Projects of the Electronics Division

Project Review 2007

Outlook

- Projects in 2007
- Status of Selected Projects
  - HEC-II
  - MAGIC-I Summing-Trigger
  - MAGIC-II Camera

Projects in 2007

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

- Additional Projects
  - Cresst (EP)
  - Gerda (EA, EE, EP)
  - H1 Jet-Trigger at DESY (EE)
  - ILC / SiPM (EE)
  - Muon Cooling (EP)
  - SCT (EA)
  - Support for the Semiconductor Laboratory (EP)

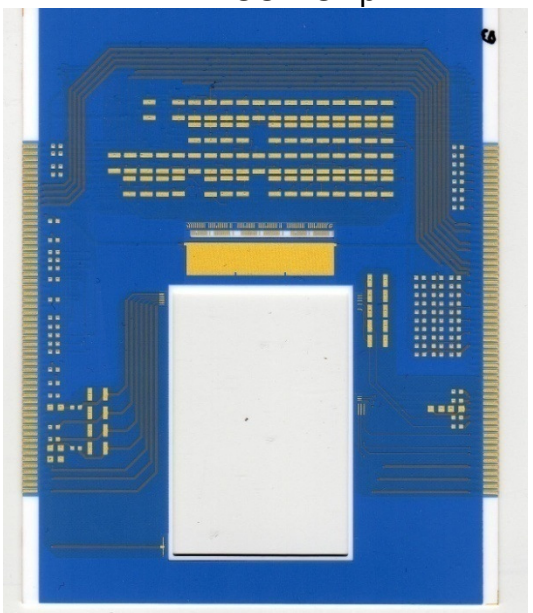
Group Naming

EA: Elektroanlagen

EE: Elektronik Entwicklung

EP: Elektronikproduktion

Ceramic Board for
HLL CCD-Chip



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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)

Some Specifications for the new Amplifier:

• Radiation Hardness	Neutrons	$1.5 \cdot 10^{15}$
	Protons	$2 \cdot 10^{12}$
	Gammas	50 kGy
• Power Consumption		< 250mW/Chip
• Dynamic Range		10^4
• Input Impedance		$50 \pm 2\ \Omega$
• Gain Variation		< 2%
• Xtalk		< 2%

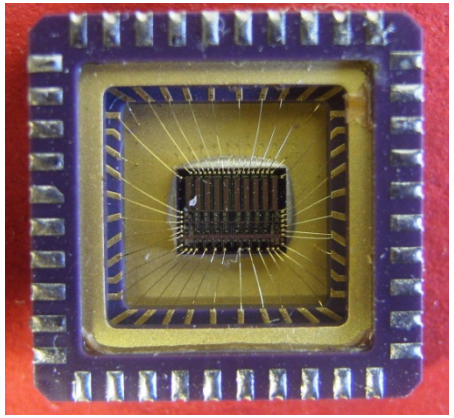
Project has started with two Technology Partners:

- Institute for Semiconductor Physics (Frankfurt/Oder) (SiGe)
- Triquint (GaAs)

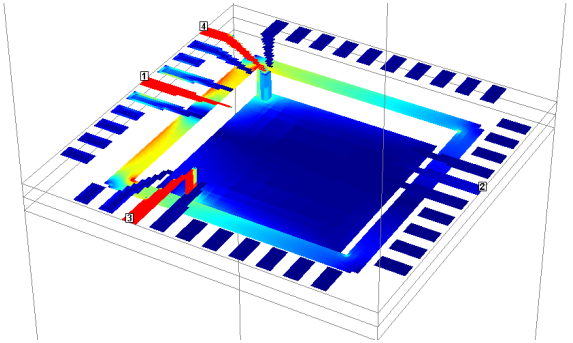
HEC-II / Some Simulations and Measurements

Chip of the
HEC-I Amplifier:

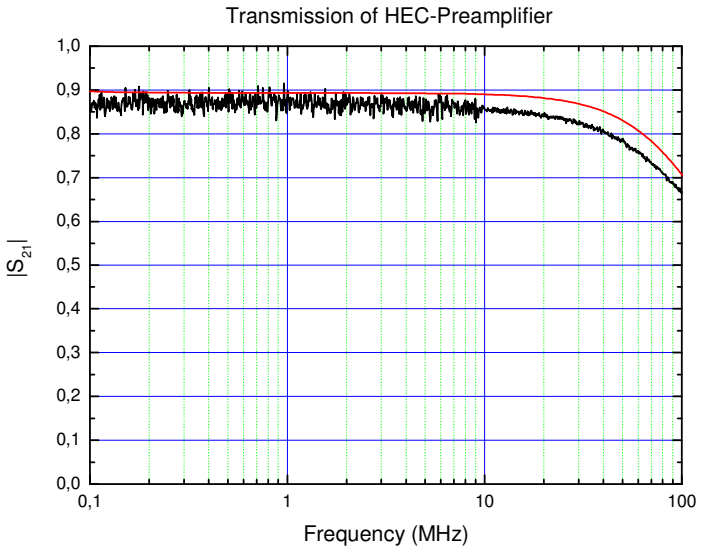
(Used as a
Reference)



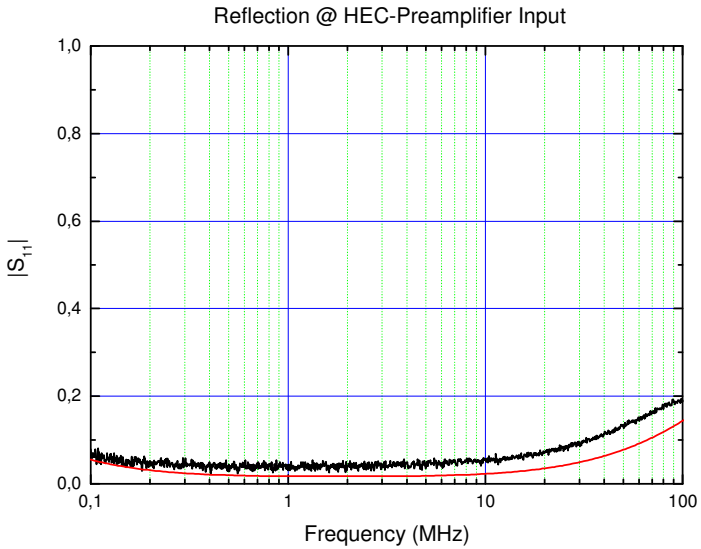
Simulation of
the Package:
Current Distribution
@140MHz



Behaviour of the HEC-I Chip with Package (@ Room Temperature):



Red: Simulation
Black: Measurement



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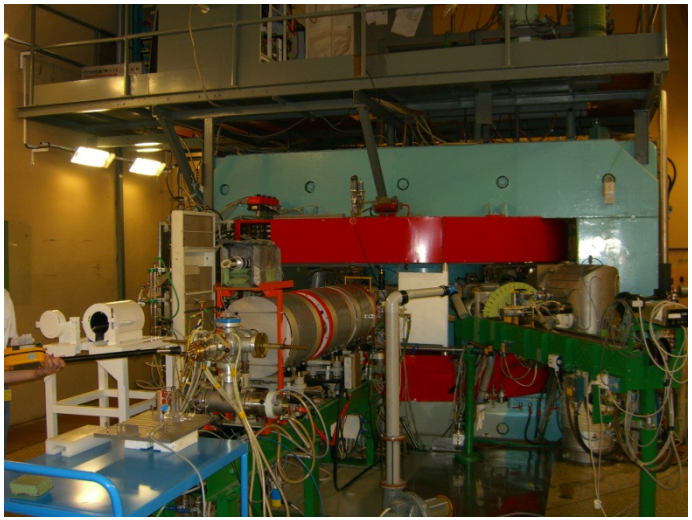
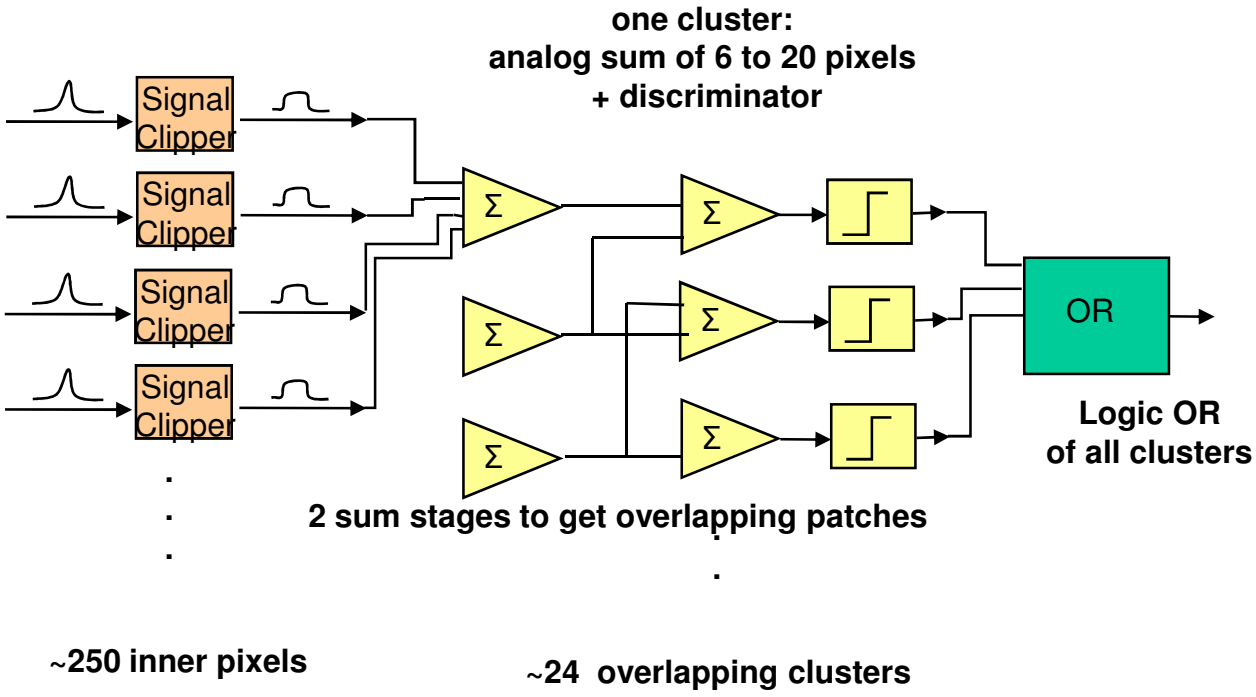
HEC-II / Radiation Test

- Now: Preparing the Setup for the Radiation Test
- Radiation Test at a Cyclotron in Rez (near Prague)
- Selecting the Technology from Results (SiGe or GaAs)
- Starting the Chip (Amplifier) Development



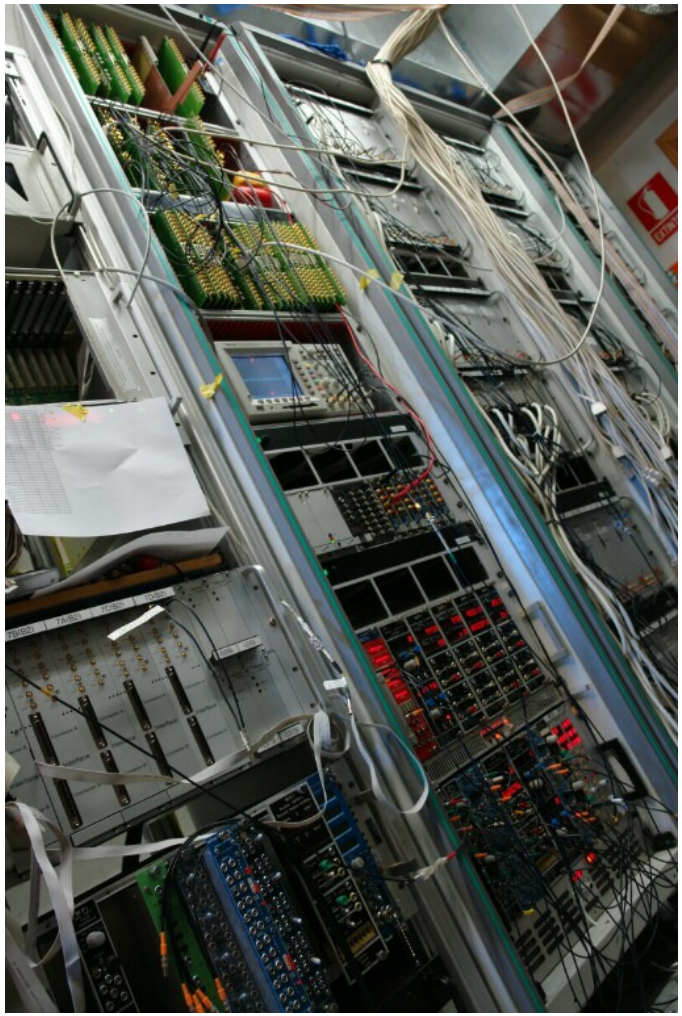
MAGIC-I Summing-Trigger / Principle

- Provide the smallest possible FWHM of the analog pulses
- Clip the analog signal at certain level to avoid big amplitudes from afterpulses
- Sum several clipped signals -summing patch. Showers will pile-up, low signals are not clipped !
- Overlap summing patches for uniform camera coverage.
- To issue a trigger: Apply thresholds to patches -not to individual pixels!



MAGIC-I Summing-Trigger / Realisation

- Start (Development): April 2007
- Fabrication and Test: June – August 2007
- Installation in La Palma: September 2007
- Taking First Data: October 2007



Some Specs:

- Bandwidth: 200 MHz (1ns risetime)
- Deadtime of Clipping Stage: 1.5 ns
- Input dynamic range: +-1.5 V

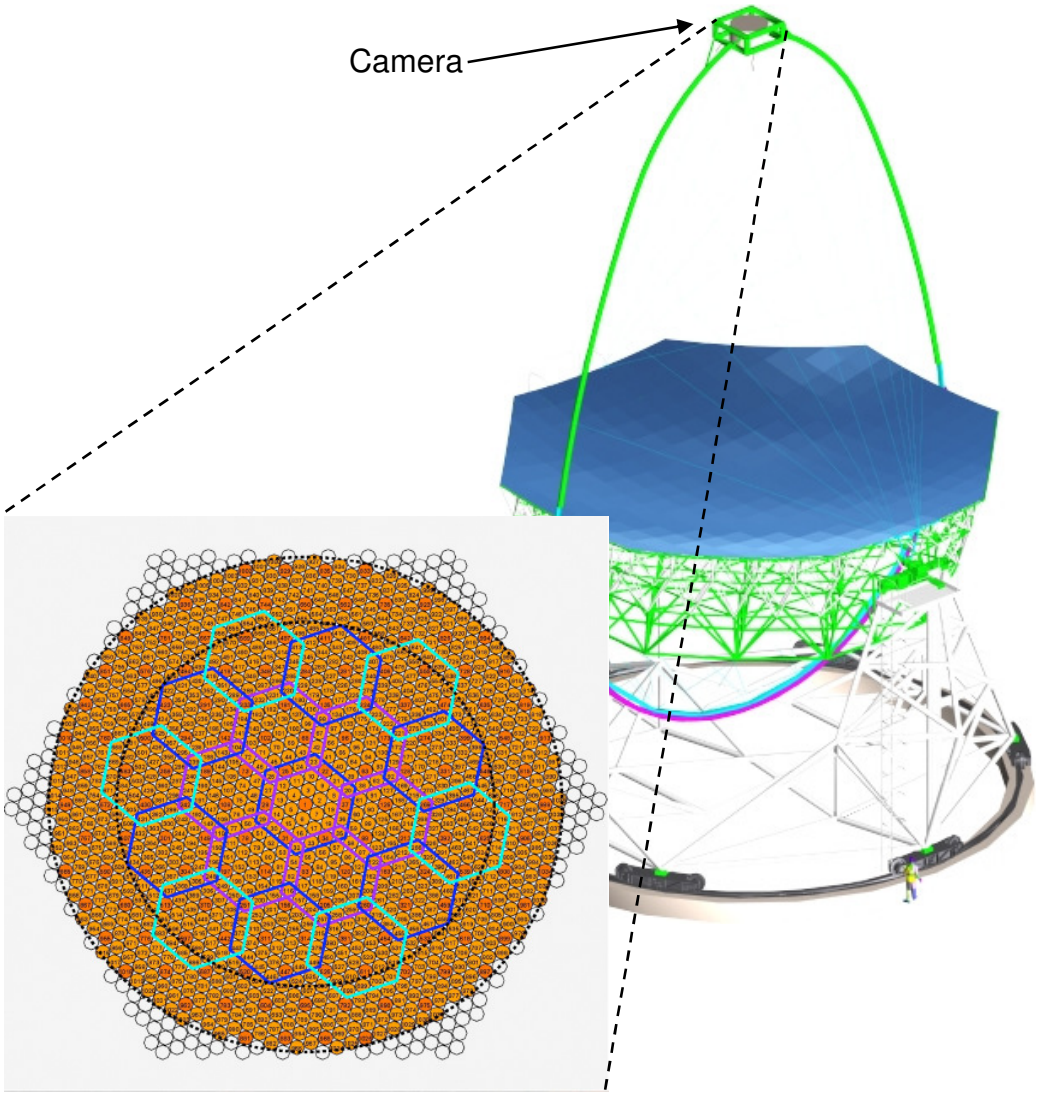
- Adjustable clipping level
- Adjustable Gain
- Differential input
- adjustable discriminator level

Input Signal 2.3 ns --> diskriminator input : 2.6 ns

MAGIC-II Overview

Main Task:

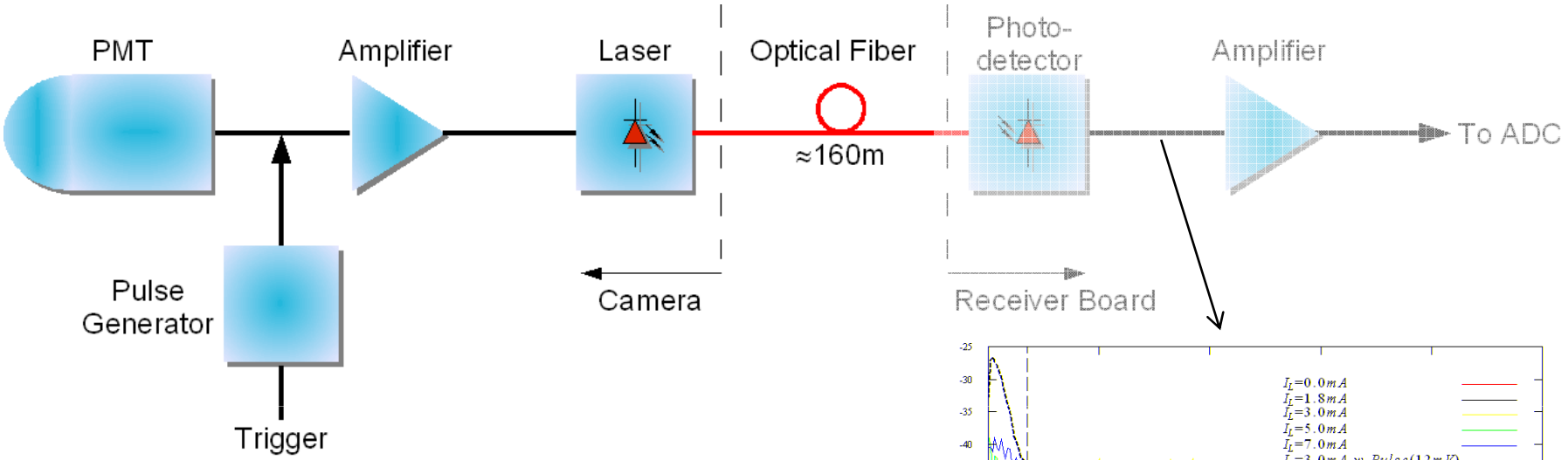
- Development of Camera Electronics
  - Signal Transmission System
  - Camera Control System
  - Test Signal Generation
  - Power Distribution

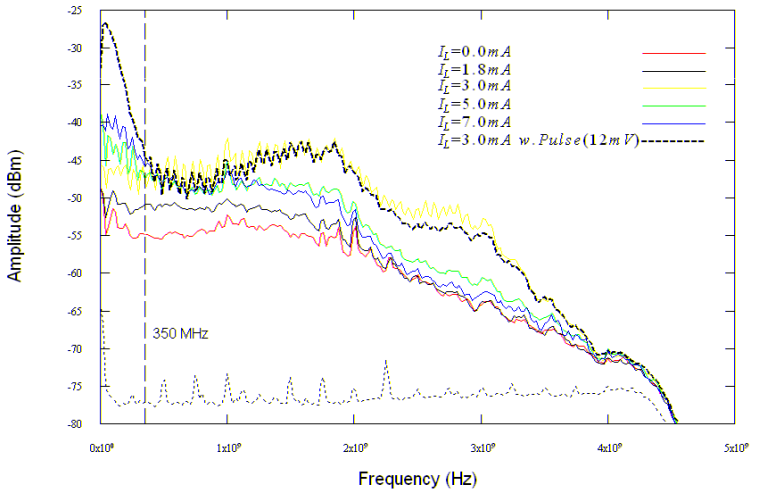


Camera:

- 1039 Pixels
  (Photomultipiers + Signal Transm.)
- 7 Pixels are grouped into a Cluster
- Each Cluster has its own Test Pulse Generation and Control System

MAGIC-II Signal Transmission

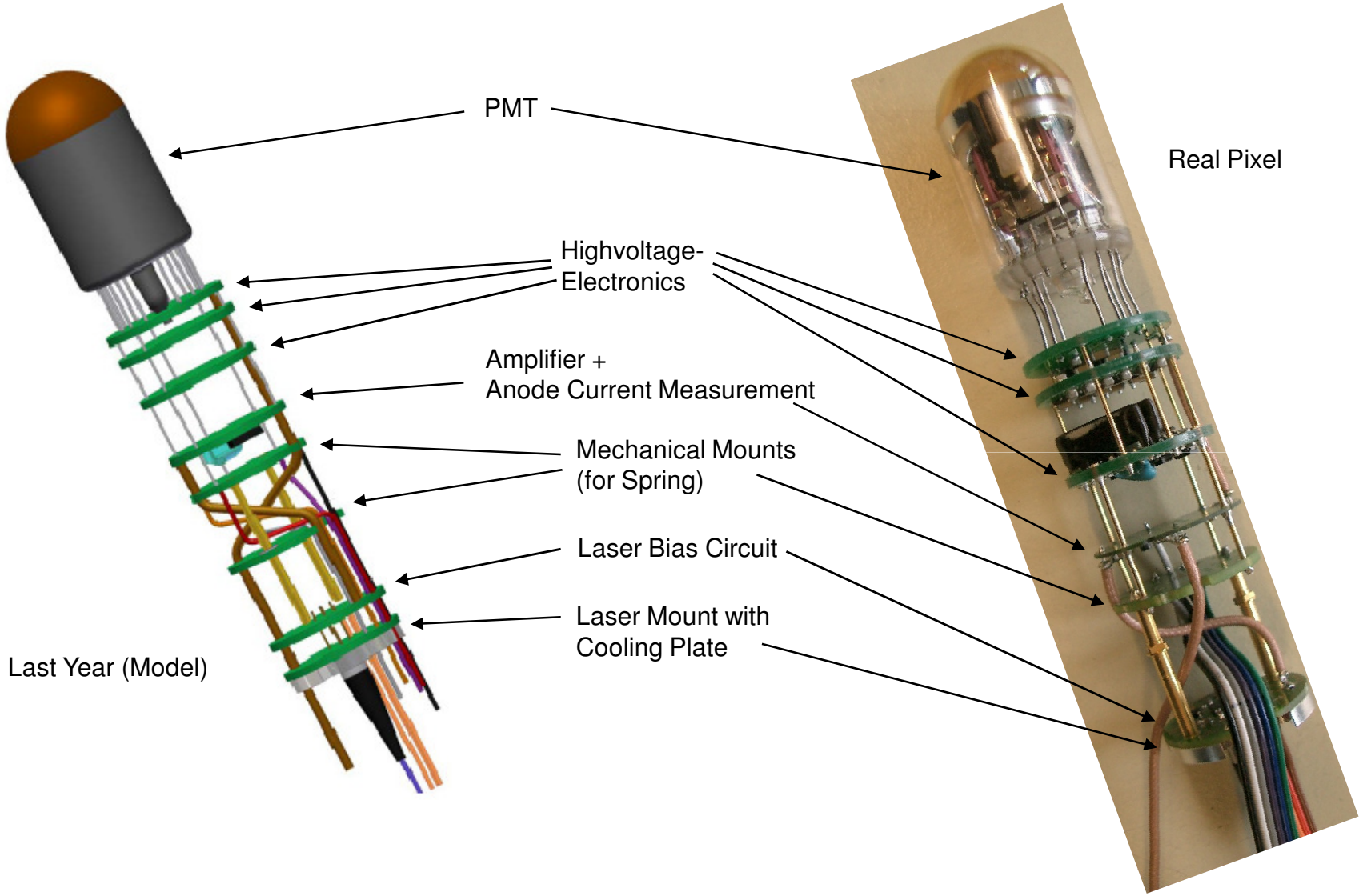




- High Dynamic Range: 60dB
- Low Noise for Single Photoelectron Resolution
- High Bandwidth for good Pulse Reconstruction
  (Possible better Hadron/Gamma Separation)

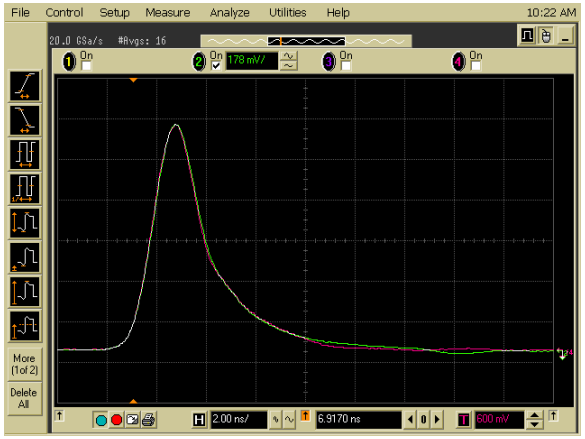
  Actual Bandwidth is approx. 700MHz (limited Bandwidth for Noise Reduction)

MAGIC-II Pixel

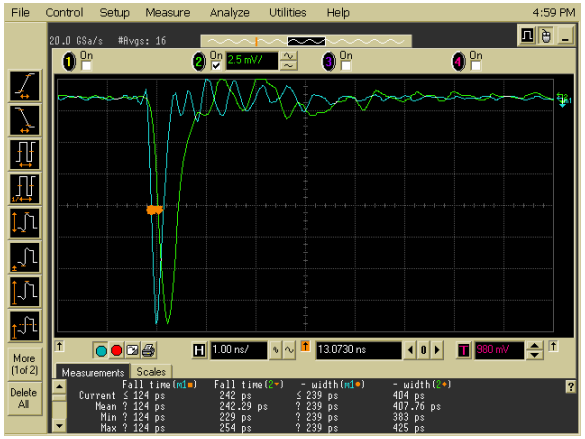


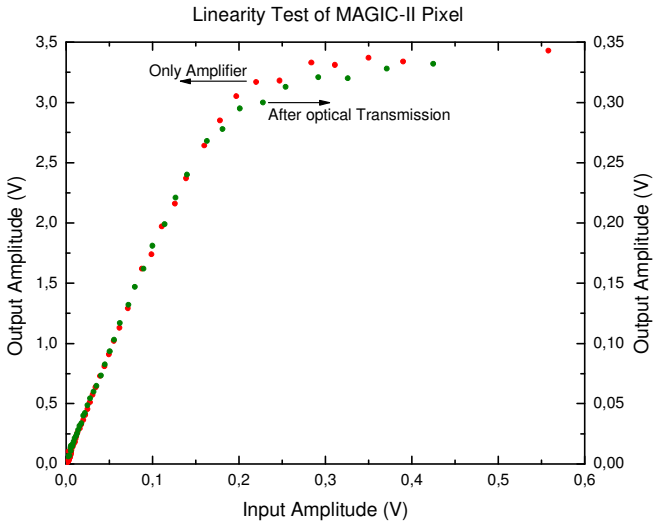
MAGIC-II Pixel / Electrical Characteristics

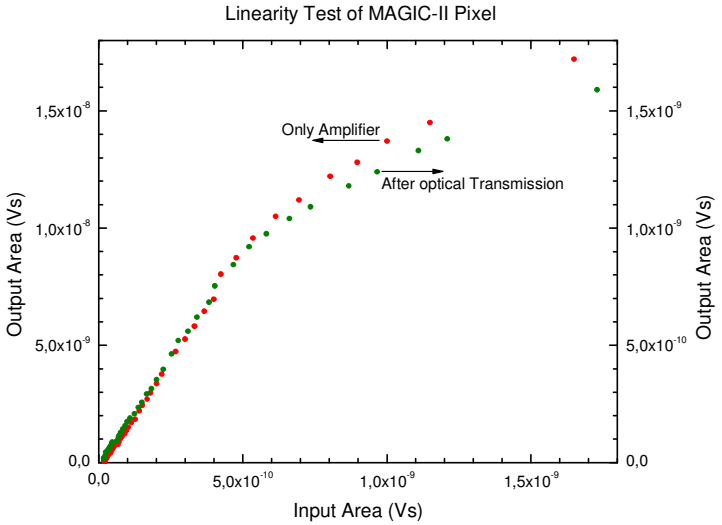
Amplifier Response to a 2.4 ns Pulse



Response of the Signal Chain to a Short Current Pulse







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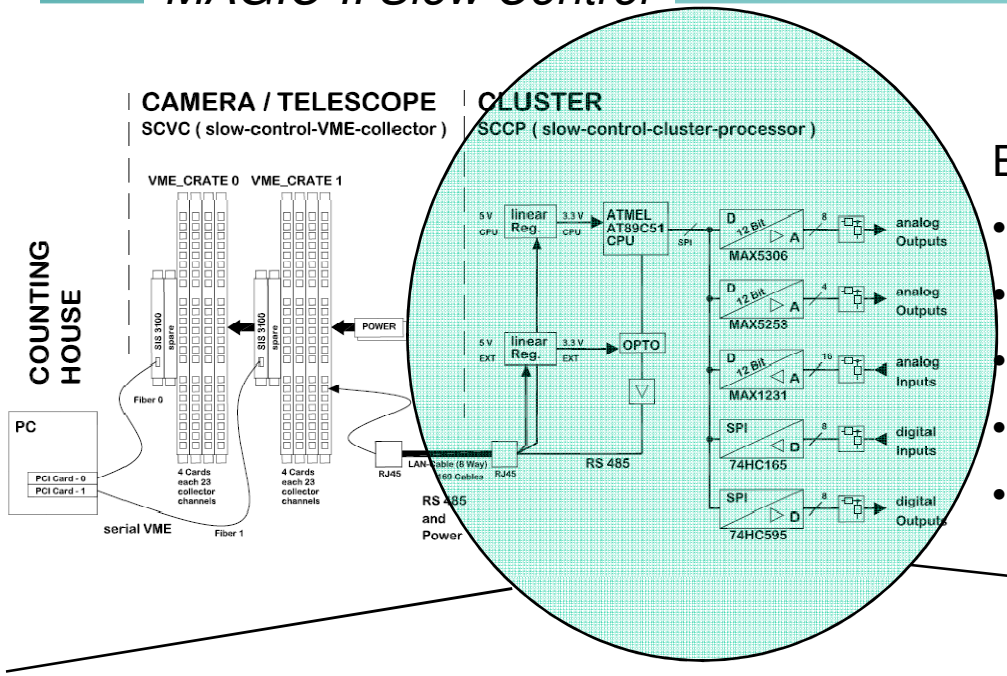
MAGIC-II Slow Control



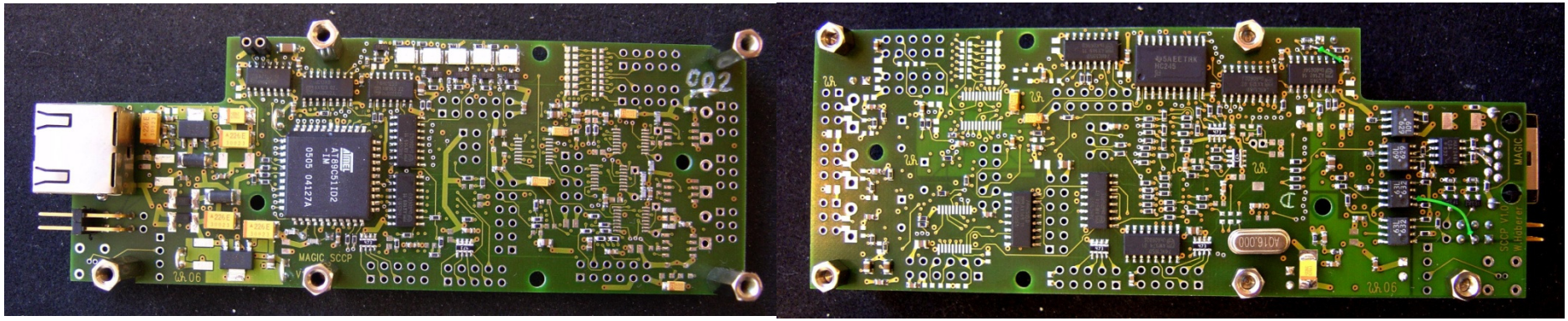
Each Cluster has its own Microcontroller for

- High Voltage Setting
- Laser Bias Setting
- PMT Anode Current Measurement
- Temperature Measurement
- Test Pulse Control (Level Setting)

Top View

Size: 48mm x 170mm

Bottom View



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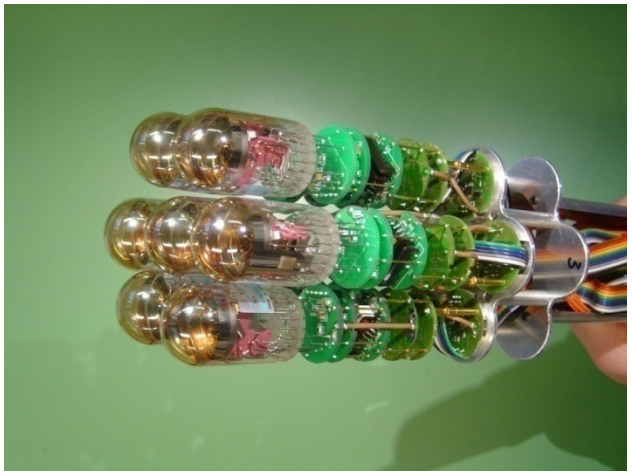
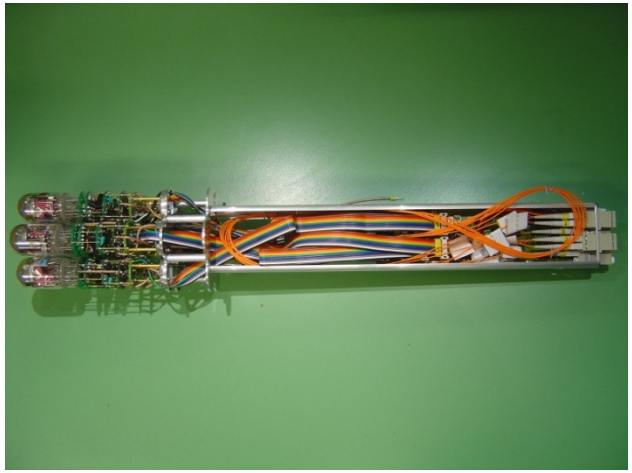
MAGIC-II Cluster / Some Impressions

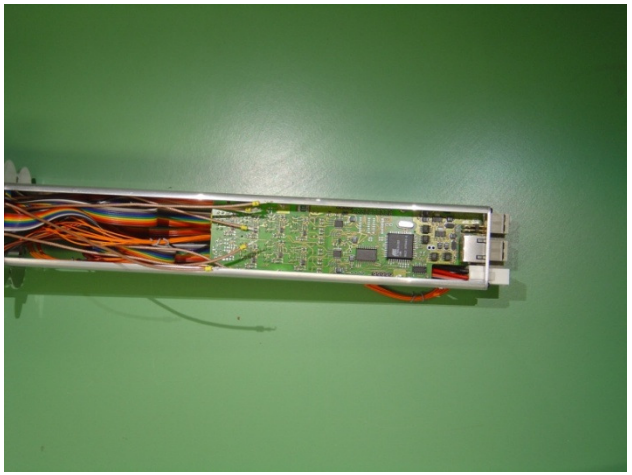
7 Pixels @ Top of a Cluster



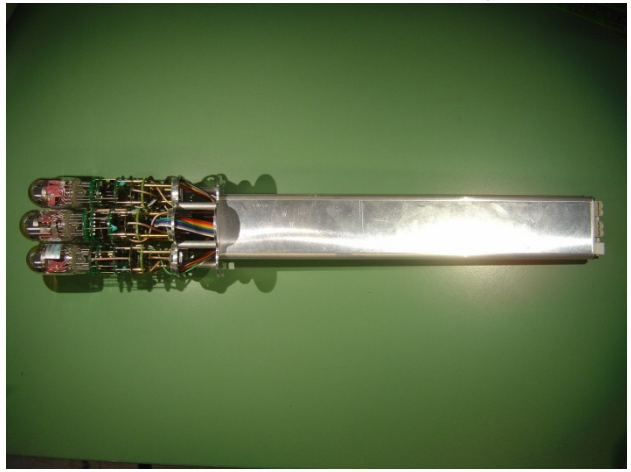
Open Cluster with Cabeling



Slow Control and Fiber Connectors



Cluster (Closed Body)



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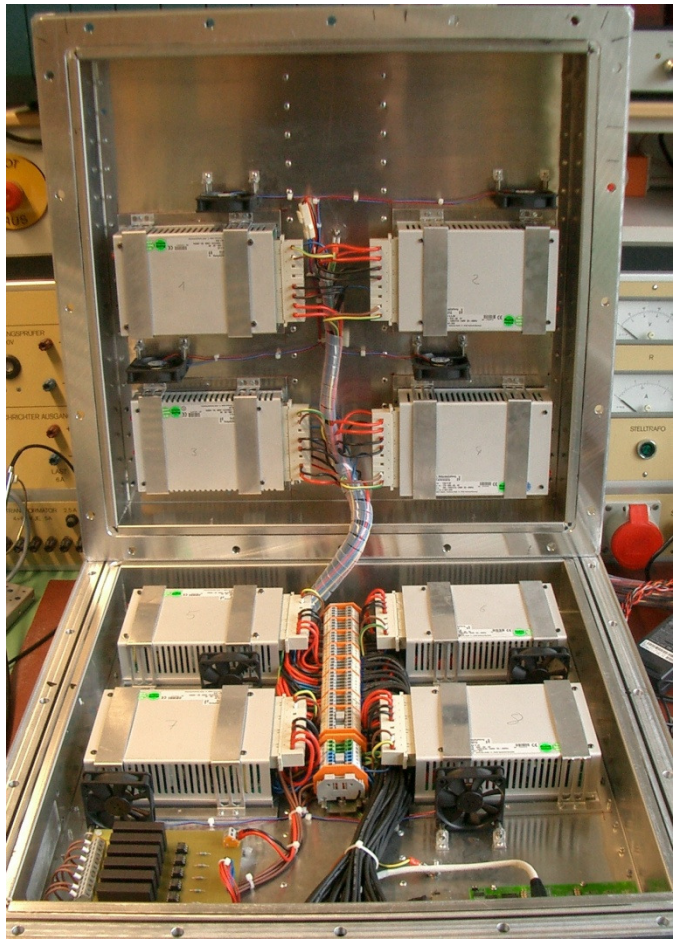
MAGIC-II Camera Support Systems

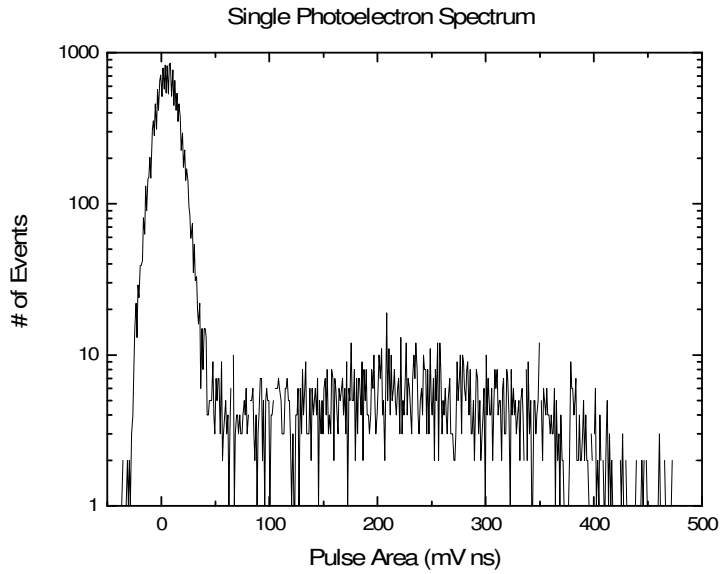
Low Noise Power Supply (5V)



Shutter Control System

MAGIC-II Cluster / Some Specs

- Cluster: 7 Pixels + 1 Slow Control + 1 Test Pulser
- Bandwidth ~ 1 GHz (700 MHz after Reduction)
- Time Resolution < 500 ps
- Noise Figure ~ 4 dB
- Dynamic Range ~ 60 dB
- Pixel-Crosstalk: ~ 1%
- Single Photoelectron Resolution @ PMT-Gain = 20000



Thank You Very Much
for Your Attention