PARTICLE PRODUCTION OF A GRAPHITE TARGET SYSTEM FOR THE INTENSITY FRONTIER

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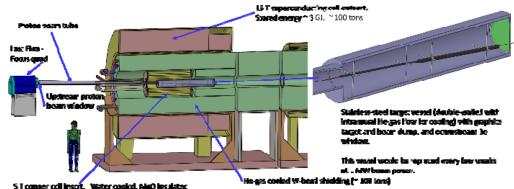
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The target system for a Muon Collider or Neutrino Factory is designed to produce ~ 10^{14} μ/s (both μ+ and μ-) via decay of pions from 1-4 MW of 6.75-GeV protons.

The system is inside a 15-20-T solenoid magnet whose field tapers down to 2 T over 5 m.

The superconducting magnet coils must be protected from radiation damage by massive shielding: W beads cooled by He gas.

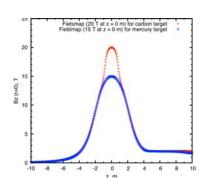## Carbon Target Optimization in a Peak Field of 20 T, using the MARS15(2014) Code
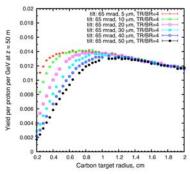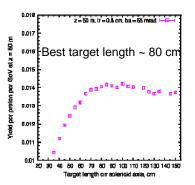
Target length = 80 cm

Beam radius = ¼ target radius

Target rod radius = 0.8 cm

Beam/target tilt = 65-mrad to the solenoid axis

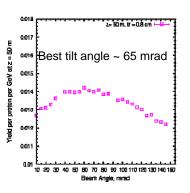Particle production decreases slowly with increasing beam transverse emittances from 5 to 50 mm-mrad.

The beam dump must be inside the target system.

The beam dump for the graphite target can consist of 2 additional graphite rods, with radii of 2.4 cm.

This beam dump intercepts about two-thirds of the unscattered proton beam while causing only 8% decrease in the yield.

Mercury Target Optimization in a Peak Field of 15 T

In a possible upgrade to 2-4 MW beam power it may be favorable to use a liquid metal target, such as mercury.

A flowing mercury jet target is not mechanically compatible with the 5-T insert, so a peak field of only 15 T is considered.

Target radius = 0.5 cm

Beam angle = 65 mrad

Beam radius = 0.3 target radius

Beam/Hg jet crossing angle = 24 mrad

The beam dump is a pool of mercury

The mercury target has about 10% more yield than the carbon target.