



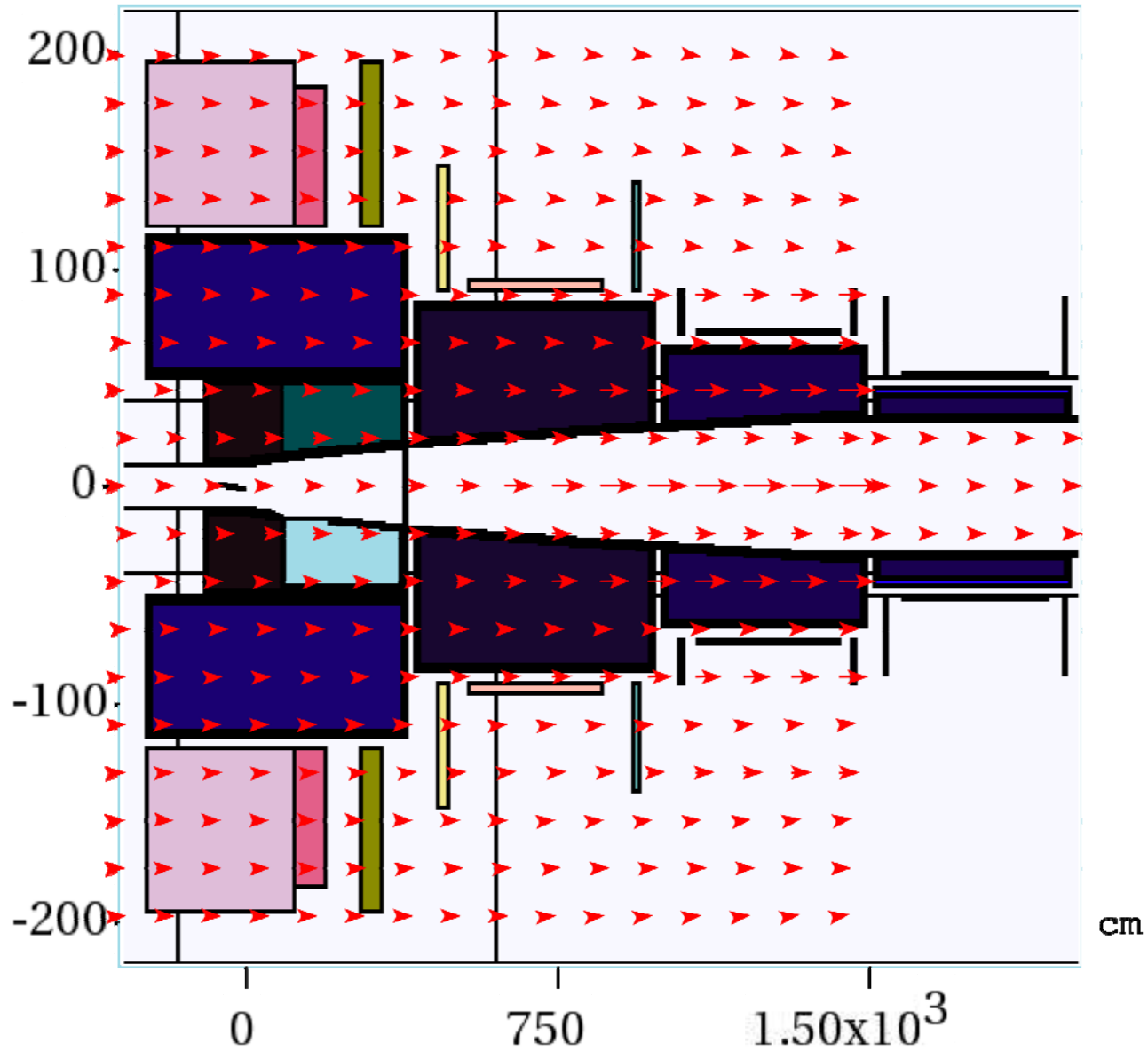
Particle Production with Carbon Target and IDS120j Configuration at 3 GeV (update)

X. Ding, UCLA

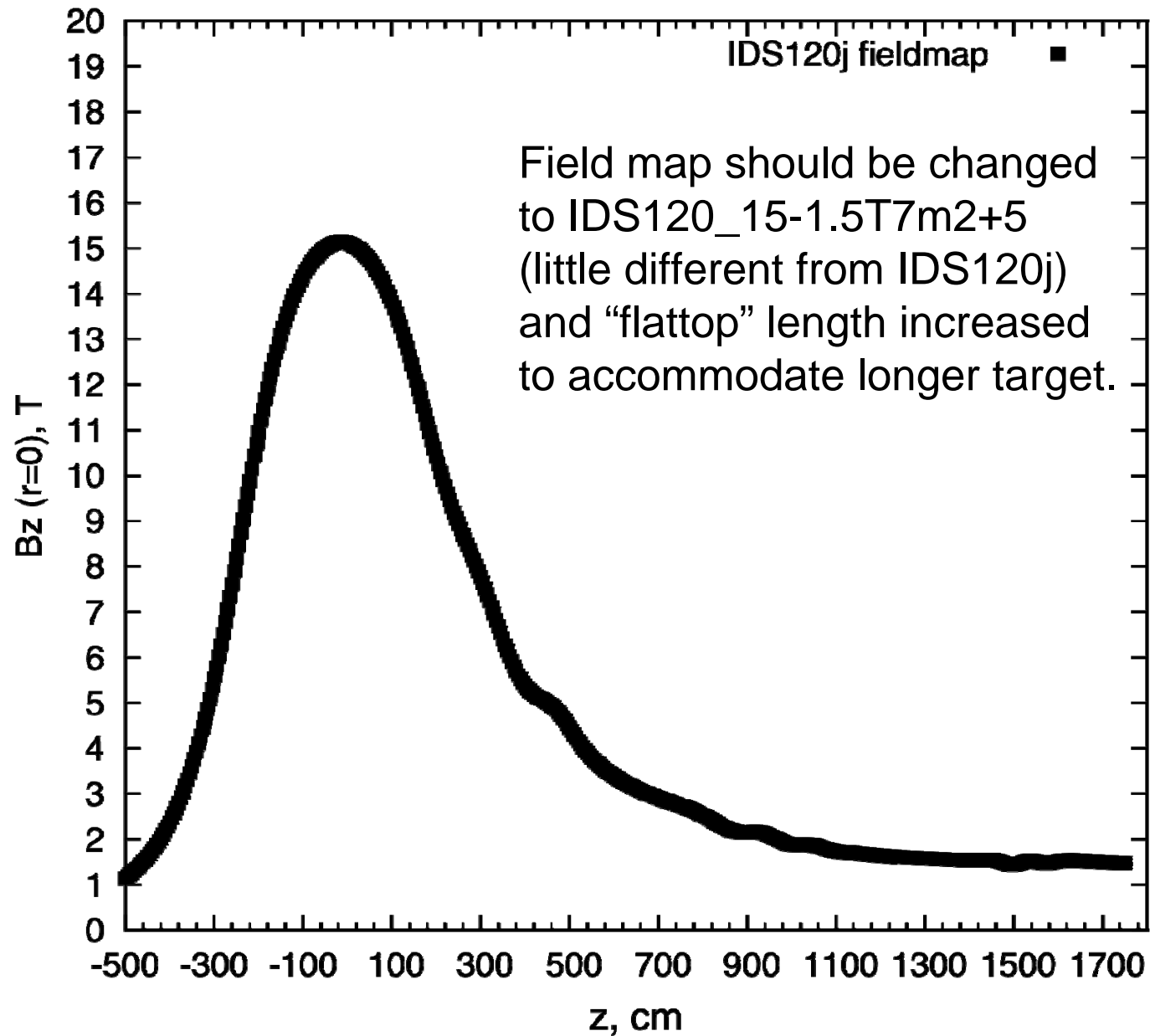
Target Studies
Nov. 14, 2013



IDS120j Geometry



Fieldmap



Target Station Setting

- IDS120j Configuration and Fieldmap (15T→1.5T);
- MARS15(2012) in LAQGSM mode (IQGSM=1);

Installation of New version of MARS15 is expected!

Dr. N. Mokhov is planning to upgrade MARS15 worldwide, with many new developments and features implemented. Among other things, the energy ranges controlled by IQGSM of the ICEM card will be changed.

- Proton beam: 3 GeV (KE) and launched at $z = -100$ cm;
- Carbon Target setting: with or without tilt angle to SC axis;
- Production Collection: (50 m downstream, $40 \text{ MeV} < \text{KE} < 180 \text{ MeV}$).

Incident Particle Energy and the threshold in matter for subsequent generated particles

- ENRG E0 EM EPSTAM EMCHR EMNEU EMIGA EMIEL

E0: The incident particle kinetic energy;

EM: The hadron threshold energy (Default:0.0145 GeV);

EPSTAM: The star production threshold kinetic energy (Default:0.03 GeV);

EMCHR: The threshold energy applied collectively to muons, heavy ions and charged hadrons (Default: 0.001 GeV);

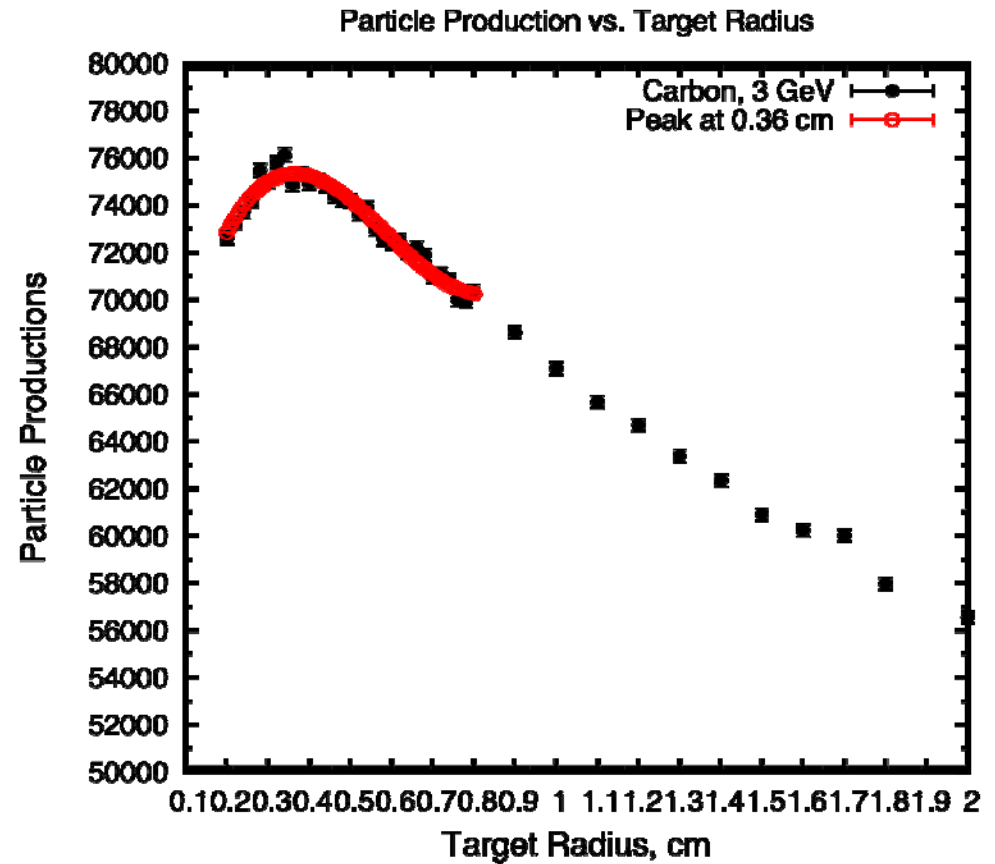
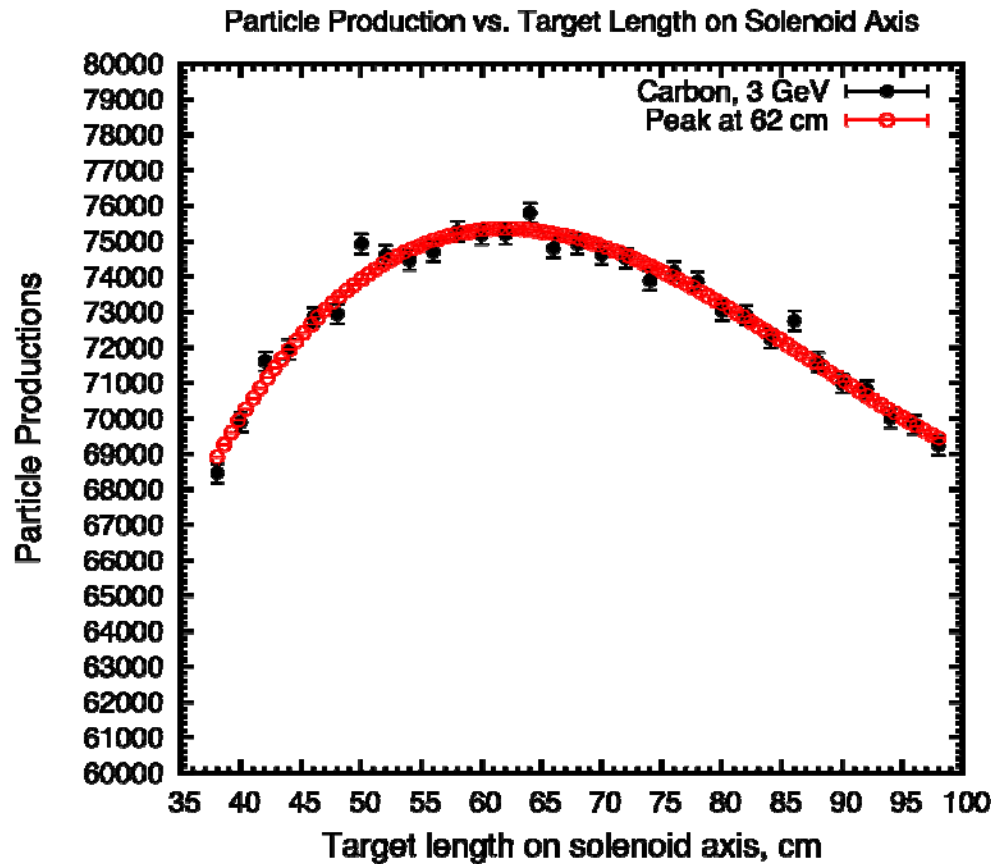
EMNEU: The threshold energy for neutrons (Default: 10^{-4} GeV)

EMIGA: The threshold energy for γ (Default: 10^{-4} GeV);

EMIEL: The threshold energy for e^{\pm} (Default: $5 \cdot 10^{-4}$ GeV)

**Use non-default setting: ENRG 1=3 2=0.02 3=0.3 4=0.01
5=0.05 6=0.01 7=0.01**

Carbon Target without Tilt Angle (10^6 events)



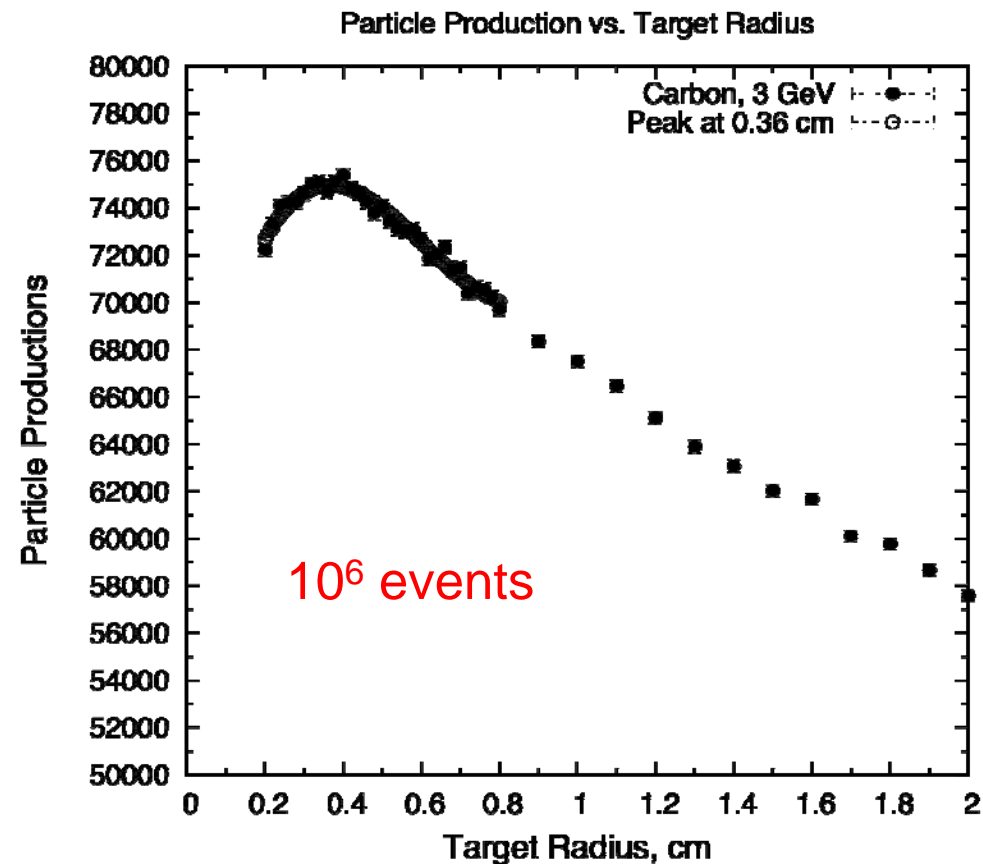
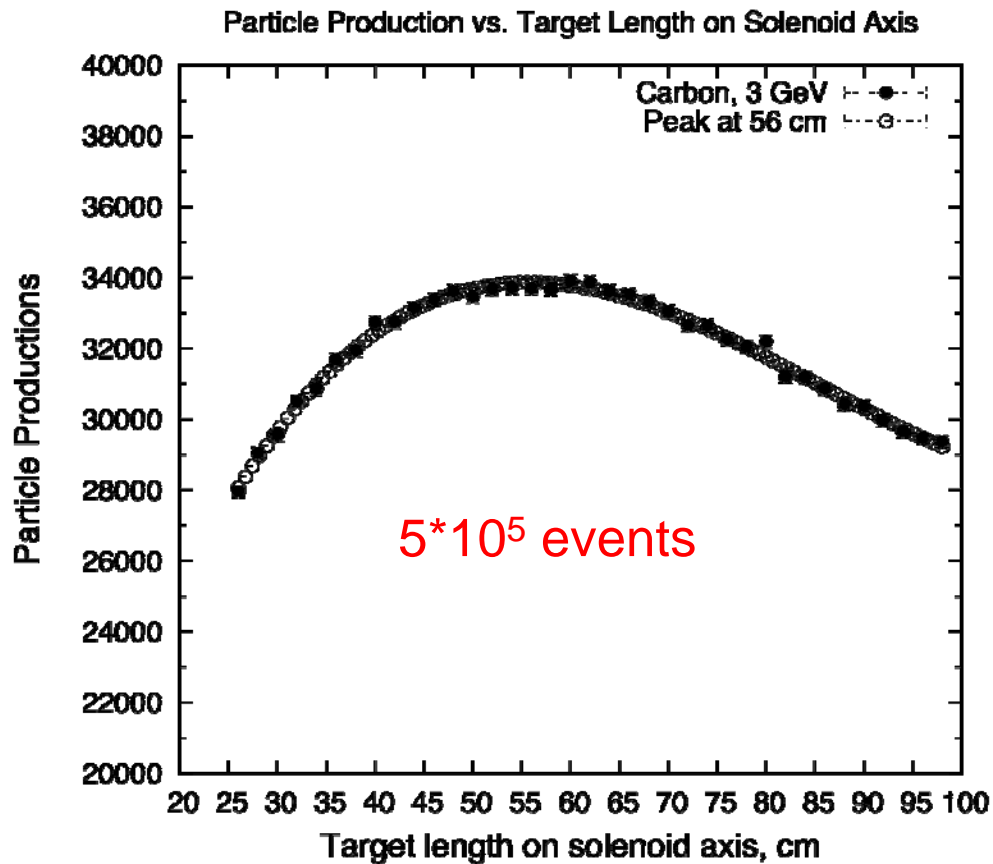
Use target radius/beam radius = 4.

Optimized target length is 62 cm for target radius fixed at 0.36 cm.

Optimized target radius is 0.36 cm for target length fixed at 62 cm.

Yield is 0.025 per proton and per GeV.

Carbon Target without Tilt Angle



Study with radii of target and beam in ratio 4:1.

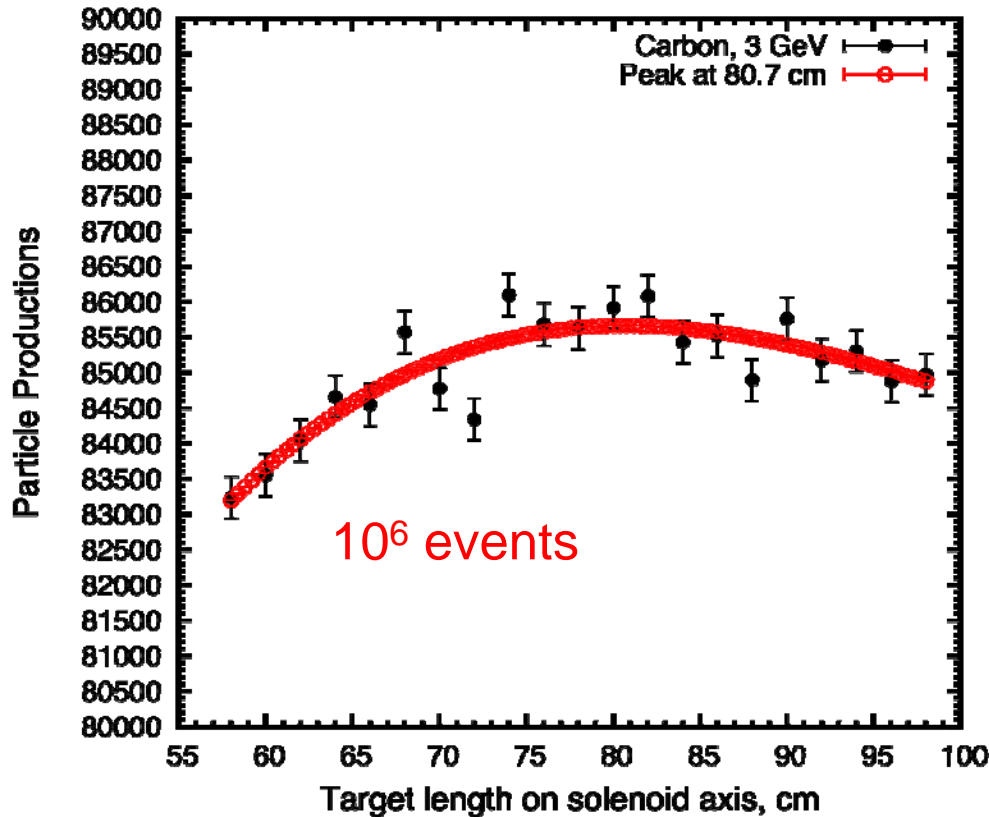
Optimized target length is 56 cm for target radius fixed at 1 cm.

Optimized target radius is 0.36 cm for target length fixed at 56 cm .

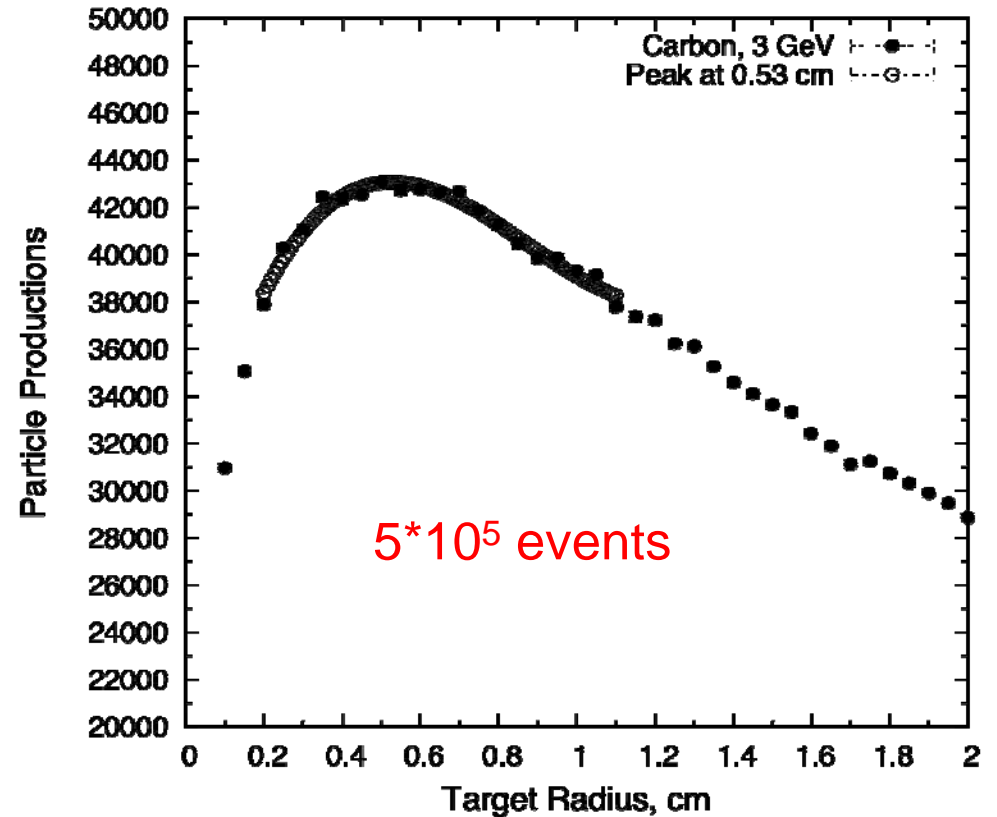
Yield is 0.025 per proton and per GeV for target radius at 0.36 cm and Yield is 0.0225 for target radius at 1 cm (10% less than case for target radius at 0.36 cm).

Carbon Target with Tilt Angle

Particle Production vs. Target Length on Solenoid Axis



Particle Production vs. Target Radius



Study with radii of target and beam in ratio 4:1.

Beam and target have same angle at $z = -37.5$ cm, value = 50 mrad.

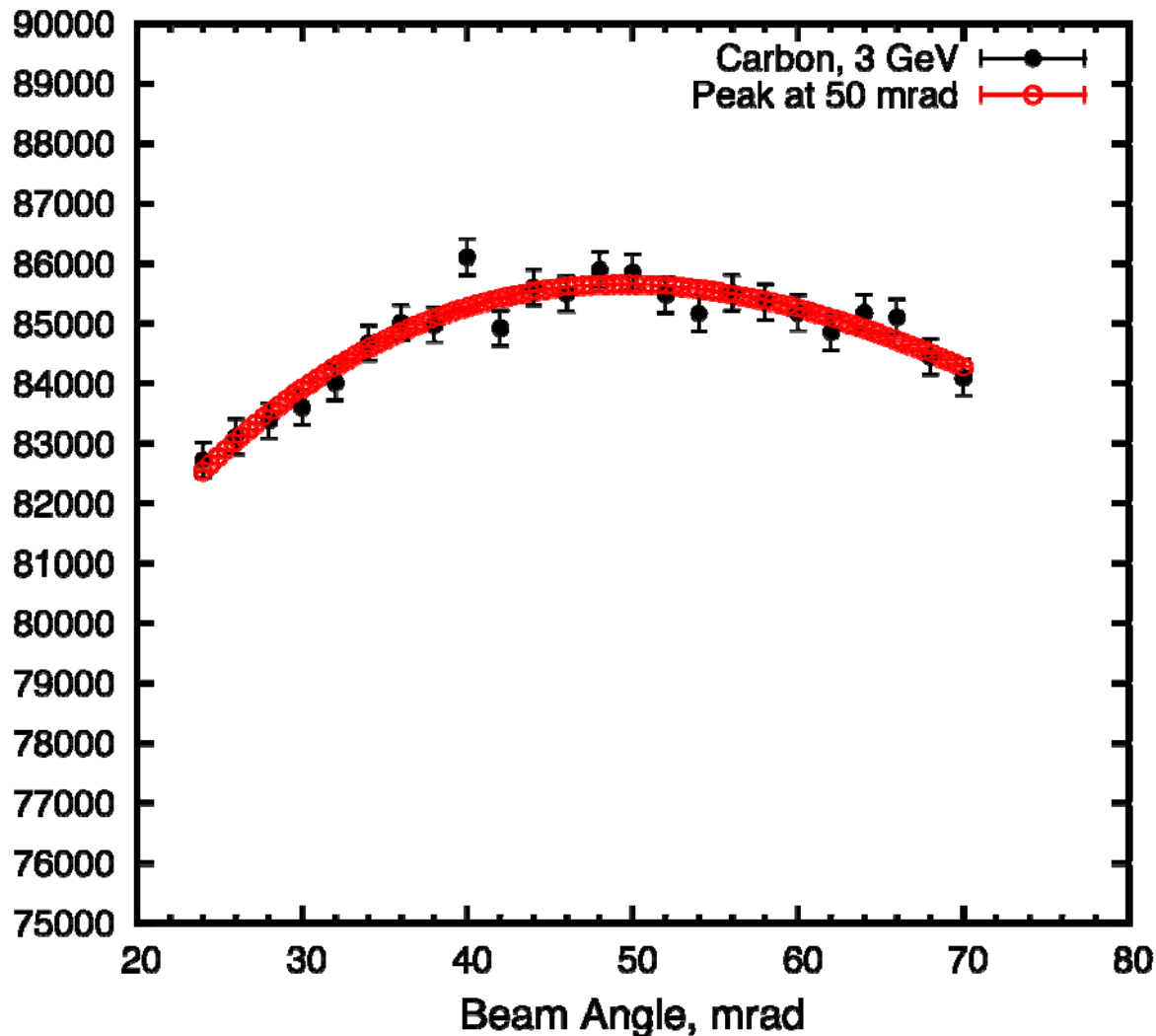
Optimized target length is 80.7 cm for target radius fixed at 0.5 cm.

Optimized target radius is 0.53 cm for target length fixed at 80.7 cm

Yield is 0.0287 per proton and per GeV. About 14% higher in particle production than the case without tilt angle.

Carbon Target with Tilt Angle (10^6 events)

Particle Production vs. Beam Angle (Rod Angle)



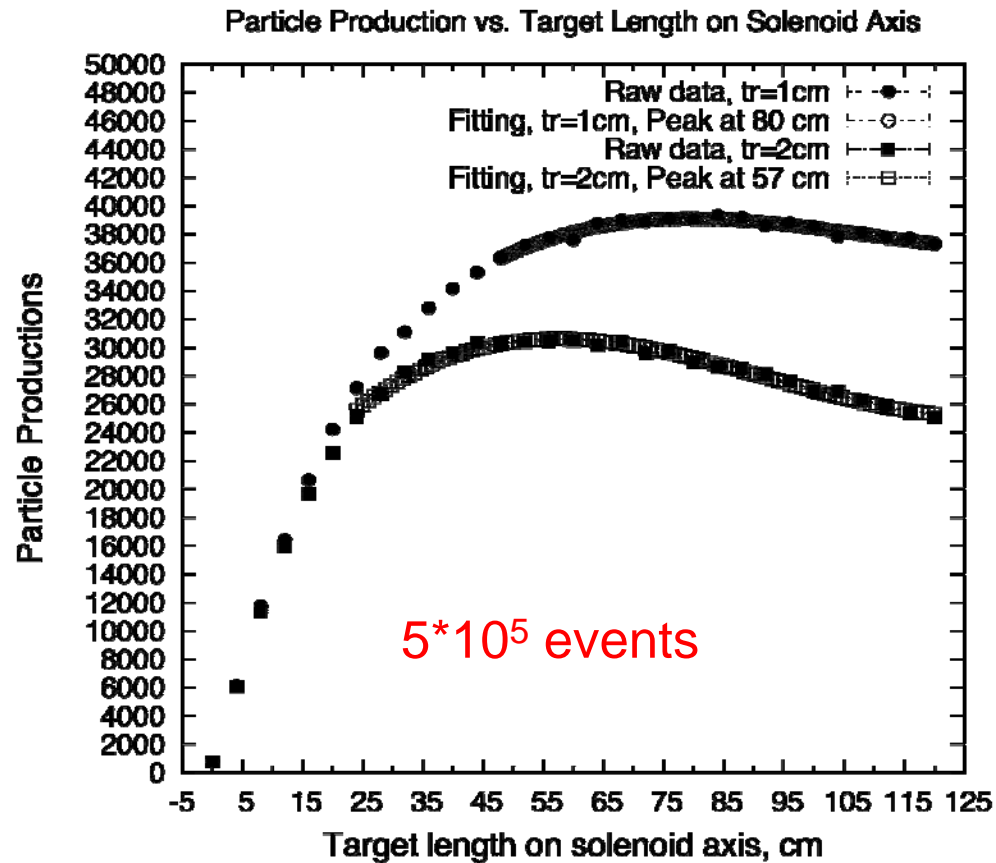
Study with radii of target and beam in ratio 4:1.
(Target radius is set to 0.5 cm.
Beam radius is set to 0.125 cm.)

Target length is set at 80.7 cm.

Beam and target have same angle at $z = -37.5$ cm.

Optimized beam/target angle is 50 mrad to SC axis.

Carbon Target with Tilt Angle



Study with radii of target and beam in ratio 4:1.

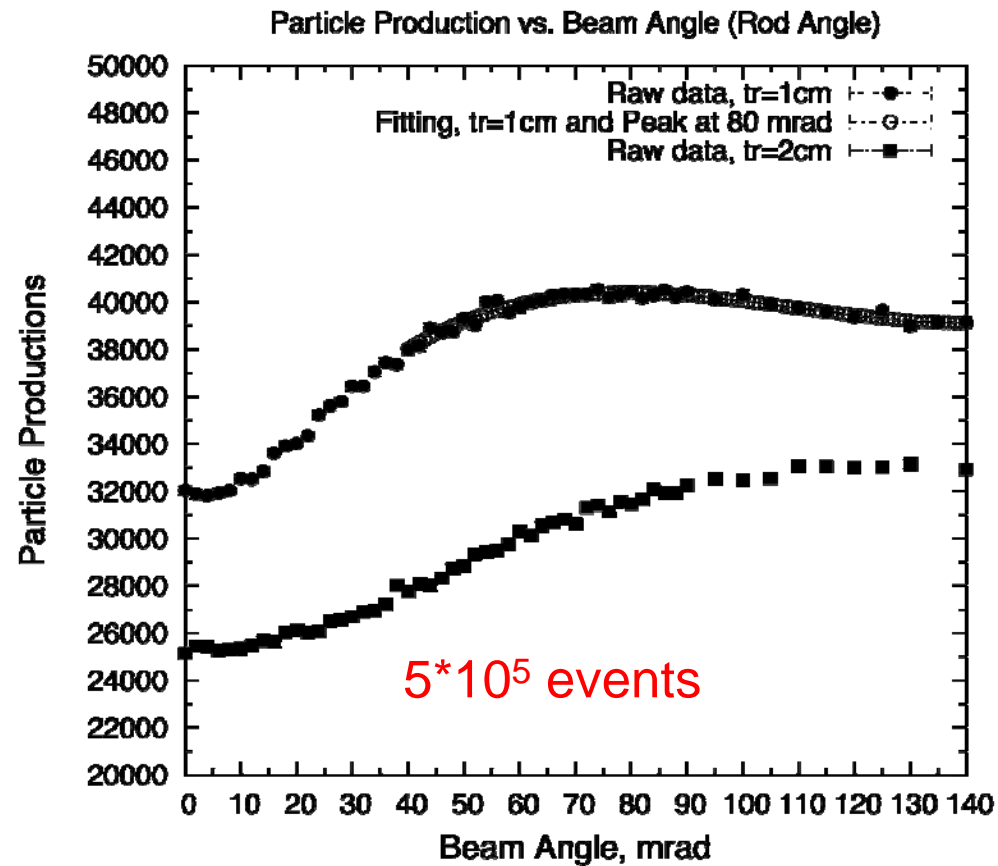
Optimized target length is 80 cm for target radius fixed at 1 cm.

Optimized target length is 57 cm for target radius fixed at 2 cm.

Peak yield is 0.0267 per proton and per GeV for target radius of 1 cm.

Peak yield is 0.02 per proton and per GeV for target radius of 2 cm.

Carbon Target with Tilt Angle



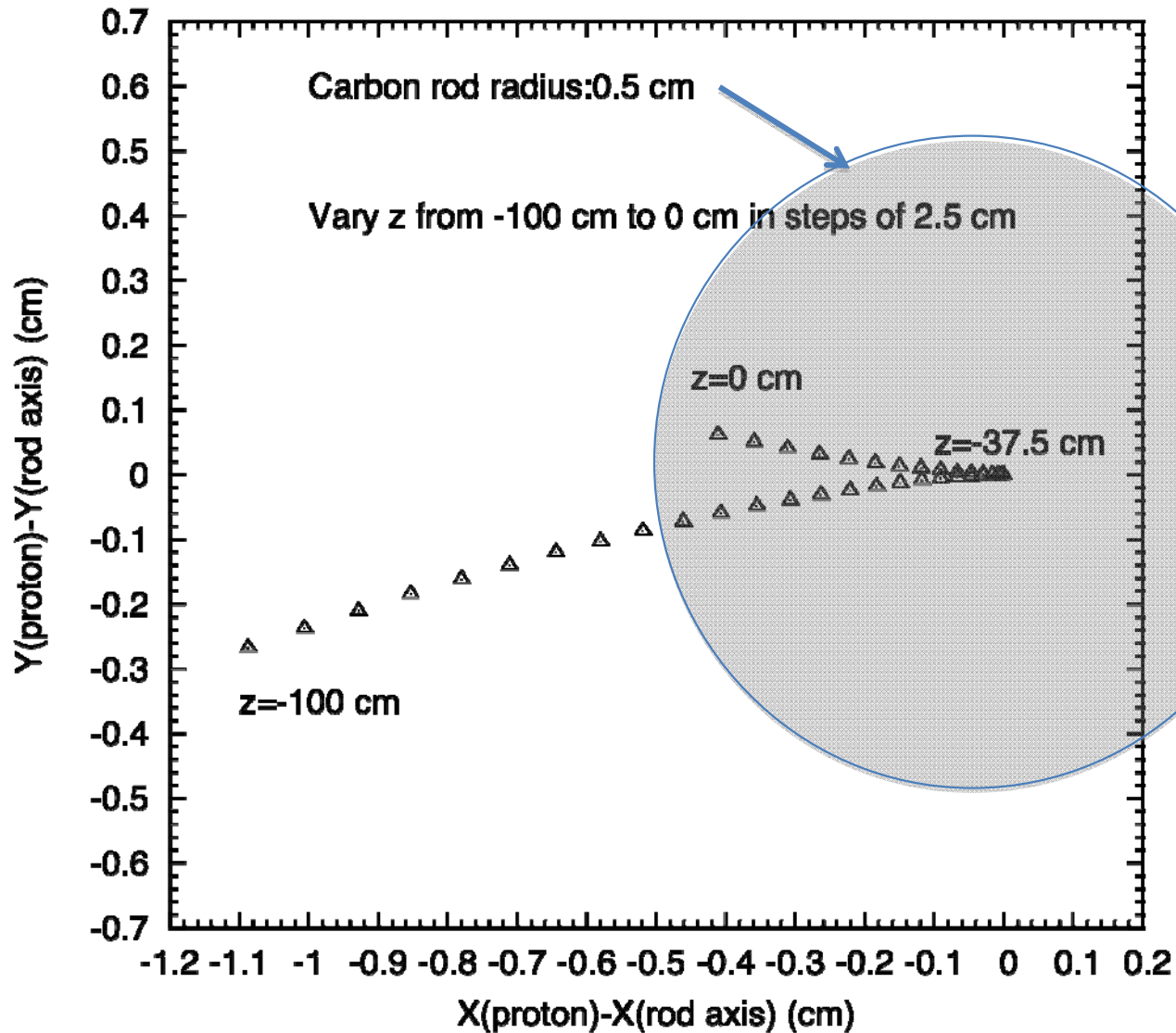
Study with radii of target and beam in ratio 4:1.

Optimized beam angle is 80 mrad for target radius fixed at 1 cm.

No peak of beam angle found in range for target radius fixed at 2 cm.

Peak yield is 0.0267 per proton and per GeV for target radius of 1 cm (7% less than case for target radius at 0.53 cm).

Single Particle Tracking



IDS120j configuration;
Carbon target at 3 GeV;
Target length along solenoid axis: 76.5 cm;
Target radius: 0.5 cm;
Beam radius: 0.125 cm;
Beam angle: 50 mrad;
Target angle: 50 mrad.

Issue: fate of unscattered protons.

Offset between Beam and Center of the Target at $z = -37.5$ cm

