Rapid-Cycling Magnet Prototyping

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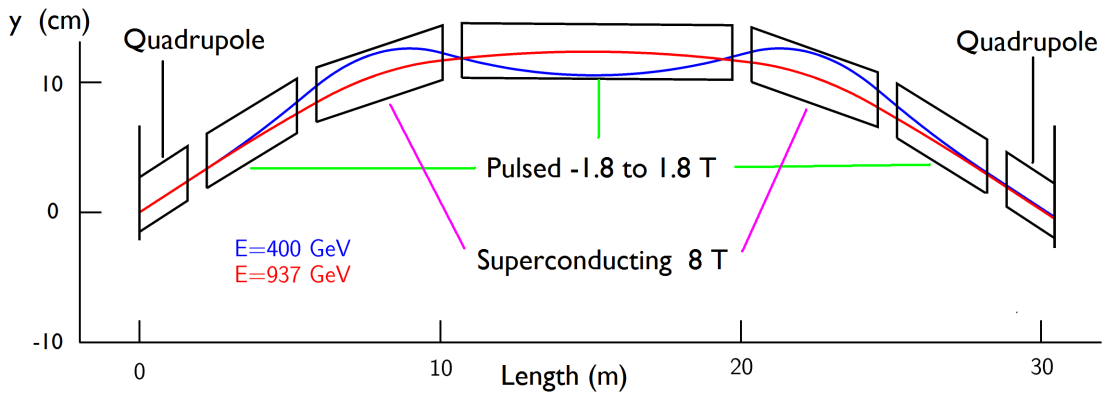
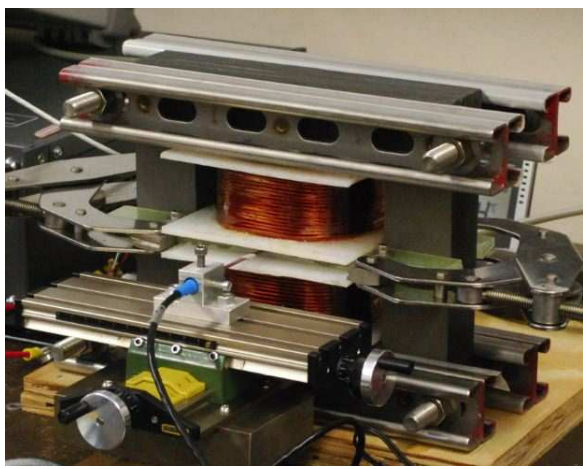
Muon Accelerator Program

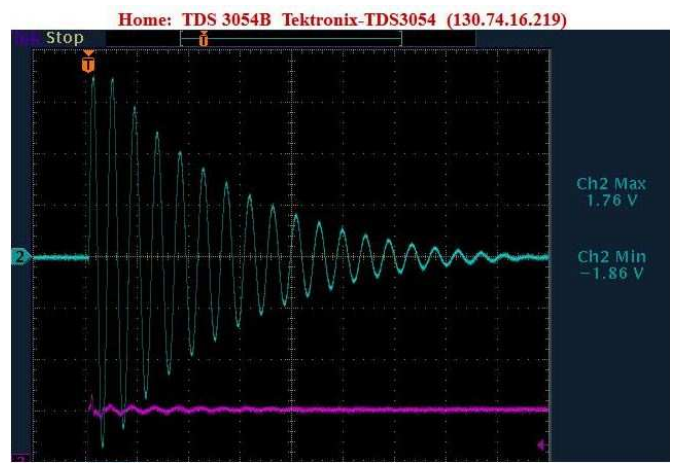
Past: Muon Synchrotron Acceleration Dipoles

- **Interleave fixed 8T & pulsed ± 1.8T dipoles. Berg & Garren, Summers et al., arXiv:0707.0302. "Lattice" MAP-4335 (2012)**



- **1.8T @ 1410 Hz achieved, but field quality only 1:1000 Summers et al., arXiv:1207.6730**





Latest work: BH measurement of ultra low carbon steel

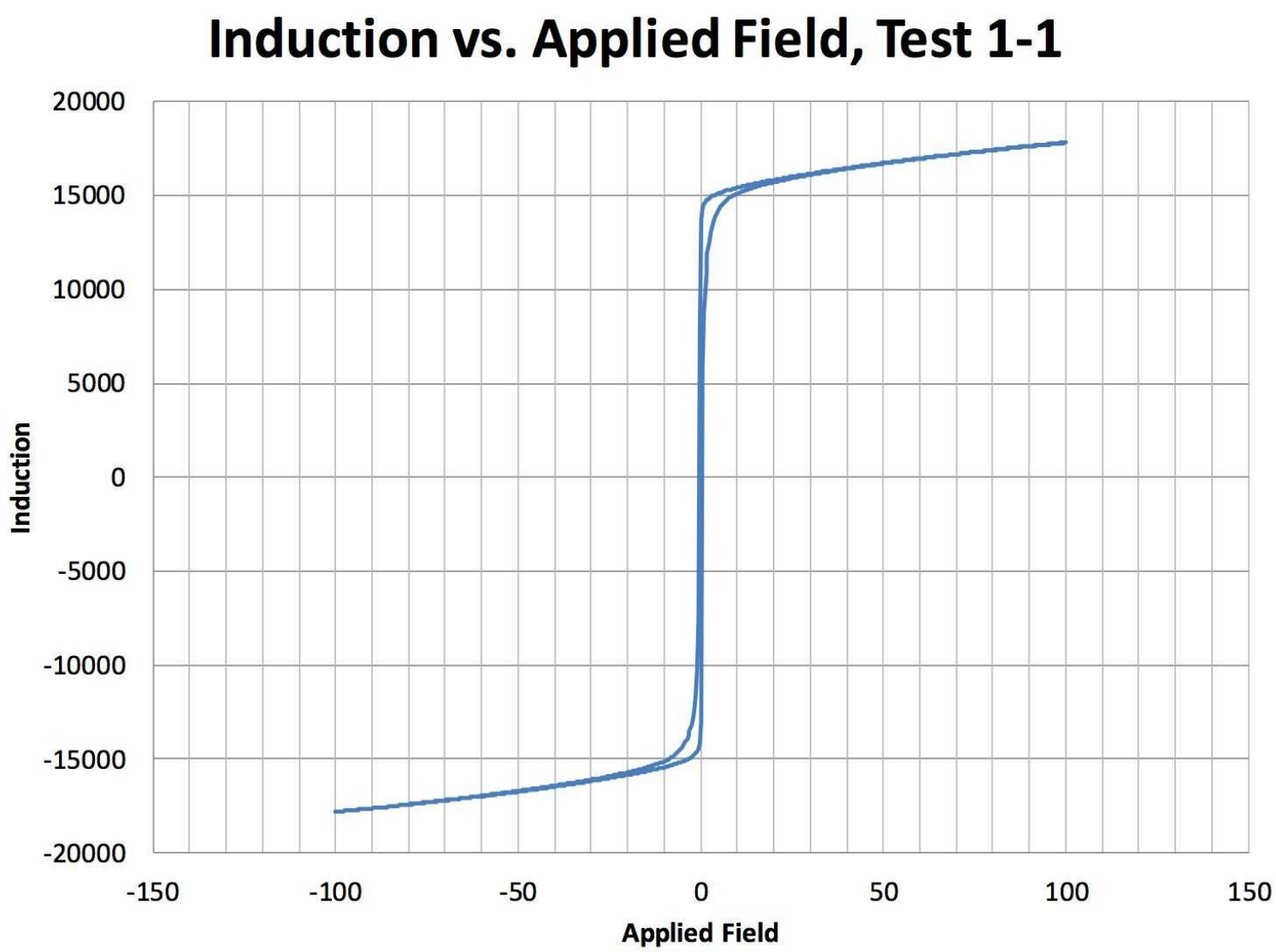
- Strips of CMI-B ultra low carbon steel (similar to LEP steel)
  Measured with Epstein frame and Hysteresigraph 5500

Induction Oersteds	B field Gauss	Permeability μ
1.3	14700	11300
4.0	15018	3750
10.3	15405	1500
50.3	16712	332
100	17801	178

- CMI-B steel has excellent permeability at 15000 gauss
  CMI-B steel has reasonable permeability at 17800 gauss

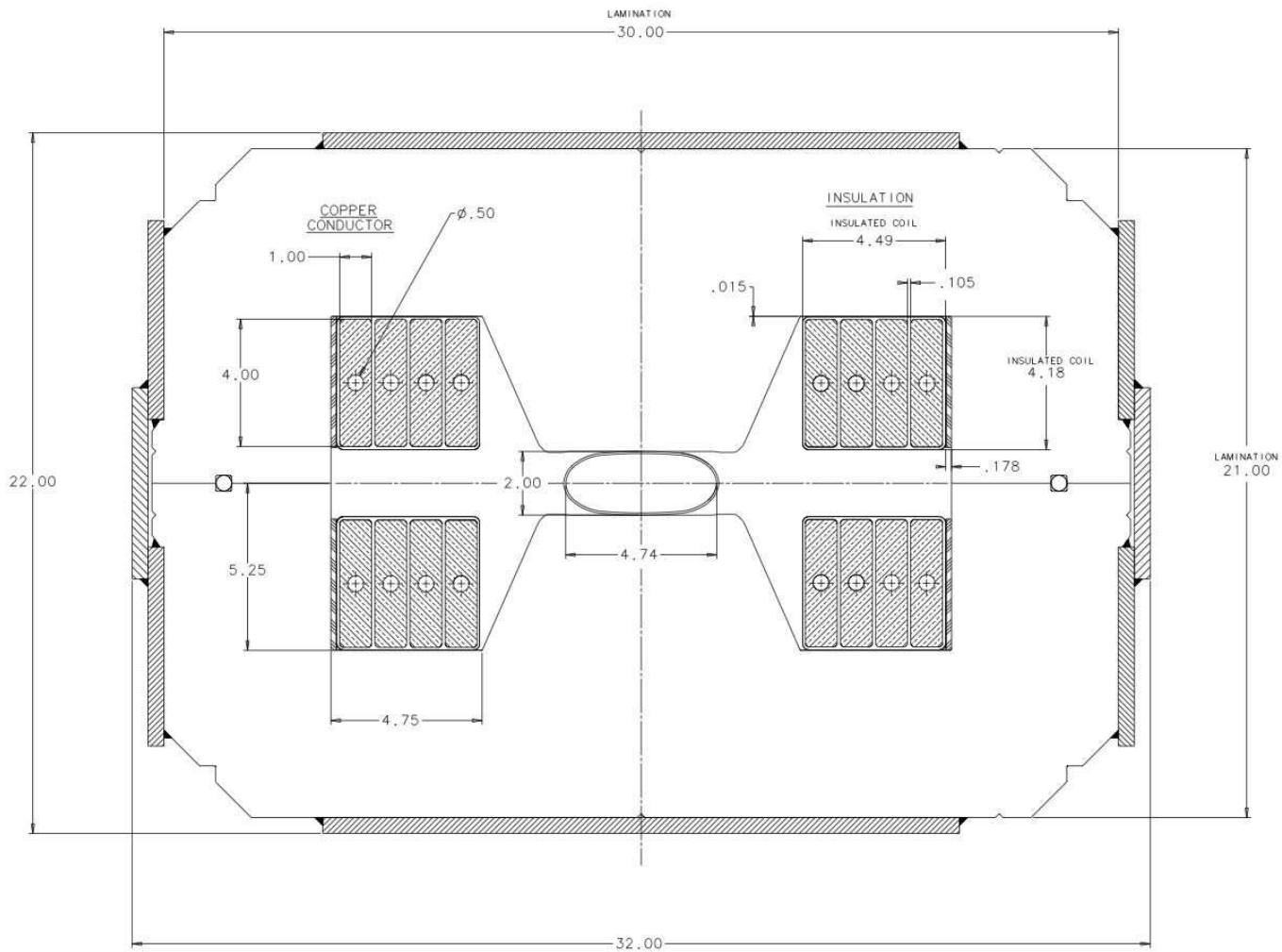
Latest Work: BH plot of ultra low carbon steel

- **Oersted versus Gauss plot.**



Lamination shape

- **Follow the design of Fermilab main injector dipoles**
  Use a tapered pole to lower B and raise permeability quickly.
  Minimize the energy, $B^2/2\mu$, in the flux return yoke



Power supply ready to go for ultra low carbon steel dipole

- **Power supply with fast 1200 volt, 600 amp IGBT switch.**