Vertexing Analysis: L1L2, L2L2, and 2016 Data

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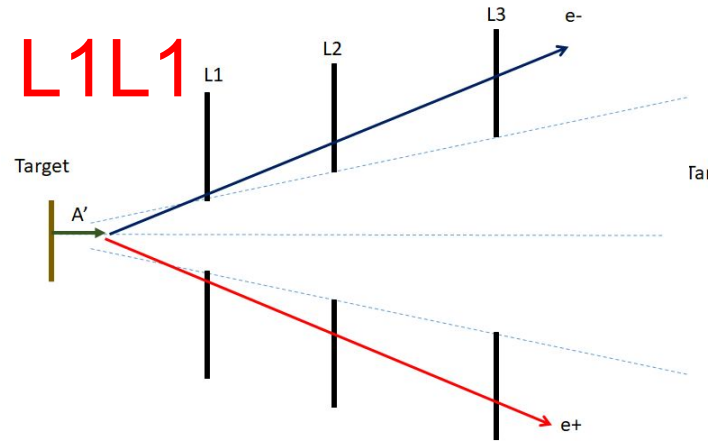
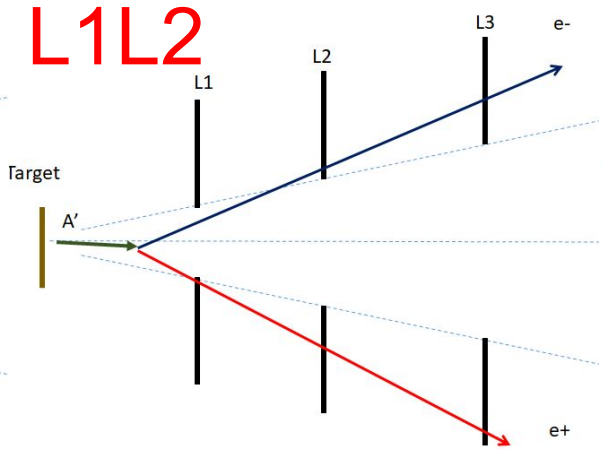
May 23, 2018

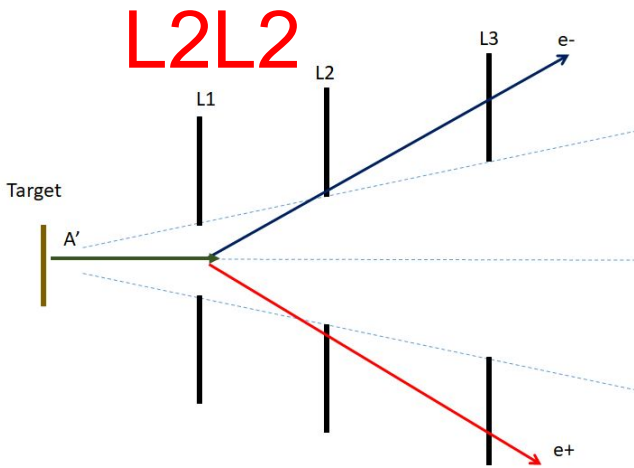
Dividing the Vertex Analysis into Categories

Vertex analysis is divided into mutually exclusive categories based on which particles hit which layers

L1L2/L2L2 capture the longer-lived A's, improve low ε reach

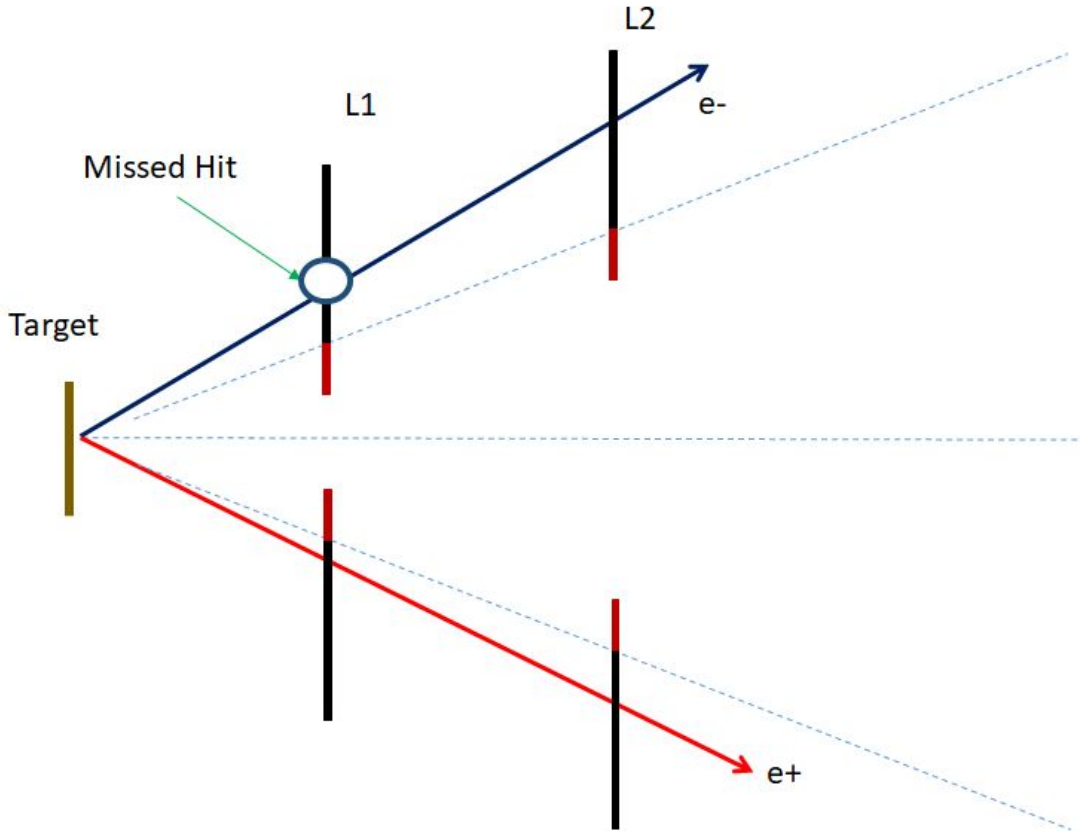






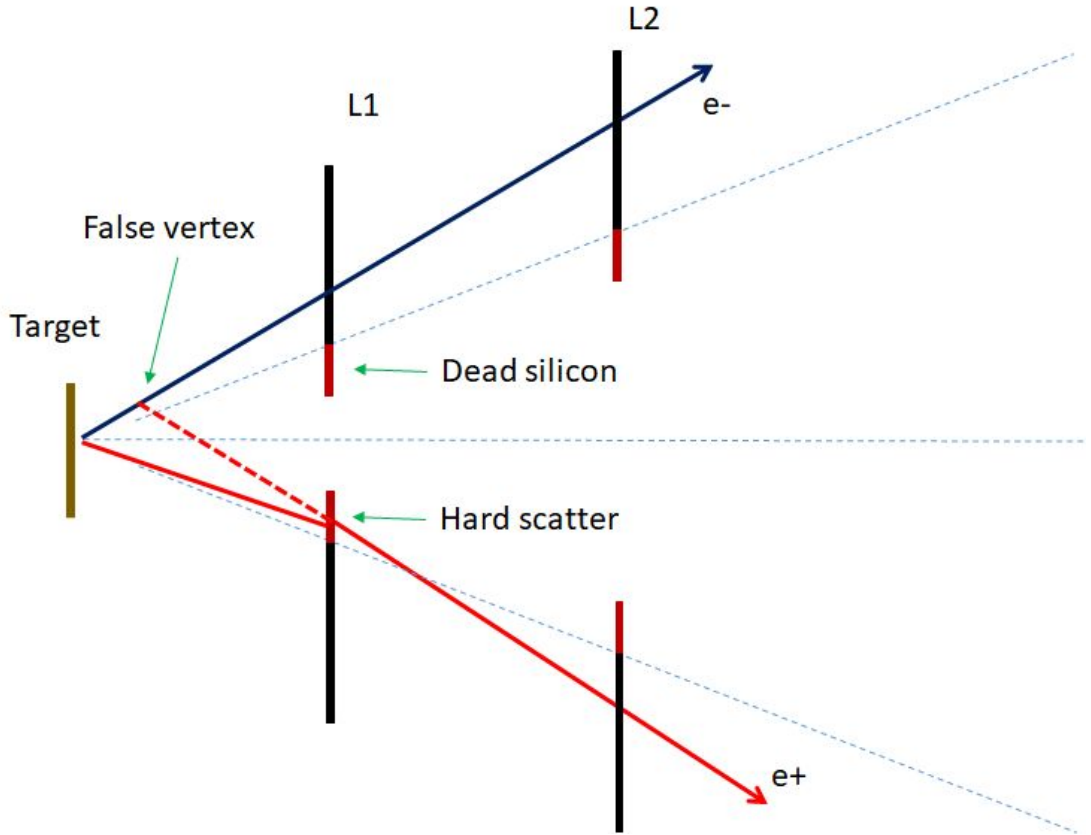
Possible Types of Background for L1L2 and L2L2

1. Hit inefficiencies (not present in MC!)



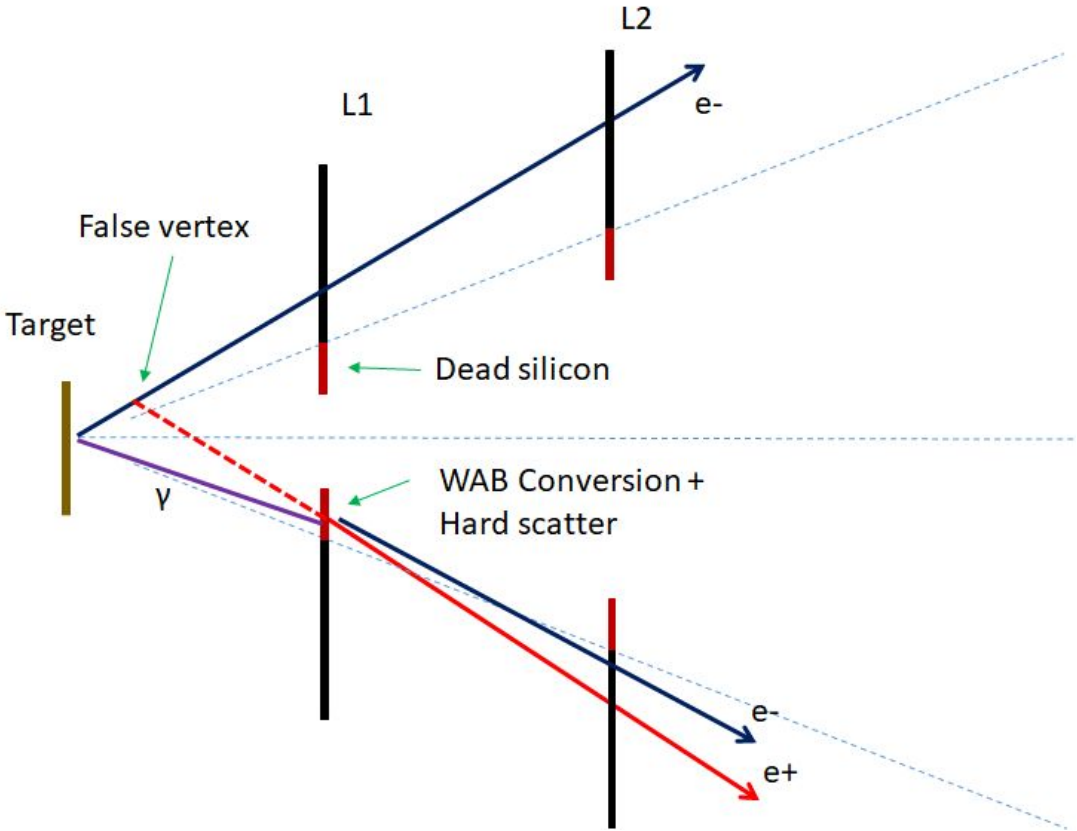
Possible Types of Background for L1L2 and L2L2

1. Hit inefficiencies (not present in MC!)
2. Large scatters in the dead silicon into the active region



Possible Types of Background for L1L2 and L2L2

1. Hit inefficiencies (not present in MC!)
2. Large scatters in the dead silicon into the active region
3. Wab conversion in dead silicon and large scatter into the active region



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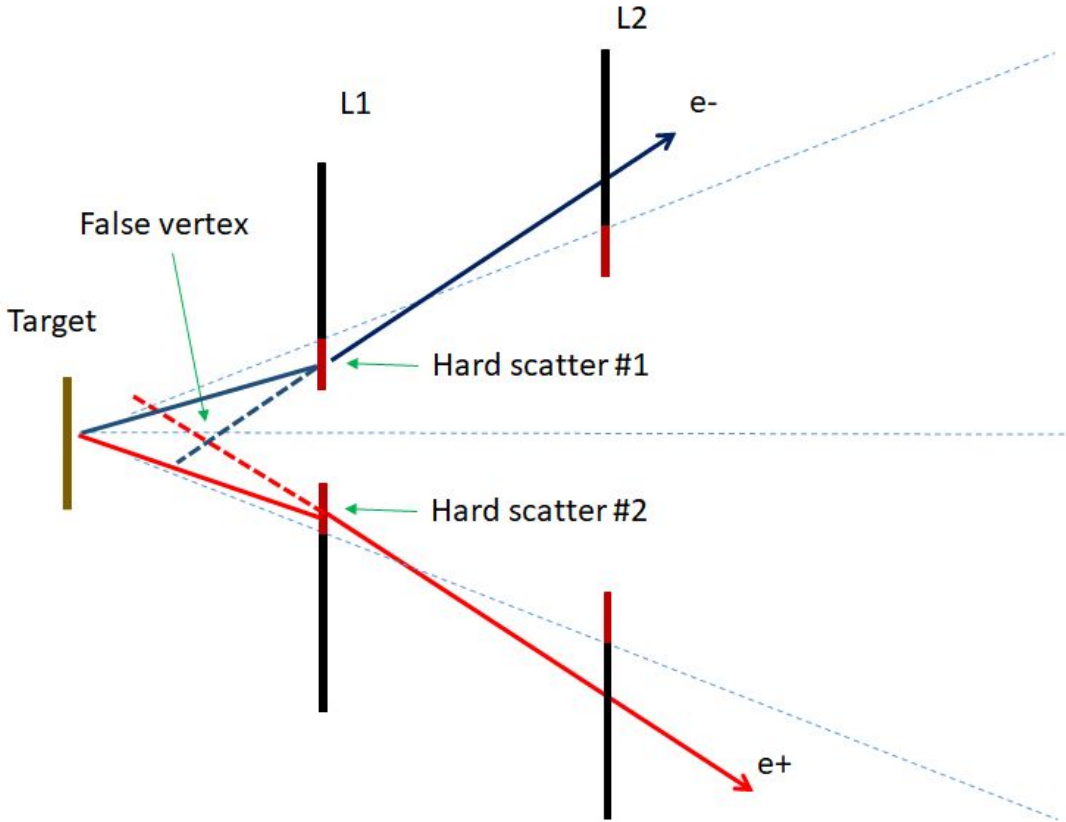

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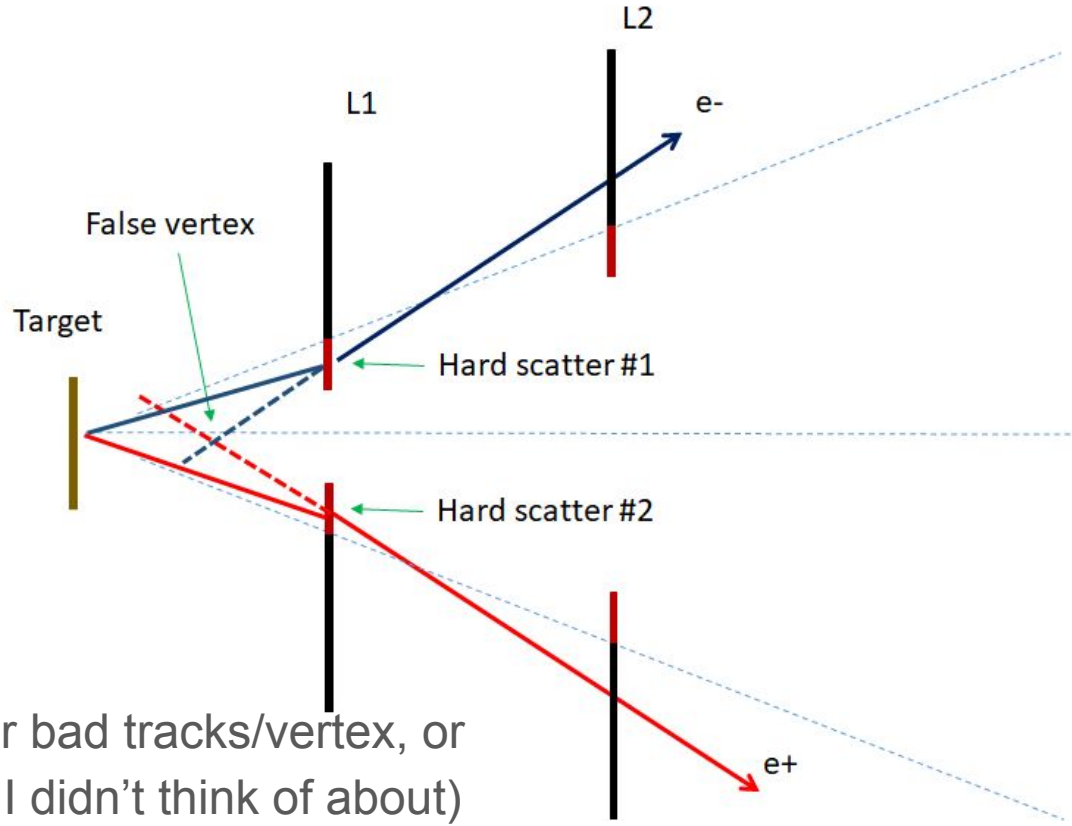

(or some combination of all of these, or bad tracks/vertex, or hits from other particles, or something I didn't think of about)

Possible Types of Background for L1L2 and L2L2

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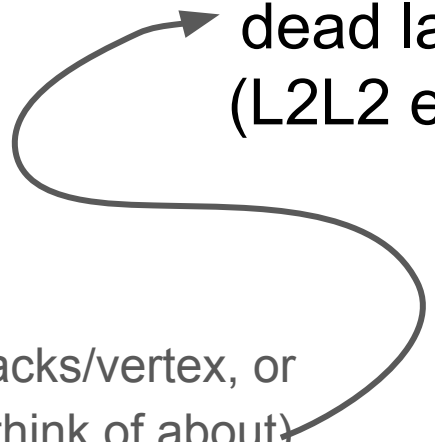
Tridents produced in Layer 1 silicon dead layers!! (L2L2 events)



(or some combination of all of these, or bad tracks/vertex, or hits from other particles, or something I didn't think of about)

Developing the Necessary Tools

Adding necessary **truth information** to the analysis (Matt S., Takashi, Jeremy)

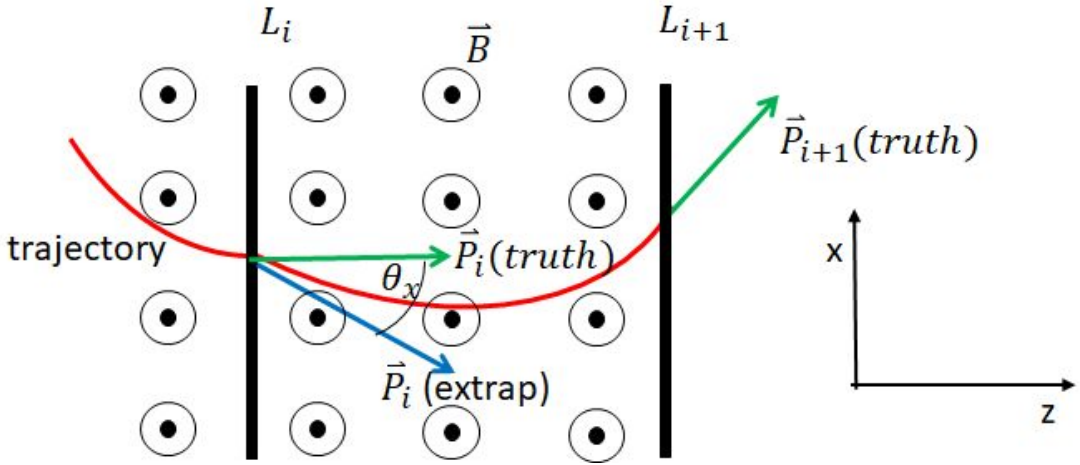
Physics info, Ecal info,and SVT info (both active and **inactive layers**)

Use SVT info to compute **scattering angles**

Useful to other analysis as well!

(and room for others to help!)

Match V0 daughter particles to truth MC particles!



Cuts

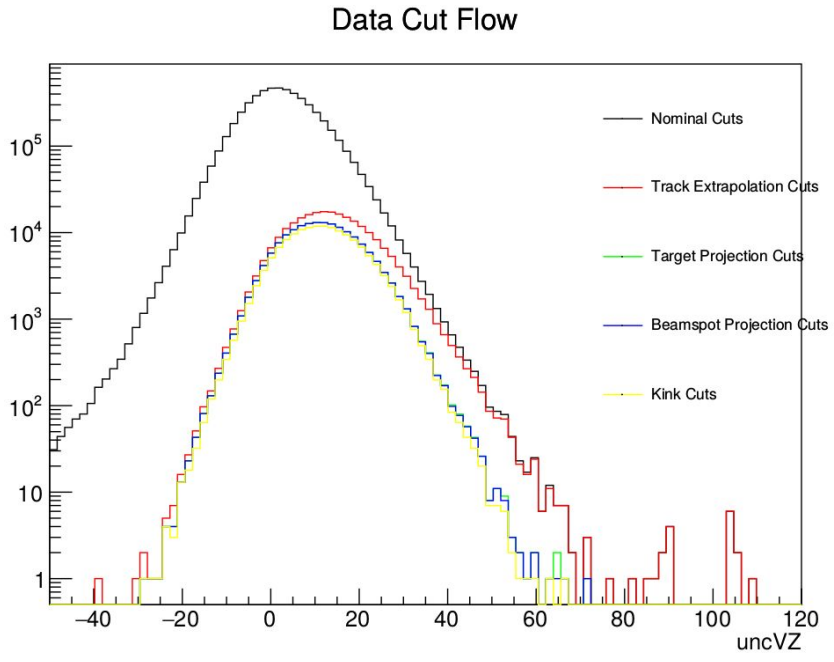
“Nominal” Vertexing Cuts:

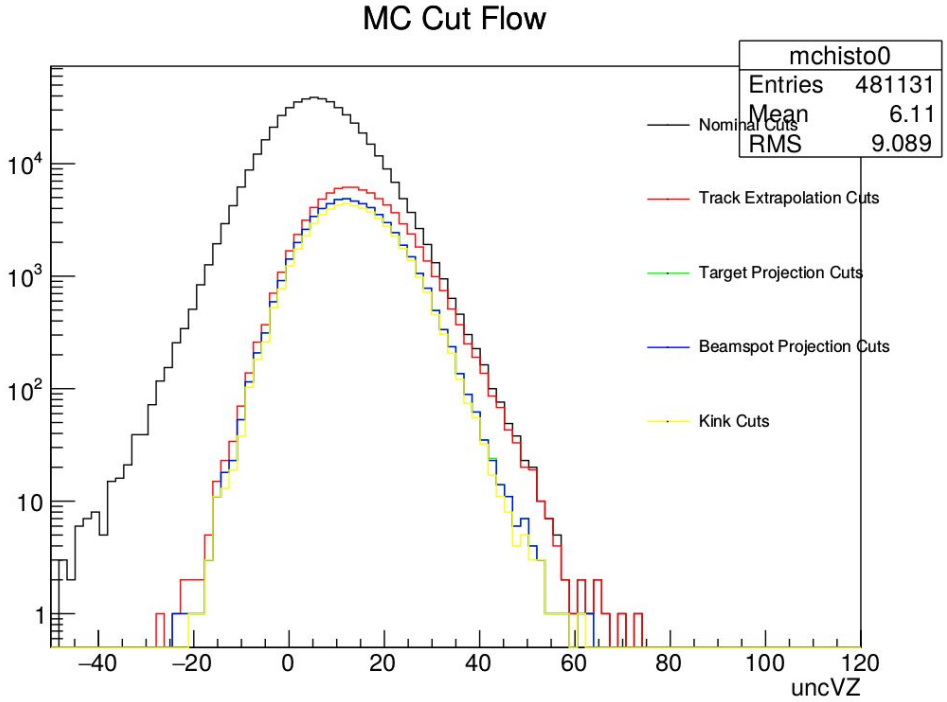
isPair1; layer cuts; matchChi2<10;trackT - ClT <4; clT diff<2; eleClY*posClY<0; bscChisq<10; bscChisq-uncChisq<5; trkChisq<30; abs(eleP-posP)/(eleP+posP)<0.5;e leP<ebeam*0.75; uncP<ebeam*1.15;radiative; isolation cuts

(These don’t change the result much)

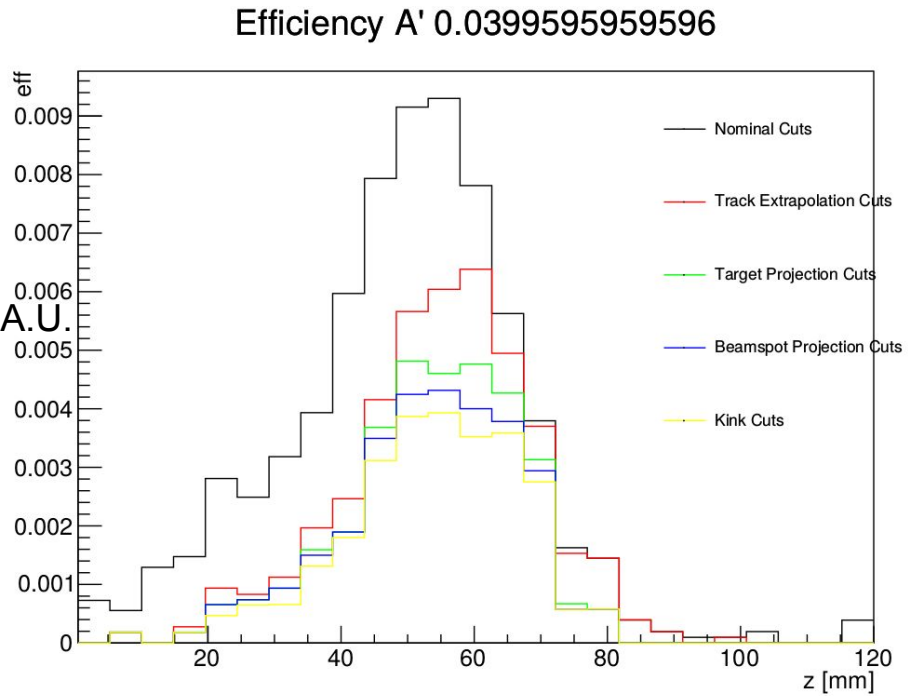
Exploring Cuts: Track Extrapolation, Kinks, Target Projection, Beamspot Projection, and Silicon (for L2L2 only)

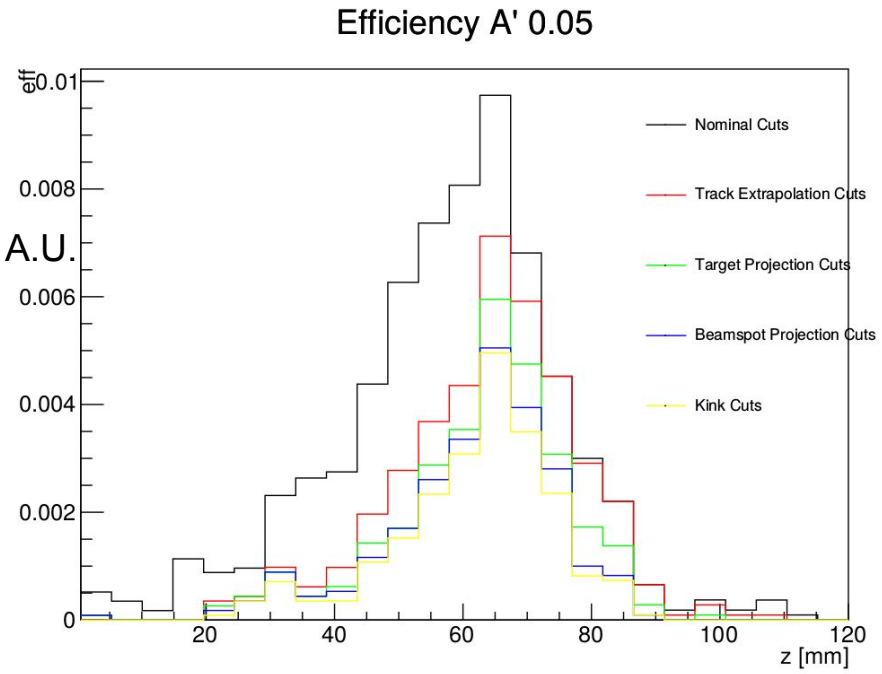
L1L2 Cutflow



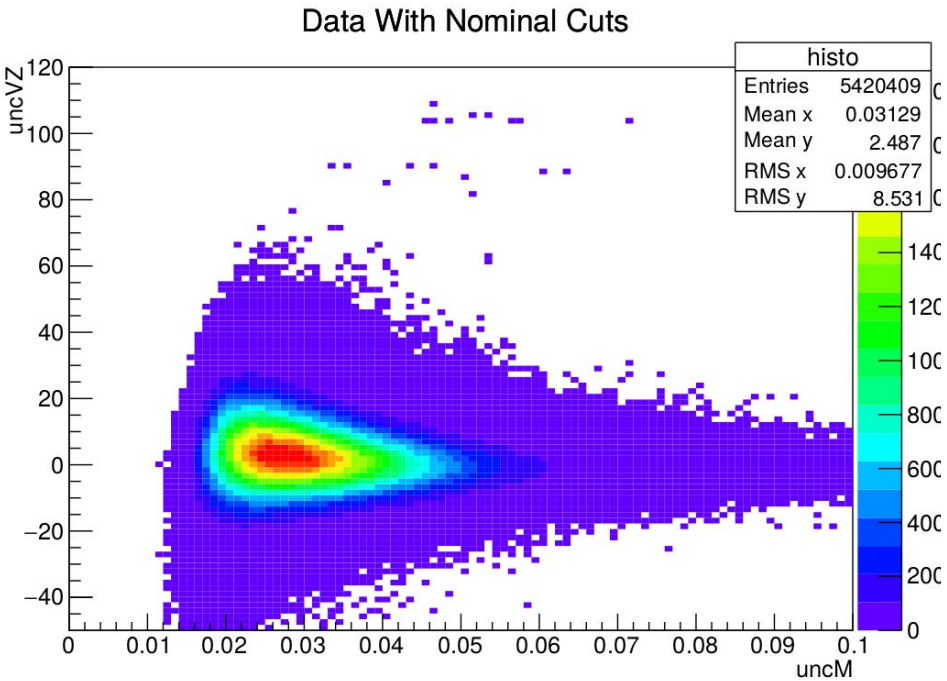


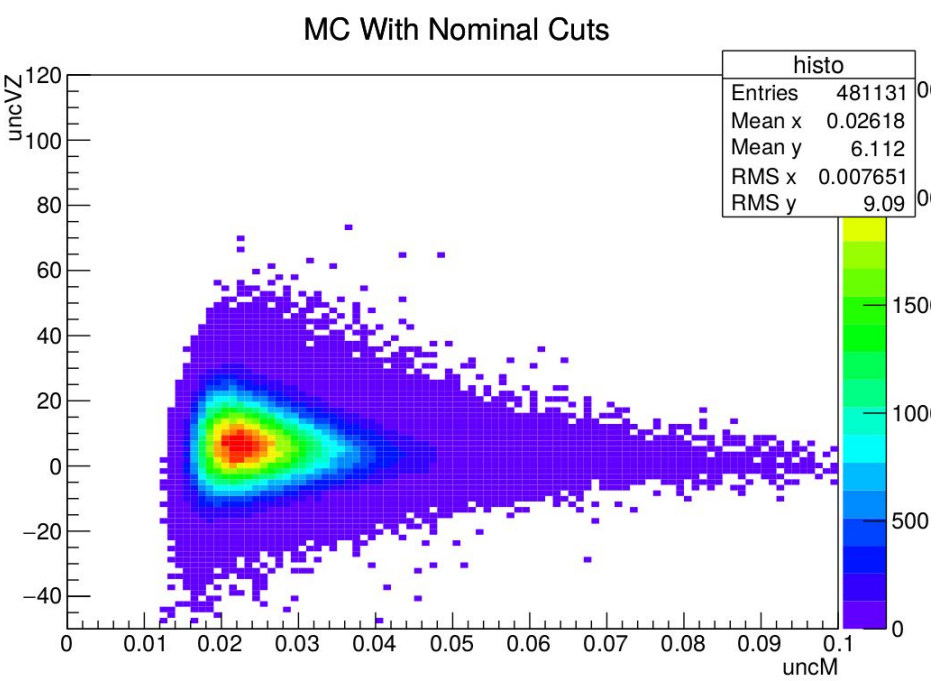
L1L2 A’ Cutflow





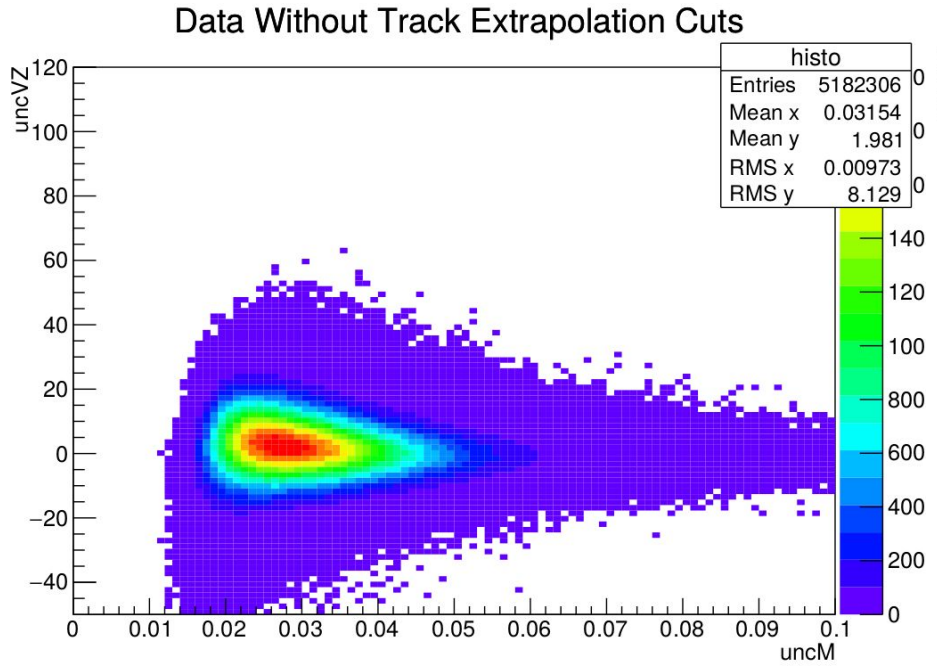
L1L2 Nominal Cuts

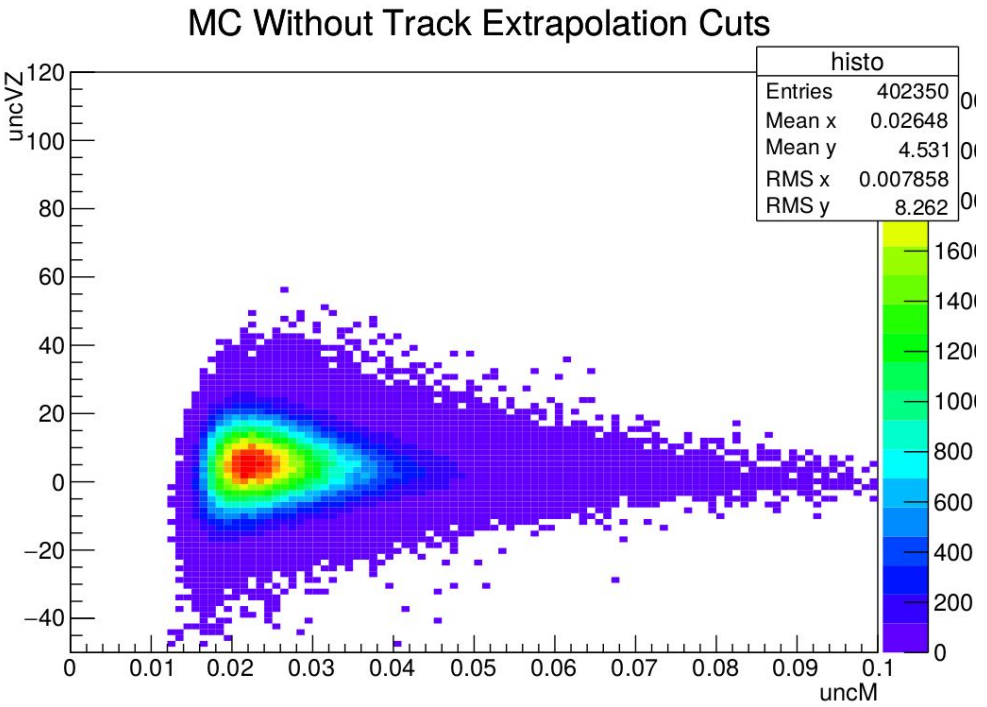




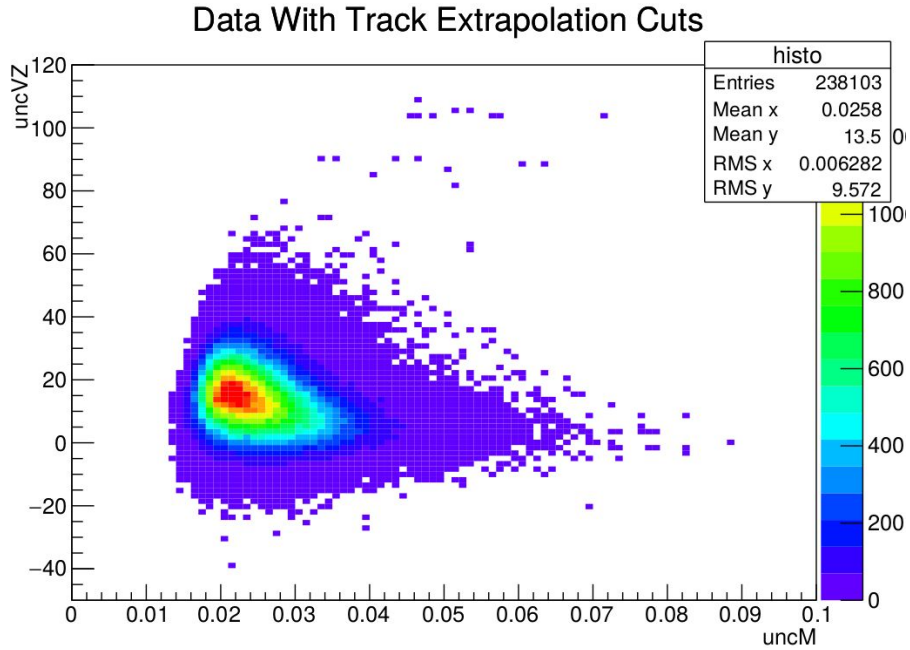
L1L2 Without Track Extrapolation Cuts

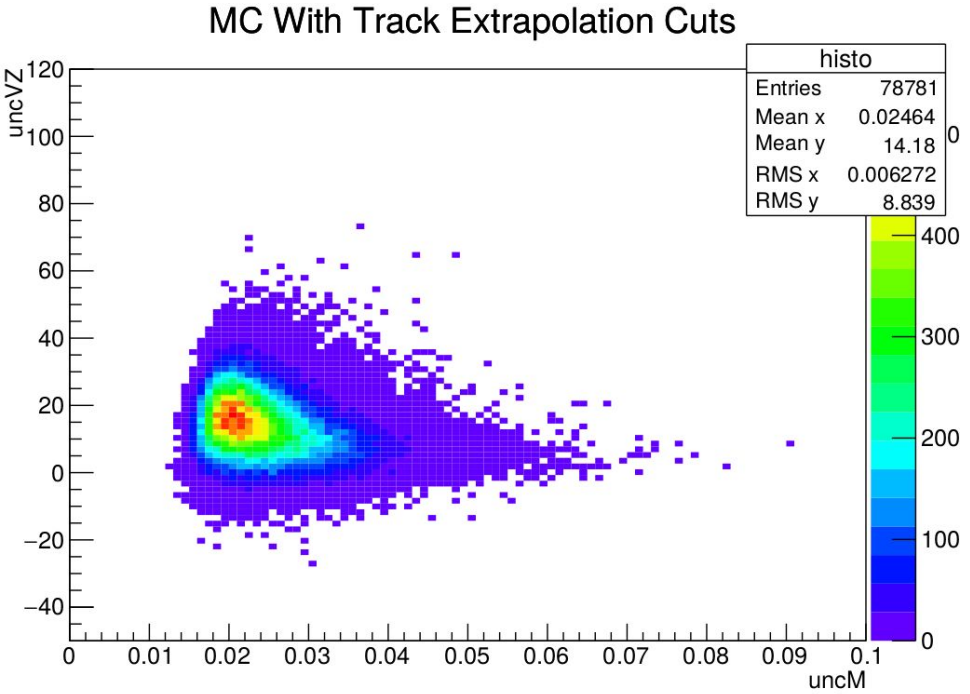
Events removed by track extrapolation





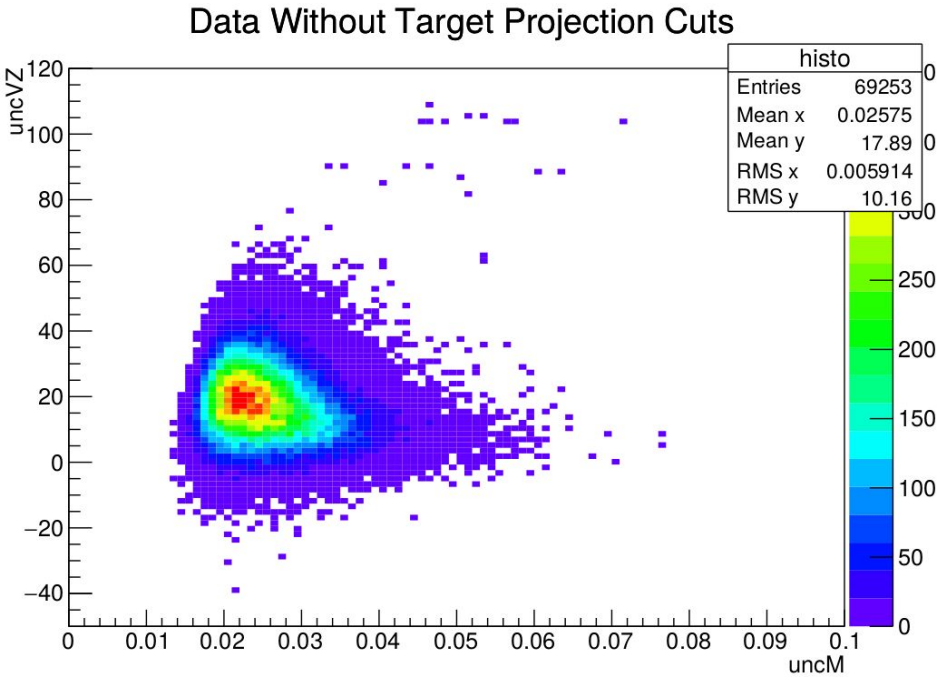
L1L2 With Extrapolation Cuts

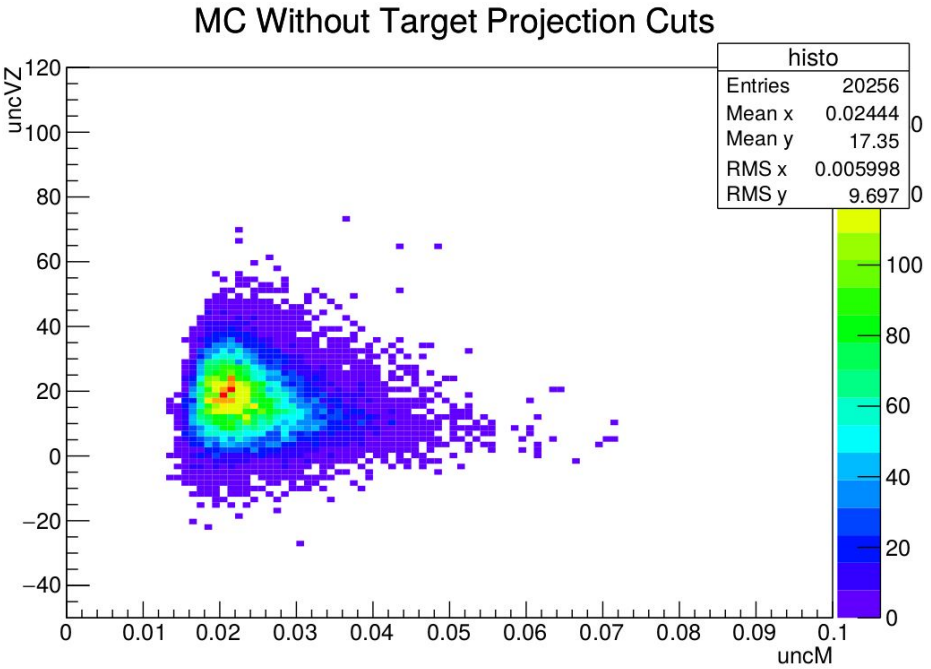




L1L2 Target Projection Cuts

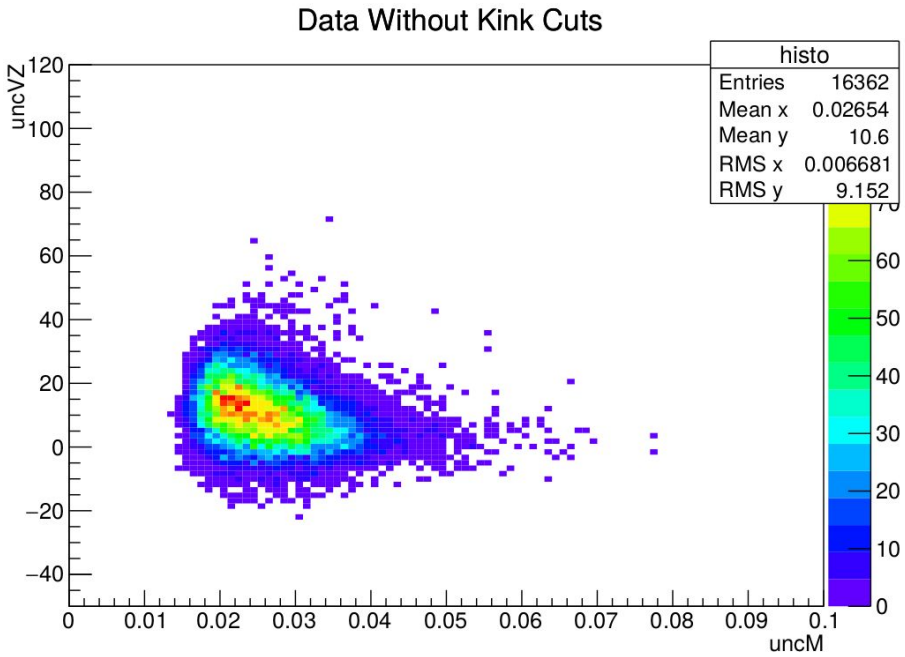
Events removed by target projection cuts

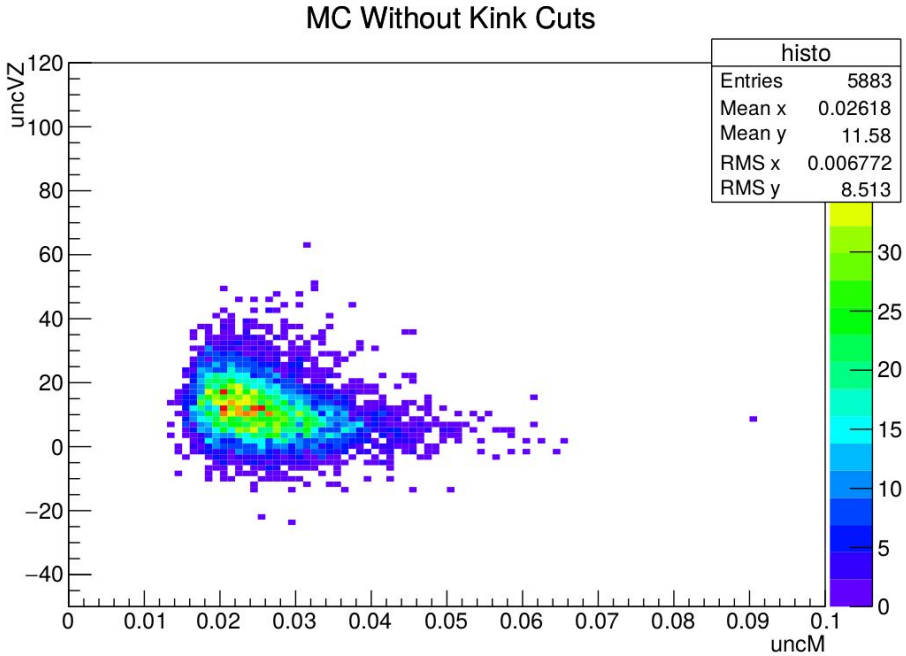




L1L2 Kink Cuts

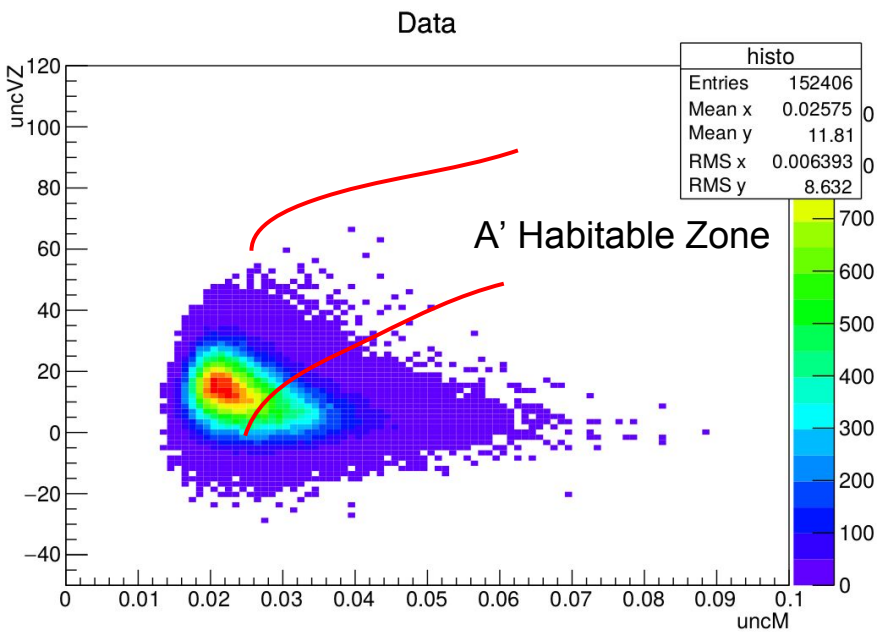
Events removed by kink cuts

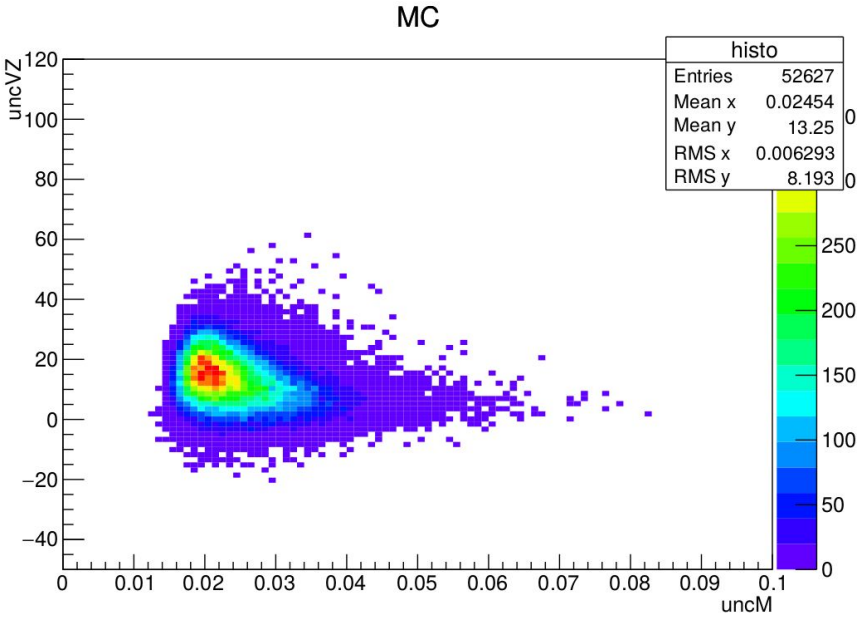




Current State of L1L2

Rates of Data/MC do not agree for L1L2





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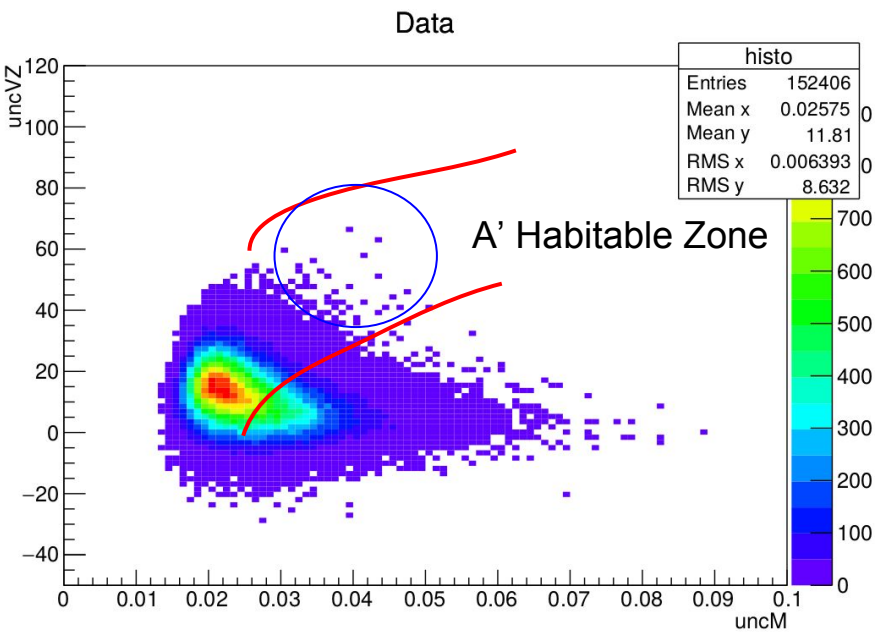
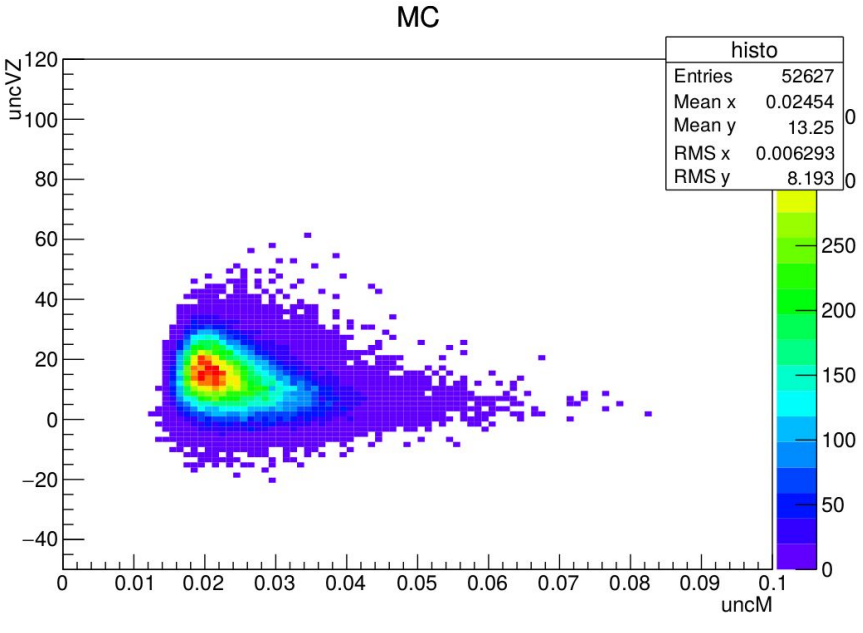
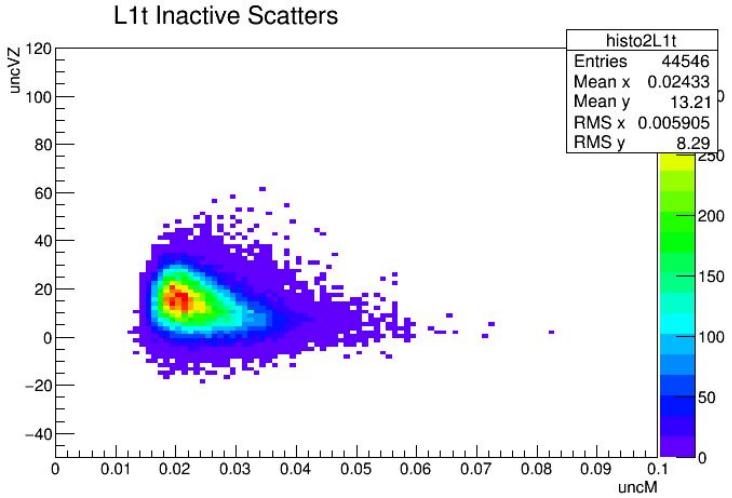
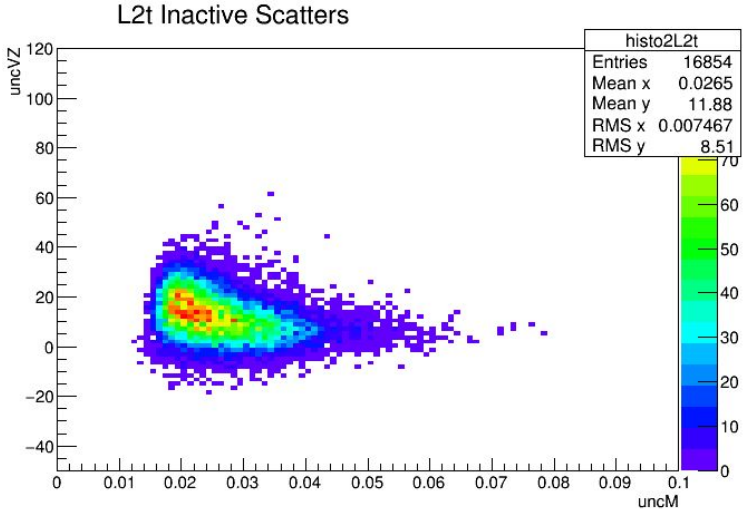
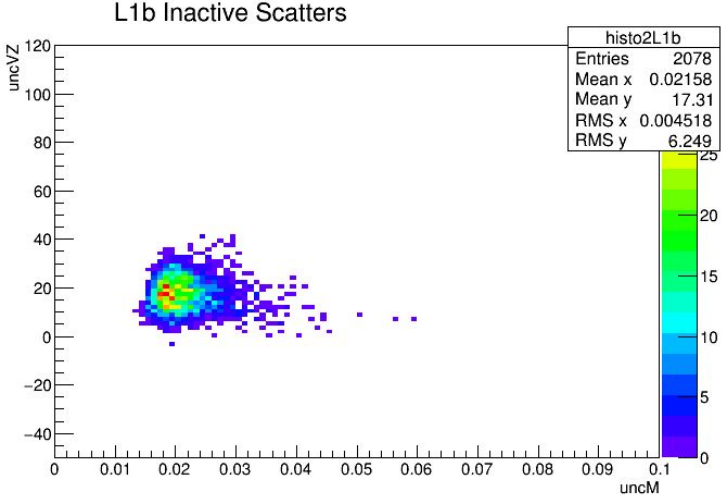
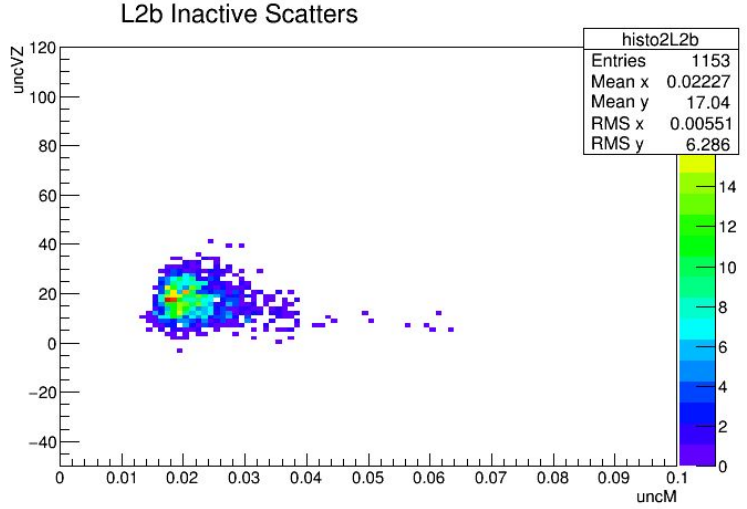





L1t Inactive Scatters
histo2L1t
Entries 44546
Mean x 0.02433
Mean y 13.21
RMS x 0.005905
RMS y 8.29
uncVZ
uncM

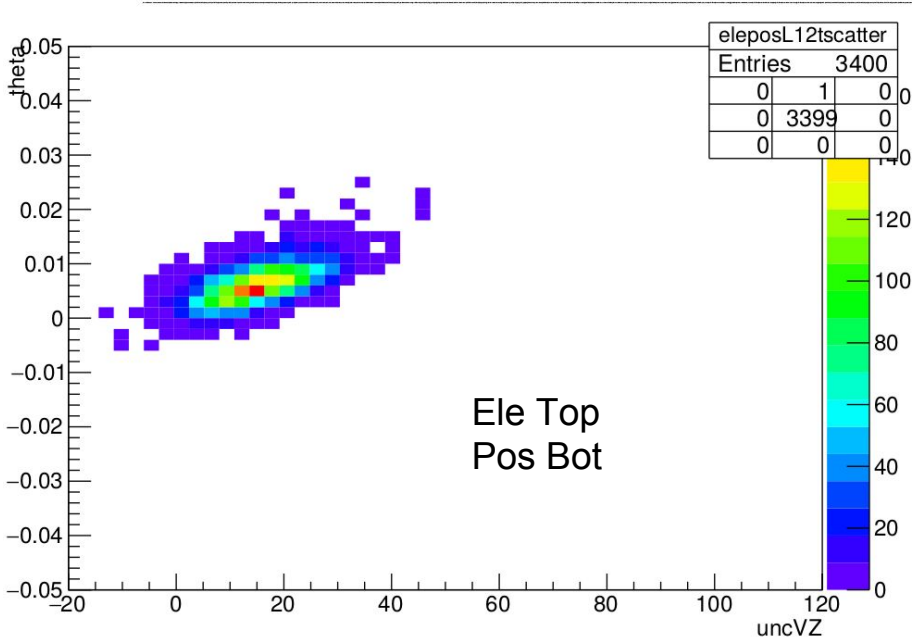

L2t Inactive Scatters
histo2L2t
Entries 16854
Mean x 0.0265
Mean y 11.88
RMS x 0.007467
RMS y 8.51
uncVZ
uncM

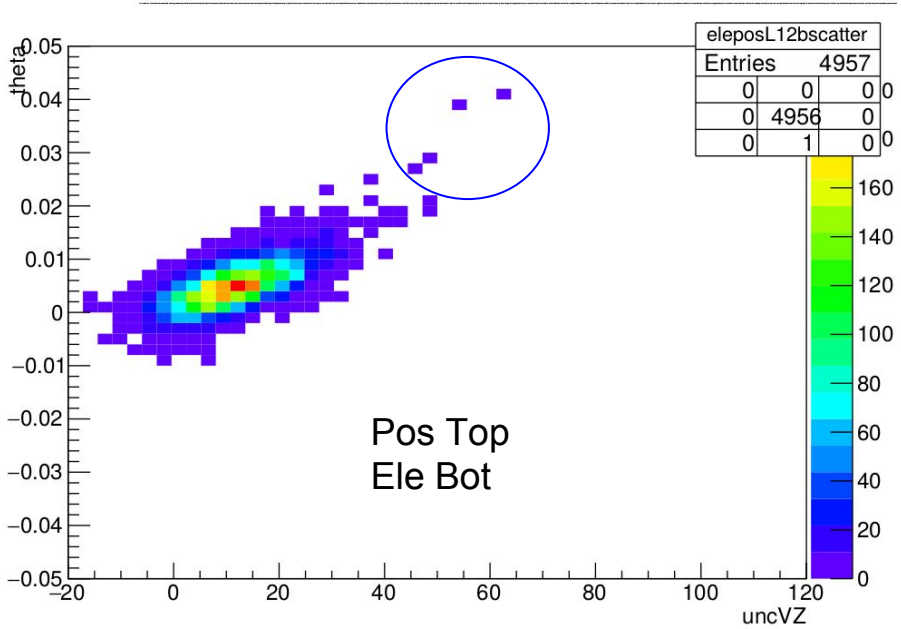

L1b Inactive Scatters
histo2L1b
Entries 2078
Mean x 0.02158
Mean y 17.31
RMS x 0.004518
RMS y 6.249
uncVZ
uncM


L2b Inactive Scatters
histo2L2b
Entries 1153
Mean x 0.02227
Mean y 17.04
RMS x 0.00551
RMS y 6.286
uncVZ
uncM

Large Scatters in L1L2

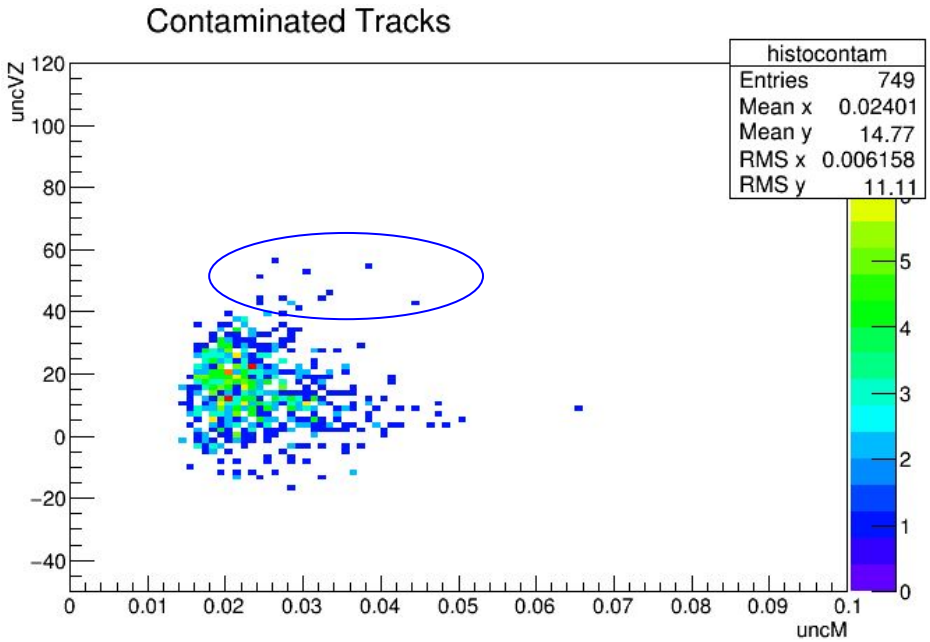
Difference in scattering angle of e+e- away from beam

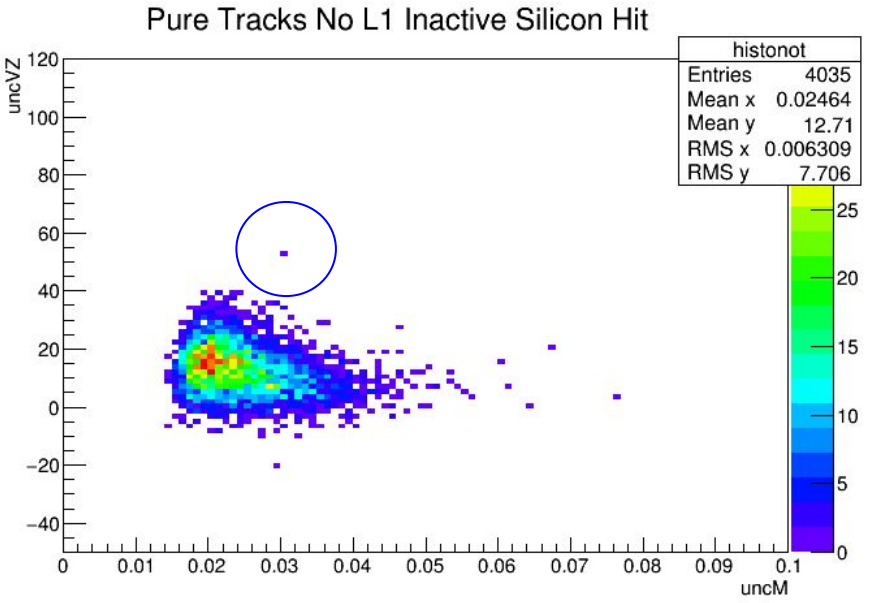




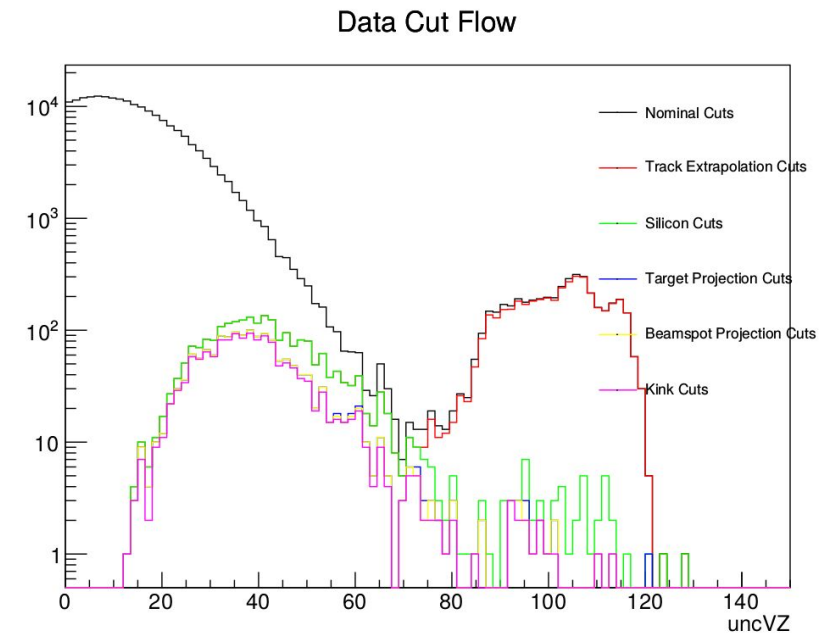
Remaining L1L2 Background

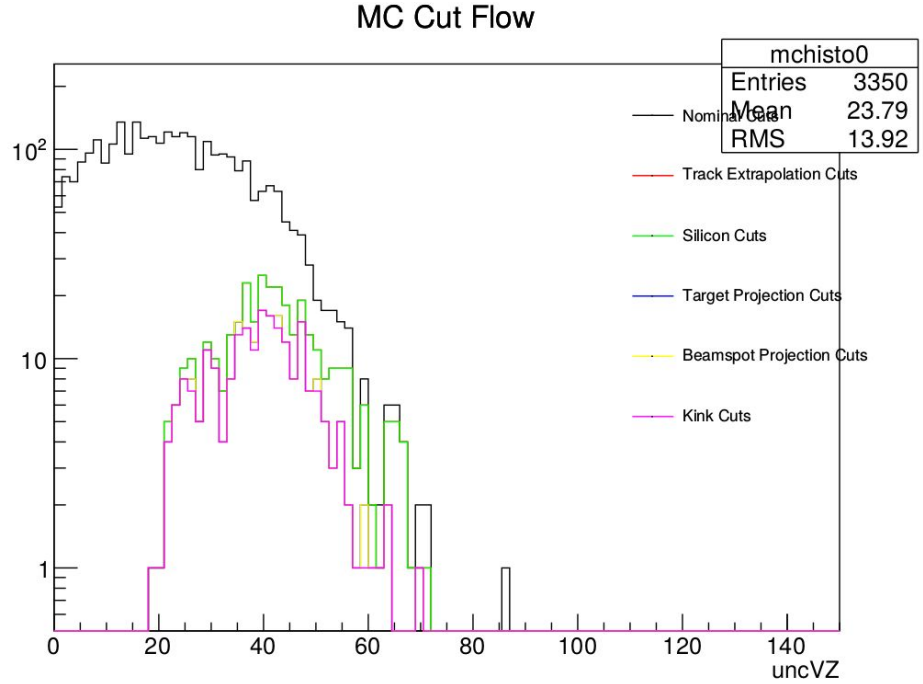
Contaminated tracks have at least one hit not associated with matched tracks



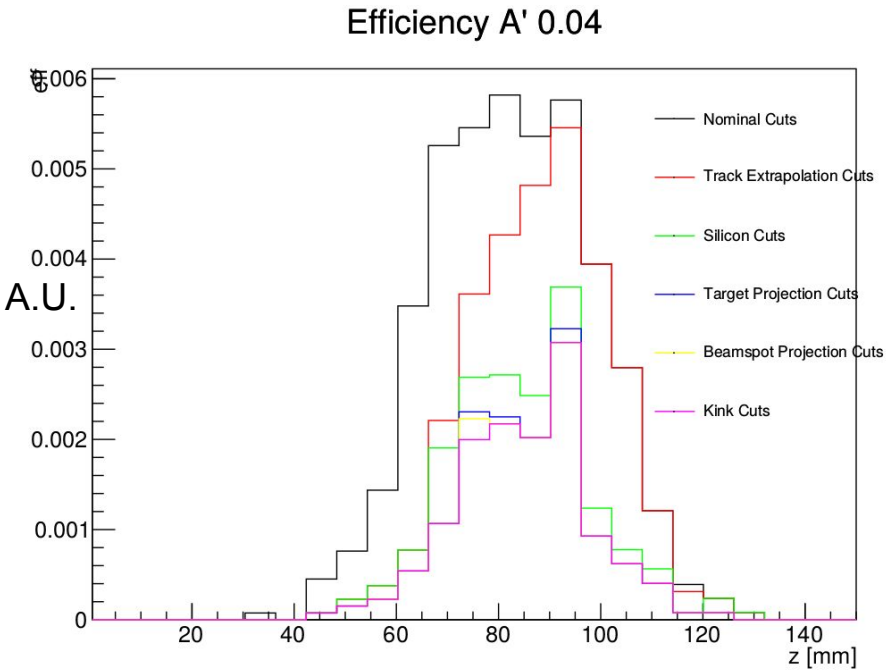


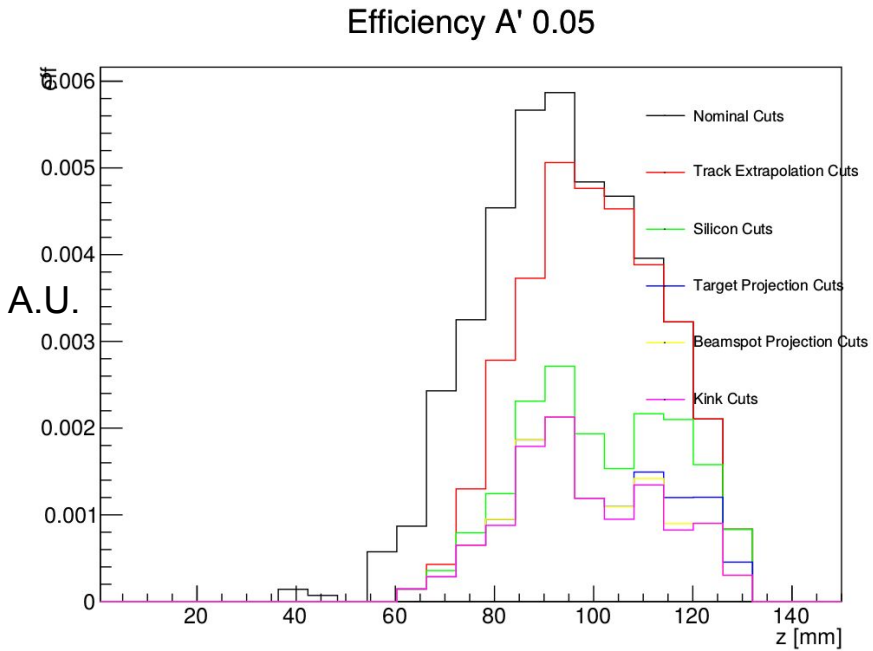
L2L2 Cutflow



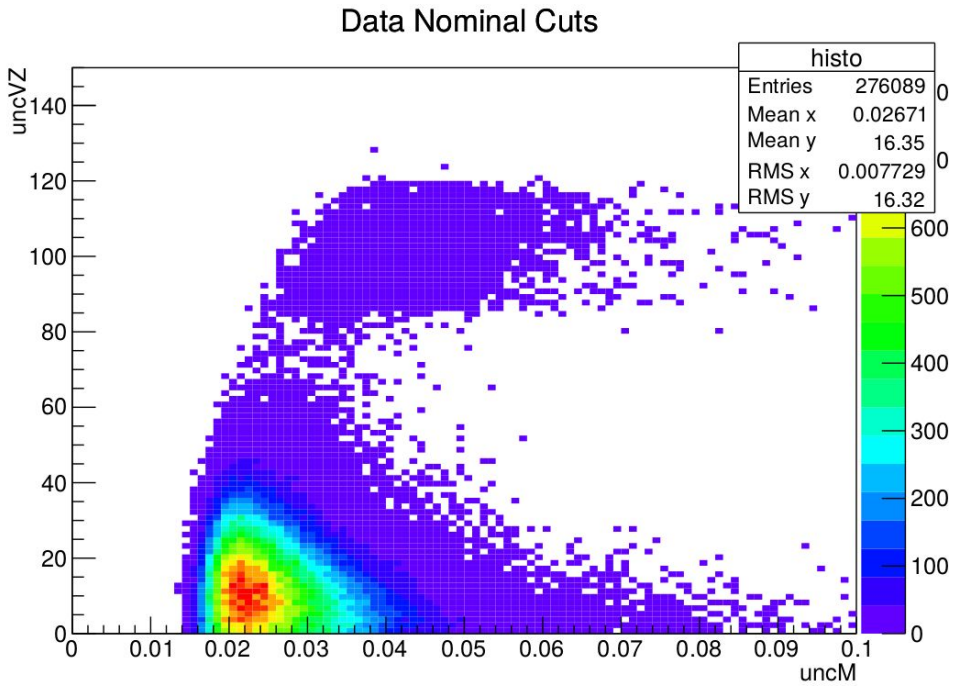


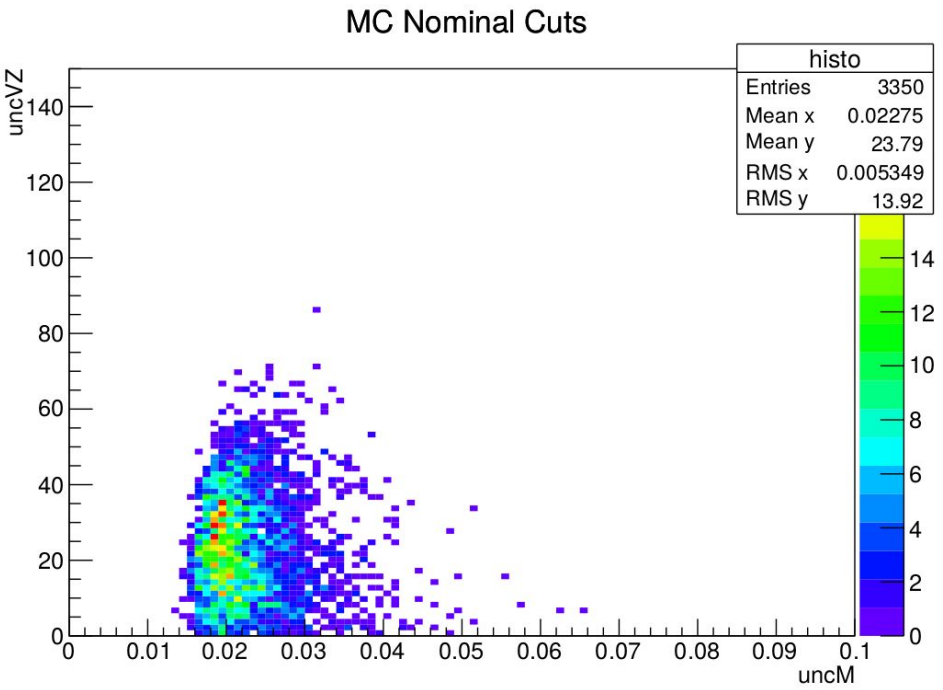
A’ L2L2 Cutflow





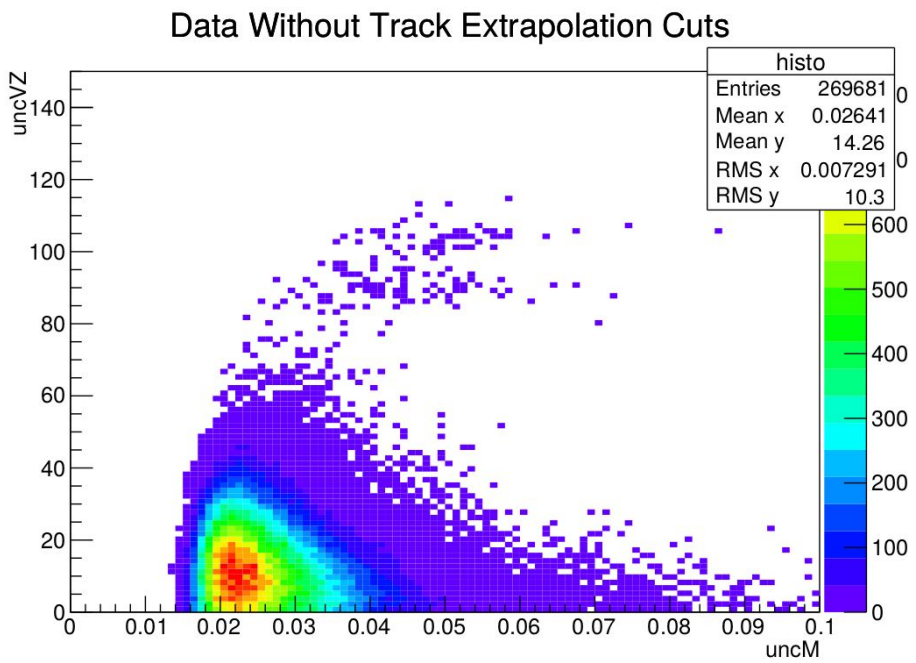
L2L2 Nominal Cuts

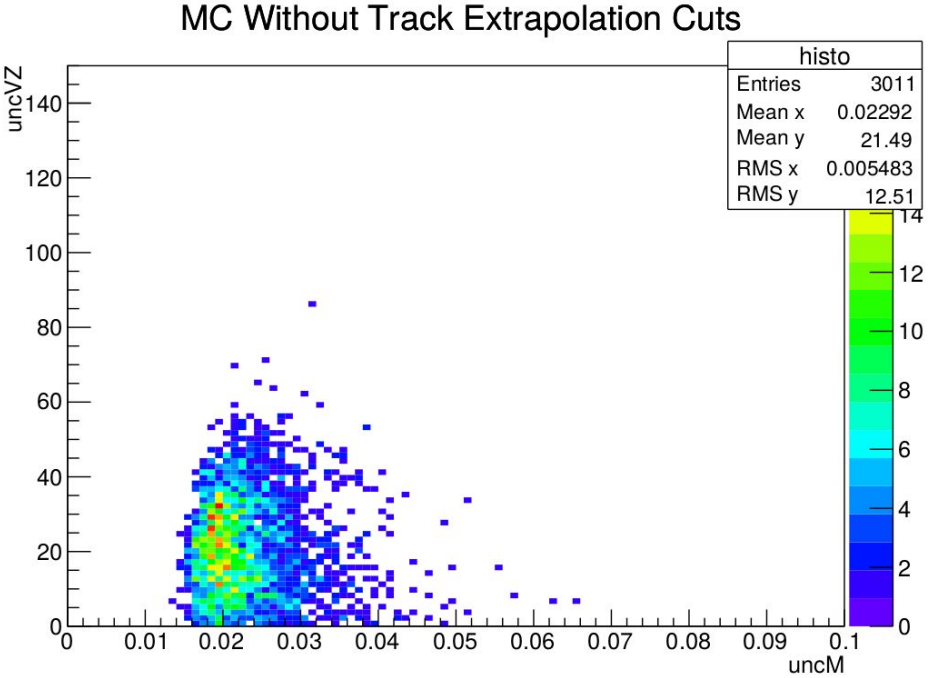




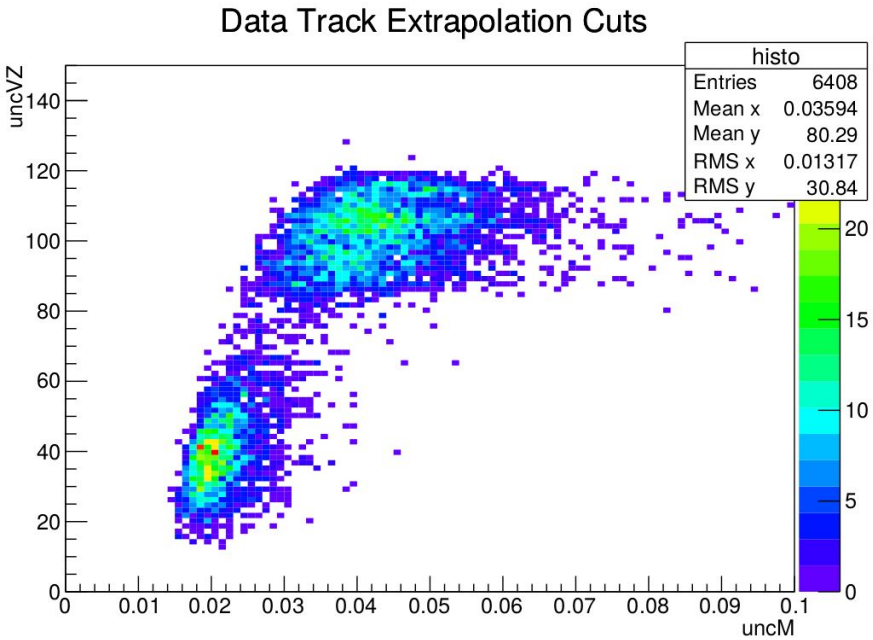
L2L2 Track Extrapolation Cuts

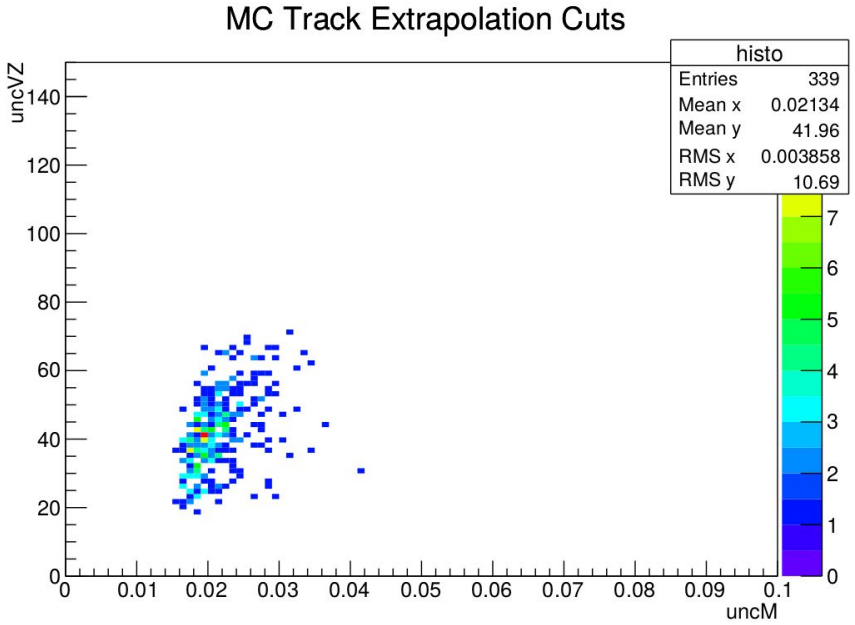
Events removed by track extrapolation



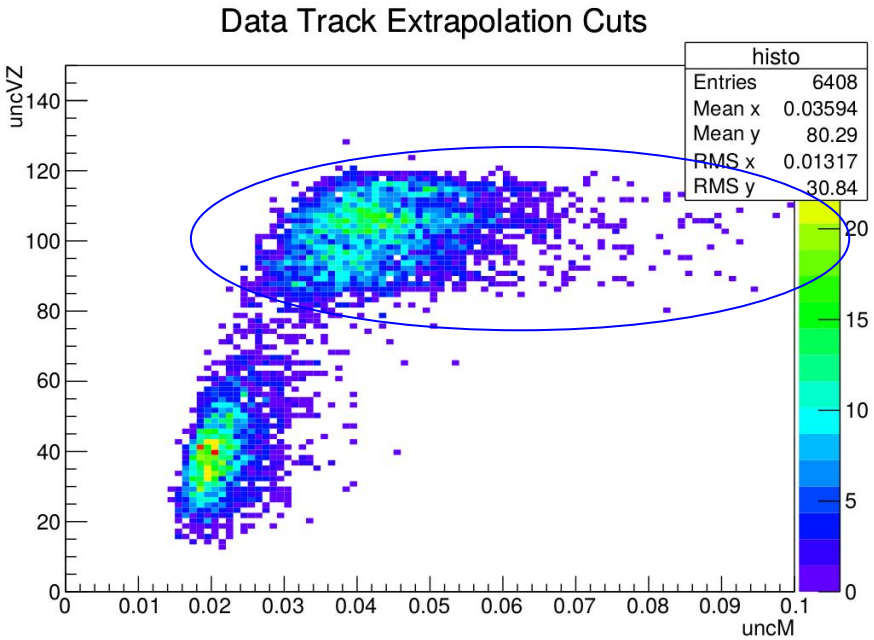


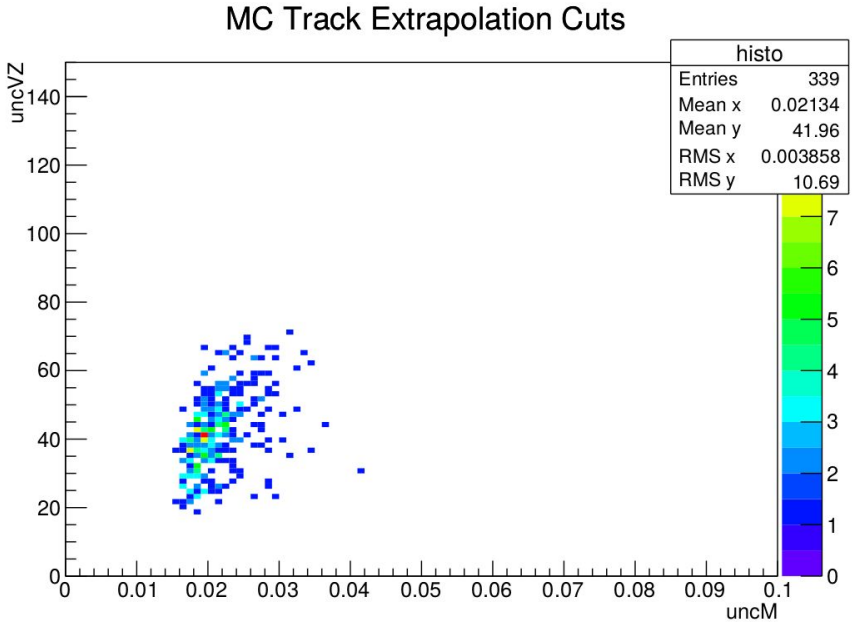
L2L2 After Track Extrapolation Cuts





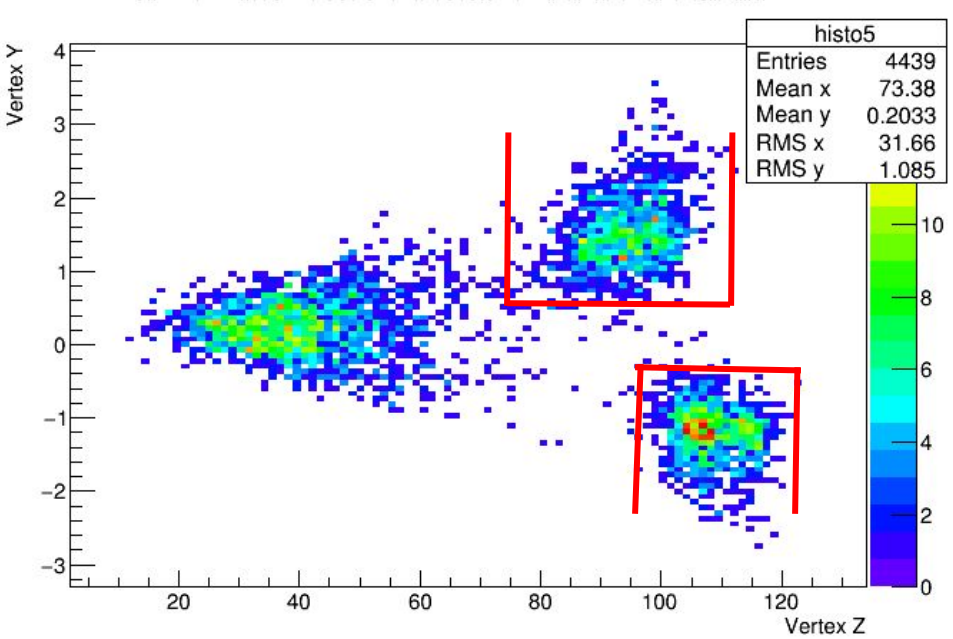
L2L2 After Track Extrapolation Cuts

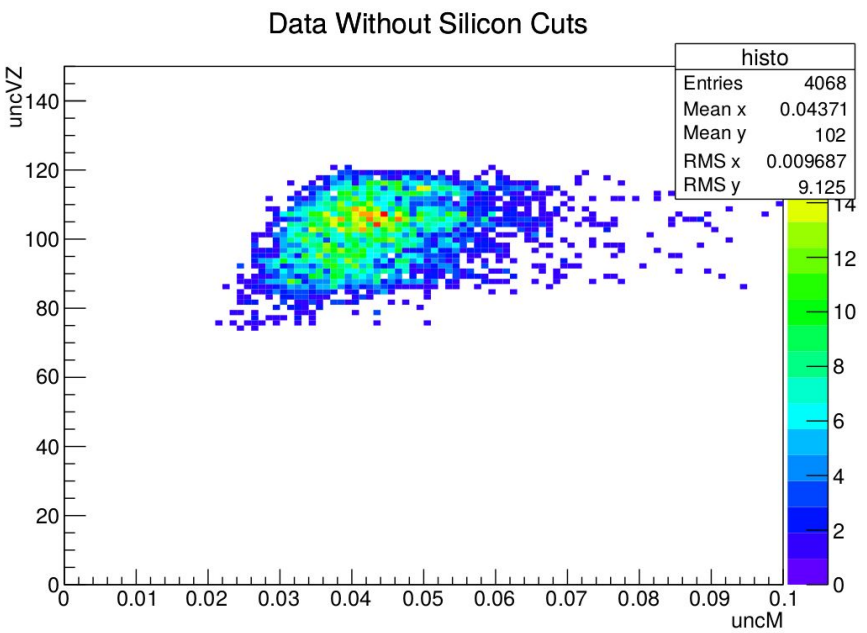




L2L2 Very High Z Events

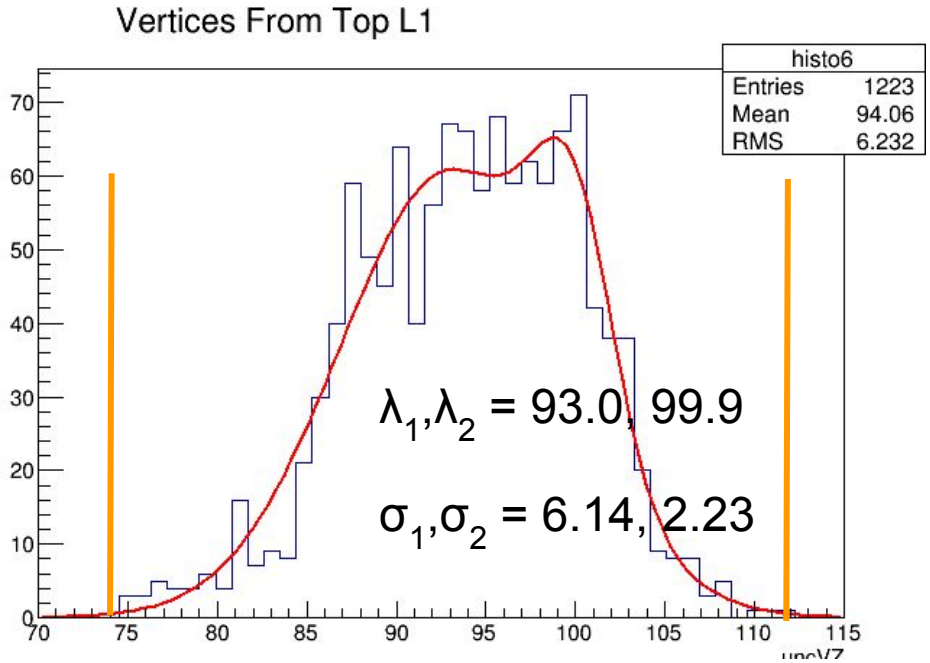
Xsec: Si/W ~ 0.009; Nevents Si/W ~ 0.0003

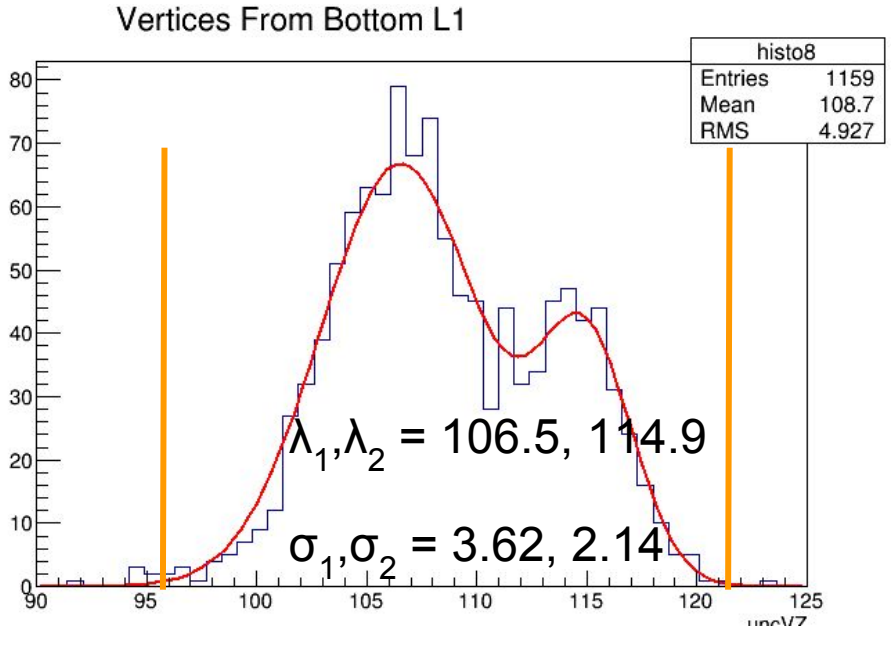




L2L2 Tridents Produced at Silicon

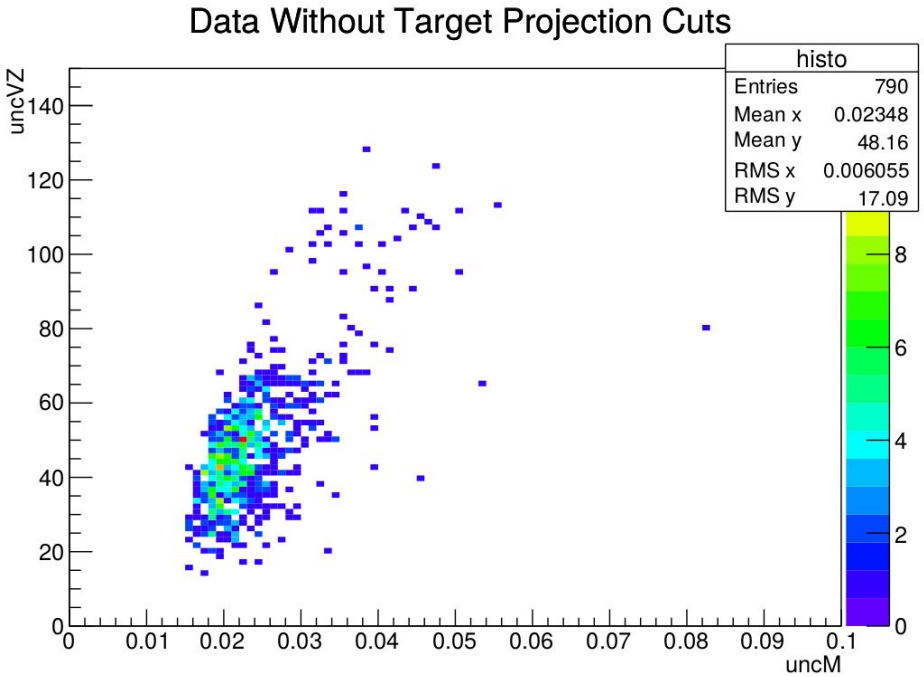
Fit sum of 2 gaussians (for 2 sensors) in top and bottom and cut at 3σ

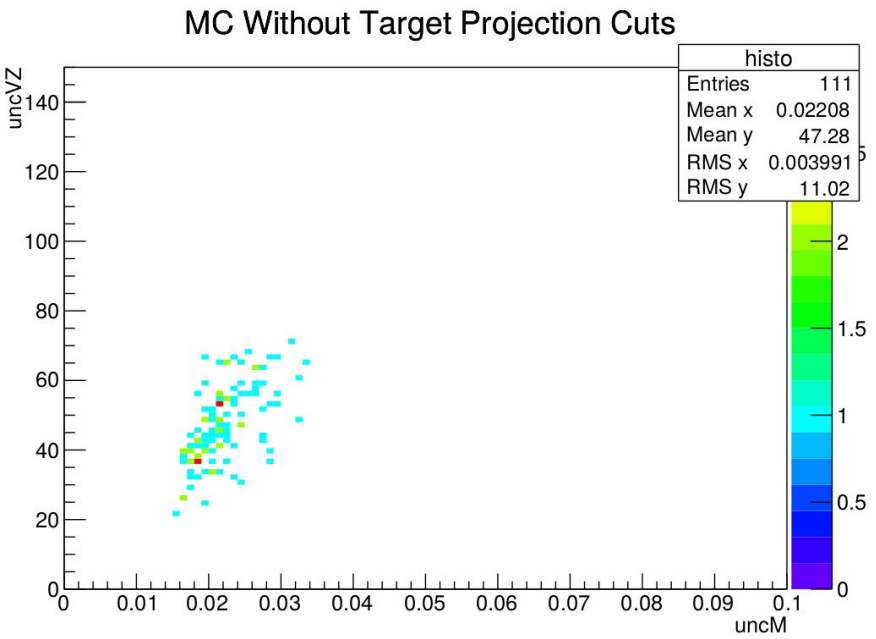




L2L2 Target Projection Cut

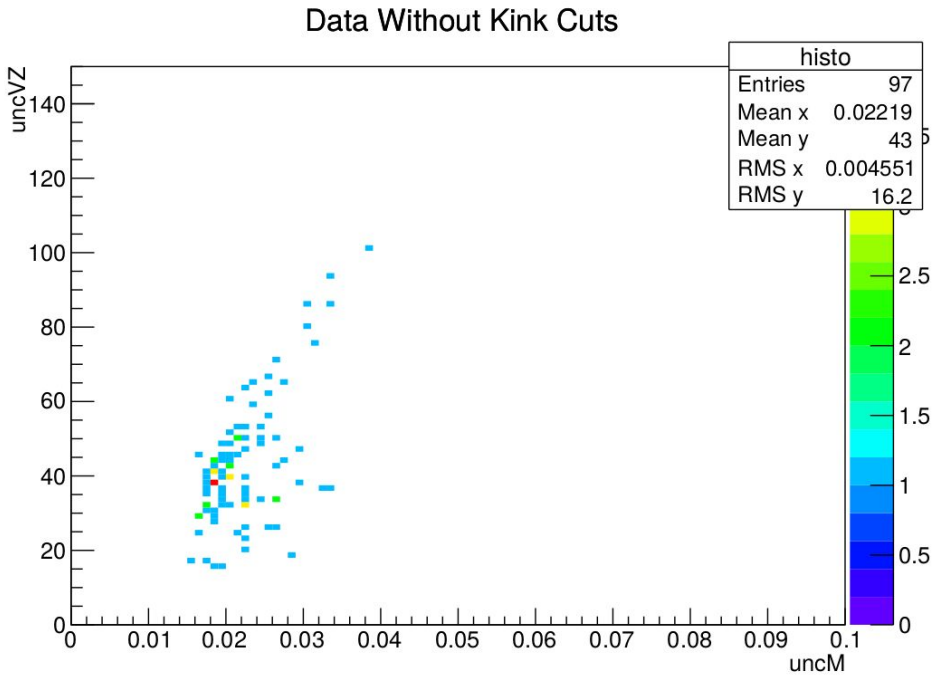
Events removed by target projection cuts

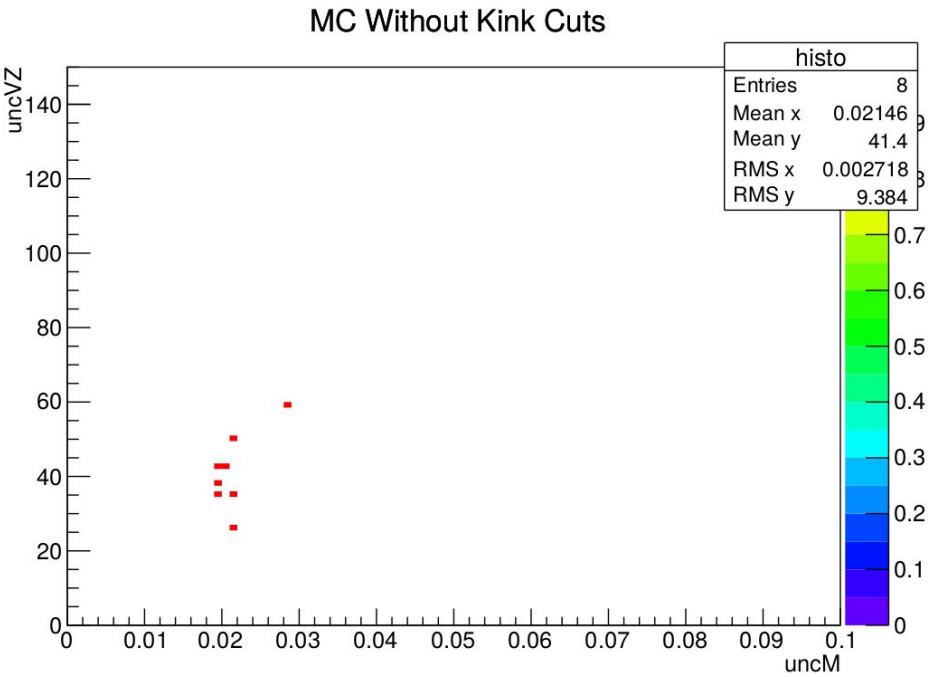




L2L2 Kink Cuts

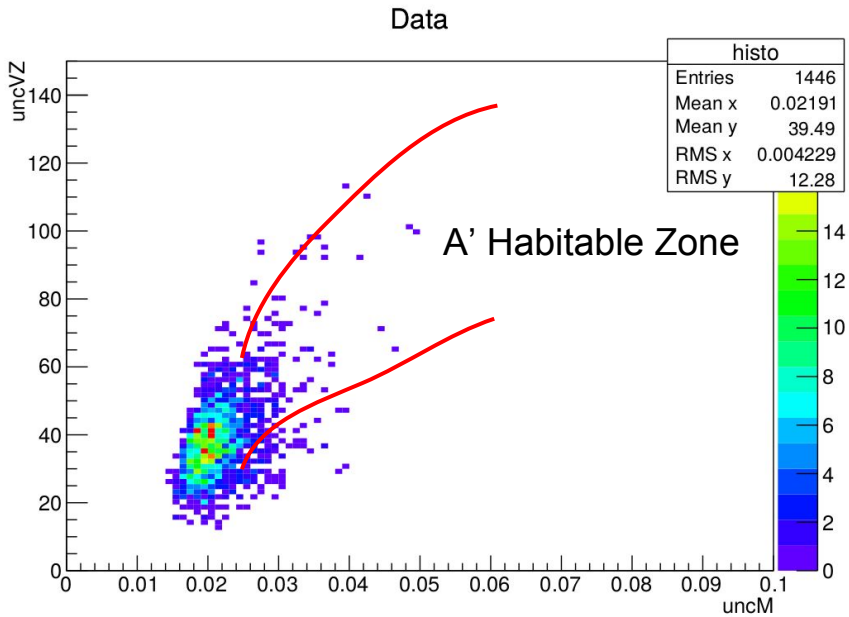
Events removed by kink cuts

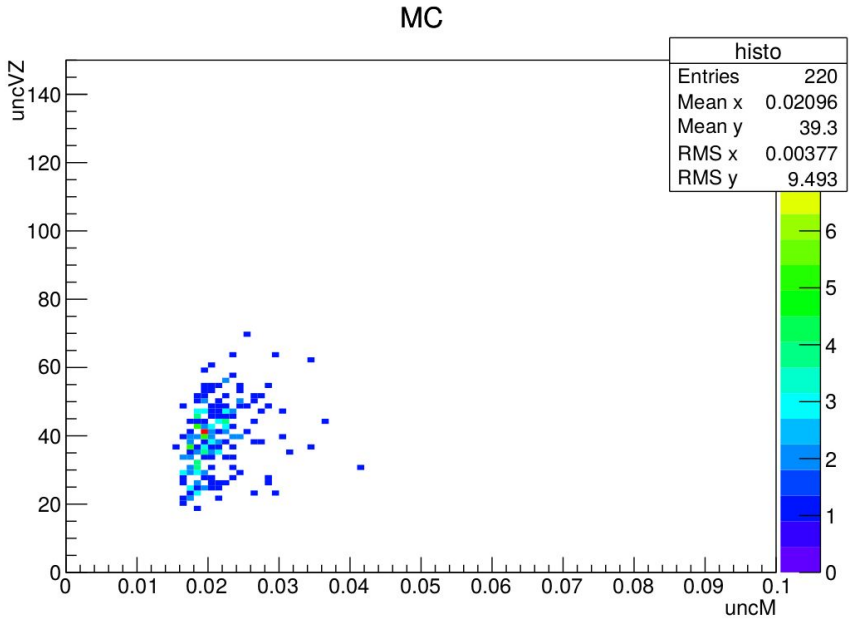




Current State of L2L2

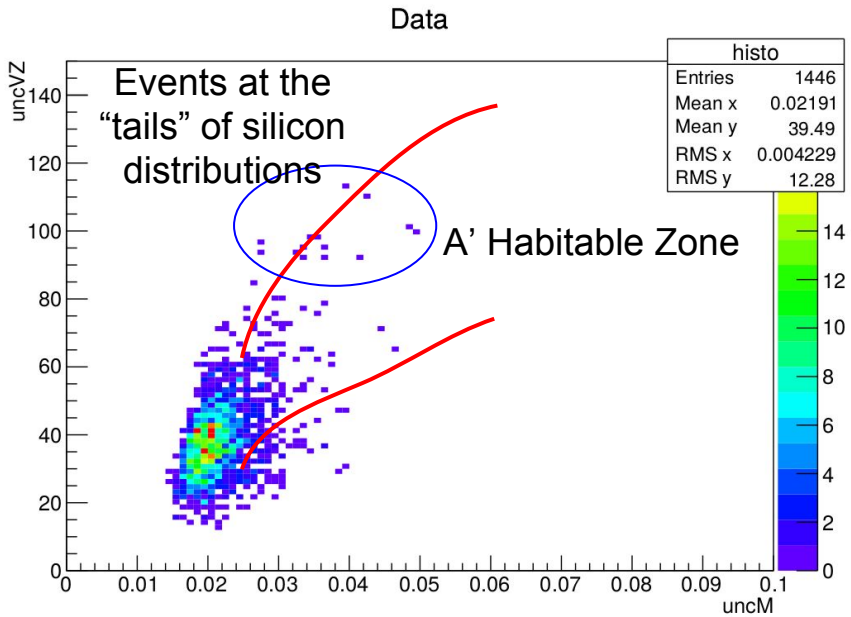
Rates of data/MC for L2L2 do not agree

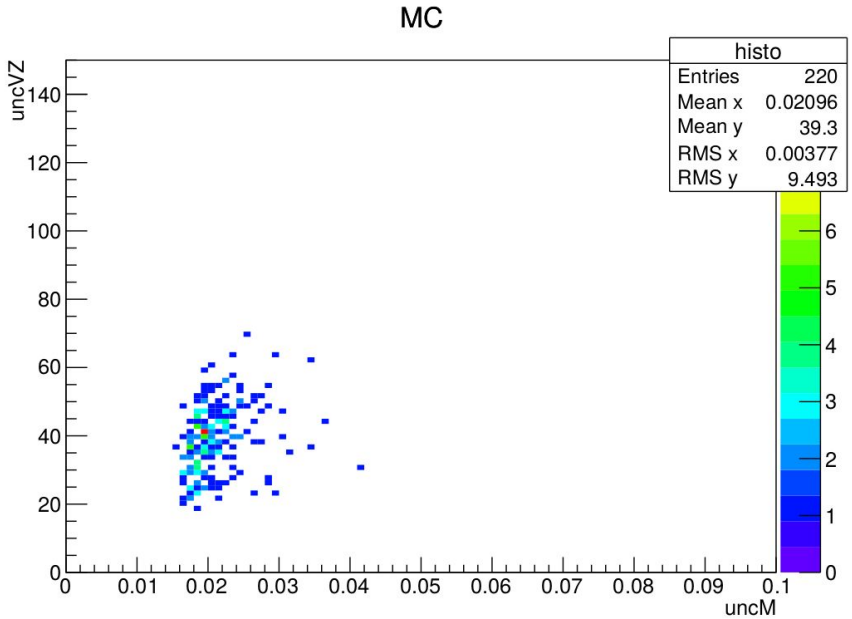




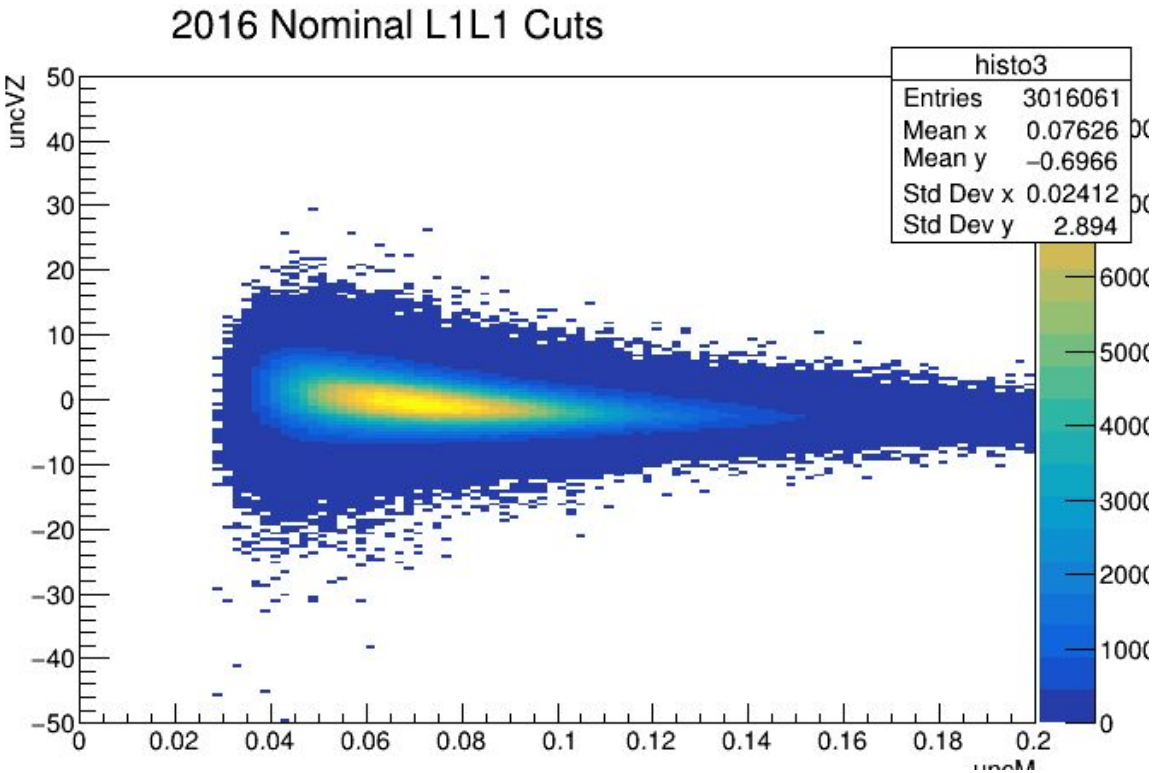
Current State of L2L2

Rates of data/MC for L2L2 do not agree





10% 2016 Pass1 Data L1L1 Preliminary



Conclusion

L1L2/L2L2 analysis are an ongoing process, but have made significant progress due to newly developed truth MC.

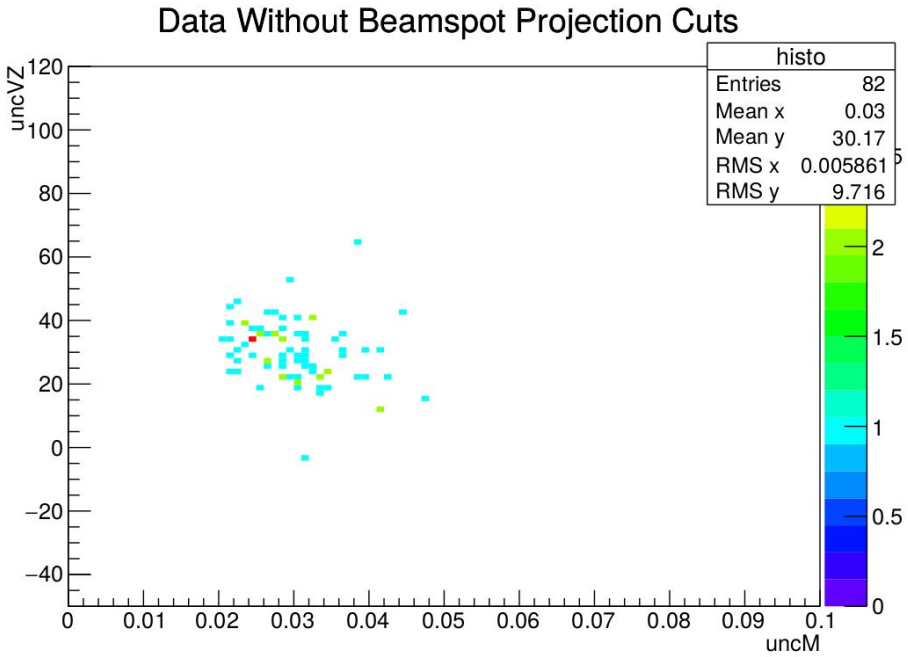
Rates of Data/MC do not agree for L1L2 and L2L2. Why? Do we need more (biased) MC? (however shapes agree)

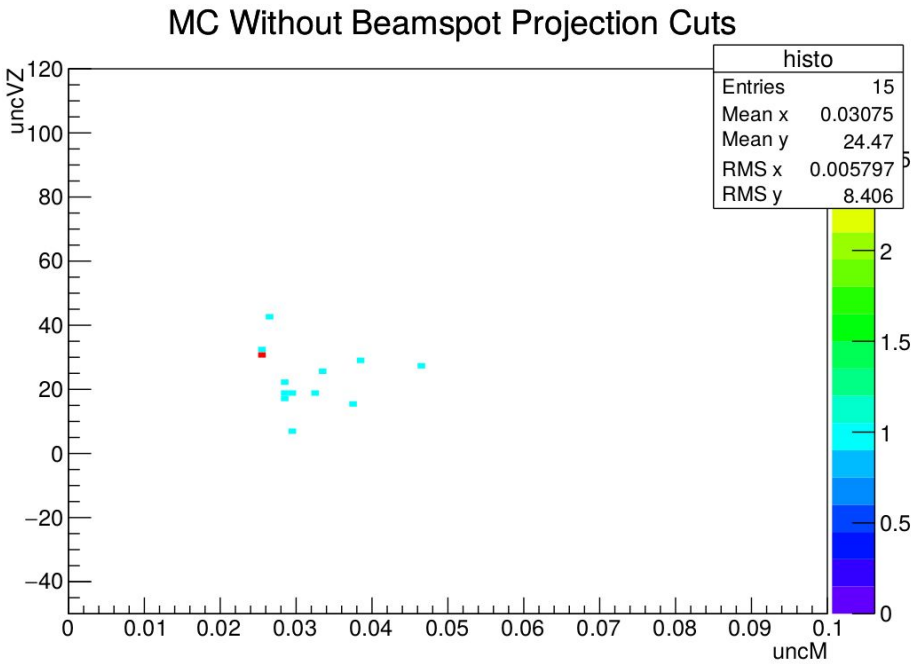
There are specific backgrounds in both L1L2/L2L2 that are not well understood that need more work (aim at the background events in A’ habitable zone)

L2L2 tridents produced at the silicon needs to be simulated (Takashi) and optimized

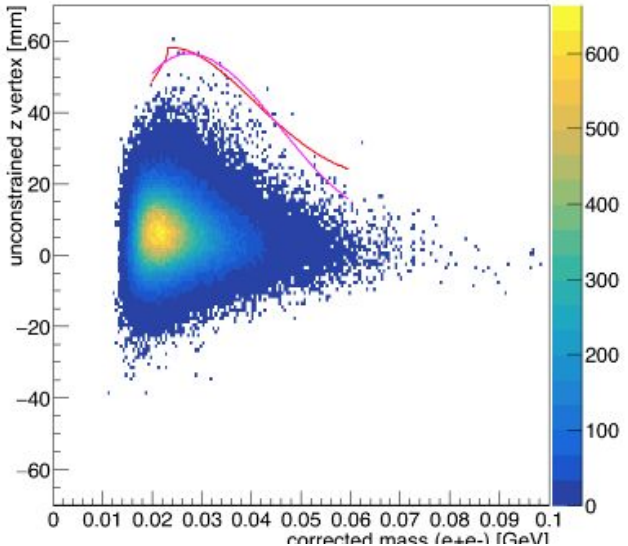
Can we (do we want to) include this with the L1L1 result for iChep?

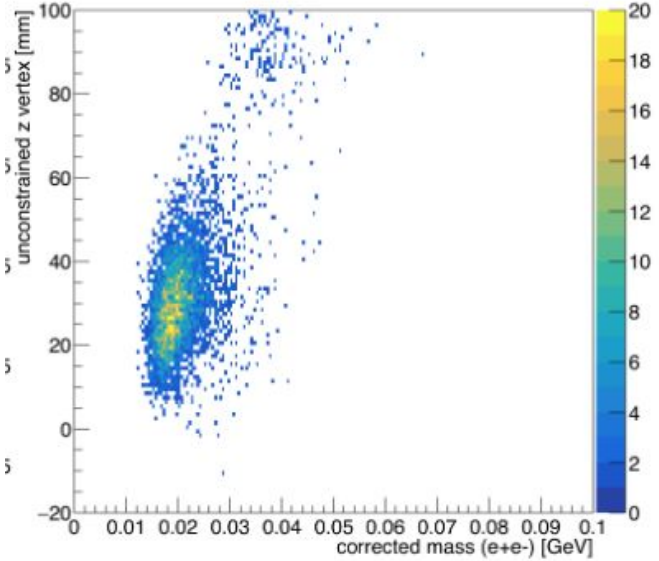
L1L2 Beamspot Projection Cuts





tweakPass6


unconstrained z vertex [mm]
60
40
20
0
−20
−40
−60
0 0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.1
corrected mass (e+e-) [GeV]
600
500
400
300
200
100
0


unconstrained z vertex [mm]
100
80
60
40
20
0
−20
0 0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.1
corrected mass (e+e-) [GeV]
20
18
16
14
12
10
8
6
4
2
0