Jefferson Lab

Calibrating the CLAS Drift Chambers

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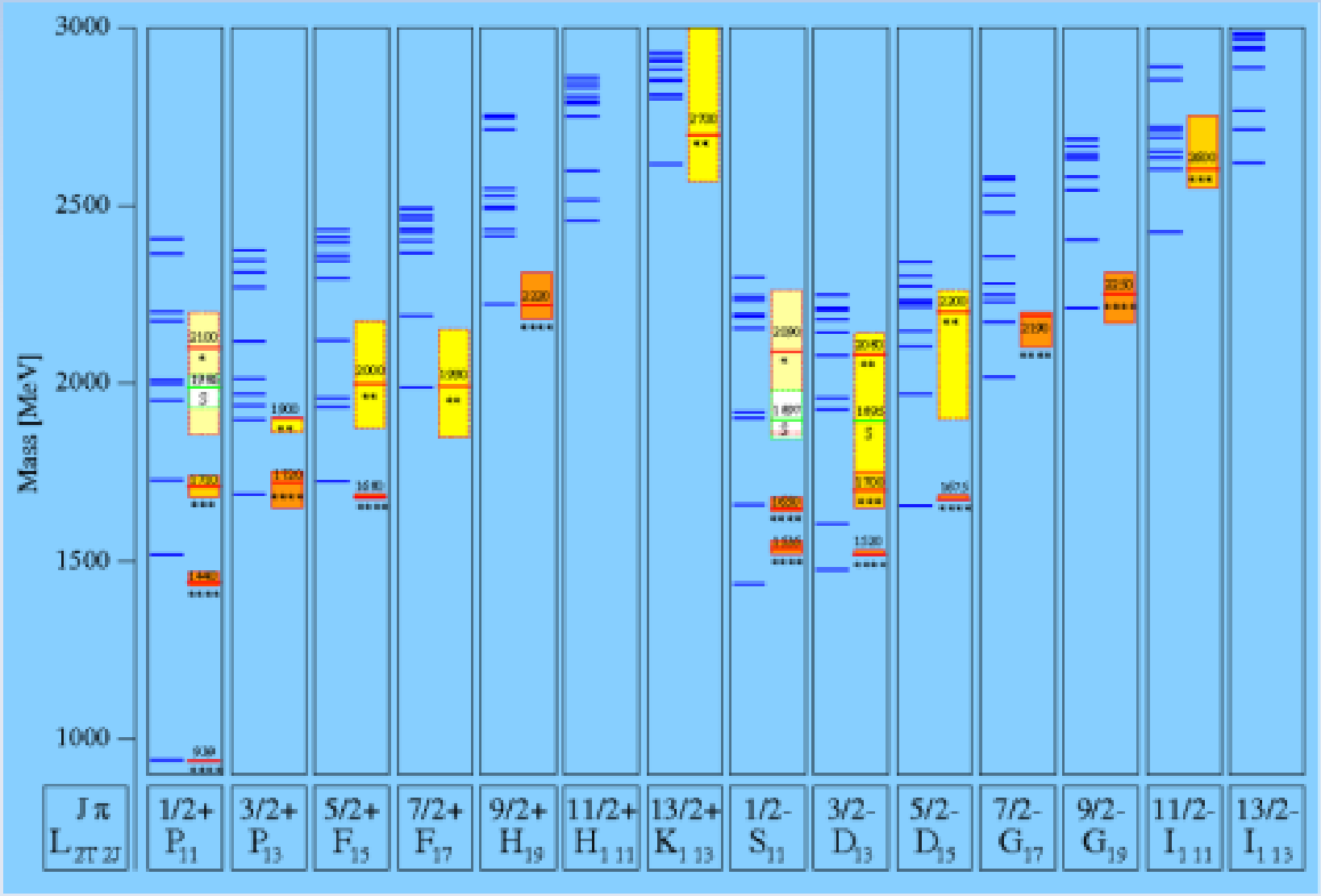
Florida State University October 10, 2008

Nucleon Resonances



—— U. Löhring, B.C. Metsch, and H.R. Petry. Eur. Phys. J. A10, 395-446(2001)

Unseen Resonances?

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N Spectrum	11	3	6	2
Δ Spectrum	7	3	6	6

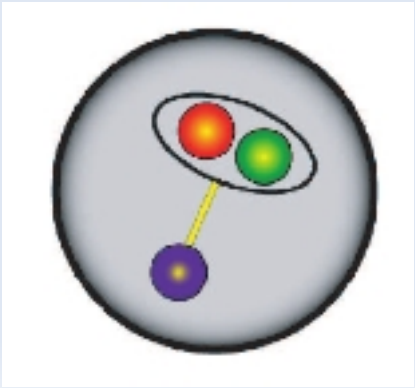
according to PDG
(Phys. Rev. D66 (2002) 010001)

Many questions remain unanswered.

Possible Solutions:

Quark-Diquark Structure:

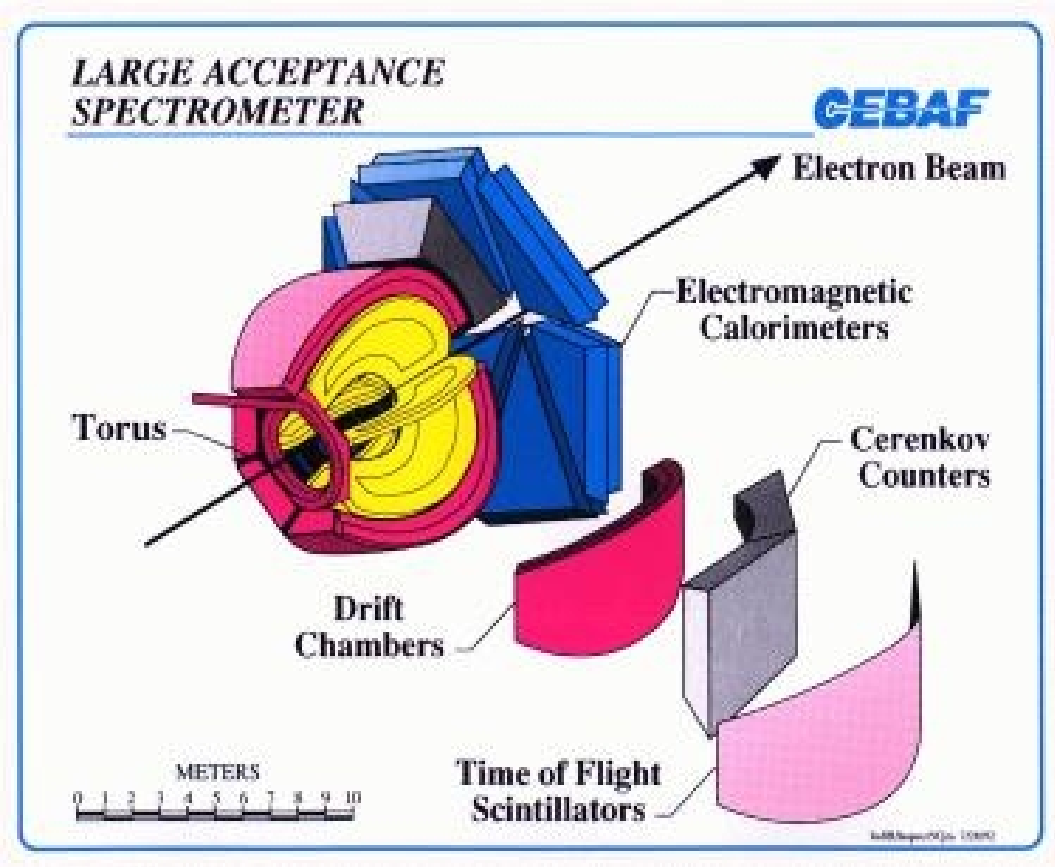
Two quarks somehow form one object; reducing degrees of freedom.

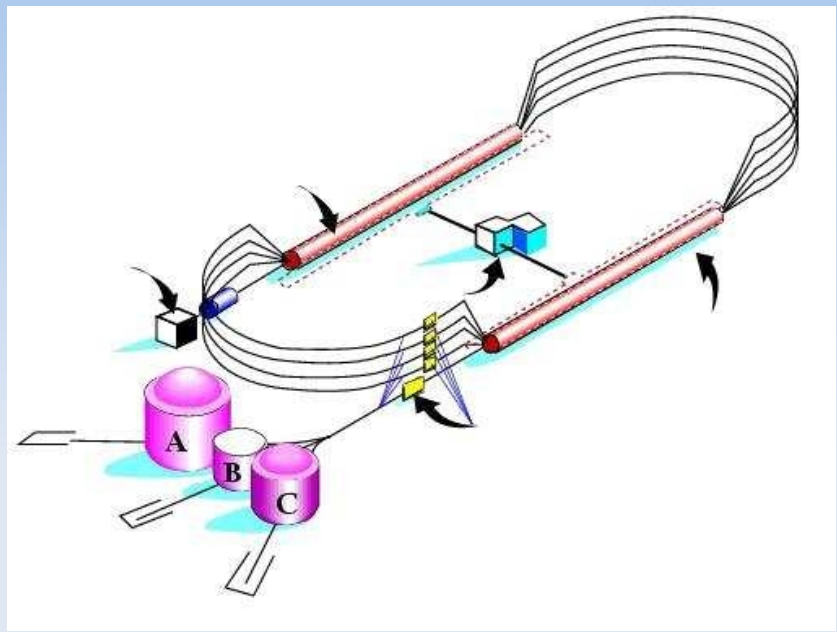


Yet to be discovered:

Nearly all previous experiments are pion-nucleon scattering. Some states may couple weakly to pion-nucleon interactions.
Use Photo-Production!

CEBAF Large Acceptance Spectrometer

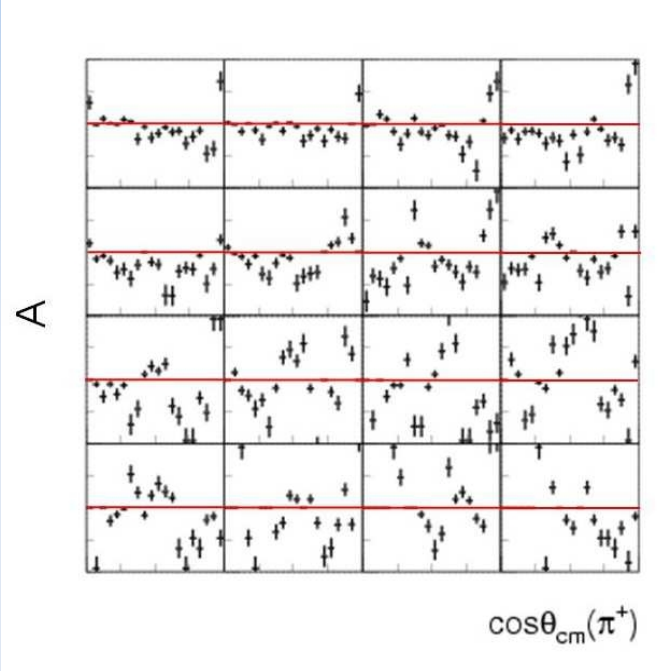




CLAS is ideal for measuring charged decay particles.

Double Polarization

Raw Asymmetry

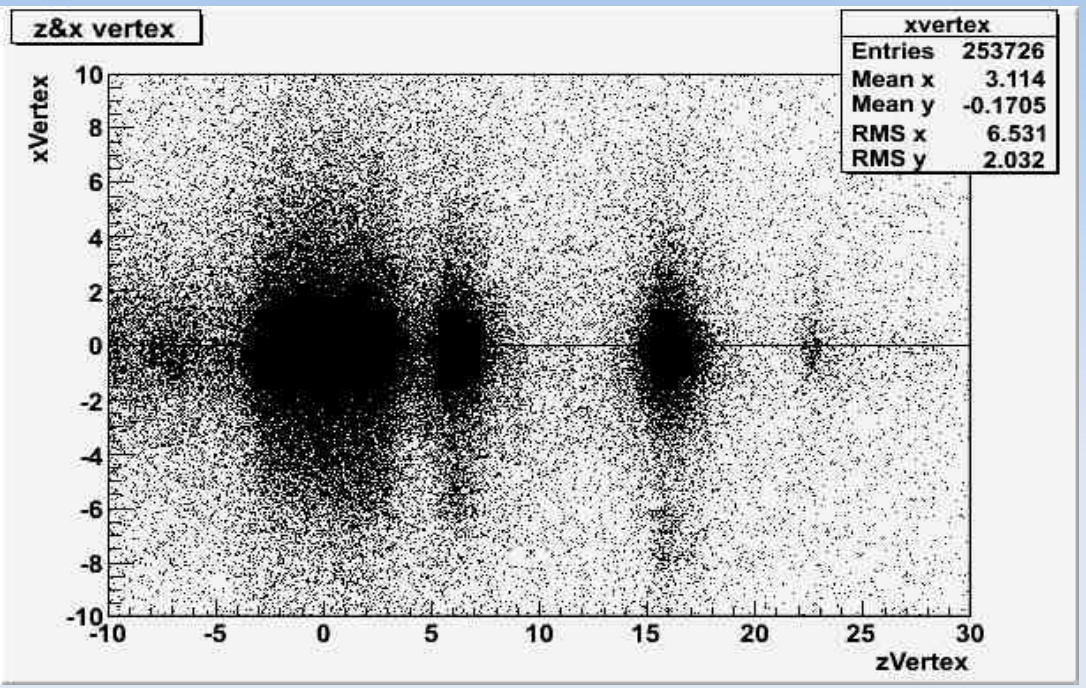


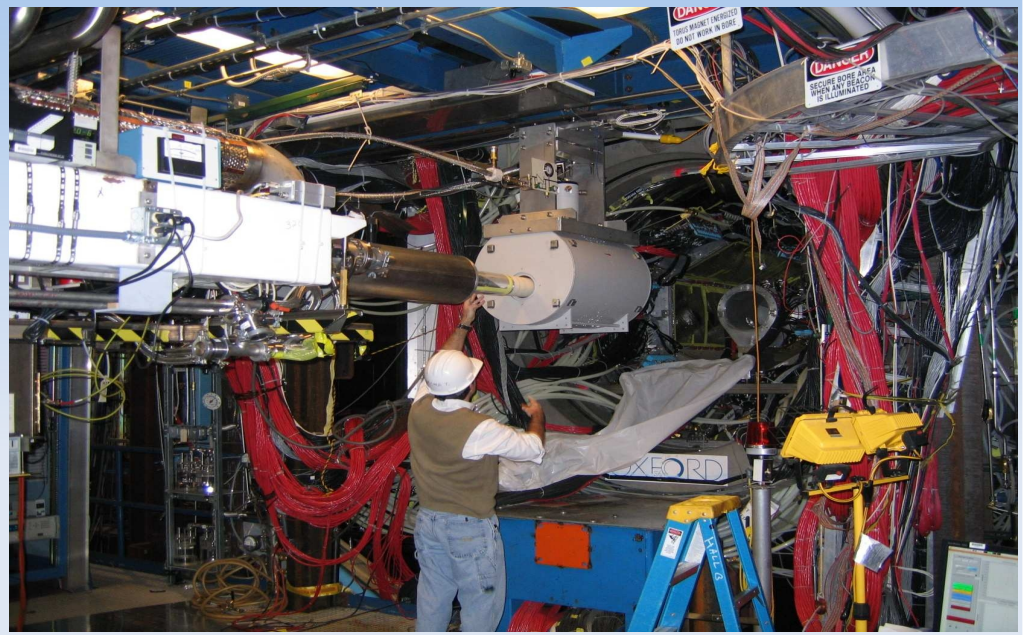
Polarization observables will help identify new resonances by providing constraints that reduce ambiguities in the data description.

Linearly and circularly polarized photons incident on a longitudinally polarized target(protons). Polarizations can be either parallel or anti-parallel.

$A = (N \leftarrow\Leftarrow - N \leftarrow\Rightarrow)/(N \leftarrow\Leftarrow + N \leftarrow\Rightarrow)$

Frozen Spin Target (FROST)





Three Targets:

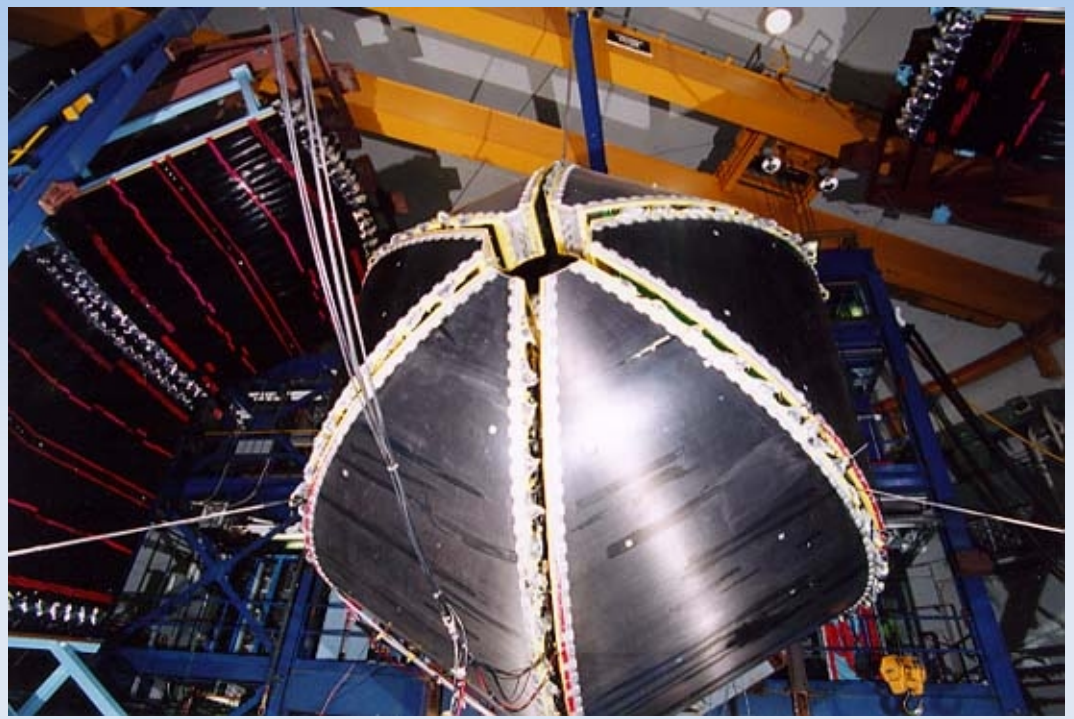
1-Butanol (C_4H_9OH)(polarized hydrogen)

2-Carbon (graphite)

3-Polyethylene (CH_2)

Doping with free radicals(TEMPO). Polarization transfer by microwave.

First Assignment



Drift Chambers:

-Detect charged particles by the ionization of gas.

-Determine the momentum of particles through toroidal magnetic field.

Drift Chamber Calibration:

-Done by fitting the “Drift Velocity Function”

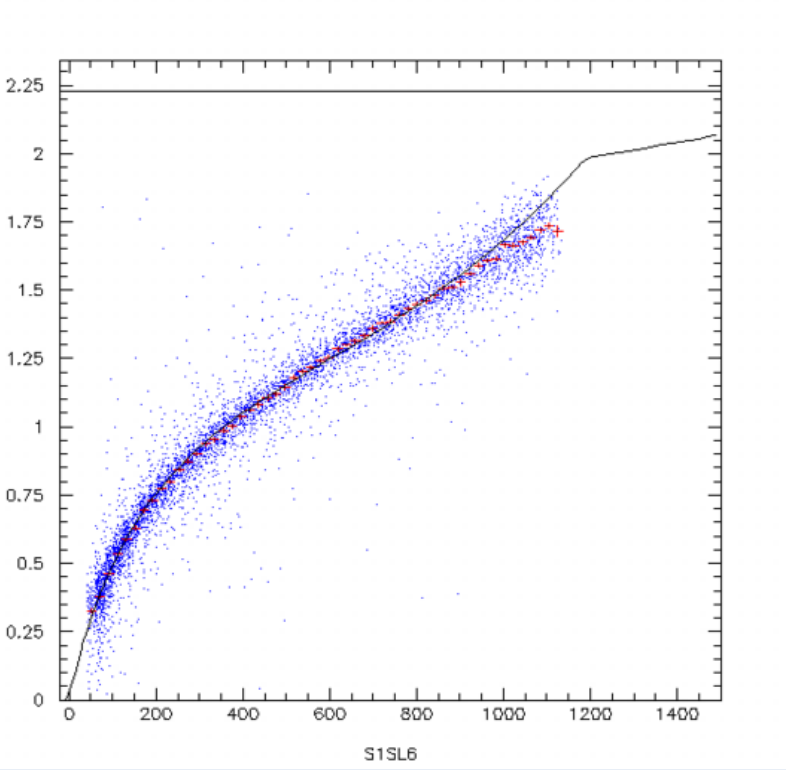
-calculated distance to sense wire vs. drift time

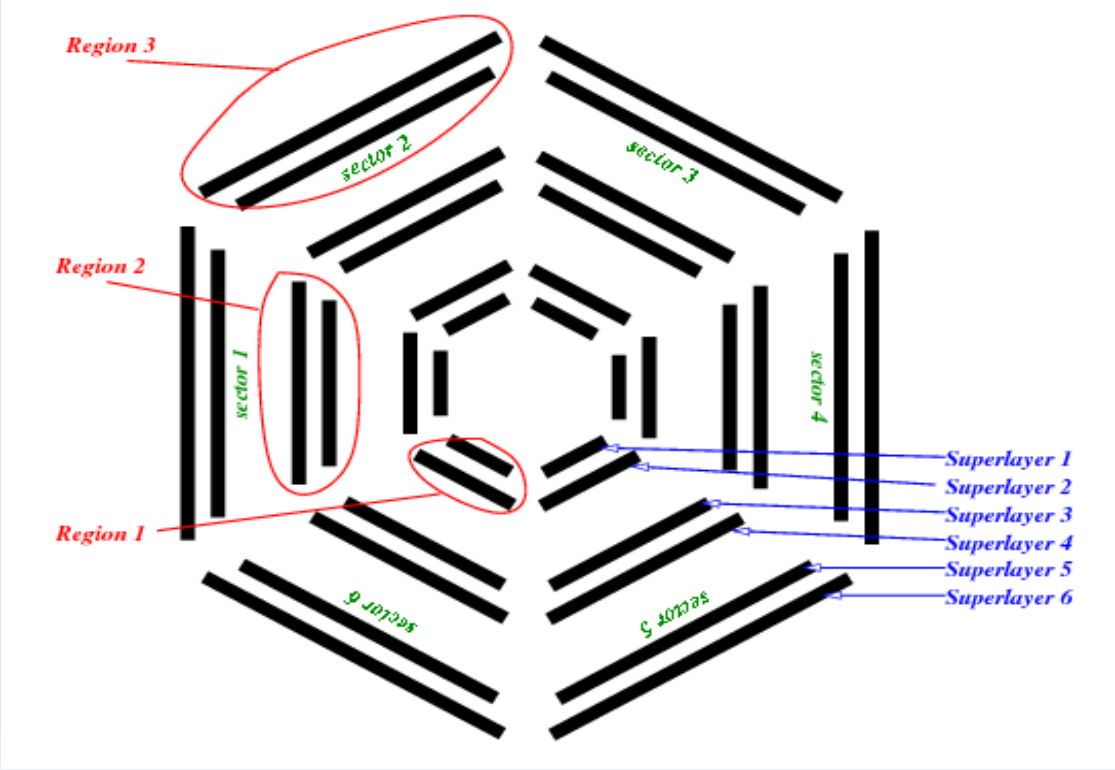
-programs: trk_mon and dc3

Calibration...

Many factors (humidity, temperature, pressure...) can affect the calculated distance vs. drift velocity scatter plot. The function must be refitted.

Independent fitting must be done for every superlayer and every sector. Thirty-six different distance vs. drift velocity functions

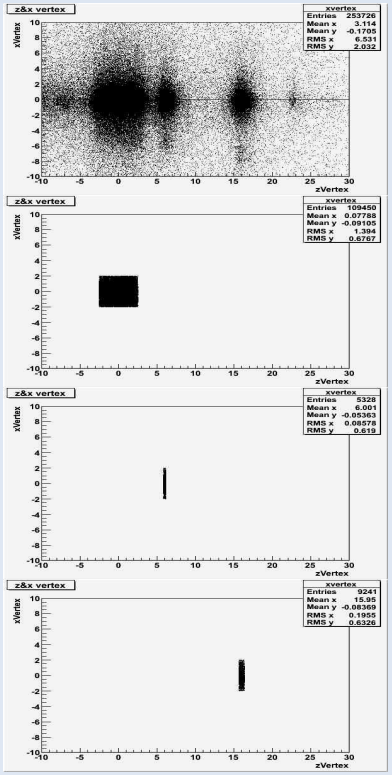




Current Project

Extraction and interpretation of information from data banks through ROOTBEER.

Vertex Cuts:

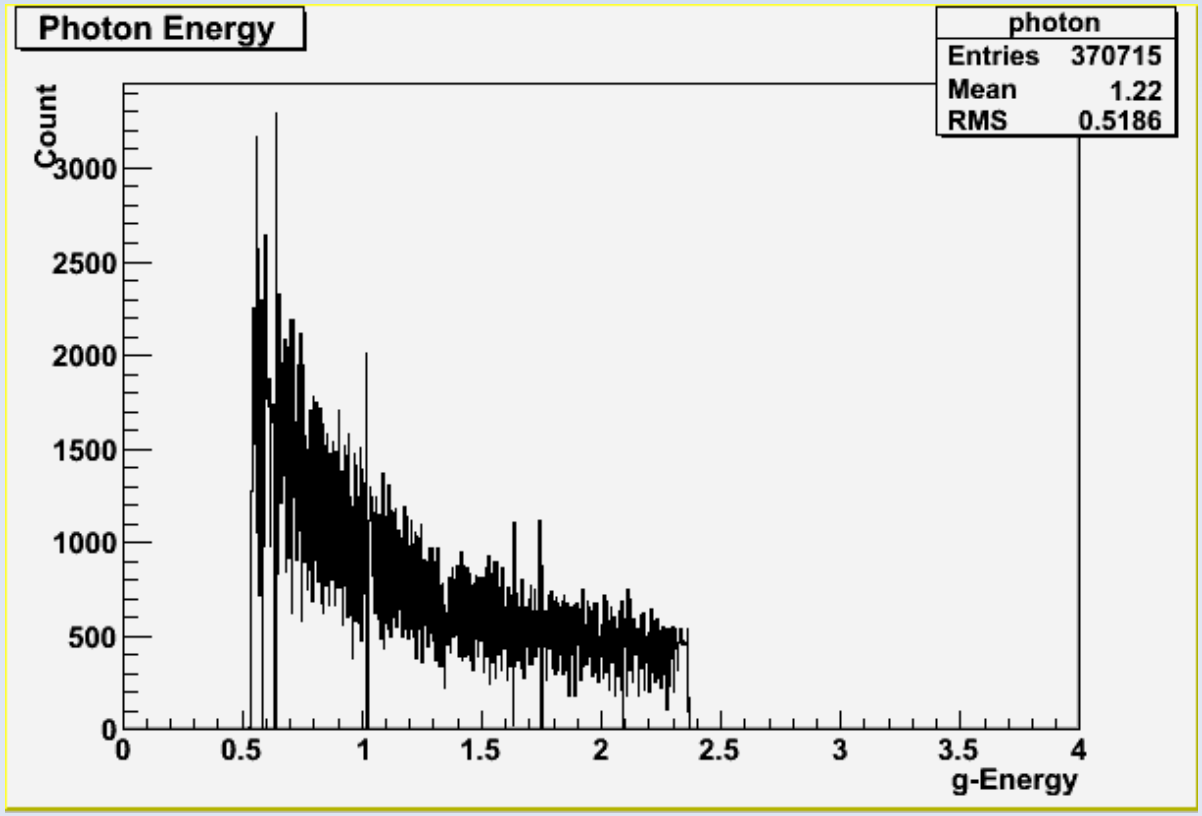


none

butanol

carbon

polyethylene



Summary and Outlook

Double-Polarization Program-

- -almost complete sets for Nπ, Nη, Nππ, ...
- -FROST completed longitudinal polarization in Spring 2008
- -Transverse polarization scheduled for 2009

Analysis-

-Calibration near completion.

-Look for polarization observables in double-pion reactions.

Acknowledgments

Volker Crede, "Baryon Spectroscopy with CLAS", Montpellier, 07/08/2008
"Overview of CLAS Physics", Montpellier, 07/08/2008

Thomas Jefferson National Accelerator Facility website, "www.jlab.org"

D. Lawrence, M. Mestayer. "CLAS Drift Chamber Calibration: Software and Procedures". April 27, 2005.