

Hall C Status – January 2021



Hall C Publications + students

Ruling out color transparency in quasi-elastic $^{12}\text{C}(e,e'p)$ up to Q^2 of 14.2 (GeV/c) 2

Accepted to PRL ([arXiv:2011.00703](https://arxiv.org/abs/2011.00703)) (Bhetuwal et al.)

Deepak Bhetuwal, Holly Szumila-Vance

Probing the Deuteron at Very Large Internal Momenta

[Phys. Rev. Lett **125**, 262501 \(2020\)](#) (Yero et al.)

Carlos Yero

A Precision Measurement of the Beam-Normal SSA in Forward-Angle Elastic ep Scattering (QWEAK)

[Phys. Rev. Lett **125**, 112502 \(2020\)](#) (Androic et al.)

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

[Phys. Rev. C **101**, 055503 \(2020\)](#) (Androic et al.)

Proton form factor ratio $\mu_p G_E^p/G_M^p$ from double spin asymmetry (SANE)

[Phys. Rev. C **101**, 035206 \(2020\)](#) (A. Liyanage et al.)

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

[Nucl. Instrum. Meth. A **956**, 163375 \(2020\)](#) (T. Horn et al.)

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

[Nucl. Instrum. Meth. A **957**, 163429 \(2020\)](#) (D. Day et al.)

Graduated Students: [Carlos Yero \(First 12 GeV thesis\)](#), more expected this year

Upcoming Hall C Publications

12 GeV:

SHMS NIM paper

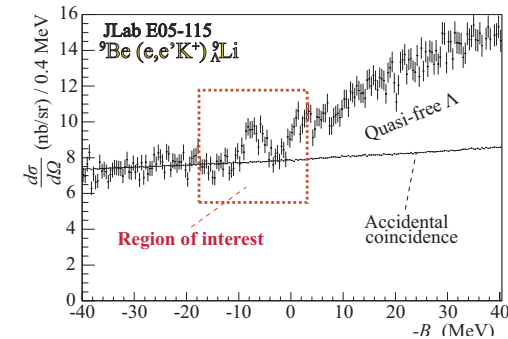
Lunch discussion today – Roger Carlini

F2 d/p ratios

F2 Analysis – William Henry

F2 Physics – Debaditya Biswas

...



6 GeV:

${}^9\text{Be}(e,e'K^+)_{\Lambda}{}^9\text{Li}$ – Hyperlithium

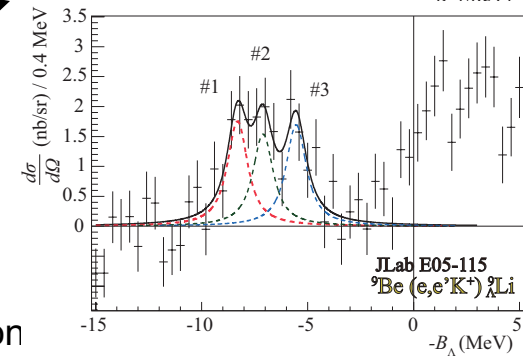
“Measurement of the beam-normal single spin asymmetry for elastic electron scattering from ${}^{12}\text{C}$ and ${}^{27}\text{Al}$ Transverse ${}^{12}\text{C}$ and ${}^{27}\text{Al}$ asymmetries” (Draft)

Parity Violating (longitudinal polarized beam) ${}^{27}\text{Al}$ asymmetry (Partial Draft)

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

Transverse polarization $N \rightarrow \Delta$ on proton

QWEAK – Greg Smith



Hall C – 2020

Fall 2019

Polarized ^3He target installed

Spring 2020

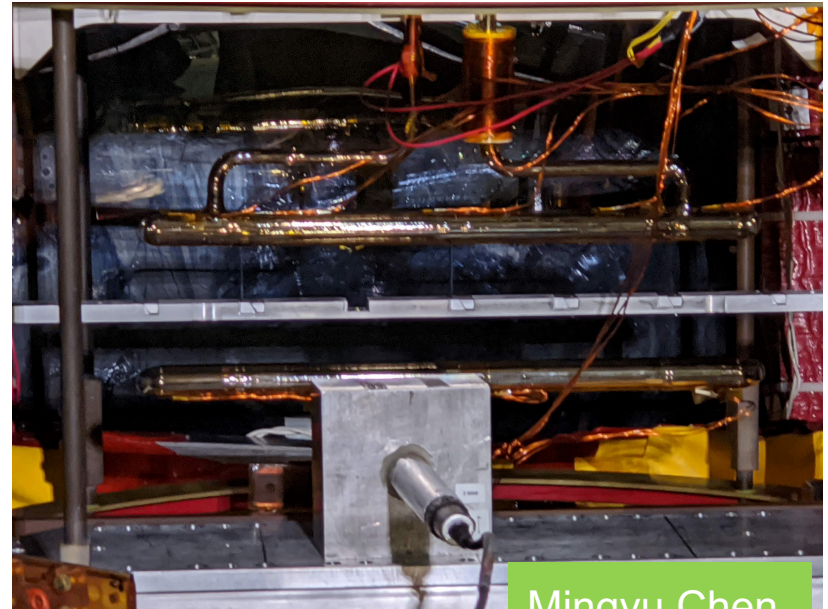
E12-06-110 A_1^n run

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

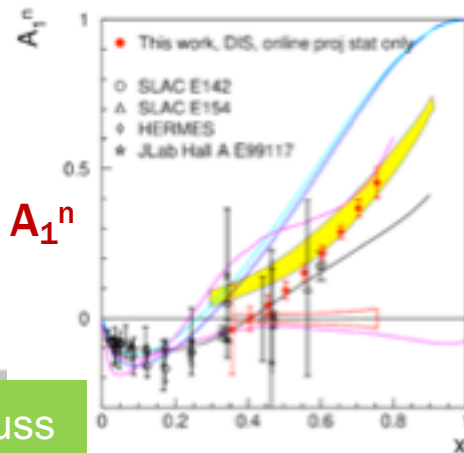
August/September 2020

E12-06-121 g_2^n/d_2^n

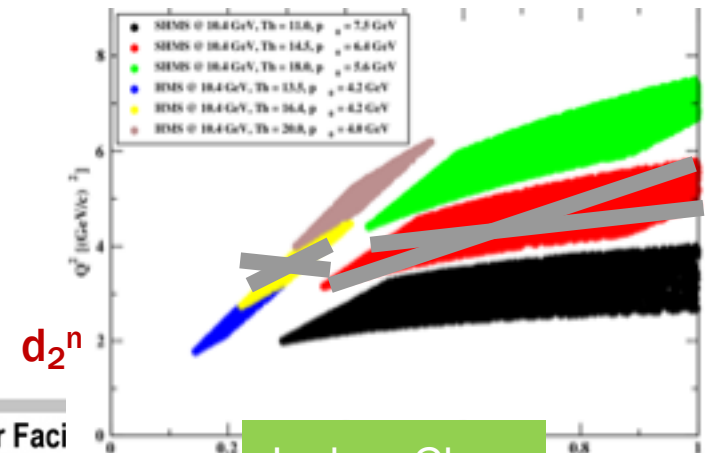
E12-06-121A ^3He elastic asymmetry



Mingyu Chen



Mike Nycz



Junhao Chen

Hall C – 2021+

Oct 2020 – June 2021

Scheduled Accelerator Down

Hall Maintenance

June 21–Oct 11, 2021 (moving to August – December)

E12-19-006 **Exclusive $p(e,e'\pi^\pm)$ LT separated cross sections (PionLT)**

Scaling and Pion Form Factor

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

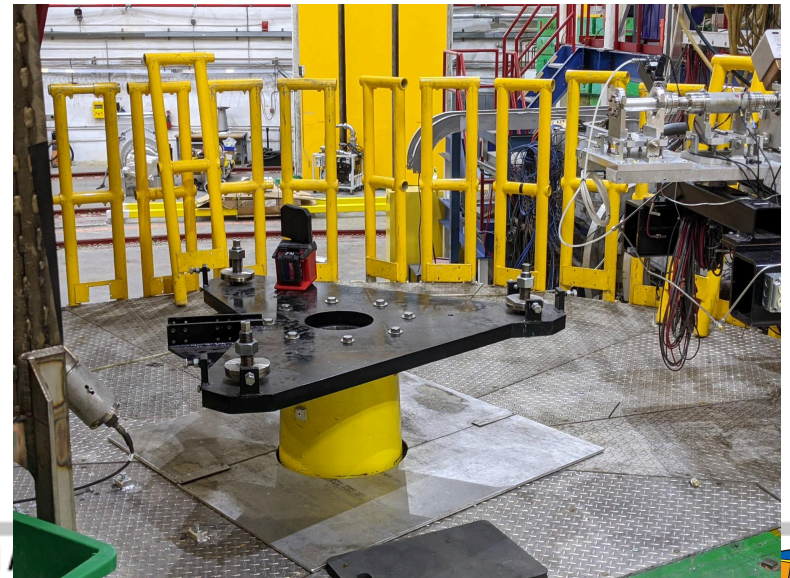
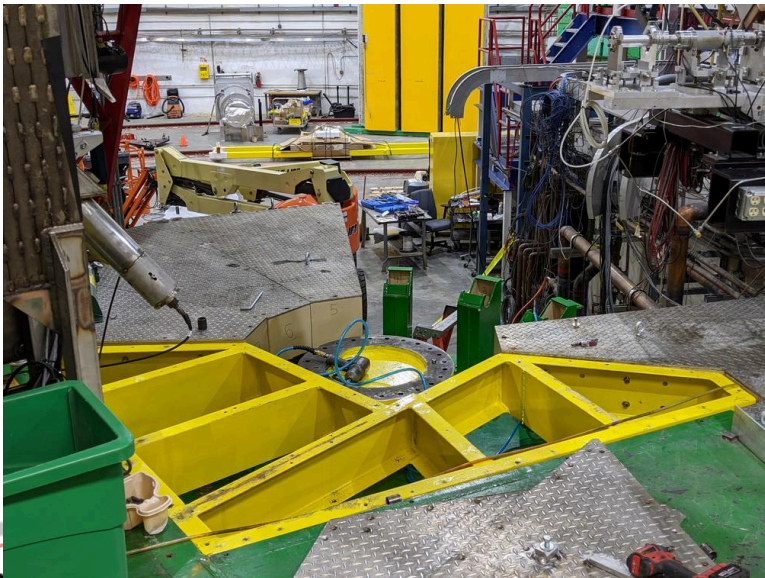
Beam Energies 9.2, 8.0, 9.9, 6.0 GeV

2022 (May?)

Standard equipment solid and cryotarget experiments

CaFe, EMC, $x > 1$, NucR, PionLT, LAD ... ?

Restoring standard configuration



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

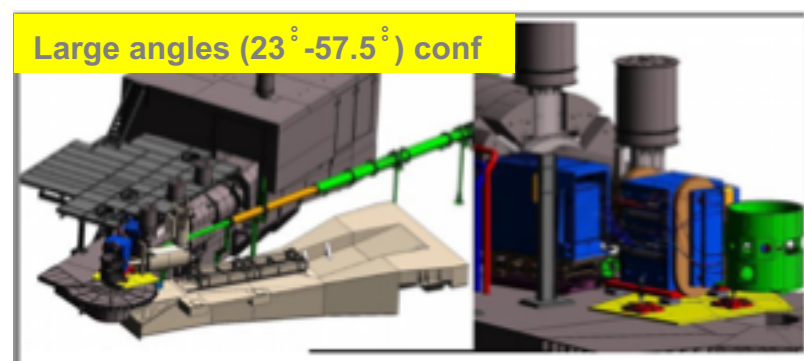
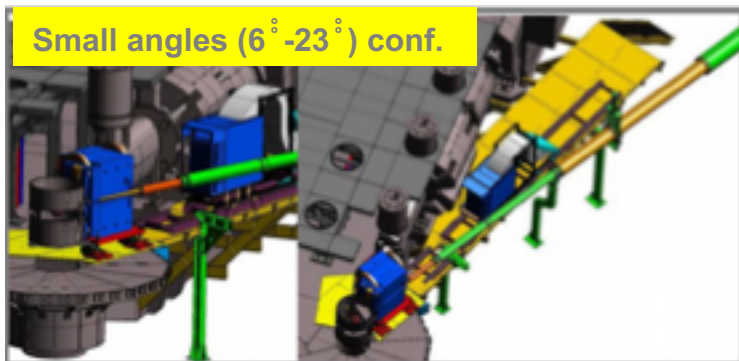
NPS: PbW04 calorimeter behind sweep magnet
Rides on SHMS carriage. Small and large angle configurations

Supported by NSF MRI PHY-1530874

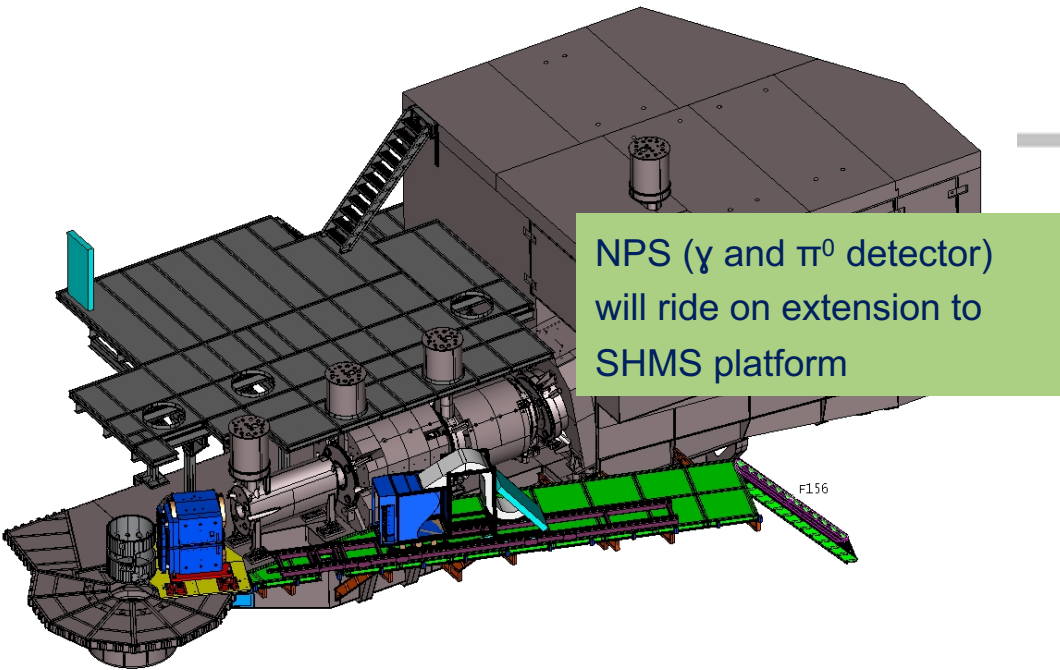


Sweep Magnet assembled and tested at JLAB

Tanja Horn



NPS Support Structure



NPS Frame

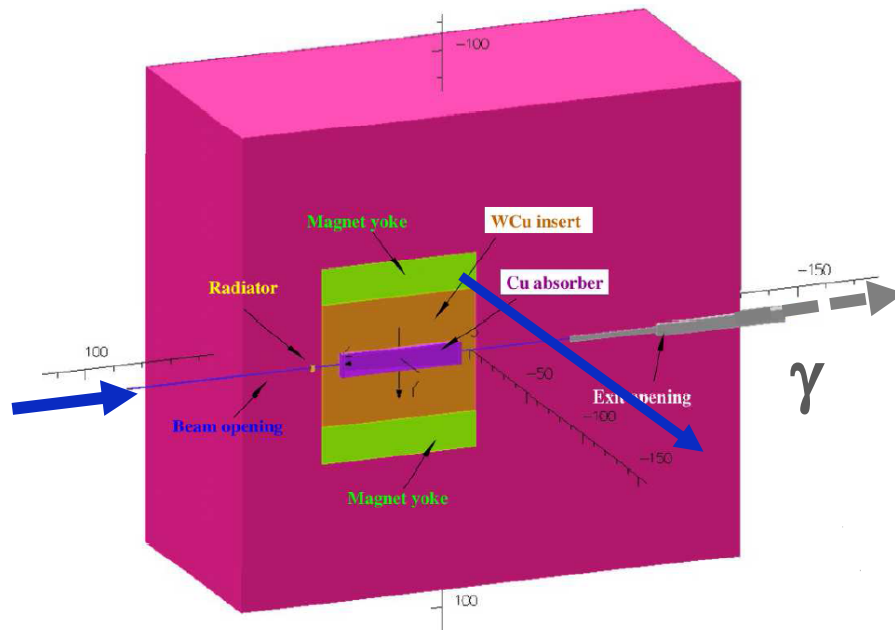
NPS Calorimeter frame fabricated at Orsay.

Now at JLab in Test Lab



A high-intensity compact photon source that could provide a factor of 30 gain in figure-of-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)**

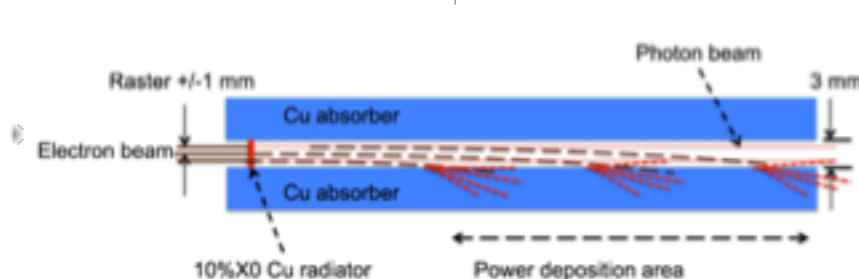


CPS conceptual design:

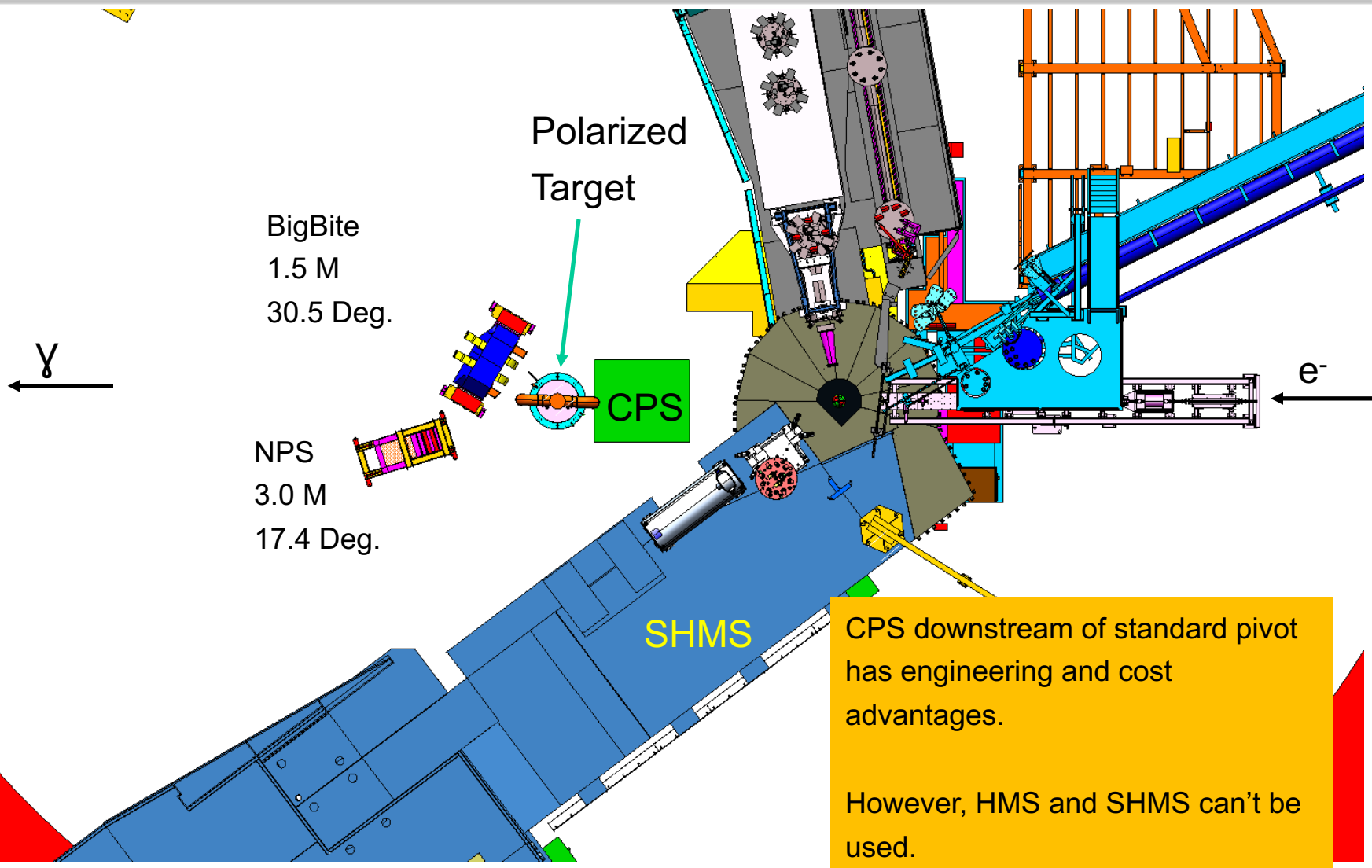
- a radiator to produce photons
- a magnet to dump the electrons with a small photon collimator
- a central copper absorber to handle the power deposition
- tungsten powder and borated plastic to hermetically shield the induced radiation dose as close to the source as possible.

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

Hall C engineering group developing
thermal model – 35 kW heat load



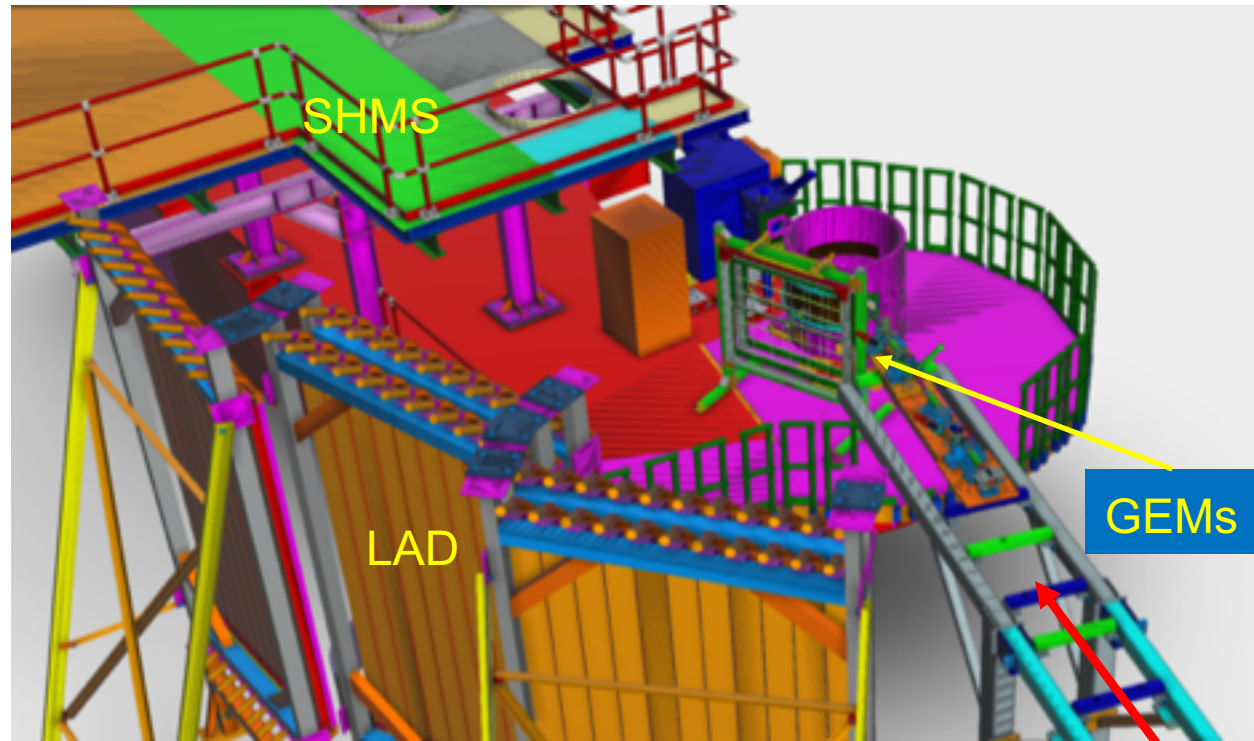
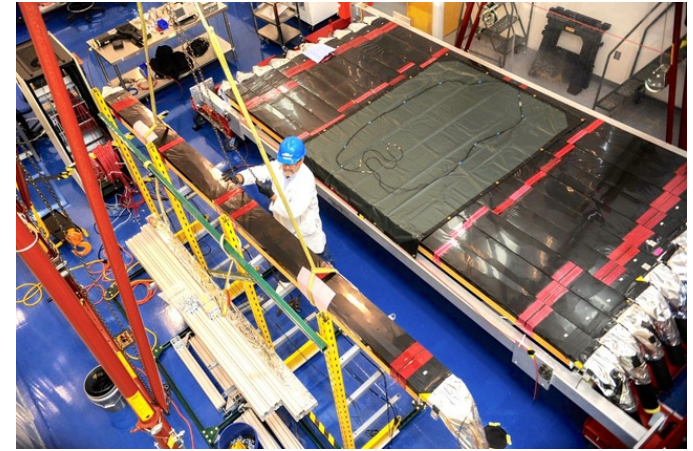
CPS – Downstream of Pivot



LAD – Large Acceptance Detector

Tyler Kutz

- E12-11-007: Deuteron EMC – $d(e, e' \text{ backward } p)$
- 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.
- Successful ERR review
- Scheduling requested



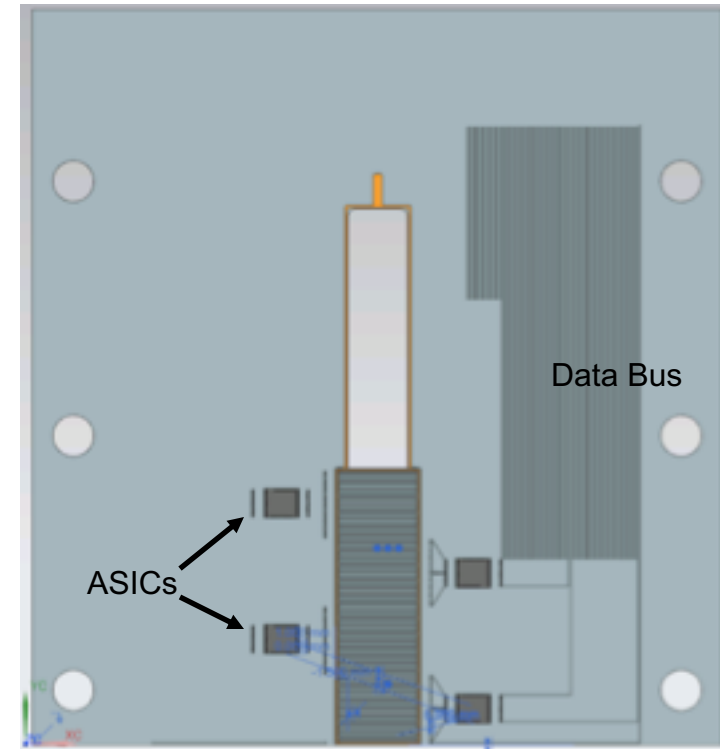
Polarimetry upgrade

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 diamond 128 strip electron detector
 - Under design (Jim Fast)
 - On board amplification (VAC32C.2 ASIC)

Moller Polarimeter:

- New superconducting solenoid (identical to Hall A's).
- MOLLER collaboration using for Kerr effect measurements.
- Installation soon.



Diamond with
128 strips at 245
micron pitch

High Momentum Spectrometer

HMS is over 25 years old

Remains critical element of 12 GeV program

$P \leq \sim 7.4 \text{ GeV}$

New quadrupole power supplies delivered

Hodoscope replacement underway

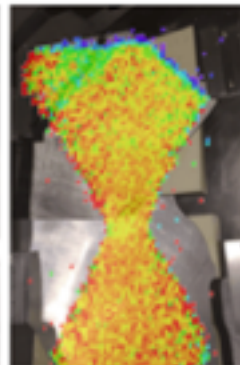
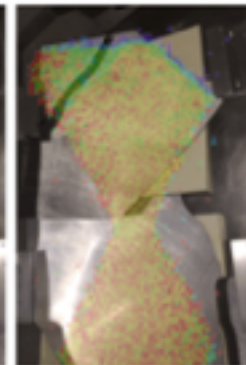
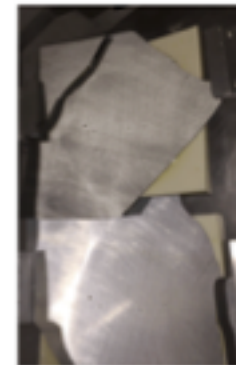
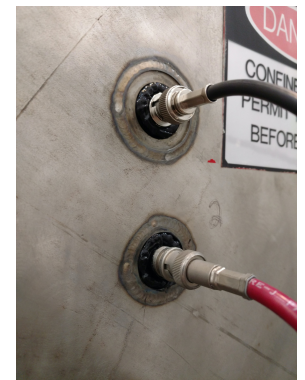
New drift chambers for 12 GeV

Cherenkov light leak (250 Khz) repaired (2020)

Broken cherenkov mirrors repaired (2018)

Aerogel needs new tubes

NIM Paper?



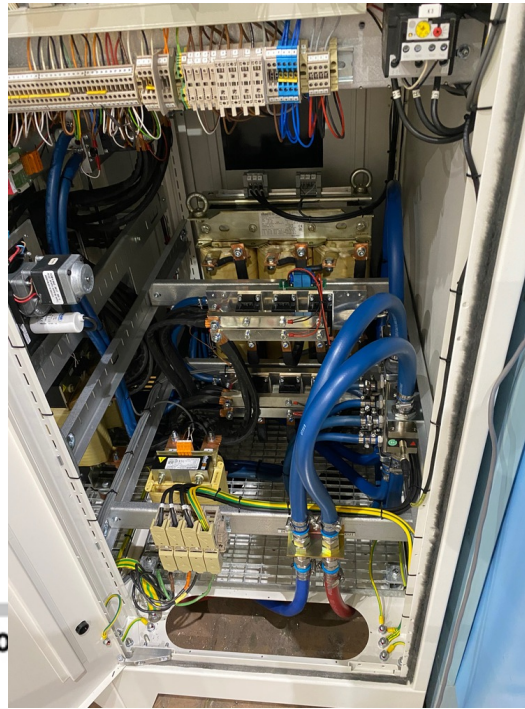
HMS Quadrupole Power Supplies

Three new HMS quadrupole power supplies from Danfysik delivered

Replacing 25+ year old supplies

Remote polarity reversing will be restored

Testing underway



HMS Hodoscope refurbishment

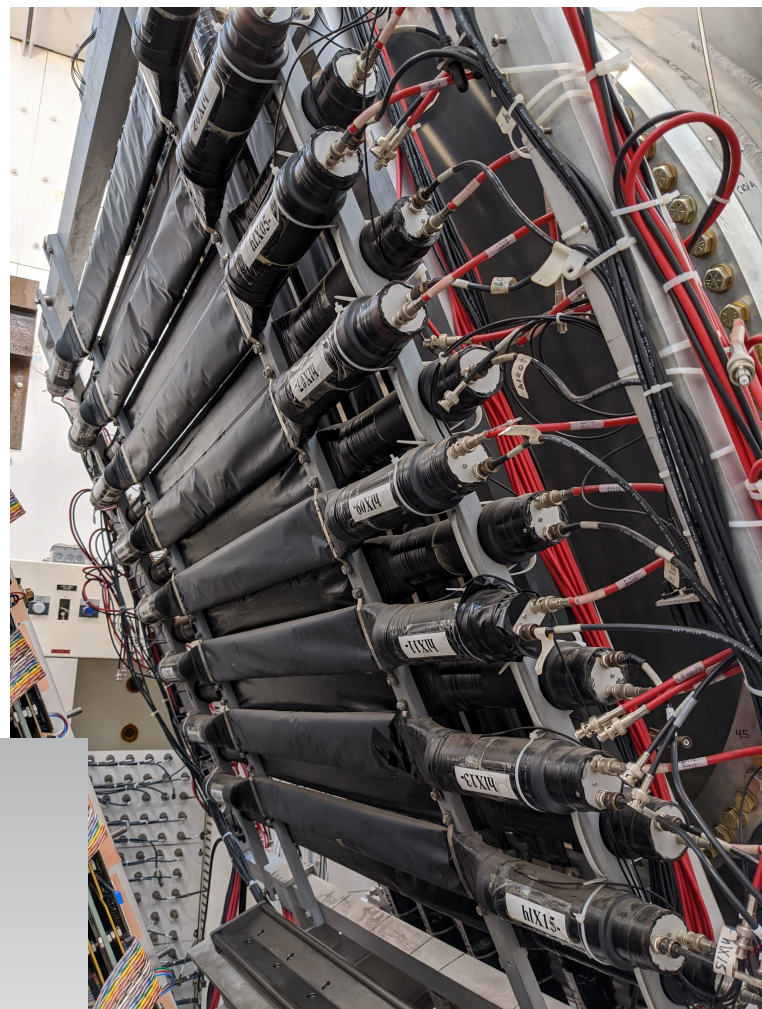
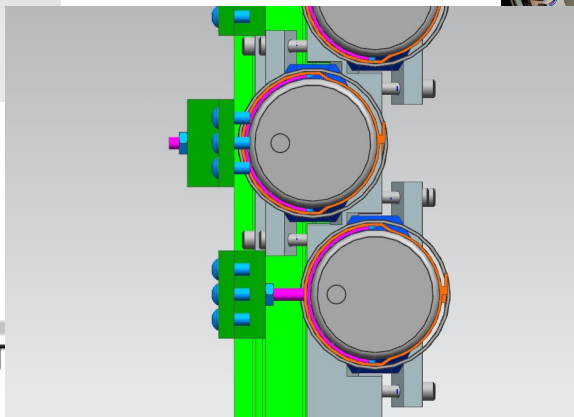
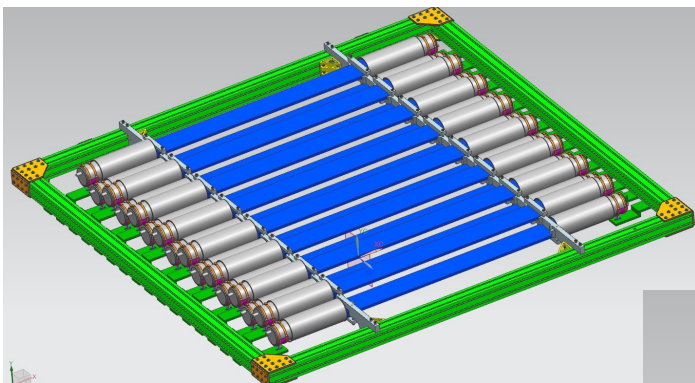
HMS hodoscope:

- >25 year old plastic

- ~15 year old tubes

New tubes, scintillator light guides

New frame



HMS Hodoscope refurbishment

New hodoscope frames designed

New tubes and plastic delivered

Dipole fringe fields measured at hodoscope PMT locations. Maximum seen is 3 gauss with dipole @ 2750A. ($> 7.2 \text{ GeV}/c$)



Past and future shift work during pandemic

- Hall C completed polarized target experiments under MEDCON5
 - Extensive target work - PPE (N95) used when working in close quarters
 - Counting house limited to 3 people (2 shift workers + RC)
 - Due to travel restrictions, limited pool from which to draw shift workers
 - Guidelines were challenging to follow
- Future run in 2021?
 - Slow vaccine roll out. 0.65% of Newport News infected per week.
 - MEDCON4 still has room capacity limits
 - Even if no local restrictions, collaborators may be unable/reluctant to travel
- Allowing remote shift work could be useful even in absence of pandemic
 - Remote on-campus counting house
 - Remote counting houses at off-campus locations

Hall C Remote Counting House

- Always be at least one local person in the Hall C CH
 - Target controls
 - Fall back if connection issues
 - Always available to respond to local alarms/issues
- Remote hardware spec defined and managed by Hall C / JLab
 - Computer + monitor layout
 - (Not a laptop or recycled hardware)
 - JLab CUE-based linux
 - VOIP phone
- 2-factored VPN connection
 - System behaves as if it is “local” to Hall C cluster
- Hall C has hardware for on-site remote.



Hall C Remote Counting House

- Persistent set of common screens delivered to remote user

Mirrored in physical CH

Available for RC, other experts to view as well

- Always-on 'video-conferencing' between remote and local CH
- VOIP phone system
 - Allows MCC/JLab locals to call existing/standard Hall C CH number(s) and have it ring both local CH and remote CH
- A lot of details and corner cases; both security and practical, have been thought through.
- Concept tested during A1n/d2n

- Setting up remote (university) CH
 - Acquire specified hardware – 3K\$
 - Configure as specified
 - Dedicate hardware and room to CH