



# Wire-Cell ProtoDUNE Local Meeting

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# Wire-Cell 3D Imaging & Clustering

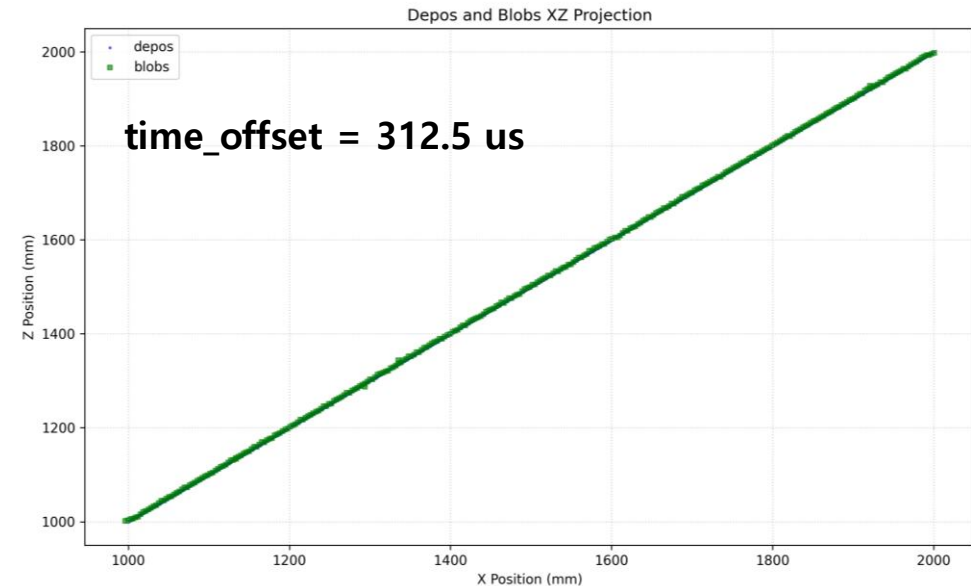
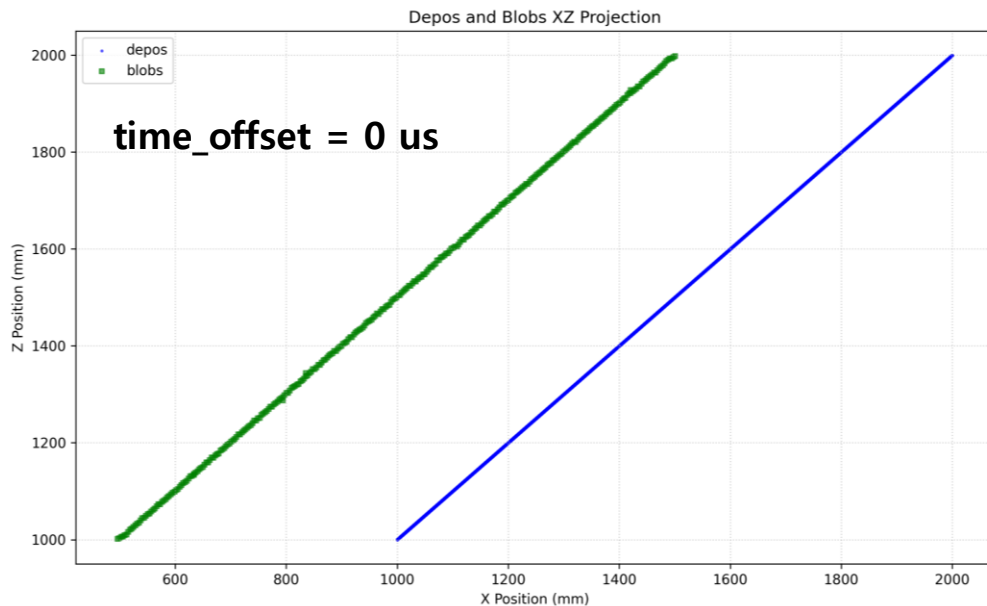
## Blob Depo Fill: Adding true info in the conventional pipeline

✓ Zero charge in BlobDepoFill is due to the time offset value

**PDHD** : Single track sim(apa2, thetaXZ=45 deg)

```
blob_depo_fill(anode, name, drift_speed=params.lar.drift_speed) :: g.pnode({
  type: "BlobDepoFill",
  name: "blobdepo-filler-%s"%name,
  data: {
    // fixme, breaks detector independence
    speed: drift_speed, //1.56*wc.mm/wc.us,
    time_offset: 312.5*wc.us, //314*wc.us,
```

- drift\_speed: 1.6 mm/us
- time\_offset: 0 -> 312.5 us



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```

- **drift\_speed: 1.6 mm/us**
- **time\_offset: 0 -> 312.5 us**

The values came from `'sim.ducto.start_time'` in PDHD `'params.jsonnet'`

```
ductor : {
  nticks: $.daq.nticks + response_nticks,
  readout_time: self.nticks * $.daq.tick,
  start_time: tick0_time - response_time_offset,
},

local response_time_offset = $.det.response_plane / $.lar.drift_speed,
```

- tick0\_time = -250 us (the absolute time of the first tick)
- response\_plane = 10cm (where the field response functions start)
- response\_time\_offset = 62.5us
- **start\_time = - 312.5 us**

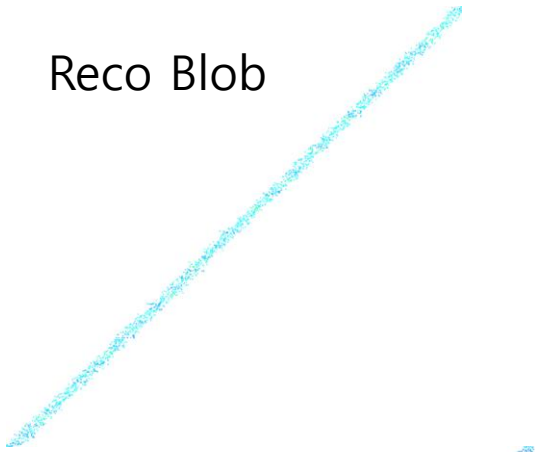
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## Blob Depo Fill: Adding true info in the conventional pipeline

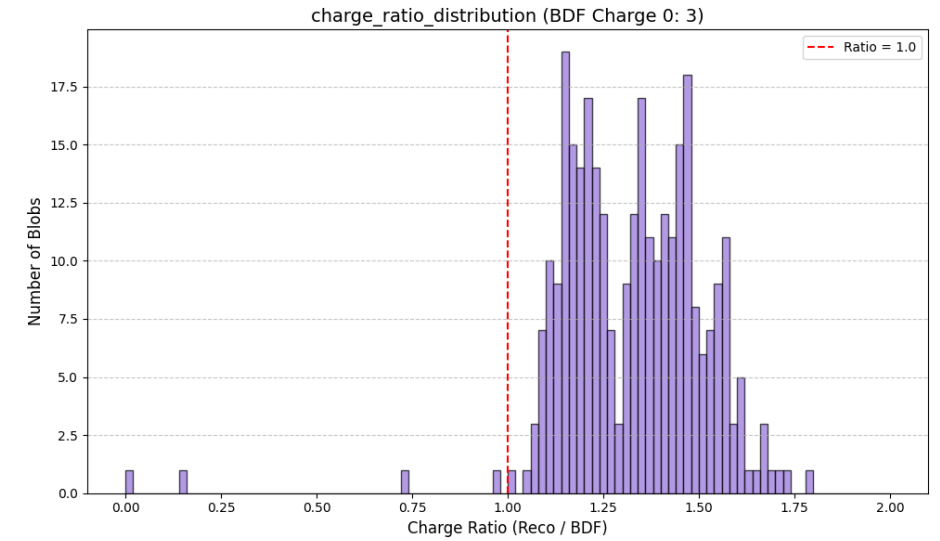
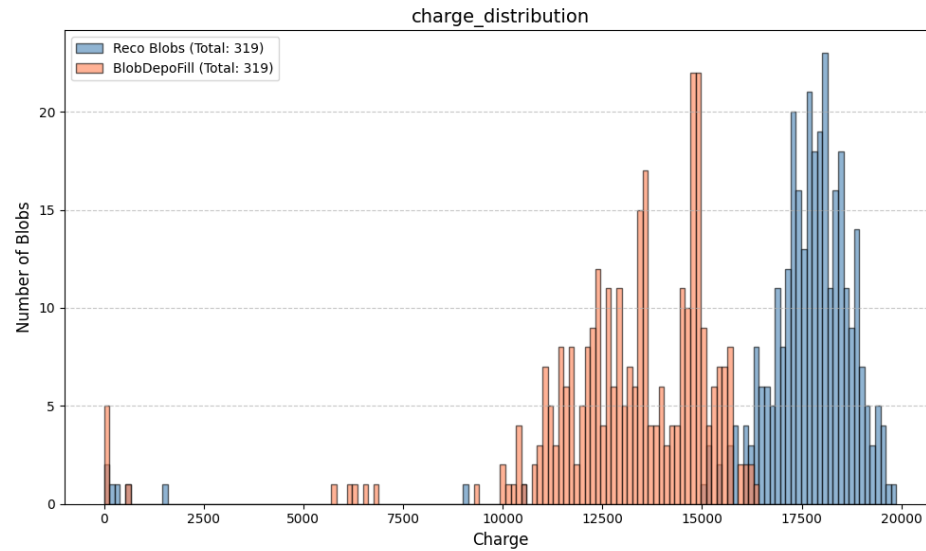
**PDHD** : Single track sim(apa2, thetaXZ=45 deg)

<https://www.phy.bnl.gov/twister/bee/set/2a446d42-2231-4dc6-ad64-a4c74e9d0831/event/0/?theme=light>

Reco Blob



BlobDepoFill



- Charge distributions are not well-match yet.
- Fine tunings for the time offset is required.

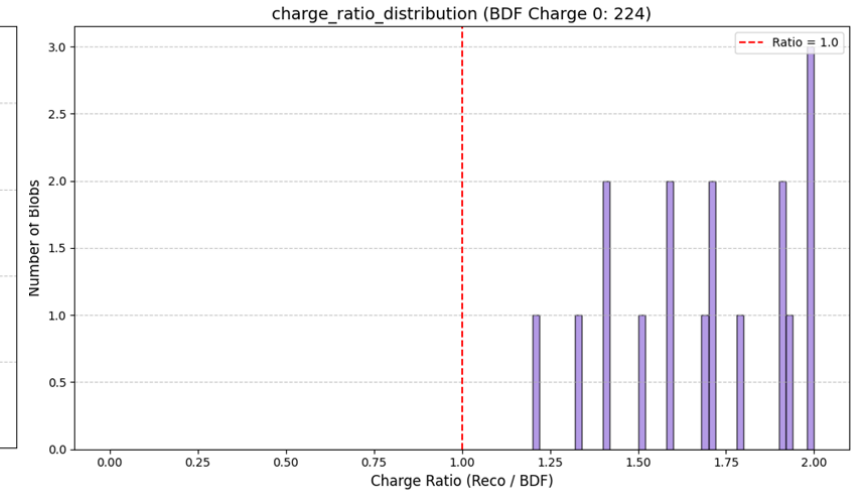
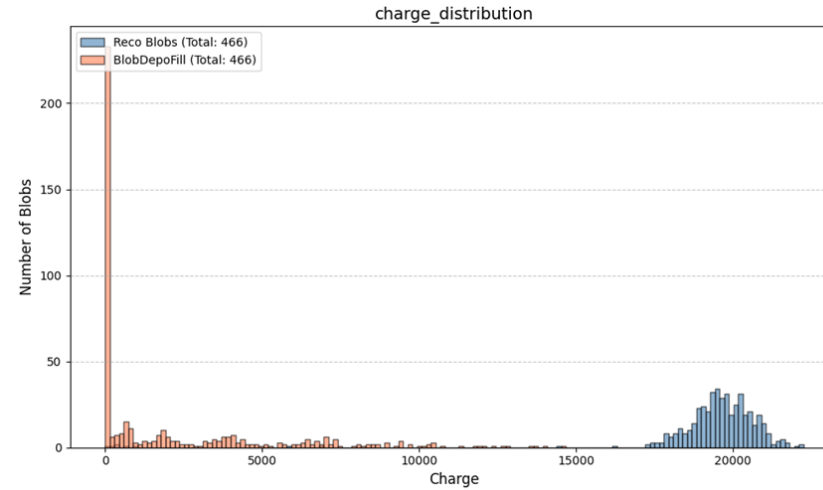
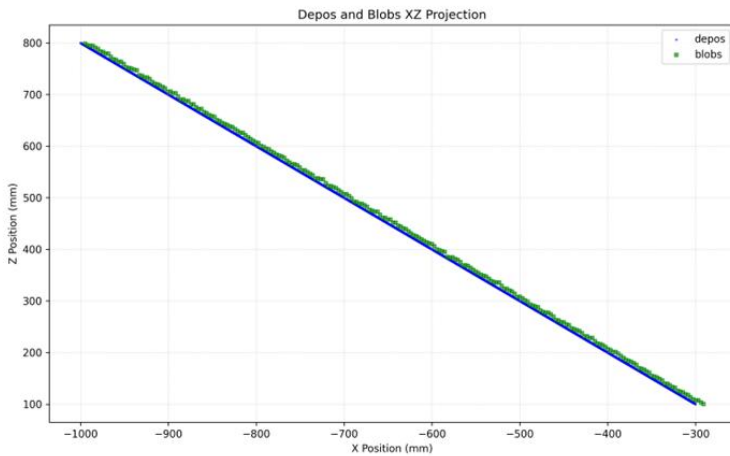
# Wire-Cell 3D Imaging & Clustering

## Blob Depo Fill: Adding true info in the conventional pipeline

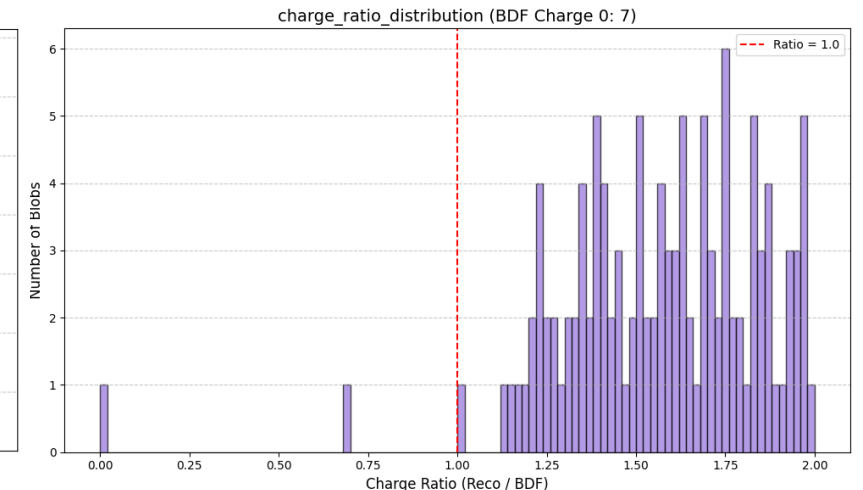
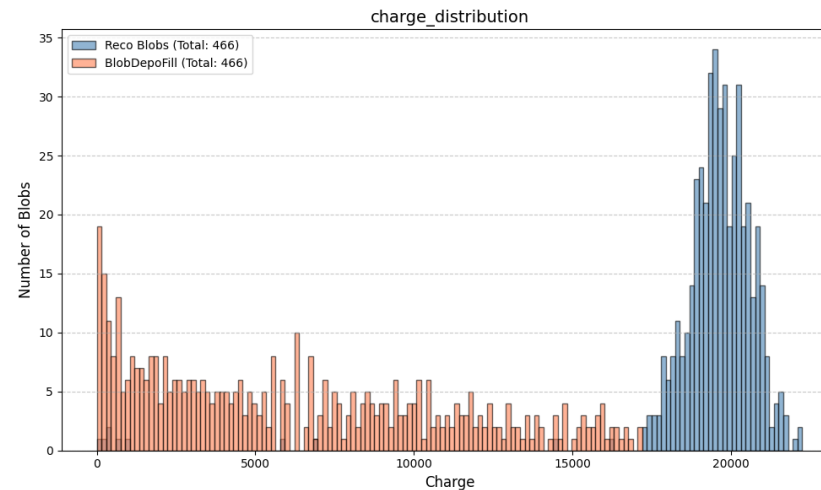
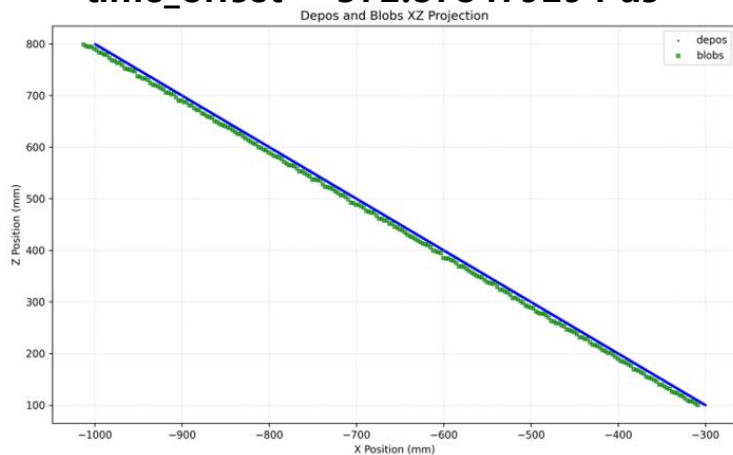
**PDVD** : Single track sim(crp0 , thetaXZ=45 deg)

- drift\_speed: 1.473 mm/us
- time\_offset: 360.6833 -> 372.878479294 us

- time\_offset = 360.6833 us



- time\_offset = 372.878479294 us

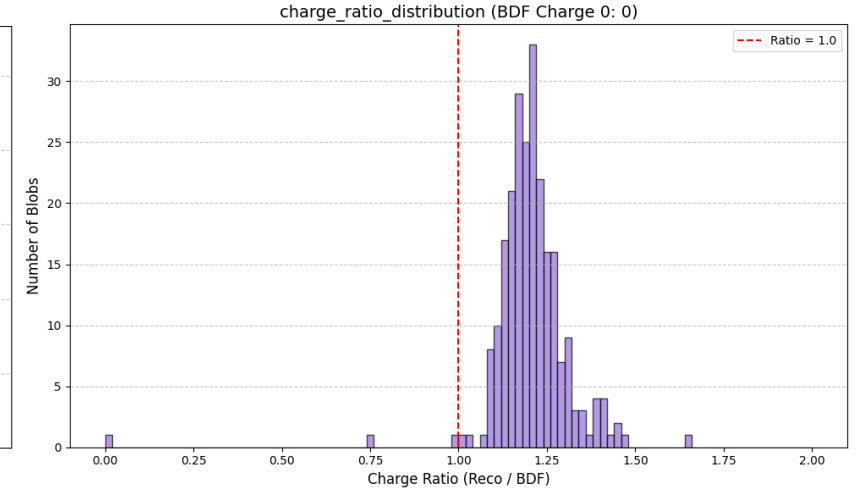
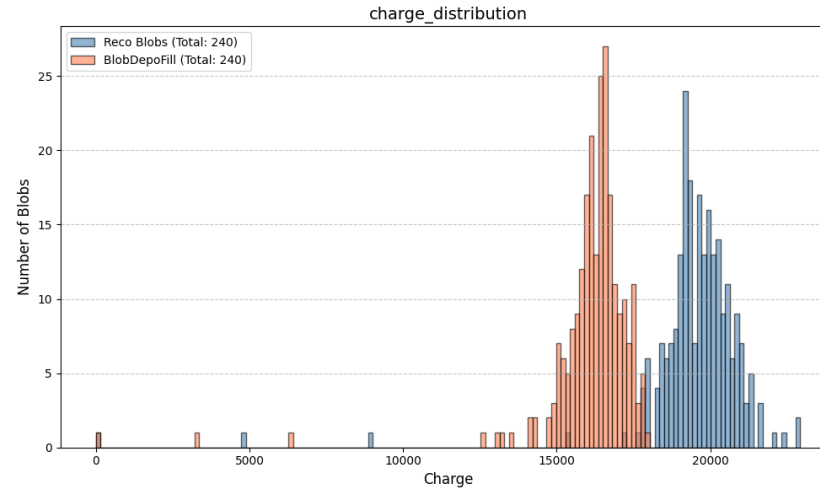
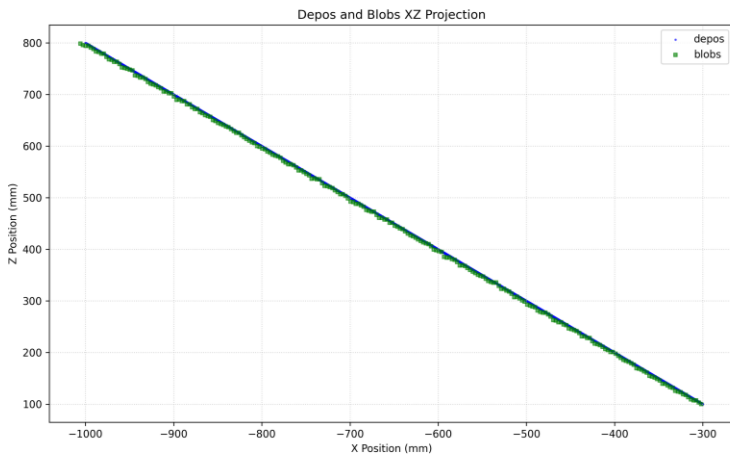


# Wire-Cell 3D Imaging & Clustering

## Blob Depo Fill: Adding true info in the conventional pipeline

**PDVD** : Single track sim(crp0 , thetaXZ=45 deg)

- **time\_offset = 368 us**



- Also, fine tunings are required for both PDHD&PDVD.
- The metrics for charge can be calculated.
- The metrics can be refined to better represent the charge ratio distribution.

# Backup

# 2. Wire-Cell 3D Imaging & Clustering

## Blob Depo Fill: Adding true info in the conventional pipeline

### Metrics

- Two metrics for 3D Imaging performance evaluations in the **Blob level**

blob size -> charge smearing  
ghost evaluation  
de-ghosting algorithm performance

$$\text{Purity} = \frac{\text{Number of blobs with non-zero true charge}}{\text{Total number of reconstructed blobs}}$$

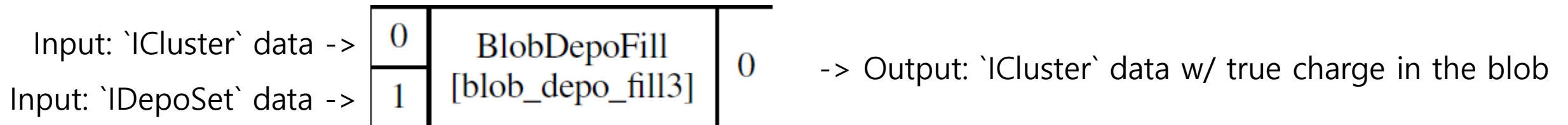
$$\text{Efficiency} = \frac{\text{Total true charge in blob}}{\text{Total true charge}}$$

### BlobDepoFill

(<https://github.com/WireCell/wire-cell-toolkit/blob/18a8a5c06c8f8001e8dea5e3a577570ee473b79b/img/src/BlobDepoFill.cxx#L2>)

- Replace charges of reco blob with true charges in the blobs
- This node only replace the charge info, not position info, giving the position of reco blob

→ BlobDeopFill approach can be used for only evaluating about charge

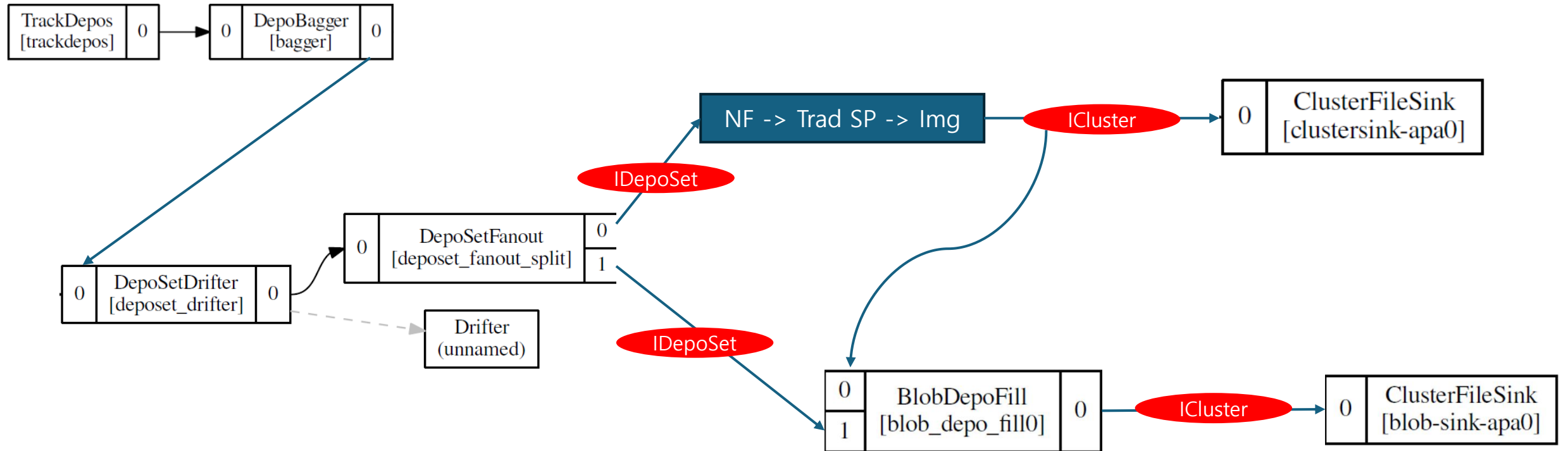


# 2. Wire-Cell 3D Imaging & Clustering

## Blob Depo Fill: Adding true info in the conventional pipeline

New PDHD configuration including BlobDepoFill nodes

- Wire-Cell standalone simulation: NF -> Trad SP -> Img
- Add BlobDepoFill nodes to the conventional img pipeline



# 2. Wire-Cell 3D Imaging & Clustering

## Blob Depo Fill: Adding true info in the conventional pipeline

### Previous Jay&Haiwang's study

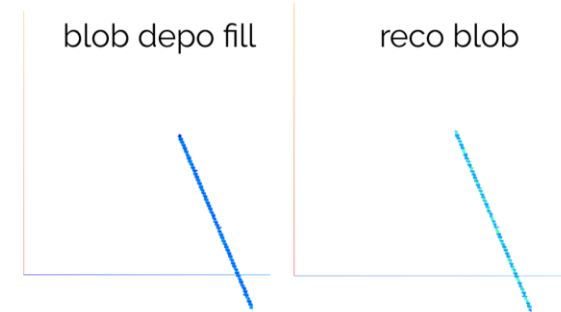
- BlobDepoFill requires some time offsets
- Hard coded now

test with a track with thetaXZ=20

- BEE: <https://www.phy.bnl.gov/twister/bee/set/a6630d3d-2e98-4275-97be-1d05fad3f76c/event/0/>
- color (charge) is different between "block" due to different size filled with the same amount of charge (we think)
- both are aligned well, sharing the same blob

```
local thetaXZ = 20*wc.deg;
local thetaXZ2 = 45*wc.deg;
local thetaXZ3 = 60*wc.deg;

local stubby_bottom = {
  head: wc.point(-50, 50, 50, wc.cm),
  // tail: wc.point(100*(1 + std.tan(thetaXZ)), 100, 100*(1+1), wc.cm),
  tail: wc.point(50*(1 + std.tan(thetaXZ)), 50, 50*(1+1), wc.cm),
};
```



- Investigation of time offsets
- Reproducing and comparing results with those of Jay&Haiwang will help validate my work
- Calculating metrics about charge with respect to different track angles