Report on Activities in France

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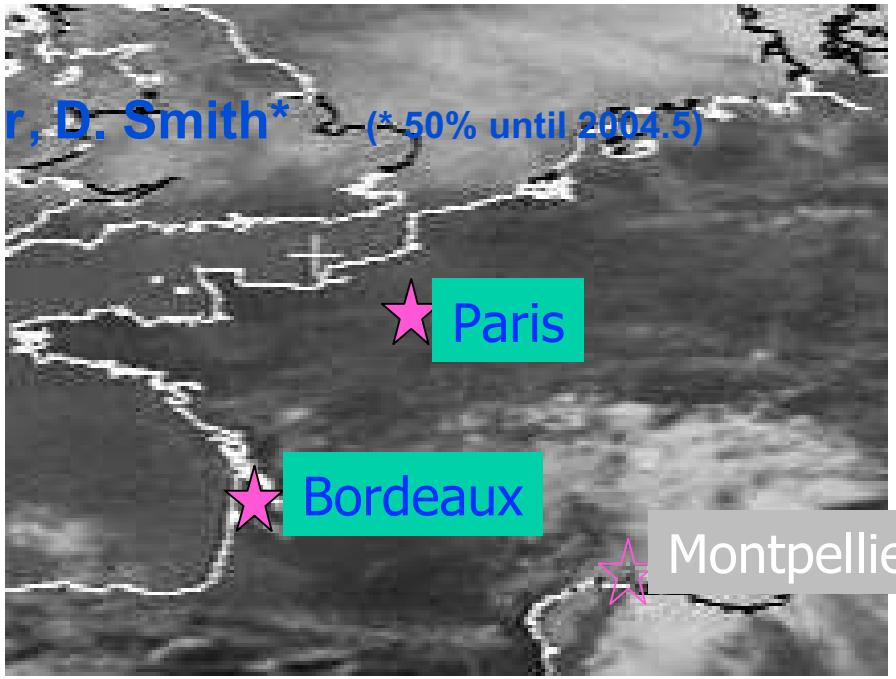
Centre National de Recherche Scientifique (CNRS)

Outline

- Laboratories & Personnel
- Fabrication of Calorimeter Mechanical Structure
  - (see Calorimeter Status talk presented by B. Lott on behalf of N. Johnson)
- Testbeam measurements of CAL heavy ion response
  - (ditto)
- Software: CAL, Core, and Science.
- Participation in Integration & Test at SLAC

Laboratories & Personnel (1)

- Post-CNES, the IN2P3/CNRS is enabling work to continue.
- LLR (formerly the LPNHE), Ecole Polytechnique (Paris suburbs)
  - G. Bogaert, G. Dubus, B. Giebels, H. Videau
  - Student: P. d,Avezac
  - O. Ferreira leads the fabrication team (4 people)
  - 2 software engineers
- CEN Bordeaux-Gradignan
  - D. Dumora*, B. Lott, T. Reposeur, D. Smith* (* 50% until 2004.5)
  - Student: J. Bregeon
- APC- Paris R. Terrier
- College de France A. Djannati-Atai
- Groupe d,Astroparticules de Montpellier
  - A. Jacholkowska, E. Nuss, F. Piron

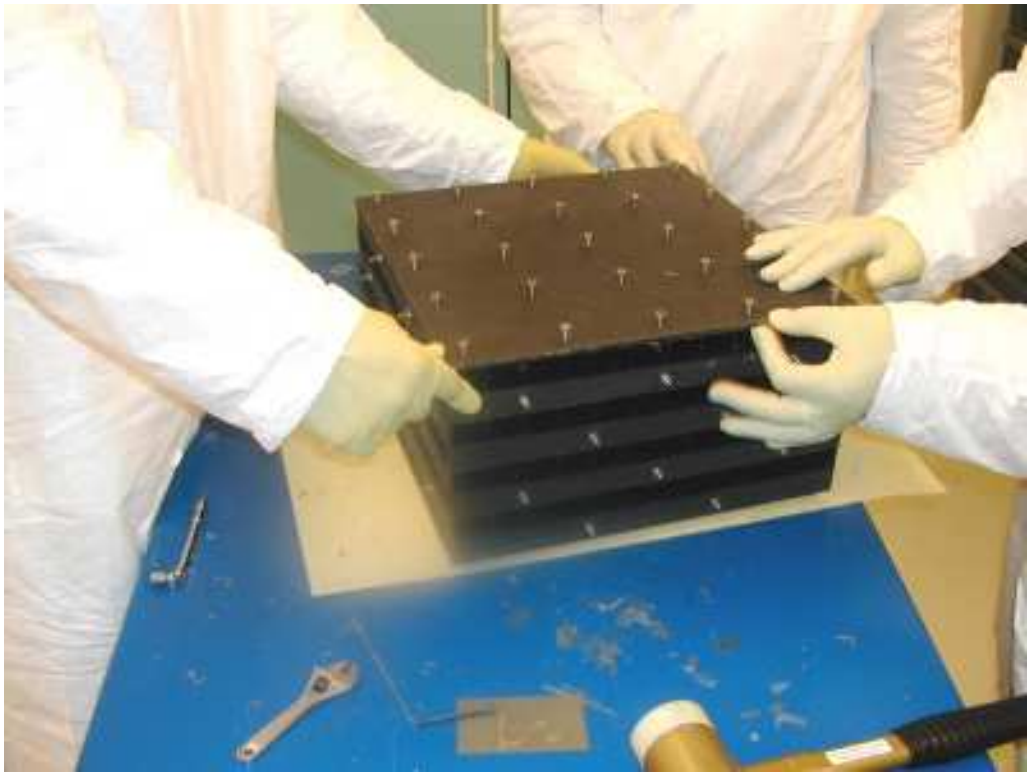


Laboratories & Personnel (2)

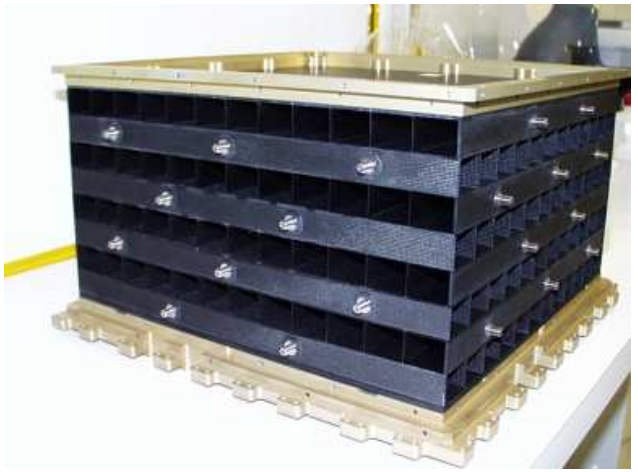
- CEA-Saclay construction team disbanded
  - Contributed CDE,s to August CERN testbeam.
  - J.F. Gliecenstein worked on testbeam and is working on testbeam data analysis.
  - CDE test benches for flight hardware, shipping containers.
- CEA-Saclay scientific work continues
  - Led by I. Grenier.
  - Co-responsibility for catalog.
  - Galactic sources working group.
  - Potentially more manpower once Integral, XMM pressure subsides.

Fabrication of CAL Structures

- EM and QUAL are behind us. All effort now directed to ***FLIGHT*** .
- SM1 great, SM2 to be better. Then SF1. All done a year from now.
- Refer to CAL status talk for details.

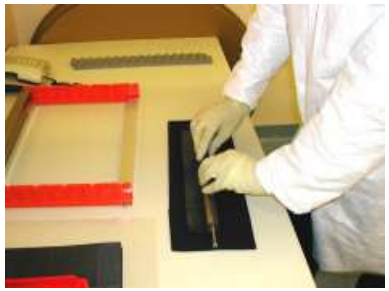


Mechanical Structure
France (IN2P3/LLR)



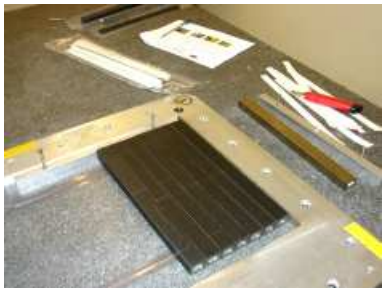
Composite Structure – LLR Ecole Polytechnique

Wrapping of Mandrels



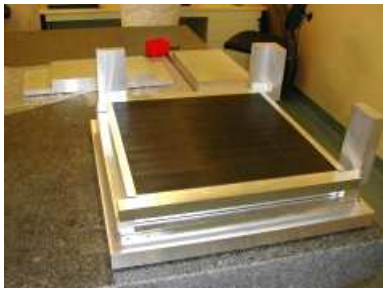
•Each Mandrel Wrapped with One Pre-Preg Ply

Preparation of Layer



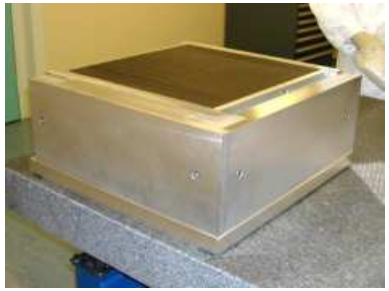
- Stacking of Mandrels and Lateral Lay-Ups with Inserts
- Mechanical Pressure to Add Global Plies

Stacking of Layers



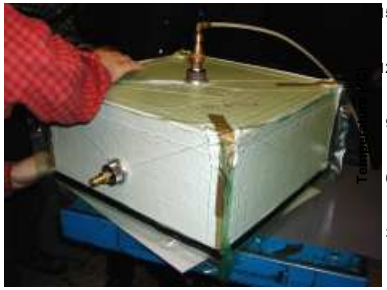
•Stacking of Layers, Base and Top Lay-Ups with Inserts

Closing of Mold



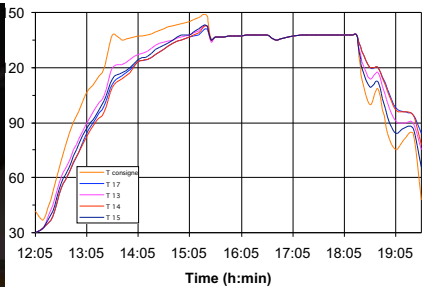
- 4 Side Plates and Cover
- Mechanical Stops to Control Outer Dimensions

Vacuum Bagging



- Release Film
- Breather Felt
- Vacuum Bag

Autoclave Curing



- Temperature 135°C
- Pressure 7 bars
- Cure Time 4h

Structure Removal

- Removal of Layer Frame
- Removal of 96 Mandrels
- Cleaning

Metrology

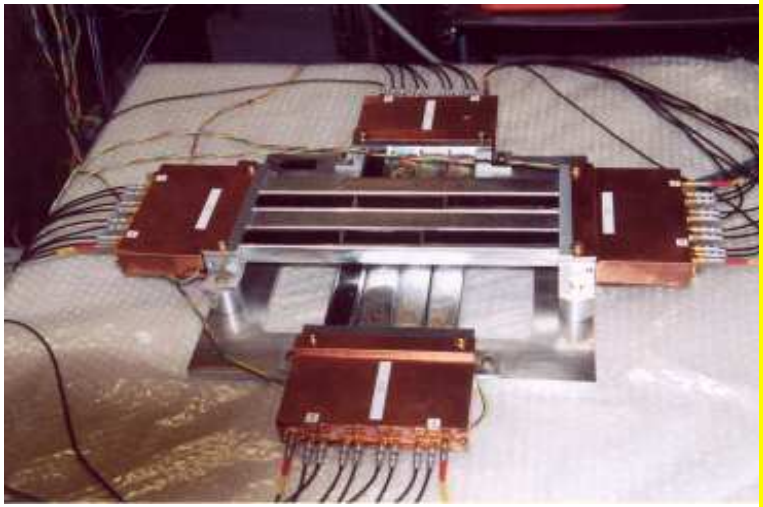
- Outer Dimensions
- Position of Inserts
- Dimension of Cells

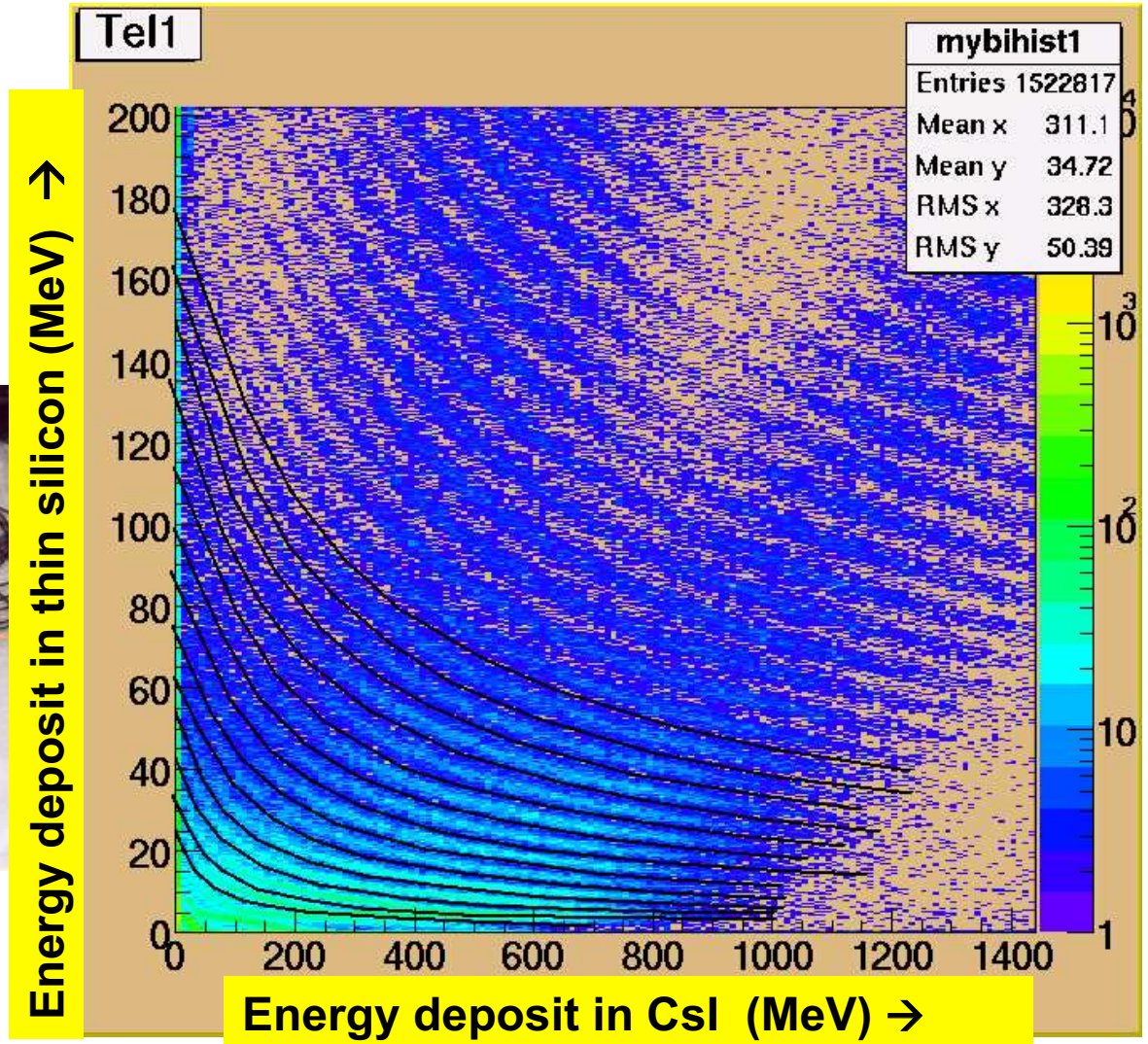
Testbeam campaigns, 2002-2003

- **Recall that GLAST CAL will be calibrated in orbit using cosmic ray heavy ion dE/dx energy deposition.**
- **Want energy scale to be right? Then need accurate Monte Carlo!** *Nota bene*: **no good CsI heavy ion data in the GLAST energy range.**
- **14-24 November 2003: EM CAL to GSI Heavy Ion beam (Darmstadt, near Frankfurt) to measure detailed CsI response in the configuration specific to CAL.**
- **'Getting it right, requires myriad complementary measurements.** (e.g. low energy non-linear response) **Bordeaux built a CsI mini-stack using GLAST CDE,s with superior electronics, which we have been studying in proton, muon, and electron beams (CERN 7/2002 and 8/2003), as well as a low energy heavy ion beam (GANIL, 4/2003).**

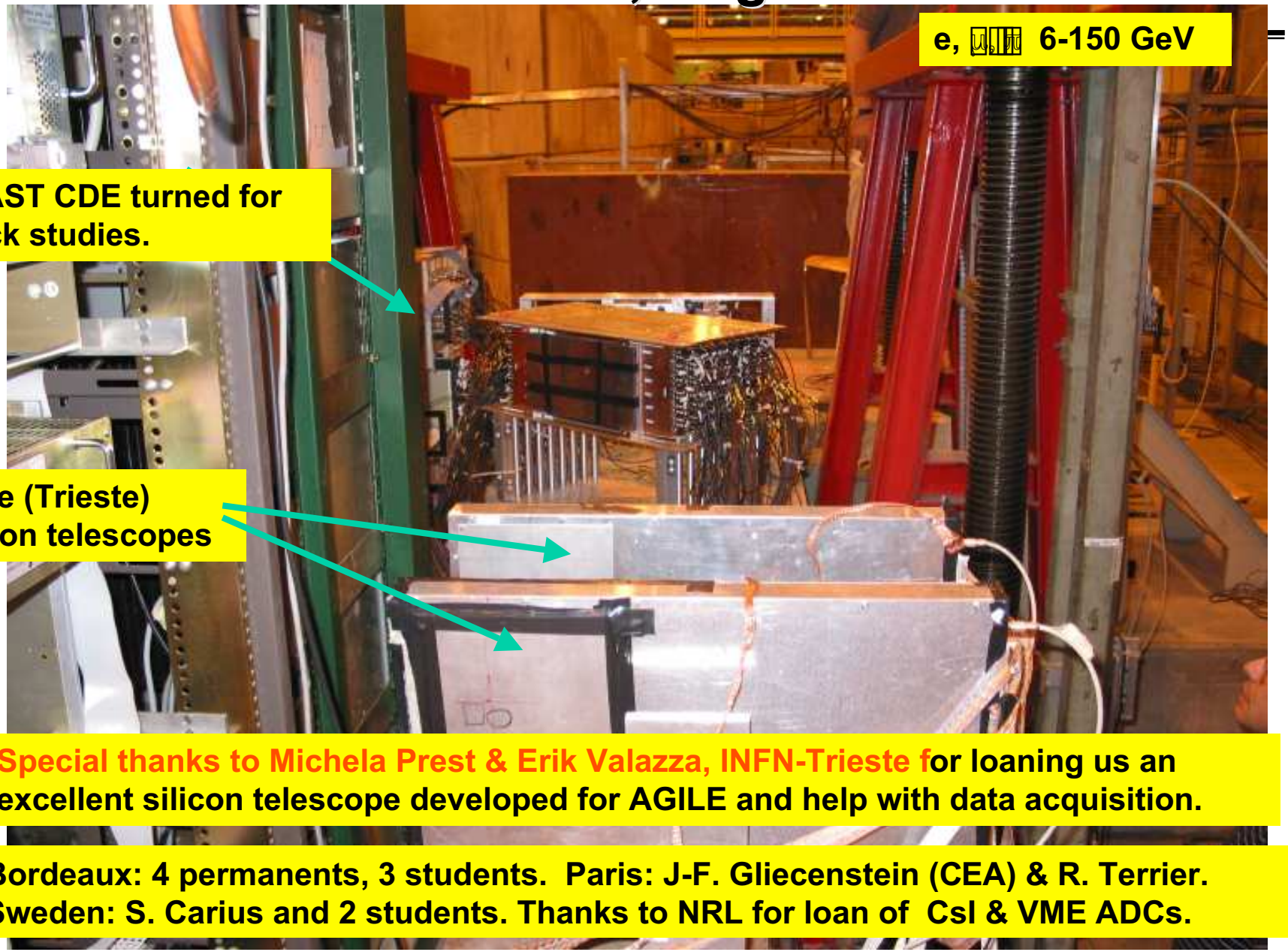
GANIL , April 2003

73 MeV/nucleon beam fragments into a large range of nuclei.





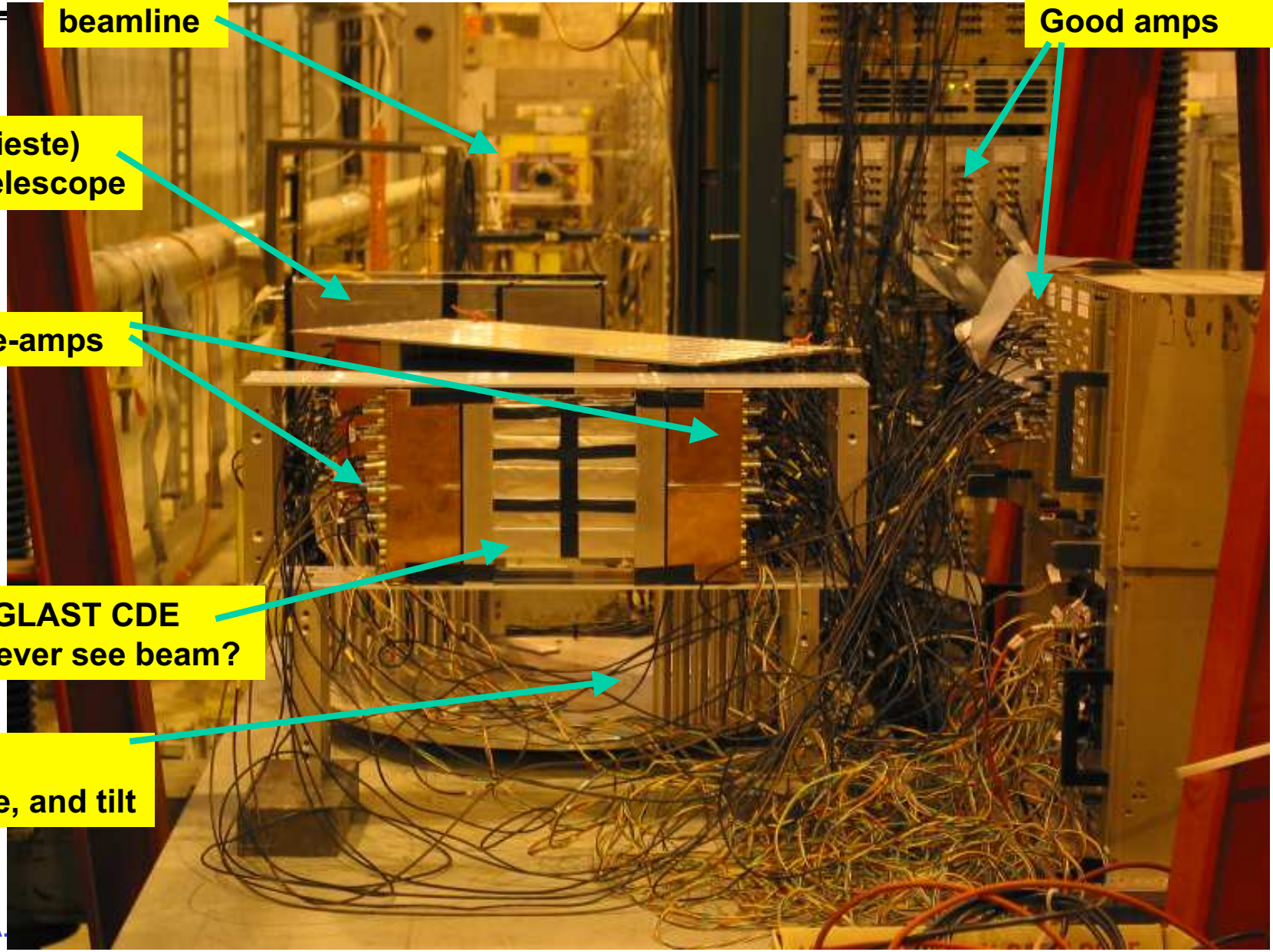
CERN H6A, August 2003



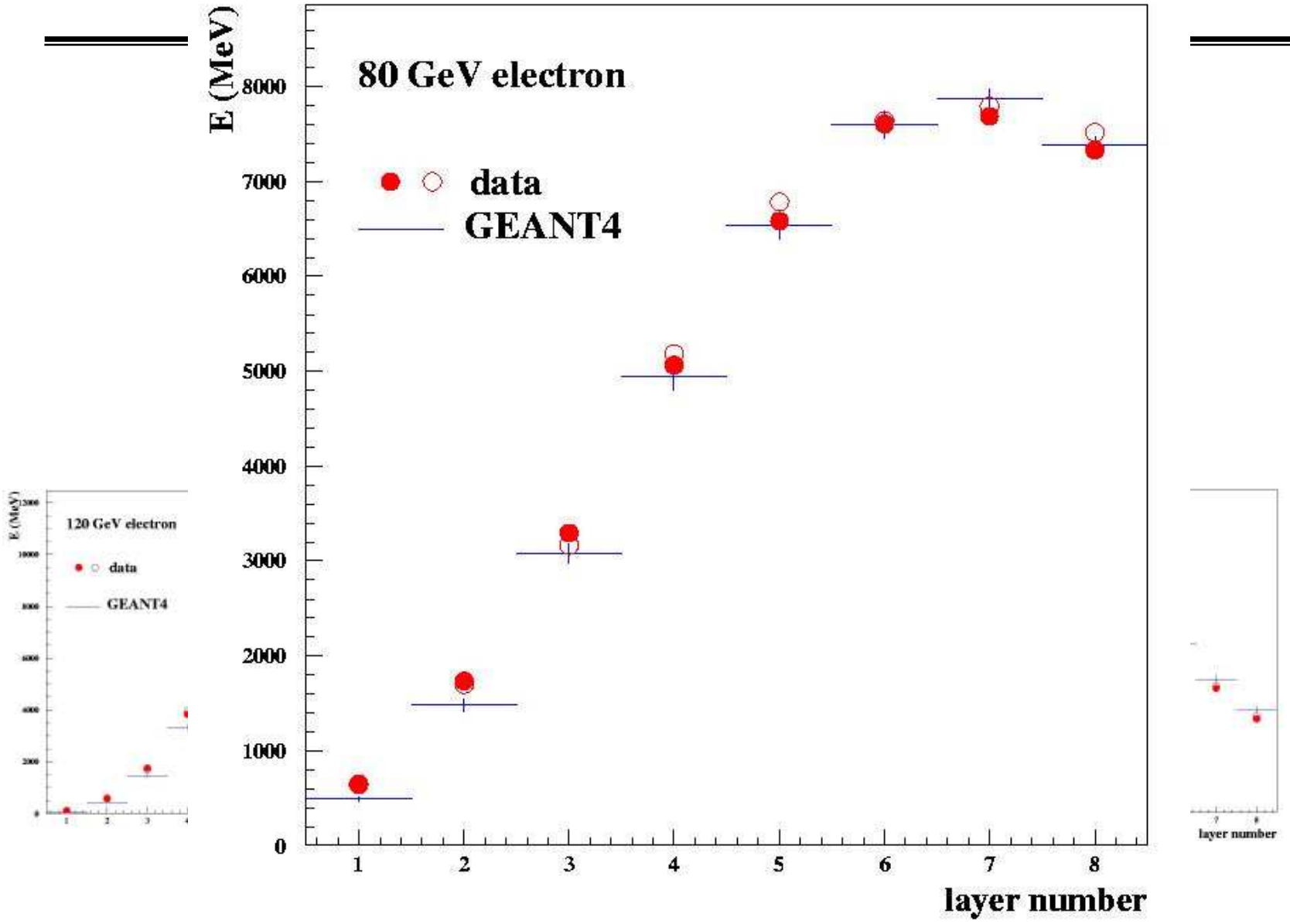
Special thanks to Michela Prest & Erik Valazza, INFN-Trieste for loaning us an excellent silicon telescope developed for AGILE and help with data acquisition.

Bordeaux: 4 permanents, 3 students. Paris: J-F. Gliecenstein (CEA) & R. Terrier. Sweden: S. Carius and 2 students. Thanks to NRL for loan of CsI & VME ADCs.

CERN H6A, August 2003

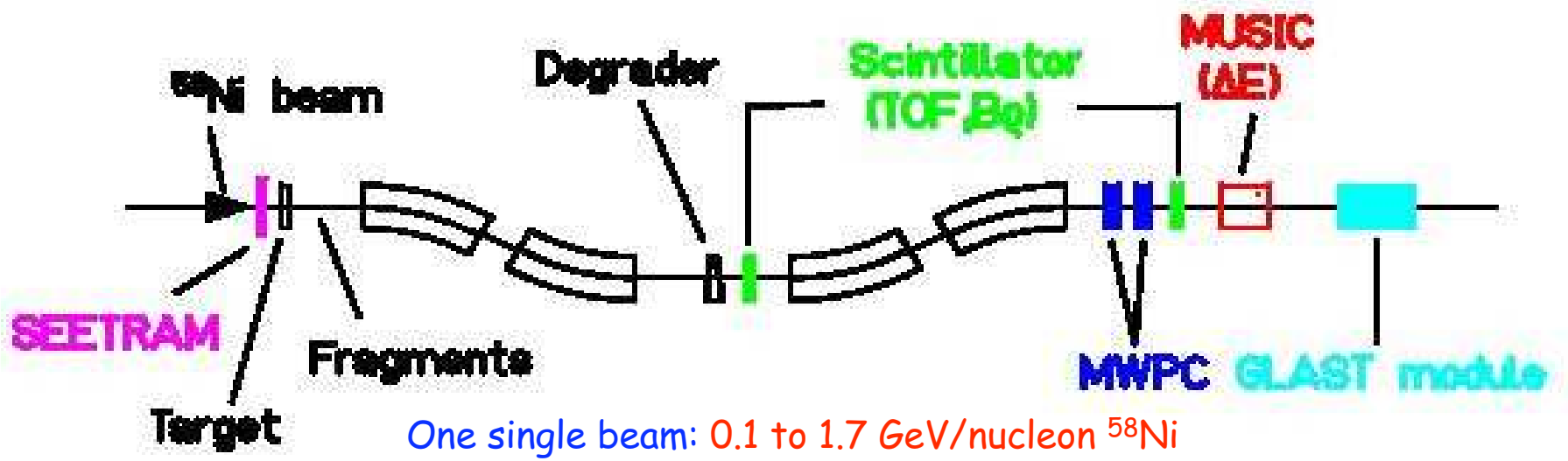


Longitudinal shower profile



GSI Darmstadt, November 2003

- Nightly shifts for 10 days.
- GSI FRS (= Fragmentation Separator) provides event-by-event details of particle species, position, and energy.
- NRL, *three* IN2P3 labs, Swedes to participate.



One single beam: 0.1 to 1.7 GeV/nucleon ^{58}Ni

All fragments are produced simultaneously.

Software Contributions (1)

- CAL software
  - Energy reconstruction (B. Giebels + P. D,Avezac)
  - clustering algorithms (G. Musat)

- In-flight calibration
  - E. Grove (NRL) is in charge
  - Logical continuation of ongoing heavy ion work (led by B. Lott)
  - JQMD heavy ion code running with Geant 4 in Bordeaux

  (thanks to T. Koi)

- CORE software
  - ROOT I/O optimization, and elimination of memory leaks : required changes in collaboration with Root authors, and changes in mcRootData for improved use of TRef-s (U. Berthon)

Software Contributions (2)

- **Science software**
  - Error estimators for the maximum likelihood detection method. Participation in the FITS data format working group (G. Dubus).
  - Bordeaux activity will increase as testbeam load subsides.
- **Data Challenge**
  - Preparing Lyon batch system for a fraction of Data Challenge 1 generation, to help SLAC (B. Giebels).
  - Bordeaux absent from DC1 due to testbeams, aim for DC2!
- **Pulsar barycentering**
  - Have provided C++ heliobarycentering code validated by detection of optical Crab pulsar with Celeste.

Contributions to Integration and Test

- Participation in integration of EM CAL and TRK. (B. Giebels, G. Bogaert, P. d,Avezac)
- Increased contributions to I&T in 2004 (Bordeaux too!)

Summary

- France is contributing to the hardware both by designing and building the CAL structure, by measuring the detailed CAL response in a variety of testbeams, and by helping I&T.
- France is contributing to the software from low-level CAL reconstruction, including testbeam-derived calibration constants, through to end-level Science analyses.
- A solid core of 8 permanent scientists from two IN2P3 laboratories is firmly in place. 3 colleagues from a 3rd laboratory are working to convince the collaboration to allow them to join us.
- CEA-Saclay participation down but not out.