

Optical Detector Software

Alex Himmel, Duke University

ELBNF Collaboration Meeting

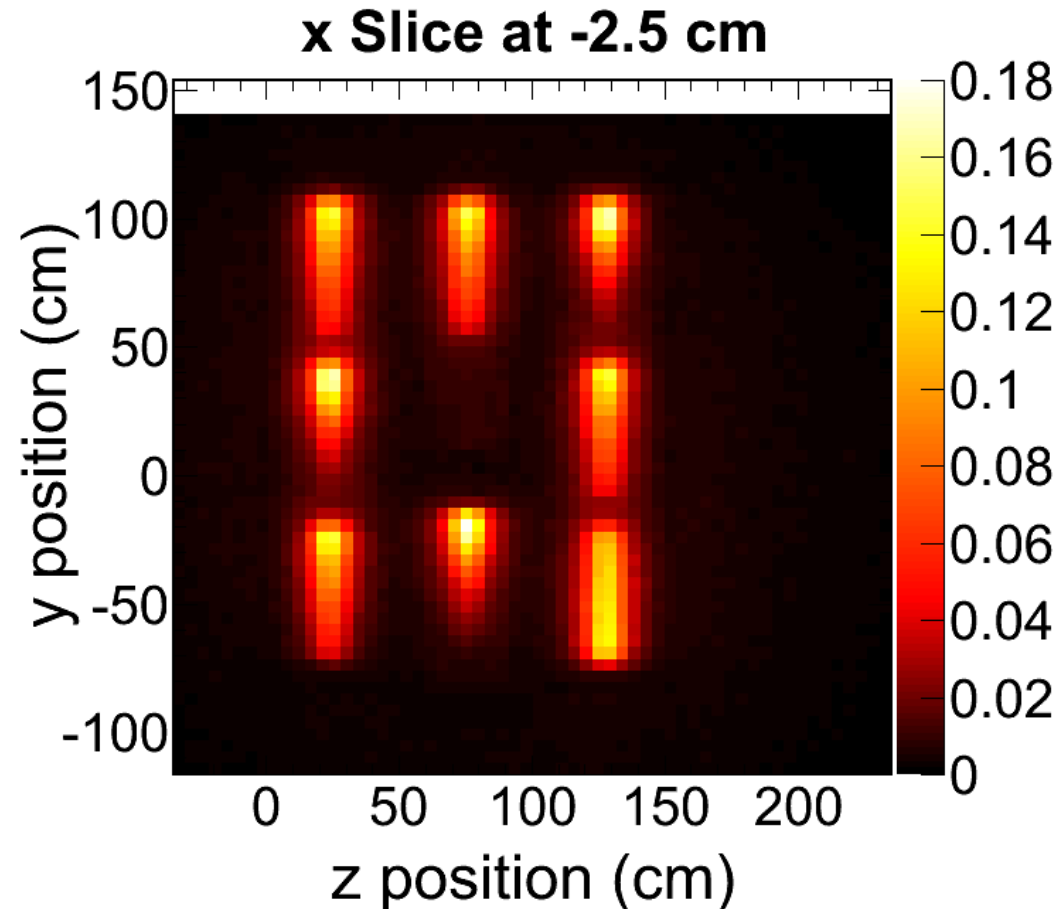
January 22nd, 2014

Simulations

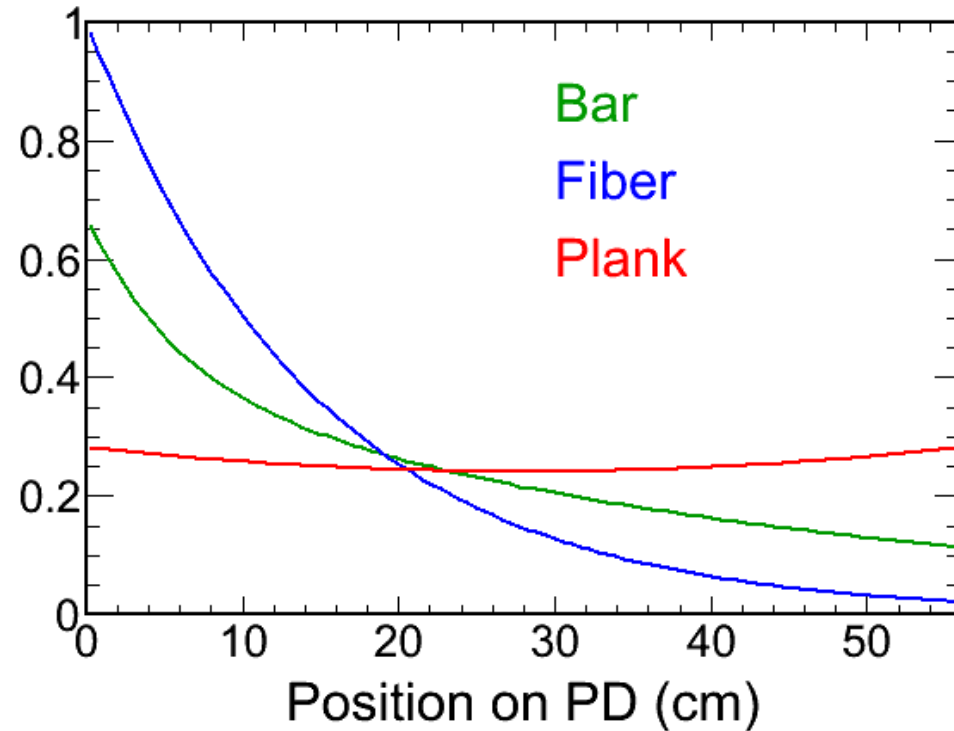
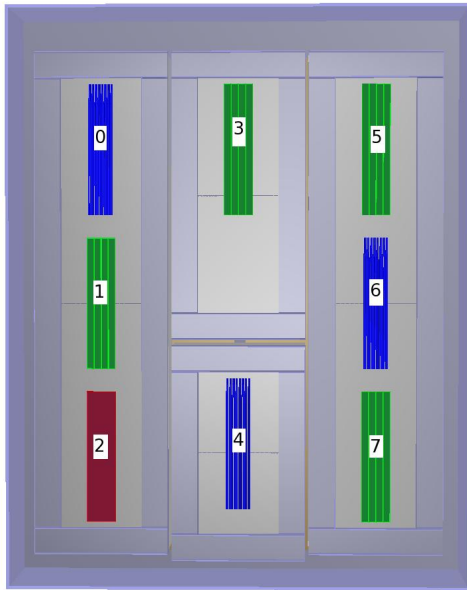
- **Test Dewars**
 - TallBo at Fermilab – Johnathan Lowery
 - CSU – Dylan Adams
 - Used to extract performance information from tests
- **System components**
 - SiPM response – Ronald Musser
 - Light attenuation in acrylic bars – Johnathan Lowery
- **35ton Prototype**
 - Yujing Sun, AH
 - Develop tools with an eye towards the far detector

Photon Simulation in 35ton Prototype

- Photon Library method adapted from MicroBooNE.
- Slow to generate the library, fast to simulate events.
 - Does not scale easily to far detector sizes
 - Some new ideas, but nothing in place yet
- Innovations here can be easily shared among LAr experiments.



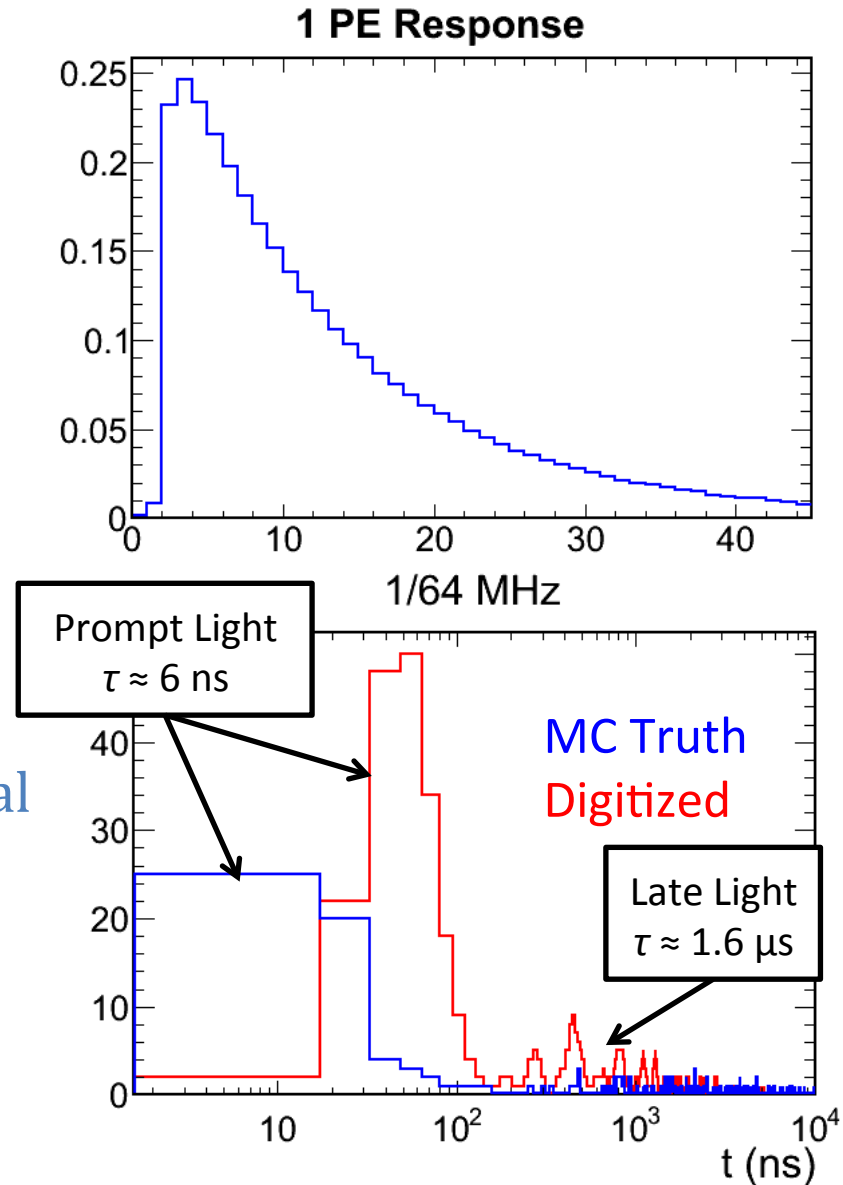
LBNE-Specific Changes



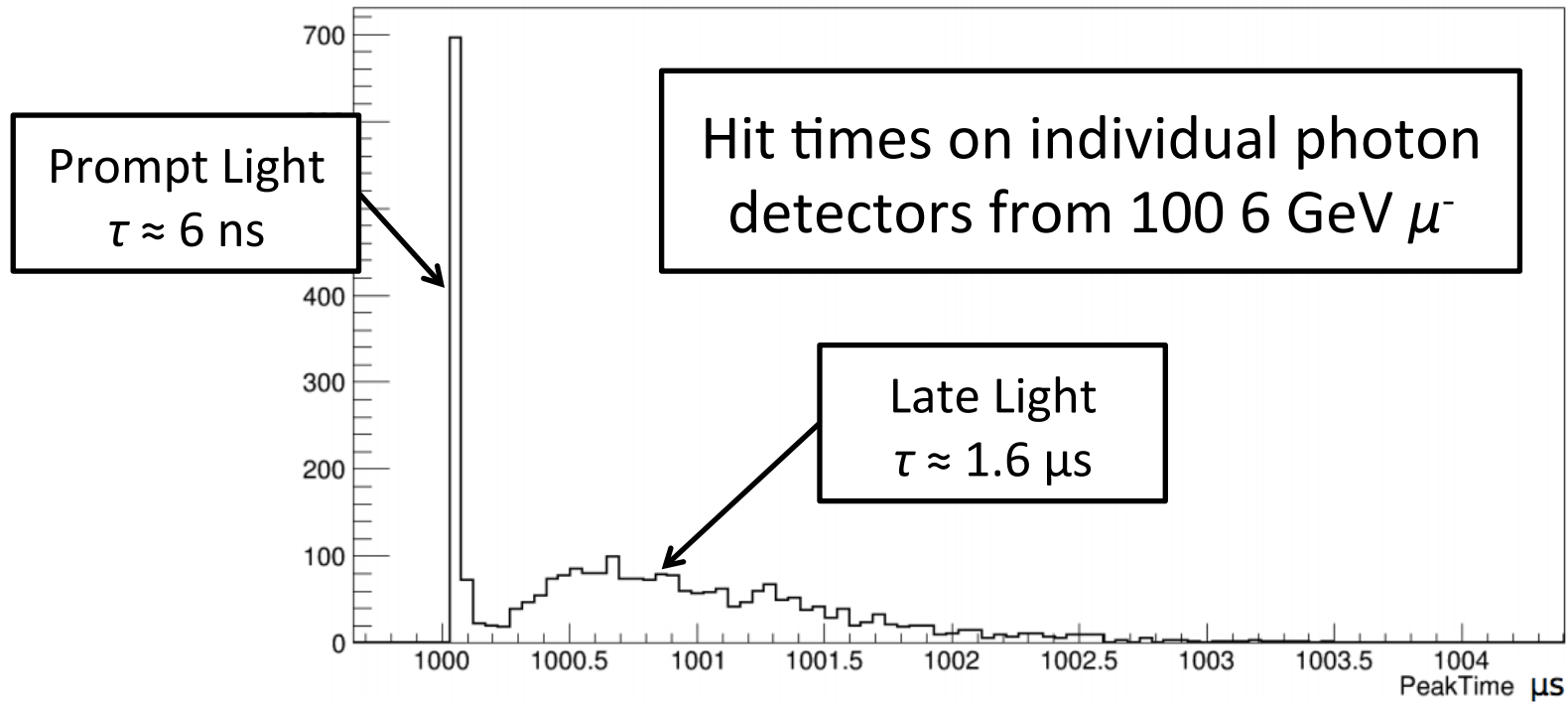
- Need to incorporate the variable sensitivity of our photon detectors
 - Position-dependent efficiency due to attenuation
- Implemented and incorporated into the photon library.

Electronics Simulation

- Custom electronics designed at Argonne (SSP)
 - Read out waveforms for each PD signal
- Use an empirical waveform for each photoelectron
 - Sum up waveforms over time
 - Add in noise, saturation
 - Still needed: after-pulsing, pedestal
 - Configured based on bench tests
- Highly experiment-specific

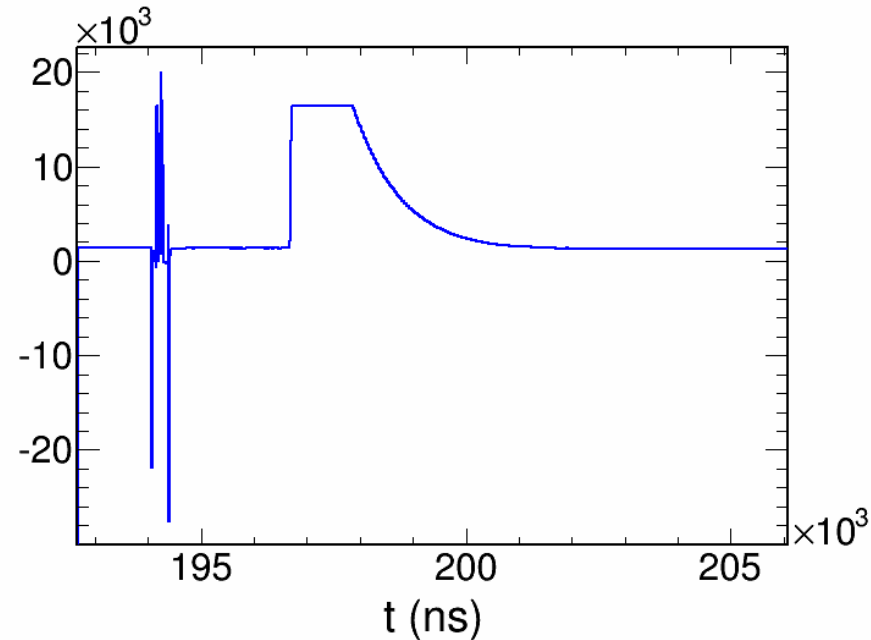
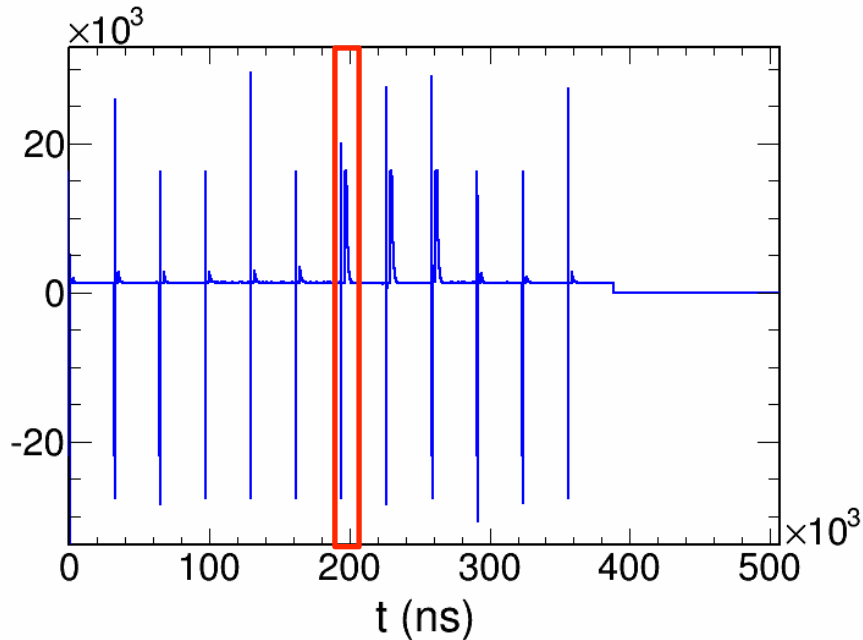


Photon Reconstruction



- Reconstruction for the digitized signals is in development now
 - Gleb Sinev
 - Inspired by, but separate from, the MicroBooNE reconstruction.
- So far have reconstruction for optical hits
 - Isolated peaks on individual channels
 - Grouping hits in time and channels into a “flash” in progress.

Reading SSP Data



- The tools are in place to read in raw SSP data into ART data products for analysis in the framework.
- Same data format at digitizer simulation so reconstruction can be applied to both data and MC.

Conclusions

- Photon simulation working for the 35ton
 - Can be adapted fairly easily to new geometries.
- Reconstruction under way
- Ready soon for new physics studies
 - reconstruction opens up many opportunities
 - efficiency vs.
 - energy
 - total light level
 - position
 - noise
 - etc.
- Will soon have data from the 35ton to analyze