high abrasion resistance, making it suitable for this application.

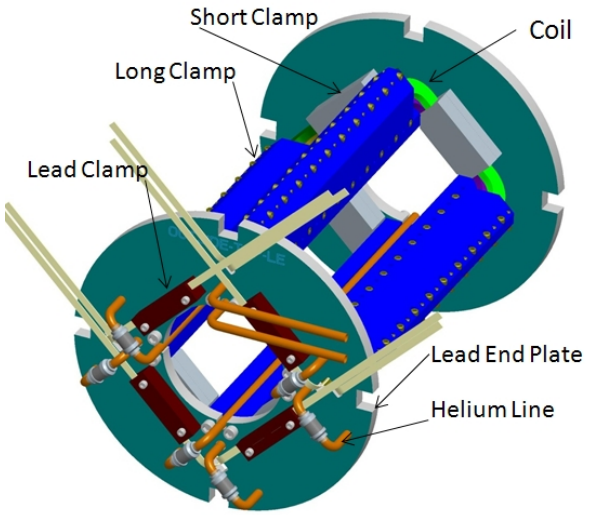

Figure 3: Coil Assembly with Clamps and End plates.

The ~13 layers of cryogenic insulation consist of thin aluminum reflective sheet and ceramic based cloth serving as the separator. The traditional materials (aluminized mylar and spun polyester cloth separator 'Reemay') do not offer adequate radiation resistance.

Warm-to-cold insulating structural supports are traditionally made of phenolics such as G-10, G-11, or similar composite plastics. Such epoxy-based materials cannot be used here, so in cases where such insulating support is needed, ceramic parts are employed. Examples of ceramic parts are the axial coil thermal slides, and the coil mid-section-to-cryostat radial supports.

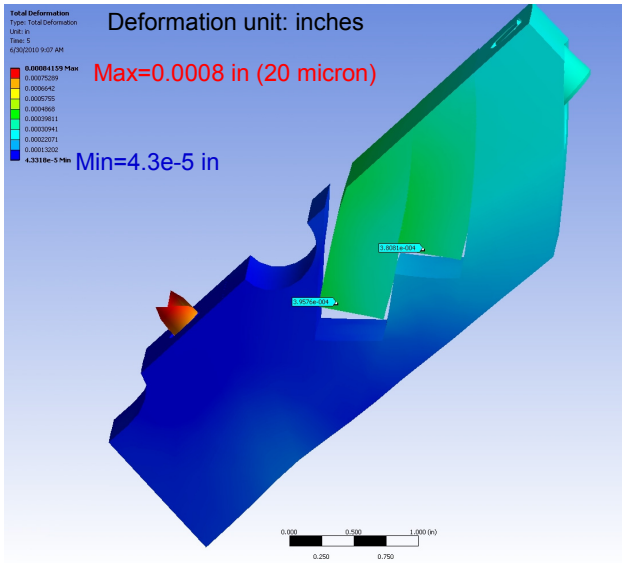

Figure 4: ANSYS analysis of long clamp CS with Coils.

Analyses

The ability of the clamping system to withstand radial and axial Lorentz forces has been studied. Bolts joining the clamps together and attaching the clamps to the end plates have been sized and arranged to maintain stress and deflection within acceptable limits. Analysis results indicate that deformation in the coils does not exceed 25 microns anywhere (Figures 4 & 5).

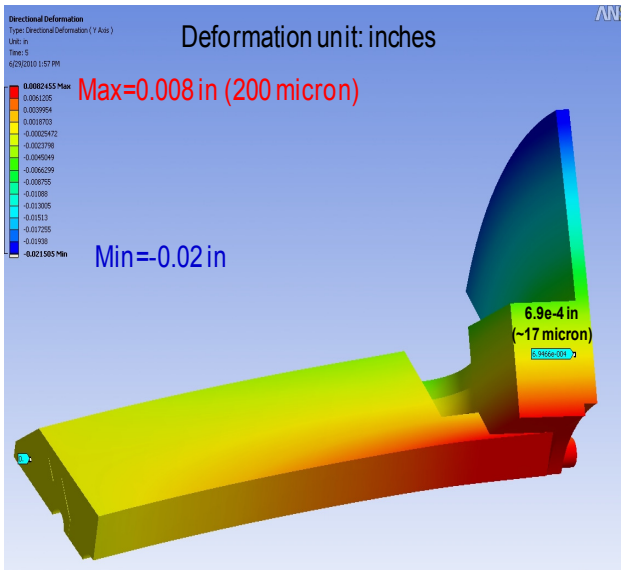

Figure 5: ANSYS analysis of coil axial deformation.

CONCLUSION

BNL's newly designed FRIB Quadrupole R&D magnet has the features necessary to operate in a harsh accelerator environment. When completed later this year, extensive cold testing will validate the design and confirm its usefulness as a stable and long-lasting HTS accelerator magnet.

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