

Hall A Analysis Software Status & Plans

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Hall A Collaboration Meeting
January 31, 2020

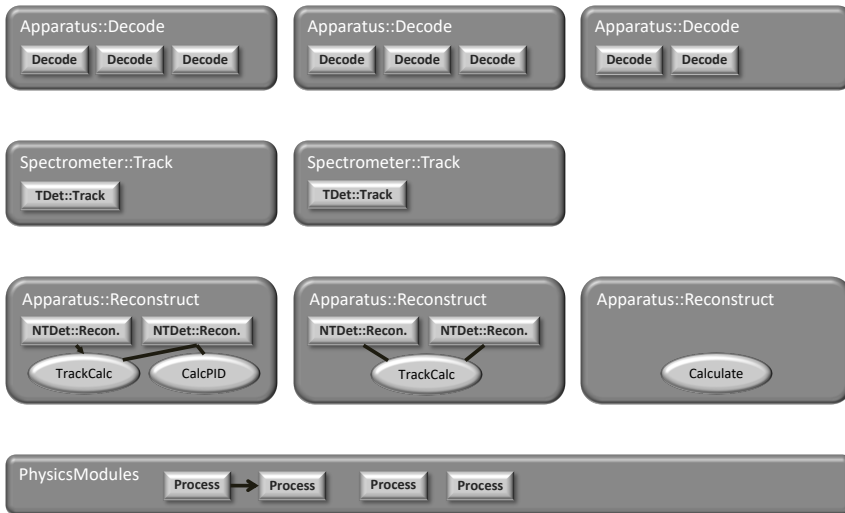
Podd Status

- Current release: **1.7.0** (7 Feb 2020)
 - ▶ Many updates and new features (see next page)
 - ▶ Requires C++11 compiler (RHEL 7)
 - ▶ Drops support for obsolete ROOT 5
- Priority development: **2.0-devel**
 - ▶ **Multithreading**
 - ▶ Intended for SBS
 - ▶ Will require C++17 (e.g. RHEL 8, devtoolset-8, llvm-toolset-7.0)
 - ▶ Existing code will likely need minor modifications
 - ▶ ETA: Summer/Fall 2020
- Auxiliary development: **1.8-devel**
 - ▶ Include features missed in 1.7 (see later)
 - ▶ Maintain system requirements and API of version 1.7 as much as possible
 - ▶ ETA: as time permits

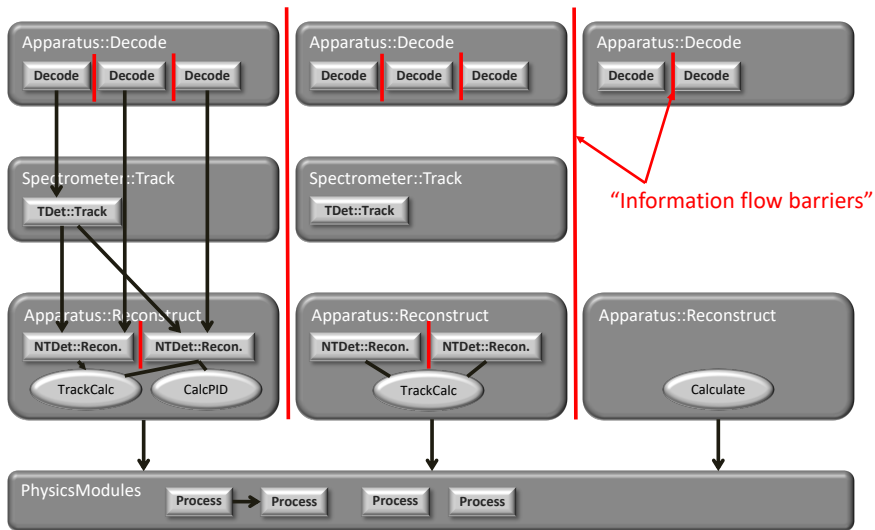
New in Podd 1.7

- Decoder upgrades
 - ▶ Support for CODA 3 data format, bank data and **event block decoding** (Bob Michaels)
 - ▶ **EVIO** upgraded to **version 5.2** (better I/O performance and many bugfixes)
 - ▶ Includes FADC decoders developed for Tritium experiments
- New module type: “InterStageModule”
 - ▶ May combine information from arbitrary detectors after each processing stage
 - ▶ Needed for coincidence time correction in Tritium $\Lambda\Lambda$
 - ▶ Removes a significant limitation of Podd; many other possible uses
- Build system overhaul
 - ▶ **CMake build system** added (used by SBS, for example)
 - ▶ SCons build system significantly improved (used by hcana)
 - ▶ Old make system removed
- Extensive code cleanup & reorganization
 - ▶ Libraries split into core and Hall A parts: `libPodd` and `libHallA`

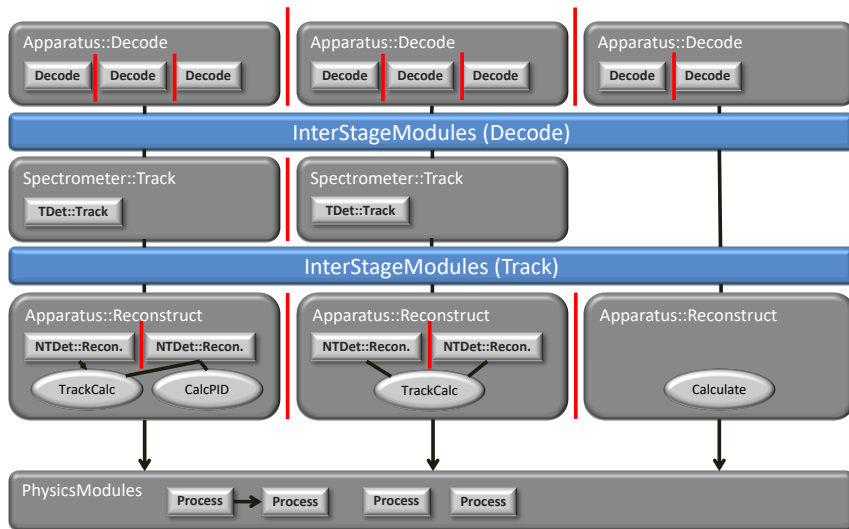
Inter-Stage Modules



Inter-Stage Modules



Inter-Stage Modules



Building with CMake

Prerequisites:

- Install ROOT (root-config should be in PATH, or set \$ROOTSYS)
 - ▶ Farm: run setroot_CUE.csh. RHEL: install from EPEL. macOS: install from Homebrew.
 - ▶ See also https://redmine.jlab.org/projects/podd/wiki/ROOT_Installation_Guide
- Ensure you have CMake ≥ 3.5 (cmake --version. cmake3 on RedHat)

Building the Hall A analyzer with CMake

```
$ git clone https://github.com/JeffersonLab/analyzer.git
$ cd analyzer && mkdir build && cd build
$ cmake ..
$ make [-j4]
$ ./apps/analyzer
```

Notes:

- Installing recommended (make install): Set CMAKE_INSTALL_PREFIX
- For debug build, set CMAKE_BUILD_TYPE
- Works with common IDEs (Eclipse, CLion, Xcode)
- Will phase out aging SCons build system (too many limitations)

SBS Software Status & Plans

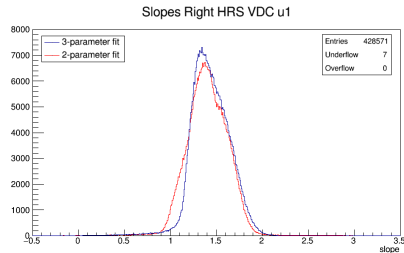
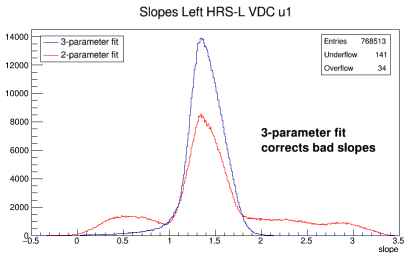
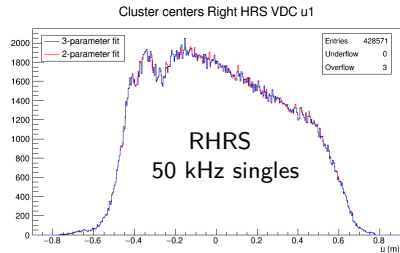
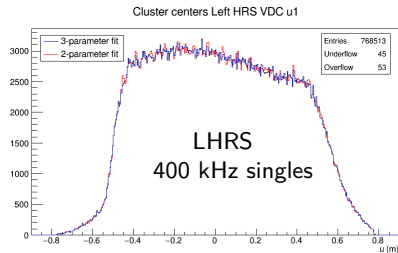
- SBS plan to use Podd framework. Anticipate to have multithreading available
- Standalone simulation well developed (g4sbs)
- **Reconstruction library** underway: <https://github.com/JeffersonLab/SBS-offline>
 - ▶ Decoders implemented for all subsystems
 - ▶ Optics & spin transport models done
 - ▶ **GEM cluster finding & tracking under development** (main challenge!)
 - ▶ Later: event display, online analysis
- Data handling will be challenging (by Hall A standards)
 - ▶ Raw data rates **several GB/s**. Will need preprocessing
 - ▶ Storage **200–1300 TB per experiment** (sim+raw+prod) (4+ planned).
Please check/update!
 - ▶ Simulation and analysis CPU requirements **1–4 M-core-hours (MCH) per experiment**
 - ▶ Hall A farm quota is currently 6 MCH/year (5% of farm), probably need to double

- Event-based parallelization/**multithreading**
 - ▶ Essential for SBS online replay
 - ▶ Reduced memory footprint compared to multiple individual jobs
 - ▶ Requires **thread safe** user code (→ no globals, statics)
- I/O improvements
 - ▶ Output system upgrade (full set of data types, object variables)
 - ▶ TBD: **HIPO** output file format support
 - ▶ TBD: **EVIO 6** input format support (HIPO-like raw data files)

Lower-Priority Features → Podd 1.8 (or 2.1)

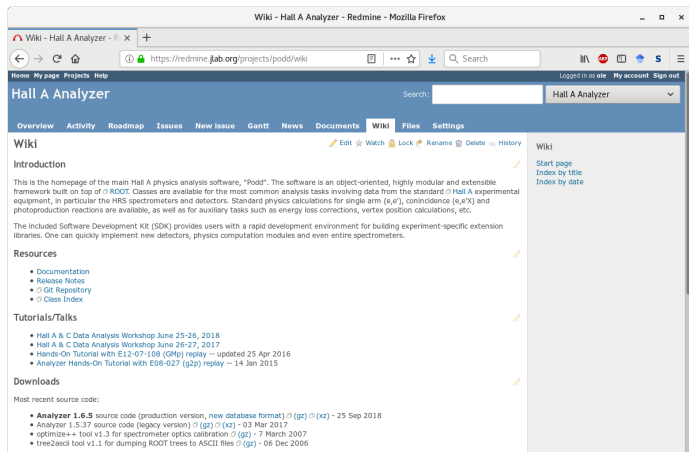
- High-rate VDC analysis (useful mainly for APEX)
- Abstracted database API
 - ▶ Lets hcana reuse Podd database readers
 - ▶ Allows easy integration of other backends (e.g. ccdb)
- “Nice to have” items
 - ▶ Test suite (unit & integration tests)
 - ▶ Analysis metadata (configuration parameters, source & replay information)
 - ▶ Improved log messages (readability, configuration, logfile, etc.)
 - ▶ Containerized distribution

VDC Cluster Analysis—2-Parameter vs. 3-Parameter Fit



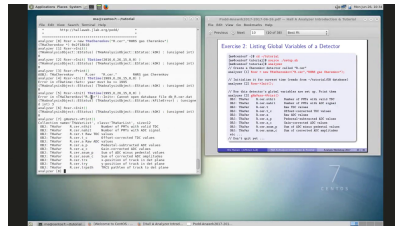
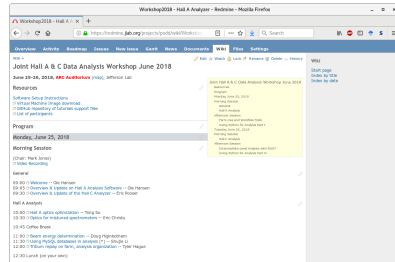
Project Home: Redmine Wiki

- <https://redmine.jlab.org/projects/podd/wiki/>
- Integrated wiki, **bug tracker**, document database and more
- *hcana* docs on Hall C wiki



Good Starting Point for New Users: Analysis Workshops 2017/2018

- Workshop pages linked on main wiki
- **Joint Hall A & C** analysis workshops in summers 2017 & 2018
- Live **hands-on tutorials**, using preconfigured virtual machine environment
- Simulation, calibration, on- & offline data analysis, ROOT basics, etc.
- BlueJeans **recordings** available (linked on workshop page, CUE login required)



Next Analysis Workshop: Survey Results

Results of last summer's survey re next analysis workshop:

- Only 13 responses :-(
- Average/median experience level: 6.25/6.50 (scale 0–10)

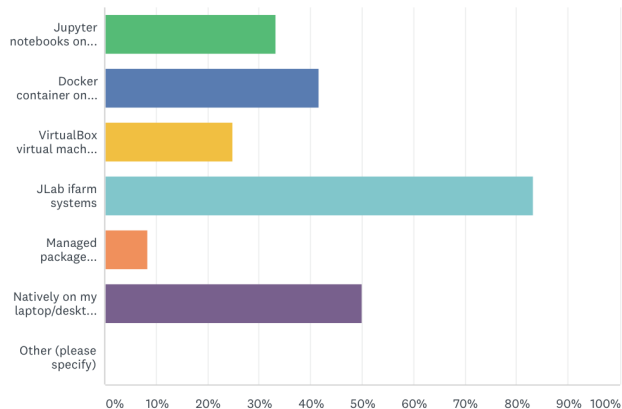
Topics:

	1	2	3	4	5	Score
Advanced ROOT	1		4	5	6	3.94
Hall A simulations	1	2	2	4	4	3.62
Analysis in Python		2	5	3	3	3.54
Cross section analysis	1	2	2	5	3	3.54
Hall C simulations	1	2	4	3	3	3.38
Batch farm usage	1	3	3	3	3	3.31
Example analyses	1	5	1	2	4	3.23
Plugin modules	1	4	3	2	3	3.15
Replay scripts	1	5	2	2	3	3.08
Optics optimization	3		6	1	3	3.08
Counting house computing	3	3	2	2	3	2.92
Detector calibration	3	1	5	2	2	2.92
Asymmetry analysis	3	2	2	5	1	2.92
Intermediate ROOT	3	3	7			2.31
Basic ROOT	7	5			1	1.69

Next Analysis Workshop: Computing Environment

In which environment would you like to run interactive exercises, example programs, etc.? Please check one or two options that you think would work best for you.

Answered: 12 Skipped: 1



Scientific Computing Update: Hall A /volatile Disk Move

- We have a bigger, faster, meaner Lustre file system for /volatile and /cache!
- Hall A /volatile allocation will be doubled,
- Halls B have already migrated
- rsync of Hall A data currently in progress
- **Switchover** probably **Tuesday (4-Feb)**, along with Hall D
- Source data kept under /volatile/halla-old for ≈ 1 week
- **Please do not create a lot of new data on /volatile at this time!** Postpone new production replays on the farm until after the switchover.

Summary

- Hall A analysis software continues to be used by current experiments, is **actively maintained** and continually upgraded
- Significant development work (multithreading etc.) underway for **SBS**
- Many **learning resources**, documentation and examples can be found our archived recent analysis workshops.
- The next analysis workshop is planned for this summer
- More disk space (at least 2x) for farm jobs will be available very shortly