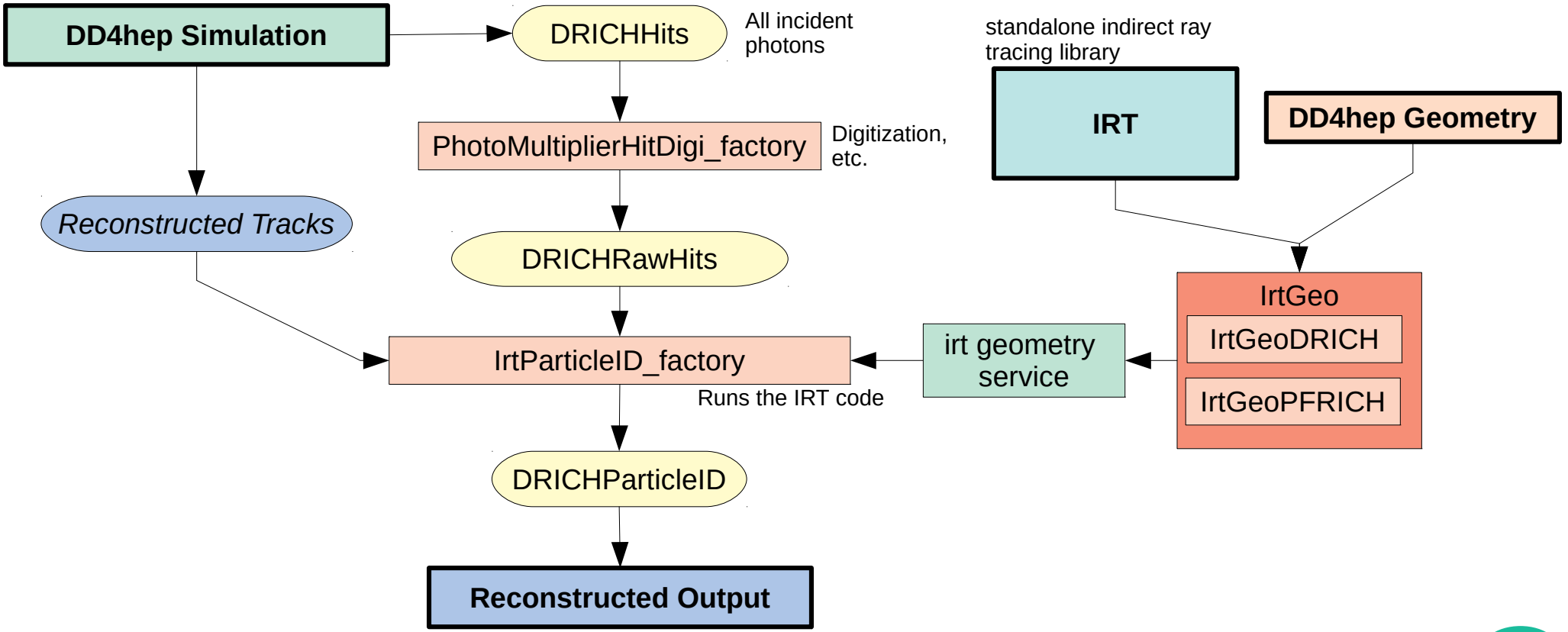
dRICH Reconstruction Update

Christopher Dilks
dRICH Meeting
16 November 2022

DRICH EICrecon Plugin Plan



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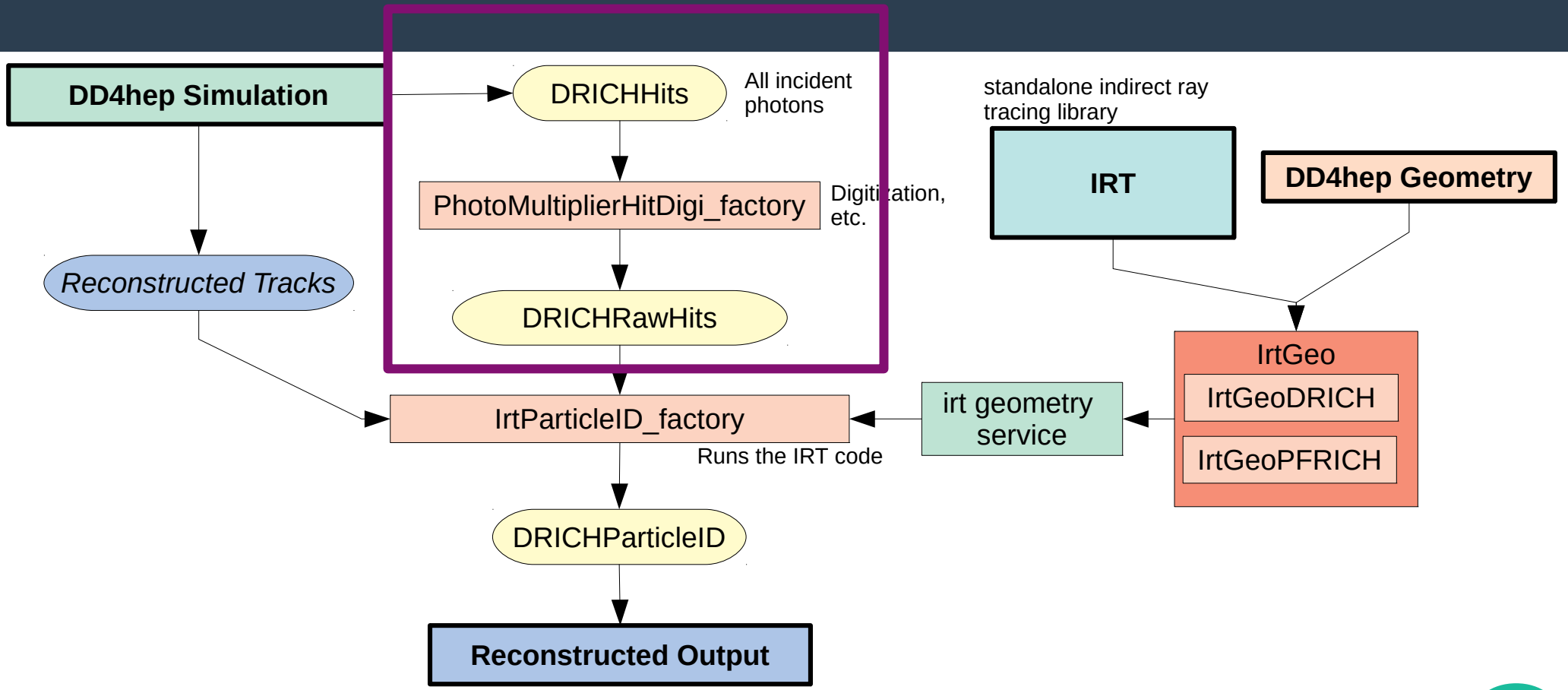
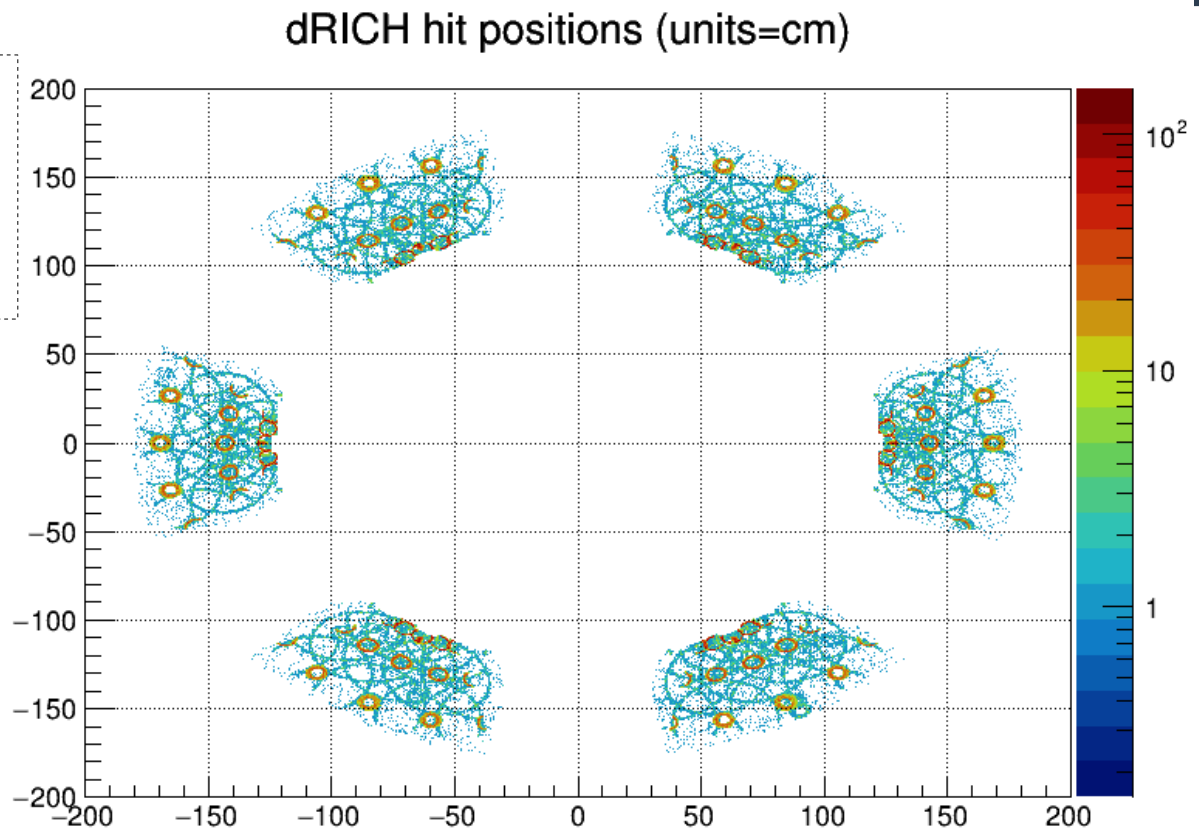


Simulation Sample

- 40 GeV pions
- Fixed (θ,ϕ) momenta spanning full acceptance
- 20 pions thrown per momentum

```
simulate.py -t5 -s -n20
```

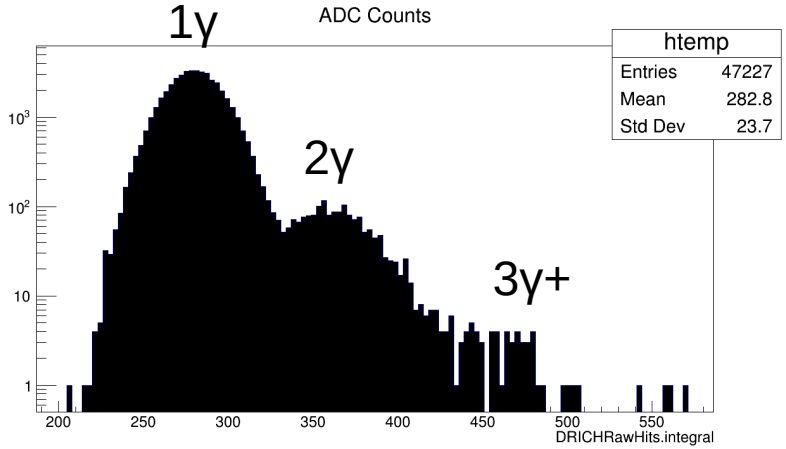


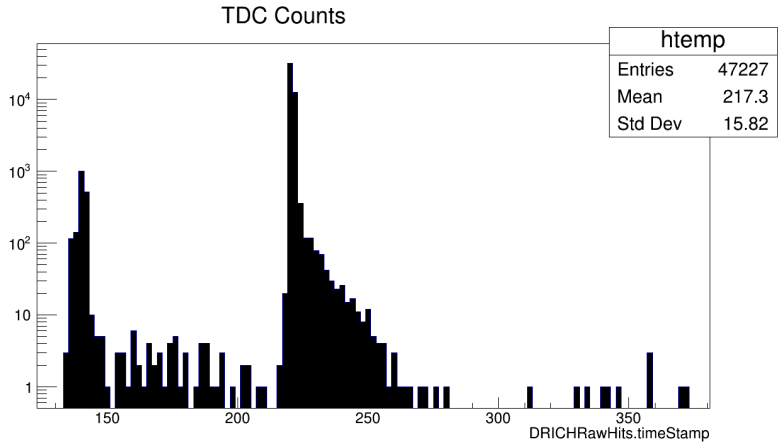
Digitization

- General PMD digitization algorithm from Chao Peng, ported to EICrecon by Thomas Britton
  - src/algorithms/digi/PhotoMultiplerHitDigi
- **TODO: validate configuration parameters**
- **TODO: why 2 TDC peaks? Likely from high-θ pions punching throuh sensors**
  - Sharp peaks from gas, tails from aerogel
  - Not correlated to pion θ or NPE
  - Visible in pre-digitized hits too

```
std::vector<std::pair<double, double> > quantumEfficiency = {
  {325*dd4hep::nm, 0.04},
  {340*dd4hep::nm, 0.10},
  {350*dd4hep::nm, 0.20},
  {370*dd4hep::nm, 0.30},
  {400*dd4hep::nm, 0.35},
  {450*dd4hep::nm, 0.40},
  {500*dd4hep::nm, 0.38},
  {550*dd4hep::nm, 0.35},
  {600*dd4hep::nm, 0.27},
  {650*dd4hep::nm, 0.20},
  {700*dd4hep::nm, 0.15},
  {750*dd4hep::nm, 0.12},
  {800*dd4hep::nm, 0.08},
  {850*dd4hep::nm, 0.06},
  {900*dd4hep::nm, 0.04}
};
```

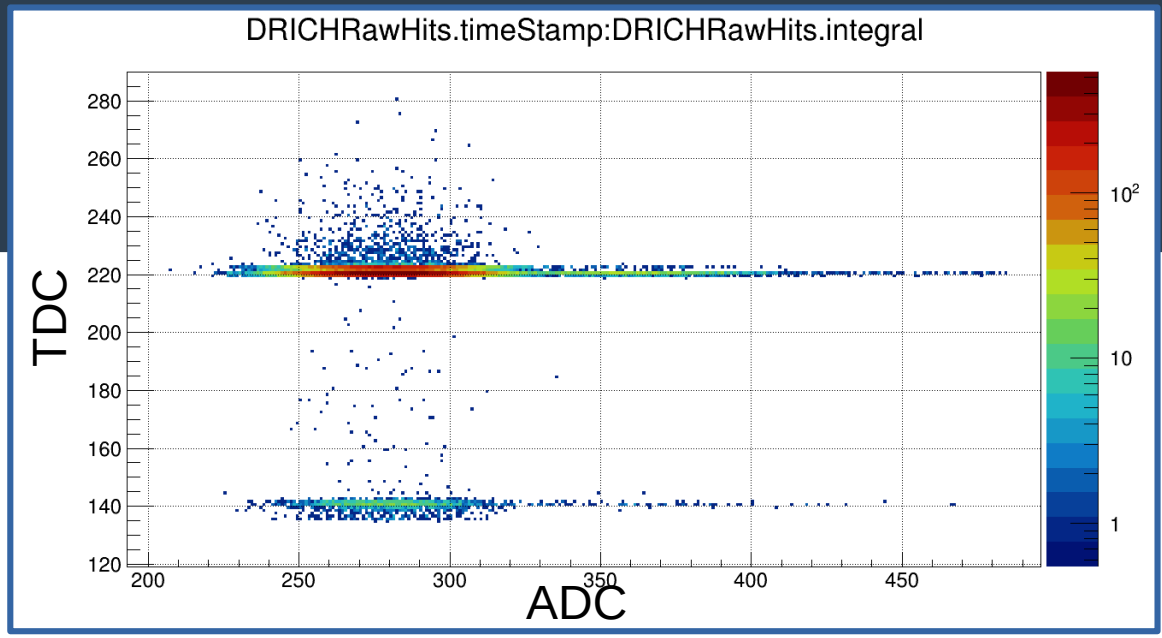
```
// triggering
double hitTimeWindow = 20.0*dd4hep::ns;
double timeStep      = 0.0625*dd4hep::ns;
double speMean       = 80.0;
double speError      = 16.0;
double pedMean       = 200.0;
double pedError      = 3.0;
```

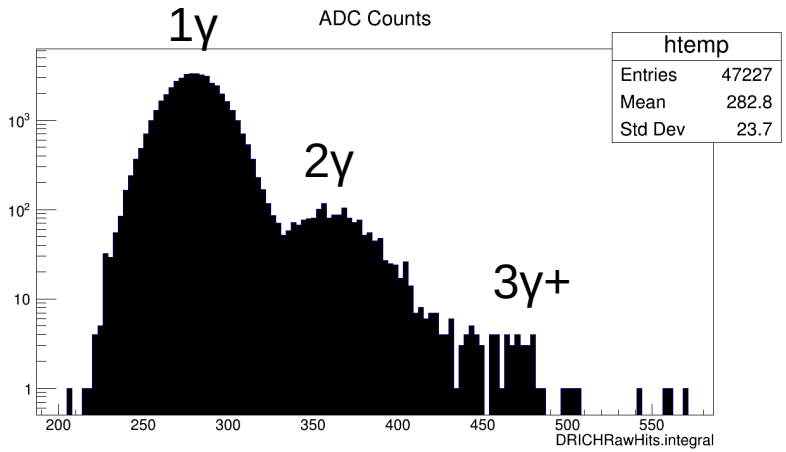


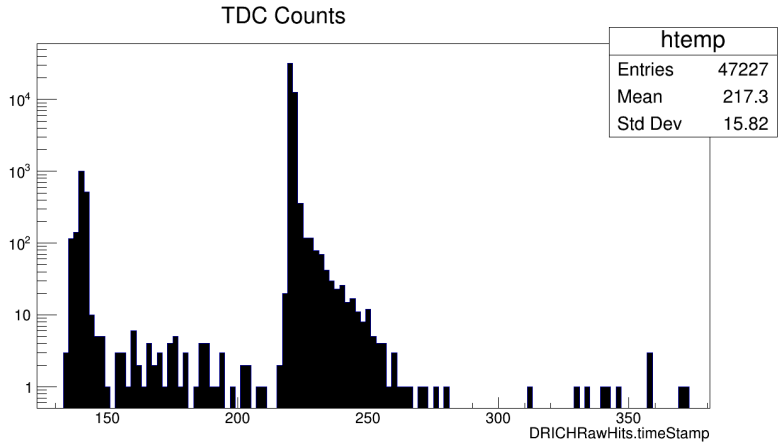


Digitization

- TDC vs. ADC correlation →

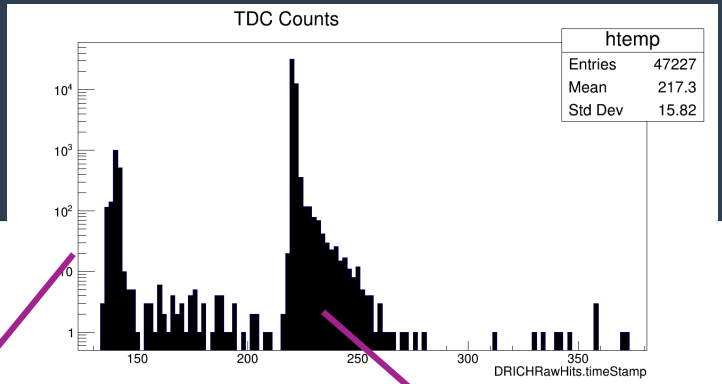


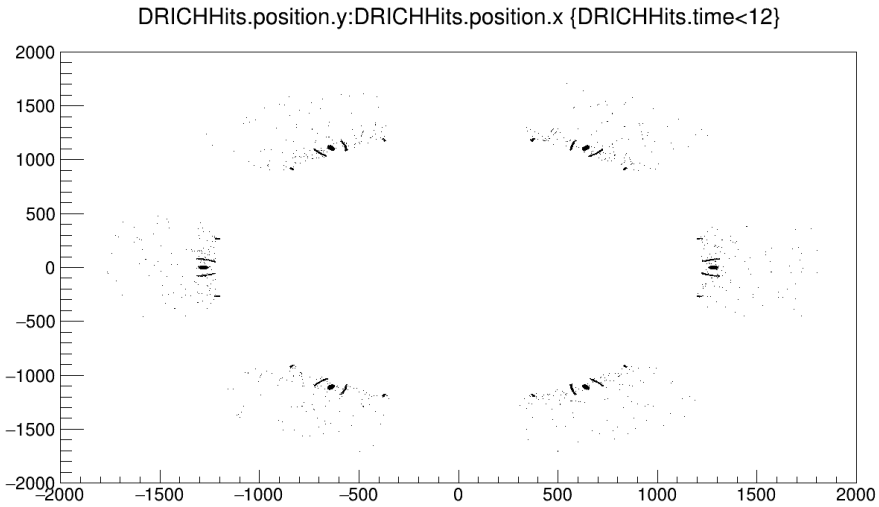


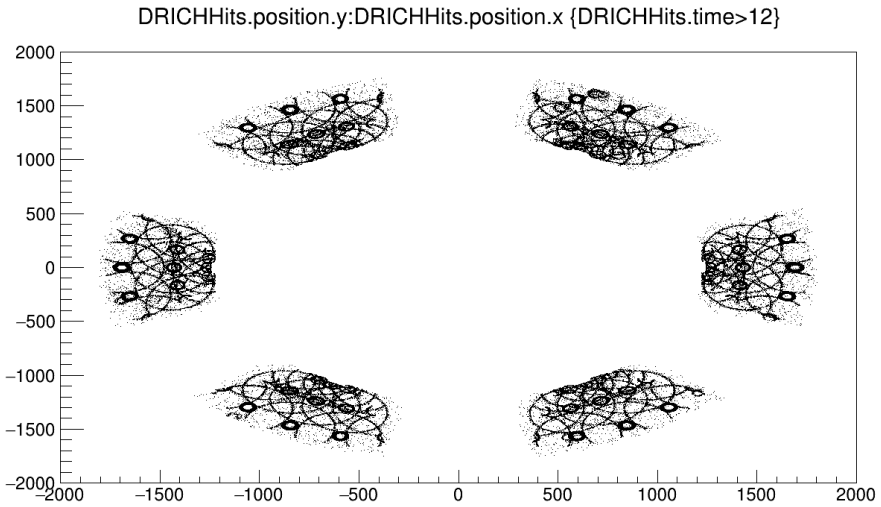


About time peaks

Check hit distributions, cutting on pre-digitized hit time [ns]







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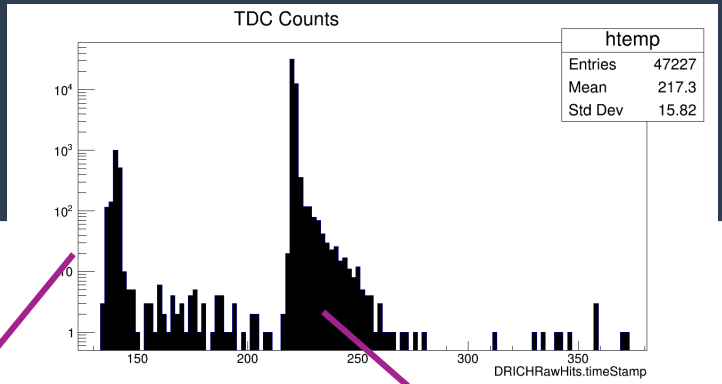
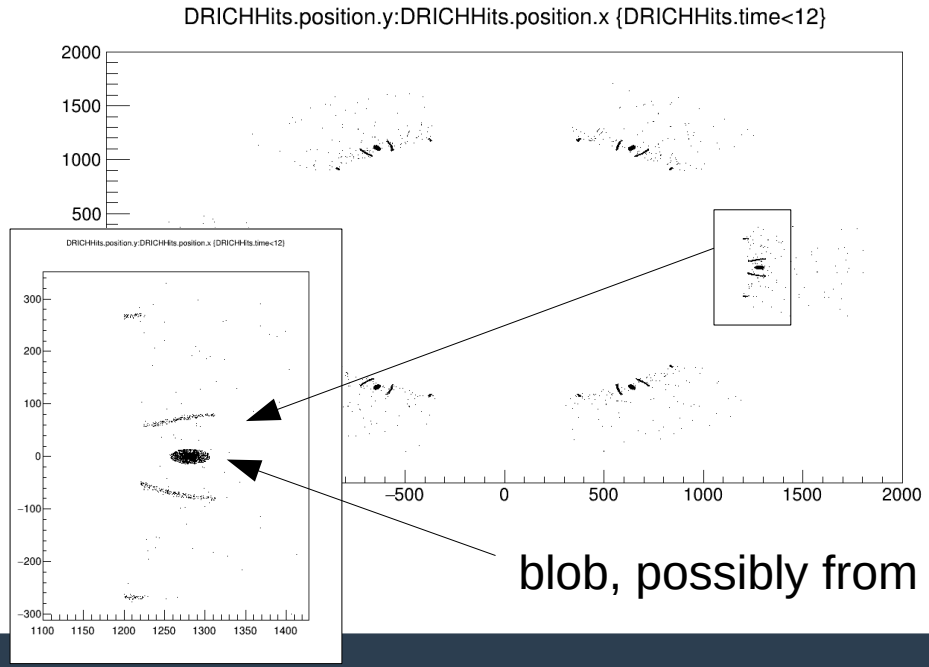
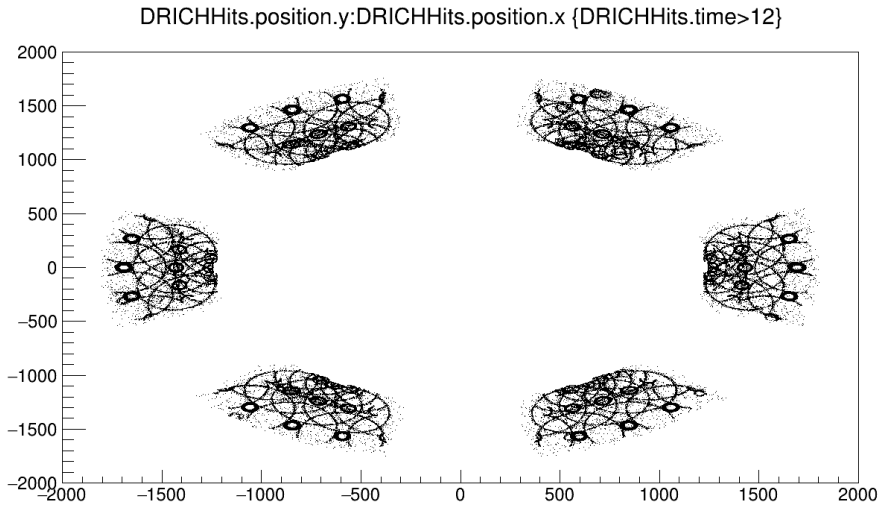
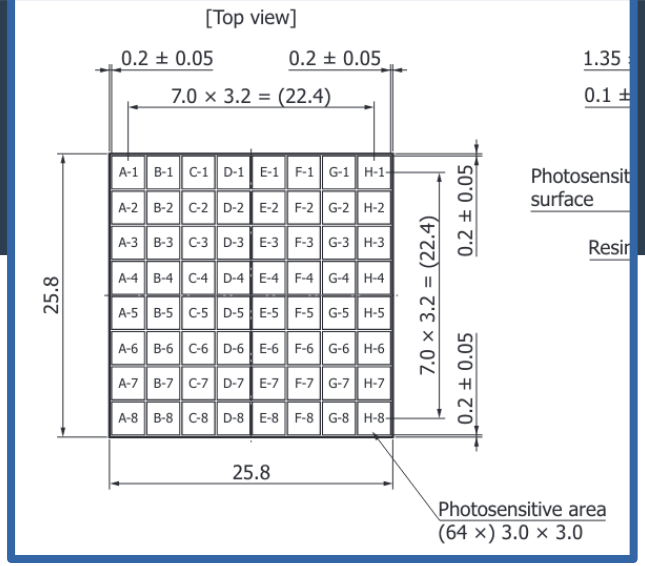






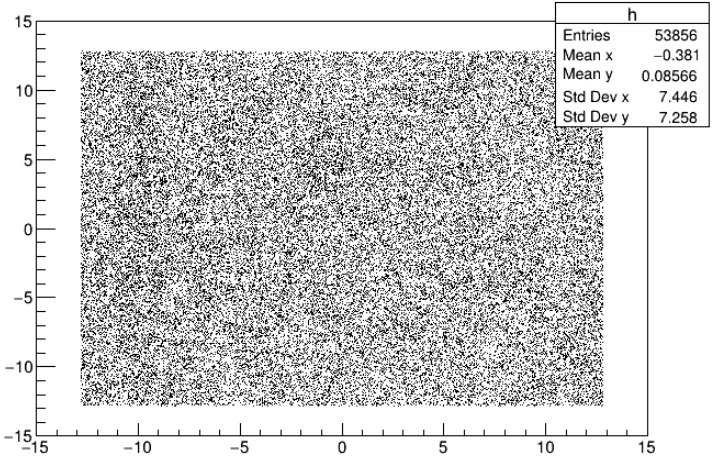
blob, possibly from high-θ pions punching through the sensors

Pixel Gap Mask

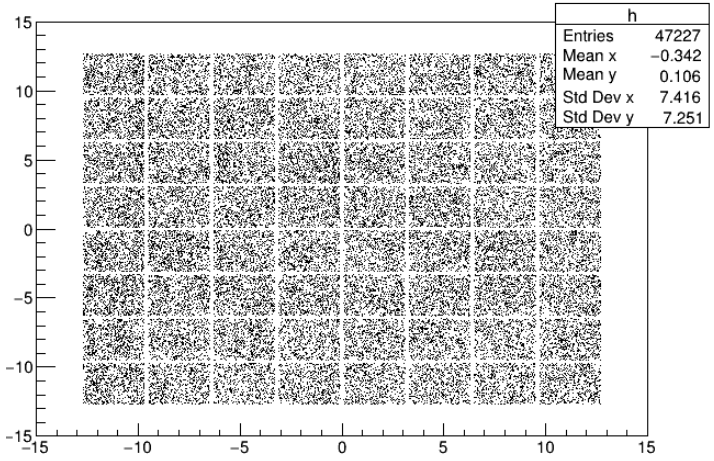


- SiPM model: S13361-3050NE-08
  - Pixel size: 3.0 x 3.0 mm
  - Pitch: 3.2 x 3.2 mm
  - **88%** of incident photons hit a pixel
- Add “gap mask” to PhotoMultiplierHitDigi

sensor hit positions



→ with gap mask



Safety Factor

- **70%**
- **What is the origin of this “standard” number?**

Dear Chris,
the reasoning was the following (as far as memory runs)
the mirror refelectivity, gas transparency, sensor efficiency everything will become less optimal than the values used in simulation and hence impact in the effective number of photons. This safety factor is thus to provide a conservative estimate of the npe.
The rationale is purely emperical and the number is an adhoc number.

Cheers,
Chandra

Noise Injection

- Noise injection should be added to PhotoMultiplierHitDigi
  - https://github.com/eic/EICrecon/issues/352
- See G4SiPM for ideas…
- **Open project! Would have common benefit for other subsystems!**

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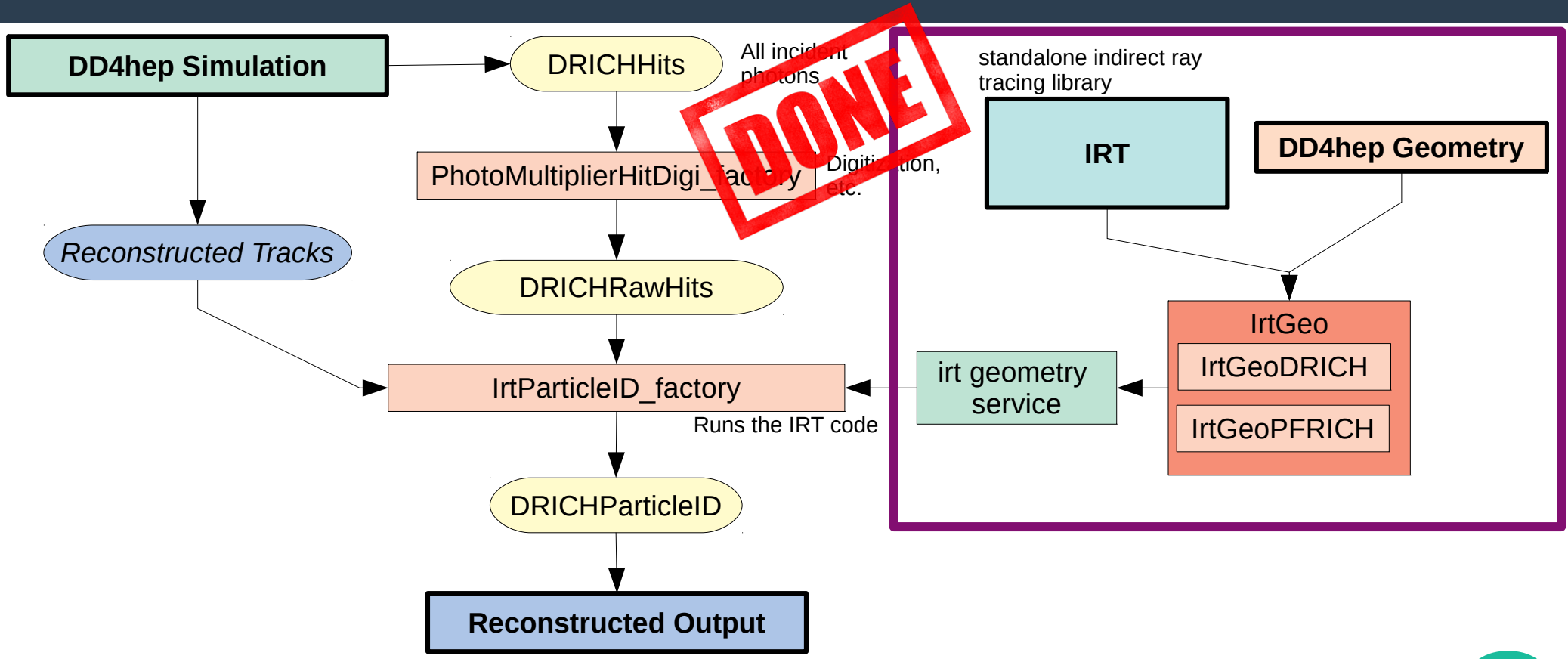
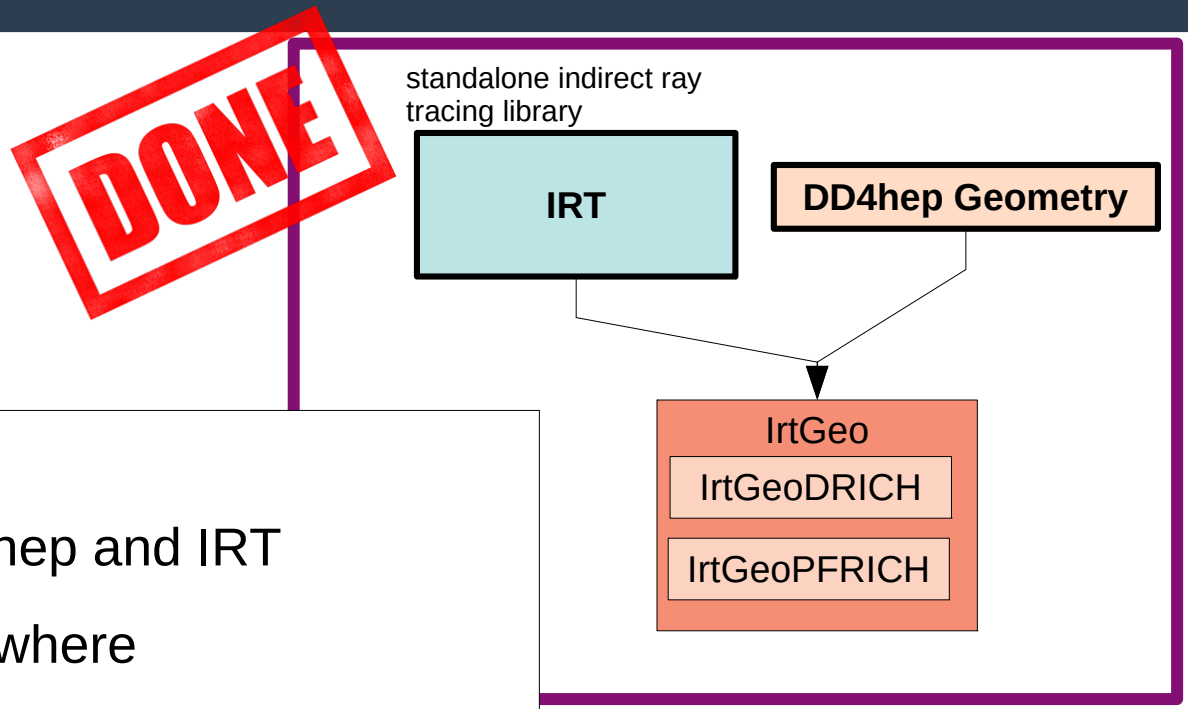


Binding DD4hep and IRT Geometry



IrtGeo

- Geometry bindings between DD4hep and IRT
- Buildable standalone, for use anywhere
- Integrated with EICrecon as an additional geometry service, similar to ACTS

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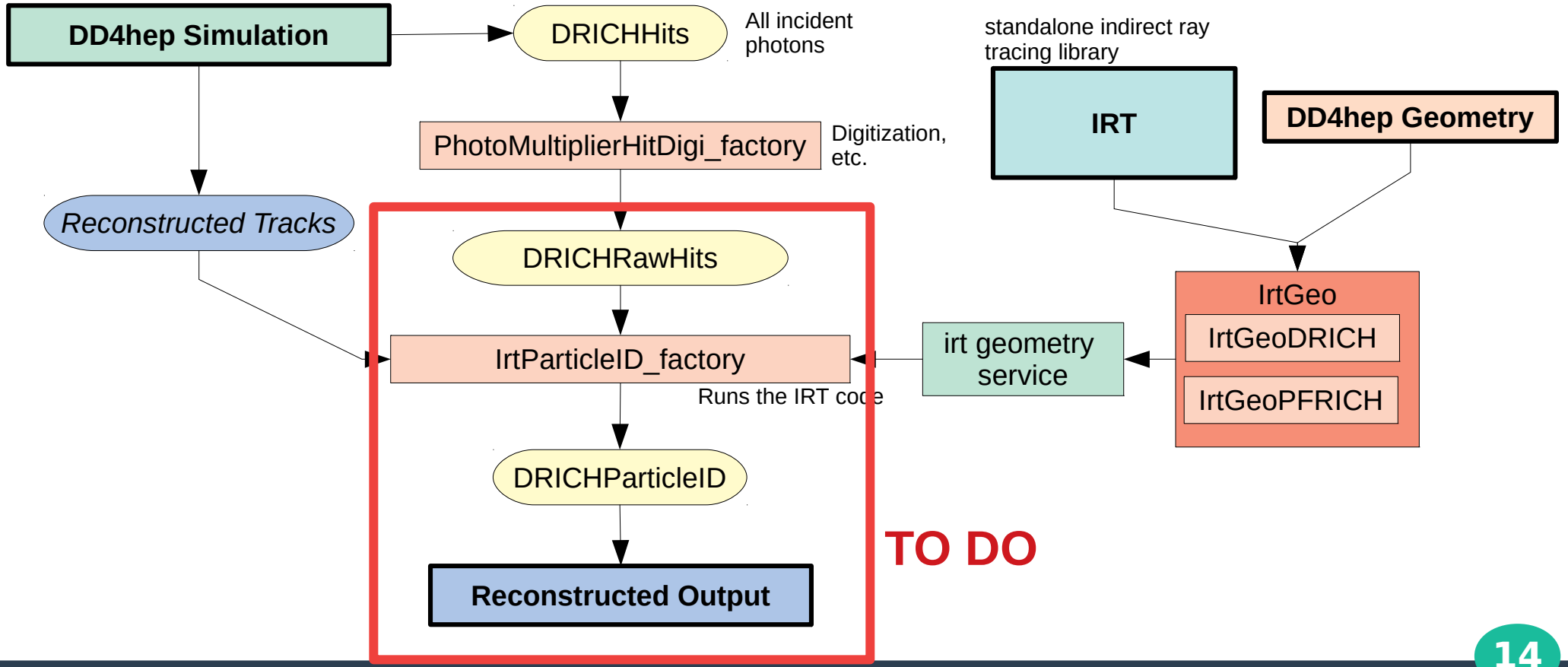
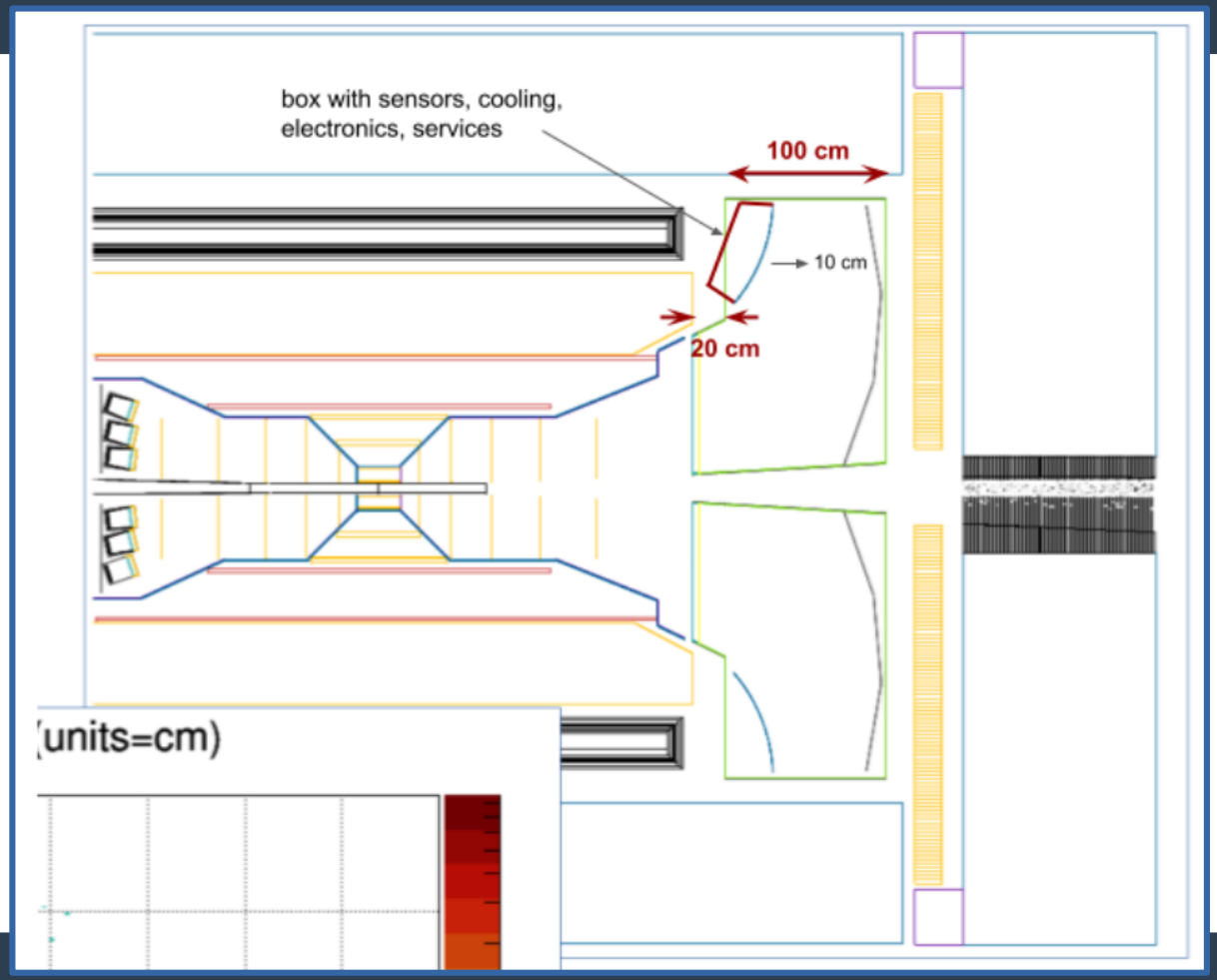


Modeling Services

- https://github.com/eic/epic/issues/175
- Add service material for the sensors
  - Resin substrates
  - Bases, Support, Cooling, …
- Need to shift the sensors forward, and re-focus the mirror



Meeting Times

- Poll for time: https://www.when2meet.com/?17174145-urUaG
- No good time for all
- Propose Separate bi-weekly meetings
  - 12:30 EST – keep as is
  - 21:30 EST– additional meeting, friendly to colleagues in Asia
  - Focus on details relevant to those who can attend
  - Keep both meetings up-to-date with respect to each other