

# Liquid Argon Calibration Ideas

Glenn Horton-Smith  
Kansas State

LBNE EPSCoR Proposal Meeting  
2011/03/15

# What we might want to calibrate in LAr TPC

- Drift velocity – time to position conversion
- Collected charge per energy deposit vs. drift distance
- Scintillation light yield vs. energy

# “No cost” calibration sources

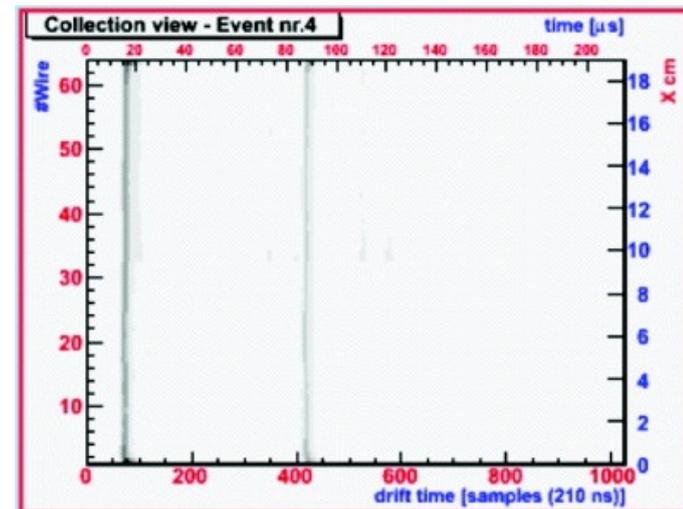
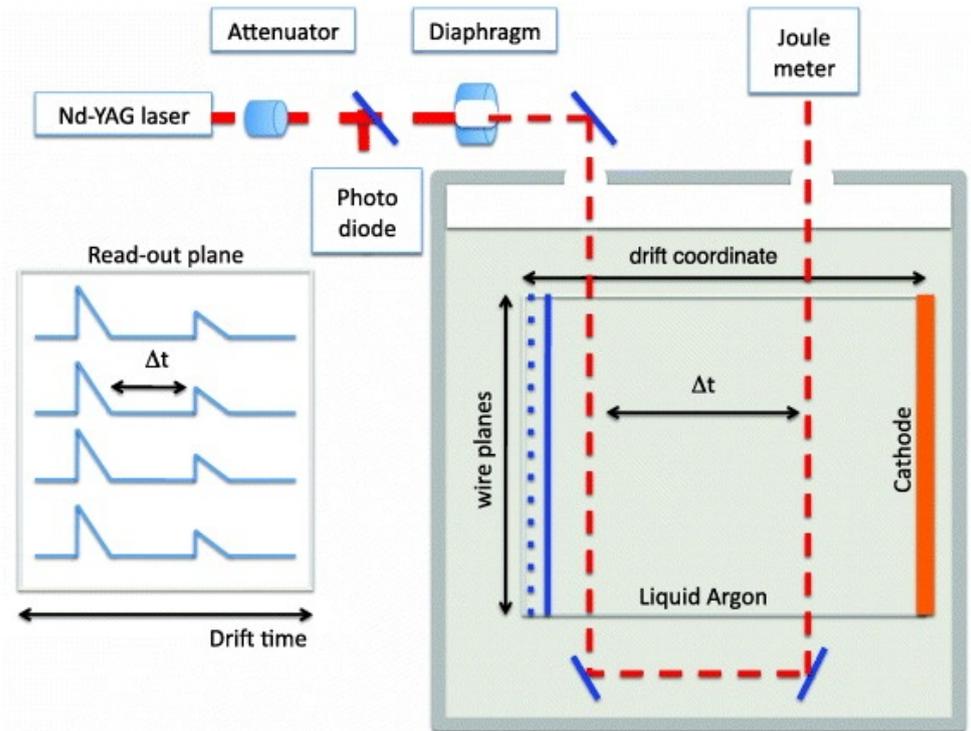
- I found one document about calibration for LAr in Doc-DB: LBNE-Doc-639  $\pi^0$  from muons for calibration (Sebastian White)
- Also have Michel electrons from stopping muons.
- These are “free” in terms of material and engineering costs, just require people to study.

# Possible calibration devices

- Muon telescope – for tracking position and trajectory of muons entering LAr TPC
- Laser beam to create ionization tracks by 2+1 photon ionization as in B.Rossi, et al, [New J.Phys.12:113024,2010](#)
- For low energy deposits, we can even consider a radioactive source, such as Th232 or AmBe.
  - For example, supernova physics wants ~5 MeV threshold [LBNE-Doc-1024 (M.Shaevitz), -3337 (K.Lee)]

# Some info on laser technique

- Needs 266 nm wavelength laser: 4<sup>th</sup> harmonic of a Nd-YAG laser or 3<sup>rd</sup> harmonic of Ti-Sapphire. (~\$20K)
- Absorption of 2 photons and then another ionizes the argon.
- Two figures from the Rossi paper at right.
- Yet to be demonstrated over 1~2 m drift.



# K-State resources

- [J.R.MacDonald](#) lab for AMO physics: resources for lasers, vacuum, cryo, electronics.
- Calibration source experience for KamLAND, etc.
- Muon paddles.

# SDSMT

- Muon detectors
- Electronics

# Next

- Identify specific technical tasks...

Next: identify specific technical tasks