Status of the calorimeter DAQ

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- Introduction
- Overview and overall status
- Individual component status
- Milestone and immediate future
- Summary

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Introduction

- Basic R&D into data acquisition systems for itself and for calorimeters at the ILC
- Develop a system using industrial standards and advances: flexible, high-speed serial links, scalable, using off-the-shelf components
- Deliver working DAQ system for technological/EUDET prototype calorimeters
- DAQ system could be applicable for final system

Overall DAQ architecture

Detector Unit: ASICs

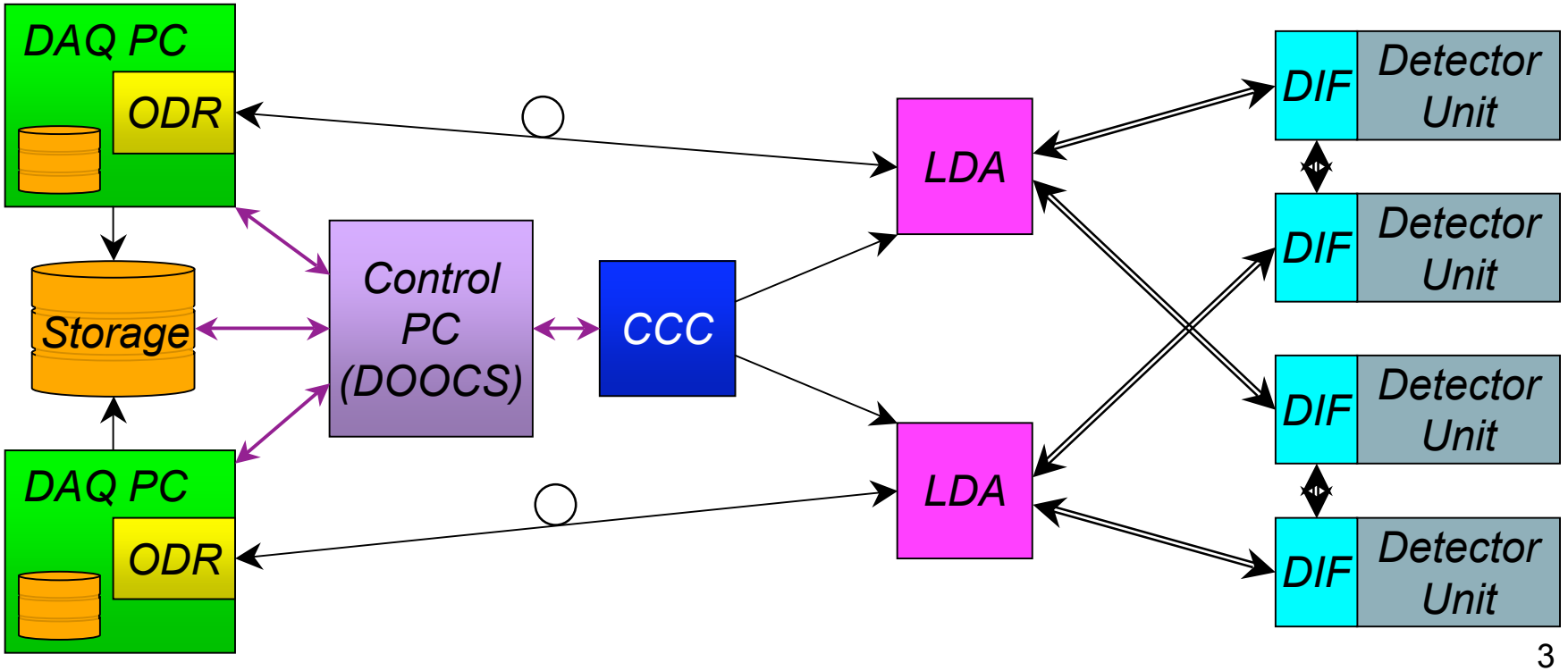
DIF: Detector InterFace connects generic DAQ and services

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

ODR: Off-Detector Receiver is PC interface

CCC: Clock and Control Card fansout to ODRs (or LDAs)

Control PC: Using DOOCS



What's new in the last year

- ODR further optimised: rate, number of links, host architecture, etc.
- LDA hardware tests (feedback to commercial partner) and firmware
- CCC grew in complexity: designed, re-designed and re-re-designed.

(Very) complicated board now in hand

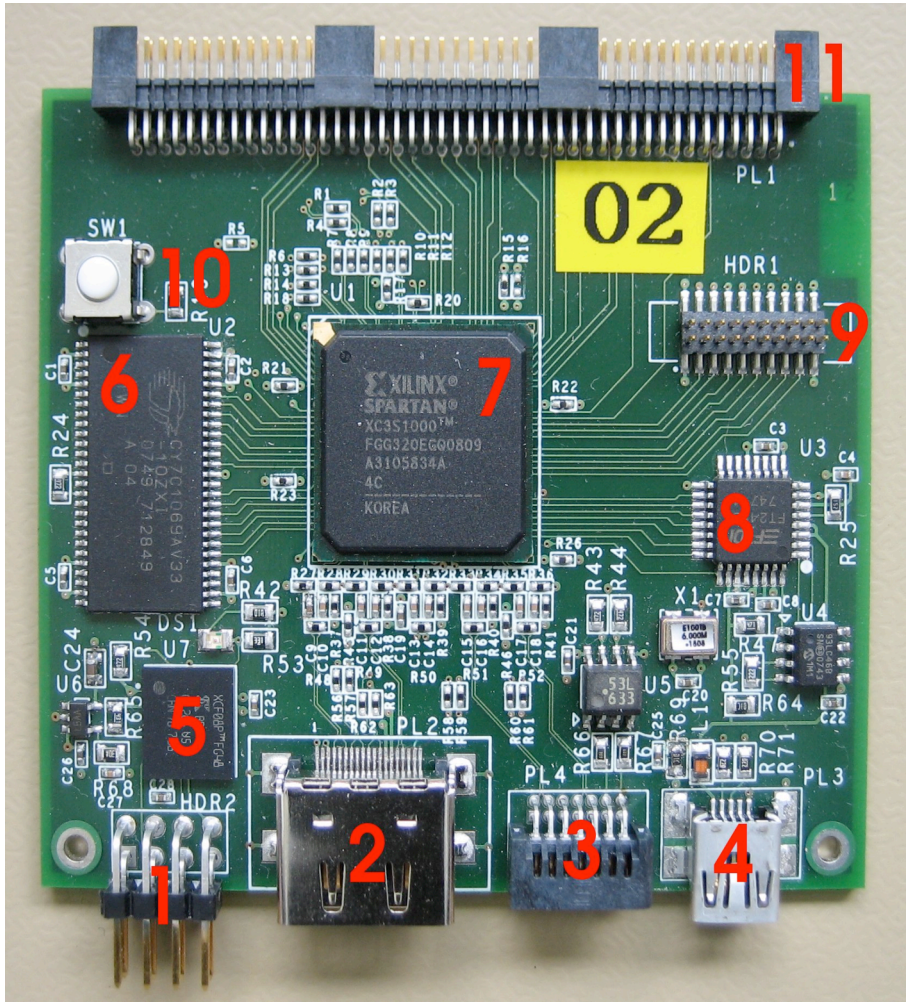
- A lot of work on DIF design and standardisation (different CAL flavours)
- Versions of DIFs exist and under test
- Choice and implementation of DOOCS software

- Have all pieces of hardware and progress on firmware and software

- See talks:
  - V. Bartsch, DAQ Status, JRA3 parallel session
  - T. Wu, DAQ software, Common DAQ parallel session

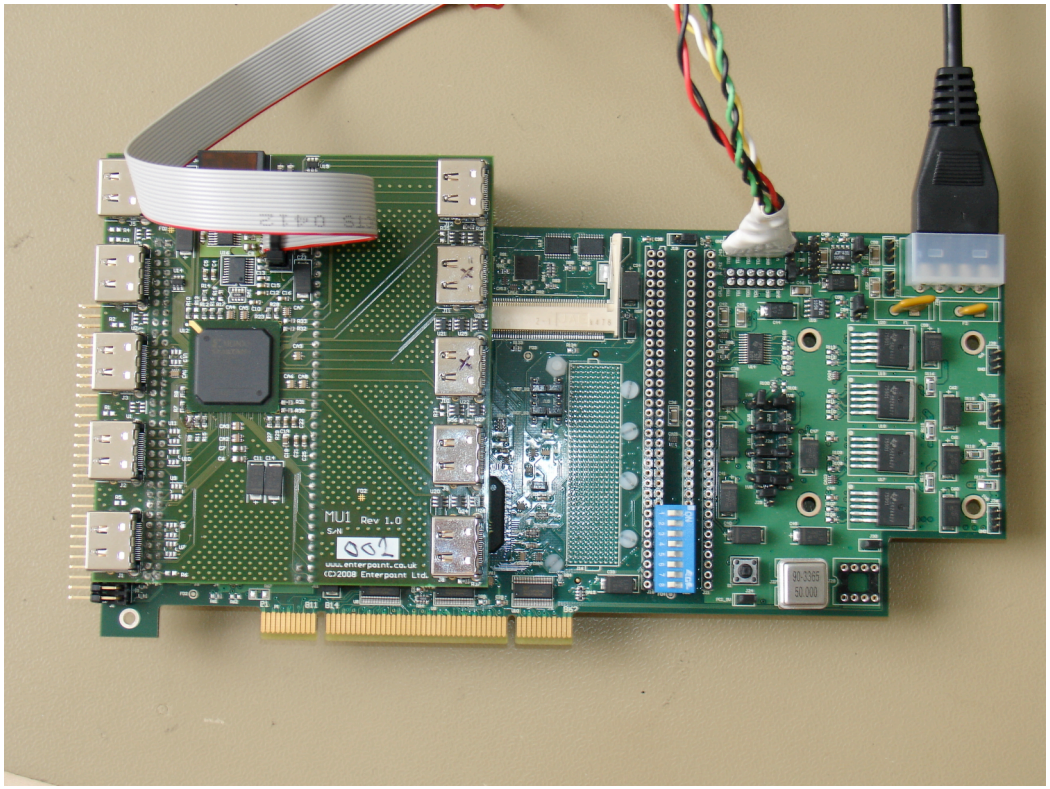
ECAL DIF status

- Hardware tests done and firmware development started
- 2 DIFs produced and parts available for 10 more
- Using a pseudo-LDA, link between DIF and LDA formed
- (Other DIFs being developed)



LDA status

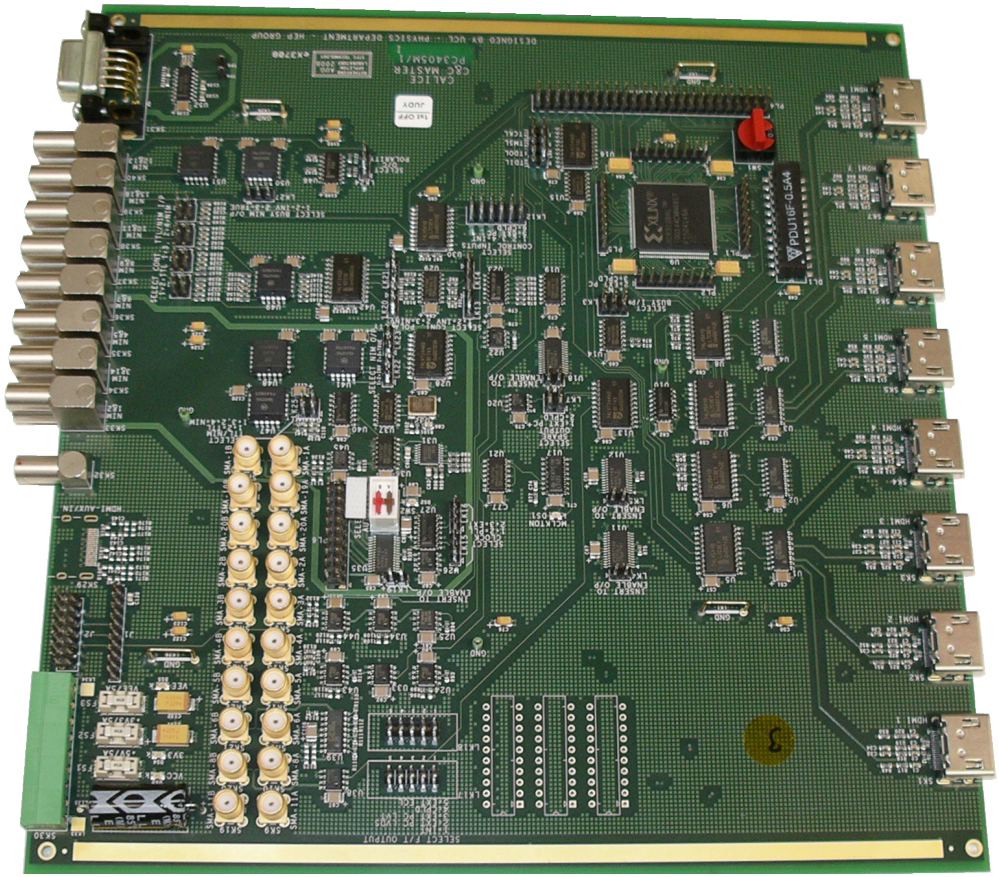
- LDA should serve 10 DIFs, aggregate data and send to ODR
- Using commercial board from Enterpoint
- However, board came back with problems acknowledged by manufacturer - re-spin now
- ODR-LDA protocol progressing
- LDA-DIF link being documented



CCC status

• Complicated board designed and just got back from manufacture
• Two produced with option of eight more after testing
• Incorporating all the needs and connectors requested by calorimeter groups

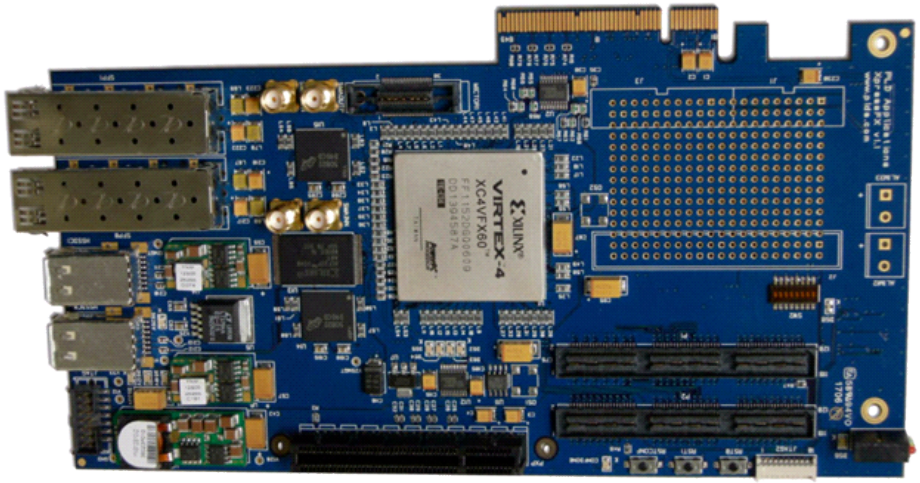
• CLOCK: machine
• TRAINSYNC_OUT: synchronisation of all front-end slow clocks
• FAST_OUT: transfer asynchronous triggers
• FAST_IN: used by DIFs to “stop acquisition”



Board in hand for just over a week: hardware tests and firmware development

ODR status

- The ODR is a commercial FPGA board with high speed serial links and PCIe bus
- Receives and sends data on fibres
- Customised firmware and software
- Optimisation of performance
- Interfaced with DAQ software

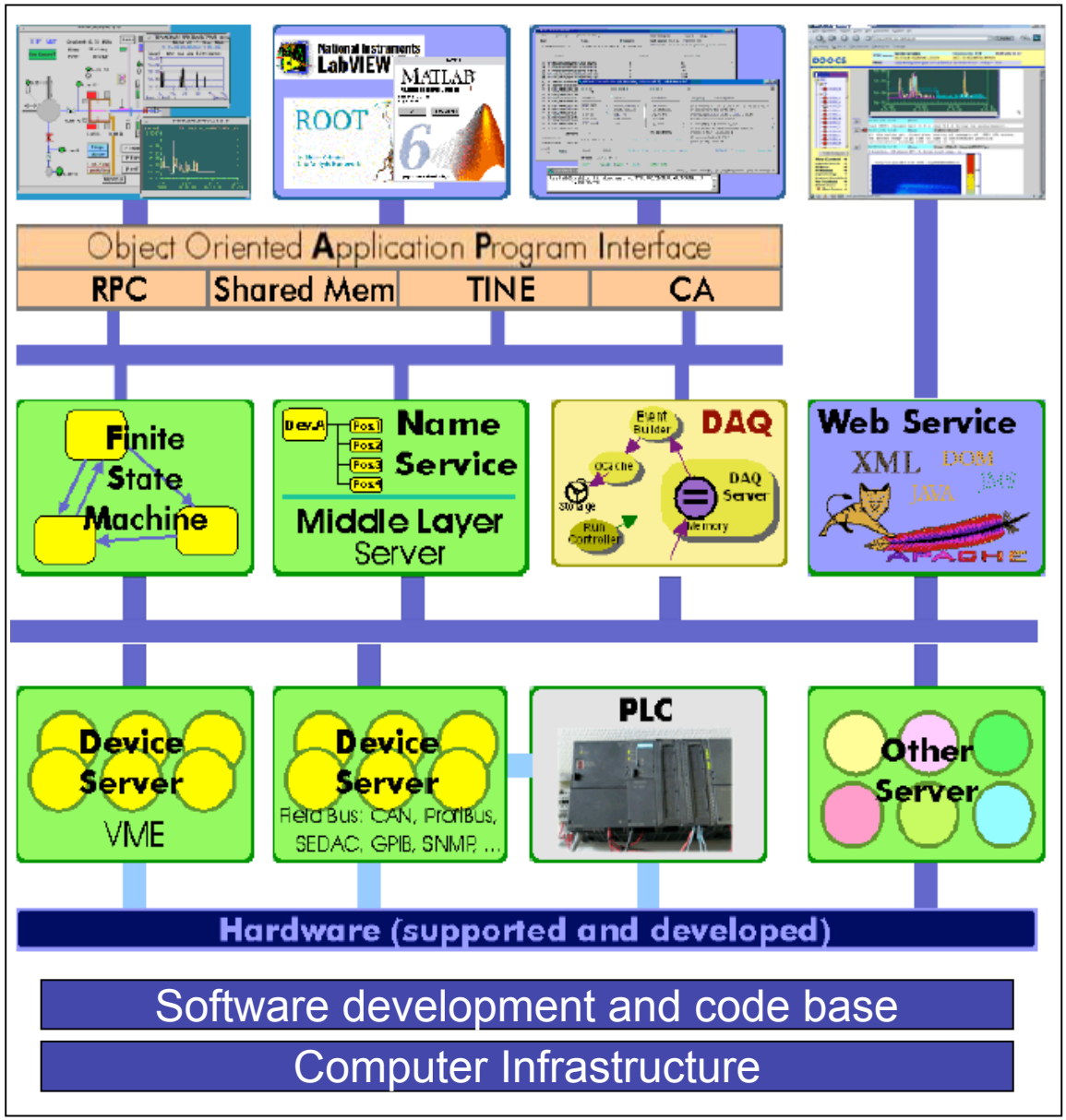


Off-detector receiver is working and ready to go

Software status

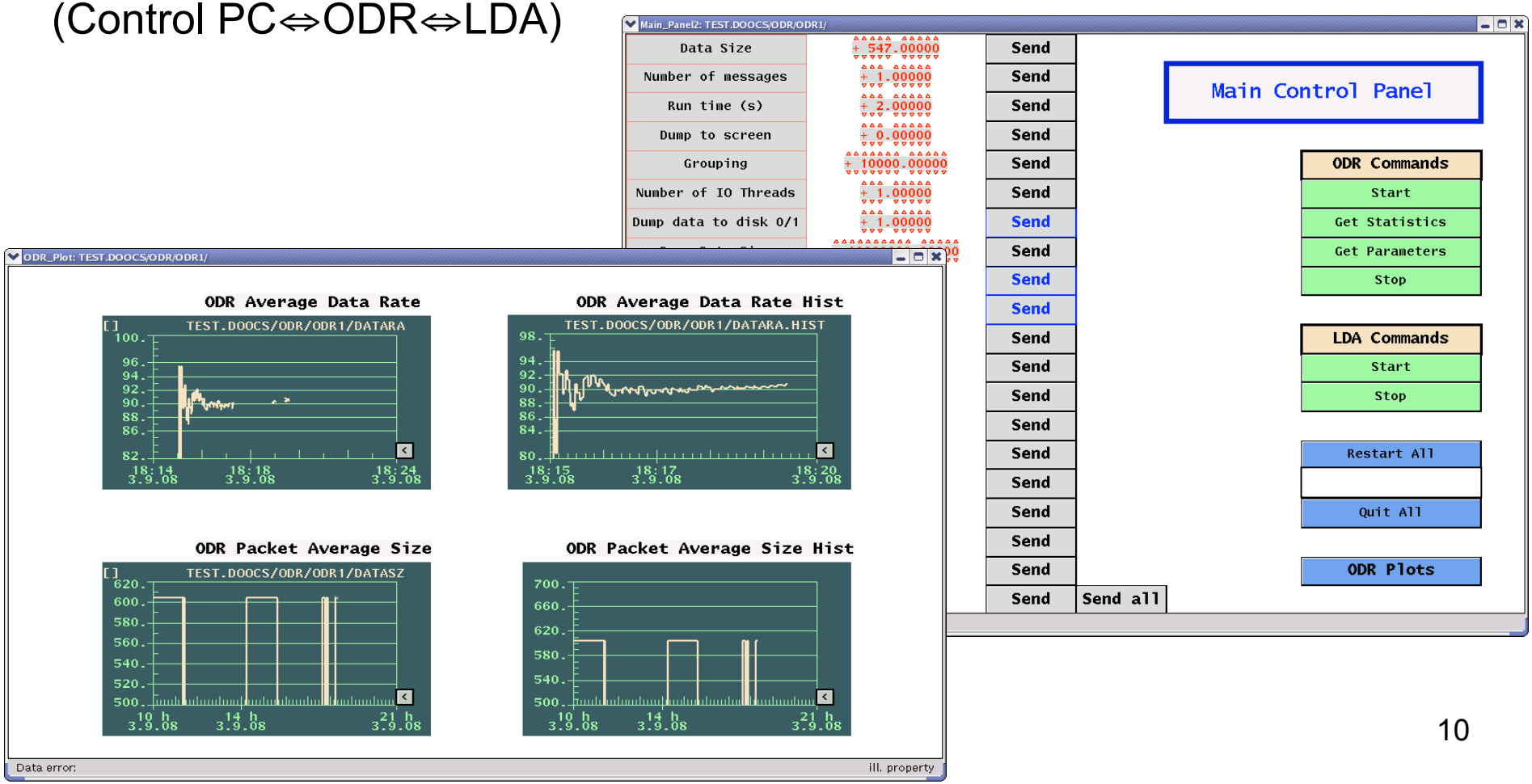
- Several calorimeter types each of significant complexity: O(10^4) channels, O(10^3) ASICs, O(10^2) DAQ electronics boards
- Need control software which can handle these numbers and has a large functionality and preferably already written (and supported)
- Chose DOOCS being developed at DESY for XFEL

`tesla.desy.de/doocs/doocs.html`

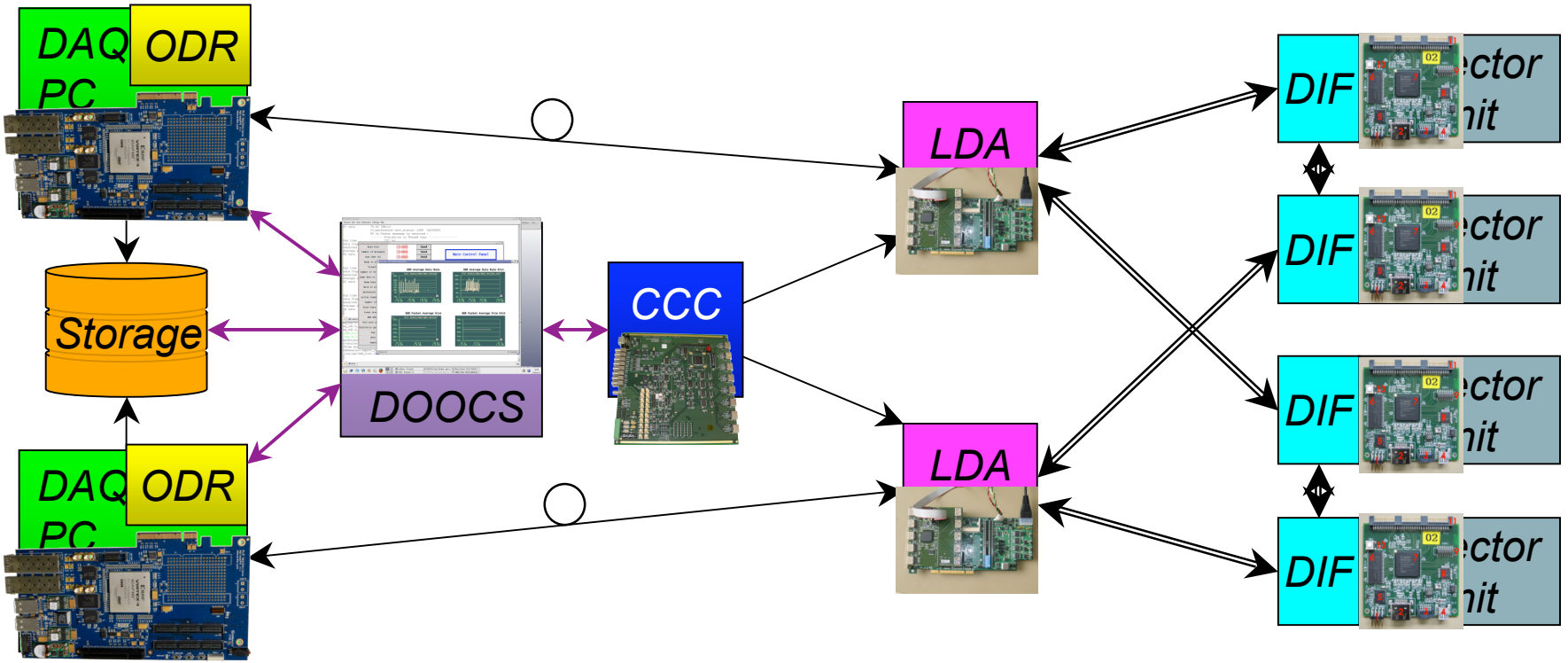


DOOCS development

- Defining hardware interfaces: started with ODR - first hardware layer and most advanced
- Have set-up LDA emulator and passed data in this system (Control PC⇔ODR⇔LDA)



Milestone: DAQ prototype available



- All components exist (and mostly working): hardware, firmware and software
- Link tests between some components done

Immediate plans

- All hardware “in” hand and software and firmware making progress
- More hardware tests (LDA, CCC) with focus switching to firmware and software (all)
- Working towards full DAQ link test (being held up by LDA re-spin)
- Individual calorimeters will want to have their own mini test DAQ (soon): help understand detectors and ease future integration
- Deliverable in Month 42 (June 2009): DAQ system available
- We have to be ready before everyone else…

Summary

- All DAQ components to some extent “in hand” and tested to different amounts of detail:
  - ODR firmware well-advanced, other components under development
  - LDA only current stumbling block to be re-done by manufacturer
  - DIF and CCC boards so good so far
  - DOOCS software looks like a good option
- Could have full system tests in month or so
- Expect to complete DAQ build on time by mid-2009