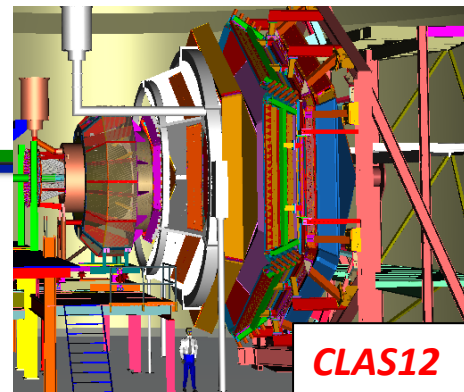
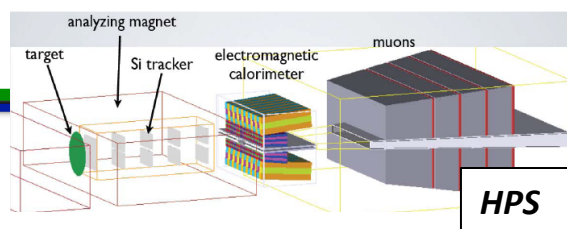
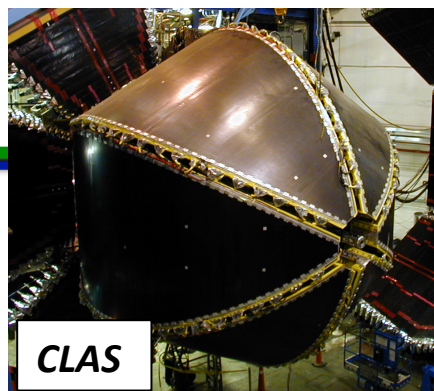




Hall B Report

***Volker D. Burkert
Jefferson Lab***

Meeting of the JLab PAC39 June 18-22, 2012

Goals for 2012

- Continue publishing high impact results
- Complete the N^* program on neutrons with polarized HD target
- Electron test run with HDIce-IBC
- Parasitic tests for HPS experiment (-> PAC presentation by HPS team)
- Begin de-installation of CLAS in preparation for CLAS12
- Offline software review for CLAS12

Physics publications since PAC38 (ref. Journals)

Collaboration publications

- 1) Evidence for the onset of **color transparency** in ρ^0 electroproduction in nuclei, El Fassi et al., PLB 712 (2012) 326
- 2) Measurement of the **neutron F_2^n** structure function in spectator tagging, N. Baille et al., PRL 108 (2012) 199902
- 3) Measurement of **generalized form factors** near threshold in $\gamma p \rightarrow n\pi^+$ at high Q^2 , K. Park et al., PRC 85 (2012) 035208
- 4) Branching Ratio of the Electromagnetic **Decay of the $\Sigma^+(1385)$** , D. Keller et al., PRD 85 (2012) 059903
- 5) Upper limits for the photoproduction of **the $\Phi^-(1860)$** off the deuteron, H. Egiyan et al., PRC 85 (2012) 015205
- 6) Measurement of the nuclear multiplicity ratio for **K^0_s hadronization** in CLAS, A. Daniel et al., PLB 706 (2011) 26
- 7) Beam spin asymmetries in **semi-inclusive π^0** production, M. Aghasyan, et al., PLB 704 (2011) 397-402

Collaboration papers submitted for publications

- 1) Exclusive π^0 electroproduction str. funct. and their relationship to Transversity GPDs, I. Bedlinsky et al. (PRL)
- 2) Deep exclusive π^+ electroproduction off the proton at CLAS, K. Park et al., arXiv:1206.2326 (PRC)
- 3) A study of $P_{11}(1440)$ and $D_{13}(1520)$ resonances in $ep \rightarrow e p \pi^+ \pi^-$, V. Mokeev et al., arXiv:1205.3948 (PRC)
- 4) Comparison forward/backward pp pair knockout in $^3\text{He}(e, e' pp)n$, H. Baghdasaryan et al., arXiv:1202.5317 (PRC)

Review

Electroexcitation of nucleon resonances, I. Aznauryan and V. Burkert, Prog. Part. Nucl. Phys. 67 (2012) 1-54

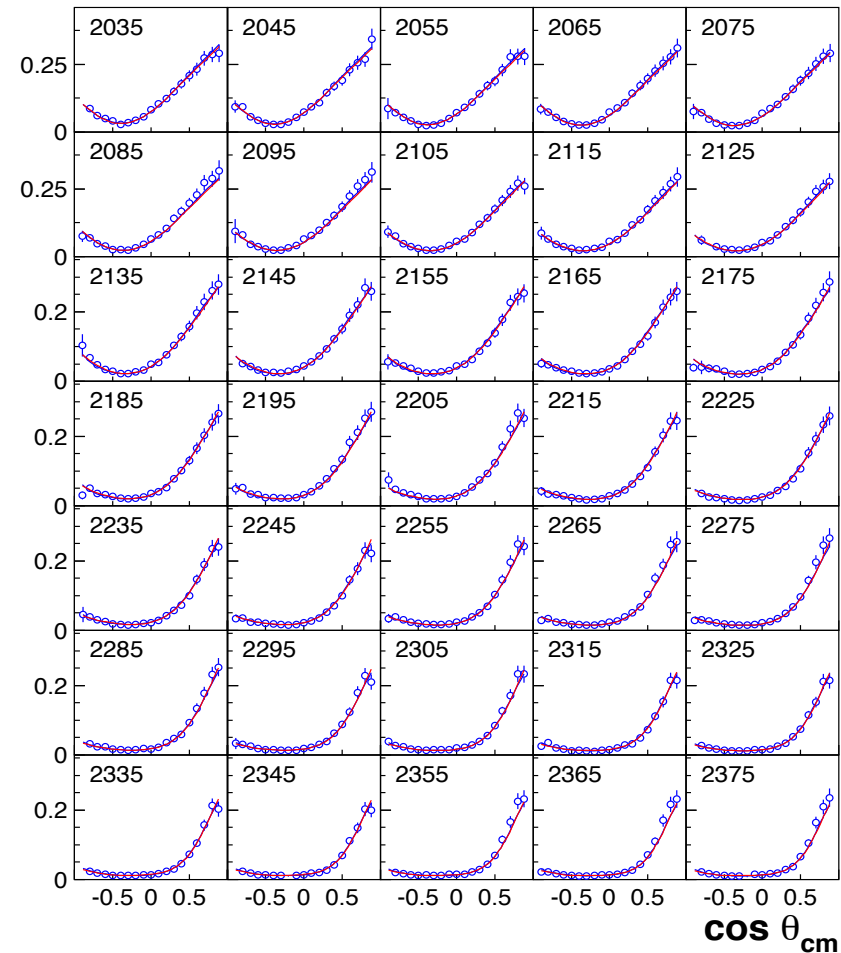
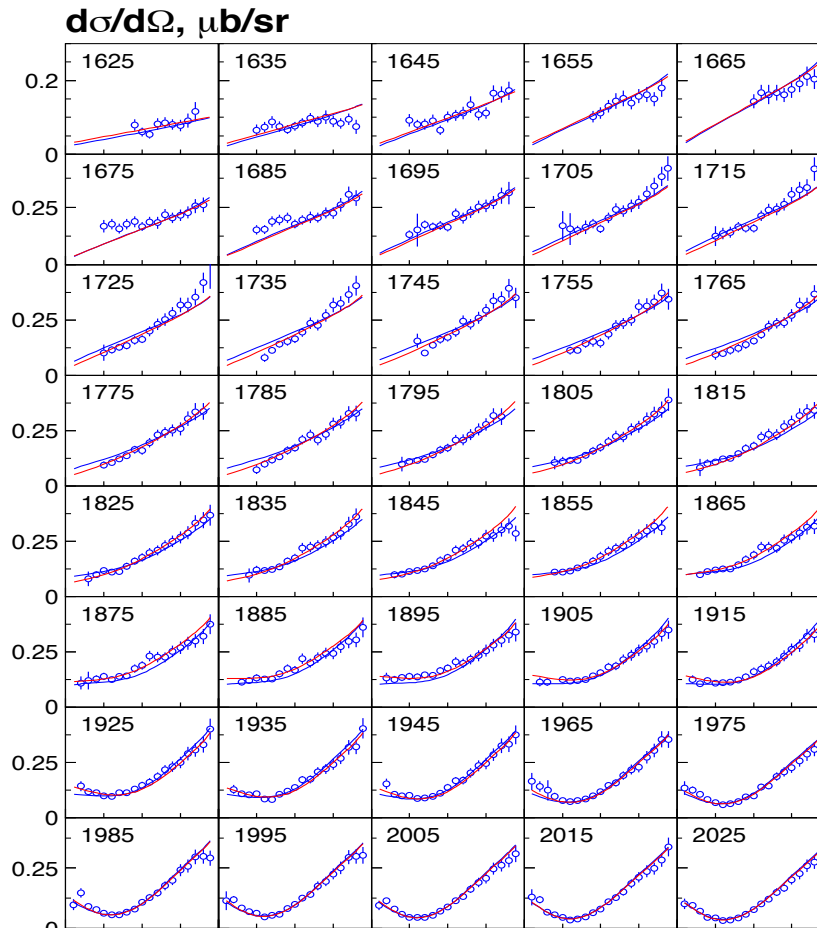
N* photoproduction program ✓-published, ✓-acquired

	σ	Σ	T	P	E	F	G	H	T_x	T_z	L_x	L_z	O_x	O_z	C_x	C_z
$p\pi^0$	✓	✓	✓		✓	✓	✓	✓	Proton targets							
$n\pi^+$	✓	✓	✓		✓	✓	✓	✓								
$p\eta$	✓	✓	✓		✓	✓	✓	✓								
$p\eta'$	✓	✓	✓		✓	✓	✓	✓								
$p\omega/\phi$	✓	✓	✓		✓	✓	✓	✓								
$K^+\Lambda$	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
$K^+\Sigma^0$	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
$K^{0*}\Sigma^+$	✓	✓									✓	✓				

CLAS results $\gamma p \rightarrow K^+ \Lambda \rightarrow K^+ p \pi^-$

Bonn-Gatchina Coupled Channel Analysis, A.V. Anisovich et al, EPJ A48, 15 (2012)

(Includes nearly all new photoproduction data)

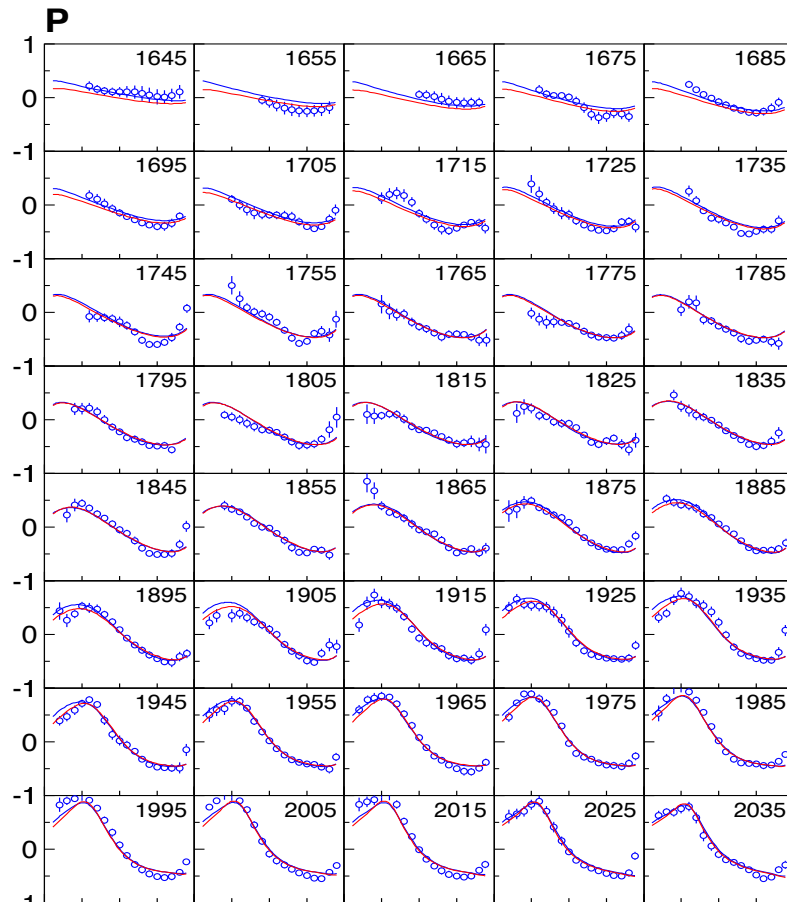


M. Mc Cracken et al. (CLAS), Phys. Rev. C 81, 025201, 2010

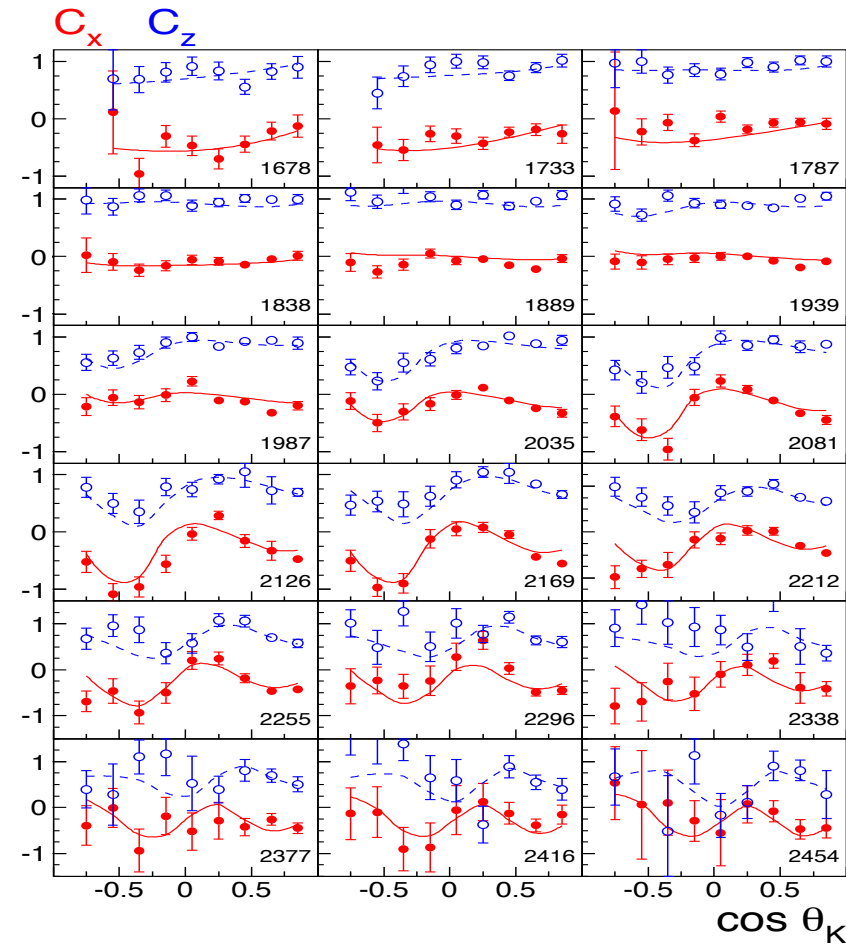
CLAS results $\vec{\gamma}p \rightarrow K^+ \vec{\Lambda} \rightarrow K^+ p \pi^-$

Bonn-Gatchina Coupled Channel Analysis, A.V. Anisovich et al, EPJ A48, 15 (2012)

(Includes nearly all new photoproduction data)



M. Mc Cracken et al. (CLAS), Phys. Rev. C 81, 025201, 2010



D. Bradford et al. (CLAS), Phys.Rev. C75, 035205, 2007

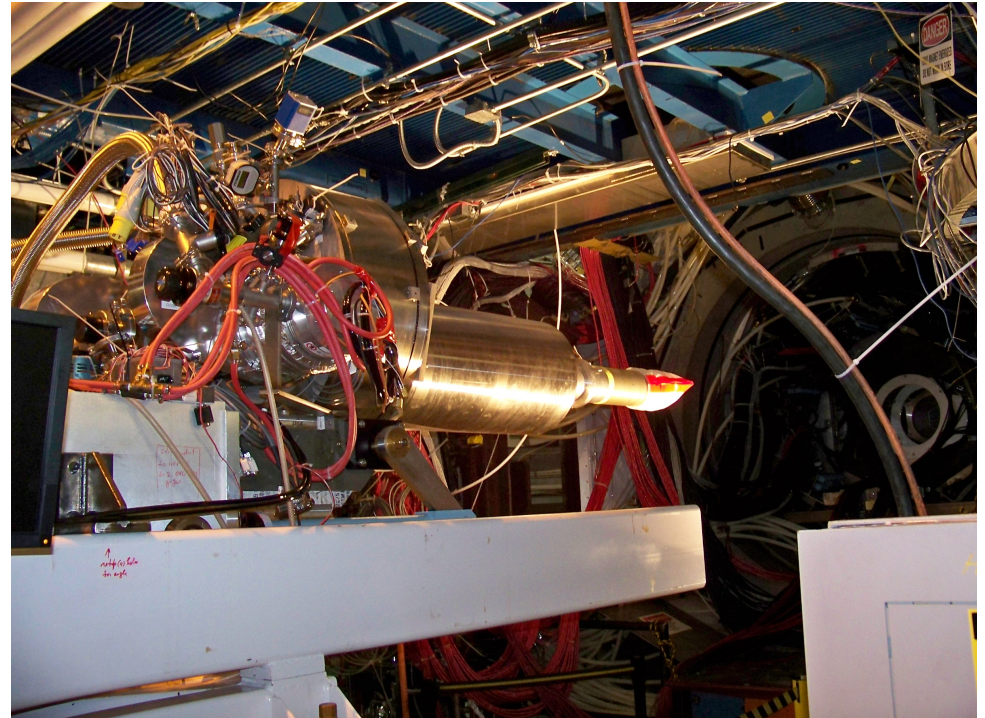
Evidence for new N^* states and couplings

State $N((\text{mass})J^P)$	PDG 2010	PDG 2012	$K\Lambda$	$K\Sigma$	$N\gamma$
$N(1710)1/2^+$	*** (not seen in GW analysis)	***	***	**	***
$N(1880)1/2^+$		**	**	*	**
$N(1895)1/2^-$		**	**	*	***
$N(1900)3/2^+$	**	***	***	**	***
$N(1875)3/2^-$		***	***	**	***
$N(2150)3/2^-$		**	**		**
$N(2000)5/2^+$	*	***	**	*	**
$N(2060)5/2^-$		***		**	***

Bonn-Gatchina Analysis – A.V. Anisovich et al., EPJ A48, 15 (2012)
(First coupled-channel analysis that includes nearly all new photoproduction data)

HDice operations during g14 / E06-101

- HD targets condensed, polarized and aged to the Frozen-Spin state in HDice Lab.
 - transferred as solid, polarized HD between cryostats; moved to Hall B
 - In-Beam Cryostat (IBC) operates in Hall at 50 mK, 0.9 tesla
 - g14 ran from Nov/11 to May/12 with 15mm $\varnothing$ $\times$ 50mm long HD cells
 - γ -beam lifetimes $\sim$ years with 10^8 γ /s
-
- HD targets used for electron beam test in Feb/12 and Mar/12
 - ➔ H polarization does not appear to suffer radiation damage with 1 nA; D does
 - ➔ heat removal needs improvement – faster beam raster, larger diameter cell, shorter cooling wires.

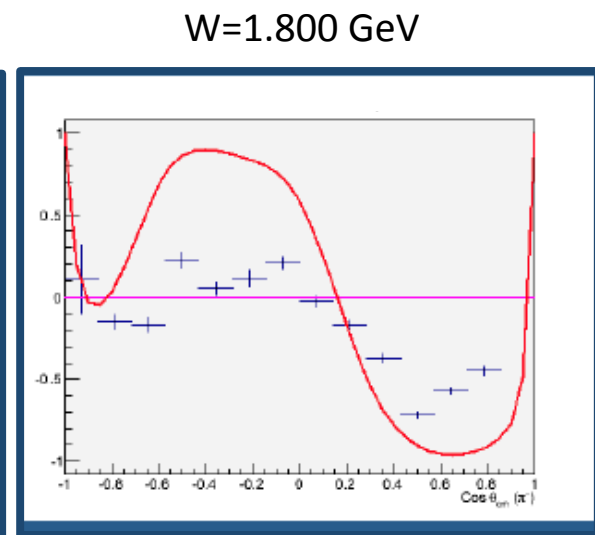
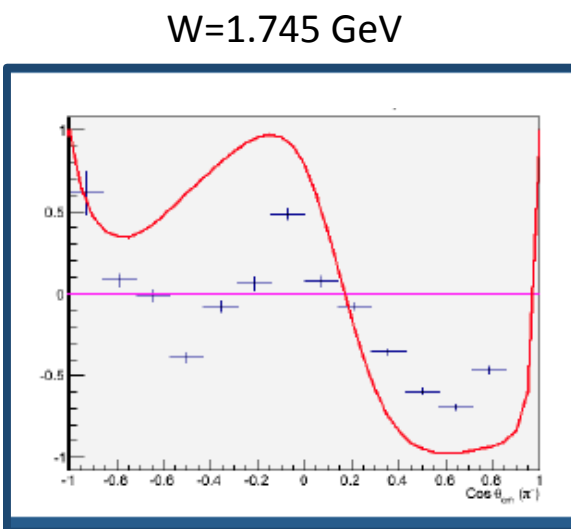
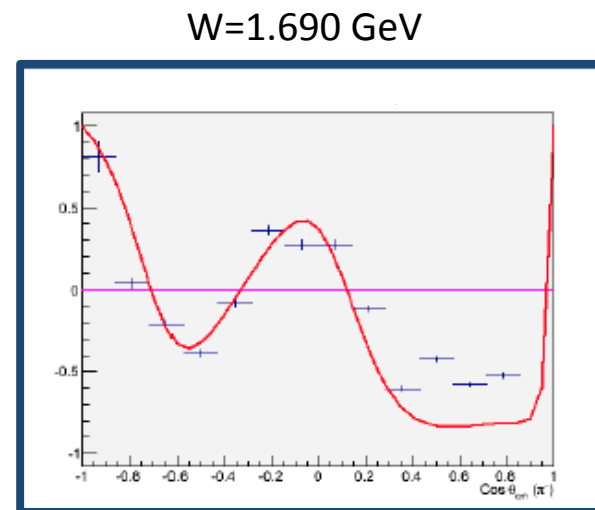
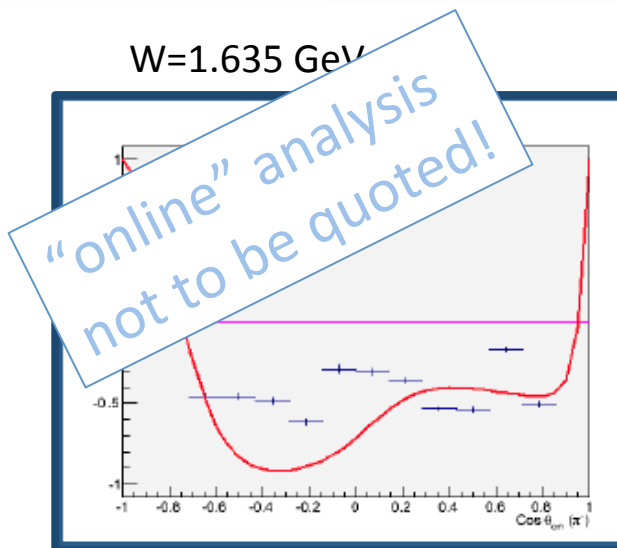


Double asymmetry E^n on neutron

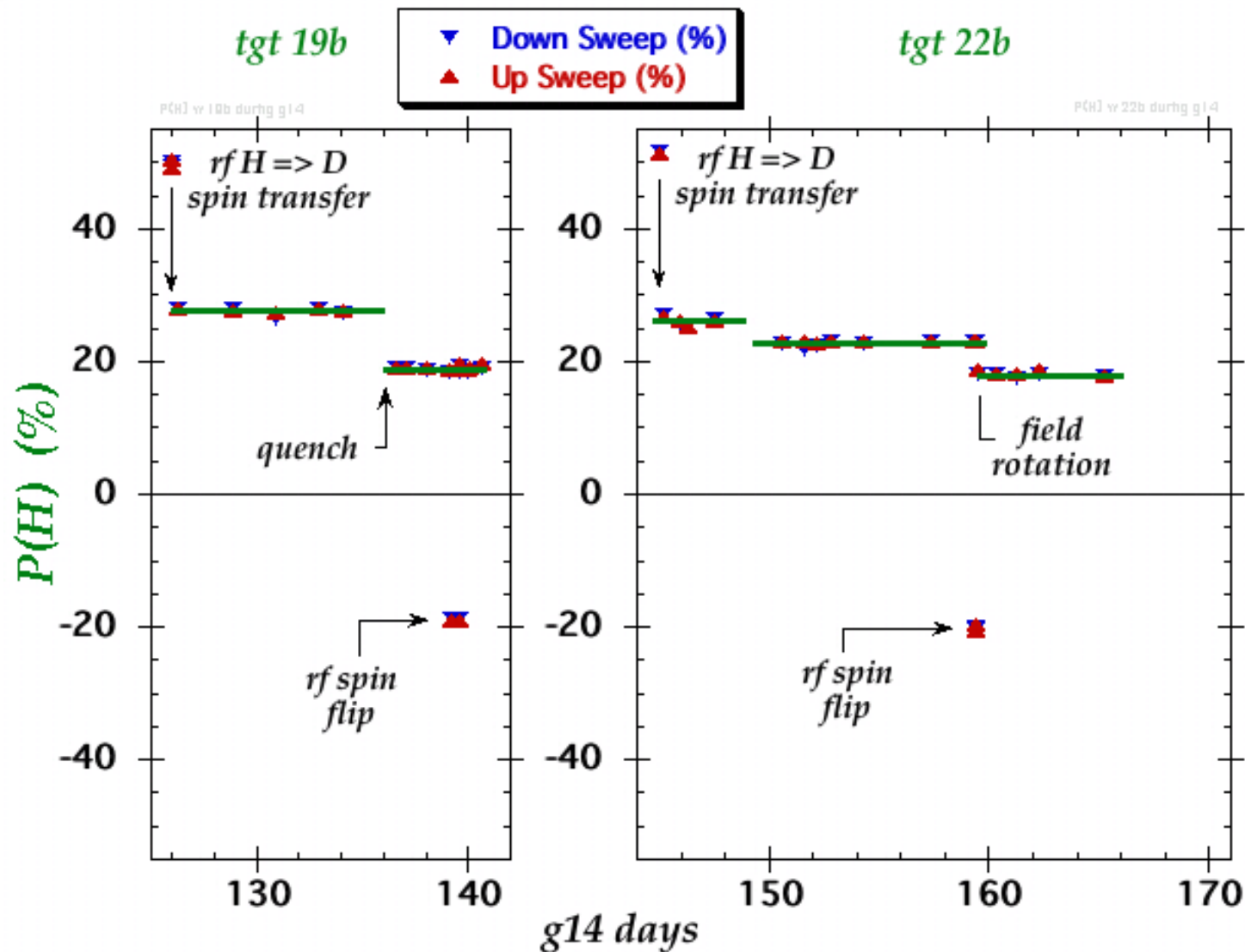
Sample bins

$$\vec{\gamma}\vec{n} \rightarrow \pi^- p$$

— projections
from SAID



$\vec{H}$ D polarization during g14/E06-101



Hall B experiments – run groups (6/18/2012)

Proposal	Physics	Contact	Rating	Days	Group	New equipment	Energy	Run Group	Target
E12-06-108	Hard exclusive electro-production of π^0, η	Stoler	B	80	119 + 30	RICH (1 sector) Forward tagger	11	A F. Sabatié	liquid H ₂
E12-06-112	Proton's quark dynamics in SIDIS pion production	Avakian	A	60					
E12-06-119	Deeply Virtual Compton Scattering	Sabatie	A	80					
E12-09-103	Excitation of nucleon resonances at high Q ²	Gothé	B+	40					
E12-11-005	Hadron spectroscopy with forward tagger	Battaglieri	A-	119					
PR12-12-001	Timelike Compton Scatt. & J/ψ production in e+e-	Nadel-Turonski		130					
PR12-12-007	Exclusive φ meson electroproduction with CLAS12	Stoler		60					
PR12-12-008	Photoproduction of the very strangest baryon	Guo		80					
E12-07-104	Neutron magnetic form factor	Gilfoyle	A-	30	90	Neutron detector RICH (1 sector) Forward tagger	11	B K. Hafidi	liquid D ₂ target
PR12-11-109 (a)	Dihadron DIS production	Avakian							
E12-09-007a	Study of partonic distributions in SIDIS kaon production	Hafidi	A-	56					
E12-09-008	Boer-Mulders asymmetry in K SIDIS w/ H and D targets	Contalbrigo	A-	TBA					
E12-11-003	DVCS on neutron target	Niccolai	A	90					
E12-06-109	Longitudinal Spin Structure of the Nucleon	Kuhn	A	80	170	Polarized target RICH (1 sector) Forward tagger	11	C S. Kuhn	NH ₃ ND ₃
E12-06-119(b)	DVCS on longitudinally polarized proton target	Sabatie	A	120					
E12-07-107	Spin-Orbit Correl. with Longitudinally polarized target	Avakian	A-	103					
PR12-11-109 (b)	Dihadron studies on long. polarized target	Avakian							
E12-09-007(b)	Study of partonic distributions using SIDIS K production	Hafidi	A-	110					
E12-09-009	Spin-Orbit correlations in K production w/ pol. targets	Avakian	B+	103					
E12-06-106	Color transparency in exclusive vector meson production	Hafidi	B+	60	60		11	D	Nuclear
E12-06-117	Quark propagation and hadron formation	Brooks	A-	60	60		11	E	Nuclear
E12-10-102	Free Neutron structure at large x	Bueltman	A	40	40	Radial TPC	11	F	Gas D ₂
TOTAL run time				1501	539 (569)				

Hall B new proposals (6/18/2012)

Proposal	Physics	Contact	Rating	Days	Group	Equipment	Energy	Group	Target
C12-11-111	SIDIS on transverse polarized target	M. Contalbrigo	C2	110	110	Transverse target	11	RG-G	HD
PR12-12-009	Transversity w/ di-hadron on transvere target	H. Avakian		110					
PR12-12-010	DVCS with transverse polarized target in CLAS12	L. Elouadrhiri		110					
All transverse target proposals				330	110				
C12-11-006	Heavy Photon Search at Jefferson Lab (HPS)	J. Jaros	C2	180	180	New setup in alcove	2.2, 6.6	RG-H	Nuclear
C12-11-106	High Precision Measurement of the Proton Charge Radius	A. Gasparian	C2	15	15	Primex	1.1, 2.2	RG-I	H2 gas
TOTAL PAC39 beam time request				525	305				

Summary of Hall B experiments/proposals

Proposal approved & cond. approved	PAC proposal days	PAC group days
PAC38 beam time for approved RG A-F	1231	539
New proposals for RG A	270	30
New proposals for RG G	330	110
All CLAS12 proposals	1831	679
PAC39 beam time request for RG H	180	180
PAC39 beam time request for RG I	15	15
All non-CLAS12 proposal	195	195
All Hall B proposals: All CLAS12 + all non-CLAS12 PAC38 time approved + PAC39 time requested	2026	874
Years needed to run the program either as individual experiments or as run groups (55% efficiency, 35 weeks/year, multiplicity=3)	20.0 years	8.7 years

Selection of run group A for first physics

- LH2 target enables measurement of detector and tracking efficiencies and acceptances
 - compare to well known cross sections, e.g. elastic $p(e,ep)$, exclusive $p(e,e'p)\pi^0$, $p(e,e'\pi^+)n$, inclusive $p(e,e')X$, ...
- Provides detector calibration in momentum, angle, through tracking, particle id, missing masses, e.g. $ep \rightarrow ep(\pi^0, \eta, \omega)$, $e\pi^+(n)$, $ep\pi^+(\pi^-)$
- Serves multitude of high impact experiments
- Groups well organized and ready for expedient analysis

Hall B scheduling - tentative

During first 5 years all approved + proposed experiments would get part (or all) of approved time

Run Group	Days	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Total	869	6/15 ↓									
RG-A (proton)	149										
RG-B (deut.)	90										
RG-C (NH ₃)	120										
RG-C-b (ND ₃)	50										
RG-F (BoNuS)	40										
RG-E (Hadr.)	60										
RG-D (CT)	60										
RG-G (TT)	110										
RG-H (HPS)	180										
RG-I (ProRad)	10										

Assumption: Acceptable beam in use = 55% of scheduled time.

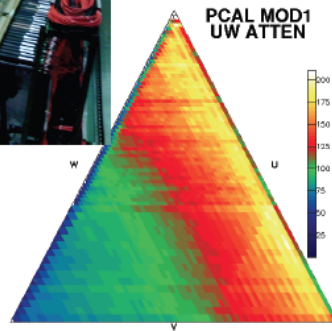
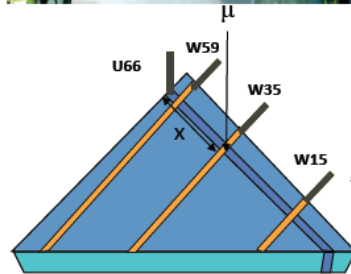
Expected 1st Papers from early run

Proposal	Physics	1 st conference paper	months (after run)
E12-06-119	Deeply Virtual Compton Scattering	$p(e,e'\gamma)$, A_{LU} , GPD H	4
E12-06-112	Proton's quark dynamics in SIDIS pion production	$p(e,e'\pi^+)X$, A_{LU}	4
E12-06-108	Hard exclusive electro-production of π^0 , η	$p(e,e'p\pi^0)$ A_{LU} , σ_u , σ_{LT} , σ_{TT} , σ_e	9
E12-09-103	Excitation of nucleon resonances at high Q^2	$p(e,e'\pi^+)n$, σ_u , σ_{LT} , σ_{TT} , σ_e	12
E12-11-005	Hadron spectroscopy with forward tagger	$p(\gamma, \pi^+\pi^+\pi^-)n$, $p(\gamma, N\pi\eta)$	12
PR12-12-001	Timelike Compton Scatt. & J/ψ production in e^+e^-	$p(\gamma, e^+e^-)$, yield	6
PR12-12-007	Exclusive ϕ meson electroproduction with CLAS12	$p(e,e'p\phi)$, σ_u , σ_{LT} , σ_{TT}	12
PR12-12-008	Photoproduction of the very strangest baryon	$p(\gamma, \Xi, \Omega)$, yield	9

CLAS12 – CalCom & Software

CLAS12 – Commissioning Plan Hall B 12 GeV Upgrade

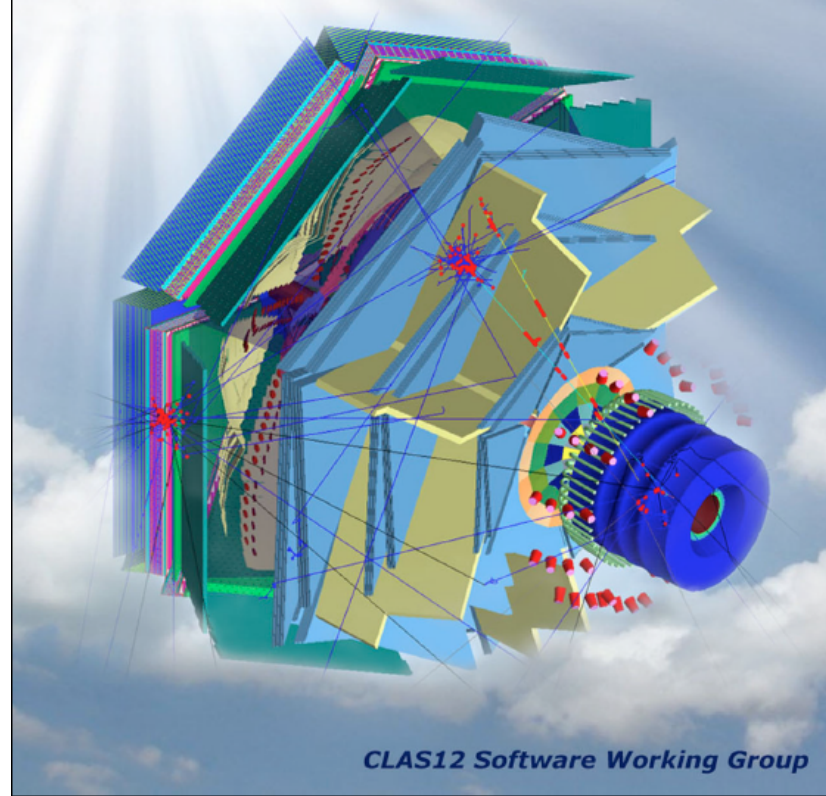
June 2012



CLAS12 CALCOM Group

CLAS12 - Software Document Hall B 12 GeV Upgrade

May 2012



CLAS12 Software Working Group

<https://www.jlab.org/conferences/12gevhbsr/>

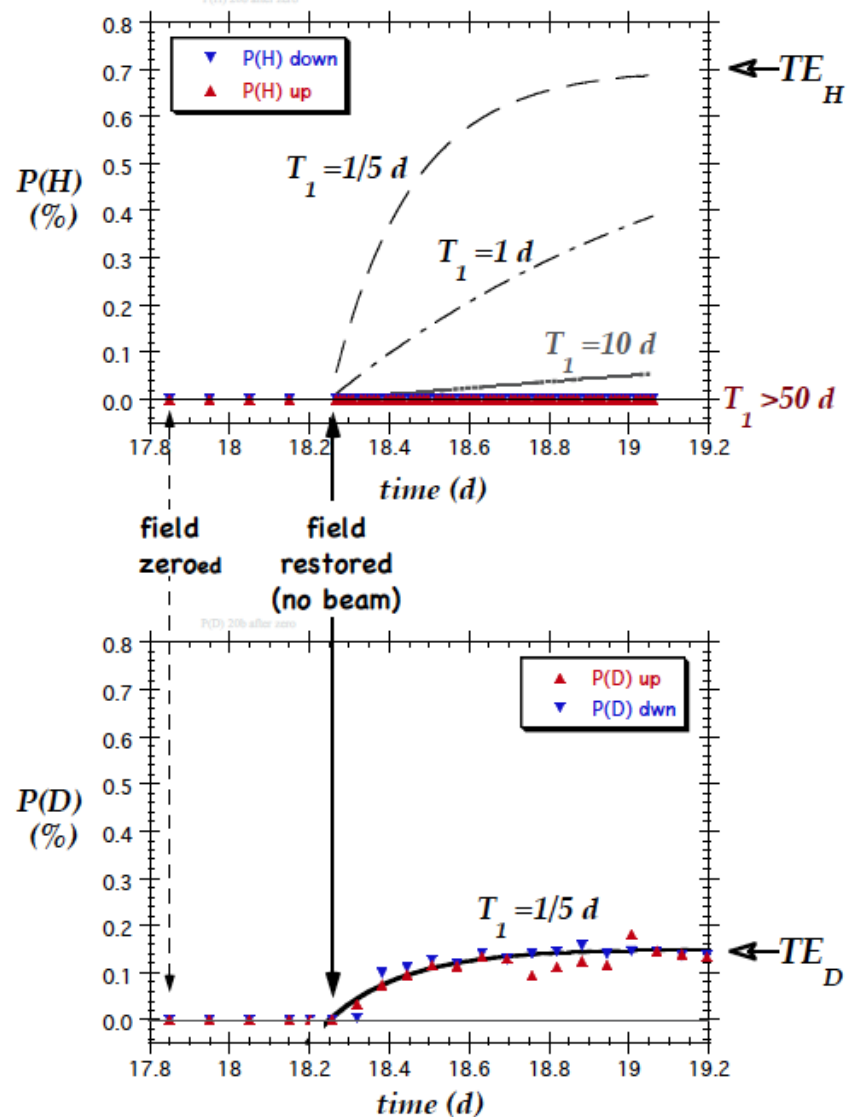
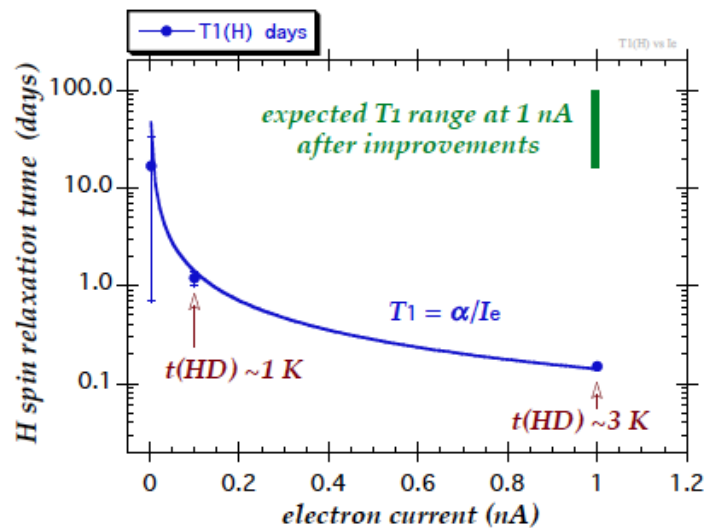
Concluding remarks

- Hall B continues to produce high quality results covering a broad range of topics in hadronic/nuclear physics. Major recognition of the N* program in PDG 2012.
- Completed a major run group (G14-HD) that measures $K\Lambda$ photo production on polarized neutrons to access excited neutrons.
- Major progress on the construction of the CLAS12 base equipment. Detector construction is >50% complete. Offline software reviewed, on track for series of planned “stress test” starting 10/2012 until 1/2014.
- Additional user proposed detectors are entering the construction stage, RICH in prototyping stage undergoing beam tests at CERN.
- Ran electron beam tests of HDIce cryostat. Conducted HPS tests parasitically to G14-HD.

Backup slides

HD electron beam tests

eHD radiation damage studies



HD target improvements for e-beam

