FY 09 AES Phase I Crab Cavity SBIR Progress

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Prototype Crab Cavity SBIR Objectives

- Collaborators are AES, BNL, SLAC, and LBL
- Phase 1
  - Preliminary Design of Cavity (3 man months supported by SBIR)
    - Coordinate transfer of Physics Design - Complete
    - Develop initial mechanical solid model - Complete
    - Perform Initial Thermal and Structural Analysis – Underway
      - Principle issue currently is cooling requirement for coaxial beam pipes
    - Preliminary Mechanical Design and Fabrication Feasibility Study – Largely Complete
- Phase 2
  - Complete mechanical design with supporting thermal/structural analysis.
  - Generate complete fabrication drawing package for the Crab Cavity.
  - Fabricate Prototype Crab Cavity
  - Perform BCP and HPR on Prototype Crab Cavity at AES if our facilities can accommodate it. We anticipate that we will be able accommodate an 800 MHz elliptical crab cavity.
  - Support Crab Cavity VTF testing at BNL

Overall Cavity Configuration

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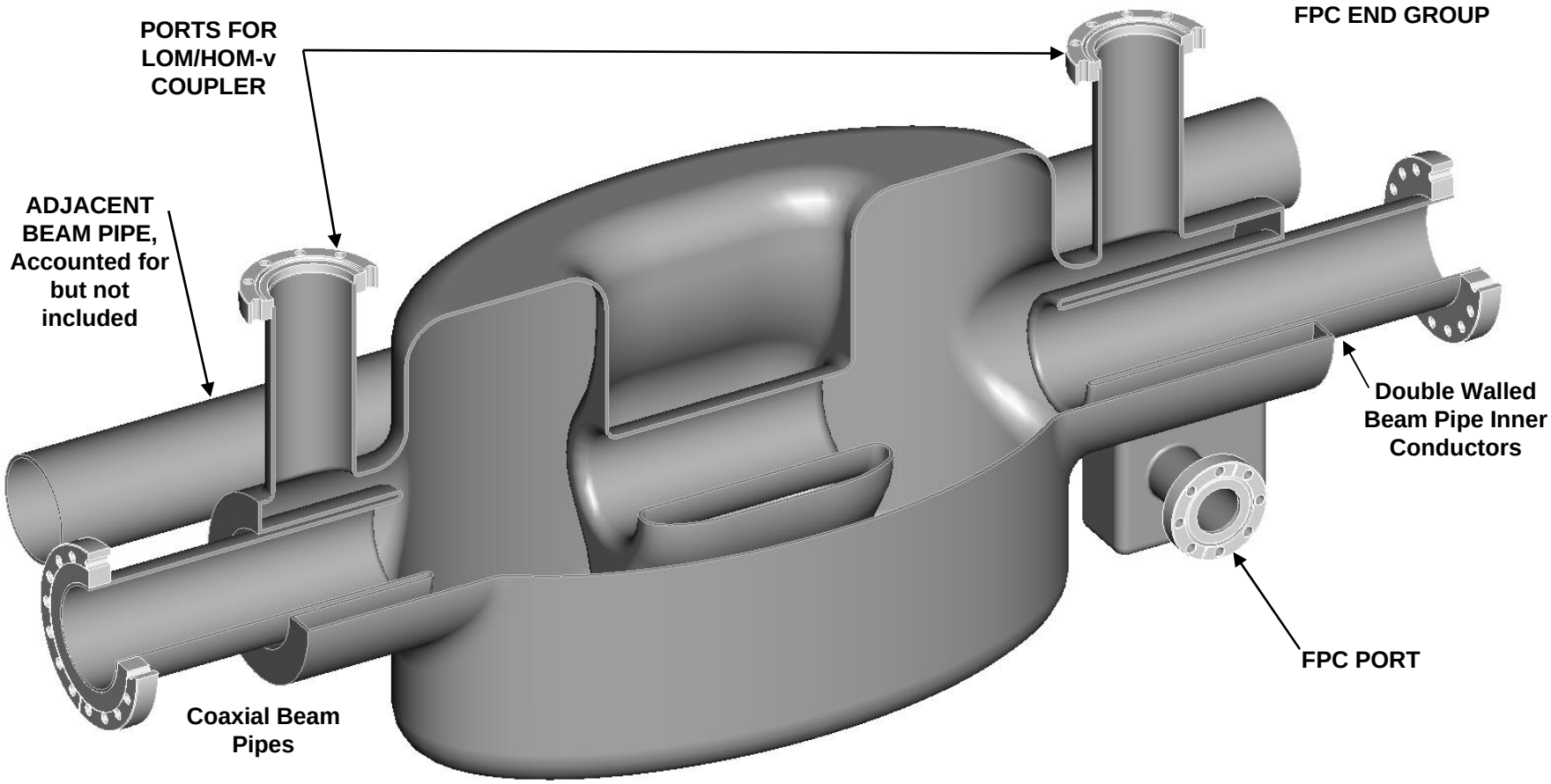
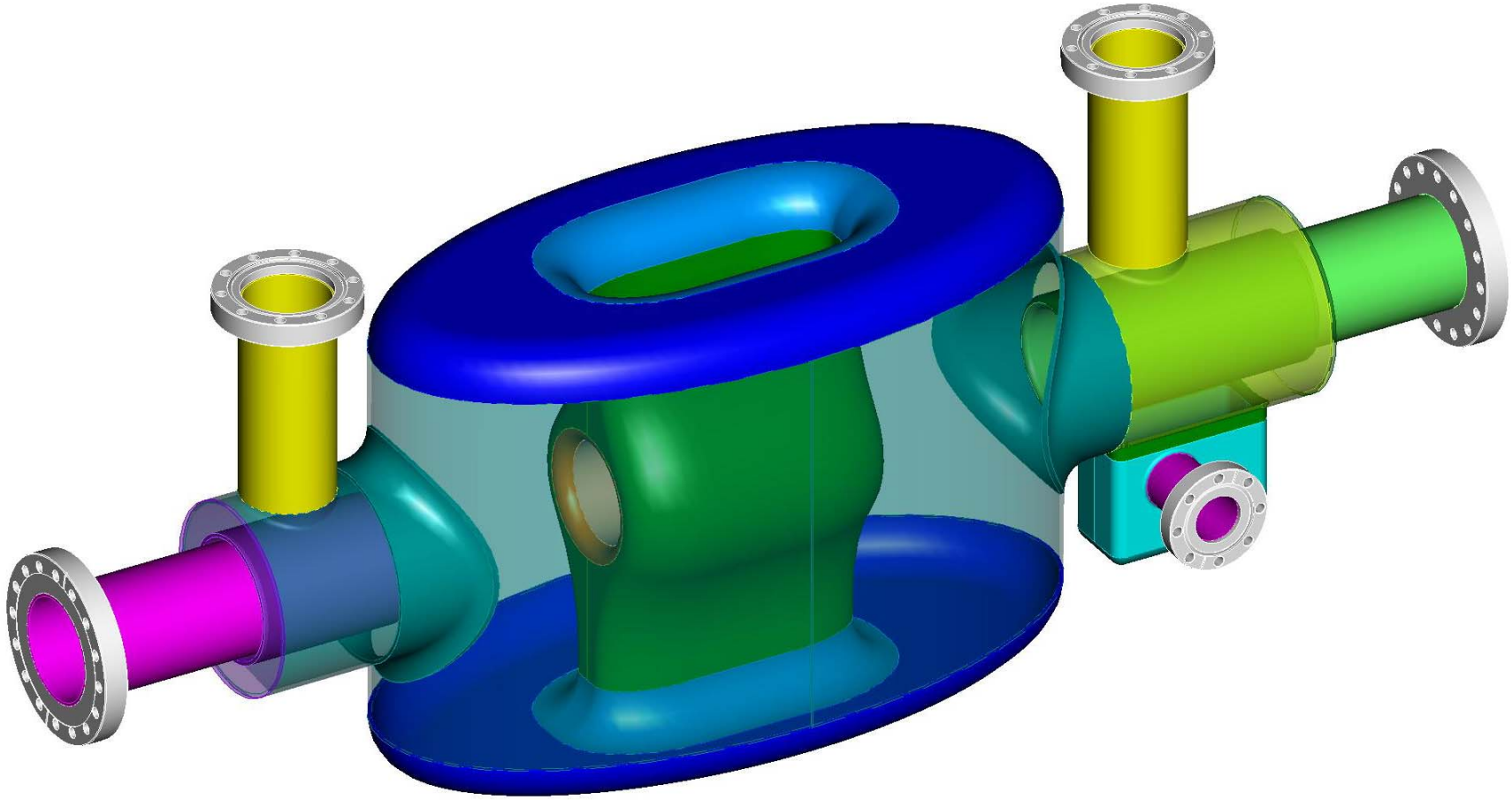


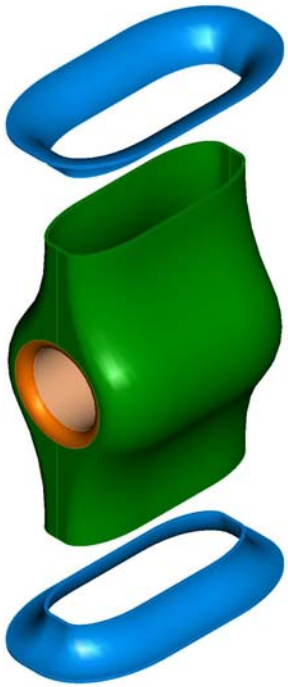
- Most of the cavity will be surrounded by a LHe vessel in the operational design but not in the prototype.
- Cooling of the Beam Pipe Inner Conductors could be flood cooled 2K LHe or forced 5K He, this question is currently being addressed.
- 5K He adds significant complications for VTA testing

Parted out Welded Assembly

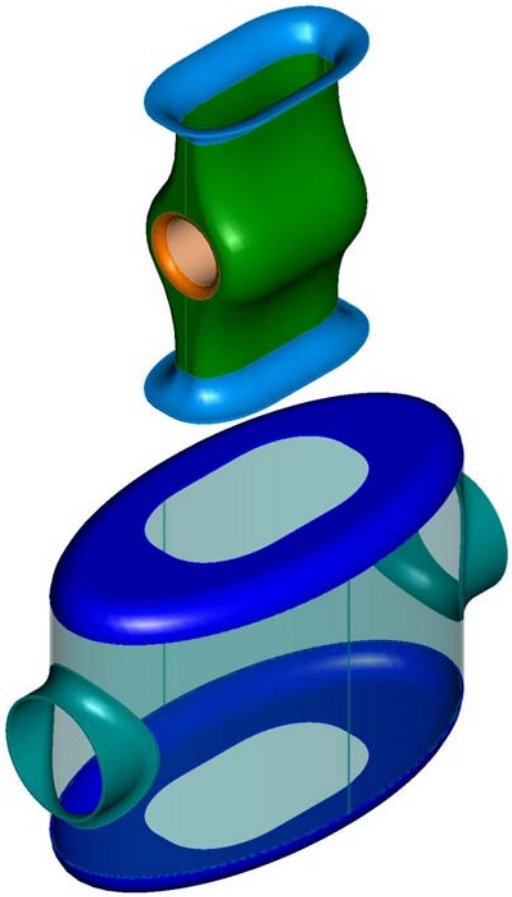


- **39 Welding steps joining 32 parts will be required to fabricate each cavity.**
- **In addition there are machining operations between many of the welds.**

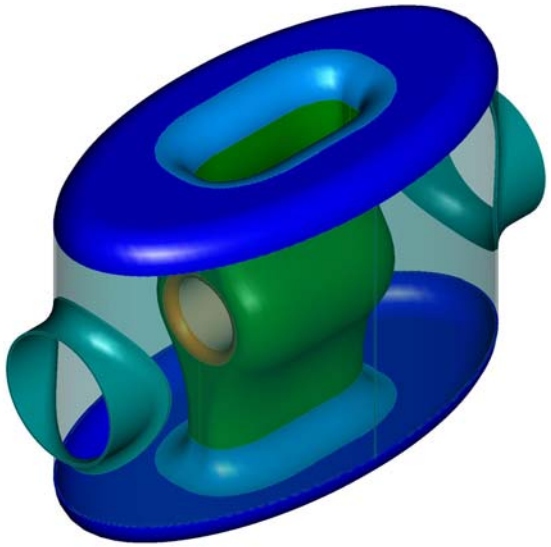
Welding Sequence A: Inner & Outer Conductor



8 Welding steps required to fabricate the inner conductor

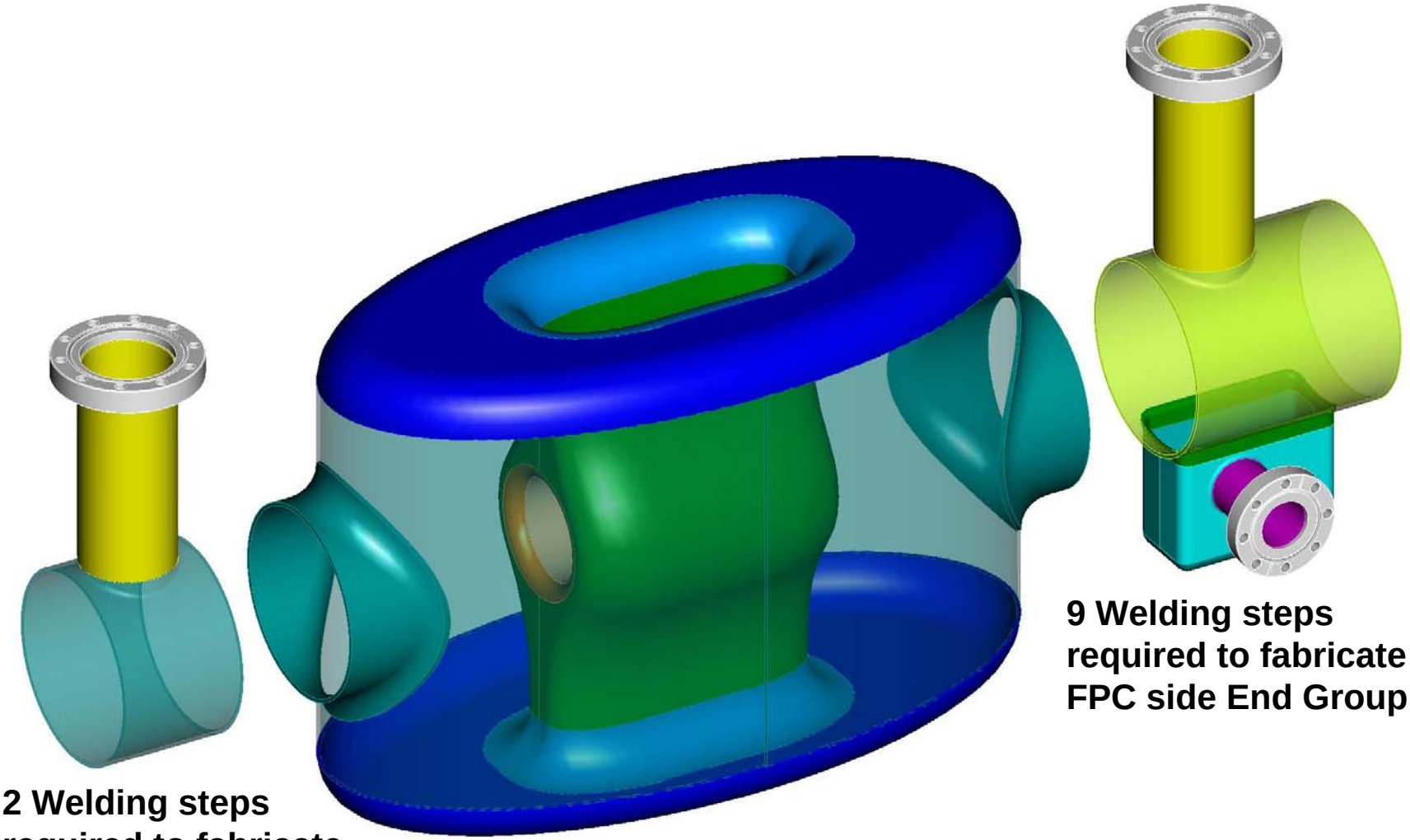


6 Welding steps required to fabricate the outer conductor



2 Welding steps required to connect the inner and outer conductor

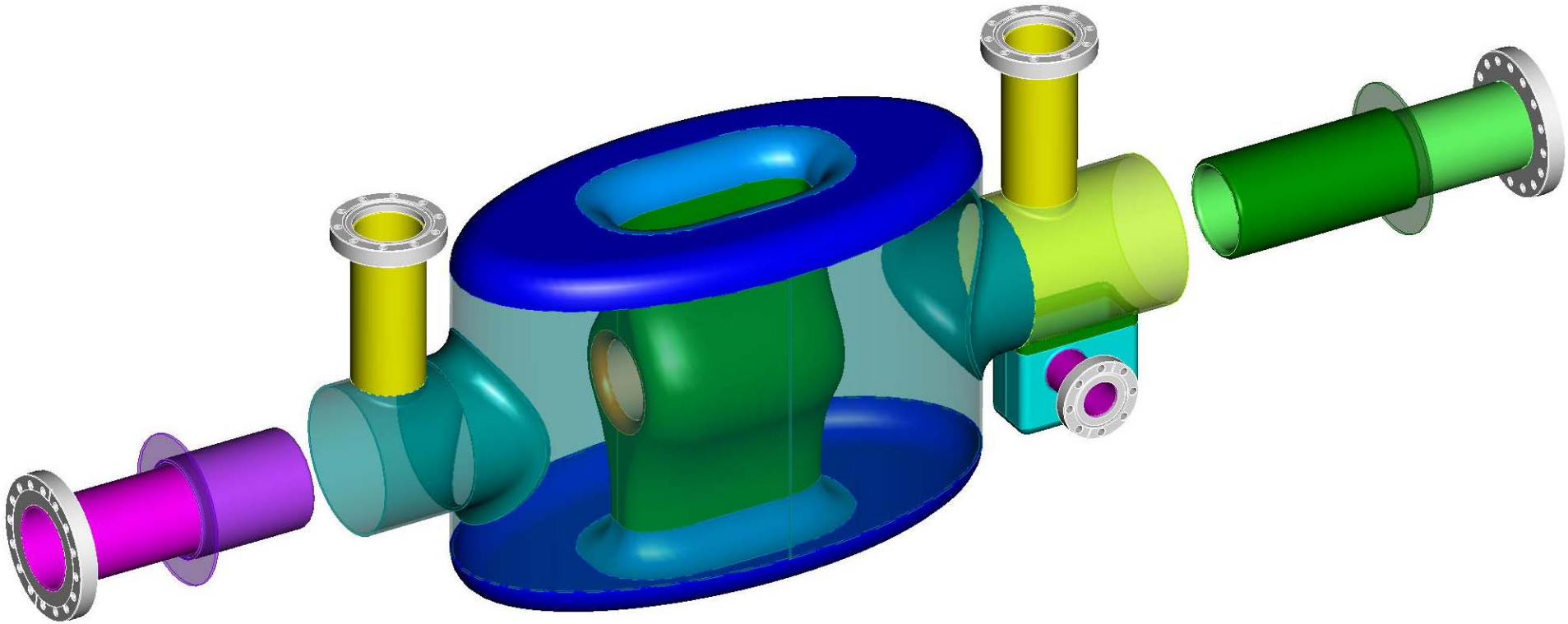
Welding Sequence B: End Groups



2 Welding steps required to fabricate short side End Group

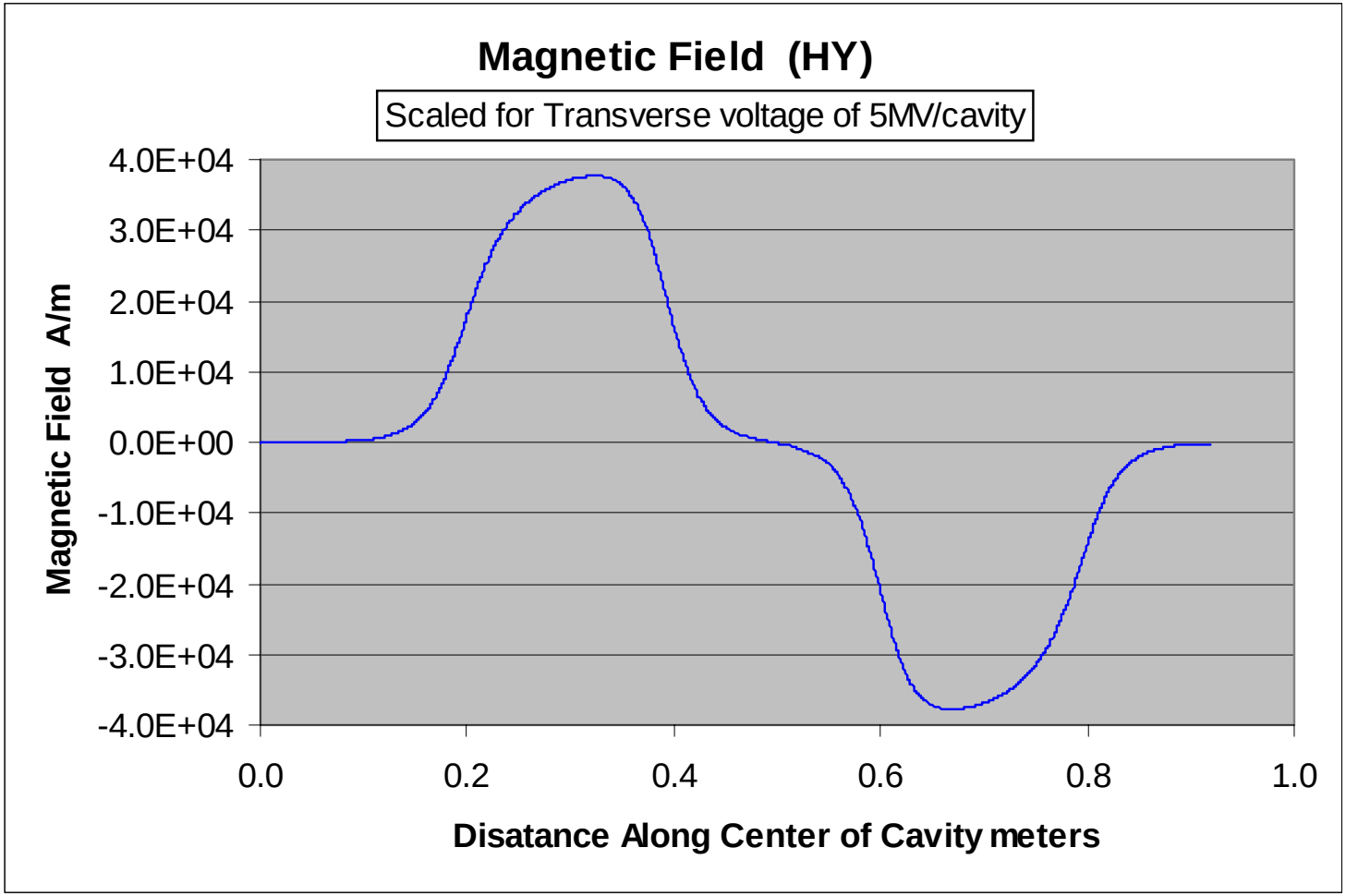
9 Welding steps required to fabricate FPC side End Group

Welding Sequence C: Coax BP ICs



- **3 Welding steps are required to fabricate each double walled beam pipe inner conductor.**
- **Fabricating the inner conductors in the fashion is actually cheaper than machining them from bar. They are too thick to roll and seam weld.**

RF Analysis: Normalization



- **Magnetic field on Axis used to normalize cavity fields.**
- **Surface Fields will be used to calculate heat loads**

RF Analysis: Surface H Fields and Initial Wall Powers

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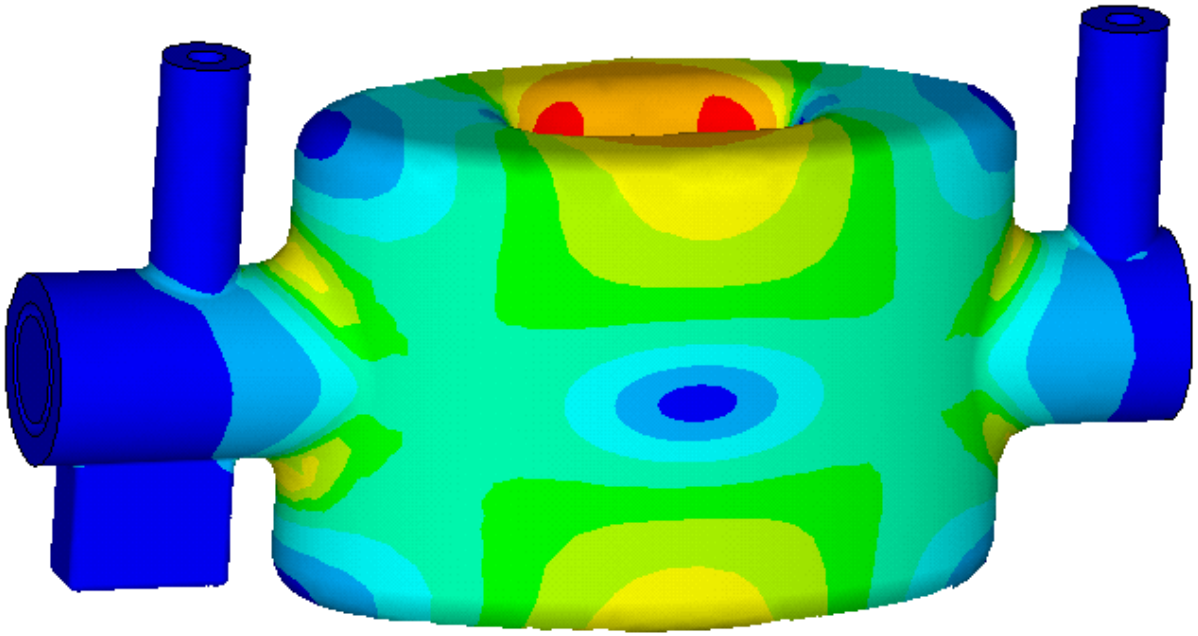
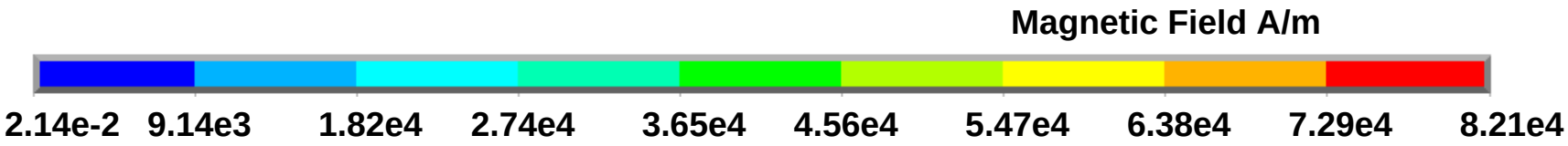
Surface Power Loss
2K = 11.2 watts
4.2K = 70.5 watts





Work Remaining

- Phase 2 proposal due May 20
- Complete mechanical design work and determine fabrication cost for cavity
- Complete thermal and structural analysis, primary concern will be cooling requirement for coaxial beam pipes
- We are on track for May 20