Update: E-resolution

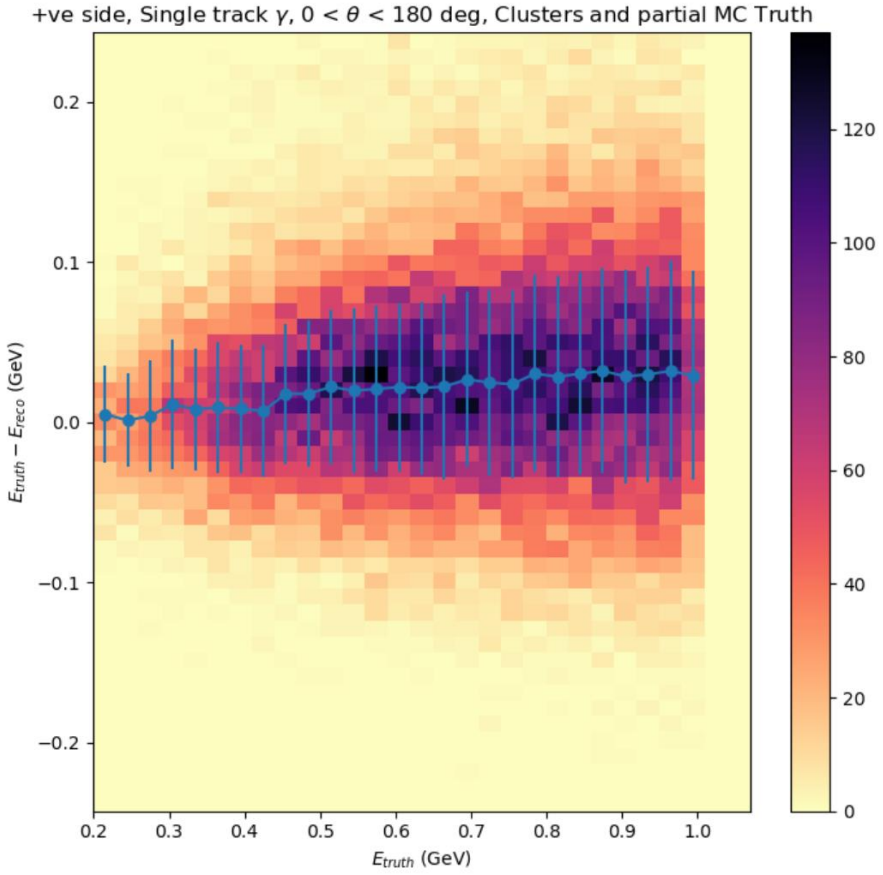
Previously: Cluster with partial information

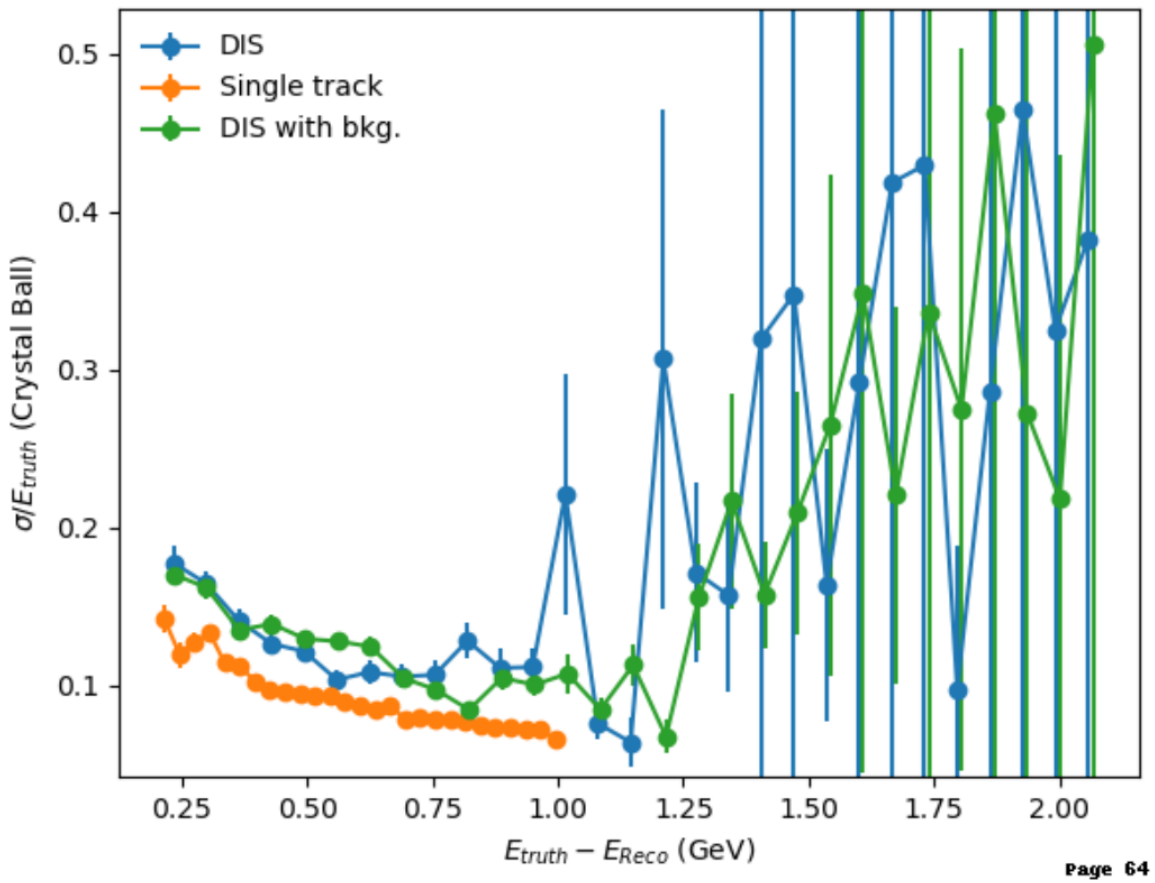
1. Take attenuated hits.
2. Perform attenuated correction with true-z **smeared with gaussian random number**.
   - Only take data from +ve z side of SiPM
3. NPE -> energy by linear fit.
4. Feed the corrected hits to cluster algorithm
   - EcalBarrelScFiRecHits -> EcalBarrelScFiProtoClusters -> EcalBarrelScFiClustersWithoutShapes
5. Use existing truth association
6. Draw Ereco vs Etruth for energy resolution

Update

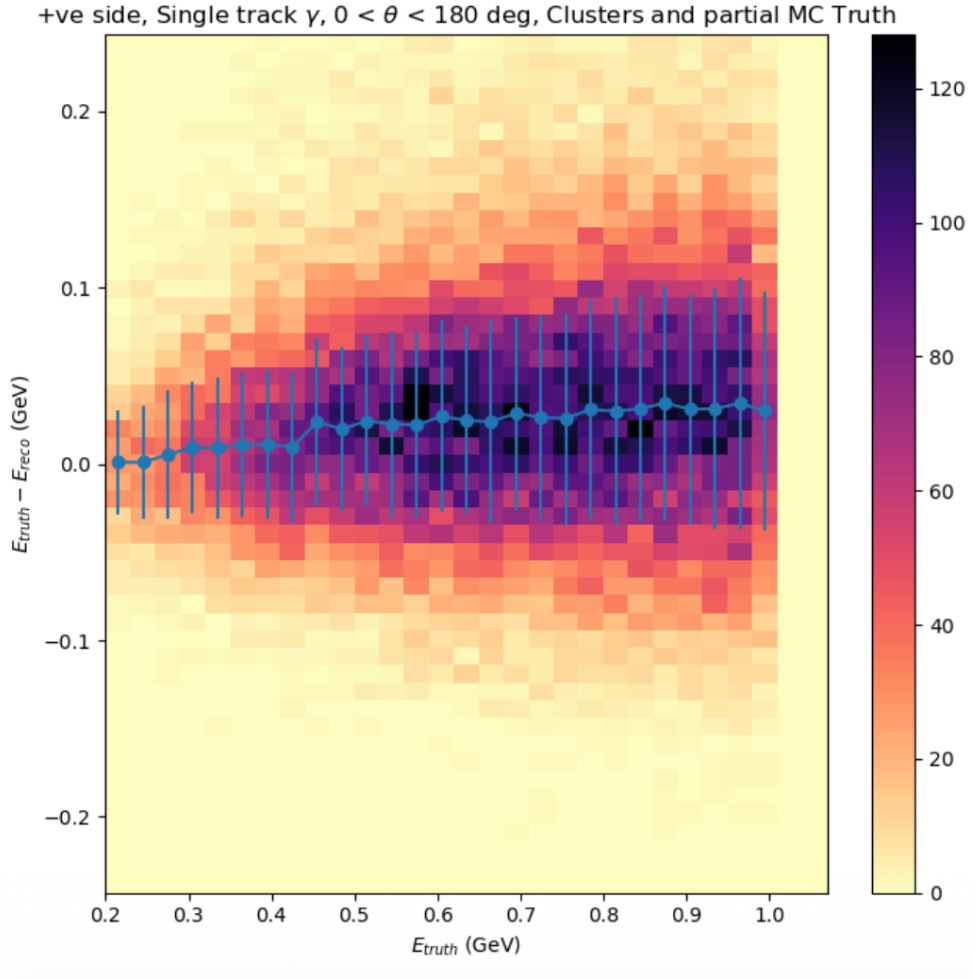
- Etruth bin width effect increases fitted energy width.
- Will fit crystal-ball to Etruth – Ereco distribution instead.

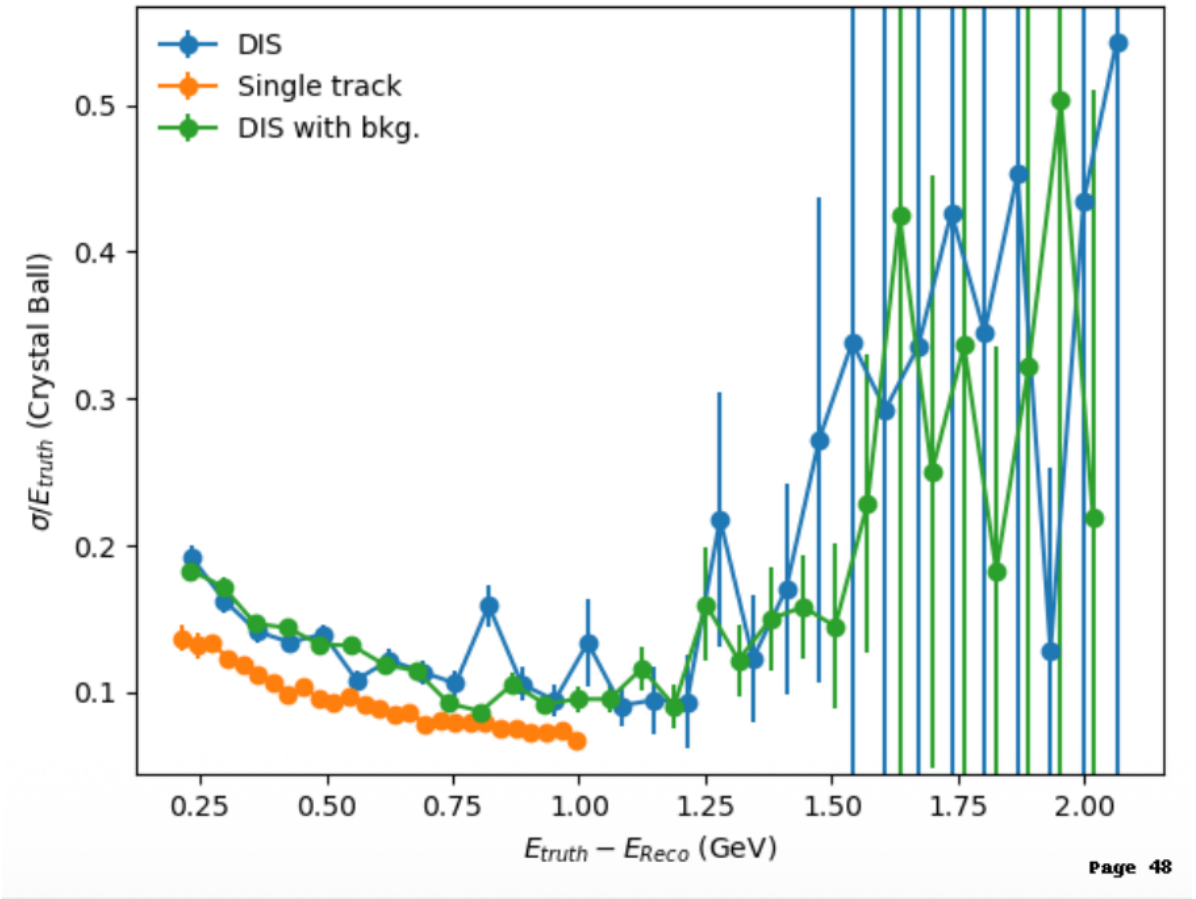
Plotted Etruth – Ereco for resolution
Assumed perfect z-resolution





Plotted Etruth – Ereco for resolution
Assumed z-resolution = 40 mm

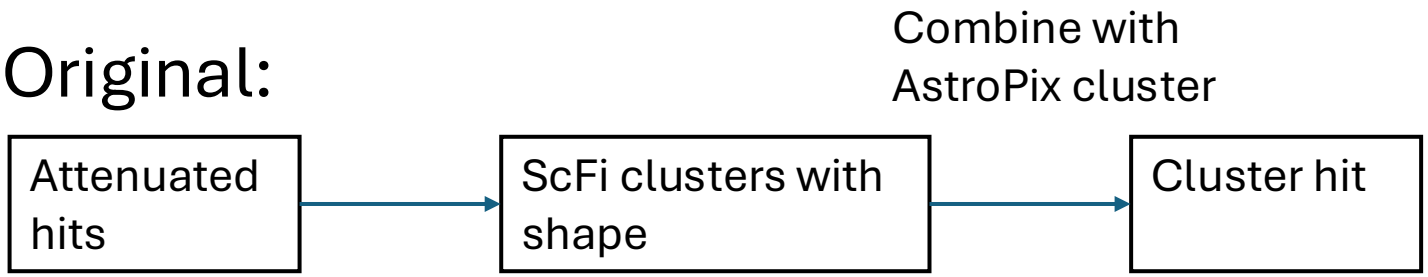




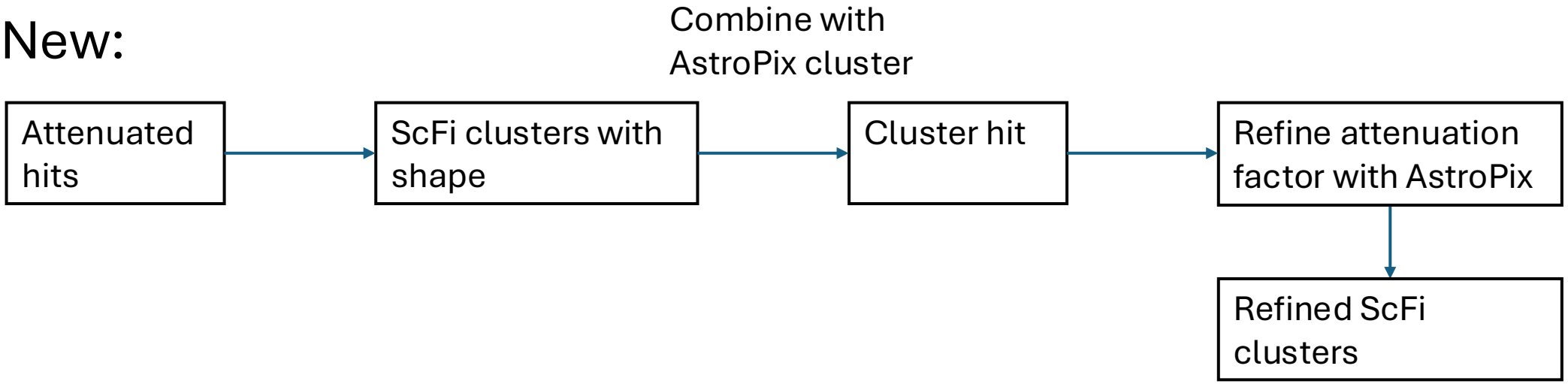
Improved clustering algorithm

Background

- Use AstroPix z-location and extrapolate to ScFi fiber position for attenuation correction.
- Original:



- New:



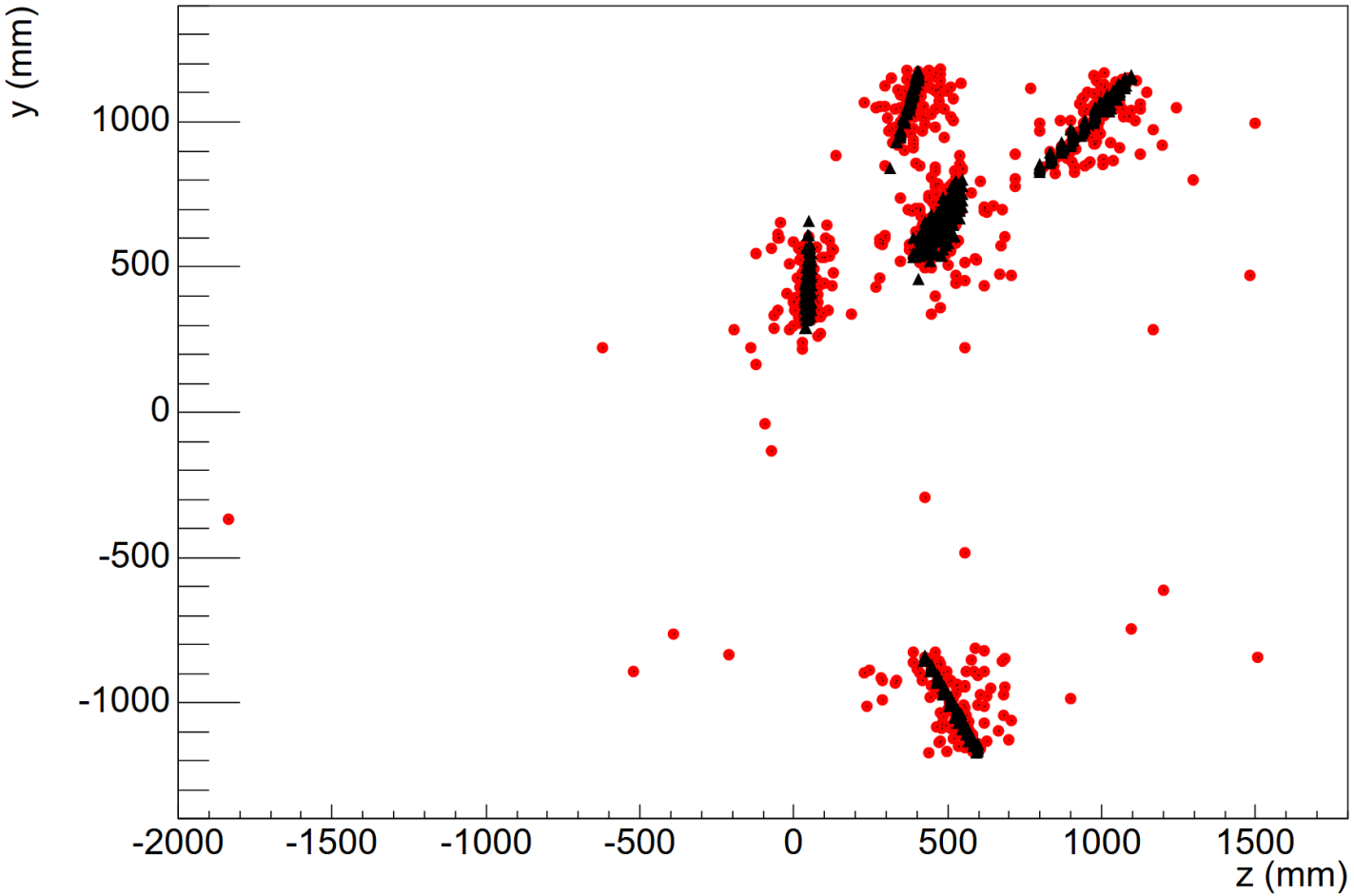
EcalBarrelScFi PositionRefiner

```
app->Add(new JOmniFactoryGeneratorT<CalorimeterScFiPositionRefiner_factory>(
    "EcalBarrelScFiRefinedRecHits",
    {"EcalBarrelScFiRawHits", "EcalBarrelClusters"},
    {"EcalBarrelScFiRefinedRecHits"},
    {
        .side="P",
    },
    app // TODO: Remove me once fixed
    ));
app->Add(new JOmniFactoryGeneratorT<CalorimeterIslandCluster_factory>(
    "EcalBarrelScFiRefinedProtoClusters", {"EcalBarrelScFiRefinedRecHits"}, {"EcalBarrelScFiRefinedProtoClusters"},
    {
        .adjacencyMatrix{},
        .peakNeighbourhoodMatrix{},
        .readout{},
        .sectorDist = 50. * dd4hep::mm,
        .localDistXY{},
        .localDistXZ = {80 * dd4hep::mm, 80 * dd4hep::mm},
        .localDistYZ{},
        .globalDistRPhi{},
        .globalDistEtaPhi{},
        .dimScaledLocalDistXY{},
        .splitCluster         = false,
        .minClusterHitEdep    = 5.0 * dd4hep::MeV,
        .minClusterCenterEdep = 100.0 * dd4hep::MeV,
        .transverseEnergyProfileMetric{},
        .transverseEnergyProfileScale{},
        .transverseEnergyProfileScaleUnits{},
    },
    app // TODO: Remove me once fixed
    ));
app->Add(new JOmniFactoryGeneratorT<CalorimeterClusterRecoCoG_factory>(
    "EcalBarrelScFiRefinedClustersWithoutShapes",
    {
        "EcalBarrelScFiRefinedProtoClusters", // edm4eic::ProtoClusterCollection
#if EDM4EIC_BUILD_VERSION >= EDM4EIC_VERSION(8, 7, 0)
        "EcalBarrelScFiRawHitLinks", // edm4eic::MCRecoCalorimeterHitLink
#endif
        "EcalBarrelScFiRawHitAssociations" // edm4eic::MCRecoCalorimeterHitAssociation
    },
    {"EcalBarrelScFiRefinedClustersWithoutShapes", // edm4eic::Cluster
#if EDM4EIC_BUILD_VERSION >= EDM4EIC_VERSION(8, 7, 0)
     "EcalBarrelScFiRefinedClusterLinksWithoutShapes",
#endif
     "EcalBarrelScFiRefinedClusterAssociationsWithoutShapes"}, // edm4eic::MCRecoClusterParticleAssociation
    {.energyWeight = "log", .sampFrac = 1.0, .logWeightBase = 6.2, .enableEtaBounds = false},
    app // TODO: Remove me once fixed
    ));
```

Algorithms

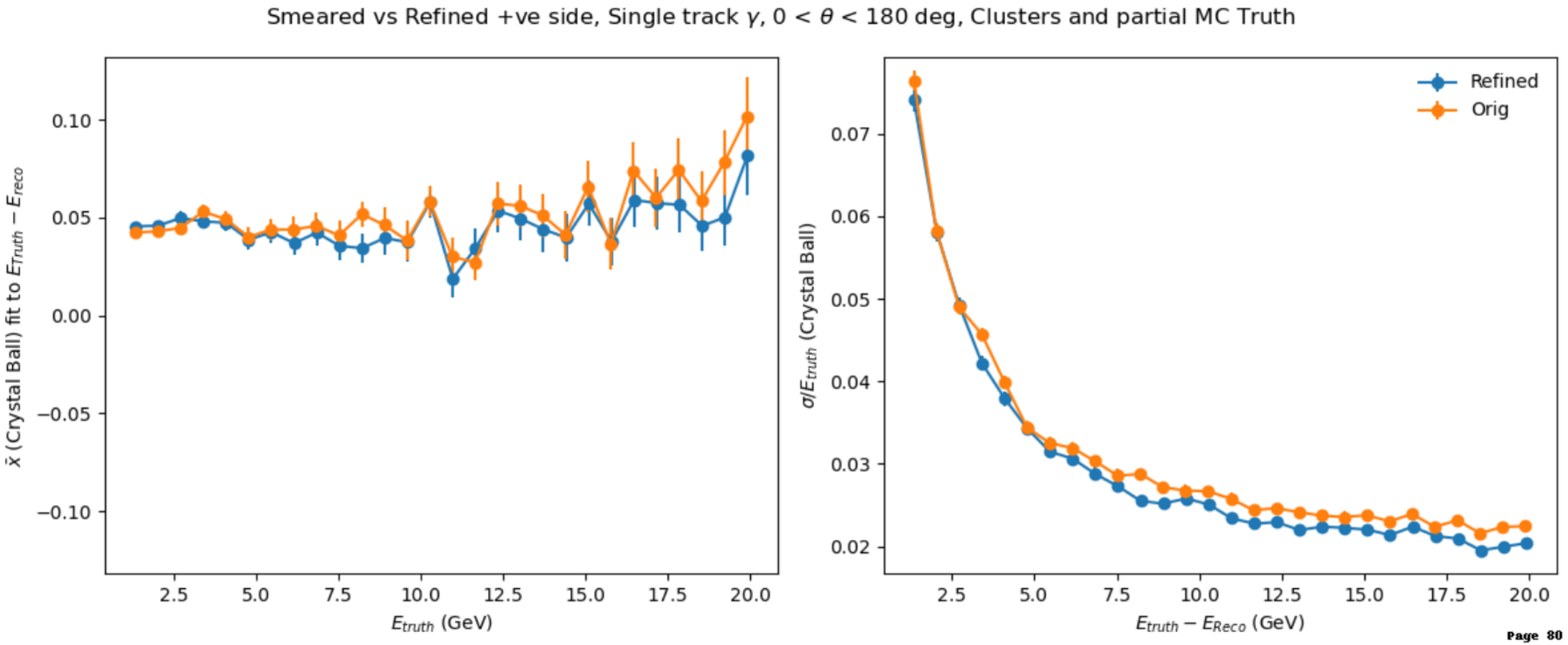
- If there are >= 2 AstroPix hits:
  - Fit a straight line between all AstroPix points.
  - Find the closest point between the straight line and ScFi fiber.
  - Re-calculate attenuation with Z-location from that point.
- If there is only one AstroPix hits:
  - Use shape information from ScFi cluster.
  - Extrapolate AstroPix points with ScFi shape.

Hit position



- Red: z-pos with 100 mm smearing.
- Black: Refined ScFi cluster with AstroPix position.

Energy resolution
z-pos smeared by 100 mm.



Energy resolution
z-pos smeared by 40 mm.