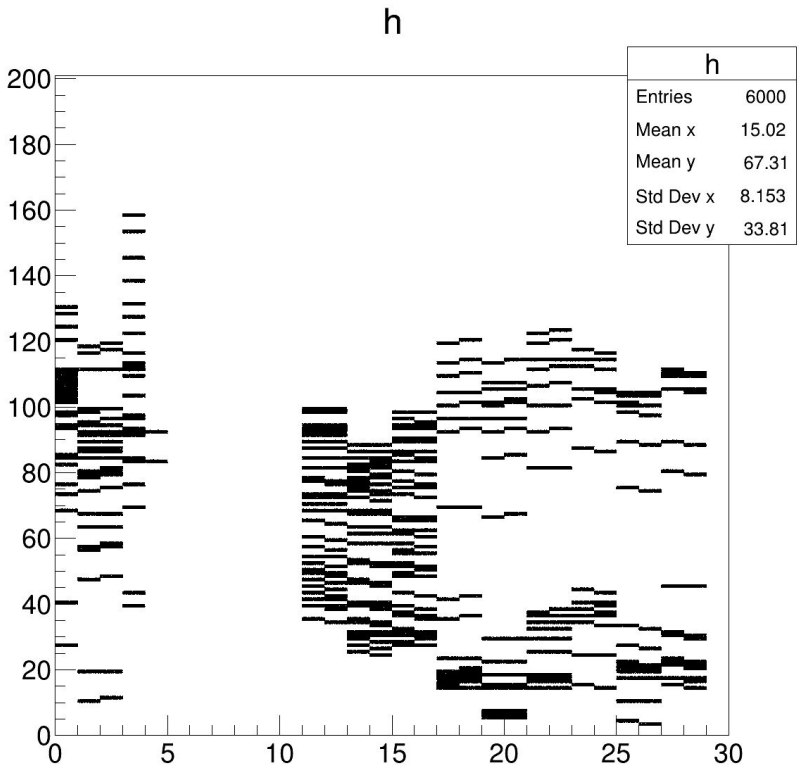
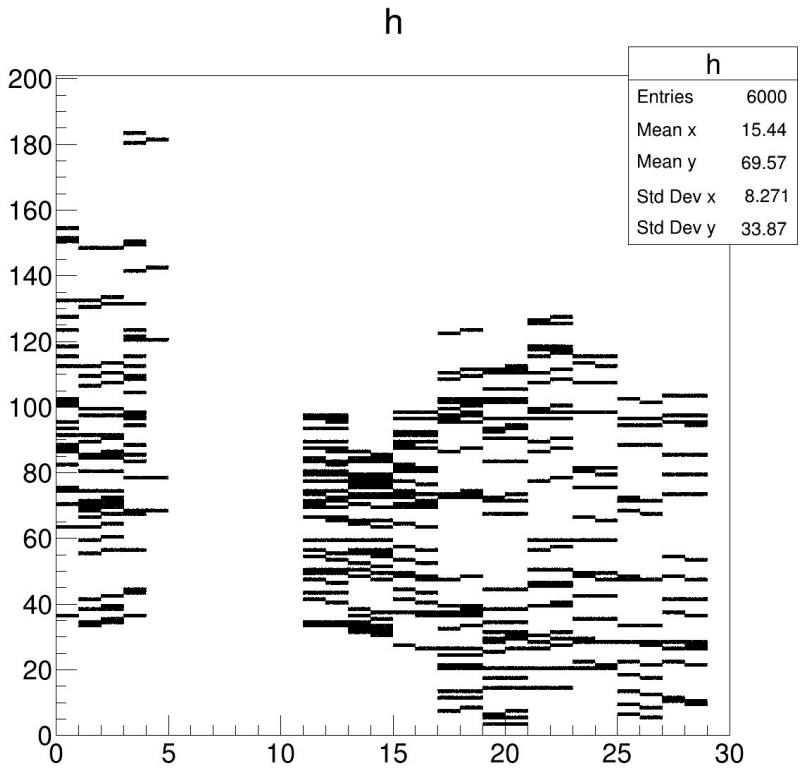
QTracker Filtering Update

1/25/22

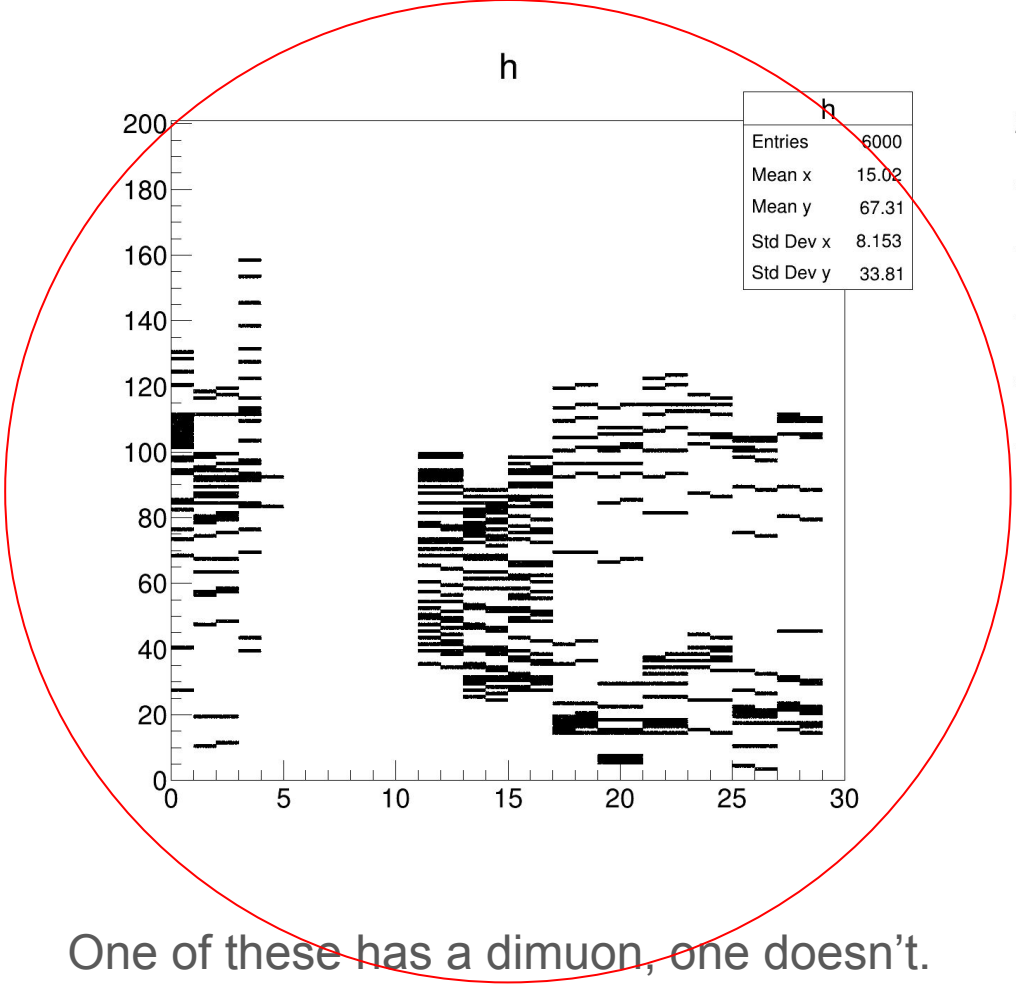
Process

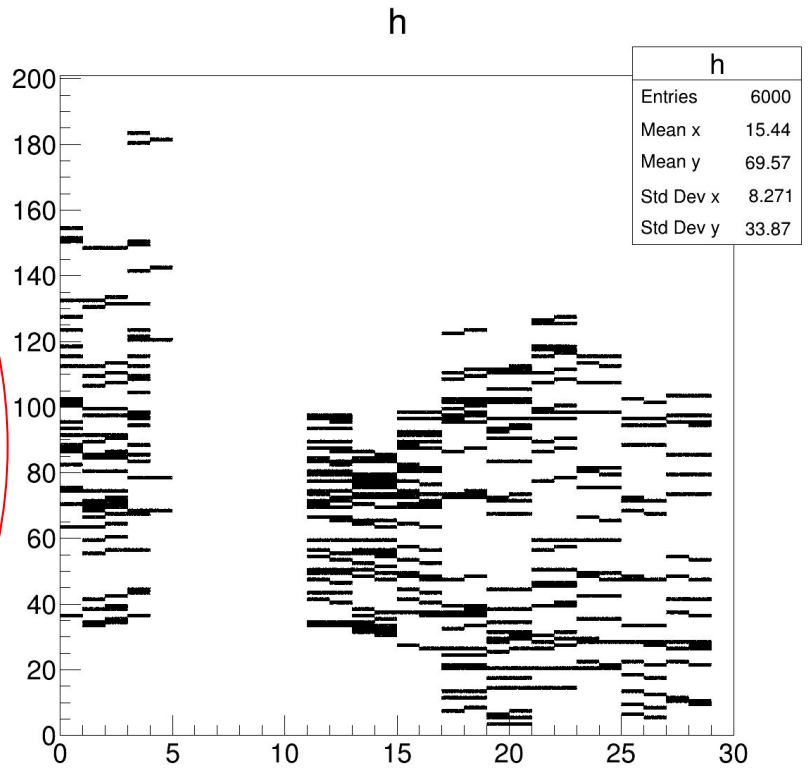
- Take Monte Carlo simulated particle tracks and combine them into more complicated events
  - Random number of full tracks (Poisson distribution with mean 2)
  - Possibly add dimuon track from target (probability 25%)
  - Add single station tracklets to event to make data noisy
  - Add random noise
- Using these events, train a neural network to differentiate between events with dimuon pair and without.
- Evaluate performance, including false positive and false negative rate, and improvement of signal to noise ratio.



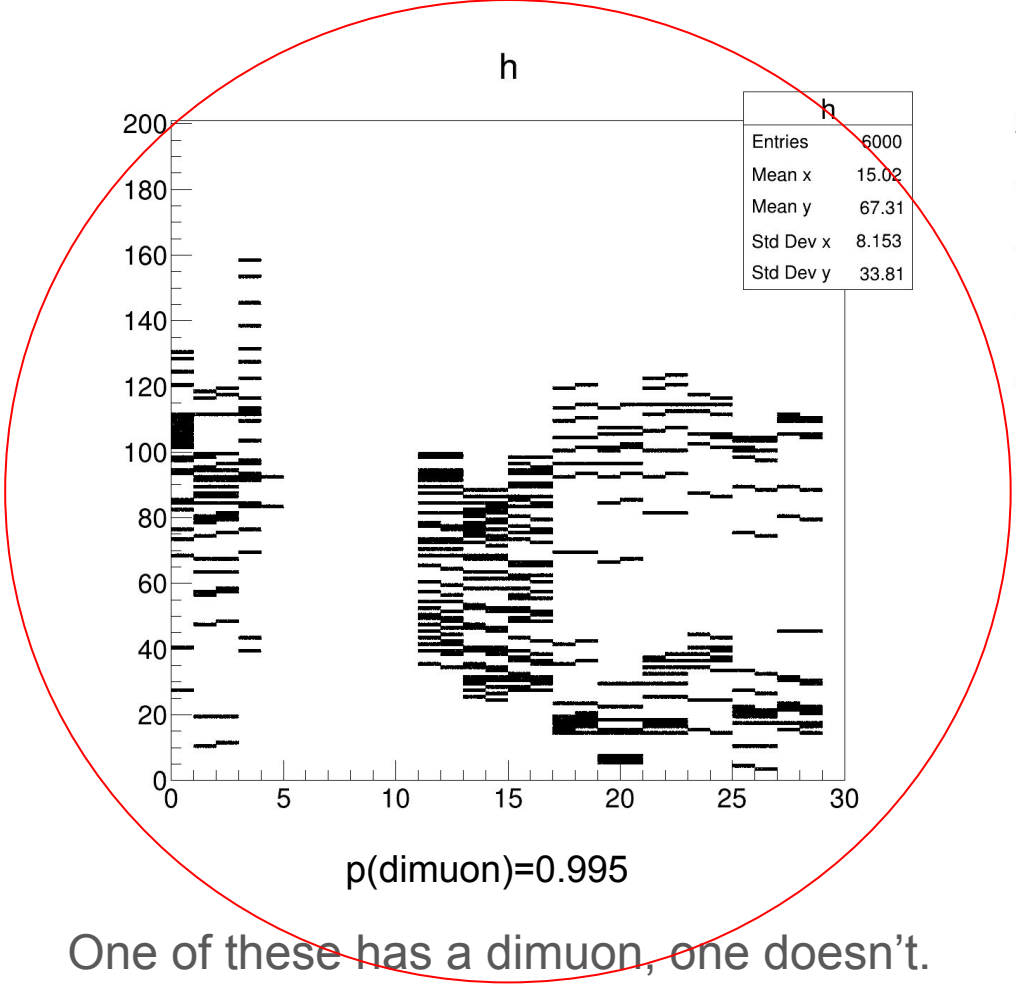


One of these has a dimuon, one doesn’t.

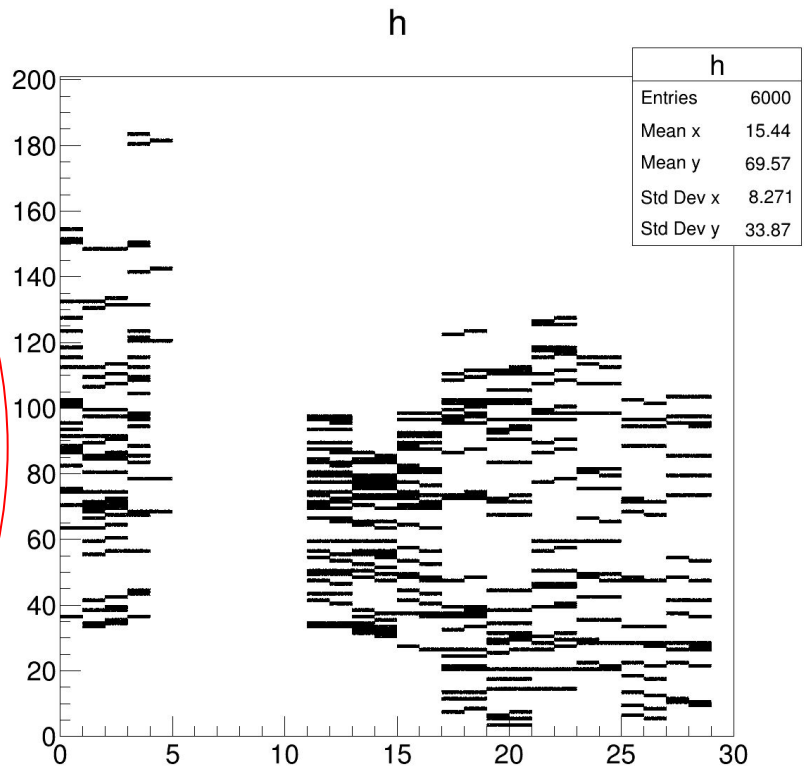




One of these has a dimuon, one doesn't.



p(dimuon)=0.995



p(dimuon)=0.002

One of these has a dimuon, one doesn't.

Performance of model:

- 98.7% overall accuracy
  - 2.3% false negatives
  - 0.8% false positives
- 20% signal/noise ratio to 96.5%
- The false positives can be tweaked slightly lower, but false negatives start to go up quickly. With 0.6% false positives, up to 13.8% false negatives.
- Depending on the actual signal/noise ratio of data, could drastically reduce processing time for K-tracker and rest of Q-Tracker
- As of right now, 97% signal to noise ratio is about as high as it gets.