Fermilab | U.S. DEPARTMENT OF ENERGY | Office of Science

art framework status

Kyle J. Knoepfel

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Fermilab Frameworks Workshop

art

Outline

This talk is a high-level talk and not so much about framework capabilities.

- Recap of the past few years
- Why art is the way it is
- art's user community
- art's governance and development models
- Currently supported experiments and projects
- Items on the near and further-out horizons

Over the last few years

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- Minor enhancements in framework functionality
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- Migrations to GitHub

  All repositories and issues; no documentation yet.
- Significant steps forward with build system and Spack

  See Chris Green's talk tomorrow
- Upgraded software stacks and compilers

  As of art 3.13.02 (released last week), we have a distribution that supports C++20
- Token support

  As of art 3.13.01/critic 1.12.02

As we restart development…

We need to understand where we are.

- Experiments are further along in their lifecycles than they were a few years ago
- art's development is more integrated with LArSoft than it used to be
- New ideas, technologies, constraints (etc.) have arisen in the last 4 years
- Some of the ideas we had 4 years ago may not make sense to pursue

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Each of these has changed over time.

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  Breaking changes for users

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- **Human error**

  Is the software tested? How well?

  Are the *irreversible* parts of development understood?

art's user community

- Many art users are doing development for experiments that are not yet running:

  Reconstruction algorithms not yet finalized

  Workflows are under development

- They are often involved in multiple non-collider experiments at the same time.
- They are involved in software development including event-generation, material simulation, processing raw data, reconstruction, to analyzing quantities of physical interest.
- They are defining experiment-specific data models.
- They are generally willing to (drastically) rethink any stage of the physics workflow:

  Event representation, exploring other I/O libraries, etc.

art's governance model

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- Each stakeholder has one or more representatives (or an art contact) that convey the needs of the stakeholder to the art developers.

  Stakeholders meet bi-weekly (nominally every 2nd Tuesday at 9 am, CDT) at the art stakeholder meeting, where experiences are shared, and development decisions are sometimes made.

  These meetings do not adhere to formal parliamentary procedure (it has never been necessary), but we do seek overwhelming stakeholder consensus when pursuing a direction that substantially affects stakeholders.

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Development is primarily guided (*and* constrained) by:

- Global *and* individual stakeholder needs
  - *We need to design the code to avoid behaviors that conflict between stakeholder needs*
- Experiment requirements established early on in art's development
- Strategic directions established by Fermilab's upper management
- Technological advances in (and limitations of) software and hardware
- Computing industry best practices
- Our own perceptions of what would be helpful for experiments

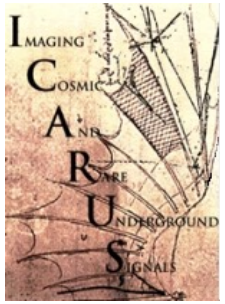
art provides the framework needs for ~2k physicists

ArgoNeuT

artdaq project

DUNE DEEP UNDERGROUND NEUTRINO EXPERIMENT

EMPHATIC experiment



LArIAT experiment

LArSoft

μBooNE

Mu2e

g−2

NOvA

SBND Short-Baseline Near Detector

Previous users

DARKSIDE

next

art versions in use

ArgoNeuT
artdaq
DUNE FD
EMPHATIC
ICARUS
LArSoft
MicroBooNE
Mu2e
Muon g-2
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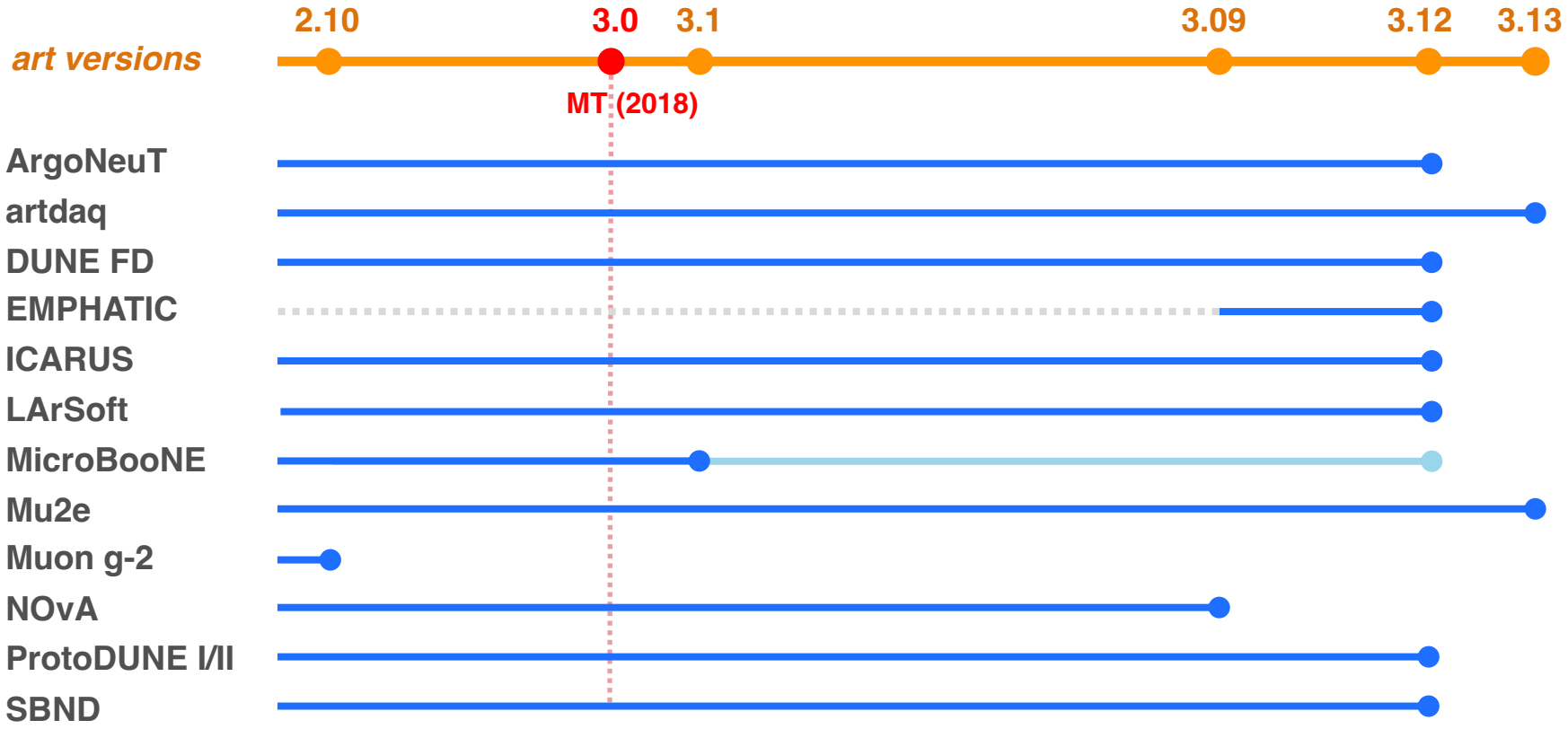

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Items on the near horizon

- **Spack**

  Chris Green will discuss this tomorrow.

- **AlmaLinux 9**

  Our AL9 software will not support native UPS products
  We have an AL9 development machine and are getting a Jenkins machine

- **Wider adoption of CSAID-supported tools**

  If your experiment does not use cetmodules/CMake, we will be contacting you

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None of these are framework-related per se.
Substantial non-framework effort expended by our developers.

Items further out

- Adaptable frameworks LDRD *(See Future framework directions talk)*

  Motivated by DUNE's framework requirements (see https://indico.cern.ch/e/hsf-dune-review)
  Decomposition of "events" into more helpful units of processing for DUNE's use.
  We don't know yet how this influence art development.

- Efficient scheduling of CPUs and accelerators in framework jobs

  CMS has an elegant technique for this *(See Chris Jones' talk next)*

- Easier AI/ML usage within a framework context

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- **More items to be determined from this workshop…**

Conclusion

- Despite the feature freeze, art development has moved forward.
- Thank you for your patience.
- The art framework exists to support you.
- We expect changes down the road…and you will help us decide what those are.
- We look forward to your input at this workshop.
- We know there are things that could be better; let's talk about them.