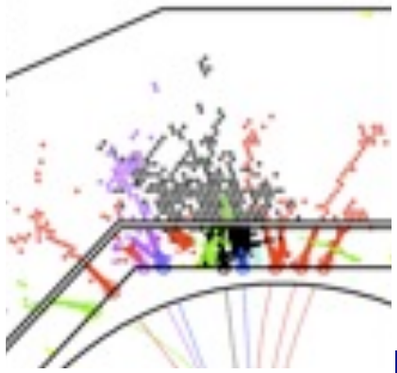
CALICE views and needs

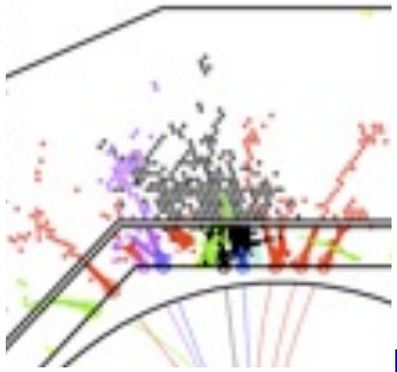
Felix Sefkow

Informal discussion on future EU projects for the ILC community
LAL, Orsay, 29. November 2013



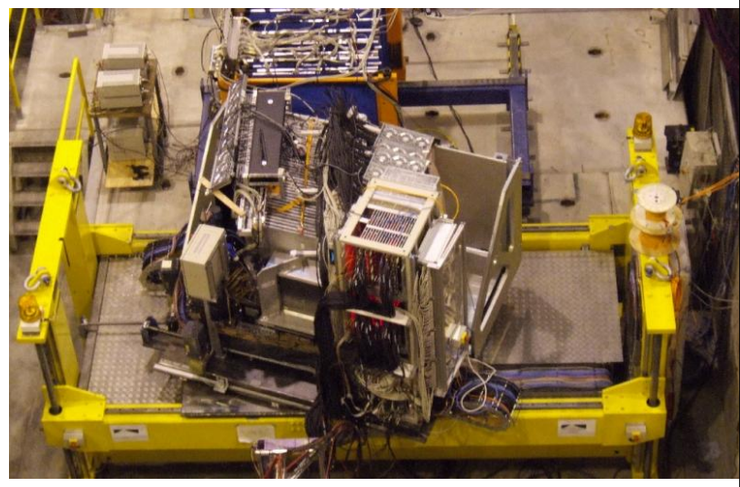
Outline:

- Big picture: status of calorimeter development
- Previous EU projects EUDET and AIDA
- Upcoming topics
- General remarks



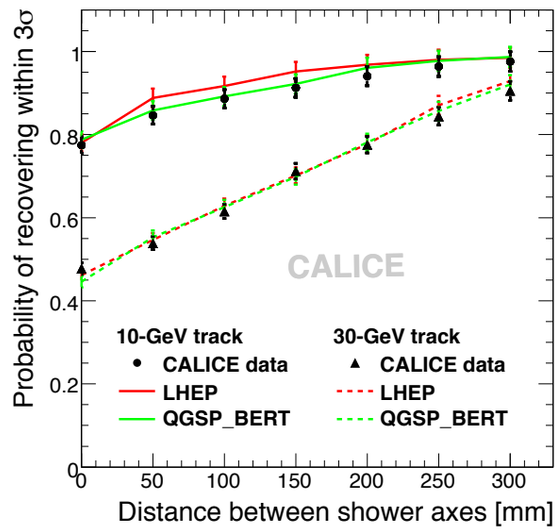
First phase: PFLOW validation

- Physics prototypes: new technologies proof of principle
- Validate detector understanding, shower models, algorithms



- 7 years of test beam: 2006-2012, DESY, CERN, Fermilab

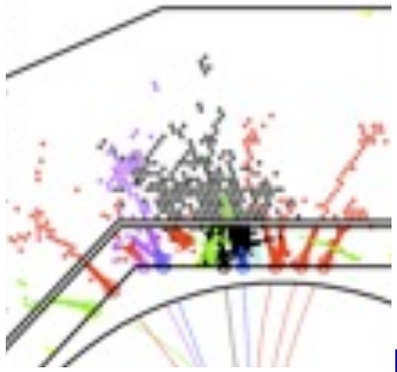
- Status of analyses corresponds to time since data taking
  - Si ECAL, scintillator HCAL almost completed and published, still more on the way
  - gaseous HCALs in full swing, prelim. results on performance, validation of simulation and algorithms still to come



- Need to support analyses: common software framework for test beam and detector concepts

- Need continued Geant 4 support
  - e.g. unique shower decomposition tools

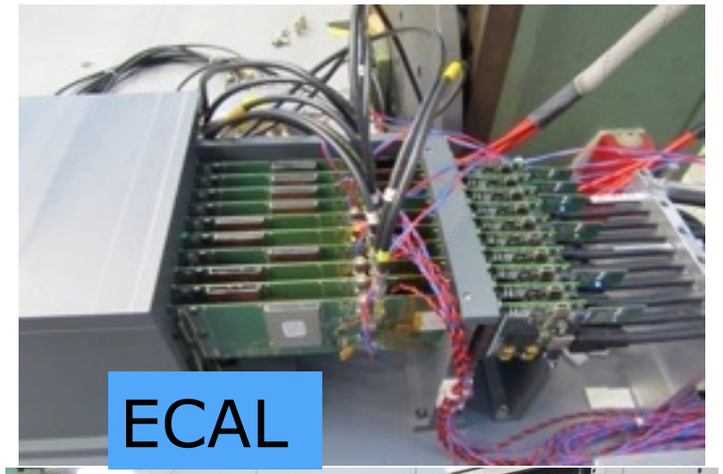
2013:
4 journal papers
7 preliminaries

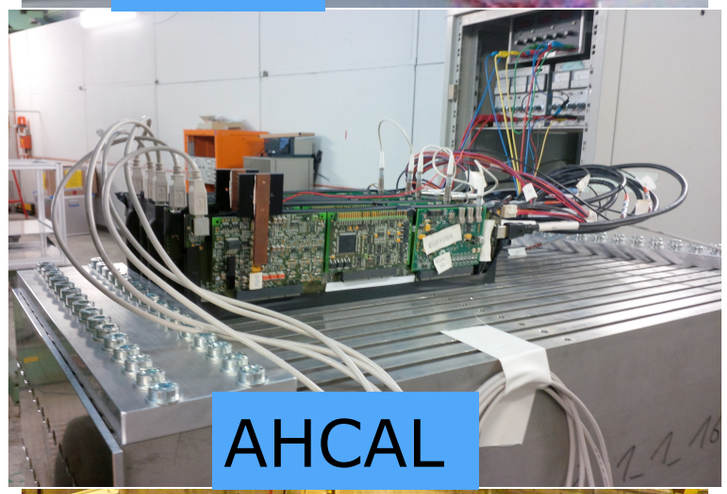


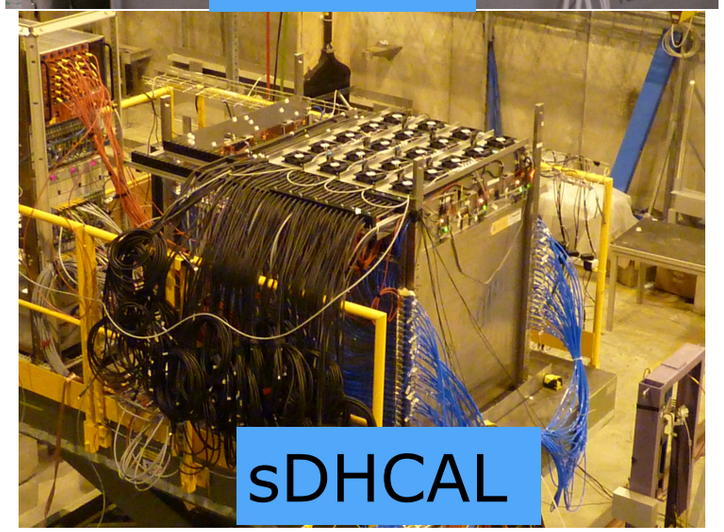
Technological prototypes

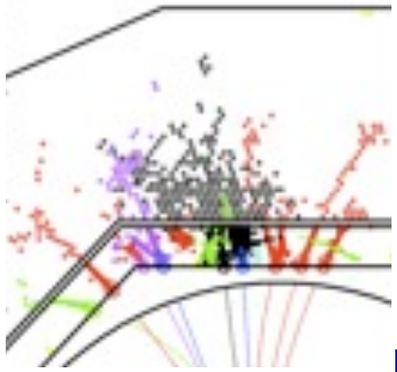
- Electronics integration, power pulsing
- Compact design: absorbers and PCBs
- Scalability

- Integration solutions exist
- Components were prototyped
- Si ECAL, scintillator HCAL: small set-ups tested, <10 small layers
- Gas HCAL: the only large 2nd gen prototype
- None addresses all integration issues yet
- Funding limited



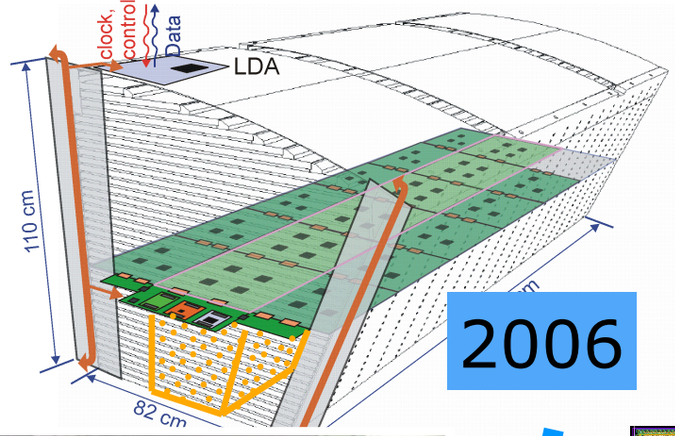




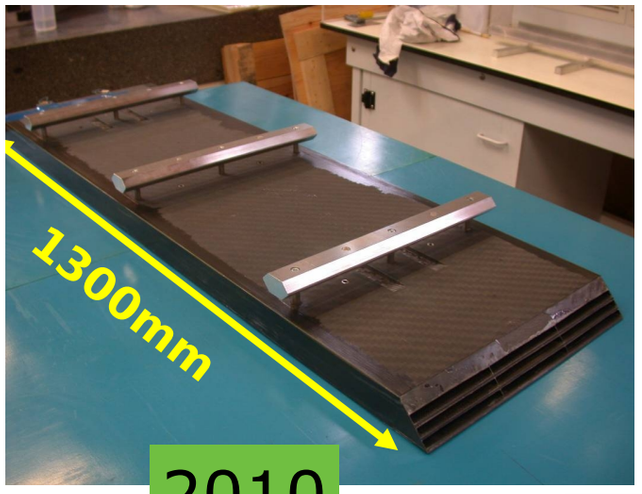


EUDET 2006-2010

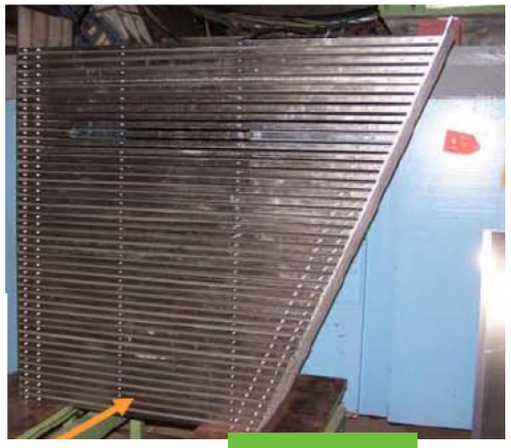
- Kick-started technological prototype phase in 2006
- JRA3: ECAL, HCAL, FCAL, electronics and DAQ
- Absorbers: Tungsten for ECAL, steel for AHCAL
- ASICs for ECAL, AHCAL and sDHCAL
- read-out units, DAQ
- Geant 4 support



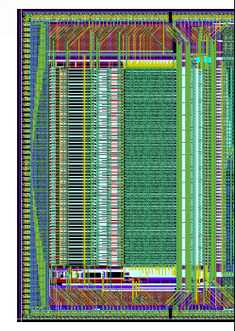
2006

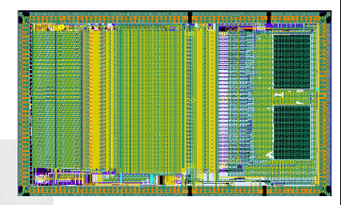


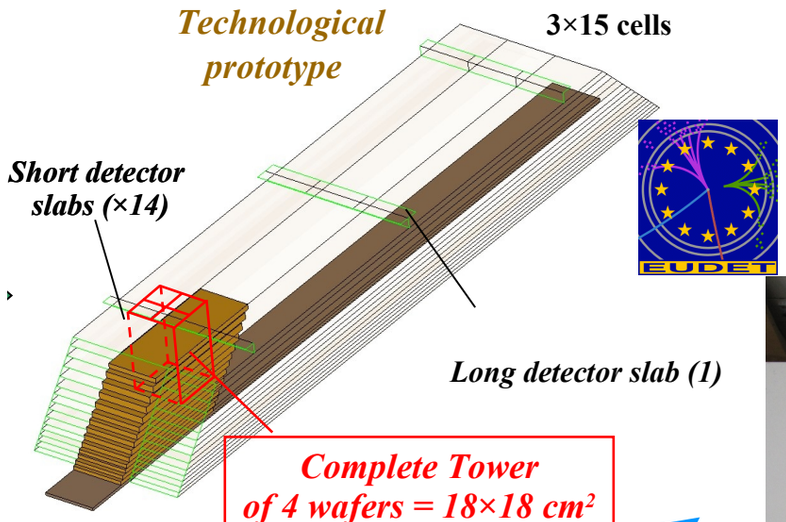
2010



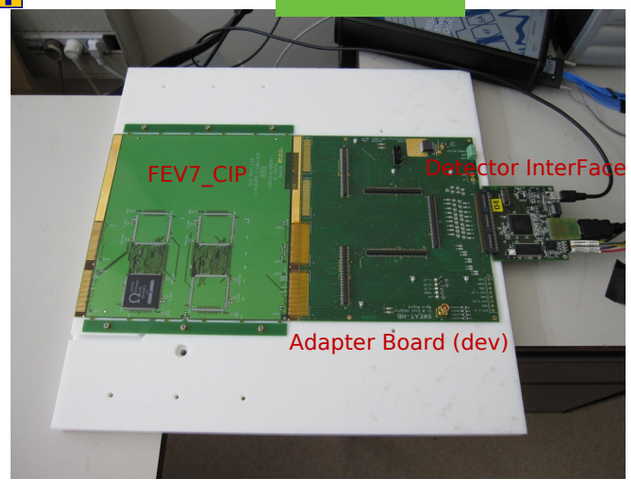
2010

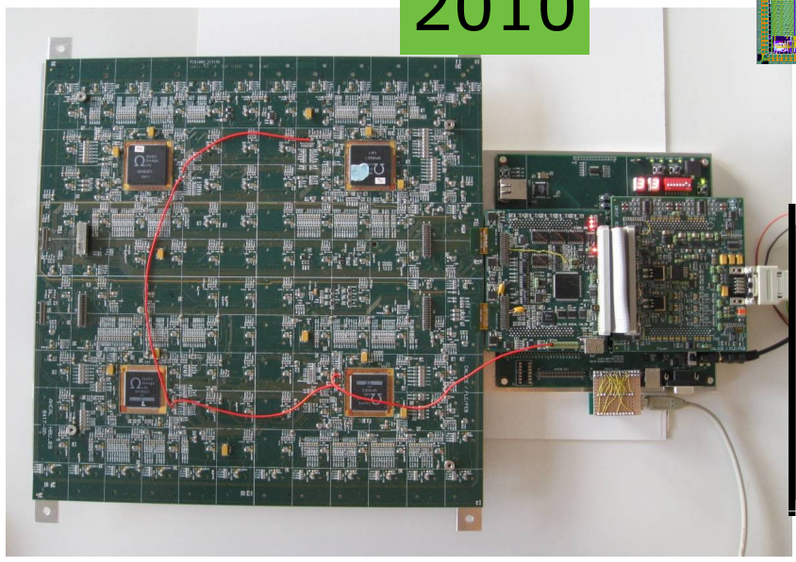


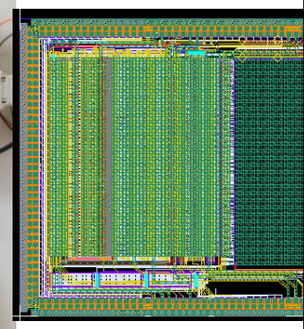


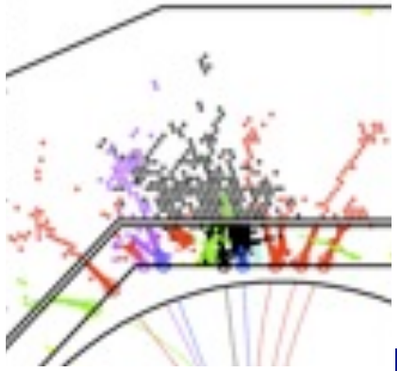


2006



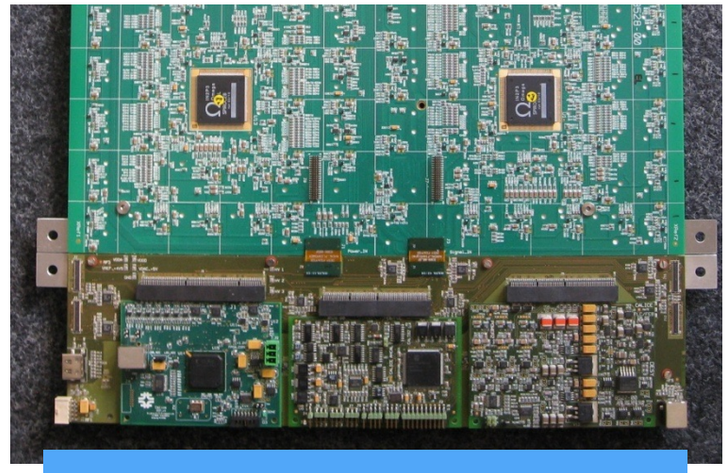






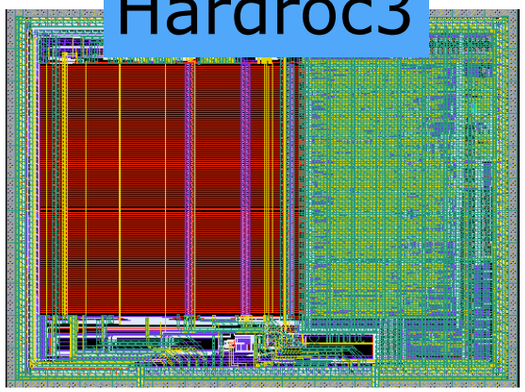
AIDA 2011-2014

- AIDA strongly based on EUDET legacy
- 3rd generation ASIC for sDHCAL
- Compact electronics interfaces
- First steps into technological prototype, see previous slides
- Test beam infrastructure: tungsten stack and gas system
  - tungsten not in EU funded part
- Smaller projects, e.g. SiPM gain stabilisation
- Geant 4 validation

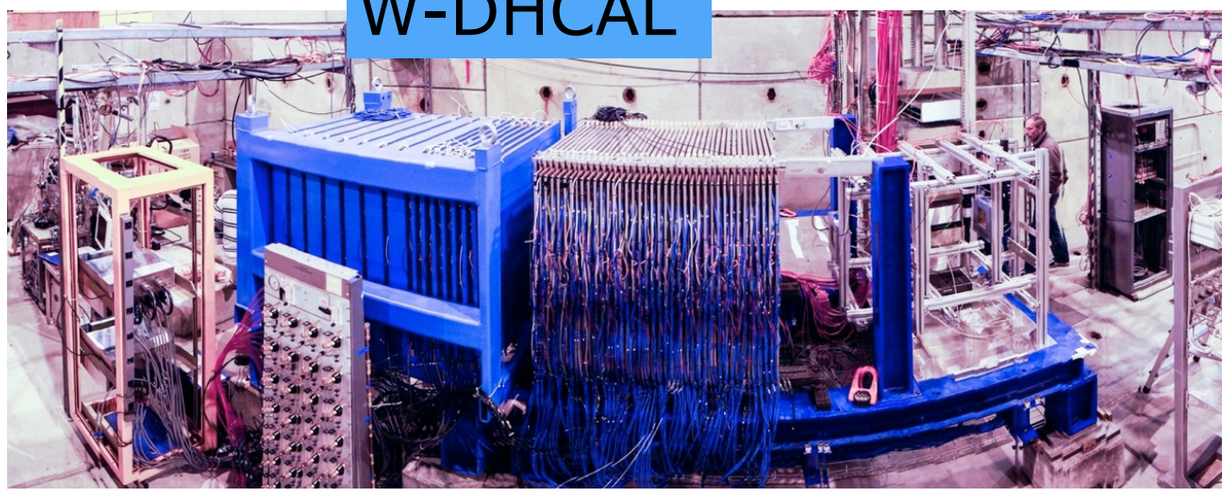


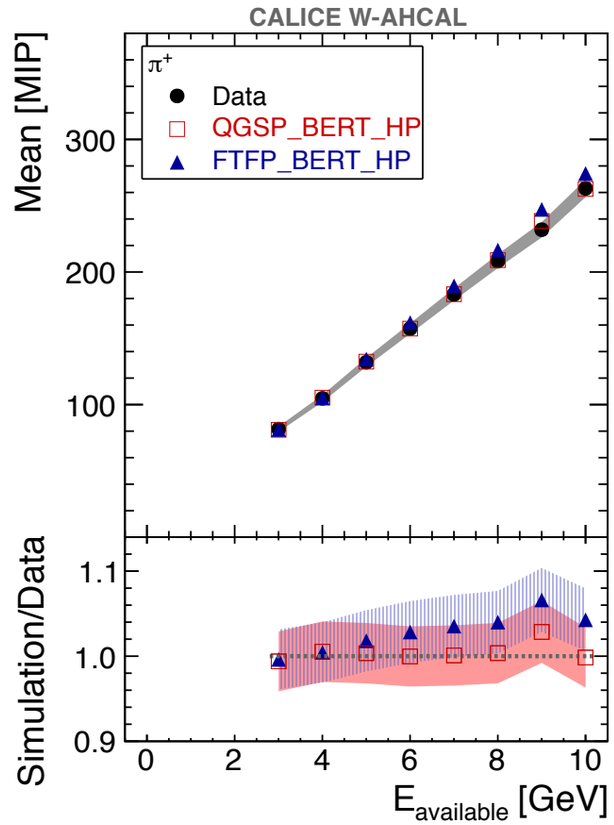
DAQ, Calib, Power

Hardroc3

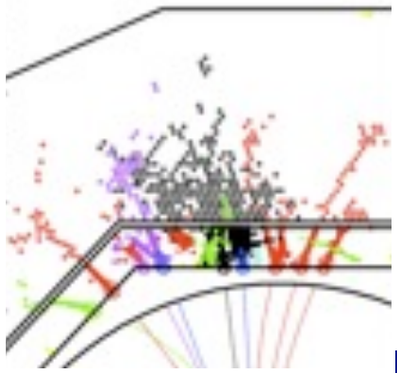


W-DHCAL





subm. to JINST



EUDET → AIDA

- AIDA had more partners and less money

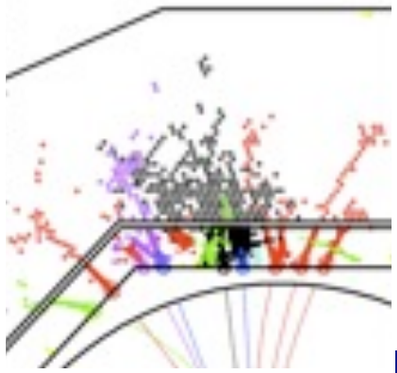
- Calo in EUDET: 2 M€ (incl. FCAL and DAQ)
- Calo in AIDA: 0.75 M€ (incl. FCAL)

€

- Impact is directly proportional to investment €

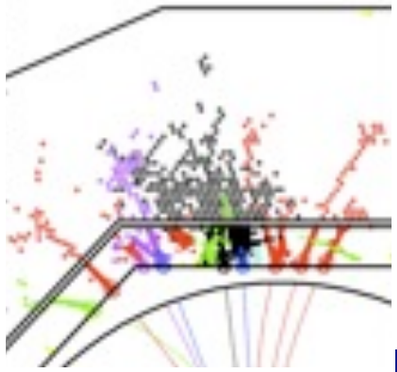
- AIDA lives on EUDET legacy and national funding
  - large test beams with existing instrumentation

- Common DAQ suffers from too broad scope
  - "EUDAQ" driven by telescopes for everyone incl. LHC
  - Focus of EUDET effort lost before development completed

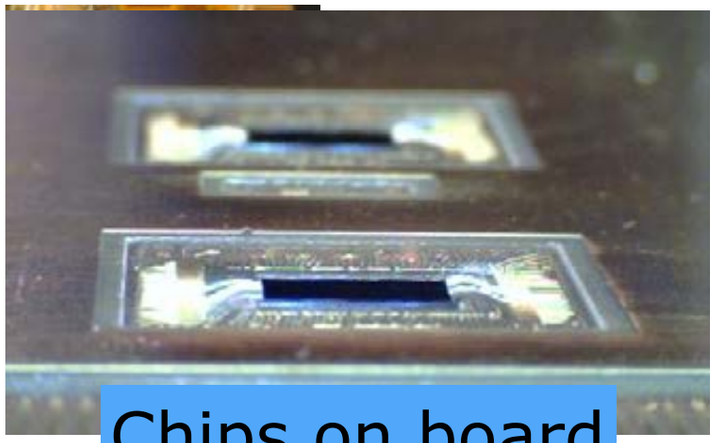


Upcoming topics and needs

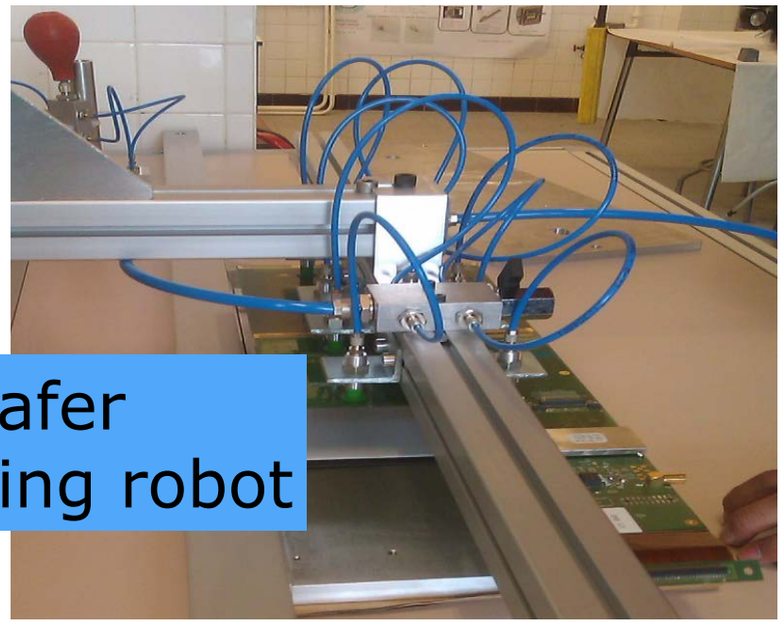
- The technological prototype phase has only started
- We have prototyped the components
- Now need to assemble systems, with many of them
- Demonstration that we can handle the large numbers at reasonable cost and time: part of establishing high granularity
- The topics:
  - system integration, data concentration, power distribution, cooling
  - cost optimisation: e.g. Si sensors, PCBs
  - industrialisation, automation
  - quality assurance, test stands
  - ASIC technology
- The needs:
  - prototypes: data concentrators, power supplies, cooling systems
  - cooperation with industry
  - robots, test stands - small scale prototypes, but scalable
  - ASIC upgrade



Examples

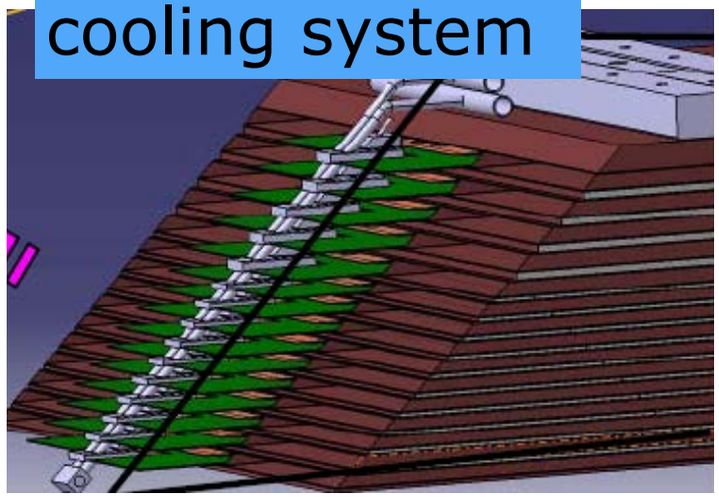


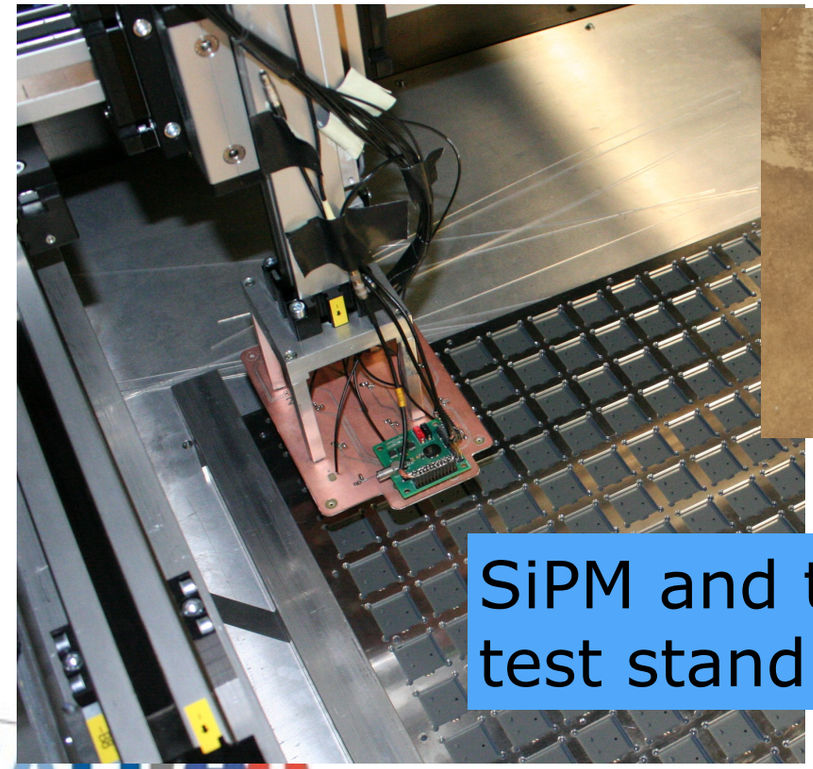
Chips on board



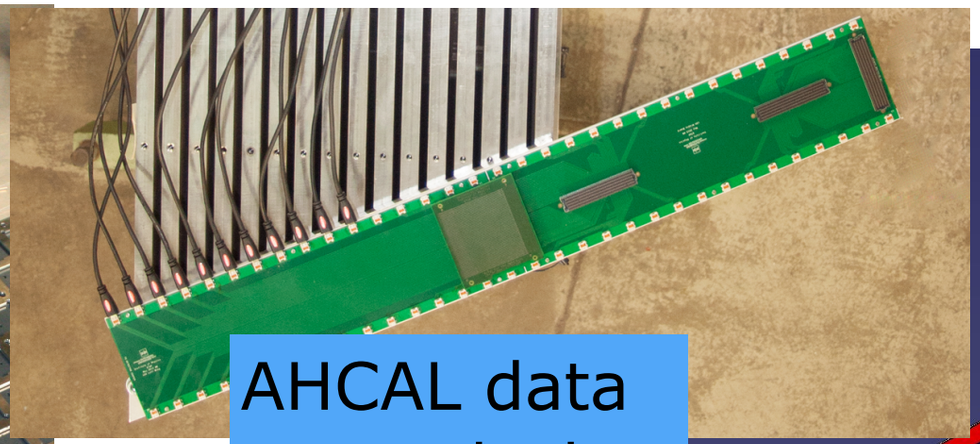
Si wafer glueing robot

ECAL leak-less cooling system



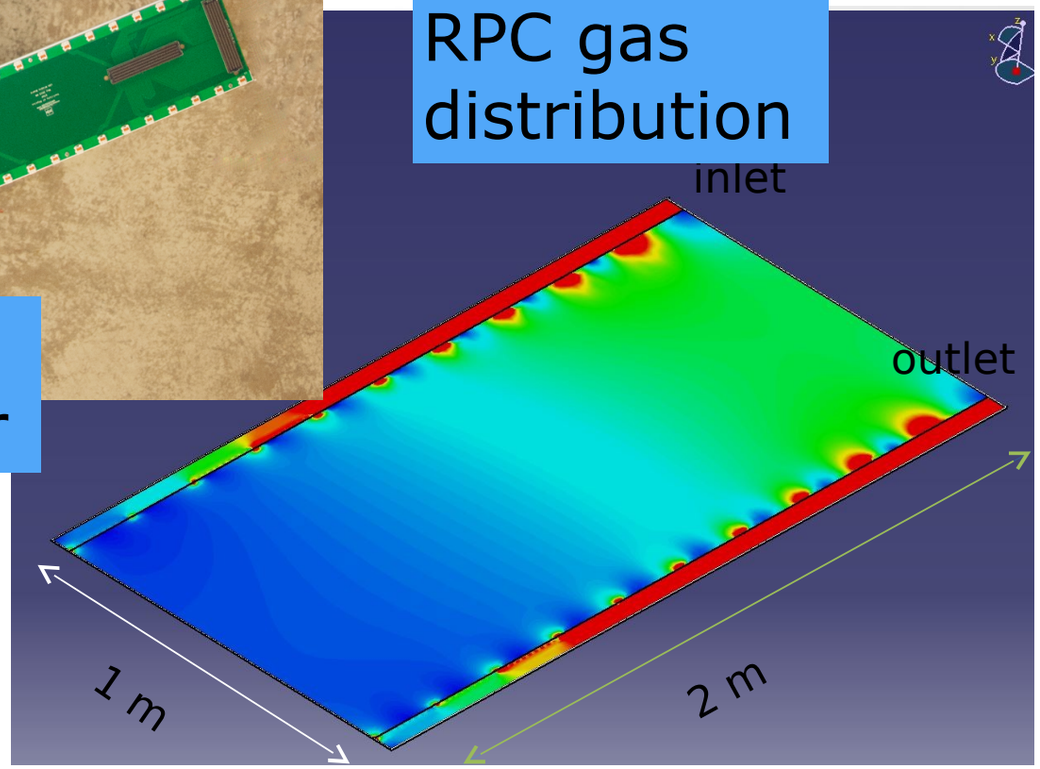


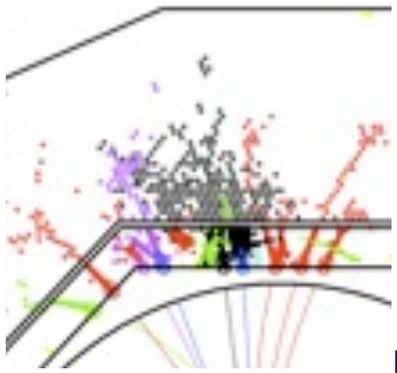
SiPM and tile test stand



AHCAL data concentrator

RPC gas distribution





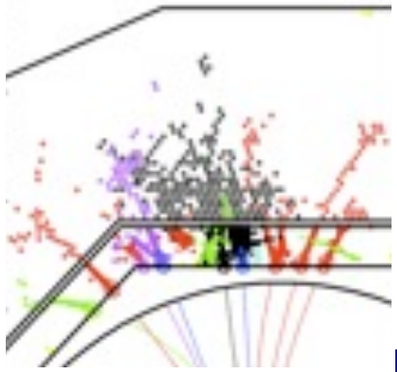
Projects

- Discussion on concrete proposals has just started
  - AHCAL and electronics / DAQ meeting next week
  - will liaise with ECAL and sDHCAL

- Need to see what matches the idea of infrastructure initiative

- Need to improve existing (EUDET + AIDA) infrastructure

- Example from German AHCAL groups:
- support for instrumentation of the stack
  - ASICs, ASIC test stand, HBU production, module integration
  - HD, MZ, W, DESY



CALICE and ILD, SiD

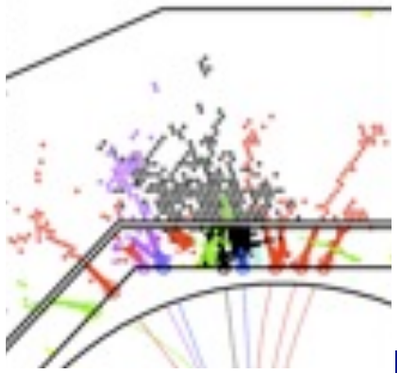
- We continue seeking close co-ordination - also in preparation of next EU proposals

- Common DAQ:
- we certainly need common standards - timing and run protocols, data models, software interfaces - across the calorimeters for combined tests
- could start from there, but should encompass other sub-detectors - vertexing, tracking, muon - from an early stage on
- in Europe naturally organised with strong role of ILD
- from CALICE perspective should be open to SiD players, too

Personal view:
could be strong point
of next proposal

- Mechanics / Engineering:
- upcoming integration topics such as earth-quake safety need to be dealt with in concept group context

- Common software:
- mentioned above: test beam validation and detector performance / optimisation



Discussion

- CALICE is definitely interested in an AIDA follow-up
- Co-operation with other communities / LHC has pros and cons
  - DAQ: loss of focus, gas HCAL: synergies with CMS upgrade
- Problem of AIDA is not so much the mixture, but the volume

- Stronger focus on smaller number of projects welcome, but need to be found and agreed upon

- CALICE is looking forward to embed future EU-funded projects, following the successful model of EUDET and AIDA

- We wish to continue our fruitful cooperation with non-European partners in all regions, EU-funded or not