

EG4 Status Report

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Seoul National University

June 18th, 2010 @J-Lab

Introduction

Goal of Experiment:

The generalized Gerasimov-Drell-Hearn(GDH) Sum Rule for proton & deuteron at low Q^2 (0.01 - 0.5 GeV²) by measuring the g_1 then its first moment(Γ_1).

Measurements:

- ▶ Using the inclusive spin-dependent electron-proton scattering,
- ▶ Measure the spin structure function g_1 , down to 6° of electron scattering angle, from

$$\frac{d\sigma^{\rightarrow\leftarrow}}{dE'd\Omega} - \frac{d\sigma^{\rightarrow\Rightarrow}}{dE'd\Omega} = \frac{4\alpha^2}{Q^2} \frac{E'}{ME\nu} \left[(E + E' \cos\theta) \underline{g_1(x, Q^2)} - 2Mxg_2(x, Q^2) \right]$$

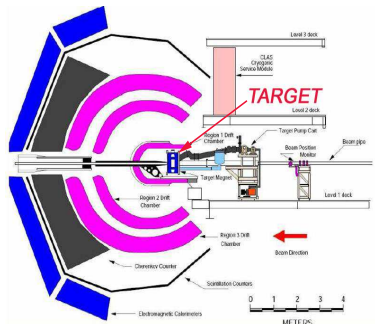
- ▶ and Evaluate the generalized GDH integral:

$$I_{GDH} = \frac{16\pi^2\alpha}{Q^2} \Gamma_1 = \frac{16\pi^2\alpha}{Q^2} \int_0^1 g_1(x) dx$$

Experimental Set-up

About the experiment:

- ▶ Data taken from February to May 2006
- ▶ Used beam energies: 1.5(for commissioning), 1.3, 1.0, 2.0, 2.3, 3.0 GeV.
- ▶ Targets: $^{15}\text{NH}_3$ for (Longitudinally) polarized proton and $^{15}\text{ND}_3$ for Deuteron

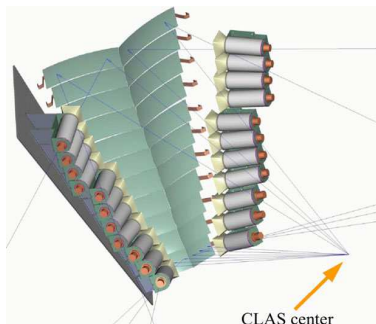


- ▶ New Cherenkov Detector(from INFN-Genova) installed in Sector 6 for high electron detection efficiency.
- ▶ Out-Bending torus field
- ▶ Target Polarizations: Proton near 80% and Deuteron near 35%.

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Overall Status

Spokepersons:

*NH*₃: M. Battaglieri, A. Deur, R. De Vita, M. Ripani (Contact)

*ND*₃: A. Deur (Contact), G. Dodge, K. Slifer

Post Doc.:

S. K. Phillips

Ph.D. Students:

K. Adhikari, H. Kang, K. Kovacs

Institutions:

INFN Genova, J-Lab, Old Dominion U., Seoul National U.,

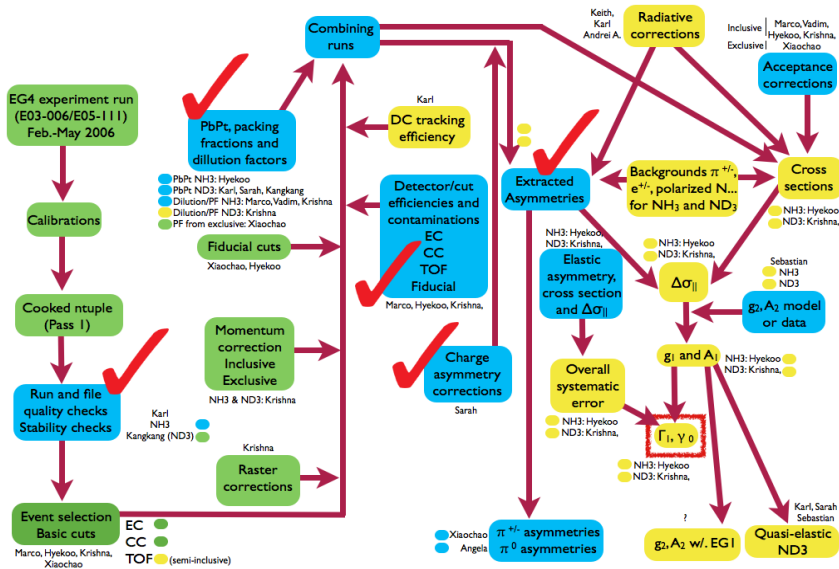
U. of New Hampshire, U. of Virginia

Overall Status

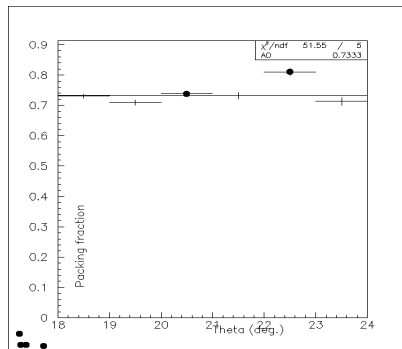
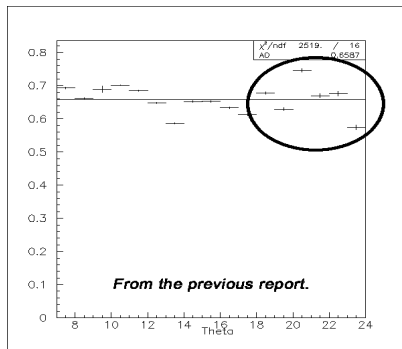
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EG4 Analysis Flowchart

Color code: ● Done ● under way ● to be done



Packing Fraction from Vadim Drozdov



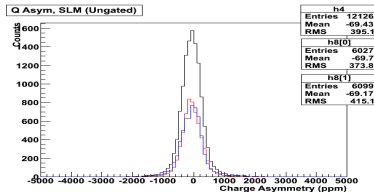
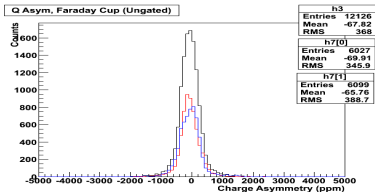
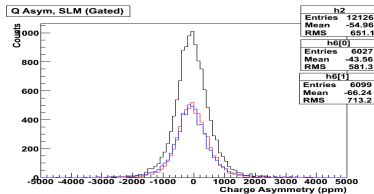
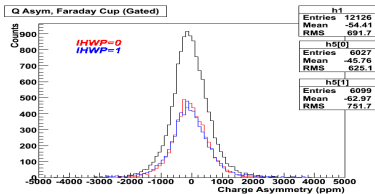
Packing Factor by fitting experimental data to simulated data.

- ▶ Basic electron selection cuts and fiducial cuts are used.
- ▶ corrections for quasielastic ^{15}N and for nuclear elastic peak of ^{15}N are applied.
- ▶ Independent analysis in terms of difference of cross section is to be compared with.

Charge Asymmetry from Sarah Phillips

Charge Asymmetry(Faraday Cup gated and SLM gated)

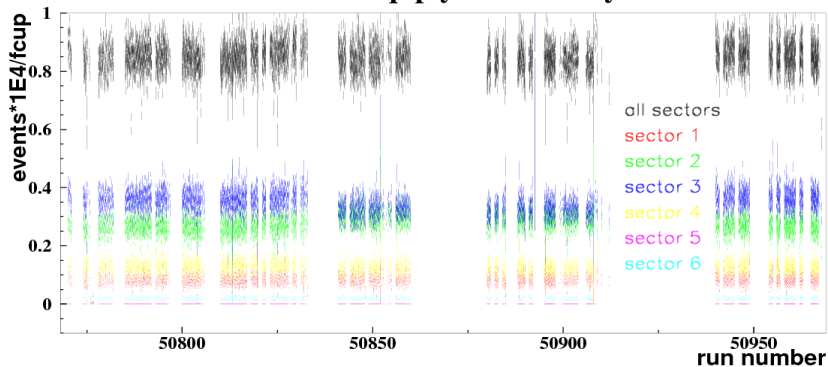
- ▶ Charge asymmetry obtained from file by file and Results from each 6 beam energy are checked.
- ▶ No big problems are shown. Tiny tails can be simply cut off.



Stability Checks from Xiaochao Zheng

- ▶ Yield check using π^+ channel for each target and for all 6 Beam energies.
- ▶ Unstability at 2.0 GeV NH_3 runs are not understood yet.

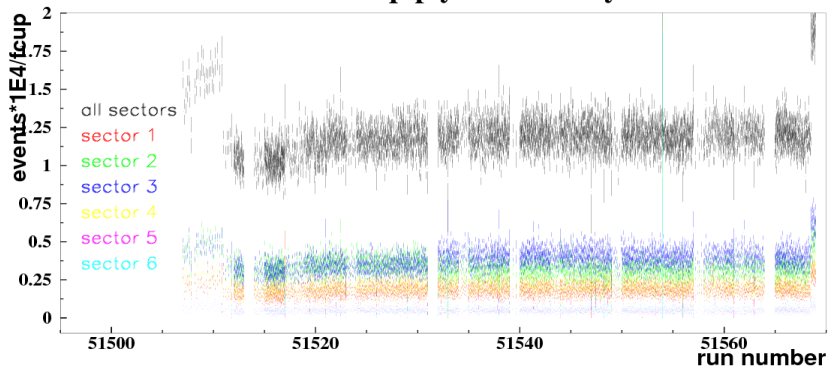
3 GeV nh3l runs pip yield stability check



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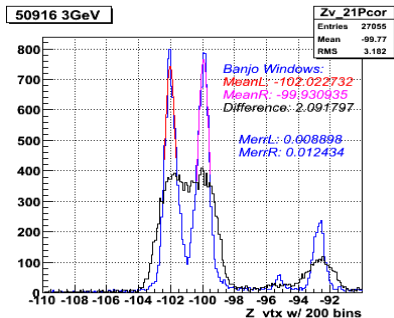
2 GeV nh3l runs pip yield stability check



Banjo Length and CC inefficiency Study by K.Adhikari

Banjo Length Study

- ▶ Discrepancy between a direct measurement(2.18cm) and obtained number from vertex distributions(using empty w/o He target).
- ▶ A direct measurement might not reflect the whole situations of the experiment.

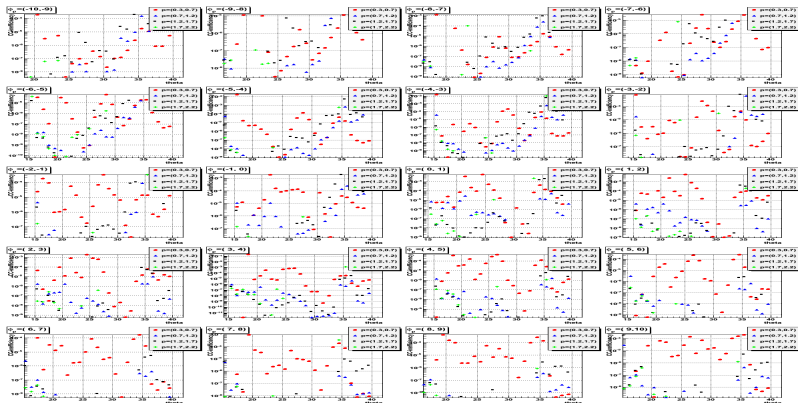


- ▶ Distance bet. two peaks are the banjo length.
- ▶ The values from each beam energy are averaged.
- ▶ Obtained banjo length is **2.10 ± 0.02 cm.**

Banjo Length and CC inefficiency Study by K.Adhikari

Study of Inefficiency of Cherenkov Counter

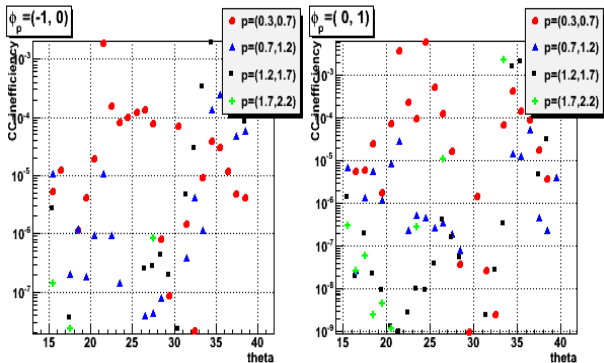
- ▶ inefficiency = $\exp(-\langle N_{phe} \rangle - 1.0)$ for each kinematic bin(p, θ, ϕ) for each beam energy



Banjo Length and CC inefficiency Study by K.Adhikari

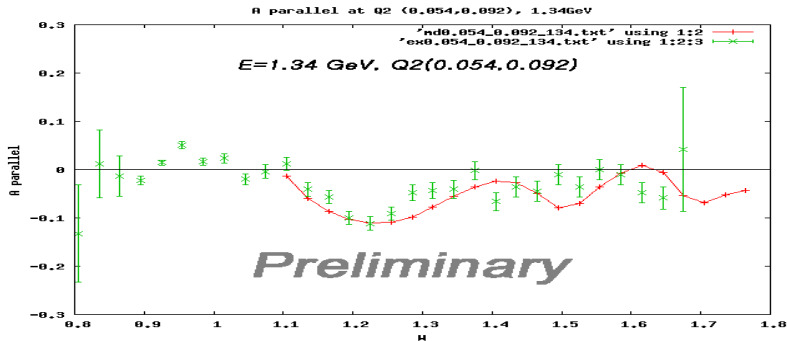
Study of Inefficiency of Cherenkov Counter

- ▶ inefficiency = $\exp(-\langle N_{phe} \rangle - 1.0)$ for each kinematic bin(p, θ, ϕ) for each beam energy



- ▶ Inefficiency might be at least **less than** 10^{-3} .

Deuteron Asymmetry from K. Kovacs

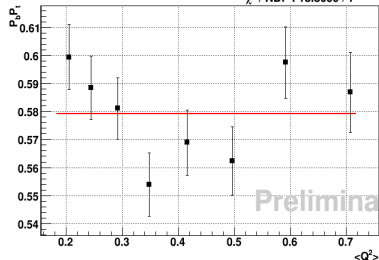


- ▶ Extracted asymmetry after $P_b P_t$ (under way) and dilution factor (under way) analysis.
- ▶ Agreements with Model build by Peter Bosted (See a red line).

P_t monitoring and $P_b P_t$ from H. Kang

$P_b P_t$ results

$P_b P_t$ from 3 GeV Runs

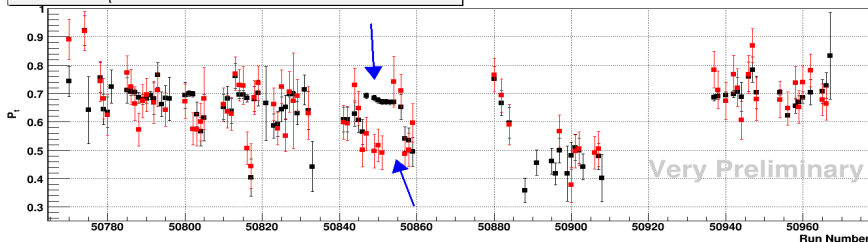


- ▶ Finalized momentum corrections are applied.
- ▶ Still, the Q^2 dependence is investigated.

P_t monitoring

- ▶ P_t from elastic events has low statistics.
- ▶ P_t including inelastic events is tried for more statistics.
- ▶ Determined P_t and P_t with inelastic events are well matched.

P_t (Black) | P_t (Red, including Inelastic evnts) from 3.0 GeV Runs



Summary

Works done recently:

- ▶ Banjo Length is determined to be 2.10 ± 0.02 cm.
- ▶ Beam Charge Asymmetries (Almost).
- ▶ Analysis of “Osipenko” cuts (Almost).
- ▶ Deuteron Physics Asymmetries (Preliminary).

Works in Progress:

- ▶ CC inefficiency studies.
- ▶ $P_b P_t$, Packing fraction and Dilution factor.
- ▶ Stability checks.
- ▶ Proton Physics Asymmetries.

Thank you!

From elastic events:

$$\blacktriangleright P_t = \frac{A_{measured}}{P_b \cdot DF \cdot A_{phys}}$$

Including inelastic events:

$$\blacktriangleright P_b P_t A_{phys} / 0.75 = A_{measured} \frac{1}{DF} / 0.75$$