Understanding MIPP Beam

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Plan for beam PID

- For every run, fit beam momentum, store in DB
  - BeamMomCalc module
- Beam Cherenkov has ADC and 2 sets of TDC's
  - Look at TDC's to make sure that all signals are in time and we have no pileup
  - Calculate e, μ, π, K, p hypotheses likelihoods
  - (Maybe) use beam chamber track to determine whether charge is expected to be shared between inner and outer PMTs

BeamMomCalc

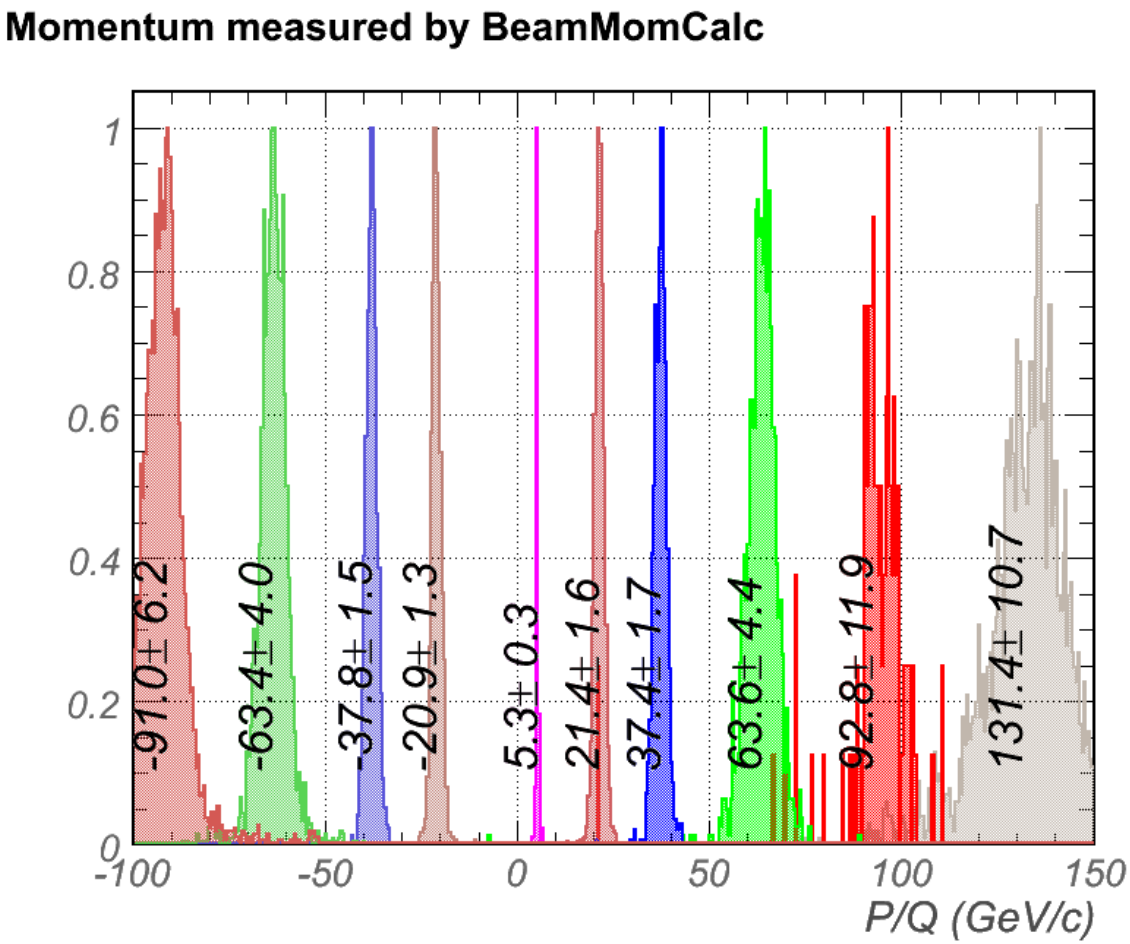
- Takes BC, C123, C456 track segments and forms a TrkCand
- TrkCand does a “fast”, non-iterative fit
  - $\theta_x(z) = \frac{0.3\,q}{p_z} \int_{z_0}^{z} B_y(z')\,dz'$
  - $x(z) = x_0 + \frac{dx}{dz}(z - z_0) + \int_{z_0}^{z} \theta_x(z')\,dz' = x_0 + P_{x0} z + Q\lambda(z),$
  - Where $\lambda(z) = 0.3 \int_{z_0}^{z} dz' \int_{z_0}^{z'} B_y(z'')\,dz''$
  - λ's are calculated for each chamber once a choice of z_0 is made
  - Will be MIPP Note 100

BeamMomCalc Results

- I took a run from at almost every momentum, processed through pass2 on FNAL farm

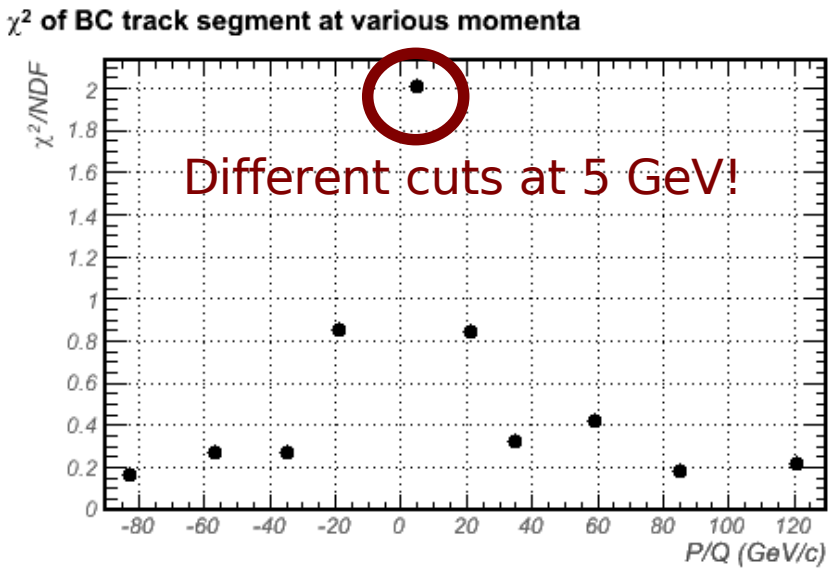
Run	Momentum	Target
13688	-84	Empty Cryo
12450	-58	Beryllium
12210	-35	Empty
13844	-20	Empty Cryo
13939	5	LH2
13996	20	Carbon
12704	35	Empty
12346	58	Carbon
13594	84	LH2
15921	120	Carbon

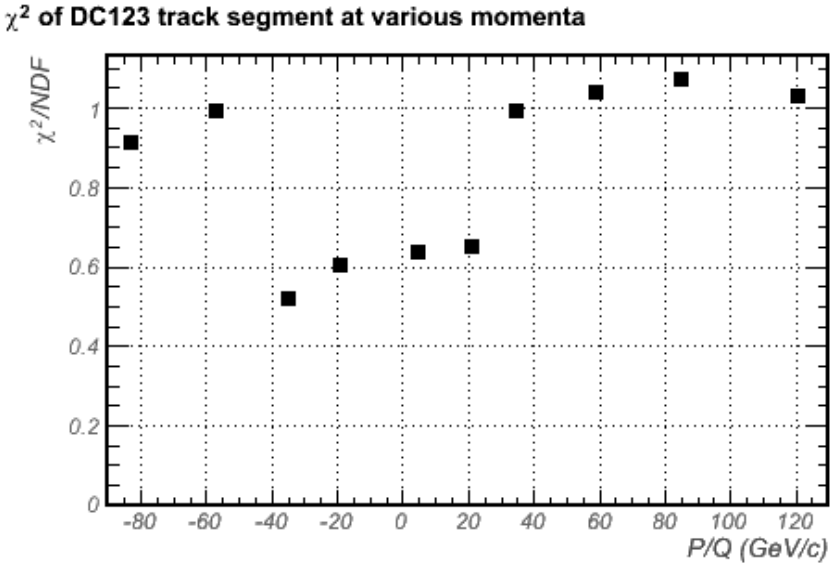
All momenta come out ~10% larger. I have no idea why.



Multiple Scattering at 5 GeV

- At 5 GeV/c, there is no way to get direction and momentum of beam particle w/ BC's
  - Multiple scattering through 2 BCkovs is awful
  - Confirmed with evd
- To measure momentum, looser cuts on BC123 segments were used





Things to do at IU

- Understand the 10% momentum error
  - Apparently comes from BC's
- How do we verify relative strength of JGG and Rosie fields?
- Make a study of beam Cherenkov ADC behavior and fold it into PID likelihood