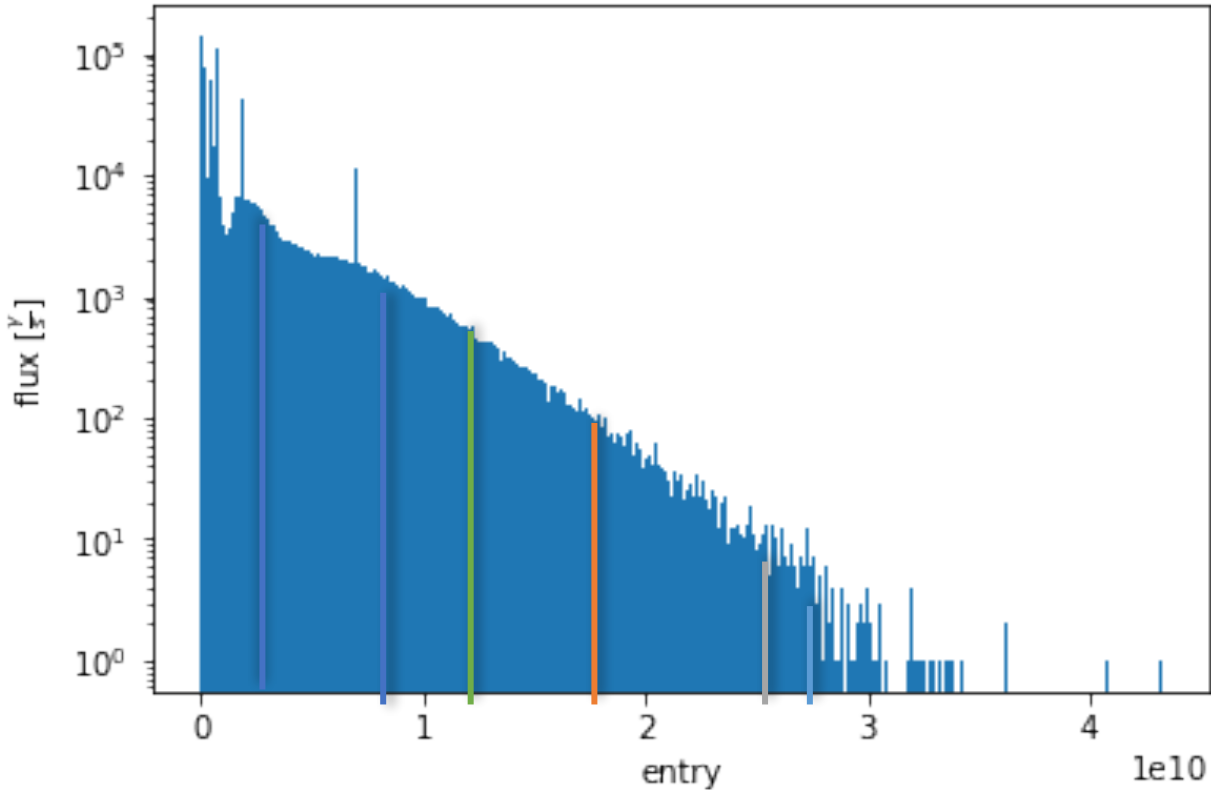# Synchrotron Radiation Update

Benjamen Sterwerf

photon entry versus flux [$\frac{\gamma}{s}$]

1.) Generator

- Store each photon and its flux as a bin in a histogram.

- Randomly sample photon using this flux distribution as the sampling distribution.

- Each selected photon contributes 1/flux to the time integration

- Results using 100 ns time integration window

Integration Window for 1 Event

Length of Time Integration

# 2.) Create a container for many <u>multiple-photon</u> events

- Using a HEPMC3 file to store the many multiple-photon event

- Disadvantage: Due to repositioning of momentum vectors from their respective vertices to the vertex (0,0,0) (found by Rey), we cannot store multiple-photon events as their own separate events.

- Workaround: Create a single multiple-photon event-file where every HEPMC event is a single-photon and create a key that will keep track of which event the photons belong too in case the events ever need to be separated again.
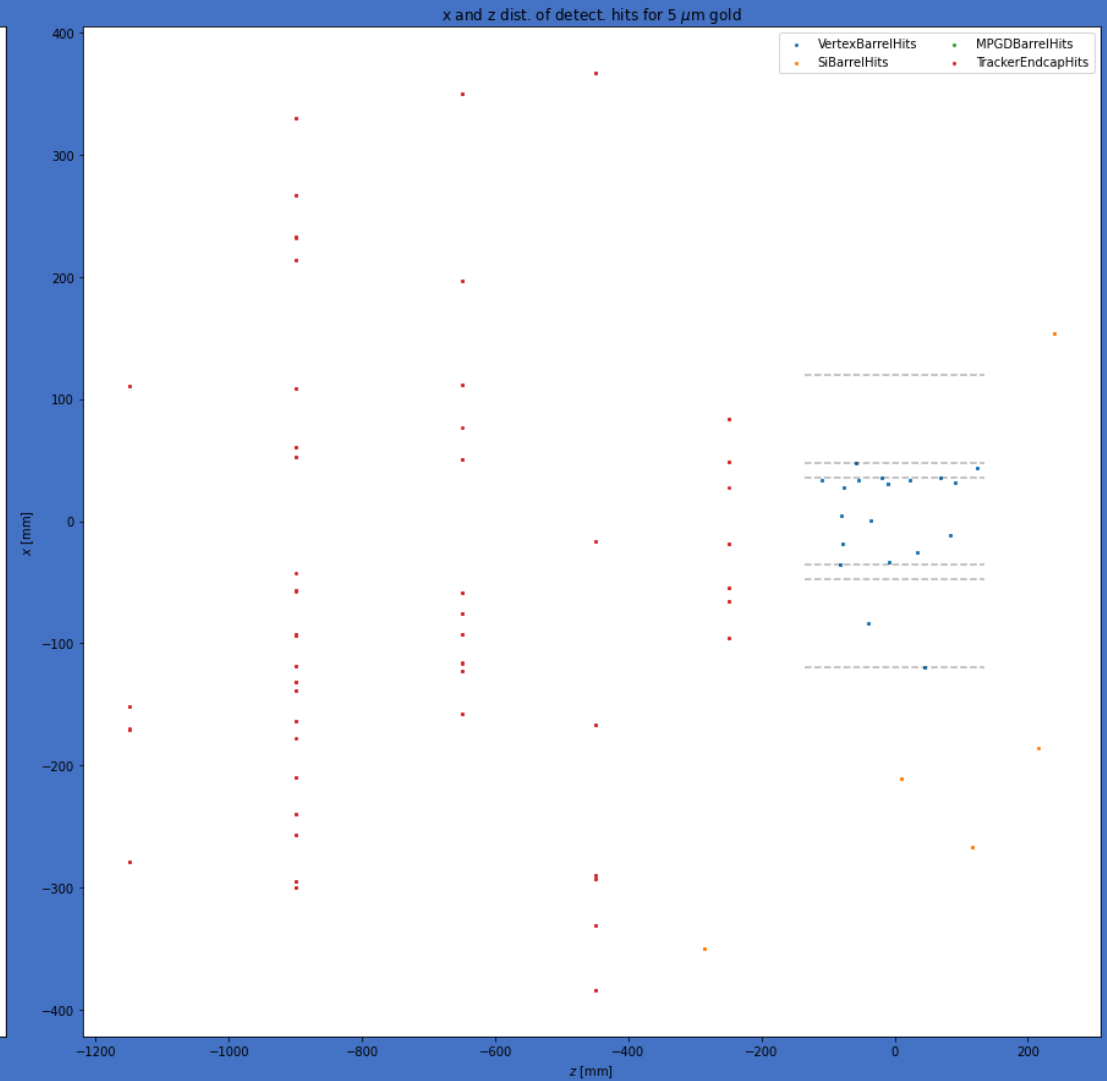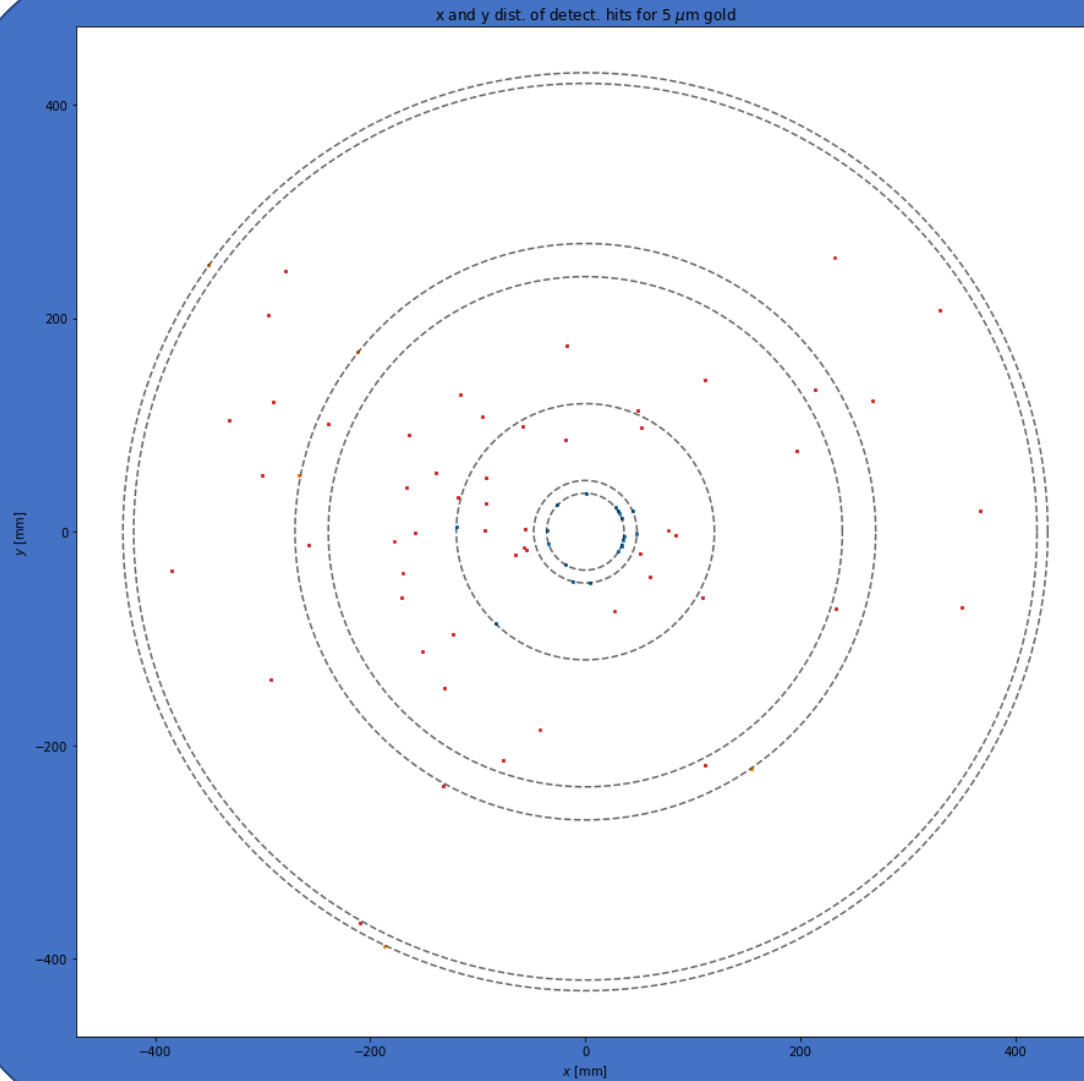
Example format of one
photon

```
HepMC::Version 3.02.04
HepMC::Asciiv3-START_EVENT_LISTING
E 0 0 1 @ -29.3752 1.42695 -4259.95 0.0000000000000000e+00
U GEV MM
P 1 0 22 -8.333043520000001e-09 1.5862558592000003e-10 -5.6127943872e-06 5.612800000000001e-06 -2.541212349152819e-09 1
```
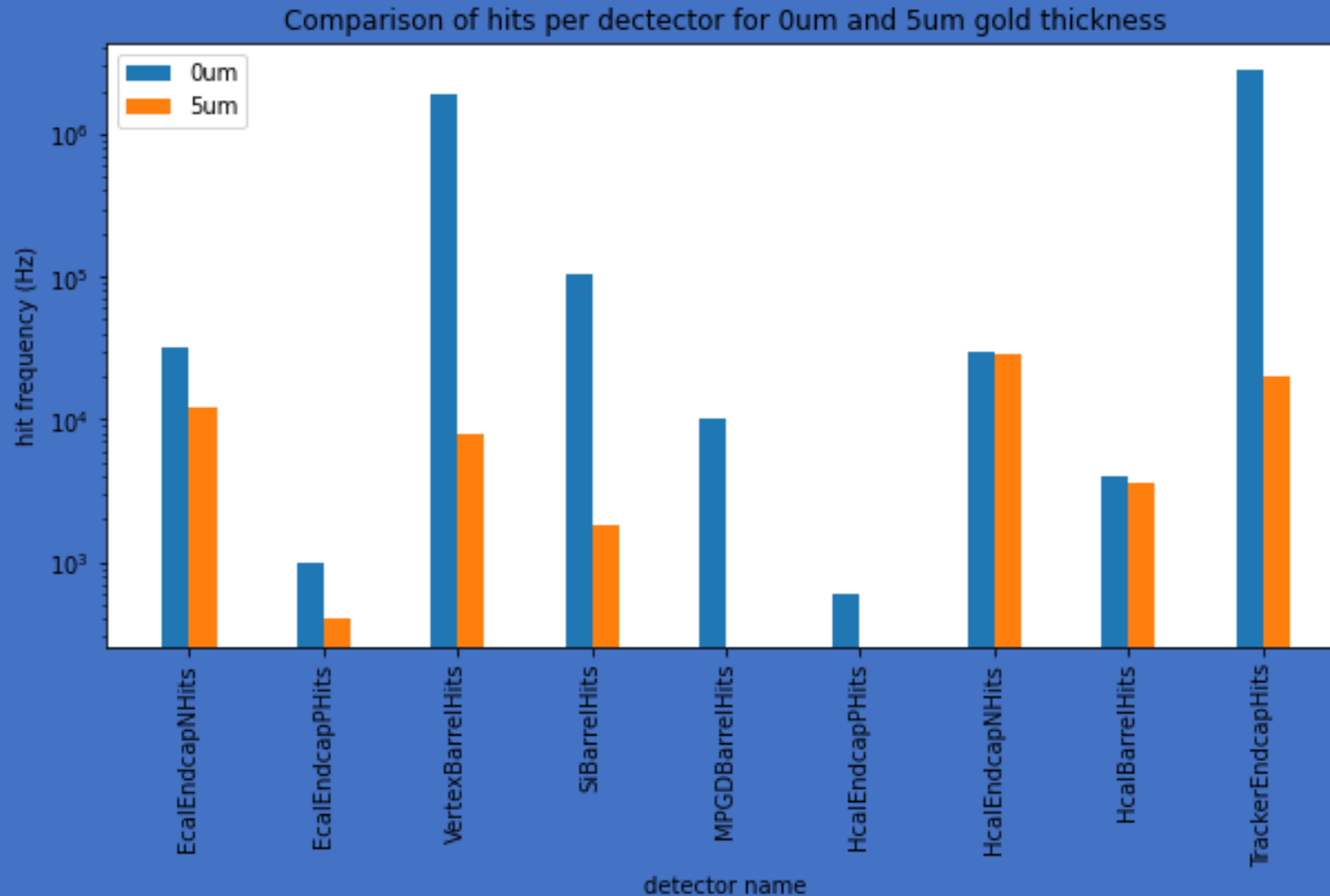
3) Propagate the HEPMC File through GEANT

- Current implementation: HEPMC file contains 50000 multi-photon events.
  - Event time 100 ns
  - The events shown below happen right before interaction with the gold coating of the detector.

Example Event Inputs
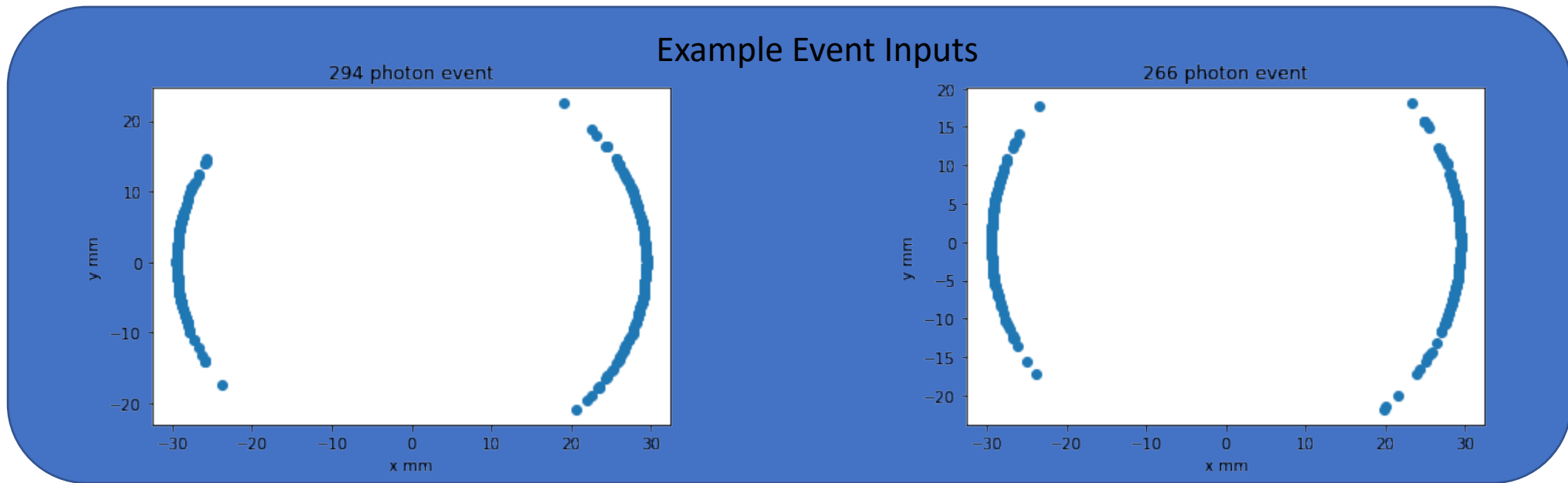
4) Reconstruction of Hit Distributions
5um Gold Coating

x and y dist. of detect. hits for 5 μm gold

x and z dist. of detect. hits for 5 μm gold

Hit Frequency Comparison between 0 and 5 um Gold Coating

Comparison of hits per dectector for 0um and 5um gold thickness

DIS and SR Recombination Results

Beam Current Specifications

x and y dist. of detect. hits for 5 μm gold

x and z dist. of detect. hits for 5 μm gold

Legend:
- EcalEndcapNHits
- EcalEndcapPHits
- VertexBarrelHits
- SiBarrelHits
- MPGDBarrelHits
- HcalEndcapPHits
- HcalEndcapNHits
- HcalBarrelHits
- TrackerEndcapHits
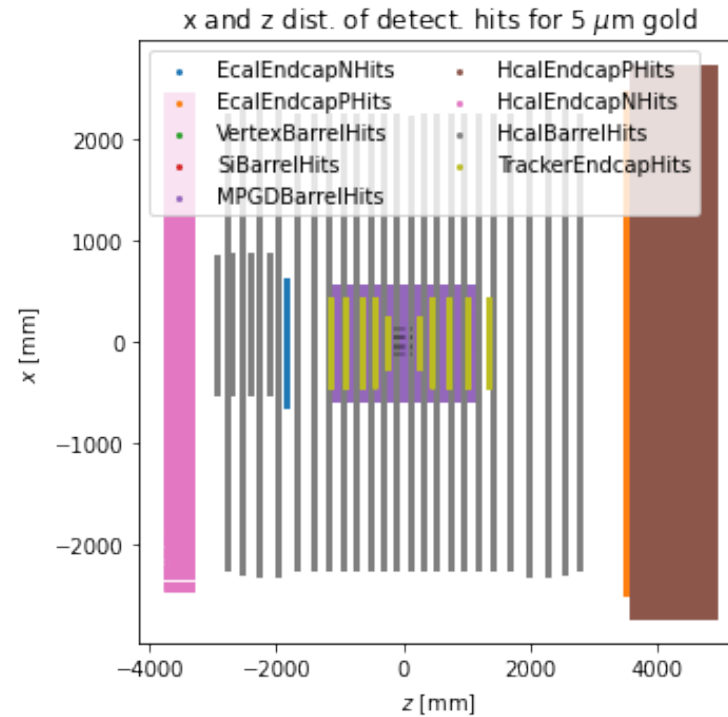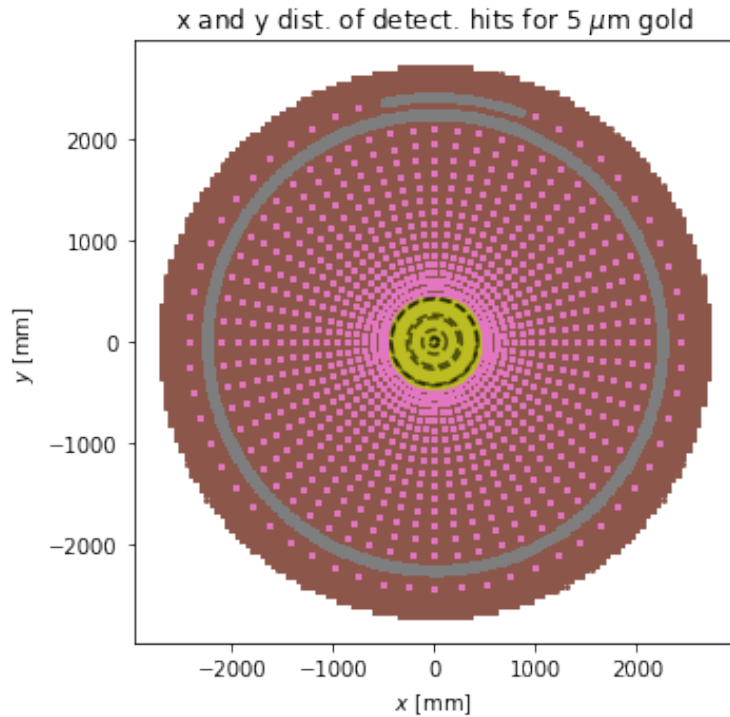
- The provided Synchrotron Radiation Facet Files were provided for 2.5 mA electron beams with E=10GeV.
  - Therefore, the Pythia Events were Created according to this specification.
  - Later it will be possible to Change the Electron Beam current
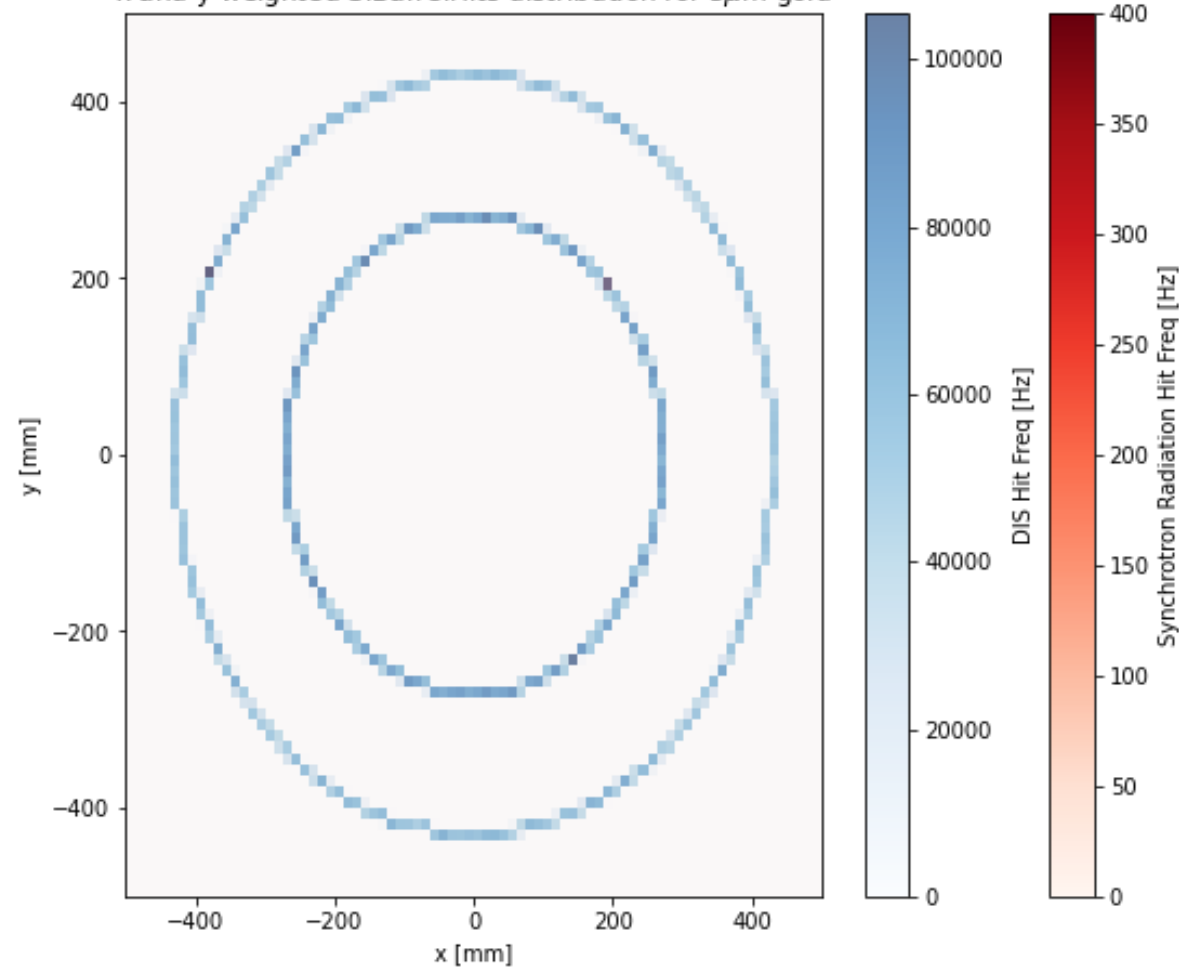
Recombination Scheme
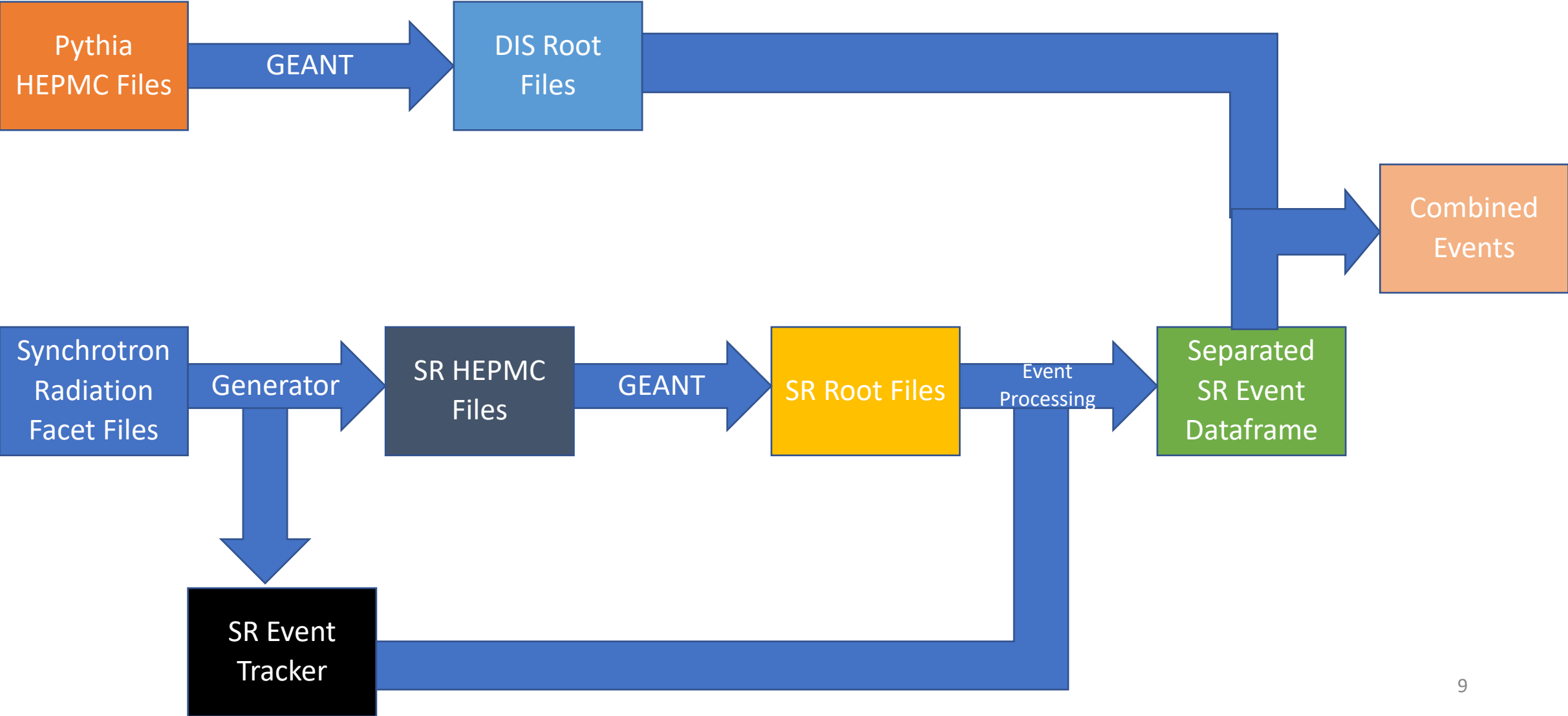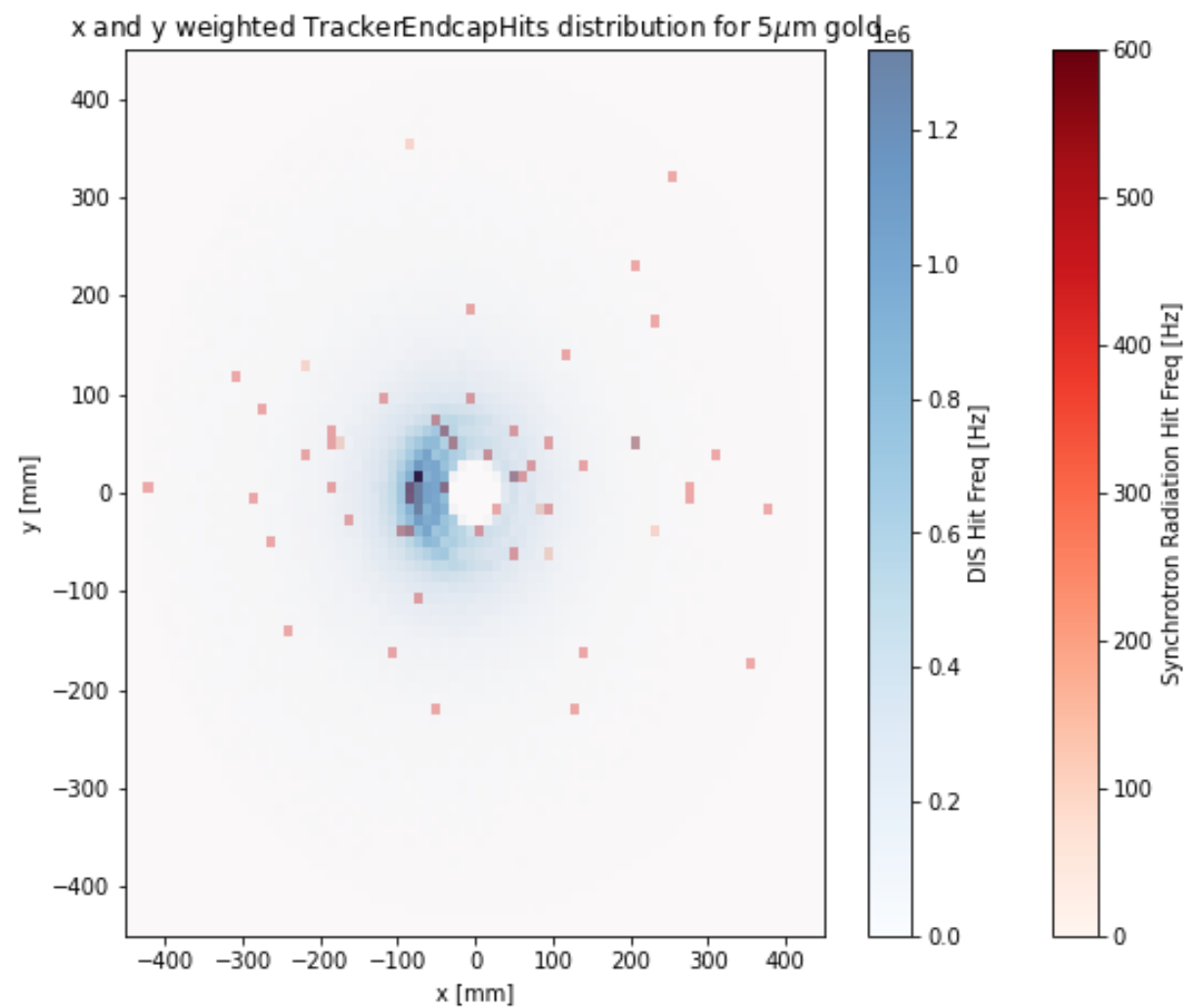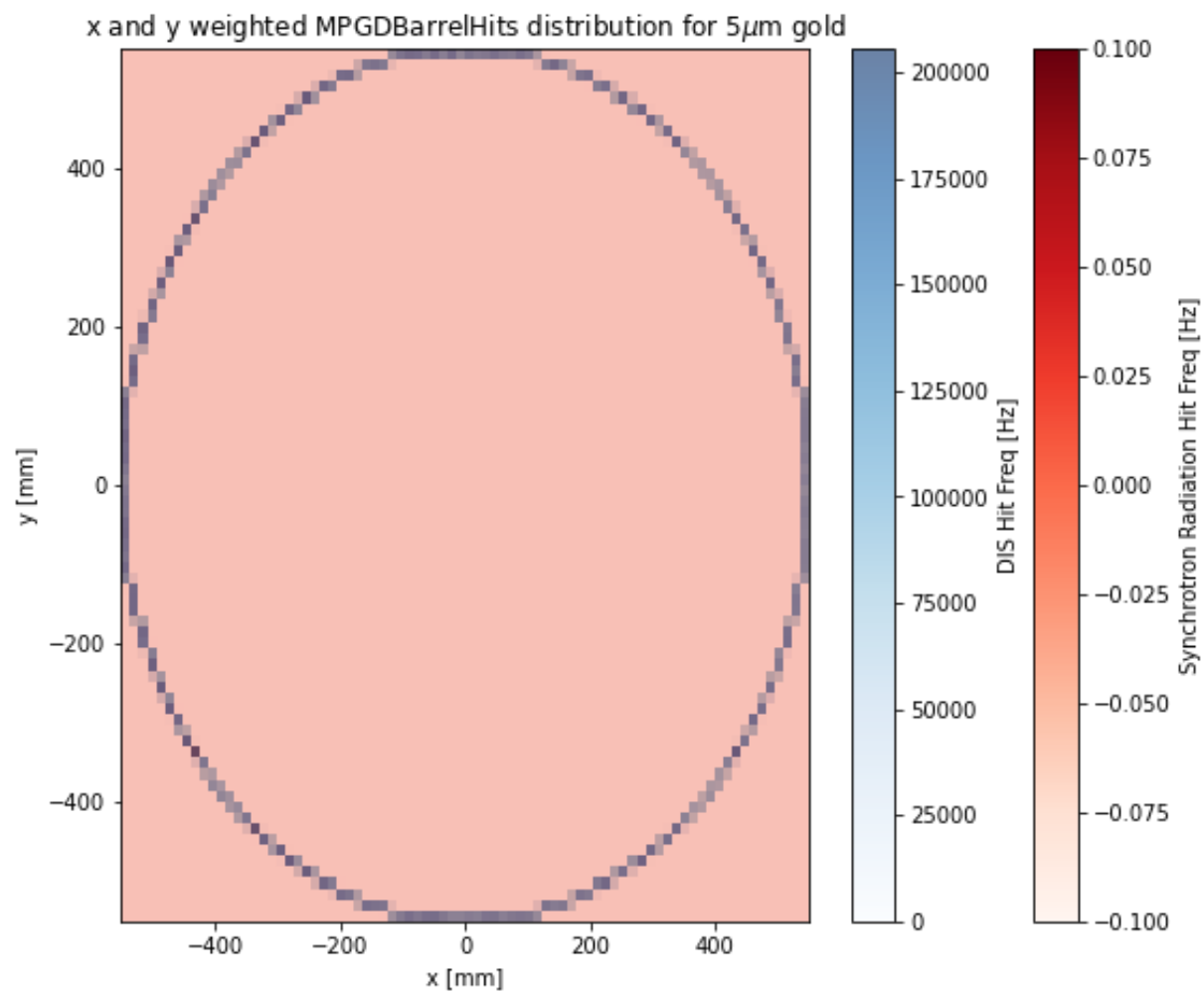
Combined DIS and SR Plots Per Subdetector (XY)

x and y weighted VertexBarrelHits distribution for 5μm gold
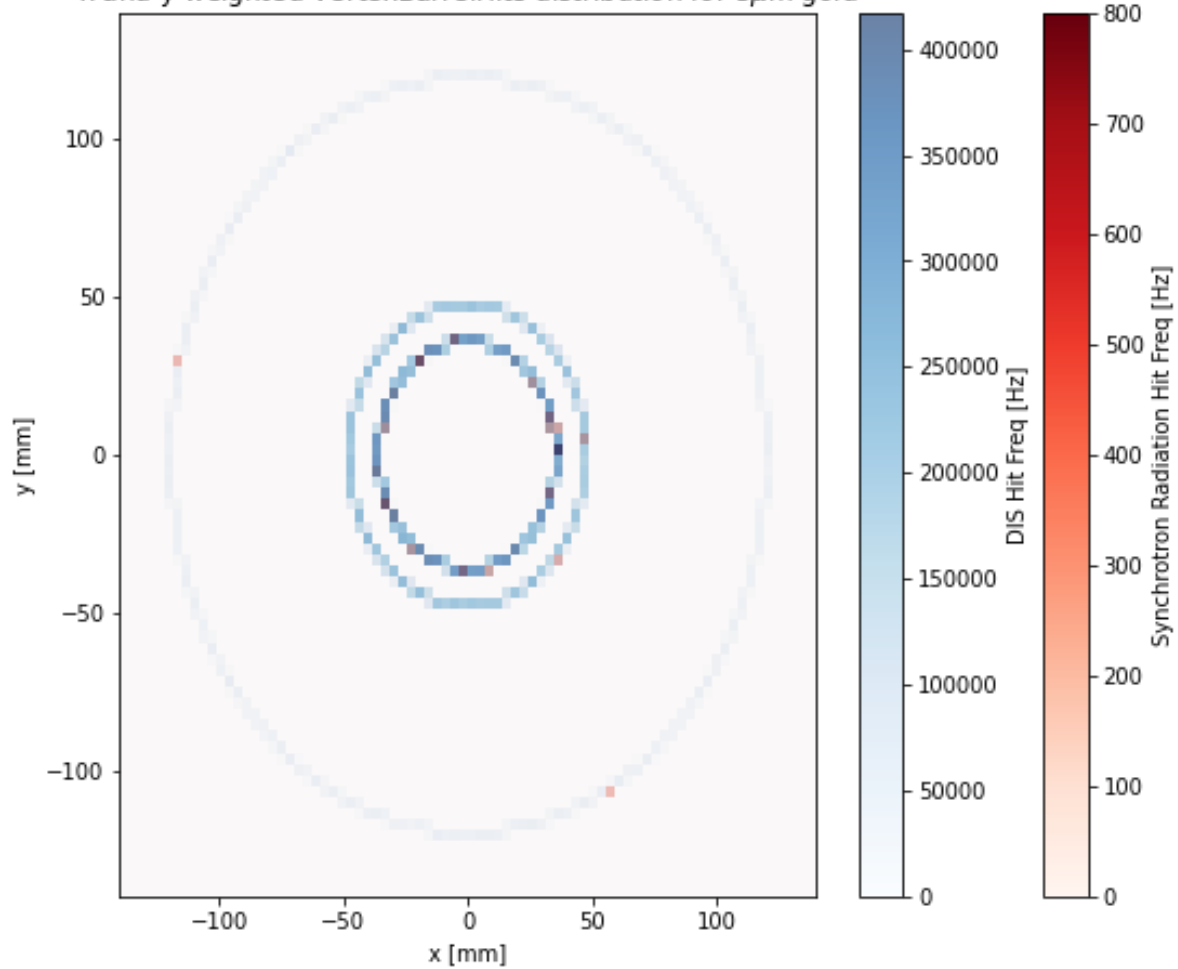
x and y weighted SiBarrelHits distribution for 5μm gold

Combined DIS and SR Plots Per Subdetector (XY)

x and y weighted MPGDBarrelHits distribution for 5μm gold

x and y weighted TrackerEndcapHits distribution for 5μm gold

Combined DIS and SR Plots Per Subdetector (XZ)

z and x weighted VertexBarrelHits distribution for 5μm gold
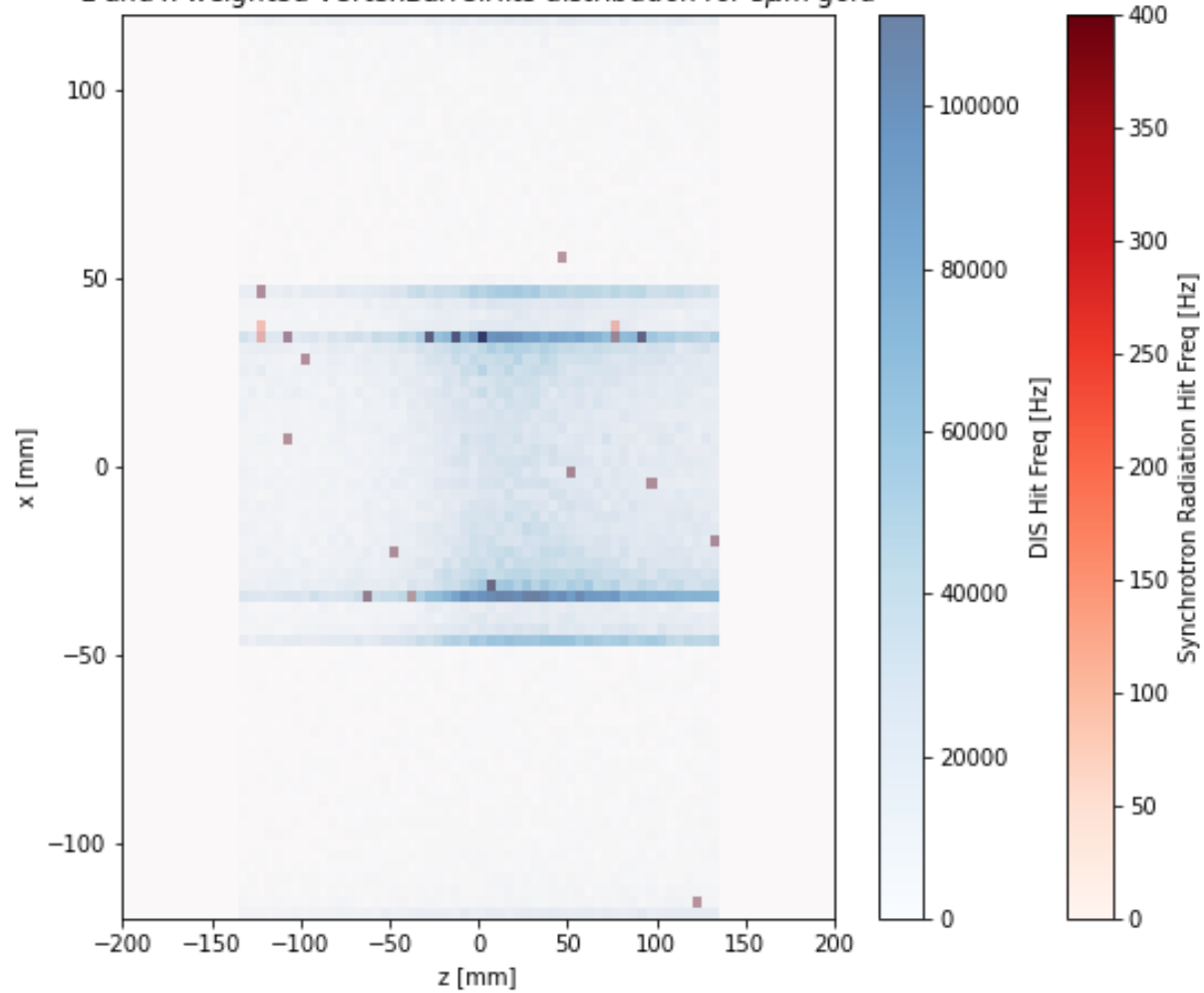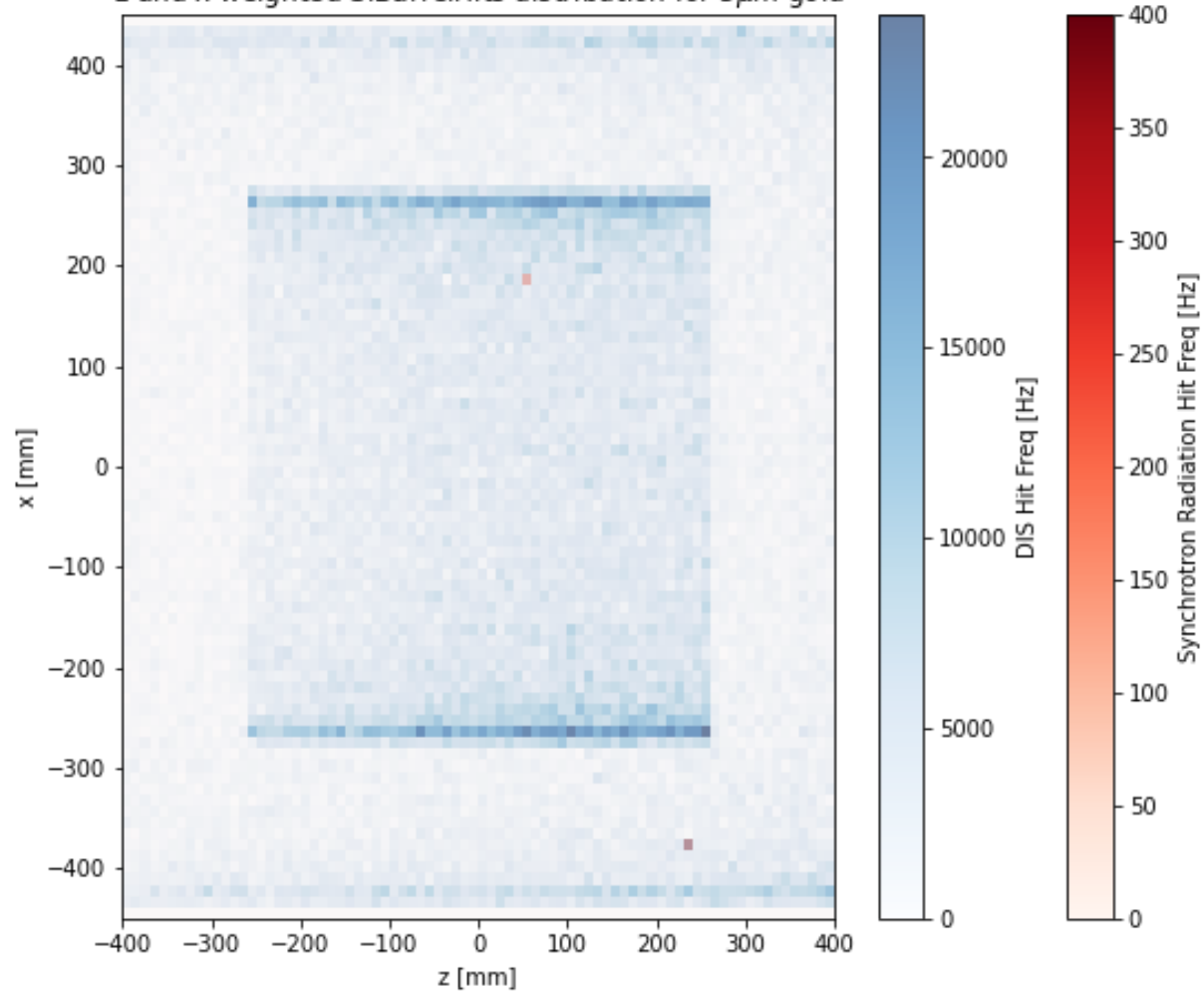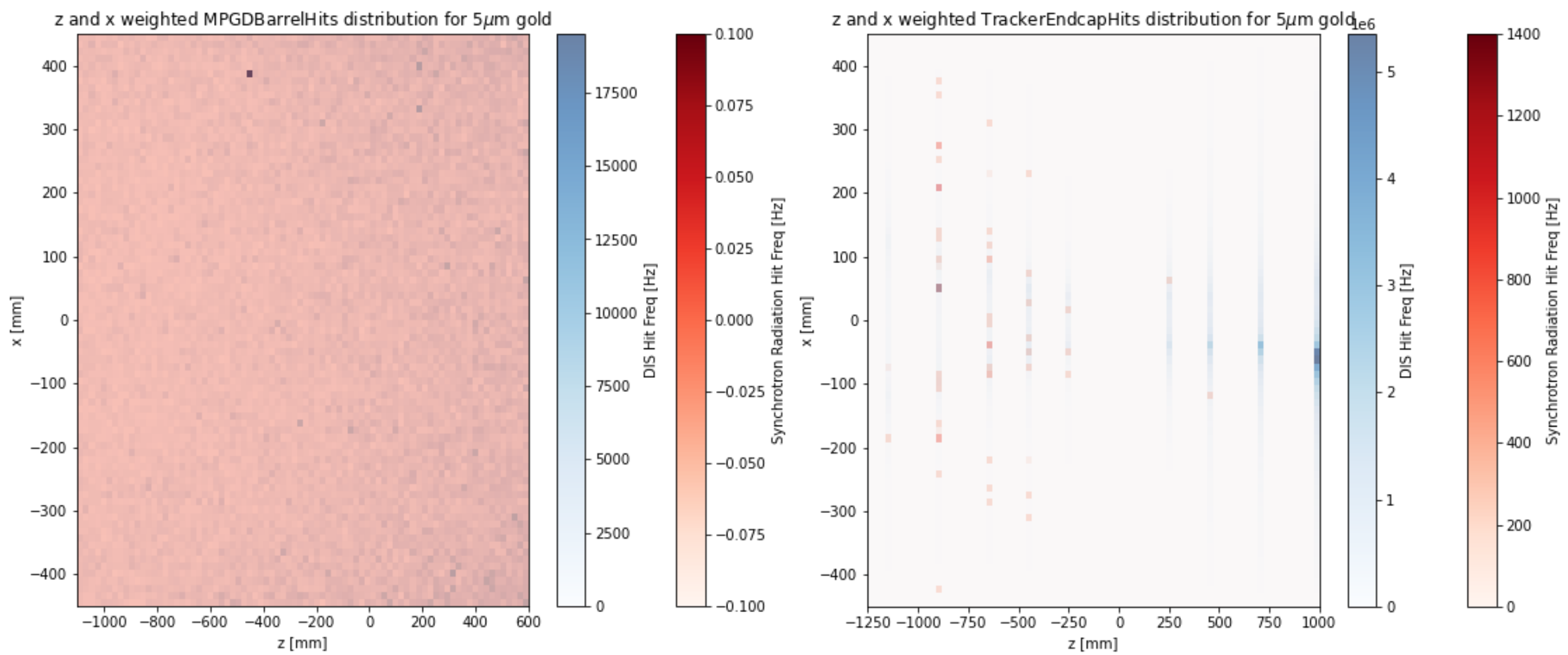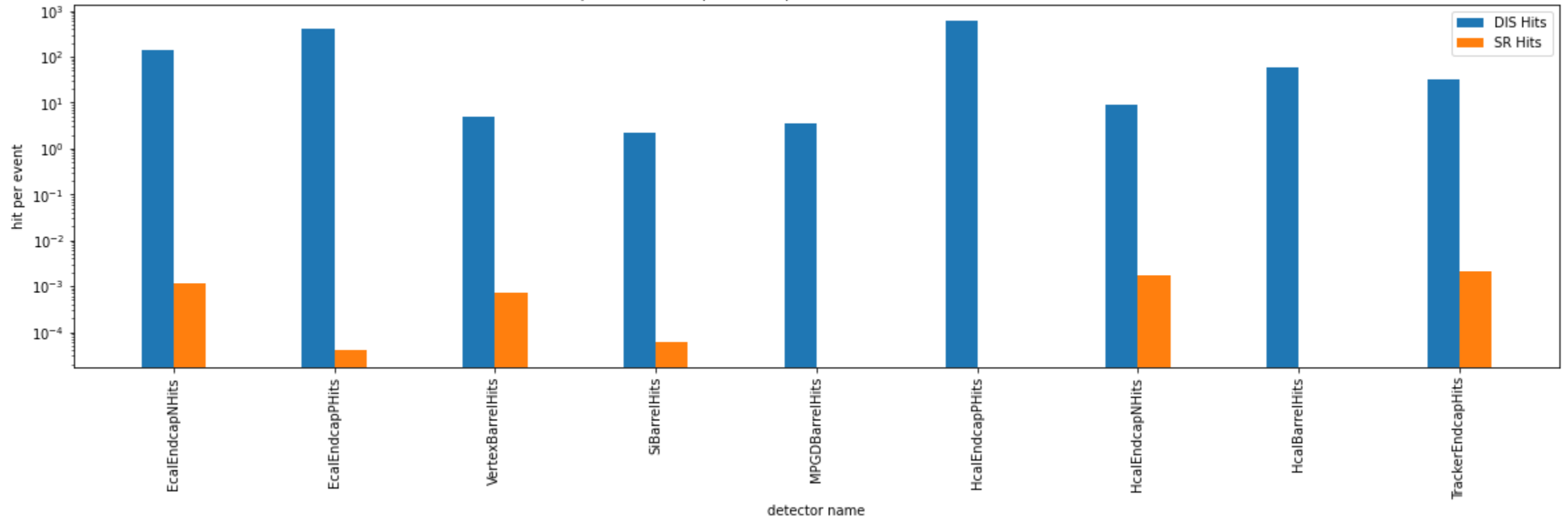
z and x weighted SiBarrelHits distribution for 5μm gold

Combined DIS and SR Plots Per Subdetector (XZ)

z and x weighted MPGDBarrelHits distribution for 5μm gold

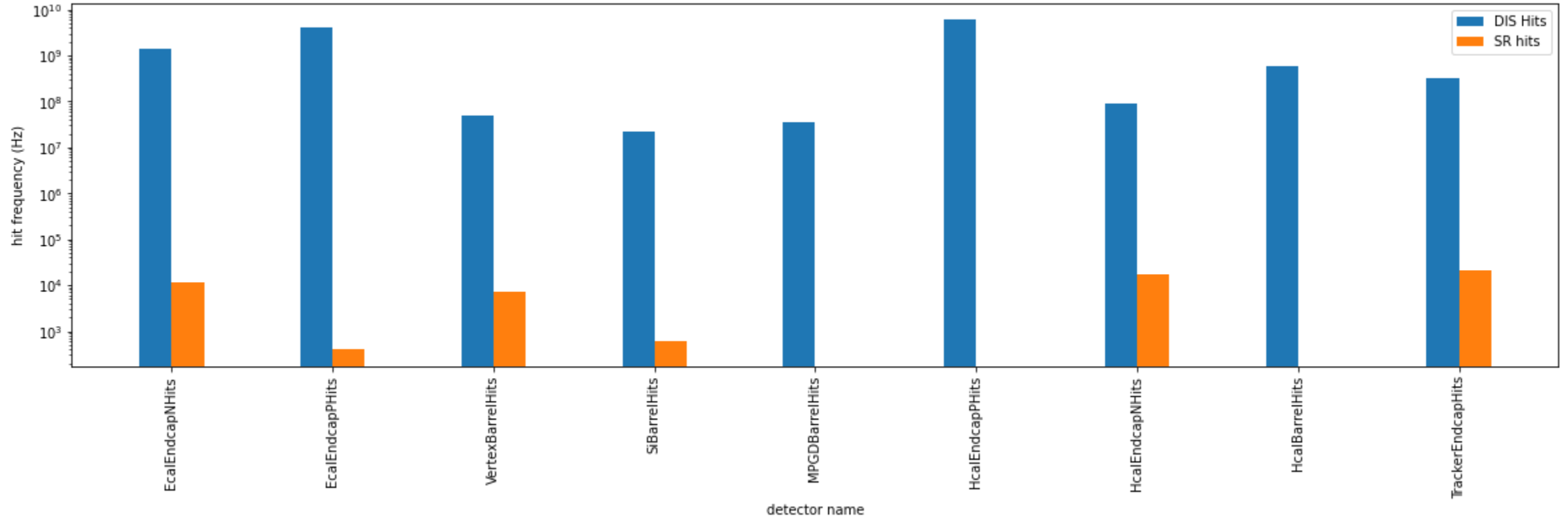z and x weighted TrackerEndcapHits distribution for 5μm gold

Hits Per Event Per Subdetector Comparison

Comparison of Hits per Event per Dectector for DIS Hits and SR Hits

Hit Frequency Per Subdetector Comparison

Comparison of Hit Frequency per Dectector for DIS Hits and SR hits

Summary Slide

- Created a photon event Generator with user defined parameters
- Created the capability to transform these events into multi-event HEPMC3 files with HEPMC defined as either:
  - Each event corresponding to a single photon (Pre-vertexing fix), with a key to sort individual photons
  - Each event corresponding to an actual event ()
- Propagating these photons through geant to recreate hit distributions
- Match Event Specifications with DIS events and pair the background hit distributions with the signal hit distributions created using Pythia.

Next Steps

- Currently working on developing an admixing technique for the background and signal events in order to look at effects on tracking reconstruction.