Proton Antiproton Electroproduction off Protons at CLAS12

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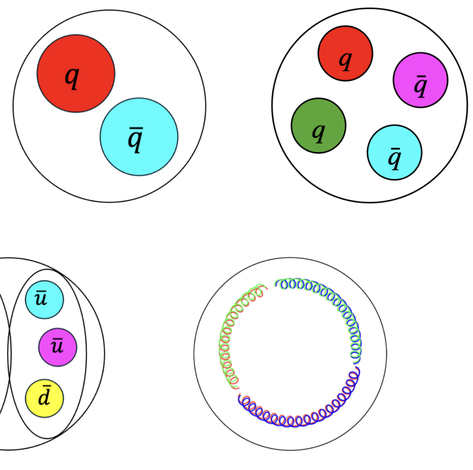
History

- Evidence for potential narrow resonance is scarce in the $p\bar{p}$ system
- Near mass threshold resonances reported in $p\bar{p}$ system by BES-III[1]
- Previous high statistics photoproduction analyses focused on extraction of cross sections and show no evidence of narrow resonances[2][3]

Motivation

- Previous experiments have shown no evidence for wide resonances in the $p\bar{p}$ system
- Production mechanism of $p\bar{p}$ system remains unclear
- Potential exotic states [4][5]
  - Baryonium: Bound $N\bar{N}$ system
  - Tetraquarks: Bound $q\bar{q}q\bar{q}$ system
  - Glueballs
  - Intermediate Mesons



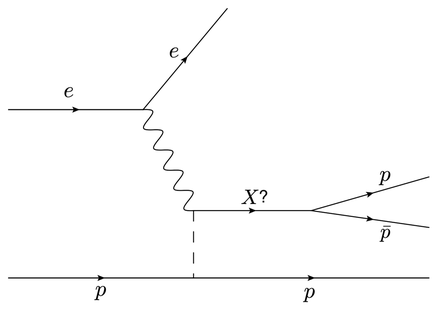
Reactions

Looking at the reaction:

- $ep \rightarrow epp(\bar{p})$

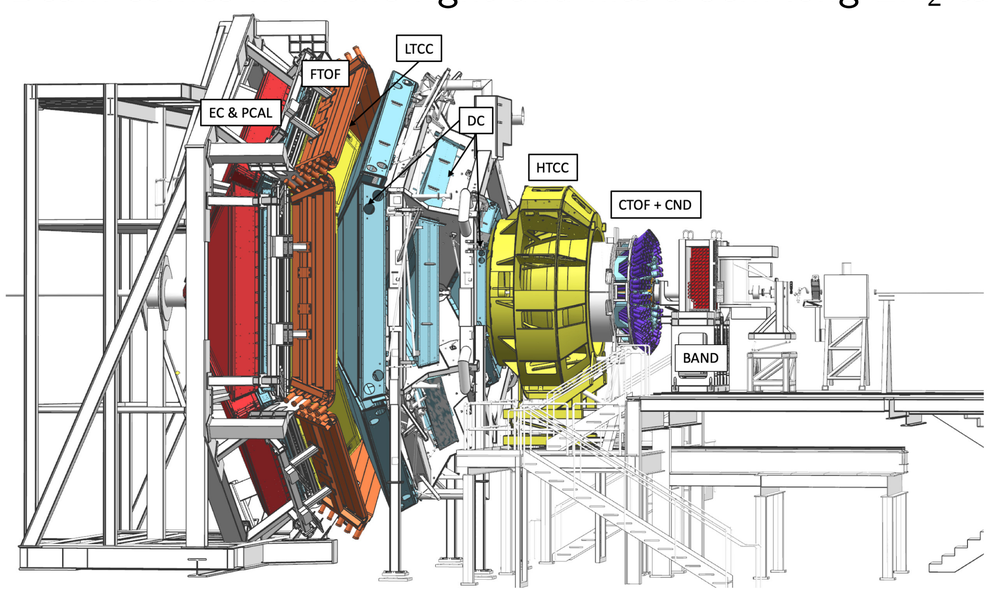
Using CLAS12 Run Group A data

- 10.2 GeV electron beam
- 10.6 GeV electron beam



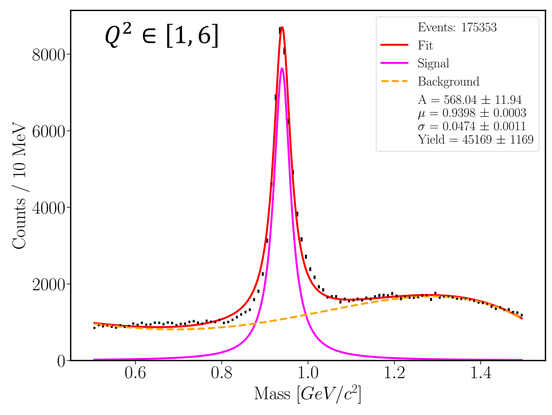
CLAS12 Detector

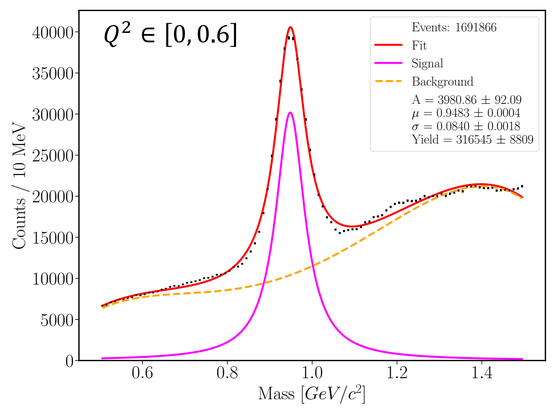
- CEBAF Large Acceptance Spectrometer [6]
- Beam comes from the right and hits a 5cm long LH_2 target



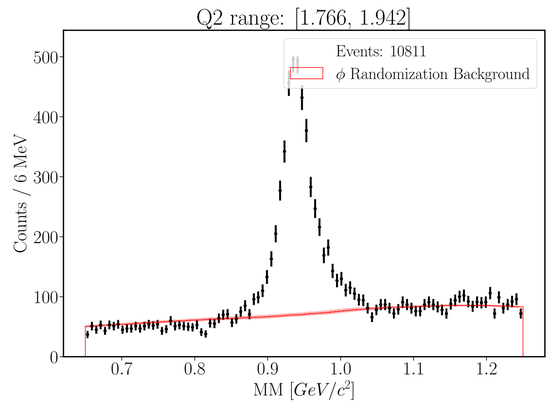
Analysis

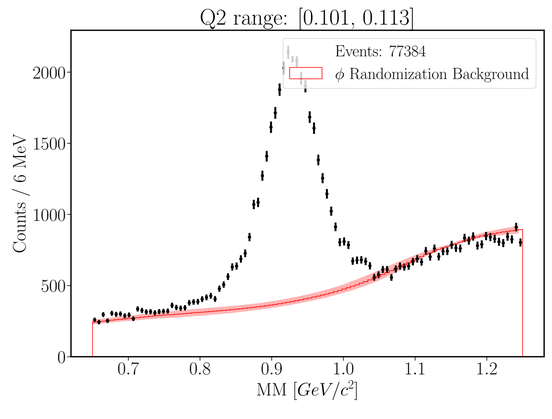
- Missing mass technique is used to reconstruct the missing particle



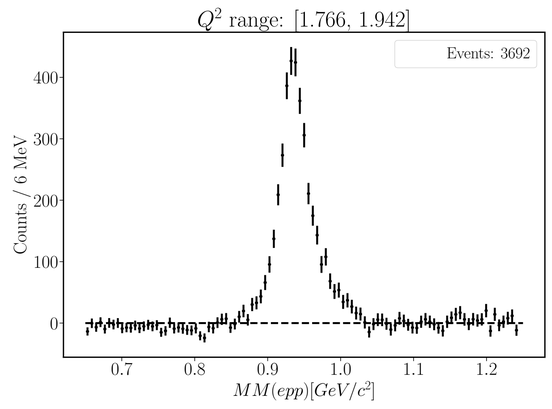


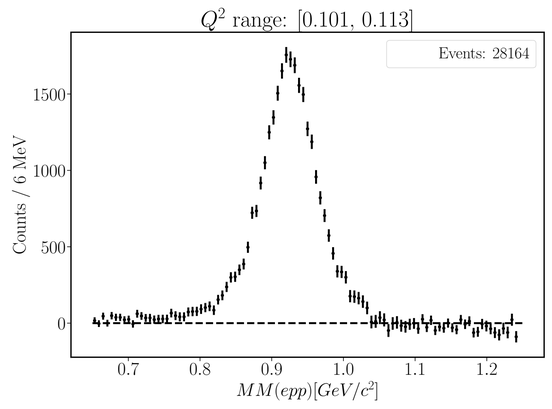
- Data driven background estimation using ϕ randomization





- Background subtracted missing mass distributions





Outlook

- Simulations to understand the acceptance and efficiency
- First time cross section extraction for $p\bar{p}$ electroproduction
- Amplitude Analysis
- Background Studies (Combinatorial and Physics based backgrounds)
  - Two identical fermions in the final state
  - Uncorrelated background

Acknowledgments

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References

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[3] Hao Li. "Baryon-Antibaryon Photoproduction off the Proton". PhD thesis. Carnegie Mellon University, Dec. 2023.
[4] Thomas Gutsche et al. "Search for the glueball content of hadrons in γp interactions at GlueX". In: *arXiv:1605.01035* (2021).
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[6] V.D. Burkert et al. "The CLAS12 Spectrometer at Jefferson Laboratory". In: *Nuclear Instruments and Methods in Physics Research* (2020).

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