EIC meson structure

June 14th, 2021

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Goals

- Control and quantification of the theory and model uncertainties
  - This will allow me to explore the limitations of the Sullivan process and single-pion exchange framework which also can be extended to the kaon structure function
- Kaon structure function projections
- Integration to Fun4All
- Optimization of 2nd IR with different central detector concepts

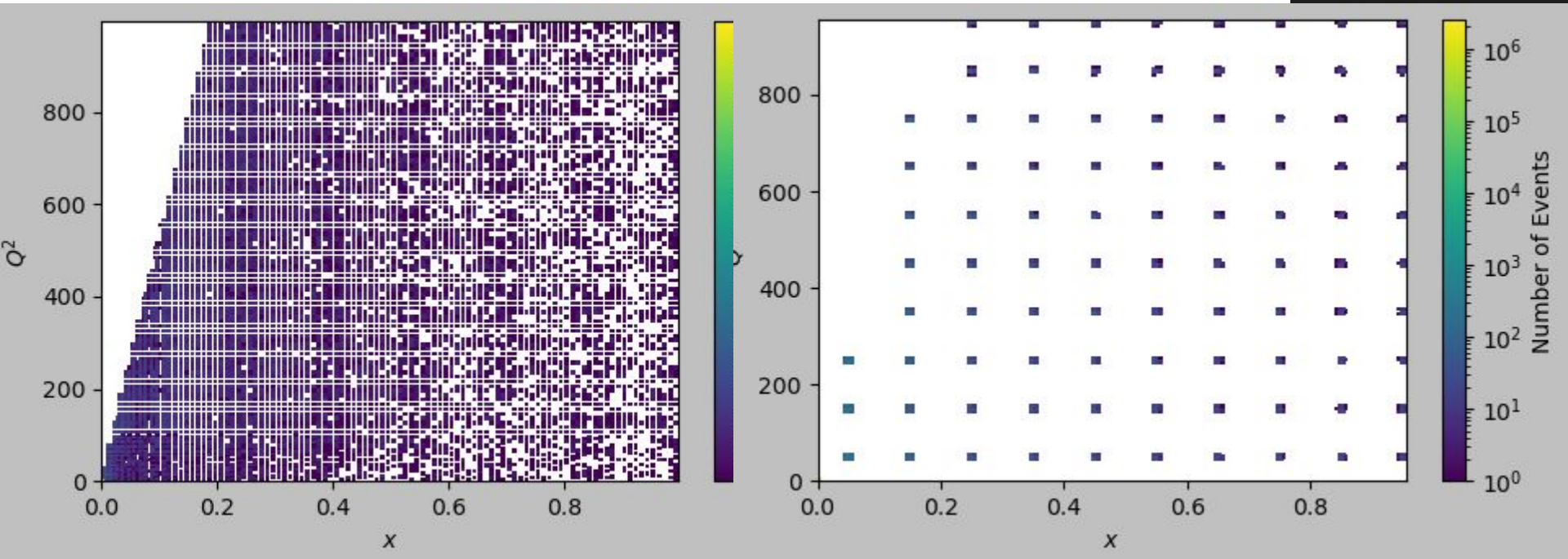
Update Summary

- As I said last meeting, I have been updating my generator to allow more dynamic binning
- An odd bug has been found through this process
  - Only affects the t-distribution
- The output of the generator had to be updated so it could be integrated into the Fun4All framework
  - The output is updated but having issues with EICsmear trying to read it in

pi_n_10on135_x0.001-1.000_q1.0-1000.0

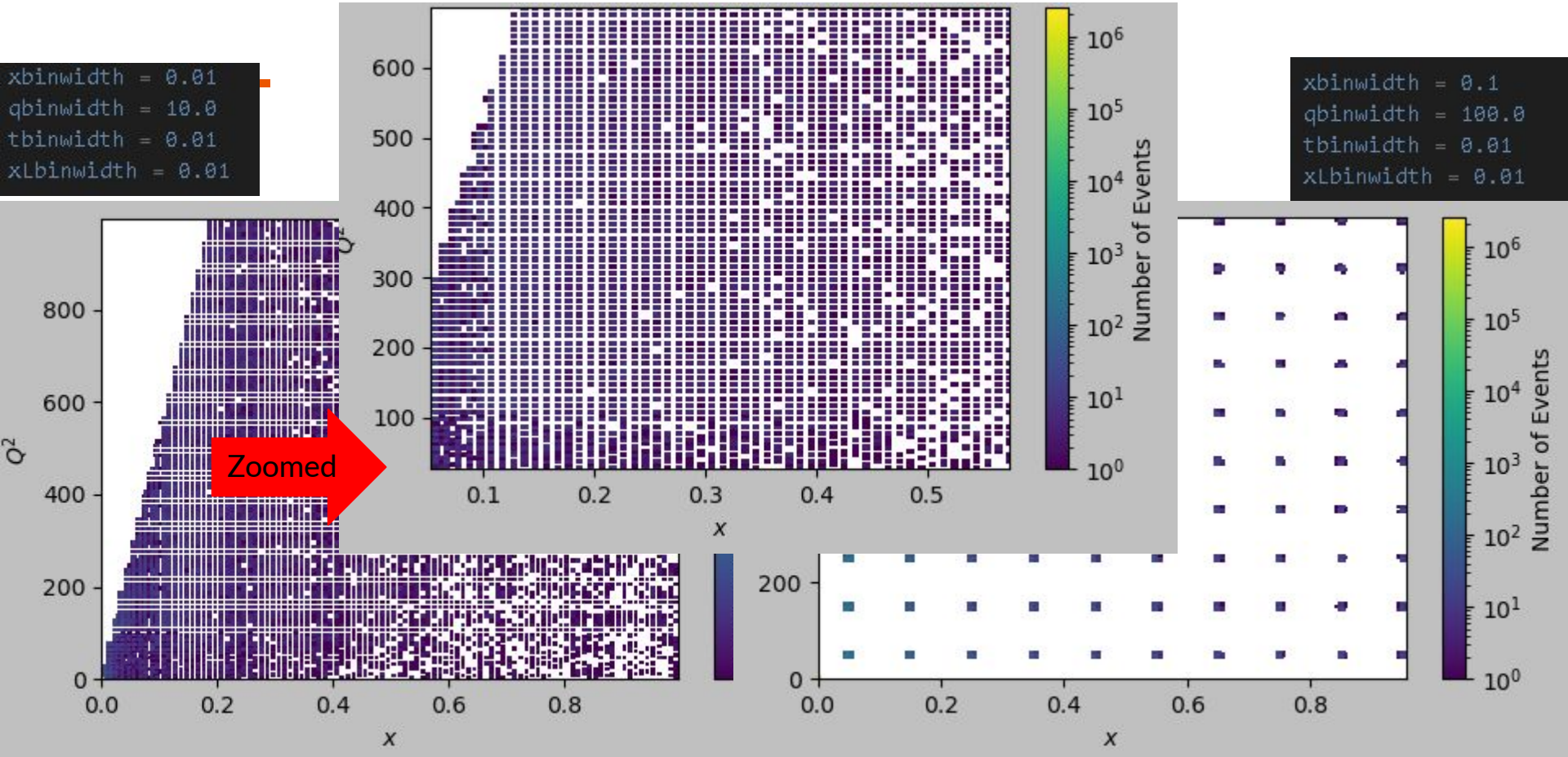
```
xbinwidth = 0.01
qbinwidth = 10.0
tbinwidth = 0.01
xLbinwidth = 0.01
```

```
xbinwidth = 0.1
qbinwidth = 100.0
tbinwidth = 0.01
xLbinwidth = 0.01
```



pi_n_10on135_x0.001-1.000_q1.0-1000.0

```
xbinwidth = 0.01
qbinwidth = 10.0
tbinwidth = 0.01
xLbinwidth = 0.01
```

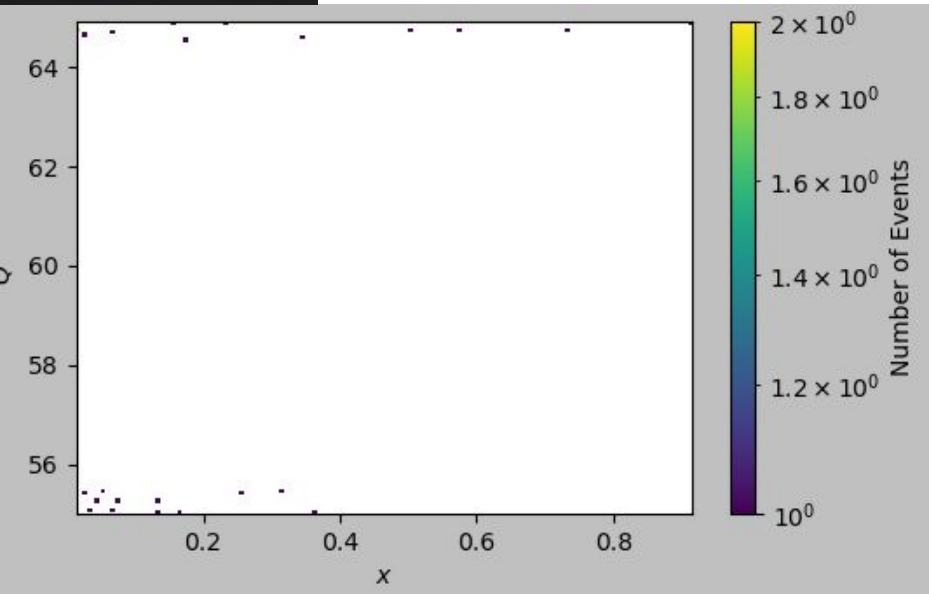



```
xbinwidth = 0.1
qbinwidth = 100.0
tbinwidth = 0.01
xLbinwidth = 0.01
```

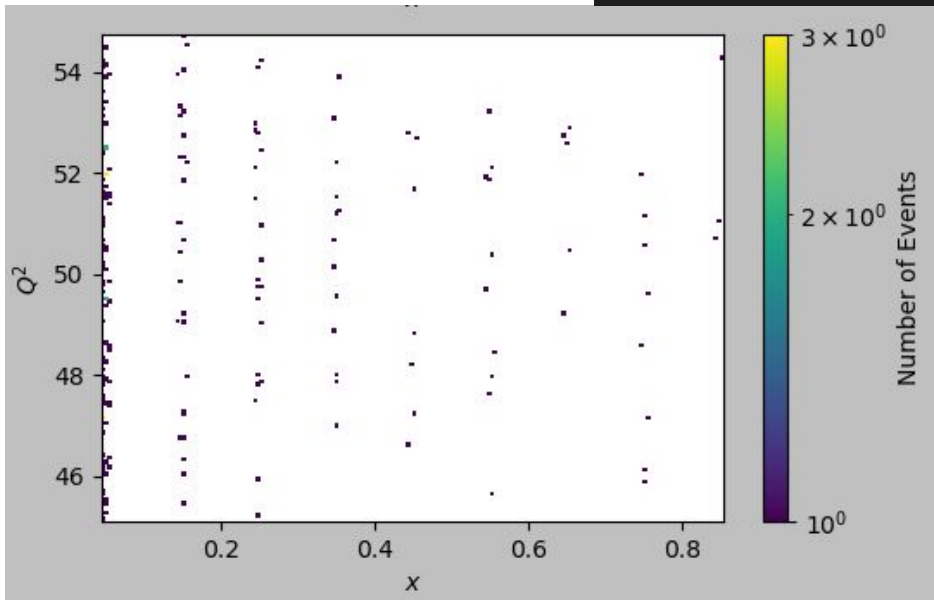
```
pi_n_10on135_x0.001-1.000_q1.0-1000.0
```

```
cut60 = ["Q2cut3","xLcut85","ycut"]
{"Q2cut3" : ((55.0 <= Q2) & (Q2 <= 65.0))}
{"xLcut85" : ((0.8500 <= xL) & (xL <= 0.8600))}
```

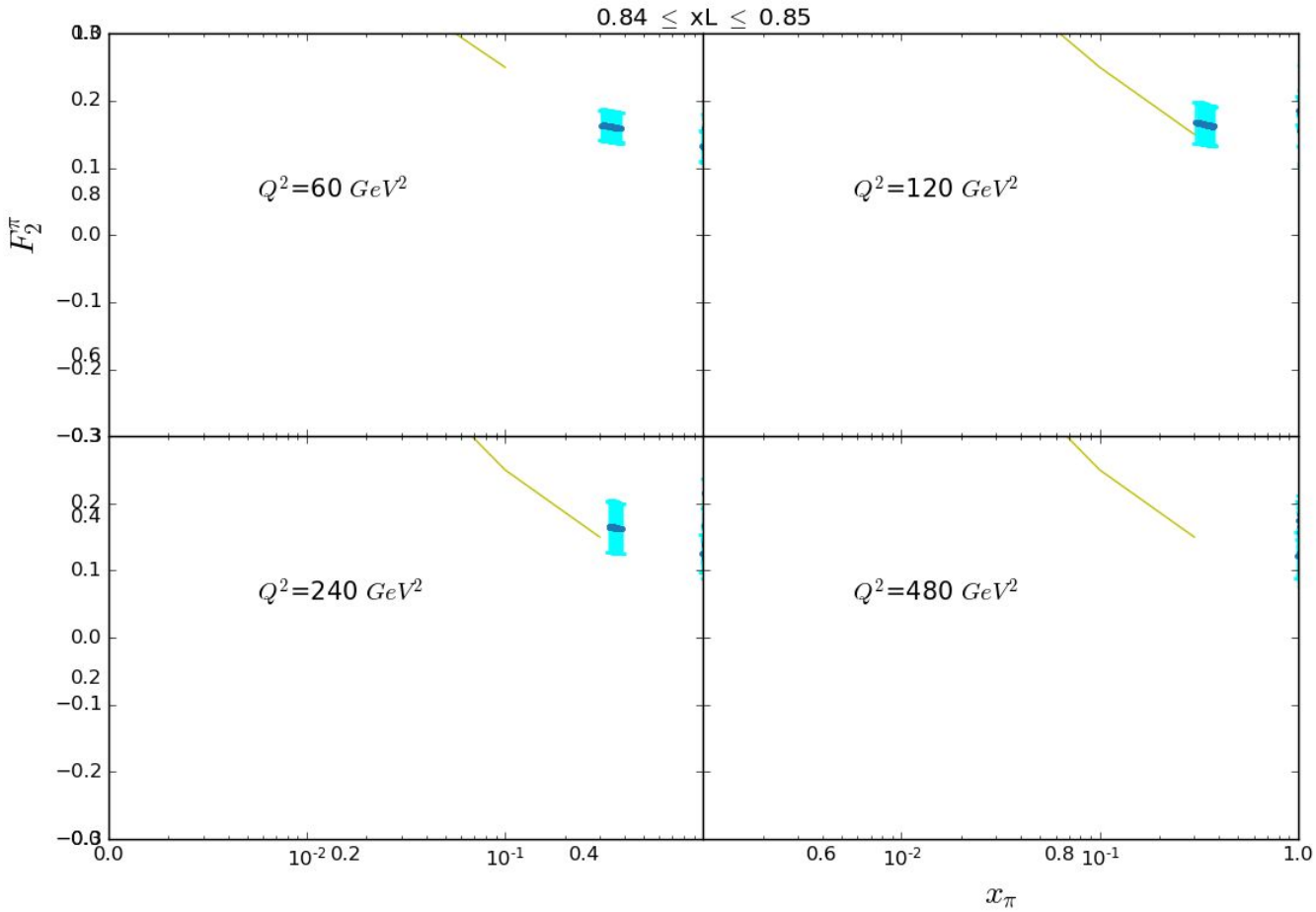
```
xbinwidth = 0.01
qbinwidth = 10.0
tbinwidth = 0.01
xLbinwidth = 0.01
```




```
xbinwidth = 0.1
qbinwidth = 100.0
tbinwidth = 0.01
xLbinwidth = 0.01
```

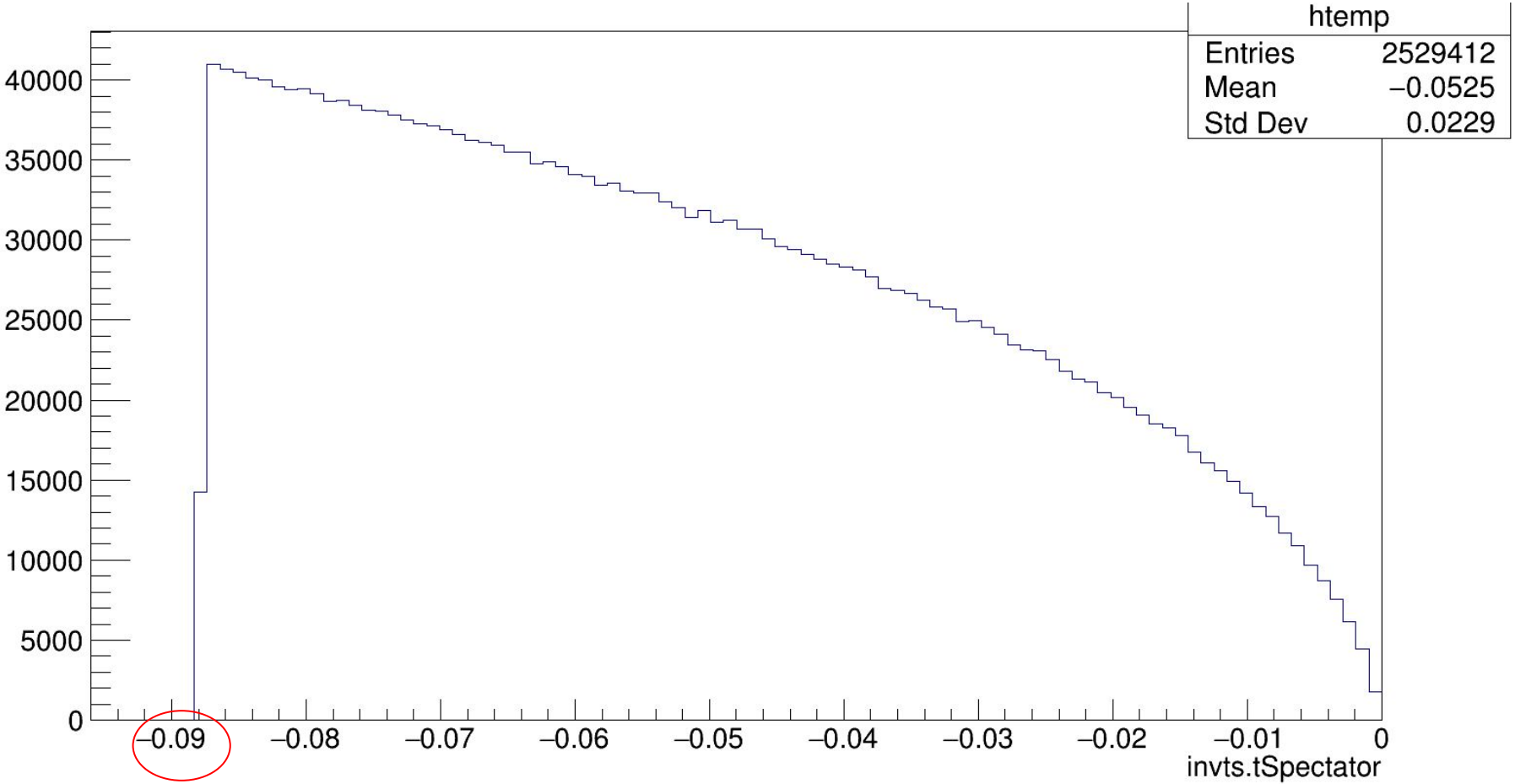


pi_n_10on135_x0.001-1.000_q1.0-1000.0




```
xbinwidth = 0.1
qbinwidth = 100.0
tbinwidth = 0.01
xLbinwidth = 0.01
```

Found one big issue...this odd cut at t



My t is calculated by the following equation...

$$t = (P_{pr} - P_n)^2 = M_{pr}^2 + M_n^2 - 2P_n \cdot P_{pr}$$

where

P_{pr} is the incident proton (i.e. proton beam)

and the LN is defined by the following...

$$P_n = P_{n,rest}.Boosted()$$

$$\vec{P}_{n,rest} = pS_{rest} sin(acos(cos(\theta_{recoil})))[cos(\phi_{recoil})\hat{x} + sin(\phi_{recoil})\hat{y}] + pS_{rest} cos(\theta_{recoil})\hat{z}$$

$pS_{rest} = pS_{max}(uw)^{1/3}$ // uniform in 3p^2 dp = d(p^3), pSMax=0.3, uw = ran3.Uniform()

$cos(\theta_{recoil}) = 2ux - 1$ // ux = ran3.Uniform()

$\phi_{recoil} = \pi(2uy - 1)$ // uy = ran3.Uniform()


```
SIMPLE Event FILE
==========================================
I, ievent, nParticles
==========================================
I       K(I,1)  K(I,2)  K(I,3)  K(I,4)  K(I,5)  P(I,1)  P(I,2)  P(I,3)  P(I,4)  P(I,5)  V(I,1)  V(I,2)  V(I,3)
==========================================
0       1       1
==========================================
1       21      11      0       3       4       -0.027134       0.182672        -9.992511       9.992511        0.000511        0.000000        0.000000        0.000000
2       21      2212    0       5       6       -0.012465       -0.004165       135.025032      135.025032      0.938272        0.000000        0.000000        0.000000
3       21      22      1       0       0       4.898869        -21.778319      -15.863878      27.385338       0.000000        0.000000        0.000000        0.000000
4       1       11      1       0       0       -4.926003       21.960991       5.871367        23.259914       0.000511        0.000000        0.000000        0.000000
5       1       2112    2       0       0       2.699837        -0.097800       114.399623      114.435365      0.939565        0.000000        0.000000        0.000000
6       1       211     2       0       0       -4.898869       21.778319       15.863878       27.385694       0.139570        0.000000        0.000000        0.000000
=============== Event finished ===============
```

```
root -l
gSystem->Load("libeicsmear.so")
BuildTree("target.dat", ".", -1, "log.txt")
```

```
Error in <TROOT::TVector2::Phi_0_2pi>: function called with NaN
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```