Projects of the Electronics Division

Project Review 2008

Max-Planck-Institut für Physik
(Werner-Heisenberg-Institut)

Outline

- Projects in 2008
- Requests for 2009
- Status of Selected Projects
  - HEC-I
  - HEC-II
  - MAGIC-I Sum-Trigger
  - MAGIC-II Camera

Projects in 2008

- Main projects
  - HEC Hadronic Endcap Calorimeter (EA, EE)
  - HEC-II HEC Electronics Upgrade for the SLHC (EA, EE)
  - MAGIC-II Air Cherenkov Telescope Camera (EA, EE, EP)
  - MDT Monitored Drift Tube Chambers (EA)
  - MDT-II MDT Electronics Upgrade for the SLHC (EA, EE)

- Additional projects
  - Cresst (EP)
  - Gerda (EA, EE, EP)
  - ILC / SiPM (EE)
  - Muon Cooling (EP)
  - SCT (EA)
  - Support for the Semiconductor Laboratory (EP)

Group naming
EA: Elektroanlagen
EE: Elektronik Entwicklung
EP: Elektronikproduktion

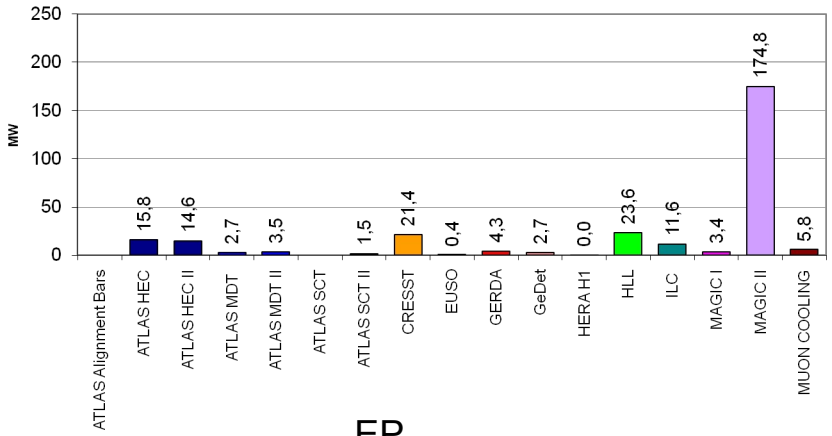
Projects in 2008

Average manpower/quarter (Nov. 2008):

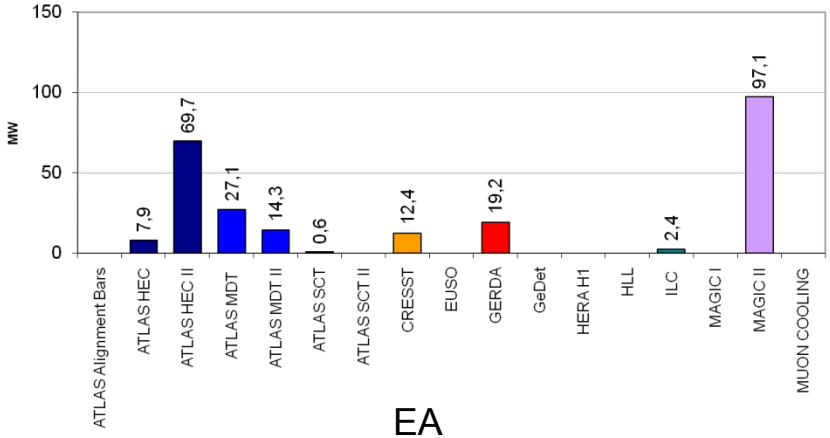
Elektronikproduktion (EP):
78MW/Q (Nominal 65MW/Q)

Elektroanlagen (EA):
68 MW/Q (Nominal 65MW/Q)

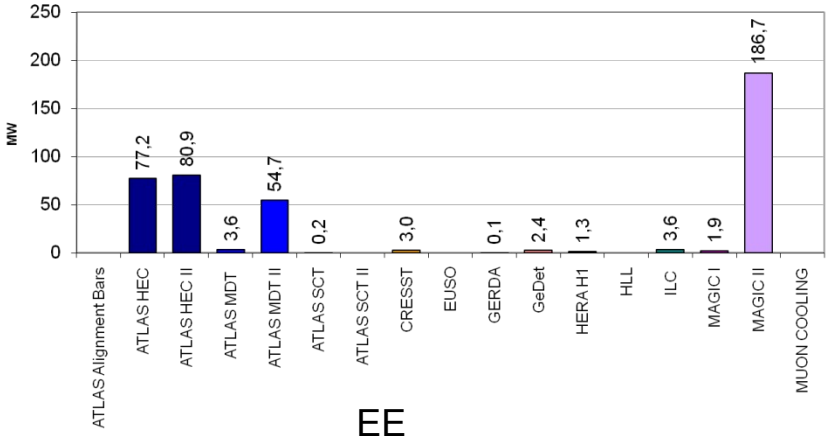
Elektronik Entwicklung (EE):
110MW/Q (Nominal 90MW/Q)



EP



EA

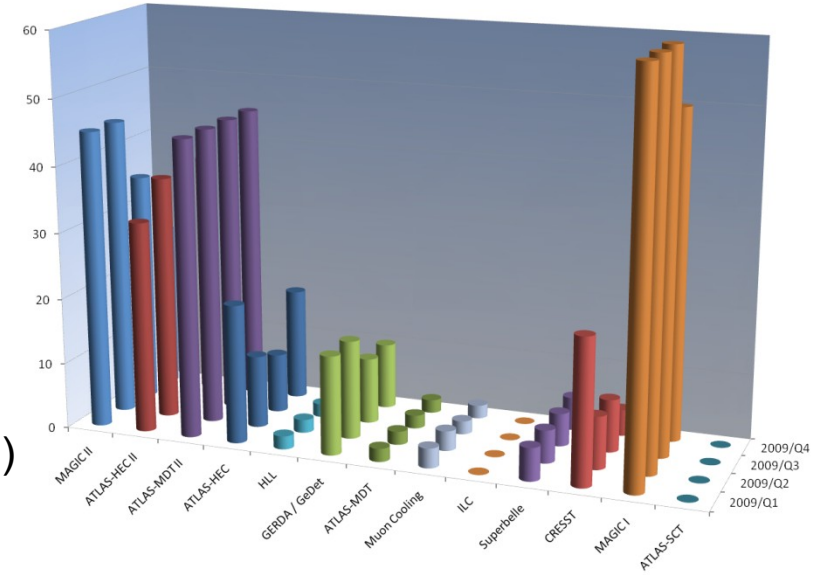


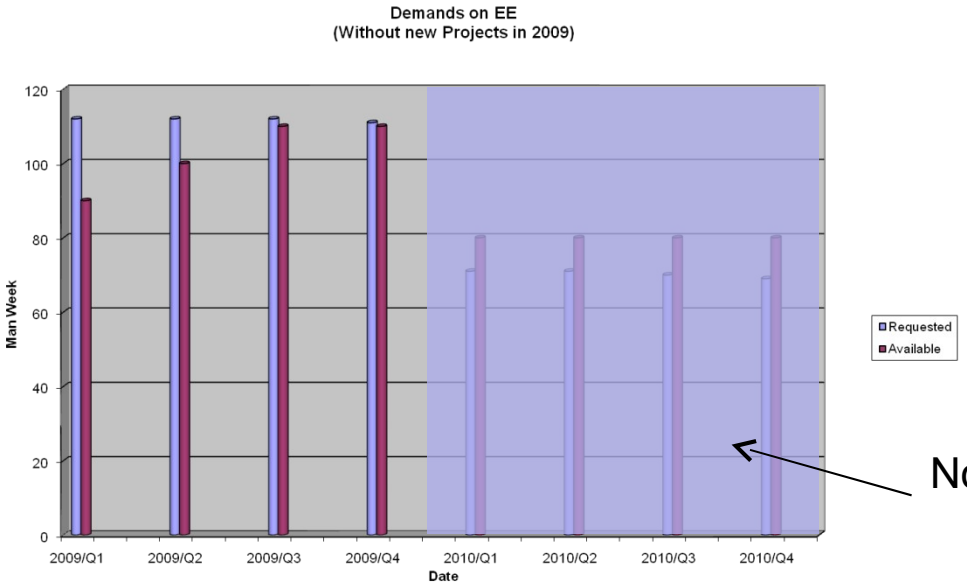
EE

Requests for 2009

Main tasks in 2009 (requested):

- New MAGIC-I camera (MAGIC-II clone)
- Improved sum-trigger
- Chip development for SLHC-HEC (HEC-II)
- Low-voltage development for SLHC-HEC
- Upgrade for MDT-I (CSM-Chip)
- Chip development for SLHC-MDT (MDT-II)
- CSM module development for SLHC-MDT (MDT-II)





Some requests are underestimated!!!

-> We will do our best!!!

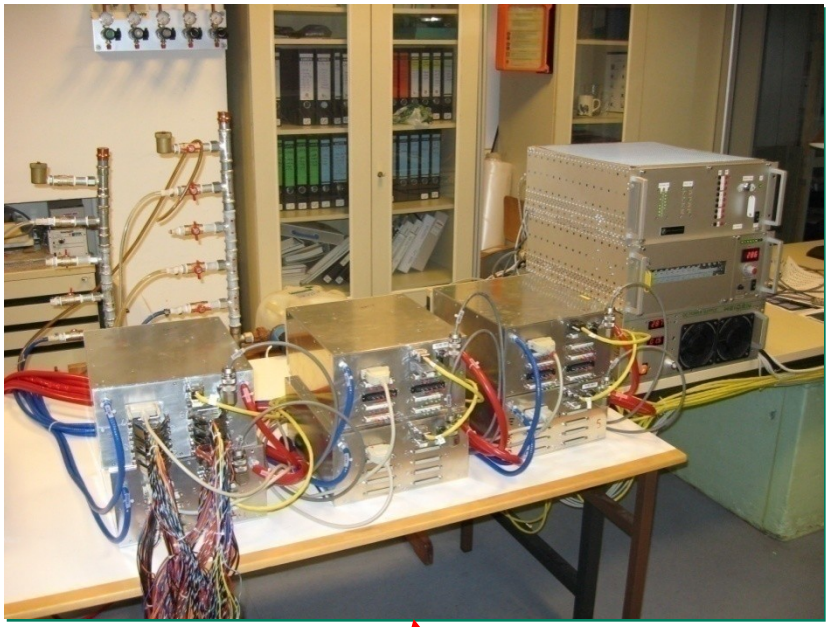
Not complete for 2010

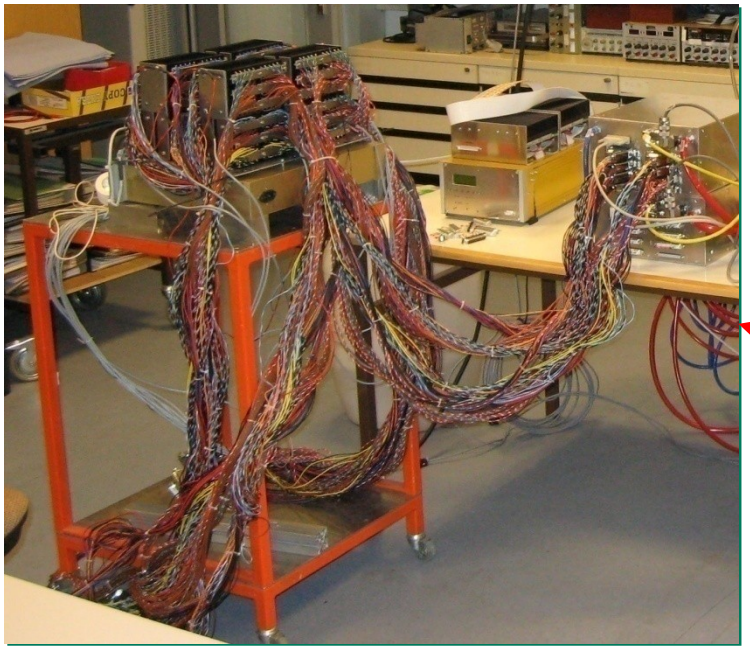
Status of Selected Projects

HEC-I / Low-Voltage System

The HEC low-voltage system is installed in the ATLAS-detector and works well!

(One low-voltage box was changed
-> Problem with DC-DC converter)



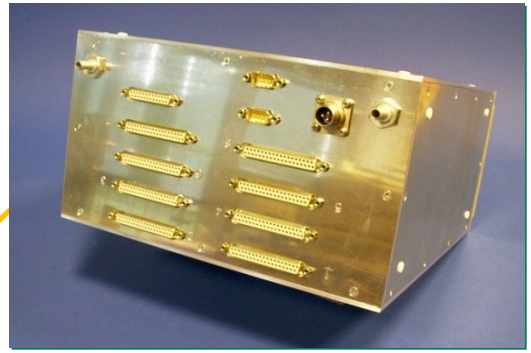


Test system in our lab

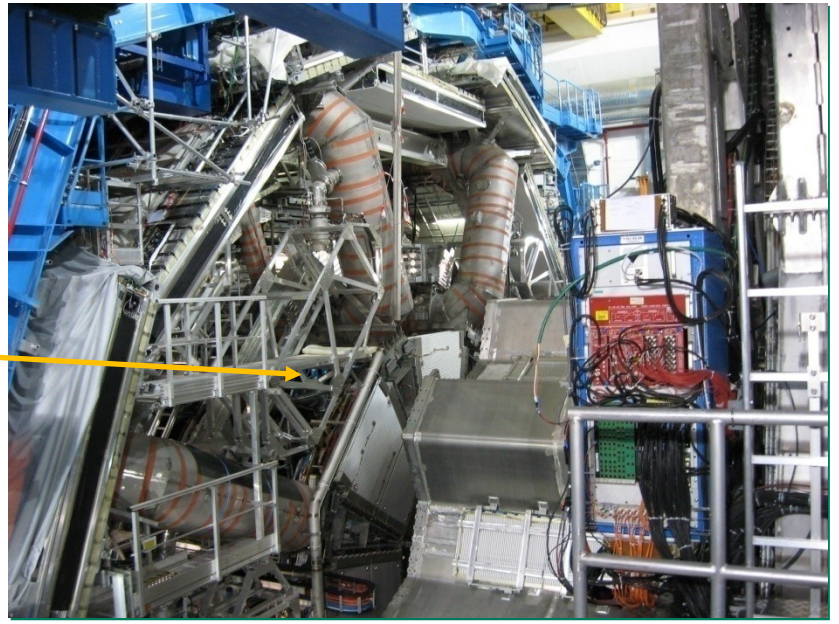
HEC-I / Some Data about Low-Voltage

Low-voltage system supplies the power for the HEC-amplifiers

- One 280V supply
- One control system
- 8 low-voltage boxes
  (Mounted between the tile fingers)
- One box per quadrant
- Each box is for 40 preamplifier-boards
- Full control and monitoring



LV-box



Assembled into the ATLAS-detector

Upgrade of the Hadronic Endcap Calorimeter (HEC-II)

SLHC luminosity upgrade leads to increased particle rates

-> Improved amplifiers for the ATLAS-HEC (Factor 10 higher radiation hardness)

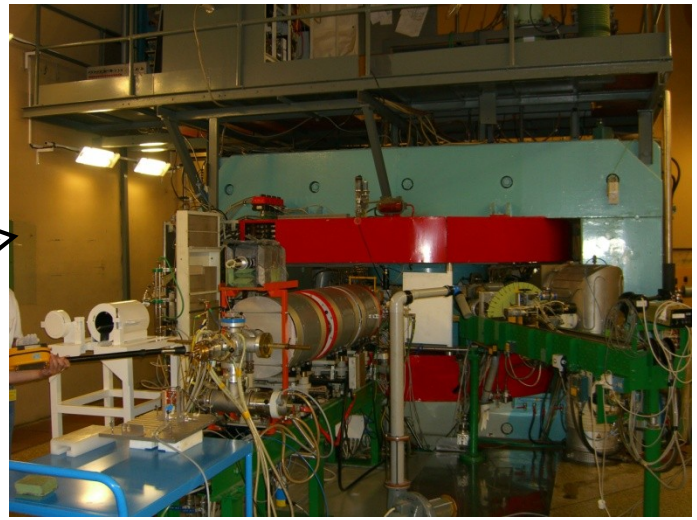
-> Reduced structure size in amplifier chips (e.g. 250nm or less)

-> Possible use of a different technology (SiGe instead of GaAs)

Investigation of technologies from different partners:

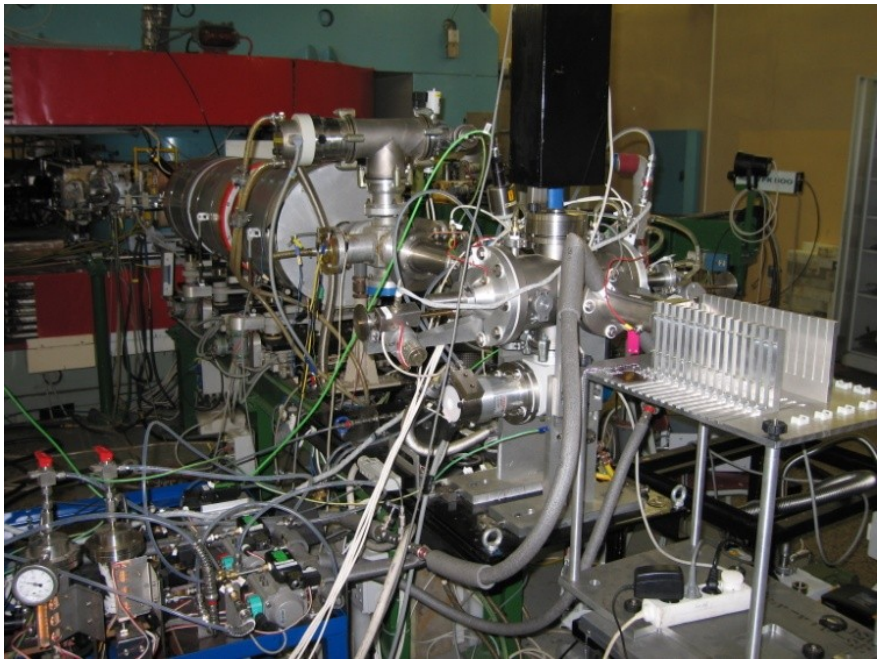
- Institute for Semiconductor Physics (Frankfurt/Oder) (SiGe, CMOS)
- Triquint (GaAs)
- IBM (SiGe)
- AMS (SiGe)

- Radiation test (neutrons) at cyclotron in Rez (near Prague)



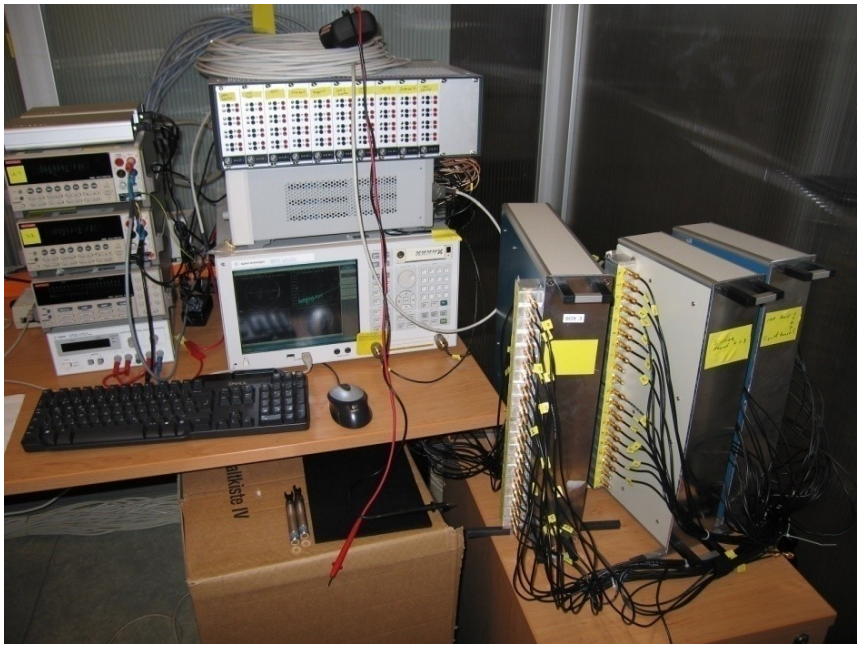
- Selecting the technology from results (CMOS, SiGe or GaAs)

Some Words about the Radiation Measurement



- Testing up to 37 devices (transistors)
- Measuring DC-values and S-parameters
- Measurement during neutron irradiation

About 40m cable between the transistor and the measurement system.



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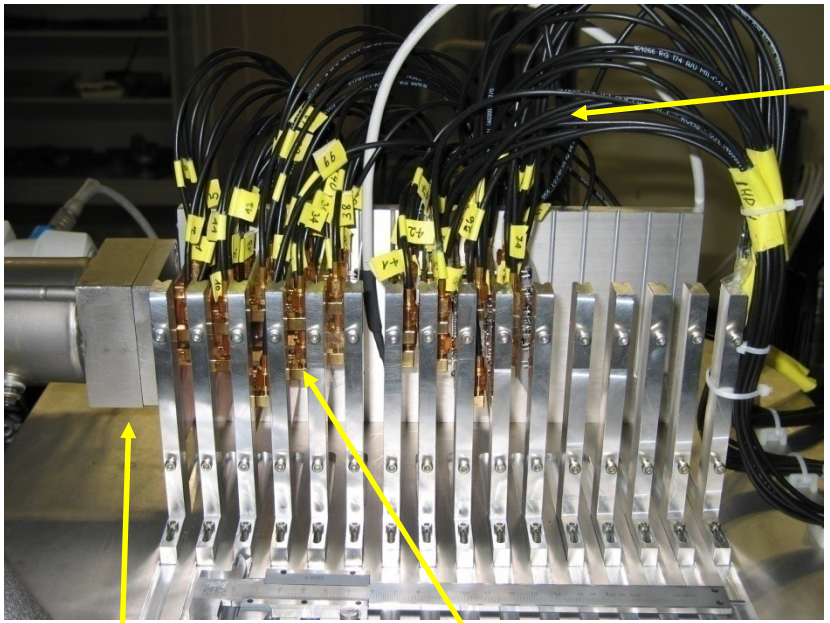


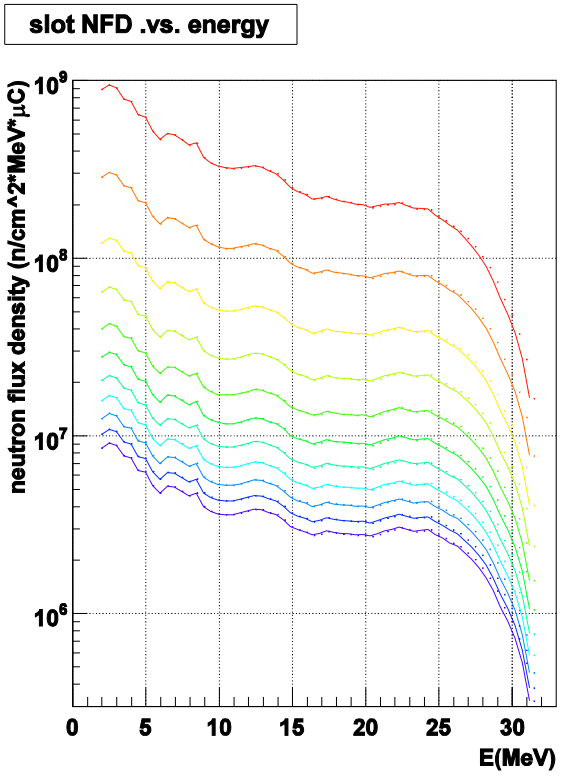
Cabling for RF/DC-signals

Deuterium target
(neutron source)

Up to 11 boards
with devices under test

Up to four devices per board located in the beam

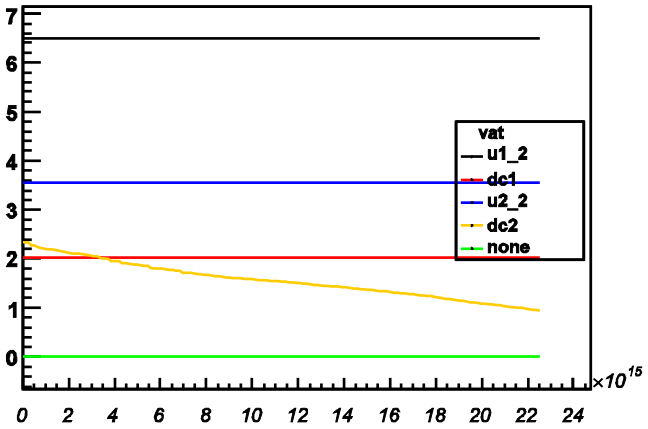
Neutron flux density spectrum
at different positions:



Example: SiGe-Bipolartransistor

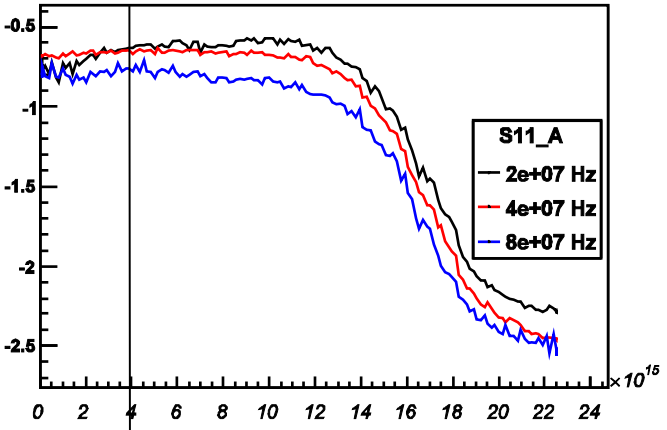
- npn-bipolartransistor from IHP
- SiGe-technology
- 0.42x0.84µm² structure size
- 2 elementary cells in parallel
- Included ESD-protection

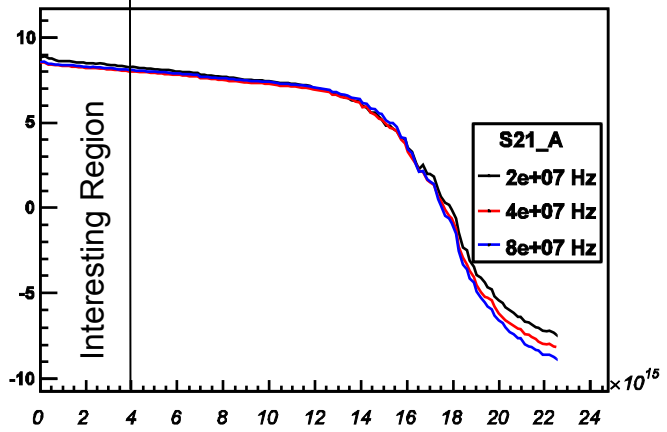
- Positioned in slot 1



Currents and voltages

Parameter S11 (“Impedance”)





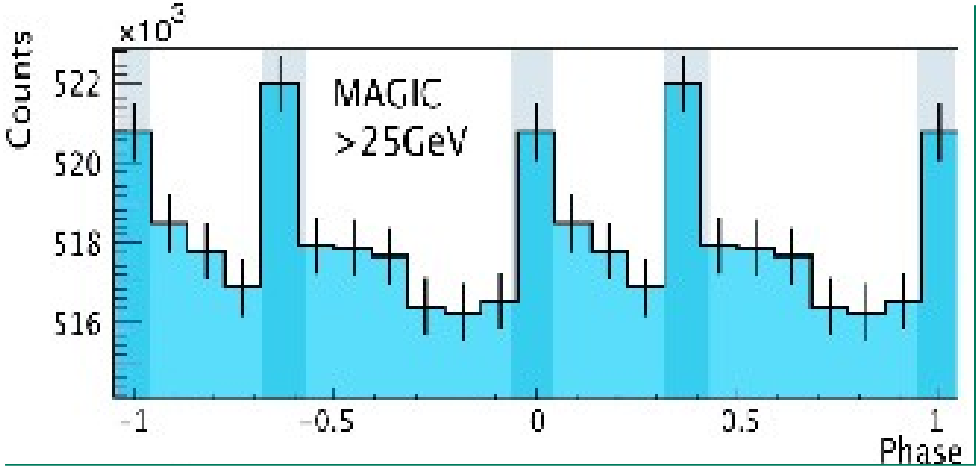
Parameter S21 (“Gain”)

MAGIC-I Sum-Trigger

- Start (Development): April 2007
- Fabrication and test: June – August 2007
- Installation in La Palma: September 2007
- Taking first data: October 2007

Reaching the lowest energy threshold (~25 GeV) ever achieved by any Cherenkov telescope up to date

Light curve of Crab pulsar (2008):

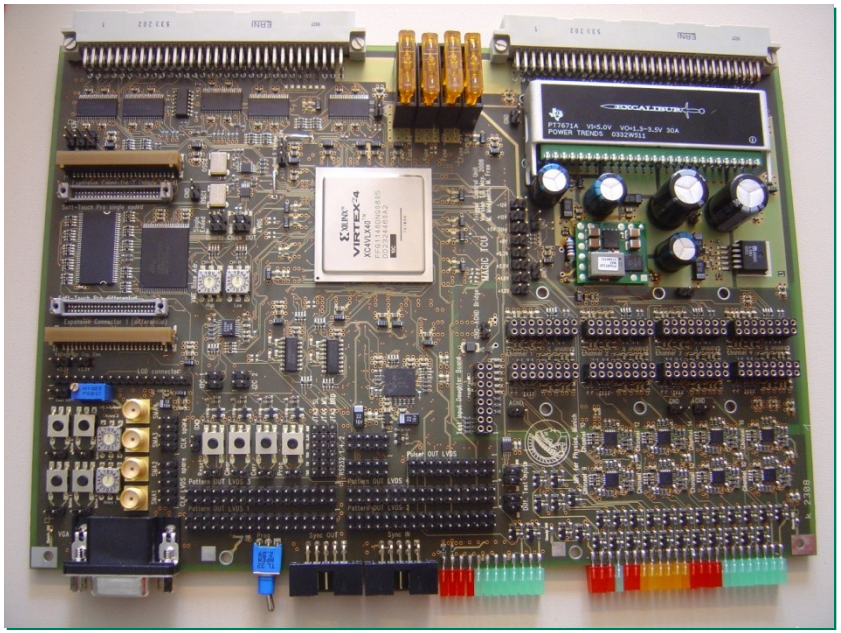


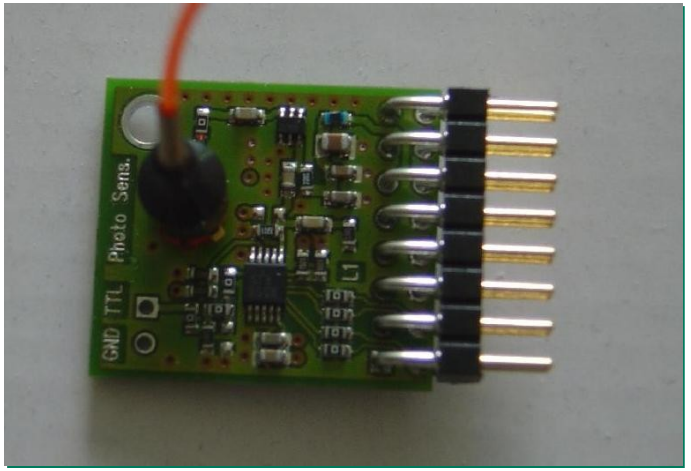
Additional MAGIC-II Development

Control system for calibration laser, test pulser, …

- FPGA: Xilinx Virtex-4 4VLX40FF1148
- 8 sockets for pulser daughter boards
- Pulse frequency: 0.023 Hz .. 50 MHz
- Pulse width: 10 ns .. 42.9 s
- Leading edge of the 16 pulses adjustable in steps of 11 ps
- 1 socket for pulse input daughter board with max. 2 input channels
- 2 x RS232 input, one on default front panel
- Connector to attach a 4x20 LCD
- Mezzanine board socket with 36 single ended signals and 19 differential
- Option for external clock for pulsers
- Option to cascade several boards
- VGA output

- board for optical link



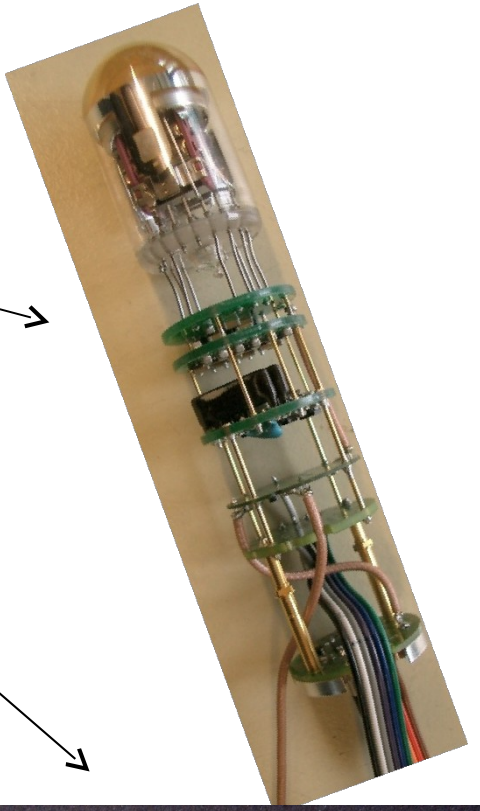


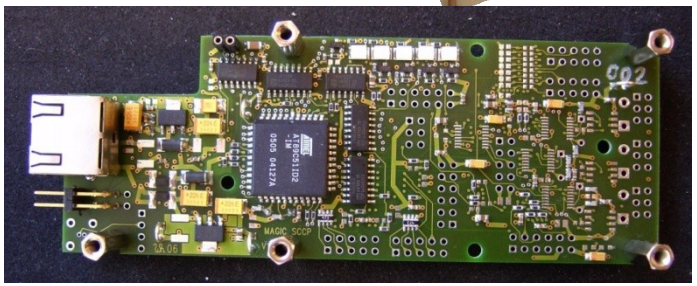
Production for MAGIC-II in 2008

- Production of pixel-boards
- Assembling the pixels
- Production of control boards (SCCP)
- Production of test pulser boards
- Test of all parts and the assembled pixels

- Assembling the clusters
- Testing the clusters (function , flatfielding, …)
- 169 clusters (+spares) are ready in October
- Shipped to La Palma in November
- Installing the clusters in only two weeks
- After installation the camera is “switched on” in only one week

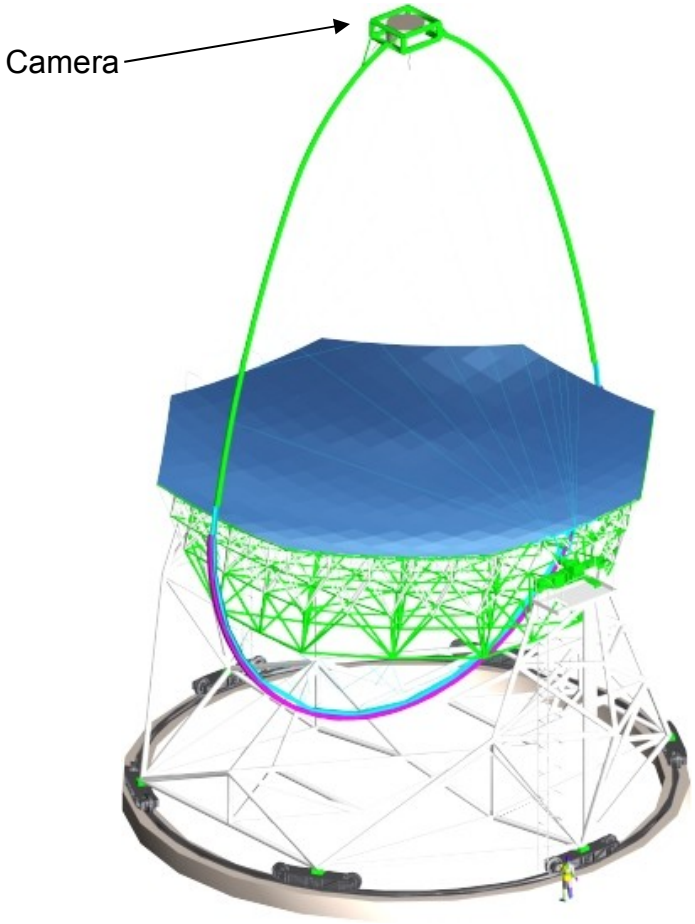
The installation is completed 3-4 months before the plan!





MAGIC-II Overview

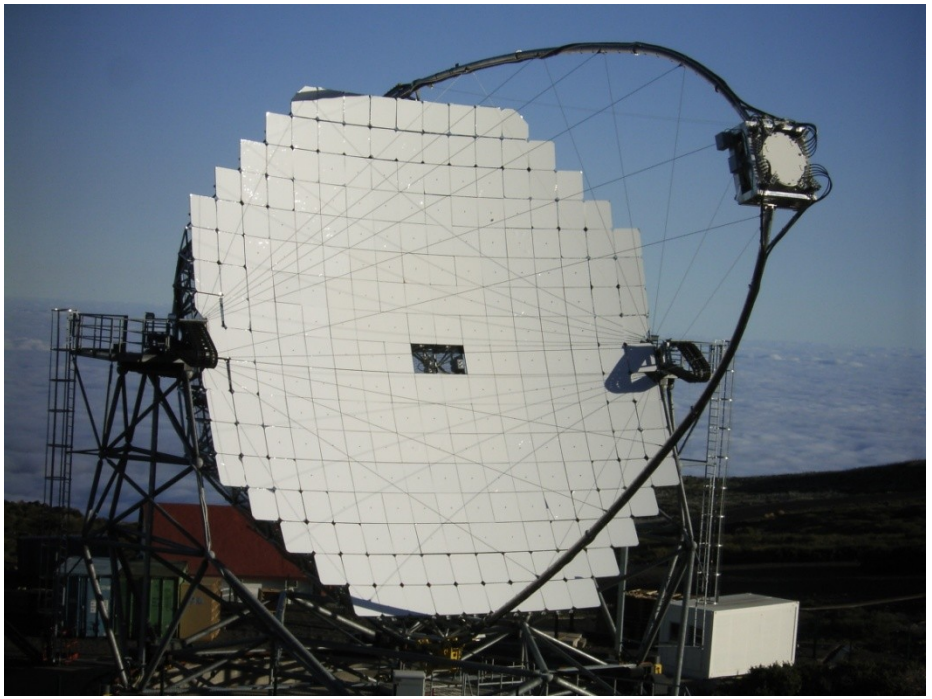
Situation 2007:



Main task:

- Development of camera electronics
  - Signal transmission system
  - Camera control system
  - Test signal generation
  - Power distribution

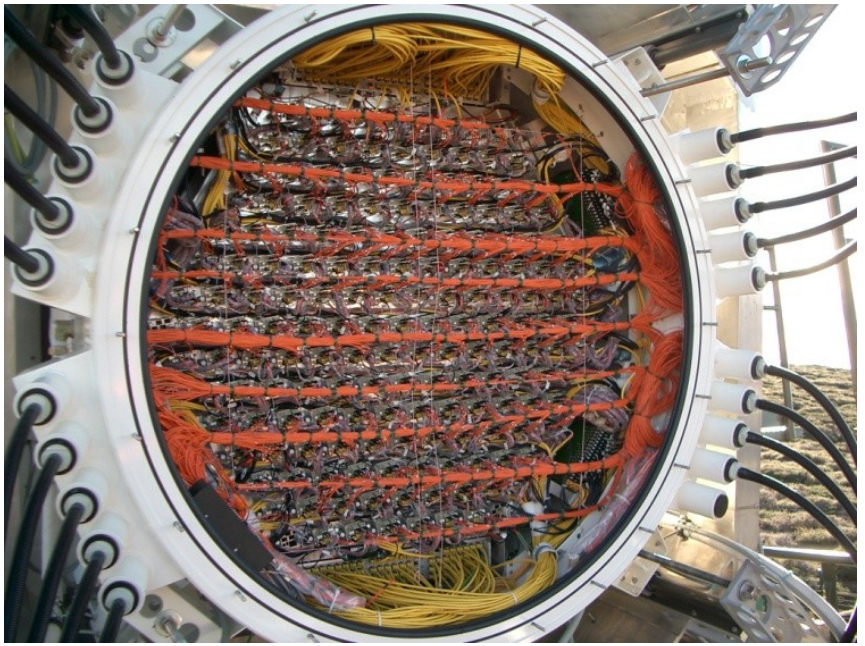
November 2008:



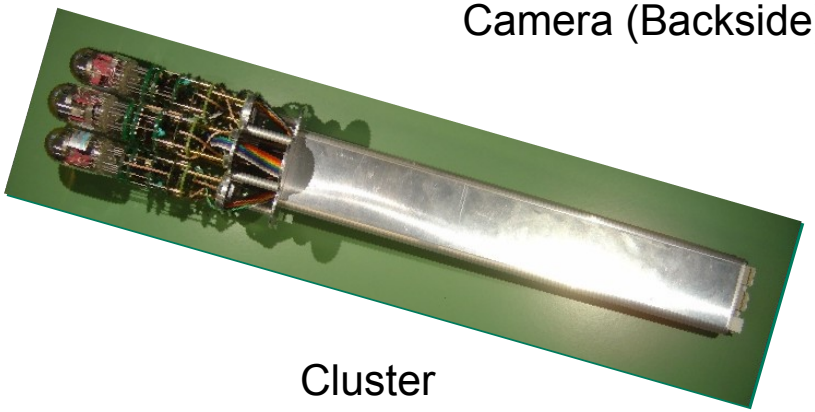
MAGIC-II Camera

- 1039 pixels
  (photomultipiers + signal transm.)
- 7 pixels are grouped into a cluster
- Each cluster has its own test
  pulse generation and control system

Camera (Frontside)

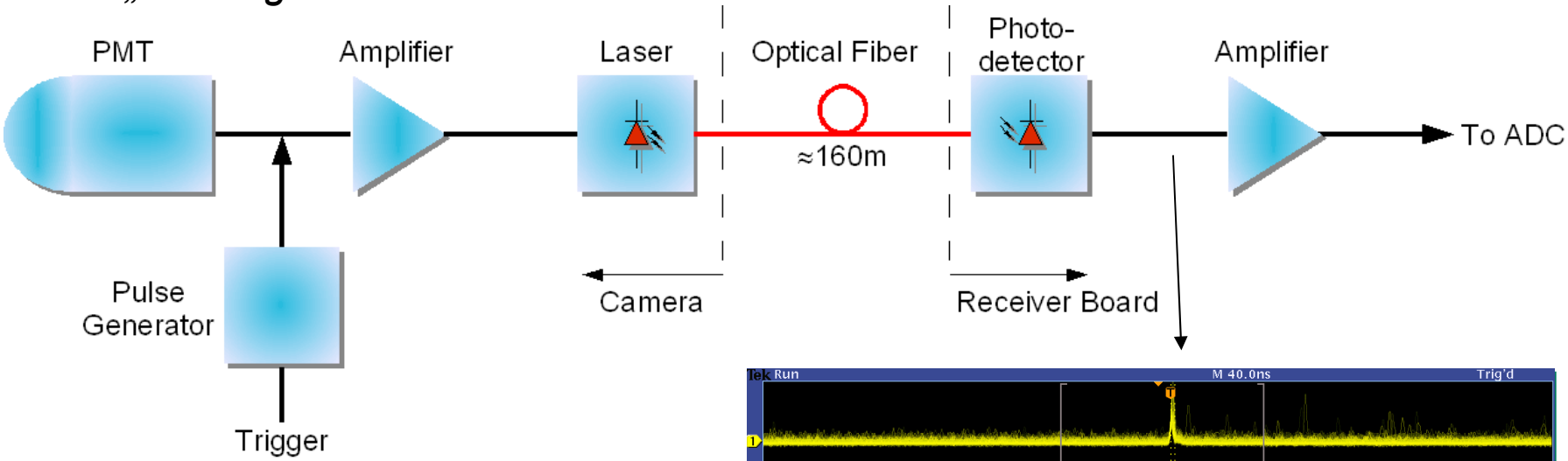


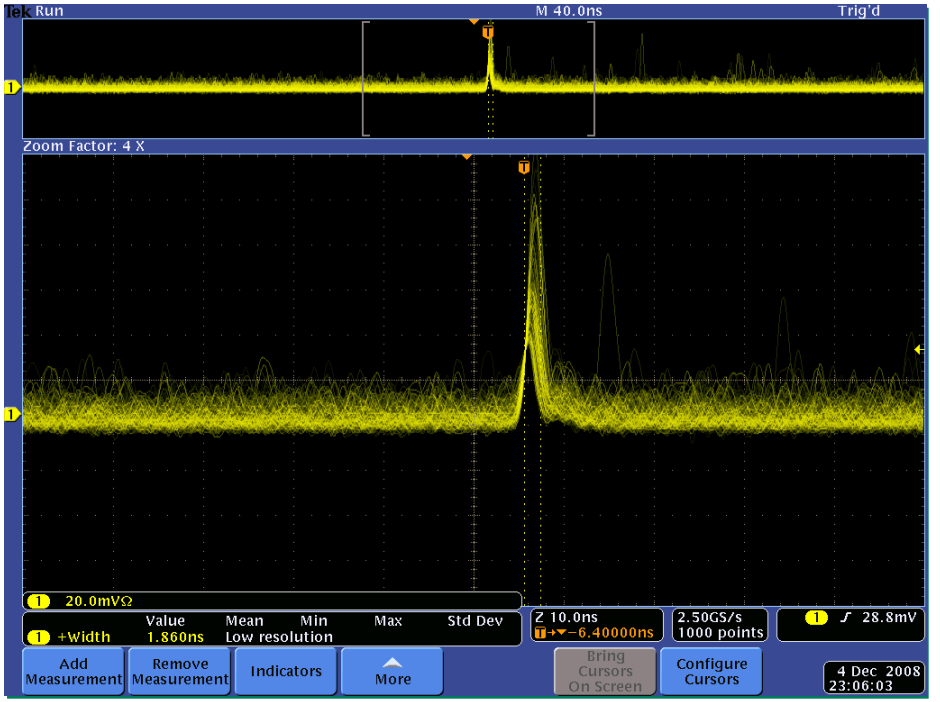
Camera (Backside)



Cluster

„First Light“





4. December 2008:

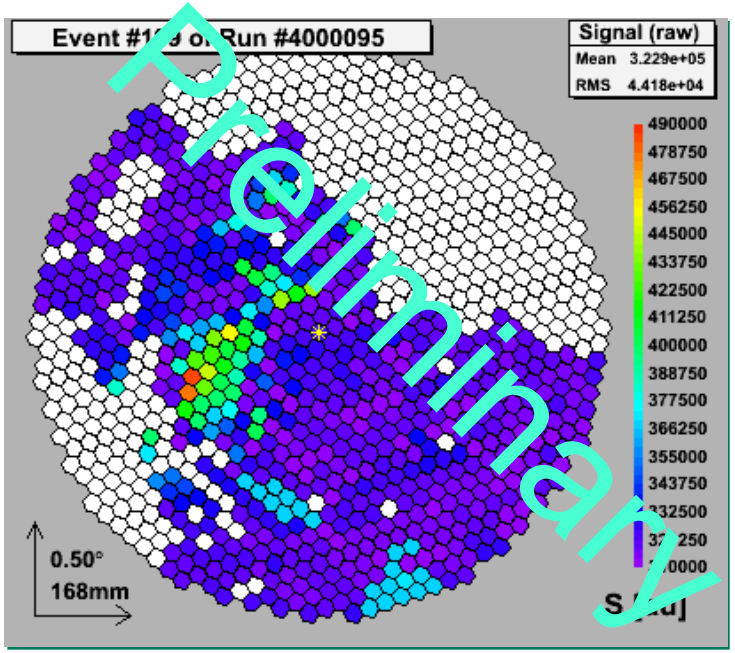
- First look to the night sky background
- Typical pulsewidth: 1.8ns

- Small coupling from VME-access at some outer ring pixels (Will be solved in spring 2009)

First Measurement

Excerpt from an e-mail received from La Palma (Juan Cortina , last week):

- Checked DCs for dark time (~1 uA, fine) and we saw stars drifting when pointing at zenith
- Introduced default HV settings based on measurements at MPI.
  They produce relatively flat anode DCs
- We have taken the first showers with MAGIC-II!



Thanks to all people making possible these nice results, especially the HEC-I crew and the MAGIC crew for their encouraged work to be ready in time.

Thank you very much
for your attention