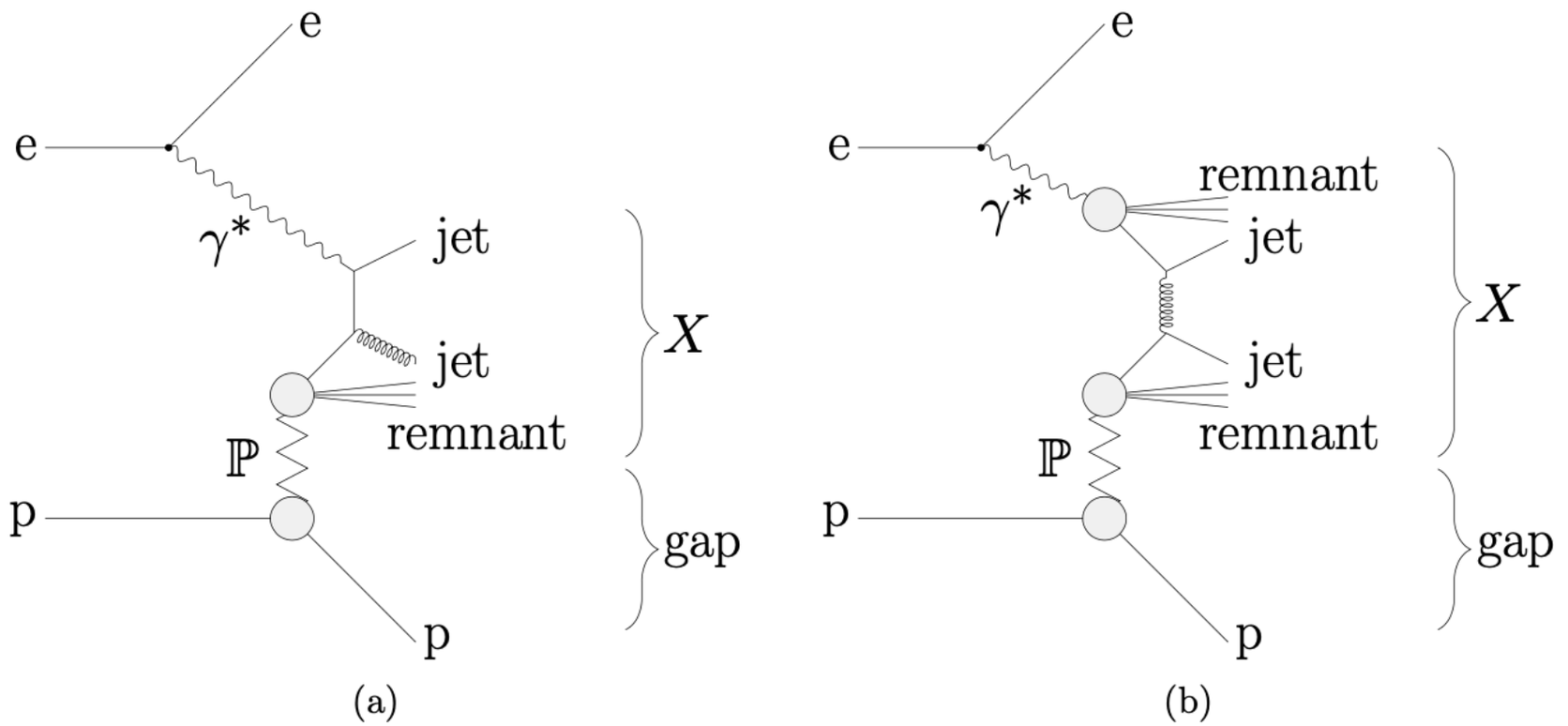
Detector acceptance requirements for diffractive dijet photoproduction in ep

Zhengqiao Zhang

Brookhaven National Laboratory

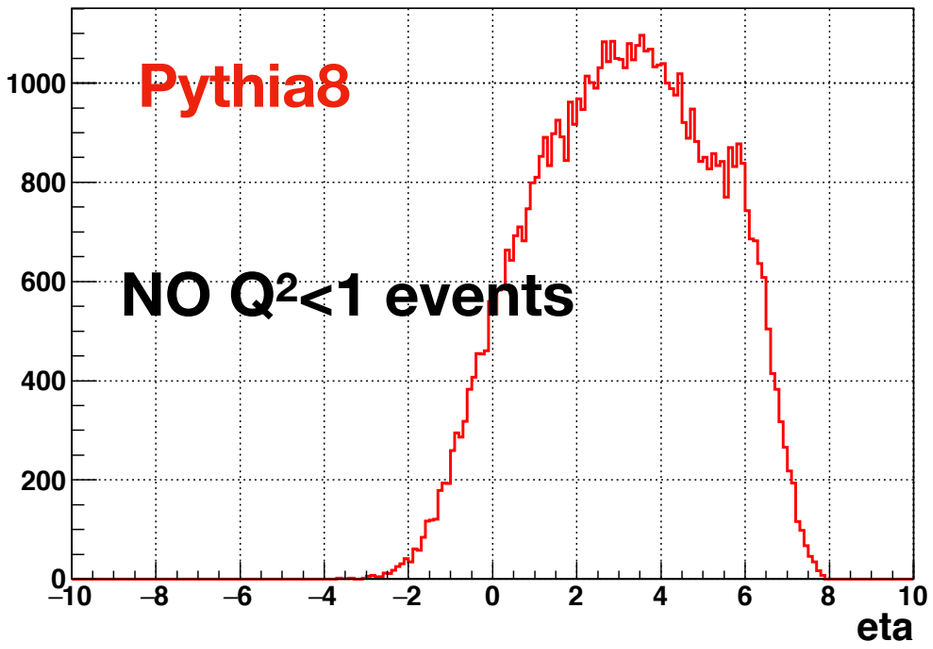
Diffractive dijet photoproduction in ep



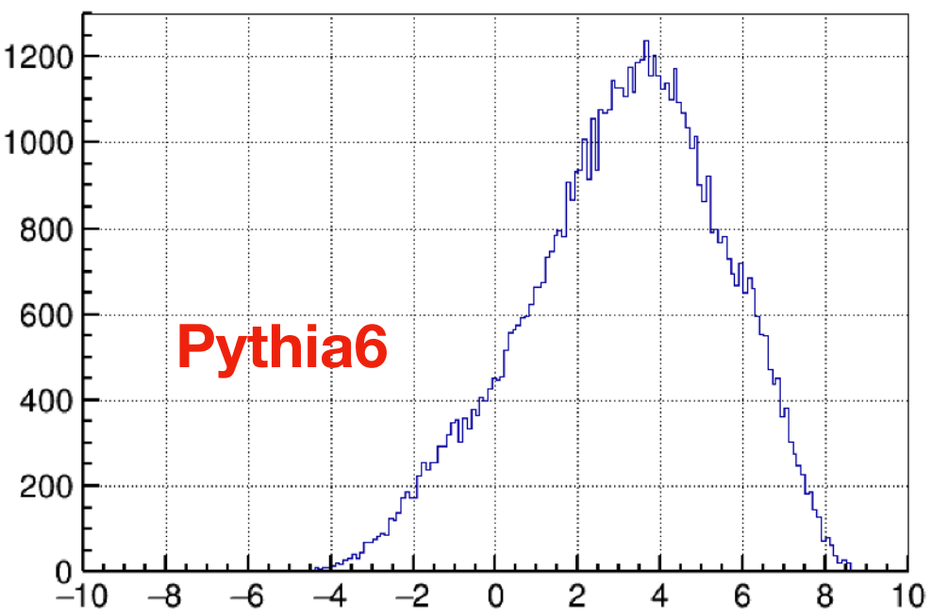
- Leading-order Feynman graphs for diffractive dijet production with photons in ep collsions;
- Left part is from direct photon contribution;
- Right part is from resolved photon contribution;
- Using Pythia8301 for our simulation;

One technique to tag on diffraction is to require a "rapidity gap" in the detector. This means that there is a region in the detector from the hadron beam towards the center of the detector in which there is no activity from the hadronic final state. The efficiency for detecting, and the purity of, diffractive events therefore depends strongly on the rapidity coverage of the detector.

DIS events from Pythia8301



275X18 GeV



Pythia8 configuration for DIS:

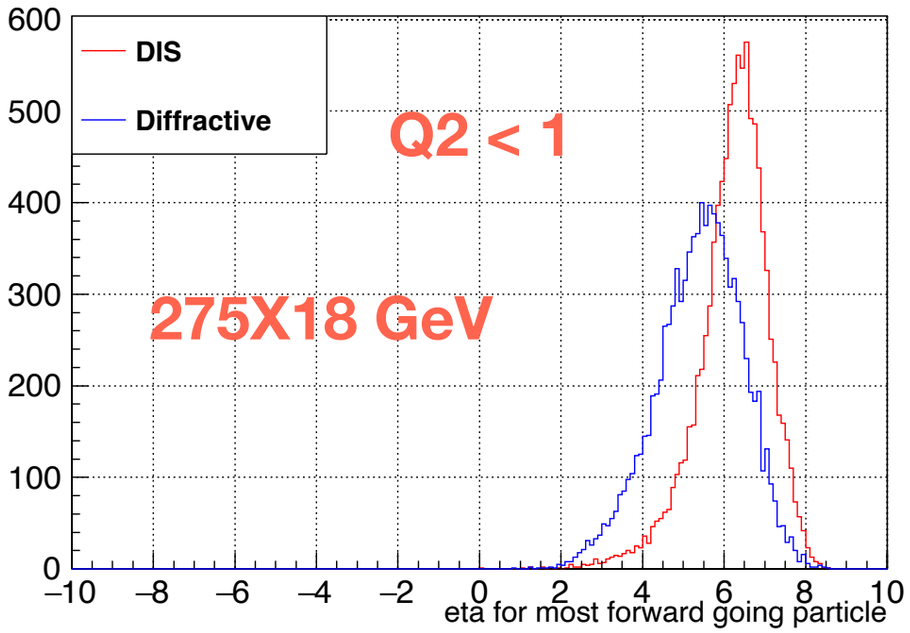
```
pythia.readString("Beams:frameType = 2");
pythia.readString("Beams:idA = -11");
pythia.readString("Beams:idB = 2212");
pythia.readString("Beams:eA = 5.");
pythia.readString("Beams:eB = 41.");
pythia.readString("WeakBosonExchange:ff2ff(t:gmZ) = on");
pythia.settings.parm("PhaseSpace:Q2Min", Q2min);
// Set dipole recoil on. Necessary for DIS + shower.
pythia.readString("SpaceShower:dipoleRecoil = on");
pythia.readString("SpaceShower:pTmaxMatch = 2”);
// QED radiation off lepton not handled yet by the new proce
pythia.readString("PDF:lepton = off");
pythia.readString("TimeShower:QEDshowerByL = off");
```

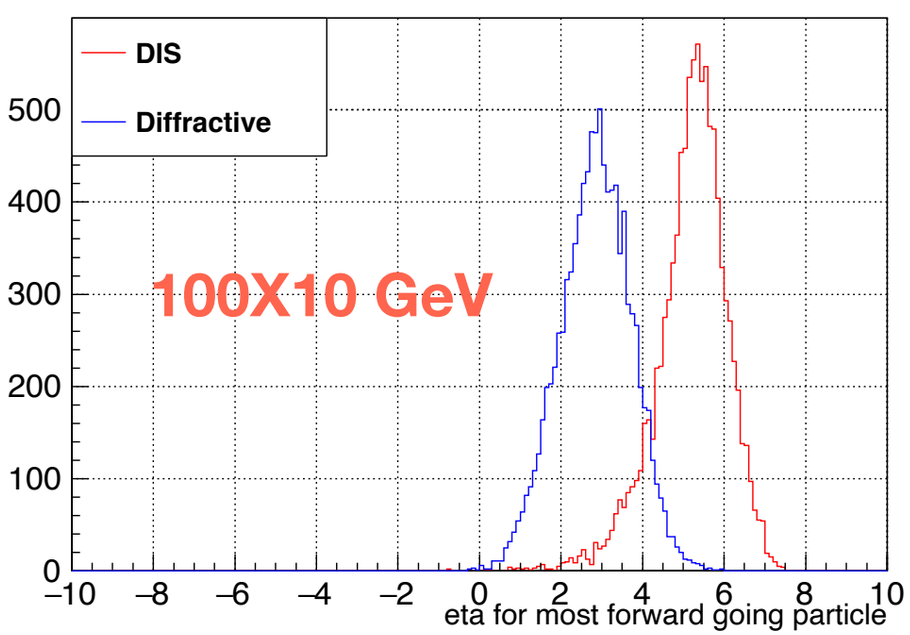
Used the Pythia6 events in RCF:
/gpfs/mnt/gpfs02/eic/DATA/PYTHIA/ep/TREES/
pythia.ep.18x275.5Mevents.1.RadCor=0.Q2.all.root

/gpfs/mnt/gpfs02/eic/DATA/PYTHIA/ep/TREES/
pythia.ep.10x100.1Mevents.RadCor=0.root

Most forward going particle (MVP)

DIS events from Pythia6





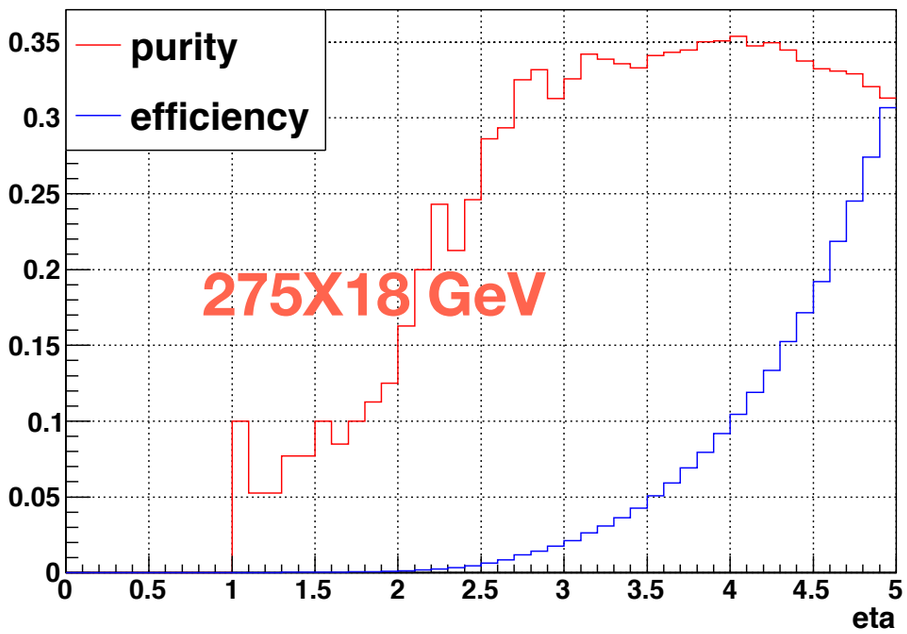
No Q2 < 1 DIS events in Pythia8 right now, need to figure it out;

Some comments from Ilkka Helenius' paper:

In both cases a beam remnant is left behind from the Pomeron, while resolved photoproduction also gives rise to a beam remnant from the hadronic photon. Multiple scatterings or multiparton interactions (MPIs) are expected between the remnants, but also in the larger photon-proton system. The particles produced by the latter type of MPIs may destroy the diffractive signature, the rapidity gap between the diffractive system and the elastically scattered proton (or meson, depending on the side of the diffractive system).

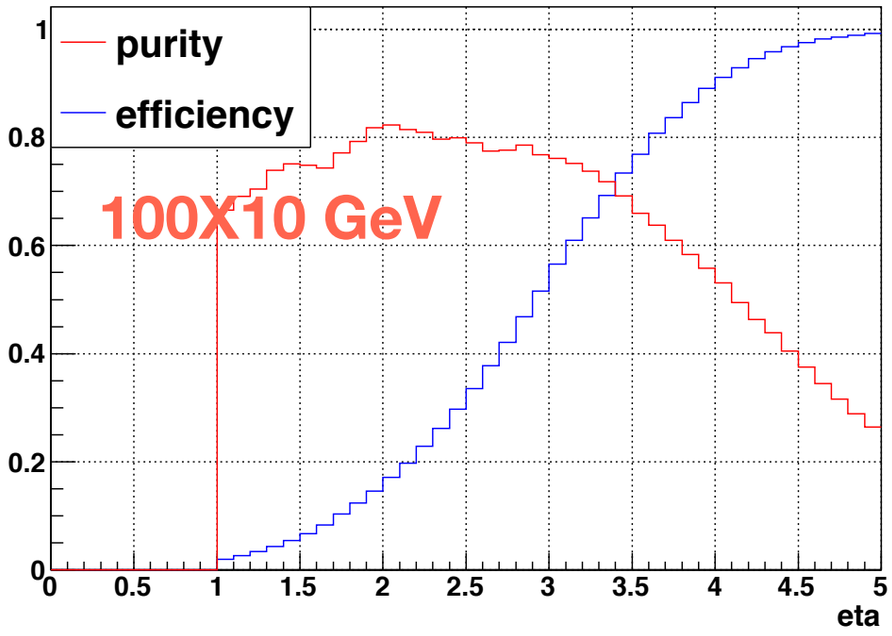
Purity and efficiency

DIS events from Pythia6

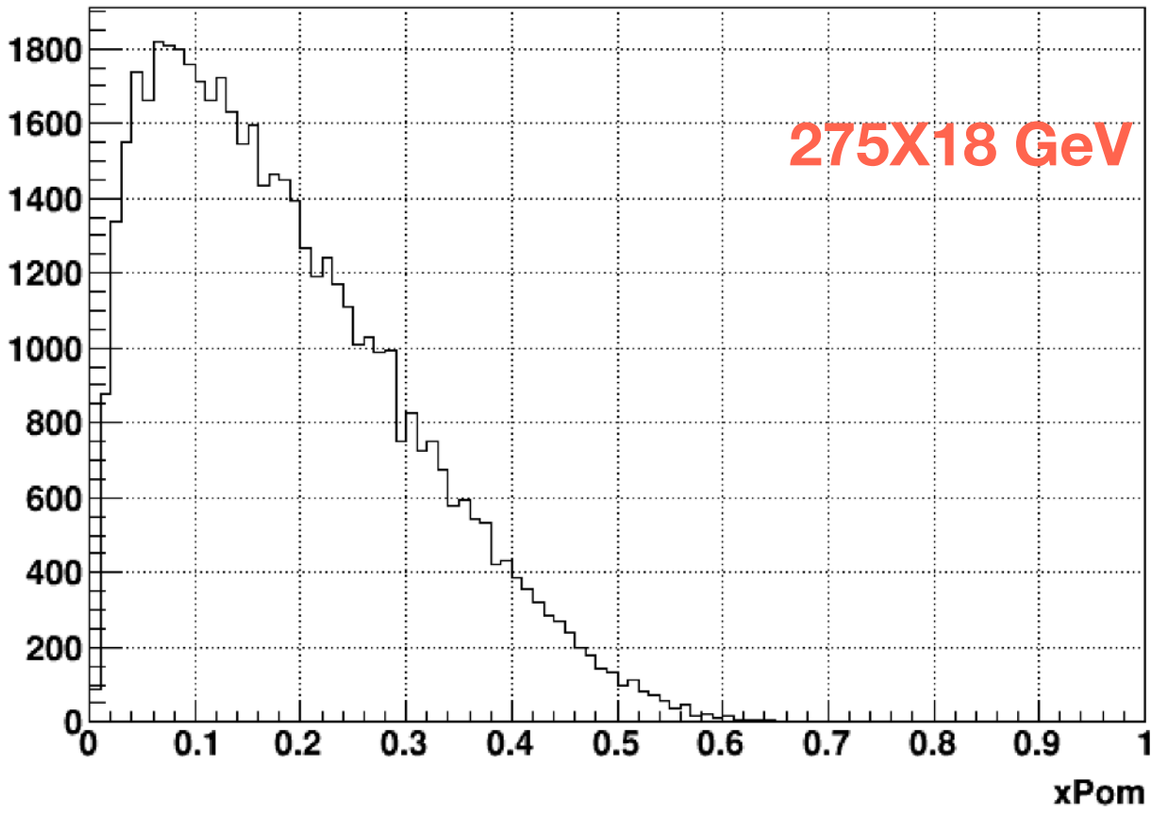


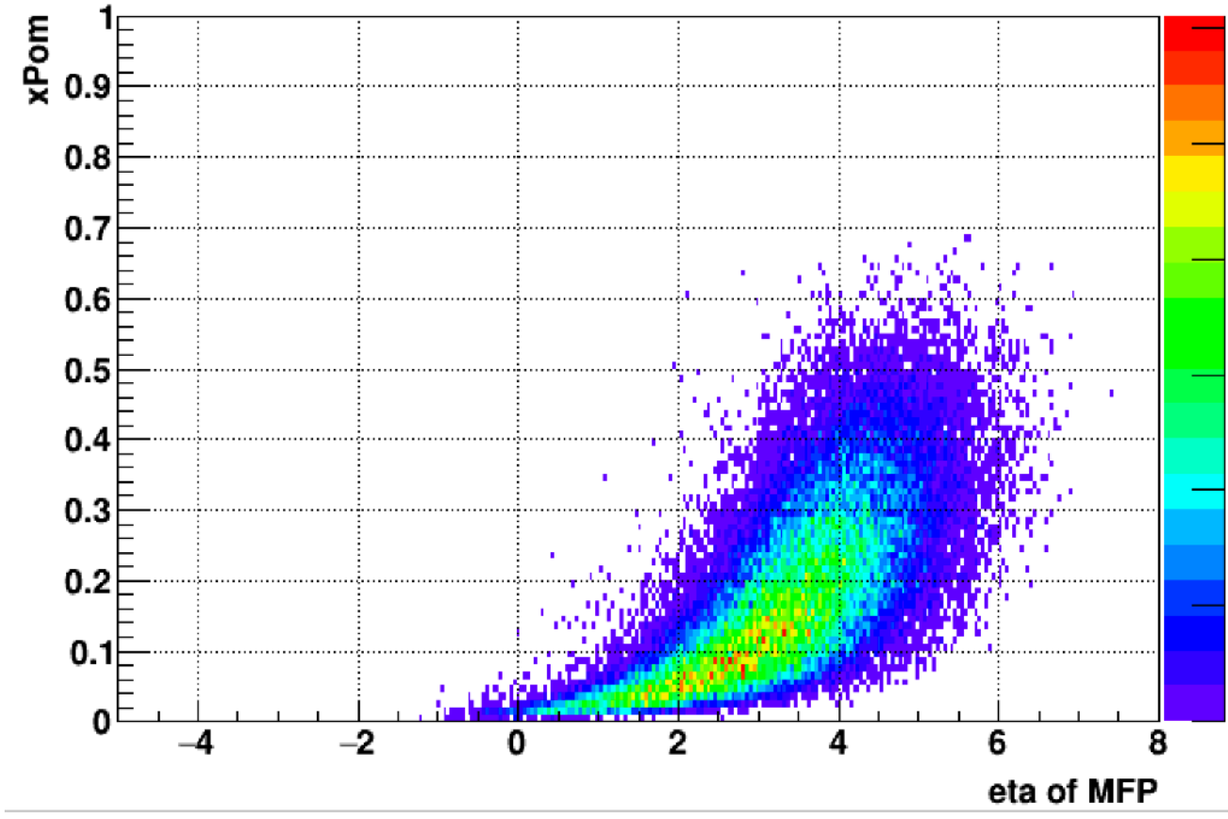
DIS events : diffractive events = 90:10

Purity = NO. diffractive events / NO. total events;
Efficiency = NO. diffractive events / NO. total diffractive events



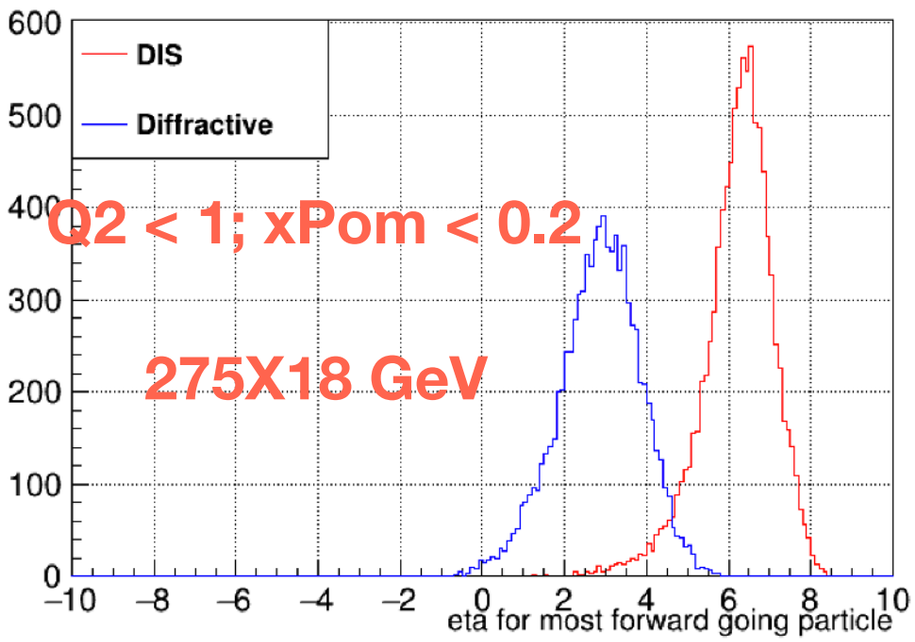
Hard diffractive events from Pythia8

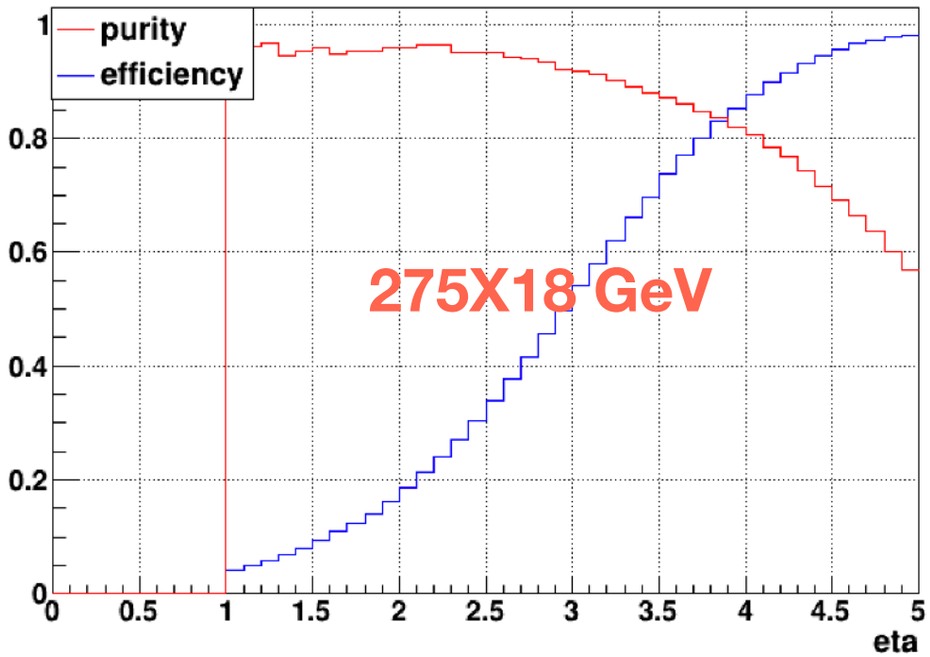


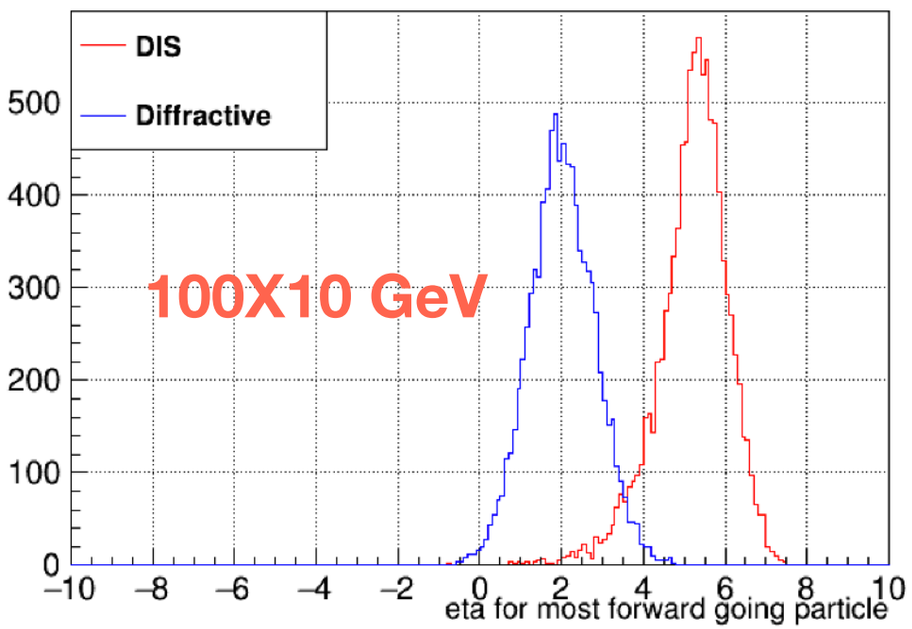


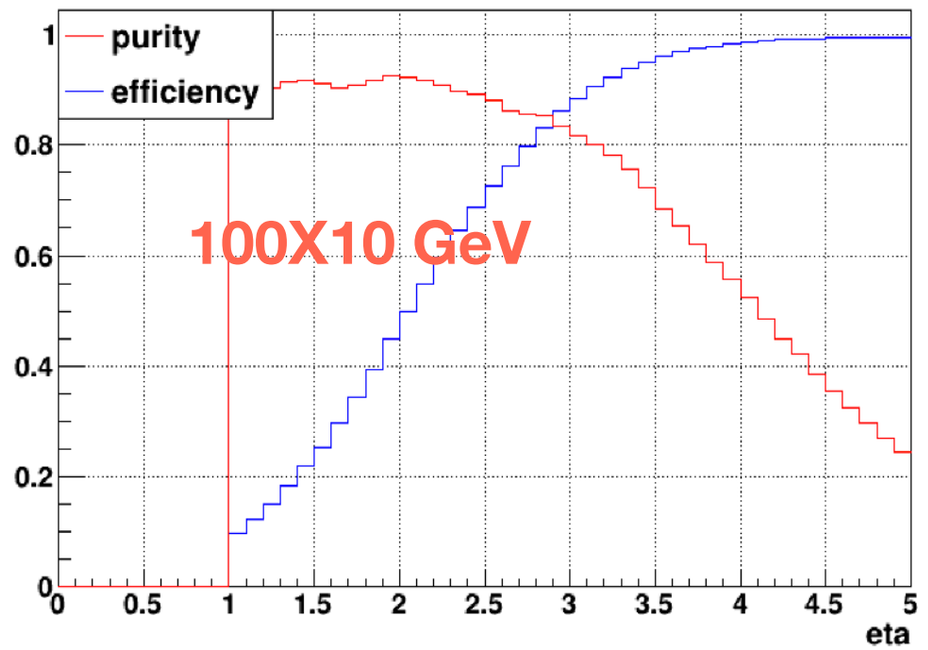
Purity and efficiency

DIS events from Pythia6

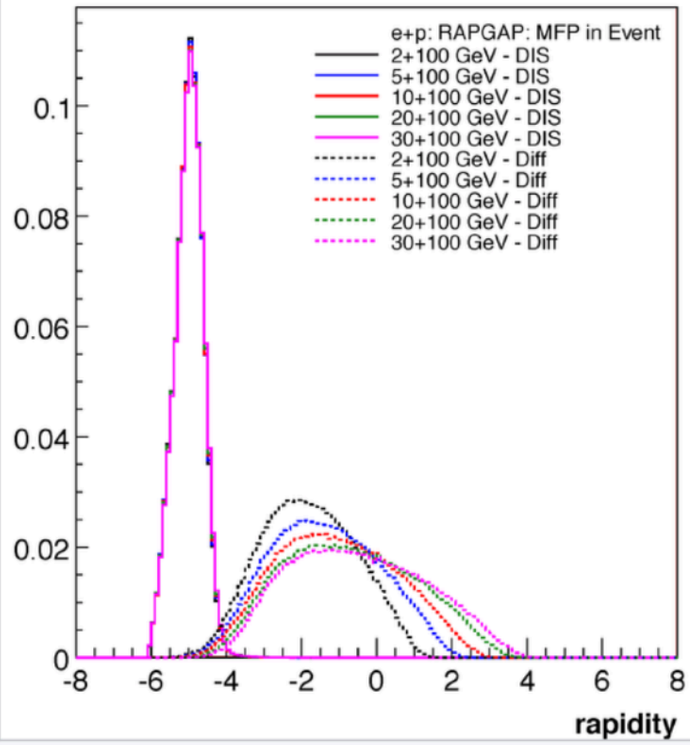




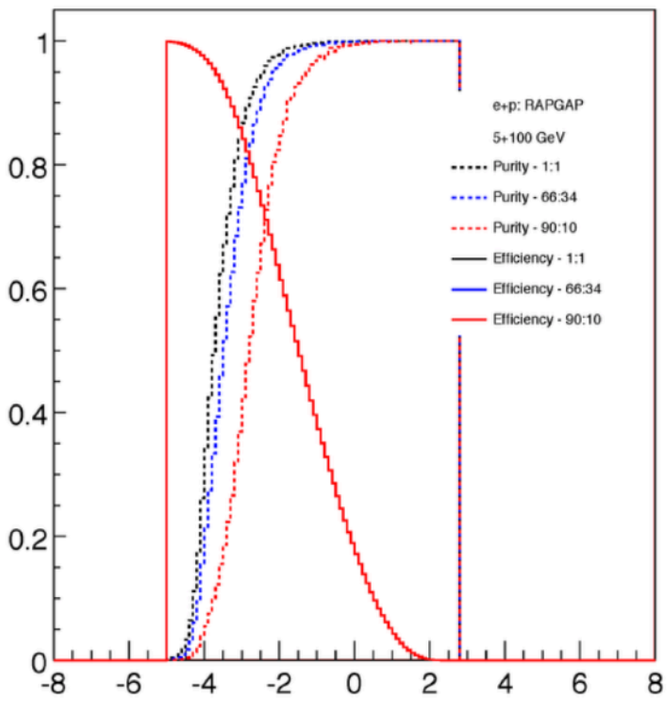




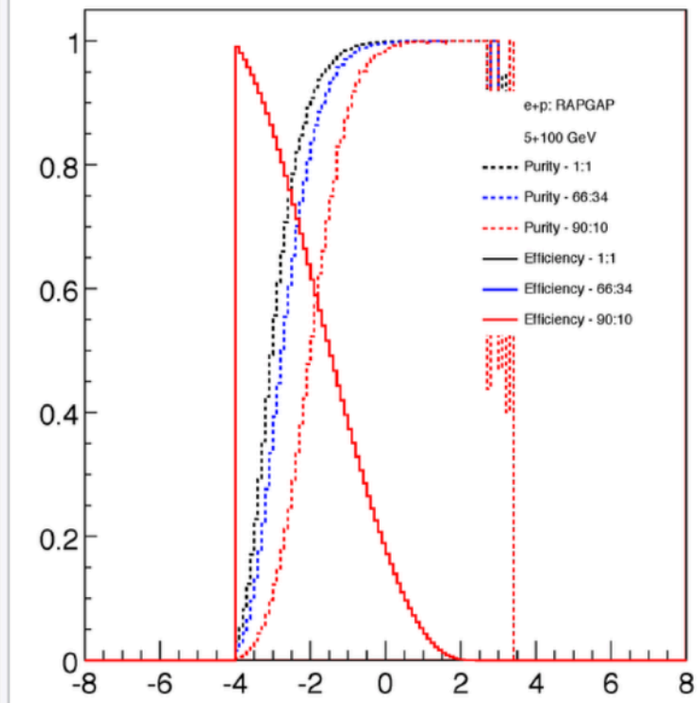
Previous study



MVP for DIS and Diffractive events



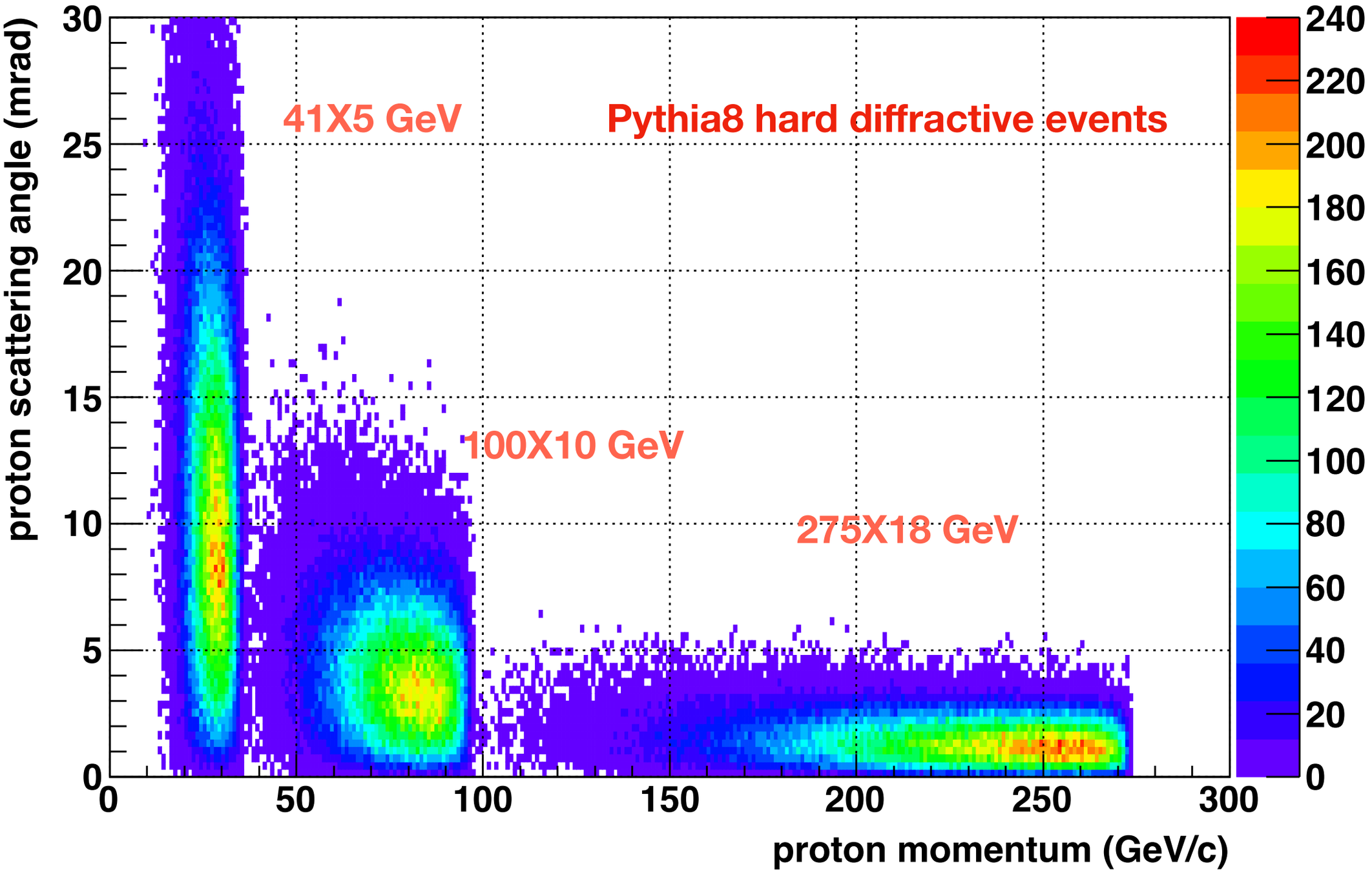
Detection efficiency and purity for diffractive events, acceptance $-5 < \eta < 5$.



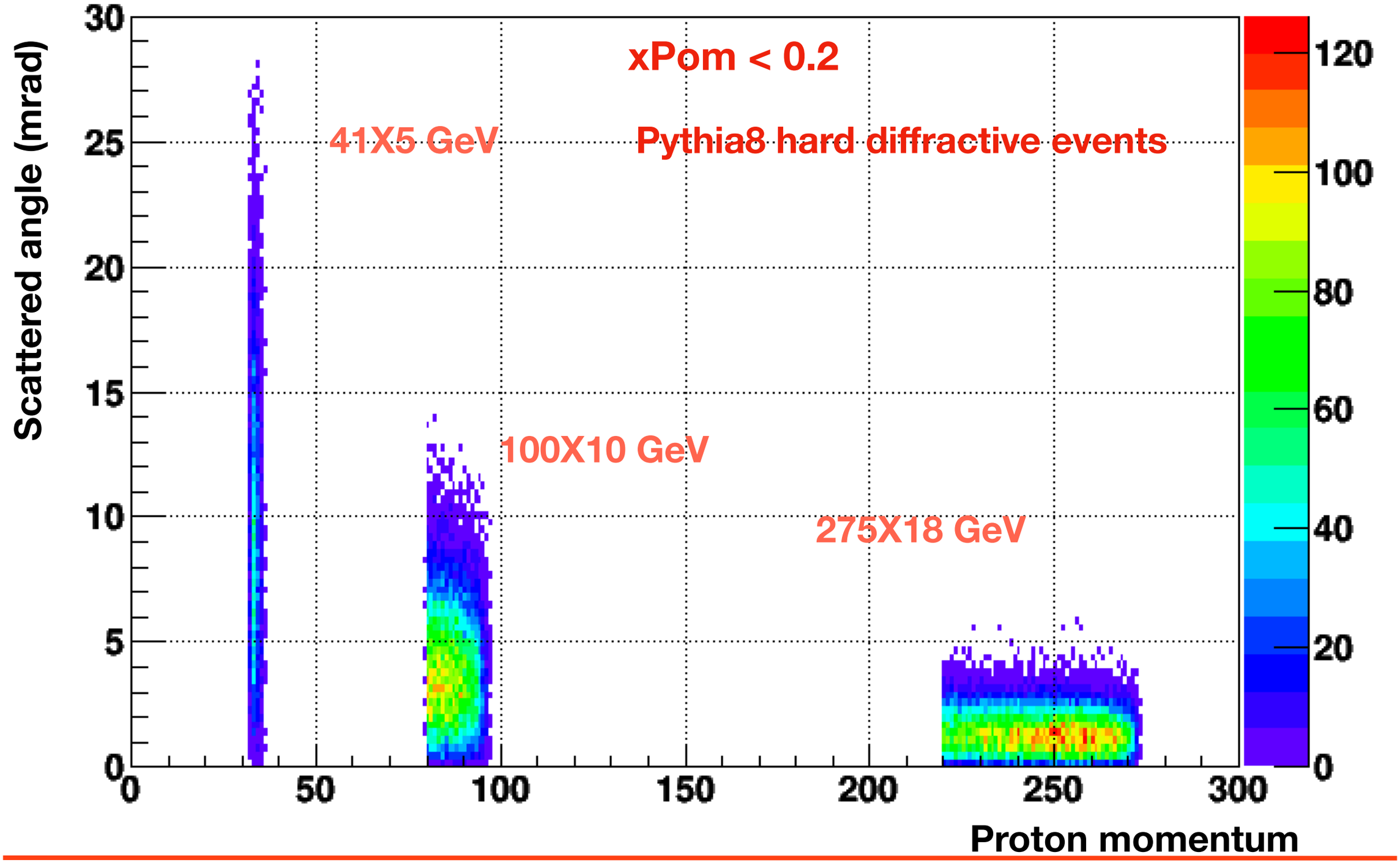
Detection efficiency and purity for diffractive events, acceptance $-4 < \eta < 4$.

- **e+p: RAPGAP model**
- A rapidity coverage of -4 to 2 is required to have a detection efficiency > 90% and a purity > 90% for diffractive events assuming a cross section ratio to DIS as measured at HERA (10:90).

Proton detection

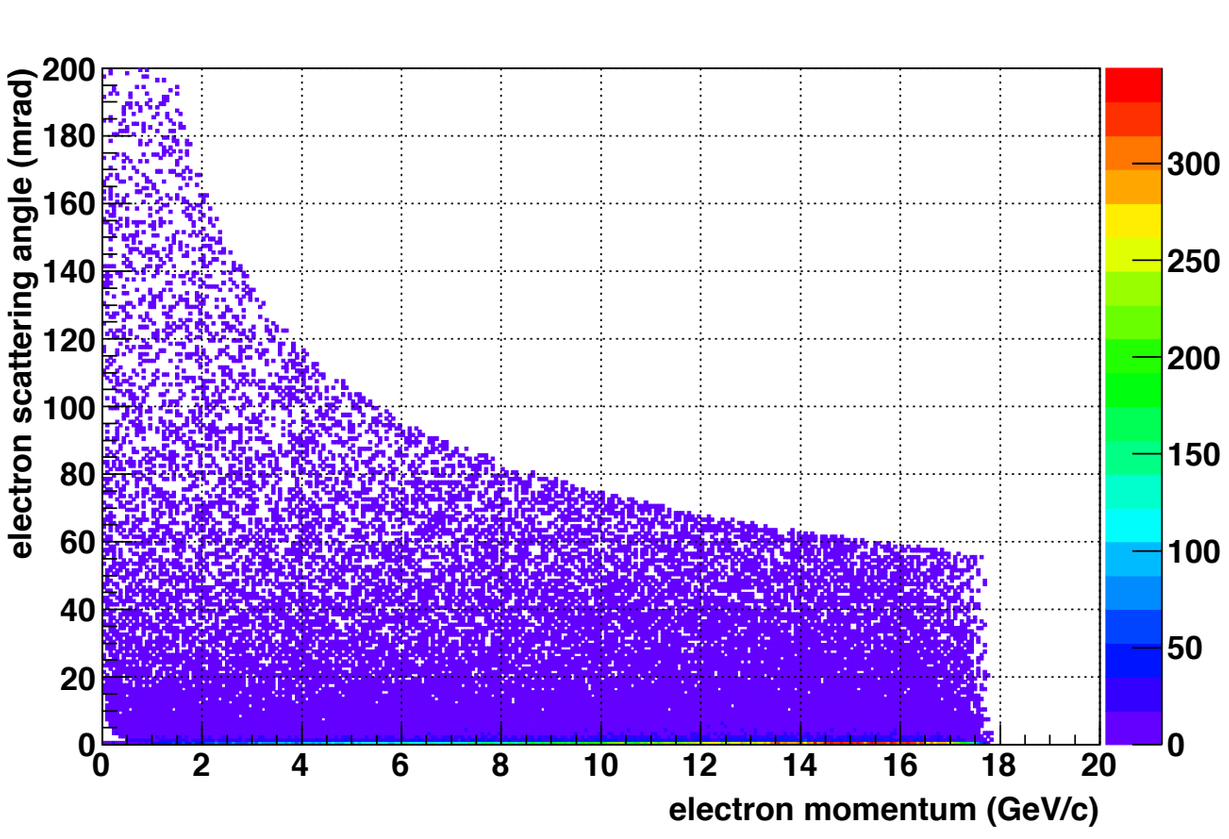


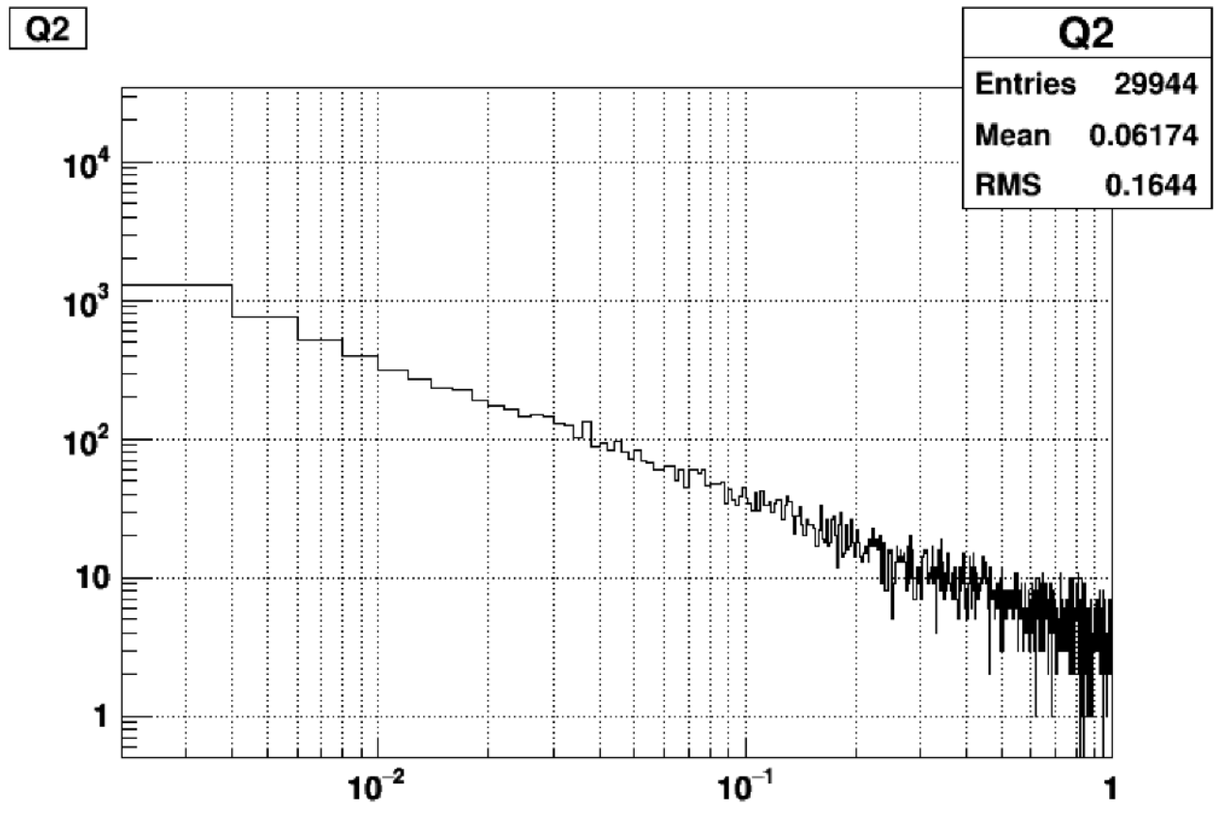
Proton detection



Electron detection

275X18 GeV





Pythia8 hard diffractive events

Summary

- We study the detector acceptance for hard diffractive events;
- More work needs to be done to better understand like Q^2 cut, cross section in Pythia8;
- We would update this study using Pythia8 for DIS events;

Thank you!

Back up