Report from the Technical Board

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CALICE Collaboration Meeting Cambridge/UK Sept. 2012

Role of Technical Board

- Important executive body of CALICE

- Keeping track of activities

- Forum of experts of different detector technologies

- Foster collaboration between different projects

- Identification of needs for co-ordination and ressources

- Technical preparation of strategic decisions to be taken by CALICE steering board

- TB can (and maybe should?) be the main communication channel between CALICE and testbeam sites
  At least when preparing major beam test
  At least it has to ensure that this communication happens

Since Shinshu ….

Once again busy months …

- Large scale beam tests (i.e. 1m³ prototypes)
  - RPC DHCAL @ CERN => WDHCAL with T3B-RPC
  - SDHCAL prototype (including Micromegas)

- Smaller scale beam tests
  - SiW Ecal @ DESY

- Planning of 2nd half of 2012 (CERN, DESY)
  CERN: SDHCAL, WDHCAL, AHCAL
  DESY: Ecals, AHCAL

- CALICE Document for DBD

WDHCAL Overview

- **Tungsten – DHCAL: configuration**

39 Tungsten plates (10 mm thick)

+ 39 RPC-DHCAL layers

8 Iron plates (25.4 mm thick)

+ 8 RPC-DHCAL layers

8 Iron plates (100 mm thick)

+ 8 RPC-DHCAL layers

- **Readout channel count**

54 x 96 x 96 = 497,664

Run plans

PS – 2 weeks in May (done)

SPS – 2 +1 +1 weeks in June, August and November

Statistics

Polarity	Momentum	# of events (18 mm Pb)	# of events (Air)
Negative	*1*		540,660
	2		964,361
	3		1,006,185
	4		1,030,302
	5		1,185,235
	6		1,268,235
	7		
	8		,196,804
			2,044,22
			1,007922
	12		300,666
	15	305,735	
	20		
	30		
	40		
	50	886,201	

Polarity	Momentum	# of events (18 mm Pb)	# of events (Air)
Positive	4		13,243
	6		
			5,27,234
			359,768
	60		10,125
	80	2,022,540	
	150	250,861	← 1,268,235
	180	303,917	← 1,065,337
	TOTAL	**2,577,318**	**4,823,742**

Significantly more data than in 4 months at FNAL*

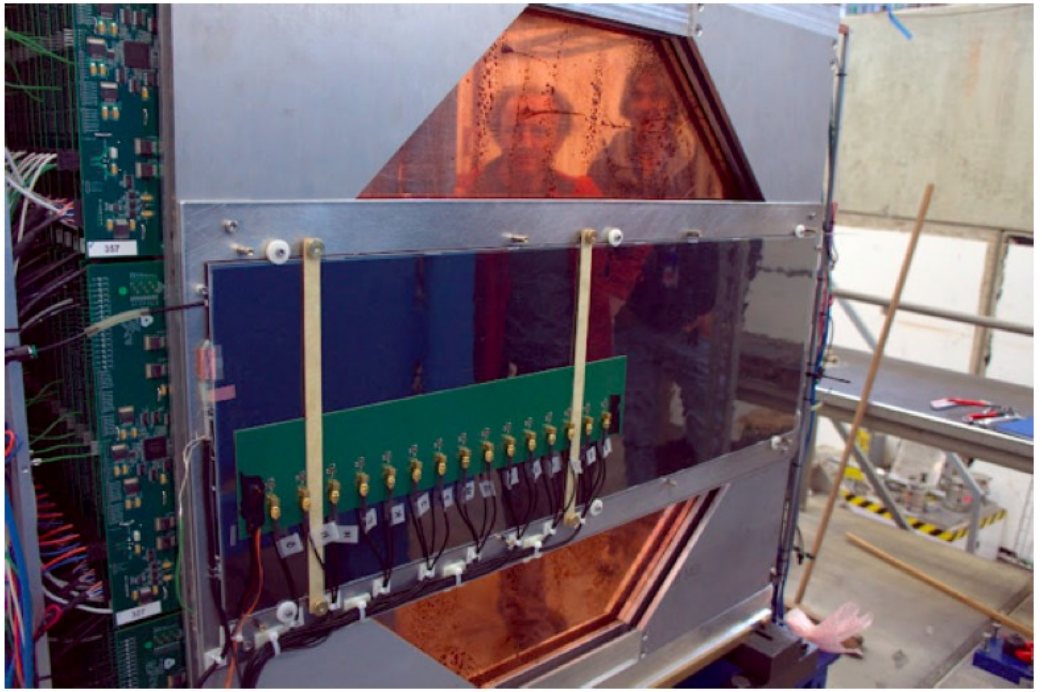
18 mm Pb → mostly pions, some electrons, muons
Air → mostly electrons, some pions, muons

	Pions	Electrons	Muons	All
Grand **TOTAL**	7,591,821	18,067,187	4,920,679	30,579,687

*Add August data

T3B/FastRPC

Application of T3B concept to DHCAL



Installation behind WDHCAL
Using a spare RPC from ANL

Running in May/June 2012

Event yield

- PS: 15M hadron trigger (however small energy), 1.7M Muon events

- SPS: Statistics at 60, 80 and 180 GeV
  ~500kEvents in sync with WDHCAL
  High statistics in dedicated runs

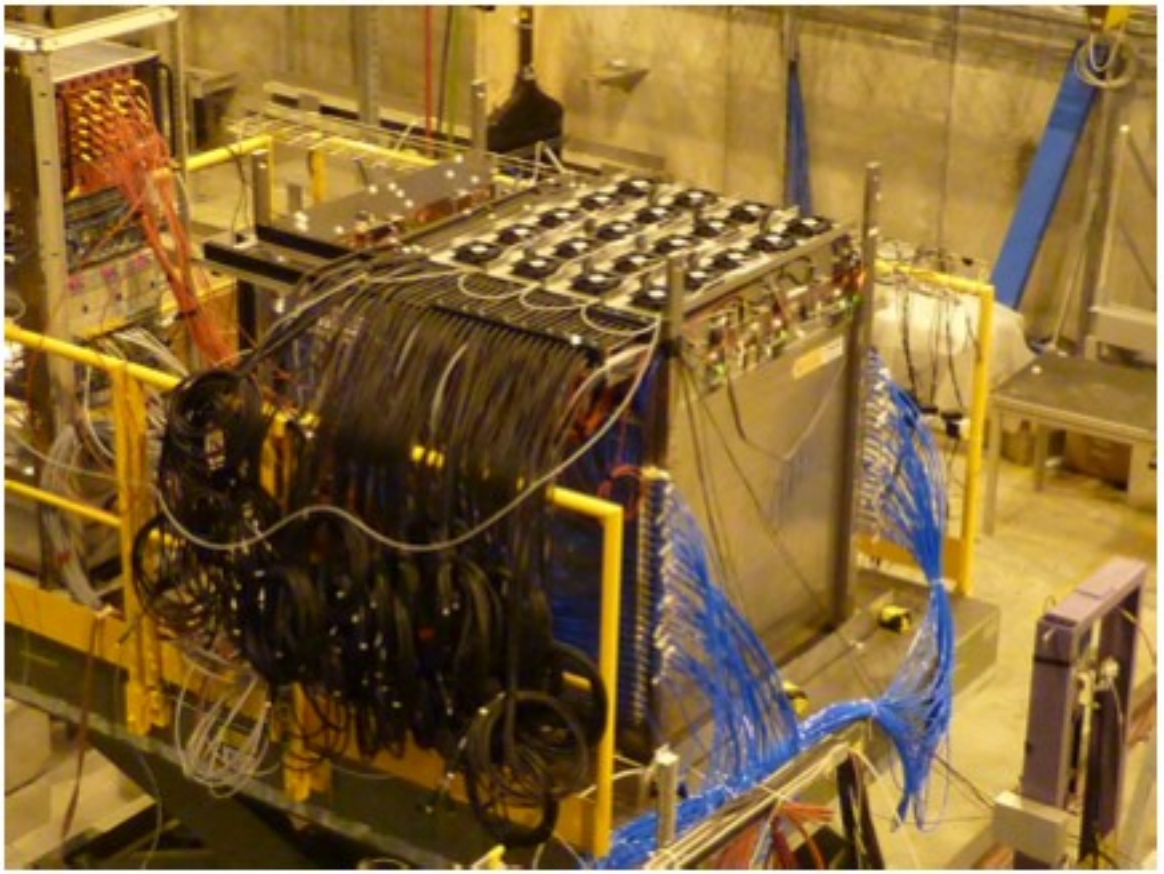
SDCHCAL Beam Tests in 2012

- Beam tests at PS and SPS
  T9, H2 and H6

- (At least)
  48 GRPC chambers of

- Two Micromega chambers
  incorporated in May

- Hybrid DAQ worked stable
  Throughout the data
  taking



GRPC - Comments of 2012 running

•2012 TB strategy

Our aim with the first TB period was to

•see the prototype response with no calibration (all electronics gain put to 1)

✓ localize noisy channels, noisy zones to correct for in next TB

✓ see the three thresholds effect and see how to use them in coherent way

Detector performance: Smooth running, no major faults (at least not to my knowledge)

Data yield:

•PS: have enough statistics (> 50000/energy point)

• SPS:

May period: Comparatively small statistics due to unfavorable beam conditions

•August period: Much better conditions after close collaboration with CERN operators

Comments on Micromega data taking

- Simultaneous readout of Hardroc and Microroc in steel structure

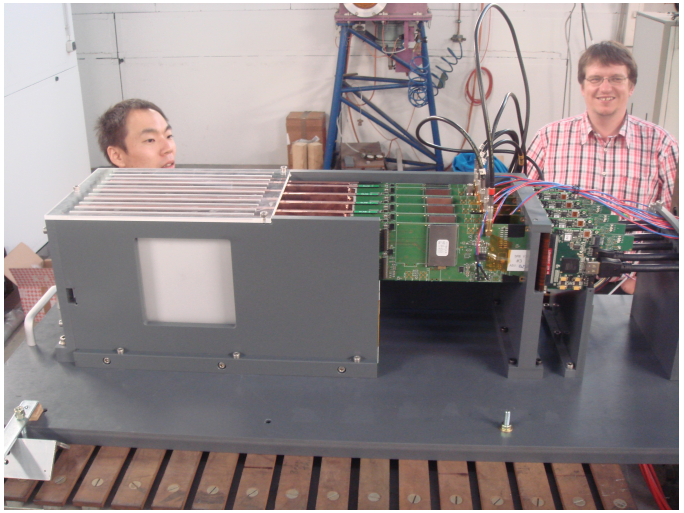
- At SPS problems with Microrocs which suddenly turned noisy
  → Micromegas chambers were out of r/o for some time

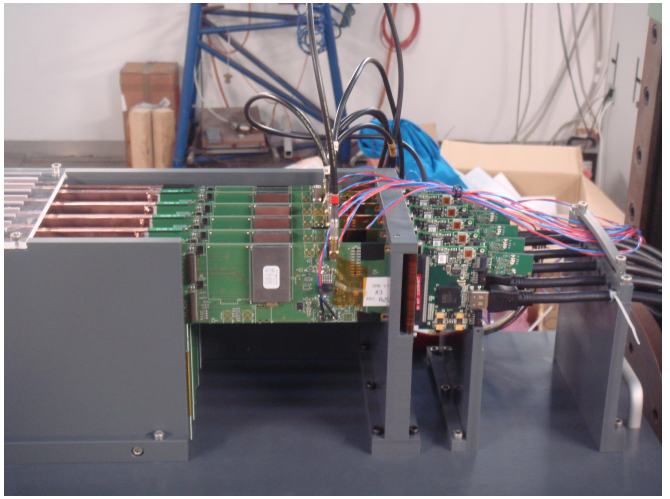
If included

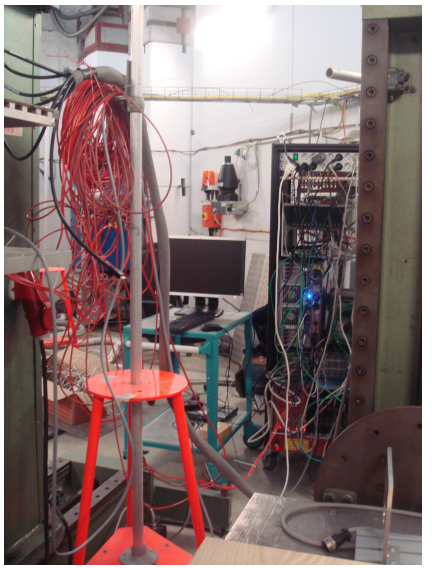
- Preliminary analysis
  - Muon run (100 GeV):
    MICROMEGAS performances are compatible with what was measured in 2011, except that Mmegas are in a SS sandwich
    efficiency = 96% (excluding dead zones 2.5%) multiplicity = 1.20

Towards tech. Prototype - SiW Ecal running

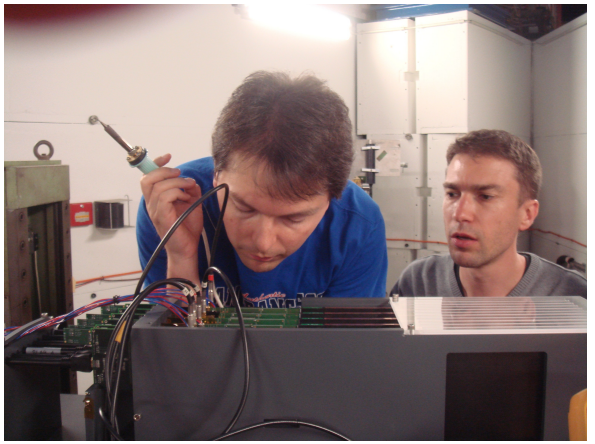
Data taking @ DESY: 26/3/12 – 5/4/12 Getting experience and team forming
16/7/12 – 3/8/12 System test with several layers







... the real experts at work
This was @ 1am!!!!
Still the detector run perfectly



Goals of test beam

- **Main goal: Determine signal over noise ratio of the detector**
  Remember: R&D target is 10:1

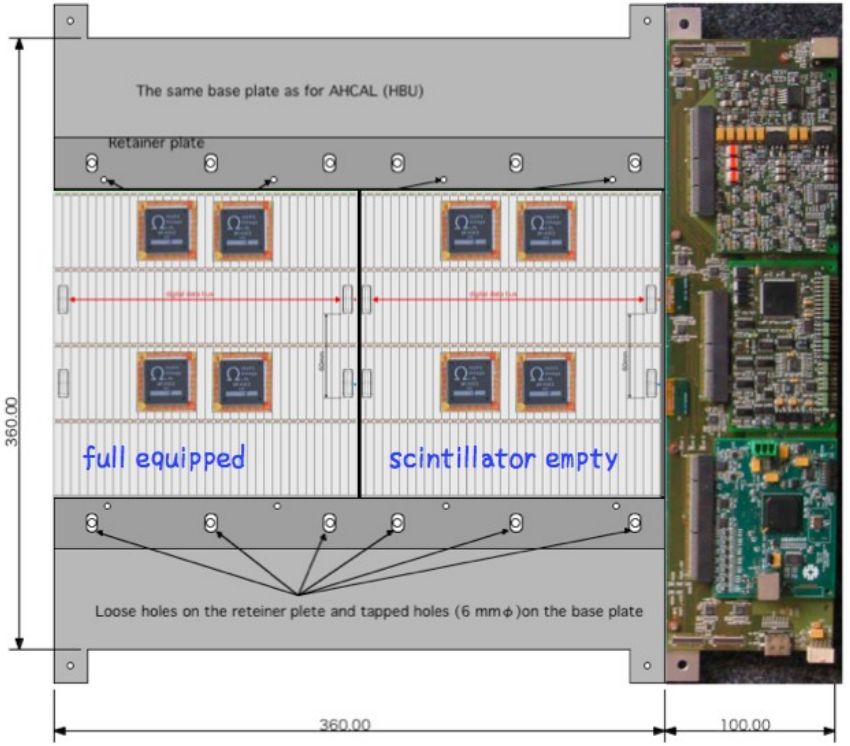
- Establishment of calibration procedure for a larger number of cells

- Homogeneity of response (x,y scan of detector)

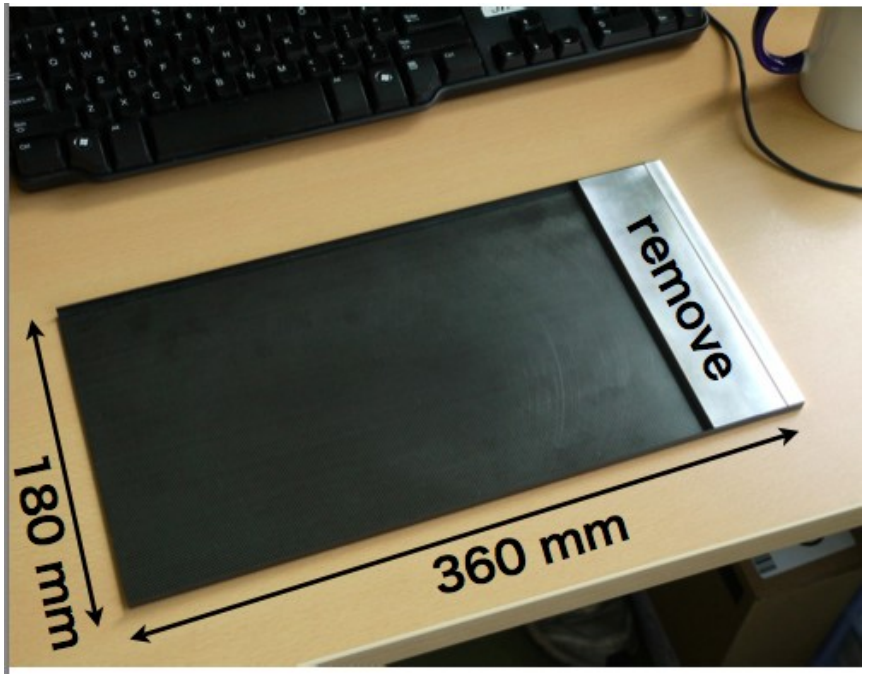
- Small physics program
  Electrons between 1-6 GeV

- Technical tests (Power pulsing)

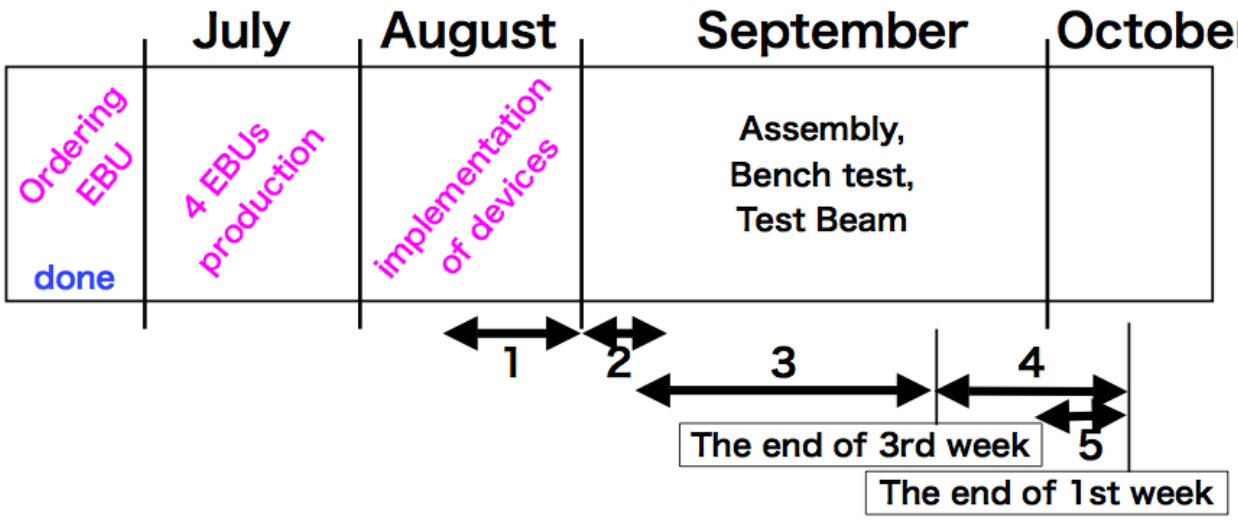
ScintEcal – Towards engineering prototype



Scint Ecal layer on HBU board



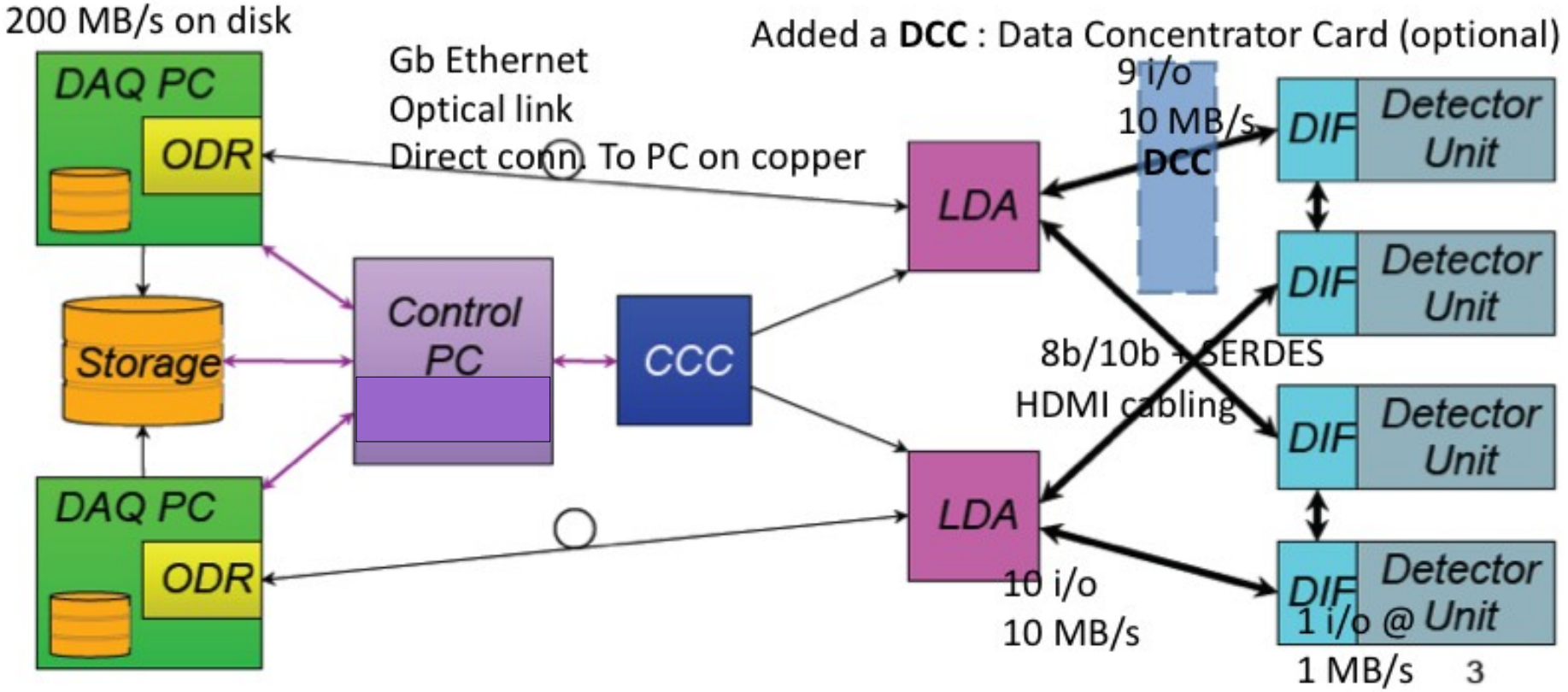
Layer to be integrated into U board
(same as for SiW Ecal)



DAQ system overview

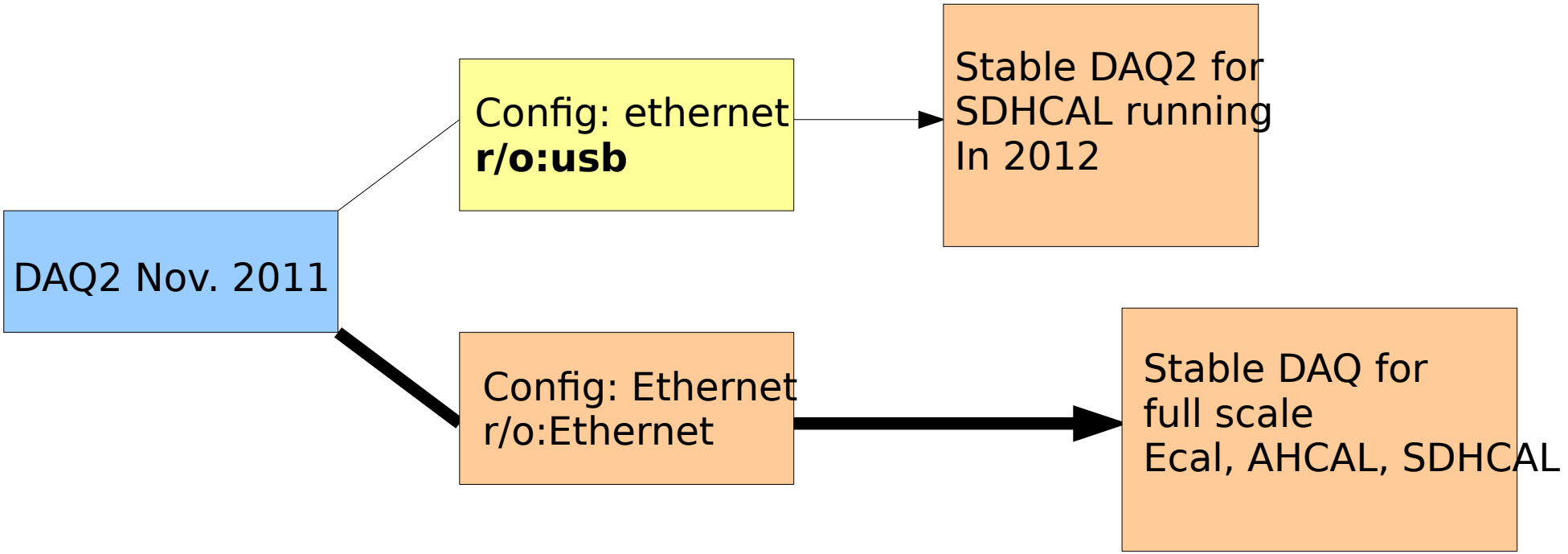
(**Detector Unit** : ASICs)
DIF : Detector InterFace connects generic DAQ and services
LDA : Link/Data Aggregator fans out/in DIFs and drives links to ODR

ODR : Off-Detector Receiver is PC interface
CCC : Clock and Control Card fans ou to ODRs (or LDAs)
Control PC : Using XDAQ

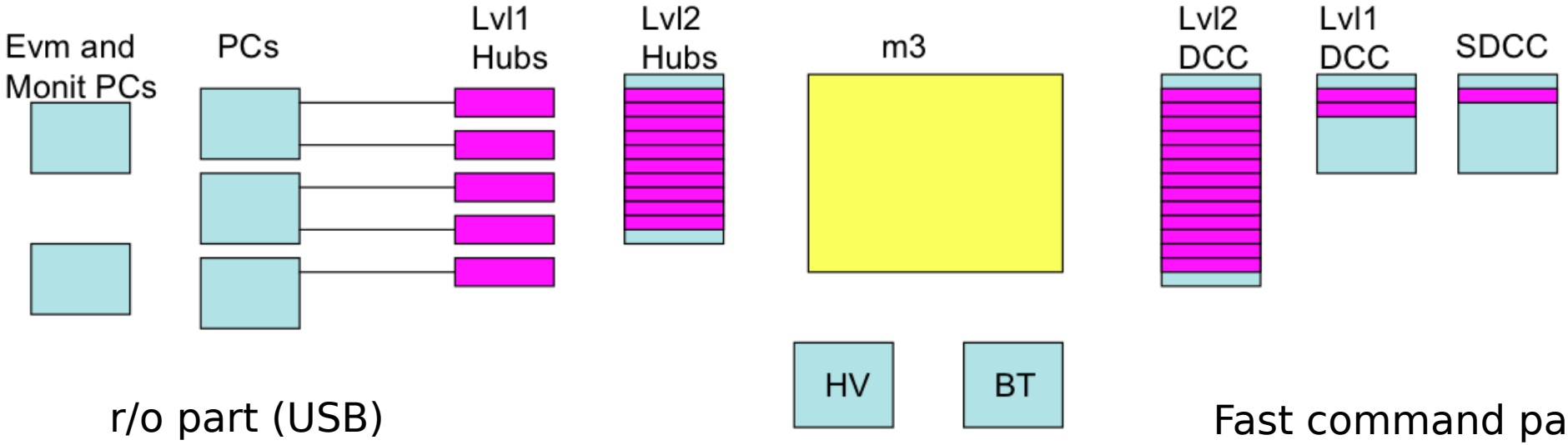


DAQ2 Current status

(Temporary!!!) split of DAQ2 development in order to assure success of SDHCAL running in 2012



Intermediate DAQ2 and SDHCAL preparation



r/o part (USB)
PCs with xdaq
for event recording

Fast command part
(ethernet)

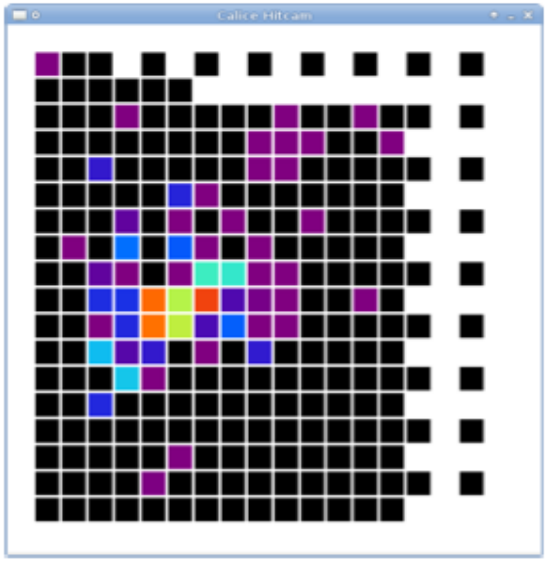
- Agreement within TB:
  In spring 2012 SDHCAL will be equipped with 48 GRPC + 2 Micromega chambers

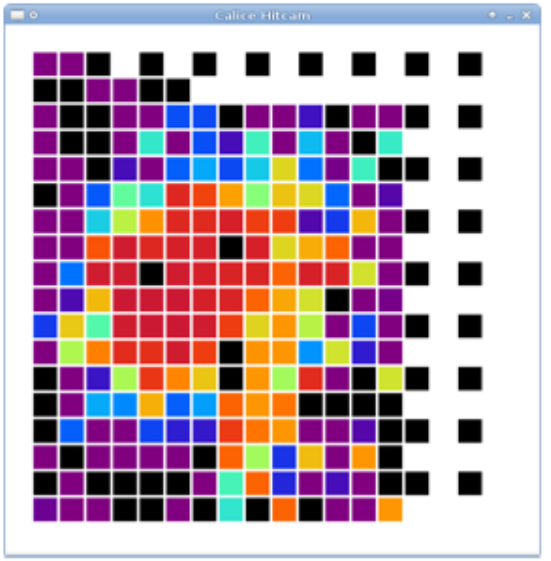
- Status as of 15/2/12 (Date of a DAQ review)
  39 GRPC chambers integrated into DAQ, stable running over days
  Data quality → see later
- DAQ2 will be operational also for Micromegas

- Full system test (48+2) planned for 15/3/12 (=1 month before start at PS)

DAQ:

- Up to 6 layers together
- Clean procedure to run an acquisition
  - no crash in one week of data taking
  - few corrupted events
- Remote access for all devices (CCC, LDA, DIF, power supplies, HV...)
  - no access to the beam test area (except to add or remove tungsten plates)
- Online beam monitor
- Python scripts to loop over parameters (calibrations)
- External software needed to create slow control files by hand for each layer

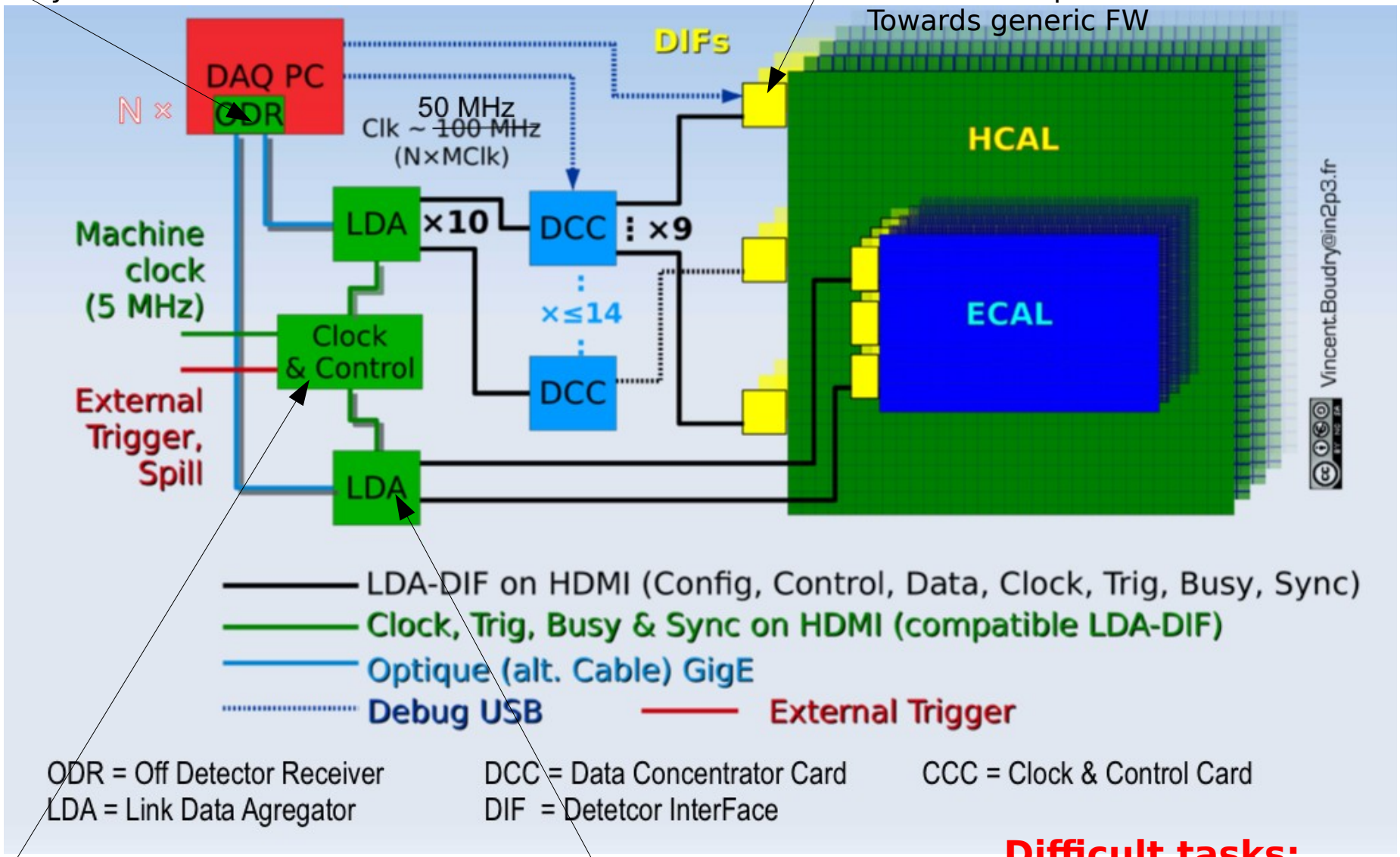




DAQ2 – 'Main' trunk

ODR:
Stability of data transfer in network

DIF:
Continous improvement of FW
Towards generic FW



CCC:
Revision of system level features
Firmware

LDA:
Replaced by **GigaDCC**

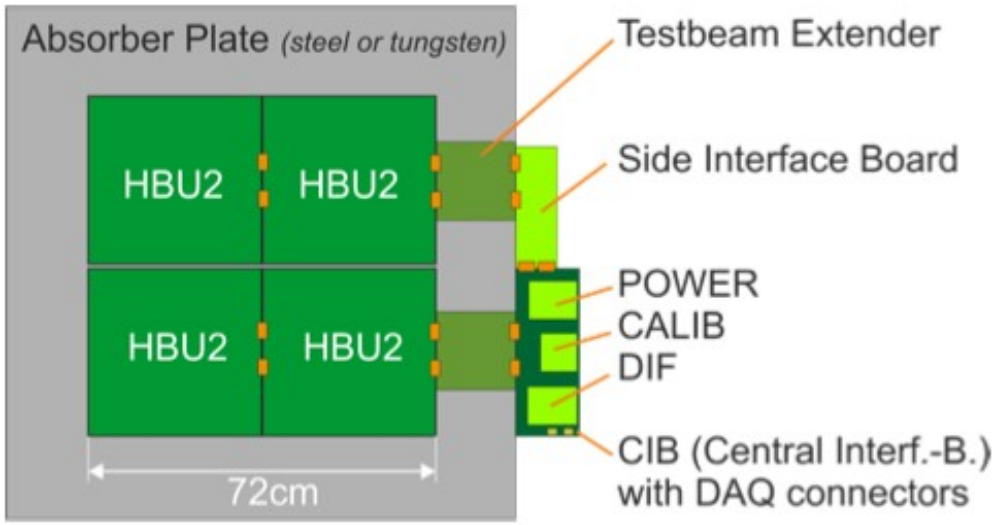
Difficult tasks:
Only small number
Of people!!!!

CALICE requests for 2012

	PS request	SPS request	Comment
WDHCAL	3 weeks in T9	2x3 weeks in H8	PS in spring 2012 SPS in late autumn
SDHCAL GRPC	2-3 weeks in T9	2x3 weeks in H2	Current request includes no secondary devices (e.g. Mmegas) PS in late spring 2012 (April) SPS in spring 2012 (May) SPS in autumn 2012
Micromegas	-	1 week	Autums where steel stack is, parasitic running with GRPC

N.B: Support for beam tests at CERN and DESY possible via AIDA

AHCAL – Engineering prototype – Towards CERN beam test



- 4 Hcal Base Units constitute one layer

- Number of tests at DESY

Test beam goals:
- System test of prototype with 4 HBUs
- Time structure of hadronic Showers

- Will sit on back of WDHCAL

Open questions:
- Synchronisation of events with WDHCAL
- Mechanical integration

Beam test at CERN in November 2012

12-September-2012

2012 SPS Fixed Target Programme

Version 1.0

Colour code: blue (dark shading) = not yet allocated ; yellow (light shading) = not allocatable or Machine Development

	P1	P2	P3	P4	P5	P6
	39 15 Apr 24 May	39 24 May 2 Jul	39 2 Jul 10 Aug	39 10 Aug 18 Sep	39 18 Sep 27 Oct	37 27 Oct 3 Dec
T2 -H2	NA Setup 7 · CALICE SDHCAL 14 · 3	CMS HCAL 4 · CMS MPGD 7 · A MMEGAS 7 · CREAM 70 · NA61 TR 9 · NA61 pPb 5	NA61-pPb 39	NA61 pPb 20 · NA61 AFOCAL 11 · NA61 pPb 8	NA61 pPb 20 · NUCLEON 7 · CMS CALSiBT 12	CMS CALSiBT 9 · TWICE 7 · SDHCAL 7 · MMEGAS 7 · SCE 7
T2 -H4	NA Setup 7 · CMS ECAL 7 · H4IRRAD 10	H4IRRAD 11 · RD51 14 0 · CMS ECAL 9	PHOTAG 12 · RD51 14 · SOIPIX 6 · CMSPIX 5 · H4IRRAD 7	H4IRRAD 7 · LHCf 10 · LHCf 8 · NA63 14	PANDA 13 · DAMPE 7 · CALET 7 · CMS ECAL 9 · 3	2 · CBM GEM 4 · RD51 13 · H4IRRAD 11 · H4IRRAD 7
T4 -H6	NA Setup 7 · 3 · XSECT 6 · A IBL 8	A IBL 20 · CERF 50 · BELSVD DEP 7 · A ITS 7	NA62 STRAW 7 · PEBS 7 · RD42 11 · A MMEGAS 14	A BCM 7 · MONOPIX 10 · CALICE SDHCAL 14 · A BL 8	A IBL 13 · RD42 11 · BII DEPFET 7 · A IBL/ITS 8	A 5 · GTK ITS 6 · ITS 6 · SupB BIIPID 6 · A 3 · PIX ITS 4 · CBM 4 · 3
T4 -H8	NA Setup 7 · APPS AIDA 7 · TIMEPIX 7 · 3	LHCb AMUONS 11 · CALICE WDHCAL 14 0 · UA9 7 · CLIC 7	RD50 7 · 7 · DREAM 14 · WDHCAL 7 · A FOCAL 7	LHCb WP9PIX 14 · APPS AIDA 7 · NUCLEON 14 · 1	TOTEM CLIC 6 · CALET 14 · UA9 14 · LHCb AM 5	LHCb AMUON 6 · CALICE WDHCAL 10 · LHCb AMUON 9 · DREAM 12
T4 -P0	NA Setup 7 · 17	39 0	39	39	39 · 2	NA62 35
T6 -M2	NA Setup 7 · COMPASS 17	COMPASS 39 0	COMPASS 39	COMPASS 38 · 1	20 · COMPASS 19	COMPASS 37
CNGS · CNGS 16	CNGS 39	CNGS 39 0	CNGS 39	CNGS 39	CNGS 39	CNGS 37

CALICE @ CERN 2012: GRPC SDHCAL 5 weeks, Mmegas 1 week (dedicated) WDHCAL 4.5 weeks

Very well served in particular after revision of plan for 2nd half of 2012

This is the RESULT of a close conversation with CERN responsibles

Towards DBDs

Reminder on CALICE criteria on 'Technologie readiness'

- **Established performance:** energy resolution, linearity, uniformity, two particle separation
- **Validated simulation:** longitudinal and transverse shower profiles, response, linearity and resolution, for electrons and hadrons
- **Operational experience:** dead channels, noise, stability, monitoring and calibration
- **Scalable technology solutions:** power and heat reduction, low volume interfaces, data reduction, mechanical structures, dead spaces, services and supplies
- **Open R&D issues:** analysis and R&D to be completed before a first pre/production prototype can be built, cost reduction and industrialization issues

- Internal draft as basis for discussions at meetings of concept groups ready on 21/5/12

- Since beginning of july orientation towards public document (facing some inertia!)

This meeting is start of publication phase

Current draft – v2.3

Draft version 2.3

Summary of CALICE results and activities

The CALICE Collaboration

September 16, 2012

Abstract

The CALICE collaboration conducts calorimeter R&D for highly granular calorimeters, mainly for their application in detectors for a future lepton collider at the TeV scale. The activities ranges from generic R&D with small devices up to extensive beam tests with prototypes comprising up to several 100000 calorimeter cells. CALICE delivers the proof of principle that highly granular calorimeters can be built, operated and understood. The successes achieved in the past years allows for addressing now the step from prototypes to calorimeter systems for particle physics detectors.

- Largely ready for circulation in CALICE

- Needs streamlining, improvement on presentation style etc.

- Need decision how to deal with analysis of SDHCAL data
  Results wait approval by editorial board and CALICE before
  Included in public document

- Plan is to publish document to arXiv on 1/10/12
  → Final publication strategy to be discussed at this meeting

Summary and outlook

- Followed activities of seven technologies
  - Beam tests all over the place
  - End of 2012 all technologies proposed in CALICE will have had Major scale beam test
  - 2nd generation prototypes of Ecals and AHCAL are emerging

- Very favorable assignment of beam time by CERN (particular true for 2nd half of 2012)

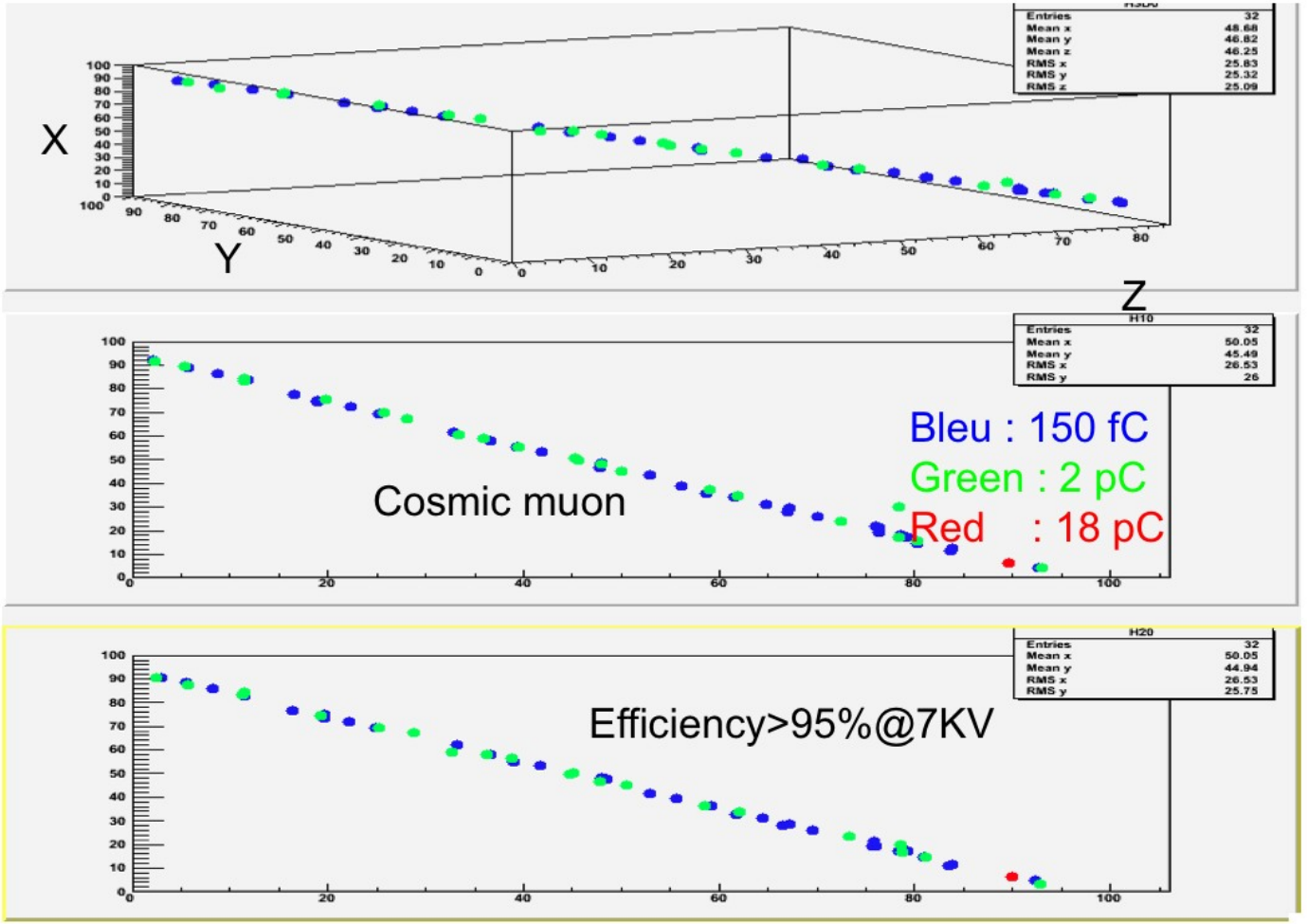
- Stable running of hybrid DAQ for SDHCAL

- Stable running of 'real' DAQ2 in SiW Ecal beam test
- Slow but steady progress with 2 generation prototypes
  Ecal, AHCAL towards small scale beam tests
  Will benefit from stabilisation of DAQ2

- Public CALICE document for DBD nearly ready

Backup

SDHCAL – Data quality, Trigger rates and success rates



Clean cosmic tracks recorded with 39 chambers At IPNL

- Three thresholds Present

- Interesting Observation in Shower events → (S)DHCAL session

Z^5

- Situation of 15/2/12: Readout with pulser at 5 Hz
  About 5 good cosmic tracks/readout => “Success rate” ~ 25 Hz

- (After optimisation of noise and thresholds)
  Expect around 1500 events per 10 s. spill at SPS

DAQ2 Running modes

A major source of misunderstanding, therefore here once and for all

FEE and DAQ are rather conceived for ILC matters and less for beam tests

1) ASIC keep data in memory with depths of
   127 for HARDROC/MICROROC
   15/16 for SKIROC/SPIROC

2) The buffer is emptied on

a) Arrival of external trigger (Pulser or scintillator) – **Beamtest mode**

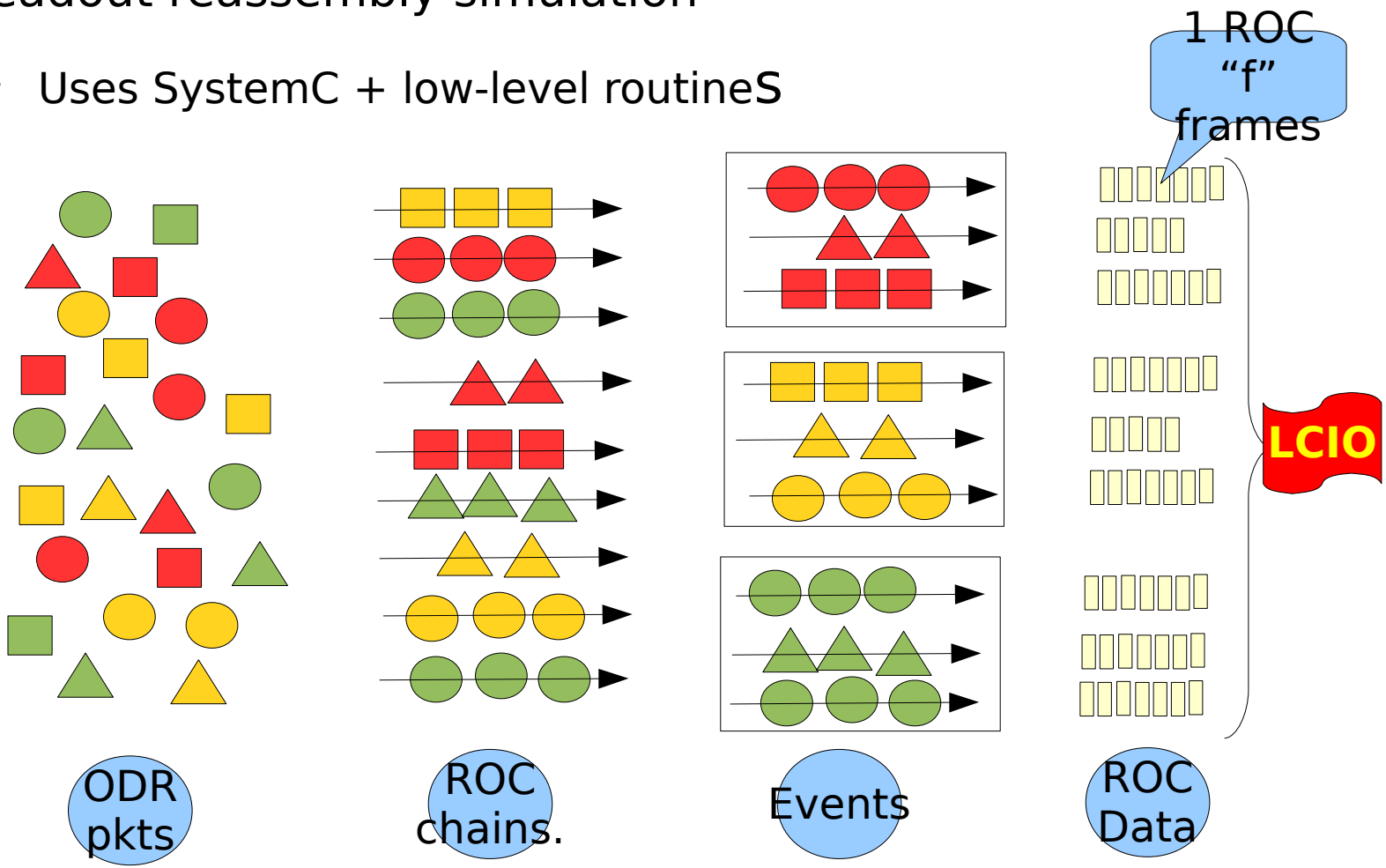
b) Acquisition start at beginning of spill – Acquisition end at end of spill
   Buffers a flushed upon RAMFULL (of at least one ASIC) – **ILC mode**

Upon every detector readout a number of good events can be expected

It is therefore more appropriate to speak of a **success rate** instead of a trigger rate
- Buffers are also filled (and emptied) due to noise
If f_{noise} >> infinity we read out noise => small success rate
If f_{noise} → 0 buffers are filled with 'good events' => high success rates

Towards s/w for Technological Prototypes

- Readout reassembly simulation
  - Uses SystemC + low-level routineS



And Then?

Interface online/offline?

Data Format
Proposal exist
For SDHCAL

Scheme by D.Decotigny (LLR)

Needs tight communication between DAQ team, CALICE Software Team and ILC Core software Team

CALICE specific: Gerald Grenier to collaborate with s/w coordinator for SDHCAL
Other detectors
Usage of CALICE database?

CALICE Software

- Software coordinator Shaojun Lu

- Contacts for subdetectors:
  SiW Ecal: ???, R.Poeschl
  ScintEcal: Cotera
  AHCAL: Angela, Shaojun
  (S)DHCALS: Gerald Grenier
  TCMT: K. Francis?
  Tracking: P. Dauncey, D. Jeans
  Simulation/Mokka: G. Musat

- All physics prototypes are implemented in Mokka
  SDHCAL GRPC as well

- Data processing:
  Support by M.S. Amjad, D.Jeans, A. Kaplan, K. Krastev, N.Feege, L. Weuste and S. Lu
  Data processing on request

- CALICE s/w needs to be put on broader basis
  Efficient s/w group is essential for publishing physics results