

SNS US-Japan Meeting

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WCSim Simulation

ID Diameter : 3m

IDHeight : 2m

Cathod coverage : [7.5, 15, 30, 60, 78]%

3-inch PMT numbers : [488, 999, 1984, 3956, 5056]

QE: same as 20-inch

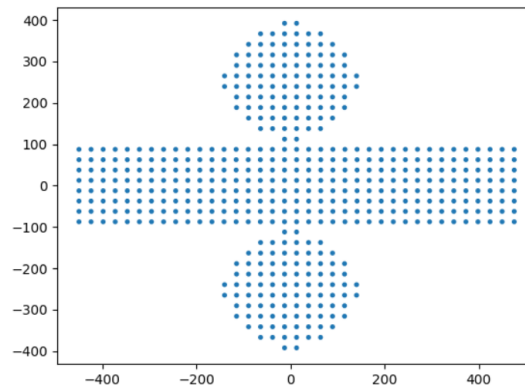
Input particle : gamma

Direction: Uniform

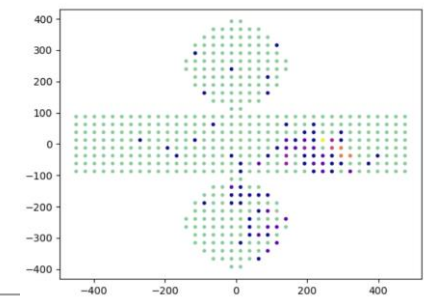
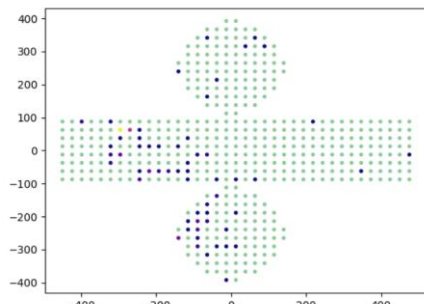
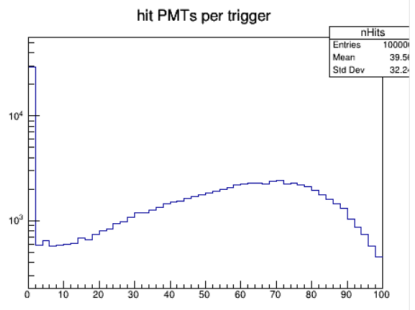
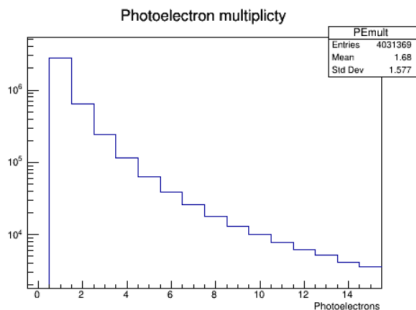
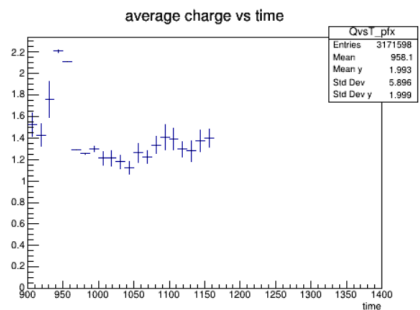
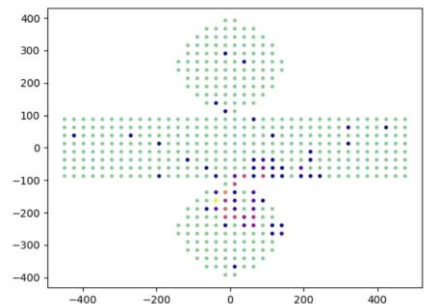
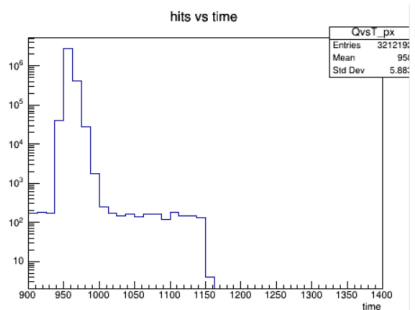
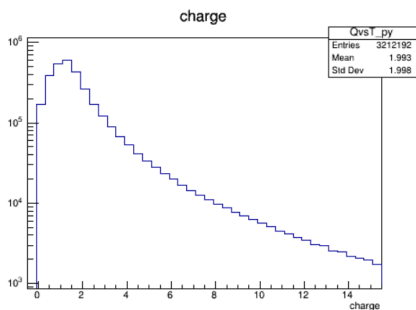
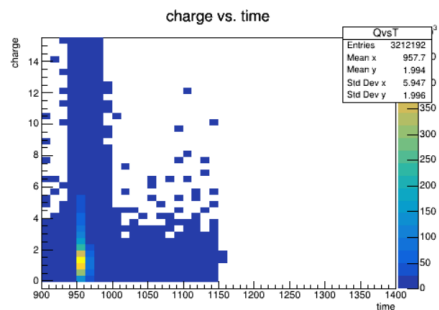
Position : Uniform

MC Statistics: 10,000 event

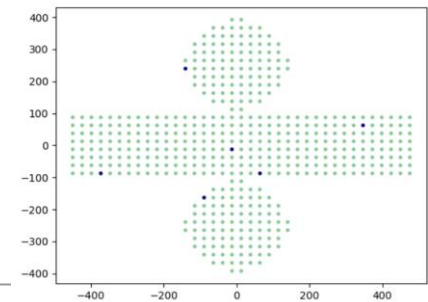
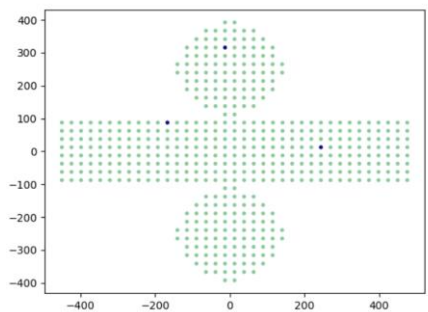
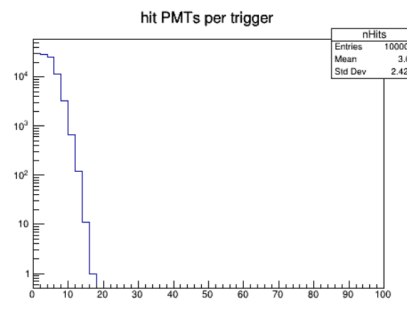
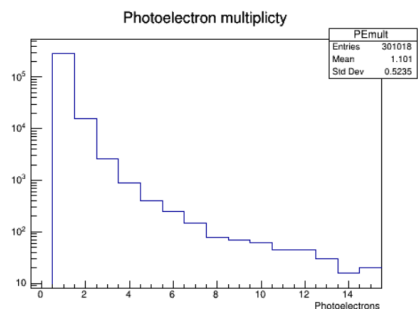
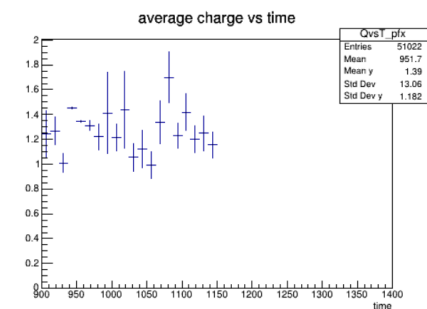
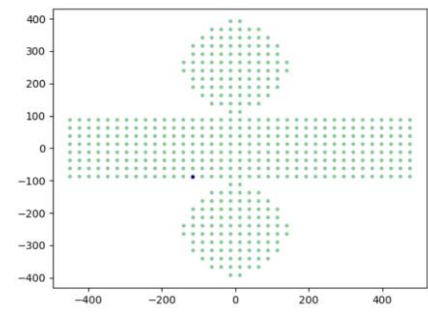
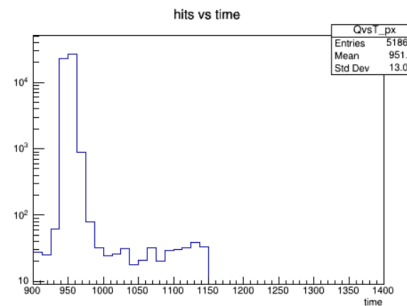
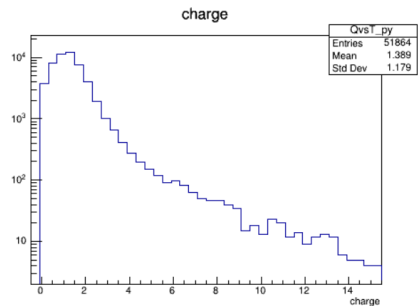
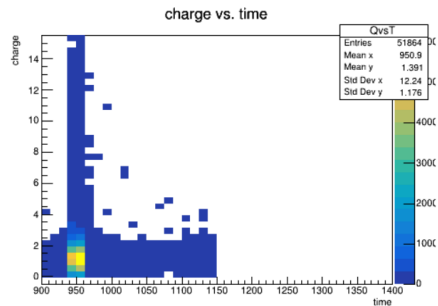
coverage 7.5% #448 PMT



Input gamma energy : 40MeV

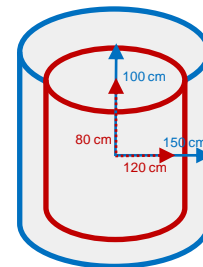


Input gamma energy : 2.2MeV

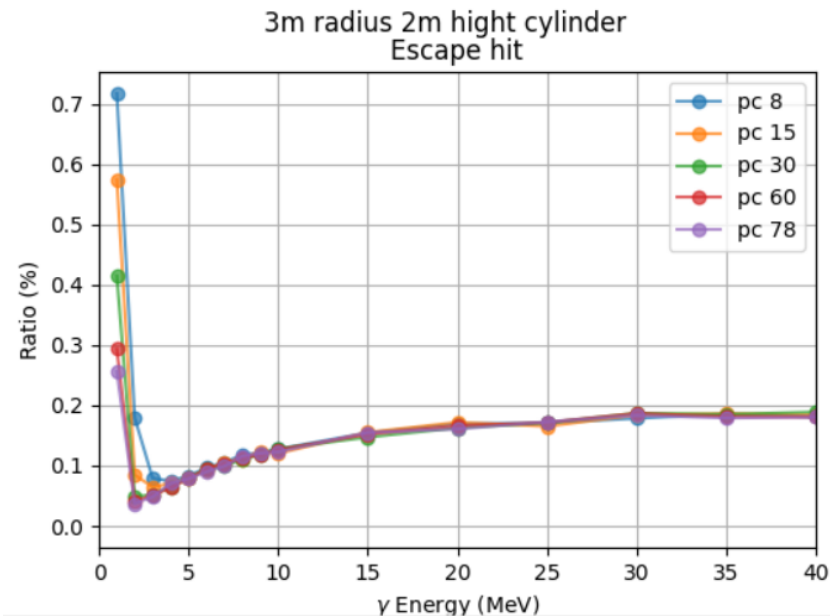
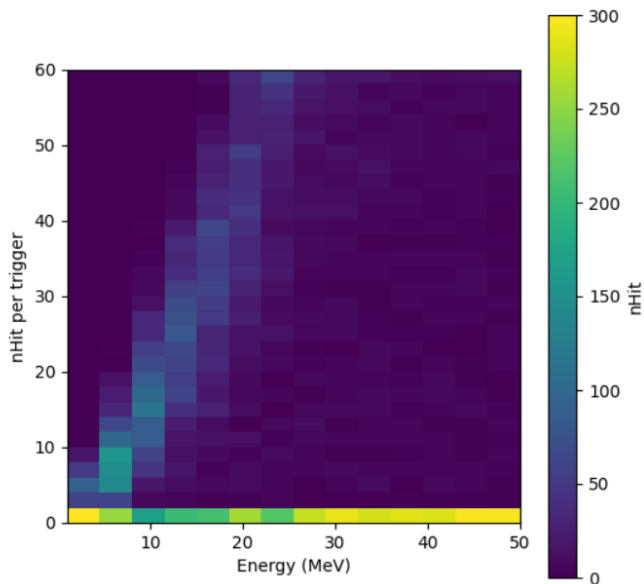


WCSim Simulation

(P.S with fiducial volume cut [radius -30cm, height -20cm])



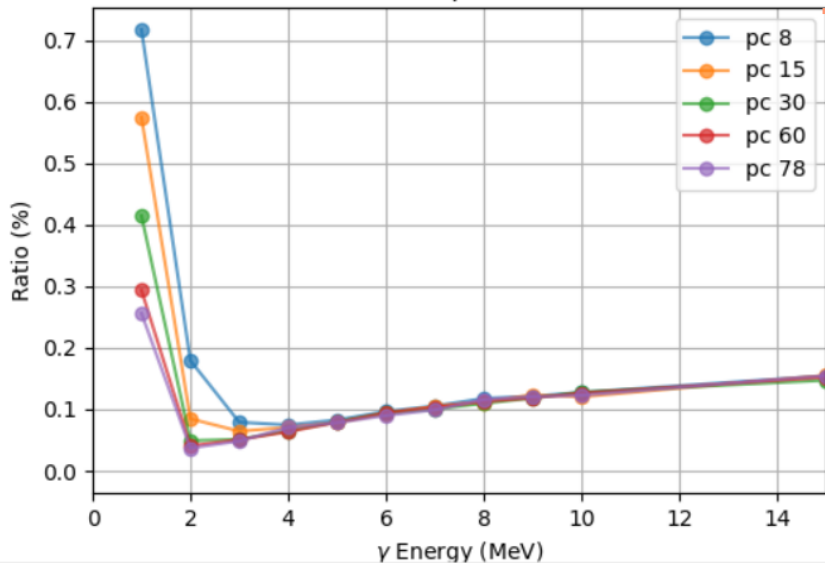
Escape photon increase with energy increase



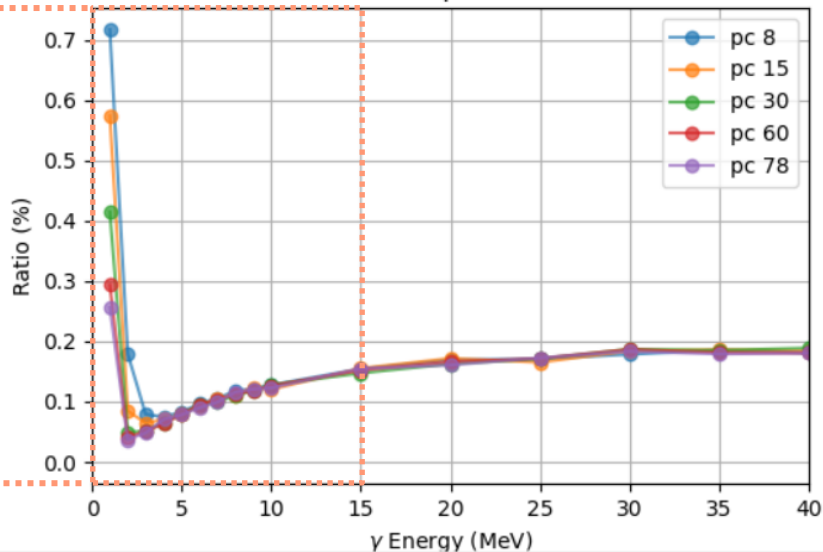
WCSim Simulation

Escape photon increase with energy increase

3m radius 2m high cylinder
Escape hit

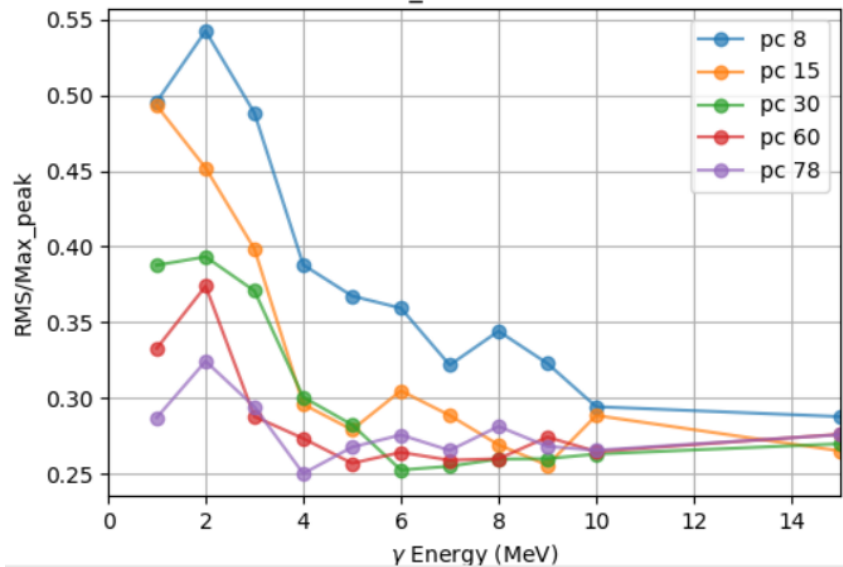


3m radius 2m high cylinder
Escape hit

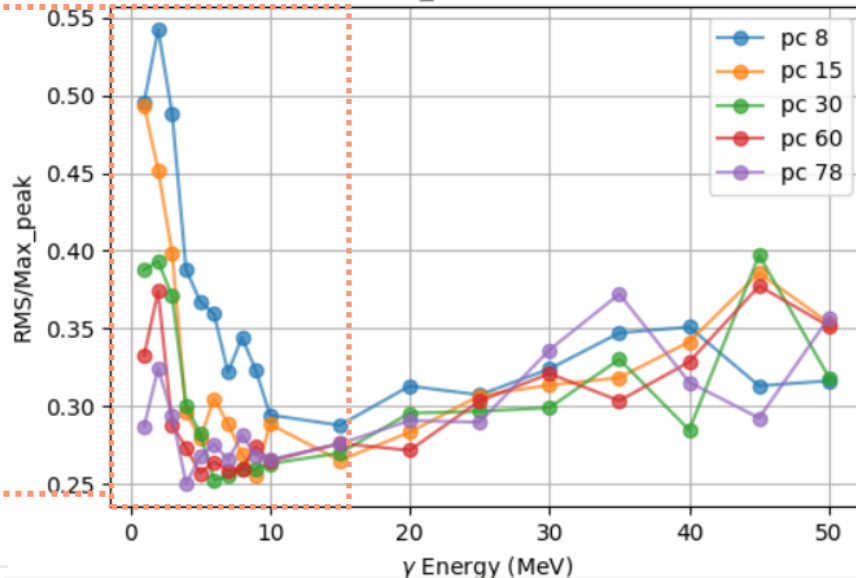


Energy resolution : RMS / nHit Peak

3m radius 2m high cylinder
E_resolution

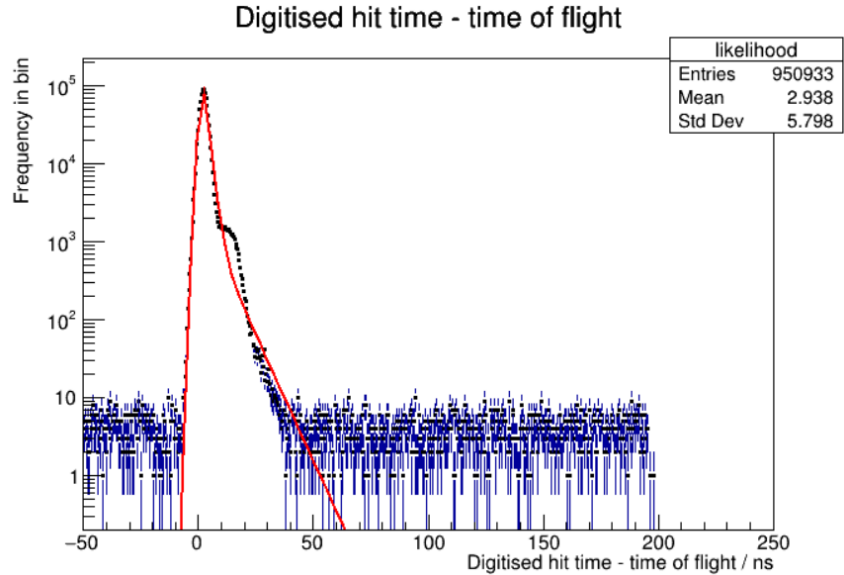
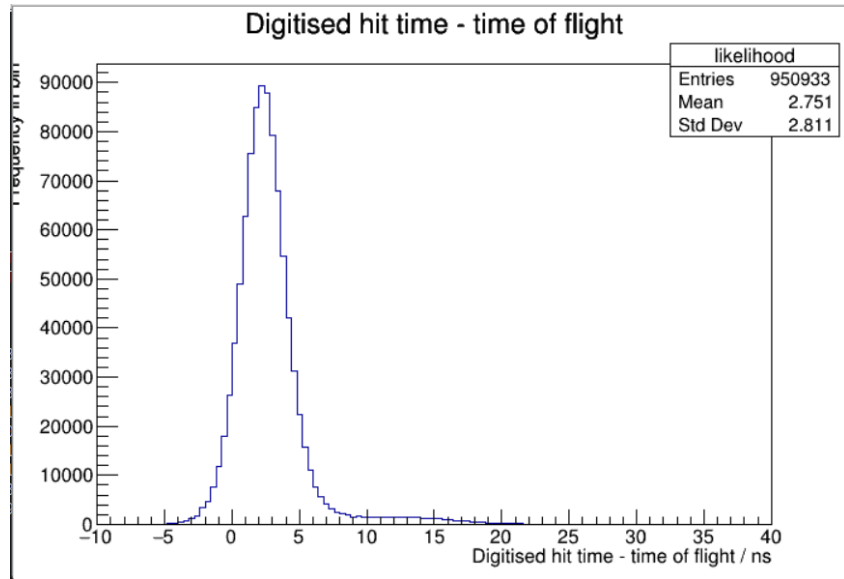


3m radius 2m high cylinder
E_resolution



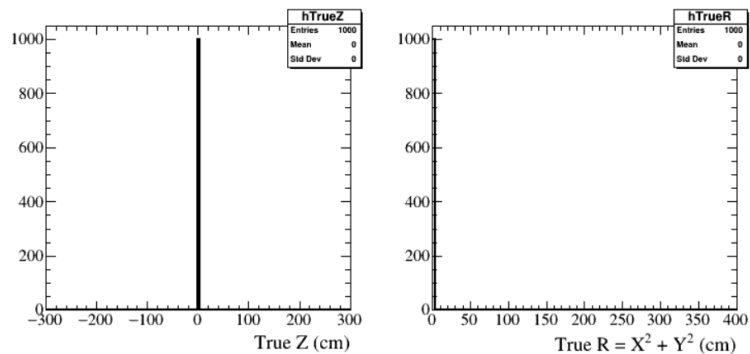
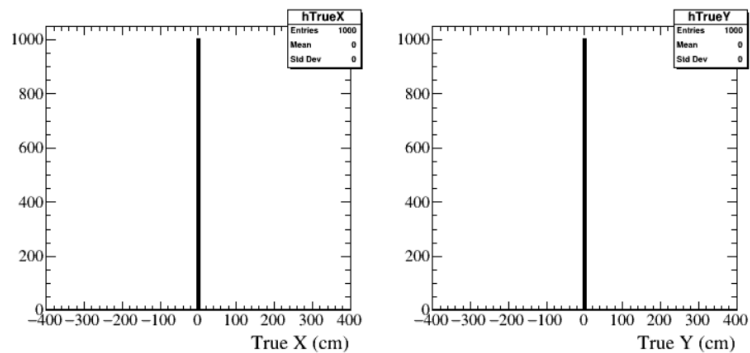
Vertex Reconstruction, WCSim, Bonsai

Create T-TOF PDF for the 3m x 2m detector (pc: 78%)

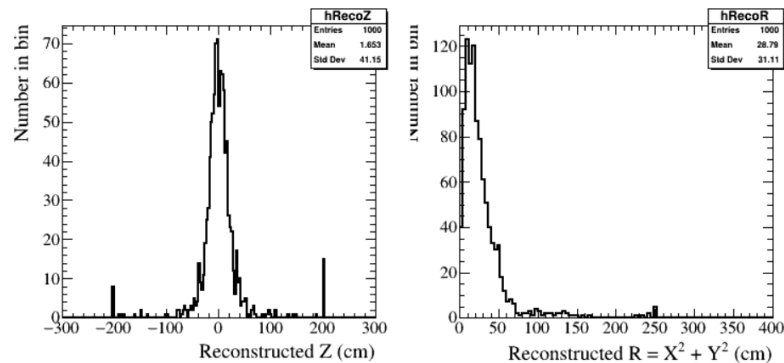
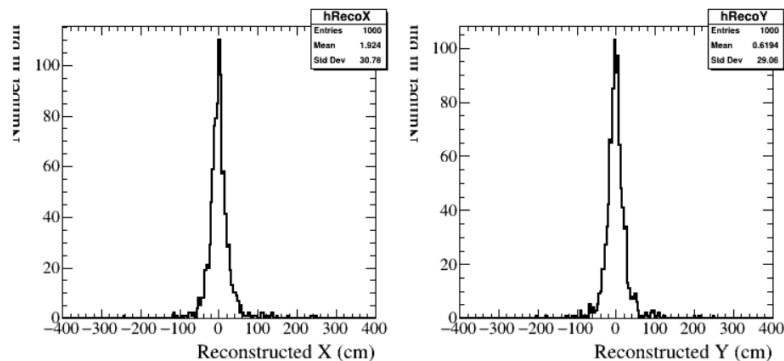


WCSim, Bonsai, e⁻ 10 MeV , Position (0, 0, 0), Direction: Uniform

MC Truth



Reconstructed

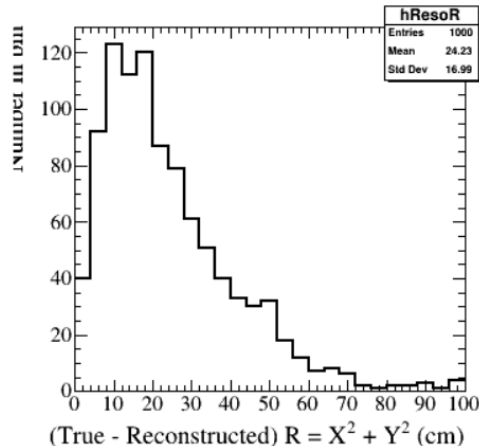
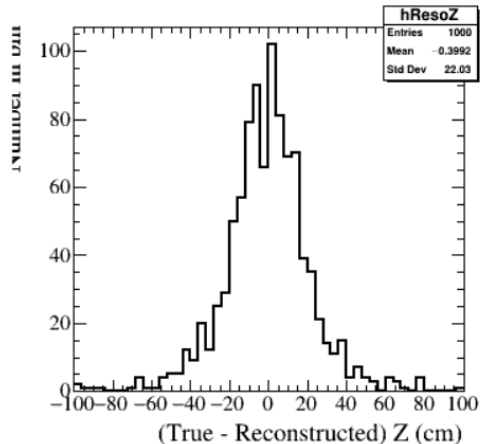
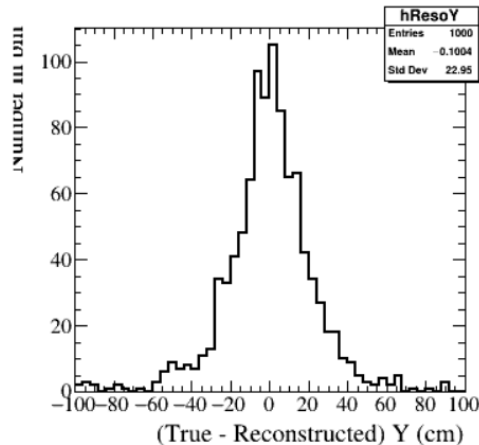
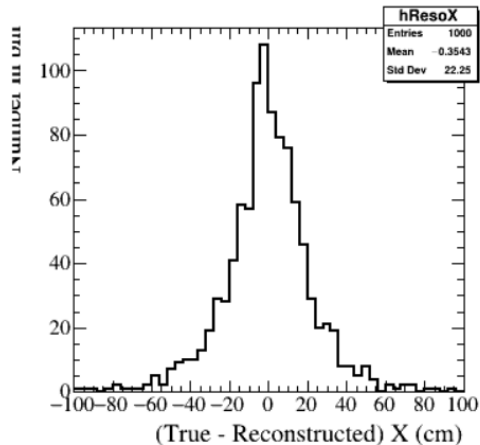


Vertex Fit, WCSim, Bonsai

(Reconstructed - MC Truth) =>

PC: 78%

#PMT: 5000

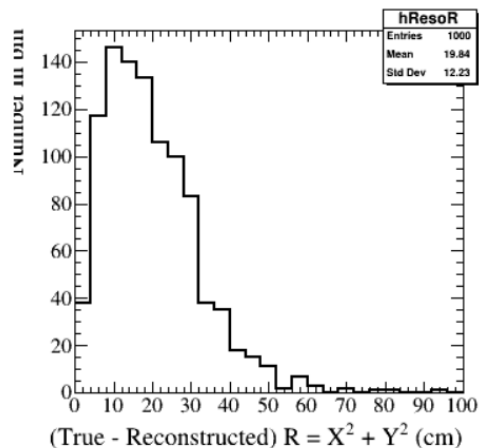
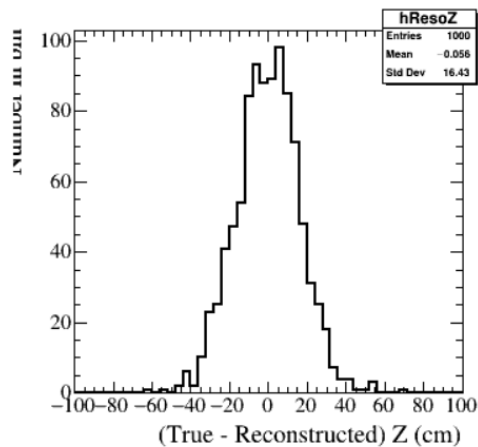
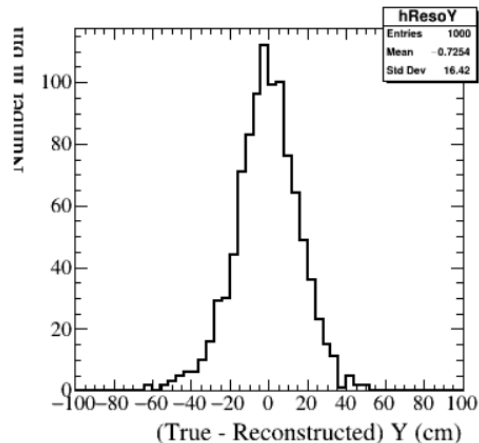
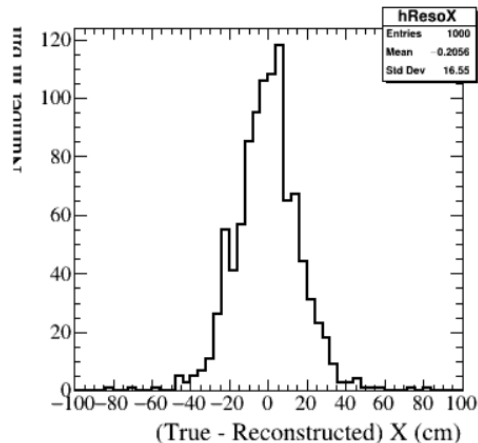


Vertex Fit, WCSim, Bonsai

(Reconstructed - MC Truth) =>

PC: 60%

#PMT: 4000

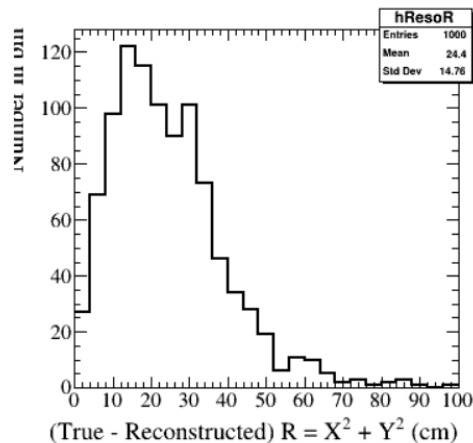
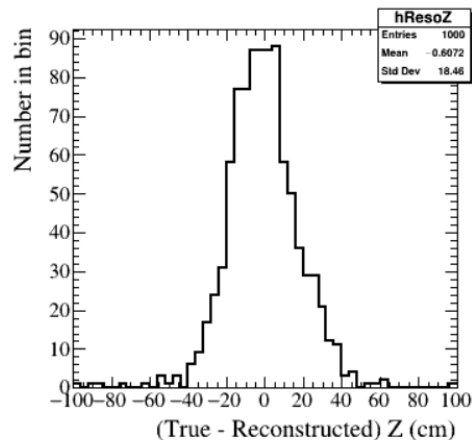
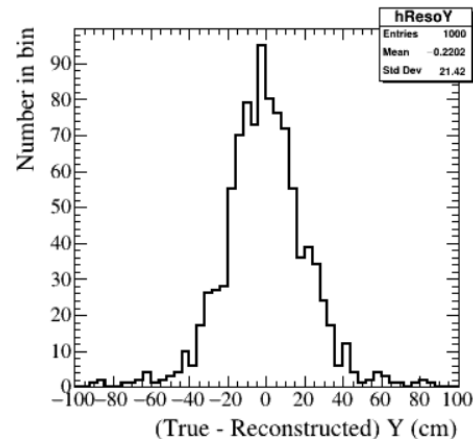
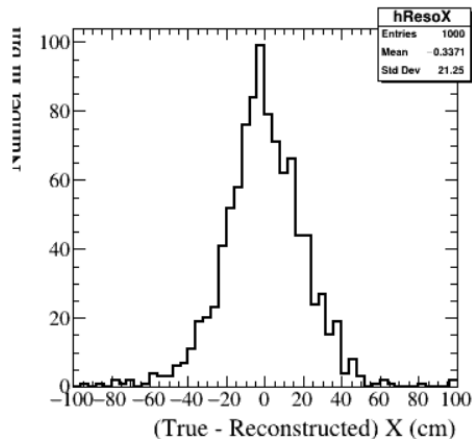


Vertex Fit, WCSim, Bonsai

(Reconstructed - MC Truth) =>

PC: 30%

#PMT: 2000

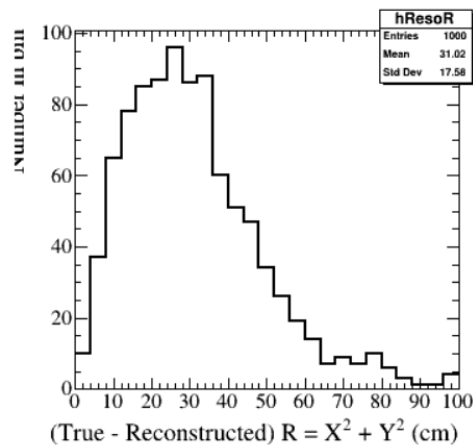
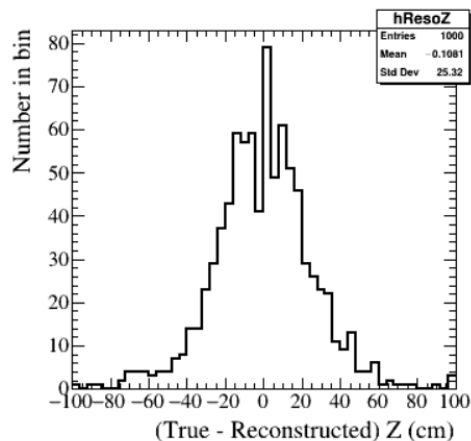
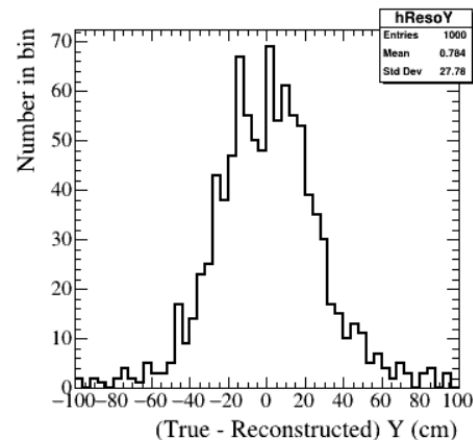
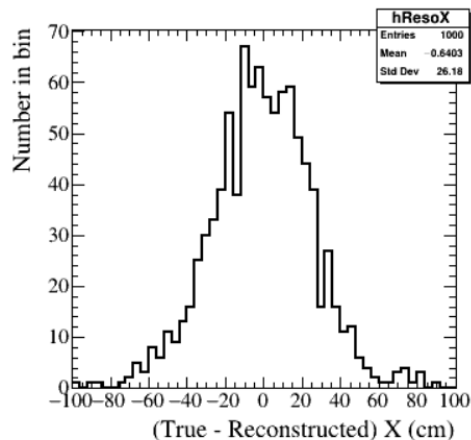


Vertex Fit, WCSim, Bonsai

(Reconstructed - MC Truth) =>

PC: 15%

#PMT: 1000

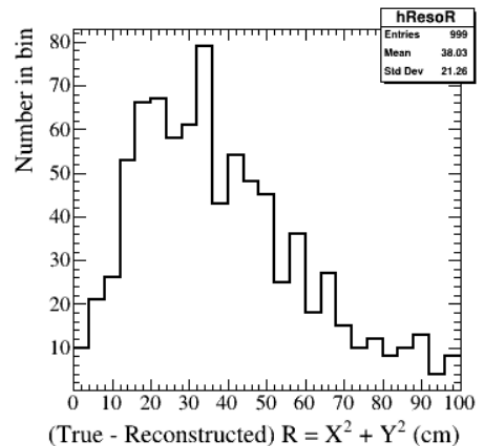
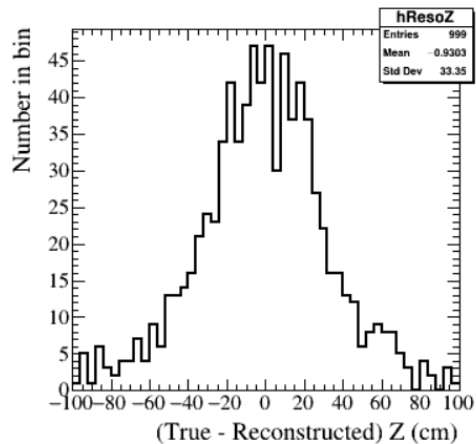
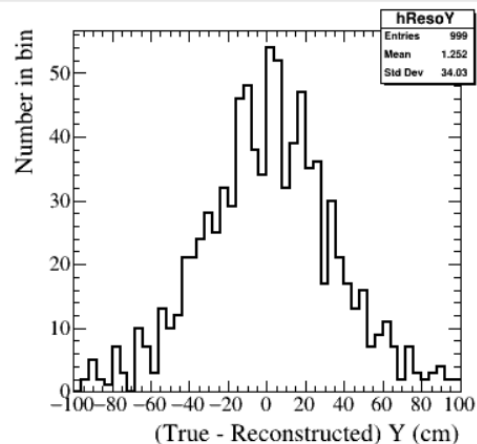
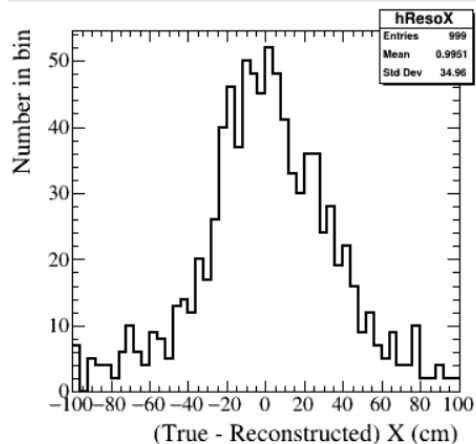


Vertex Fit, WCSim, Bonsai

(Reconstructed - MC Truth) =>

PC: 7.8%

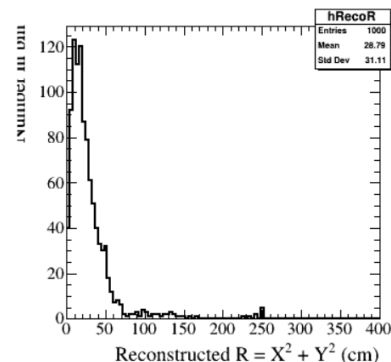
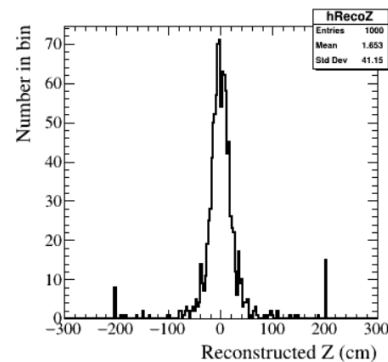
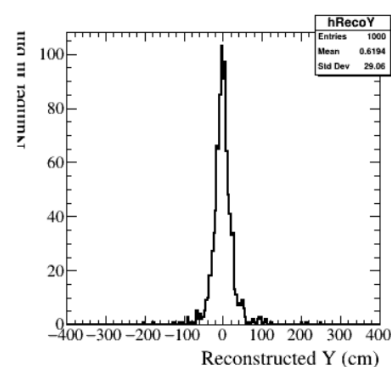
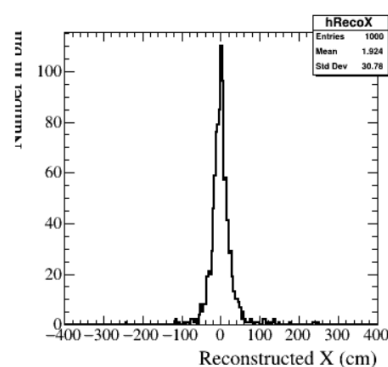
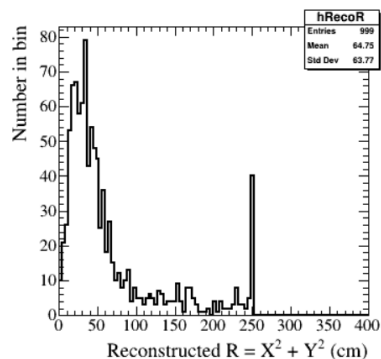
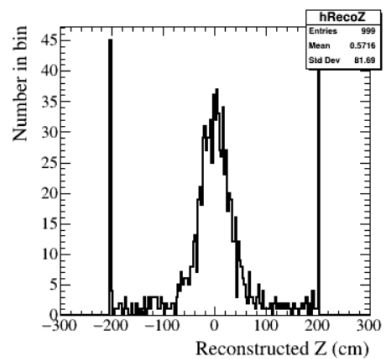
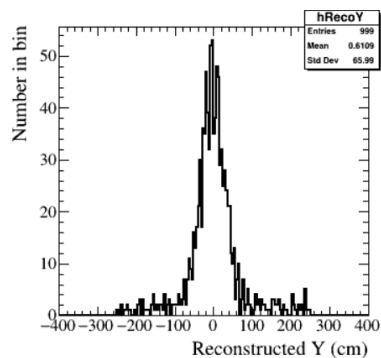
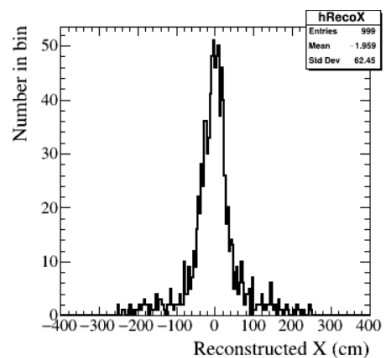
#PMT: 500



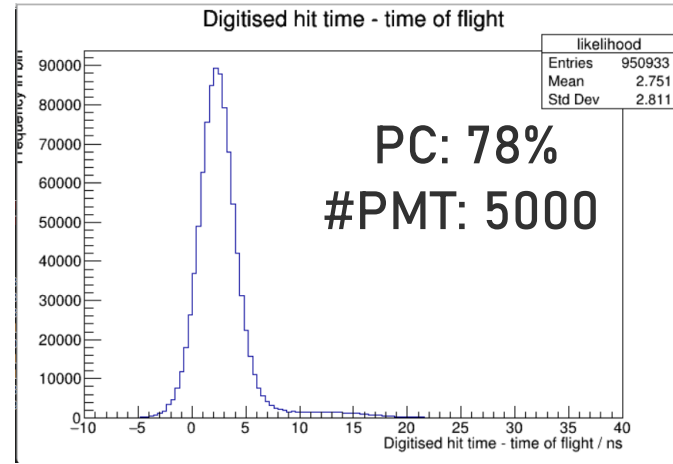
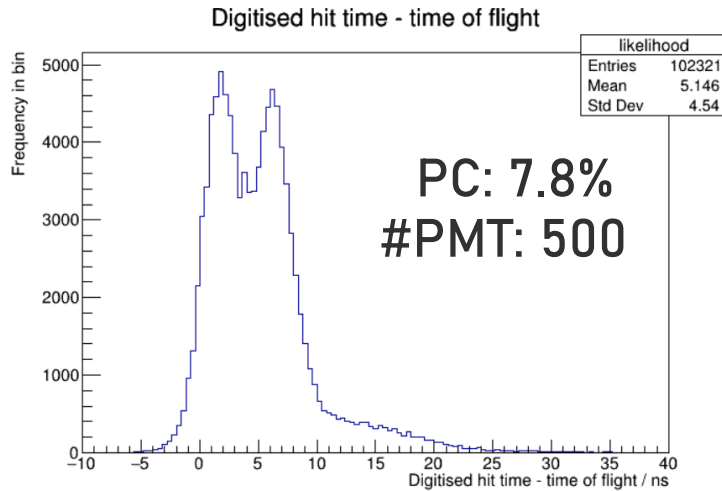
Reconstruction

PC: 7.8%
#PMT: 500

PC: 78%
#PMT: 5000



PDF



Known issues

1. T-TOF distribution generated by WCSim can have a peak at non-0 value. The discrepancy from 0 ns is small as ~ 0.7 ns. In current tuning, this is ignored. Though, this may affect to reconstruction.

Looking at the code, hit time is defined by the time hitting the glass surface (`WCSimConstructPMT.cc`). But to calculate T-TOF, the geometry we use is the the PMT position on the detector wall. (In SK case, we consider the time difference between hit time on the glass surface and real signal output.) This will result the peak at non-0. This effect may be taken into account, for better vertex reconstruction.

2. We have another tuning file, `$BONSAIDIR/data/fit_param.dat`
 - There's some parameters to tune, but currently we're using same set up as SK.