

Hall C Status – January 2020



Hall C Publications + students

Exclusive π^+ electroproduction off the proton from low to high $-t$ (FPI)

[Phys. Rev. C 100, 065204 \(2019\)](#) (S. Basnet et al.)

Unique Access to u-Channel Physics: Exclusive Backward-Angle Omega Meson Electroproduction

[Phys. Rev. Lett. 123 182501 \(2019\)](#) (Li et al.)

Determination of the Proton's Weak Charge and Its Constraints on the Standard Model

[Annual Rev of Nuclear and Particle Science 69, \(191\) \(2019\)](#) (Carlini, van Oers, Pitt, Smith)

Measurements of Non-Singlet Moments of the Nucleon SF and Comparison ... for $Q^2=4 \text{ GeV}^2$

[Phys. Rev. Lett. 123, 022501 \(2019\)](#) (I. Albayrak et al.)

Revealing Color Forces with Transverse Polarized Electron Scattering (SANE)

[Phys. Rev. Lett. 122, 022002 \(2019\)](#) (W. Armstrong et al.)

Scintillating crystals for the Neutral Particle Spectrometer in Hall C at Jlab

[Nucl. Instrum. Meth. A956, 163375 \(2020\)](#) (Horn et al.)

Conceptual Design Study of a Compact Photon Source (CPS) for Jefferson Lab

[Nucl. Instrum. Meth. A957, 163429 \(2020\)](#) (Day et al.)

Parity-Violating Inelastic Electron-Proton Scattering at Low Q^2 Above the Resonance Region (QWEAK)

[arXiv:1910.14591](#) (Androic et al.)

Graduated Students: [Anna Lee](#), [Sheren Alsalmi](#), [James Dowd](#)

Nuclear Physics News – Vol 29, 2019 Issue 4

Testing the Standard Model at the Precision Frontier with the Q_{weak} Experiment

Carlini, van Oers, Pitt, Smith



Papers in preparation

Q_{weak} : Transverse beam asymmetry on ^{27}Al

Transverse beam asymmetry on proton

Parity violating asymmetry on ^{27}Al

Deuteron electrodisintegration (E12-10-003)

Color Transparency (E12-06-107)

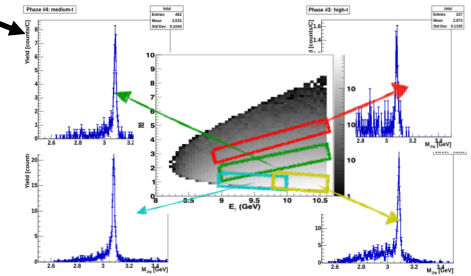
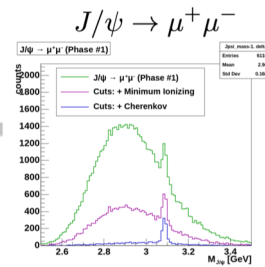
Hall C – 2019

Spring 2019

E12-16-007 LHCb charmed pentaquark via J/ψ production

E12-09-002 Completed SIDIS-CSV

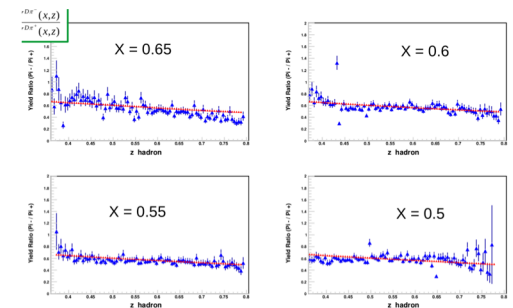
E12-09-011 (e,e'K) Completed data need for L/T separations



Summer 2019

E12-06-101/E12-07-105 Short low pass run for pion form factor + scaling

E12-15-001 Generalized polarizabilities of the proton in VCS



Late 2019

Installed polarized ^3He target

Initial commissioning for E12-06-110 **A1n**

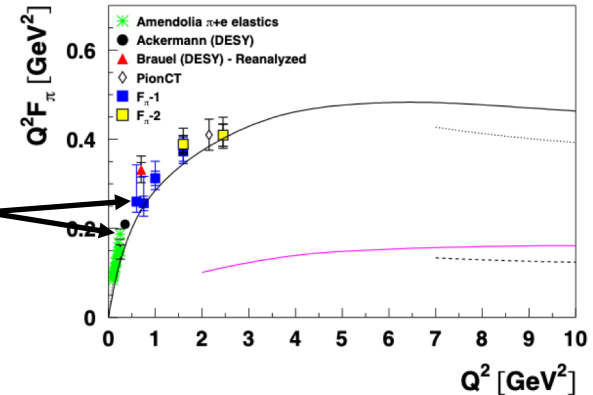
E12-06-121 g2n/d2n

Hall C – Summer 2019 low energy running

E12-06-101/E12-07-105 Short low pass run for pion form factor + scaling

Q^2 (GeV ²)	x_B	L/T complete	Purpose
0.375	0.09	Yes ✓	Form Factor
0.425	0.1	Yes ✓	Form Factor
1.45	0.3	No	Reaction mechanism
2.12	0.4	No	Reaction mechanism

Future running will bring further pion form factor and scaling data



Low Q^2 points match on to onto $\pi^+\pi^-$ elastic scattering data

E12-15-001 - $p(e,e'p)\gamma$

Generalized polarizabilities of the proton in VCS

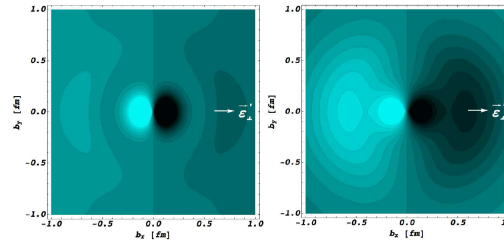
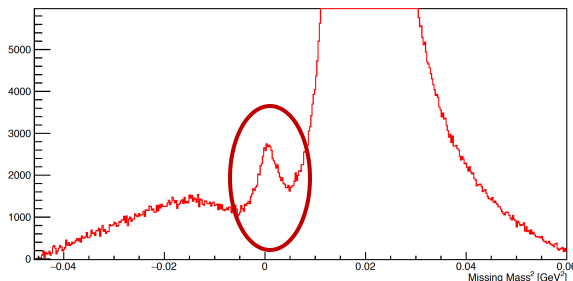
Measure proton's electric & magnetic Gen. Polarizabilities

Address puzzling α_E enhancement at low Q^2

Map nucleon polarization densities

Preliminary results – Spring 2020

Missing mass reconstruction of photons



Two Models of Induced polarization in a proton when submitted to an e.m. field

Polarized ^3He target

Target for A_1^n / d_2^n (E12-06-110, E12-06-121)

Installed in Fall 2019

Target polarizations 50-60%

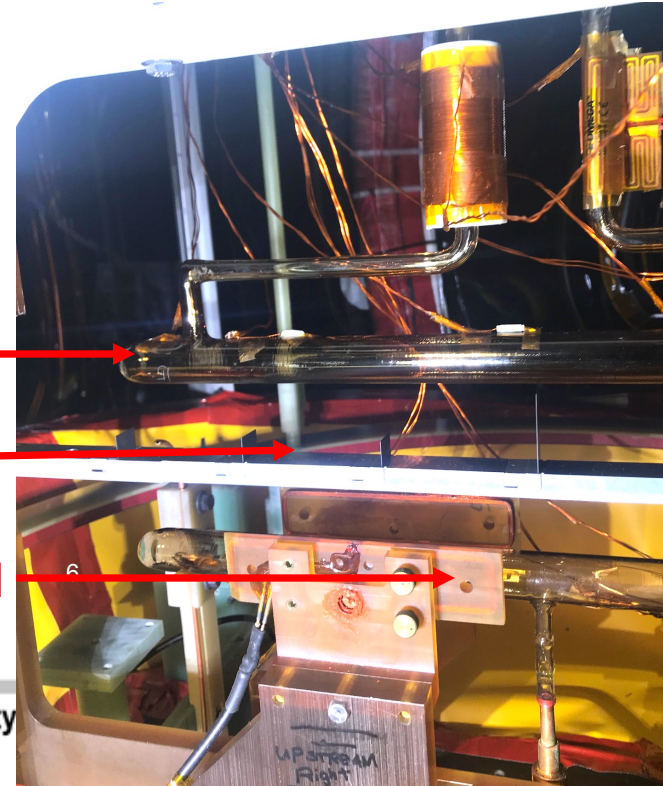
A_1^n data taking in progress - Sign up for Shifts!



^3He Cell

Optics targets

Reference Cell



Neutral Particle Spectrometer

NPS (Expts E12-13-010/E13-13-007, E12-14-003/E12-14-005) passed ERR, beam time request submitted

NPS Sweep magnet (CUA/ODU MRI) mapped in test lab

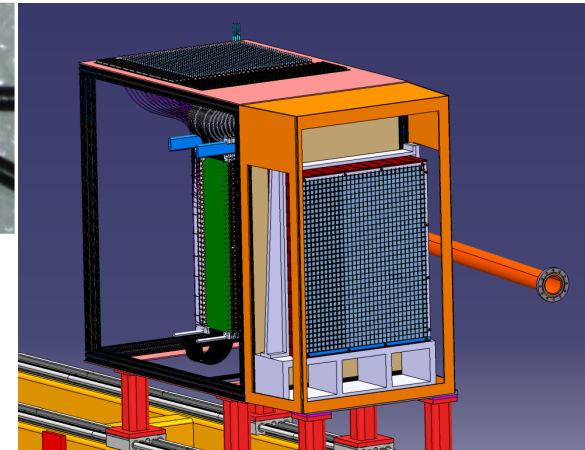
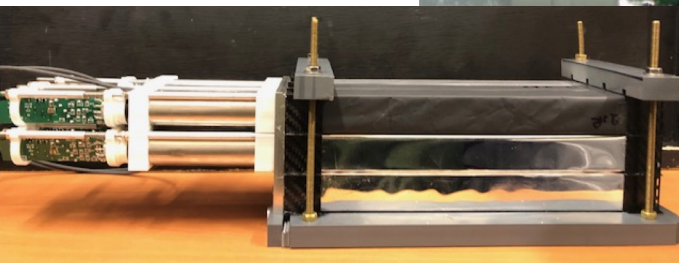
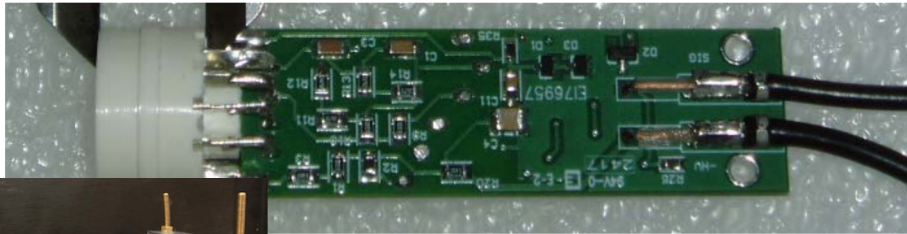
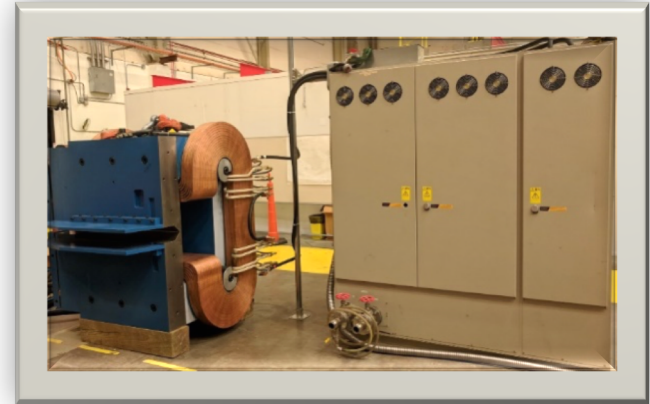
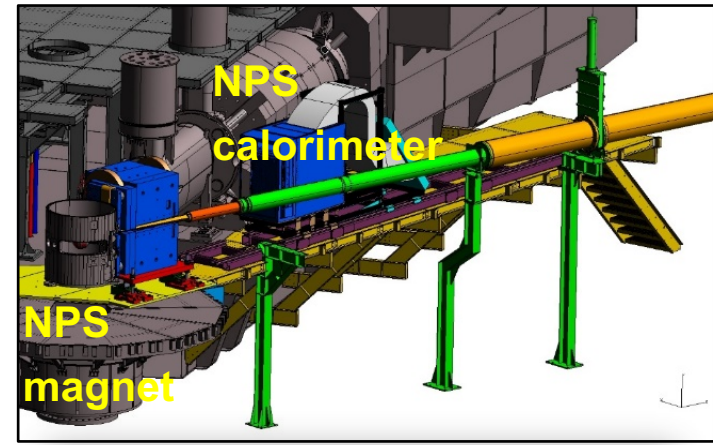
Calorimeter frame designed (Orsay).

Crystal testing ongoing (CUA). Crytur PbWO_4 crystals in production, all received (50 so far) pass tests.

Paper on crystals published. **NIM A956, 163375 (2020)**

Base fabrication (Ohio) complete, PMTs on hand.

Software/DAQ development ongoing (Orsay, JMU, Glasgow, JLab)

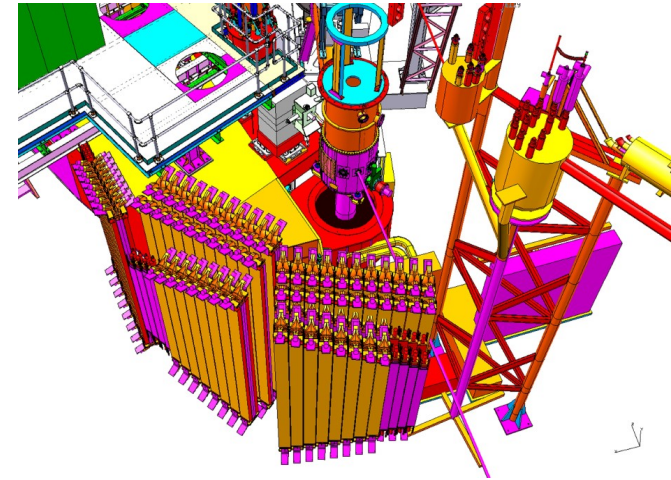
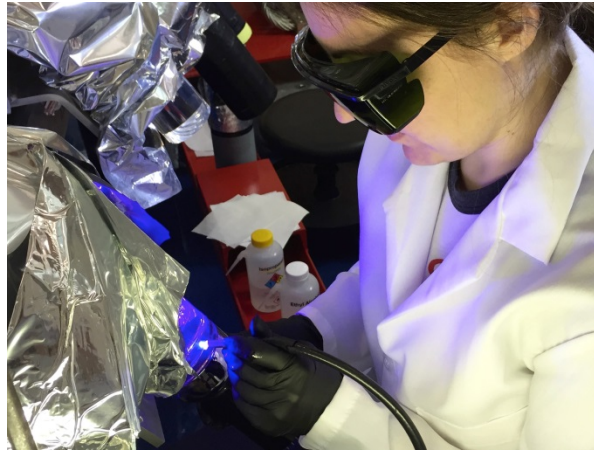


LAD – Large Acceptance Detector

- E12-11-007: Deuteron EMC – d(e,e' backward p)
- Very large solid angle for $L = 10^{36} \text{ cm}^{-2} \text{ s}^{-1}$ and $\theta > 90^\circ$
- Optimized for medium momentum nucleons

$$0.3 \leq p_N \leq 0.7 \text{ GeV}/c$$

- Needs 5 scintillator planes which are built from old CLAS-6 TOF scintillators.
- Five planes refurbished @ODU by ODU, KSU, TAU, MIT, GWU and back at JLab in ESB.
- HV supply for scintillator planes delivered.
- Preparing for ERR review in 2020



Instrumentation

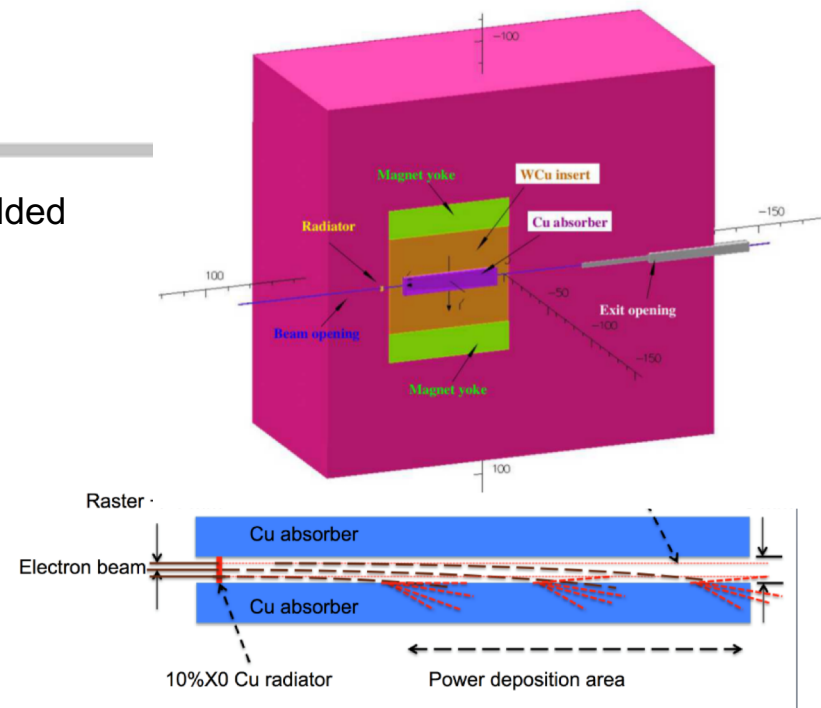
Compact Photon Source - Combines in a single shielded assembly all elements necessary for the production of high-intensity photon beams and ensures that the operational dose rates are acceptable

Optimized to minimize weight

Magnet CAD design and preliminary drawings

CPS article published

Nucl. Instrum. Meth. A957, 163429 (2020)



Precision Polarimetry in Halls A/C – HIPPOL Capital Project

Compton Polarimeter:

- New laser system for Hall C (low gain -> high gain cavity)

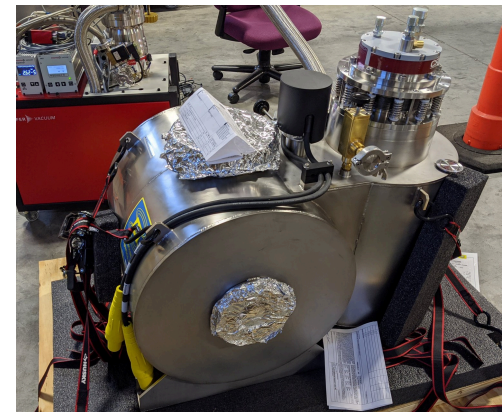
- Upgrade Hall C electron detector DAQ to match Hall A (VTROC)

- New electron detectors for Hall A & C (

Moller Polarimeters:

- Hall A improvements to support MOLLER (Tracking GEM, better collimation)

- New superconducting solenoid (identical to Hall A's) procured



Notes

Replacement power supplies for HMS quadrupoles on order, expect delivery ~September

Currently running with reversing switches disabled

Plan to install before 2021 run period

HMS hodoscope refurbishment

Scintillator > 25 years old, tubes ~15 years old

Replace scintillator plastic, light guides and tubes

SHMS NIM paper – need to resume writing/editing

<https://github.com/JeffersonLab/shmsNIM>

“The SHMS 11GeV/c Spectrometer in Hall C at Jefferson Lab”

Archival NIM Article

1. Introduction: [D. Gaskell](#)

- A. Brief overview of JLab accelerator and electron beam
- B. The ongoing physics program of Hall C (what has Hall C been good at?)
- C. Physics program in the 12GeV era (what we will do in the future)

2. Specifications for the upgraded Hall-C Spectrometer: [H. Fenker](#)

3. Design and Development of the SHMS Systems

- 3.1. Magnetic Optics: [M. Jones](#)
- 3.2. Shield House Layout, Shielding Design: [T. Horn](#)
- 3.3. Scintillator Trigger Hodoscopes: [I. Niculescu](#), [G. Niculescu](#)
- 3.4. Quartz-bar Trigger Hodoscope: [S. Malace](#)
- 3.5. Drift Chambers: [E. Christy](#)
- 3.6. Heavy-Gas Cerenkov Counter: [G. Huber](#)
- 3.7. Noble-Gas Cerenkov Counter: [D. Day](#)
- 3.8. Aerogel Cerenkov Counter: [T. Horn](#)
- 3.9. Preshower and Shower Counters: [H. Mkrtchyan](#), [V. Tadevosyan](#)
- 3.10. Trigger and Data Acquisition: [B. Sawatzky](#)
- 3.11. Software: [E. Pooser](#), [S. Wood](#)

3.11.1. Online Monitoring

3.11.2. Common-use Analysis Packages

4. SHMS Performance: Operating Experience and Commissioning Results ([H. Fenker with Input from ALL](#))

Results highlighting results from each part of section 3

5. Conclusion

Progress stalled since Feb. '19

- Some sections could use updates (recent data, etc)
- Some need fleshing out
- Final integration

We'll try to push again to get this out this summer. Grab the files from one of the links below!

- *Git preferred (login to github first!)*
- Zip OK for now
- Questions/help, contact:
 - Brad Sawatzky <brads@jlab.org>
 - Steve Wood <saw@jlab.org>

“Author Organizers”

- Have agreed to either write the sections or organize others who will do the writing.

“Contributions”

- In LaTeX (text) and .pdf (figures) – using Elsevier’s style guide.
- Howard provided template files and directory structure at link above.

“Version Control”

- Zip file: <https://userweb.jlab.org/~saw/shmsnim/>
 - Moved to git (future development):
 - <https://github.com/JeffersonLab/shmsNIM>
- Follow README on git page for instructions!