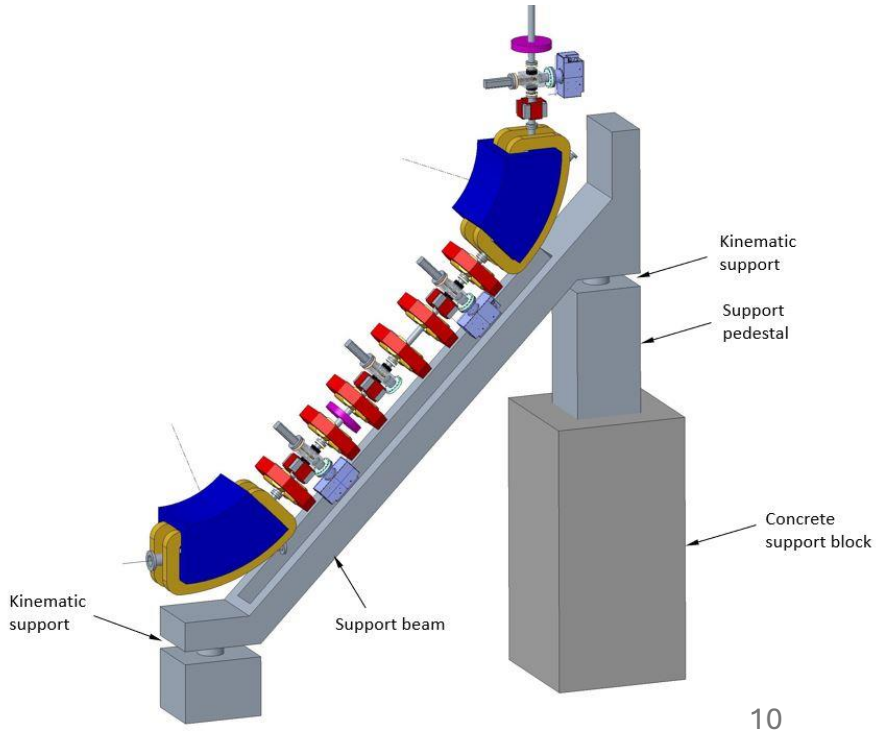


Low Energy Line Support Systems

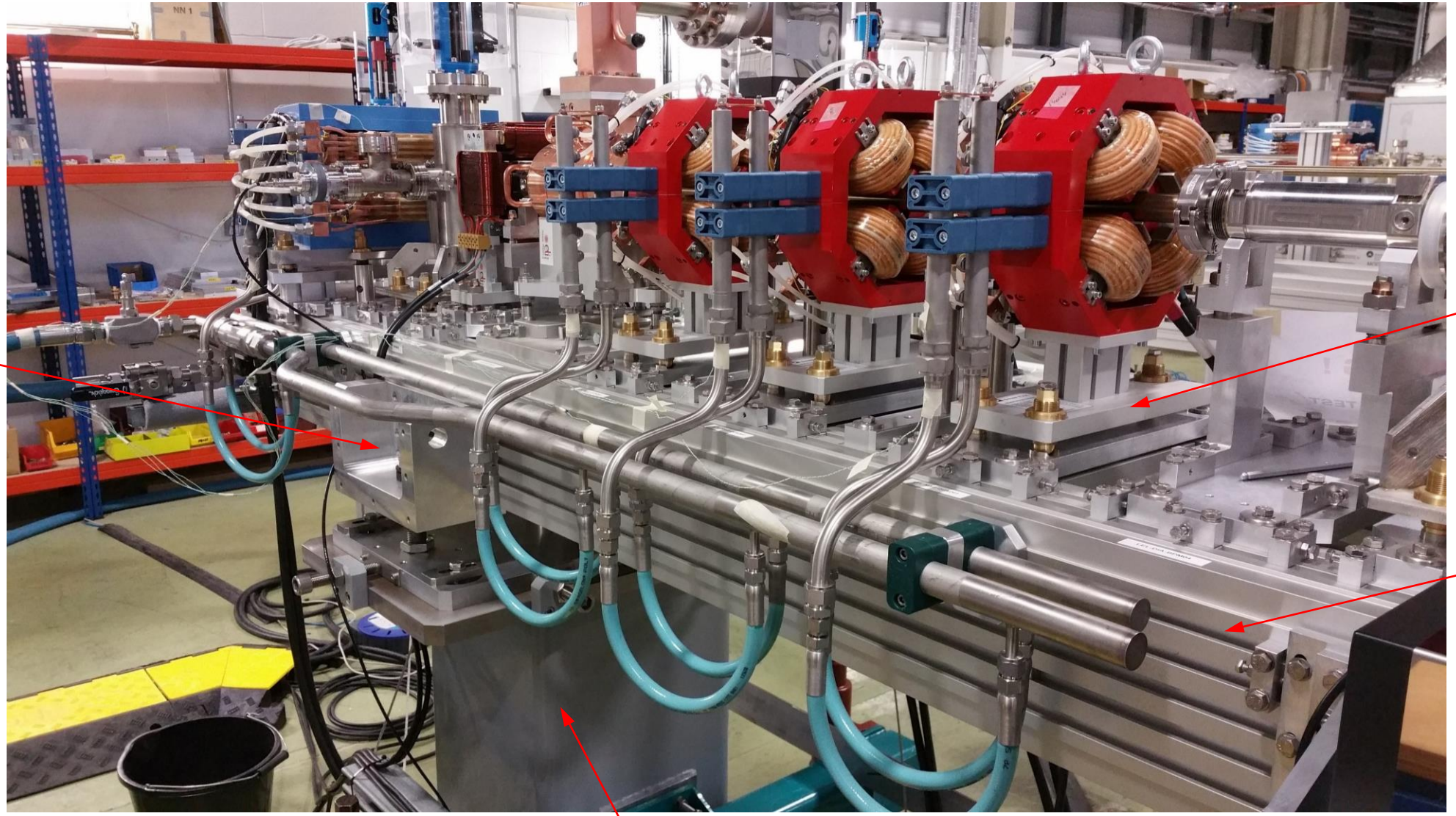




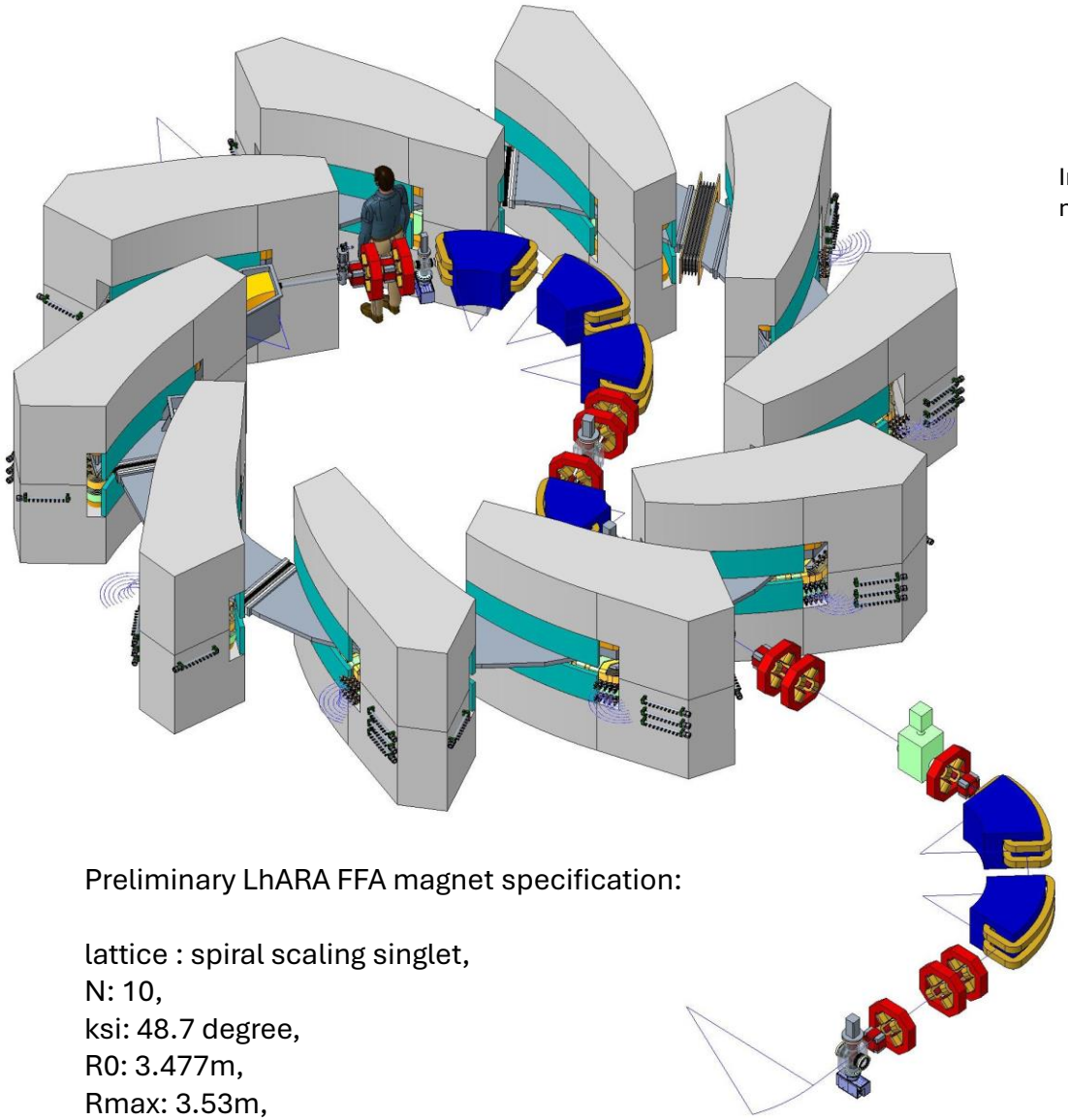


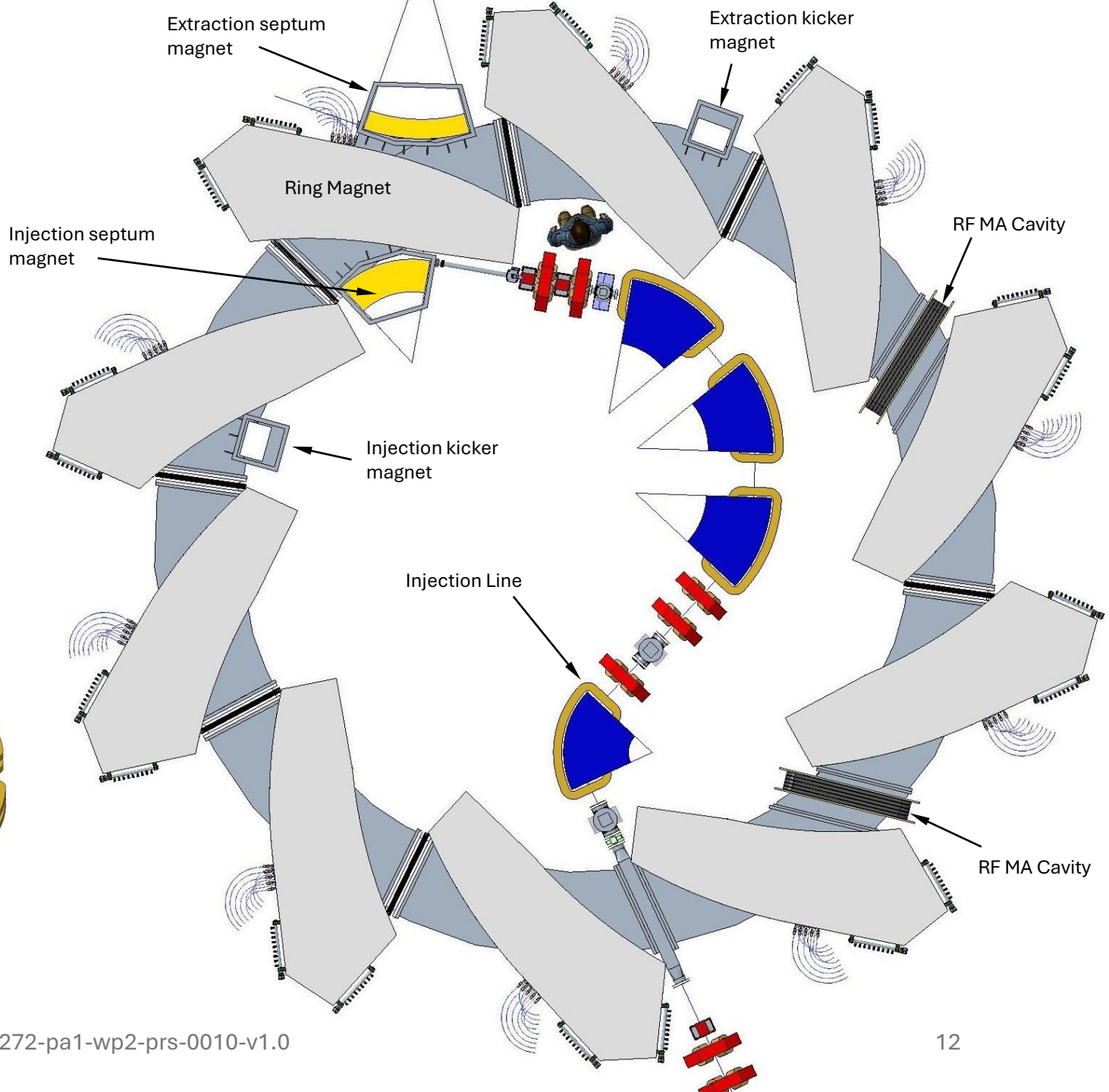


Low Energy Line Support Systems Example



FFA Injection Line & Ring Magnet Yoke

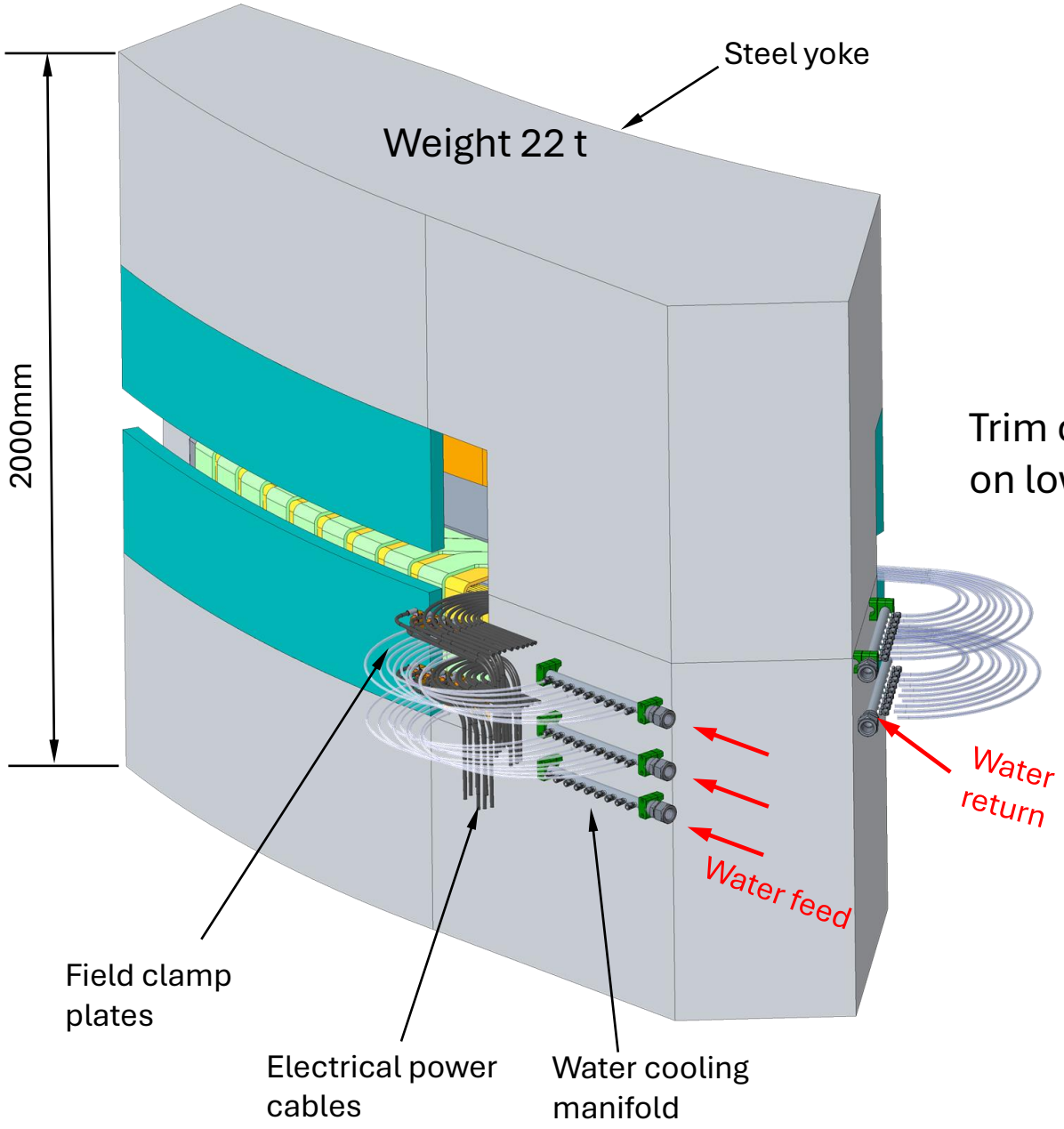


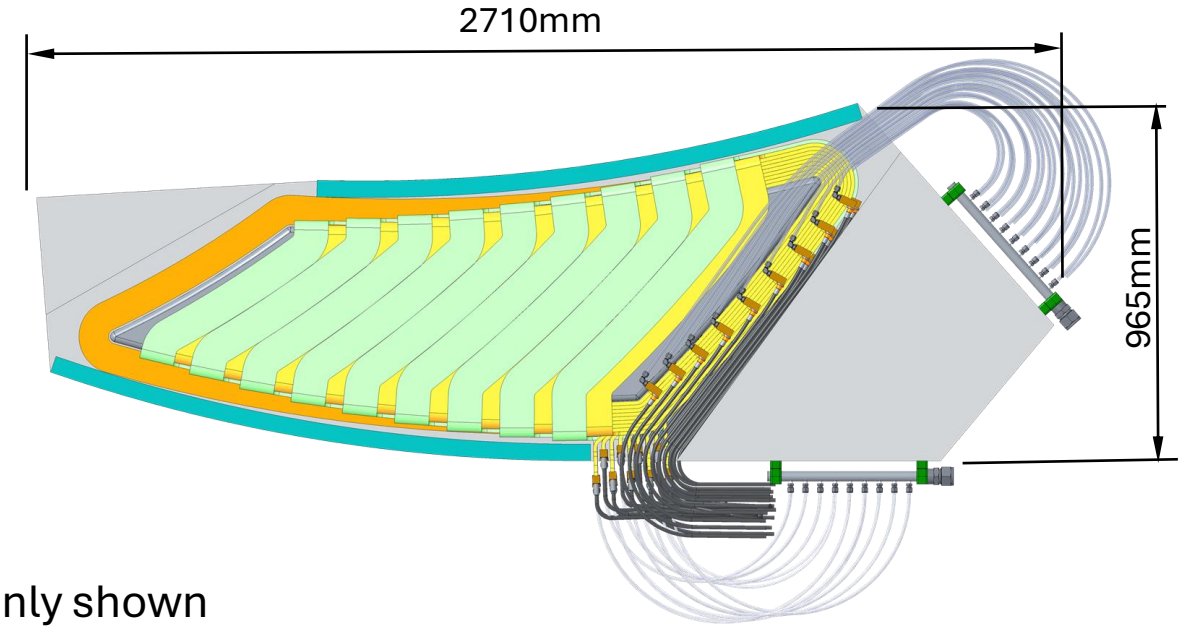


Preliminary LhARA FFA magnet specification:

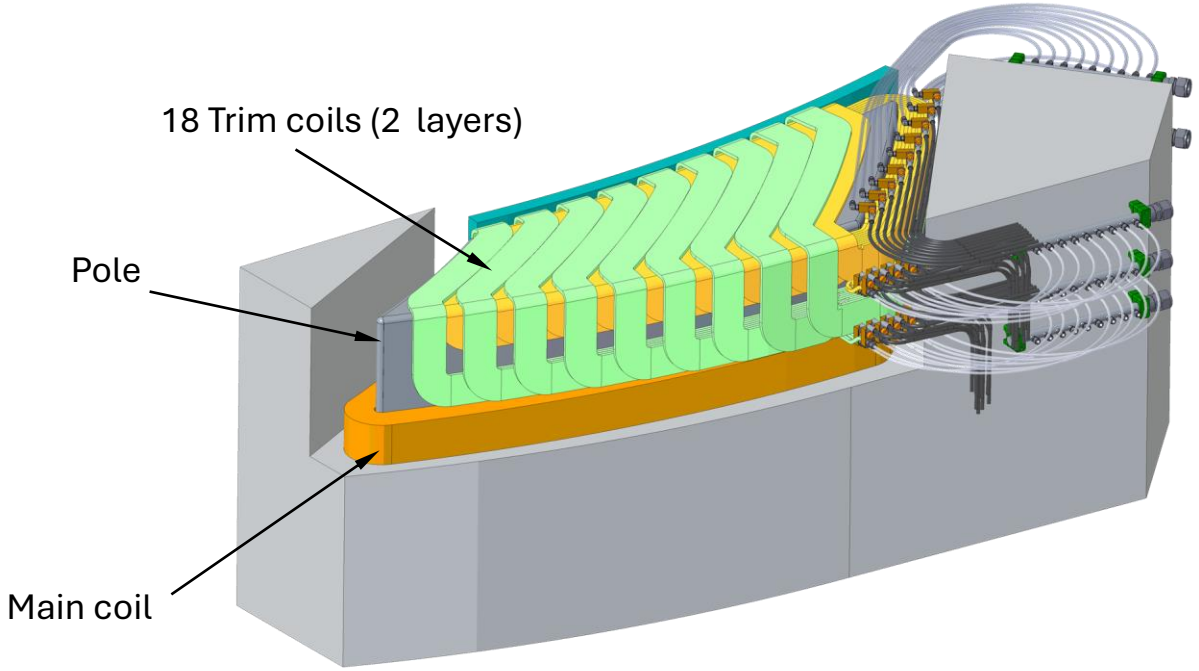
lattice : spiral scaling singlet,
N: 10,
ksi: 48.7 degree,
R0: 3.477m,
Rmax: 3.53m,
Rmin: 2.88m,
Gap: 9.5cm.

FFA Magnet

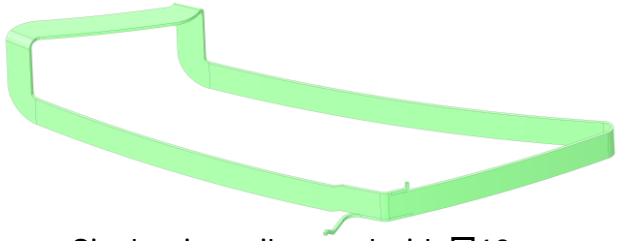




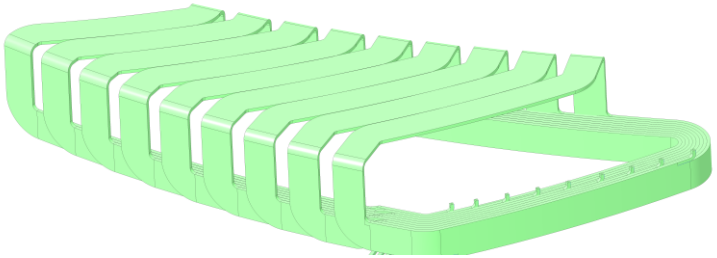
Trim coils only shown on lower pole

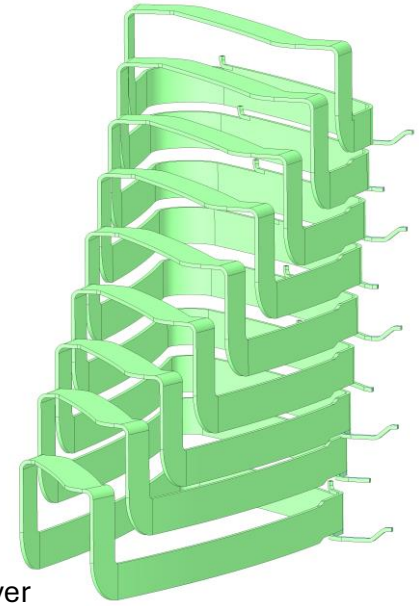


Trim Coils

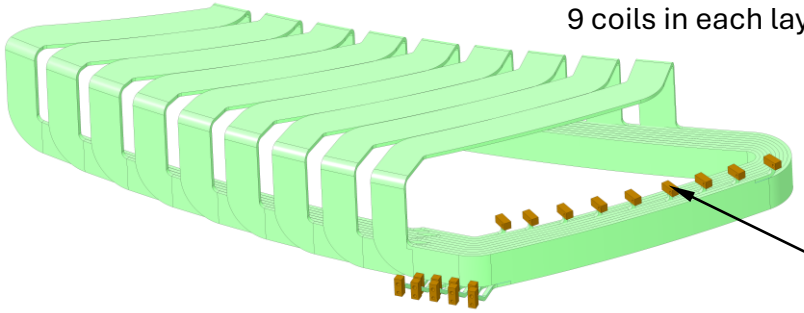


Single trim coil wound with ☐10mm conductor with Ø6mm hole

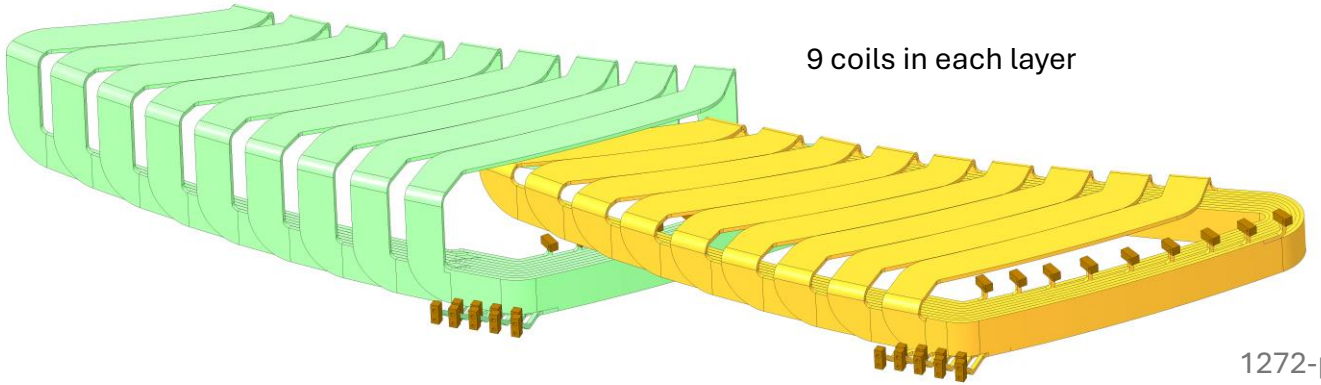




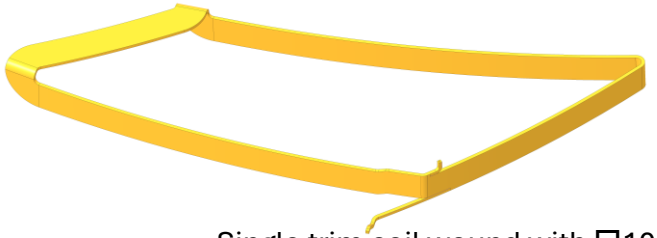
9 coils in each layer



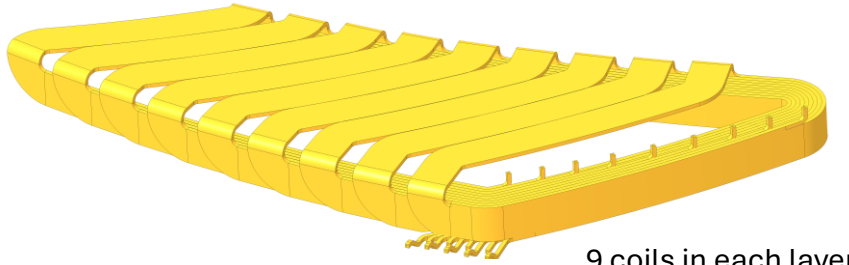
Braze connector blocks for water and electrical connections



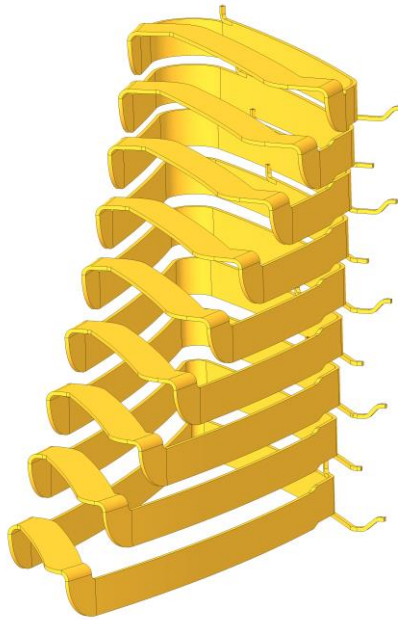
9 coils in each layer

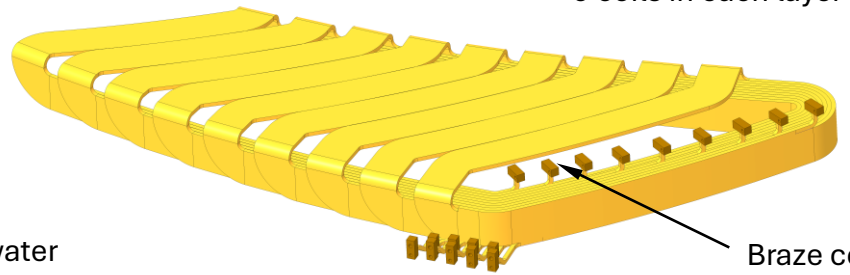


Single trim coil wound with ☐10mm conductor with Ø6mm hole

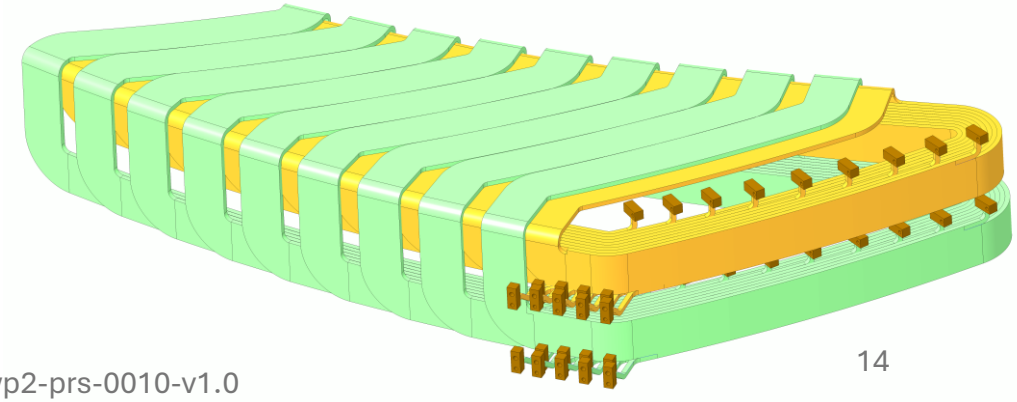


9 coils in each layer

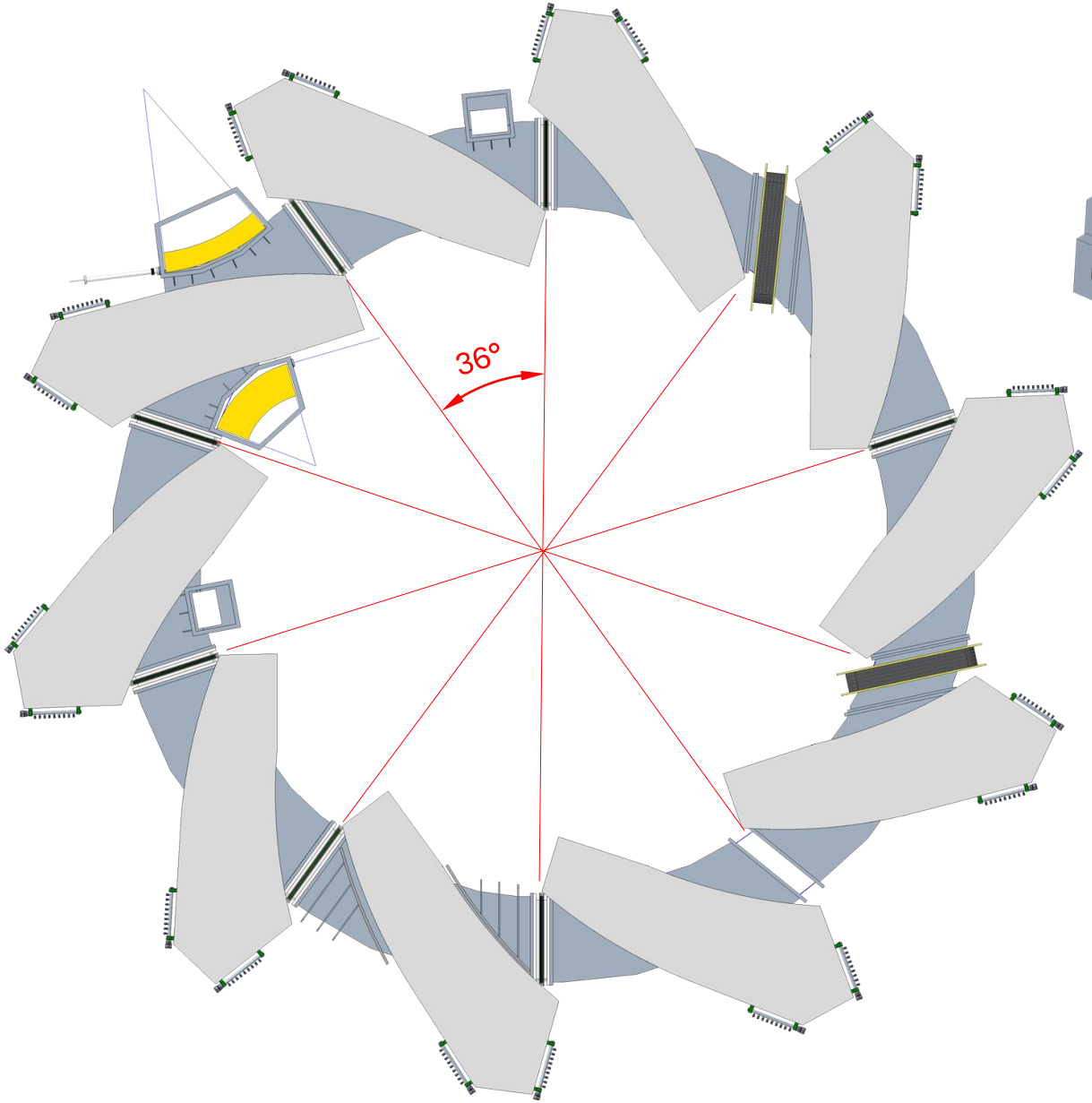


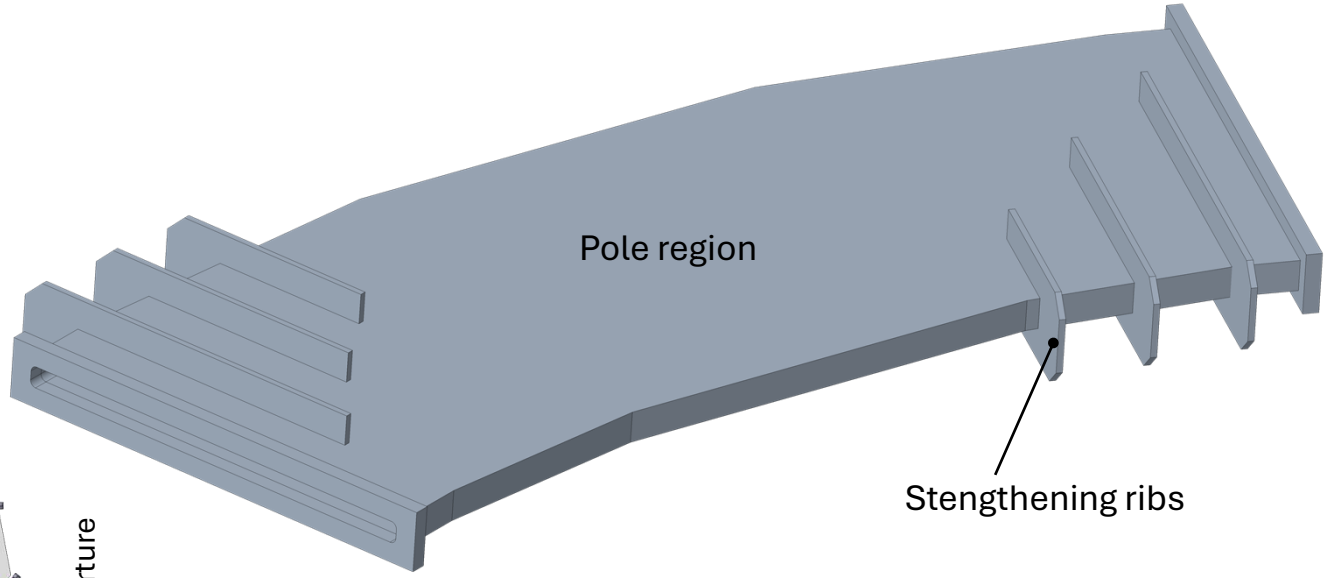


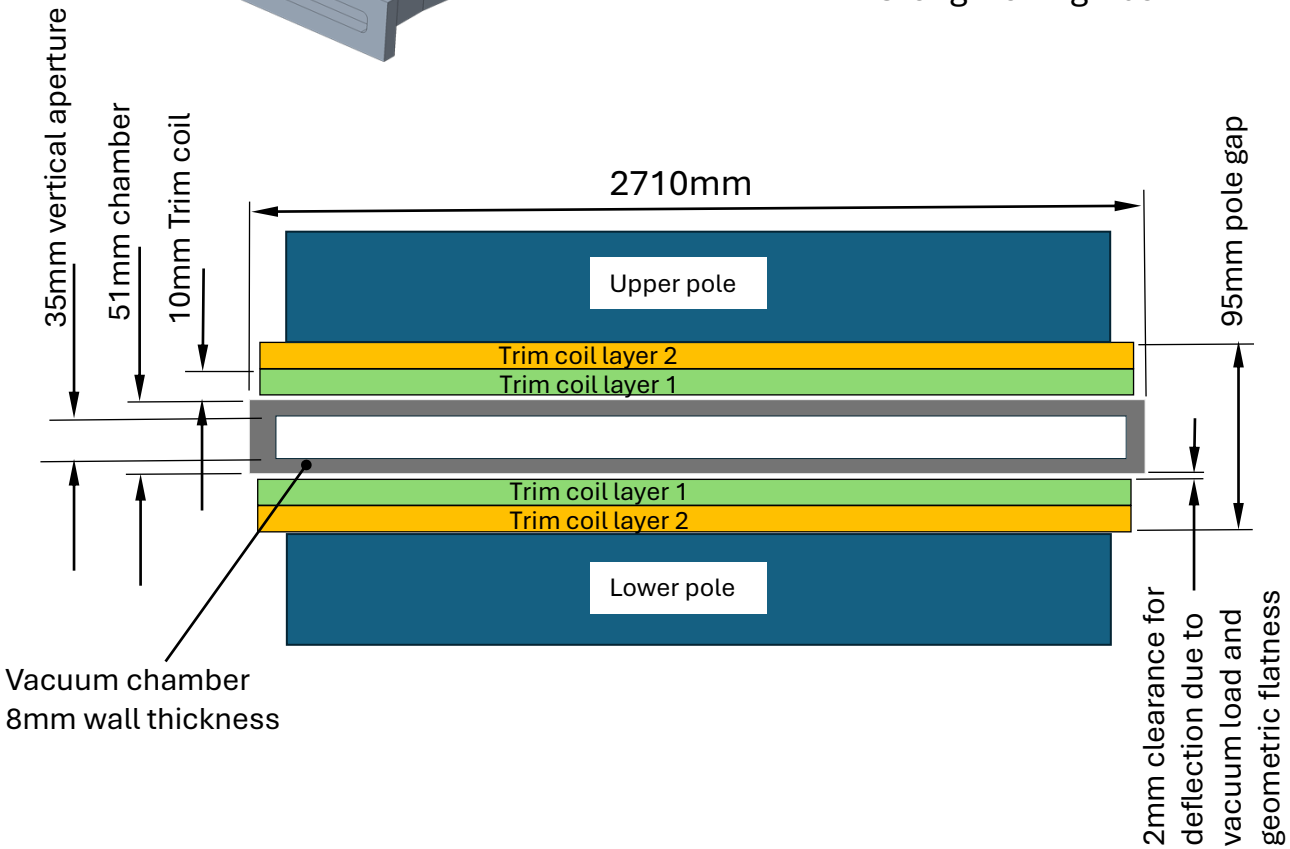
Braze connector blocks for water and electrical connections



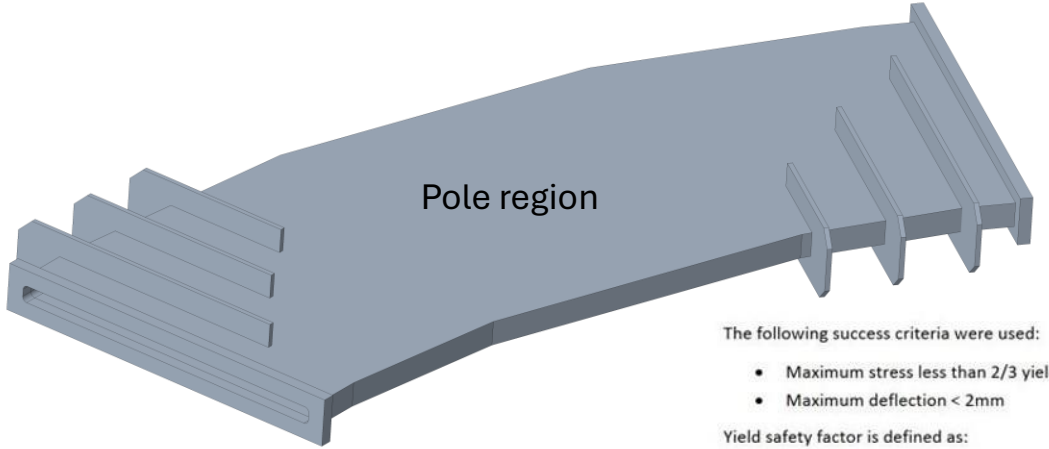
Ring Vacuum Chamber – Stainless Steel

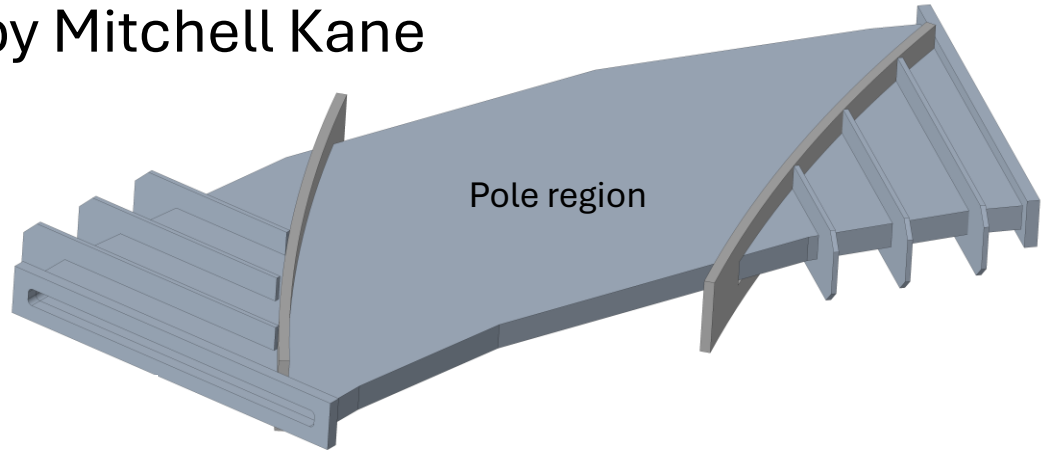






Ring Vacuum Chamber – Finite Element Analyses by Mitchell Kane





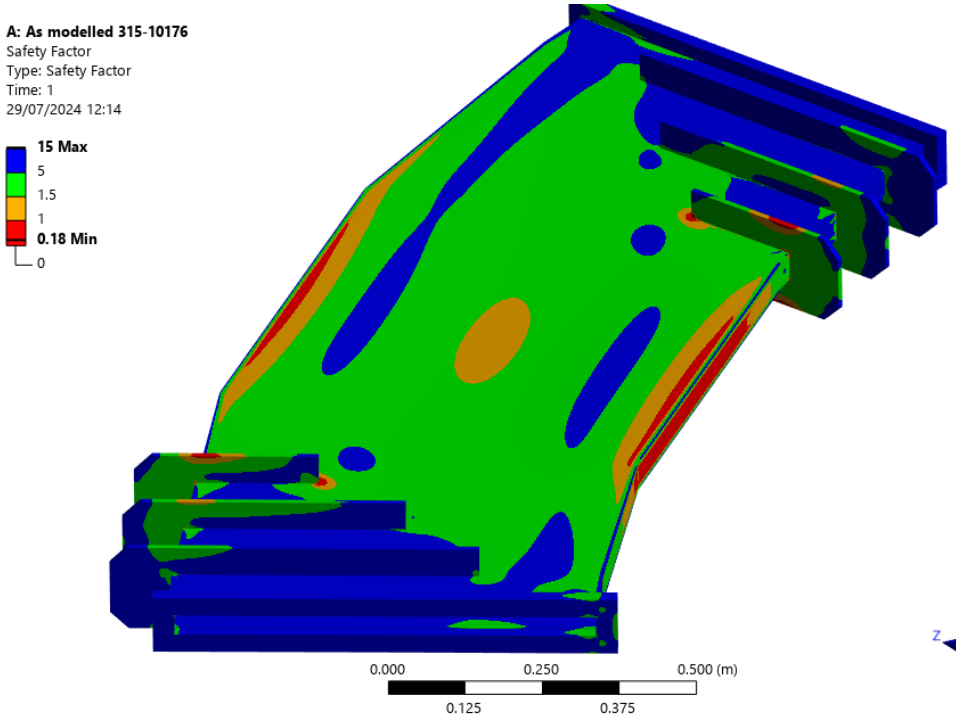
The following success criteria were used:

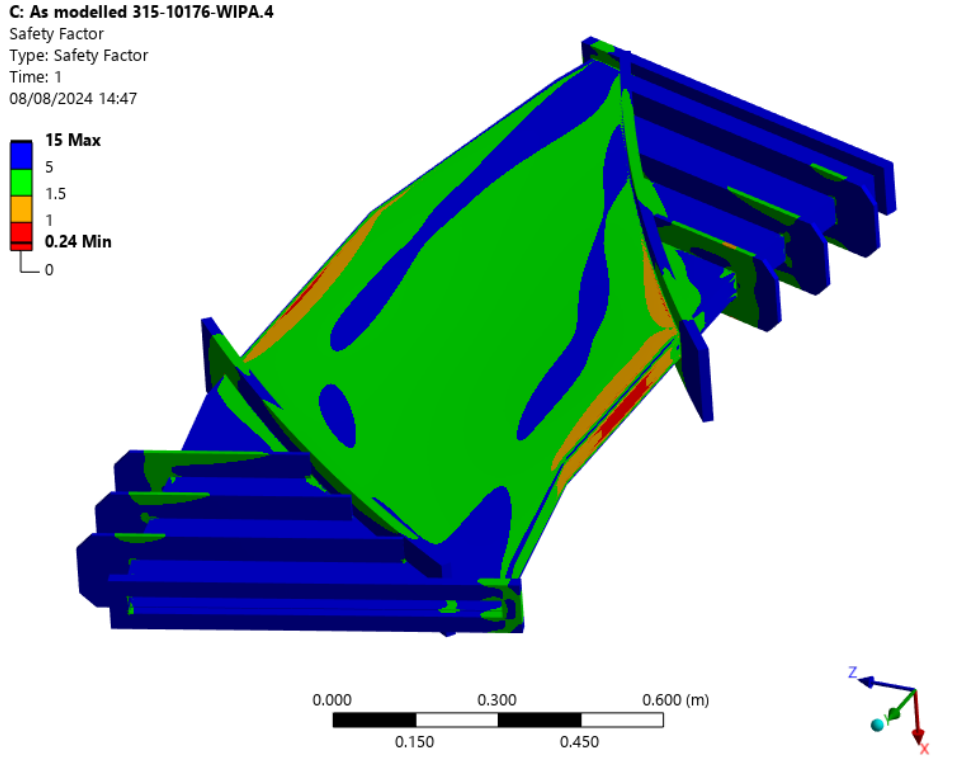
- Maximum stress less than 2/3 yield, i.e., yield safety factor of 1.5
- Maximum deflection < 2mm

Yield safety factor is defined as:

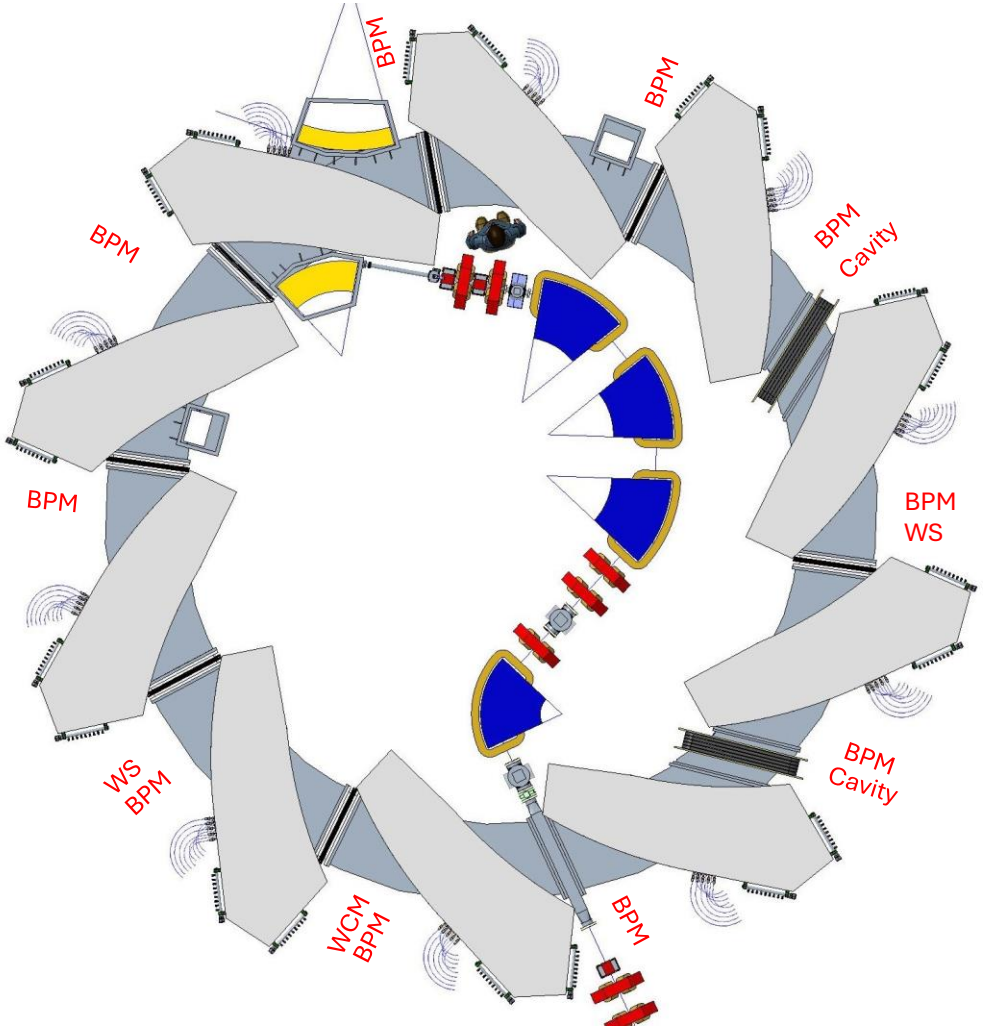
$$Yield\ safety\ factor = \frac{Yield\ stress}{Stress}$$

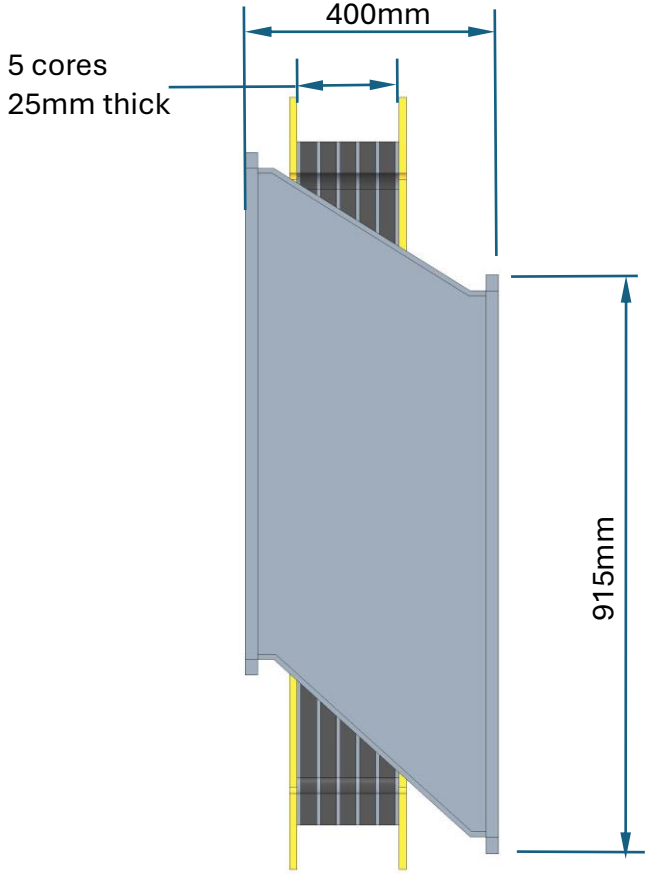
Yield safety factors are used for easier comparisons between materials. It is clearer to determine whether stresses are acceptable without having to refer back to the yield stress for each material.

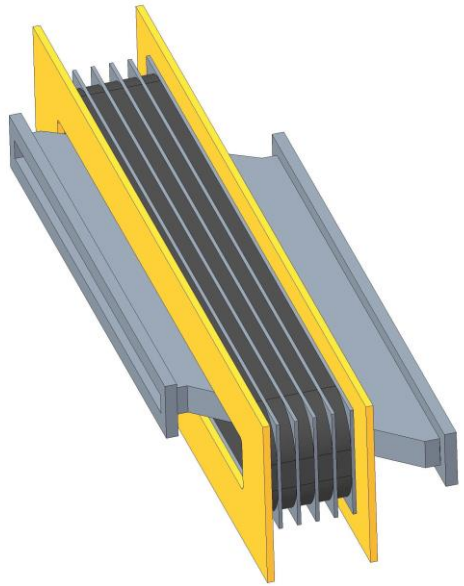




RF Cavity

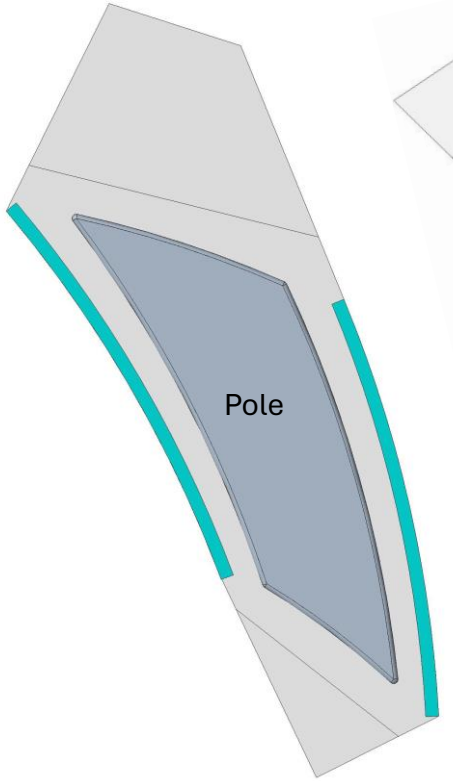






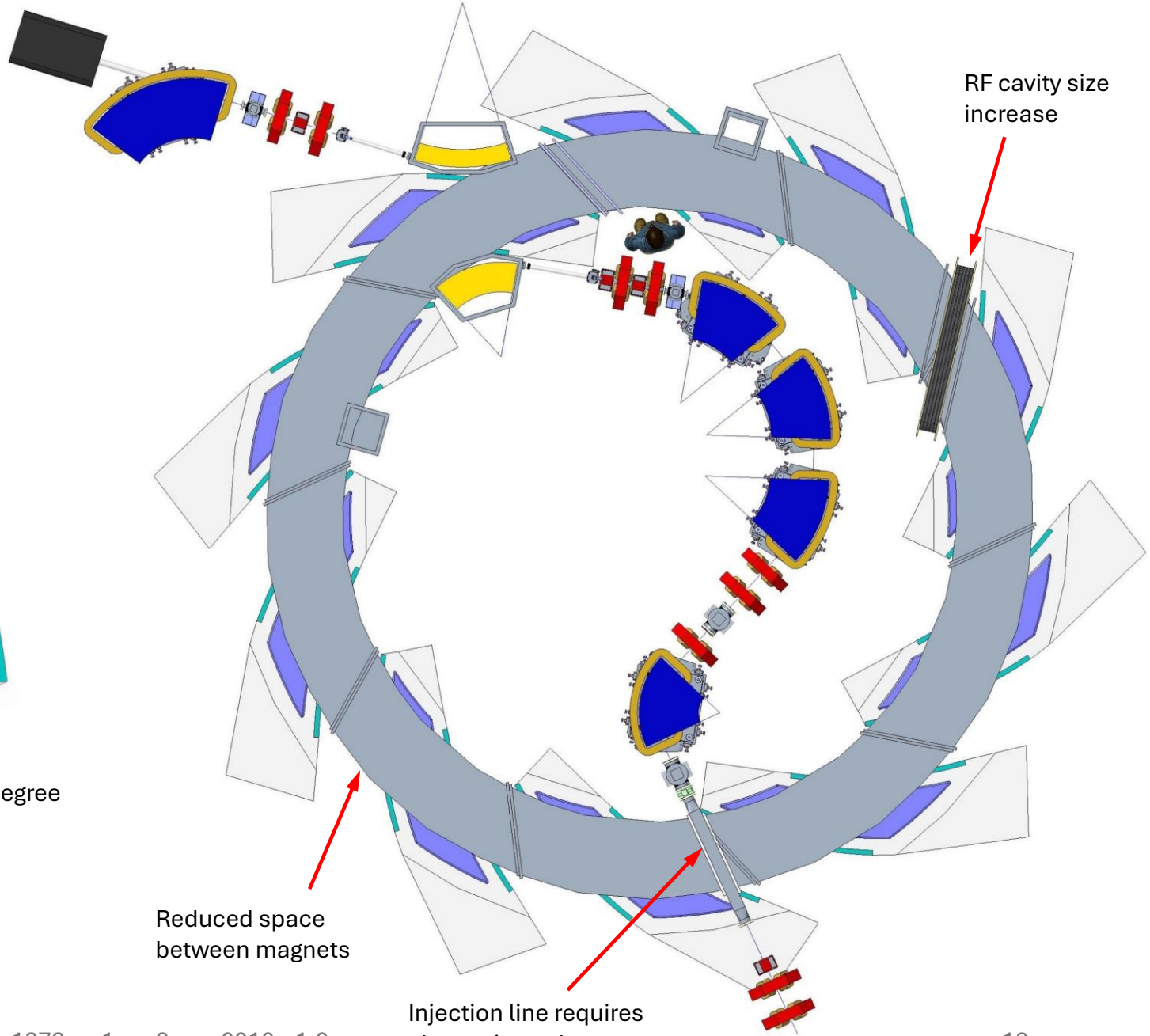
FFA MA Cavity

FFA Ring - spiral angle 53.9 degrees

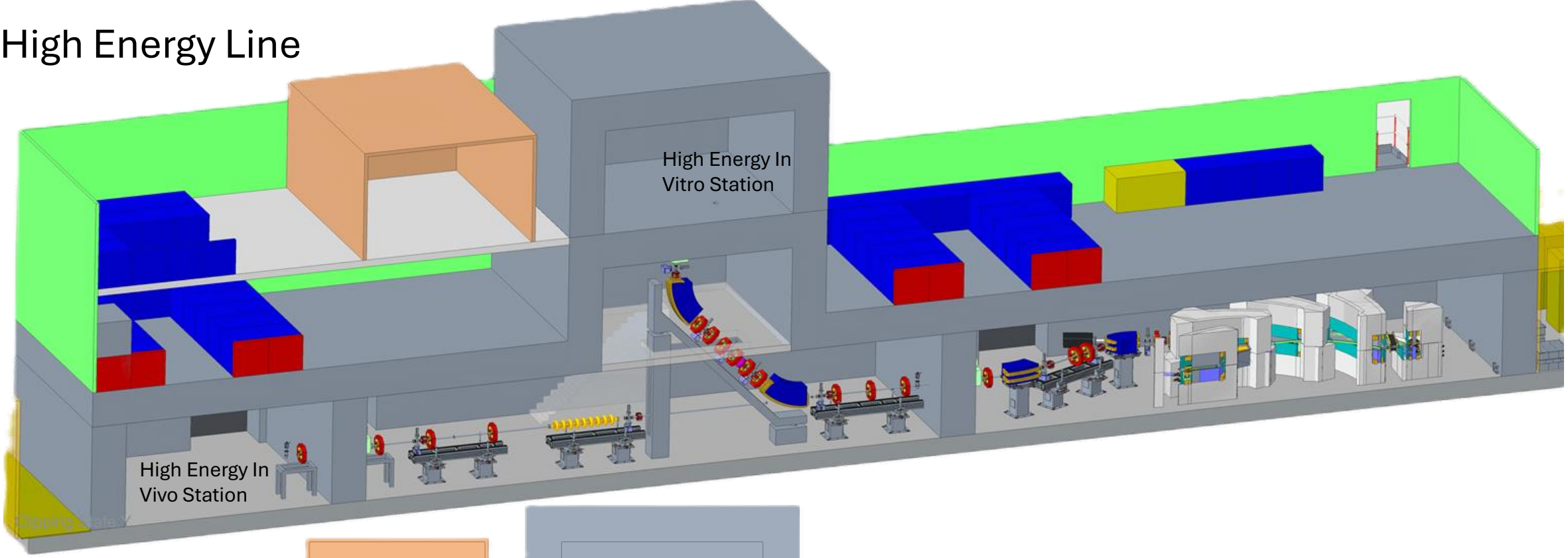


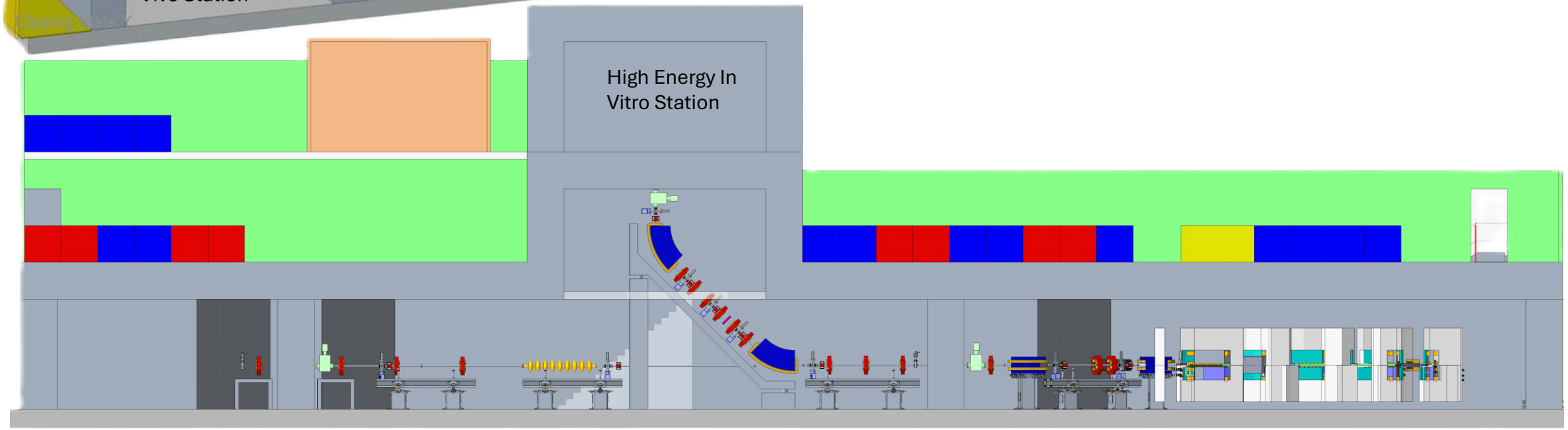
Spiral angle 48.7 degree

Spiral angle 53.9 degree



High Energy Line





Questions

Any questions that cannot be answered by the team in attendance can be sent to myself at

clive.hill@stfc.ac.uk

Thank you