Deuteron Electro-Disintegration at Very High Missing Momenta (E10-003)

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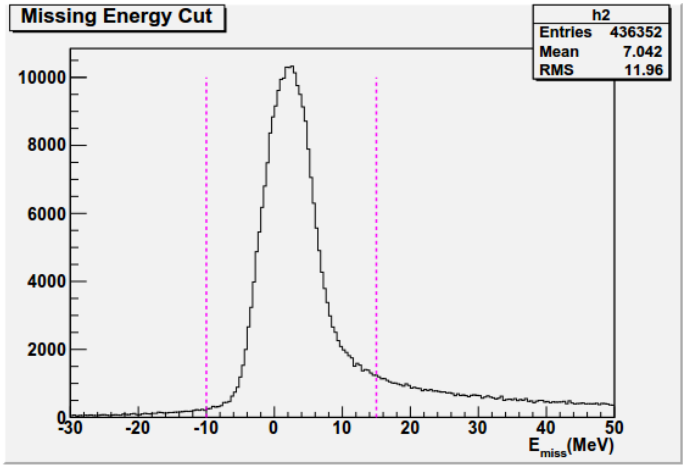
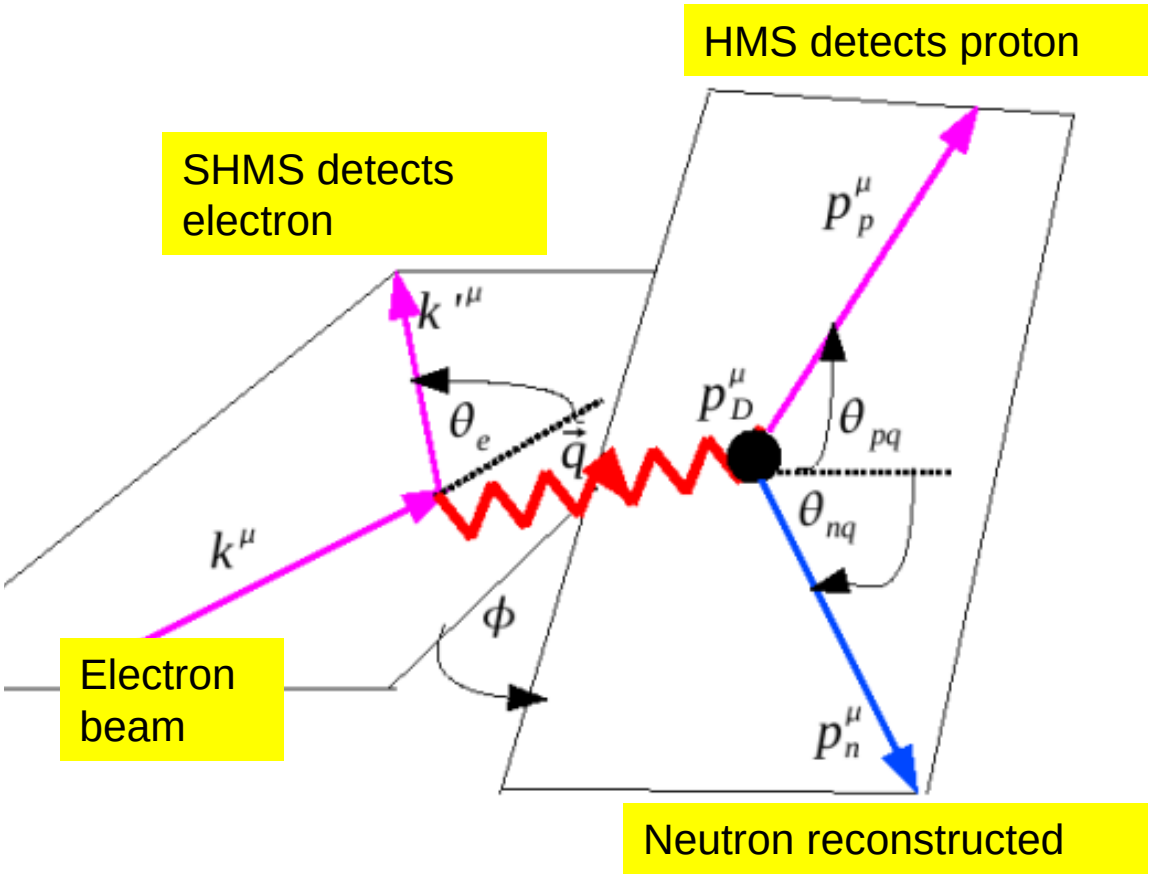
D(e,e'p)n exclusive reaction by using cut on missing energy with the neutron energy and angle reconstructed

$$\vec{p}_m = \vec{q} - \vec{p}_p.$$

$$\cos\theta_{nq} = \frac{q - p_p \cos\theta_{pq}}{\sqrt{q^2 + p_p^2 - 2qp_p\cos\theta_{pq}}},$$

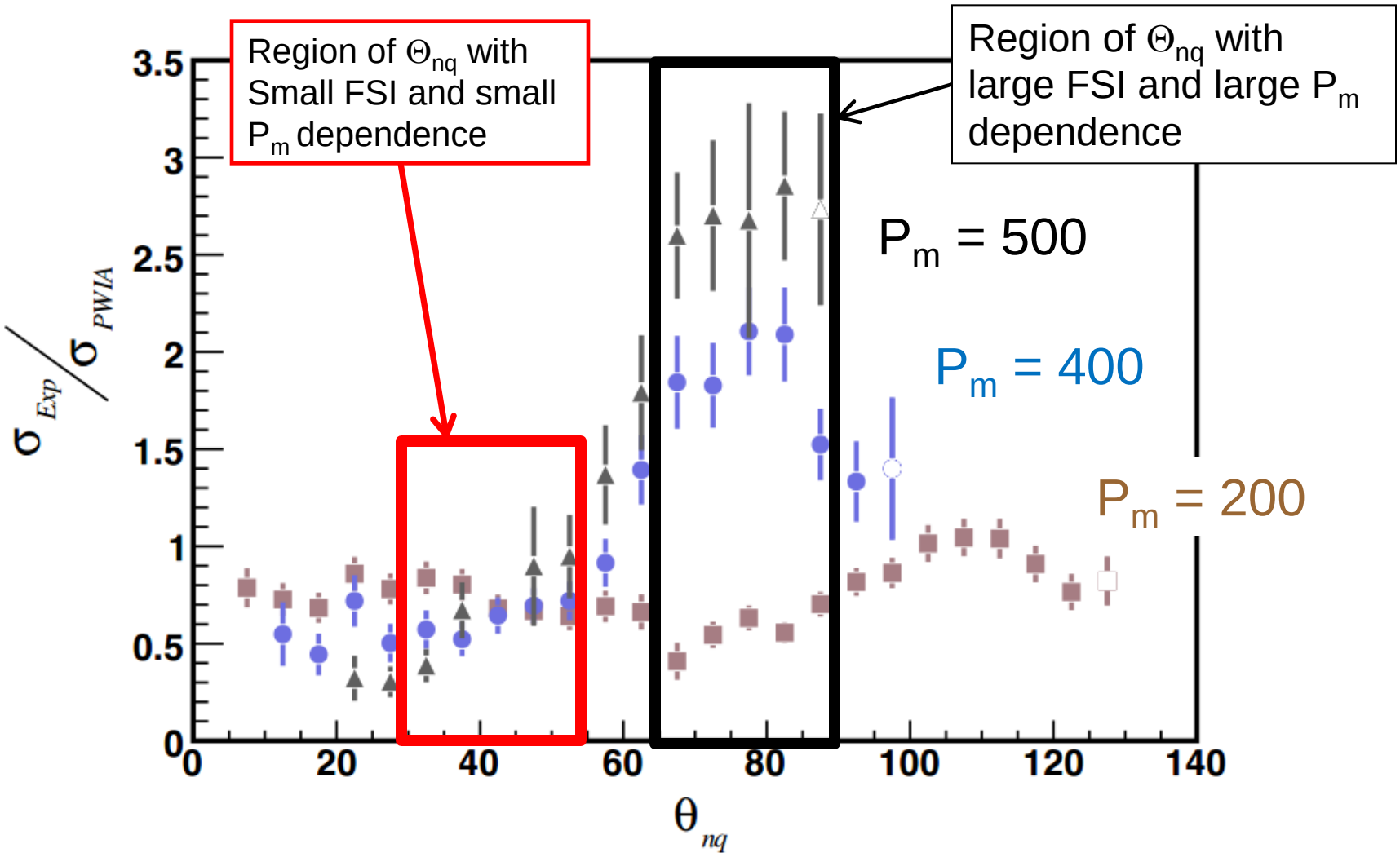
$$E_{miss} = M_d - M_p - M_n = \omega - T_p - T_n$$





Previous Hall A experiment

Data for d(e,e'p) n reaction at $Q^2 = 3.25$ GeV^2.



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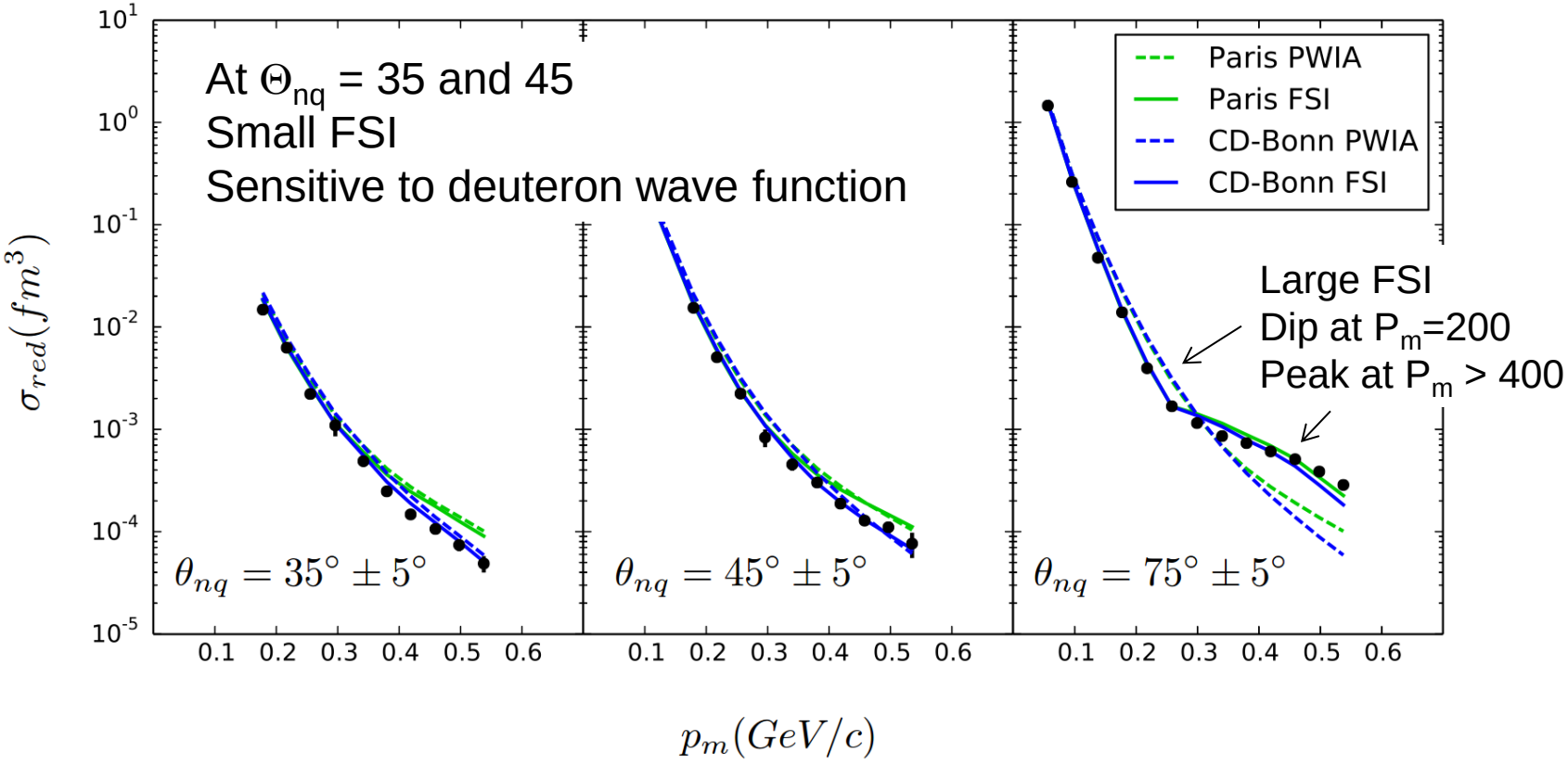
Previous Hall A experiment

Compare reduced cross section to theoretical calculation of only PWIA, PWIA+FSI with different NN potentials.

In PWIA, σ_{red} maps the momentum distribution.



Experimental Goals

Motivation:

- Explore a new kinematical region of the 2-nucleon system above $p_m > 500$
- No Deuteron data exist at these kinematics!
- Short range correlation studies cover similar region on missing momenta
- Models are able to reproduce the present data with 20%.
- Signs of a dependence on NN potential athighest missing momentum

The experiment will:

- Determine cross sections at missing momenta above 0.5 GeV/c
- Measure at well defined kinematic settings at $Q^2 = 4.25$
- Selected kinematics to minimize contributions from FSI
- Selected kinematics to minimize effects of delta excitation

Outline a scaled down version of the experiment for the Hall C commissioning period.

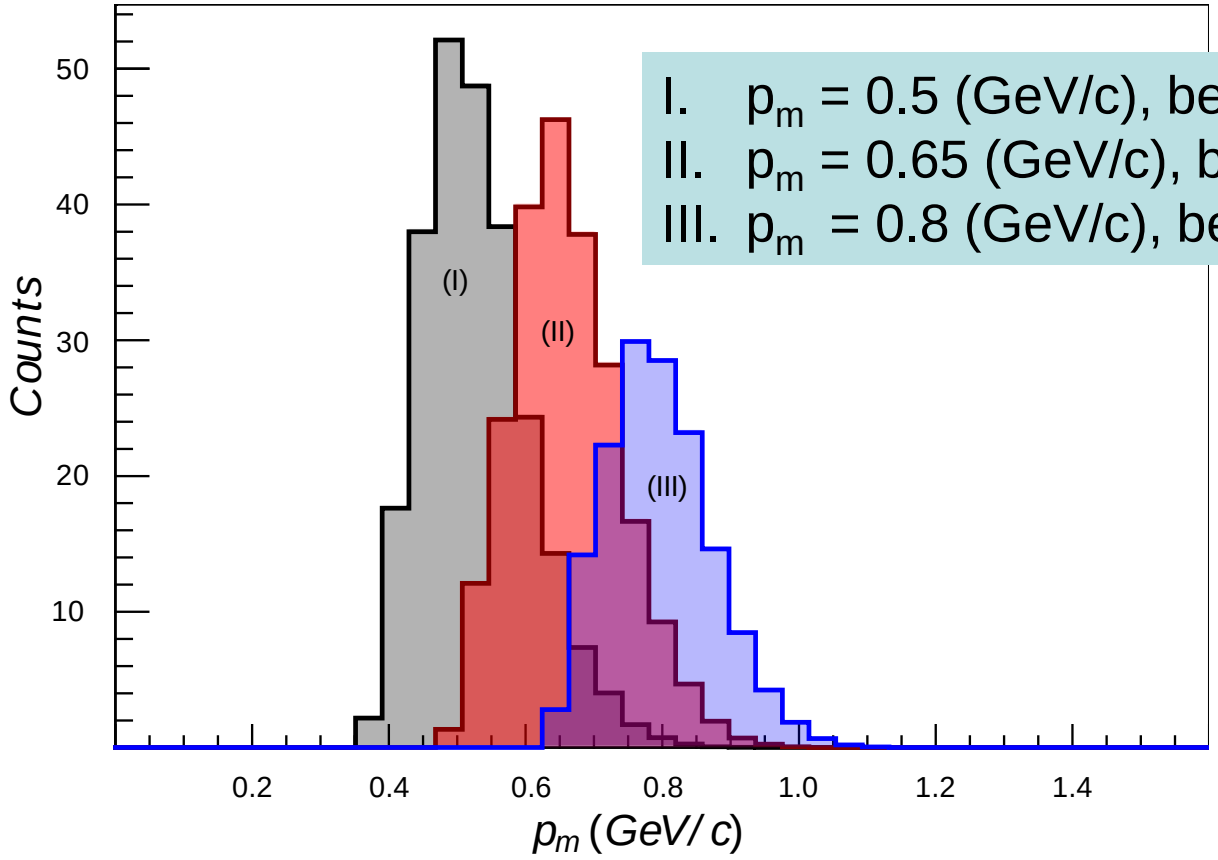
Kinematics and Beam Time

Beam:
Energy: 11 GeV
Current: 70μA

Electron arm *fixed* at:
SHMS at p_{cen} = 9.32 GeV/c
θ_e = 11.68° Q^2 = 4.25 (GeV/c)^2
x = 1.35 θ_{nq} = 40°

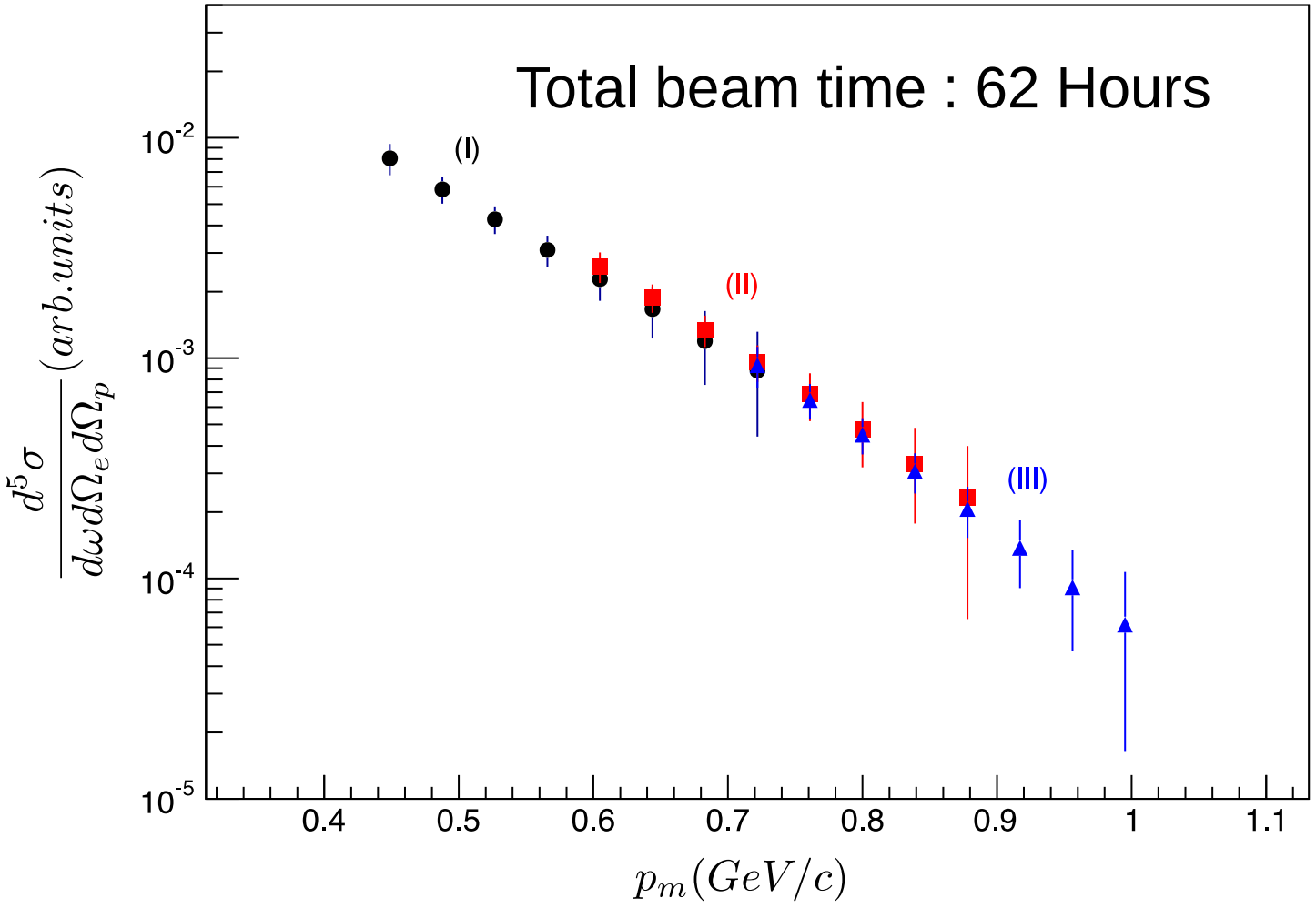
Vary proton arm to measure :
p_m = 0.5, 0.65, 0.8 GeV/c
HMS 2.12 ≤ p_{cen} ≤ 2.3 geV/c
Angles: 59.6° ≥ θ_p ≥ 53.1

Detect electron and proton and reconstruct missing mass of neutron.



I. p_m = 0.5 (GeV/c), beam time 8 hours
II. p_m = 0.65 (GeV/c), beam time 18 hours
III. p_m = 0.8 (GeV/c), beam time 36 hours

Expected Results



Summary

- New Deuteron data in unknown kinematic territory
  where exepcted a much larger NN model dependence
- This phase one has a modest requirement on precision
- PID:
  - e/π separation with Cherenkov and calorimeter
  - p identification with coincidence timing
- Data can be produced while performing spectrometer commissioning
- Experience gained during this experiment will help later experiments that require higher precision
- Good preparation for the complete experiment with much higher statistics.