

Hall-D Highlights

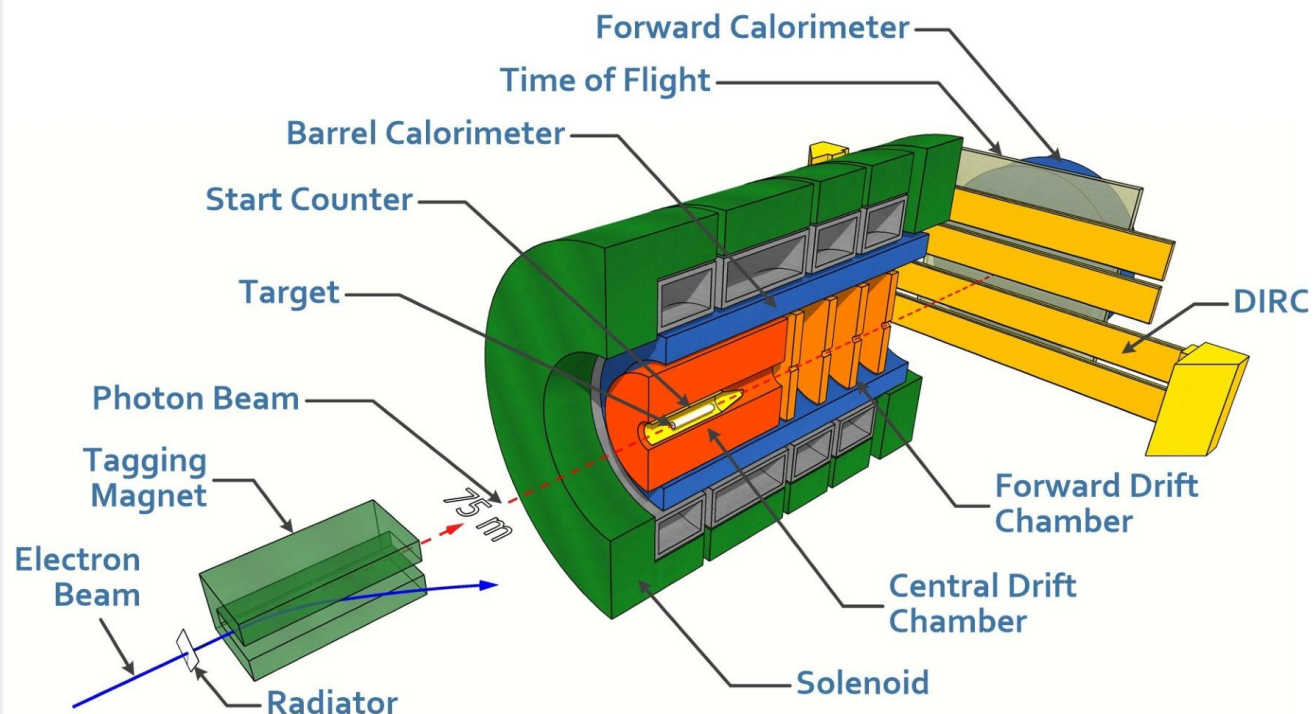
Nizar Septian

Jefferson Lab User's Organization Satellite Meeting 2026

Oct. 12, Philadelphia, PA

GlueX detector at Experimental Hall-D:

- ✓ Built to study light meson spectrum.
- ✓ Fixed-target photoproduction experiment with ~35% linearly polarized photon beam at ~8.5 GeV.
- ✓ Polarized photon beam constrains Partial-Wave Analysis (PWA).
- ✓ $\sim 4\pi$ coverage for photons and charged particles reconstruction.
- ✓ GlueX-I collected $L_{int} = 125 \text{ pb}^{-1}$ (coherent peak)
- ✓ GlueX-II is ongoing, target $L_{int} \approx 400 \text{ pb}^{-1}$, ~85% complete

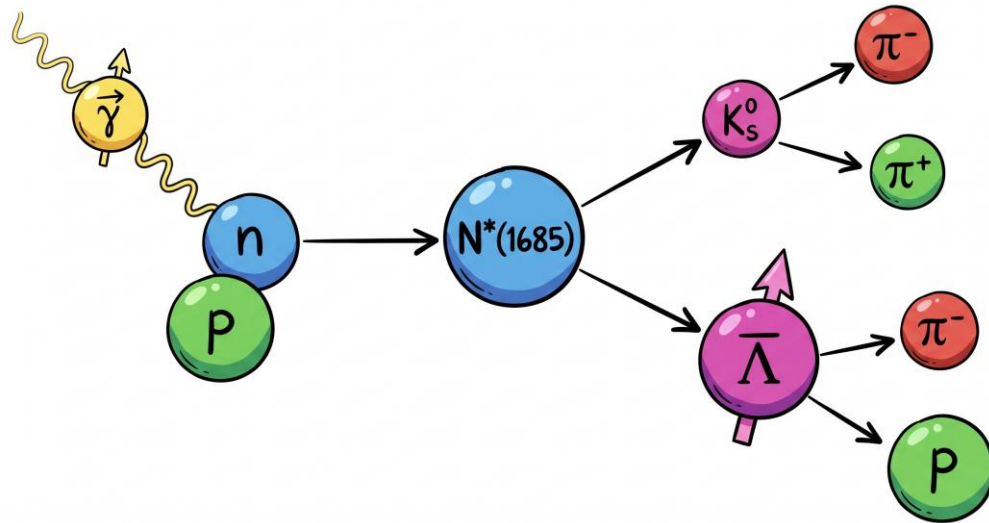


NIM A 987 164807 (2021)

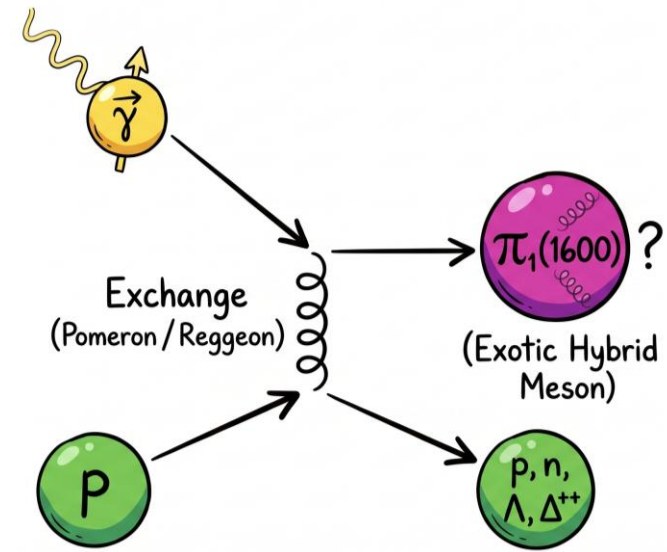
GlueX Run 2026 Summary

Year	Dates	Calendar days	Beam, GeV	ABU ¹ + BANU	ABU	Experiment	PDL	Comment	PAC days ³	PAC days total
2026	May 2 - May 31	31	3.8	72%	63%	E12-25-005	B.Zihlmann	GlueX-Low-Energy 28 PAC days approved	20	20
2026	July 10 - Aug 14	36	11.8	55%	48%	E12-12-002	B.Zihlmann	GlueX-II/JEF 220 PAC days approved total	17	194

- 2026 run was scheduled for GlueX-Low-Energy and GlueX-II/JEF program.
- Only 10 weeks for Hall-D.



GlueX low energy

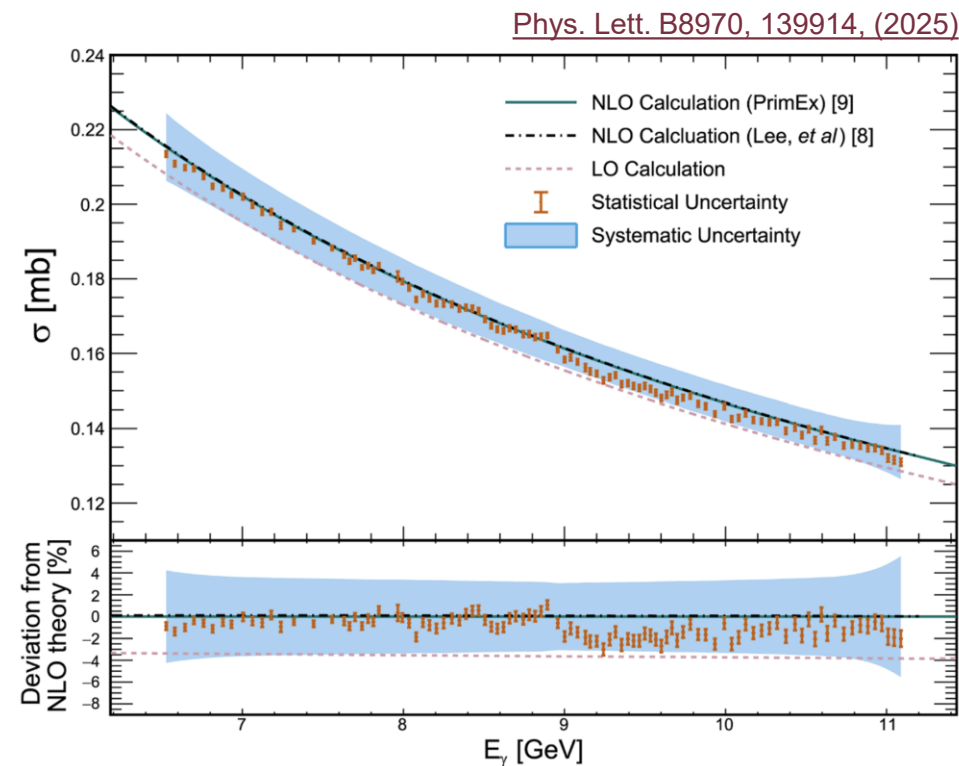
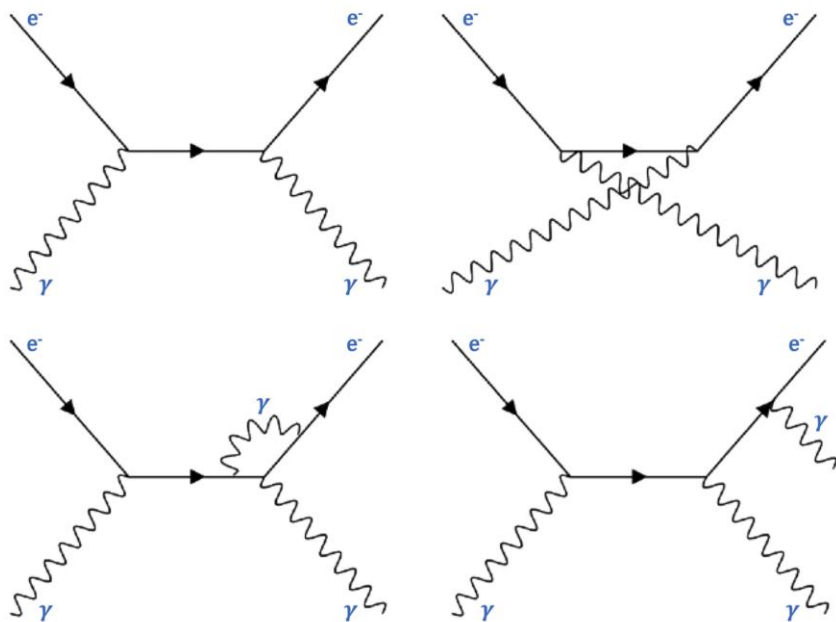


GlueX hybrid mesons search

Recent Publications

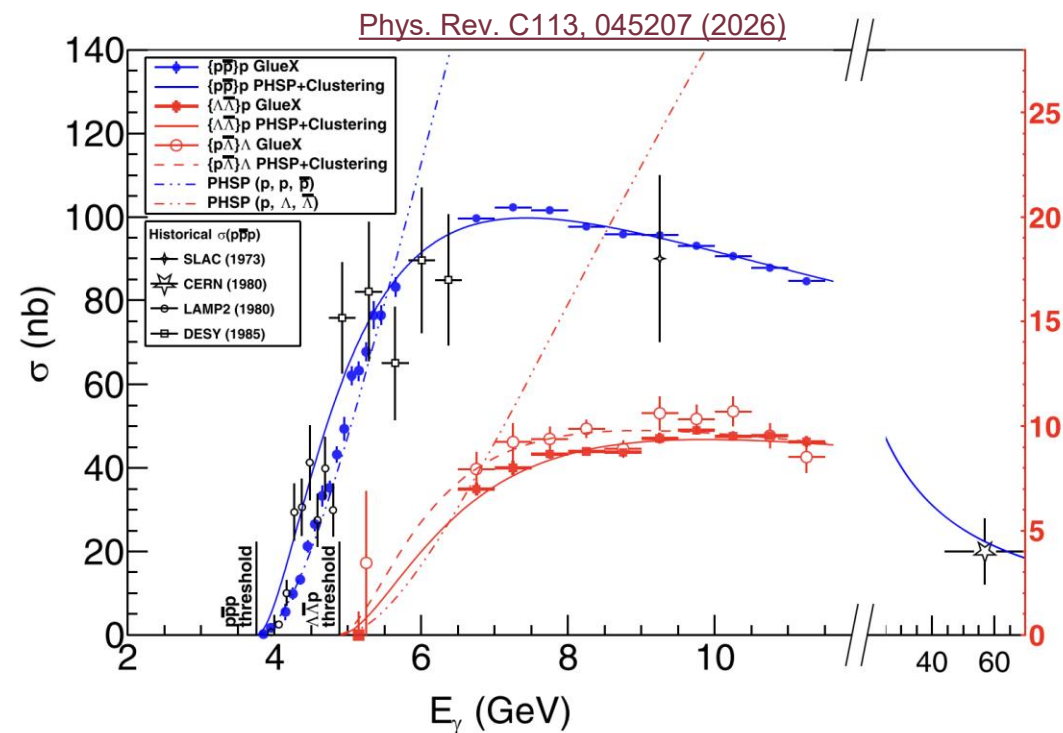
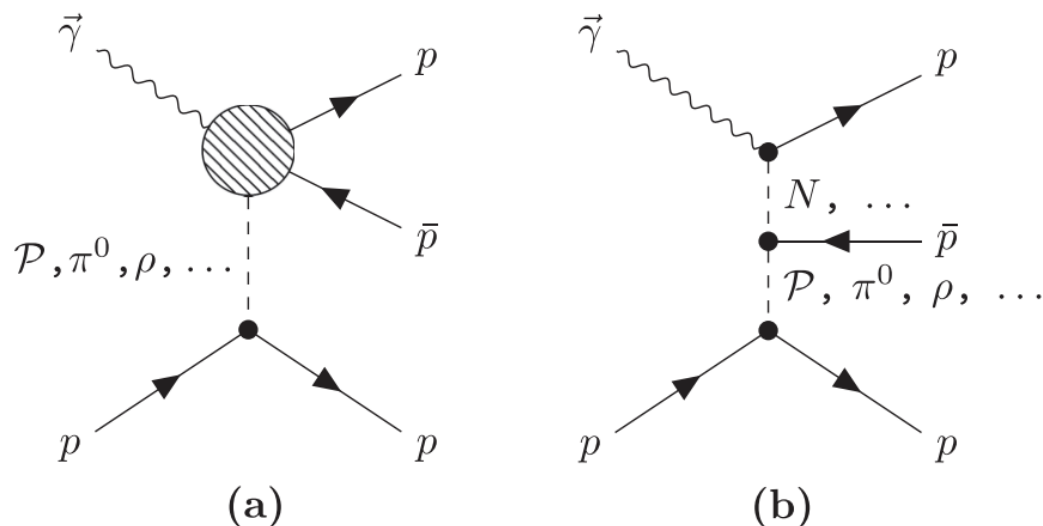
Total compton scattering cross-section

- The total cross section for Compton scattering off atomic electrons, $\gamma e \rightarrow \gamma' e'$, was measured using photons with energies between 6.5 and 11.1 GeV incident on a ^9Be target.
- **First** measurement of this fundamental QED process within this energy range.
- Benchmark for future precision measurements.



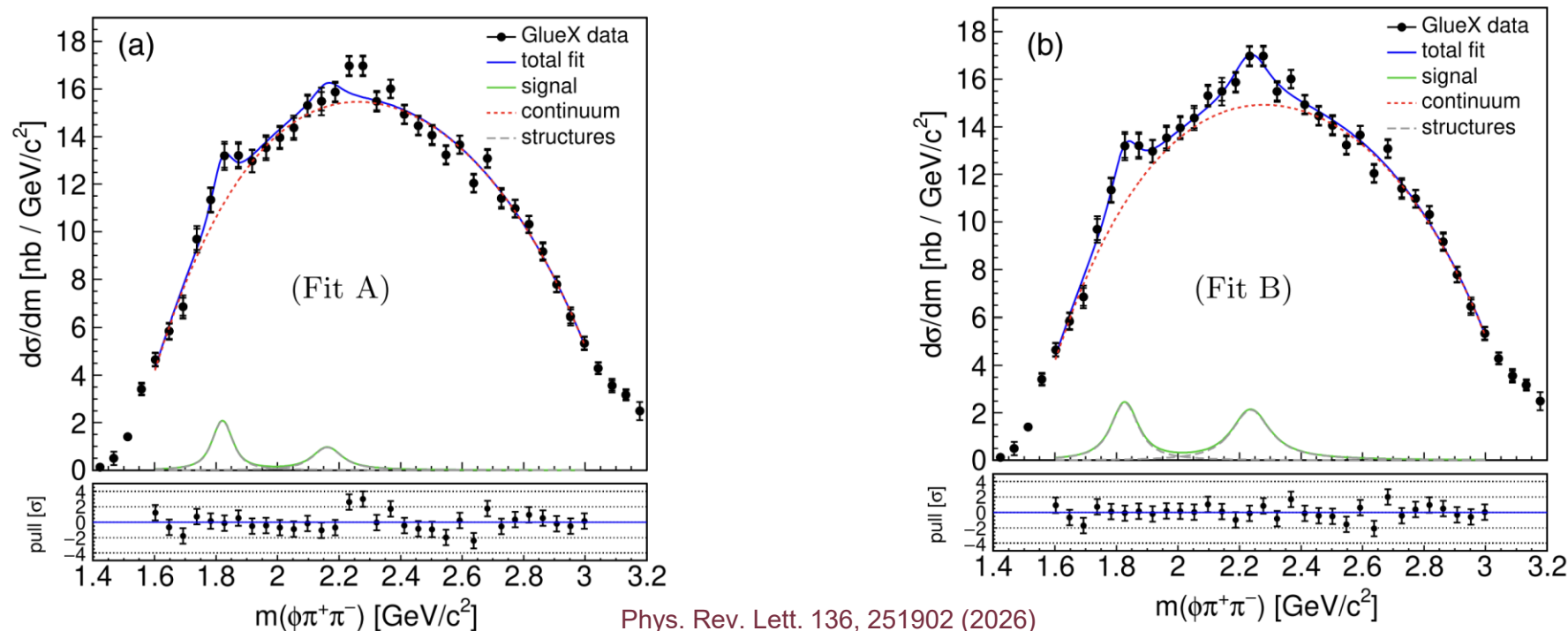
Baryon-antibaryon photoproduction cross sections off the proton

- **First** measurement of $\Lambda\bar{\Lambda}$ and $p\bar{p}$ photoproduction (up to 11.6 GeV), consistent with Regge-like t -channel exchange.
- Angular distributions are successfully described by a simple double t -channel exchange model.
- Found no narrow resonances and confirming the expected $s\bar{s}$ pair suppression relative to $d\bar{d}$.



Recent Publications

Search for the $Y(2175)$ in $\gamma p \rightarrow \phi \pi^+ \pi^- p$

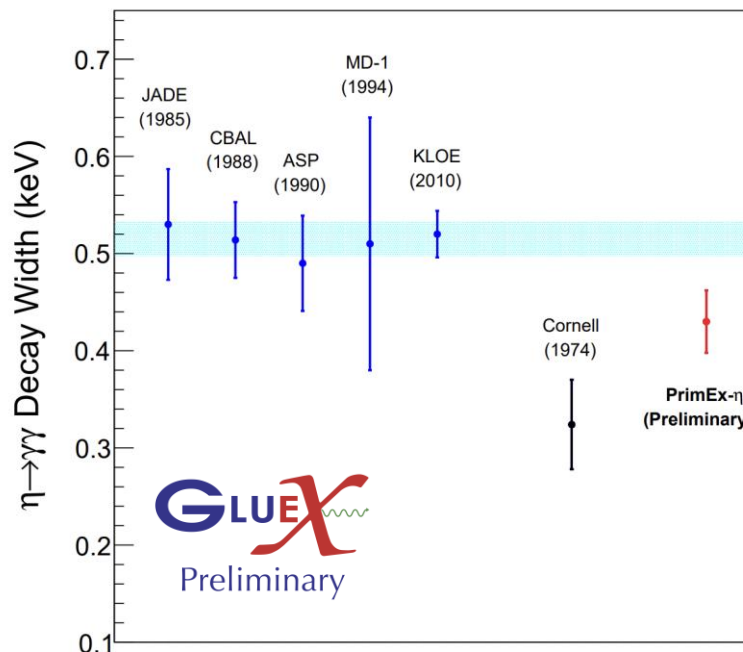
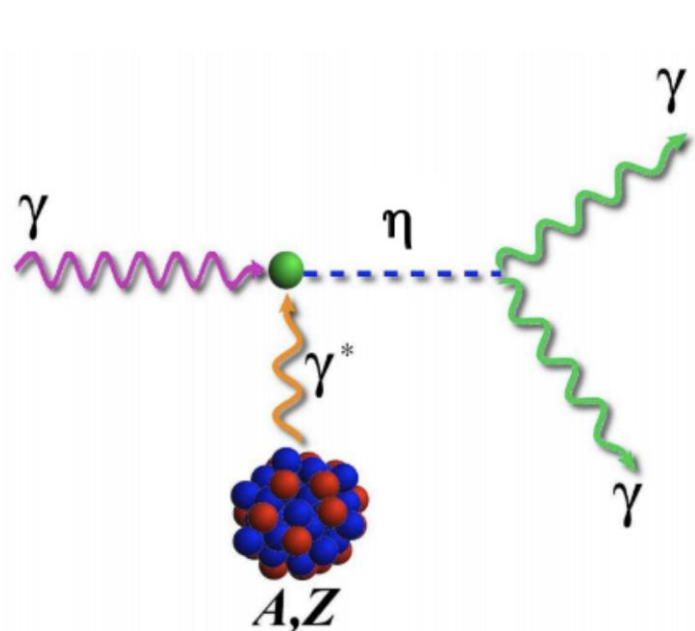


- **First** photoproduction search for the strangeonium-like $\phi(2170)$ state in $\phi \pi^+ \pi^-$.
 - Hybrid? Tetraquark? Molecule?
- Found no evidence using standard PDG parameters and established upper cross-section limits.
- Discovered a distinct structure at $2.24 \text{ GeV}/c^2$ (with $\sim 5\sigma$ significance) and found evidence for a second structure at $1.82 \text{ GeV}/c^2$.

Recent Progress

PrimeEx- η

- Precision measurement of the η radiative decay width, $\Gamma(\eta \rightarrow \gamma\gamma)$, through the Primakoff production mechanism.
- Long-standing discrepancy between collider experiments and Primakoff method (1974).
- Internal (GlueX) review underway, publication soon to follow.



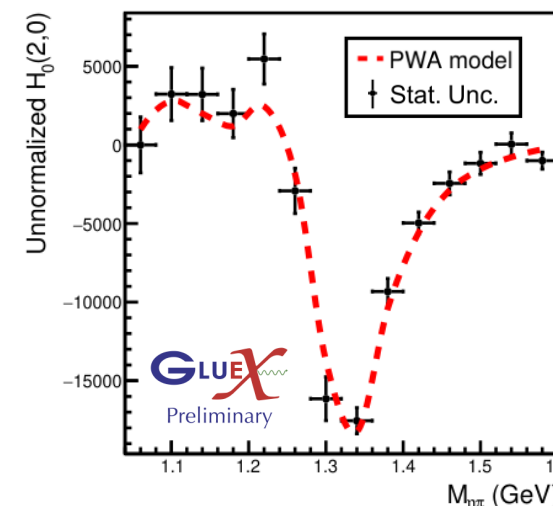
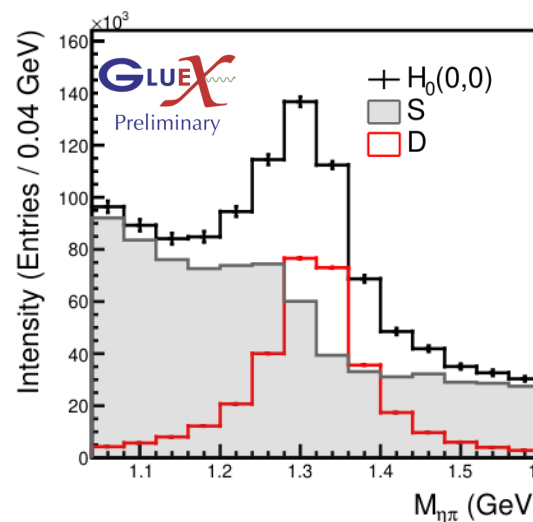
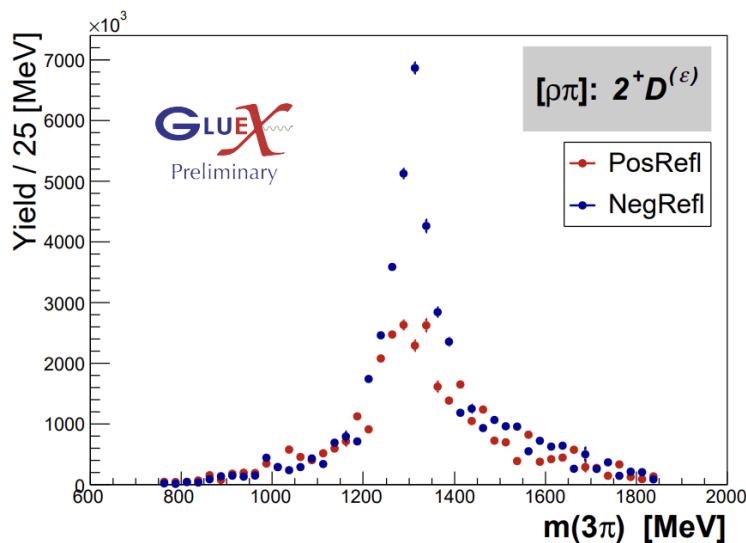
- PDG:
 $\Gamma_{\eta \rightarrow \gamma\gamma} = 0.515 \pm 0.018$ keV
- PrimEx- η :
 $\Gamma_{\eta \rightarrow \gamma\gamma} = 0.431 \pm 0.032$ keV

$$N_{\sigma} = \frac{|\Gamma_{\eta \rightarrow \gamma\gamma}^{PDG} - \Gamma_{\eta \rightarrow \gamma\gamma}^{PrimEx}|}{\sqrt{\sigma_{PDG}^2 + \sigma_{PrimEx}^2}} = 2.3$$

Recent Progress

Search for $\pi_1(1600)$ in photoproduction

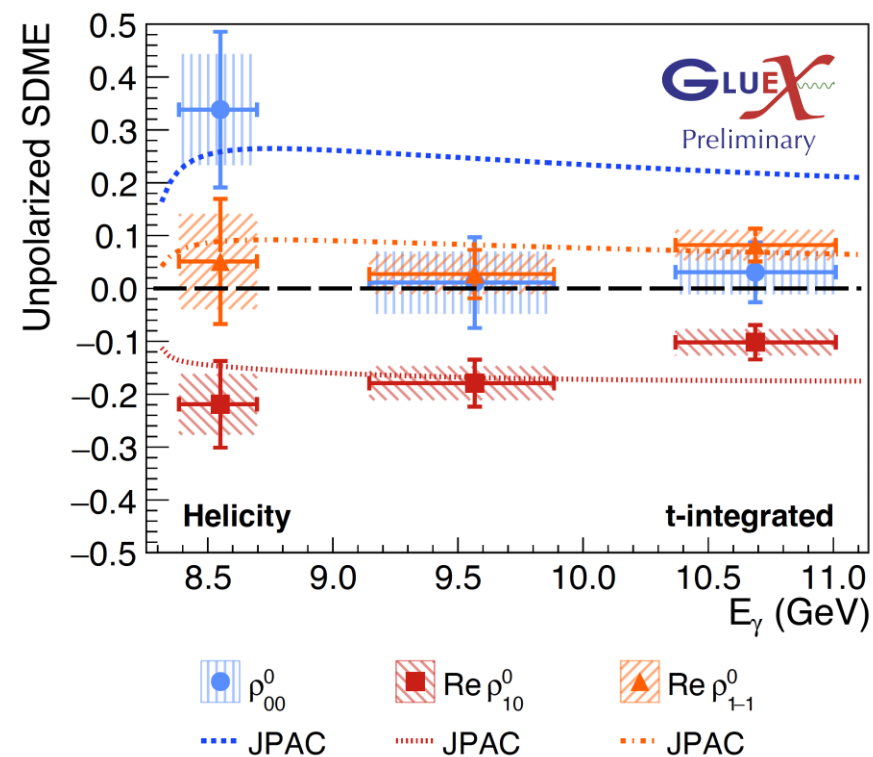
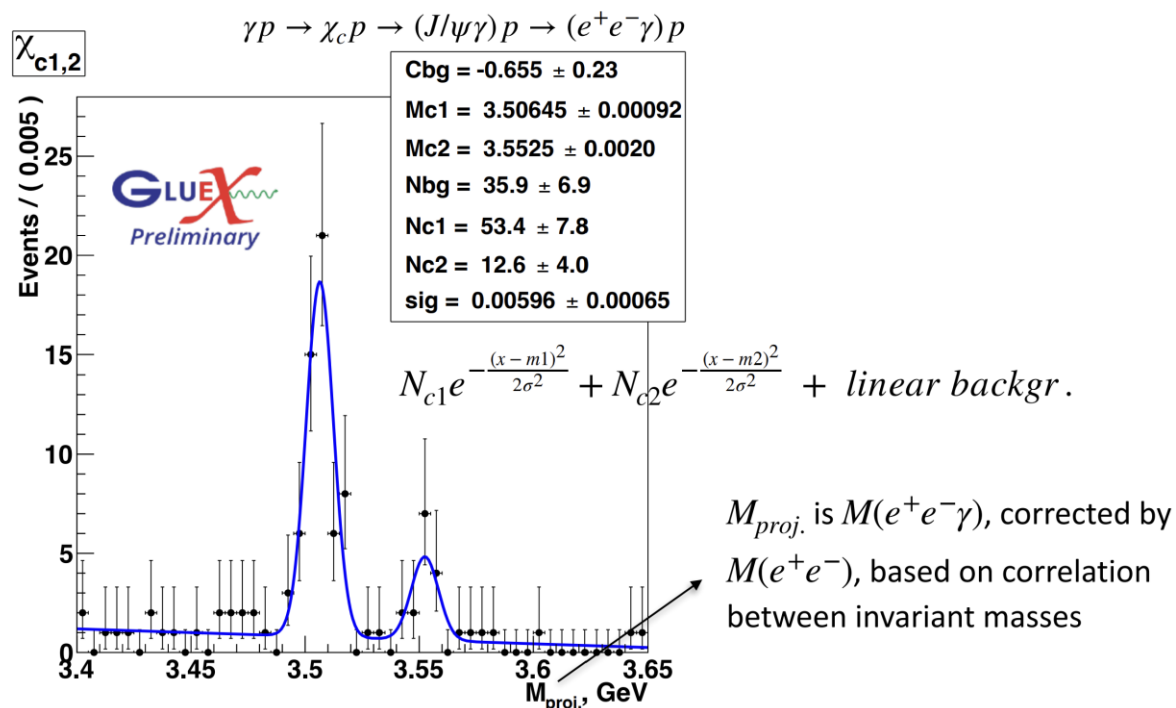
- $\pi_1(1600)$ is an exotic hybrid meson candidate seen in multiple channels and production mechanism.
 - Not yet** observed in photoproduction.
- Active searches in multiple channels at GlueX: $\eta^{(\prime)}\pi$ and 3π .
- $\eta\pi^0$ moments reveals potential non-zero exotic P -waves contribution.
 - Interpretation is still not clear: **resonance**, **non-resonant physics**, **backgrounds**, **analysis artifacts**?
 - Requires more study and input from theory.
- Preliminary 3π partial-wave analysis see the $a_2(1320)$ signal as D -waves!



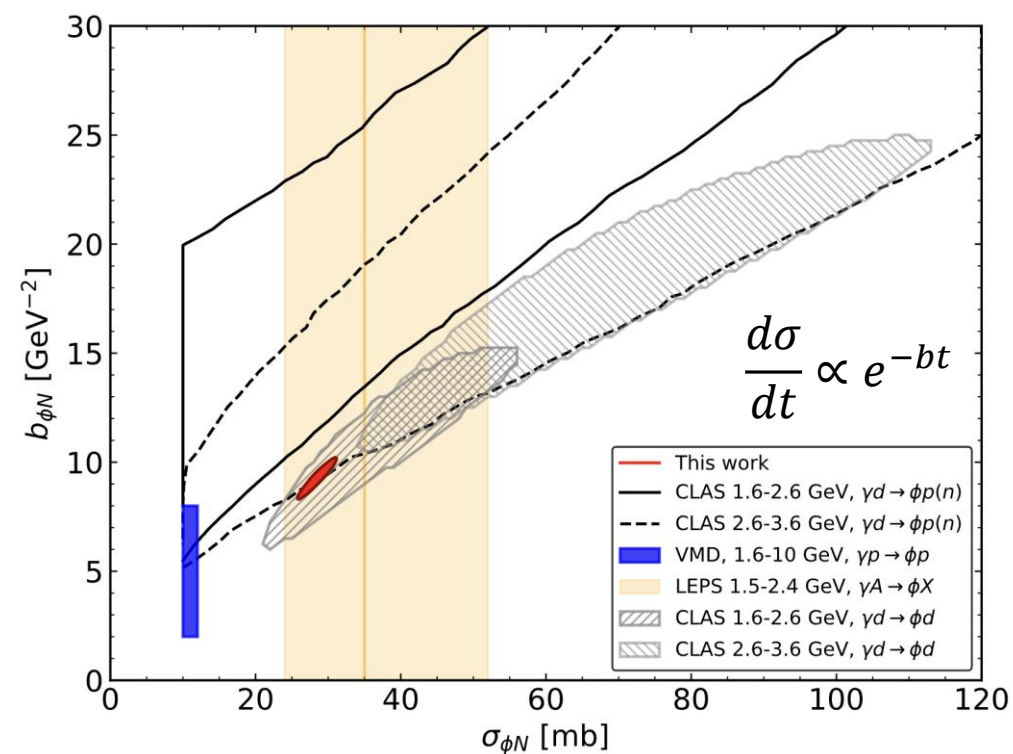
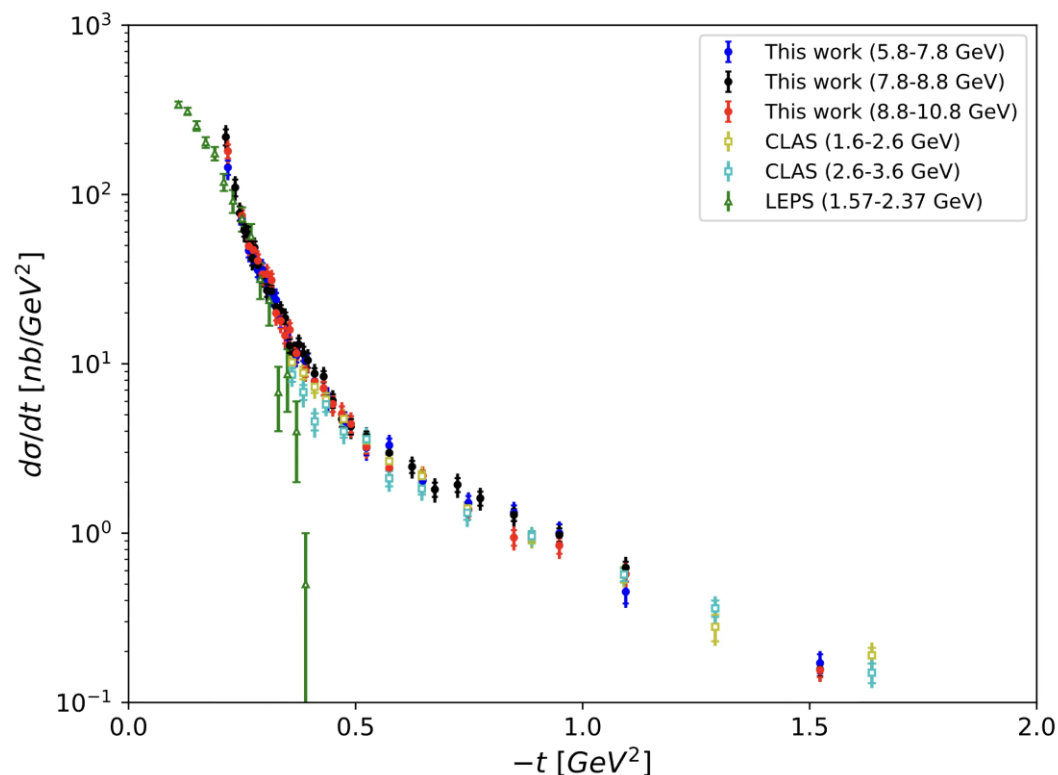
Recent Progress

Charmonium photoproduction

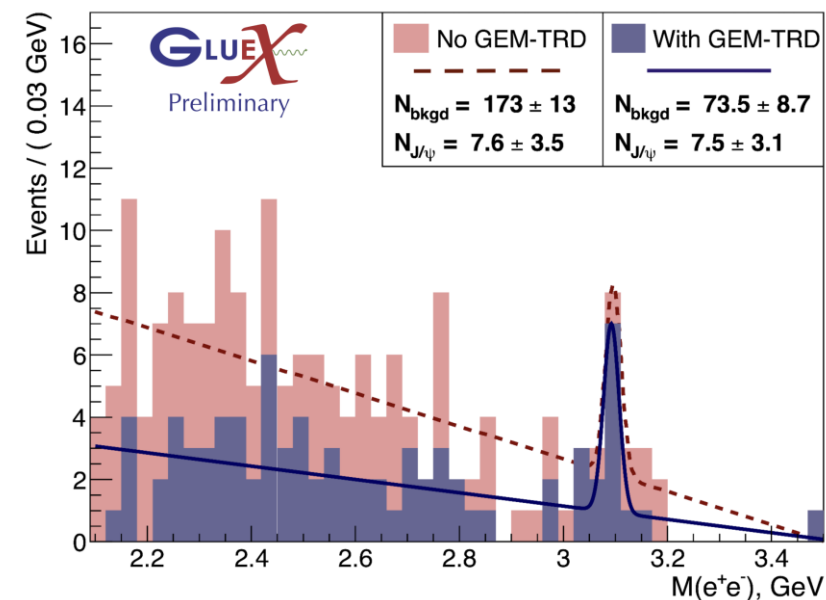
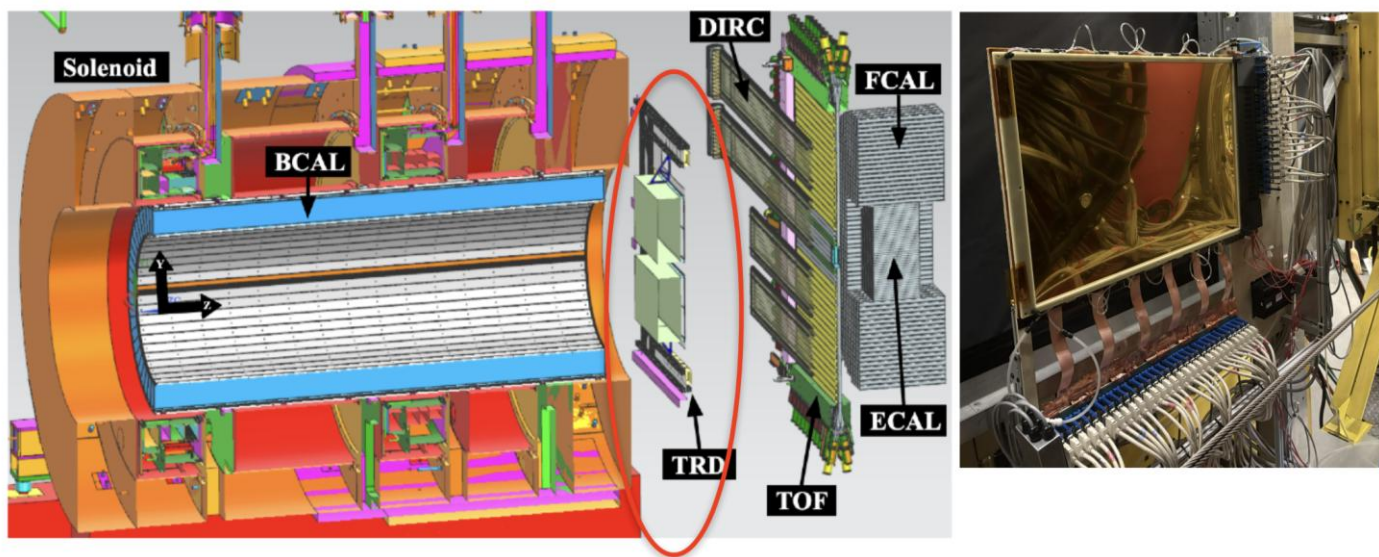
- J/ψ photoproduction is the most cited GlueX paper.
- **First** evidence for photoproduction of C -even charmonium: $\chi_{c1,2}$
- **First** J/ψ angular analysis with photon beam.
- Flagship program for GlueX-III.



- Measurement of coherent ϕ meson photoproduction from the deuteron target at 5.8-10.8 GeV.
- Extraction of the total $\phi - N$ cross section.
- Talk by Bo Yu on Tue, Oct 13 in H05 session.

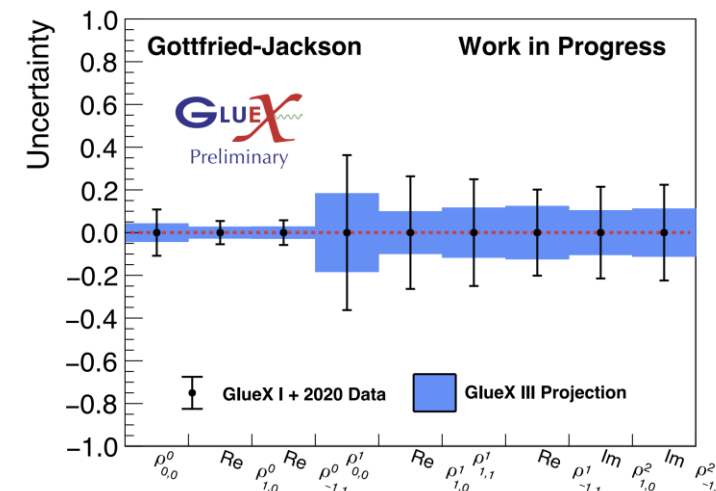
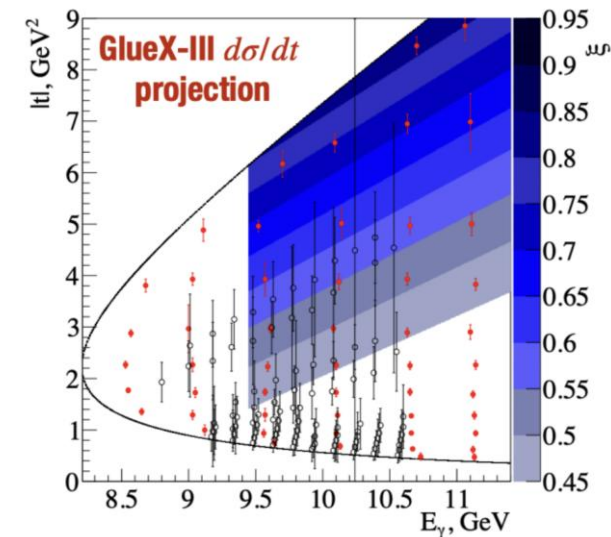


- Plan for 2027: finish low energy, GlueX-II/JEF, start GlueX-III/JEF-II.
- High-intensity GlueX-III/JEF-II focused on charmonium physics and rare decays [200 PAC days]
 - Doubled beam intensity
 - Improved e/π separation with new GEM-TRD detector



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 - Doubled beam intensity
 - Improved e/π separation with new GEM-TRD detector
 - Threshold production of higher-mass charmonia (with different J^{PC}) adds a new dimension in studying gluonic content of the proton.

Run Period	PAC Days	J/ψ Yield	In coh. peak	χ_{c1} Yield	$\psi(2S)$ Yield
All Phase I	120	2,180	326	↓	↓
2020 Phase II	67.5	1,780	162	52	12
2023 Phase II	28.1	741	67	↓	↓
2024-2026 Phase II	109	2,874	262	48	11
2027-2028 Phase III	200	11,271	1,795	364	178
Projected Total		18,846	2612	464	201



- 2026:
 - Data take for GlueX low-energy runs
 - Data taken for GlueX-II/JEF with available beam
- New results across a broad physics program
 - Compton scattering
 - Baryon–antibaryon photoproduction measurements
 - First photoproduction search for $Y(2175)$
- Hybrid-meson searches are advancing
 - Angular analyses suggest possible exotic meson contributions, but establishing their resonance nature requires further analysis and theory input.
- Charmonium photoproduction studies reach new milestones
 - First evidence for C -even charmonium photoproduction
 - The first charmonium amplitude analysis with a polarized photon beam is in the work!
- SRC/CT program measure ϕN photoproduction cross-section on nucleon targets
- Gluex plan for 2027:
 - Finish low energy, GlueX-II/JEF, start GlueX-III/JEF-II.
- Rich portfolio of planned experiments
 - Nuclear targets: He_4 [85 PAC days], D_2 [LoI]
 - Polarized targets: GDH sum rule [33 PAC days], ϕN cross section [65 PAC days]
 - K -long beam facility: 200 PAC days, could run over 2031-32



gluex.org/thanks