Magnet Design for the Target System of a Muon Collider/Neutrino Factory

(THPRI087, IPAC14, June 19, 2014)

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Possible Muon collider/Neutrino Factory Complex

- Graphite target ($\rho \sim 1.8$ g/cm$^3$), radiation cooled.
- Target inside high-field solenoid magnet (20 T) that collects both $\mu^\pm$.
- Target and proton beam tilted with respect to magnetic axis.
- Superconducting magnet coils shielded by He-gas-cooled W beads.
- Proton beam dump via a graphite rod just downstream of the target.

Front End

- Target
- Taper
- Decay Channel
- Buncher
- Rotator
- Cooler

Proton beam tube
15-T superconducting coil outsert, Stored energy $\sim 3$ GJ, $\sim 100$ tons
Last Final-Focus quad
Upstream proton beam window
5-T copper-coil insert. Water-cooled, MgO insulated
He-gas cooled W-bead shielding ($\sim 100$ tons/module)

Chicane

The Front End solenoid magnets also capture high-energy protons.
A sequence of tilted coils forms a bent-solenoid Chicane to deflect these protons out of the muon beam.
A proton absorber ($\sim 10$ cm Be) removes remaining soft protons after the Chicane.

Field Map
0 $< r < 4$ m
-5 $< z < 11$ m
($z = 0$ at center of target)