Electron reconstruction and A_1^n, $A_1^{^3\mathrm{He}}$ update II

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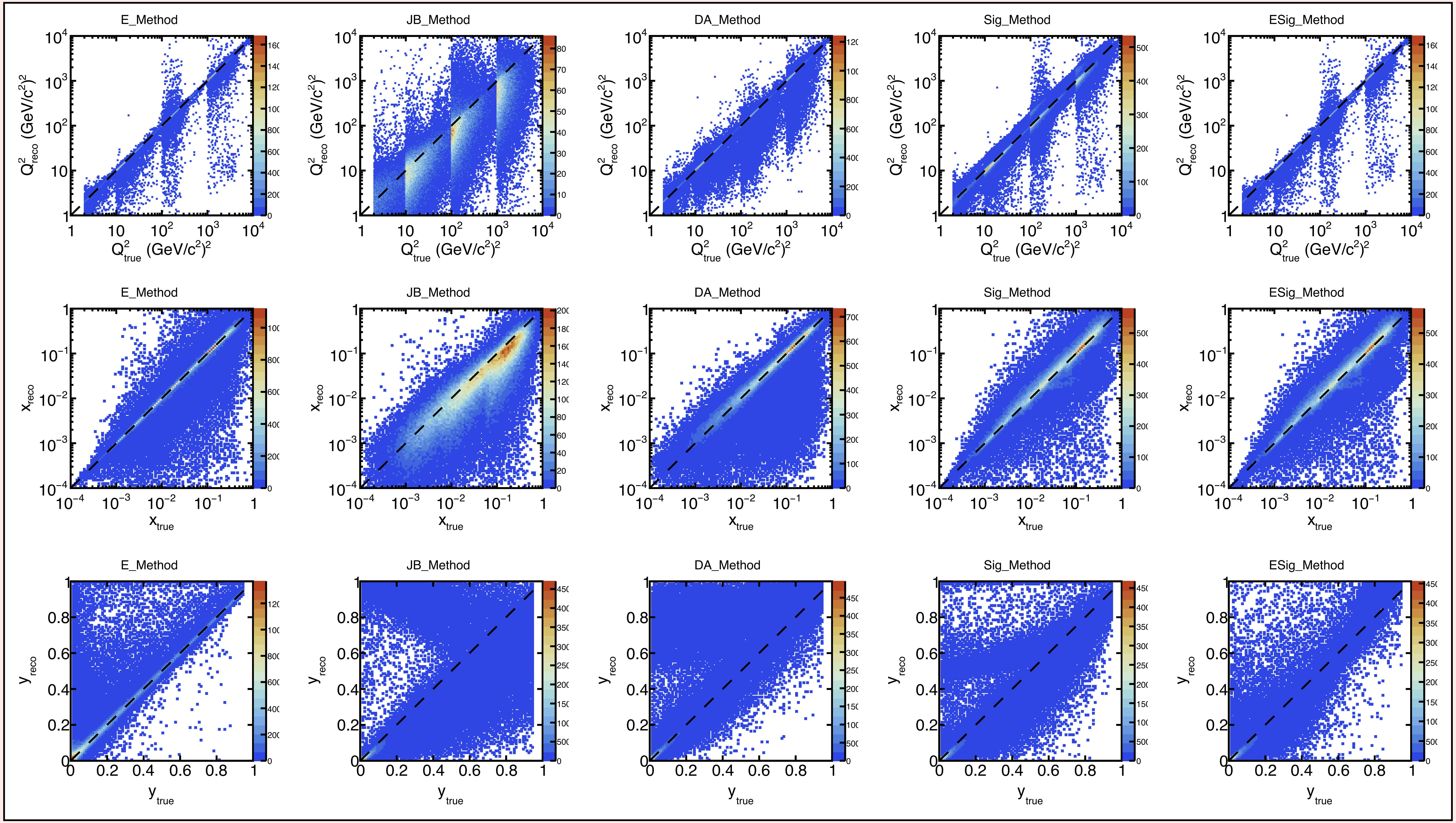
Joint inclusive/EWBSM PWG meeting
06/17/2025

Stony Brook University

Center for Frontiers in Nuclear Science

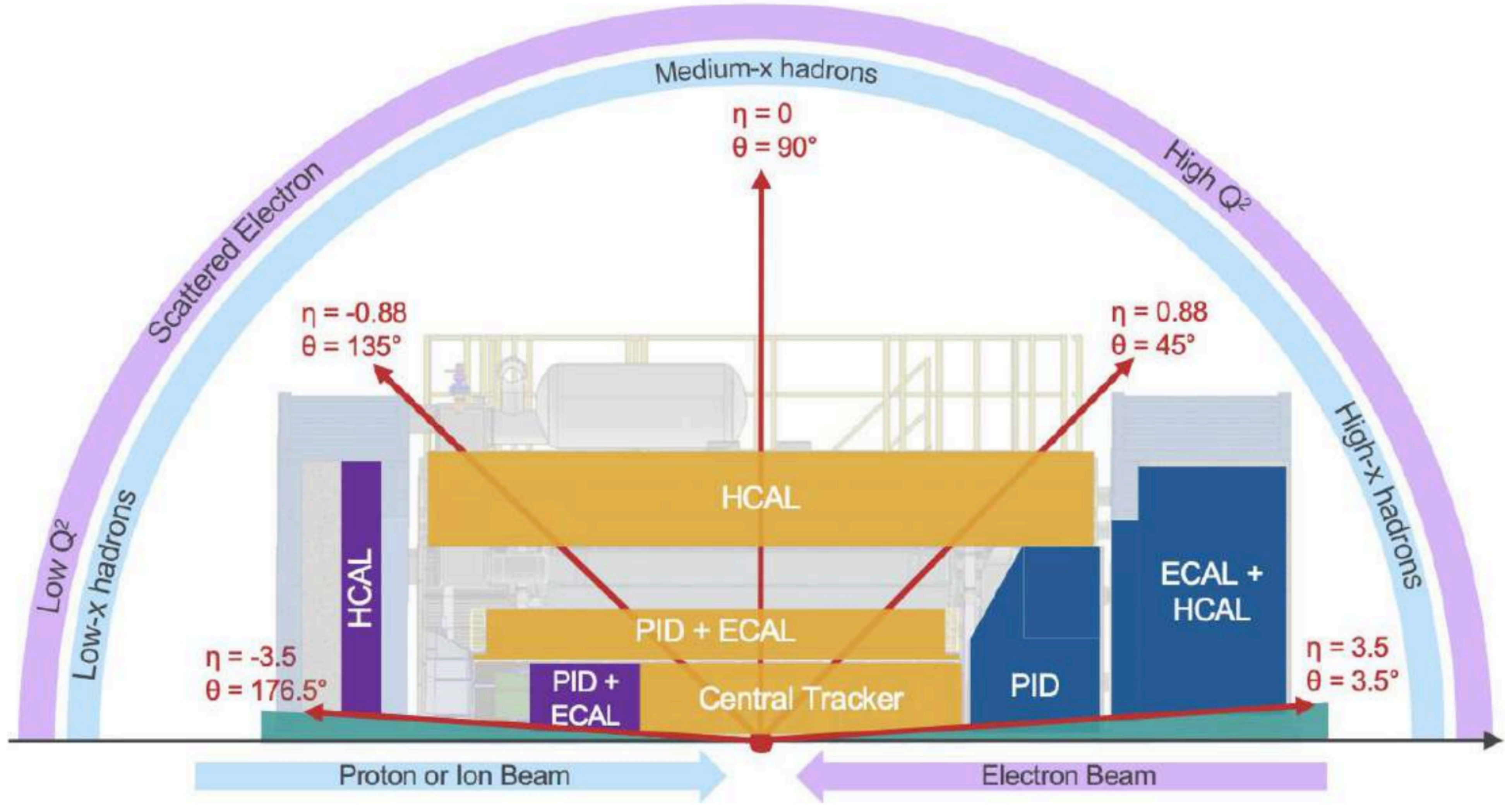
ePIC

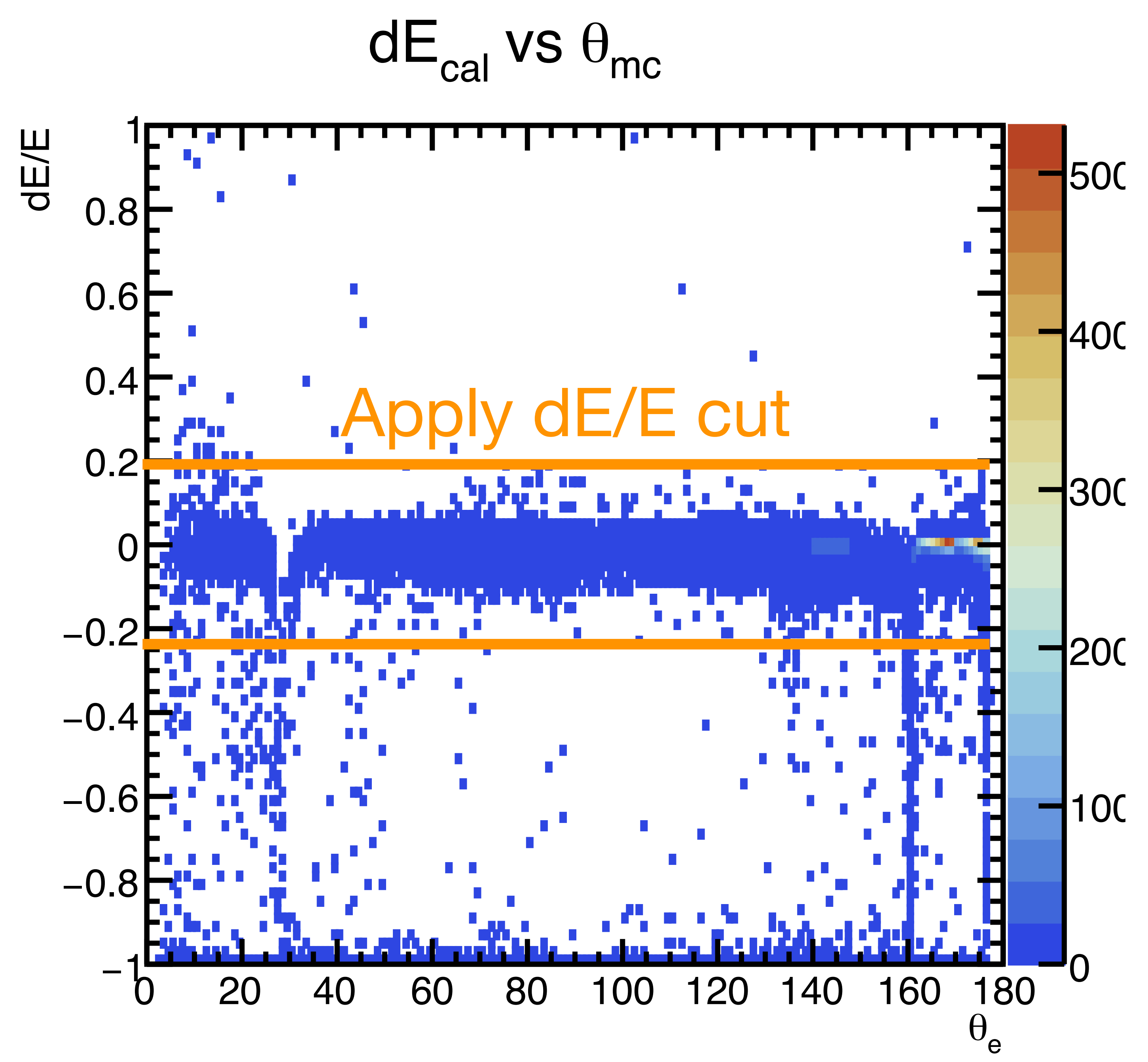
Recap: e recon. (Truth ID)

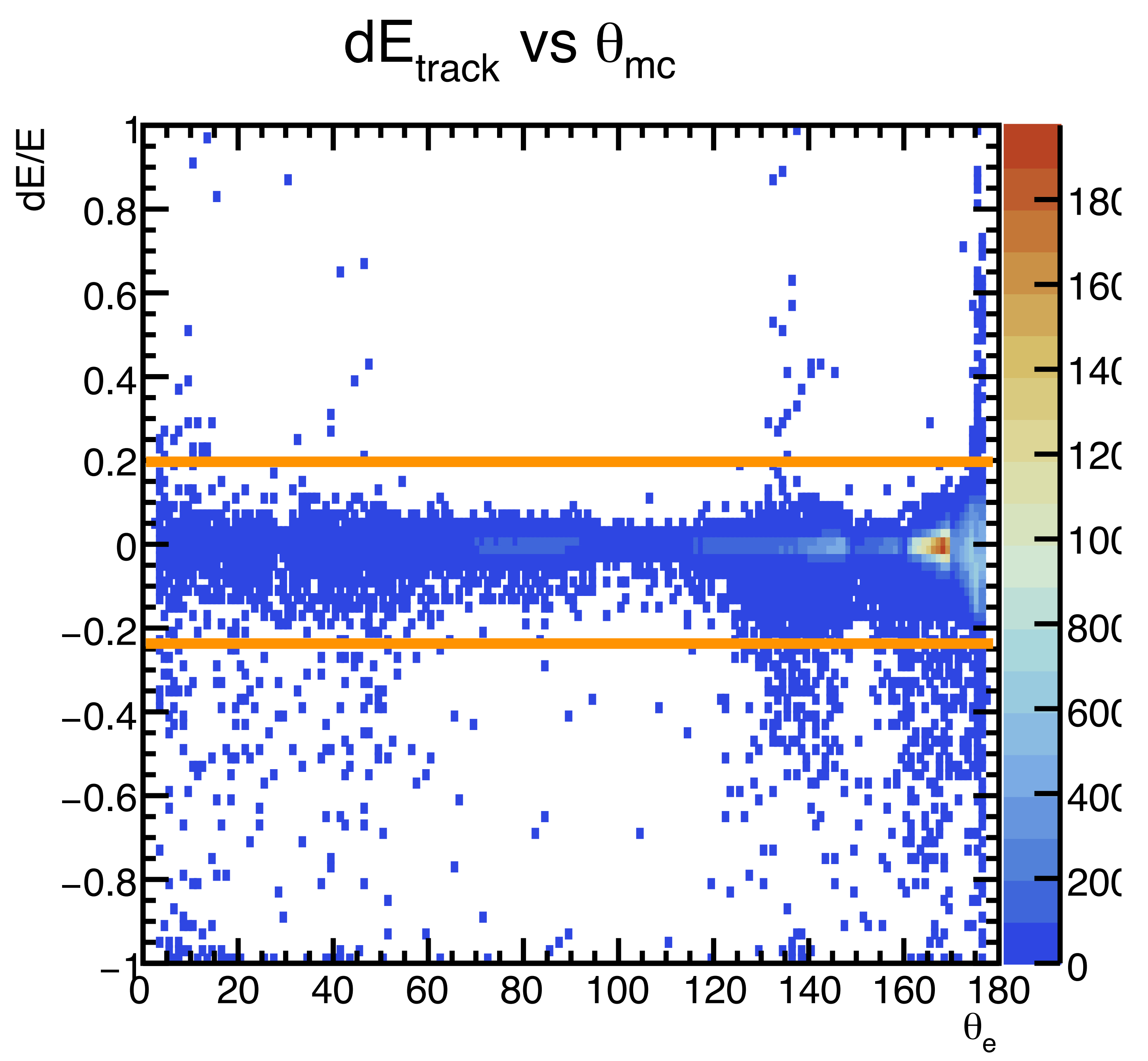


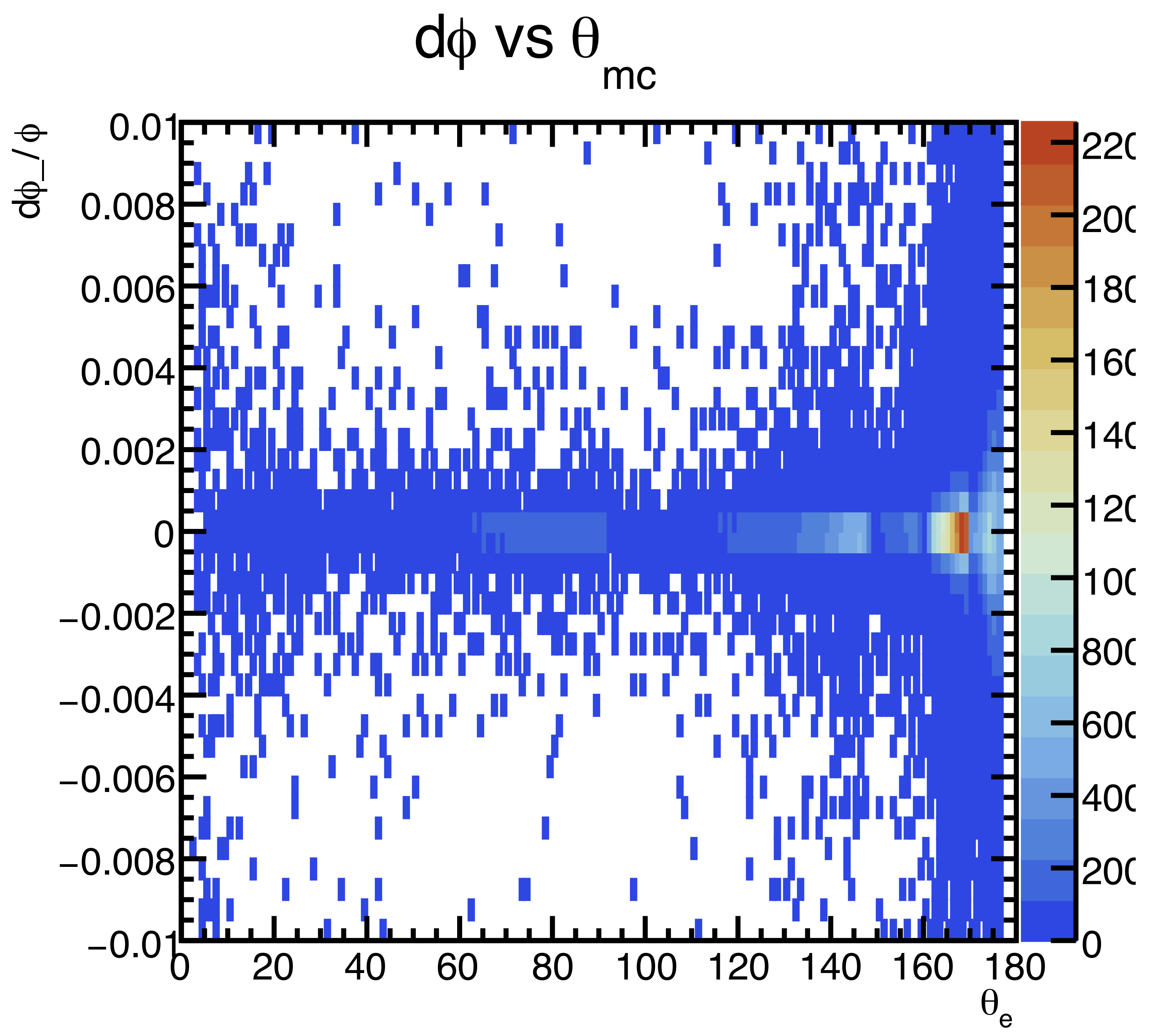
Recap: e recon. (Truth ID)

* EPIC 24.03.1 Sim. ep 18x278 GeV



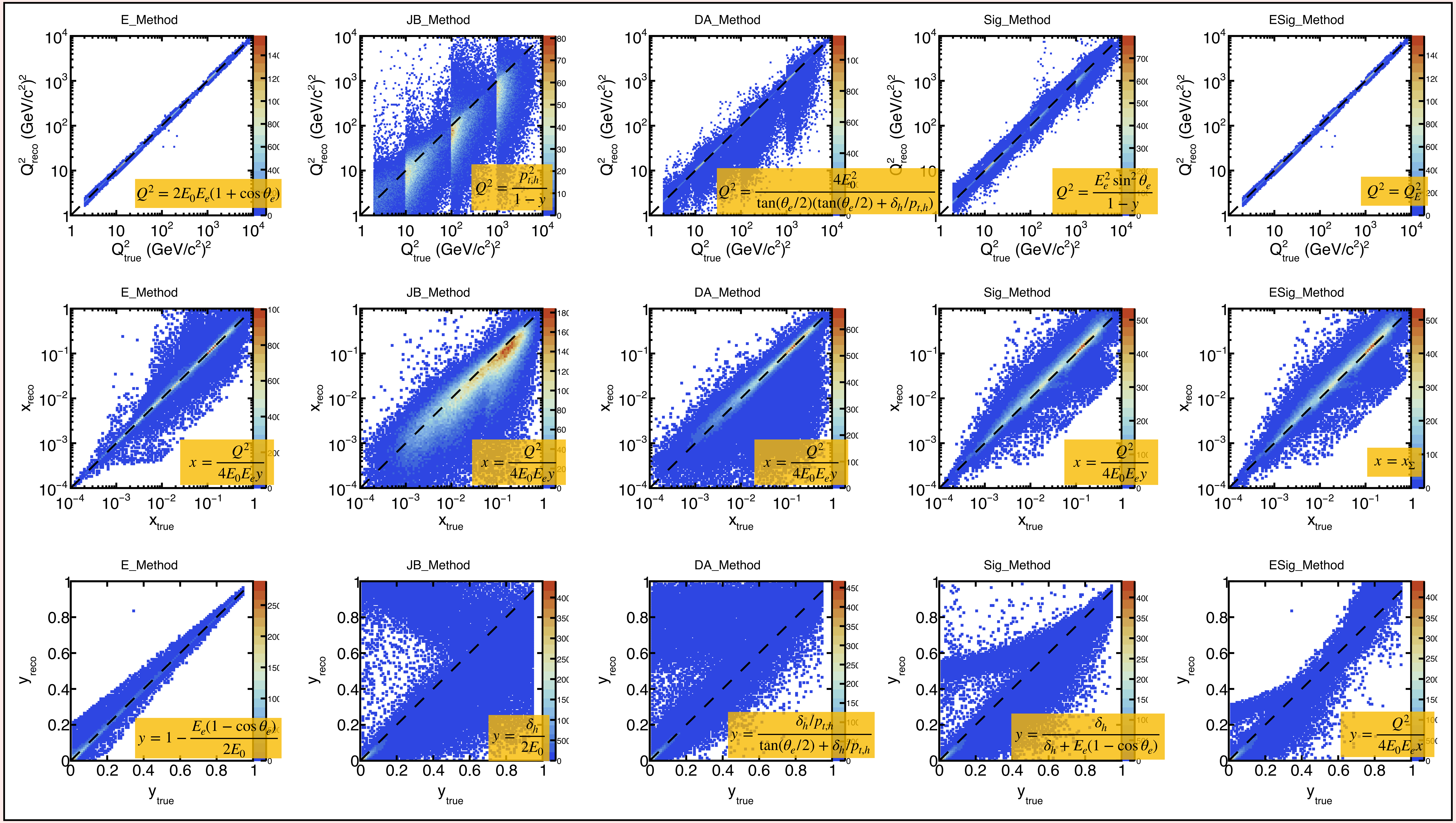






Recap: e recon. (Truth ID) - with dE/E cut

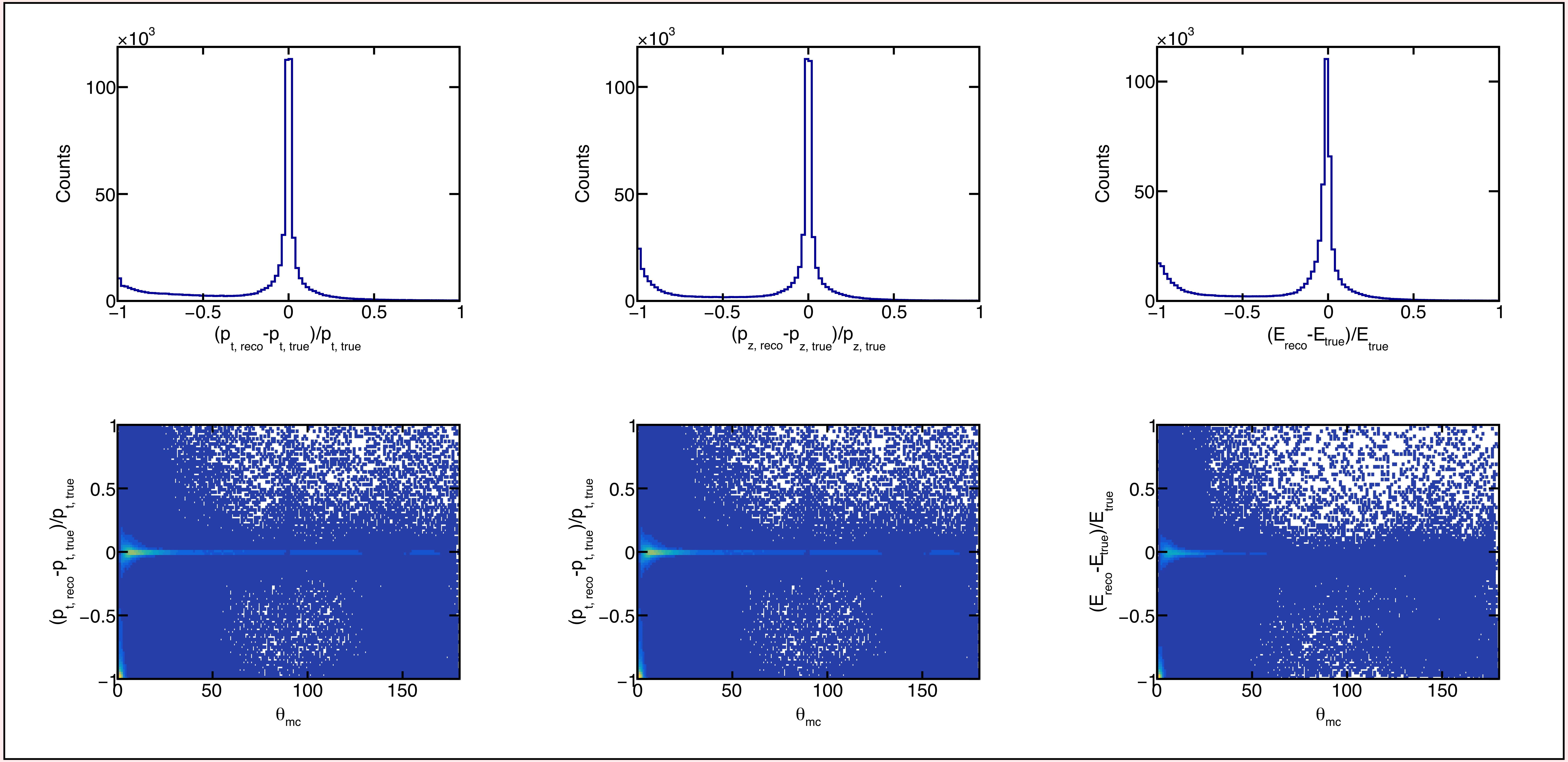
$$p_{t,h}^2 = (\sum_h p_{x,h})^2 + (\sum_h p_{y,h})^2 \qquad \delta_h = \sum_h E_h - p_{z,h}$$



HFS reconstruction

* EPIC 24.05.0 Sim. ep 18x278 GeV

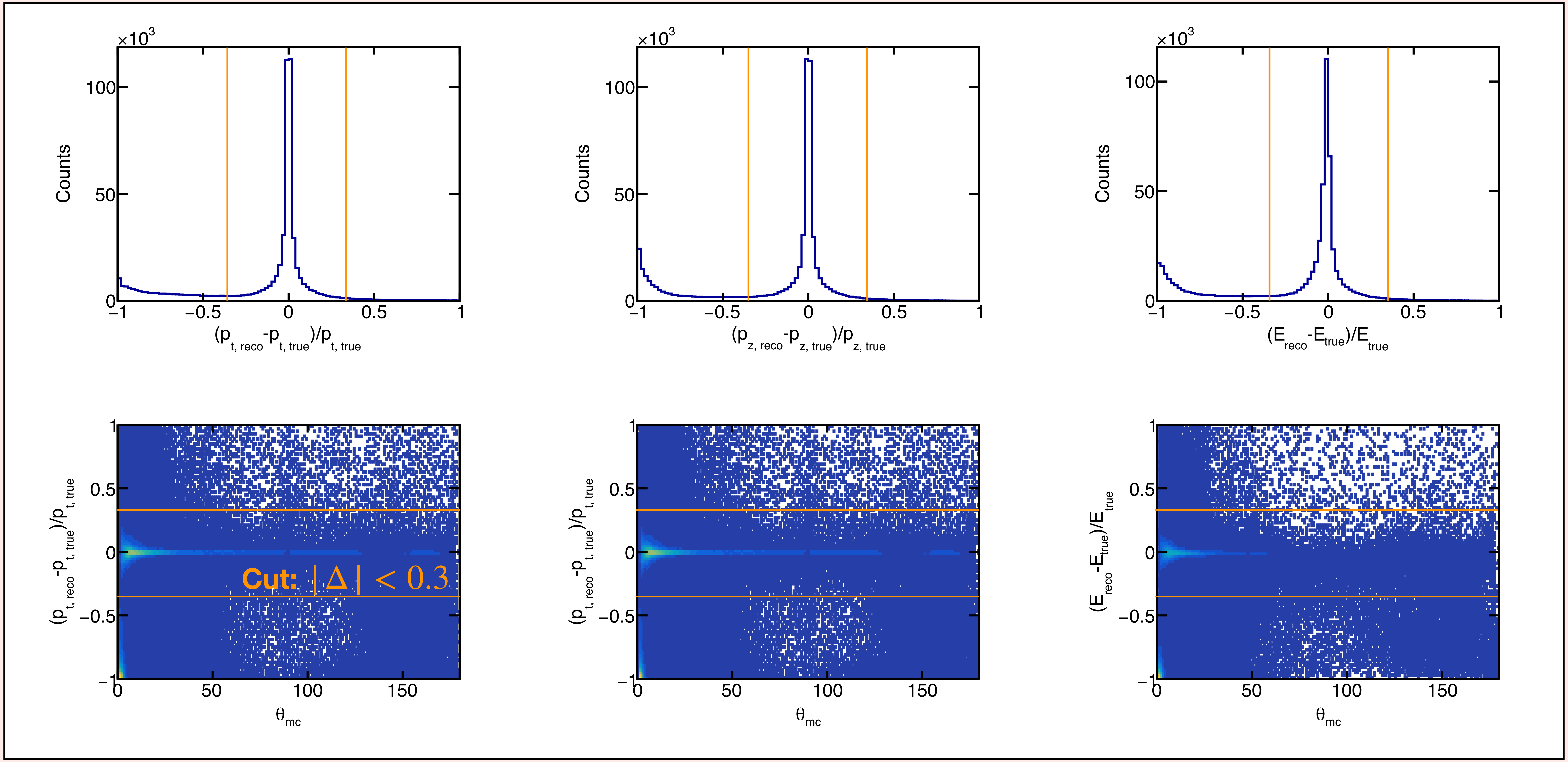
$$p_{t,h}^2 = (\sum_h p_{x,h})^2 + (\sum_h p_{y,h})^2 \qquad \delta_h = \sum_h E_h - p_{z,h}$$



HFS reconstruction

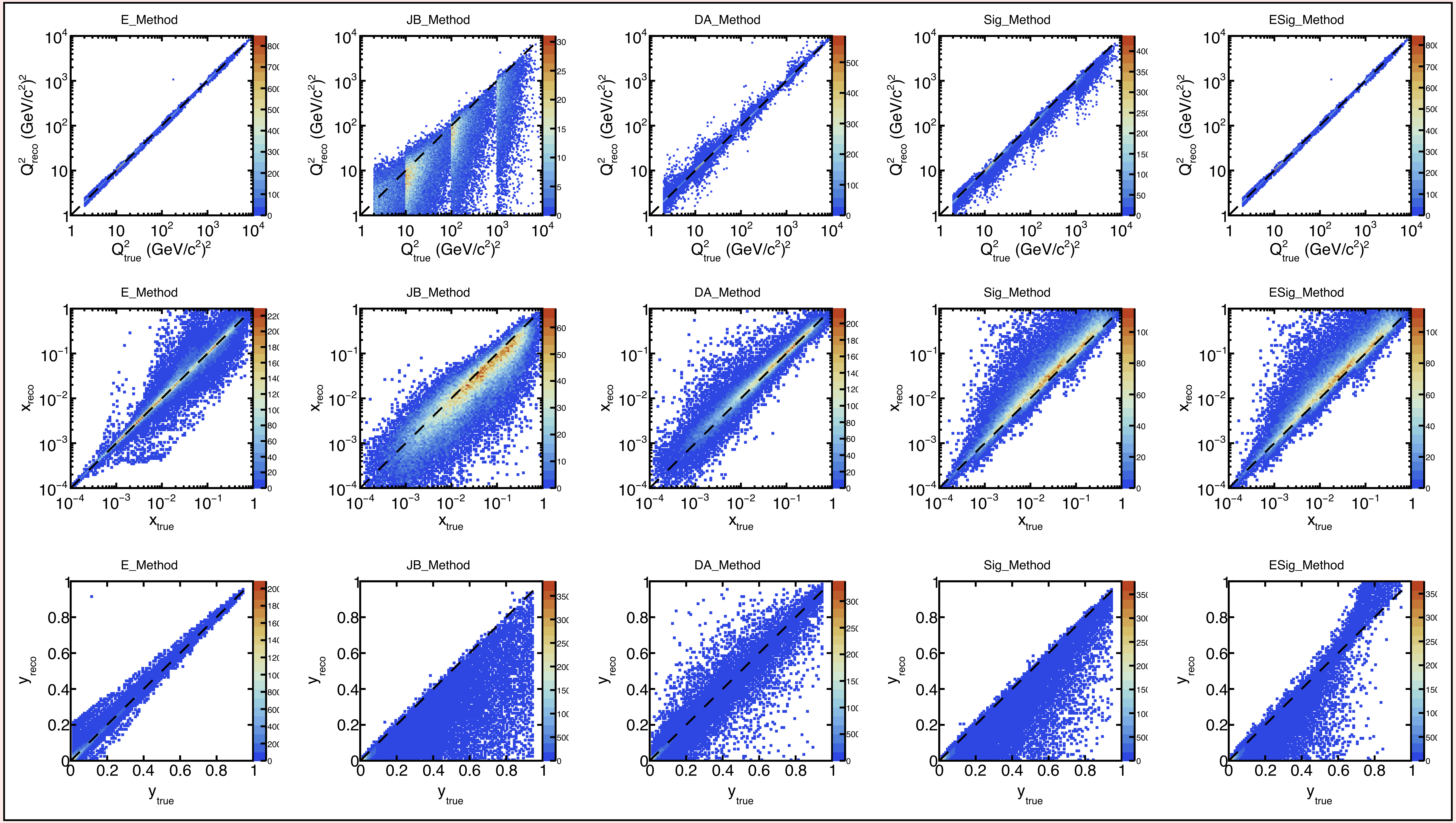
* EPIC 24.05.0 Sim. ep 18x278 GeV

$$p_{t,h}^2 = (\sum_h p_{x,h})^2 + (\sum_h p_{y,h})^2 \qquad \delta_h = \sum_h E_h - p_{z,h}$$



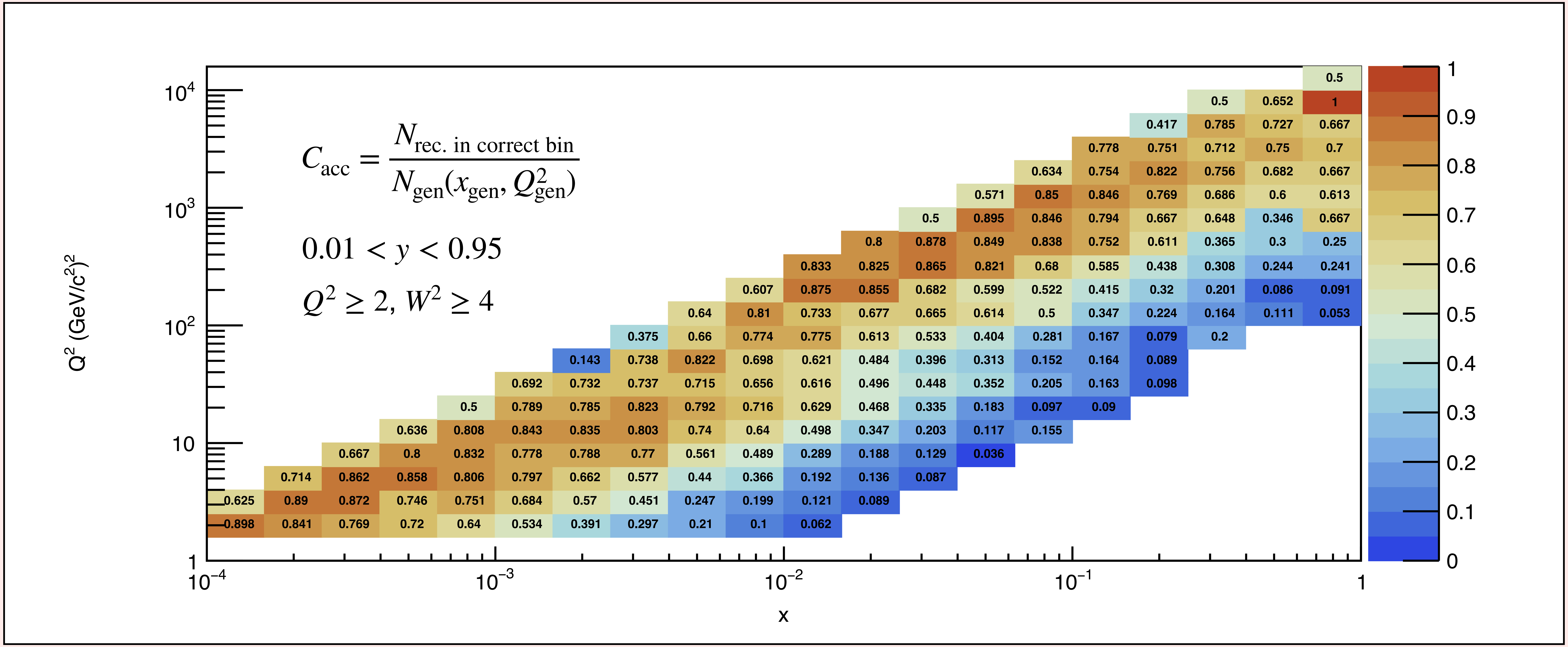
e recon. (Truth ID) - with HFS KE cut

* EPIC 24.05.0 Sim. ep 18x278 GeV

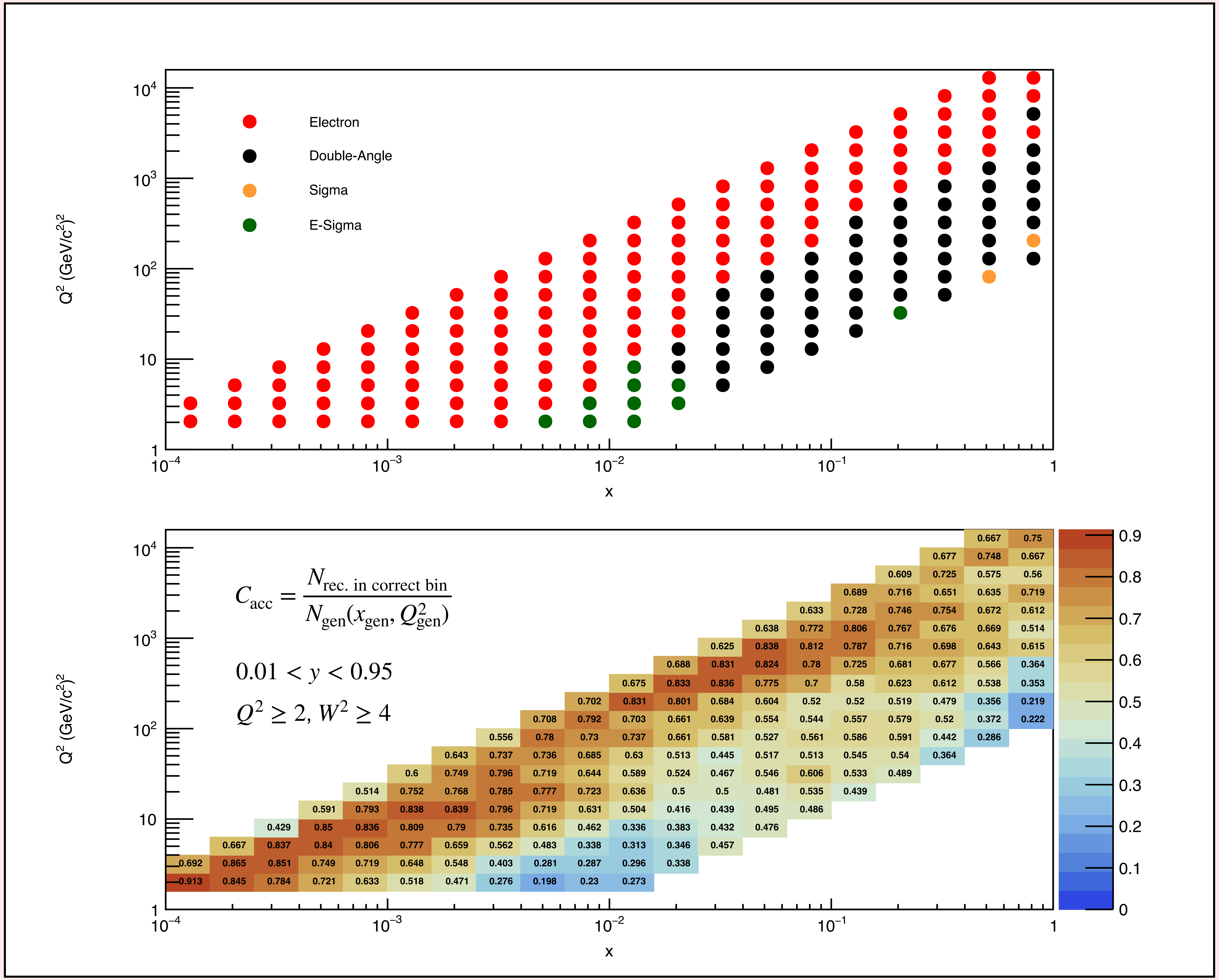


Select eRecon method

Electron Method Bin Efficiency

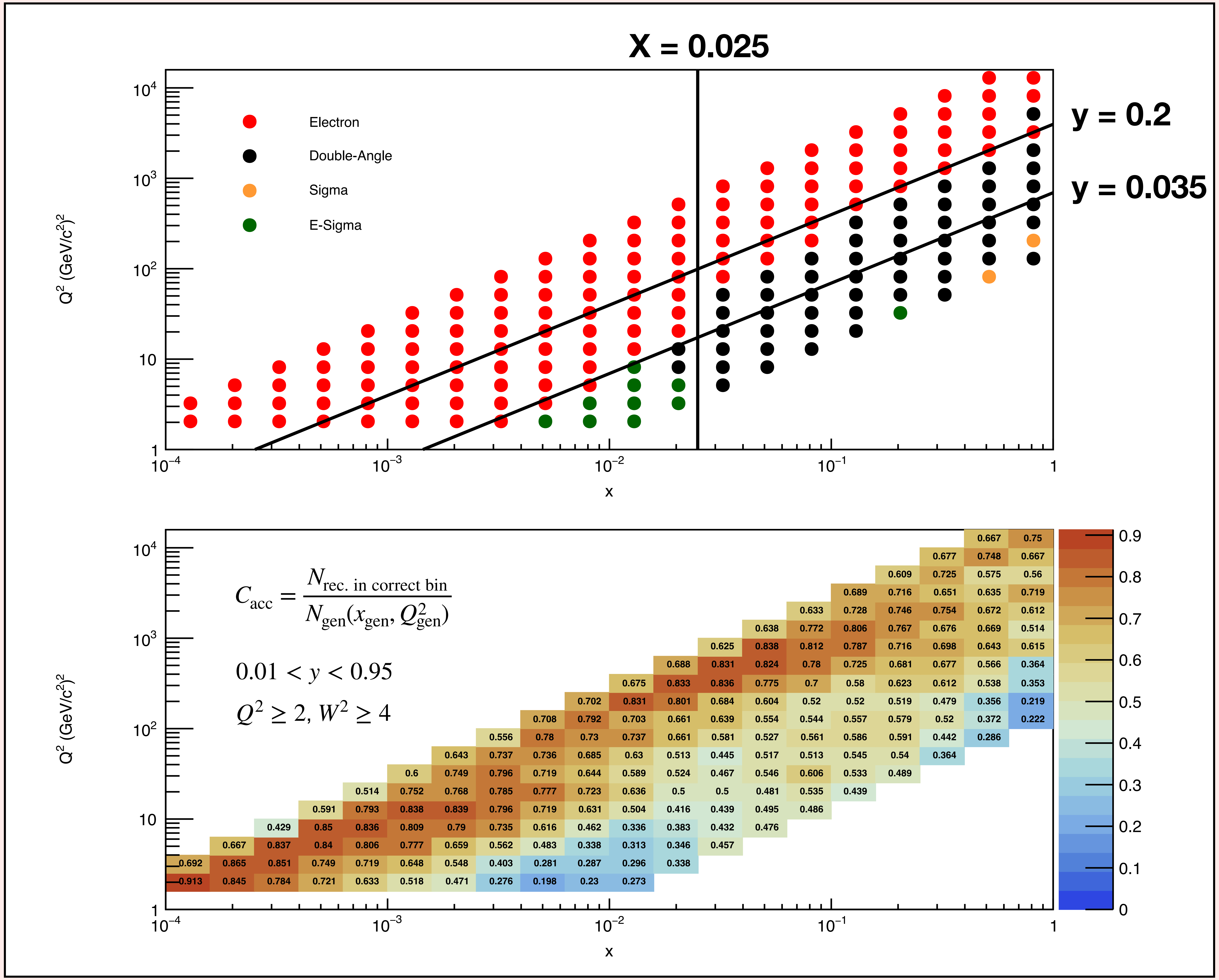


Select eRecon method



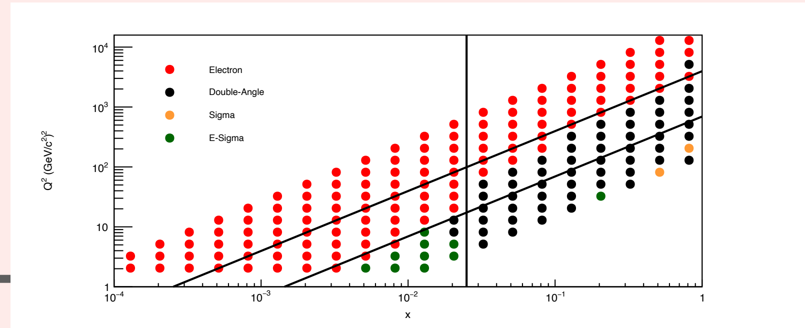
Select eRecon method

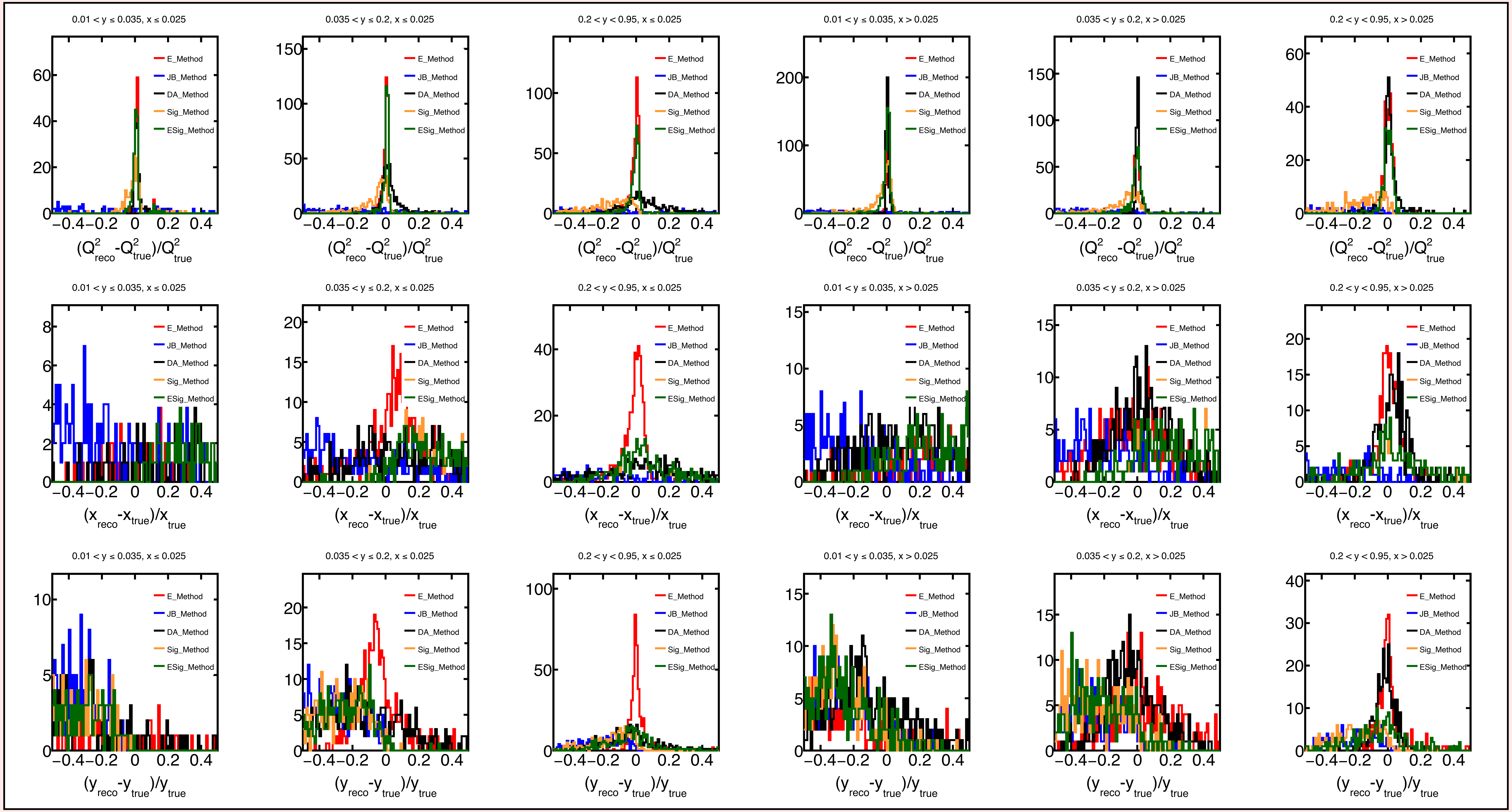
* EPIC 24.05.0 Sim. ep 18x278 GeV



Select eRecon method

* EPIC 24.05.0 Sim. ep 18x278 GeV





A_1^n from $e\,^3$He DIS:

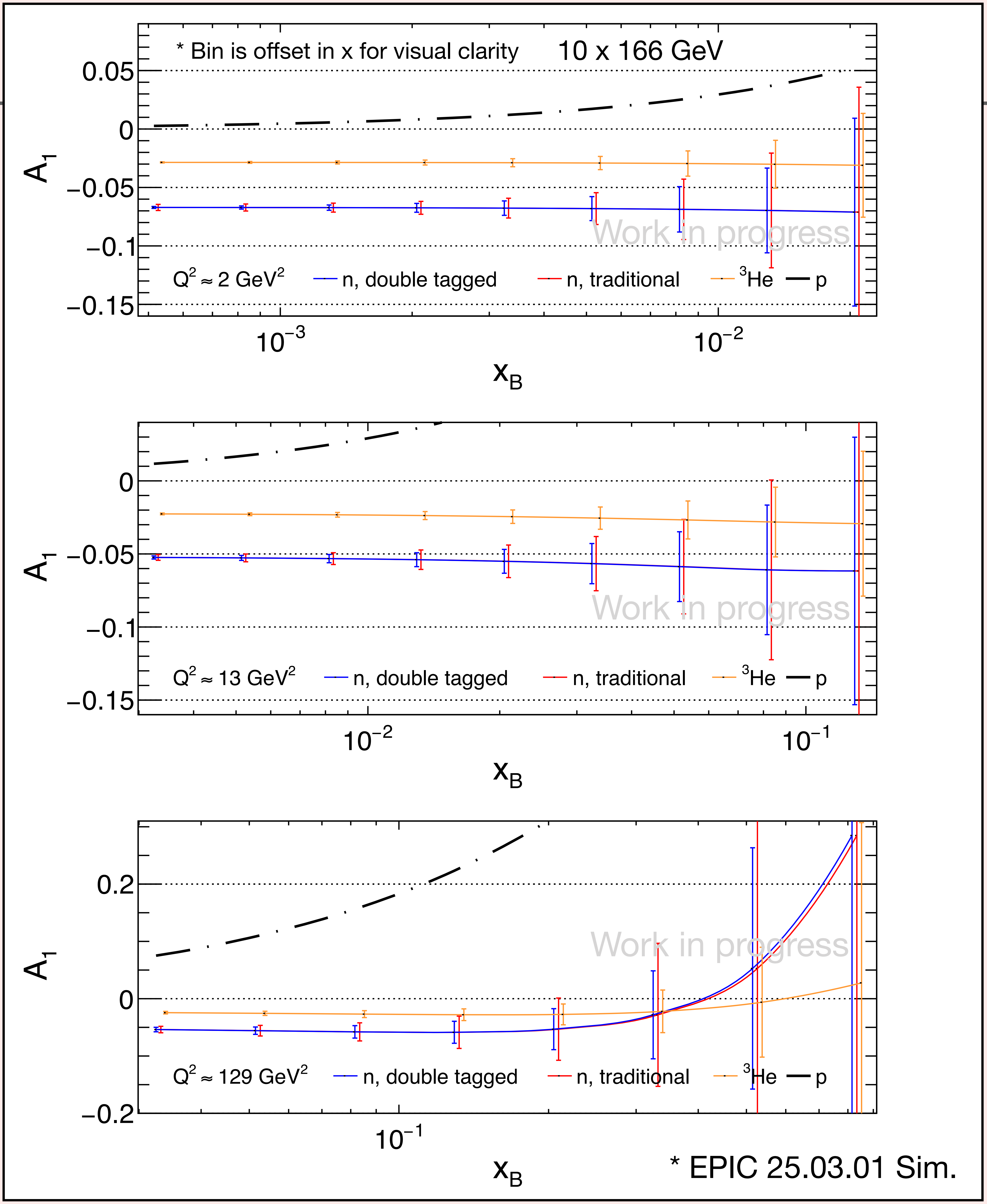
- $A_1(x, Q^2) \equiv \dfrac{\sigma_{1/2} - \sigma_{3/2}}{\sigma_{1/2} + \sigma_{3/2}} = \dfrac{A_\parallel}{D(1+\eta\xi)} - \dfrac{\eta A_\perp}{d(1+\eta\xi)}$
- $\mathscr{L} = 8.65\ \mathrm{fb}^{-1}, P_e = P_n = 70\,\%$
- Data split evenly between $A_\parallel$ and $A_\perp$
- $\delta A_{\parallel,\perp} = \dfrac{1}{\sqrt{N} P_e P_N}$

Correction!

- $A_1^{^3\mathrm{He}} = P_n \dfrac{F_2^n}{F_2^{^3\mathrm{He}}} A_1^n + 2P_p \dfrac{F_2^p}{F_2^{^3\mathrm{He}}} A_1^p$

Was using $F_2^{^3\mathrm{He}}$ per nucleon

- Bin A_1^n calculated from: Doi: 10.2172/824895
- $F_2^{^3\mathrm{He}} = F_2^D + F_2^p$, all F_2's are taken from JAM22
- Correction not yet applied



A_1^n from e^3He DIS (updated):

- $A_1(x,Q^2) \equiv \dfrac{\sigma_{1/2}-\sigma_{3/2}}{\sigma_{1/2}+\sigma_{3/2}} = \dfrac{A_\parallel}{D(1+\eta\xi)} - \dfrac{\eta A_\perp}{d(1+\eta\xi)}$
- $\mathscr{L} = 8.65\ \mathrm{fb}^{-1}, P_e = P_n = 70\,\%$
- Data split evenly between $A_\parallel$ and $A_\perp$
- $\delta A_{\parallel,\perp} = \dfrac{1}{\sqrt{N}P_e P_N}$
- $A_1^{^3\mathrm{He}} = P_n \dfrac{F_2^n}{F_2^{^3\mathrm{He}}} A_1^n + 2P_p \dfrac{F_2^p}{F_2^{^3\mathrm{He}}} A_1^p$
- Bin A_1^n calculated from: Doi: 10.2172/824895
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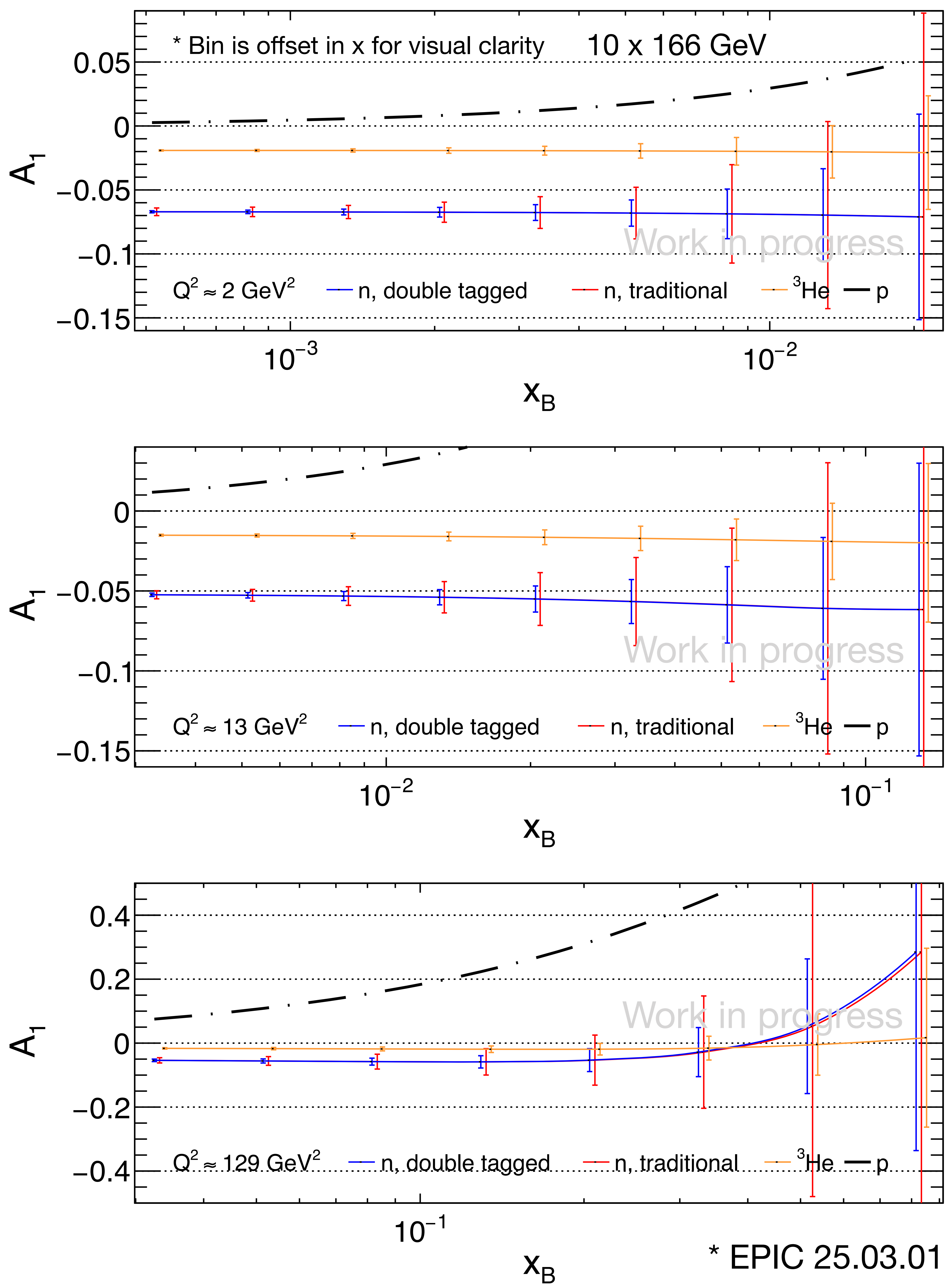

* EPIC 25.03.01 Sim.

A_1^n from e^3He DIS (updated):

- $A_1(x,Q^2) \equiv \dfrac{\sigma_{1/2}-\sigma_{3/2}}{\sigma_{1/2}+\sigma_{3/2}} = \dfrac{A_\parallel}{D(1+\eta\xi)} - \dfrac{\eta A_\perp}{d(1+\eta\xi)}$
- $\mathscr{L} = 8.65\ \text{fb}^{-1}, P_e = P_n = 70\,\%$
- Data split evenly between $A_\parallel$ and $A_\perp$
- $\delta A_{\parallel,\perp} = \dfrac{1}{\sqrt{N}P_eP_N}$
- $A_1^{^3\text{He}} = P_n \dfrac{F_2^n}{F_2^{^3\text{He}}} A_1^n + 2P_p \dfrac{F_2^p}{F_2^{^3\text{He}}} A_1^p$
- Bin A_1^n calculated from: Doi: 10.2172/824895
- $F_2^{^3\text{He}} = F_2^D + F_2^p$, all F_2's are taken from JAM22
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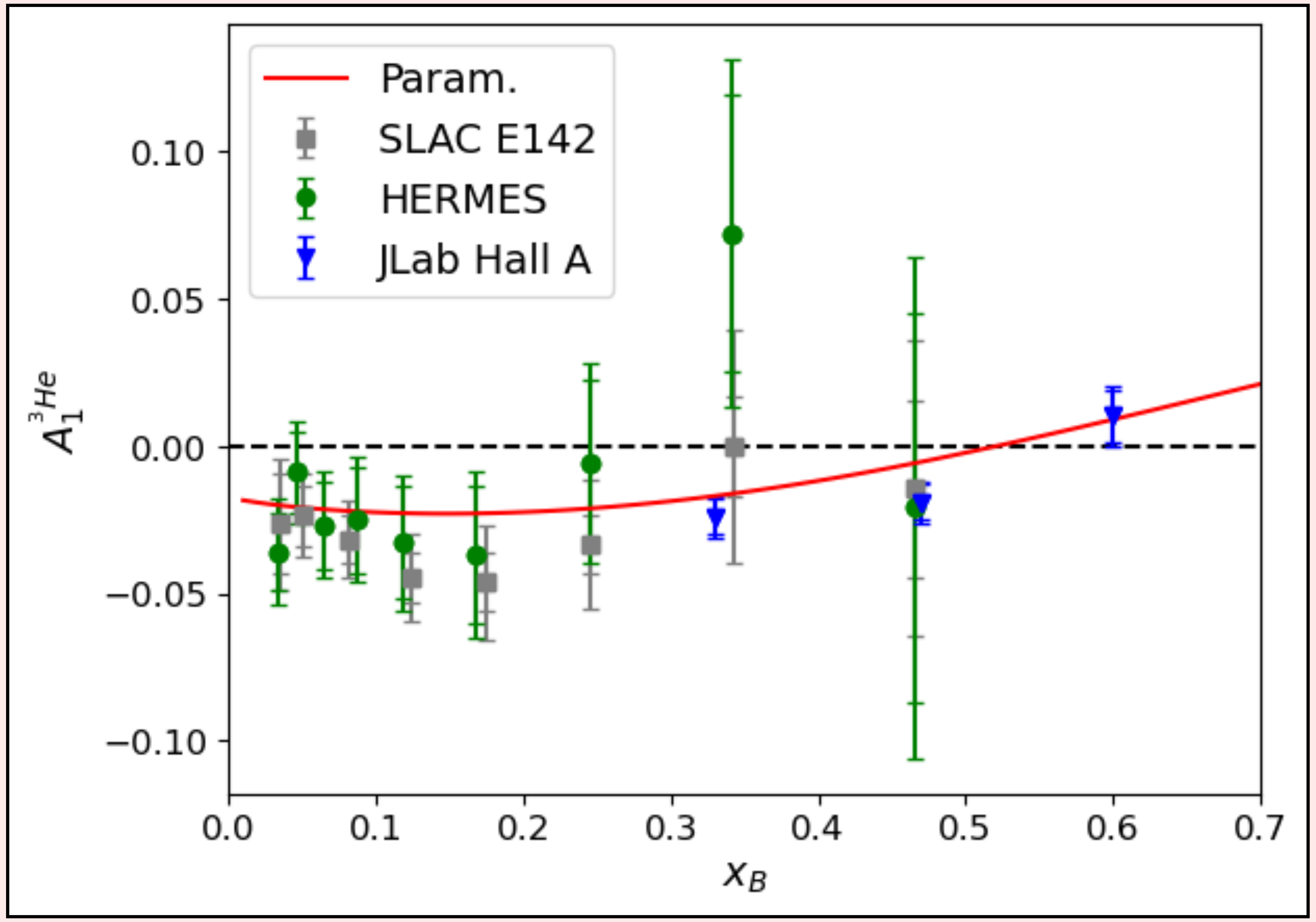


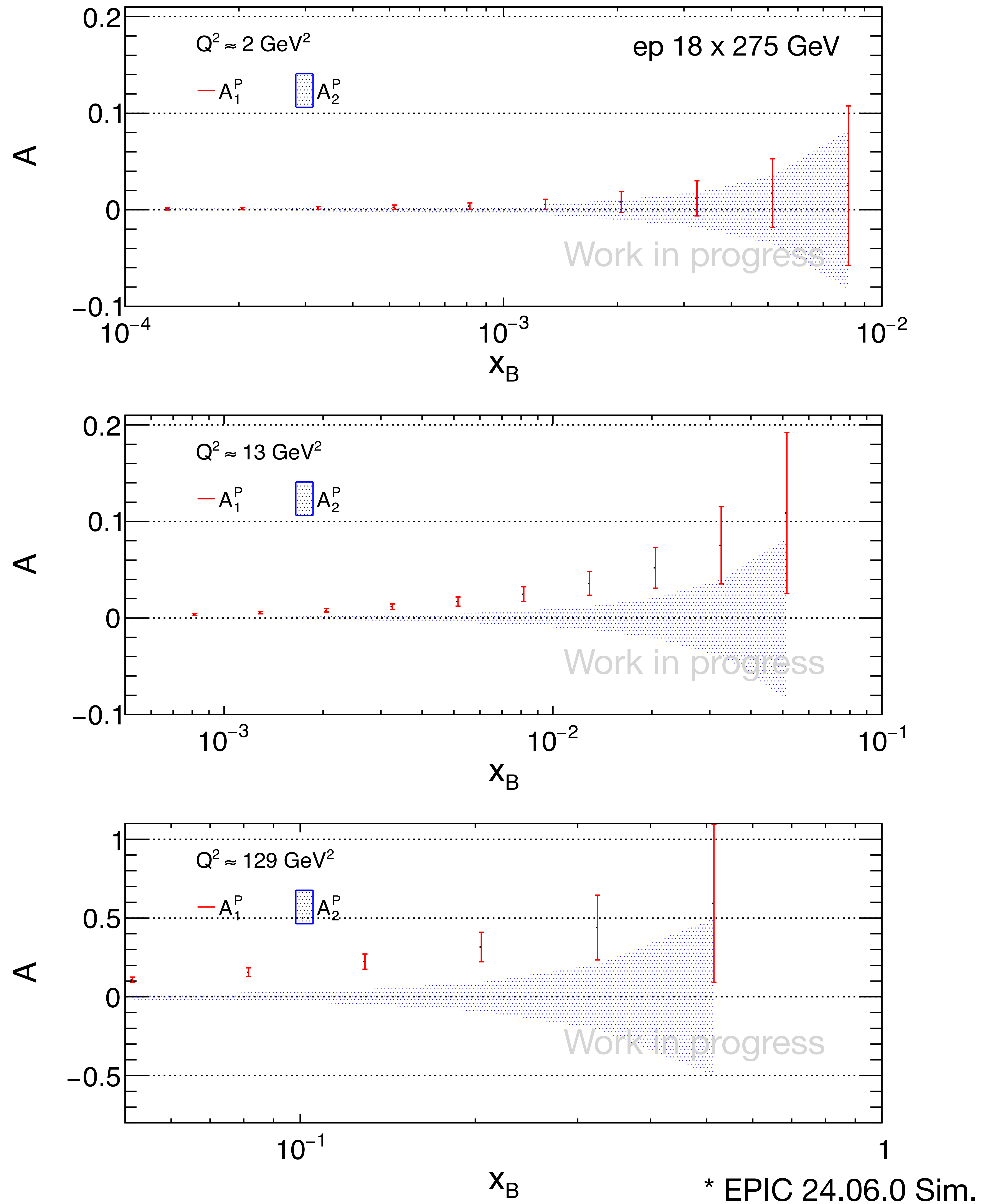
SLAC E142: https://doi.org/10.1103/PhysRevD.54.6620

HERMES: https://doi.org/10.1016/S0370-2693(99)00964-8

JLab Hall A: https://doi.org/10.1103/PhysRevC.70.065207

A_2 and g_2?

- $$A_1(x,Q^2) \equiv \frac{\sigma_{1/2}-\sigma_{3/2}}{\sigma_{1/2}+\sigma_{3/2}} = \frac{A_\parallel}{D(1+\eta\xi)} - \frac{\eta A_\perp}{d(1+\eta\xi)}$$
- $$A_2(x,Q^2) \equiv \frac{2\sigma_{LT}}{\sigma_{1/2}+\sigma_{3/2}} = \frac{\xi A_\parallel}{D(1+\eta\xi)} - \frac{A_\perp}{d(1+\eta\xi)}$$
- $$\gamma A_2(x,Q^2) + A_1(x,Q^2) = (1+\gamma^2)\frac{g_1(x,Q^2)}{F_1(X,Q^2)}$$
- $$\frac{A_2(x,Q^2)}{\gamma} - A_1(x,Q^2) = (1+\gamma^2)\frac{g_2(x,Q^2)}{F_1(X,Q^2)}$$
- $$g_2(x,Q^2) = g_2^{ww}(x,Q^2) + \bar{g}_2(x,Q^2)$$
- $$g_2^{ww}(x,Q^2) = -g_1(x,Q^2) + \int_x^1 \frac{g_1(y,Q^2)}{y}dy$$



* EPIC 24.06.0 Sim.