Preliminary MIPP cross-section on the production of soft pions and protons from 0.1 to 1.0GeV/c

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We used numbers from a MIPP analysis to try and produce a tentative cross-section. All numbers are preliminary as is the results.

-120 GeV/c proton beam on Bismuth and Carbon targets was used to get pion and proton production cross section up to 1.0 GeV/c

- Only secondary particles coming from primary vertex were counted

- Vertex cut was put on primary vertex using Andre's vertex z distribution for Carbon target, actually the same thing should have been done for Bismuth target. Same cut was used for Bismuth

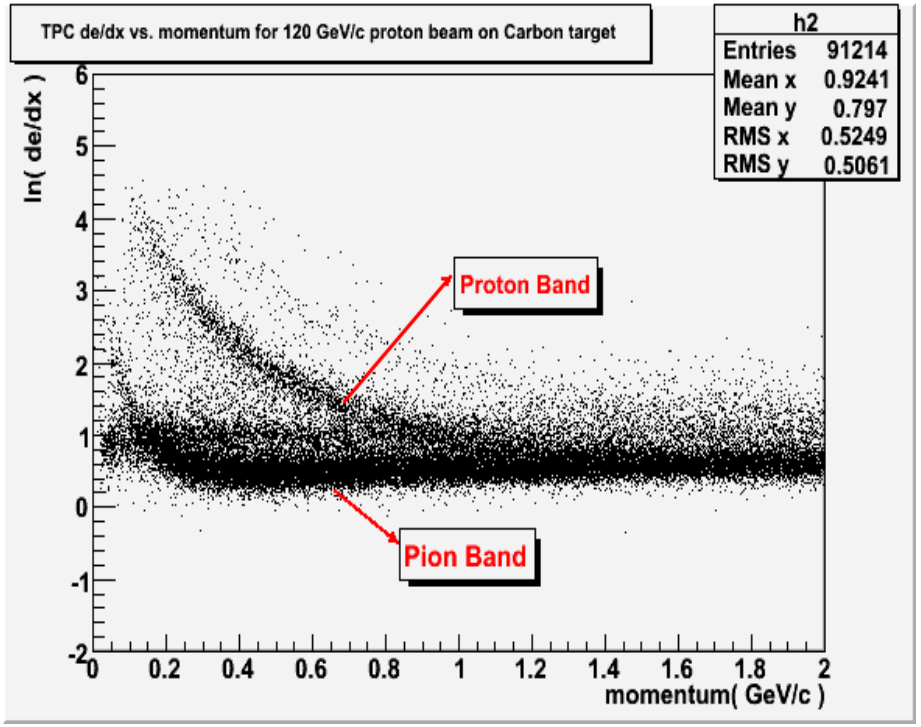
-TPC dE/dx v.s momentum plots were used to select pion and proton bands

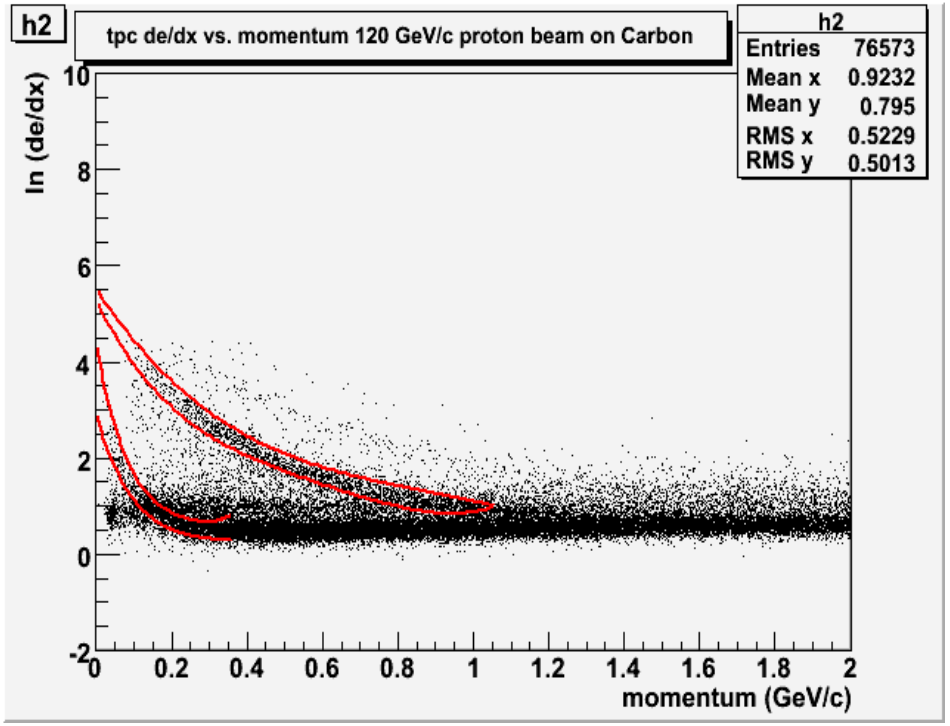
-Andre's pileup code for 120 GeV/c beam was used to eliminate pile up events

-Empty target results were subtracted from full target results

- Not any Monte Carlo correction was studied

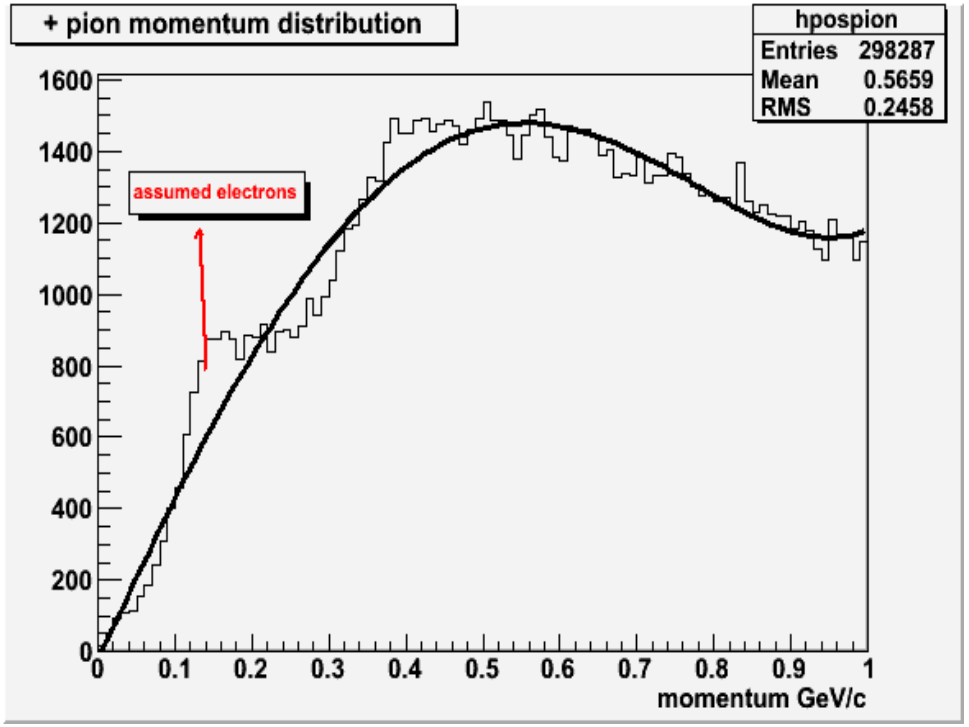
TPC dE/dx vs. momentum plot for Carbon target

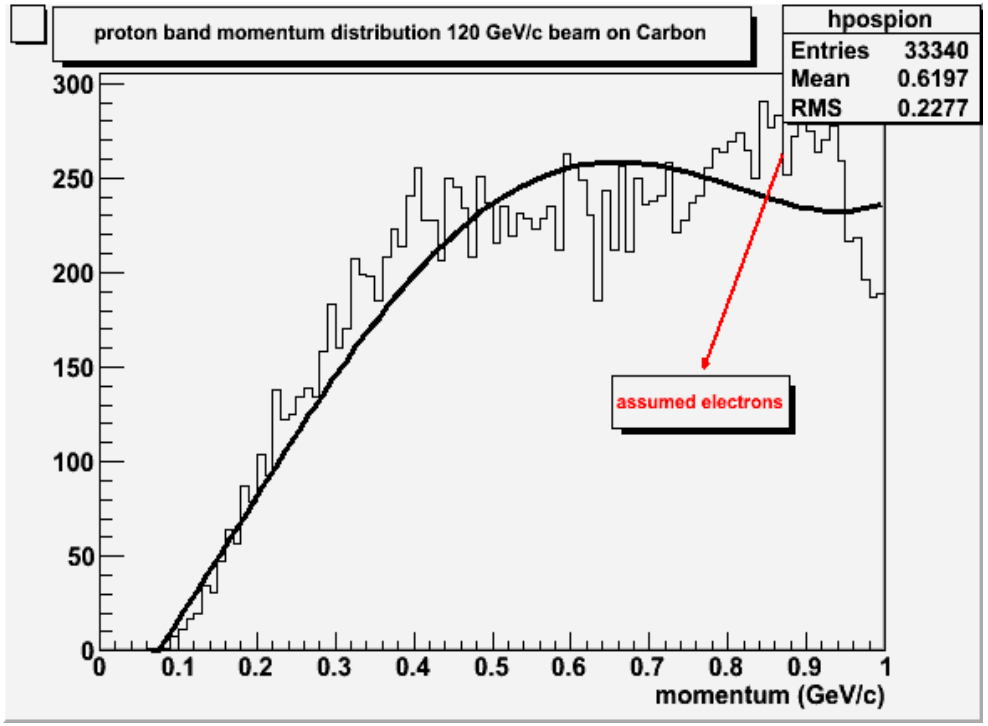




Pion and proton bands were fitted as polynomial. For this, different points were taken from upper and lower boundary, and these points were fitted as polynomial.

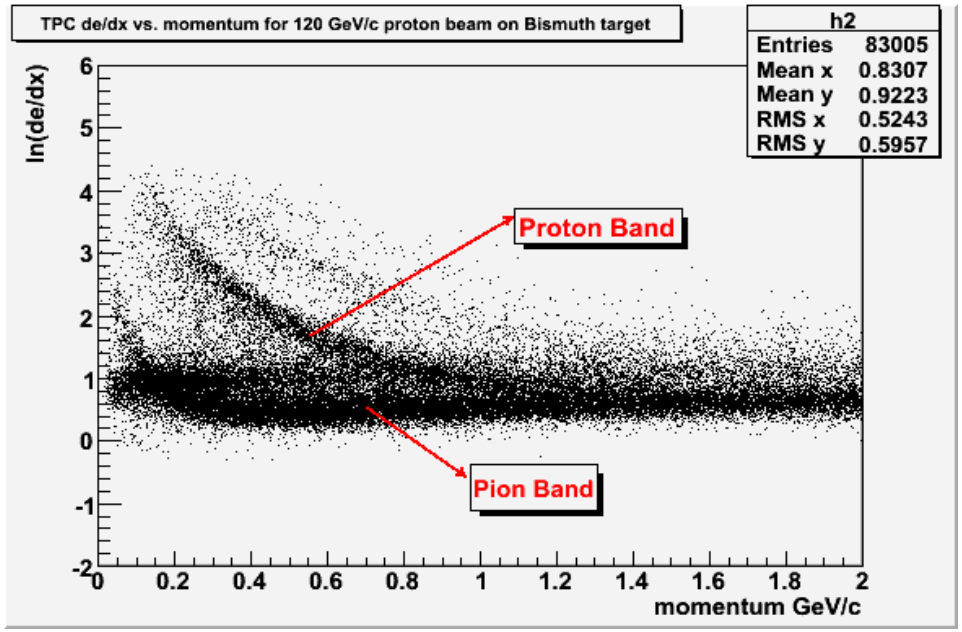
Pion and Proton band momentum distribution for Carbon target

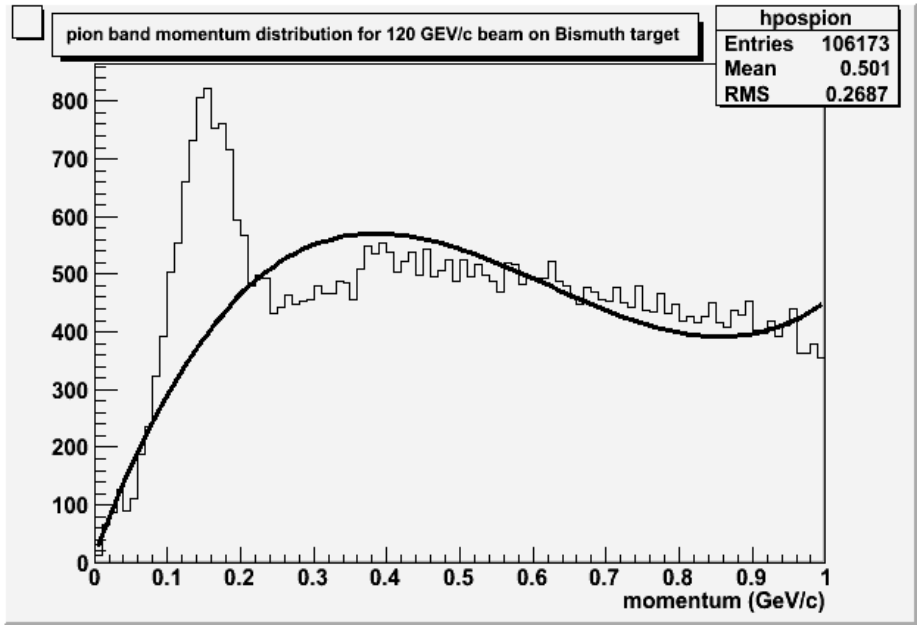


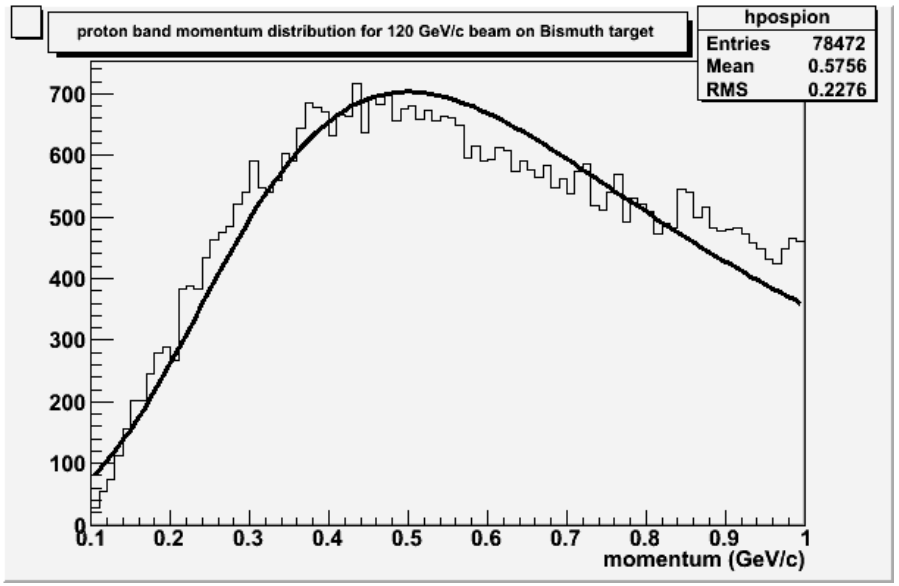


The distributions were fitted as exponential + polynomial. The data was reduced using fit/data ratio when calculating production cross section between 0.1 and 0.2 GeV/c for pion and 0.7-1.0 GeV/c for proton.

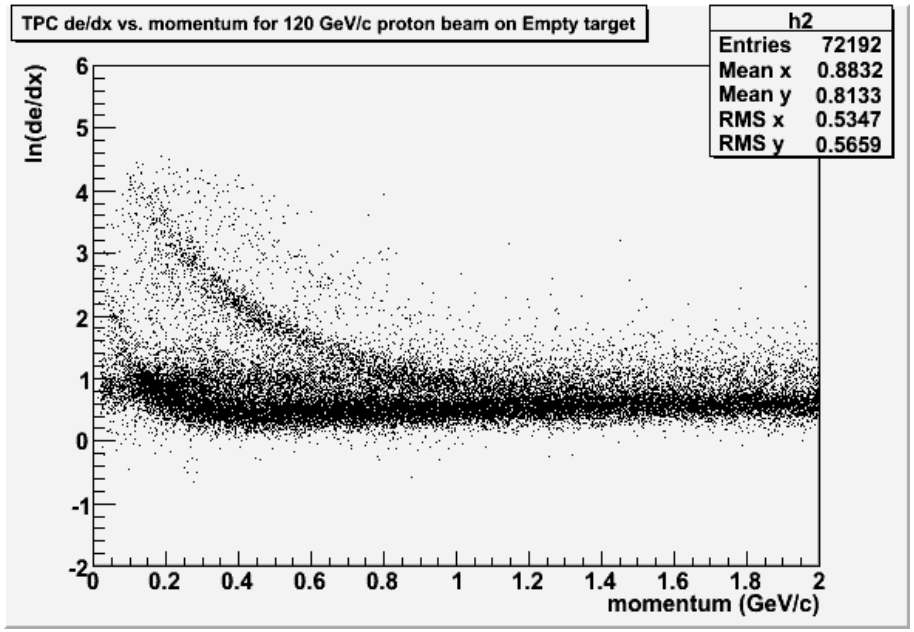
TPC dE/dx vs. momentum for Bismuth target

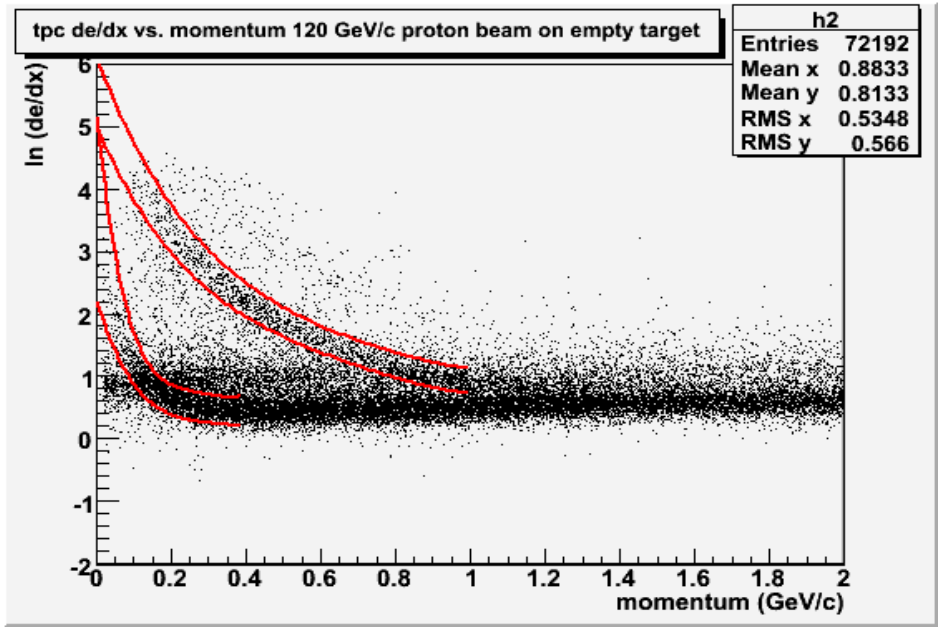


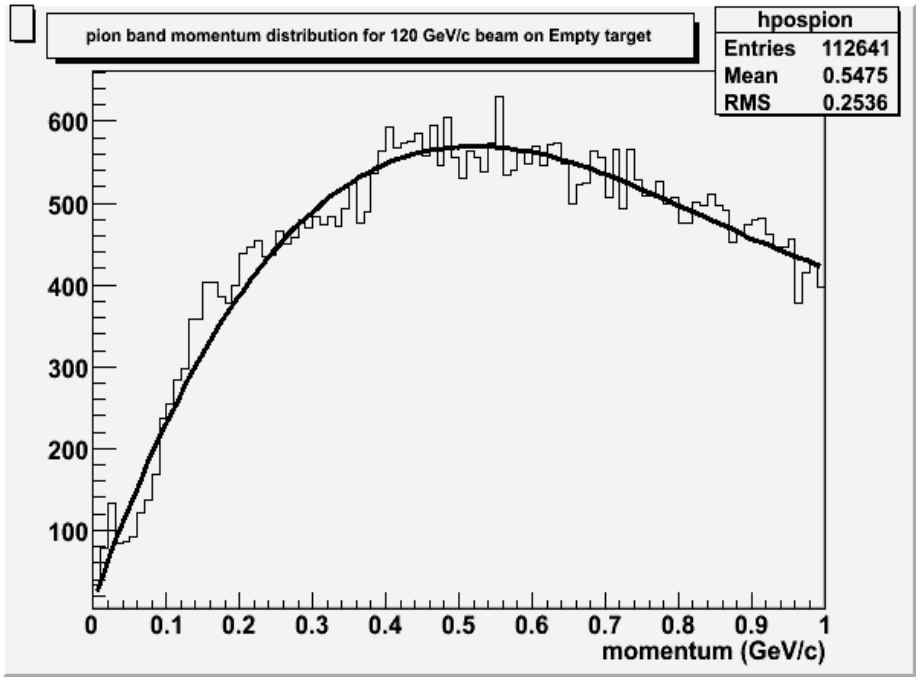


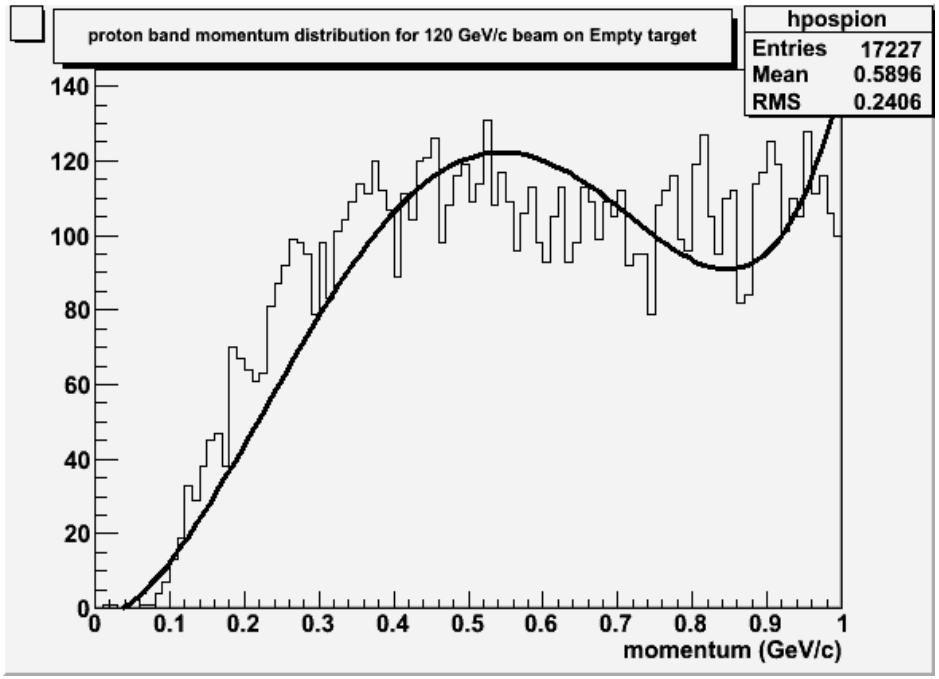


TPC dE/dx vs. momentum for Empty target



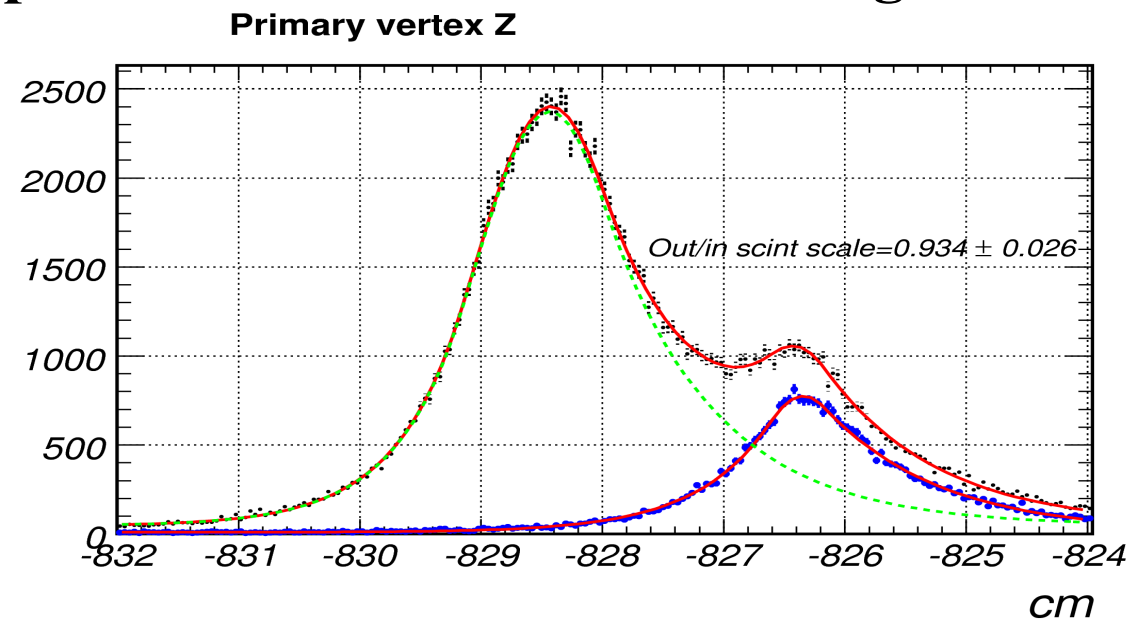






PRIMARY VERTEX CUT

Primary vertex z distribution for 120 GeV/c proton beam on 2% Carbon target



For our calculation primary vertex has been cut between -832 and -825

Formula for Cross Section

$$\frac{d^2\sigma_\pi}{dpd\Omega}(p,\cos\theta) = \frac{A}{2\pi N_A \rho}\frac{1}{a(p,\cos\theta)}\frac{N_\pi(p,\cos\theta)}{N_b \Delta p \Delta\cos\theta}$$

N_π= Number of pions coming from primary vertex in certain momentum and polar angle bin

N_b=Number of incident proton beam, N_A= Avogadro number

Δp=0.1(GeV/c) Momentum bin size

$\Delta\cos(\theta)$=0.1(str) polar angle bin size

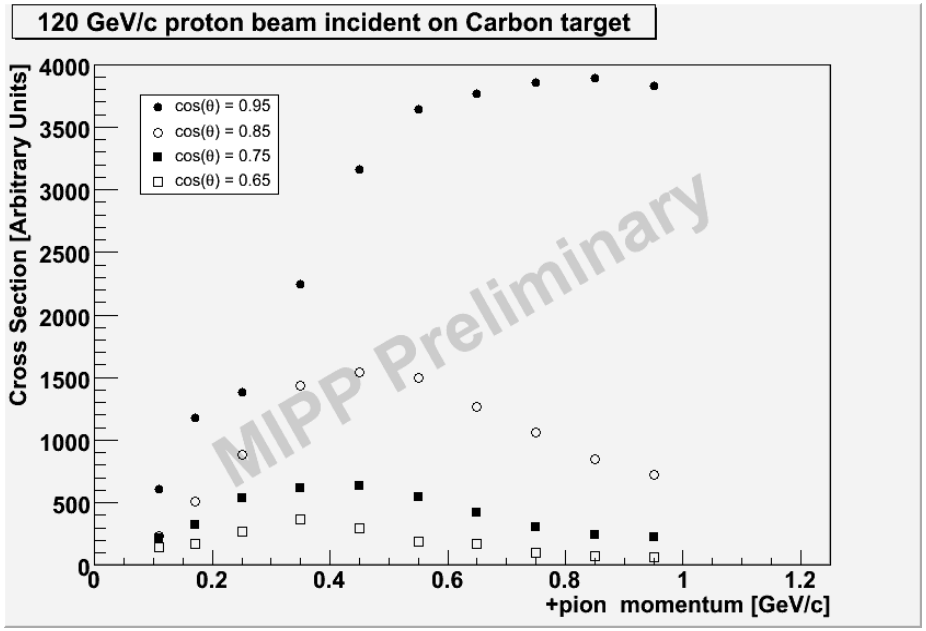
a=1 Monte Carlo acceptance

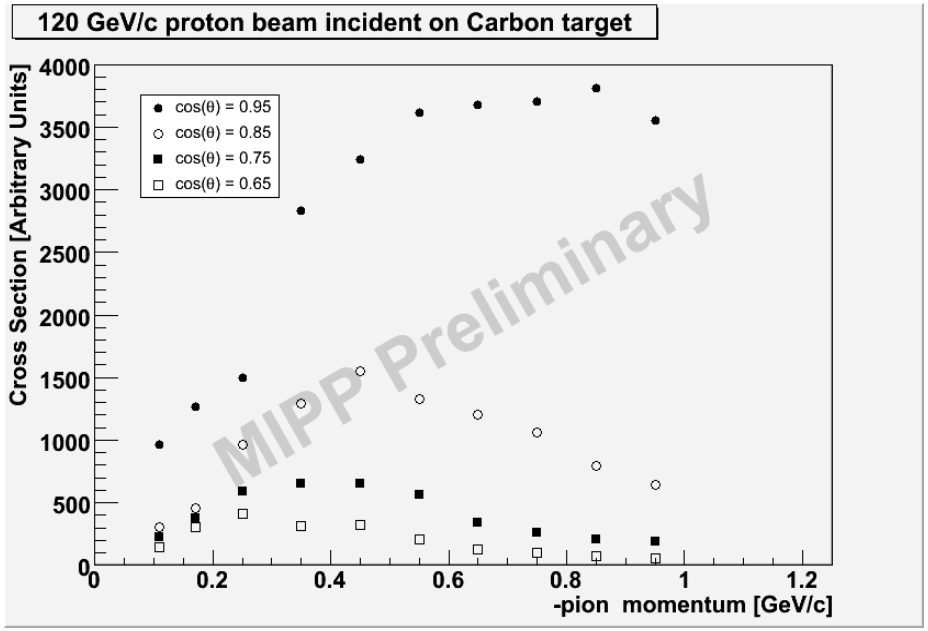
ρ=[g/cm^2] Target Areal density A=[g] Atomic weight of target

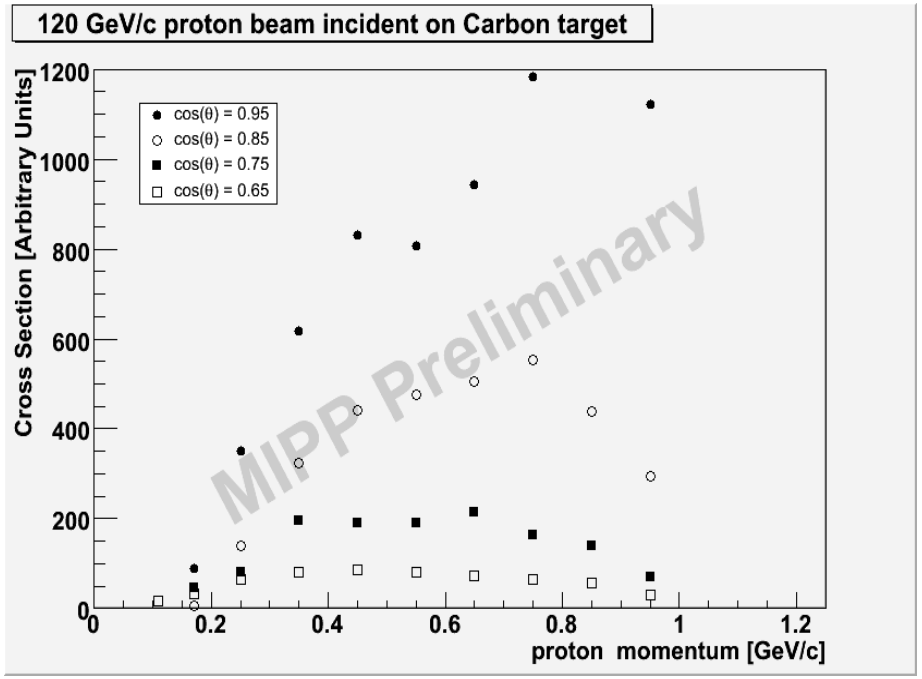
For 120 GeV/c proton w/ interaction trigger is not prescaled

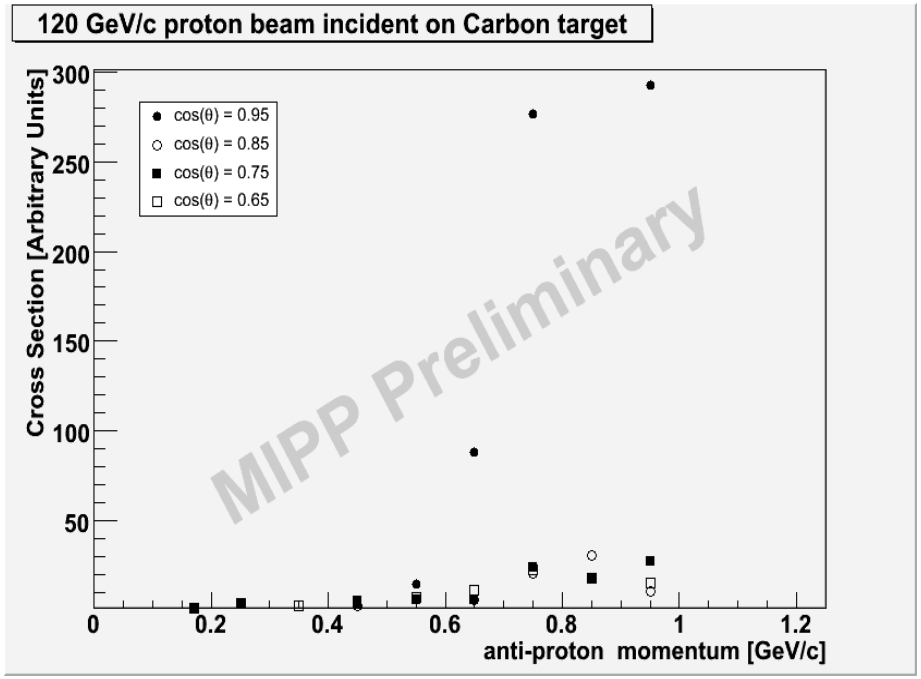
-Interaction trigger efficiency correction should be put for each bin. I will do that later.

Results for Carbon target

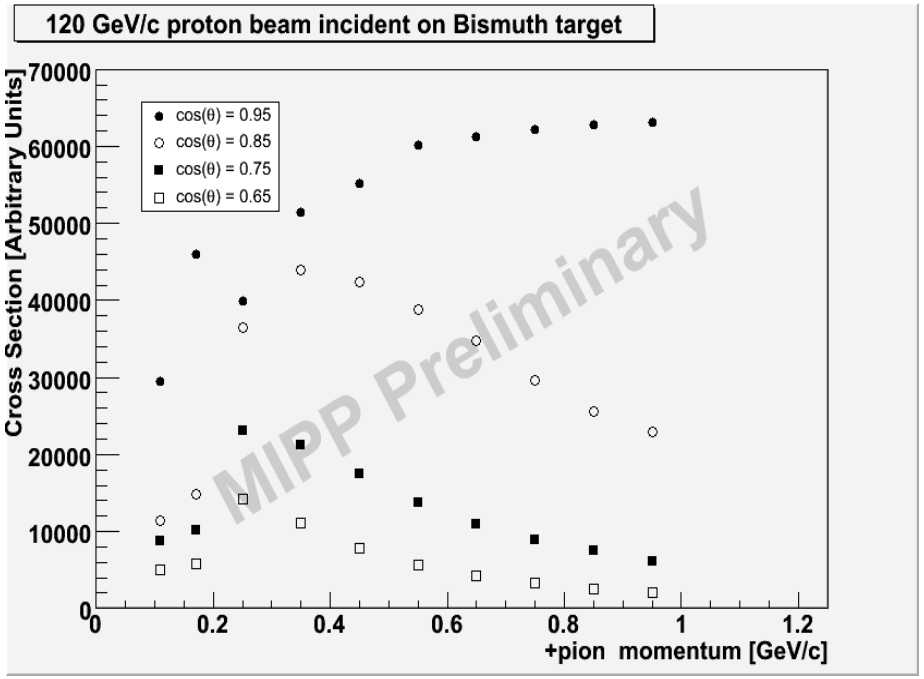


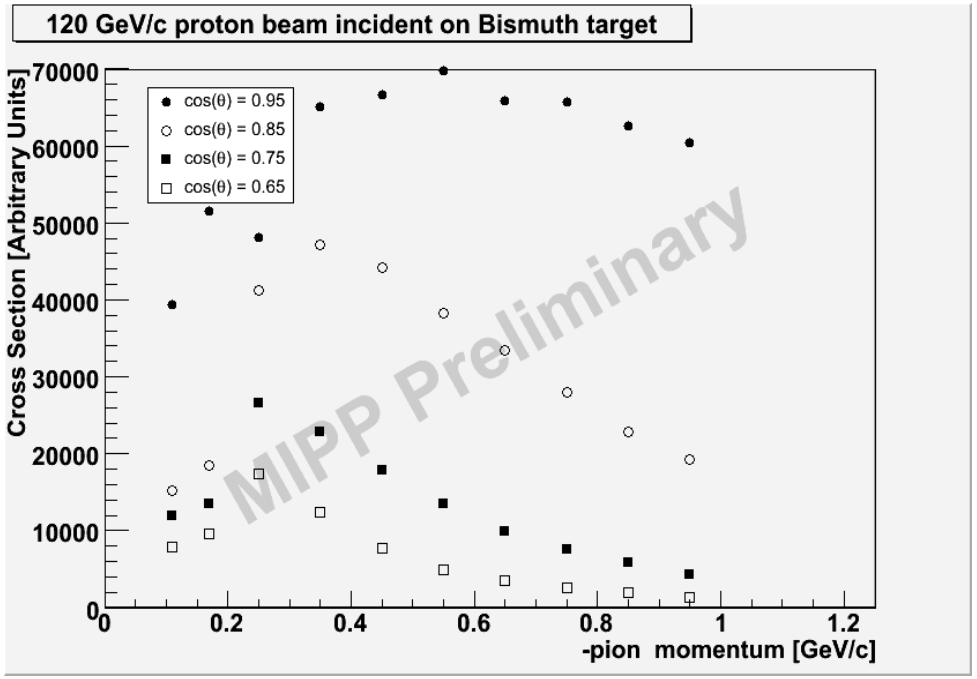


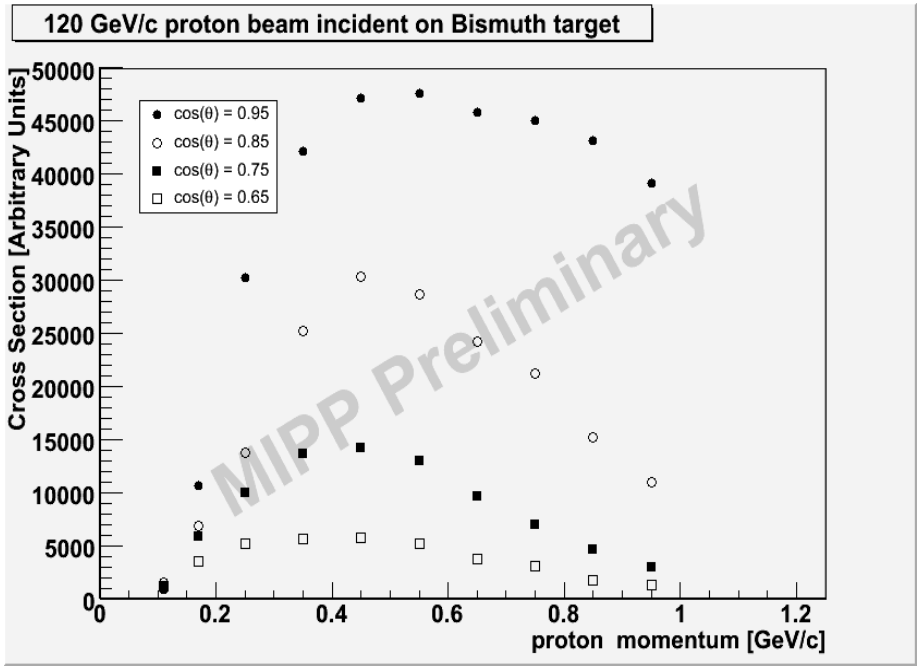


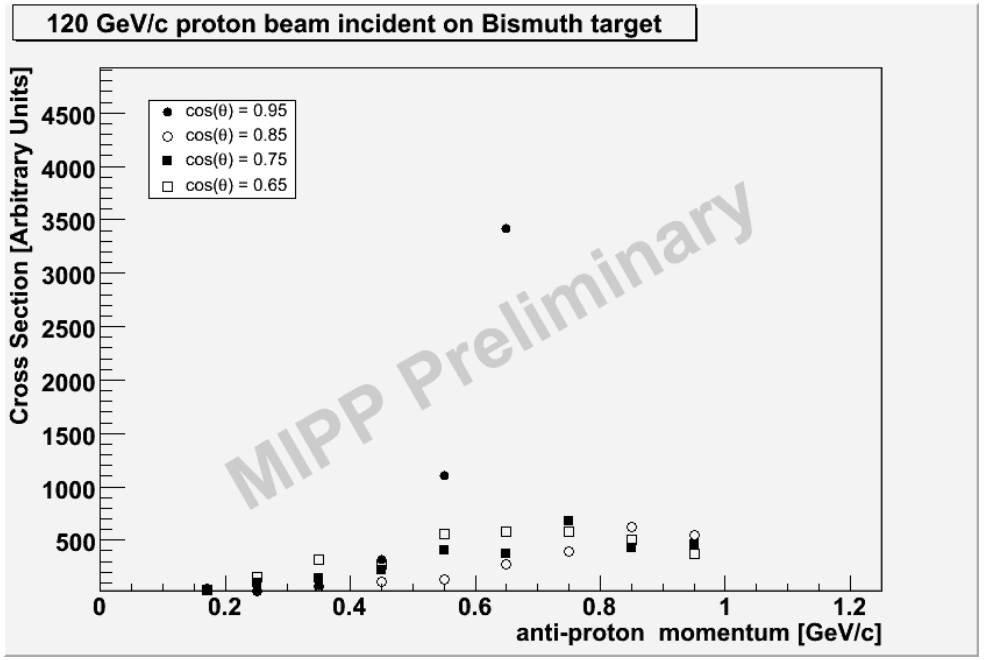


Results for Bismuth target

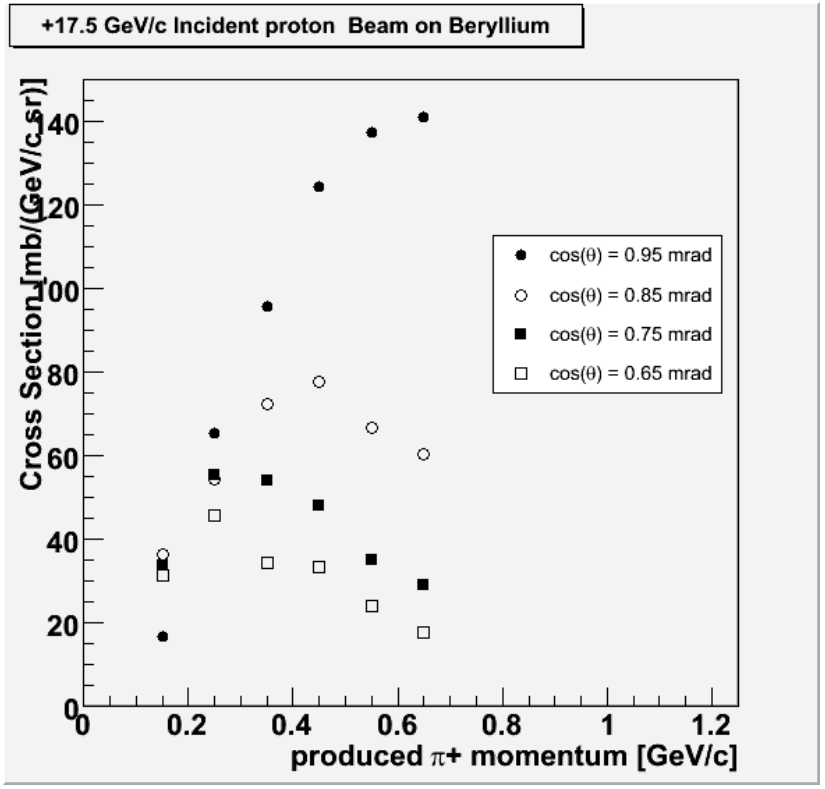


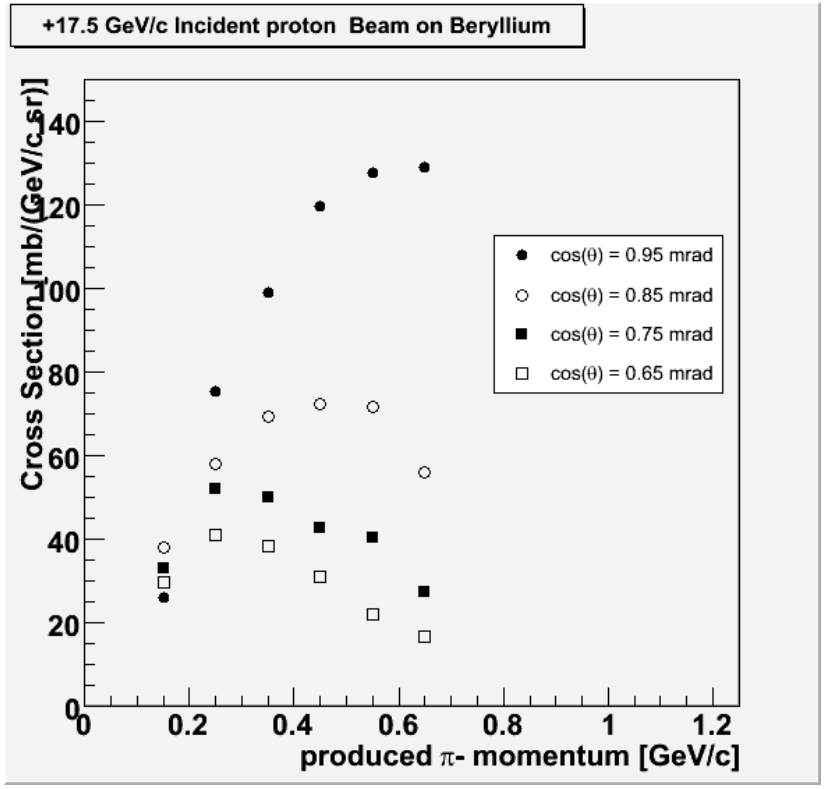






These are published plots from E910 for 17.5 GeV/c proton beam on Beryllium target





Conclusion

- It seems pion+ and pion- follow same tendency with previous results. Proton is also has similar tendency but anti-proton production is so low.

-Future work is to put interaction trigger efficiency into current results.

- With TPC PID working, calculation will be repeated for 120 GeV/c and 58 GeV/c