Review on 2008 and Prospects for 2009

Roman Pöschl
LAL Orsay

- Publications
- Data taking at FNAL
- Collected Data and Glimpse on Quality
- EUDET Prototype
- Summary and Conclusion

CALICE SiW Ecal Meeting Orsay Dec. 2008

Starting the Harvest – Publications on 2006 data taking

Jinst

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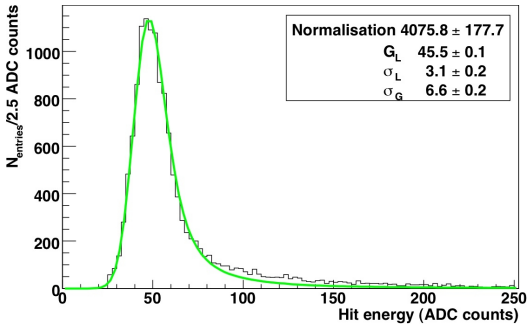
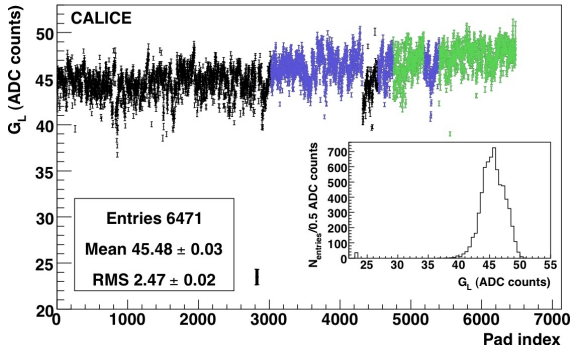
ACCEPTED: *July 25, 2008*
PUBLISHED: *August 5, 2008*

Design and electronics commissioning of the physics prototype of a Si-W electromagnetic calorimeter for the International Linear Collider

Editor in Chief: A.M. Magnan, Imperial



S/N
Calibration
Uniformity

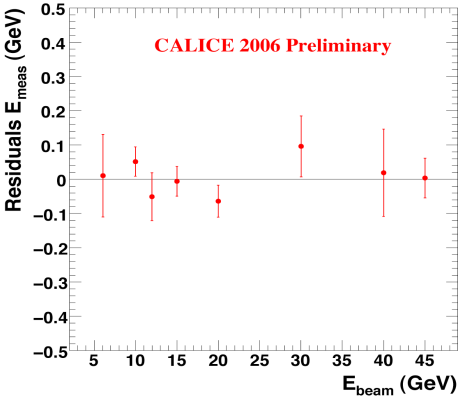


Experience to deal with different manufacturers and production series

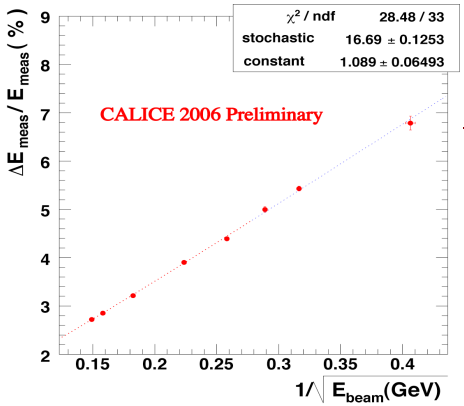
Essential for final detector ~3000m^2 of Silicon needed

Response of the CALICE Si-W Electromagnetic Calorimeter Physics Prototype to Electrons

Editor in Chief: C. Carloganu, LPC



- Linearity O(1%)



$$\frac{\Delta E_{meas.}}{E_{meas.}} = \left[\frac{16.7 \pm 0.1}{\sqrt{E\,[\mathrm{GeV}]}} + (1.1 \pm 0.1)\right]\%$$

Compromised by acceptance effects

Ongoing analyses and goals for 2009
- Subject of dedicated discussion today -

- Advanced study on shower shape analysis

  Response w.r.t to Electrons, George and Valeria

  -> Next SiW Ecal publication ?

- Analysis of VFE exposed to high energetic showers (R.P.)

  - No effect visible in small sample, suited observables?
  - Analysis to be extended to full sample
  - Expectation from MC?

- Hadronic response of SiW Ecal

  - Two analyses started
  - Aim for publication 12/2009?

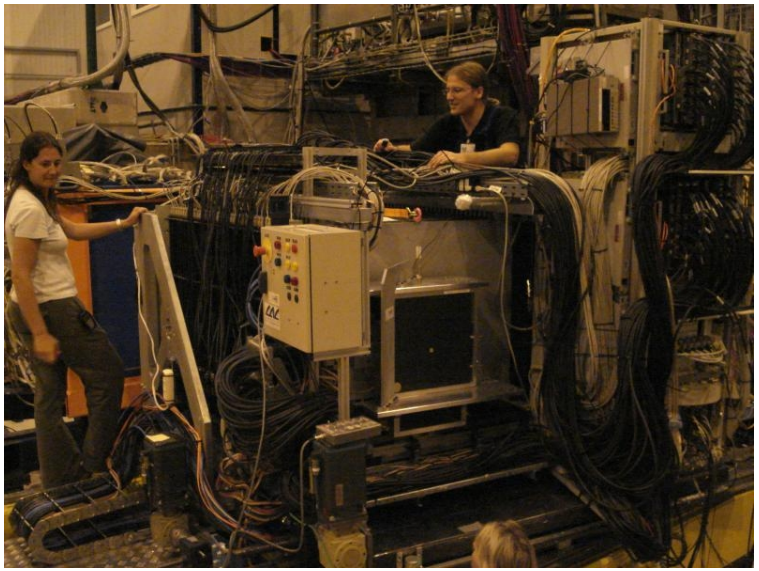
(Better) Coherence between Testbeam data analysis and Full detector simulation

- How does the Ecal response limit the precision at the ILC?
- Guideline: How does my result influence the precision of an ILC Detector?
  E.g. if I find the perfect hadronic model, how does the experimentation
  at the ILC benefit from that?

CALICE Testbeam Data Taking

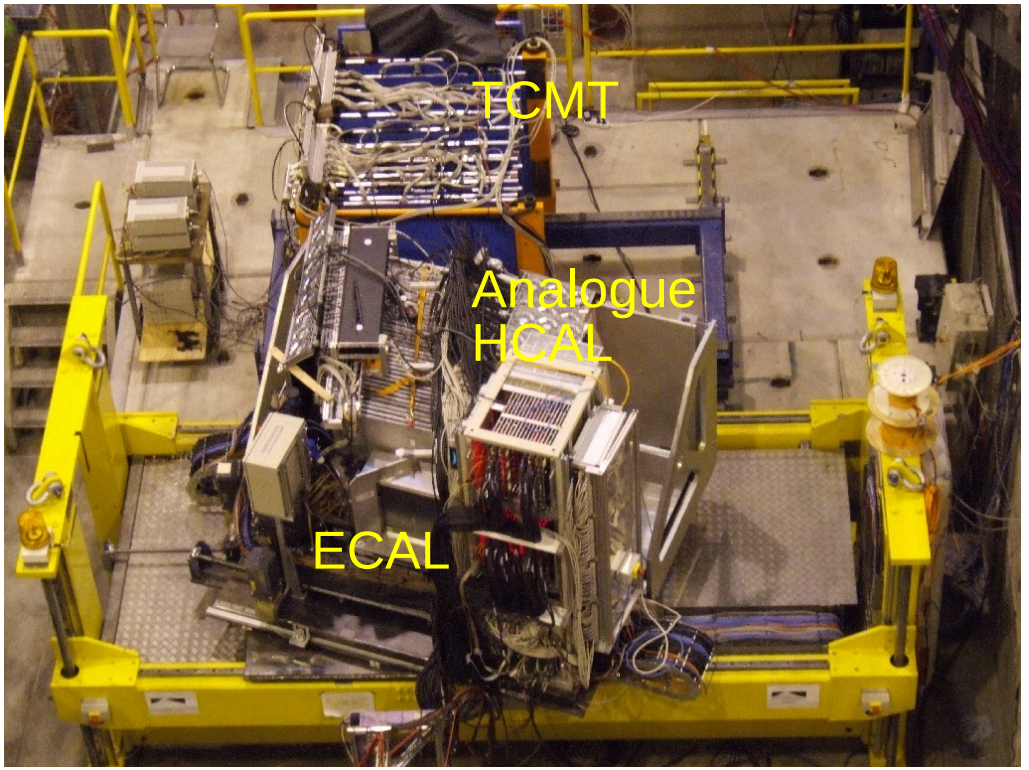
Large scale testbeam effort by CALICE Collaboration

Data taking 2006, 2007, 2008



Slabs slit into alveolas

Testbeam Setup at CERN 2007



Data taking 2006 2/3 equipped Ecal
Data taking 2007 (nearly) fully equipped Ecal
Data taking 2008 fully equipped Ecal

Detector Installation

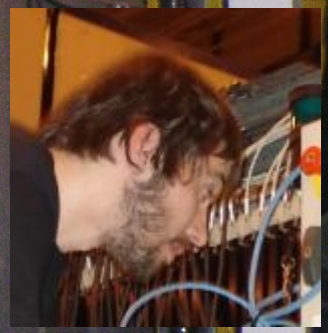
- Equipment ready by 25th of April – Ready to accept beam on the 29th of April

- Setup – Combined effort of DESY, Uni Heidelberg, NIU, LLR, LAL and FNAL

- Setup comprises SiW Ecal, Ahcal and TCMT
  plus beamline equipment

- Sept. 09 Data taking with Scint Ecal, Ahcal and TCMT

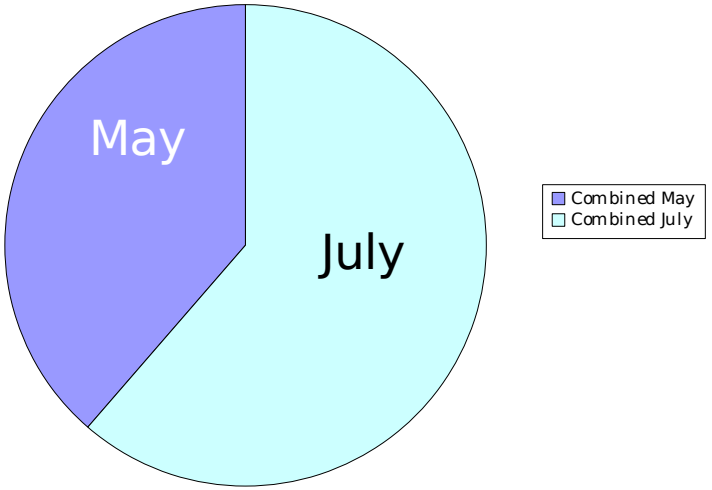
SiW Ecal Crew @ FNAL



Picture courtesy of I. Polak

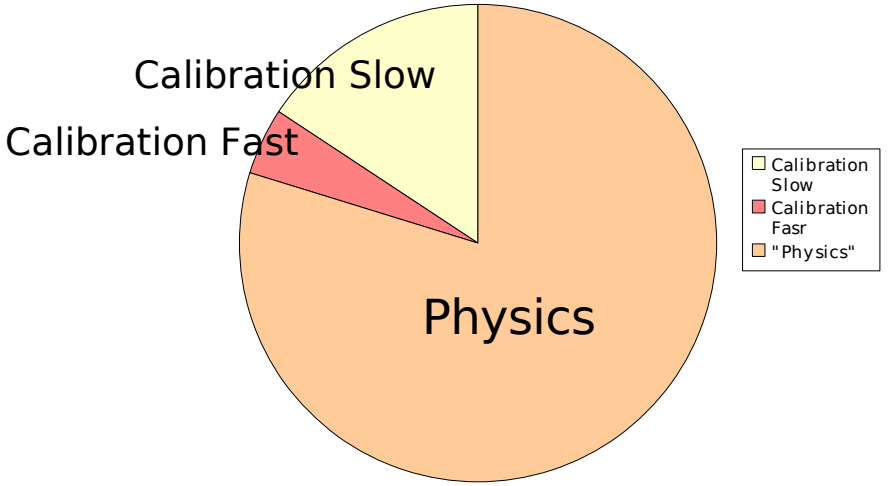
“Luminosity” - Recorded Data

Combined Data May/July



Total: 17.3 kEvens in beamData Runs

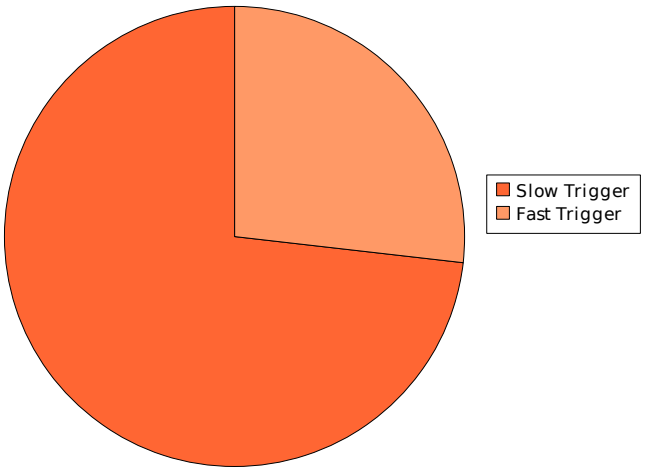
Calibration/"Physics"



~20% Calibration Data, i.e. muons

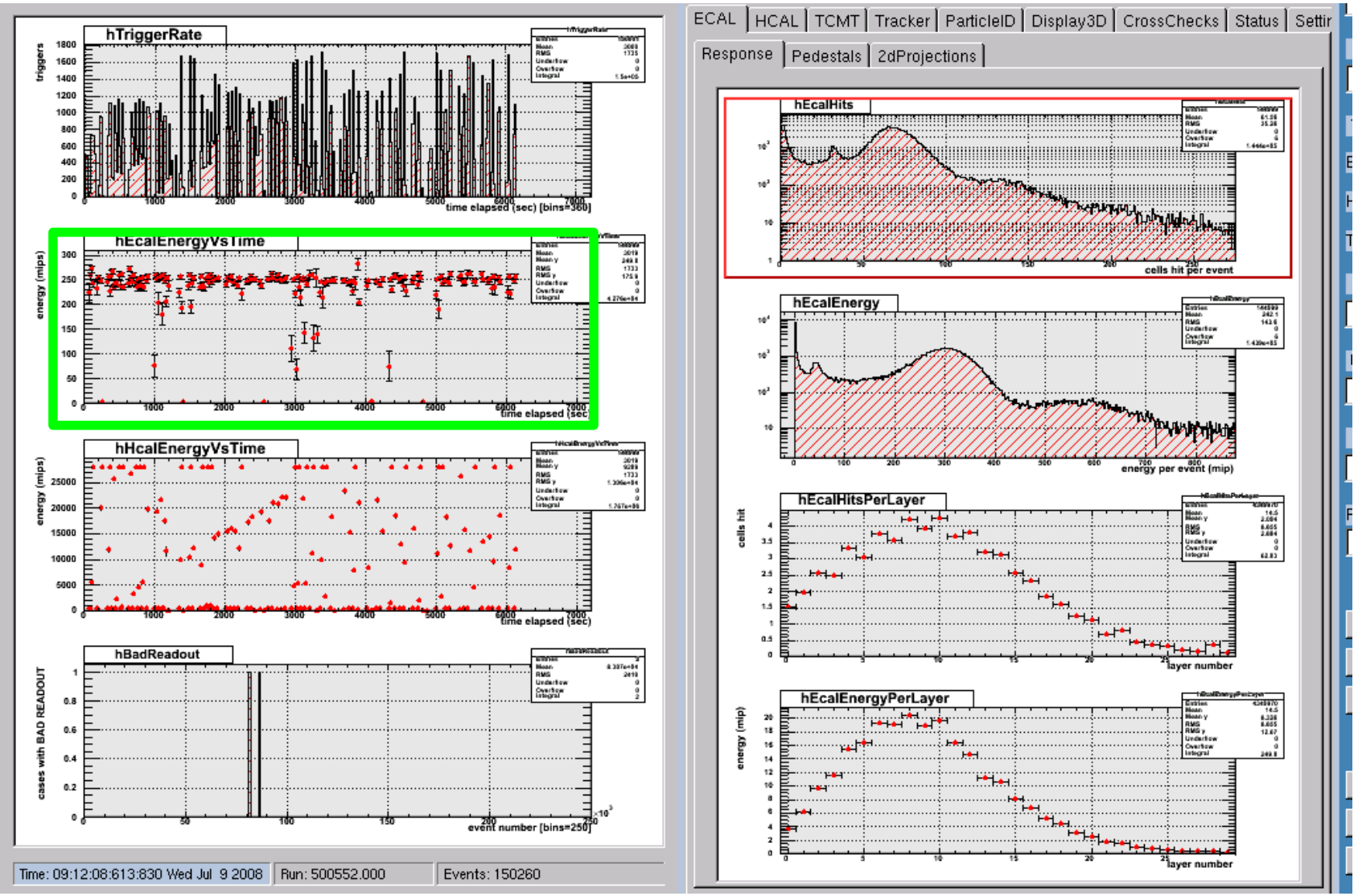
All data recorded with Ecal on

Fast/Slow Trigger Data



~25% with Fast Trigger (mostly e-)

Impressions from the Ecal Running I



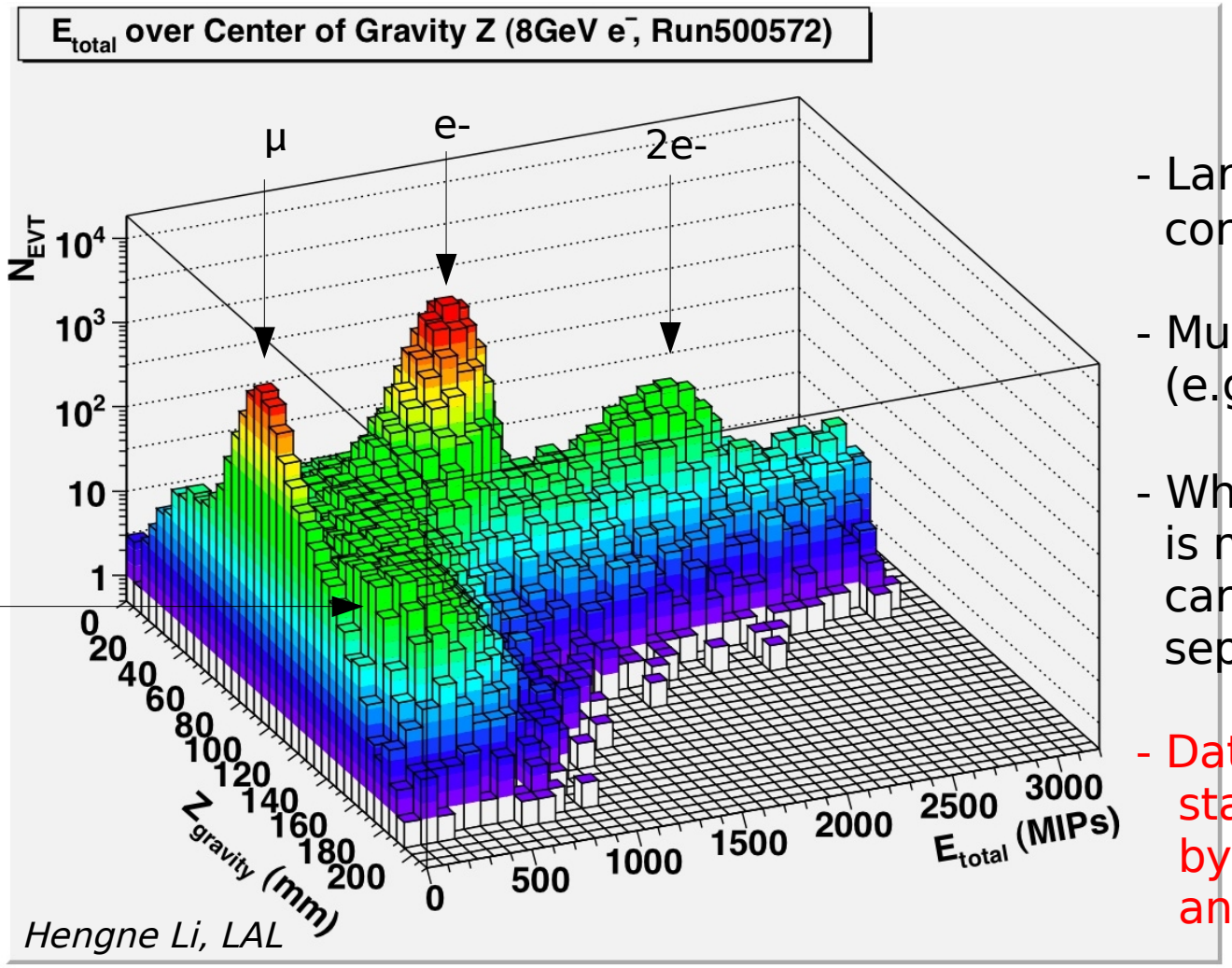
Ecal Noise largely tamed

No noisy layers for > 90% of time

Suggest to prepare data analysis such that Events with Ped. Shifts are simply rejected not corrected

Analysis of 2008 Data - General Remarks on DQ

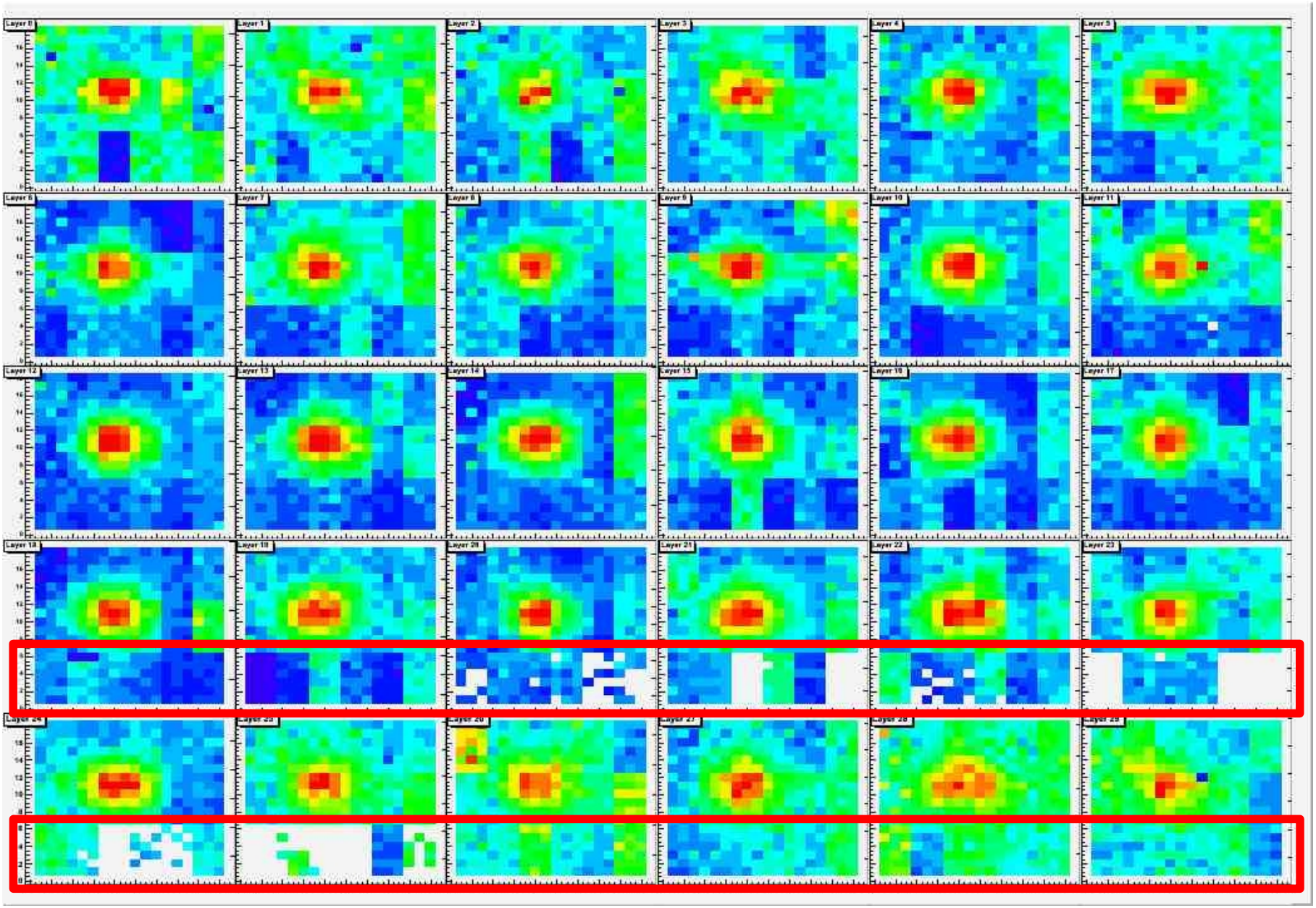
Ecal spectrum



- Large μ contamination?
- Multiparticle events (e.g. up to 5 π's)
- Where Cerenkov is missing Ecal can be used to separate particles
- Data analysis has started (see talks by Hengne and Philippe)

- Fully equipped Ecal
- Rich e- sample – Repetition of 2006 low e- electron data
- Low energy hadron with overlap to cern range
- For future testbeams it is Important to obtain a profound picture on FNAL beam quality

Hit Maps ...

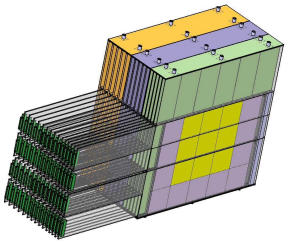


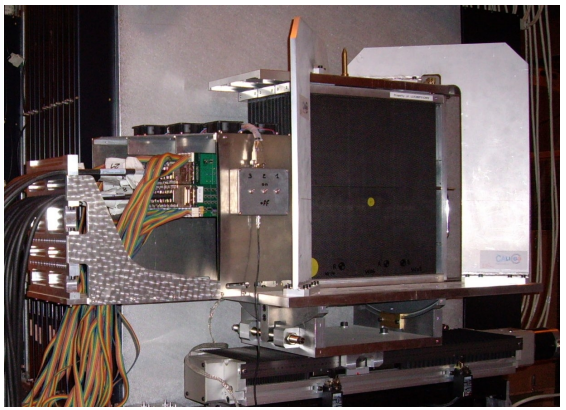
Marcel Reinhard, LLR

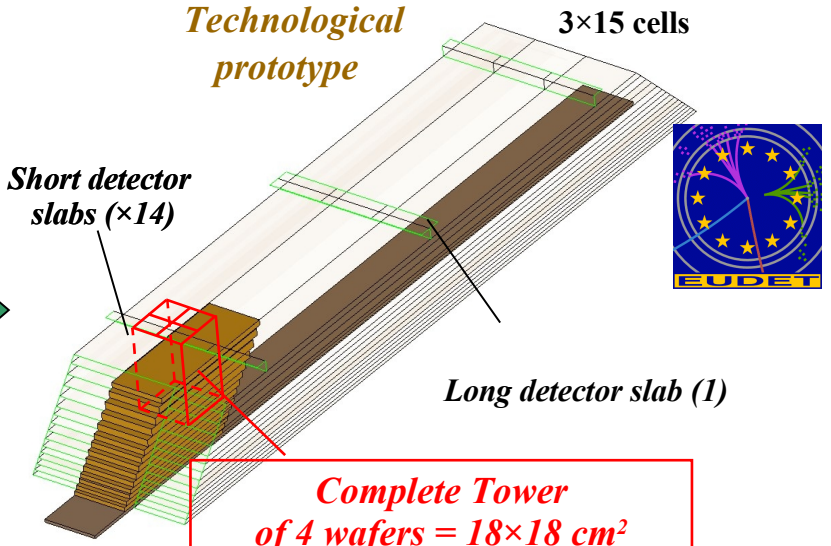
Dead Cells in bottom layers – Main reason for repatriation of Ecal

EUDET Prototype

- Logical continuation to the physical prototype study which validated the main concepts : alveolar structure , slabs, gluing of wafers, integration
- Techno. Proto : study and validation of most of technological solutions wich could be used for the final detector (moulding process, cooling system, wide size structures,…)
- Taking into account industrialization aspect of process
- First cost estimation of one module







• 3 structures : 24 X_0
(10×1,4mm + 10×2,8mm + 10×4,2mm)
• sizes : 380×380×200 mm3
• Thickness of slabs : 8.3 mm (W=1,4mm)
• VFE outside detector
• Number of channels : 9720 (10×10 mm²)
• Weight : ~ 200 Kg

• 1 structure : ~ 23 X_0
(20×2,1mm + 9×4,2mm)
• sizes : 1560×545×186 mm3
• Thickness of slabs : 6 mm (W=2,1mm)
• VFE inside detector
• Number of channels : 45360 (5×5 mm²)
• Weight : ~ 700 Kg

The groups working on the EUDET Electromagnetic Calorimeter

- What we call “EUDET Module” is in fact the next SiW Ecal CALICE Prototype

- Financial support by EU but largest fraction of funding still from “Calice” ressources!!!!

- Detailed overview on status this -> afternoon

Parties Involved

6 Laboratories are sharing out tasks in according to preferences and localization:

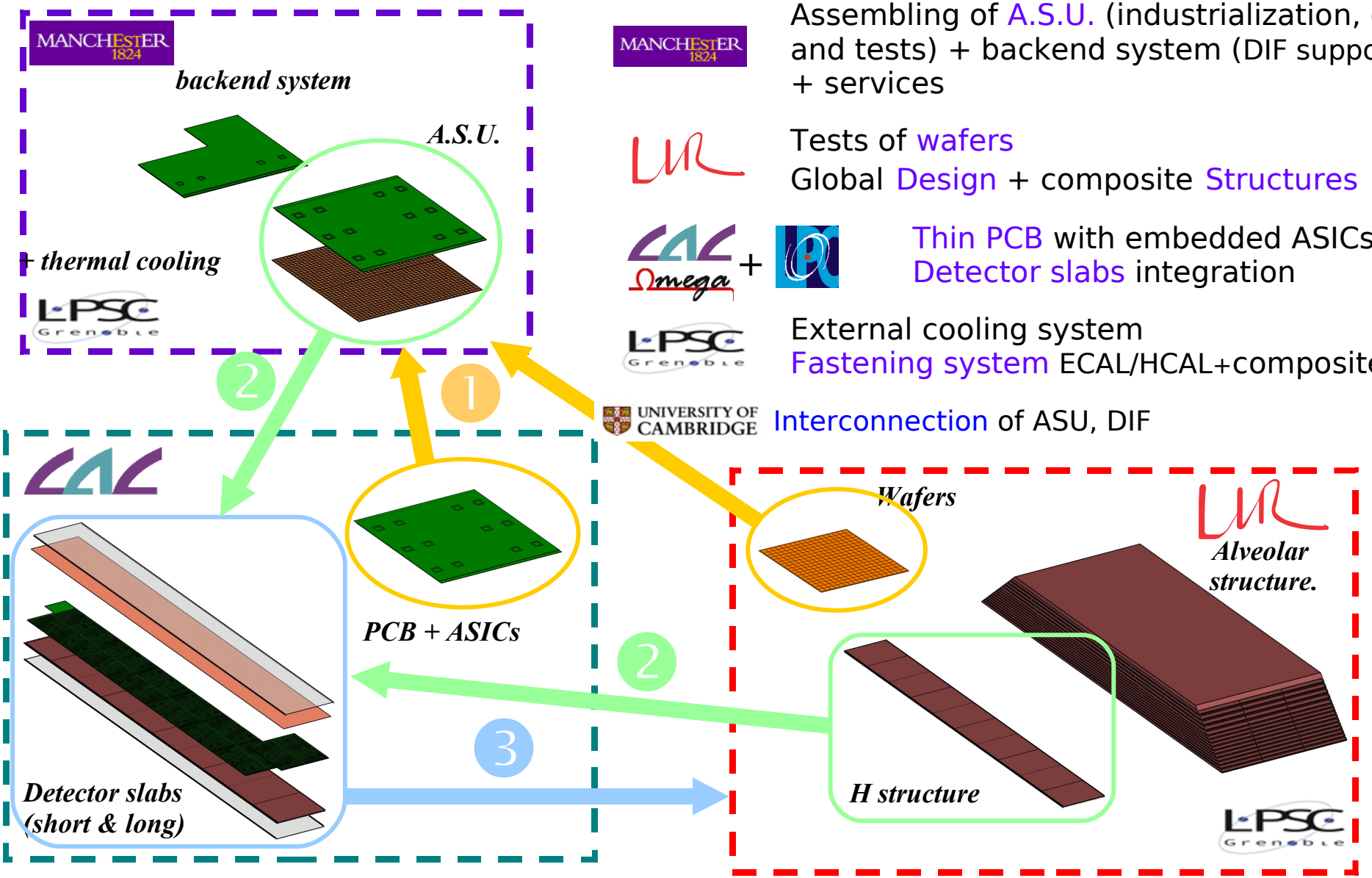
Assembling of A.S.U. (industrialization, gluing and tests) + backend system (DIF support) + services

Tests of wafers
Global Design + composite Structures

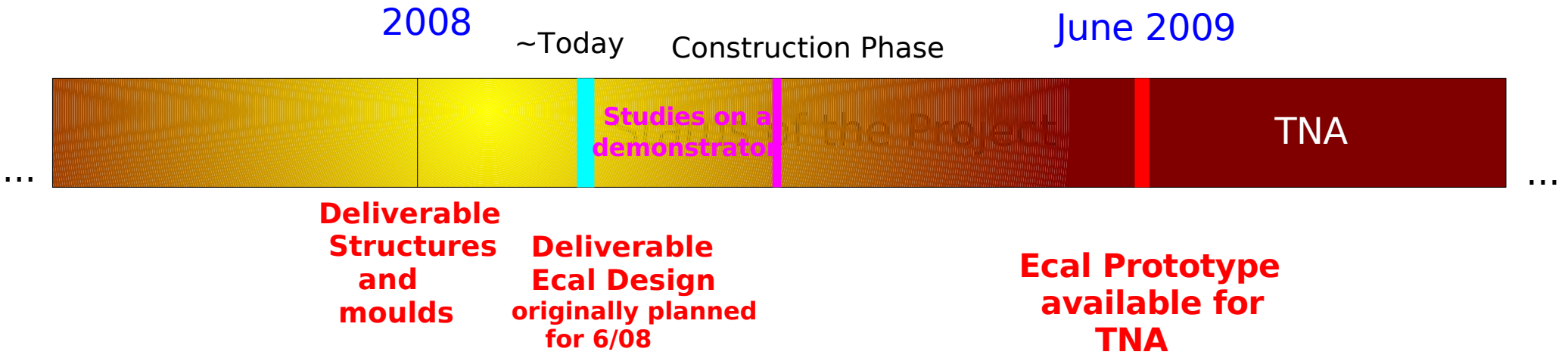
Thin PCB with embedded ASICs
Detector slabs integration

External cooling system
Fastening system ECAL/HCAL+composite plates

Interconnection of ASU, DIF



Timeline of the Project



- No major delays

- Design Phase concluded
  Details see talk in JRA3 parallel session
  and ...

- Milestone(s) are accompanied by two EUDET Memos

Two EUDET Memos published in 2008

EUDET-Memo-2008-07

EUDET-Memo-2008-07

ECAL Si/W – Design and Fabrication of moulds for the EUDET Module

M.Anduze, R. Poeschl

July 01, 2008

Covering apects of the alveolar structures

EUDET-Memo-2008-11

JRA3 Electromagnetic Calorimeter Technical Design Report

M. Anduze[1], D. Bailey[2], R. Cornat[1], P. Cornebise[3], A. Falou[3], J. Fleury[3], J. Giraud[5], M. Goodrick[4], D. Grondin[5], B. Hommels[4], R. Poeschl[3], R. Thompson[2]

September 30, 2008

Abstract

This note describes the design of the prototype for an Silicon Tungsten electromagnetic calorimeter with unprecedented high granularity to be operated in a detector at the International Linear Collider (ILC). The R&D for the prototype is co-funded by the European Union in the FP6 framework within the so called EUDET project in the years 2006-2010. The dimensions of the prototype are similar to those envisaged for the final detector.

Already at this stage the prototype features a highly compact design. The active and passive parts as well as the readout electronics are fully integrated within 2000 μm.

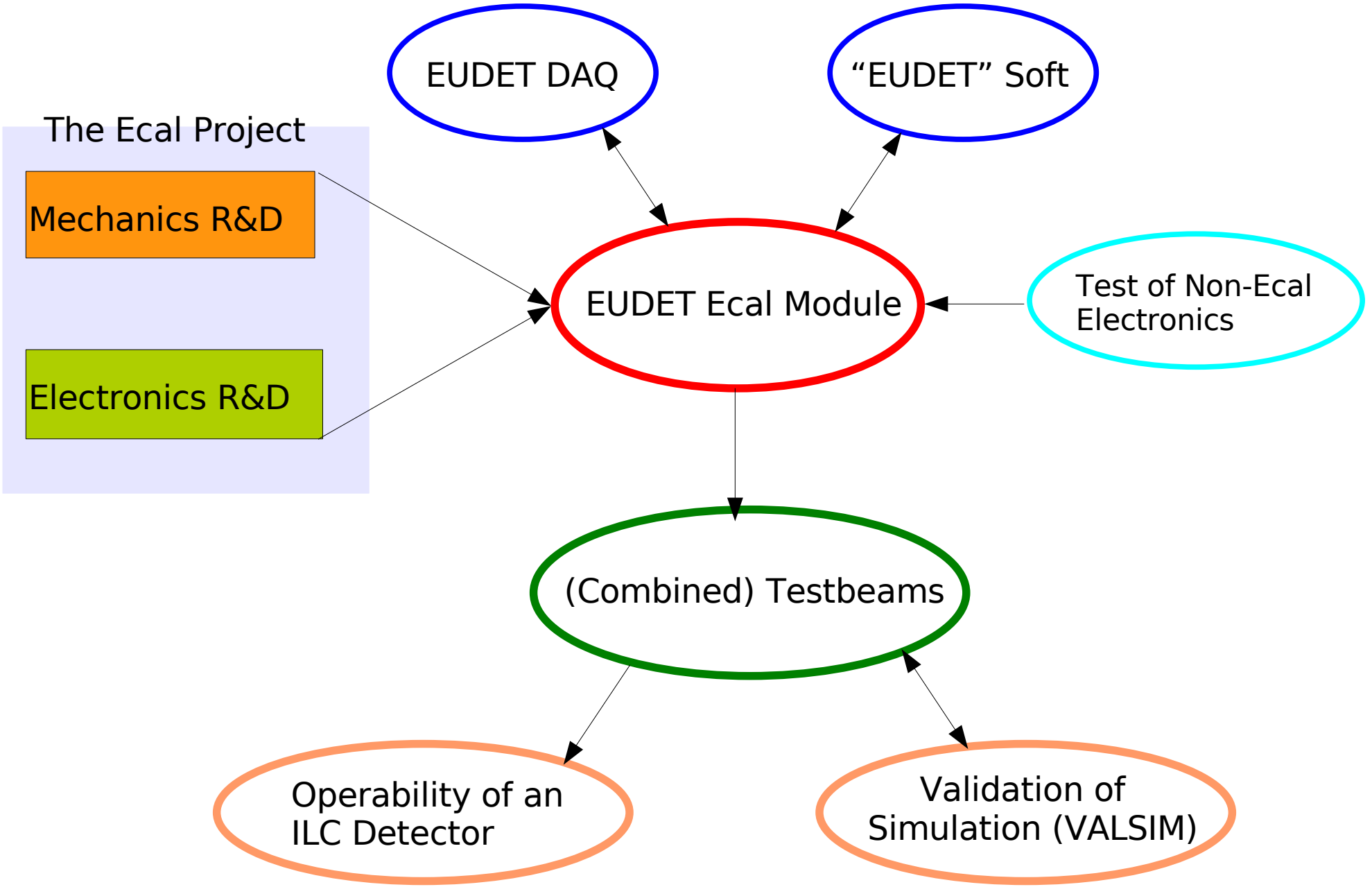
Addresses all issues of the technical realisation

1 LLR – Ecole Polytechnique – IN2P3/CNRS, France
2 University of Manchester, England
3 LAL – IN2P3/CNRS, France
4 University of Cambridge, England
5 LPSC – IN2P3/CNRS, France

1

Memos do document the significant progress of the project in 2008

EUDET Module and Transnational Access - > June 2009



Mainlines for 2009

- 2009 should be the analysis year!!!
  - Finalizing of shower shape analysis
  - Large bulk of 2007 data still poorly analysed – Scope/Aim of analyses?
  - Hadrons in the Ecal – Exploration of high granularity
  - Tighten the interplay with full detector studies
  - Detector LOI's in 2009 – Impact of Calice results?

  - Revision of current Ecal software and improvement of e.g. digitisation?

- Testbeam at FNAL with DHCAL towards end of 2009 !?
  - Completion of first round of CALICE Program
  - Please reserve some resources in your travel budget!

- Construction of EUDET Module
  - First half of the year mainly hardware
  - Needs to be accompanied by software/analysis effort by late summer '09
    responsibles for task?

- Preparation of next round of test beams
  - Definition of Programs
  - Preparing the requests of beam times
    (I)LC Testbeam meeting – First week of november 09

Backup ....

CALICE Testbeam at FNAL

- Installation Phase: 7/4/08 – 25/4/08

- Commissioning Phase: 28/4/08 – 7/5/08

- "Physics Runs" Phase: 7/5/08 - 27/5/08

General Running Conditions:

- Day operation – Beam between ~6m and 6pm
- Testbeam delivery interrupted by "Shot Setup"
  for TEVATRON experiments
  ~2 hours during our running
- No major machine downtime
  Some failures towards the end of the running
  Compensated by two extra half days
  on 26/5/08 and 27/5/08 – Running 6am – 12pm
  Agreement on short notice

FERMILAB provides excellent support for our running

- see above
- e.g. Extensive help during (non trivial)
  setup of computing

- Restart Phase: 1/7/08 – 4/7/08

- Calibration Runs: 4/7/08 – 9/7/08
  Calibration with Fast Trigger
  Calibration with Slow Trigger
- "Physics Runs" Phase: 9/7/08 – 1/8/08
  'Fast Trigger Running': 7/7/08 – 13/7/08
  'Slow Trigger Running': >13/7/08

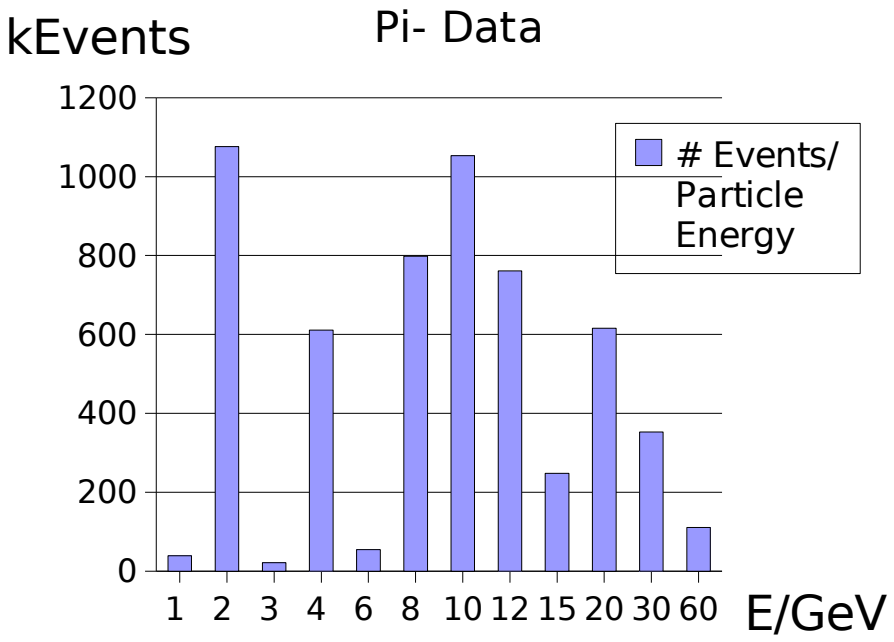
General Running Conditions:

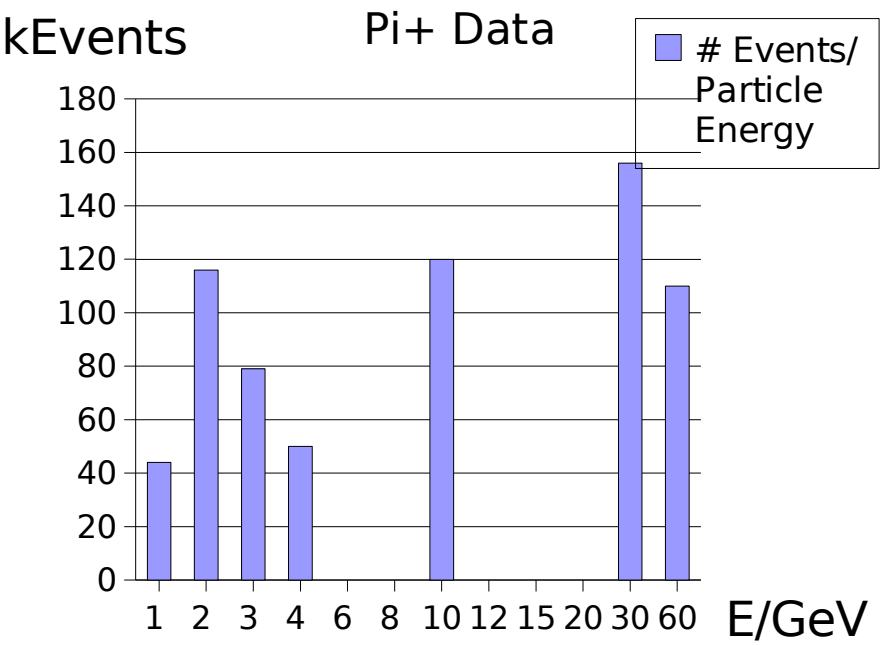
- Night operation – Beam between ~8pm and 10am
  Machine (and detectors) suffered from hot FNAL summer (up tp 42°C)
- Testbeam delivery interrupted by "Shot Setup"
  for TEVATRON experiments
  ~2 hours during our running
- Major machine downtimes (at least until 22/7/08)
  up to 50% during several days
  Partially compensated by extensions > 10am

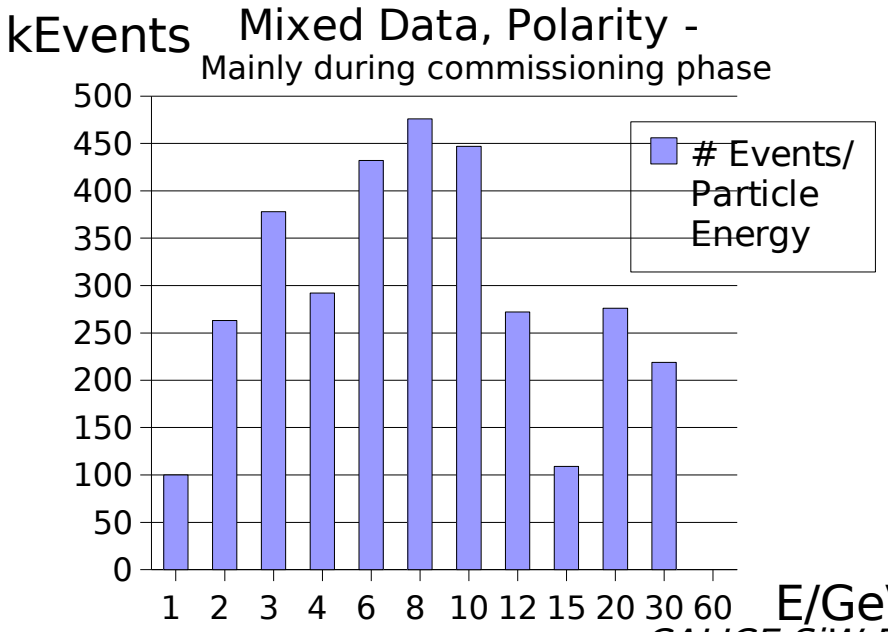
- Downtime did cut into our program!

Concern was brought to FERMILAB Management and acknowledged.
Mostly open to extensions but also harsh cuts of beam (scheduled) on-time

Breakdown of recorded data I – Slow Trigger



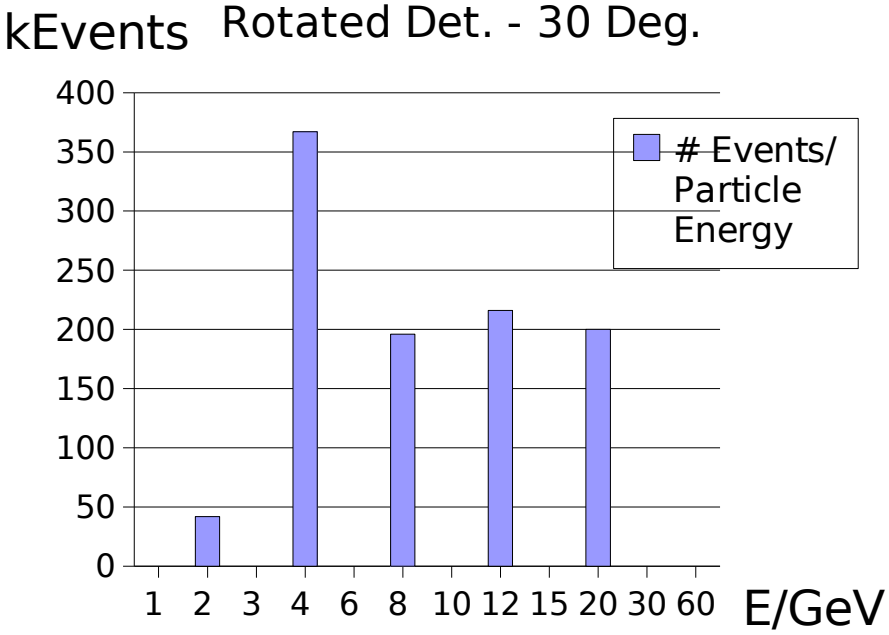


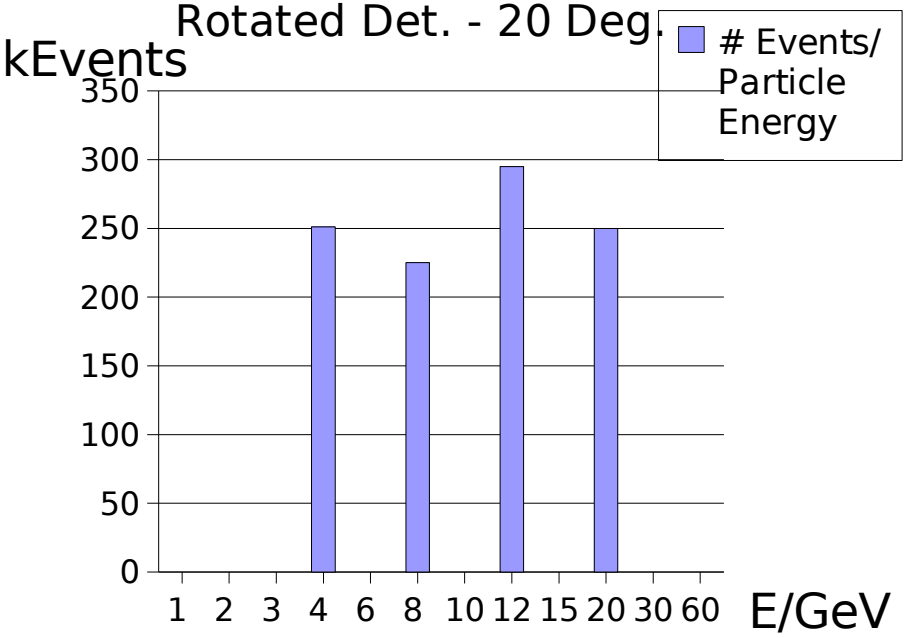


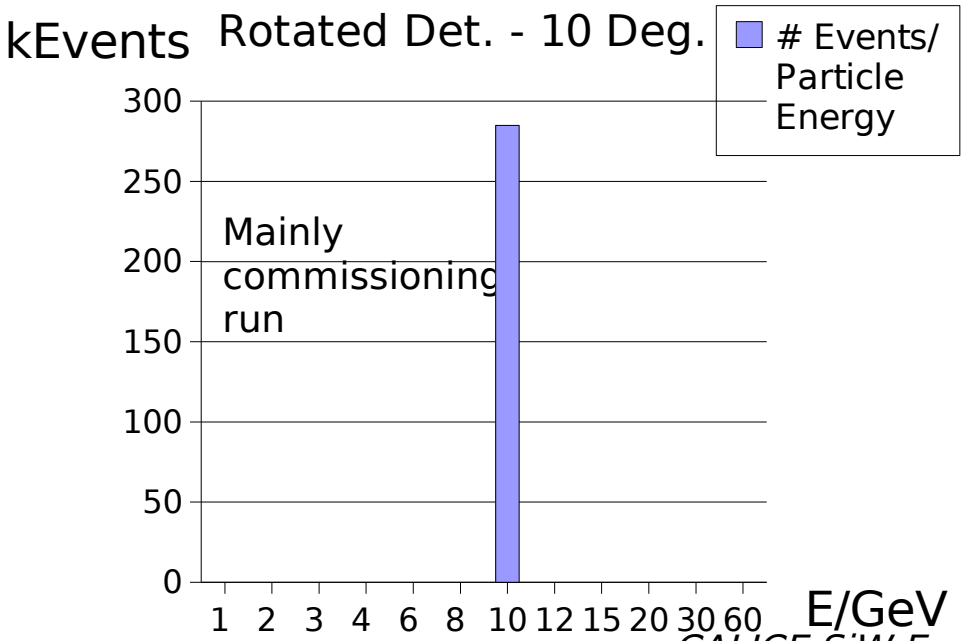
Managed to accumulate hadron data at both polarities

Significant larger sample at negative polarities

Breakdown of recorded data II – Slow Trigger/"Special" Data





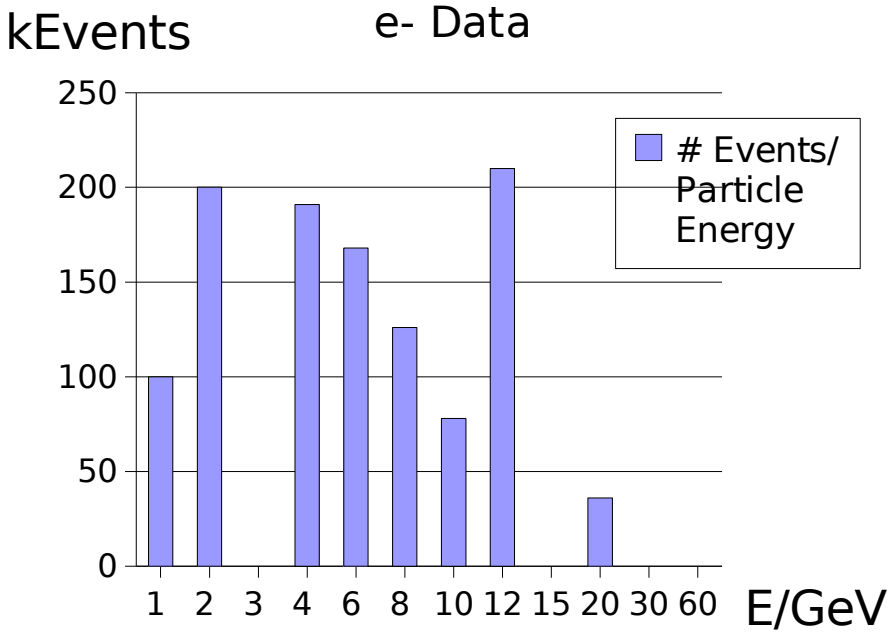


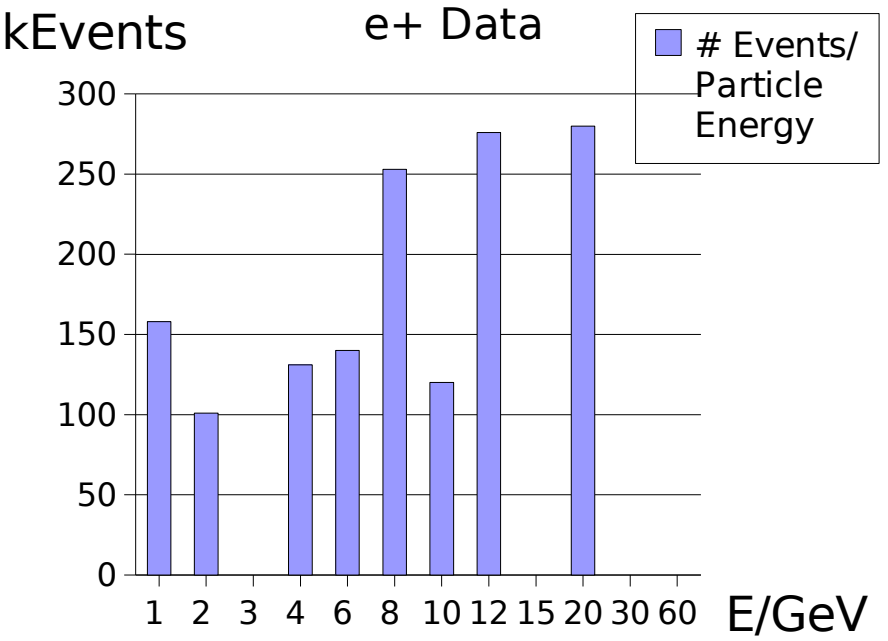
Rotation program suffered most from significant beam down time

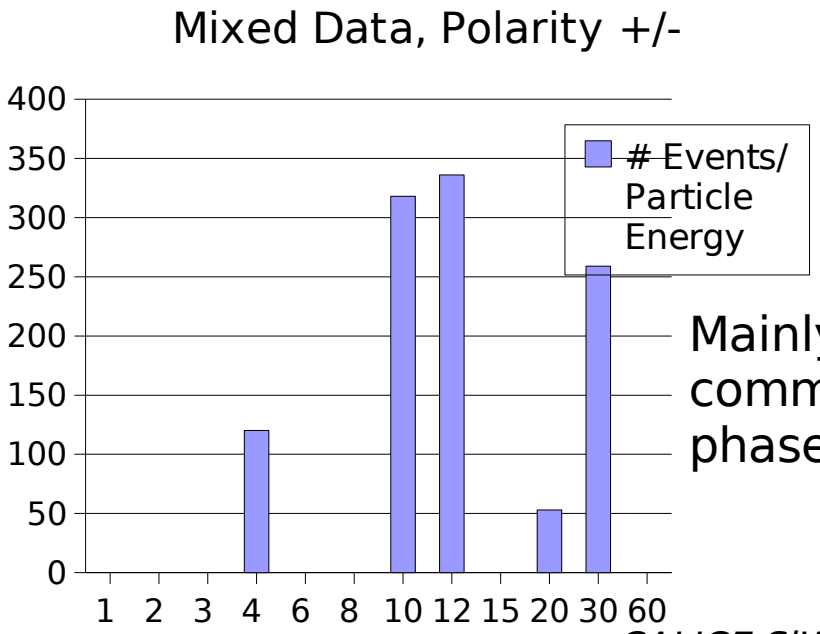
Still, considerable amount of data collected

To this adds a shifted detector program with total ~500k Triggers at 10 and 30 GeV
and high energy proton running 160k Events

Breakdown of recorded data III – Fast Trigger







Mainly during commissioning phase

Considerable samples at small energies with fully equipped Ecal

Pion content increases gradually with increasing energy