Photon Detector Simulation/ Reconstruction Needs

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- We need to assign names to these tasks – some tentative names penciled in
- All (nearly all?) tasks for the LBNE FD have 35T Phase 2 equivalents. These if anything must be completed earlier

PD Geometry in FD GDML

The jobs

Also Need for 35T

- Write scripts that add the acrylic bars and assign
    readout channels to them.
- Coordinate with David Warner (CSU) on mechanical design
    (See David's talk at the Houston meeting on Nov. 30 for dimensions)
- Integrate them with the TPC geometry scripts.
- Check for overlapping geometry (is this now automatic?)
- Assign channel ID's to readout
- Example in Ben Jones's MicroBooNE work.
    Not quite like ours, as he added PMT's
    to MicroBooNE, but as the LBNE GDML-making perl scripts are based on the
    MicroBooNE examples, a similar path can be followed

Ben's technical manual:

https://indico.fnal.gov/materialDisplay.py?materialId=0&confId=6188

PD Response Simulation

Need to digitize hits in the PD system.

Stan writes in his Houston talk that we desperately need the model of the response:

Need P(z): the probability that a single UV photon striking the bar a
distance z from the SiPM produces a pulse in the SiPM.

Also need the pulse shape for a single photoelectron.

Integrating over the WLS efficiency, absorption in the bar, and the SiPM detection
efficiency.

WLS bar response: Zelimir Djurcic?   Or designee?
SiPM response: Thomas Kutter? Or designee?

Also Need
for 35T

Slow and Fast Simulation

Also Need
for 35T

- Full simulation of photons needed to build the photon library
  - Validation of photon simulation before generating library (maybe the library can be visualized in a way that allows us to check it for obvious flaws).
  - Make sure physics list is complete – scintillation, Cherenkov, reflection, absorption, scattering

- Library building and checking. Early question – how big is it? What resolution is needed on the production voxels? Can we make use of symmetry? (MicroBooNE's library took 220K Hours of CPU to build. We may have to do it several times as we consider different configurations, such as transparency of field cages

- Store the library in LArSoft's svn repository in the designated data area

- Validate fast simulation with library lookup – compare against slow simulation for a sample of events.

Event Display with PD System

LBNE FD Event Display is going to be a challenge! May have to thumbnail the TPC's and click to zoom.

Need to display PD data along with the TPC data.
- Have imprecise position information and precise timing information
- TPC data have precise position information and an unknown start time for cosmics, and a known start time for the beam.

May just need a separate window with position vs. time, coordinated with the TPC readout.

Display reconstructed output – association of light with tracks

Also Need
for 35T

PD Reconstruction

Also Need
for 35T

- Background/Dark noise rejection
- Optical hit finding
- Picking which track/cluster is associated with which flash of light
- Assignment of likelihoods for prompt and late light
- Event timing extraction
- Calorimetry (may help in particle association)

Penciled-in name: Stan. Would like help from Ben Jones
as we have working simulation and reconstruction from him,
but it may be a consulting role

PD Performance

Need plots of
- Photons/MIP in selected places in the detector
- Position resolution
- Energy resolution
- Timing resolution
- Correct-assignment fractions vs.
  particle type, number of additional cosmics, event position

Also Need
for 35T