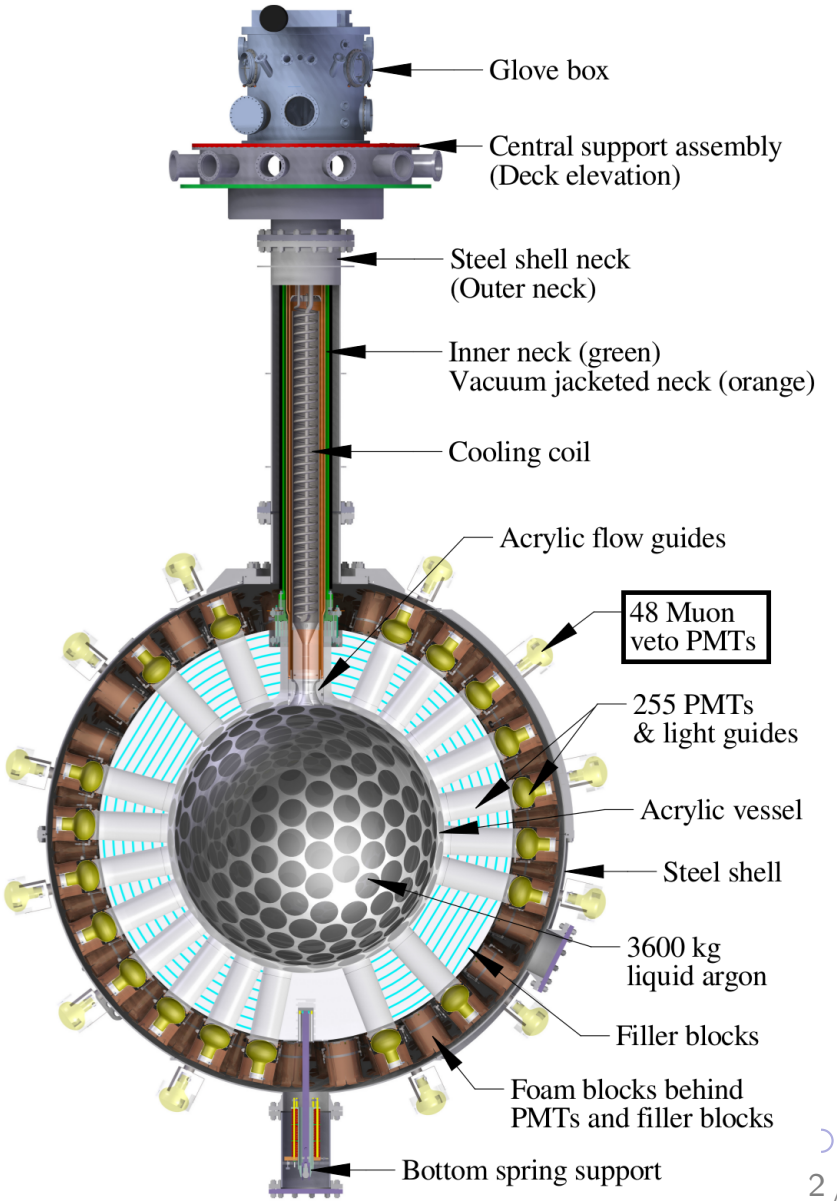
Characterizing the muon veto response for the DEAP-3600 dark matter search

Ameen Ismail

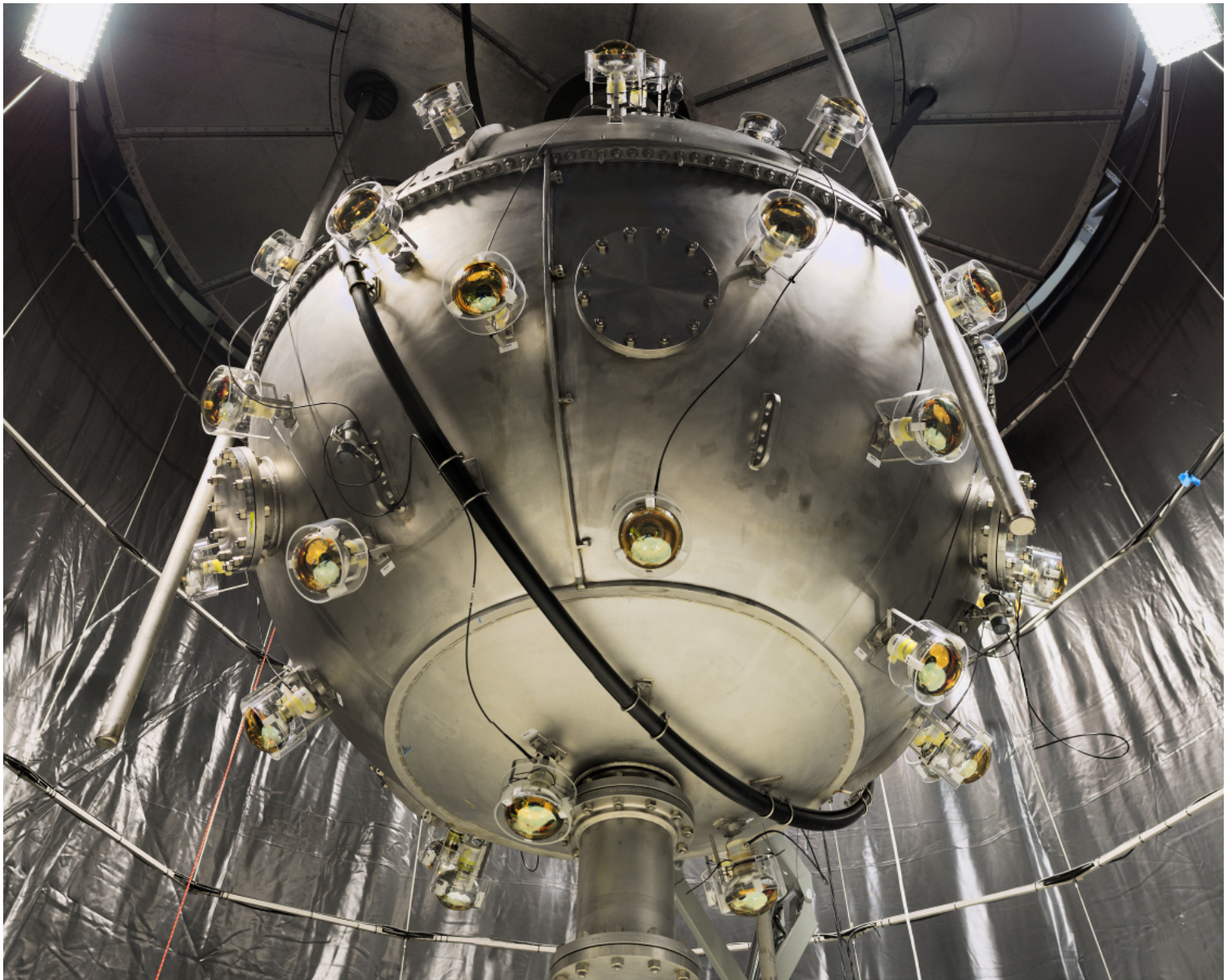
16 August 2017

Introduction: DEAP and the muon veto system

- **D**ark matter **E**xperiment with **A**rgon **P**ulse-shape discrimination
- Detector surrounded by water tank
- Muons passing through produce Cerenkov light
- Viewed by 48 muon veto PMTs



A look at the detector



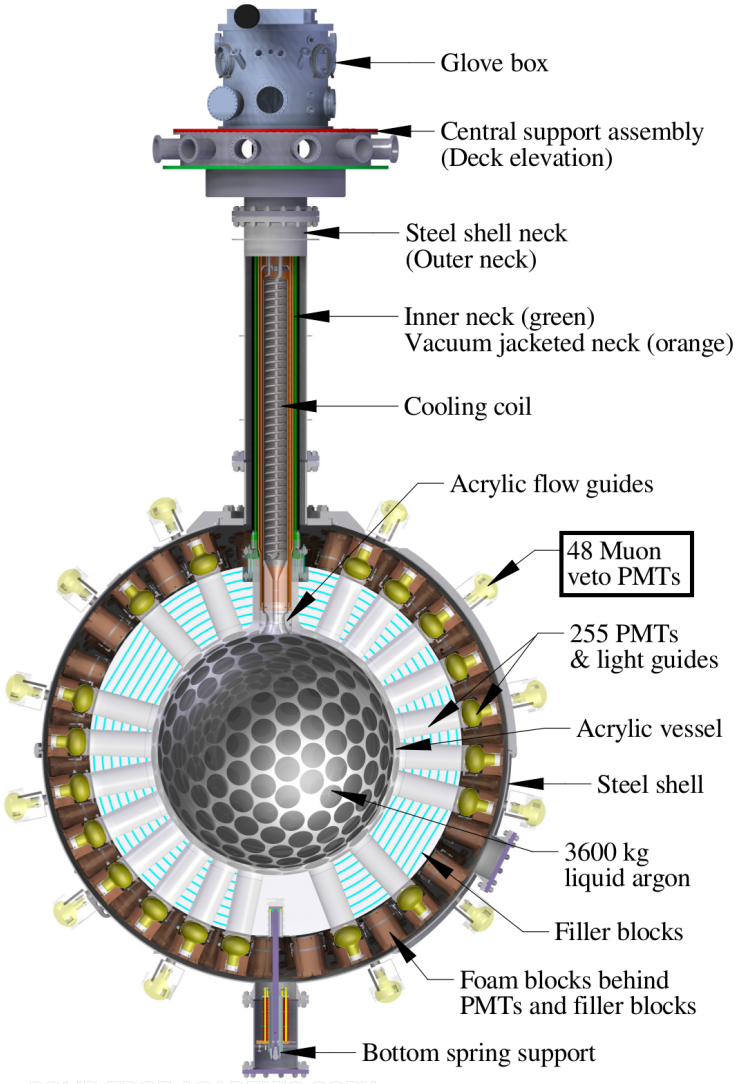
Relevant analysis variables

muonVetoN/nhit

- Number of muon veto PMTs triggered in an event
- Trigger condition: waveform must fall some threshold amount below baseline

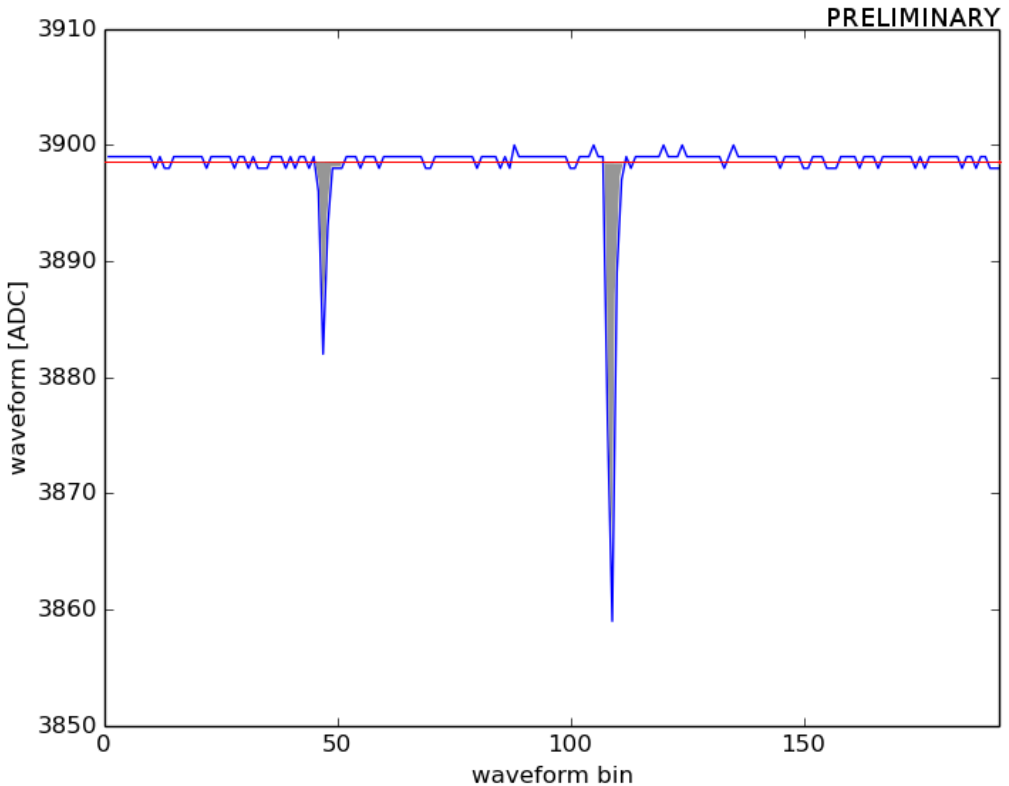
qPE

- Estimates number of photoelectrons (PE)
- Defined as $\sum_{\text{PMTs}} \frac{\text{charge deposited}}{\text{mean single PE (SPE) charge}}$
- Requires SPE calibration



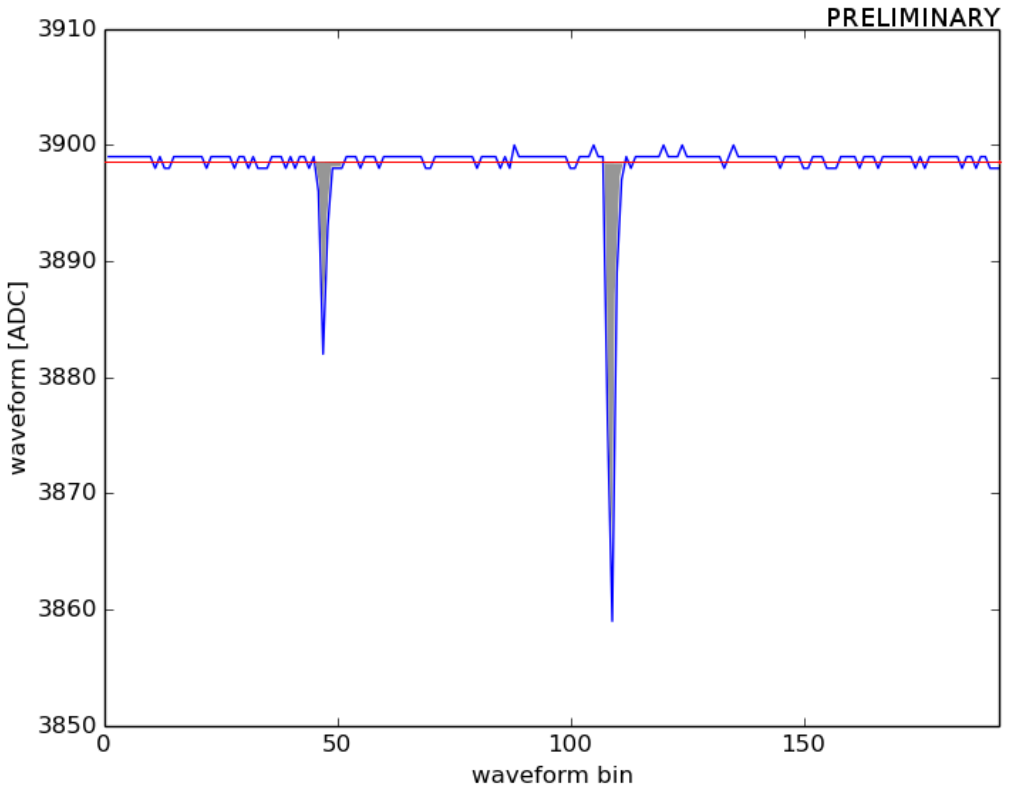
Raw waveforms

- Digitized into 192 samples
- Baseline value $\sim$ 3900 ADC
- Charge is baseline-subtracted integral
- Multiple peaks are possible

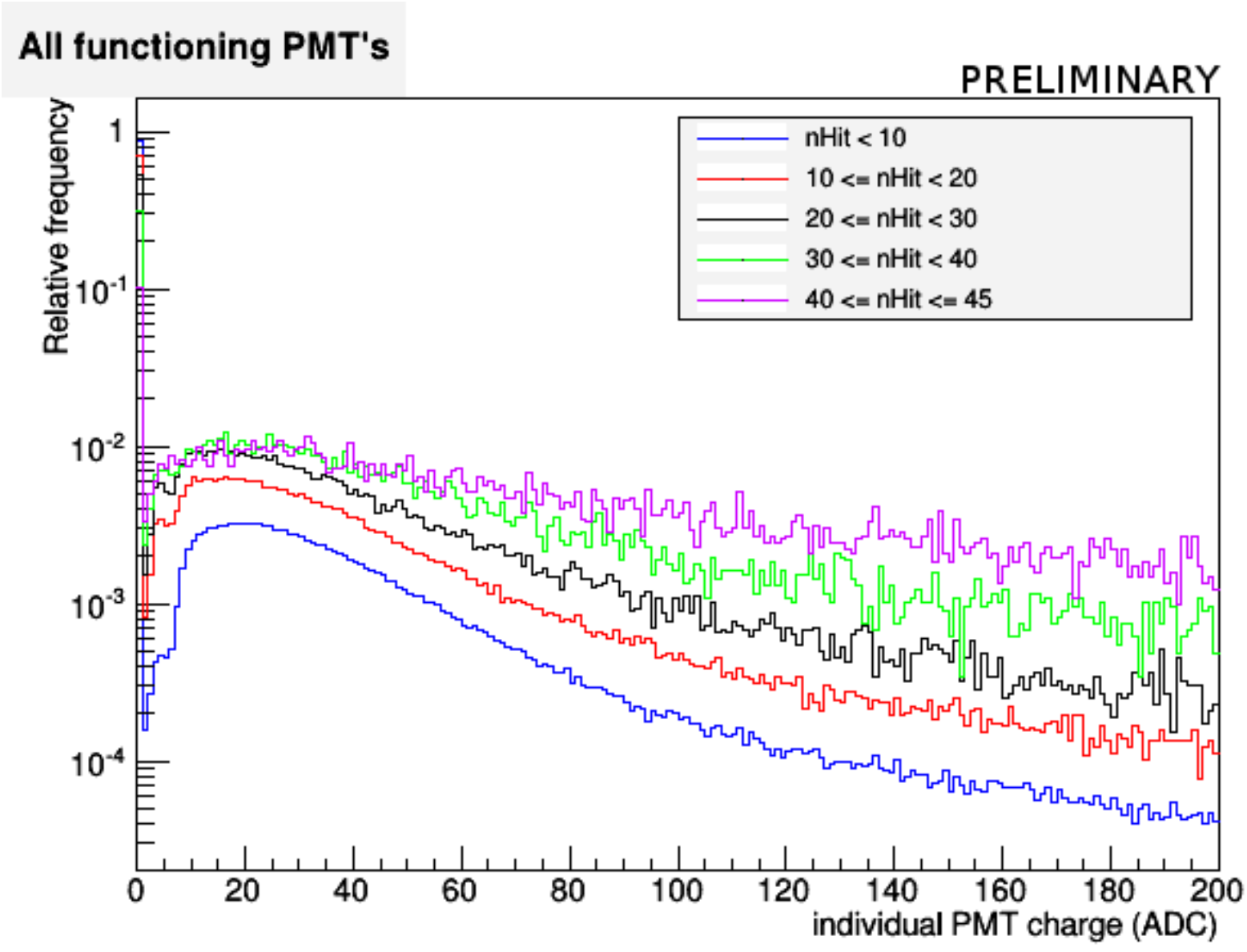


Methods

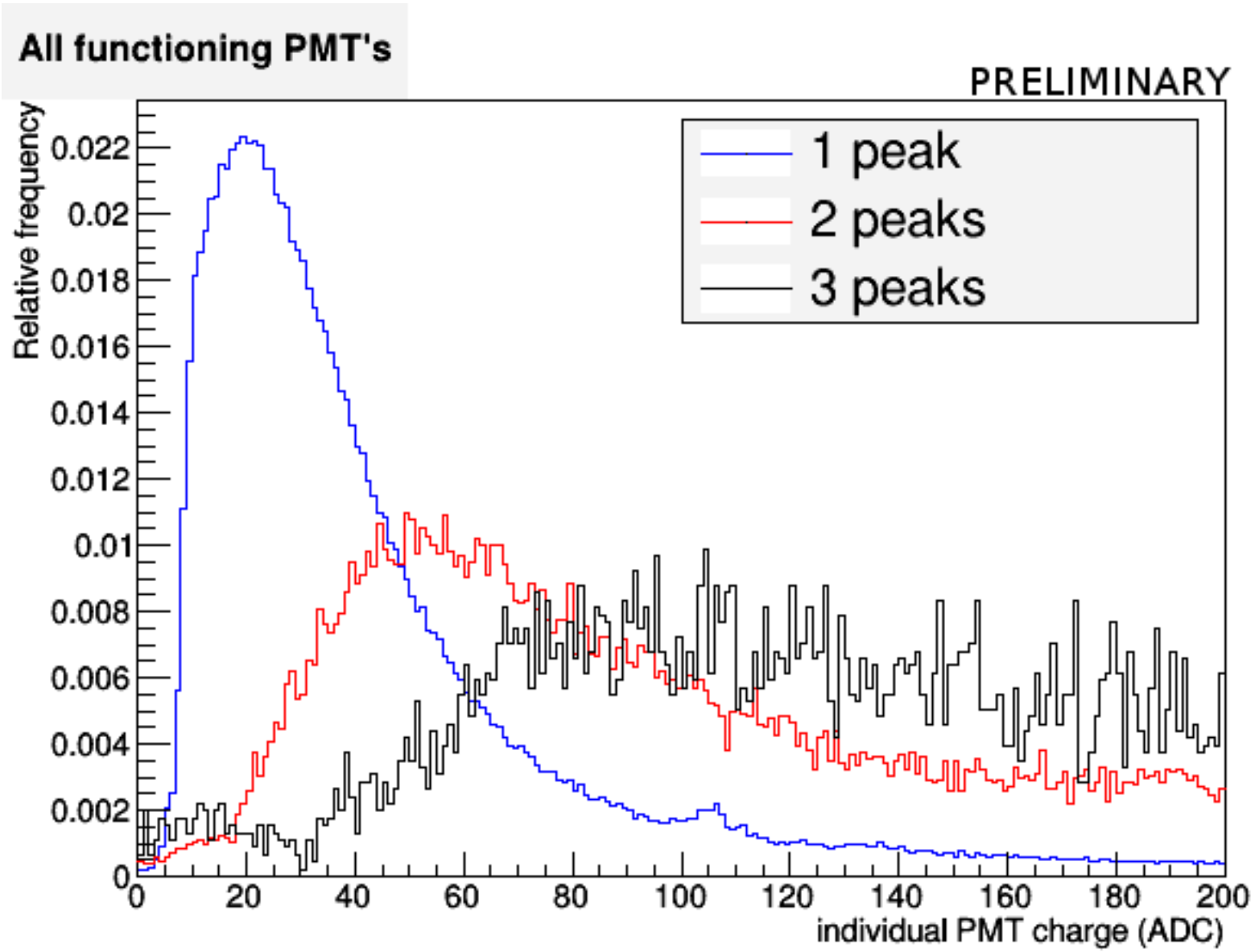
- Looked at events with muonVetoN ≥ 2
- Dependence of charge disitributions on muonVetoN and on nPeaks
- Made SPE charge distributions and fitted them



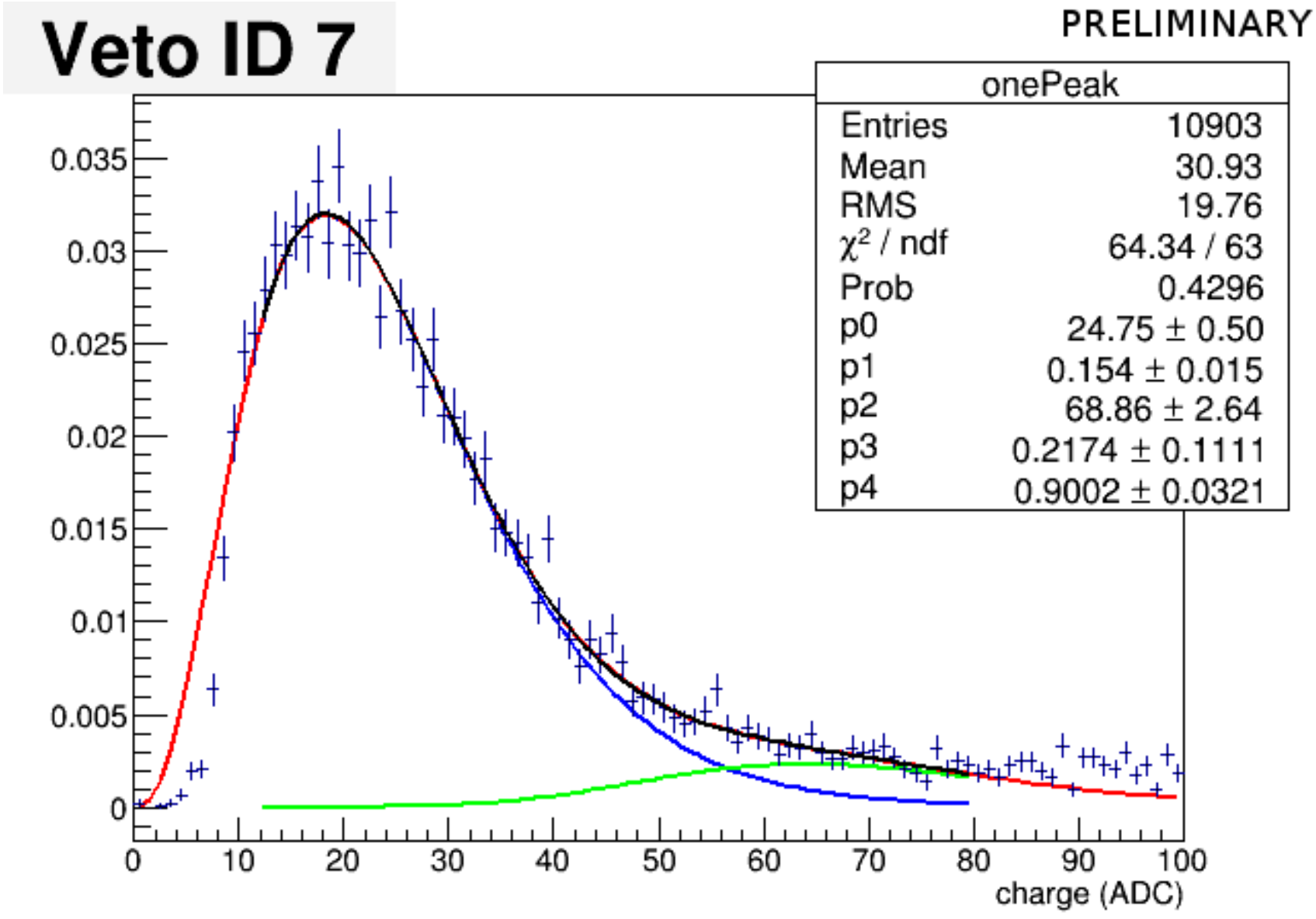
Charge distributions: muonVetoN



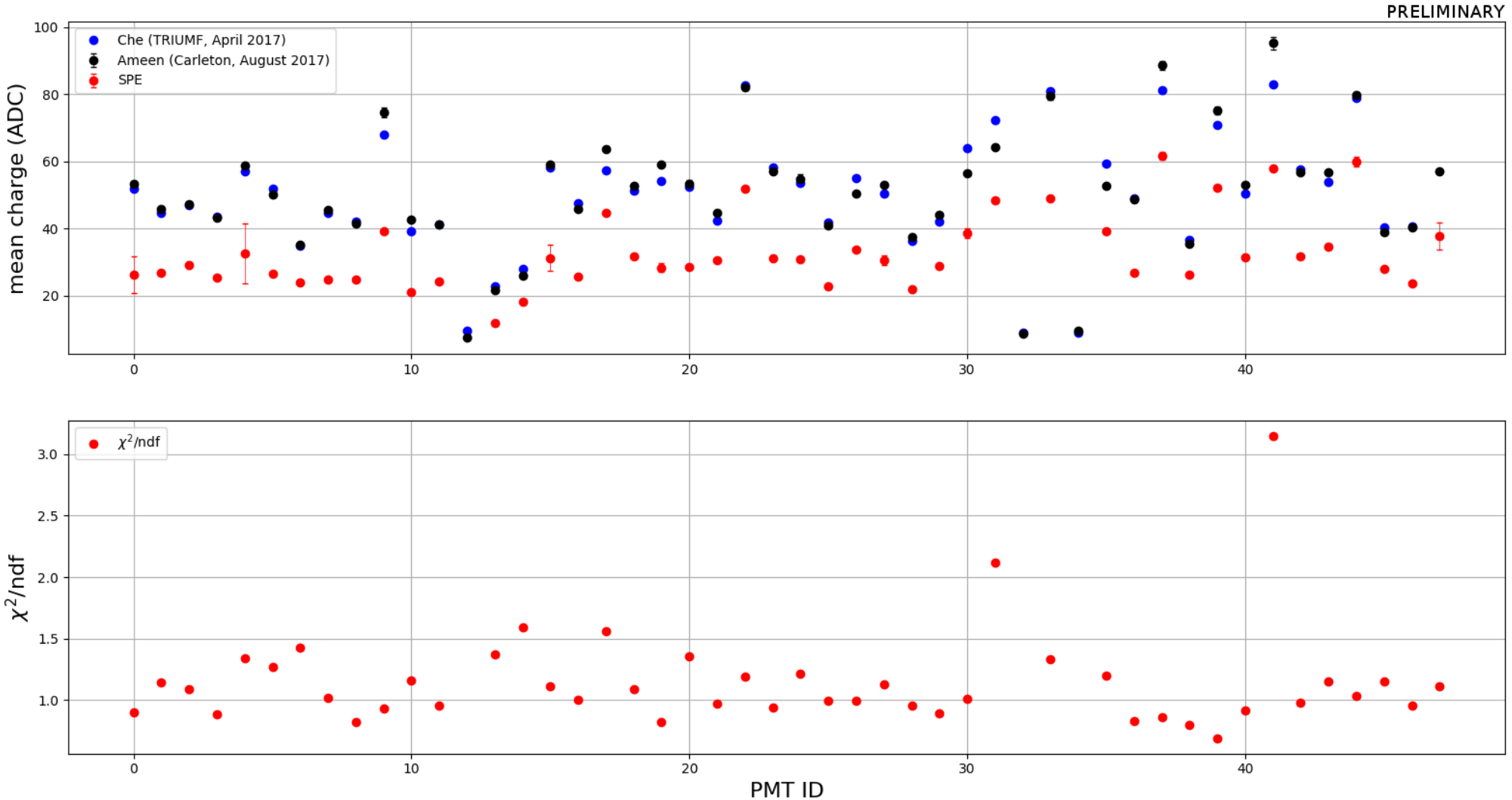
Charge distributions: peaks



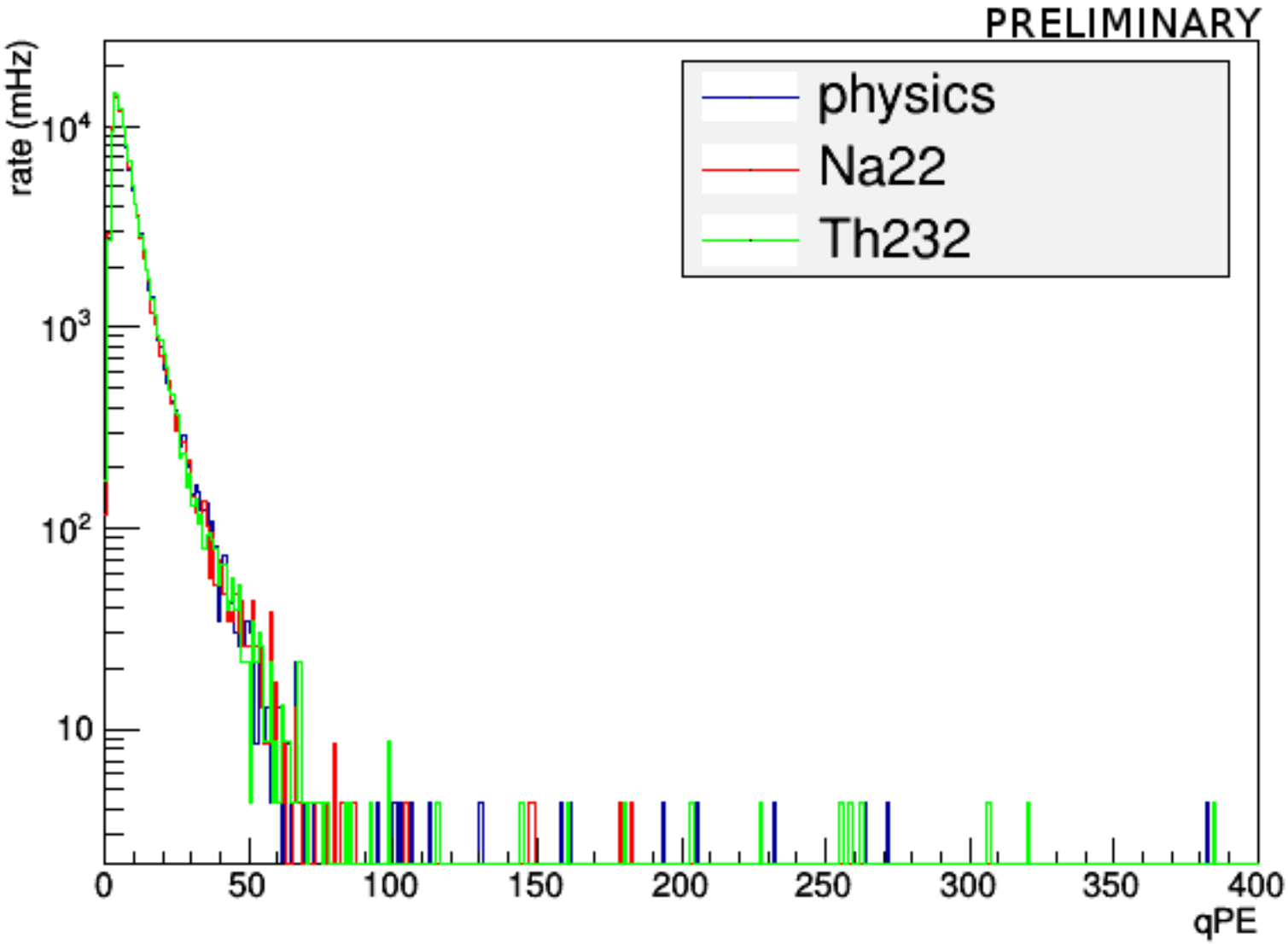
SPE charge sample distributions



SPE and mean charges



qPE distributions



Summary and next steps

- Examined effect of muonVetoN and number of peaks on charge distributions
- Obtained mean SPE charges for all functioning muon veto PMTs
- More qPE distributions are forthcoming