LArSoft Steering Group Meeting Notes for March 11, 2020

Attendees: Erica Snider, Herb Greenlee, Tom Junk, Tracy Usher, Katherine Lato

Erica: We have less effort than expected from the SciSoft team for the next few months. As expected, Lynn Garren has officially retired, with her tasks distributed. However, she is still around and is still doing much of her previous tasks. Unexpectedly, a project in SCD has taken half of Kyle Knoepfel's effort (from 90% on LArSoft down to 40%) and a significant portion of Pattrick Gartung's time.

There are eight major items in our work plan, plus other items as there is time available to work on them. The status of each has been updated in the work plan. Please review that document for details.

A long discussion of the event display followed. The situation here has changed since the last Steering Group meeting. The project sought a partner to develop and support an official event for LArSoft, but this effort did not succeed. Instead, the project will pursue making it possible to run each of the various EDs developed by various people for experient constituencies within LArSoft and Gallery. At a minimum, this would include initializing geometry and calibrations data (if needed) from appropriate LArSoft services, and some configuration via FHiCL.

1. Existing event display options
    a. LArSoft Event Display (ROOT based)
        i. In principle can display everything both in 2D and 3D
        ii. Very slow for large detectors.
        iii. Works for all detectors. Can display multiple data items and labels at once
    b. TITUS (Qt based)
        i. Combination of python (3) and C++ and is based on the PyQT5 interface.
        ii. Updated version (by Marco Del Tutto and Gianluca Petrillo) of the event display originally authored by Corey Adams (QT based) for MicroBooNE
        iii. Runs in gallery. Being used by ICARUS. Works for MicroBooNE, ArguNeut and possibly DUNE.
        iv. Native 2D displays of low-level data
    c. WebEVD (using three.js/WebGL for access to OpenGL)
        i. Chris Backhouse developed
        ii. In use at ProtoDUNE. Has been updating based on feature requests.
        iii. Runs in LArSoft & Gallery.
        iv. Doesn't have a native 2D display.
    d. Eve based for SBND
        i. Umut Kose developed.
        ii. 3D Oriented

      iii.   Eve is a ROOT module based on experiment-independent part of the ALICE event display developed in cooperation between ALICE offline project and ROOT.
- e. Bee event display (based on WebGL)
  - i. Developed by Chao Zhang for use with wire-cell.
  - ii. 3D oriented.
  - iii. Uses three.js.
  - iv. Doesn't run in LArSoft and Gallery, uses wire-cell data format, so requires conversion step

Round Robin:

Tracy for ICARUS
- ICARUS will be taking data soon. Running multi-threaded so we can siphon off events and put them to the Event Display.
- In order to run multi-threaded need some service definitions flipped from LEGACY to SHARED. Data is coming in the next few weeks, so they want this soon. They're only interested in multi-threaded within an event, not multiple events in flight.
  - [Noted that art 3.05 will allow the necessary changes to the services. Will be integrated into LArSoft as soon as possible]
- Using TITUS event display.
- Interested in Herb's presentation at the LArSoft Coordination meeting yesterday, [Accessing Calibration Data Using HTTPS and SQLITE](). There are a number of DB issues to resolve.
- Working to get everything ready to go.
- Are they on their own for paying for Slack? Answer: Fermilab has an Enterprise IM called Jabber. DUNE gets its Slack paid for by the University of Chicago. MicroBooNE by Yale. So "yes".

Tom Junk for DUNE
- GArSoft side
- Have an issue between the gas and the liquid. Using LArSoft for the liquid. Next step is to run LArG4 an GArG4 in the same job. Need to get the simulations to work together.
  - [Noted that new LArSoft LArG4-based simulation should be able to handle pixels. Just need to write the anode simulation.]
- For non-supernova data, we will write all the data in the time windows so the boundary effects are no worse than they are now. Supernova-burst processing in the DUNE Far Detector presents unique challenges due to the large volume of data that are produced in each trigger.
  - An uncompressed supernova-burst processing readout for 100 seconds will take about 150 TB of storage for one single-phase far detector module for just the TPC wire data, and DUNE will have four modules. These data will be divided into smaller chunks both in time and by detector component. These components are likely to be the anode plane assemblies (APA) due to the granularity of the data preparation processing.
  - Waveforms from the wires are de-noised and deconvolved, and pulses that are approximately Gaussian appear in the processed waveforms. The deconvolution is done in frequency space and the Fourier transform applied needs to have 100 microseconds of waveforms after the last

region of interest ends in order for edge effects not to introduce artifacts in the regions of interest.

- ○ Since the data are divided into ranges of time, neighboring chunks of data need to be available in memory so that regions of interest occupying times up to and even straddling the chunking boundaries can be deconvolved without introducing artifacts in the physics. Our actual requirement is that the data chunking and processing stage not introduce artifacts, but it can also be made concrete with these requirements: *It must be possible to break trigger records down into smaller chunks (e.g. one APA) and be able to stitch those chunks back together.*
- Participating in the framework requirements task force. Does LArSoft have a position on future frameworks? Answer: As far as we know, art is the underlying framework. Nonetheless, our coding standard is to have the algorithms be independent of the framework, but it's not widely adhered to.

Herb Greenlee for MicroBooNE
- We agree with the plan.