Hadron Spectroscop Working Group - I

Remote connection: https://bluejeans.com/928575007

Convener: Dr. Marco Battaglieri (INFN-GE)

08:20 **Hadron Spectroscopy Working Group Business** *20'*
Speaker: Dr. Marco Battaglieri (INFN-GE)

08:40 **JPAC report** *20'*
Speaker: Dr. Alessandro Pilloni (Jefferson Lab)

09:00 **Contribution of N* resonances to unpolarised inclusive electron scattering** *20'*
Speaker: Dr. A.N. Hiller Blin (Mainz University)

09:20 **Evaluation of the inclusive electron scattering off proton observables from the CLAS/world data** *20'*
Speaker: A. Golubenko (Moscow State University)

09:40 **Photoproduction of d* dibaryon resonance from g10 dataset** *20'*
Speaker: Mr. Taya chetry (Ohio University)

Hadron Spectroscopy Working Group - II

Remote connection:https://bluejeans.com/928575007

Convener: Dr. Marco Battaglieri (INFN-GE)

Location: F113

10:30 **The omega->pi0e+e- from g12 data set** *20'*
Speaker: Susan Schadmand (Forschungszentrum Juelich)

10:50 **Photoproduction of Lambda* resonances ifrom g12 data set** *20'*
Speaker: Utsav Shrestha (Ohio University)

11:10 **Lambda-proton scattering from g12 data set** *20'*
Speaker: Joey Rowley (Ohio University)

11:30 **Photoproduction of Proton-antiproton pairs from g12 data set** *20'*
Speaker: William Phelps (The George Washington University)

11:50 **Proposal: J/psi Photoproduction off the Deuteron** *20'*
Speaker: Yordanka Ilieva (University of South Carolina)

12:10 **HSWG analysis reviews status** *20'*
Speaker: Dr. Marco Battaglieri (INFN-GE)

HSWG

CLAS Collaboration Meeting
JLab, July 12 2018

+ HS/Deep/Nuclear CLAS12 analyses joint session

Agenda

✳ CLAS6 data analysis
✳ Status of ongoing analysis (update from previous collaboration meeting)
✳ Dedicated (joint) session for CLAS12

Activities

✳ Resumed a weekly HSWG meeting focused on Low-Q2 specific needs:
- FT Calibration (in coordination with the CALCOM and FirstExperiment)
- MesonExTrigger studies
- pId task force

✳ Meeting on Tuesday at 11:00 (JLab-time)
✳ All groups are encouraged to look at the data (low/high level) to check calibration, possible issues,
✳ CLAS12 data analysys are needed to optimize fall run conditions (luminosity, acceptance, trigger efficiency, …)
✳ List of ongoing analysis on HSWG wiki page
✳ CLAS6 analysis ready for a plenary talk next time

Talks

✳ Over all CLAS contributions, HSWG-related are 22% in 2018
✳ On going elections of HSWG representatives in the CSC

Elected HSWG representatives:	**A.d'Angelo** **L.Guo**

✳ JSA-TFC funds $15k allocated for 2018

WG Reviews status

Released

Measurement of Sigma in pi- photoproduction on the neutron from the g13b dataseta

PI: D.Sokhan (GlasgowU) et al.
RC: Eugene Pasyuk (Chair), Nicholas Zachariou , Paul Mattione
Started Jul 2016
Status: waiting for comment from author, ????

Determination of E double polarization observable for the reaction gn—>K+Sigma- from g14

PI: N.Zachariou
RC: Annalisa DAngelo (Chair), Michael Dugger , Maurik Holtrop
Status: started on Nov 9, 1 round in ~2 months, quick response from the PI, II round close to be distributed

Search for Csi* Photoproduction from Threshold to 3.3 GeV

PI: K.Hicks
RC: David Ireland (Chair), Carlos Salgado , Yordanka Ilieva
Status: started on Oct 15, 1 round in 1 month, waiting for PI response

WG Reviews status

New since last meeting

Measurement of the G Double-Polarisation Observable in Positive Pion Photoproduction

PI: L.Zana
RC: S.Strauch (Chair), P.Cole, D.Sokhan
Status: started on July 9 2018

Polarization Observables in (Vector-)Meson Photoproduction (FROST)

PI: V.Crede
RC: K.Livingston (Chair), V.Mokeev
Status: started on , 1 round done

In progress

Vector-Meson Photoproduction decaying to Multitrack-Final States using CLAS-g12 Data

PI: Z.Akbar
RC: John Price (Chair), Susan Schadmand , Eugene Pasyuk
Status: started on Jan 1, progressing

WG Reviews status

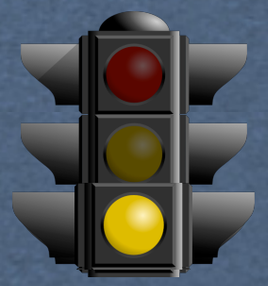
In progress

Photoproduction of the 3π mesons in the reaction $\gamma p \rightarrow \pi+\pi+\pi-n$ with CLAS detector at 6 GeV/c2

PI:P.Eugenio
RC: D.Glazier (chair), A.Filippi, M.Dugger
Status: 2nd round, response received, almost done

Dalitz Plot Analysis of eta' to eta pi pi − from CLAS g12 Data Set

PI:S.Ghosh
RC:V.Crede (chair), A.Rizzo, E.Pasyuk
Status: Started in July'17; first round of comments on Sept 17: no response from the PI since then.
Scarce communication with the review committee. Is the analysis dead ?????



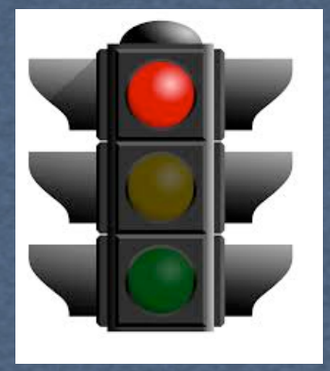
Exclusive pi- Electroproduction off the Neutron in Deuterium in the Resonance Region

PI: Y.Tian
RC: Nikolay Markov (Chair), Mikhail Bashkanov , Eugene Isupov
Status: 1st round in August, waiting for response from PI, still waiting

Polarization Observables T and F in the $\vec{p}(\vec{\gamma},\pi 0)p$ Reaction

PI:H.Jiang
RC: Barry Ritchie (Chair), Volker Crede , Bryan McKinnon
Status: the group is working on major issue

WG Reviews status



Radiative decay of eta' to pi+ pi- gamma from g11 data set

PI:G. Mbianda Njencheu
RC: R. Schumacher,S.Schadmand,A.Celentano
Status: no response in many months ??????

Spin observables in eta meson photoproduction on the proton from FROST data

PI: R.Tucker (ArizonaU) et al.
RC: K.Livingston, J.Price, Xiangdong Wei
Sterted July 2016
Status: on-hold, still on-hold but authors are alive, paused for a while, still on-hold, …

Pentaquark search in g10 by using the MMSA method

PI: Kenneth Hicks et al.
RC: Stepan Stepanyan (Chair), Lei Guo , Bryan McKinnon
Started Aug 2015
Status: NO progress

KLambda and KSigma from FROST

PI: N.Walforf et al.
RC: S.Strauch, M.Holtrop, P.Mattione,
Started May 2015
I round of comments in May 2015, waiting for a revised
Status: stalled for a long while, now it seems to be resurrected, unfortunately NO, no news …
Should we give the analysis to another group?

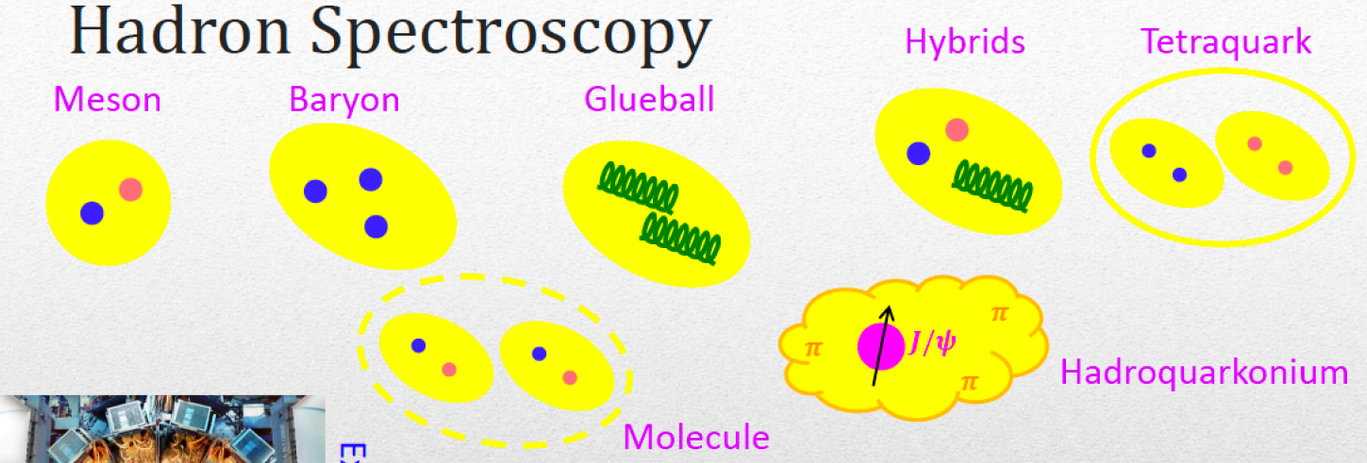
Exclusive Photo-Production Measurement of K+Sigma*- off Quasi-Free Neutrons in Deuterium

PI: H.Lu (SCU) et al.
RC: N.Zachariou, M.Dugger, D.MacGregor
Started in 2012 (!)
Status: ?????????????

Update on JPAC activities

Alessandro Pilloni

Hadron Spectroscopy



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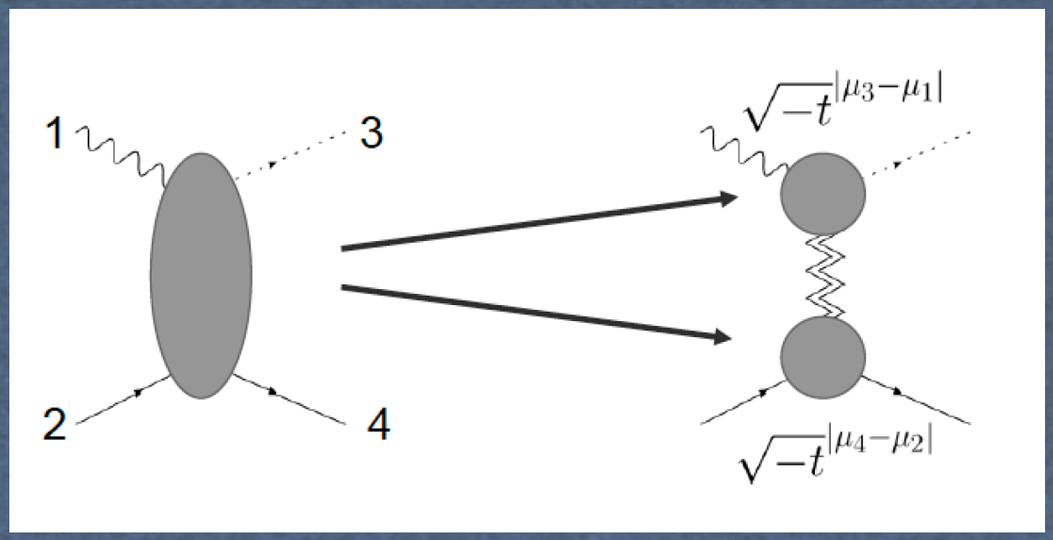
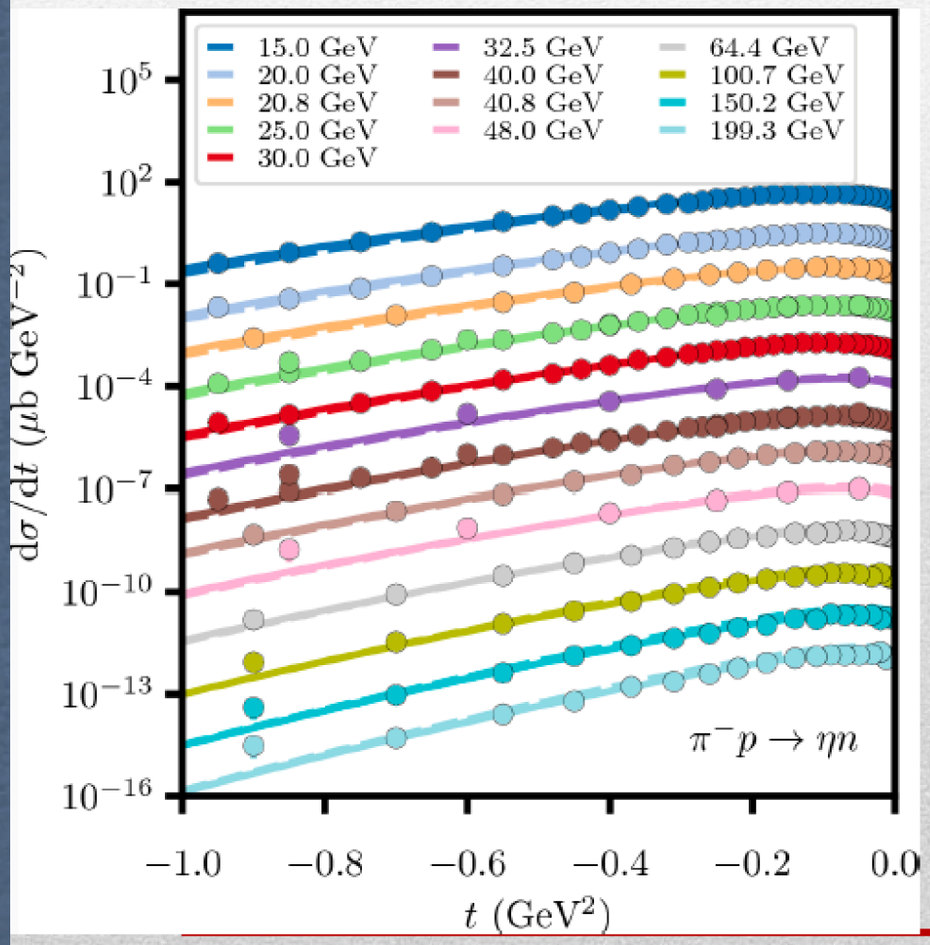
Outline

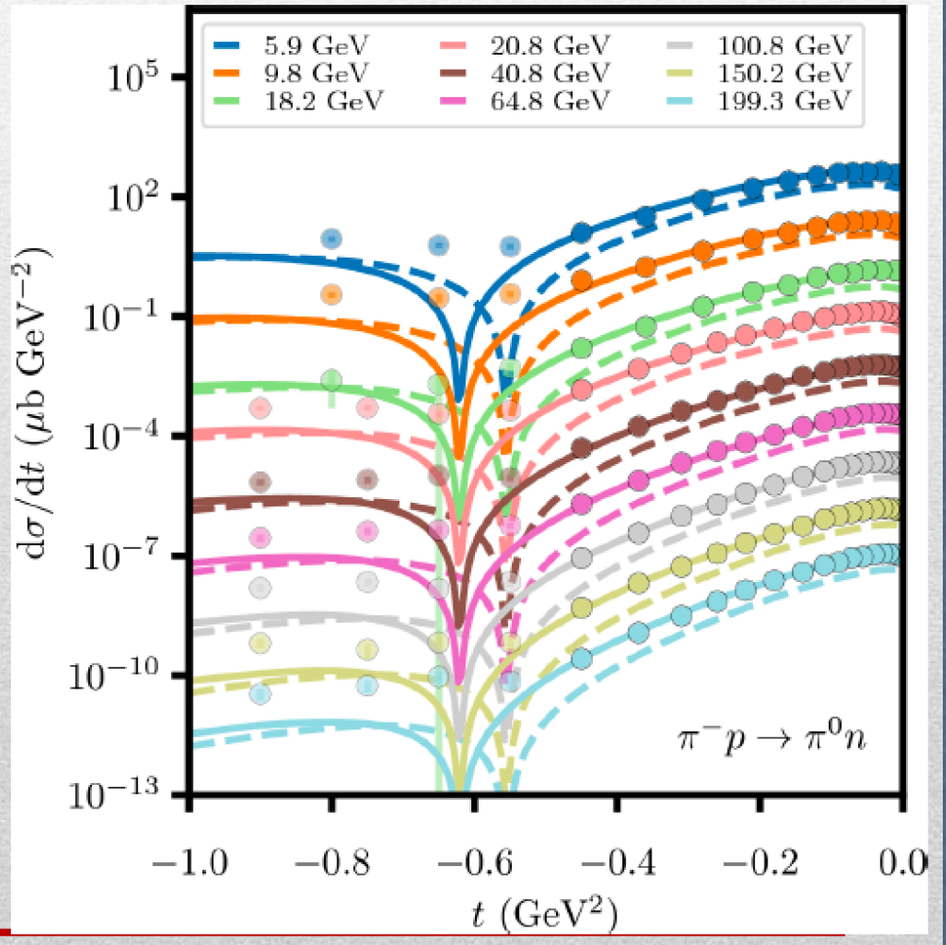
- Test of Regge Factorization
- Pion Photoproduction with FESR
- What is the formalism to search for resonances?
- Exotic resonances in $\eta\pi$
- (flash) Still Pentaquark photoproduction

Factorization at high energies

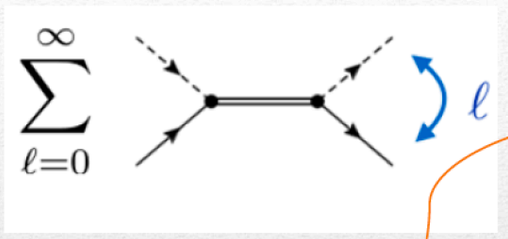


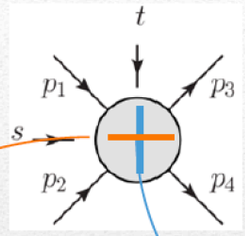
Reaction
$\pi^+ p \to X$
$K^\pm N \to X$
$\pi^- p \to \pi^0 n$
$\pi^+ p \to \pi^0 \Delta^{++}$
$\pi^- p \to \eta n$
$\pi^- p \to \eta' n$
$\pi^+ p \to \eta \Delta^{++}$
$K^+ n \to K^0 p$
$K^- p \to \overline{K}^0 n$
$K^+ p \to K^0 \Delta^{++}$
$K^- n \to \overline{K}^0 \Delta^-$
$K^- p \to \overline{K}^0 \Delta^0$
$K^- p \to \pi^- \Sigma^{*+}$
$K^- p \to \pi^- \Sigma^+$
$K^- p \to \pi^0 \Lambda$
$\pi^+ p \to K^+ \Sigma^{*+}$
$\pi^+ p \to K^+ \Sigma^+$
$\pi^- p \to K^0 \Lambda$
$\pi^- p \to K^0 \Sigma^0$
$K^- p \to \eta \Lambda$
$K^- p \to \eta' \Lambda$

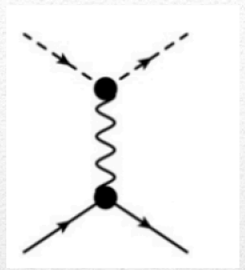


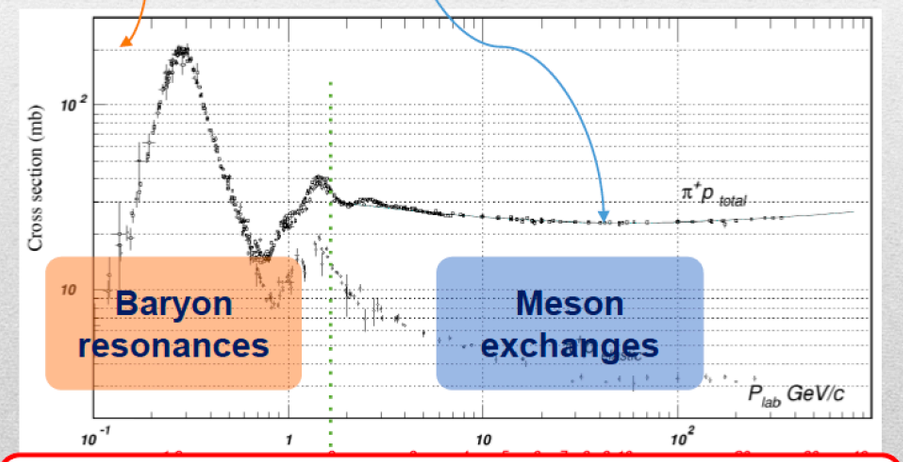


π photoproduction with FESR





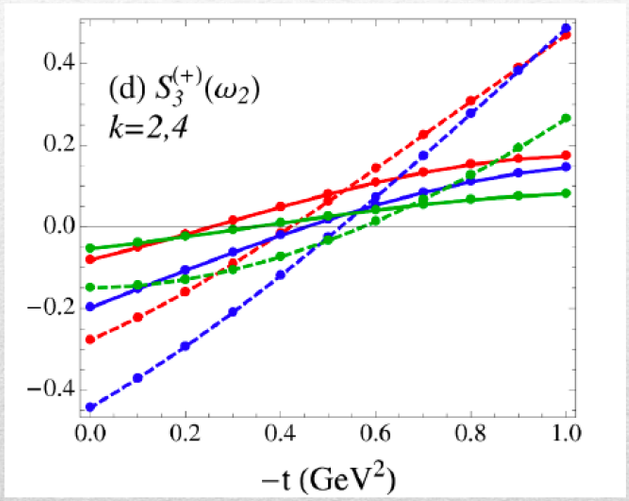




Connect low- and high-energy dynamics

π photoproduction with FESR

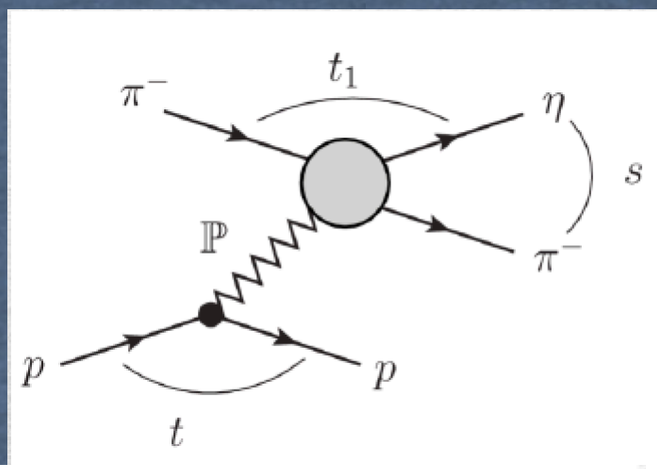
V. Mathieu et al. (JPAC), arXiv:1806.01891



FESR can also help improving the low-energy models
For example, models imply an unexpected large contribution from ω_2 exchanges
If that is not the case, the J^P of some resonances (as $N(1680)$) must have reconsidered

Searching for resonances in $\eta\pi$

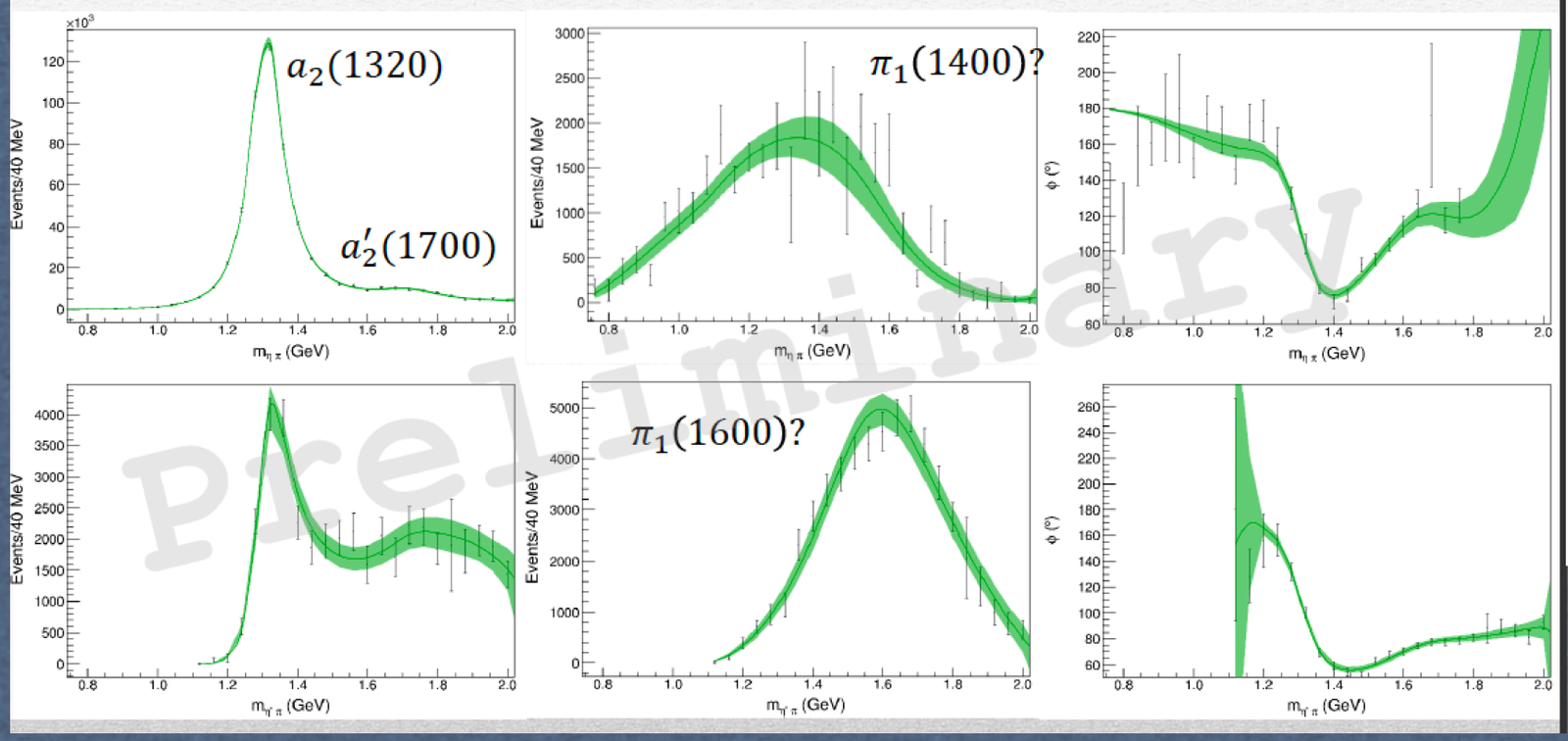
A. Jackura, M. Mikhasenko, AP *et al.* (JPAC & COMPASS), PLB779, 464-472

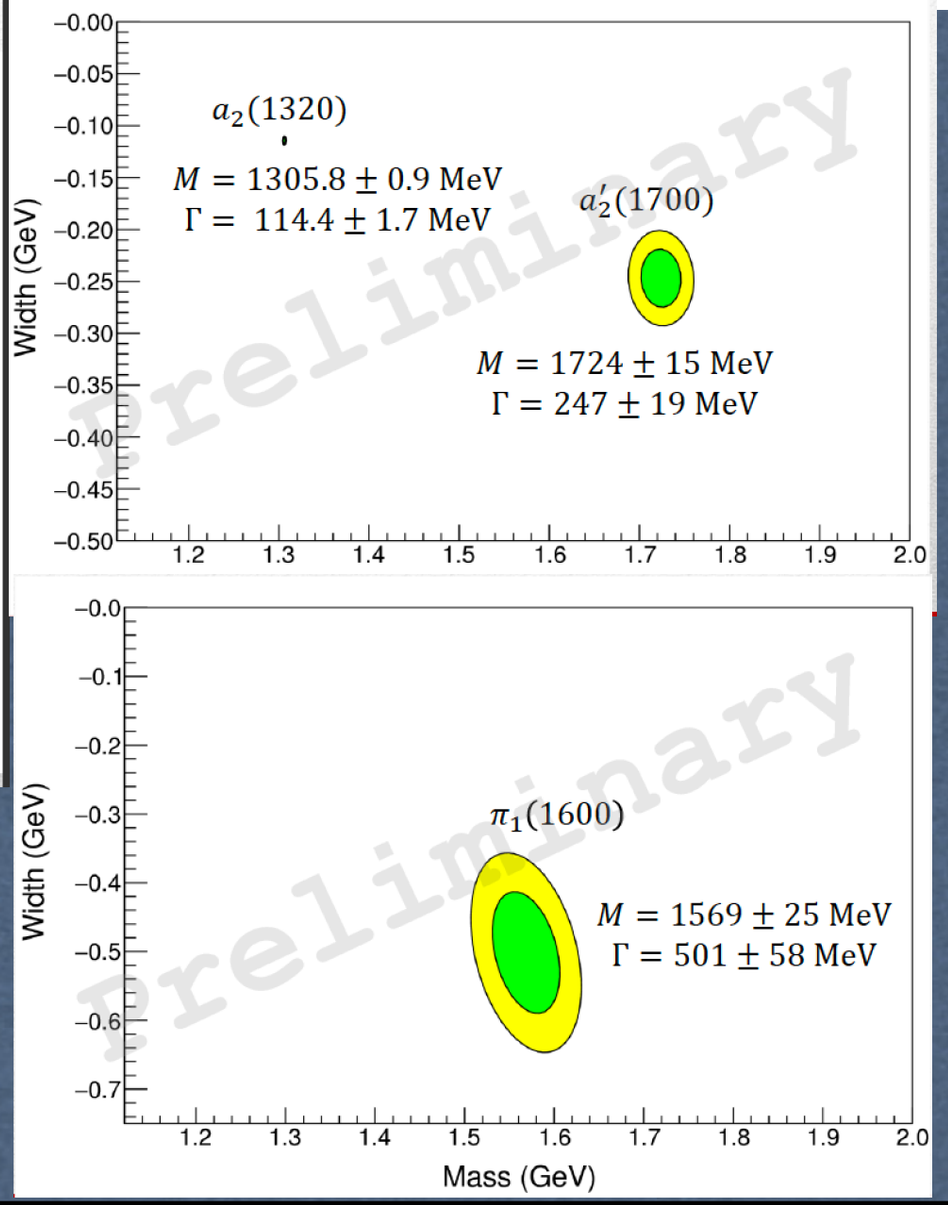


Searching for resonances in $\eta\pi$

- Coupled channel analysis of $\eta\pi$ and $\eta'\pi$ almost completed

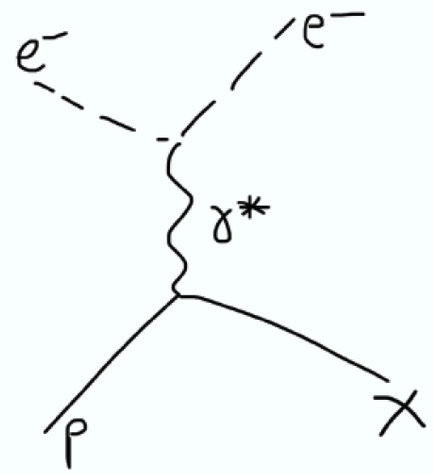
A. Rodas, AP *et al.* (JPAC), in preparation





Contribution of N* resonances to unpolarised inclusive electron scattering

2018-07-12



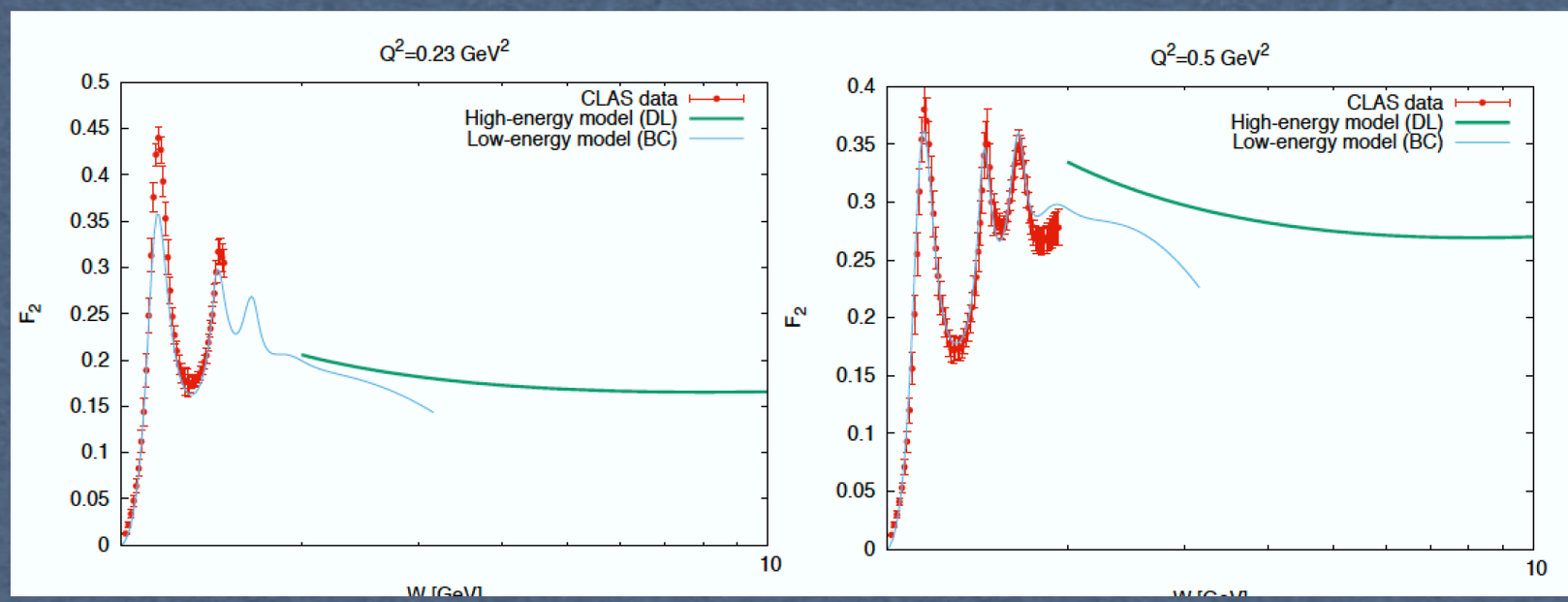
Astrid N. Hiller Blin

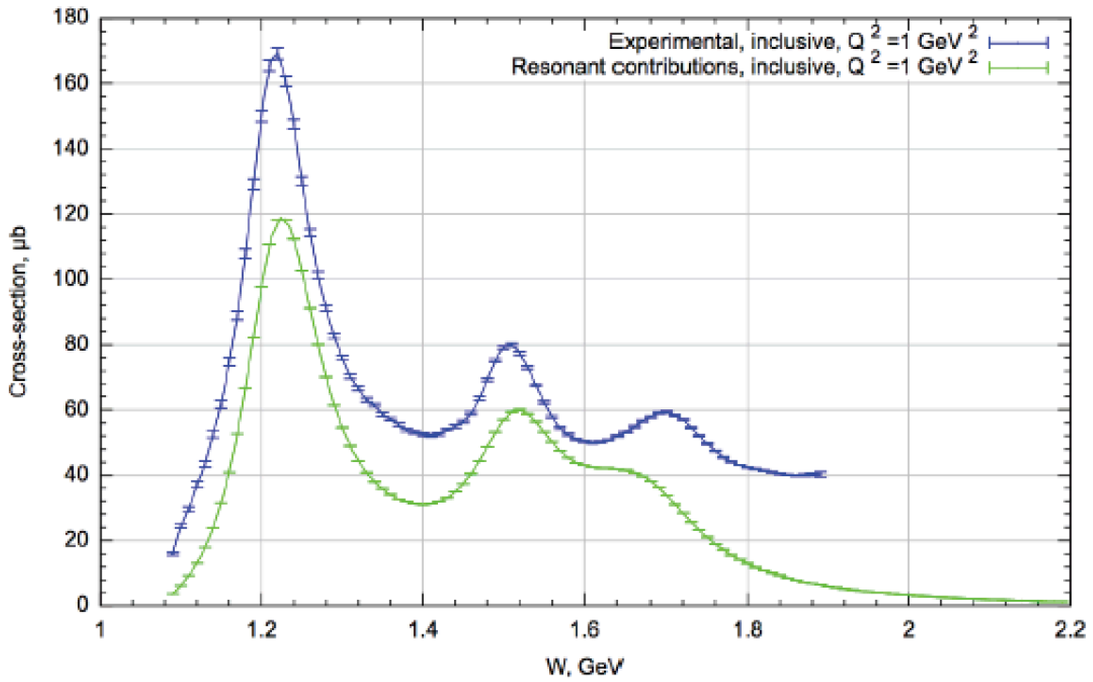
JGU Mainz

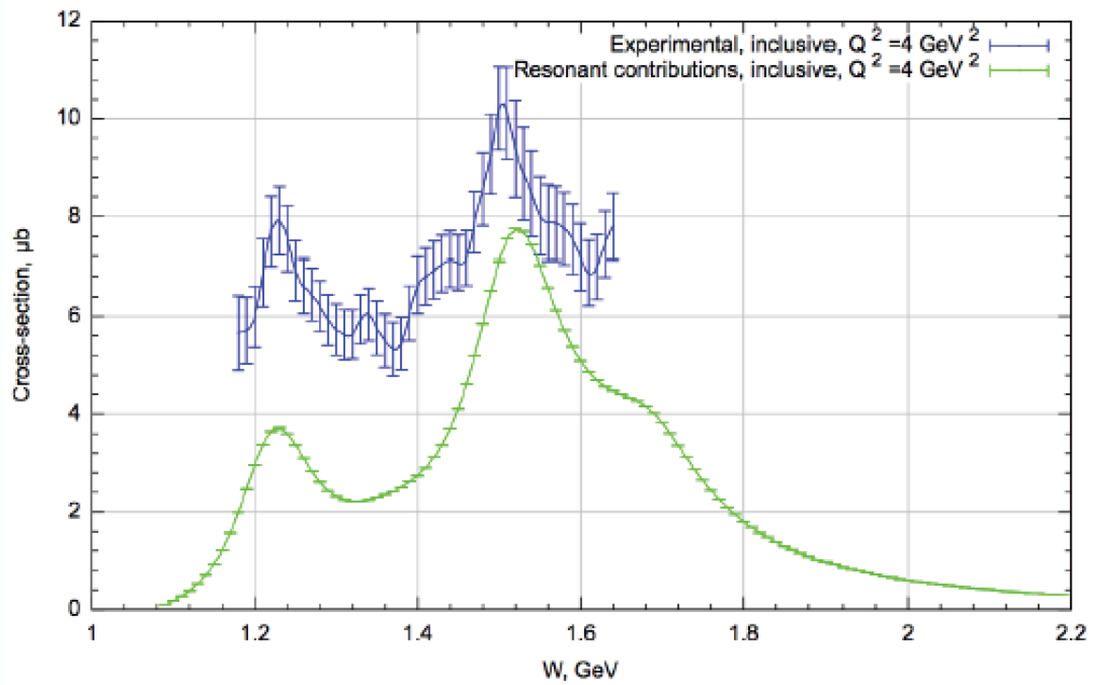
$$F_1(\nu, q^2) \propto \sigma_T(\nu, q^2)$$

$$F_2(\nu, q^2) \propto \sigma_T(\nu, q^2) + \sigma_L(\nu, q^2)$$

- Tests on quark-hadron duality
- Comparison with CLAS(12) **F_2 data**: **Existing** narrow binning in Q^2 and W; Experiments at higher Q^2 in **12-GeV era**. (See talk by Markov)
- Connection with CLAS(12) **electrocouplings**



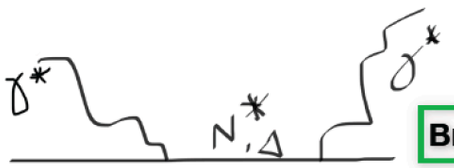




Mokeev et al., PRC 86 (2012) 035203

$$\sigma_{T,L}(W,Q^2) = \sigma^R_{T,L}(W,Q^2) + \sigma^{NR}_{T,L}(W,Q^2)$$

Christy and Bosted, PRC 86 (2010) 055213



Breit-Wigner resonance model

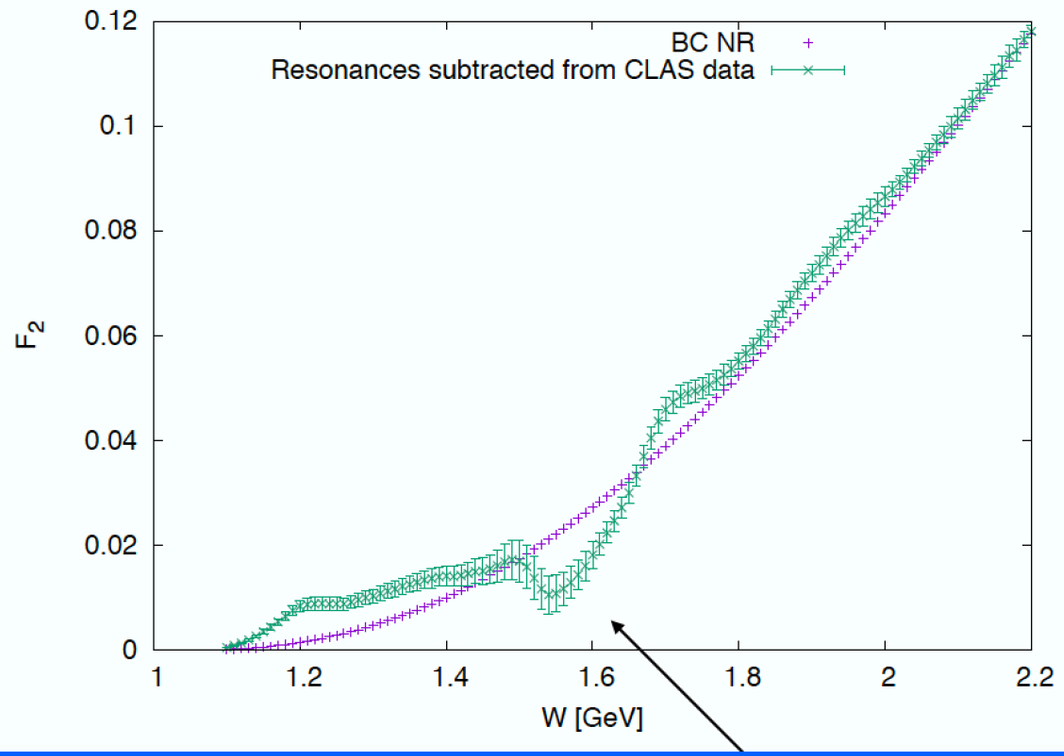
$$\sigma^R_{T,L}(W,Q^2) = \frac{\pi}{q^2_\gamma} \sum_{N^*,\Delta^*} (2J_r+1) \frac{M_r^2 \Gamma_{\text{tot}}(W) \Gamma^{T,L}_\gamma(M_r)}{(M_r^2 - W^2)^2 + M_r^2 \Gamma^2_{\text{tot}}(W)}$$

All (****) resonances to be included

$$A_{1/2}(Q^2),\ A_{3/2}(Q^2),\ S_{1/2}(Q^2)$$

Duality in CLAS F_2 data

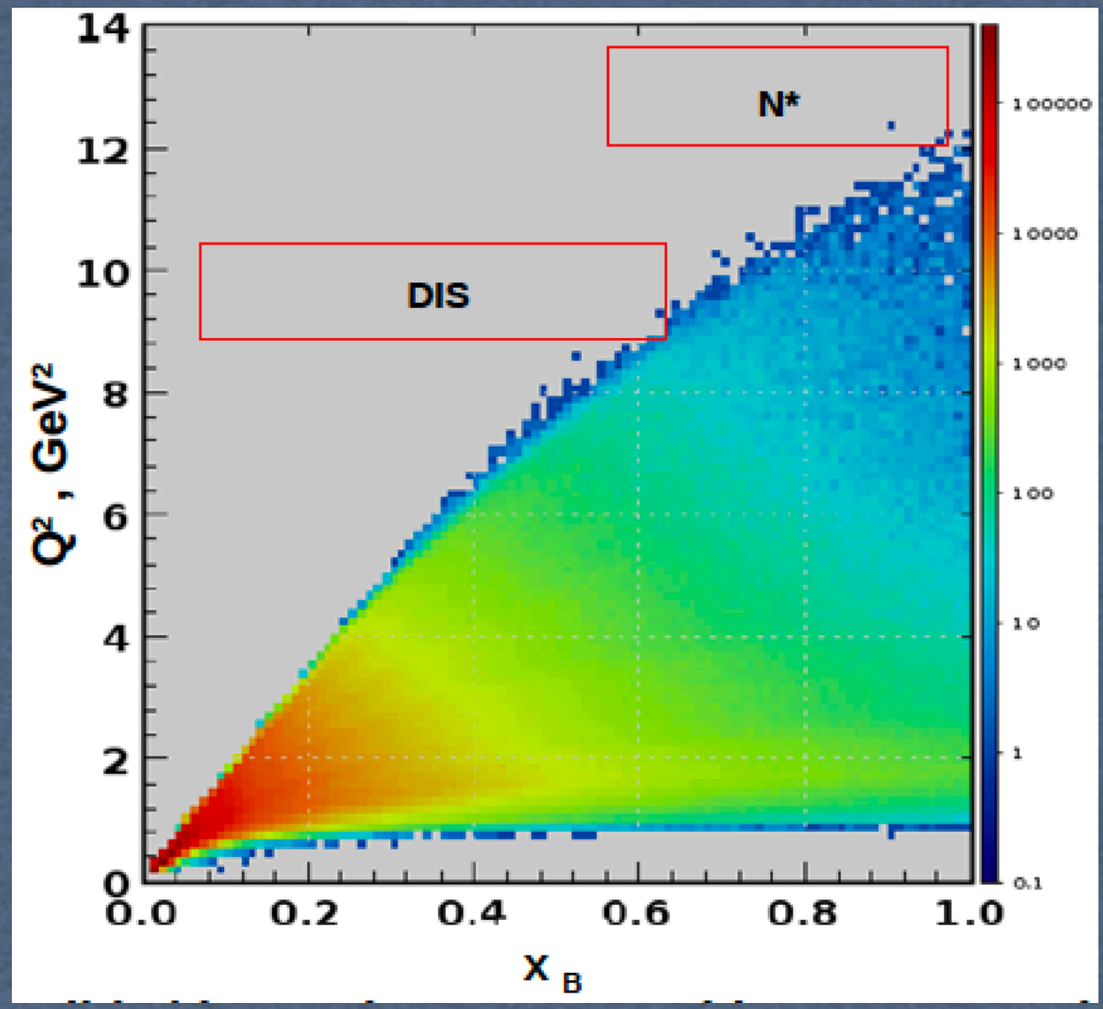
Q^2=5.0 GeV^2



Evaluation of the inclusive structure functions for the experiments with CLAS12

A. Golubenko, V. Chesnokov

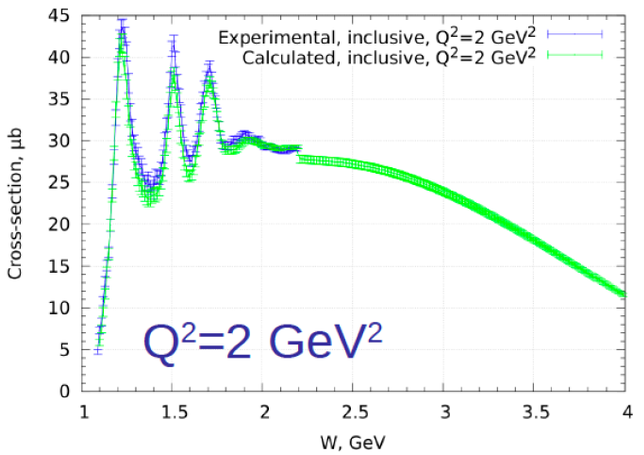
Moscow State University

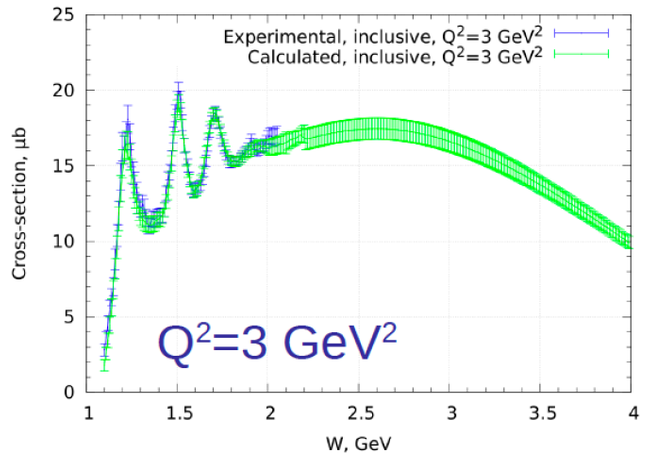


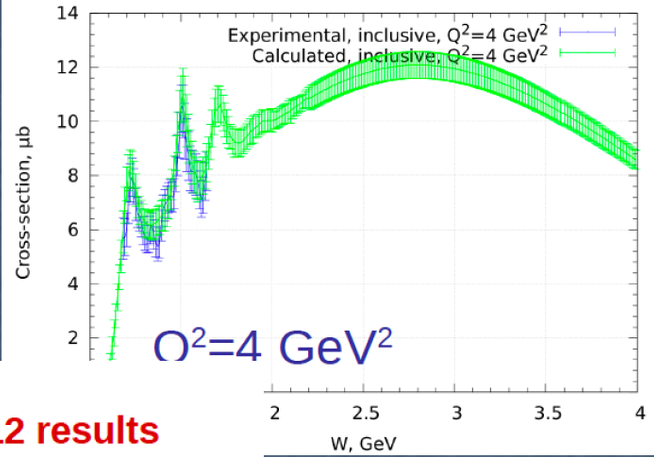
- Benchmark for the CLAS12 performance
- Check for normalization of exclusive/inclusive reaction cross-section
- Validation for the electron detection efficiency
- The tool for evaluation of inclusive electron scattering cross-section γ_v+p→p+X from the CLAS/world data was developed

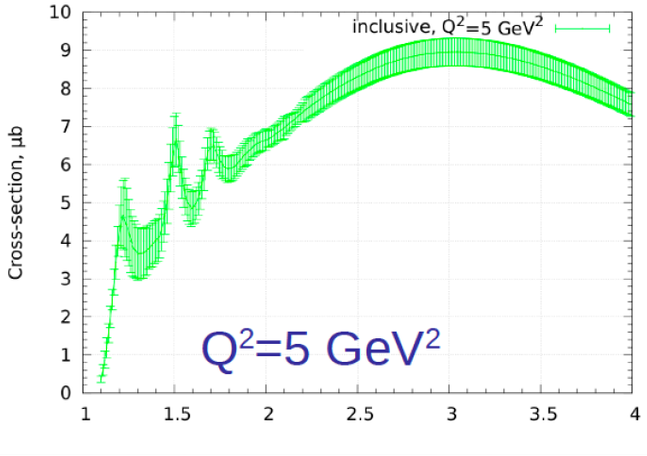
- CLAS data were used for the interpolation of inclusive cross-sections in the kinematic range covered by CLAS
- For the extrapolation of the data we used P. Bosted fit
- Combination of these interpolation/extrapolation were fitted this dependence in spirit of operator product expansion

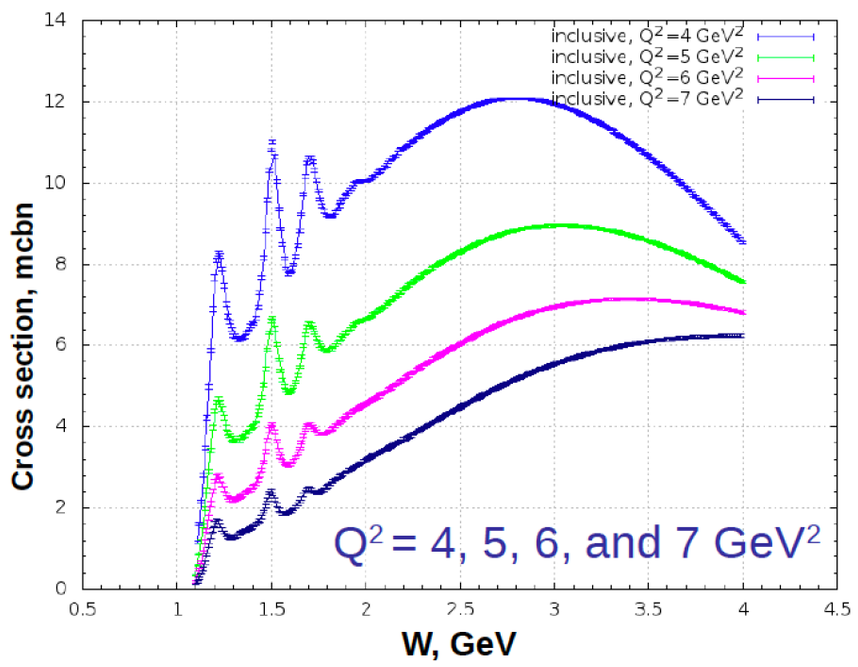
$$F_{1,2}(W,Q^2) = C_0^{1,2}(W) + \frac{C_1^{1,2}}{Q^2} + \frac{C_2^{1,2}}{Q^4} + \ldots$$





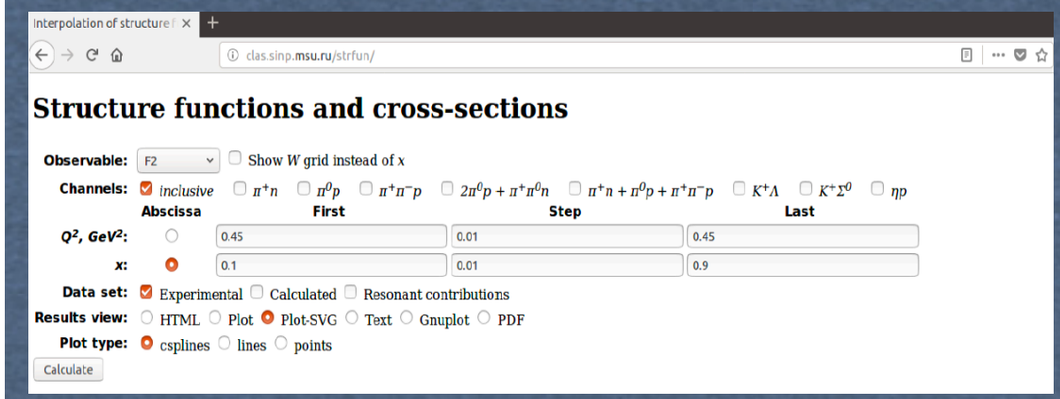






Projected CLAS12 results

- Electron beam energy: 10.6 GeV
- Integrated luminosity: $12.8*10^{10}$ mb^{-1}
- Bin sizes: W= 0.01 GeV and Q^2 = 0.1 GeV^2
- Expected statistical accuracy is in the range from 0.2% to 2.0%



A study of the $\gamma d \rightarrow \pi^+\pi^- d$ reaction

(A possible d^* resonance)

Taya Chetry
Ken Hicks
Ohio University

Reinhard Schumacher
Carnegie Mellon University

- Dibaryon: Particle with baryon number B = 2.
- Composed of six valence quarks
  - Six quarks in a bag.
- Theoretically expected and long sought resonances.

d* (2380)

Motivation

- The WASA@COSY result for ΔΔ by studying: $pn \rightarrow d\pi^0\pi^0$
- M ~ 2370 MeV, Γ ~ 70 MeV
- $I(J^P) = 0(3^+)$: Fact arrived from the reaction is purely isoscalar.

  P. Adlarson, et al., Phys. Lett. B 721 (2013) 229

  P. Adlarson, et al., Phys. Lett. B 743 (2015) 325

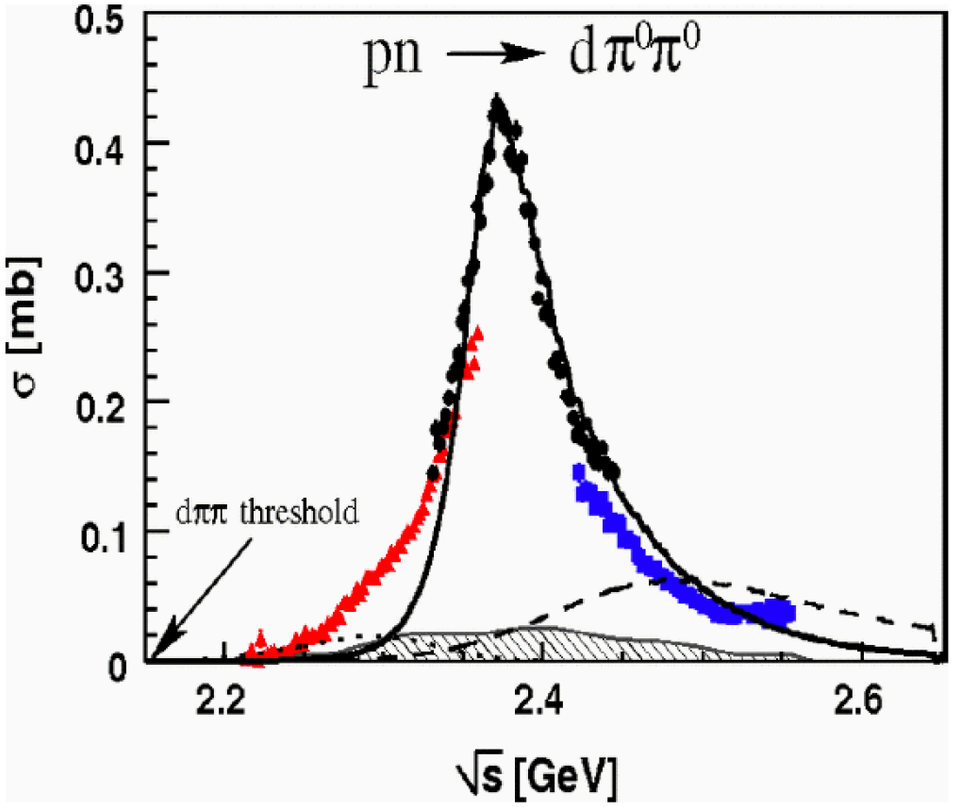
  P. Adlarson, et al., Phys. Rev. Lett. 112 (2014) 202301

  P. Adlarson, et al., Phys. Rev. C 90 (2014) 035204

- On the production of isotensor dibaryons: $pp \rightarrow pp\pi^+\pi^-$

  arXiv:1803.03192 (18 April 2018)
  arXiv:1803.03193 (18 April 2018)

  D_{21} ?



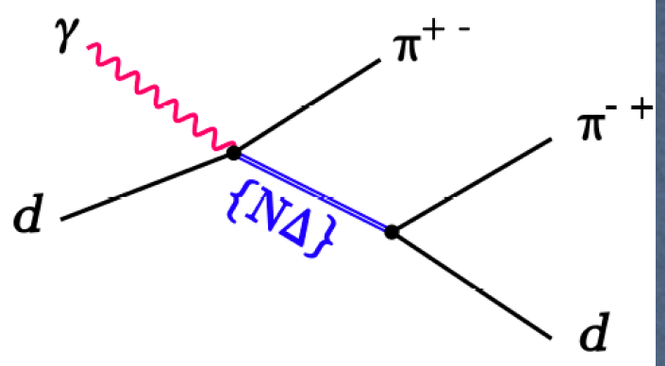
P. Adlarson *et al*
Phys Rev Lett 106, 242302 (2011)

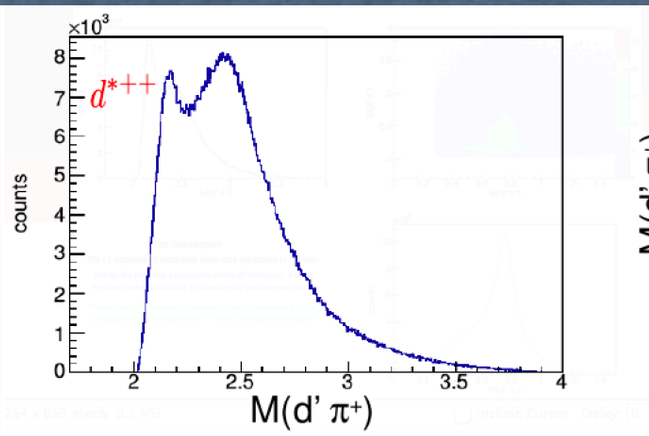
g10 @ CLAS

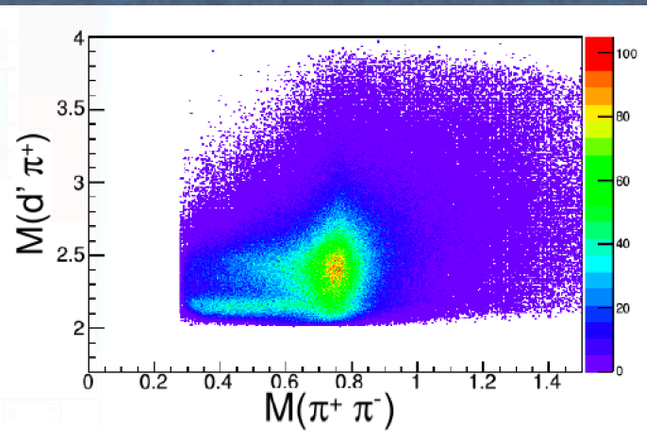
- Photons on deuteron target
- Spin:

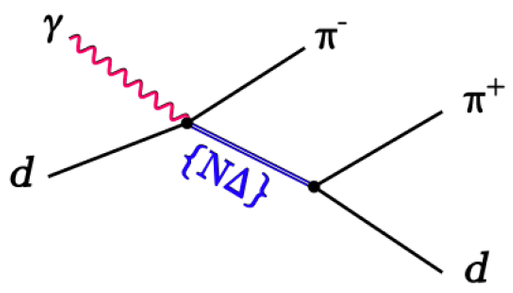
  $1 + 1 \rightarrow J = \{0, 1, 2\}$
- Isospin:

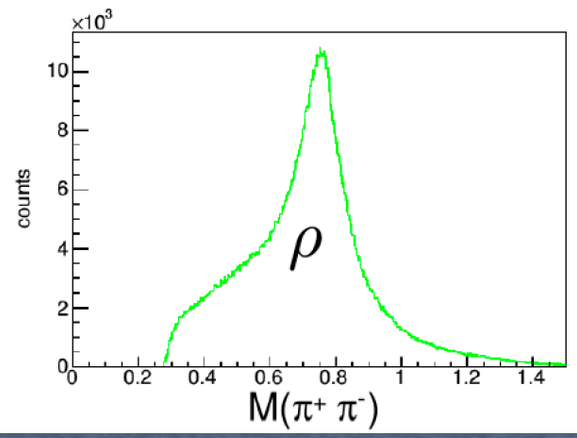
  $\{0, 1\} + 0 \rightarrow \{0, 1\}$



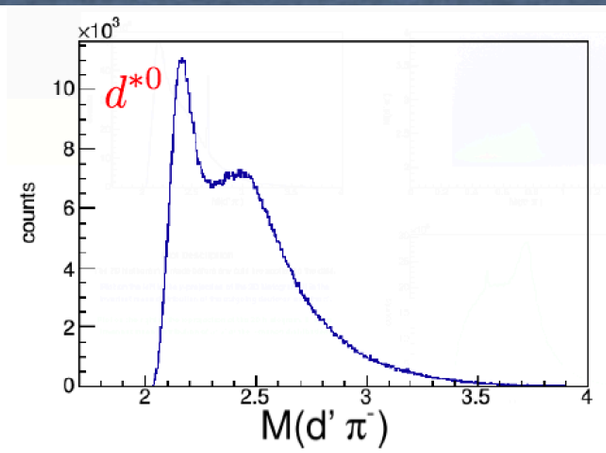


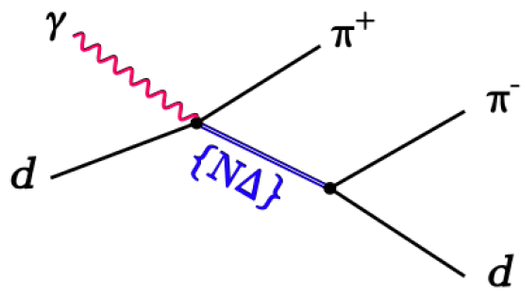


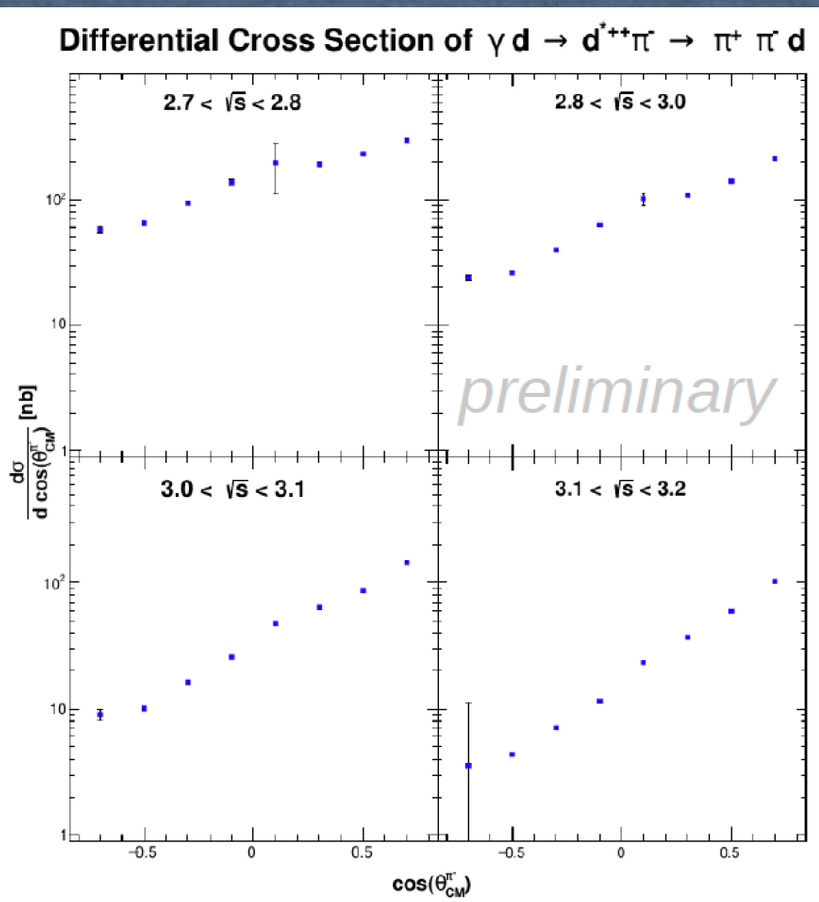




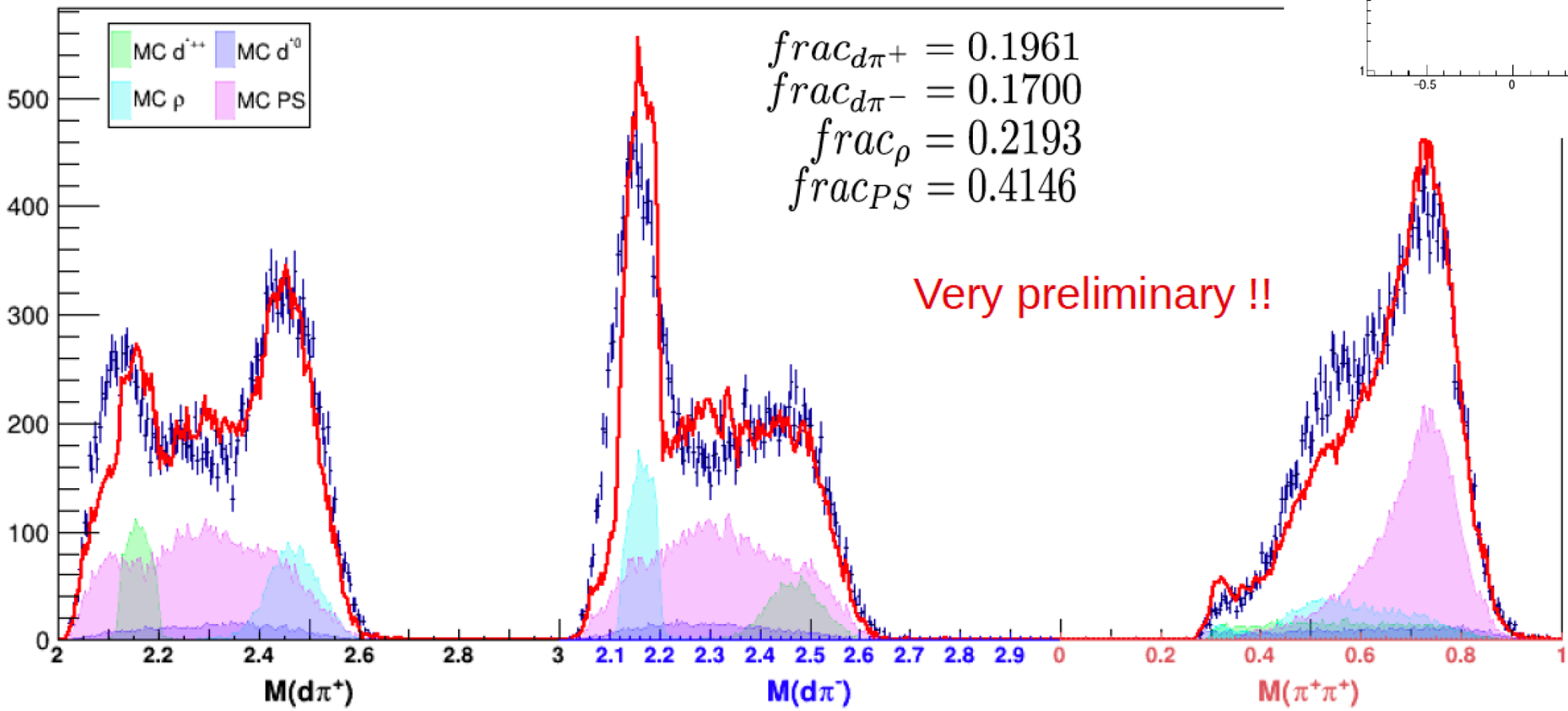
- $d\pi^+$ mass distribution.
- Basic cuts applied.
- Structure at about 2150 MeV.







$W = [2.95,3.08]$ $Cos\theta^{\pi^-}_{CM} = [-0.4,-0.2]$

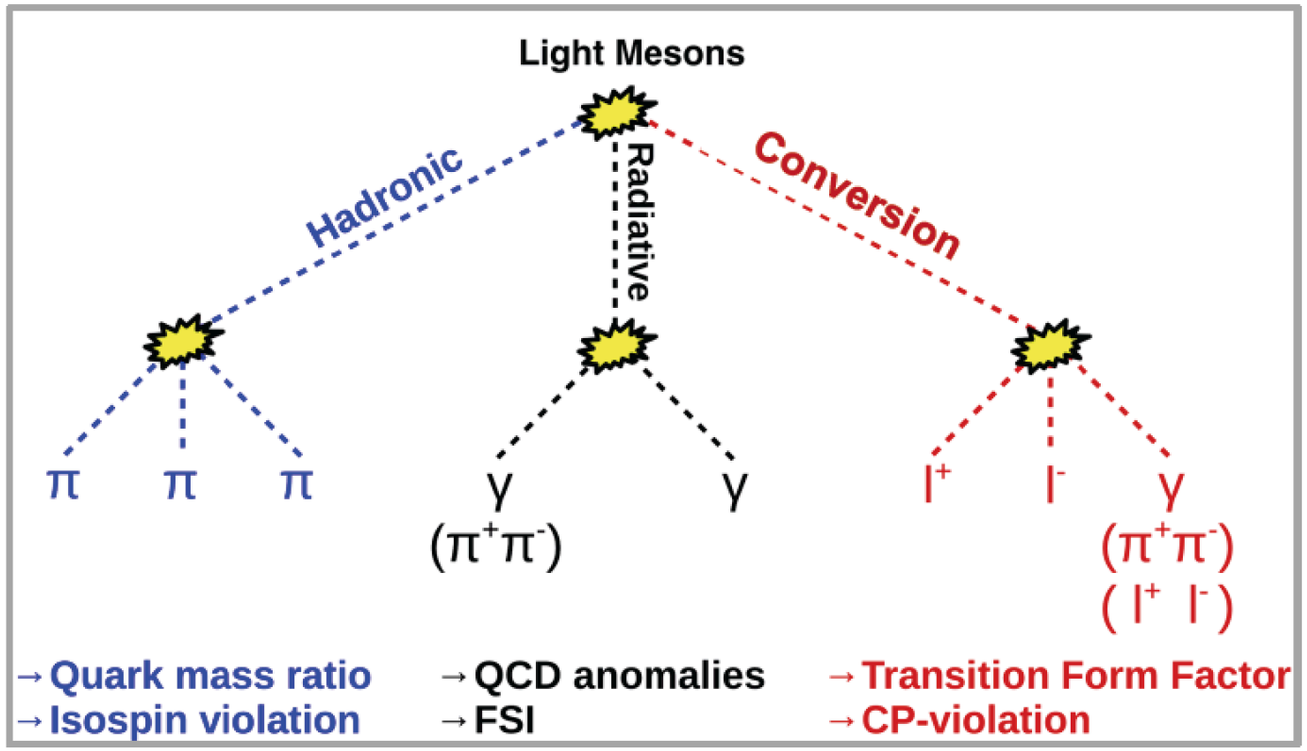


ω→πee analysis of CLAS g12 data

HSWG at CLAS collaboration meeting
July 2018

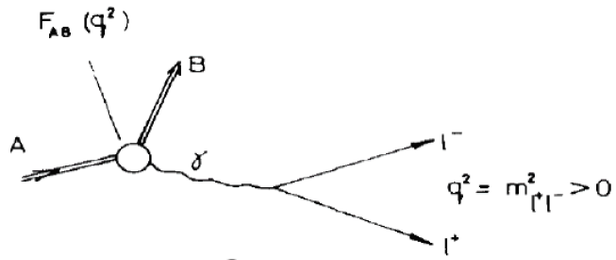
Susan Schadmand, IKP

light meson decays



hadronic decays: Dalitz plot analysis			
η → π⁰ π⁺π⁻	g12	Daniel Lersch	• analysis report in progress
ω → π⁰ π⁺π⁻	g12	Chris Zeoli	• PhD 2016 FSU
η' → η π⁺π⁻	g12,(g11)	Sudeep Ghosh	• analysis report submitted • PhD thesis submitted
f.s. η π⁺π⁻	g12	Cathrina Sowa	• PhD 2016 Bochum
radiative decays: box anomaly, branching ratio			
η' → π⁺π⁻γ	g11	Georgie Mbianda Njencheu	• analysis report submitted • PhD 2017 ODU
η → π⁺π⁻γ	g11	Torri Roark	
ρ→ π⁺π⁻γ	g11	Tyler Viducic	
conversion decays: electromagnetic transition form factor			
π → γ e⁺e⁻	g12	Michael Kunkel	• paper submitted (π^0 cross section) • PhD 2014 ODU
ω → π⁰ e⁺e⁻	g12	Susan Schadmand	
η' → γ e⁺e⁻	g12	(Michaela Schever, Master 2015)	• Jülich proposal for CLAS12 (M.Kunkel and D.Lersch),

Transition Form Factors



$$\frac{d\Gamma(A \to B\, l^+ l^-)}{dq^2 \cdot \Gamma(A \to B\gamma)} = \left|F_{A\to B}(q^2)\right|^2 \cdot |\mathrm{QED}|$$

$F_{AB}(q^2) = [1 - q^2/\Lambda^2]^{-1}$ (single) pole approximation

$$F_{AB}(q^2) \simeq 1 + q^2[\mathrm{d}F_{AB}/\mathrm{d}q^2]\big|_{q^2\simeq 0} = 1 + q^2 b_{AB} = 1 + \tfrac{1}{6} q^2 \langle r^2_{AB}\rangle$$

$\Lambda \simeq m_\rho$ $(\Lambda^{-2} = b_{AB})$

'standard' VMD, b~1.69/GeV²

slope parameter

size (transition region)

ω→πee cut-based g12 analysis

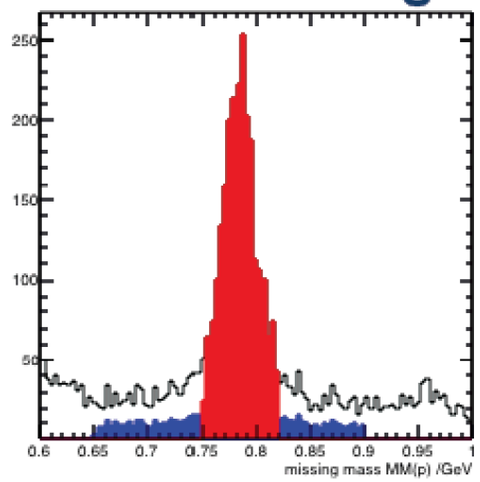
corrections and cuts*:

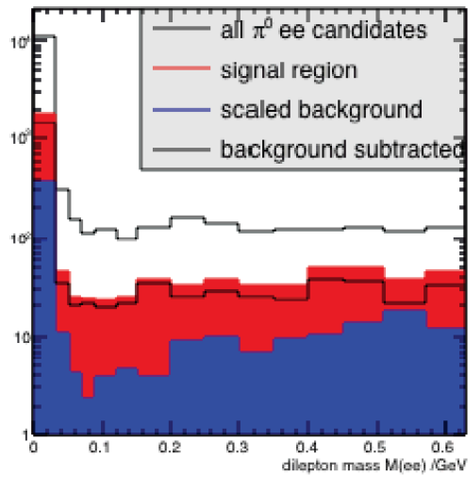
- skim:
  =1proton and =1positive and =1negative topology
- available root tree:
  =1electron and =1positron (IsLepG7)

- data only:
  - loop over in-time photons
  - beam corrections
  - momentum corrections

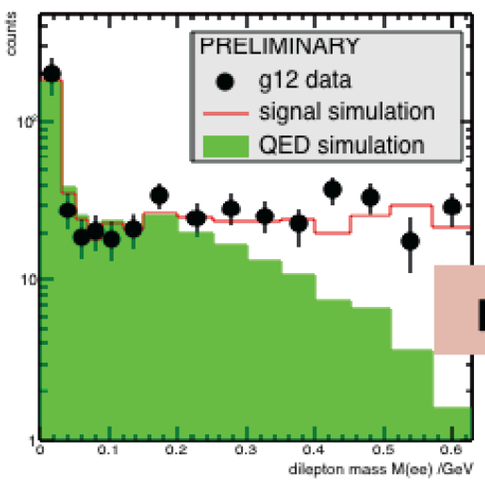
- event cuts:
  - sqrt(Vx*Vx+\
  - abs(Ep_Beta
- fiducial and TOF
  - (Em_tofpass && Ep_

smooth background subtraction

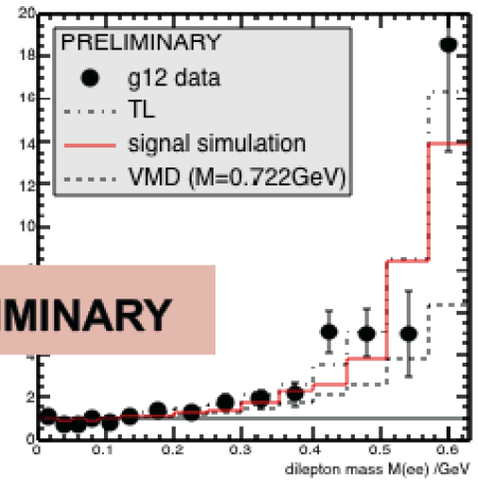




in-peak and smooth background subtracted

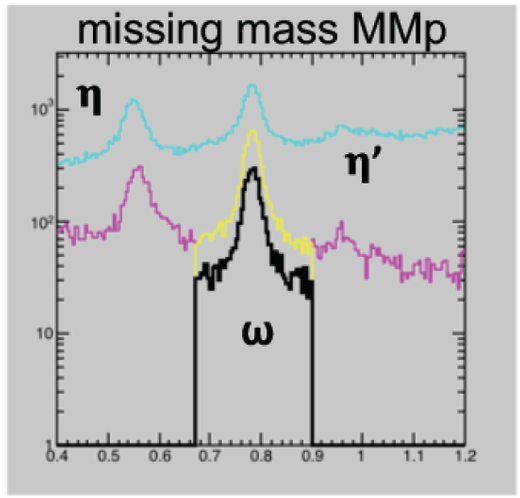


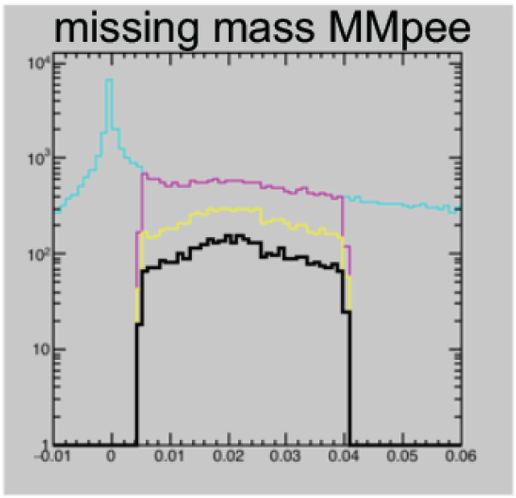
data / QED simulation

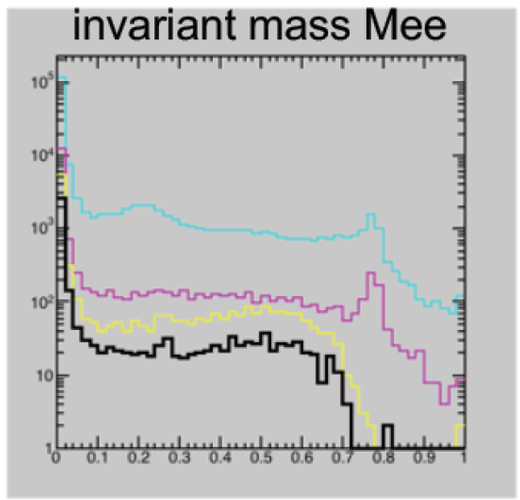


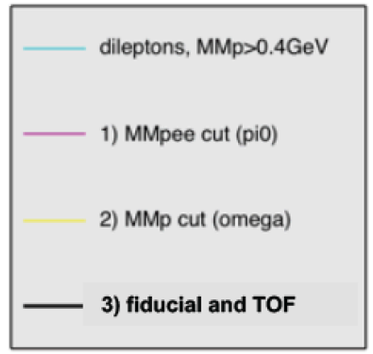
PRELIMINARY

analysis strategy cut-based analysis



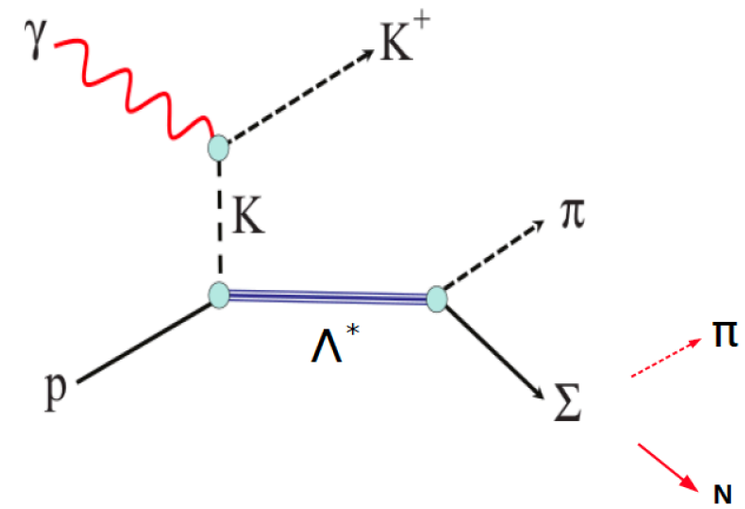






A Study of γp → K⁺Λ* reaction

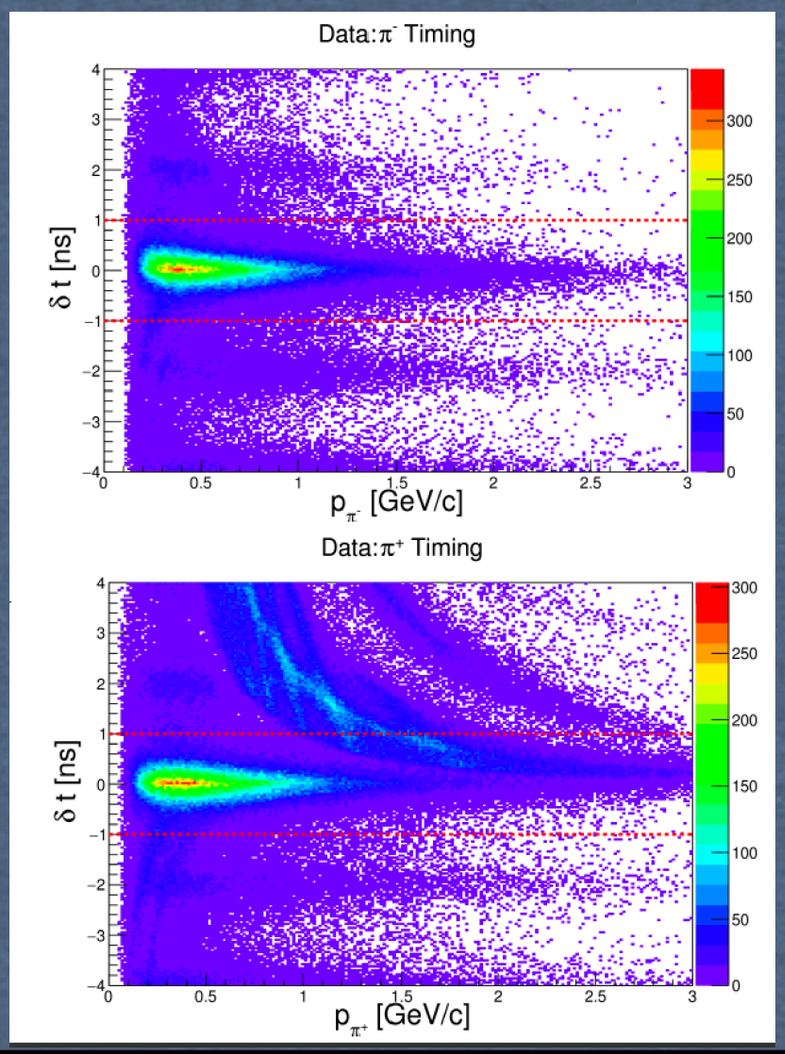
U. Shrestha, T. Chetry and K. Hicks
Ohio University

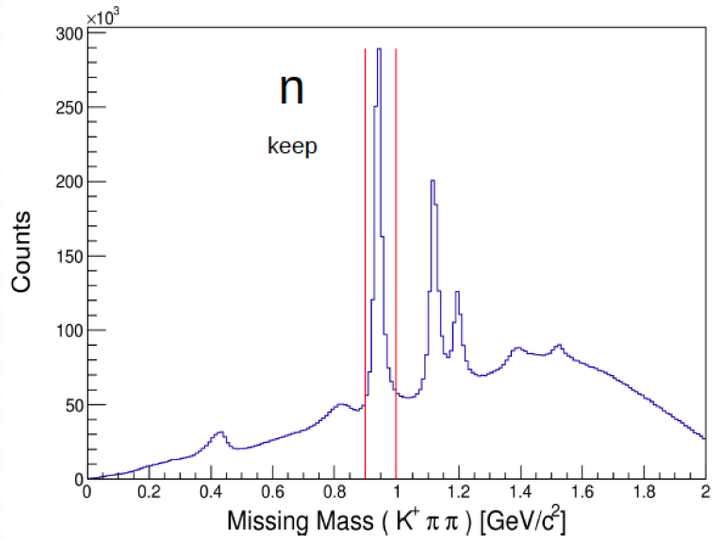


$\gamma + p \rightarrow K^+ + \Lambda^*$

$\Lambda^* \rightarrow \Sigma^+ + \pi^-$

$\Lambda^* \rightarrow \Sigma^- + \pi^+$

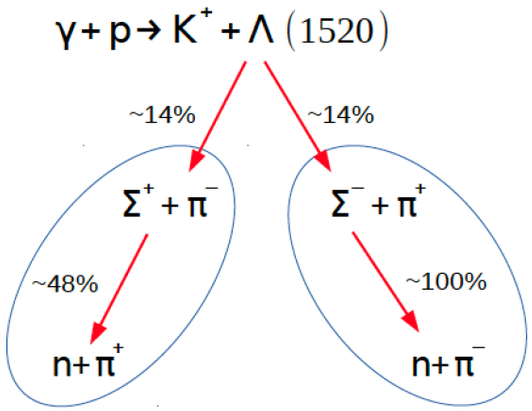


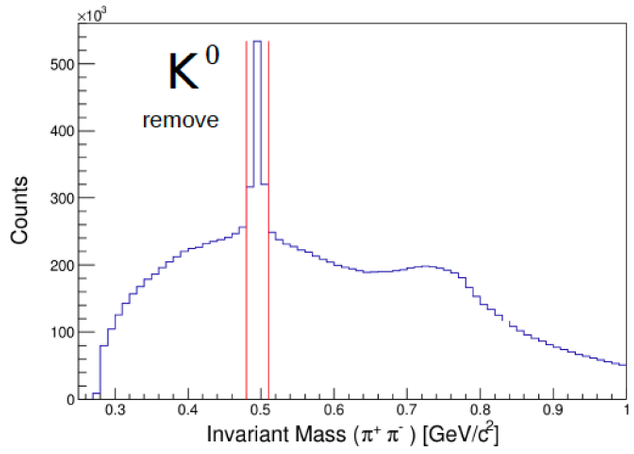


Cuts

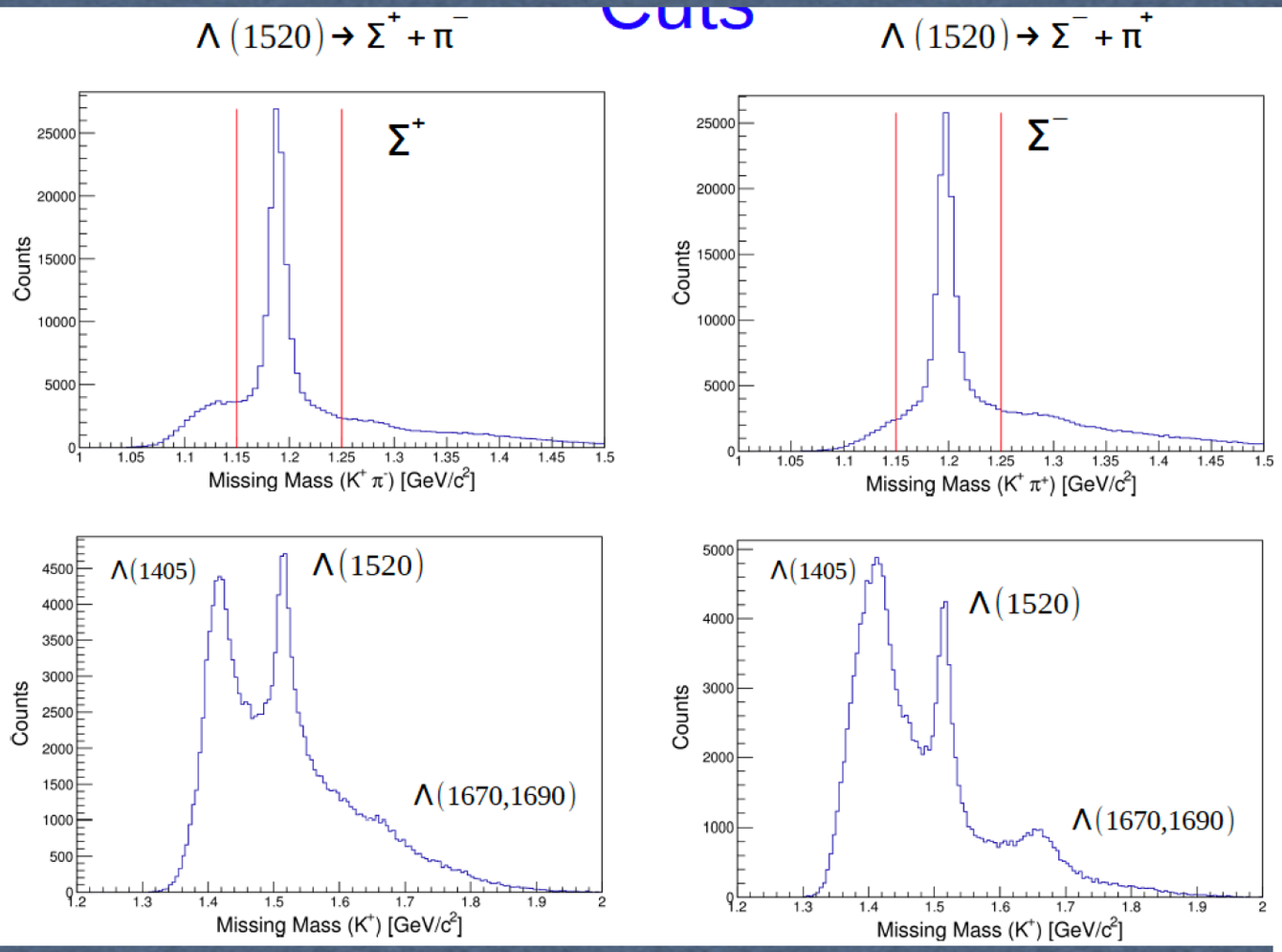
$0.9 < MM(K^+\pi\pi) < 1.0$ [GeV]

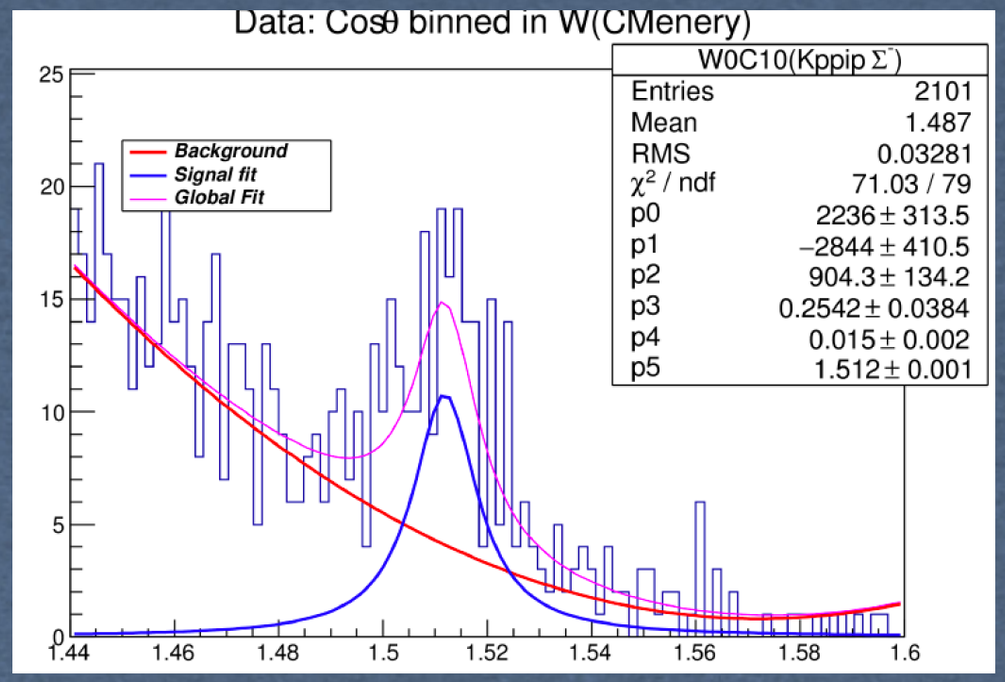
$\gamma + p \rightarrow K^+ + \Lambda(1520)$



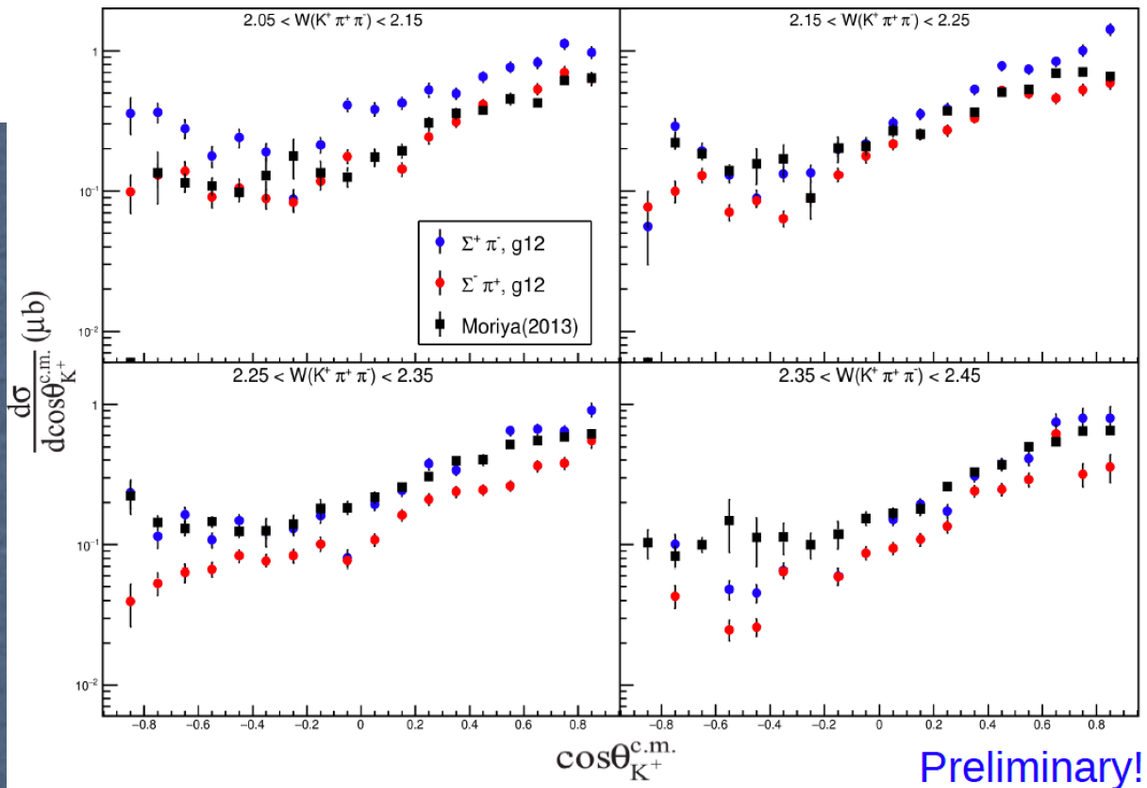


Cuts





Differential Cross-section

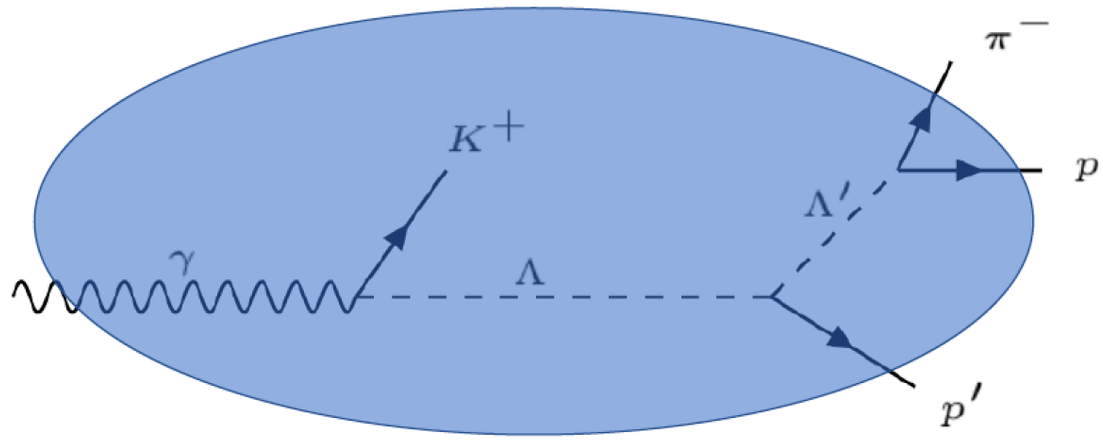


Preliminary!!!

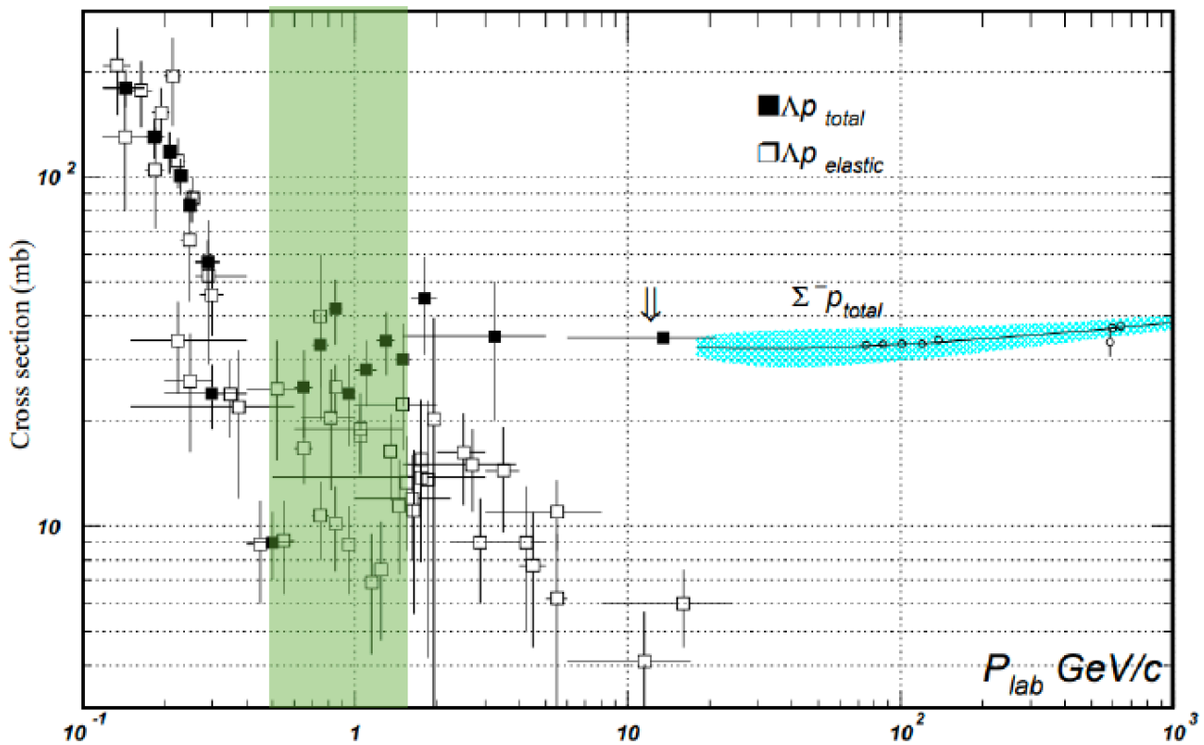
Preliminary Lambda-Nucleon Scattering with g12 at Jefferson Lab

Joey Rowley, Kenneth Hicks (Ohio University)
John Price (Cal State Univ Dominguez Hills)

Reaction

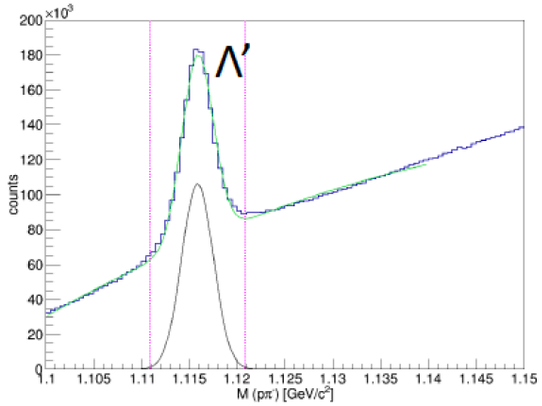


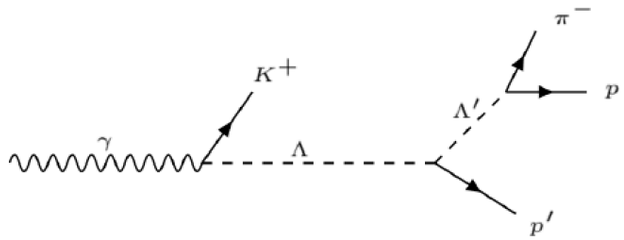
- p, p', π^- detected
- $\Lambda p'$ scatter elastically

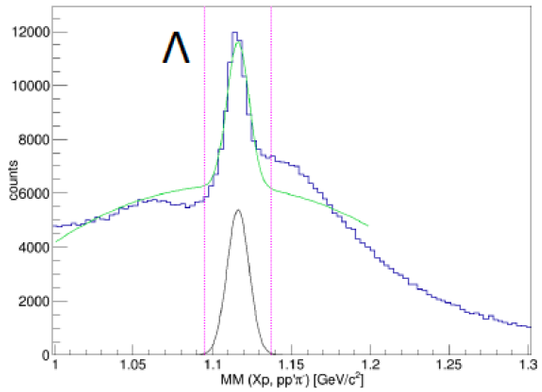


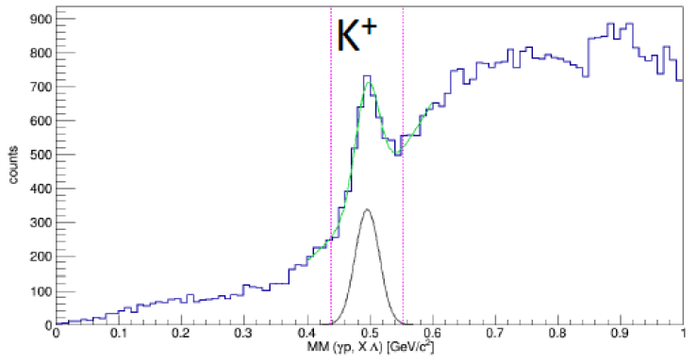
$$\gamma p \rightarrow K^+ \Lambda$$
$$\Lambda \mathrm{p} \rightarrow \Lambda' p' \rightarrow p' p \pi^-$$

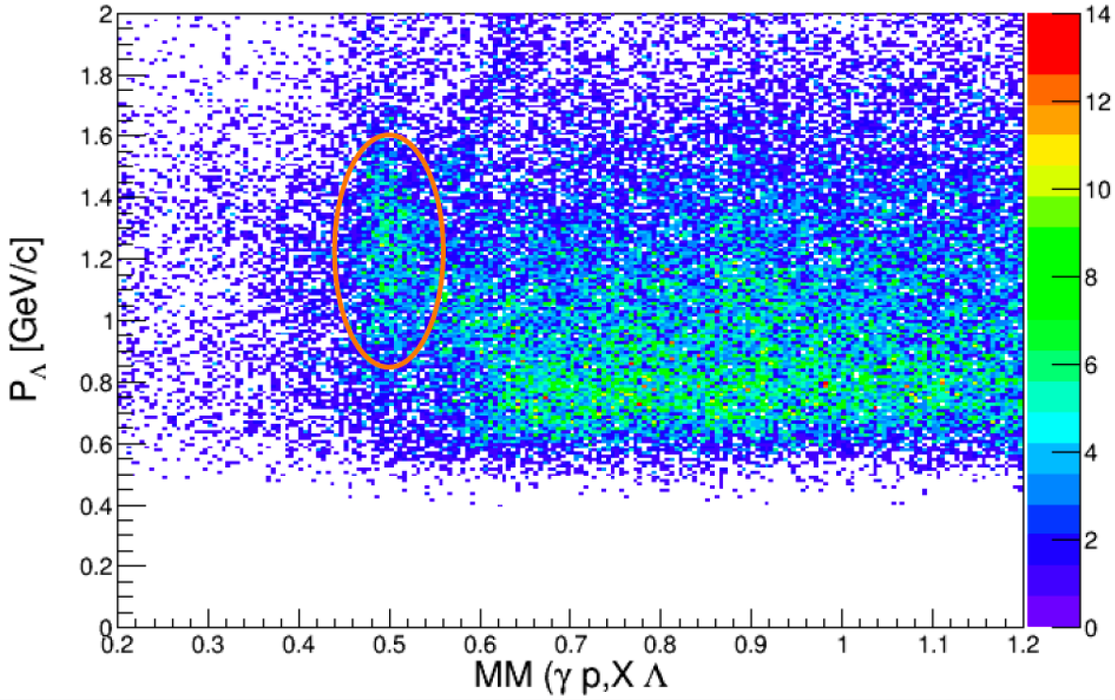
- Data from g12
- Reconstruct Λ' mass: $M(\Lambda') = M(p\pi^-)$
- Reconstruct incident Λ
- Identify K^+ by missing mass
- Use known $K^+\Lambda$ cross section to get flux











$$\frac{d\sigma}{dcos(\theta)}(E) = \frac{Y}{A * \mathcal{L} * \text{b.r.} * \Delta\cos(\theta)}$$

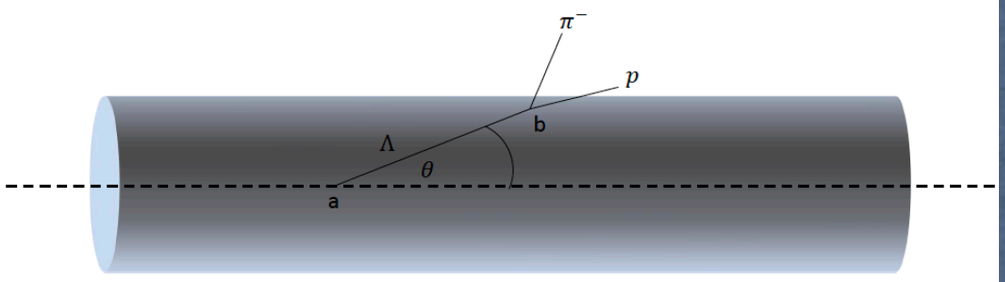
Y: Yield
A: Acceptance
$\mathcal{L}$: Luminosity
b.r: Branching ratio (for $p\pi^-$)

$\frac{d\sigma}{dcos(\theta)}(E)$: Energy dependent cross section

$$L_\Lambda(E_\Lambda) = \frac{\rho_T * N_A * l}{M} * N_\Lambda(E_\Lambda)$$

Λ Decay Length (l)

Assume Simplest case: Lambda along z-axis

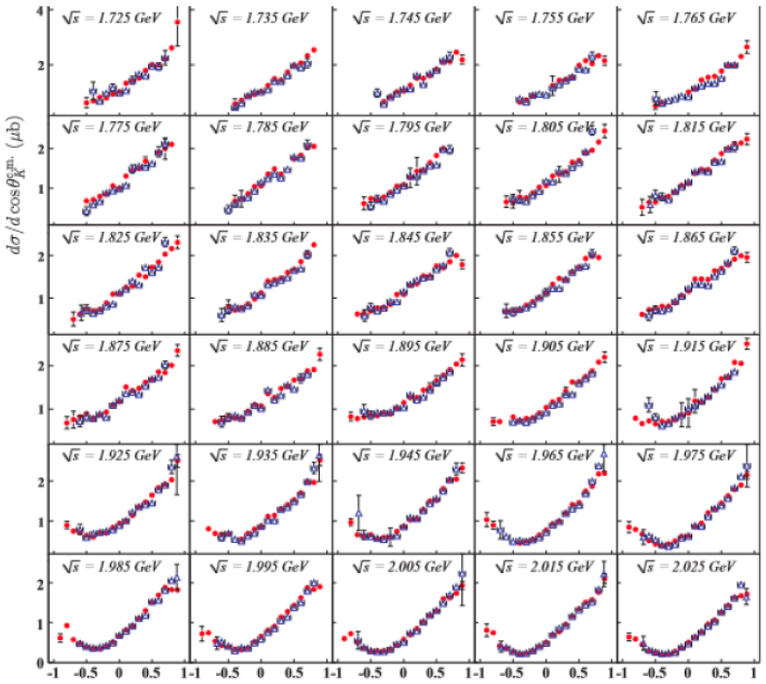


Distance between a and b is the Λ decay length

$$L_\Lambda(E_\Lambda) = \frac{\rho_T * N_A * l}{M} * N_\Lambda(E_\Lambda)$$

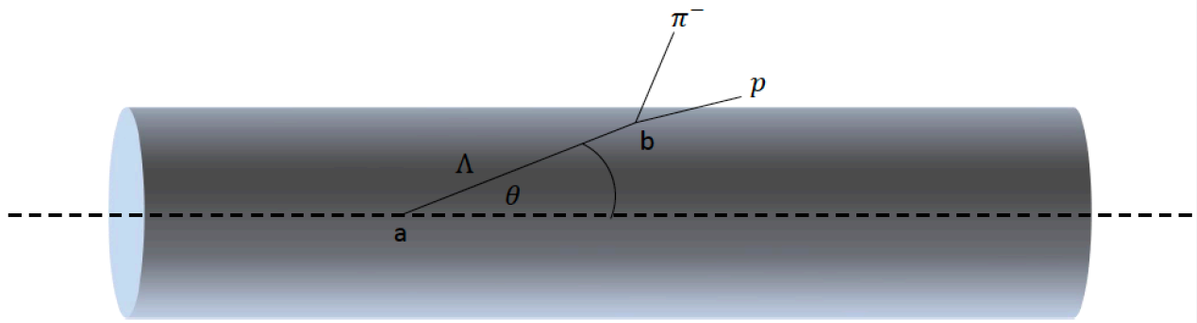
$N_\Lambda(E_\Lambda)$

$$\frac{d\sigma}{d\Omega} = \frac{N_\Lambda}{2\pi * L_\gamma * \Delta\cos(\theta)}$$

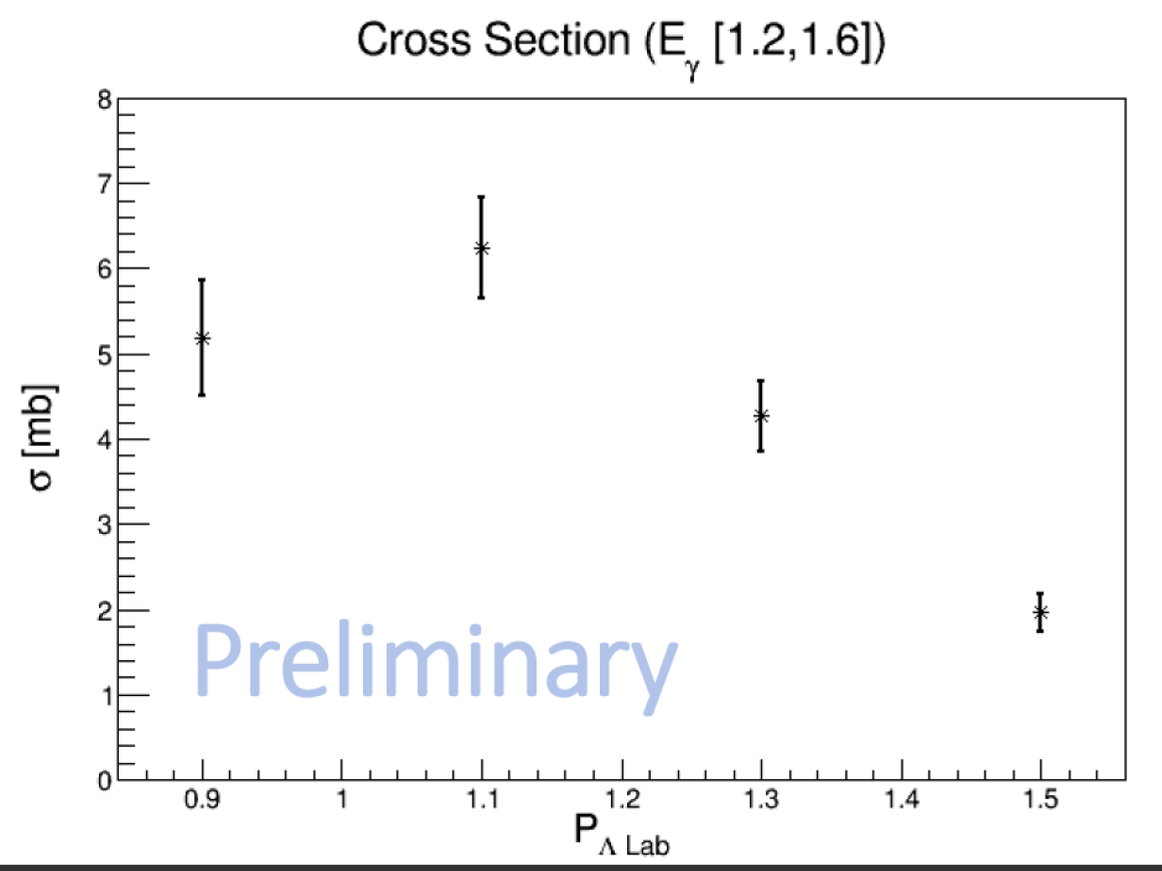


Λ Decay Length (l)

Assume Simplest case: Lambda along z-axis

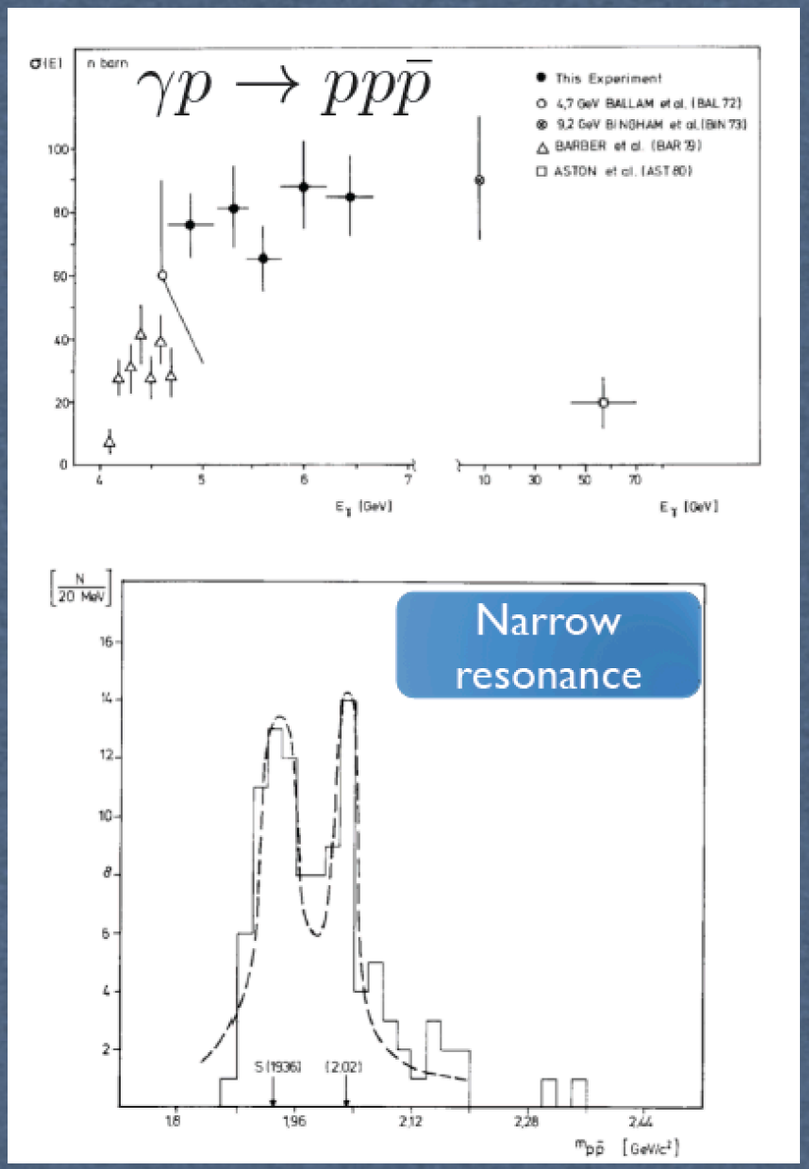


Distance between a and b is the Λ decay length

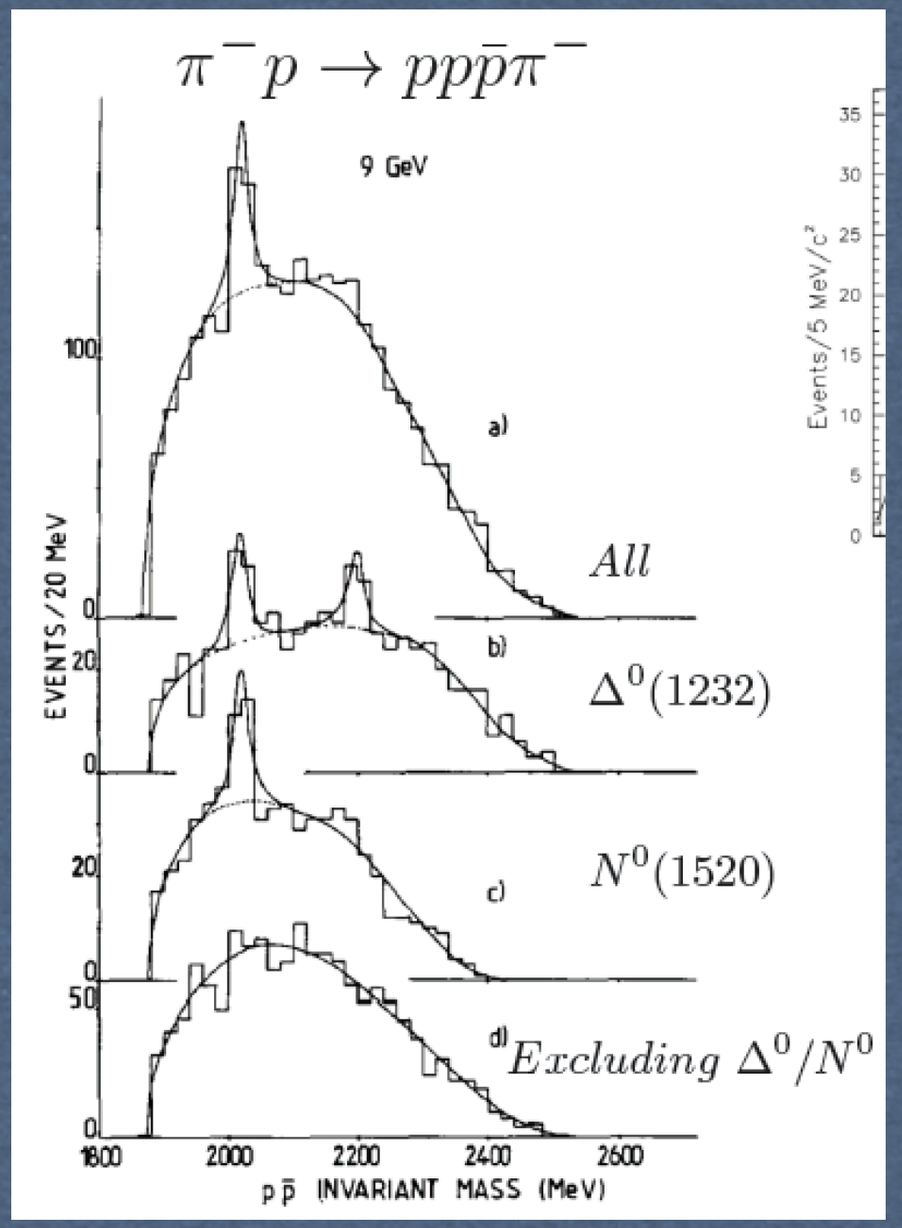


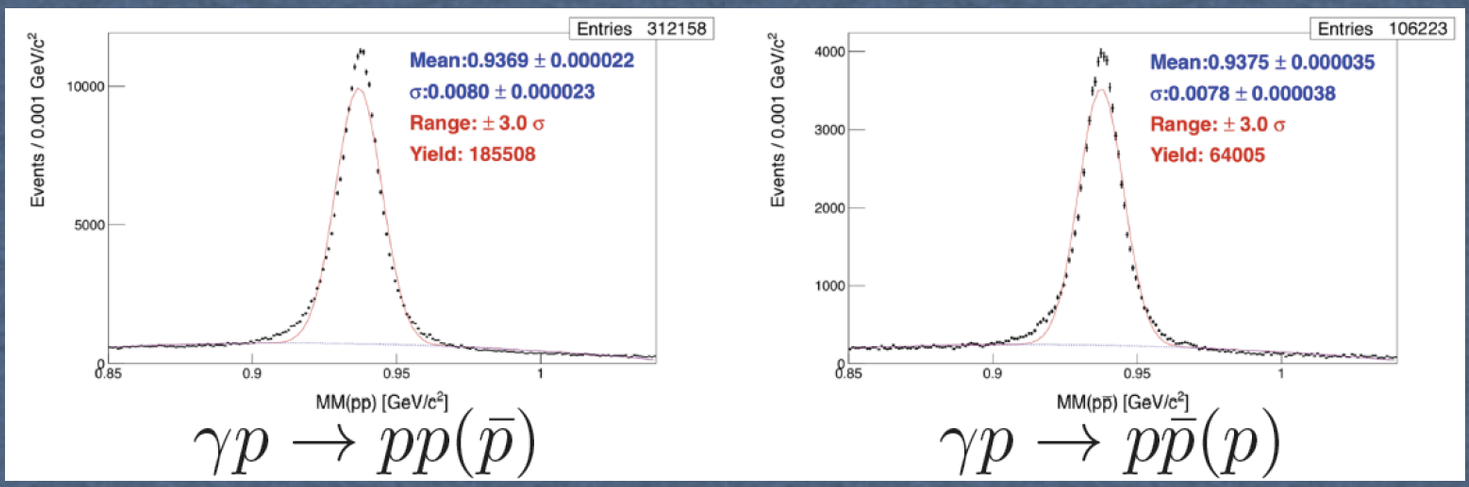
ANTIBARYON PHOTOPRODUCTION USING CLAS AT JEFFERSON LAB

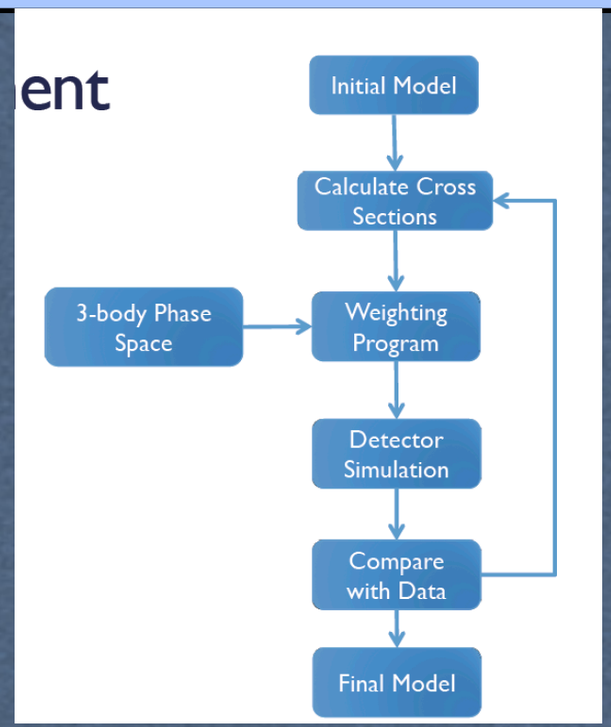
William Phelps

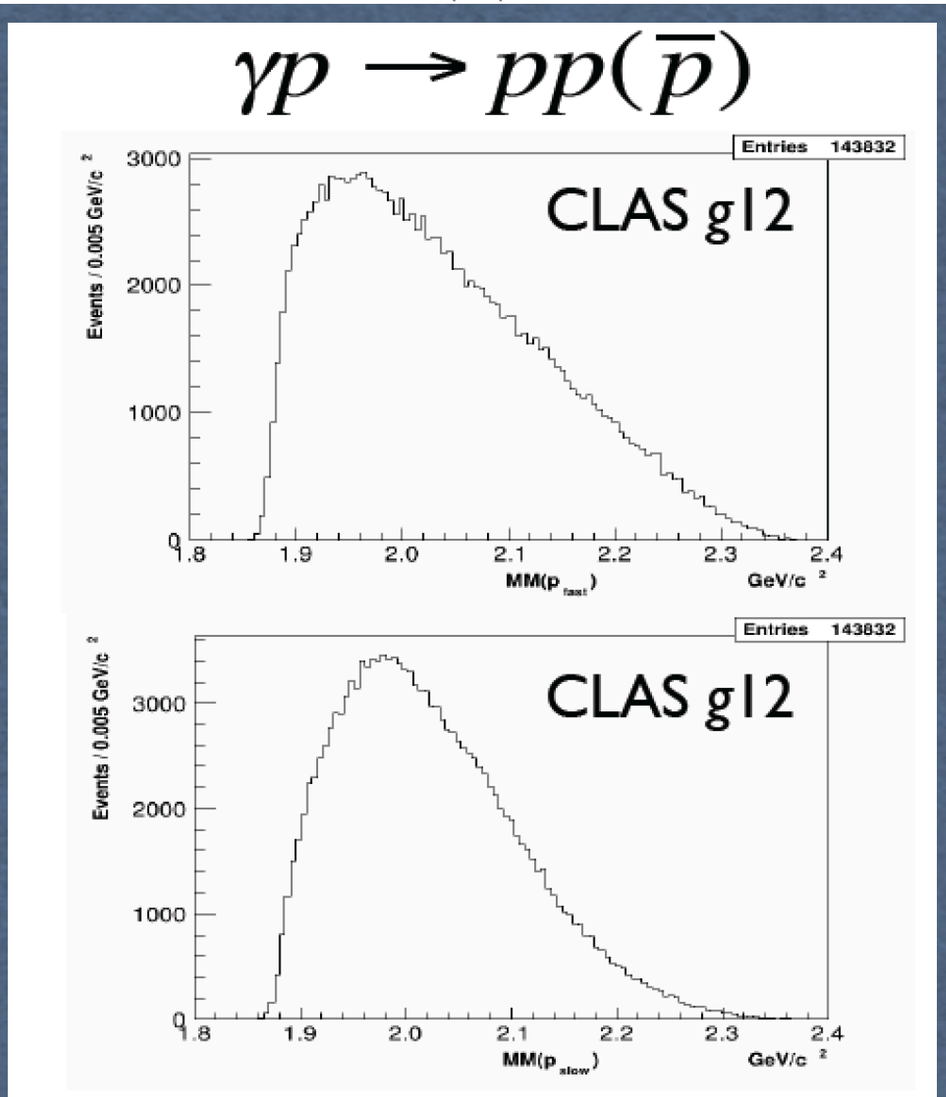


- Narrow resonances have been long been sought after as potential baryonium states
- Early photoproduction experiments from DESY and LAMP2 claim to see evidence for narrow resonances at 2.02 and 2.2 GeV
- Narrow resonances observed in pion production with the latest results still showing evidence for a narrow resonance



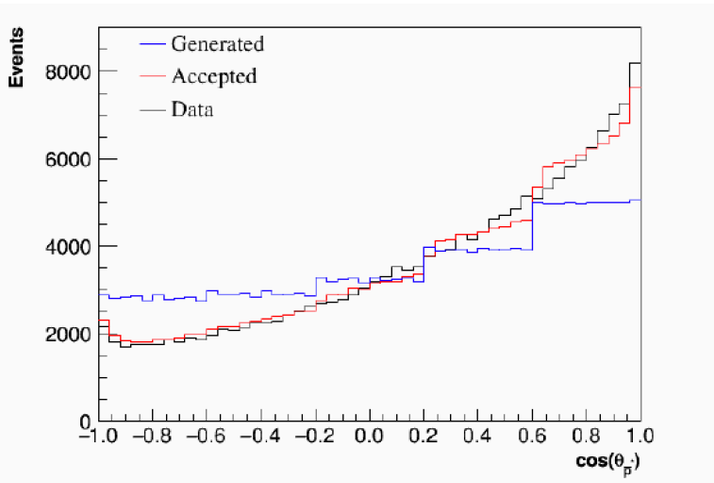


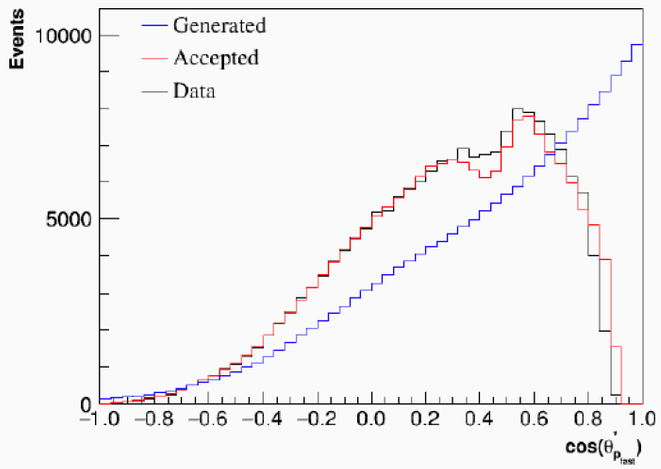


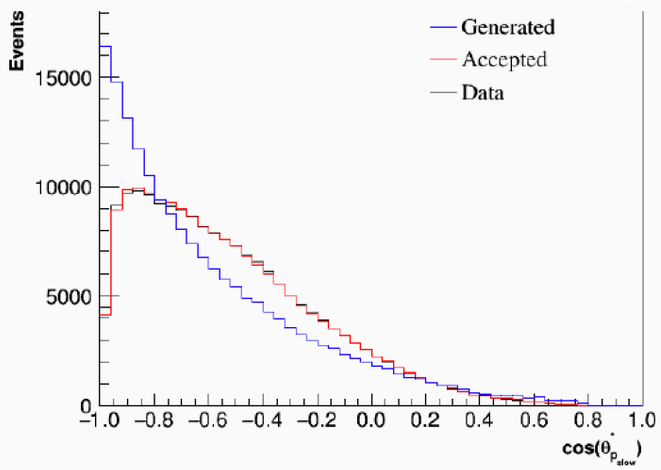


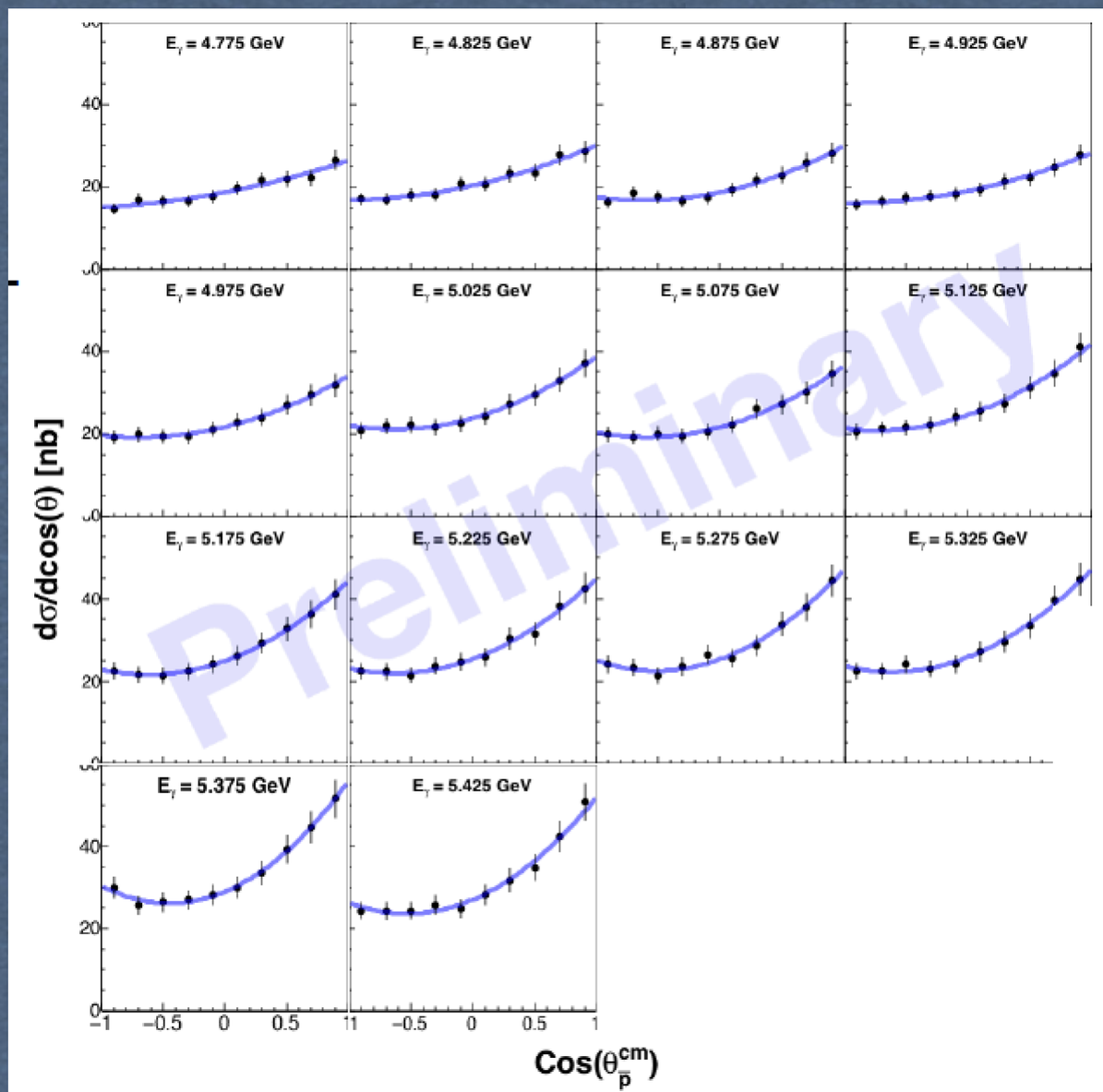
MC Comparison

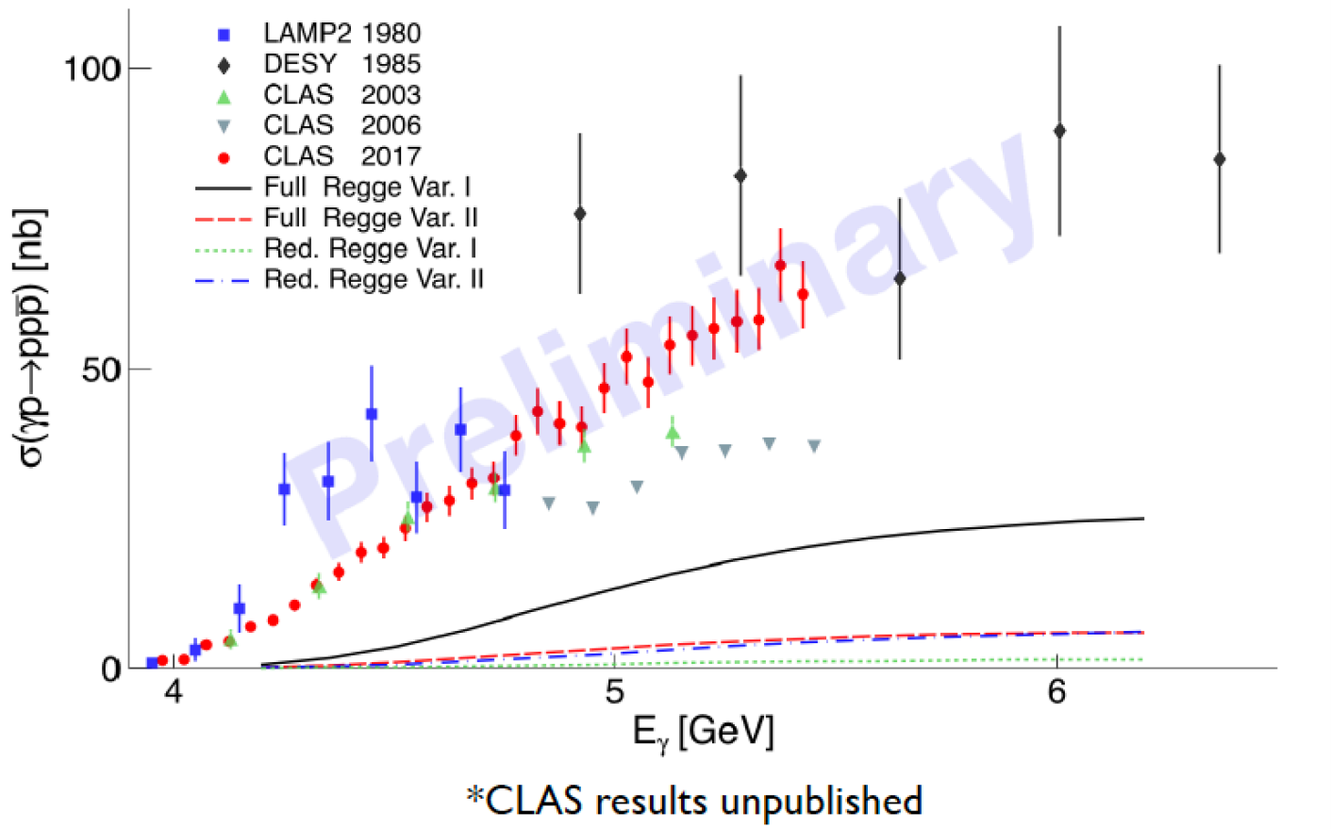
- The final model from the new generator matches the data very well in all kinematic distributions
- Further tuning and interpolation of the cross sections could improve results further









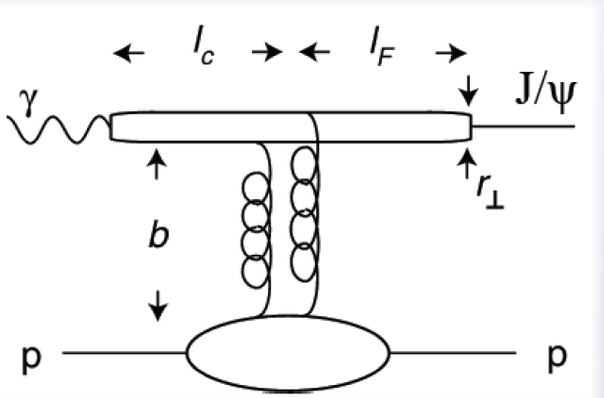


*CLAS results unpublished

Study of J/ψ Photoproduction off Deuteron
PR12-11-003B

M.D. Baker, A. Freese, L. Guo, Ch. Hyde, **Y. Ilieva**, **B. McKinnon**, **P. Nadel-Turonski**, M. Sargsian, **V. Kubarovs**, **S. Stepanyan**, N. Zachariou, **Zh.W. Zhao**

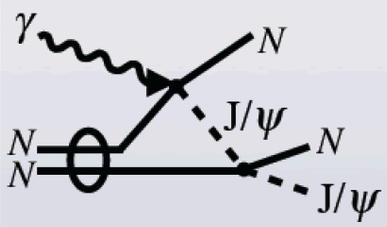
- Final-State Interactions (J/ψN rescattering)
  - Estimate $\sigma_{J/\psi N}$
- Quasi-free photoproduction off neutron: $\gamma(n) \rightarrow J/\psi n$
  - Search for isospin partners of LHCb pentaquarks
  - Test bound-nucleon gluonic form factors
- Coherent photoproduction: $\gamma d \rightarrow J/\psi d$
  - Study gluonic form-factor of deuteron



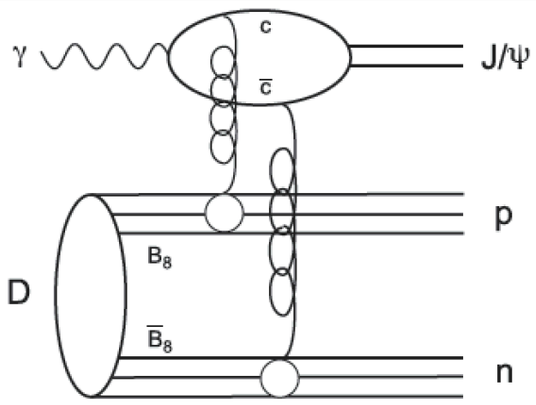
- Small transverse size: $r_\perp \sim 1/m_c = 0.13$ fm
- $E_{thr} = 8.2$ GeV, $l_c \simeq 2E_\gamma^{lab}/4m_c^2 = 0.36$ fm
- At threshold, $|t_{min}| = 1.7$ (GeV/c)^2
- $b \sim 1/|t|^{1/2} = 0.2$ fm
- The $c\bar{c}$ couples to the gluon field in the target. Process dominated by multi-gluon exchange.
- Probes the short-range structure of the target.

S. J. Brodsky, E. Chudakov, P. Hoyer, J.M. Laget, Phys. Lett. B 498, 23 (2001).

Incoherent Photoproduction: J/ψN FSI



- Direct access to J/ψN→J/ψN and the elementary J/ψN total cross



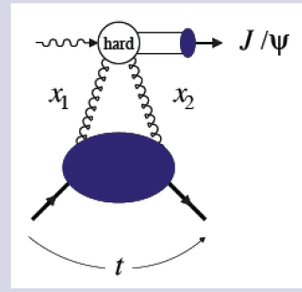
Hidden-color component contribution dominates the cross section above neutron momenta of 500 MeV/c.

Coherent Photoproduction

The t-dependence of the cross section can provide access to the deuteron gluonic structure (gluon form factor)

E_{thr}=5.66 GeV →$|t_{min}|$=3.31 (GeV/c)^2

E=11 GeV →$|t_{min}|$=0.26 (GeV/c)^2



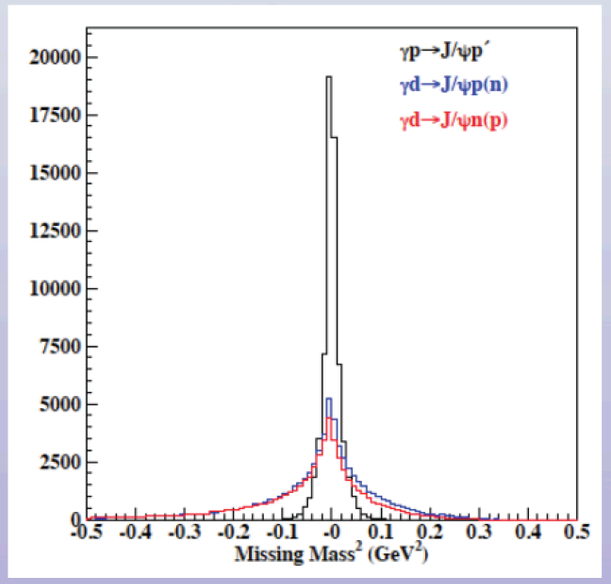
$\varsigma = x_1 - x_2$

Large skewness

Hard scale set by the $c\bar{c}$ distance $r_\perp$~1/m_c=0.13 fm. Probe is hard for all Q^2.

Quasi-Free Quasi-Real Photoproduction off Bound Proton and Neutron

$ed \rightarrow J/\psi N(e'N_s)$



Detected: strike nucleon, J/psi decay products

Undetected: scattered electron, spectator nucleon

QF QR production identified kinematically by selection of events with small missing transverse momentum and small missing mass, assuming the target was at rest:

$$eN \rightarrow J/\psi NX,\ X \equiv e'$$

$E_\gamma = p_{N,z} + p_{J/\psi,z}$

Quasi-Real Incoherent Photoproduction

$ed \rightarrow J/\psi pn(e')$

Detected: scattered nucleons, J/psi decay products

Undetected: scattered electron

CLAS Acceptance estimated with latest MC (4a.2.3) and reconstruction (5c.3.5): overall acceptance for rescattering: 5%.

Cross section estimates from model of A. Freese et al.

Expected total FSI yield: less than 10% of total QF yield, i.e. < 1 - 2 FSI events/day

In addition: $ed \rightarrow J/\psi Ne'(N)$, making use of the forward tagger.

Compatibility with Run Group B

Proposed measurements are compatible Run Group B Configuration

- Unpolarized LD2 target and 11-GeV electron beam, L=10^{35} $s^{-1}cm^{-2}$.
- Standard CLAS electron trigger.
- Charged-hadron detection in the Forward and Central Detectors.
- Neutron detection in the Forward Detector (will look for CND capabilities as well).
- Full torus field; electrons in-bending (75%), electrons out-bending (25%).
- Forward Tagger in operation.

Addition trigger: muon trigger (established in RGA).

Coherent Photoproduction

$ed \rightarrow J/\psi d(e')$

Detected: scattered deuteron, J/psi decay products

Undetected: scattered electron

No current cross section model estimates. Published data for φ photoproduction off proton and deuteron targets, $\frac{\sigma_{\gamma d \rightarrow \phi d}}{\sigma_{\gamma p \rightarrow \phi p}} = 1 - 4\%$.

Expected total coherent yield: ~ 1 event /2-3 PAC days. Expected t-coverage, 0.3 - GeV/c^2.