Summer Workshop

August 9, 2007

Hall C Update &
PAC32 Results

Recent Publications

E01-004	Determination of the Pion Charge Form Factor at $Q^2=1.60$ and 2.45 $(GeV/c)^2$	PRL 97, 192001
E01-006	Proton G_E/G_M from beam-target asymmetry	PRC 74, 035201
	Radio frequency picosecond phototube	NIM A566, 321
	Extracting Nucleon Strange and Anapole Form Factors from World Data	PRL 97, 102002
E01-006	Proton Spin Structure in the Resonance Region	PRL 98, 132003
E93-021	Determination of the Pion Charge Form Factor for $Q^2=0.60$-1.60 $(GeV/c)^2$	PRC 75, 055205
E99-118	Longitudinal-Transverse Separations of DI Structure Functions at Low Q2 for Hydrogen and Deuterium	PRL 98, 142301
E00-108	Onset of Quark-Hadron Duality in Pion Electoproduction	PRL 98, 022001
E94-110	Measurements of R=s_L/s_T and the Separated Longitudinal and Transverse Structure Functions in the Resonance Region	nucl-ex/0410027
G0	Transverse Beam Spin Asymmetry in Forward-Angle Elastic Electron-Proton Scattering	arXiv:0705.1525

Recent Running

Experiments completed in Hall C in last year

Exp	Title	Spokespersons
E04-115	G0 Backward Angle Measurement	D. Beck
E04-101	Parity-Violating Asymmetry in the N-Δ Region	N. Simicevic and S. Wells
E04-001	Measurements of F_2 and R on Nuclear Targets	A. Bodek and C. Keppel
E06-009	Measurement of $R=\sigma_L/\sigma_T$ on Deuterium in the Nucleon Resonance Region and Beyond	M. Christy and C. Keppel
E05-017	Measurement of Two-Photon Exchange in Unpolarized Elastic e-p Scattering	J. Arrington

- G0 Backward ran until March, 2007
- In April 2007, restored Hall C to base equipment configuration to run E04-001, E06-009 and E05-017 until July 2007

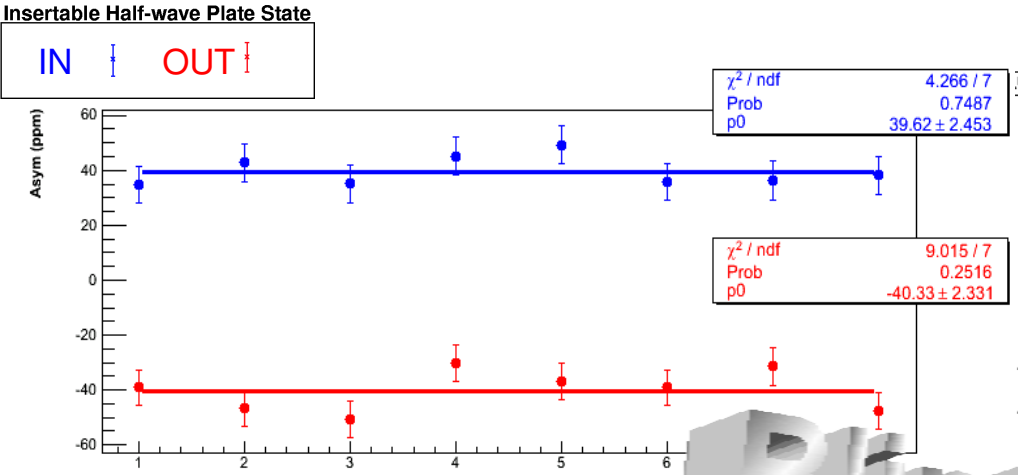
G0 Apr '07 Update

D. Beck UIUC
Apr. 07

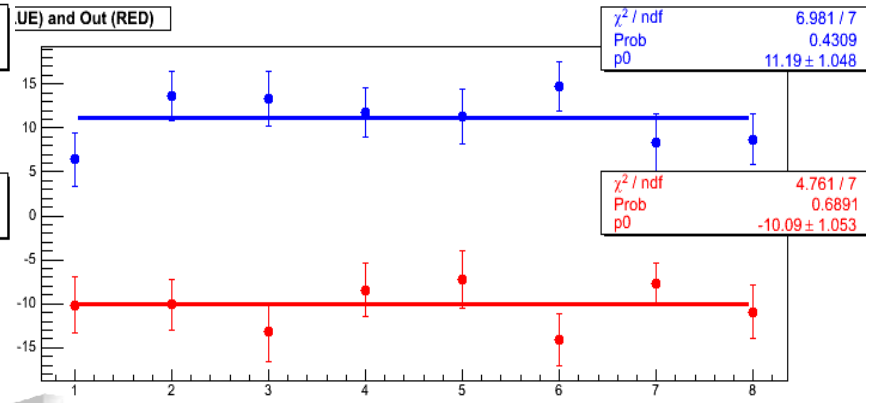
- All data taking completed
- Hydrogen: 362, 687 MeV
  - 90 C, 100 C collected, respectively at 84% polarization
  - ?, 170 C proposed at 75% polarization
- Deuterium: 362, 687 MeV
  - 65, 45 C collected, respectively: 84% polarization
- Backgrounds:
  - very clean hydrogen elastic signal: all backgrounds total ~5-10%
  - deuterium has backgrounds up to 20% in elastic
    - mostly randoms from real pions ⊕ accidental Cherenkov
    - measure concurrently

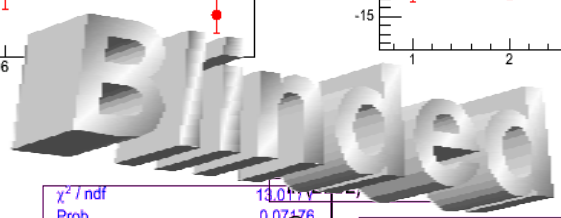
G0 Backward - Raw Elastic Asymmetries

LH2, 687 MeV

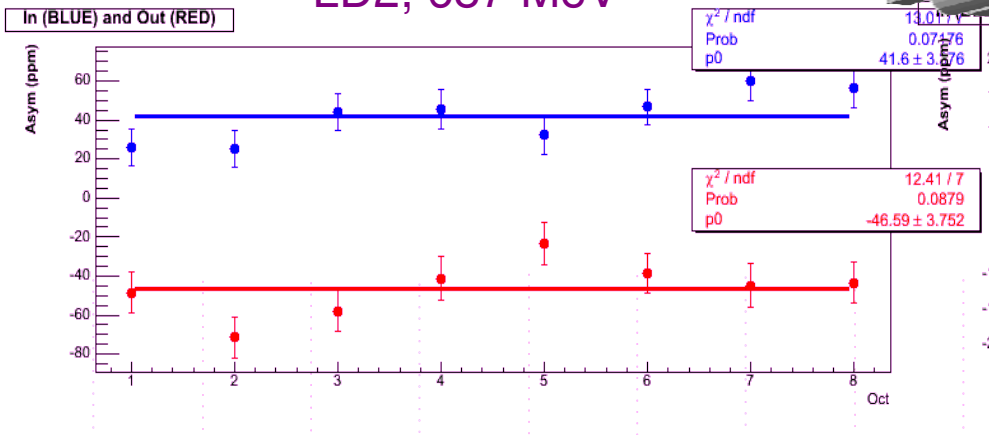


LH2, 362 MeV

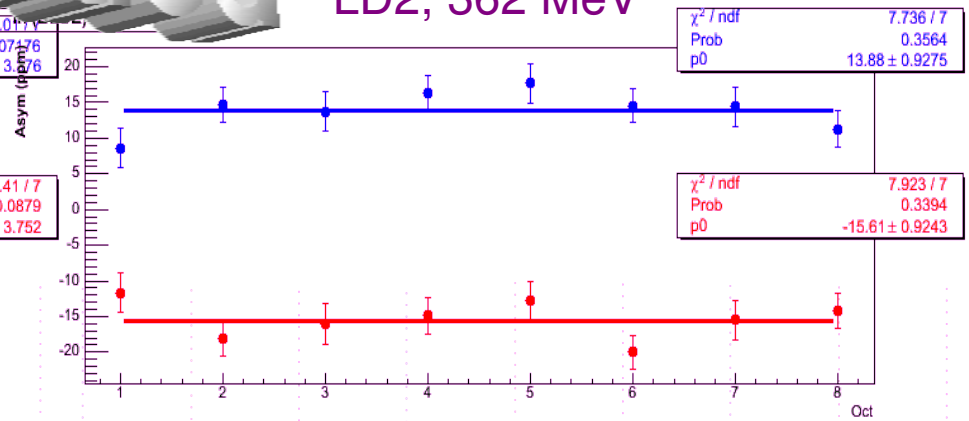




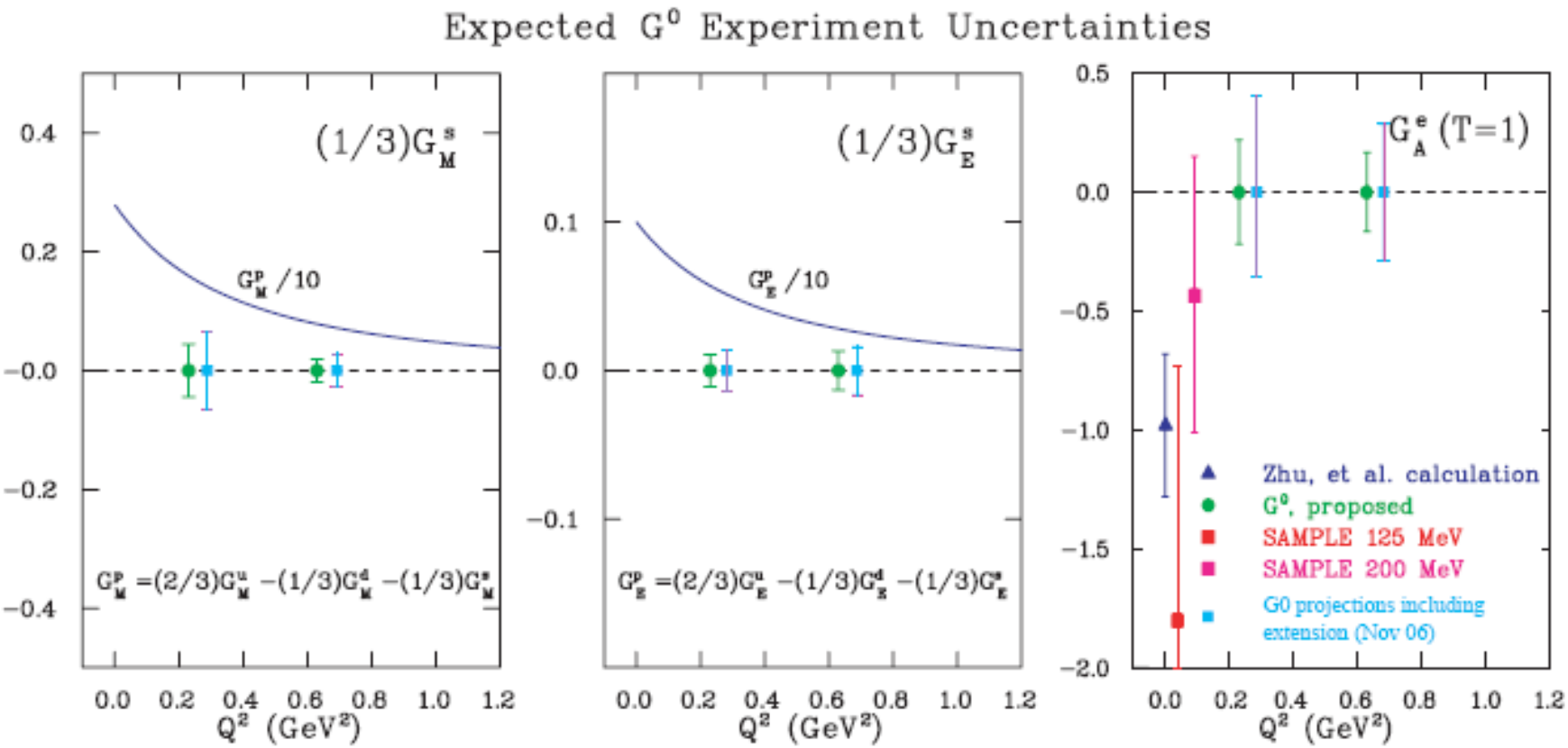
LD2, 687 MeV



LD2, 362 MeV



Expected G0 Results



November projections (including extension)

- goals for charge accumulation met

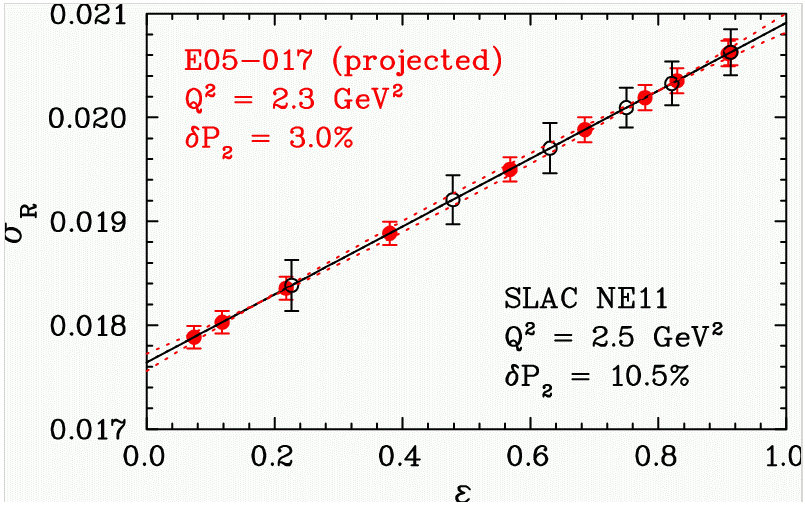
E05-017 – Two photon exchange in elastic ep

> 100 kinematic settings

Projected linearities

Q2	dP
0.98	2.3%
1.34	2.7%
2.29	3.0%

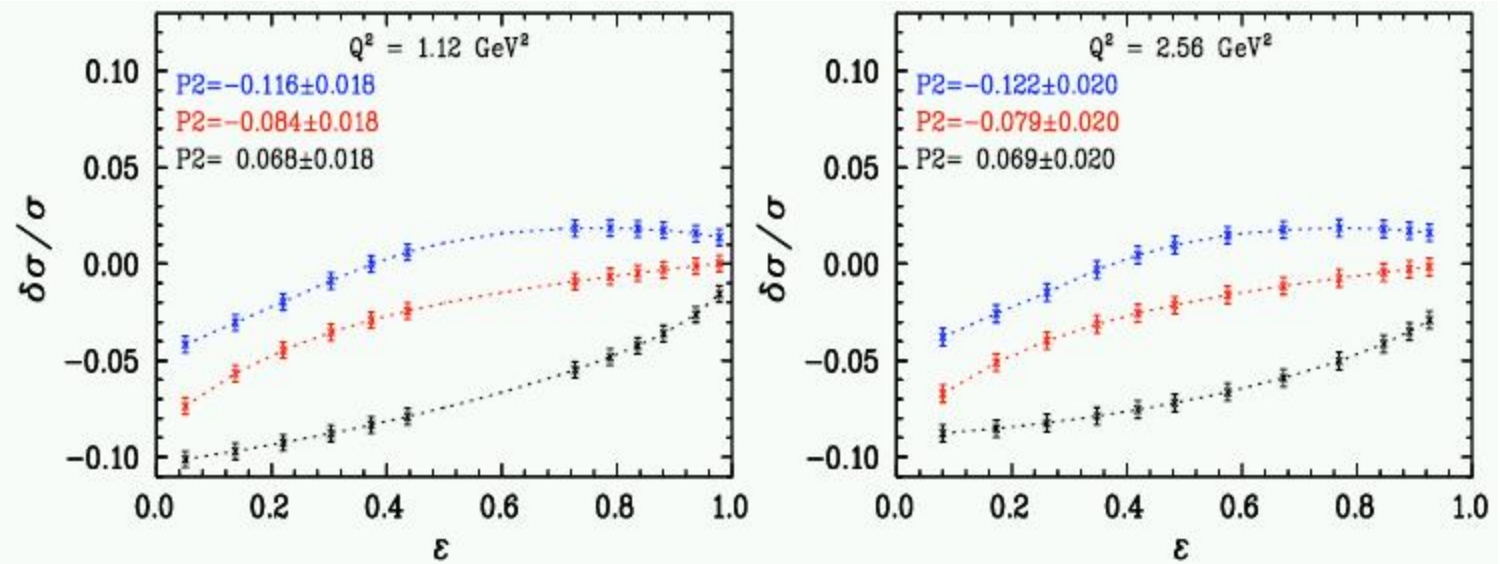
World average -12.8+/-10.3%



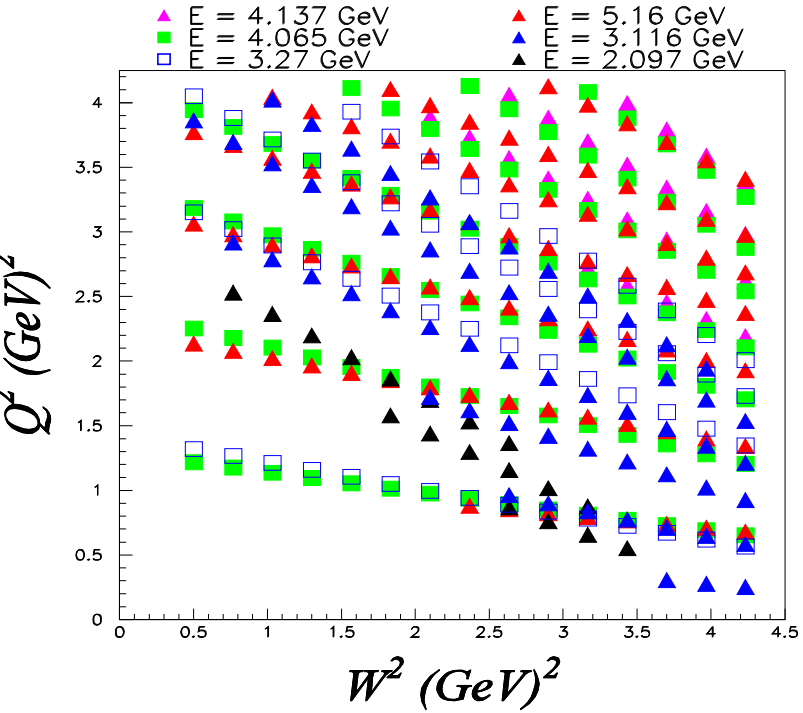
Chen, et.al.

Blunden, et.al.

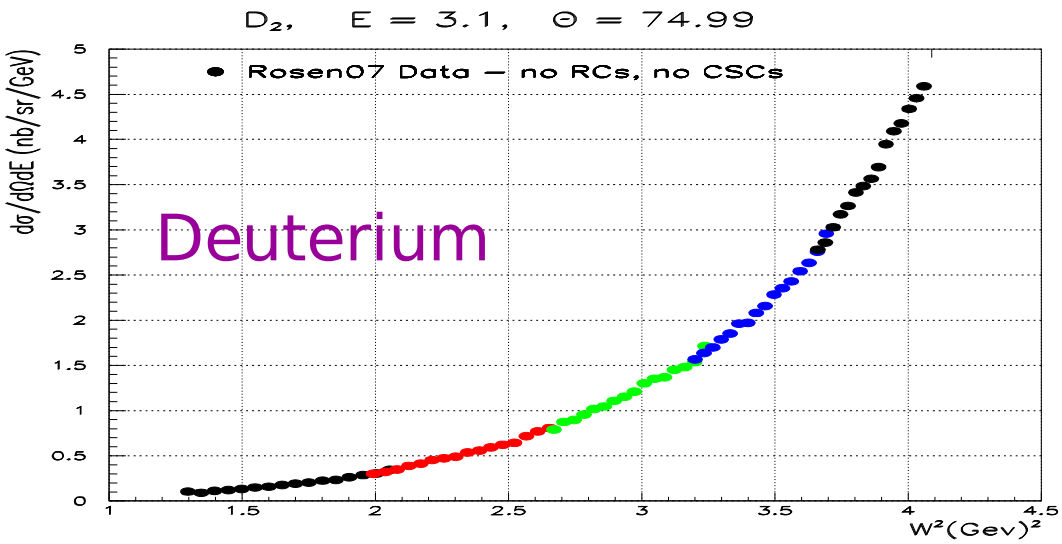
Afanasev, et.al.

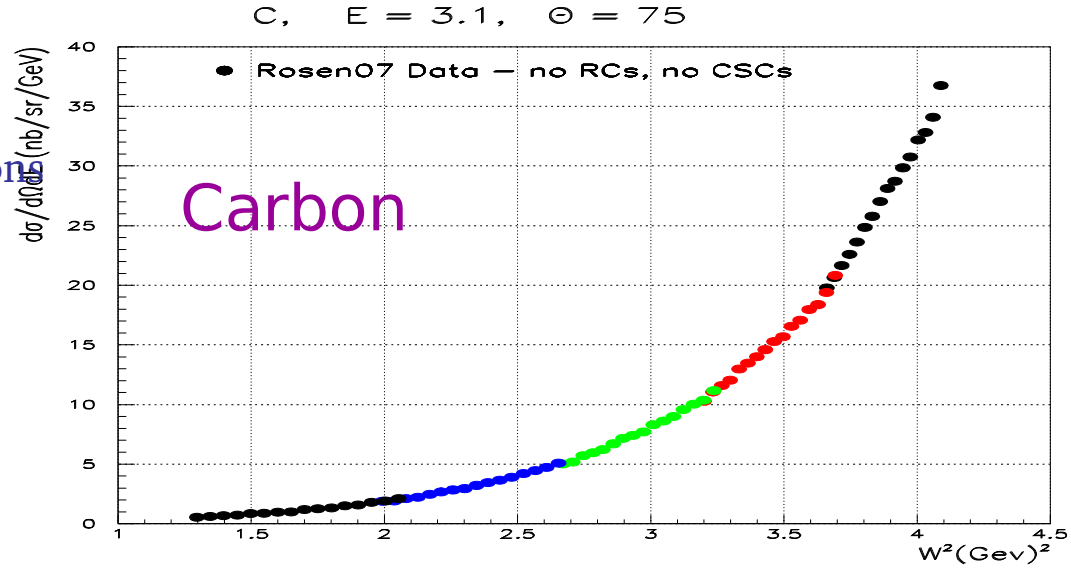


E04-01 / E06-09 – F2 and R on Nuclei



Online cross sections!



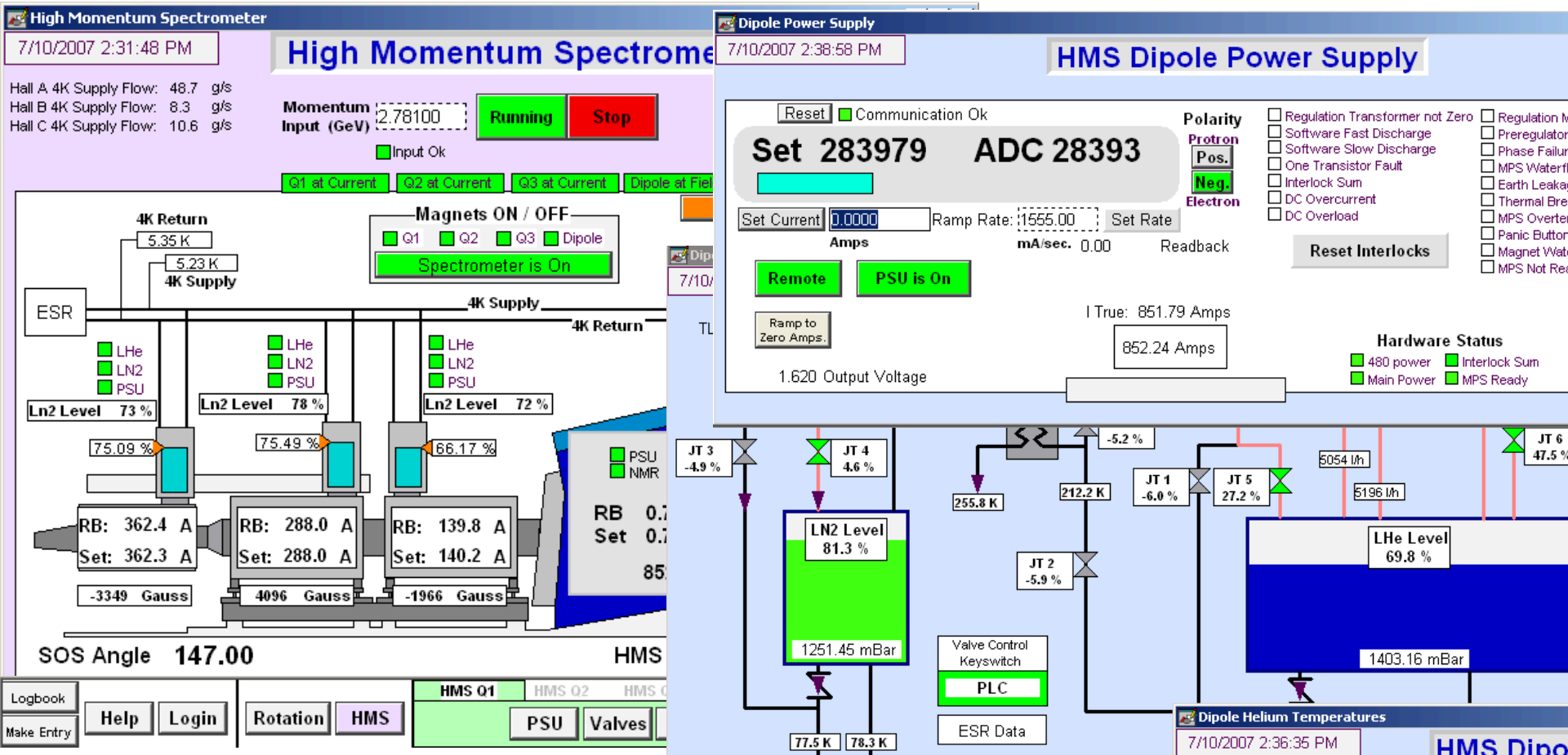


- ~100 scans, ~500 settings
- Precision L/T separated structure functions F_1, F_2, F_L, R
- H, D, Al, C, Fe/Cu
- Low Q^2 ran January 2005
- Moment extractions (compare to lattice predictions at $Q^2 = 4$ GeV^2)
- Useful for neutrino MC input

New HMS Control System

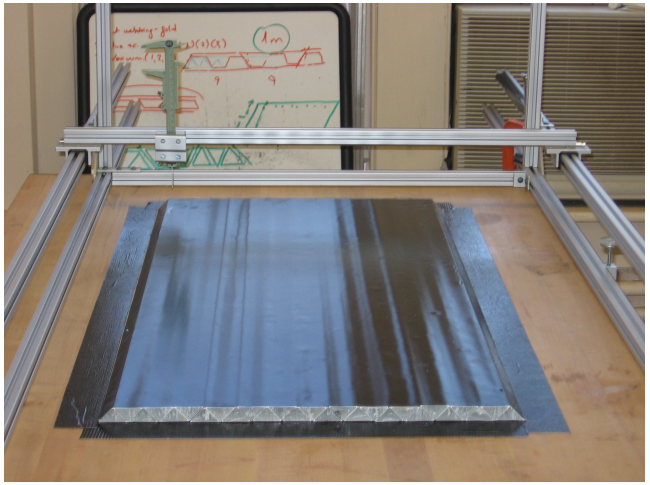
(*Mike Fowler, Steve Lassiter*)

Replaced aging separate systems for dipole and each quad with integrated system for all magnets (cryogenics and power supplies) and spectrometer angle.
Modern, maintainable PLC, move electronics out of hall.
Model for SHMS controls
Used for May-July 07 running

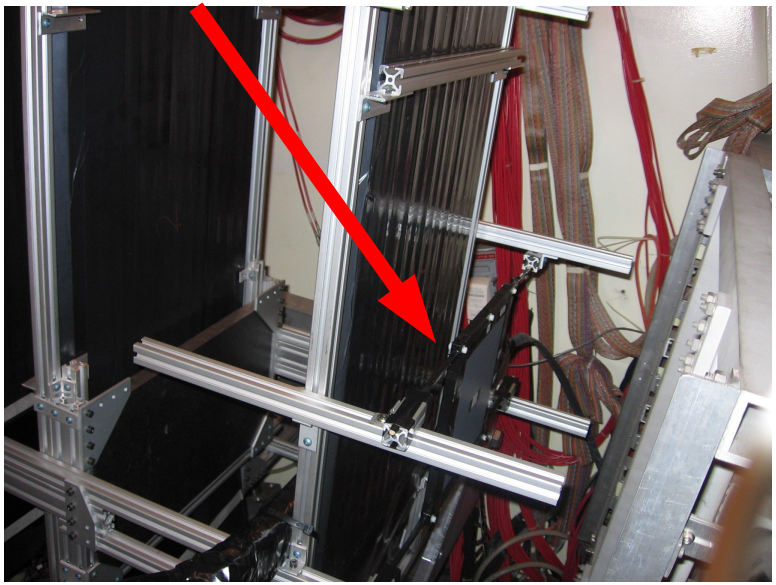


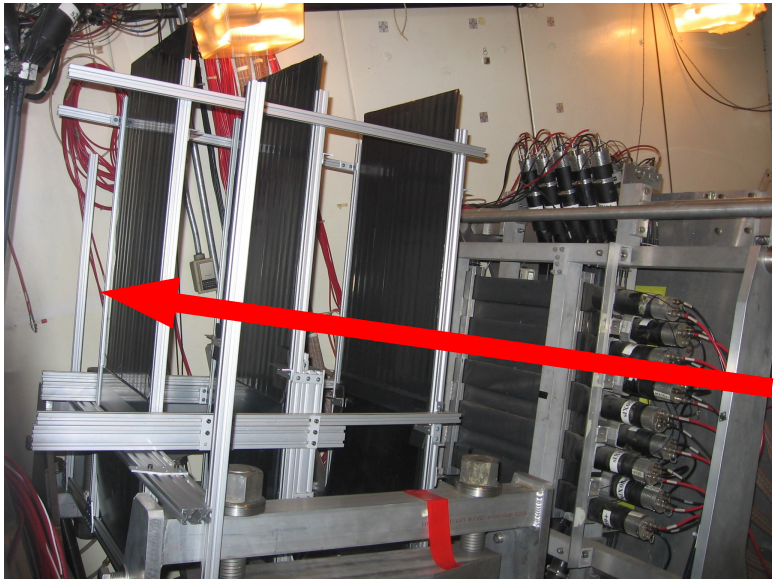
Detector tests in SOS

Recent Hall C running HMS only
SOS parked at ~140 degrees
Operated to give 100-500 MeV/c pions to test:
- SANE tracker (Norfolk State)
- SANE Lucite
- MINERvA detector planes (Hampton and W&M)



SANE Tracker





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Upcoming Experiments

Hall C Approved Experiment Summary

Base Equipment Experiments (0 experiments, 0 days):

Large Installation Experiments beyond G0 (10 experiments, 222+ days):

(315 days with Qweak Phase-II)

E04-108	Measurement of G_E^p/G_M^p to $Q^2 = 9$ GeV^2	40 days	A
E04-019	Measurement of the Two-Photon Exchange Contribution in e-p Elastic Scattering Using Recoil Polar.	18 days	A-
E07-002	Polarization Transfer in Wide Angle Compton Scattering	3 days	B
E07-003	Spin Asymmetries on the Nucleon Experiment	34 days	A
E04-113	Semi-Inclusive Spin Asymmetries on the Nucleon	25 days	A-
E05-101	Helicity Correlations in Wide-Angle Compton Scattering	14 days	A-
E07-011	A High Precision Measurement of g1d/F1d	8 days	A
E05-008	The Qweak Experiment: A Search for Physics at the TeV Scale via a Meas. of the Proton's Weak Charge	35+ days	A
E04-110	The Neutron Electric Form Factor at $Q^2 = 4.3$ GeV^2 from the D(e,e'n) Reaction via Recoil Polarimetry	25 days	A-
E05-115	Spectroscopic Investigation of Hypernuclei in … (II)	20 days	A-

Color coding indicates experiments using similar apparatus

Near term 2007-08 and beyond

Oct 2007-Jan 2008

- E04-019 2γ Exchange in ep Polarization Transfer
- E04-108 G_e^p/G_M^p up to $Q^2 = 9$ (GeP-III)
- E07-002 Polarization Transfer in Wide-Angle Compton Scattering

March-May 2008

- E04-108 G_e^p/G_M^p up to $Q^2 = 9$ (GeP-III)

Aug?-Dec 2008

- E07-003 Spin Asymmetries on the Nucleon Experiment
- E04-113 Semi-Inclusive Spin Asymmetries on the Nucleon
- E05-101 Helicity Correlations in Wide-Angle Compton Scattering
- E07-011 High Precision Measurement of g1d/F1d

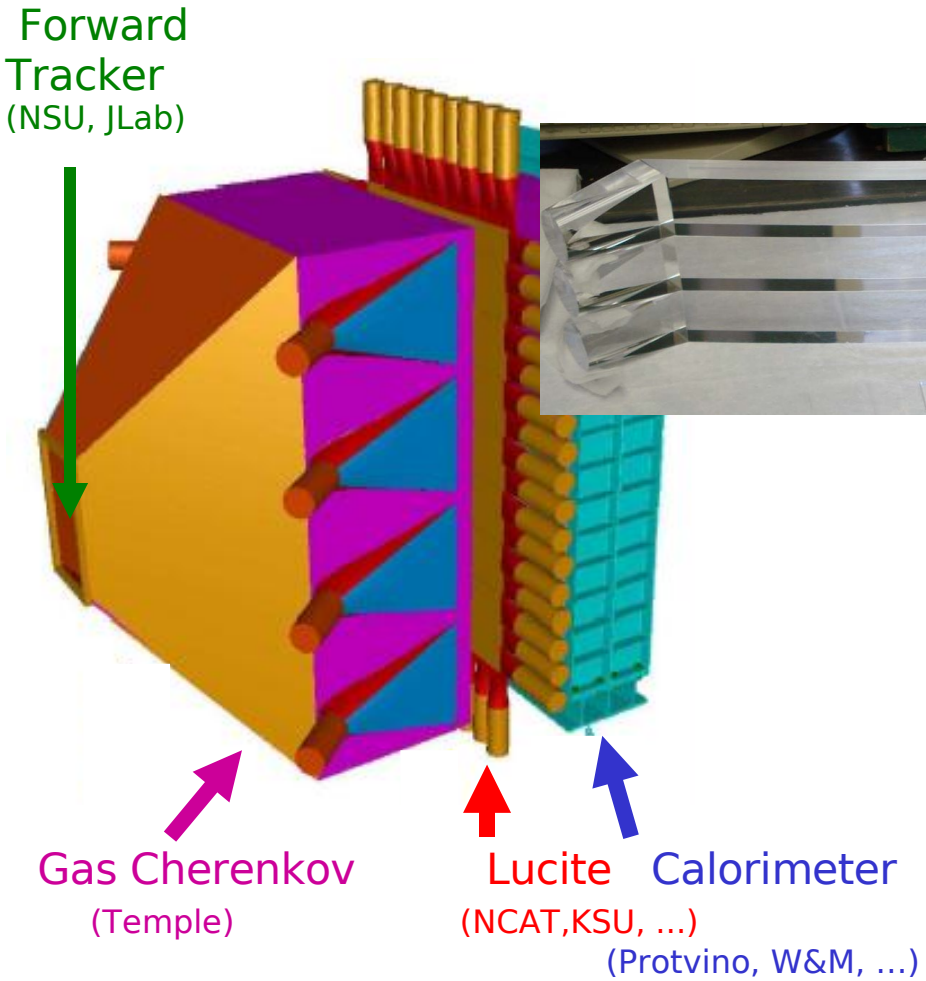
2009-12GeV shutdown

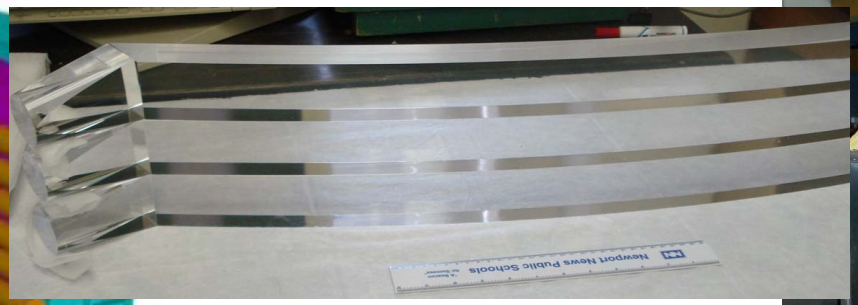
- HES/HKS – Hypernuclear experiment
- Qweak
- Remaining Poltar/BigCal and Gen if time available

Spin Asymmetries on the Nucleon Status

Now four experiments with similar setup:

E07-003 “SANE” (Rondon, Choi, Meziani):	g_1 & g_2 at $Q^2 = 4$ GeV^2
E04-113 “Semi-SANE” (Bosted, Day, Jiang, Jones):	Semi-Inclusive Spin Asymm.
E05-101 WACS (Day, Wojtsekhowski):	Helicity correlations in WACS
E07-003 g1d/F1d (Bosted, Wesselmann, Jiang)	Deuteron spin structure





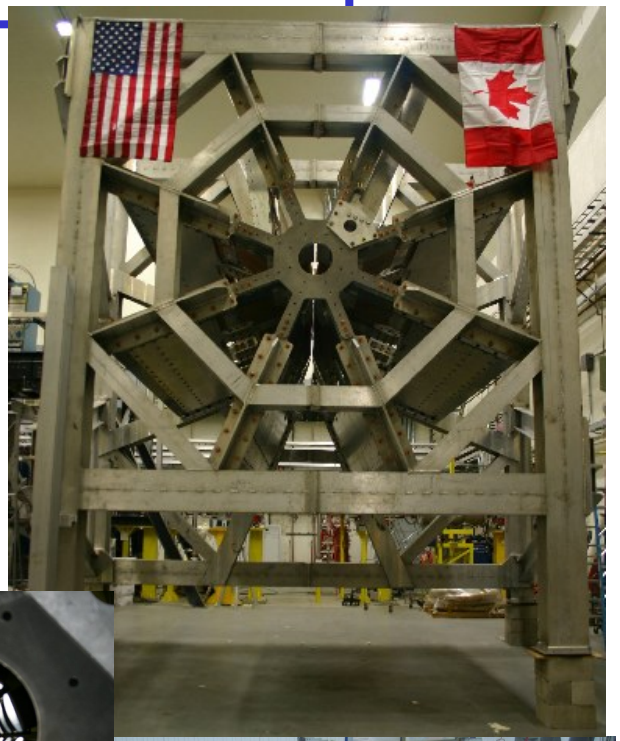
Status:

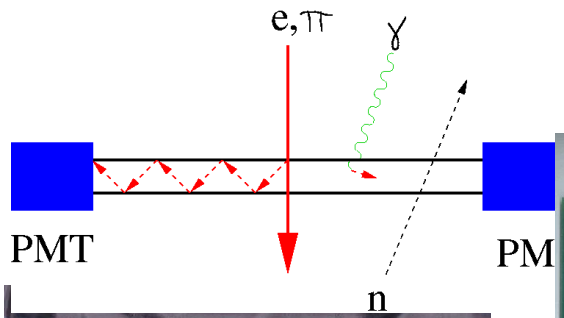
- Recent Readiness Review
- Cerenkov Frame delivered, mirrors being coated
- Forward tracker prototype tested in SOS
- Lucite designed, parts on order
- Calorimeter ~ BigCal of GEp-III, augmented with gain monitoring (UVa)
- Scattering Chamber ordered

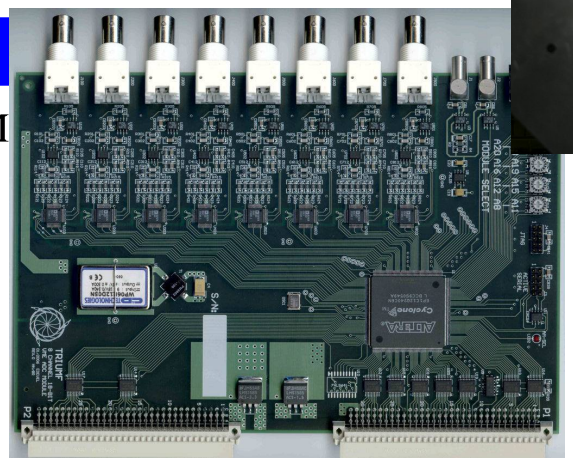
(encompasses all four experiments)

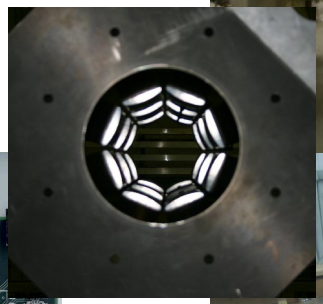
“A Search for New Physics Beyond the Standard Model at the TeV Scale”

- QTor magnet assembly complete at MIT/Bates. Preparing for testing.
- 9.5 kA power supply delivery imminent
- (Synthetic) Quartz detectors and PMTs are in.
- Electronics in production: 18-bit ADC’s + I-to-V’s (LANL/TRIUMF),
  Preamplifiers: final production (TRIUMF)
  Irradiation test done: no long-term damage
- Progress in tracking detectors and rotator mechanisms (LaTech, VPI, W&M)
- On track for Phase-I in 2009



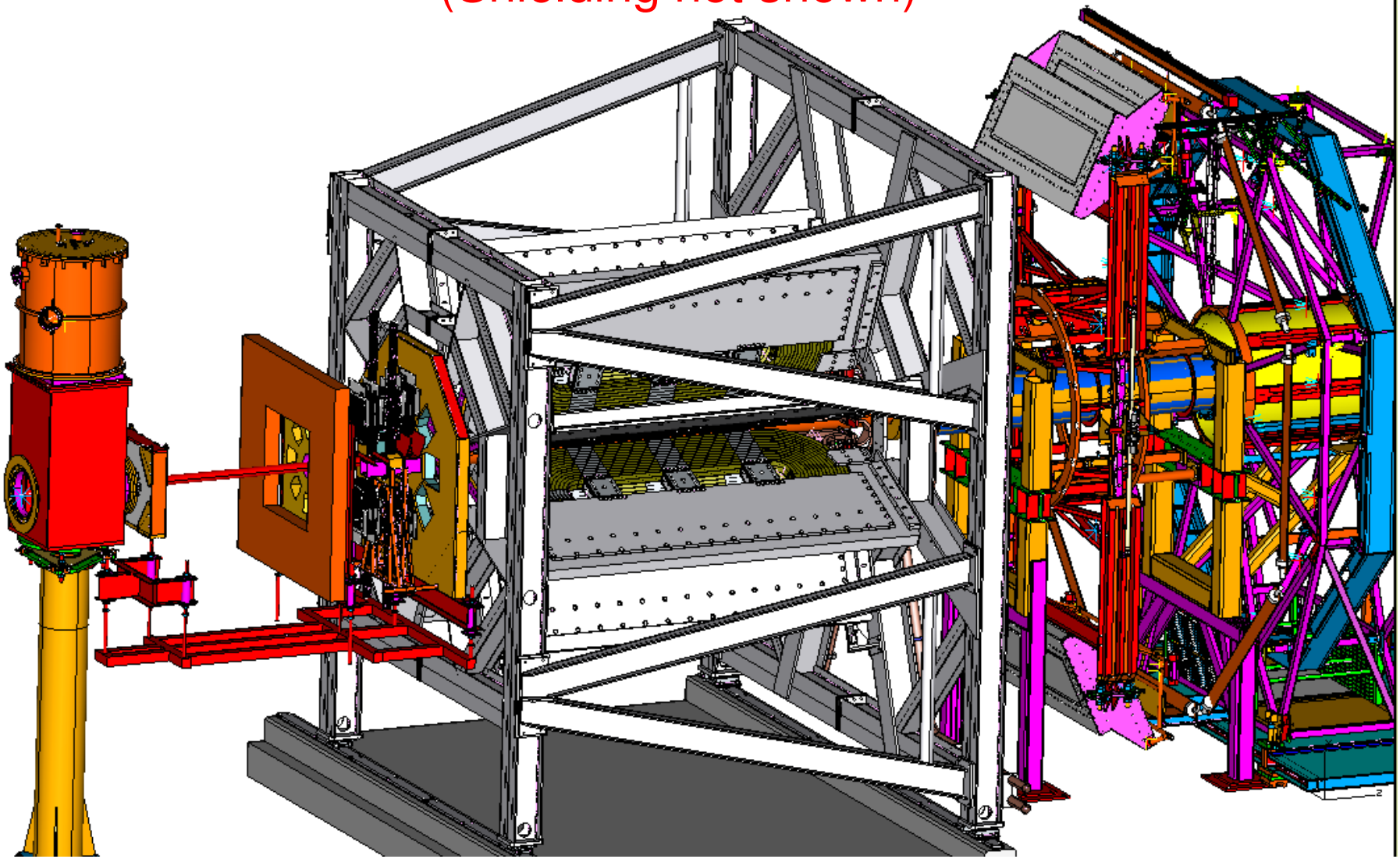






Current Detail of Qweak CAD / Assembly Drawing

(Shielding not shown)



PAC 32 Results
(12 GeV PAC)

PAC 12 GeV Review Grading

Categorize Proposals:

- **APPROVAL**: This proposal, based on what we know today, is highly likely to be of sufficient scientific merit that it will be included in the priority list to be established for the first 5 years of 12 GeV Operations
  - Provide comments on technical and scientific issues that should be addressed by the proponents prior to a second review and the assignment of scientific priority at a future PAC

- **CONDITIONAL APPROVAL**: This proposal has the potential for falling into the YES category but serious work is needed to clarify scientific and/or technical issues
  - Provide comments on technical and scientific issues that should be addressed by the proponents prior to its presentation to a future PAC

- **DEFER**: This proposal does not appear to have the potential for falling into the YES category, and a major effort will be needed to justify its inclusion based on identified fundamental problems
  - Provide comments on technical and scientific issues that must be addressed by the proponents prior to its presentation to a future PAC

12 GeV Proposals Actions

12 GeV Proposal #	TITLE	CONTACT PERSON	HALL	DAYS	PAC Action
12-07-101	Hadronization in Nuclei by Deep Inelastic Electron Scattering	B.Norum	C	15	Conditional Approval
12-07-102	Precision Measurement of the Parity-Violating Asymmetry in Deep Inelastic Scattering off Deuterium using Baseline 12 GeV Equipment in Hall C	P. Reimer	C	36	Conditional Approval
12-07-103	The Nuclear Transparency of Pion-photoproduction from ^{4}He at 12 GeV	D. Dutta	C	14.5	Defer
12-07-104	Measurement of the Neutron Magnetic Form Factor at High Q^2 Using the Ratio Method on Deuterium	G. Gilfoyle	B	56	Approval
12-07-105	Scaling Study of the L-T Separated Pion Electroproduction Cross Section at 11 GeV	T. Horn	C	42	Approval
12-07-106	The A-dependence of J/Psi Photoproduction near Threshold	E. Chudakov	C	23	Conditional Approval
12-07-107	Studies of Spin-Orbit Correlations with Longitudinally Polarized Target	H. Avakian	B	103	Approval
12-07-108	Precision Measurement of the Proton Elastic Cross Section at High Q^2	B. Moffit	A	31	Approval
12-07-109	Large Acceptance Proton Form Factor Ratio Measurements at 13 and 15 $(GeV/c)^2$ Using Recoil Polarization Method	L. Pentchev	A	60	Approval

3 Letters of Intent for 12 GeV

12GeV LOI #	TITLE	CONTACT PERSON	HALL
LOI12-07-101	Lambda Polarization in the Target Fragmentation Region (Letter of Intent)	Harut Avakian	B
LOI12-07-102	Tagged Neutron Structure Function in Deuterium with CLAS12 (Letter Of Intent)	Sebastian Kuhn	B
LOI12-07-103	A detailed study of semi-inclusive deep-inelastic pion production on unpolarized proton and deuteron targets with the CLAS12 detector	Xiaodong Jiang	B

PAC32 Recommends that ALL of these Letters of Intent be developed into full proposals