Activities at IFAE / U.A.Barcelona

IFAE (Institut de Física d'Altes Energies)

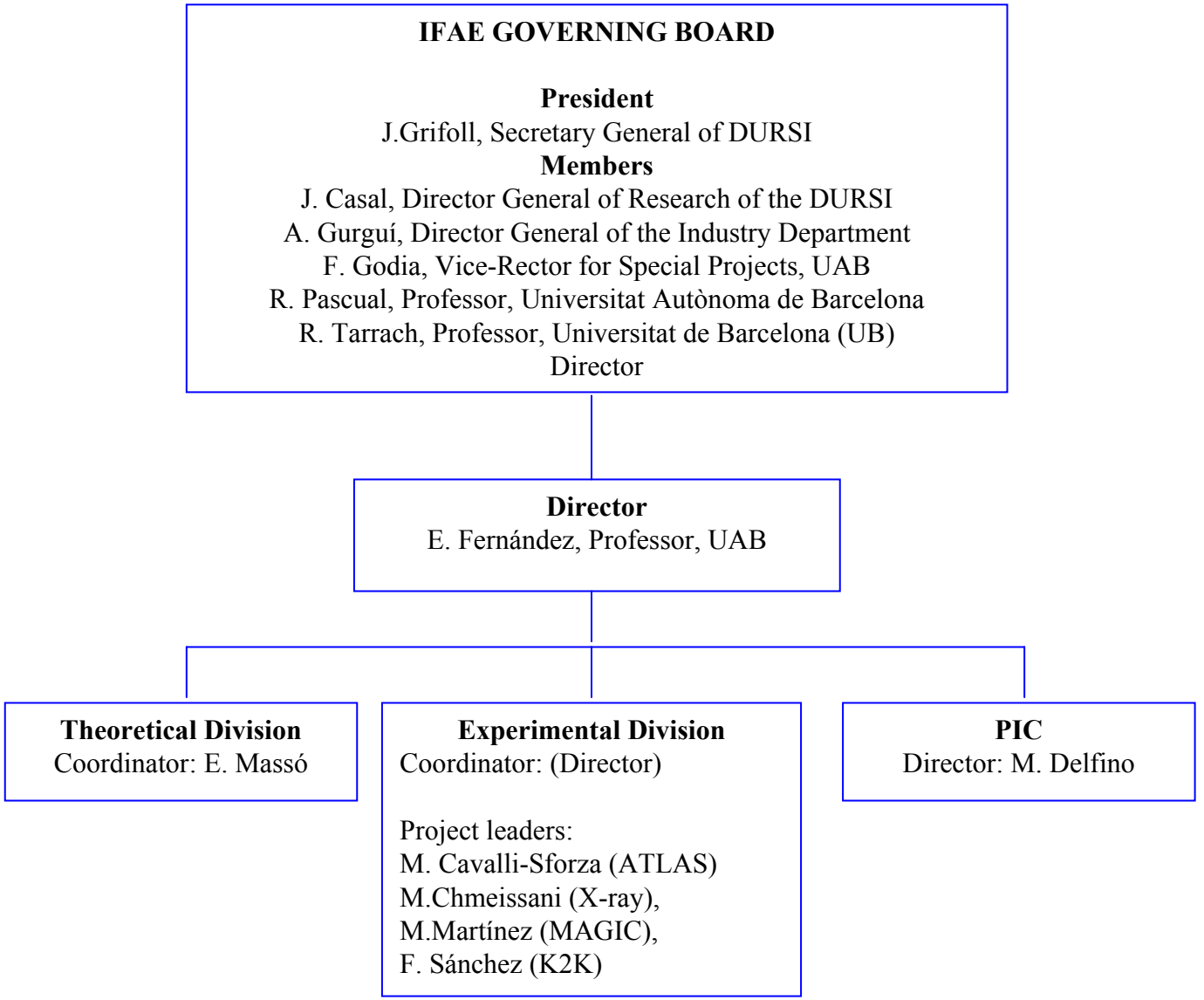
- The IFAE is a Consortium between the Autonomous University of Barcelona (UAB) and the Department of Universities, Research and Information Society (DURSI) of the Government of Catalonia.

- The IFAE is an institution with its own "juridical personality".

- It can ask for, and manage, projects from regional, national and EU sources, and can hire its own personnel directly. This provides a lot of flexibility in the operations (and also some problems).

- The IFAE is also a "University Institute" of UAB.

IFAE Structure



IFAE Personnel:

- Permanent staff: hired directly by the Institute from its own funds.
- Project Personnel: hired by IFAE from project funds.
- Associated Personnel: persons from UAB, DURSI, or Univ. of Barcelona (UB), after asking explicitly for association to the Governing Board and after having been accepted.
- Graduate students: from Universities or from IFAE.

All the permanent staff (scientist and engineers) belong to the Experimental Division.

Funding.

There are basically three sources of funding:

Yearly grant from DURSI: essentially covers the salaries of the permanent staff. We are now in the process of going to 4-year funding periods.

Overheads from projects.

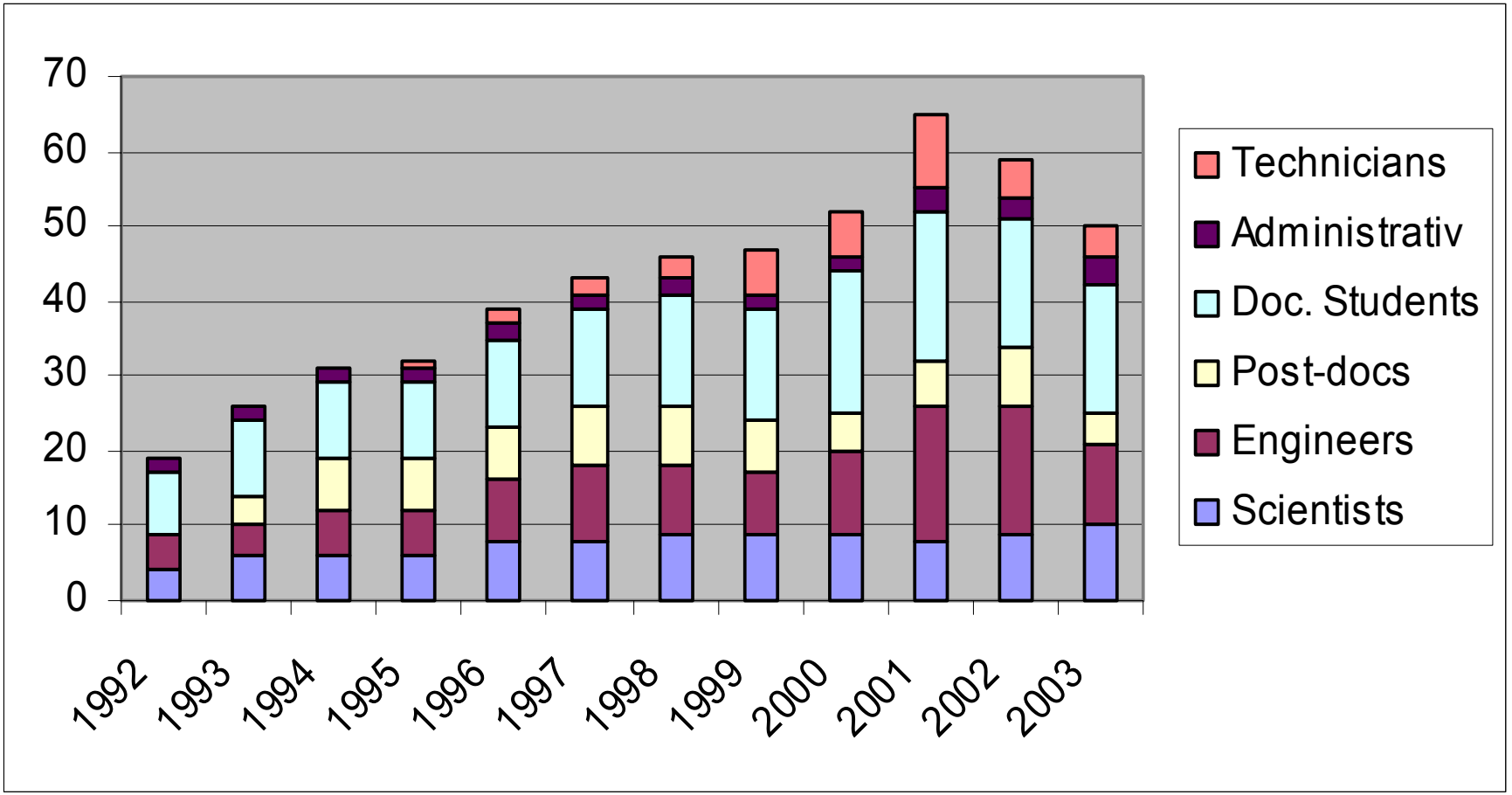
Project funds from several sources: local, national (CICYT), EU.

"In-kind" operating funds from UAB.

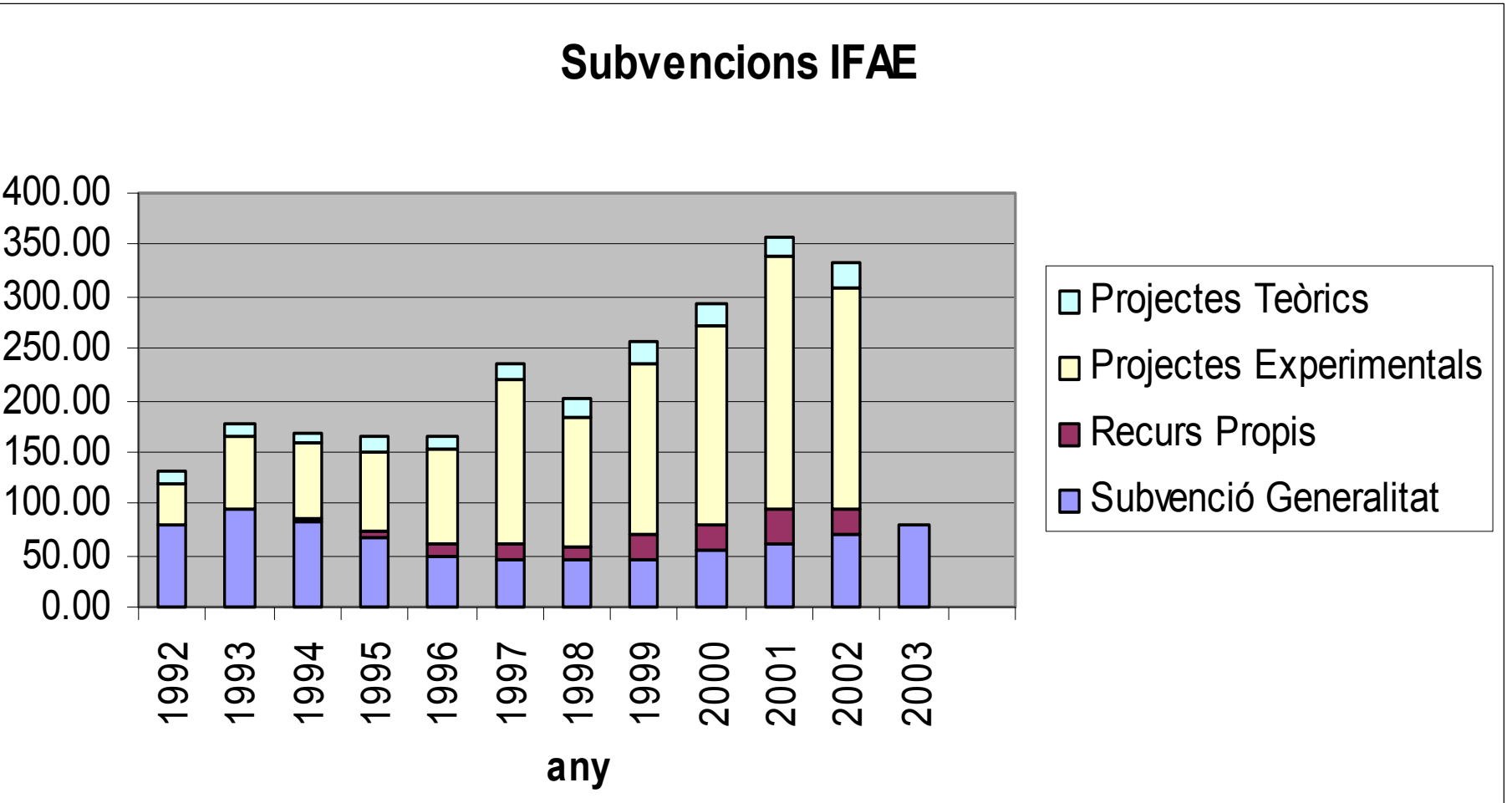
IFAE Experimental Division	IFAE	UAB	TOTAL
Scientists	5	3	8
Ramon y Cajal	1	1	2
Engineers	2		2
Software engineers	1		1
Administrative	1	1	2
Technicians	2		2
TOTAL Permanent Staff	12	5	17
Post-Docs	4		4
Aministrative (projects)	2		2
Engineers (projects)	3		3
Doctoral Students	10	7	17
Software engineers (projects)	5		5
Technicians (projects)	2		2
TOTAL	38	12	**50**

IFAE Experimental Division	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Scientists	4	6	6	6	8	8	9	9	9	8	8	8
Ramon y Cajal											1	2
Total Scientists	4	6	6	6	8	8	9	9	9	8	9	10
Engineers (staff)			1	2	2	2	2	2	2	2	2	2
Software engineers (staff)	1	1	1	1	1	1	1	1	1	1	1	1
Engineers (projects)			1	1	3	5	5	4	6	9	7	3
Software engineers (projects)	4	3	3	2	2	2	1	1	2	6	7	5
Total Engineers	5	4	6	6	8	10	9	8	11	18	17	11
Post-Docs		4	7	7	7	8	8	7	5	6	8	4
Doctoral Students	8	10	10	10	12	13	15	15	19	20	17	17
Administrative (staff)	2	2	2	2	2	2	2	2	2	2	2	2
Aministrative (projects)										1	1	2
Total Administrative	2	2	2	2	2	2	2	2	2	3	3	4
Technicians (staff)								2	2	2	2	2
Technicians (projects)				1	2	2	3	4	4	8	3	2
Total Technicians				1	2	2	3	6	6	10	5	4
Total Personnel	19	26	31	32	39	43	46	47	52	65	59	50

Personnel of the IFAE Experimental Division



IFAE Funding (Mptas) 1€ = 166 Ptas



IFAE Scientific Program

ATLAS (and, most likely, CDF)

M.Cavalli-Sforza, M.Bosman, Mario Martinez-Perez, J.M.Crespo, Ll.Miralles
G. Blanchot, A. Pacheco, G. Merino, I. Korolkov, K.Karr , M.Dosil, O.Noriella,
C. Iglesias, X.Portell, O.Saltó, E.Segura, C. Deluca, J.Ferrer

MAGIC (and, most likely, ECO)

M. Martínez, J. Cortina, E.Fernandez, G.Blanchot, Ll.Miralles, J.Flix,
E.Domingo, M.Gaug, O.Blanch, J.Lopez,T. Schweizer, J.Ferrer,Ll.Jane

K2K (and, most likely, JHF-nu)

F. Sánchez, E.Fernandez, E.Aliu, X. Espinal, A. Rodríguez

Digital x-ray radiography (Medipix + DearMama)

M Chmeissani, Georges Blanchot C. Puigdengoles, M. Maiorino, G. Pellegrini, S. Rodriguez,
[E.Fernandez,E.Bartolome, X. Espinal, J. Garcia, Y. Yañez, E.J. Buis, M.A. Cruz]

ATLAS (what is that?)

ATLAS at IFAE

1. Hadron calorimeter (TileCal)

   - Since 1993, IFAE among starters, early designers
   - R&D, prototypes, prepare series production : ’93-’98
   - Assembly, tests of 64 modules (1 of 3 barrels): ’98-’02

2. TDAQ (Event Filter)

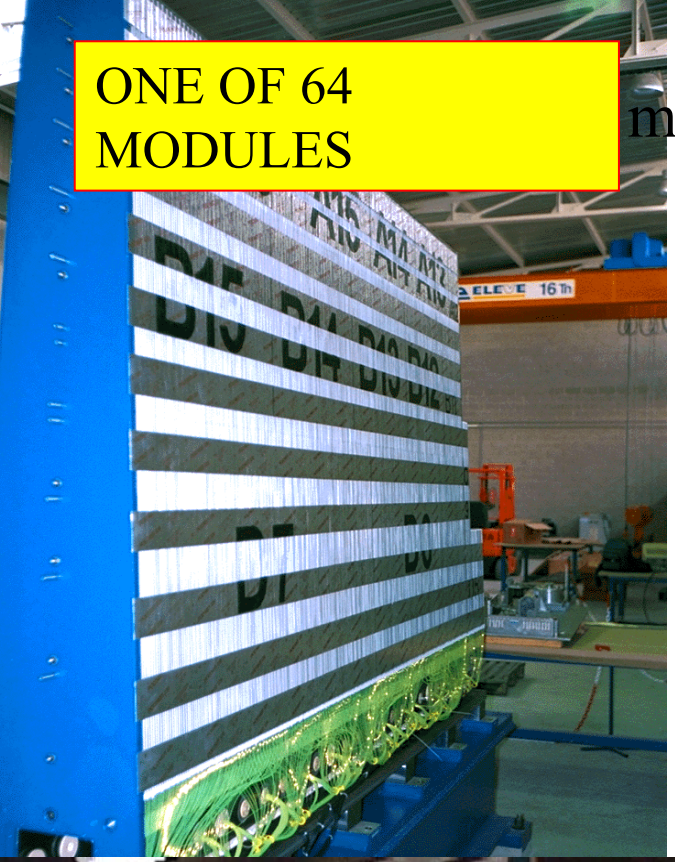
   - Since 1999
   - On-line full event reconstruction, highest level filter
   - good introduction to physics analysis

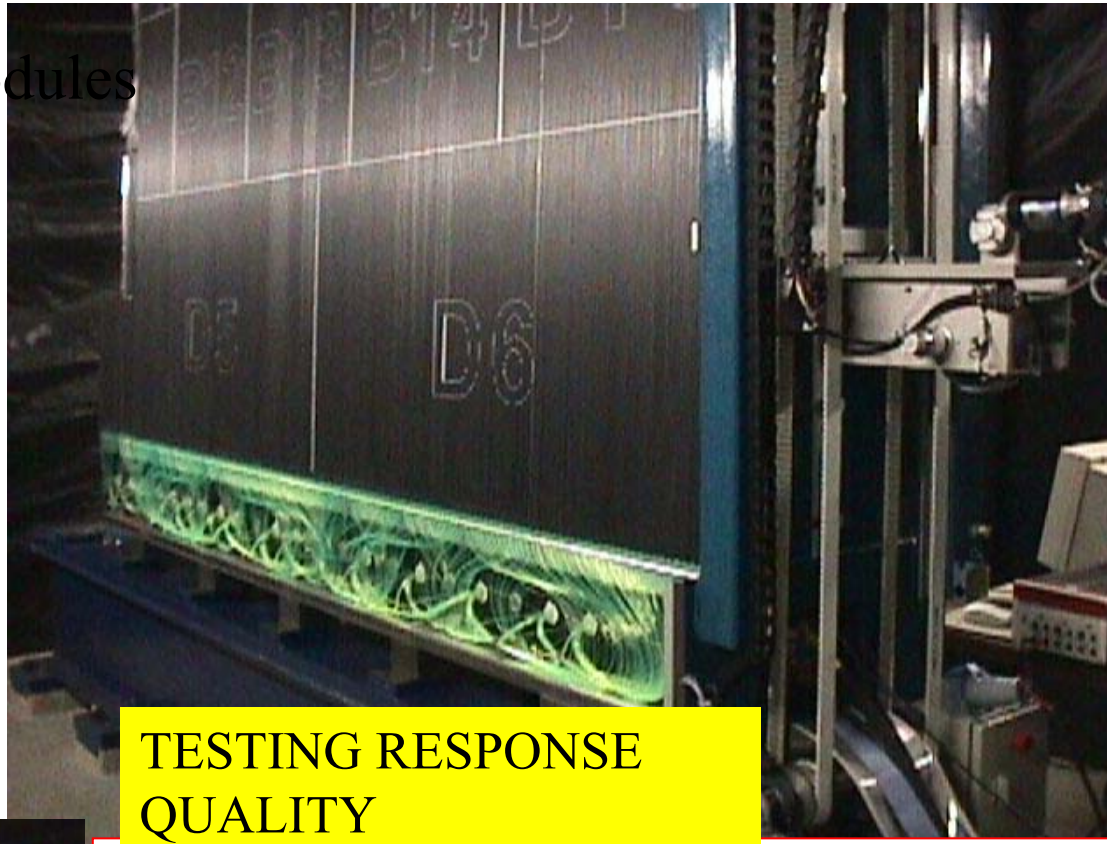
3. Analyses/Physics/software/computing:

   - test beam data, hadron shower simulations, calorimeter performance studies, Jet/Etmiss algorithms, new software coordination, SUSY Higgs searches, prepare for GRID…

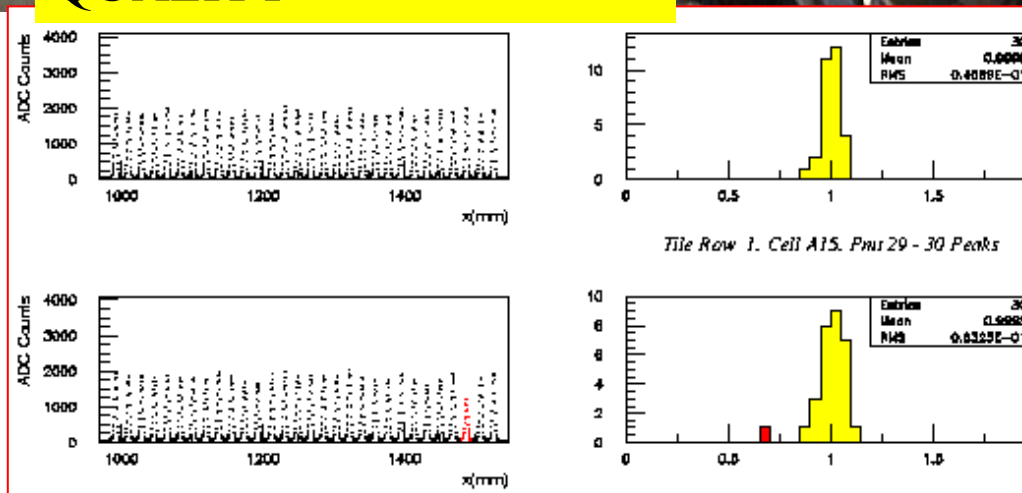
ONE OF 64 MODULES

modules



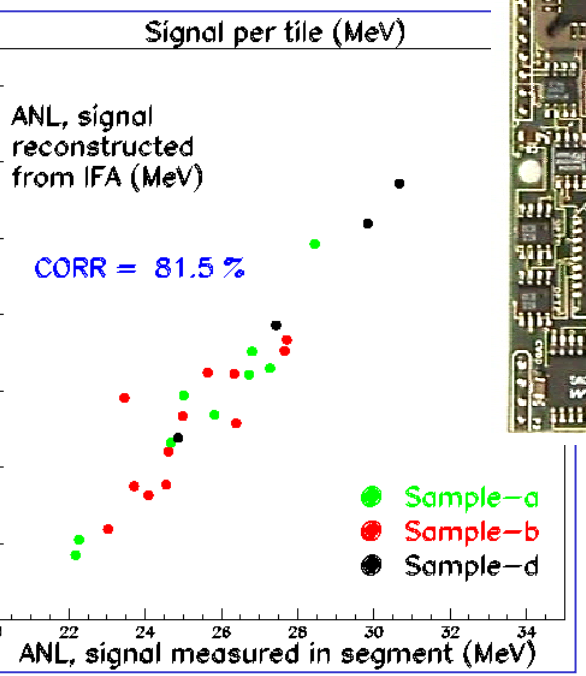


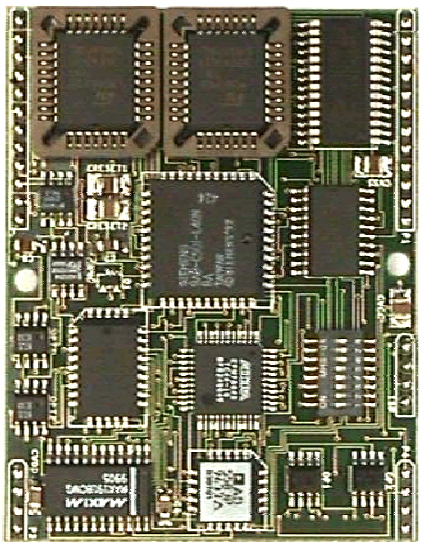
TESTING RESPONSE QUALITY



TILECAL CALIBRATION ELECTRONICS

- For source, Min.Bias current monitoring
- Stability, transport of energy scale
- Demonstrated to 2% precision with muons





TILECAL TO 2007:

1. Min. Bias system development (IFAE specific)
2. Preassemble barrels (to mid 2004)
3. Install in cavern (to mid ’05)
4. Commission it (electronics, sources, etc… 2005-’06)
5. Make it work within ATLAS
6. Test beam, ‘03 + ’04

…it will keep us busy till 2007 + beyond

SURFACE PREASSEMBLY
OF EXT. BARREL C
(THE 64 MODULES BUILT AT IFAE)

TileCal Project engineer: L.Miralles

32 modules: 16 March '03

44 modules: 26 March '03

IFAE joined **Event Filter** in Sep 99

Motivation

Good preparation for physics analysis

•EF is in charge of trigger process and detector/physics monitoring

•EF has access to full detector info uses offline reconstruction framework (Athena) & algorithms

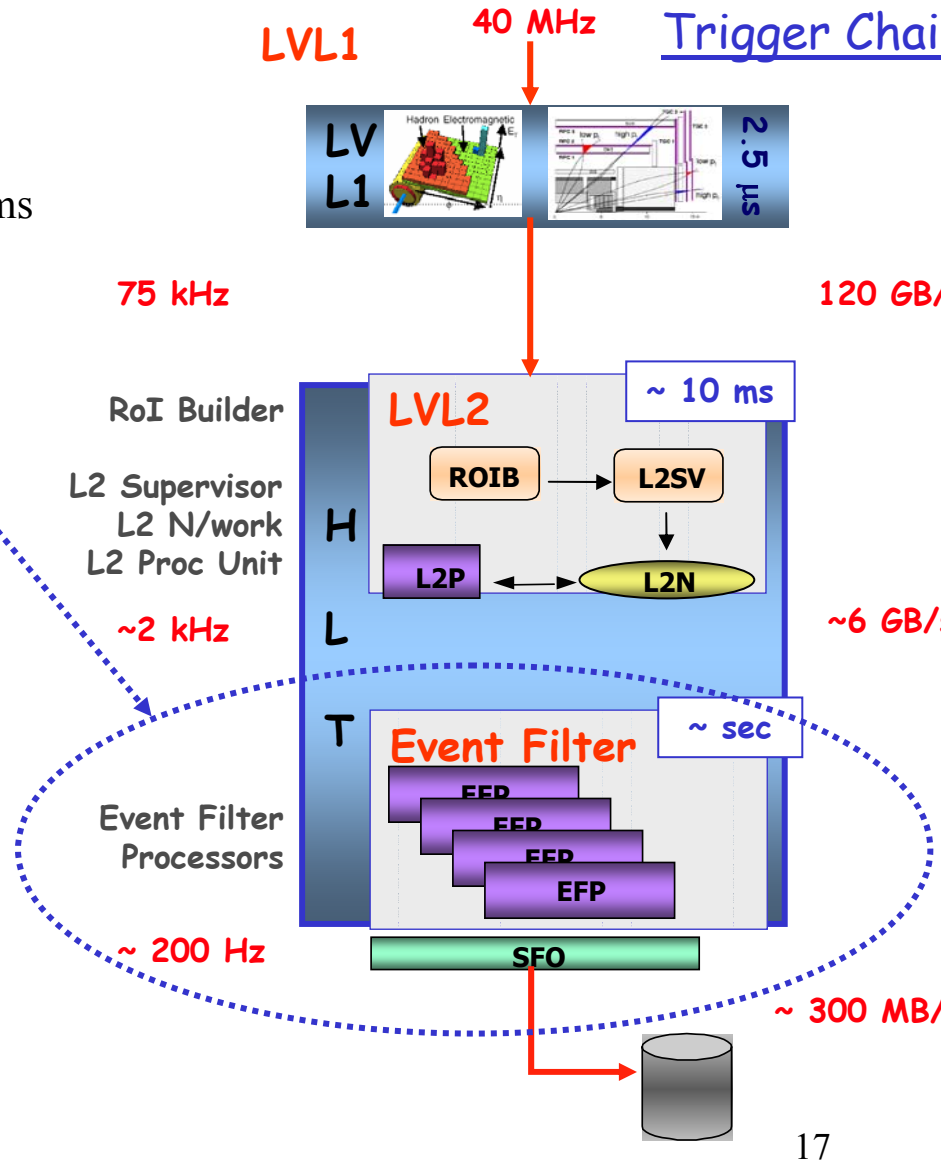
IFAE contribution to TDAQ

Motivation

IFAE joined **Event Filter** in Sep 99

Good preparation for physics analysis

- EF is in charge of trigger process and detector/physics monitoring
- EF has access to full detector info uses offline reconstruction framework (Athena) & algorithms



IFAE contribution to TDAQ

FAE joined **Event Filter** in Sep 99

Motivation

Good preparation for physics analysis

- EF is in charge of trigger process and detector/physics monitoring
- EF has access to full detector info uses offline reconstruction framework (Athena) & algorithms

FAE's Contribution so far

ware

- Event Filter Dataflow
- Develop all interfaces between Athena and EF, measure performances in HLT testbeds

ware

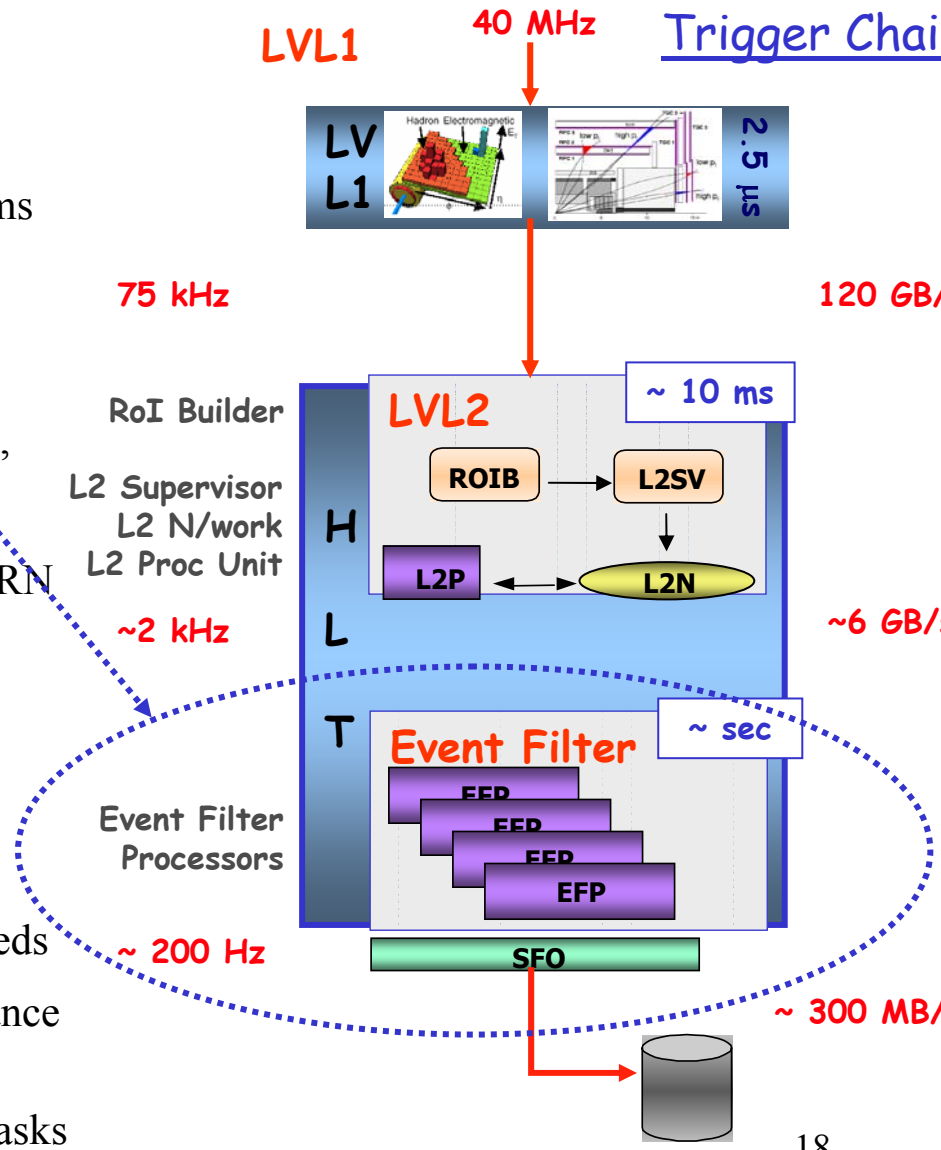
- 5 Dual Processors for TDAQ prototype at CERN
- Small local development testbed

power

- 1 fulltime PostDoc, 1-2 Students, Senior(MB)

rospects

- Validation of baseline EF architecture in testbeds
- Development of algorithm - physics performance evaluation
- Development of detector/physics monitoring tasks
- Integration of EF in Grid, use of Grid tools



IFAE contribution to Data Analysis, Simulation and LHC Physics

The mail lines of work at IFAE are:

- Analysis of testbeam data of Tilecal prototypes and final modules
  - study performance of calorimeter in design phase, collect information for calibration with final modules, study methods for signal definition, etc.
    - ⇨ Various NIM papers & ATLAS notes, contributions to Tilecal and Physics T.D.R., five Diploma Thesis
- Detailed MonteCarlo simulation of calorimeters
  - detailed simulation of calorimeter response with Geant3 and Geant4 used for design of detector and preparation for physics analysis
    - ⇨ A workshop, various ATLAS notes, contribution to T.D.R., three Diploma Thesis

IFAE contribution to Data Analysis, Simulation and LHC Physics

❑ Jet and Missing ET reconstruction

❖active contribution to the ATLAS working group in charge of Jet, Tau and missing ET: study of reconstruction algorithms, calibration strategies, global calorimetry performance, new code development, etc.

⇨ Various ATLAS notes, contributions to Calorimeter Performance and Physics T.D.R., participation in Physics Workshop

❑ LHC Physics studies

❖prepare for LHC physics: more emphasis will be given to this activity as the LHC start-up gets closer.

⇨ So far one Diploma Thesis on Heavy Higgs discovery potential and one PhD Thesis on Charged Higgs discovery and mass measurement

COLLABORATION-WIDE ACTIVITIES

Working groups/panels/task forces

Jets and ET(miss) study group (M.Bosman, Convener since 1994)

Radiation/Shielding task force (calculate/redesign ATLAS shielding, M.Bosman, Chair,'00-'03)

Forward physics and luminosity (M.Cavalli-Sforza, Chair, '00-'01)

Collaboration Matters:

Collab. Board Chair/Dep.Chair('97-'00, M.Cavalli), also involving membership of several committees RRB, Magnet Overview Board) and authorship, publication matters.

TileCal Inst. Board Chair, ('01-'03, M.Cavalli)

National Contact Physicist ('02-..., M.Cavalli)

National Computing Board (A.Pacheco, Spanish representative, 2000 onwards)

3. Spanish Common Projects:

- ATLAS barrel toroid cryostats and CMS cranes: industrial contacts,
liaison engineer: by Ll. Miralles.

STUDENT TRAINING

Policy has been that students do theses with running expts., when possible

- **11 Diploma Theses topics**

among former students, 1 CERNRes.Phys, 1 CERN LD Staff, 1 CERN Fell., 1 M.Curie Fellow, 1 FNAL Wilson Fellow.

- **2 PhD theses in preparation**
- **3 Engineering School projects**

ATLAS Toroid Vacuum Vessels

JOINING CDF AT FNAL

- **WHY:** to cover the "LHC Physics Gap"
  to train students with running experiment, real data
  to prepare for LHC physics
- **HOW**: New junior faculty ("Ramon y Cajal" contract) Mario Martínez will join IFAE, and will lead new initiative in CDF.
  In addition, 2-year postdoctoral position funded through EU RTN contract.
- This will form the nucleus of a small, FNAL based group, that would include students doing theses at FNAL, and part-time involvement of IFAE – based seniors(MB, MCS) and postdoc.
- **Contacts** with CDF management (mainly through M.Martínez) led to a proposal presented to CDF Executive Board (March 6) that appears to have been well received. Official answer in May.
- **WHAT:** We propose to develop a **Data Quality Monitor** :
  An on-line system, linked to CDF DAQ, to flag in real time problems – from trivial apparatus malfunctions to anomalies in physics-oriented plots – that threaten integrity of data and their use for physics analyses.

Data Quality Monitor
(Overview)

User Tools
WWW documentation

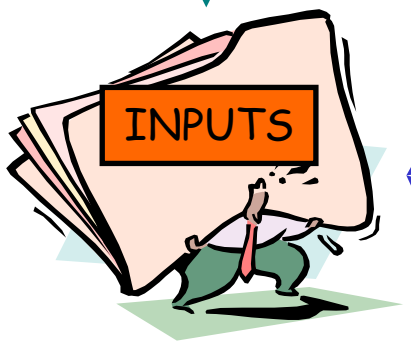
DataBase(s)

Detectors
(Calibrations &
Dead/Hot Channels)

Consumers
(Bits & Plots)

CDF/BO

DQM



INPUTS

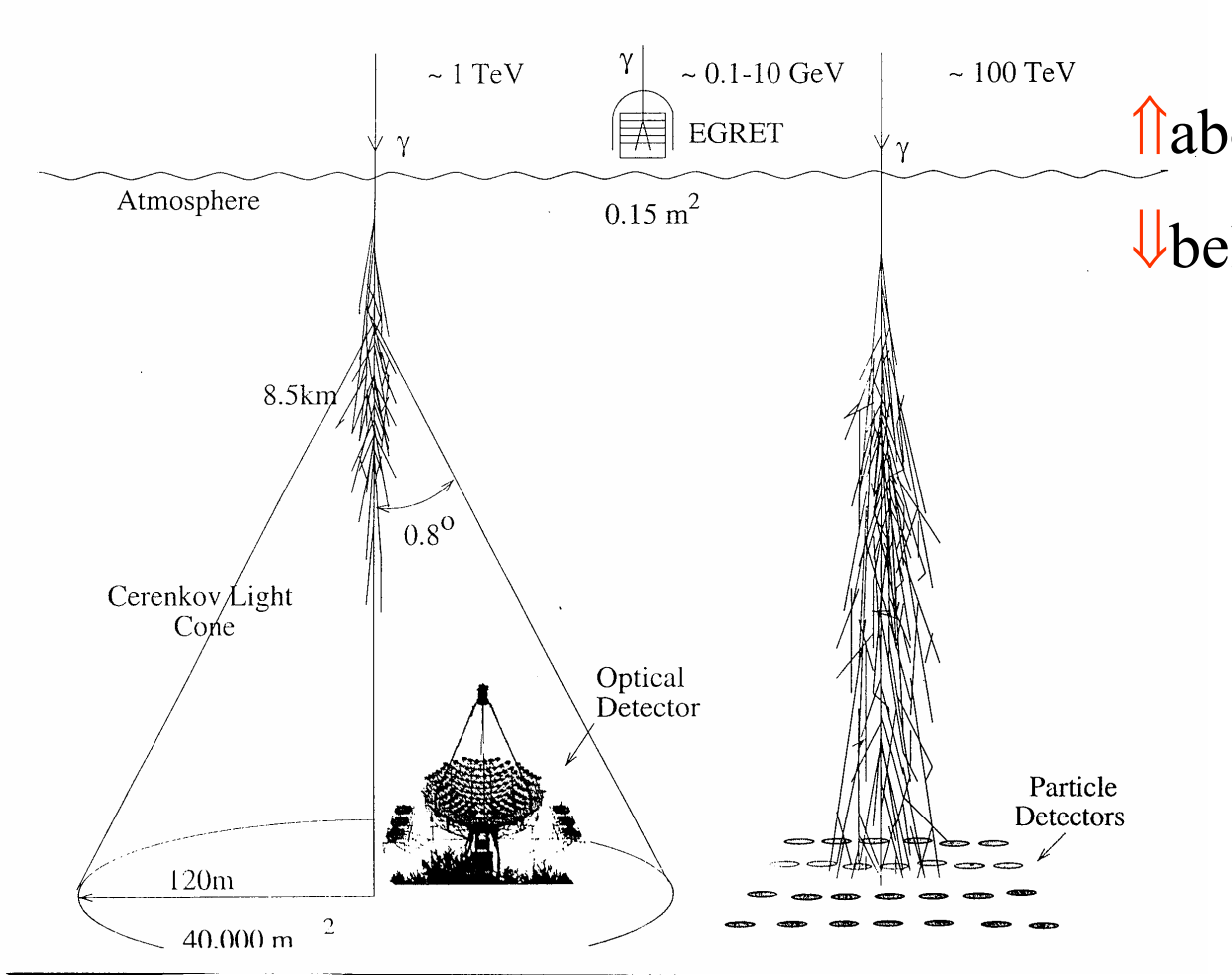
Iteration with
Detect./Phys. Groups

Phys. Validation
Analysis Modules

Physics Groups
(Distributions &
Cross Sections)

IFAE involvement in

MAGIC (Major Gamma Ray Imaging Cherenkov Telescope)

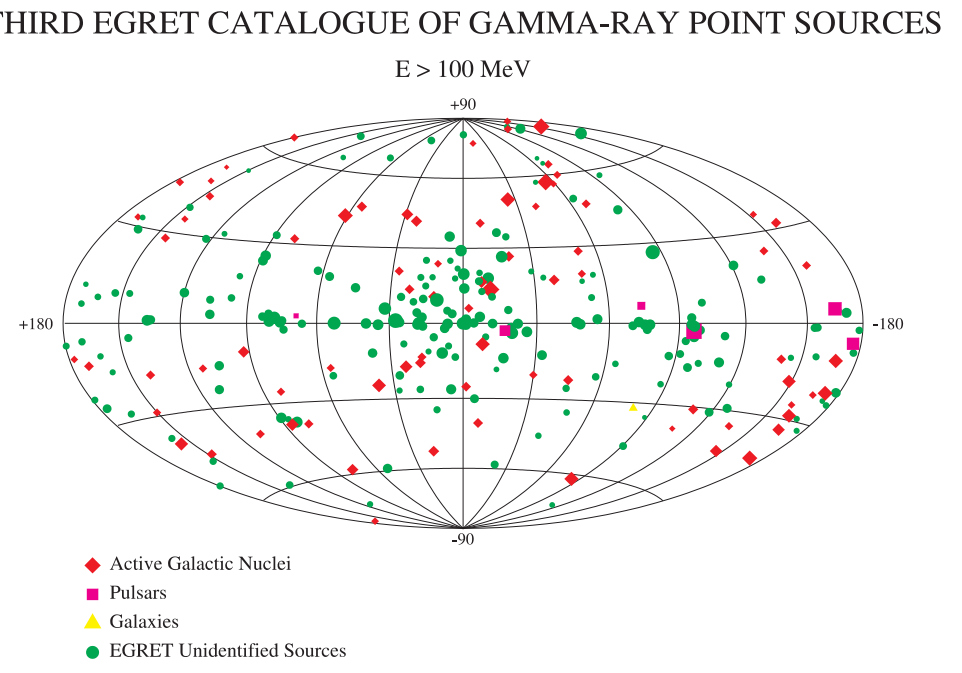


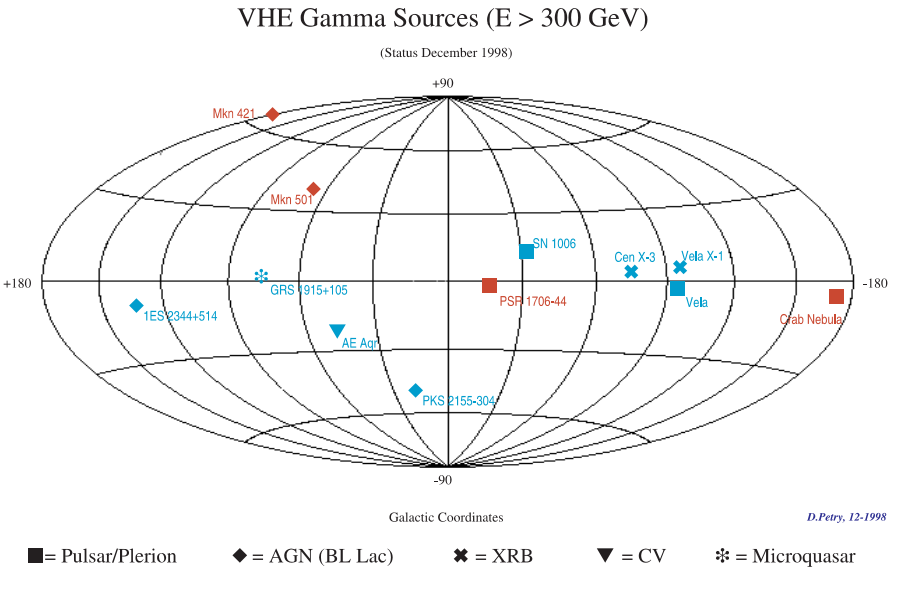
⇑above atmosphere

⇓below atmosphere

Around 270 sources have been detected by the EGRET detector on board of the CGRO. (60% are "unidentified", e.g. without an optical counterpart).

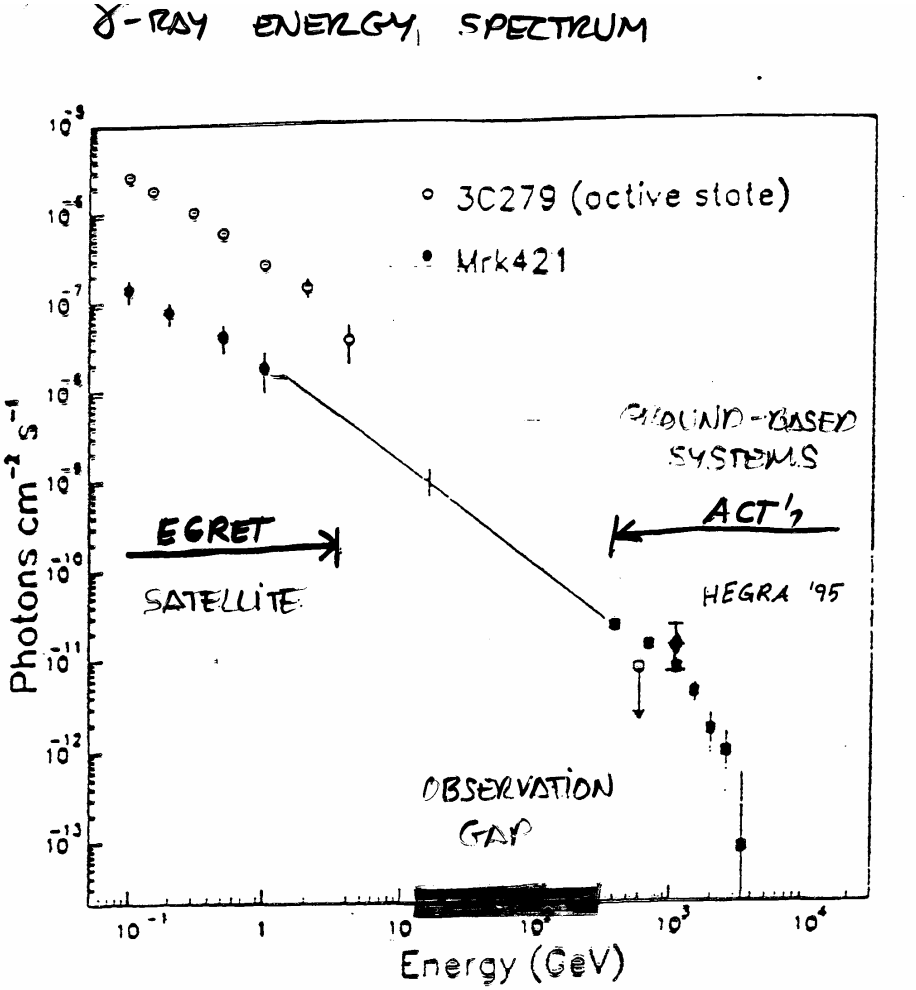
7 high-energy sources (> 300 GeV) have been seen by Cherenkov telescopes.





Window of opportunity: observational gap between 10 and 300 GeV

MAGIC aims at closing this gap. Many sources should emit in this energy range.



The MAGIC Collaboration

MPI Munich, Germany
IFAE Barcelona, Spain
INFN/U. Padua, Italy
U. Würzburg, Germany
UCM Madrid, Spain
U. Siegen, Germany
UAB Barcelona, Spain
Crimean Observatory, Ukraine
U.C. Davis, U.S.A.
Sternwarte Goettingen, Germany
U. Lodz, Poland
INR Moscow, Russia
U. Siena, Italy
U. Potshefstroom, South Africa
Tuorla Observatory, Finland
Yerevan Phys. Institute, Armenia

http://magic.mppmu.mpg.de/MAGICWeb/

A predecessor of MAGIC: the HEGRA detector

Technological Innovations

17 m diameter dish

Ultra light carbon fiber frame

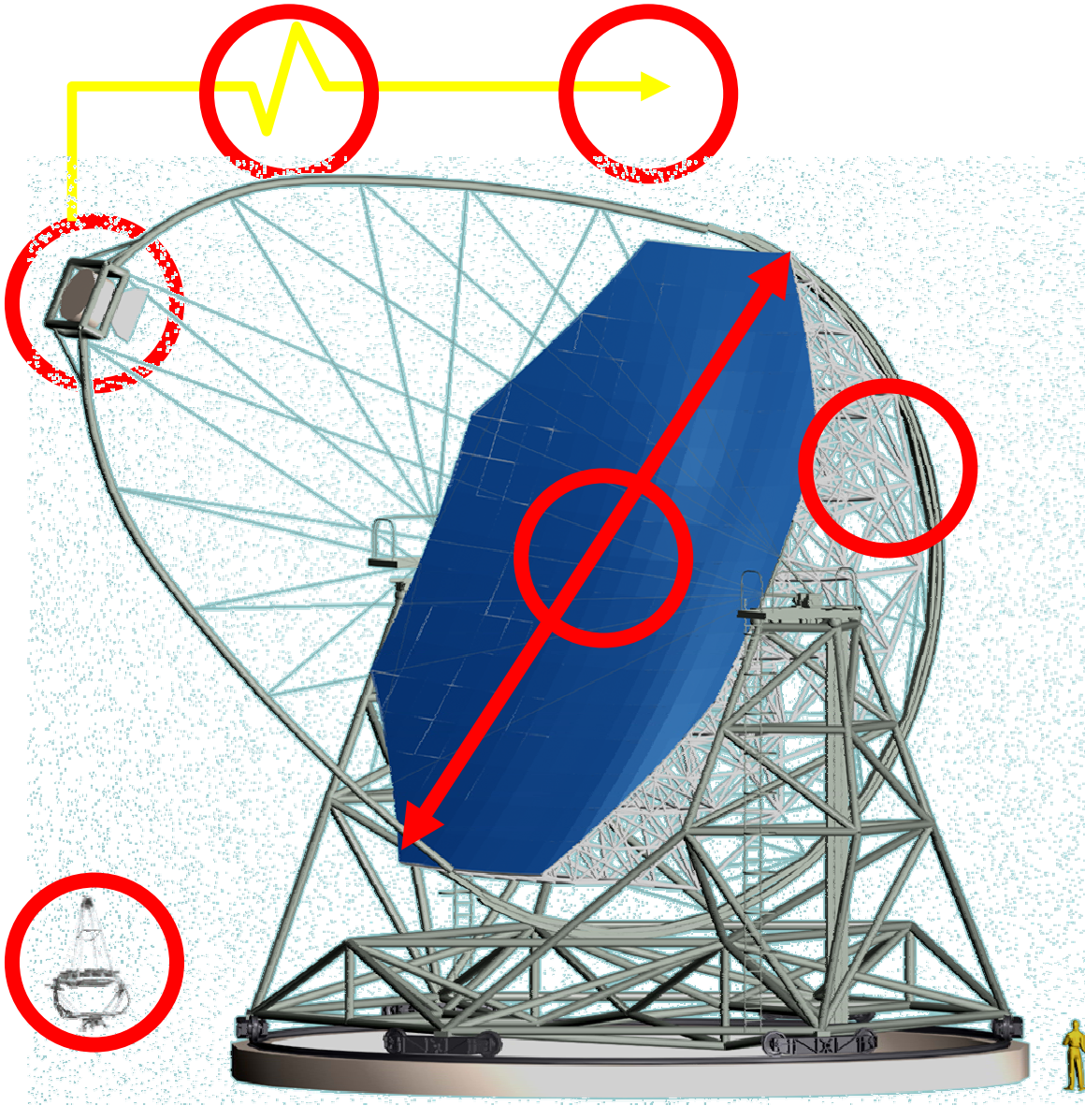
Active mirror control

577 pixels, 3.9 deg FOV camera

Optical signal transport

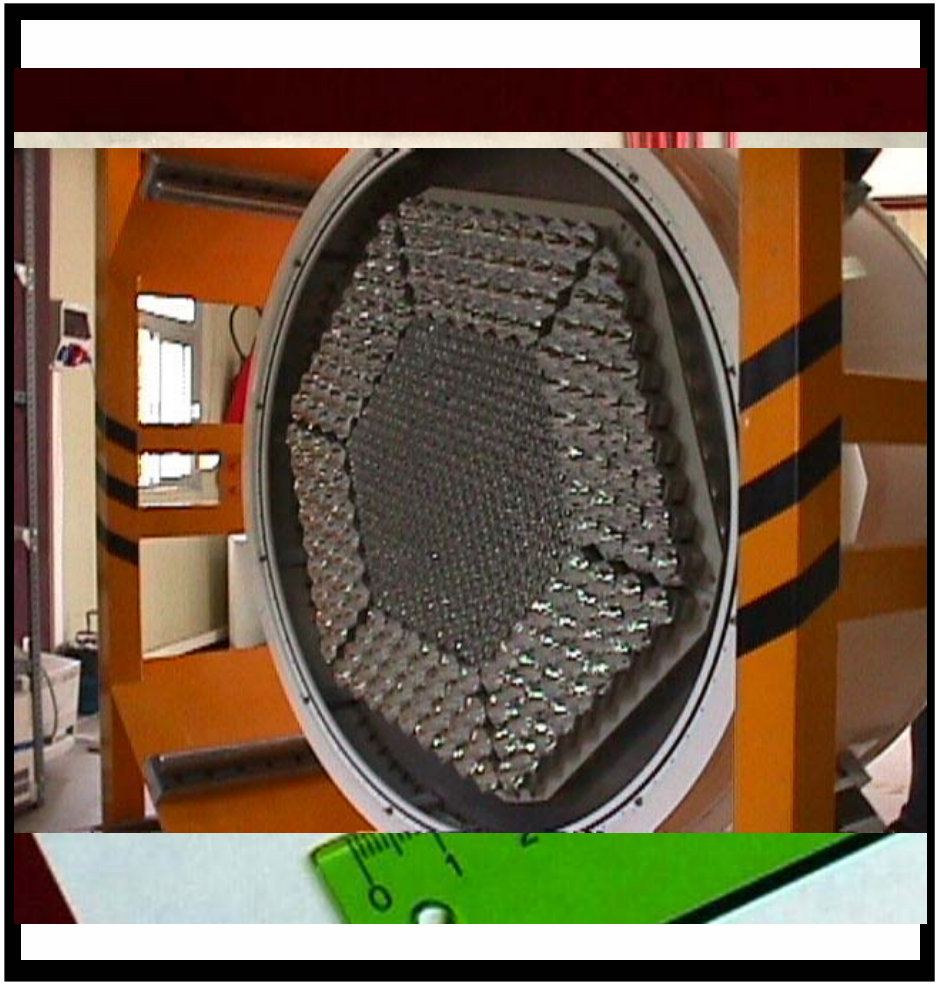
Fast pulse sampling: 300MHz-1GHz FADCs

LIDAR



The camera

- Matrix of 577 PMTs
- Two sections:
  - Inner part: 0.1^0 PMTs
  - Outer part: 0.2^0 PMTs
- Pixels
  - Bialkali PMTs, <QE>~26% (330-450 nm)
  - Modular Pixels.
- Plate of Wiston cones
  ⇒ Active camera area ~100%



The site, construction progress

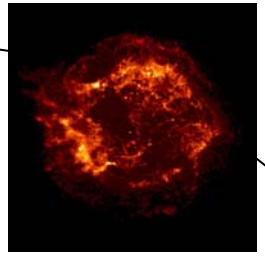
- Site contract signed in May 2000
- Construction started in Nov. 2001

The site, construction progress

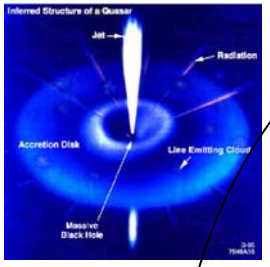
- Aug

THE PHYSICS GOALS

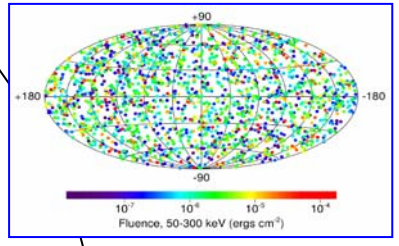
Pulsars



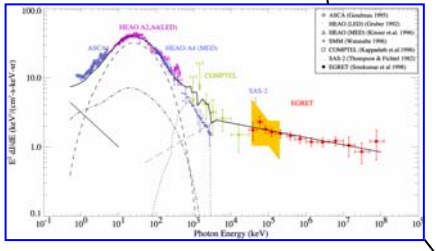
SNRs



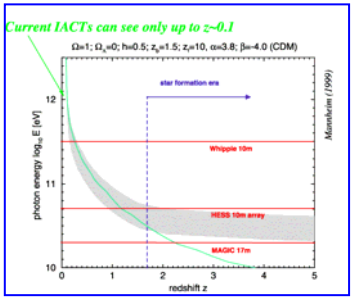
AGNs



GRBs



γ-ray Backg.



Cosmological γ-ray Horizon

Cold Dark Matter

Invariance of c

The cosmological γ-ray horizon

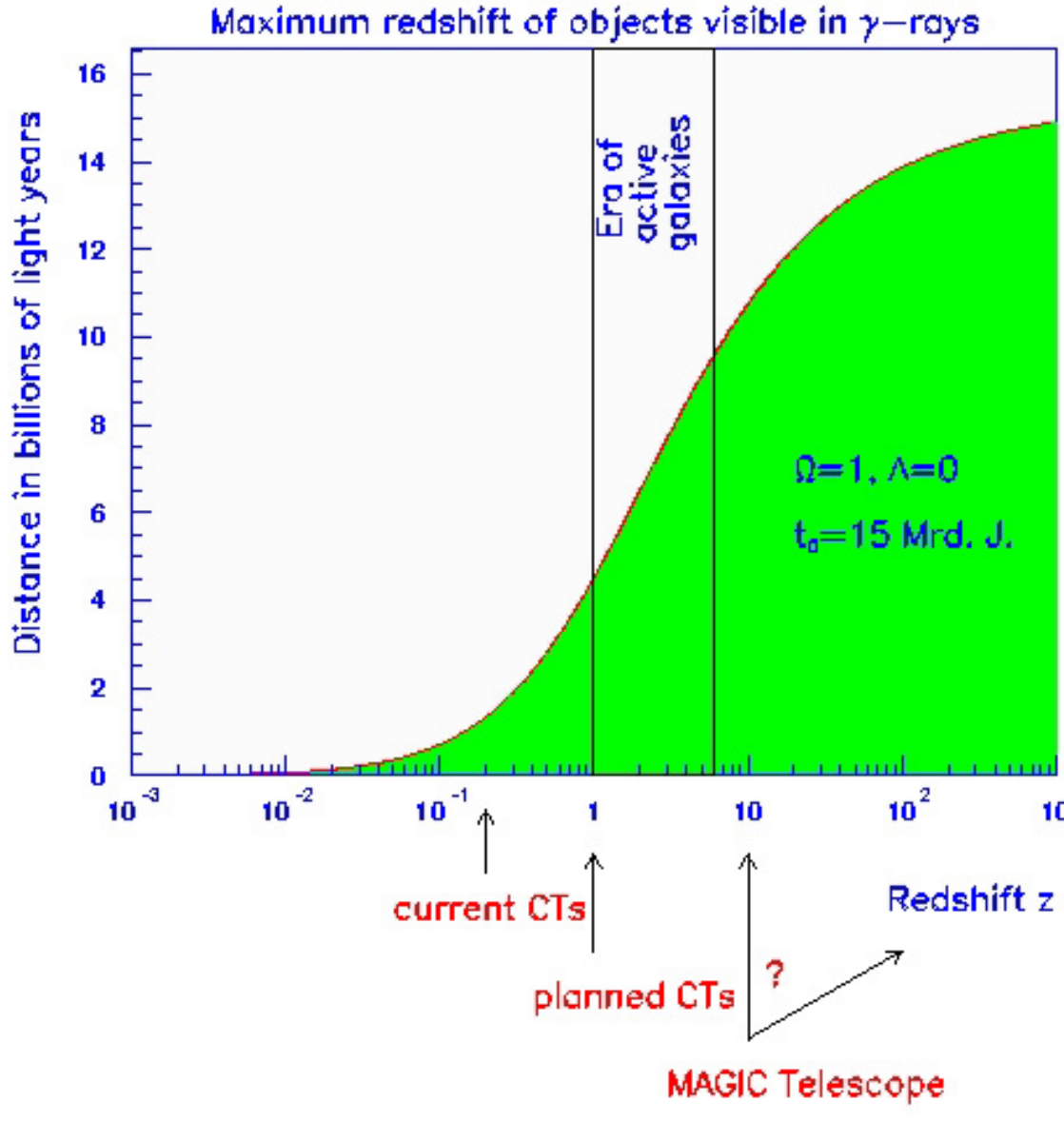
High energy γ-rays are absorbed in IR background.

$\gamma_{HE}\ \gamma_{IR} \rightarrow e^+ e^-$

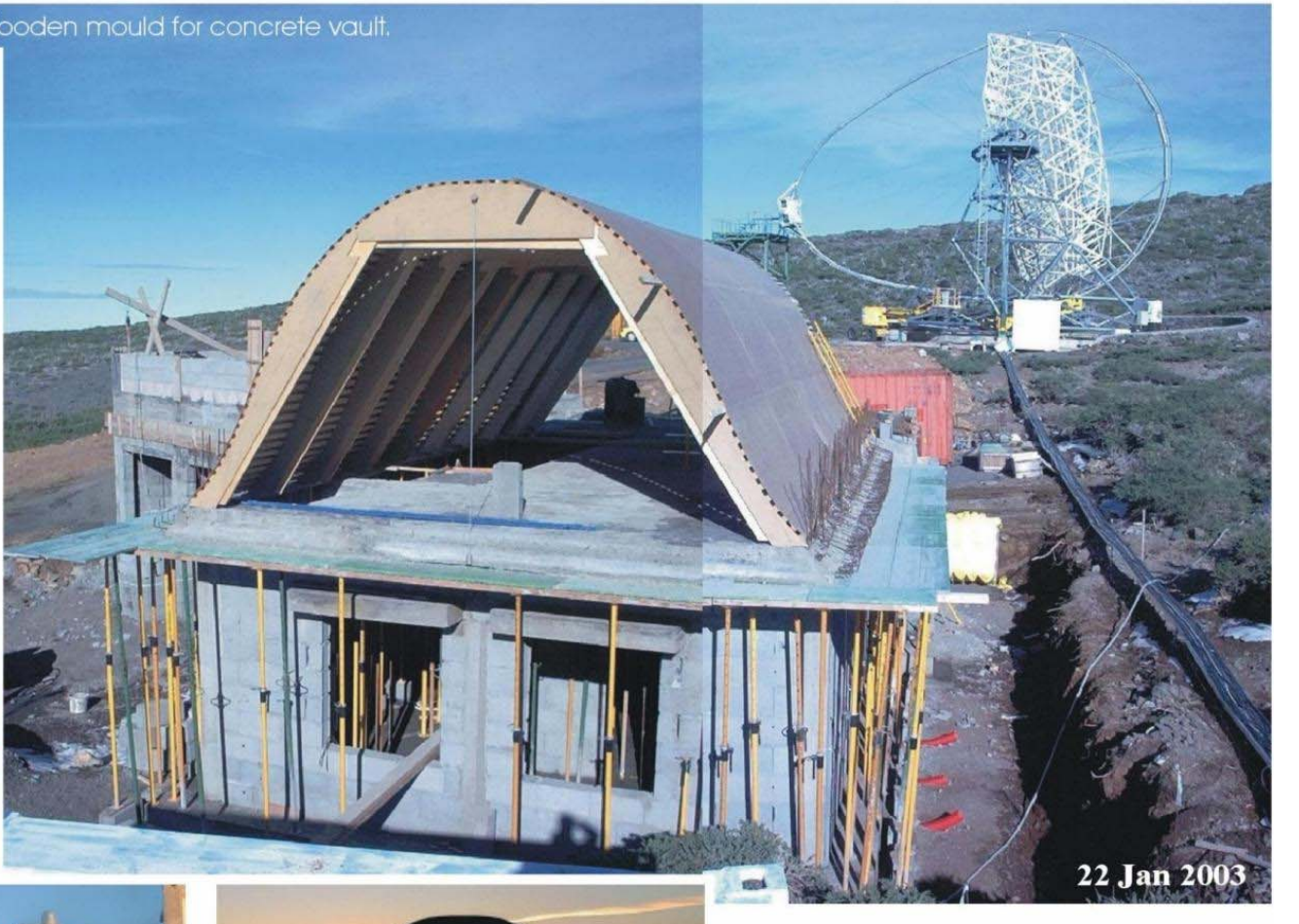
MAGIC will see the bulk of the cosmological AGNs

Many new AGNs could be discovered

They could be used for cosmological measurements



Wooden mould for concrete vault.



CONTROL HOUSE
MAGIC Telescope

Possible Evolution:

→ A cluster of MAGIC-like telescopes (basically 1 approved and "almost" funded)

→ An (even larger) MAGIC (1000m^2)?

The site at the Roque de los Muchachos is excellent and appropriate for either alternative. It should become the site of the

ECO (European Cherenkov Observatory)

IFAE Involvement in K2K

In nov. of 2002 several European groups joined the K2K collaboration in Japan:

Univ. of Geneva

Univ. of Rome (I)

Univ. of Valencia

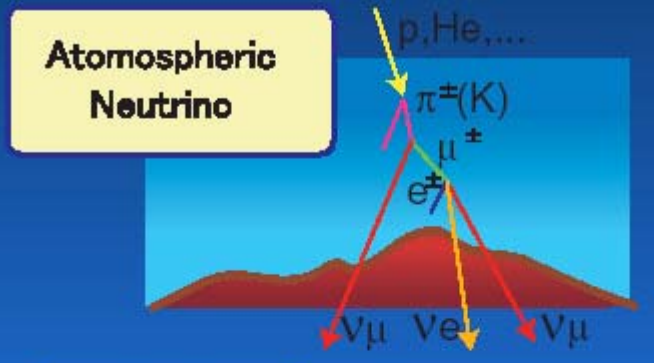
Saclay

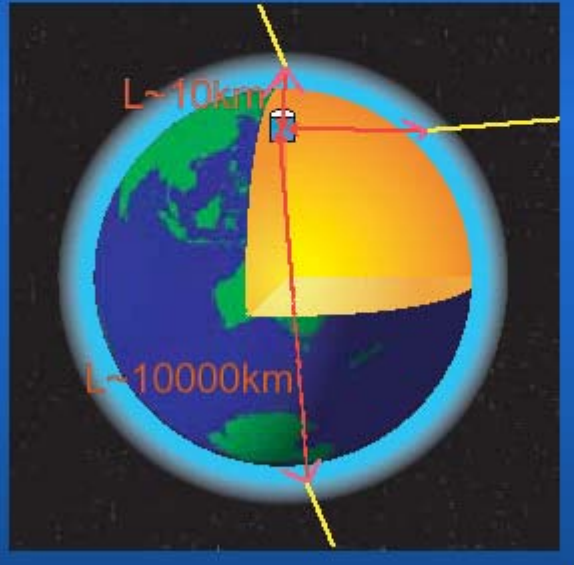
IFAE

We see this as a possible involvement in the JHF-Nu program, in which several groups (~15) from Europe are interested.

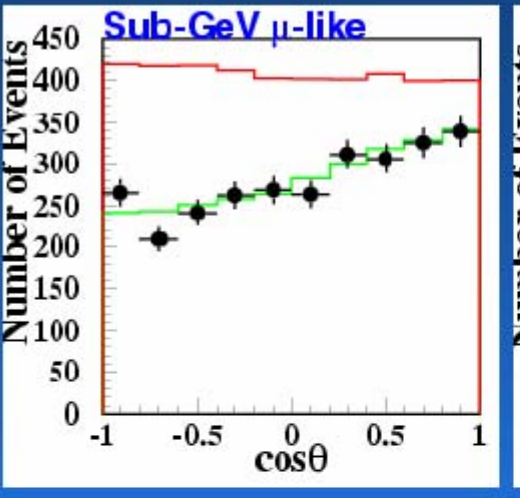
Atmospheric ν result from Super-K

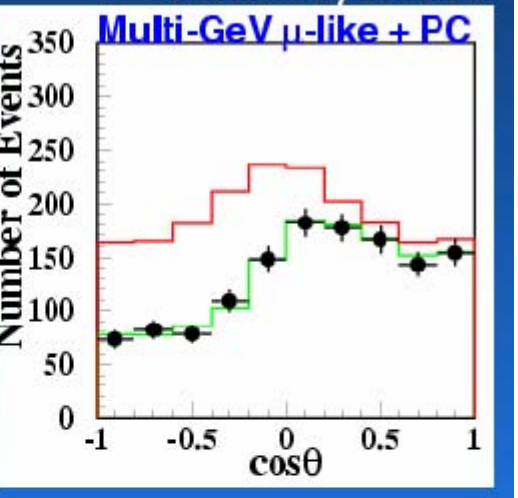
1289 days data





mainly depends on distance to travel; *L*





$$1.6\times10^{-3} < \Delta m^2 < 4\times10^{-3}\ [\mathrm{eV}^2]$$
$$\sin^2 2\theta > 0.88$$
with 90% C.L.

Best fit:

$$\chi^2_{\min} = 132.7/137\ \text{d.o.f.}\ \text{ at}$$
$$(\Delta m^2, \sin^2 2\theta) = (2.4\times10^{-3}\ \mathrm{eV}^2, 1.00)$$

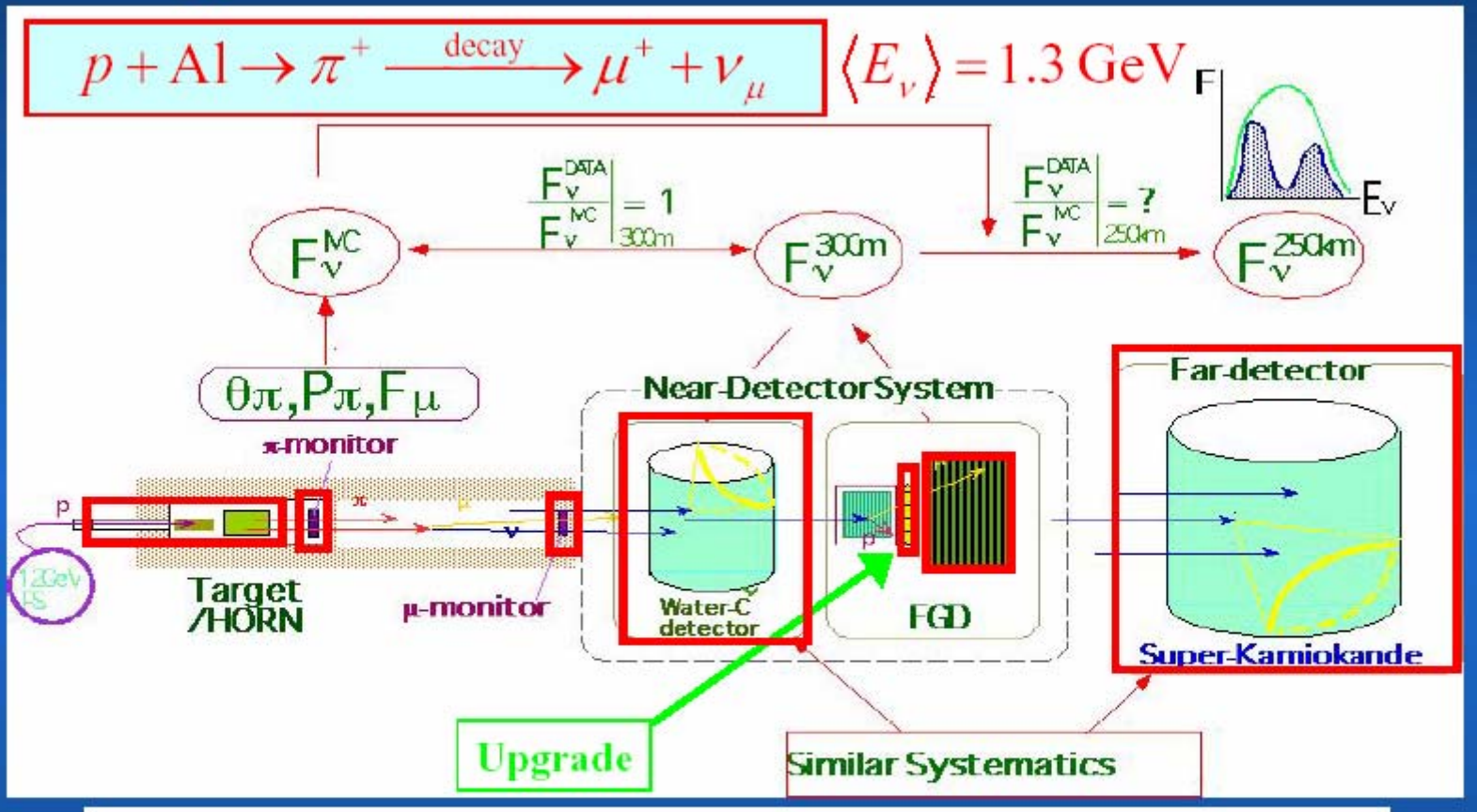
K2K experiment

Super-Kamiokande (Far Detector)
- 50 kt Water Cherenkov Detector

12GeV PS @ KEK
- ν Beam
- Beam Monitor
- Near Detector

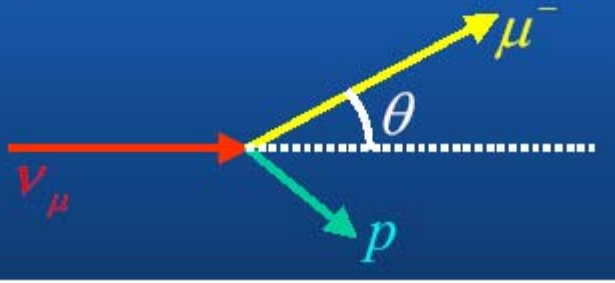
To conform the atm. ν result by E_ν spectrum distortion with the use of
- well-defined ν beam
- definite distance *L*
- Comparison of KEK/SK measurements

Strategy of K2K -K2K detectors-



CCQE int.: $\nu_\mu + n \rightarrow \mu^- + p$

$$E_\nu = \frac{m_N E_\mu - m_\mu^2/2}{m_N - E_\mu + p_\mu \cos\theta_\mu}$$



Data before SK accident:

# of events @ SK $\sin^2 2\theta = 1.0$

Event Category	Observed	Null Osci.	$\Delta m^2 = 3\times10^{-3}$ eV^2
1 ring μ-like	30	44.0±6.8	24.4
1 ring e-like	2	4.4±1.7	3.7
Multi ring	24	32.2±5.3	24.3
Total	56	$80.6^{+7.3}_{-8.0}$	52.4

The probability of null oscillation is only 3%

K2K has resumed data-taking in January 2000.

It will run for another 1 year (most likely 2 years).

Upgrade of FD -low E_ν spectrum & ν-int. study-

- K2K will install a brand new near detector **in summer 2003**

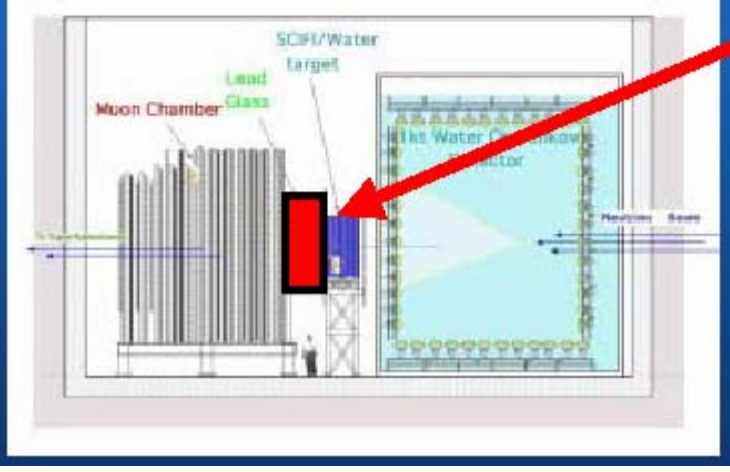
L=250km, $\Delta m^2 = 3 \cdot 10^{-3}$ $\cdots$ $E_\nu \sim$ 0.6GeV

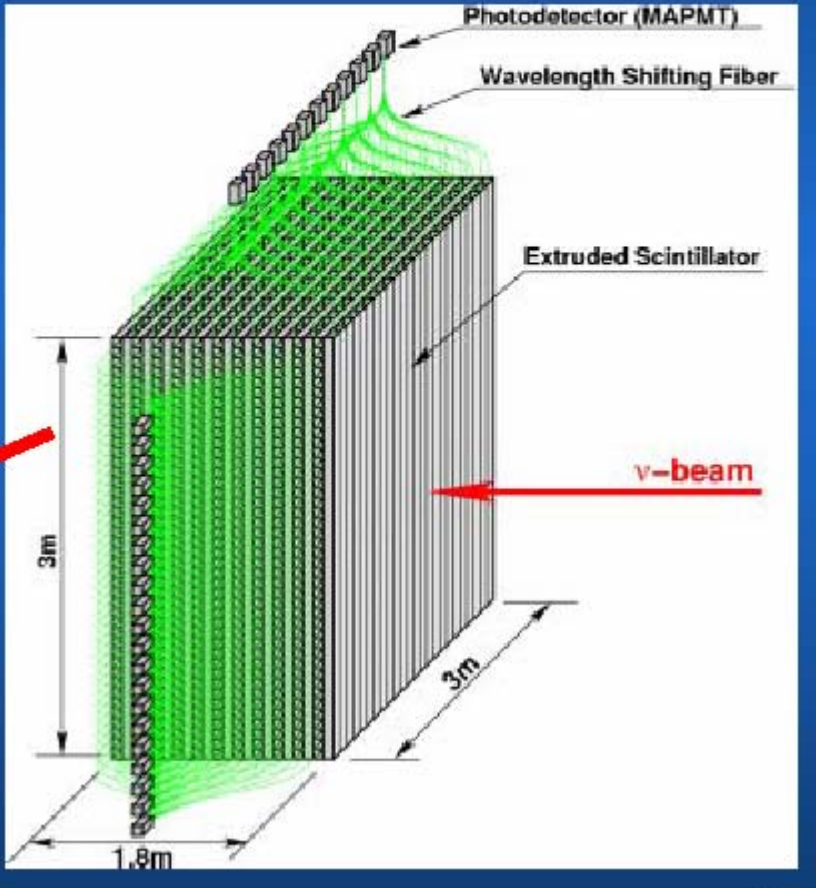
Full Active (solid) Scintillator Tracker (SciBar: named by Ichikawa)

- High efficiency for a short (< 4cm) track
- Detect a proton down to 350 MeV/c
- PID (p/π) and the momentum measurement by dE/dx
- Fine segments (1 2 300cm^3)

➢ Precise measurement of ν flux < 1 GeV

➢ Study non-QE (B.G.) ν interaction





IFAE/UAB contribution to K2K

Hardware

Electron catcher for SciBar detector (pending approval by KEK coll.)

- Old calorimeter from Chorus/Harp provided by the Rome group.
- Design of the readout electronics.
- Design of the supporting structure if Rome does not provide it.
- Contribution to the installation/commissioning of the detector.

SciBar main tracker

- Contribution to the installation of the detector during the summer of 2003.
- Contribution to the commissioning of SciBar, including alignment and detector calibration during the fall of 2003.

IFAE/UAB contribution to K2K

Software

Reconstruction software of SciBar detector.

- Track finding using a cellular automaton algorithm.
- Track refit using a Kalman Filter in collaboration with Valencia Univ.
- Particle identification and momentum reconstruction.

Analysis goals

- Analysis of SciBar data: studies on ν Quasi-elastic interactions, multi-π and single π^0 production, ν_e beam contamination,...
- Analysis of the beam extrapolation from near detector to SuperKamiokande using modern analysis tools.

n the medium
ime future: JHF-ν

ff-axis conventional beam.
$_{\nu}$ < 1 GeV.
ase line of 295 Km to
SuperKamiokande.

High intensity neutrino flux with
$<E_\nu> \sim$ 0.7 GeV at maximum of
the $\nu_\mu - \nu_\tau$ oscillation for
$\Delta m^2_{23} \sim 0.003$

New JHF (Japan Hadron Facility)
High intensity proton accelerator
50 GeV
0.75 MW

$$U_{MNS} = \begin{pmatrix} U_{e1} & U_{e2} & U_{e3} \\ U_{\mu 1} & U_{\mu 2} & U_{\mu 3} \\ U_{\tau 1} & U_{\tau 2} & U_{\tau 3} \end{pmatrix}$$

$$= \begin{pmatrix} 1 & & \\ & c_{23} & s_{23} \\ & -s_{23} & c_{23} \end{pmatrix} \begin{pmatrix} c_{13} & & s_{13}e^{-i\delta} \\ & 1 & \\ -s_{13}e^{i\delta} & & c_{13} \end{pmatrix} \begin{pmatrix} c_{12} & s_{12} & \\ -s_{12} & c_{12} & \\ & & 1 \end{pmatrix}$$

Atmospheric

Solar

Goal of JHF: measure θ_{13} from subdominant ν_μ to ν_e oscilation $\Rightarrow$ measure ν_e appearance in ν_μ beam.

X-ray Project in IFAE

- As we know from digital cameras for conventional photography, the days of photographic film are numbered.

- The same will happen with x-ray radiography, but CCD's are not adequate for several reasons (efficiency, threshold, noise...)

- The idea is to develop a device that can deliver radiographies with low-dose, high contrast and high resolution (with a maximum exposure time of 2 s).

X-ray Project in IFAE

- We proposed to use a high-Z semiconductor as the x-ray detector, coupled to a highly integrated pixelated chip.

- The project was funded by the EU Fifth Framework Program.

- Project cost 1.8M € ; Duration 48 months. Started in January 2002.

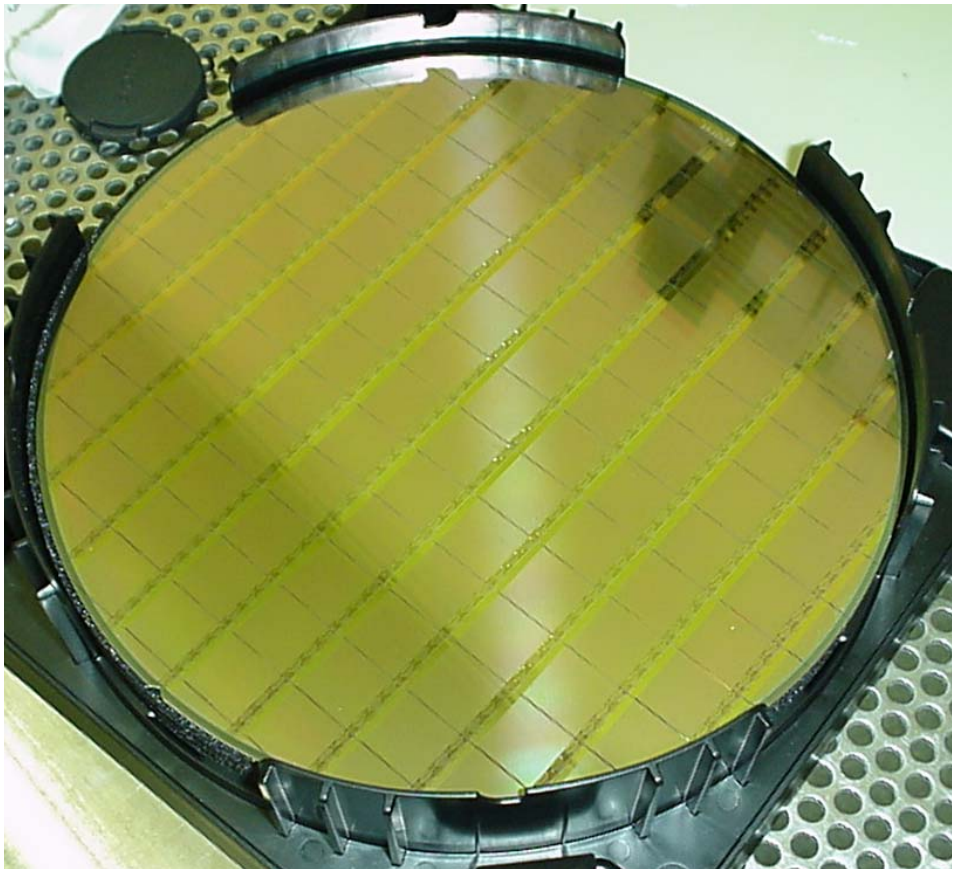
X-ray Project in IFAE

The project is being carried out in collaboration with:

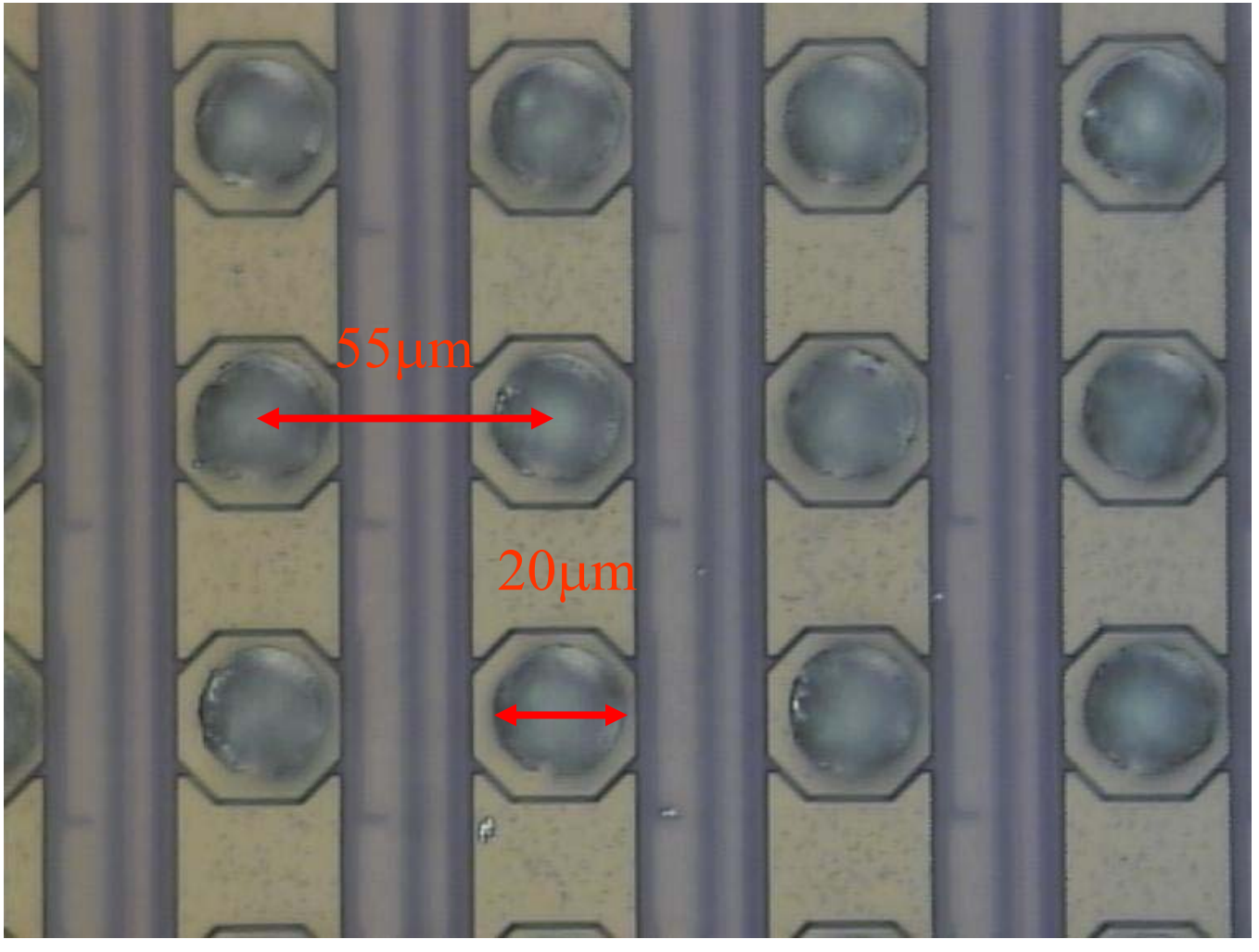
- 3 Hospitals (Austria, France, Spain)
- 1Center for Micro-Electronics (CNM, Spain)
- 1Company that fabricates X-ray machines

IFAE contributions:

- Coordination of the project
- Readout Pixel chip (via the Medipix Collaboration)
- Pixilated Cd(Zn)Te detectors
- Driver electronics for the Readout Chip
- Data Acquisition
- Tests, calibration, and simulation
- Overall system integration on prototype of the entire device

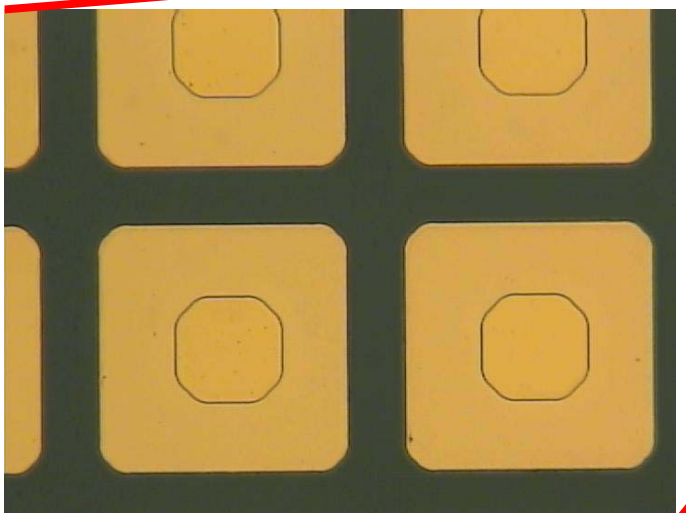


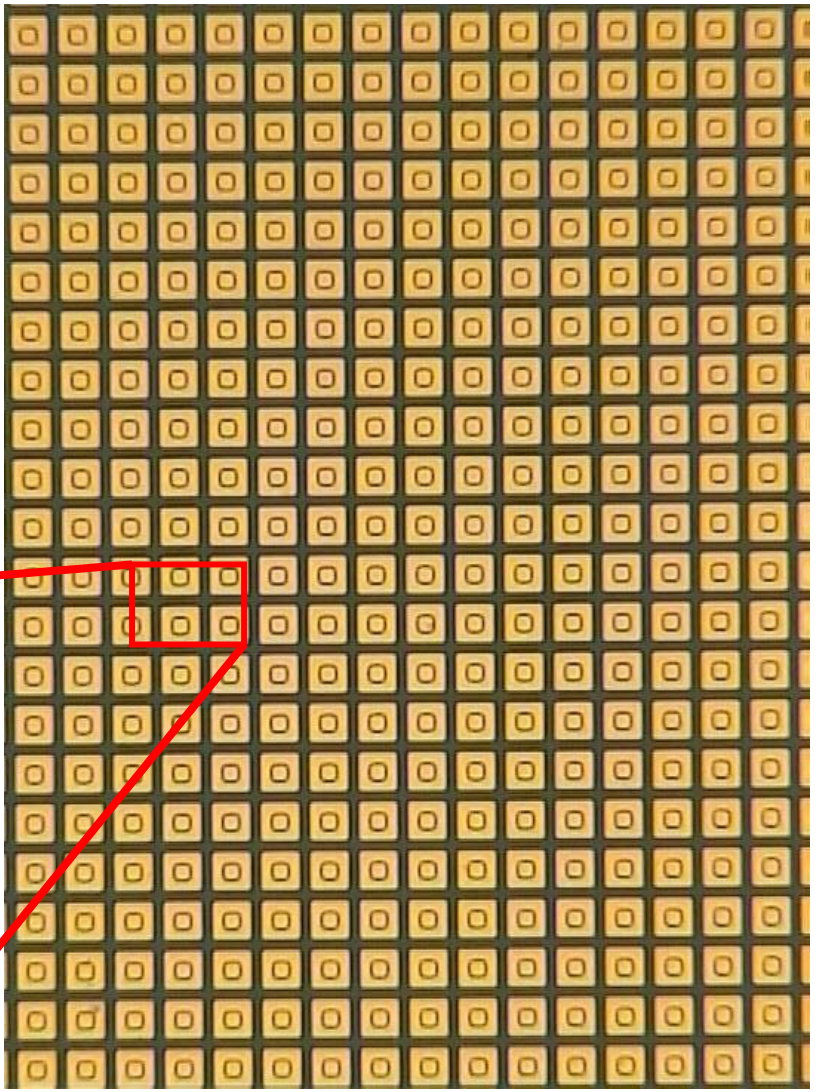
8” wafer of Medipix-II chips



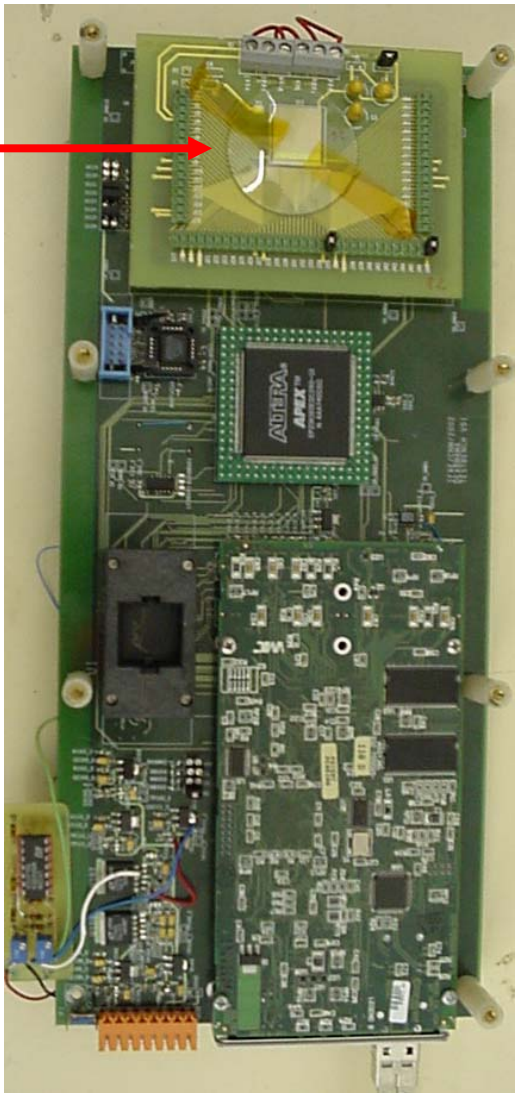
Section of Medipix-II chip with 20µm Indium bump balls

- CdTe detector with 65K pixels
- Pixel pitch 55 μm
- Gap between adjacent pixels 10 μm
- Pixel pad size 45 μm X 45 μm

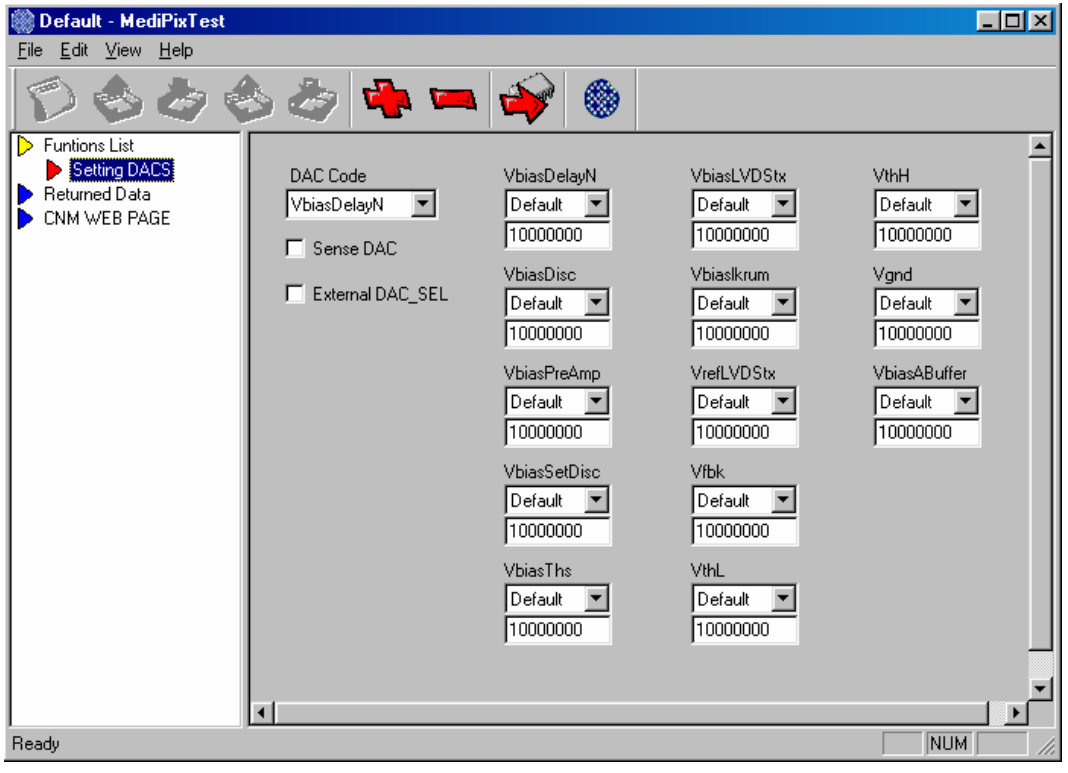




One Medipix-II chip



Driver card to Read/Write
the Medipix-II chip
interfaced with PCI card



The Graphic User Interface is being developed to R/W to the PCI card and the drivers of Medipix-II chip

- Final device (no name yet): will deliver a digital image of size 20 cm x 24 cm (the "standard" mammography). This means that one has to use an array of detectors and/or move them.
- A patent has been filed for the method of image capture.
- The image will be captured in 1s and it will be reconstructed and displayed in 1 s, thus providing on-line imaging.
- Data transfer rate between detector and PC will be 1 Gbit/s. Data size per frame is 350 Mbits (40 MB).
- Spin-offs: collaborations with,

  - CNM in Barcelona and Madrid, for other applications of CdZnTe detectors.

  - UDIAT (Parc Taulí Hospital, Sabadell).

http://www.ifae.es

Institut de Física d'Altes Energies

Institute for High Energy Physics

[Who we are]

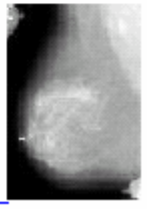
Upcoming Events

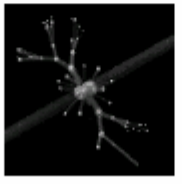
Samoil Bilenky "NEUTRINOS" Lecture IV Friday @12h TRANSPARENCIES(html) (PPT)

[Phones & emails] [Local Information] [UAB Map] [News] [Jobs]

Experimental Group	Aleph · Atlas · Grid · Hera-B · LHCb · Magic · Neutrino · X-Ray · Meetings
Theory Group	Theory Group Home Page · Group Members · Upcoming and Recent Seminars · Jobs and Fellowships
Synchroton Group	Synchroton Group HomePage · Group Members
Computing @IFAE	Main Page · Linux · WebMail · Grid · System Manager's Area
PhysicsLinks	CERN · Spires UK · Physics on the web · Durham HEP emails · HEP






For comments and changes on this page send email to webmaster