

Offline Electron Reconstruction Validation

Caleb Fangmeier
Ilya Kravchenko, Greg Snow

University of Nebraska - Lincoln

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INTRODUCTION

- ▶ Our goal is to study **seeding** for the **offline** Gsf tracking with the **new pixel detector**.
- ▶ Ongoing studies¹ in HLT examine the resolution of RecHits used in Gsf Tracking.
- ▶ In those studies, the resolution is computed by measuring the distance between the **RecHits** and the extrapolated paths from ECAL **super-clusters** (SCs).
- ▶ For **offline** reconstruction, we compute residuals by comparing the position of **RecHits** and associated **SimHits**.
- ▶ Knowing these resolutions is important in choosing the size of search windows in the hit matching algorithm used in electron reconstruction.

¹https://indico.cern.ch/event/613833/contributions/2646392/attachments/1486134/2307836/EGMHLT_PixelMatching_Jun30.pdf

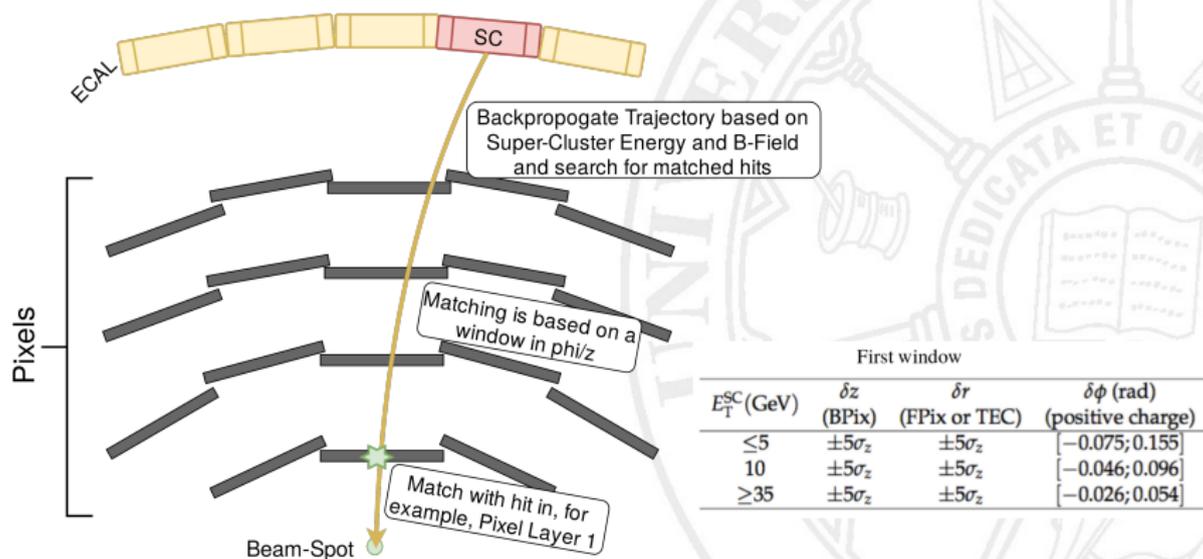
INTRODUCTION

- ▶ We use Rafael Lopes de Sa's analysis setup² that is derived from the standard offline tracking reconstruction tool TrackingNtuple from Validation/RecoTrack.
- ▶ Source dataset:
`/DYJetsToLL_M-50_TuneCUETP8M1_13TeV-madgraphMLM-pythia8/
PhaseIFall116DR-FlatPU28to62HcalNZSRW_81X_upgrade2017_realistic_v26-v1/
GEN-SIM-RAW`
- ▶ Using Release CMSSW_8_1_0
- ▶ Figures in this talk use 31790 events (could be re-run with more)

²[https://](https://github.com/rafaellopesdesa/cmssw/tree/ValidationGsfTracks81X)

github.com/rafaellopesdesa/cmssw/tree/ValidationGsfTracks81X

GSF ELECTRON SEEDING I



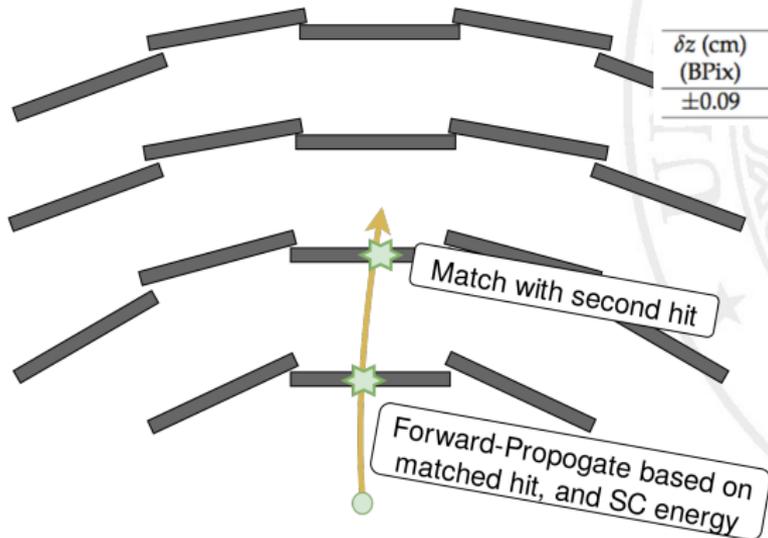
Windows from <https://indico.cern.ch/event/611042/contributions/2464057/attachments/1406271/2148742/ElectronTracking30112016.pdf>

Gsf Electron Seeding II

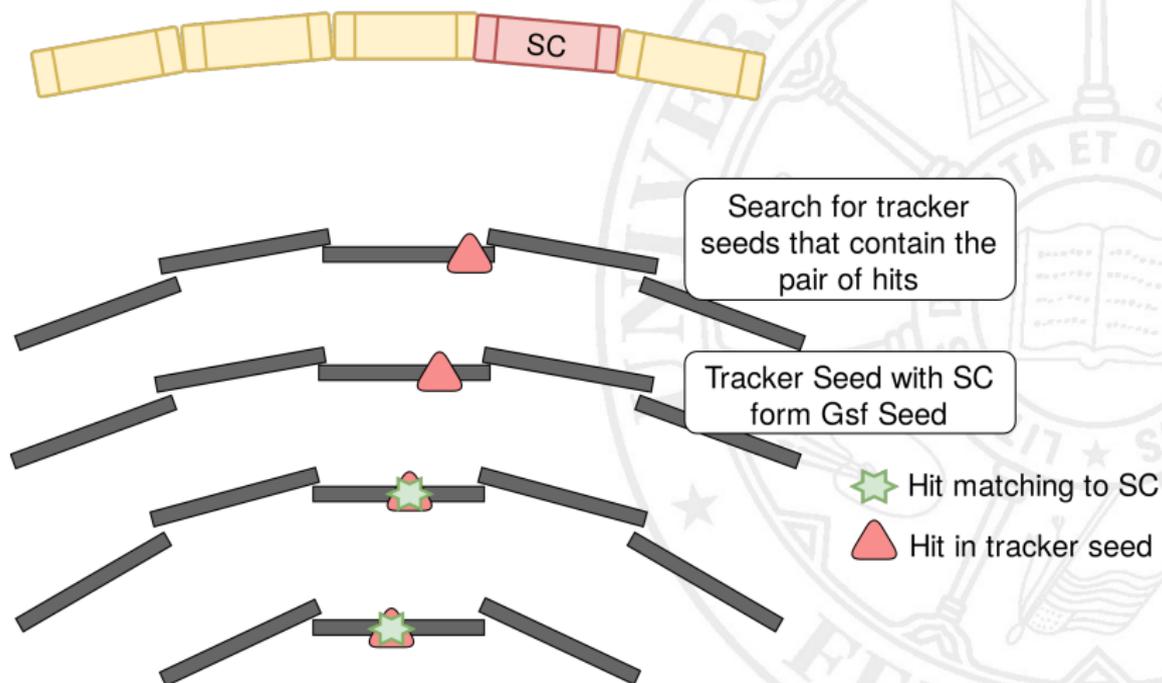


Second window

δz (cm) (BPix)	δr (cm) (FPix)	δr (cm) (TEC)	$\delta\phi$ (rad) (BPix)	$\delta\phi$ (rad) (FPix or TEC)
± 0.09	± 0.15	± 0.2	± 0.004	± 0.006

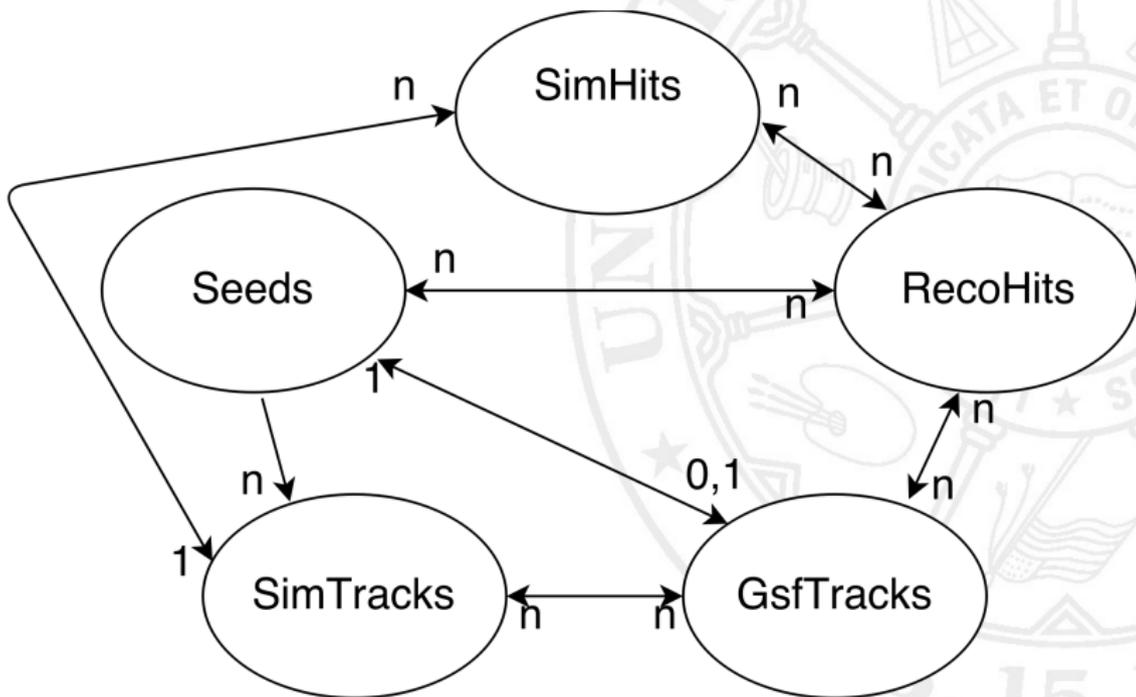


Gsf Electron Seeding III



TRACKINGNTUPLE

The TrackingNtuple format contains (among others) the below crosslinked collections

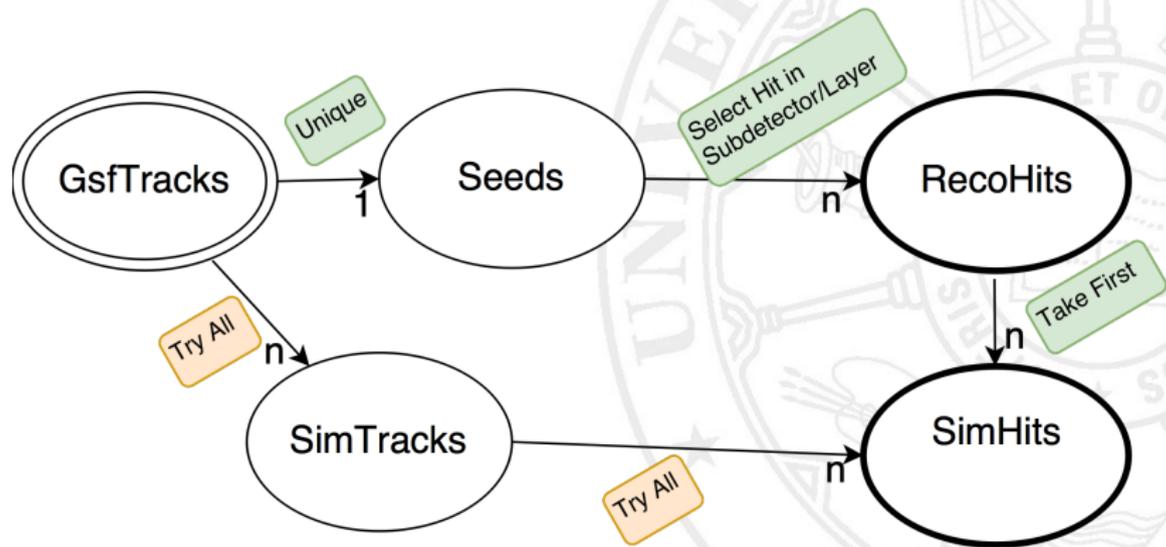


FINDING SIMHIT/RECHIT PAIRS

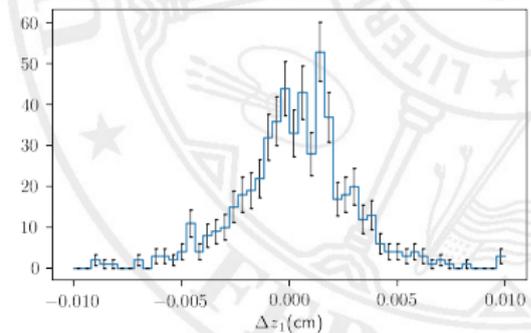
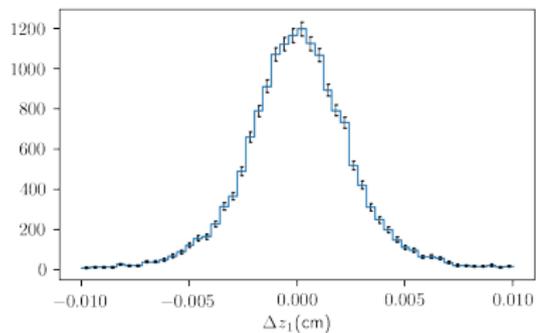
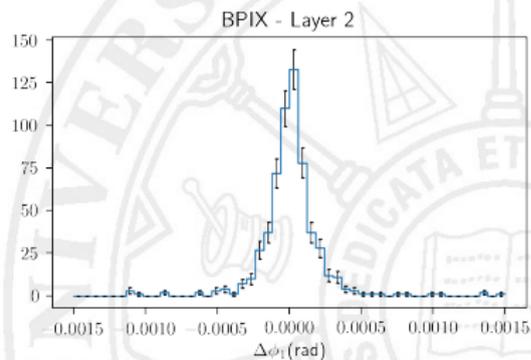
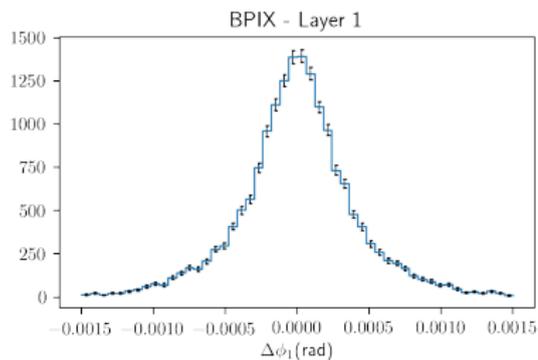
To find residuals for calculating resolutions, require a pair containing 1 RecHit and 1 SimHit. Procedure is as follows:

1. For each Track, get it's Seed (unique)
2. For each RecHit in the Seed, require
 - ▶ It is in the specified subdetector (e.g. BPIX Layer 1)
 - ▶ It is the 1st/2nd hit in the Seed.
 - ▶ It is matched to at least one SimHit.
3. For each RecHit (**B**) passing the above, take the first matched SimHit (**A**).
4. Now look through all SimHits associated with SimTracks associated with the original Track. If **A** exists in this set. Make a pair of SimHit **A** and RecHit **B**.

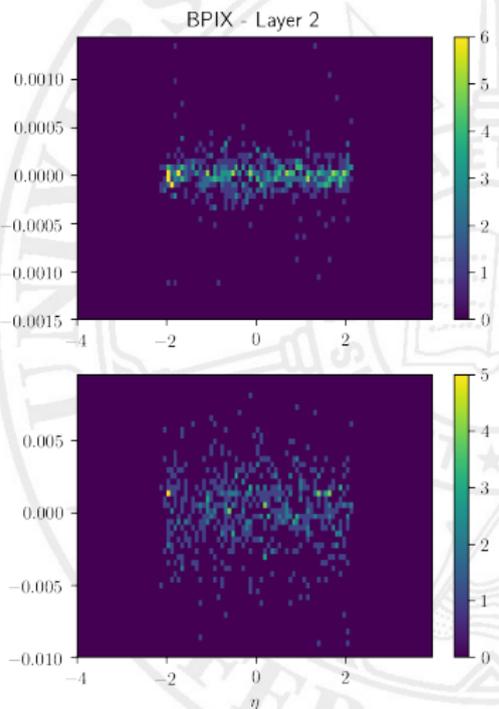
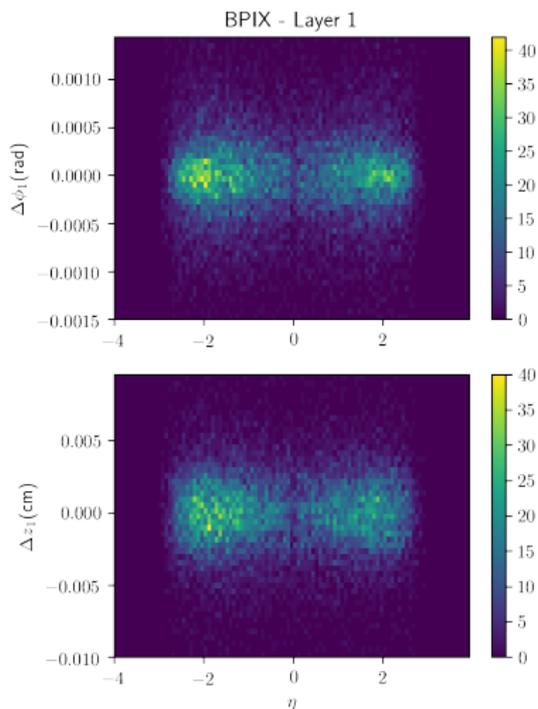
FINDING SIMHIT/RECHIT PAIRS



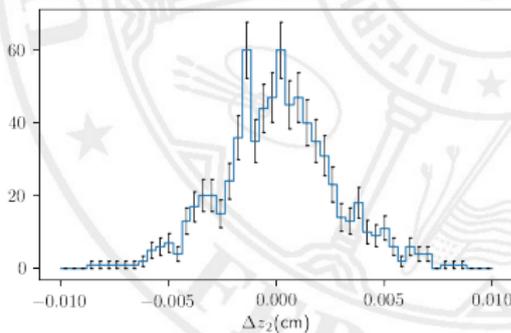
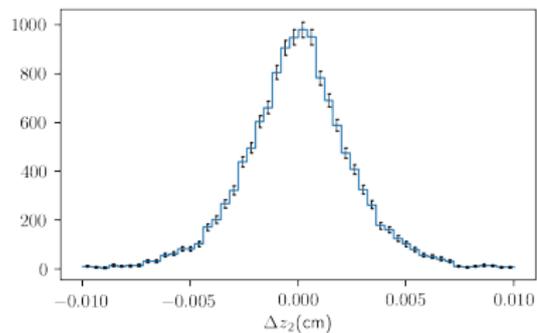
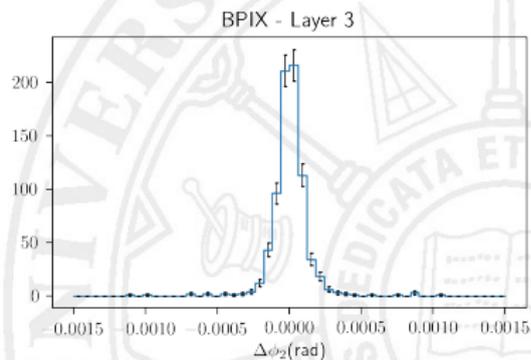
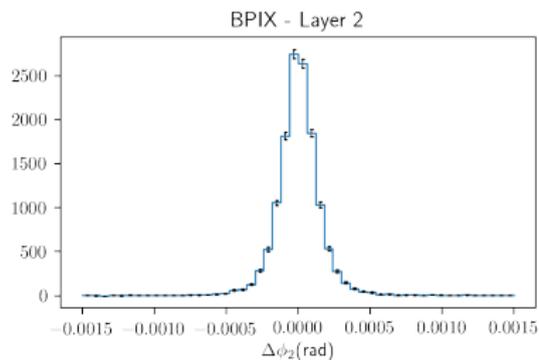
BPIX HIT 1 RESOLUTION



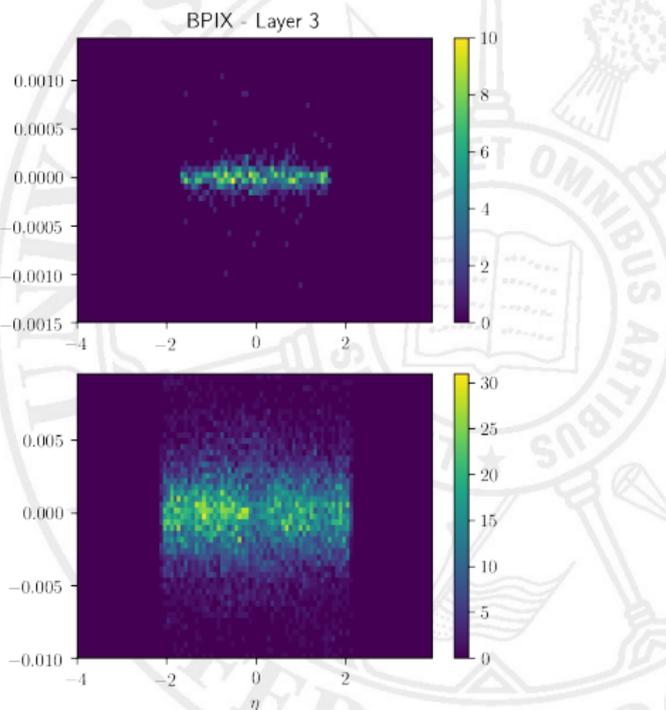
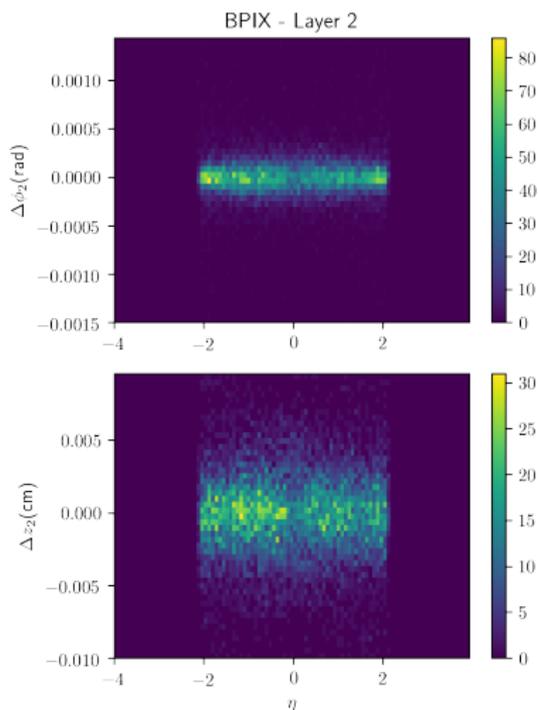
BPIX HIT 1 RESOLUTION vs. η



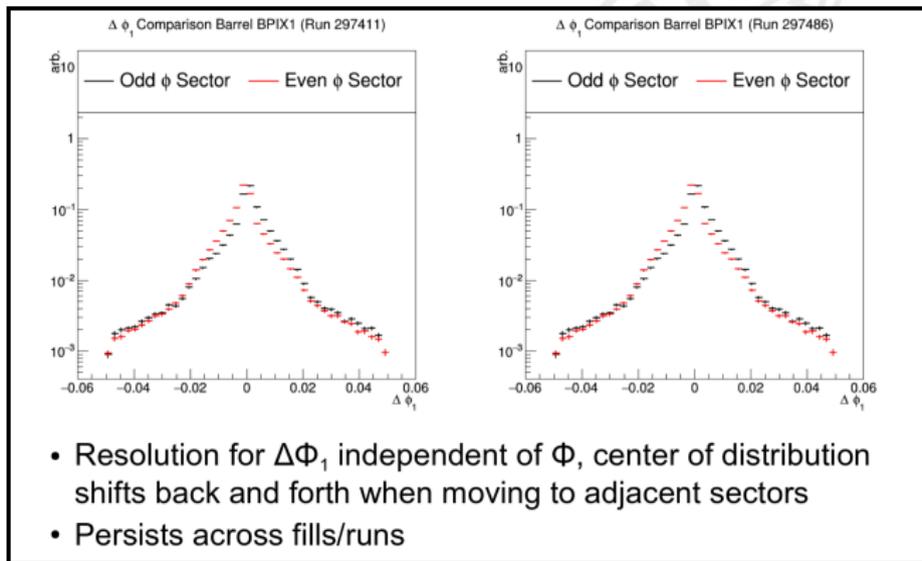
BPIX HIT 2 RESOLUTION



BPIX HIT 2 RESOLUTION vs. η

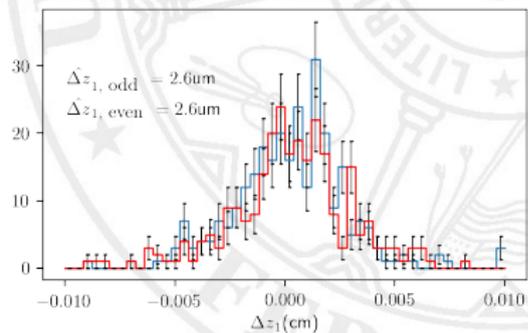
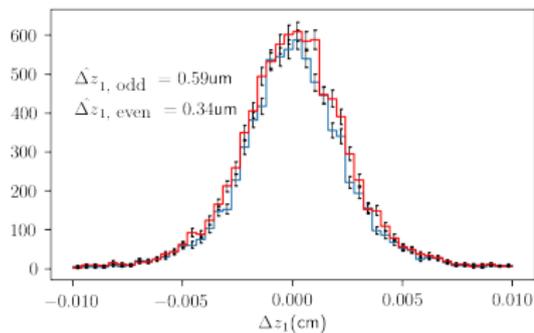
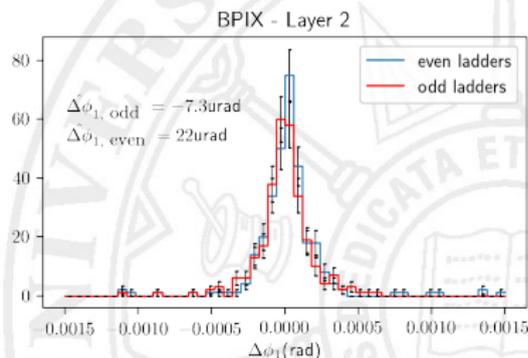
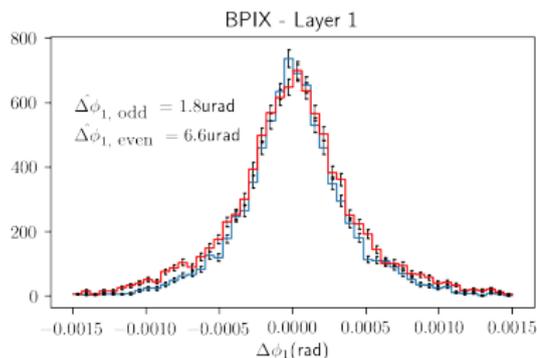


RESOLUTION DEPENDENCE ON EVEN/ODD LADDER NUMBER



- ▶ Above From Dylan Rankin's June 30 Presentation. (See slide 1)
- ▶ We have slightly different definitions of $\Delta\phi_1$, but wanted to investigate ourselves.

RESOLUTION DEPENDENCE ON EVEN/ODD LADDER NUMBER



CONCLUSIONS

- ▶ Analysis machinery for offline electron RECO studies with MC truth is in place.
- ▶ Preliminary plots of $\Delta\phi_{1/2}$ and $\Delta z_{1/2}$ for BPIX Layers 1/2 are shown.
- ▶ Code for this analysis is here:

```
git.fangmeier.tech/caleb/EGamma_ElectronTrackingValidation
```

- ▶ next to come
 - ▶ run on larger event samples (trackingNtuples are generated, just need to use)
 - ▶ include FPIX
 - ▶ investigate reasons for rec hit inefficiencies
 - ▶ introduce triplet-based pixel matching for the seeds and repeat the studies