

# Online Stopped Muon Filter

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# Stopping Muon Filter Algorithm

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- Load wire endpoints and wire-to-channel maps
- Calculate total charge on collection planes in each TPC
- Cut 0: Only muons that enter the active volume are considered:  
( $0 < x \leq 200$  cm,  $-85.25 < y \leq 125$  cm,  $0 < z \leq 153.516$  cm)
- Cut 1: reject events with significant ( $> 1000$ ) charge deposition in TPCs on short drift side
- Cut 2: reject events without greater ( $< 50000$ ) charge in TPCs on long drift side
- Find first and last collection plane wires with hits - one of these should be exit point
- Scan over all hits
  - Loop over all hits on first and last collection plane wire to be hit
  - For each of those hits, check times and positions against hits on induction planes
  - If a triplet of hits on each of the three wire planes within 3 time ticks of each other and within 2 cm of each other in z occurs on the first or last collection plane wire, an entrance/exit point is found
- Cut 3: reject events with more or less than exactly one entrance/exit point

# Event Sample and Results

- 10000  $\mu^+$  from MCC 3 LSU AntiMuon sample (DetSim)
- Cut 0: Only muons that enter the active volume are considered:  
( $0 < x \leq 200$  cm,  $-85.25 < y \leq 125$  cm,  $0 < z \leq 153.516$  cm)
- Cut 1: reject events with significant ( $> 1000$ ) charge deposition in TPCs on short drift side
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- Cut 3: reject events with more or less than exactly one entrance/exit point

Table 1: Muons after Cuts

Cumulative Cut(s) Applied	Throughgoing	Stopping
Cut 0	4883	546
Cut 1	4047	515
Cut 2	3314	337
Cut 3	1024	137

# Throughgoing Muons

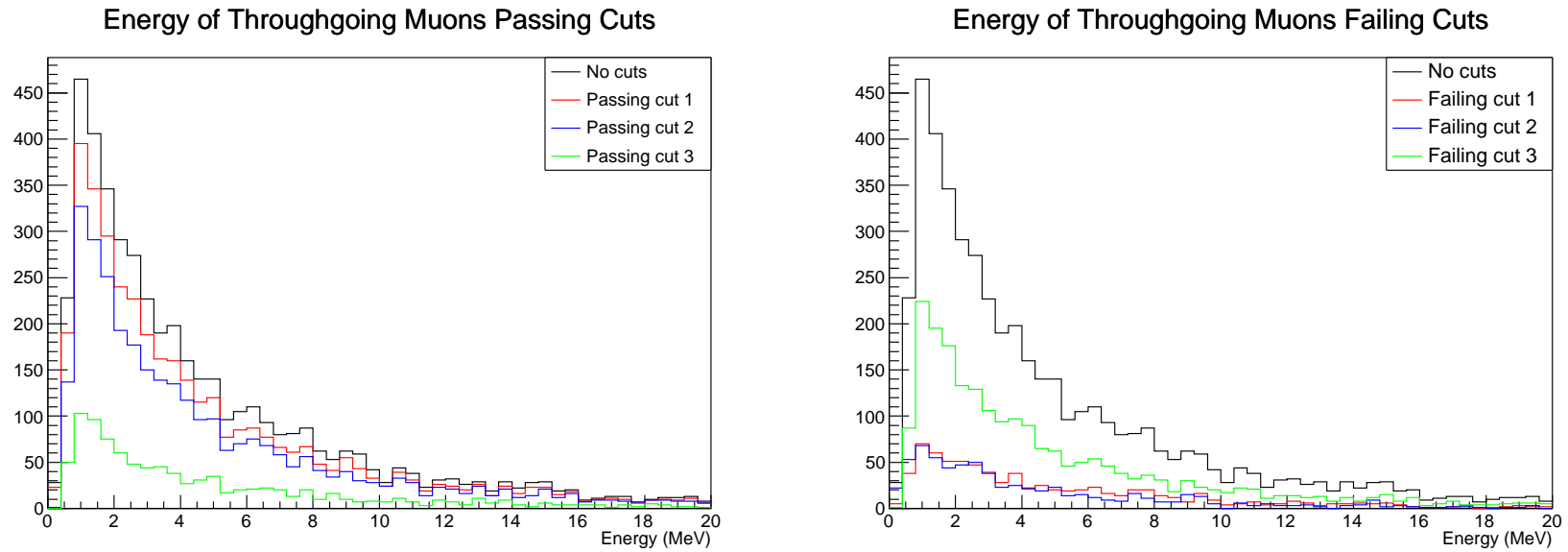


Figure 1: Throughgoing muon energies passing and failing cuts

# Throughgoing Muons

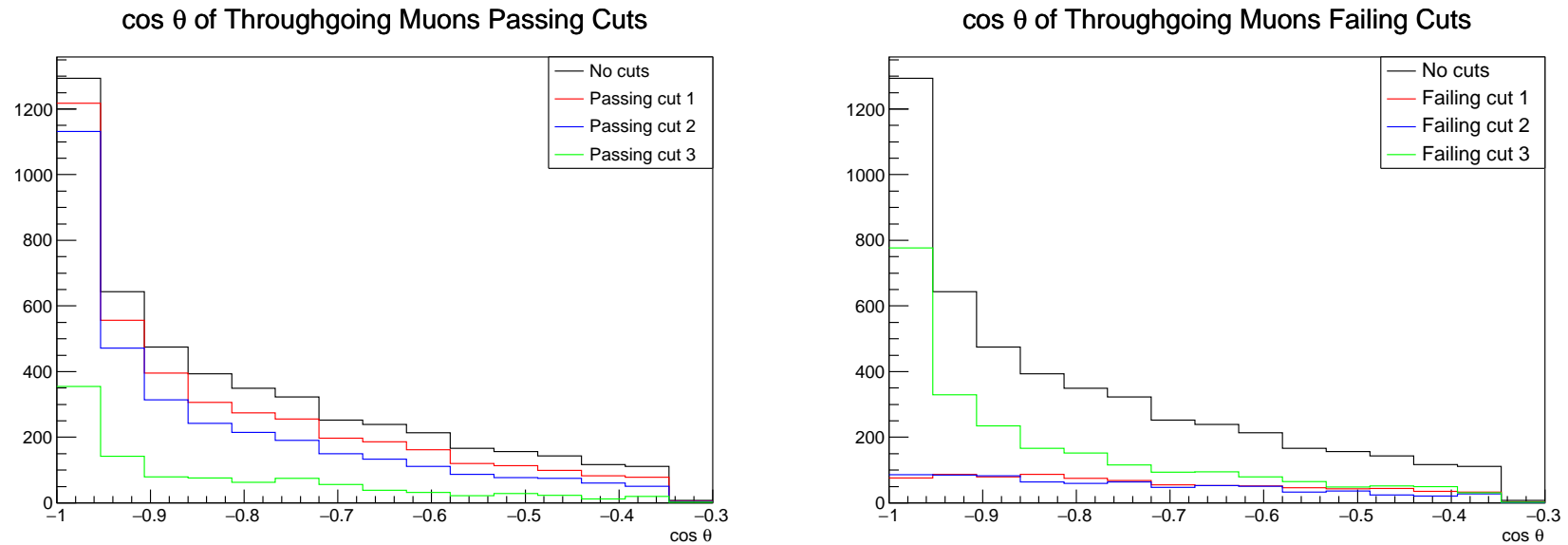


Figure 2: Throughgoing muon angles passing and failing cuts

# Throughgoing Muons

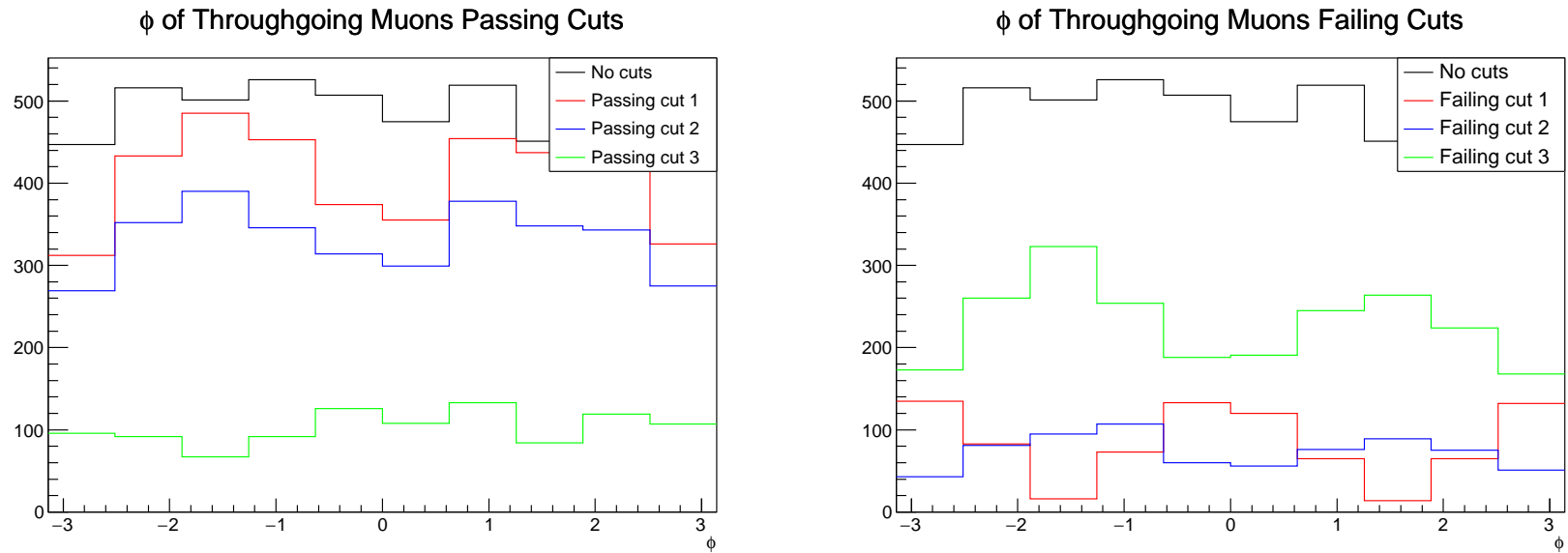


Figure 3: Throughgoing muon angles passing and failing cuts

# Throughgoing Muons

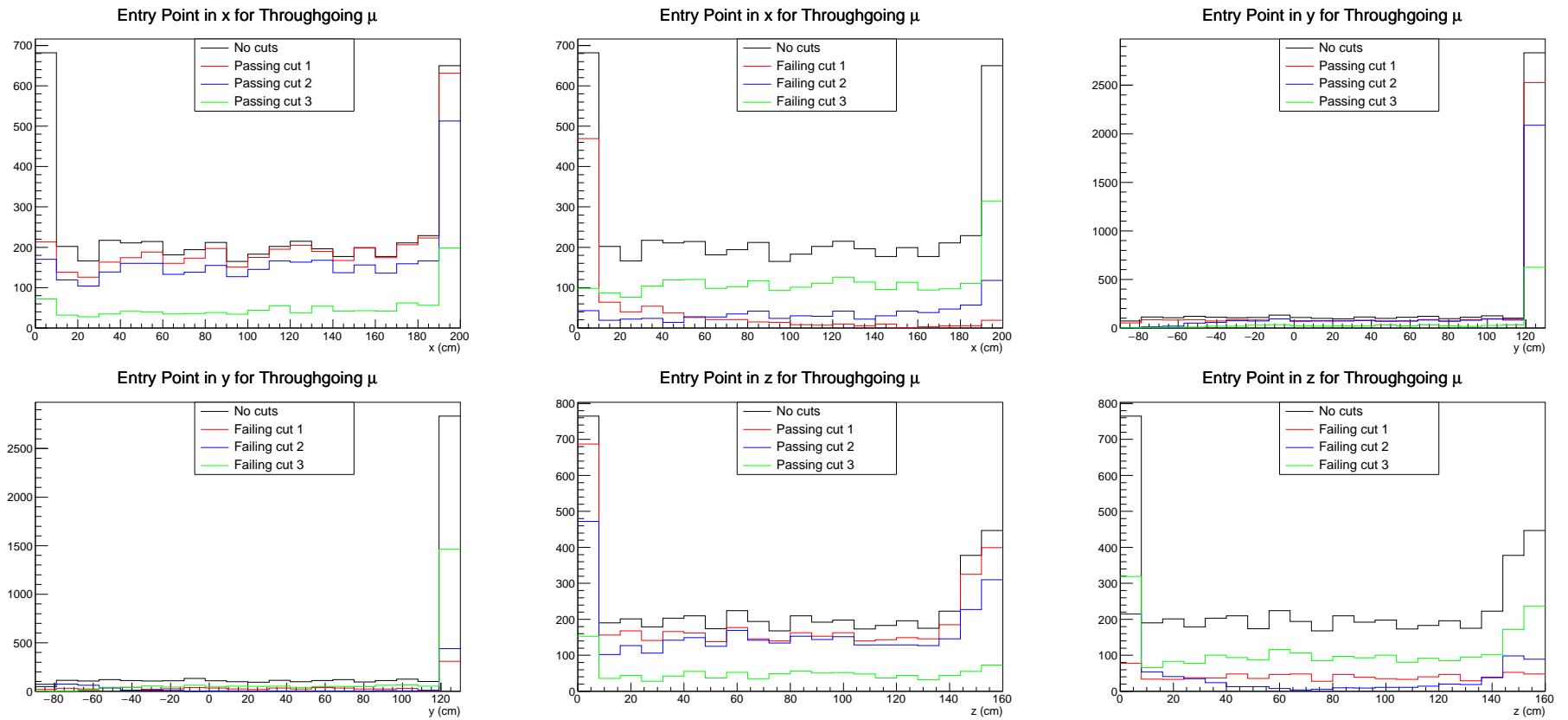


Figure 4: Throughgoing muon entry points passing and failing cuts

# Throughgoing Muons

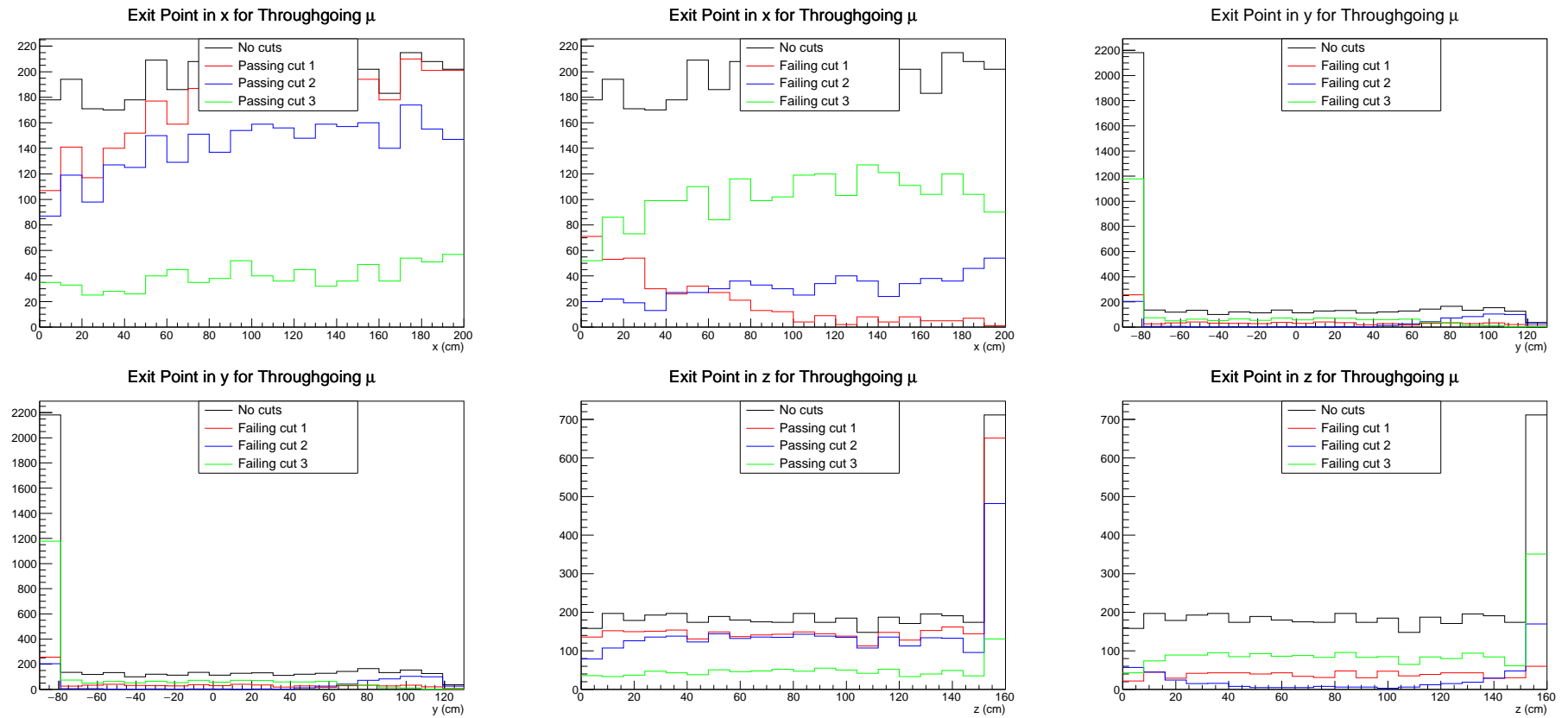


Figure 5: Throughgoing muon exit points passing and failing cuts



# Stopping Muons

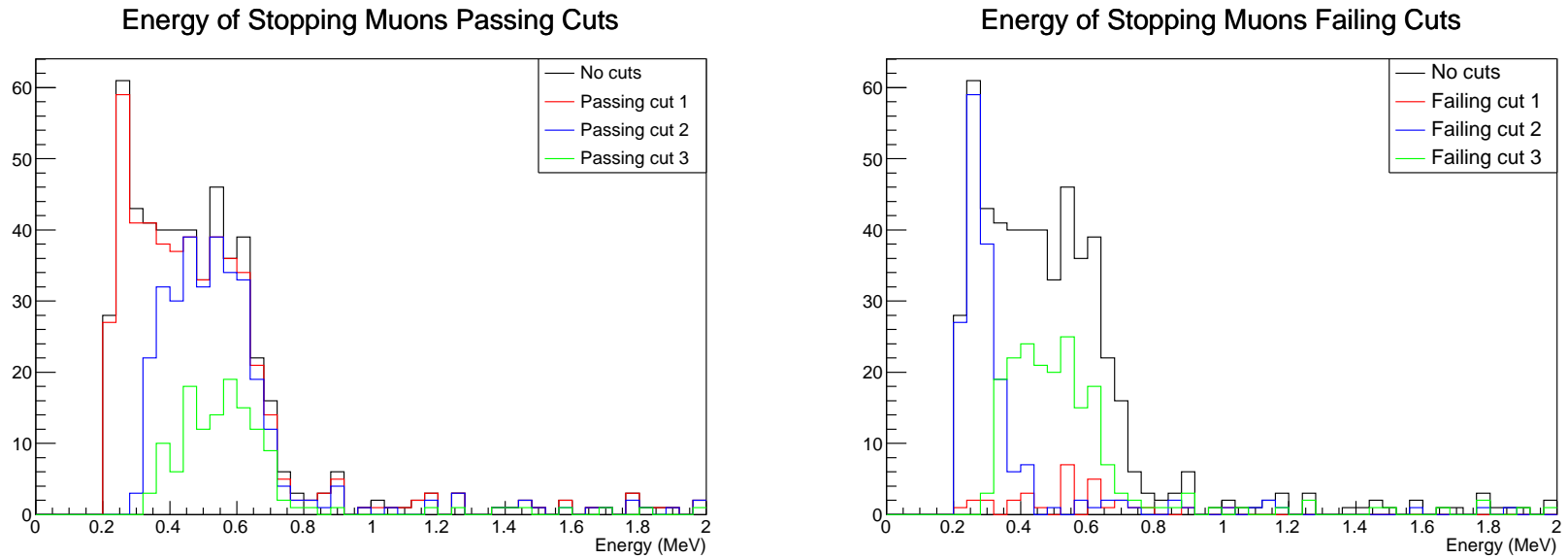


Figure 6: Stopping muon energies passing and failing cuts

# Stopping Muons

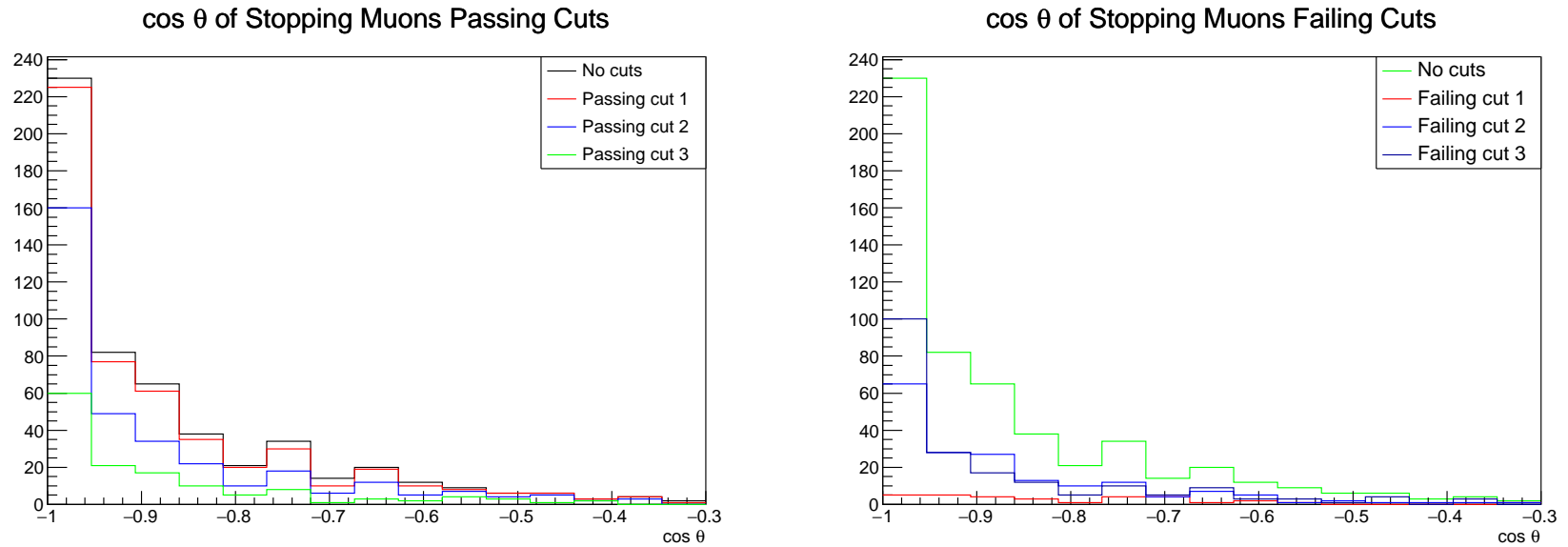


Figure 7: Stopping muon angles passing and failing cuts

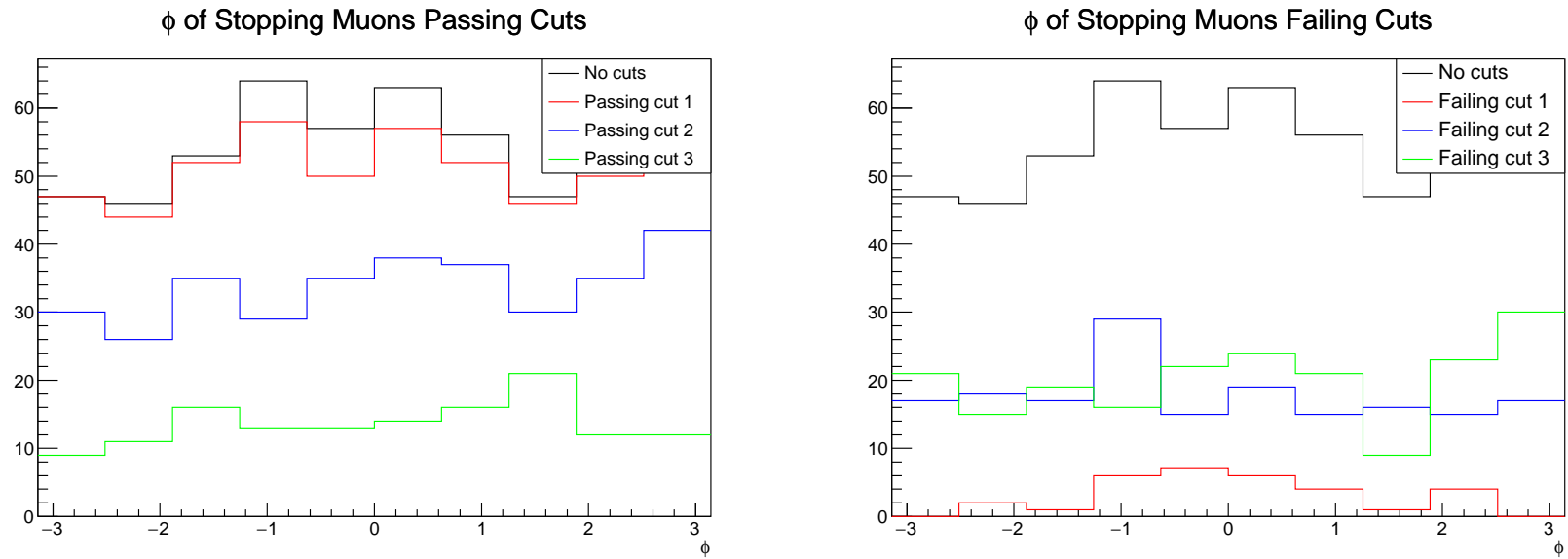


Figure 8: Stopping muon angles passing and failing cuts

# Stopping Muons

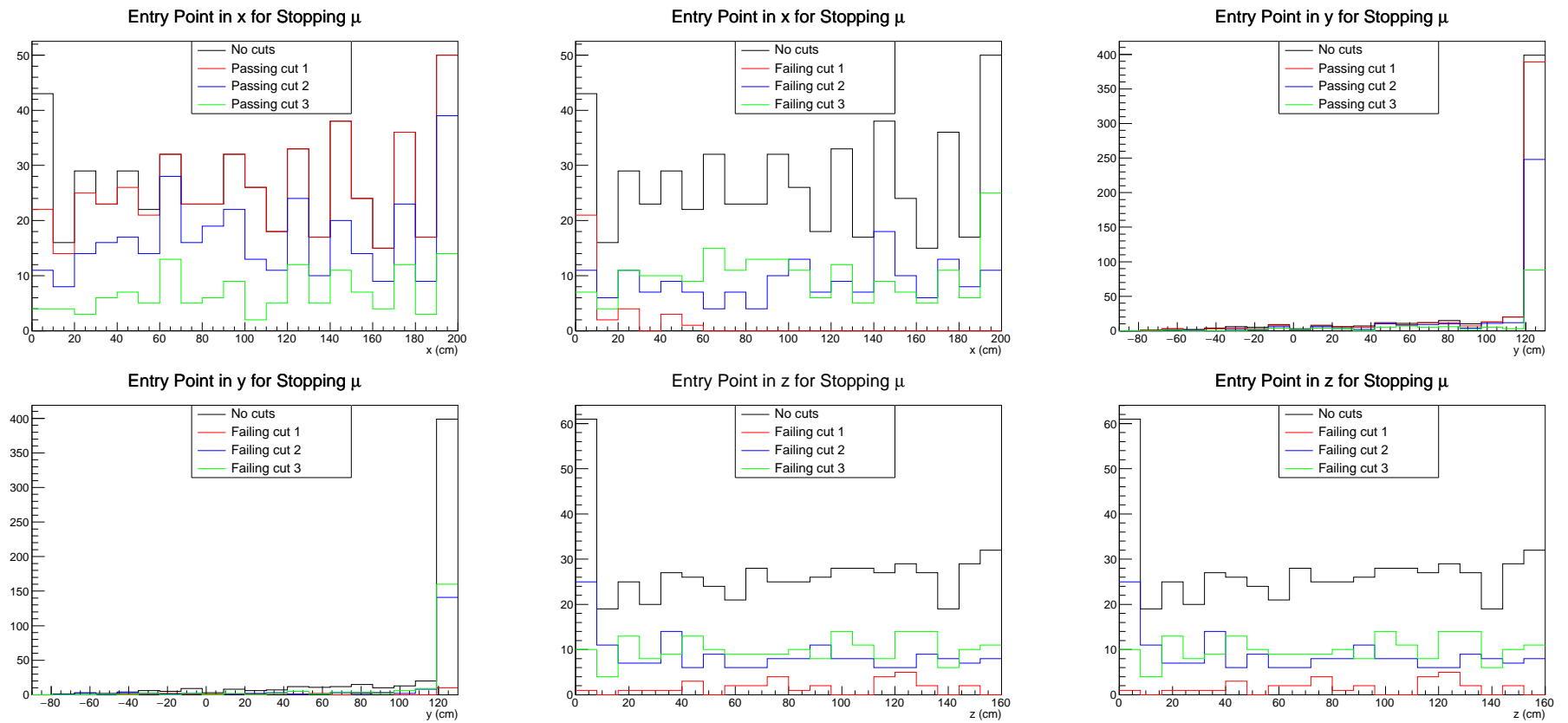


Figure 9: Stopping muon entry points passing and failing cuts

# Next Steps

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- Use  $y$  information in triplets to determine if entrance/exit candidates are on edges of detector
- Examine events of throughgoing muons that pass filter to determine how they are faking
- Measure efficiency and purity with samples of throughgoing and stopping muons of diverse energies and directions