Hall D Report

Current Hall D staff: 12 staff scientists, 1+1 postdocs, 2 engineers, 1 designer, 5 technicians
Collaborations: GlueX (150 authors), SRC-CT (70 authors), KLF

1. Experiments in Hall D
2. Preparations for future experiments
3. Results and publications since PAC53
   - 4 journal publications
   - 7 PhDs awarded

Physics Program in Hall D

Experiment	name	Collab.	Title	PAC rating	PAC days	data taken
E12-06-102	GlueX-I	GlueX	Mapping the Spectrum of ... and Gluonic Excitations	A	120	100%
E12-12-002	GlueX-II	GlueX	A study of meson and baryon decays to strange final states	A	220	80%
A	JEF	GlueX	Rare η Decays: The JLab η Factory (JEF experiment)	Grp	100	75%
E12-10-011	PrimeX-η	GlueX	Measurement of the $\eta \to \gamma\gamma$ Decay Width via Primakoff	A-	79	100%
E12-13-008	CPP/NPP	GlueX	Measuring the Pion Polarizability in the $\gamma\gamma \to \pi\pi$ Reaction	A-	25	100%
E12-19-003	SRC/CT	SRC	Studying Short-Range Correlations with Real Photon Beam	B+	15	100%
E12-25-005		GlueX	GlueX with a 1-4 GeV Photon Beam	A-	28	71%
			Not yet started			
E12-19-001	KLF(KLONG)	KLF	Strange Hadron Spectroscopy with Secondary KL Beam	A-	200	
E12-20-011	REGGE	GlueX	The high-energy contribution to the GDH sum rule	A-	33	
E12-24-006	GlueX-III	GlueX	Photoproduction of Charmonia at High Luminosity	A	200	
E12-25-002	Nuclear J/ψ	SRC	Photoproduction of J/ψ as a Probe of Nuclear Gluons	B+	85	
E12-25-012		GlueX	ϕ Production off Tensor Polarized Deutron	A-	65	

- considerable installation / new equipment required

- finished data taking

Physics Program in Hall D

Proposals/LOI to PAC54

- Run-group proposal: E12-11-006A JEF with GlueX-III
- Run-group proposal: P12-26-006 Hypernuclear with KLF
- LOI: LOI12-26-007: Photoproduction on Deuteron

Experiment				PAC rating	PAC days	data taken
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E12-12-002			tates	A	220	80%
A	JEF	GlueX	Rare η Decays: The JLab η Factory (JEF experiment)	Grp	100	75%
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- considerable installation / new equipment required - finished data taking

Hall D run history https://www.jlab.org/Hall-D/runs.html

Hall D physics runs

Year	Dates	Calendar days	Beam, GeV	ABU[1] + BANU	ABU	Experiment	PDL	Comment	PAC days[3]	PAC days total
2016	Feb, 3 - Mar, 23	49	12.0	?	?	E12-06-102	B.Zihlmann	Engineering run, solenoid at 1	~25	25
2017	Jan, 30 - Mar, 9	40	11.7	58%	51%	E12-06-102	B.Zihlmann	Production	20	45
2018	Jan, 12 - Mar, 5	52	11.7	52%	46%	E12-06-102	B.Zihlmann	Production	26	71
2018	Mar, 29 - May, 6	38	11.7	58%	52%	E12-06-102	B.Zihlmann	Production	19	90
2018	Sep, 21 - Nov, 26	66	11.7	53%	47%	E12-06-102	B.Zihlmann	Production	33	**123**
2018	Nov, 28 - Dec, 9	12	10.3	?	N/A	E12-10-011	L.Pentchev	Commissioning, low energy	N/A	
2018	Dec, 12 - Dec, 18	7	9.0	?	N/A	E12-10-011	L.Pentchev	Commissioning, low energy	N/A	
2019	Feb, 8 - Feb, 21	13	11.6	45%	N/A	E12-12-002	B.Zihlmann	1/2 DIRC Commissioning	6	6
2019	Feb, 21 - Mar, 5	15	11.6	52%	37%	E12-10-011	L.Pentchev	Installation, Production on Be, LHe, FOM=0.97[4]	7.3	7.3
2019	Mar, 8 - Apr, 15	38	11.2	73%	68%	E12-10-011	L.Pentchev	Production on LHe, FOM=0.85[4]	16.1	23.4
2019	Nov, 25 - Dec, 20	25	11.4	34%	32%	E12-12-002	B.Zihlmann	DIRC commissioning, actual start Dec, 3. PAC days = 0.32*25	8	14
2020	Jan, 10 - Mar, 24	75	11.4	62%	56%	E12-12-002	B.Zihlmann	Production with DIRC at high rate. First 2 weeks - lower rate	38	52
2020	Jul, 27 - Sep, 21	56	11.4	46%	38%	E12-12-002	B.Zihlmann	Production with DIRC at high rate	21.5	73.5
2021	Sep, 16 - Nov, 4	50	10.1	51%	45%	E12-10-011	L.Pentchev	Production on LHe, FOM=0.56[4]	14	37.4
2021	Nov, 8 - Dec, 21	43	10.9	70%	60%	E12-19-003	L.Pentchev	Production on LHe, LD, C FOM=0.73[5] PAC=43*0.6*0.73=19	19	**19**
2022	Jun, 8 - Aug, 17	71	11.6	46%	41%	E12-13-008	S.Taylor	CPP/NPP	29	**29**
2022	Aug, 27 - Dec, 18	113	11.6	64%	59%	E12-10-011	L.Pentchev	PrimeX-η Production on LHe, FOM=0.91[4]*0.85(TAGM)	51.6	**89**
2023	Jan, 12 - Mar, 19	67	11.6	48%	42%	E12-12-002	B.Zihlmann	GlueX-II Production. ABU was used to calculate the PAC days	28.1	102
2025	Apr, 6 - Sep, 3	150	11.73	68%	63%	E12-12-002	B.Zihlmann	**GlueX-II + JEF** 80 PAC days total, 65 PAC days production	75	177
2026	May 2 - May 31	31	3.8		65%	E12-25-005	B.Zihlmann	**GlueX-Low-Energy** *28 PAC days*	20	20
2026	July 7(?) - Aug 30	55(?)	11.8			E12-12-002	B.Zihlmann	**GlueX-II/JEF** Remaining PAC days: *43*	28(?)	205

E12-12-002	GlueX-II
E12-10-011	PrimeX-η
E12-13-008	CPP/NPP
E12-19-003	SRC
E12-25-005	LowEnergy

Hall D run history https://www.jlab.org/Hall-D/runs.html

Hall D physics runs

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2018	Dec, 12 - Dec, 18	7	9.0	?	N/A	E12-10-011	L.Pentchev	Commissio	/A	
2019	Feb, 8 - Feb, 21	13	11.6	45%	N/A	E12-12-002	B.Zihlmann	1	6	6
2019	Feb, 21 - Mar, 5	15	11.6	52%	37%	E12-10-011	L.Pentchev		7.3	7.3
2019	Mar, 8 - Apr, 15	38	11.2	73%	68%	E12-10-011	L.Pentchev	P	16.1	23.4
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E12-12-002 GlueX-II
E12-10-011 PrimeX-η
E12-13-008 CPP
E12-19-00

2025 run
E12-12-002(A) GlueX-II/JEF
approved 220 PAC days
Accumulated in 2019-2025:
177 PAC days

Hall D run history https://www.jlab.org/Hall-D/runs.html

Hall D physics runs

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E12-12-002 GlueX-II
E12-10-011 PrimeX-η
E12-13-008 CPP/NPP
E12-19-003 SRC
E12-25-005 L

2026 run
E12-25-005
GlueX 1-4 GeV
71% complete

Hall D run history https://www.jlab.org/Hall-D/runs.html

Hall D physics runs

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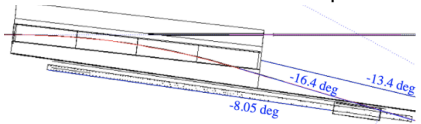
E12-12-002 GlueX-II
E12-10-011 PrimeX-η
E12-13-008 CP
E12-19-

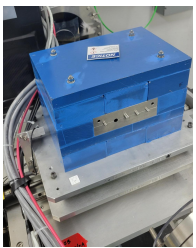
2026 run
E12-12-002(A) GlueX-II/JEF
220 PAC days
The start has been delayed
Running to completion?

E12-25-005 2026 run: 4 GeV electrons, coherent peak at 1 GeV

Moving high-resolution and high-density TAGM from 3/4 to 1/4 of the enpoint energy



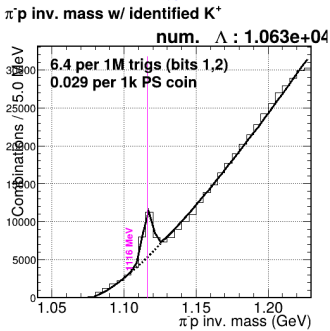
New collimator
Hole 5 mm ⇒ 9 mm



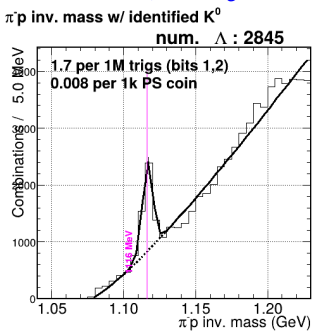
Short run, focused on Λ production off deuteron, for:

- Study $\gamma n \to \Lambda^0 K^0_S$, searching for a 1685 MeV structure observed in $\gamma n \to \eta n$
- Measurement of the decay parameter α_Λ

Candidates for $\gamma p \to K^+ \Lambda^0$



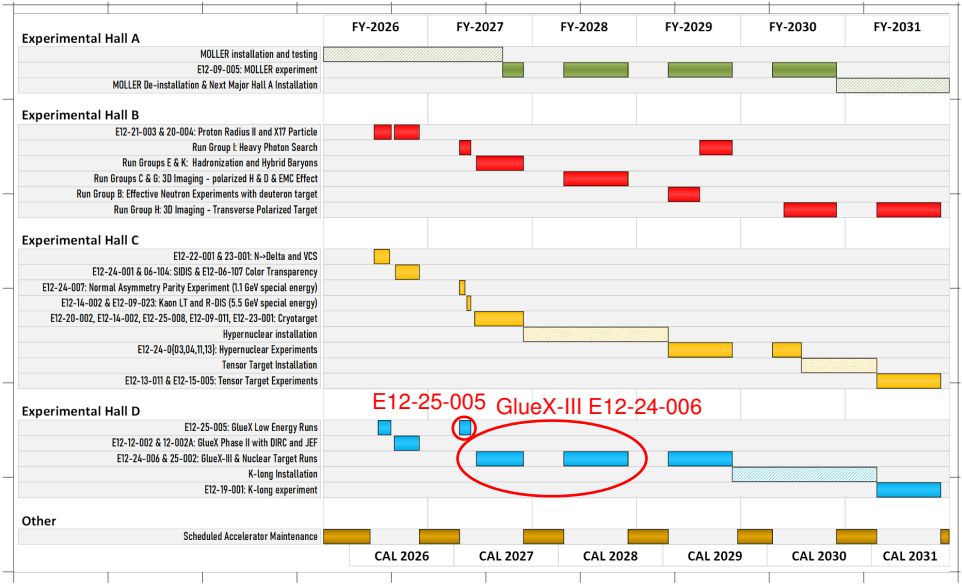
Candidates for $\gamma n \to K^0_S \Lambda^0$



Effective mass $p\pi^-$, GeV

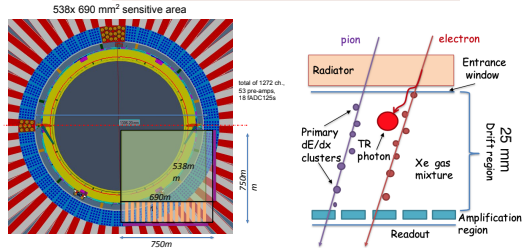
Expectation for the whole run: 260k $K^+\Lambda$ and 67k $K^0_S\Lambda$

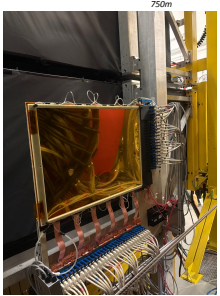
Hall D schedule outlook for 2027-2028



GEM-TRD development for GlueX-III: improvement of e^+/e^- PID

GEM TRD: prototyping and testing





- 1/4 size prototype has been tested in PS with electrons
- Installed in front of DIRC and tested with pions in the real GlueX environment
- Efficiency dependence on the flux and gain studied

Positive results: starting the design of the full system

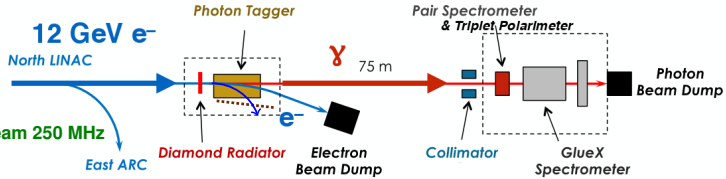
- Planning to run in 2027 with 1/4 GEM-TRD
  in 2028 with full GEM-TRD
- Pre-ERR for GEM-TRD Dec 4. **Recommendations:**
  - *Test of the full electronics chain*
  - *Reevaluate manpower at UVA*:
- The recommendations have been mostly addressed

New VPX ADC
PR submitted for 1-st batch

Analog front-end
Technical design is ongoing

Full electronics testing in the Fall of 2026

KLF(KLONG) experiment: design is ongoing

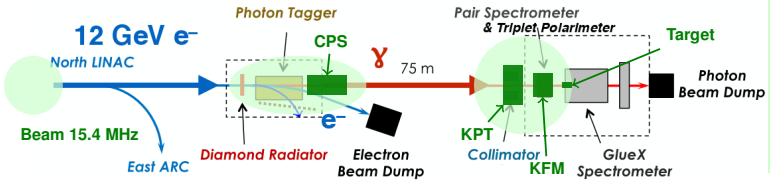


Areas in Hall D Complex

1. Tagger Hall
2. Collimator cave
3. Hall D Pair spectrometer
4. Hall D Solenoid spectrometer

Photon beam e^- 300 nA $\Rightarrow$ 0.04% RL $\Rightarrow \varnothing$=5 mm collimator $\Rightarrow \varnothing$=20 mm LH_2 target

KLF(KLONG) experiment: design is ongoing

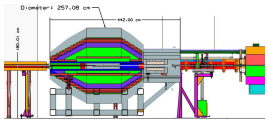


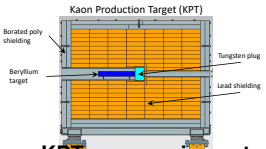
KLF Installation

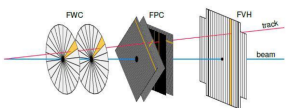
1. Injector 4 ns → 64 ns
2. CPS - Compact Photon Source
3. KPT - Kaon Production Target
4. KFM - Kaon Flux Monitor
5. LH_2 target of a larger diameter
6. New Start Counter

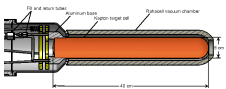
Photon beam e^- 300 nA ⇒ 0.04% RL ⇒⌀=5 mm collimator ⇒⌀=20 mm LH_2 target

Kaon beam e^- 5 μA ⇒ 10% RL ⇒⌀=60 mm, L=40 cm Be target ⇒L=10 cm W-absorber ⇒⌀=60 mm LH_2 target









CPS: new equipment

- Input: 5 μA beam
- 60 kW beam dump
- 10-20% RL radiator
- Output:12kW photon beam
- Responsibility: JLab

KPT: new equipment

- Be target ⌀,L=60,400 mm
- 10 cm W plug for photons
- Shielding
- Beam pipes to LH_2 target
- Responsibility: JLab

KFM: partly recycled

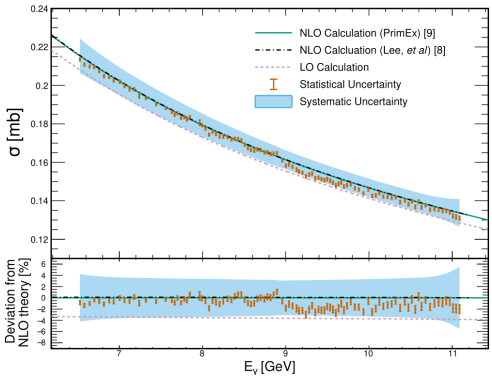
- Flux monitor
- Detectors from Jülich
- Detectors: Uni. of York
- Electronics/support: JLab

Target and Start Counter

- ⌀ 60 mm LH_2 target (JLab)
- New start counter (Osaka Uni)

PLB 870, 139914 (2025)

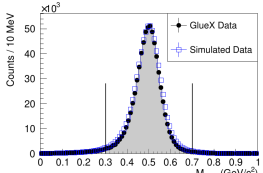
First Measurement of the Total Compton Scattering Cross Section between 6 and 11 GeV

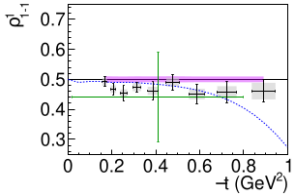


- Comparison with theory at a $\approx$ 3% level
- Important step for the PrimeX-η goals

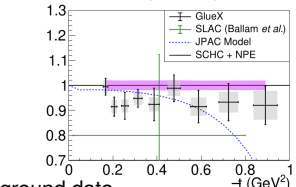
PRC 112, 025203 (2025)

Measurement of SDMEs in $\gamma p \to \phi p$, $\phi(1020) \to K^0_S K^0_L$





Beam asymmetry Σ



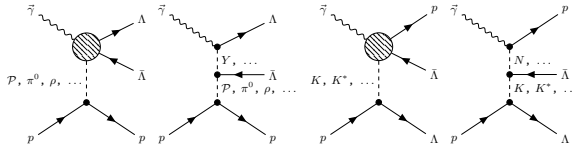
- High statistics, low background data
- Pomeron exchange dominates at $E_\gamma \approx 9$ GeV
- Older data at $E_\gamma < 3$ GeV - deviation from Pomeron exchange; at $E_\gamma > 20$ GeV - Pomeron exchange

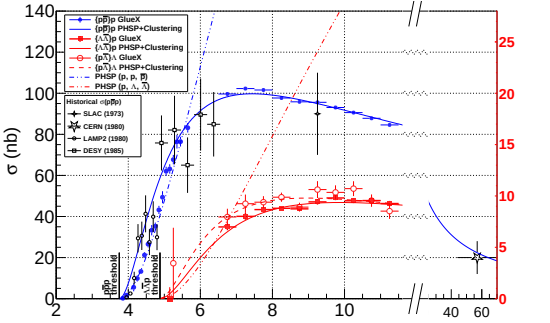
GlueX E12-06-102: Recent publications journals

PRC 113, 045207 (2026)

Baryon anti-Baryon Photoproduction off the Proton

$\gamma p \to (p + \overline{p}) + p; (\Lambda + \overline{\Lambda}) + p; (p + \overline{\Lambda}) + \Lambda$

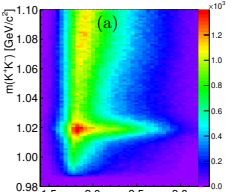


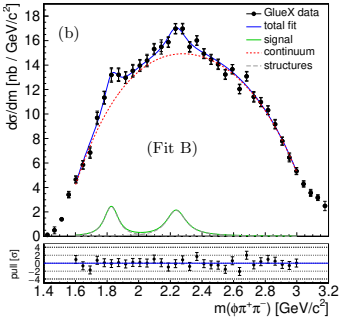


PRL 136, 251902 (2026)

Search for the Y(2175) in the photoproduction cross section measurement of $\gamma p \to \phi\pi^+\pi^- p$

$\gamma p \to \phi(K^+K^-)\pi^+\pi^- p$





- $Y(2175)$ 1^{--} has been observed in e^+e^-; PDG $\phi(2170)$ mass 2130-2240 MeV; width 30-200 MeV
- GlueX: no structure at 2170 MeV, however a $\approx 5\sigma$ structure at 2240 MeV
- GlueX: an additional $\approx 3\sigma$ structure at 1820 MeV