OPTIMIZATION OF PARTICLE PRODUCTION FOR A STAGED NEUTRINO FACTORY

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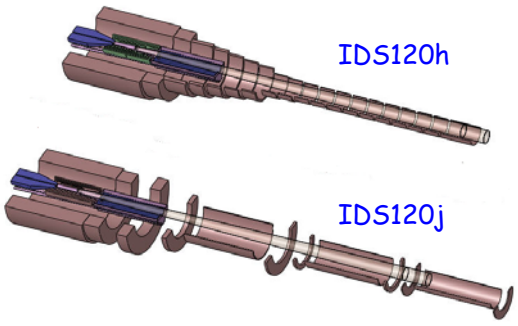
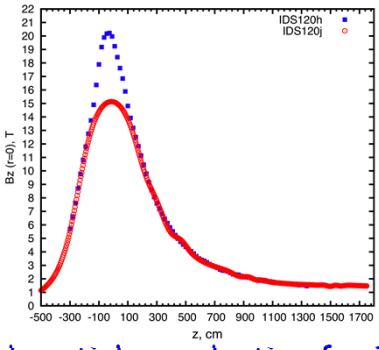
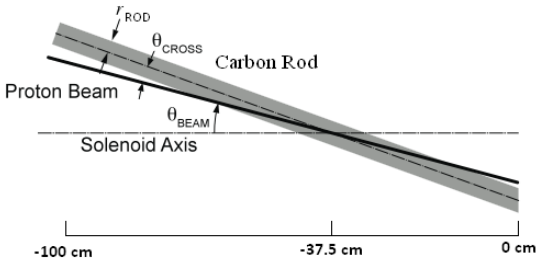
1. IDS120h and IDS120j target system, field along the solenoid axis and target geometry

The geometric parameters of a carbon target for a Staged Neutrino Factory were optimized to maximize particle production by an incident, parallel proton beam with kinetic energies (KE) at 3-GeV using the MARS15 (2012) code (denoted MARS15 below).

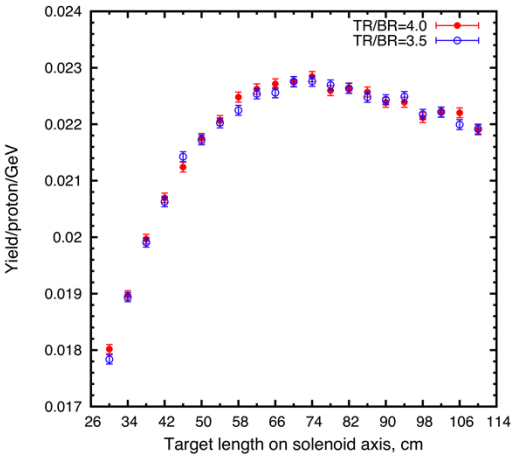


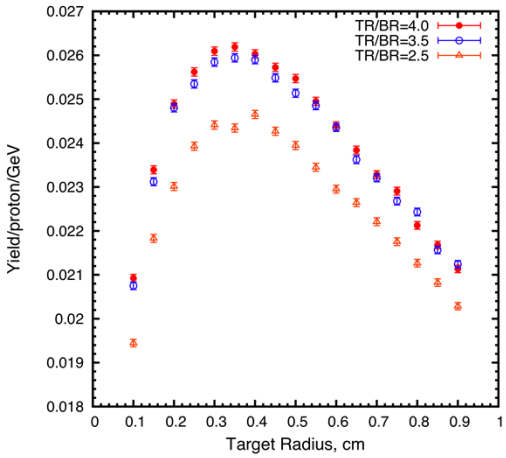


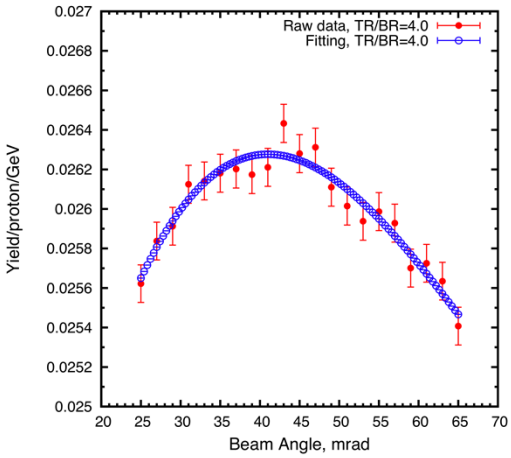


2. Optimized target parameters and particle production for IDS120h with MARS15 default mode

The optimized parameters for the IDS120h target system when the beam radius was ¼ of the target radius and the target and beam were tilted by the same angle with respect to the solenoid axis, were a target length of 72 cm, a target rod radius of 0.346 cm, and an incoming proton beam angle equal to 42 mrad. The optimized production is 0.0262 / proton / GeV.







3. Particle production and energy spectra for IDS120j configuration from 10^5 protons

We run both the MARS15 and FLUKA for the IDS120j target system. We used four MARS15 modes.

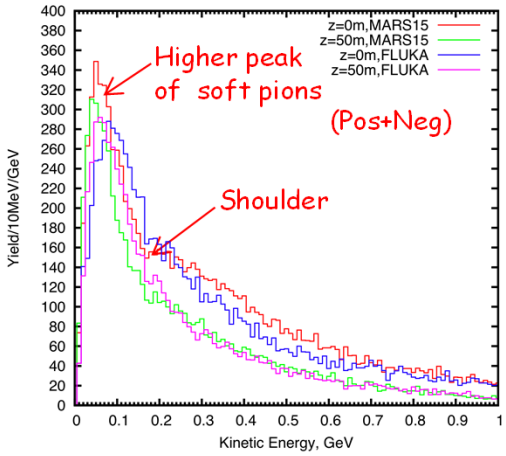
Mode 1: MARS15 default mode (without either LAQGSM or the MCNP tables); Mode 2: MARS15 with MCNPDATA;

Mode 3: MARS15 in LAQGSM mode; Mode 4: MARS15 in LAQGSM mode with MCNPDATA.

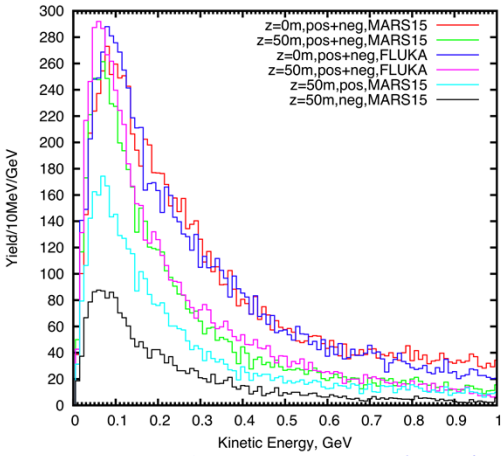
A strange shape with both a peak and shoulder of soft pions at z = 0 m for the MARS15 default mode is observed. However, this was not present when MARS15 was used in LAQGSM mode, in which the results were more comparable with those from FLUKA. In addition, production of negative pions is only half that for positive in the energy range useful for a Neutrino Factory.

Running	Yield/proton/GeV z = 0 m	Yield/proton/GeV z = 50 m
MARS15 Mode 1	0.0341	0.0261
MARS15 Mode 2	0.0335	0.0254
MARS15 Mode 3	0.0299	0.0279
MARS15 Mode 4	0.0296	0.0273
FLUKA	0.0334	0.0298

All positive and negative pions and muons



MARS15 default mode & FLUKA



MARS15 in LAQGSM mode with MCNPDATA & FLUKA