Status of Completed Experiments

2008
• BigBite
  • E04-007 $\pi^0$ electroproduction first stage analysis complete
  ➔ E08-007 low-$Q^2 G_E^p/G_M^p$ submitted to PRL
• BigBite plus polarized $^3$He
  ➔ E06-010 neutron transversity $^3$He Collins and Sivers, neutron results to be shown
• E07-013 normal SSA preliminary results

2009
• E06-014 $d_2^n$ analysis on track
• E08-005 Target SSA preliminary results
• E05-102 Quasi-elastic $^3$He $G_E^n$ results close
• E05-109 HAPPEEx-III unblinding expected in January, total error < 4%
• E08-011 DIS-Parity expected total error 4-5%, unblinding this summer

2010
➔ E06-002 Lead Parity 25% of expected statistics collected, due to radiation issues, systematic error goals achieved, unblinding before APS
  ➔ C12-10-009 APEX test run resolved all of PAC concerns, will also yield physics
• E08-025 n-DVCS slow start due to ESR and ARS problems
• E07-007 p-DVCS has achieved close to 80% of data
E02-013 $G_E^n$ up to high $Q^2$

S. Riordan et al., PRL 105, 262302 (2010), 1008.1738 [nucl-ex]

- New data allow sensitive test of models, but also a flavor separation of EMFF
- In impact-parameter IMF space d-quark (in proton) appears more extended than u-quark
- Comparison of $Q^2F_2/F_1$ scaling of proton, neutron and u,d quarks
New Hall A polarization-transfer data show gradual decrease of $G_E^p/G_M^p$ in good agreement with calibration datum of E03-104 at 0.8 GeV$^2$

Submitted to PRL

Good agreement for charge radius with other existing data, except for recent muon Lamb shift result

However, significant disagreement for magnetic radius with recent Mainz result (PRL 105, 242001 (2010))

Dispersive or other radiative corrections?

Will be clarified by upcoming Hall A measurement with polarized target

$E08-007\ G_E^p/G_M^p\ at\ low\ Q^2$
Preliminary Neutron Collin/Sivers Asymmetries

- Systematic uncertainty is still being worked on
- Curves: Diquark-quark Model (Ma), Global Fit (Anselmino), Light-Cone quark model (Pasquini)
PREX progress

Run-averaged asymmetry placed at “-1.0” (~ppm) for presentation

Lessons of PREX
- Last 3 days @ 70 uA promising:
  - 125 ppm detector noise @15 Hz equiv. flip rate
- Raster synched to flip rate to reduce noise due to target
- Transverse asymmetry $A_T < 2$ ppm

Proposed new measurements with fixes to vacuum system and shielding

Asymmetry
Wien x ihwp = -1

(product of Wien flip and IHWP flip)

$\frac{\Delta R_N}{R_N} \sim 2.5\%$
(Ultimate goal: 1%)

$\frac{1}{2}$ our data; the sign flips with Wien x IHWP flip

Plan to release results at April 2011 APS meeting

Good chi-square: data are statistical
All data [Sign flips removed]

“slug” ≈ 1 day

$\chi^2$/ndf 30.65/22

Thomas Jefferson National Accelerator Facility
Operated by the Jefferson Science Associates for the U.S. Department Of Energy
APEX test run has resolved all PAC35 issues

High Resolution Spectrometers

- Use of the Gas Cherenkov in trigger, timing - proposed 20 ns, demonstrated 10 ns
- Operation of the VDC at 5 MHz track rate - demonstrated up to 8 MHz
- Operation of the positron arm PID - demonstrated up to 0.8 MHz
- Operation of trigger/DAQ - demonstrated total dead time of 8% at full luminosity
- Extended multi-foil target designed and built

Preliminary (and conservative) projection of test run sensitivity
- Will surpass all existing data in mass range 180 to 240 MeV

Precision of the complete proposal
Publications (incl. submissions) in 2010

- A. Shahinyan et al., The Electromagnetic calorimeter in JLab Real Compton Scattering Experiment, resubmitted to NIMA, 0704.1830 [physics.ins-det]
- I. Pomerantz et al., Hard Photodisintegration of a Proton Pair, PLB 684, 106 (2010), 0908.2968 [nucl-ex]
- M. Coman et al., Cross Sections and Rosenbluth Separations in \(^1\text{H}(e,e'K^+)^\Lambda\) up to 2.35 GeV\(^2\), PRC 81, 052201 (2010), 0911.3943 [nucl-ex]
- M. Paolone et al., Polarization Transfer in the \(^4\text{He}(e,e'p)^3\text{H}\) Reaction at \(Q^2 = 0.8\) and 1.3 GeV\(^2\), PRL 105, 072001 (2010), 1002.2188 [nucl-ex]
- J. Glister et al., Polarization Observables in Deuteron Photodisintegration below 360 MeV, submitted to PLB, 1003.1944 [nucl-ex]
- S. Riordan et al., Measurements of the electric form factor of the neutron up to \(Q^2=3.4\ \text{GeV}^2\) using the reaction \(^3\text{He}(e,e'n)pp\), PRL 105, 262302 (2010), 1008.1738 [nucl-ex]
- Y. Qiang et al., Properties of the \(\Lambda(1520)\) resonance from high-precision electroproduction data, PLB 694, 123 (2010)
- X. Zhan et al., New measurement of the proton’s size and structure using polarized photons, submitted to PRL
- S.P. Malace et al., A precise extraction of the induced polarization in the \(^4\text{He}(e, e'p)^3\text{H}\) reaction, submitted to PRL, 1011.4483 [nucl-ex]
- L.B. Weinstein et al., Short-range correlations and the EMC effect, submitted to PRL, 1009.5666 [hep-ph]
- D.W. Higinbotham, J. Gomez and E. Piasetzky, Nuclear Scaling and the EMC Effect, submitted to PLB, 1003.4497 [hep-ph]

- Total number of Hall A publications: Science 1, PRL+PLB 43(+5), PRC 18, NIM 18(+1)

- Hall A has been running now for over 13 years, with an average publication output of ~6
- Top cited Hall A publications: 1 500+, 1 250+, 6 100+, 17 50+
### Scheduled Experiments in Hall A

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The time required for the installation of BigBite has forced to significantly reduce the running time for the deuteron threshold electro-disintegration experiment (E08-008). DOE has provided most of the acquisition funding required for the two A-rated experiments E08-027 ($g_2^p$) and E08-007 ($G_E^p/G_M^p$ at very low $Q^2$). The Hall C SC magnet for the polarized target has been repaired at Oxford, is being cooled down at UVa and the design is progressing well. A new estimate of 8-10 weeks for the transition from $g_2^p/G_E^p$ has made it impossible to run hypernuclear (E07-012) before the start of the 12 GeV installation.
Open issue:
Because of the continuing resolution the schedule is only firm through March 2011
Status of engineering and design for $g_2^P/G_E^P$

Design and engineering efforts (from three divisions!) progressing well
• Three large experimental projects in preparation for Hall A
  ➔ SuperBigbite:
    ➔ The project is being split into two projects, the first one below 2 M$ to be funded by JLab capital funding (starting in FY12), the second one to be submitted as an MIE proposal to DOE
    ➔ Second technical review at JLab very supportive, to be followed by mail review within a few months
  ➔ MOLLER:
    ➔ Fully approved by PAC34
    ➔ Director’s review on January 14/15 at JLab highly successful
    ➔ Waiting for CD-0, probably in FY13
  ➔ SoLID:
    ➔ Technical conceptual design completed by ANL
    ➔ Fully approved at PAC35 (as well as SIDIS with SoLID)
    ➔ Waiting for Mont to organize Director’s Review
• Tentative projection for start-up of 12 GeV Upgrade (budget-driven):
  ➔ FY14 “Hall A (why not SBS?)” commissioning, no physics beam
  ➔ FY15 23 PAC days
  ➔ FY16 50 PAC days
  ➔ FY17 91 PAC days
The research program in Hall A is highly successful, and has a bright future, both for the remainder of the 6 GeV program and for that with the upgrade. The presently approved proposals will take ~10 years to complete (if one includes installation time):

- ~1 year with the HRS pair
- ~1.5 years with SuperBigbite
- ~2.5 years with MOLLER
- ~3.5 years with SoLID, including SIDIS

Clearly, it will take a very strong collaboration effort (together with sufficient and timely DOE funding and an expeditious beam delivery) to accomplish this.