Target Solenoid Issues

Neutrino Factory Feasibility Study II

Video Conference

9 October 2000

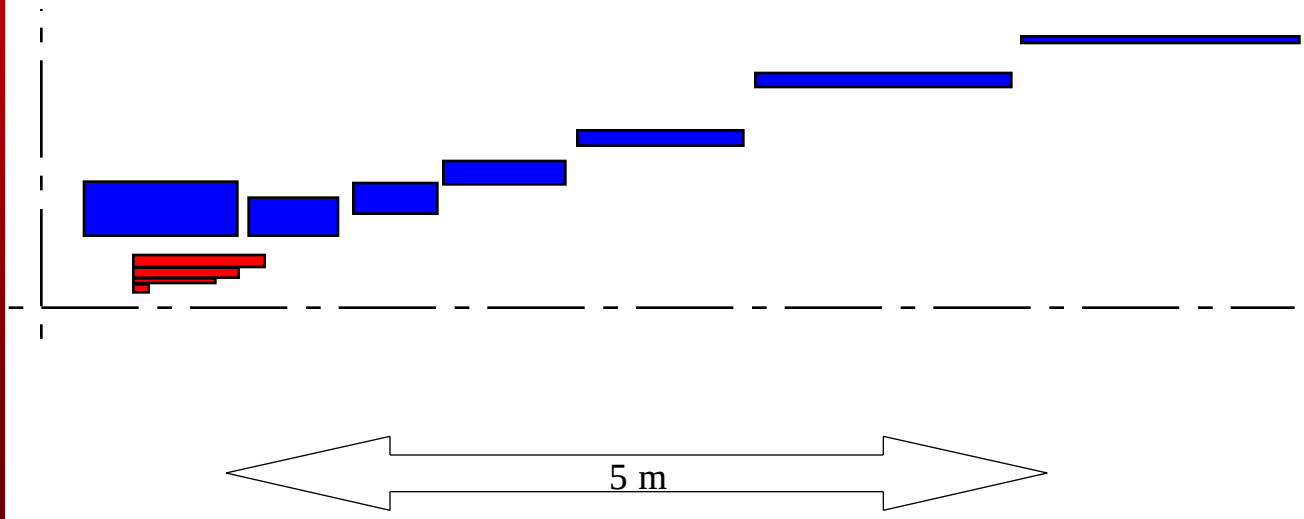
Target Solenoid System

- High fields (20 T combined)
- High radiation environment
  - heating
  - damage
- Remote maintenance requirement

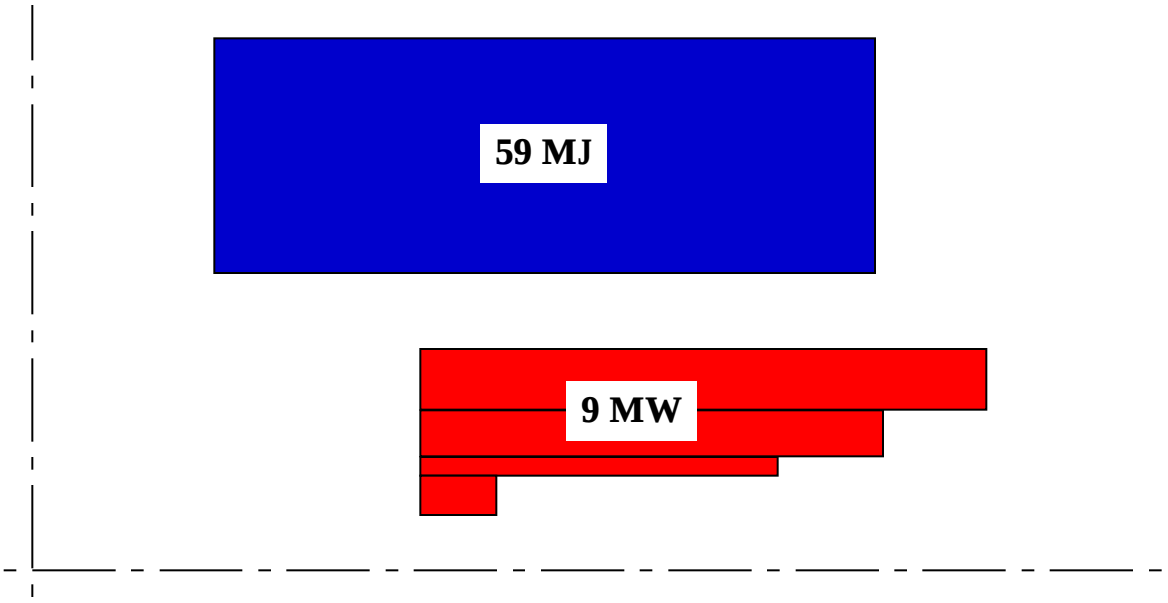
Traditional Options

- Bitter-plate technology chosen for Study I
  - high J
  - short-lived but low-cost & easily replaceable
  - co-mingled conductor, insulation, & water
- Hollow-copper technology proposed for Study II
  - low J
  - long-lived but higher cost & difficult to replace
  - insulation separated from cooling water

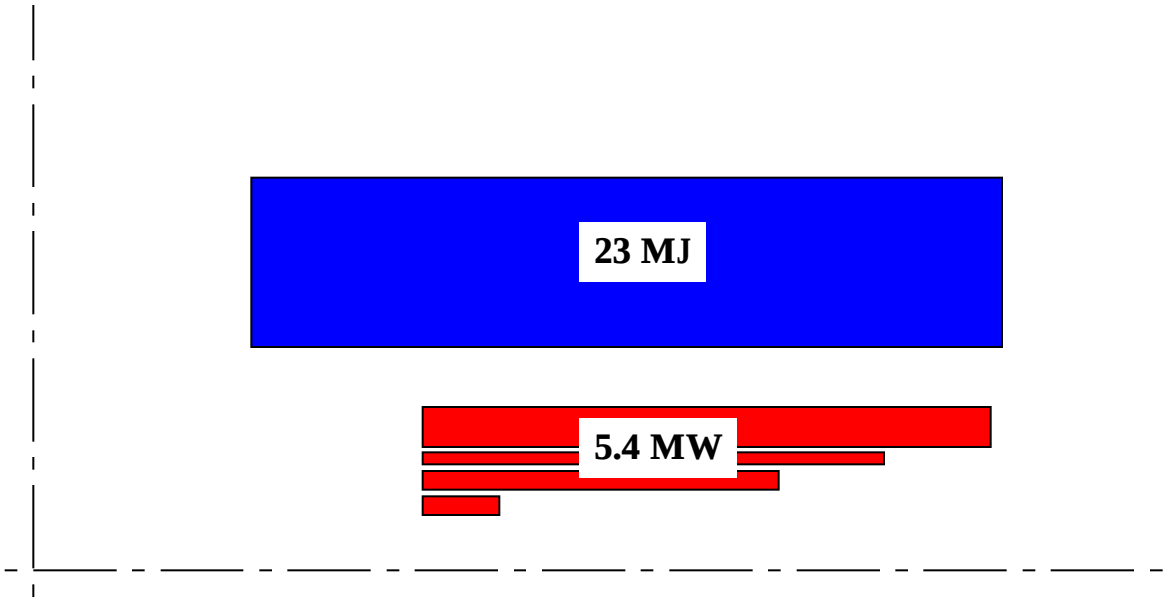
Study-II Target and Decay-Channel Solenoid System



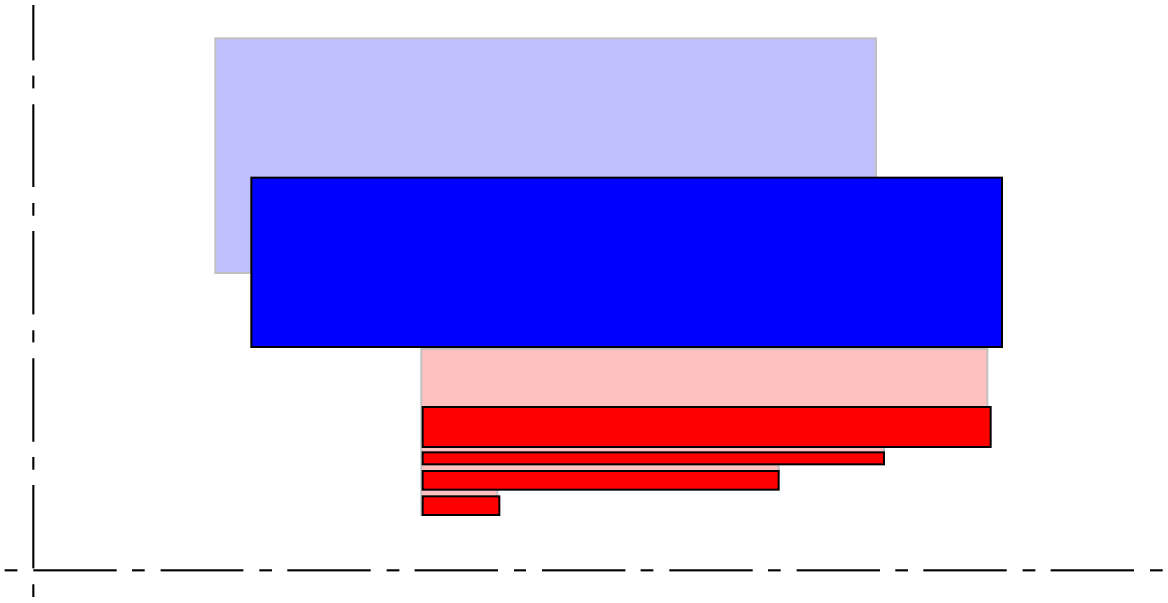
Baseline Hollow-Copper Option



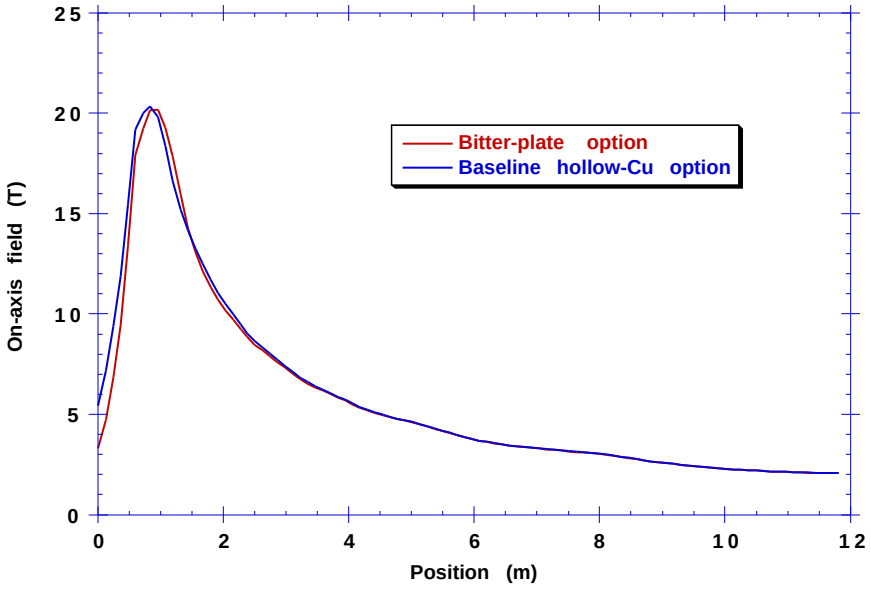
Alternative Bitter-Plate Option



Options Overlaid



Field on-axis, two options

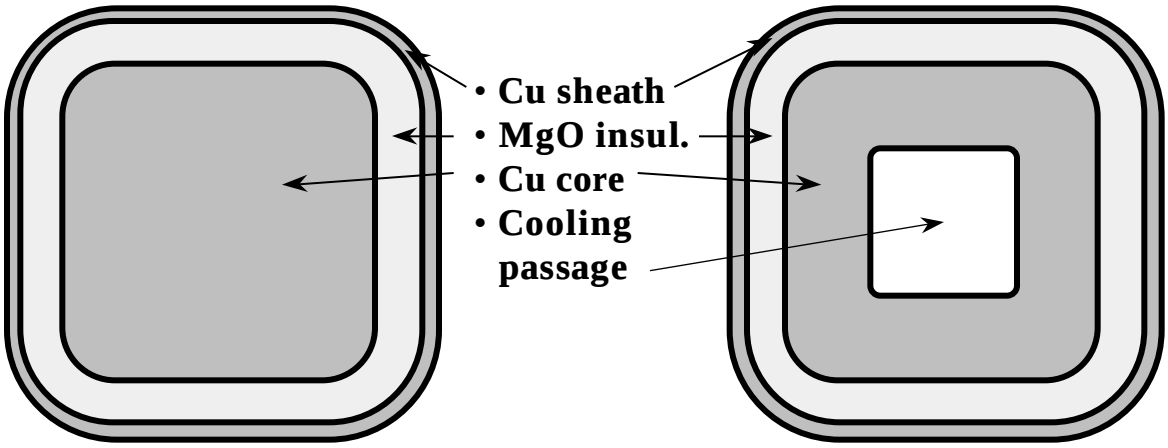


The D-Coil Pair, ORNL ca. 1966

- 3-in-hand, double-pancake winding
- 8-T field on axis
- 10 MW
- $J_{pack} \approx 20$ A/mm^2

Note supply and return headers and connections

The Mineral-Insulated Conductor (MIC) options



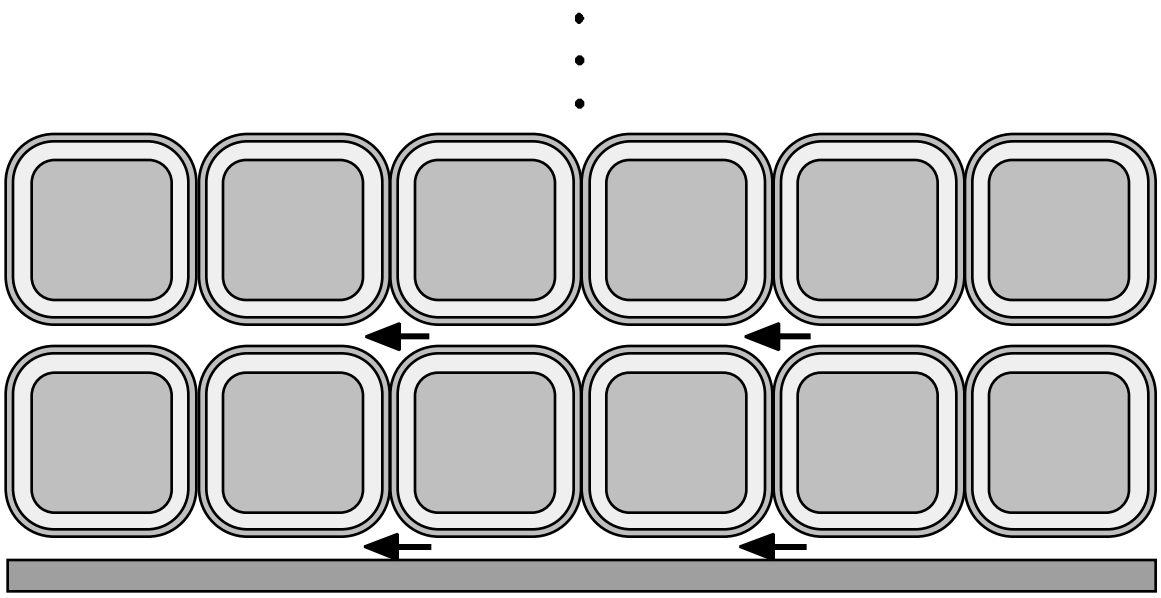
Solid Core **Hollow Core**

From "Development of Radiation-Resistant Magnets for the JHF Project," K.R. Tanaka et al., presented at MT-16 (preprint provided by Bob Weggel). However, general concept dates back at least to Art Harvey, LLNL and Jim Luton, ORNL, early 1970s.

Limitations

- Conductor length
  - Present lengths in the 30 – 60-m range
- Operating voltage
  - Uncertain, limited by termination design
- Practical winding-pack current density
  - approx. 10 A/mm^2 or less for HC-MIC
  - maybe 60 A/mm^2 or higher for SC-MIC

Solid-core MIC, layer wound, with cross-flow cooling



Proposed approach

- Optimize two options for comparison
- Identify critical issues for each
- Define essential R&D