

Group D

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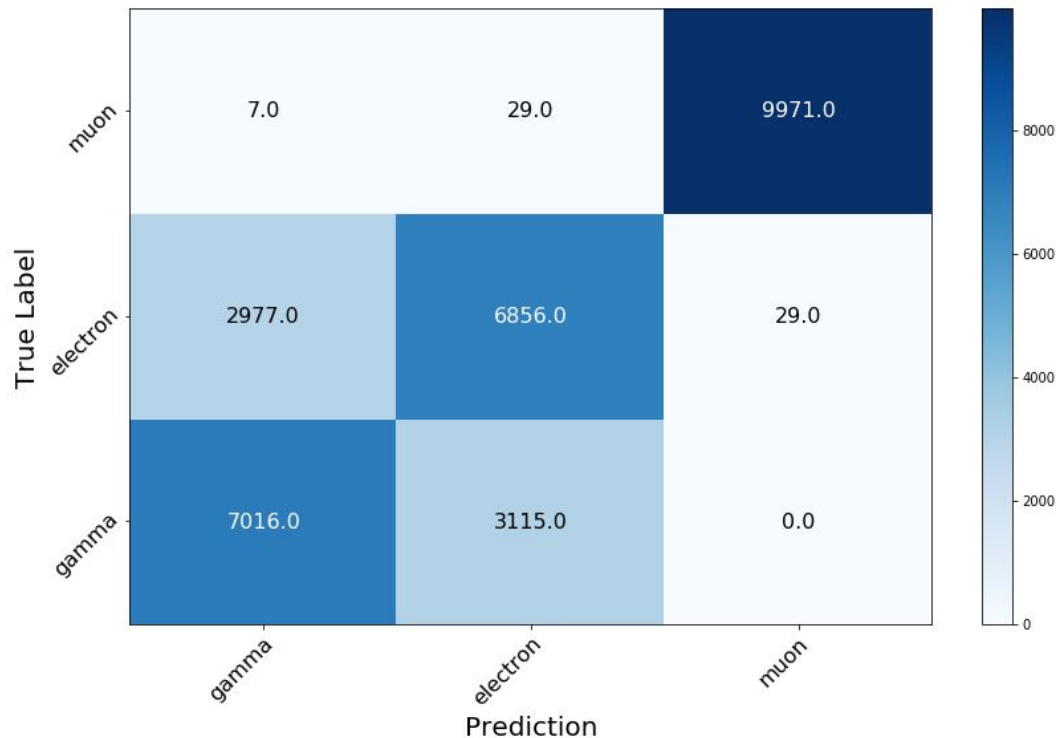
Barry Pointon

Outline

- Basic particle classification
- Study of failed events

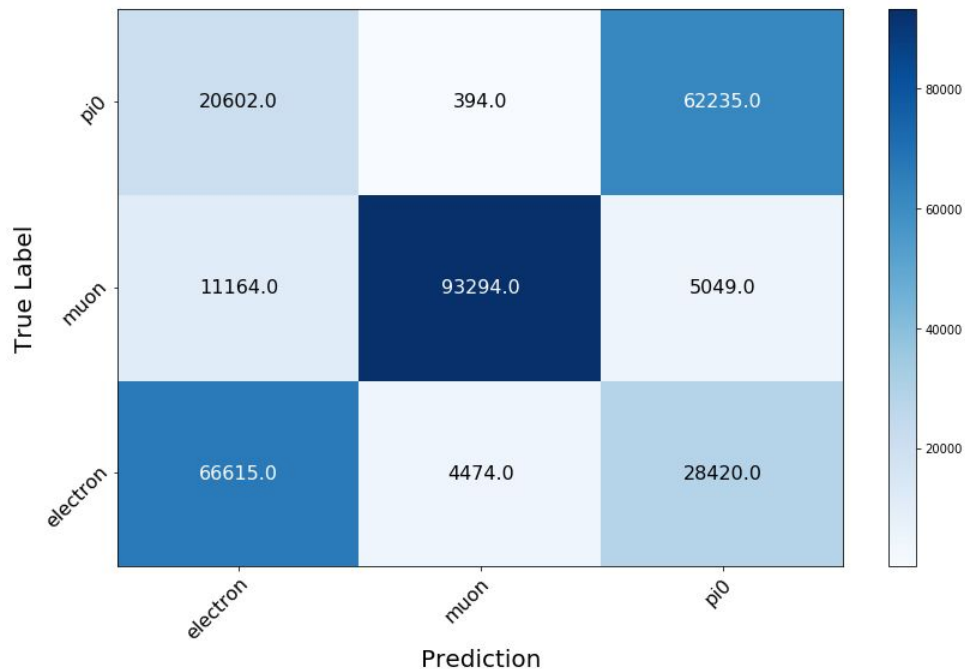
Particle classification

- E61 detector with 3" PMTs
- CNN structure:
 - Conv2d(2,10,7)
 - MaxPool2d(2,2),
 - Conv2d(10,20,3)
 - Conv2d(20,20,5)
 - MaxPool2d(2,2),
 - Conv2d(20,40,5)
 - Conv2d(40,40,5)
 - MaxPool2d(2,2),
 - Conv2d(40,80,3)
 - MaxPool2d(2,2) + MLP
- Kernel size seems to be the most important parameter for e/gamma separation
 - Correlations on a larger scales (7x7) improve accuracy from 50% to 70%



Particle classification (mPMT)

- 3” PMTs inside a PMT module are used as a “color” (time is not used)
- CNN structure:
 - Conv2d(19,38,3)
 - Conv2d(38,38,3)
 - MaxPool2d(2,2),
 - Conv2d(38,72,3)
 - Conv2d(72,72,3)
 - MaxPool2d(2,2) + MLP
- Muon ID accuracy is worse compared to regular 3” PMTs



Particle classification (mPMT)

- Different approach is needed to pick up correlations inside a mPMT module:
 - MLP for individual modules or
 - couple of custom CNN kernels which jump between modules

More Testing: investigate failures of e/mu classification

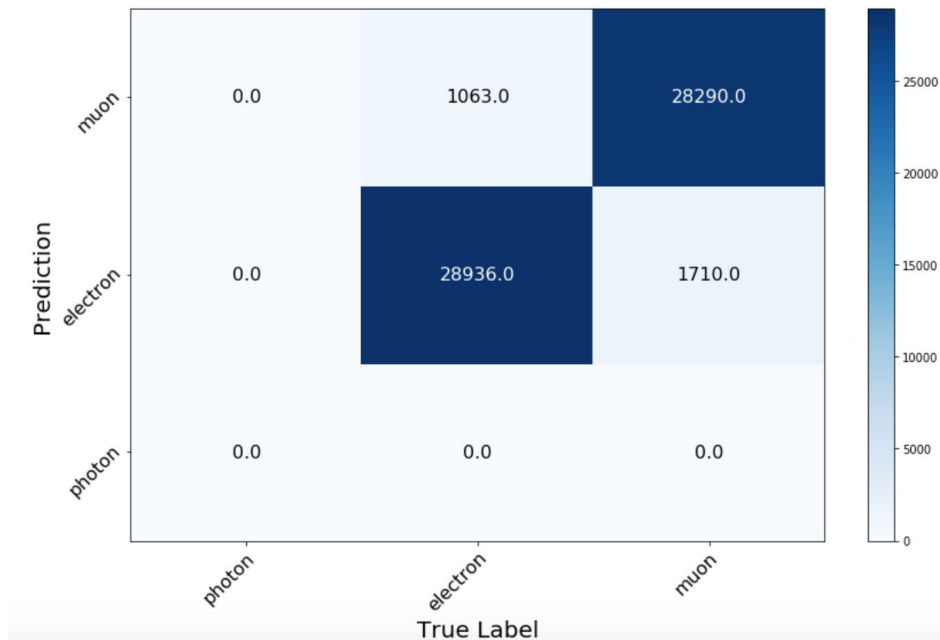
Use original CNN

Use IWCDgrids/varAll dataset

Find ~3-5% misID rate between e/mu

What types of events fail?

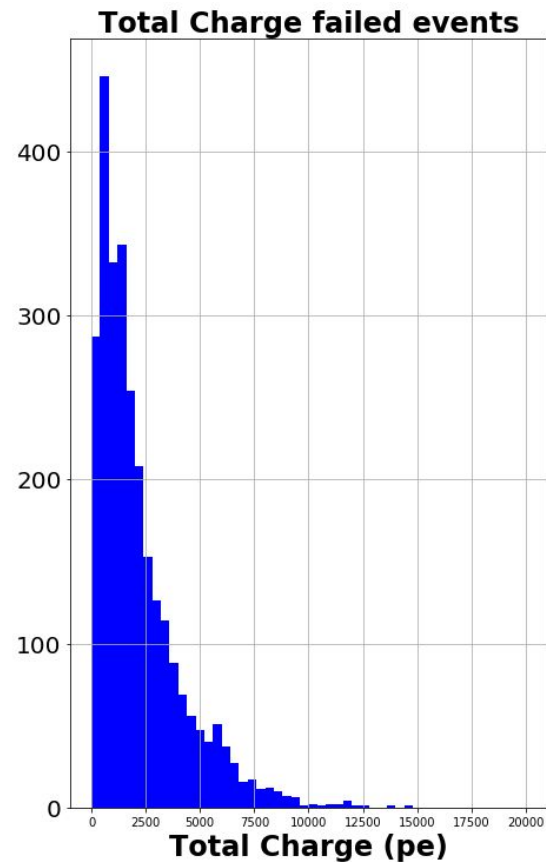
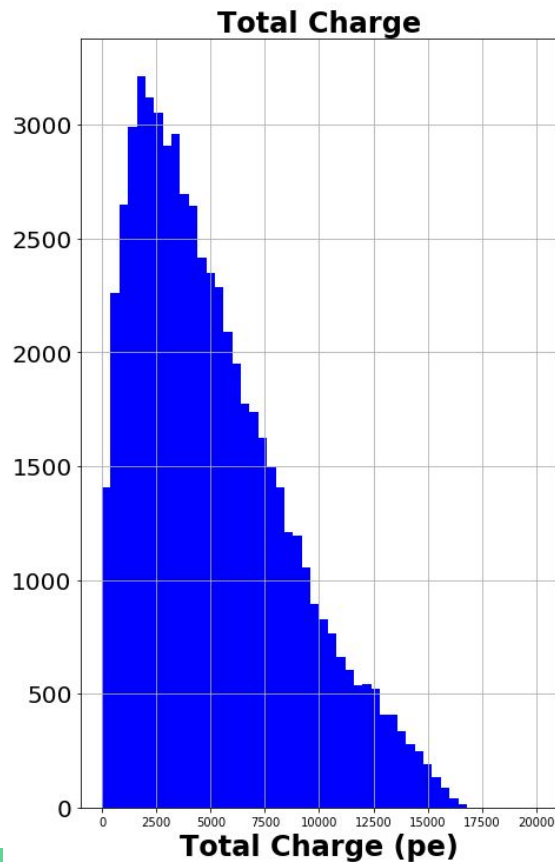
Hypothesis: events where most of C-ring hits endcaps or very close to wall.



Failed events vs total charge

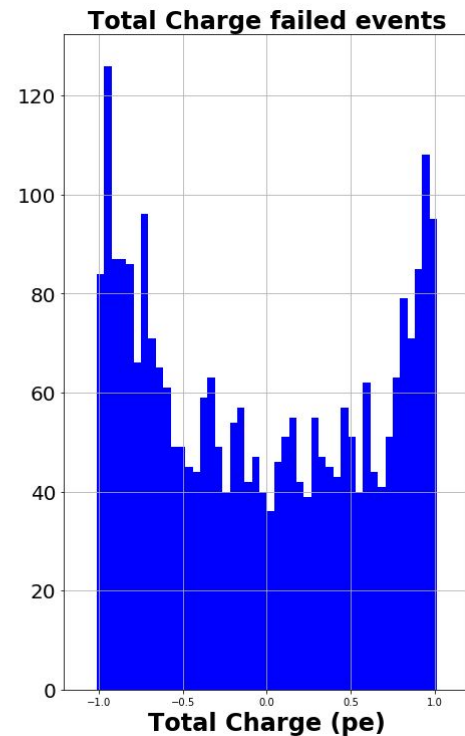
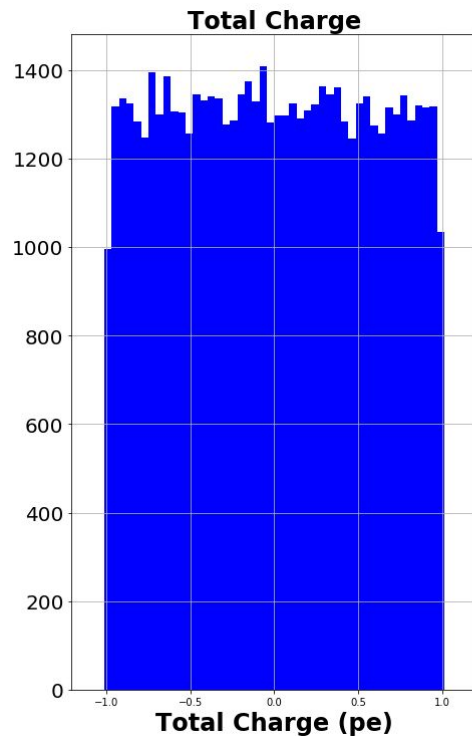
Failed events have smaller charge than full distribution

More charge than I expected though; reflected light from endcaps?



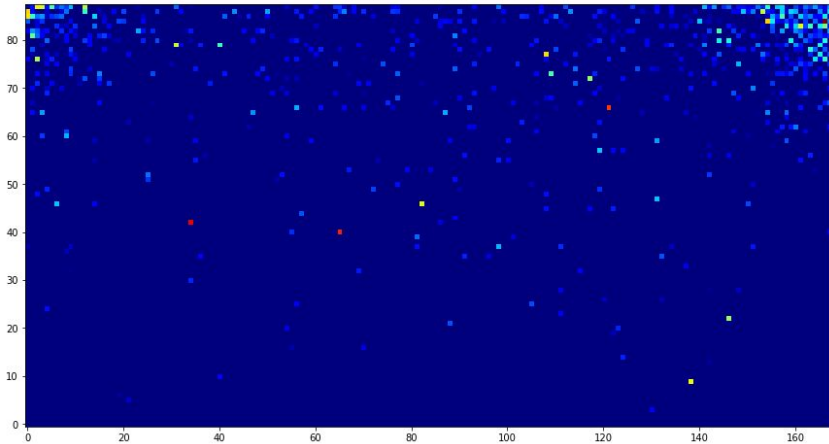
Failed events vs Y direction

Failed classification is more likely to be in direction of end-caps.

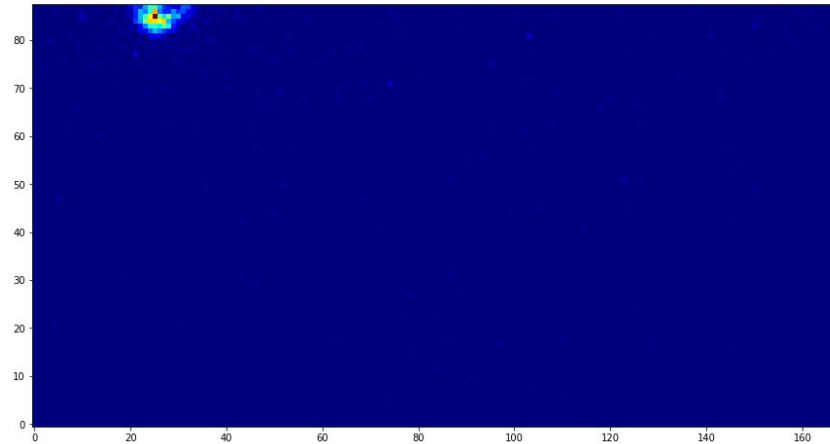


Event Displays; failed electrons

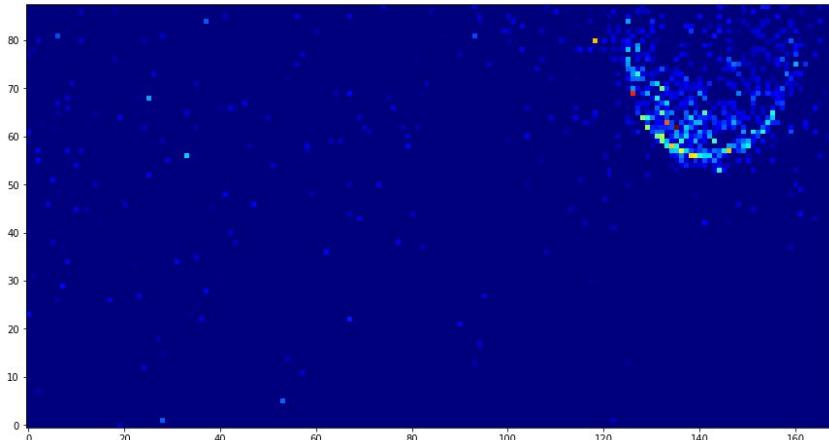
Failed Electrons



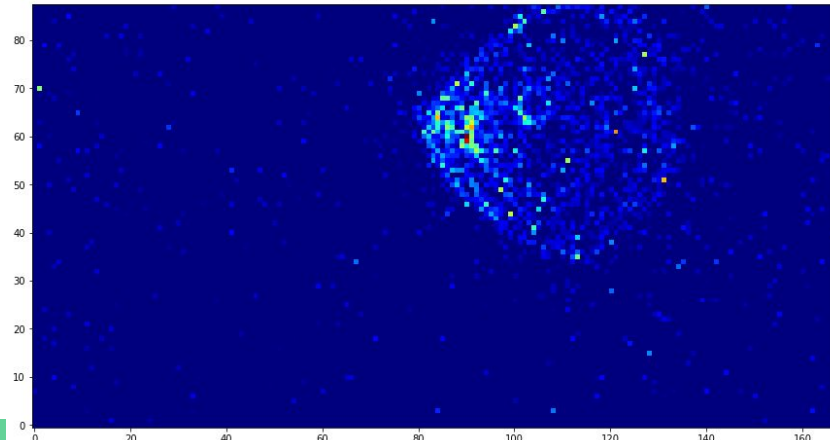
Failed Electrons



Failed Electrons

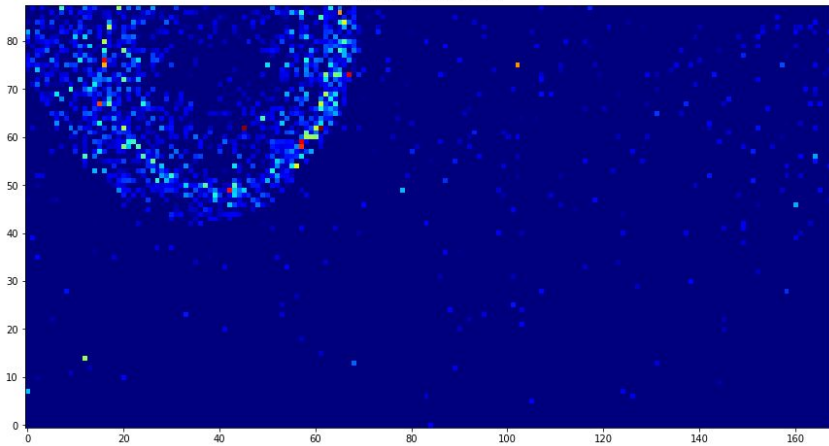


Failed Electrons

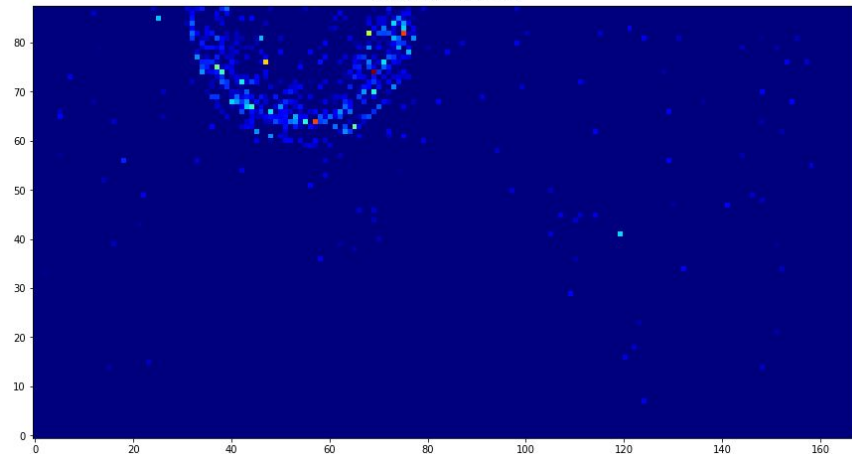


Event Displays; failed muons

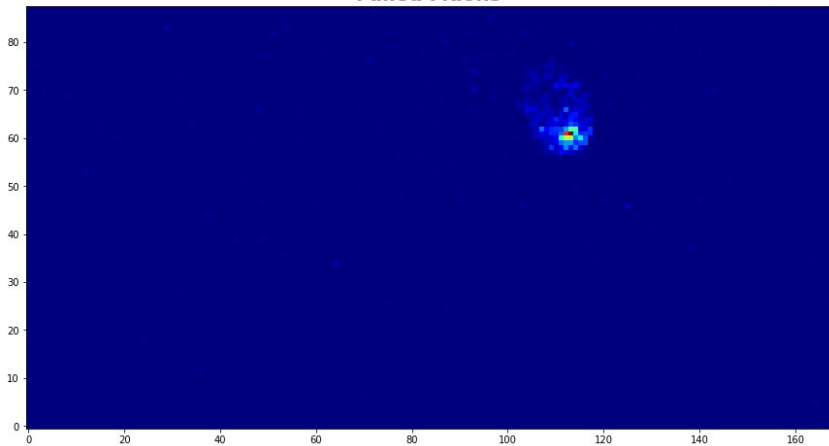
Failed Muons



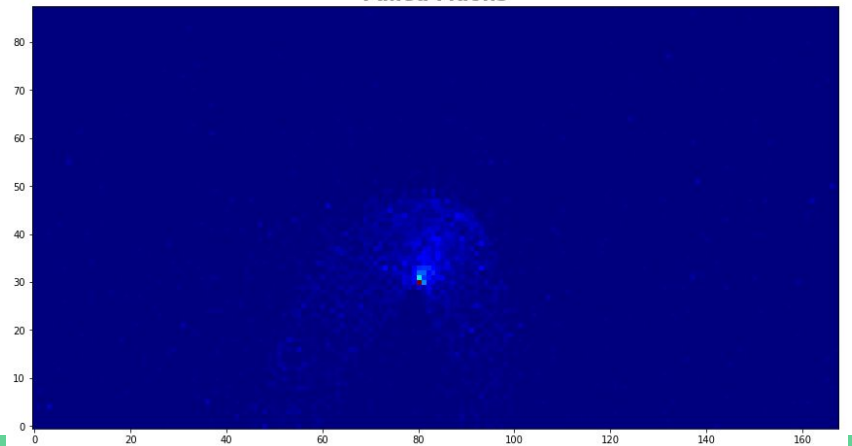
Failed Muons



Failed Muons



Failed Muons



mPMT: PMT index translated image bin

CNN could be trained using higher resolution

