

Light simulation and low energy reconstruction in LArSoft

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Goal: get a first idea of what has to be done in
LArSoft and assign tasks

Outline

- Roadmap for light simulation and reconstruction
- Low energy reconstruction
- Summary of open tasks
- Discussion

Light sim/reco roadmap for LArSoft: what needs to be done?

1. Geometry:

- Geometry is a .gdml file listing all elements of the detector and their positions (cryostat, insulation, membrane, liquid/gas argon, wires etc.)
- .gdml file is generated with a perl script
- charge readout: wires need to be tagged with "volTPCWire"
- example of a single wire in the .gdml file:

```
-<physvol>  
  <volumeref ref="volTPCWireZ"/>  
  <position name="posWireZ761" unit="cm" x="0" y="0" z="87.82"/>  
  <rotationref ref="rPlus90AboutY"/>  
</physvol>
```

- same needs to be done for light readout (tag: "volOpDetSensitive"). Recycle from single phase perl script.

2. Photon libraries:

- Full optical simulation is very slow
- need photon libraries (table with ratio of photons detected/photons produced for each voxel/PMT pair as function of time)
- Good news: there is a script to produce photon libraries in LArSoft (using the grid)
- Geometry needs to be ready for this!
- People from LAPP are already working on photon libraries in Qscan

3. Digitization and reconstruction:

- Output from geant4: number of PE as function of time for each PMT
 - Need to digitize waveforms and reconstruct them
- Tools are available for this in LArSoft for single phase, need to be adapted to/checked for dual phase

detailed info on previous points in: <http://microboone-docdb.fnal.gov/cgi-bin/RetrieveFile?docid=2313&filename=OpticalPhysicsTechnicalManual.pdf&version=1>

Getting ready for low energy reconstruction in LArSoft

1. Light: see previous slides
 2. Charge: sim and reco chain is working fine, but:
 - there will be some major changes on hit shaping, finding and fitting soon (see my presentation in SB session)
- Doesn't make sense to start with low energy reconstruction before this work is done
- Plan: work in parallel on light sim/reco and charge sim/reco and start analysis when this work is done

Summary of open tasks before we can start with analysis:

1. Light (big tasks):

- Geometry
- Photon libraries
- Digitization and reconstruction

2. Charge:

- Hit shaping, finding and fitting (Christoph Alt)
- + other (minor) tasks

3. General

- Rotating geometry to have drift in y-direction (Balint Radics)