Dressed Cavity Fabrication and Integration

Tom Nicol

February 17, 2014

Dress Cavity and Cryomodule Highlights

- Three cavity designs.
  - 4-Rod (Daresbury)
  - Double Quarter Wave (Brookhaven)
  - RF Dipole (Old Dominion University and SLAC)
- (Probably) a single vendor for all three dressed cavity assemblies.
- Funding source for US dressed cavities is a $1M 2013 Phase 2 SBIR award to Niowave for the crab cavity cryomodule design and fabrication. Due to changes in the down-select process and SPS testing requirements, the original scope is not relevant.
- Niowave built the prototype for all three designs.
- No dressed cavities have been built.
- The cryomodule for both US cavities will be designed and built at CERN. As of the end of the December workshop at CERN, Daresbury will design and build their own cryomodule.
- Desire as much commonality in the three cryomodule designs as possible.

Dress Cavity and Cryomodule Highlights (cont'd)

- Goal is at least two cryomodules tested in SPS to ensure at least one US design.
- BNL is coordinating the double quarter wave cavity design.
  - Bare cavity design at BNL
  - Dressed cavity design in collaboration with CERN
- ODU is coordinating the RF dipole cavity design.
  - Bare cavity design at ODU
  - Dressed cavity design in collaboration with Fermilab
- If an end-lever tuner is used, the design will likely be based on one from Saclay. Otherwise the tuner will be the responsibility of BNL and ODU.
- The input coupler will be provided by CERN.
- CERN will assist with pressure vessel code compliance issues.
- In addition to being involved in the RF dipole dressed cavity design, Fermilab will play provide oversight in the fabrication of all three dressed cavity designs.

CERN-ACC-NOTE-2013-003

HiLumi LHC

FP7 High Luminosity Large Hadron Collider Design Study

Scientific / Technical Note

Functional Specifications of the LHC Prototype Crab Cavity System

Baudrenghien, P

et al

28 February 2013

The HiLumi LHC Design Study is included in the High Luminosity LHC project and is partly funded by the European Commission within the Framework Programme 7 Capacities Specific Programme, Grant Agreement 284404.

This work is part of HiLumi LHC Work Package 4: **Crab cavities**.

The electronic version of this HiLumi LHC Publication is available via the HiLumi LHC web site <http://hilumilhc.web.cern.ch> or on the CERN Document Server at the following URL: <http://cds.cern.ch/search?p=CERN-ACC-NOTE-2013-003>

CERN-ACC-NOTE-2013-003

Functional Specifications of the LHC Prototype Crab Cavity System

P. Baudrenghien, K. Brodzinski, R. Calaga, O. Capatina, E. Jensen, A. Macpherson,

E. Montesinos, V. Parma

Keywords: Crab Cavity cryostat LHC SPS

Summary

This document outlines the functional specifications for LHC prototype crab cavities to be tested in the SPS, and describes a first look at the RF system, cryomodule and cryogenic aspects. These guidelines are prepared with input from experts at CERN and the HiLumi collaboration, including EuCARD and USLARP.

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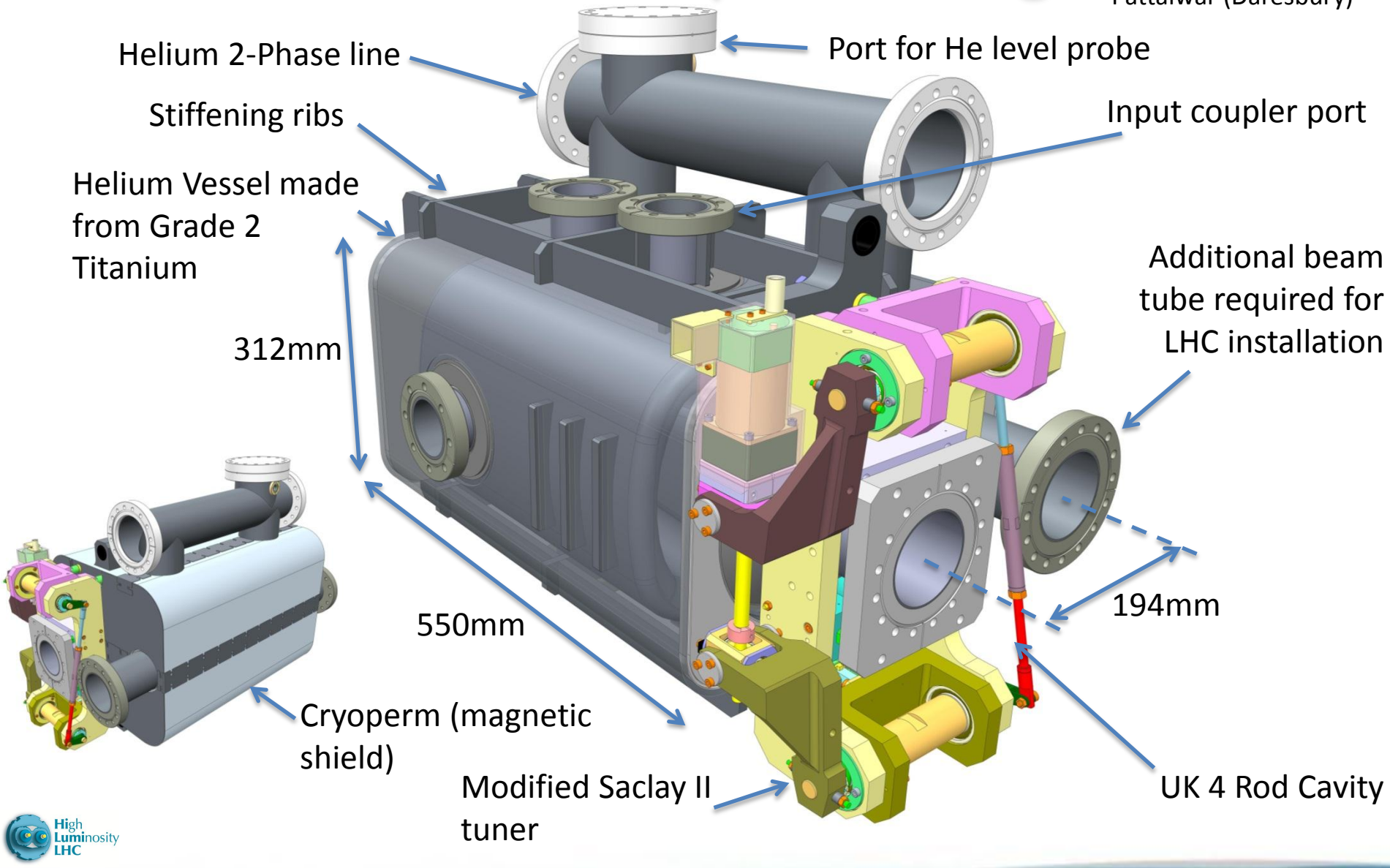
4-Rod (Daresbury)

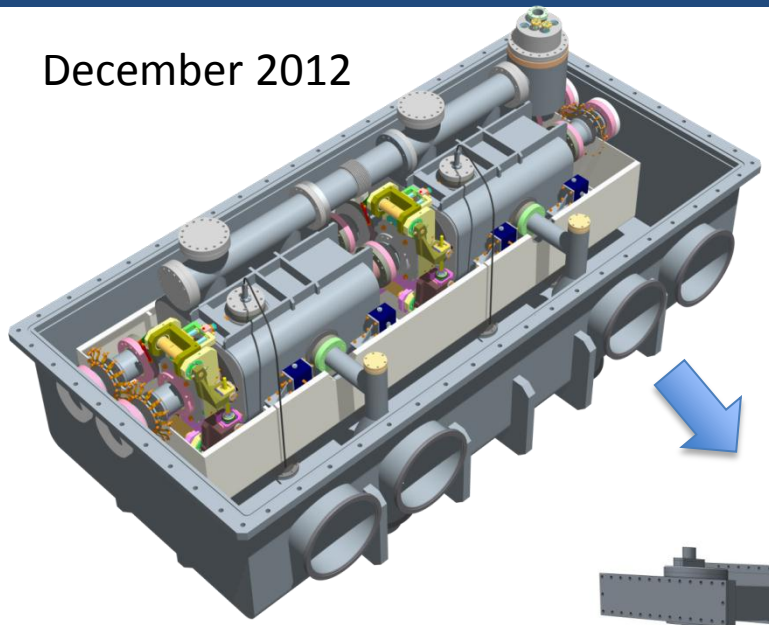
Helium vessel conceptual design

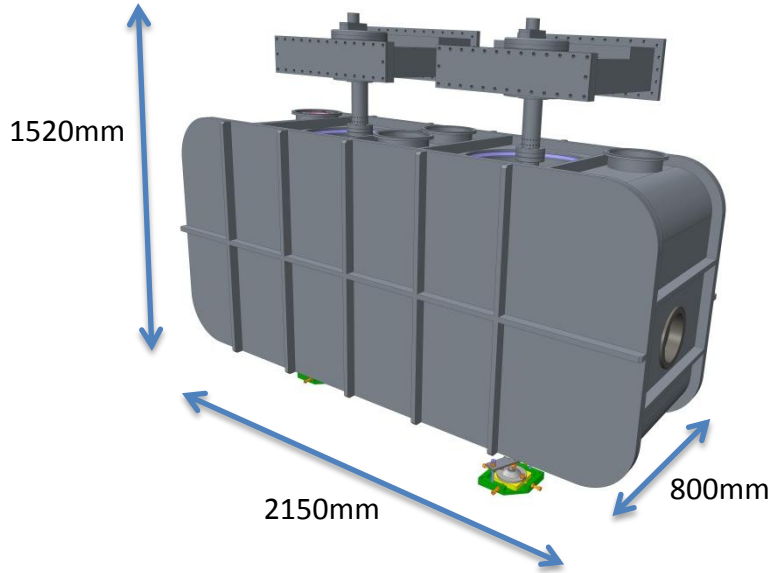
Slides from Tom Jones and Shrikant Pattalwar (Daresbury)



Cryomodule Concept

December 2012





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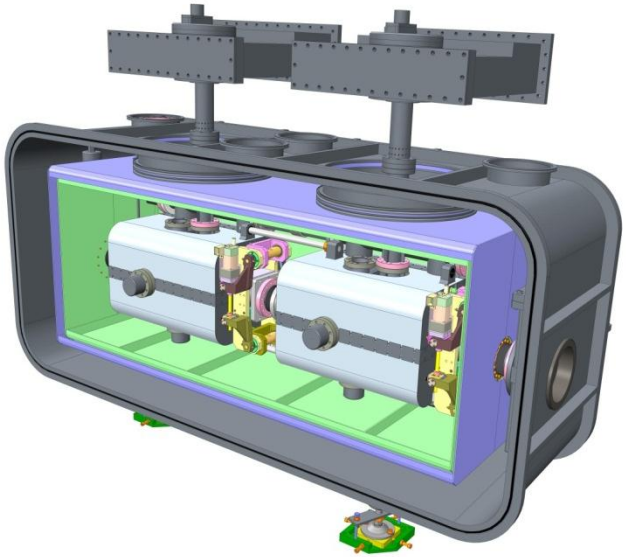


Design Approach

Provide sufficient and easy access to internal components during assembly and after installation

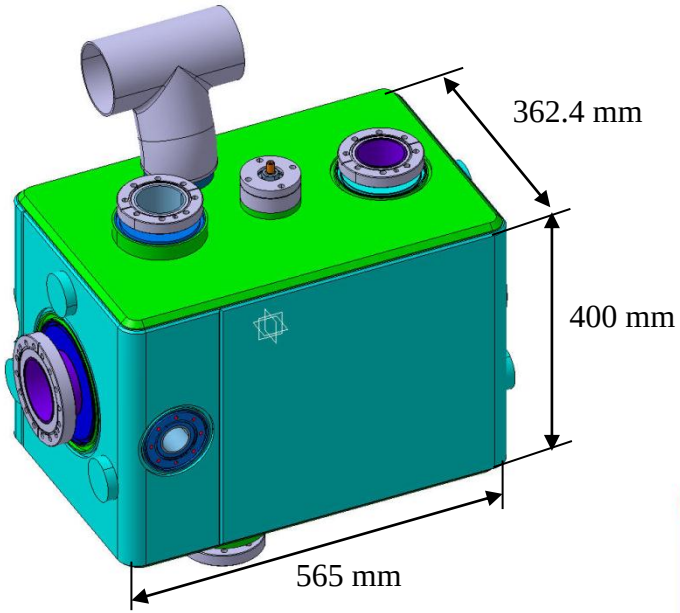
More details in - Conceptual design of a Cryomodule for Crab Cavities for HiLumi-LHC
S. Pattalwar, et al, MOP 087, SRF 2013, Paris

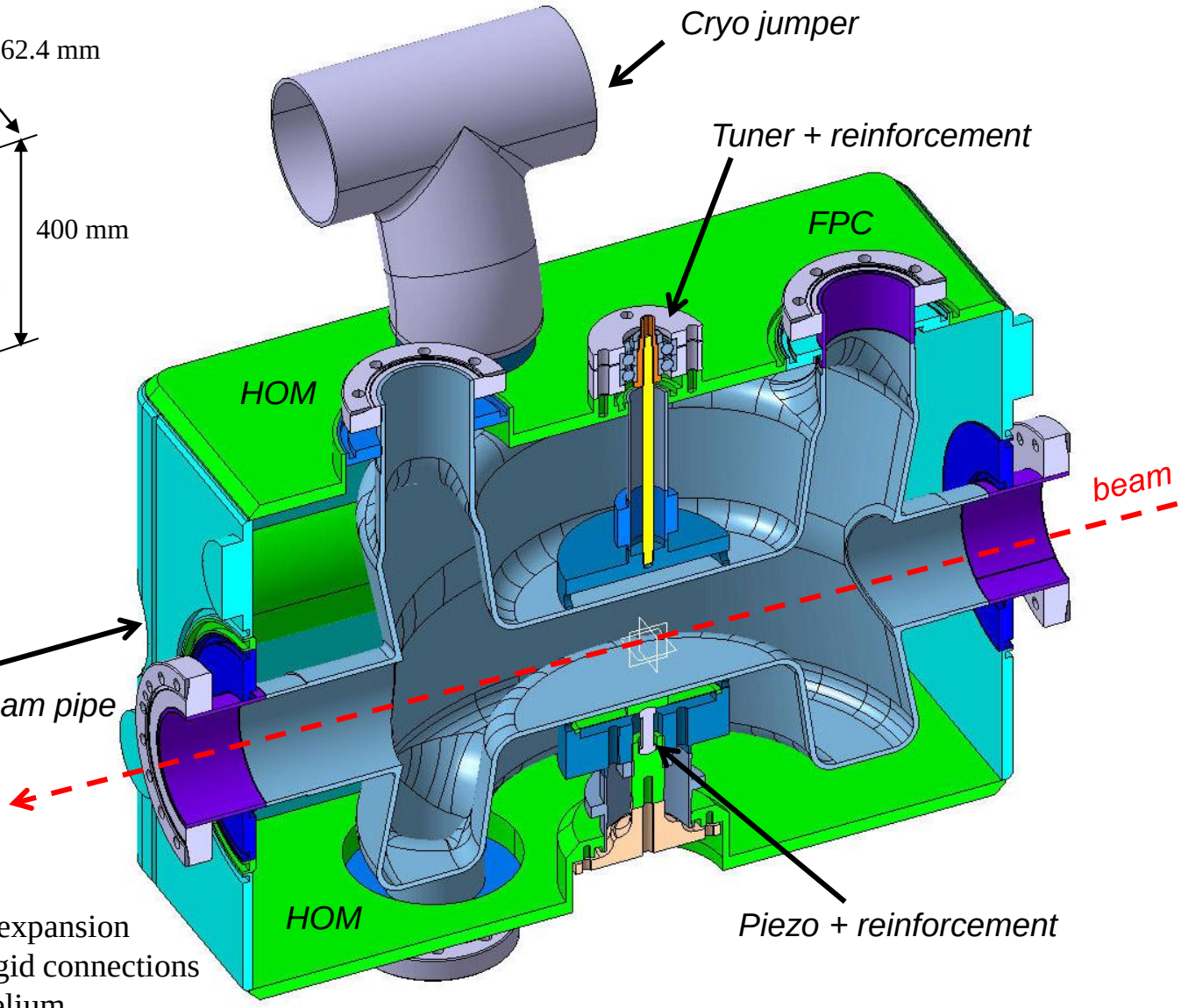
High Luminosity LHC

Double Quarter Wave (BNL)

Helium vessel in titanium (BNL-CERN)

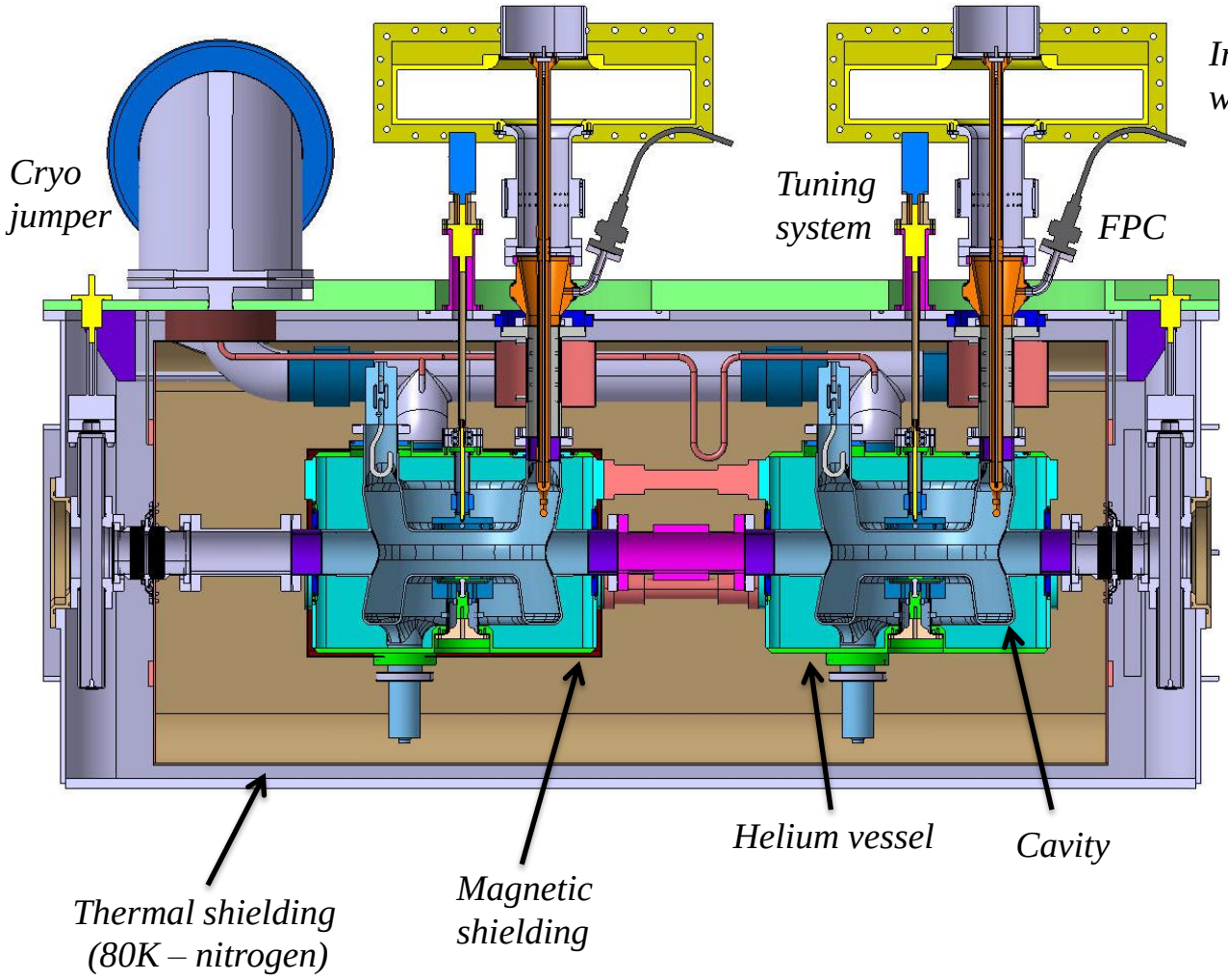
Slides from Silvia Verdú-Andrés (BNL)

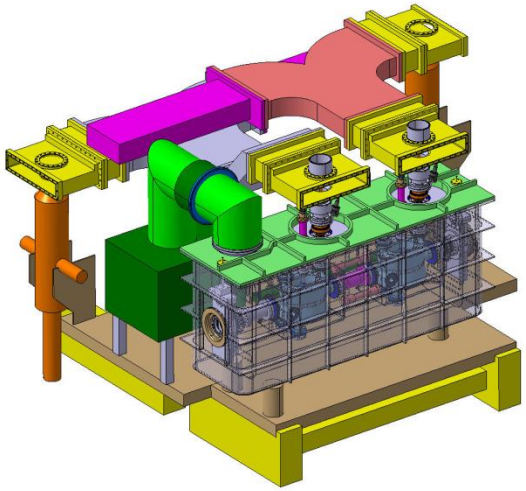




- Titanium shows same thermal expansion coefficient than Niobium → rigid connections
- Compact design, 55 liters of helium

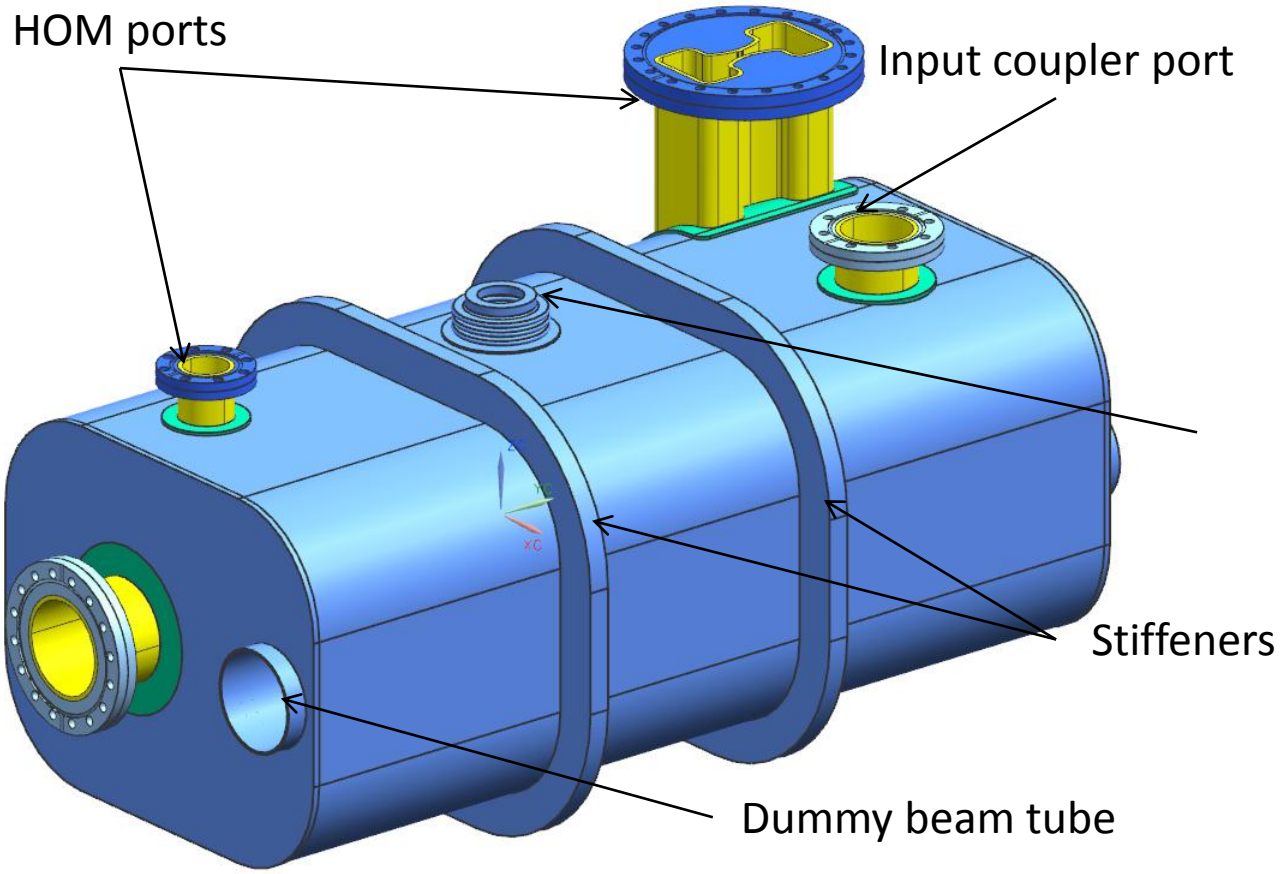
Integration of dressed cavity into cryomodule (CERN)

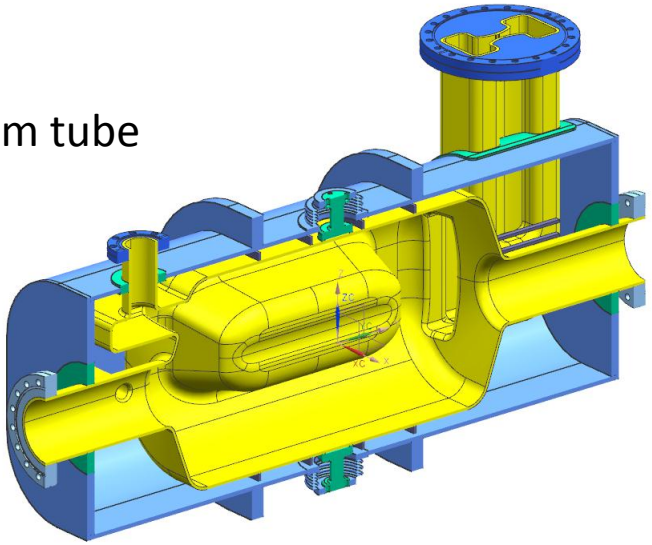




FOR MORE DETAILS FOLLOW THE TALK BY LUIS ALBERTY

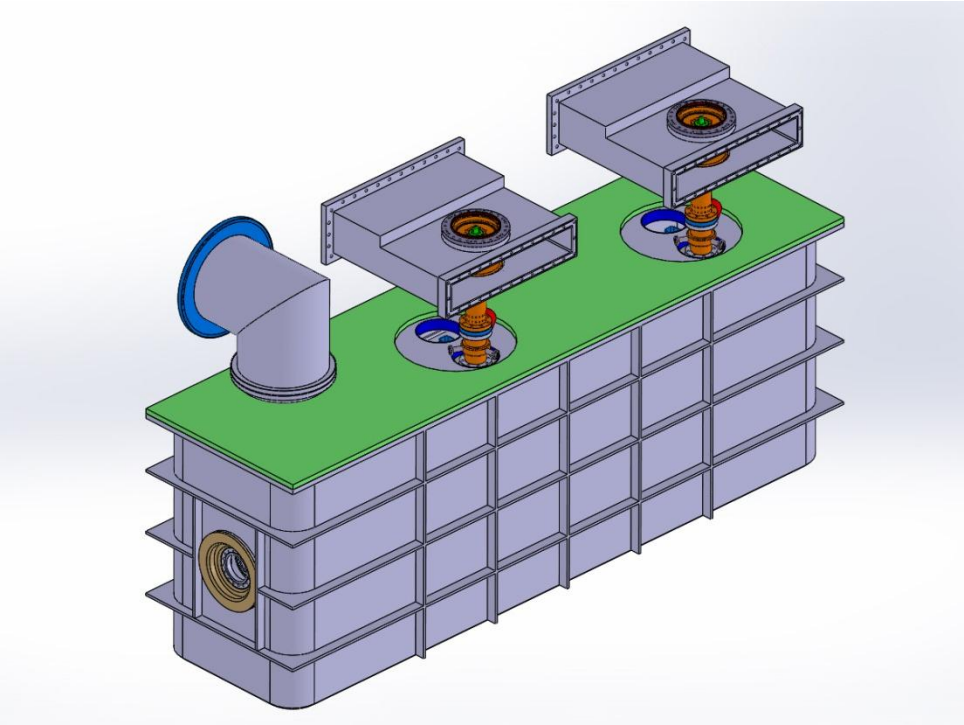
RF Dipole
(ODU and Fermilab)

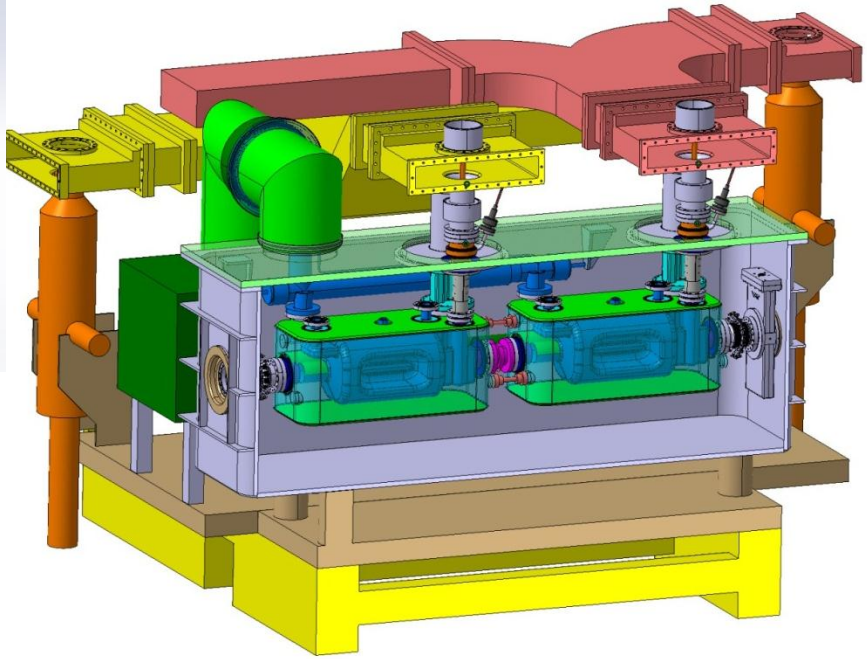




RF dipole dressed cavity assembly

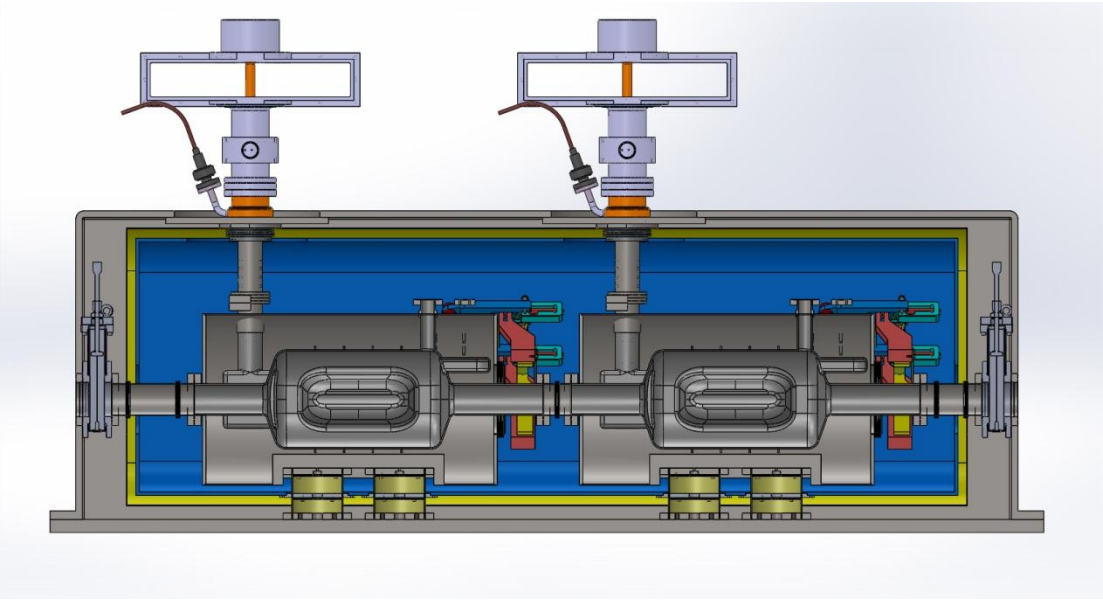
February 2014

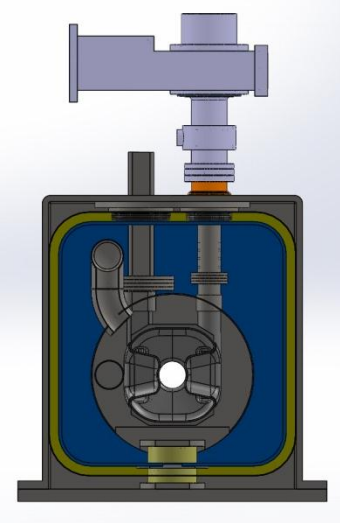


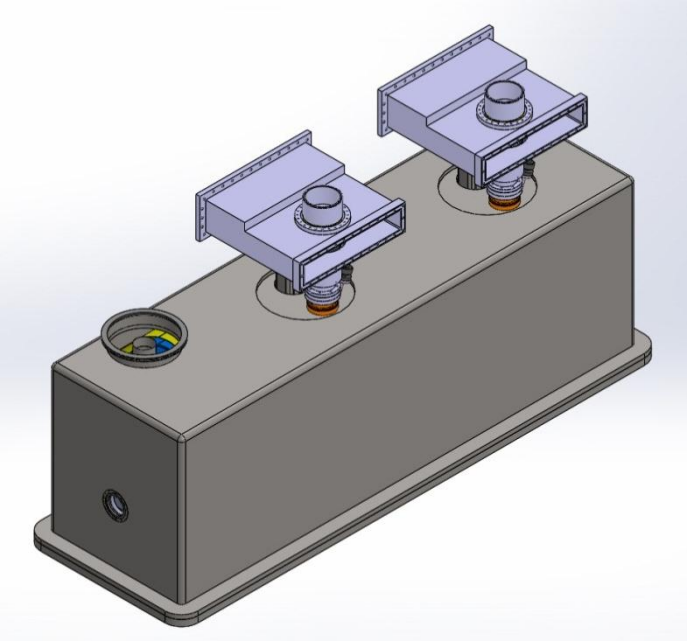


RF dipole cryomodule assembly concept

From 2013 CERN integration model







RF dipole cryomodule assembly concept cross section

From December 2013 workshop

Dress Cavity and Cryomodule Status

- Preliminary designs for the DQW and RF dipole cavities are complete at BNL and ODU respectively.
- Dressed cavity helium vessels, tuners, HOM interfaces, etc. are in process at BNL, ODU, CERN, and Fermilab.
- Solid model and drawing data is being managed through CERN's EDMS.
- The initial release of this data to Niowave took place in February.
- The release of the final design is scheduled for April.
- In addition to oversight we need to develop a workflow consisting of inspection criteria, milestones, hold points, etc. to aid the fabrication process.
- CERN will approve all drawings, material and fabrication specs, etc. prior to manufacture.