Klong_hits9a

November 23, 2024

1 Klong beam simulation: GlueX detector hits, take 9 (planar beam pipe shielding)

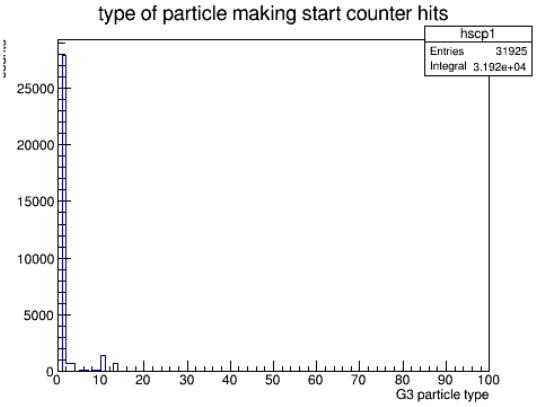
In previous studies of the Klong beam simulation, the focus was on the flux of particles of different kinds at the entry to the GlueX detector. Initial results showed that the principal background components are

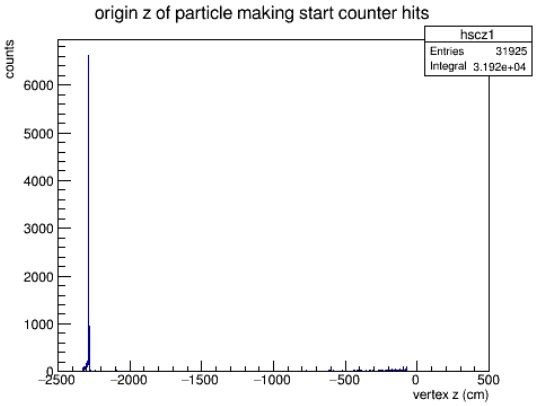
1. soft gammas with 1-10 MeV energy, half inside the beam pipe and the other half spread out over an area including the innermost rings of the CDC;
2. low-energy neutrons with a peak energy around 1 MeV, with exponentially dropping flux all the way up to ~1 GeV;

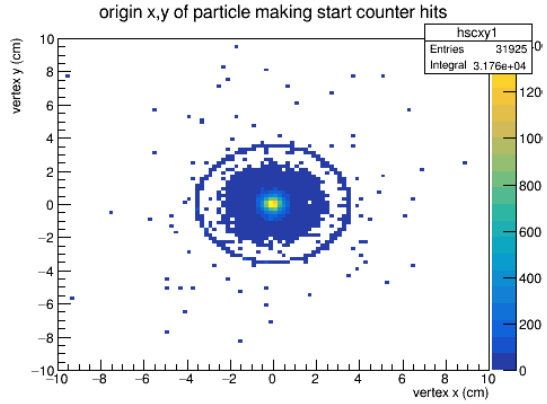
One of the big unanswered questions that came up during the KLF Readiness Review in August, 2024 was what impact these backgrounds will have on our ability to trigger on the desired klong reactions in the presence of the background, and how the reconstruction of these reactions will be impacted by extra hits in the detector coming from background particles.

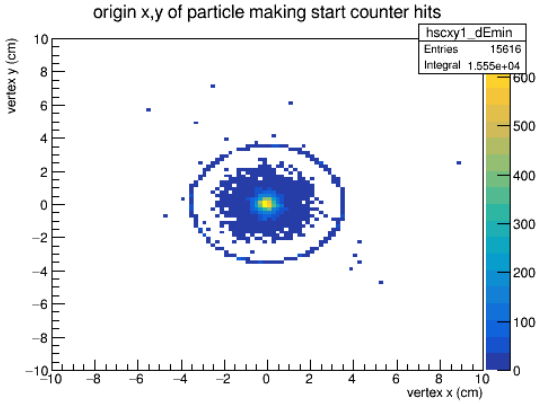
This is a nineth simulation of the KLF beam in Hall D, with the same statistics as the first. The only change from take 8 is that instead of the iron shielding tube wrapped around the beam pipe starting 2m downstream from the pair spectrometer and ending 3m upstream of the entrance to the GlueX detector, a rectangular lead wall is placed 3m upstream of the entrance to the GlueX detector. The lead wall is rectangular 1.4m x 1.4m and 10cm thick, with a 8cm x 8cm square hole in the middle for the beam pipe. The gap between the round beam pipe and the square hole is blocked by a lead donut of thickness 20cm that wraps tightly around the beam pipe and extends out to 15cm radius. Everything else about the simulation is unchanged from take 8.

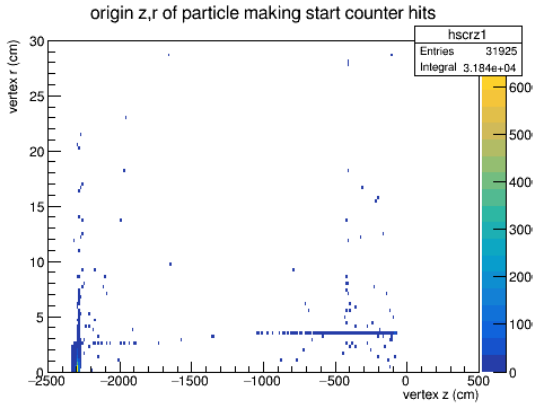
1.1 Plots of origin vertex positions of particles that produce hits in the GlueX detectors

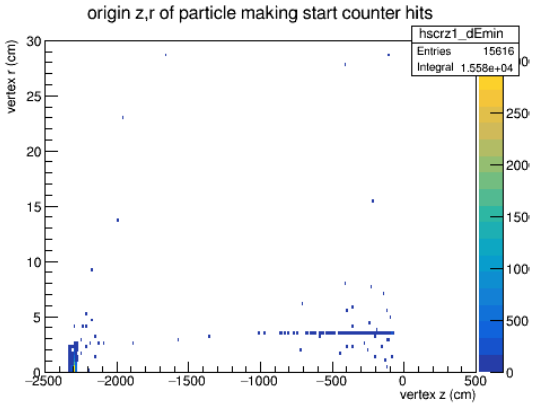


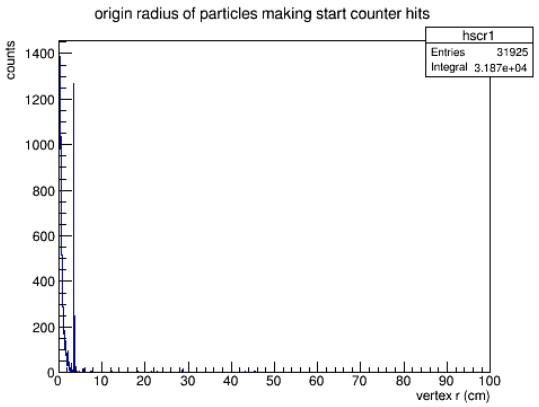


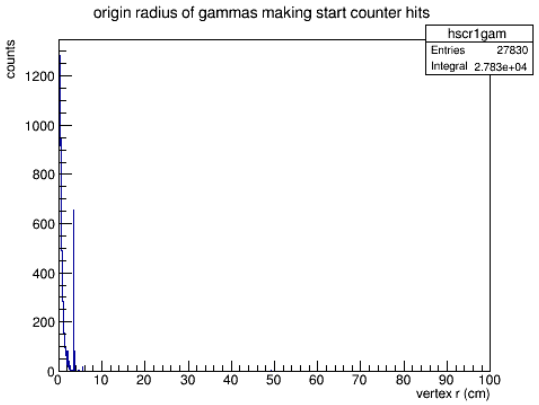


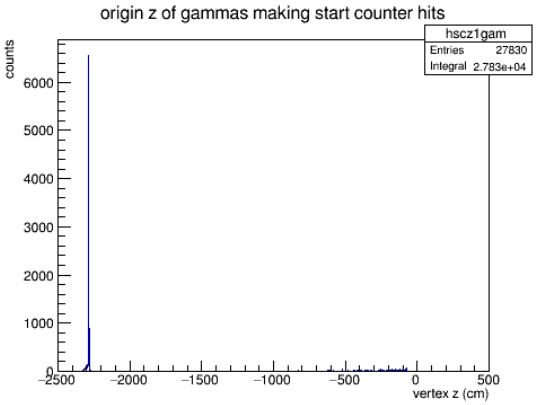


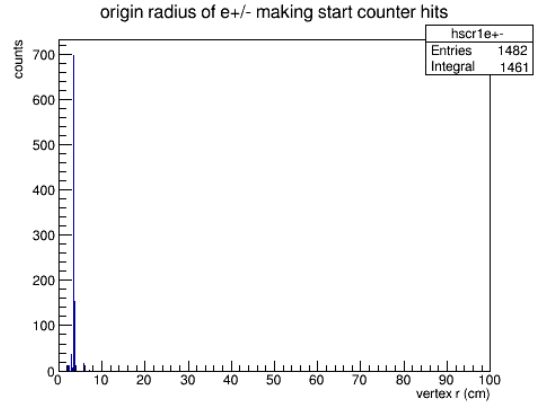


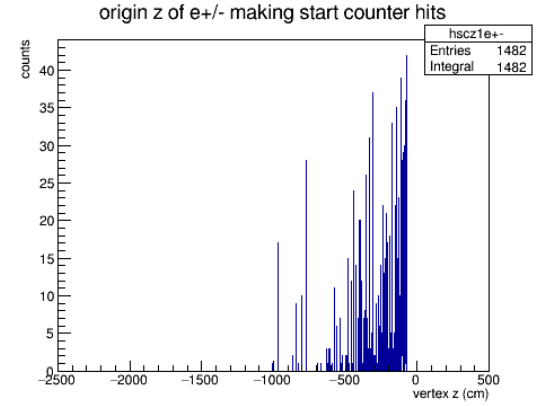


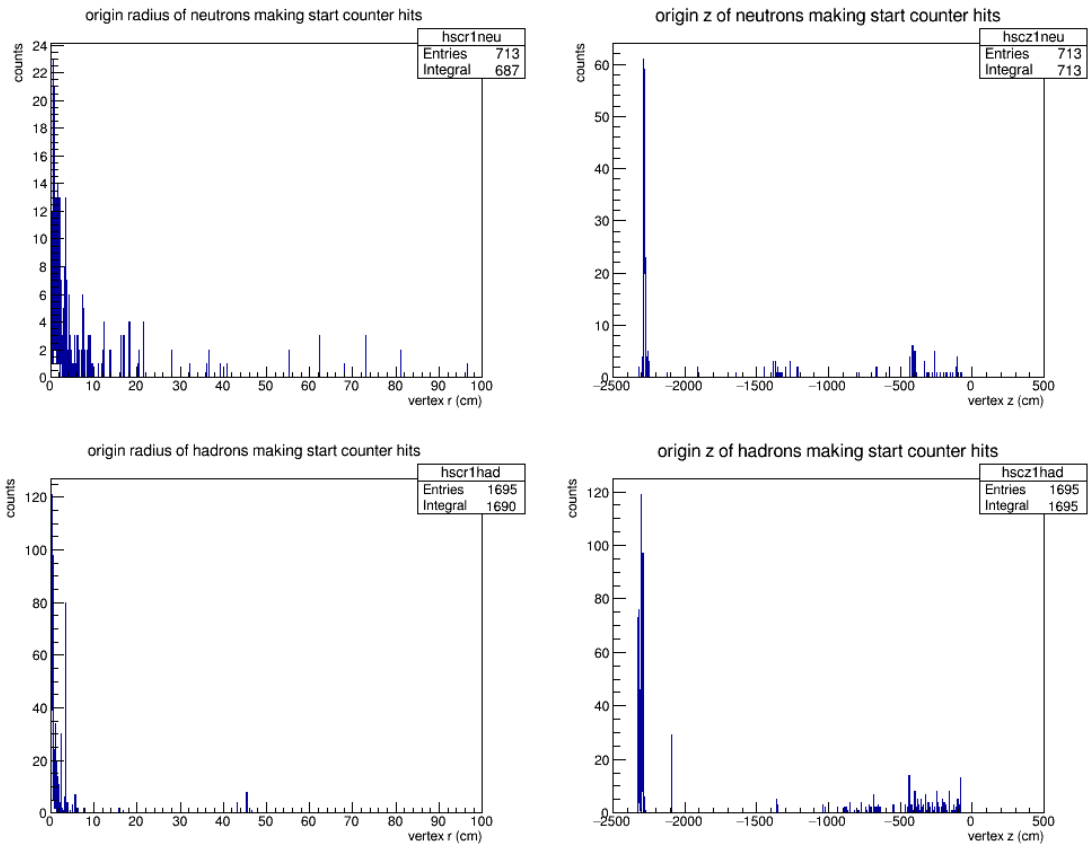

origin radius of particles making start counter hits
hscr1
Entries 31925
Integral 3.187e+04
counts
vertex r (cm)


origin radius of gammas making start counter hits
hscr1gam
Entries 27830
Integral 2.783e+04
counts
vertex r (cm)


origin z of gammas making start counter hits
hscz1gam
Entries 27830
Integral 2.783e+04
counts
vertex z (cm)


origin radius of e+/- making start counter hits
hscr1e+-
Entries 1482
Integral 1461
counts
vertex r (cm)


origin z of e+/- making start counter hits
hscz1e+-
Entries 1482
Integral 1482
counts
vertex z (cm)



1.2 Find the maximum radius of the background sources

Follow the chain of interactions all the way from the incident beam photon at the KPT target down to the interaction in the start counter, and find the maximum distance from the beam axis that is probed by the particle chain. This can tell us where adding shielding around the beam line might have an effect on the background rate, and where it cannot.

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total fraction beyond 4cm is 0.00822
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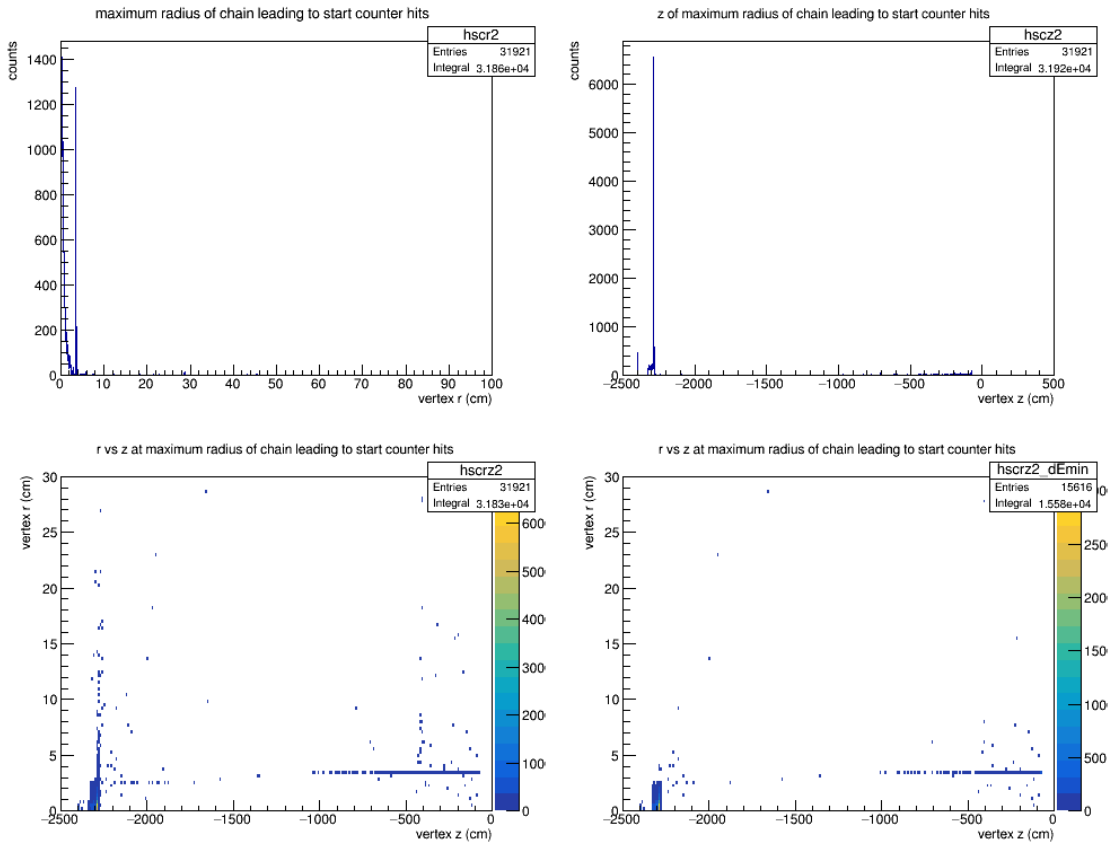
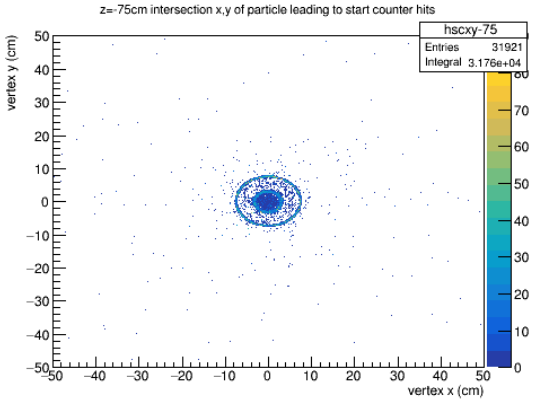
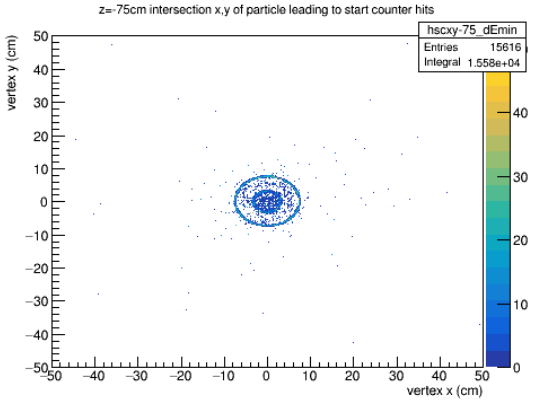
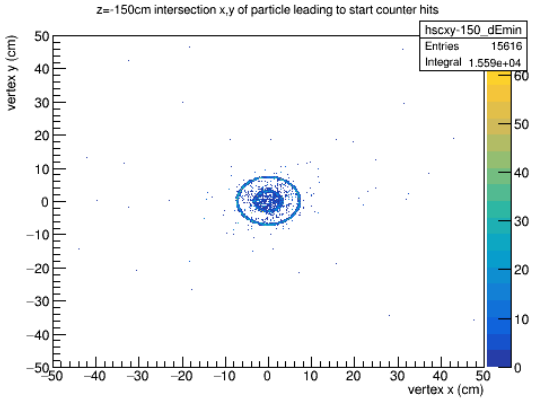


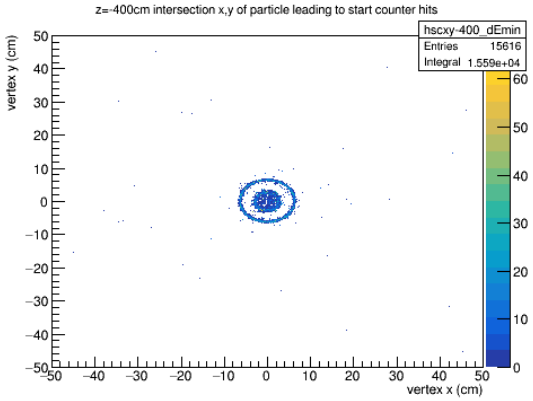
1.3 Find the intersection of the background trace at the entrance to the target

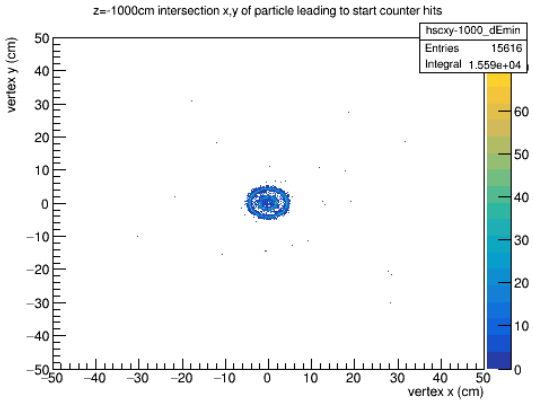
Just upstream of the liquid hydrogen target assembly there is a virtual detector plane denoted DET5 in the beamline geometry. It is shown in the above plots by a wall-to-wall and ceiling-to-floor plane in the above projection plots, located at z = -75cm. Look at the transverse distribution of the intersection of whatever particle produces a hit in the start counter, either by interacting in the start counter itself later on after passing through DET5, or by producing secdondaries that eventually generate a hit in the start counter.

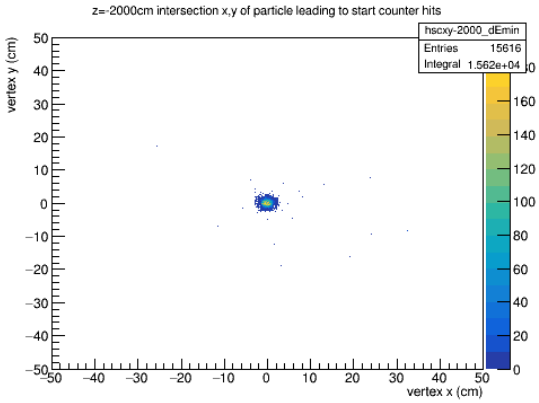

z=-75cm intersection x,y of particle leading to start counter hits
hscxy-75
Entries 31921
Integral 3.176e+04
vertex y (cm)
vertex x (cm)

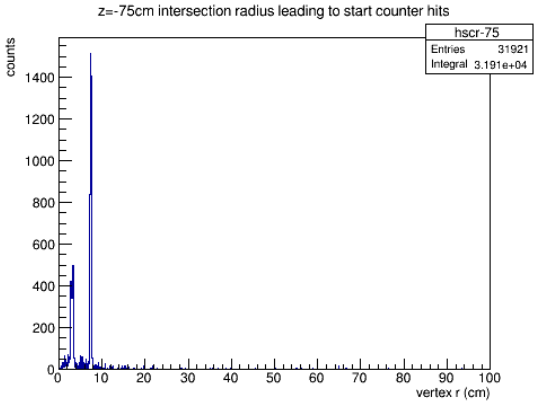

z=-75cm intersection x,y of particle leading to start counter hits
hscxy-75_dEmin
Entries 15616
Integral 1.558e+04
vertex y (cm)
vertex x (cm)

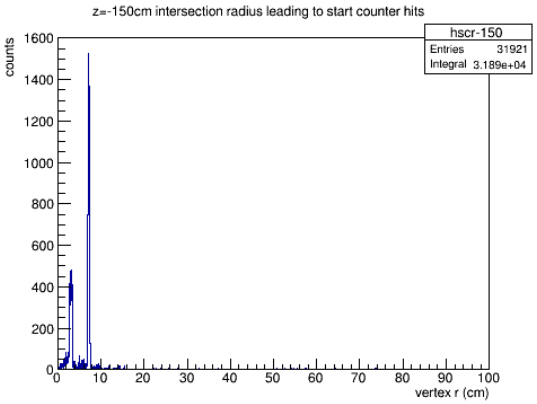

z=-150cm intersection x,y of particle leading to start counter hits
hscxy-150_dEmin
Entries 15616
Integral 1.559e+04
vertex y (cm)
vertex x (cm)

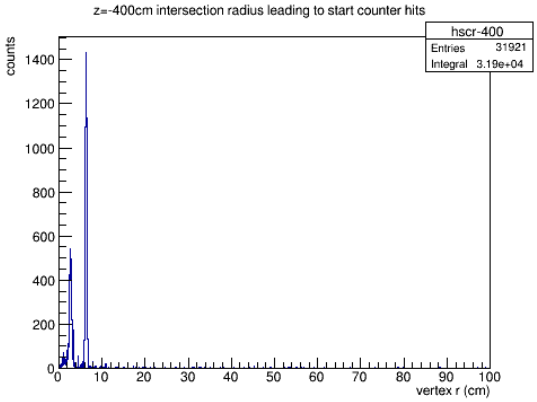

z=-400cm intersection x,y of particle leading to start counter hits
hscxy-400_dEmin
Entries 15616
Integral 1.559e+04
vertex y (cm)
vertex x (cm)

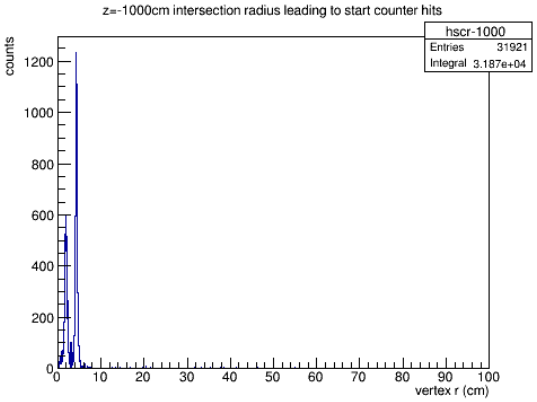

z=-1000cm intersection x,y of particle leading to start counter hits
hscxy-1000_dEmin
Entries 15616
Integral 1.559e+04
vertex y (cm)
vertex x (cm)

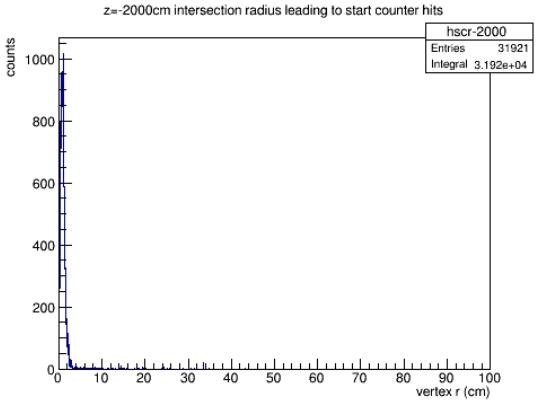

z=-2000cm intersection x,y of particle leading to start counter hits
hscxy-2000_dEmin
Entries 15616
Integral 1.562e+04
vertex y (cm)
vertex x (cm)


z=-75cm intersection radius leading to start counter hits
hscr-75
Entries 31921
Integral 3.191e+04
counts
vertex r (cm)

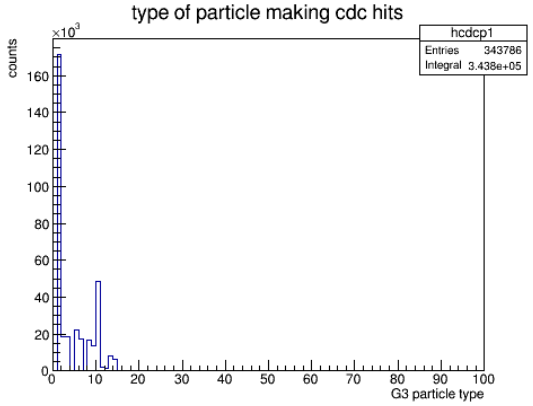

z=-150cm intersection radius leading to start counter hits
hscr-150
Entries 31921
Integral 3.189e+04
counts
vertex r (cm)

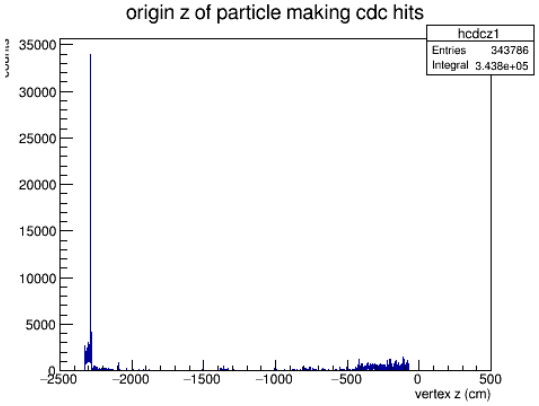

z=-400cm intersection radius leading to start counter hits
hscr-400
Entries 31921
Integral 3.19e+04
counts
vertex r (cm)

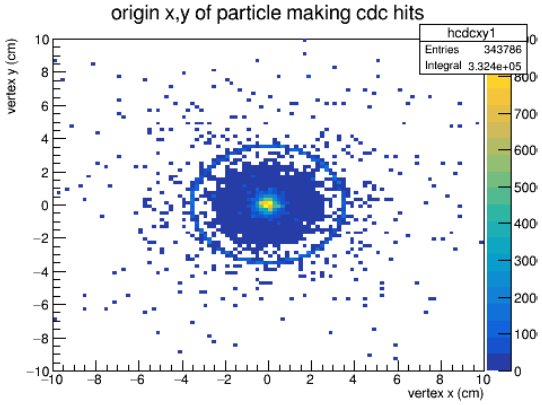

z=-1000cm intersection radius leading to start counter hits
hscr-1000
Entries 31921
Integral 3.187e+04
counts
vertex r (cm)

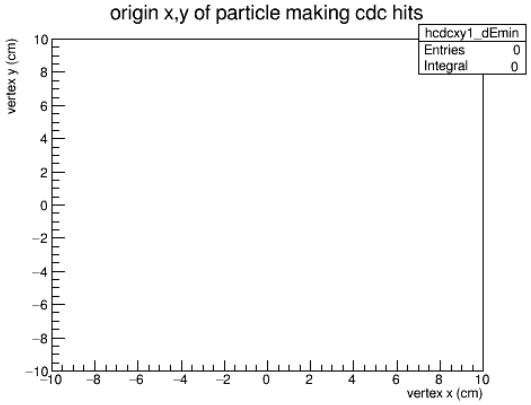

z=-2000cm intersection radius leading to start counter hits
hscr-2000
Entries 31921
Integral 3.192e+04
counts
vertex r (cm)

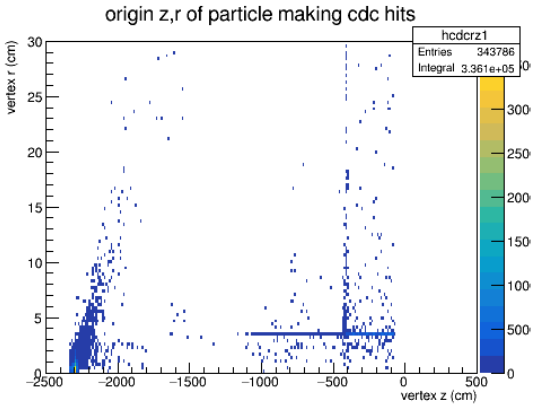
1.4 Repeat all of the same plots for the CDC

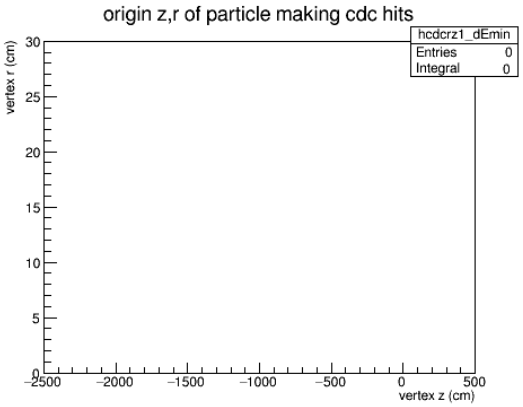


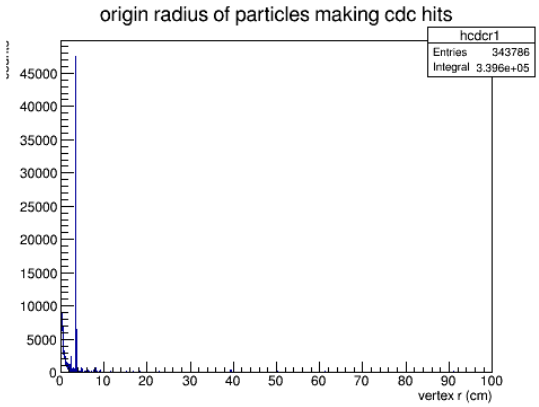


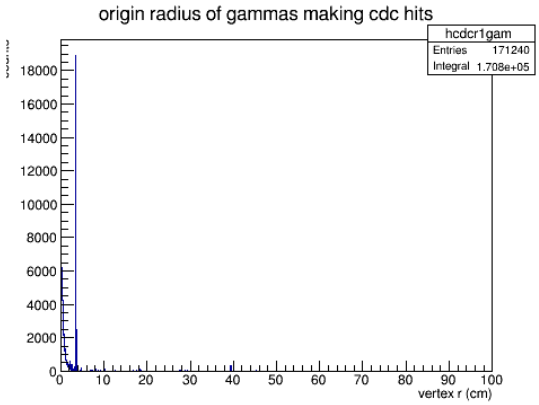


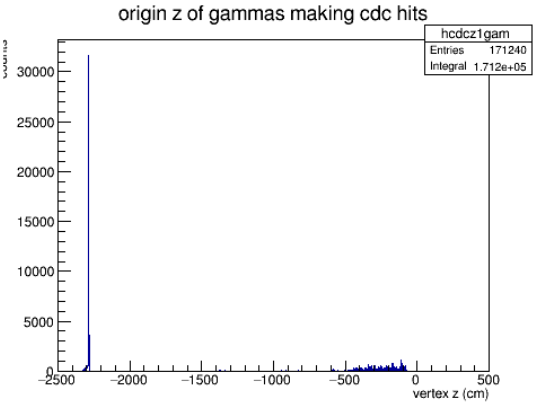


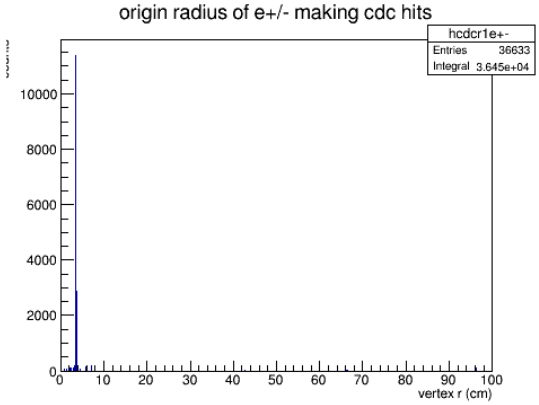


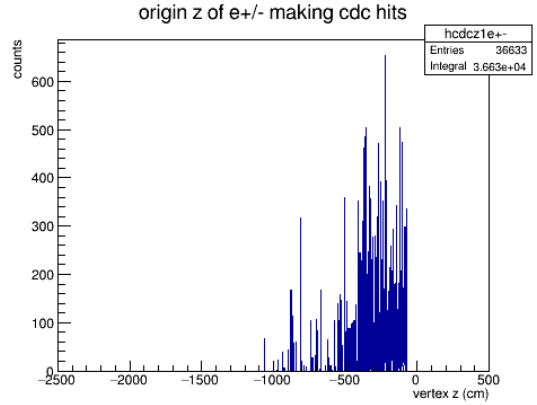


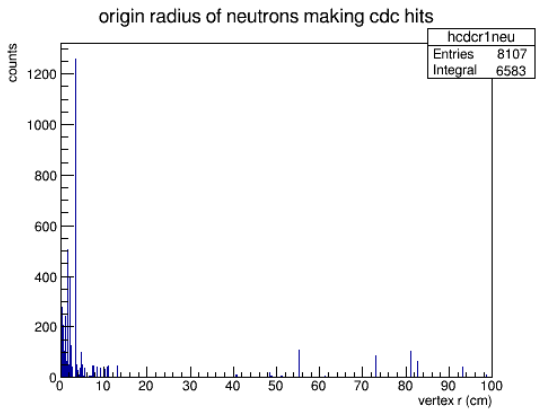

origin radius of particles making cdc hits
hcdcr1
Entries 343786
Integral 3.396e+05
vertex r (cm)

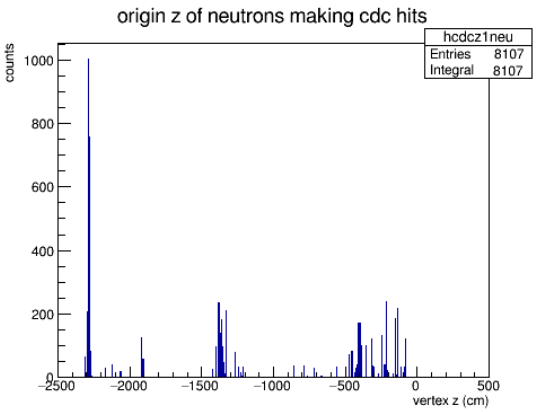

origin radius of gammas making cdc hits
hcdcr1gam
Entries 171240
Integral 1.708e+05
vertex r (cm)

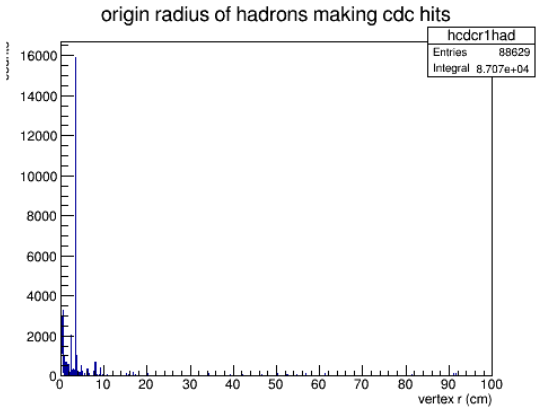

origin z of gammas making cdc hits
hcdcz1gam
Entries 171240
Integral 1.712e+05
vertex z (cm)

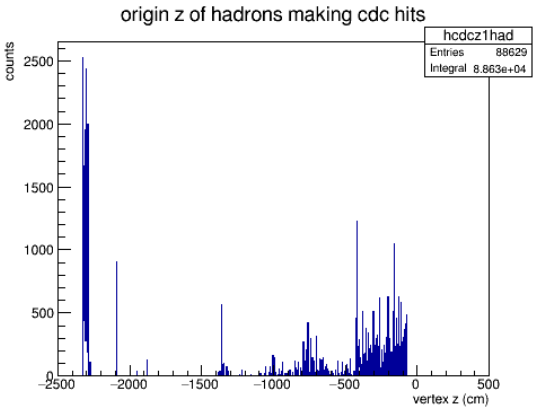

origin radius of e+/- making cdc hits
hcdcr1e+-
Entries 36633
Integral 3.645e+04
vertex r (cm)


origin z of e+/- making cdc hits
hcdcz1e+-
Entries 36633
Integral 3.663e+04
counts
vertex z (cm)










```
total fraction beyond 4cm is 0.0553
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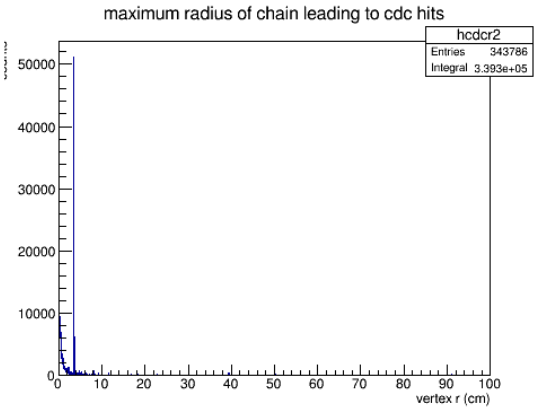
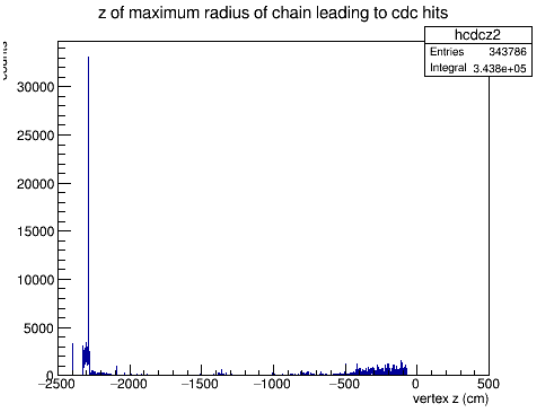
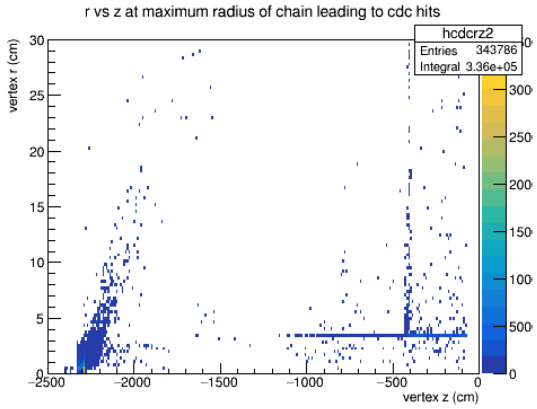
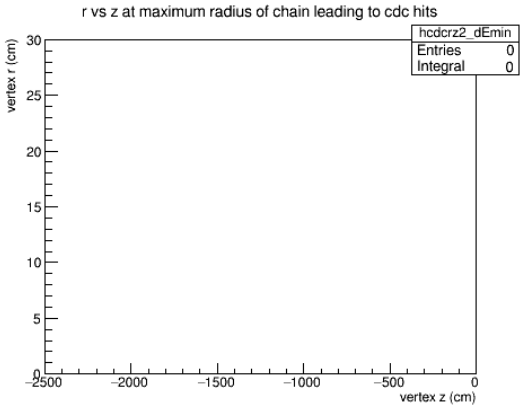
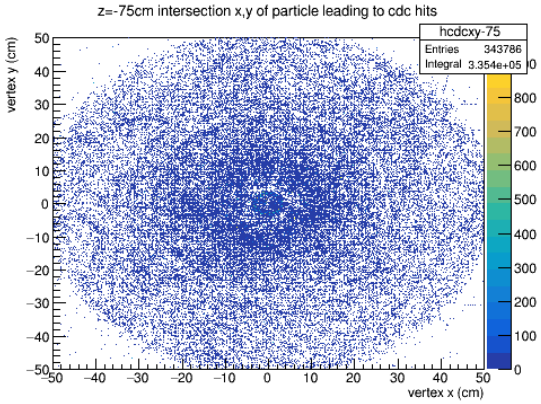
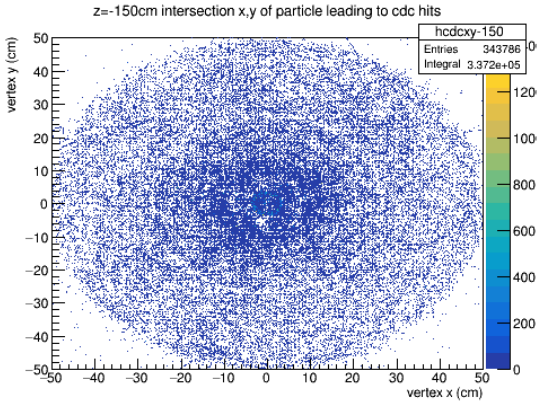

maximum radius of chain leading to cdc hits
hcdcr2
Entries 343786
Integral 3.393e+05
vertex r (cm)

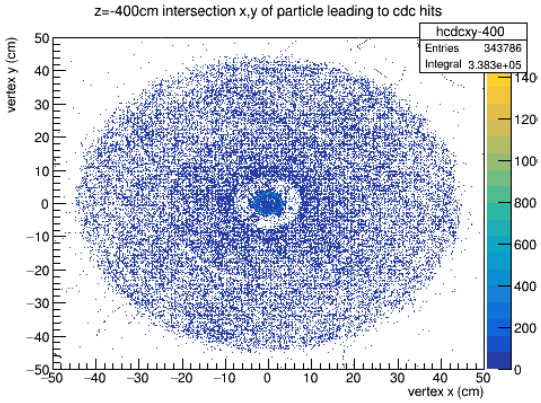

z of maximum radius of chain leading to cdc hits
hcdcz2
Entries 343786
Integral 3.438e+05
vertex z (cm)

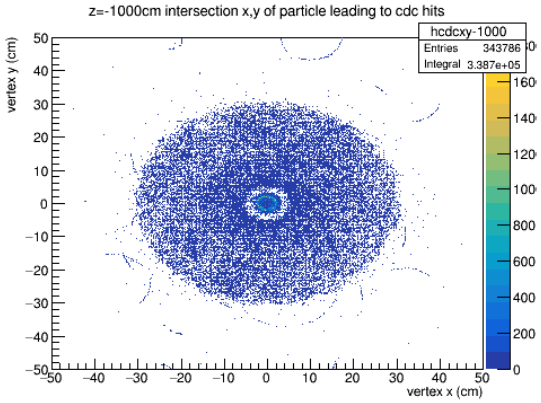

r vs z at maximum radius of chain leading to cdc hits
hcdcrz2
Entries 343786
Integral 3.36e+05
vertex r (cm)
vertex z (cm)

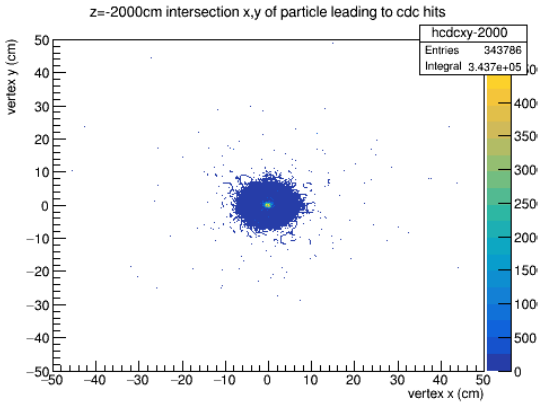

r vs z at maximum radius of chain leading to cdc hits
hcdcrz2_dEmin
Entries 0
Integral 0
vertex r (cm)
vertex z (cm)

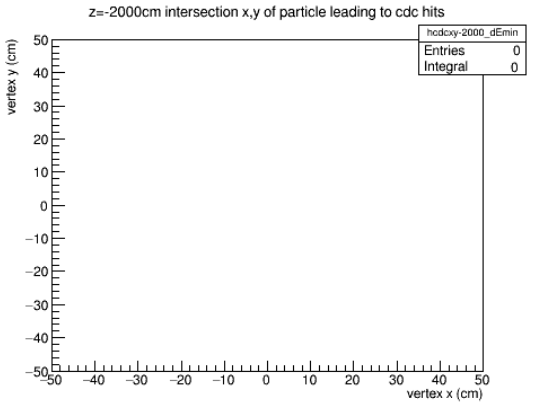

z=-75cm intersection x,y of particle leading to cdc hits
hcdcxy-75
Entries 343786
Integral 3.354e+05
vertex y (cm)
vertex x (cm)

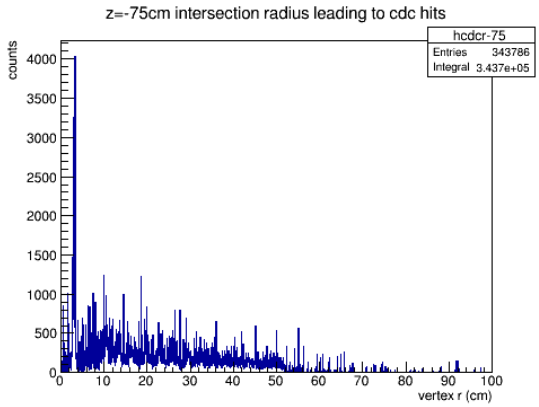

z=-150cm intersection x,y of particle leading to cdc hits
hcdcxy-150
Entries 343786
Integral 3.372e+05
vertex y (cm)
vertex x (cm)

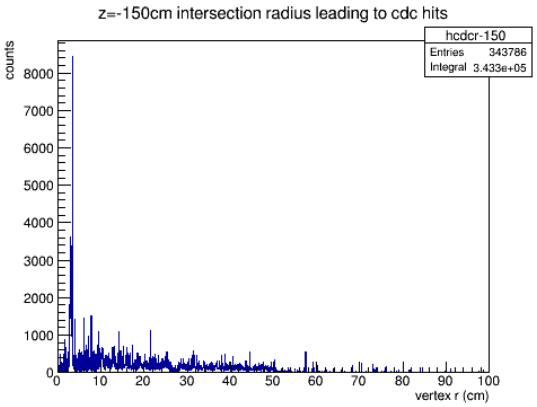

z=-400cm intersection x,y of particle leading to cdc hits
hcdcxy-400
Entries 343786
Integral 3.383e+05
vertex y (cm)
vertex x (cm)

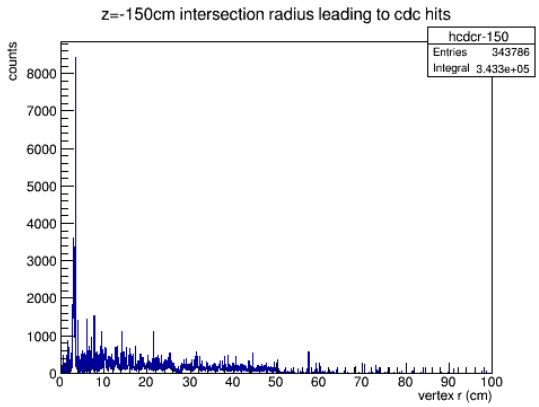

z=-1000cm intersection x,y of particle leading to cdc hits
hcdcxy-1000
Entries 343786
Integral 3.387e+05
vertex y (cm)
vertex x (cm)

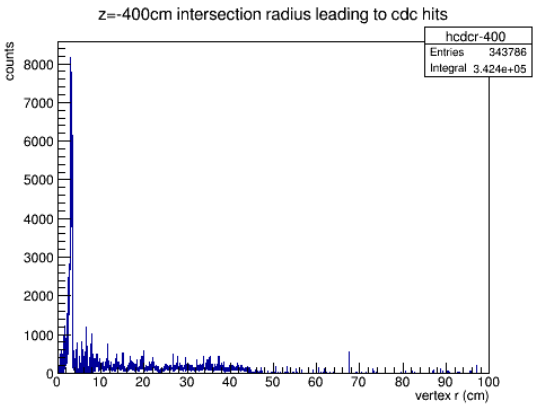

z=-2000cm intersection x,y of particle leading to cdc hits
hcdcxy-2000
Entries 343786
Integral 3.437e+05
vertex y (cm)
vertex x (cm)

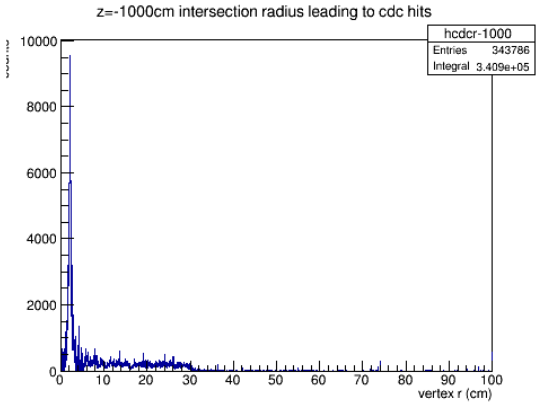

z=-2000cm intersection x,y of particle leading to cdc hits
hcdcxy-2000_dEmin
Entries 0
Integral 0
vertex y (cm)
vertex x (cm)

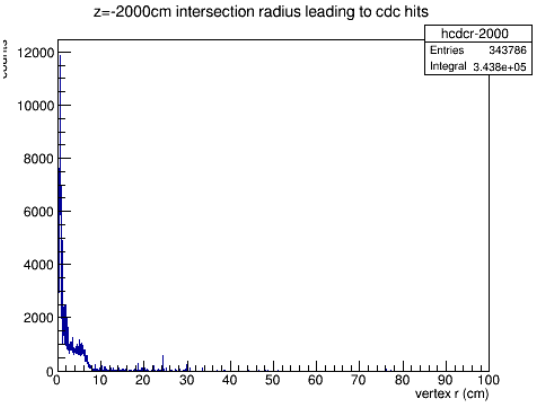

z=-75cm intersection radius leading to cdc hits
hcdcr-75
Entries 343786
Integral 3.437e+05
counts
vertex r (cm)

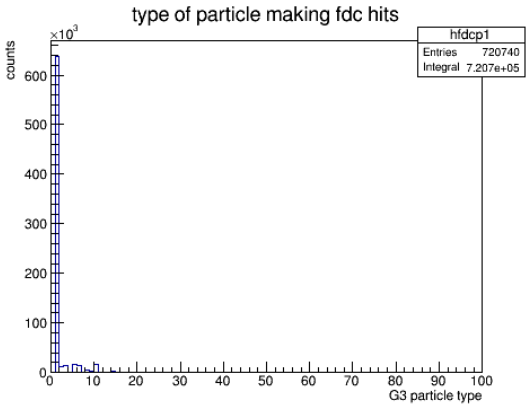

z=-150cm intersection radius leading to cdc hits
hcdcr-150
Entries 343786
Integral 3.433e+05
counts
vertex r (cm)

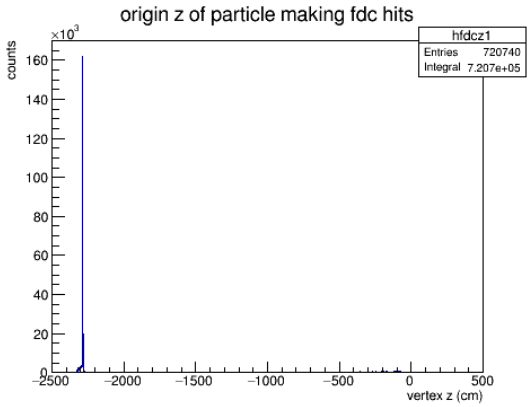

z=-150cm intersection radius leading to cdc hits
hcdcr-150
Entries 343786
Integral 3.433e+05
counts
vertex r (cm)

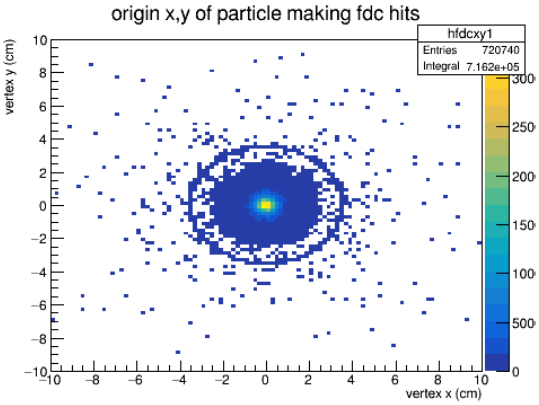

z=-400cm intersection radius leading to cdc hits
hcdcr-400
Entries 343786
Integral 3.424e+05
counts
vertex r (cm)

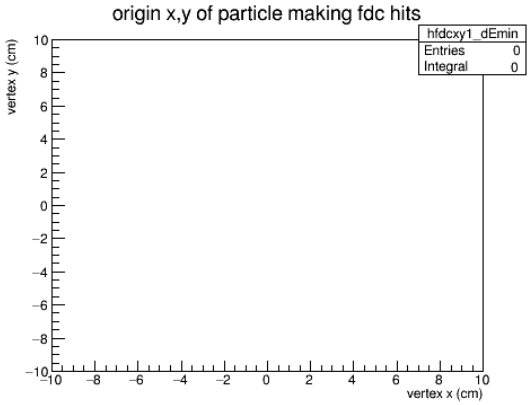

z=-1000cm intersection radius leading to cdc hits
hcdcr-1000
Entries 343786
Integral 3.409e+05
vertex r (cm)

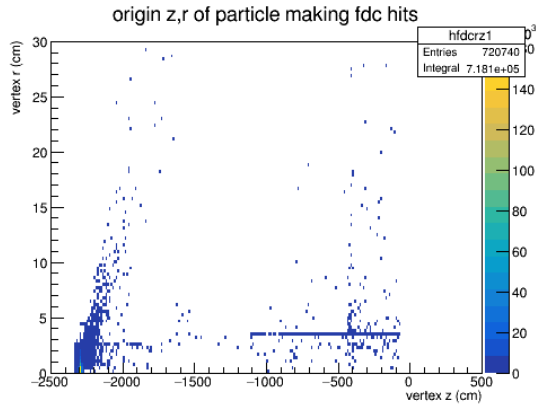

z=-2000cm intersection radius leading to cdc hits
hcdcr-2000
Entries 343786
Integral 3.438e+05
vertex r (cm)

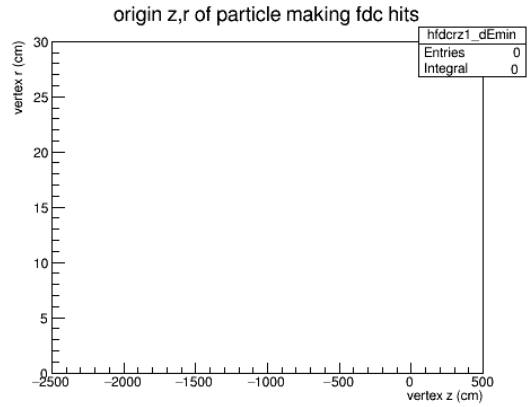

type of particle making fdc hits
hfdcp1
Entries 720740
Integral 7.207e+05
counts
G3 particle type

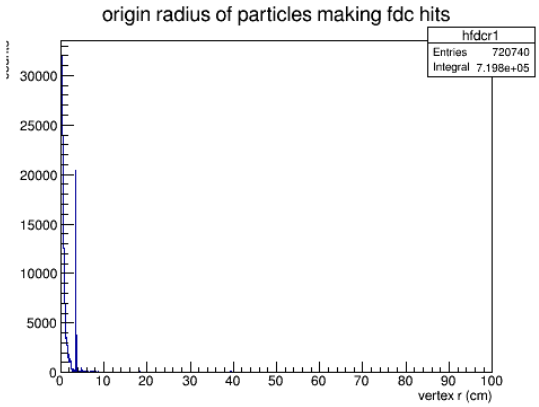

origin z of particle making fdc hits
hfdcz1
Entries 720740
Integral 7.207e+05
counts
vertex z (cm)

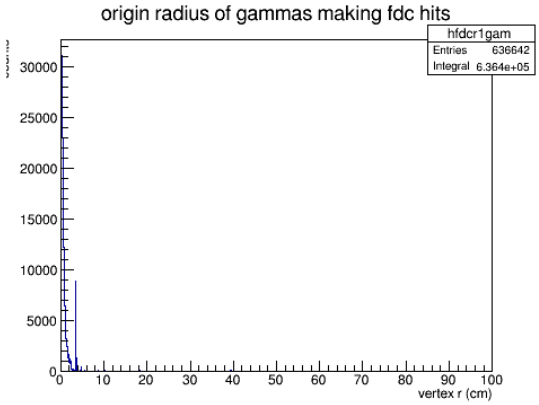

origin x,y of particle making fdc hits
hfdcxy1
Entries 720740
Integral 7.162e+05
vertex y (cm)
vertex x (cm)

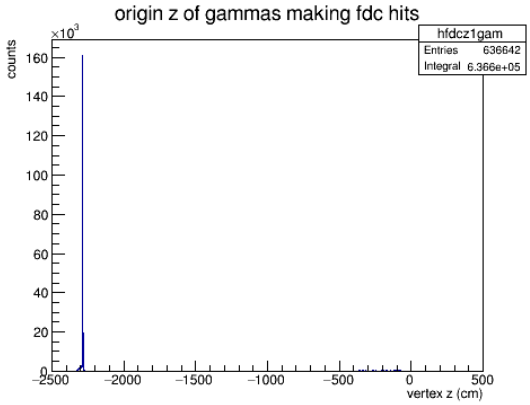

origin x,y of particle making fdc hits
hfdcxy1_dEmin
Entries 0
Integral 0
vertex y (cm)
vertex x (cm)

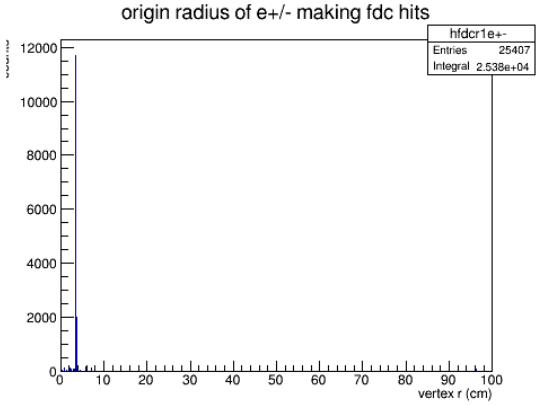

origin z,r of particle making fdc hits
hfdcrz1
Entries 720740
Integral 7.181e+05
vertex r (cm)
vertex z (cm)

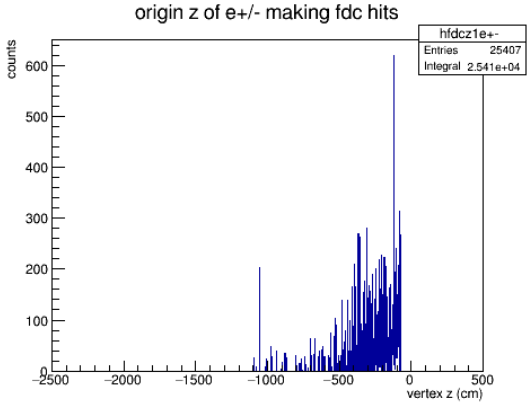

origin z,r of particle making fdc hits
hfdcrz1_dEmin
Entries 0
Integral 0
vertex r (cm)
vertex z (cm)

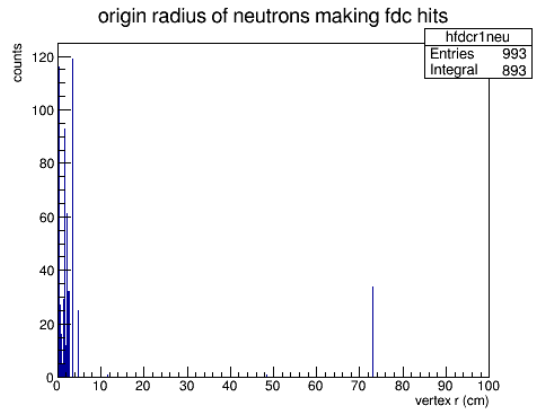

origin radius of particles making fdc hits
hfdcr1
Entries 720740
Integral 7.198e+05
vertex r (cm)

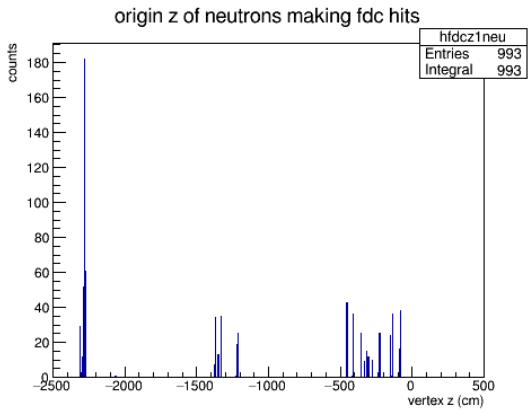

origin radius of gammas making fdc hits
hfdcr1gam
Entries 636642
Integral 6.364e+05
vertex r (cm)

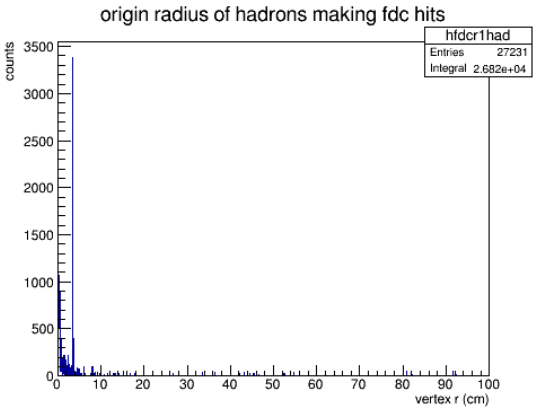

origin z of gammas making fdc hits
hfdcz1gam
Entries 636642
Integral 6.366e+05
counts
vertex z (cm)

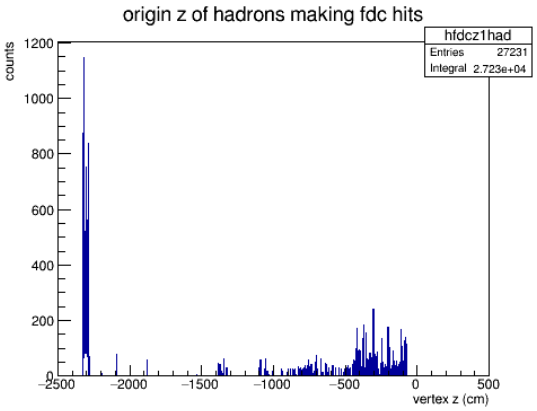

origin radius of e+/- making fdc hits
hfdcr1e+-
Entries 25407
Integral 2.538e+04
vertex r (cm)


origin z of e+/- making fdc hits
hfdcz1e+-
Entries 25407
Integral 2.541e+04
counts
vertex z (cm)

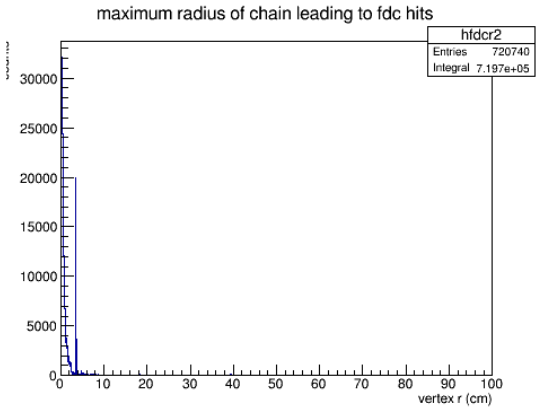


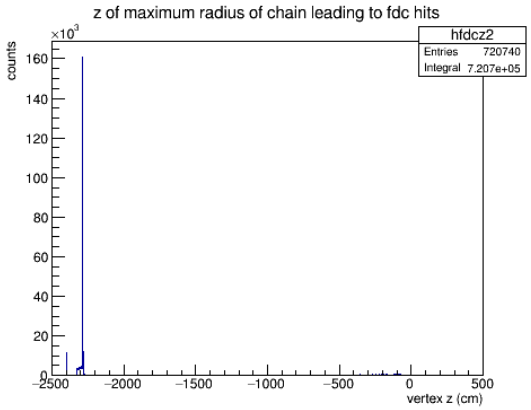


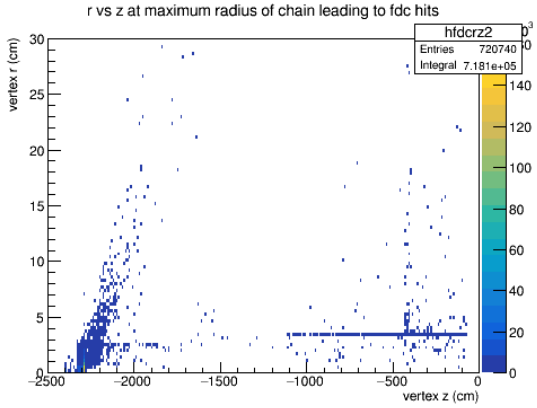


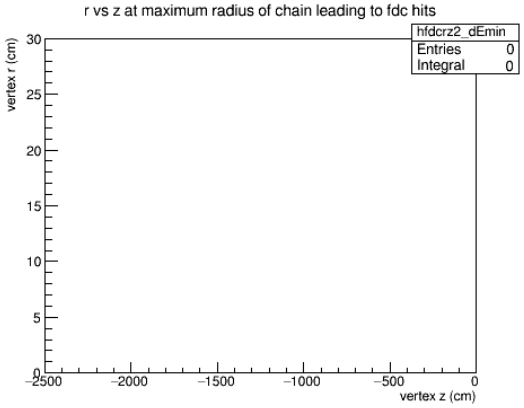


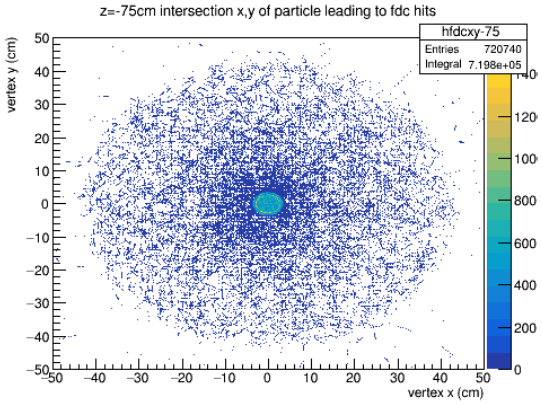

```
total fraction beyond 4cm is 0.0141
```

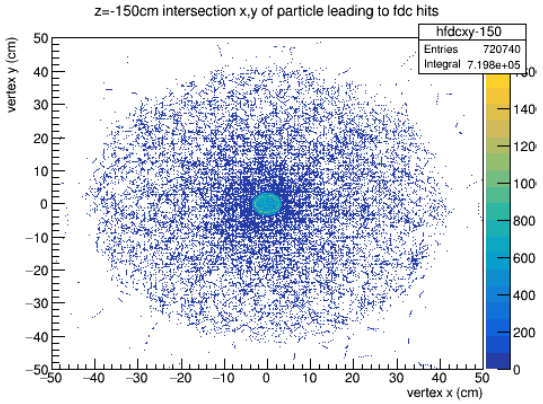

maximum radius of chain leading to fdc hits
hfdcr2
Entries 720740
Integral 7.197e+05
vertex r (cm)

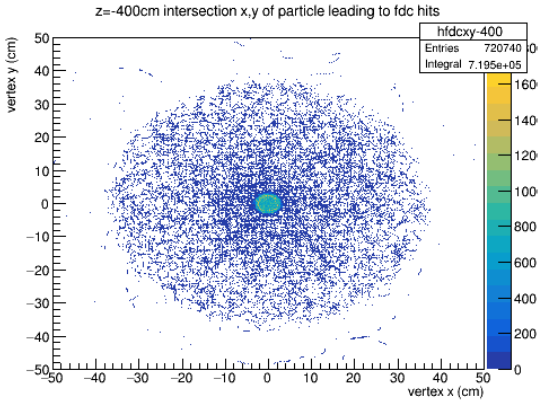

z of maximum radius of chain leading to fdc hits
hfdcz2
Entries 720740
Integral 7.207e+05
counts
vertex z (cm)

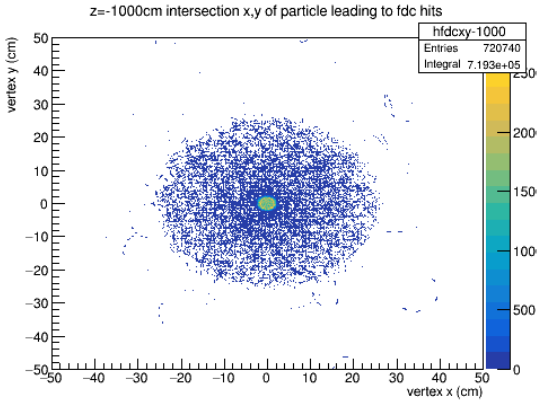

r vs z at maximum radius of chain leading to fdc hits
hfdcrz2
Entries 720740
Integral 7.181e+05
vertex r (cm)
vertex z (cm)

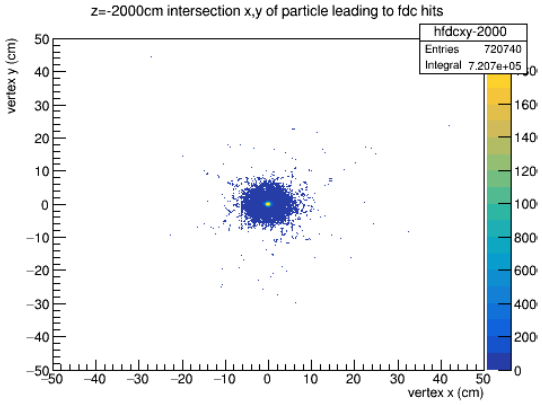

r vs z at maximum radius of chain leading to fdc hits
hfdcrz2_dEmin
Entries 0
Integral 0
vertex r (cm)
vertex z (cm)

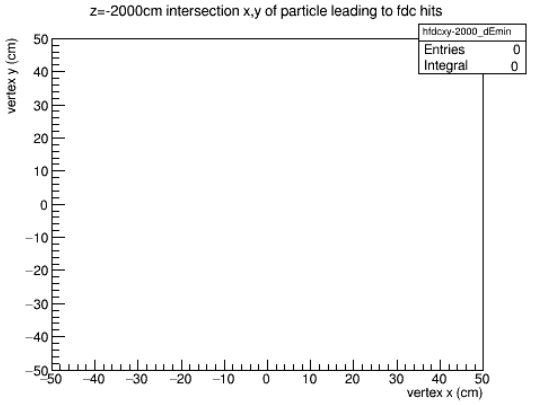

z=-75cm intersection x,y of particle leading to fdc hits
hfdcxy-75
Entries 720740
Integral 7.198e+05
vertex y (cm)
vertex x (cm)

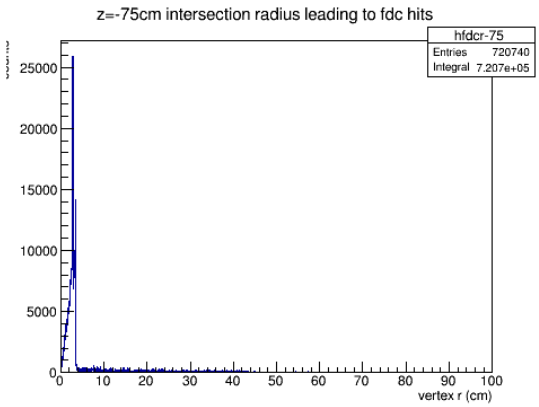

z=-150cm intersection x,y of particle leading to fdc hits
hfdcxy-150
Entries 720740
Integral 7.198e+05
vertex y (cm)
vertex x (cm)

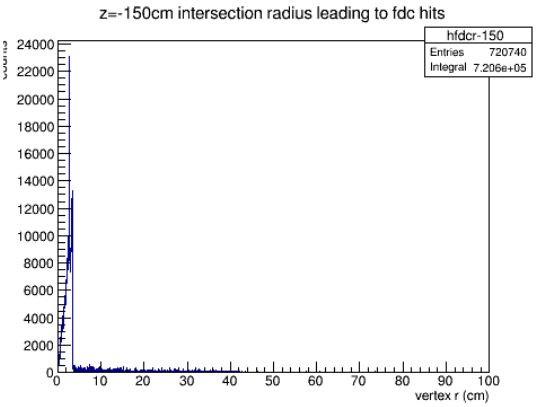

z=-400cm intersection x,y of particle leading to fdc hits
hfdcxy-400
Entries 720740
Integral 7.195e+05
vertex y (cm)
vertex x (cm)

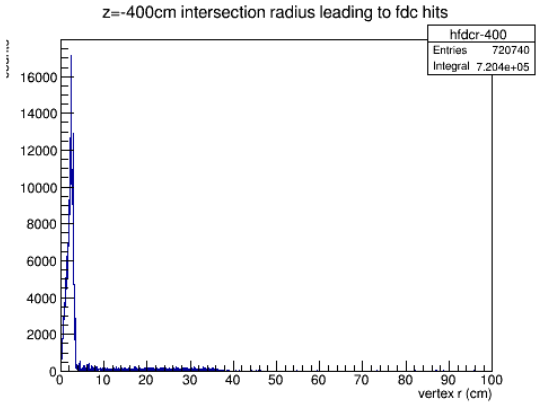

z=-1000cm intersection x,y of particle leading to fdc hits
hfdcxy-1000
Entries 720740
Integral 7.193e+05
vertex y (cm)
vertex x (cm)

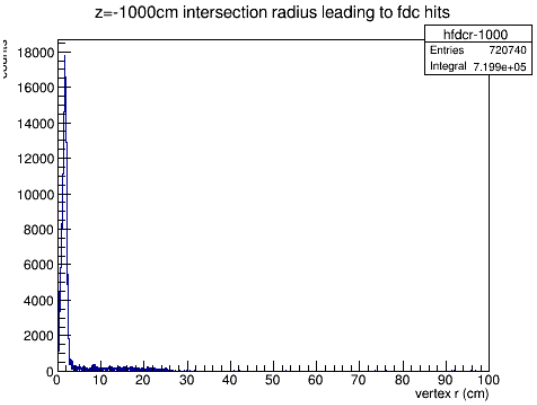

z=-2000cm intersection x,y of particle leading to fdc hits
hfdcxy-2000
Entries 720740
Integral 7.207e+05
vertex y (cm)
vertex x (cm)

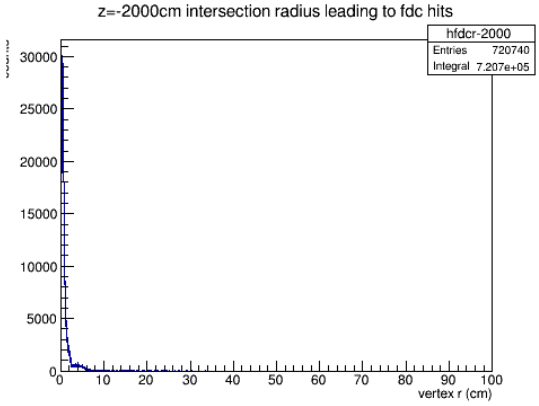

z=-2000cm intersection x,y of particle leading to fdc hits
hfdcxy-2000_dEmin
Entries 0
Integral 0
vertex y (cm)
vertex x (cm)

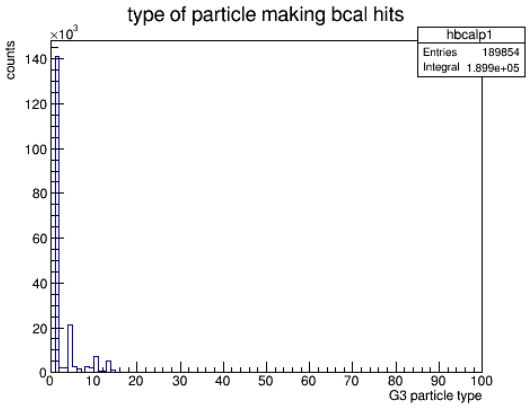

z=-75cm intersection radius leading to fdc hits
hfdcr-75
Entries 720740
Integral 7.207e+05
vertex r (cm)

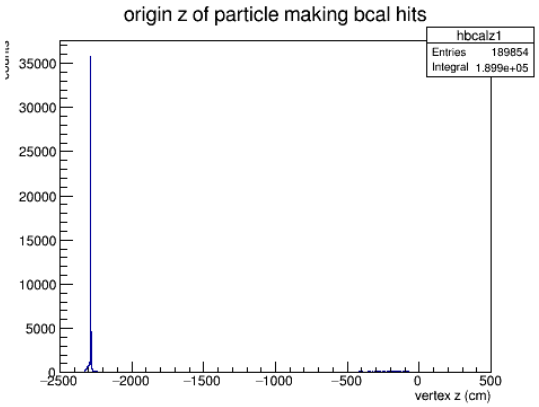

z=-150cm intersection radius leading to fdc hits
hfdcr-150
Entries 720740
Integral 7.206e+05
vertex r (cm)

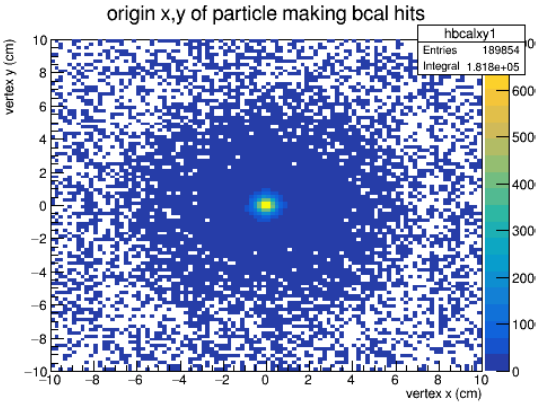

z=-400cm intersection radius leading to fdc hits
hfdcr-400
Entries 720740
Integral 7.204e+05
vertex r (cm)

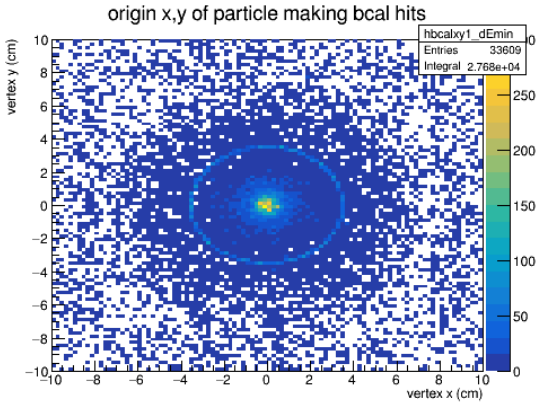

z=-1000cm intersection radius leading to fdc hits
hfdcr-1000
Entries 720740
Integral 7.199e+05
vertex r (cm)

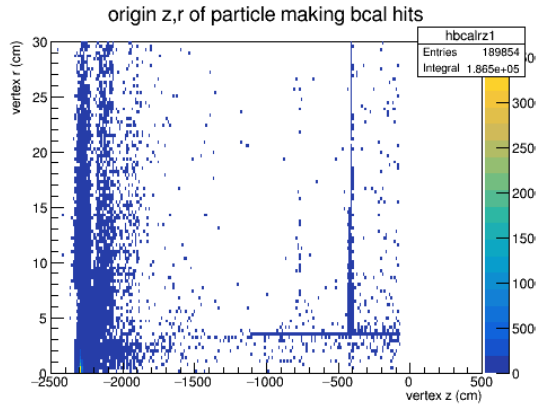

z=-2000cm intersection radius leading to fdc hits
hfdcr-2000
Entries 720740
Integral 7.207e+05
vertex r (cm)

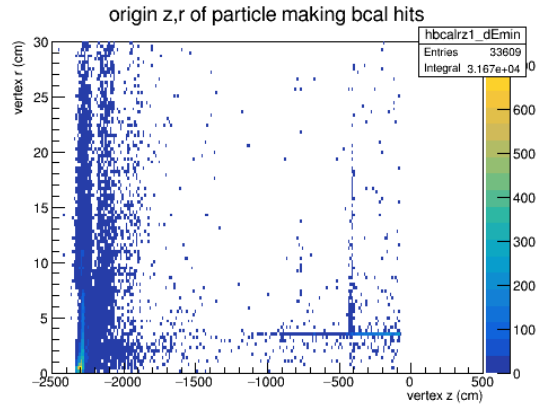

type of particle making bcal hits
hbcalp1
Entries 189854
Integral 1.899e+05
counts
G3 particle type

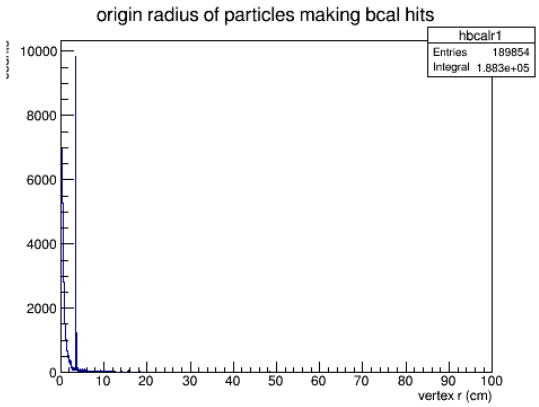

origin z of particle making bcal hits
hbcalz1
Entries 189854
Integral 1.899e+05
vertex z (cm)

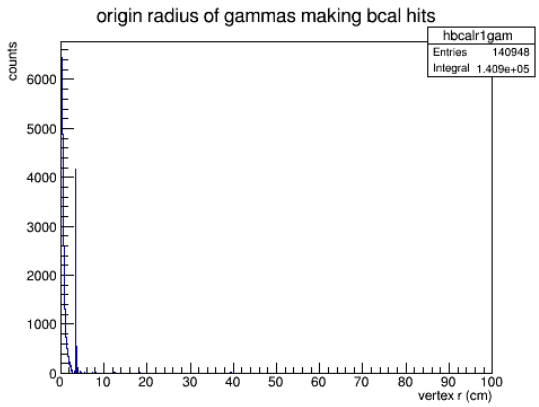

origin x,y of particle making bcal hits
hbcalxy1
Entries 189854
Integral 1.818e+05
vertex y (cm)
vertex x (cm)

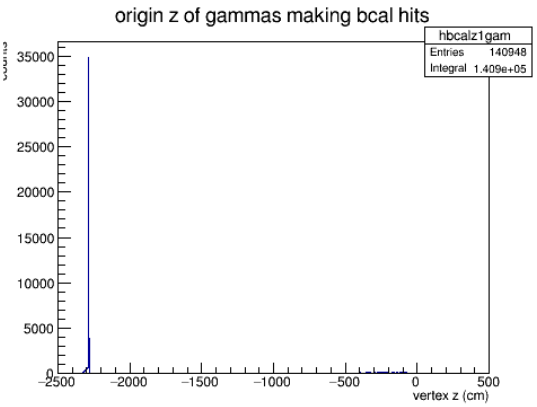

origin x,y of particle making bcal hits
hbcalxy1_dEmin
Entries 33609
Integral 2.768e+04
vertex y (cm)
vertex x (cm)

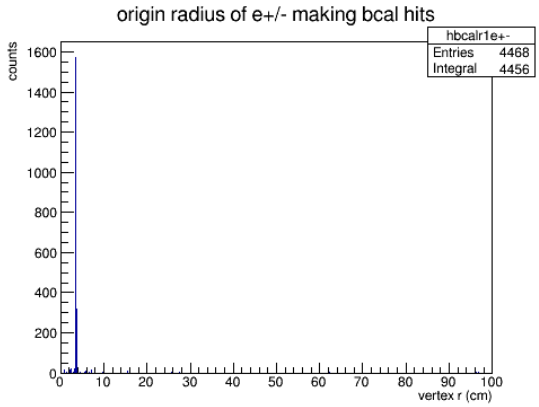

origin z,r of particle making bcal hits
hbcalrz1
Entries 189854
Integral 1.865e+05
vertex r (cm)
vertex z (cm)

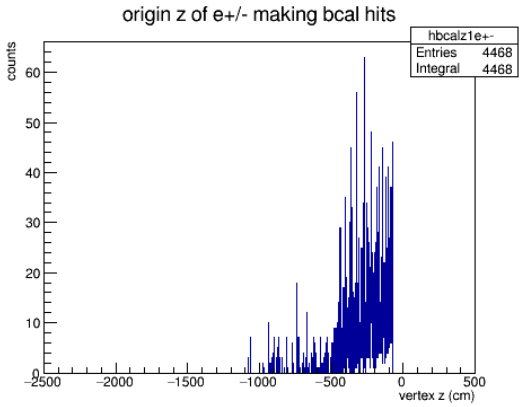

origin z,r of particle making bcal hits
hbcalrz1_dEmin
Entries 33609
Integral 3.167e+04
vertex r (cm)
vertex z (cm)

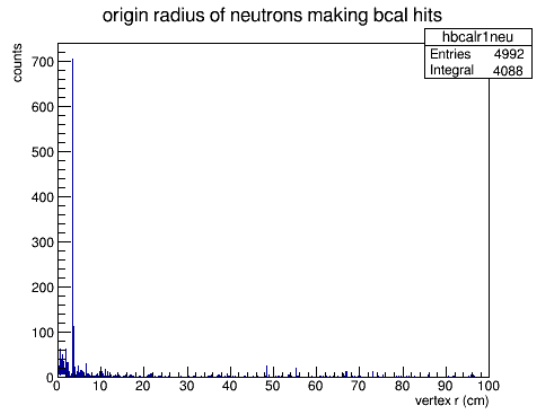

origin radius of particles making bcal hits
hbcalr1
Entries 189854
Integral 1.883e+05
vertex r (cm)

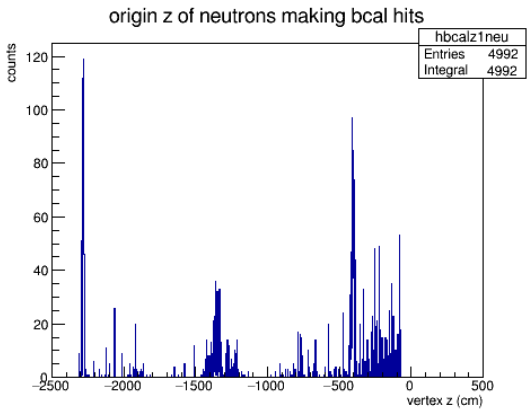

origin radius of gammas making bcal hits
hbcalr1gam
Entries 140948
Integral 1.409e+05
counts
vertex r (cm)

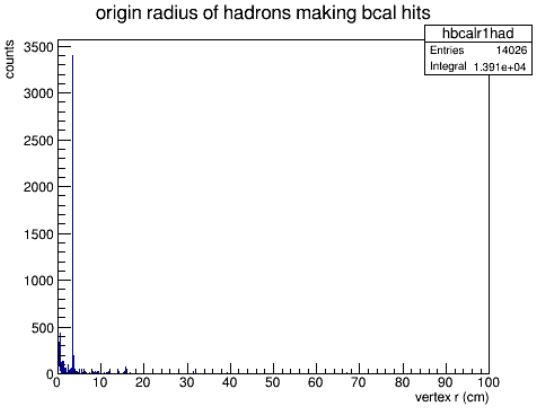

origin z of gammas making bcal hits
hbcalz1gam
Entries 140948
Integral 1.409e+05
vertex z (cm)

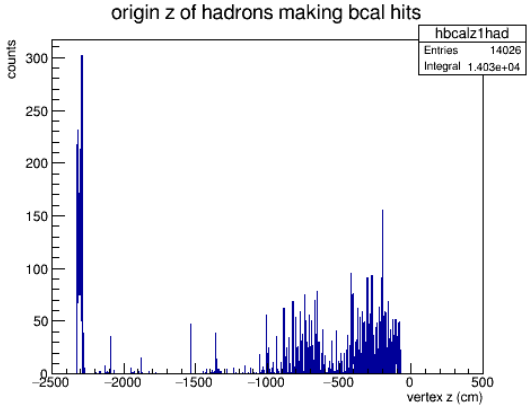

origin radius of e+/- making bcal hits
hbcalr1e+-
Entries 4468
Integral 4456
counts
vertex r (cm)


origin z of e+/- making bcal hits
hbcalz1e+-
Entries 4468
Integral 4468
counts
vertex z (cm)

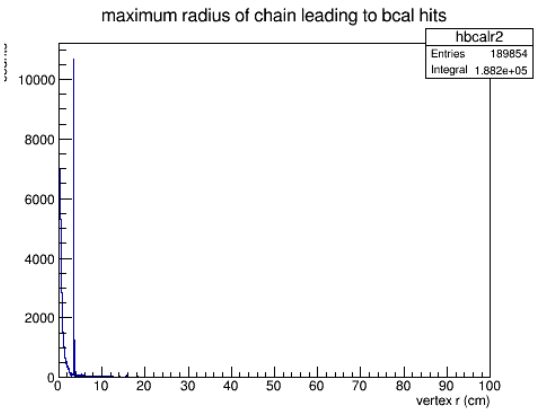


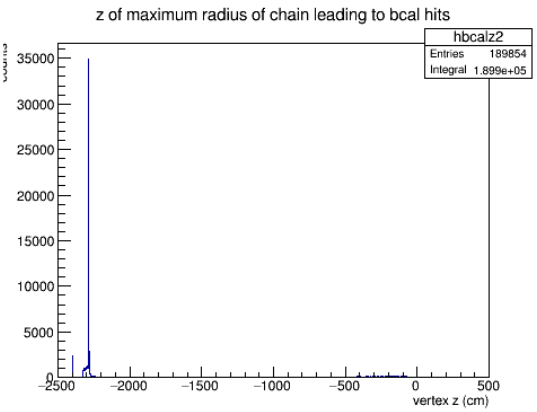


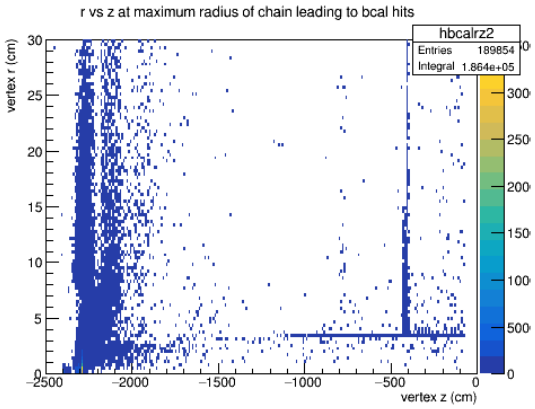


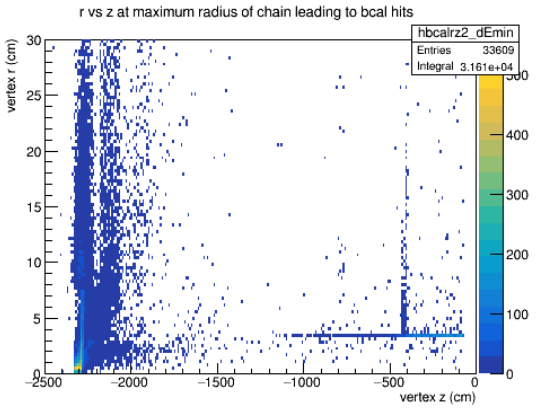


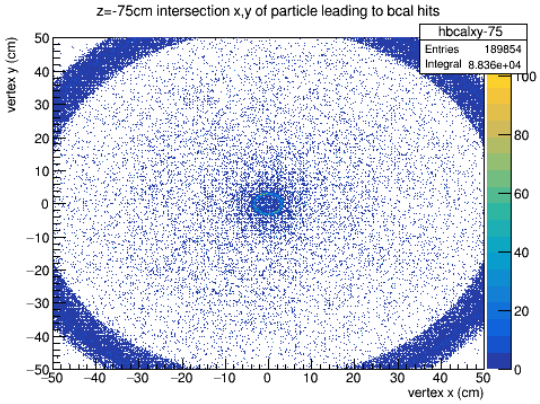

```
total fraction beyond 4cm is 0.076
```

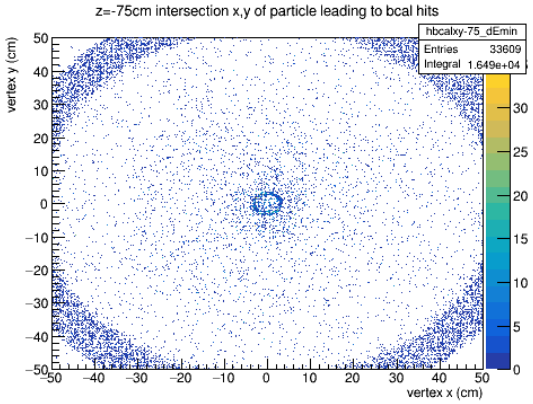

maximum radius of chain leading to bcal hits
hbcalr2
Entries 189854
Integral 1.882e+05
vertex r (cm)

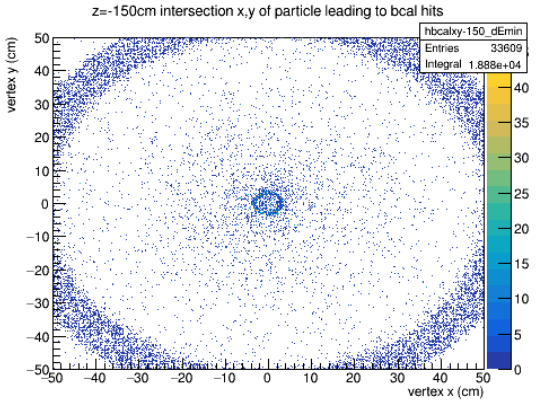

z of maximum radius of chain leading to bcal hits
hbcalz2
Entries 189854
Integral 1.899e+05
vertex z (cm)

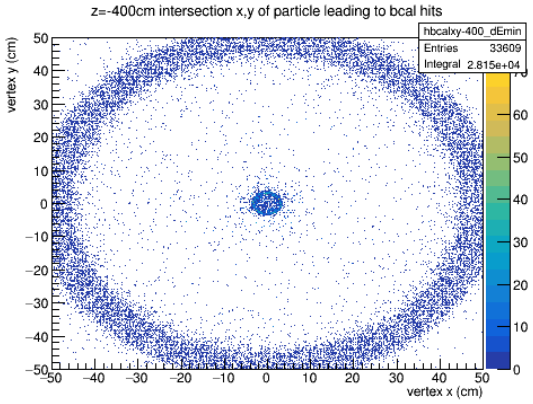

r vs z at maximum radius of chain leading to bcal hits
hbcalrz2
Entries 189854
Integral 1.864e+05
vertex r (cm)
vertex z (cm)

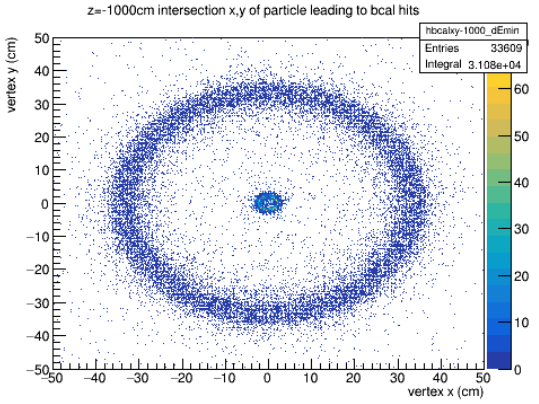

r vs z at maximum radius of chain leading to bcal hits
hbcalrz2_dEmin
Entries 33609
Integral 3.161e+04
vertex r (cm)
vertex z (cm)

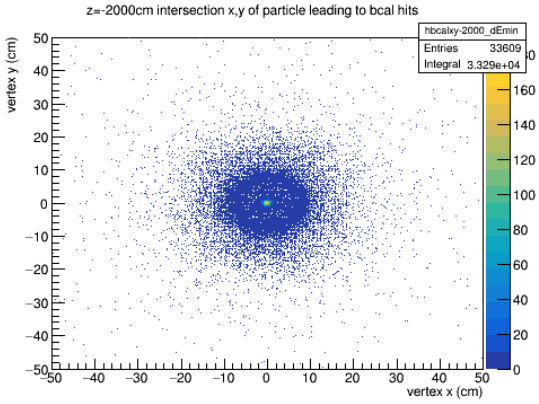

z=-75cm intersection x,y of particle leading to bcal hits
hbcalxy-75
Entries 189854
Integral 8.836e+04
vertex y (cm)
vertex x (cm)

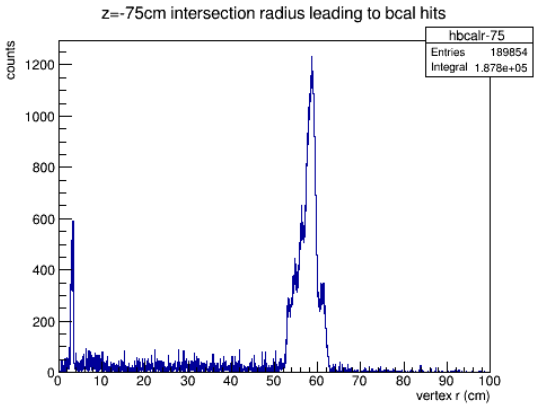

z=-75cm intersection x,y of particle leading to bcal hits
hbcalxy-75_dEmin
Entries 33609
Integral 1.649e+04
vertex y (cm)
vertex x (cm)

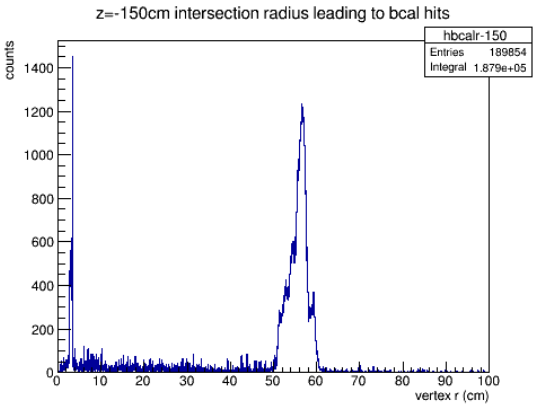

z=-150cm intersection x,y of particle leading to bcal hits
hbcalxy-150_dEmin
Entries 33609
Integral 1.888e+04
vertex y (cm)
vertex x (cm)

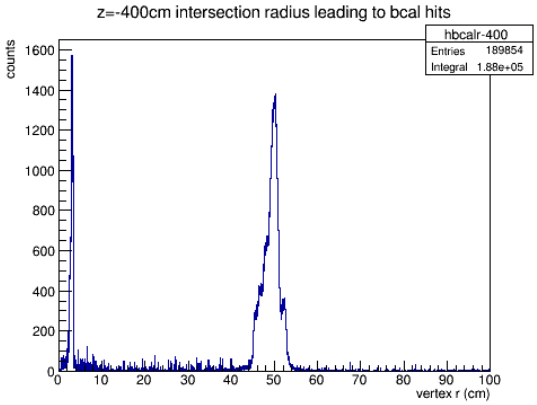

z=-400cm intersection x,y of particle leading to bcal hits
hbcalxy-400_dEmin
Entries 33609
Integral 2.815e+04
vertex y (cm)
vertex x (cm)

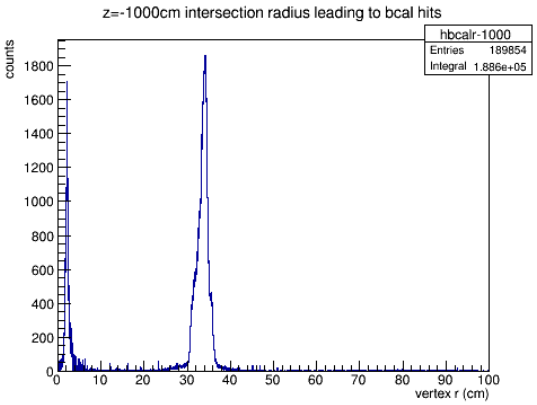

z=-1000cm intersection x,y of particle leading to bcal hits
hbcalxy-1000_dEmin
Entries 33609
Integral 3.108e+04
vertex y (cm)
vertex x (cm)

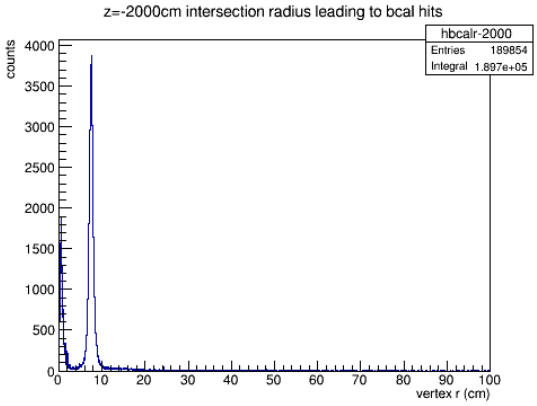

z=-2000cm intersection x,y of particle leading to bcal hits
hbcalxy-2000_dEmin
Entries 33609
Integral 3.329e+04
vertex y (cm)
vertex x (cm)

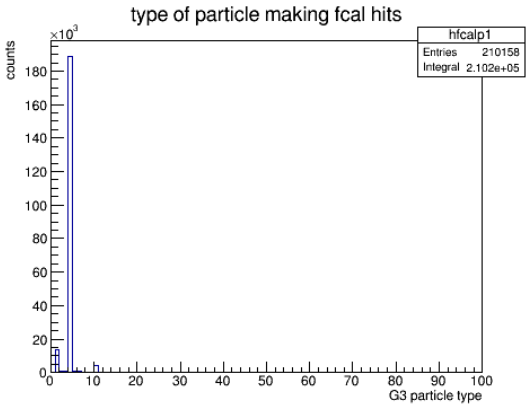

z=-75cm intersection radius leading to bcal hits
hbcalr-75
Entries 189854
Integral 1.878e+05
counts
vertex r (cm)

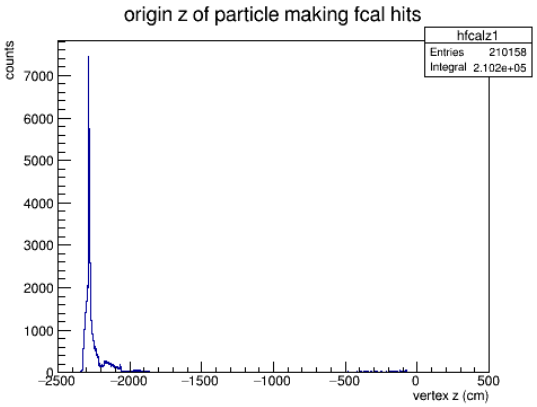

z=-150cm intersection radius leading to bcal hits
hbcalr-150
Entries 189854
Integral 1.879e+05
counts
vertex r (cm)

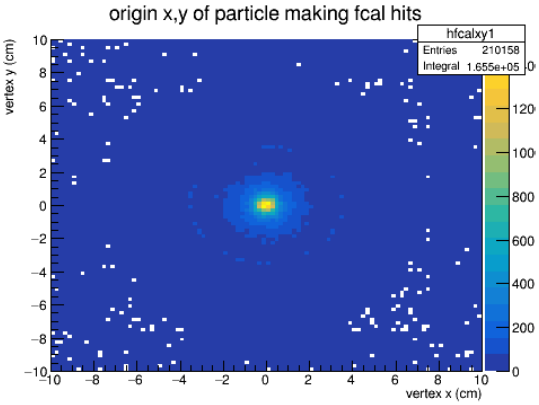

z=-400cm intersection radius leading to bcal hits
hbcalr-400
Entries 189854
Integral 1.88e+05
counts
vertex r (cm)

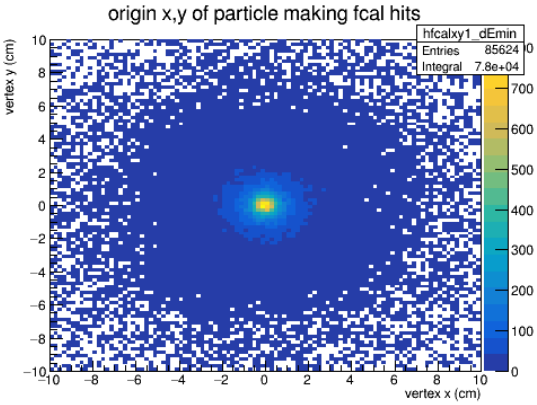

z=-1000cm intersection radius leading to bcal hits
hbcalr-1000
Entries 189854
Integral 1.886e+05
counts
vertex r (cm)

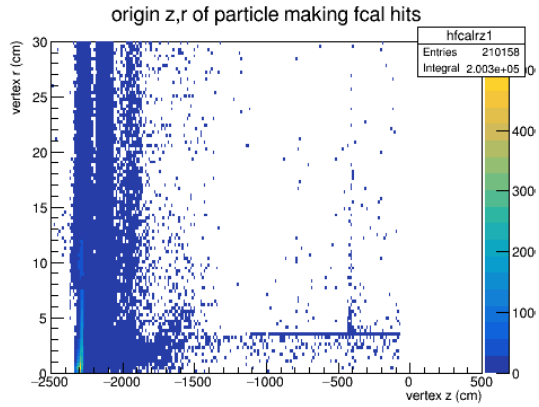

z=-2000cm intersection radius leading to bcal hits
hbcalr-2000
Entries 189854
Integral 1.897e+05
counts
vertex r (cm)

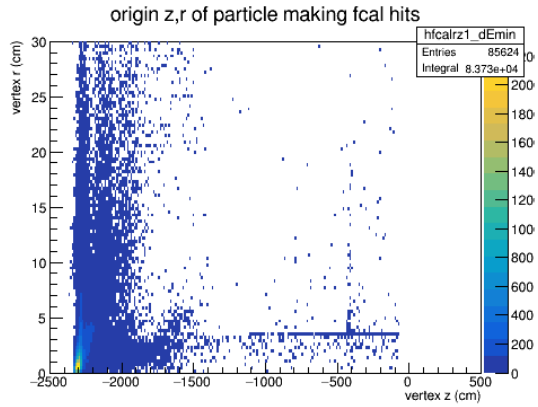

type of particle making fcal hits
hfcalp1
Entries 210158
Integral 2.102e+05
counts
G3 particle type

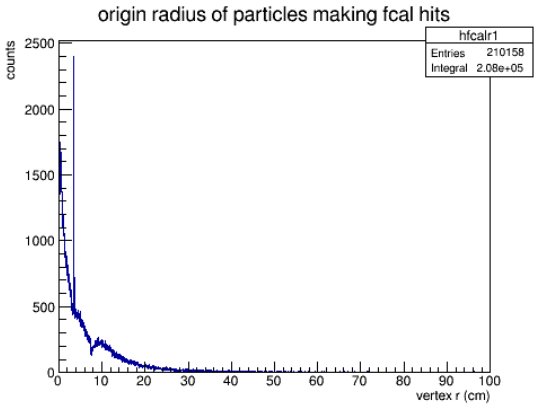

origin z of particle making fcal hits
hfcalz1
Entries 210158
Integral 2.102e+05
counts
vertex z (cm)

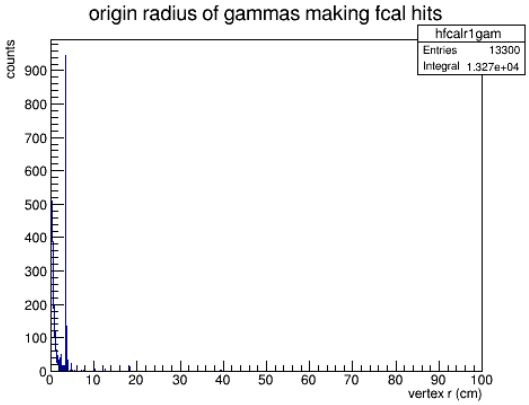

origin x,y of particle making fcal hits
hfcalxy1
Entries 210158
Integral 1.655e+05
vertex y (cm)
vertex x (cm)

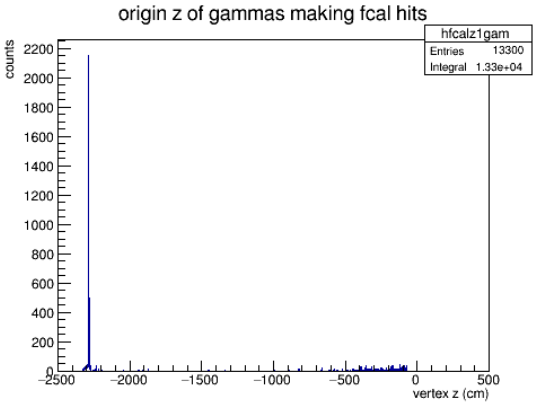

origin x,y of particle making fcal hits
hfcalxy1_dEmin
Entries 85624
Integral 7.8e+04
vertex y (cm)
vertex x (cm)

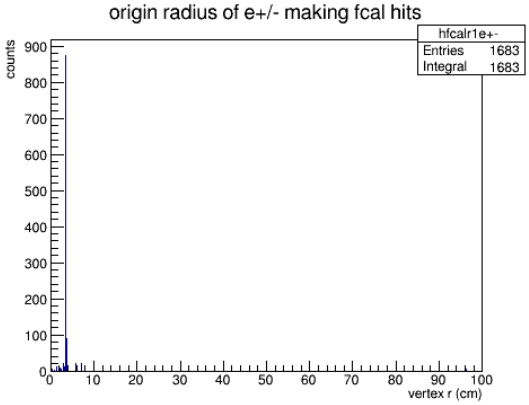

origin z,r of particle making fcal hits
hfcalrz1
Entries 210158
Integral 2.003e+05
vertex r (cm)
vertex z (cm)

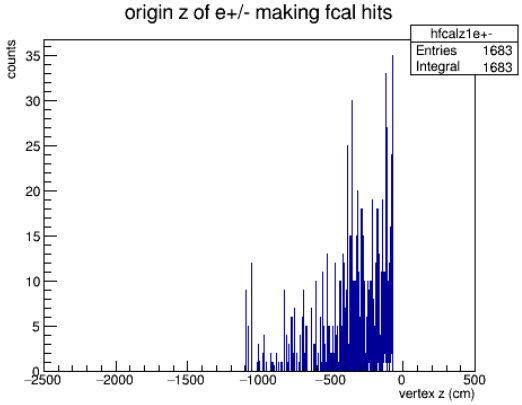

origin z,r of particle making fcal hits
hfcalrz1_dEmin
Entries 85624
Integral 8.373e+04
vertex r (cm)
vertex z (cm)

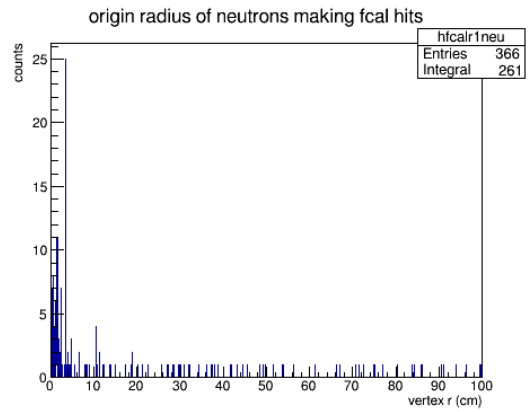

origin radius of particles making fcal hits
hfcalr1
Entries 210158
Integral 2.08e+05
counts
vertex r (cm)

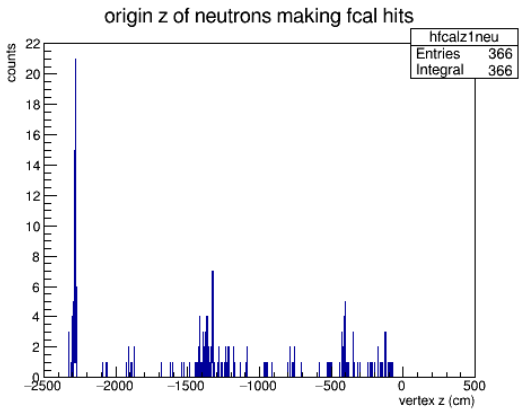

origin radius of gammas making fcal hits
hfcalr1gam
Entries 13300
Integral 1.327e+04
counts
vertex r (cm)

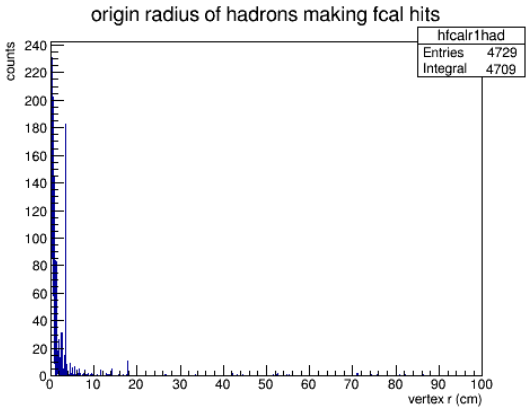

origin z of gammas making fcal hits
hfcalz1gam
Entries 13300
Integral 1.33e+04
counts
vertex z (cm)

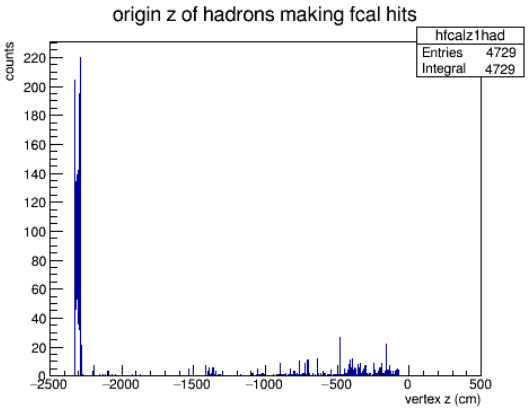

origin radius of e+/- making fcal hits
hfcalr1e+-
Entries 1683
Integral 1683
counts
vertex r (cm)


origin z of e+/- making fcal hits
hfcalz1e+-
Entries 1683
Integral 1683
counts
vertex z (cm)







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total fraction beyond 4cm is 0.469
```
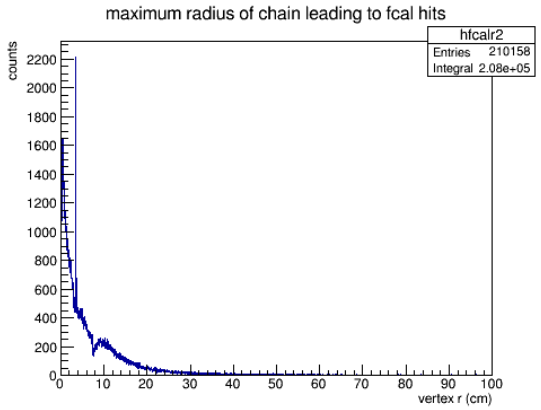
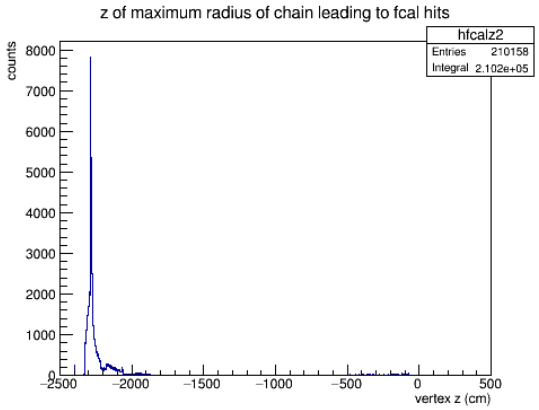
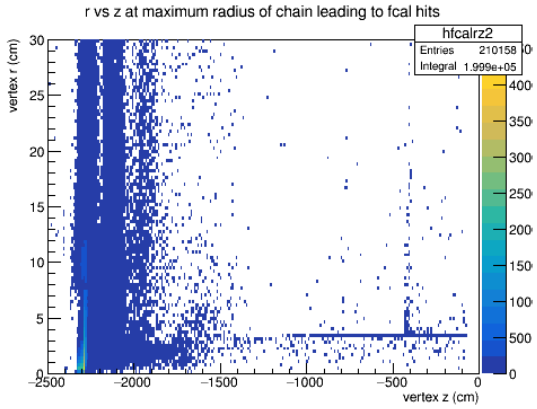
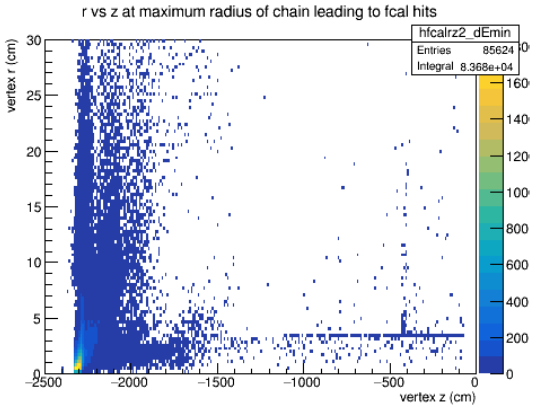
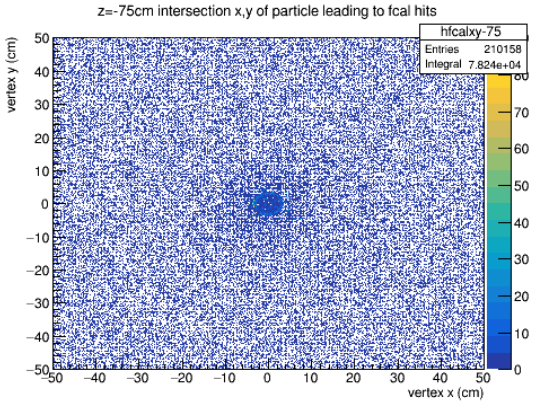
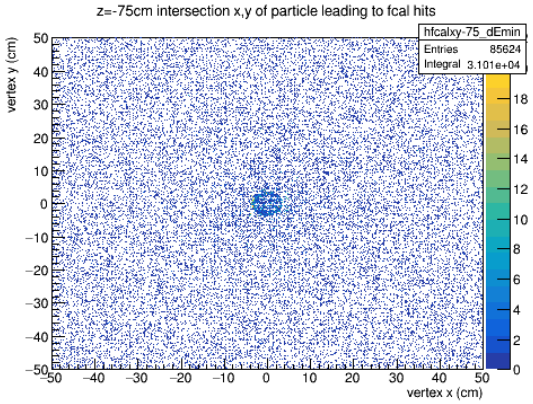


maximum radius of chain leading to fcal hits
hfcalr2
Entries 210158
Integral 2.08e+05
counts
vertex r (cm)

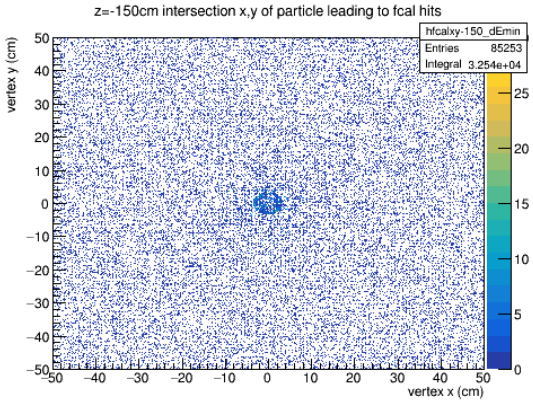

z of maximum radius of chain leading to fcal hits
hfcalz2
Entries 210158
Integral 2.102e+05
counts
vertex z (cm)

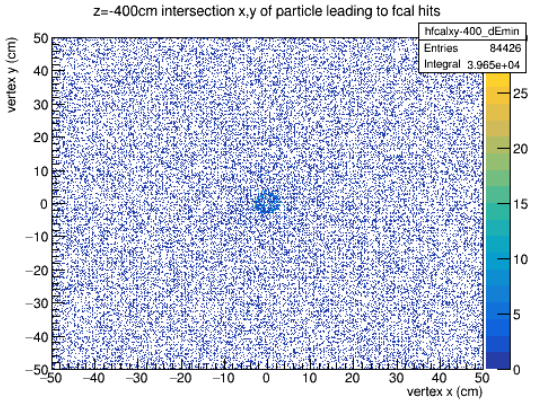

r vs z at maximum radius of chain leading to fcal hits
hfcalrz2
Entries 210158
Integral 1.999e+05
vertex r (cm)
vertex z (cm)

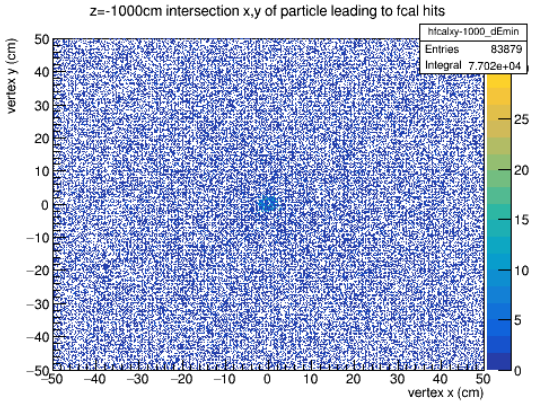

r vs z at maximum radius of chain leading to fcal hits
hfcalrz2_dEmin
Entries 85624
Integral 8.368e+04
vertex r (cm)
vertex z (cm)

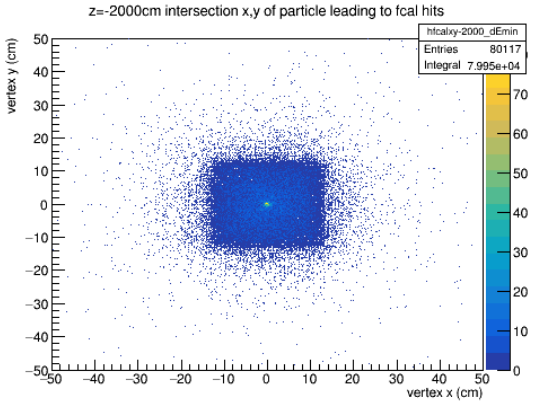

z=-75cm intersection x,y of particle leading to fcal hits
hfcalxy-75
Entries 210158
Integral 7.824e+04
vertex y (cm)
vertex x (cm)

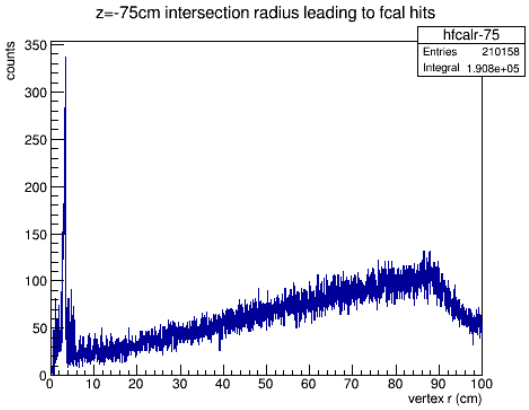

z=-75cm intersection x,y of particle leading to fcal hits
hfcalxy-75_dEmin
Entries 85624
Integral 3.101e+04
vertex y (cm)
vertex x (cm)

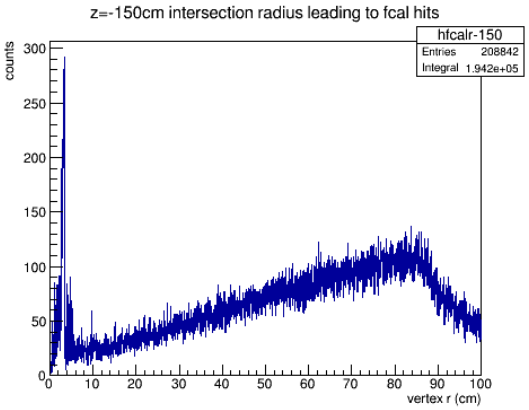

z=-150cm intersection x,y of particle leading to fcal hits
hfcalxy-150_dEmin
Entries 85253
Integral 3.254e+04
vertex y (cm)
vertex x (cm)

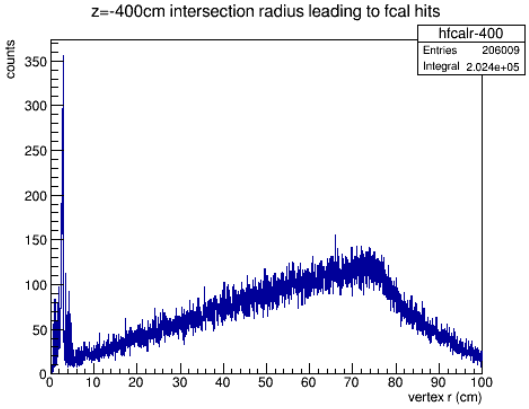

z=-400cm intersection x,y of particle leading to fcal hits
hfcalxy-400_dEmin
Entries 84426
Integral 3.965e+04
vertex y (cm)
vertex x (cm)

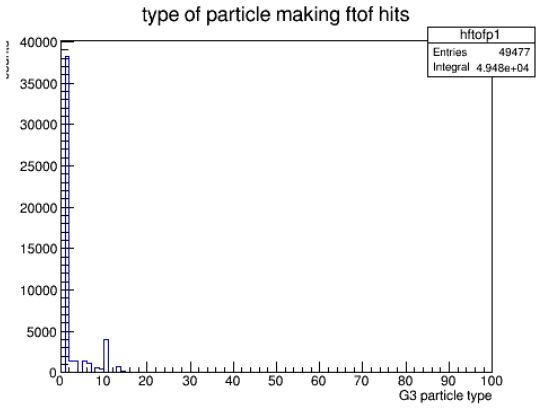

z=-1000cm intersection x,y of particle leading to fcal hits
hfcalxy-1000_dEmin
Entries 83879
Integral 7.702e+04
vertex y (cm)
vertex x (cm)

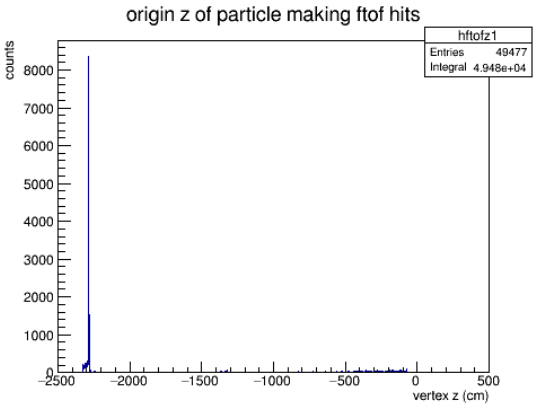

z=-2000cm intersection x,y of particle leading to fcal hits
hfcalxy-2000_dEmin
Entries 80117
Integral 7.995e+04
vertex y (cm)
vertex x (cm)

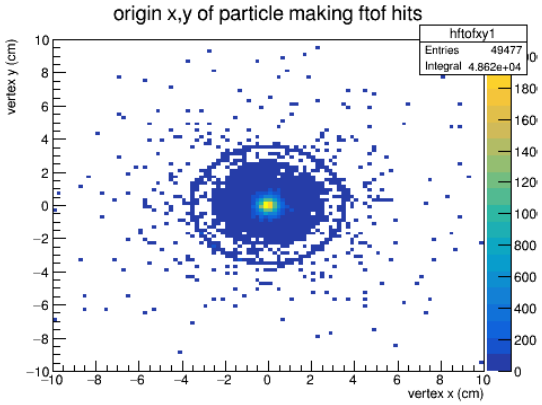

z=-75cm intersection radius leading to fcal hits
hfcalr-75
Entries 210158
Integral 1.908e+05
counts
vertex r (cm)

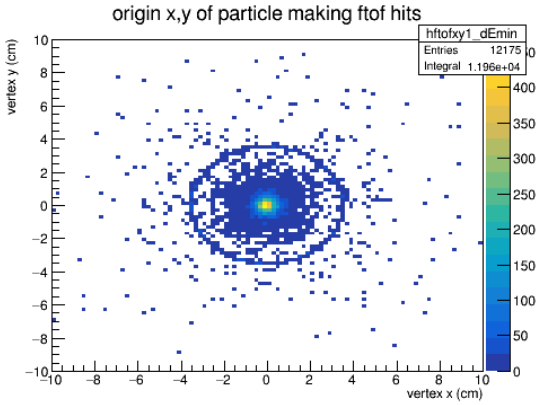

z=-150cm intersection radius leading to fcal hits
hfcalr-150
Entries 208842
Integral 1.942e+05
counts
vertex r (cm)

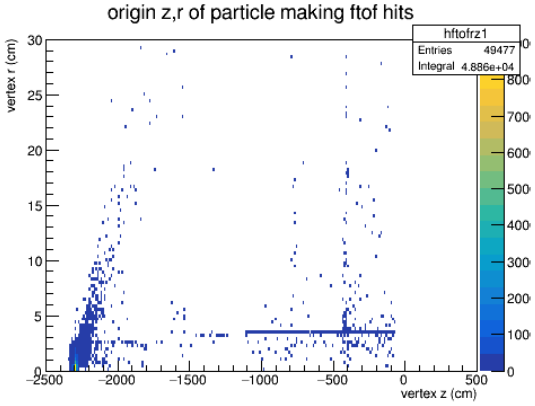

z=-400cm intersection radius leading to fcal hits
hfcalr-400
Entries 206009
Integral 2.024e+05
counts
vertex r (cm)

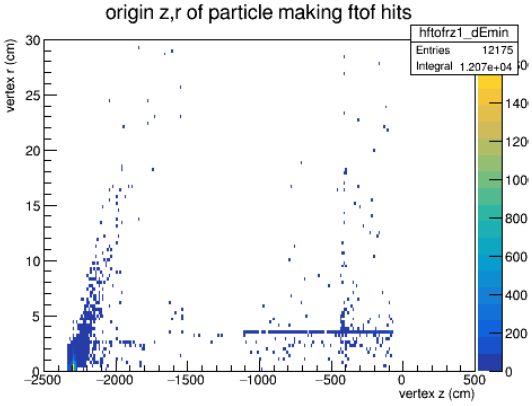

type of particle making ftof hits
hftofp1
Entries 49477
Integral 4.948e+04
G3 particle type

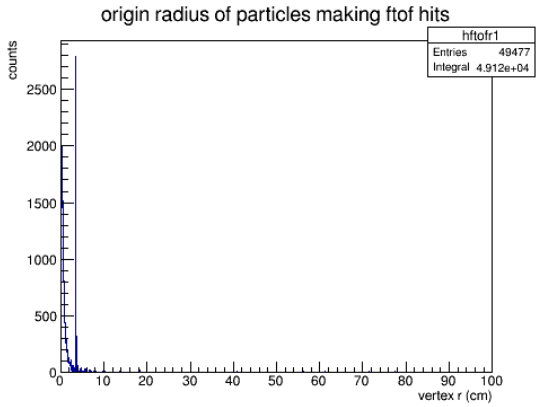

origin z of particle making ftof hits
hftofz1
Entries 49477
Integral 4.948e+04
counts
vertex z (cm)

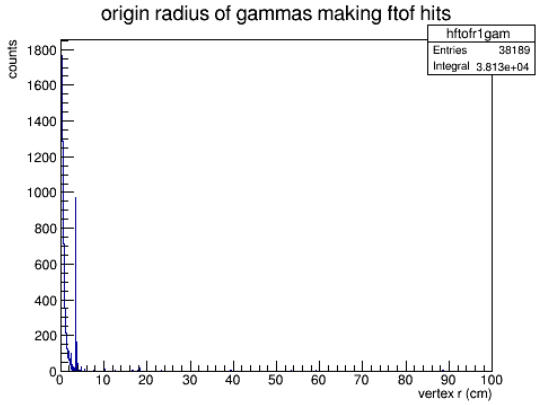

origin x,y of particle making ftof hits
hftofxy1
Entries 49477
Integral 4.862e+04
vertex y (cm)
vertex x (cm)

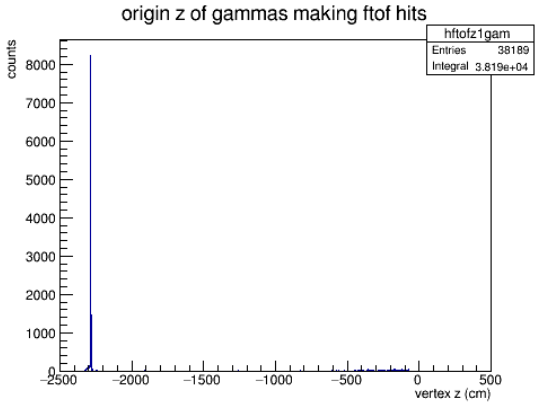

origin x,y of particle making ftof hits
hftofxy1_dEmin
Entries 12175
Integral 1.196e+04
vertex y (cm)
vertex x (cm)

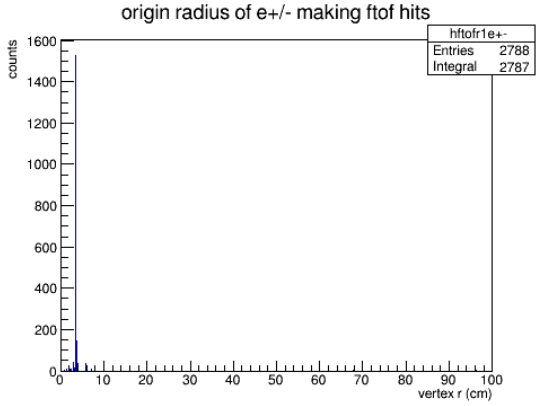

origin z,r of particle making ftof hits
hftofrz1
Entries 49477
Integral 4.886e+04
vertex r (cm)
vertex z (cm)

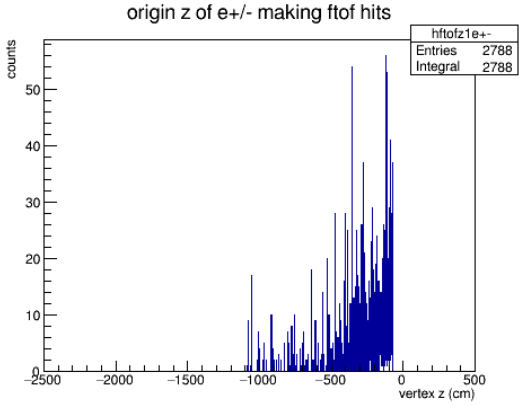

origin z,r of particle making ftof hits
hftofrz1_dEmin
Entries 12175
Integral 1.207e+04
vertex r (cm)
vertex z (cm)












```
found 53 histograms that need filling, follow progress on dask monitor dashboard at http://cn447.storrs.hpc.uconn.edu:8790/status

/srv/.local/lib/python3.9/site-packages/distributed/client.py:3362: UserWarning: Sending large graph of size 28.75 MiB.
This may cause some slowdown.
Consider loading the data with Dask directly
 or using futures or delayed objects to embed the data into the graph without repetition.
See also https://docs.dask.org/en/stable/best-practices.html#load-data-with-dask for more information.
  warnings.warn(
```