EUCARD2 – Crab Cavities CI Bids

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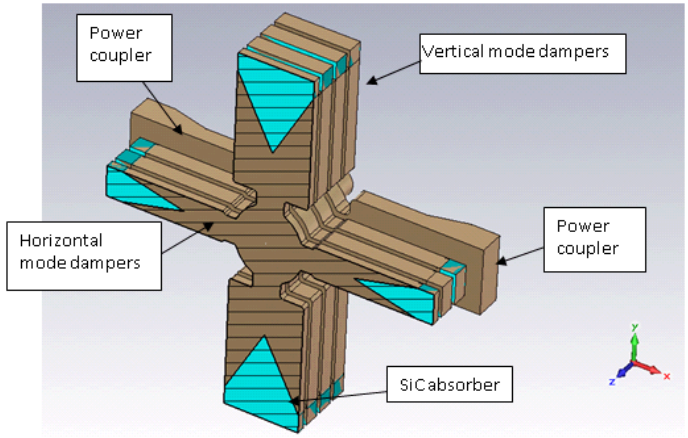
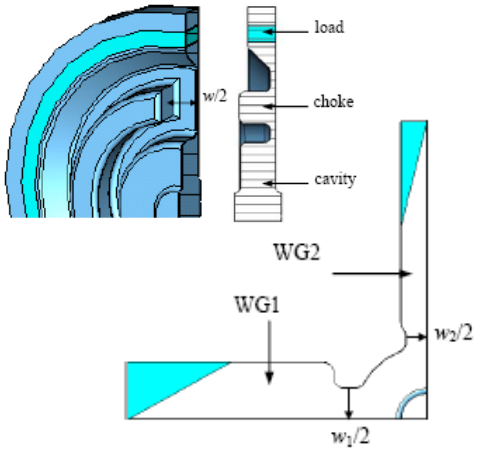
EUCARD1

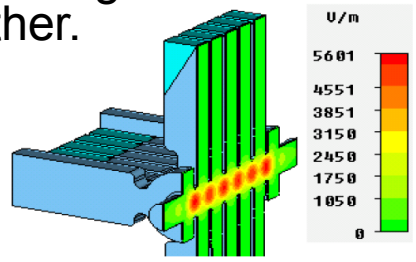
- Task 1: CLIC Crab Cavities
  - Focussed on a basic design of the CLIC crab cavity and high gradient test of the mid cells
- Task 2: LHC Crab Cavities
  - Design of compact cavity shape.
  - Beadpulls on an Aluminium test cavity.
  - Hopefully a copper prototype will also be built
- Task 3: Crab LLRF
  - CLIC phase stability study and phase measurement
  - LHC LLRF work

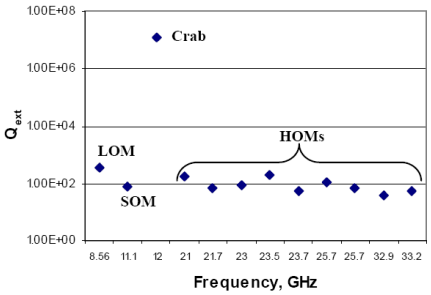
CLIC Crab Cavity R&D

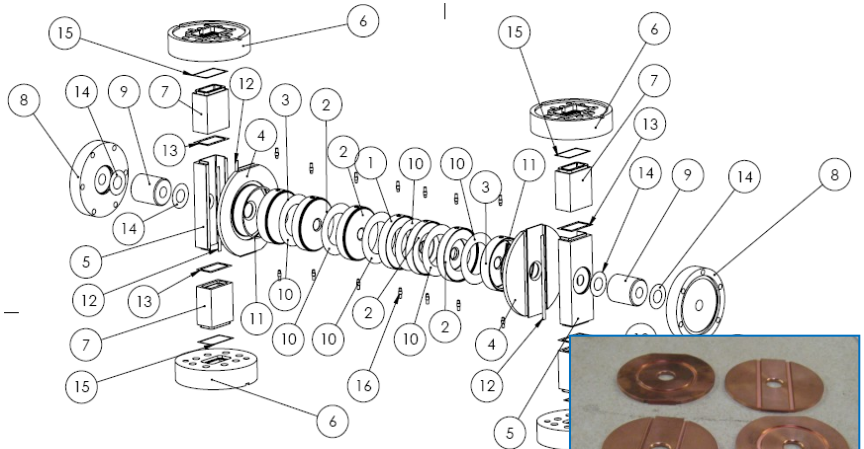
- **CLIC-CC R&D:**
  - Multi-cell 11.9942 GHz dipole-mode cavity developed.
  - Various mode damping schemes investigated:
    - Choke
    - Waveguide
  - An optimised 7-cell, waveguide damped design being investigated further.

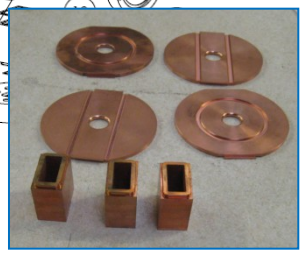












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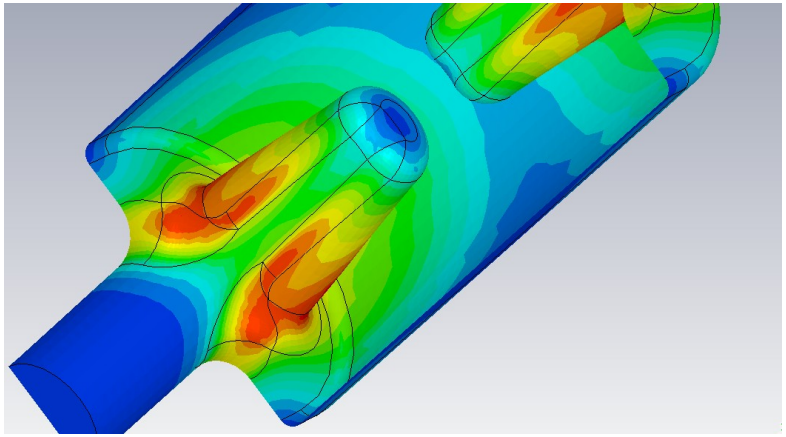
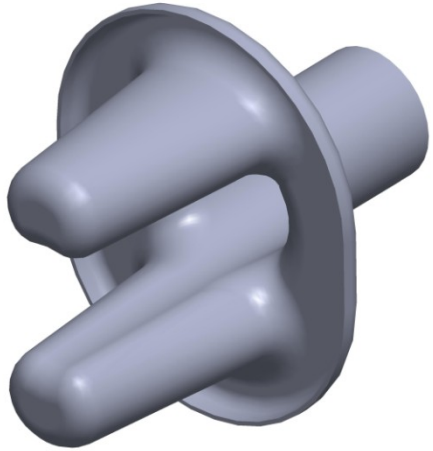
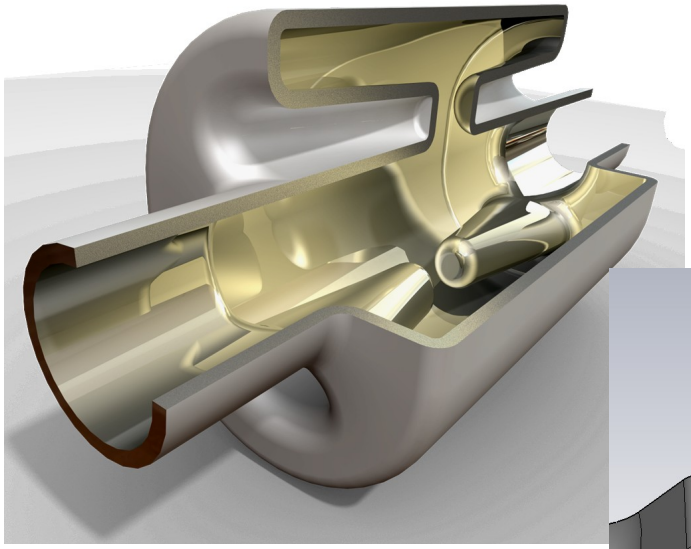
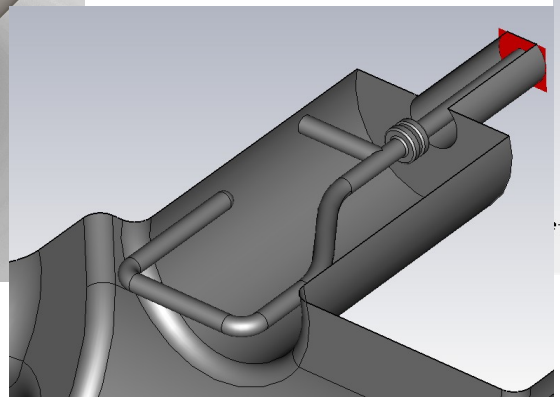
- **LLRF R&D:**
  - CLIC-CC and LHC-CC phase control models under development.

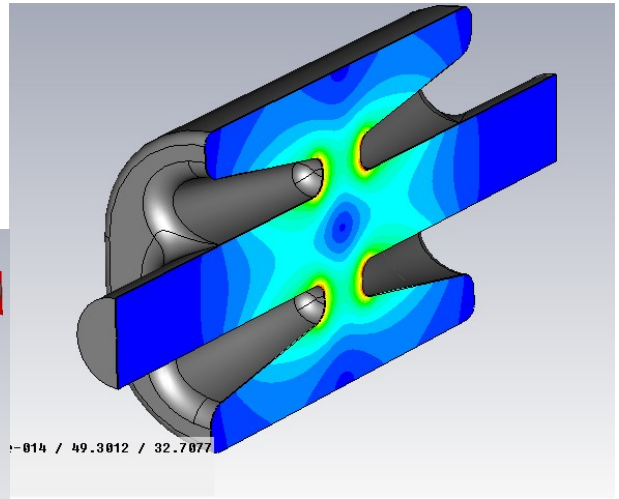
LHC Crab Cavity









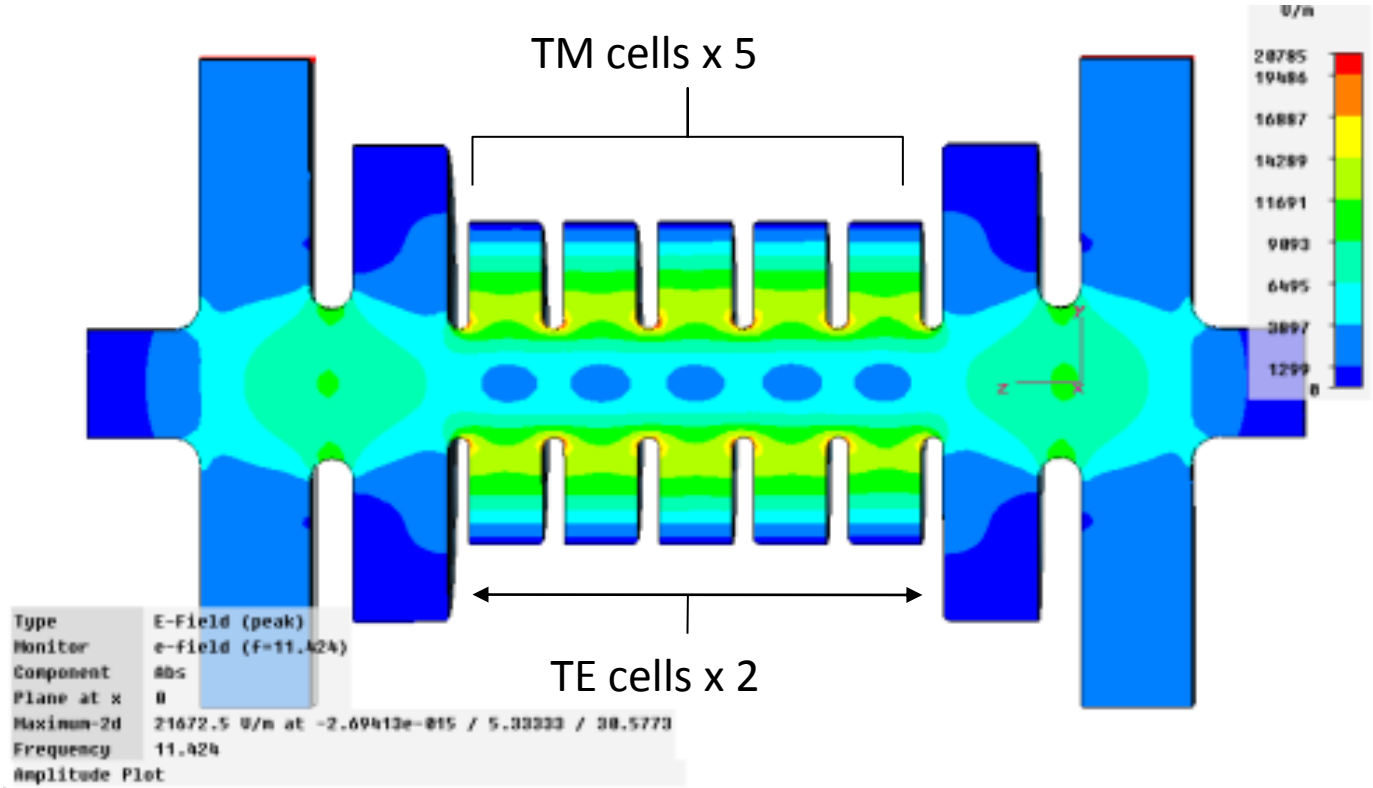


EUCARD 2

- CLIC Crab Cavities
  - Task 1: CLIC High Gradient Testing
  - Task 2: CLIC Crab Beam Dynamics & Wakefields
  - Task 3: CLIC Crab High Power Distribution
- LHC Crab Cavities
  - Task 4: LHC Crab Cryomodule Design
  - Task 5: Cavity Testing

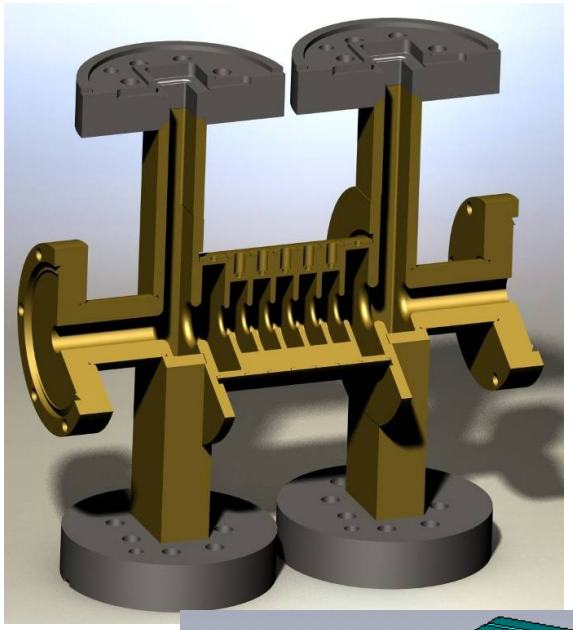
Gradient Testing

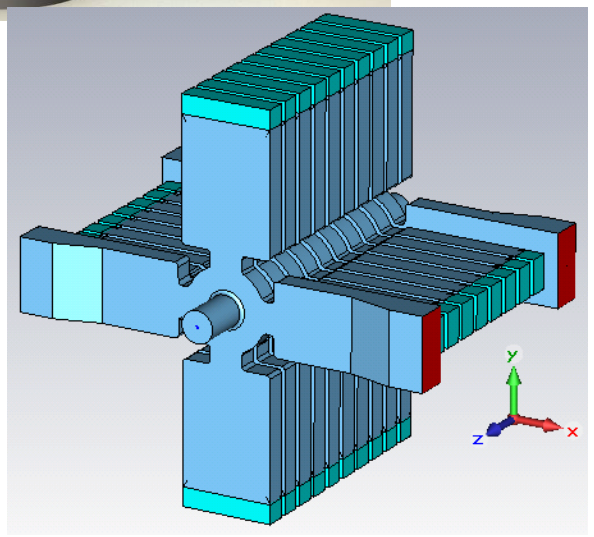
- To determine the maximum operating gradient for the CLIC crab cavity a special design of test cavity, compatible with the SLAC high power klystron and test stand is needed. It has been designed and is being manufactured.
- The mid cells operate at TM_{110} dipole mode for maximum axial field while the matching end cells at TE_{111} dipole mode so that axial field =0



CLIC Crab High Gradient Tests

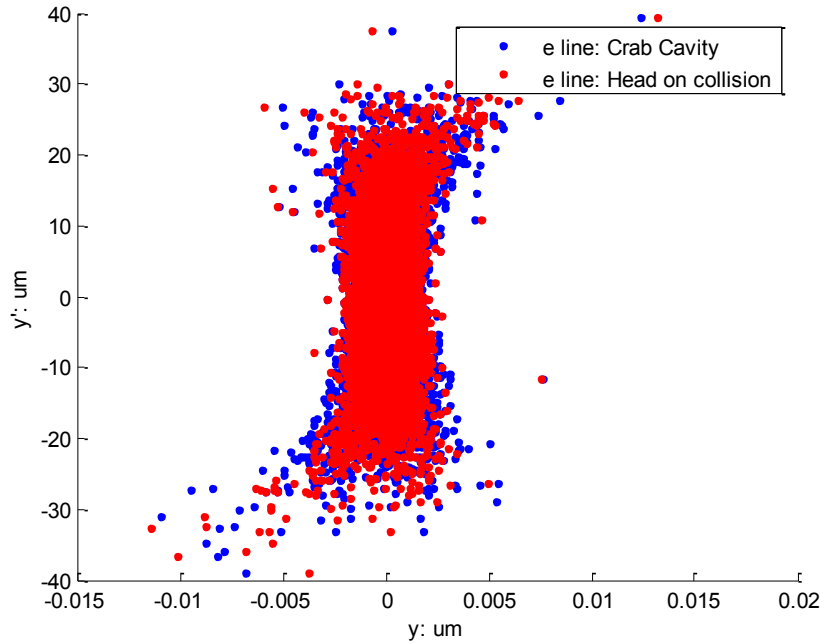
- Test 1: Middle Cell Testing (EUCARD)
- Test 2: Coupler and cavity test (Cavity made in EUCARD but testing performed in EUCARD2)
- Test 3: Damped Cell Testing (EUCARD 2)





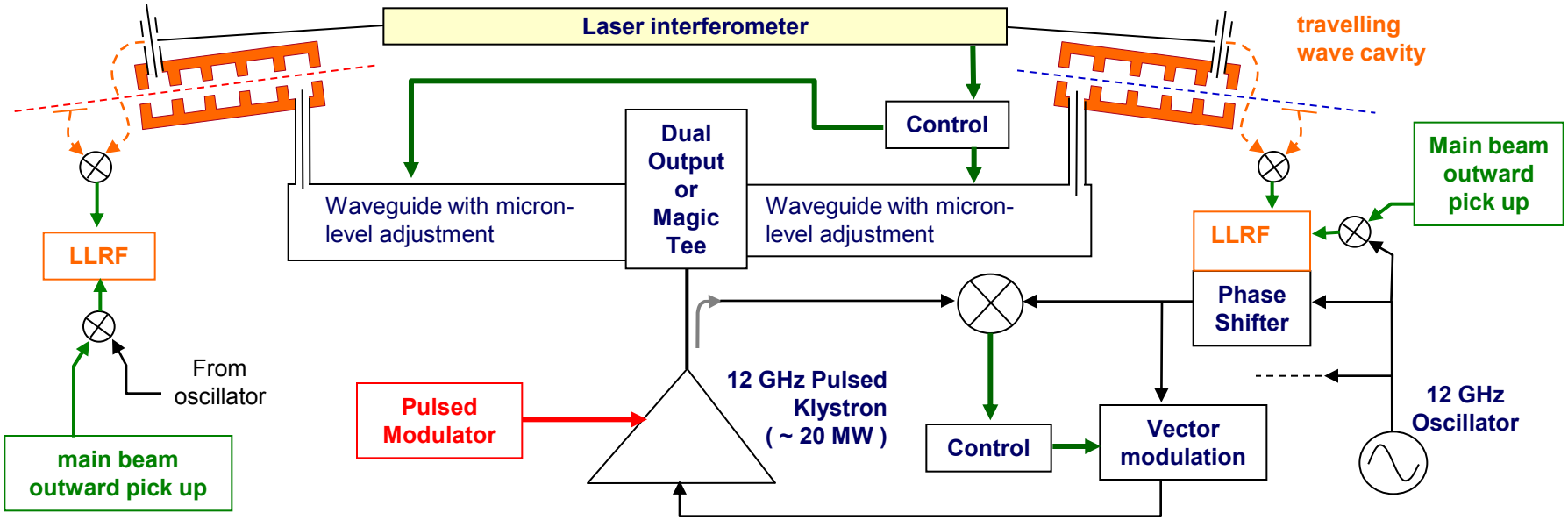
CLIC Beam Dynamics and Wakefields

- Found emmittance growth caused by crab cavity in CLIC BDS (Sextupole related)
- Need further studies on mitigation of this effect
- Also need to study wakefields in depth (single and multi-bunch)



CLIC Crab High Power Distribution

- Need to understand long term phase stability of the distribution scheme
- Requires an experiment to measure phase transients.

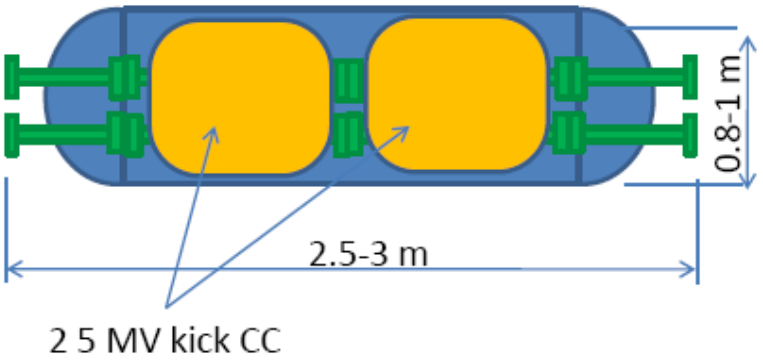


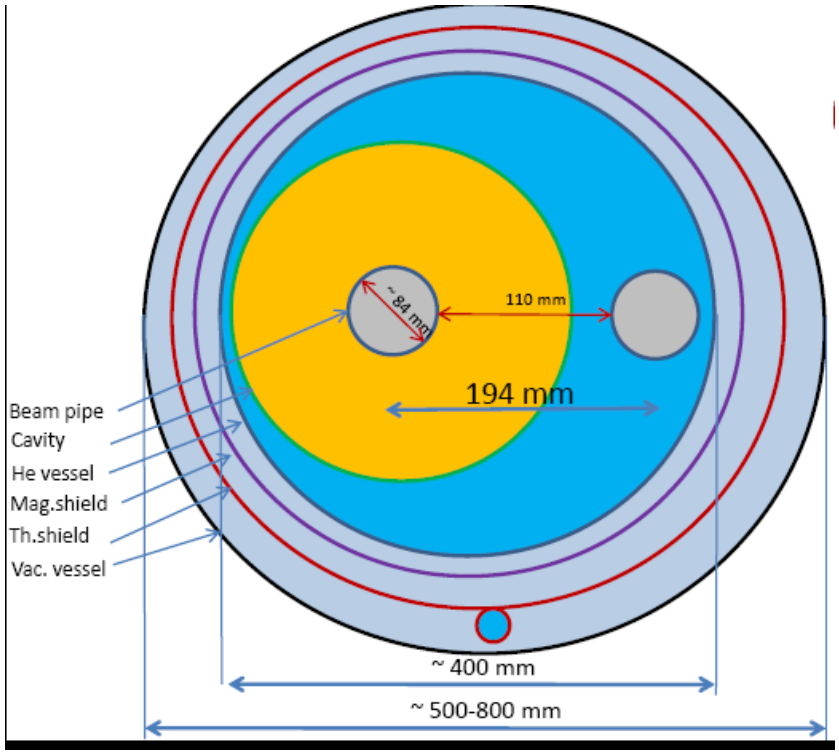
CLIC - Crab cavities

- Lancaster, Manchester, STFC and CERN
  - 5 FTE UK Staff Effort (2.5 Manc, 2 Lancs, 0.5 STFC) £20k travel
  - £80k equipment (£30k Distribution, £50k Cavity Testing)
- EUCARD 2 will focus on:
  - Beam dynamics and wakefield studies
  - Construction of a damped structure
  - High Power Distribution
  - Exact package will depend on current negotiations at CERN on CLIC crab programme

LHC Crab Cryomodule

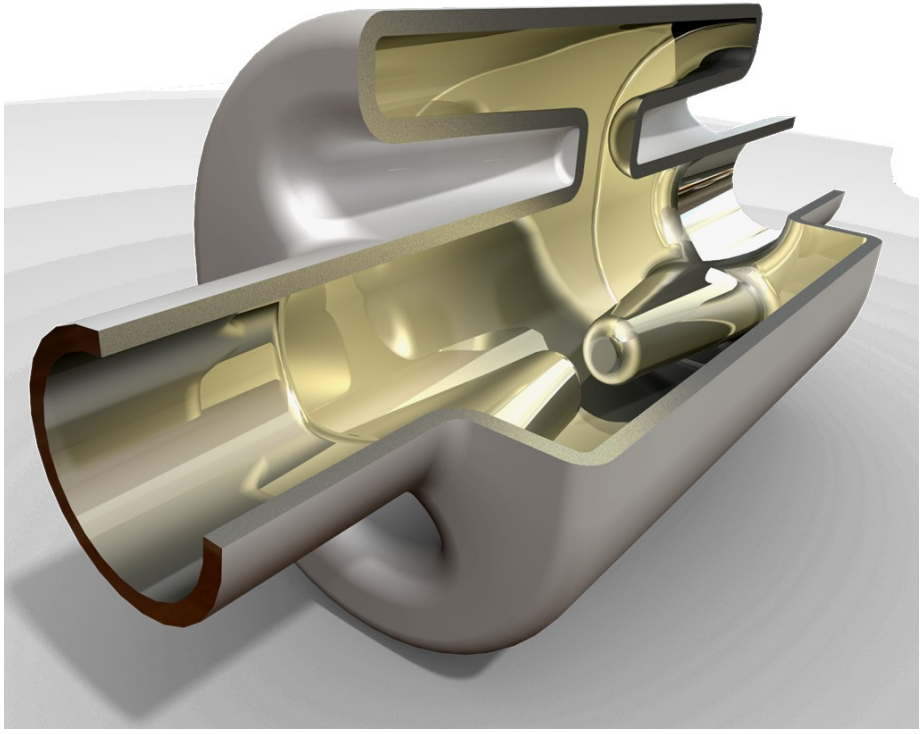
- HiLumi covers a conceptual cryostat design but EUCARD2 would look into an engineering design





LHC Crab Cavity Testing

- Cavity designed in EUCARD and aluminium models made.
- Need to prototype in Niobium.
- Engineering study in HiLumi project but has little or no capital
- Would also pay for a rig at Daresbury to perform vertical tests



LHC – Crab cavities

- Lancaster, CERN, STFC, (CEA?)
- Mainly covered by HiLumi LHC FP7 proposal
- This doesn't cover prototyping or engineering design of the cryostat.
- Need to discuss EUCARD2 bid with CERN today
  - Likely to look at Cryostat Design and Cavity Testing
  - 4 FTE CI Staff Effort (1 x Lancs + 3 x STFC)
  - £120k capital

Summary

- Crab cavities workpackage will follow on from EUCARD1.
- LHC Crab cavity funded through FP7 HiLumi LHC proposal.
- EUCARD2 focuses on the CLIC Crab Cavities.
- Crab cavities
  - 9.0 FTE's CI staff effort + CERN?
  - £20k travel
  - £200k capital