

Hall-B Status Report

- News from Hall-B Group and Collaborations
- Run Schedule and Run Preparation for Hall B
- Update on Hall-B Theses and Publications

There will be a Hall-B Business Meeting this Friday 12:00 pm with information on projects, subcontracts and research tracking

Patrick Achenbach

July 8, 2025



News from Hall-B Group and Collaborations



News from Hall-B Group

JOINT APPOINTMENTS

- 👍 **New Joint Appointment with Lamar University**
 - 5-year assistant professor position with Hall B
 - Candidates have been interviewed
- 👤 **Joint Appointment of Anselm Vossen with Duke U**
 - JLab support discontinued after two 3-year terms
 - Continuation of Hall B projects at Duke U with more specialized support from JLab/Hall-B in future

TRANSITIONS

- **Donald Williams** left Spin-Polarized Fusion Team
 - Transitioned to a permanent Technician position in Physics Division Target Group
 - Continues to work on Hall B projects
- **Gagik Gavalian** left Hall B Offline Software Group
 - Continues to work on Hall B projects

POSTDOCS

- 👤 **New LDRD Postdoc position on AI/ML**
 - Selected candidate rejected position
 - Position not re-approved by leadership
- **Richard Tyson** will leave in mid October
 - Regular completion of his 2-year term
 - Regular succession is planned

PROMOTIONS

- **Florian Hauenstein** to Staff Scientist II
 - **Rafayel Paremuzyan** to Staff Scientist II
- Congratulations, well deserved!



Awards to Hall-B Staff

Tom W. Bonner Prize in Nuclear Physics

- **Volker Burkert**
 - “For exemplary leadership in the development of high-performance instrumentation for large acceptance spectrometers that have enabled breakthroughs in fundamental nuclear physics through electroproduction measurements of exclusive processes”



11/20/1985: Volker's
1st day at CEBAF



Service Award

- **Calvin Mealer**
 - For 25 years of dedication to JLab



Employee Excellence Awards

- **Calvin Mealer, Dontre Tucker, Steve Docherty**



- For their outstanding service to JLab

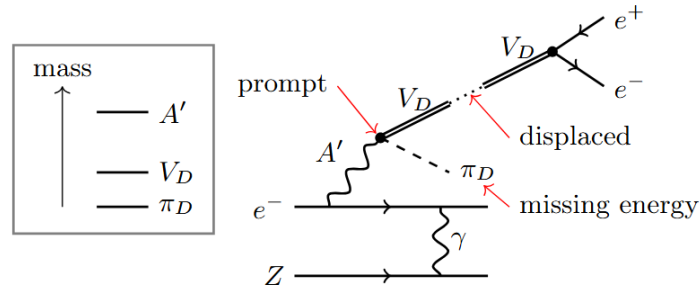
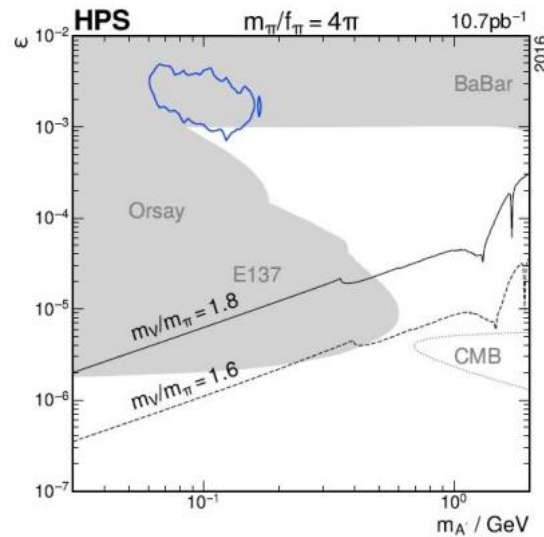
Feodor Lynen Research Fellowship

- **Bhawani Singh**
 - Declined due to incompatibility of JLab as host institution



HPS COLLABORATION

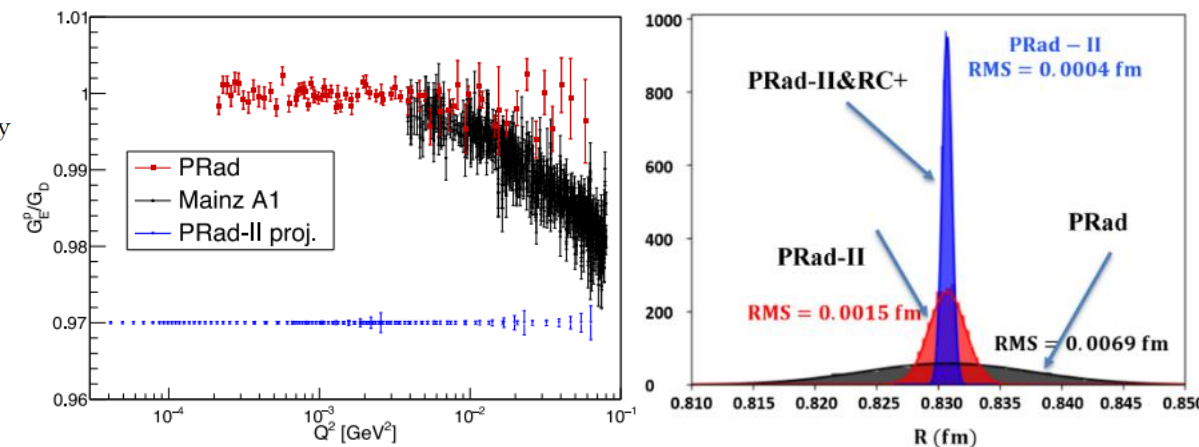
- Semi-annual **HPS Collaboration Meeting** at JLab from June 3–5, 2025 with 23 registered participants
- SIMPs paper draft "*Displaced Vertex Searches for Electroproduced Strongly Interactive Massive Particles with the 2016 HPS Dataset*" based on two analysis notes from **Alec Spellmann** and **Tom Eichlersmith** using full unblinded 2016 statistics:



- Improvements in calibration, alignment, processing

PRAD COLLABORATION

- **PRad-II/X17 passed the Experimental Readiness Review on May 8–9, 2025**
 - Review committee provided constructive comments and few recommendations
 - Preparations for PRad-II/X17 run in FY26 continuing with close monitoring of procurements and installation schedule
- **McMule Group joined PRad Collaboration** as collaborators on radiative corrections:



Run Schedule



FY25 Run Status

SAD or scheduled Run Group	Setup / Status	Target	Beam Energy	Start Date	End Date	Scheduled Calendar Days	Remaining PAC Days Before Run	Scheduled PAC Days = Cal Days/2	Actual PAC Days from ABUs	Remaining PAC Days After Run
SAD 2024				2024-05-19	2025-03-19	304				
RG-L	ALERT	high pressure gas	2,1	2025-04-05	2025-04-12	7	55,0	3,5	1,0	54,0
pass change				2025-04-12						
RG-L	ALERT	high pressure gas	11	2025-04-12	2025-07-01	80	54,0	40,0	36,0	18,0
RG-L	ALERT	high pressure gas	11	2025-07-01	2025-08-04	34	18,0	17,0		1,0
pass change				2025-08-04						
RG-L	ALERT	high pressure gas	2,1	2025-08-04	2025-08-07	3	1,0	1,5		-0,5
pass change				2025-08-07						
RG-L	ALERT	high pressure gas	6,6	2025-08-07	2025-09-03	27	17,0	13,5		3,5
SAM 2025	reconfigure						151	sum:	75,5	

last
week
←

end of
run in
Sept.
←

- We are at about 60% of the run time with about 50% of ABUs collected [with 1 significant digit]
- 2 additionally approved weeks compensating for 2 lost weeks because of accelerator issues

Change-over from ALERT DIS to SRC Run

- Two consecutive pass changes in one week should be scheduled on **Monday & Thursday**
 - **Option 1: week starting July 28, 2025**
 - **Option 2: week starting August 4, 2025**
- **ALERT DIS (high-energy) run**
 - Still recovering from particularly low accelerator availability in early May (about 1 week behind)
 - Running **median current** (325 nA) while originally low- and high current parts were planned; scheduled run time is expected to provide sufficient statistics for all approved analyses
 - Assuming high run efficiency in July, **Option 1** would complete the experiment
- **ALERT SRC (low-energy) run**
 - Benefits from commissioning/debugging/repairs
 - Assuming high run efficiency in August, **Option 2** would complete the experiment

Note: assuming high run efficiencies both in July and August, we are fine either way

Update on Run Schedule Planning

- 👍 **PRad-II/X17 passed Experiment Readiness Review on 8-9 May, 2025**
 - Hall C plans a program that requires reducing energy gain to around **700 MeV/pass**
 - This fits well with the low beam energies required for PRad-II
 - Such beam energies will not be available during the coming years of MOLLER running
- 👎 **ERR for RG-G will not happen in FY26:** Irradiation infrastructure and LiD samples will not be ready in January 2026 to produce highly-polarized target material

Chris Keith: *“It is looking more and more like we’ll get one chance per year at the injector and that is the month or so before beam is delivered to the halls.”*

- **RG-A / RG-B / RG-E / RG-K will be ready:** small modifications to the Hall-B cryotarget planned
- **HPS could be ready for FY27**

Many scheduling aspects were discussed during the last Hall-B Business Meeting in March 2025

FY26 Run Schedule

CEBAF
rescale
→

Scheduled Experiment	Setup / Status	Target	Beam Energy	Start Date	End Date	Scheduled Calendar Days	Remaining PAC Days Before Run	Scheduled PAC Days = Cal Days/2	Remaining PAC Days After Run
PRad-II/X17	HyCal/GEMs	Radiator	3,5	2026-01-26	2026-02-02	7	40,0	3,5	36,5
PRad-II	HyCal/GEMs	H2 gas	3,5	2026-02-02	2026-03-02	28	36,5	14,0	22,5
	pass change			2026-03-02					
PRad-II	HyCal/GEMs	H2 gas	0,7	2026-03-02	2026-03-23	21	22,5	10,5	12,0
	CEBAF rescale			2026-03-23	2026-04-04	12			
PRad-II	HyCal/GEMs	H2 gas	2,2	2026-04-04	2026-05-04	30	12,0	15,0	-3,0
	reconfigure			2026-05-04	2026-05-09	5			
X17 Search	HyCal/GEMs	Ta foil	2,2	2026-05-09	2026-06-29	51	60,0	25,5	34,5
						sum: 154	sum: 68,5		

←
setup
change

- **PRad-II** scheduled for **completion of the experiment** including non-standard beam energies
- **X17 Search** scheduled for **~50% of the experiment** with one of two planned beam energies

Possible FY27 Run Schedules

SAD or scheduled Run Group	Setup / Status	Target	Beam Energy	Start Date	End Date	Scheduled Calendar Days	Remaining PAC Days Before Run	Scheduled PAC Days = Cal.Days/2	Actual PAC Days from ABUs	Remaining PAC Days After Run
RG-E		liq. D2 & nucl. doublet	11			66	33	33		0
	reconfigure	change				7		4		
RG-K		liq. H2	8.8			120	52	60		0
sum:								97		

Or:

SAD or scheduled Run Group	Setup / Status	Target	Beam Energy	Start Date	End Date	Scheduled Calendar Days	Remaining PAC Days Before Run	Scheduled PAC Days = Cal.Days/2	Actual PAC Days from ABUs	Remaining PAC Days After Run
RG-E		liq. D2 & nucl. doublet	11			66	33	33		0
	reconfigure	change				7		4		
HPS	HPS setup	nuclear	4.4			120	105	60		45
sum:								97		

Combinations with RG-A and RG-B are also possible, some months with Hall-B cryotarget are a must!

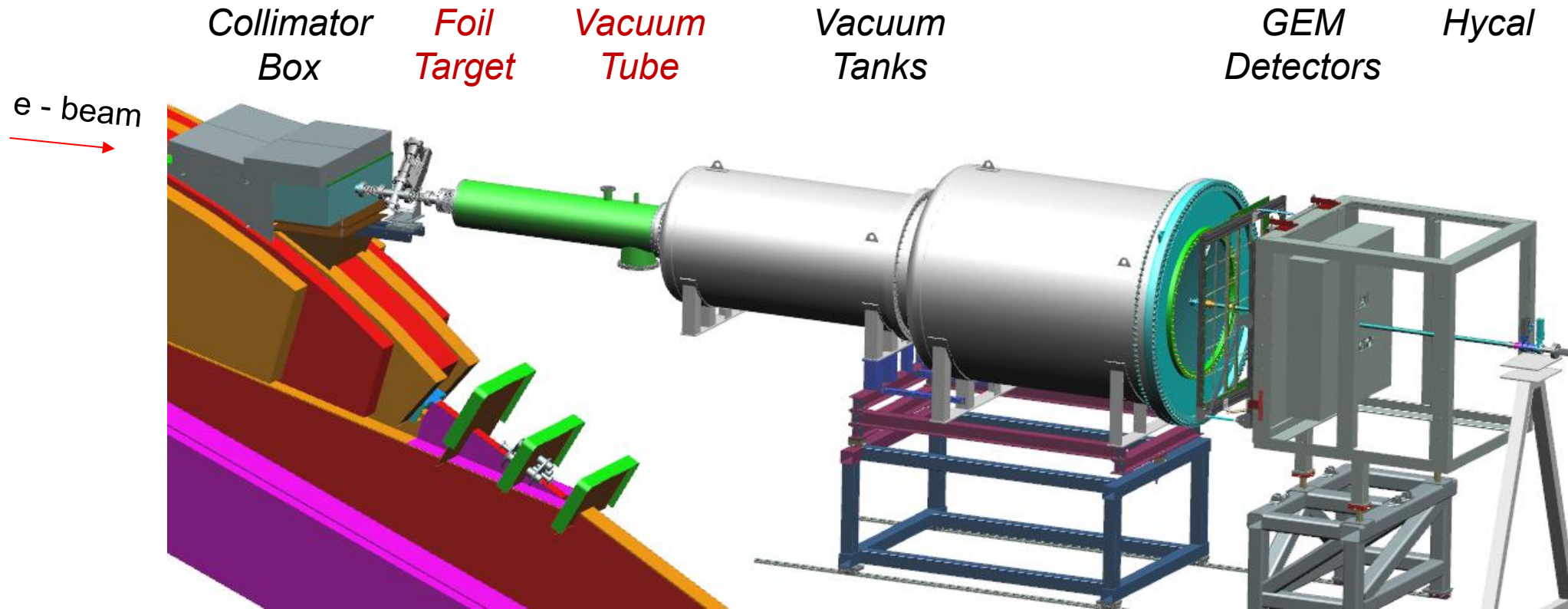
PRad Run Preparations



PRad-II/X17 Setup in Hall B

Experimental setup based on existing PRad equipment

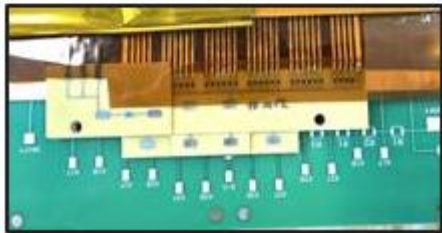
- For X17 specific: foil targets ($1\text{ }\mu\text{m Ta}$) and new vacuum tube
- Large vacuum tanks to minimize scattering
- Two planes of GEM detectors for tracking
- HyCal Calorimeter for electron/positron detection



GEM Detector Status

- Two planes (4 layers) of **newly constructed and characterized GEMs**

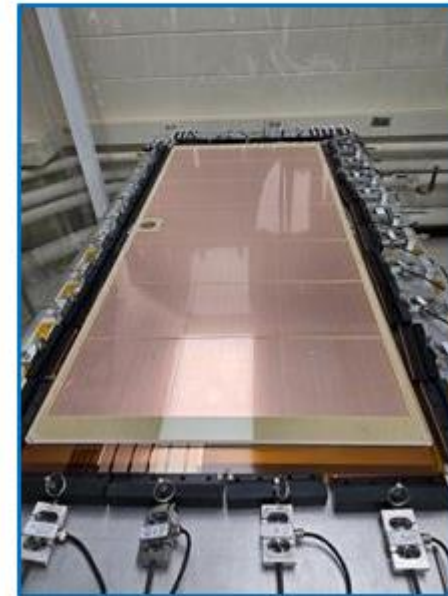
Procurement



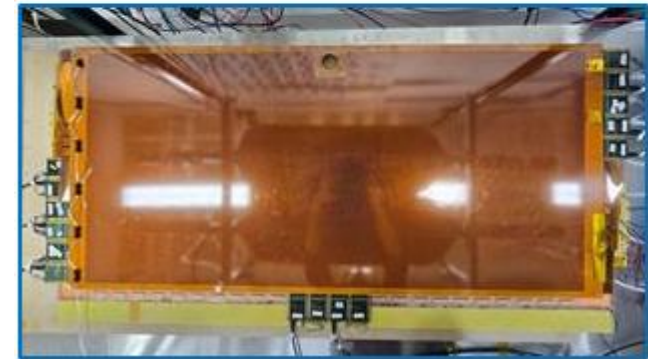
Pre-cleanroom activities



Cleanroom activities



Post-cleanroom activities

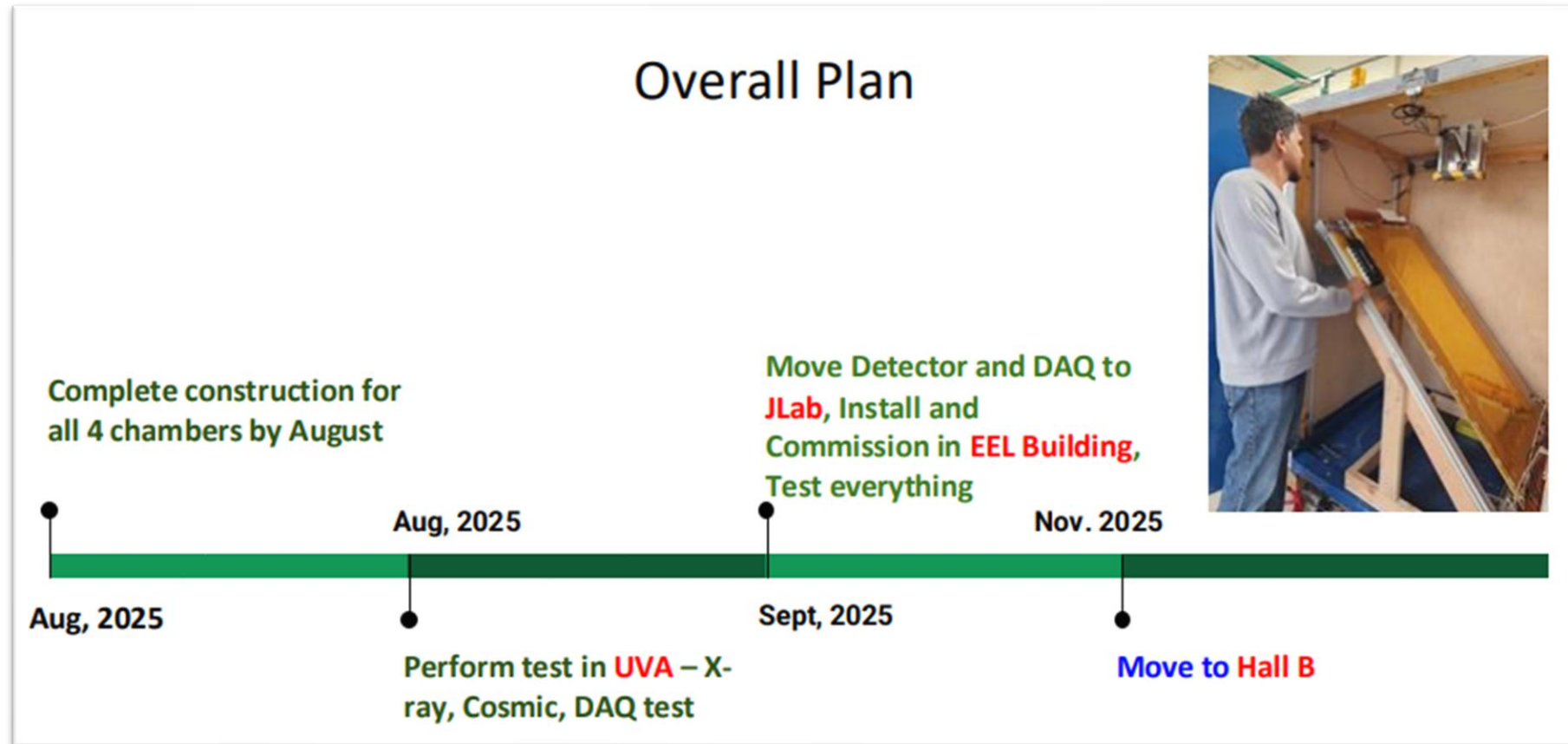


UVa is subcontracted for procurement, fabrication, and tests

- Frames
- Foils
- Honeycomb plates

Readiness of GEM Detector Integration

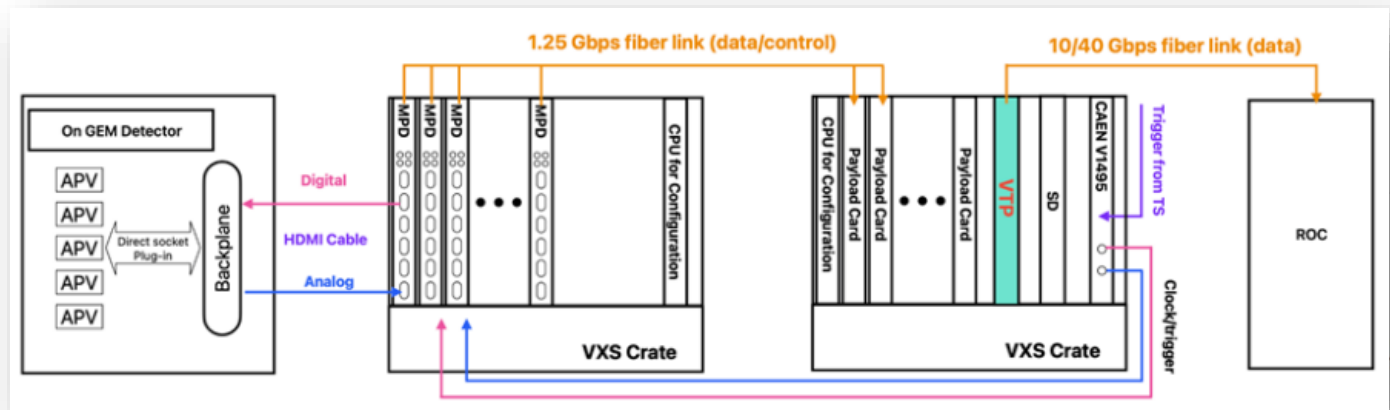
- First module assembly completed and with on-going characterization
- Timeline presented by Nilanga Liyanage during the ERR in May:



Collaboration is on track to provide the equipment this summer

Readiness of GEM Detector DAQ

- Based on VTP-MPD system currently used in SBS program
- Status presented by Nilanga Liyanage during the ERR in May:



DAQ Component Readiness

-II/X17 GEM DAQ

Module Name	Required Quantity
VXS crate	3
Payload Cards	12
MPD modules	48
backplanes	52 (1-, 2-, 3-slot combined)
APV	144
SD	3
TI Card	3
CAEN V1495	1
CPU	3
VTP	3
fan-in-fan-out NIM modules	as needed (depends on module)
HDMI Cables (10 m)	104
1-to-4 fibers	12
Wiener MPOD ompv 8008	13 (ready in Hall B)

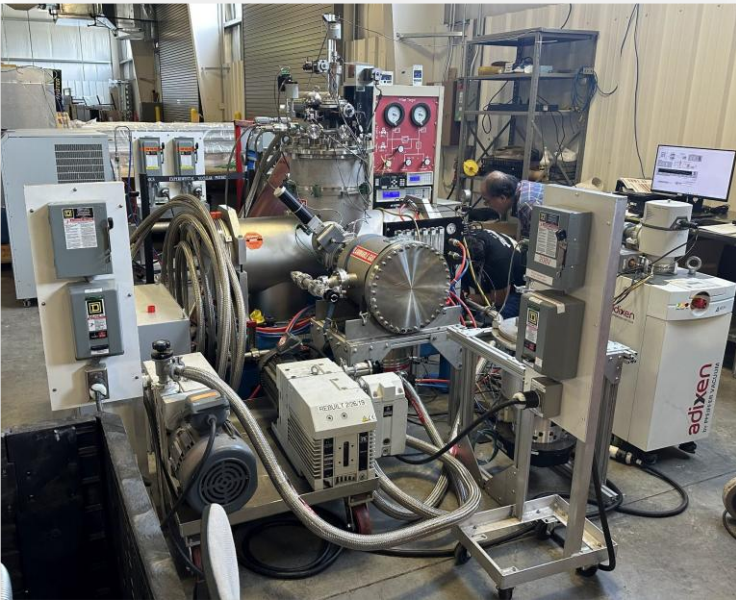
Table 1: List of Modules

- Ready in Hall B ✓
 - VXS crate, TI cards, CPU
 - Wiener MPOD ompv 8008
- From SBS program ✓
 - MPD, VTP, SD, Payload Cards
 - CAEN V1495
 - Fan-in-Fan-out modules
 - HDMI cables, 1-to-4 fibers
- Already purchased for PRad-II/X17 ✓
 - APV hybrid cards
- Manufacturing in Progress (expected June 2025)
 - backplanes

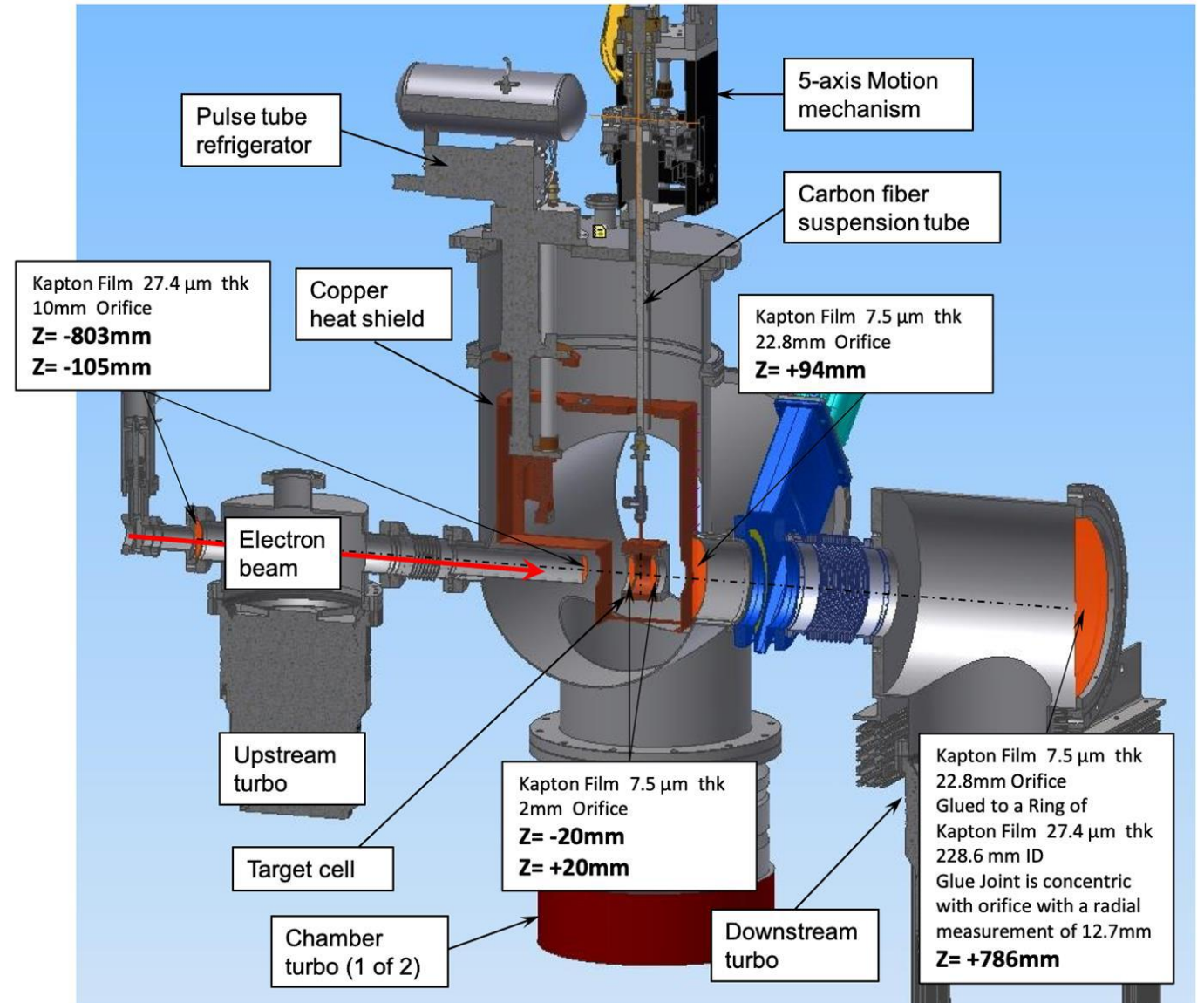
DAQ was tested at UVa with
25 kHz event rate

Windowless Hydrogen Gas Flow Target

- Target cell: 75 x 75 x 40 mm³
- Windowless: beam enters and exits via 2 mm orifices in 7.5 μ m thin polyimide foils
- 40 mm target thickness at 0.63 mbar pressure and 19.5 K temperature

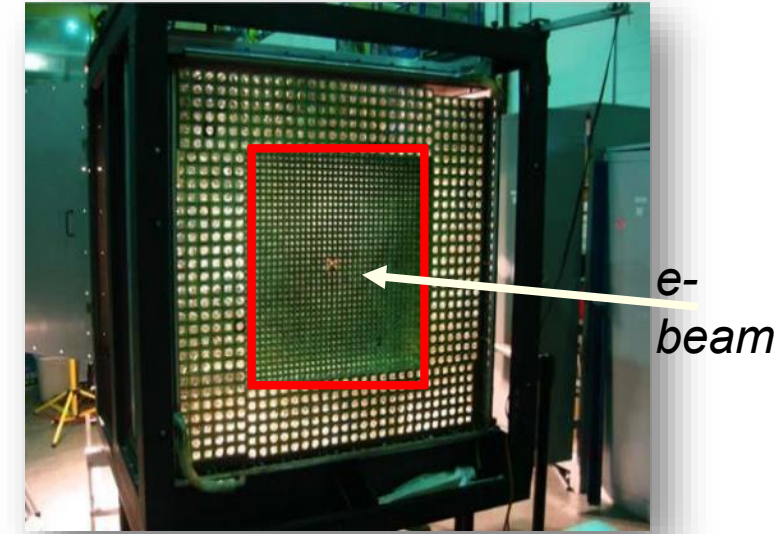


Target was tested with helium in ESB



HyCal Electromagnetic Calorimeter

- 34 x 34 = 1156 PbWO₄ modules, each 2 x 2 x 18 cm³
- 68 x 68 cm² total detection area
- 2 x 2 crystals removed from center for beam passage



HyCal Layout (Module ID Notation) (Front View - PbWO₄ ON) (V) LMS

1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034
1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068
1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102
1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136
1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170
1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204
1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	1222	1223	1224	1225	1226	1227	1228	1229	1230	1231	1232	1233	1234	1235	1236	1237	1238
1239	1240	1241	1242	1243	1244	1245	1246	1247	1248	1249	1250	1251	1252	1253	1254	1255	1256	1257	1258	1259	1260	1261	1262	1263	1264	1265	1266	1267	1268	1269	1270	1271	1272
1273	1274	1275	1276	1277	1278	1279	1280	1281	1282	1283	1284	1285	1286	1287	1288	1289	1290	1291	1292	1293	1294	1295	1296	1297	1298	1299	1300	1301	1302	1303	1304	1305	1306
1307	1308	1309	1310	1311	1312	1313	1314	1315	1316	1317	1318	1319	1320	1321	1322	1323	1324	1325	1326	1327	1328	1329	1330	1331	1332	1333	1334	1335	1336	1337	1338	1339	1340
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1579	1580	1581	1582	1583	1584	1585	1586	1587	1588	1589	1590	1591	1592	1593	1594	1595	1596	1597	1598	1599	1600	1601	1602	1603	1604	1605	1606	1607	1608	1609	1610	1611	1612
1613	1614	1615	1616	1617	1618	1619	1620	1621	1622	1623	1624	1625	1626	1627	1628	1629	1630	1631	1632	1633	1634	1635	1636	1637	1638	1639	1640	1641	1642	1643	1644	1645	1646
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1681	1682	1683	1684	1685	1686	1687	1688	1689	1690	1691	1692	1693	1694	1695	1696	1697	1698	1699	1700	1701	1702	1703	1704	1705	1706	1707	1708	1709	1710	1711	1712	1713	1714
1715	1716	1717	1718	1719	1720	1721	1722	1723	1724	1725	1726	1727	1728	1729	1730	1731	1732	1733	1734	1735	1736	1737	1738	1739	1740	1741	1742	1743	1744	1745	1746	1747	1748
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1885	1886	1887	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918
1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952
1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054
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2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156



For Reference W1 = 1001 so W16 = 1000+16

HyCal is ready for the experiments

Signal cable conversion and testing – DONE; fADC testing – DONE; HV CAEN crate testing; – DONE; LMS test – DONE; LMS fiber repairs – DONE; HyCal module testing – repair of one remaining channel

Updated X17 Signal Simulations

MadGraph5 A' production

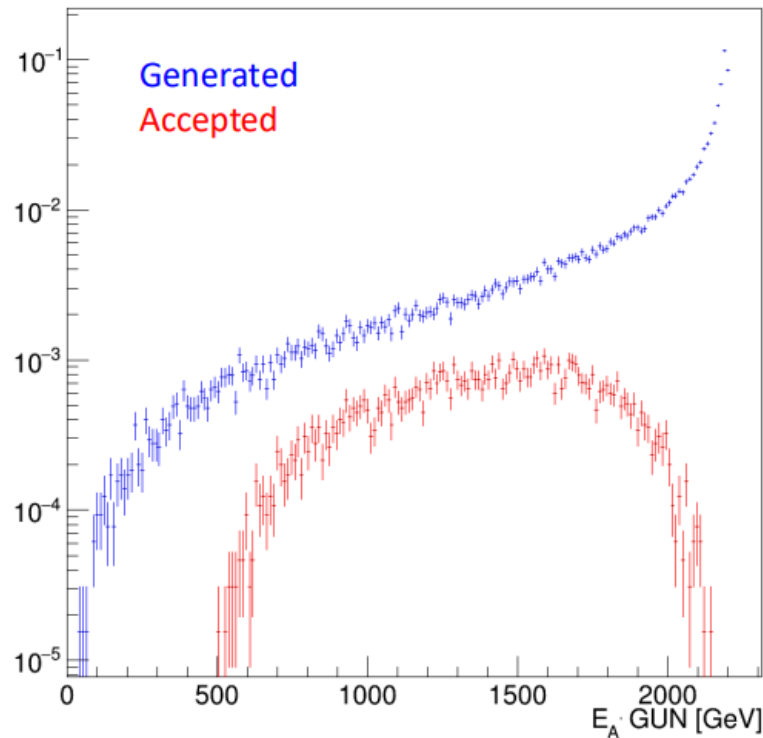
GEANT4

Reconstruction

Analysis

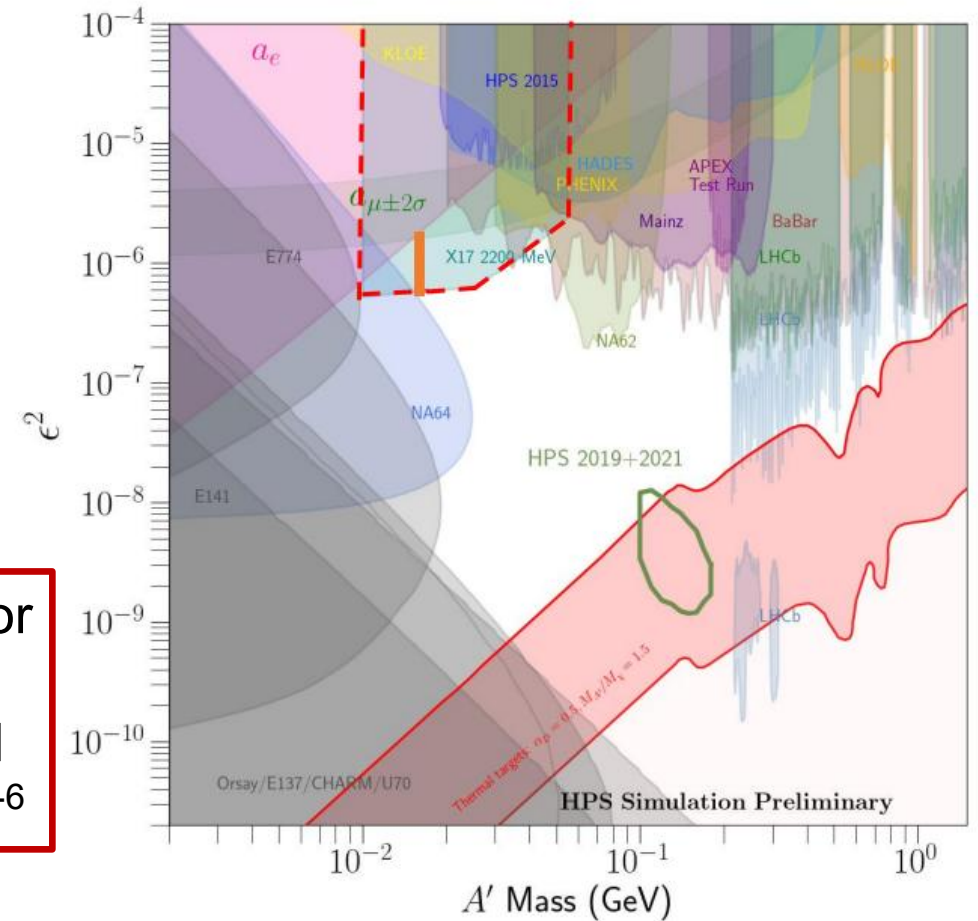
$$e + \text{Ta} \rightarrow \text{Ta} e^- e^+ e^-$$

$M = 17 \text{ MeV}$



Experiment can exclude or validate the X17 for masses 3 – 60 MeV and couplings $\epsilon^2 \approx 5 \times 10^{-7} - 10^{-6}$

$E_b = 2.2 \text{ GeV}; I = 50 \text{ nA}; 40 \text{ PAC days}$



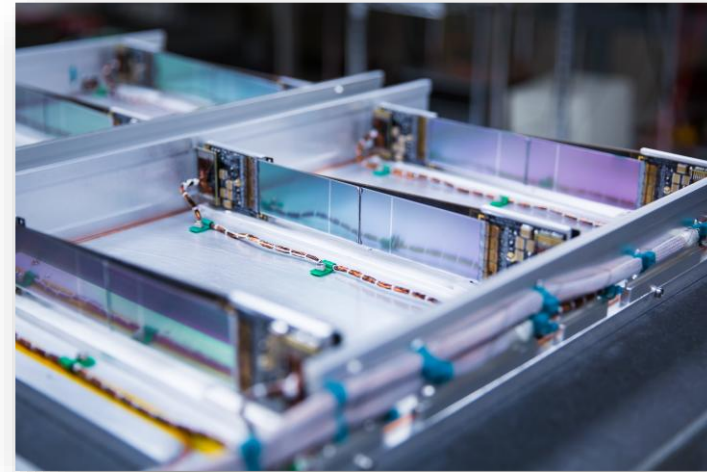
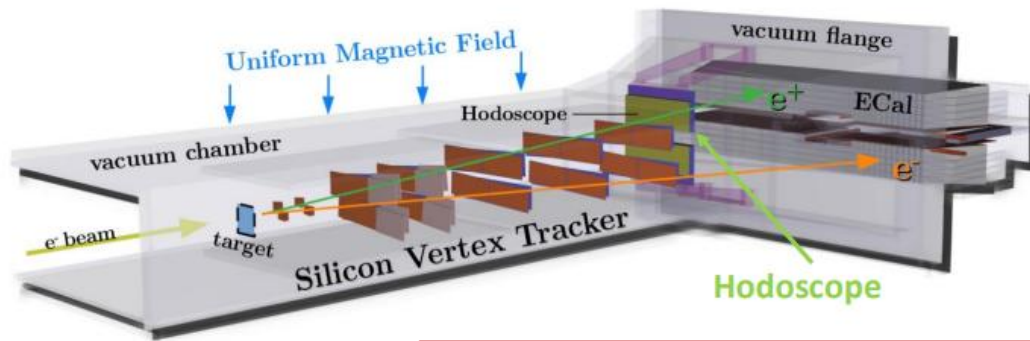
HPS Run Preparations



Expected Improvements Compared to 2021 Run

- **Operations**
 - SVT alignment, field-off runs with acceptance in all layers, fully surveyed detector
- **Hardware**
 - SVT modules, ECal chiller, DAQ update, servicing of Frascati magnet system
- **Optimized run periods**
 - Optimum is ~7 weeks at 4 GeV and ~6 weeks at 2 GeV beam energy
 - HPS has requested **60 PAC days of two-pass running**, to be followed by a final one-pass run

[Timothy Nelson, “HPS Overview”, HPS Collaboration Meeting (June 2025)]



Readiness of **sensors** seems to be most relevant component

HPS Sensitivity in Minimal A' Scenario

HPS 2019+2021 Run

“Existing data (75 days) opens up significant region of sensitivity”

[Timothy Nelson, “HPS Overview”, HPS Collaboration Meeting (June 2025)]

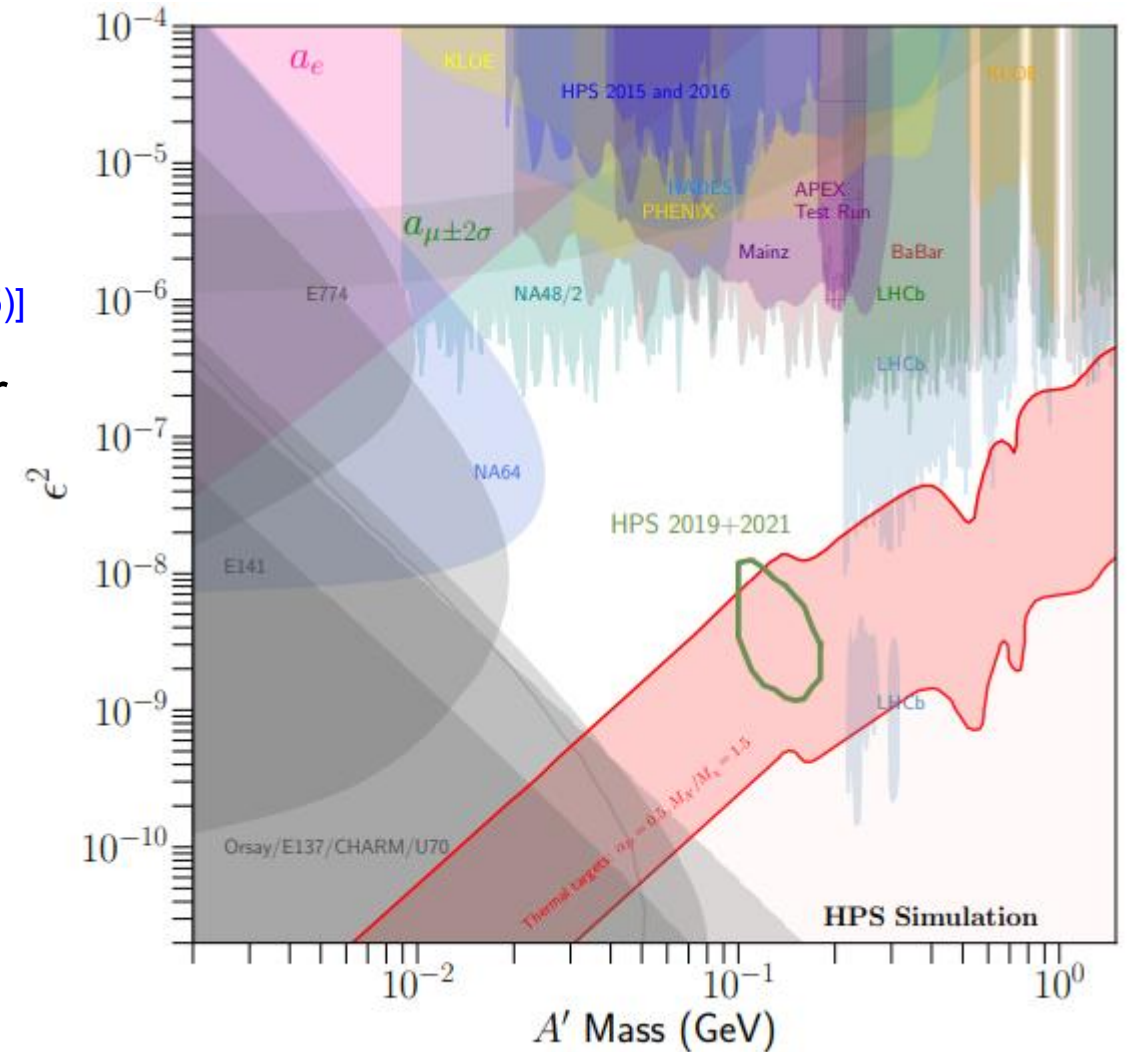
Two physics runs completed with upgraded detector

2019 run:

- $E_b = 4.55$ GeV
- Lumi = 128 pb^{-1}
- Target $8\mu\text{m}$ and $20 \mu\text{m}$ W foils

2021 run:

- $E_b = 3.74$ GeV
- Lumi = 168 pb^{-1}
- Target: $20 \mu\text{m}$ W foil



HPS Sensitivity in Minimal A' Scenario

HPS Full Luminosity

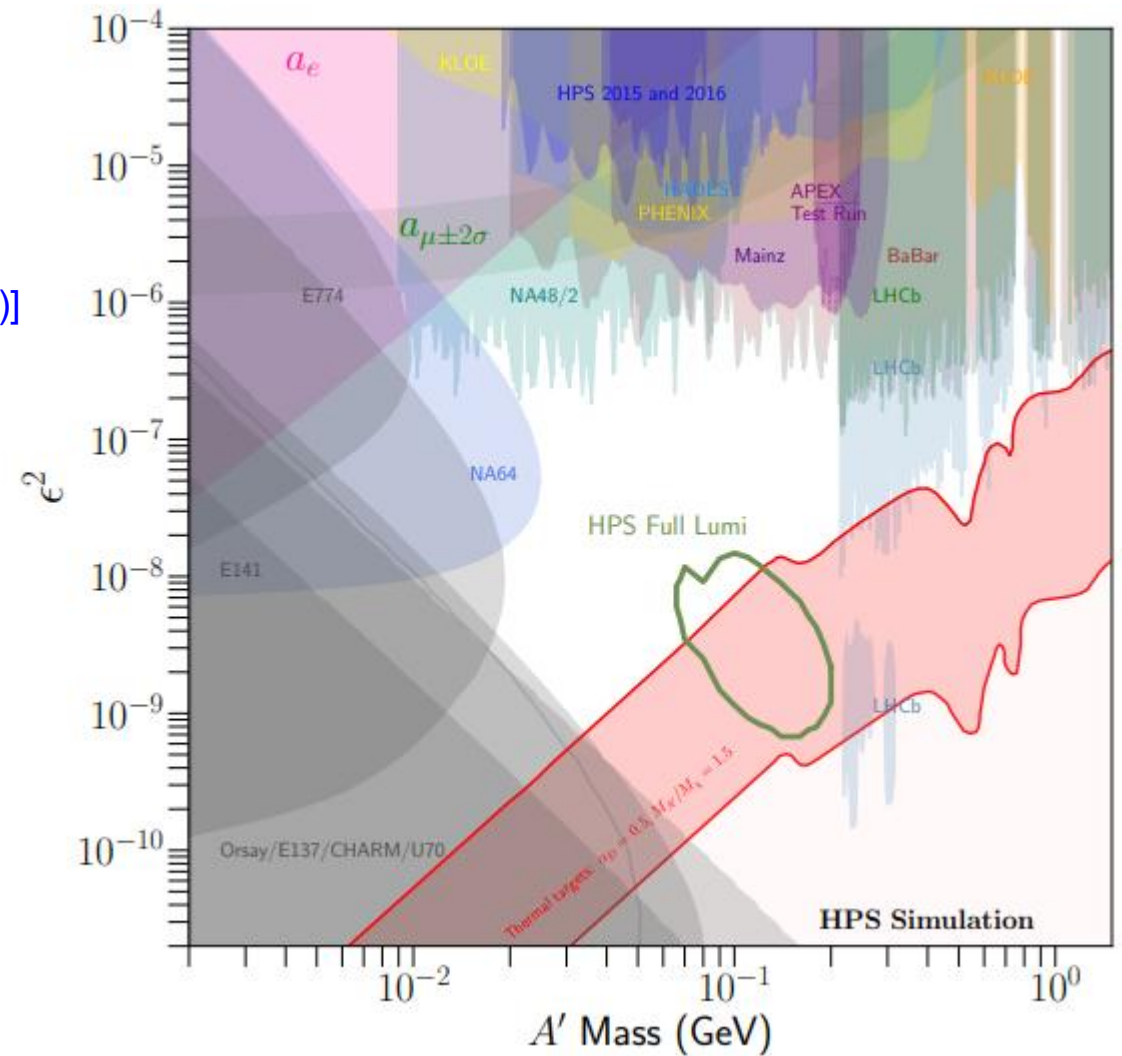
“Future run plan (105 days) more than doubles this region”

[Timothy Nelson, “HPS Overview”, HPS Collaboration Meeting (June 2025)]

Progress in dark photon searches has been incremental.

What happened?

- a) These are hard experiments*
- b) These are difficult searches*



Updates on Theses and Publications



Two New Completed PhD Theses in CLAS

THE STRUCTURE FUNCTION OF THE FREE NEUTRON AT HIGH X-BJORKEN

by

Madhusudhan Pokhrel

B. Sc. December 2013, Tribhuvan University, Nepal
M. Sc. December 2016, Tribhuvan University, Nepal
M. S. May 2019, Old Dominion University, USA

A Dissertation Submitted to the Faculty of
Old Dominion University in Partial Fulfillment of the
Requirements for the Degree of

DOCTOR OF PHILOSOPHY

PHYSICS

OLD DOMINION UNIVERSITY
May 2025

Approved by:

Stephen Bueltmann (Director)

Sebastian Kuhn (Member)

Raul Briceno (Member)

Yuan Zhang (Member)

Sylvain Marsillac (Member)

FIRST CLAS12 DOUBLE-PION ($N\pi\pi$) ELECTROPRODUCTION ANALYSIS

by

Krishna Chandra Neupane

Bachelor of Science
Tribhuvan University, 2011

Master's Degree in Physics
Tribhuvan University, 2014

Submitted in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy in

Physics

College of Arts and Sciences
University of South Carolina
2025

Accepted by:

Ralf Gothe, Major Professor

Fred Myhrer, Committee Member

Steffen Strauch, Committee Member

Viktor Mokeev, Committee Member

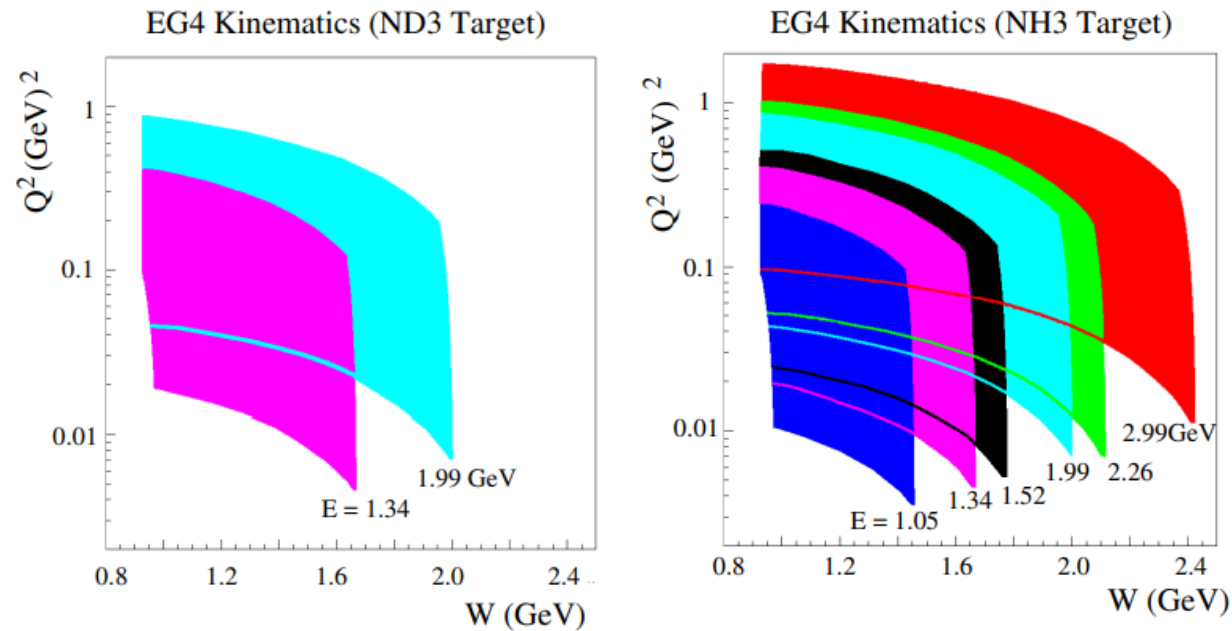
Ann Vail, Dean of the Graduate School

In 2025:

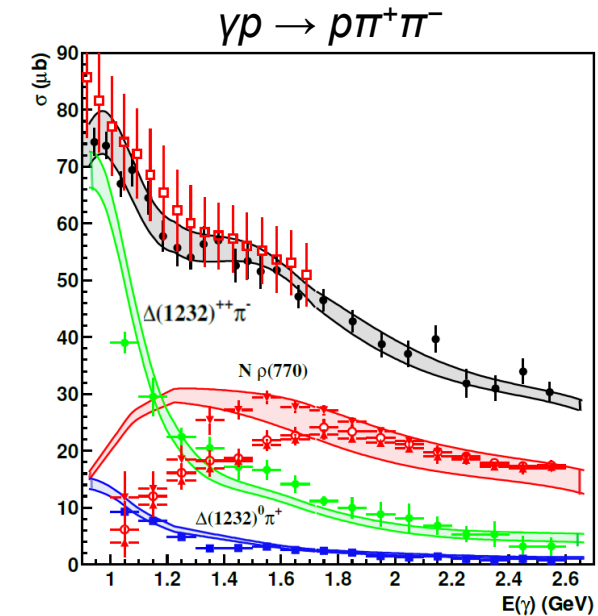
- Madhusudhan Pokhrel
- Krishna Neupane

Update on Publications Using CLAS Data

A. Deur *et al.* (CLAS Collaboration), “*Measurement of the nucleon spin structure functions for $0.01 < Q^2 < 1 \text{ GeV}^2$ using CLAS*”, **Phys. Rev. C 111, 035202 (Mar. 2025)**



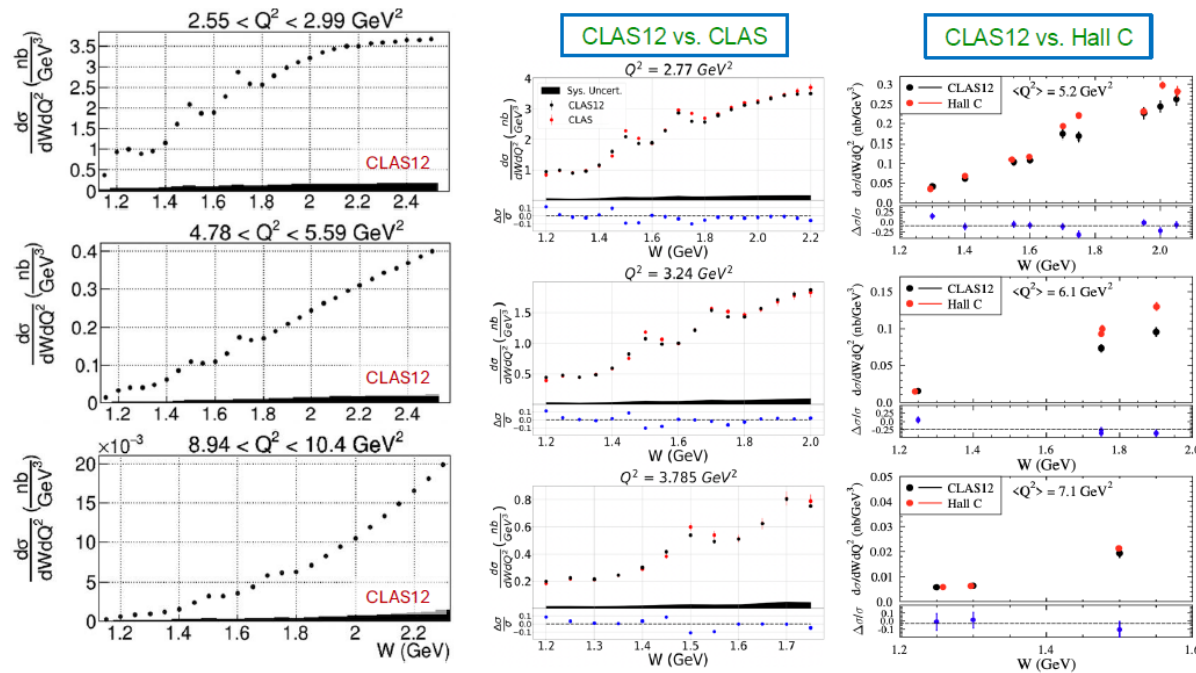
A.V. Sarantsev, *et al.* (CLAS Collaboration), “*Photoproduction of two charged pions off protons in the resonance region*”, **Phys. Rev. C 111, 035203 (Mar. 2025)**



Update on Publication Using CLAS12 RG-A Data

V. Klimenko *et al.* (CLAS Collaboration),
“*Inclusive Electron Scattering in the Resonance
Region off a Hydrogen Target with CLAS12*”,
accepted in Phys. Rev. C (June 2025)

- First inclusive electron scattering cross sections
- JLab press release is prepared**



CLAS12 Provides a New View of the Proton Spectrum

New data bring physicists closer to a full understanding of the proton's structure

NEWPORT NEWS, VA – The small but mighty proton serves as a foundation for our universe. It abides at the very heart of matter, giving rise to everything we see around us as it anchors the nucleus of the atom. Yet, its own structure is unbelievably complex, and the quest to understand the details of that structure has occupied theorists and experimenters alike since its discovery over a century ago.

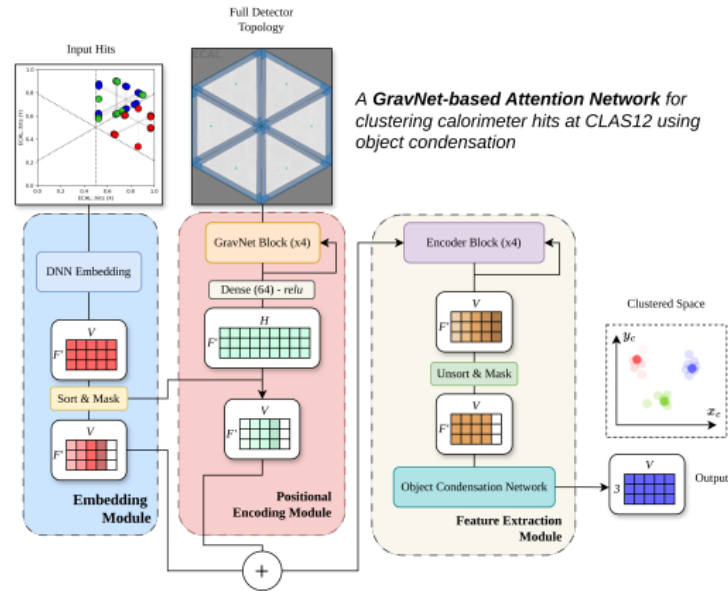
“The visible universe is made of protons,” said Kyungseon Joo, a physics professor at the University of Connecticut. “And so, if you want to understand the universe, it’s important to understand how the proton is structured. We think we understand it quite well, but a lot of things are still missing.”

In 2018, an international team of researchers began taking new measurements of the proton in experiments conducted at the U.S. Department of Energy’s Thomas Jefferson National Accelerator Facility with a new apparatus called CLAS12. Now, the first results

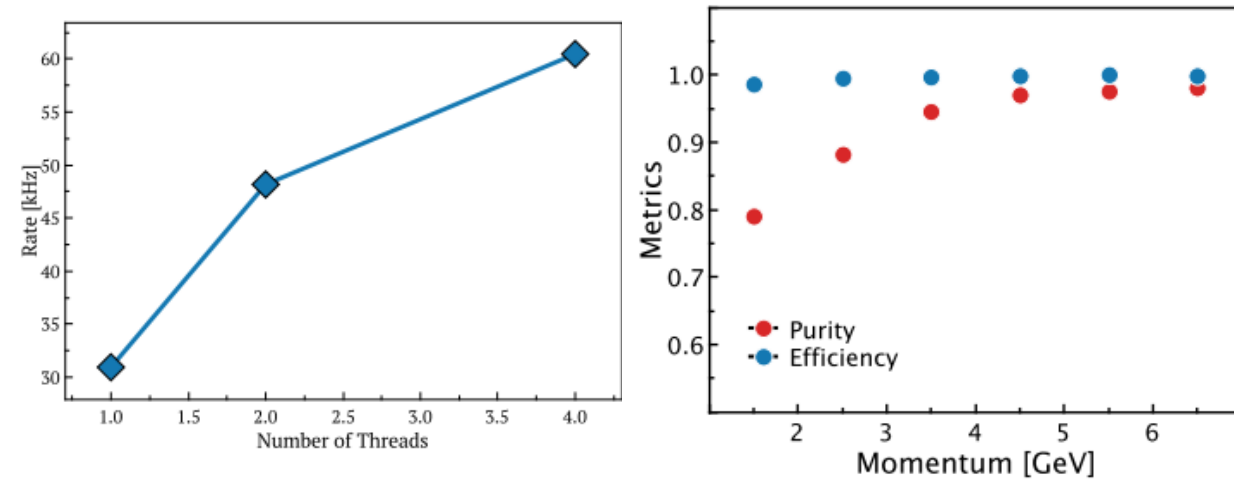
New Publications on Analysis Methods

Gregory Matousek and Anselm Vossen, “*AI-Assisted Object Condensation Clustering for Calorimeter Shower Reconstruction at CLAS12*”, arXiv: 2503.11277 [physics.ins-det], DOI: <https://doi.org/10.48550/arXiv.2503.11277>

- **AI-based clustering method** for calorimeter
- Networks for hit representations
- Object condensation for hit clustering



Gagik Gavalian and Richard Tyson, “*Online Electron Reconstruction at CLAS12*”, submitted to Comput. Phys. Commun. (2025)



- **AI-based electron reconstruction**
- Electron identification purity above 75% retaining an efficiency close to 100% within fiducial region

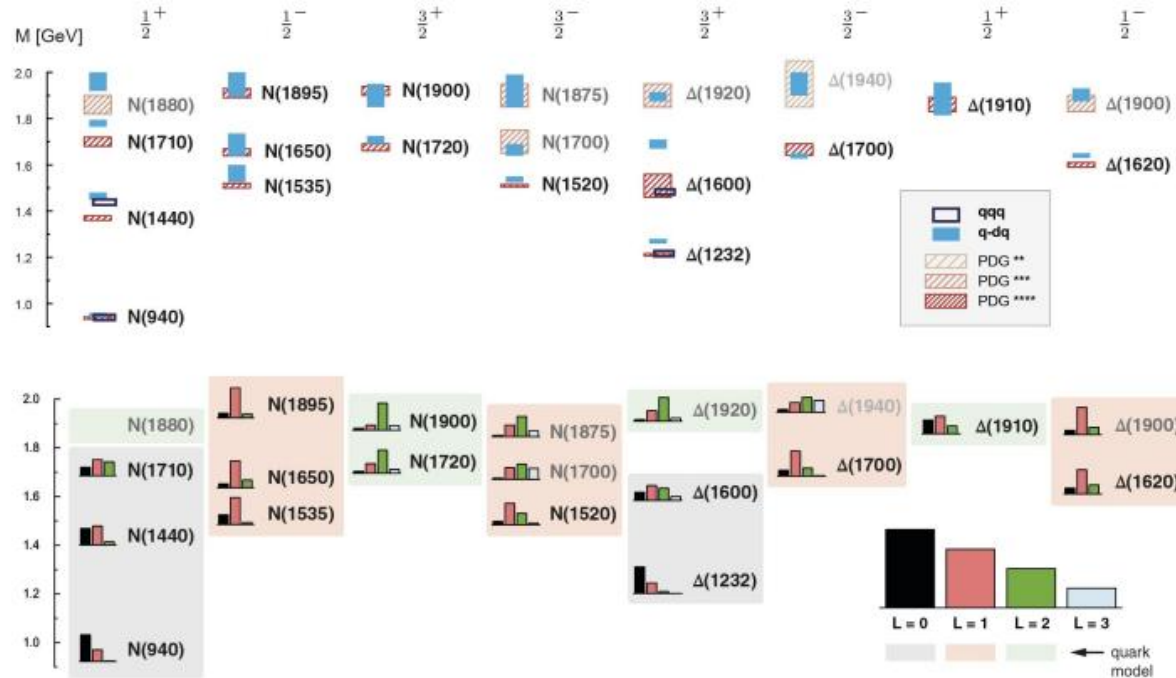
New Publication on Data Presentation

V.D. Burkert, A. Camsonne, P. Chatagnon, K. Cichy, M. Constantinou, H. Dutrieux, I. M. Higuera-Angulo, C. Mezrag, D. Richards, P. Sznajder, “*Open database for GPD analyses*”, arXiv: 2503.18152 [hep-ph], DOI: <https://doi.org/10.48550/arXiv.2503.18152>, submitted to Eur. Phys. J. C (?)

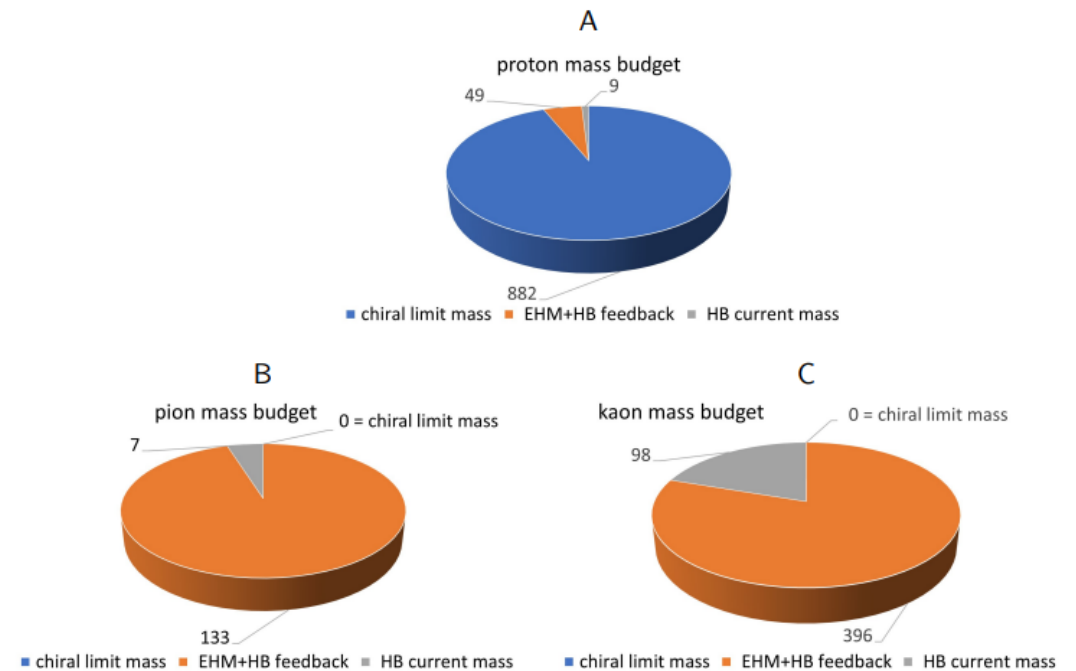
- **Open database** for use in exploration of GPDs
- Designed to store experimental and lattice-QCD data
- Can aid in benchmarking GPD models
- Utilizes a new data format based on YAML

New Reviews

Volker Burkert, Gernot Eichmann, Eberhard Klempt, “*The impact of γN and $\gamma^* N$ interactions on our understanding of nucleon excitations*”, arXiv: 2506.16482 [hep-ph], DOI: <https://doi.org/10.48550/arXiv.2506.16482>, submitted to Prog. Part. Nucl. Phys.

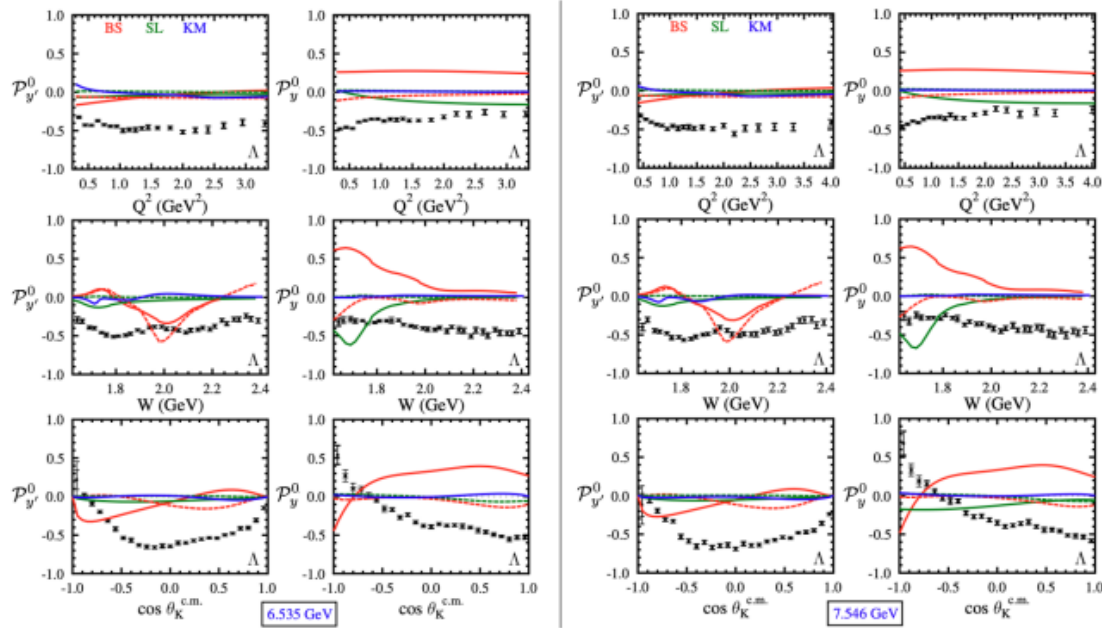


Patrick Achenbach, Daniel S. Carman, Ralf W. Gothe, Kyungseon Joo, Victor I. Mokeev, Craig D. Roberts, “*Electroexcitation of Nucleon Resonances and the Emergence of Hadron Mass*”, arXiv: 2505.23550 [hep-ph], DOI: <https://doi.org/10.48550/arXiv.2505.23550>, accepted in Symmetry (July 2025)



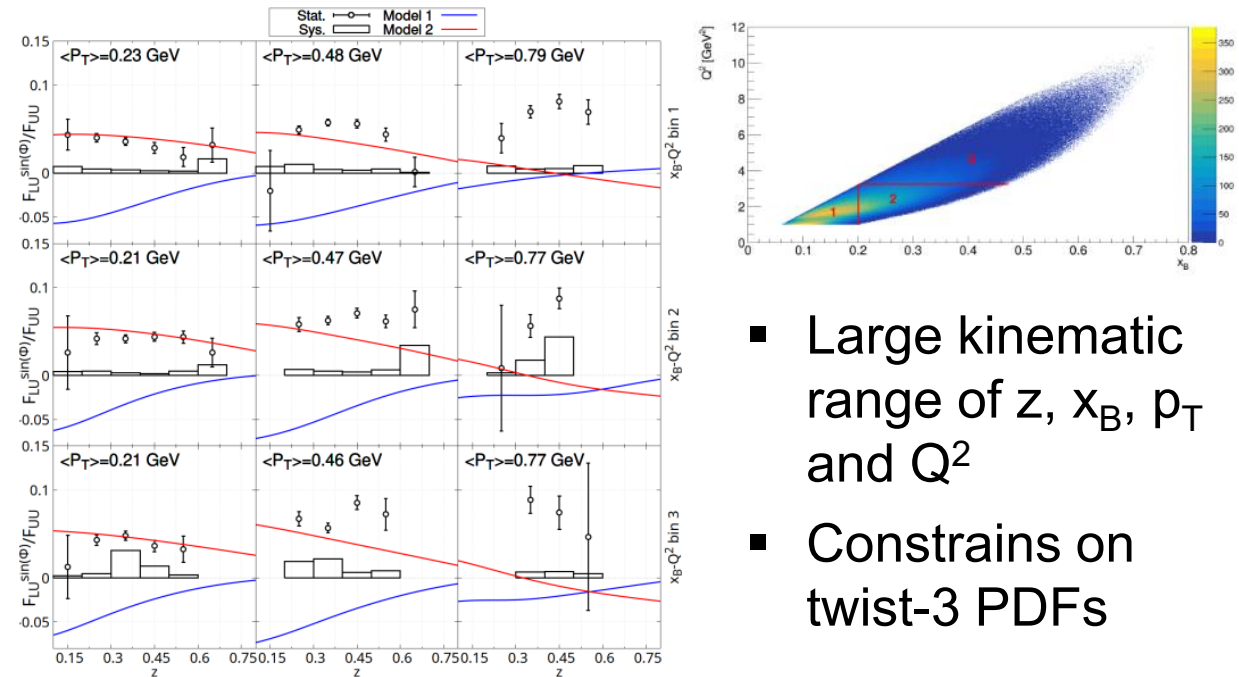
New Publications Using CLAS12 Data

D.S. Carman *et al.* (CLAS Collaboration), “*Recoil Polarization in $K^+ \Lambda$ Electroproduction in the Nucleon Resonance Region with CLAS12*”, arXiv: 2505.12030 [nucl-ex], DOI: <https://doi.org/10.48550/arXiv.2505.12030>, submitted to Phys. Rev. C



- Polarization observables extend existing data on Λ and first electroproduction measurements for Σ^0

A. Kripko *et al.* (CLAS Collaboration), “*Multi-dimensional Measurements of Beam Single Spin Asymmetries in Semi-Inclusive Deep-Inelastic Charged Kaon Electroproduction off Protons in the Valence Region*”, arXiv:2504.0858 [hep-ex], DOI: <https://doi.org/10.48550/arXiv.2504.08580>, submitted to Phys. Rev. Lett.

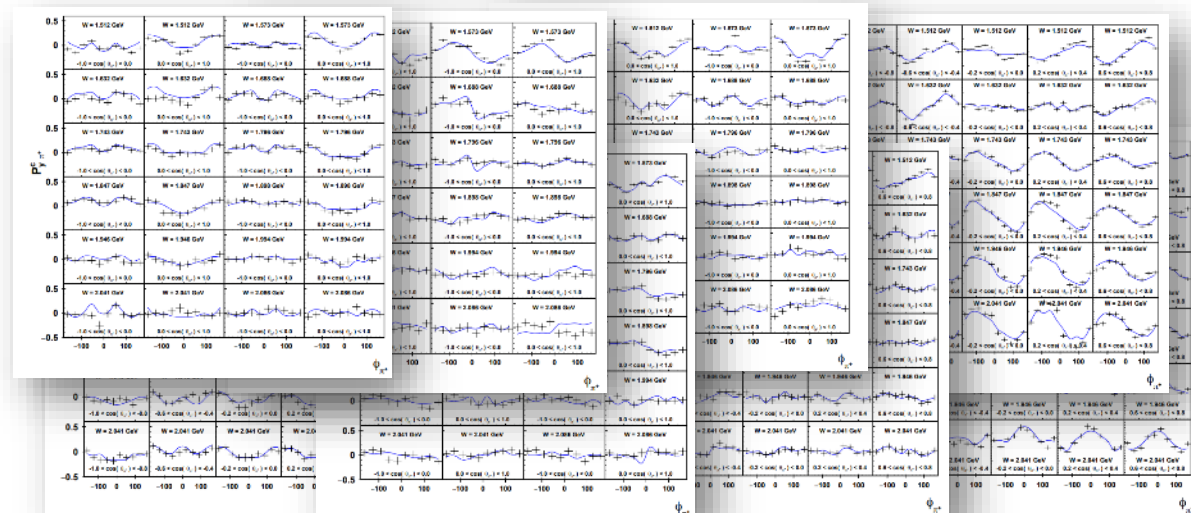


- Large kinematic range of z , x_B , p_T and Q^2
- Constrains on twist-3 PDFs

New Publications Using CLAS Data

P. Roy *et al.* (CLAS Collaboration),
*“Measurement of Single- and Double-Polarization
 Observables in the Photoproduction of $\pi^+\pi^-$ Pairs
 off the Proton Using CLAS at Jefferson
 Laboratory”*, arXiv: 2504.21119 [nucl-ex], DOI:
<https://doi.org/10.48550/arXiv.2504.21119>,
 submitted to Phys. Rev. C

- Beam and target asymmetries, and beam-target double-polarization observables measured using a transversely polarized target (FROST)



A.V. Sarantsev, E. Klempt, K.V. Nikonov, T. Seifen, U. Thoma, Y. Wunderlich, P. Achenbach, V.D. Burkert, V. Mokeev, V. Crede, “*Decays of N^* and Δ^* Resonances into $N\rho$, $\Delta\pi$, and $Nf_0(500)$* ”, arXiv: 2503.16636 [nucl-th], DOI: <https://doi.org/10.1103/qfpf-tcs3>
Phys. Rev. C 112, 015202 (2 July, 2025)

- Masses, widths and branching ratios of N^* and Δ^*

[illegible]

New Outreach Publication

Raffaella De Vita, “*The CLAS12 Experiment at Jefferson Lab*”, to appear in the Encyclopedia of Particle Physics (2026)

Patrick Achenbach, “*Experiments at Jefferson Lab*”, to appear in the Encyclopedia of Particle Physics (2026)

Encyclopedia of Particle Physics Kindle Edition

Format: Kindle Edition

Encyclopedia of (Hadron- and) Particle Physics will be a brand new, up to date reference work consisting of approximately 180 articles, headed up by an editorial board of world-leading hadron- and particle physicists. It will provide a first point of entry to the literature for all graduate/post-graduate students and early career-researchers working in and studying physics, especially those with an interest in hadron- and particle physics within the standard model and beyond. It will also be indispensable to all serious readers in the interdisciplinary areas (astrophysics, nuclear physics, particle therapy, accelerator physics) where particle physics is of utility. With a clear and logical template binding all chapters, content will be divided into the following six sections, each of which will contain chapters written by leading scientists who have pursued theoretical tools and methods and/or gathered and evaluated the most important data published within the field: Section 1: General Concepts of Particle Physics. This will provide an overview on general concepts that play a major role in every area of hadron and particle physics. Section 2: Hadron Physics. The strong interaction of quarks and gluons and the resulting hadron physics provides a broad field of interest with major discoveries (exotic hadrons) in the past decade. Understanding the strong interaction also provides the background for the search of physics beyond the standard model. Section 3: Lepton, Flavour and Higgs Physics. The electromagnetic and weak interaction of quarks, leptons and the Higgs particle provides a unique testing ground for the physics of the standard model with major advances in the past decades. Section 4: Neutrino Physics. This area has emerged in the past decade as a separate and highly innovative field with major discovery potential in the next years. Section 5: Beyond standard model physics. This section will provide introductions into the landscape of concepts of physics beyond the standard



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Add to List

Raffaella De Vita, “*The CLAS12 Experiment at Jefferson Lab*”, to appear in the Encyclopedia of Particle Physics (2026)

The CLAS12 Experiment at Jefferson Lab

R. De Vita^{a,b}

^aThomas Jefferson National Accelerator Facility, Newport News, VA 23606, United States of America

^bIstituto Nazionale di Fisica Nucleare, Sezione di Genova, Via Dodecaneso 33, 16146 Genova, Italy

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Chapter Article tagline: update of previous edition, reprint.

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Abstract

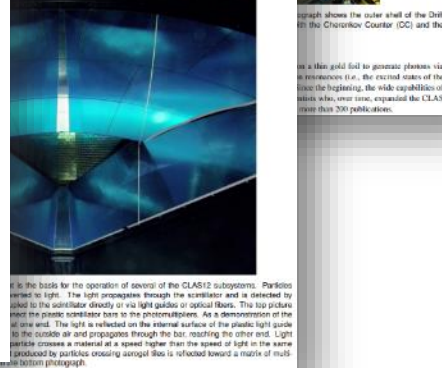
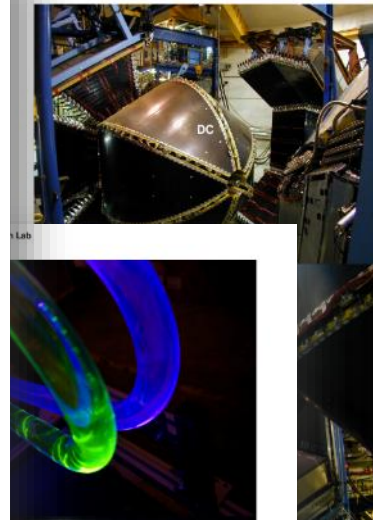
The CLAS12 experiment in Hall B at Jefferson Lab utilizes high-energy electrons produced by the CEBAF accelerator to probe the nuclear medium and understand its structure and the forces that govern it. The core of the experiment is a large acceptance spectrometer designed to detect, over broad kinematics, the particles emerging from the interaction of the electron beam with a fixed target. In operation since 2018, CLAS12 has already completed several measurements on different targets, from hydrogen to heavy nuclei, studying the microscopic structure of the proton and the neutron, the spectrum of hadrons produced in these reactions, and the behavior of the strong force in the nuclear medium. These measurements will shed light on fundamental questions about the properties of the strong force and the structure of ordinary matter.

Keywords: CLAS12, spectrometer, large acceptance, luminosity, electron beam, hadron physics



Fig. 1 The CLAS12 experiment in Hall B at Jefferson Lab. The photograph shows the CLAS12 detector complex. The overall extension of CLAS12 in the horizontal direction is about 13 m. Click on this link to view a video on the experiment.

CLAS12 Experiment at Jefferson Lab



Patrick Achenbach, “*Experiments at Jefferson Lab*”, to appear in the Encyclopedia of Particle Physics (2026)

Experiments at Jefferson Lab

Patrick Achenbach^{a,*}

^aThomas Jefferson National Accelerator Facility, Experimental Nuclear Physics Division, Newport News, Virginia 23606, USA

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Abstract

This chapter presents experiments conducted at Thomas Jefferson National Accelerator Facility (Jefferson Lab), a U.S. Department of Energy national laboratory in Newport News, Virginia. There, physicists exploring the nature of matter make use of the Continuous Electron Beam Accelerator Facility (CEBAF), a DOE Office of Science user facility that enables the research of more than 1,650 scientists worldwide. CEBAF's precise electron beams can reach energies up to 12 billion electron-volts and exhibit high degrees of polarization. Jefferson Lab's first experiment began taking data in 1995. Since then, the facility has become a world leader in the study of quantum chromodynamics. Today, experiments are carried out simultaneously in four experimental halls, each with specialized capabilities. The primary instruments in use are focusing or large-acceptance magnetic spectrometers, many of which feature superconducting elements. Jefferson Lab's physics program provides unprecedented insight into the particles and forces that shape the visible universe.

Keywords: Jefferson Lab, electron scattering, magnetic spectrometer, quarks and gluons, hadron structure, hadron spectroscopy, Standard Model tests, nuclear structure, QCD spectroscopy

*patricka@jlab.org

Experiments at Jefferson Lab



Concluding Remarks

- Hall B had an **initially difficult but so far successful run** in Hall B
- It is scheduled to **complete all ALERT experiments** in this run period
- The SAM until January 2026 will be used for **installation of PRad-II/X17 setup**
- These experiments are scheduled to run in 2026 to
 - Validate existence or set an experimental upper limit on the X17
 - Search for hidden sector particles in the 3–60 MeV mass range
 - Validate existence or resolve discrepancy in proton form factor data
 - Improve the precision on the proton charge radius
- **CLAS Collaboration in Hall B** continues to **deliver high-level physics results**

Thanks to all collaborators for their valuable contributions!