



Jefferson Lab



ECal Software; Set up, Monitoring and Calibration

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HPS Software Review
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Outline

- Introduction
- Software Tasks, Assignments and Schedule
- Monitoring
- Calibration
- Recent Progress
- Summary and Outlook

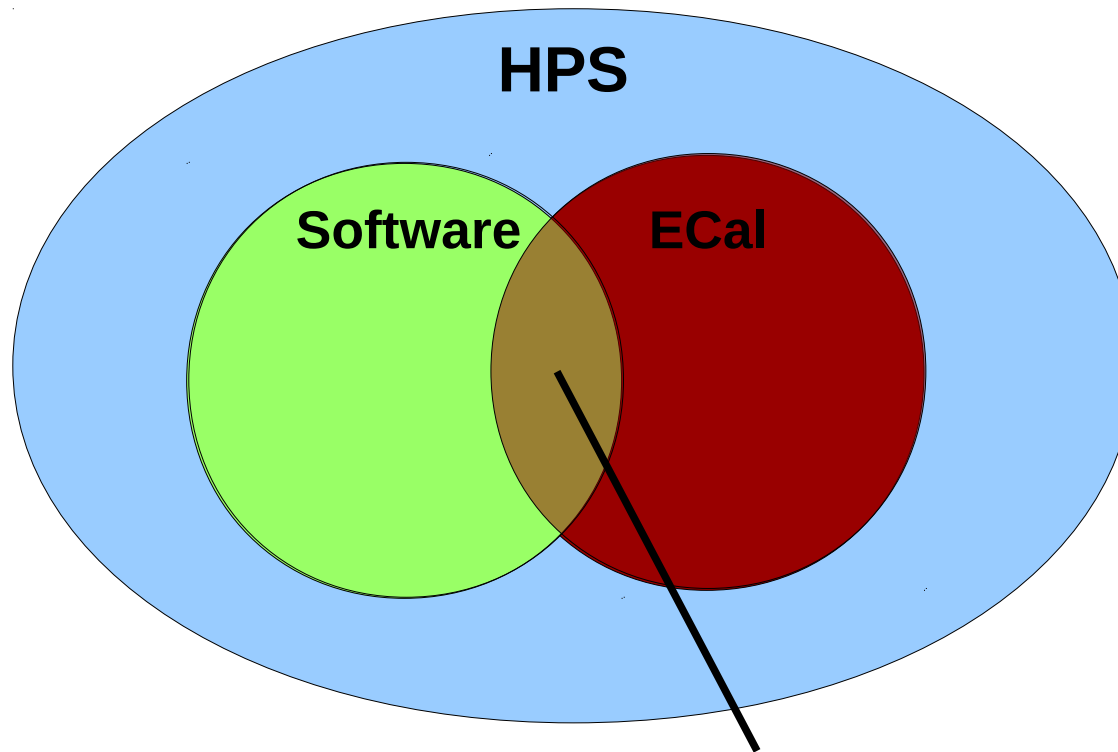


Introduction

- Significant recent efforts in the organisation of the ECal software project
- Aided by a moderate influx of new collaborators in the final months of 2013
- An ECal software co-ordinator was recently appointed (me), as part of efforts towards the ECal group taking on responsibility for the simulation and reconstruction toolchain
- From these steps, the plan is to have all necessary components in place and tested in time for installation

Scope

- What do we mean by ECal software?



“ECal software” covers software activities relating to the simulation, reconstruction, monitoring, calibration and triggering of the HPS ECal



ECal Software Tasks

- Step 0 – identify tasks coming under the remit of ECal software
- List not exhaustive, shown here for guidance
 - Simulation
 - GEANT4 geometry updates
 - Digitization and electronic noise
 - Production of data for the group
 - Maximum energy in a crystal
 - Reconstruction
 - Testing cluster algorithms
 - Evaluate sampling fraction
 - Cluster position corrections, for electron, photon and positron
 - Cluster timing
 - Cluster pattern
 - Matching with tracking
 - Verify clustering algorithms
 - Study different clustering algorithms



ECal Software Tasks (cont.)

- Monitoring
 - Light monitoring system and software
 - Occupancy and rates
- Calibration
 - Track based calibration
 - π^0 reconstruction
 - Cosmic triggering and calibration
 - Single electron scattering
 - Position corrections
- Trigger Studies
 - Understanding trigger algorithms at board and crate level
 - Rates of physical noise
 - Algorithm optimization
- Online Software
 - Trigger monitoring
 - ECal data quality check



ECal Software Tasks

- Step 1 – Task assignments
- Final assignments in progress
 - Simulation
 - GEANT4 geometry updates – Daria Sokhan (Glasgow)
 - Digitization and electronic noise – Gabriel Charles (IPN Orsay)
 - Production of data for the group – Gabriel Charles (IPN Orsay)
 - Maximum energy in a crystal
 - Reconstruction
 - Testing cluster algorithms – Kyle McCarty (UNH)
 - Evaluate sampling fraction – Stuart Fegan (INFN Ge)
 - Cluster position corrections, for electron, photon and positron
 - Cluster timing
 - Cluster pattern
 - Matching with tracking
 - Verify clustering algorithms – Kyle McCarty (UNH)
 - Study different clustering algorithms – Holly Vance



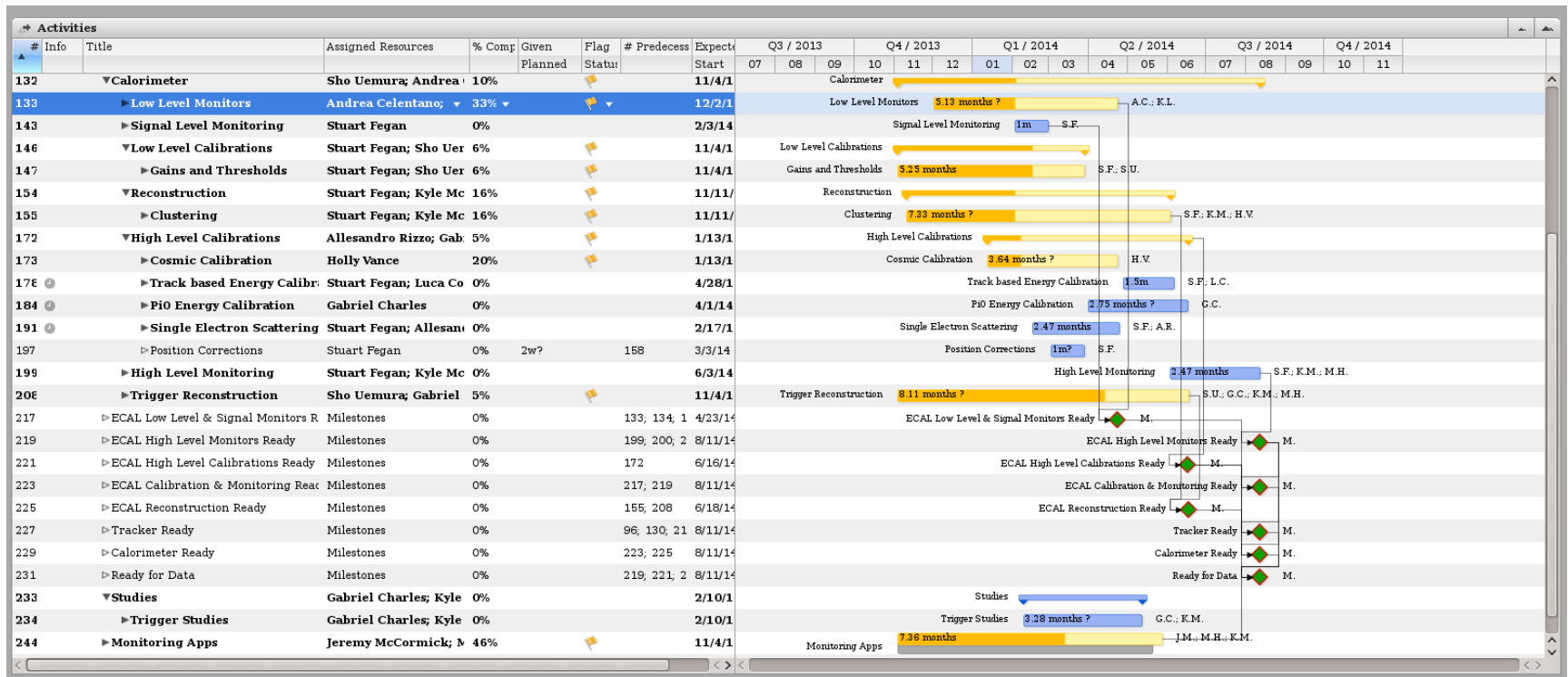
ECal Software Tasks (cont.)

- Monitoring
 - Light monitoring system and software – Andrea Celentano (INFN Ge)
 - Occupancy and rates – Andrea Celentano (INFN Ge)
- Calibration
 - Track based calibration – (INFN Ro2)
 - π^0 reconstruction – Gabriel Charles (IPN Orsay)
 - Cosmic triggering and calibration – Holly Vance
 - Single electron scattering – (INFN Ro2)
 - Position corrections
- Trigger Studies – K. McCarty & G. Charles
 - Understanding trigger algorithms at board and crate level
 - Rates of physical noise
 - Algorithm optimization
- Online Software
 - Trigger monitoring – Kyle McCarty (UNH)
 - ECal data quality check



Schedule

- Several tasks already well under way, or completed
- More details available in the software schedule





Monitoring

Light monitoring system

Motivations for a light monitoring system in the HPS ECal

1) During debugging, it is critical to switch on/off channels independently for debugging.

- Test the correct functionality of all APDs / amplifiers.
- Check all the electronic channels.
- Verify correct cabling.
- The system provides a fast **pre-equalization** during in-lab commissioning, both for energy and timing, before real **calibration** with physics is performed.

2) During operations, the system can measure fluctuations in the ECAL components.

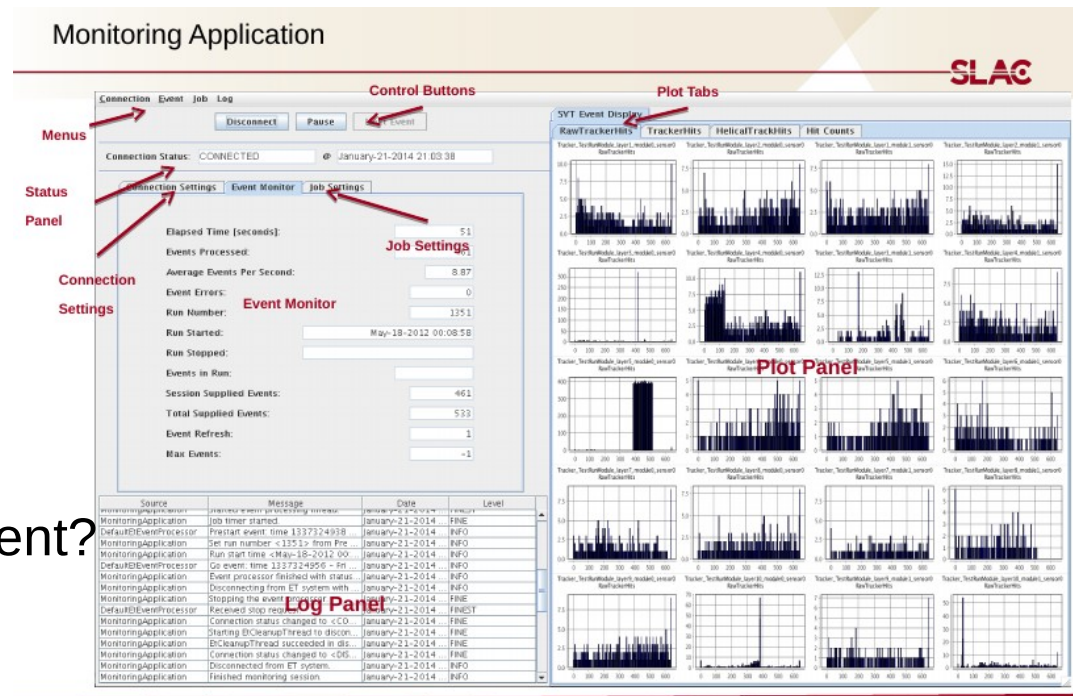
- PbWO_4 crystals are radiation-sensitive, light transmission lowers resulting in effective LY loss.
- Such a process is non-uniform in the ECal, due to the different irradiation in each crystal.
- Crystals response needs to be monitored continuously and, if necessary, re-equalized.
- Possible APDs gain variation during time needs to be under control.

3) The system can be used for crystals annealing, to recover the radiation damage

A. Celentano, talk last week at HPS collaboration meeting

Monitoring

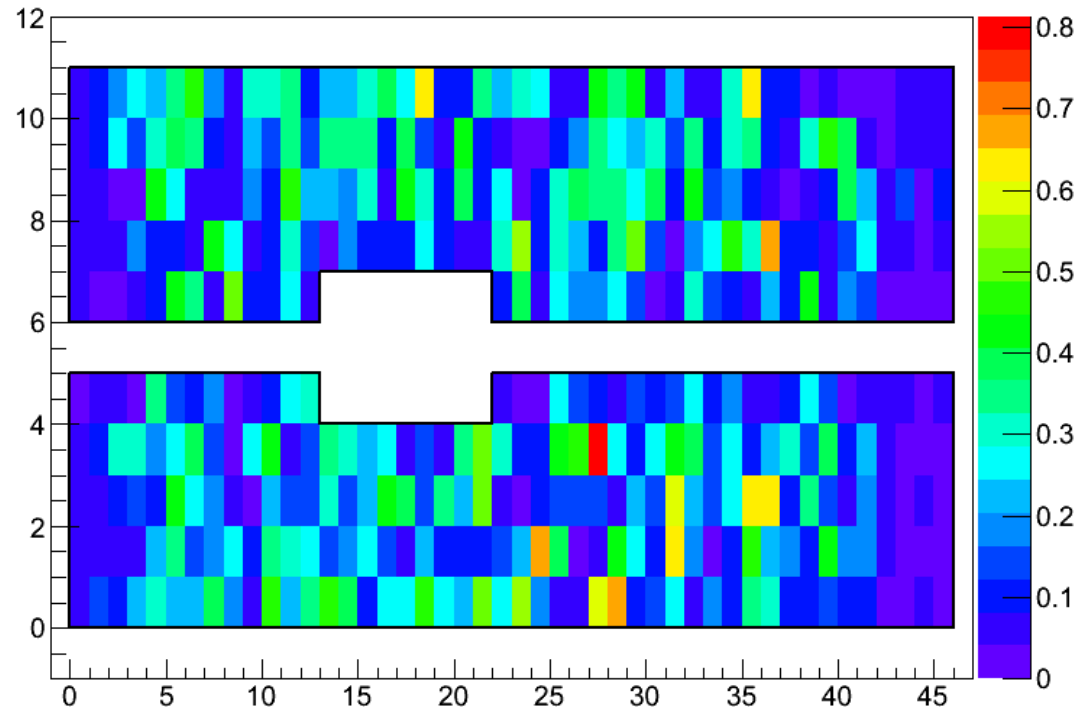
- LED system forms part of the low level monitoring, and will provide pre-calibration equalisation of ECal channels
- Mostly complete, save final EPICS integration and user front-end
- Higher level monitoring is separate to this, and covers quality of cluster data, monitoring of energy resolution, and trigger monitoring
- Monitoring application should be a useful start to these tasks
- Event display;
 - wired/JAS3?
 - Something independent?



Calibration

- Step zero of calibration process, production of sample data, already in place
- Basic tools available for handling this data

Average energy deposition



- Next step: clustering



Software Workshop

- Several collaborators involved in ECal software are attending the software workshop this week
- An ideal opportunity to push ECal software forward, and disseminate knowledge on HPS software back to our respective groups
- This will be particularly useful for those of us in Europe where the time difference with experts here can be frustrating.



Summary and Outlook

- The attention of the ECal group is now turning to ensuring that the required software will be ready and available in time for experimental running
- The management framework is in place for effective communication between the ECal software project and the wider HPS software and ECal groups
- Tasks and scheduling are coming together, with a few tasks remaining to be assigned to willing collaborators
- Ready to push on and redouble our efforts for the challenges ahead