

Mosè Mariotti

15 MAGIC years memories

From the beginning to
present:
construction, operations and
several upgrades to now

outline

- ❖ the trigger construction
- ❖ the mirrors construction and installation
- ❖ the second telescope
- ❖ the upgrade



When a new good idea is possessing you, it is like a genius coming out from the lamp... later it is almost impossible to put it back (Razmik sometime in the 199x)

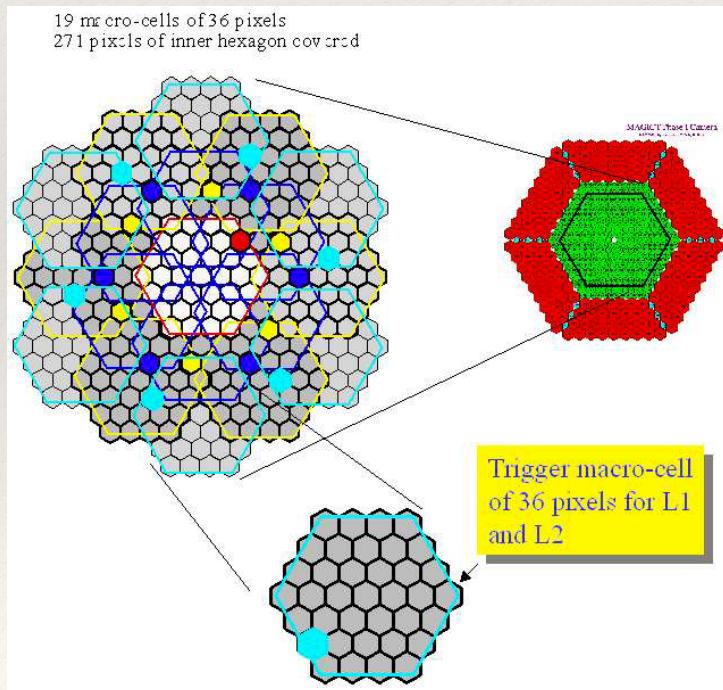
First kick off meeting in ENG

Previous century with a
challenging idea in mind:
MAGIC.

Homework 1: TRIGGER



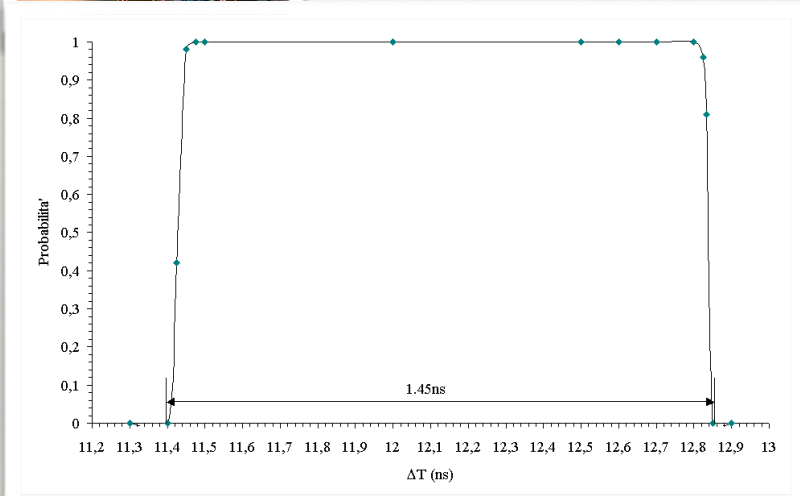
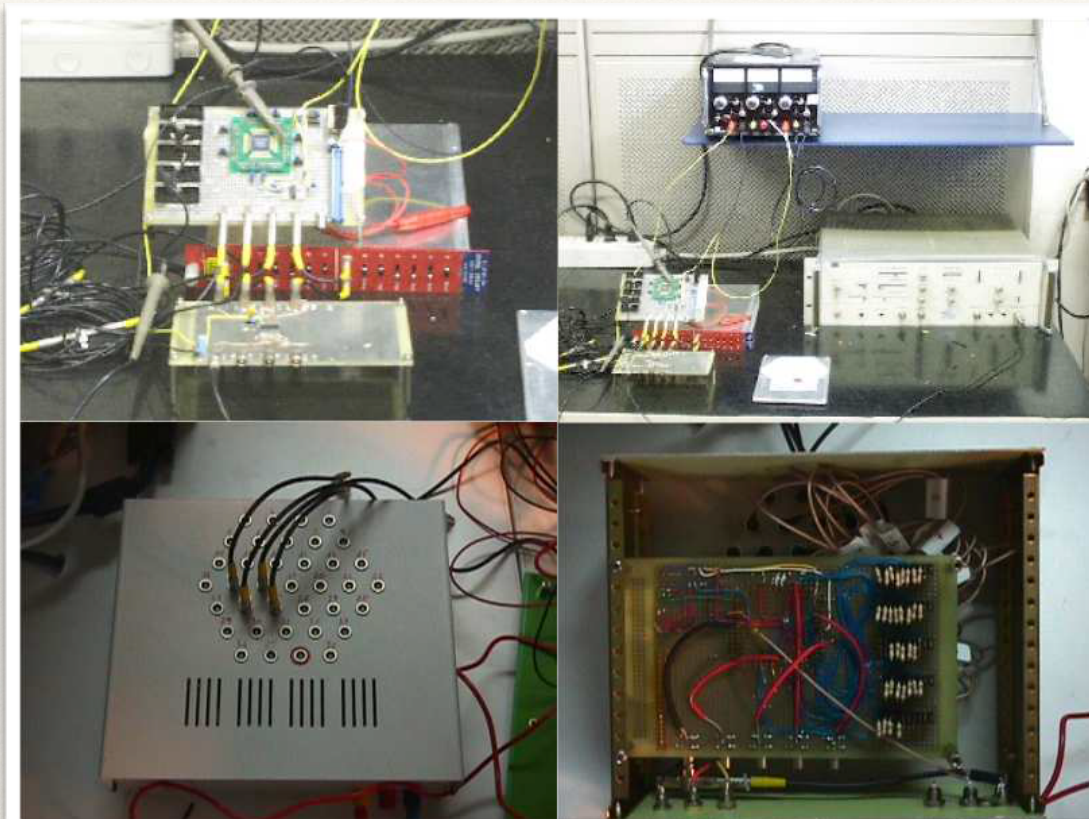
The challenge was to make tight time coincidence on close compact configuration from 2NN to 5NN over the whole inner camera:
~ 5 thousand pattern programmed in logic device



Which device?

How to realize sub-ns path from discriminators to the logic device

Homework 1: TRIGGER

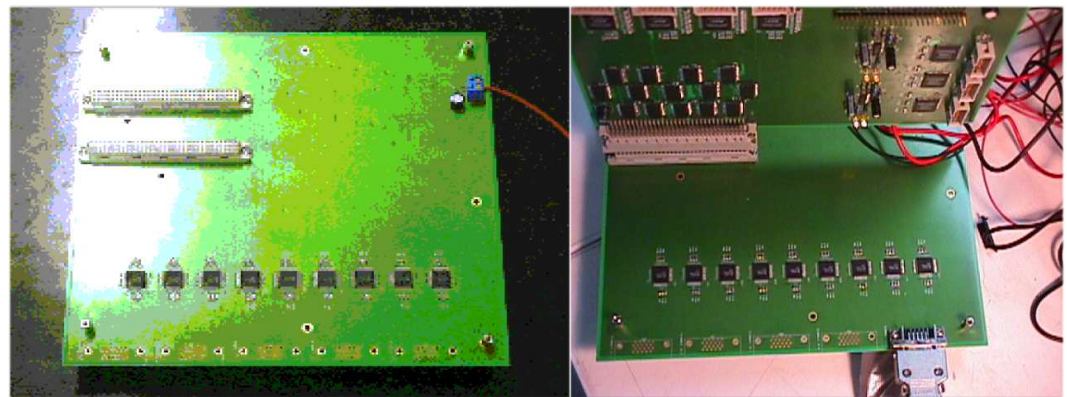
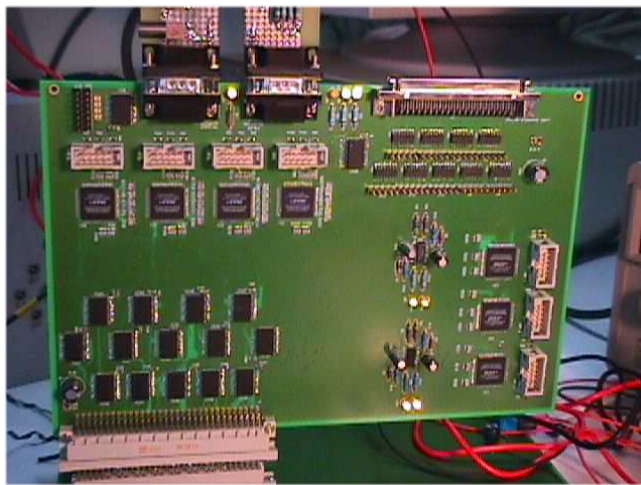


PLD device chosen (the faster available)
10 ns granted for digital application, however
with a lot of care in the programming we reach
“gate” even below ns



Homework 1: TRIGGER

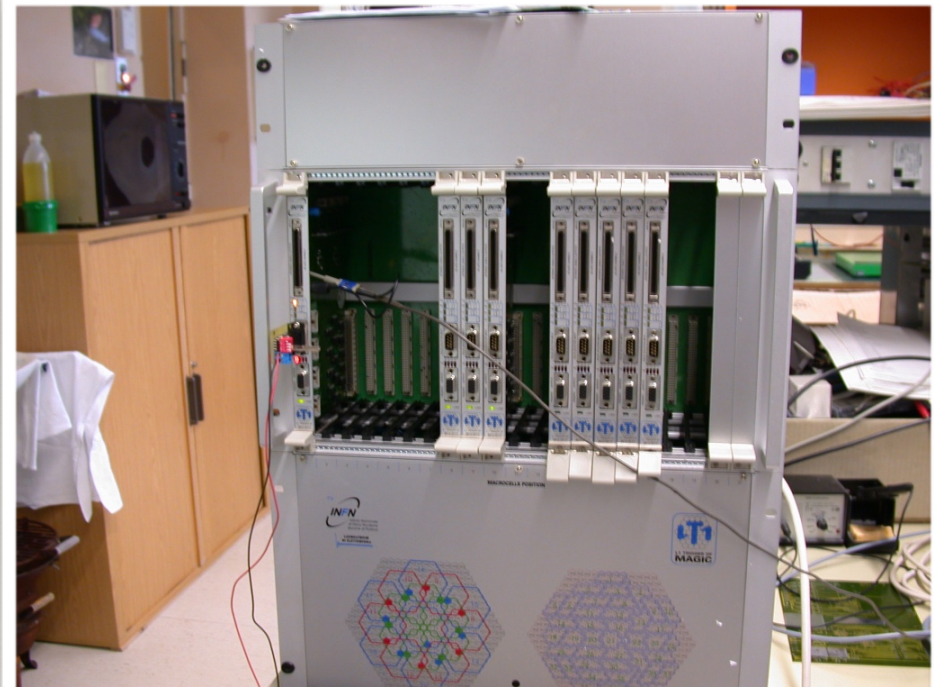
test of the test trigger
board at IFAE



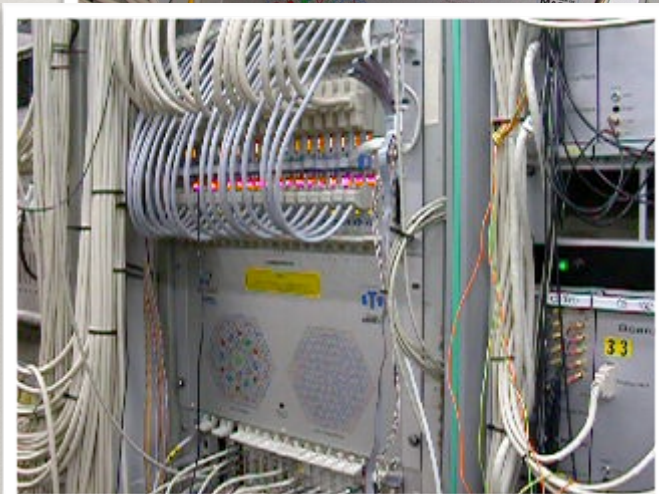
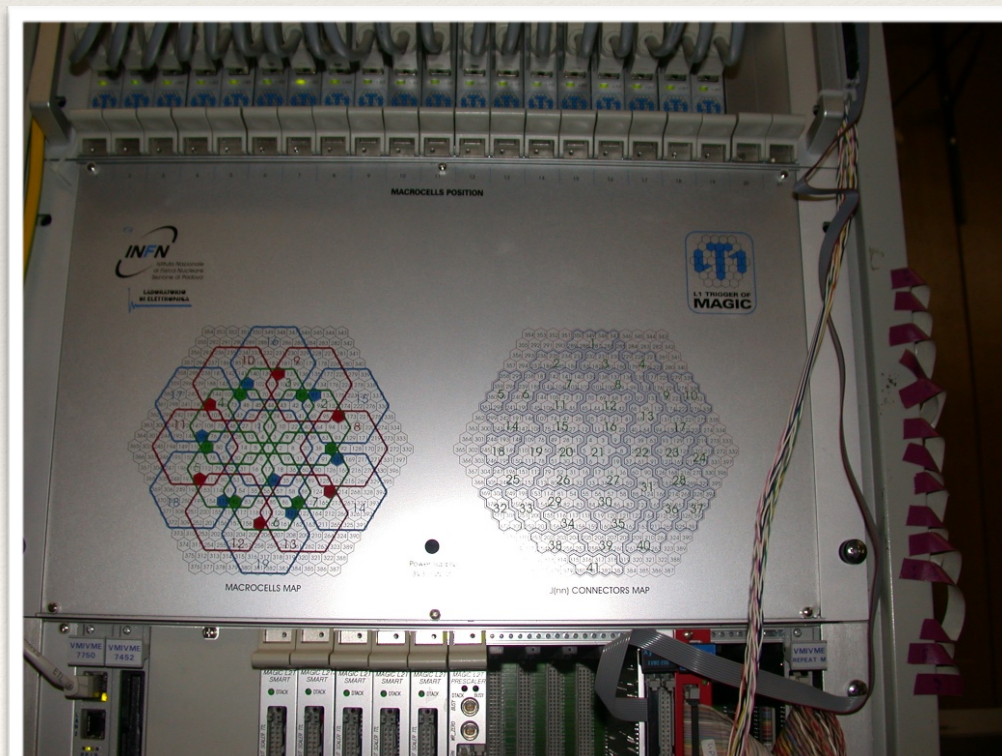
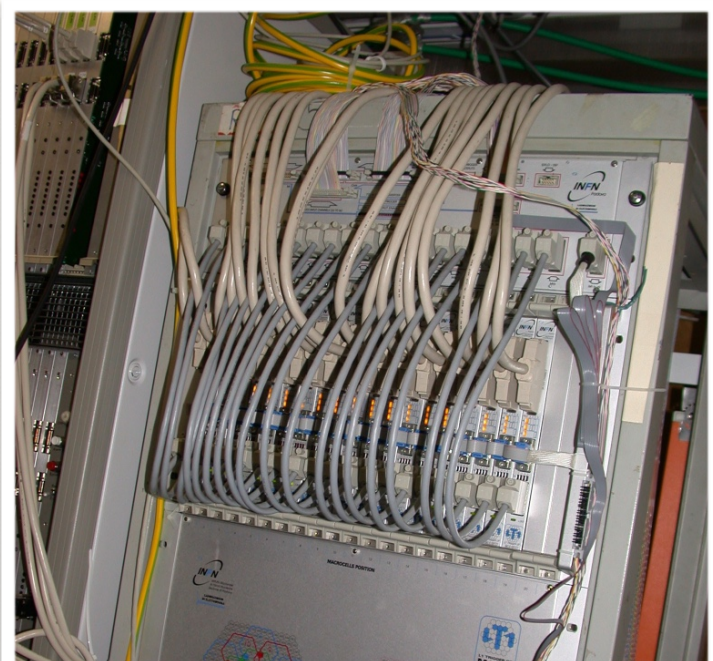
Homework: TRIGGER



test of the test trigger crate and boards in the final configuration at MPI

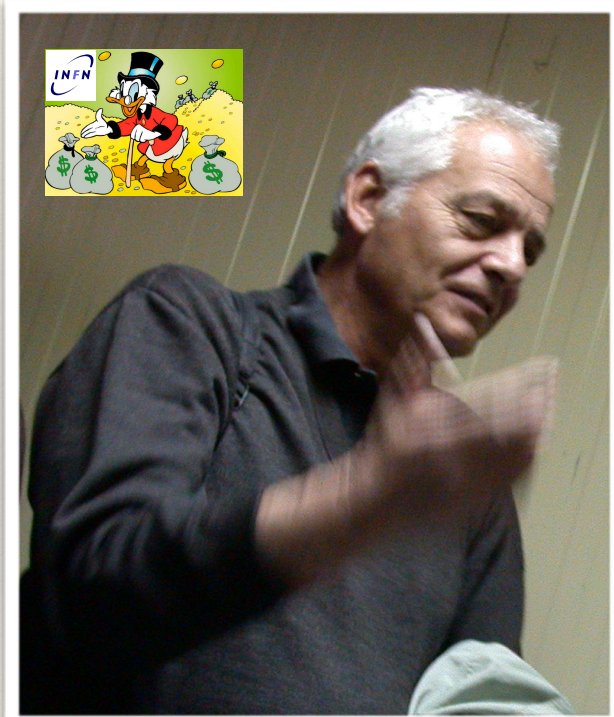


TRIGGER delivered to La Palma



Homework 2: Mirrors

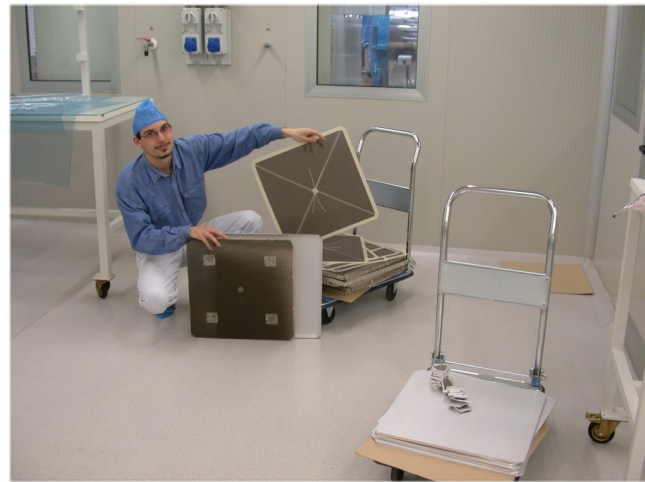
INFN is rich... try to get
resources for MAGIC



Produce 700 mirrors for the reflector:
All aluminum mirrors
diamond mirror technology
Quartz coating protection
internal heating resistors

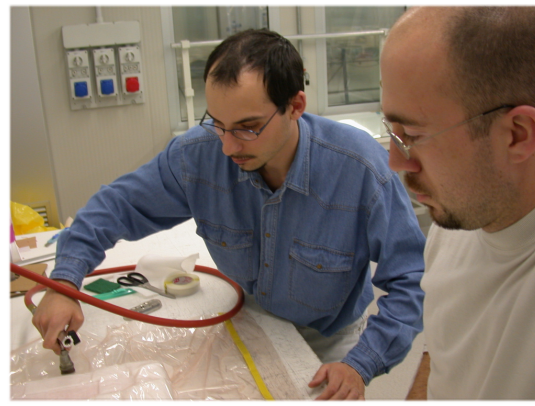
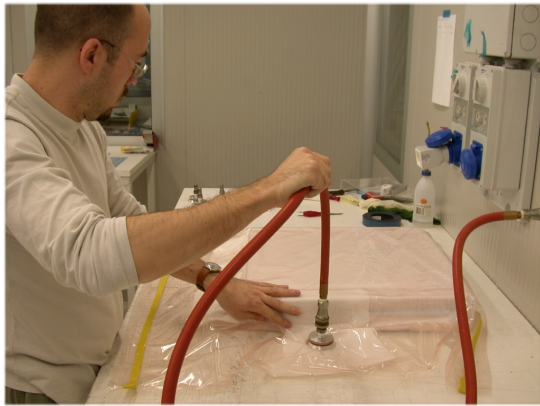
Homework 2: Mirrors

raw blank construction made by very professional workers



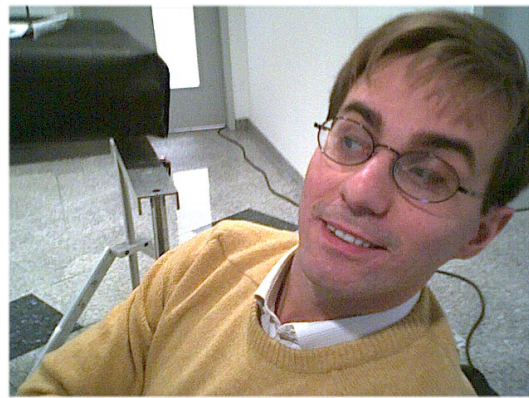
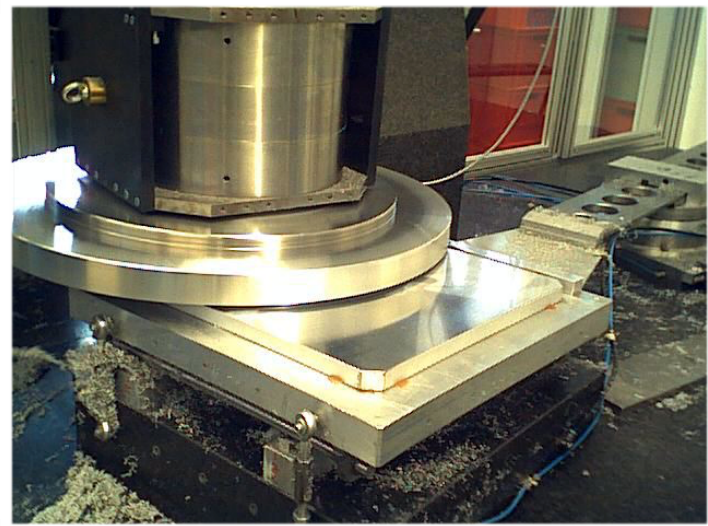
Homework 2: Mirrors

raw blank construction



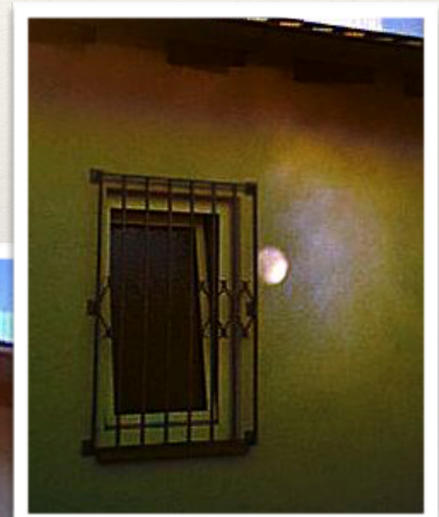
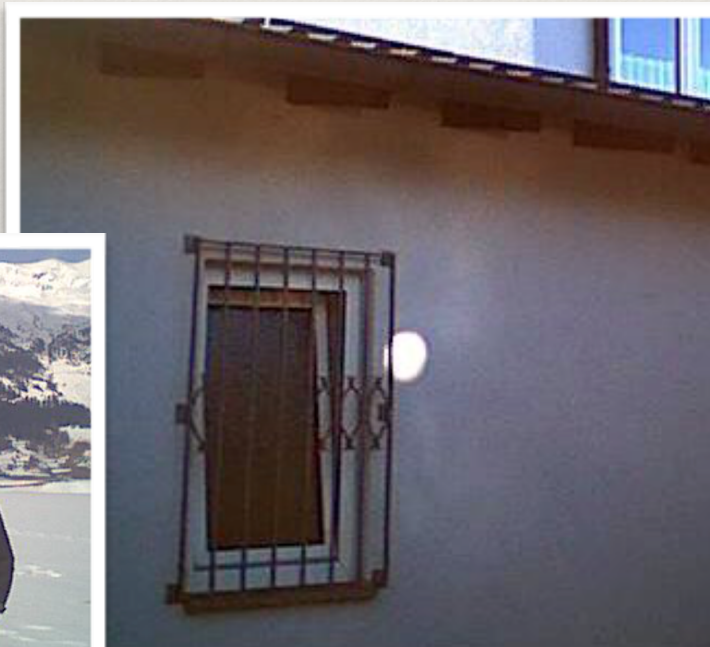
Homework 2: Mirrors

diamond milling and optical measurement @ LT-ULTRA



Homework 2: Mirrors

Many trips @LT-ULTRA across the alps,
Sometime we (I for sure) had fun to image the sun with a fresh new produced
mirror



collaborative task with MPI

mirrors alignment and mounting on a panel @ Eching



Finally the installation

Mirrors mounting on the telescope... always by (the same) professional workers



The Magic reflector alignment



The same fun... image the sun...
this time with a almost 1000 mirrors at
the same time after the alignment



Unfortunately because slow rate mirror
production... the reflecting surface was
not complete for the inauguration event
leaving a funny shape

The Magic I inauguration

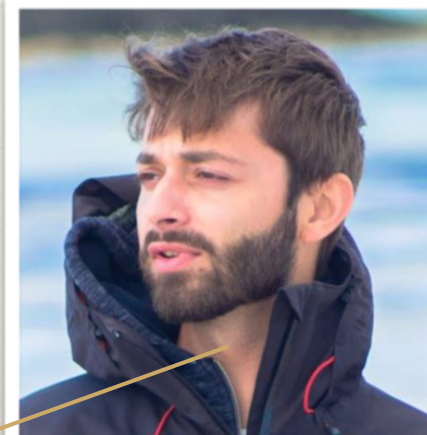


2018



2003

15 years ago!!!



2018



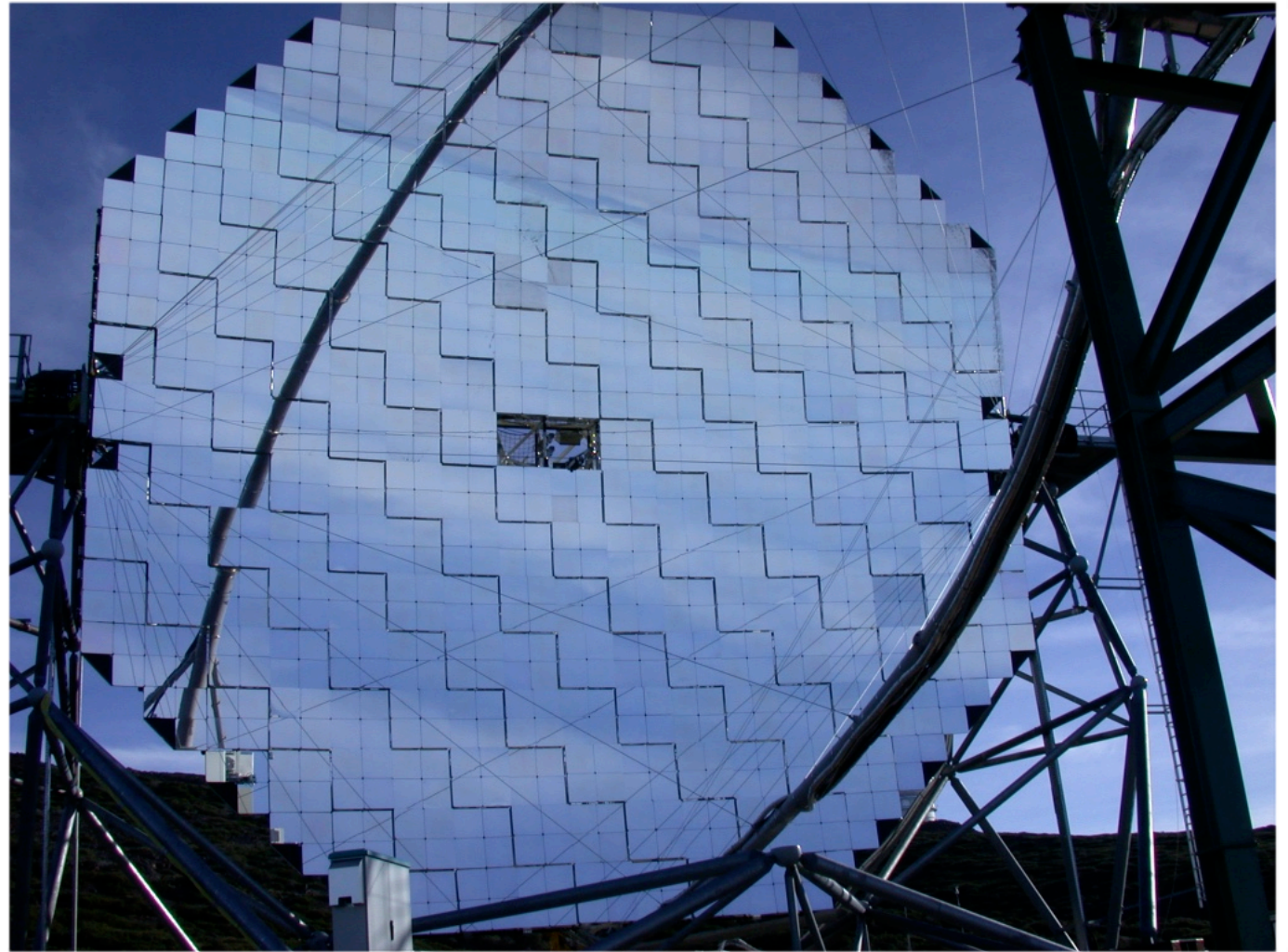
2018

Is the only picture I have made by Masahiro and given to me

a small mistake...

Mirrors were too close
and interfering each other
during adjustments:

we had to stagger the panels!



Many scientific meetings..

Barcelona.... meetings around the table are our favored



Yet one other meeting



Schools to educate young scientist

Brave teachers



Schools to educate young scientist

training for coach

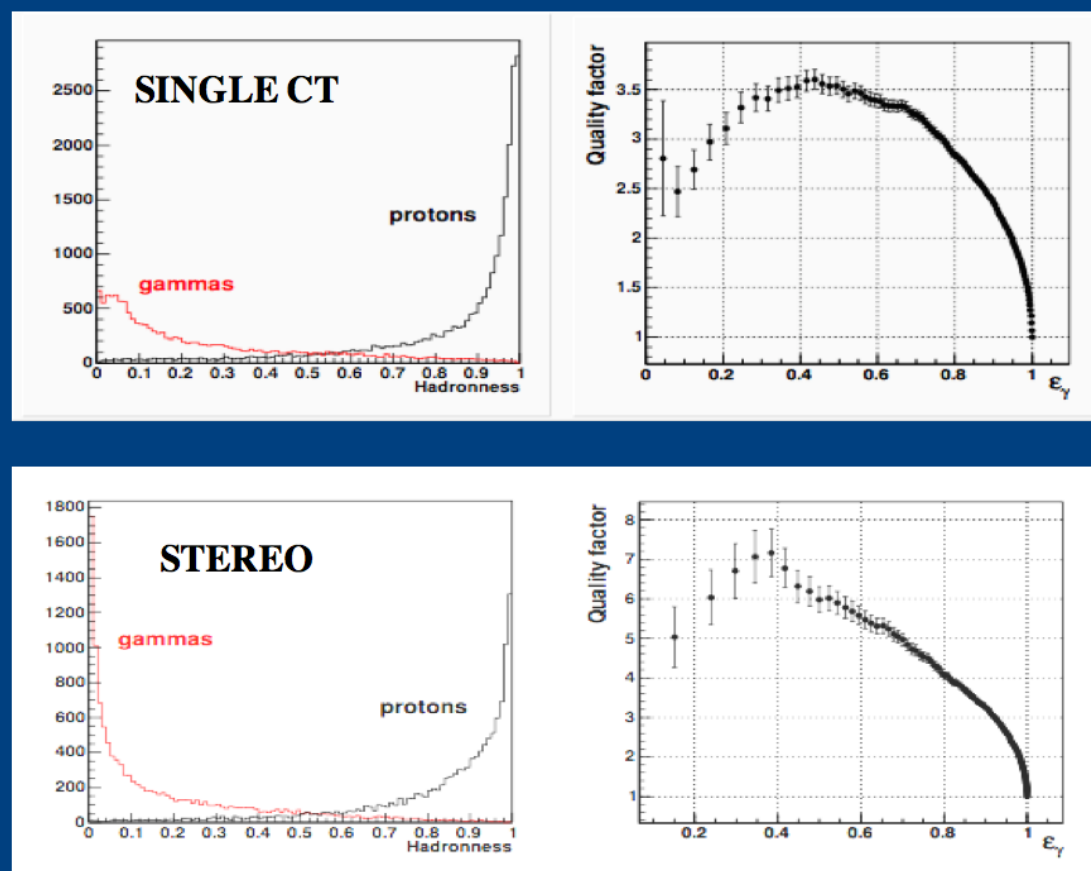


Brave teachers together with students



We need a second telescope

Performance of γ / hadron separation



The budget

Steering committee:
who is doing what in a
“barely legal” document



Wireless: USER: rareko@utu.fi
PASSWORD: mag42T%%!!

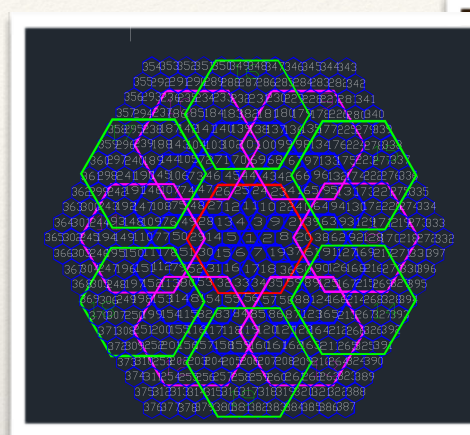
	KE		
INFN	1300	MIRRORS	→ INFN
TVORLA	20-40	FADC	→ INFN + IFAE
ETH	350	D&Q	→ INFN + IFAE
DAVIS	250	TRIGGER	→ INFN
BERLIN	60	AMC	→ ETH + MPI
LØDS	50	STRUCTURE	→ MPI
WÜRZBURG	200	UNDERCARRY...	→ MPI
SPAIN	1200	DRIVE	→ WÜ
MUNICH	1500+ 600	FRONT-END	→ MPI + IFAE
JAPANESE	500	OPTICAL LINK	→ MPI + IFAE
		INFRASTRUCTURE	→ MPI + COMMON + MPI + DAVIS + JAPAN + I + BEN + MAD
		CAMERA	→ IFAE
		RECEIVER	→ MPI + ETH
		PANELS	→ INFN + ETH
		LOCAL COMPUTING	→ IFAE
		DATA CENTER	→ IFAE

We call it “The Clone”

however not really a clone:

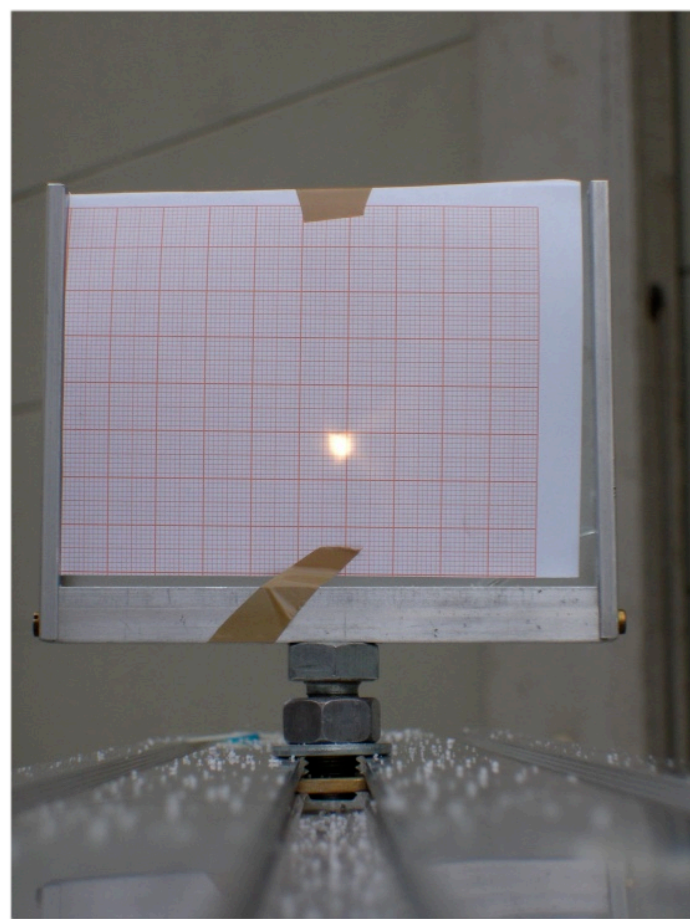
- 1 m² mirror
- new camera
- new sampling electronic
- wider trigger area

Again many groups of very committed and enthusiastic professionals started the construction of the different elements



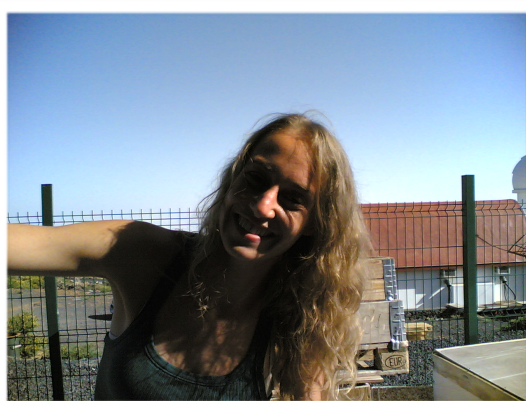
Climate chamber optical test

we did many tests... also temperature deformation:
indoor vs outdoor optical test (30° temp. variation)



MagicII mirrors mounting

Different crew, however very professional!



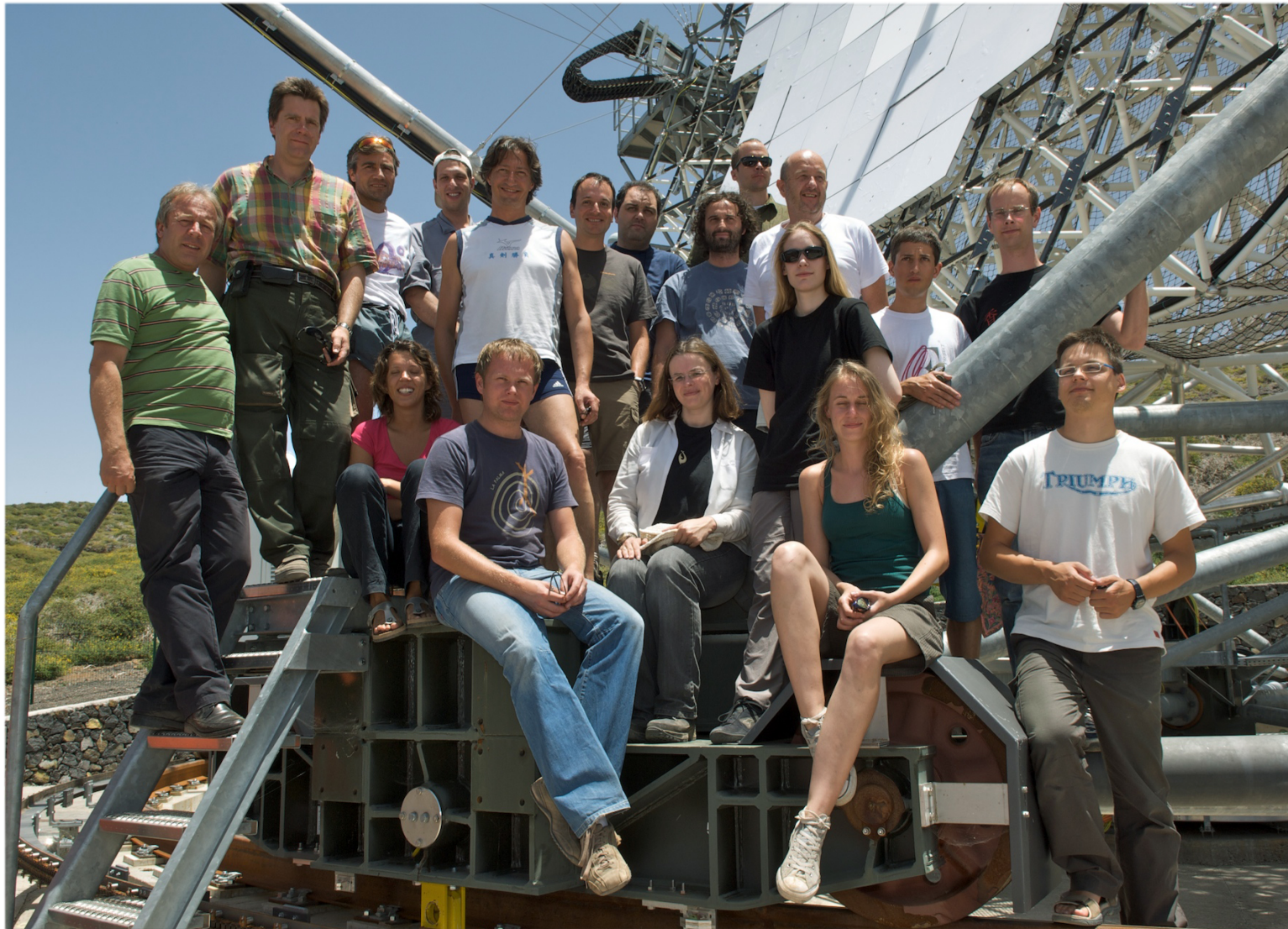
MagicII mirrors mounting: lunch



MagicII mirrors mounting: dinner



MagicII mirrors mounting



Magic II inauguration



However.. it was not a “clone”

(already) decided to make an Upgrade to make homogeneity between the 2 telescopes

New camera for MAGIC 1 (identical to MAGIC II)

New sampling electronics and DAQ

Larger trigger

Sum trigger (as a option)

again works



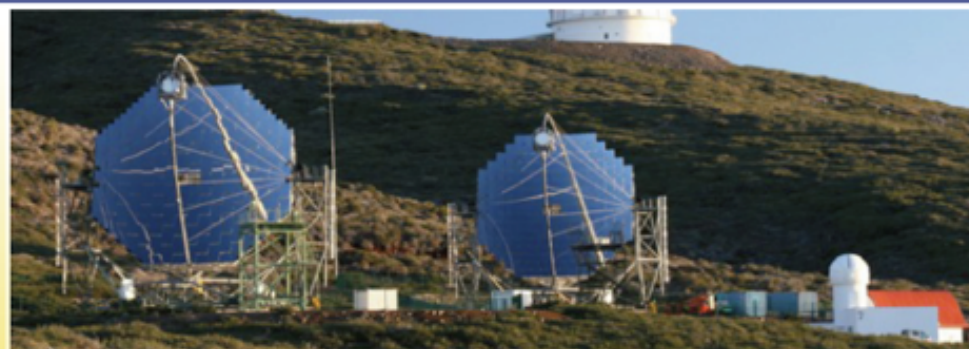
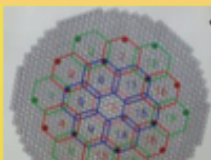
The UPGRADE

MAGIC upgrade

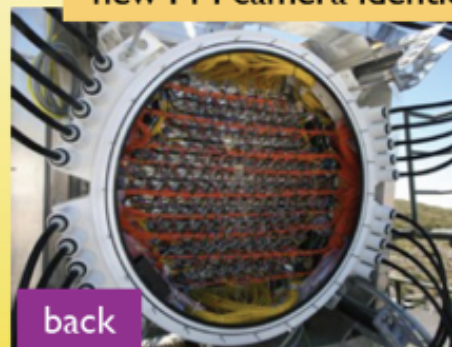
Goals of the upgrade:

- stability of operation for the next 5-10 years (increase duty cycle)
- unification of the subsystems (easy maintenance)
- increase sensitivity to extended sources (due to larger trigger area of MAGIC-I)
- Decrease readout dead-time from 10% to $<1\%$ at stereo rate 300 Hz
- and lower the energy threshold (due to analog sum trigger)

Level-I trigger has double the area



new M-I camera identical to the M-II camera



back



front

readout based on DRS4 chip has $<30 \mu\text{s}$ dead-time



mezzanine designed by

The upgrade

MAGIC upgrade

Status:

- readout upgraded in MAGIC-I (from MUX-FADC) and MAGIC-II (from DRS2) to DRS4 in 2011
- Improved electronics room in 2011
- Improved computing in 2011
- Camera and trigger of MAGIC-I exchanged June-July 2012
- Commissioning until October 2012
- Installation of new sum-trigger in Winter 2012-13

new electronics room



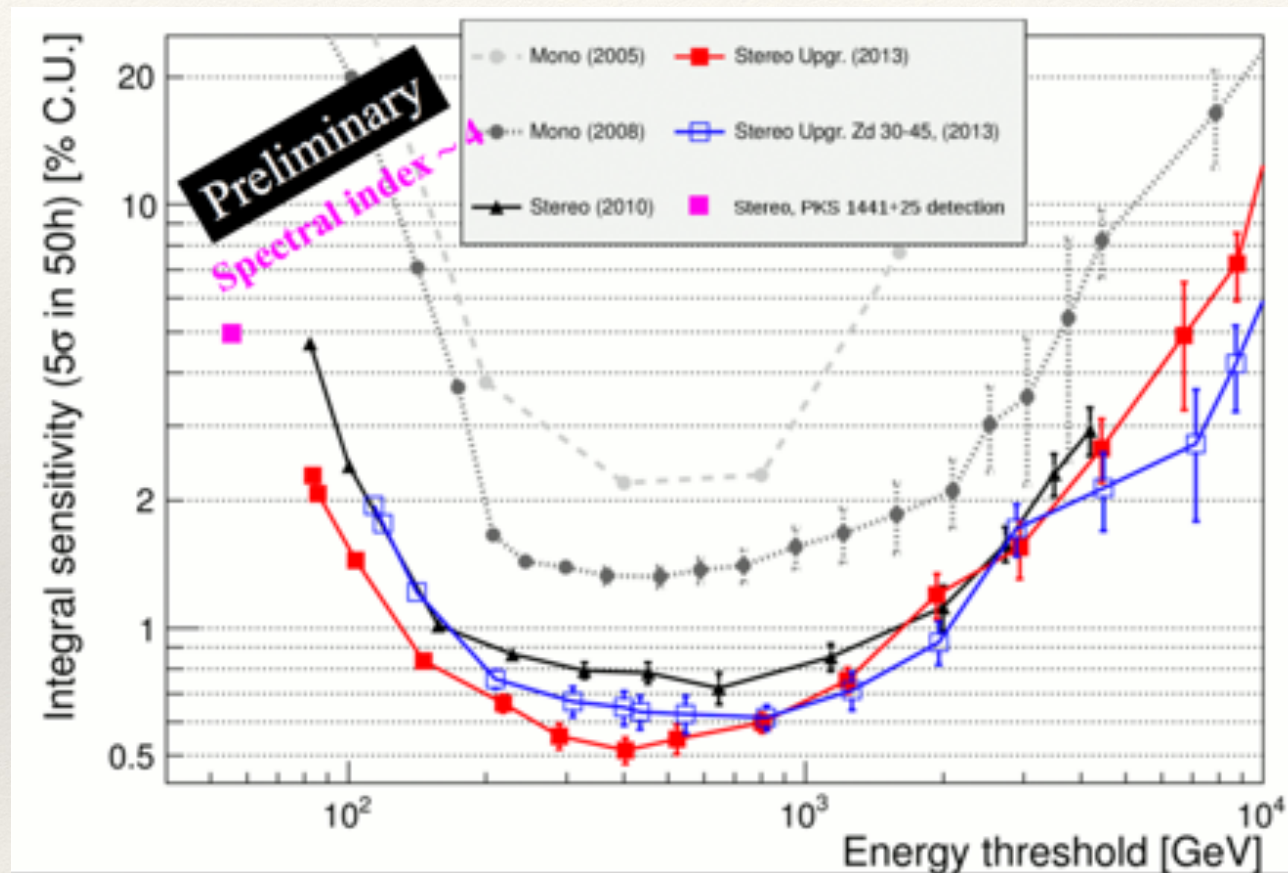
installation of the new
M-I camera



MPI team after installing
the new camera



Advanced detector for advanced physics



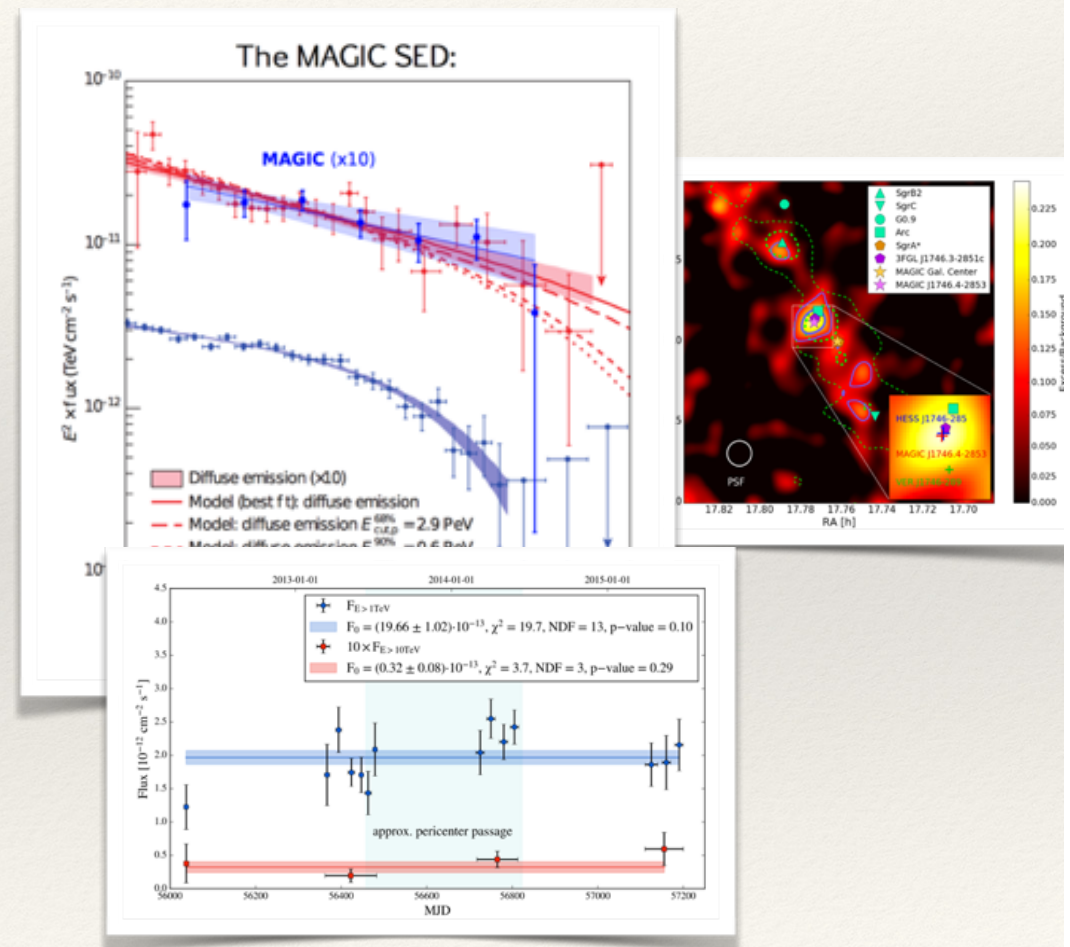
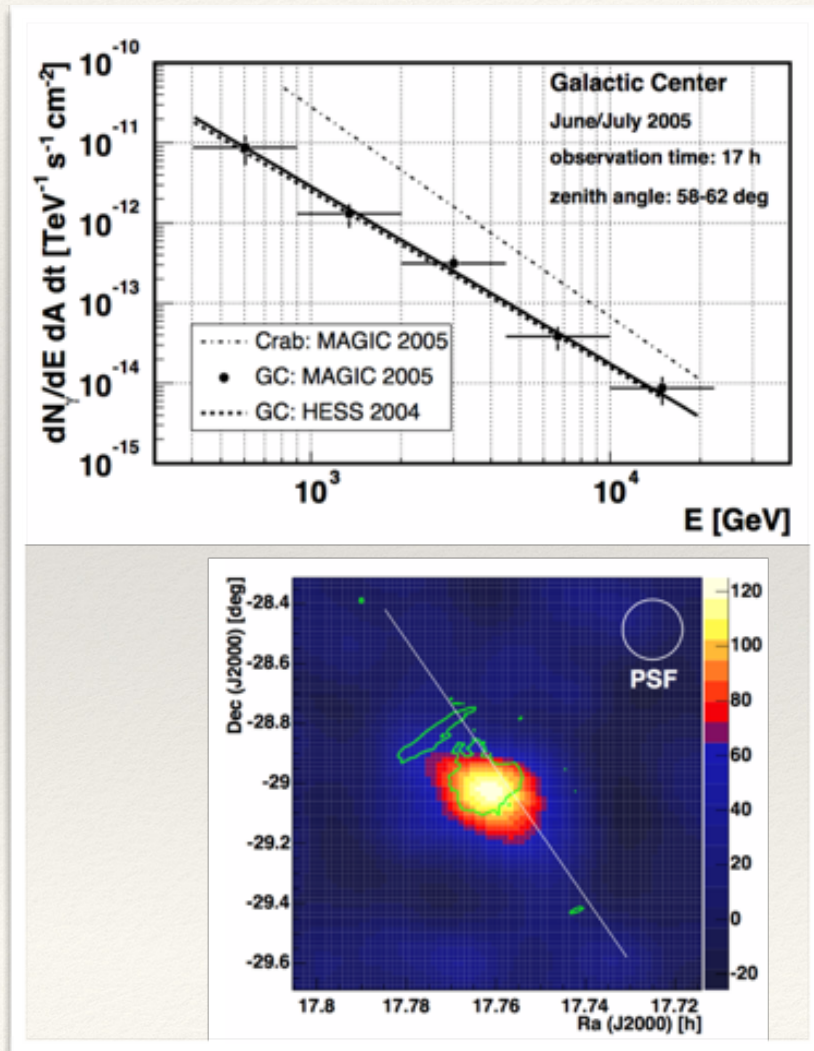
4-fold improvement in sensitivity over the last decade
→ ~10-fold improvement at the lowest energies !!

Advanced detector for advanced physics

2005

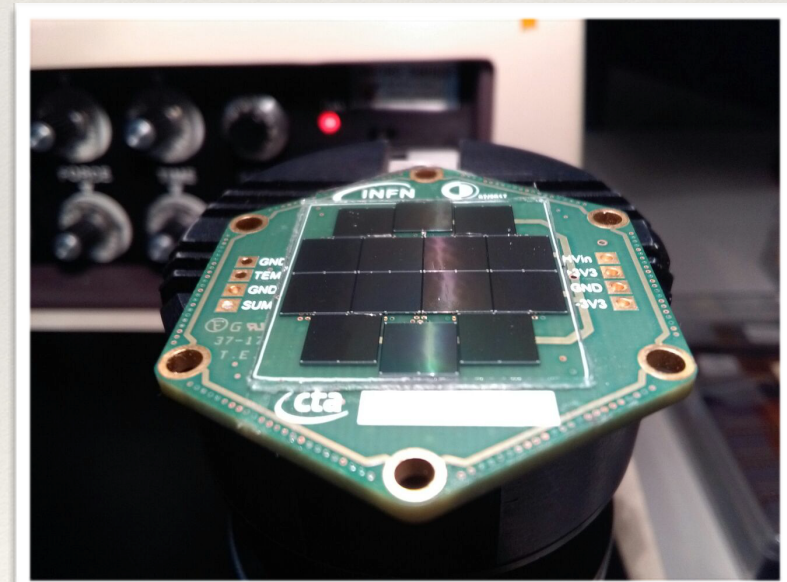
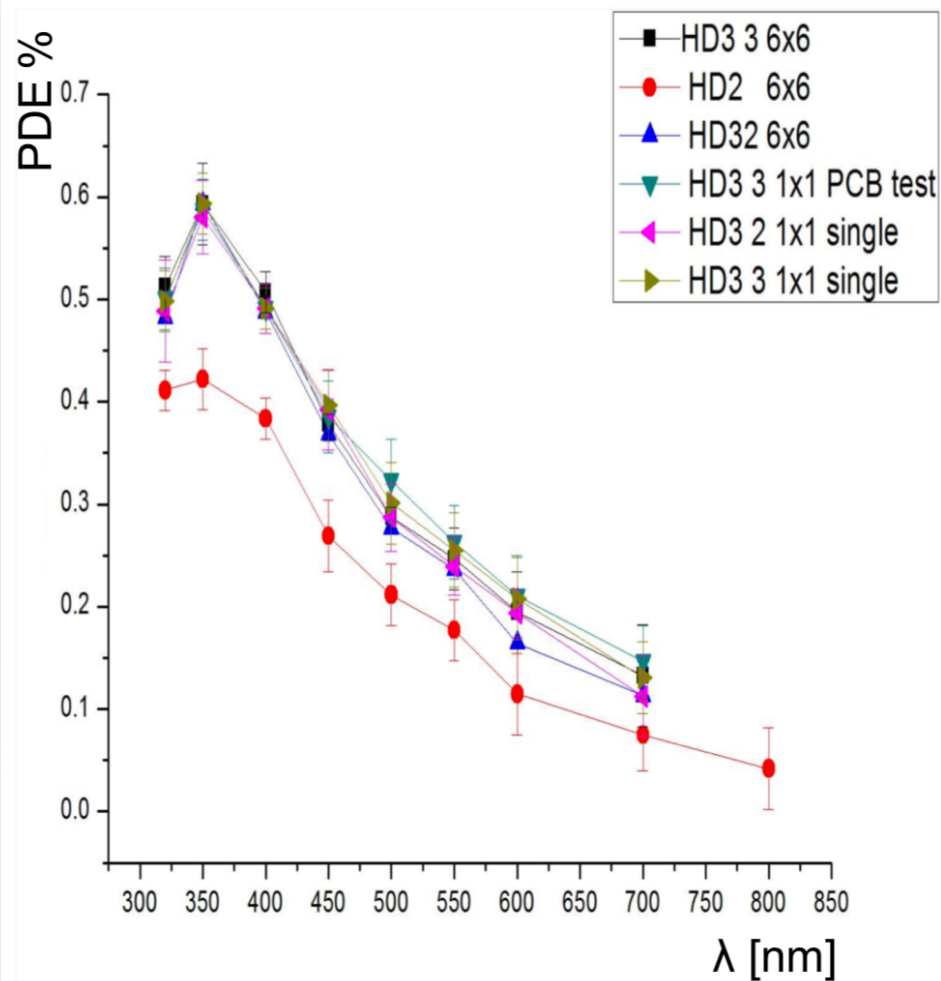
Galactic center

now



Advanced detector for advanced physics

Room for one other upgrade?



We are missing all of them



Maurizio



Nikolaj



Daniel



Leo

Koji Saito