Report from the Technical Board

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CALICE Collaboration Meeting Heidelberg September 2011

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 May 2011 ....

Once again busy months ...

Major beam tests (i.e. 1m³ prototypes)

- RPC DHCAL
- Physics Prototype of W-HCAL
- SDHCAL prototype

Smaller scale beam tests

- Micromegas
- GEMs

Planning of autumn running at CERN

- Beam time at PS and at SPS

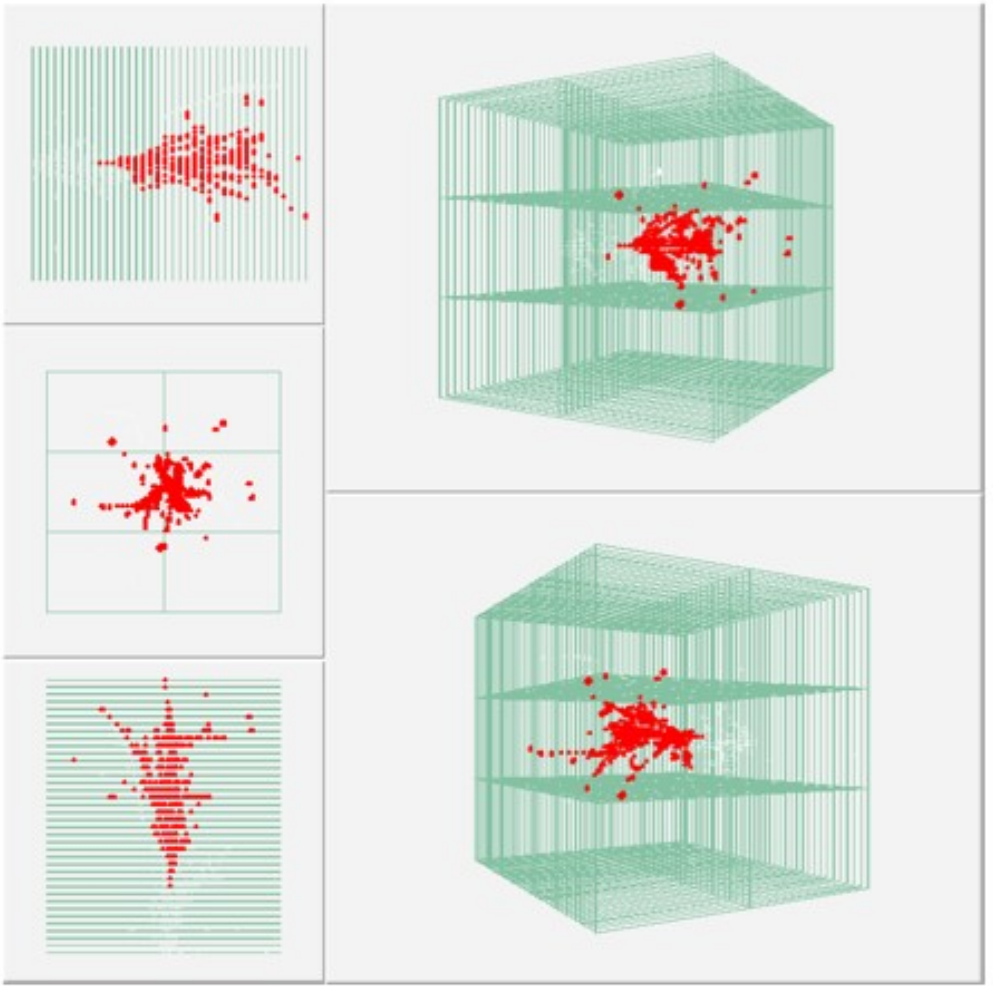
Revisiting of status of growing projects

- Tech. prototypes of AHCAL, Scint and SiW Ecal

Past: Successful data taking with physics prototypes
Now: Careful investigation of technological solutions

US-DHCAL and “associates”

Setup on CALICE stage as of October 2010



Test beams at FNAL:

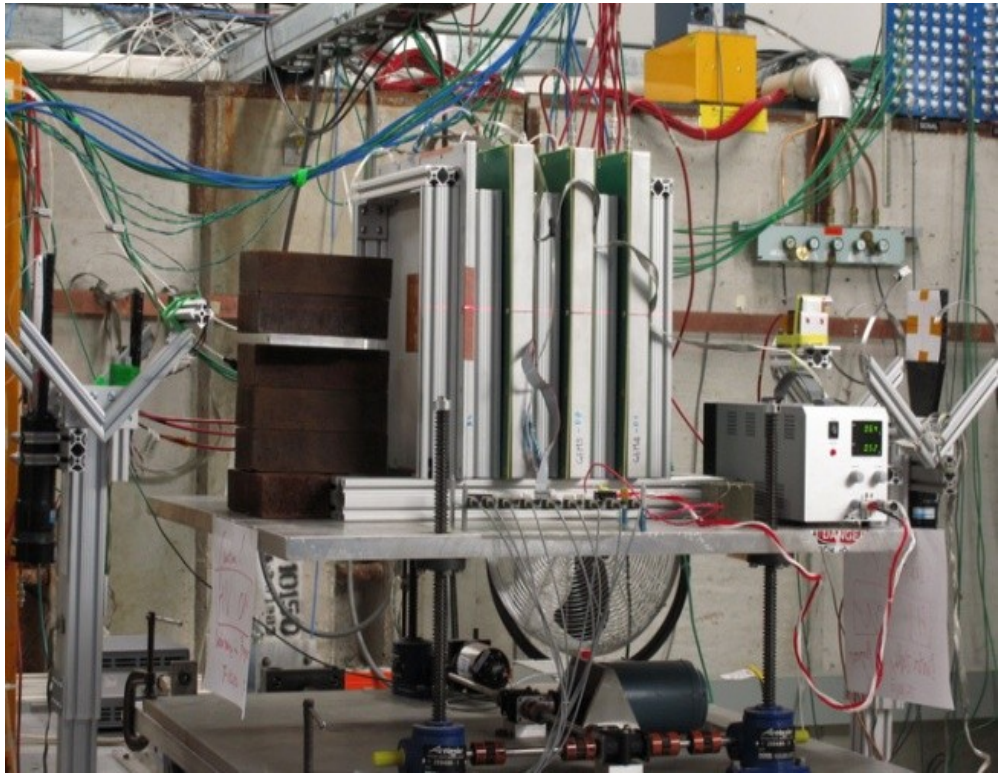
Run period October 2010: Combined running with TCMT 38/10

Run period January 2011: Standalone with TCMT replaced by RPCs

Run period April 2011: Combined running with SiW Ecal

Run period May/June 2011: Standalone (partially) in rotated position

GEM beam test at FTBF in August 2011



Test of different r/o electronics

GEM6: Read out by 13bit KPiX

GEM7, GEM5, GEM4: Read out by 1bit DCAL chip

GIA: Medical image intensifier prototype with 12 bit ADC

Test program

- Response run
- Threshold scan
- HV Scan
- Position scan
- Pion response and pion shower

Program could be fully conducted also due to extreme concern by FNAL staff

Manpower is an issue (3 persons for 14 days)

CALICE WHCAL testbeam at SPS H8

Two testbeam periods

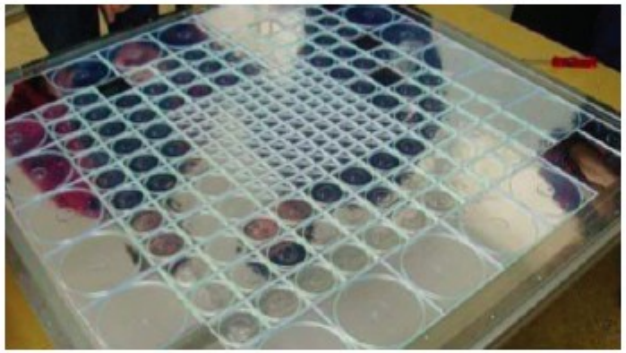
- 7 days in June: energies up to 50 GeV
- 7 days in July: energies up to 300 GeV

- Very efficient and succesful data taking periods
  Approximately 5 Mio. triggers
  Kaon sample!!!

- Valuable experience on how to deal with the H8 beam line
  Keyword wobbling

Whcal Prototype

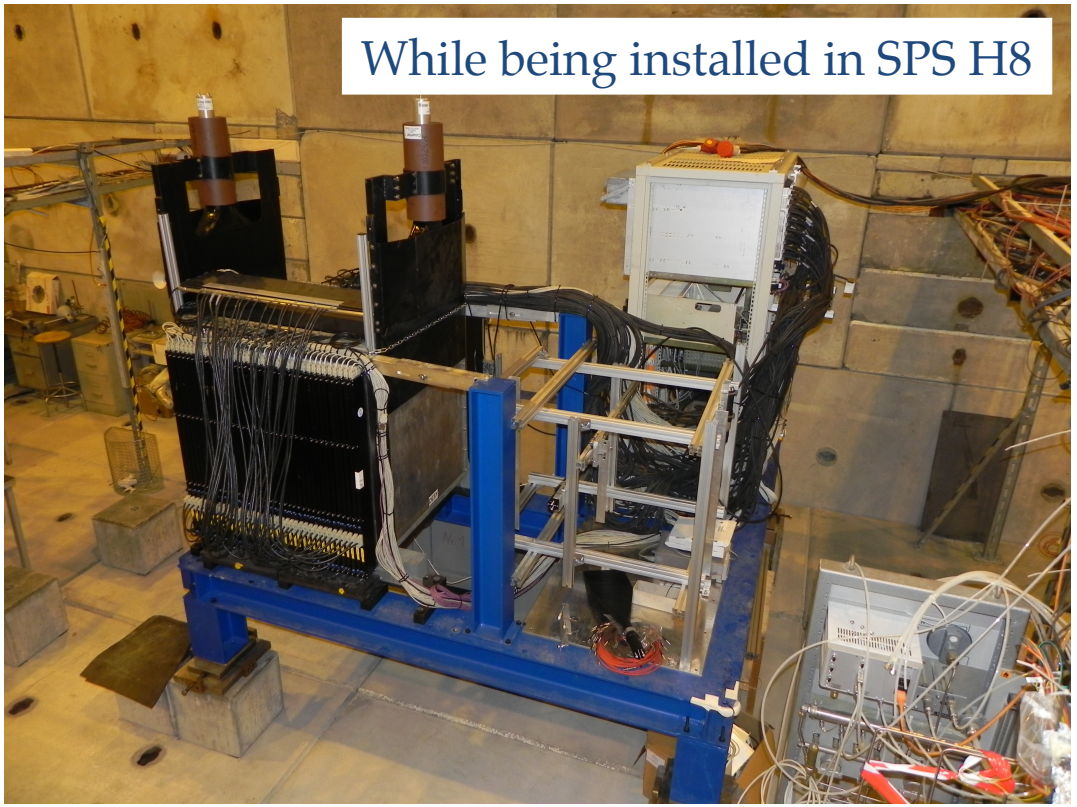
Main purpose: Validation of Geant4 simulation for hadronic showers in tungsten



Scintillator tiles 3x3 cm2 (in centre)
Read out by SiPM

19th July 2011

Current HCAL setup has 38 W layers.
Including active material this is ~4.8 λ



Whcal stack hosts also T3B counters

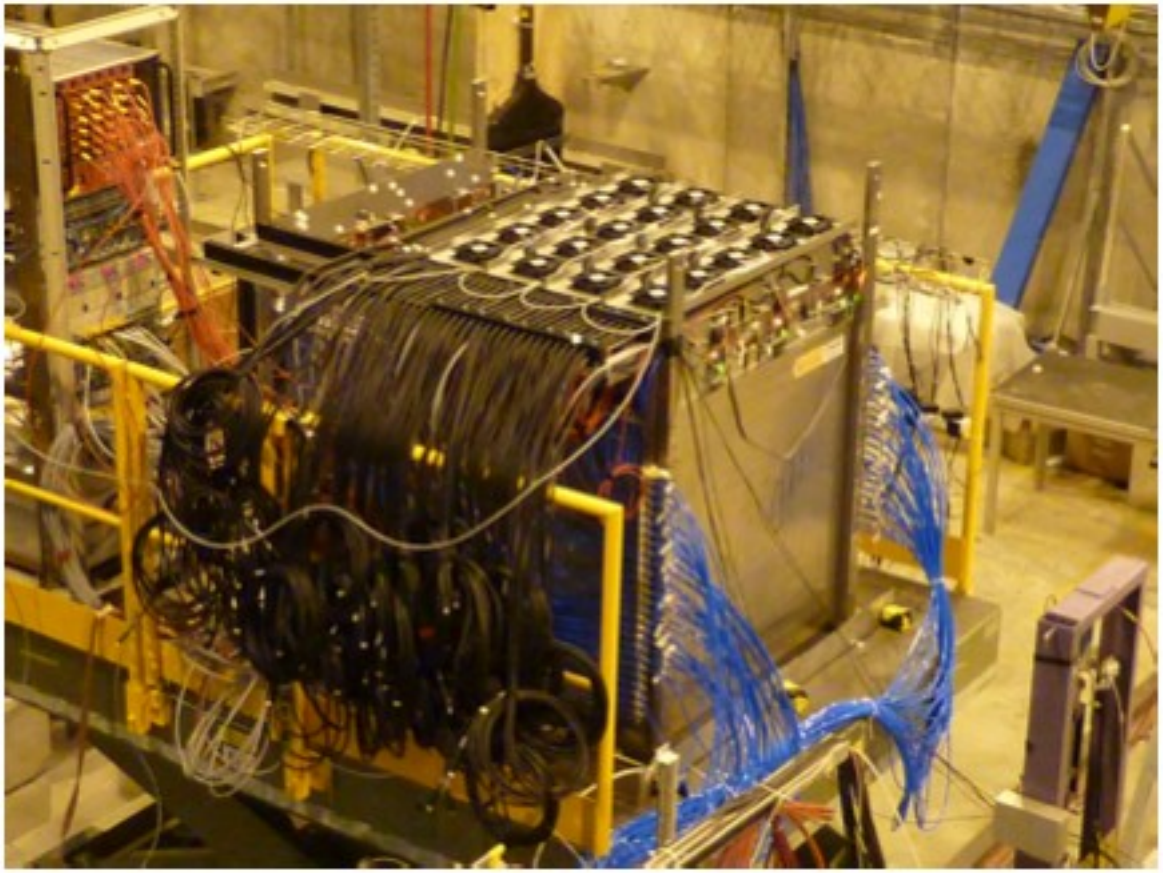
SDHCAL beam test in June

- Stack with 30 layers assembled (35 layers produced until June)
  Setup includes Mechanical structure and gas system

- Mounted onto stage in H2
  on June 17th

- Full beam control on
  June 23rd
  Before sharing with CMS

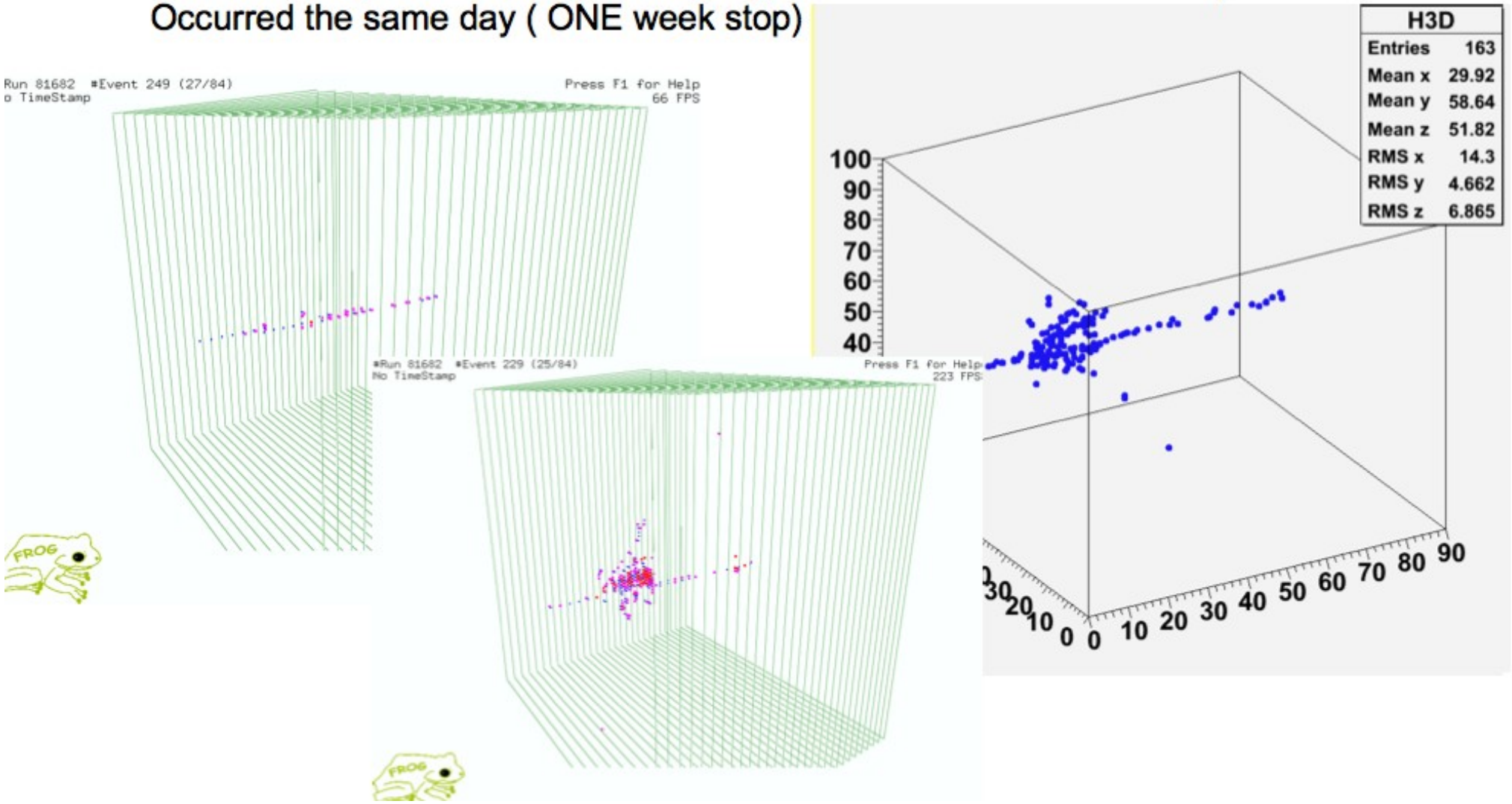
- Severe problems with
  Bringing DAQ2 into
  operation
  Switch back to USB based
  DAQ system
  (not adequate workaround)



June period must be regarded as a (pre-) commissioning run
However …

TB at H2 :

One day run with 24 chambers, One night with 28 Chambers
Using 150 GeV muons (with some contamination from pions)
On first of July 30 chambers were ready to take data but the SPS stop
Occurred the same day (ONE week stop)

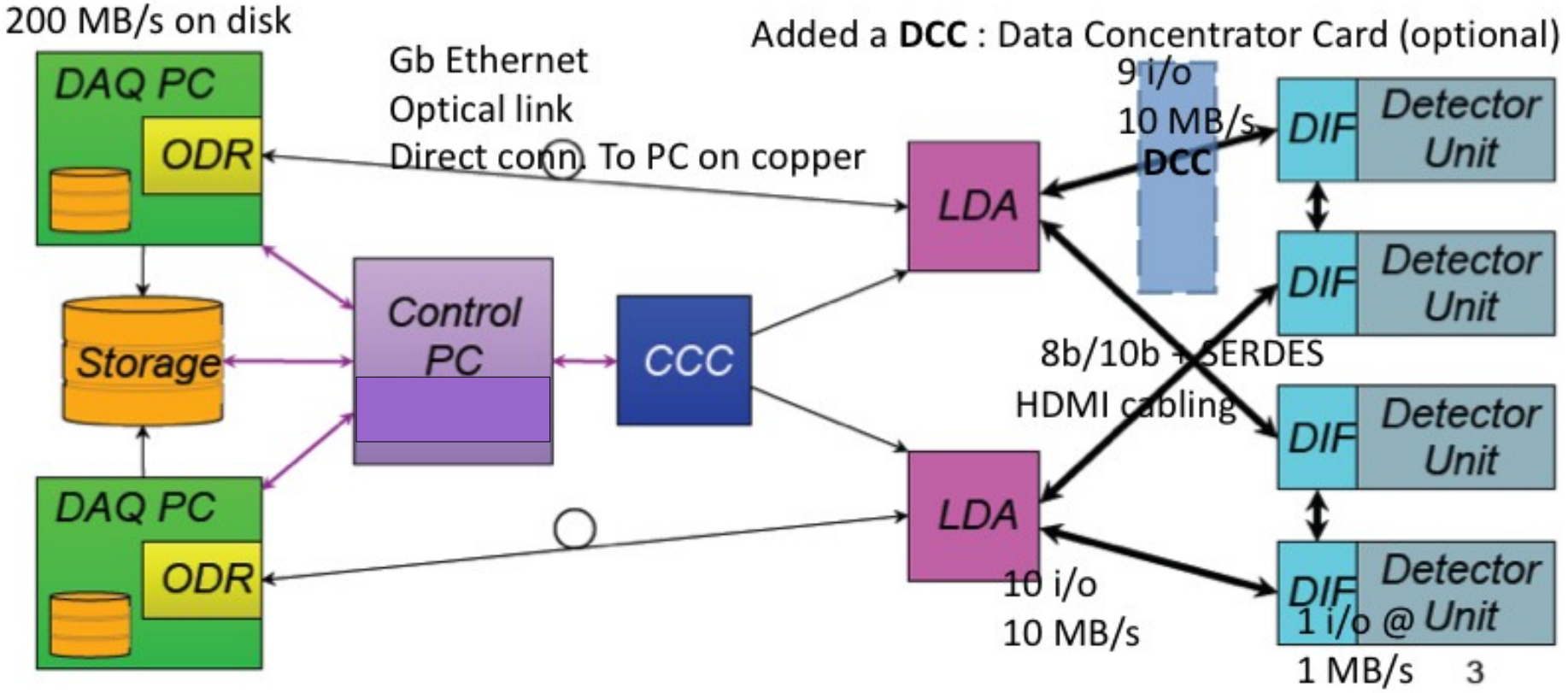


Promising validation of SDHCAL 1m3 stack

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 Issues cont'd

- DAQ2 is a non trivial system which requires sophistcated interplay of several new components

  Hardware provided by British groups and ready
  Interplay between components assured by firmware to be implemented In different components
  Progress since beginning of 2010 slowed down by (forced) drop out of British groups - Activities taken in charge by French groups

- It looks as if the June run came a bit too early for the DAQ2

  There were a number of small things which prevented the DAQ from being operational as required for a 1m3 beam test
  Many FW components still in (though at the end of) debugging phase

- Despite of problems CALICE owes a lot to the physicists and engineers Who bring the DAQ2 into operation for the SDHCAL

  The success of all current technological prototypes depends on that
  Might have been appropriate to look closer where support might have been needed

Considerable progress since June

- DAQ can buffer a large number of events (before major showstopper)

- 15 GRPC chambers (connected to 1 LDA) are running w/o a problem
  > 15 layers problems occurred due to high data volume (?)

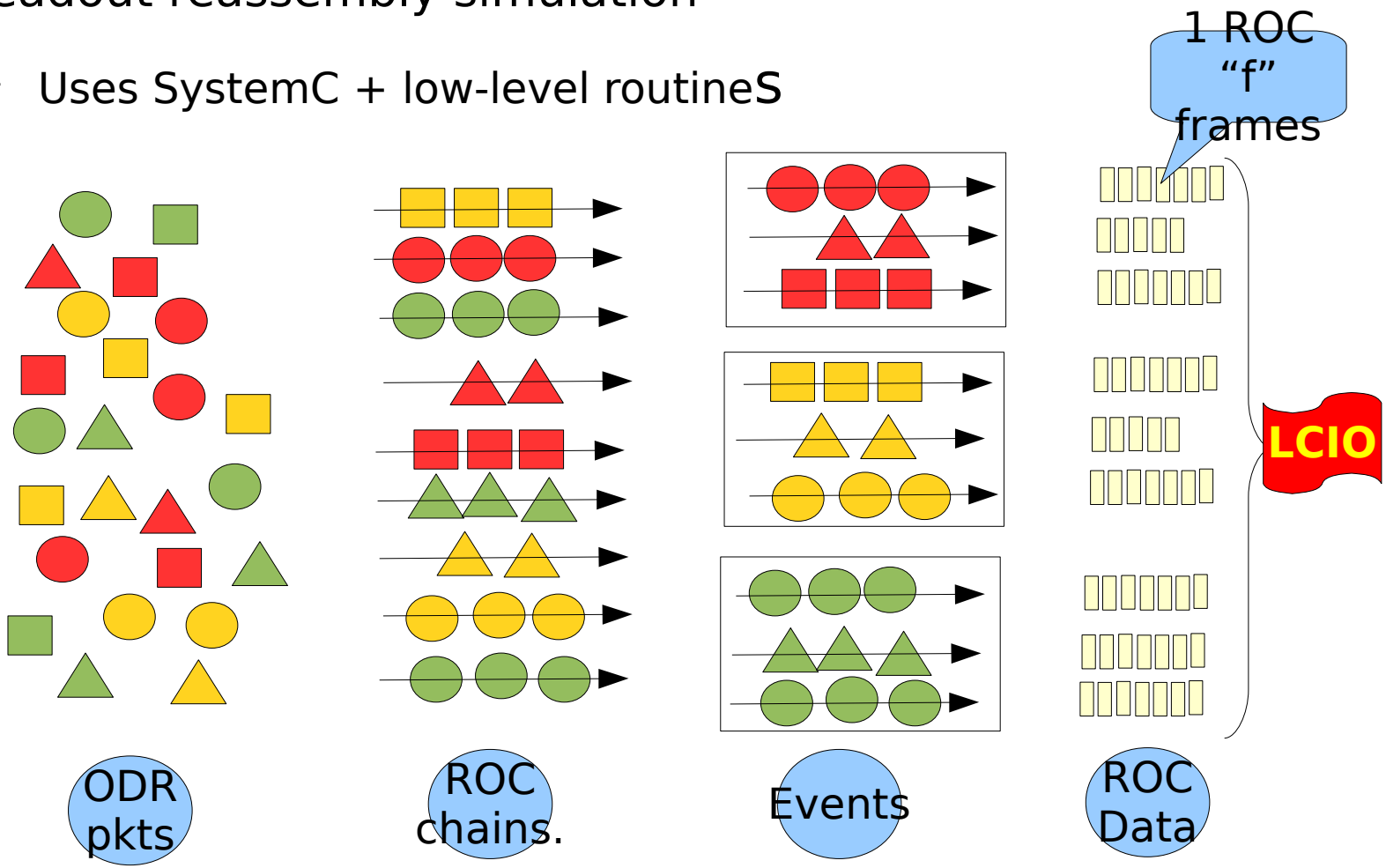
- 1 LDA can serve 30 chambers
  Enough for PS running

- Running at SPS with up to 48 layers
  Need to incorporate 2nd LDA into setup

- DAQ2 got and will progressively ready for successful running at PS and SPS

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?

Beam test of Micromegas

- Beam test between 3/8/11 and 22/8/11 at H4 beam line at CERN

  3/8/11 – 9/8/11 as user CALICE

  9/8/11 – 22/8/11 as part of RD51 collaboration

  CALICE period most useful since full control over the beam

  RD51 less useful due to high rates required for other RD51 projects

- 1m² chamber equipped with 144 MICROROC circuits

  Main purpose was characterisation of MICROROC under beam conditions

  Efficient startup - First beam signal on 4/8/11 2000h

- A number of systematic studies

  Drift and mesh voltage scans for different MICROROC shaping times

  Position scans

  DAC scans

- Chamber and MICROROC chips worked perfectly

  Remember MICROROC was urgent development to cope with

  Small Micromega signals

- Next step: Few chambers in SDHCAL stack at SPS

  Naturally both systems will use DAQ2

CERN beam time – Autumn 2011

PS beam time for CALICE: 12/9/11 – 26/9/11

- Commissioning run of SDHCAL
- Compensates for problematic June run at SPS

SPS beam time for CALICE: 27/9/11 – 12/10/11
14 beam days + 1 machine day (28/9/11)

Decision on repartition:

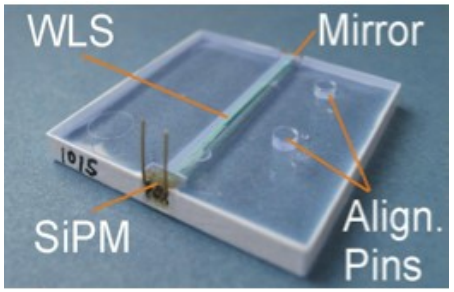
27/9/11 (8h) – 3/10/11 (8h) Whcal running (5 days on beam)
3/10/11 (8h)– 12/10/11 (8h) SDHCAL running (9 days on beam)

Brief justification of decision:

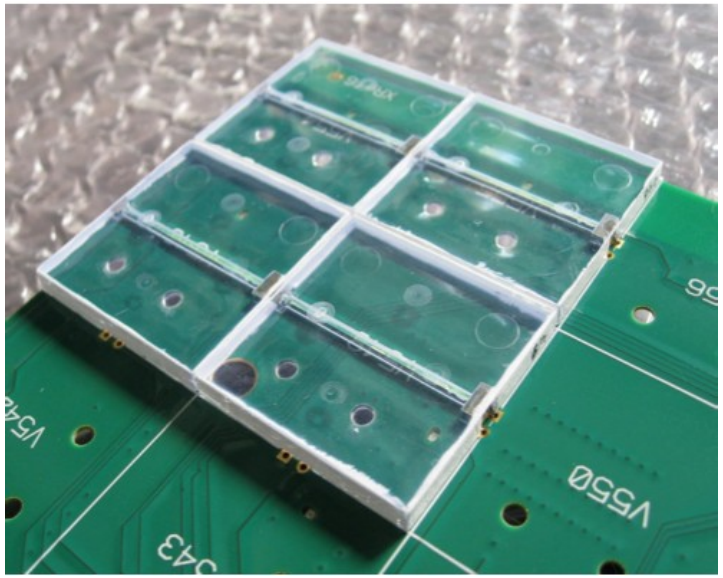
- Risk minimisation w.r.t. exploitation of assigned beam time
  Takes into account priority to be given to SDHCAL program, but yet enables completion of started measurement program (WHCal), e.g. Kaons
- Risk minimisation w.r.t. transports
- Availability of hardware/systems, both old and new

AHCAL - Technological prototype

- Mechanics well advanced – See also earlier meetings



Tile delivery expected from ITEP
Expected to have 600 tiles by end of September
Enough to equip 4 Hcal Base Units (HBUs)

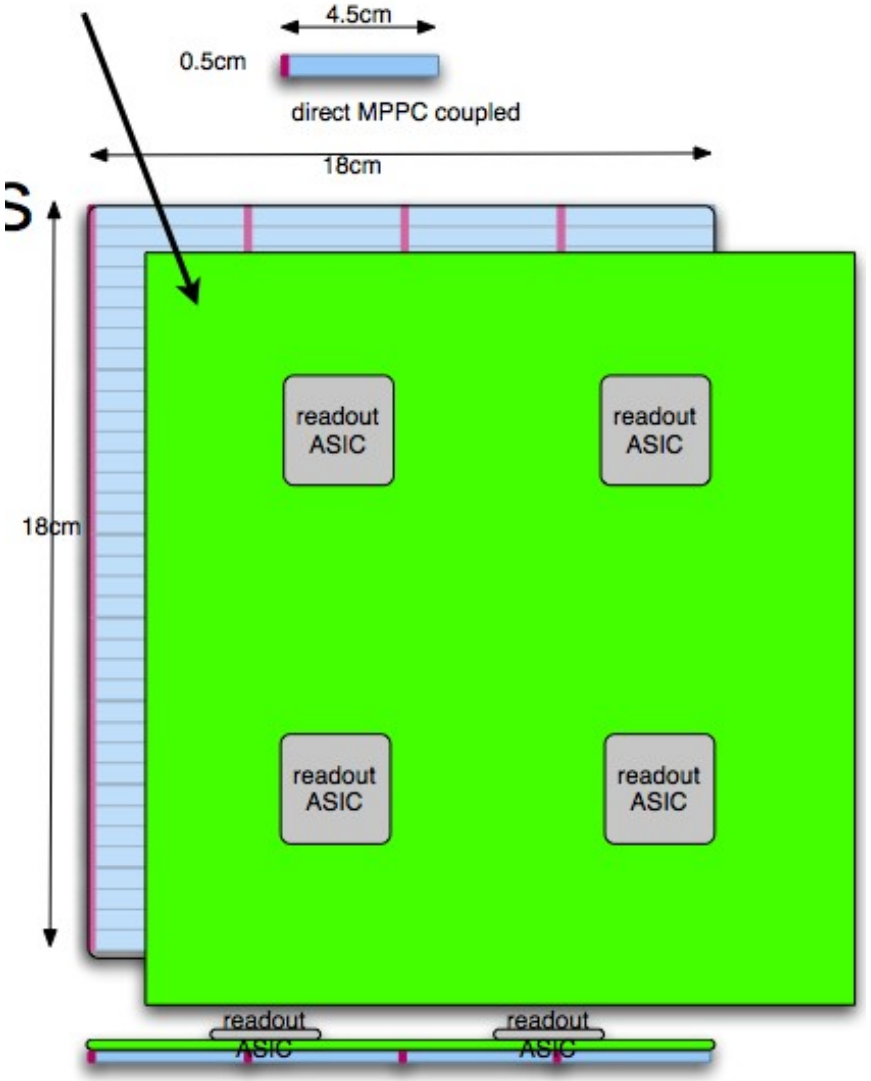


Development of AHCAL ASUs
Ensemble of tiles,
Hcal Base Units (HBUs)
and SPIROC2b circuits

Current focus:
TDC of SPIROC chip

DESY test beam as soon as one HBU is functional
Based on DAQ2 (USB based DAQ possible but maybe less desirable)

Scintillator Ecal – Technological prototype



- R&D work by Japanese (and Korean groups)

  Scintillator strips
  MPPC and connection to tiles

  Proof of principle given

- Realisation of Ecal Base Units (EBU)

  requires engineering support
  (within CALICE)

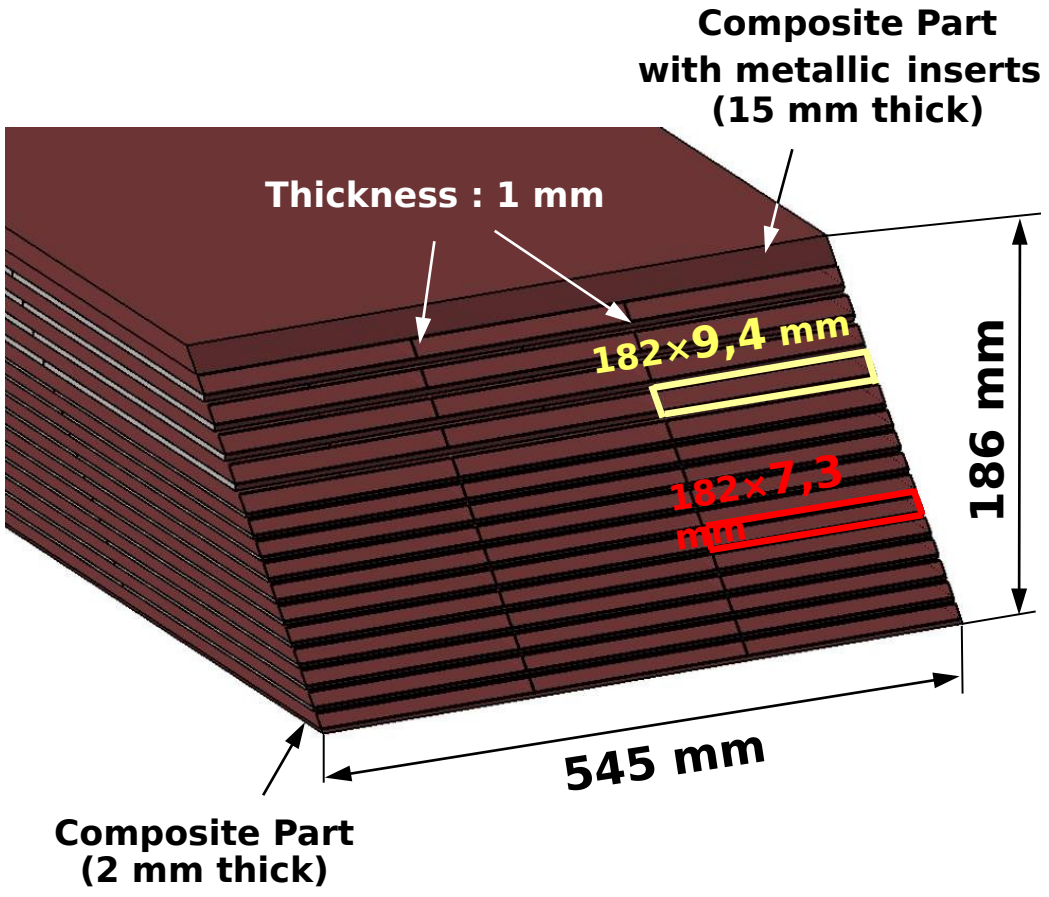
  Main open issue: Fixation of
  tiles within EBU

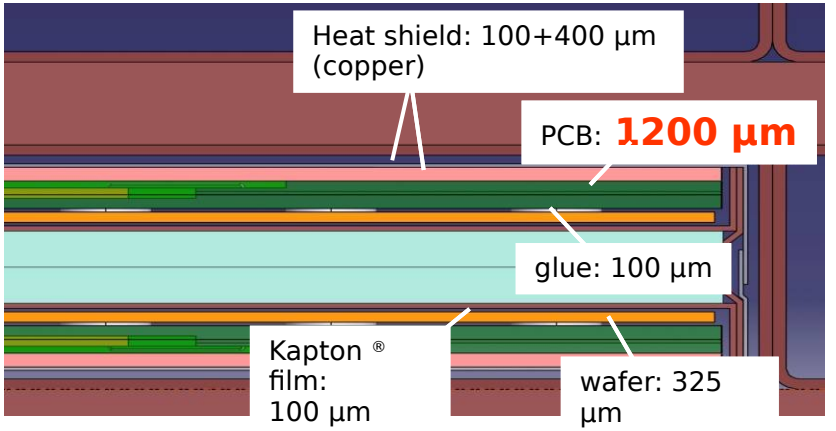
Timeline:

2011 Design phase
2011 – 2012 production phase
Beginning 2012: Test in Japan
2012 Installation in 'EUDET Module'
Structure (SiW Ecal)
2012 Beam test in multi layer
Structure with SiW Modules

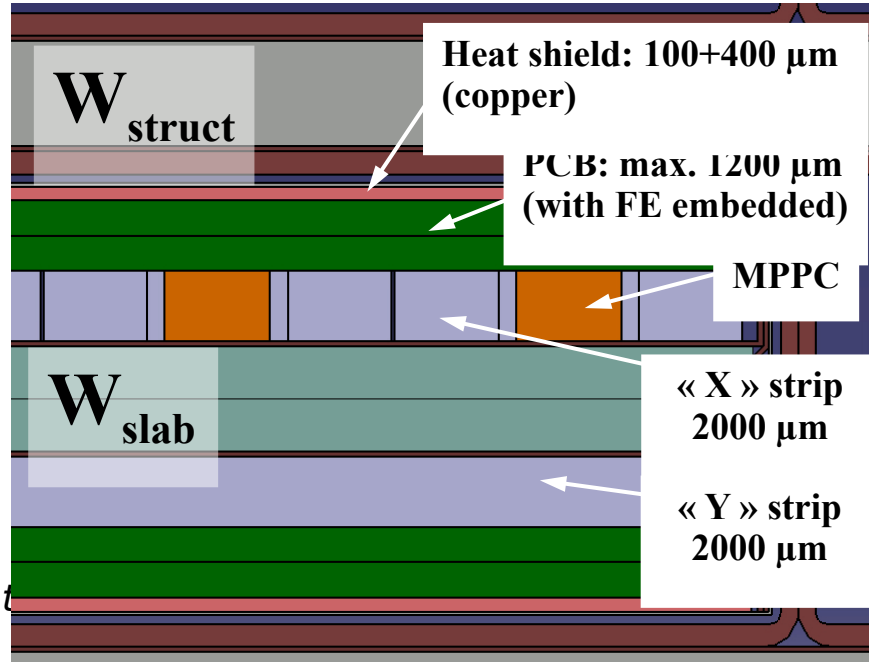
Expect considerable benefit from recently approved funding for ILC detcor R&D

Collaboration SiW-Scint Ecal



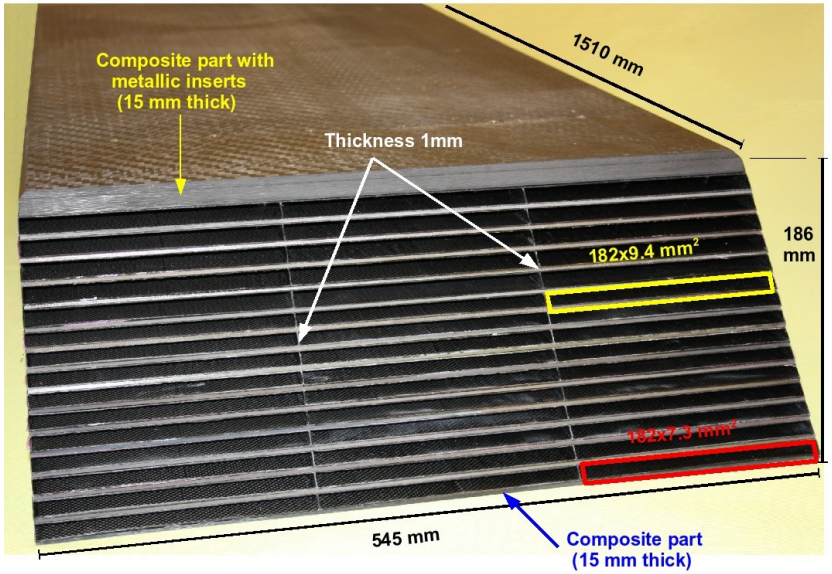


ECAL W/Scin

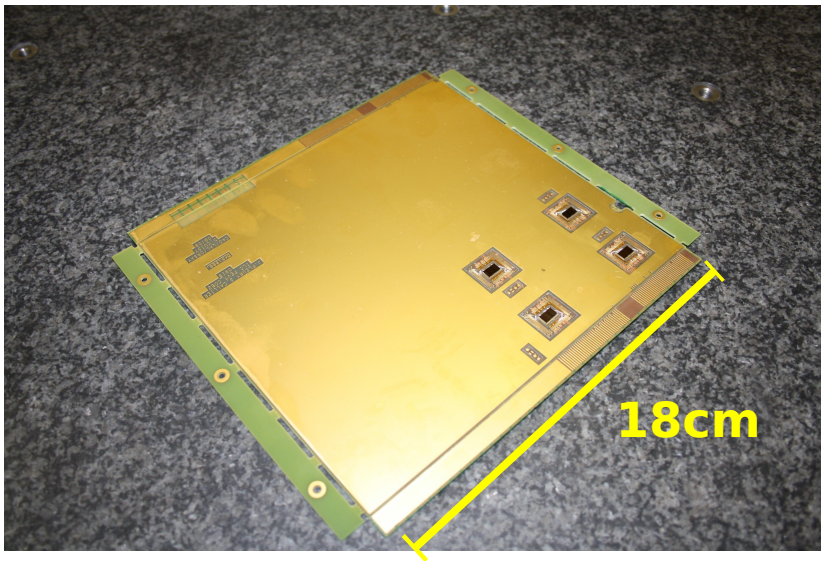


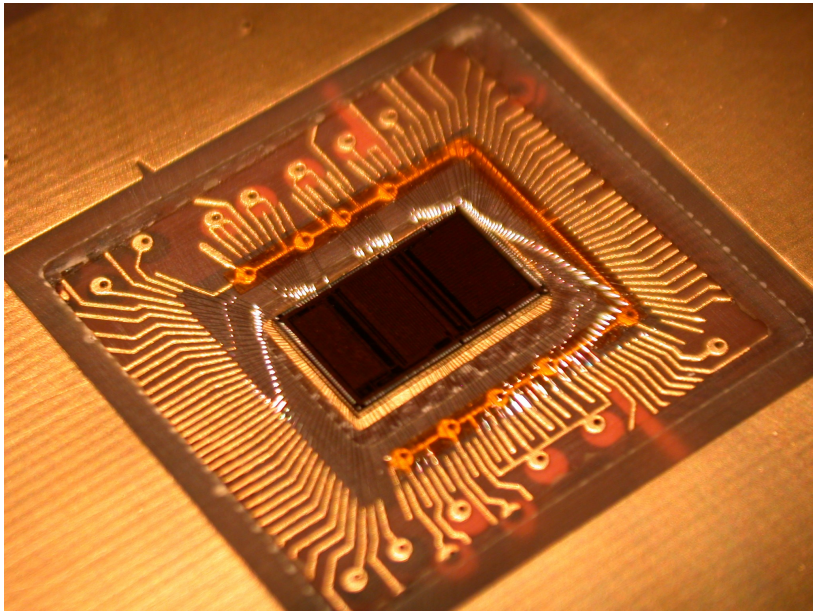
- Alveolar structure applicable for both Ecal proposals
- Details on integration are currently worked out.
  Communication SiW Ecal-ScintEcal-DESY
- Schedule to be precised in coming months

EUDET “legacy”

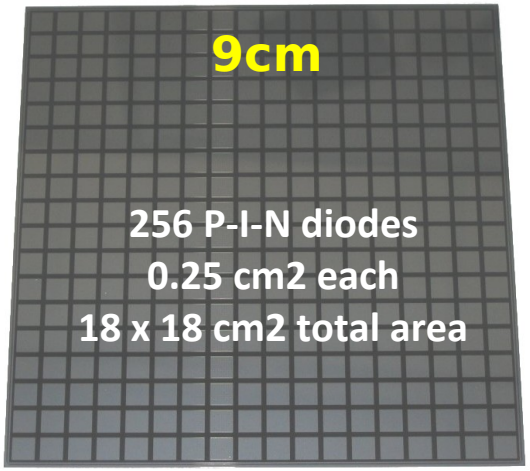


Alveolar strucuture
to house layers (self supporting)





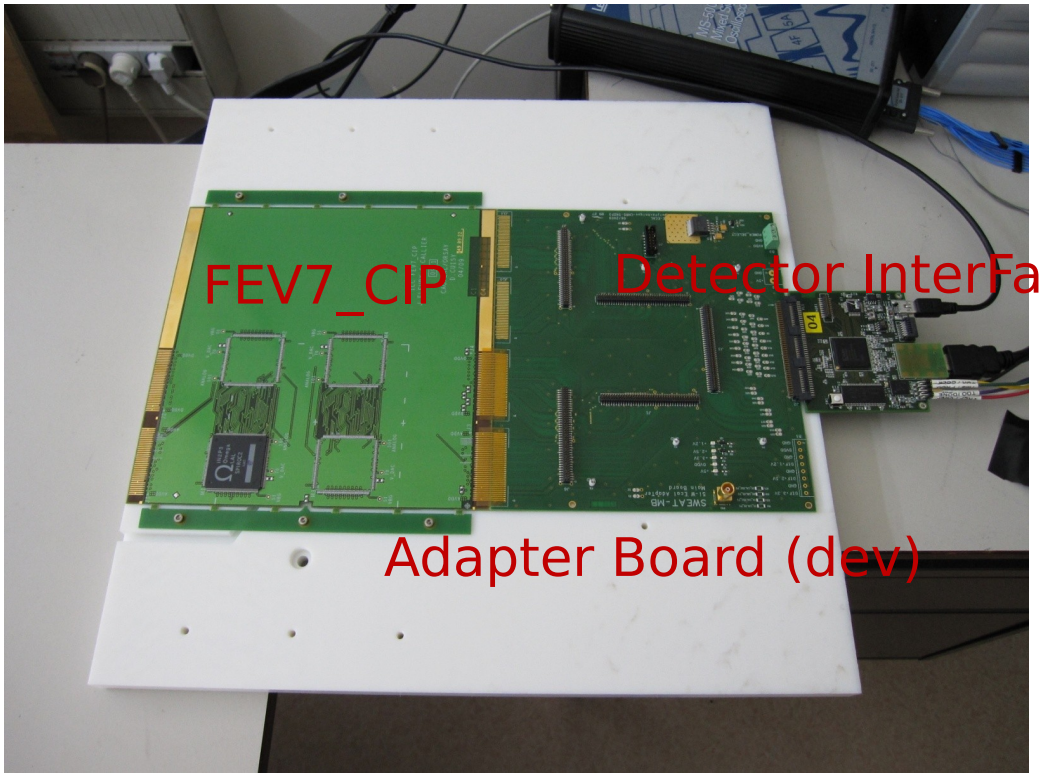
Front end electronics



Silicon sensors

Bringing the Ecal into operation …

Some delay since Ecal adopted DAQ2 from the very beginning !!!!



First variant of ASU uses SPIROC chip
Packaged chip (conservative start)

Significant progress during Summer 2011
→ Ecal session

Further work include

- Cooling system (ready)
- Interconnection of many ASUs
- Mechanical assembly

Next steps:
- Reliable operation of Current Ecal ASUs
- Orientation towards SKIROC and FEV8
  First ASU expected not earlier than summer 2012

First beam tests with small untis during autumn/winter 2011/12
More tests during 2012 when more ASUs will become available (including tests in magnetic fields)

Towards DBD ...

- CALICE TB has started a discussion on criteria for technological Readiness
  → Discussion not intensified due to priority of current test beam issues

- Strategy is to define readiness criteria ourselves and present them to concepts (and RD)
  Criteria have been defined by TB and approved by CALICE SB

- Will ask for endorsement by DESY PRC (or succeeding body)

Summary and outlook

- Passing through very busy times
  E.g. June saw a time with three (!) 1m³ beam test
  Successful beam tests of DHCAL and Whcal
  Stress test for SDHCAL
  DAQ2 was an issue → Stabilisation phase → Ready for autumn

- Priority for autumn should be to get a valuable data sample with the SDHCAL

- … and to conclude the running with the Hcal scintillator physics prototype
  Hardware (DAQ and Detector) is starting to age severely
  Time to put the the prototypes of first hour to rest

- Slow but steady progress with 2 generation prototypes
  Ecal, AHCAL towards small scale beam tests
  Will benefit from stabilisation of DAQ2

- Software is an issue

- DBD preparation should move into focus of activities

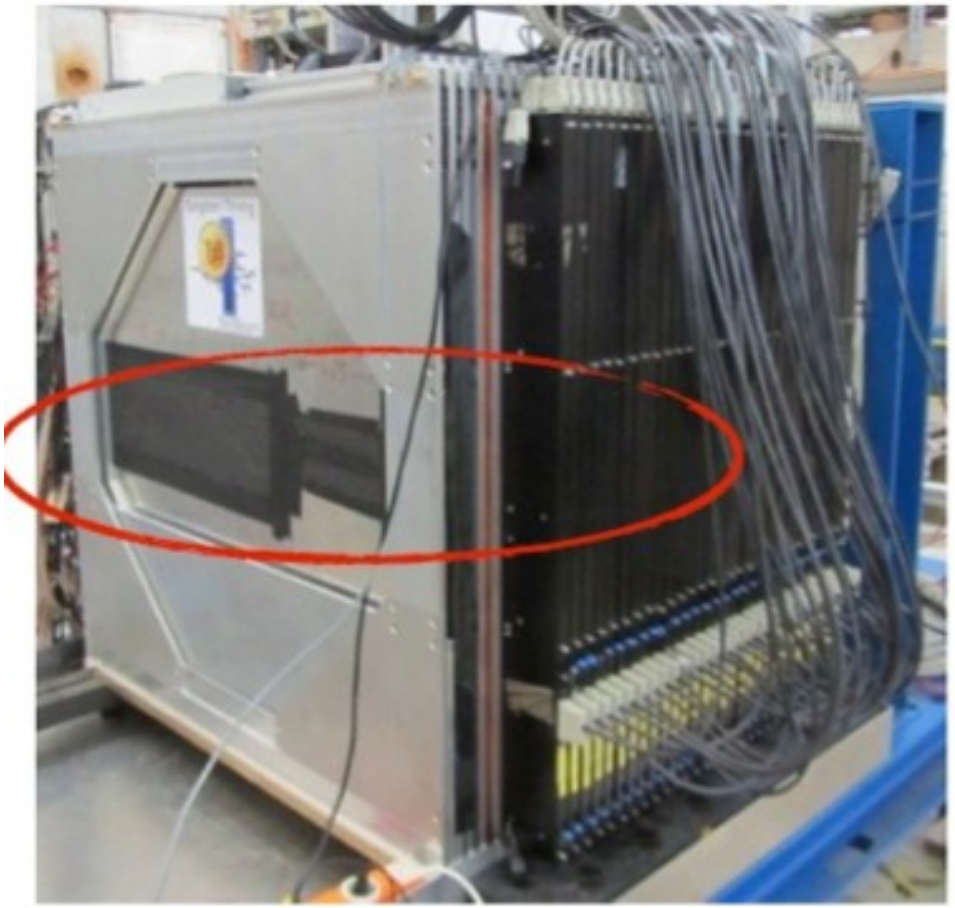
- Planning of 2012/13 beam test campaigns

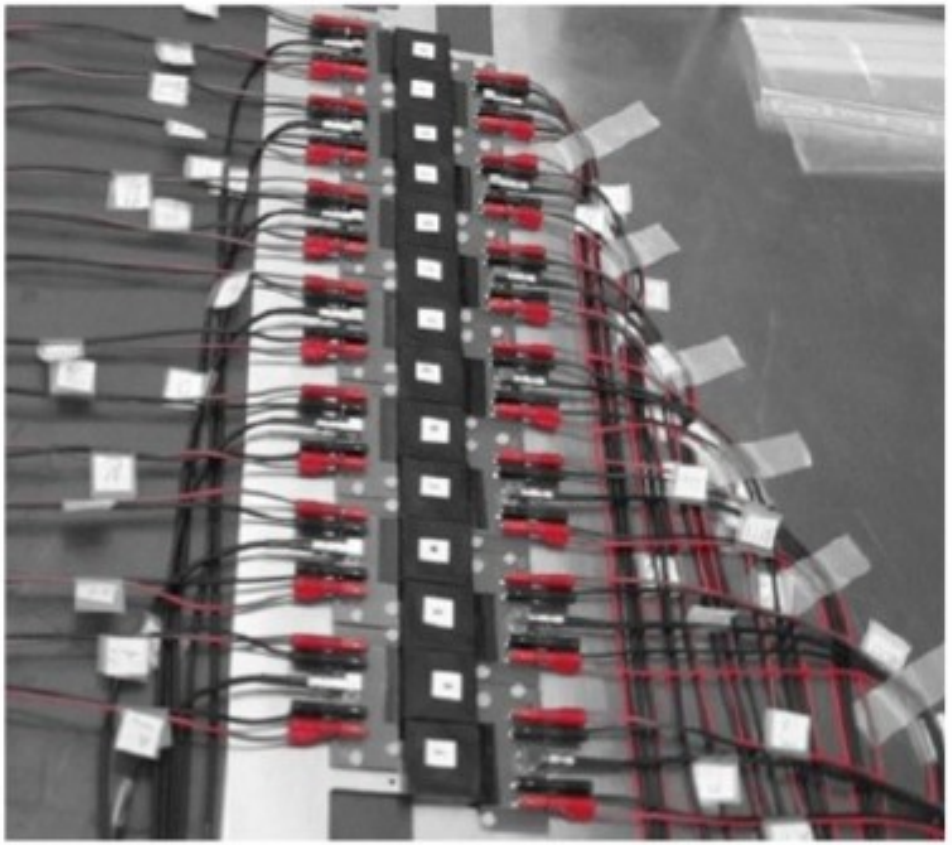
Backup

T3B – Timing structure of hadronic shower

- One layer, with a row of 14 - 15 scintillator tiles with a size of 3 x 3 cm^2 read out with Hamamatsu MPPC50C and fast digitizers with deep buffers

  - Installed at the end of the WHCAL setup





Impressions from SDHCAL construction

Delivery to CERN of mechanical structure at the 1st of June 2011

Software for recent test beams

Software coordination: Angela Timoce Lucaci → Shaojun Lu

- W-AHCAL test beam at CERN 2010
  - conditions database have been built
  - reconstruction has been updated, and the data have been reconstructed
- SiW ECAL + DHCAL test beam at FNAL 2010 - 2011
  - conditions database have been created
  - SiW-ECAL reconstruction commissioning
  - US DHCAL integration to CALICE reconstruction is in progress (Jacob)

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