THE SPIN STRUCTURE FUNCTION g_2 FROM SLAC E155X

STEPHEN ROCK
UNIVERSITY OF MASSACHUSETTS
REPRESENTING THE E155X COLLABORATION

April, 2002

- EXPERIMENT
- SOME THEORY
- g_2 AND A_2 FOR PROTON/DEUTERON
- Q^2 DEPENDENDENCE OF g_2 AND A_2
- TWIST-3 MATRIX ELEMENT d_2
- SUM RULES
- π^- ASYMMETRIES
- FUTURE

E155/E155x Collaboration

P. Anthony, R. Arnold, T. Averett, H. Band, N. Benmouna, C. Berisso, H. Borel
P. Bosted, S. Bültmann, M. Buenerd, T. Chupp, S. Churchwell, G.R. Court
D. Crabb, D. Day, P. Decowski, P. DePietro, R. Erbacher, R. Erickson
A. Feltham, H. Fonvieille, E. Frlez, R. Gearhart, V. Ghazikhanian, J. Gomez
K. Griffioen, C. Harris, M.A. Houlden, E. W. Hughes, C. Hyde-Wright, G. Igo
S. Incerti, J. Jensen, J. Johnson, P. King, Yu. G. Kolomensky, S. Kuhn
R. Lindgren, R. Lombard-Nelsen, J. Marroncle, W. Meyer, J. McCarthy
P. McKee , D. McNulty, G. Mitchell, J. Mitchell, M. Olson, S. Penttila
G. Peterson, G. G. Petratos, R. Pitthan, D. Pocanic, R. Prepost, C. Prescott
L. M. Quin, B. Raue, D. Reyna, L.S. Rochester, S. Rock
O. Rondon-Aramayo, F. Sabatie, S. St. Lorant, I. Sick, L. Sorrell, T. Smith,
F. Staley L. M. Stuart, Z. Szalata, Y. Terrien, L. Todor, A. Tobias, T. Toole,
S. Trentalange, D. Walz, R. Welsh, F.R. Wesselmann, T. Wright, C. Young
B. Youngman, M. Zeier, H. Zhu, B. Zihlmann

American University
Universität Basel
University Blaise Pascal
Ruhr-Universität Bochum
California Inst. of Technology
University of California–Los Angeles
PNC Saclay
Florida International University
Kent State University
University of Liverpool
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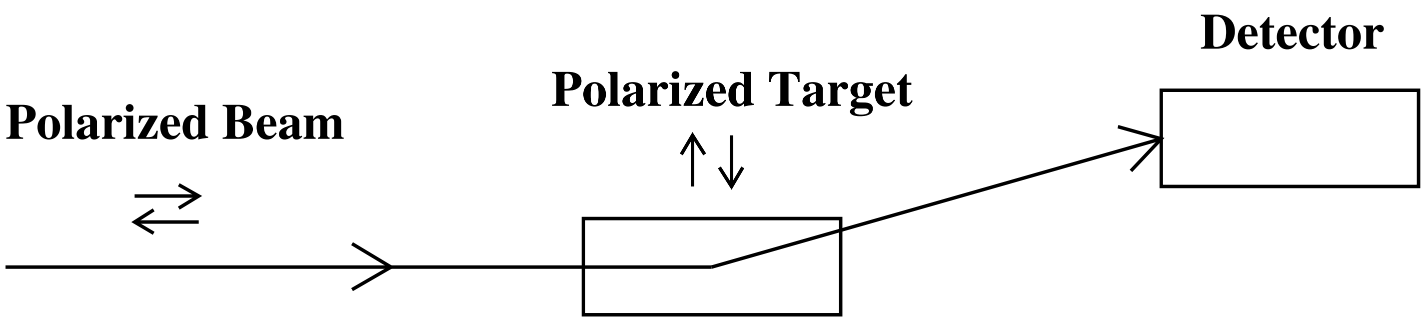
University of Wisconsin

Polarized Deep Inelastic Scattering



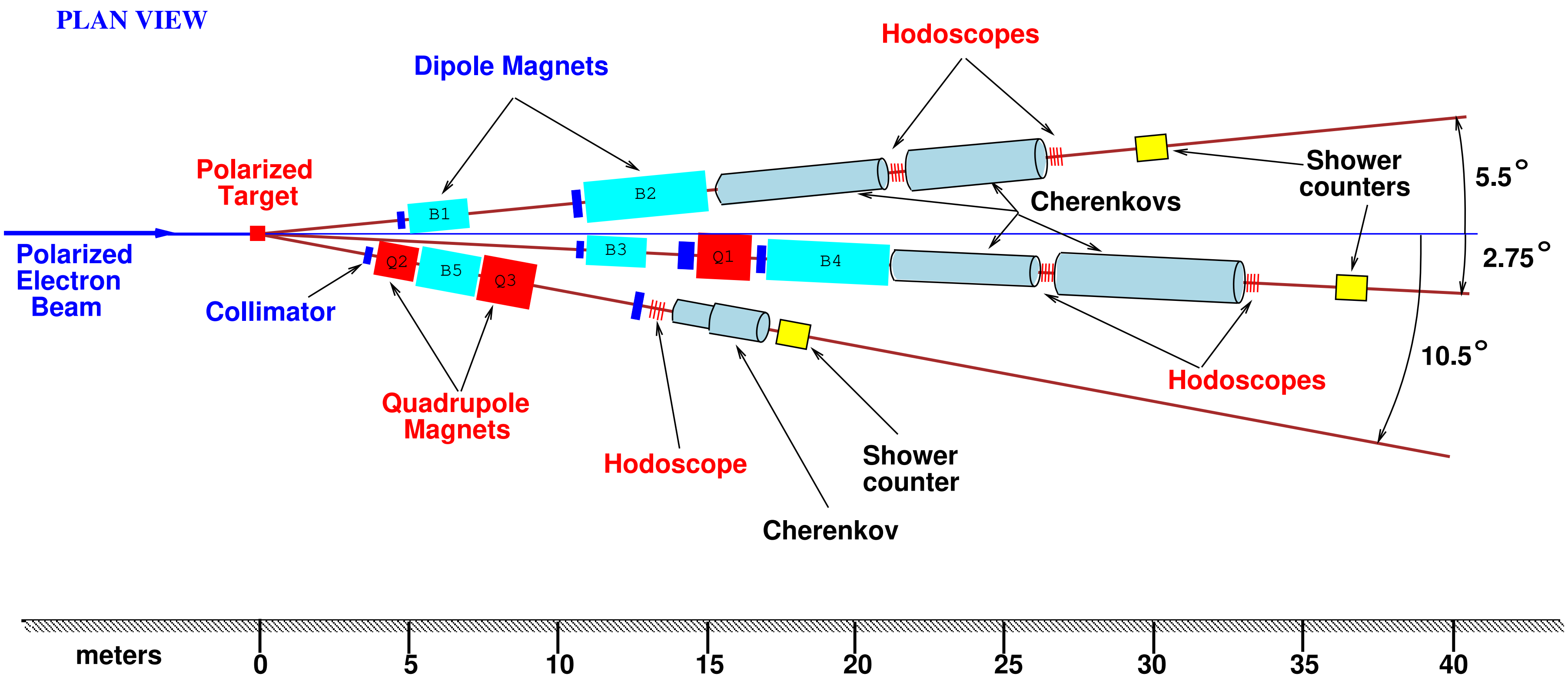
$$A_\perp = \frac{\sigma^{\downarrow\leftarrow} - \sigma^{\uparrow\leftarrow}}{\sigma^{\downarrow\leftarrow} + \sigma^{\uparrow\leftarrow}} = f_k E' \sin(\theta)[g_1(x,Q^2) + \frac{2E}{\nu} g_2(x,Q^2)]$$

$$A_\parallel = \frac{\sigma^{\uparrow\downarrow} - \sigma^{\uparrow\uparrow}}{\sigma^{\uparrow\downarrow} + \sigma^{\uparrow\uparrow}} = f_k[g_1(x,Q^2)[E + E'\cos(\theta)] - \frac{Q^2}{\nu} g_2(x,Q^2)]$$

$\mathbf{g_1}$ and $\mathbf{g_2}$ are the polarized structure functions.

- $\rightarrow$ $\mathbf{A}_\parallel$ is primarily sensitive to g_1
- $\rightarrow$ $\mathbf{A}_\perp$ is more sensitive to g_2
- $\rightarrow$ f_k includes contribution from kinematics and unpolarized structure functions

E155 Spectrometers



EXPERIMENTAL OVERVIEW

- SLAC ELECTRON BEAM:
  - POLARIZATION $P_b = 0.83$
  - ENERGY $E = 29.1$ or $E = 32.3$
  - 120 HZ, 400 nsec SPILLS, 25 nA
- TRANSVERSELY POLARIZED TARGETS:
  - 1 K, 5 T, D.N.P
  - NH3 (PROTONS) $< P_t >= 0.70$
  - LiD (DEUTERONS) $< P_t >= 0.22$
  - RADIATION DAMAGE
- SCATTERED ELECTRONS
  - $2.75^o, 5.5^o$, AND 10.5^o
  - CHERENKOV AND LEAD GLASS FOR PARTICLE I.D.
  - HODOSCOPES FOR TRACKS ($dP/P \approx 0.03$)
- PHOTOPRODUCED INCLUSIVE PIONS

$\boxed{\text{POLARIZED ELECTRON BEAM}}$

- **Intense 29/32 GeV Beam**
- **Highly polarized : $\mathbf{P}_b = 0.832 \pm 0.030$**
- **Helicity varied randomly from pulse to pulse (120 Hz)**
- **Beam polarization measured with Møller detector systems**

$$A = \frac{N_{e^-}(\uparrow\uparrow) - N_{e^-}(\uparrow\downarrow)}{N_{e^-}(\uparrow\uparrow) + N_{e^-}(\uparrow\downarrow)}$$

$$= -P_{beam}P_{foil}\frac{(7+\cos^2\theta_{cm})\sin^2\theta_{cm}}{(3+\cos^2\theta_{cm})^2}$$

$\rightarrow$ **20-50 μm thick target foils**

POLARIZED TARGETS

- **Solid cryogenic targets**
  - Magnet at 5 T
  - Temperature 1K
- **Dynamic nuclear polarization using microwaves**
- **Radiation Damage Limits** $< P_t >$
  - **Raster the Beam**
  - **Anneal**
- ^{15}**NH$_3$ used for proton target**

$\longrightarrow$ **Improved μwave power delivery $\rightarrow < \mathrm{P_t} > \approx$ .70**

$\longrightarrow$ **ERROR 1.7%**

- ^{6}**LiD used for deuteron target**

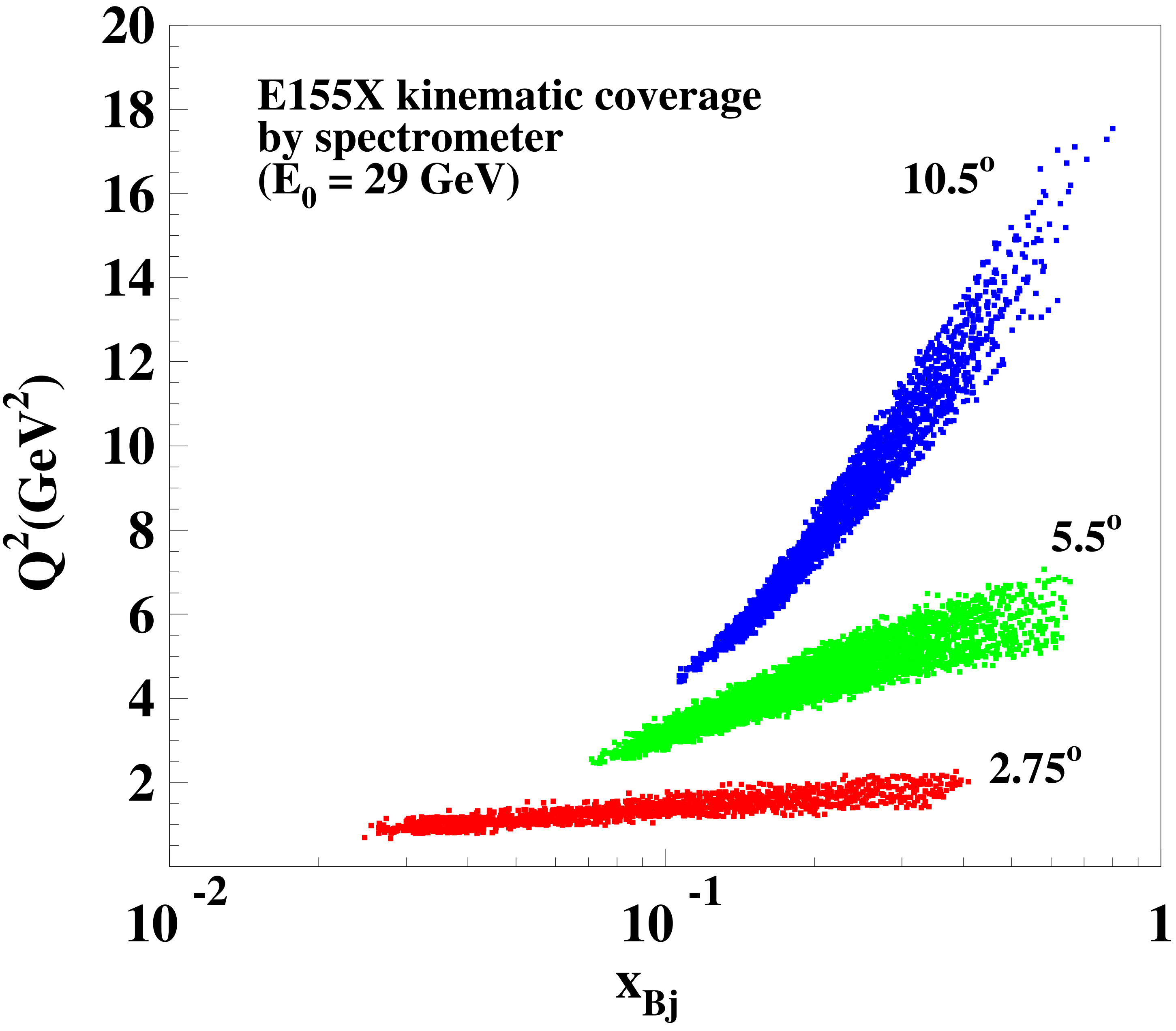
$\longrightarrow$ **LiD $\approx$ 50% improvement in dilution over** $^{15}ND_3$

$\longrightarrow$ **LiD 6 times as radiation resistant**

$\longrightarrow$ $< \mathrm{P_t} > \approx$ **.22**

$\longrightarrow$ **ERROR = 3.5%**

KINEMATICS


E155X kinematic coverage
by spectrometer
(E_0 = 29 GeV)
10.5°
5.5°
2.75°
Q^2(GeV^2)
20
18
16
14
12
10
8
6
4
2
10 -2
10 -1
1
x_{Bj}

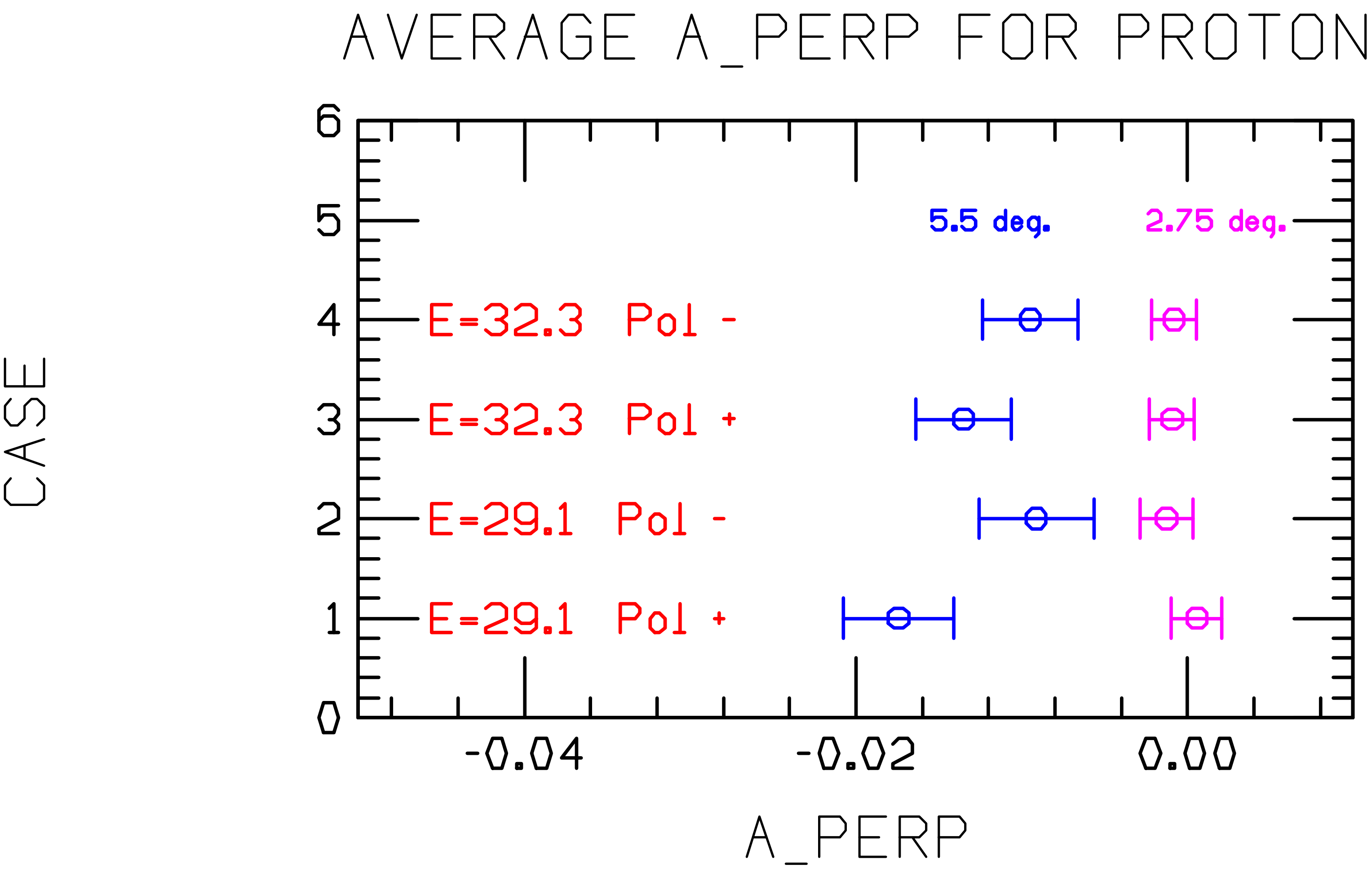
$\boxed{\text{THE } A_\perp \text{ ASYMMETRY}}$

$$\tilde{A_\perp} = \frac{1}{f_{RC}}\Big[\frac{C_1}{fP_t}\Big(\Big(\frac{N_L - N_R}{N_L + N_R}\Big)\frac{1}{P_b} + A_{EW}\Big) + C_2\Big] + A_{RC}$$

- N_L AND N_R ARE RATES FOR L AND R BEAM HELICITY, CORRECTED FOR PAIR-SYMMETRIC CONTRIBUTIONS (FEW PERCENT) AND π MIS-IDENTIFIED AS ELECTRONS (FEW PERCENT)
- $C_1 \approx 1$ CORRECTS FOR POLARIZED ^{15}N or Li
- ADDITIONAL CORRECTION FOR ^{7}Li and LiH CONTAMINATION PLANE OF ELECTRON SCATTERING.
- f IS DILUTION FACTOR (≈ 0.16 PROTON)
- A_{EW}: ELECTROWEAK ASYMMETRY ($\approx 8 \times 10^{-5} Q^2$)
- f_{RC} AND A_{RC}: RADIATIVE CORRECTIONS
  - f_{RC} Mostly from Elastic and Quasi-elastic tail: Increases Statistical Error
  - A_{RC} Mostly From Resonance and DIS

SYSTEMATIC CHECKS

- **TARGET POLARIZATION ALIGNED (+) OR ANTI-ALIGNED (-) WITH B FIELD**
- **BEAM ENERGY CHANGED BY 3.2 GeV TO PRECESS SPIN BY π IN TRANSPORT LINE.**
- **CORRECT FOR EW ASYMMETRY (DEPENDS ONLY ON BEAM HELICITY)**
- **ANY REMAINING FALSE ASYMMETRIES (I.E. HELICITY-DEPENDENT BEAM POSITION) WOULD SHOW UP AS A DIFFERENCE IN AVERAGE $A_\perp$. NONE SEEN.**



DETERMINATION OF g_2 and A_2

- WE USE MEASURED $\tilde{A}_\perp$ and E155 g_1 FIT TO OBTAIN g_2 USING:

$$g_2 = \frac{yF_1}{2E'(\cos\Theta - \cos\alpha)}[\tilde{A}_\perp \nu \frac{(1+\epsilon R)}{1-\epsilon} - \frac{g_1}{F_1}[E\cos\alpha + E'\cos\Theta]]$$

- WE CAN COMPARE g_2 TO THE SIMPLE TWIST-2 MODEL OF WANDZURA-WILCZEK

$$g_2^{WW}(x, Q^2) = -g_1(x, Q^2) + \int_x^1 \frac{dy}{y} g_1(y, Q^2)$$

- WE CAN ALSO EXTRACT VIRTUAL PHOTON-NUCLEON ASYMMETRY

$$A_2(x, Q^2) = \frac{2\sigma_{TL}}{\sigma_T^{1/2} + \sigma_T^{3/2}} = \gamma \frac{g_1(x, Q^2) + g_2(x, Q^2)}{F_1(x, Q^2)}$$

- COMPARE TO POSITIVITY LIMIT
$A_2 < \sqrt{R(x, Q^2)}$

- COMPARE TO SOFFER LIMIT
$A_2 < \sqrt{R(1 + A_1)/2}$

$\boxed{\text{SYSTEMATIC ERRORS}}$

$A_\perp$ ERRORS

- **RADIATIVE CORRECTIONS**
  - Used Many Different Models of $A_\perp$
  - Resonance, twist-3, Quasi-elastic ..
- **MULTIPLICATIVE ERR: 5.1% (p); 6.2% (d)**
  - **TARGET POL: 1.7% (p); 4.5% (d)**
  - **DILUTION FACTOR: 3.0% (p); 2.1% (d)**
  - **BEAM POLARIZATION: 3.7%**

g_2 ERRORS

- **g_1: 5% INCLUDES MODEL ERRORS**
- **POLARIZATION ANGLE**
- **F_2: 2%**
- **R**

SIMPLE FIT USED TO CALCULATE g_2^{WW}

$$Q^2 > 1$$

$$g_1^p/F_1^p = x^{.700}(.817+1.014x-1.489x^2)(1-.04/Q^2)$$

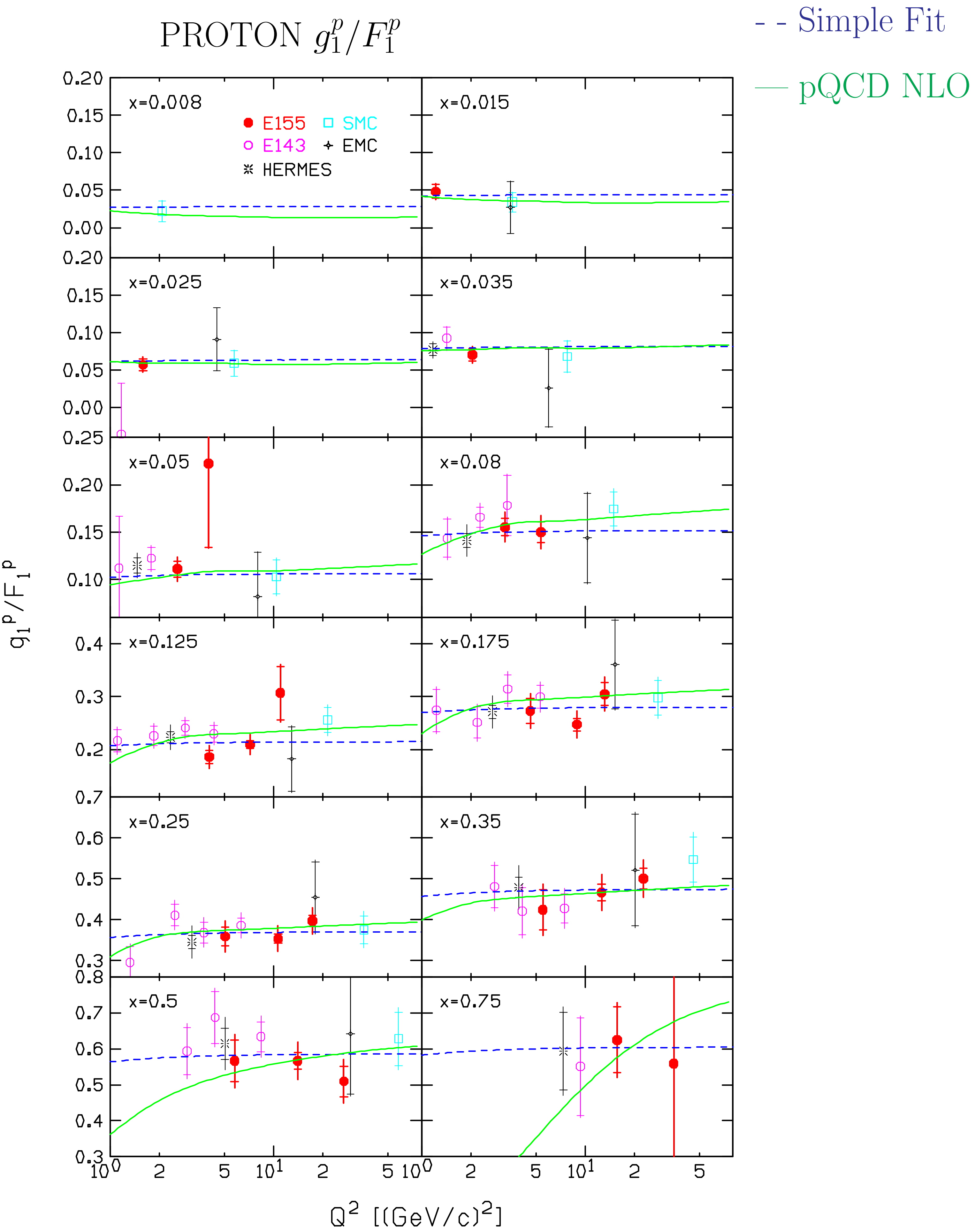
$$g_1^n/F_1^n = x^{-.335}(-.013-.330x+.761x^2)(1+.13/Q^2)$$

Q^2 DEPENDENCE

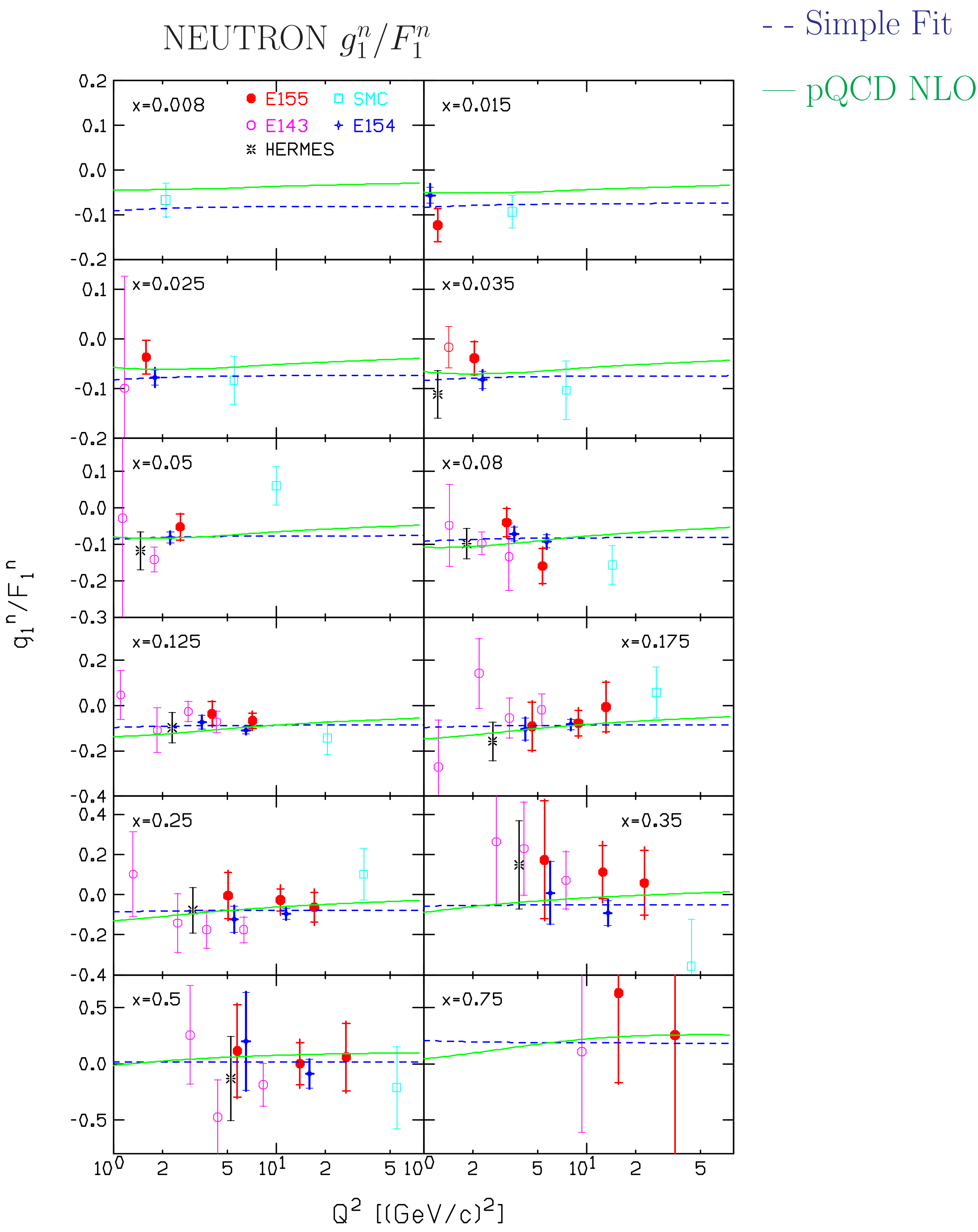
Proton -0.04 ± 0.06

Neutron 0.13 ± 0.45

OTHER FITS USED: INCLUDED IN SYSTEMATIC ERROR ON g_1



PROTON g_1^p/F_1^p
- - Simple Fit
— pQCD NLO
E155
SMC
E143
EMC
HERMES
x=0.008
x=0.015
x=0.025
x=0.035
x=0.05
x=0.08
x=0.125
x=0.175
x=0.25
x=0.35
x=0.5
x=0.75
g_1^p/F_1^p
Q^2 [(GeV/c)^2]



NEUTRON g_1^n/F_1^n
- - Simple Fit
— pQCD NLO
E155
SMC
E143
E154
HERMES
x=0.008
x=0.015
x=0.025
x=0.035
x=0.05
x=0.08
x=0.125
x=0.175
x=0.25
x=0.35
x=0.5
x=0.75
$g_1{}^n/F_1{}^n$
Q^2 [(GeV/c)^2]

$\boxed{\mathbf{g_2(x, Q^2)}\ \text{STRUCTURE FUNCTION}}$

- **Wandzura-Wilczek g_2 expression (twist-2 only)**

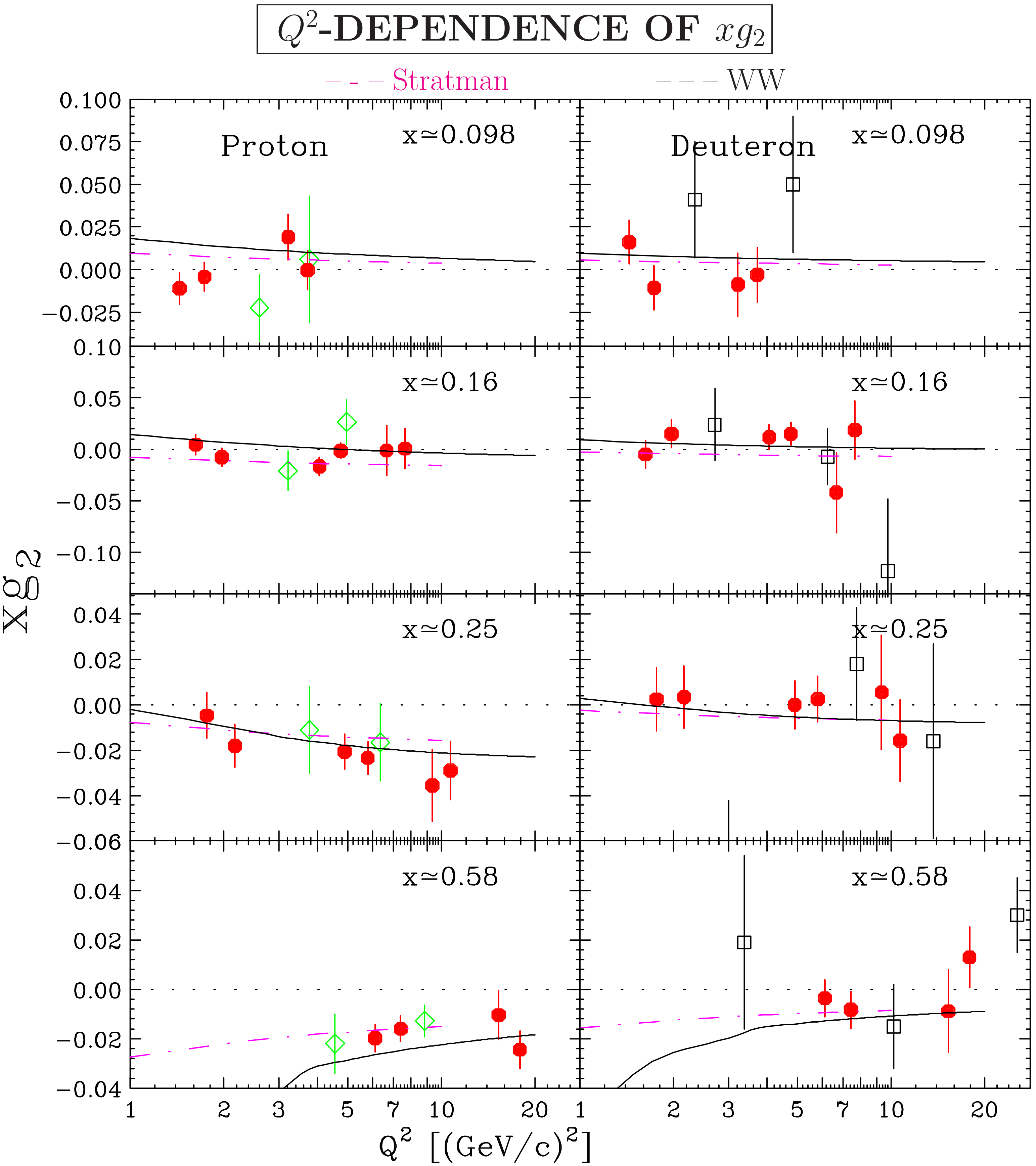
$$g_2^{WW}(x, Q^2) = -g_1(x, Q^2) + \int_x^1 \frac{dy}{y} g_1(y, Q^2)$$

- **In general there are additional contributions.**

$$g_2(x, Q^2) = \underset{\Downarrow}{\overset{\text{twist-2}}{}} g_2^{WW}(x, Q^2) - \int_x^1 \frac{\partial}{\partial y}\Big(\underset{\Downarrow}{\overset{\text{twist-2}}{}}\frac{m}{M} h_T(y, Q^2) + \underset{\Downarrow}{\overset{\text{twist-3}}{}}\xi(y, Q^2)\Big)\frac{dy}{y}$$

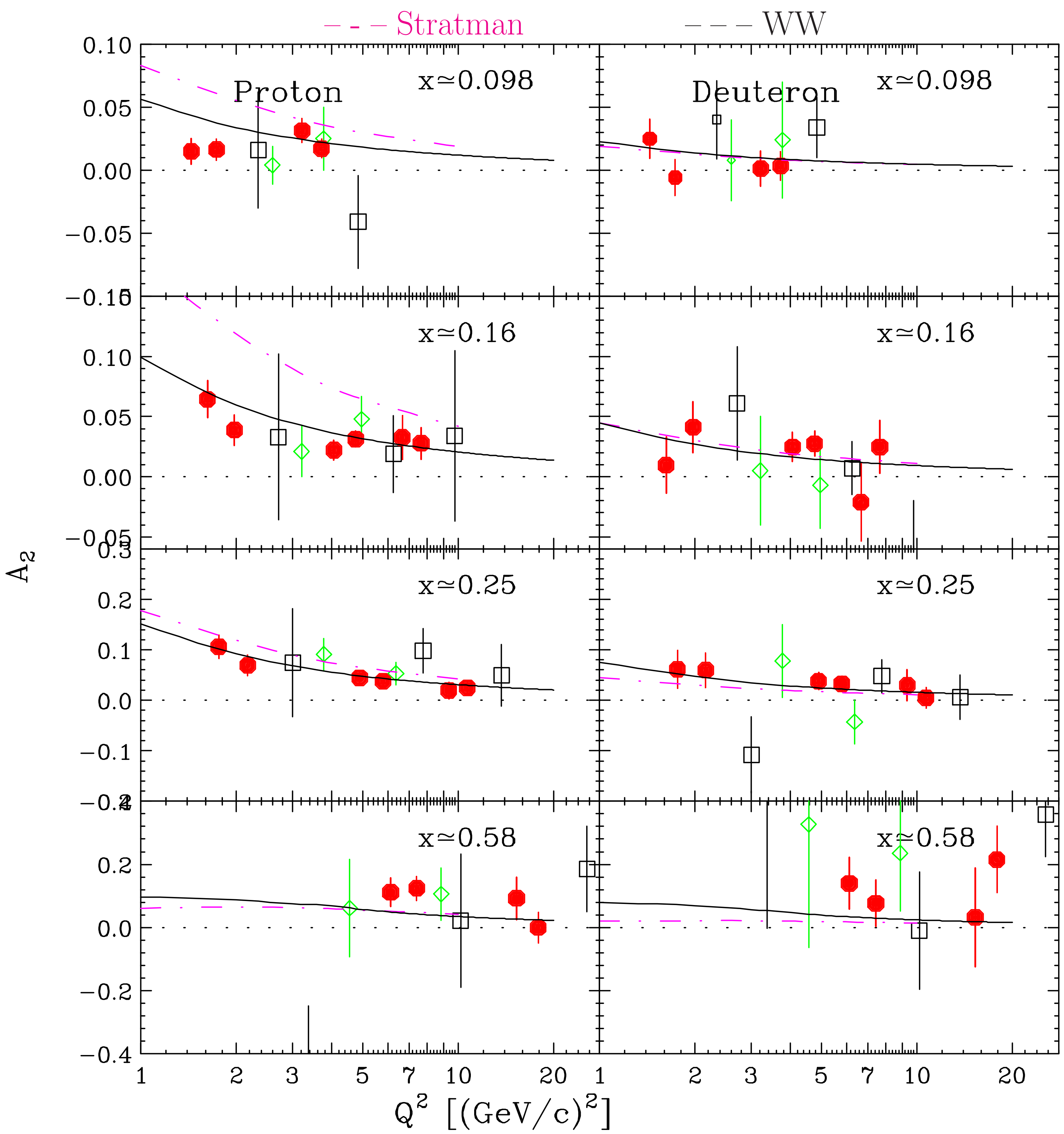
$$= g_2^{WW}(x, Q^2) + \overline{g_2}(x, Q^2)$$

- **$\overline{g_2}$ includes quark-gluon correlations (ξ) inside the nucleon**
- **Twist-2 term (quark transverse spin distribution h_T) in $\overline{g_2}$ suppressed by $\frac{m}{M} << 1$**

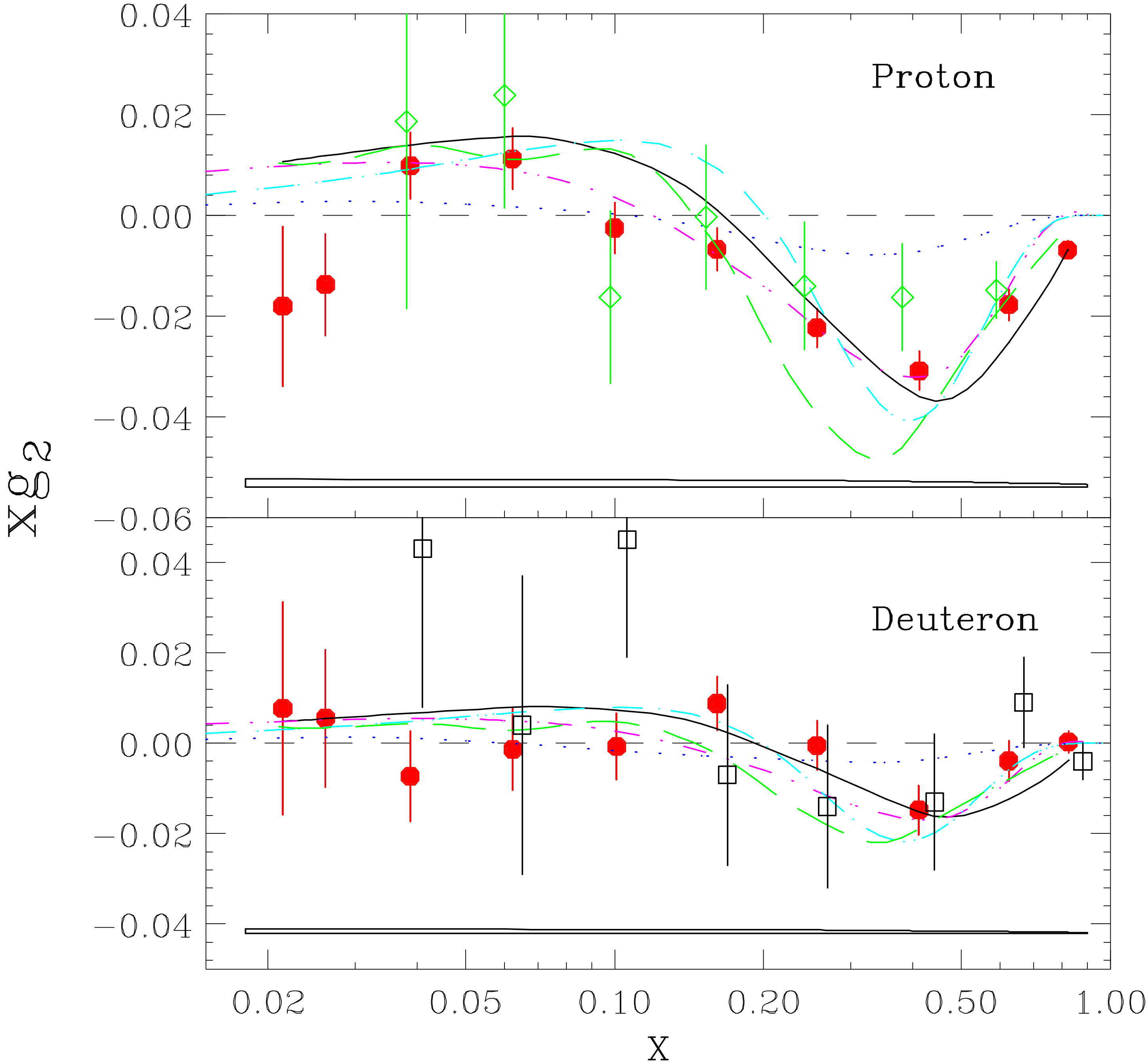


Q^2-DEPENDENCE OF xg_2
Stratman
WW
Proton
Deuteron
x≃0.098
x≃0.16
x≃0.25
x≃0.58
xg_2
Q^2 [(GeV/c)^2]

Q^2-DEPENDENCE OF A_2



RESULTS FOR Q^2-AVERAGED xg_2



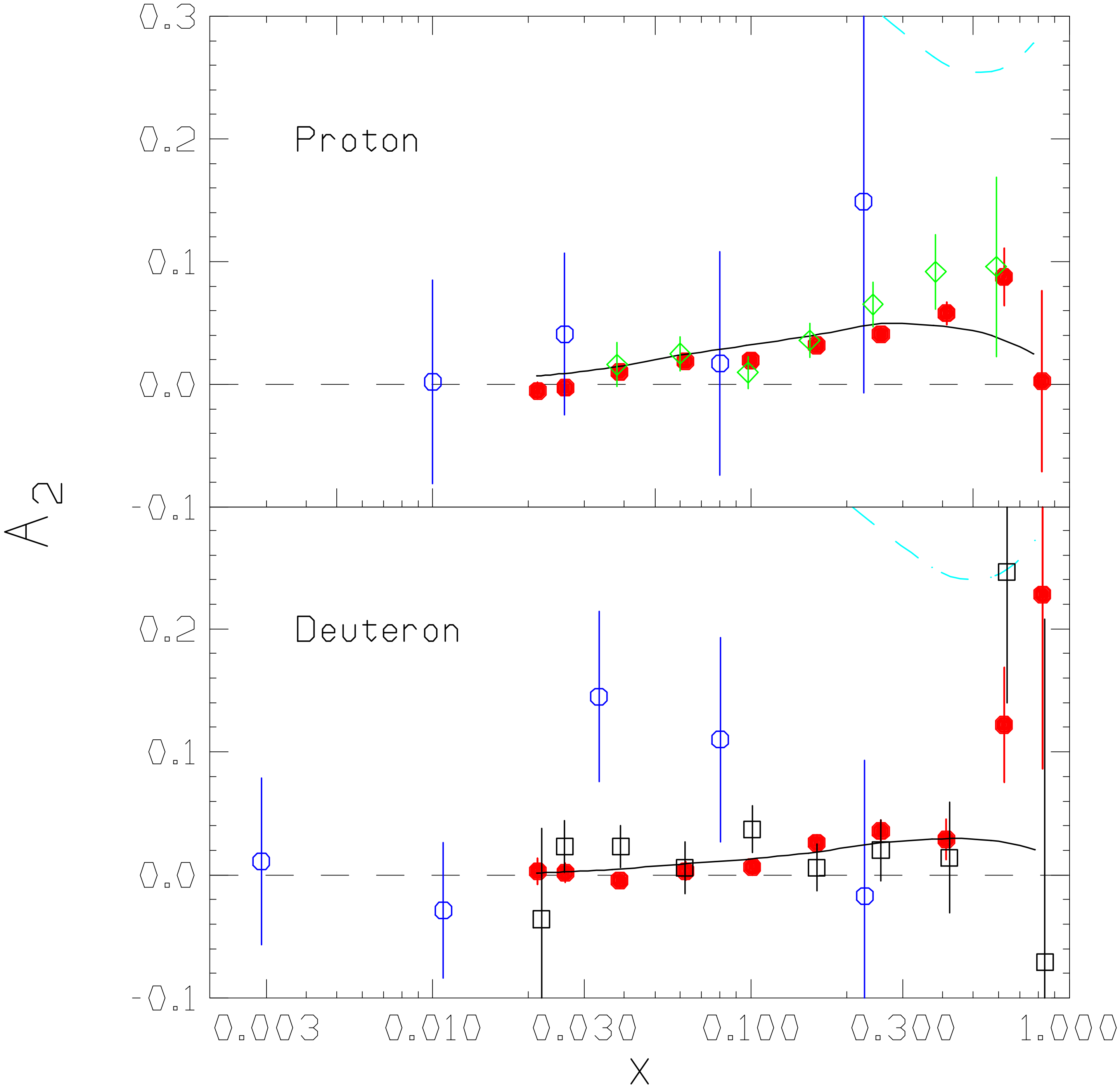
_____ **WW** __ . __ **Stratmann** .... **Song**

__ __ __ **Weigel** ___ ___ **Wakamatsu**

◇ **E143** □ **E155**

$$\chi^2/\mathrm{df}\ \text{agreement with}\ g_2^{WW} = 3.1(p) \quad 1.2(d)$$

RESULTS FOR Q^2-AVERAGED A_2



◇ E143 □ E155 ○ SMC

— — — $\sqrt{R(1+A_1)/2}$

$\boxed{\text{Operator Product Expansion}}$ (OPE) For g_1 and g_2

OPE USED IN QCD TO SEPARATE THE PHYSICS INTO A PERTURBATIVE PIECE (easily treated) AND A NONPERTURBATIVE PIECE (unknown matrix elements).

$$\Gamma_1^{(n)} = \int_0^1 x^n g_1(x, Q^2)dx = \frac{a_n}{2}, \quad n = 0, 2, 4, \ldots$$

$$\Gamma_2^{(n)} = \int_0^1 x^n g_2(x, Q^2)dx = \frac{1}{2}\frac{n}{n+1}(d_n - a_n)$$

n=2,4,...

a_n are the twist-2 and d_n are the twist-3 matrix elements.

$$d_2 = \int_0^1 x^2[2g_1(x, Q^2) + 3g_2(x, Q^2)]dx$$

$$= 3\int_0^1 x^2 \overline{g_2}(x, Q^2)dx$$

Q^2 DEPENDENCE

- All the Integrals are at FIXED Q_o^2 whilst the Measurements have Q^2 and x correlated.
- For g_1 integrals, we have 'evolved' to fixed Q^2 using Q^2 dependent fits to g_1/F_1
- For g_2 we use:

  $$g_2(x, Q_o^2) = \overline{g_2}(x, Q_m^2) + g_2^{WW}(x, Q_o^2)$$

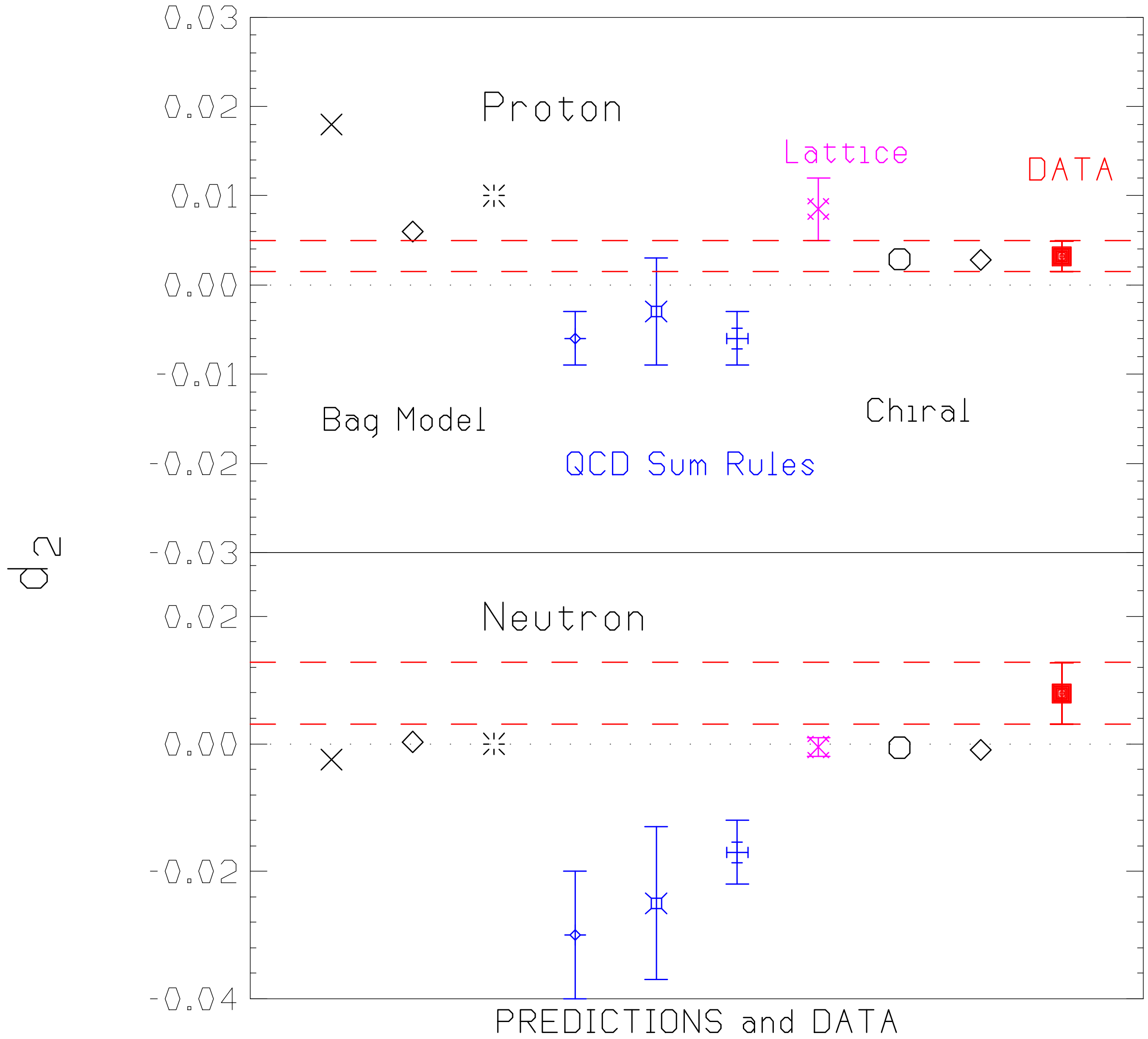
  and ASSUME that the Q^2 dependence of $\overline{g_2}(x, Q^2)$ is negligible.
- d_2 depends logarithmically on Q^2.
- To calculate g_2^{WW} we utilize a global Q^2 dependent fit to g_1/F_1.
  - g_1/F_1 has errors.
  - Statistical Errors on g_2 Dominate
- Low x Extrapolation: Suppressed By x^2
- High x Extrapolation: g_2 Very Small

THE TWIST-3 d_2 MATRIX ELEMENT

$$d_2 = 3\int_0^1 x^2[g_2(x,Q^2) - g_2^{WW}(x,Q^2)]dx$$

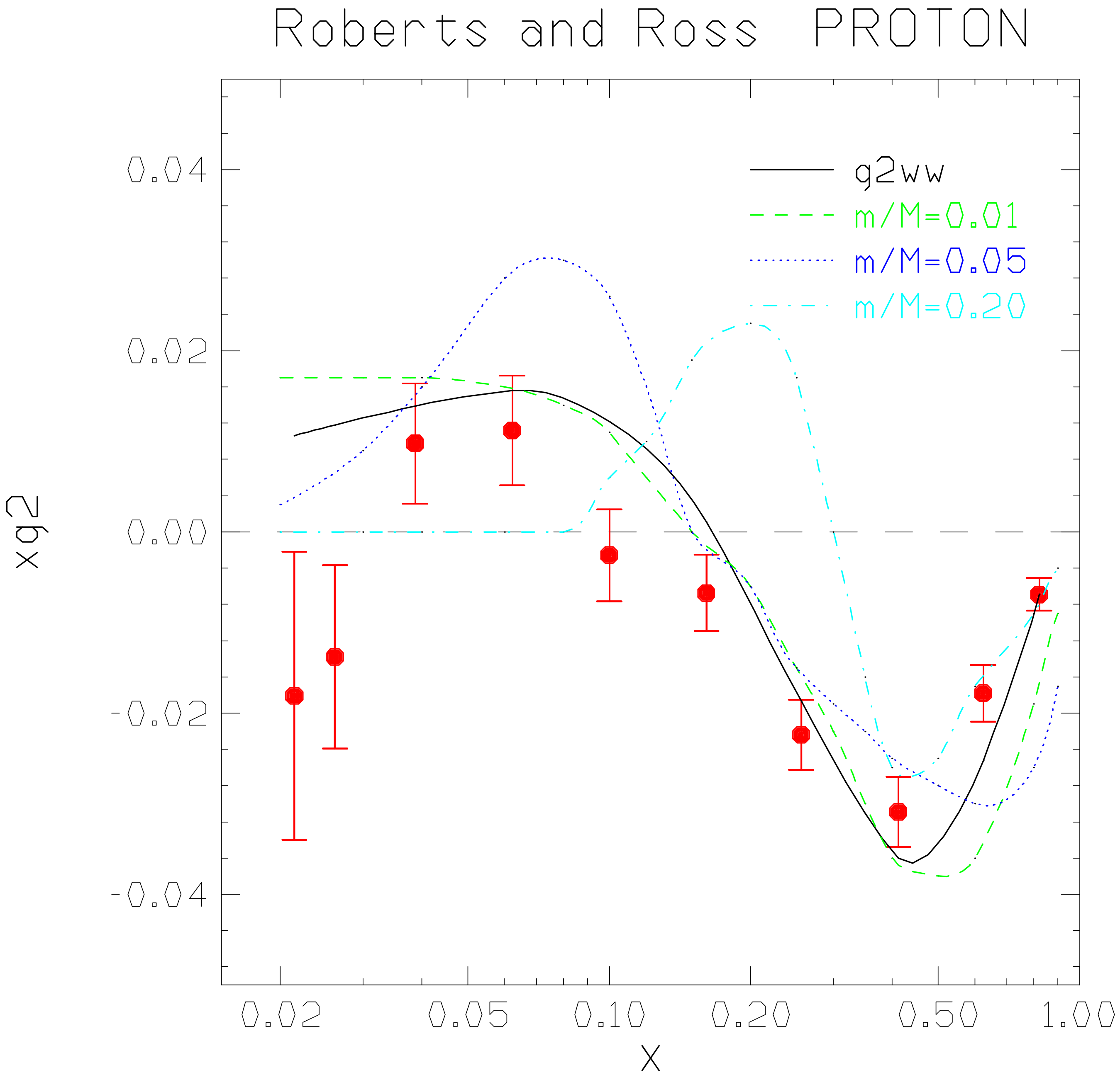
E155X: $0.0025 \pm .0016 \pm .0010$(proton)
$0.0054 \pm .0023 \pm .0005$(deuteron)

AVERAGE: $0.0032 \pm .0017$(p) $\quad 0.0079 \pm .0048$(n)



QUARK MODEL WITH TRANSVERSE MOMENTUM

$$\mathbf{A_2F_1 \propto \; g_1{+}g_2 \; = \int_x^{k_T^2 max} dk_T^2 \tilde{h}(x+\frac{k_T^2}{xM^2})}$$



BURKHARDT-COTTINGHAM SUM RULE

$$\int_0^1 \mathbf{g_2(x)dx = 0}$$

- **Derived from Virtual Compton Scattering Dispersion Relations.**
- **Does not follow from the OPE since $n = 0$.**
- **Validity depends on the lack of singularities fo**
  - **Dramatic rise of g_2 at low x could invalidate the sum rule**

$$\int_{.02}^{.9} \mathbf{g_2(x)dx \text{ at } Q^2 = 5}$$

	E155X	AVERAGE
P:	$-0.044 \pm 0.008 \pm .003$	$-0.042 \pm .008$ (5 σ)
D:	$-0.008 \pm 0.012 \pm .002$	$-0.006 \pm .011$

LOW x EXTRAPOLATION

IF $g_2 = g_2^{WW}$ AT LOW $\mathbf{x}$

$$\int_0^x \mathbf{g_2^{WW}(y)dy = x\left[g_2^{WW}(x) + g_1(x)\right]}$$

$$\int_0^{.9} = -0.022 \pm 0.008(p) \quad -0.002 \pm .011(d)$$

$$\boxed{\textbf{EFREMOV-TERYAEV-LEADER SUM RULE}}$$

$$\int_0^1 x[g_1^V(x) + 2g_2^V(x)]dx = 0$$

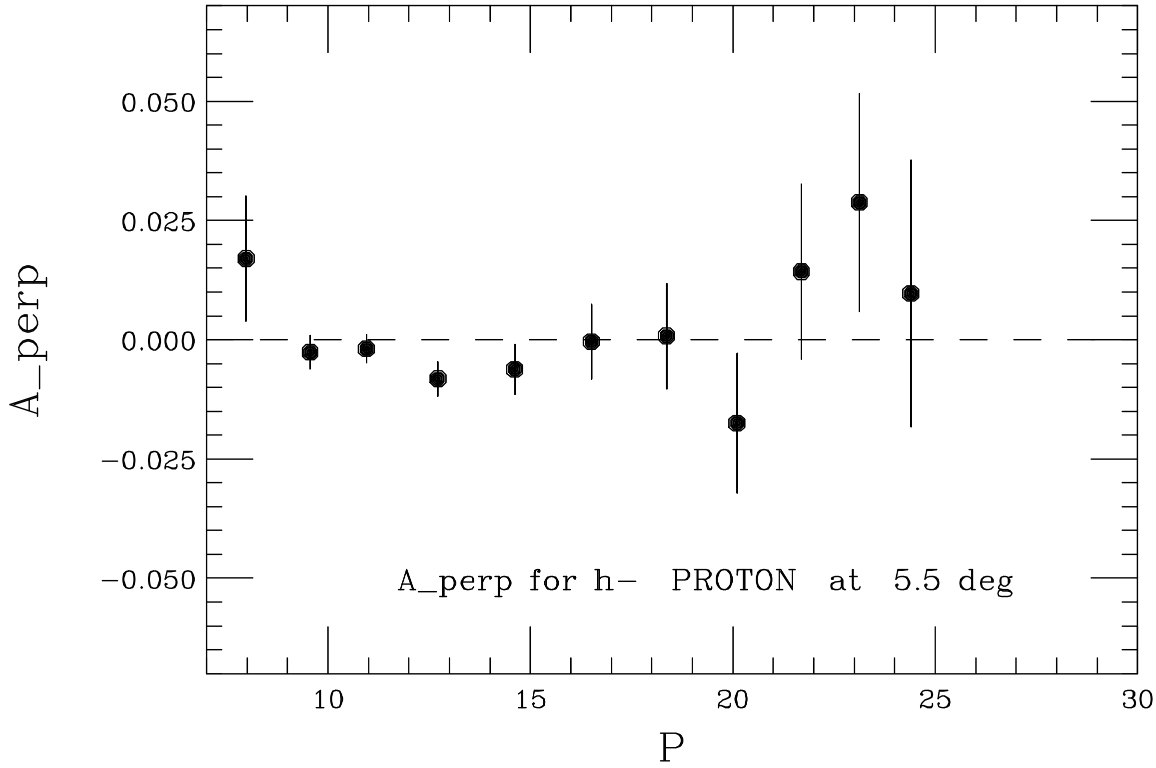
IF $\Delta u_{sea} = \Delta d_{sea} \Rightarrow$

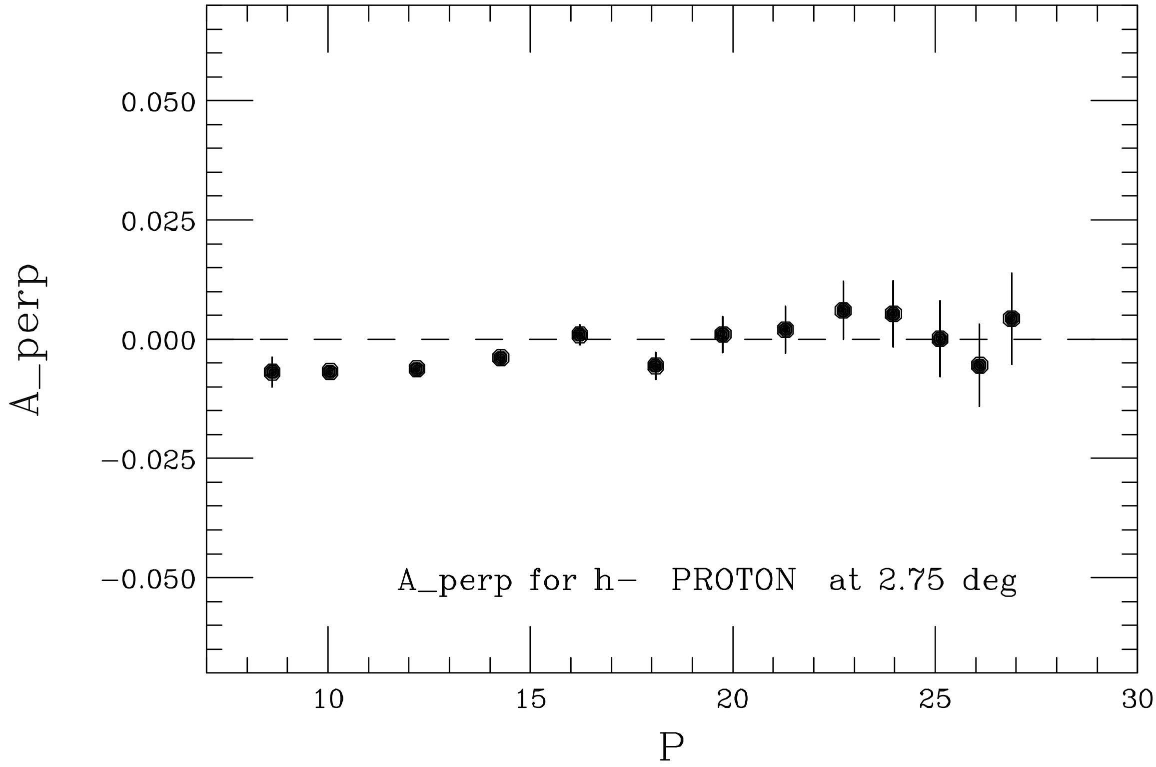
$$\int_0^1 x[g_1^p(x) + 2g_2^p(x) - g_1^n(x) - 2g_2^n(x)]dx = 0$$

E155X	AVERAGE
$-0.013 \pm .008 \pm .002$	$-0.011 \pm .008$

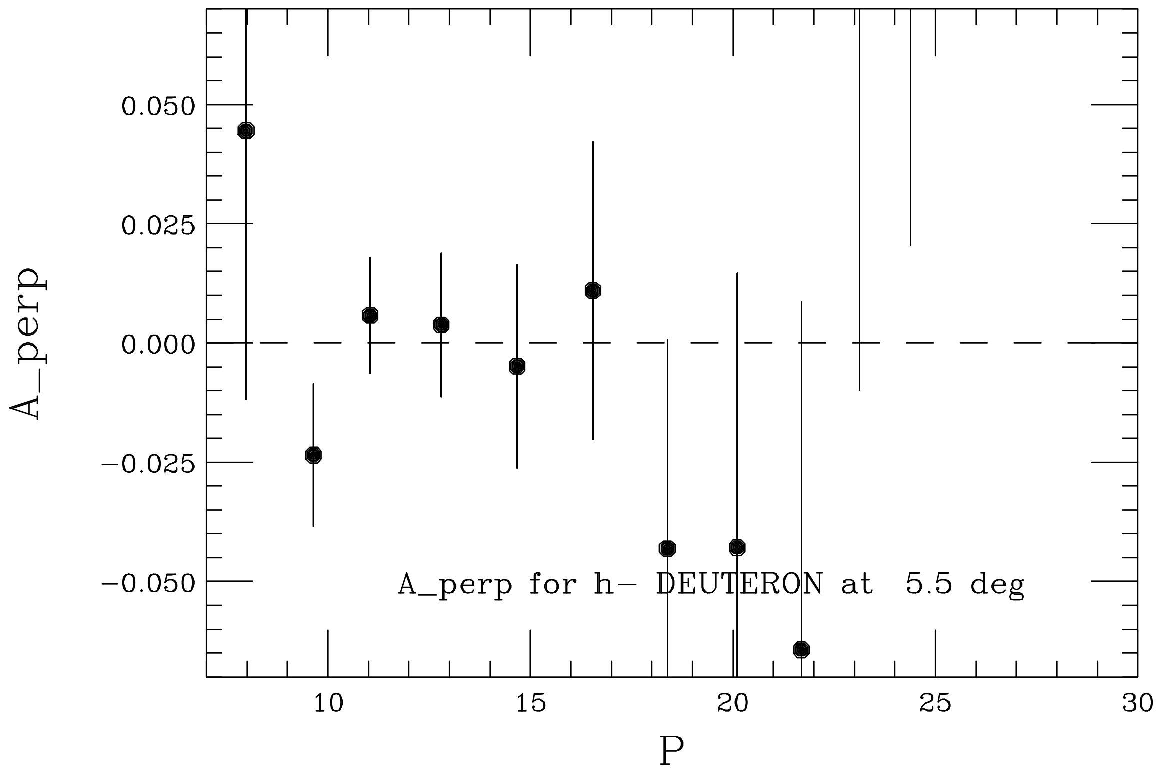
LOW x EXTRAPOLATION SUPPRESSED BY x FACTROR

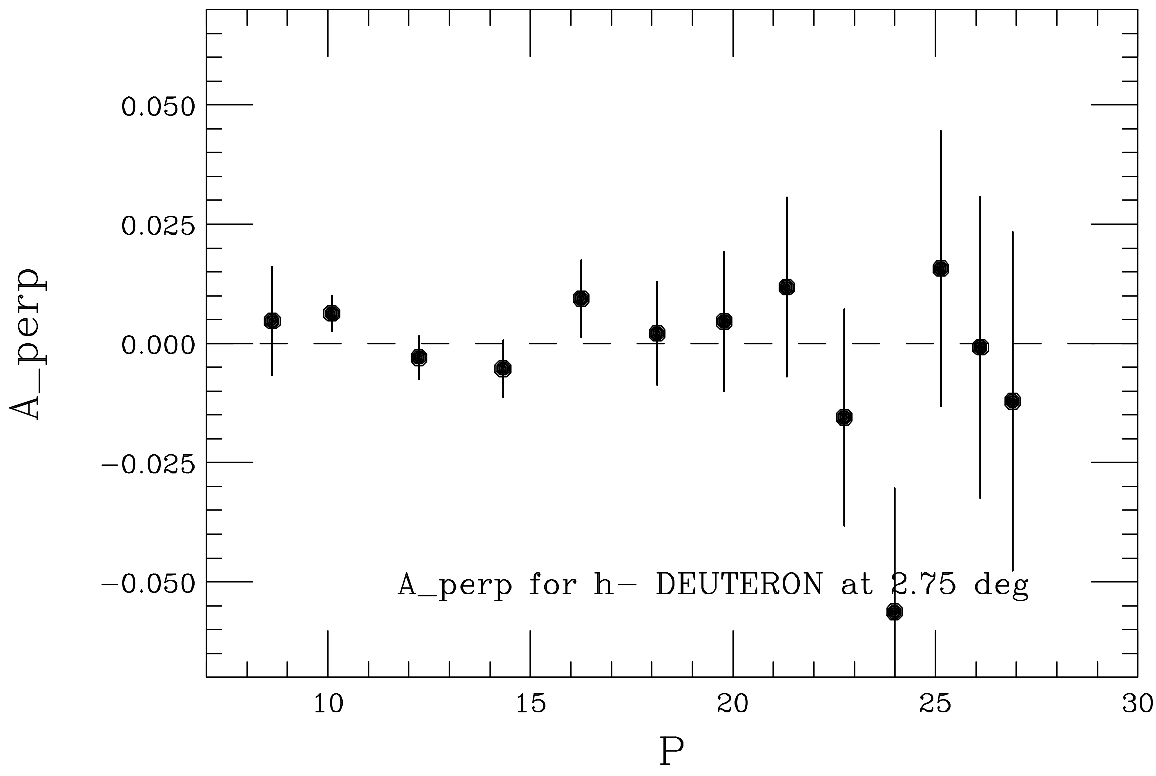
TRANSVERSE PION ASYMMETRIES from P





TRANSVERSE PION ASYMMETRIES from D





$\boxed{g_2 \text{ SUMMARY}}$

- PROTON g_2 IS POSITIVE FOR $x < 0.1$, NEGATIVE FOR $x > 0.2$.
- ROUGH AGREEMENT SEEN WITH SHAPE OF g_2^{WW} and BAG MODEL OF STRATMANN
- DISAGREES IN DETAIL WITH g_2^{WW}: $\chi^2/\text{dof} = 3.1$
- $A_2 < \sqrt{R(1 + A_1)/2}$
- PROTON A_2 IS POSITIVE FOR ALL x, $A_2 \to 0$ FOR $x \to 0$.
- d_2 SMALL
- ELT SUM RULE OK
- BURKHARDT-COTTINGHAM SUM RULE NOT OK FOR PROTON
- JLAB EXPERIMENTS ON g_2

PRESENT AND FUTURE A SLAC

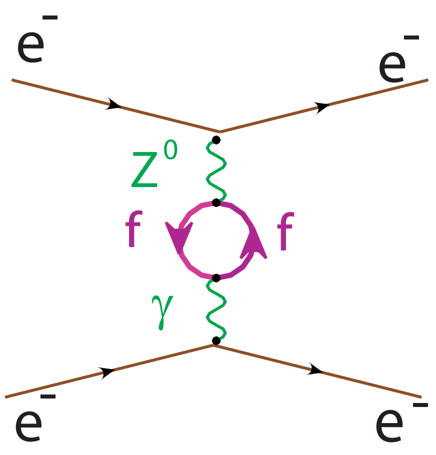
POLARIZED MOLLER SCATTERING-E158

- RUNNING NOW AND NEXT YEAR
- ELECTRON-ELECTRON SCATTERING
- MEASURE $\sin^2\theta_W$ at SMALL Q^2

3 PHOTOPRODUCTION EXPERIMENTS

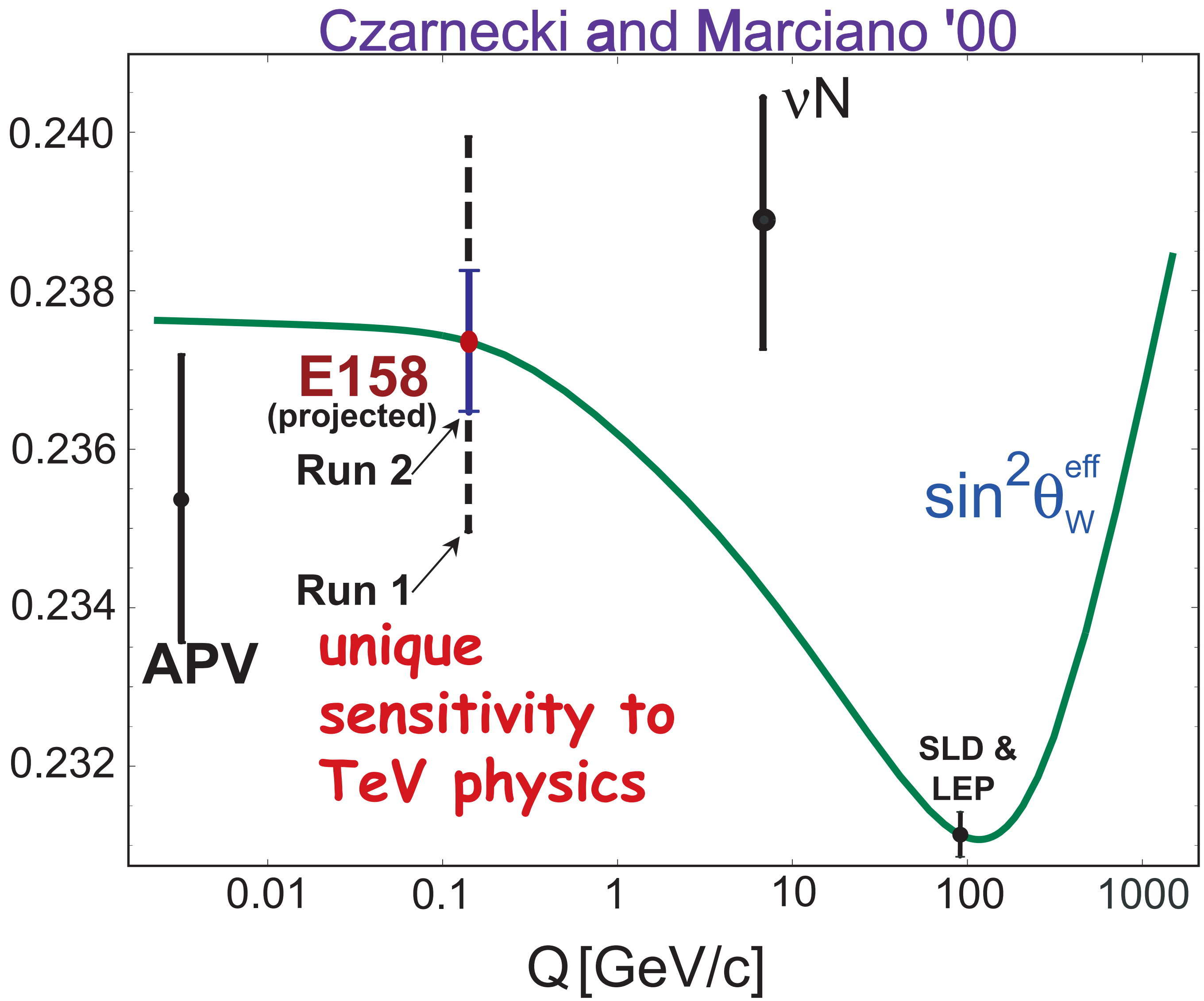
The Weak Mixing Angle at Low Q

- Unique Low Energy Leptonic Reaction
- $A_{LR} \propto (1 - 4\sin^2\theta_W)$: Added Senstivity



$A_{tree} = 0.32$ ppm

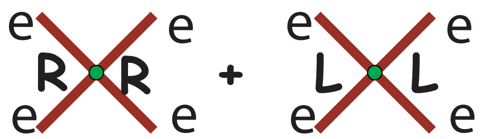
$A_{1\text{-loop}} = 0.18$ ppm

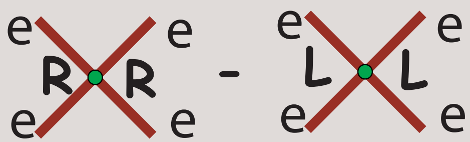


E158 New Physics Sensitivity

E158

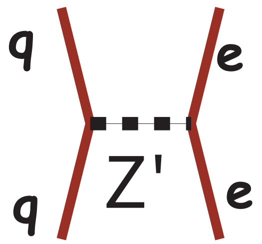
LEP II

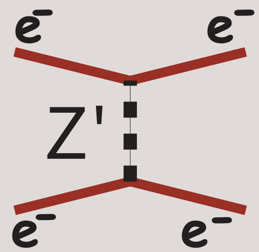




15 TeV compositeness

Fermilab

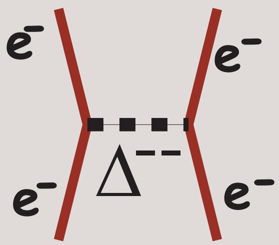




0.5-1.0 TeV GUTs

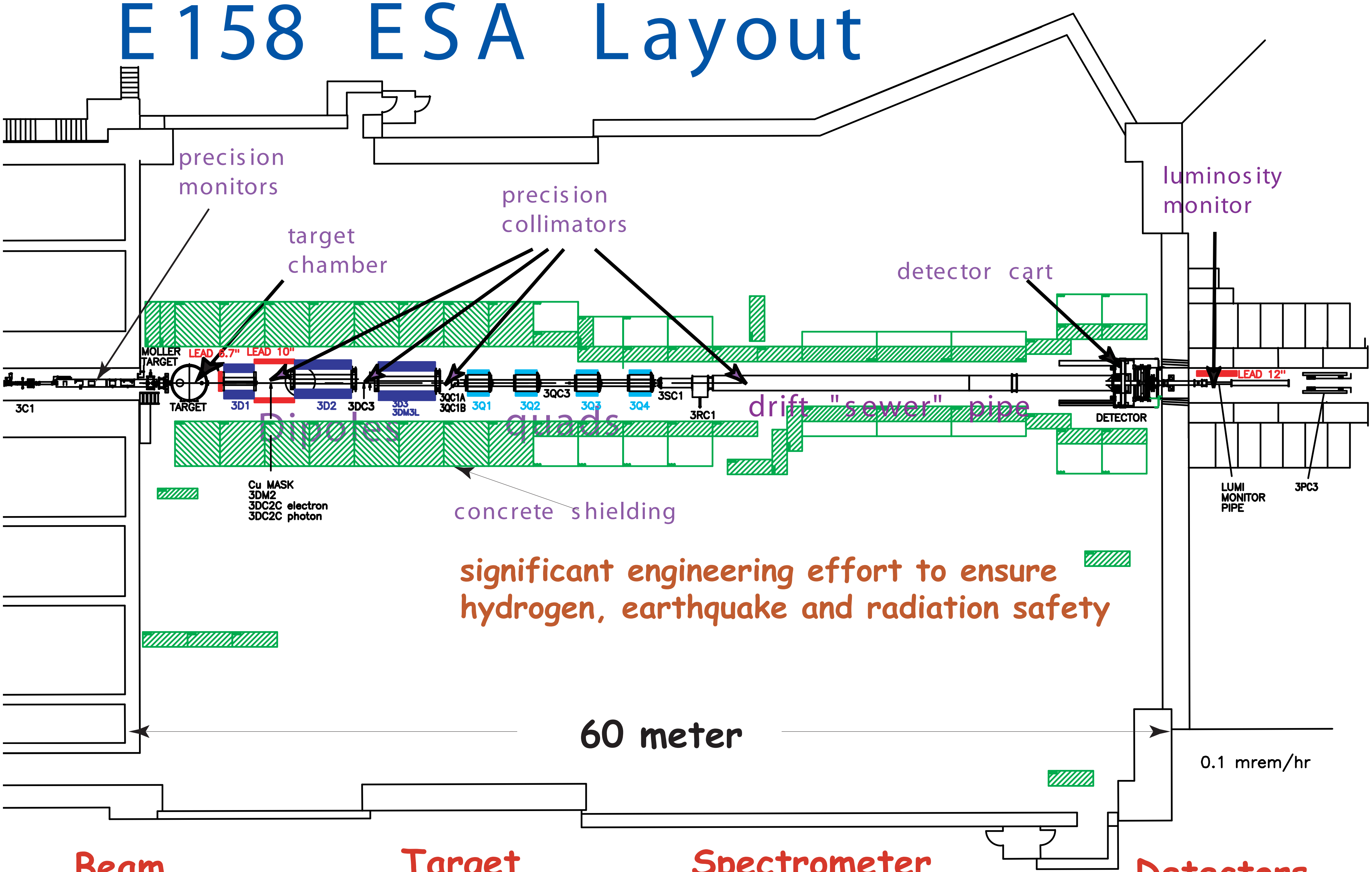
0.5-2.5 TeV extra dimensions

doubly charged scalar exchange



$\frac{g^2}{2M_\Delta^2} < 0.01\ G_F$ lepton flavor violation

E158 ESA Layout



Beam
High intensity,
precision monitoring

Target
liquid hydrogen,
1.5 m long

Spectrometer
3 dipoles, 4 quadrupoles,
precision collimators

Detectors
measure signal,
background

Polarized Beam

ITEM	Goal	MAY 2001	FEB 2002
Beam Charge	6×10^{11}	2.4×10^{11}	6×10^{11}
Intensity Jitter	2% rms	1.5% rms	0.5% rms
Position Jitter	<10% of spotsize	5% of spotsize	5% of spotsize
Spotsize Jitter	<10% of spotsize	10% of spotsize	5% of spotsize
Energy Spread	0.3% rms	0.3% rms	0.1% rms
Energy Jitter	0.2% rms	<0.1% rms	0.03% rms
Polarization	75%	(67 +/- 8)%	80%

tremendous work by accelerator dept:
- high beam current
- low beam jitter
- high energy
- high polarization
- low impact on PEP

Comparison of E158 and NLC Beam Parameters

Parameter	E158	NLC-500
Charge/Train	6×10^{11} (*)	14.3×10^{11}
Train Length	250ns	260ns
Bunch spacing	0.3ns	1.4ns
Rep Rate	120Hz	120Hz
Beam Energy	45 GeV	250 GeV
e^- Polarization	80%	80%

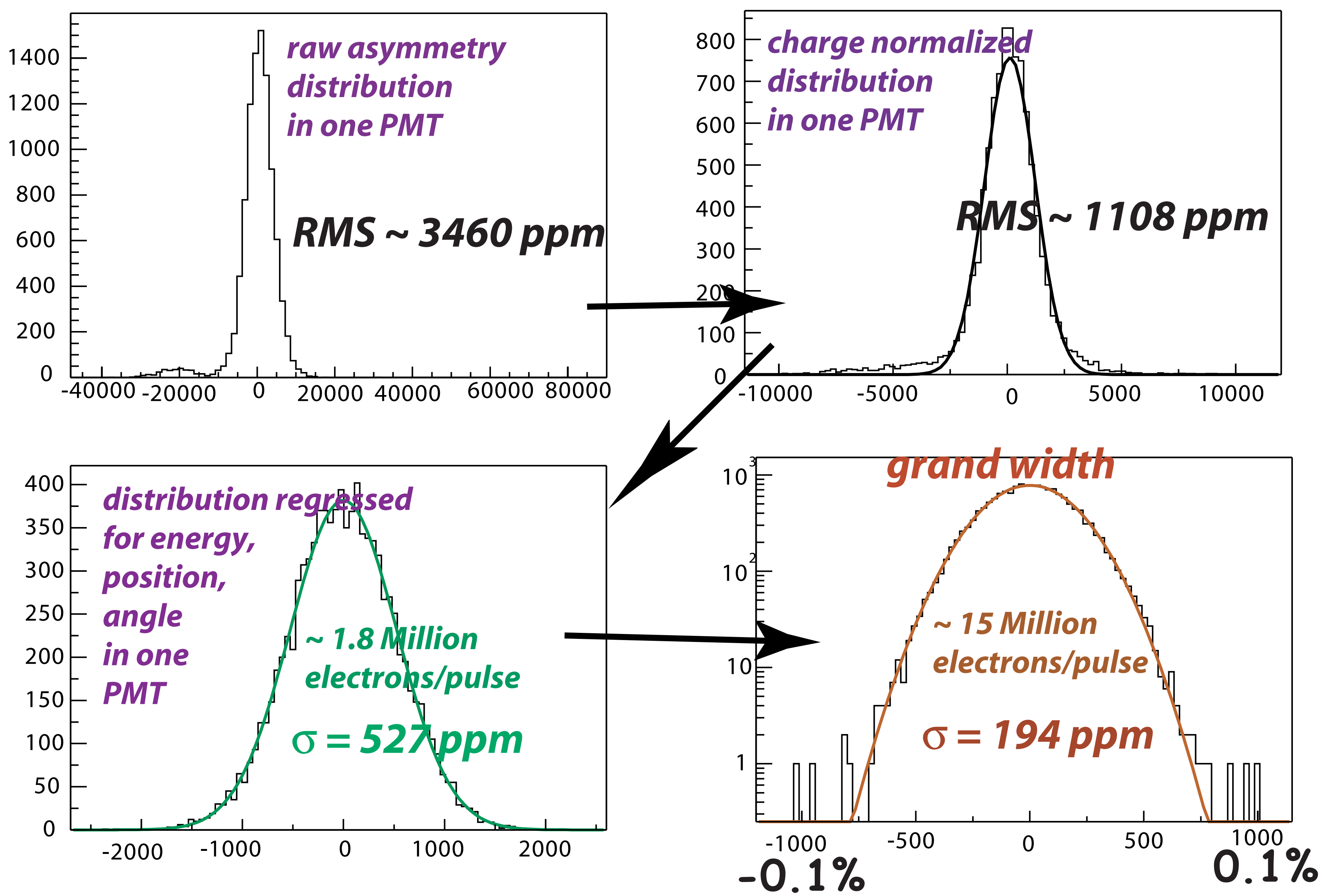
*polarized source has x5 overhead in available beam charge

NEW!

Gradient-doped strained GaAs photocathode
(developed for NLC)

Statistics via Regression

observed left-right asymmetry distribution



12 million pulses accumulated so far: stat. error ~ 85 parts per billion

3 PHOTOPRODUCTION EXPERIMENTS

POLARIZED QUASI-MONOENERGIC PHOTON BEAM

- **A DEPENDENCE OF J/ψ and ψ': $\sim$ 2004**

    - **J/ψ-NUCLEON CROSS SECTION FOR QUARK-GLUON PLASMA**
    - **COLOR TRANSPARENCY**

- **GLUON POLARIZATION FROM OPEN CHARM: $\sim$ 2005**
    - **30-45 GeV**
    - **Polarized LiD Target 60%**
    - **Single Muon Spectrometer**
    - **Perhaps μ pairs and J/ψ**

- **GDH SUM RULE: $\sim$ 2006**
    - **Total Hadronic Cross Section Asymmetry**

$$\int_{k_\pi}^{\infty} \frac{dk}{k} \Delta\sigma^{\gamma N}(k) = \frac{2\pi^2 \alpha \kappa^2}{M^2}$$

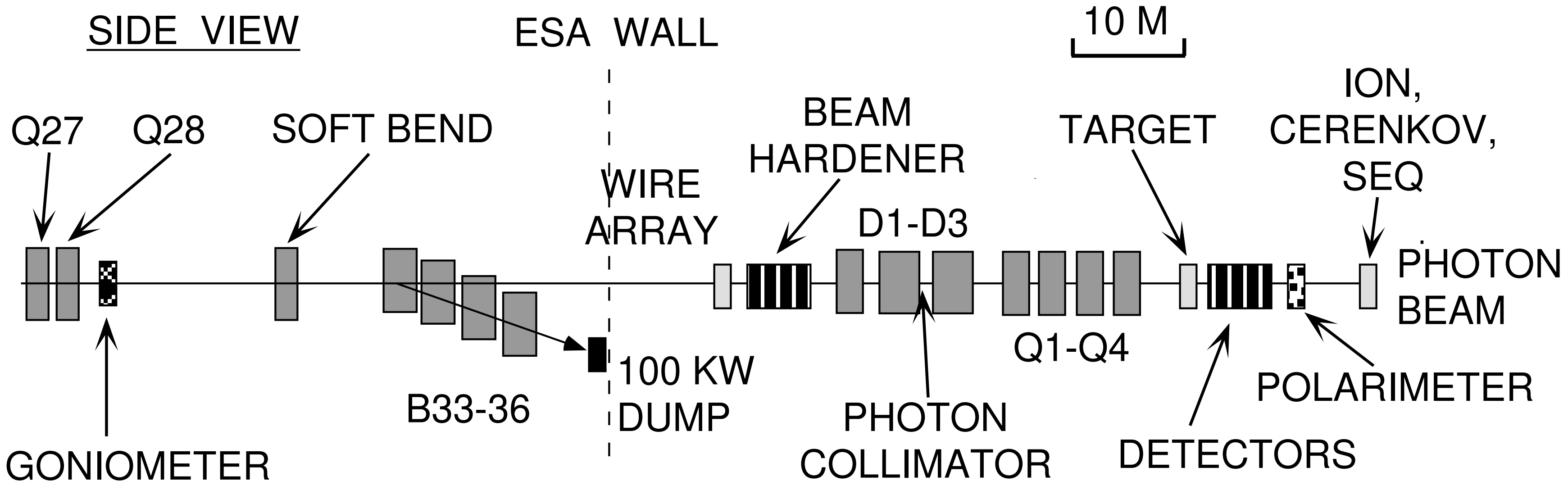
    - **10-45 GeV**
    - **LOWER ENERGIES AT JLAB, MAMI, LEGS, GRAAL, ELSA**
    - **NH_3 and ND_3 Targets**

$\boxed{\text{FUTURE}}$

CAN WE LEARN ANTHING WITH

- TRANSVERSE POLARIZED BEAM
- TRANSVERSE POLARIZED TARGET
- LINEARLY POLARIZED BEAM

POLARIZED QUASI-MONOENERGIC PHOTON BEAM



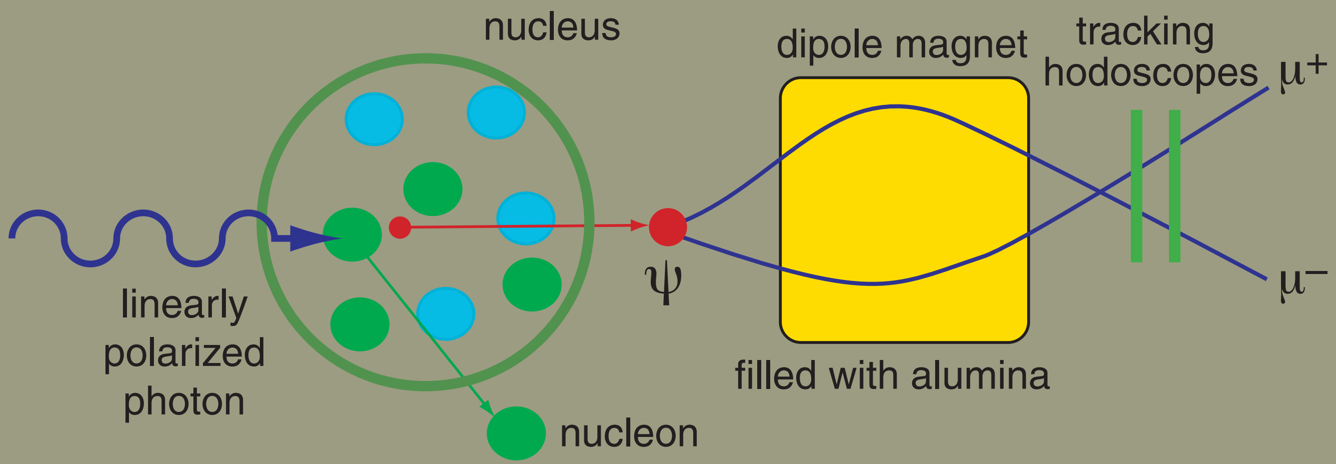
E160

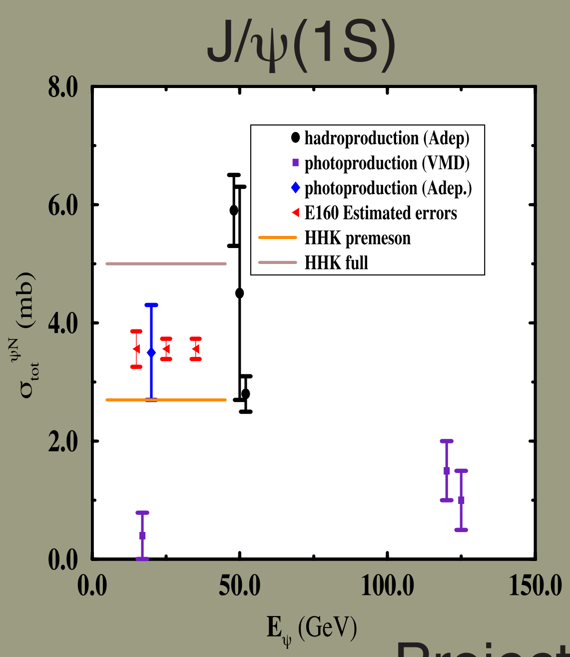
Measurement of the A-Dependence of J/ψ(1S) and ψ(2S) Photoproduction

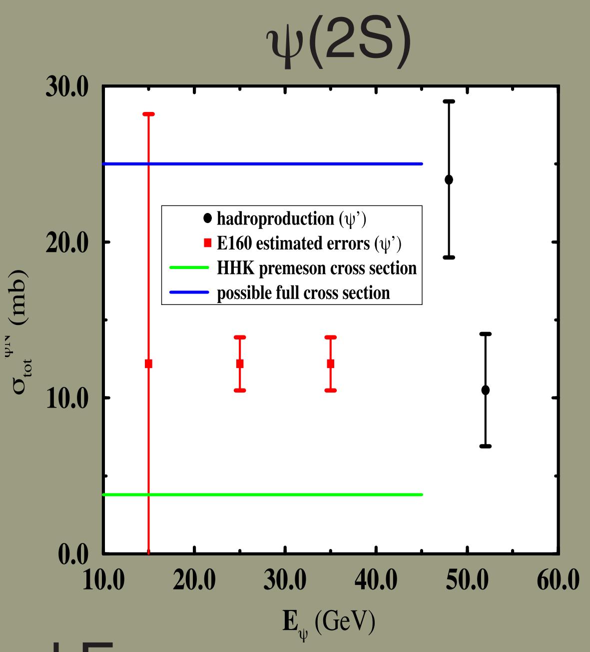
Goals

1) Study production and interaction of charmonium in nuclei from Be to Au at energies from 15 to 35 GeV.

2) Constrain causes for charmonium suppression in heavy ion collisions.

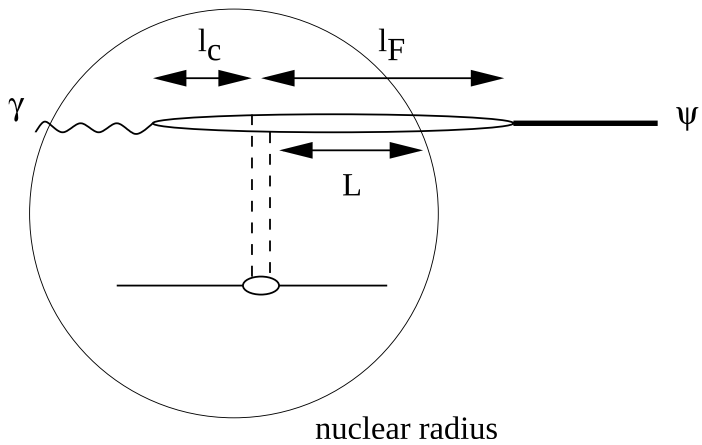


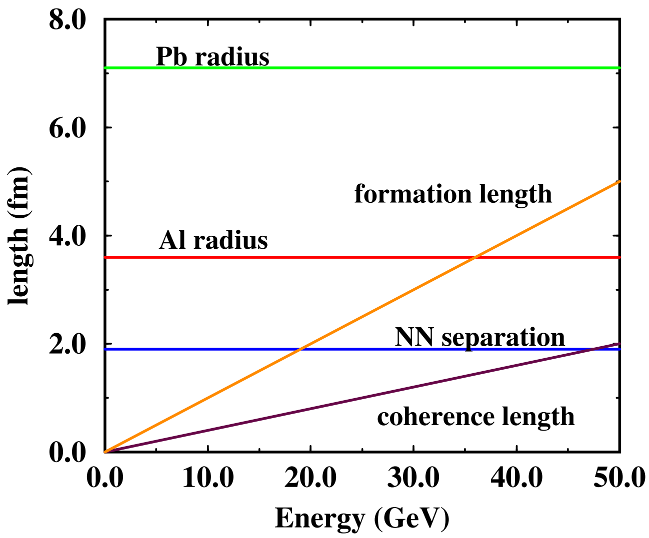




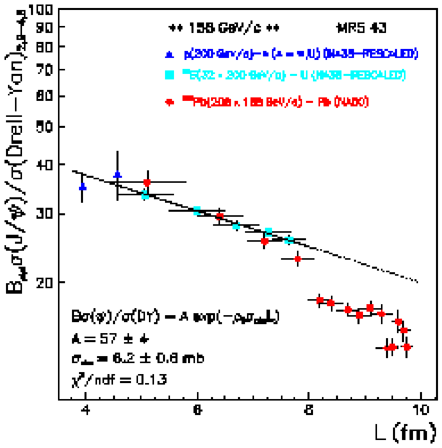
Projected Errors

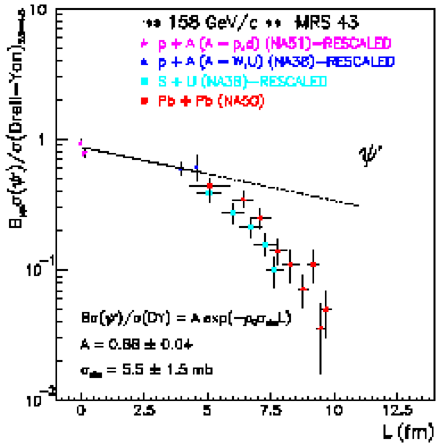
Length Scales





J/ψ Suppression for Heavy Ions



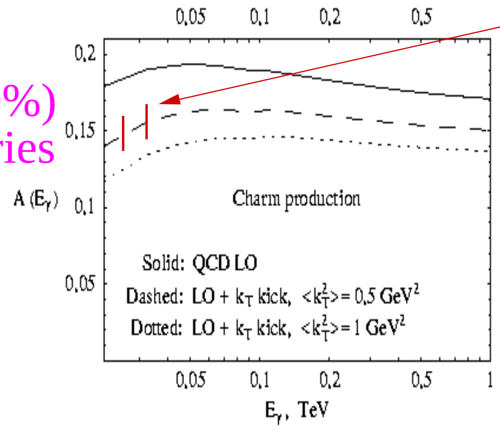


- From B. Müller, nucl-th/980623:
- It's still unclear whether J/ψ is a reliable probe for quark-gluon plasmas.
- Suppression in light targets is the result of the $A^{0.92}$ dependence of the $pA \to J/\psi X$ cross section.
- The color octet model provides a credible mechanism, but there is no direct evidence for it.
- Available evidence points toward a novel suppression in Pb+Pb collisions.
- Color singlet absorption on hadronic comovers does not explain the Pb+Pb data.

Ivanov, Capella, Kaidalov

NPB586(2000)382, hepph0104301

Large (20%) asymmetries



inelastic
4 targets

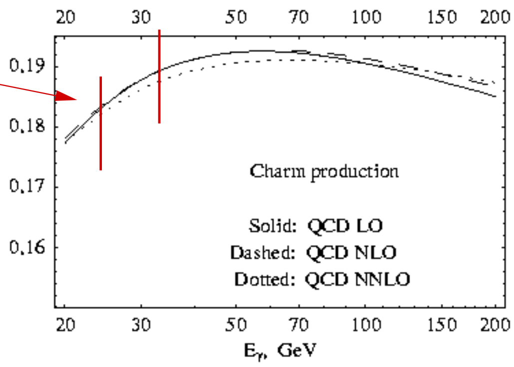
sensitivity to k_T^2 transverse gluon momentum

$\gamma + N \longrightarrow q + X$

(includes open charm)

elastic
4 targets

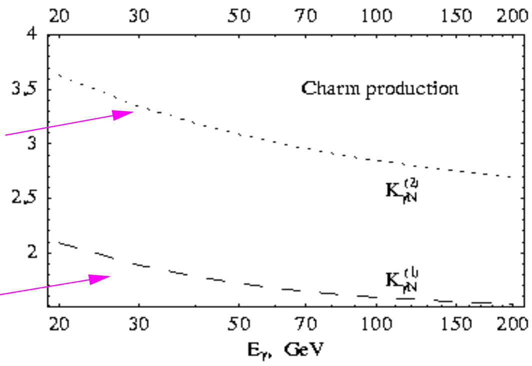
A



asymmetries are remarkably insensitive to perturbative order
$\Longrightarrow$ accurate pQCD prediction that can be put to the test

$\frac{\text{NNLO}}{\text{NLO}}$

$\frac{\text{NLO}}{\text{LO}}$



cross sections are extremely sensitive to perturbative order

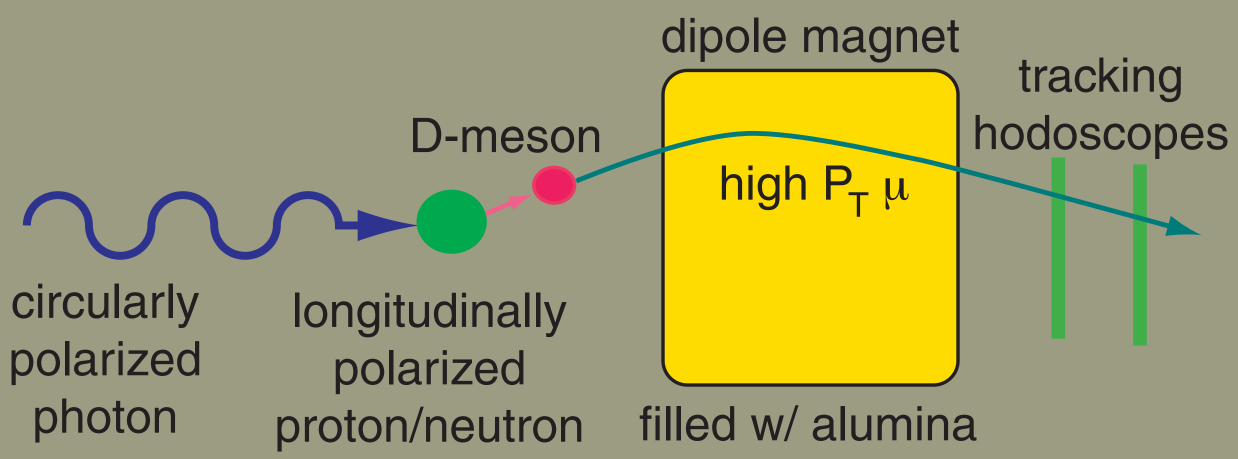
- $A = \frac{1}{P_\gamma}\frac{\sigma(\phi=0)-\sigma(\phi=\frac{\pi}{2})}{\sigma(\phi=0)+\sigma(\phi=\frac{\pi}{2})}$; P_γ = linear polarization; ϕ = angle between the linear polarization plane and the $\mu^+\mu^-$ decay plane; $\delta A = \frac{\pi}{2}/\sqrt{N}$.

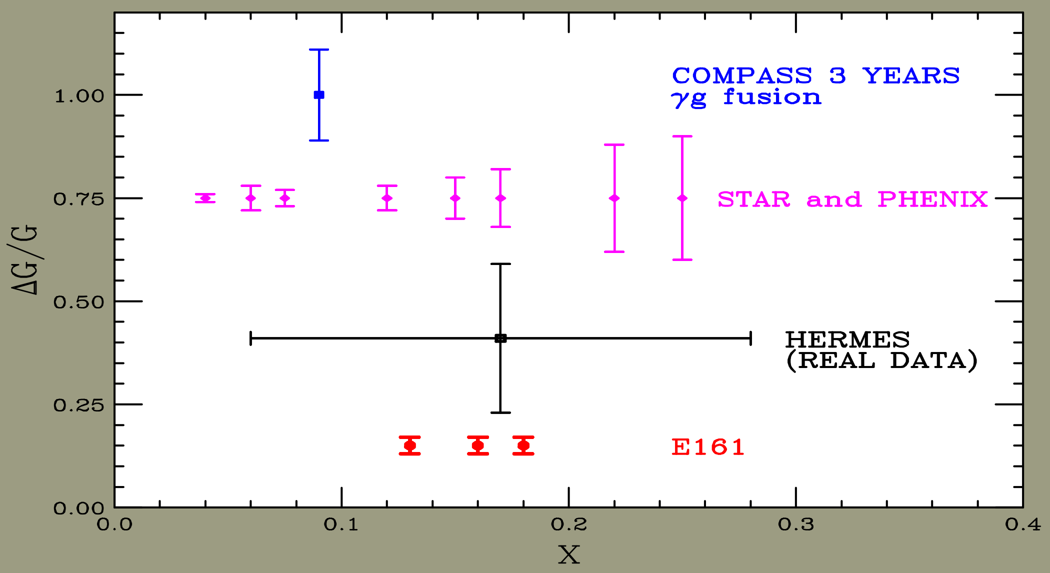
E161

Gluon Spin in Nucleons Using Polarized Open Charm Photoproduction

Goal

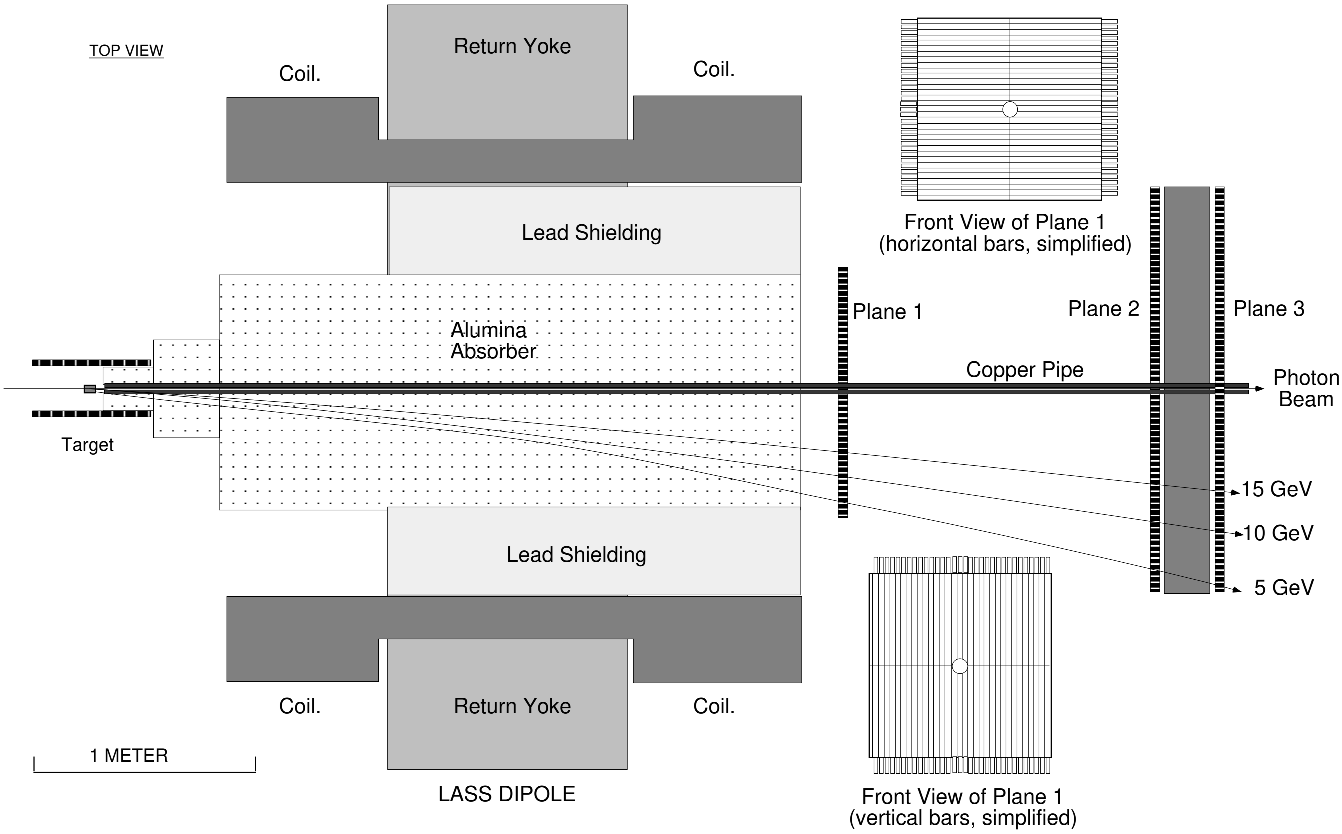
Find gluon contribution to the nucleon "Spin Puzzle" using photoproduction of open charm (dominated by photon-gluon fusion diagram). Complementary to measurements at RHIC-Spin and COMPASS.





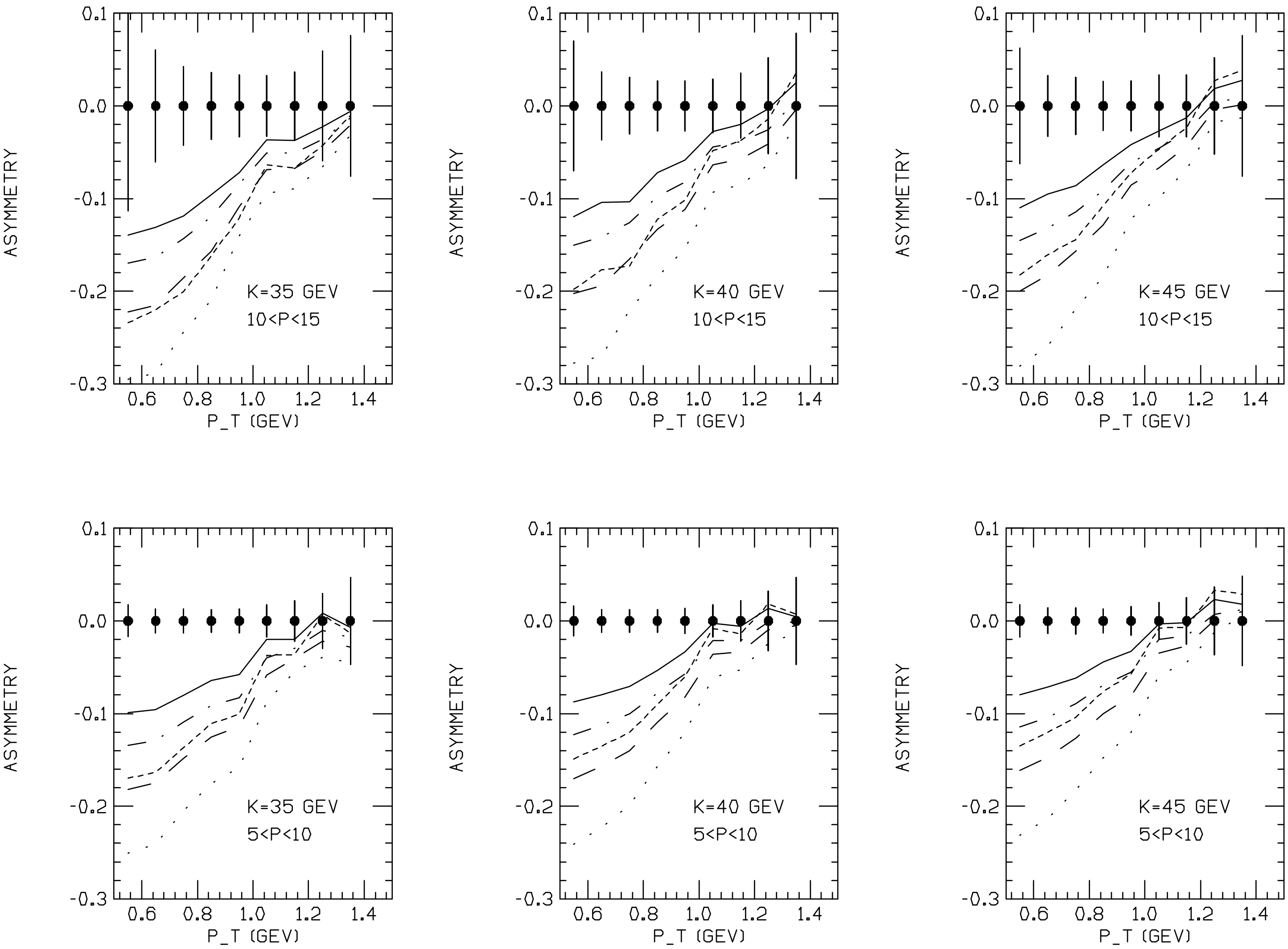
Projected Errors

DETECTOR FOR OPEN CHARM



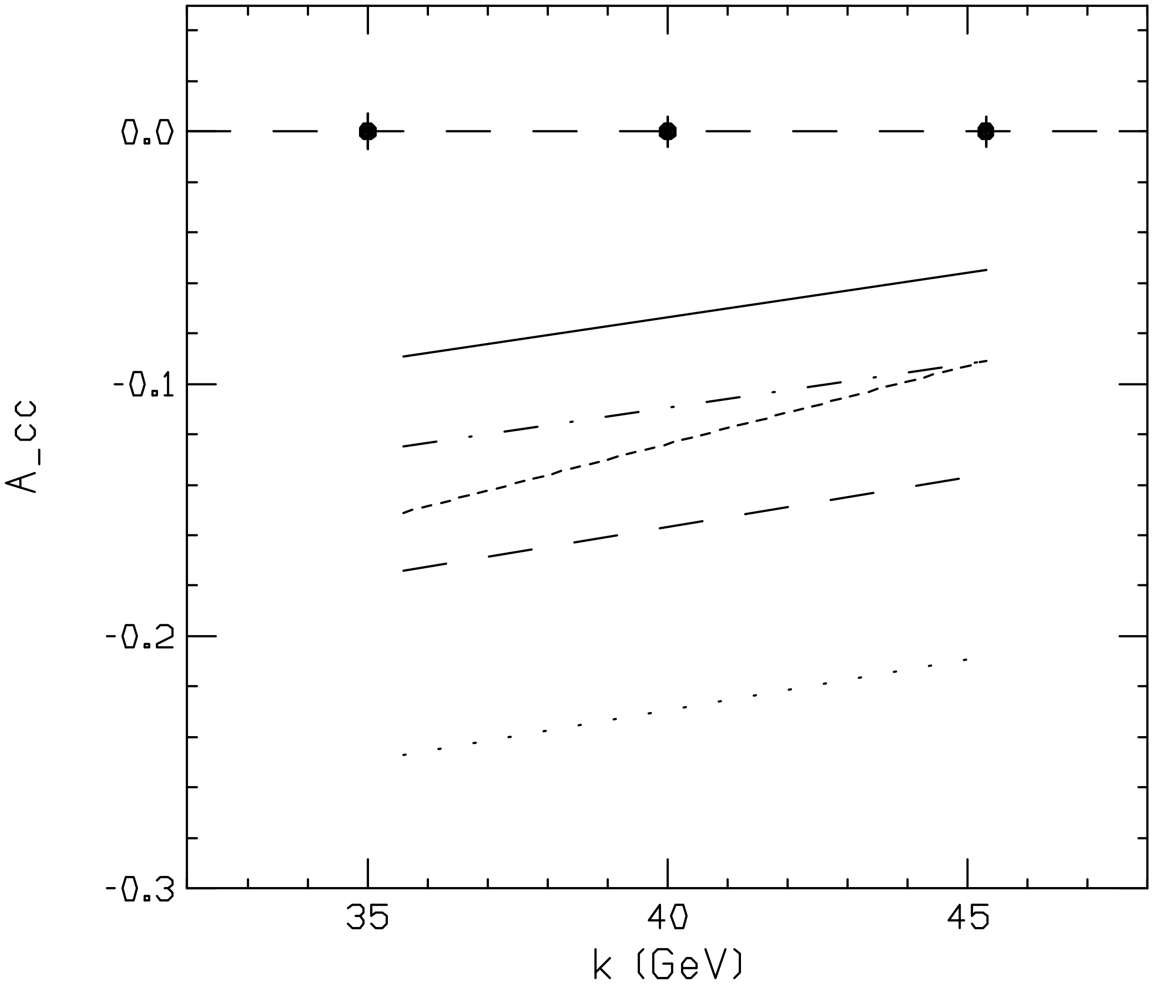
Overall plan view of the main components of the spectrometer. The absorber fills most of the gap of the LASS dipole, and also extends into the warm bore of the target magnet. A thick evacuated copper beam pipe contains the photon beam. The three detector planes are made from scintillator hodoscopes. Two simplified front views of the front plane are shown. The dashed curves are typical trajectories for muons with $p_t = 0.7$ and $P = 5$, 10, and 15 GeV.

EXPECTED ERRORS



Asymmetries for the five fits to the gluon polarization as a function of p_T^μ of the detected muon. The top row is for $10 < P_\mu < 15$ GeV and the bottom row for $5 < P_\mu < 10$. The three columns correspond to peak beam energies of 35, 40 and 45 Gev. The points indicate the projected statistical errors. Experimental systematic errors will be highly correlated from point-to-point, and will be approximately 0.10 of the measured asymmetries.

AVERAGE EXPECTED ERRORS



Asymmetries for the five fits to the gluon polarization as a function of beam energy. The points, arbitrarily placed at zero asymmetry, indicate the projected statistical errors for the running conditions given in the text, averaged over p_T.

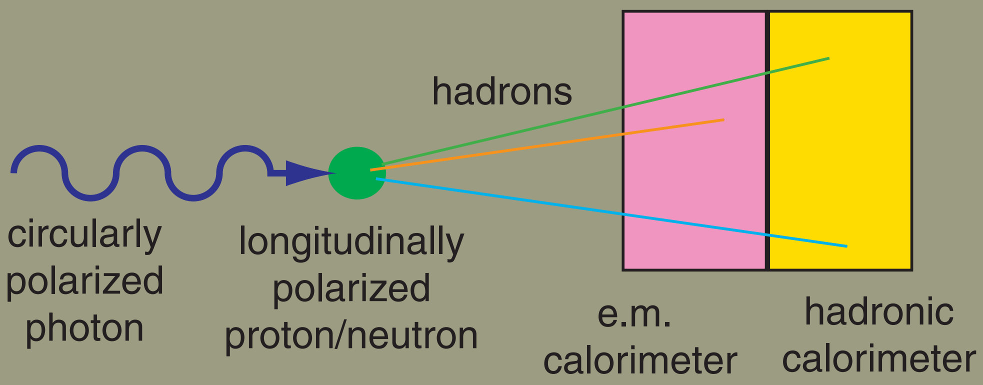
E159

Measurement of $\Delta\sigma(k)$ and the High Energy Contribution to the GDH Sum

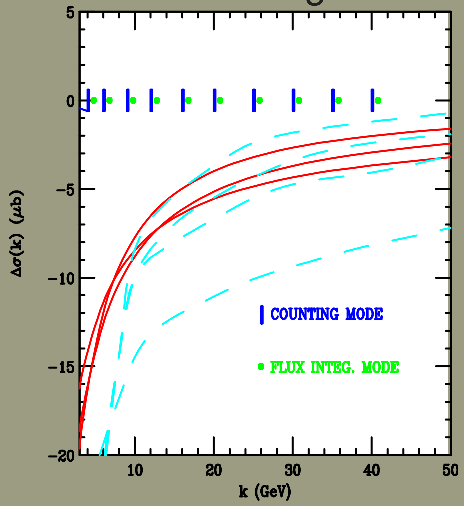
Goals

1) Measure helicity dependence of cross section to absorb circularly polarized photons on polarized nucleons in the energy range 5 to 45 GeV.

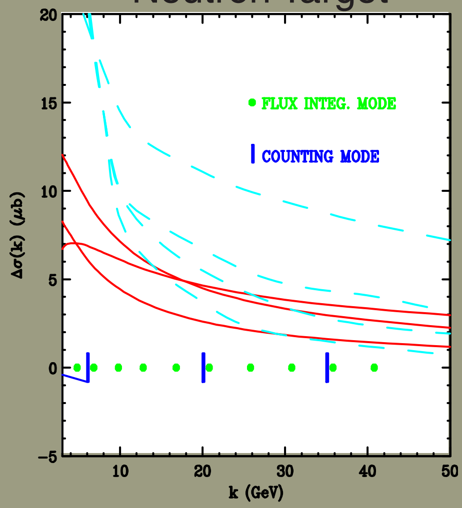
2) Test the fundamental GDH Sum Rule.



Proton target



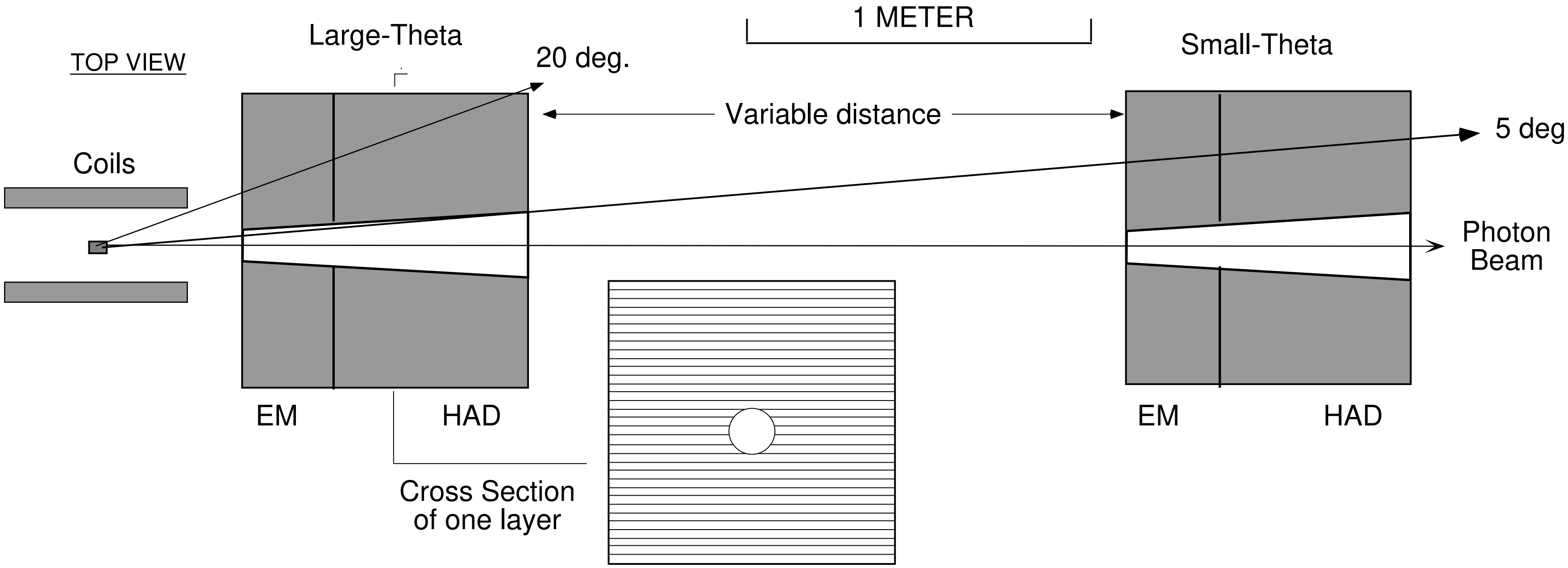
Neutron Target



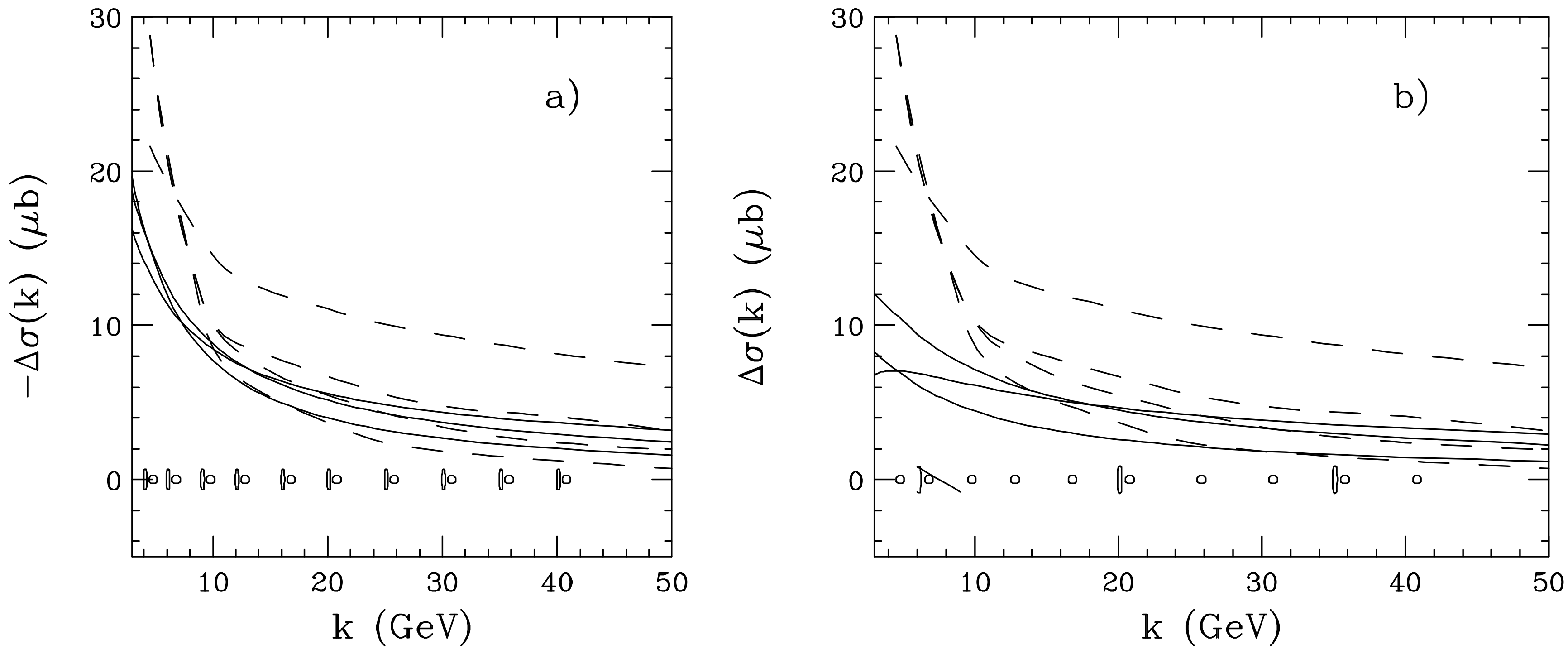
Projected Errors

www.slac.stanford.edu/exp/e159

GDH SUM RULE DETECTOR



GDH: ASYMMETRY ERRORS



Estimated a)proton b) neutron errors for $\Delta\sigma^{\gamma p}(k)$ for this proposal as a function of photon energy for the counting mode (rectangles) and flux integration mode (circles). The symbol heights represent the expected statistical errors in the more conservative analysis. Systematic errors are not shown, but are expected to be 6% to 8% of the measured values of $\Delta\sigma^{\gamma N}(k)$. The dashed curves are representative models.

SUMMARY

- MANY FIXED TARGET EXPERIMENTS IN FUTURE
- CALIBRATION OF GLAST
- NOT MUCH TO REPORT AT FUTURE DIS CONFERENCES