Status of EUDET NA2 - ANALYS

Common Analysis and Simulation Software

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Objectives for task ANALYS

- **development of a common data analysis and simulation infrastructure:**
  - for exchange, analysis and comparison of tbeam data
  - for simulation of test beam experiments
  - GRID data repository and processing infrastructure
- **strategy**
  - the testbeam software effort is tightly integrated with the overall common ILC/LDC software effort:
  - benefit from synergies where possible
- **deliverable**
  - first version of the common data analysis and simulation framework ready after 21 month (done)
  - final report (end of EUDET)

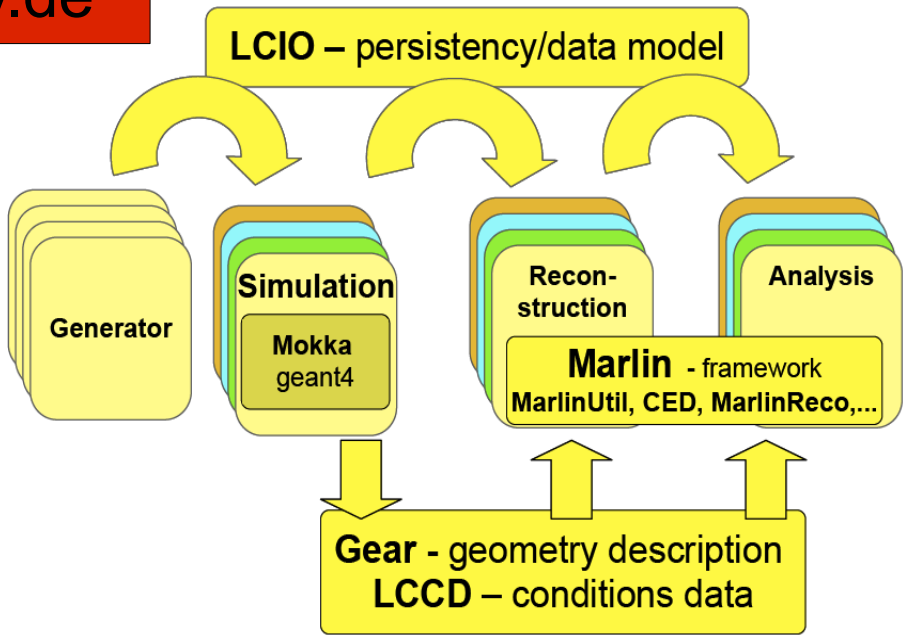
Usage of budget - ANALYS

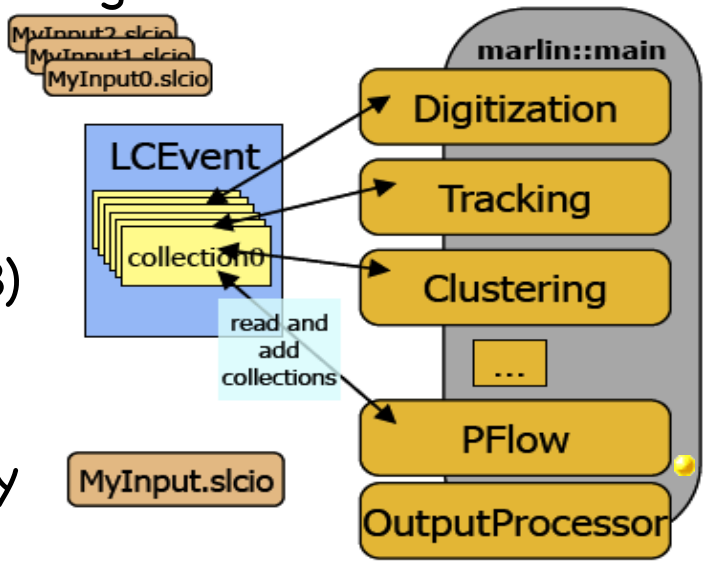
- DESY
  - commitment 12ppm: F.Gaede 25% for full project length
  - 12ppm (scientist) converted to hire a programmer for 18 month
    - started August 2006 - ended December 2007
    - used funds from COMP to extend contract until end of project
- RFWU-Bonn (K.Desch)
  - 8ppm (scientist) combined with funds from JRA2 to hire a postdoc that works on JRA2 and ANALYS (MarlinTPC sw project)
    - started early 2007
- IPASCR (J.Cvach)
  - commitment 3ppm: PhD student that works part time on calorimeter simulation with geant

EUDET & ILD Core Software Tools

http://ilcsoft.desy.de

- **Mokka** (LLR)
  - geant4 simulation application
- **LCIO** (DESY/SLAC)
  - international standard for persistency format / event data model
- **Marlin**
  - core application framework for reconstruction & data analysis
- **GEAR** geometry package f. reconstruction
- **LCCD**
  - conditions
  - data toolkit (DB)
- **CED**
  - 3d event display





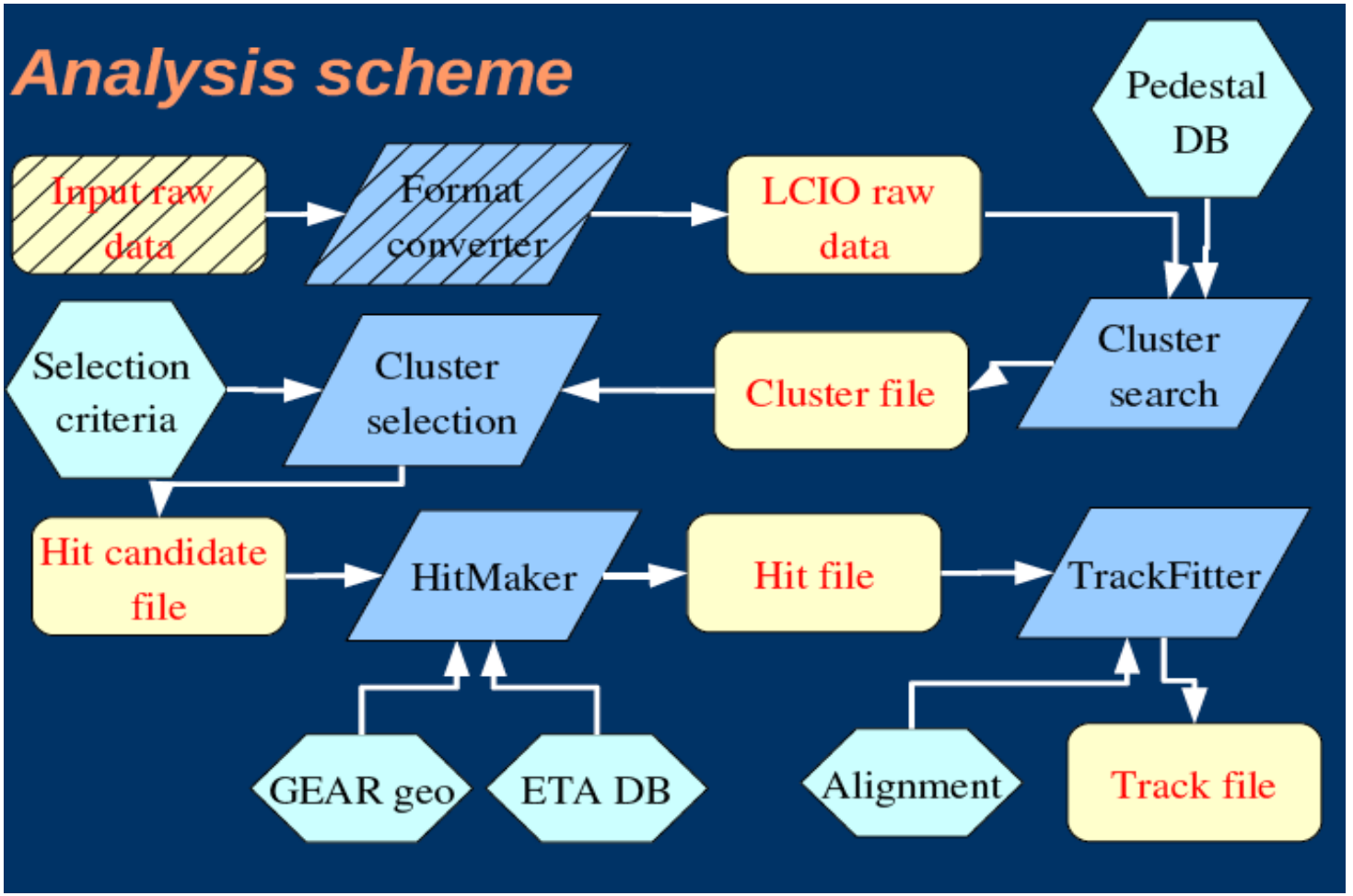
- complete framework used in Monte Carlo & real experiments:
  - **ILD detector concept** studies
  - **Calice** calo testbeam
  - **LC-TPC** testbeam
  - EUDET - **Pixel Telescope**

synergies between testbeam and global detector optimization

Core Software Status

- milestone: first version of core framework reached in 2007 (after 21 month)
  - -> EUDET Report 2007-11
- in 2008 and 2009
  - minor feature requests and bug reports from tbeam community
  - heavily focused on LOI Monte Carlo mass production
    - 60 M events fully simulated and reconstructed (v01-06)
  - quite some improvements in software also for tbeam, e.g. event overlay mechanism
  - valuable feedback from tbeam community (digitization)

JRA1 – EUTelescope I

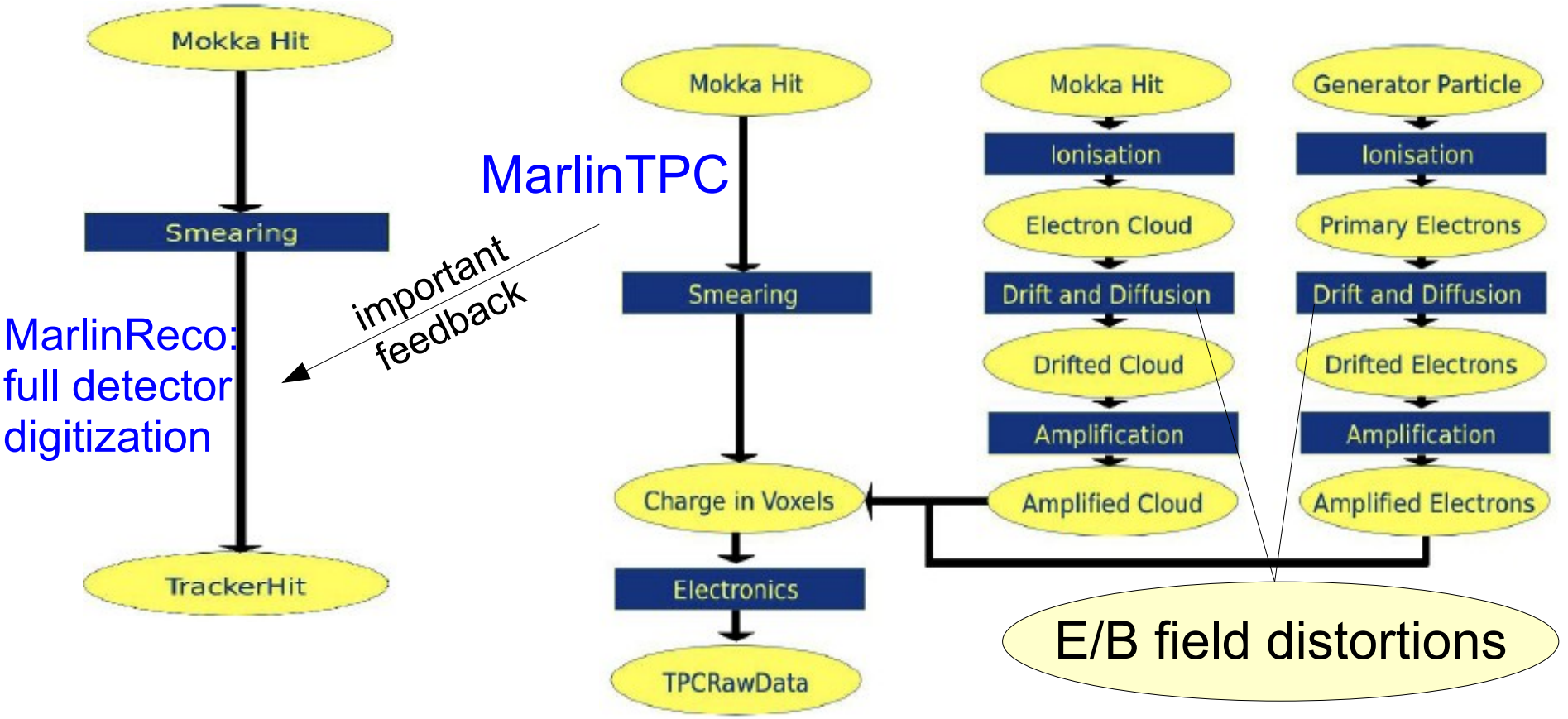


- JRA1 – EUTelescope
  - usage of Mokka, LCIO, Marlin, Gear (LCCD?)
  - ported existing code to common framework (2007)
  - use of Grid for data storage and processing

JRA1 – EUTelescope II

- basic framework existed already in 2008 – improvements this year:
  - improvement of the DUT alignment
    - users can use common software for alignment
    - two strategies:
    - 1 – align DUT and telescope based on hit collection together
    - 2 – align telescope and then use track fit to align DUT
  - data taking is ongoing
    - ~1.3 TByte accumulated
    - processing currently ongoing

JRA2 – MarlinTPC

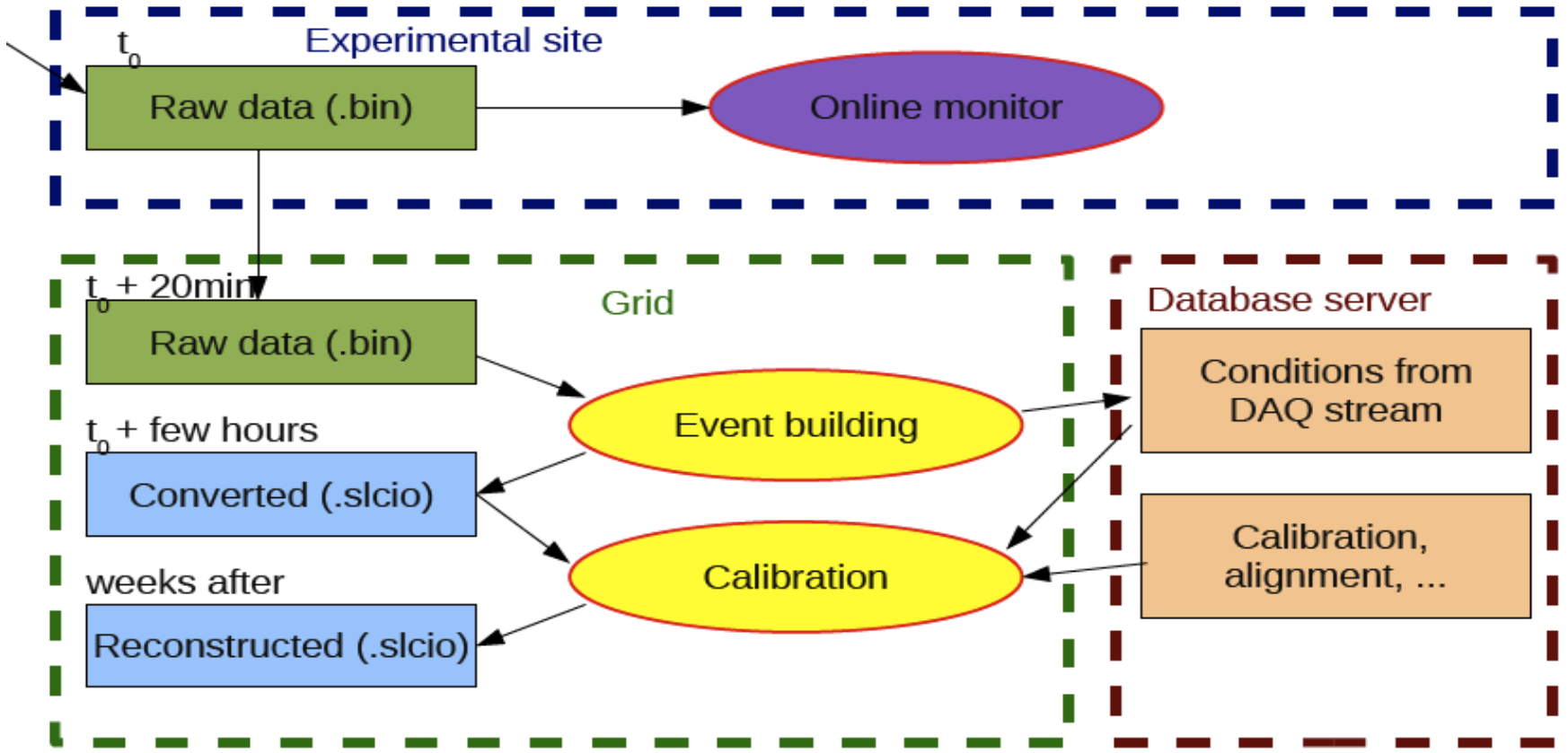


- JRA2 - MarlinTPC
  - usage of LCIO, Marlin, Gear, LCCD
  - started with EUDET
- use of Grid for data storage and processing

JRA2 – MarlinTPC II

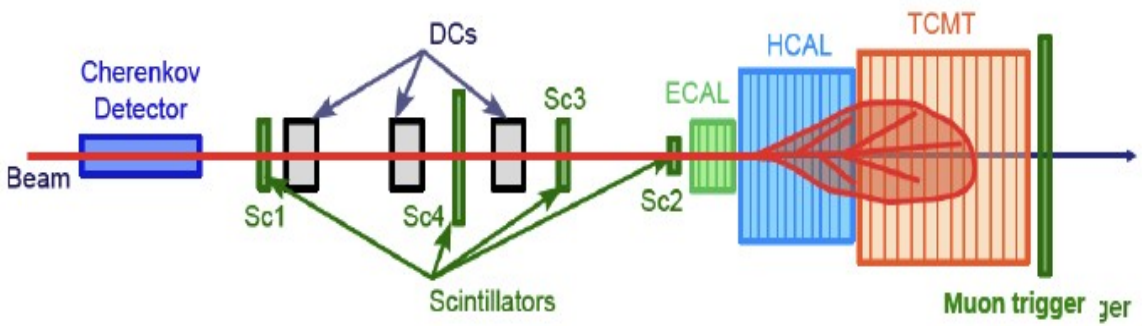
- MarlinTPC sophisticated simulation with various levels of detail:
  - hit smearing -> charge in voxels
  - electron cloud or primary electron drift
  - effects of either B or E field distortions
- currently further improvements of simulation and reconstruction code
- adopting of LCCD and setup of conditions data base
- accumulated test beam data:
  - ~ 100 M events (2 TByte)
  - processing ongoing

JRA3 – Calice software I



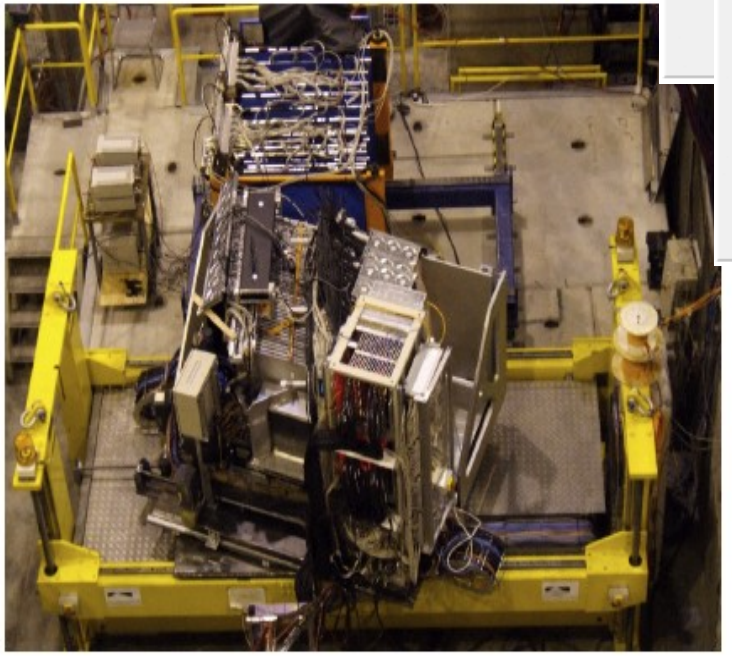
- JRA3 - CALICE tbeam software
  - usage of Mokka, LCIO, Marlin, Gear, LCCD
  - started before EUDET
  - massive use of Grid for processing and data storage

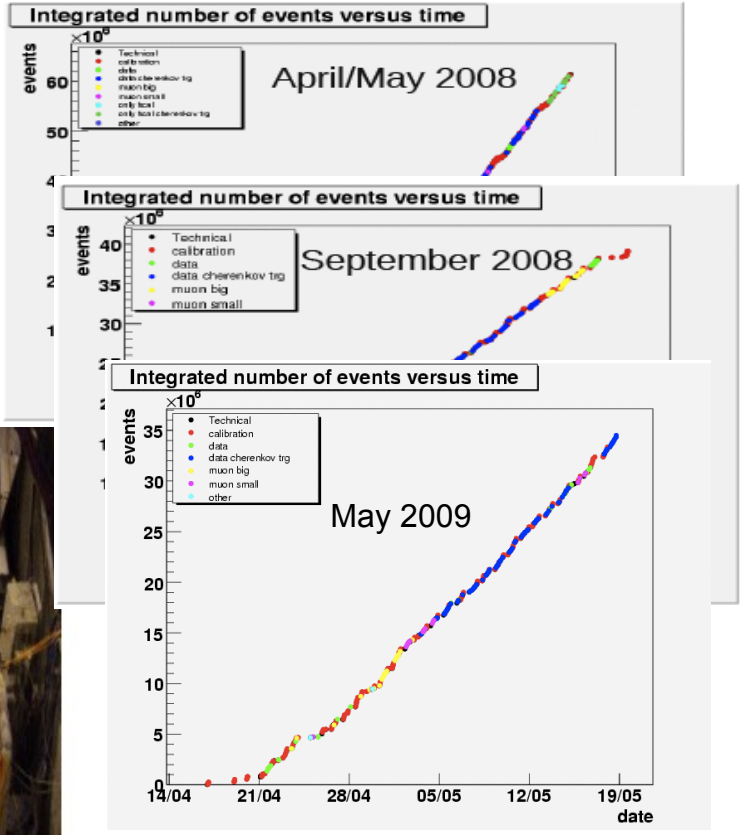
JRA3 – Calice software II



Data recorded:

- 2006 – DESY/CERN
- 2007 - CERN
- **2008 - Fermilab MTBF**
- Si-W/Sci-W ECAL, HCAL, TCMT
- e± 1-50 GeV
- μ± (mainly for calibration)
- π± 2-180 GeV
- Various impact points
- Angles of incidence:
  0±, 20±, 30±, 45±
- Typically ~200K events per configuration.





>350 Mio events
~50 TB (incl.MC/processed)

- data analysis very actively ongoing for years
- focus on improving the calibrating and understanding of the data

Summary

- NA2 task ANALYS: "Provide a software framework for simulation and analysis (of testbeam data)"
- EUDET milestone: "Version 1.0 after 21 month" reached
- software is fully Grid compatible and the Grid is used for data storage and analysis

- **all EUDET JRAs have now fully adopted the common software framework**
- **now focus on improving the 'physics' part of the software**
- **still some (minor) feature requests for core software**