

# **EUDET**

## **Detector R&D towards the International Linear Collider**



[www.eudet.org](http://www.eudet.org)

**Joachim Mnich**

**DESY**

**September 2007**

# Introduction to EUDET



- EU funded program supporting ILC detector R&D in Europe



SIXTH FRAMEWORK PROGRAMME  
Structuring the European Research Area Specific Programme  
RESEARCH INFRASTRUCTURES ACTION

- Follows EU projects which (partially) support ILC machine R&D:

**2003 CARE:**            **Coordinated Accelerator Research in Europe**  
**Integrated Infrastructure Initiative (I3)**

**2004 EUROTeV:** **European Design Study Towards a Global TeV Collider**  
**Design Study**

**2005 EUDET:**        **Detector R&D towards the International Linear Collider**  
**Integrated Infrastructure Initiative (I3)**

# Introduction to EUDET



## EUDET

- **is NOT a detector R&D programme in its narrower sense**  
but provides a framework for ILC detector R&D with larger prototypes

**I3 = Infrastructure**

- **does NOT cover all needs (financial & human resources)**

**additional resources required**

**e.g. to exploit EUDET infrastructures  
and to do ,real‘ detector R&D**

# Introduction to EUDET



## Project start:

- **January 2006, for a duration of 4 years**

## Budget:

- **21.5 million Euro total, including own commitments**
- **7.0 million Euro EU contribution**

## Manpower:

- **≈ 57 FTE total, including own commitments**
- **≈ 17 FTE funded by EU**
  
- **31 partner institutes in Europe (23 according to EU counting)**  
provide own commitments & receive EU funds
- **26 associated institutes worldwide**  
contribute to design & construction of infrastructures  
interested in later exploitation

# EUDET Partner Institutes:



**Charles University Prague**  
**IPASCR Prague**



**HIP Helsinki**



**LPC Clermont-Ferrand**  
**LPSC Grenoble**  
**LPHNE Paris**  
**Ecole Polytechnique Palaiseau**  
**LAL Orsay**  
**IReS Strasbourg**  
**CEA Saclay**



**DESY**  
**Bonn University**  
**Freiburg University**  
**Hamburg University**  
**Mannheim University**  
**MPI Munich**  
**Rostock University**



**Tel Aviv University**



**INFN Ferrara**  
**INFN Milan**  
**INFN Pavia**  
**INFN Rome**



**NIKHEF Amsterdam**



**AGH Cracow**  
**INPPAS Cracow**



**CSIC Santander**



**Lund University**



**CERN Geneva**  
**Geneva University**



**Bristol University**  
**UCL London**

**+ 26 associated institutes**

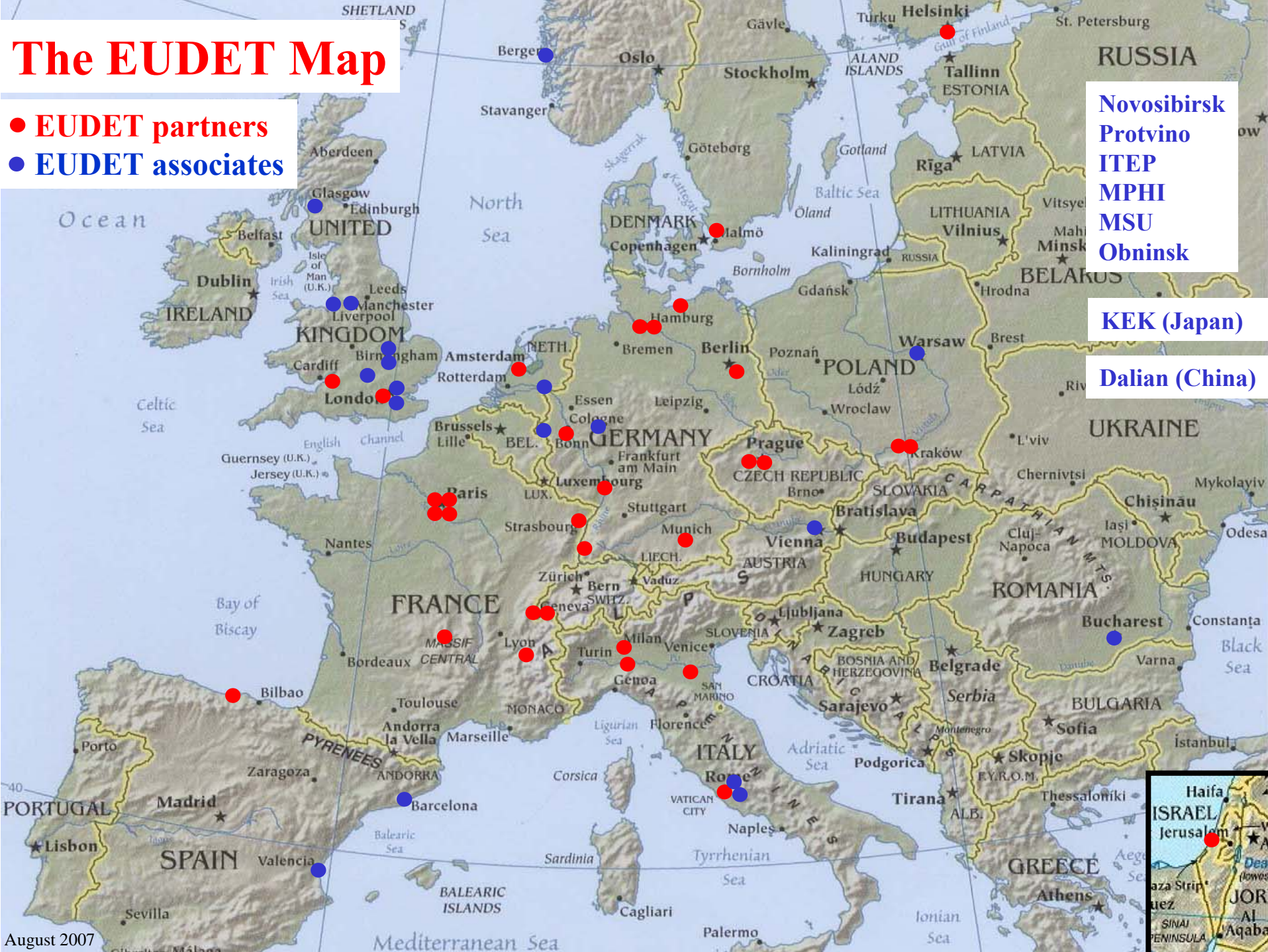
# The EUDET Map

- EUDET partners
- EUDET associates

Novosibirsk  
 Protvino  
 ITEP  
 MPHI  
 MSU  
 Obninsk

KEK (Japan)

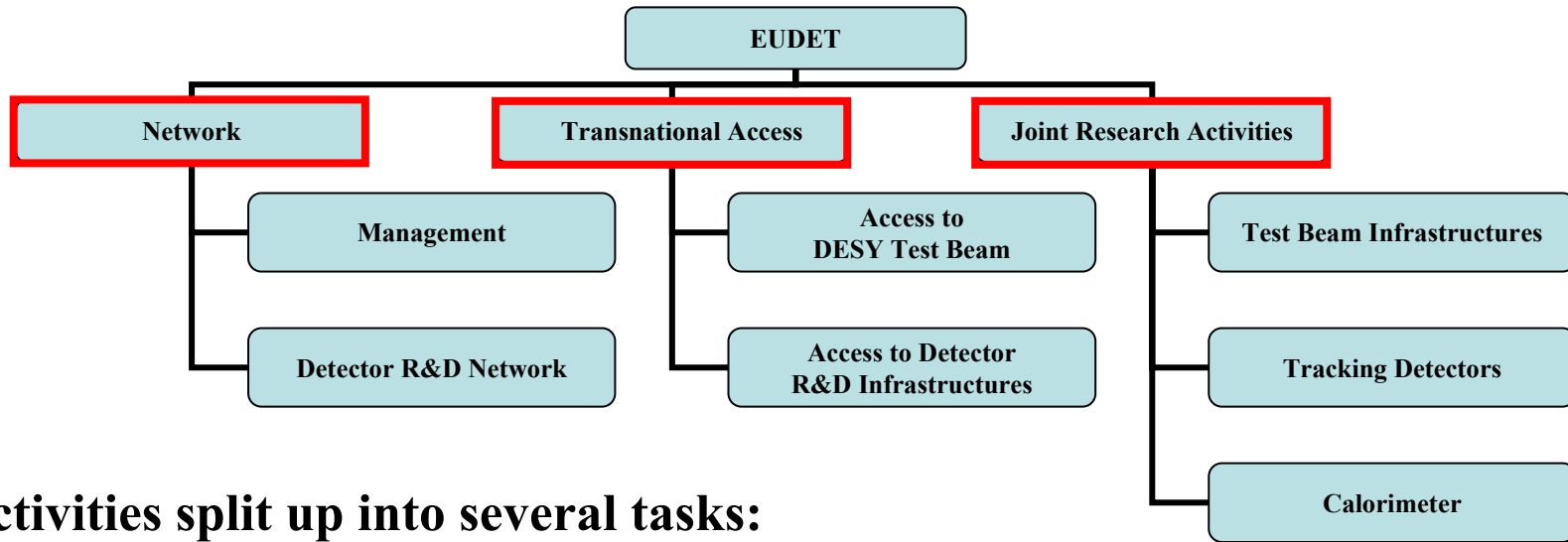
Dalian (China)



# EUDET Structure



**13 projects based on three pillars (mandatory):**



**Activities split up into several tasks:**

## **Detector R&D Network:**

- Information exchange and intensified collaboration
- Common simulation and analysis framework
- Validation of simulation
- Deep submicron radiation-tolerant electronics

## **Tracking Detectors:**

- Large TPC prototype
- Silicon TPC readout
- Silicon tracking

## **Test Beam Infrastructure:**

- Large bore magnet
- Pixel beam telescope

## **Calorimeter:**

- ECAL
- HCAL
- Very Forward Calorimeter
- FE Electronics and Data Acquisition System

# Joint Research Activities



## JRA1: Testbeam Infrastructure

- **Large bore magnet:**
  - 1 Tesla,  $\text{\O} \approx 85$  cm, stand-alone He cooling, supplied by KEK
  - infrastructure (control, field mapping, etc.) through EUDET
  
- **Pixel beam telescope**
  - 6 layers of MAPS detectors
  - CCD and DEPFET pixel detectors for validation
  - DAQ system

**Note: all EUDET infrastructure is movable**

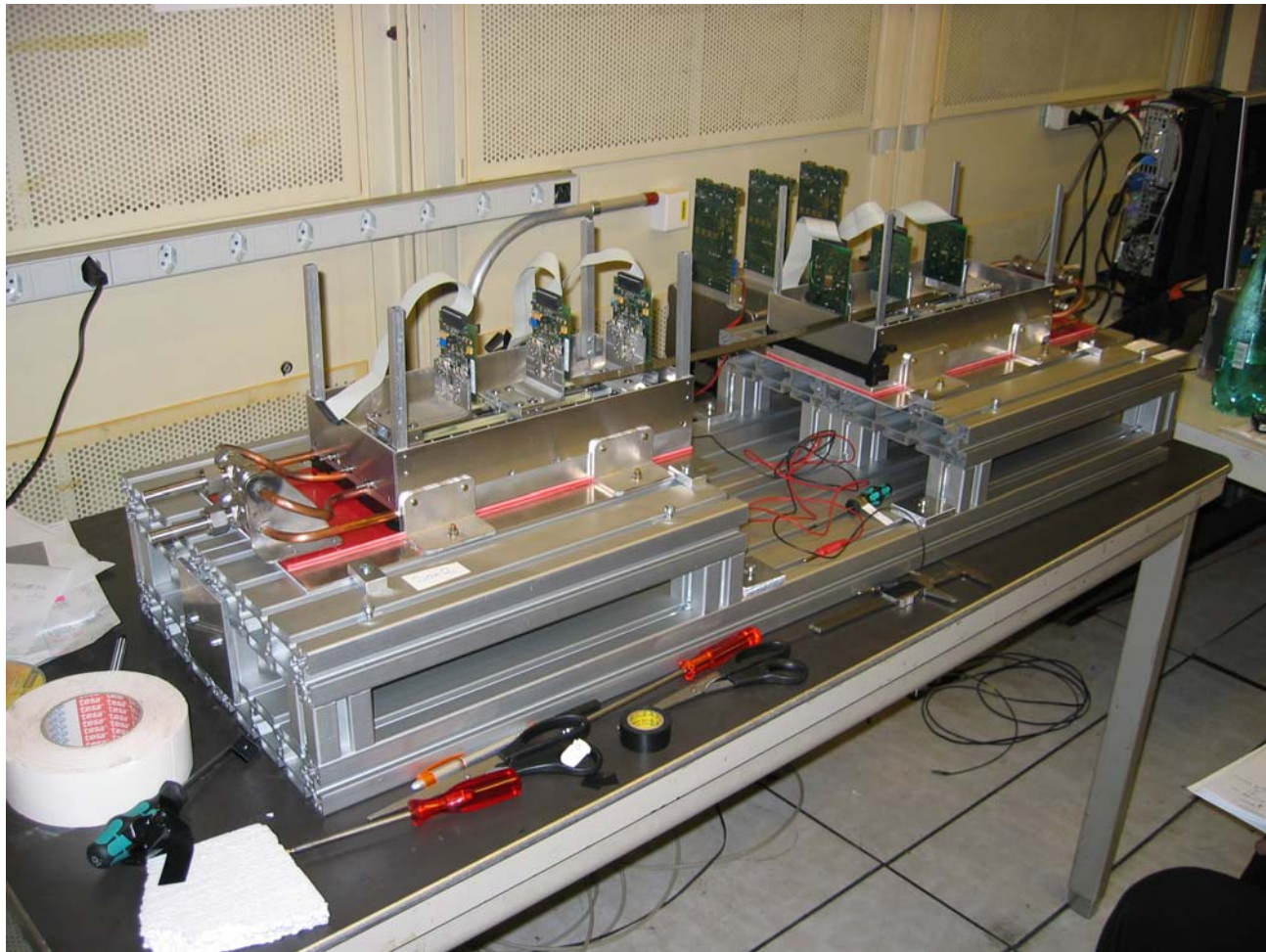
- construction & initial tests at DESY
- later exploitation at CERN, FNAL etc. possible



# Example: Beam Telescope



- **1<sup>st</sup> version of pixel beam telescope:**
  - analogue, reduced readout speed
  - tested & commissioned at DESY
  - now in CERN testbeam



# Joint Research Activities



## JRA2: Tracking Detectors

- **Large TPC prototype:**
  - low mass field cage (for JRA1 magnet)
  - modular endplate system for large surface GEM &  $\mu$ Megas systems
  - development of prototype electronics for GEM &  $\mu$ Megas
  
- **Silicon TPC readout:**
  - development MediPix  $\rightarrow$  TimePix
  - TPC diagnostic endplate module incl. DAQ
  
- **Silicon tracking:**
  - large & light mechanical structure for Si strip detectors
  - cooling & alignment system prototypes
  - multiplexed deep submicron FE electronics

# Joint Research Activities



## JRA3: Calorimeter

- **ECAL:**
  - scalable prototype with tungsten absorbers
  - Si-sensors & readout chips
  
- **HCAL:**
  - scalable prototype
  - multi-purpose calibration system for various light sensing devices
  
- **Very Forward Calorimeter:**
  - laser-based positioning system
  - calibration system for silicon and diamond sensors
  
- **FE Electronics and Data Acquisition System for the calorimeters**

# Networking Activities



**Very important part of the project!**

- **Information exchange and intensified collaboration:**
  - web based information system
  - annual workshops (open to everyone)
  
- **Common simulation and analysis framework:**
  - development of common software framework (testbeam analysis & ILC simulation)
  - small grid based computer cluster
  
- **Validation of simulation:**
  - e.g. Geant4 shower simulation
  
- **Deep submicron radiation-tolerant electronics:**
  - access through CERN contracts

# Transnational Access



- imposed by the EU to open trans-European access to research facilities
- not really necessary in High Energy Physics

However, we could take advantage of it:

- some travel support for European groups
  - using the DESY testbeam (as of 2006)
  - using the EUDET infrastructures (as of 2008):
    - beam telescope
    - TPC
    - Si TPC
    - Si tracking
    - calorimeter
- Note: some I3s in FP6 spend up to 60% of the EU contribution on TA

- EUDET needs to make advertisement for it

**EUDET** Detector R&D towards the International Linear Collider

### Transnational Access to Detector R&D Infrastructures

EUDET is a project supported by the European Union in the Sixth Framework Programme (FP6) structuring the European Research Area. This project aims at creating a coordinated European effort towards research and development for the next generation of large-scale particle detectors. EUDET comprises 23 European partner institutes and 24 associated institutes working in the field of High Energy Physics.

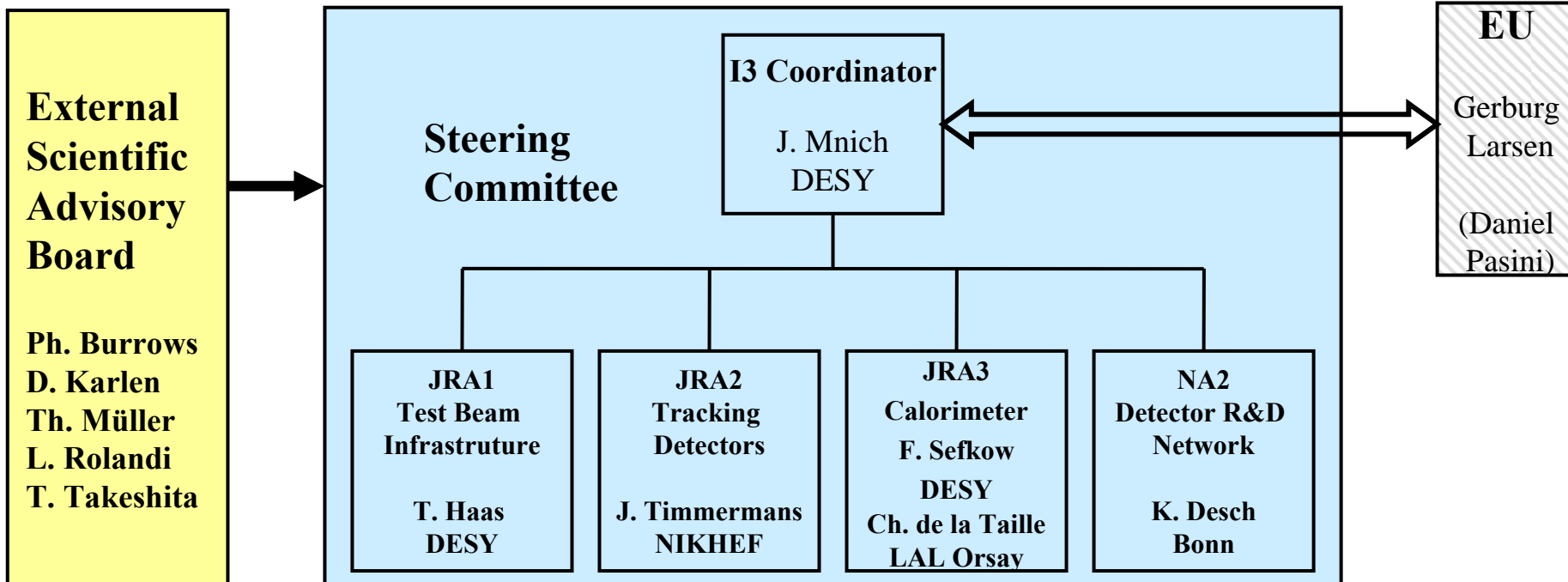
EUDET provides in the framework of the Transnational Access scheme travel support for groups from the EU and countries associated to FP6 using the following infrastructures:

TA1: Experiments at DESY testbeam (<http://testbeam.desy.de>)  
TA2: Experiment using infrastructure developed in the EUDET project: high precision beam telescope; large, low mass TPC field cage; silicon based TPC readout system; infrastructure for development of SI-Stripdetectors; infrastructures for development of granular calorimeters.

**TO APPLY FOR EC FUNDED ACCESS**

visit our web site <http://www.eudet.org> to get more information about the modalities of application.

# EUDET Management (NA1)



European members form  
Selection Board for TA

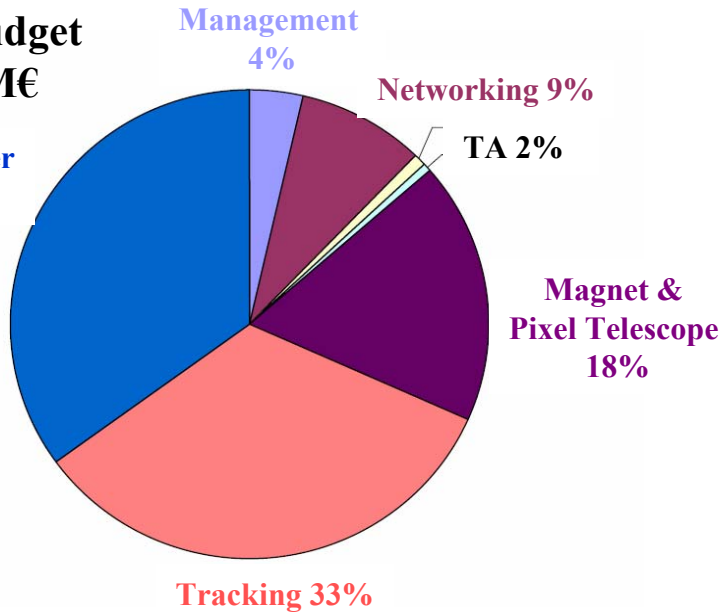
- Institution Board with 1 representative of each partner
- Regular meetings of Steering Committee
- Appointment of task leaders for the various work packages
- Annual EUDET meetings and workshops

# EUDET Budget and Time Profile

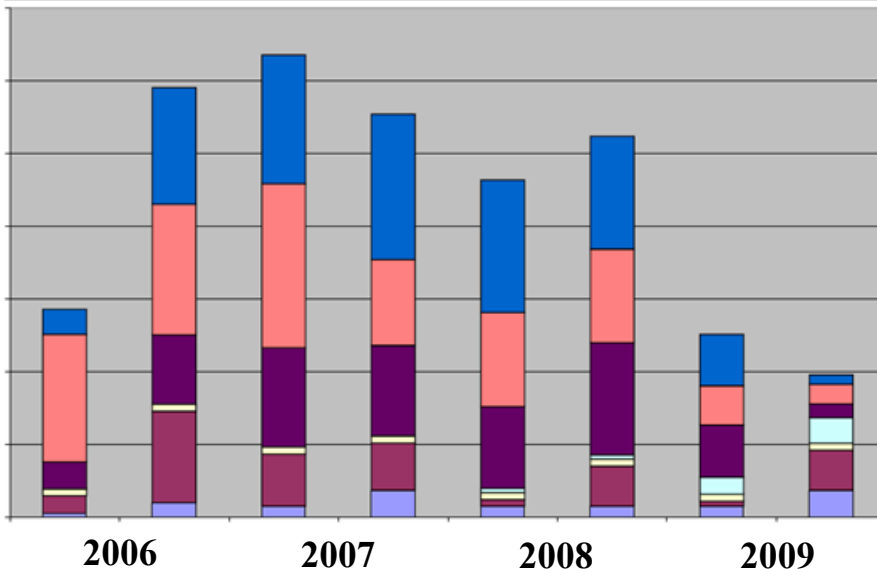


Total budget  
21.5 M€

Calorimeter  
33%



- most of the resources for the development of the infrastructures



- ramp-up first half 2006
- full swing activities for 2.5 years
- last year: phase-out and exploitation of infrastructures

# EUDET in the ILC Framework



**Tried to fully incorporate in the ILC detector R&D**

- **make optimal use of EUDET resources on international scale**
- **avoid unnecessary duplication**

**Special attention:**

- **EUDET is a contract between the partner institutes and the EC with well defined milestones and deliverables, e.g. for 2006**

Activity	Deliverable Nr.	Deliverable title	Workpackage /Task Nr.	Lead Contractor(s)	Delivery date	Nature
JRA1	JRA1-D1	SDC prototype 1	C	CNRS-IReS	9	Prototype
NA1	NA1-D1	1 <sup>st</sup> Annual Report		DESY	12	Report
NA2	NA2-D1	Version 1.0 of electronic information system	C	TAU	12	Web page
NA2	NA2-D2	Proceedings of 1 <sup>st</sup> EUDET workshop	F	DESY	12	Report
JRA2	JRA2-D1	Preamplifier prototype	A	CERN,ULUND, UROS	12	Hardware
JRA2	JRA2-D2	TimePix chip	B	CERN,FOM/NI KHEF	12	Prototype
JRA3	JRA3-D1	Conceptual report	A,B,C,D,E	DESY,CNRS-LAL	12	Report
JRA3	JRA3-D2	DHCAL ASIC	E	CNRS-LAL	12	Prototype

- **Need for some independent structures managements, meetings, ...**
- **Somewhat reduced flexibility**



# More on Duties and Obligations



## The way to and the obligations of an I3:

- **Before project start:**
  - **proposal: sharp deadline**
  - **annex 1 to contract: detailed work description with milestones & deliverables, negotiations with Brussels**
  - **consortium agreement: legal document**
  - **other paper work**
- **During project:**
  - **organisation of annual meetings**
  - **submission of annual reports including detailed financial report (checked to Euro cent!) and audit certificates from all partners**
  - **concept of depreciation**
  - **mid-term review**
  - **produce scientific papers, notes, reports and talks**

**Details may differ in FP7, full information available in November**

- **EU money is hard-earned money!**  
**needs good organisation and lots of administration**

# Role of EUDET for ILC Detector R&D



## My personal view!

- Provides some additional resources for ILC detector R&D in Europe but EU money is limited and financial profit per institut is modest
- More important: structuring!
  - EUDET was and still is crucial for entering new phase in ILC detector R&D
  - joining forces to prepare design and tests of larger prototypes
  - stimulated cross-technology collaboration
- Could be instrumental in raising additional national funds
- EUDET provides resources to and takes responsibilities in the collaboration which had to be carefully synchronised with the other collaborators e.g. with ILC collaborations as CALICE, FCAL, SILC, LCTPC
- EUDET required well defined program framework set by funding agency (European Union)