Status and Cut Flow for 2016 Vertexing Analysis

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HPS Analysis Workshop 2020
January 21, 2020

Introduction

- This talk:
  - Preliminary cutflow and cuts to be explored
  - Isolation cut/bad hits discussion
- At this workshop:
  - Tail Fits + Zcuts (data, tritrig-wab-beam)
  - Mass Resolution
  - Acceptance
  - Intro to ML approach
  - Reach projections
  - Plans for limit setting
- Detailed Plots: https://confluence.slac.stanford.edu/display/hpsg/Analysis+Workshop+2020

Update on Large MC Samples and Documentation

SLAC

- Tritrig-wab-beam 100% sample
  - 22/30 Complete
  - Showing results from 20/30 tritrig-wab-beam sample
- Tritrig x3 sample
  - Complete
- Documentation - we are behind (to be discussed tomorrow)
- Plots shown in this talk are 10% of data and ⅔ * 100% tritrig-wab-beam

Cut Flow - Preprocessing Cuts

- Preprocessing cuts (i.e. MOUSE cuts)
- Track Chisq/dof < 6 for MC

Cut Description	Requirement
Cluster Time Difference	$\lvert t_{e^+Cluster} - t_{e^-Cluster}\rvert < 2.5$ ns
e^+ Track-Cluster Time Difference	$\lvert t_{e^+Track} - t_{e^+Cluster} - 55\rvert < 10$ ns
e^- Track-Cluster Time Difference	$\lvert t_{e^-Track} - t_{e^-Cluster} - 55\rvert < 10$ ns
Ecal clusters in opposite volumes	$y_{e^+\ \mathrm{Cluster}} \times y_{e^-\ \mathrm{Cluster}} < 0$
Loose track-cluster match	$\chi^2 < 15$
Beam electron cut	$p(e^-) < 2.15$ GeV
Track Quality	$\chi^2/dof < 12$
Maximum Vertex Momentum	$V_{0p} < 2.8$ GeV

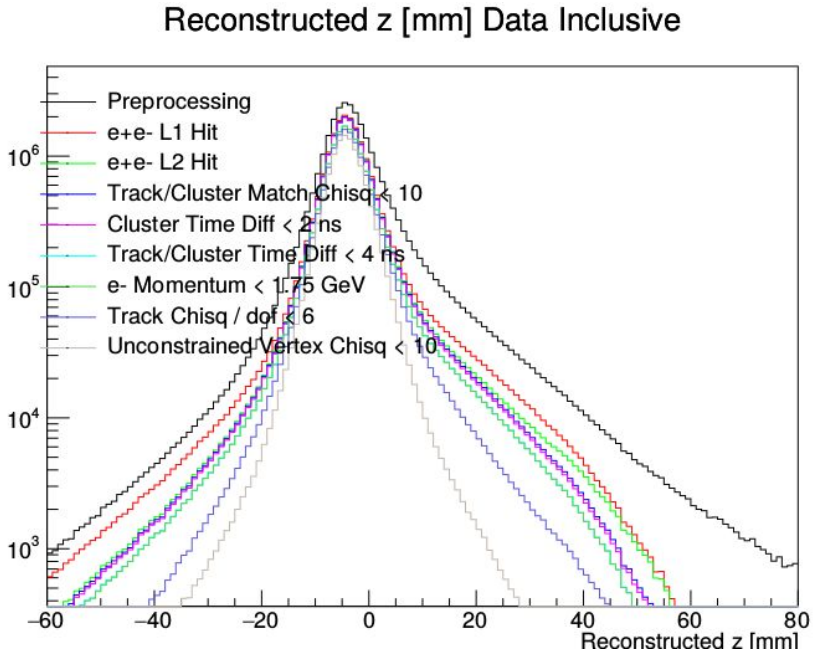
Table 2: Requirements applied to V_0 particles during the reconstruction stage for data (i.e. MOUSE cuts).

Cut Flow - Preselection Cuts

- Essentially tighter MOUSE cuts
- Unlikely to loosen

Cut Description	Requirement
Layer 1 Requirement	e^+ and e^- have L1 hit
Layer 2 Requirement	e^+ and e^- have L2 hit
Track-cluster match	$\chi^2 < 10$
Cluster Time Difference	$\lvert t_{e^+Cluster} - t_{e^-Cluster}\rvert < 2$ ns
Track-Cluster Time Difference	$\lvert t_{e^+Track} - t_{e^+Cluster} - \text{offset}\rvert < 4$ ns
Track-Cluster Time Difference	$\lvert t_{e^-Track} - t_{e^-Cluster} - \text{offset}\rvert < 4$ ns
Beam electron cut	$p(e^-) < 1.75$ GeV
Track Quality	$\chi^2/dof < 6$
Vertex Quality	$\chi^2_{unc} < 10$

Table 4: Requirements applied to V_0 after reconstruction as an initial set to study. T
offset for data is 56 ns and the time offset for MC is 43 ns.



Cut Flow - Preselection Cuts

- (See more detailed cutflow plots)

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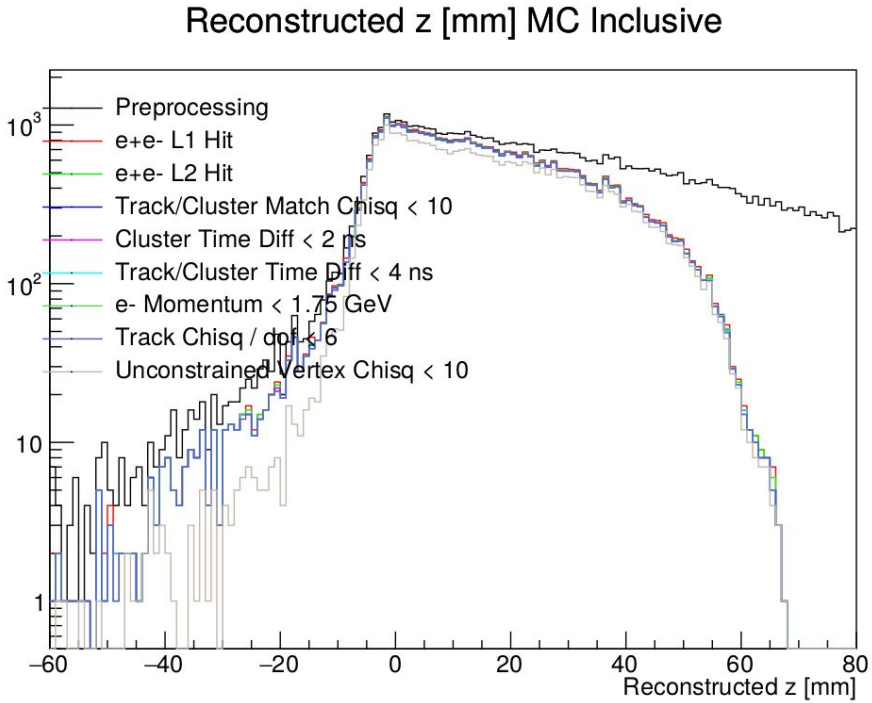
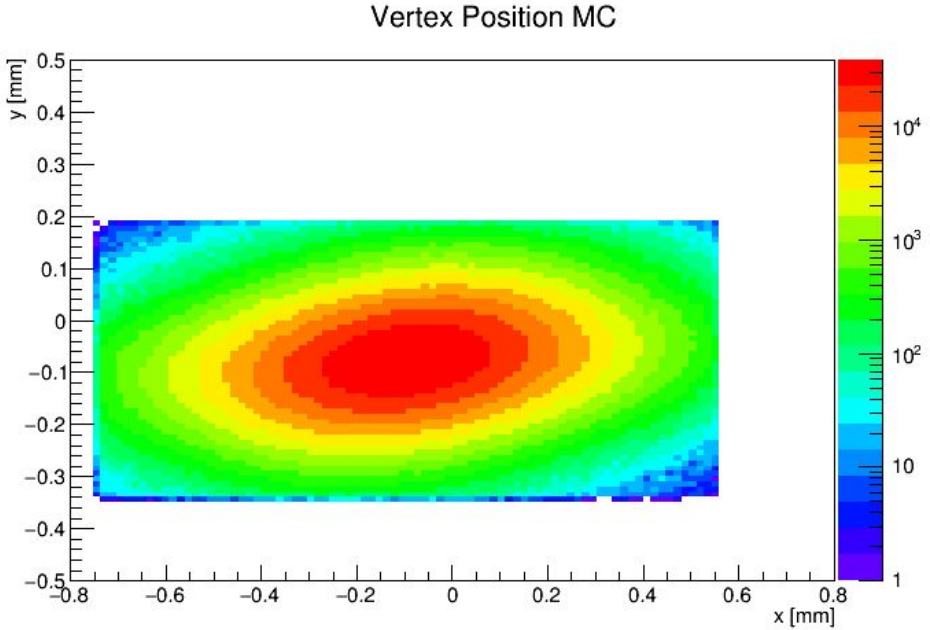
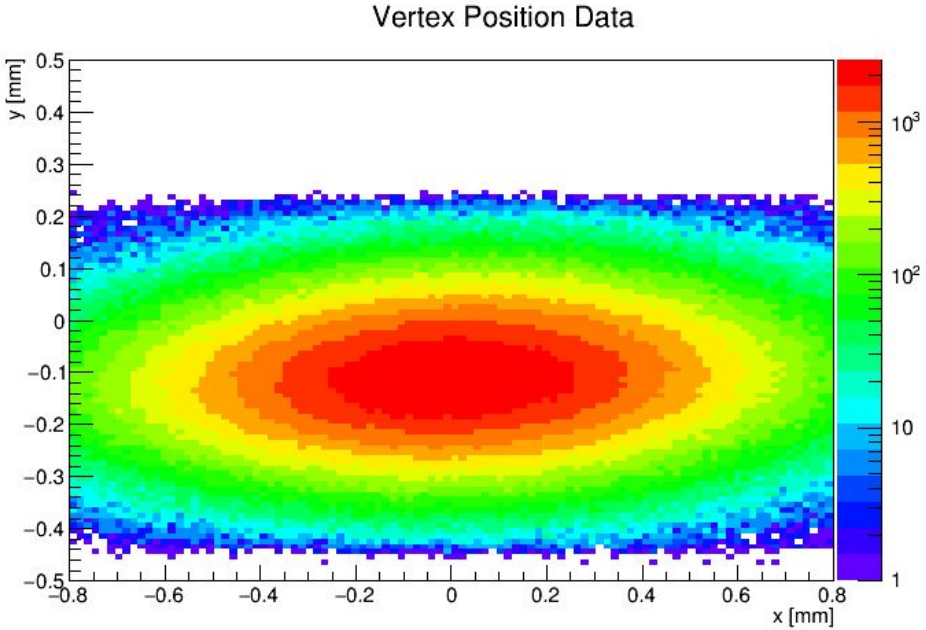


Cut Flow - V0 Position Cut

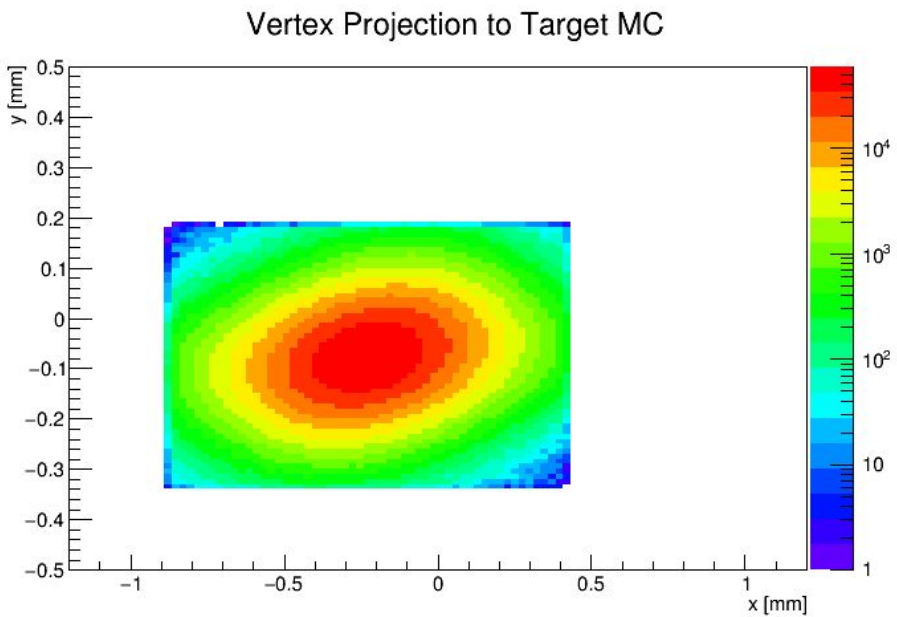
- Rectangular cut on vertex x/y position - fitted 3σ (data run-dependent).
- We should do an elliptical cut. How tight?

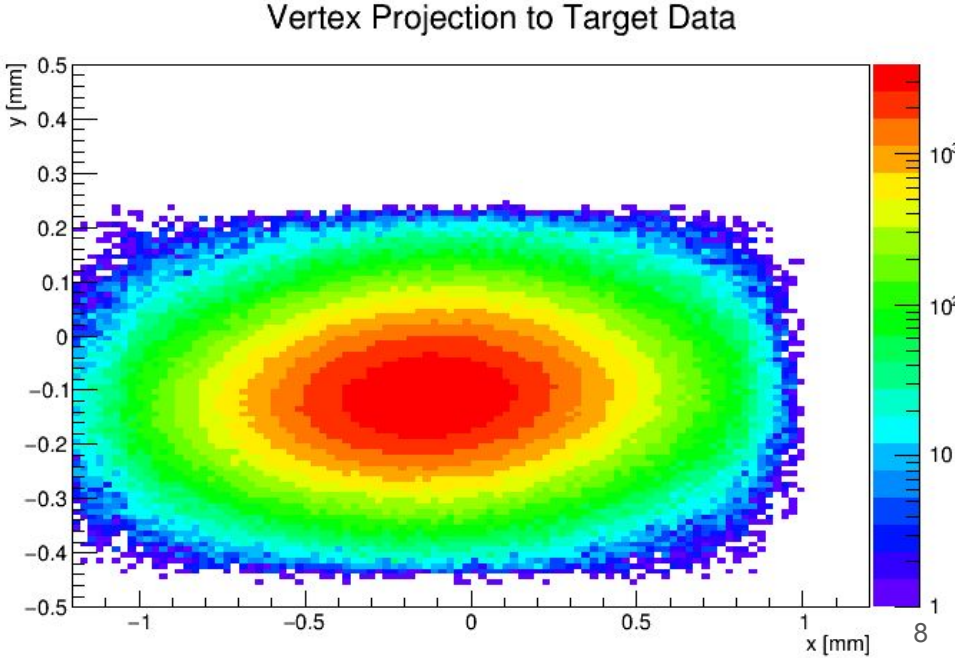




Cut Flow - V0 Projection Cut

- Rectangular cut on vertex x/y projection - fitted 3σ (data run-dependent).
- Need to do an elliptical cut (like we did for 2015 vertexing analysis)



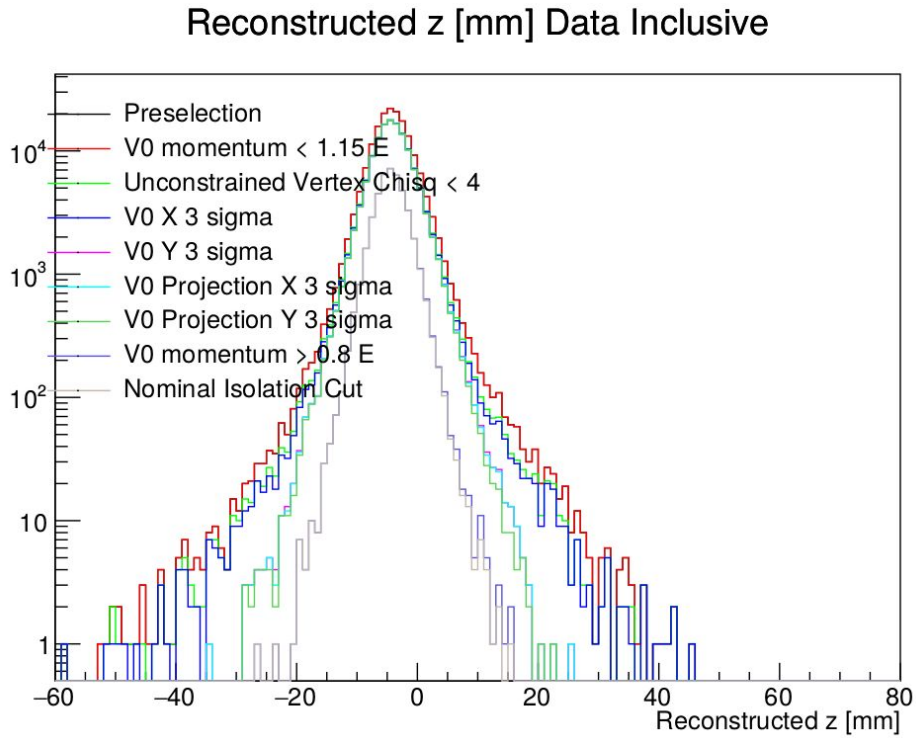


Cut Flow - Tight Cuts

- These cuts are still being explored
- Other cuts to be explored - bscChisq, impact parameters (Z0), VZ errors
- After this, select only events with single V0s to study (will choose the “best” V0 later)

Cut Description	Requirement
Tight Vertex Quality	$\chi^2_{unc} < 4$
Radiative Cut	$V_{0p} > 0.8\ e_{beam}$ GeV
Maximum Vertex Momentum	$V_{0p} < 1.15\ e_{beam}$ GeV
V0 projection to target	Fitted 3σ cut
V0 x and y position	Fitted 3σ cut
Isolation Cut	$\delta + \frac{1}{2}(z0 + z_{targ}\ \frac{P_Y}{P}\ \text{sign}(P_Y)) > 0$

Table 5: Cuts currently being studied.



Cut Flow - Tight Cuts

- (See more detailed cutflow plots)

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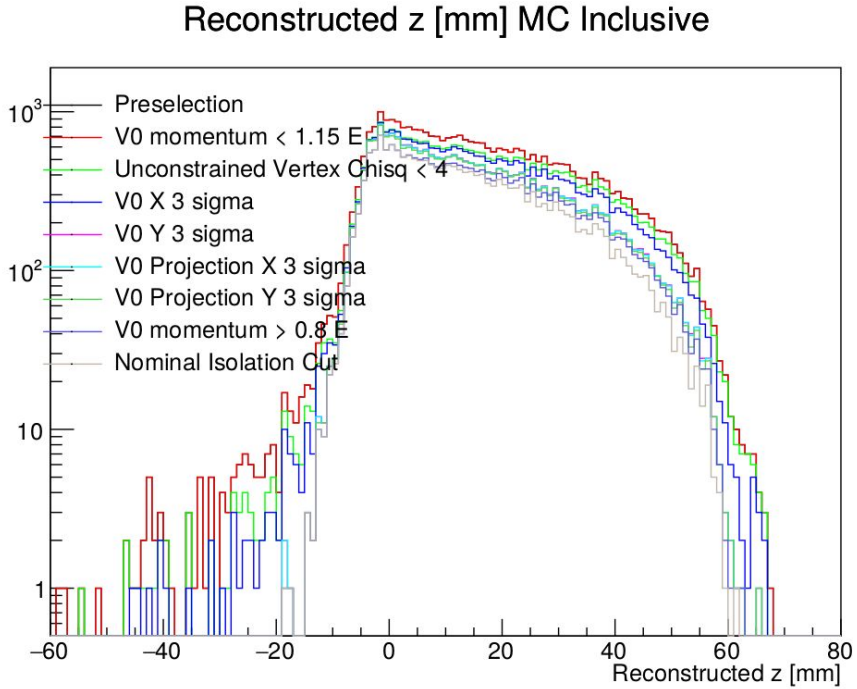


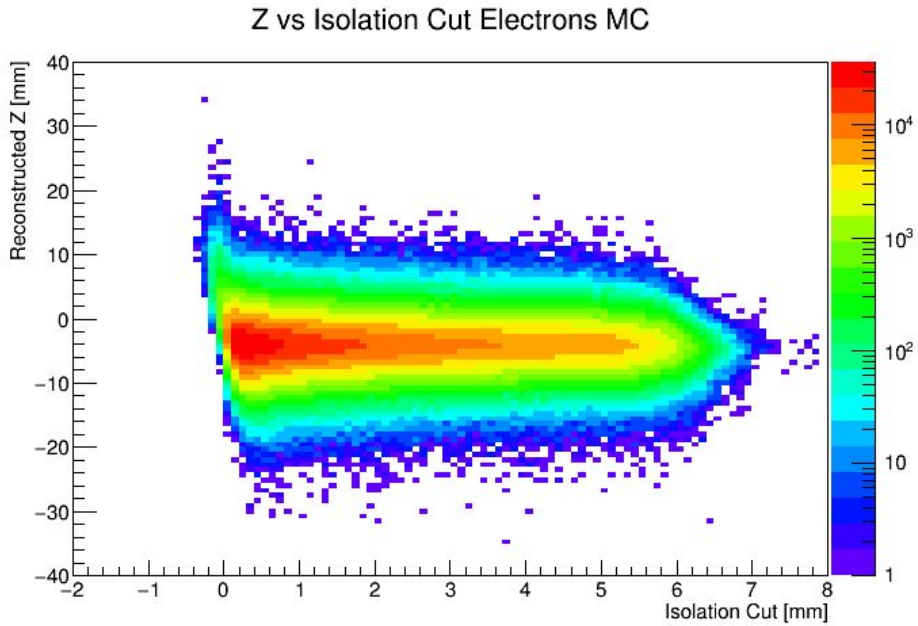
- TODO: add numbers to these cuts
- Look at High Z plots

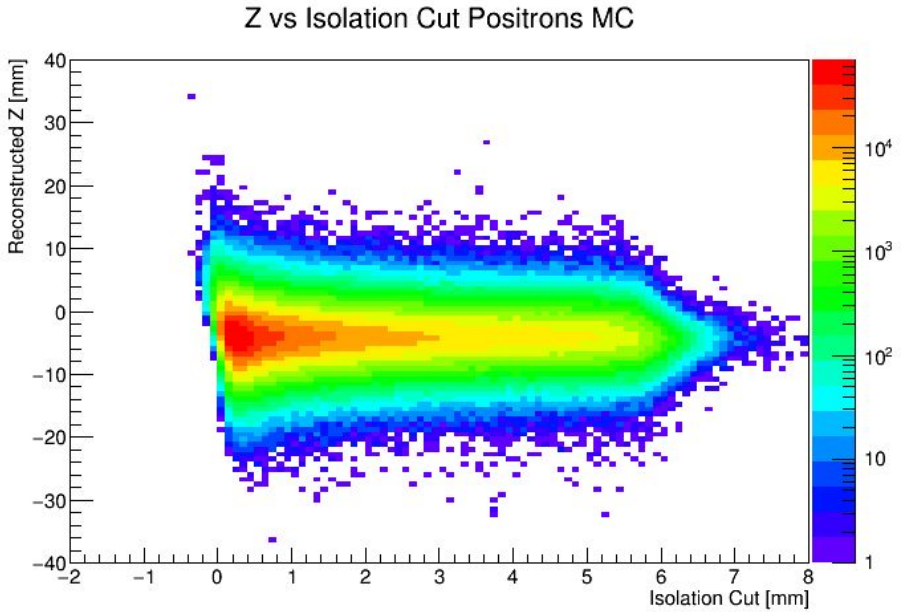
Bad Hits

- Strategy for this analysis
  - Tighten up the isolation cut (see next slides for plots)
- I have previous work on refitting tracks/vertices for bad hits
  - This was useful to do. I learned a lot, for instance many bad hits come from FEEs
  - I will make these refit plots and include them in my thesis
  - Practically, this will probably be too complicated for this analysis (we have to run some reconstruction on the data to make use of it)

Isolation Cut MC

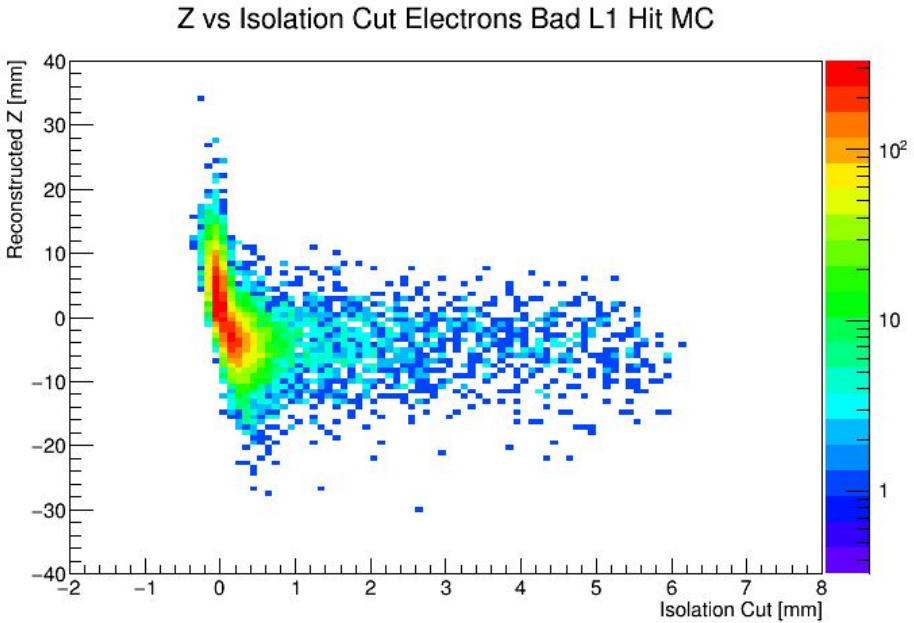
- Tight cuts without the isolations cut for MC

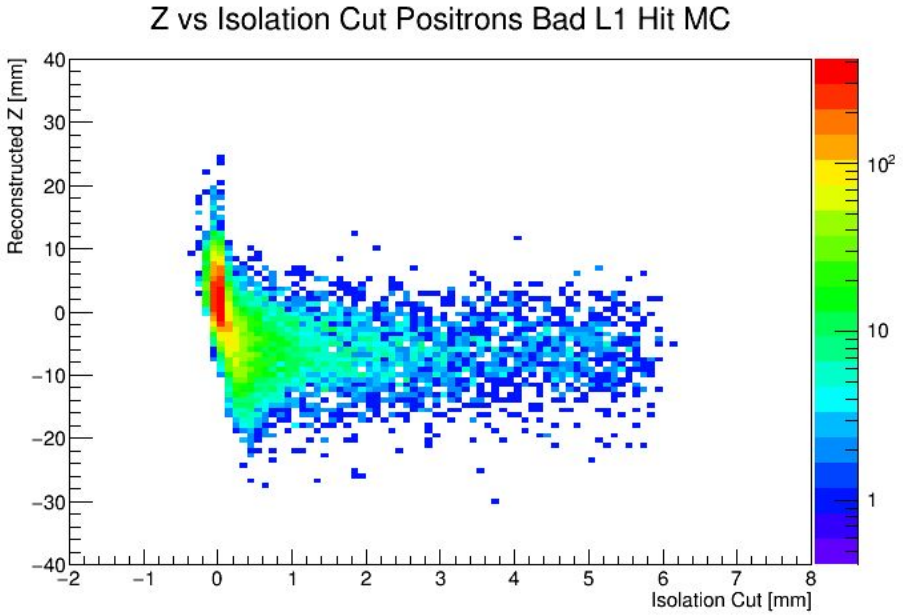




Isolation Cut MC L1 Bad Hit

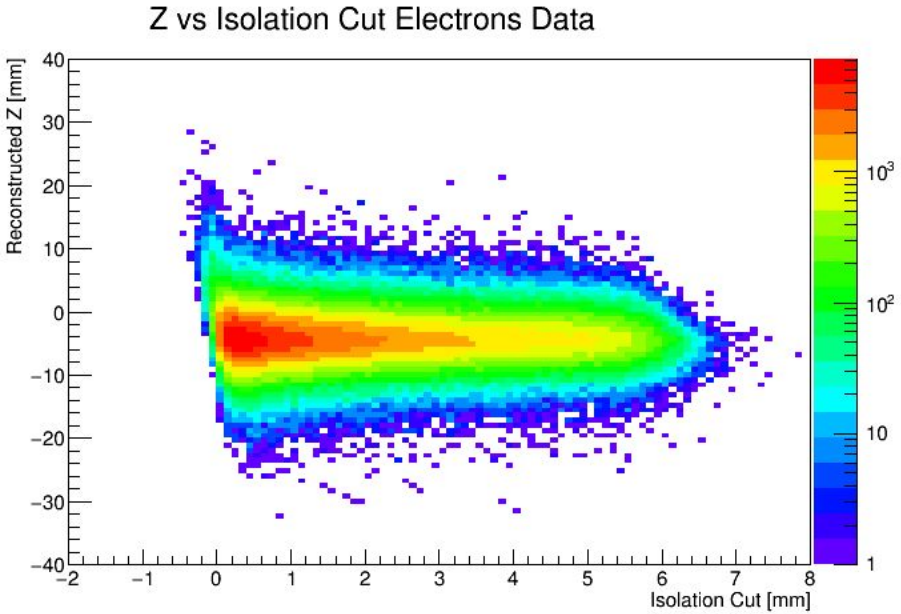
- Tight cuts without the isolations cut for MC
- Select only tracks with a bad hit in L1

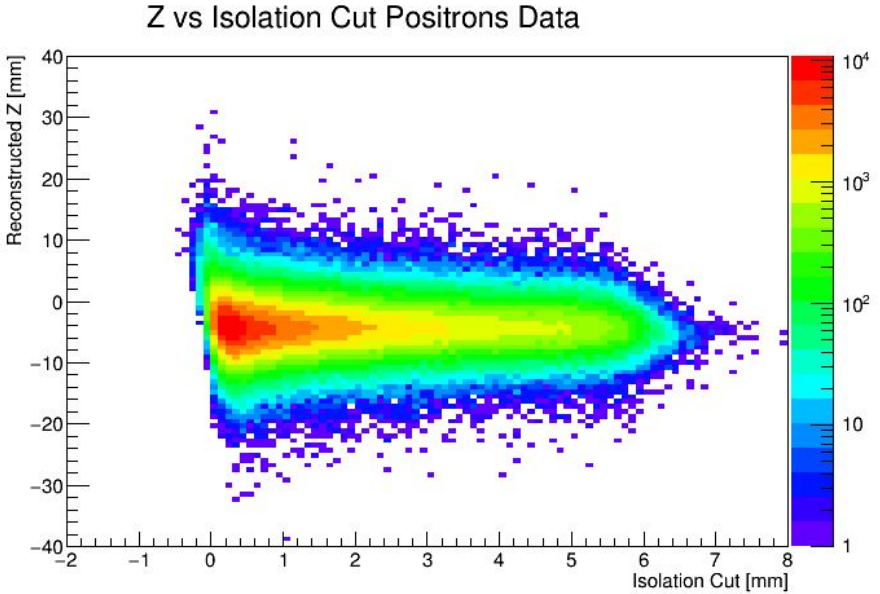




Isolation Cut Data

- Tight cuts without the isolations cut for Data





Isolation Cut A' MC

- Isolation cut efficiency for A' 100 MeV MC