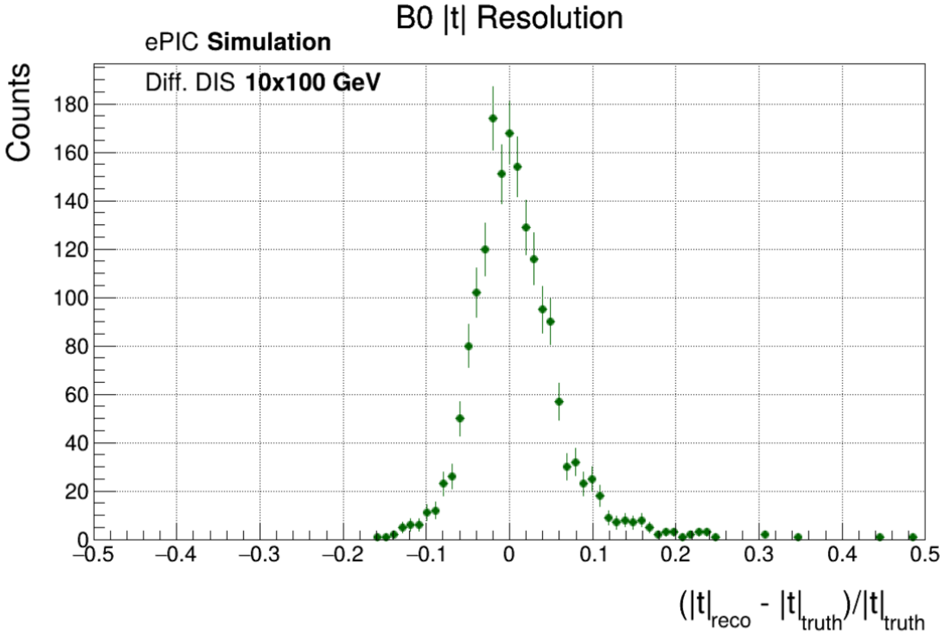
DPDF Meetings

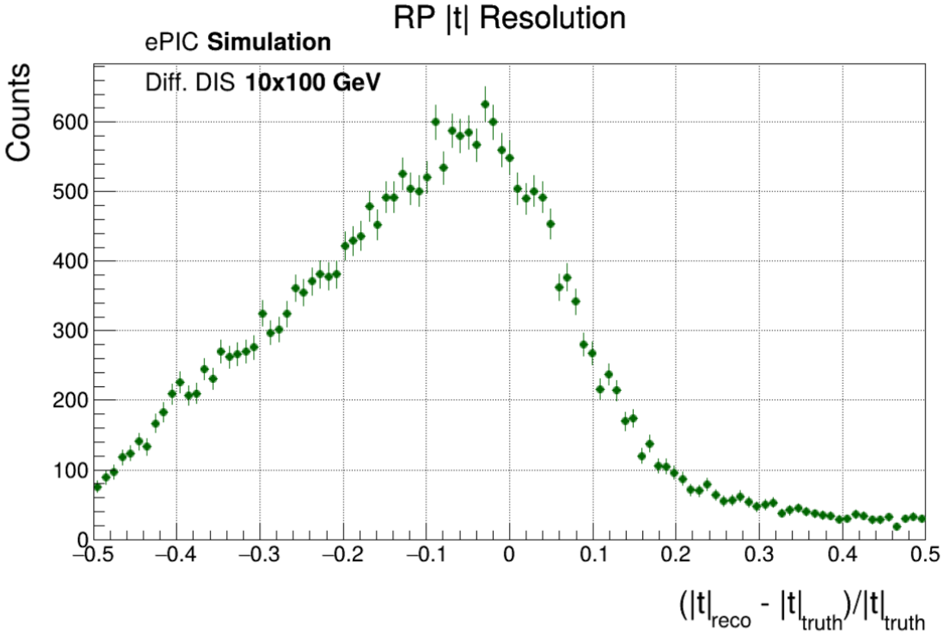
28 Oct.

Follow up

- Alex spoke about the RP resolution, inhis talk he confirm what Oliver said. Basically they have a new method for RP reconstructions
- Unfortunately this means that the rad/norad need to be simulated again (can be done over weekend)

- Roman pots should have good precision, see Alex's talk: https://indico.bnl.gov/event/26543/#4-rp-reconstruction
- Reco method: *t*RECO BABE

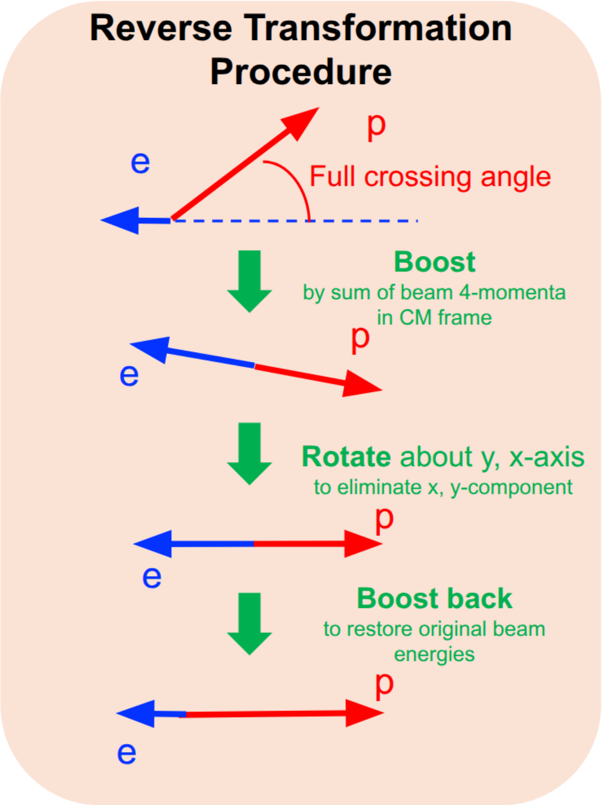




From Alex's talk May 2024

How to Get Back to True MC from Afterburned

Boost and rotation is determined by beam particles of event (event-by-event)



- **<u>Two approaches</u>**
  - **True MC events** for true MC to full-reco comparison
    - Remove ALL effects to get back generated MC information.
  - **Realistic events** remove only crossing angle, keep beam FX in events
    - This is an important distinction!! Crossing angle can be accounted-for in real events, but beam effects such as angular divergence are random and cannot be removed from a real event!

https://indico.bnl.gov/event/23345/contributions/91606/attachments/54642/93490/Analysis%20of%20ePIC%20Output%20With%20Afterburned%20Events.pdf

How to Get Back to True MC from Afterburned

```
// Accessing final-state particles
for(const auto& v : evt.vertices())
{
  for(const auto& p : v->particles_out())
  {
    TLorentzVector mc(p->momentum().px(), p->momentum().py(), p->momentum().pz(), p->momentum().e());
    mc.Boost(b);
    mc.RotateY(rotAboutY);
    mc.RotateX(rotAboutX);
    mc.Boost(bb);

    // After this, all particles are back to true MC level

  }
}
```

- <u>**Two approaches**</u>
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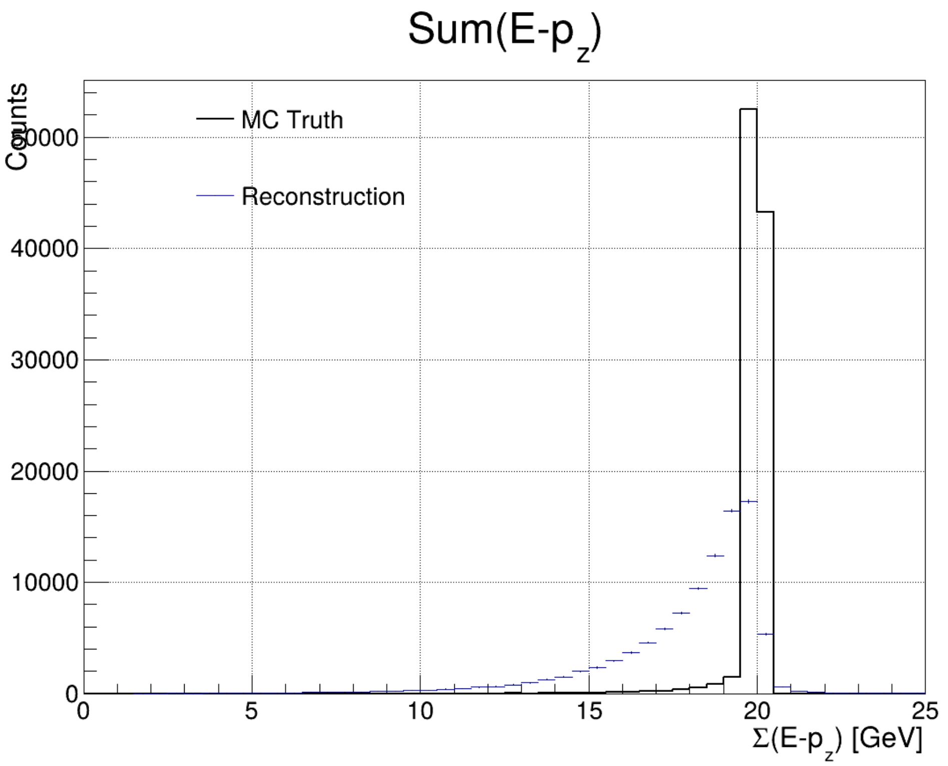
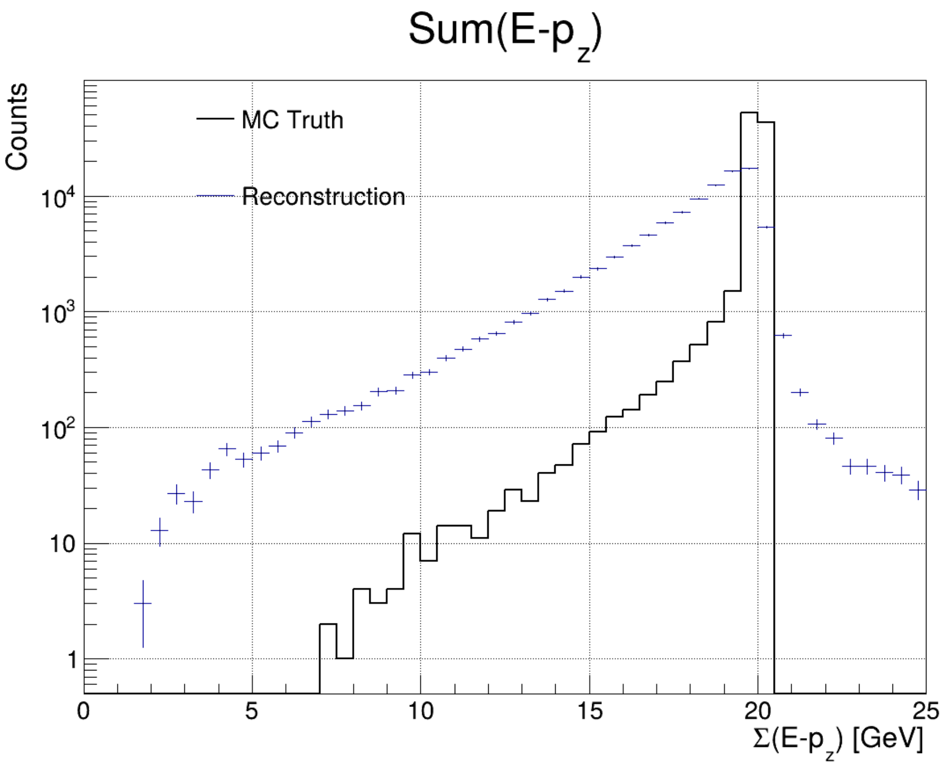
1: Overview – Kinematic Distributions

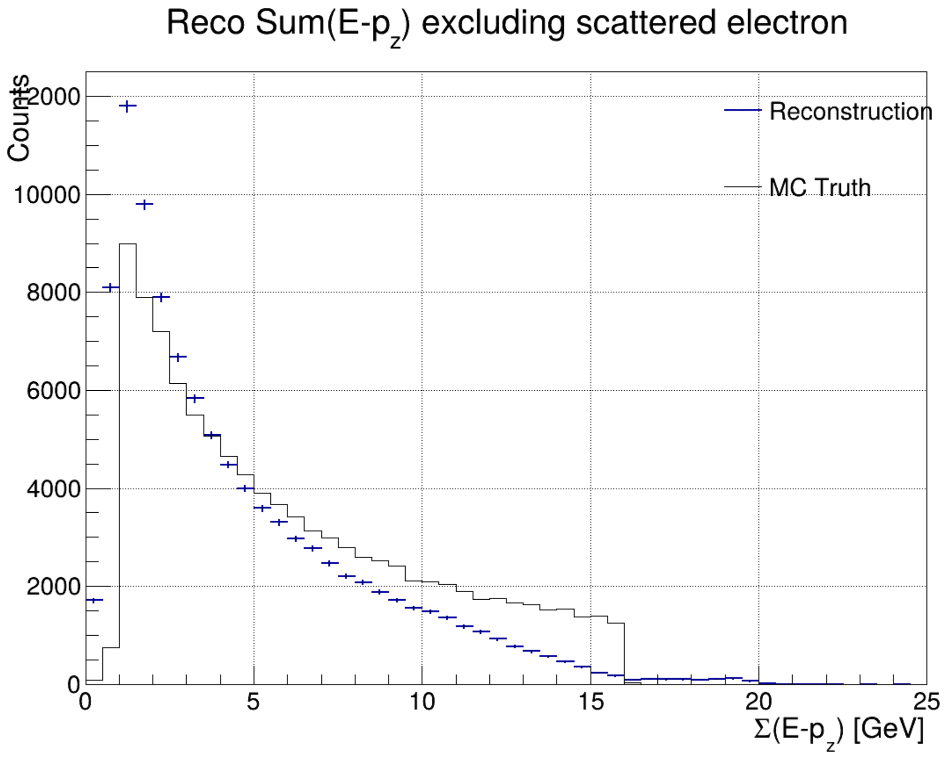
- E **–** p_z, **including** the scattered electron, should peak at, $2E_e = 20\text{GeV}$

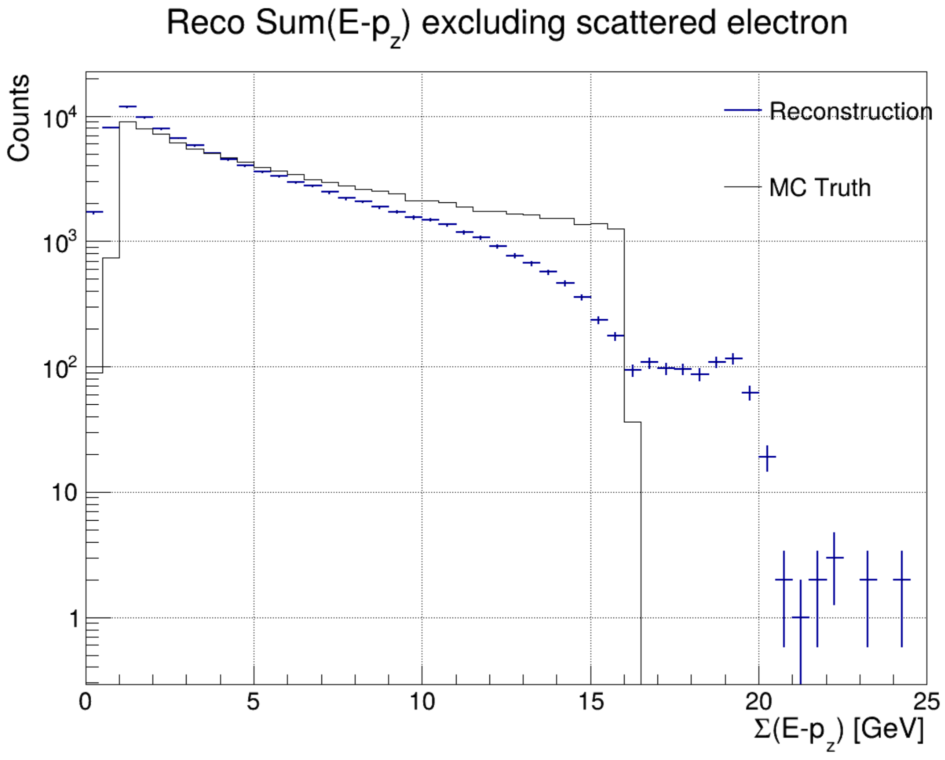




1: Overview – Kinematic Distributions

- E – p_z, **excluding** the scattered electron, should peak at 0 GeV,
- Since we had a lower cut for 'y', it peaks at $2y_{\min}E_e$
- Similar cut imprint for max of 'y'





$$y_{\mathrm{JB}} = \frac{1}{2E_e^{\mathrm{eff}}} \sum_h (E_h - p_{z,h}),$$

Simulation Campaign Request

- **Generator validation successful** – no issues observed with **RAPGAP**
- Requested samples: **RAPGAP version: v3.310**
- **10×130 GeV Diffractive inclusive** events with & without QED radiation (Priority – Early Science Study)
  - **Target statistics:** Considering a luminosity of $10 fb^{-1} = 10^7 nb^{-1}$, this corresponds to a number of events of: $4.22(nb) \times 10^7(nb^{-1}) \simeq 4.2 \times 10^7$ events
  - Original target: 42M events for full statistics **–> Optimized:** Factor 10 reduction with statistical error rescaling
  - 4M events with radiative effects (pseudodata)
  - 4M events without radiative effects for study of rad corrections (also used MC for acceptance/efficiency)
  - **Total: 8M events**
- **18×275 GeV** (Saturation Studies) **Diffractive inclusive** events (with/without QED radiation)
  - Cross section: $\sigma \approx 7.38$ nb
    - Request: 7.5M events with radiative effects (pseudodata)
    - Request: 7.5M events without radiative effects
    - **Total: 15M events**

Kong's comment/requsts

Hi Hadi,

Thanks for the virtual updates.

Comments:

- It is not clear to me the samples have radiative effects or not; I remember you had the comparison before, but not sure if that still applies as you have many updates now? A comparison with and without this effect was previously shown and may need updating.
- I like the QA checklist plots and comparisons among different method. Since you are doing a similar analysis as Win, it may be useful to make a similar Q2 vs x plots to illustrate the phase space and most importantly, uncertainty. Would be nice to show us what method works best for which phrase space. You already asked this too, will do this after the cross section. Phase space coverage
- Maybe I forgot, do you have a eta_max distribution? Remember at HERA, there were two methods to do diffraction. One with tagged proton, while the other only via the eta_max in your tracking/calorimeter. Similar to my comments to others, we should also explore the two methods and show the full capability of ePIC. I think he's pointing to LRG method.
- For the simulation request, please follow the instructions which I hope you know what they are. (a form + github repo for version control). Salvatore sent me the form, I don't know about github repo. From this point I infer that he's on board with sample request.

Looking forward to your update next week.

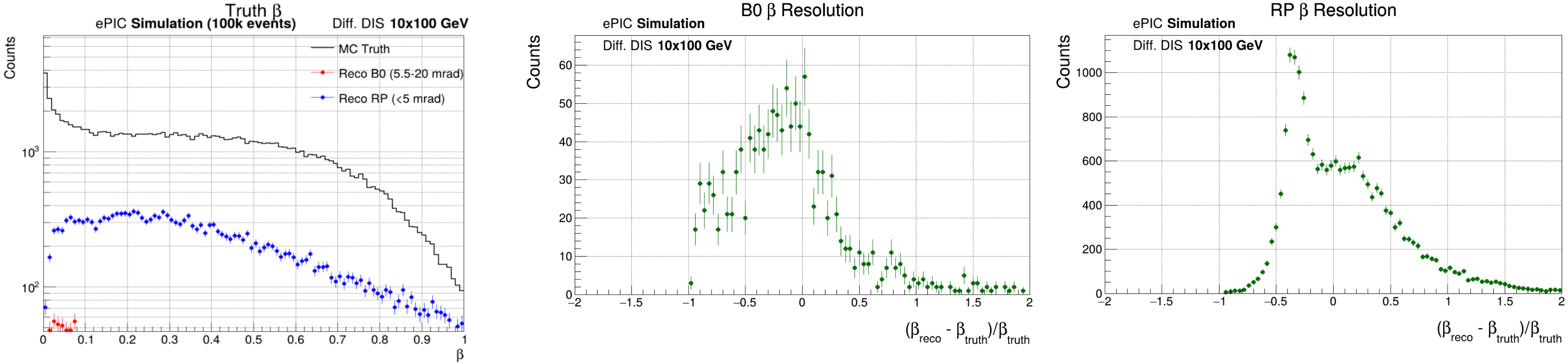
Now working on

- Working on beta, $\beta = \frac{x}{x_{\mathbb{P}}}$
- Triple differential reduced cross section

$$\frac{\mathrm{d}^3\sigma}{\mathrm{d}\beta\,\mathrm{d}Q^2\,\mathrm{d}x_{\mathbb{P}}} = \frac{4\pi\alpha^2}{\beta Q^4}\left[1 - y + \frac{y^2}{2}\right]\cdot\tilde{\sigma}^{D(3)}\left(\beta, Q^2, x_{\mathbb{P}}\right)$$

where:

$$\tilde{\sigma}^{D(3)}\left(\beta, Q^2, x_{\mathbb{P}}\right) = F_2^{D(3)}\left(\beta, Q^2, x_{\mathbb{P}}\right) - \frac{y^2}{1+(1-y)^2}F_L^{D(3)}\left(\beta, Q^2, x_{\mathbb{P}}\right)$$


Truth β
ePIC Simulation (100k events)
Diff. DIS 10x100 GeV
MC Truth
Reco B0 (5.5-20 mrad)
Reco RP (<5 mrad)
Counts
β
B0 β Resolution
ePIC Simulation
Diff. DIS 10x100 GeV
Counts
(β_reco - β_truth)/β_truth
RP β Resolution
ePIC Simulation
Diff. DIS 10x100 GeV
Counts
(β_reco - β_truth)/β_truth