

TOF Simulations Status

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Hit rate estimation

- Thanks to Honey Kindri
- MC samples
 - /volatile/eic/EPIC/RECO/26.02.0/epic_craterlake/Bkg_Exact|S_2us/GoldCt/10um/DIS/NC/10x100/minQ2=1/
 - /volatile/eic/EPIC/RECO/26.02.0/epic_craterlake/DIS/NC/10x100/minQ2=1/
- Compare situation with and without backgrounds
- Occupancy plots
 - hits/event
 - hits/event/area
 - hit/mm²
- Please let us know any comments if these plots are not expected ones

Answers to questions from John 1 / 2

- **Question. 1**

Since you are making these plots from the reco hits, I assume that the pixelization of the detector is applied at the digitization stage? In the plots on page 4/5 when you normalize by area, is this the area of the pixel or the area of the bin in the histogram? Basically I am asking is the dead area between pixels accounted for in some way?

- **Answer**

pixelization is applied at the simulation/segmentation stage, before digitization. The detector uses a Cartesian Grid XY segmentation defined in DD4hep, so the energy deposits are already assigned to discrete 0.1 mm x 0.1 mm pixels at the level of the SimTrackerHit (as defined in tof endcap.xml). The digitization stage (charge sharing, pulse shaping, ADC/TDC) operates on these already pixelized channels and does not redefine the segmentation. The area used for normalization is the area of the histogram bin, not the pixel area.

Regarding dead area:

The geometry includes dead regions at the module/board level (e.g. spacing, gaps, central hole), so those inactive regions are accounted for. However, within a sensor, the CartesianGridXY segmentation assumes ideal tiling of the sensitive surface. There is no explicit inter-pixel gap or reduced fill factor modeled. Therefore, dead area between modules is included geometrically, but there is no additional dead area implemented between neighboring pixels within a sensor.

Answers to questions from John 2/2

- **Question. 2**

Do the simulations include any charge sharing between the pixels (clusters) or is there just a single FTOF pixel per hit? I think this was being worked on in the reconstruction but I don't know the current status. This will affect the occupancy per hit because a given hit can fire more than one pixel.

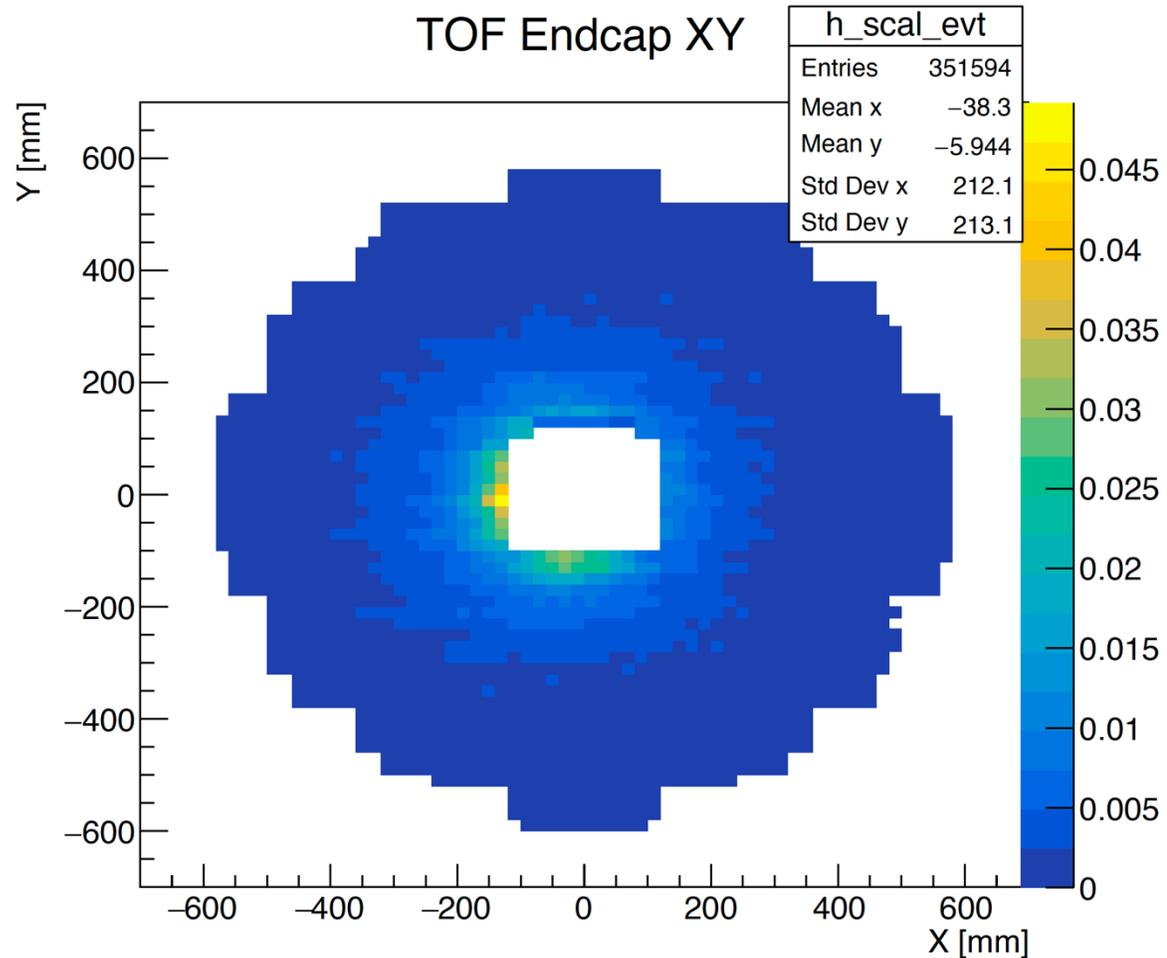
- **Answer**

Yes, the simulations do include charge sharing between pixels. After the energy deposit is assigned to a pixel via the DD4hep CartesianGridXY segmentation in DD4hep, the digitization chain runs the SiliconChargeSharing factory. This step redistributes the deposited charge to neighboring pixels before pulse shaping and ADC/TDC digitization.

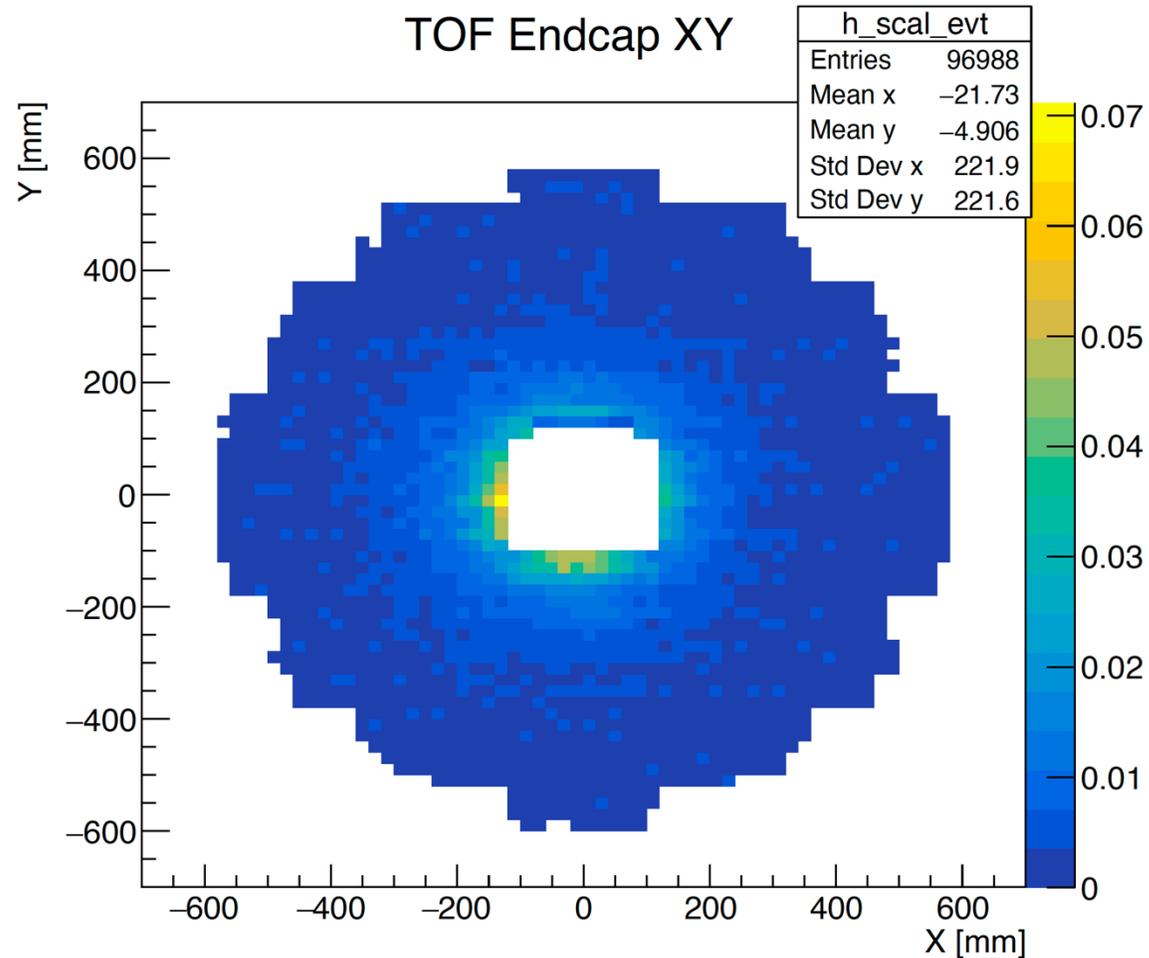
Therefore, the model is not single-pixel-per-hit**. A given hit can produce a small multi-pixel cluster depending on the charge-sharing parameters (currently configured with a relative sigma of ~ 1 pixel in both x and y). As a consequence: A single particle hit can fire more than one pixel. The occupancy per hit can therefore be greater than one channel. The exact multiplicity depends on the chosen charge diffusion parameters and pixel size. So yes — charge sharing is included, and it does affect the occupancy accordingly.

hits/event

Without BKG

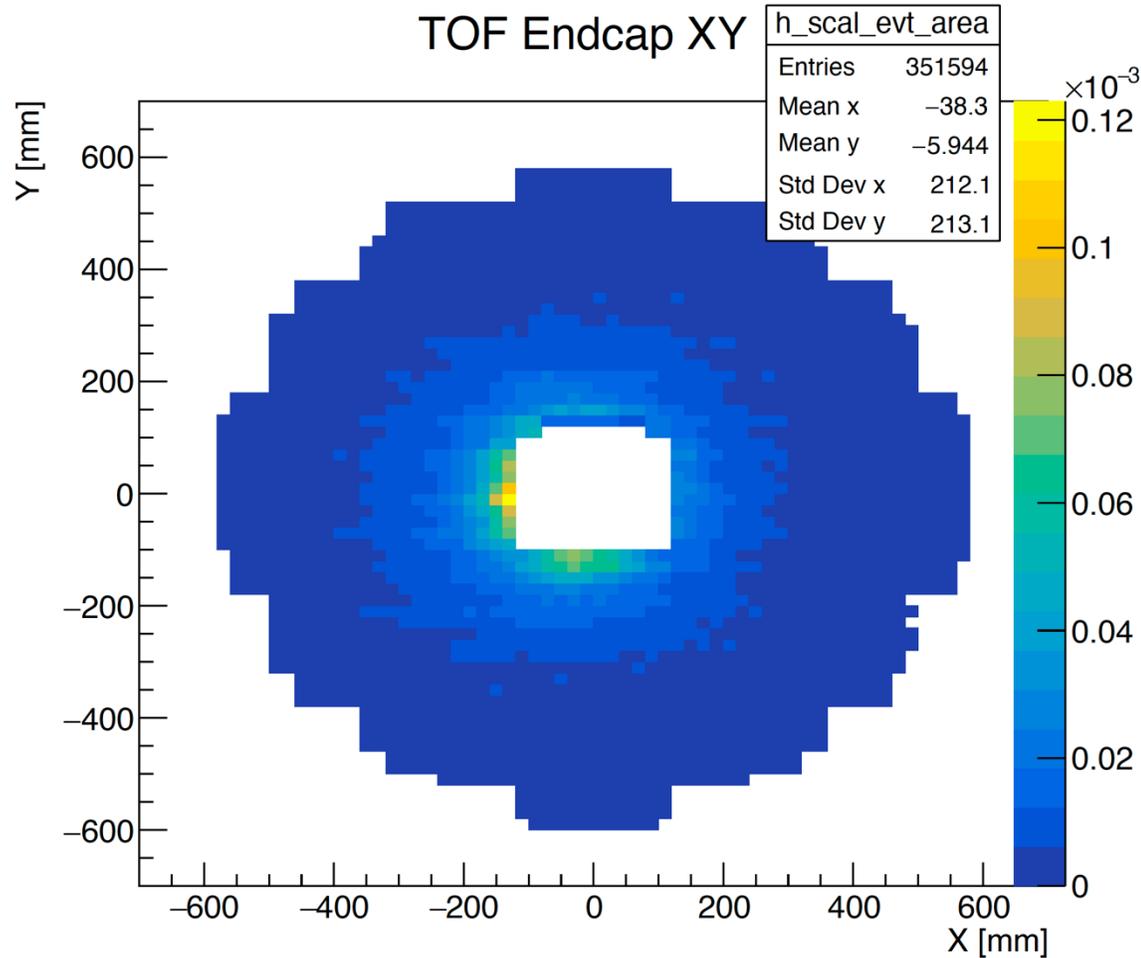


With BKG



hits/event/area

Without BKG



With BKG

