

Cryogenic Test Results of the SPS Prototype RF-Dipole Crabbing Cavity with Higher Order Mode Couplers (TUPO033)

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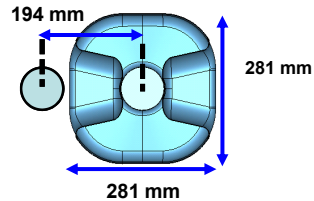
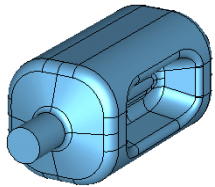
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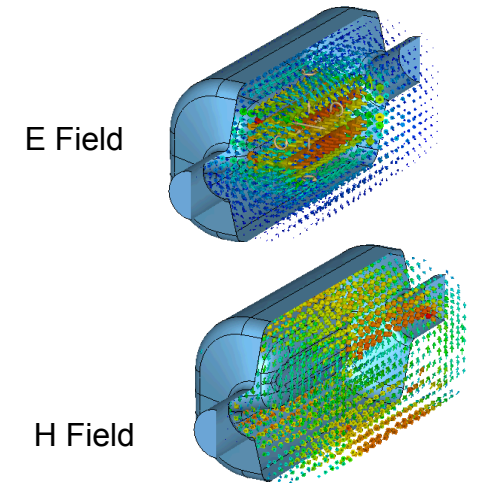
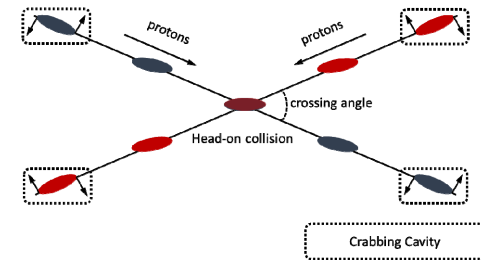
³SLAC National Accelerator Facility

Introduction

- **LHC High Luminosity Upgrade of CERN**
 - Crab cavity systems will be installed at ATLAS and CMS interaction points
 - Crabbing cavities allow head on collision of bunches increasing the luminosity
- **SPS Prototype RF-Dipole Crabbing Cavity**
 - Prototype with all ancillary components
 - Crabs the proton beam in horizontal plane
 - Designed to meet the compactness required for LHC

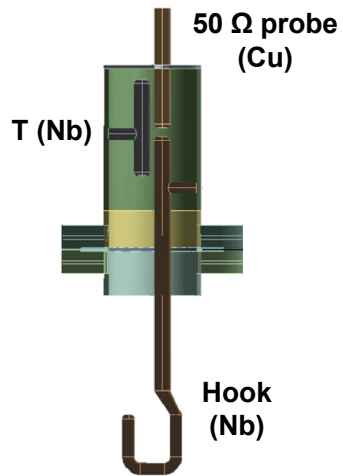
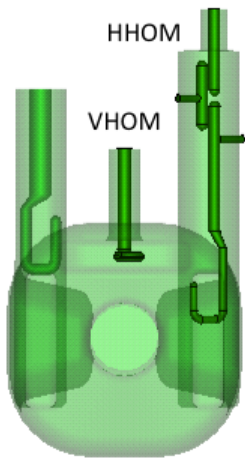


- **RF-Dipole Cavity:**
 - Operates in TE_{11} -like mode

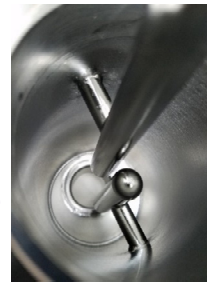


HOM Couplers

- Has only two HOM couplers
 - Horizontal HOM high pass filter
 - Vertical HOM coupler
- HOM couplers fabricated at Jefferson Lab
- HOM couplers are designed to damp modes up to 2 GHz
- Couplers are located at low field region on cavity body



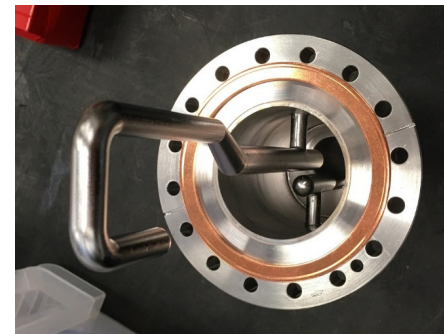
Parts of the
HHOM
prototype



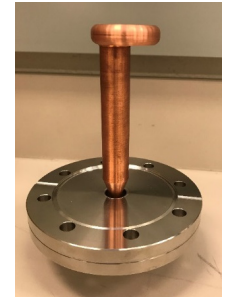
HHOM high
pass filter



Probe



VHOM Coupler



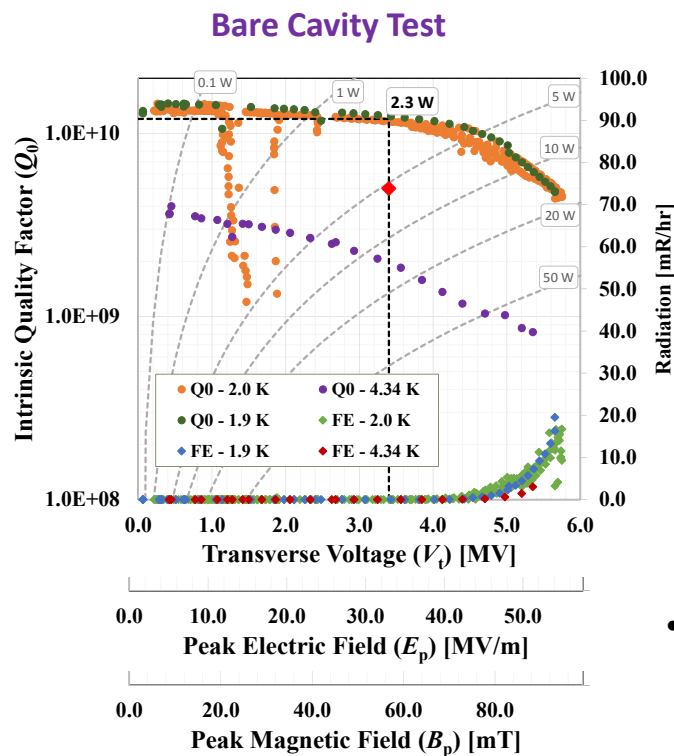
Cryogenic Test Results

Bare cavity test

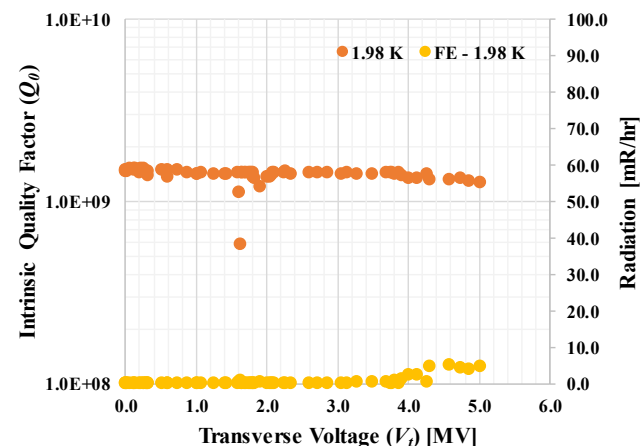
- Quenched at maximum V_t of 5.8 MV with $E_p=56$ MV/m and $B_p=96$ mT
- Low field $Q_0 > 1.3 \times 10^{10}$
- No field emission below 4.5 MV

Cavity test with the two HOM couplers

- Cavity achieved a V_t of 5 MV and didn't quench \rightarrow RF power limited
- No new multipacting levels observed at the couplers
- Similar field emission as in bare cavity test



Cavity Test with HOM Couplers



- Reduced Q_0 due to incorrectly sized Cu gasket which exposed stainless steel to rf field.
- Confirmed by rf simulation.

Conclusion and Plan

- *No kicking voltage degradation with all HOM dampers*
- *No new multipacting observed at the couplers.*
- *Similar field emission as in bare cavity test.*
- *Cavity will be re-tested with correct gaskets.*

Thank you and come to see the poster TUPO033!