CARBON TARGET OPTIMIZATION FOR A MUON COLLIDER/ NEUTRINO FACTORY WITH A 6.75 GEV PROTON DRIVER

(THPRI089, IPAC14, June 19, 2014)

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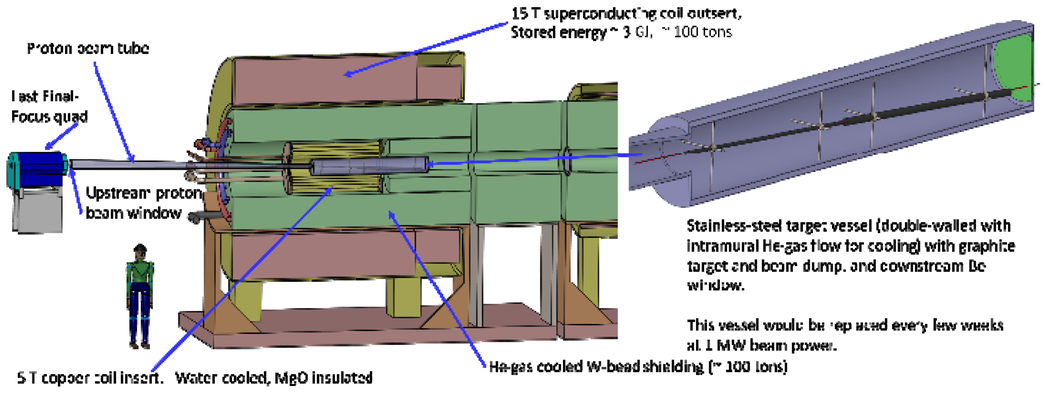
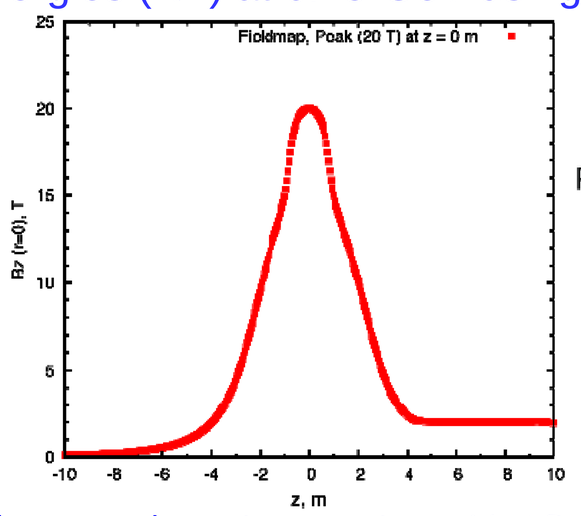
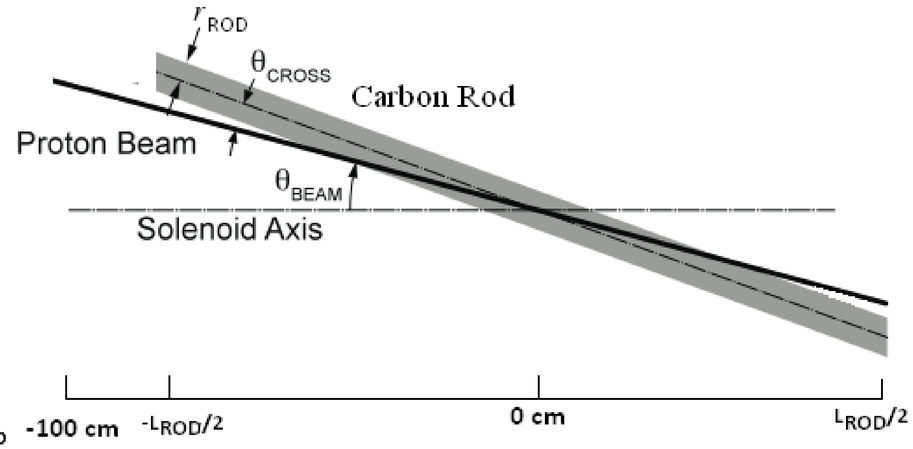
1. 20to2T5m target system configuration, field along the solenoid axis, and target geometry

The geometric parameters of a carbon target for a Muon Accelerator Staging Study were optimized to maximize particle production by an incident, parallel proton beam with kinetic energies (KE) at 6.75-GeV using the MARS15 (2014) code (denoted MARS15 below).

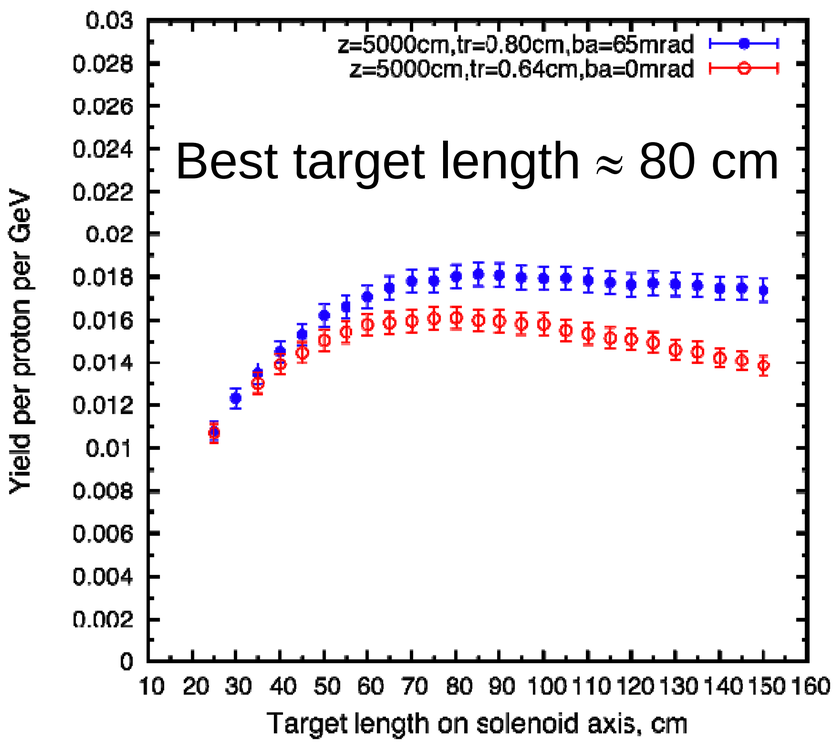


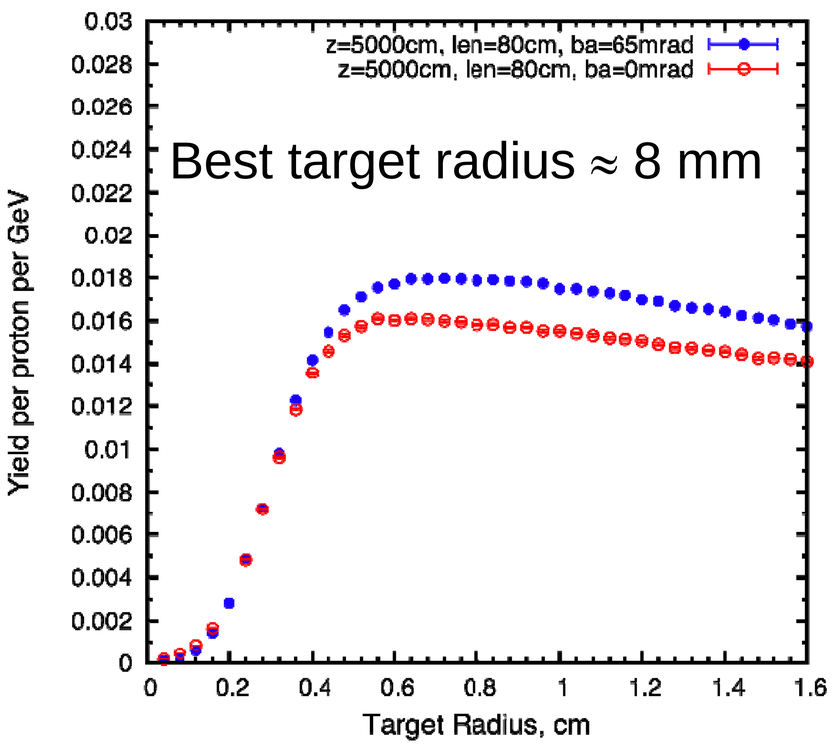


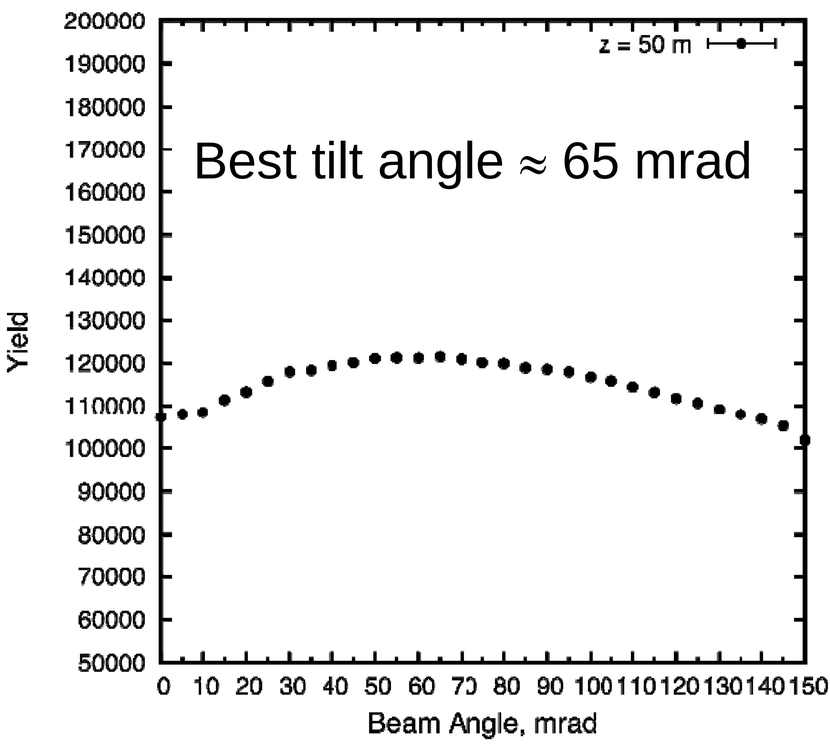


2. Optimized target parameters and particle production using MARS15 with event-generator-control default setting (ICEM 4=1)

The optimized parameters for the 20to2T5m target system when the beam radius was ¼ of the target radius and the target and beam were tilted by the same, 65-mrad angle with respect to the solenoid axis, were target length of 80 cm, target rod radius of 0.8 cm. For 6.75-GeV (KE) beam, about 13% advantage in yield to tilting the carbon target/proton beam over no tilt.

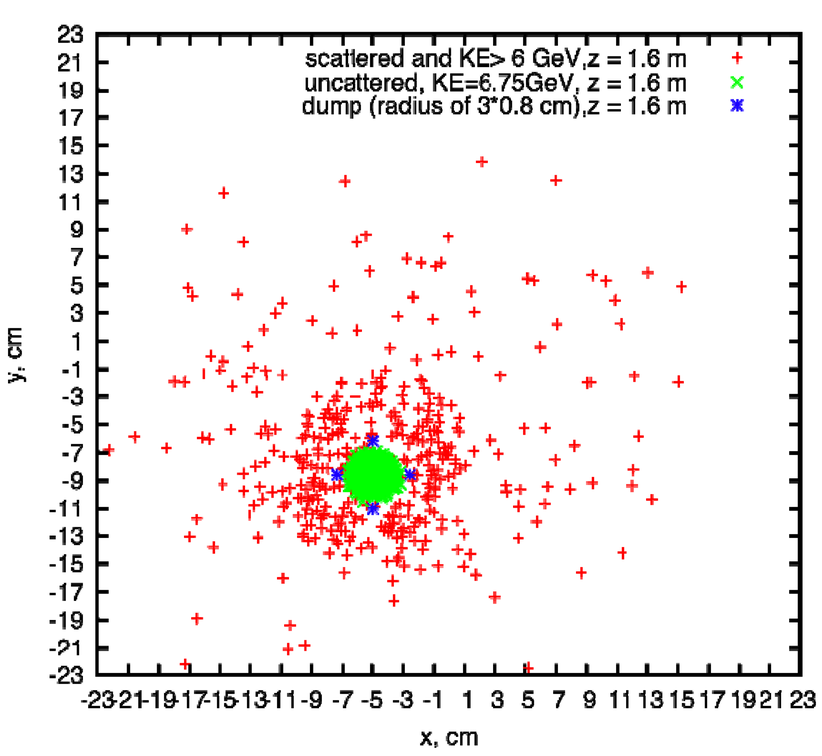




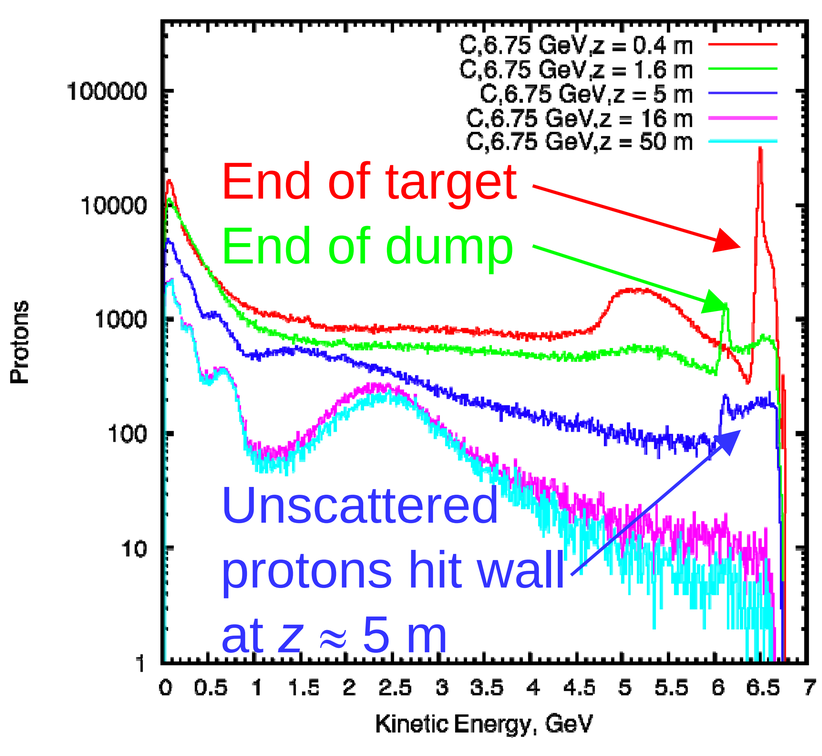


3. Beam dump study for 20to2T5m target system (with 65 mrad tilt of beam)

A graphite proton beam dump, 120-cm long, 24-mm radius, can intercept most of the (diverging) unscattered proton beam.



High-energy protons at the end of the beam dump.



Remaining protons at 5 positions along the beamline, when using a graphite beam dump.

L_{dump} (cm)	R_{dump}/R_{target}	Total KE (protons) (r<23 cm) [Watts]	Total KE (non-protons) [Watts]	Protons KE>6 (×9.26 ×10^{10})	Yield at z=50m (×9.26× 10^{10})
0	0	88359	105454	301	1241
40	1	85504	105007	270	1268
80	1	88318	102577	318	1256
120	1	85932	100030	299	1230
40	2	77262	101664	207	1246
80	2	75493	97715	206	1196
120	2	78364	96967	204	1171
40	3	72615	101494	176	1085
80	3	64610	97569	112	1142
120	3	66430	94936	130	1135