

# *CET Multicore Framework Status*

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## *CET “retreat”*

The entire CET group spent four days working on the DAQ project based on Darkside-50, mentioned in my previous workshop talk.

The program includes use of MPI and OpenMP parallelism.

- MPI processes of three types: (1) to simulate detector, (2) to accept event fragments and forward them to the event builder, and (3) to build events and process them with **art**.
- Event builder process runs multiple threads: (1) receives MPI messages and enters events into an event pool (2) runs the **art** main function, notably the `EventProcessor` and input.
- In one version, **art** is single-Schedule but runs modules parallelised with OpenMP; in a second version **art** runs multiple Schedules, using an OpenMP task to process each event.

We also met with reps from Intel, to discuss CnC. We found nothing to change our current plan of action.

## Status

- We had to bring up 6 newly-delivered development and testing machines.
- We established our use-cases for benchmarking and comparisons.
- We found a critical bug in glibc 2.12 (used in SL6), involving interaction between `dlopen` and thread-local storage. Use of OpenMP and `dlopen` thus causes failures. We've had to use SLF5 machines (with glibc 2.5) for our development work.
- We have implemented a stand-alone Huffman compression algorithm, tuned for the DarkSide50 data, obtaining  $\times 5$  compression and a rate of about 280 Hz. Will report more when we have this algorithm integrated into **art**. We also have two other table-based candidate algorithms in preliminary implementations (pod and sub-exponential algorithms).

## *Status (continued)*

- All building done with `cetbuildtools` and made into UPS products.
- Most of the pieces for communication between the “MPI thread” and the “**art** thread” are in place, but they need integration.
- We’ve started to address thread safety in multi-Schedule **art**; verified the important `EventProcessor` state machine is not involved with Schedules’ state.
- We have plans in place for working around lack of thread-safety in Root dictionaries.
- Presented our plans for use of parallel **art** in triggering at NOvA DDT meeting.
- We have all relevant infrastructure built with C++11 (GCC 4.6.1 using `-std=c++0x`). We have been taking advantage of new C++ features (lambda expressions, `unique_ptr`, assuming use of r-value references, `constexpr`, and `auto`).