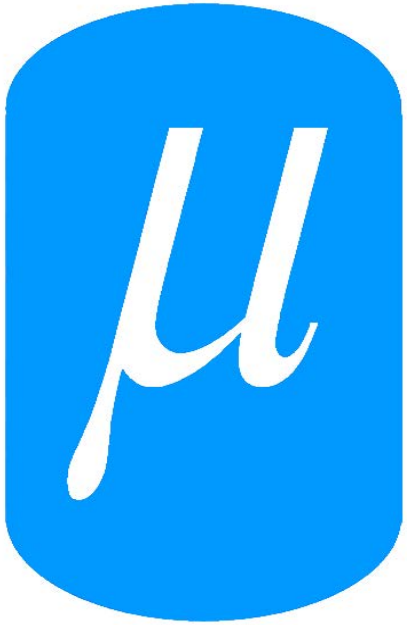
Radio Frequency Component Development at Muons, Inc



Muons, Inc.
Innovation in research

Program Goals.

With our collaborators we are developing the enabling RF technologies for the next generation of energy and intensity frontier accelerator facilities.

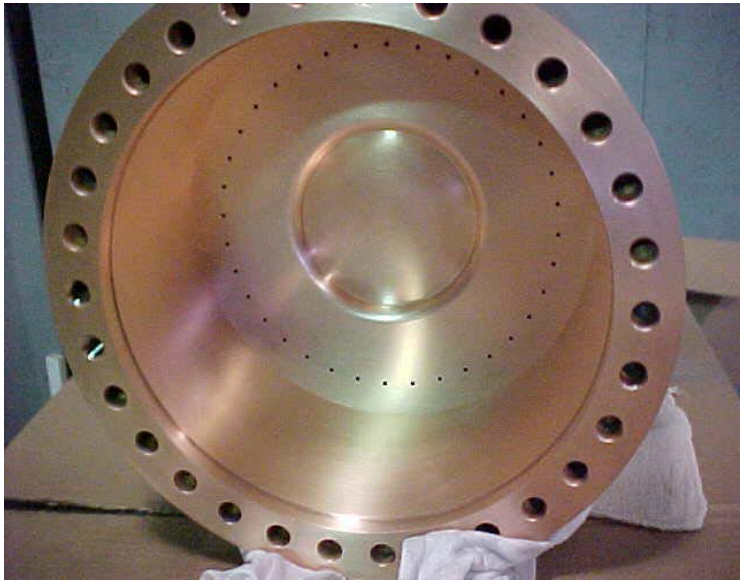
Our RF R&D program services the demanding needs of national labs covering normal conducting RF cavity design and simulation, superconducting cavity design and simulation, higher order mode dampers, and RF power sources for a variety of applications.

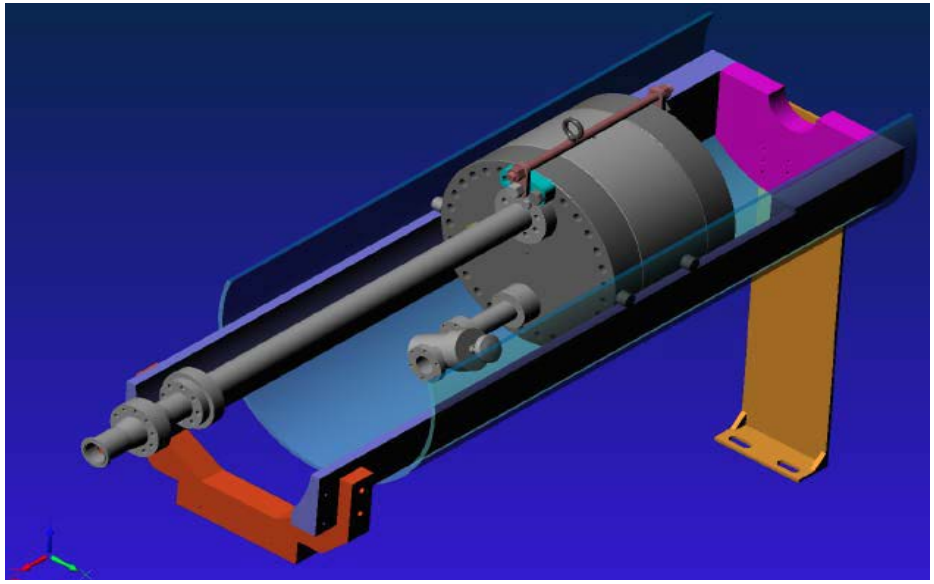
In additional to servicing the demanding needs of national labs, our technologies are of significant impact for high energy linear accelerators due to performance improvements and thus cost reductions.

The following slide show presents a brief summary of our R&D program.

Normal Conducting RF Cavities

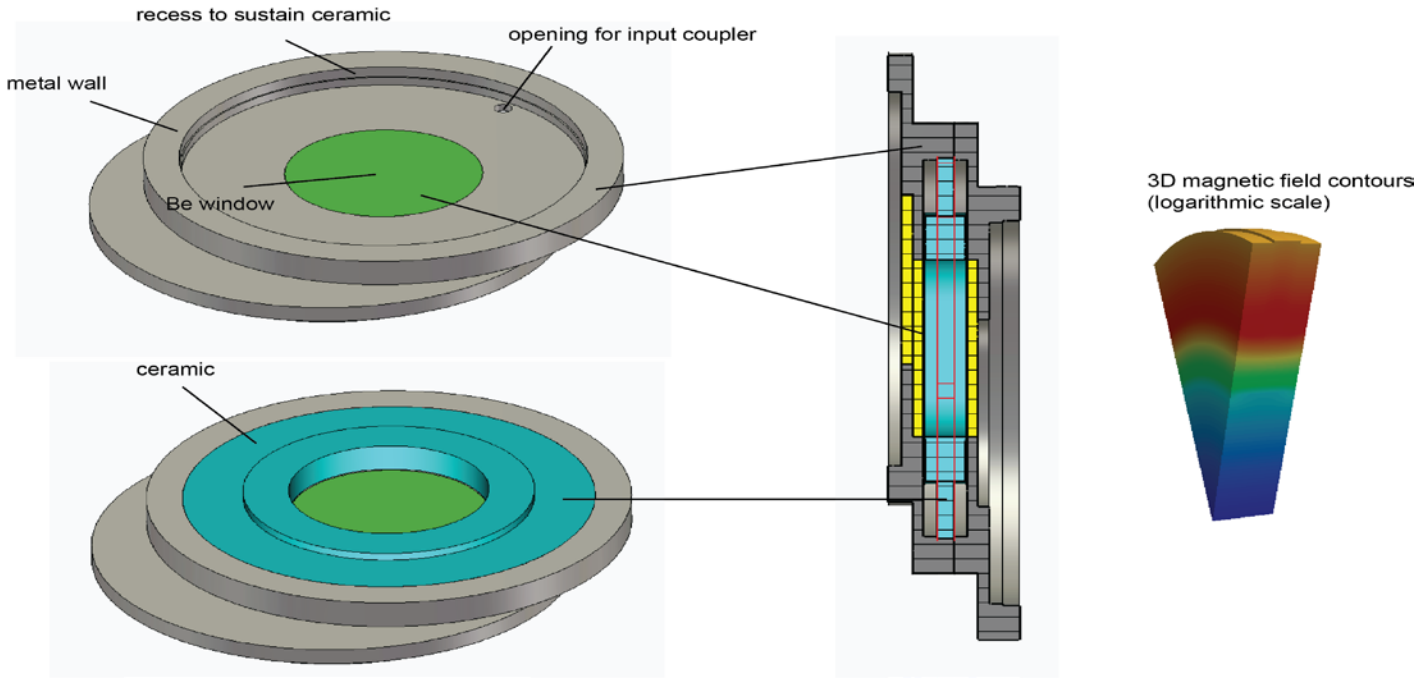
We have designed, built and commissioned a 805 MHz modular normal conducting cavity that can be operated in either vacuum or with 200atm of pressure. This unique cavity has removable endplates that allow for easy material/fabrication testing. Included in the design is a high pressure compatible power coupler.





The cavity was designed for 30MV/m and has been successfully operated in the Muon Test Area at the Fermi National Accelerator Lab with both a zero Tesla background magnetic field and a three Tesla background field.

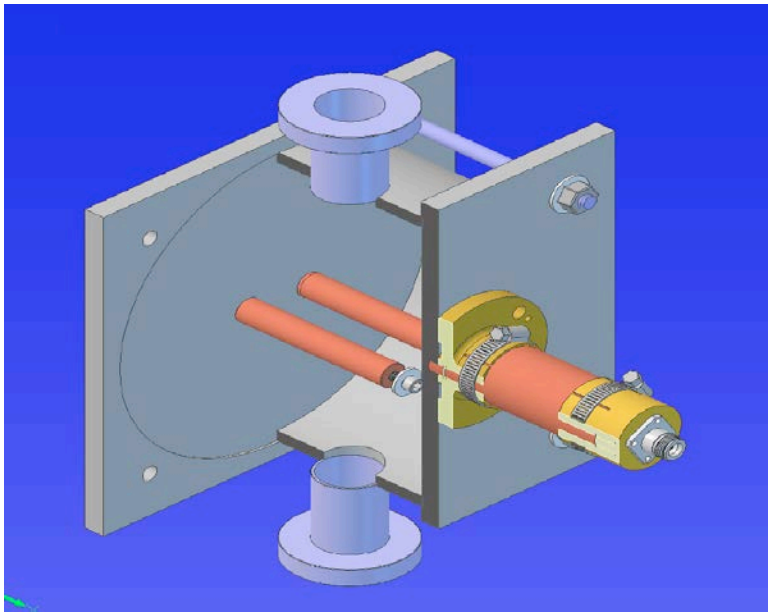
Dielectric Loaded RF Cavities

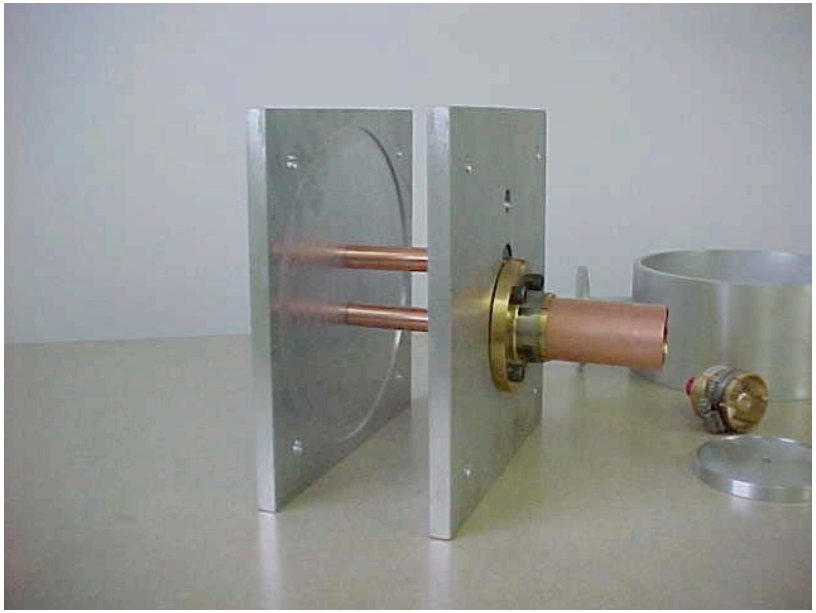


In order to satisfy the demands of a helical Muon cooling channel (a Muons, Inc. technology that will enable a Muon Collider), these dielectric loaded cavities are designed to fit inside the bore of a 10 T superconducting Nb3Sn helical solenoid. We are currently performing the Technology testing before moving to fabrication in 2013/2014.

Novel Crab Cavity Design

Our modular crab cavities will greatly reduce the cost of these accelerator components. The designs of many collider interaction regions call for crab cavities. These cavities can also be used as beam line switches in applications such as accelerator driven sub-critical reactors and for distributing beam to multiple users.

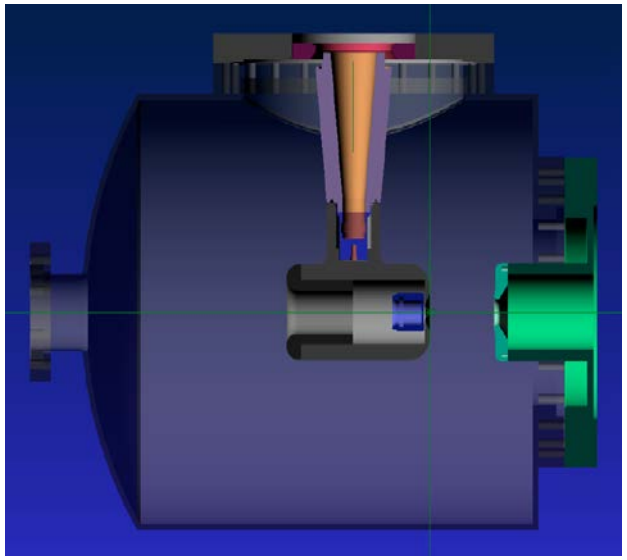


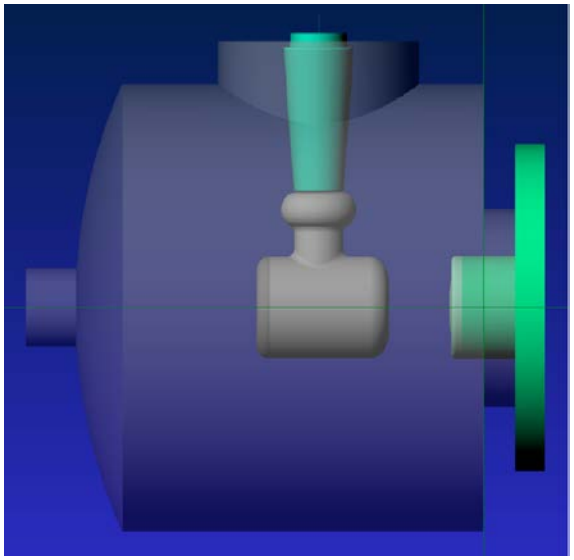


NC DC Photo-Injector Gun

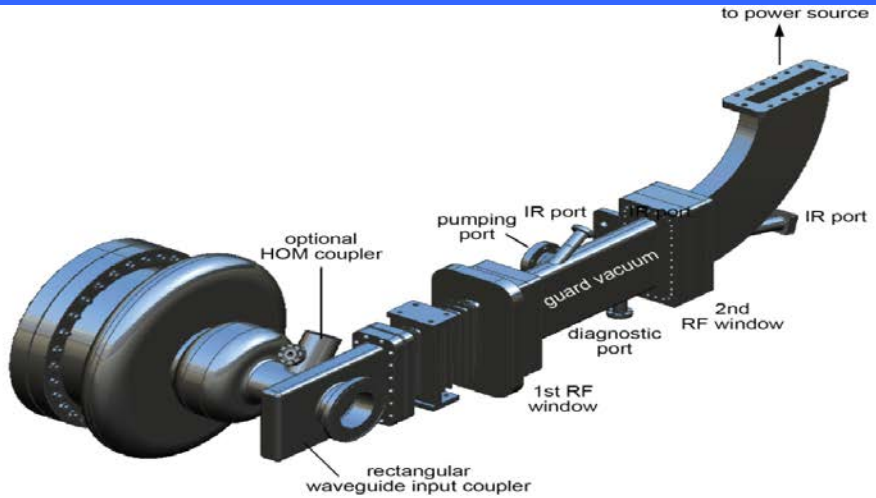
Low gradient gun designs have applications in high power microwave tubes, X-ray tubes as well as various types of accelerator sources. We have several inverted ceramic electrode concepts for a high brightness photo-injector gun.

The original designs were for Jlab and are for an axially symmetric DC Gun with an inverted ceramic that operates with less than 5 MV/m at 350 kV and designed for an in-situ replaceable photo-cathode.



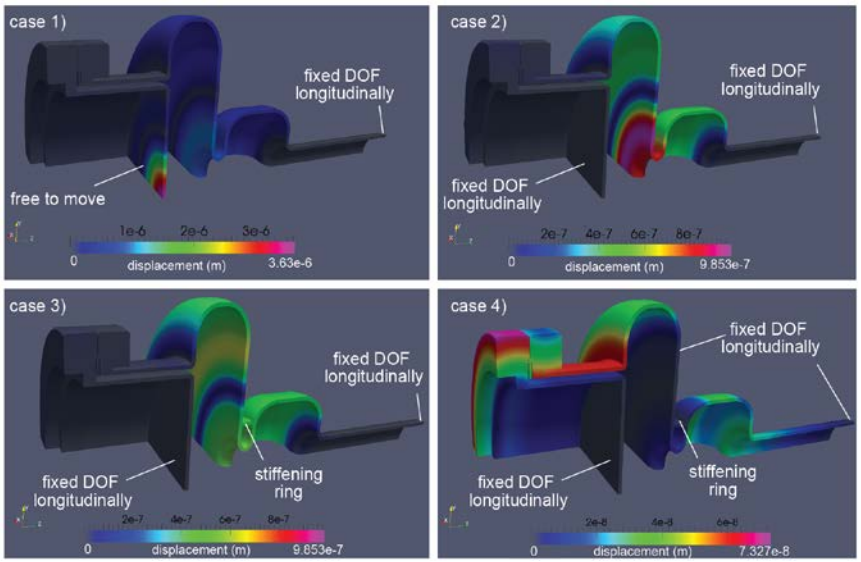


SRF High Brightness Photon-Injector Gun



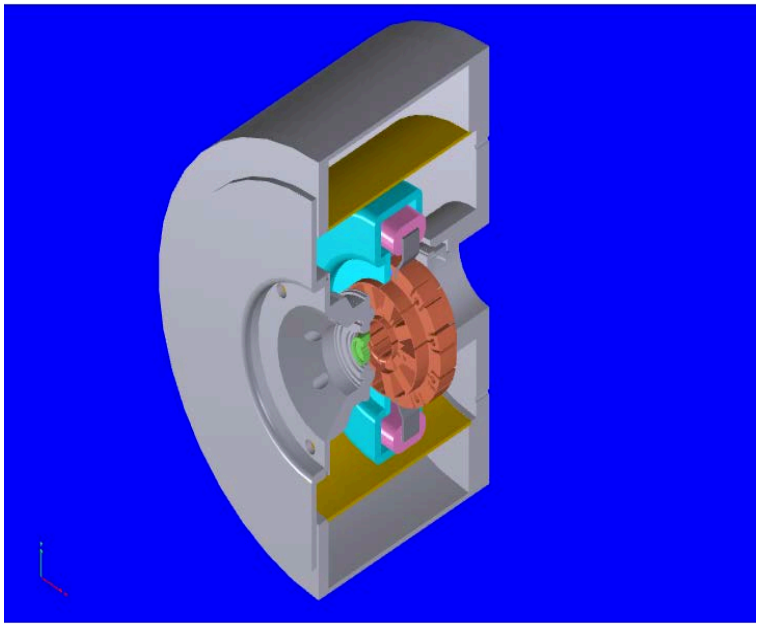
existing JLab 1.5 GHz coupler waveguide tested for up to 13 kW CW

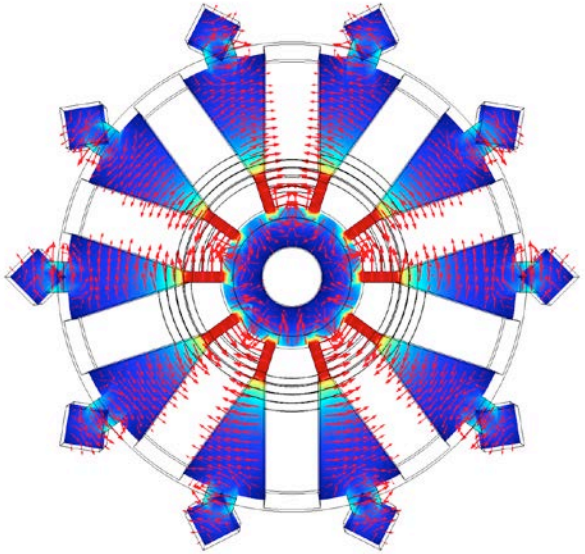
One of the recent highlights is the development of a superconducting photo-injector cavity. This cavity offers the potential of running in continuous mode (CW), while sustaining a high peak electrical field at the photocathode. This would translate to a significant improvement in beam brightness beyond state-of-the-art. Additionally the most complicated assembly issues of traditional systems are bypassed by a novel design.



RF Power Sources: Magnetrons

One of our specialties is the development of low cost RF power source schemes using magnetrons. These are currently being developed for both existing facilities (Jlab) and next generation high power superconducting linear accelerator facilities such as Project X (FNAL) and ADSR.



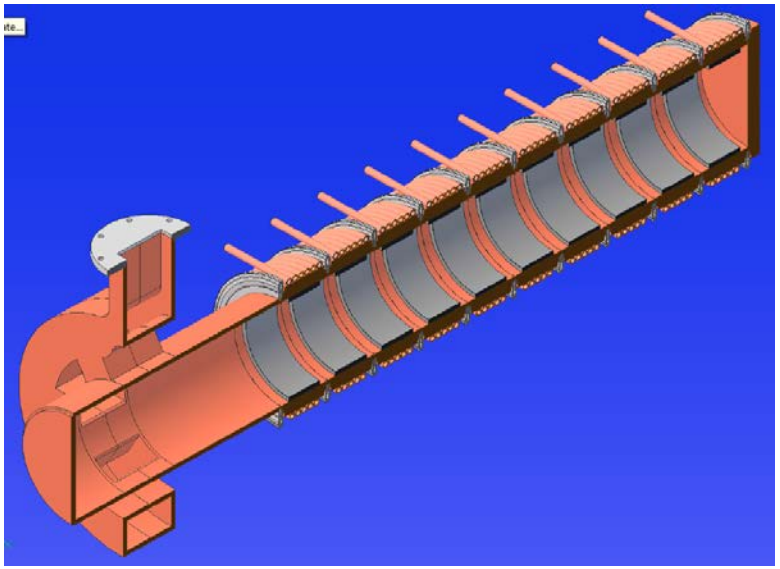


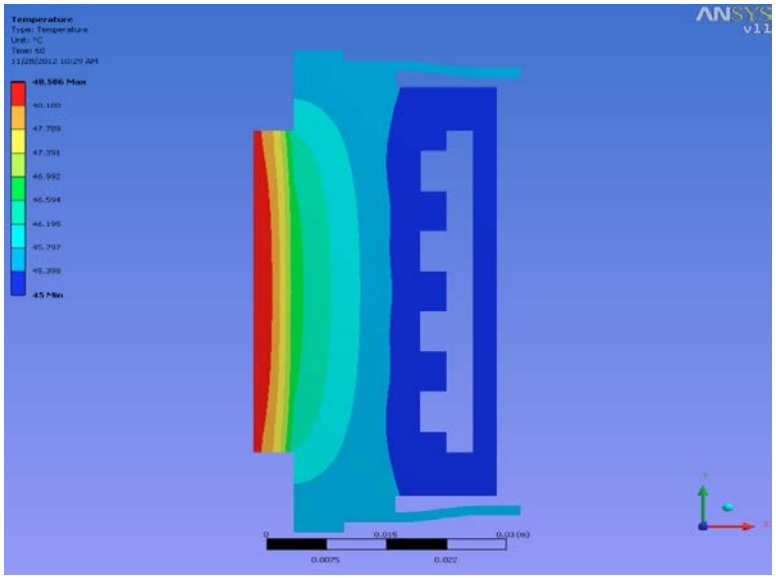
Comsol simulation of resonant modes

High Power S-Band Vacuum Loads

We are developing a high-peak-power RF load for use in ultra-high vacuum systems such as those found in the acceleration systems at particle accelerators.

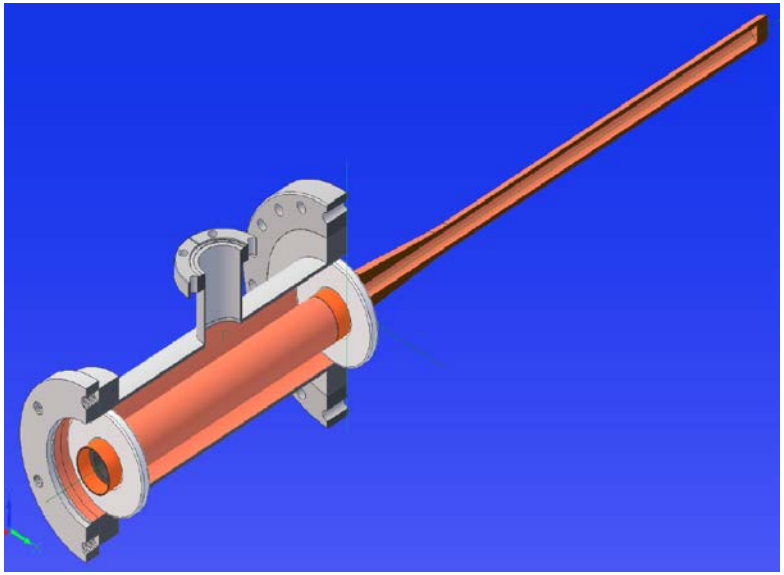
This dry load system will have a wide range of application from beam line HOM loads to TE01 dry loads. Every SRF accelerator will benefit from the use of this material. The ability to cast the material into novel shapes allows for low cost solutions which would otherwise be prohibitive due to machining costs of more traditional lossy ceramics.





RF Coaxial Window Coupler

Muons, Inc. is currently designing a dual window RF coaxial coupler at 400 MHz for JLAB. The unique concept uses the size, spacing, and dielectric constant of the windows to properly match coupler. The design employs Muons' proprietary compression window design. Thermal and Stress analysis is performed using ANSYS.



Compression window