GEM Digitization Implementation

Setup

g4DL → **Reconstruct & Sample** → **Create Gaussians**

Passes locations of energy deposits in ROOT file. Unable to pass actual track information

Reconstruct track information from energy deposits. Use track information to randomly sample points of ionization on path
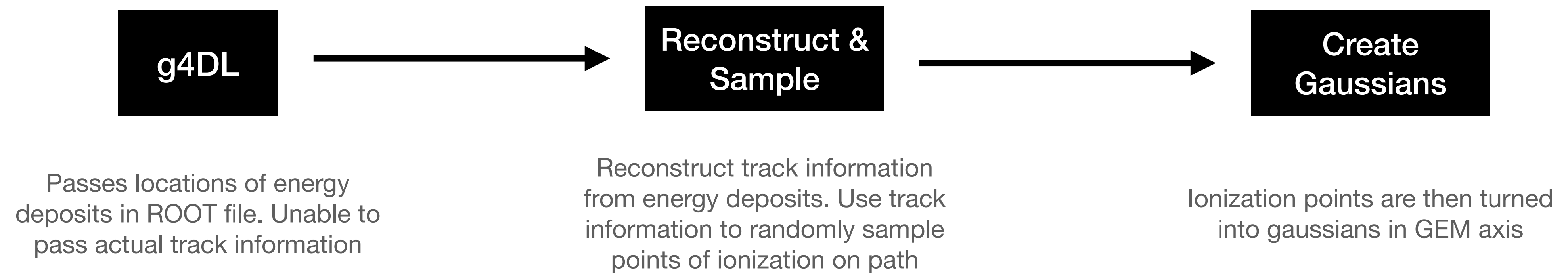
Ionization points are then turned into gaussians in GEM axis

Reconstruct & Sample

Length is calculated through g4DL energy deposits

# of secondary electrons is randomly generated through lookup table then uniformily distributed along path

Gain of each secondary electron is randomly generated through lookup table

Sampling of gain and # of electrons done in O(1), very fast
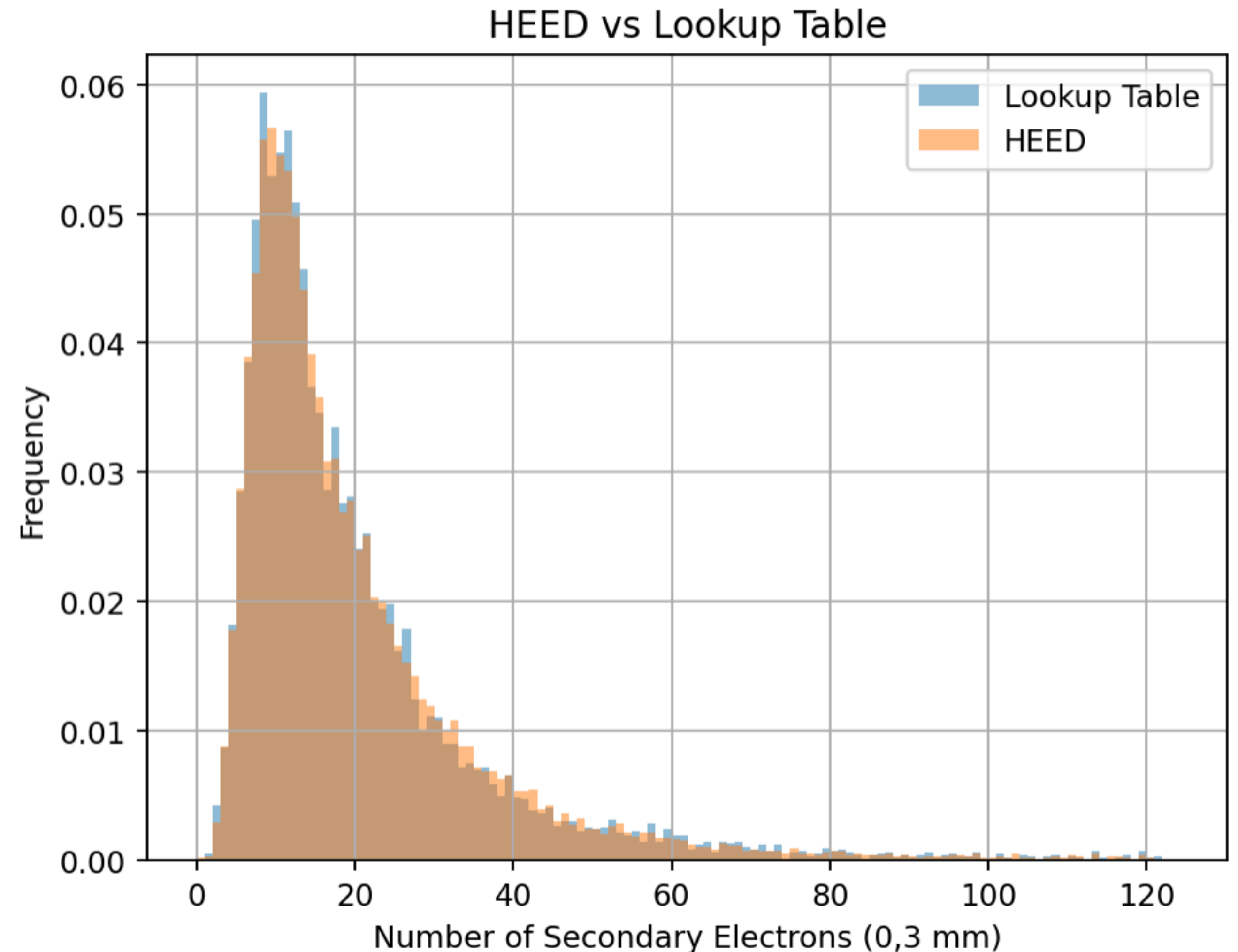
Secondary Electron Count Distribution

Lookup Table

5e3 length lookup table is stored

Random integer is generated from uniform $[0, 5 \cdot 10^3]$

Look at corresponding value in index of lookup table
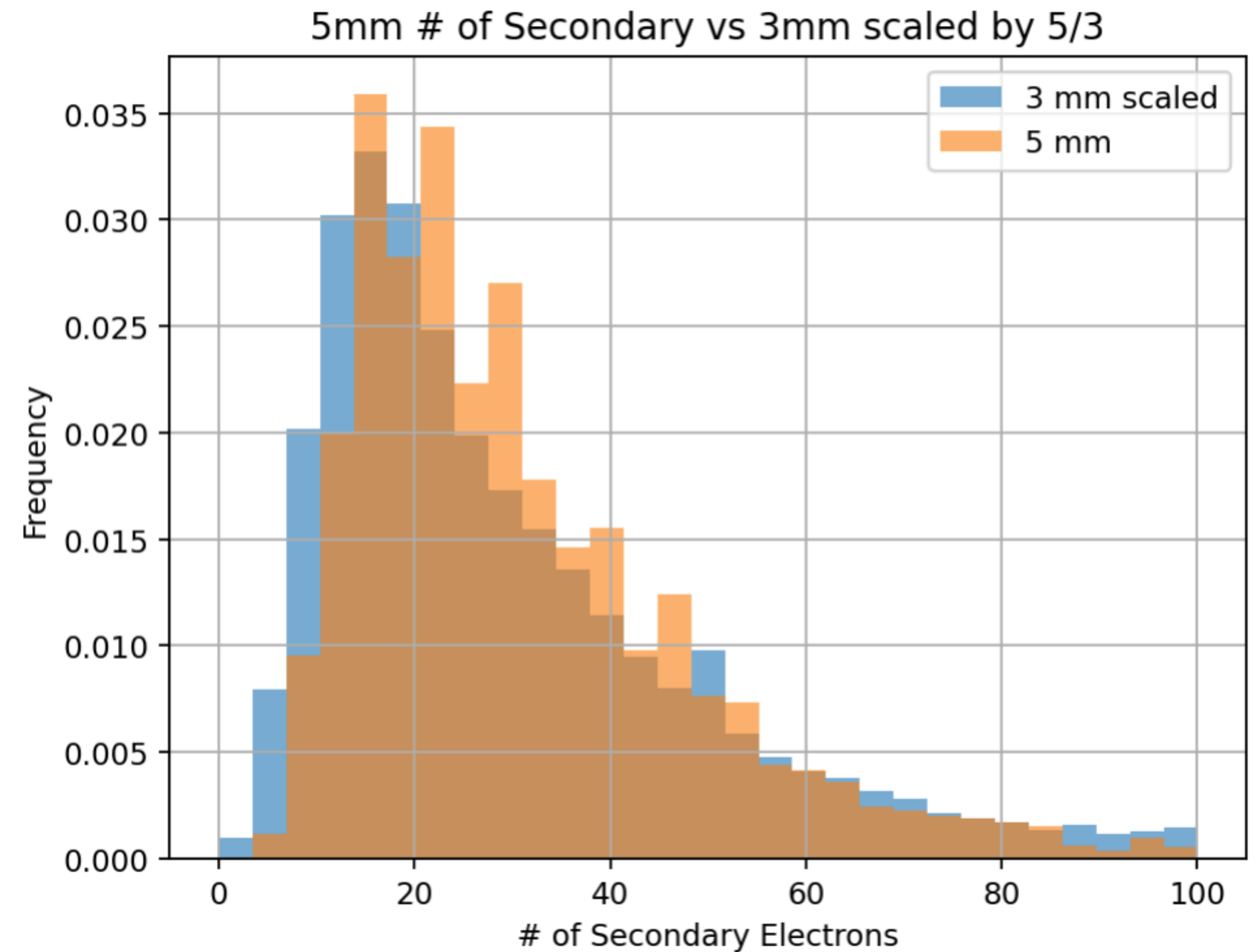
Normalized to 3mm and will be scaled accordingly

Secondary Electron Count Distribution
Scale Comparison

Most lengths are between 4-5mm,

Can be close enough to approximate

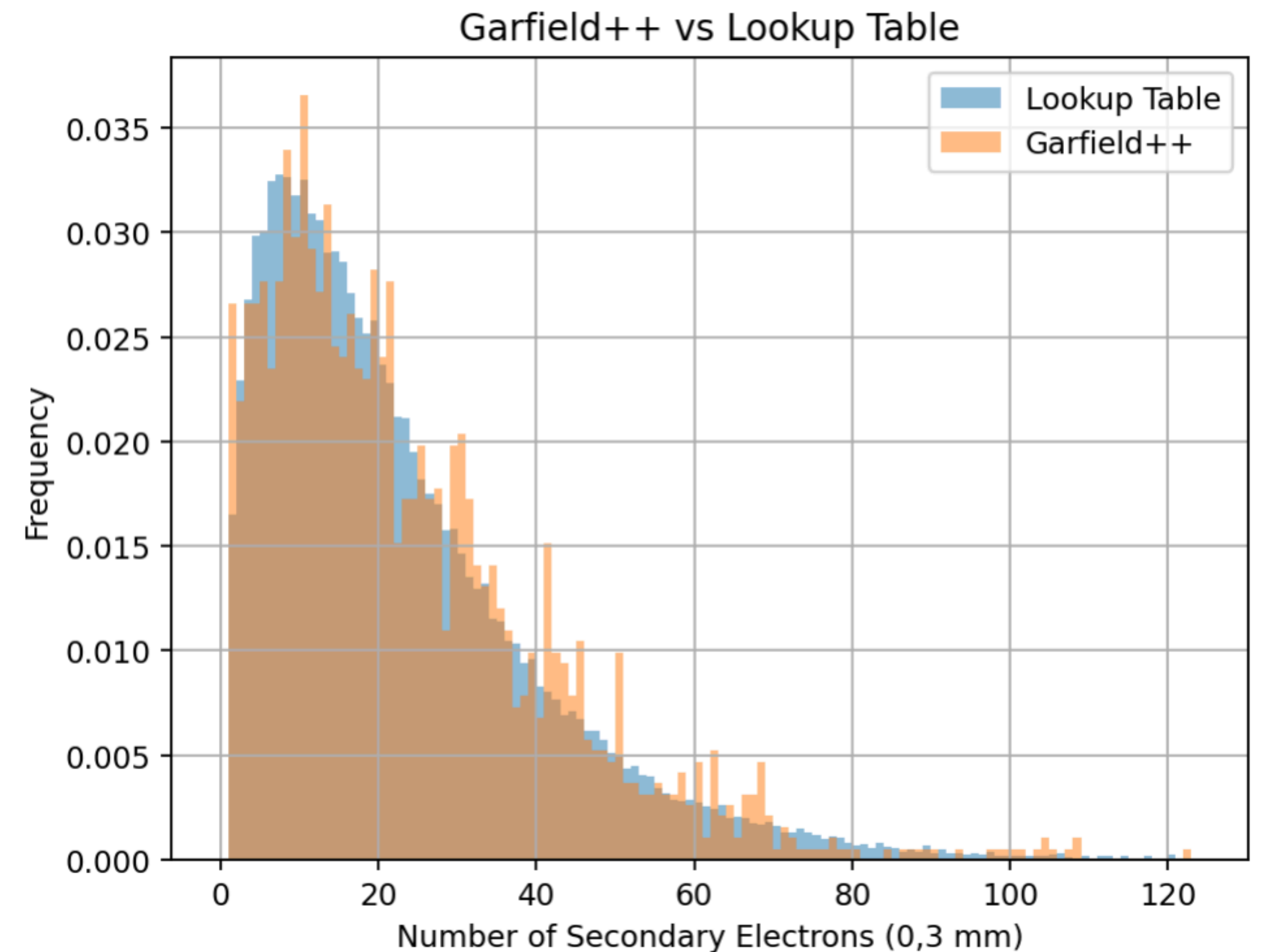5mm # of Secondary vs 3mm scaled by 5/3

Gain Distribution
Lookup Table

Created lookup table based
on the fit done on data from
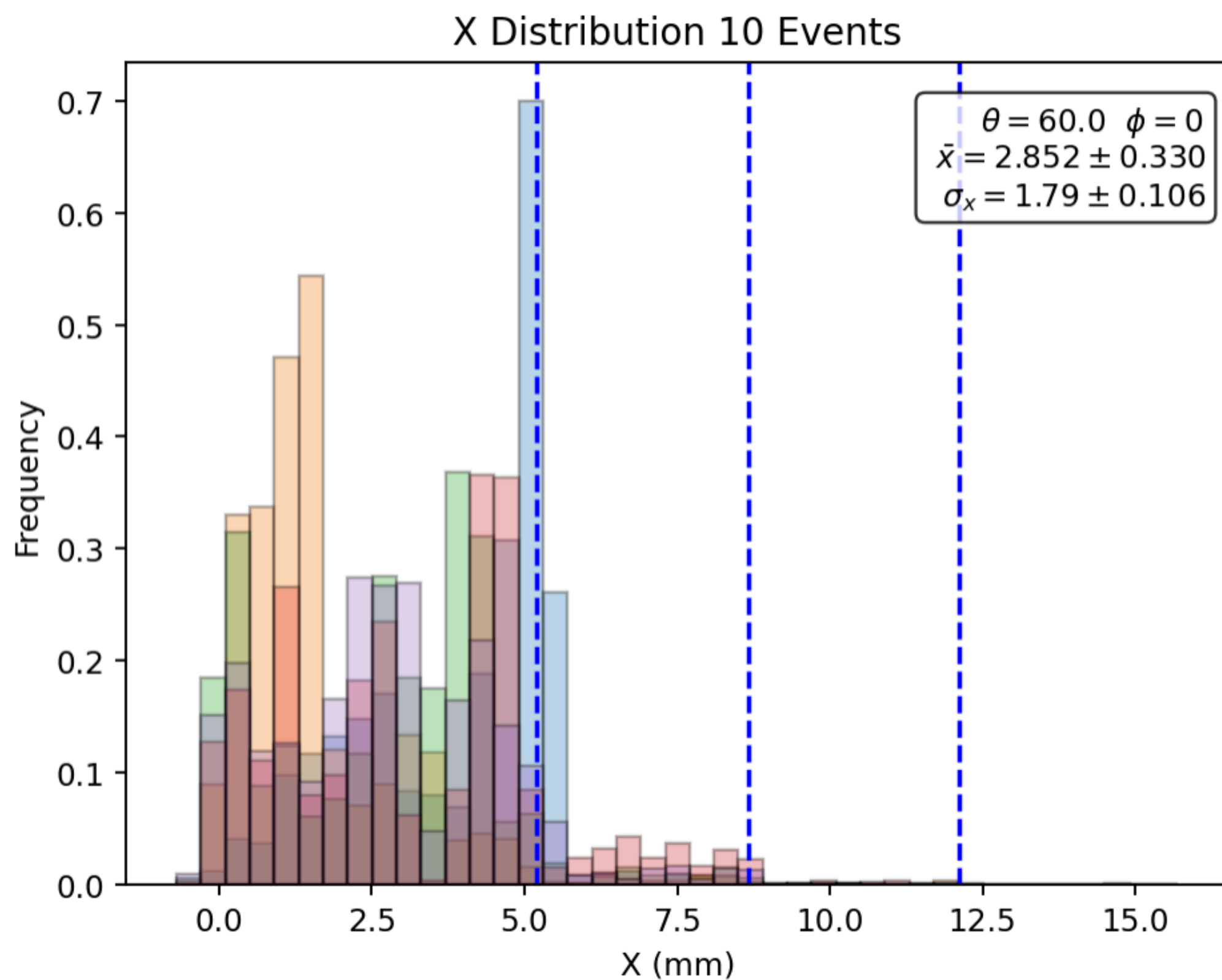garfield++

Same process to that of
secondary electrons

Create Gaussians

For each X and Y positions of secondary electrons, a gaussian * the gain is applied to the surrounding 5 channels

Check for Sanity
At 60deg

Also matches up at 60 deg, we see
about 14~15 channel wide signal and
many small individual peaks