Cornell University
Laboratory for Elementary-Particle Physics

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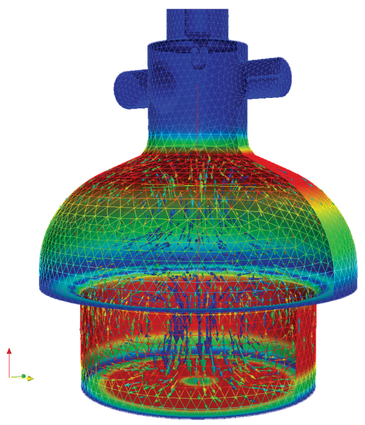
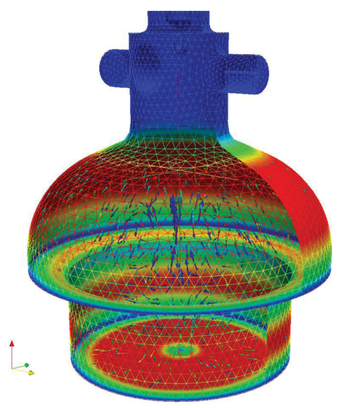
Mechanical Design of a TE cavity Insert

DESIGN OF THE MUSHROOM CAVITY

Currently there is a need to test possible new superconductors for use in particle accelerators. A cavity has been designed which maximizes the magnetic field on a sample plate.



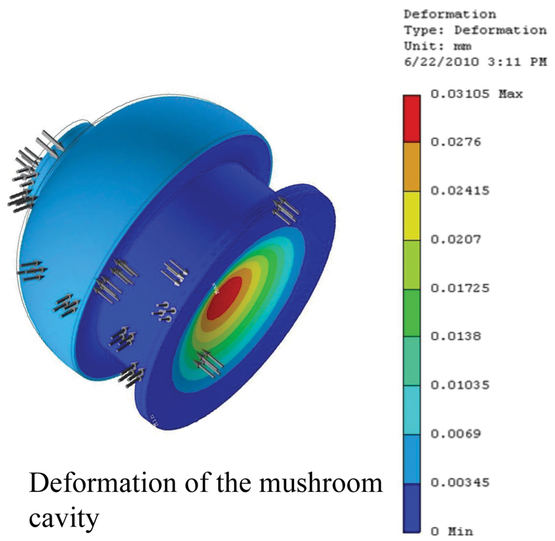
The magnetic field of TE012 mode .



The magnetic field of TE013 mode .

Before the mushroom cavity can be built, it is important to run a stress analysis to make sure that the cavity can withstand one atmosphere of pressure due to the inside of the cavity being under ultra high vacuum.

Autodesk Inventor was used to create a 3D model. The model was designated as being made of Niobium and then an embedded ANSYS program ran a stress analysis.



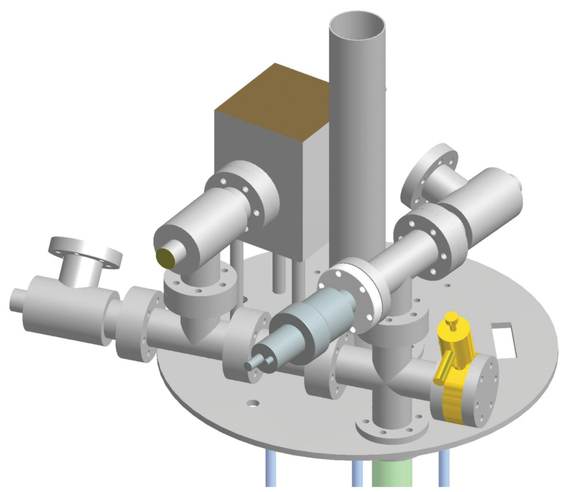
Deformation of the mushroom cavity

This shows the deformation that would occur if the cavity was under vacuum pressure. The max deformation, shown as red, is 0.03 mm. This is an acceptable amount of deformation.

DESIGN OF THE INSERT

The newly designed cavity is a nonstandard size. A new test insert needed to be designed. Using other test inserts as examples, an insert was designed in Autodesk Inventor to accommodate the new cavity.

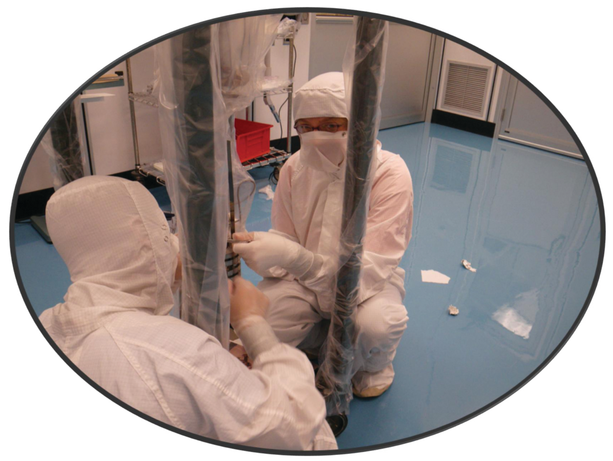
The support system and system for moving the bellows.



The top of the insert with the vacuum system.

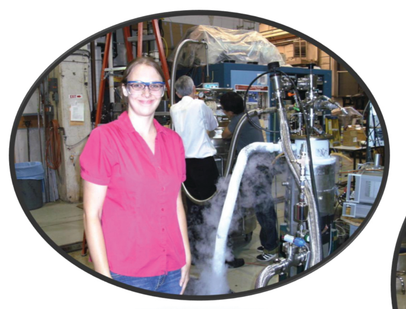
Single cell and five cell cavity inserts were used as examples to create the insert for the mushroom cavity. The cavity needed to be supported to withstand vacuum pressure. Also, the input coupler needs to be adjusted when the cavity is being tested.

ASSEMBLY AND RF TEST OF PILLBOX CAVITY



Working in the cleanroom

Cornell's cleanroom has parts that are classified as class 100, and parts that are classified as class 10. A class 10 cleanroom has no more than 10 particles that are 5 microns thick per cubic foot. For comparison, average air has millions of particles.



Liquid Helium, at 4.2K, being added into the dewer

Testing of the pill box cavity.

On the left is me. Next is the network analyzer, which measurers the amount of power that is picked up by the pick up coupler. The tall cylinder in the middle is the dewer with the cavity in it. On the far right is the vacuum pump for the cavity.

LEPP, the Cornell University Laboratory for Elementary-Particle Physics, has joined with CHESS to become the Cornell Laboratory for Accelerator-based Sciences and Education (CLASSE). LEPP's primary source of support is the National Science Foundation.
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