E04-007 STATUS REPORT

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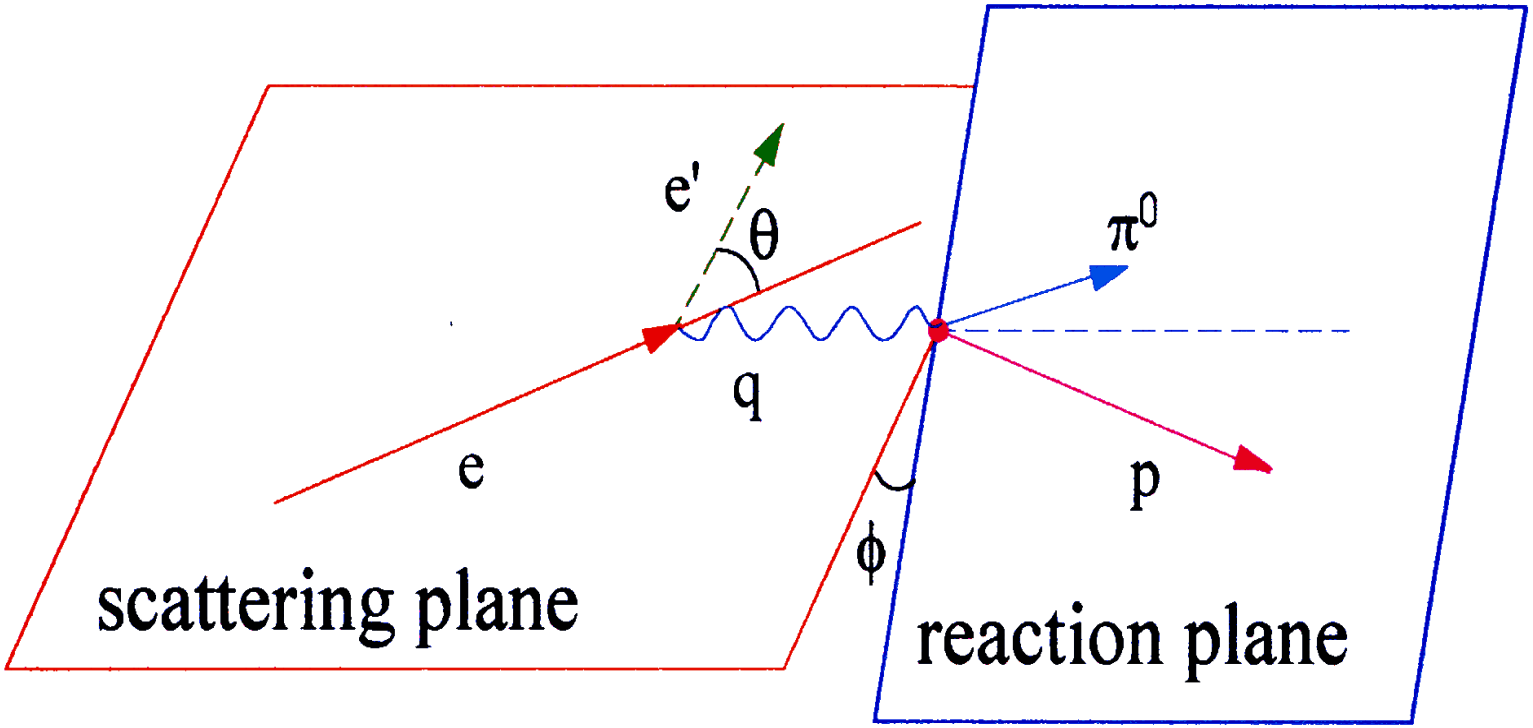
Ph. D. students: K. Chirapatpimol, P. Peng

and

Hall A collaboration

Jun 9, 2011

H(e,e'p)π°



Cross Section $$\frac{d^5\sigma}{d\Omega_{e'}\,dE_{e'}\,d\Omega_\pi^*} = \Gamma_v \frac{d\sigma}{d\Omega_\pi^*}$$

Structure Function Expansion of Cross Section

$$\frac{d\sigma}{d\Omega_\pi^*} = \sigma_T(\theta_\pi^*) + \varepsilon_L\sigma_L(\theta_\pi^*) + \sqrt{2\varepsilon_L(1+\varepsilon)}\,\sigma_{LT}(\theta_\pi^*)\cos\phi_\pi^* + \varepsilon\,\sigma_{TT}(\theta_\pi^*)\cos 2\phi_\pi^* + h\sqrt{2\varepsilon_L(1-\varepsilon)}\,\sigma_{LT'}(\theta_\pi^*)\sin\phi_\pi^*$$

Structure functions $\sigma_T + \varepsilon\sigma_L, \sigma_{LT}, \sigma_{TT'}$ and $\sigma_{LT'}$ are obtained through measurement of ϕ_π^* and beam helicity dependence.

Near threshold, structure functions are dominated by two S-wave (E_{0+}, L_{0+}) and five P-wave ($M_{1+}, M_{1-}, L_{1+}, L_{1-}, E_{1+}$) pion multipoles whose Q^2 dependence provides a crucial test of LETs predicted by CHPT.

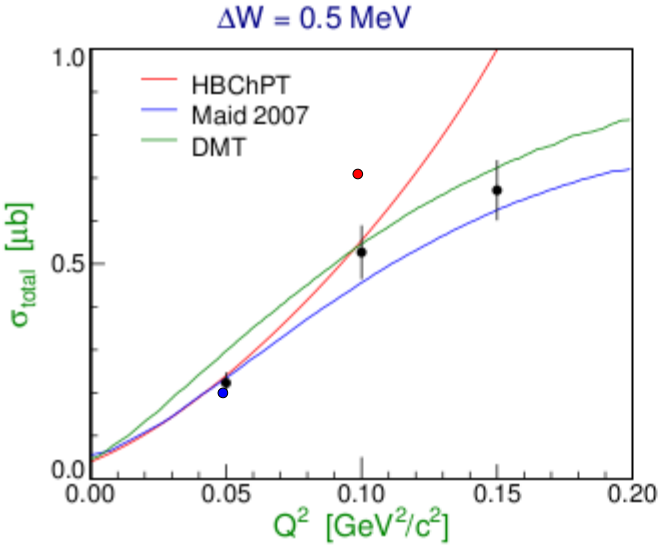
Measurement of Q^2 and W dependence above threshold also tests various unitarized models (DMT, MAID, Sato-Lee).

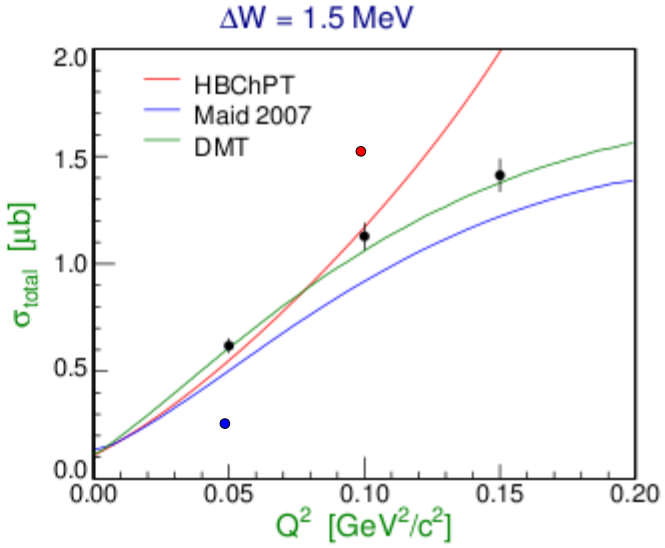
Beam Asymmetry

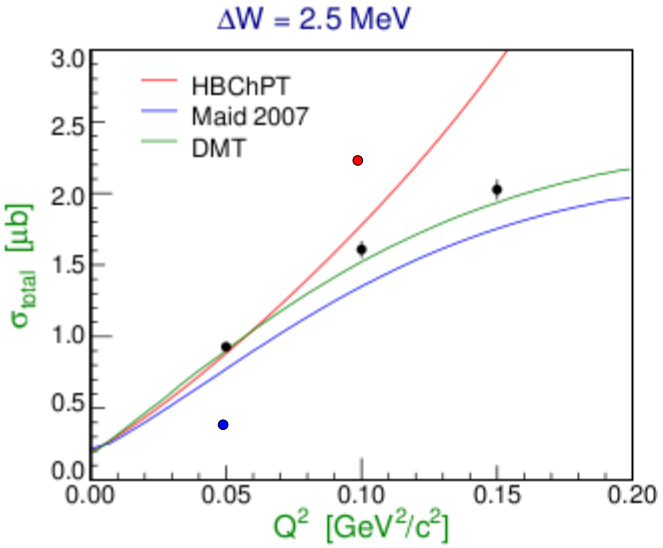
$$A_{LT'} = \frac{\sqrt{2\varepsilon_L(1-\varepsilon)}\,\sigma_{LT'}(\theta_\pi^*)\sin\phi_\pi^*}{\sigma_T(\theta_\pi^*) + \varepsilon_L\sigma_L(\theta_\pi^*) + \sqrt{2\varepsilon_L(1+\varepsilon)}\,\sigma_{LT}(\theta_\pi^*)\cos\phi_\pi^* + \varepsilon\,\sigma_{TT}(\theta_\pi^*)\cos 2\phi_\pi^*} = \frac{1}{P_e}\frac{(N^+ - N^-)}{(N^+ + N^-)}$$

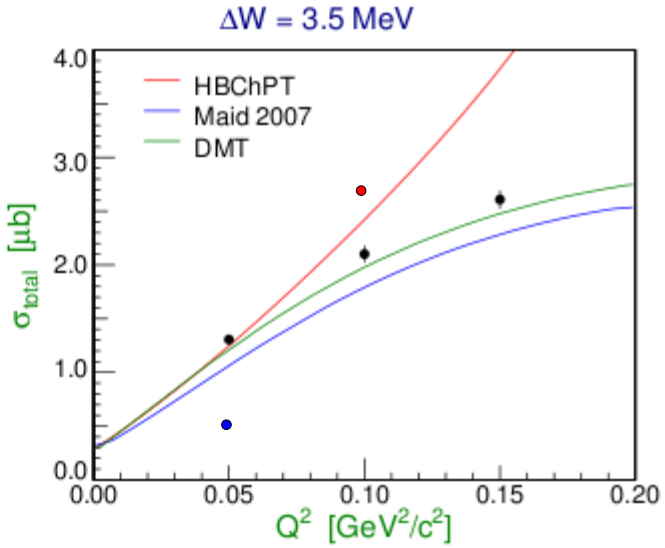
$A_{LT'}$ strongly sensitive to the imaginary part of longitudinal s - wave multipole (L_{0+}) which is affected by pion rescattering corrections.

Mainz Data









- Harald Merkel
  6th International Workshop on Chiral Dynamics
  July 6-10 2009
  Bern, Switzerland

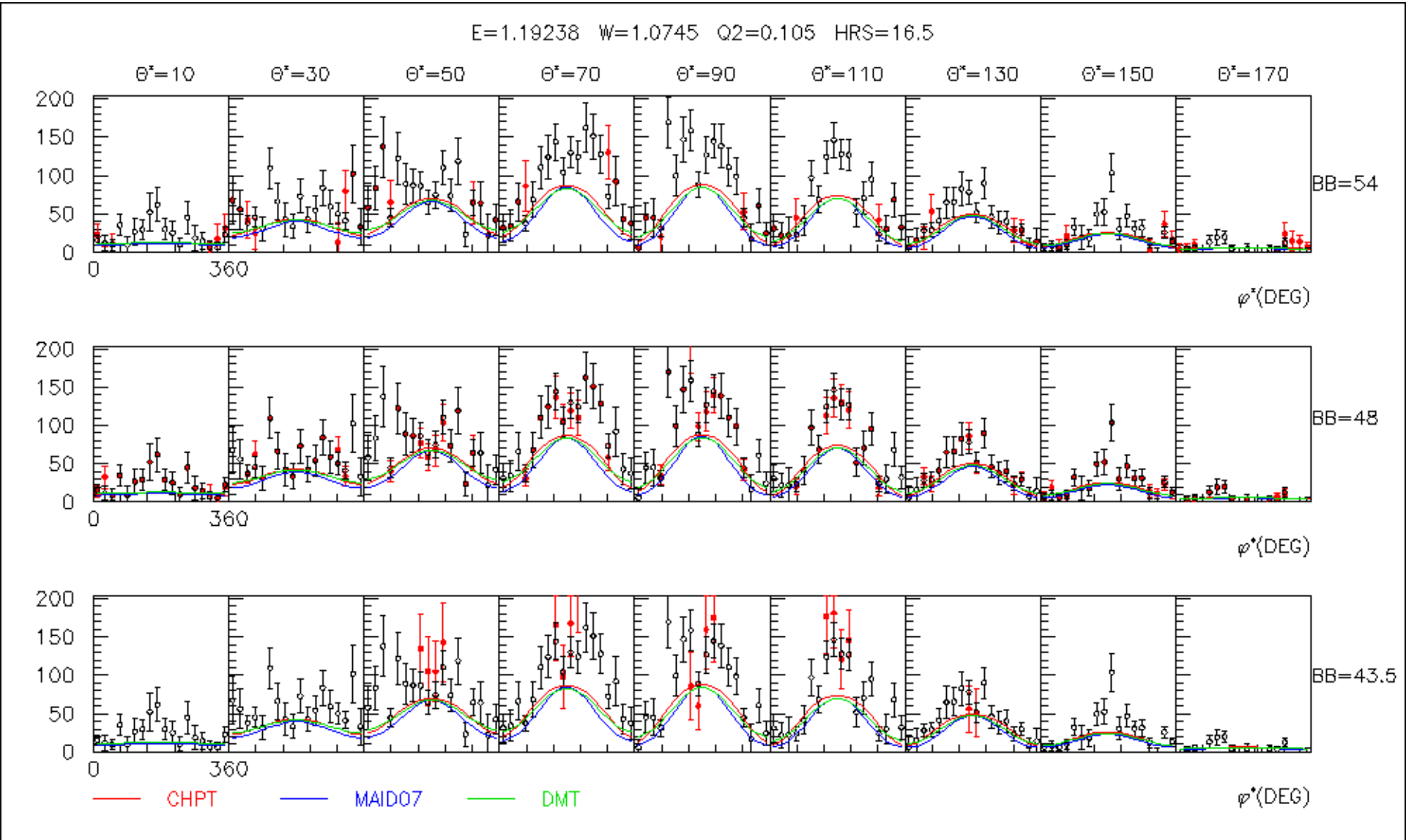
- Q^2=0.1 (GeV/c)²
  Distler PRL 80, 2294 (1998)

- Q^2=0.05 (GeV/c)²
  Merkel et al.
  PRL 88, 1230 (2002)

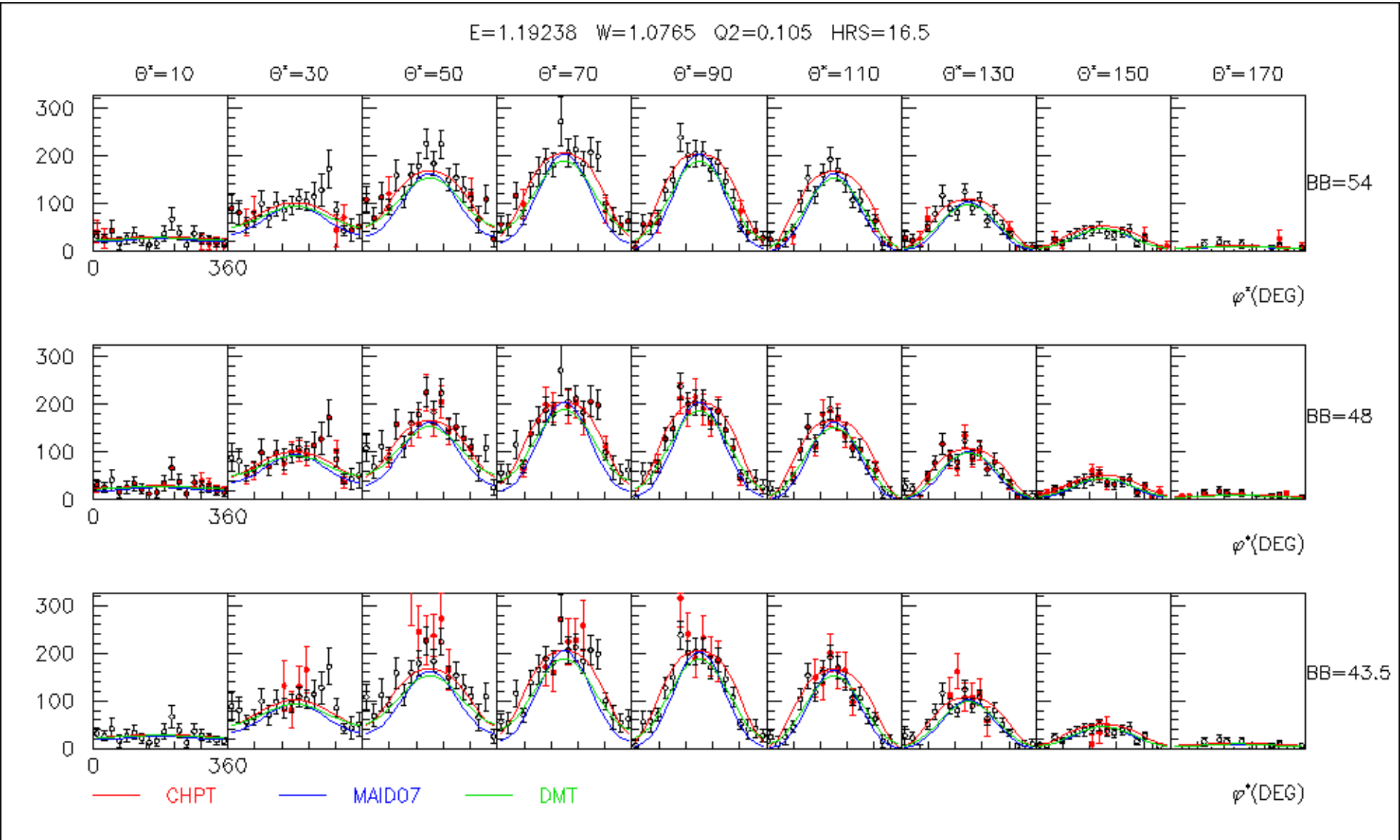
HBChPT was fitted to old data set up to Q2=0.1

Preliminary

Yield was normalized to acceptance, live time, chamber efficiency and beam charge.
Model cross sections were evaluated at bin centers and multiplied by
ΔQ2ΔWΔΩ * Δφ_e and luminosity to calculate the predicted yield.



Preliminary



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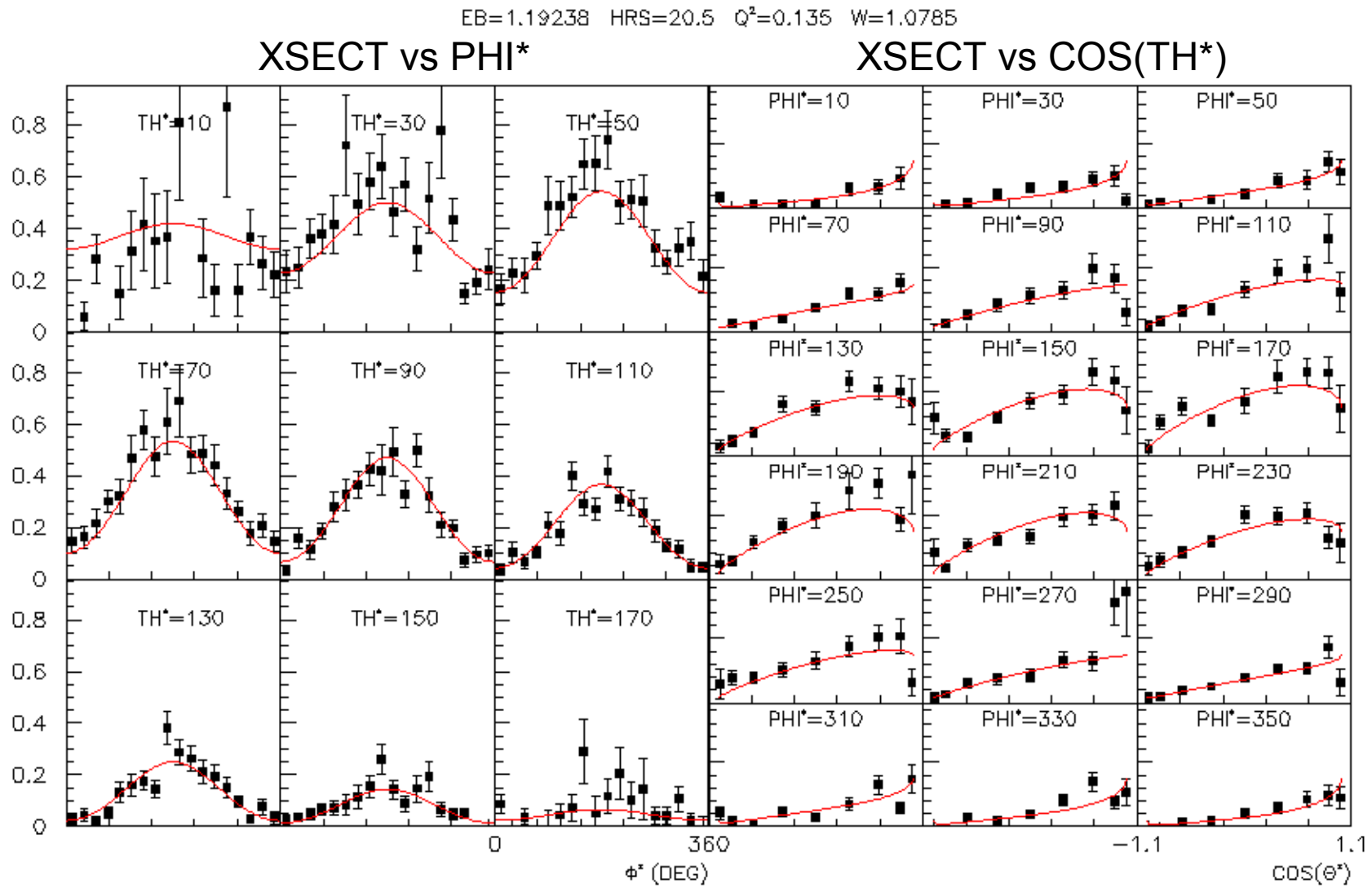
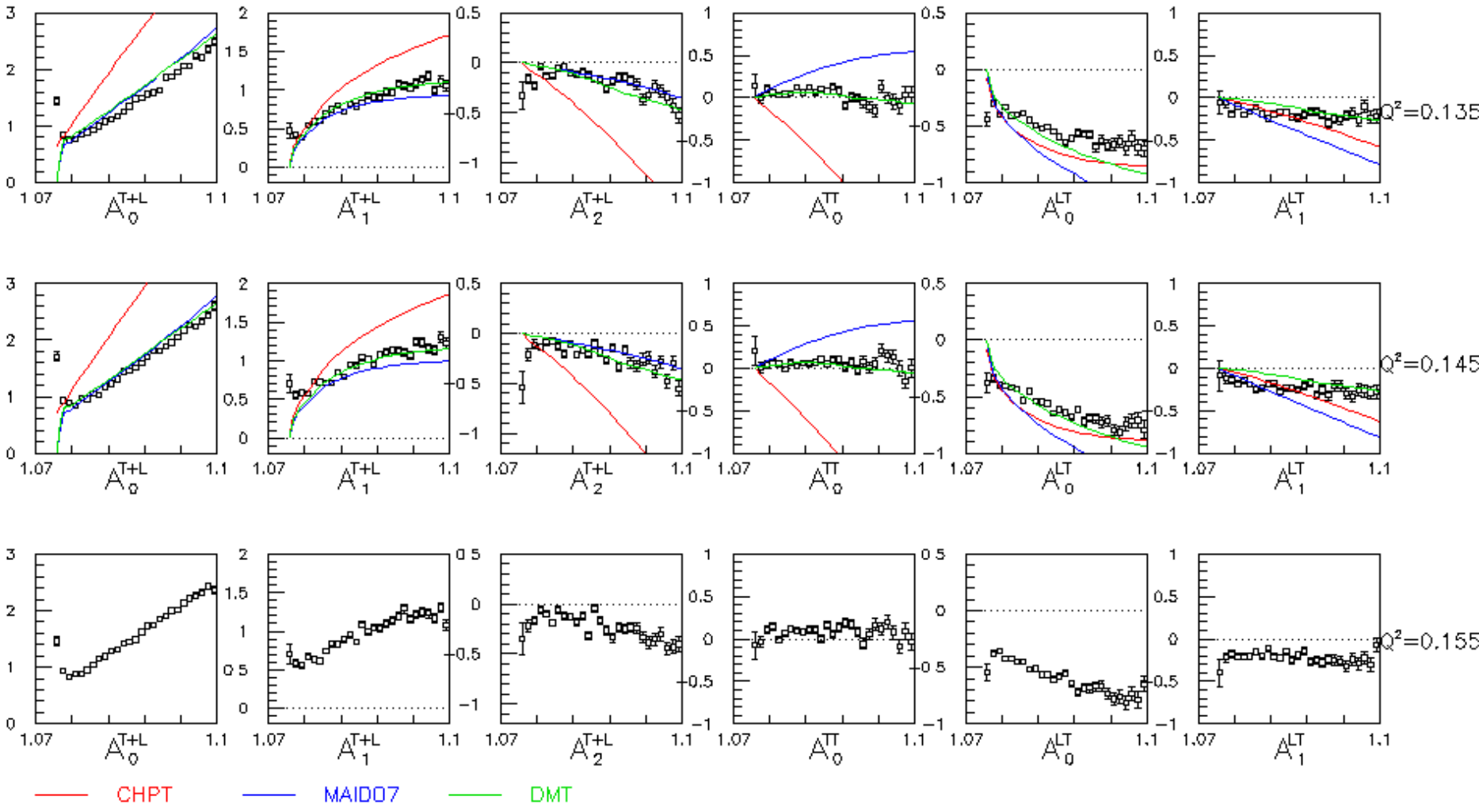


Preliminary

$$\frac{d\sigma}{d\Omega_\pi^*} = \frac{p_\pi^*}{k_\gamma^*}(A_0^{T+L} + A_1^{T+L}P_1(cos\theta^*) + A_2^{T+L}P_2(cos\theta^*) + \epsilon A_0^{TT} sin^2\theta^* cos2\phi^* + \sqrt{2\epsilon_L(1+\epsilon)}(A_0^{LT} + A_1^{LT}P_1(cos\theta^*))sin\theta^* cos\phi^*)$$

EB=1.19238 HRS=20.5



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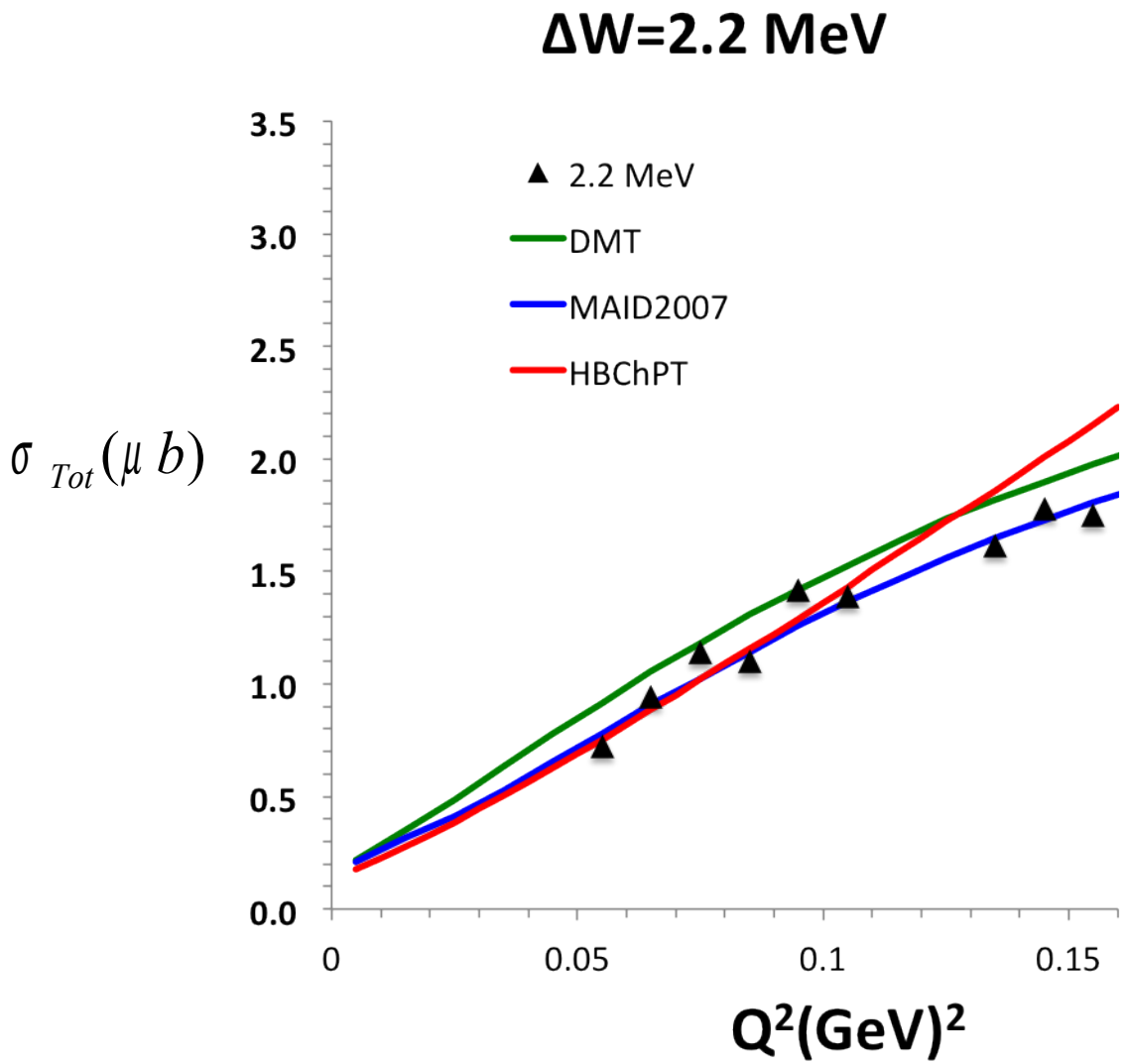

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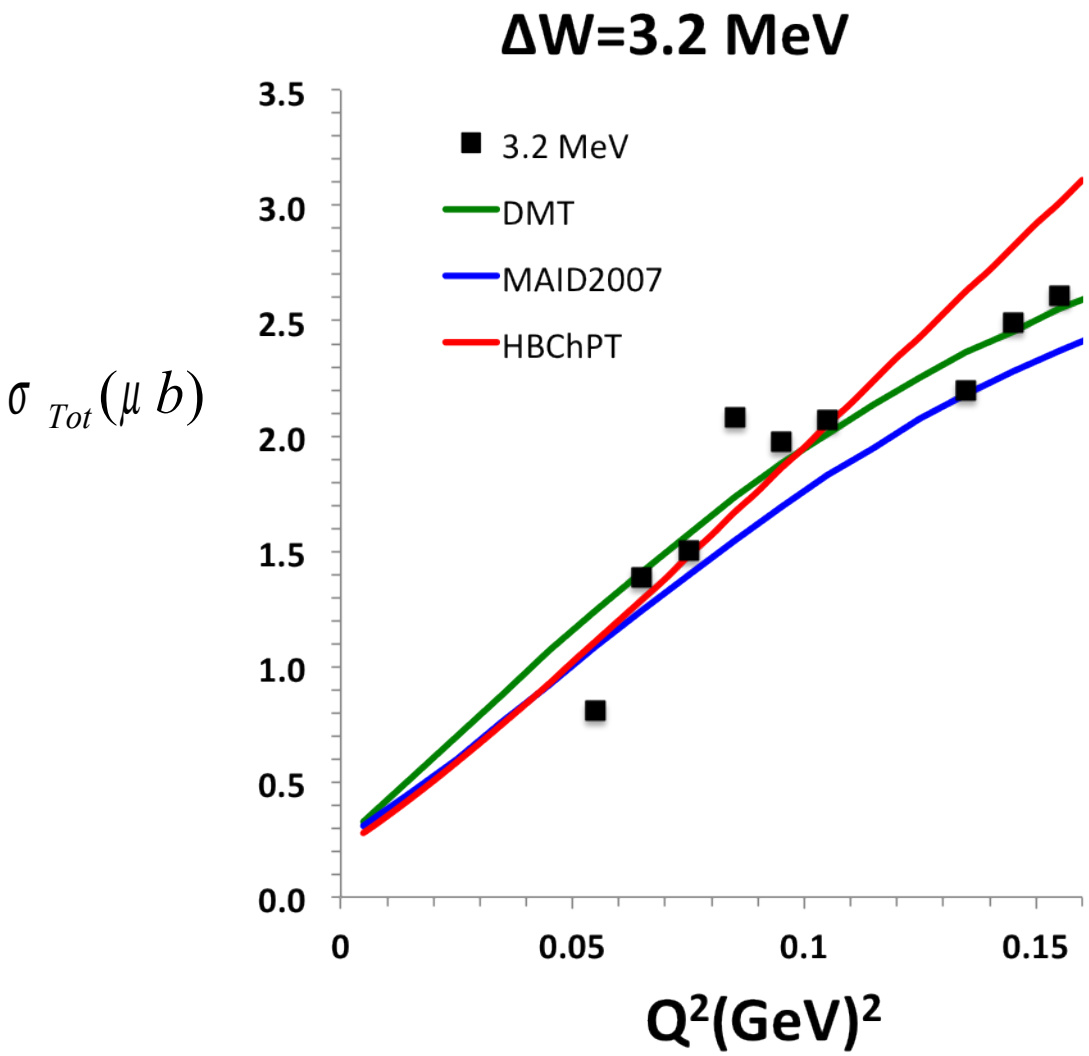
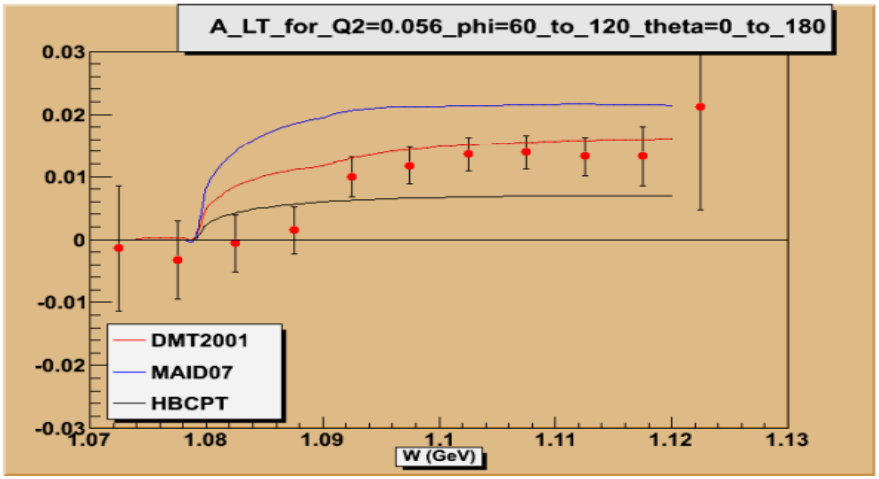


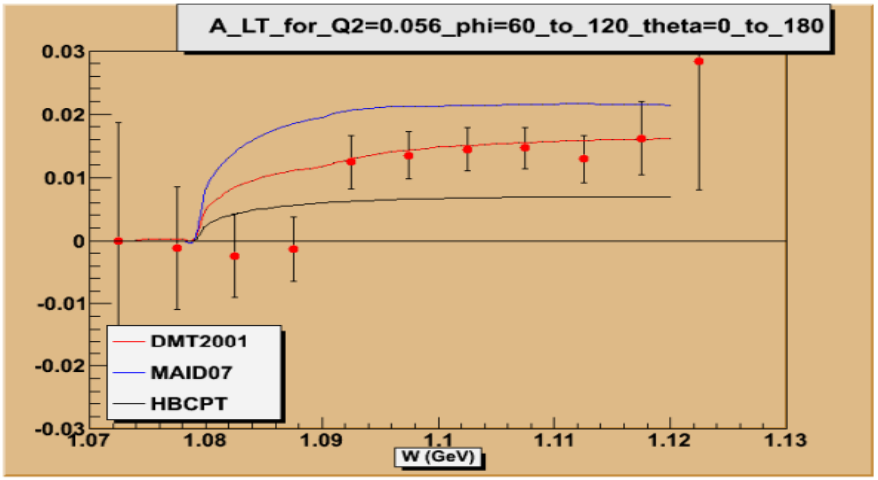
Preliminary result

Beam Asymmetry ALT'

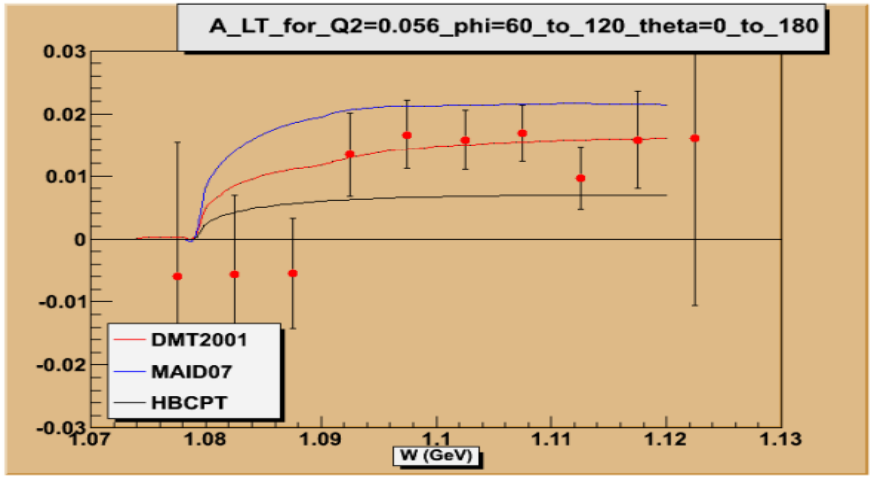
$$A_{LT'} = \frac{\sqrt{2\varepsilon_L(1-\varepsilon)}\,\sigma_{LT'}(\theta_\pi^*)\sin\phi_\pi^*}{\sigma_T(\theta_\pi^*) + \varepsilon_L\sigma_L(\theta_\pi^*) + \sqrt{2\varepsilon_L(1+\varepsilon)}\,\sigma_{LT}(\theta_\pi^*)\cos\phi_\pi^* + \varepsilon\,\sigma_{TT}(\theta_\pi^*)\cos 2\phi_\pi^*} = \frac{1}{P_e}\frac{(N^+ - N^-)}{(N^+ + N^-)}$$



No VZ cut

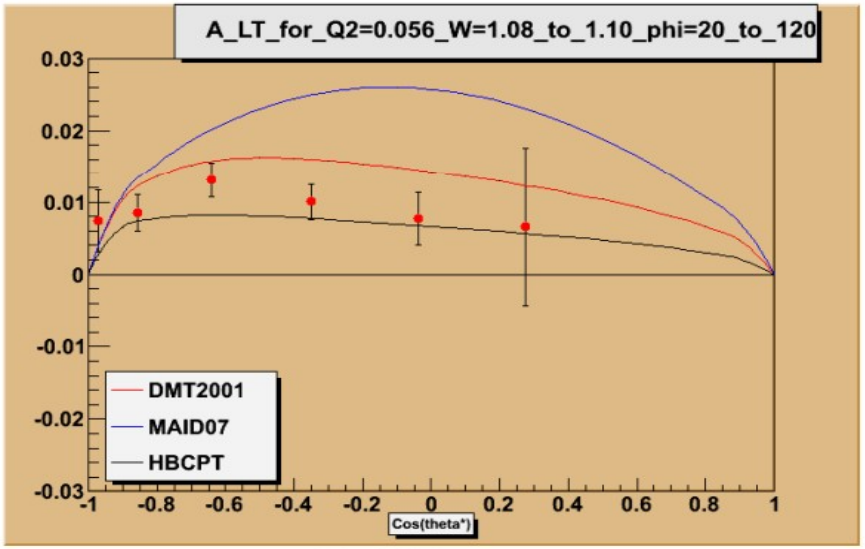


-0.02cm<VZ<0.035cm



-0.01cm<VZ<0.025cm

Preliminary result



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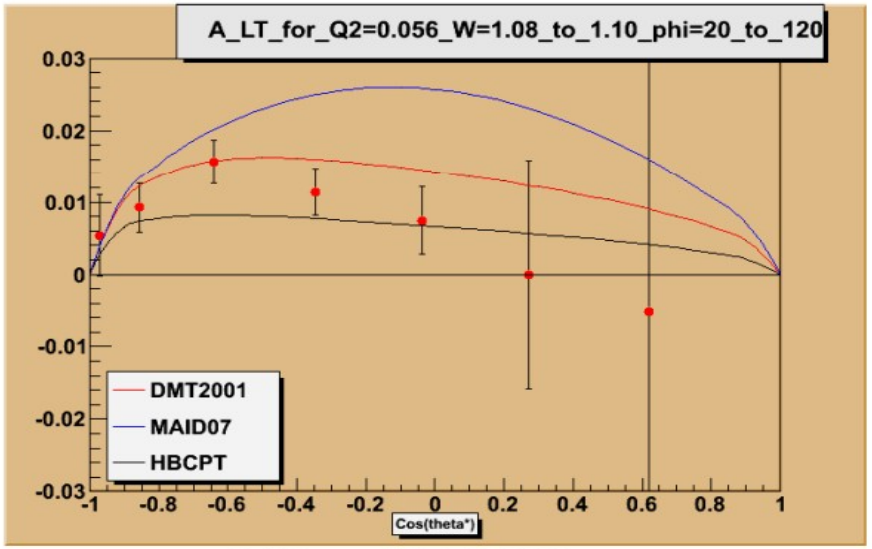
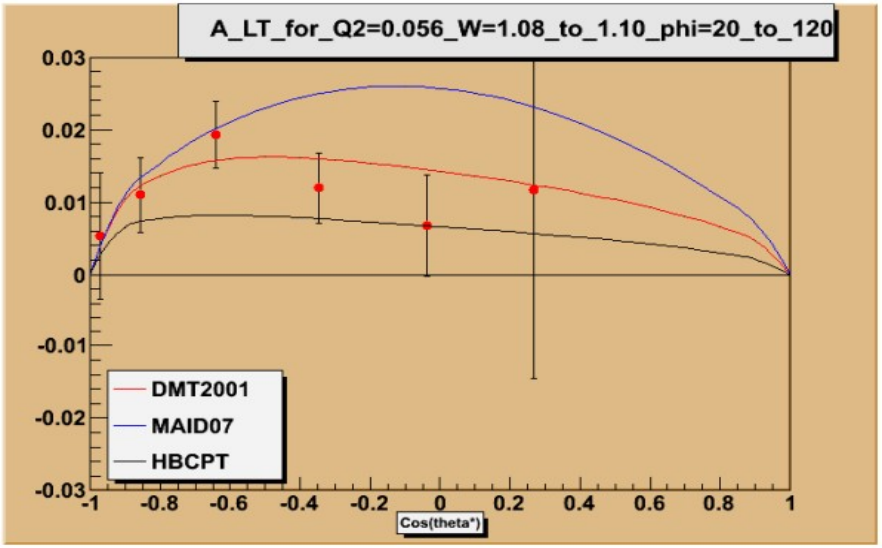
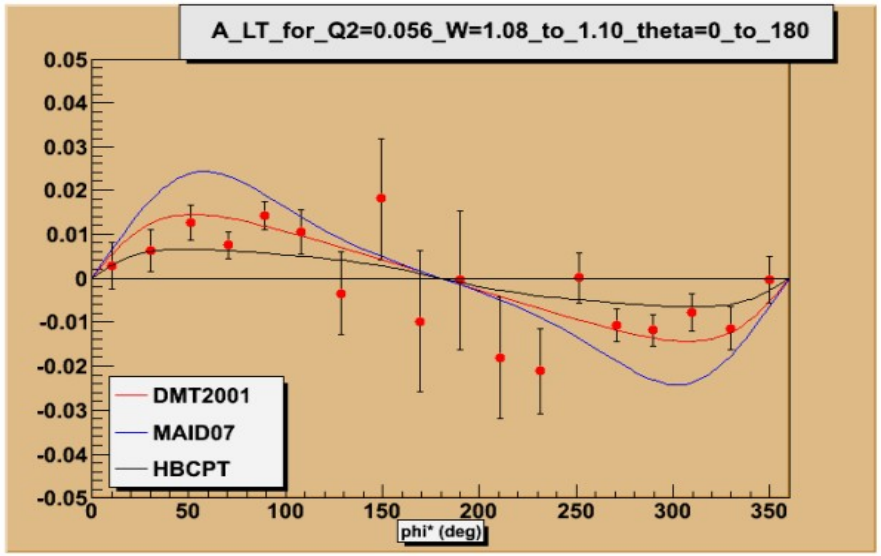


-0.02cm<VZ<0.035cm

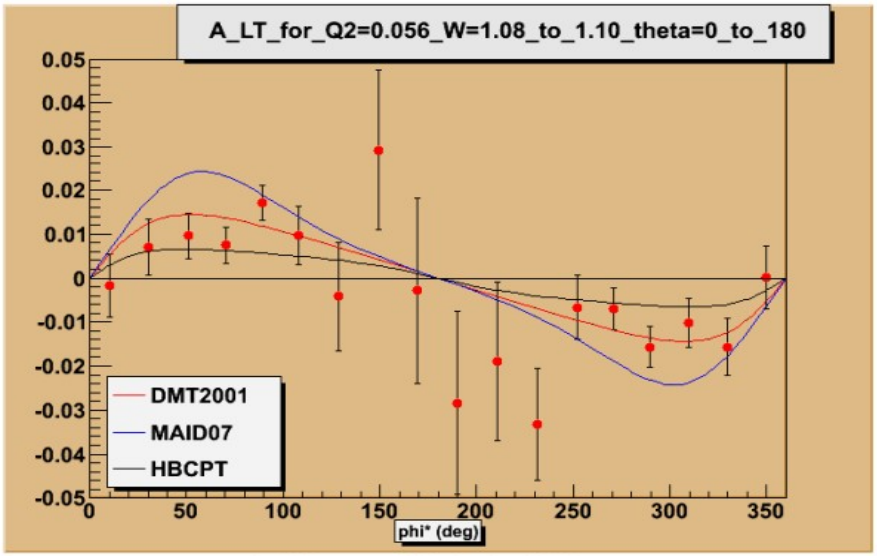


-0.01cm<VZ<0.025cm

Preliminary result



No VZ cut



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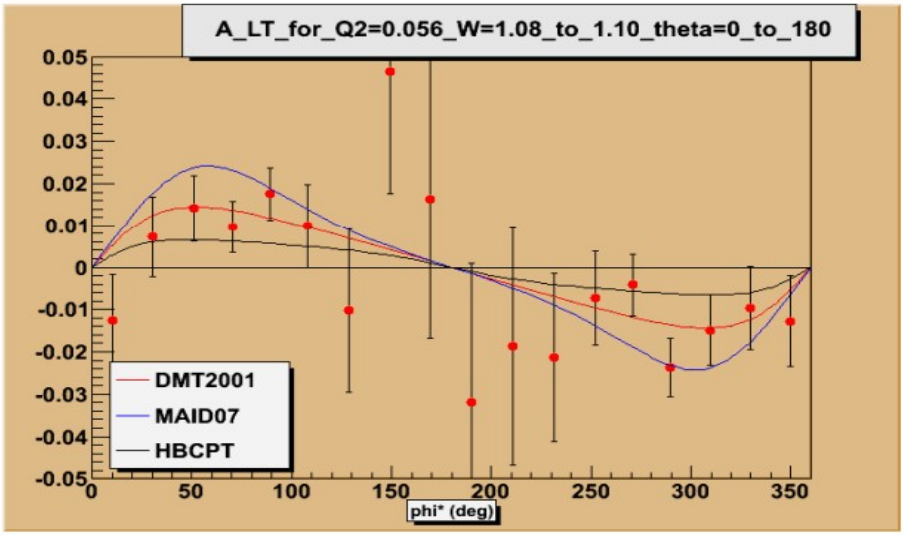
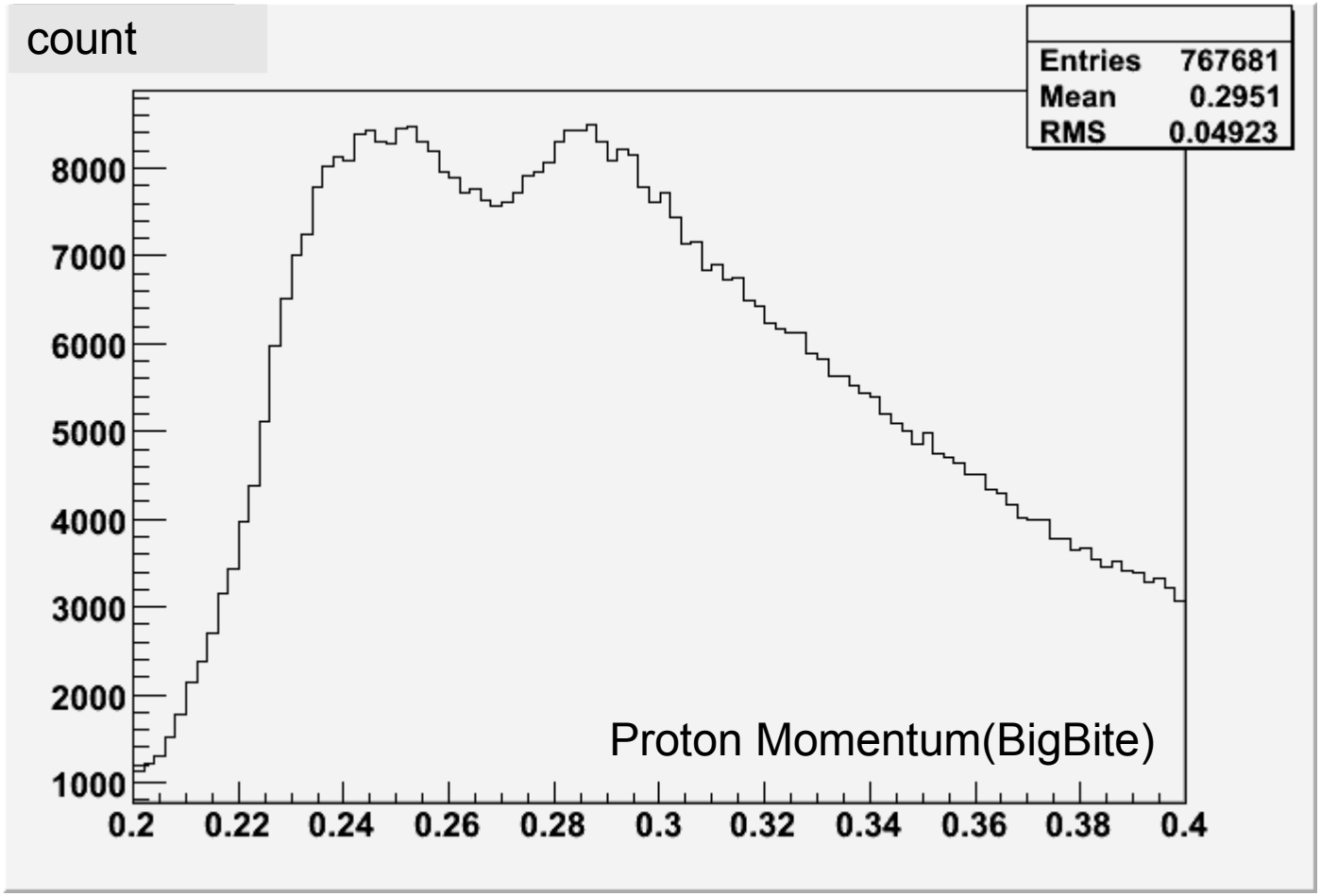


-0.01cm<VZ<0.025cm

Problem

trigger inefficiency



To Do

- Refine acceptance cuts
- Improve simulation of BigBite magnet and detector resolution
- Target background subtraction

Thank you