Some initial studies on diffractive jets

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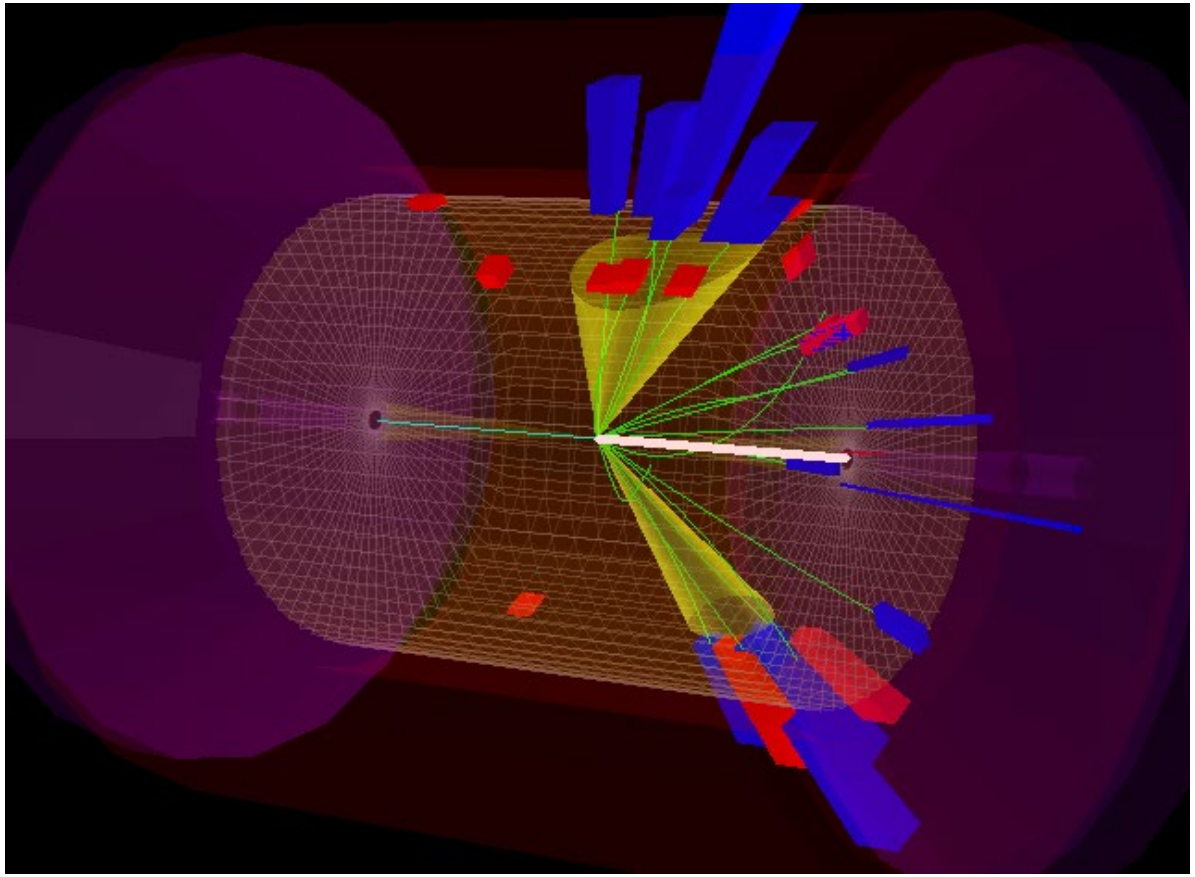
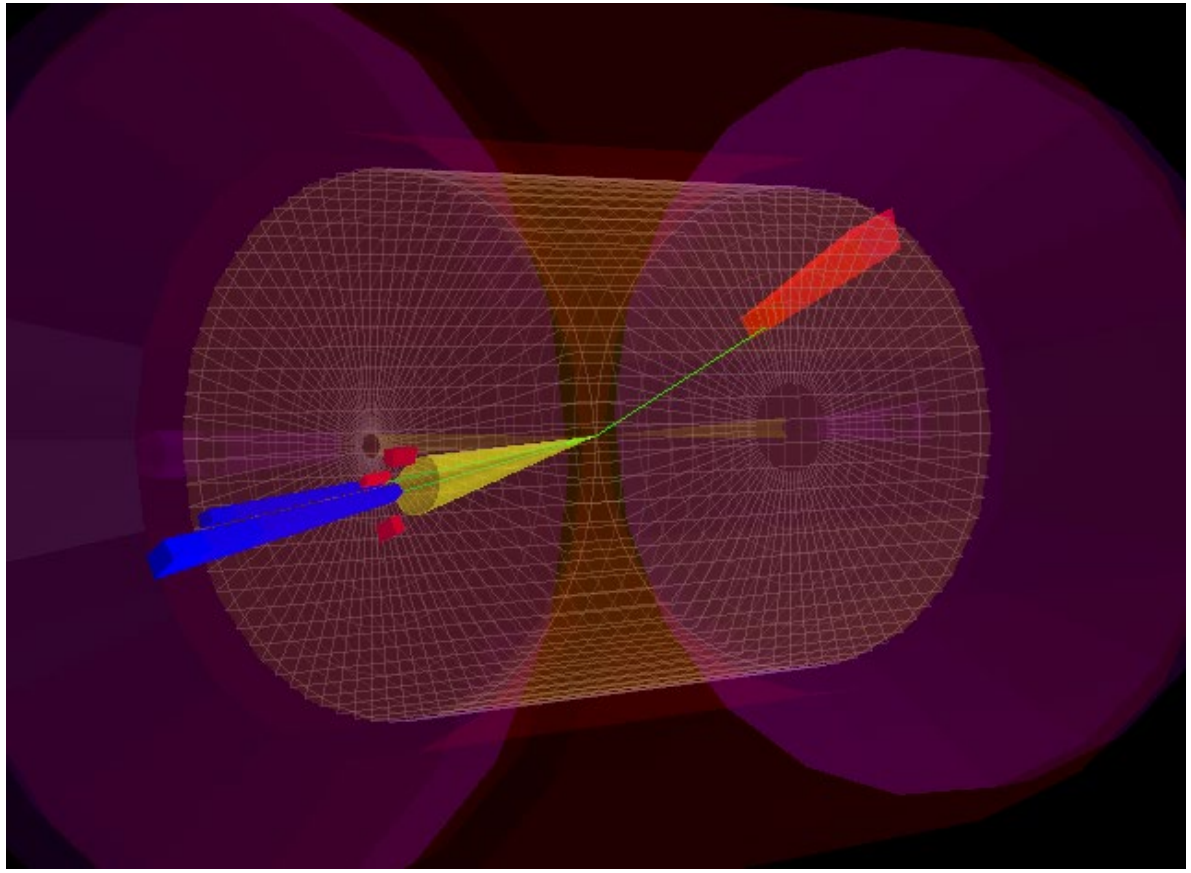


Intro

- I will present some initial studies on diffractive jet production
- I plan to concentrate on the prospects of proton-tagged study (as opposed to the rapidity-gap-selection method).
- One of the motivations for me is to find out whether forward jets in particular (eta >3.0) probe interesting kinematics.

What would you gain optimizing acceptance and resolution of forward (eta 3.0-4.0) calorimetry?

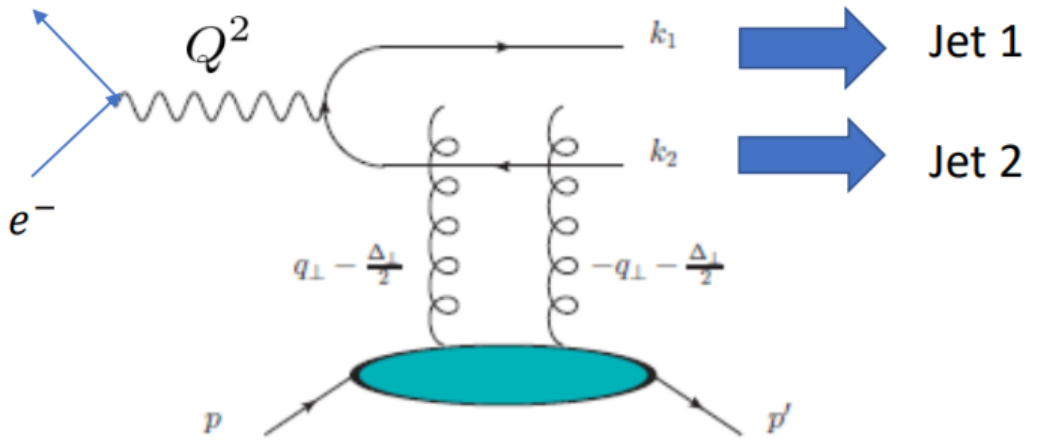
High-x physics
(inclusive DIS, electron-jet Sivers and others TMDs)
Low-x physics
(forward jets sensitive to BFKL dynamics)
Spin physics
(polarized photoproduction)
Diffractive jets ??
(quark and gluon GPDs, saturation)
High-x pi0/eta SIDIS ??
…
…



Motivation (Slide by Y. Hatta at https://indico.bnl.gov/event/7200/)

Probing Wigner (GTMD) in diffractive dijet production

YH, Xiao, Yuan (2016), see also, Altinoluk, Armesto, Beuf, Rezaeian (2015)



Jet 1

Jet 2

$$\vec{\Delta}_\perp = -(\vec{k}_{1\perp} + \vec{k}_{2\perp})$$
$$\vec{P}_\perp = \frac{1}{2}(\vec{k}_{2\perp} - \vec{k}_{1\perp})$$

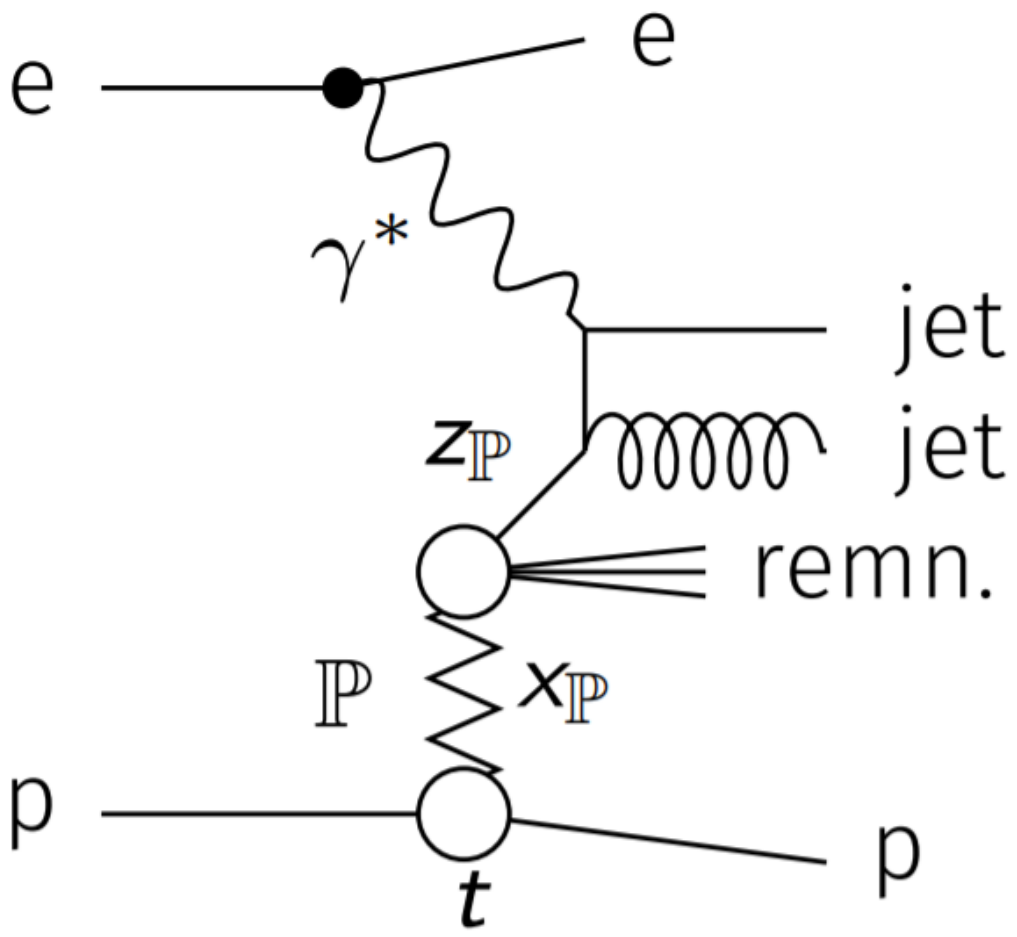
GTMD

$$\epsilon^2 = z(1-z)Q^2$$

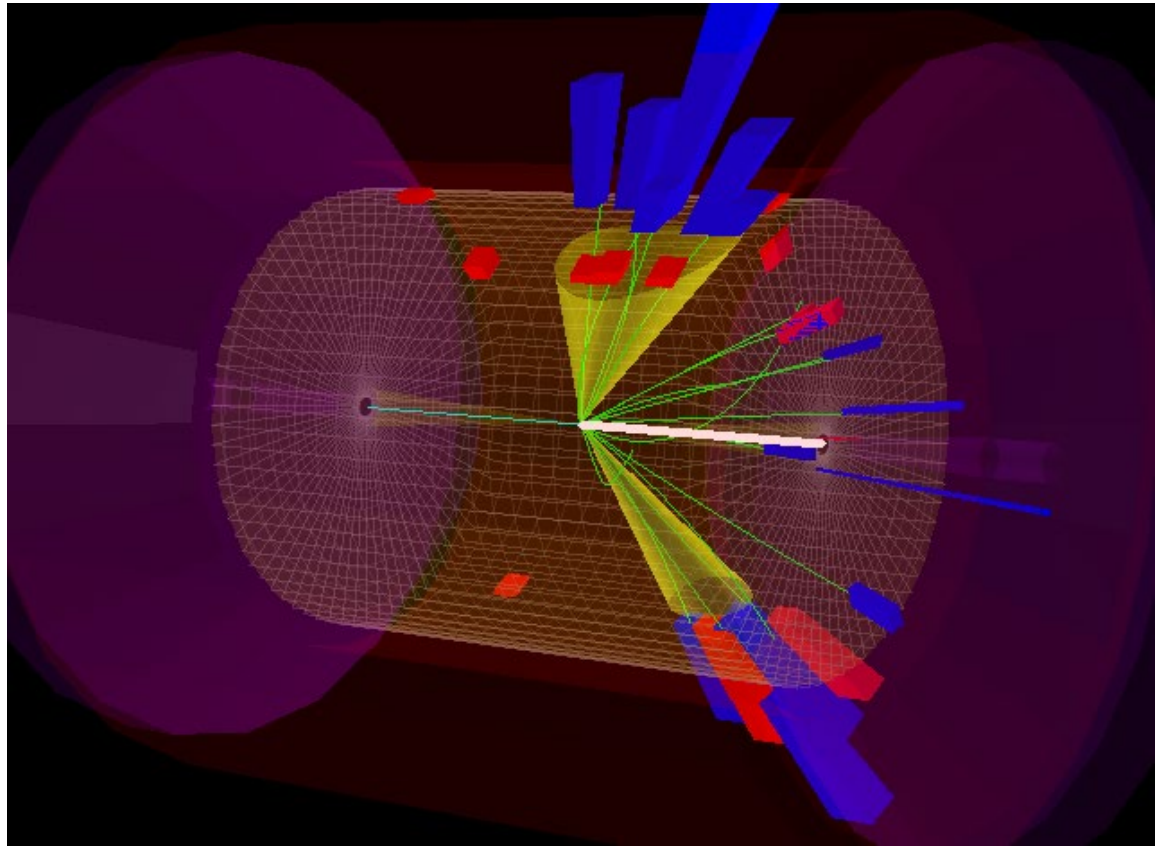
$$\frac{d\sigma}{dy_1 dy_2 d^2\vec{\Delta}_\perp d^2\vec{P}_\perp} \propto z(1-z)[z^2 + (1-z)^2] \int d^2q_\perp d^2q'_\perp S(q_\perp, \Delta_\perp) S(q'_\perp, \Delta_\perp)$$
$$\times \left[\frac{\vec{P}_\perp}{P_\perp^2 + \epsilon^2} - \frac{\vec{P}_\perp - \vec{q}_\perp}{(P_\perp - q_\perp)^2 + \epsilon^2}\right] \cdot \left[\frac{\vec{P}_\perp}{P_\perp^2 + \epsilon^2} - \frac{\vec{P}_\perp - \vec{q}'_\perp}{(P_\perp - q'_\perp)^2 + \epsilon^2}\right]$$
$$\sim d\sigma_0 + 2\cos 2(\phi_P - \phi_\Delta) d\tilde{\sigma}$$

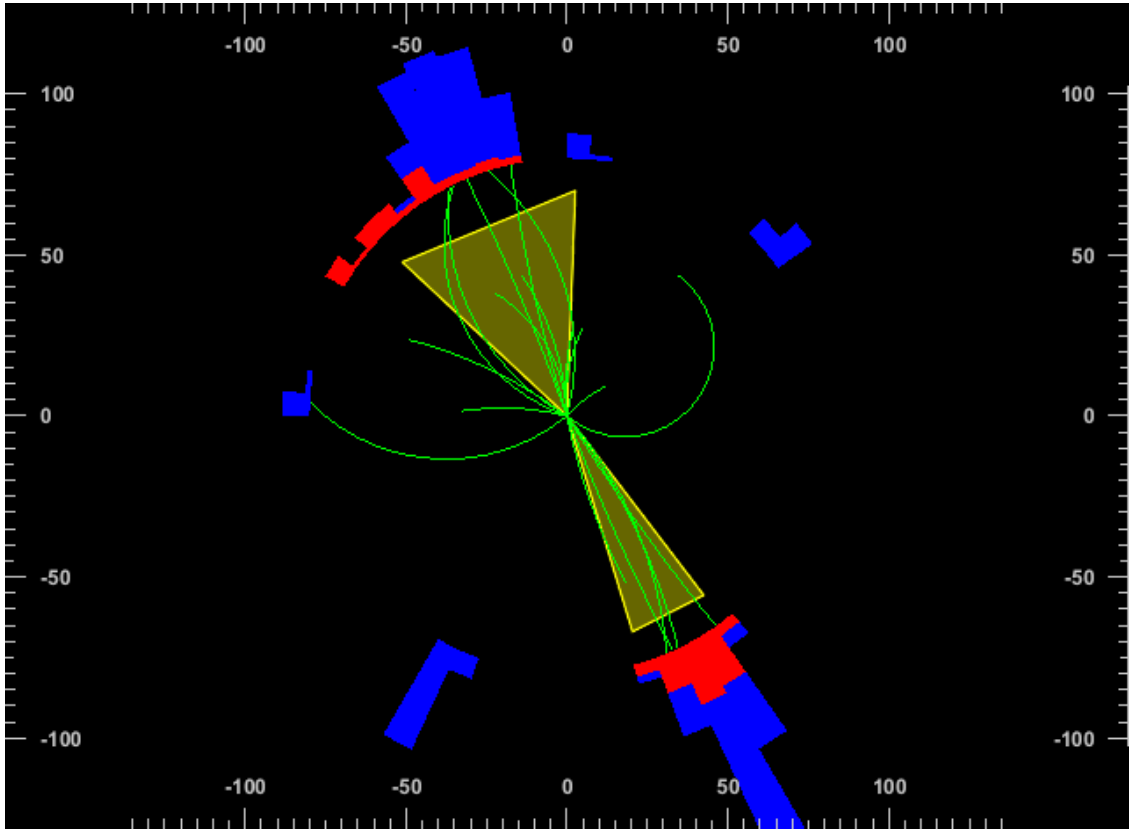
Simulation

- Pythia8, standard hard diffractive configuration see https://indico.cern.ch/event/777996/contributions/3377409/attachments/1826185/2988817/PythiaDownUnder_IH.pdf for details, tuning, etc.
- Q2<1.0 GeV2
- Jets reconstructed in the lab frame with anti-kT R=0.5.
- Jet pT>3 GeV and eta<3.5
- Energy: 18 GeV x 275 GeV



Fast simulation carried out by Delphes

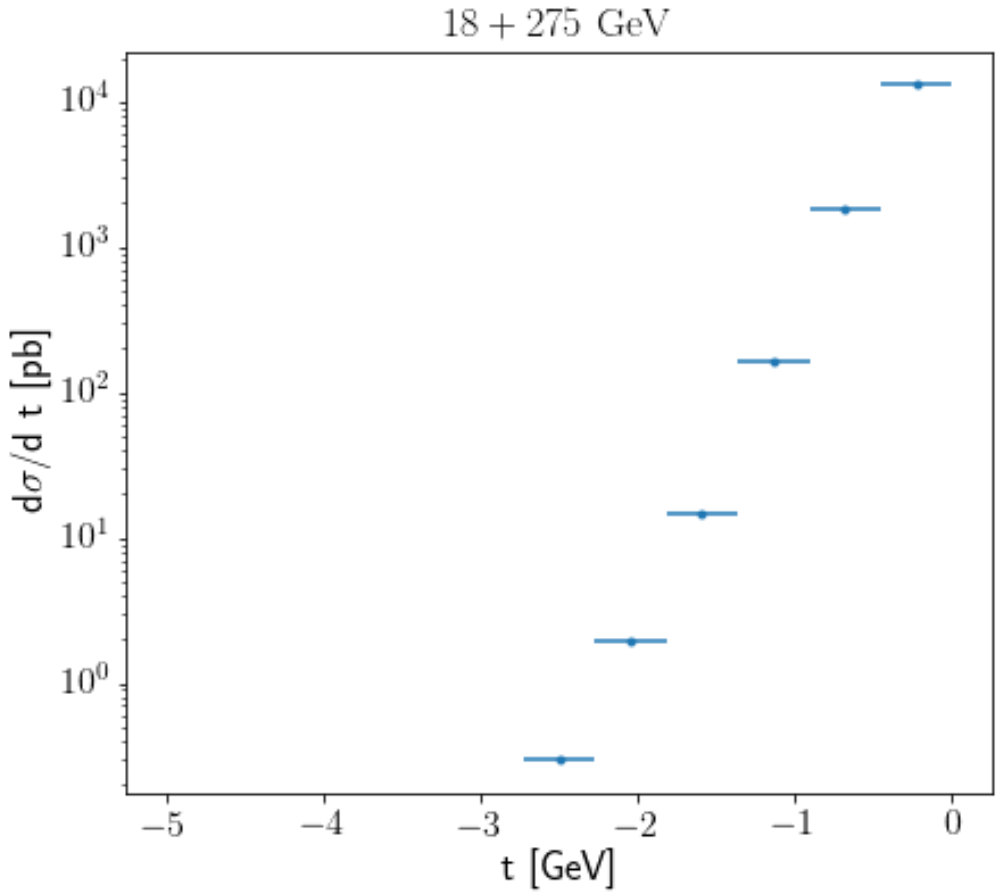


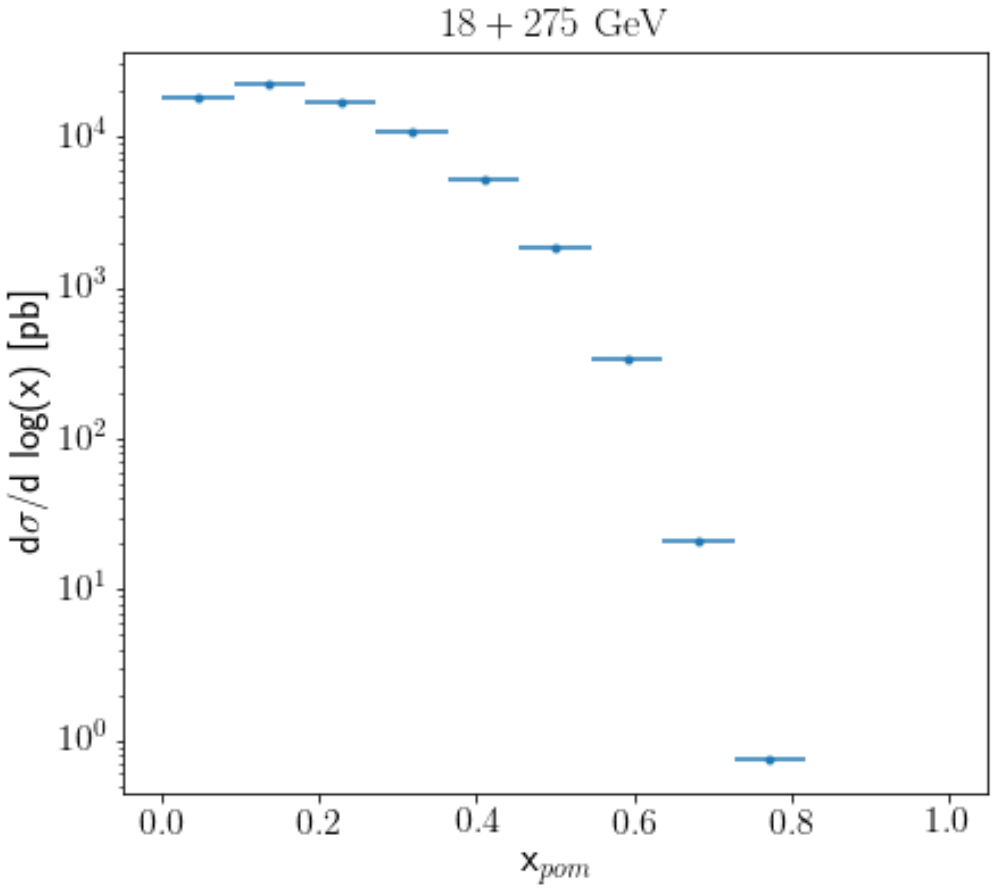


- Delphes configuration for EIC detector is available in: https://github.com/miguelignacio/delphes_EIC

Jet reconstructed with the energy-flow algorithm

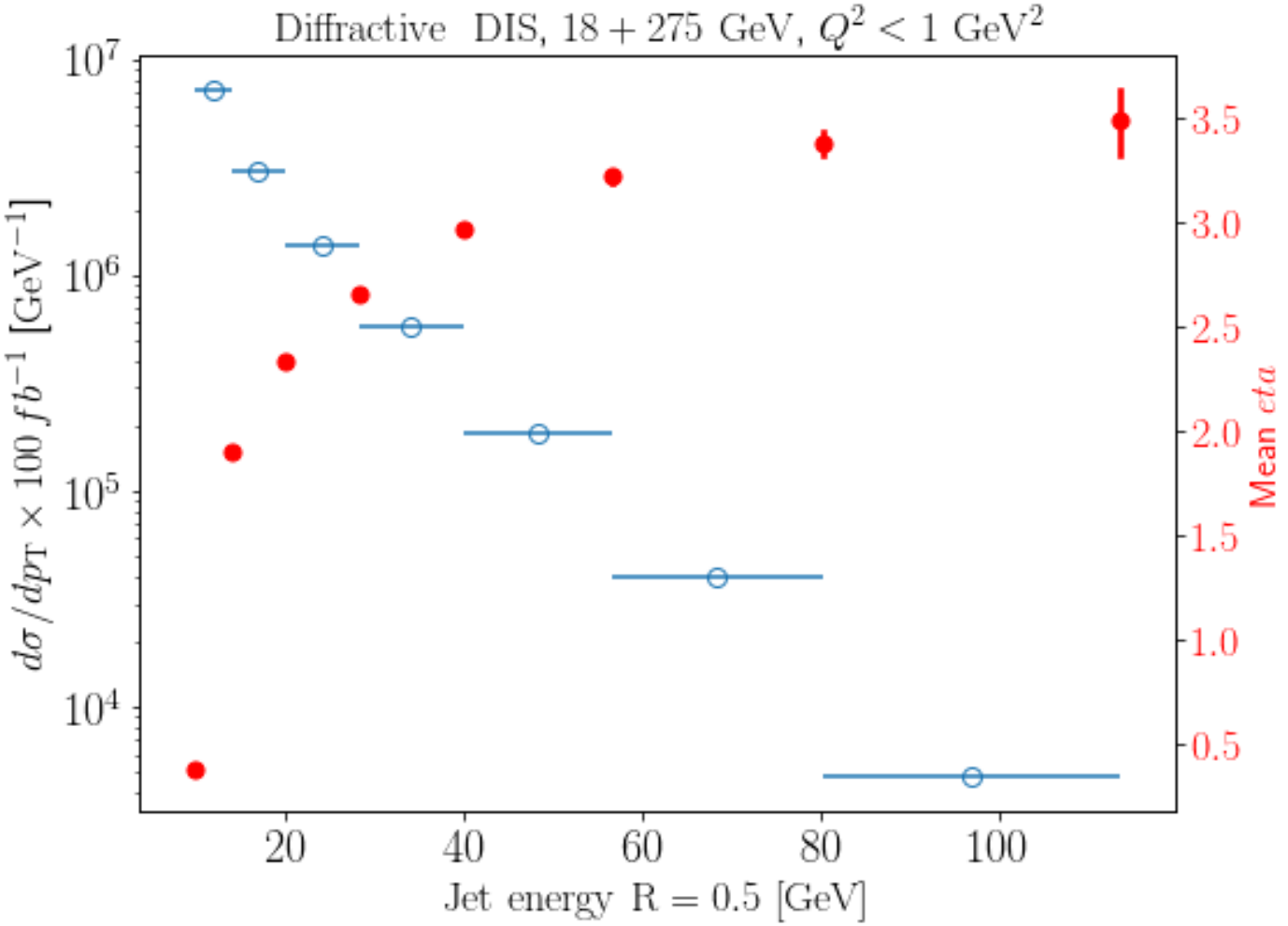
Xpom and t distribution





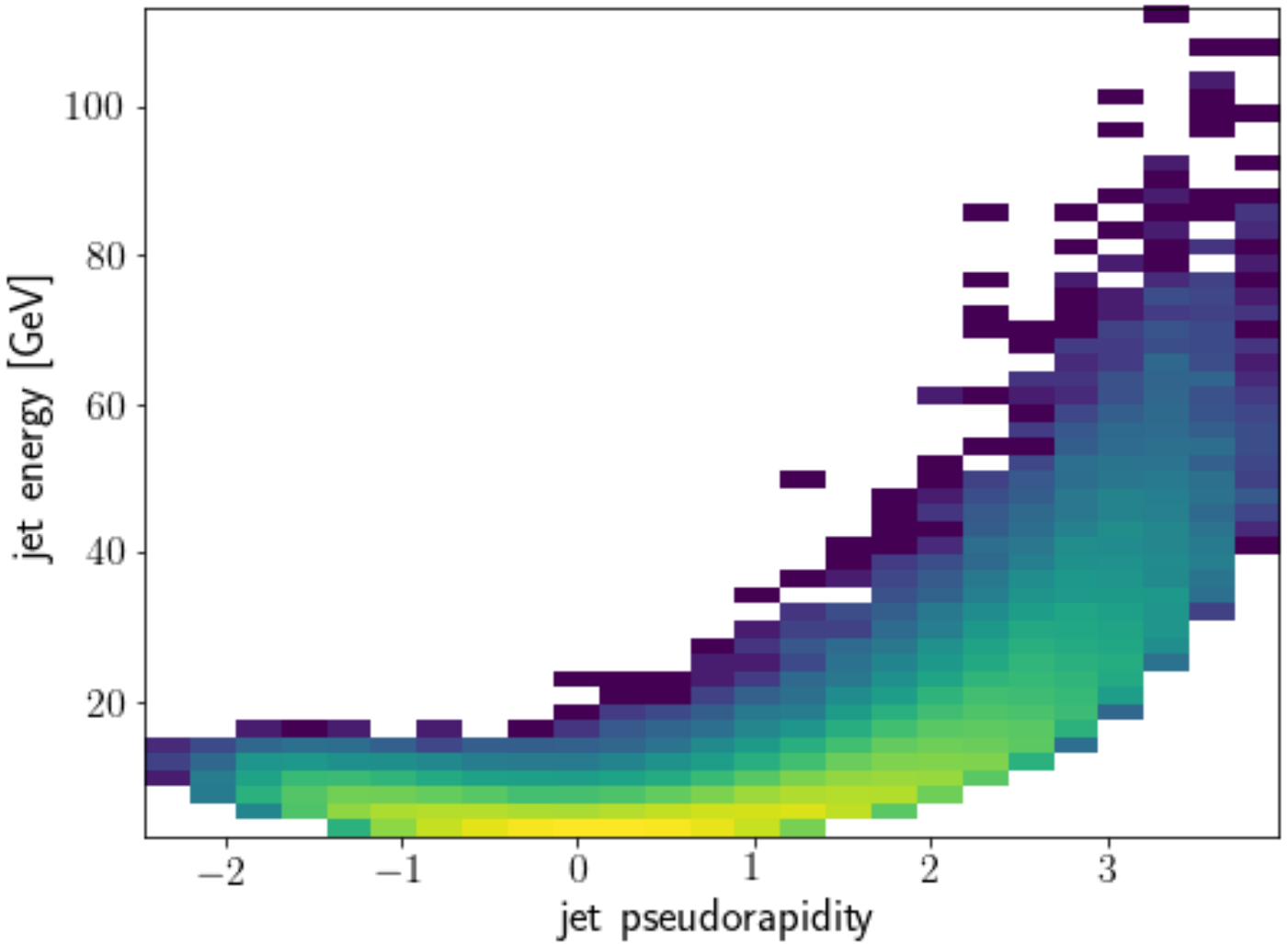
Question for you: where can I find latest estimate for acceptance of the forward protons? Which t and xpom ranges should be considered realistic?

Cross section, mean pseudorapidity



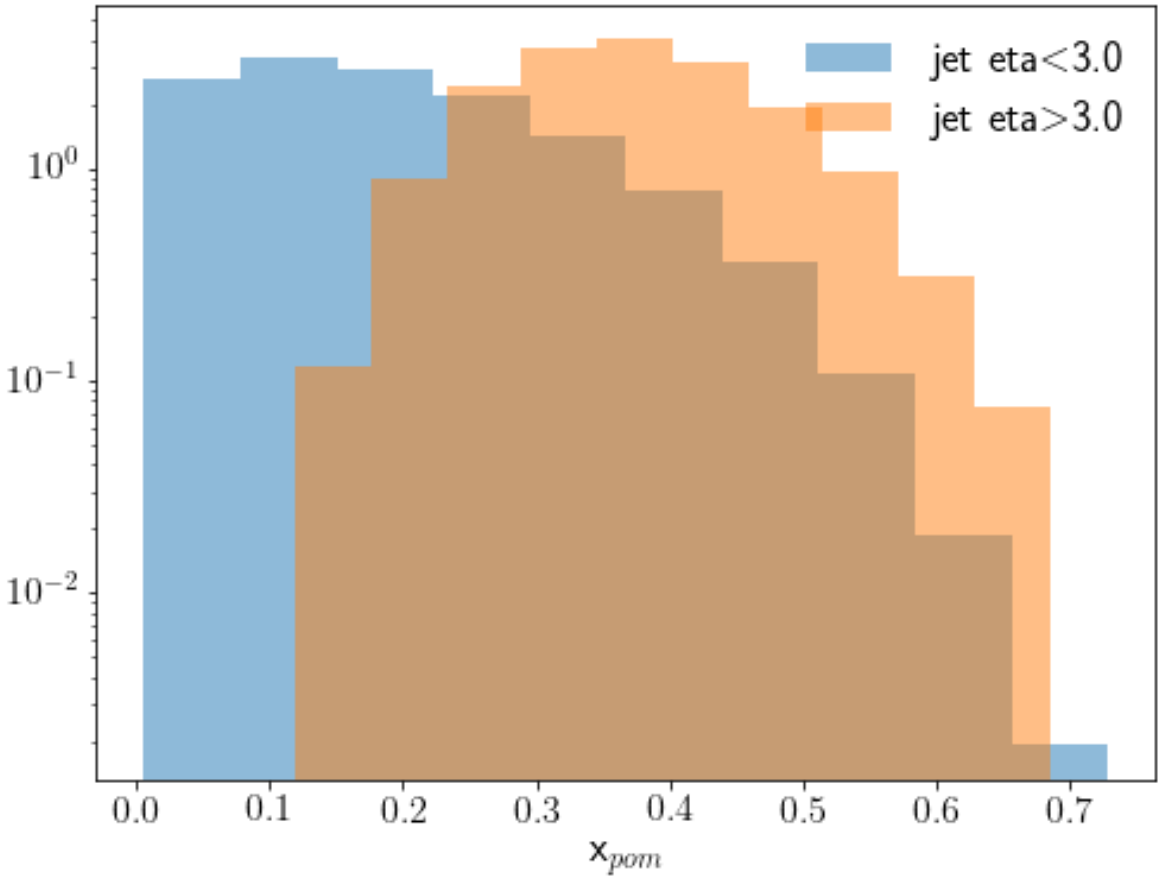
Jet energy vs pseudorapidity

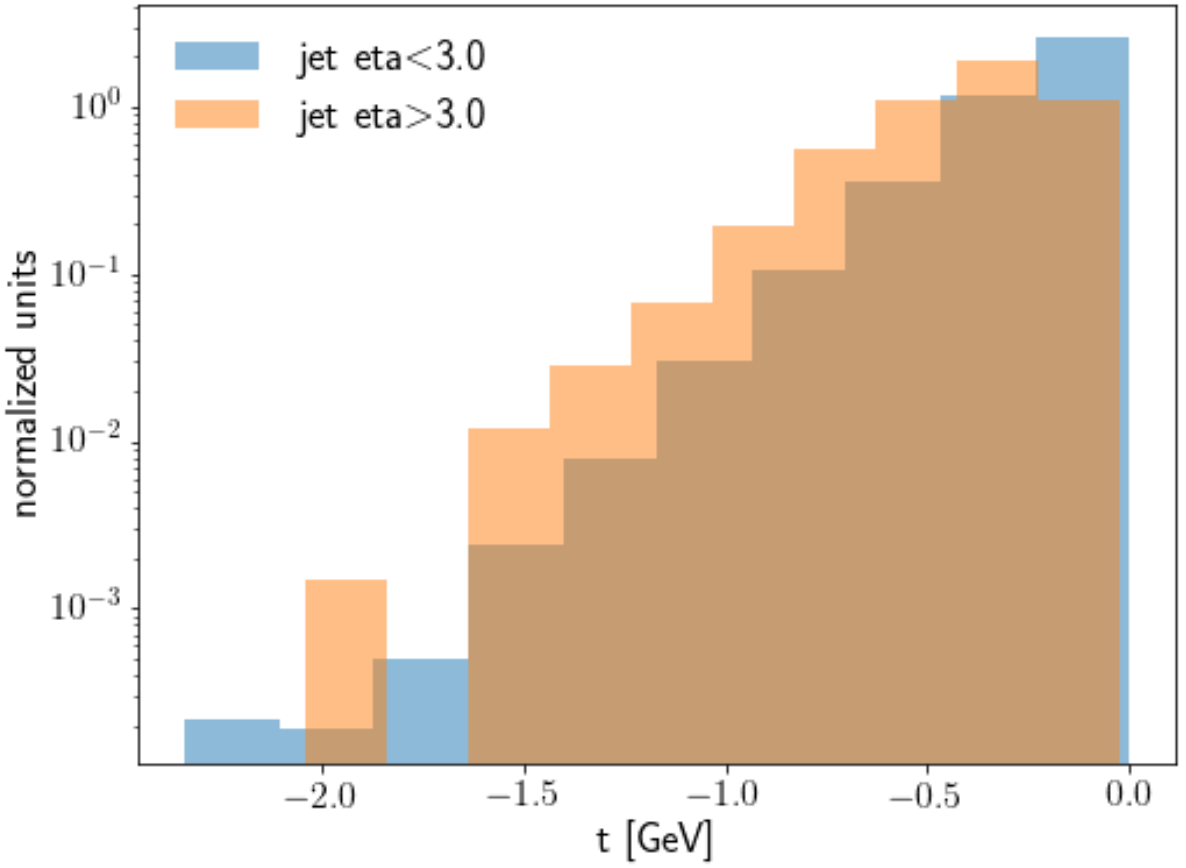
Truth level



Xpom and t distribution of forward jets

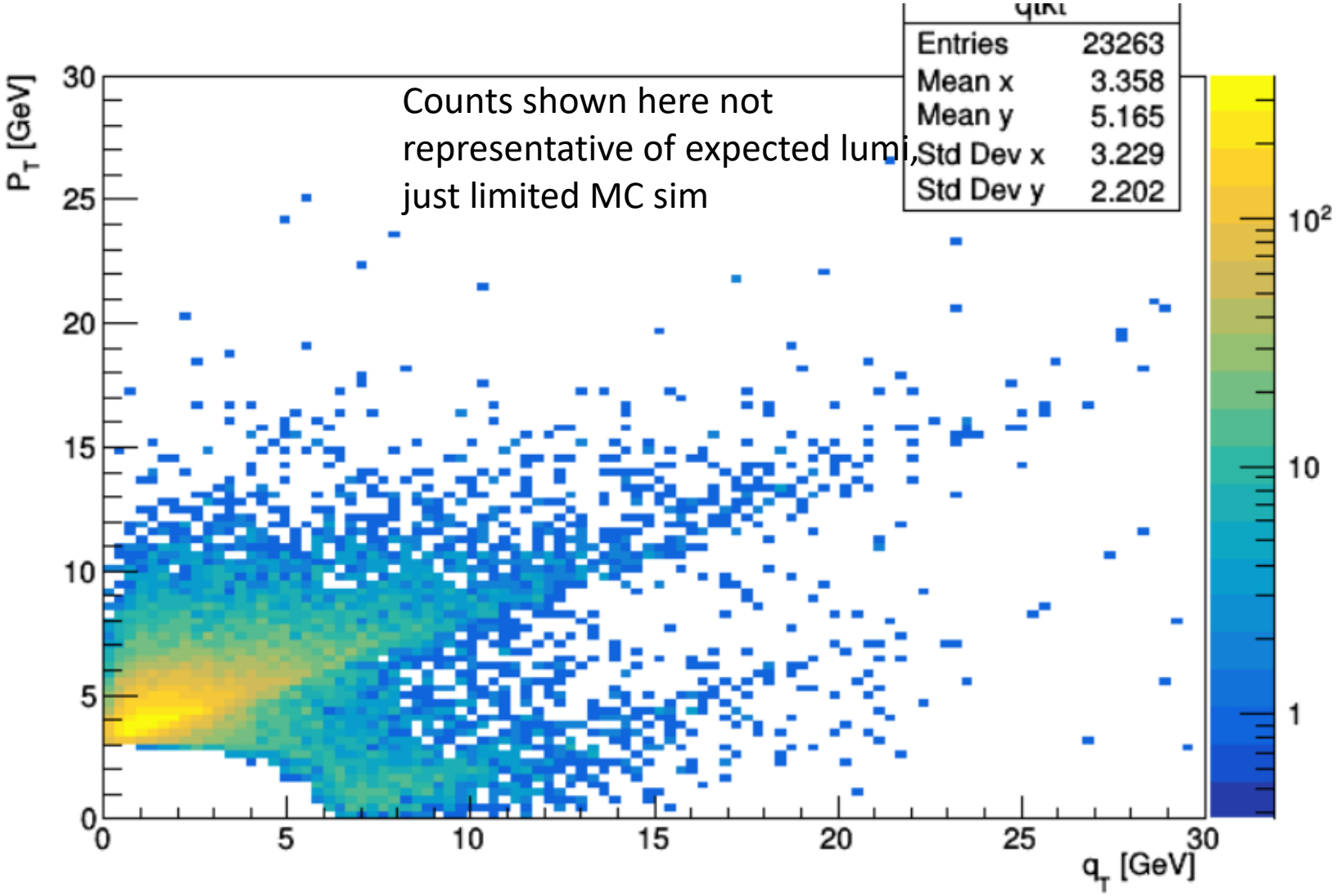
Truth level





Correlation of these variables is rather weak with jet eta.

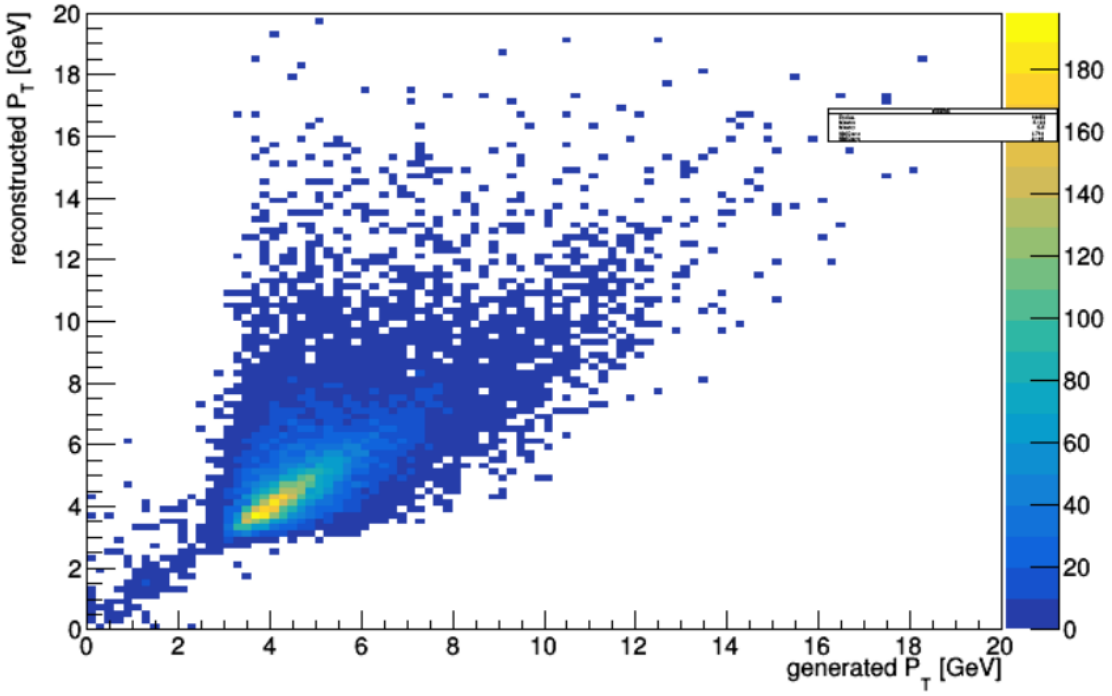
Reconstructed distributions

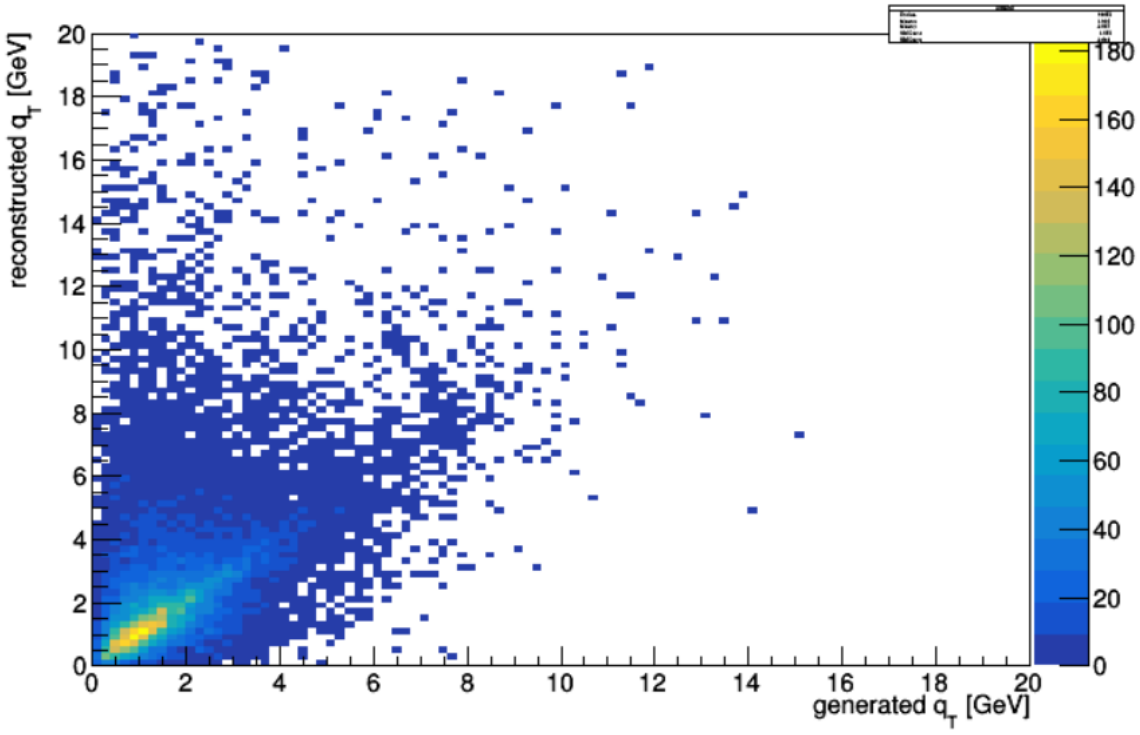


$$\vec{\Delta}_\perp = -(\vec{k}_{1\perp} + \vec{k}_{2\perp})$$

$$\vec{P}_\perp = \frac{1}{2}(\vec{k}_{2\perp} - \vec{k}_{1\perp})$$

Response matrices





Next step is to quantify resolution vs energy or eta

Conclusion

- First steps towards looking at diffractive jets kinematics, and detector smearing effects
- Next steps are to identify impact of very forward jet configurations, and quantify resolutions.