Hall C – August 2020

Hall C Publications + students

Parity-Violating Inelastic Electron-Proton Scattering at Low Q2 Above the Resonance Region (QWEAK)

Phys. Rev. C 101, 055503 (2020) (Androic et al.)

Proton form factor ratio $\mu_p G^p_E/G^p_M$ from double spin asymmetry (SANE)

Phys. Rev. C 101, 035206 (2020) (A. Liyanage et al.)

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 (FPI)

Phys. Rev. Lett. 123 182501 (2019) (W. B. Li et al.)

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

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

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

Nucl. Instrum. Meth. A956, 163375 (2020) (T. Horn et al.)

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

Nucl. Instrum. Meth. A957, 163429 (2020) (D. Day et al.)

Graduated Students: Anna Lee, Carlos Yero (First Hall C 12 GeV thesis)

Upcoming Hall C Publications

12 GeV Experiments:

Drafts in circulation:

E12-10-003 Deuteron Electrodisintegration

E12-06-107 Color Transparency

Qweak:

A Precision Measurement of Beam-Normal Single-Spin Asymmetry in Forward-θ Elastic ep Scattering

arXiv: 2006.12435 – submitted to PRL (Androic et al.)

Transverse ^{12}C and ^{27}Al asymmetries

Parity Violating (longitudinal polarized beam) ^{27}Al asymmetry

Parity Violating $N \rightarrow \Delta$ (longitudinal) on proton

Transverse $N \rightarrow \Delta$ on proton

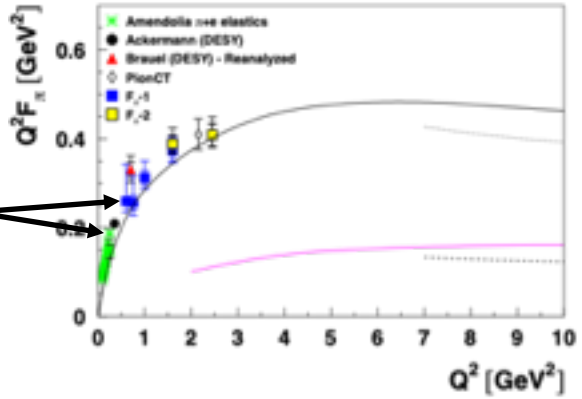
Instrumentation papers: Qweak target, Main Detector (Quartz bars)

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

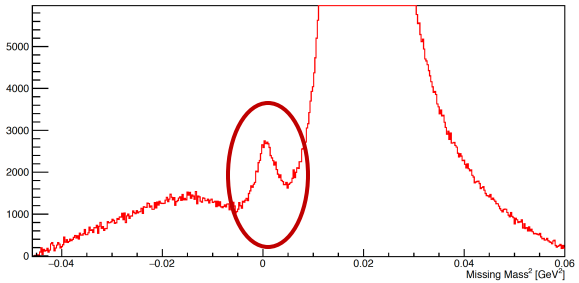


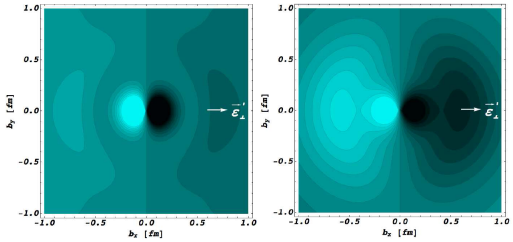
Low Q^2 points match on to onto $\pi^+ + e^-$ elastic scattering data

E12-15-001 - p(e,e'p)γ

Generalized polarizabilities of the proton in VCS

Missing mass reconstruction of photons





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

Measure proton's electric & magnetic Gen. Polarizabilities

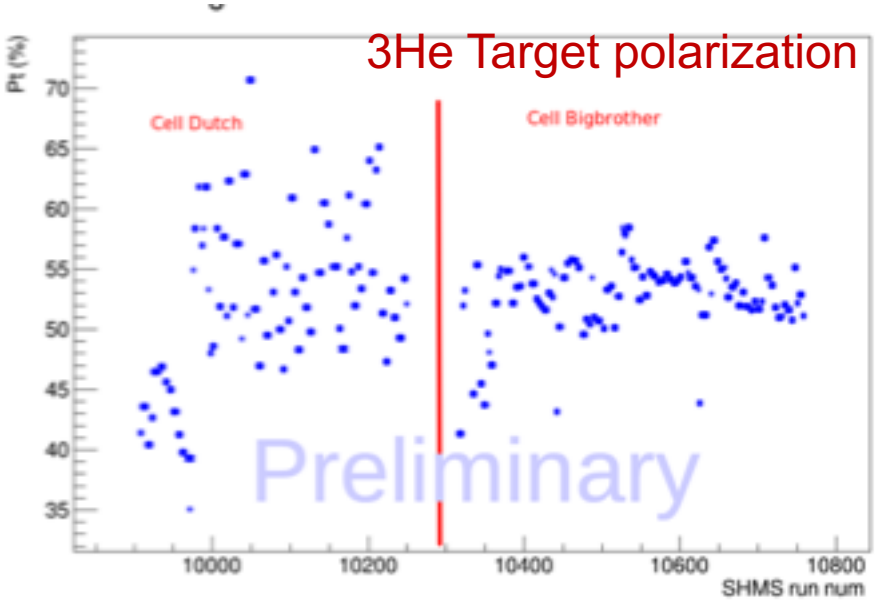
Address puzzling α_E enhancement at low Q^2

Map nucleon polarization densities

Hall C – 2020

Fall 2019

Polarized 3He target installed



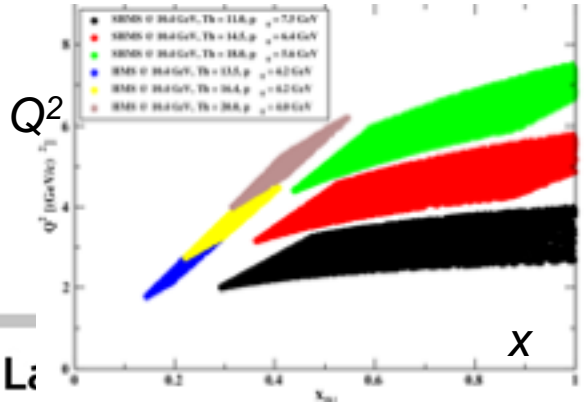
Spring 2020

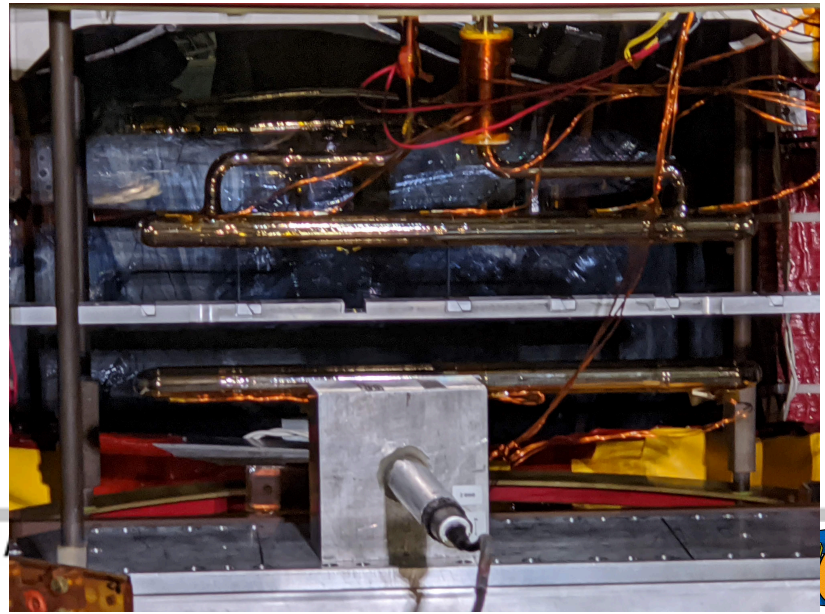
E12-06-110 A_1^n run

E12-06-121 g_2^n/d_2^n setup
interrupted by MEDCON6

Summer 2020

June/July - Extensive target tuneup
Aug/Sep – g_2^n/d_2^n 6 week run





Hall C – 2021+

Oct 2020 – June 2021

Accelerator Down

Hall Maintenance

June 21–Oct 11, 2021

E12-19-006 Excusive p(e,e′$\pi^{\pm}$) LT separated cross sections

Scaling and Pion Form Factor

(was E12-06-101 and E12-07-105)

Beam Energies 9.2, 8.0, 9.9, 6.0 GeV

Late 2021? – 2022

Standard equipment solid and cryotarget experiments

CaFe, EMC, x>1, NucR, LAD … ?

Neutral Particle Spectrometer

Motivation for NPS: Validation of Reaction mechanisms for TMDs & GPDs

5 approved experiment: **DVCS & SIDIS ($e,e'\pi^0$), WACS(γ, π^0) & pol. WACS**

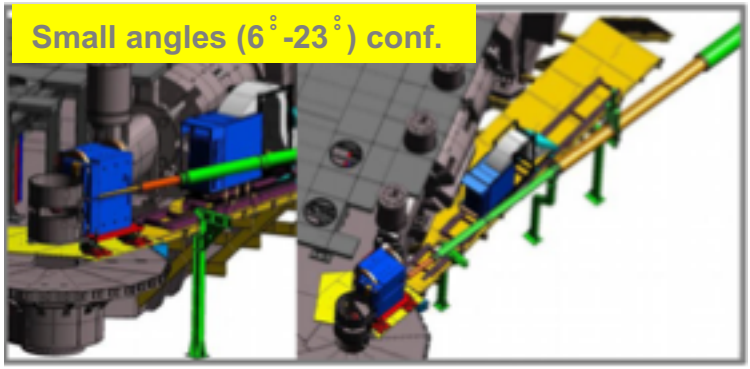
1 conditionally approved: Timelike Compton Scattering

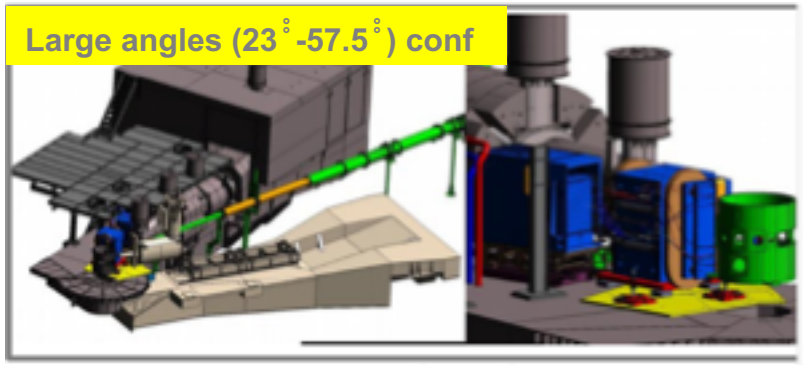
NPS (Expts E12-13-010/E13-13-007, E12-14-003/E12-14-005) passed ERR, beam time request submitted

NPS: PbW04 calorimeter behind sweep magnet
Rides on SHMS carriage. Small and large angle configurations

Sweep Magnet assembled and tested at JLAB

Supported by NSF MRI PHY-1530874





NPS: Highlights & Status

PbWO4 crystals
testing performed by CUA and AANL

PbWO4 crystals

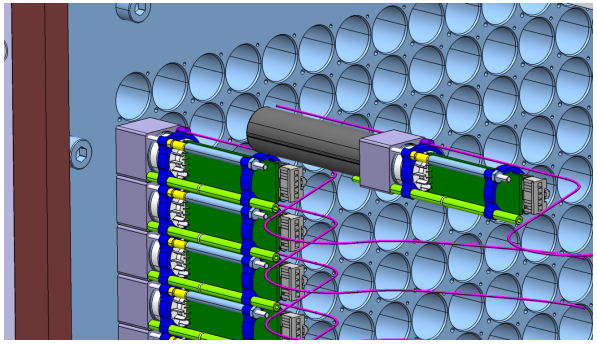
- 30x36 (1080) PbWO4 crystals of size: 2x2x20 cm3 – goal is to have all Crytur crystals – 700 now

PbWO4 crystal properties and performance tests

- NIM A **956** (**2020**) 163375

Beam test program in Hall D with 12x12 NPS prototype

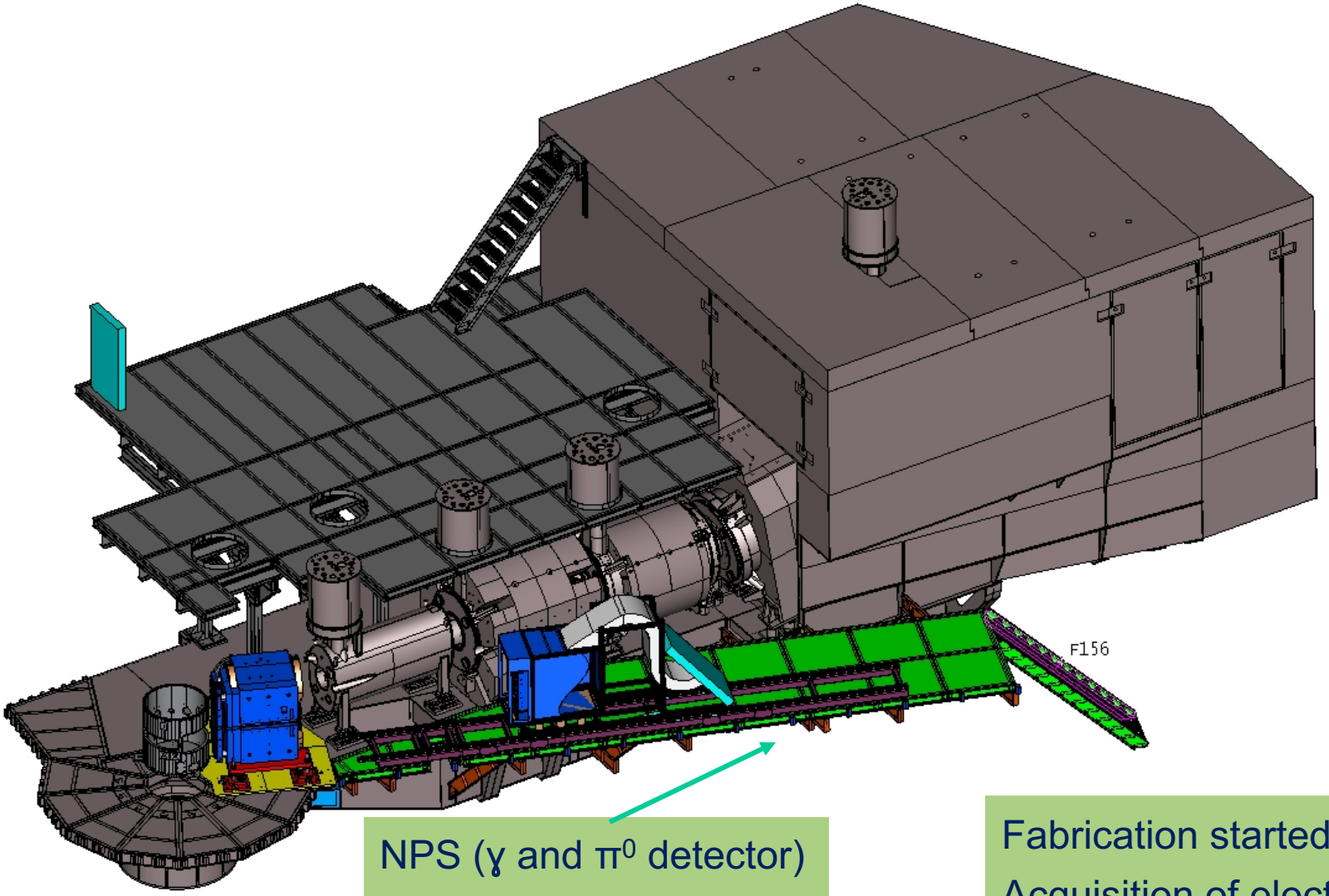
- Baseline tests completed in 2019
- Streaming readout tests in 2020
- Initial energy resolution: ~2.83%/E+2.23%/√E+0.73%



Frame infrastructure: being assembed at IPN-Orsay

- ❖ Sweeper magnet ready for full current test in Hall C
- ❖ Frame scheduled to be on-site in December 2020
- ❖ PMT`s received and spot checked - no rejections
- ❖ All (1100) active bases assembled
- ❖ Calorimeter assembly scheduled to begin in January 2021

NPS infrastructure



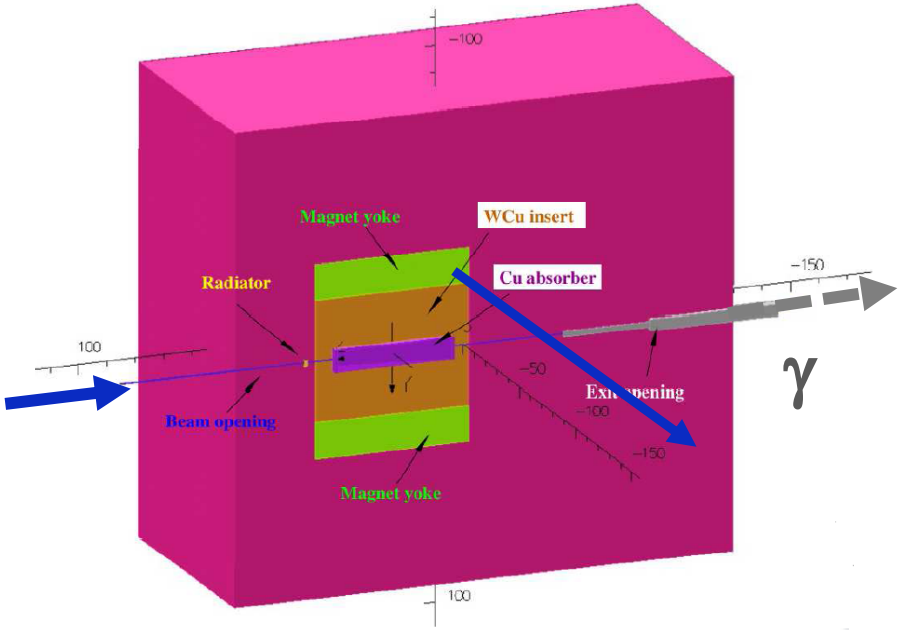
NPS (γ and π^0 detector) will ride on extension to SHMS platform

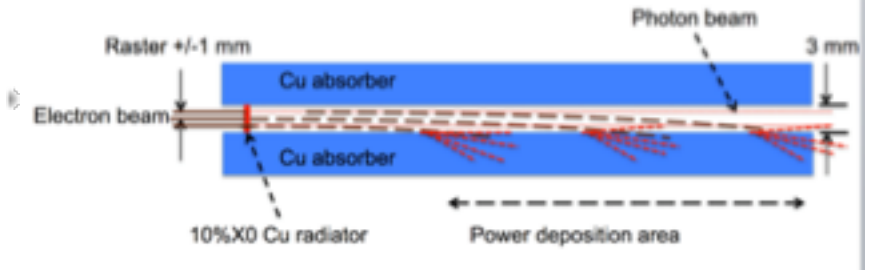
Fabrication started
Acquisition of electronics, HV, cabling continues

Compact Photon Source (Hall C)

A high-intensity compact photon source that could provide a factor of 30 gain in figure-if-merit for photo-production experiments of solid-state polarized targets

High-energy photoproduction in 3D dynamic proton structure – **two approved experiments to date (Polarized Wide-Angle Compton Scattering and Timelike Compton Scattering)**





CPS conceptual design:

- a radiator to produce photons
- a magnet to dump the electrons with a small photon collimator
- a central copper absorber to handle the power deposition
- tungsten powder and borated plastic to hermetically shield the induced radiation dose as close to the source

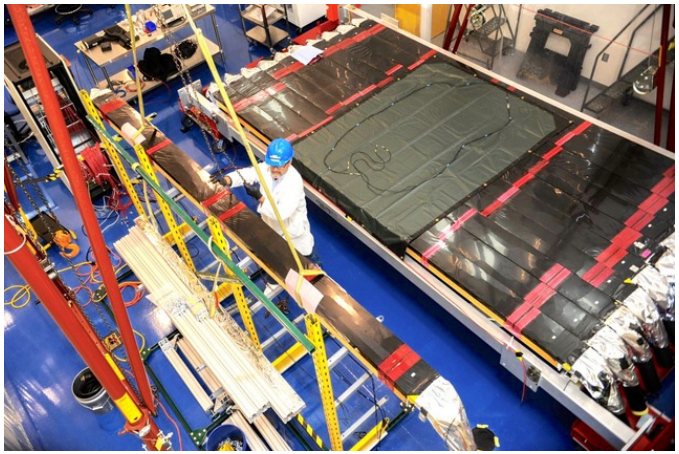
- Conceptual Design for Hall C CPS published in NIMA **957**, 163429 (**2020**)

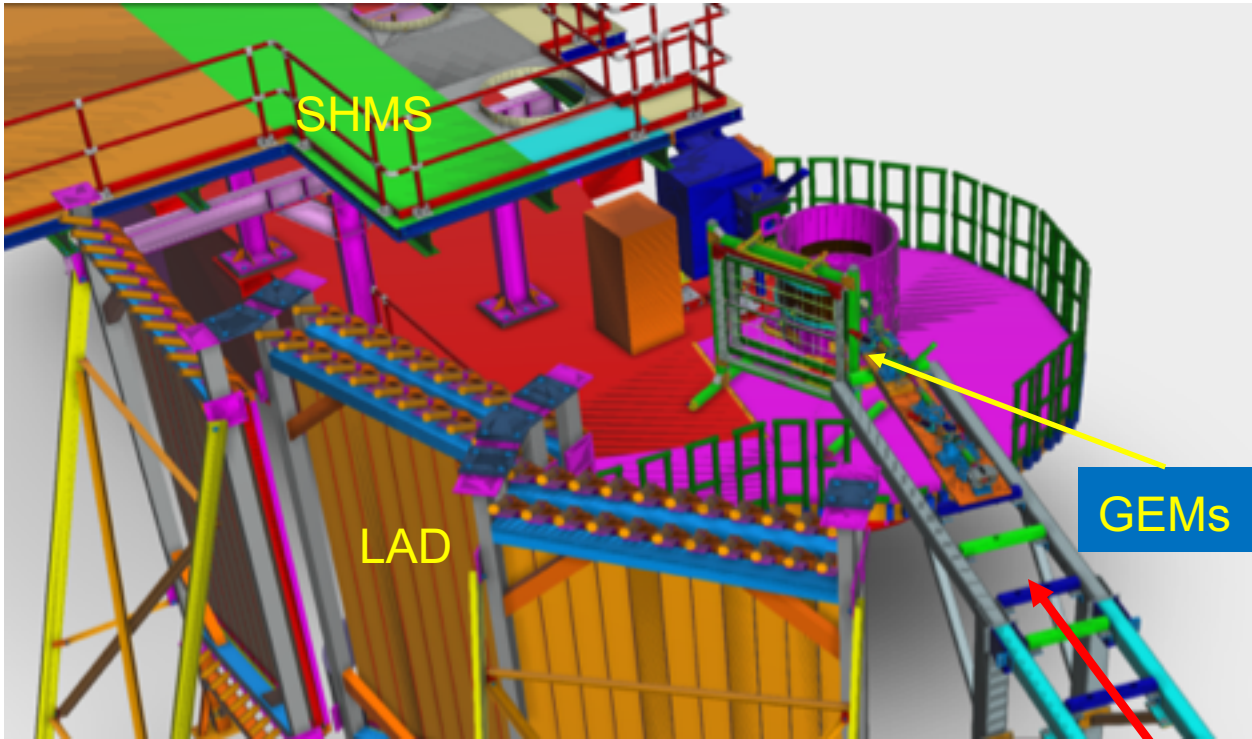
LAD – Large Acceptance Detector

- E12-11-007: Deuteron EMC – d(e,e' backward p)
- Very large solid angle for $L = 10^{36}$ cm^{-2} s^{-1} and $\theta > 90^{o}$
- 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.
- Positive ERR review held July 29, 2020



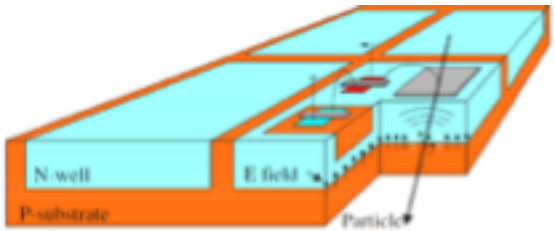


Polarimetry upgrades in A & C

Improvement funding spread across Operations, HIPPOL Capital Project and MOLLER

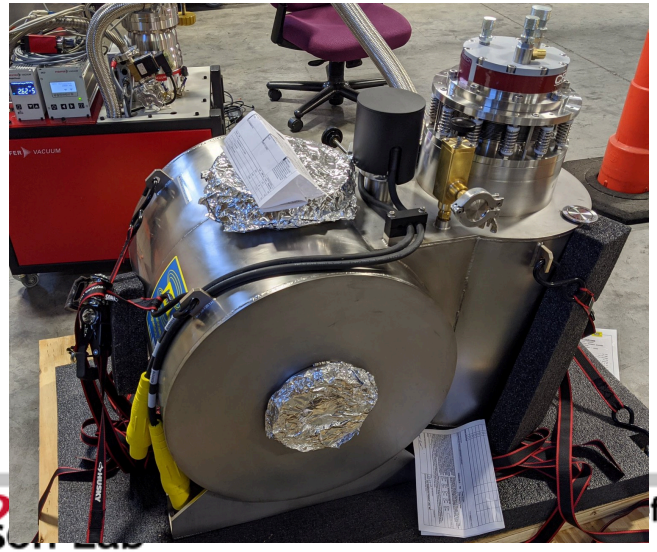
Compton Polarimeter:

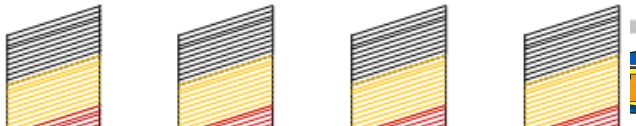
- New laser system for Hall C (low gain -> high gain cavity)
- Upgrade Hall C electron detector DAQ to match Hall A (VTROC)
- New electron detectors for Hall A & C
  - Requirements document for diamond detector developed
  - HVMAPS (High Voltage Monolithic Active Pixel Sensors) under investigation



Moller Polarimeters:

- Hall A improvements to support MOLLER (Tracking GEM, better collimation)
- New superconducting solenoid (identical to Hall A's) procured. No connection to cryo.

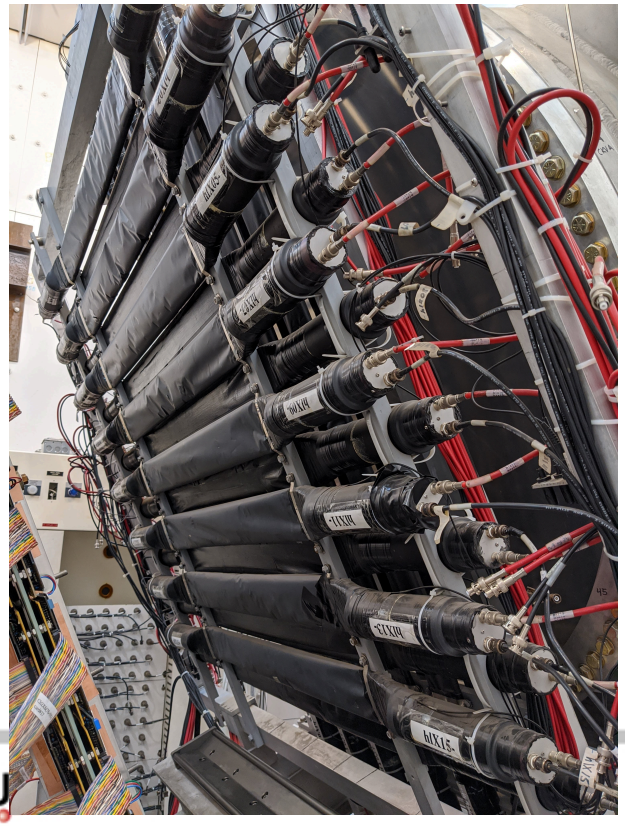




HMS Upgrades

Danfysik building replacement HMS Quadrupole power supplies. Delivery before end of 2020. Will restore remote polarity reversing of HMS.

(Existing supplies 25+ years old. One failed.)



HMS hodoscope refurbishment

Scintillator > 25 years old

Tubes ~15 years old

Replace scintillator plastic,

light guides and tubes

Keep existing frame