

Update on the SoLID Software Framework

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Jefferson Lab

SoLID Collaboration Meeting
June 8, 2018

Recap from last summer: *art* Framework Pros/Cons

art

• Pros

- ▶ Ready now
- ▶ Wide adoption
- ▶ End-to-end
- ▶ Geant4 integration demonstrated
- ▶ Good documentation → low need for support

• Cons

- ▶ Single-threaded (multi-threading under development)
- ▶ Custom build/package system
- ▶ Concern about long-term Fermilab support (?)

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art 3.0 just released

```
commit 1968559d98cfc8c3ff00bc2a59eef1d9bf2d2fba
Author: Kyle Knoepfel <knoepfel@fnal.gov>
Date: Tue Jun 5 12:13:02 2018 -0500
```

```
Bump version to 3_00_00
```

Multi-threaded event-processing

- *art* 3 supports concurrent processing of events.
 - The number of events to process concurrently is specified by the **number of schedules**
 - The user can optionally specify the number of threads.
- The user *opts in* to concurrent processing.

(nSch, nThr)	Command
(1, 1)	<code>art -c <config> ...</code>
(1, 1)	<code>art -c <config> -j 1 ...</code>
(4, 4)	<code>art -c <config> -j 4 ...</code>
(nproc, nproc)	<code>art -c <config> -j 0 ...</code>
(1, 4)	<code>art -c <config> --nschedules 1 --nthreads 4 ...</code>

- In a grid environment, number of threads is limited to the number of CPUs configured for the HTCondor slot (*art* adjusts the number of threads).

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5/31/18

K. J. Knoepfel | art stakeholders meeting



Guidance moving to *art* 3

- **Solve workflow issues first.**
 - You might have thread-safe modules and services.
 - If you're relying on illegal path configurations, you'll run into product dependency errors.

Recompile/rerun jobs with 1 schedule/1 thread (default)

Add consumes statements to modules (use -M program option for help)

Recompile/rerun jobs with 1 schedule/1 thread and use `--errorOnMissingConsumes`

Recompile/rerun jobs with more than 1 schedule/1 thread

Task-based implementation using Intel Thread Building Blocks (TBB)


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Removing the UPS package system

 Search or jump to... Pull requests Issues Marketplace Explore

JeffersonLab / **art-jlab** Private Unwatch 7 Star 0 Fork 0










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art @ JLab setup tools and support libraries <https://redmine.jlab.org/projects/art...> Edit

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60 commits 1 branch 0 releases 1 contributor

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	Update to cetbuildtools v7_03_03	Latest commit c50ec70 23 days ago
	Update to cetbuildtools v7_03_03	23 days ago
	Update README files	23 days ago
	Patch for range submodule top-level CMakeLists.txt	23 days ago
	Update README files	23 days ago
	ART_SUITE_v2_11_02 sources and first set of patches for JLab environment	24 days ago
	Initial commit	27 days ago
	Update submodules	23 days ago
	Update README files	23 days ago

 README.md

art @ JLab

Tools, scripts and patches for setting up Fermilab's [art](#) event processing framework at JLab.

art successfully passing tests

```
art -- ole@haplita:~ -- bash -- 133x60


Start 555: test_fastclonefail_r.sh ..... Passed 4.47 sec
555/579 Test #555: test_fastclonefail_r.sh ..... Passed 4.47 sec
Start 556: AssnsReaderTest_w1 ..... Passed 2.98 sec
556/579 Test #556: AssnsReaderTest_w1 ..... Passed 2.98 sec
Start 557: AssnsReaderTest_r1 ..... Passed 4.17 sec
557/579 Test #557: AssnsReaderTest_r1 ..... Passed 4.17 sec
Start 558: AssnsReaderTest_w2 ..... Passed 4.44 sec
558/579 Test #558: AssnsReaderTest_w2 ..... Passed 4.44 sec
Start 559: AssnsReaderTest_r2 ..... Passed 4.16 sec
559/579 Test #559: AssnsReaderTest_r2 ..... Passed 4.16 sec
Start 560: AssnsReaderTest_w3 ..... Passed 2.81 sec
560/579 Test #560: AssnsReaderTest_w3 ..... Passed 2.81 sec
Start 561: AssnsReaderTest_r3 ..... Passed 3.75 sec
561/579 Test #561: AssnsReaderTest_r3 ..... Passed 3.75 sec
Start 562: AssnsReaderTest_w4 ..... Passed 3.56 sec
562/579 Test #562: AssnsReaderTest_w4 ..... Passed 3.56 sec
Start 563: AssnsReaderTest_r4 ..... Passed 3.84 sec
563/579 Test #563: AssnsReaderTest_r4 ..... Passed 3.84 sec
Start 564: AssnsReaderTest_w5 ..... Passed 3.67 sec
564/579 Test #564: AssnsReaderTest_w5 ..... Passed 3.67 sec
Start 565: AssnsReaderTest_r5 ..... Passed 3.76 sec
565/579 Test #565: AssnsReaderTest_r5 ..... Passed 3.76 sec
Start 566: AssnsReaderTest_w6 ..... Passed 3.65 sec
566/579 Test #566: AssnsReaderTest_w6 ..... Passed 3.65 sec
Start 567: AssnsReaderTest_r6 ..... Passed 3.38 sec
567/579 Test #567: AssnsReaderTest_r6 ..... Passed 3.38 sec
Start 568: ProcessHistoryRegistry_t ..... Passed 0.38 sec
568/579 Test #568: ProcessHistoryRegistry_t ..... Passed 0.38 sec
Start 569: test_ptmazer ..... Passed 2.30 sec
569/579 Test #569: test_ptmazer ..... Passed 2.30 sec
Start 570: test_ptmazer2 ..... Passed 2.70 sec
570/579 Test #570: test_ptmazer2 ..... Passed 2.70 sec
Start 571: test_ptmazer3 ..... Passed 2.81 sec
571/579 Test #571: test_ptmazer3 ..... Passed 2.81 sec
Start 572: test_ptmazer4 ..... Passed 2.93 sec
572/579 Test #572: test_ptmazer4 ..... Passed 2.93 sec
Start 573: GetReleaseVersion ..... Passed 0.04 sec
573/579 Test #573: GetReleaseVersion ..... Passed 0.04 sec
Start 574: make_tool_t ..... Passed 0.37 sec
574/579 Test #574: make_tool_t ..... Passed 0.37 sec
Start 575: ParameterSet_get_CLHEP_t ..... Passed 0.21 sec
575/579 Test #575: ParameterSet_get_CLHEP_t ..... Passed 0.21 sec
Start 576: pointersEqual_t ..... Passed 0.16 sec
576/579 Test #576: pointersEqual_t ..... Passed 0.16 sec
Start 577: MallocOpts_t ..... Passed 0.16 sec
577/579 Test #577: MallocOpts_t ..... Passed 0.16 sec
Start 578: ScheduleID_t ..... Passed 0.05 sec
578/579 Test #578: ScheduleID_t ..... Passed 0.05 sec
Start 579: parent_path_t ..... Passed 0.14 sec
579/579 Test #579: parent_path_t ..... Passed 0.14 sec

100% tests passed, 0 tests failed out of 579

Label Time Summary:
DEFAULT = 1265.50 sec*proc (577 tests)
LONG = 71.53 sec*proc (2 tests)
RELEASE = 1265.50 sec*proc (577 tests)

Total Test time (real) = 1337.78 sec
mackenzie:art ole$
```

art is lightweight!



```
Develop — ole@rj:~ — -bash — 69x10

mackenzie:Develop ole$ ls ART_v2.11.02/
bin/      include/  lib/      perllib/  share/
mackenzie:Develop ole$ du -sh ART_v2.11.02/
39M      ART_v2.11.02/
mackenzie:Develop ole$
```

Need to install separately (sizes for macOS/Homebrew):

- ROOT (350 MB)
- Boost (475 MB)
- Misc. small dependencies

art Workbook Example Run

```
art-workbook — ole@rj:~ — -bash — 95x35
mackenzie:art-workbook ole$ art --version
art 2.11.02
mackenzie:art-workbook ole$ art -c fcl/IterativeAlgDevel/iterV1.fcl
%MSG-e duplicateDestination:

=====

Duplicate name for a MessageLogger Statistics destination: "cout"
Only original configuration instructions are used.

=====

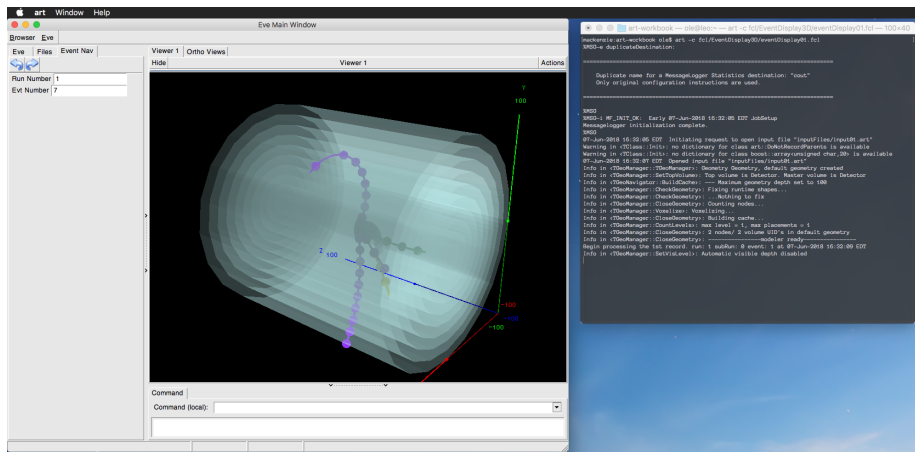
%MSG
%MSG-i MF_INIT_OK: Early 07-Jun-2018 17:56:50 EDT JobSetup
MessageLogger initialization complete.
%MSG
07-Jun-2018 17:56:50 EDT Initiating request to open input file "inputFiles/input04.art"
Warning in <TClass::Init>: no dictionary for class art::DoNotRecordParents is available
Warning in <TClass::Init>: no dictionary for class boost::array<unsigned char,20> is available
07-Jun-2018 17:56:51 EDT Opened input file "inputFiles/input04.art"
Begin processing the 1st record. run: 4 subRun: 0 event: 1 at 07-Jun-2018 17:56:51 EDT
Begin processing the 201st record. run: 4 subRun: 0 event: 201 at 07-Jun-2018 17:56:52 EDT
Begin processing the 401st record. run: 4 subRun: 0 event: 401 at 07-Jun-2018 17:56:52 EDT
Begin processing the 601st record. run: 4 subRun: 0 event: 601 at 07-Jun-2018 17:56:52 EDT
Begin processing the 801st record. run: 4 subRun: 0 event: 801 at 07-Jun-2018 17:56:52 EDT
07-Jun-2018 17:56:52 EDT Closed input file "inputFiles/input04.art"

TrigReport ----- Event Summary -----
TrigReport Events total = 1000 passed = 1000 failed = 0

TimeReport ----- Time Summary ---[sec]----
TimeReport CPU = 0.330646 Real = 0.388834

Art has completed and will exit with status 0.
mackenzie:art-workbook ole$
```

art "Toy Experiment" Event Display



Next Steps

- Finish *art-jlab* wrapper package (setup scripts, documentation)
- User SDK
- Begin developing **data model**
- Move to *art 3* once the dust settles

Recall: SoLID Software Effort Estimate

https://hallaweb.jlab.org/12GeV/SoLID/download/doc/Estimated_SoLID_Offline_Effort.xlsx

26	Digitization testing		20	
27	DAQ/Trigger emulation	JLab	16	
28	Framework integration	JLab	8	
29	Code testing/QA		6	
30	Activities coordination	Duke	12	
31				
32	Subtotal Simulations			144
33				
34	Reconstruction			
35	Framework	JLab		
36	Build system		3	
37	ROOT tree output module		6	
38	Multi-threading		12	
39	Distributed architecture		12	
40	Documentation		16	
41	Database API & integration	JLab		
42	Geometry		4	
43	Conditions		4	
44	Mapping		2	
45	Requirements determination	JLab		
46	Data model	JLab	4	
47	Tracking	Duke, JLab		
48	GEM cluster analysis		6	
49	GEM track finding SIDIS, J/Psi		24	
50	GEM track finding PVDIS		12	
51	GEM track fitting		8	
52	Calorimeter cluster finding	UVA, JLab	8	
53	Cherenkov amplitude analysis		2	
54	MRPC ToF analysis		2	
55	Overall PID framework	JLab	4	
56	Event display	JLab	8	
57	EVIO raw data decoder	JLab	12	
58	Slow Controls integration	JLab	16	
59	Testing/QA	JLab	36	
60	Activities coordination	JLab	12	
61				
62	Subtotal Reconstruction			213
63				

- 25% contingency
- 75% “developer efficiency”

98				
99	Sum			586
100				
101	Contingency	25%		147
102				
103	Sum with contingency			733
104	Developer efficiency	75%		
105	(overhead for training			
106	and collecting requirements)			
107	Overhead from efficiency			244
108				
109	Total estimated effort			977
110				
111				

Total: **977 FTE-weeks!** → more collaborators very welcome

Redmine Project Management

<https://redmine.jlab.org/projects/art-jlab>

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✓ #	Tracker	Status	Priority	Subject	Updated	% Done	Estimated time	Spent time
<input type="checkbox"/> 92	Feature	In Progress	Normal	Remove build system dependence on UPS	05/17/2018 10:29 PM	<div></div>	160.00	0
<input type="checkbox"/> 93	Task	In Progress	Normal	» Research cetbuildtools	05/04/2018 09:59 PM	<div></div>	40.00	22.00
<input type="checkbox"/> 94	Feature	In Progress	Normal	» Modify cetbuildtools	05/17/2018 10:13 PM	<div></div>	64.00	26.50
<input type="checkbox"/> 95	Feature	Resolved	Normal	» Build cetlib	05/17/2018 09:33 PM	<div></div>	16.00	27.00
<input type="checkbox"/> 96	Feature	Resolved	Normal	» Build fhiccpp	05/17/2018 09:36 PM	<div></div>	8.00	12.00
<input type="checkbox"/> 97	Feature	Resolved	Normal	» Build messagefacility	05/17/2018 09:36 PM	<div></div>	8.00	1.00
<input type="checkbox"/> 98	Feature	Resolved	Normal	» Build canvas	05/17/2018 09:37 PM	<div></div>	8.00	4.00
<input type="checkbox"/> 99	Feature	In Progress	Normal	» Build art	05/25/2018 03:16 PM	<div></div>	16.00	4.00
<input type="checkbox"/> 100	Feature	New	Normal	art module SDK	05/22/2017 11:36 AM	<div></div>	40.00	0
<input type="checkbox"/> 101	Feature	New	Normal	ROOT ntuple output module	05/22/2017 04:53 PM	<div></div>	320.00	0
<input type="checkbox"/> 131	Feature	New	Normal	art package system	05/17/2018 10:52 PM	<div></div>	105.00	1.00
<input type="checkbox"/> 132	Feature	New	Normal	Geometry service	05/22/2017 05:14 PM	<div></div>	470.00	0
<input type="checkbox"/> 133	Feature	New	Normal	» Geometry backend research	05/22/2017 05:11 PM	<div></div>	210.00	0
<input type="checkbox"/> 134	Feature	New	Normal	» Geometry backend implementation	05/22/2017 05:12 PM	<div></div>	210.00	0
<input type="checkbox"/> 135	Feature	New	Normal	» Geometry service module	05/22/2017 05:14 PM	<div></div>	50.00	0
<input type="checkbox"/> 136	Feature	New	Normal	Conditions service	05/24/2017 09:40 AM	<div></div>	265.00	0
<input type="checkbox"/> 137	Feature	New	Normal	» Conditions service module	05/22/2017 05:19 PM	<div></div>	105.00	0
<input type="checkbox"/> 138	Feature	New	Normal	» Conditions service backend	05/24/2017 09:41 AM	<div></div>	160.00	0
<input type="checkbox"/> 351	Task	In Progress	Normal	Project version control, bookkeeping	05/17/2018 09:24 PM	<div></div>	80.00	9.00
<input type="checkbox"/> 352	Bug	New	Low	FHICL Python module does not load	05/17/2018 10:08 PM	<div></div>	4.00	0
<input type="checkbox"/> 353	Bug	New	Normal	cetskelgen throws Perl warnings on macOS	05/17/2018 10:37 PM	<div></div>	2.00	0

Issues

[View all issues](#)

[Summary](#)

[Gantt](#)

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Summary

- *art* continues to be under active development at Fermilab
- Very first version of **multi-threaded *art*** just released. This eliminates our primary concern about this framework
- Successfully built *art* without the cumbersome **UPS package system**, resulting in a very lightweight installation
- Development of a **user-friendly setup** at JLab (or elsewhere) underway. Once done, will move to developing **application code for SoLID**