ILC Main Linac Superconducting Cryogen Free Splittable Quadrupole

Progress Report

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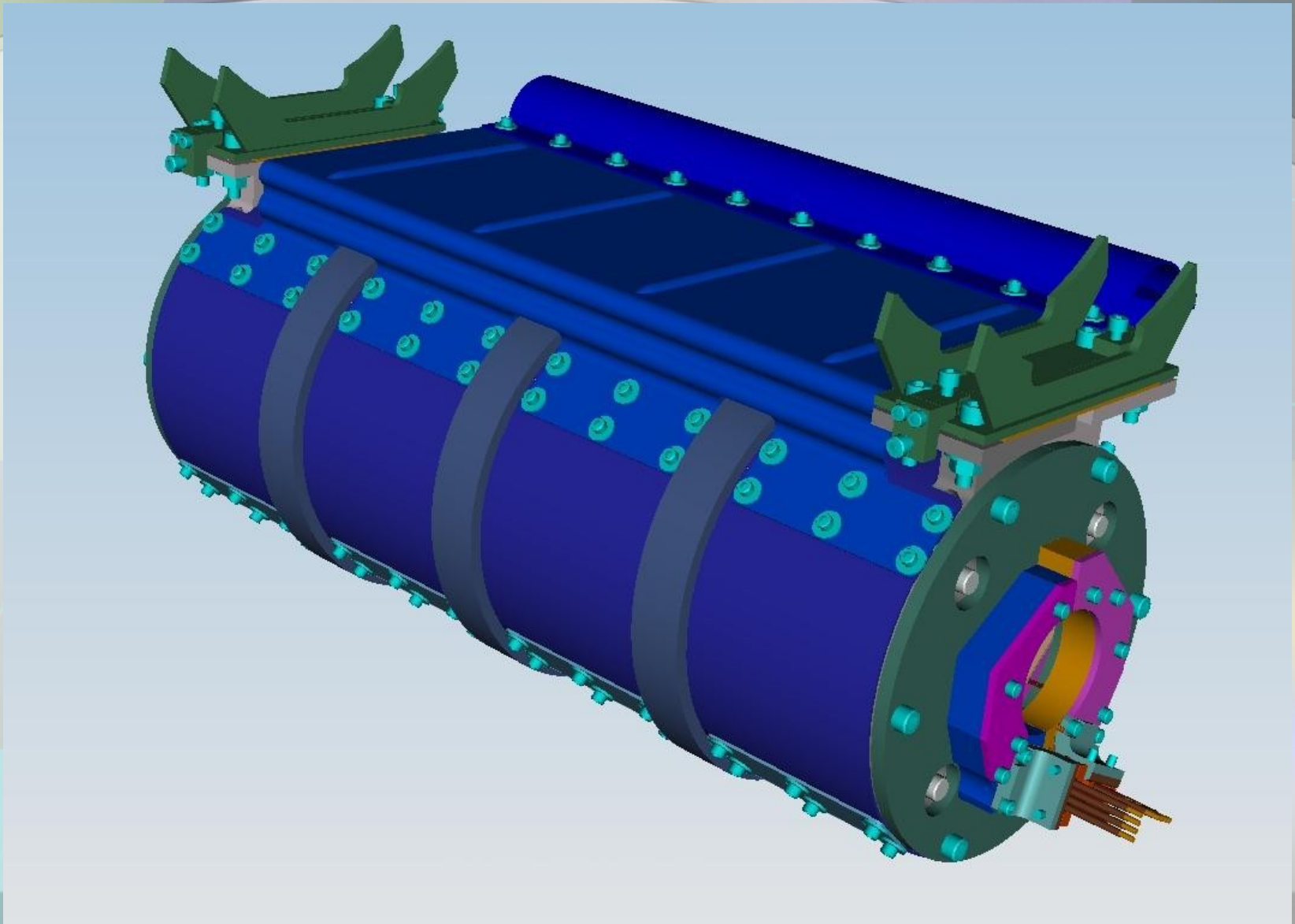
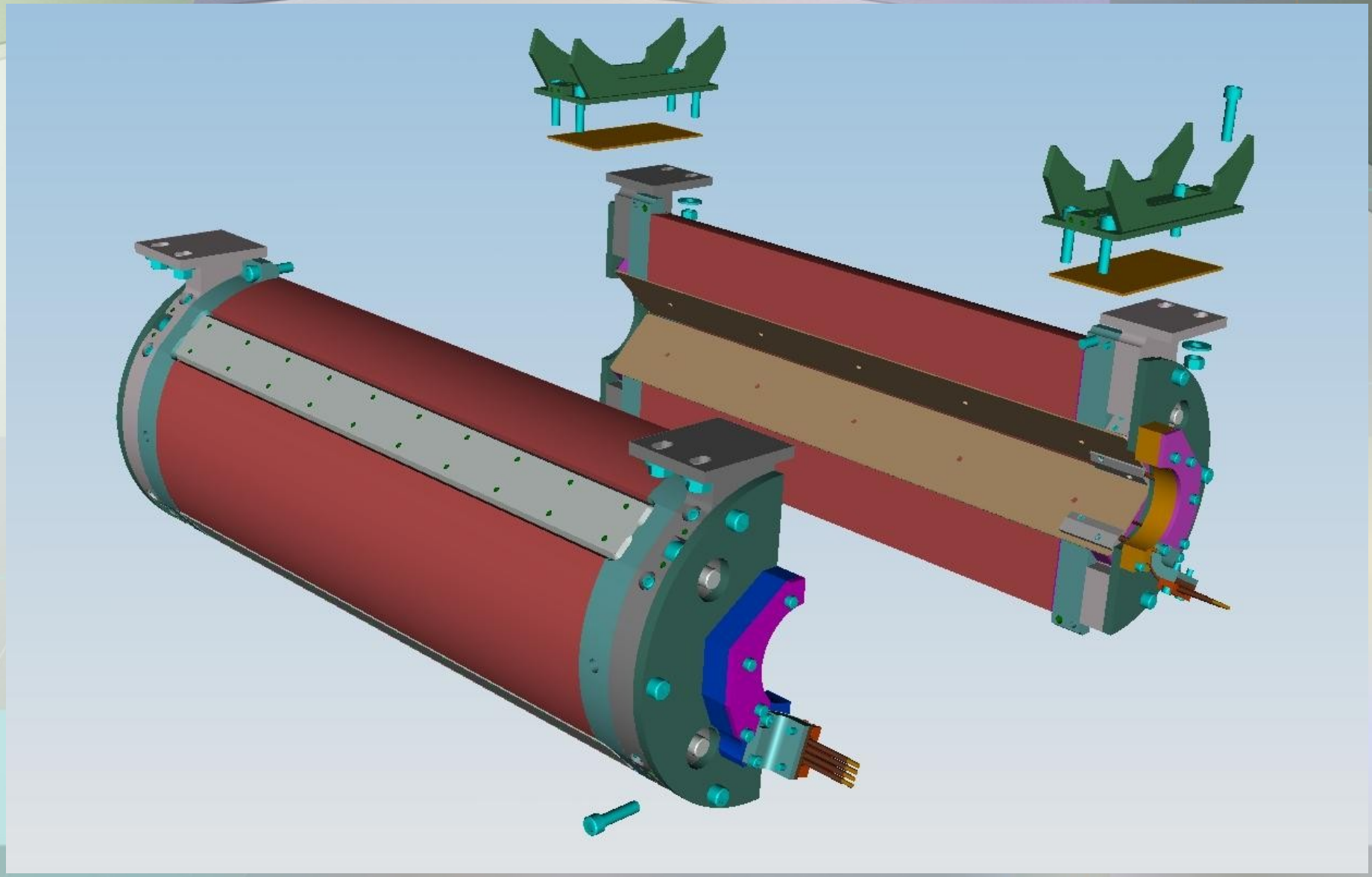
Outline

- Quadrupole design
- Quadrupole fabrication status
- Test program
- Summary and schedule
- Future test program

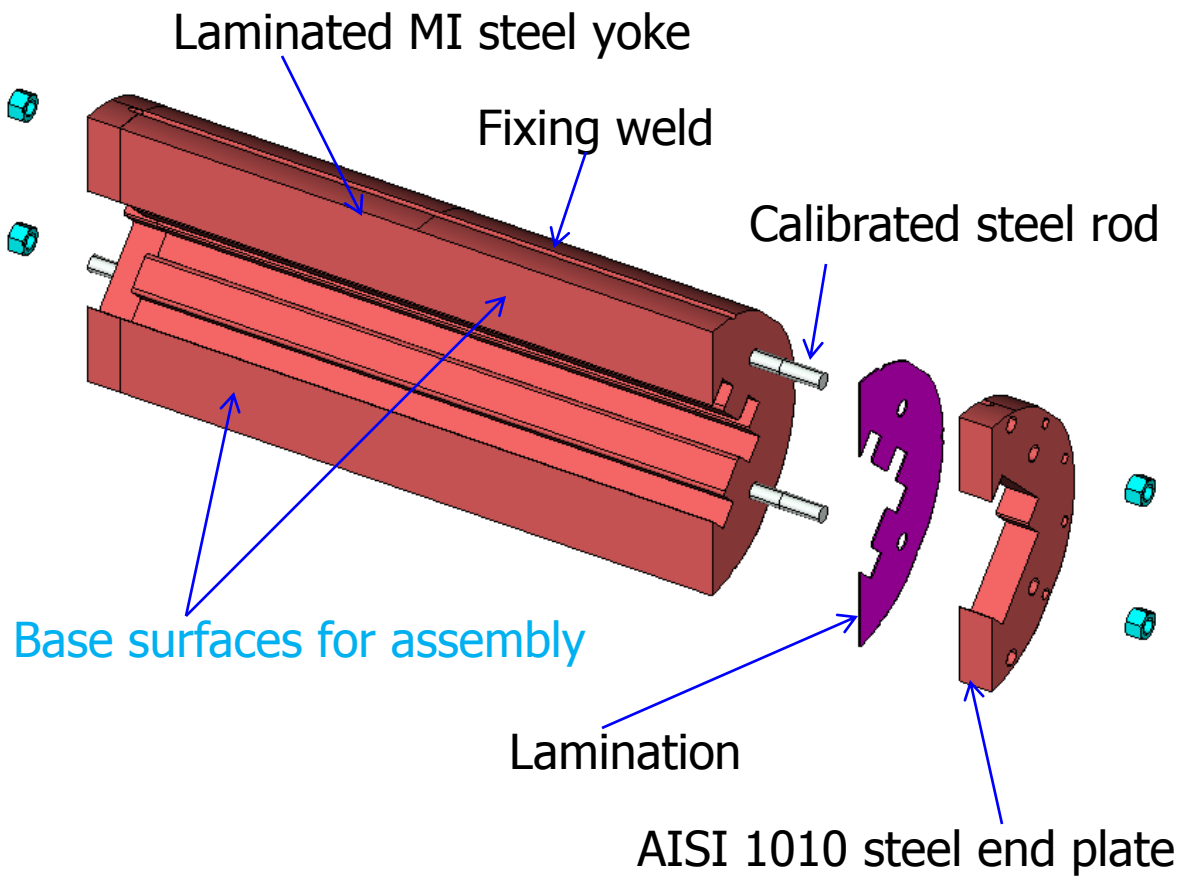
Quadrupole Cold Mass Assembly



Two Halves of the Quadrupole

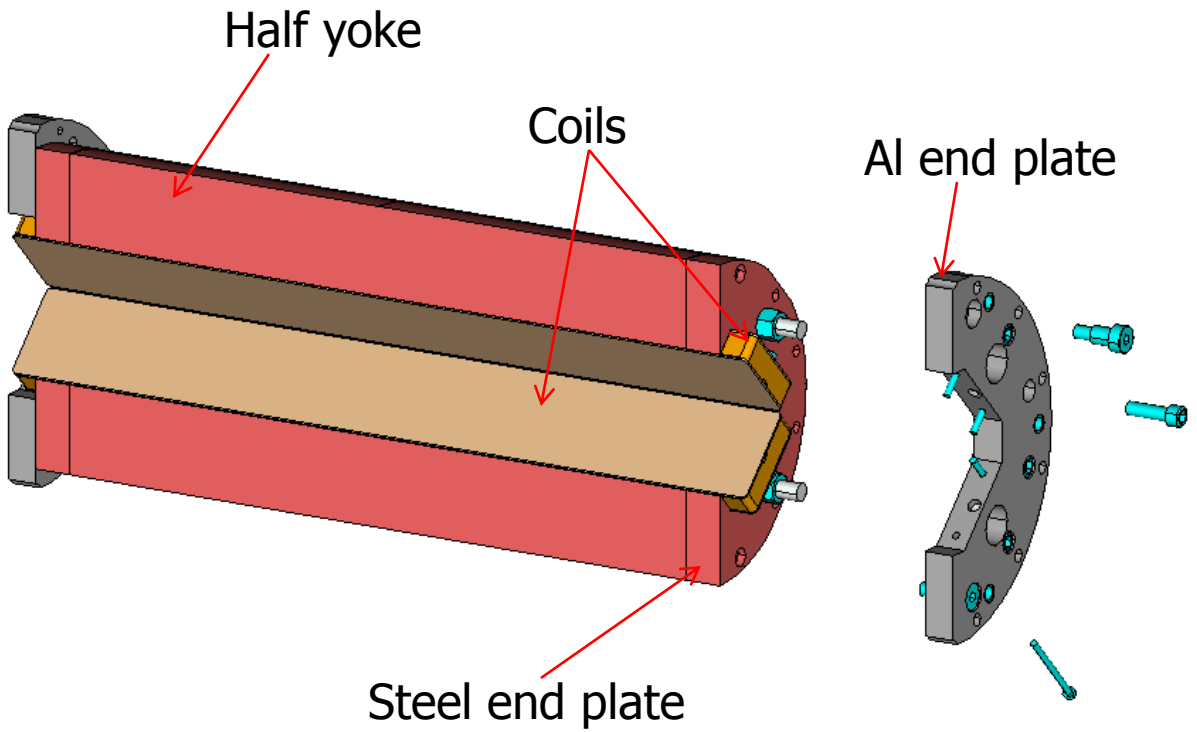


Half of Iron Yoke Assembly



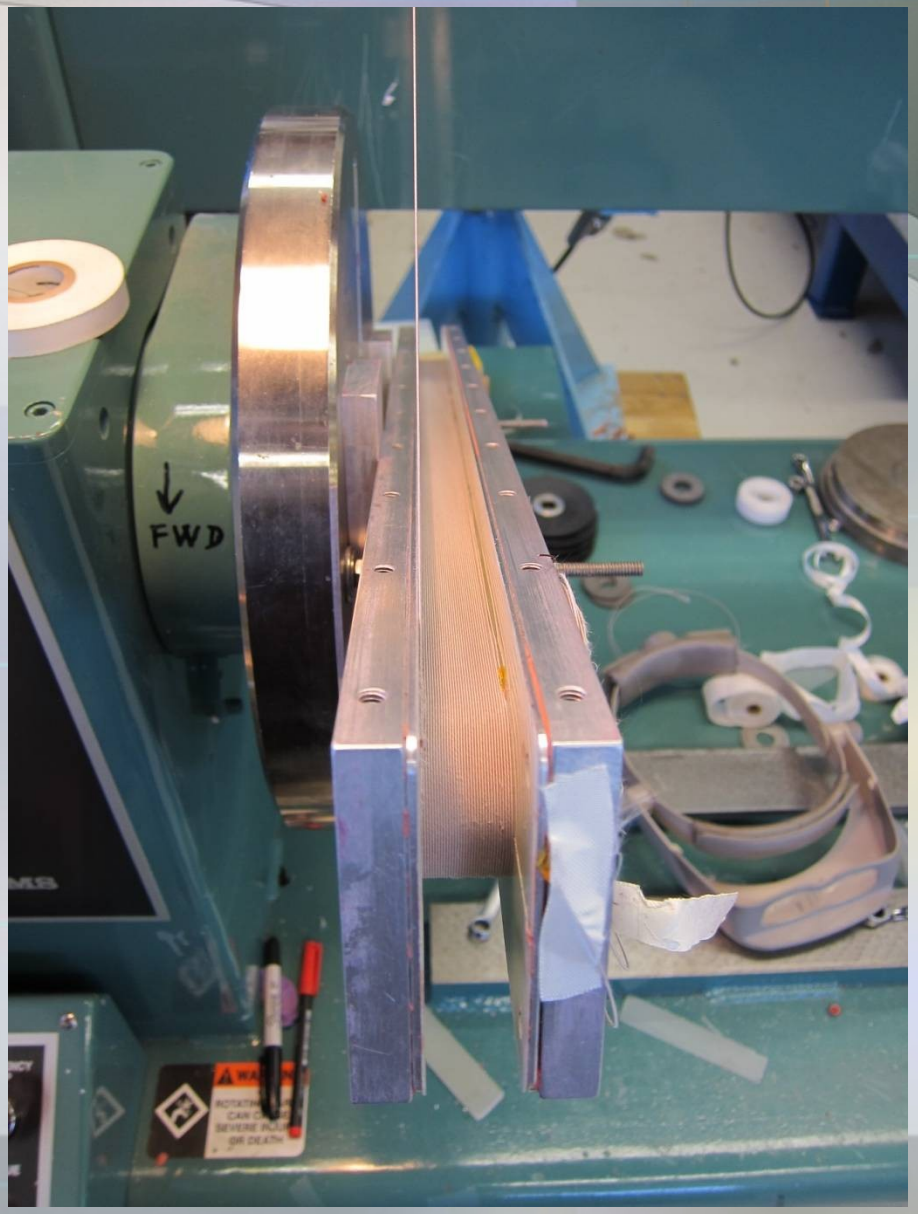
The yoke laminations are laser cut from MI low carbon 1.5 mm thick steel. The half core is assembled in the FNAL IB2 horizontal press. Calibrated rods and base surfaces provide package straightness. Final mechanical rigidity provided by fixing welds.

Half Yoke with Al End Plate

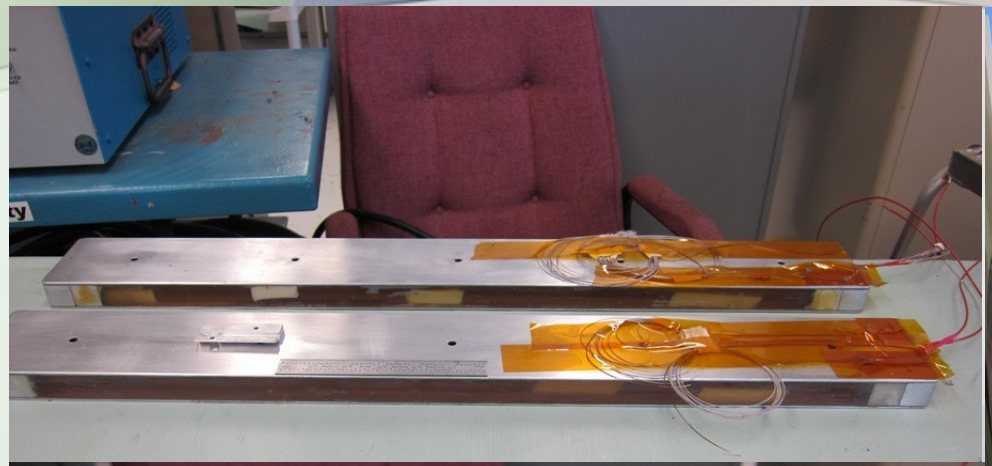


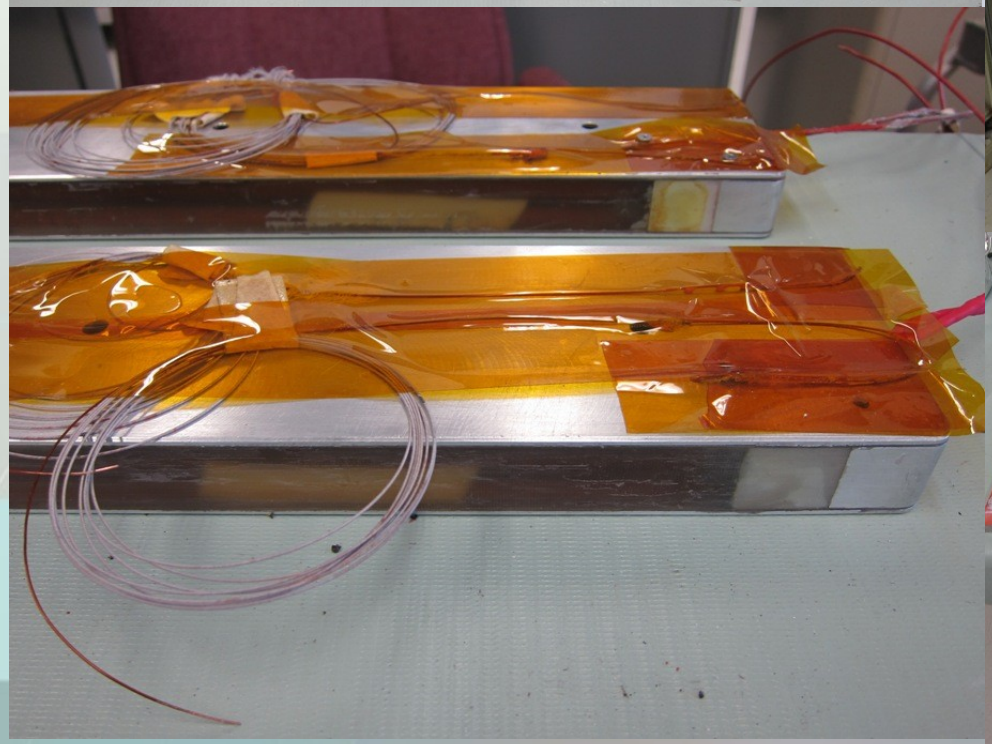
Al end plate mechanically and thermally connected to the coil and outer shell Al collars providing better thermal conductivity between coils and cooling tube.

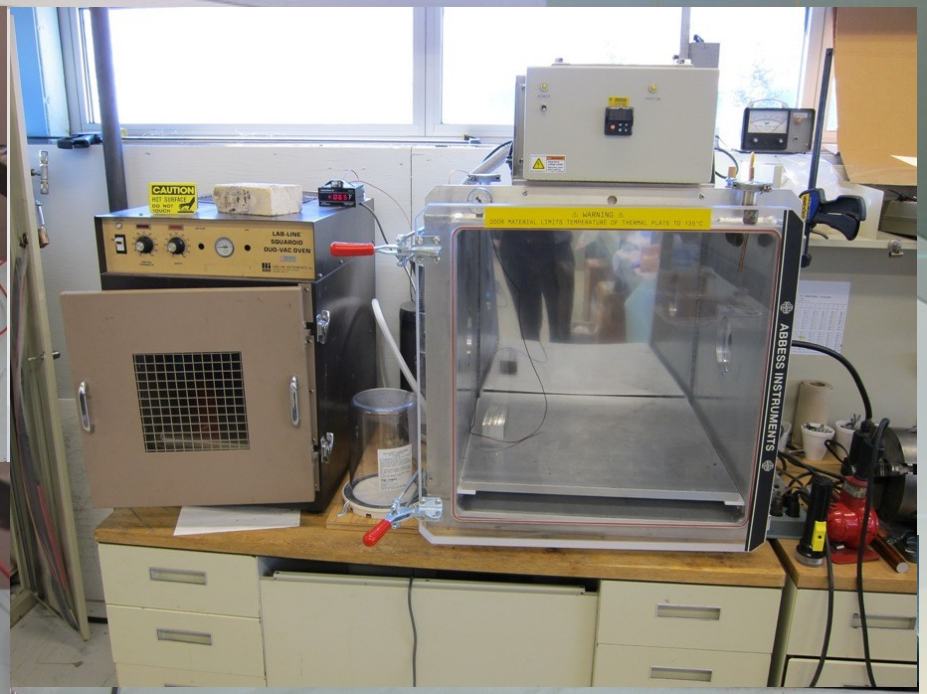
Coil N3 Winding (January 21, 2011)

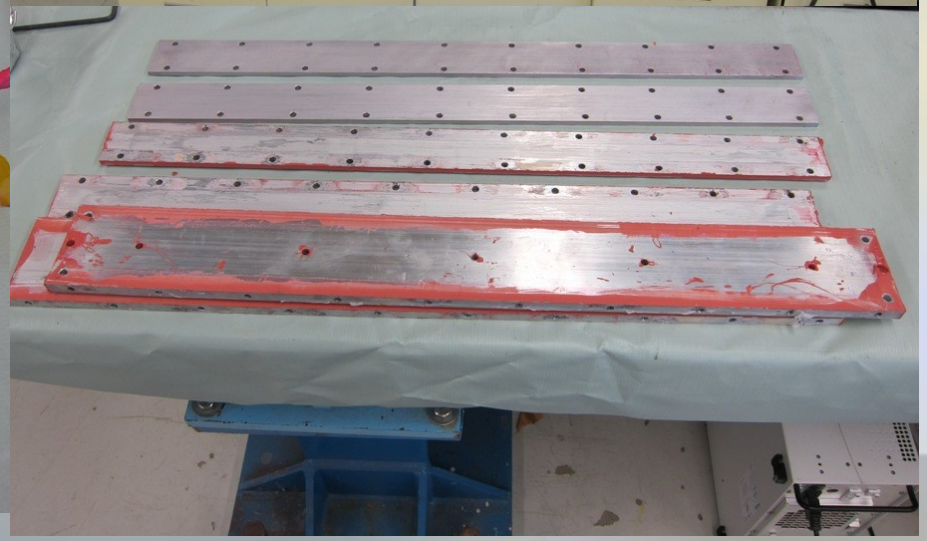


Quadrupole Coils & Tooling

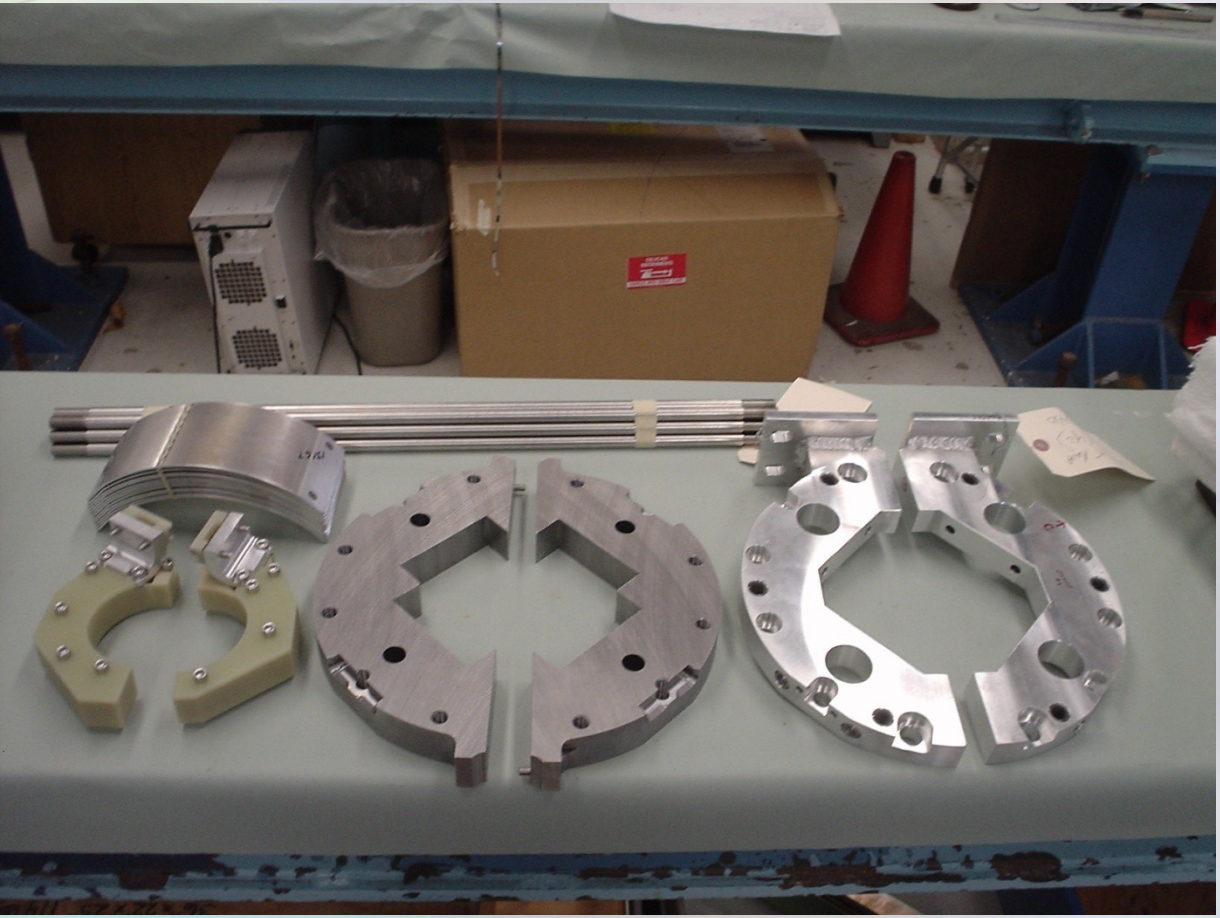






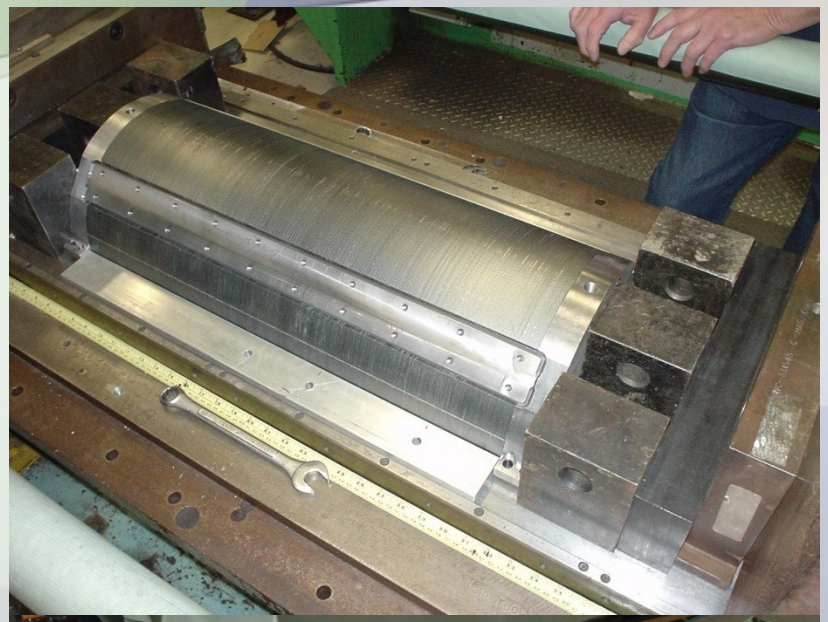


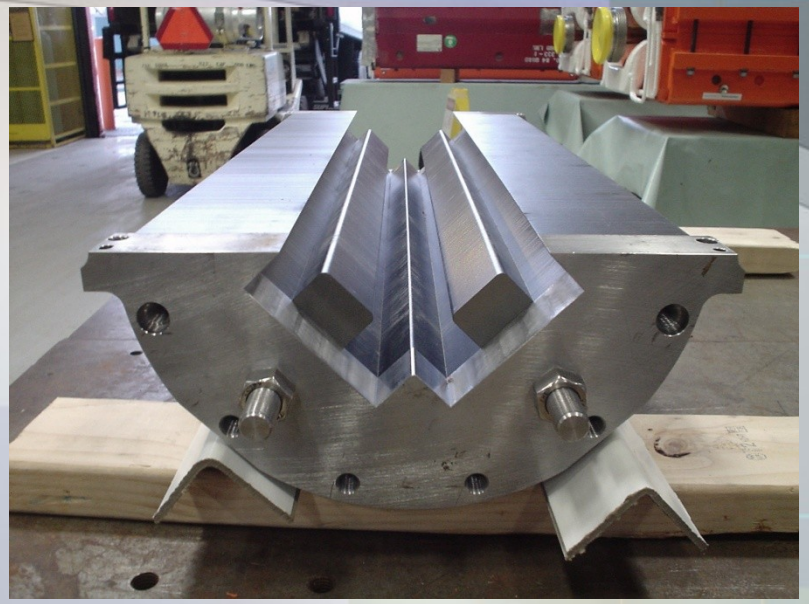
Quadrupole Parts Delivered

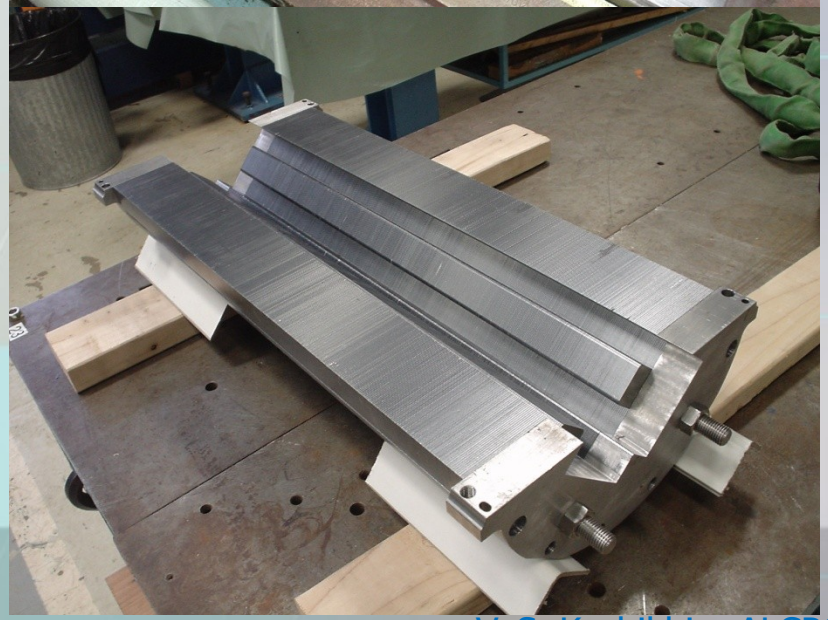


1. Coil N1, N2, and N3 are fabricated.
2. Coil N4 wound and epoxy vacuum impregnated.
3. Second set of coil tooling cleaned and is ready for the Coil N4 winding.
4. Low carbon steel end plates, Al end plates, G10 wiring plates, steel rods, yoke welding bars, Al shells are on the shelf.
5. MI low carbon steel blank pieces are inspected and will be sent to Laser Technologies for the lamination laser cutting.

Half Yoke Assembly

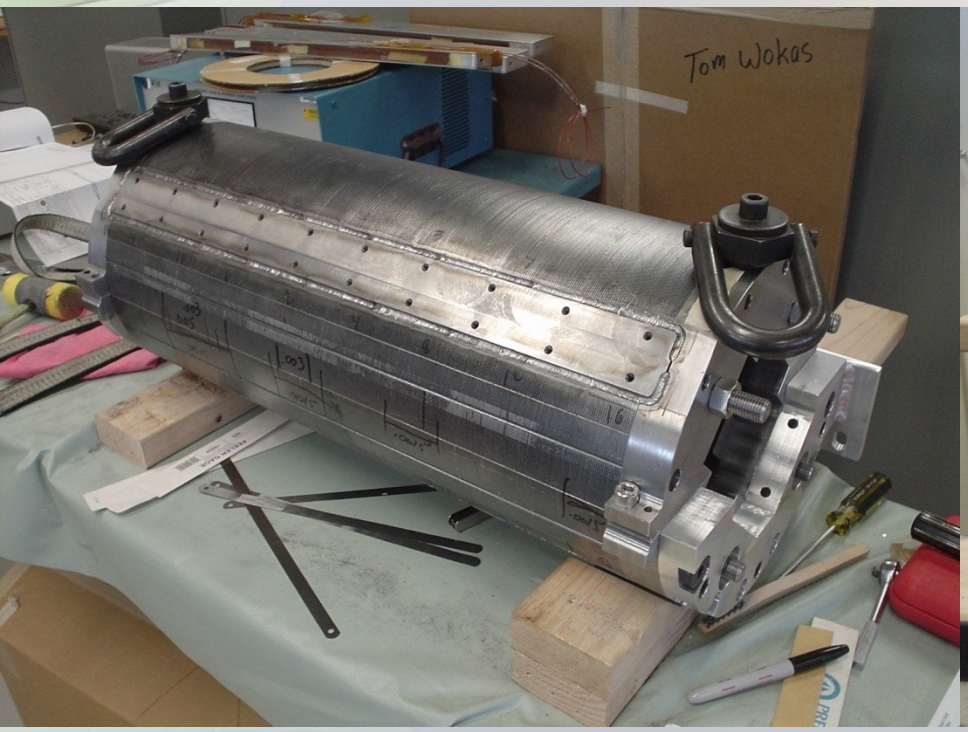


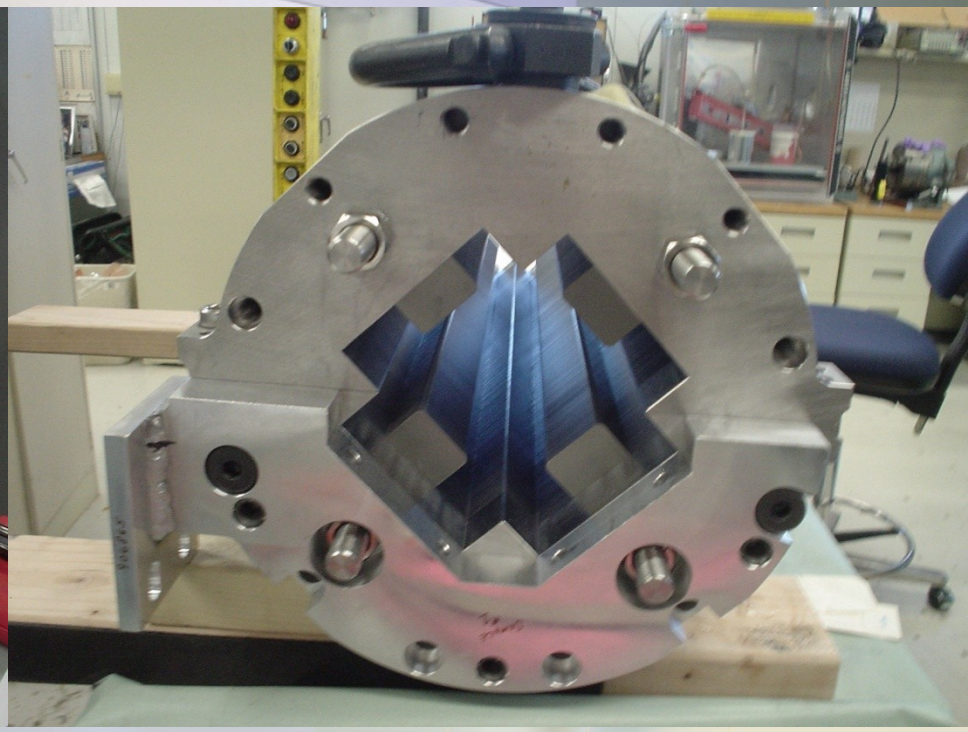




Yoke laminations mounted in the press. The half core with end plates pressed and side bars were welded. The half core straightness better than 0.1 mm.

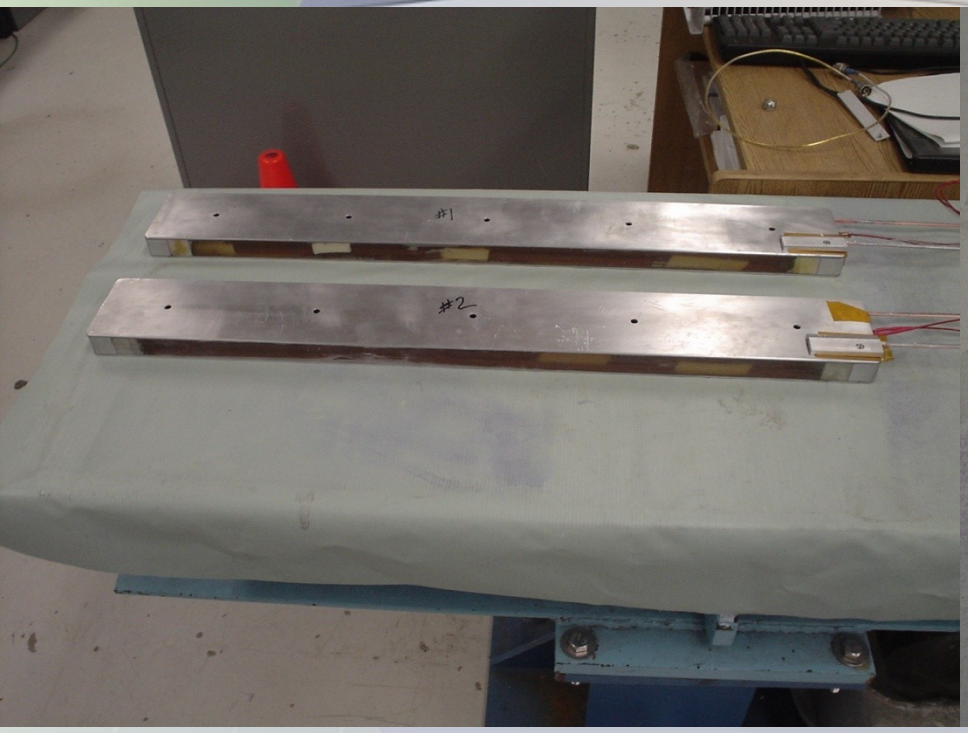
Assembled Iron Yoke

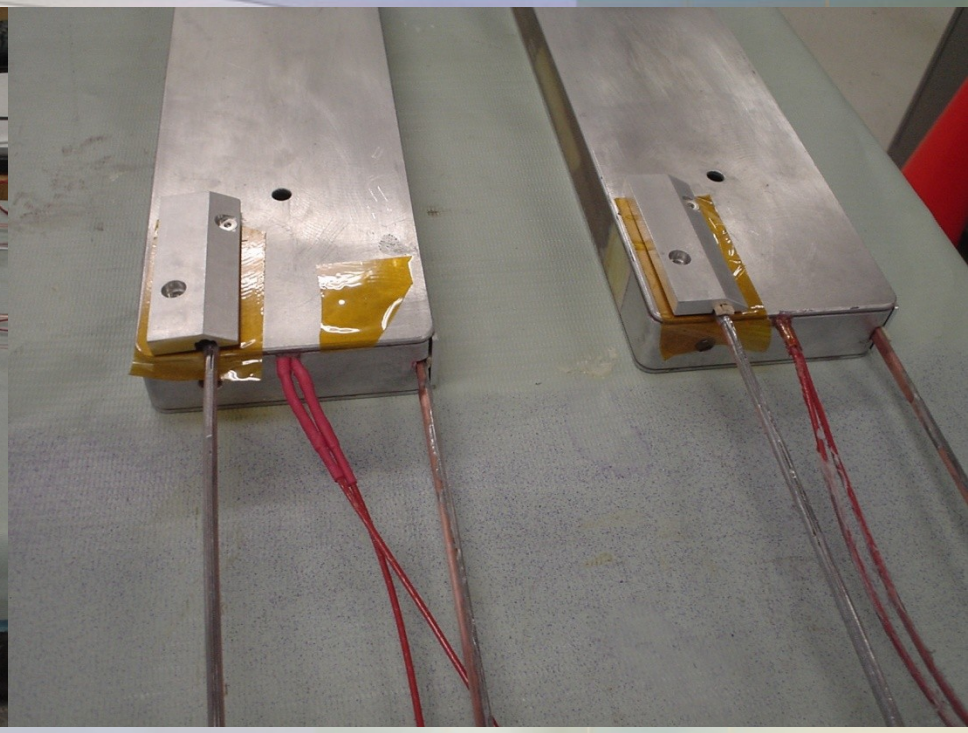




The iron yoke was assembled in the final configuration. The gap between two halves was measured and was less than 0.15 mm. After the clamping all gaps were closed. To provide the quadrupole magnetic axis stability no gaps are allowed.

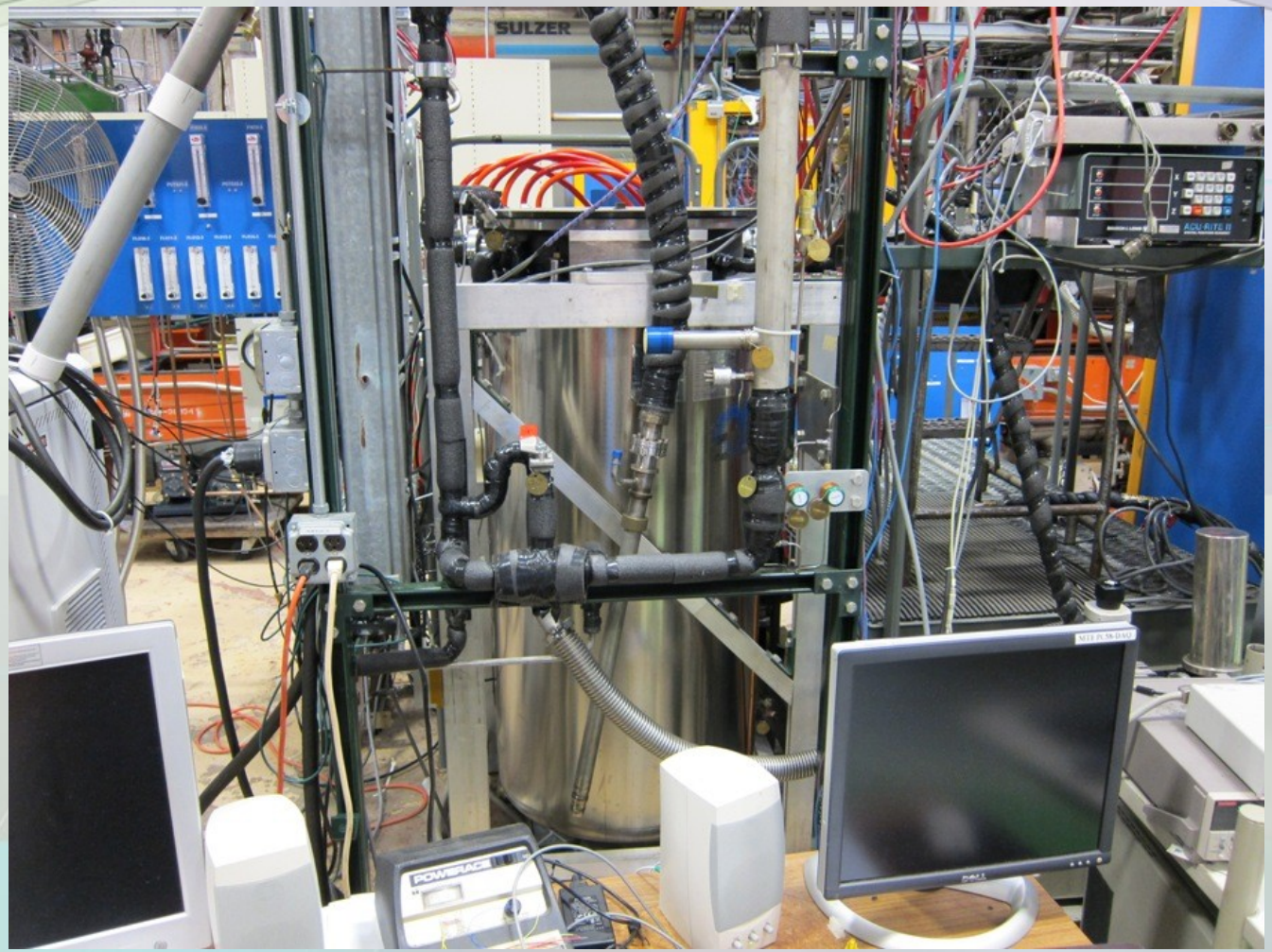
Manufactured Coils





Coils wound inside Al channel for better thermal conductivity. Both coil leads are heavily stabilized by extra copper to protect them from quenching and overheating. Each coil has a stainless steel heater.

MTF Stand 3 for Quadrupole Test



Stand 3 will be used for the initial quadrupole test and training in bath cooling mode.
It has 500 A current leads and the room temperature warm finger.
The field measurements will be done with a Hall probe.
The rotational coil measurement system could be added using some reasonable effort.

VMTF system is very busy with HFM, LARP, Mu2e, and MC magnet tests.

Next Steps and Schedule for FY2011

1. Finish quadrupole coils fabrication [March, 2011].
2. Assemble the yoke [Done].
3. Assemble the magnet [April 2011].
4. Test the magnet in a bath cooling mode using Stand 3. Make magnetic measurements by Hall probe [April-May, 2011].
5. Upgrade the Stand 3 for rotational coil measurements [FY2011, funds needed].
6. Test the magnet in the Stand 3 with magnetic measurements [FY2011].

Quadrupole Summary

- The splittable cryogen free quadrupole will be fabricated in April 2011.
- MTF Stand 3 will be used for the first magnet test and training in April-May 2011.
- The Splittable Quadrupole effort was used for NML Splittable Quadrupole design (drawings released).
- The Splittable Quadrupole technology may be implemented in Project-X superconducting magnets.