



LArSoft Work Plan for 2017

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Background

This update is based on material presented at the 2/2/17 Steering Committee meeting.

<https://indico.fnal.gov/conferenceDisplay.py?confId=13416> with monthly status indicated after each major item.

Short-term priorities; happening concurrently

The order does not imply priority.

1. Re-factoring of LArG4
 - Purpose: Separate GEANT4 functionality and LArSoft-specific parts into different units
 - Simplifies interface between material modeling and detector simulation
 - Clarifies maintenance responsibilities
 - Easier to introduce or modify models of various detector effects
 - Resources: GEANT4 team: Hans Wenzel and Krzysztof Genser
<http://cdcvns.fnal.gov/redmine/issues/14454> - 2/2/17 - 48 done /170 total hours
3/2/17 - 90/170
3/30/17 - worked on putting changes into GEANT4, need to test those.
4/27/17 - 124/170
2. Track fitting / data product improvements - phase II
 - Purpose: Provide data structures to store track fit information, and re-organize existing data structures to better match algorithm workflows
 - Provides the additional flexibility needed to accommodate the reconstruction steps downstream of pattern recognition
 - Also working to standardize the information to be produced by any track reconstruction workflow
 - This is part of a longer-term effort aimed at establishing uniform policies for the output of reconstruction

- Resources: LArSoft team: Giuseppe Cerati, Gianluca Petrillo, Erica Snider
- <http://cdcv.s.fnal.gov/redmine/issues/14047>- 2/2/17 - 70 done / 400 total hours
- 3/2/17 - 130/400
- 4/27/17 - 130/440 - working on other things (like ProtoDUNE/ICARUS integration)

3. ProtoDUNE / ICARUS integration

- Purpose: To provide the code and interface changes needed to extend LArSoft support to ProtoDUNE and ICARUS simulation and reconstruction
- Resources: Gianluca Petrillo, Erica Snider and Robert Sulej
- <http://cdcv.s.fnal.gov/redmine/issues/15086>- 2/2/17 - not estimated yet
- 3/2/17 - subtasks added

<https://cdcv.s.fnal.gov/redmine/issues/15688> - ICARUS (although generic, it applies to ICARUS)

<https://cdcv.s.fnal.gov/redmine/issues/16031> - view to describe ICARUS wire planes

Also, Protodune work - <https://cdcv.s.fnal.gov/redmine/issues/14363> + other work

ICARUS work - <https://cdcv.s.fnal.gov/redmine/issues/16031>

4/3/17 - 112/130 hours + 9/12 (ICARUS) + lots of meetings between LArSoft people & ICARUS people. Expect estimate of effort to increase.

4/27/17

- 15086 with subtasks - 9/12 hours
- 14363 - 112/130 (Note, estimate doesn't include Robert Sulej's work)
- 16031 - 8/12
- As of 4/27/17 -- 129 hours /154 estimated. Estimate may still increase as full scope of work is understood, but not necessarily.

4. SPACK - new build system for *art* and LArSoft

- Purpose:
 - To migrate to a standard set of build tools that have broad community support
 - To address portability and configurability issues raised by experiments with the current build system
 - To allow continuing use of Mac OSX as a LArSoft development platform within the context of Apple's System Integrity Protection system
- Resources: Jim Amundson, Patrick Gartung, Lynn Garren
- <http://cdcv.s.fnal.gov/redmine/issues/15313> - 2/2/17 - no estimate of hours, nor by 3/30, still asking
- Not estimated.

5. Documentation improvements such as a training page, updates to wiki pages, new LArSoft notes
 - Purpose: Keep the LArSoft Collaboration aware of changes in tools and process. Highlight information produced within LArSoft Collaboration.
 - Resources: Katherine Lato
 - Various redmine issues throughout the year. 40 -120 hours
 - As an example: <http://cdcv.s.fnal.gov/redmine/issues/14691> - LArSoft notes for January
3/2/17 - 9 hours done, extra hour to update redmine pages related.
3/2/17 - drafted LArSoft notes for March. <https://cdcv.s.fnal.gov/redmine/issues/15716> (4 / 8 hours)
4/3/17 - <https://cdcv.s.fnal.gov/redmine/issues/15716> - 9 hours total done
4/3/17 - <https://cdcv.s.fnal.gov/redmine/issues/15816> - New document on Geometry (6/23 hours)
4/27/17 - <https://cdcv.s.fnal.gov/redmine/issues/15816> 17/35 hours (new estimate, involving Erica & Gianluca)

6. Packaging NuWro. Note, a helper like GENIEhelper might require a fair amount of work and is probably not within the effort LArSoft has available.
 - Purpose: To package NuWro as a UPS product that is distributed with the LArSoft suite.
 - A more ambitious level of support would be to provide a direct interface to NuWro within LArSoft, much like GENIEHelper does for GENIE, but that work isn't being estimated here.
 - Resources: LArSoft code management: Lynn Garren
<https://cdcv.s.fnal.gov/redmine/issues/15448>
 - Note: the original request also included integrating NuWro into GENIEhelper or a similar new class. While evaluating the costs and benefits of that part of the request, we intend to address this accessibility issue.
3/2/17 - 8 / 8 - main part done

7. CI improvements
 - Purpose: Migrate the LArSoft CI system to the new system and produce a second tier of CI tests.
 - The new system has significantly improved reporting and email messaging that will enhance usability and allow the system to send emails with error reports directly to developers
 - Support for the current version in use by LArSoft is ending
 - Resources: Vito Di Benedetto and experiment contacts for the CI tests
 - <http://cdcv.s.fnal.gov/redmine/issues/15125> - done
 - <http://cdcv.s.fnal.gov/redmine/issues/15124> - in progress
3/2/17 - Have related tasks assigned. Anna tracking details.
4/3/17 - done with 15125

Longer-term priorities

A. Concurrency -

- Purpose:
 - To use multi-threading to address memory usage issues and provide flexibility in resource utilization
 - To introduce vectorization to those components of the code where speed improvements could be obtained, and to make use of currently unutilized resources
- Resources: LArSoft team and (proposed) experiment effort
 - LArSoft and users need to be educated about concurrency, and the coding rules that apply to candidate code.
 - Multi-threading will depend on support within art. LArSoft may be asked to provide realistic scenarios to test their changes.
 - MicroBooNE has already contributed effort to this project

B. Architectural changes to define algorithm interfaces for layered algorithms.

- Purpose: Provide a well-defined set of interfaces for layering algorithms within a framework that allows for run-time configurability below the level of art modules, e.g., the art “tool” currently under development
 - The primary target for this change are the algorithms used to generate, process and deconvolve raw signals from the detector
 - A major thrust is to provide a set of tools that will allow algorithms that are currently detector dependent to be generalized and incorporated into the core LArSoft code
- Resources: The LArSoft team and (proposed) experiment effort.
 - DUNE has already contributed effort to a similar project
- Note: new architectures do not need to be based around the art “tool. This is primarily about agreeing what certain interfaces look like.

C. TPC topology / locality in the Geometry service.

- Purpose: To provide a mechanism to efficiently determine the TPCs adjacent to a given TPC, as would be needed to follow tracks and showers that cross TPC boundaries
- Resources: The LArSoft team and (proposed) experiment effort
- <http://cdcvs.fnal.gov/redmine/issues/9818> -- requested by DUNE

Note:

- No effort is available to work on Event Display at this time. It is, however, a nagging issue.
- Need someone to lead an analysis on deep learning and integrating Convolutional Neural Networks (CNNs) before initiating this project. LArSoft should be available to consult, but isn't in a position to lead this effort.

Work began in 2016, continuing into 2017

Here are the LArSoft assigned projects actively being worked on:

1. <http://cdcvs.fnal.gov/redmine/issues/14454> - Refactoring LArG4
2. <http://cdcvs.fnal.gov/redmine/issues/14047> - Data product review ("phase II")
3. <http://cdcvs.fnal.gov/redmine/issues/14363> - Support detectors with drift direction different than x axis (ProtoDUNE)
4. <http://cdcvs.fnal.gov/redmine/issues/11994> - Enable use of Kalman Filter as final fitter
5. <http://cdcvs.fnal.gov/redmine/issues/12237> - Usability: add facilities for better/easier use of associations
6. <http://cdcvs.fnal.gov/redmine/issues/14048> - Provide a uniform recommendation for physics vector data structures in LArSoft data products

Other work:

- User support
- Continue to have code analysis
- Continuous architecture improvement
- Yearly workshop. Concurrency - multi-threading and vectorization options

Other topics under consideration to work on include the list of accepted, but not assigned, redmine issues.

These issues originated from a combination of problems identified by the experiments and those identified by the core LArSoft team.

1. <https://cdcvs.fnal.gov/redmine/issues/13711> Concurrency: Explore multi-threading and vectorization options - assigned to Erica on 2/20/17 - part of long term priorities.
2. <https://cdcvs.fnal.gov/redmine/issues/9818> Add knowledge of TPC topology in GeometryCore - Assigned to Gianluca, and made a milestone
3. <https://cdcvs.fnal.gov/redmine/issues/12778> LArSoft needs an error handling policy - Assigned to Katherine, starting work on this.
4. <https://cdcvs.fnal.gov/redmine/issues/13563> Obsolete LArSoft code -
5. <https://cdcvs.fnal.gov/redmine/issues/12785> review typedef cryo_tpc_view_hitmap -
6. <https://cdcvs.fnal.gov/redmine/issues/12602> Add a compact representation for the plane ID, TPC ID and cryostat ID -

8. <https://cdcv.s.fnal.gov/redmine/issues/11872> - Establish a standard way to represent particle identification results
9. <https://cdcv.s.fnal.gov/redmine/issues/11871> - Decay products in pandora do not start from the same vertex, while Projection Matching Algorithm's do
10. <https://cdcv.s.fnal.gov/redmine/issues/11066> - Load geometry from ROOT file instead of GDML file
11. <https://cdcv.s.fnal.gov/redmine/issues/10937> - Remove references to AuxDetGeo objects from Geometry service and related classes - assigned to Saba

Topic for discussion

Infrastructure that benefits a lot of people could be the target for collaboration effort. This may be a big thing that needs lots of people, or it could be smaller but the core project can't develop it, so experiments need to contribute. Discuss how experiments might contribute on things that have broad application or impact across the community, but that are not typically or easily pursued by any single experiment.