Science and Technology Facilities Council

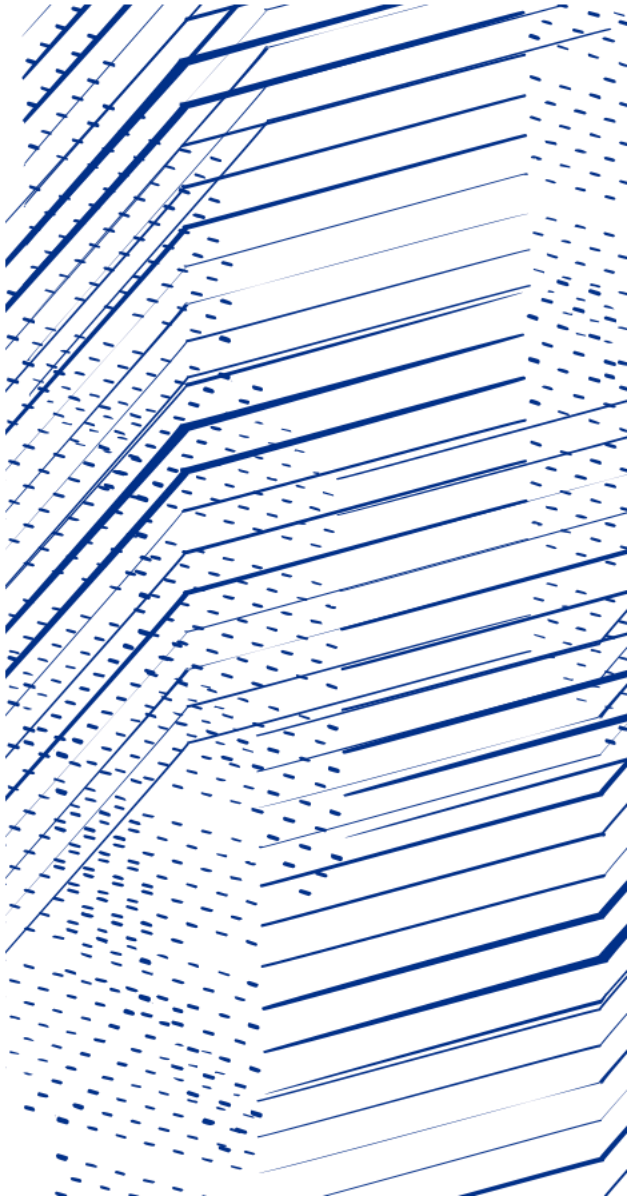
ITRF - LhARA

FFA Review

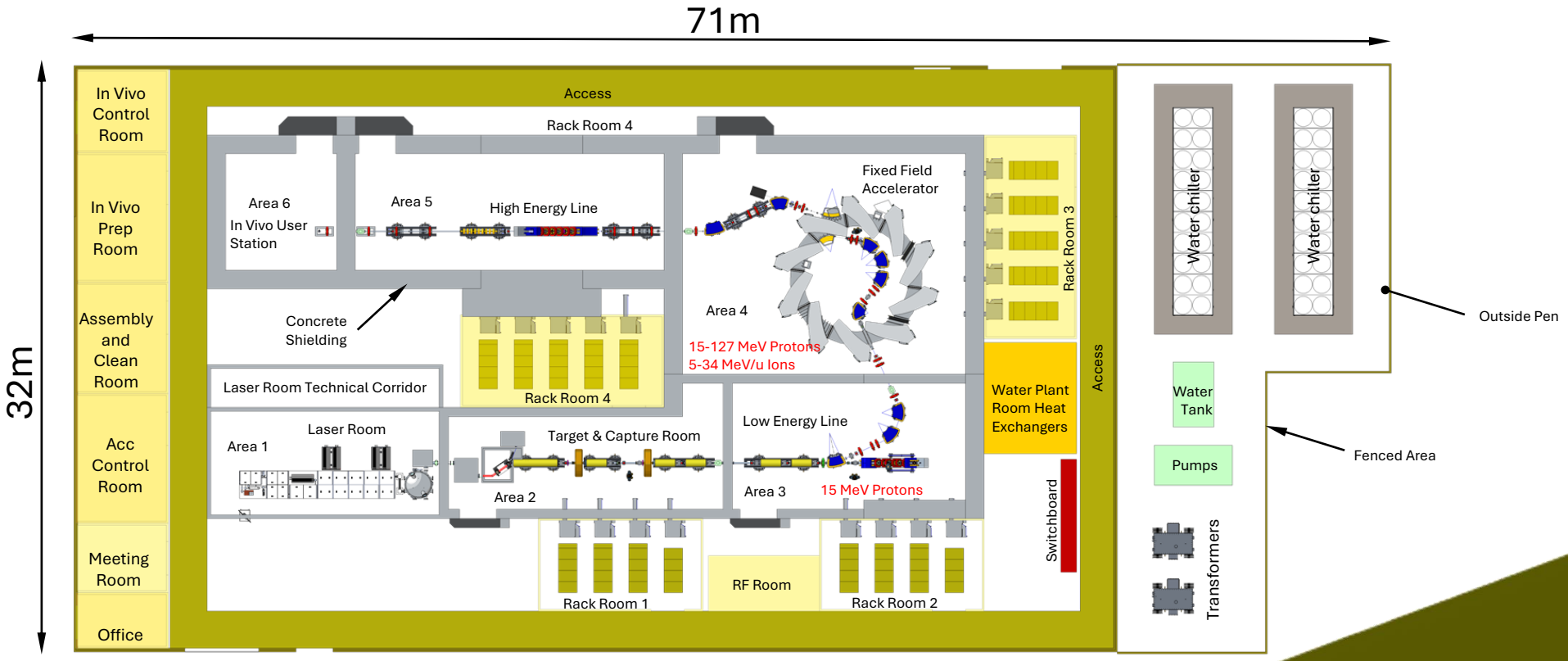
1272-pa1-meng-prs-0023-v0.1-FFA Review

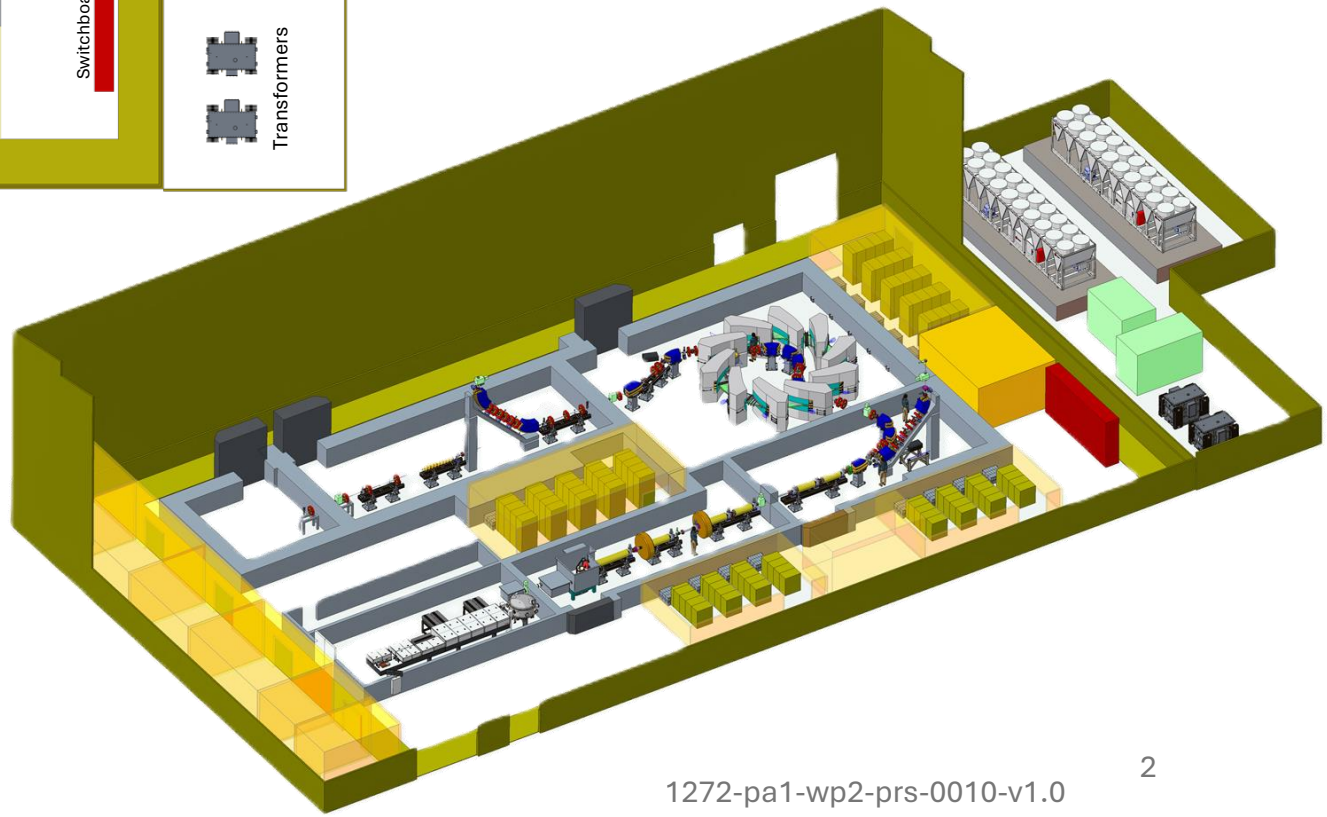
FFADesign Review
Date 26/02/25

Clive Hill, UKRI-STFC-Daresbury Laboratory

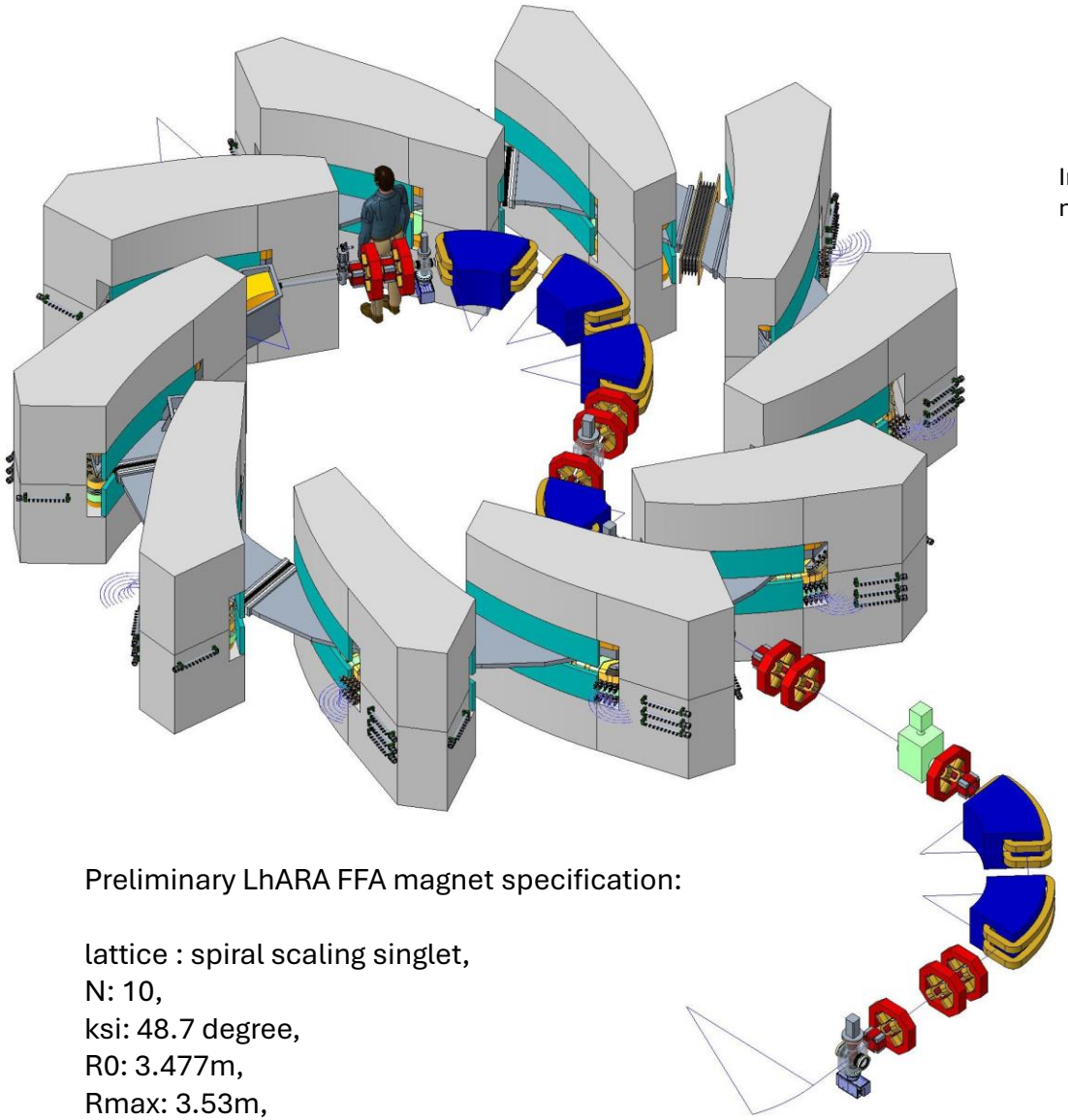


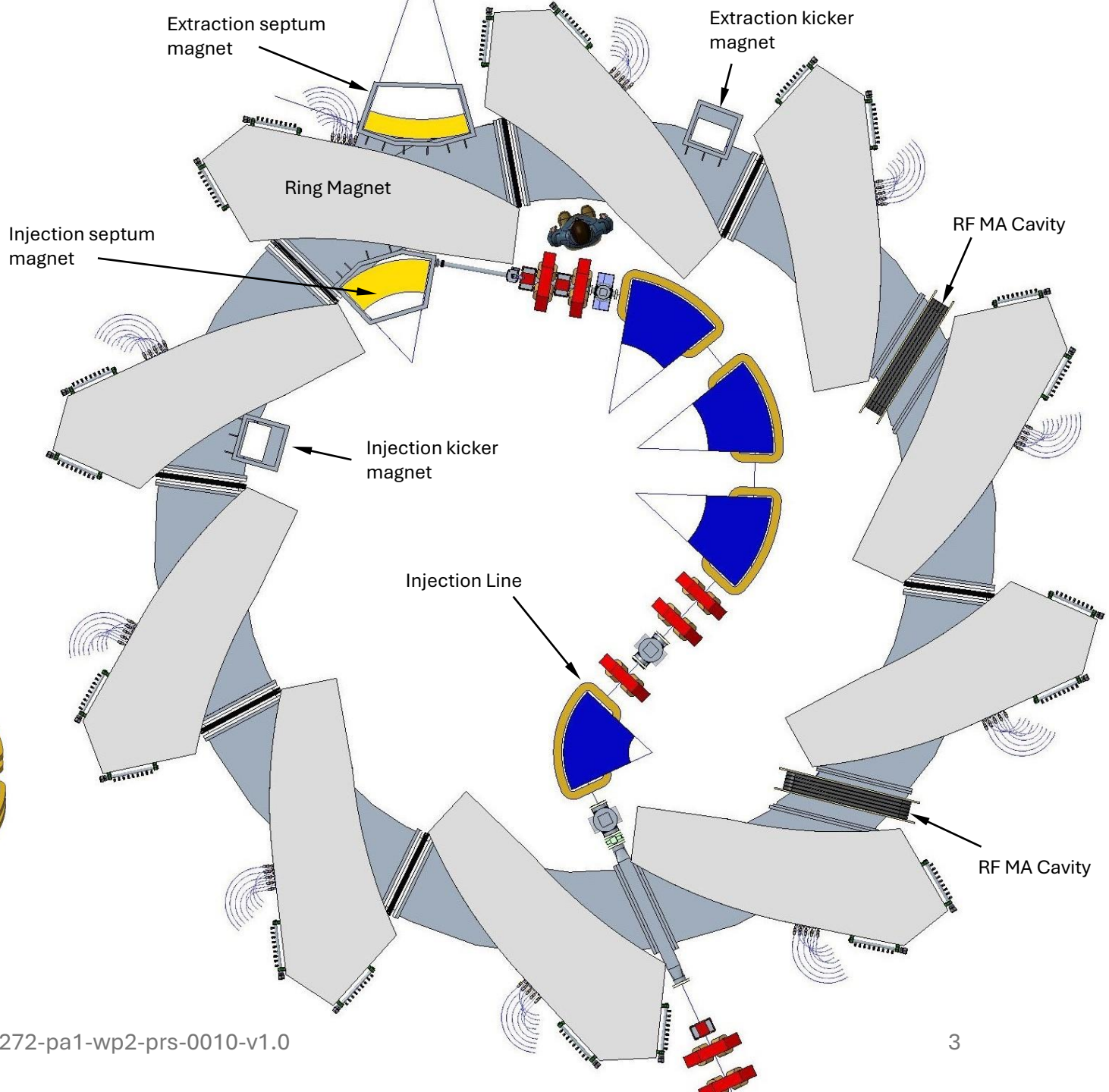
ITRF Facility Layout
Ground Floor





FFA Injection Line & Ring Magnet Yoke

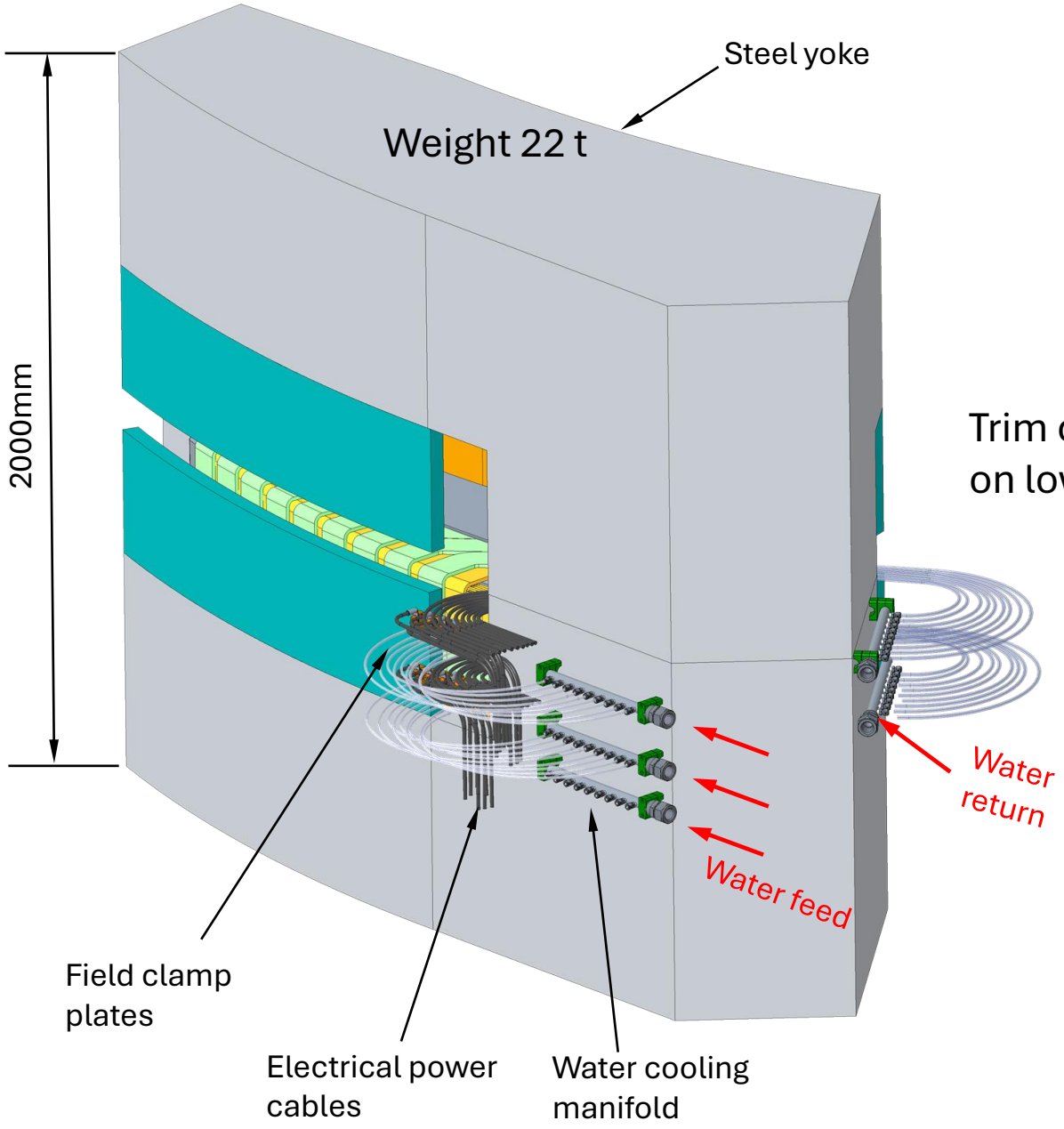


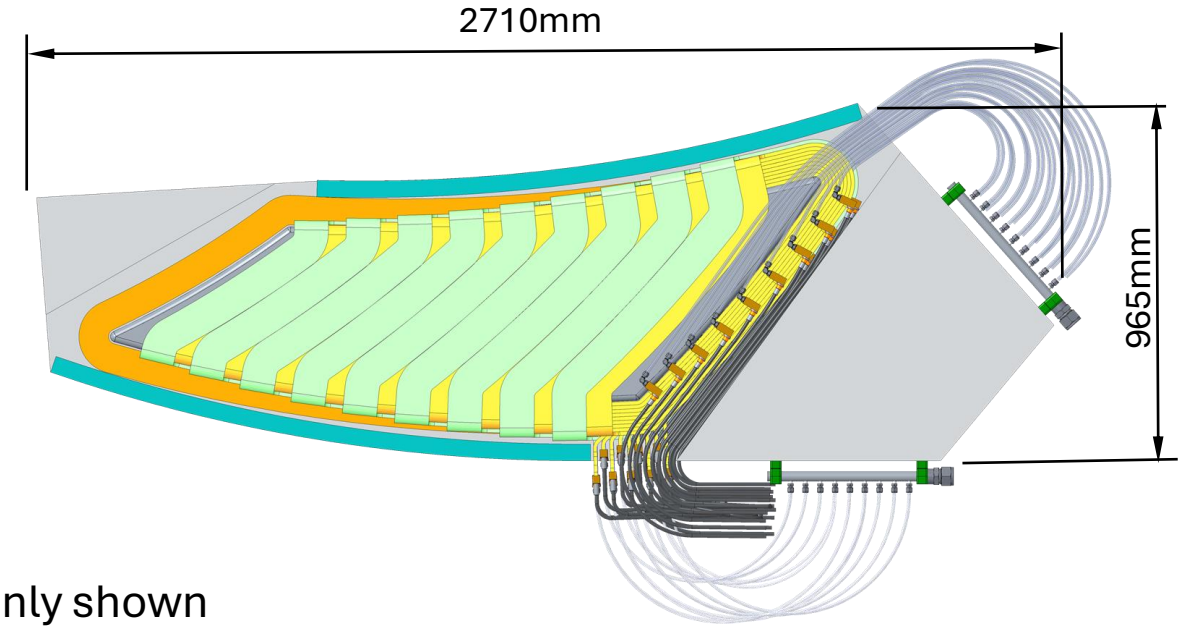


Preliminary LhARA FFA magnet specification:

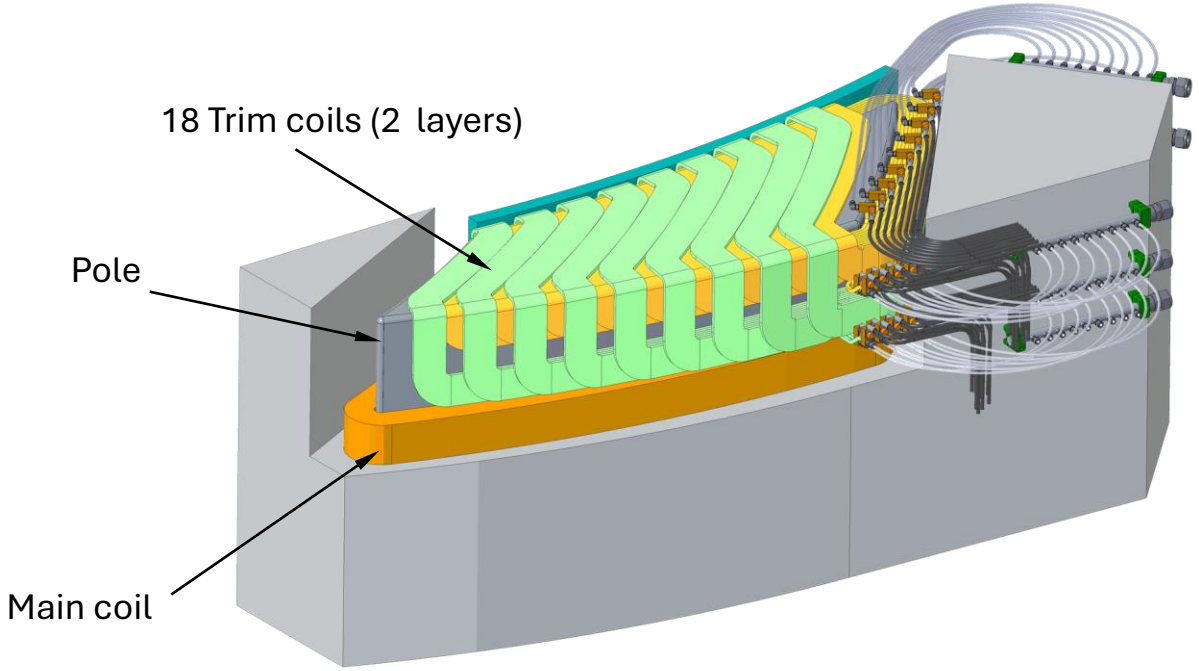
lattice : spiral scaling singlet,
N: 10,
ksi: 48.7 degree,
R0: 3.477m,
Rmax: 3.53m,
Rmin: 2.88m,
Gap: 9.5cm.

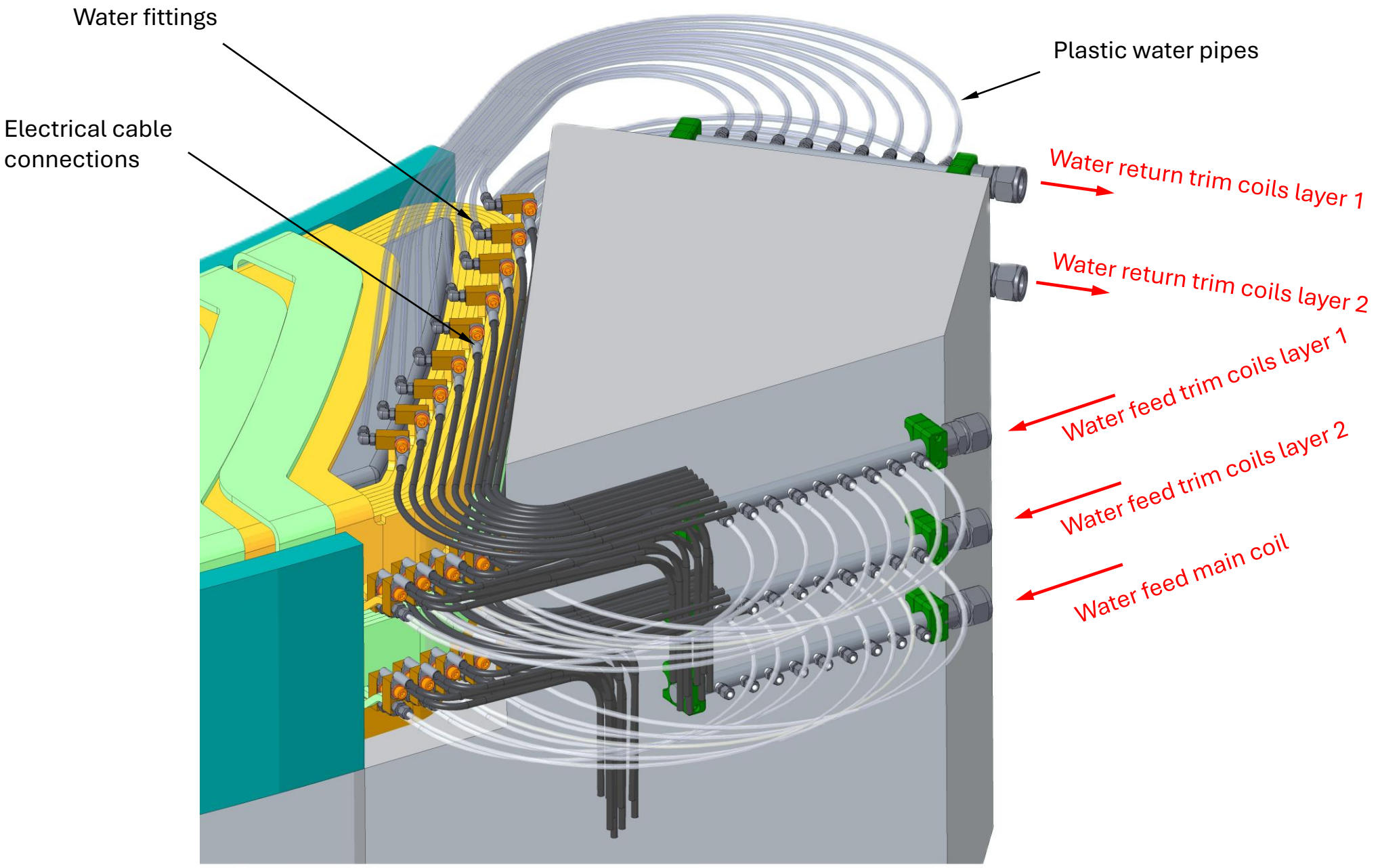
FFA Magnet



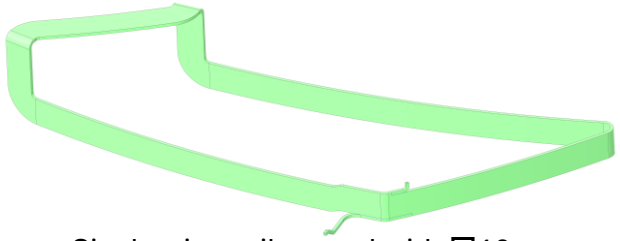


Trim coils only shown on lower pole

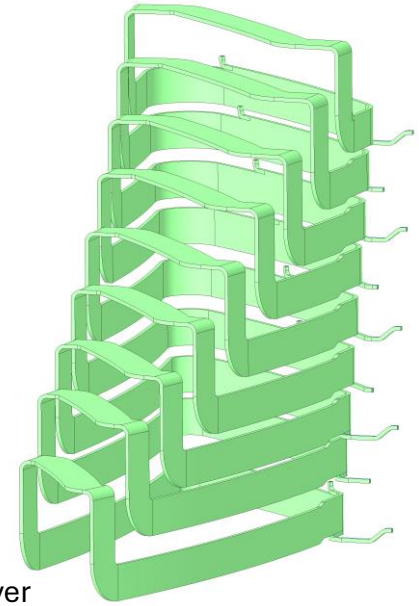


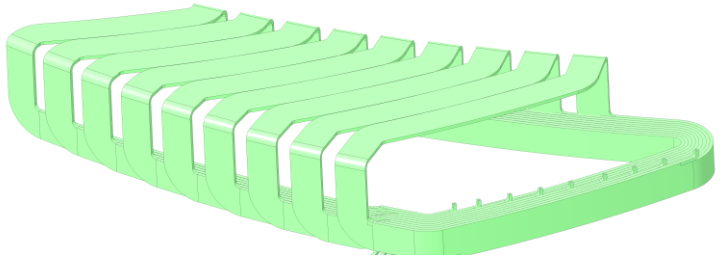

Water fittings
Electrical cable connections
Plastic water pipes
Water return trim coils layer 1
Water return trim coils layer 2
Water feed trim coils layer 1
Water feed trim coils layer 2
Water feed main coil

Trim Coils

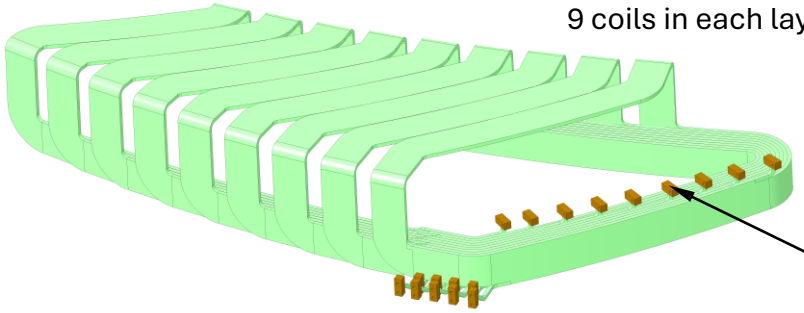


Single trim coil wound with ☐10mm conductor with Ø6mm hole

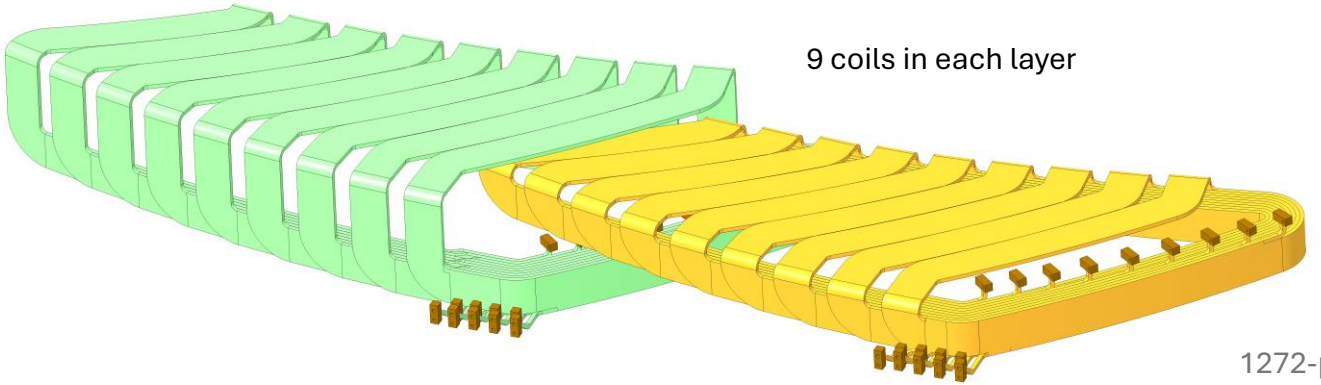




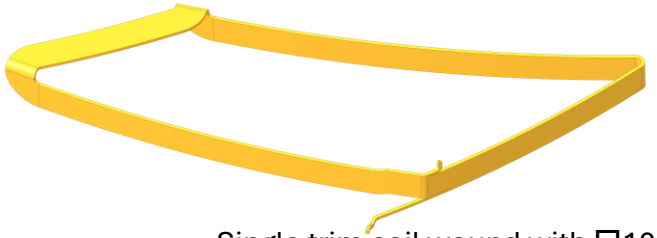
9 coils in each layer



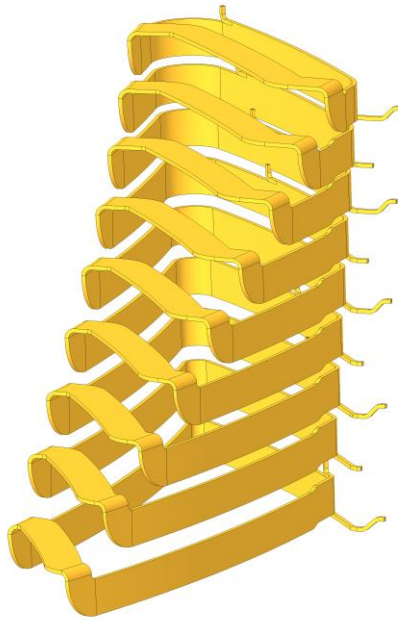
Braze connector blocks for water and electrical connections

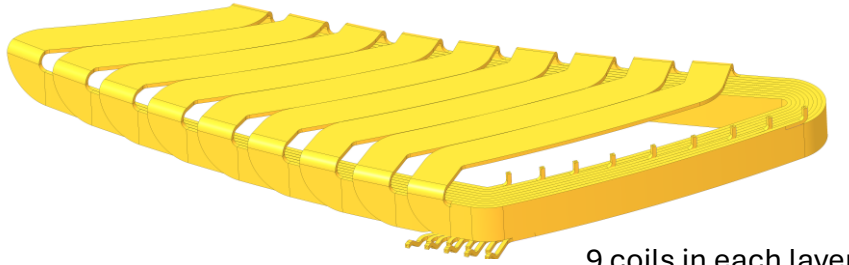


9 coils in each layer

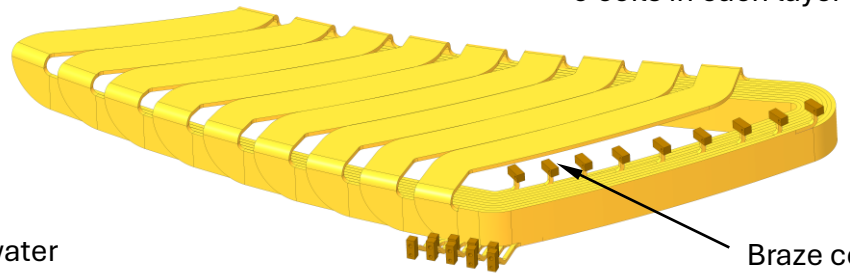


Single trim coil wound with ☐10mm conductor with Ø6mm hole

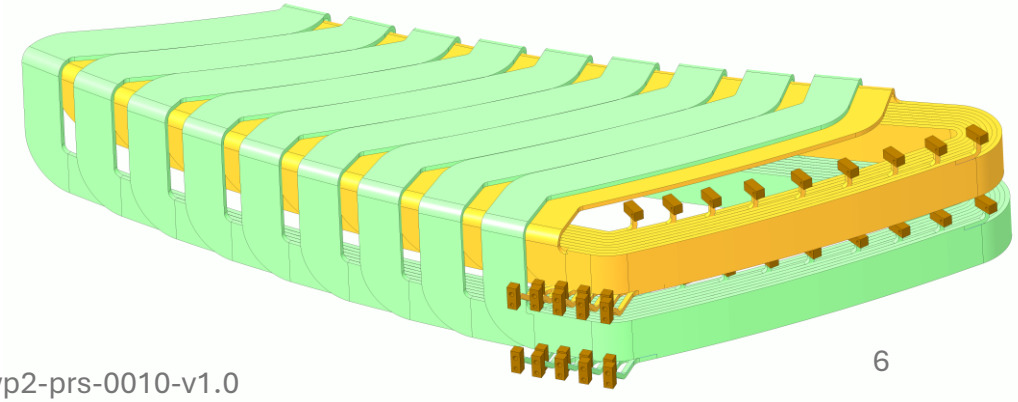




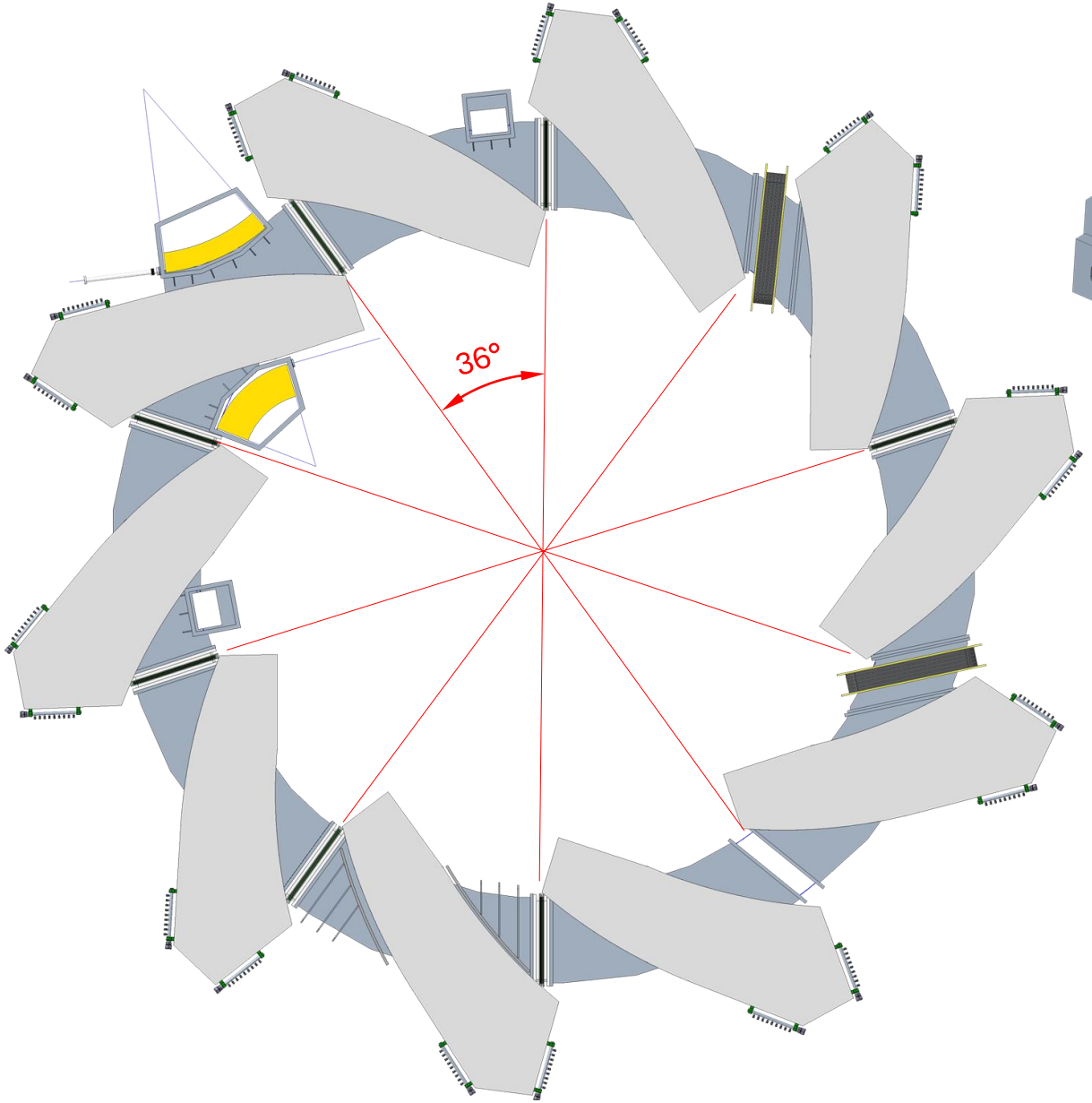
9 coils in each layer

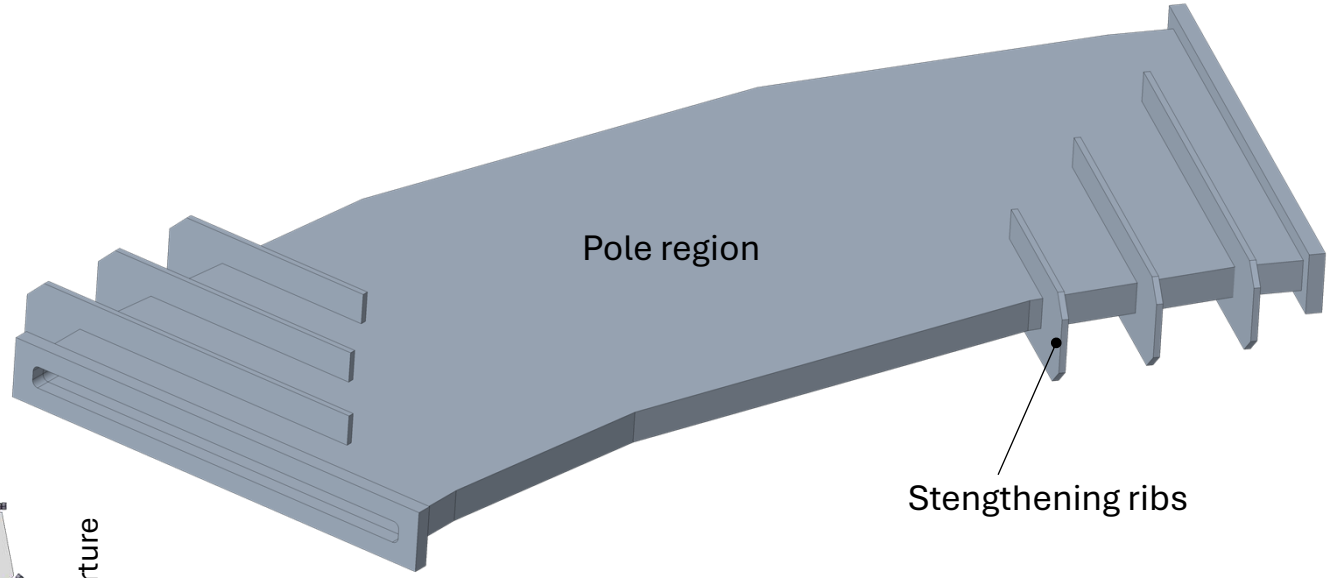


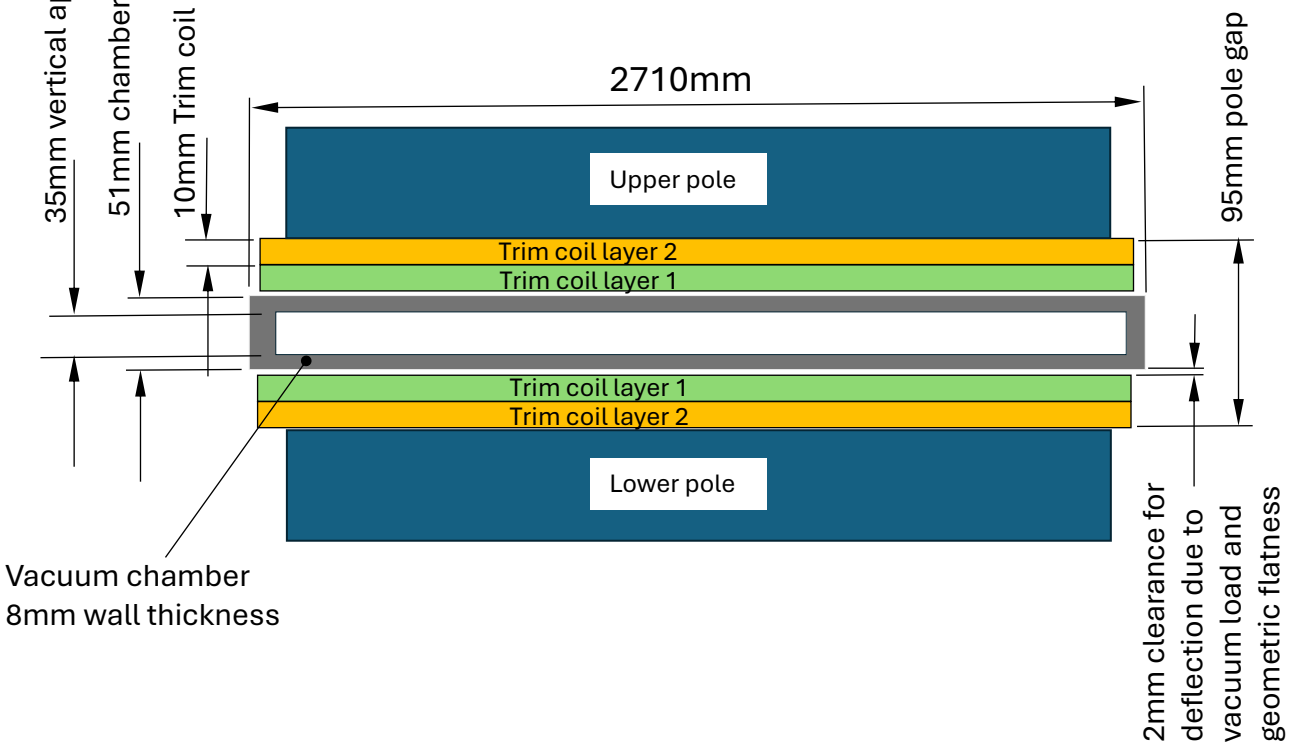
Braze connector blocks for water and electrical connections



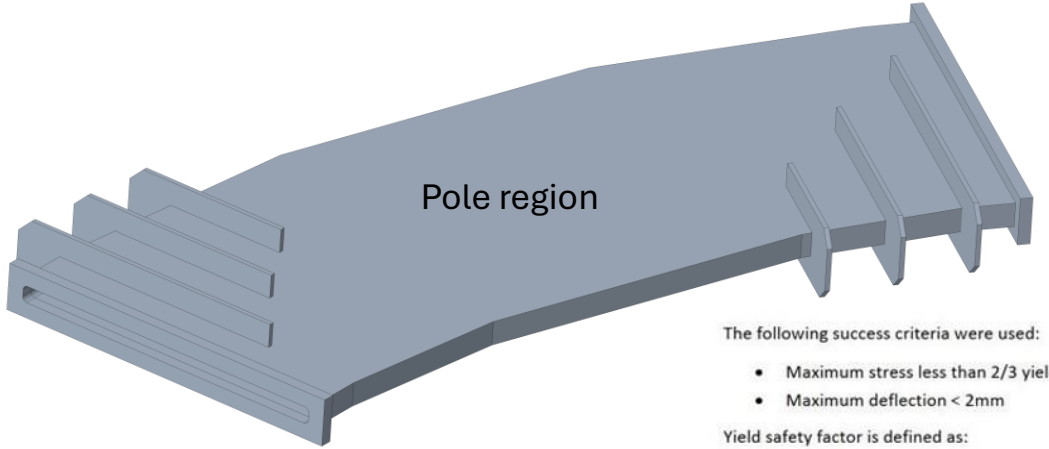
Ring Vacuum Chamber – Stainless Steel

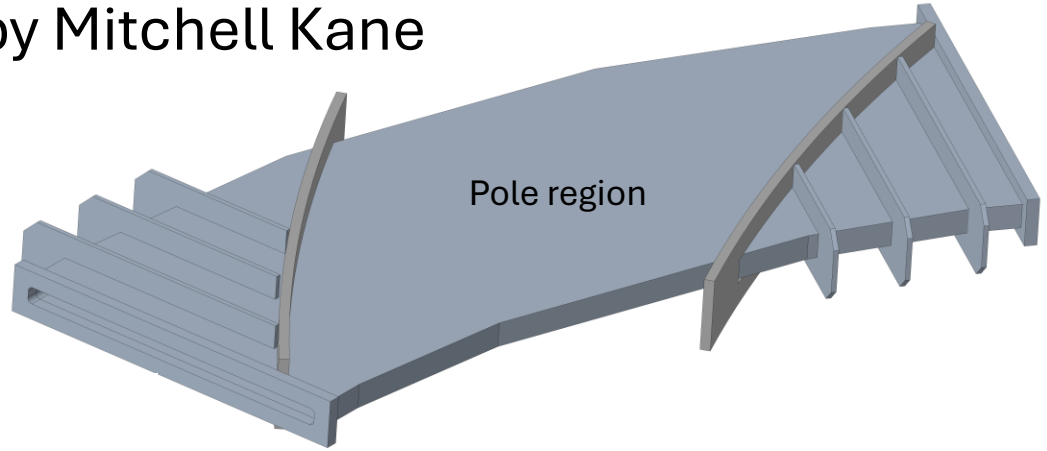






Ring Vacuum Chamber – Finite Element Analyses by Mitchell Kane





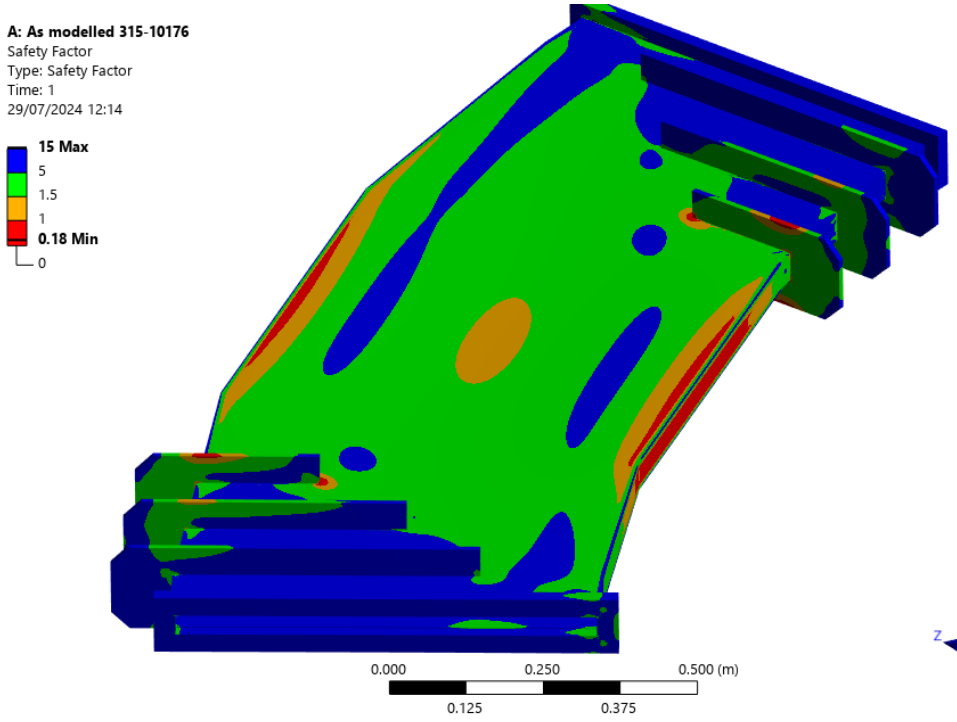
The following success criteria were used:

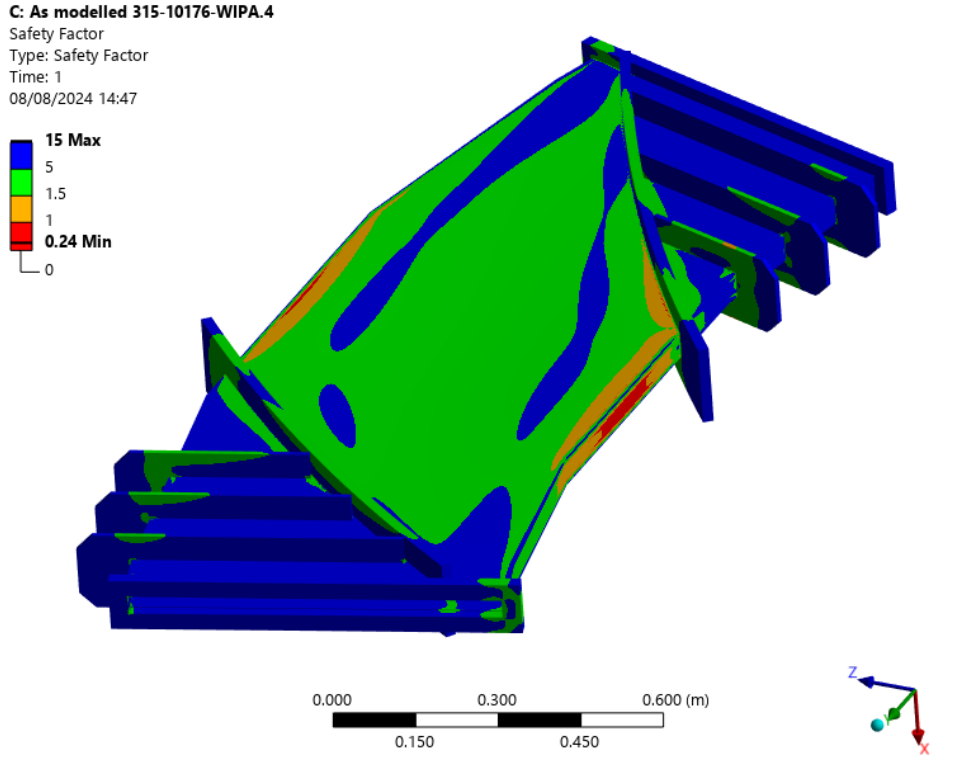
- Maximum stress less than 2/3 yield, i.e., yield safety factor of 1.5
- Maximum deflection < 2mm

Yield safety factor is defined as:

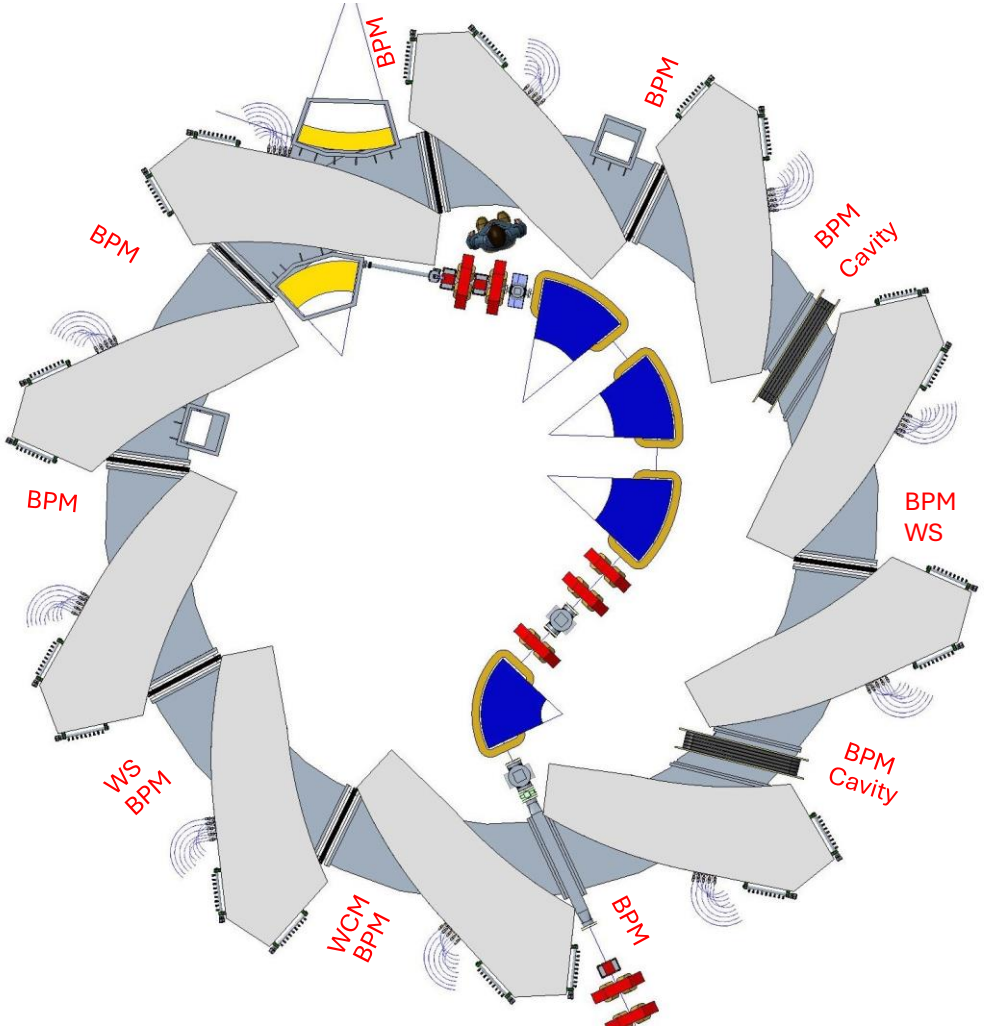
$$Yield\ safety\ factor = \frac{Yield\ stress}{Stress}$$

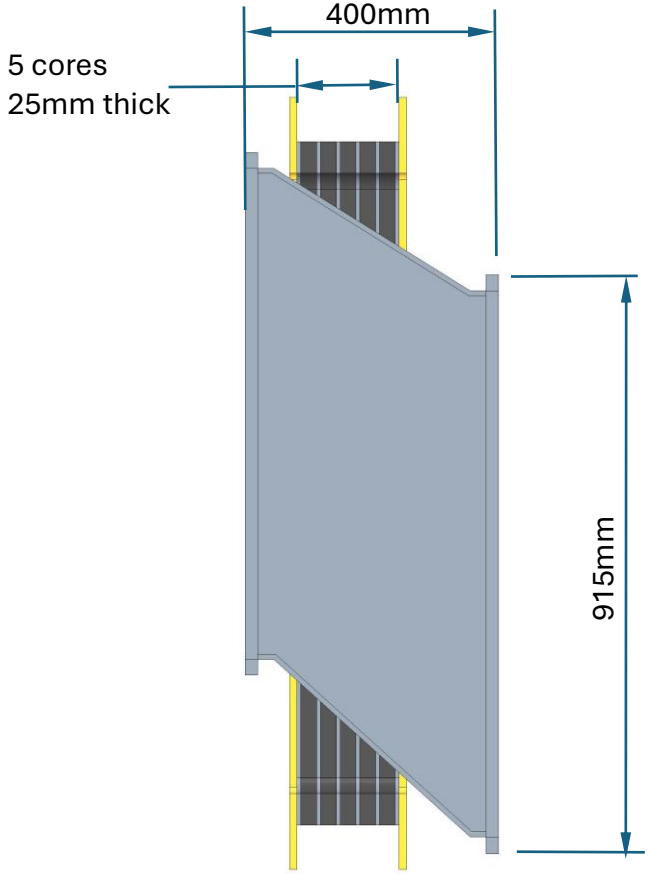
Yield safety factors are used for easier comparisons between materials. It is clearer to determine whether stresses are acceptable without having to refer back to the yield stress for each material.

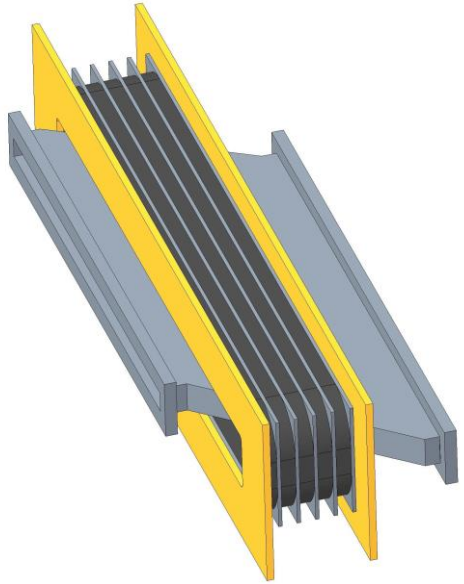




RF Cavity and Diagnostics

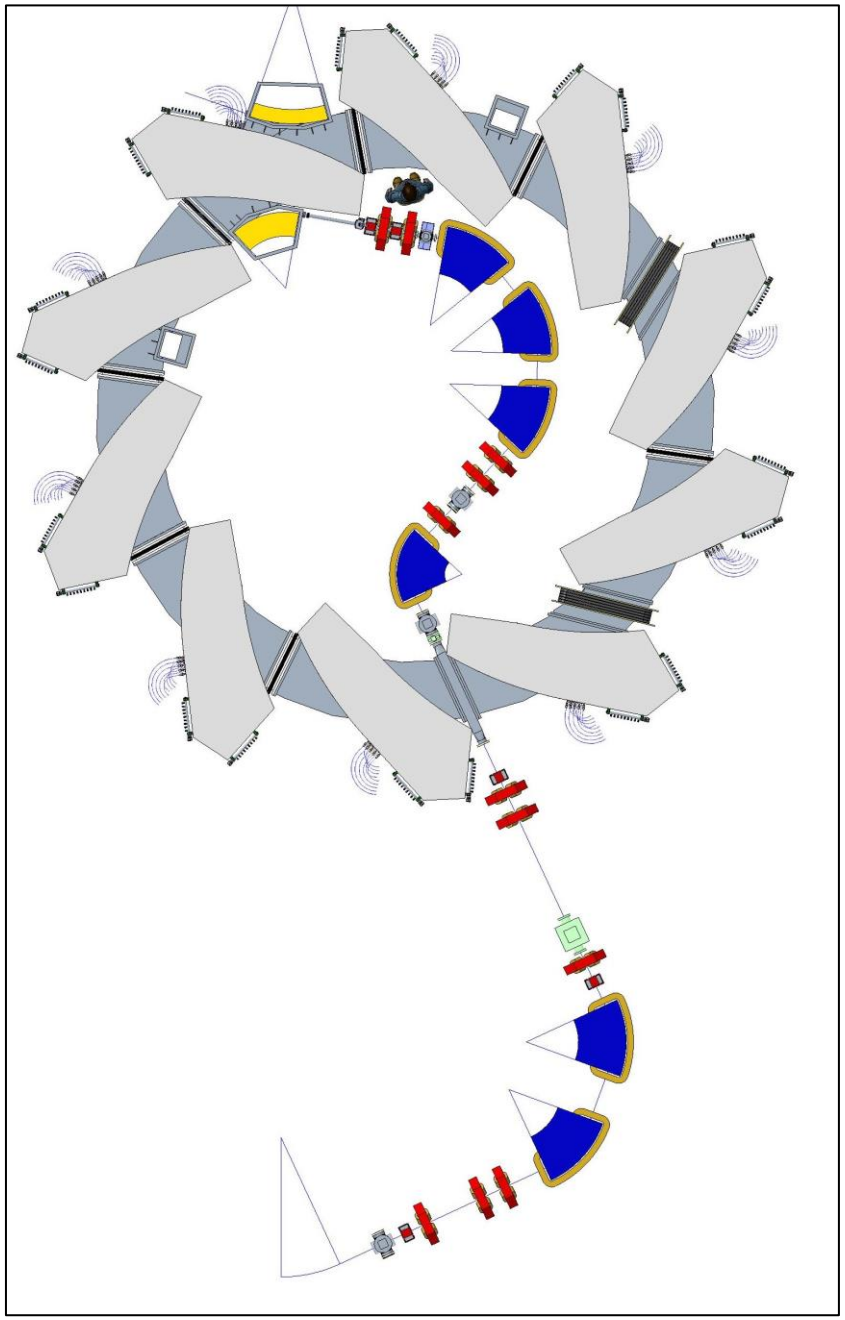


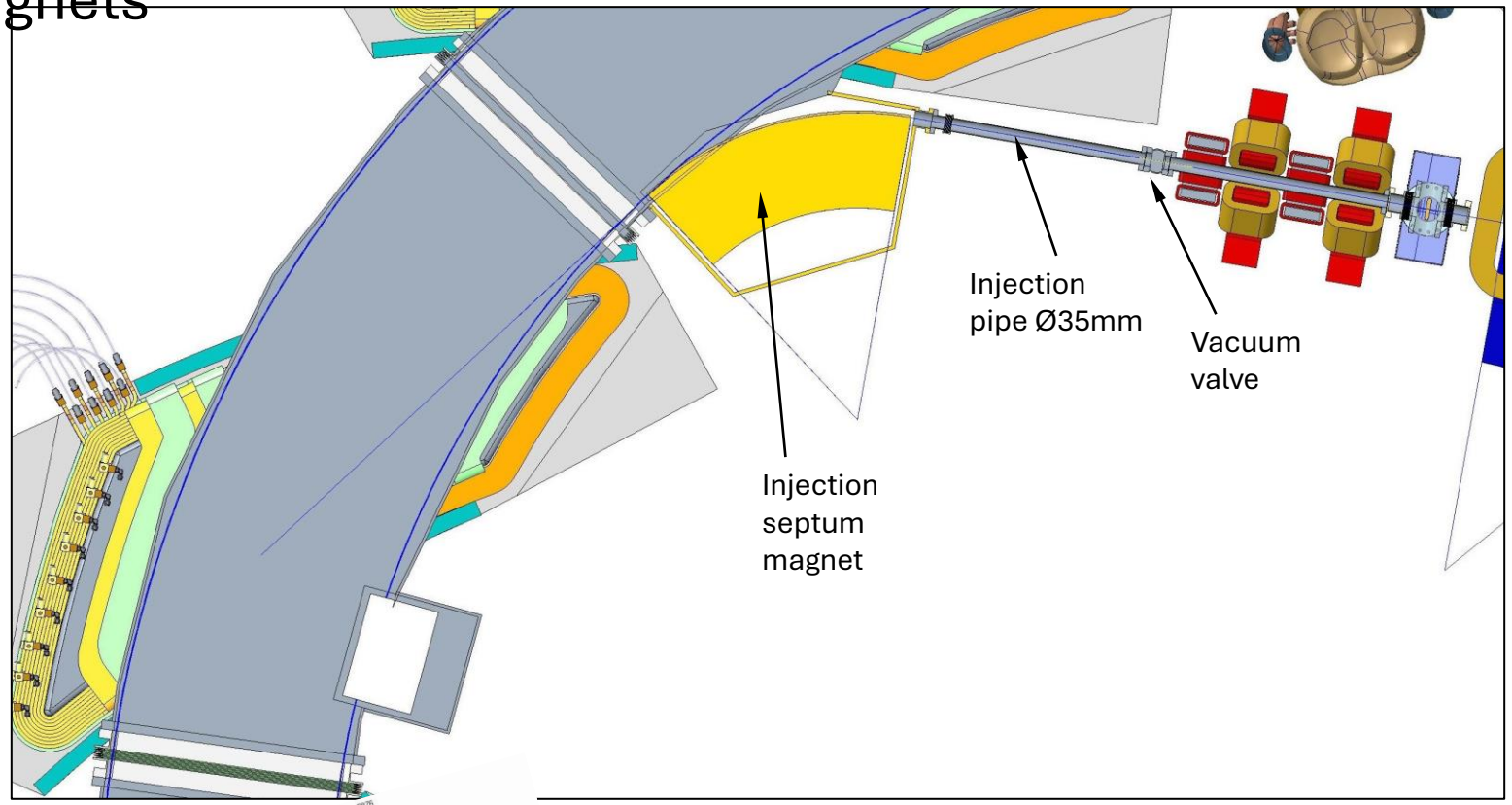


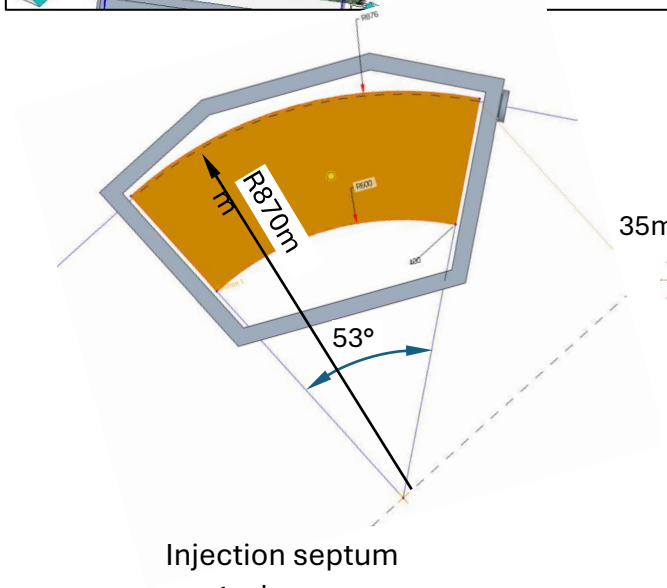


FFA MA Cavity

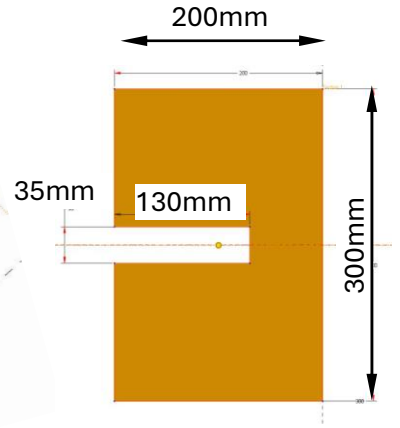
Injection Septum and Kicker Magnets





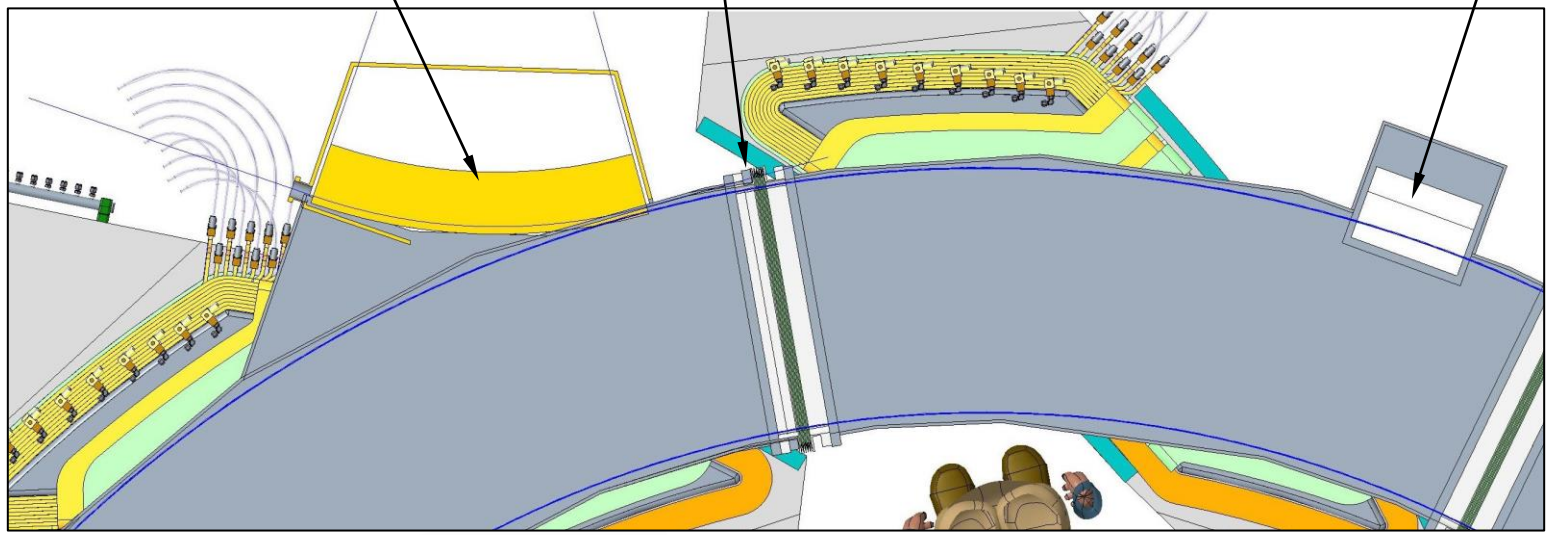


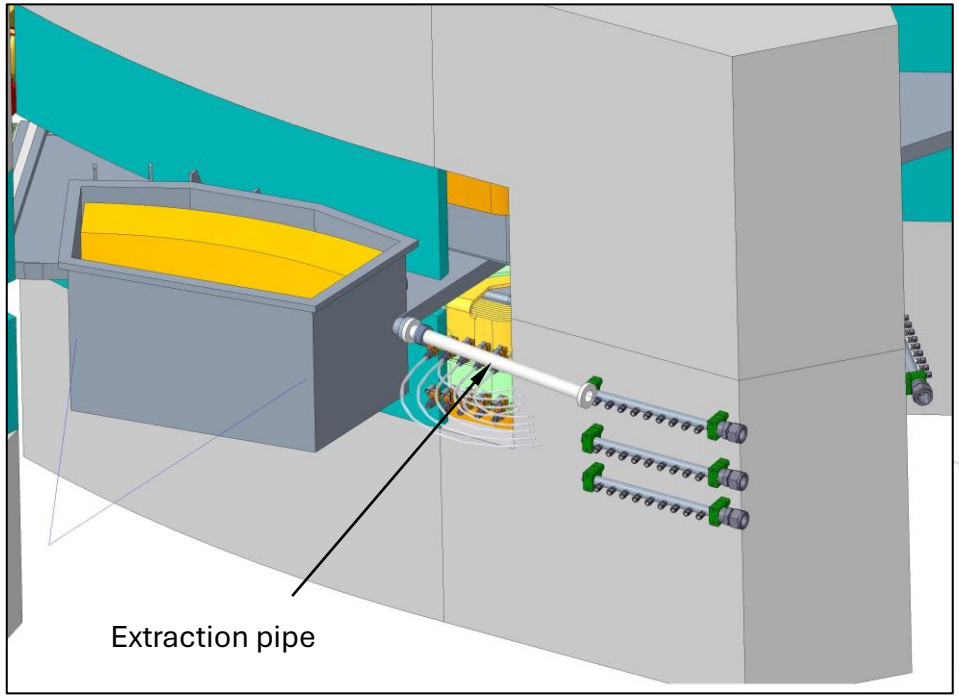
Injection septum

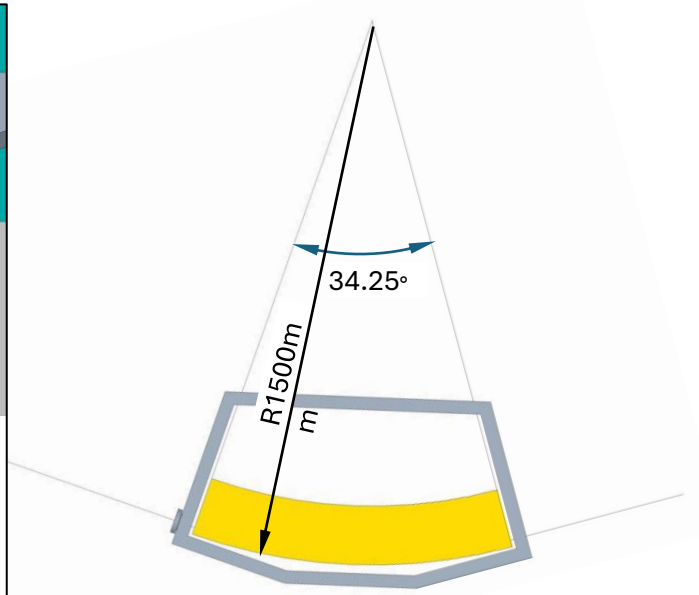


Injection C shaped
kicker magnet

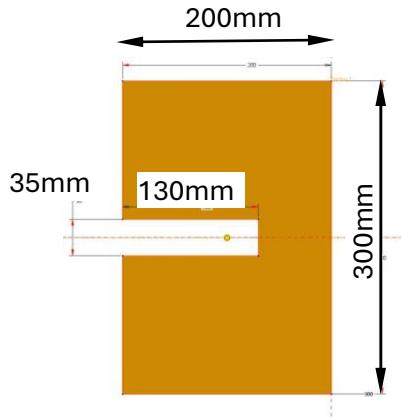
Injection Septum and Kicker Magnets







Extraction septum magnet



Extraction C shaped
kicker magnet

Non Circular Bellows

swiss made MEWASA

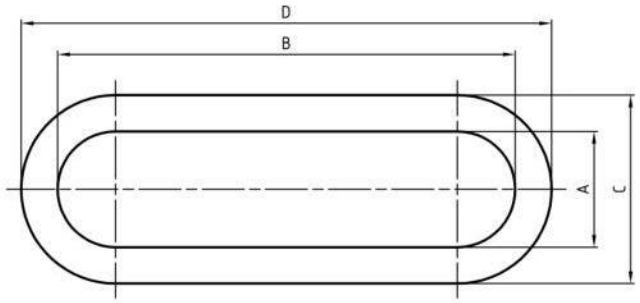
Membranbälge
Edge Welded Bellows

Home | Products | about MEWASA | Contact | Request | Downloads

Edge Welded Bellows Non Circular

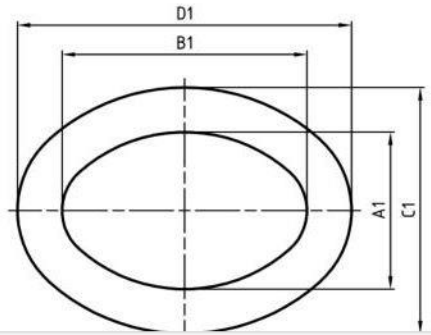
For special applications, for example as a handling system in the smallest possible vacuum space, non-circular diaphragm bellows are often used. Mewasa AG already offers you a larger selection of non-circular diaphragm bellows profiles made of 1.4404 (316L).
Thanks to our many years of experience, you also benefit from the possibility of realizing a new development specially designed for your requirements together with our R&D department.

Racetrack

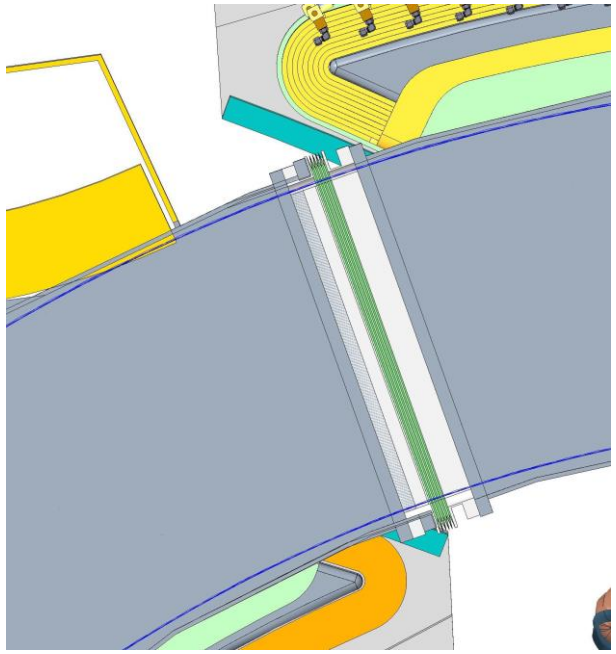


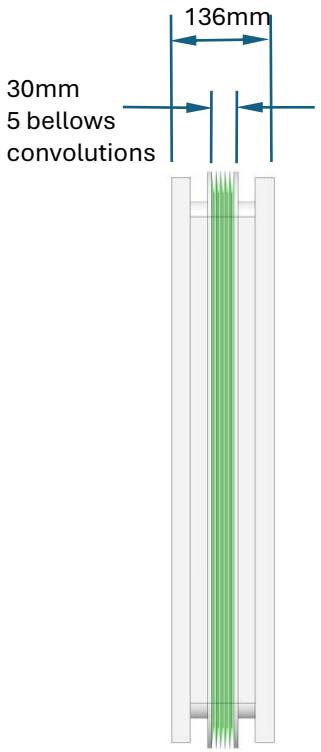
Typ	A	B	C	D
1	24	42	34	52
2	28	130	48	150
3	30	194	50	214
4	40	130	60	150
5	62.3	220.8	90.3	248.8
6	75.5	158.2	103.5	186.2
7	75.6	235	103.6	263
8	92	318	120	346
9	70	372	98	400
10	160	1200	220	1260
11	320	1360	380	1420
12	80.4	149.7	98.4	167.8

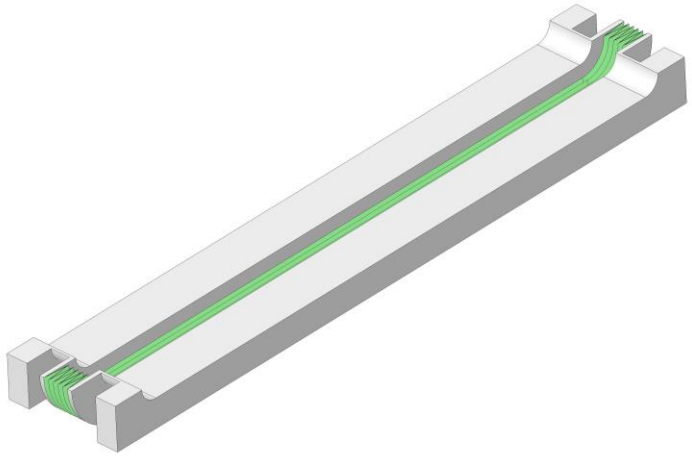
Elliptical



Typ	A1	B1	C1	D1
20	66.7	117.5	104.7	155.5

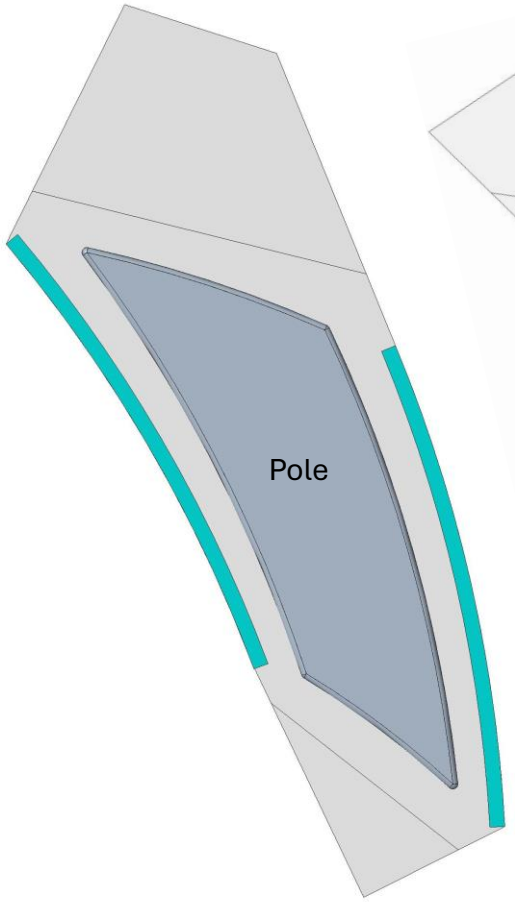




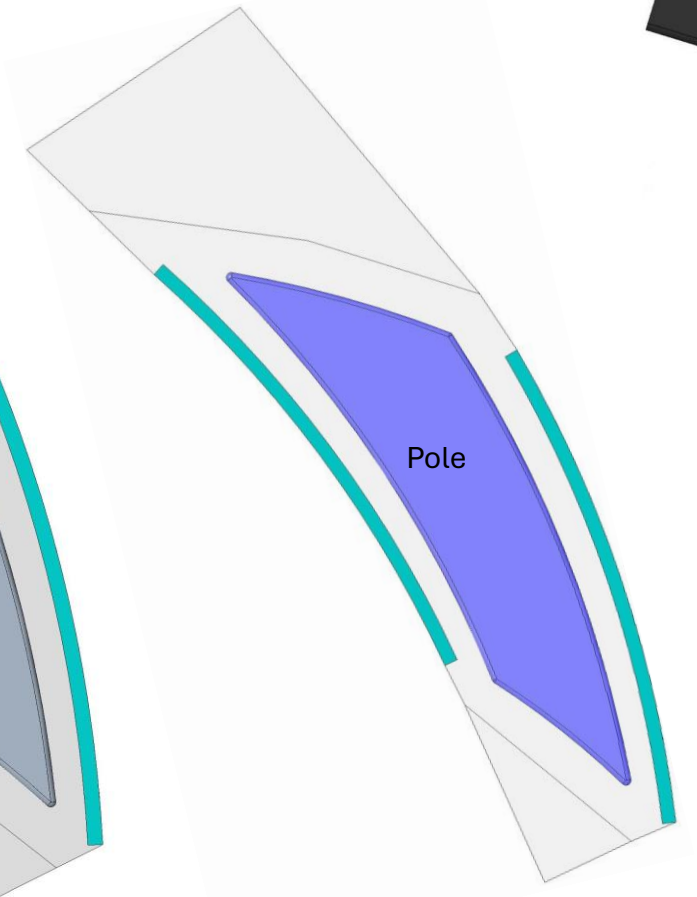


Mewasa Bellows (Bespoke)
5 convolutions
10mm axial translation
0mm lateral translation
£70k tooling cost

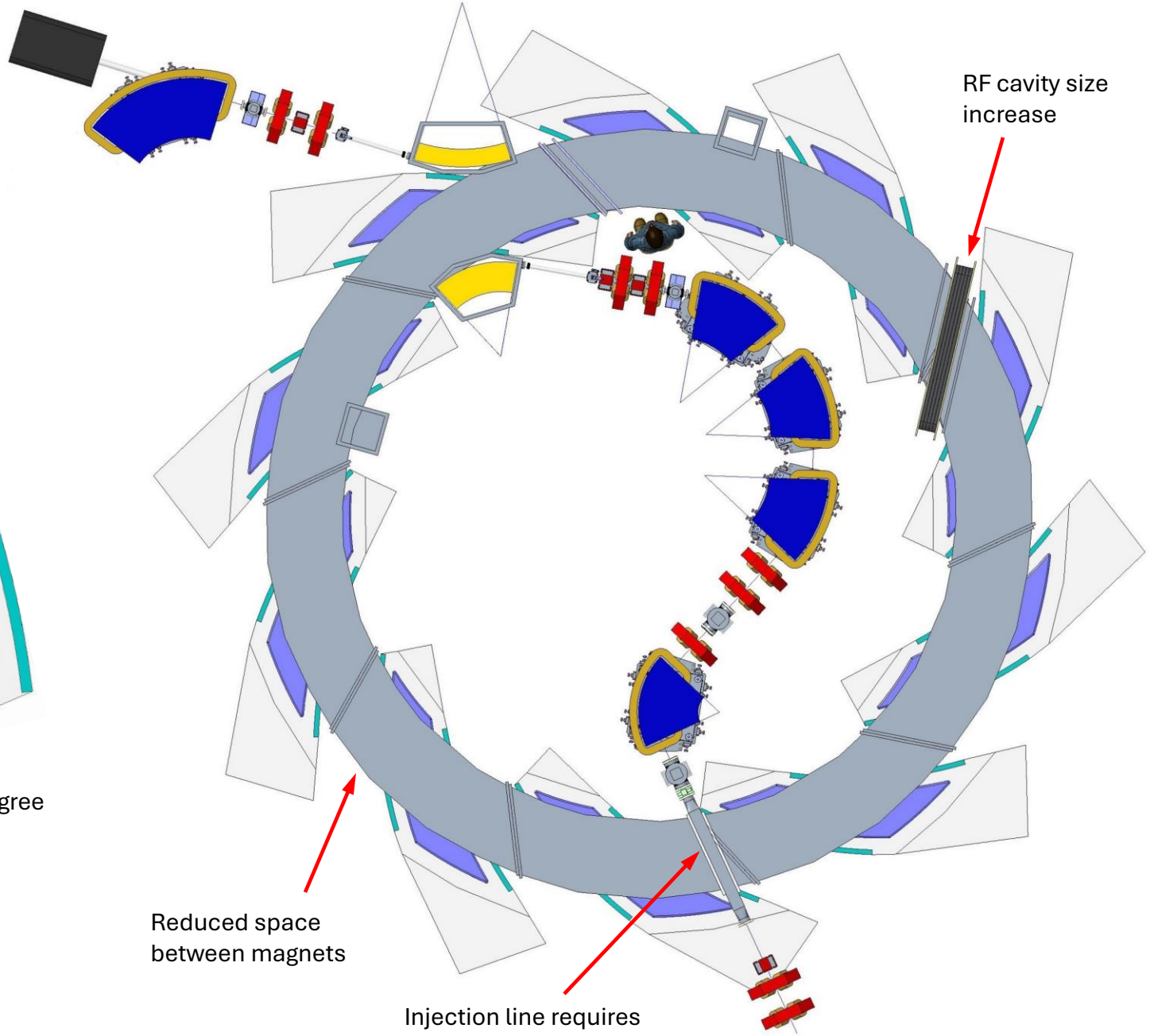
FFA Ring - spiral angle 53.9 degrees



Spiral angle 48.7 degree



Spiral angle 53.9 degree



Injection Line

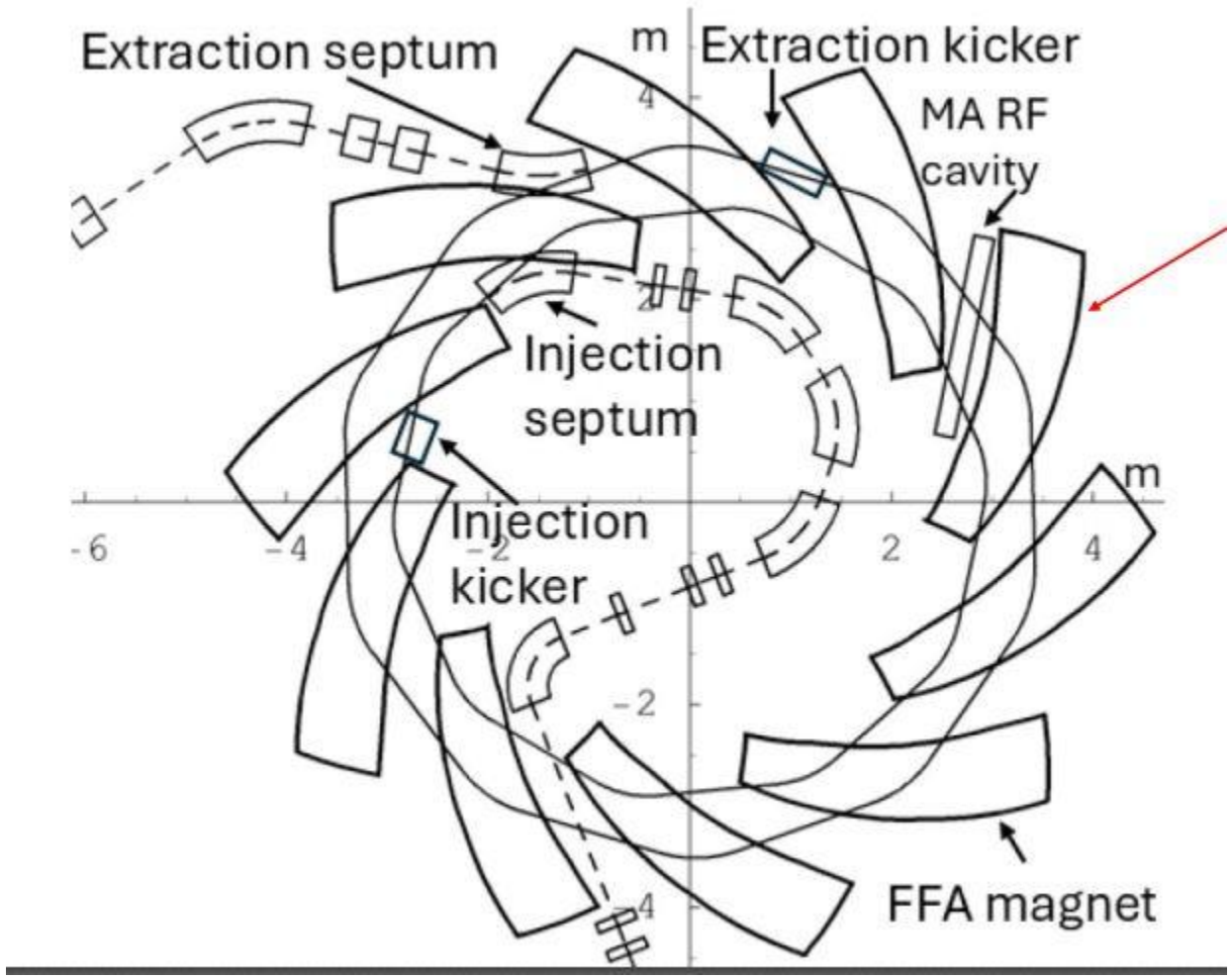
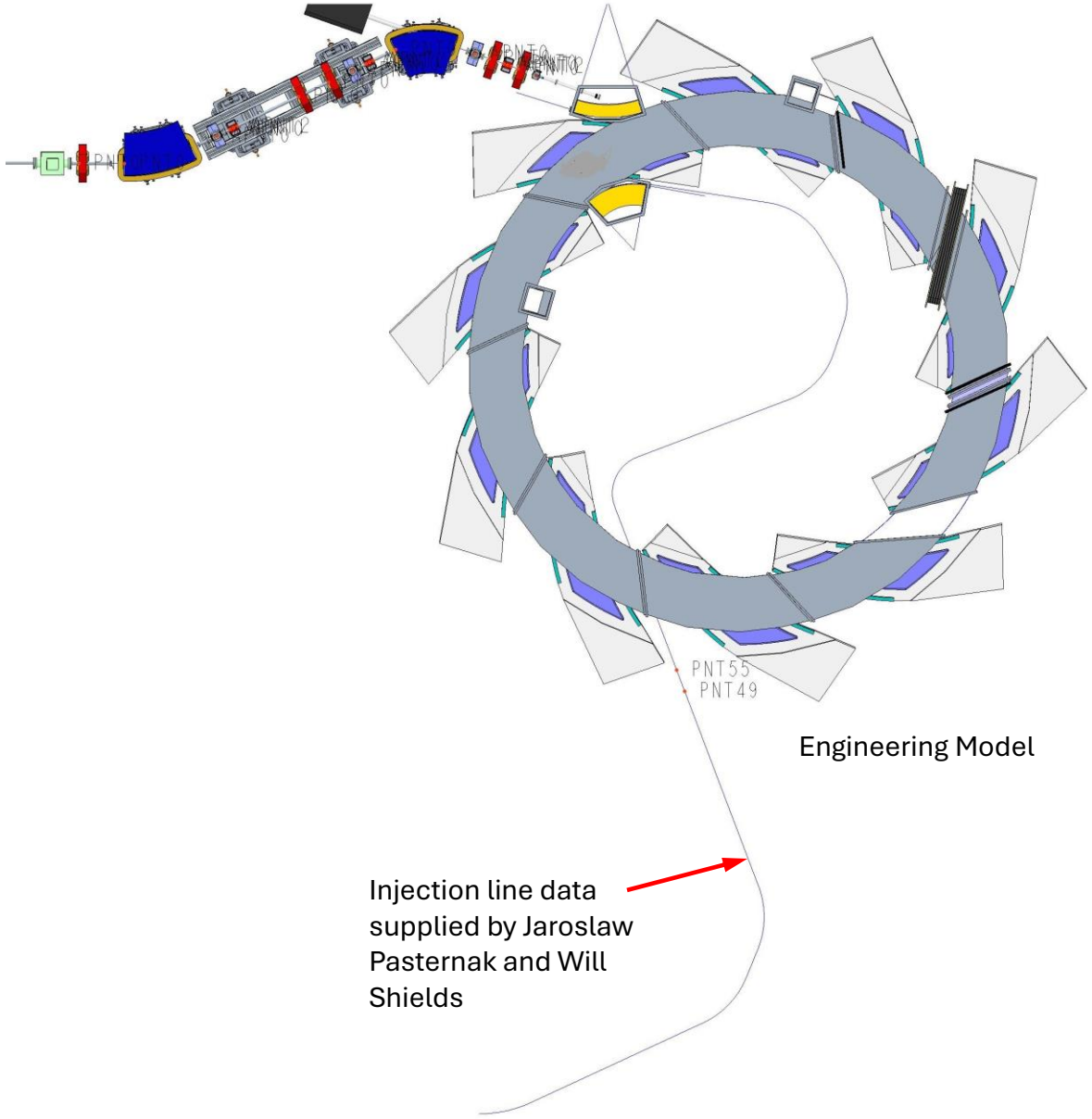


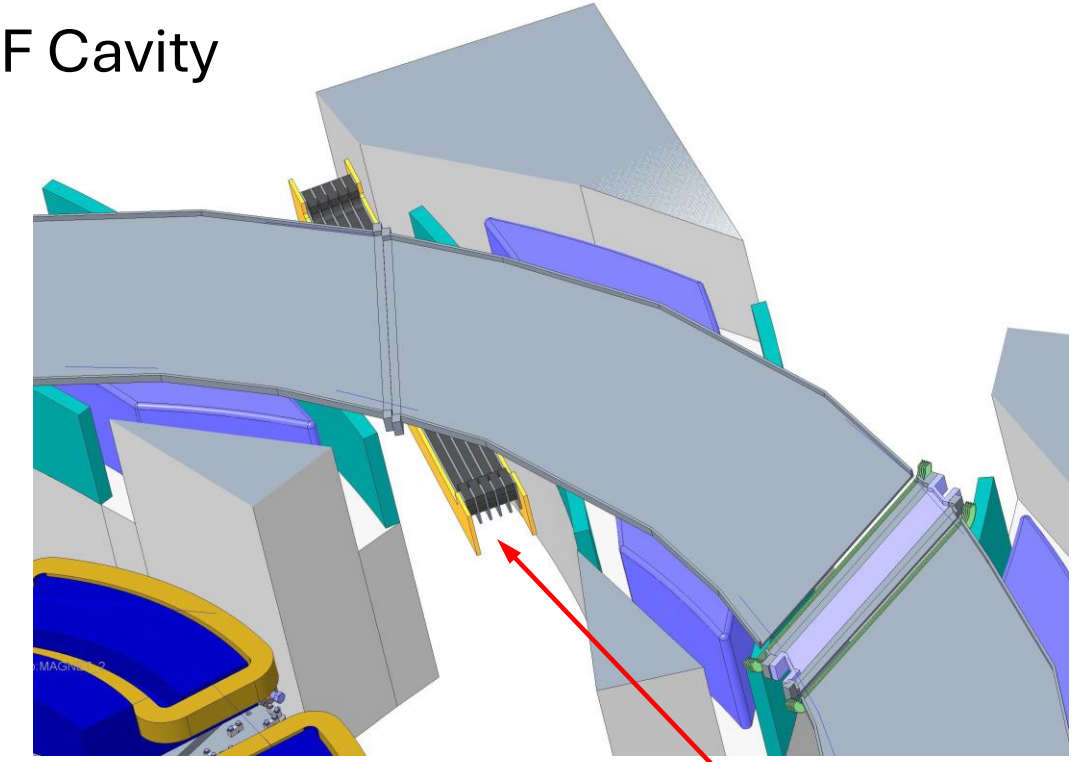
Image from Jaroslaw Pasternak

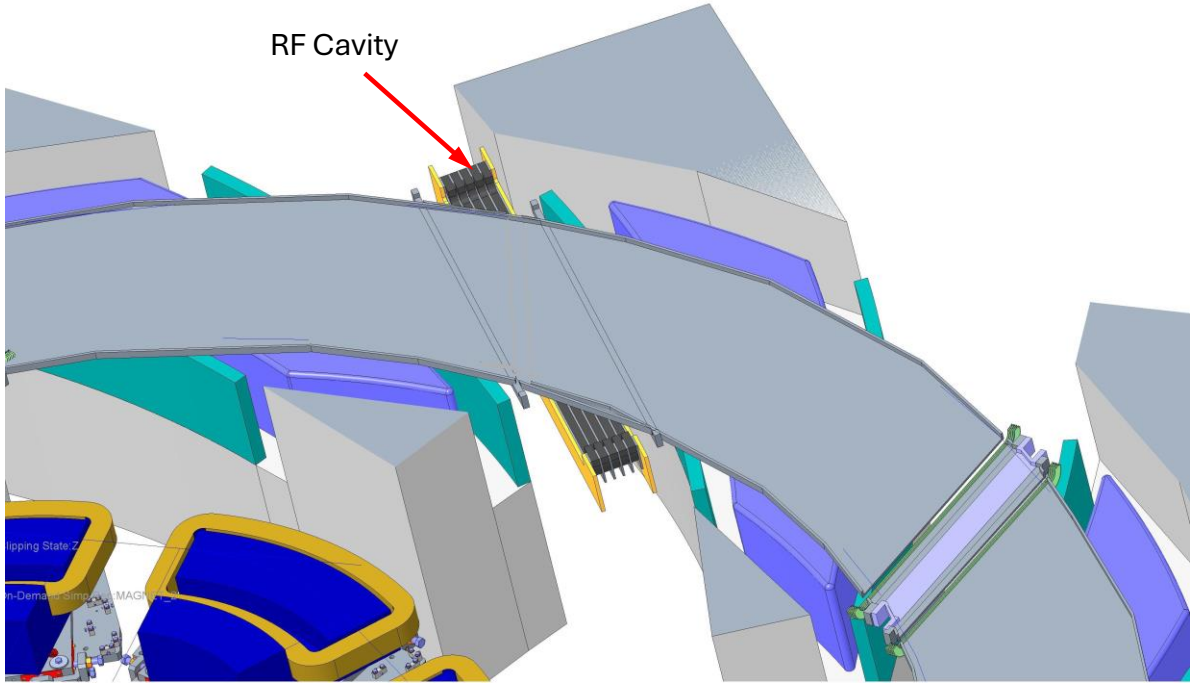


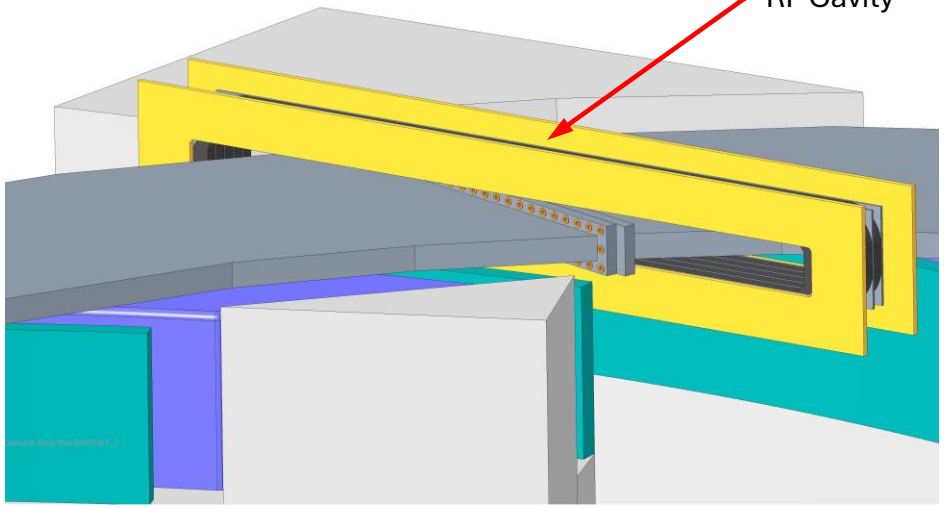
Engineering Model

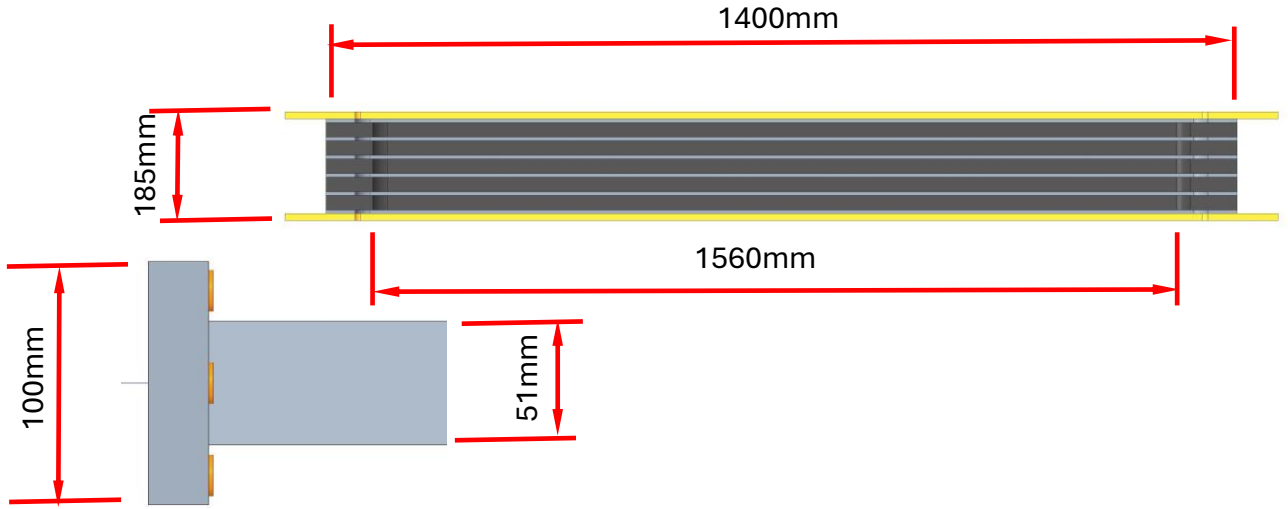
Injection line data supplied by Jaroslaw Pasternak and Will Shields

RF Cavity

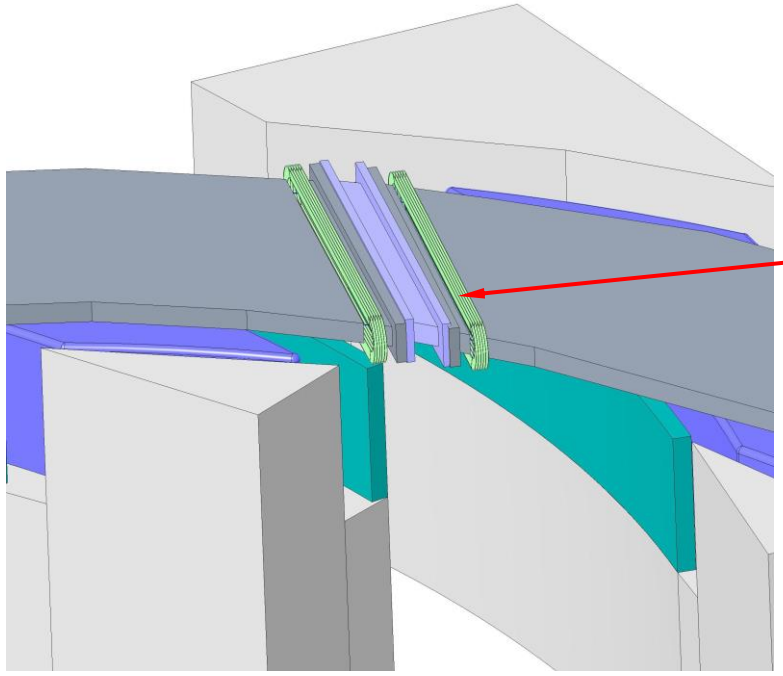






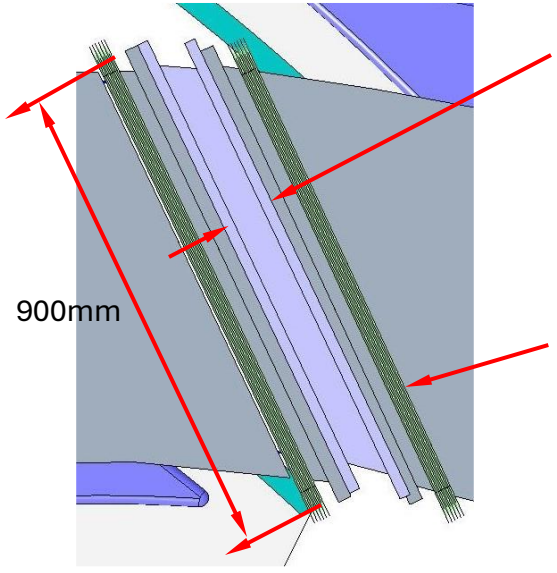


FFA Ring – space between magnets for insertion of devices (or bellows)



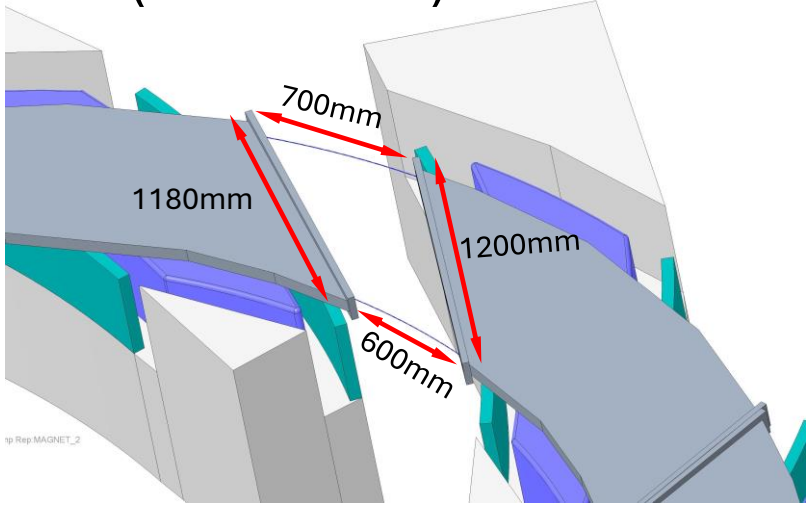
Integral bellows with vacuum chamber

Space available between magnets with smallest flange size

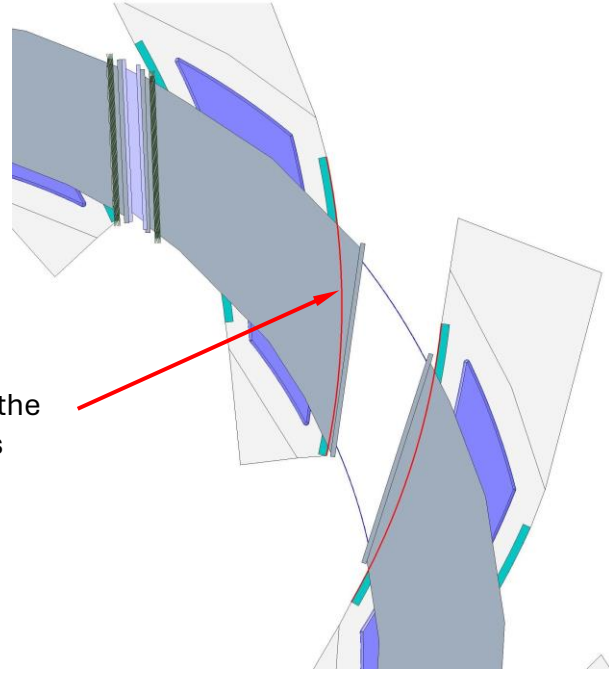


100 mm space available for insertion of diagnostics or other devices

Integral bellows



Maximum space available between magnets



Red curves are representative of the field clamp plates

Questions