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

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## Introduction: DEAP and the muon veto system

- Dark matter Experiment with Argon Pulse-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  $\sum_{PMTs} \frac{charge deposited}{mean single PE (SPE) charge}$
- Requires SPE calibration



### Raw waveforms

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



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#### Methods

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



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## Charge distributions: muonVetoN

#### All functioning PMT's PRELIMINARY Relative frequency nHit < 10 10 <= nHit < 20 20 <= nHit < 30 30 <= nHit < 40 40 <= nHit <= 45 10-2 10<sup>-3</sup> 10-4 20 80 120 0 40 60 100 140 160 180 200 individual PMT charge (ADC)

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#### Charge distributions: peaks

#### All functioning PMT's PRELIMINARY 0.02 0.02 0.018 0.018 1 peak 2 peaks 3 peaks 0.014 0.012 0.01 0.008 0.006 0.004 0.002 20 40 60 80 200 100 120 140 160 180 individual PMT charge (ADC)

## SPE charge sample distributions



### SPE and mean charges



# qPE distributions



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- 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