Update on RG-D Alignment and CT Analysis Status

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Mississippi State University

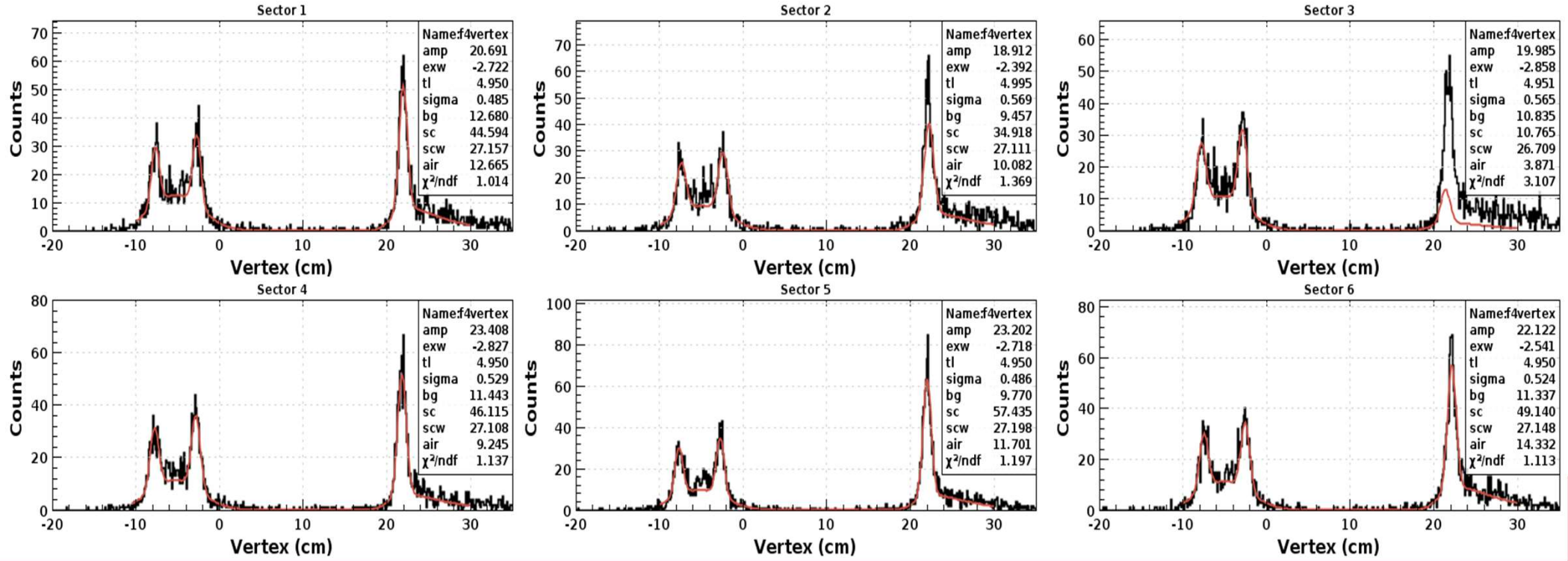
CLAS Collaboration Meeting
March 13th, 2024

Outline

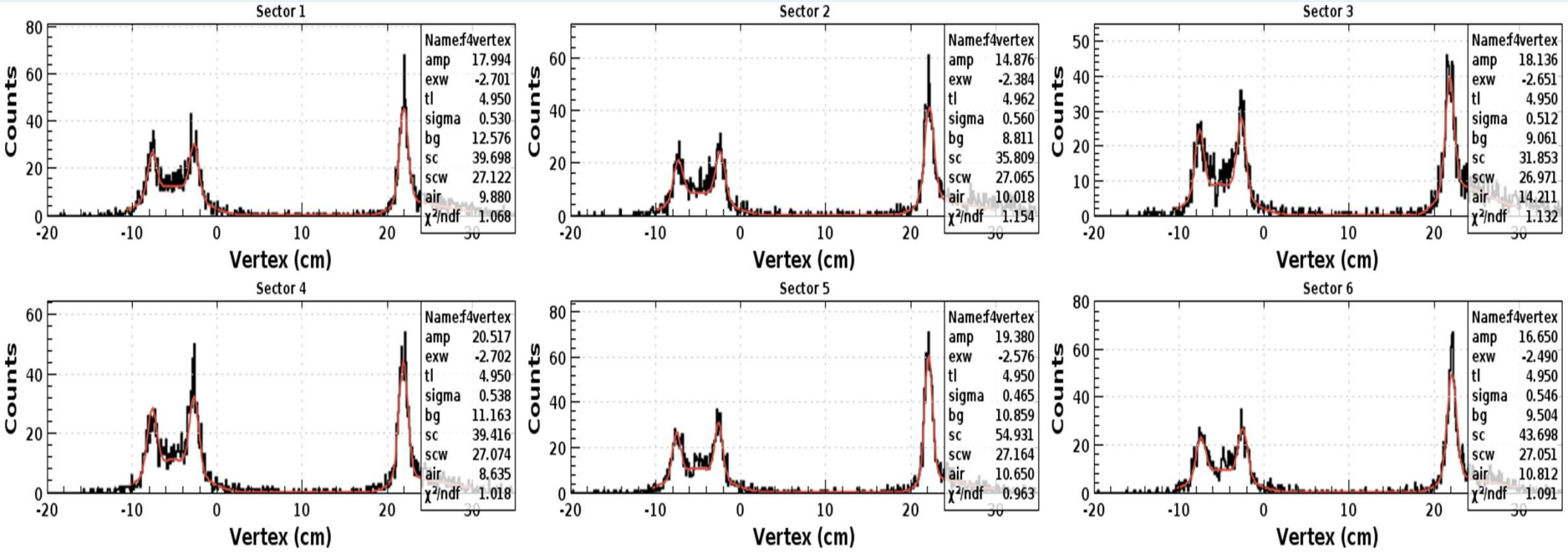
- Alignment Status
- Color Transparency (CT) Analysis Status:
  - $\pi^+\pi^-$ Invariant Mass Distributions
  - Background-Subtracted ρ^0 Distributions
  - Very Preliminary Nuclear Transparency Analysis Result
- Summary and Outlook

Previous Alignment Results: z-Vertex Distribution

- The first peak corresponds to the upstream window of empty cryogenic cell.
- The second peak corresponds to the downstream window of empty cryogenic cell.
- The downstream peak represents the scattering chamber exit window.



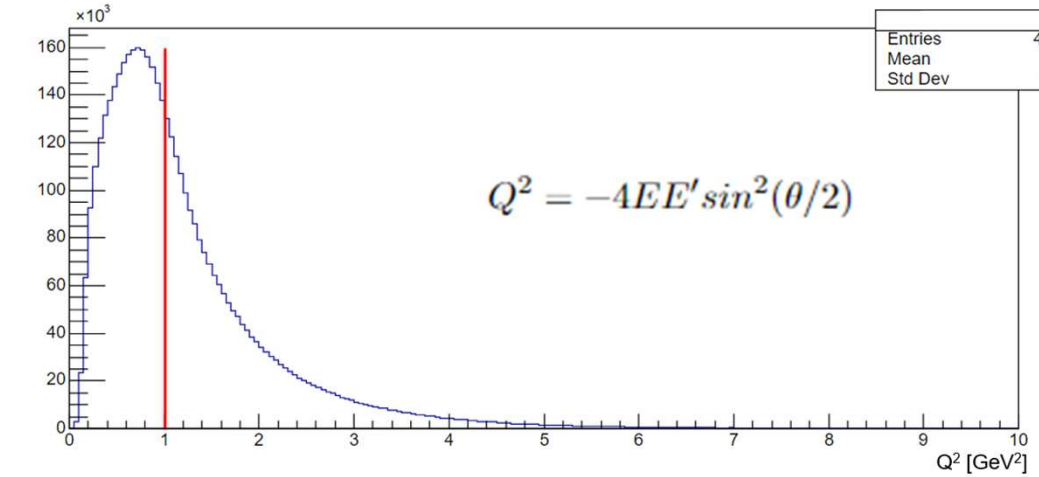
Current Alignment Results: z-Vertex Distribution

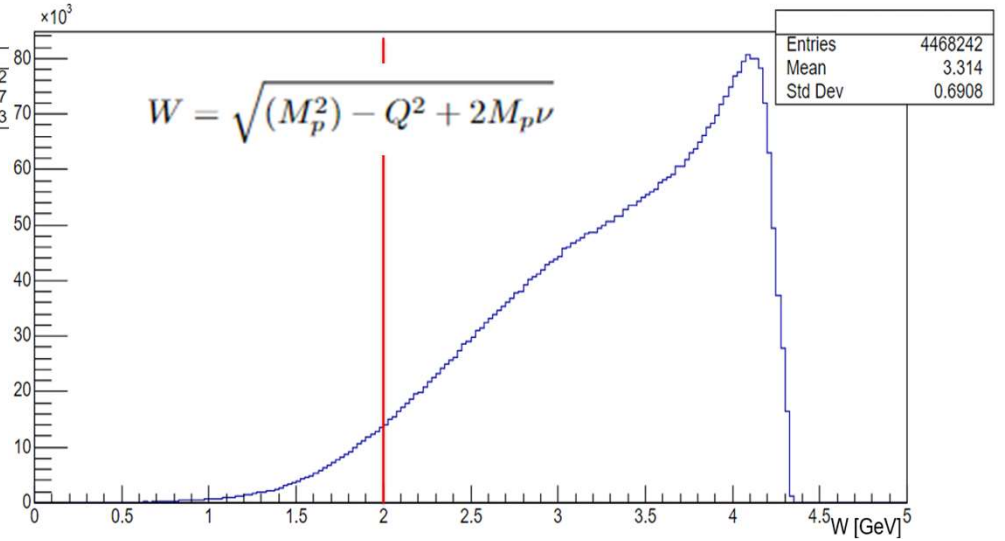


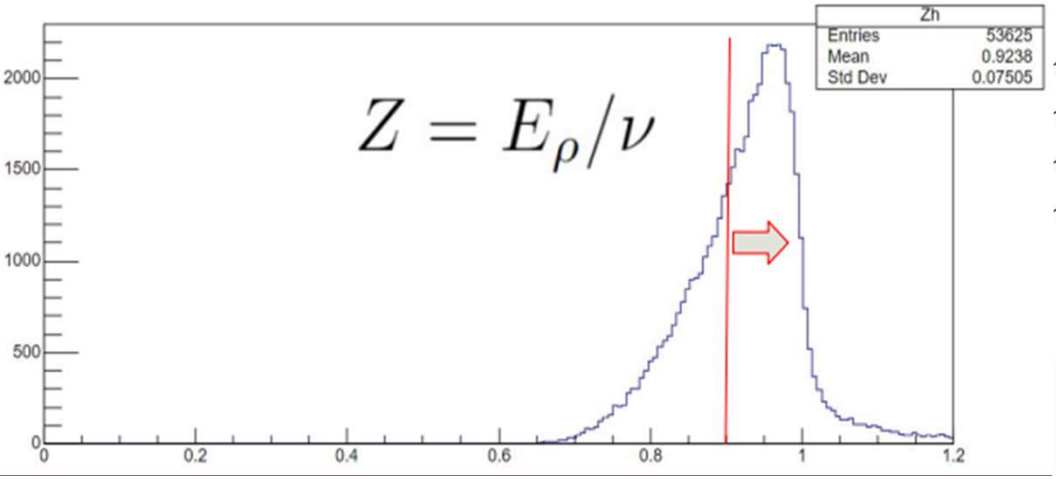
- Final RG-D alignment iteration awaits for the convergence of the calibration and alignment suites optimization efforts (See Daniel Carman CALCOM Update)

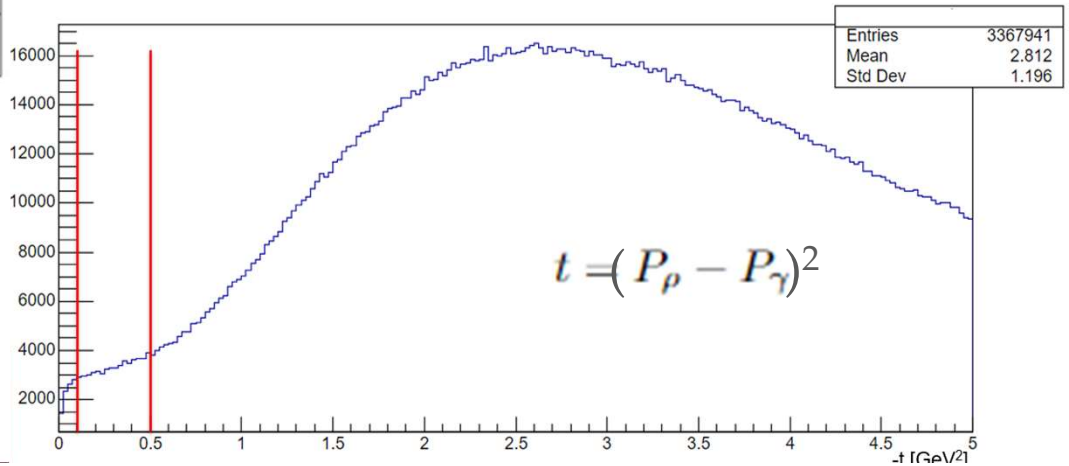
CT Analysis Status

- Kinematics for exclusive diffractive and incoherent ρ^0 electroproduction off nuclei.





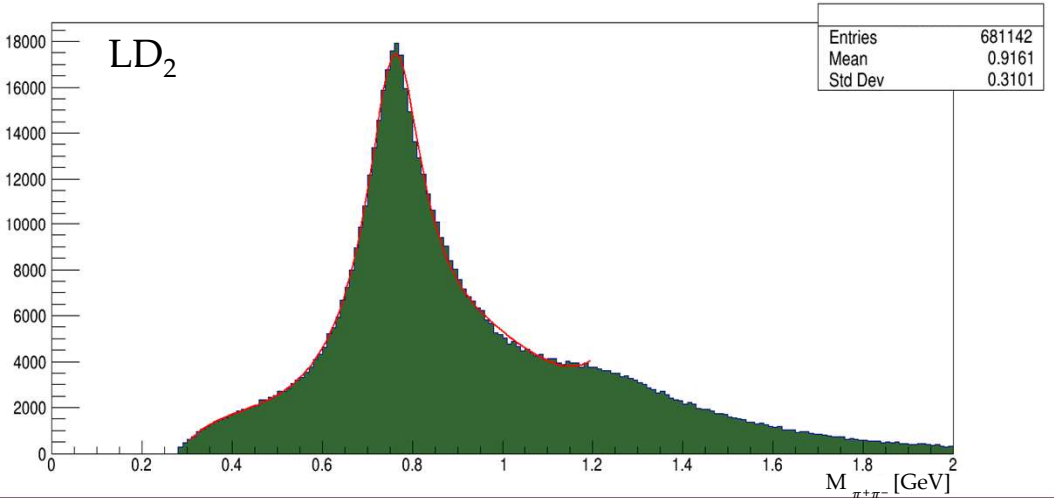




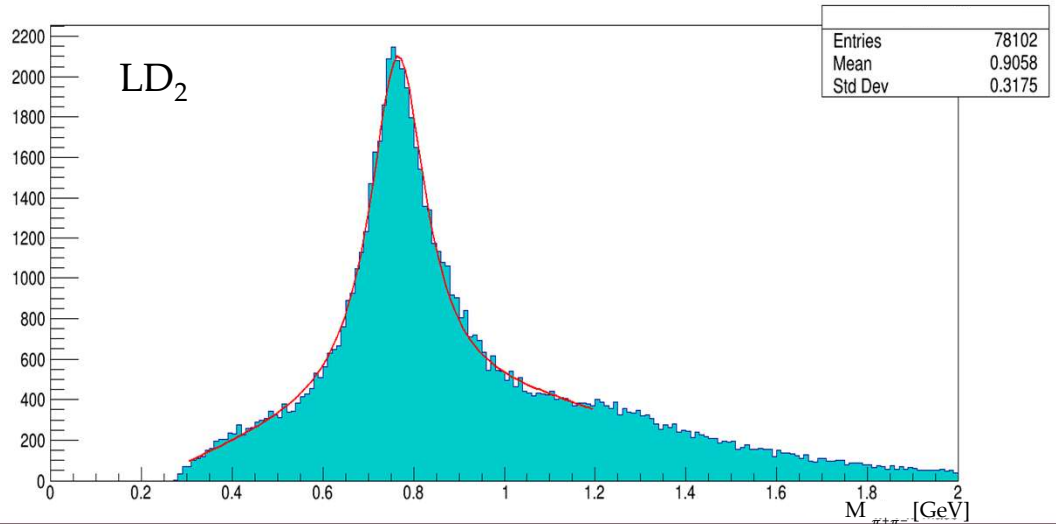
$\pi^+\pi^-$ Mass Distribution

- $\pi^+\pi^-$ mass distribution after kinematical cut for LD_2 target
- Preliminary Fit using simple Briet Wigner and 5-D polynomial

Q^2 [1->2] GeV^2

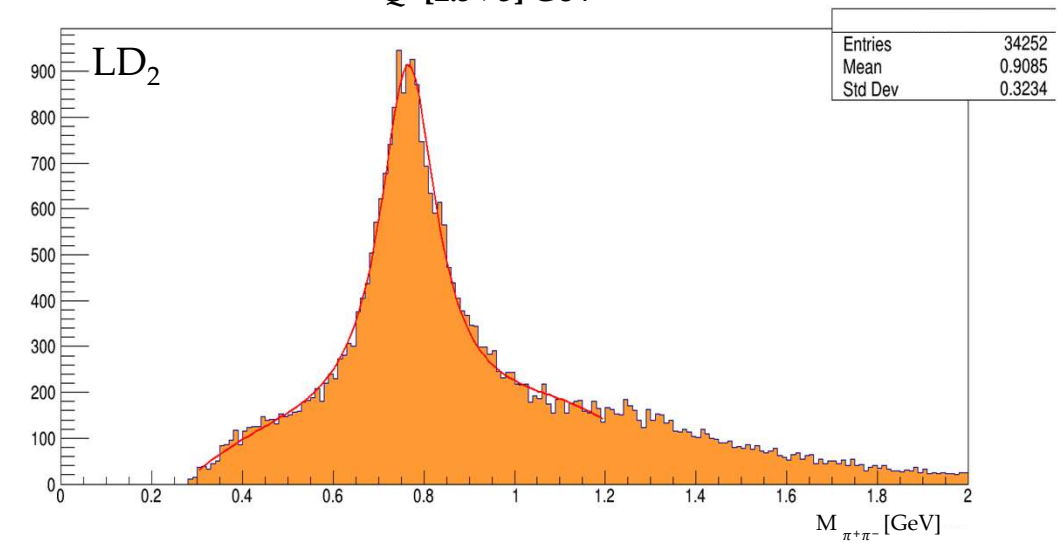


Q^2 [2->2.5] GeV^2

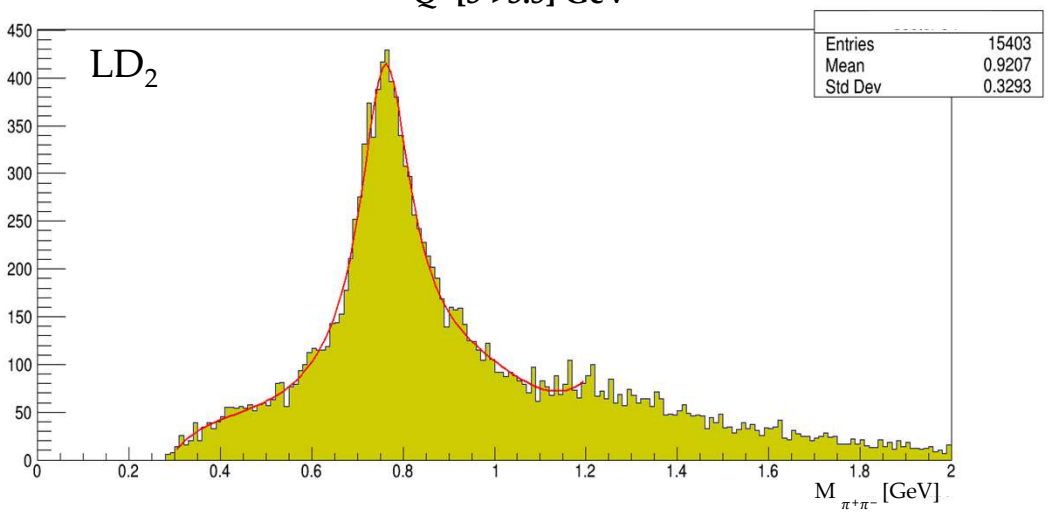


$\pi^+\pi^-$ Mass Distribution

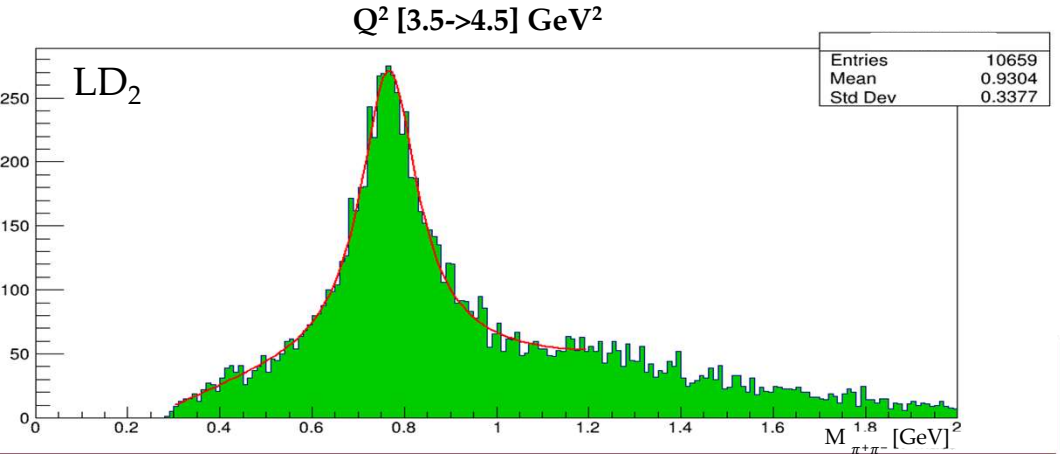
Q^2 [2.5->3] GeV^2



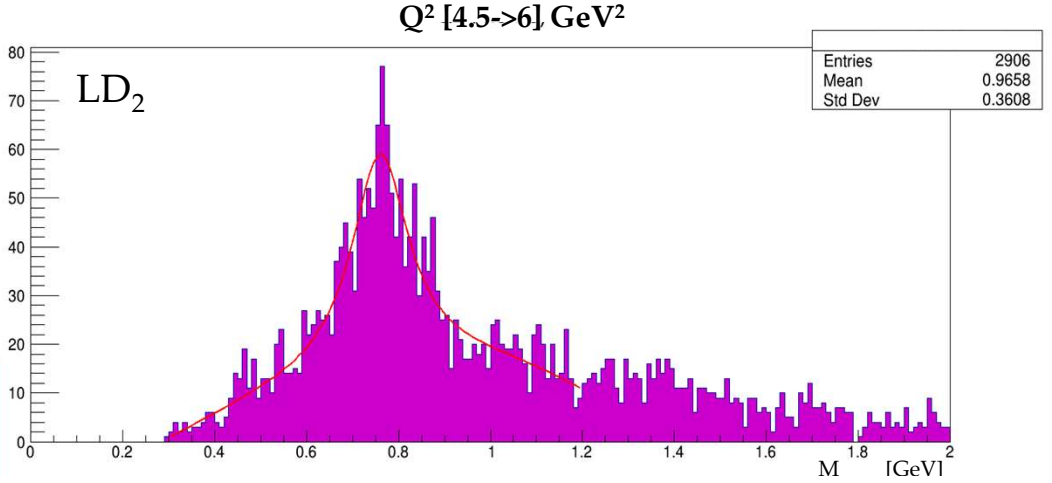
Q^2 [3->3.5] GeV^2



Q^2 [3.5->4.5] GeV^2



Q^2 [4.5->6] GeV^2



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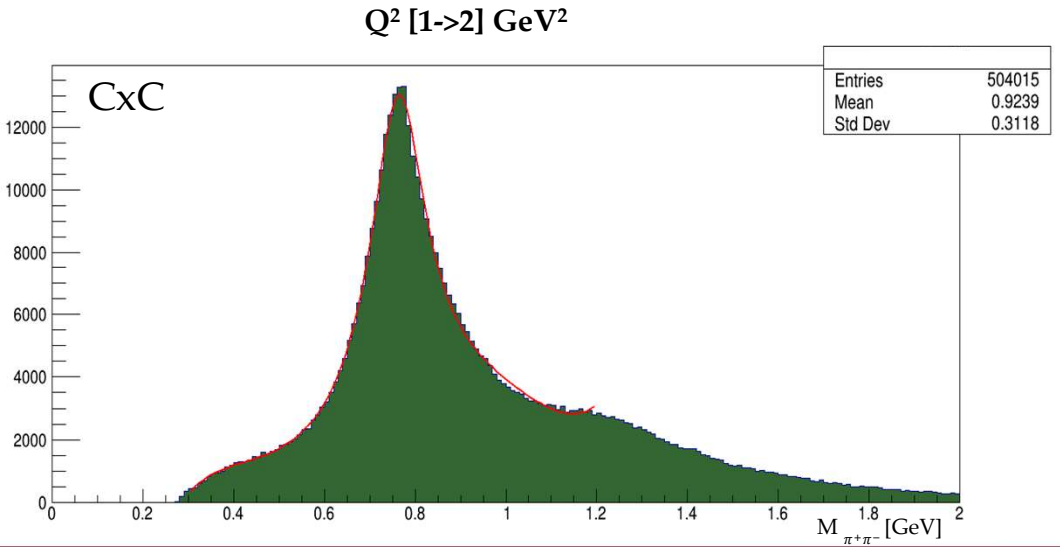

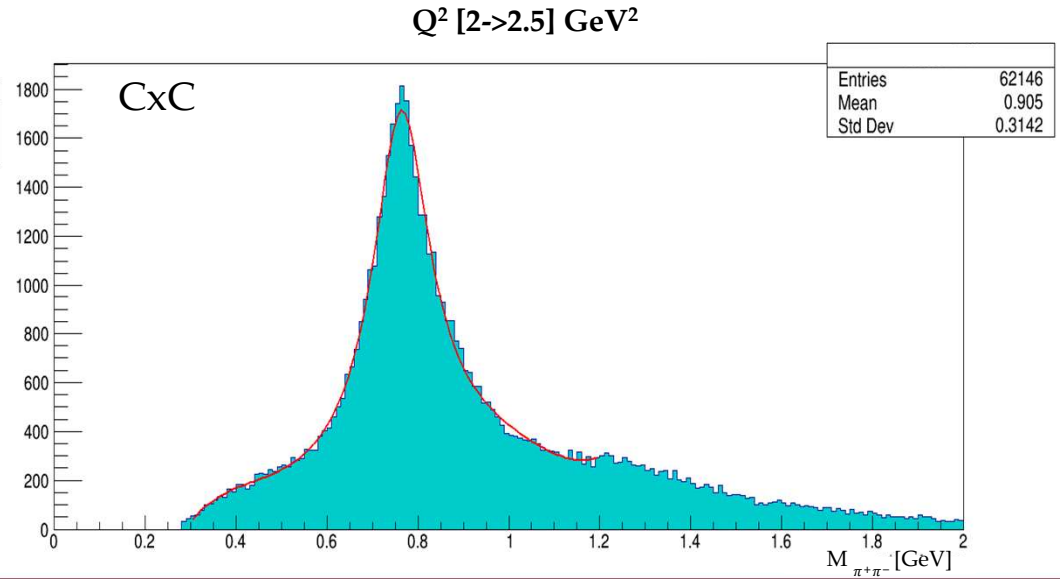

$\pi^+\pi^-$ Mass Distribution

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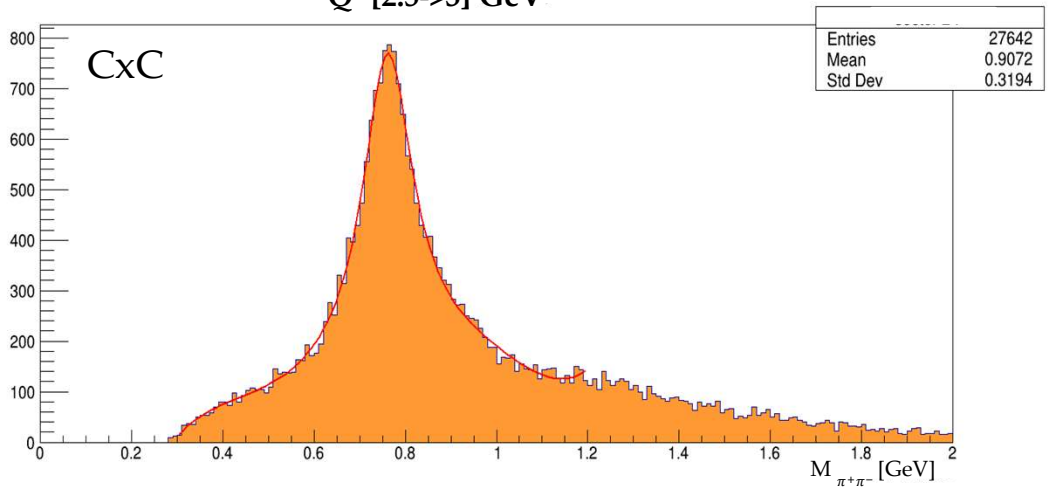
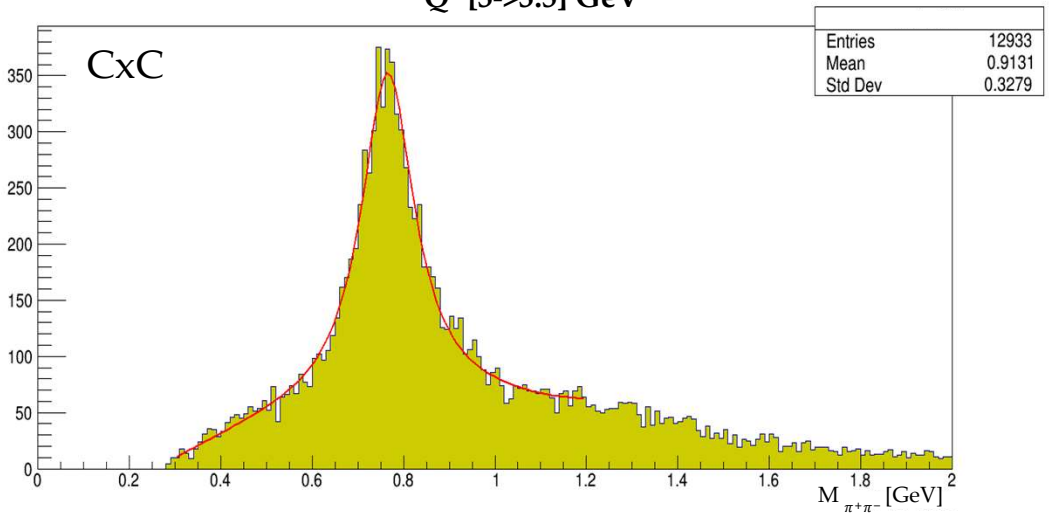


Q^2 [3->3.5] GeV^2



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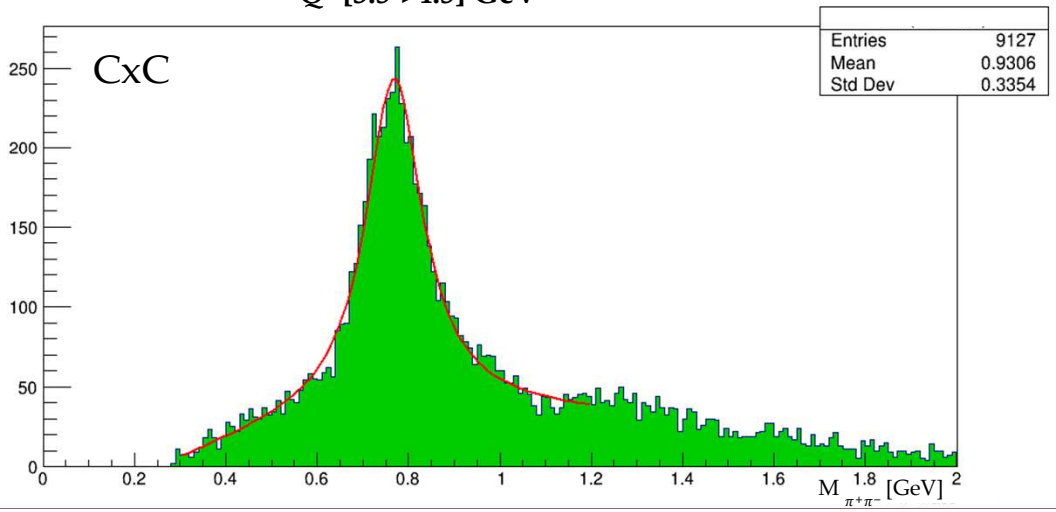

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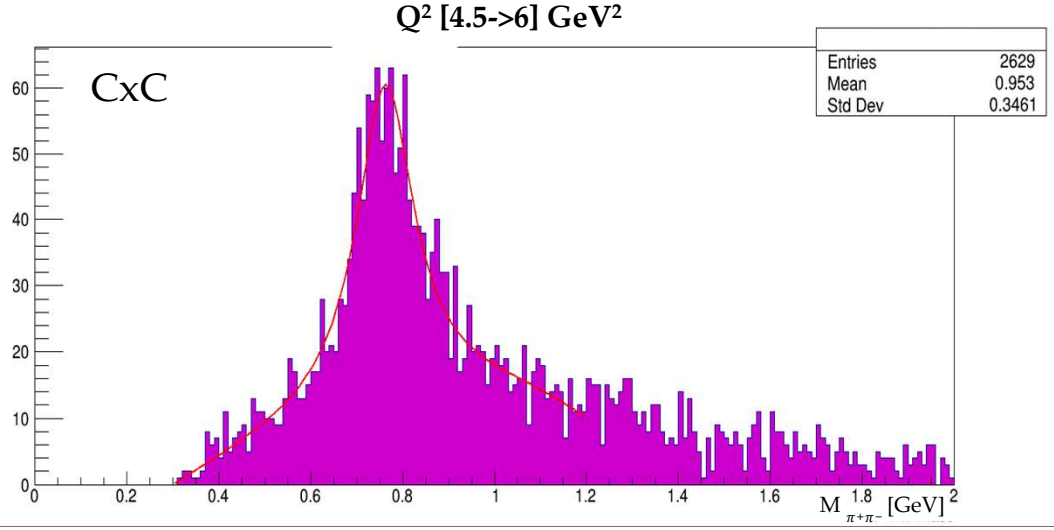
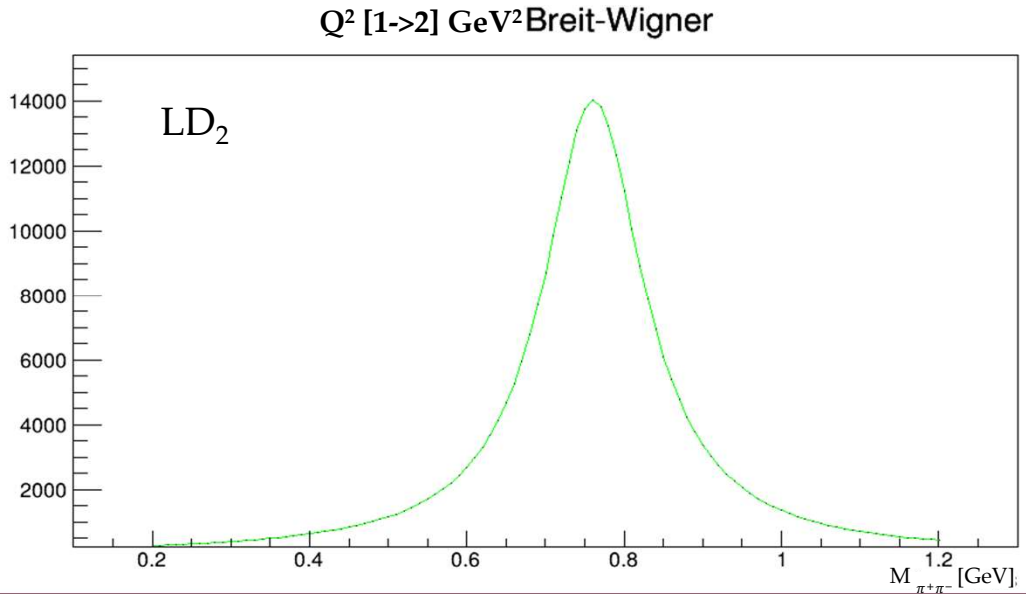
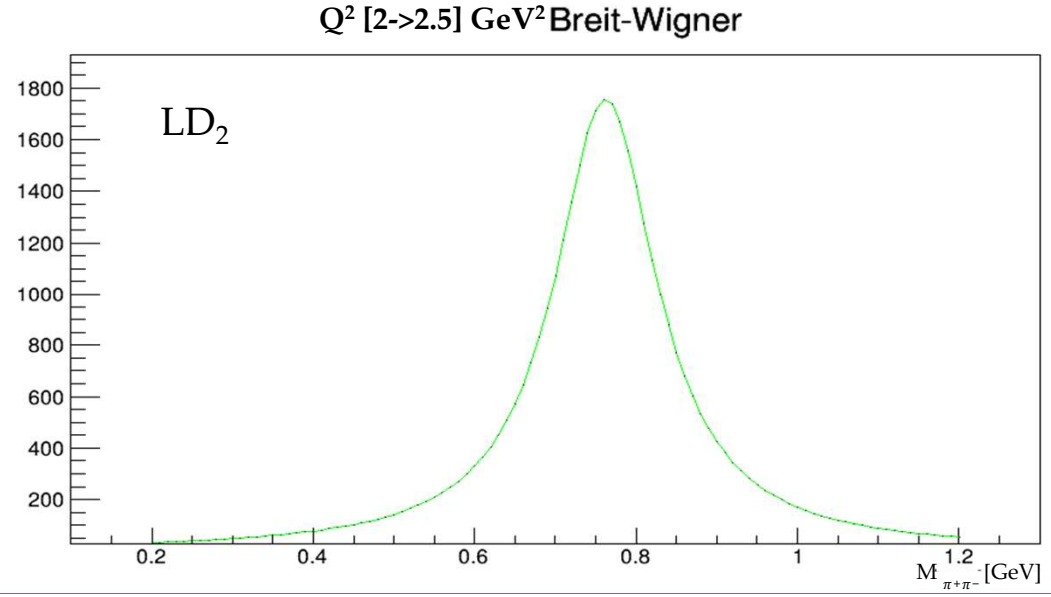


Background-Subtracted ρ^0 Distribution

- Subtract P5 from the total fit of $\pi^+\pi^-$ invariant mass distributions
- Extract ρ_0 yield by integrating the background-subtracted peak from 0.6 to 1 GeV





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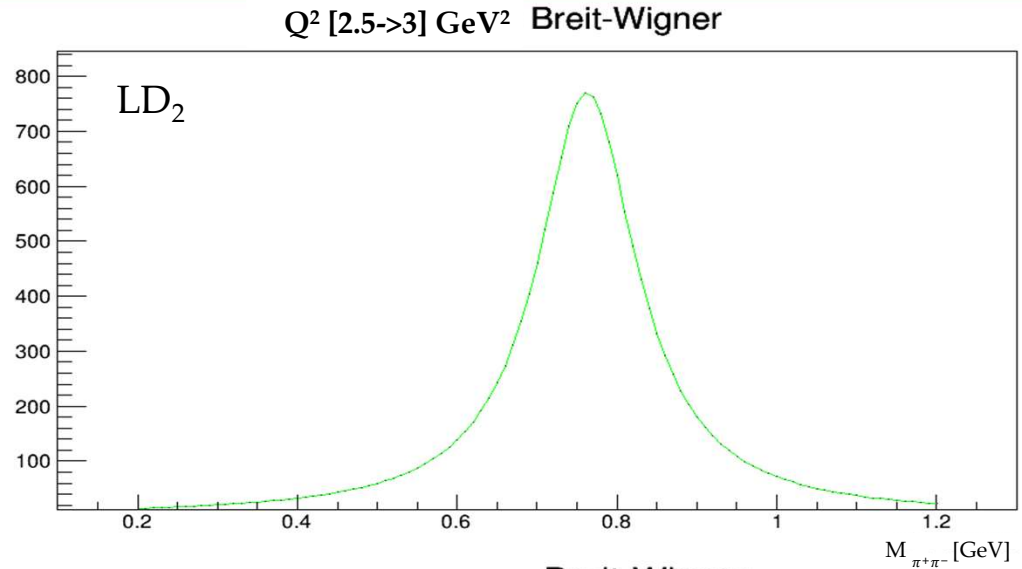

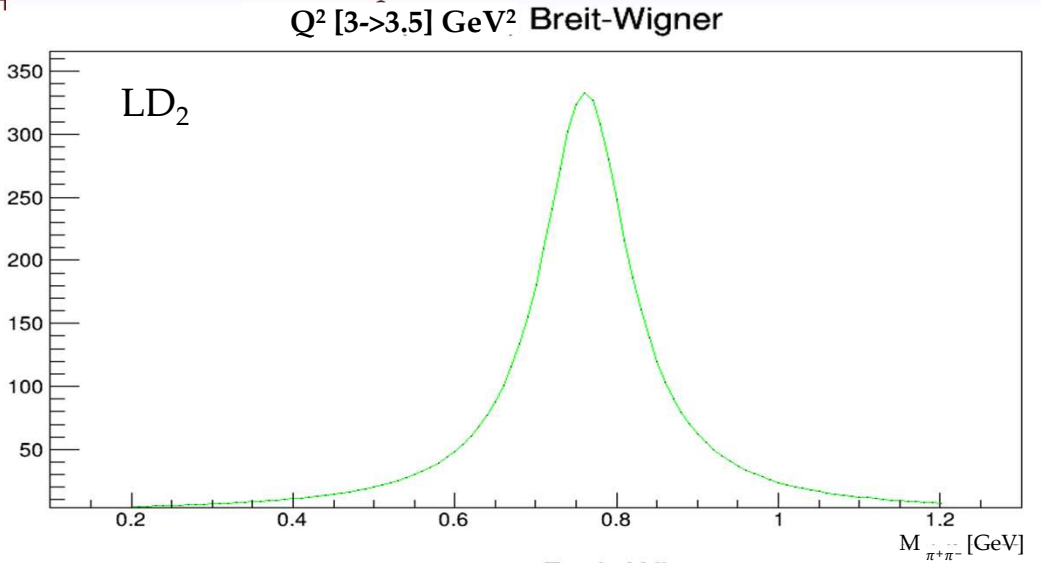

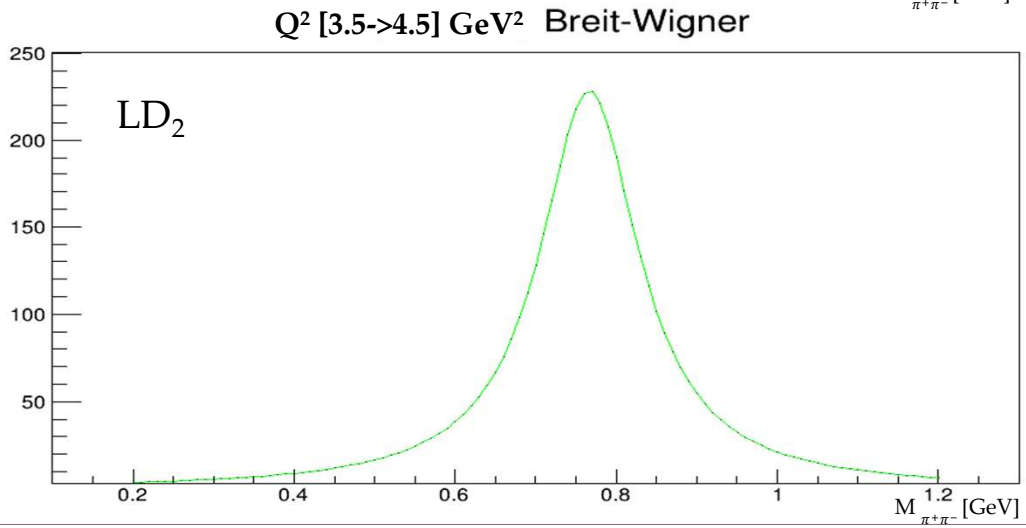

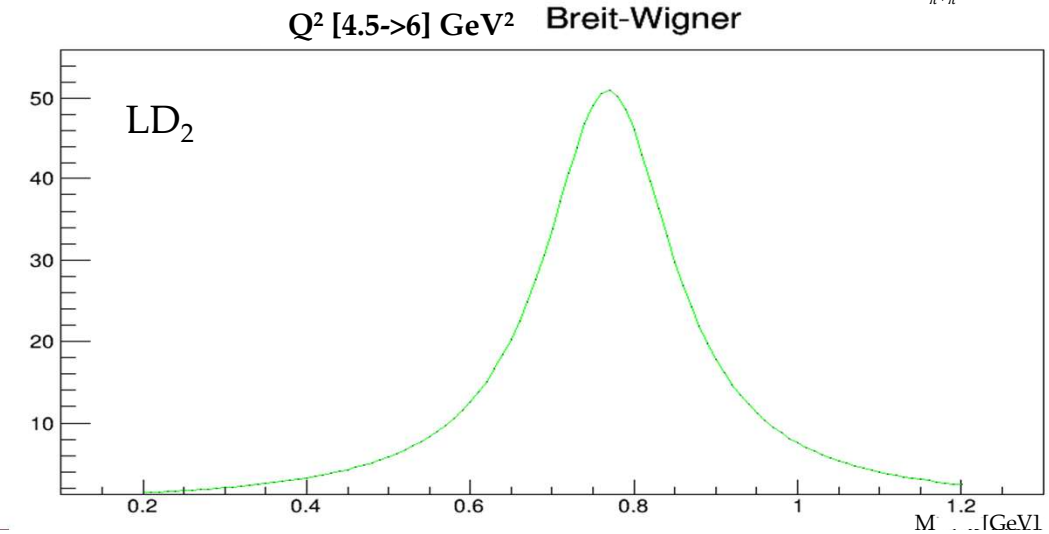

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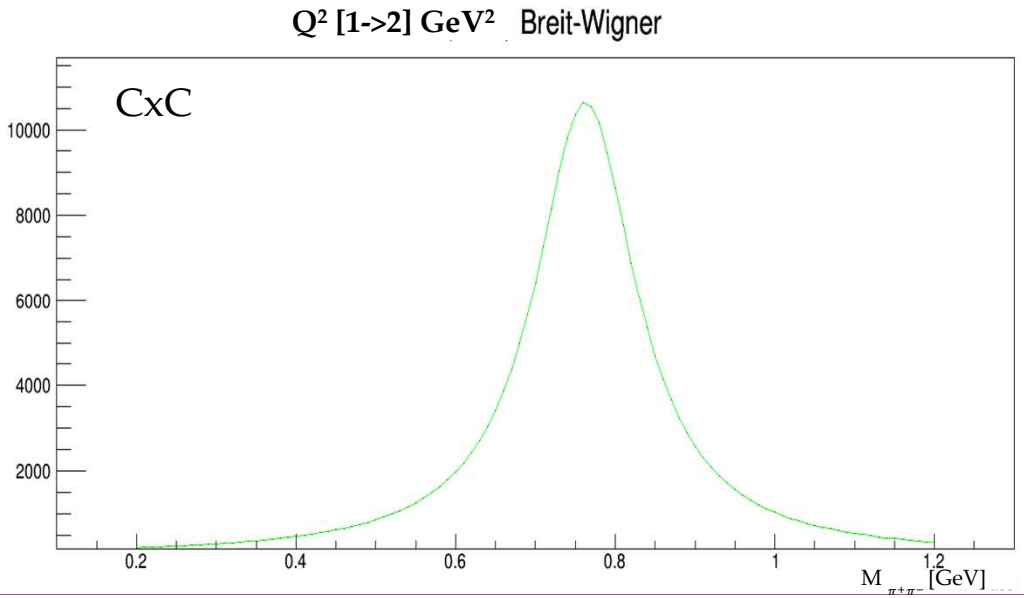

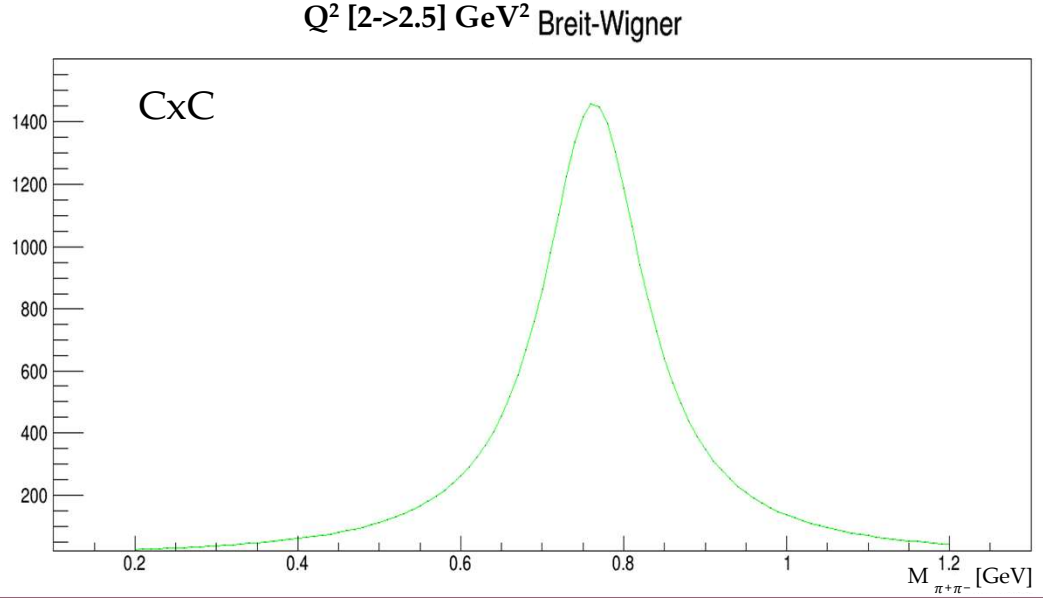

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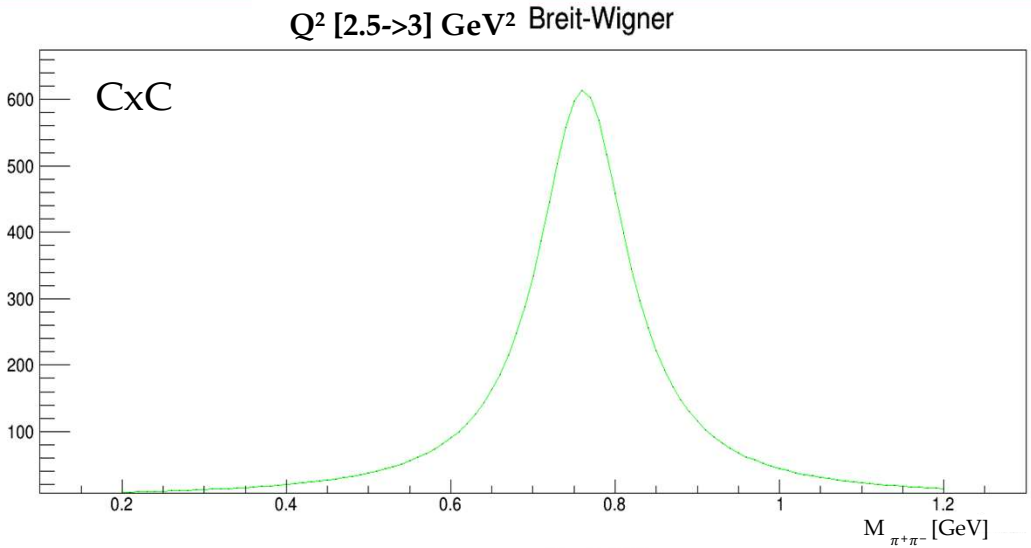
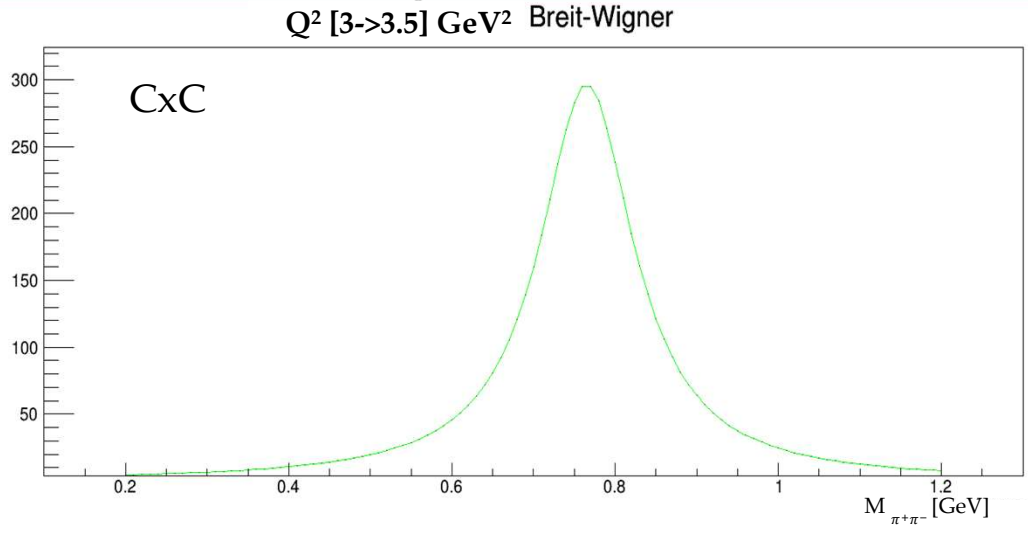
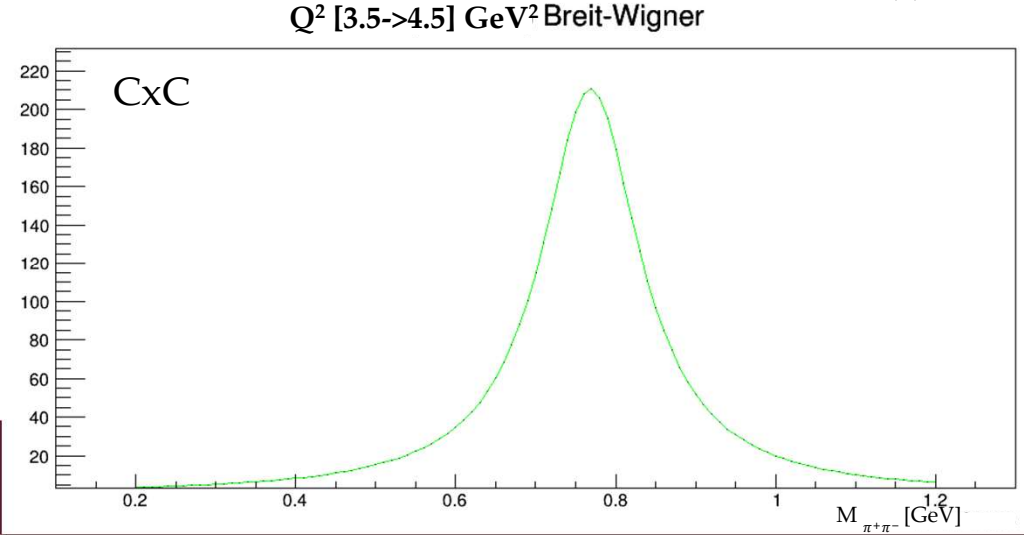
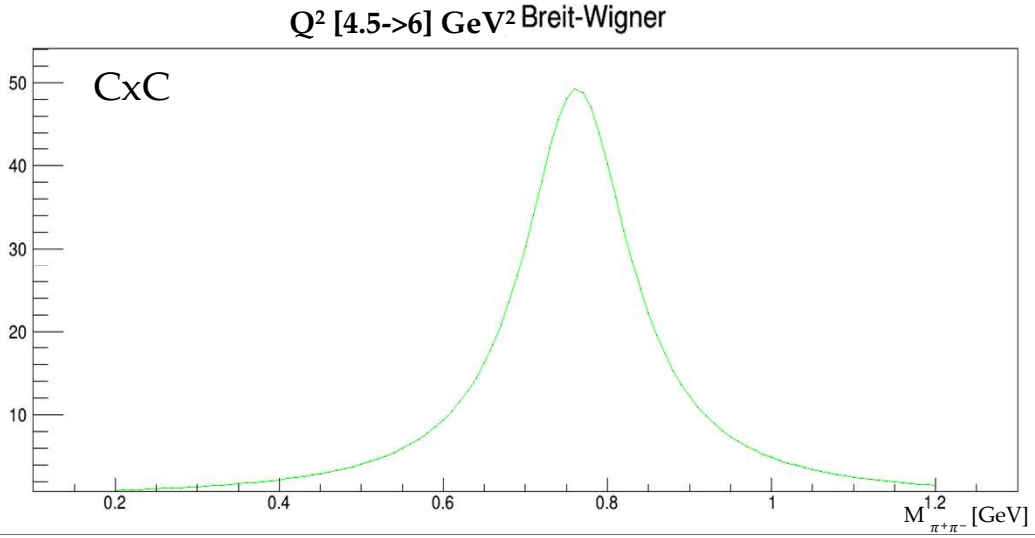








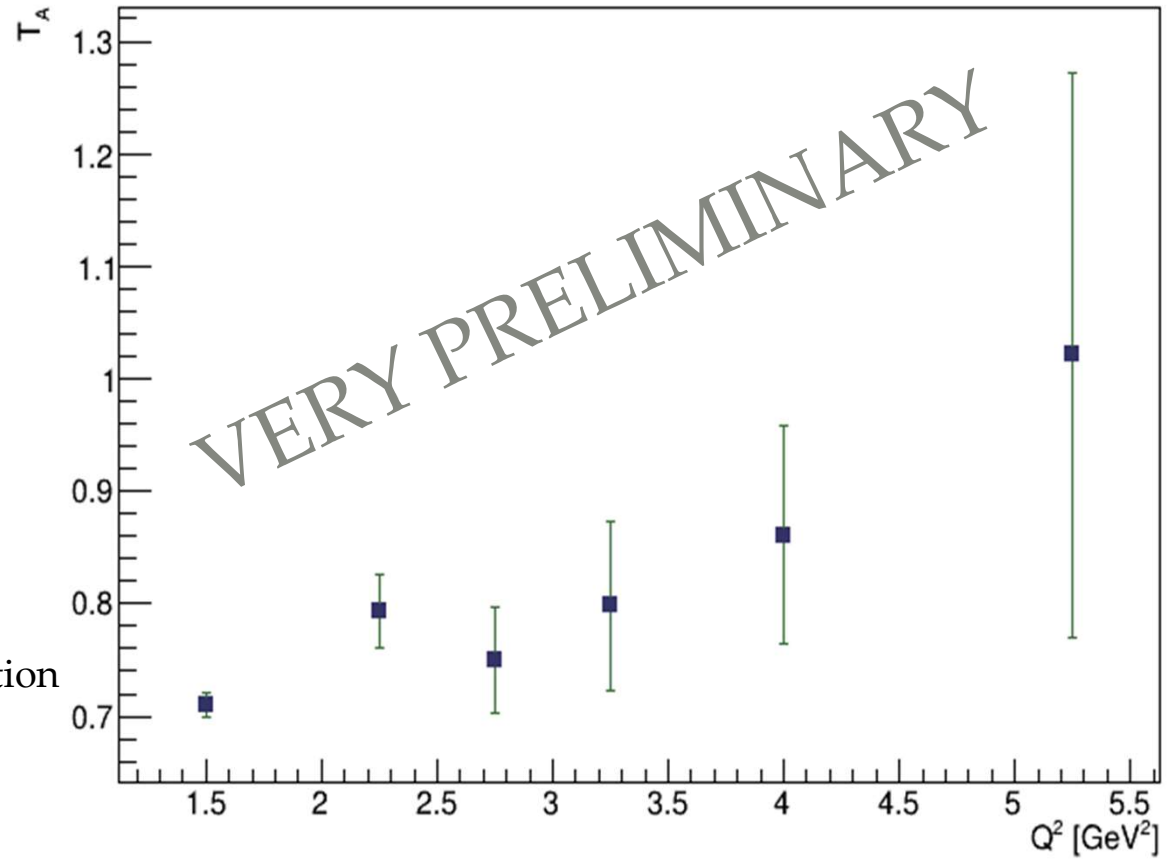
Very Preliminary Nuclear Transparency

•Extracted nuclear transparency, T_A, as

$$T_A = \frac{N_C^{\rho}}{N_D^{\rho}} \left(\frac{t_D \rho_D}{t_C \rho_C} \right)$$

where,
- N_C is the rho yield for target CxC
- N_D is the rho yield for target LD_2
- t_D = 5 cm is LD_2 thickness
- t_C = 0.4 cm is CxC thickness
- ρ_D = is the density of target LD_2
- ρ_C = is the density of target CxC

•Used a subset of 14 runs for each target configuration



Very Preliminary Nuclear Transparency

- Perform the last iteration of RG-D alignment
- Improve the statistical precision of T_A by processing the whole CxC and LD_2 datasets
- Extract the nuclear transparency results for other Cu and Sn nuclei

This work is supported by the US DOE award # DE-FG02-07ER41528v

End of Run Group D Party

Join us for a celebration marking the successful completion of Run Group D

Date: March 15, 2024
Time: 2:00 PM - 5:00 PM
Venue: Residence Facility

For more info, please contact Lamiaa El Fassi (le334@msstate.edu)