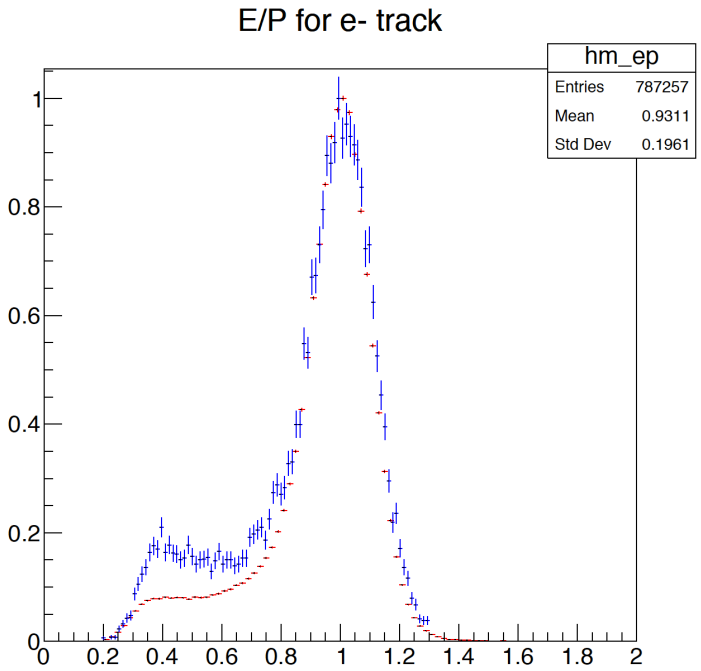
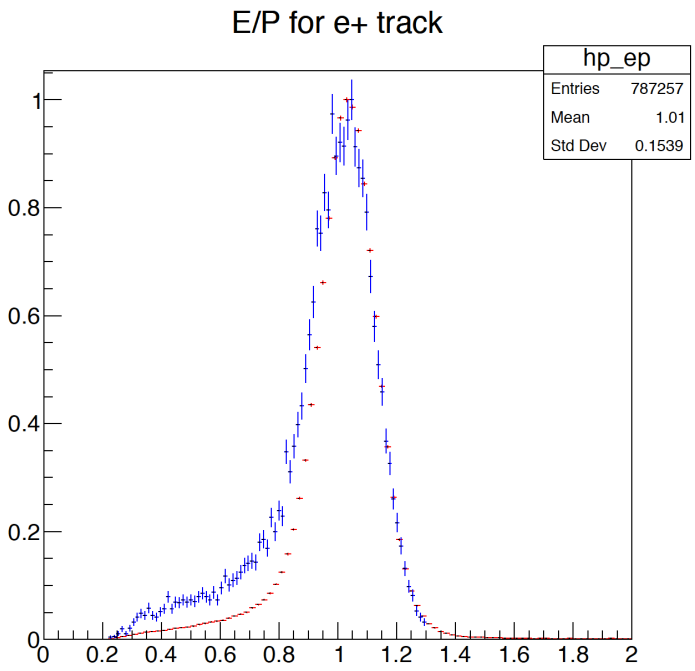
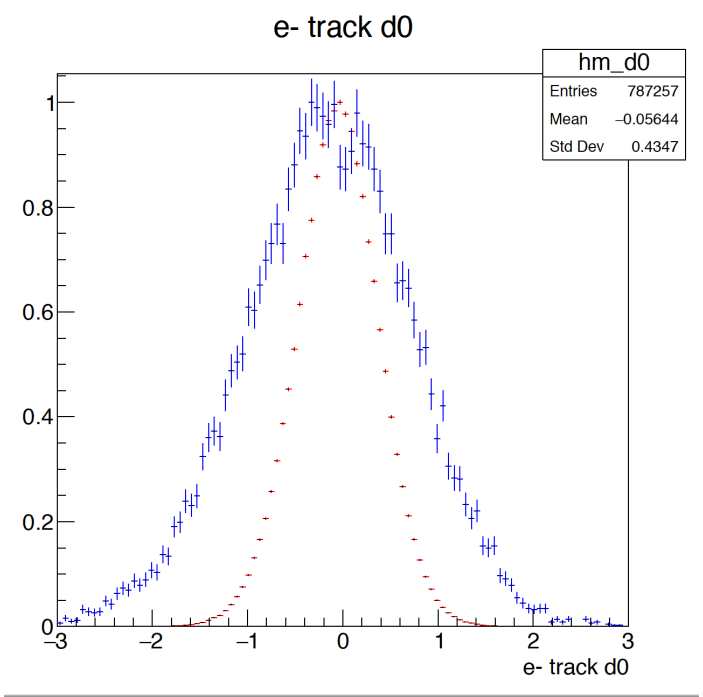
Cuts for L2L2, Vertex Reconstruction Efficiency

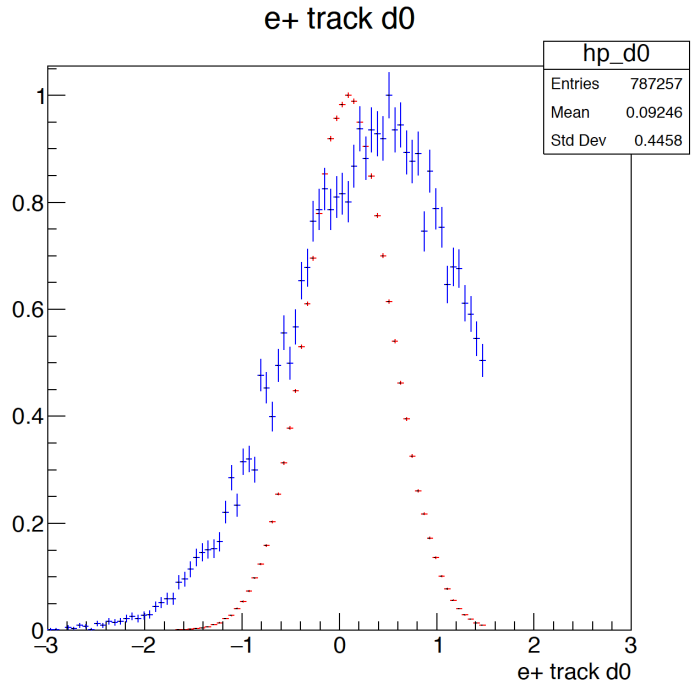

E/P for e- track
hm_ep
Entries 787257
Mean 0.9311
Std Dev 0.1961

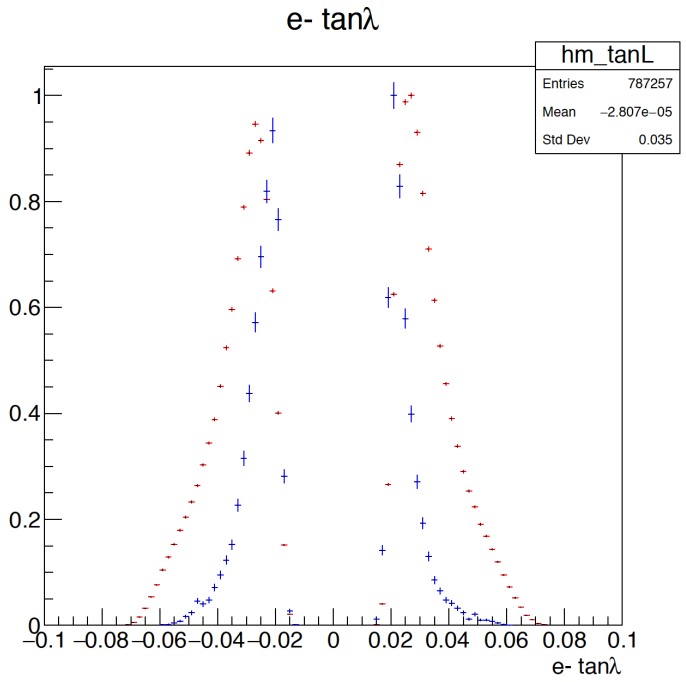

E/P for e+ track
hp_ep
Entries 787257
Mean 1.01
Std Dev 0.1539

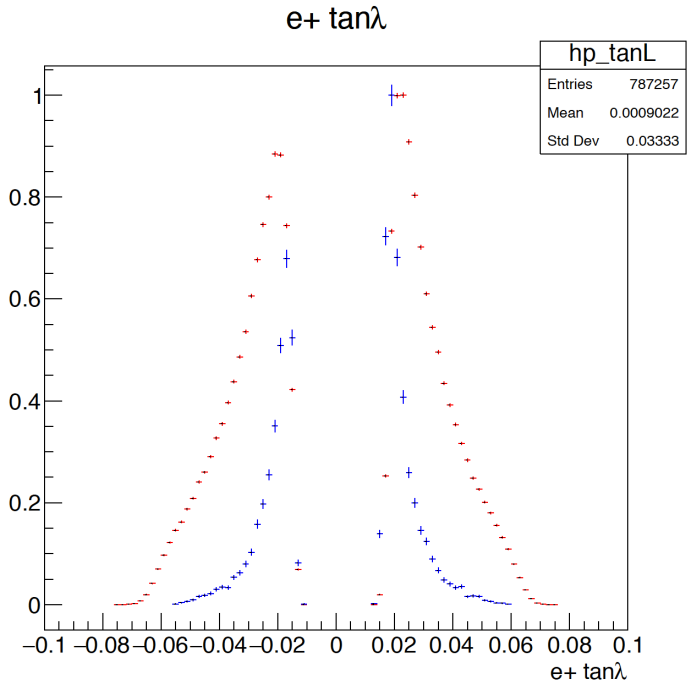
L1L1

L2L2


e- track d0
hm_d0
Entries 787257
Mean −0.05644
Std Dev 0.4347
e- track d0

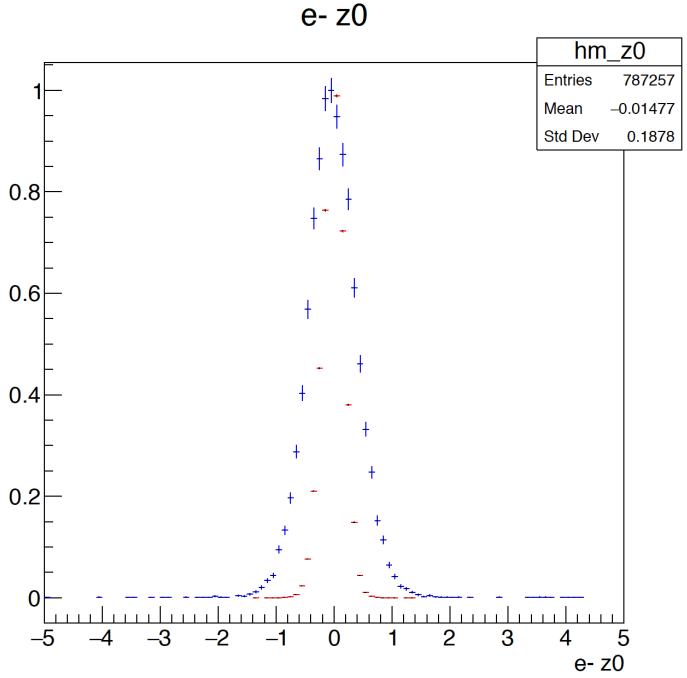

e+ track d0
hp_d0
Entries 787257
Mean 0.09246
Std Dev 0.4458
e+ track d0

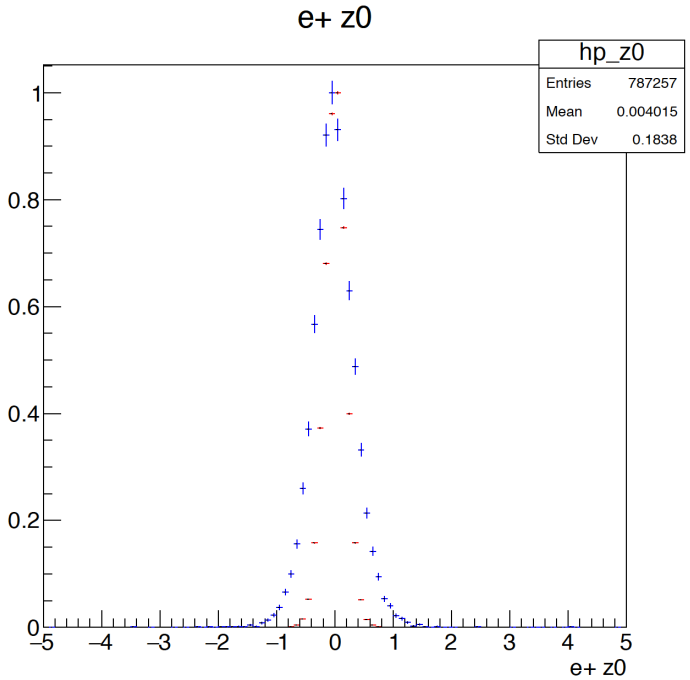

e- tanλ
hm_tanL
Entries 787257
Mean −2.807e−05
Std Dev 0.035
e- tanλ

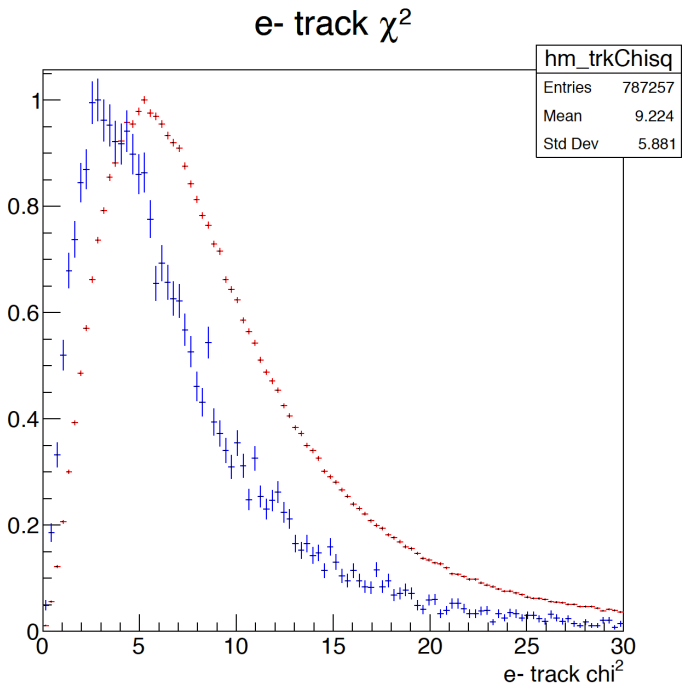

e+ tanλ
hp_tanL
Entries 787257
Mean 0.0009022
Std Dev 0.03333
e+ tanλ

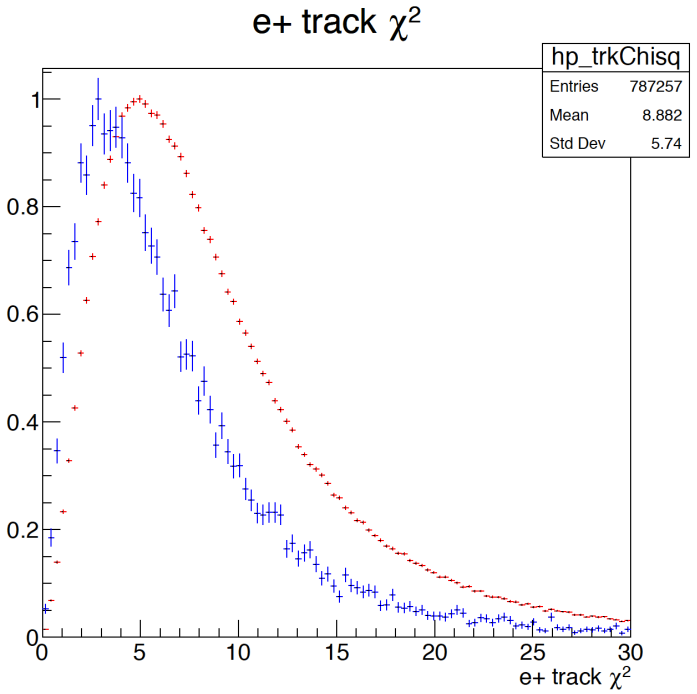
L1L1

L2L2


e- z0
hm_z0
Entries 787257
Mean −0.01477
Std Dev 0.1878
e- z0

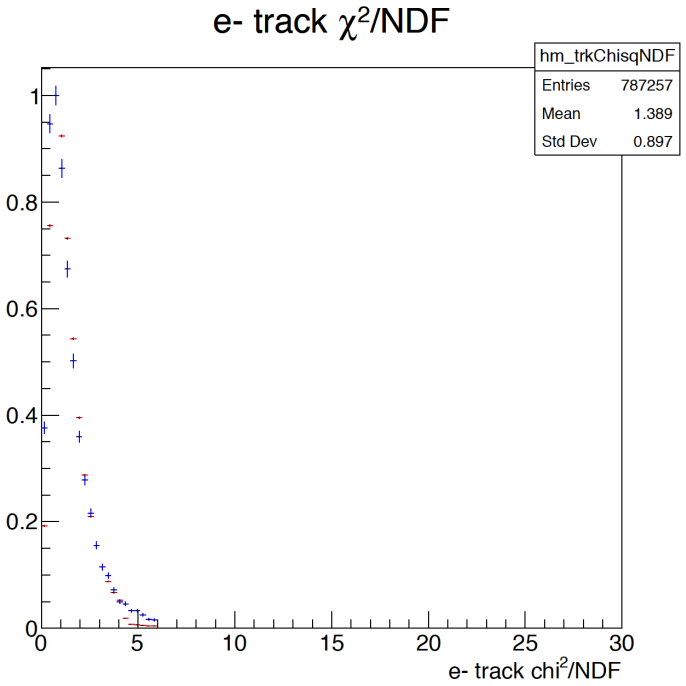

e+ z0
hp_z0
Entries 787257
Mean 0.004015
Std Dev 0.1838
e+ z0

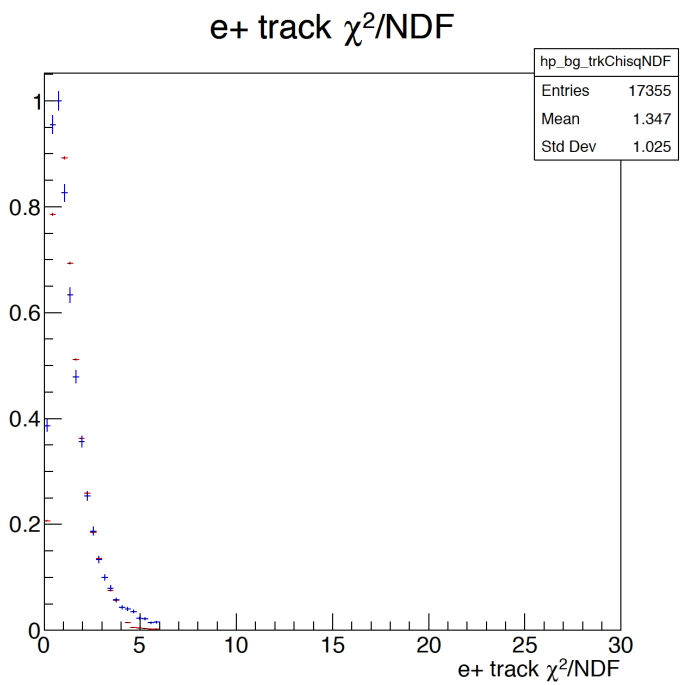

e- track χ^2
hm_trkChisq
Entries 787257
Mean 9.224
Std Dev 5.881
e- track chi^2

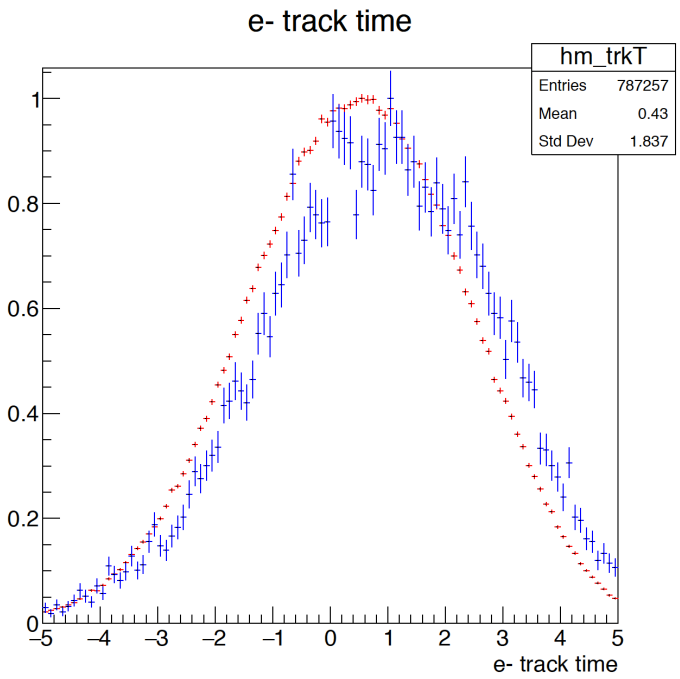

e+ track χ^2
hp_trkChisq
Entries 787257
Mean 8.882
Std Dev 5.74
e+ track χ^2

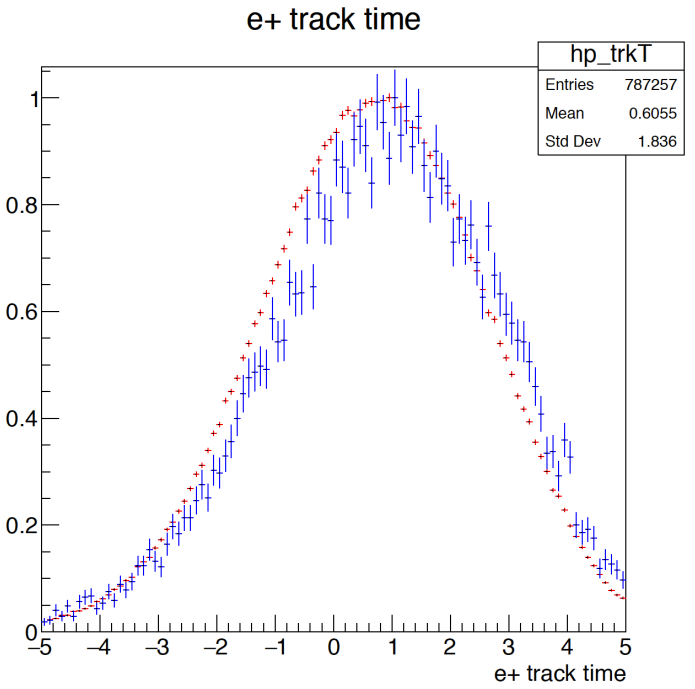
L1L1

L2L2


e- track χ^2/NDF
hm_trkChisqNDF
Entries 787257
Mean 1.389
Std Dev 0.897
e- track chi^2/NDF

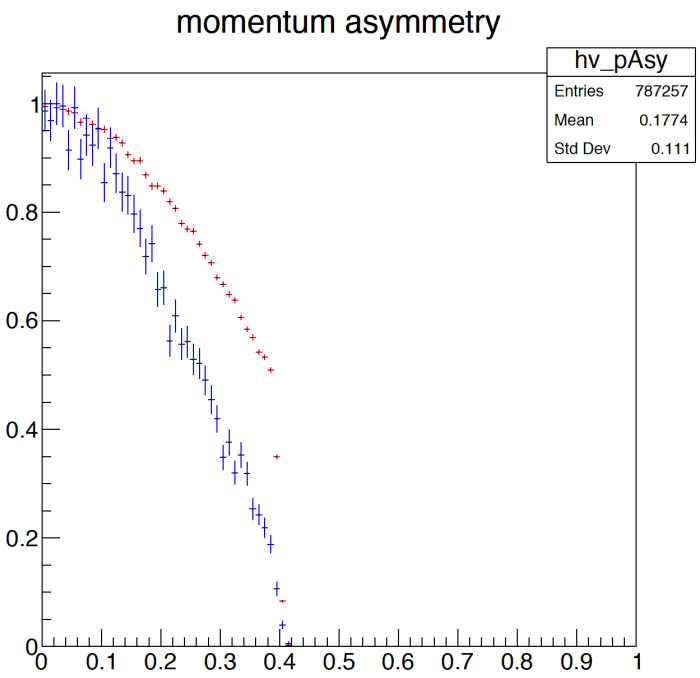

e+ track χ^2/NDF
hp_bg_trkChisqNDF
Entries 17355
Mean 1.347
Std Dev 1.025
e+ track χ^2/NDF

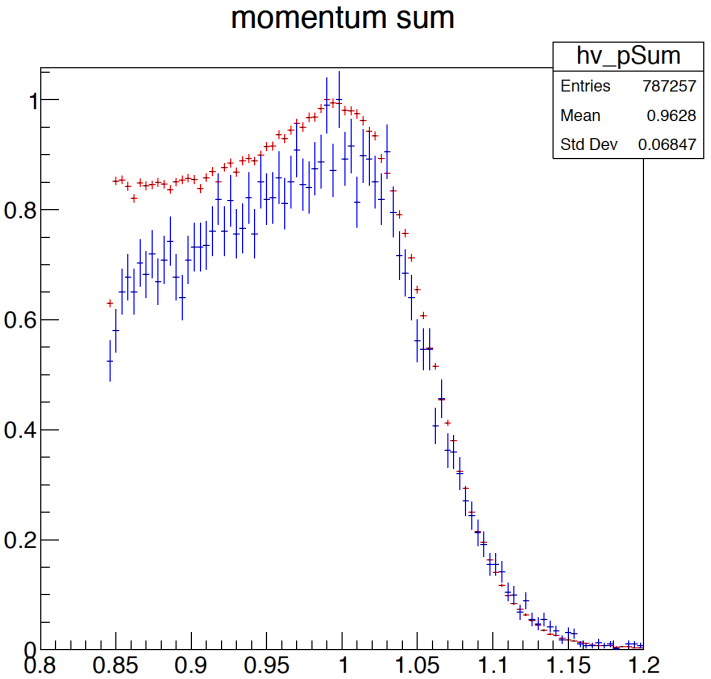

e- track time
hm_trkT
Entries 787257
Mean 0.43
Std Dev 1.837
e- track time

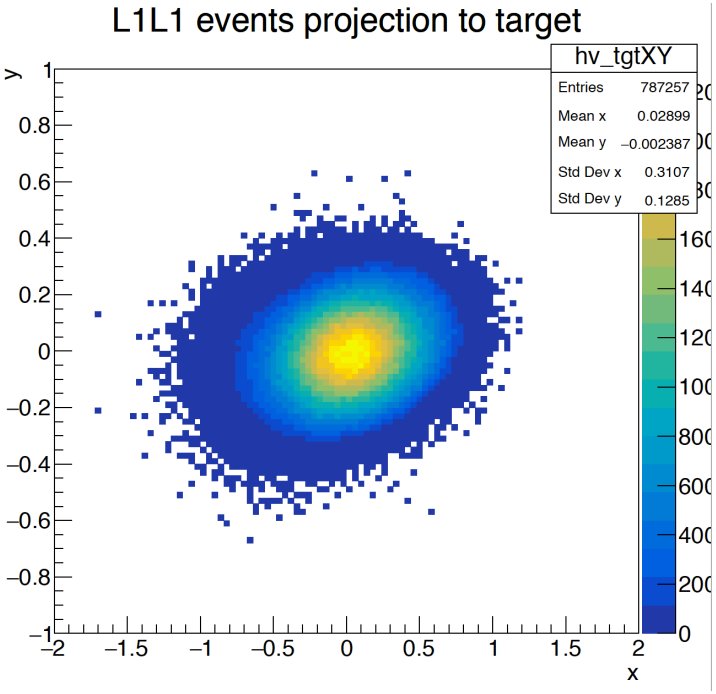

e+ track time
hp_trkT
Entries 787257
Mean 0.6055
Std Dev 1.836
e+ track time

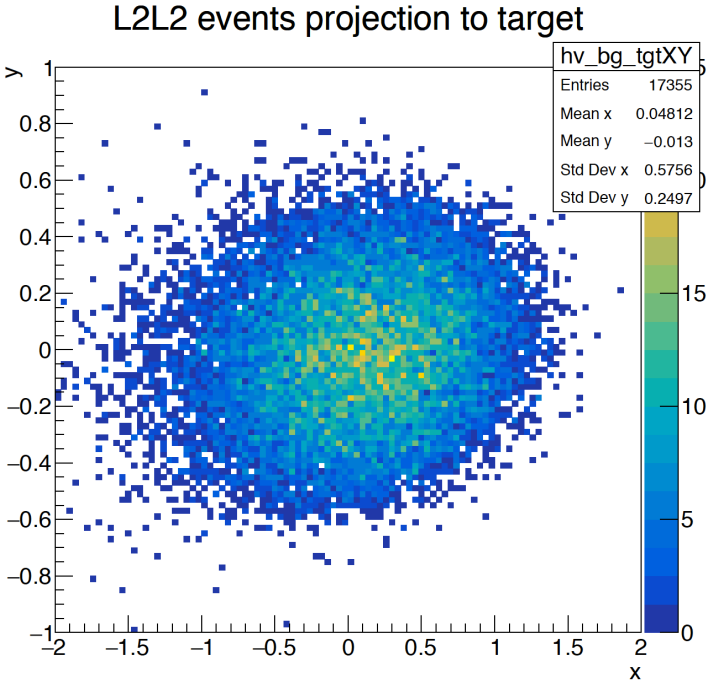
L1L1

L2L2


momentum asymmetry
hv_pAsy
Entries 787257
Mean 0.1774
Std Dev 0.111

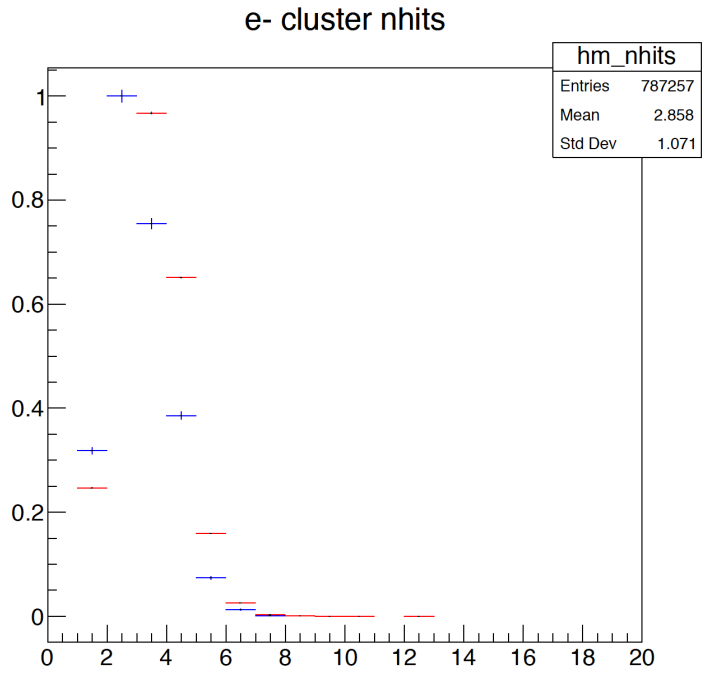

momentum sum
hv_pSum
Entries 787257
Mean 0.9628
Std Dev 0.06847

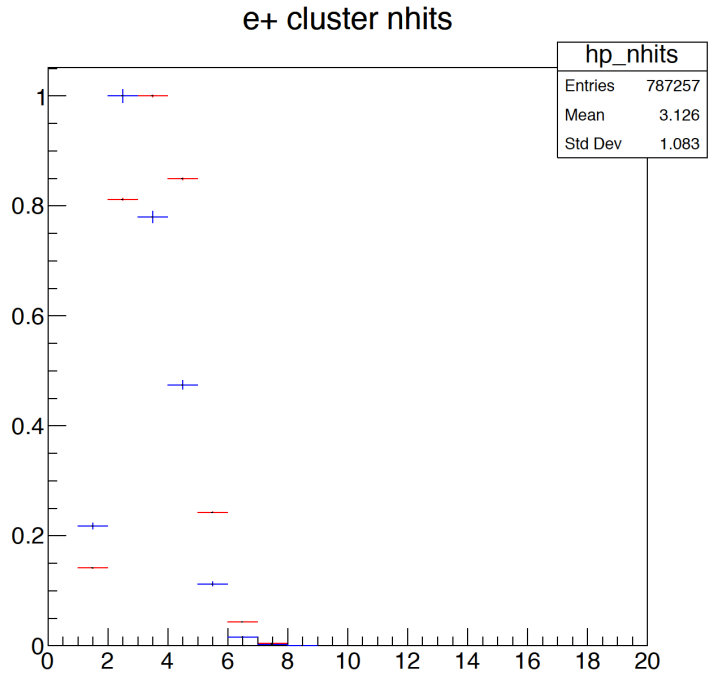

L1L1 events projection to target
hv_tgtXY
Entries 787257
Mean x 0.02899
Mean y −0.002387
Std Dev x 0.3107
Std Dev y 0.1285
y
x


L2L2 events projection to target
hv_bg_tgtXY
Entries 17355
Mean x 0.04812
Mean y −0.013
Std Dev x 0.5756
Std Dev y 0.2497
y
x

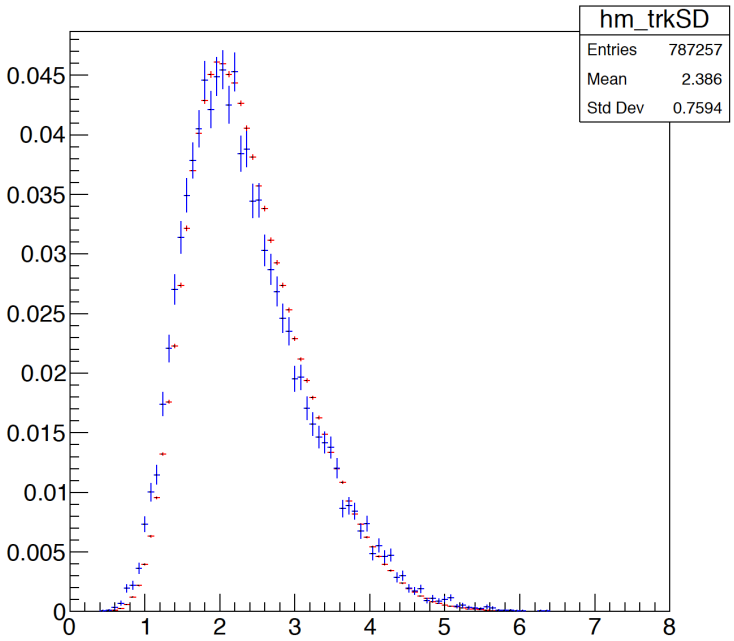
L1L1

L2L2


e- cluster nhits
hm_nhits
Entries 787257
Mean 2.858
Std Dev 1.071


e+ cluster nhits
hp_nhits
Entries 787257
Mean 3.126
Std Dev 1.083

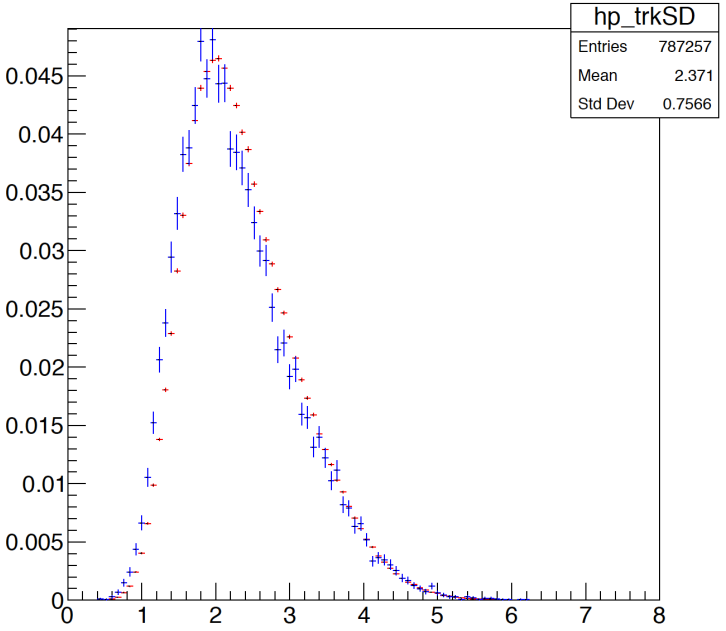
e- track time standard deviation



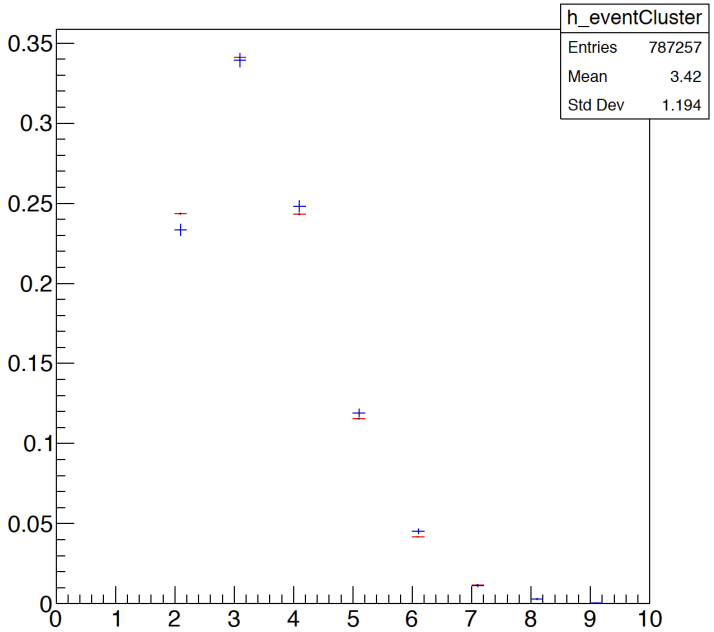
L1L1

L2L2

e+ track time standard deviation



Number of clusters in the event



More (complete) plots at:

https://userweb.jlab.org/~hszumila/vertex/compareL1L2Plots_10Feb17.pdf
https://userweb.jlab.org/~hszumila/vertex/compareL1L2Plots_v2_10Feb.pdf

Datasets	First hit of track	Number of events (SVT at 0.5mm)
L1L1	Both layer 1	1,450,796
L1L2	one track layer 1	258,613
L2L2	Both layer 2	9,442

$$S_{bin,zcut} = f_{rad}\, N_{bin}\, \frac{3\pi\epsilon^2}{2\alpha} \frac{m_{A'}}{\delta m_{A'}} \epsilon_{bin} \int_{z_{cut}}^{z_{max}} \frac{e^{ztgt-z/\gamma c\tau}}{\gamma c\tau} \epsilon_{vtx}(z, m_{A'}) dz$$

$$z_{max} = 100\ mm$$
$$\epsilon_{bin} = 0.838$$

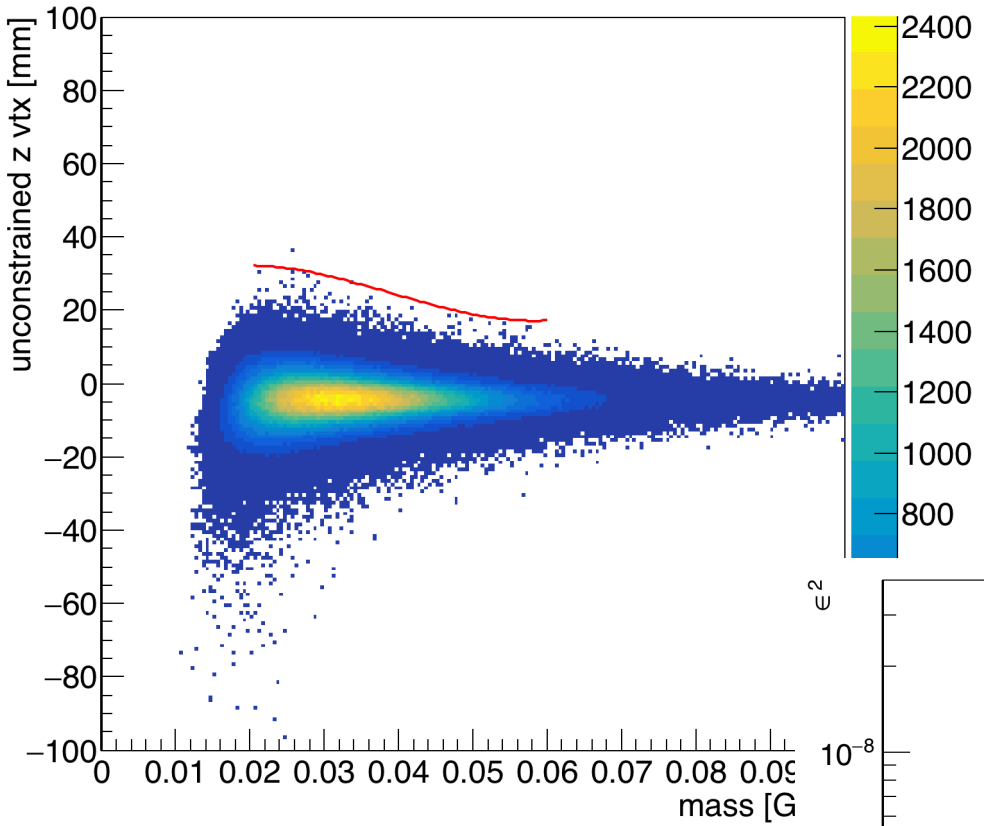
L1L1 dataset

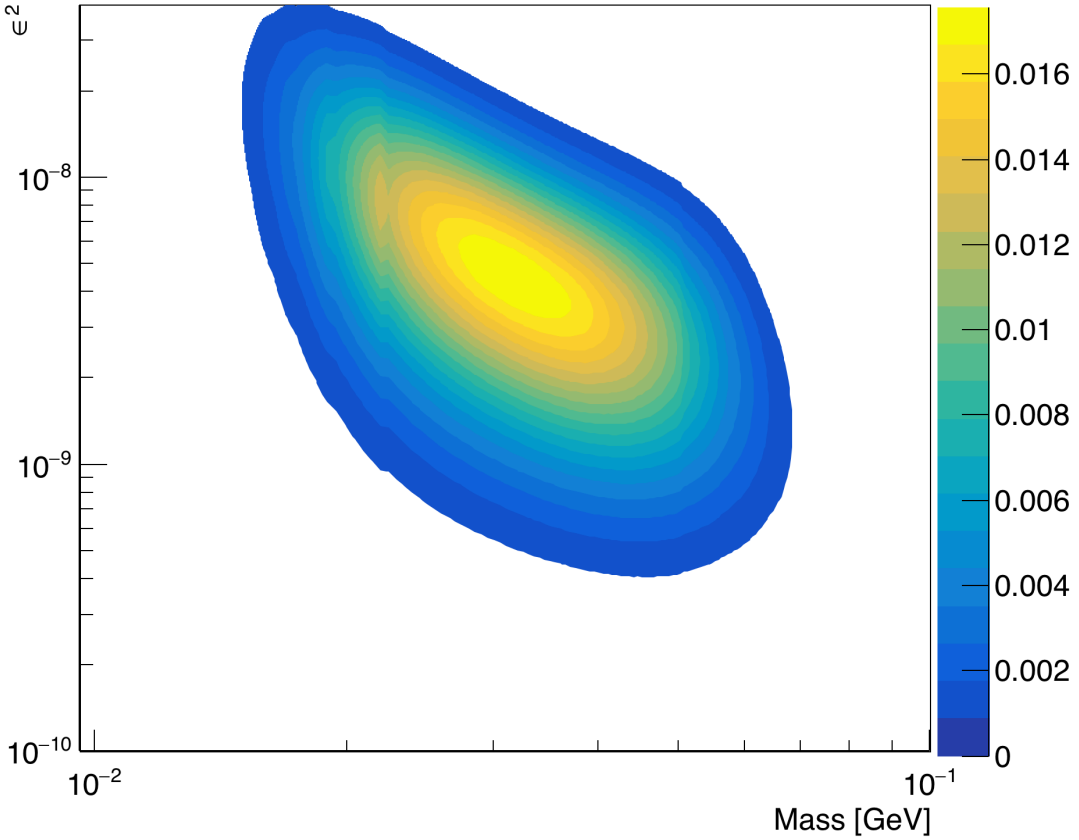
$$\epsilon_{vtx} = e^{p_0 z^3 + p_1 z^2 + p_2 z + p_3}$$

Fits at each A' mass for L1L1:
https://userweb.jlab.org/~hszumila/vertex/vertexEffMC/vertexEffFitsL1L1.pdf

$$p_0 = 1.3305E^{-5} - 4.171E^{-7}m$$
$$p_1 = -0.00118 + 2.566E^{-5}\text{m}$$
$$p_2 = -0.01$$
$$p_3 = 0.0988 - 0.011m + 0.000134m^2$$

Integrate when computing the reach.


unconstrained z vtx [mm]
100
80
60
40
20
0
−20
−40
−60
−80
−100
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
mass [G
2400
2200
2000
1800
1600
1400
1200
1000
800

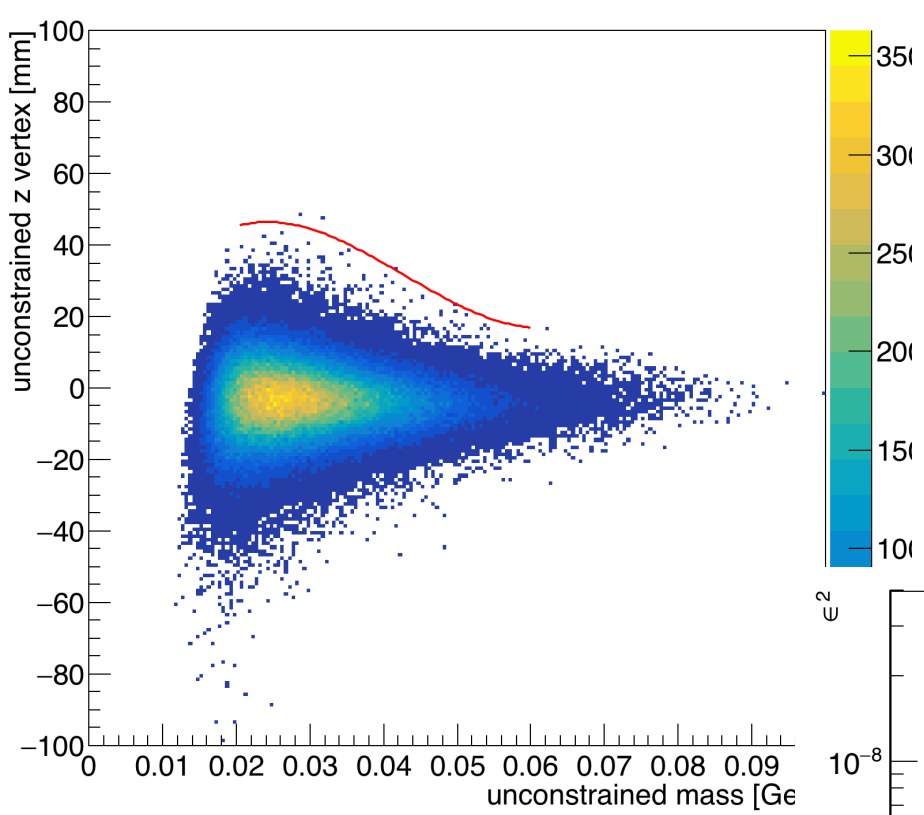

ϵ^2
10^{-8}
10^{-9}
10^{-10}
10^{-2}
10^{-1}
Mass [GeV]
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0

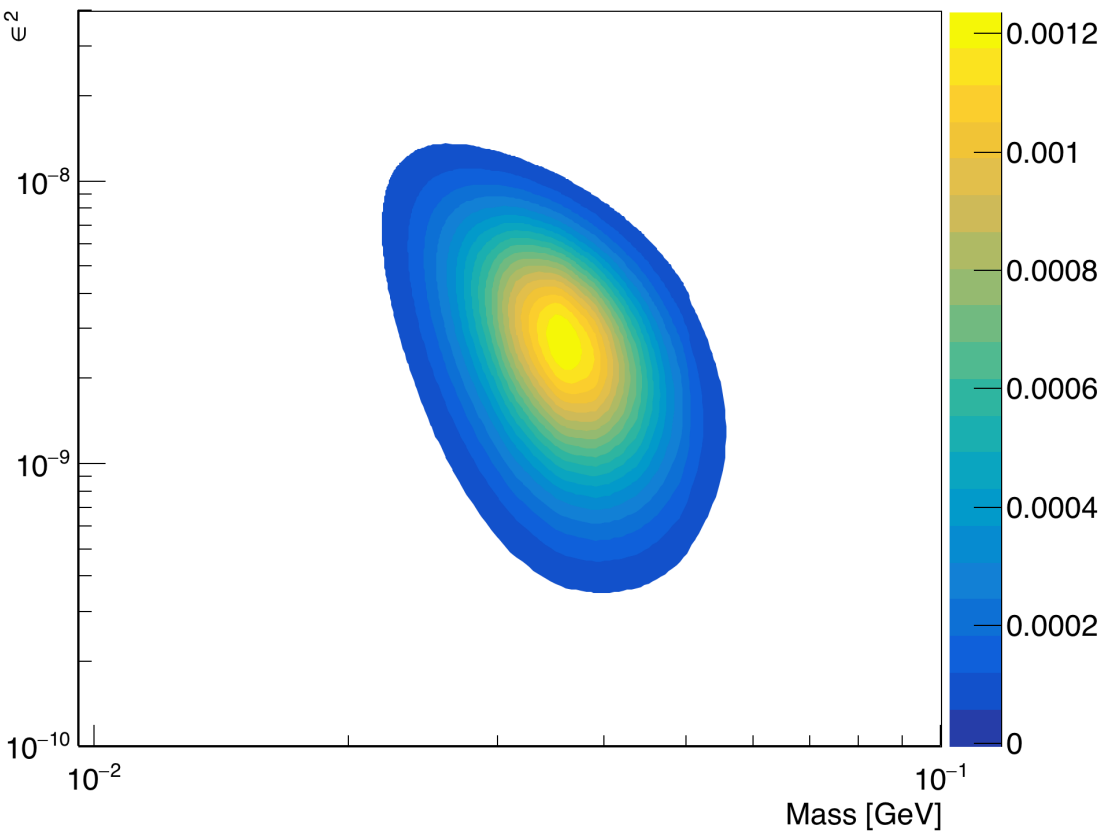
L1L2 dataset

$$\epsilon_{vtx} = p_0 e^{-(z-p_1)^2/(2p_2)^2}$$

Fits at each A' mass for L1L1:
https://userweb.jlab.org/~hszumila/vertex/vertexEffMC/vertexEffFitsL1L2.pdf

$$p_0 = -0.536 + 0.0426m - 0.00052m^2$$
$$p_1 = -34.38 + 3.126m - 0.0252m^2$$
$$p_2 = 6.87 + 0.0932m$$


unconstrained z vertex [mm]
100
80
60
40
20
0
−20
−40
−60
−80
−100
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
unconstrained mass [Ge
350
300
250
200
150
100

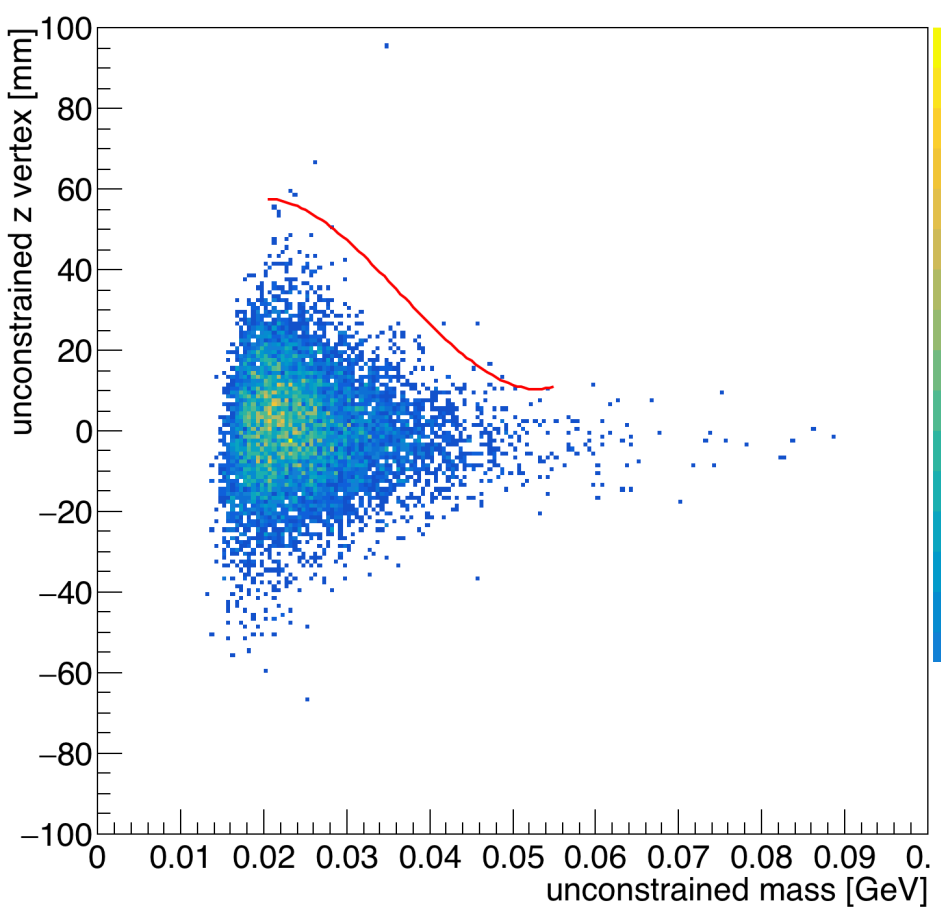

ϵ^2
10^{-8}
10^{-9}
10^{-10}
10^{-2}
10^{-1}
Mass [GeV]
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0

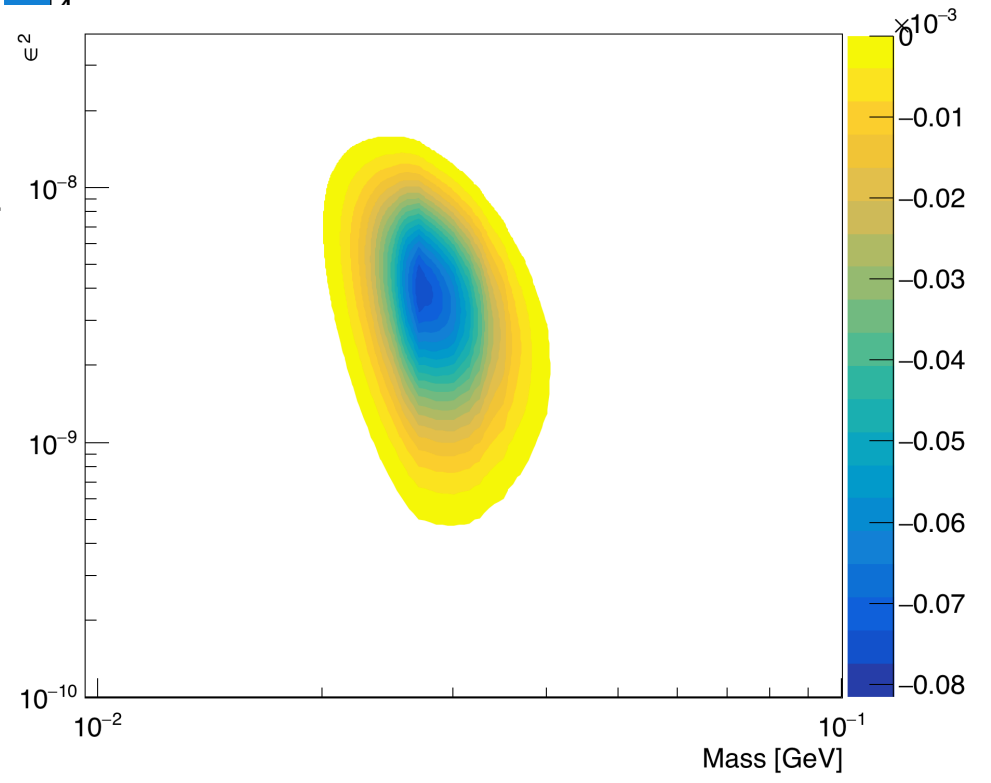
L2L2 dataset

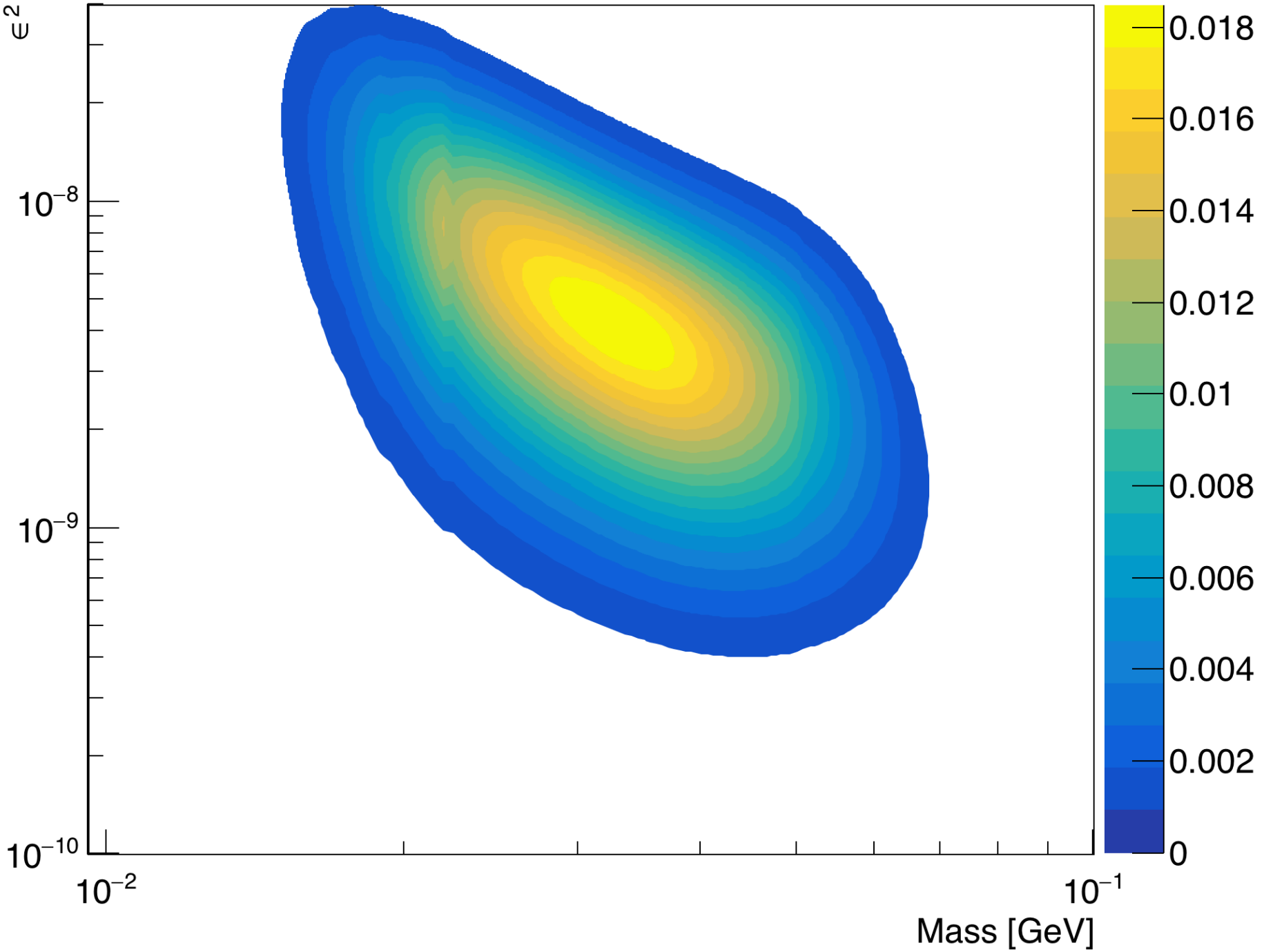
$$\epsilon_{vtx} = p_0 e^{-(z-p_1)^2/(2p_2)^2}$$

Fits at each A' mass for L1L1:
https://userweb.jlab.org/~hszumila/vertex/vertexEffMC/vertexEffFitsL2L2.pdf

$$p_0 = -0.204 + 0.013m - 0.0013m^2$$
$$p_1 = -40.3 + 4.9m - 0.047m^2$$
$$p_2 = 5.827 + 0.079m$$


unconstrained z vertex [mm]
100
80
60
40
20
0
−20
−40
−60
−80
−100
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.
unconstrained mass [GeV]
18
16
14
12
10
8
6


ϵ^2
10^{-8}
10^{-9}
10^{-10}
10^{-2}
10^{-1}
Mass [GeV]
$\times 10^{-3}$
0
−0.01
−0.02
−0.03
−0.04
−0.05
−0.06
−0.07
−0.08


ϵ^2
10^{-8}
10^{-9}
10^{-10}
10^{-2}
10^{-1}
Mass [GeV]
0.018
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0