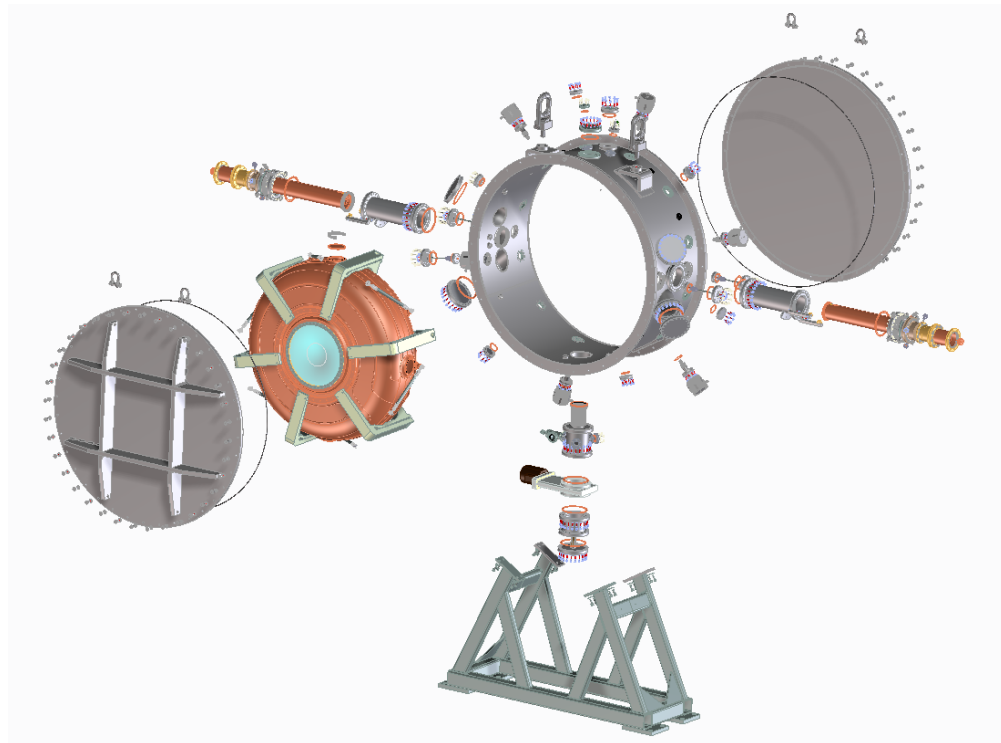


RF Modules Update

MICE Collaboration Meeting 46
Andrew Lambert
Lawrence Berkeley National Laboratory
October 7th, 2016

- **Each MICE RF module has**
 - One 201 MHz RF cavity
 - Two Beryllium windows
 - Two RF power couplers
 - One vacuum vessel hosting the 201 MHz RF cavity
 - Six tuner arms and six actuators
 - Cavity support struts
 - Vacuum pump system and water cooling
 - Diagnostics and bypass lines



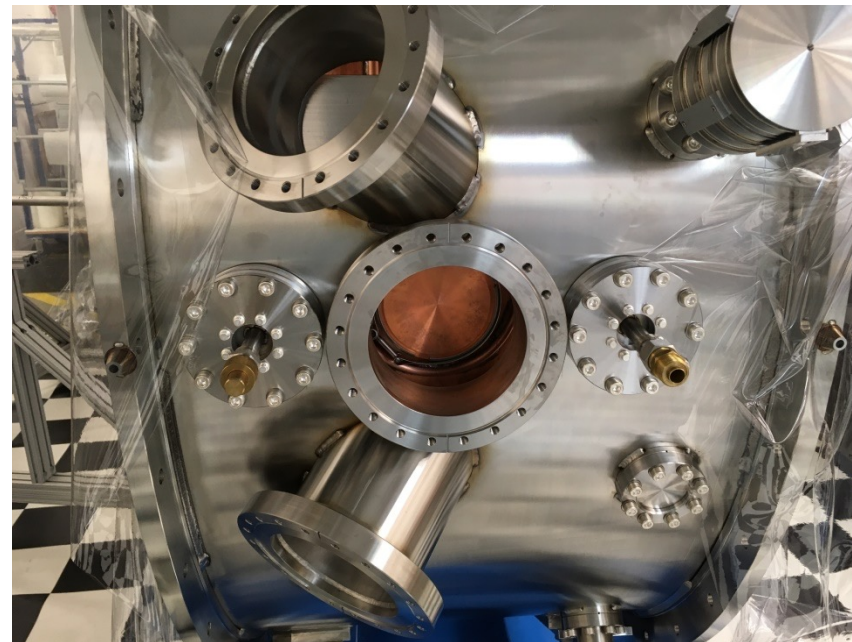
- **RF Module #1 assembly is near-complete**
 - Vacuum leak check and vacuum system testing completed
 - Installation of actuator mani-folding underway
 - RF tuning system tests to be completed mid-October
 - Shipping pallet fabrication underway
 - Shipping crate procurement underway
- **RF Module #2 assembly is underway**
 - Vacuum leak check
 - Fiducialize vacuum vessel and RF cavity
 - Clean vessel and RF cavity
 - RF couplers complete
 - Fabrication of “lesson-learned” items underway
 - Refers to flanges, vacuum components and other items that we needed to make/alter for successful module 1 assembly

RF Module 1 Assembly



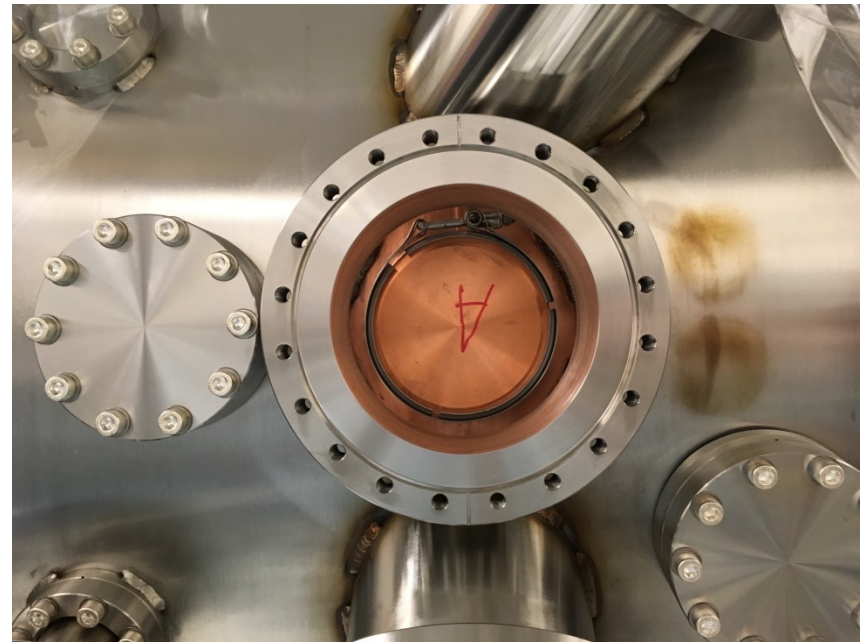
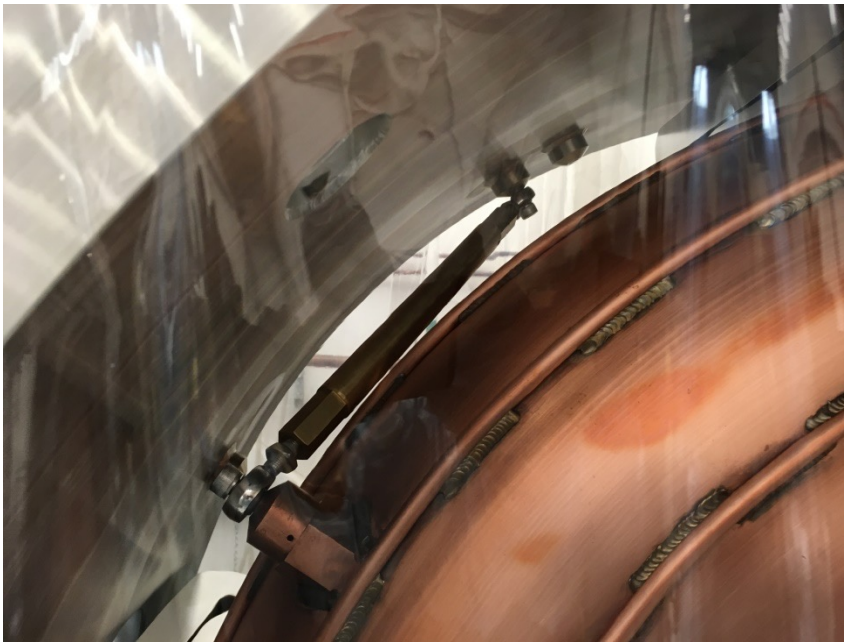
- Tuners and actuators installed
 - Six tuners on cavity body for frequency tuning
 - Actuators thread into tuner bodies; pressurize bellows “squeezes” or “stretches” the cavity to change the frequency
 - +/- 200 kHz

RF Module 1 Assembly



- Water feedthroughs welded and installed on the cavity
 - Provide cooling water to the RF cavity
 - Leak checked
 - Vacuum checked

RF Module 1 Assembly



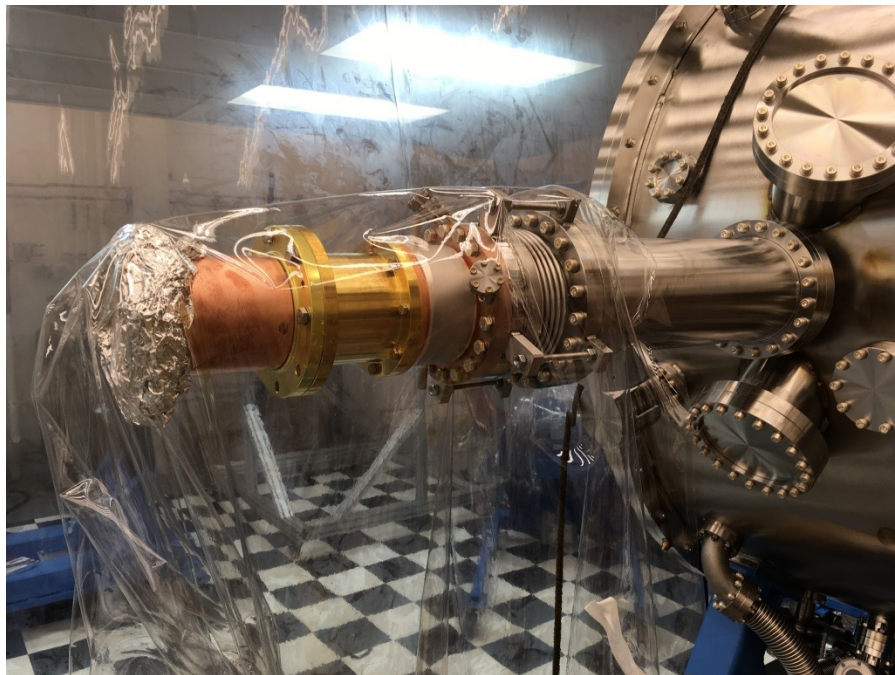
- Six strut system holds cavity in the vacuum vessel
 - Laser tracker survey of the vacuum vessel and the RF cavity determine strut length pre-installation
 - Quick installation and alignment
- RF coupler ports aligned
 - High power tested at MTA
 - Successful

RF Module 1 Assembly



- RF module 1 assembly in clean tent on short stand
 - Needs couplers, end plates, production stand

RF Module 1 Assembly



- Couplers installed to the RF cavity and vessel after cleaning
- RF pickup feedthrough port installed at top of the vessel
 - Image at right show pressure relief and nitrogen vent line during vacuum system testing

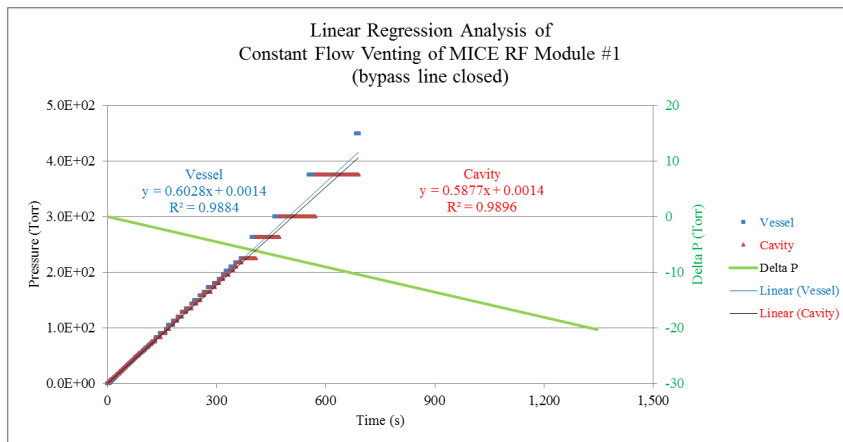
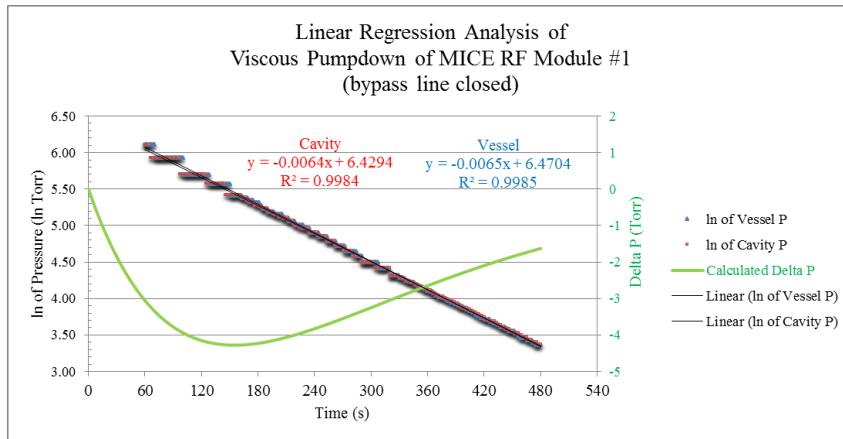


RF Module 1 Assembly



- Differential pressure box tested - Be window protection
- Tuning system fabrication and installation underway
 - Mounted on support stand plate, rigid manifold with flex line to actuators
- Once tuning tests completed
 - Install Be windows
 - Rotate, tune & mark RF coupler position
 - Package Module 1

Module 1 Vacuum Test



- Linear regression analysis of the viscous pumpdown (top) and vent (bottom)
 - In each test, the bypass line is closed
 - Conductance through differential pressure box only
 - Check valves crack at < 7.75 torr differential
 - Maximum differential pressure during pumpdown = 4.5 torr
 - Maximum differential pressure during vent = 20.0 torr
 - Exterior vacuum volume of vessel is << than outer vacuum volume at RAL, would expect lower differential during vent at RAL
- Differential pressure box acts as designed and limits differential pressure during pump-down, providing protection against Be window failure
- Closed bypass line simulates minimum conductance between the two volumes

*Special thanks to Terry Anderson of FNAL for his efforts in the vacuum system design and analysis

- Module 2 assembly is underway
 - Pre-assembly tasks
 - Vacuum leak check
 - Fiducialize vessel and cavity
 - Clean vessel and cavity
 - Fabrication tasks underway
 - Vacuum bellows weldment
 - Vacuum spool piece flange modification
 - Tuning arm modification
 - Support stand modification
 - Once all pre-assembly and fabrication tasks are complete, module assembly will commence

Schedule

Date	Task
Early October	RF Module 2 pre-assembly begins
Mid October	RF Module 1 low-power RF tuning measurement, coupler tuning
End of October	RF Module 1 is crated, RF Module 2 clean room assembly complete
	RF Module 2 support stand modifications complete, vacuum system fab items complete
Early November	Module 2 re-installed to the support stand
	Vacuum system assembly and testing
	RF system tuning system testing
End of November	RF Module 2 assembly complete
	RF Module 2 is crated
Early December	Ship RF Modules 1 & 2 to RAL

Summary

- RF module #1 assembly complete
- RF module #2 assembly is underway
- Vacuum system testing of RF module 1 is complete, actuator-tuner testing TBC
- LBNL has the necessary resources to complete two RF modules