Electron Reconstruction

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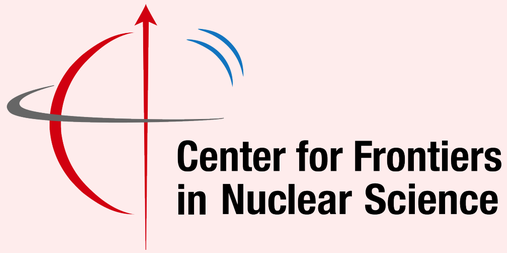
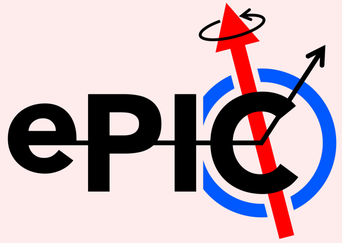
ePIC Collaboration Meeting
08/08/2025





Inclusive electron reconstruction

Current available reconstruction in EICRecon

Algorithm	Q^2	Inelasticity y	Bjorken x
Electron (E)	$2E_0E_e(1+\cos\theta_e)$	$1-\frac{E_e(1-\cos\theta_e)}{2E_0}$	$\frac{Q^2}{4E_0E_ey}$
Jacquet-Blonde (JB)	$\frac{p_{t,h}^2}{1-y}$	$\frac{\delta_h}{2E_0}$	
Double-Angle (DA)	$\frac{4E_0^2}{\tan(\frac{\theta_e}{2})(\tan(\frac{\theta_e}{2})+\delta_h/p_{t,h})}$	$\frac{\delta_h/p_{t,h}}{\tan(\frac{\theta_e}{2})+\delta_h/p_{t,h}}$	
Sigma (Σ)	$\frac{E_e^2\sin^2\theta_e}{1-y}$	$\frac{\delta_h}{\delta_h+E_e(1-\cos\theta_e)}$	
E-Sigma ($e\Sigma$)	Q_E^2	$\frac{Q_E^2}{4E_0E_ex_\Sigma}$	x_Σ

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

- Electron Finder Library
- MC info to pair track and cluster
- TruthID (associate hit to MC) for eID
- Assume first MC outgoing electron is the scattering electron

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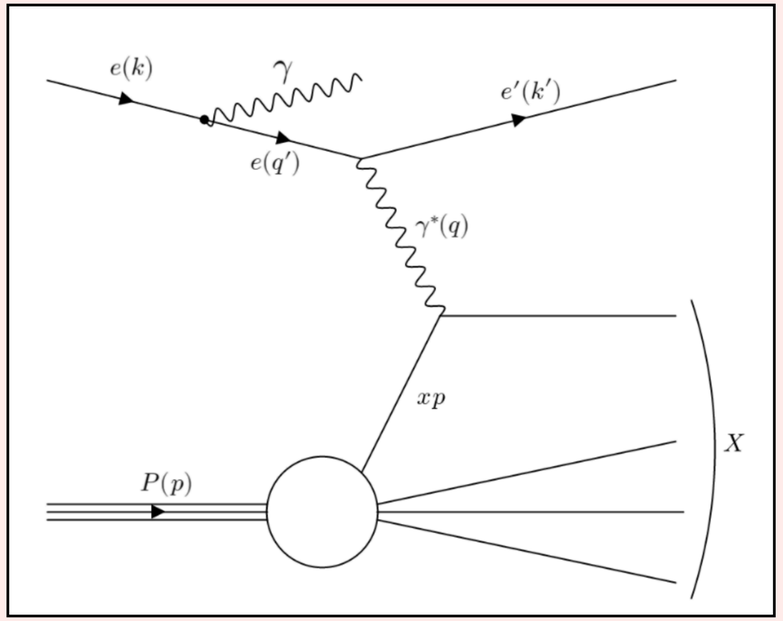
$$p_{t,h}^2=(\sum_h p_{x,h})^2+(\sum_h p_{y,h})^2 \qquad \delta_h=\sum_h E_h-p_{z,h}$$

- Uses only scattered electron info
- Assume beam energy
- Problem: Electron radiative effect



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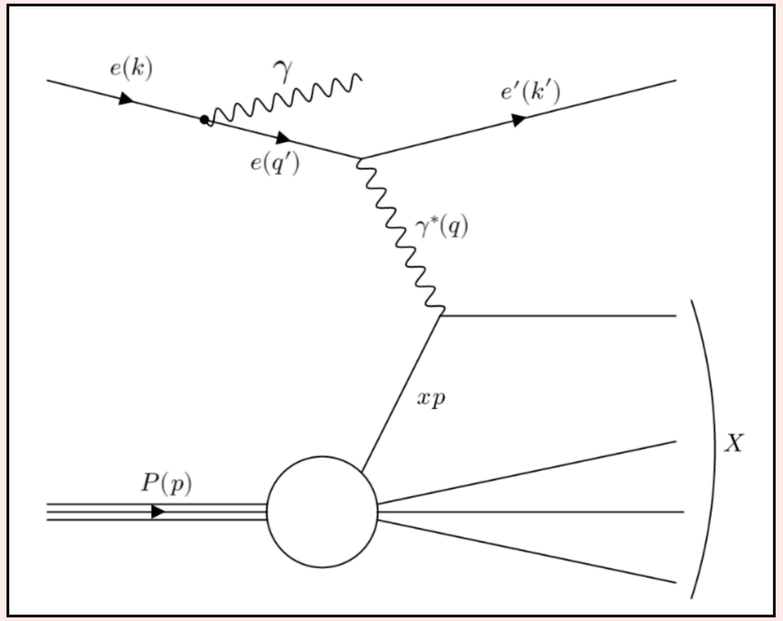
- Uses only HFS particles information
- Many particles, some with worse reconstruction resolution
- Only available method for CC DIS



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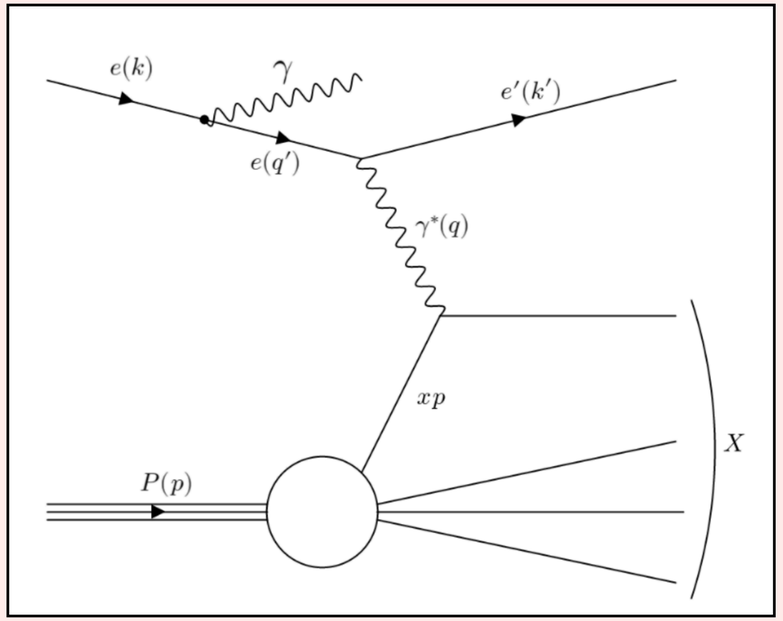
$$p_{t,h}^2=(\sum_h p_{x,h})^2+(\sum_h p_{y,h})^2 \qquad \delta_h=\sum_h E_h-p_{z,h}$$

- No use of scattered electron energy
- Errors of HFS energy are largely canceled out
- Good when energy resolution is poor



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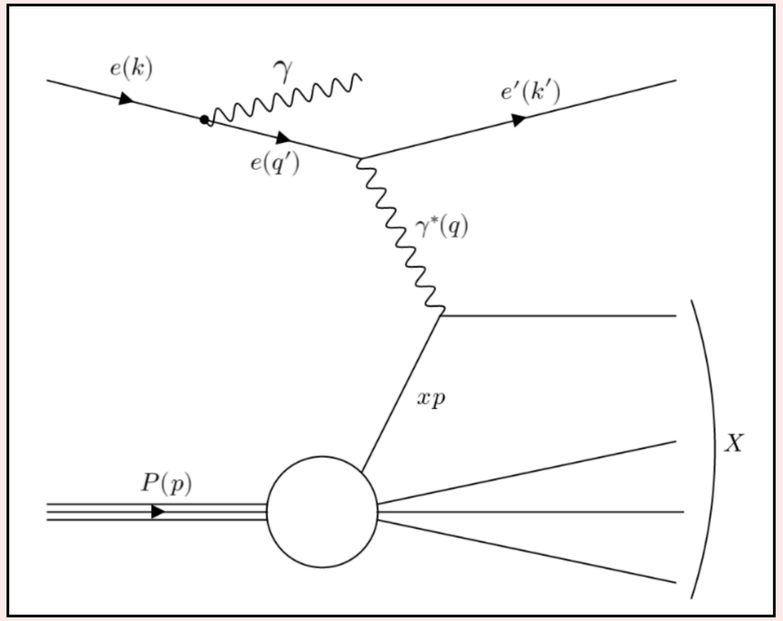
$$p_{t,h}^2=(\sum_h p_{x,h})^2+(\sum_h p_{y,h})^2 \qquad \delta_h=\sum_h E_h-p_{z,h}$$

- No use of electron beam energy
- More resistant to initial state radiation



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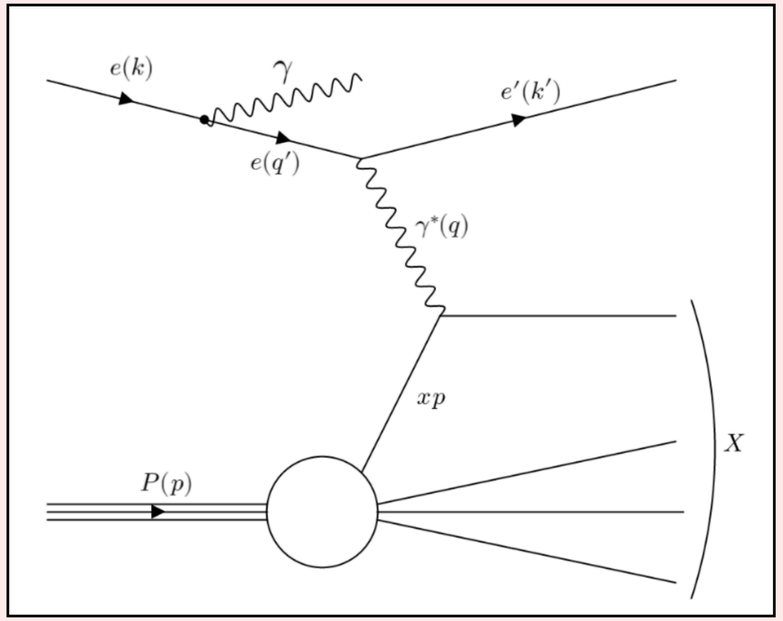
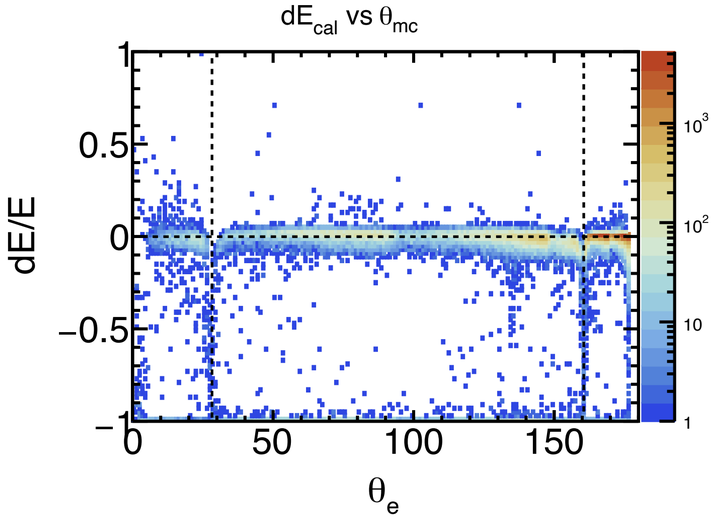
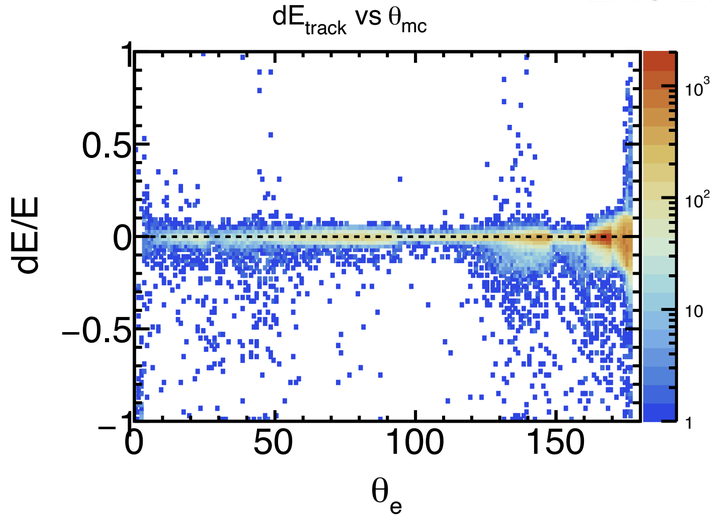
- A mix of electron and sigma method

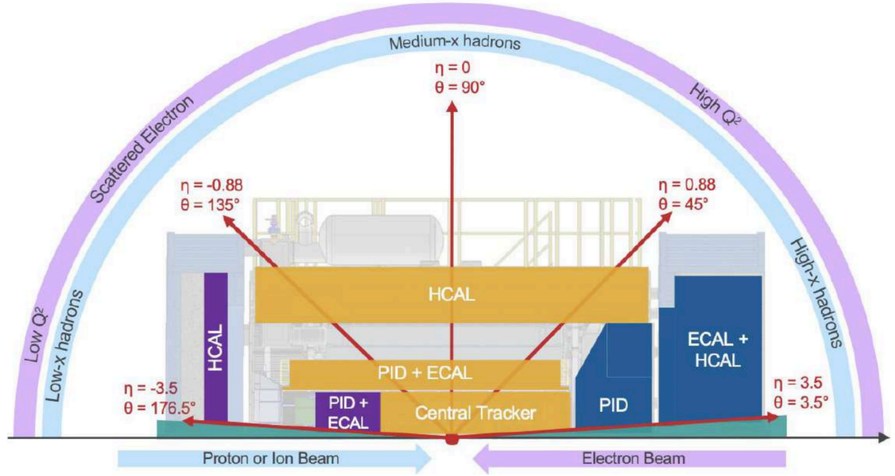


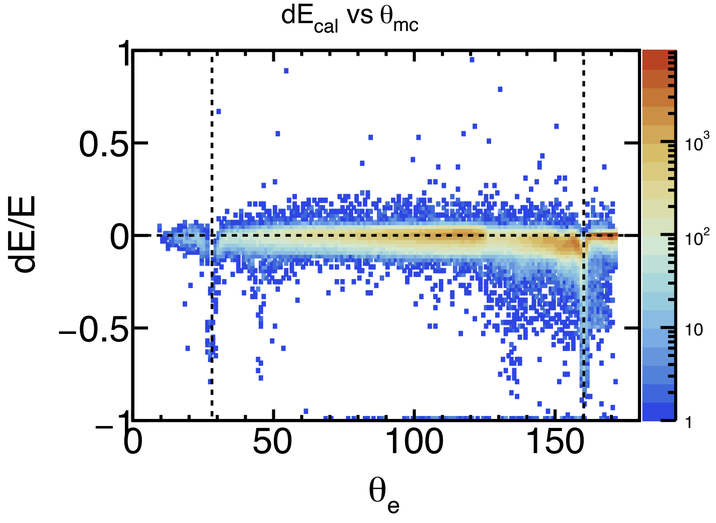
Energy and Track Resolution

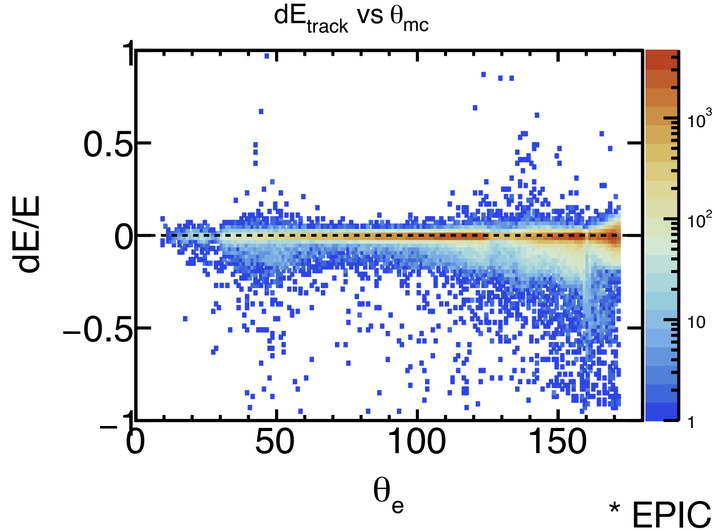
* EPIC 24.05.0 Sim. ep 18x278 GeV







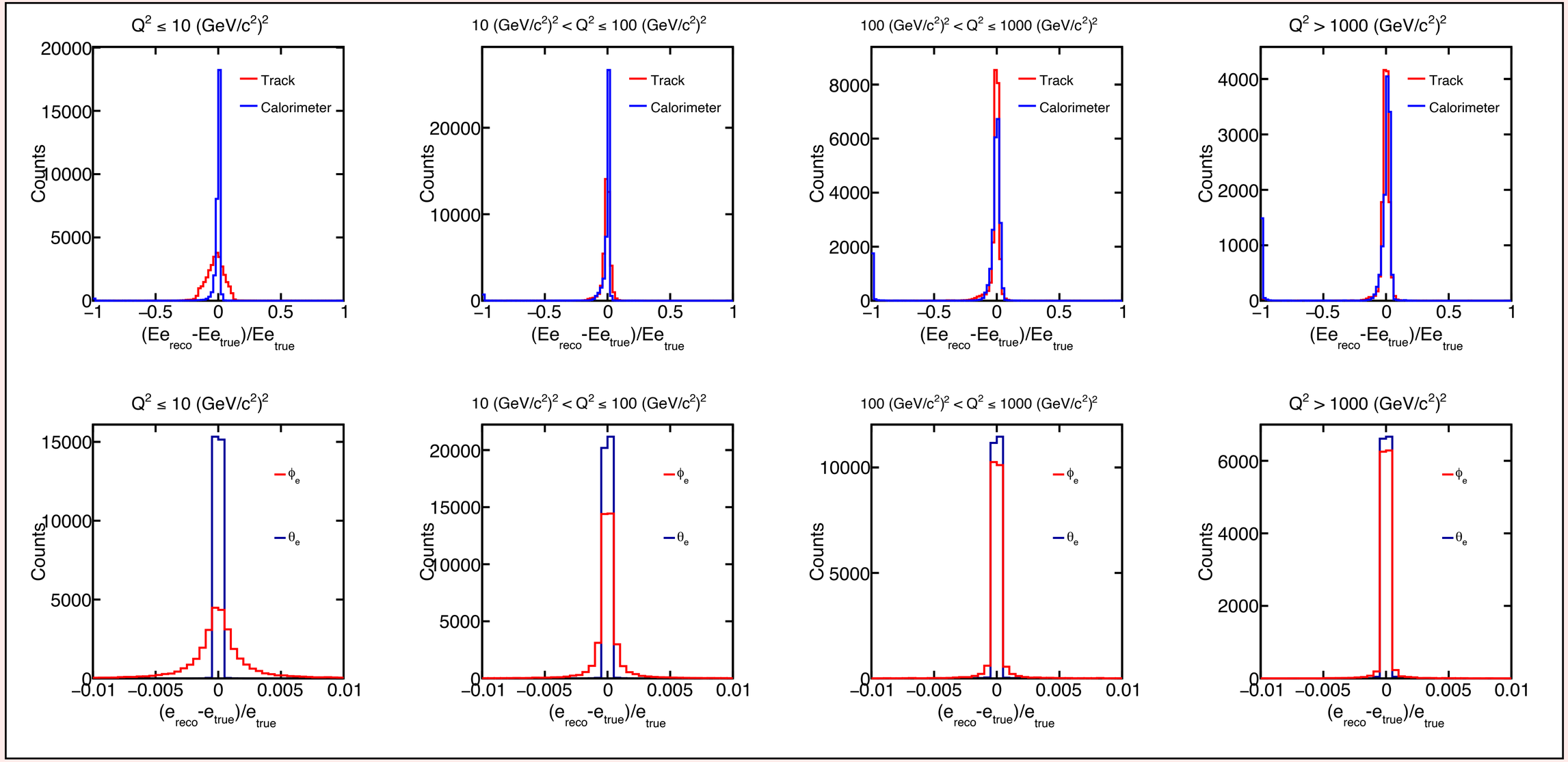




* EPIC 25.05.0 Sim. eHe3 10x166 GeV

Energy from tracks vs from clusters (ep)

* EPIC 24.03.1 Sim. ep 18x278 GeV



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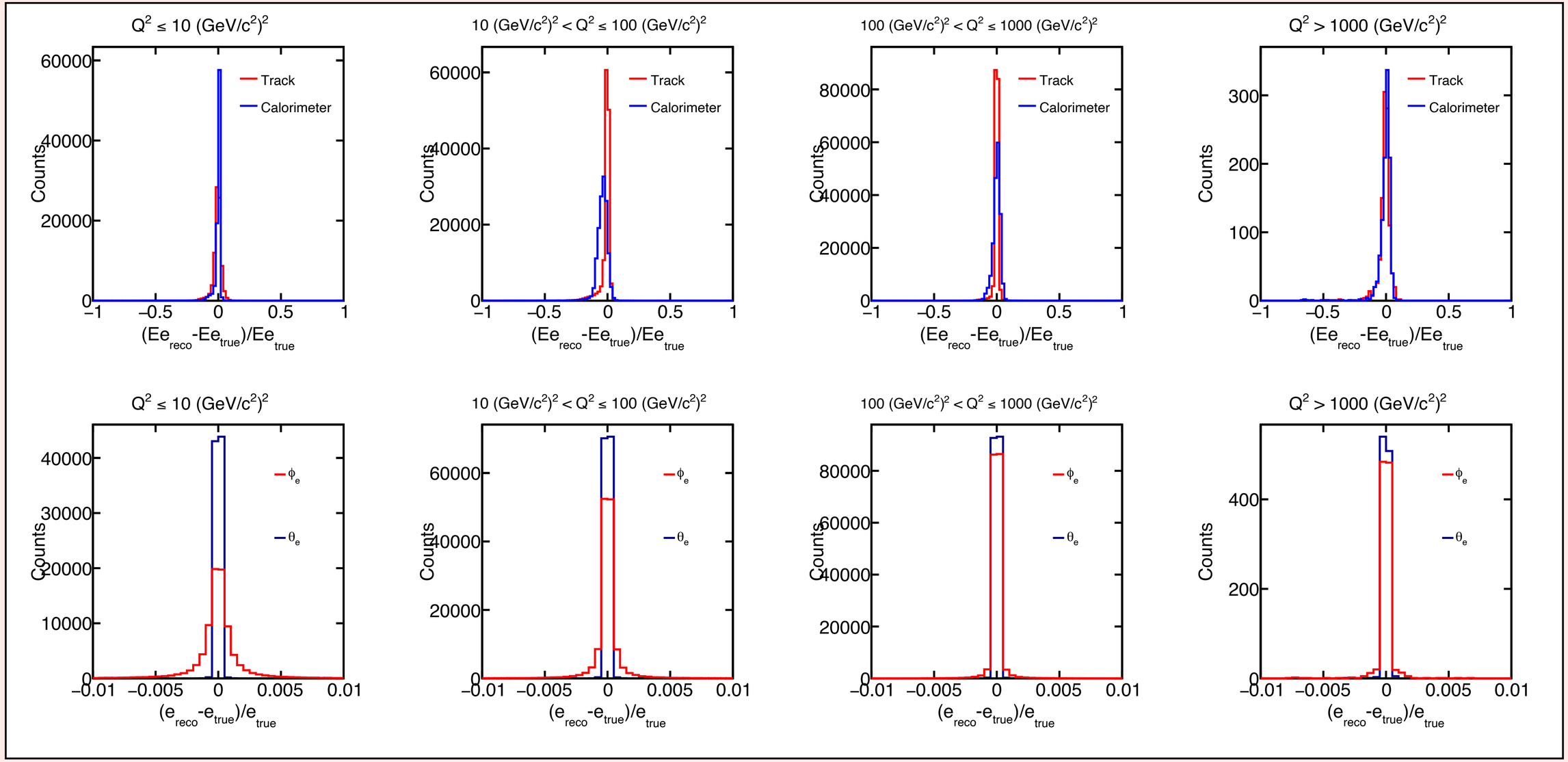
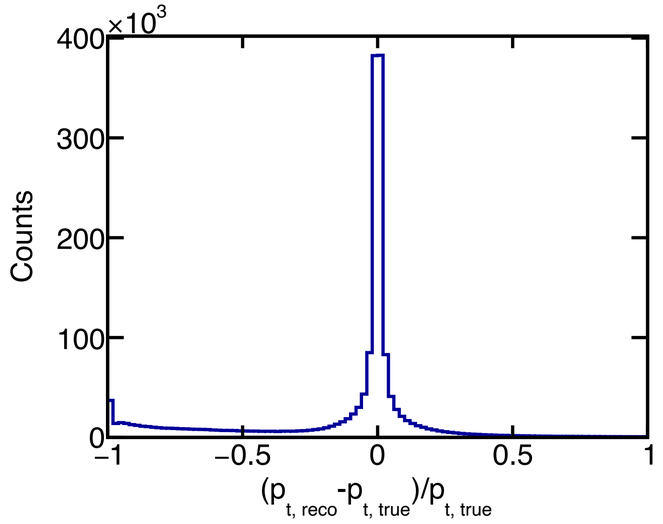
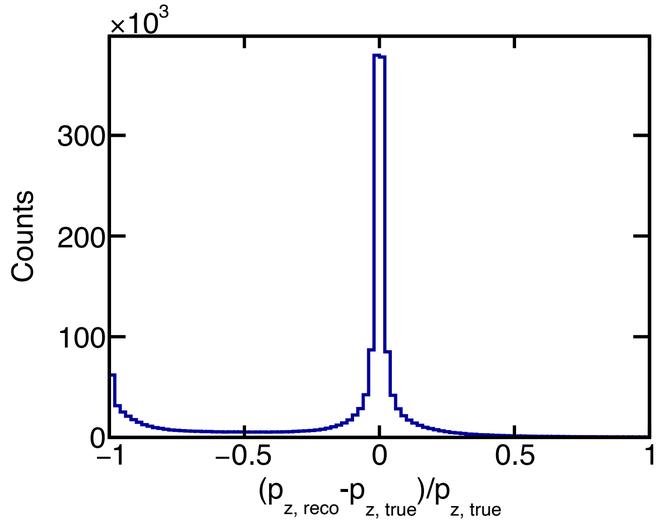
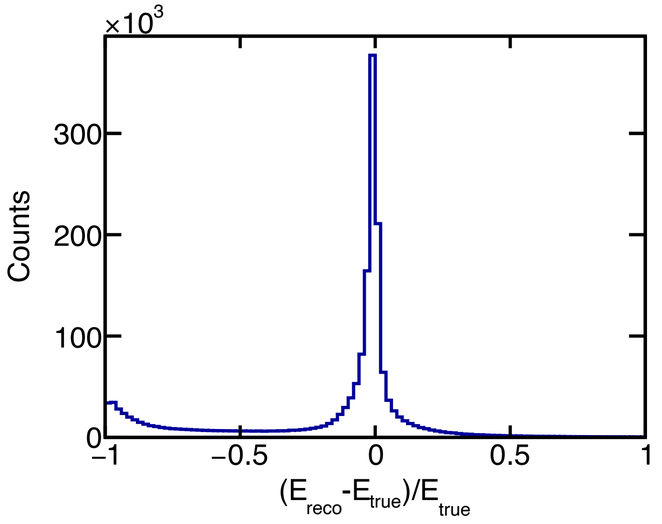
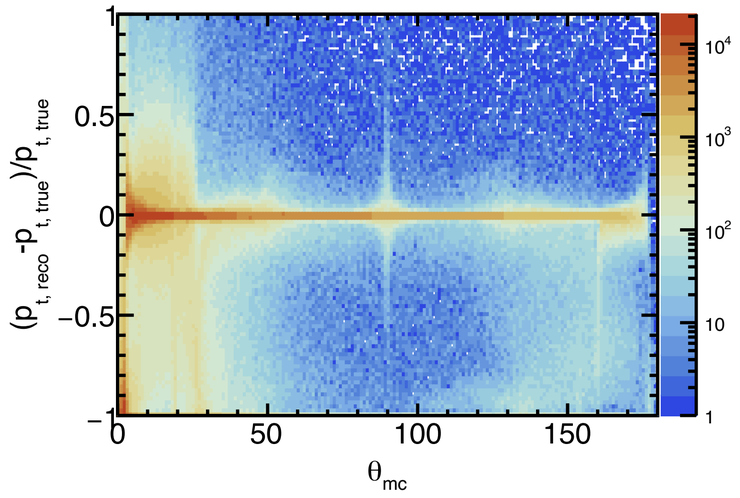


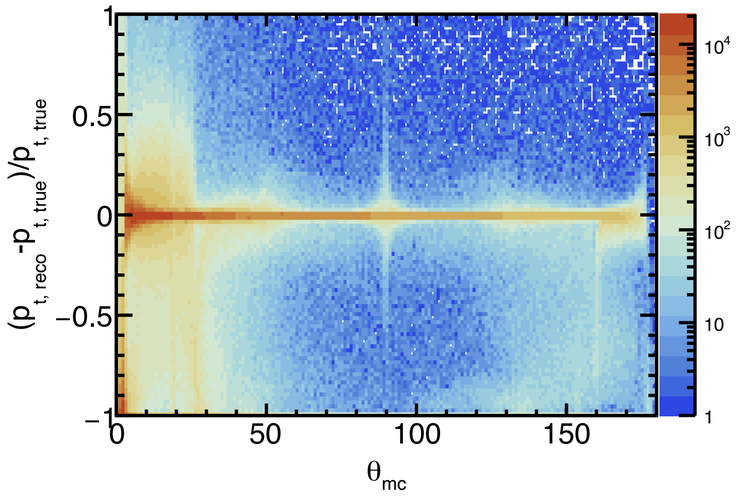
HFS reconstruction

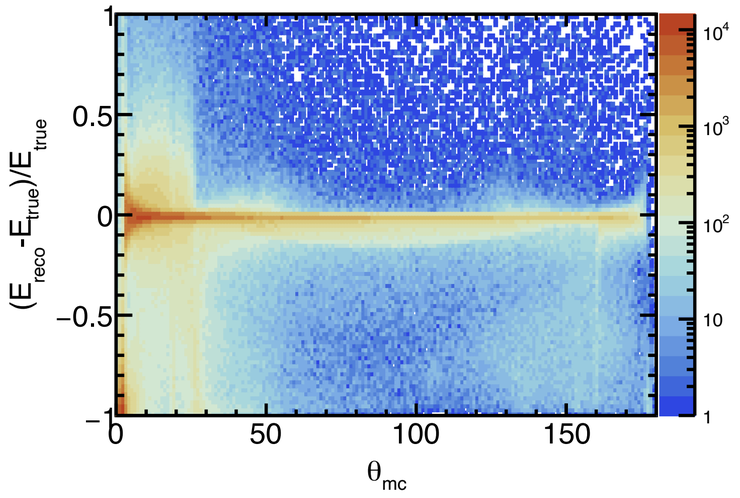






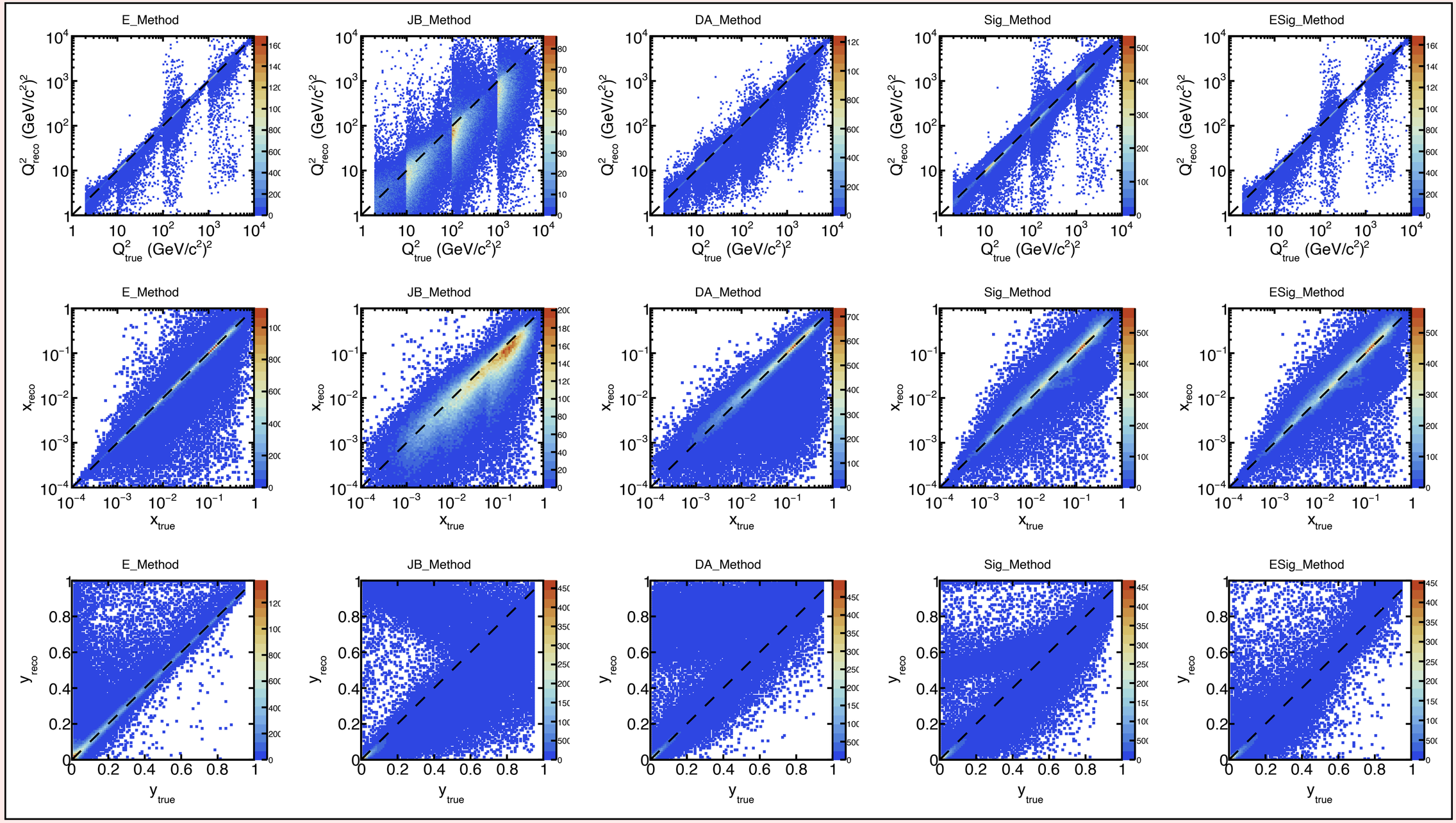




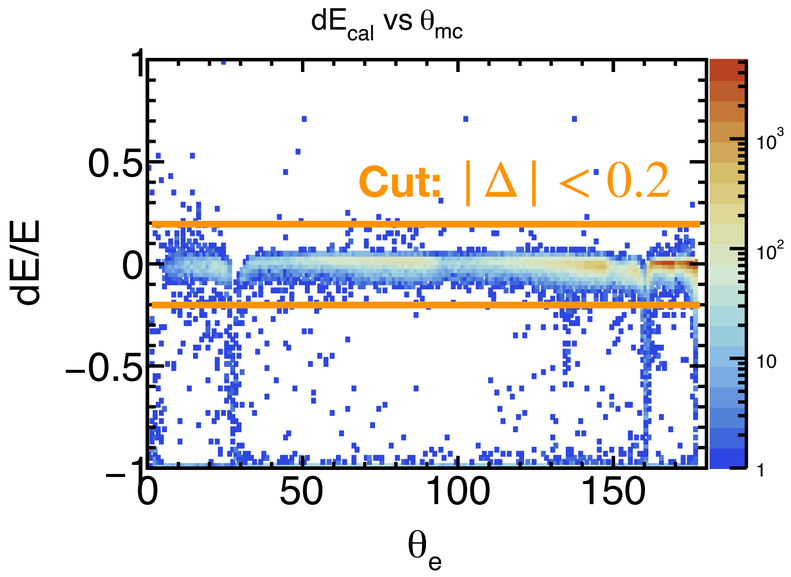


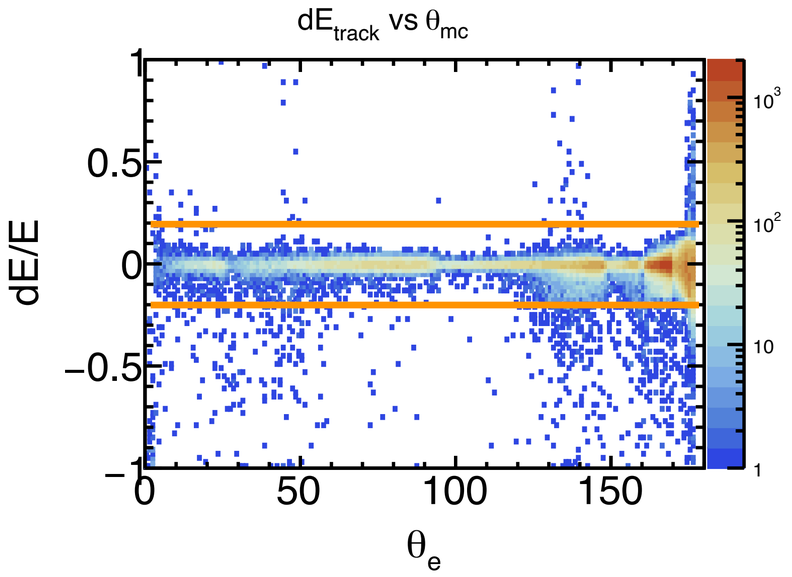
Electron Reconstruction (Truth ID)

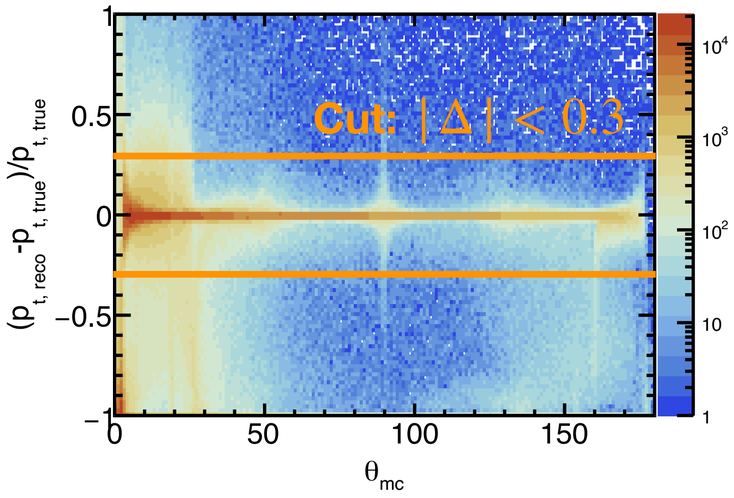
* EPIC 24.03.1 Sim. ep 18x278 GeV

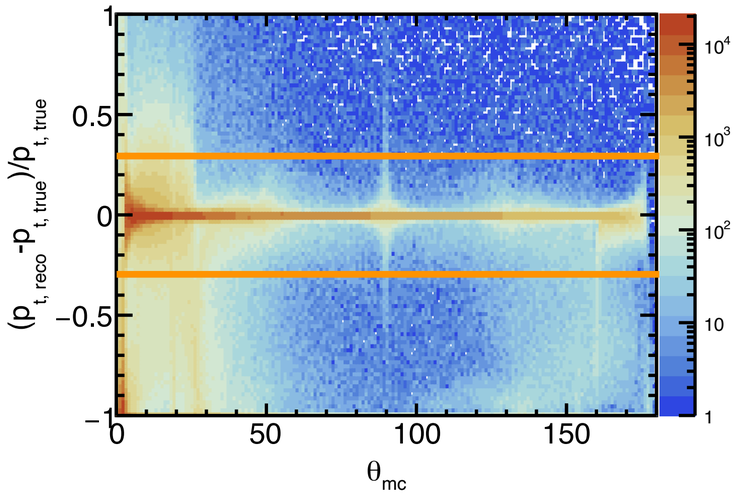


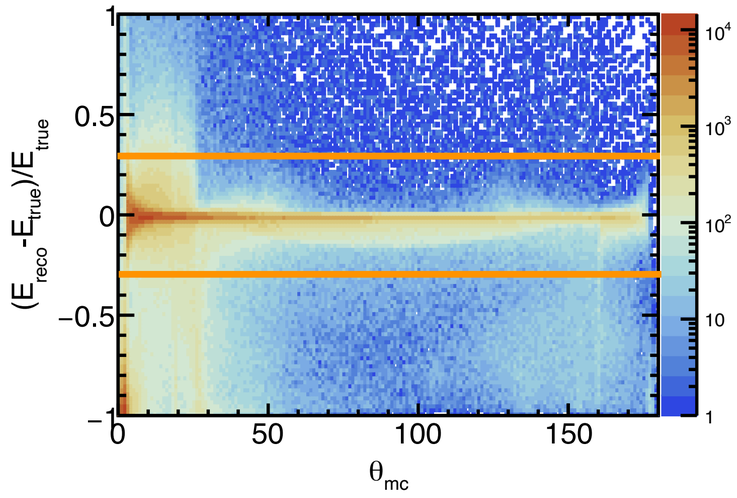
Apply QA cuts











Electron Reconstruction (Truth ID) - after cuts

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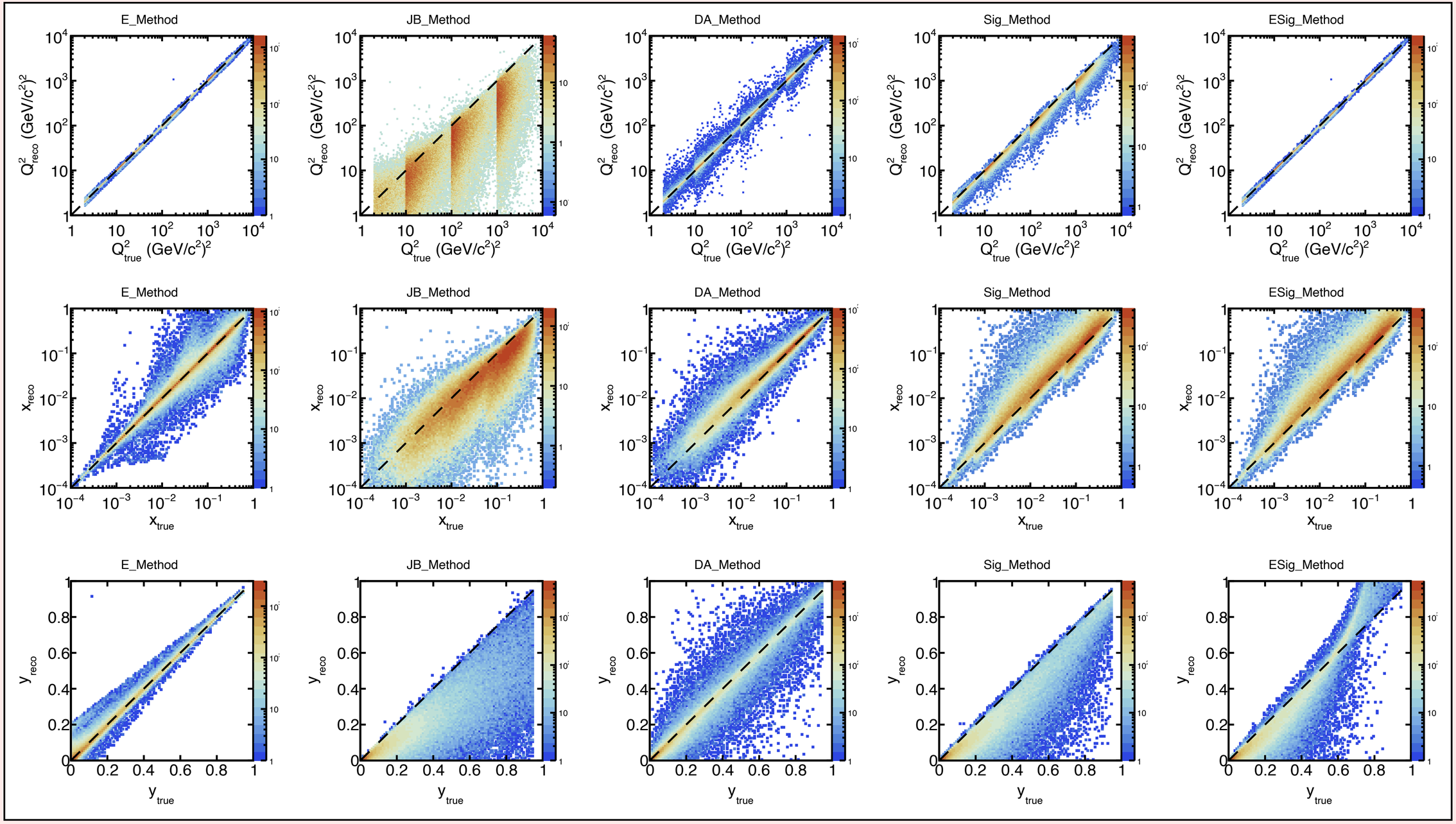
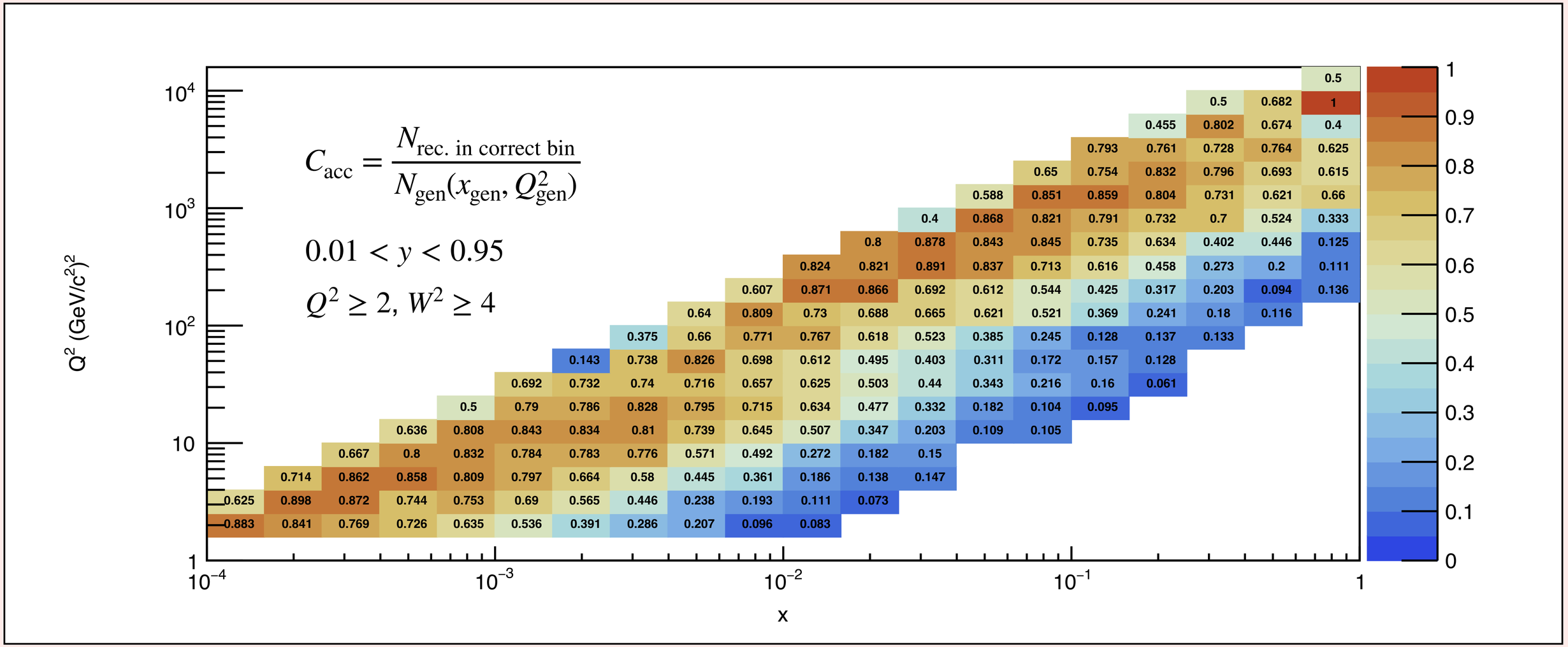


Select eRecon method

Electron Method Bin Efficiency



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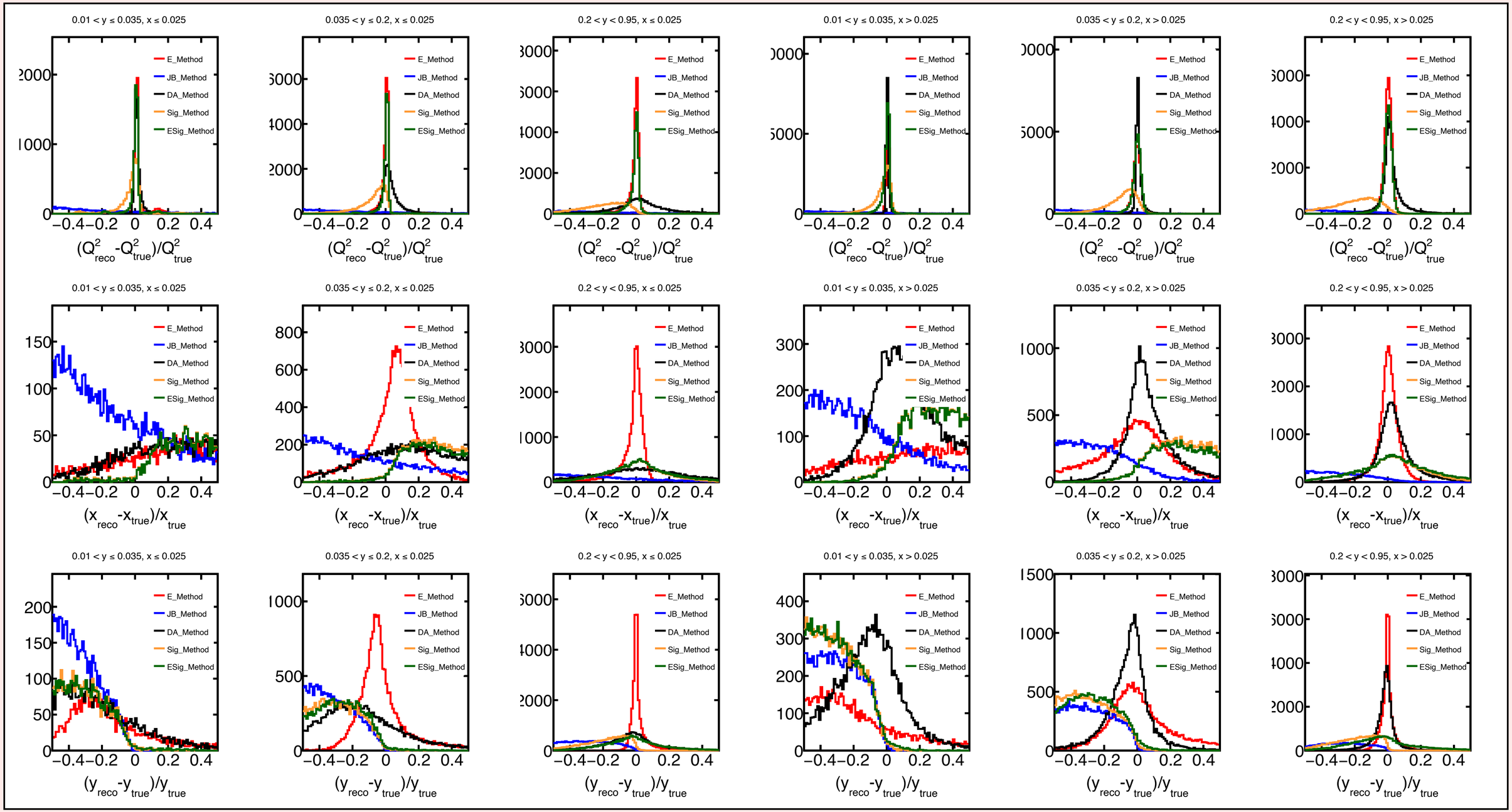

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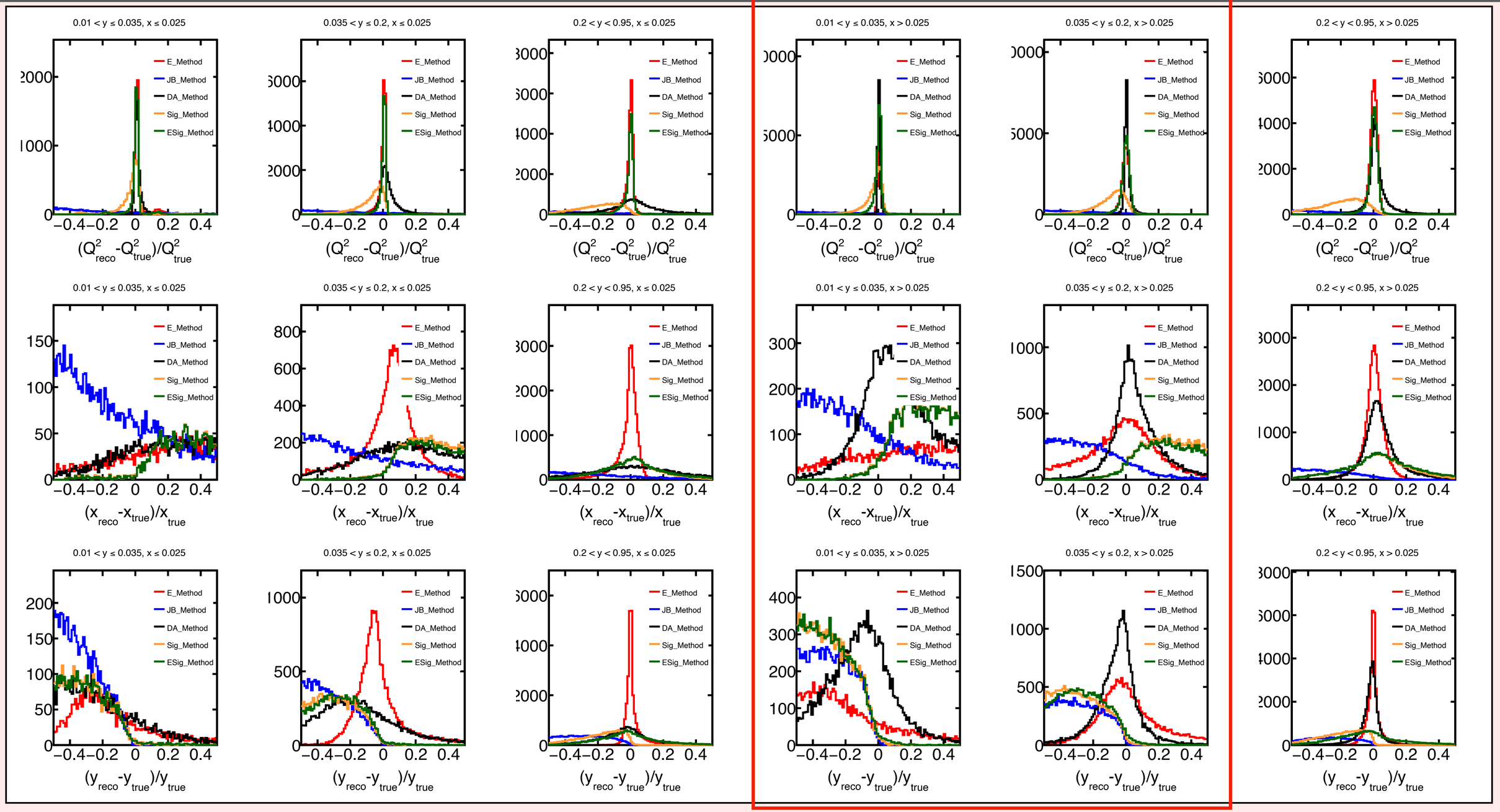
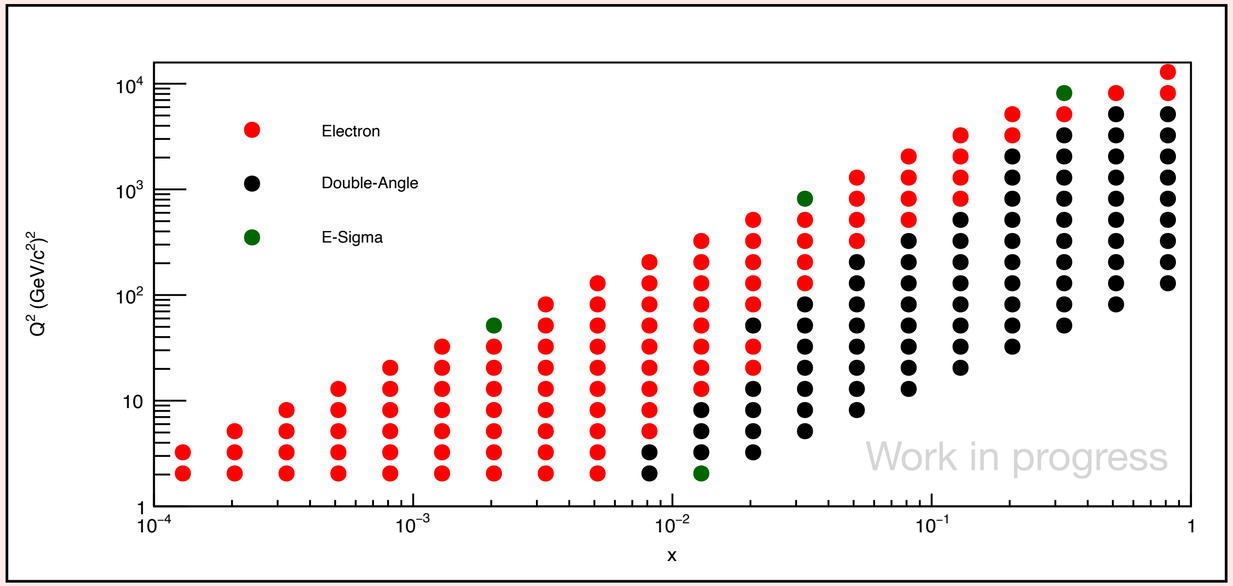
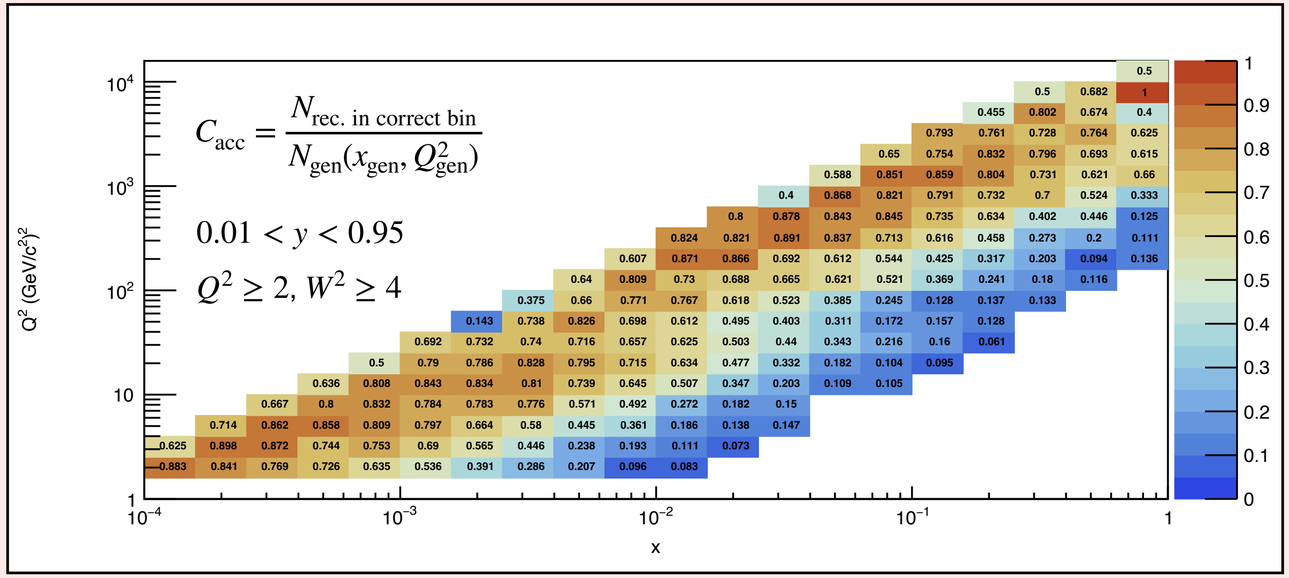
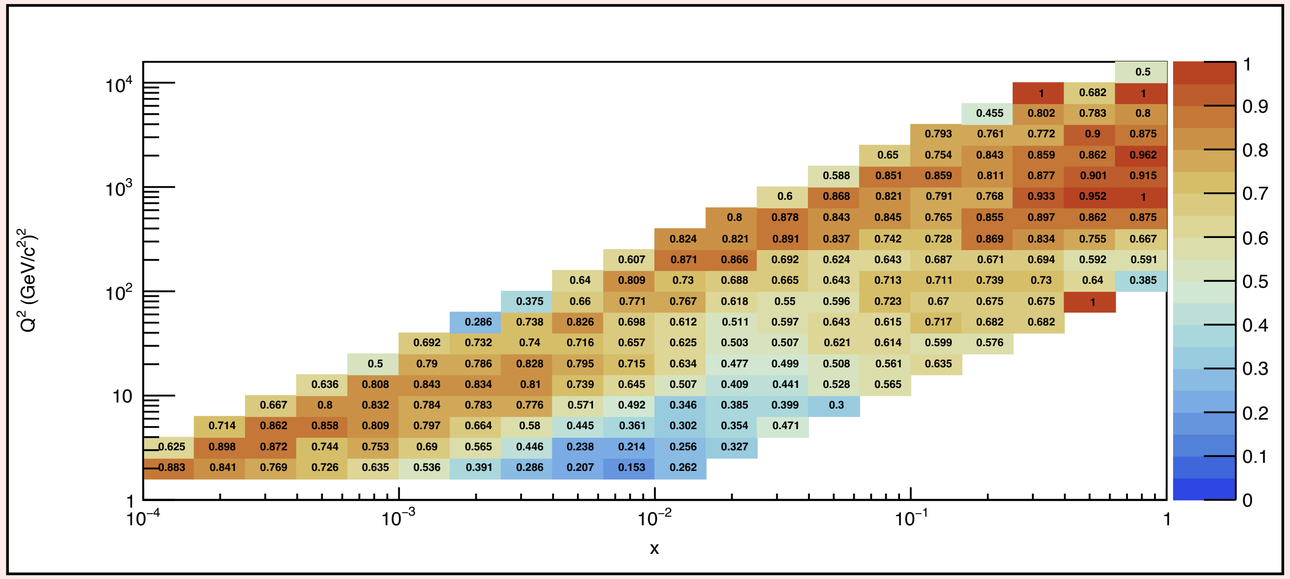


Select eRecon method

Recon. Method Lookup Table







Inclusive Physics WG Task List

Priority: **Early Science** **preTDR**

	Species	Energy (GeV)	Luminosity/year (fb-1)	Electron polarization	p/A polarization
YEAR 1	e+Ru or e+Cu	10 x 115	0.9	NO (Commissioning)	N/A
YEAR 2	e+D e+p	10 x 130	11.4 4.95 - 5.33	LONG	NO TRANS
YEAR 3	e+p	10 x 130	4.95 - 5.33	LONG	TRANS and/or LONG
YEAR 4	e+Au e+p	10 x 100 10 x 250	0.84 6.19 - 9.18	LONG	N/A TRANS and/or LONG
YEAR 5	e+Au e+3He	10 x 100 10 x 166	0.84 8.65	LONG	N/A TRANS and/or LONG
Note: the eA luminosity is per nucleon					

Physics analysis:

- NC DIS cross section
- F2, FL, F3 ..
- CC DIS cross section
- NPDFs
- A1, g1

Systematic & background:

- Pion contamination
- Electron ID sys.
- Radiative corrections

etc ..

Software development:

- Electron finder / ML recon
- Electron identification
- Bench mark plots
- New event generator

etc ..