ENERGY DEPOSITION IN MAGNETS AND SHIELDING OF THE TARGET SYSTEM OF A STAGED NEUTRINO FACTORY

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The Challenge

10% of the energy of the proton beam that drives a **Neutrino Factory** is transported into the muon-capture solenoid channel, mostly via scattered beam protons and protons from target-nucleus breakup. A **chicane** in the $\pi \rightarrow \mu$ Decay Channel removes higher-energy protons from the beam and a Be absorber removes lower-energy ones. But, the superconducting coils of the chicane must be protected against radiation damage by the deflected protons by an internal shield of He-gas-cooled tungsten beads. The radiation level must be reduced to the "ITER Limit" of 0.1 mW/g for a 10-year operational lifetime.
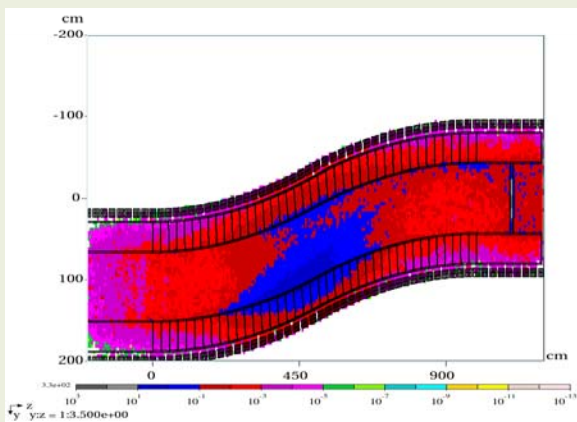
We present MARS15(2012) simulations of shielding scenarios to achieve this goal.
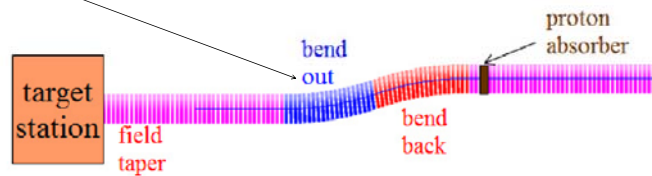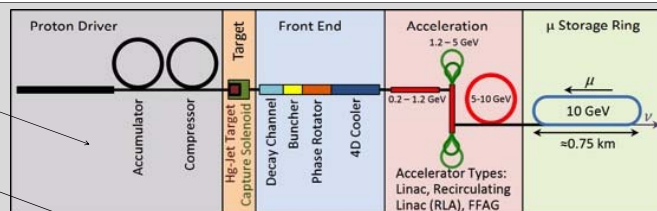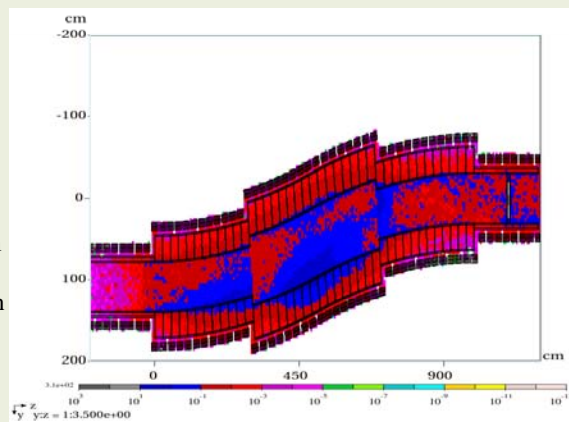

Shielding Scenarios

The nominally circular muon beam of 30 cm radius becomes elliptical with 42 cm vertical radius at the center of the chicane due to "curvature drift."
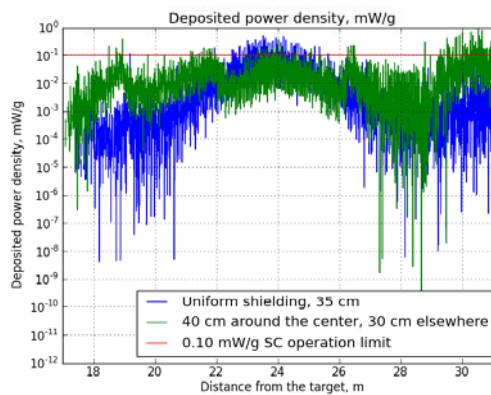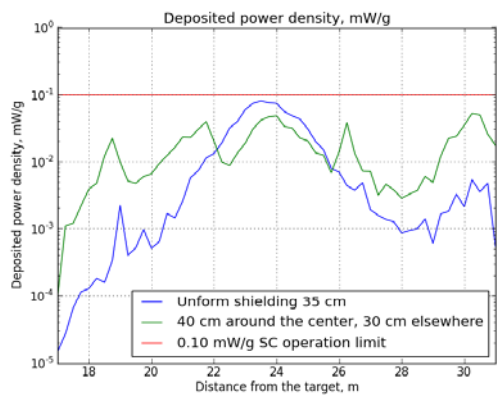
Scenario 1:
42 cm radius beampipe + 35 cm shielding

Scenario 2:
30 cm radius beampipe + 30 cm shielding outside chicane; 42 cm beampipe + 40 cm shielding in chicane.

Results of MARS15 Simulations: These scenarios come close to providing sufficient shielding everywhere.

Future Studies:

Consider elliptical beampipe inside circular coils, which would add thickness to the shielding where most needed near the center of the chicane.

Use MARS15 with MCNP data tables to model better the energy deposition by low-energy neutrons.