



# DAQ system and hardware status

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# Outline

- System overview and recent progress
- Individual (hardware) component status and functionality
- Numbers of each component and availability
- Schedule to completion of DAQ system
- (Not discussing software here, see Valeria's talk)

# DAQ system overview

**(Detector Unit: ASICs)**

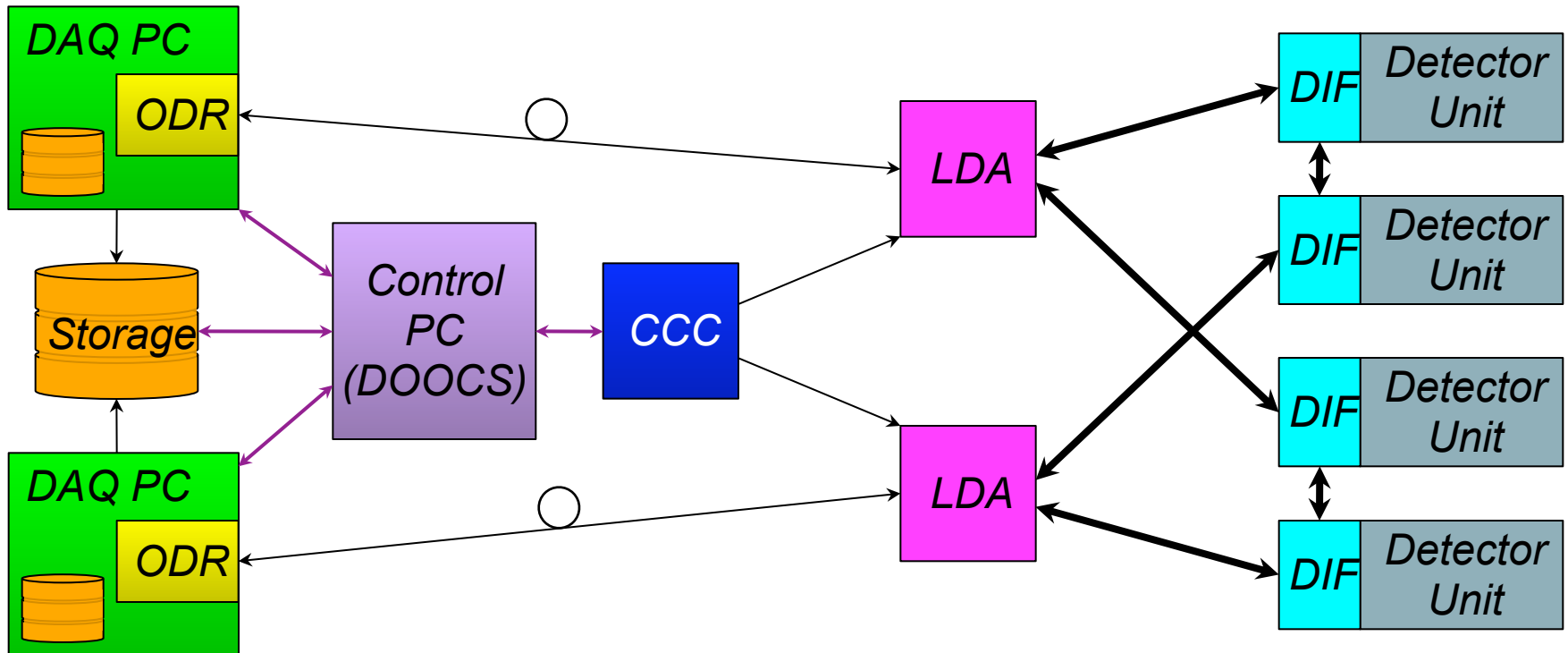
**DIF:** Detector InterFace connects generic DAQ and services

**LDA:** Link/Data Aggregator fansout/in DIFs and drives links to ODR

**ODR:** Off-Detector Receiver is PC interface

**CCC:** Clock and Control Card fans out to ODRs (or LDAs)

**Control PC:** Using DOOCS



# Overall status—progress since DESY meeting

Have been concentrating on :

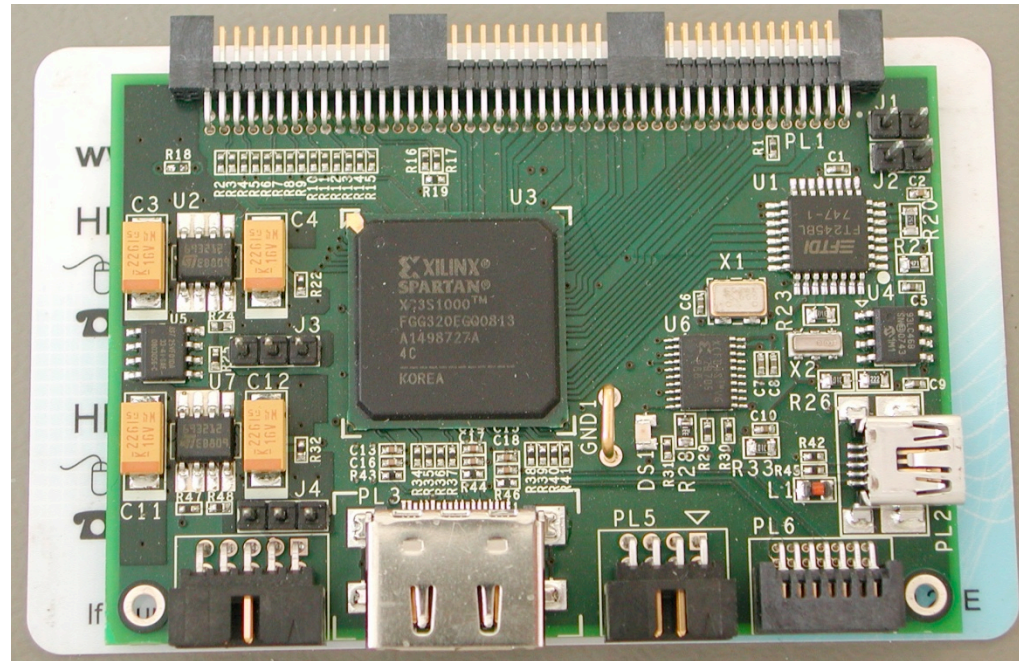
- firmware improvements and finalisation;
- final hardware tweaks and production versions of relevant components;
- hardware orders to have enough systems available for lab and beam tests;
- having (parts of) system available now to detector groups;
- acting on feedback from detector groups;
- further addition of documentation put on the CALICE twiki;
- DAQ component integration.

We need to (according to EUDET) have a working system by June 2009; it would be good for the detectors for the DAQ system to be available asap; we want to get a working system done asap and passed onto detector groups.

# ECAL DIF

The ECAL DIF is being developed by the Cambridge group :

- AHCAL and DHCAL DIFs developed by other groups, but all within the DIF task force;
- involves board design and manufacture and firmware development.
- produced a prototype board which worked well, one in use at LLR. Have reduced number of components, whilst maintaining functionality (e.g. FPGA).
- two DIFs have been produced and were powered up.
- firmware is now being ported for extensive testing.
- can then produce full run of 40 ECAL DIFs—all PCBs and components in-house.
- Stable version of firmware for DAQ tests.
- Tested using pseudo-LDA, now ongoing with real LDA.
- Updated according to proposed data format within the DIF task force.

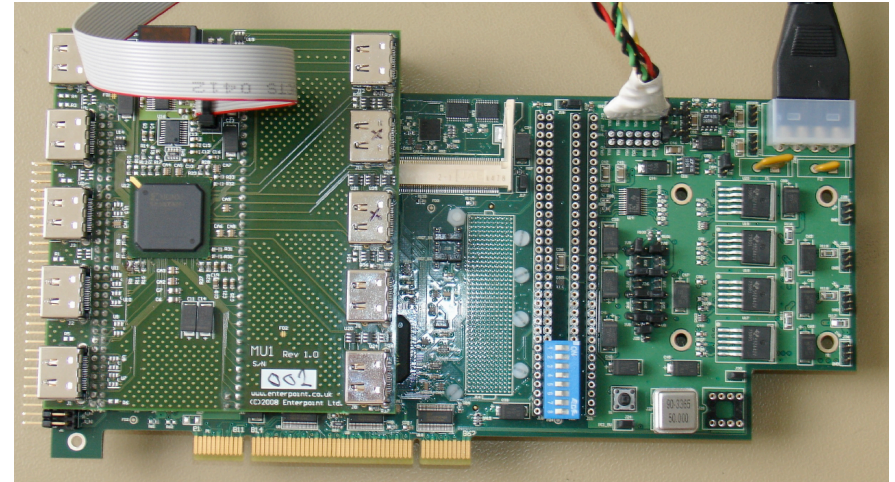
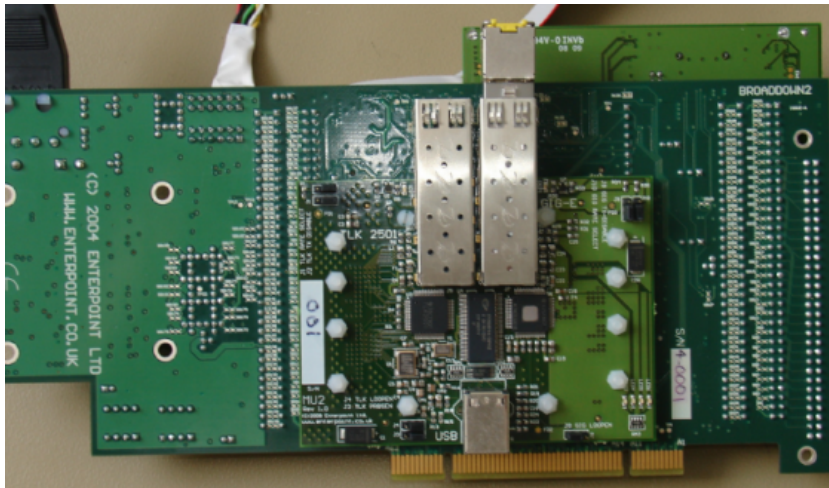


# LDA

Recall the LDA hardware, from Enterpoint, consists of :

- a (Broaddown2 → Mulldonoch2) baseboard;
- an add-on HDMI board to connect to 10 DIFs;
- an add-on ethernet board to connect to an ODR.

So this is an example of commercially-available, off-the-shelf equipment ... all of which needed some corrections/additions/modifications from ourselves...



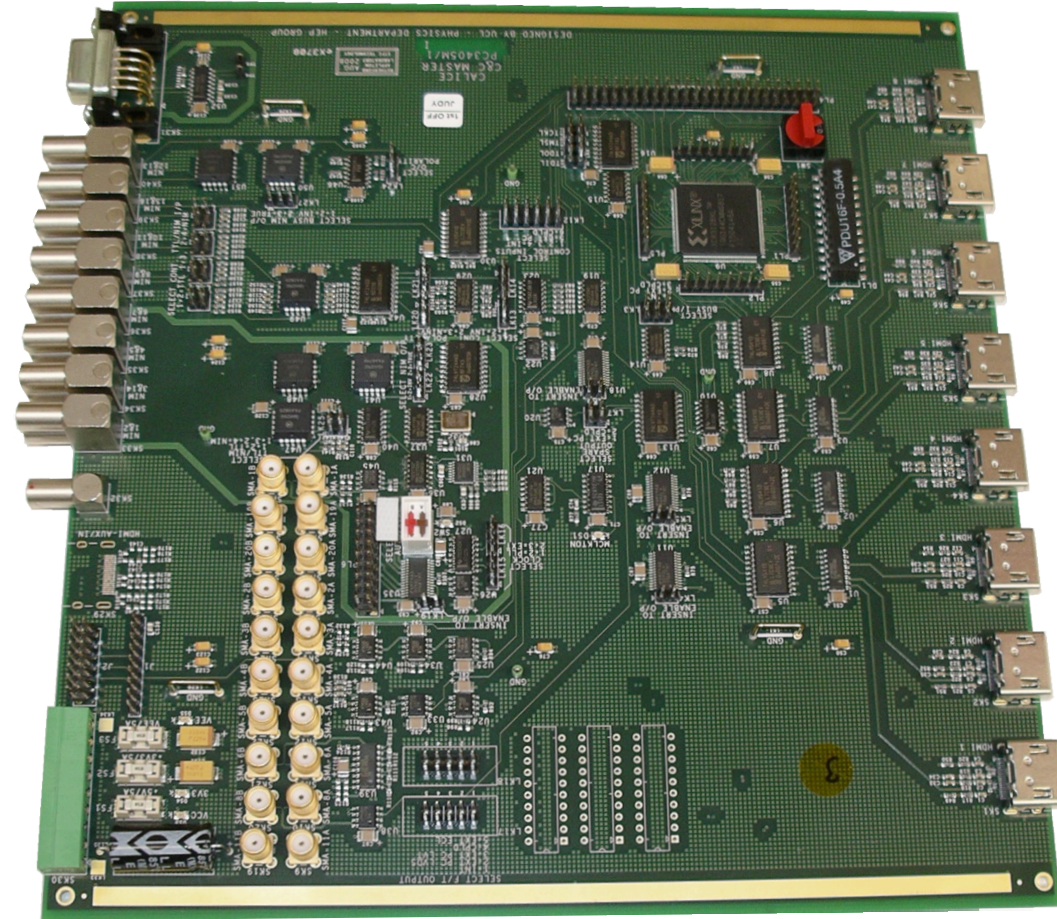
- Have 20 baseboards in-house ready for use;
- Have 5 ethernet boards in-house ready for use, with 15 being manufactured;
- Have 5 HDMI boards in-house which can be used, with 20 (AC coupled) being manufactured.

# LDA firmware

- Firmware and software development continued whilst hardware issues were being sorted out.
- A **LODDAR** was developed which made an ODR “look” like an LDA :
  - This could verify the basic firmware functionality;
  - Not a complete test as specs not exactly the same;
  - But could establish path in both directions.
- Now with real LDAs, testing communication with the DIF.
- As the LDA is in the middle, its readiness has been crucial in allowing full system tests to be started.
- See more later ...
- Getting some ready for distribution to detector groups.

# CCC

- After building and testing two prototypes, had a further eight manufactured.
- Now have five working and tested CCCs all boxed up with power supplies, etc.
- One has been in use at LLR.
- Problem found (at LLR), the serial interface clock changes when you would hope it to be stable.
- Simple hardware modification to all boards.
- Extensive documentation and manual being twiki'ed.
- Available for use by detector groups.





## ODR and DAQ PC

- System has generally been stable for a while : firmware written, linked to DOOCS, talk to an LDA emulator and a LODDAR, etc..
- Had problems with different versions of boards—essentially the same Virtex4 boards, with small modifications V1 → V2.
- Everything was stable on V1 for a long time, but could not get firmware to work on V2 boards and eventually traced down to faulty boards.
- Have received replacement V2 boards and all works fine.
- Now have 3 V1 and 2 V2 boards working and have ordered three more V2 boards (expect in a couple of weeks). It would be nice to have all V2s...
- Have three DAQ PCs with raid arrays and in process of building up three more with smaller disks for small-scale tests.

# Hardware numbers needed

Detectors' requirements :

- ECAL : 30 layers  $\Rightarrow$  30 DIFs, 3 LDAs, 1 ODR and DAQ PC, with 1 CCC
- AHCAL : 48 layers  $\Rightarrow$  (48 DIFs), 5 LDAs, 2 ODRs and 1 DAQ PC, with 1 CCC
- DHCAL : 40 layers  $\Rightarrow$  (40 DIFs), 4 LDAs, 1 ODR and DAQ PC, with 1 CCC

In general DAQ groups have to provide :

- 30 ECAL DIFs, 12 LDAs, 4 ODRs, 3 DAQ PCs, 3 CCCs;
- sufficient spares for test-beam running;
- additional systems for tests in labs.

Our procurement plan is :

- 40 ECAL DIFs
- 20 LDAs
- 8 ODRs and 8 DAQ PCs
- 10 CCCs

# Hardware in-house

- 40 ECAL DIFs :
  - All components and PCBs in-house for full complement of production DIFs;
  - Building and testing 2 (1 for LLR tests who have a prototype DIF) of them before doing production run;
- 20 LDAs :
  - Have 5 full LDAs in house—baseboards, ethernet (to ODR) and HDMI boards (to DIF);
  - Have all 20 baseboards in-house;
  - Ethernet boards (few weeks) and HDMI boards (1–2 months) on order;
- 8 ODRs and 8 DAQ PCs :
  - 5 ODRs (3 V1 and 2 V2) with 3 (V2) to receive in couple of weeks;
  - 3 DAQ PCs in-house, 3 being ordered and built.
  - 1 of the V1 ODRs and DAQ PC is at LLR
- 10 CCCs :
  - All in-house.
  - 5 tested and working, 3 to be done (2 not planned to be used—prototypes—only if needed).
  - 1 CCC is in LLR.

# Summary

- Progress being made (firmware, purchasing, developing) for all components.
- We are gradually building up a stock of components which should be sufficient for lab and beam tests. Complete in couple of months.
- In the meantime we should have enough for needs of detector groups now.
- We “just” need to give an LDA to LLR for them to have a complete system.
- Are there immediate needs for elsewhere ?
- Crucial to all of this are system tests.
- We need to finish quickly, so during the summer, we hope to have fulfilled our EUDET goal and have a robust system for use.
- Demonstration ...

# Backup

# ECAL DIF details

Changes between prototype and production DIF :

- DIF powered from rear edge, has regulators on-board (not unlike HCAL DIF)
- Analog channels have test points
- No SRAM but serial Flash-RAM
- 10MHz Xtal for local clock generation
- side-mounted USB for testing and stand-alone operation

Firmware :

- Provides pseudorandom fake data
- Reacts on fast commands from LDA
- Data format being updated to proposed DIF data format
- Fast commands :
  - Reset Spill counter
  - Increment spill counter
  - Send single packet
  - Send (random) multiple packets
  - Continuous sending of packets