Hall A Status

APS April Meeting

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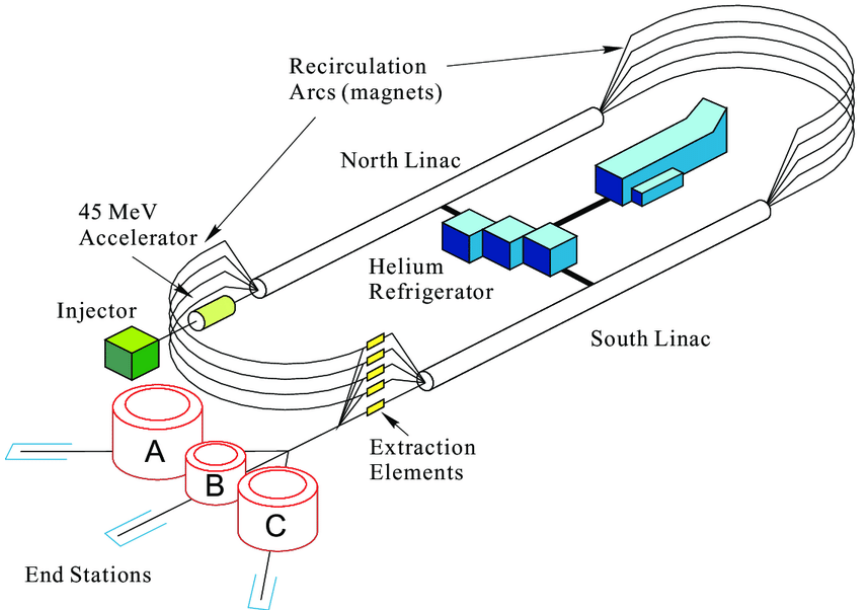
Jefferson Lab, Syracuse University

April 2024

Jefferson Lab (JLab) Hall A

- Continuous Electron Beam Accelerator Facility **(CEBAF):**
  - Injector, arc magnets, 2 Linacs, and up to a 11 GeV beam energy.
- Hall A:
  - High current, high luminosity
  - **SBS:**
    - Aims to re-solve the electromagnetic form factor of nucleons.



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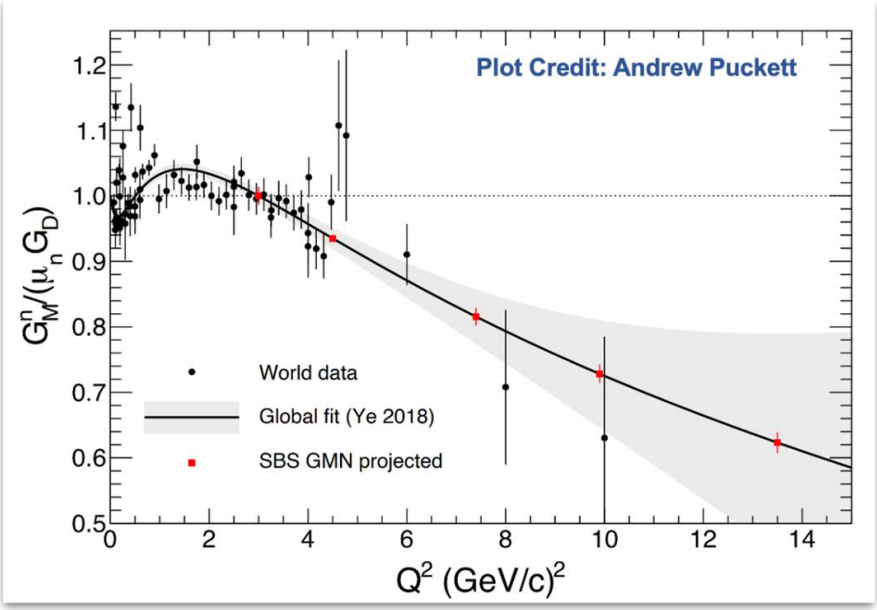
*Analysis Status: GMn (E12-09-019)

- **Relative statistical uncertainties** in GMn/GMp is estimated from the raw yields obtained from experimental data analysis.
- Projected systematic uncertainties have been taken from the experiment proposal.



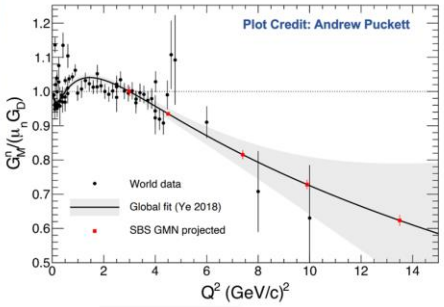
Raw Yields & Preliminary Uncertainty Projections

Table I: Estimated Raw QE Yields from SBS-G_M^n dataset

Q^2 (GeV/c)^2	E_{beam} (GeV)	Raw QE Yields	Projected $\Delta_{stat}(G_M^n/G_M^p)$	Projected $\Delta_{syst}(G_M^n/G_M^p)$
3.0	3.73	471,000	0.12%	1.4%
4.5	5.97	1,092,000	0.07%	0.6%
7.4	5.97	76,700	0.30%	1.6%
9.9	7.91	13,100	0.70%	1.8%
13.5	9.86	19,200	0.60%	2.5%

Preliminary

- Relative statistical uncertainties in G_M^n/G_M^p is estimated from the raw yields we got using the analysis shown in the previous slides.
- Projected systematic uncertainties have been taken from experiment proposal.
- Things we haven't considered:
  - HCAL p/n detection efficiency corrections
  - Radiative corrections
  - Nuclear corrections
  - Nucleon misidentification probabilities and many more



UCONN Jefferson Lab P. Datta | APS DNP Meeting | 11/29/2023 13

Slide Adapted from P. Datta, *DNP November 2023

By Satnik, JLUO Satellite Meeting, DNP 2023

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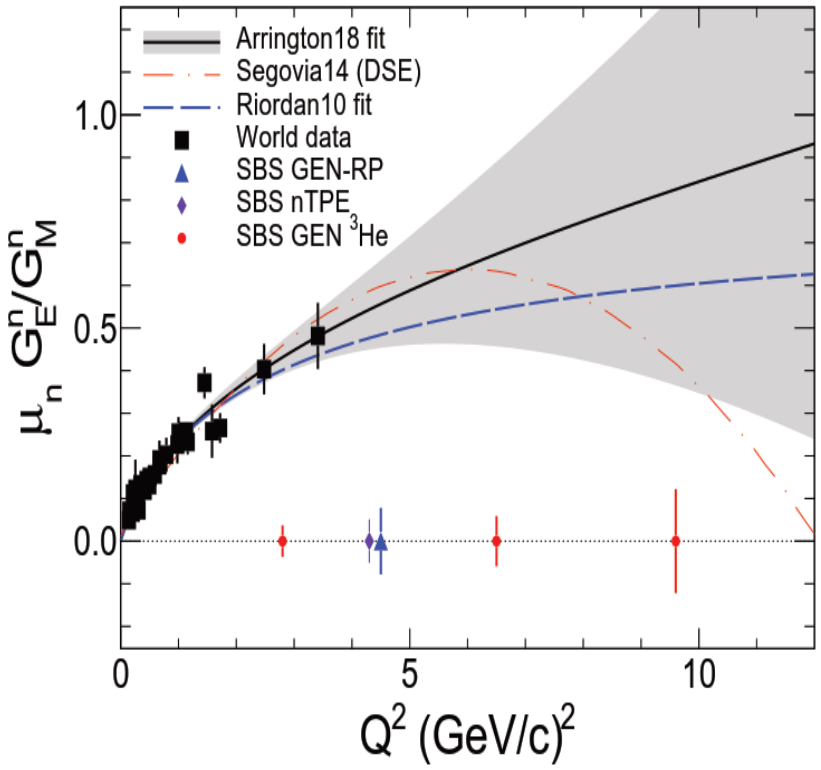
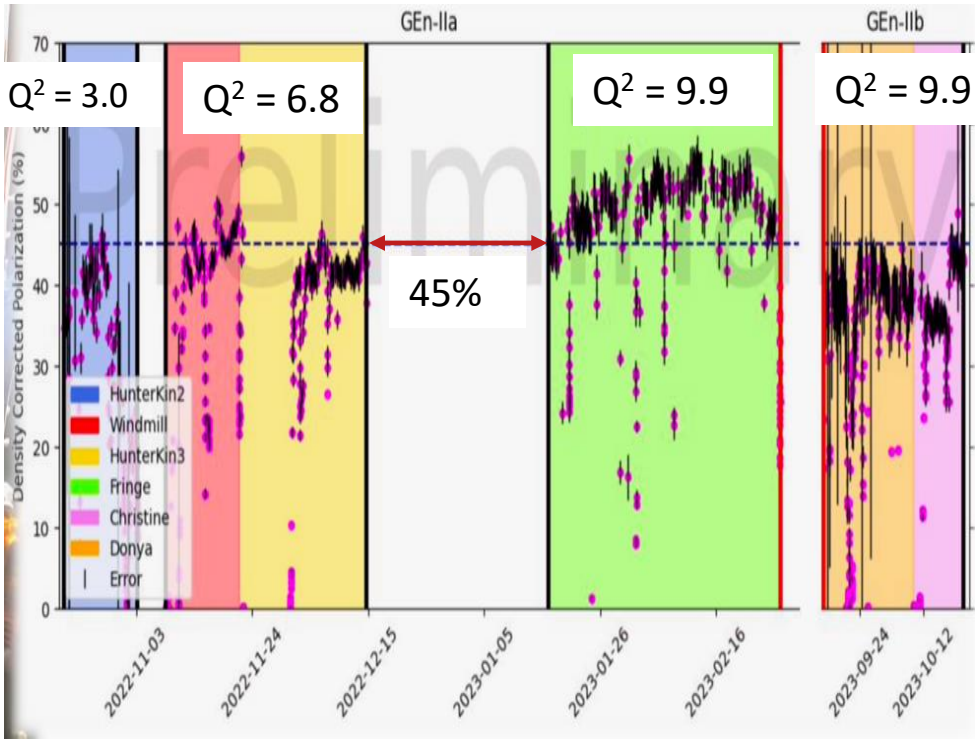
GEn using polarized helium target

- Started running the experiment at beginning of Oct 2022
- First time running with 60cm long 3He cell
  - 45-50% polarization in beam!
- Completed the Q^2 = 3.0 and 6.8 by Dec 2022. Run part of Q^2 = 9.9 from Jan to Mar 2023
- Completed the Q^2 = 9.9 kinematics by running from Sept 12 to Oct 30 2023.





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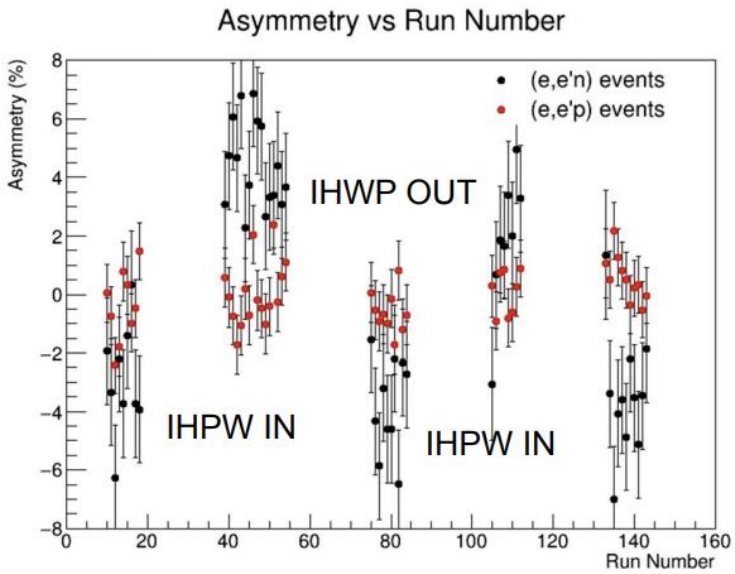
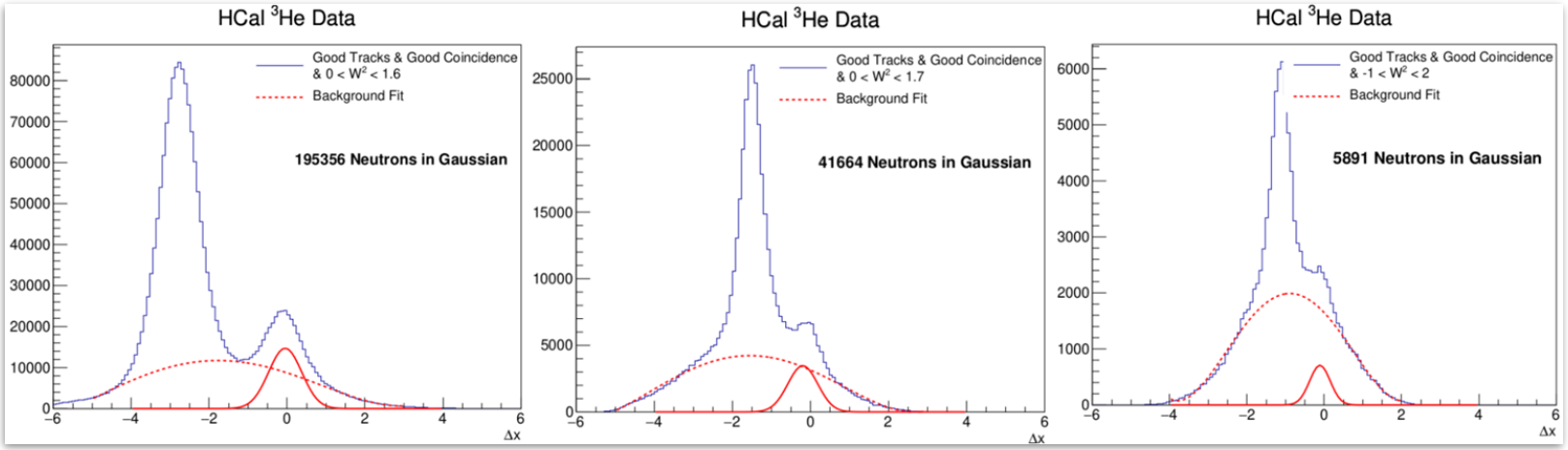
*Analysis Status: GEn (E12-09-019)

- Asymmetry measurement.
- Beam asymmetries look reasonable
- Statistical error bars updated at each kinematic point.





Slide Adapted from S. Seeds, *Southeastern APS Section 2023

Satnik, JLUO Satellite Meeting, DNP 2023

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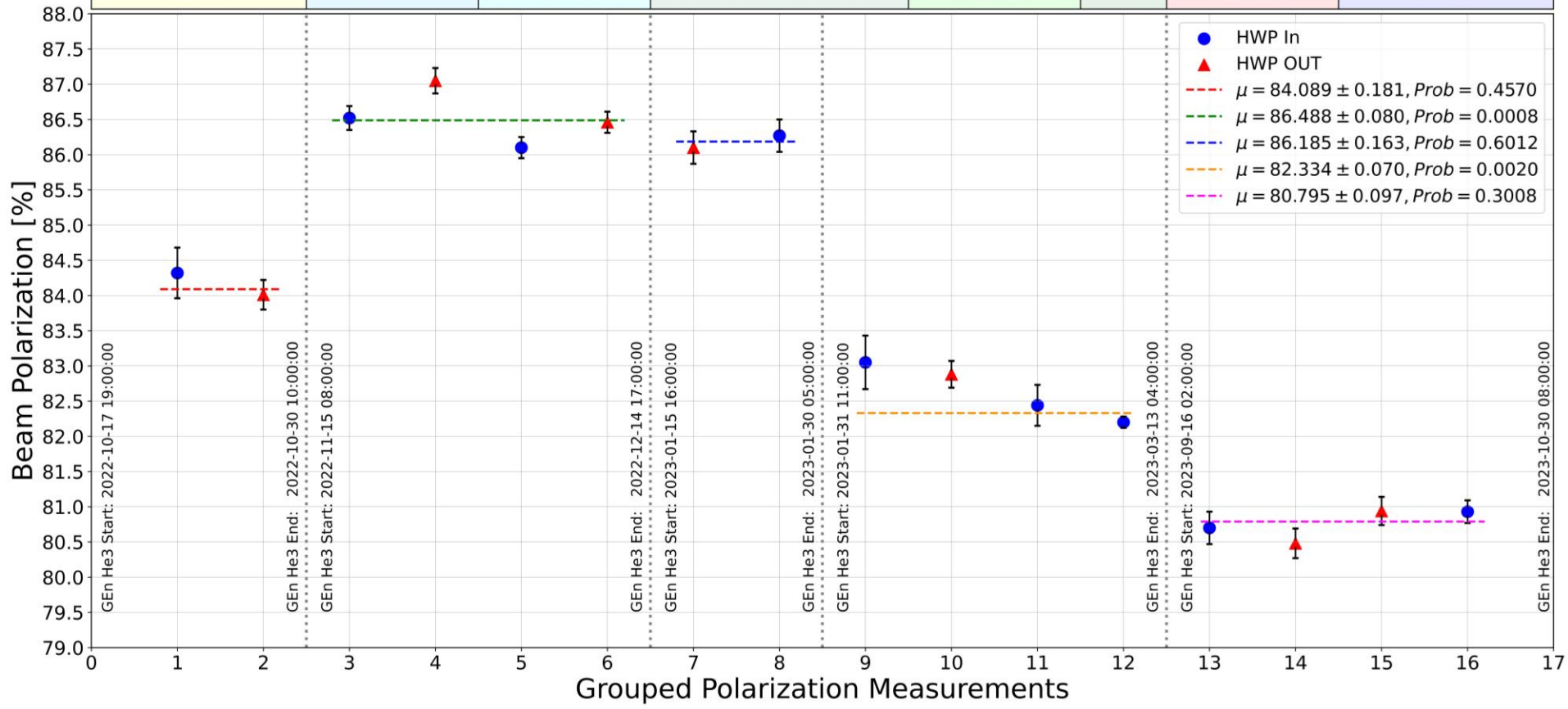
Møller Polarimetry for GEn

Energy	4.2GeV	6.3GeV		8.4GeV				
Date	10/15/22	11/17/22	12/13/22	1/30/23	2/27/23	3/13/23	9/21/23	10/19/23
Wien(H)	-23.4 °	0 °		-64.6 °	-47.2 °		-48.3 °	
H/A QE	0.2106	0.2775	0.2233	0.5021	0.3827	0.3350	0.3373	0.2758



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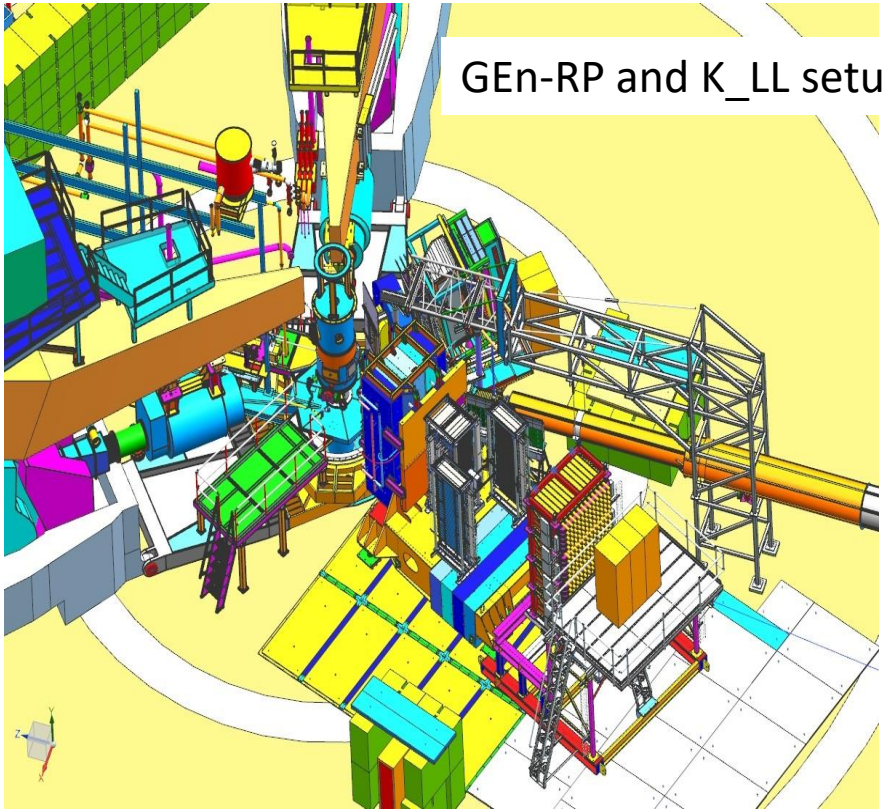
GEM work during the installation period

- The UV layers were removed from BigBite and all HV upgraded to enable for higher luminosity for GEN-RP
- SBS inline GEM stack removed from the platform, all HV upgraded and tested, moved back to the SBS platform
- Recoil side layers were brought to the hall, HV upgraded, and fully tested in the hall with cosmic

GEn-RP and K_LL in April 2024

- Measurement of the Ratio GEn/GMn by the Double-polarized $^2\mathrm{H}(\vec{e}, e'\vec{n})$ Reaction
  - Outgoing neutron polarization measured by charge exchange
  - Additional polarization measurement using the side detectors and active analyzer
- Polarization Transfer in Wide-Angle Charged Pion Photoproduction (K_LL)



GEn-RP and K_LL setup

Inline SBS GEMs installed and used in GEn.

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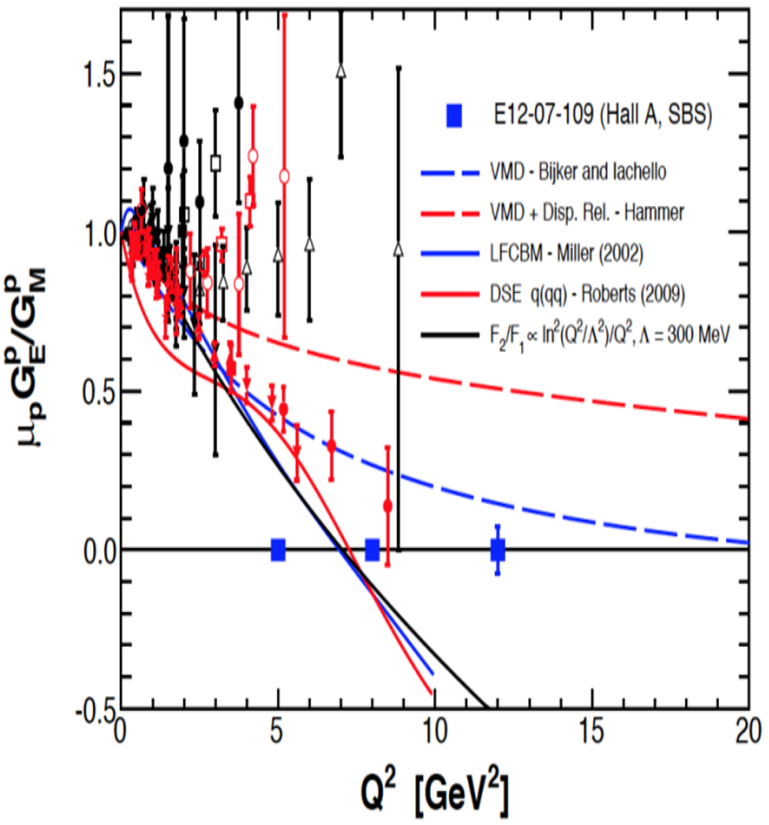
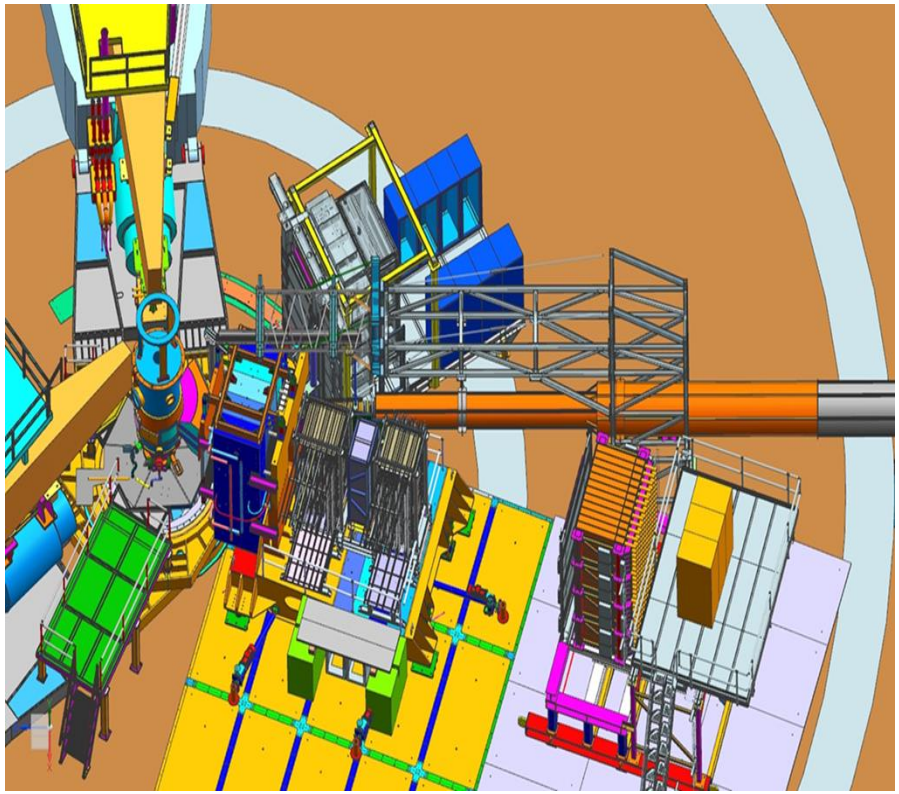
GEp experiment

- Installation begins in May 2024 and ends Oct 2024
- Experiment runs from Nov 2024 to April 2025
- Large Electron Calorimeter and Coordinate Detector replace BigBite
- Rearrange Bigbite and SBS GEM detectors
- Measure to $Q^2 = 12$





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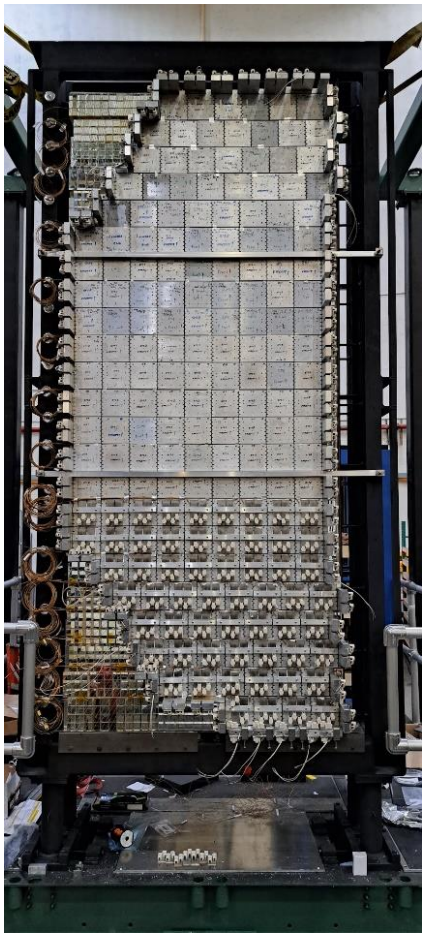
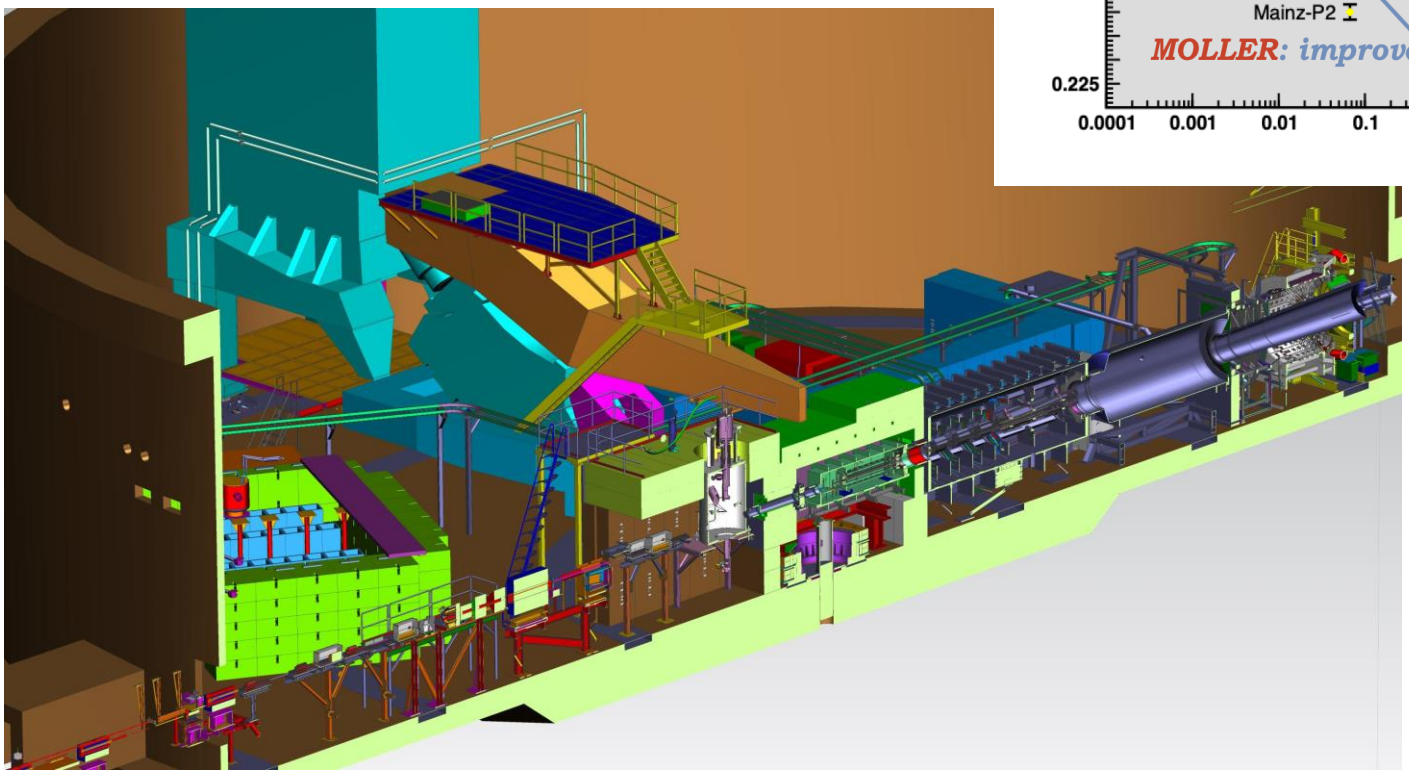
Proton electric form factor in Fall 2024

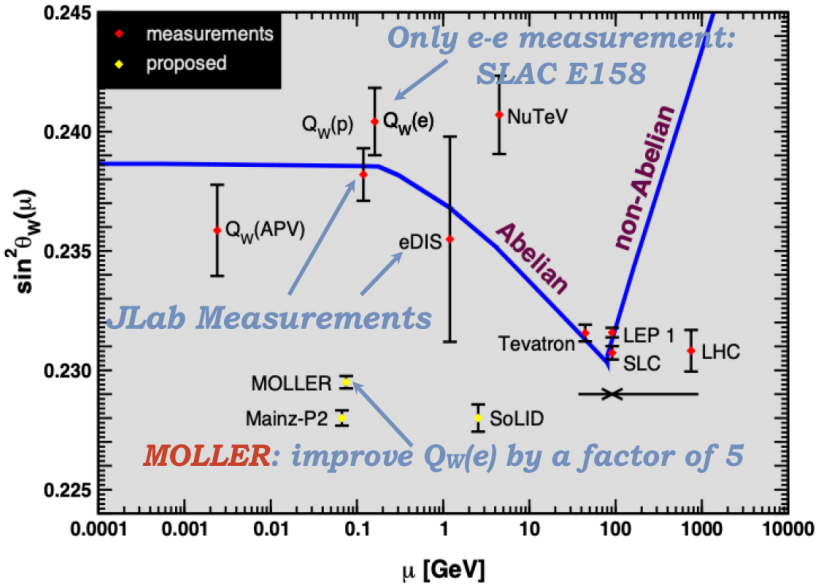
- Measure GEp by measuring recoil proton polarization in elastic scattering.



MOLLER Experiment

- Passed Cd-3A review and spending CD-3A funds.
- CD2 /CD3 review in October 2023.
- Start SBS deinstallation in May 2025
- 3 years of running.





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Hall A Schedule

Date	Activity
April 2024 – May 2024	Run GEn-RP and K_LL
May 2024	Deinstall GEn-RP and install GEp
Nov 2024 – April 2025	Run GEp
May 2025	Deinstall GEp and start MOLLER installation