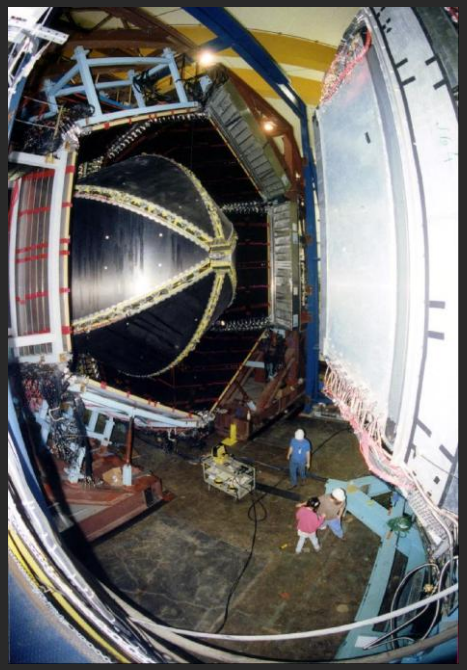
eA pion production as aid to tune GENIE

T2K NIWG – Jan. 12, 2010



Hyupwoo Lee, Melanie Day and Steve Manly

(University of Rochester)

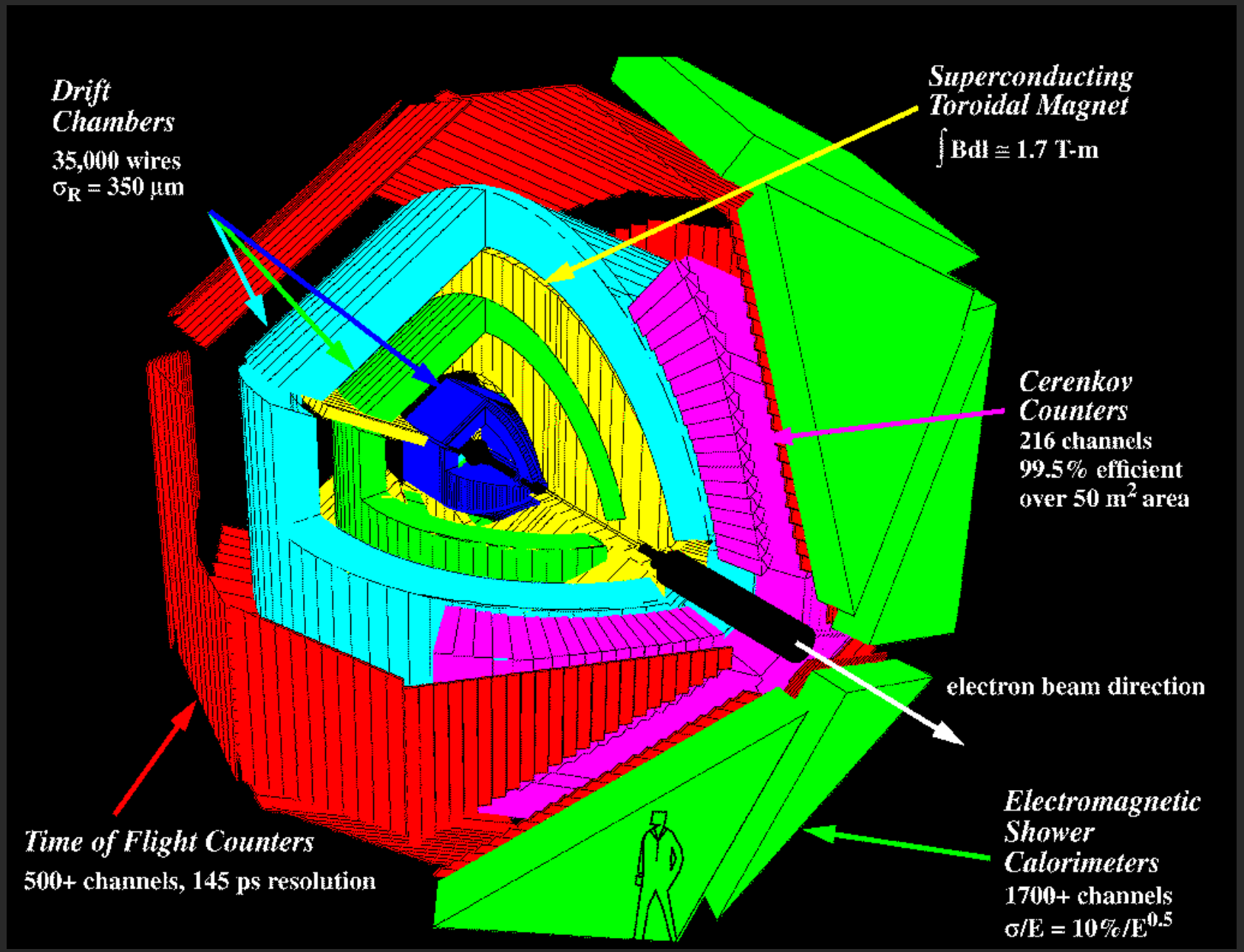
Looking at pion production in CLAS (Hall B) detector at Jefferson Laboratory - working with the eg2 experiment within the CLAS collaboration

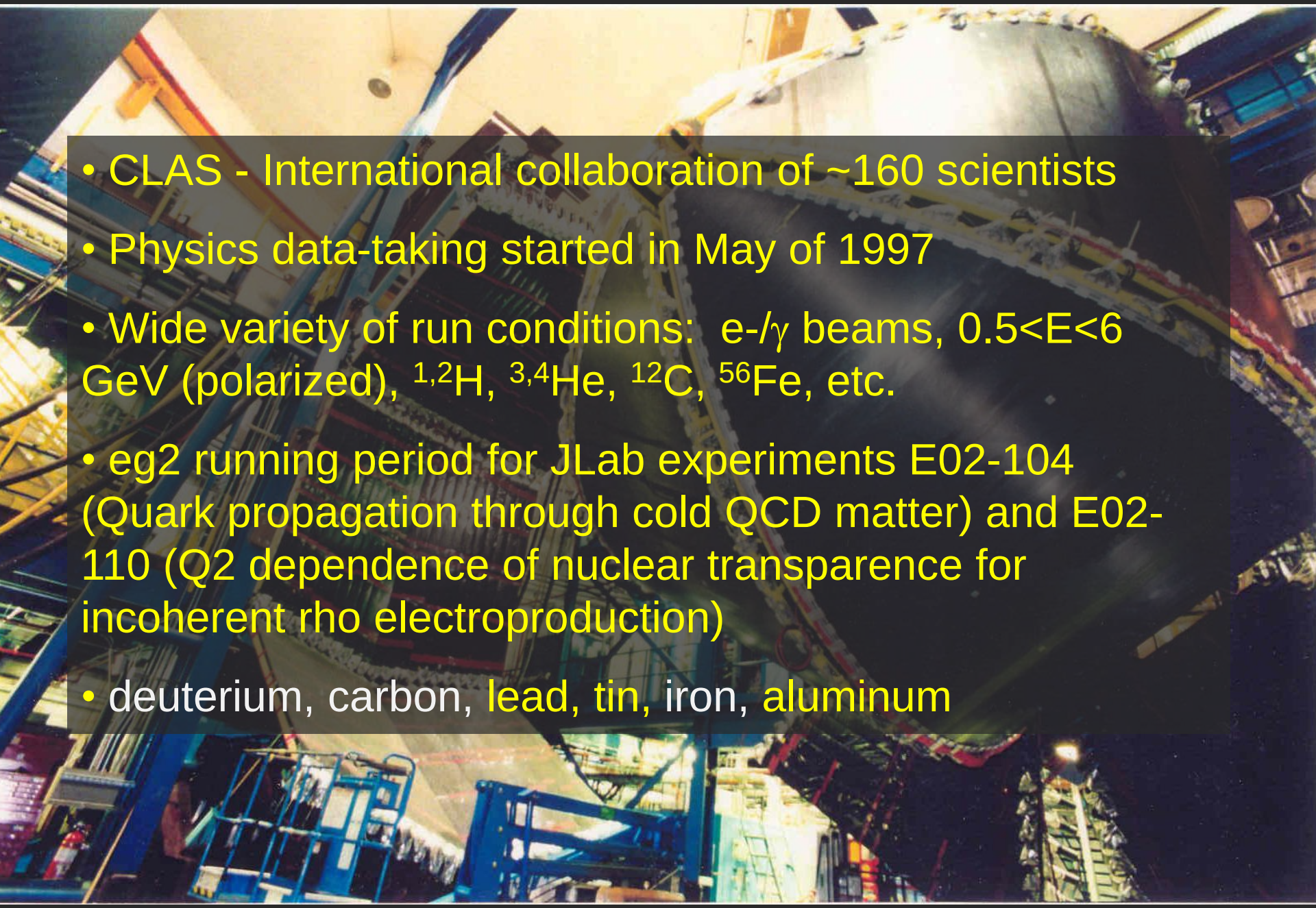
GENIE experts

Costas Andreopoulos (STFC – RAL) *– added eA to GENIE*

Hugh Gallagher (Tufts University)

CLAS: CEBAF Large Acceptance Spectrometer (Hall B)

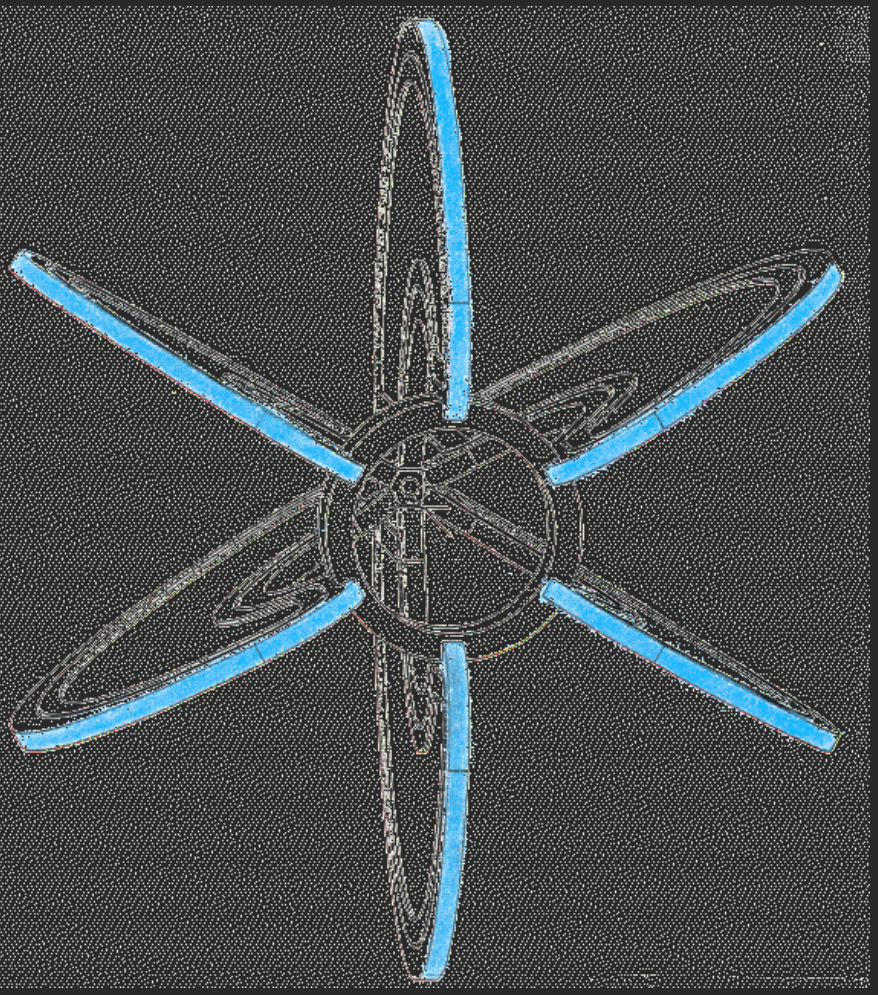


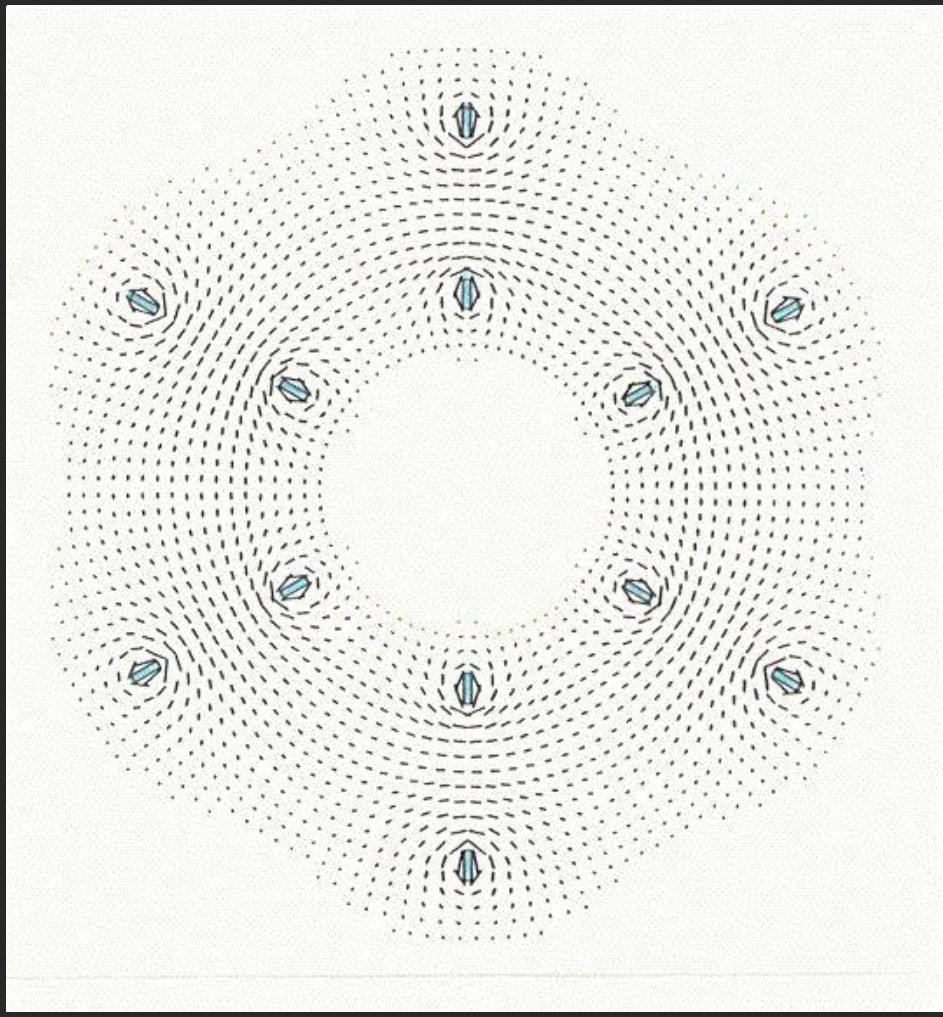


- CLAS - International collaboration of ~160 scientists
- Physics data-taking started in May of 1997
- Wide variety of run conditions: e-/γ beams, 0.5<E<6 GeV (polarized), ^{1,2}H, ^{3,4}He, ^{12}C, ^{56}Fe, etc.
- eg2 running period for JLab experiments E02-104 (Quark propagation through cold QCD matter) and E02-110 (Q2 dependence of nuclear transparence for incoherent rho electroproduction)
- deuterium, carbon, lead, tin, iron, aluminum

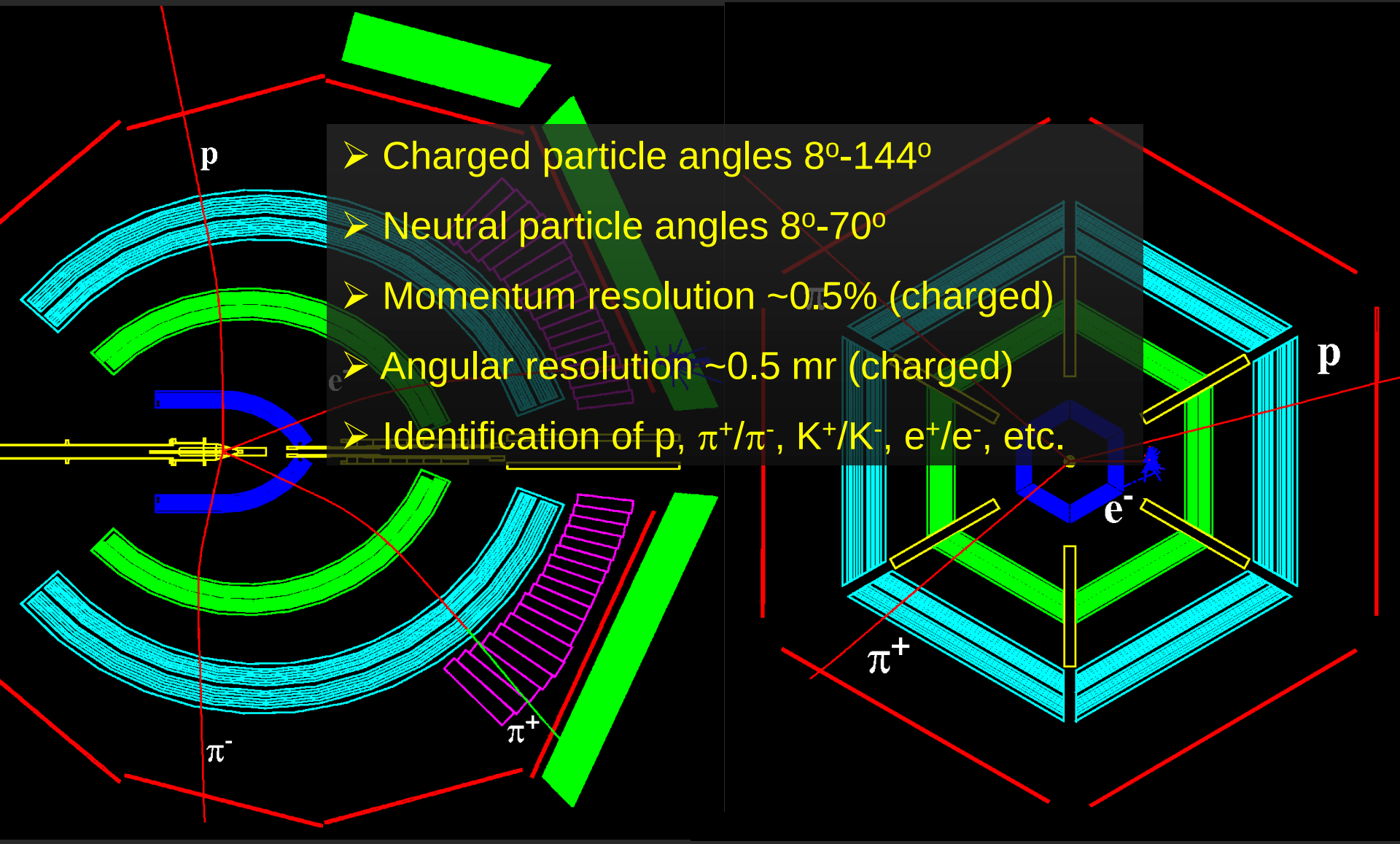
Super-conducting toroidal magnet with six kidney-shaped coils

5 m diameter, 5 m long, 5 M-Amp-turns, max. field 2 Tesla

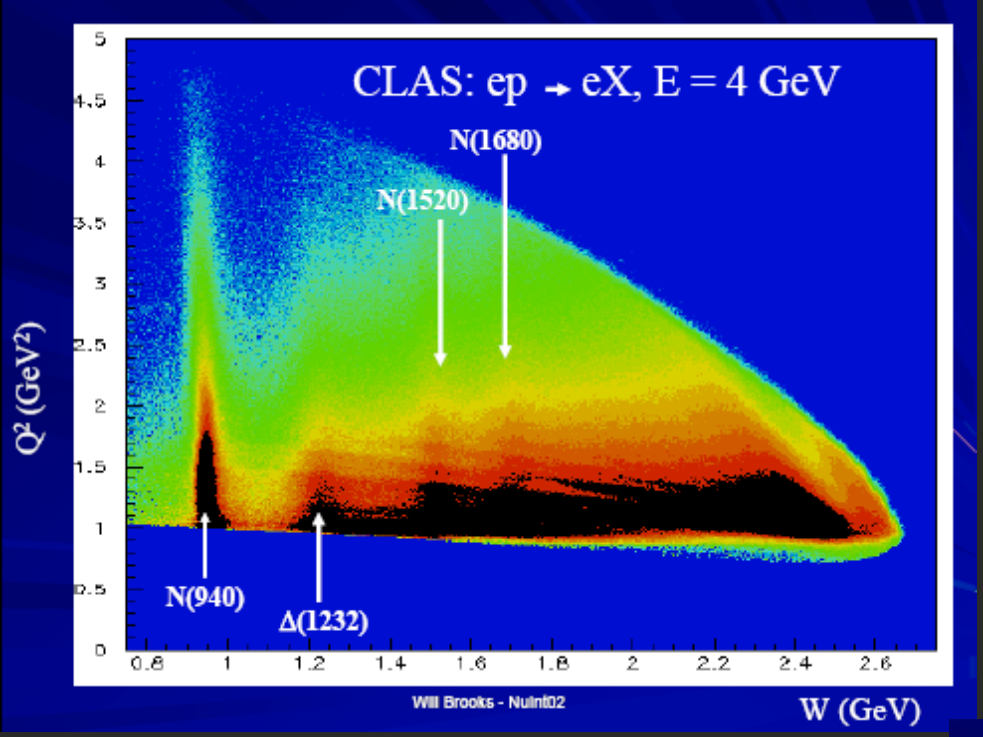


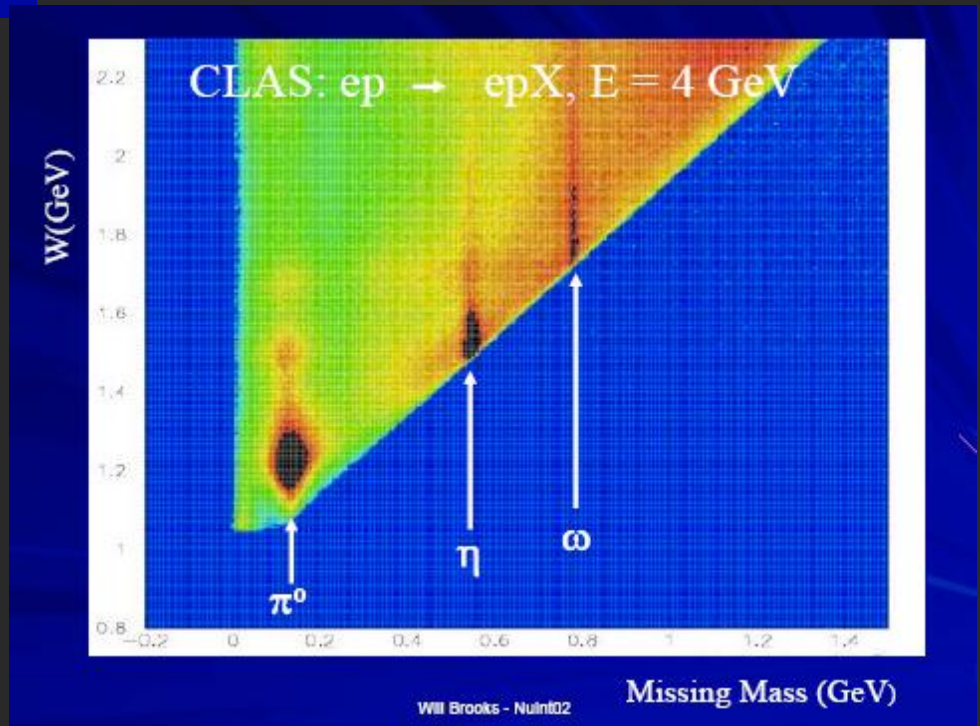


CLAS Single Event Display



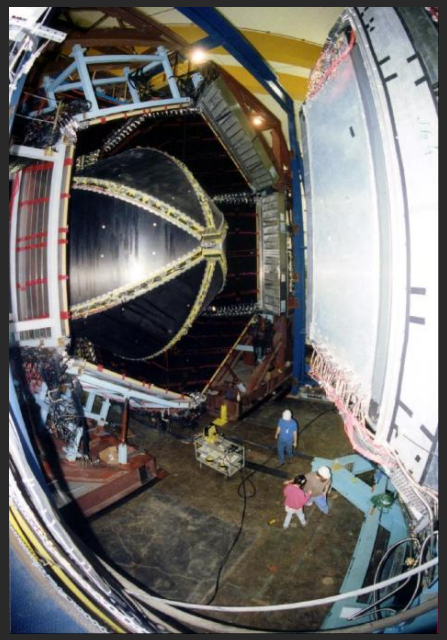
- Charged particle angles 8^o-144^o
- Neutral particle angles 8^o-70^o
- Momentum resolution ~0.5% (charged)
- Angular resolution ~0.5 mr (charged)
- Identification of p, π^+/π^-, K^+/K^-, e^+/e^-, etc.


CLAS: ep → eX, E = 4 GeV
N(1680)
N(1520)
N(940)
Δ(1232)
Q² (GeV²)
W (GeV)
Will Brooks - NuInt02


CLAS: ep → epX, E = 4 GeV
W(GeV)
π⁰
η
ω
Missing Mass (GeV)
Will Brooks - NuInt02

Initial goal: look at single charged pion production in eA data differentially for targets of deuterium, carbon and iron. Compare to GENIE, try to understand results and look at implications for GENIE – nuclear physics and intranuclear rescattering.

eA mode for GENIE enabled by Costas



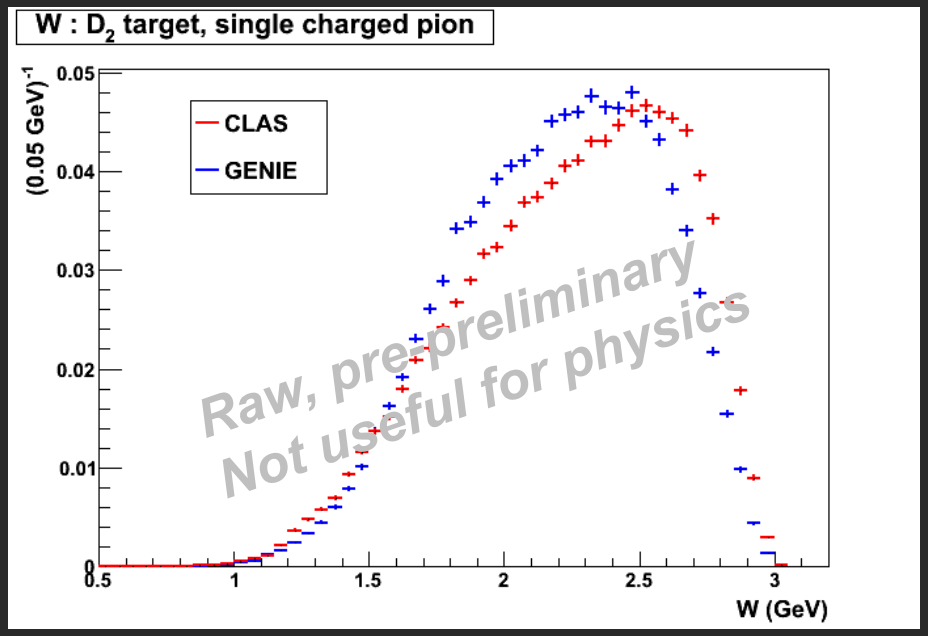
MC events and CLAS data run through same analysis chain

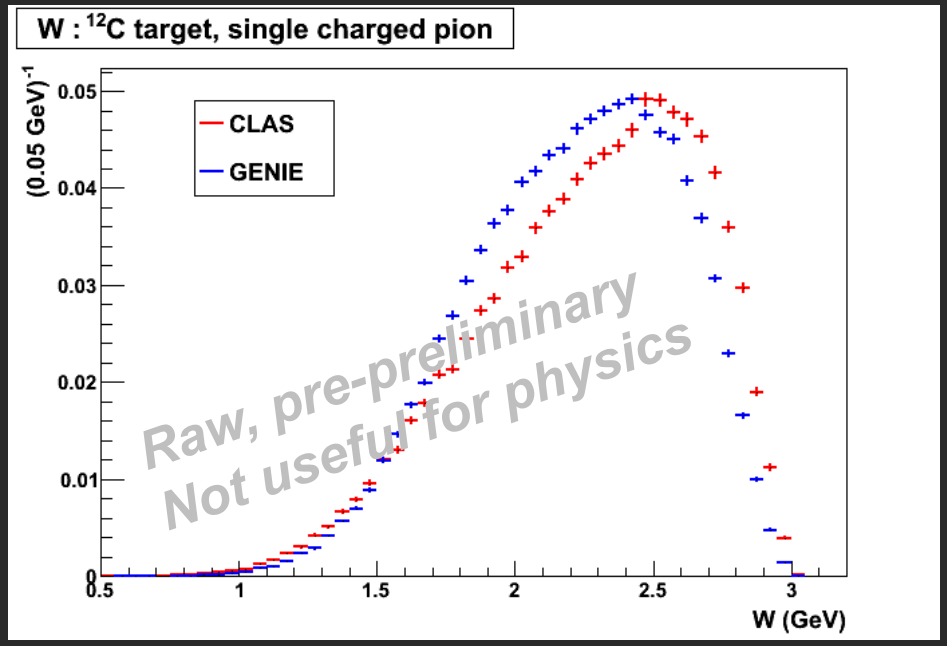
No acceptance or radiative corrections made yet

Statistical errors only and data distributions not blessed by CLAS collaboration at this time

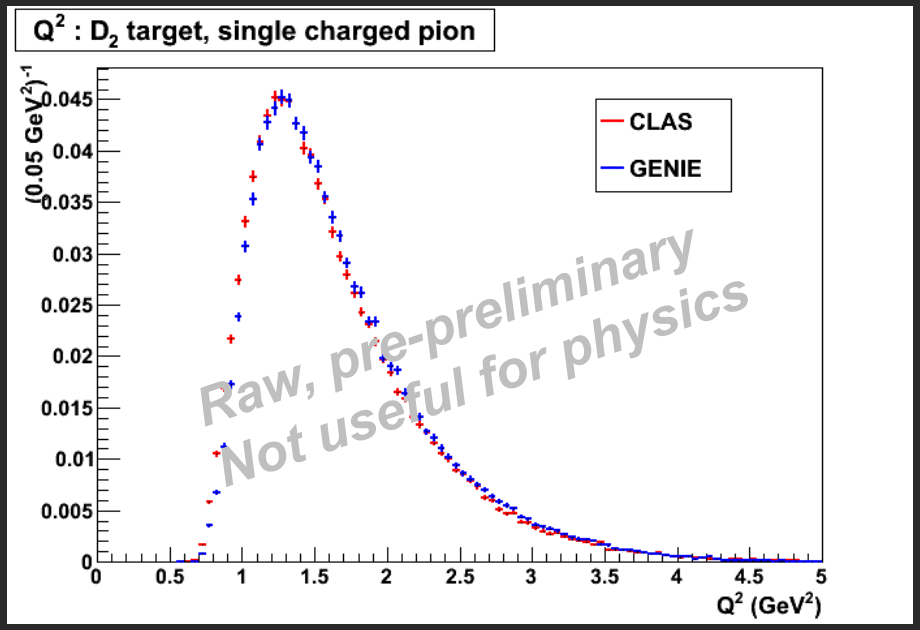
Comparison plots shown only to give indication of things to come – not in ANY way a final comparison. Not to be shown or used for physics.

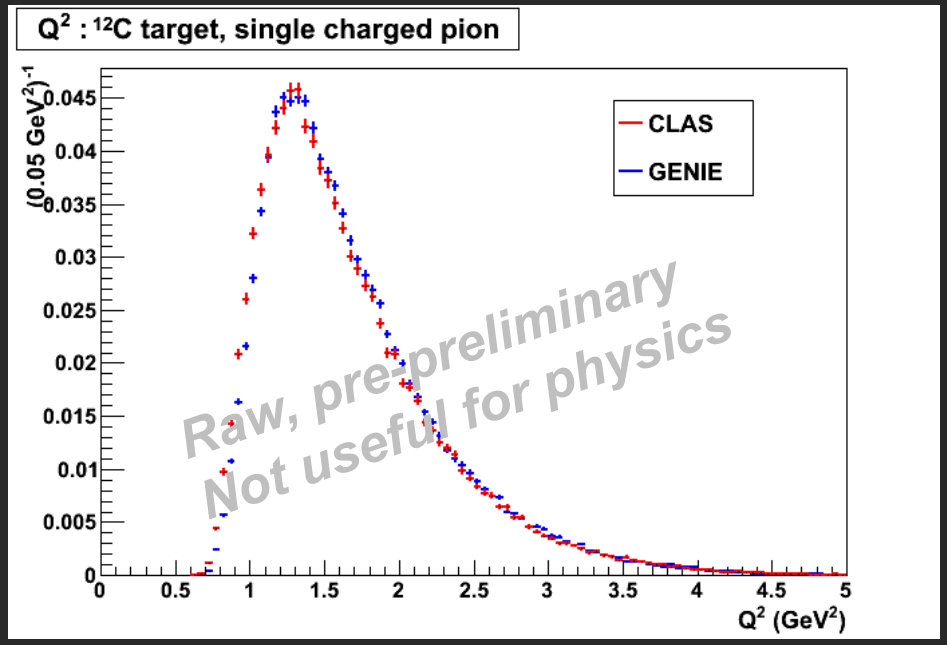
W distribution – demand single pion



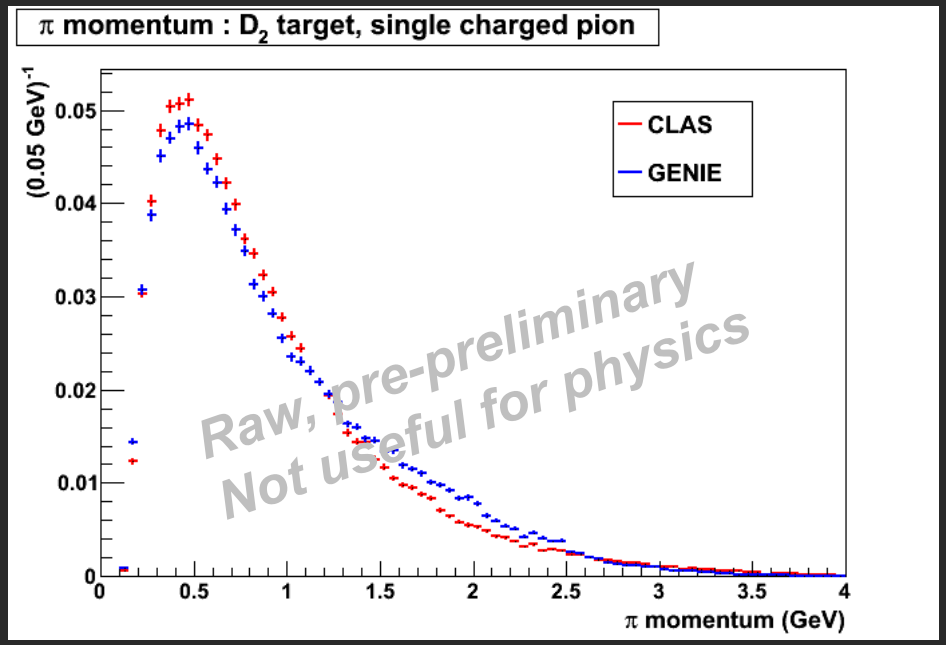


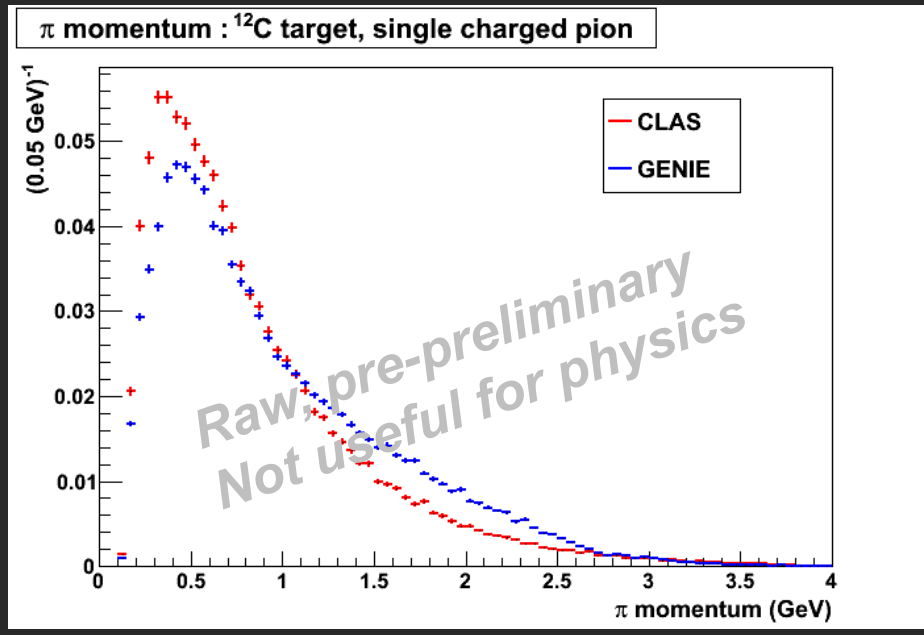
Q^2 distribution – demand single pion





Q^2 distribution – demand single pion





GENIE out of the box looks good enough to use for acceptance corrections and as starting place to study radiative corrections in the analysis

Analysis of data underway

Starting with differential cross sections for single pion production on deuterium, carbon and iron.