MICE RFCC Module Update

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Current Status of RFCC Module

- **RF Cavities:**
  - All ten cavities (two spares) are currently at LBNL and four are measured (physically and for frequency)
  - Received and accepted nine beryllium windows
  - Ten ceramic RF windows received (4 at LBNL and 6 at University of Mississippi)
  - Six full size tuner flexures will be fabricated using wire EDM (exploring vendor options)
  - Components for 6 actuators are to be fabricated (not at UM)
  - Measurements of the remaining six cavities to start in October
  - Cavity inside surface mechanical smoothing and subsequent electropolishing to start in October at LBNL

Current Status of RFCC Module

- **RF Cavities (cont.):**
  - The cavities will be “tuned” to each other for a center frequency (10 cavities) by plastic deformation after frequency measurements are complete
  - RF power coupler design and drawings are complete
  - The single cavity vacuum vessel design has been sent out for fabrication quotes from Fermilab
  - Fabrication of the single cavity vessel and associated components (e.g. RF couplers, RF tuners and actuators) will start soon
  - Single cavity vessel testing will take place at MTA, Fermilab

All Ten RF Cavities (Two Spares) at LBNL

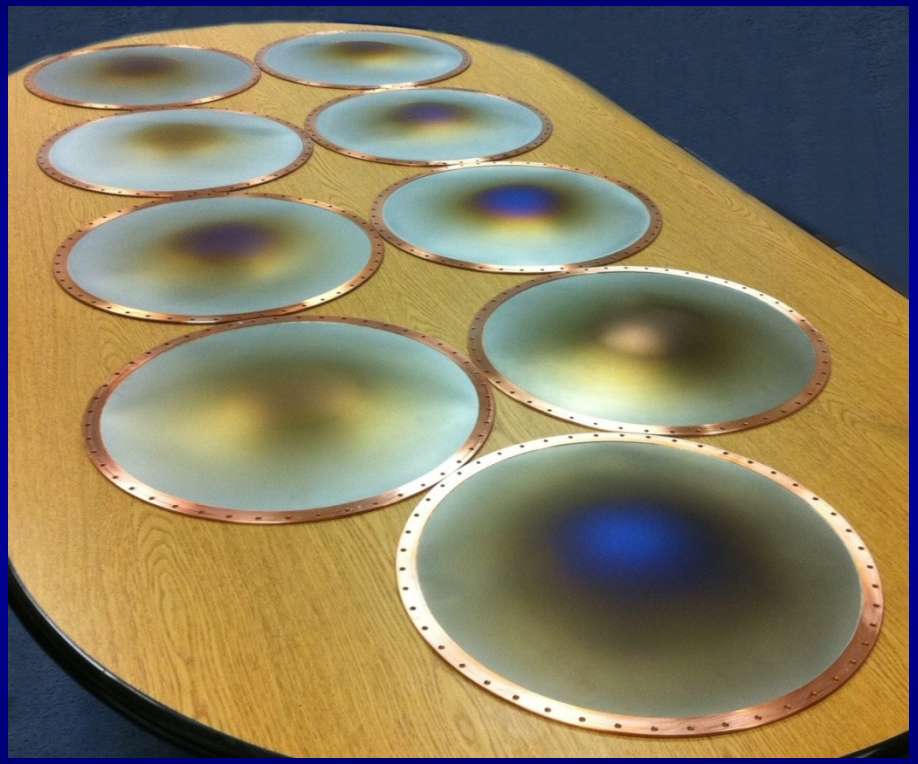
Fabrication set-up cavity

One cavity on inspection stand

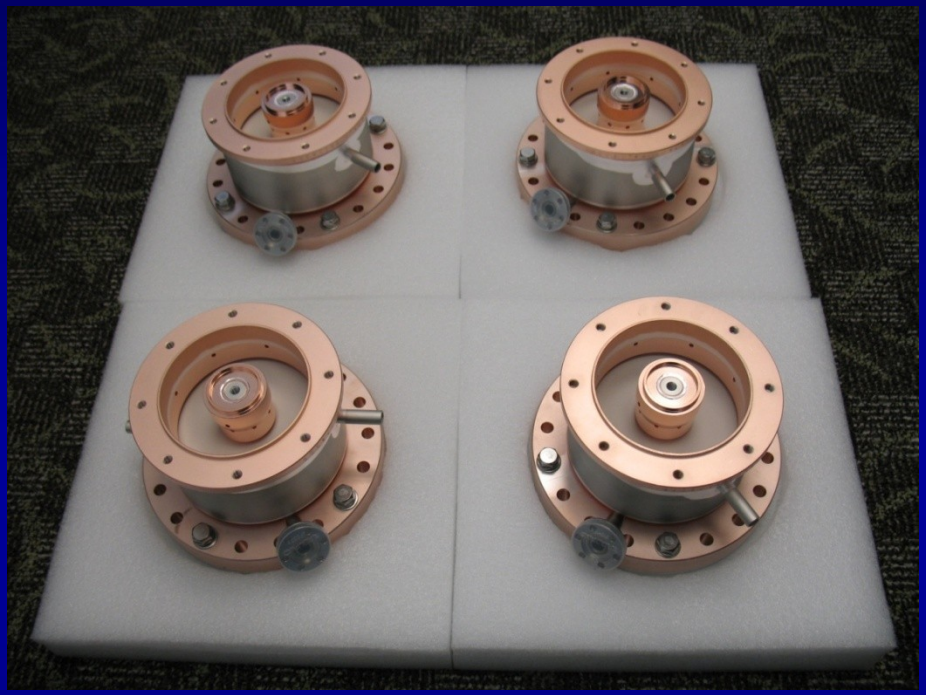
Six cavities in their shipping crates; three cavities are stored in another location

Beryllium Windows

- Eleven Beryllium windows have been fabricated
- Nine are Ti-N coated and accepted
- Two windows were rejected due to excessive distortion
- Two more will be made by Materion Electrofusion (formerly Brush-Wellman) with proposed improved fabrication technique



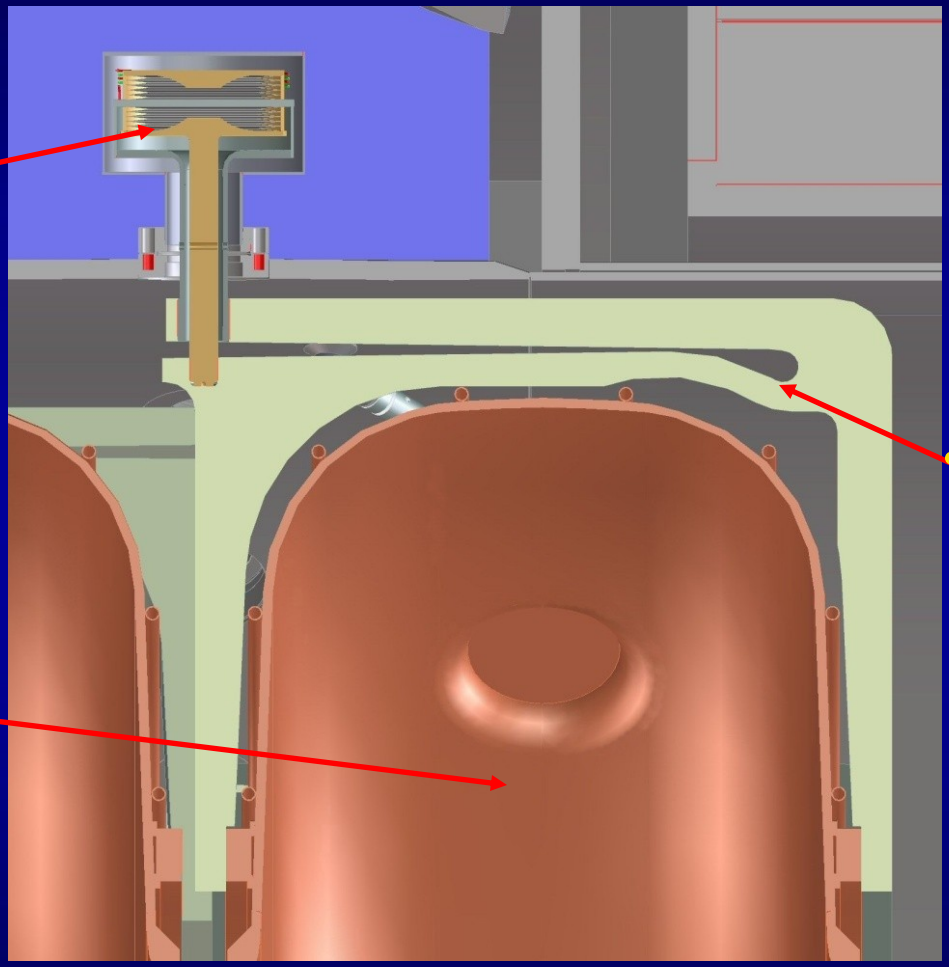
Toshiba Ceramic RF Windows



- An integral part of RF power (loop) coupler
- Ten Toshiba ceramic RF windows received by University of Mississippi
- Four delivered to LBNL for inspection, six remain at UM

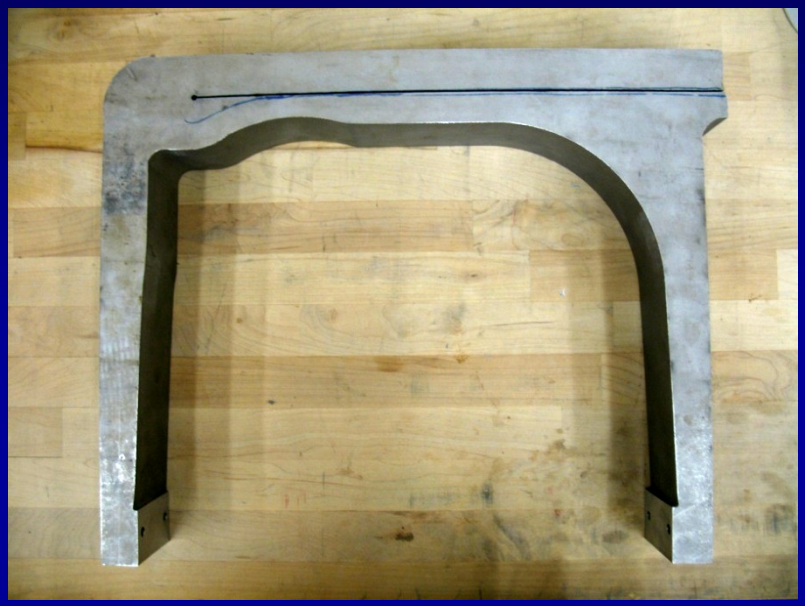
RF Cavity Frequency Tuner Components

- Dual – action actuator
- RF cavity



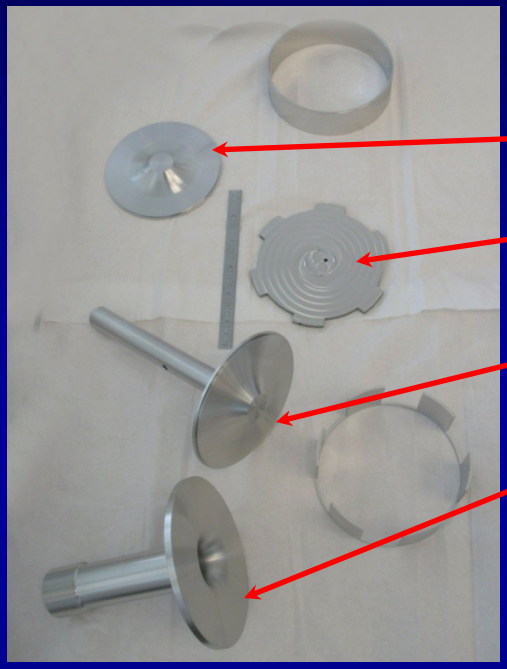
- Flexure tuner arm

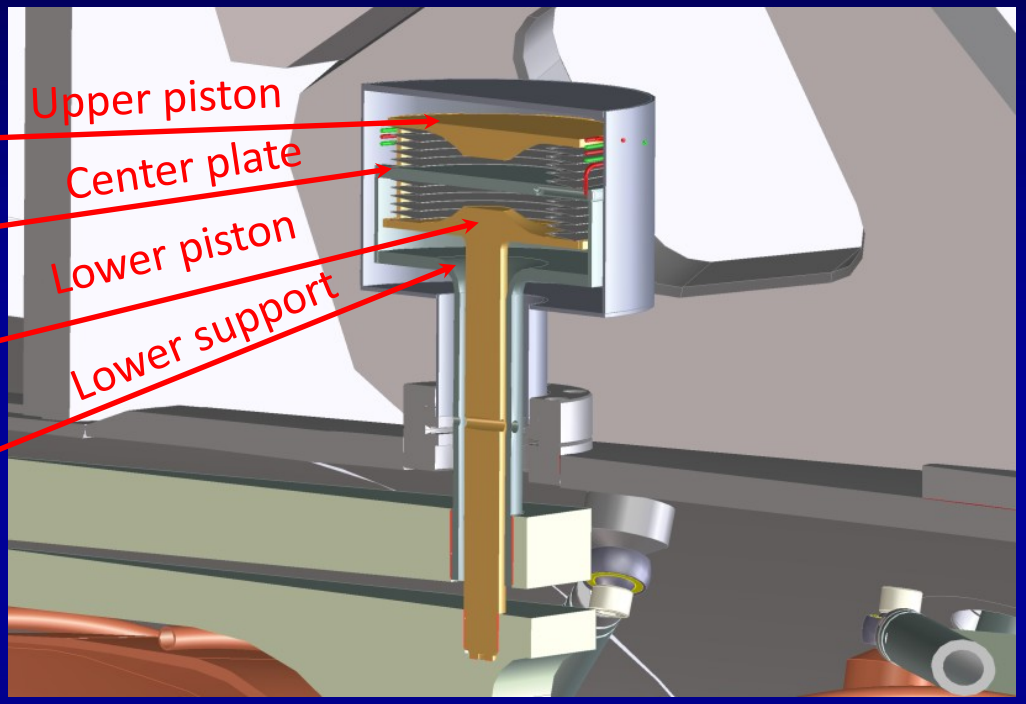
Cavity Frequency Tuner Flexure



- One tuner flexure has been fabricated at the University of Mississippi
- It has arrived at LBNL and has been inspected
- Water-jet cutting of the part left an unacceptable taper of the part wall
- The search for a suitable EDM machining vendor has started
- Secondary machining may be done at UM

Actuator Component Fabrication



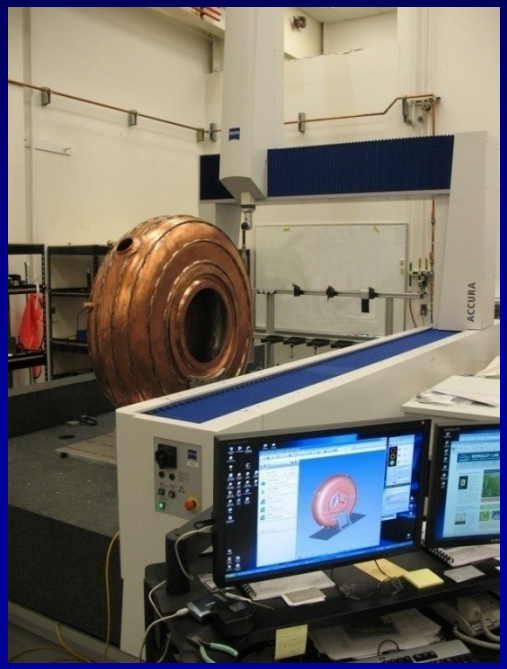


- Due to machining equipment limitations the actuator mechanical components can not be fabricated at the University of Mississippi
- Options for the fabrication of the actuator mechanical components are being explored by LBNL

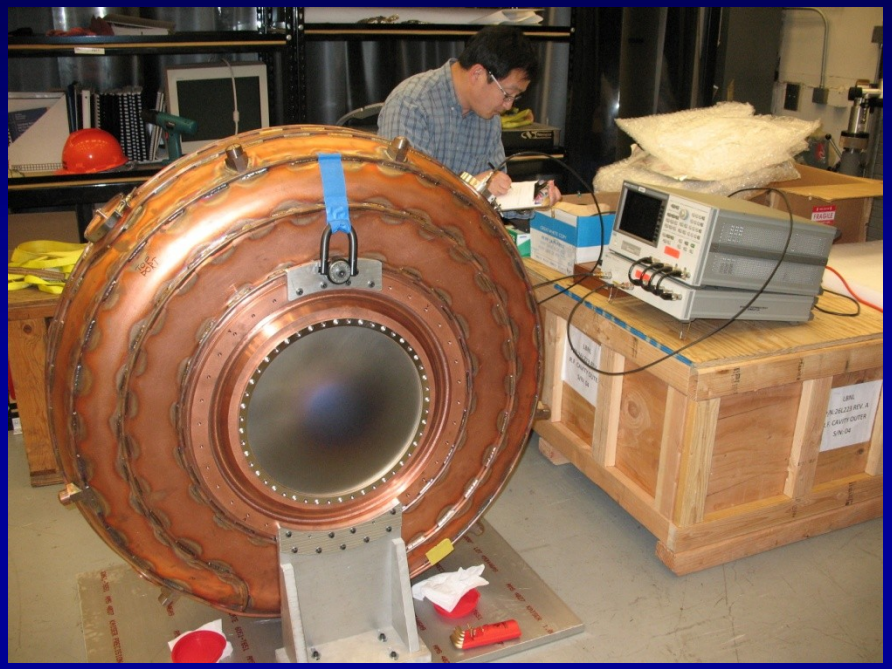
Cavity Tuner Control System

- Emerson ER3000 electronic pressure controllers have been tested at LBNL
- Pierrick Hanlet (Fermilab/IIT) will develop the control software in EPICS

Cavity Measurements



- Cavity physical measurement

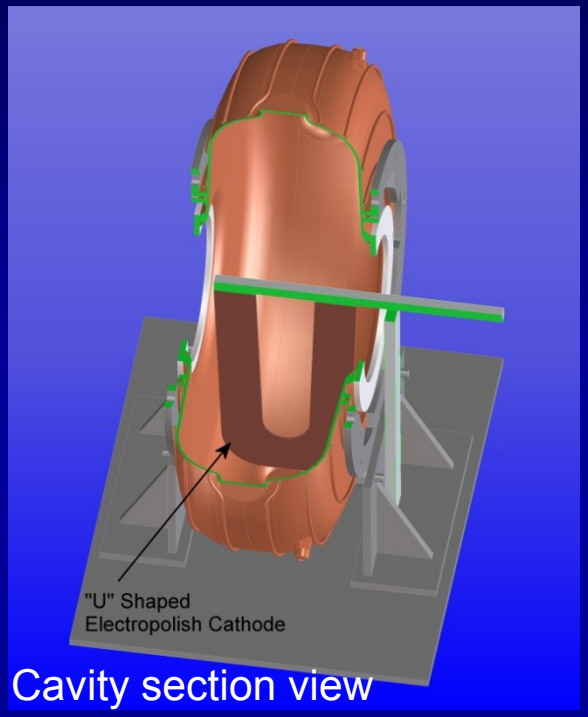


- Cavity frequency measurement

- The remaining six cavities will be measured (both physically and for frequency) starting in October 2011
- Physical measurements for the six remaining cavities expected to take approximately 1-1/2 weeks (60 hours)

Cavity Electropolish at LBNL


Jlab EP set-up



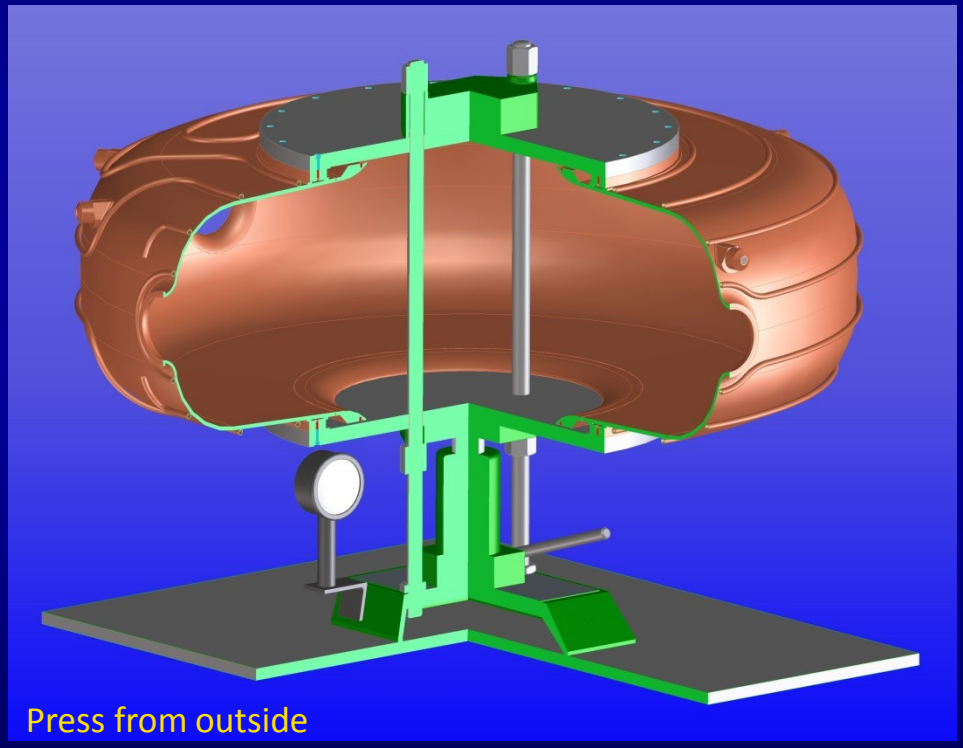
Cavity section view

- The inner surface of each cavity will be mechanically smoothed and then electropolished at LBNL using the techniques developed at JLab for the prototype cavity
- EP setup and testing will start in October of this year
- Electropolishing process will take approximately 3 days for each cavity or 6 weeks to complete all 10 cavities

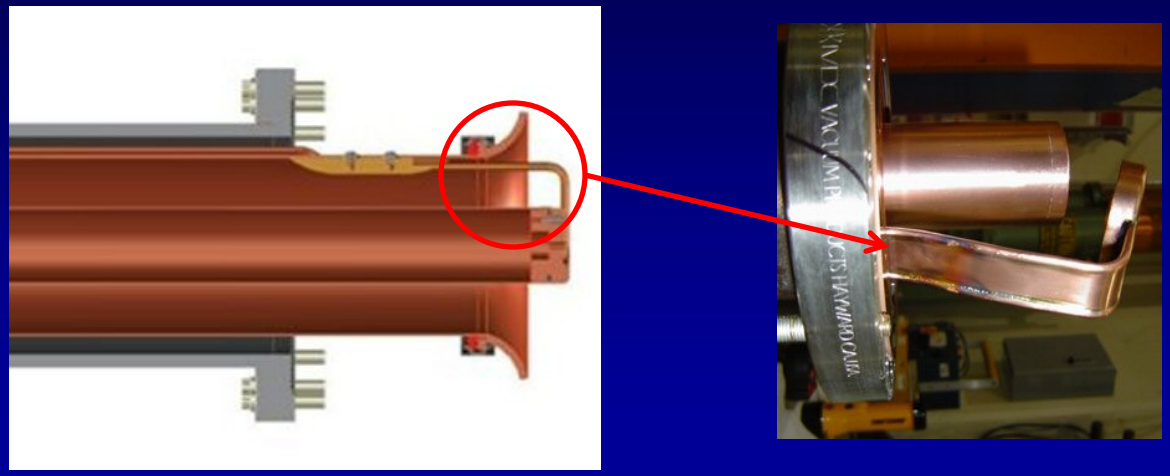
Cavity Frequency Tuning

- Cavities must be "tuned" to each other for a center frequency (10 cavities) by plastic deformation if necessary
- Will be done at LBNL after frequency measurements and electropolishing are complete
- A 12 ton press will be used for adjusting the frequency
- Design of fixturing is ongoing

12 ton press

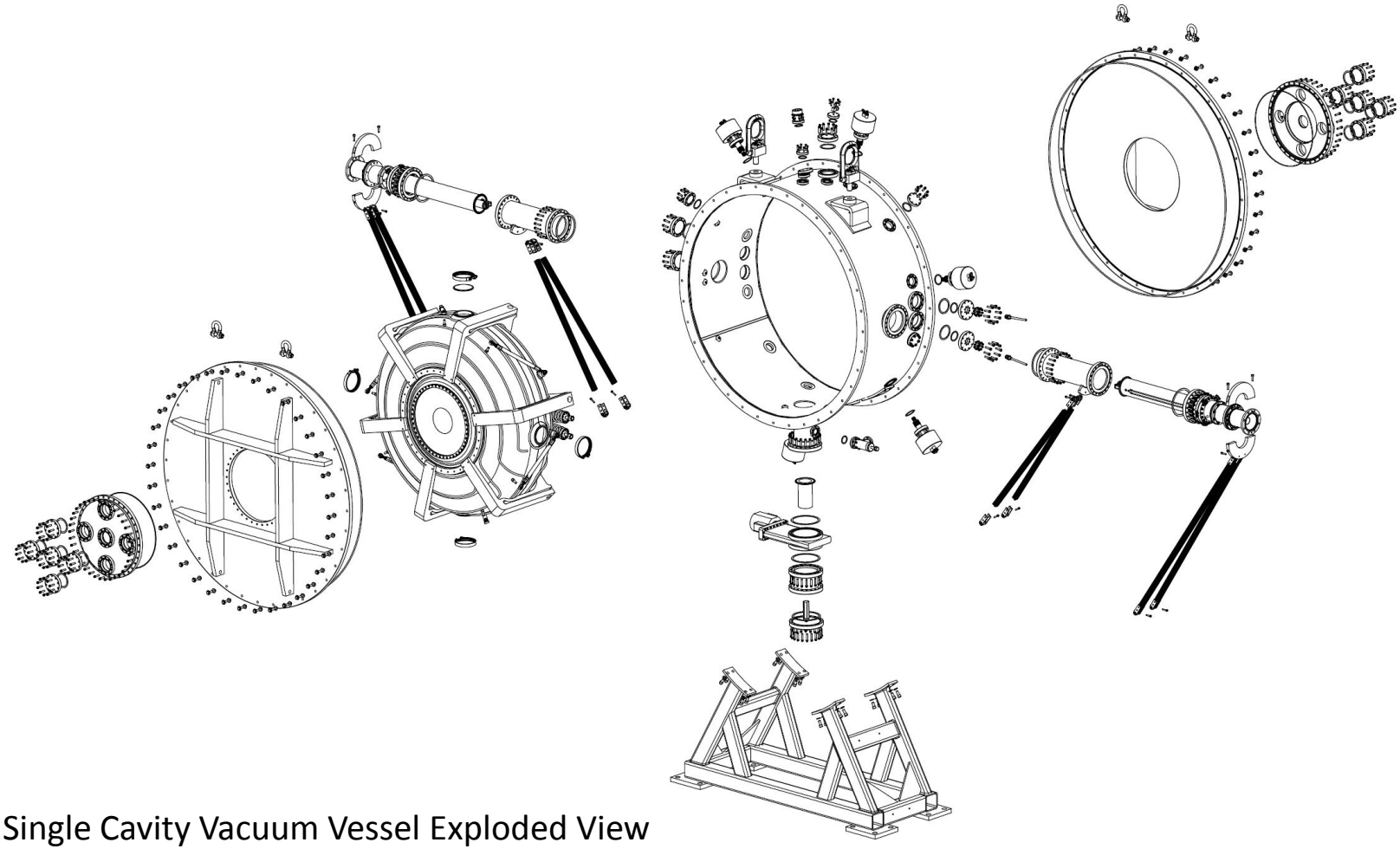

Press from outside

RF Power (loop) Coupler



- MICE RF power coupler design is complete and ready for fabrication
- Fabrication of the couplers will start soon
- Testing/experience of the prototype cavity at MTA: sparking at the coupler
- The coupler design will have a slightly increased gap spacing
- The sparking region can be Ti-N coated if necessary (will be tested at MTA using the prototype cavity)
- Adding diagnostics: arc detector at the coupler region

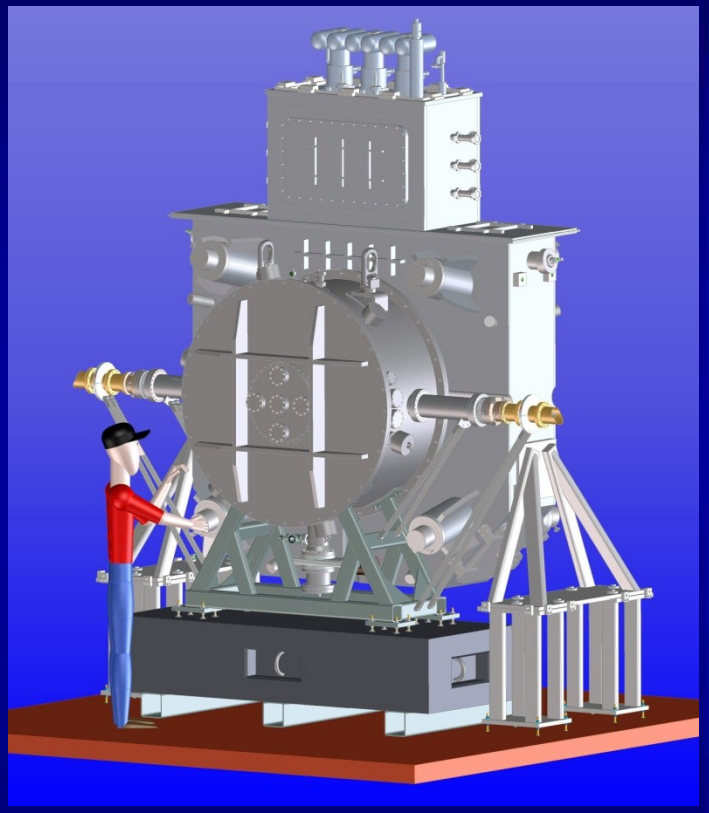
Single RF Cavity Vacuum Vessel



Single Cavity Vacuum Vessel Exploded View

Single RF Cavity Vacuum Vessel

- Design drawings have been sent out to vendors for fabrication quote (from Fermilab)
- Fermilab has received quotes and will award fabrication contract soon
- Kept the same dimensions and features of the MICE RFCC vacuum vessel (as much as possible)
- One vessel designed to accommodate two types of MICE cavities (left and right)

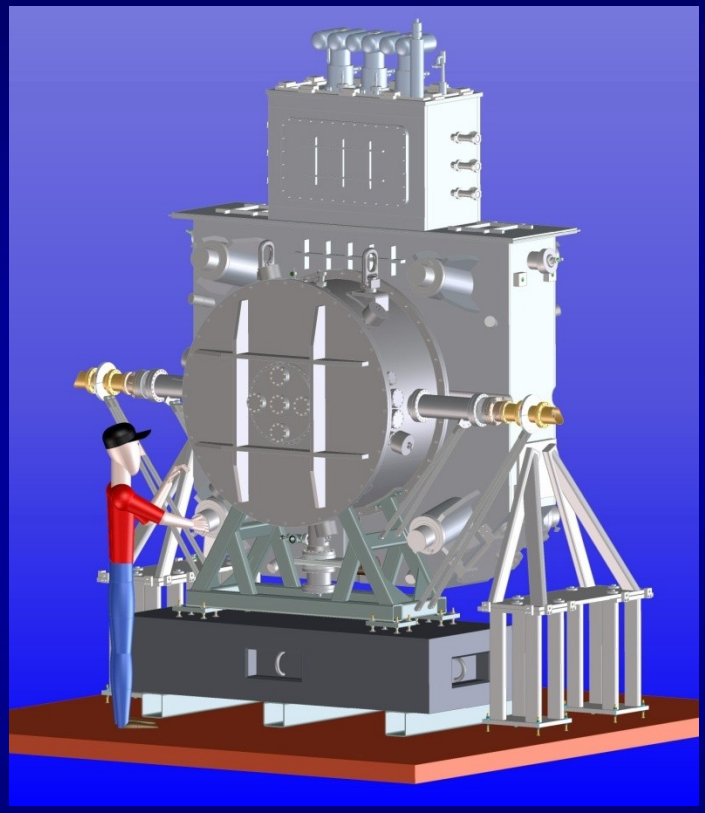


Single cavity vessel in Fermilab MTA configuration with the MUCOOL coupling coil

Advantages of Single RF Cavity Vacuum Vessel for MICE

Prior to having MICE RFCC module, the single cavity vessel will allow us to:

- Check engineering and mechanical design
- Test of the RF tuning system with 6 tuners and actuators on a cavity and verify the frequency tuning range
- Obtain hands-on experience on assembly and procedures
  - Cavity installation
    - Beryllium windows
    - RF couplers and connections
    - Water cooling pipe connections
    - Vacuum port and connections
    - Tuners and actuator circuit
  - Aligning cavity with hexapod support struts
  - Vacuum vessel support and handling
  - Verify operation of the getter vacuum system
- Future LN operation



Single cavity vessel in Fermilab MTA configuration with the MUCOOL coupling coil

RFCC Future Work

- **Vacuum Vessel:**

- Vessel design is complete but needs to be updated to incorporate changes to the interface with the new coupling coil cryostat design
- Fixturing for the assembly process needs to be finalized and drawings for fabrication generated

- **RFCC Module:**

- Finalize fixturing for module assembly and shipping
  - for aligning the frequency tuners onto cavities
  - for inserting the cavities into vacuum vessel
  - shipping skid/tilt fixturing for shipping RFCC to RAL

Plan and Schedule

- RFCC module schedule is mainly determined by the schedule of CC magnets and available funding
  - See Derun Li's and Steve Gourlay's talks from yesterday
- RF cavity work has been on-hold to save resources for SS (highest priority) and CC magnets and will resume October 2011
  - RF cavities, post processing and associated accessory components are under control at LBNL
- Schedule of RFCC fabrication is being developed, testing of the 1st CC cold mass dominates the current schedule