



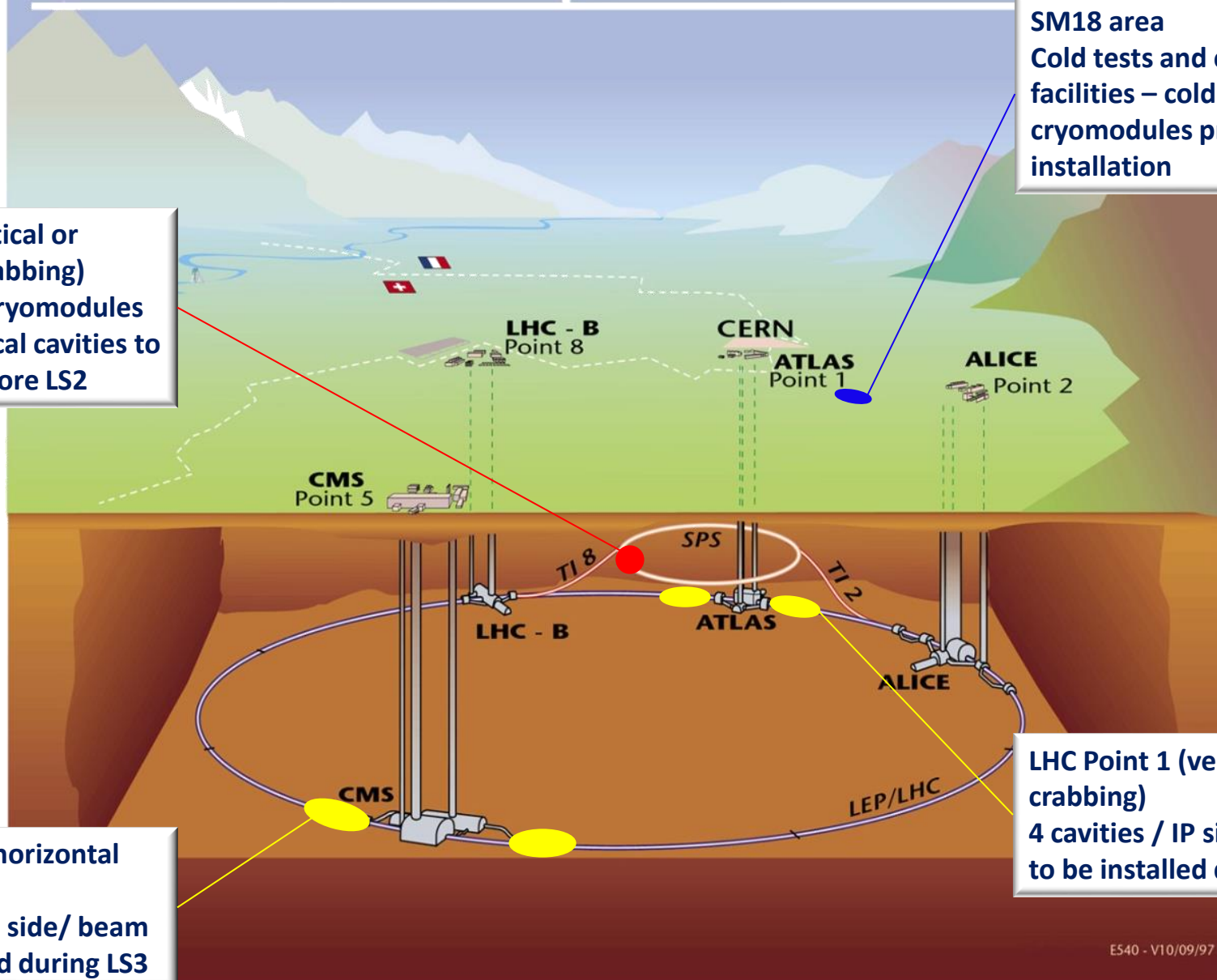
Crab cavities cryomodule

Federico CARRA
CERN, EN/MME

On behalf of crab cavities collaboration team

General

Overall view of the LHC experiments.



SM18 area
Cold tests and clean room facilities – cold test of cryomodules prior tunnel installation

SPS BA4 (vertical or horizontal crabbing)
One or two cryomodules with 2 identical cavities to be tested before LS2

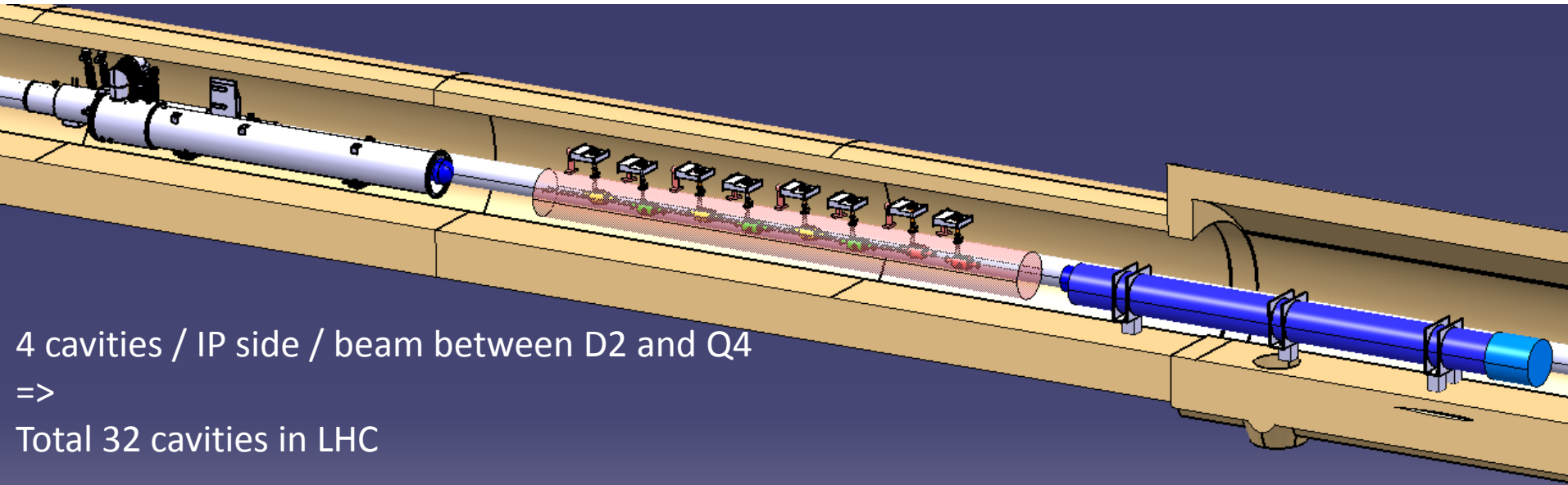
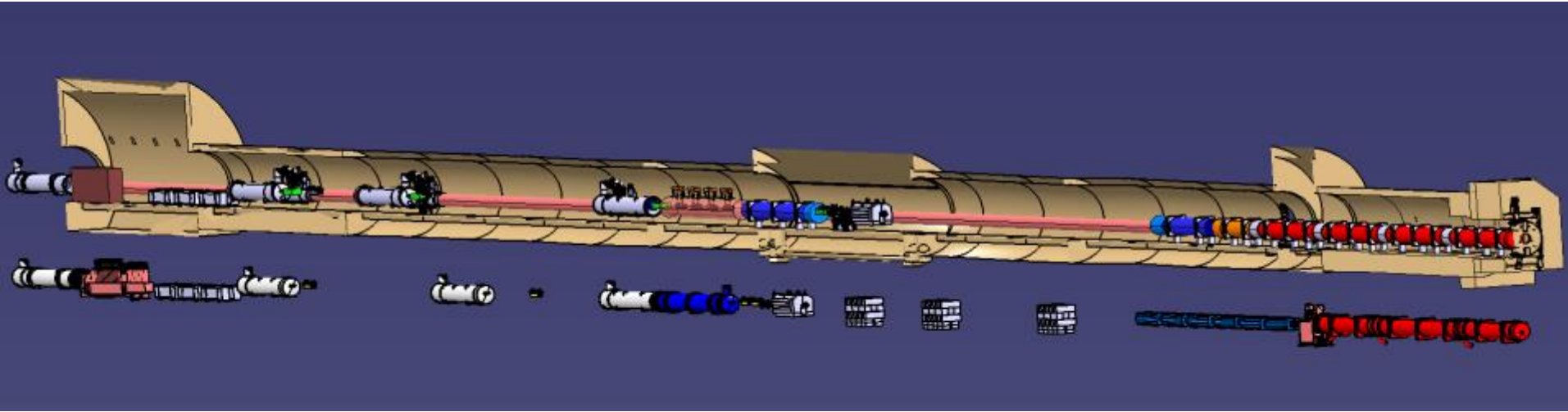
LHC Point 1 (vertical crabbing)
4 cavities / IP side/ beam to be installed during LS3

LHC Point 5 (horizontal crabbing)
4 cavities / IP side/ beam to be installed during LS3

General

- LHC

See presentation by Paolo Fessia this morning



4 cavities / IP side / beam between D2 and Q4

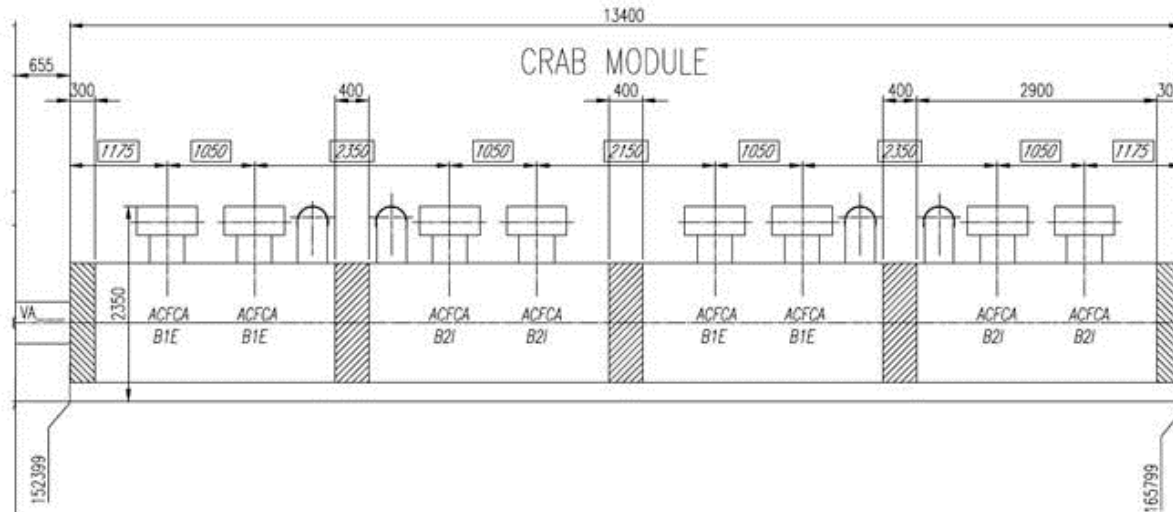
=>

Total 32 cavities in LHC

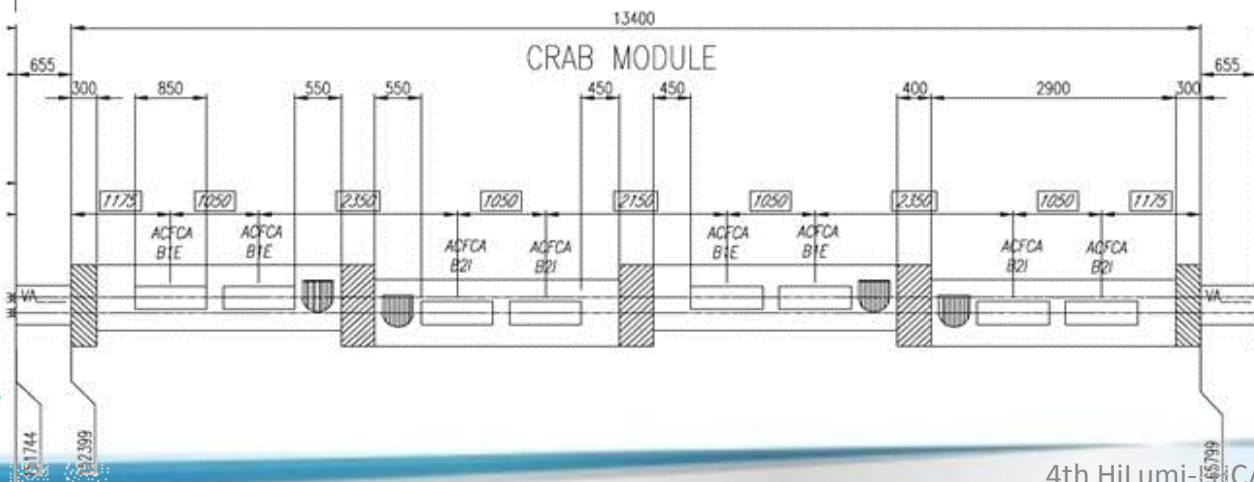
General

See presentation by Paolo FESSIA this morning

- LHC
 - 4 cryomodules x 2 cavities each / IP side



Lateral view

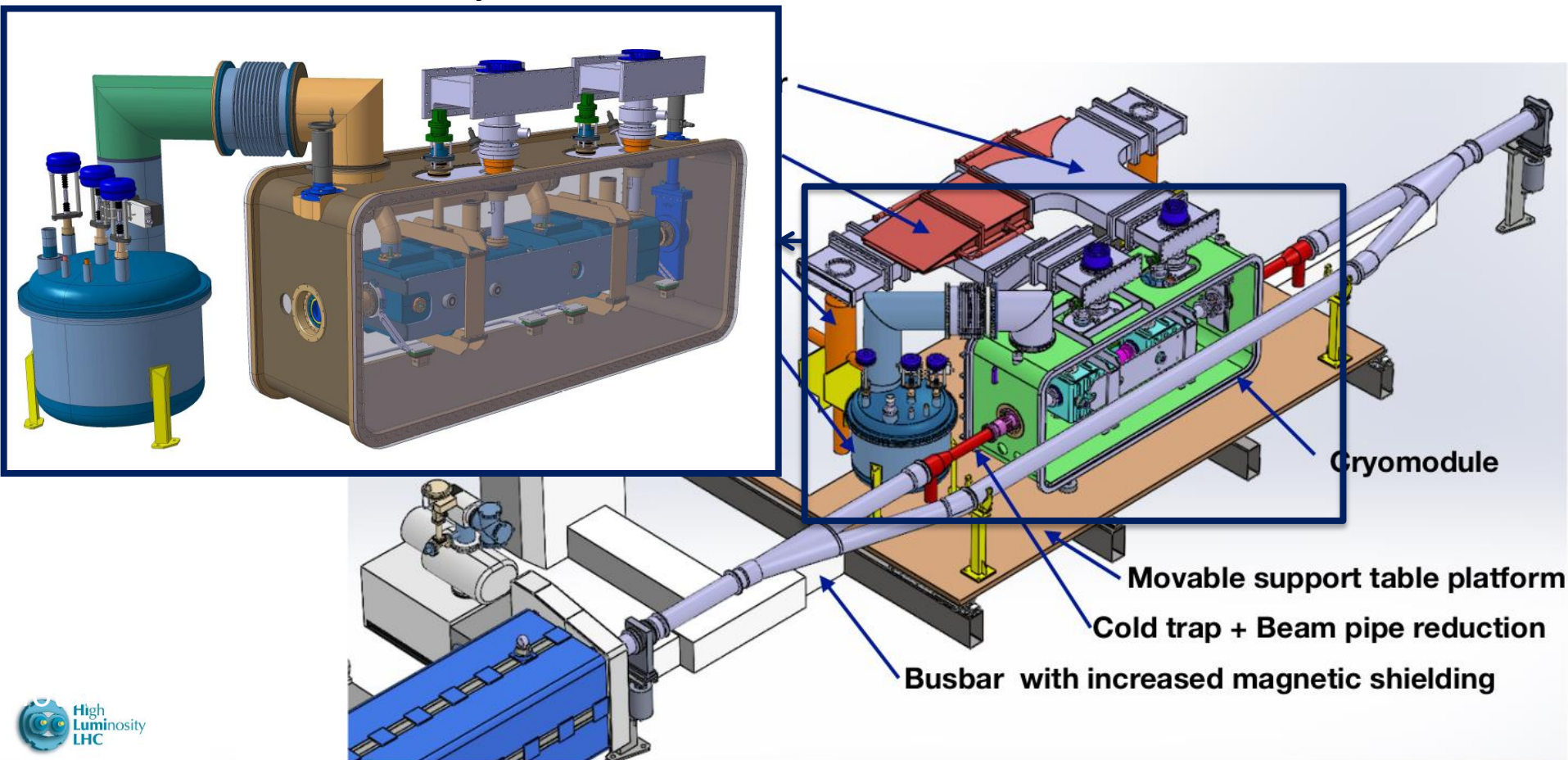


Top view

General

See presentations this morning by
Alick MACPHERSON
Krzysztof BRODZINSKI

- SPS
- Tests cavities with beam before LS2 – space for one cryomodule



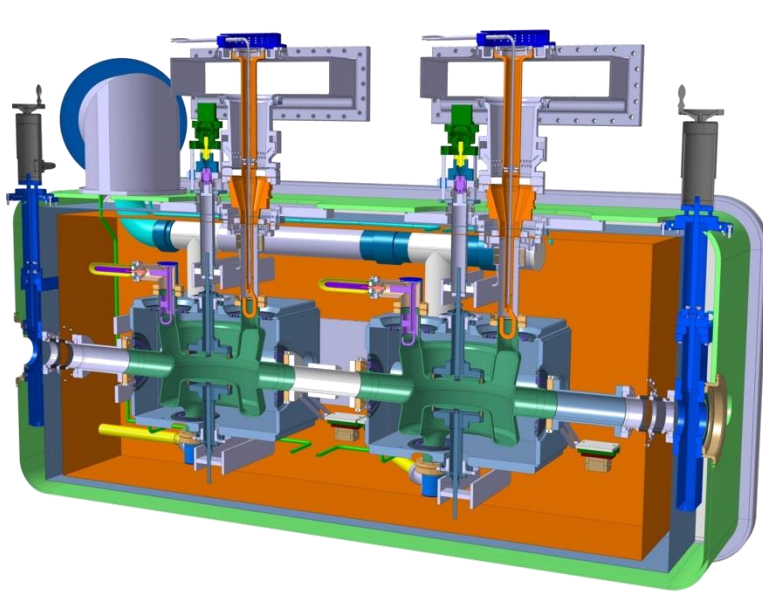
General

- SPS
 - 2 (identical) cavities in a cryomodule
 - 2 different cryomodules under design
 - Timeline:

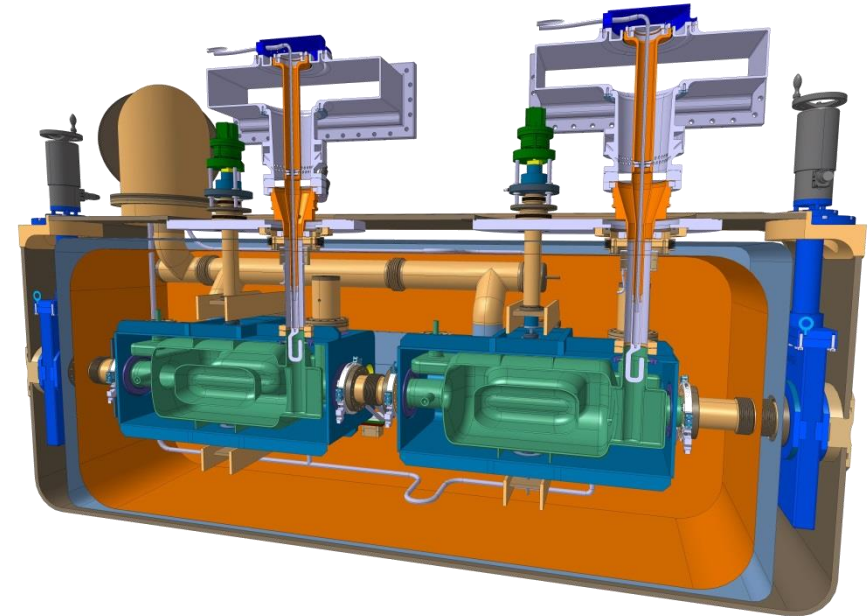
2015	Cavities fabrication and testing & Cryomodule fabrication
2016	Cryostating & SM18 Cryomodule tests
End 2016	Install Cryomodule 1 in SPS
2017	SPS Run 1
End 2017	Install Cryomodule 2 in SPS
2018	SPS Run 2

Cryomodule

Two different cryomodules under development



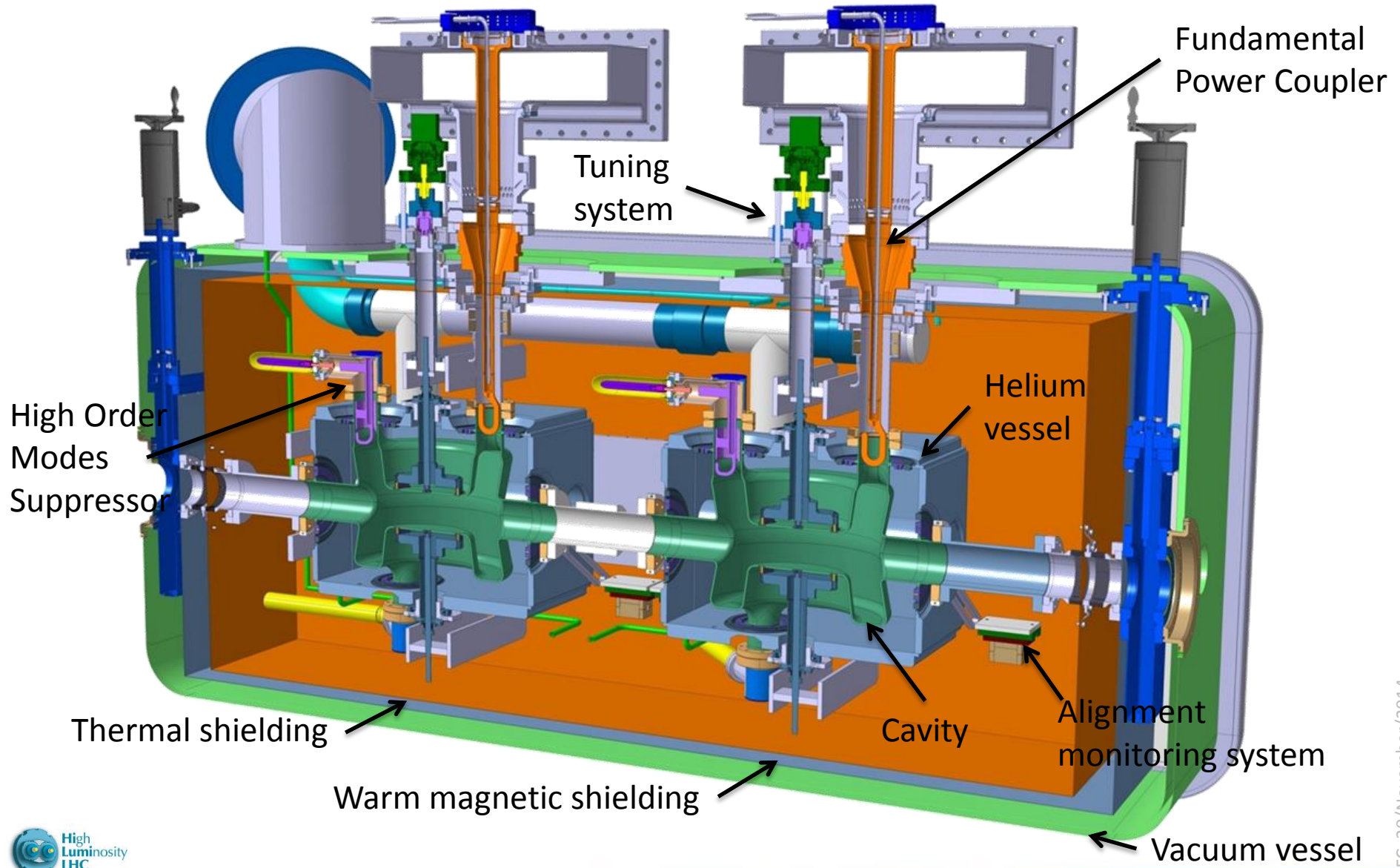
Cryomodule with DQW cavities



Cryomodule with RFD cavities

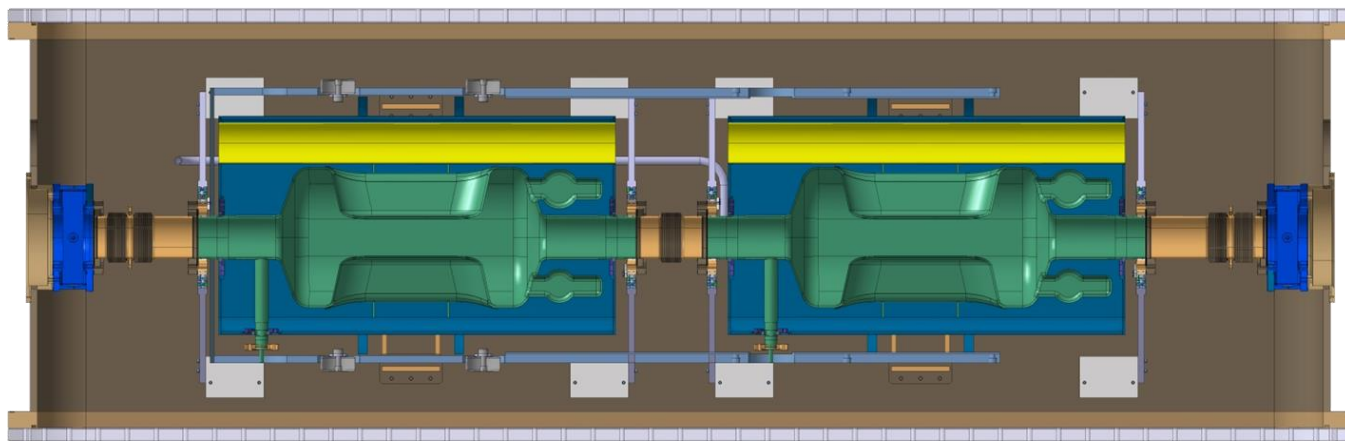
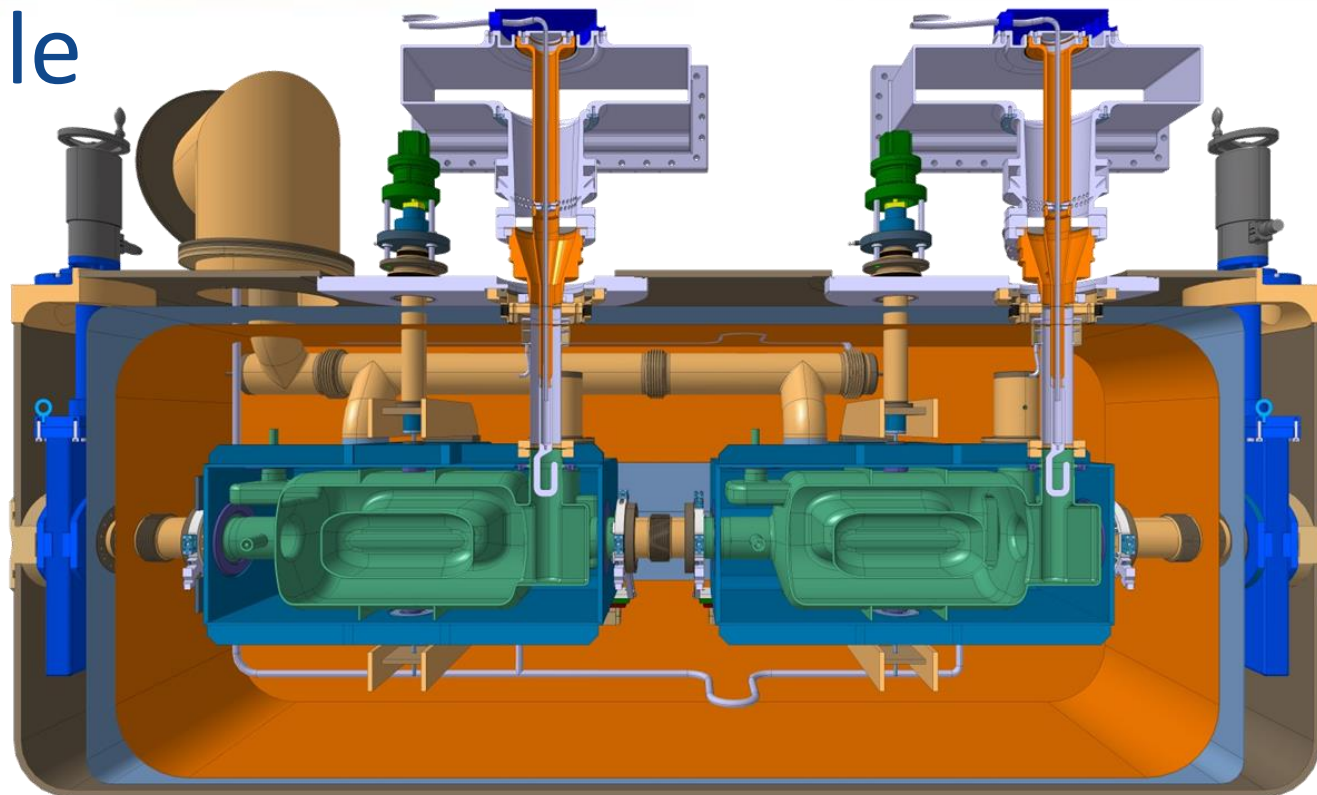
Cryomodule

Cryomodule with DQW cavities



Cryomodule

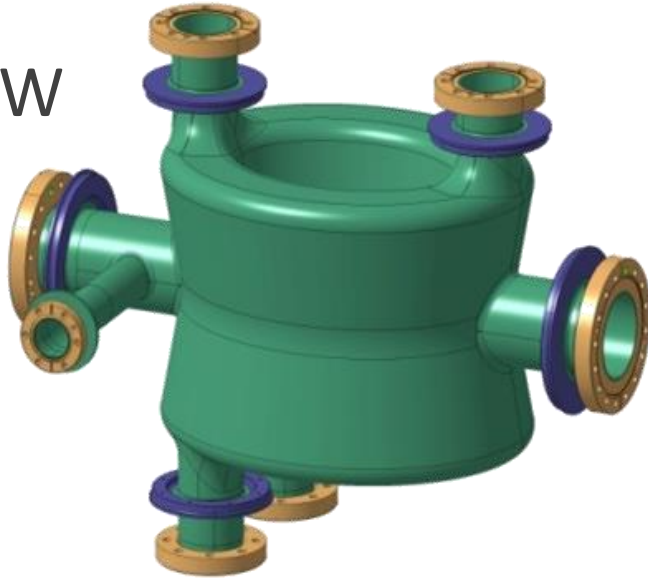
Cryomodule
with RFD
cavities



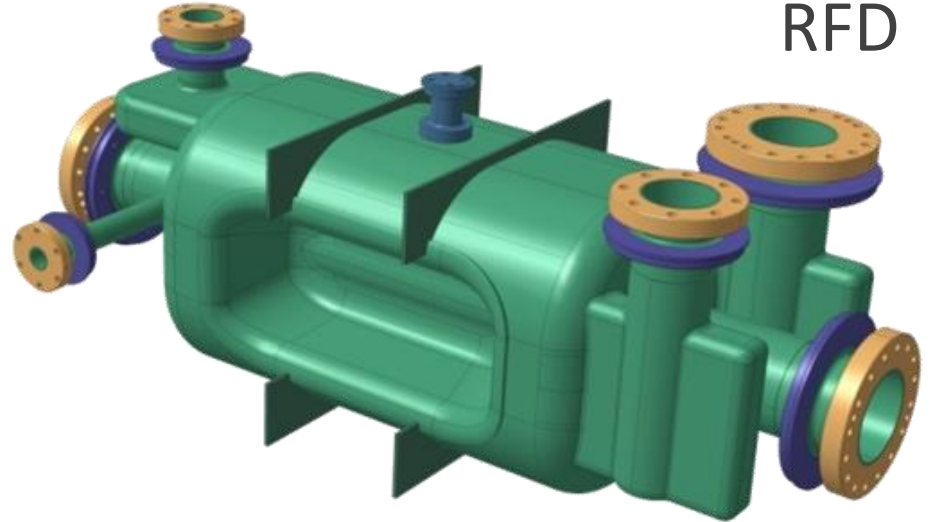
*See presentation by
Vincent BAGLIN this
morning*

Bare cavities

DQW



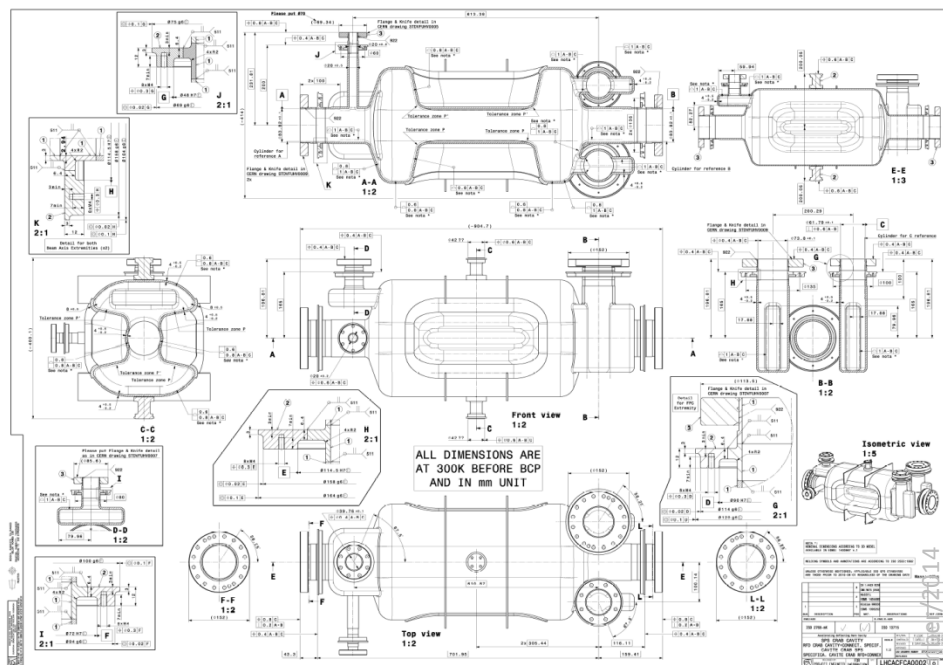
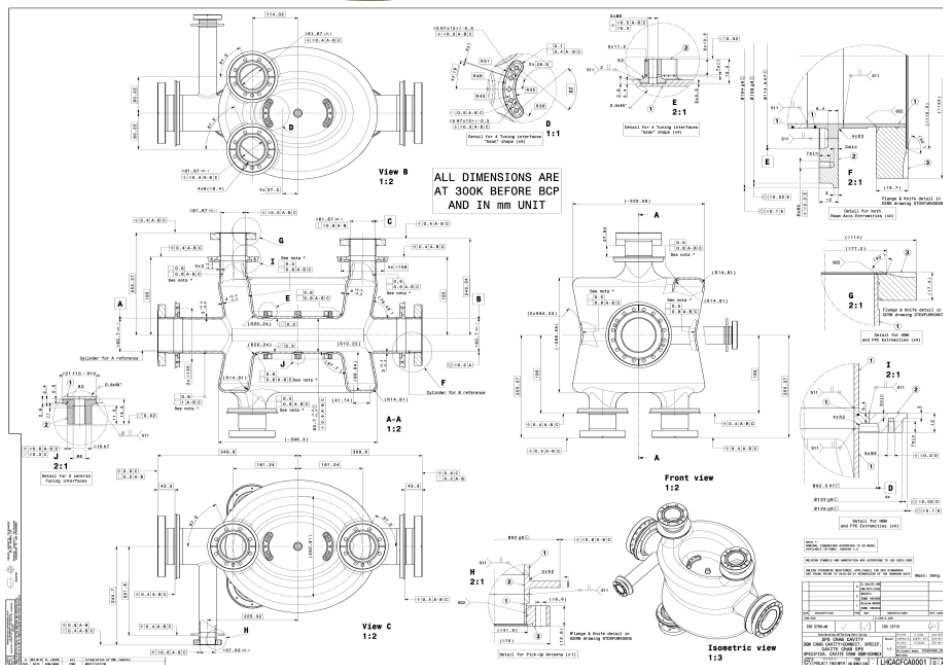
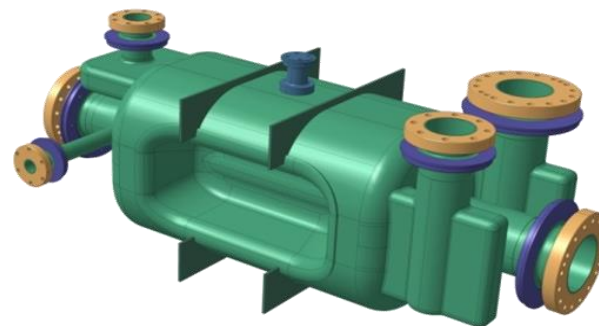
RFD



- Engineering specification by CERN / checked with LARP & UK
EDMS 1389669 "Engineering Specification for the dressed bulk niobium Crab Cavities"
- Manufacturing of cavities launched by LARP, close collaboration with CERN for QA follow-up

***See presentation by Alessandro RATTI
this morning***

Bare cavities

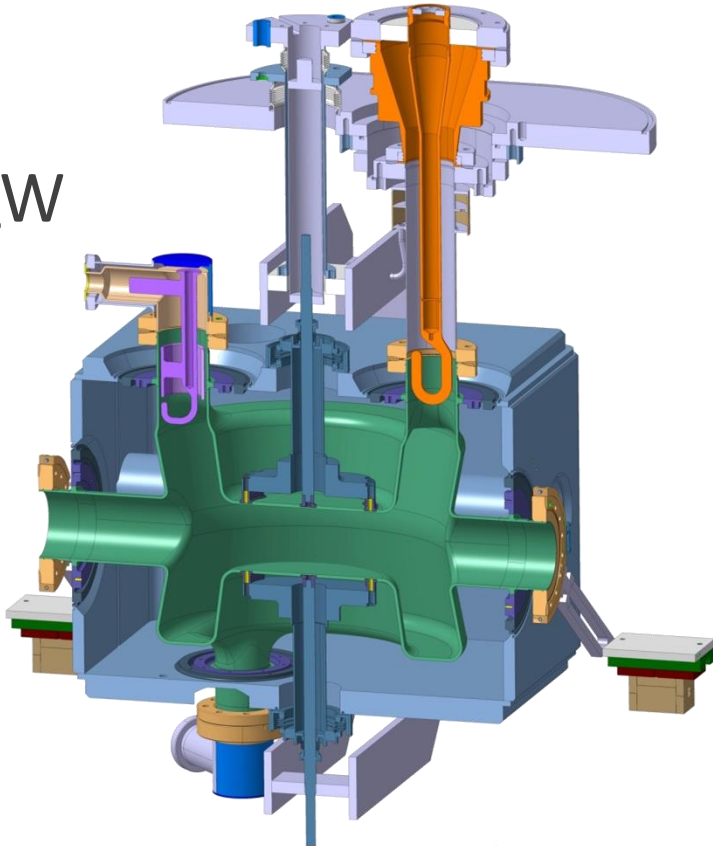


DQW Specification drawing – LHCACFA0001

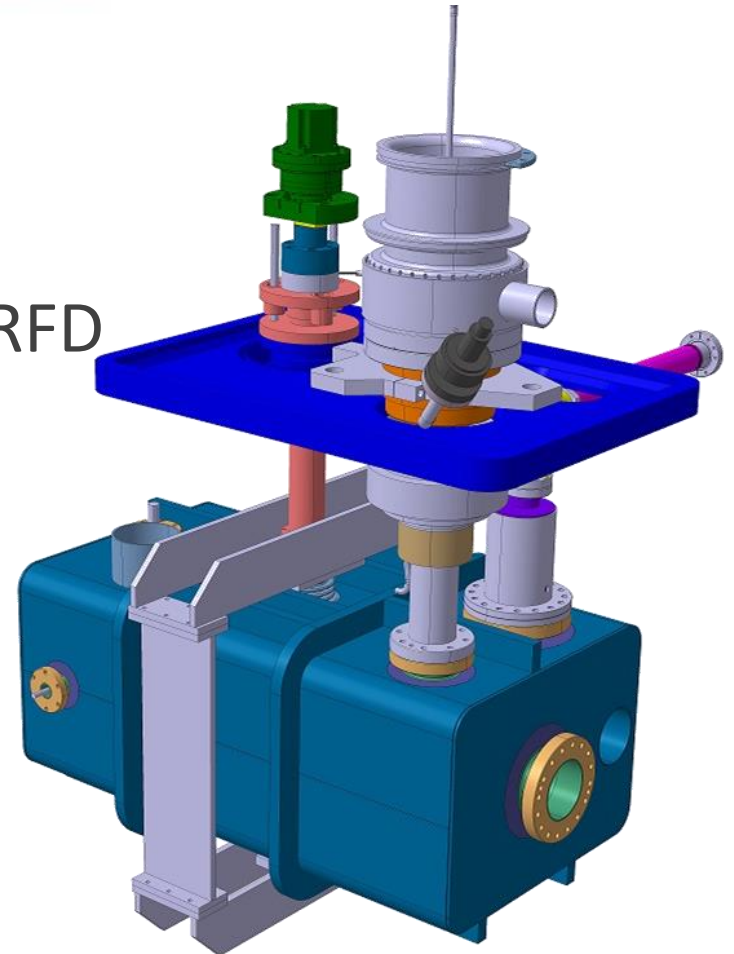
RFD Specification drawing – LHCACFA0002

Dressed cavities

DQW



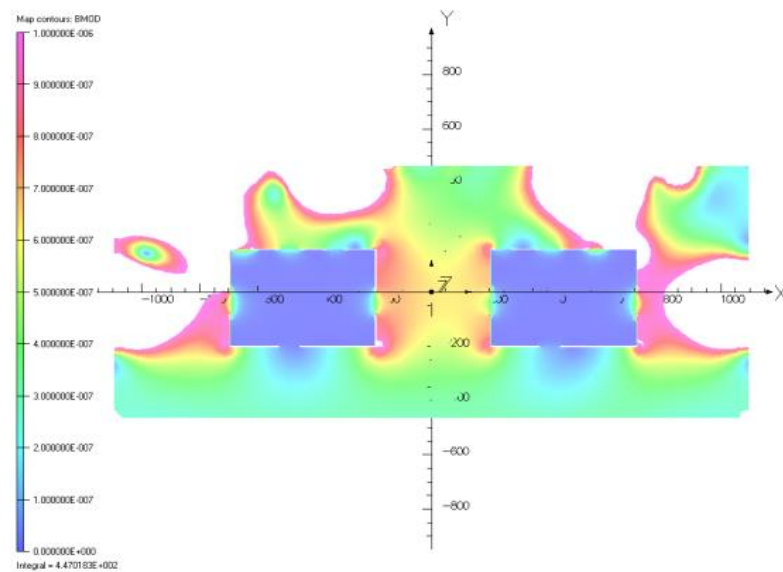
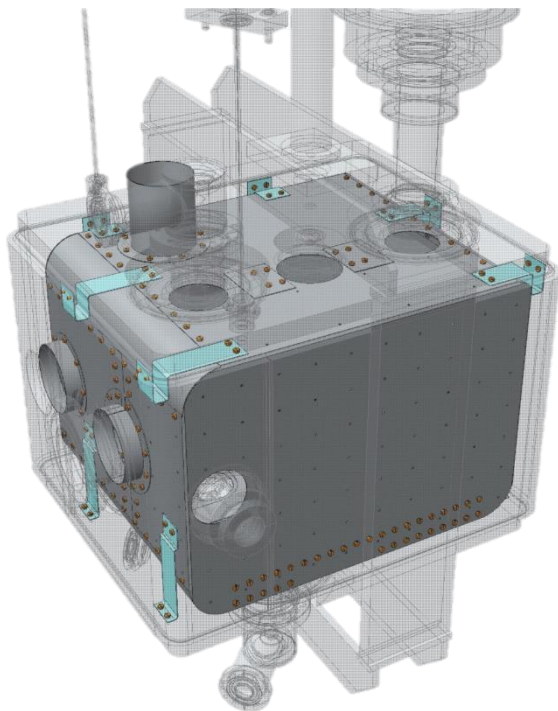
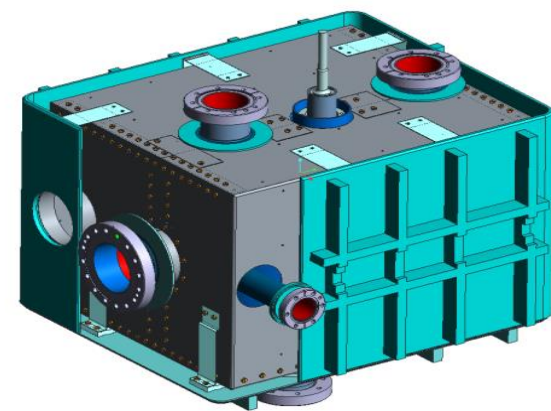
RFD



- Detailed design for manufacturing under finalization including helium vessel, HOM couplers, interface for tuning system and alignment system
- Manufacturing feasibility tests launched at CERN for different components: cavity, helium vessel, HOM, tuning system

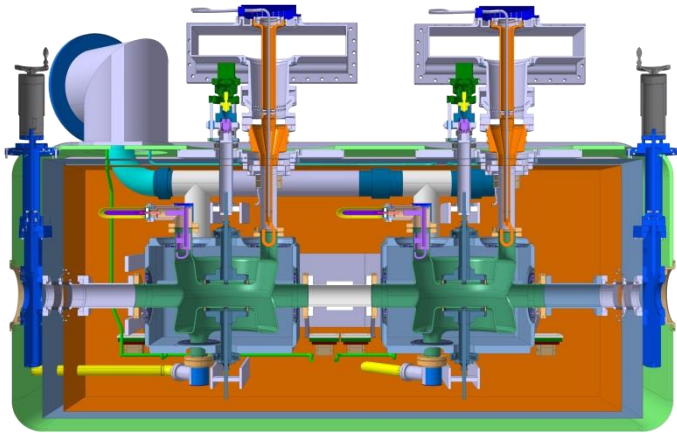
Cold magnetic shielding

Cold magnetic shielding inside helium vessel
Developed by colleagues from UK

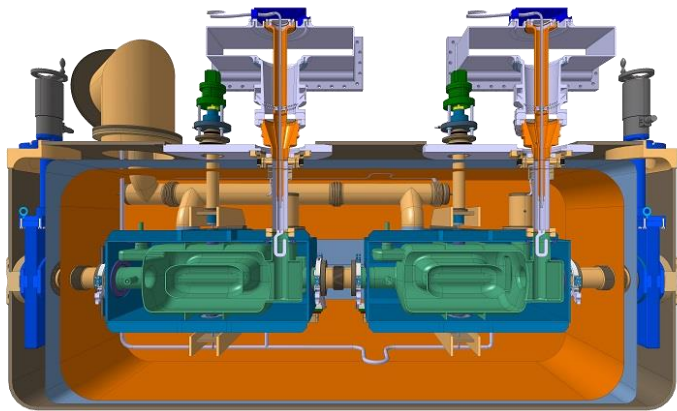


Tuning system

- Tuning system development
- Main integration constraint: limited space below RF Waveguide



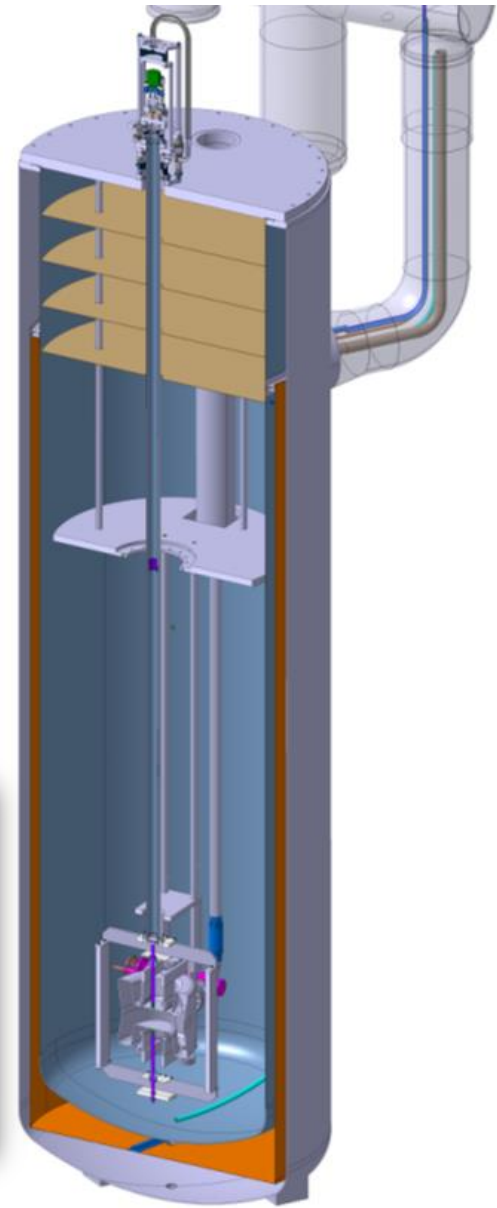
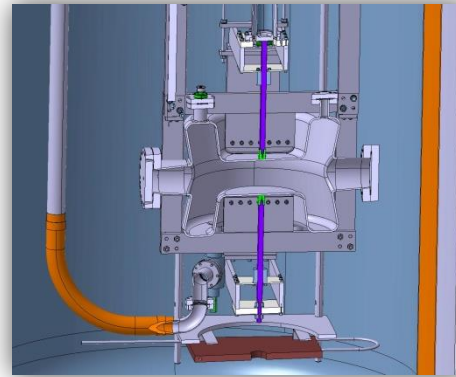
DQW



RFD

- Dedicated set-up in SM18 for tuning system validation on PoP cavities

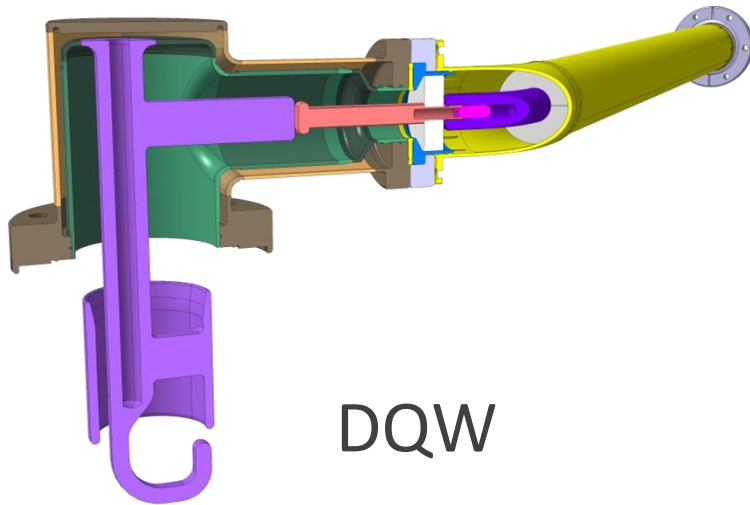
Concept approved,
fabrication
drawings in
progress



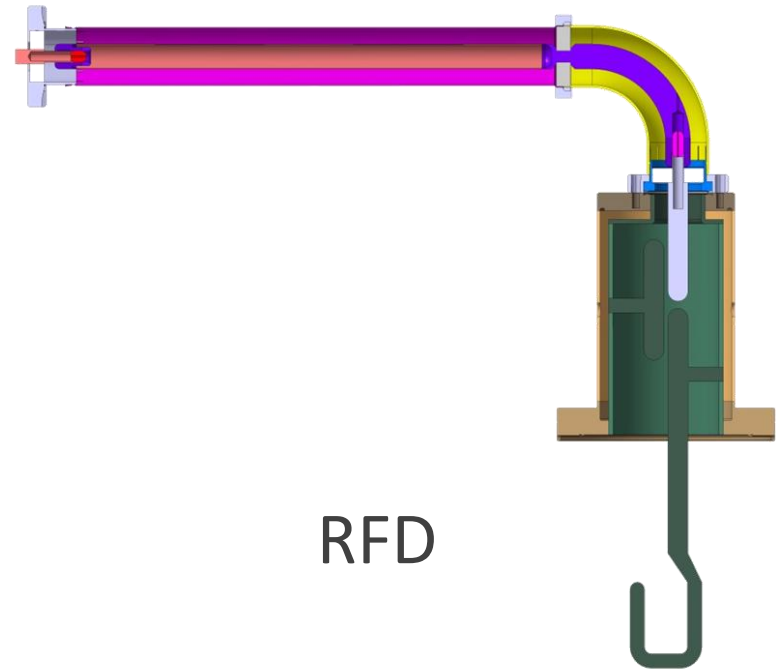
Higher Order Modes suppressor couplers

HOM couplers:

- Extensive collaboration between LARP, UK, CERN
- Complex shapes of bulk niobium with tight tolerances
- Actively cooled by superfluid helium at 2K
- Manufacturing specification drawings ongoing

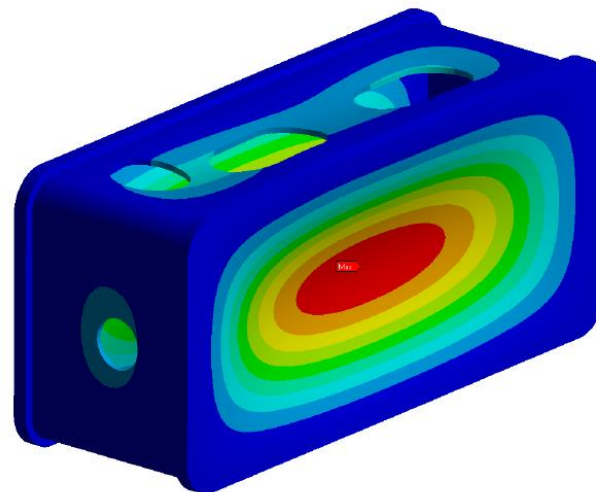
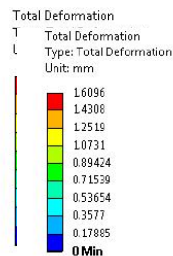
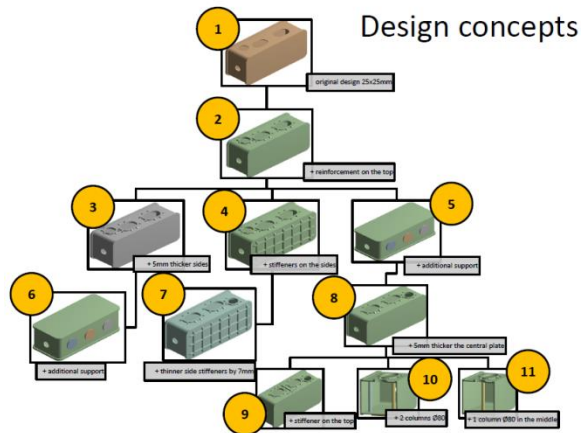


DQW

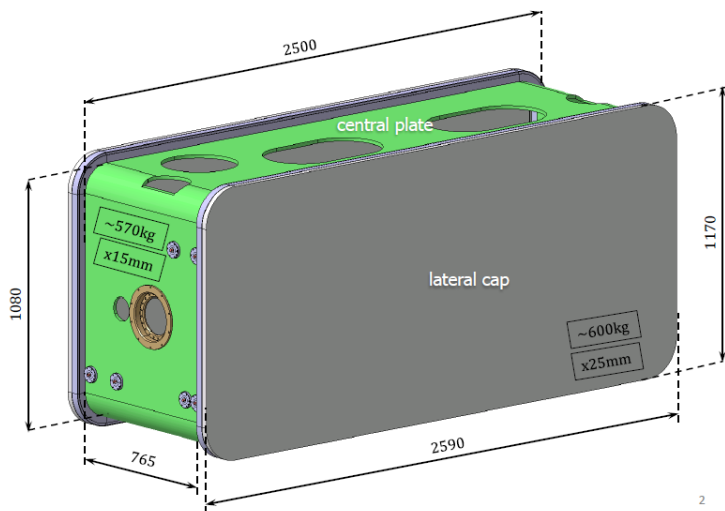


RFD

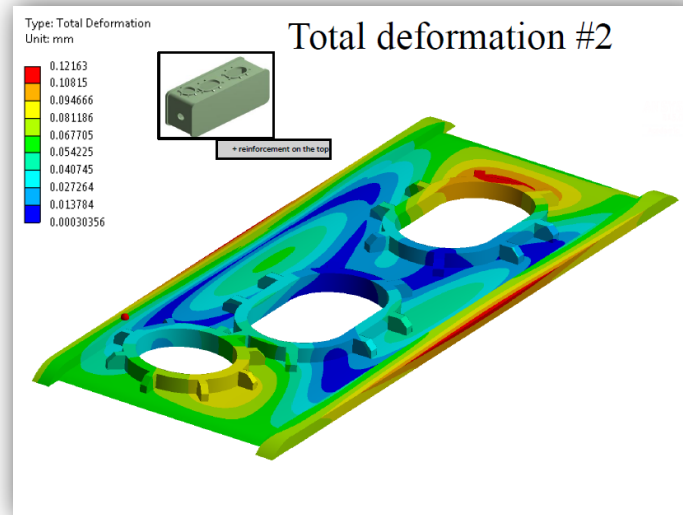
Vacuum vessel



Geometry

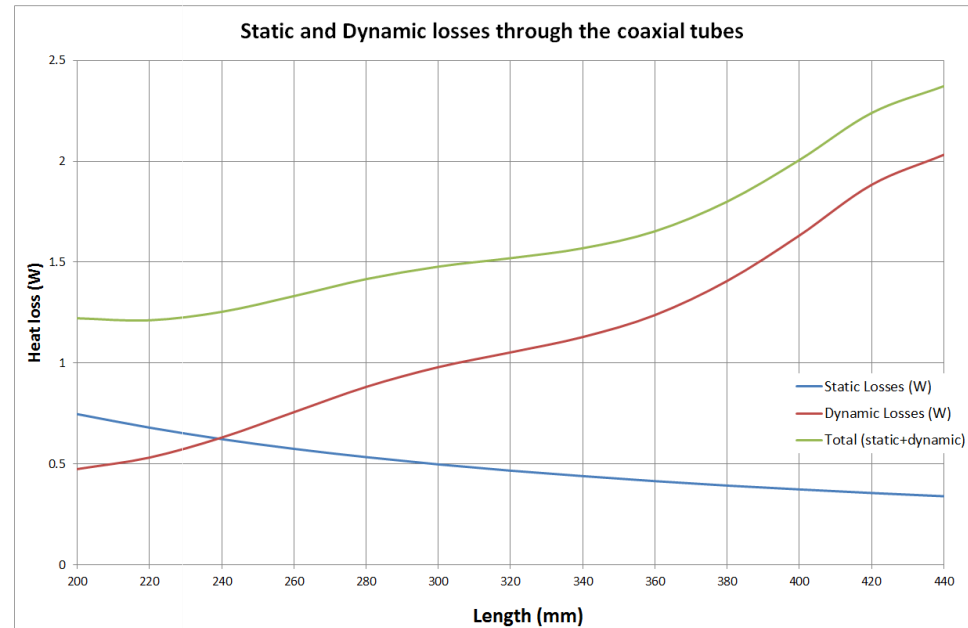
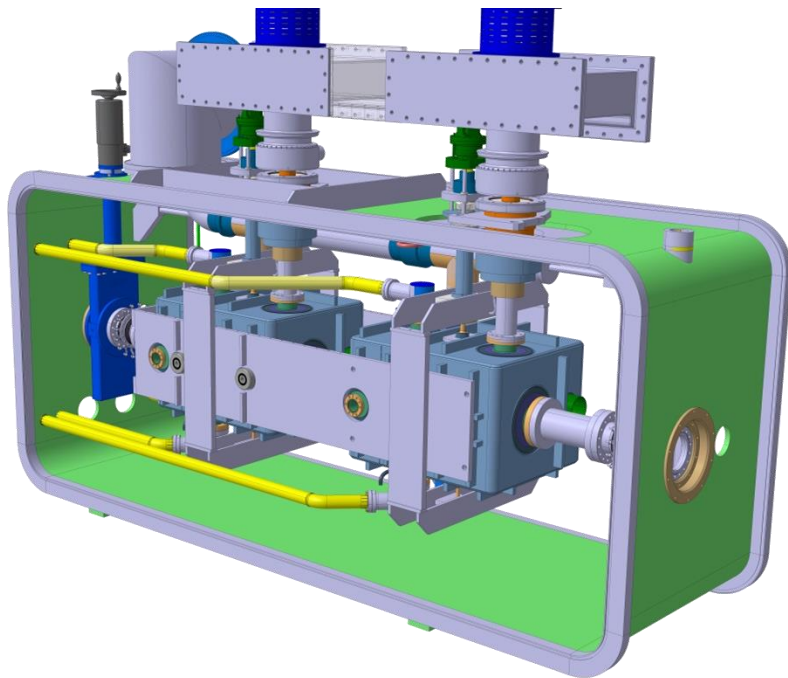


Mechanical optimization of vacuum vessel to limit deformation and guarantee cavity alignment in operation



Optimisation of thermal performance

Cryomodule thermal performance detailed optimization:
Example : HOM coaxial line – static and RF losses – geometry and thermalisation optimisation



EDMS 1405244 v.1

Total losses @ 2K : ~ 32 W (static + dynamic)

Conclusions

- Two crab cavities designs considered for tests in SPS
- Two related cryomodules development ongoing
- Bares cavities manufacturing launched; Close collaboration for engineering specification and manufacturing among UK, LARP and CERN
- Dressed cavities manufacturing specification drawings ongoing, will be launched for manufacturing this year
- Cryomodule parts under detailed design, manufacturing during 2015
- First cryomodule planned to be tested in SM18 mid-2016 and installed in SPS end-2016
- Cryomodule design for LHC planned to be as close as possible to SPS solutions