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

SOCLE Meeting Annecy Dec. 2008

Institutes and People

	Staff (Physicists)	Direct Support	Contribution
LLR	1 Permanent 1 PostDoc 1 PhD Student	Mechanics Division Electronics Division Computing Division	Analysis Mechanical Construction SiWafer Development Software Development
LPC	2 Permanent 0 PostDoc 1 PhD Student	Electronics Division Computing Division	Analysis SiWafer Development VFE Electronics
LPSC Grenoble	1 Permanent 1 PostDoc (>2009) 1 PhD Student	Mechanics Division Electronics Division	Analysis Mechanical Construction VFE Electronics
CAC Omega	0 Permanent 2 PostDoc (>2009) 2 PhD Students	Mechanics Division Electronics Division	Analysis VFE Electronics Mechanical Construction Software Development

Not too many people

Starting the Harvest – Publications on 2006 data taking

Jinst

PUBLISHED BY INSTITUTE OF PHYSICS PUBLISHING AND SISSA

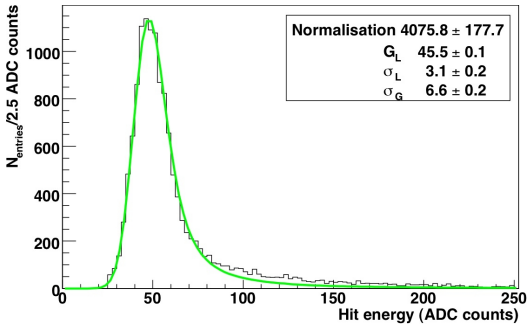
RECEIVED: *May 30, 2008*
ACCEPTED: *July 25, 2008*
PUBLISHED: *August 5, 2008*

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

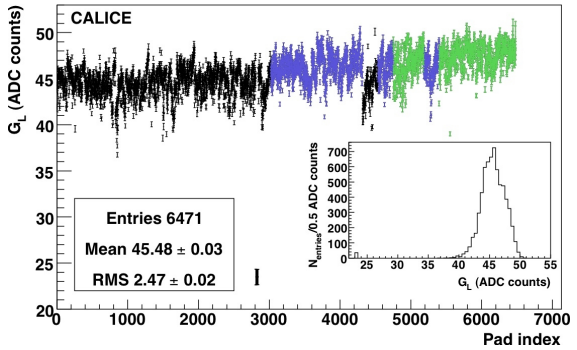
Editor in Chief: A.M. Magnan, Imperial

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

Editor in Chief: C. Carloganu, LPC

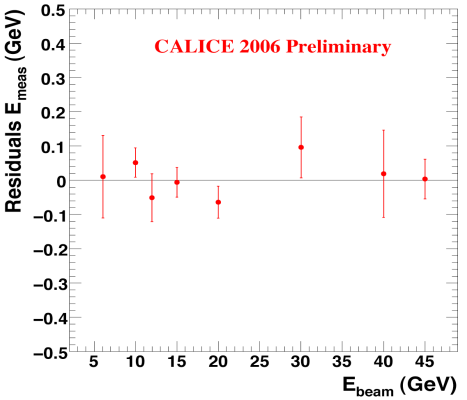


S/N
Calibration
Uniformity

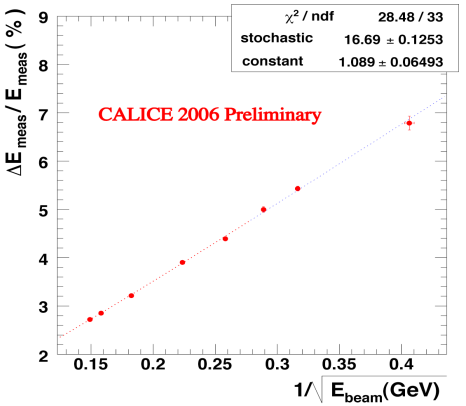


Experience to deal with different manufacturers and production series

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



- 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

- Advanced study on shower shape analysis

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

  -> Next SiW Ecal publication ?

- Advanced study on spatial resolution

  Response w.r.t to Electrons, Manqi and Laurent

  -> Next SiW Ecal publication ?

- Analysis of 2007 data started

  Response w.r.t to Electrons, LLR and LPC

- 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?

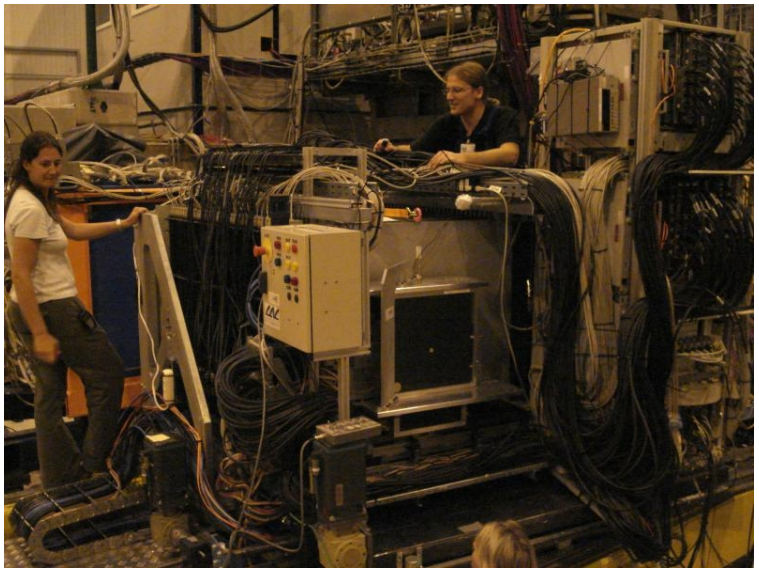
- Hadronic response of SiW Ecal

  - Two analyses started, e.g., P. Doublet LAL
  - Aim for publication 12/2009?

CALICE Testbeam Data Taking

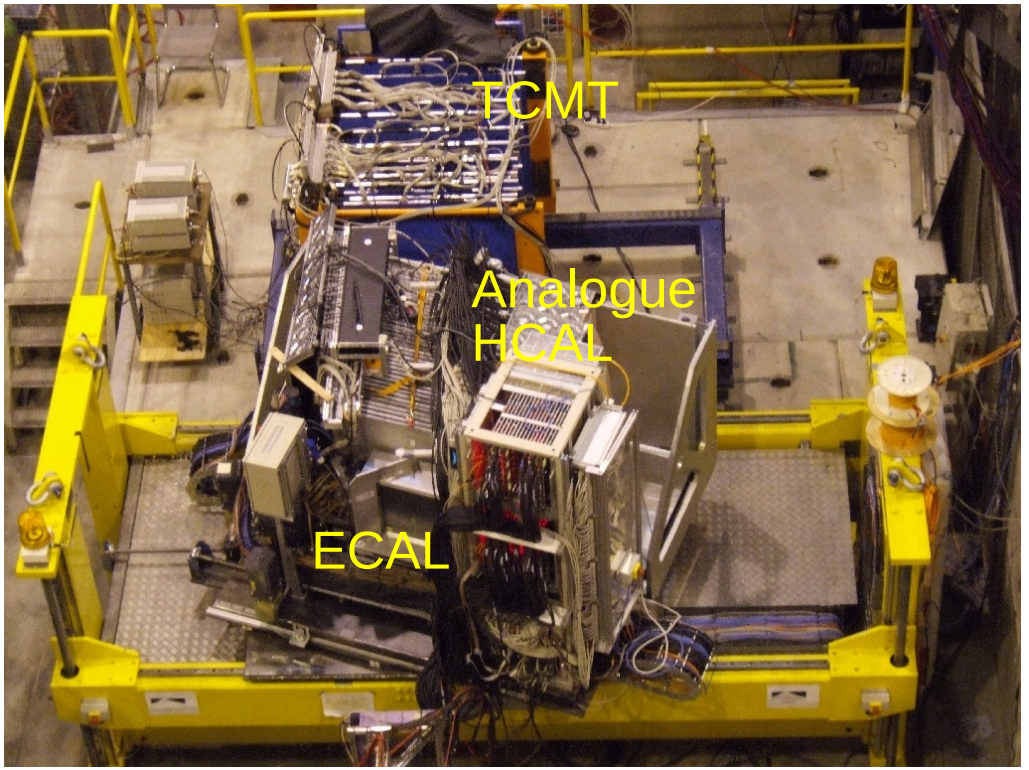
Large scale testbeam effort by CALICE Collaboration

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

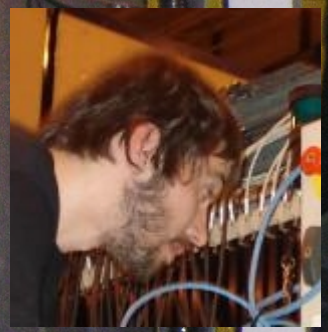
- Equipment ready by 25th of April – Ready to accept beam on the 29th of April

- 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

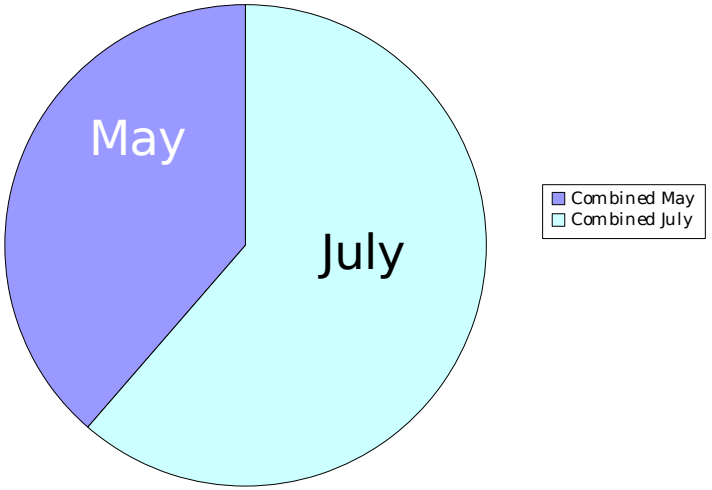


... strong french participation in shifts at FNAL

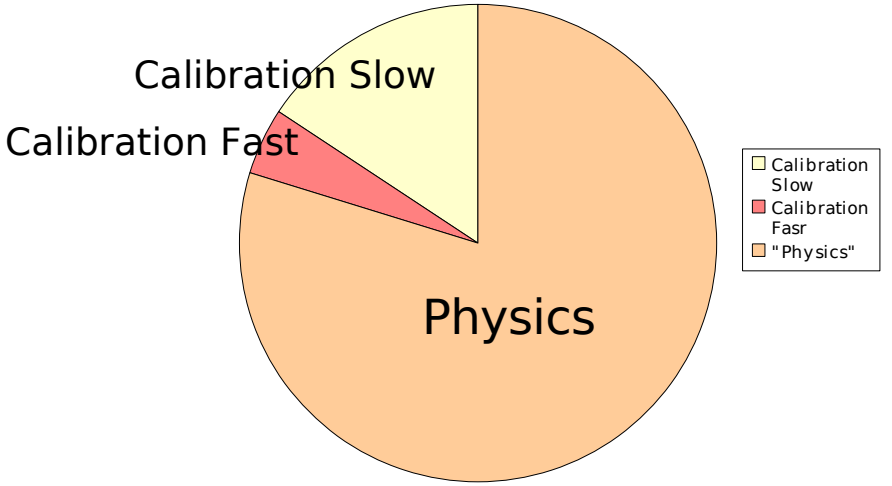
Picture courtesy of I. Polak

“Luminosity” - Recorded Data

Combined Data May/July



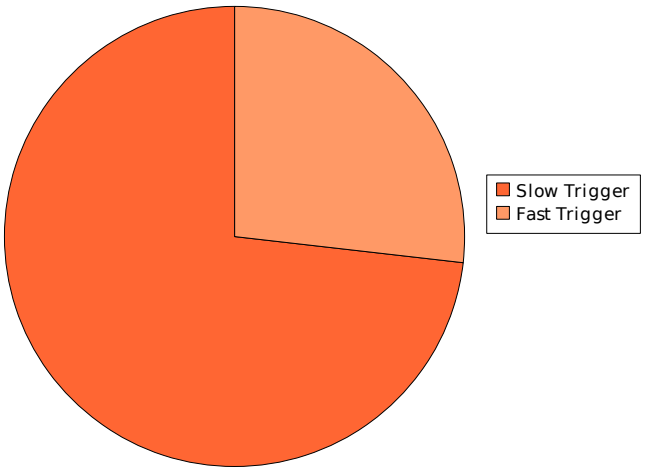
Calibration/"Physics"



Total: 17.3 kEvens in beamData Runs

~20% Calibration Data, i.e. muons

Fast/Slow Trigger Data

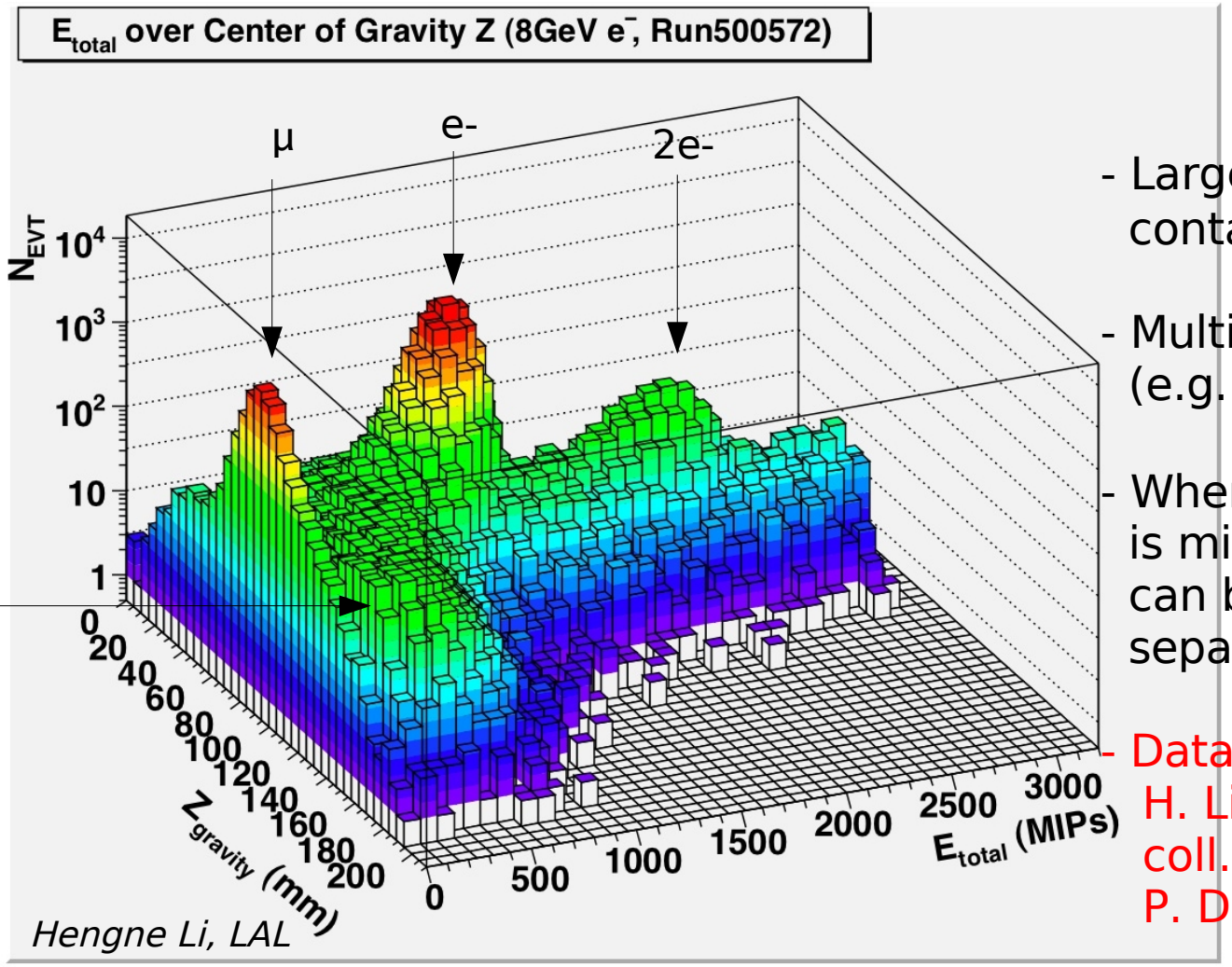


All data recorded with Ecal on

~25% with Fast Trigger (mostly e-)

Analysis of 2008 Data - General Remarks on DQ

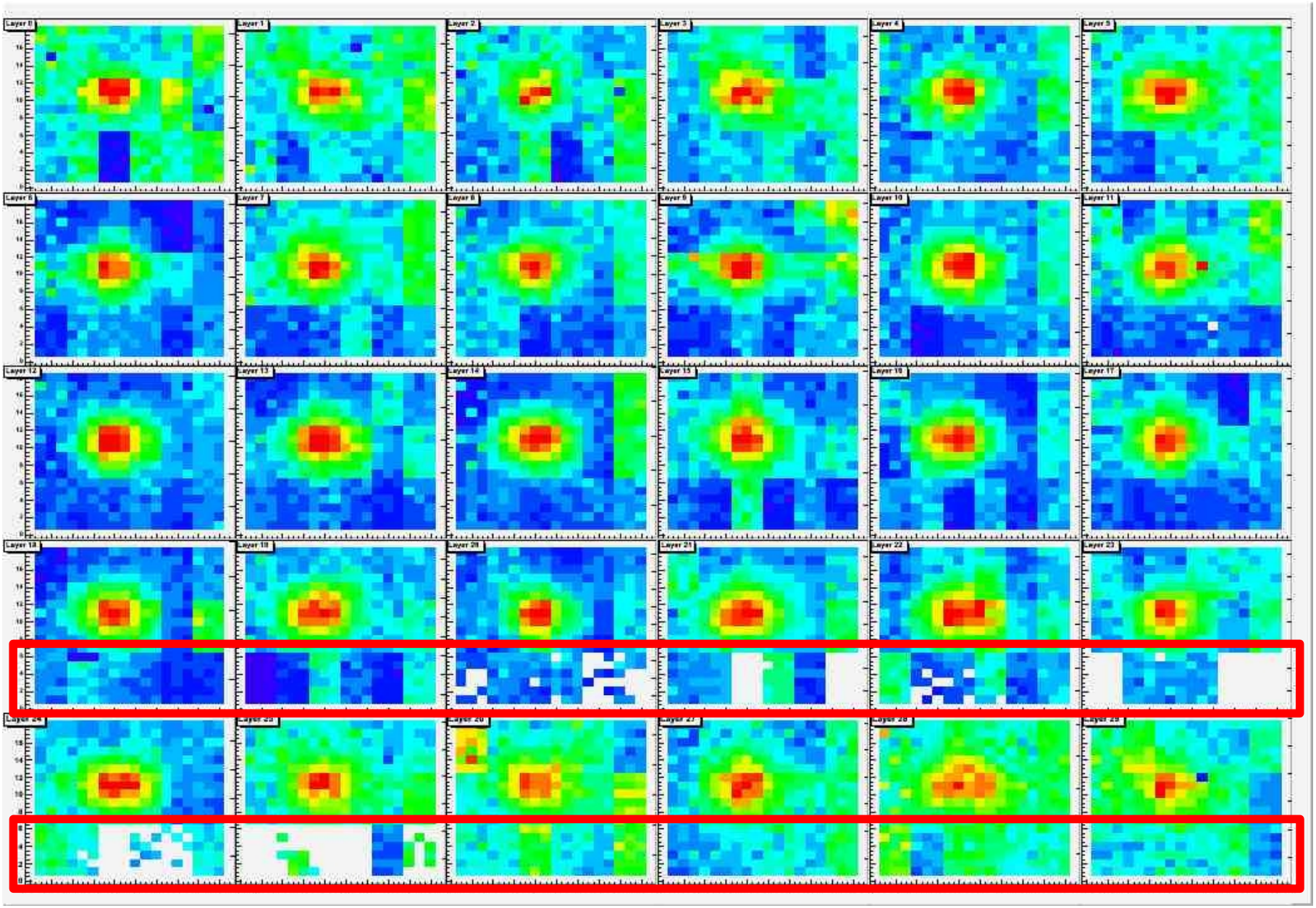
Ecal spectrum



- 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
  H. Li – Calibration
  coll. with M. Reinhard
  P. Doublet - Hadrons

- 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 ...

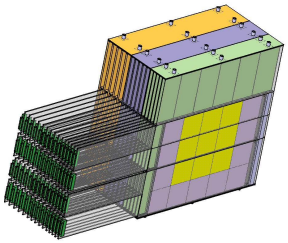


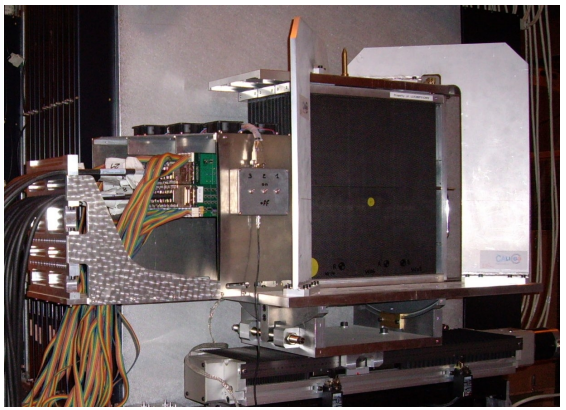
Marcel Reinhard, LLR

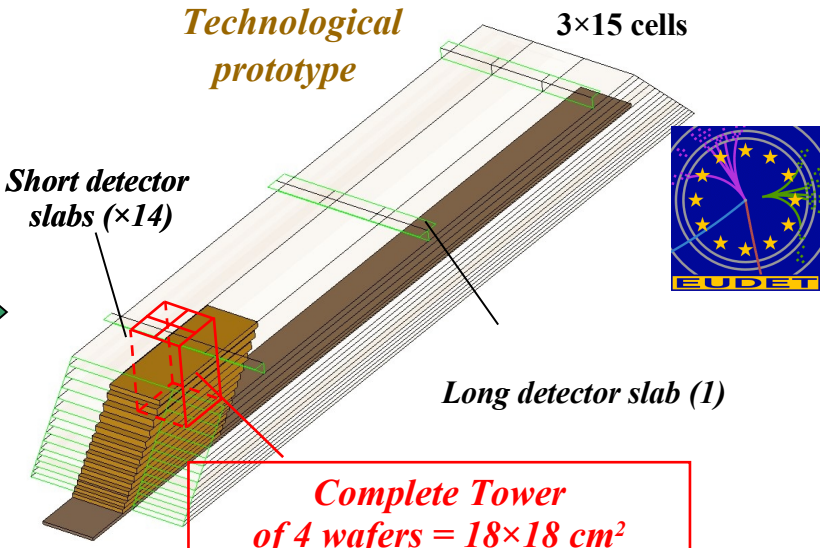
Dead Cells in bottom layers – Main reason for repatriation of Ecal

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!!!!

Parties Involved

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

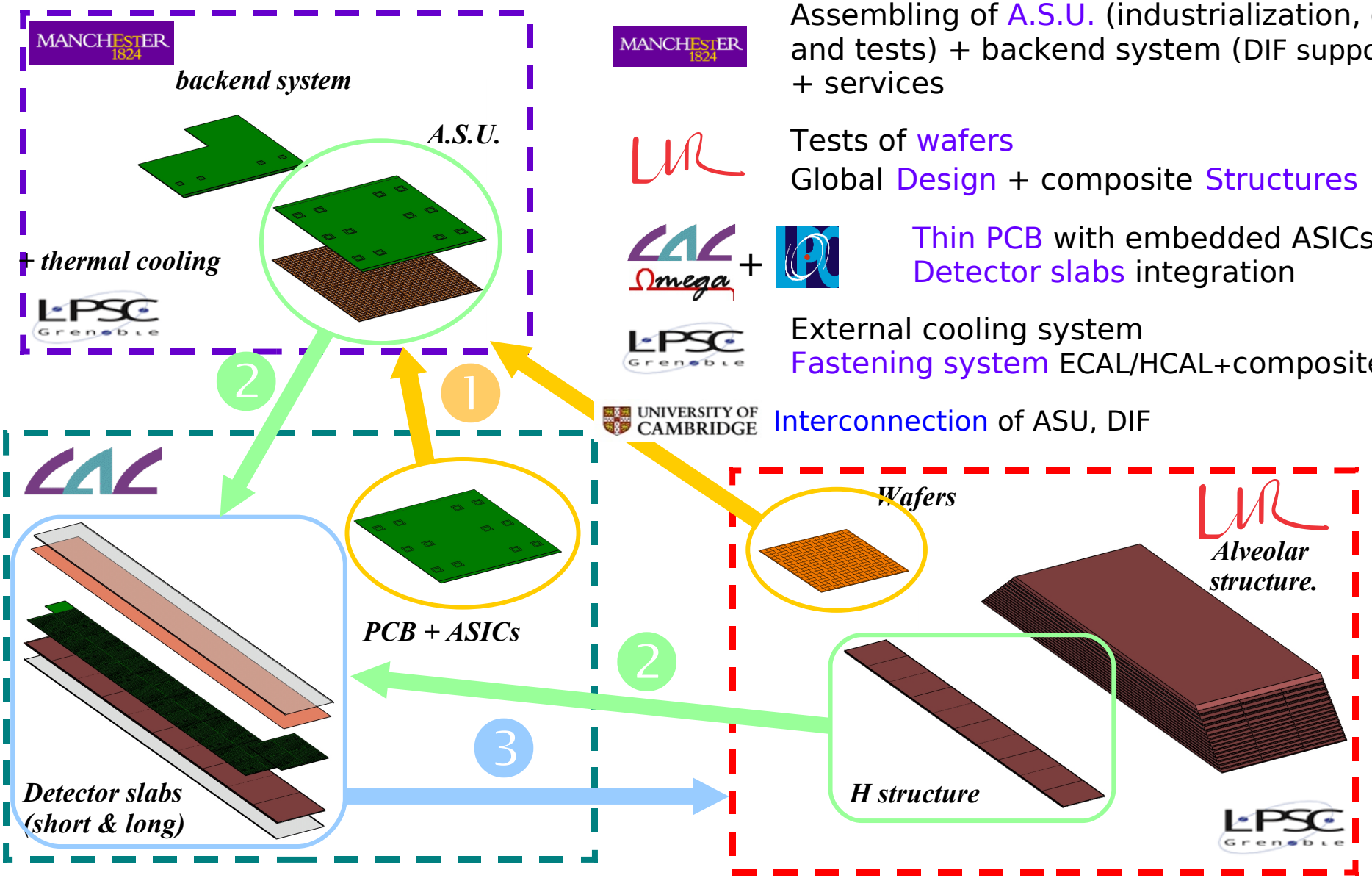
Assembling of A.S.U. (industrialization, gluing and tests) + backend system (DIF support) + services

Tests of wafers
Global Design + composite Structures

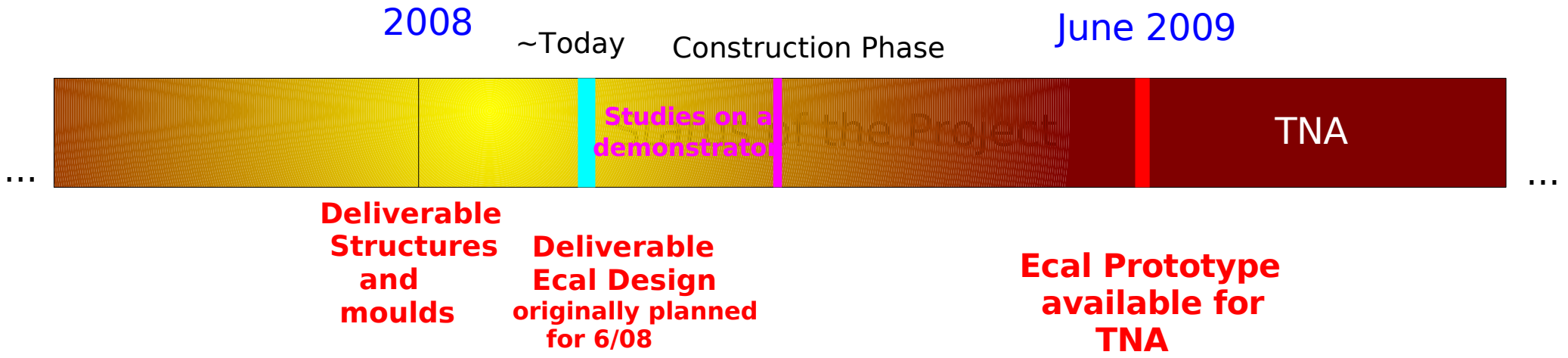
Thin PCB with embedded ASICs
Detector slabs integration

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

- Funding is still critical

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

IN2P3 Members

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[1], M. Goodrick[4], D. Grondin[1], B. Hommels[5], R. Poeschl[1], 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

Memos do document the significant progress of the project in 2008

Mainlines for 2009

- 2009 should be the analysis year!!!
  - Finalizing existing analyses
  - Large bulk of 2007 data still poorly analysed – Scope/Aim of analyses?
    Analysis has started at LLR and LPC.
  - 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?

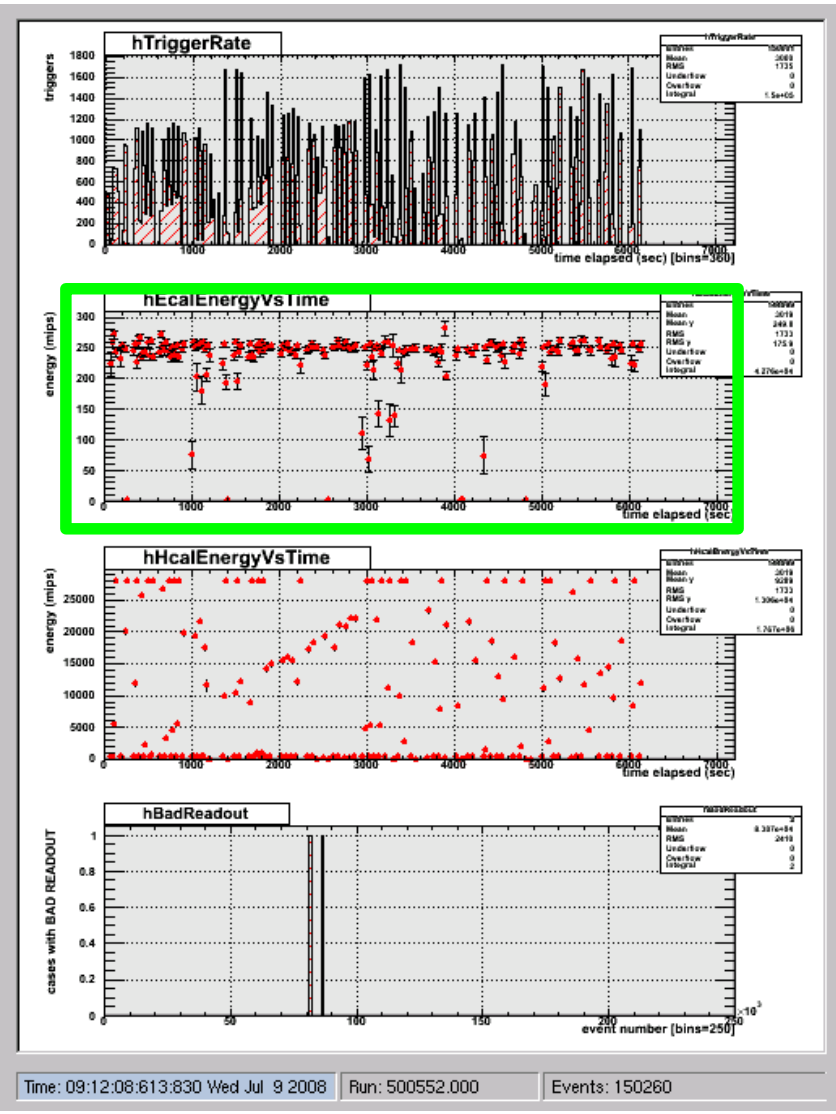
- Testbeam at FNAL with DHCAL towards end of 2009 !?
  - Completion of first round of CALICE Program
  - Please reserve some resources in your travel budget!

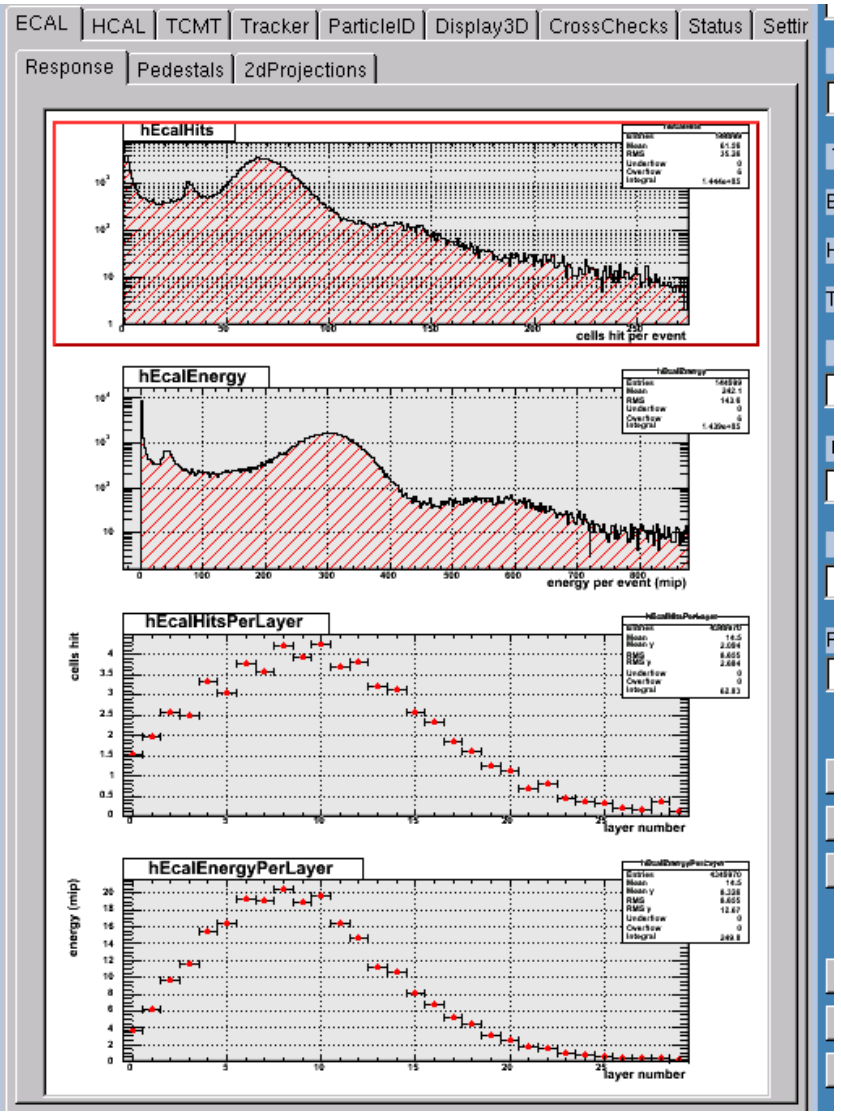
- Construction of EUDET Module
  - First half of the year mainly hardware
  - Needs to be accompanied by software/analysis effort by late summer '09
    Responsibles for task?

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

Backup ….

Impressions from the Ecal Running I



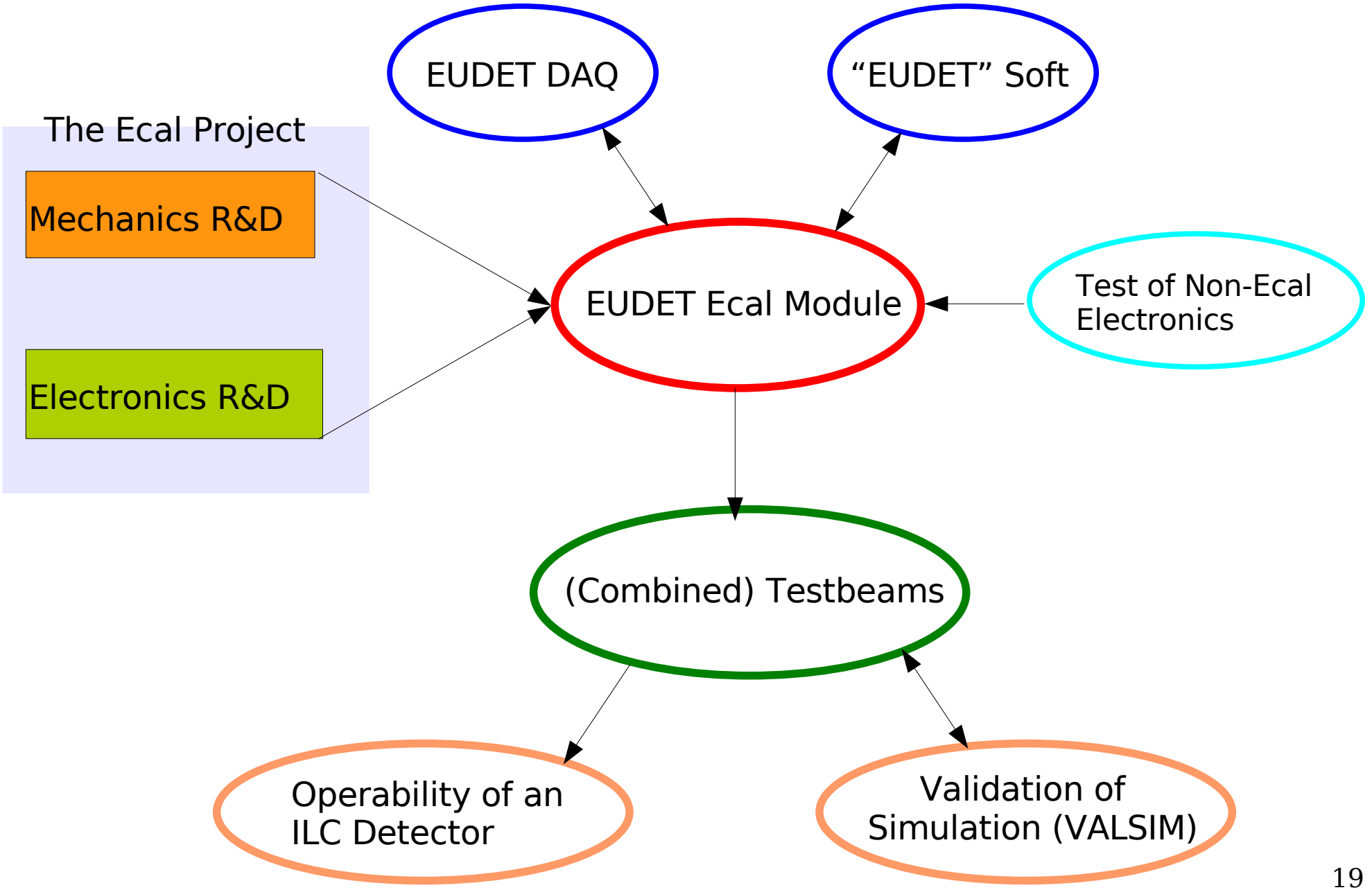


Ecal Noise largely tamed

No noisy layers for > 90% of time

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

EUDET Module and Transnational Access - > June 2009



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

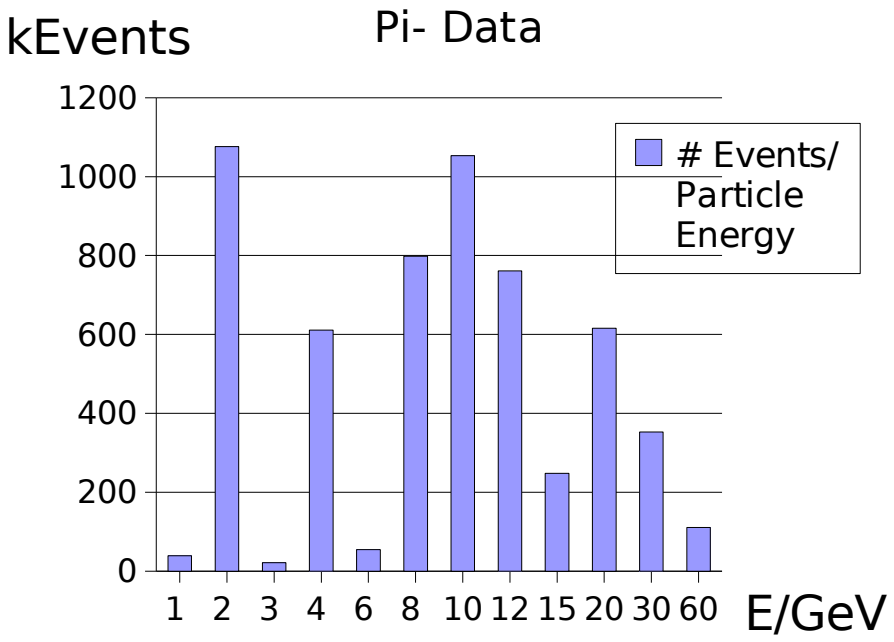
General Running Conditions:

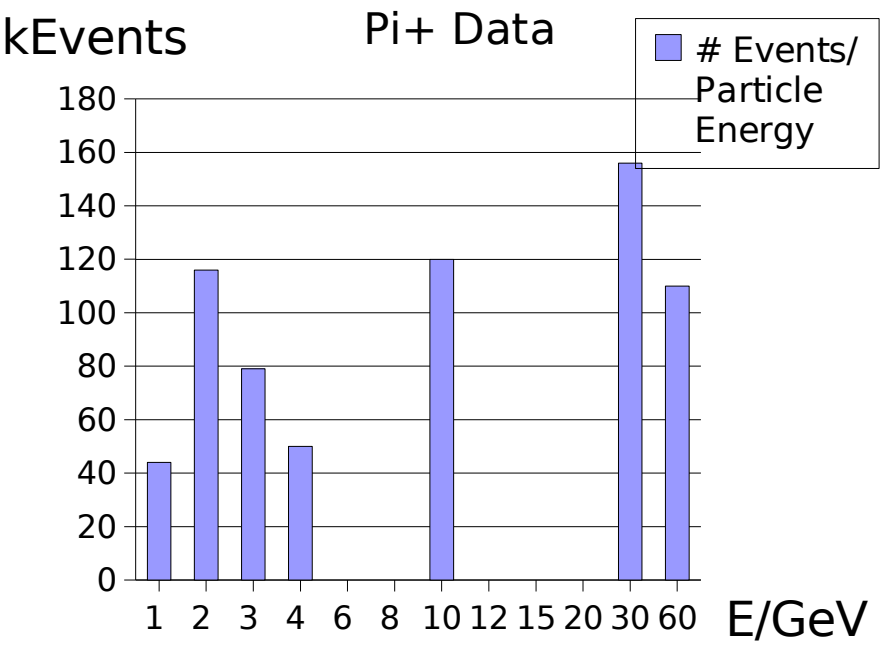
- Night operation – Beam between ~8pm and 10am
  Machine (and detectors) suffered from hot FNAL summer (up tp 42°C)
- Testbeam delivery interrupted by "Shot Setup"
  for TEVATRON experiments
  ~2 hours during our running
- Major machine downtimes (at least until 22/7/08)
  up to 50% during several days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

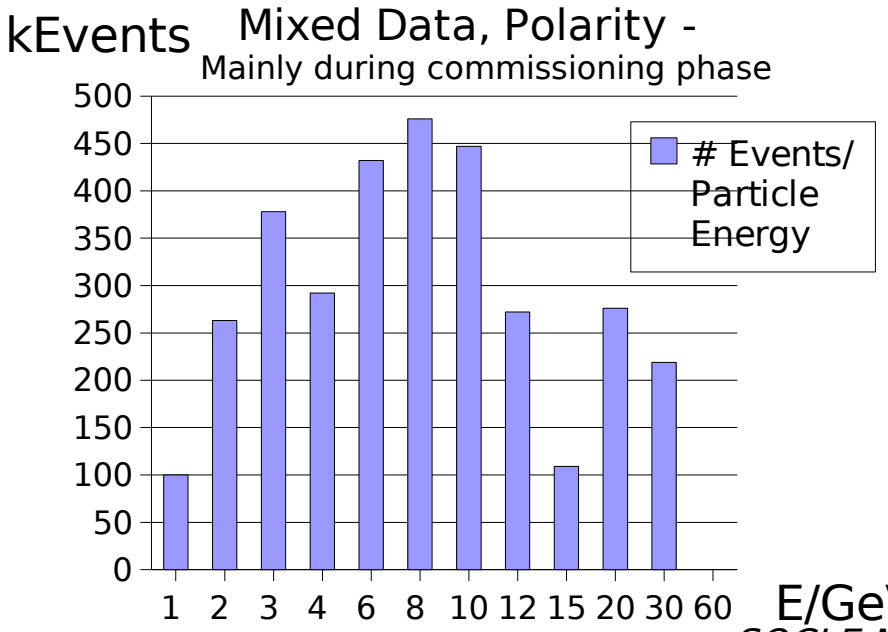
- Downtime did cut into our program!

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



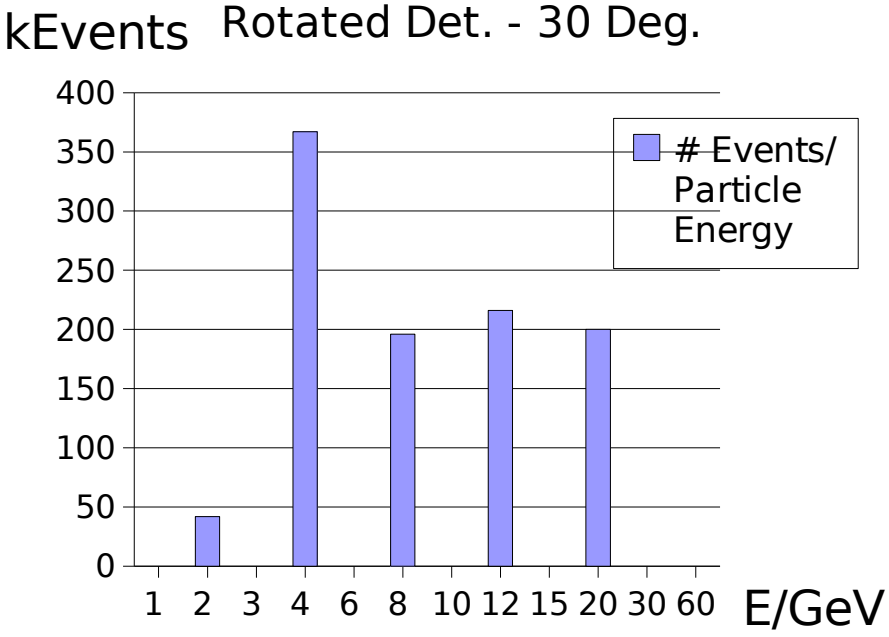


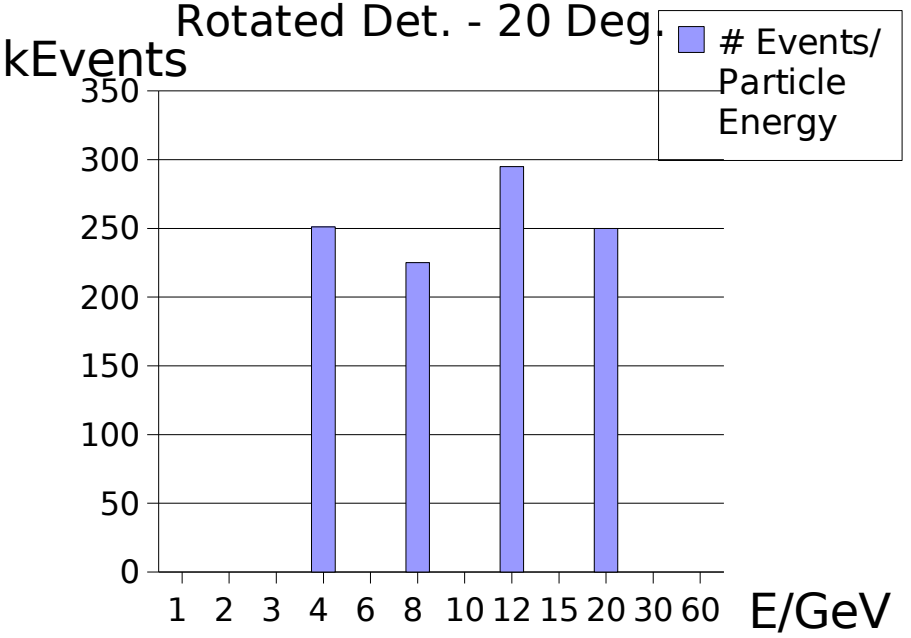


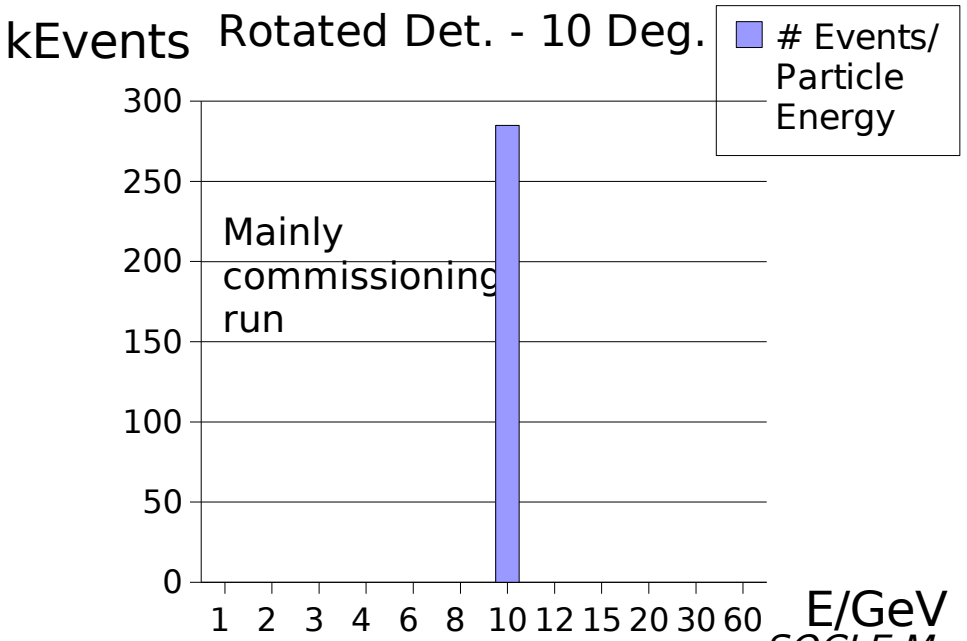
Managed to accumulate hadron data at both polarities

Significant larger sample at negative polarities

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





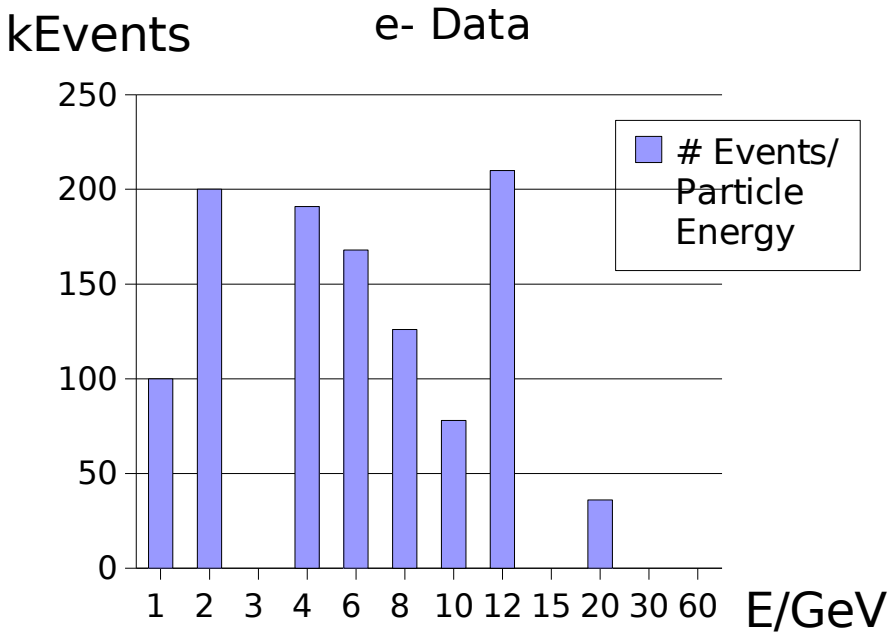


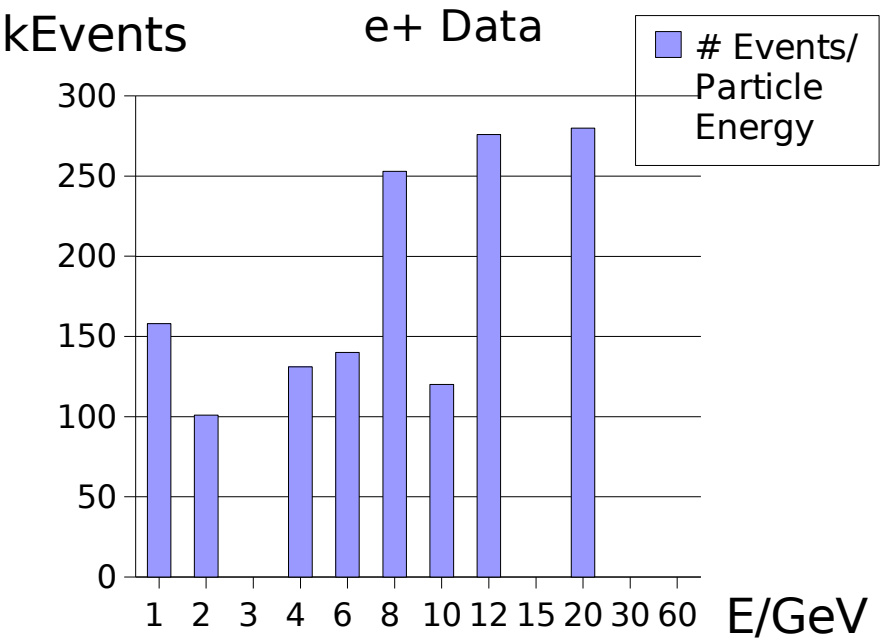
Rotation program suffered most from significant beam down time

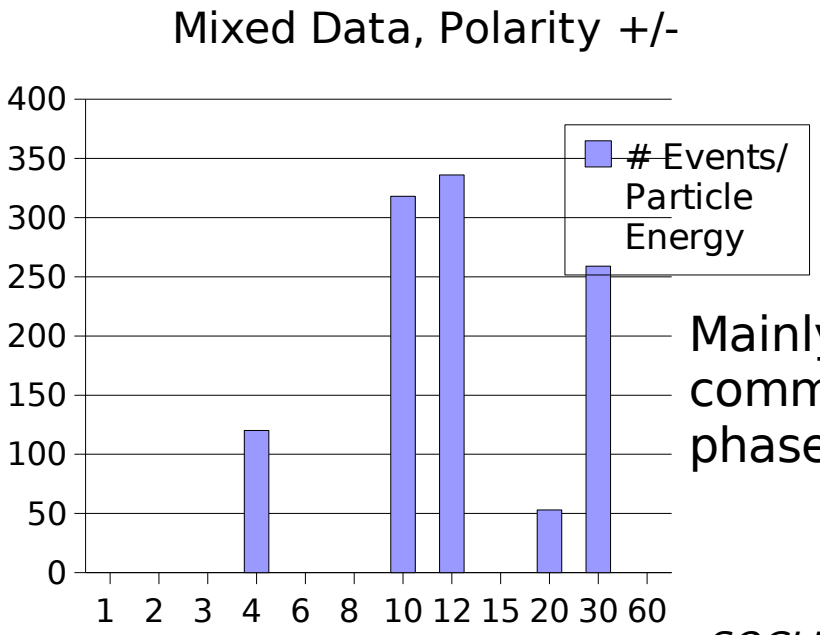
Still, considerable amount of data collected

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