AIDA work package 9.5 – Granular calorimeter infrastructure

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on behalf of CERN LCD

April 2013

wp 9.5 goals & tasks

Goals - Infrastructure for tests of different HCAL detection techniques, scintillator and gaseous.

Milestones & deliverables:

- Gas system, control & bench structure (month 20, milestone)
- Integrated infrastructure for calorimetry (month 40, del.)
- Report of comparison of GEANT4 sim & testbeam (month 46, del.)

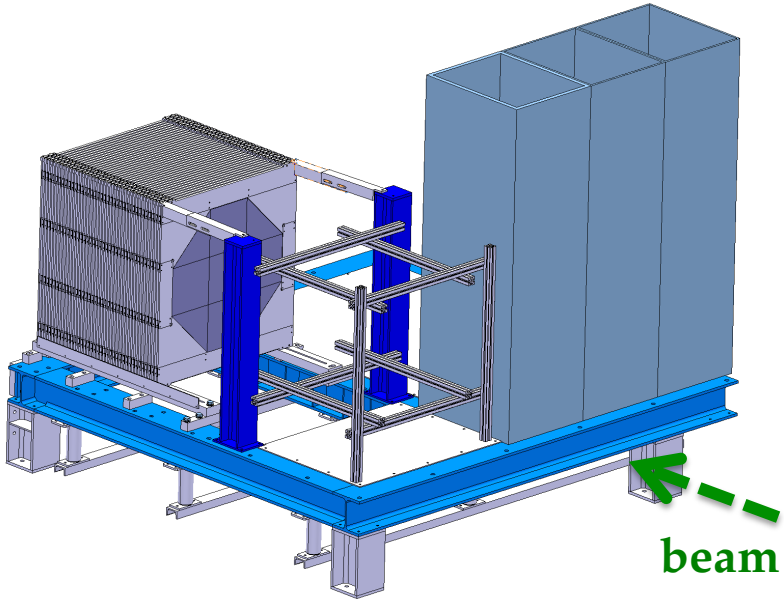
Tasks

- Readout infrastructure with picoscopes
- First version of bench structure for HCAL support
  - has been constructed and extensively used, including tail-catcher.

Closely related to WP 8.6.1:
'Support for common testbeam'

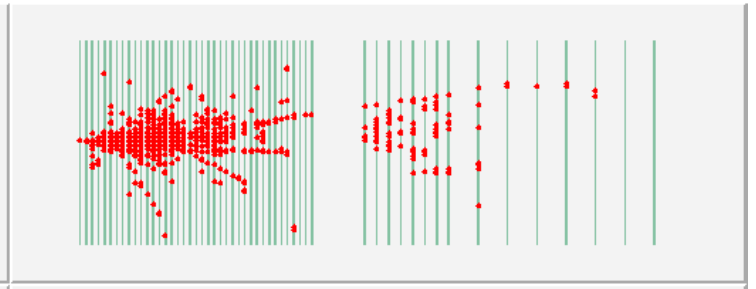
Improvements of infrastructure

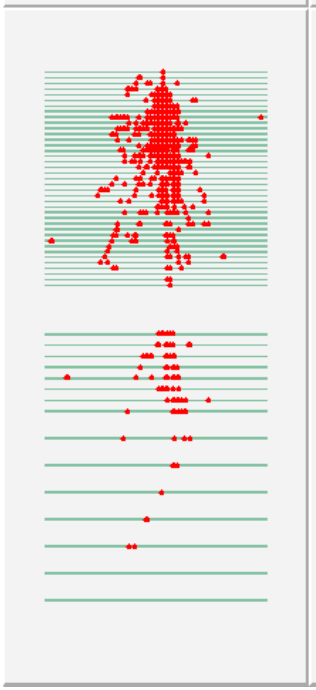
Made such that it can be transported fully equipped

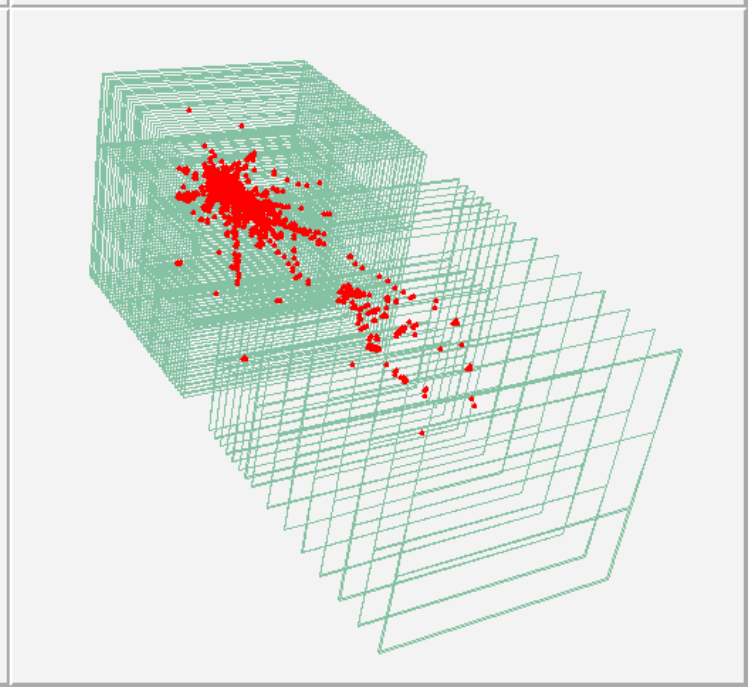


Imaging calorimetry – digital HCAL

At SPS –
210 GeV pion event display



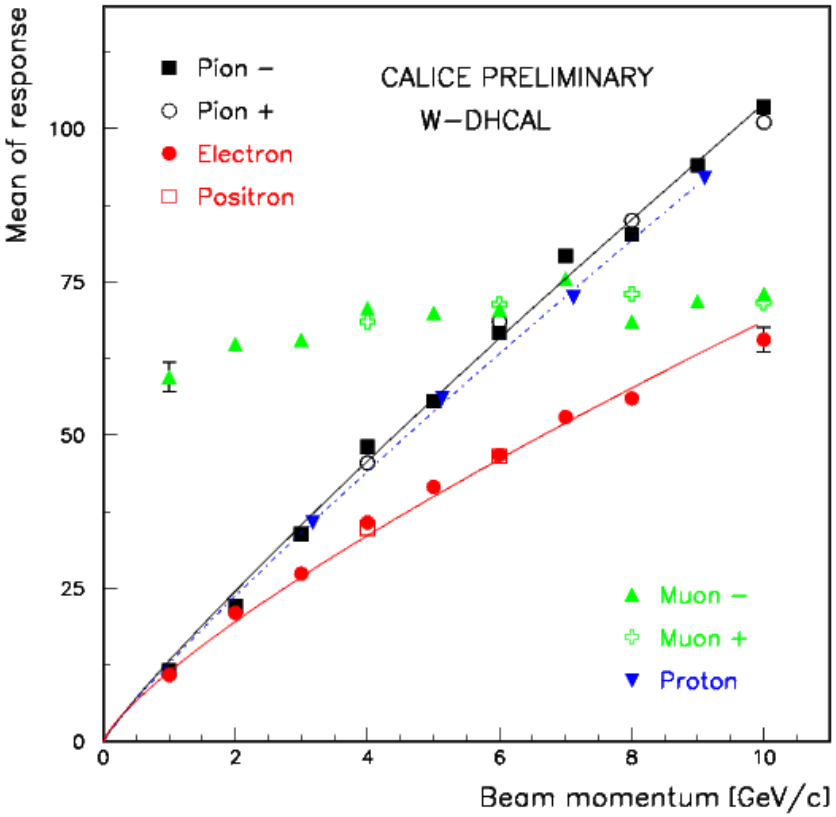


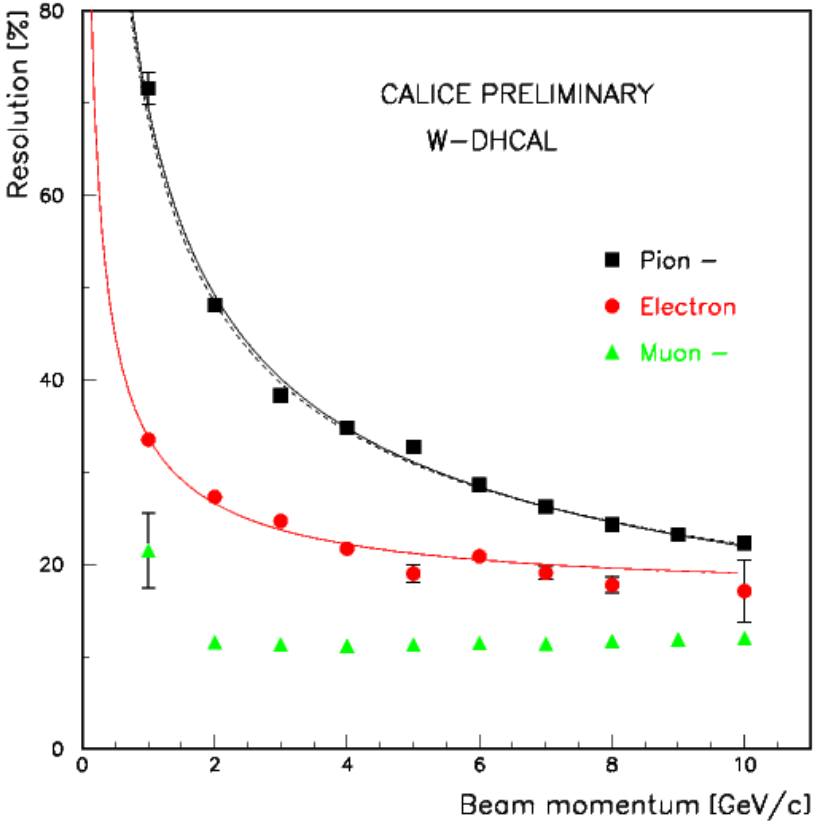


Test beams in 2012:

- PS T9: 2 weeks in May
- SPS H8: 2 + 1 + 1 weeks in June, August & November.

Response and resolution



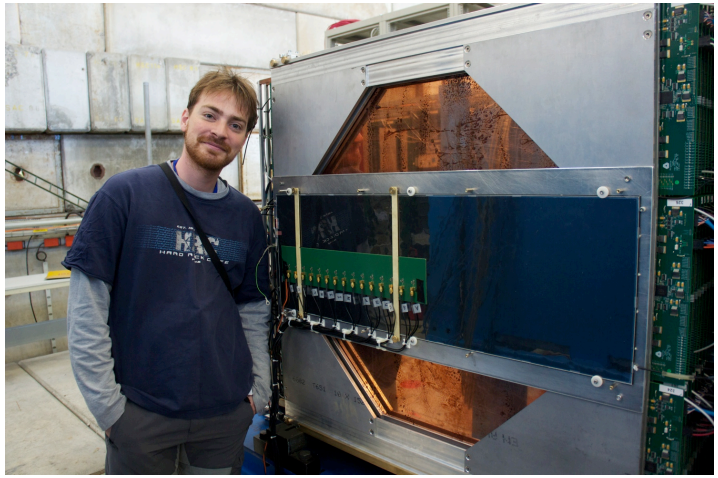


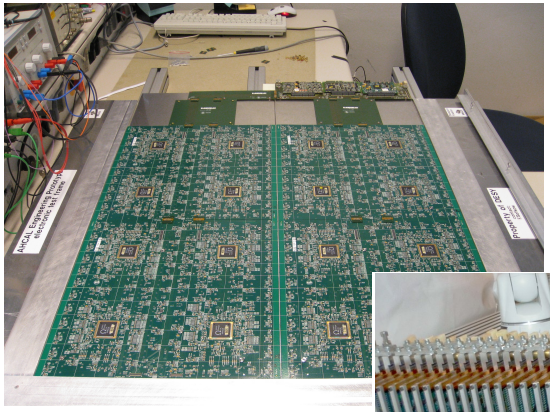
Additional detectors

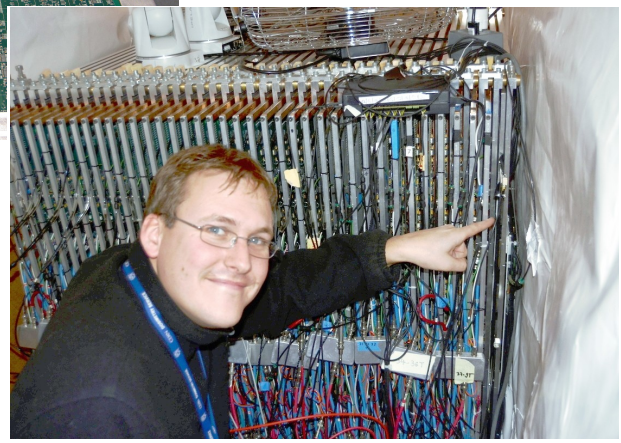
FastRPC, developed with MPI Munich:

1-D strip detector of 15 pads, each 3x3 cm^2, with ~1 ns readout accuracy, mounted on a spare glass RPC

→ study shower time development in tungsten, compare with AHCAL T3B.







2nd generation AHCAL:

- Detector integrated easily in the flexible mechanics and the overall beam infrastructure

Deliverables & milestones

WP 9.5 - Infrastructure for tests of different HCAL detection techniques

- Gas system, control & bench structure (month 20, milestone)
- Integrated infrastructure for calorimetry (month 40, del.)
- Report of comparison of GEANT4 sim & testbeam (month 46, del.)

→ Month 20 milestone: Achieved and reported.

→ Analyses are well underway; first results presented at conferences, see LCWS2012 and CALICE meeting at DESY

Prospects

- Continue with two HCAL analyses
  - In collaboration with ANL in the USA and with DESY. Would require travel money.
- Tests with 2nd generation AHCAL with time-resolving electronics are planned for in 2014 with more layers.
- Further studies on small scintillator tiles with SiPM readout
  - Assessment of overall feasibility/operation/calibration with very small cells
  - Picoscope has been bought for data acquisition
  - Synergy with AIDA partners (e.g. Bergen, DESY, MPI Munich)

Financing

2012 spending:

- 34319 (EU):
  - CHF 18'118 → manpower
- 34309 (CERN):
  - CHF 15'964 → manpower
  - CHF 9'800 → Material

	2011	2012	Total available	% spent
34309	24'395	25'764	74'300	68%
34319	0	18'118	59'800	30%

→ 34309: as scheduled, relatively more spent on material in first years.

→ 34319: a bit more available for manpower than scheduled.

Conclusion

Programs achieved

- Tungsten digital HCAL, up to 300 GeV.
  - Detector has been shipped back to the USA.
- AHCAL-2nd generation prototype
- FastRPC – High rate capable glass RPC prototype

→ Analyses are ongoing

Scintillator with SiPM readout studies have started

- Taking off smoothly thanks to common infrastructures.

Backup

Milestone MS42

A progress milestone for Deliverable 9.7:

- "Integrated infrastructure for highly granular calorimeters: An integrated infrastructure allowing for testing in beam a complete calorimeter set-up with different options for radiators, sensors or electronics."

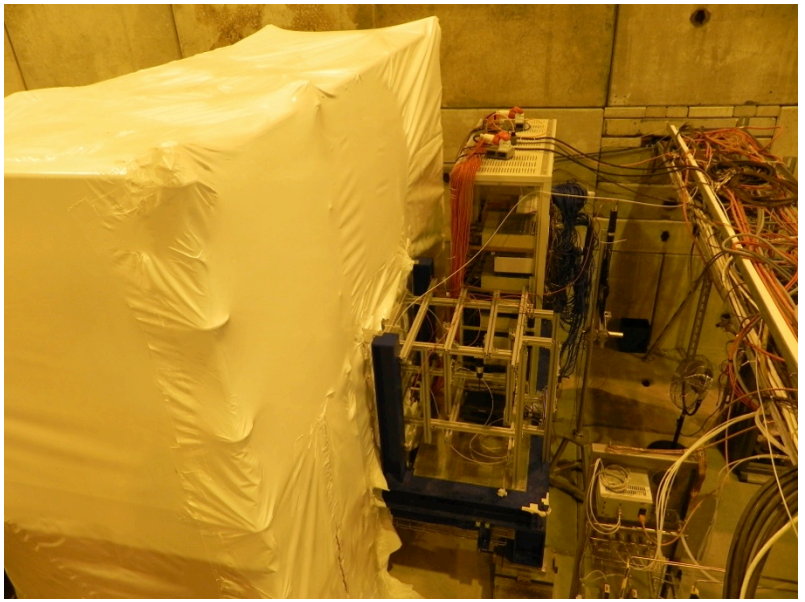
- A single gas system for the different CALICE gas detectors would at the moment serve no purpose: the equipment needed for the several technologies is for now integrated in the different prototypes.
- Based on the experience with the DHCAL system, the ones integrated with the French RPCs and the MicroMegas can be seemlessly integrated.

- The tungsten stack and tailcatcher have been equipped in 2011 and 2012 with several different sensor and electronics technologies
- Notably the analog and digital hadronic calorimeter (HCAL) technologies from the CALICE collaboration. These have successfully been tested in beam lines at the PS and SPS areas at CERN.
- As described in the 1st Periodic AIDA report, only after a few modifications for the bench structure in the beginning of 2012, could the set-up accommodate the digital HCAL.

- A description is given in
  - "Beam tests with the CALICE tungsten analog hadronic calorimeter prototype", D. Dannheim, W. Klempt, E. van der Kraaij, LCD-Note-2012-002.

SPS operation

- Two-layered tent covering the detectors, with two zip doors



- ACs to cool air inside:
  - 2x 4 kW units
  - 1x 7 kW unit

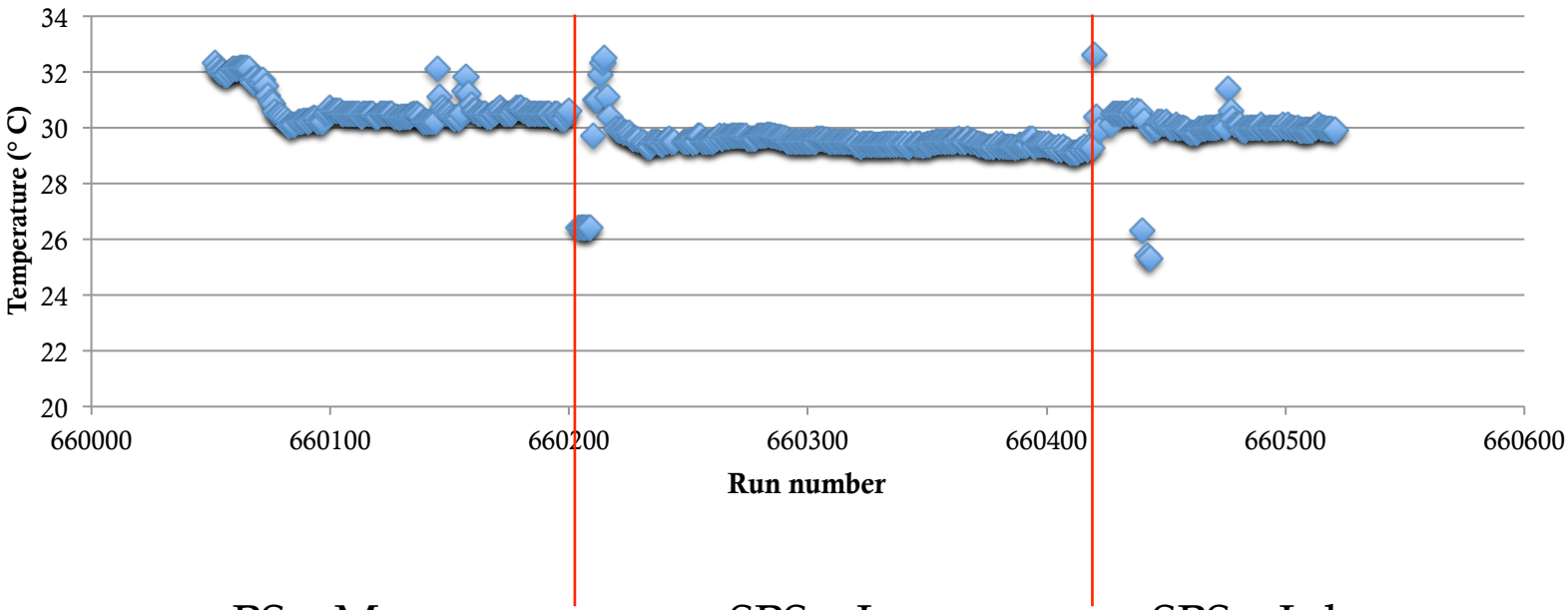
Cooling

Acquired ventilators & rented airconditioners to cool down a cabin to keep detector at stable temperature.

Result:

- Stable within +/- 0.5°C
- Fluctuations during installation →

Sudden drops: powercycle of LV
Sudden rises: AC turned itself off



PS – May
"hot" weather

SPS – June
"rainy" weather

SPS – July
"hot" weather

Money spent WP 9.5

2011, checked with cet.cern.ch:

- 34319 (EU):
  - None.
- 34309 (CERN):
  - Tools for trigger setup, CHF. 1900
  - CHF. 22.495, for two fellows participating (with each 1 person-month).

2012:

34309 (CERN):

- ~ CHF.150 per month on electronics rental
- ~ CHF.1600 for mechanics work

Financing

2012 spending:

- 34319 (EU):
  - CHF 18'118 → manpower
- 34309 (CERN):
  - CHF 15'964 → manpower
  - One picoscope for DAQ (CHF 7'010)
  - Rent for airconditioners (CHF 780)
  - Electronics pool rental (CHF 320)
  - Platform adjustments (CHF 1'690) →Total material: CHF 9'800

	2011	2012	Total available	% spent
34309	24'395	25'764	74'300	68%
34319	0	18'118	59'800	30%

→ 34309: as scheduled, relatively more spent on material in first years.

→ 34319: a bit more available for manpower than scheduled.

Resources – WP 9.5

Implementation plan version: EvdK, 20/03/2012

WP9, PH-LCD

Budget holder: **Erik van der Kraaij**

Budget codes: **EU** **34319**

CERN **34309**

PPA code: **RLC-PRJ**

WP.task	PPA	EU funding to project (CHF)	Budget code for EU funding	CERN funding for project (CHF)	Budget code for CERN funding	Person-Months	Personnel direct costs (EU funds)	Consumable and prototype direct costs (EU funds)	Travel direct costs (EU funds)	Personnel direct costs (CERN funds)	Consumable and prototype direct costs (CERN funds)	Travel direct costs (CERN funds)
WP9.5	RLC-PRJ	59,800	34319	74,300	34309	12	59,800			47,900	19,800	6,600

EU-part of budget allocation (CHF) **Code** **34319**

category / year	2011	2012	2013	2014	total		
staff (PSI)	0	0	0	0	0	Total EU fund.	Plan
fellow (PFE)	0	30000	20000	10000	60000	60000	59800 Manpower
materials (M)	0	0	0	0	0	0	0 Consumable + travel
total	0	30000	20000	10000	60000		

CERN-part of budget allocation (CHF) **Code** **34309**

category / year	2011	2012	2013	2014	total		
staff (PSI)	0	0	15600	15600	31200	Total CERN fund.	Plan
fellow (PFE)	20000	20000	0	0	40000	71200	47900 Manpower
materials (M)	5500	5500	500	500	12000	12000	26400 Consumable + travel
total	25500	25500	16100	16100	83200		

EU versus CERN post by post

Item	P-M	2011	2012	2013	2014	cost	% EU	% exisitng department resources	% additional CERN resources	EU	existing department resources	additional CERN resources	total CERN
Dominik Dannheim	2			1m	1m	31,200	0%	100%	0%	0	31,200	0	31,200
Nardulli, replaced by Lucaci in 2012	2	1m	1m			20,000	0%	100%	0%	0	20,000	0	20,000
Erik van der Kraaij (fellow)	2	1m	1m			20,000	0%	100%	0%	0	20,000	0	20,000
Erik van der Kraaij (fellow)	3		3m			30,000	100%	0%	0%	30,000	0	0	0
New Fellows	3			2m	1m	30,000	100%	0%	0%	30,000	0	0	0
Purchase of a tool		5000	5000	0	0	10,000	0%	100%	0%	0	10,000	0	10,000
Travel		500	500	500	500	2,000	0%	100%	0%	0	2,000	0	2,000
	12								Totals	60,000	83,200	0	83,200
Planned	12									59,800			74,300