EIC meson structure

## June 14th, 2021

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Goals

- Control and quantification of the theory and model uncertainties
  - 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
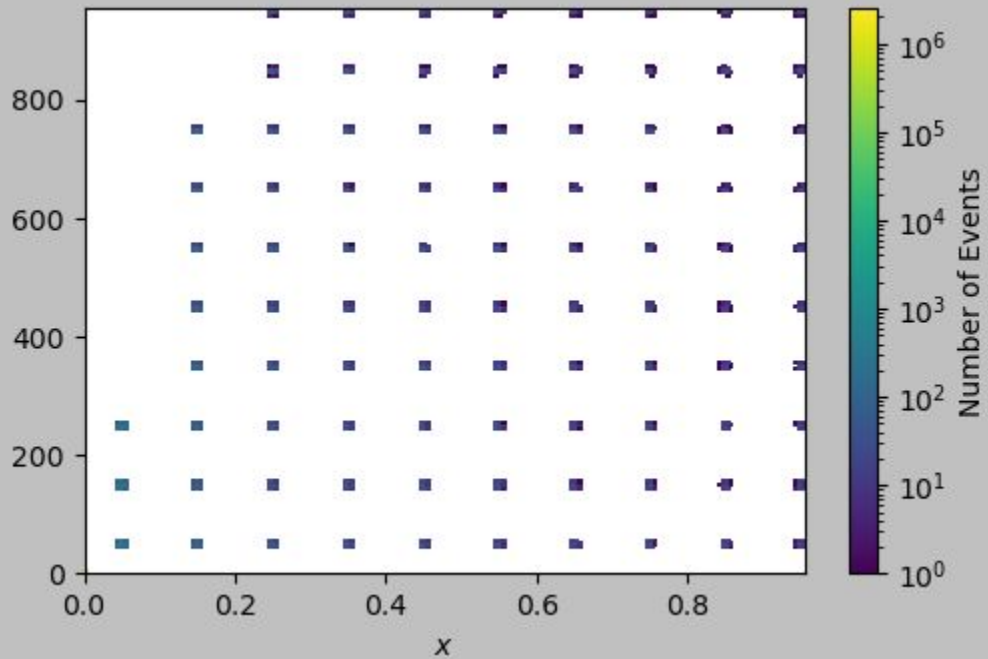- Optimization of 2nd IR with different central detector concepts

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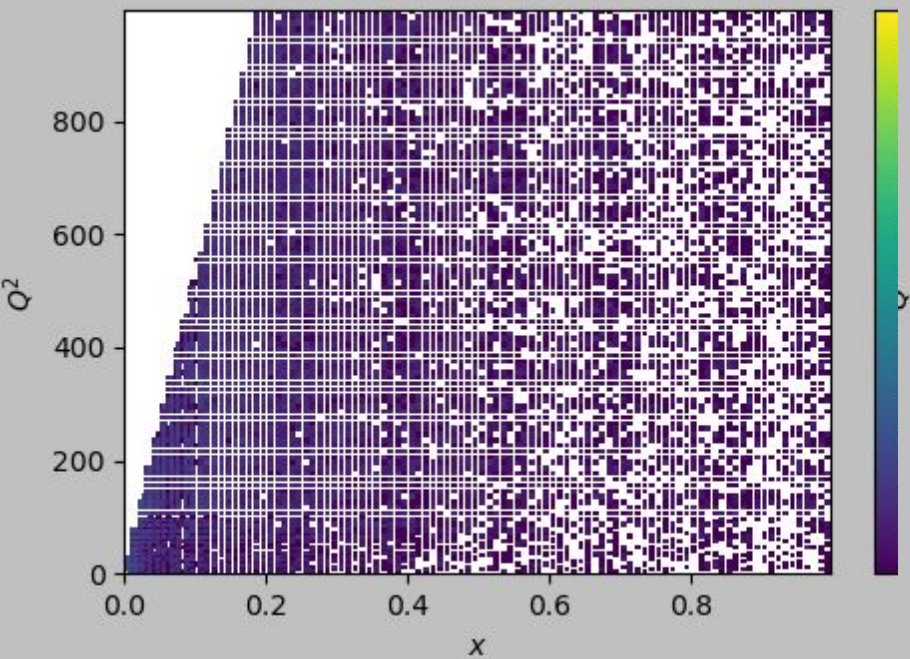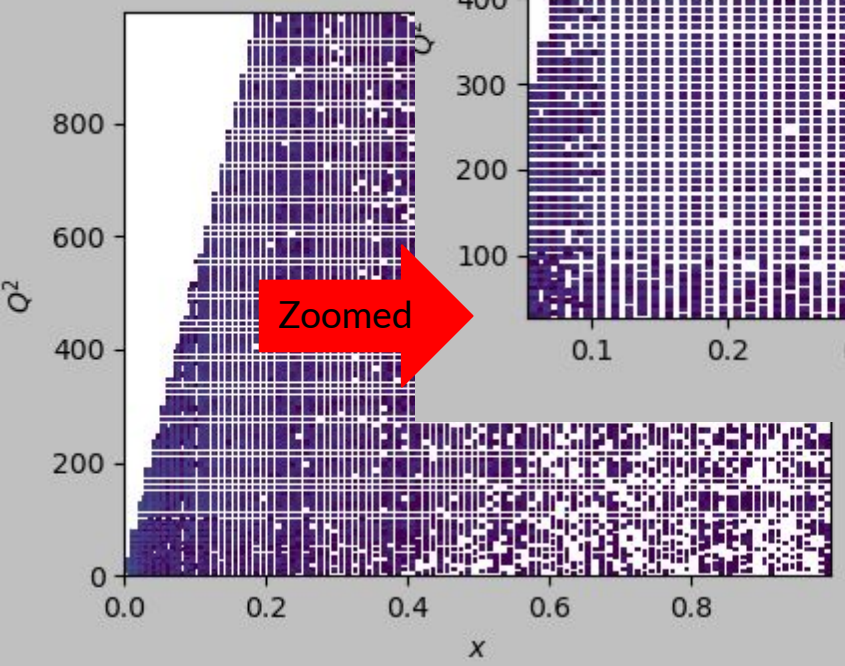
```
xbinwidth = 0.1
qbinwidth = 100.0
tbinwidth = 0.01
xLbinwidth = 0.01
```

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

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```

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xbinwidth = 0.1
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```
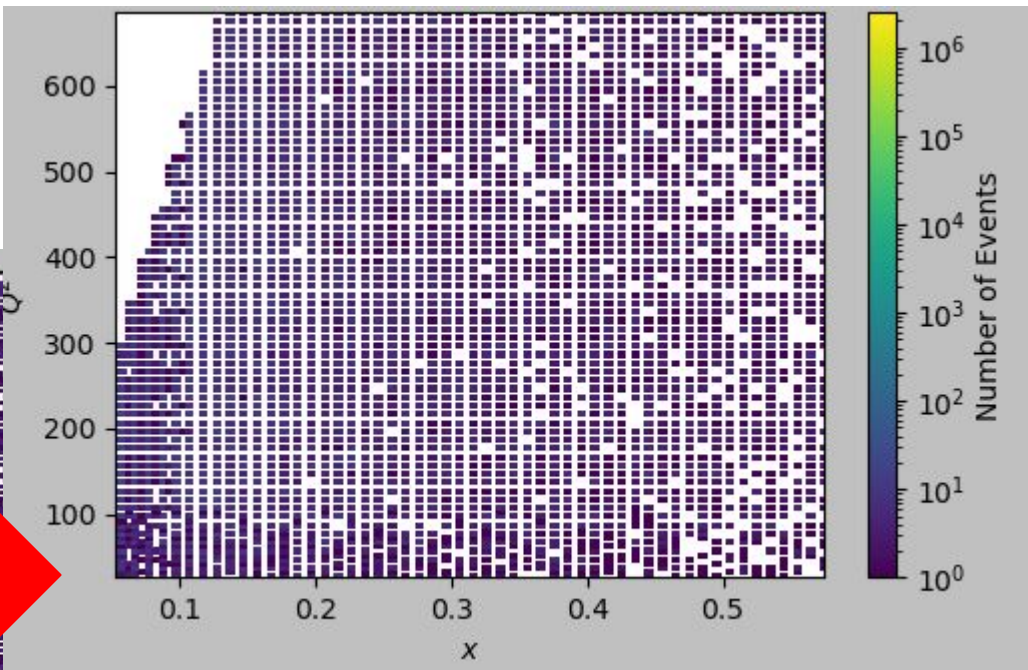
Zoomed

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))}
```
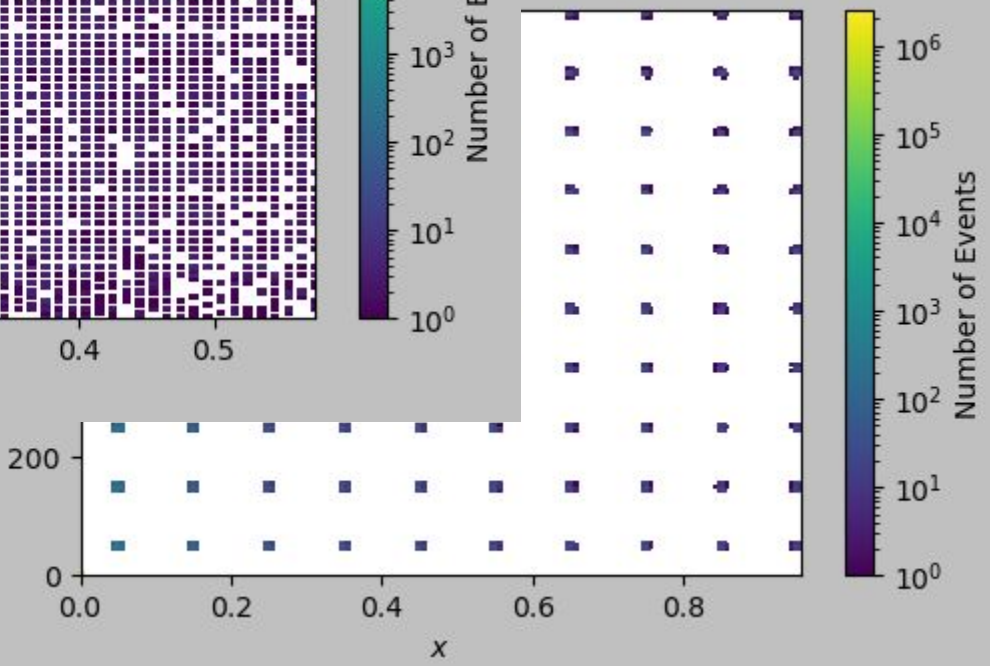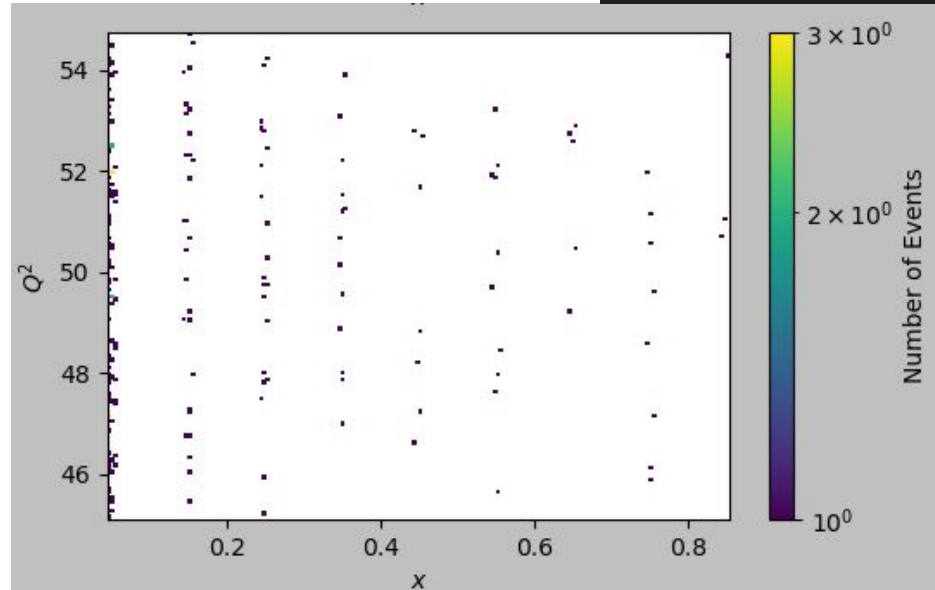
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```

$$0.84 \leq xL \leq 0.85$$

$Q^2 = 60 \ GeV^2$

$Q^2 = 120 \ GeV^2$

$Q^2 = 240 \ GeV^2$

$Q^2 = 480 \ GeV^2$

F_2^π

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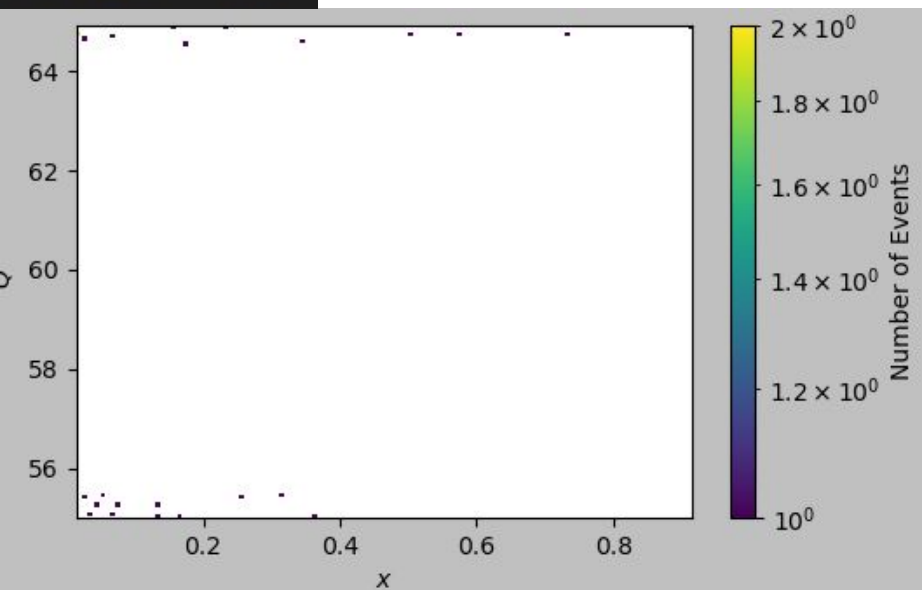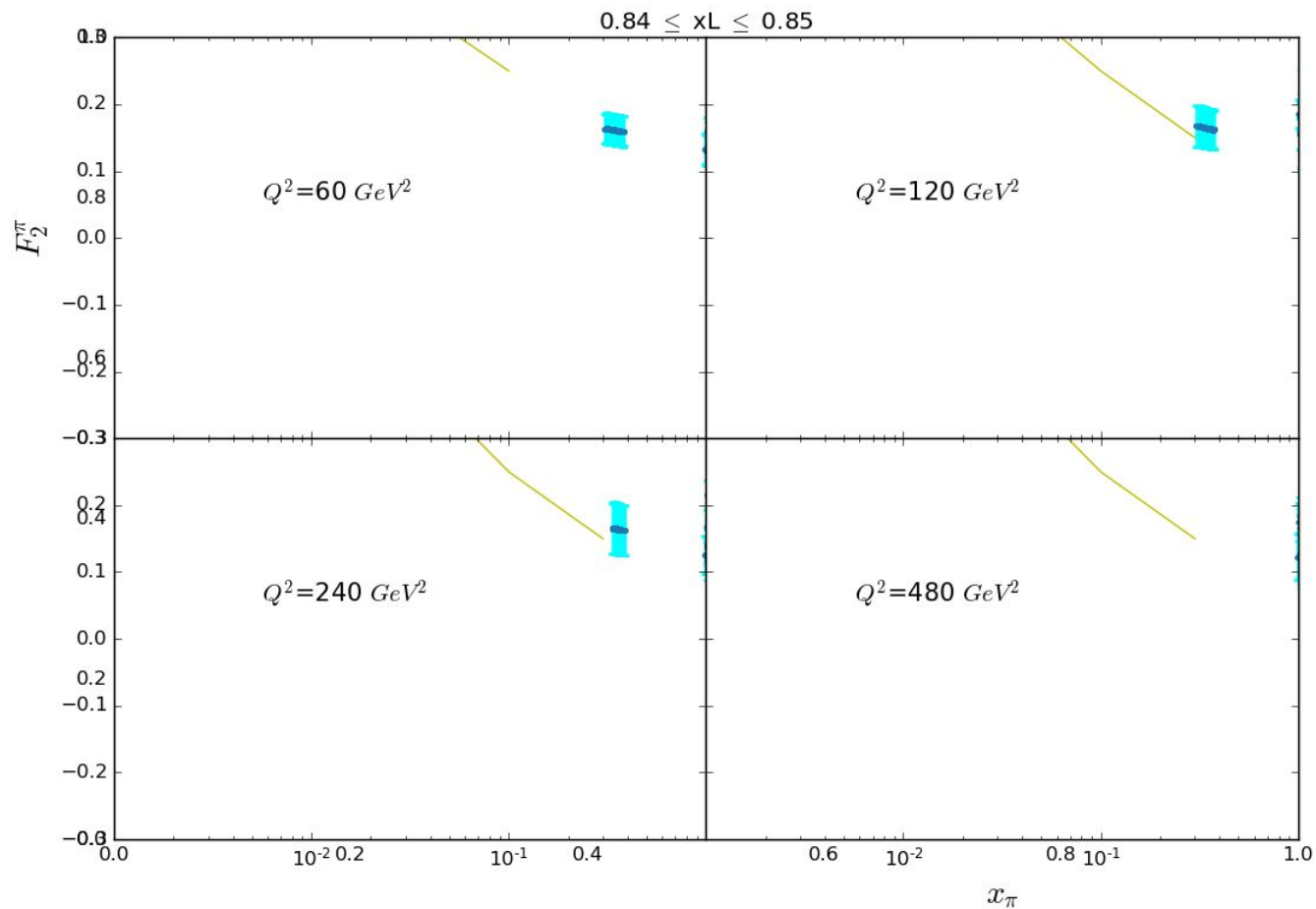
```
xbinwidth  = 0.1
qbinwidth  = 100.0
tbinwidth  = 0.01
xLbinwidth = 0.01
```

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)
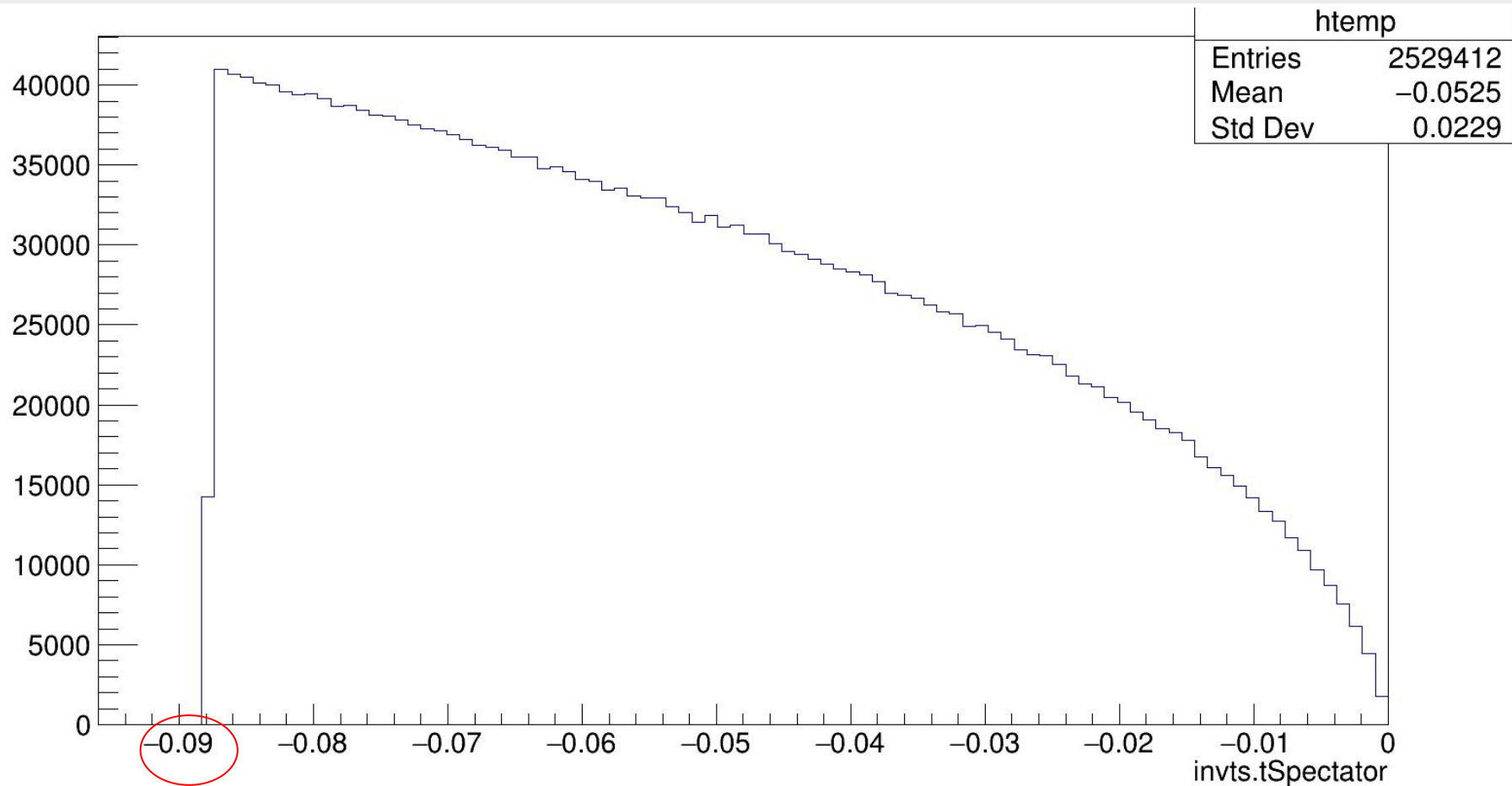
and the LN is defined by the following…

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

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

$pS_{rest} = pS_{max}(uw)^{1/3}$ // 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()

Fun4AllSingularityDistribution
⏻ Powered Off

```
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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