FoCal
Integration into ALICE

Preliminary study

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ALICE Technical Board

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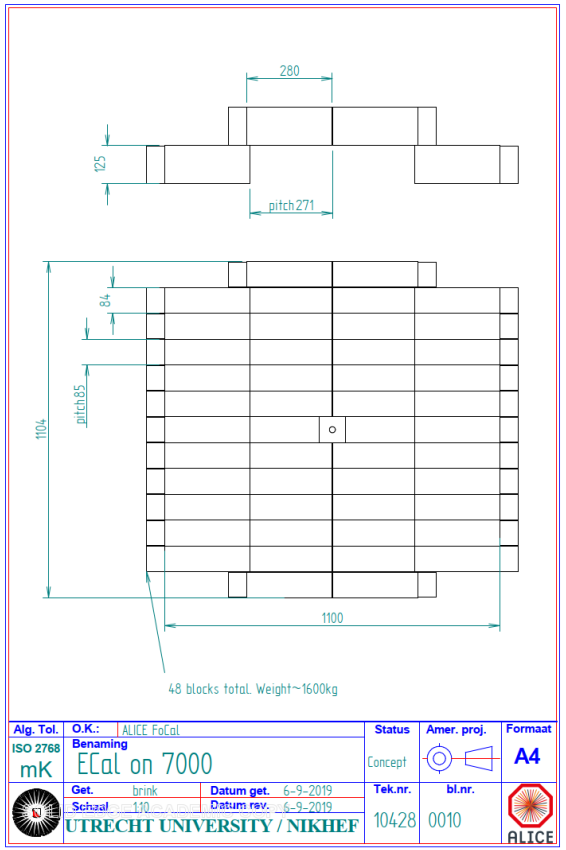
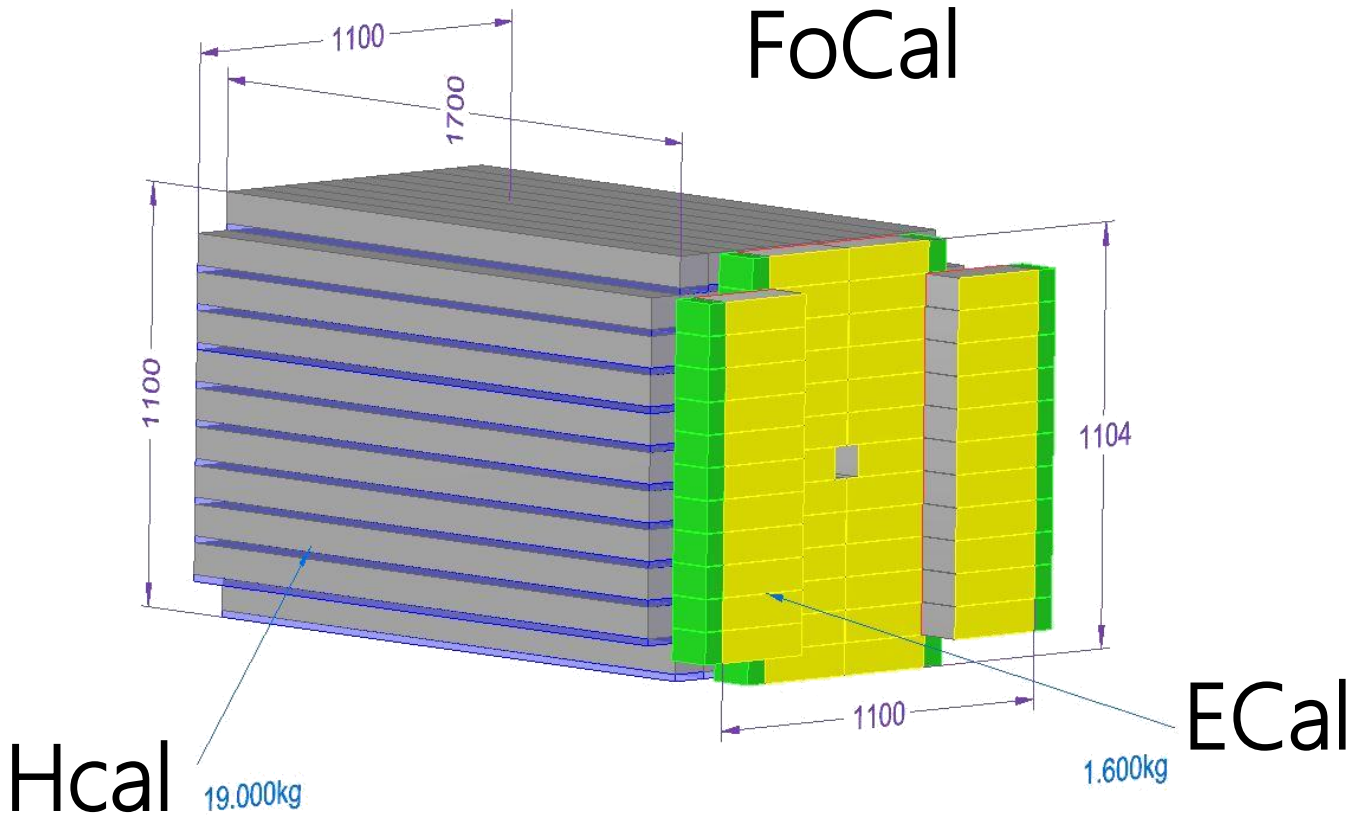
Integration into ALICE: preliminary considerations

- FoCal requirements
- ALICE Layout: RUN3 Vs RUN4 (with ITS3+FoCal)
  - FoCal Vs Beampipe
  - Focal Vs Miniframe
  - FoCal Vs ITS, MFT, FIT

FoCal requirements

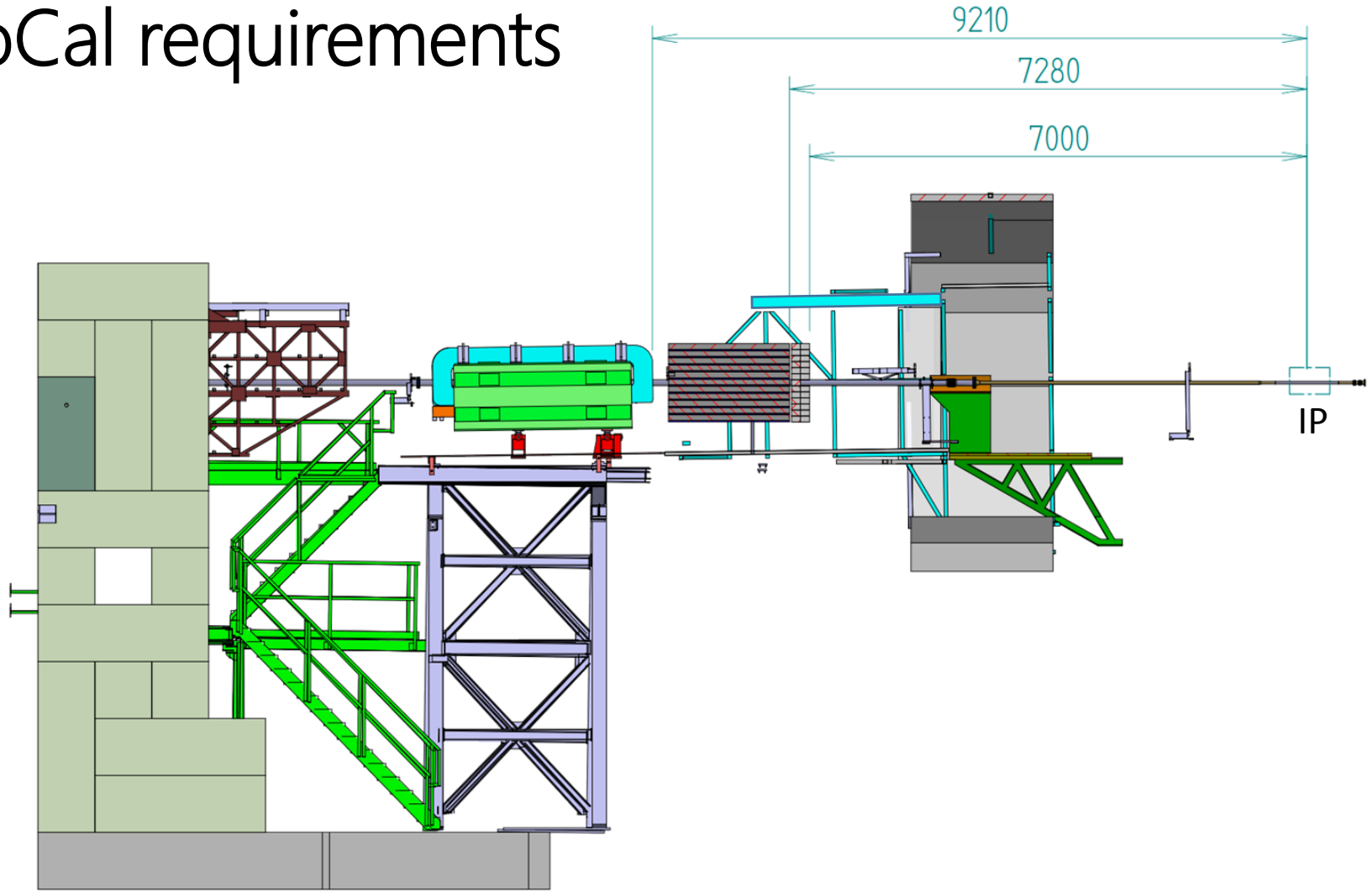




The HCal consists of lead sheets and scintillator plates.
The mix is 4.55:1 (more lead). The total weight by 1,7m long is about 20Tons.

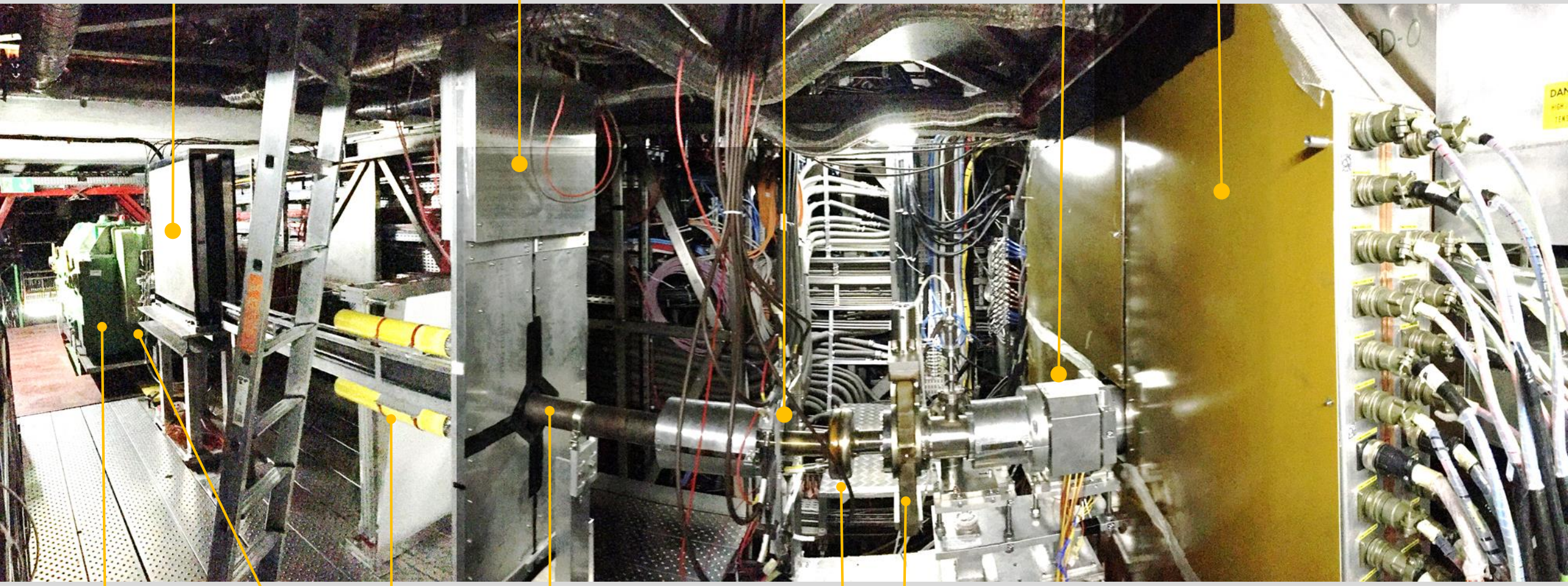
The ECal is a mix of tungsten and several other materials. An ECal block contains 31kg Wo. The total weight of ECal is about 1.6Tons +0.4Tons for the construction, cooling etc. = about 2Tons.

FoCal requirements

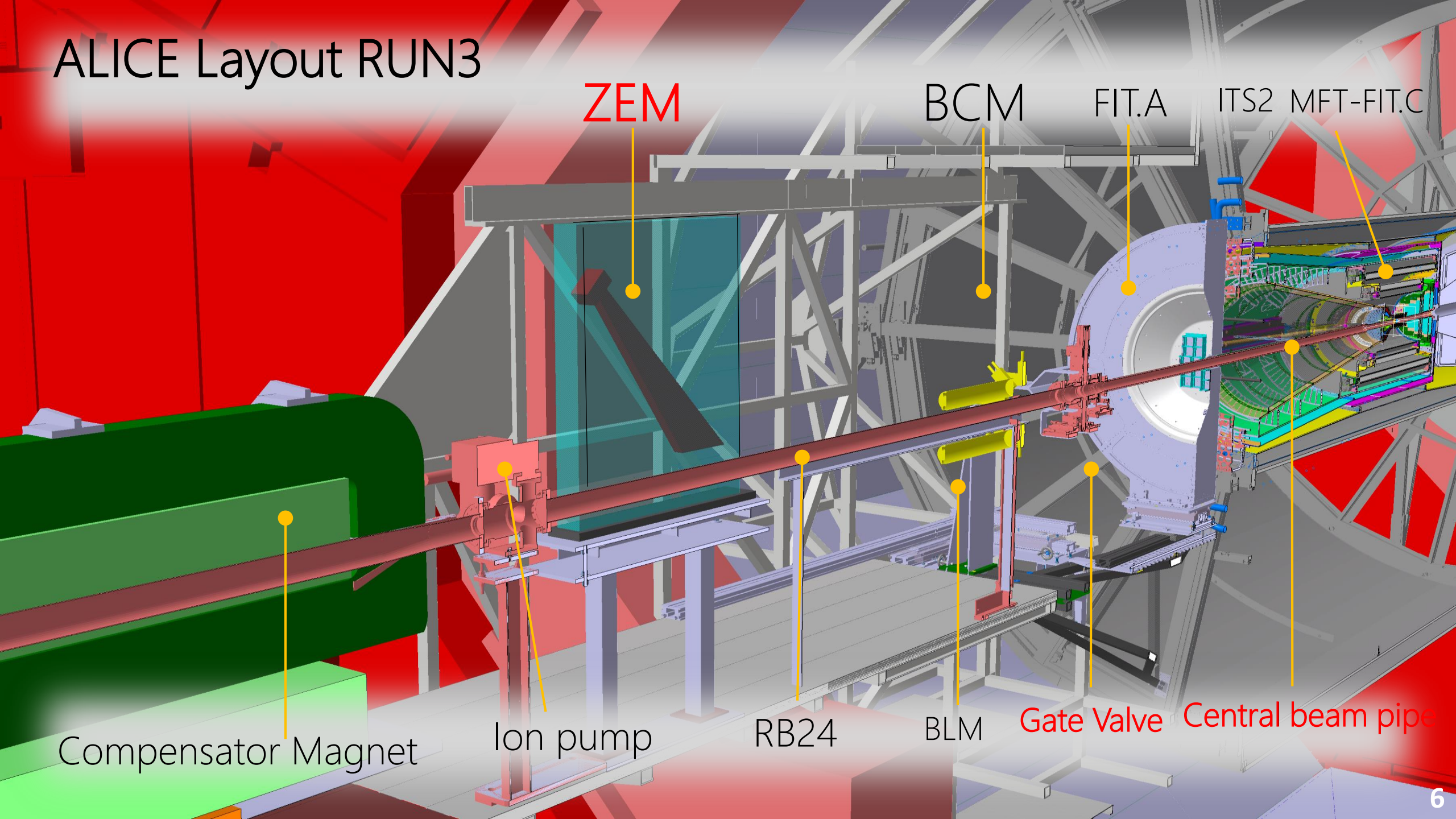


The beam pipe sits between the interaction point and the FoCal and should be **optimised to minimise conversions of photons before they reach FoCal**. …. Furthermore it is important that the beam pipe has no flanges in the rapidity range for the FoCal; this implies in particular that the main connection should either be placed behind FoCal (at 7.5 to 8.5 m) from the interaction point, or just in front of FoCal (z=7.0m) and have outer radius of 4 cm or less.

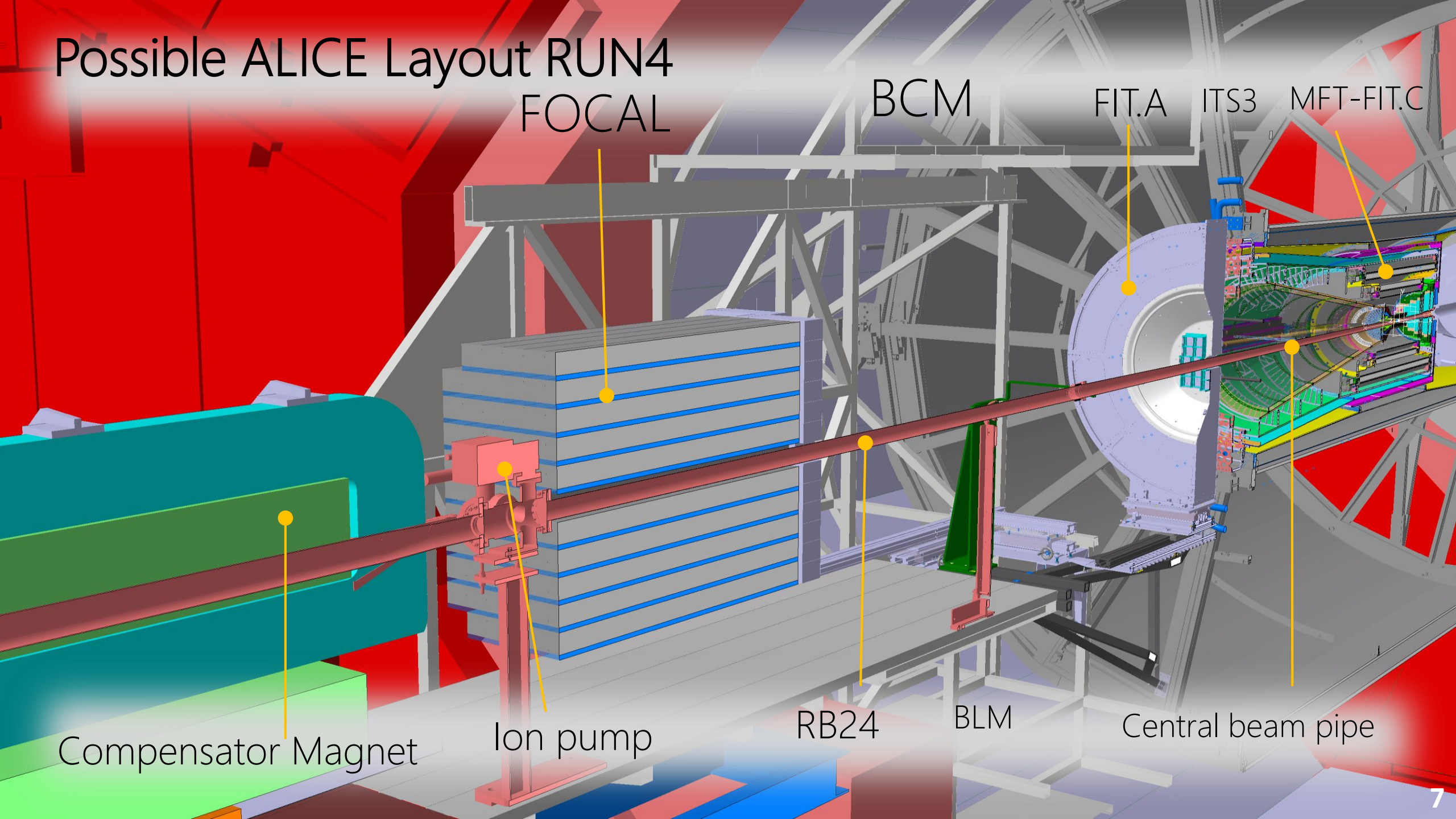
ALICE Layout RUN2



ALICE Layout RUN3

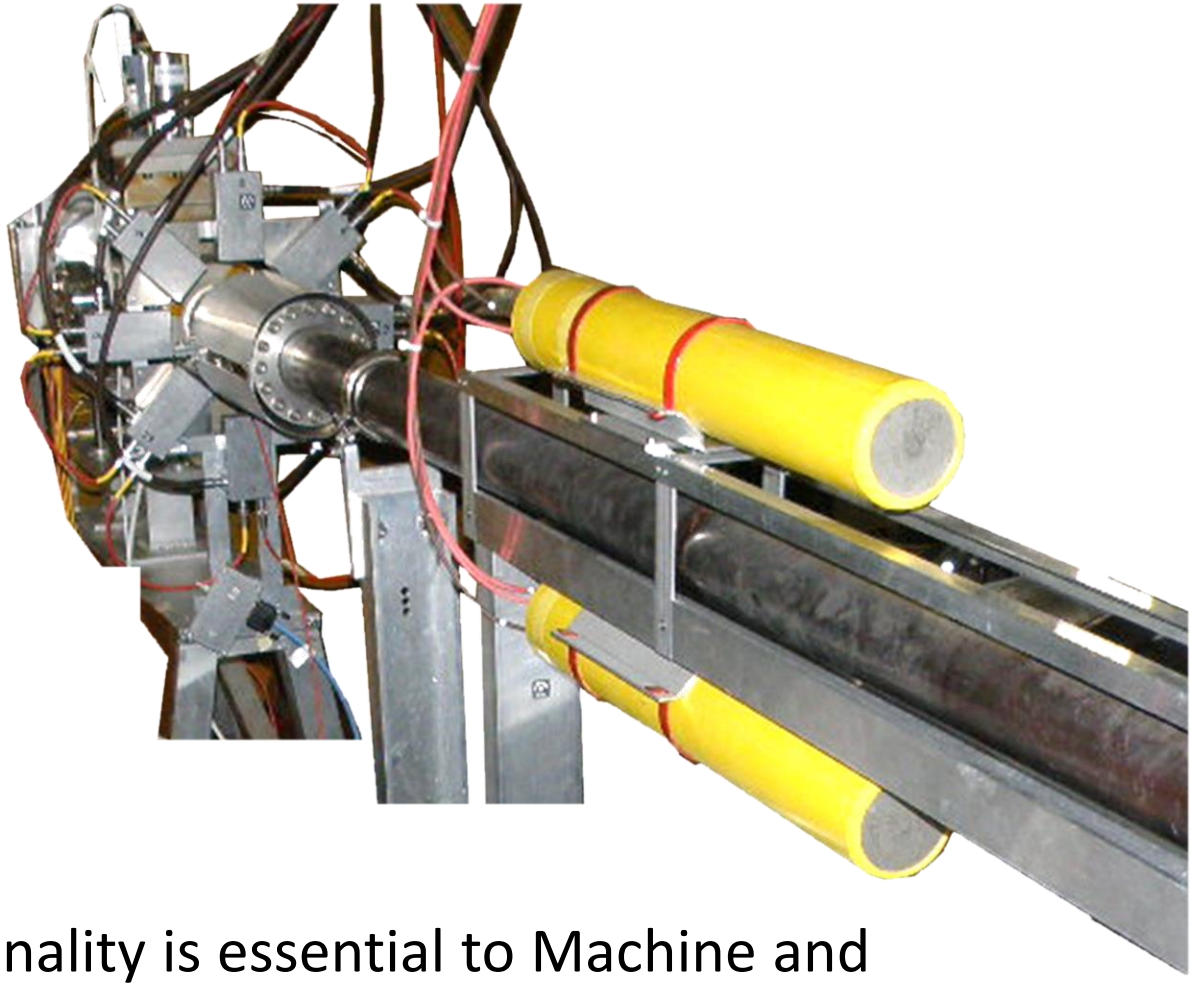


Possible ALICE Layout RUN4



Beampipe Instrumentation RUN3 Vs RUN4

BCM & BLM



Functions:

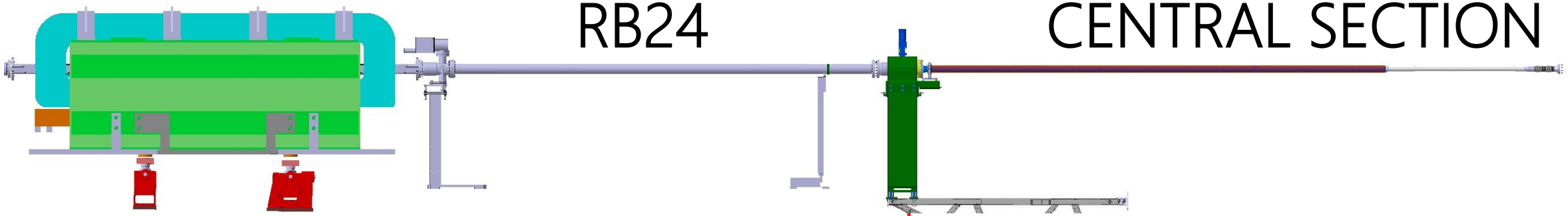
BCM (Beam Condition Monitor) triggers the Beam Dump in case of beam losses, and sets the Injection Inhibit for the ALICE/LHC injection handshake system.

BLM (Beam Loss Monitor) cross check to BCM from Machine side.

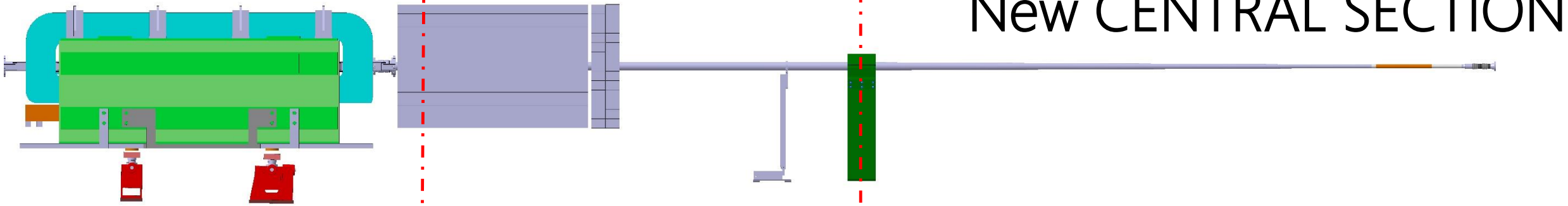
Removal/Displacement implications: their functionality is essential to Machine and ALICE operation. Displacement in Z (upstream Focal) must not affect their functionality, radial position is critical. Removal of BCM is not possible unless the same functionality is restored.

Beampipe layout: RUN3 Vs RUN4

RUN3



RUN4

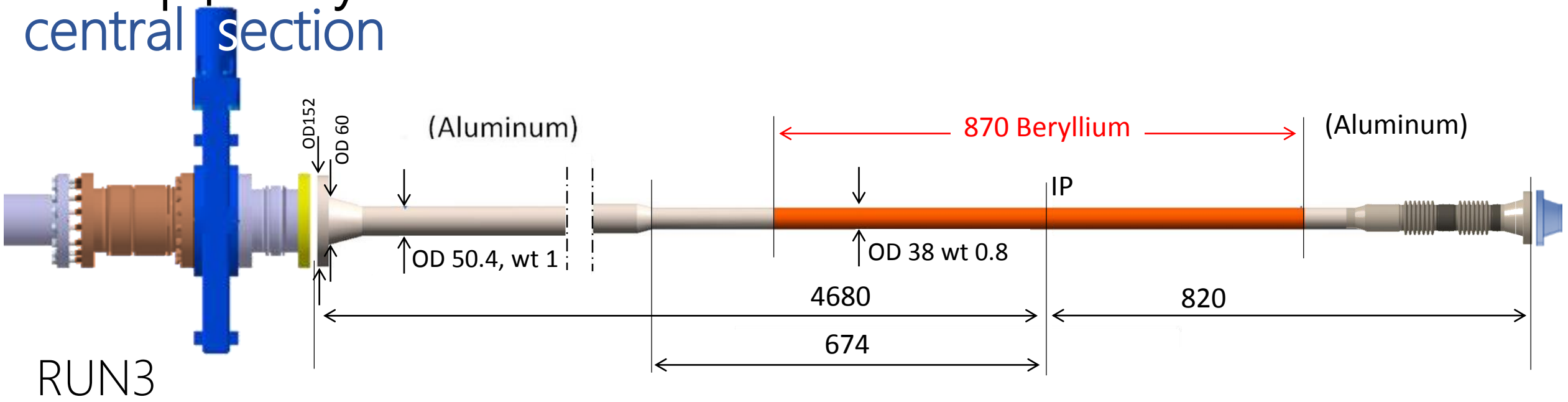


RUN4 layouts of both RB24 and central beampipe will have to be approved by LHC

Beampipe Layout: RUN3 Vs RUN4

Dimension in mm

central section



RUN3

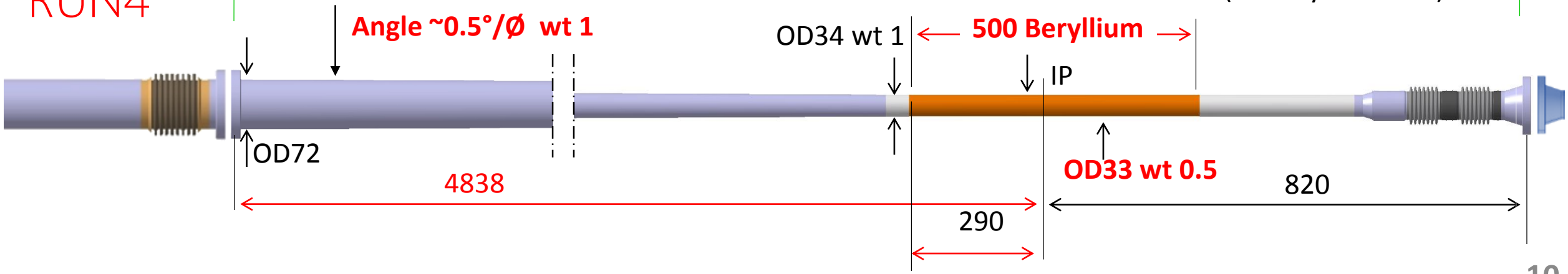
≈1000 kCHF

Aluminum ≈80 kCHF

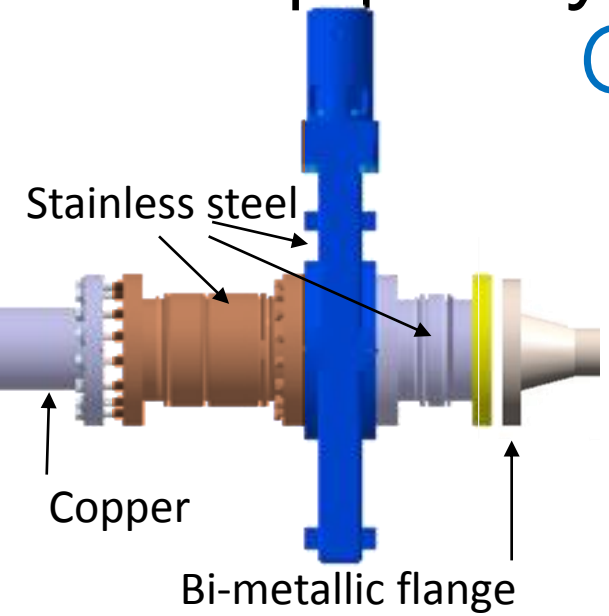
Beryllium ≈ 800kCHF

Aluminum Cost 0kCHF
(already available)

RUN4



Beampipe Layout: central section RUN3 Vs RUN4



Gate Valve

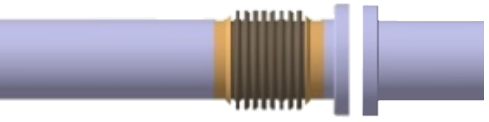
Functions: isolate the Beampipe Central section from the adiacent beampipe RB24 section.

At any intervention that requires the disconnection of RB24 the valve is closed avoiding any air contamination of the central section. Gate is closed at Technical Stops for Central BP protection

Removal implications: RB24 disconnection exposes BP central section to air.

The consequence is that the central section will require a new bakeout. This implies the removal of FIT.A, ITS Inner Barrel, ITS Outer Barrel and MFT+FIT_C

Gate Valve



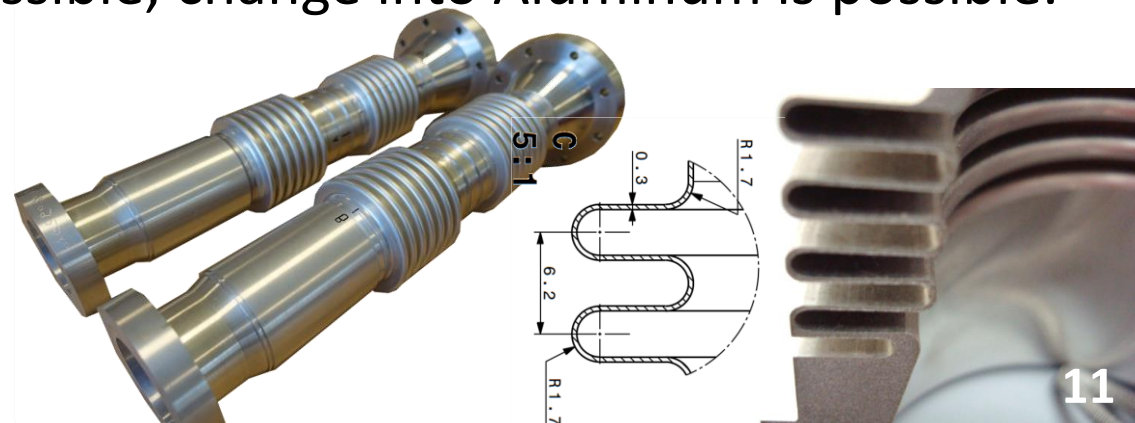
Bellow

Functions: accommodate thermo elastic and mechanical deformation

Removal implications: not possible, change into Aluminum is possible.

Standard Bellow Steel-Copper

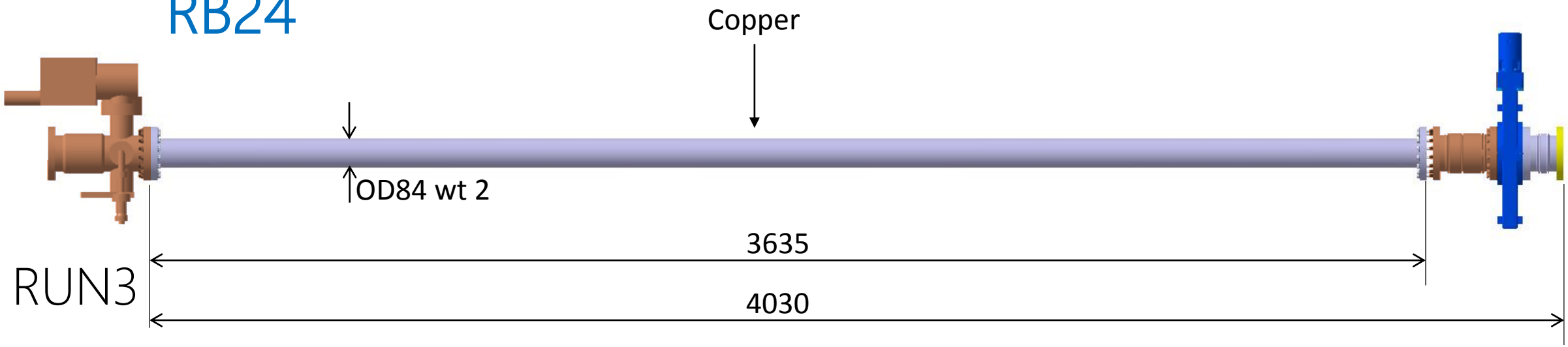
Aluminum Bellow



Beampipe Layout: RUN3 Vs RUN4

Dimension in mm

RB24

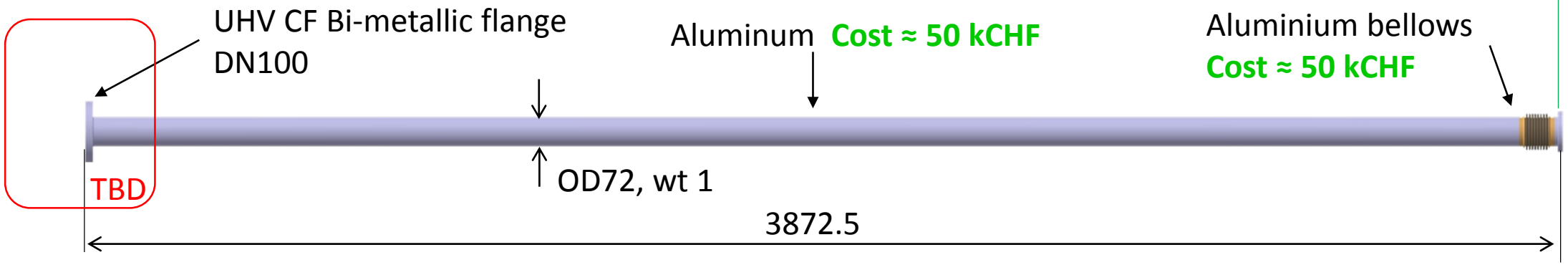


RUN3

RUN4

≈100 kCHF

Aluminium flange



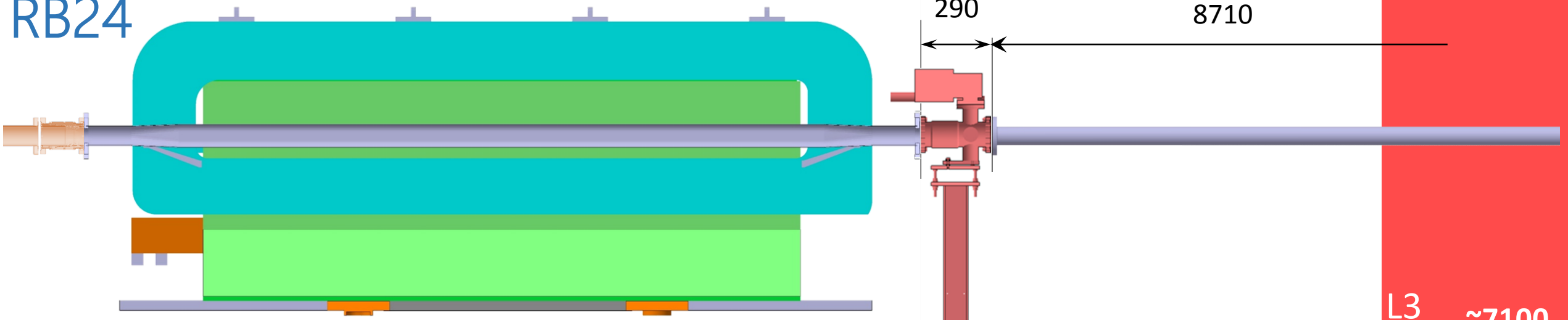
RB24 Beampipe protection and new Miniframe access procedure (if protection is removed @RUN).

Beampipe Layout: RUN3 Vs RUN4

Dimension in mm

IP=0

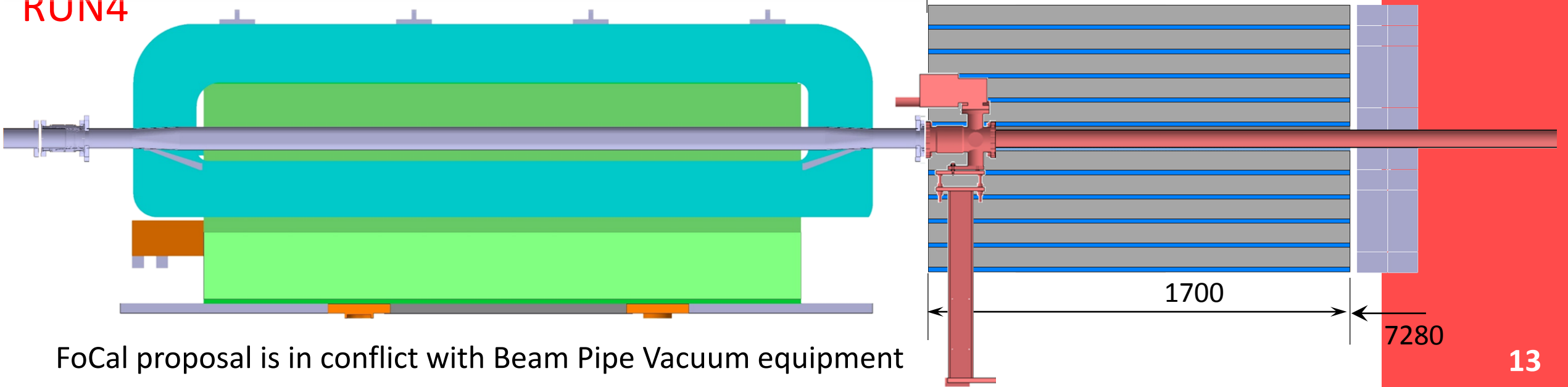
RB24



L3 ~7100

RUN3

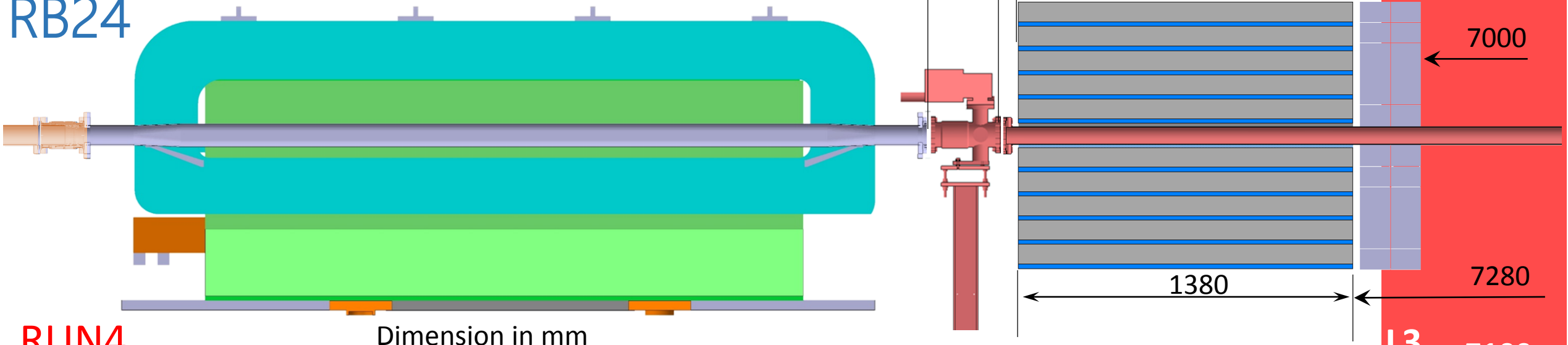
RUN4



FoCal proposal is in conflict with Beam Pipe Vacuum equipment

Beampipe Layout: RUN3 Vs RUN4

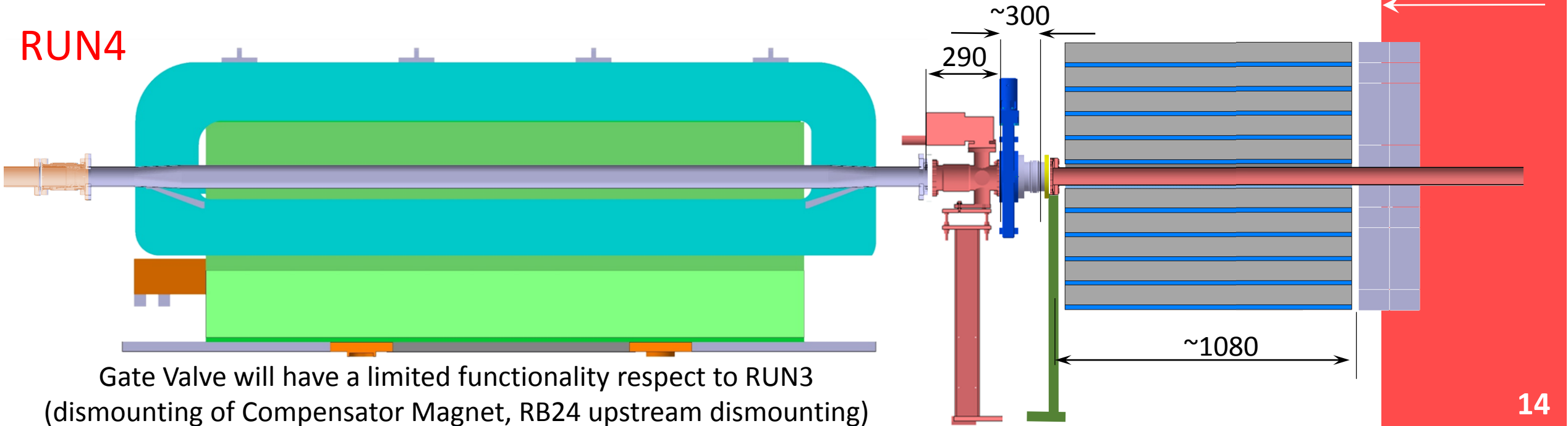
RB24



RUN4

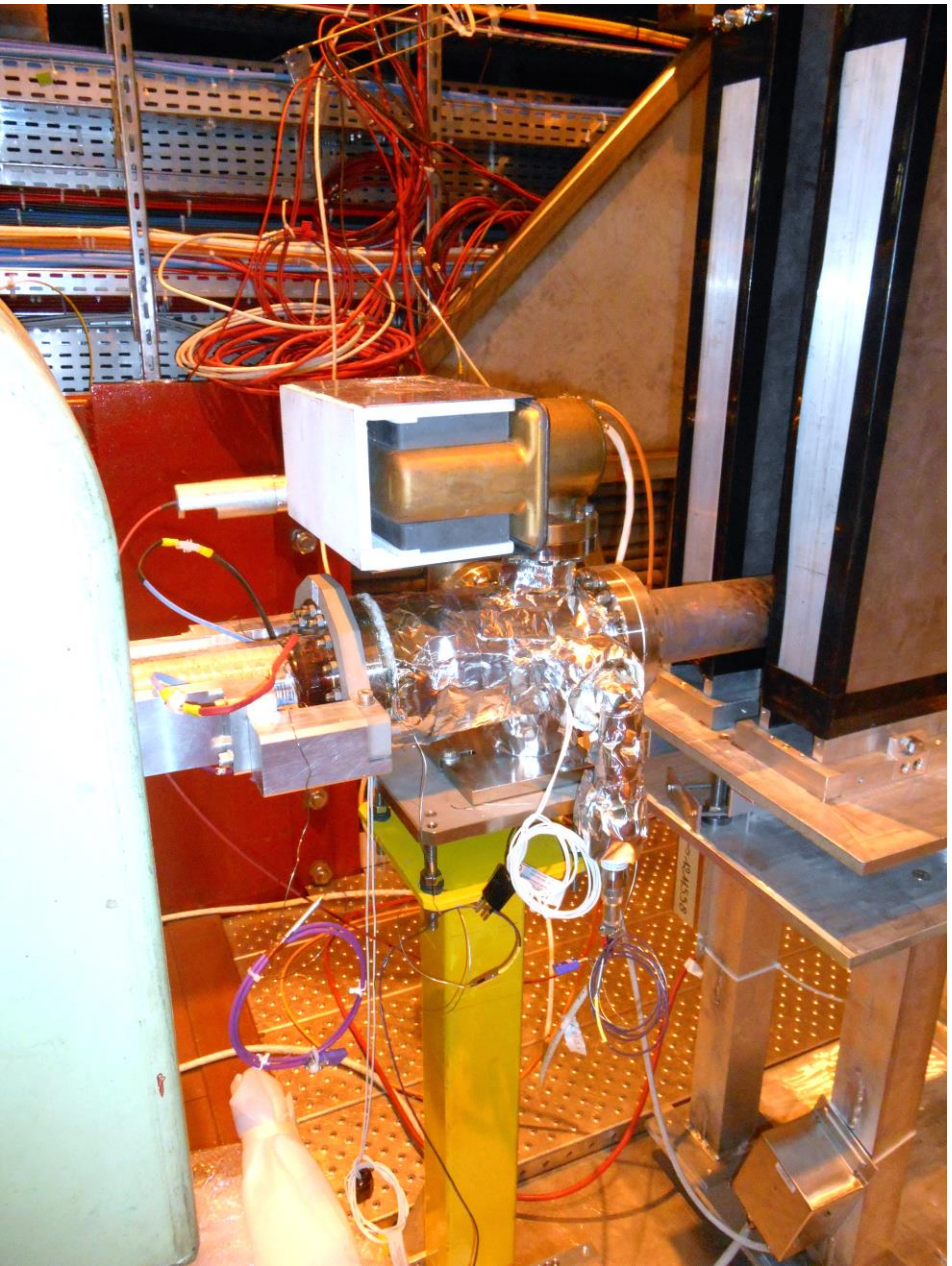
Dimension in mm

RUN4



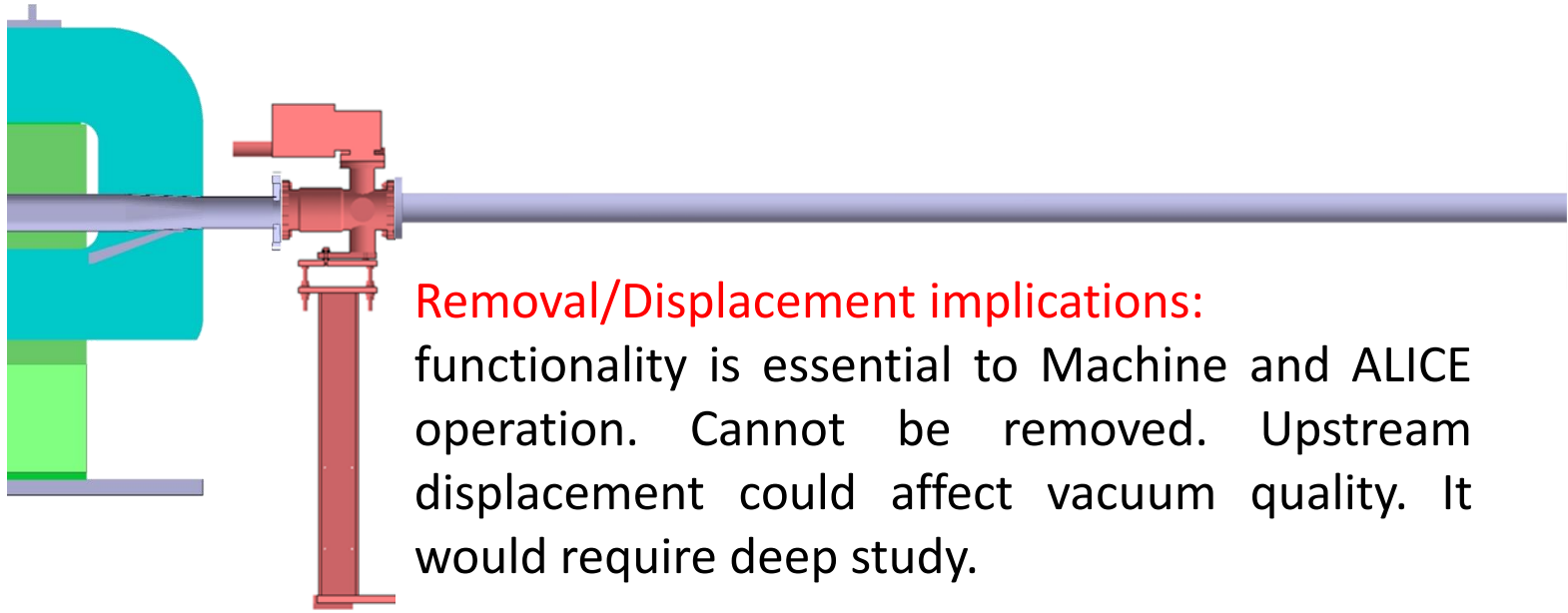
Gate Valve will have a limited functionality respect to RUN3
(dismounting of Compensator Magnet, RB24 upstream dismounting)

Beampipe Layout: central section RUN3 Vs RUN4



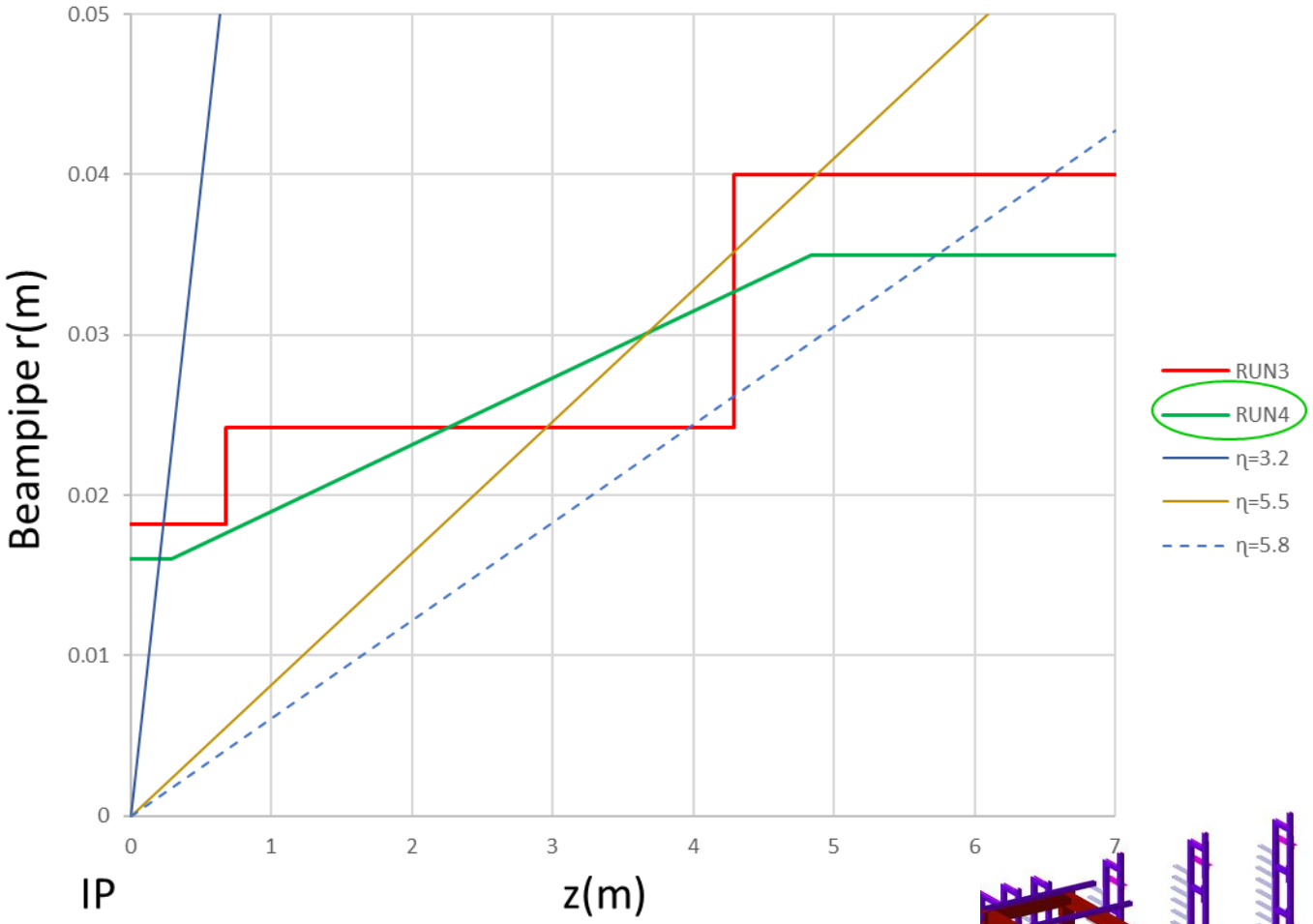
ION PUMP

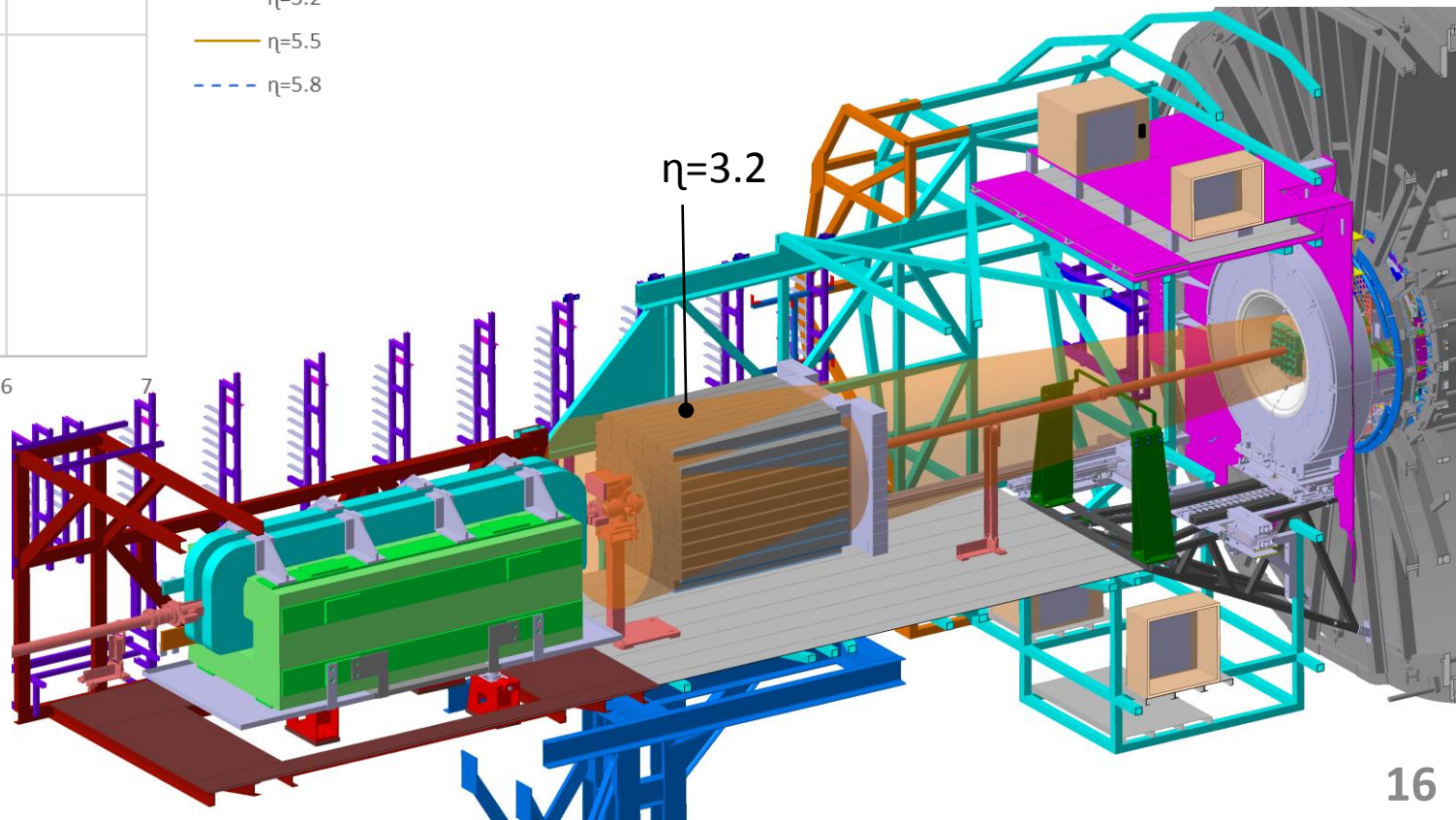
Functions: It pumps non-gatherable gases (CH4)
It is a standard LHC ion pump: Pumping speed for CH4 ≈ 30 l.s-1 (at 1e-10 mbar).
Located at about 9m form IP



Removal/Displacement implications:
functionality is essential to Machine and ALICE operation. Cannot be removed. Upstream displacement could affect vacuum quality. It would require deep study.

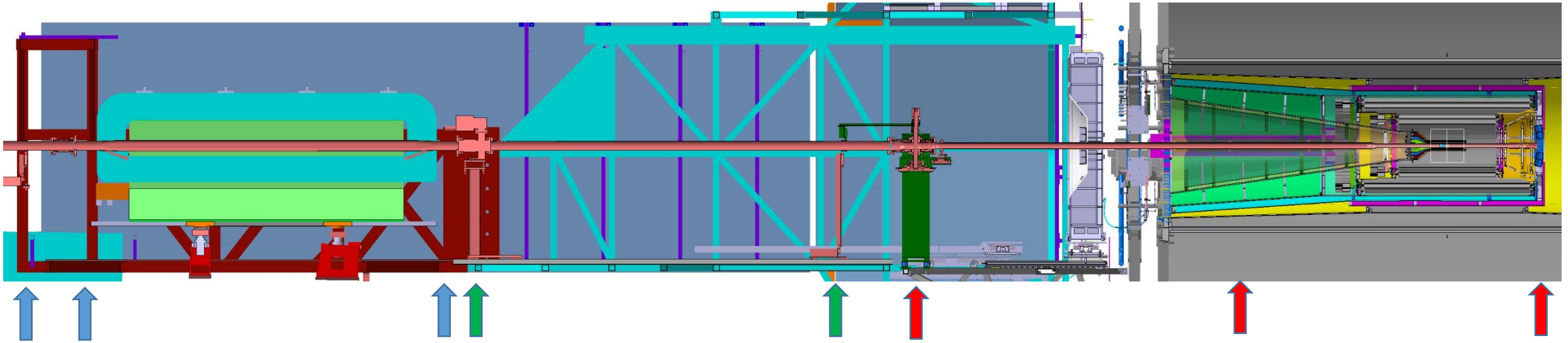
FoCal pseudorapidity and beampipe RUN3 Vs RUN4



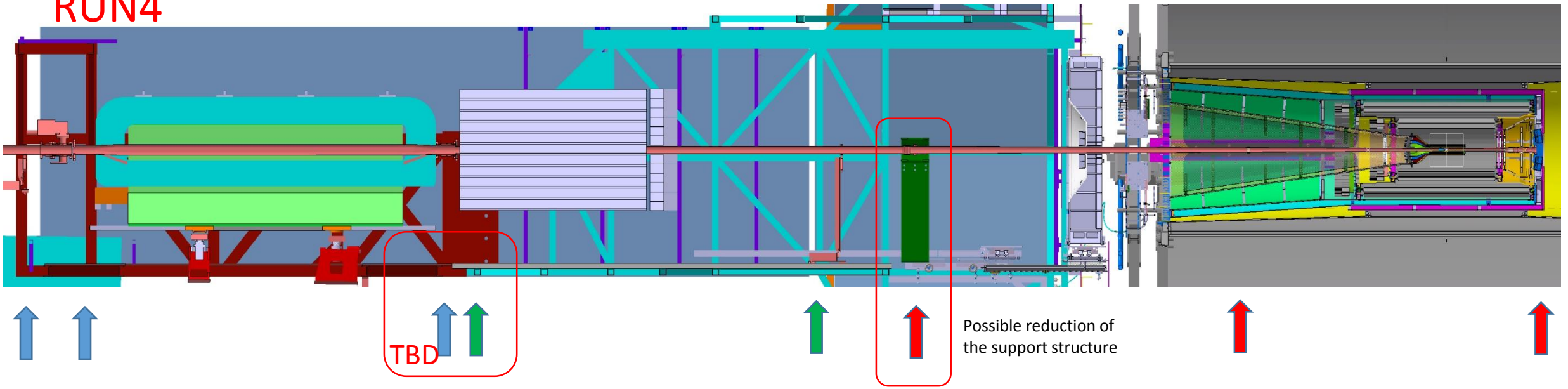


Beampipe supports: RUN3 Vs RUN4

RUN3

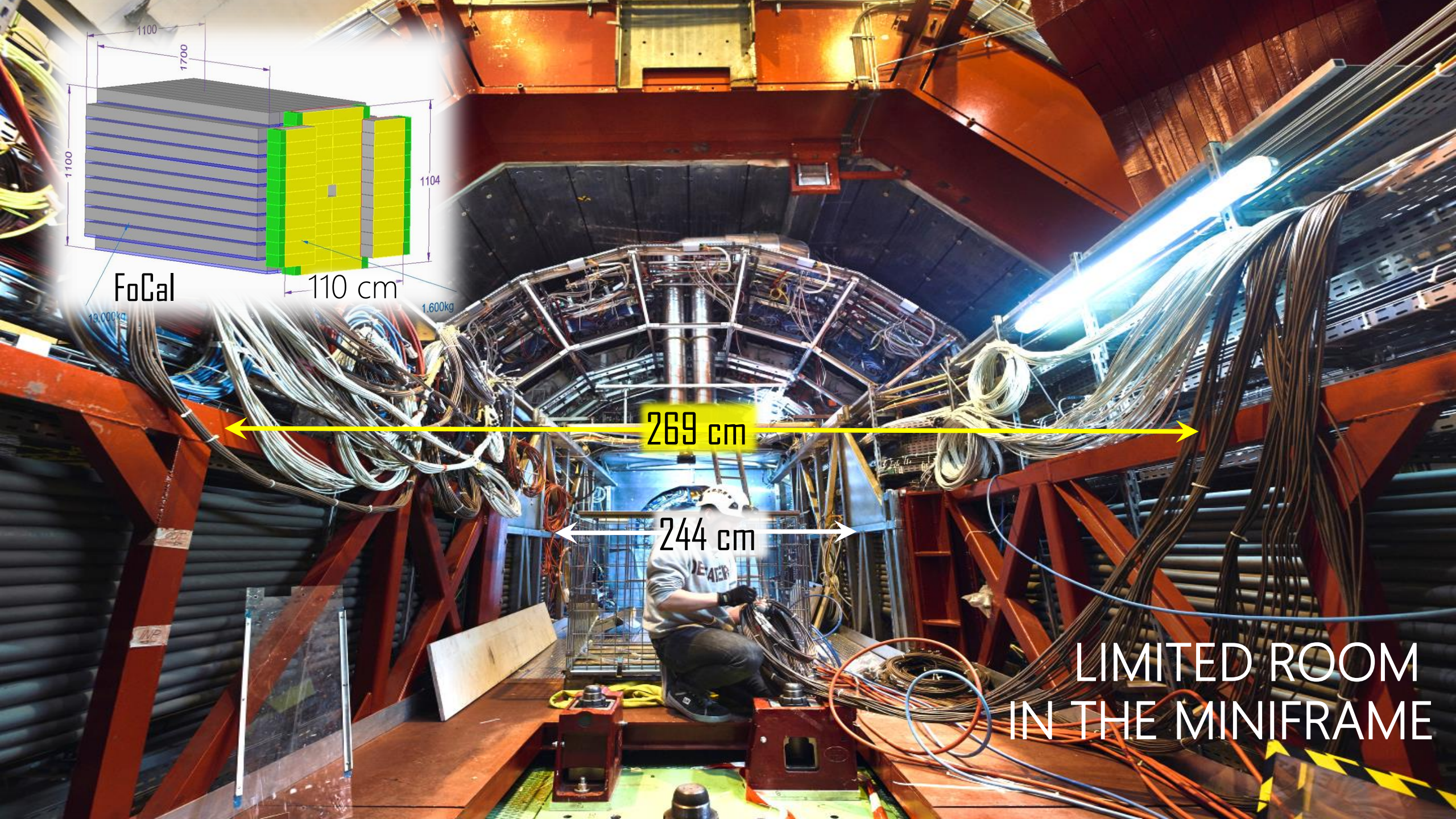


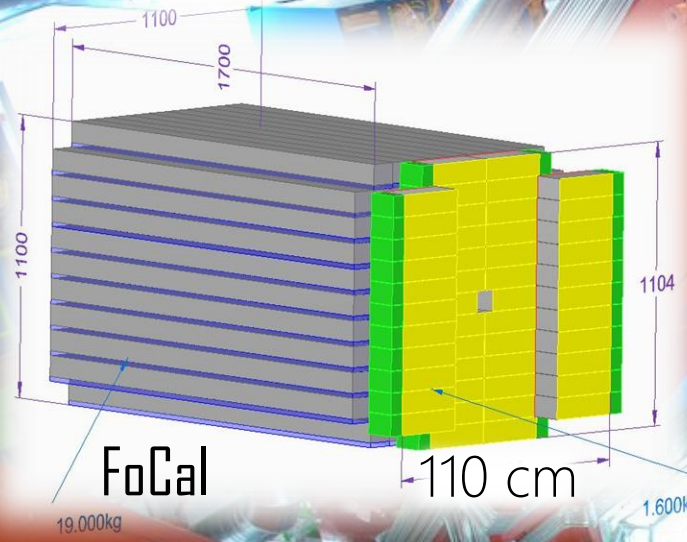
RUN4



Supports must be on FoCal Platform

Supports must be on the TPC


1100
1700
1100
1104
FoCal
110 cm
1,600kg
269 cm
244 cm
LIMITED ROOM
IN THE MINIFRAME



FoCal

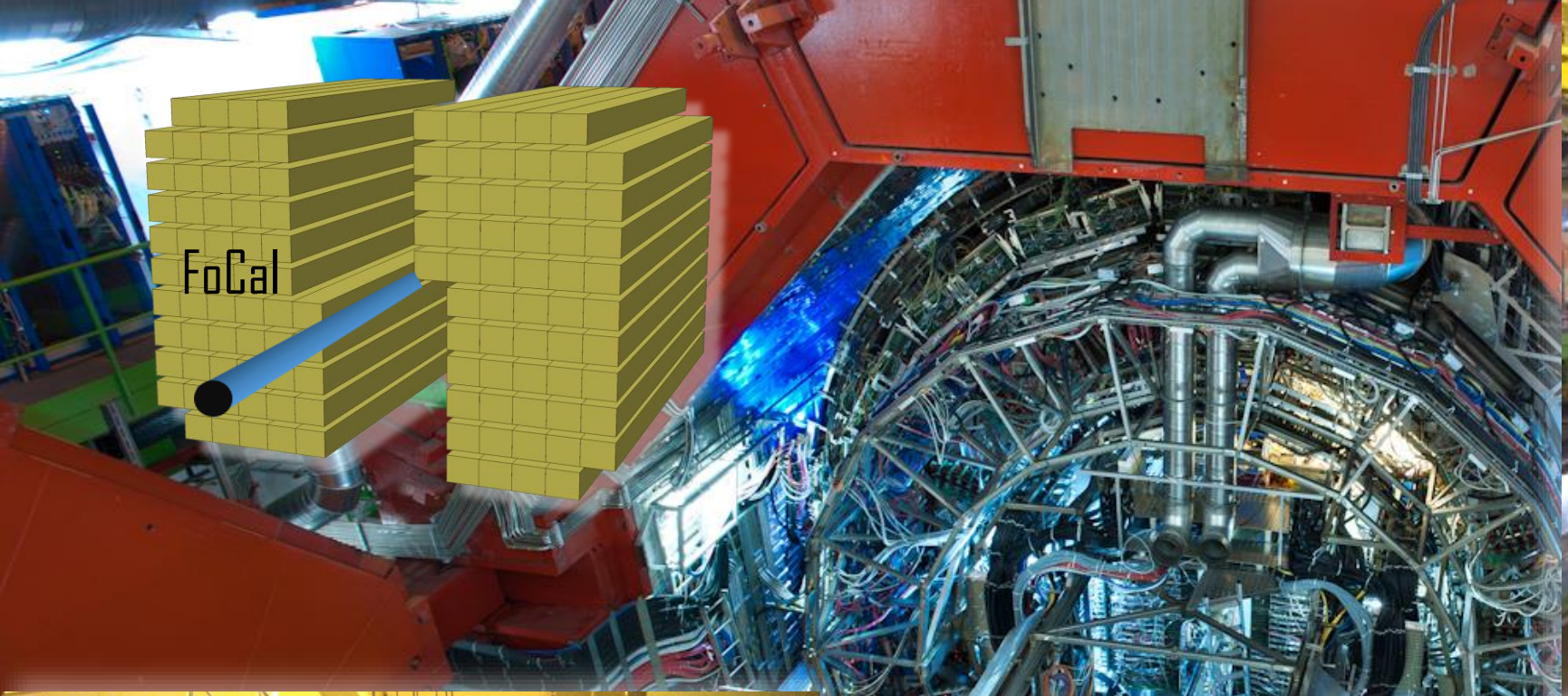
Largeur recommandée (en métres)	
Largeur d'un passage habituel entre machines ou éléments d'installation	**0.8** (distance réglementaire)
Largeur d'un accés pour intervention occasionnelle (dépannage, maintenance)	**0.6** (1)

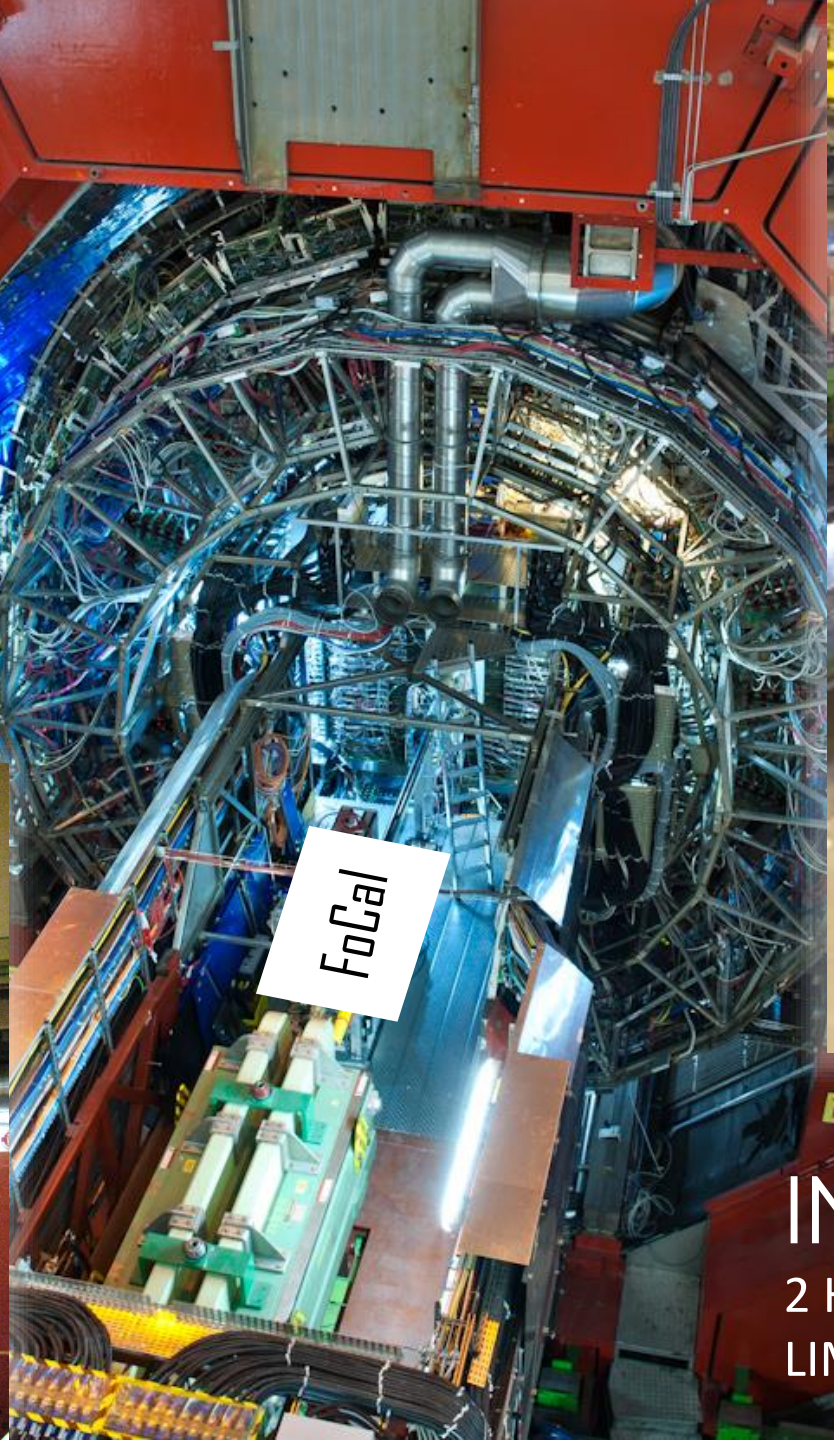
(Note 1) 0,8 si aces en cul-de-sac sur plus de 3 metres

LIMITED ROOM IN THE MINIFRAME

RESTRICTION OF SIDE PASSAGE

FoCal SERVICES VOLUME?

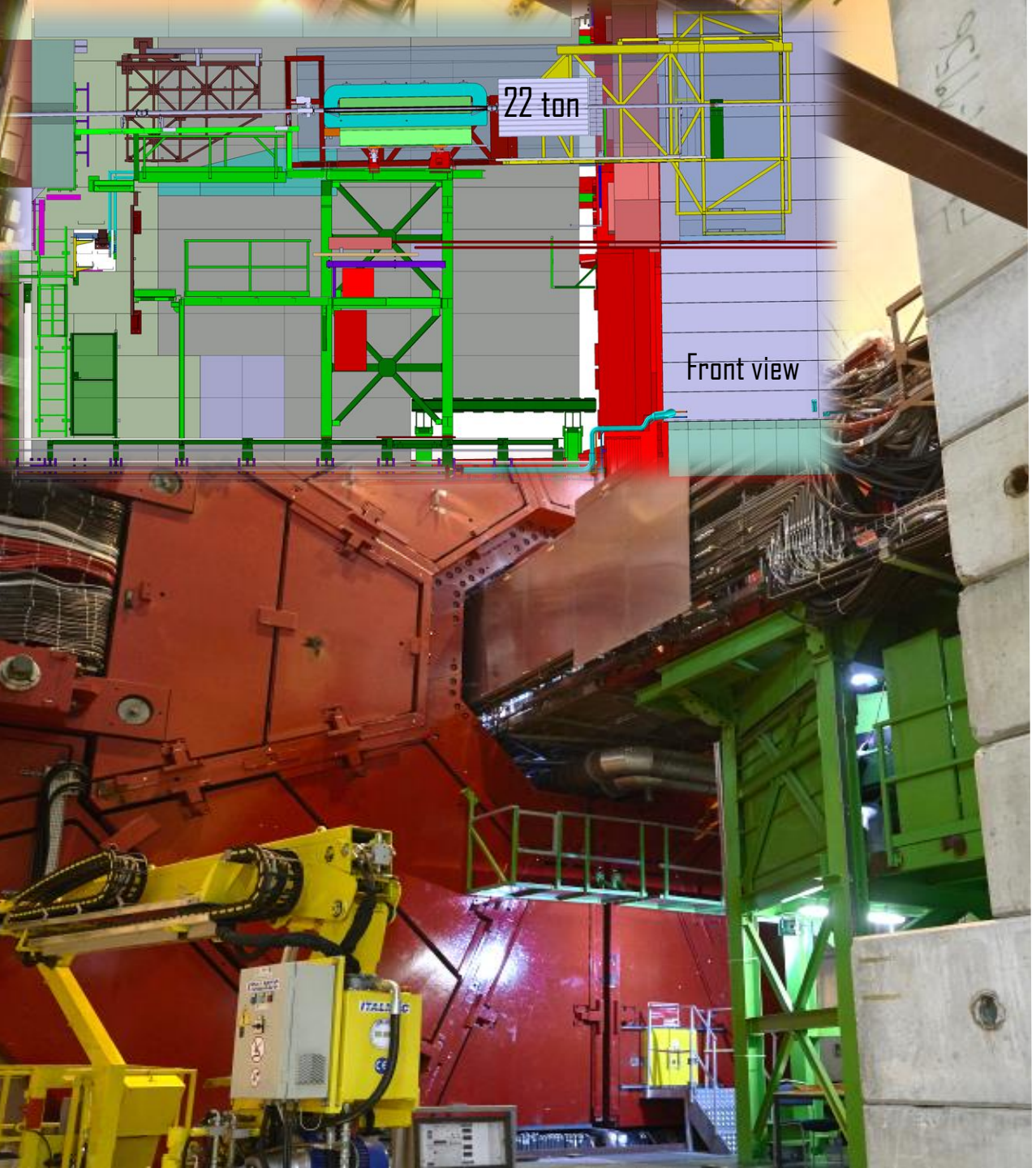




INSTALL-REMOVE

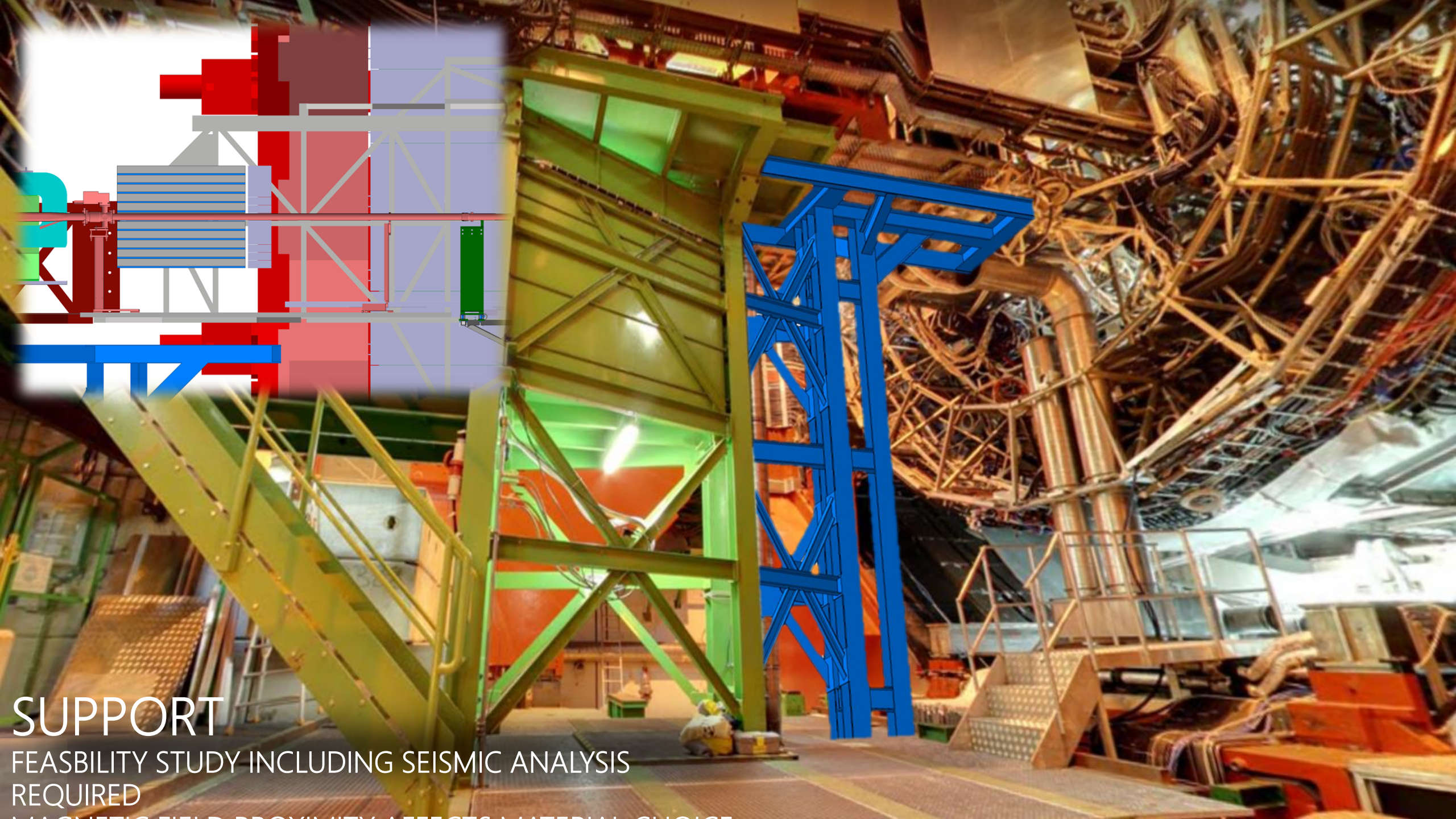
2 HALVES TO AVOID BP DISMOUNTING

LIMITED CRANE ACCEESS



SUPPORT

FOOTPRINT LIMITED BY L3 DOORS OPENING



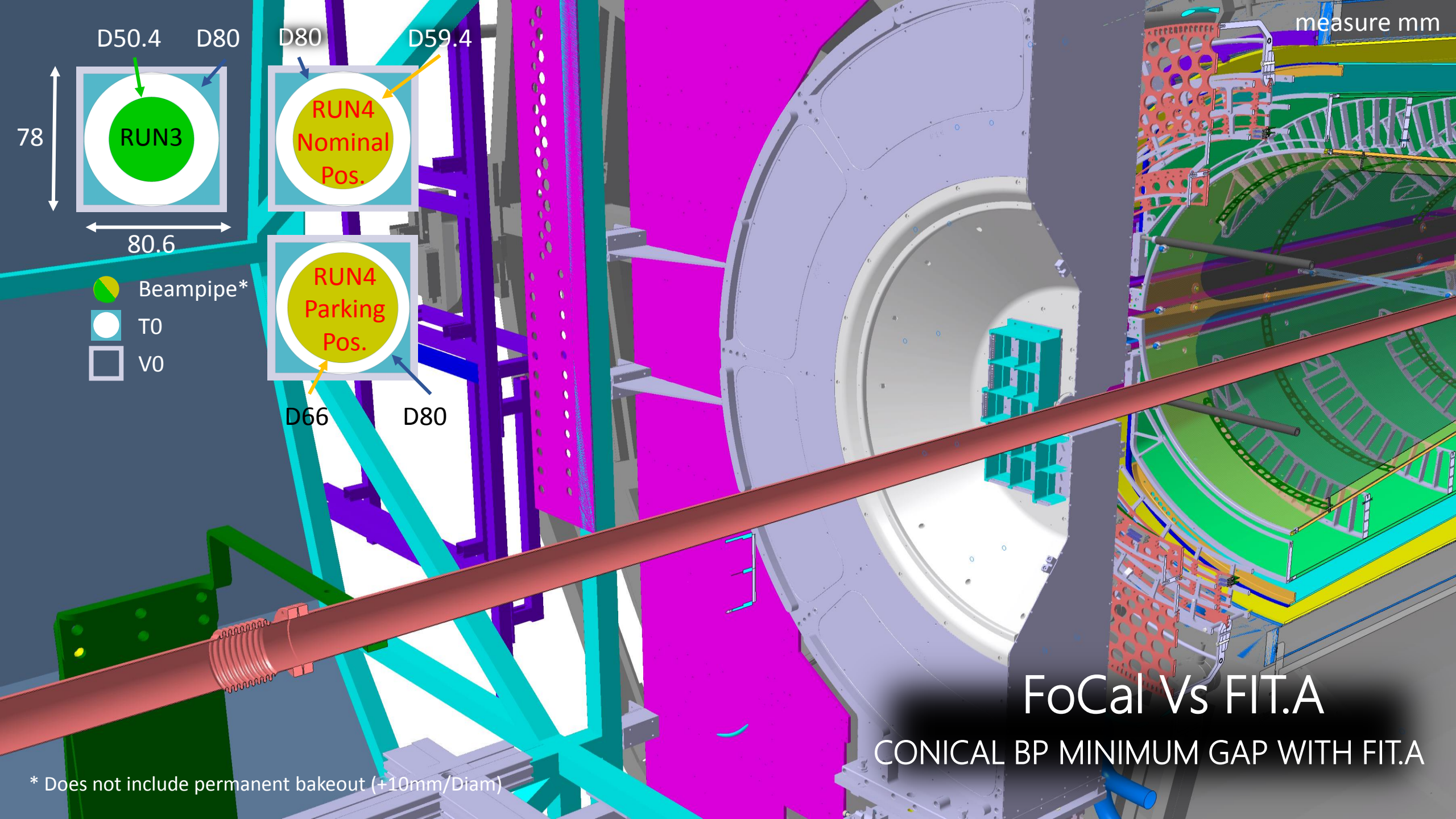
SUPPORT

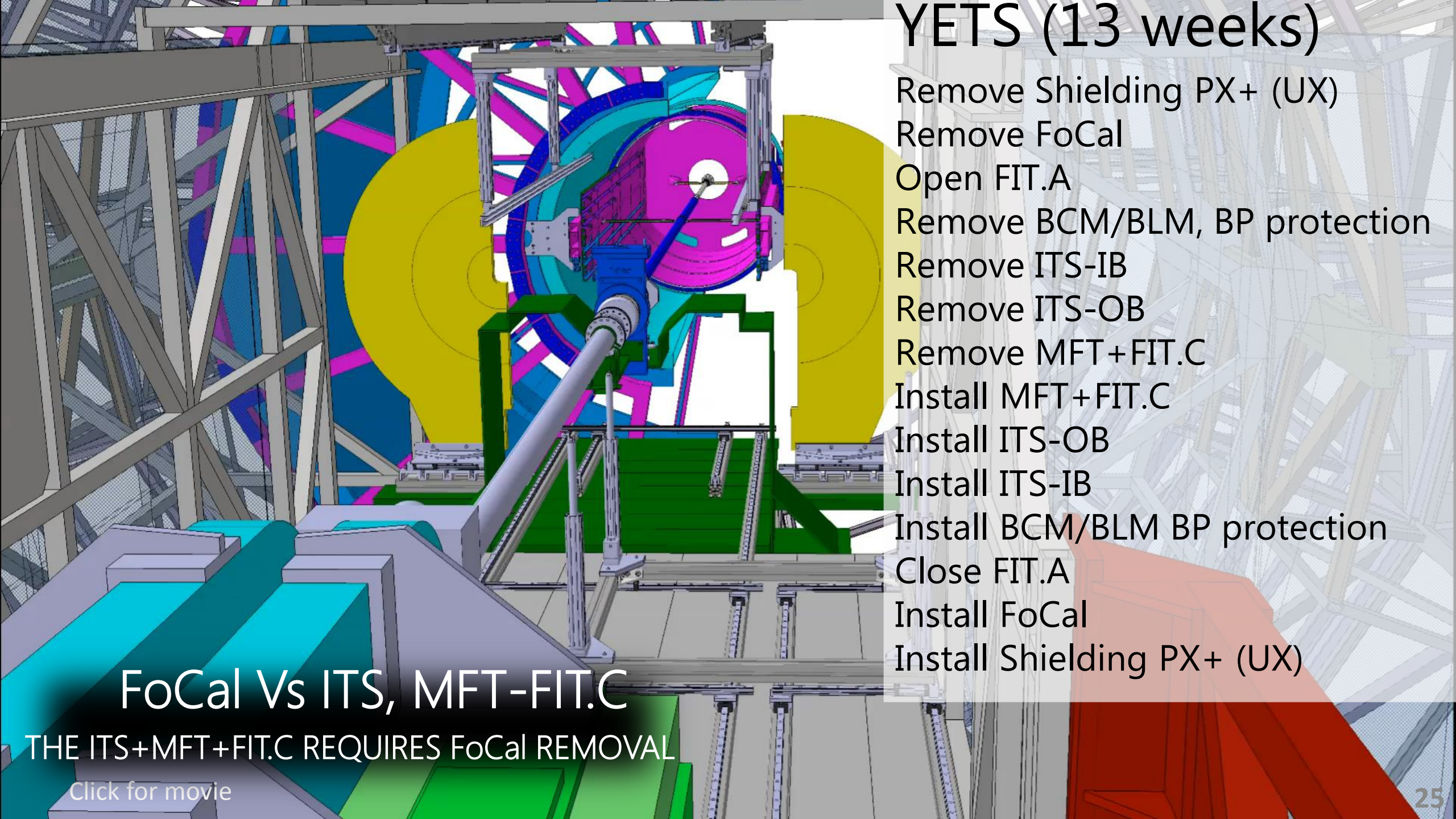
FEASBILITY STUDY INCLUDING SEISMIC ANALYSIS REQUIRED

MAGNETIC FIELD PROXIMITY AFFECTS MATERIAL CHOICE

SUPPORT

L3 VENTILATION DUCT ON THE WAY OF THE SUPPORT


D50.4
D80
D80
D59.4
RUN3
RUN4
Nominal
Pos.
78
80.6
RUN4
Parking
Pos.
Beampipe*
T0
V0
D66
D80
measure mm
FoCal Vs FIT.A
CONICAL BP MINIMUM GAP WITH FIT.A
* Does not include permanent bakeout (+10mm/Diam)



YETS (13 weeks)

Remove Shielding PX+ (UX)
Remove FoCal
Open FIT.A
Remove BCM/BLM, BP protection
Remove ITS-IB
Remove ITS-OB
Remove MFT+FIT.C
Install MFT+FIT.C
Install ITS-OB
Install ITS-IB
Install BCM/BLM BP protection
Close FIT.A
Install FoCal
Install Shielding PX+ (UX)

FoCal Vs ITS, MFT-FIT.C

THE ITS+MFT+FIT.C REQUIRES FoCal REMOVAL

Click for movie

Summary

Focal installation in ALICE implies:

- New Central Beampipe, new RB24 Beampipe
- RB24 Beampipe protection and new Miniframe access procedure (if protection is removed @RUN).
- Removal of Gate Valve → exposes BP to air at any disconnection of BP sections on the MNF →bakeout
- Removal of Focal/FIT/ITS/MFT for bakeout
- Reduction of Focal length (displacement) to preserve Ion pump position
- BLM and BCM functionality to be preserved
- Impact on ITS, MFT-FIT.C access time → FoCal must be removable w/o BP disconnection→2 halves
- Need to ensure/verify that the servicing of ITS/MFT can indeed be performed during a 13 week winter stop
- Reduction of clearance between Beampipe and FIT.A
- Removal of ZEM
- Access limitation on Miniframe →FoCal overall envelope and services TBD
- New Platform-Support (23 ton)→feasibility study → non magnetic material and seismic analysis
- Special handling procedure→crane limit due to L3 door proximity
- Modification of L3 air duct, new Beampipe supports, …