



Requests from the Framework Workshop

The SciSoft Team

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Workshop requests

Workshop requests are grouped according to the following categories:

- Build system
- Framework
 - Configuration, data model, AI/ML and GPU support, processing, usability, etc.
- Documentation
- Training
- Broader issues

Not all requests fit entirely within one category.

Legend

The requests are labeled according to the stakeholders who made them (e.g. [Mu2e](#)), with the following caveats:

- “**DUNE**” means that both **DUNE ND** and **DUNE FD** are requesting the feature.
- “**Discussion**” means the request arose during a discussion session, and there was general agreement among participants that the request should be made.
- “**All**” means there was widespread agreement among stakeholders that the request should be made.

Build system

1. [Mu2e] Create ROOT dictionaries only at build time
 - Some ROOT dictionaries are currently built only at runtime
2. [DUNE FD] Support more operating systems
3. [DUNE FD] Make the build system more flexible with respect to software versions

Framework configuration and data model

Configuration

1. [[Mu2e](#), [LArSoft](#)] Extensions requested to FHiCL language:
 - Conditional expressions
 - Basic Arithmetic
 - Access to environment variables

Data model

1. [[Mu2e](#)] Permit deep-copy filtering
2. [[Mu2e](#)] Support object extension (add more data to an object by later processing)
3. [[Mu2e](#)] Improve sparse vectors
4. [[NOvA](#)] Support `Assns<A, A>` and `Assns<A, A, D>`
5. [[SBND](#)] Add ability to import data products not created in art-processing back into later steps of art processing

Framework AI/ML and GPU support

AI/ML support

1. [[DUNE](#)] Integrate ML tools into Framework
2. [[SBND](#)] Enable CPU and GPU ML inference in framework reconstruction programs
3. [[SBND](#)] Do ML training in framework programs

GPU support

1. [[AII](#)] Framework should allow modules to make use of GPUs
2. [[DUNE FD](#), [SciDAC](#)] Integrate GPU portability solutions within a framework job
3. [[DUNE FD](#), [LArSoft](#)] Support “external work” (in CMS language), which enables asynchronous calls to a GPU

Framework processing (1)

1. [[SciDAC](#)] Support use of OpenMP pragmas for vectorization (not MT)
2. [[Unknown](#)] Choose the parallel backend (e.g. HPX instead of TBB)
3. [[SciDAC](#)] Make Jemalloc library the default allocator (like CMS)
4. [[Mu2e](#)] Need ability to interrupt a module's processing and, perhaps, trigger filtering and/or end the event
5. [[DUNE](#), [LArSoft](#), [SBND](#)] Increase event granularity
6. [[LArSoft](#)] Facility to deal with asynchronous data/continuous readout streams

Framework processing (2)

7. [LArSoft, DUNE, SBND] Support dynamic event granularity
 - Addressed by Meld LDRD
8. [DUNE FD] Synchronize reading of files with different data and granularities
9. [SBND] Increase support for per-TPC processing, without unnecessary duplication (boilerplate in each module)
10. [Discussion] Enable explicit specifications of whether algorithms are executed on GPUs
11. [Discussion] Enable the framework to choose whether algorithms are executed on GPUs
12. [DUNE FD] Need a framework-agnostic interface to CPU/GPU/task scheduling (portability)

Framework usability

1. [NOvA] Simplify data-access patterns to reduce user-visible complexity
2. [Mu2e] Change default SQLite output directory
3. [Mu2e] Time tracker should report CPU time in addition to wall-clock time
4. [Mu2e] Make the random-number generator system more flexible
5. [Mu2e] Add custom output to the main executable banner
6. [LArSoft] Provide metadata that describes batch jobs
7. [SBND] Provide facility to convert an art root file to a plain Ntuple
8. [artdaq] Provide non-ROOT API that supports art-event serialization
9. [Discussion] Make the framework take hints and/or manage lifetimes of data on GPU beyond algorithm/module boundaries

Framework miscellany

File-handling

1. [[Mu2e](#)] Support file-handling through RUCIO and not just SAM

Event display

1. [[EMPHATIC](#)] Create an event-display toolkit with “base classes”
2. [[EMPHATIC](#), [NOvA](#)] Dynamically reload modules and their configurations

Maintenance

1. [[EMPHATIC](#)] Move toy-experiment to Github
2. [[SBND](#)] Continue to support gallery

Documentation (I)

1. **[All]** Migrate documentation from redmine to somewhere else
 - Examples include readthedocs.org, github.io, self-hosted, Doxygen-based, etc.
2. **[Discussion]** Define art-related jargon in documentation
3. **[Discussion]** Make documentation searchable
4. **[Discussion]** Document `cetmodules/cetbuildtools`
5. **[Discussion]** Engage as many different learning paradigms as possible (reference, guide/tutorial, cookbook, etc.)
6. **[Discussion]** Consider using LXR or an equivalent to cross-reference framework code

Documentation (II)

7. [NOvA, EMPHATIC] Update toy-experiment and workbook (check for conflicting and deprecated advice)
8. [NOvA] Have examples
9. [NOvA] Explain best practices for art : : Assns
10. [NOvA] Explain what exit code means
 - This already exists, but it's hard to find
11. [SciDAC] Collect/provide guidance on vectorization and parallelization
12. [Discussion] Guide/tutorial “One hour to useful physics histogram”

Training

1. [SBND] Provide C++ training
2. [Discussion] Re-start art workshop

Requests that require no framework changes

1. [SBND] Need a higher level interface to POMS (e.g. like `larbatch`)
2. [SBND] Weaker coupling between LArSoft and GENIE version (e.g. can change GENIE without rebuilding other packages)
 - Already acknowledged action item by LArSoft
3. [SBND] Weaker coupling between SBND code and GENIE version
4. [SBND] Support for use of alternative generators (other than GENIE)
 - Already provided by LArSoft
5. [DUNE] Formalized language for metadata for generators
 - Part of discussion with [DUNE ND](#) framework requirements

Requests that were beyond the scope of the workshop

1. [NOvA] Provide some form of legacy UPS support on AL9
2. [DUNE ND] Collaborate with Dune ND on common framework requirements
3. [DUNE ND] Fitting framework that can handle “all inputs for fits with rigorous systematics handling”
4. [NOvA] Inter-experiment communication tools might be of great value (maybe a Slack for both art and FIFE)
5. [Discussion] Improve information-sharing forum (other than email list) that includes searchability and the ability to select a “best” answer