

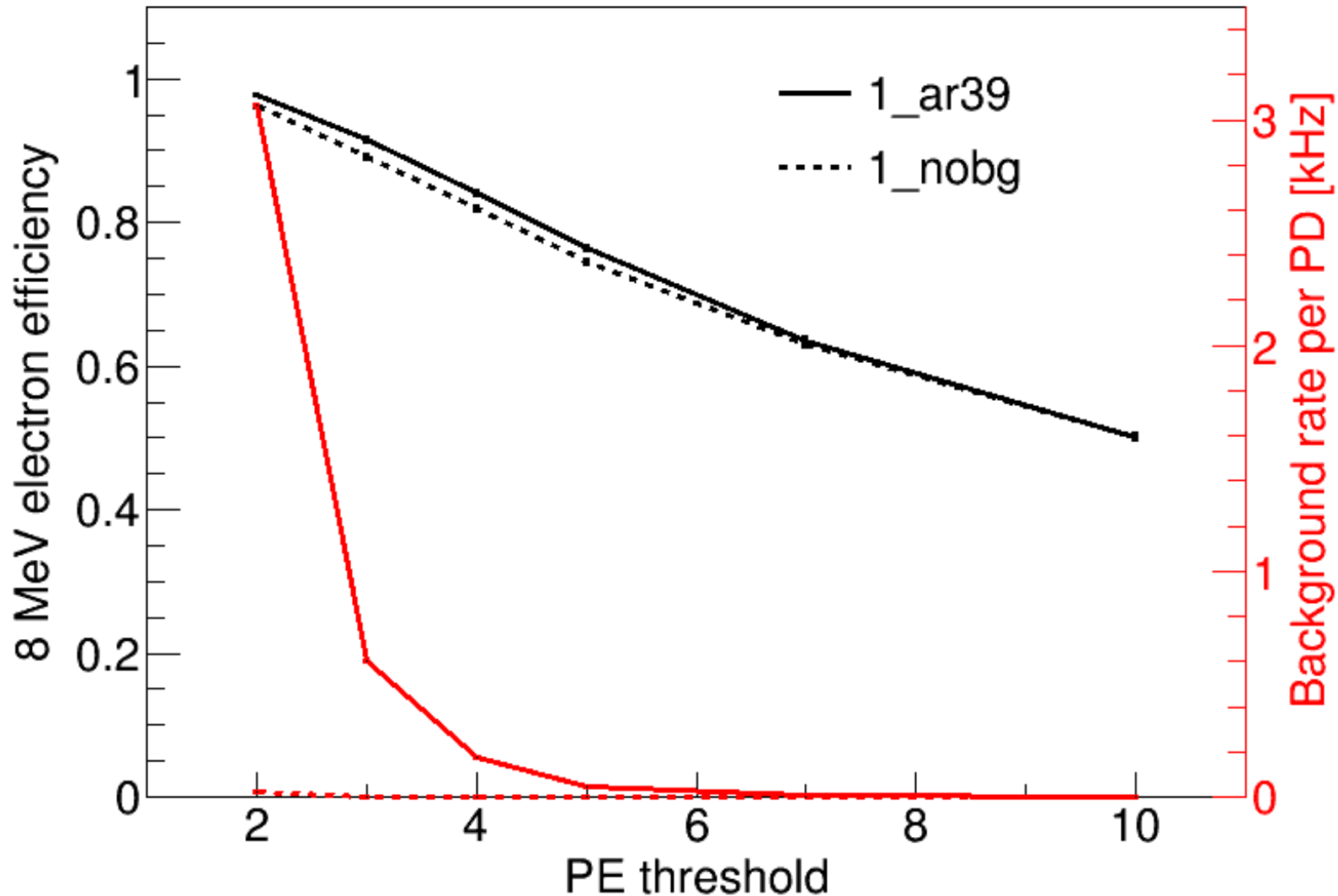
SN Update

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Photon Detector Simulation Meeting
August 17, 2016

SN PD Simulation Update

- Simulated single-electron samples using 1x2x6 (12 APA) DUNE far-detector geometry
- OpHits are now calibrated (thanks to Kevin Wood)
- Removed a wrong factor in the Ar39 calculation (now it is consistent with Kevin's results)

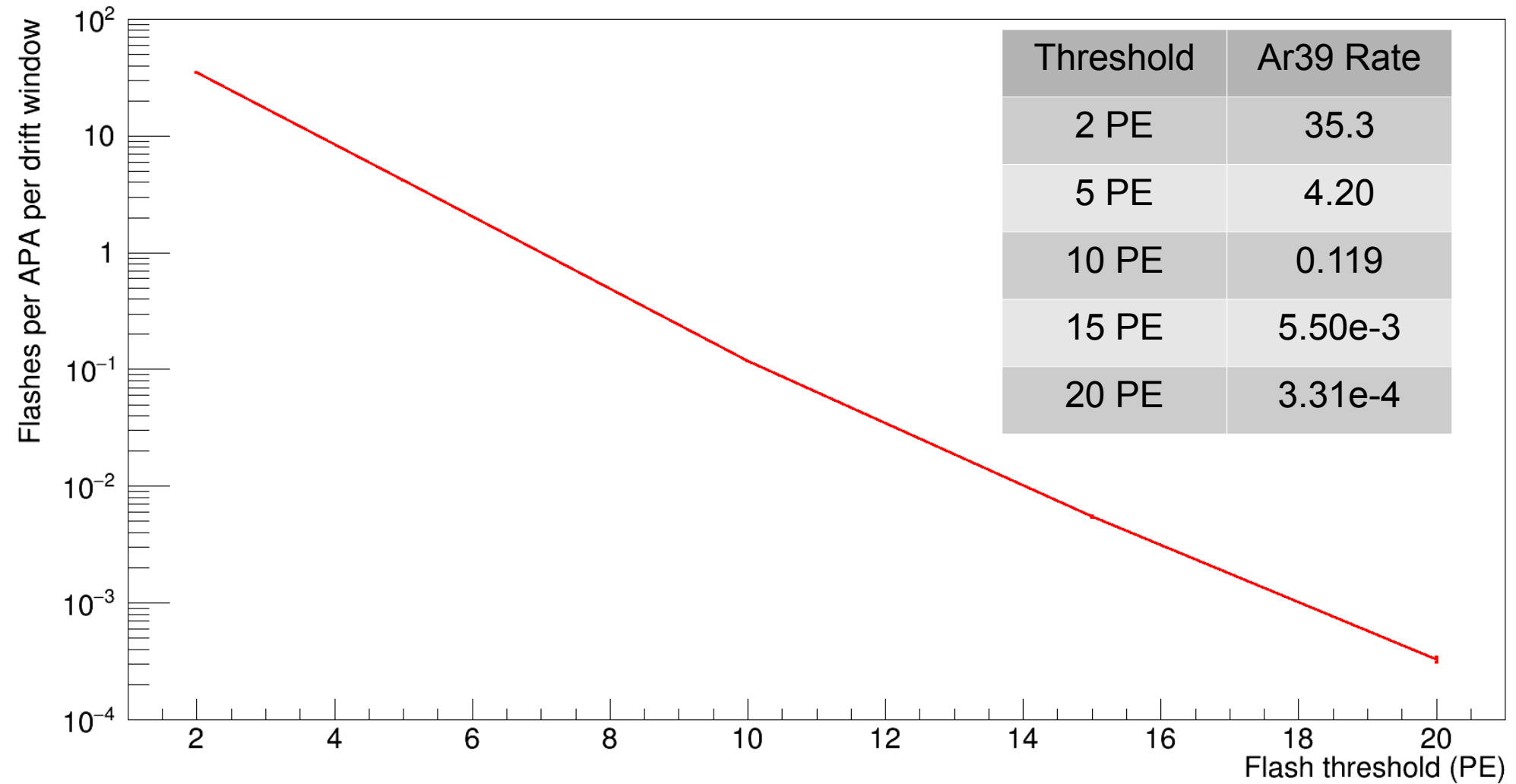
Old Efficiency-Background Plot



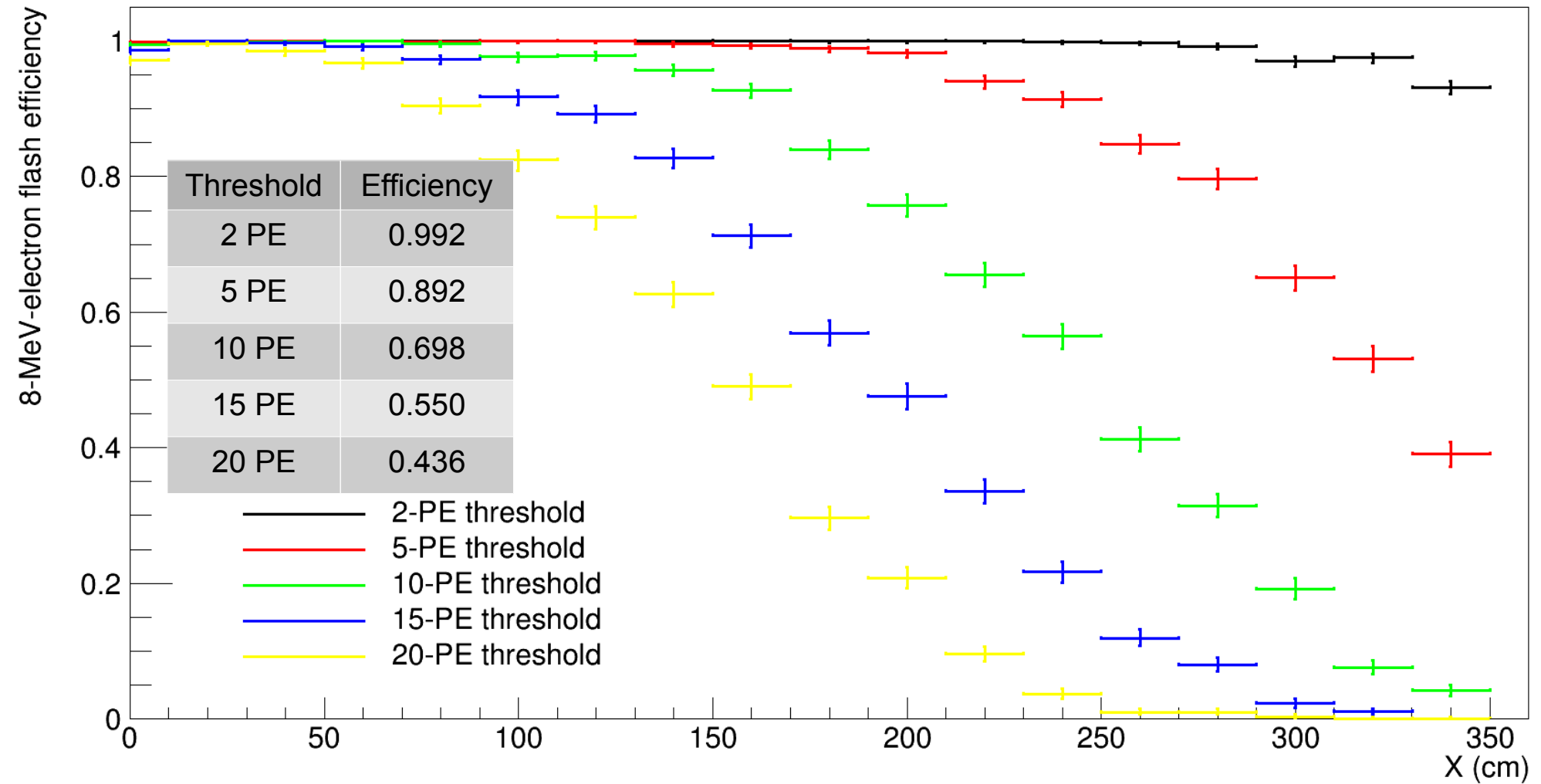
Background Rate Calculation

- Use flashes with $100 \mu\text{s} < t < 2100 \mu\text{s}$
(relative to the signal electron generation time)
- Flashes per APA and drift window = flashes/factor*drift window
- factor = $2000 \mu\text{s}$ (background readout window)
 - * 100 000 (number of events)
 - * 10 (number of PDs per APA)
 - ~~* $2000/4492$ (background readout window
/event time)~~

Ar39 Flashes per Drift Window per APA



8-MeV Single-Electron Efficiency



Next steps

- Reproduce plots that I showed before with the new geometry and OpHit calibration
- Look for other parameters that can be used for reducing ^{39}Ar background

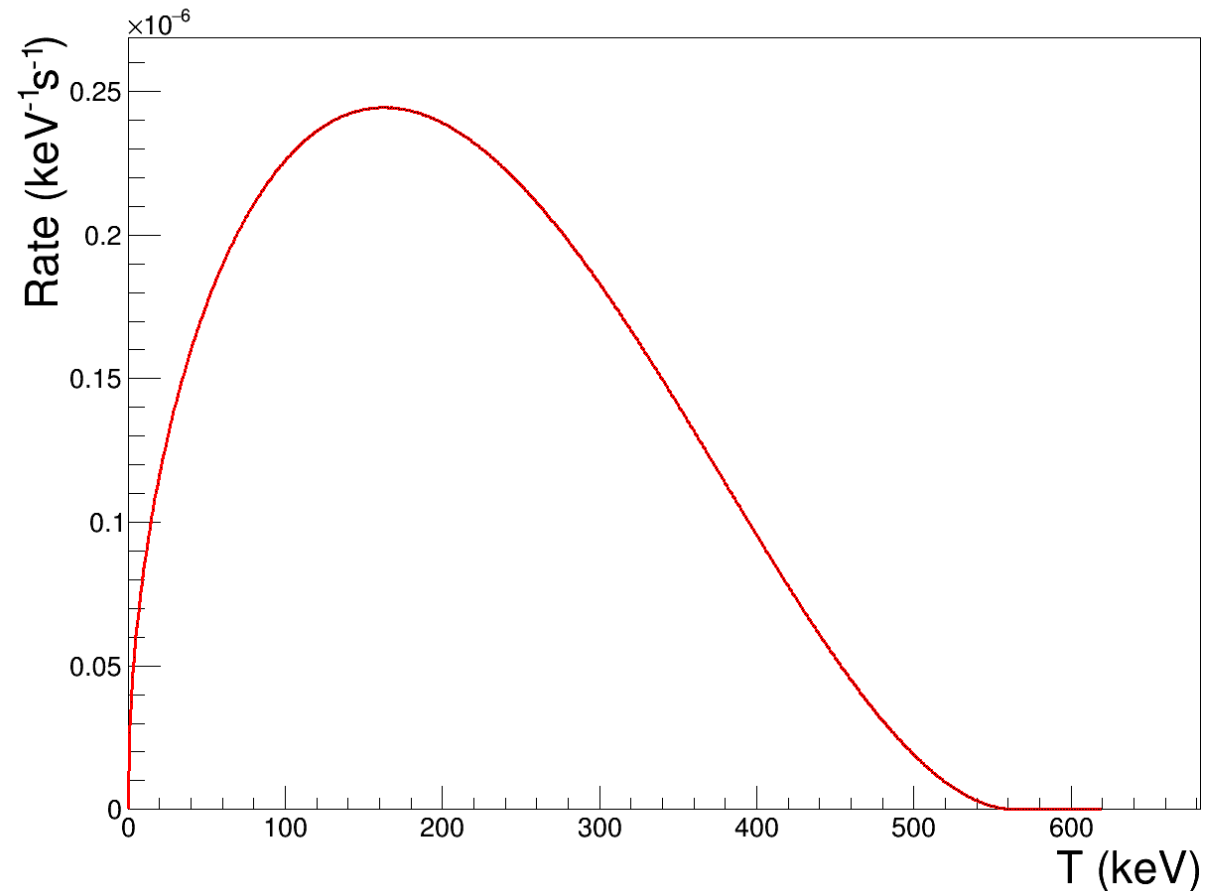
Backup slides

Efficiency calculation

- Simulate single 8-MeV electrons
- 1x2x6 (12APA) DUNE geometry
- Efficiency = events with flashes passing cuts/all events
- Cuts: $-1 \mu\text{s} < t < 10 \mu\text{s}$ (relative to the signal electron generation time)
 - Some background flashes pass the cut

Argon-39

- Natural argon
- Ar-39 rate is ~ 1 Bq/kg
- Expect few photons detected for a decay close to PDs
- Ar-39 decays can mimic attenuated supernova interactions



Simulation to estimate effect of ^{39}Ar

- ~100 000 single electron events (each sample)
- 1x2x6 (12APA) Far Detector geometry
- Isotropic direction
- Primary vertices distributed uniformly inside the active volume
- Alternative photon detector design
- 8, 17, 333, and 833 MeV primary energy

Optical reconstruction: flash

- Output of photon detector reconstruction
- Created from overlapping signals on all photon detectors
- Contains time, number of PEs, approximate Y-Z position, Y-Z widths