Trilepton Analysis: The $WH \rightarrow WWW \rightarrow l\nu l\nu l\nu$ Signal

Event Count and More w/ CMIO,

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Collider Detector at Fermilab

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Summary

Decay Probabilities

- Signal filter requires the event to have at least one lepton of at least 10 GeV, but does not require it to come from a W.
- $P(W \rightarrow \text{lepton}) \sim \frac{1}{3}$
- P(0 lep. decay) = $\left(\frac{2}{3}\right) \cdot 3 = \frac{8}{27}$
- $P(\geq 1W \rightarrow \text{lepton}) = 1 - \frac{8}{27} = \frac{19}{27}$
  - Direct count: 96476/100000 events have at least one W decaying leptonically.
- Prob. of exactly two leptonic decays: $\left(\frac{1}{3} \cdot \frac{1}{3} \cdot \frac{2}{3}\right) \cdot 3 = \frac{6}{27}$
- Given one W already decays leptonically,

  $P(\geq 2W \rightarrow \text{lepton}) = \frac{\frac{6}{27} + \frac{1}{27}}{\frac{19}{27}} = \frac{7}{19} = 0.368$
  - Prediction: $0.368 \cdot 96476 = 35503$
  - Direct count: 34718 events

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Decay Probabilities

- Given two W's already decay leptonically,
  $P(\text{all } 3W \rightarrow \text{lepton}) = \frac{\frac{1}{27}}{\frac{1}{27}+\frac{6}{27}} = \frac{1}{7} = 0.14$
  - Prediction: $0.14 \cdot 35503 = 4970$
  - Direct count: 4849 events
- For events that have all three W-bosons decaying leptonically, what is the probability of a particular W decaying in manner that passes the filter (i.e. decays to an electron, or muon, or tau provided the tau also decays to an electron or muon):
  - P(W decay passes filter) = $\frac{1}{3} + \frac{1}{3} + \frac{1}{3} \cdot (0.175 + 0.175) = 0.783$
  - P(event w/ 3 leptonic decays passes filter) = $0.783^3 = 0.48$
  - Prediction: $0.48 \cdot 4970 = 2385$
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Questions From Last Week

- Are CMIO muon objects that appear to be electron double counted in the reconstructed electron bank?
- Look at EOverP and HadE/EmE values for stubbed muons and CMIO muons.
- Eta vs. Phi for CMIO muon objects (EmE $>$ 2.0)

CMIO Muons Double Counted?

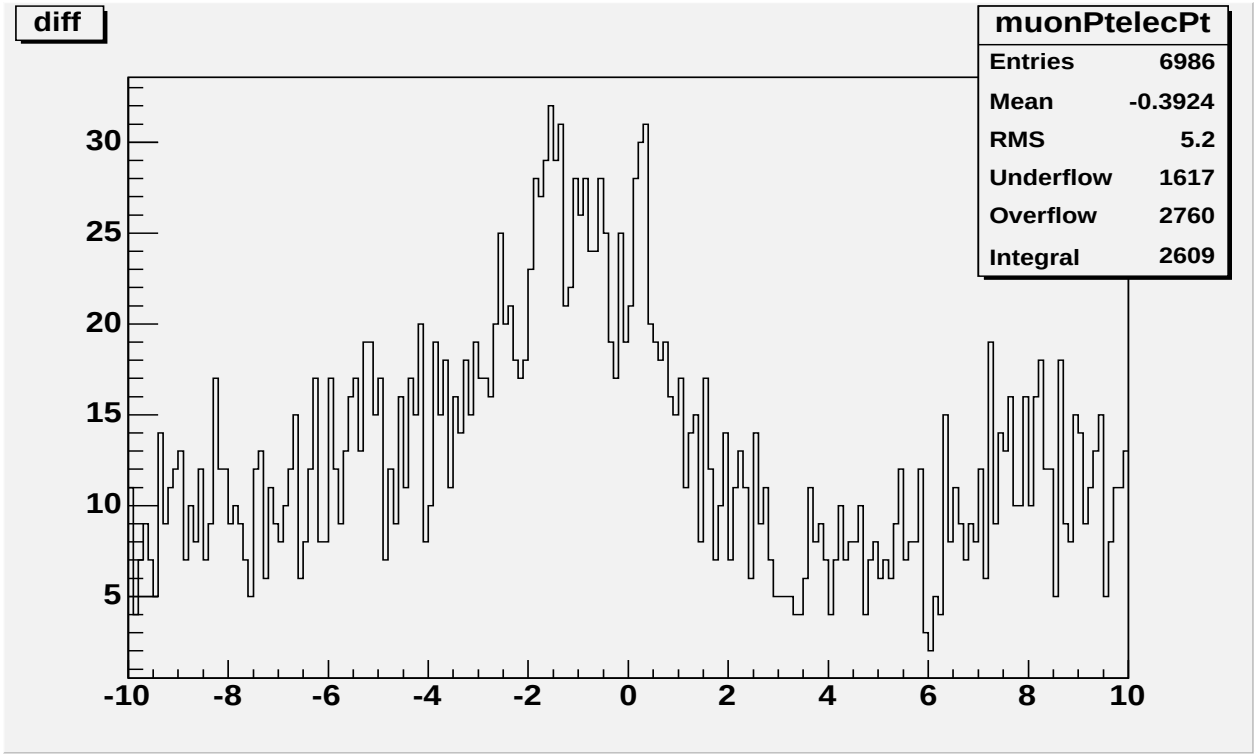


Figure: For each event, find the P_T difference between every

EOverP of Leading Leptons (muons only)

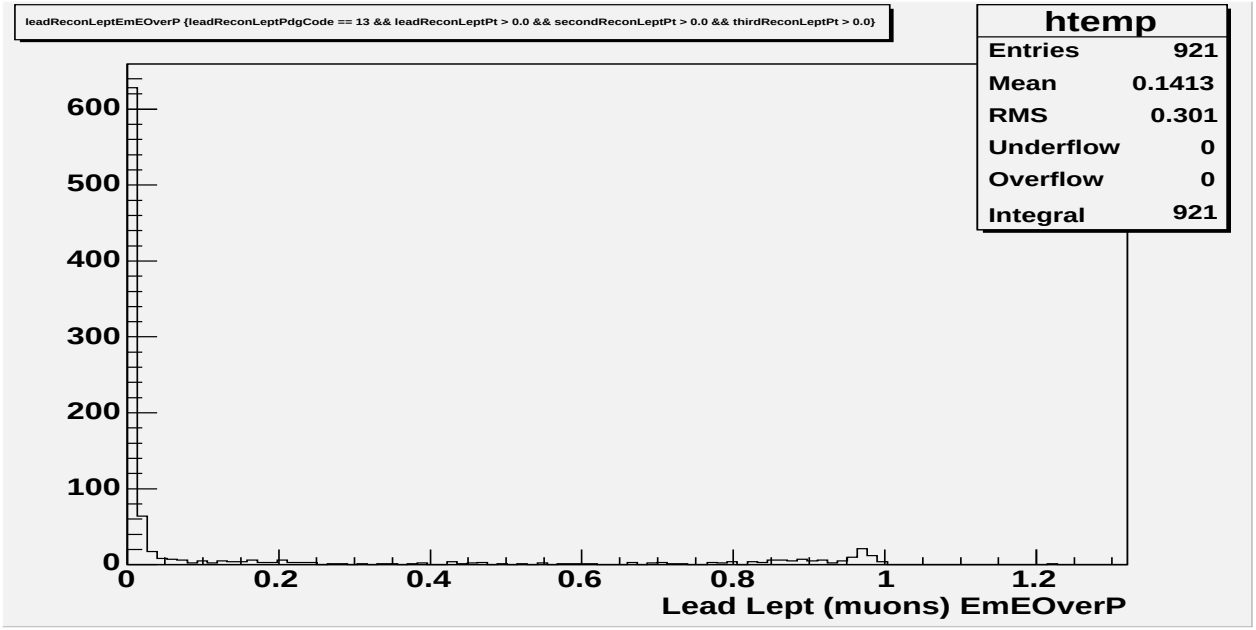
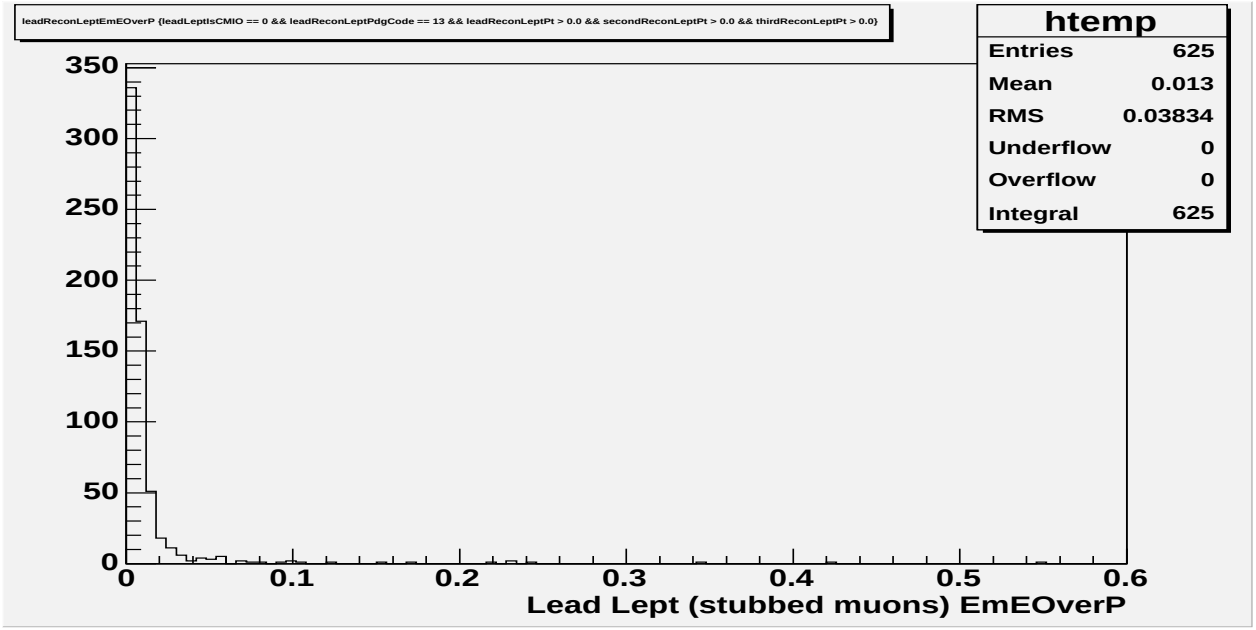


Figure: Electromagnetic energy divided by track momentum of lead leptons that are muons.

EOverP of Leading Leptons (stubbed muons only)



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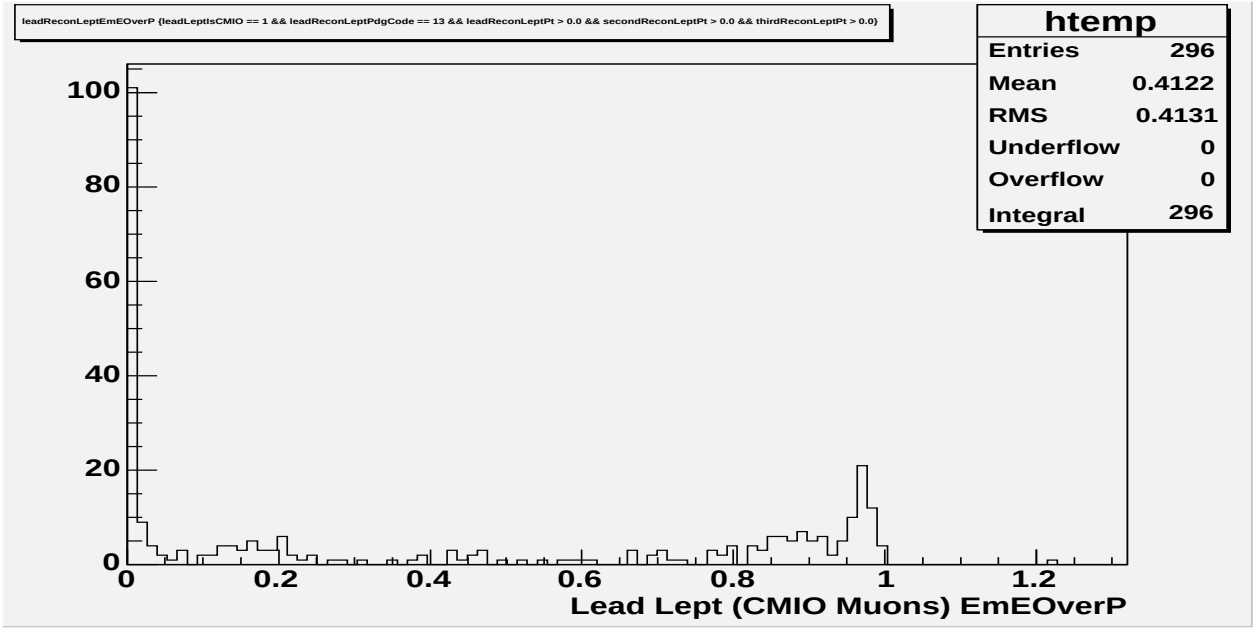
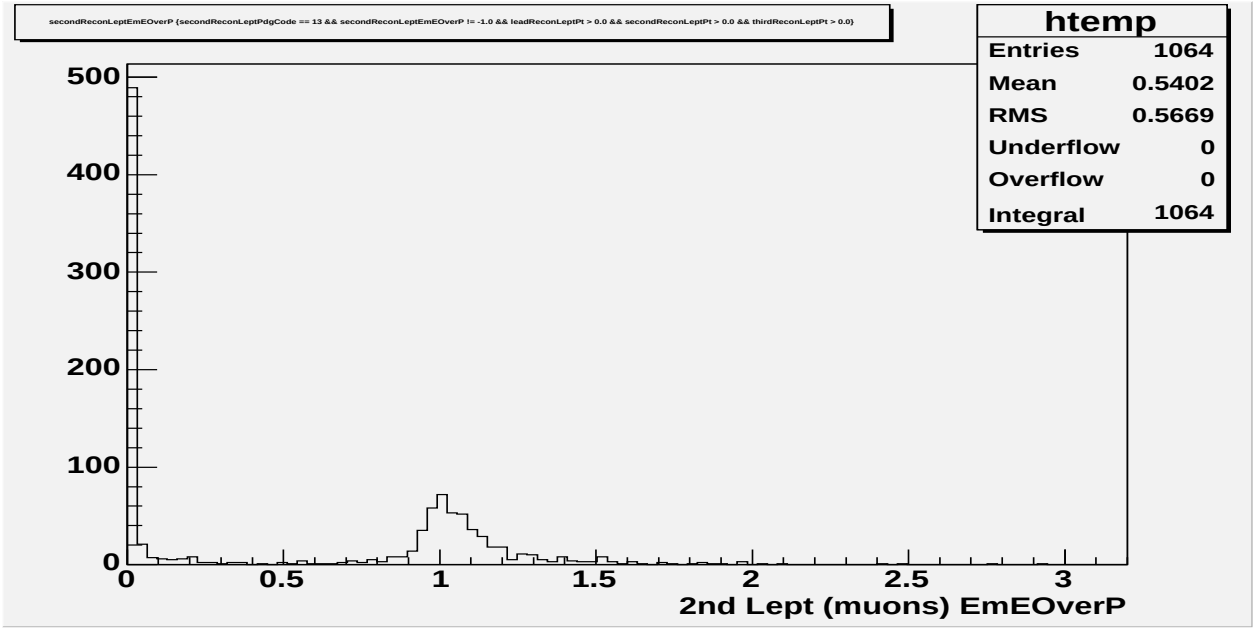


Figure: Electromagnetic energy divided by track momentum of lead leptons that are CMIO muons.

EOverP of 2nd Leptons (muons only)



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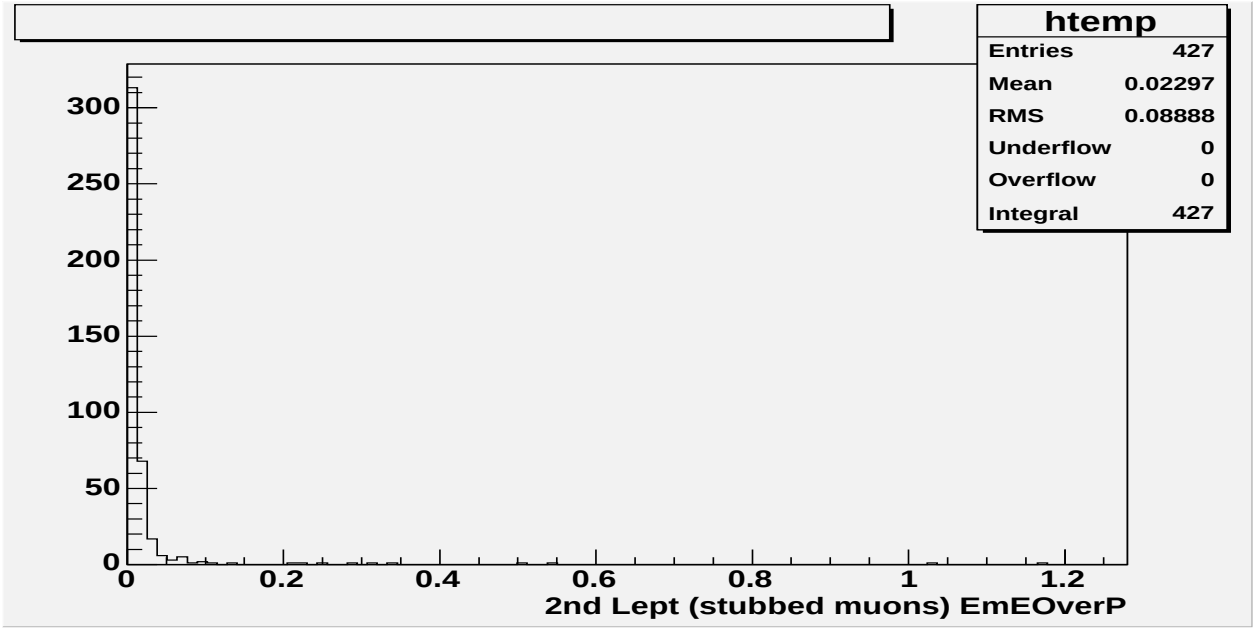

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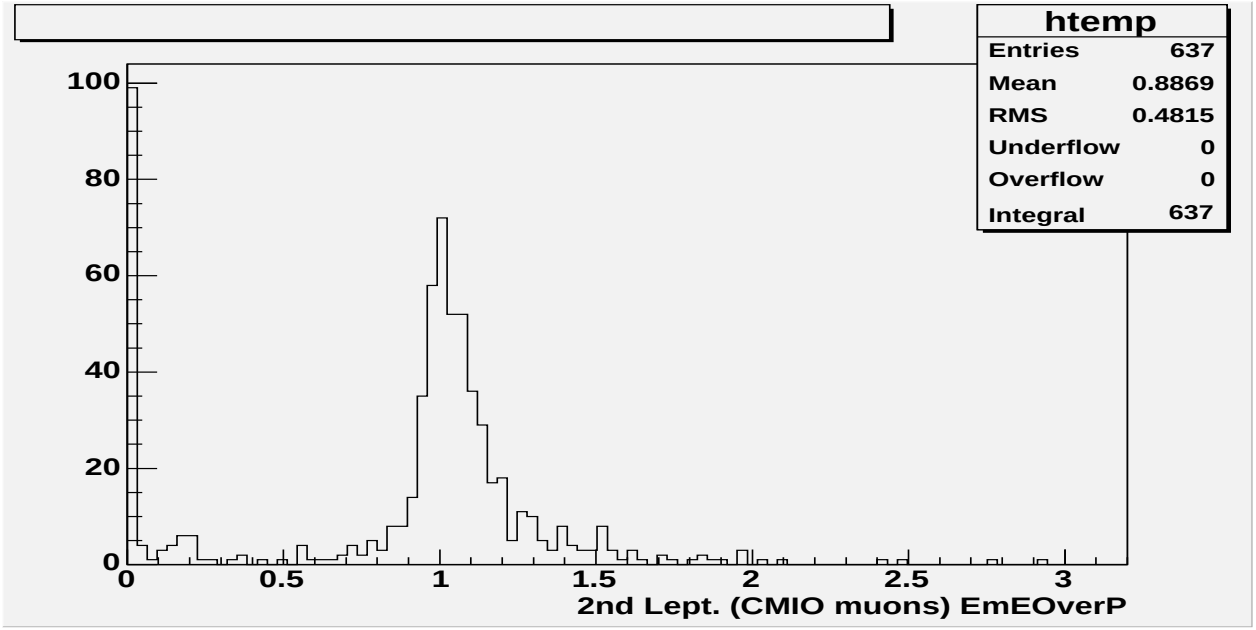

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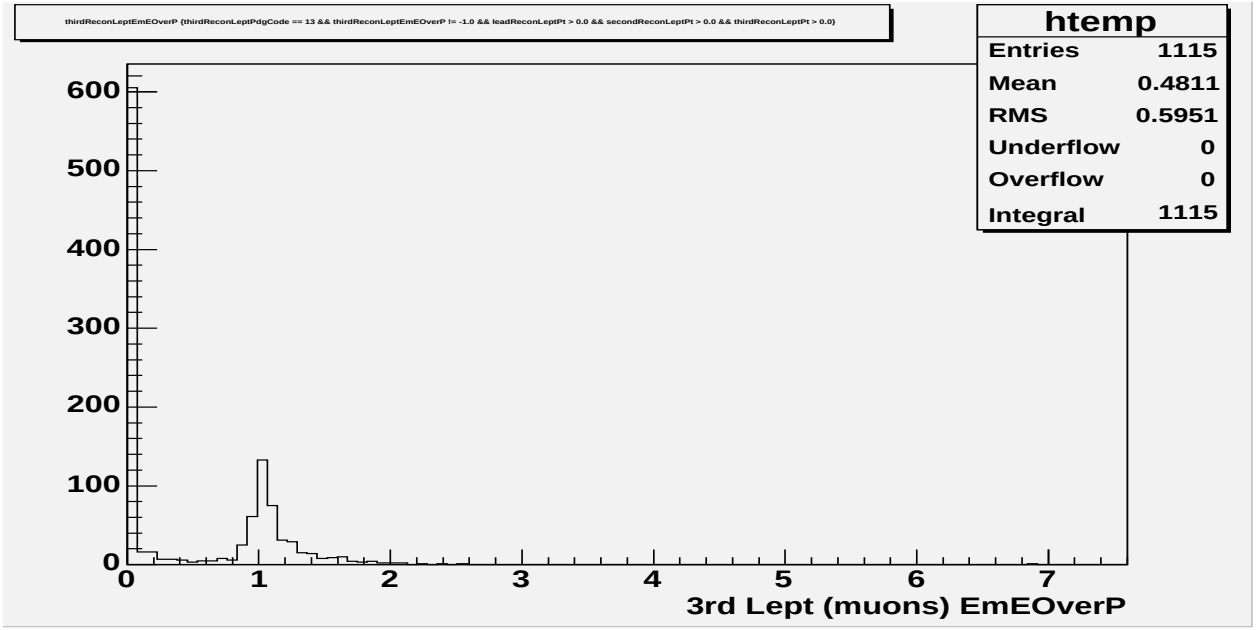

Figure: Electromagnetic energy divided by track momentum of 3rd leptons that are muons.

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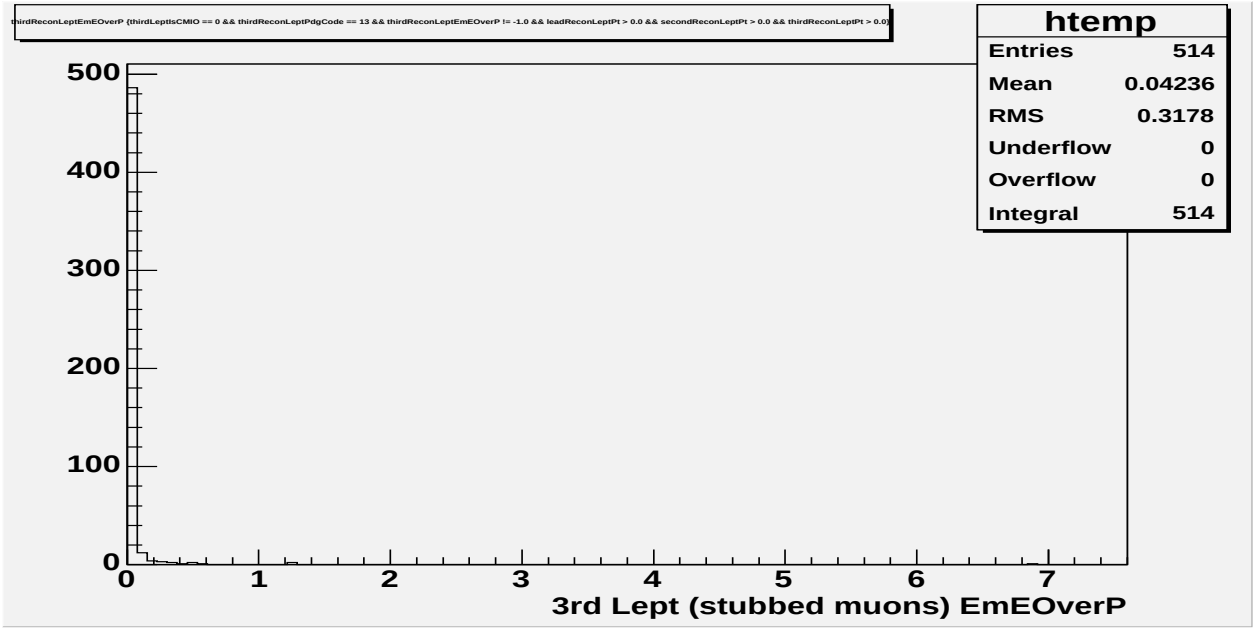

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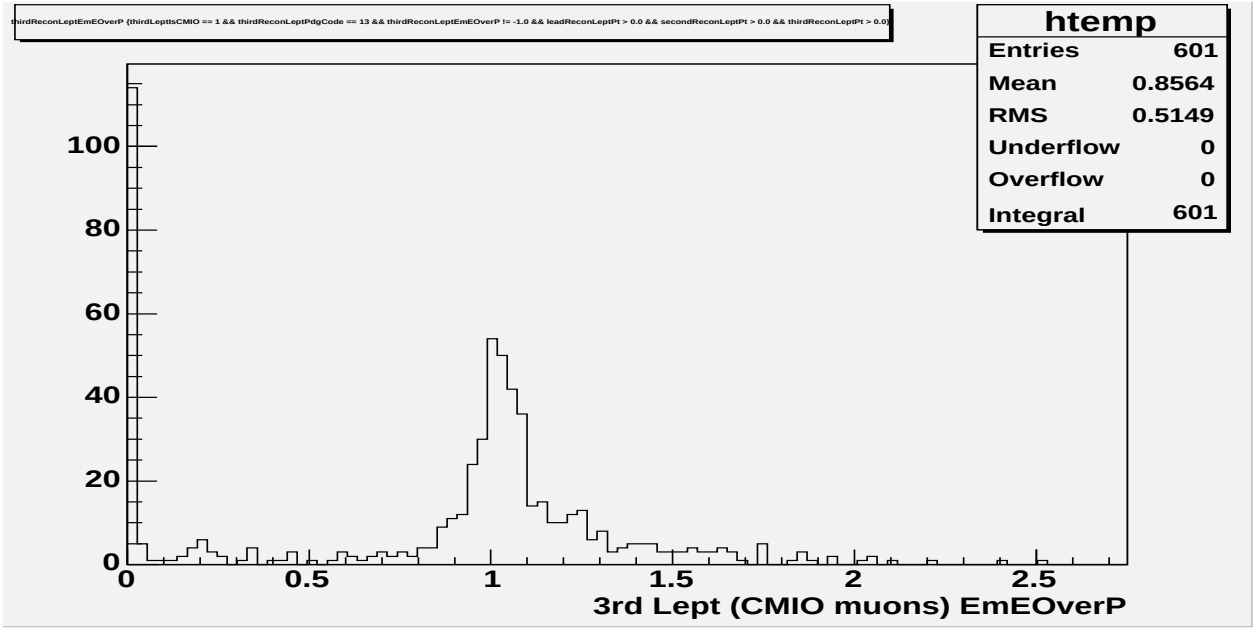

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HadE/EmE of Leading Leptons (muons only)

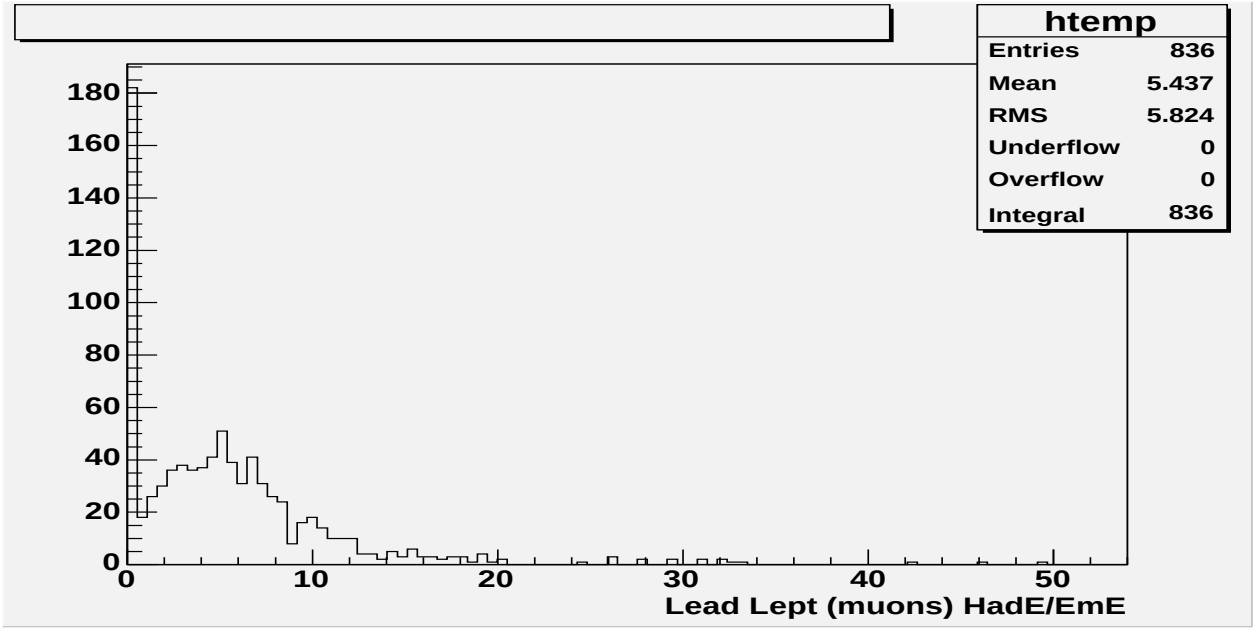
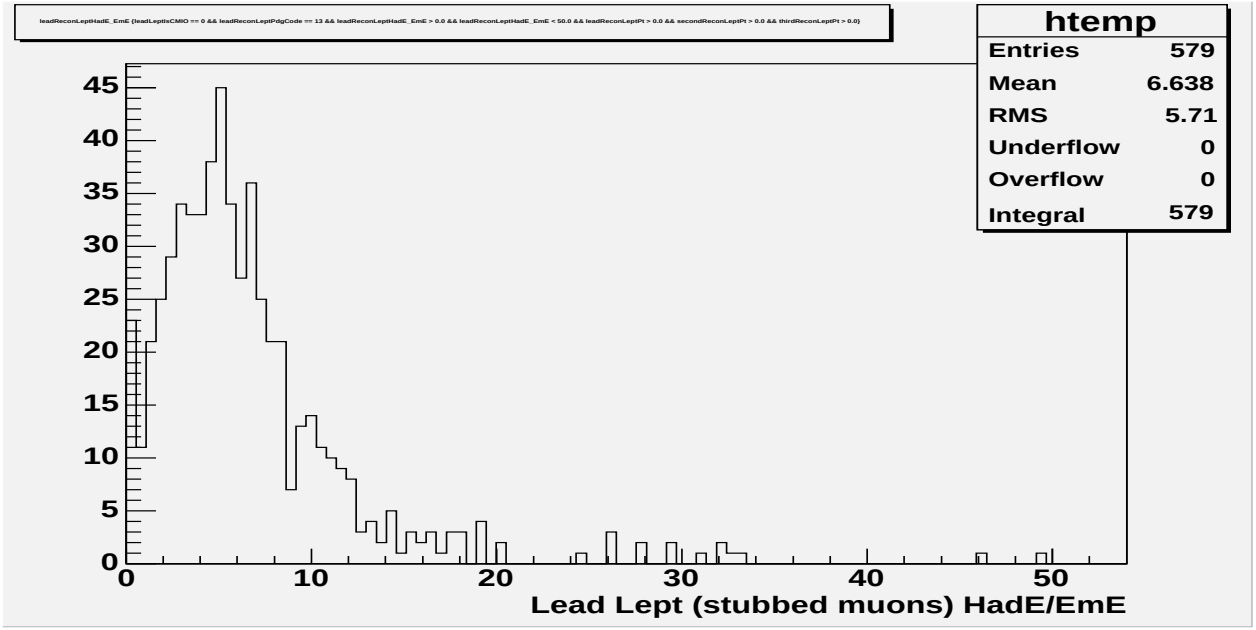


Figure: Hadronic energy divided by Electromagnetic energy of lead leptons that are muons.

HadE/EmE of Leading Leptons (stubbed muons only)



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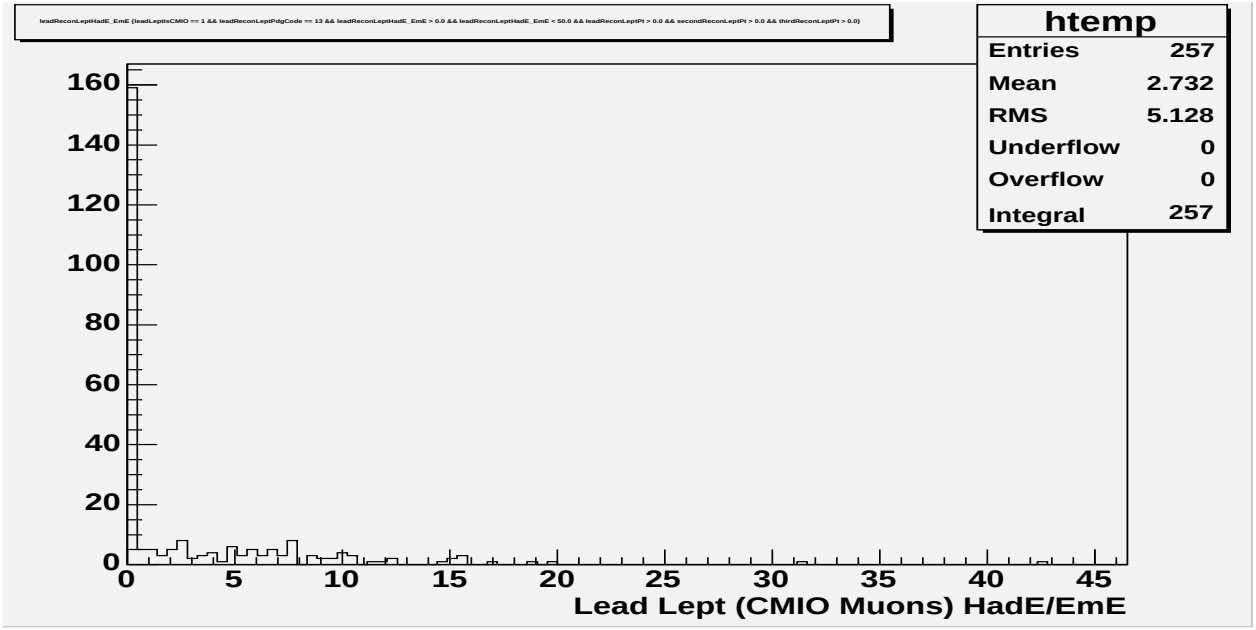

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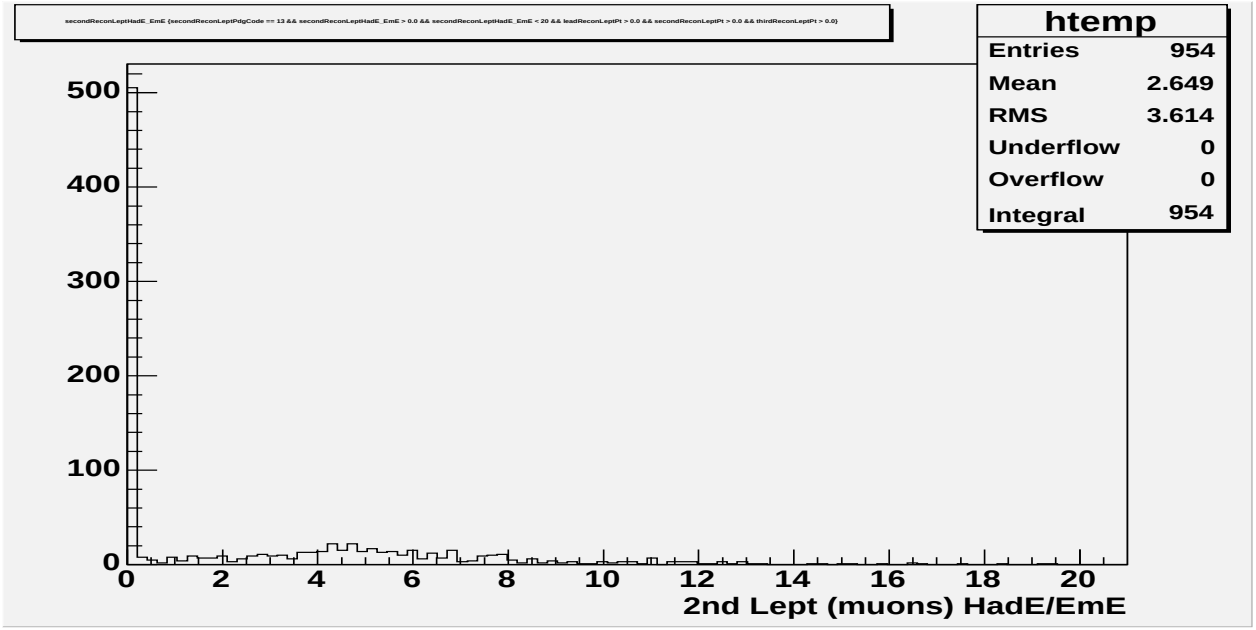
HadE/EmE of 2nd Leptons (muons only)



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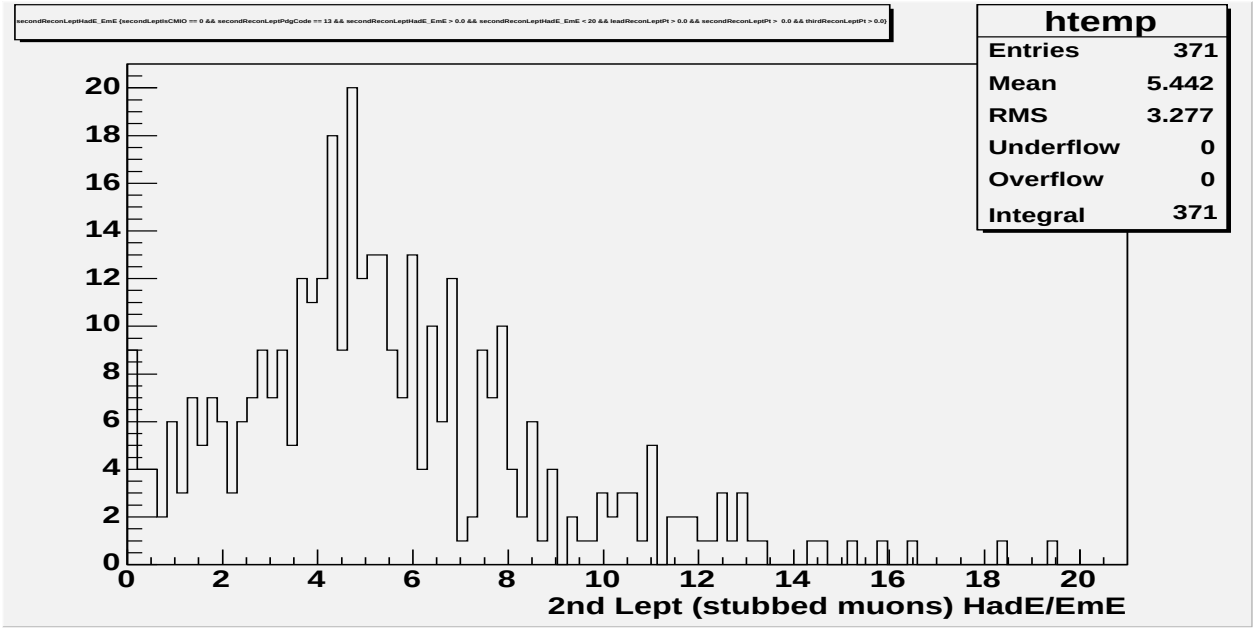
HadE/EmE of 2nd Leptons (stubbed muons only)



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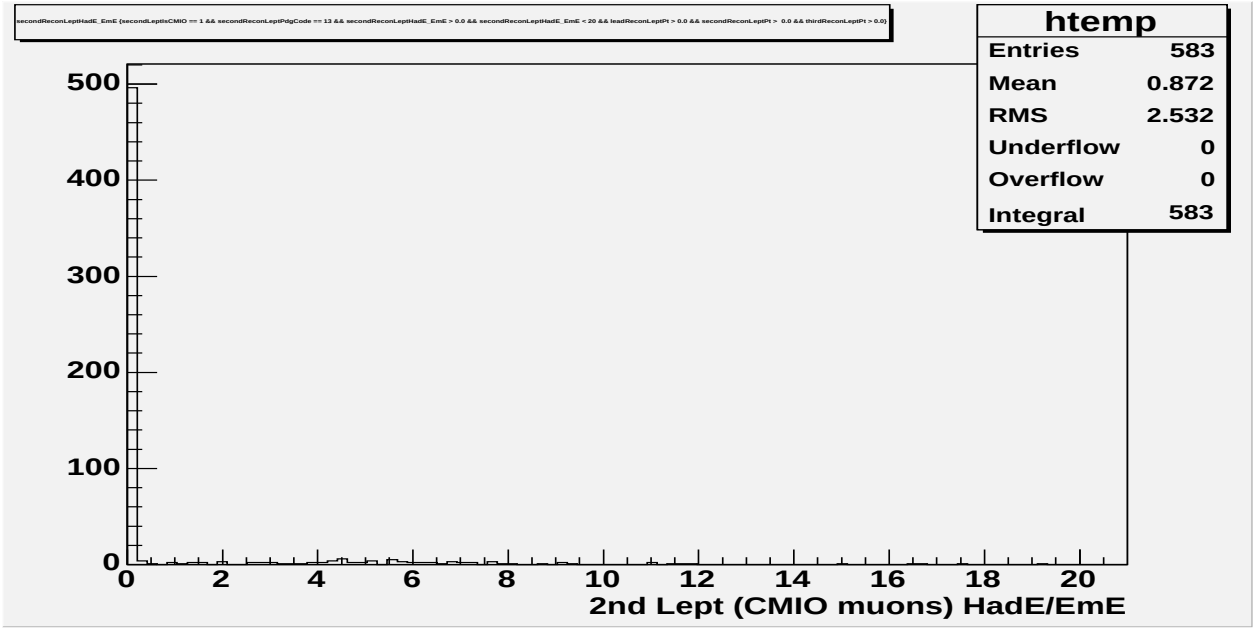

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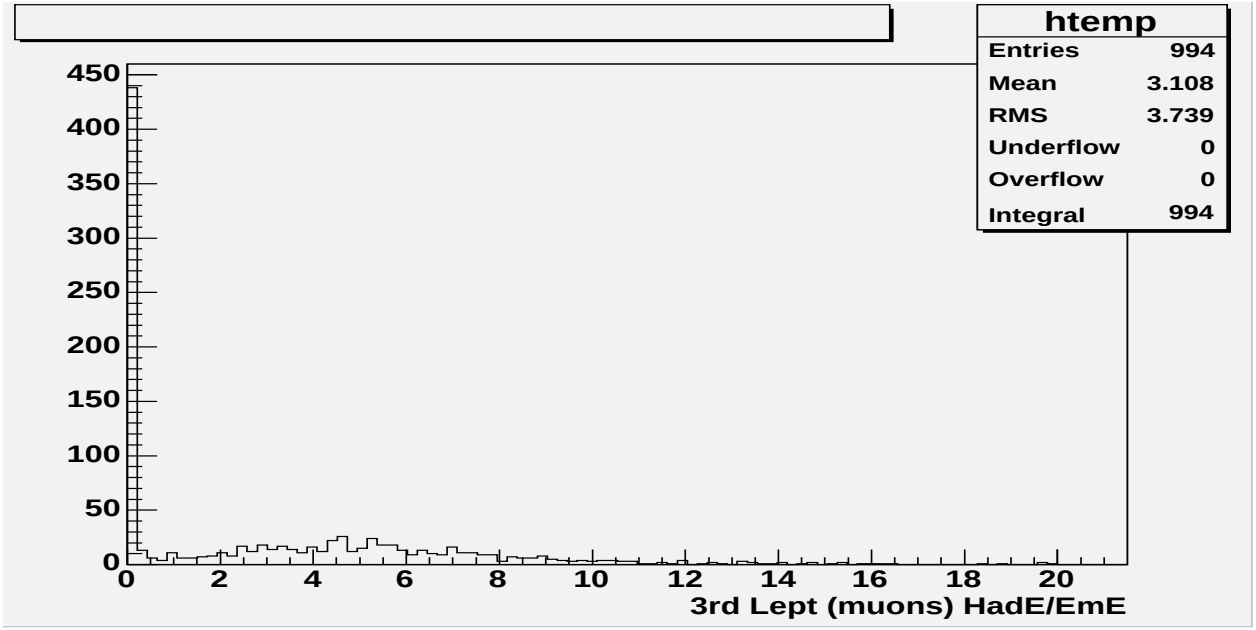

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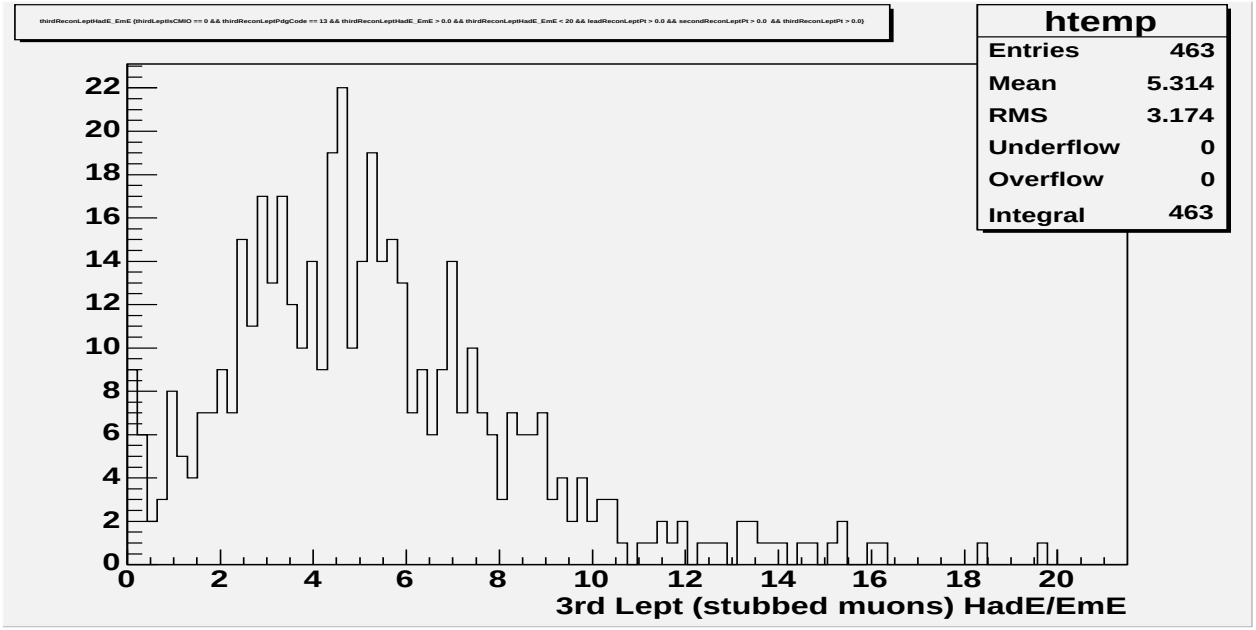

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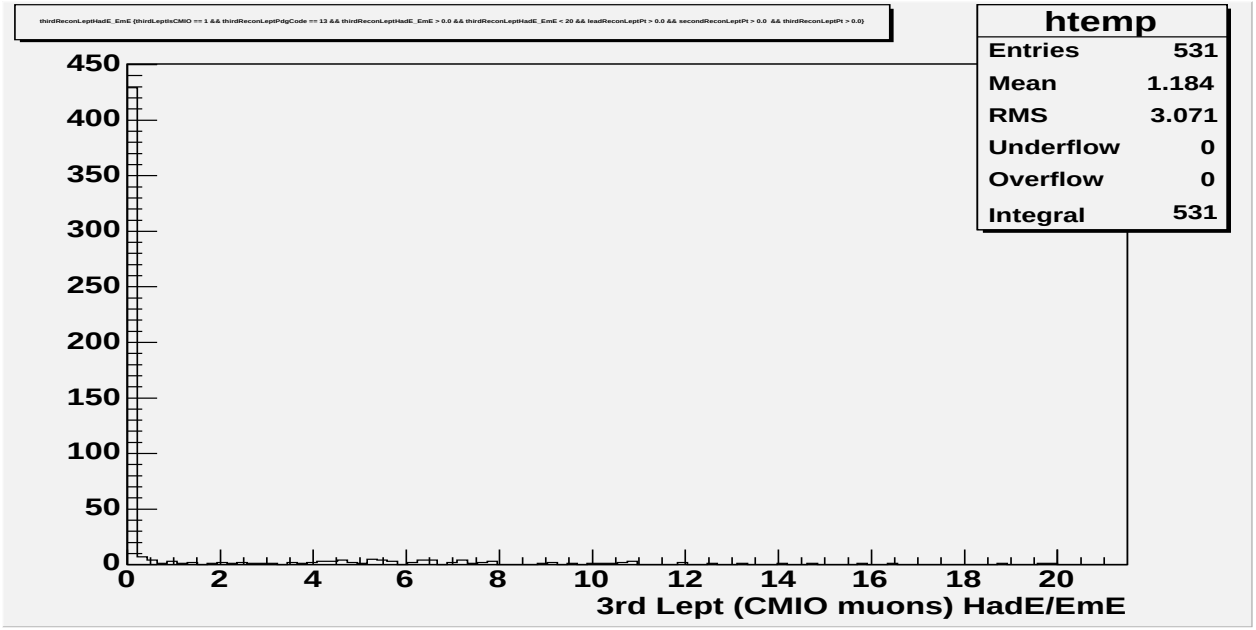

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Eta vs Phi w/ EmE $>$ 2.0

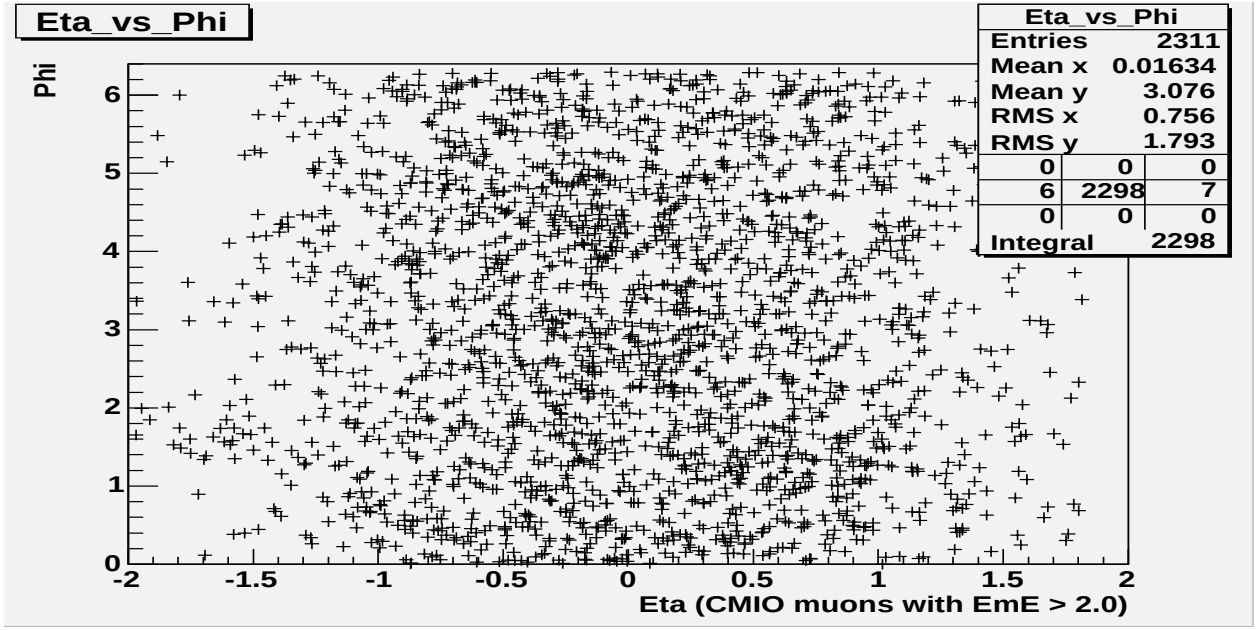

Figure: Eta vs. Phi for CMIO muons with Em. Energy $>$ 2.0

Eta vs Phi w/ EmE $<$ 2.0

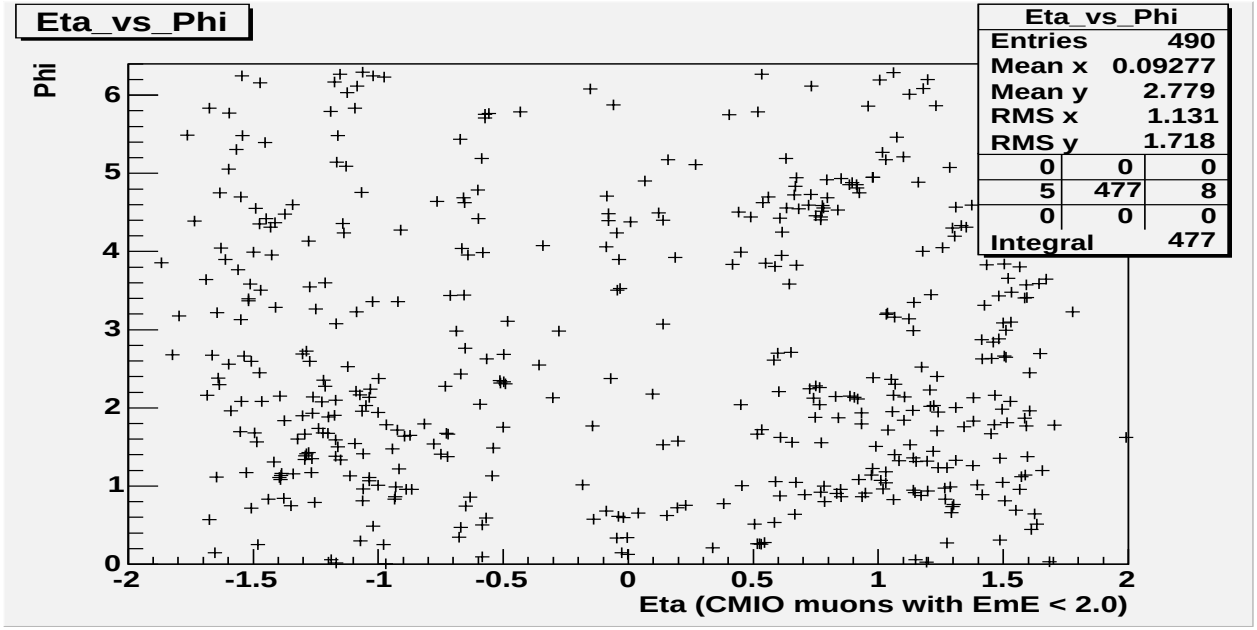

Figure: Eta vs. Phi for CMIO muons with Em. Energy $<$ 2.0