14.4. Readout systems for innovative calorimeters

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WP 14.4
April 25th, 2018

- **Milestone 58**: Definition of optical and electrical coupling of readout, interface functionality and DIF design
- **Deliverable 14.5**: Common running of calorimeter prototypes
- **Deliverable 14.6**: Adaptation of readout system for operation in compact LC detectors
Milestone 58: Definition of optical and electrical coupling of readout, interface functionality and DIF design

Verification: DIF data sheets
Date: Months 24, delivered

describes status for AHCAL DIF (produced), SDHCAL DIF (in design) and SiECAL DIF (aim for 2018)

Test bench for ASIC tests (no deliverable/milestone)

Description of subtask 14.4.2: “This activity includes test benches for front-end ASICs of highly granular calorimeters as e.g. those developed in WP4. The test bench is a prototype for mass tests for LC Experiments capable to serve experiments with similar front-end electronics.”

Status: testboard for AHCAL ASIC (SPIROC2E) in BGA package built, has been used for the “mass testing” for the ASICs for the next large prototype (~600 ASICs)
Deliverable 14.5: Common running of calorimeter prototypes

**Deliverable:** Data acquisition system to allow for a common data taking of different highly granular calorimeter prototypes in beam tests at CERN and DESY. These tests should provide data files containing events synchronised between the subsystems.

**Date:** Month 36

**Status:**
- Within WP5: EUDAQ2.0 released in June 2017
- In July 2017: combined testbeam of CMS HGCAL and CALICE AHCAL prototypes
- In September and October 2017: several more short periods of combined HGCAL + AHCAL running
  - Extended HGCAL setup
  - Consolidated DAQ (mainly the HGCAL part)
HGCAL + AHCAL data taking in October 2017

• 5 days in H6 at SPS: 18 – 23 October 2017 (originally foreseen for CMS tracker)
• fixed installation without stage -> no position scan possible
• data taken:
  • muons @ 120 GeV
  • pions: 50 – 120 GeV
  • electrons: 20 – 80 GeV
• HGCAL hardware:
  • 20 modules (was 10 in July)
  • one layer in FH with 7 modules
  • observed strong dependence of noise on the way how modules are grounded triggered further investigations
• AHCAL hardware
  • as in July
  • working reliably
• synchronisation:
  • after a fix to the SYNC board firmware: same number of triggers seen in all detectors
  • routine common running
Experience from common HGCAL + AHCAL running

- quick integration of two calorimeters with very different trigger concepts
  - only possible thanks to EUDAQ
  - inclusion of wire chambers also straight forward
  - use of HGCAL SYNC board (instead of TLU) possible because of clear definition of standards for master clock and control device
- data taken in this testbeams provided important input for HGCAL TDR (handed in in December 2017)
- more testbeam with a (nearly) fully equipped HGCAL prototype + AHCAL prototype planned for 2018

- overall a big success!
  - shows the strength of having a (relatively) simple versatile high-level DAQ system
Deliverable 14.5: Common running of calorimeter prototypes

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- within WP5: EUDAQ2.0 released in June 2017
- in July 2017: combined testbeam of CMS HGCAL and CALICE AHCAL prototypes
- in September and October 2017: several more short periods of combined HGCAL + AHCAL running
- plans for 2018:
  - 2 week of CMS HGCAL + CALICE AHCAL testbeam at SPS in October 2018
  - 2 weeks of CALICE SiECAL + CALICE SDHCAL testbeam at SPS in September/October 2018, plan to use EUDAQ
    - SDHCAL has already tested previous EUDAQ version, feedback taken into account for EUDAQ2.0
    - SiECAL plans to test EUDAQ once new hardware fully under control
- overall: requirements of Deliverable 14.5 fulfilled, first draft of writeup exists
Deliverable 14.6: Adaptation of readout system for operation in compact LC detectors

Date: Month 44

Status:
- SiECAL DIF: see talk by Dominique Breton (Dirk filling in)
- SDHCAL DIF: new version to operate a whole detector plane with 1 DIF only developed by CIEMAT
- AHCAL DIF:
  - space constraints less stringent than for ECAL
  - current generation of interfaces already designed with limited space in mind
  - no further optimisation planned at the moment
The firmware is being developed. DIF to be tested with large ASU equipped with HR3.
Summary

- **Milestone 58**: Definition of optical and electrical coupling of readout, interface functionality and DIF design  
  **Date**: Months 24  
  **Status**: milestone report delivered

- **Deliverable 14.5**: Common running of calorimeter prototypes  
  **Date**: Months 36  
  **Status**: task fulfilled, first draft of writeup exists

- **Deliverable 14.6**: Adaptation of readout system for operation in compact LC detectors  
  **Date**: Months 44  
  **Status**: on track