



# Report of the Electronics Division

Project Review 2011



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





# Outline

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- Projects in 2011
- Manpower
  - Distribution in 2011
  - Requests for 2012/13
- Future demands for the electronics division (ED)
- Status of some selected projects
  - Contribution of electronics division
  - Impressions in pictures





# Projects in 2011

- Main Projects

- ATLAS HEC front-end development (EA, EE)
- ATLAS HEC low voltage (EA, EE)
- ATLAS MDT electronics upgrade for sLHC (EE, EP)
- ATLAS MDT small tubes and chamber (EA, EP)
- MAGIC-I camera upgrade (EA, EE, EP)
- MAGIC calibration system (EE)
- MAGIC sum trigger (EE, EP)

- Minor Projects

- ATLAS SCT (EP)
- Belle-II (EP)
- CRESST (EA, EE, EP)
- CTA (EE)
- GERDA (EA)

Groups

EA: Elektronikanlagen

EE: Elektronikentwicklung

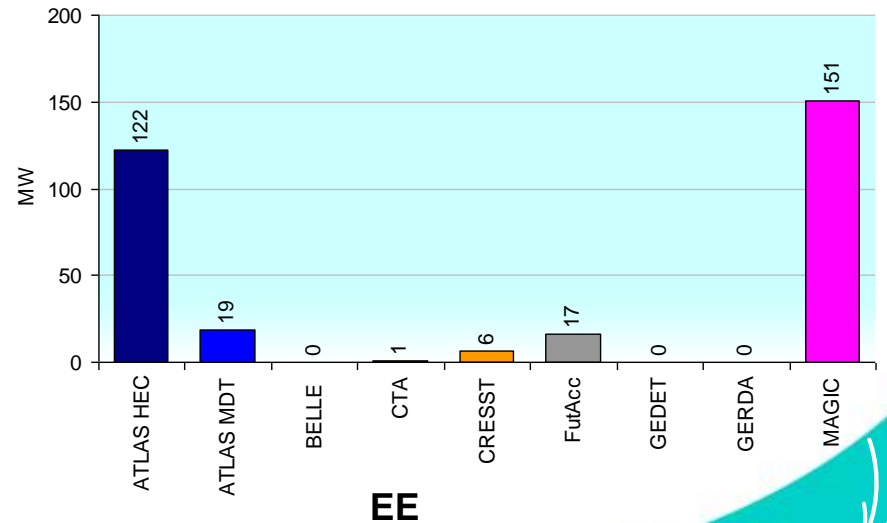
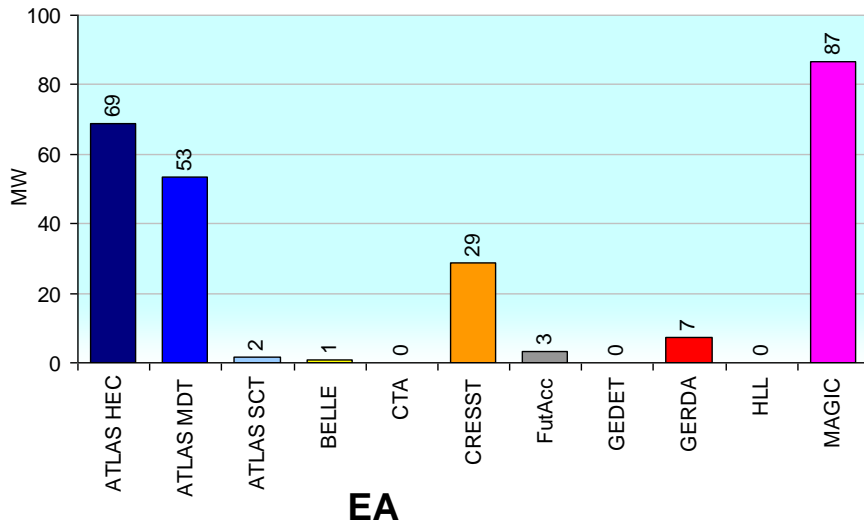
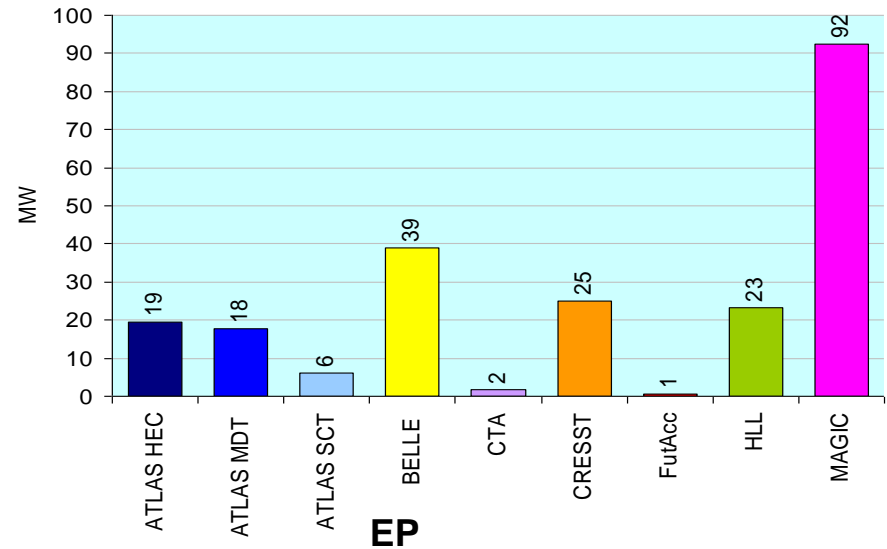
EP: Elektronikproduktion





# Work of Individual Groups in 2011

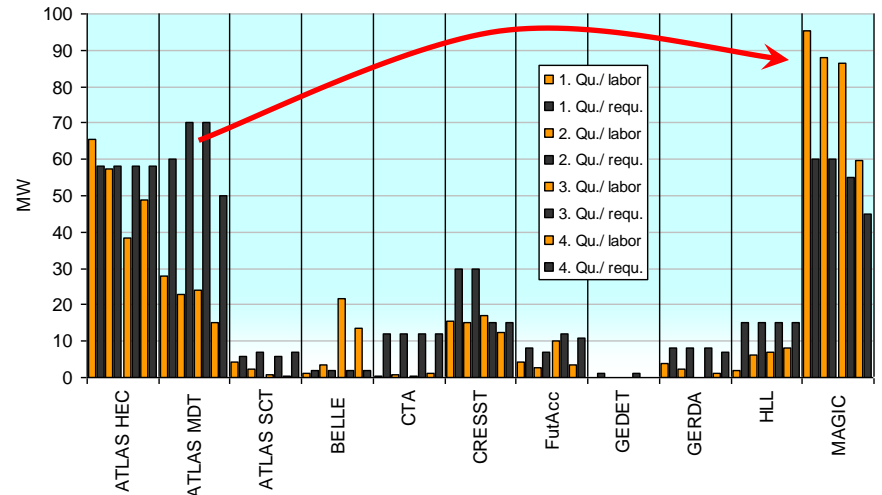
- January – November in MW (man-week)
- Assumption: 10 MW per quarter and person



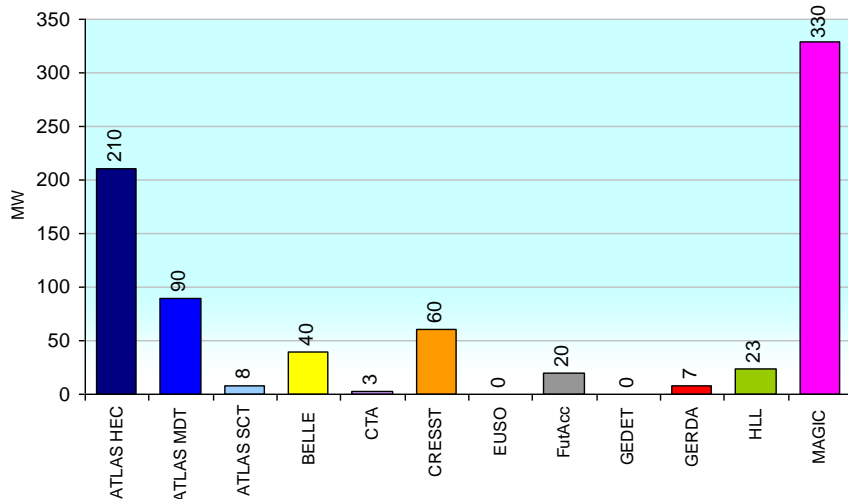


# Comparison of Work & Request 2011

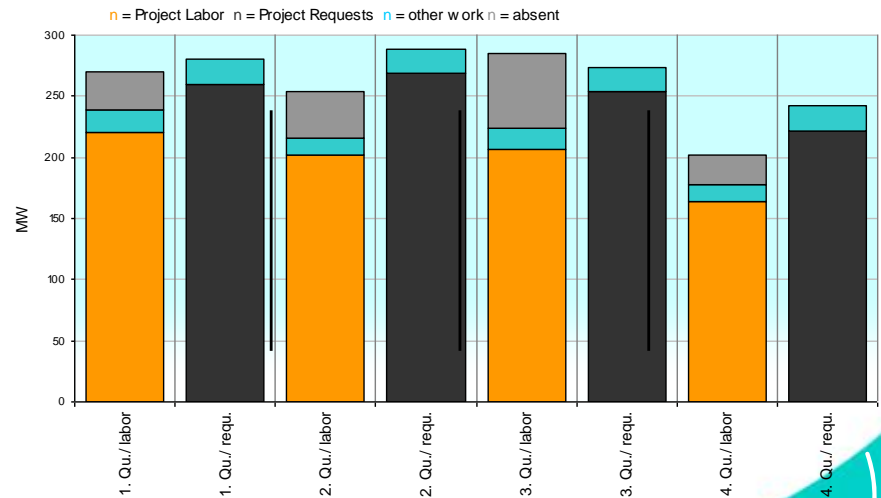
- January – November in MW (man-week)
- December is missing => lower bars for 4th quarter
- Shift of manpower from ATLAS MDT to MAGIC



Actual work vs. request (projects)



Total work of EA, EE, EP

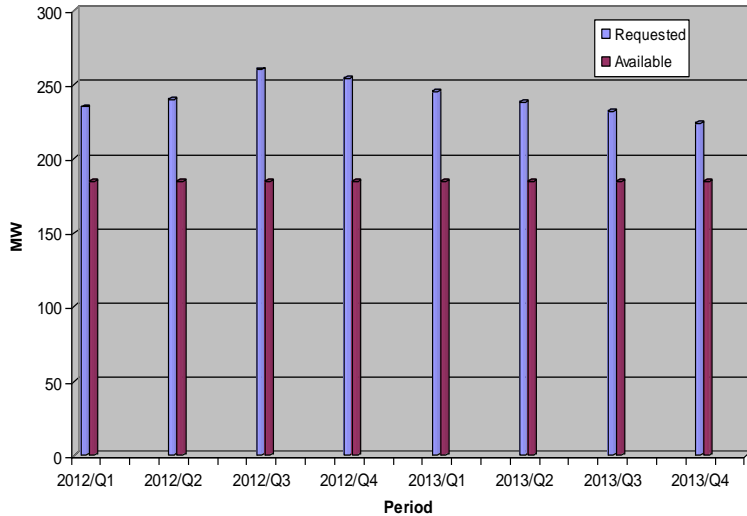


Actual work vs. request (total)

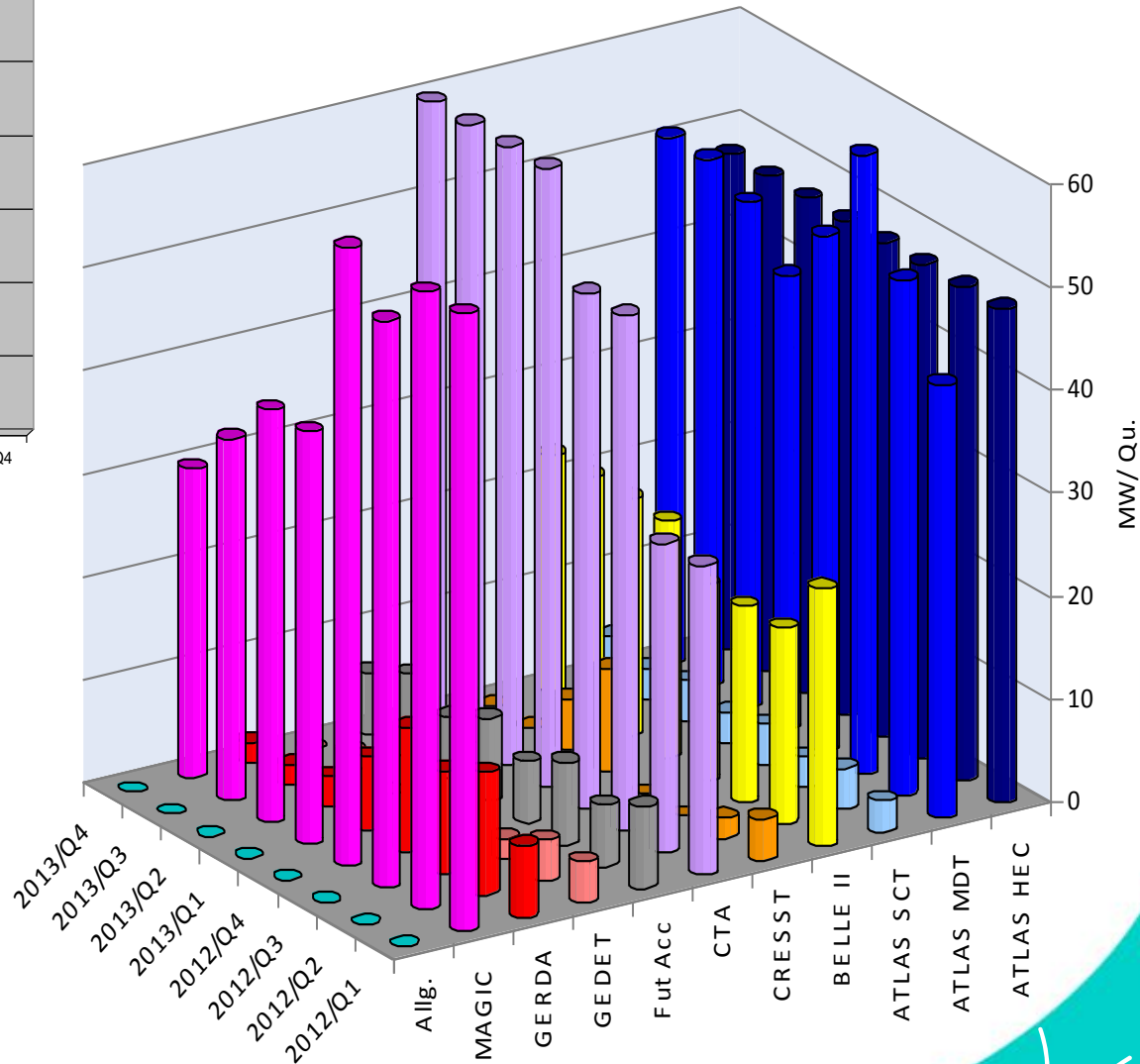




# Requests for 2012/13



- Biggest projects in 2012/13:
  - MAGIC / CTA
  - ATLAS MDT
    - small chambers
    - new front-end electronics
  - ATLAS HEC
    - ASIC design & test
    - High-reliable LV system
  - Belle-II
- Demands are larger than available resources!





# Requests for 2012

Projekt	2012/Q1			2012/Q2			2012/Q3			2012/Q4		
	EE	EA	EP	EE	EA	EP	EE	EA	EP	EE	EA	EP
ATLAS HEC	38	10		38	10		38	10		38	10	
ATLAS MDT	25	10	7	25	18	7	25	28	7	25	18	7
ATLAS SCT		1	2		2	2		1	2		2	2
BELLE II	4	10	11	4	4	11	4	4	11	4	4	11
CRESST		4			2							
CTA	10	10	10	10	10	10	10	20	20	10	20	20
EUSO												
Fut Acc	6	1	1	3	2	1	6	1	1	3	2	1
GEDET	4			4			2			2		
GERDA	5	2		5	5	2	2	8		2	8	2
HLL			4			5			5			3
MAGIC	20	25	15	20	25	15	20	20	15	20	20	20
General												
<b>Sum</b>	<b>112</b>	<b>73</b>	<b>50</b>	<b>109</b>	<b>78</b>	<b>53</b>	<b>107</b>	<b>92</b>	<b>61</b>	<b>104</b>	<b>84</b>	<b>66</b>
Available MW's (permanent)	45	55	50	45	55	50	45	55	50	45	55	50
Available MW's (fixed-term)	35	0	0	35	0	0	35	0	0	35	0	0
<b>Verfügbare MW's Gesamt</b>	<b>80</b>	<b>55</b>	<b>50</b>	<b>80</b>	<b>55</b>	<b>50</b>	<b>80</b>	<b>55</b>	<b>50</b>	<b>80</b>	<b>55</b>	<b>50</b>
Difference Available – Request	-32	-18	0	-29	-23	-3	-27	-37	-11	-24	-29	-16
Work Load (%)	140	133	100	136	142	106	134	167	122	130	153	132





# Future Focus of the Electronics Division

- Wide field of special electronics topics already covered:
  - High voltage
  - Low-power
  - Radiation-hard technologies
  - Low temperature
  - Digital data transfer + processing
- Strategy meetings with all project leaders to determine their actual and future demands. Results:
  - ASIC development (ATLAS)
  - Improvement of machinery of the production group (AVT: Aufbau- und Verbindungstechnik = assembly and bonding technology)
  - ... and all the currently supported technologies!
- ASIC design software already available: Cadence IC suite, Agilent ADS, Synopsys tools







# Project Overview and Impressions

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## Selection of prominent work

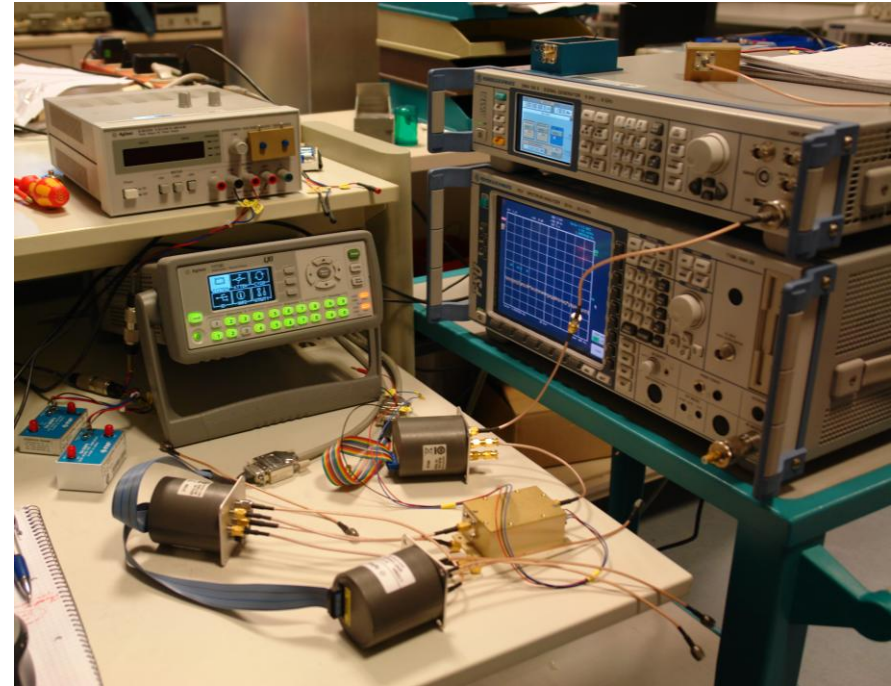
- ATLAS HEC
- ATLAS MDT
- Belle-II Pixel-Detector
- CRESST
- CTA Site Search
- MAGIC





# ATLAS HEC: Measurement Setup

- Mobile setup for radiation tests
  - 62 channels => 31 devices
  - S-parameter measurement
  - Gummel-plots



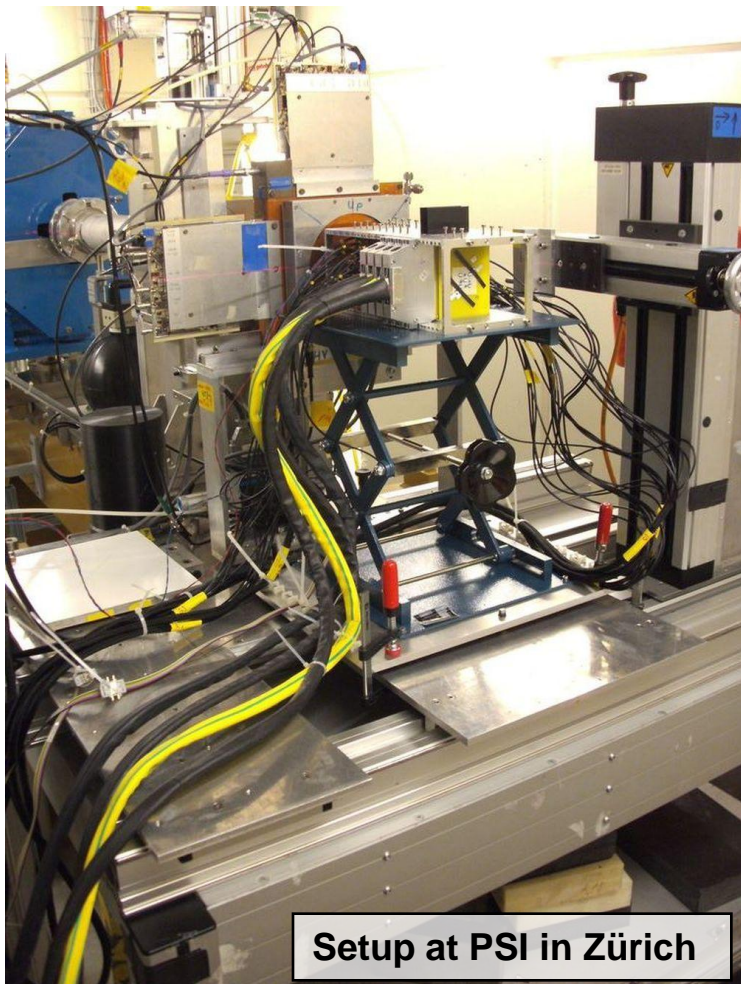
- Noise measurement setup
  - Low, middle and high frequency range
  - Software development for automatic measurement ongoing



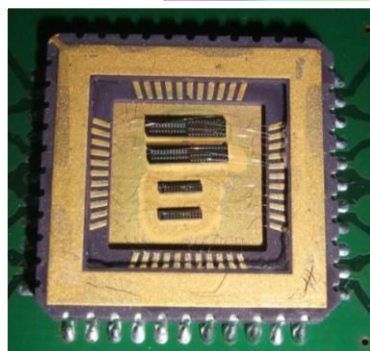
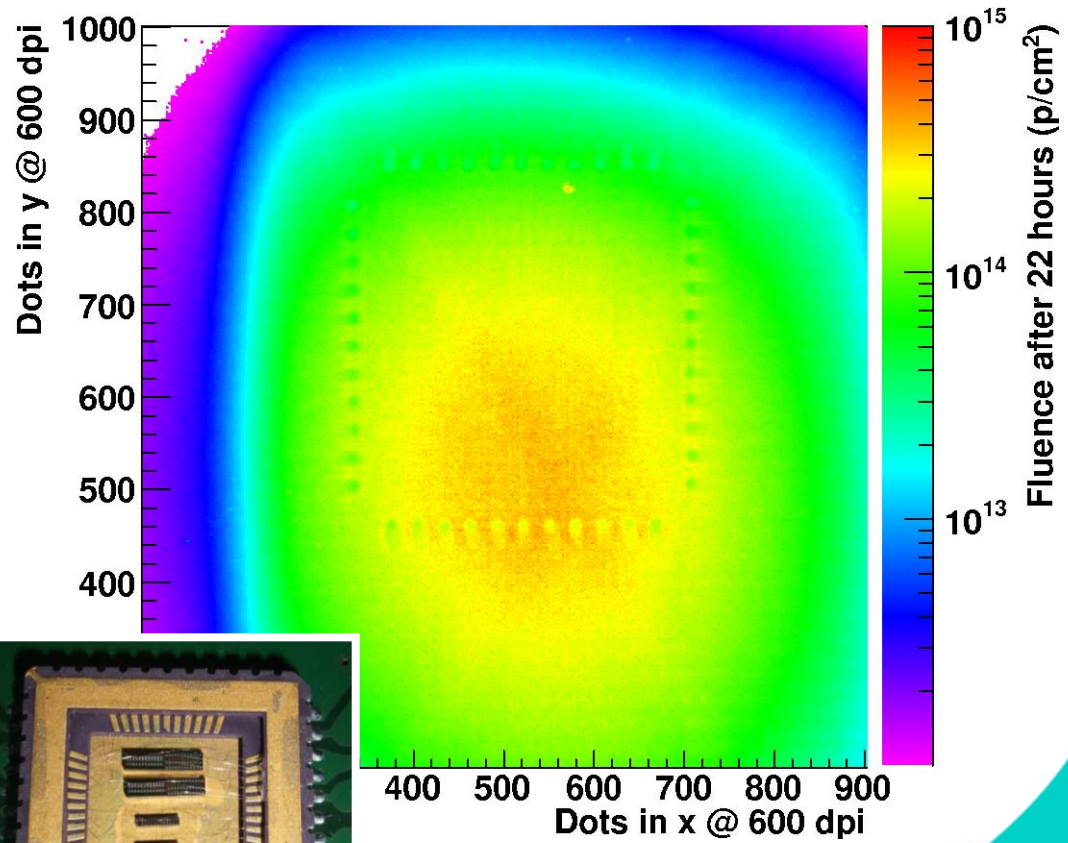


# ATLAS HEC: Proton Radiation Test

- Transistors (IBM + IHP) for new cold pre-amplifier and current chip (BB96)
- Digital components (PAL16R8, PAL16L8) for rad-hard low voltage supply



Setup at PSI in Zürich



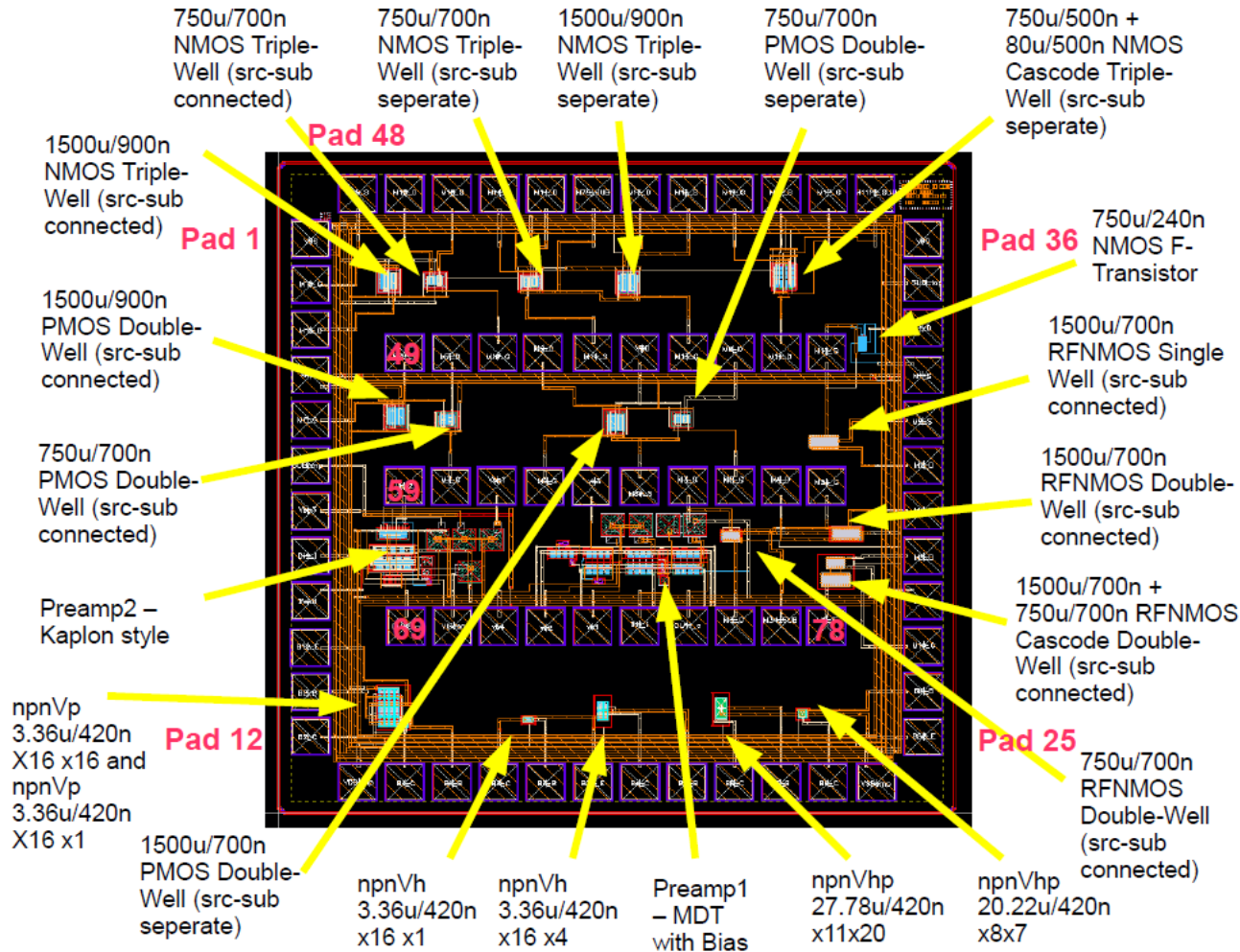
Proton Beam, E = 200 MeV  
TID = 260 kGy





# ATLAS HEC: New Pre-Amp Test-ASIC

- Process: IHP 0.25u SGB25V 5M (SiGe)
- Contains various transistors, two amplifier circuits, and two cascodes



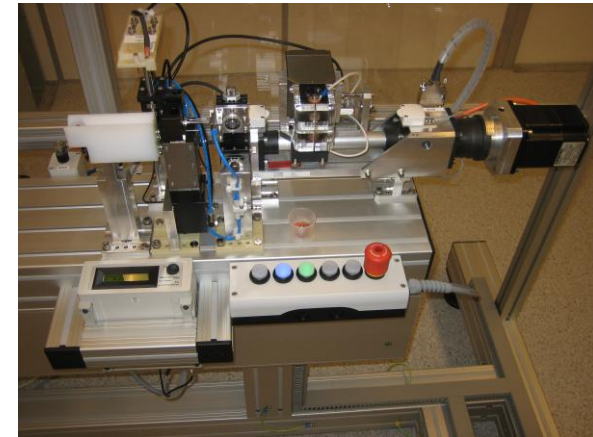
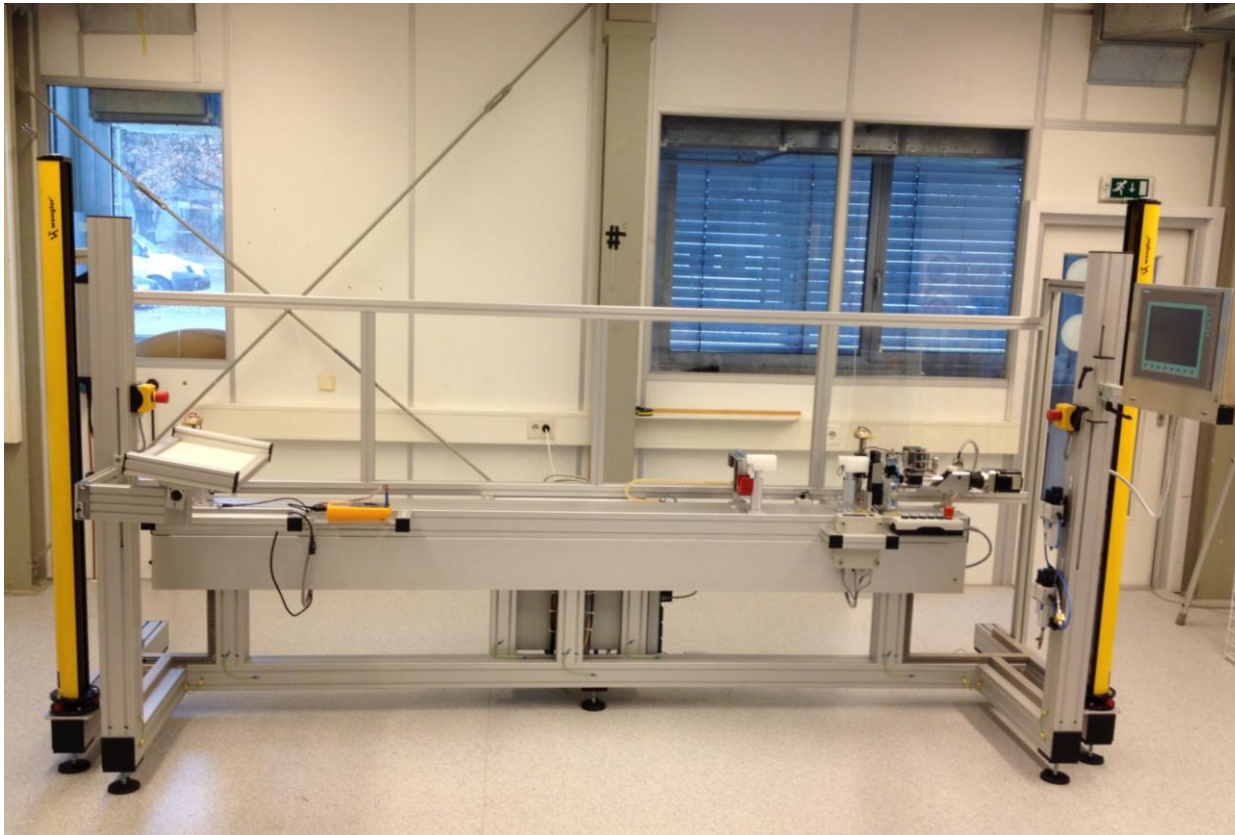
- Size: 2.1 x 2.1 mm<sup>2</sup>
- Supply: 2.5 V
- Chips received in May
- Tests to be done 2012:
  - DC
  - AC
  - Noise
  - Cold
  - Radiation





# ATLAS MDT: Small Tubes ( $\phi$ 15 mm)

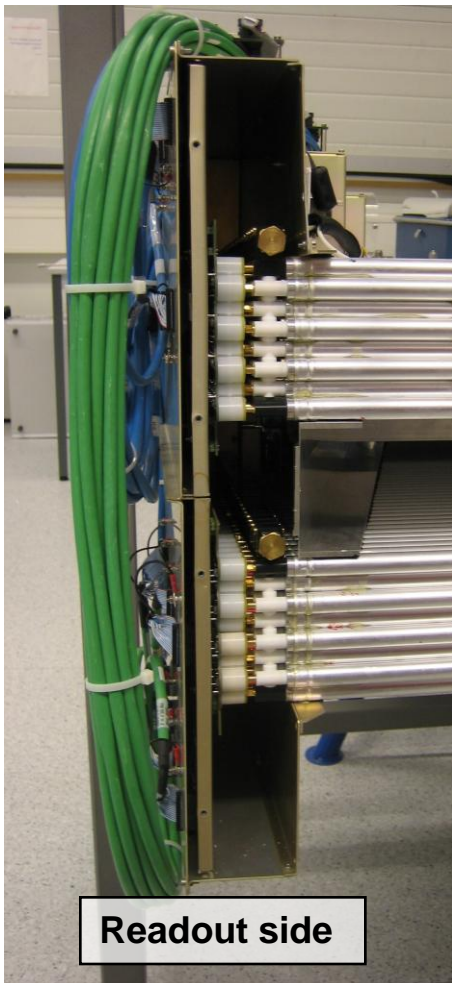
- Semi-automatic machine for wire-tensioning in drive-in phase
  - 15 mm tubes up to 2.5 m long
  - Wire tension 100 .. 1000 g +/- 2 g
- Research for new electronics ongoing



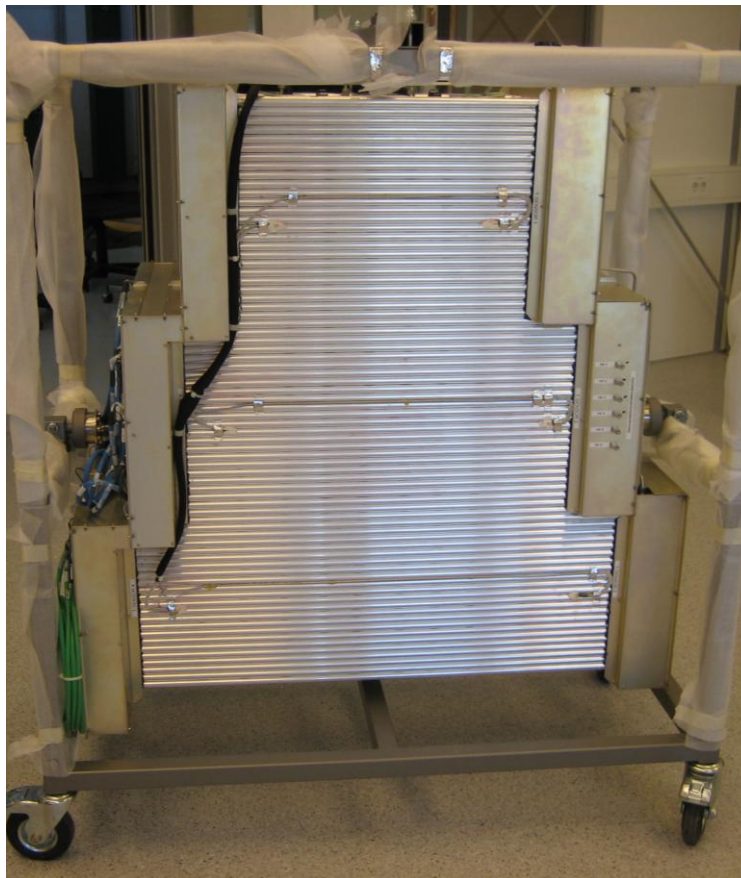


# ATLAS MDT: Chamber with Small Tubes

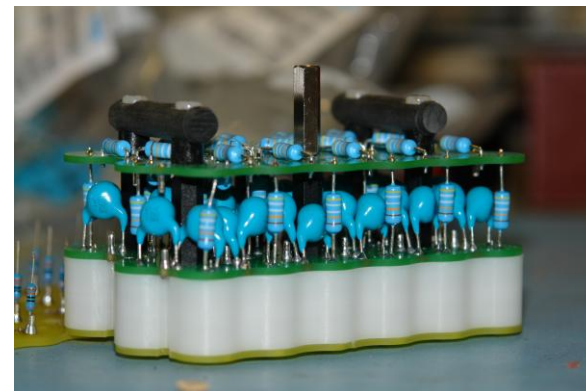
- Development of HV and readout side: new HV-decoupling in plastic “tons”
- Installation at ATLAS early 2012



Readout side



Trapezoid chamber: 768 channels



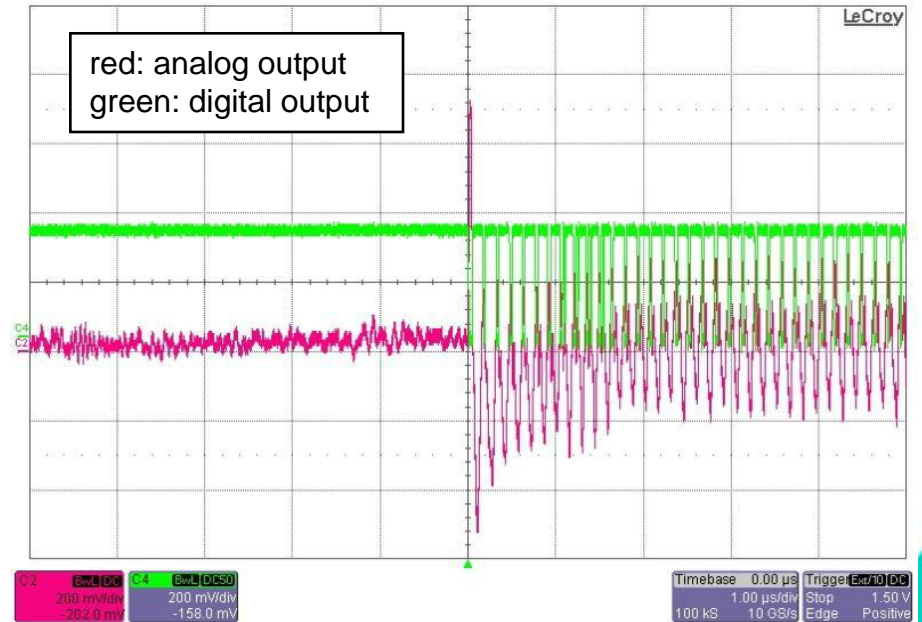
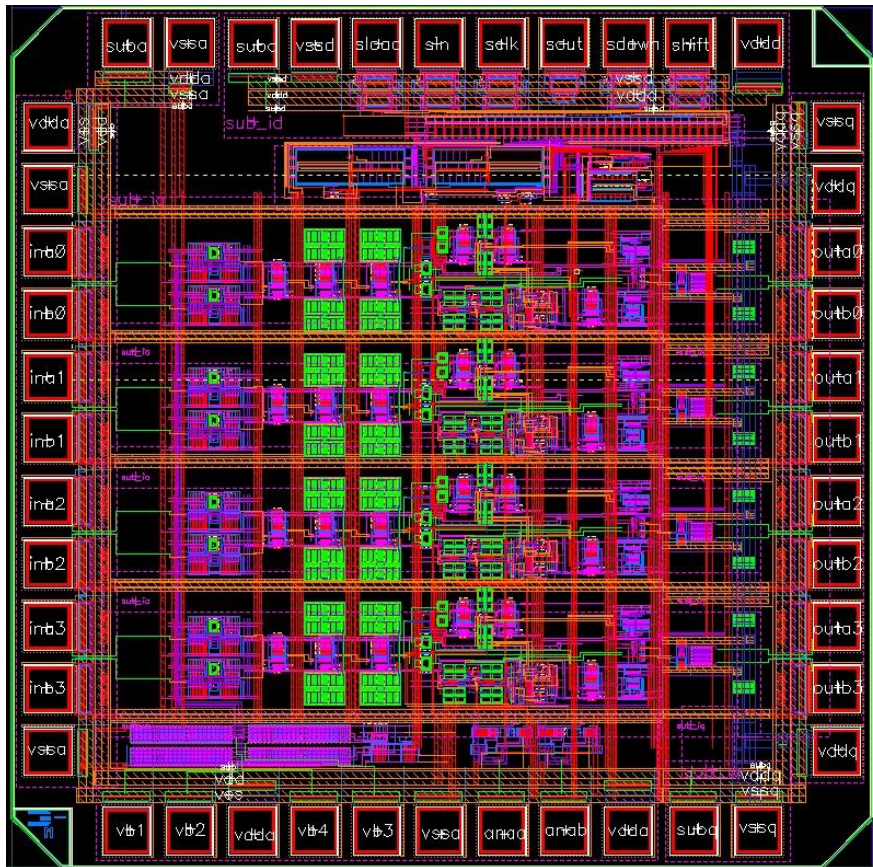
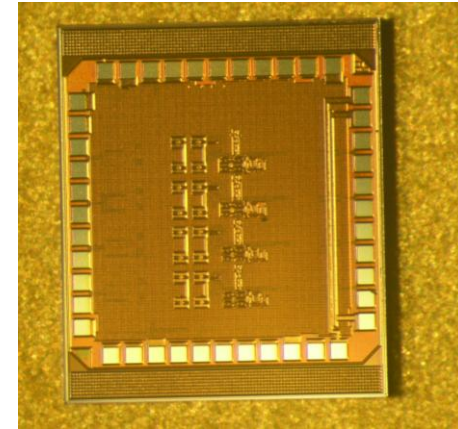
HV side with 3D-stacking





# ATLAS MDT: New ASIC ASD2LD

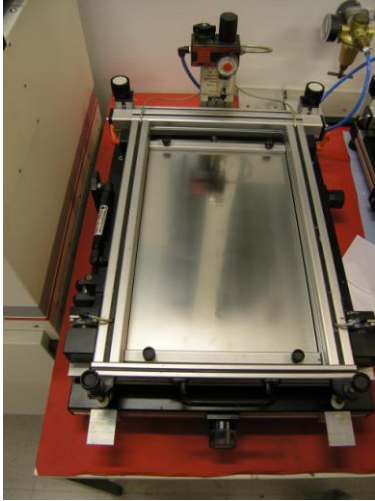
- IBM 130 nm rad-hard CMOS technology
- Analog and digital part integrated, 4 channels  
=> pickup issue of high-gain amplifier from digital part



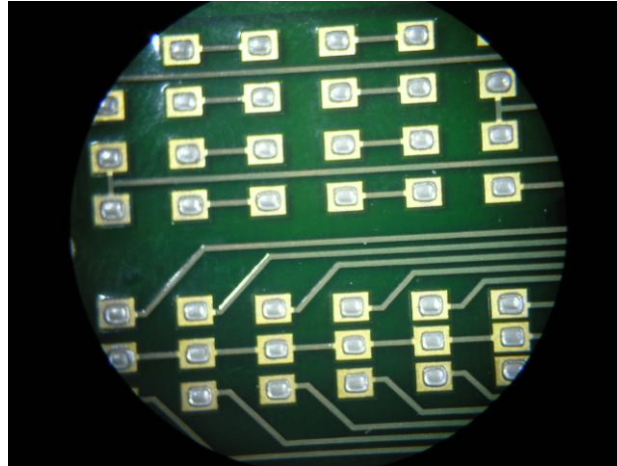
Self-triggered oscillation after response to an input pulse



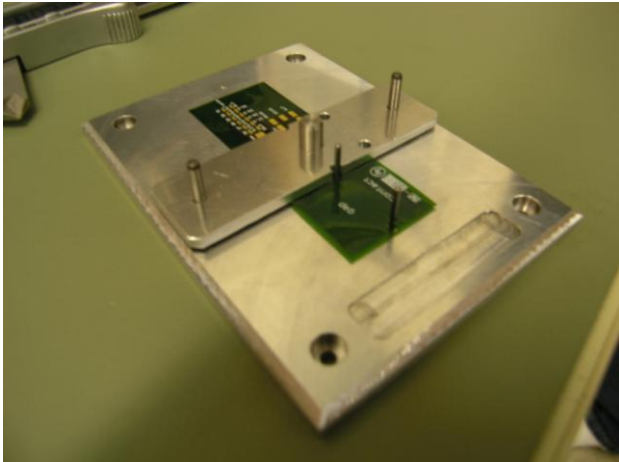
# Belle-II Pixel Detector: Studies for Gluing



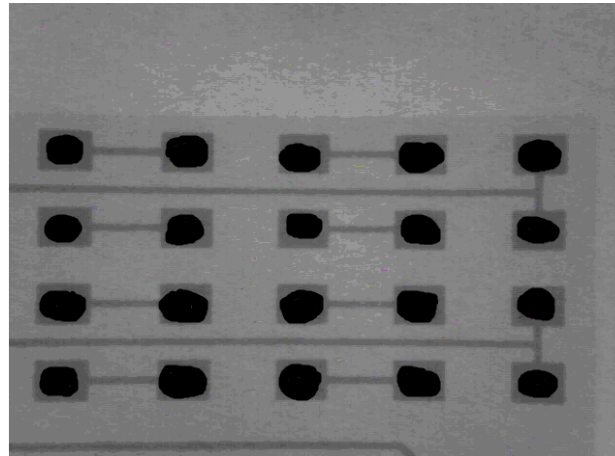
1. Print glue on Kapton cable



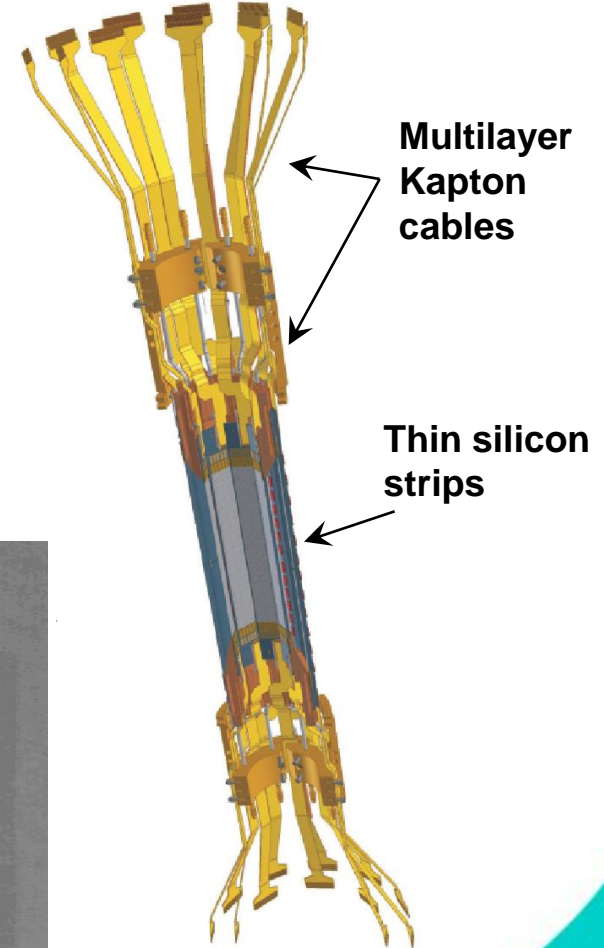
2. Check conductive glue



3. Combine cable and silicon trip.  
Apply defined force by weight.



4. Perfect distribution of glue.  
Inspected by X-ray.

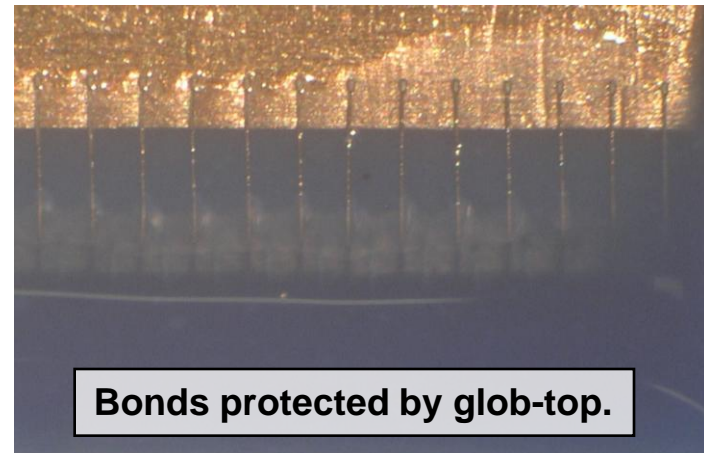
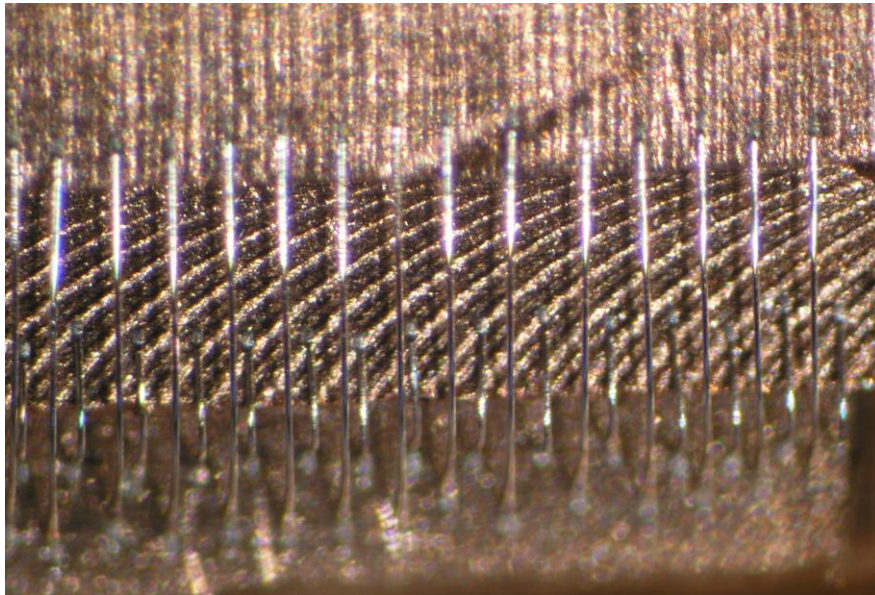
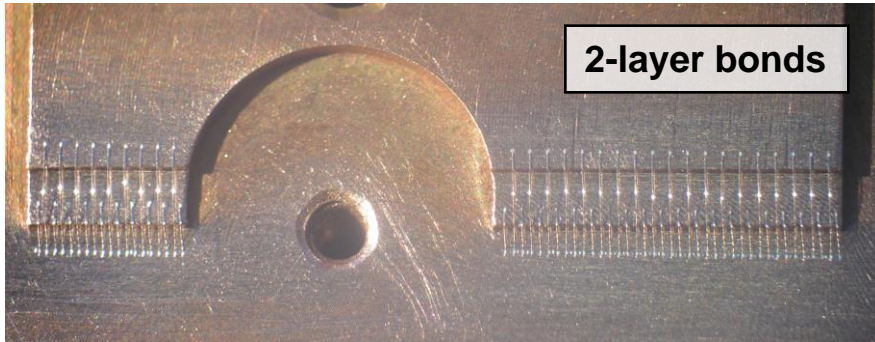






# Belle-II Pixel Detector : Studies for Bonding

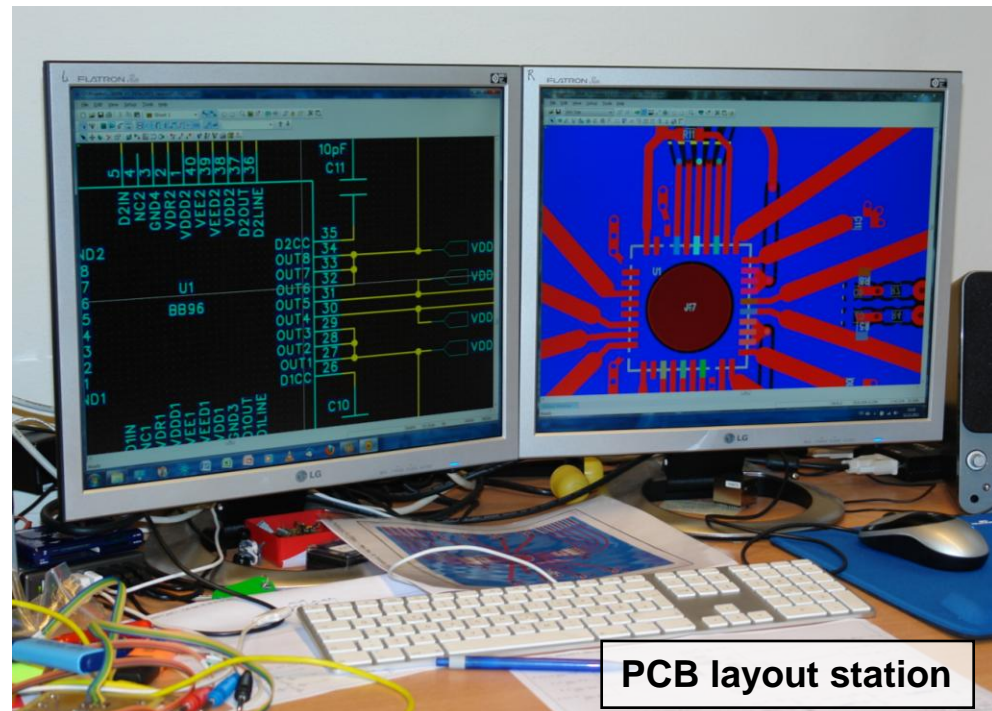
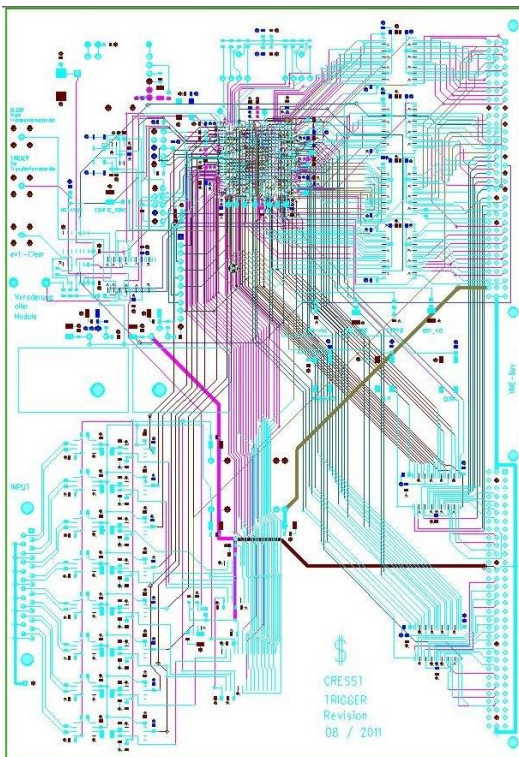
- Bonding tests with new automatic bonding machine on dummies
- Test of sealing (glob-top)





# CRESST Trigger Board

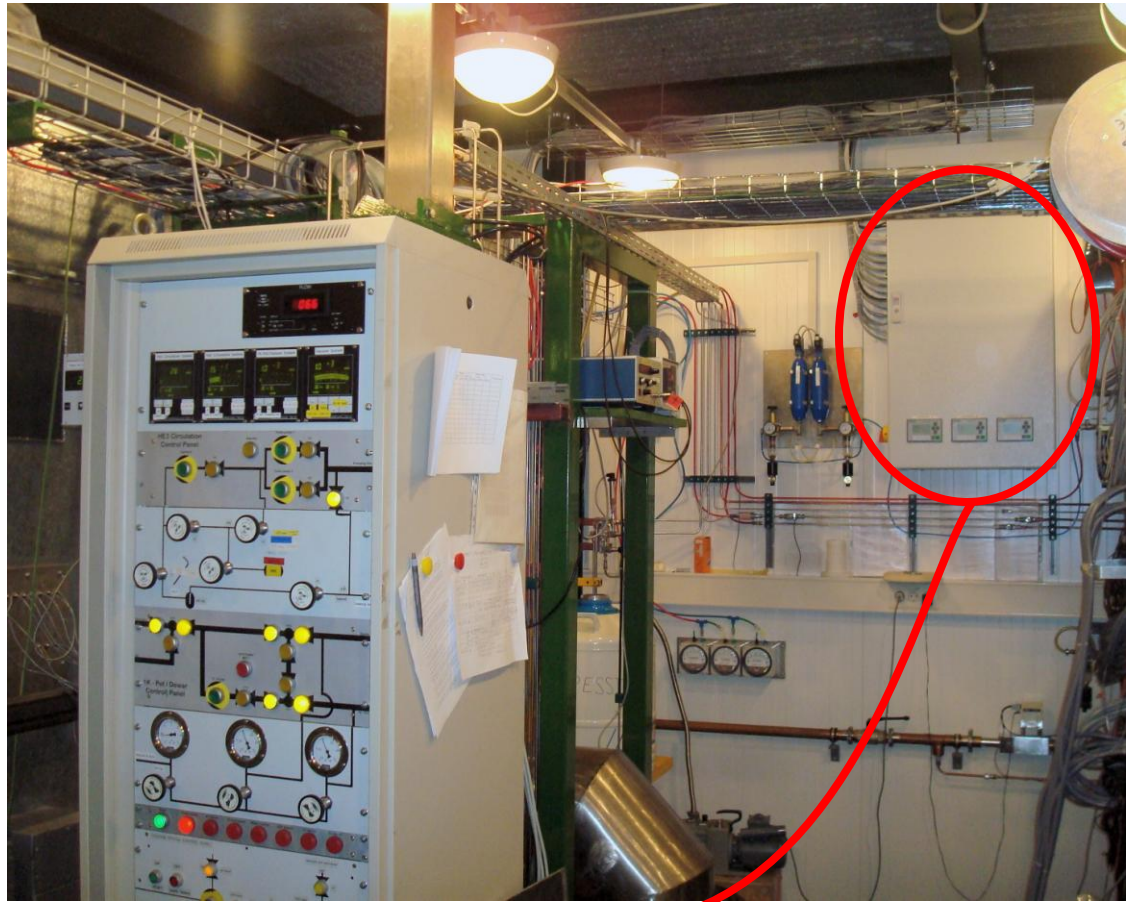
- New board design as replacement for current aging hardware. PCB schematic and layout ready, production and testing in 2012.
- Transfer of logic and control part in modern powerful FPGA  
=> single chip instead of 3 individual ones  
=> more room and flexibility for additional features





# CRESST Gas Handling System

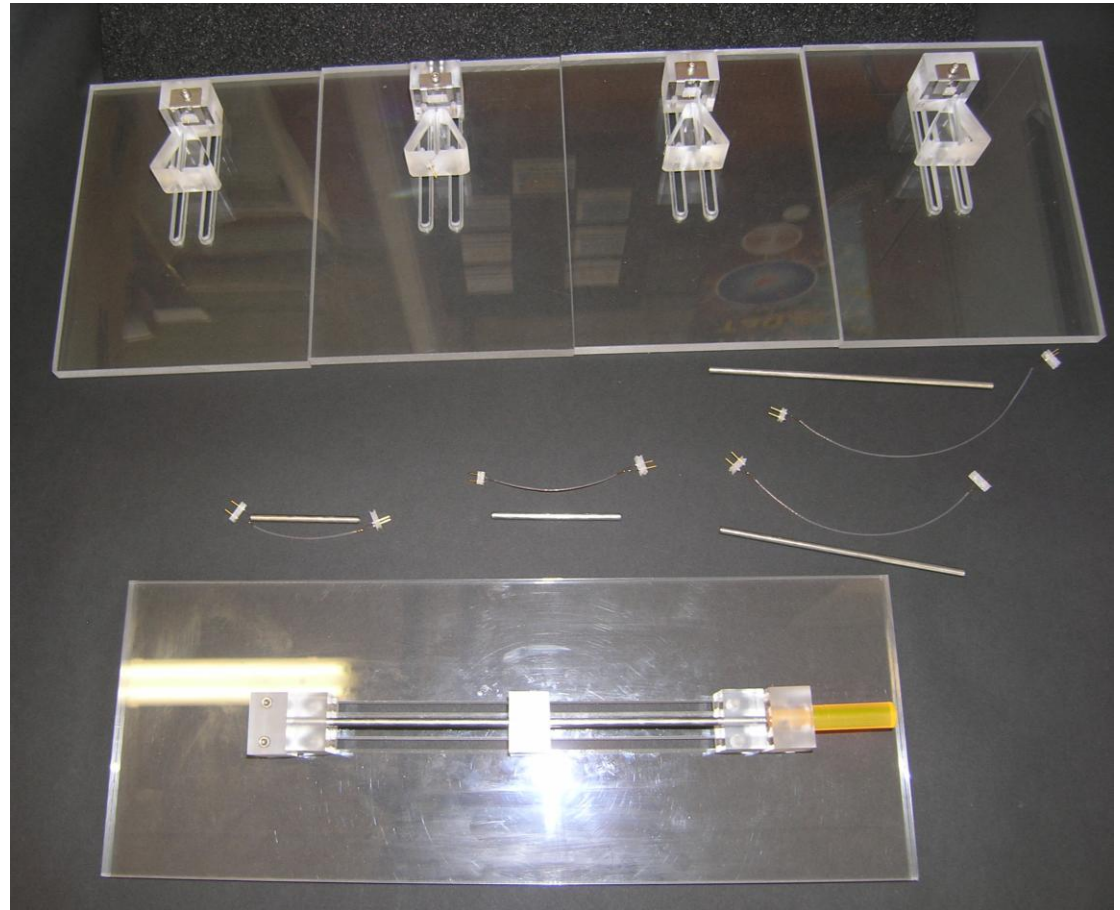
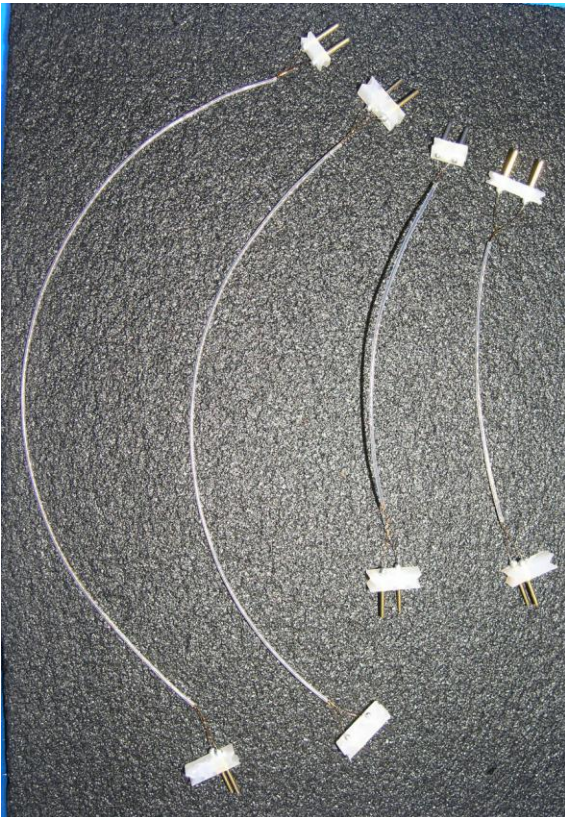
- Automatic control engineering
- Programmable logic controller
- Development and testing in Munich
- Installation of identical system in Gran Sasso





# CRESST Special Cables Production

- Development of supports for twisting and soldering
- Production of ~ 100 cables



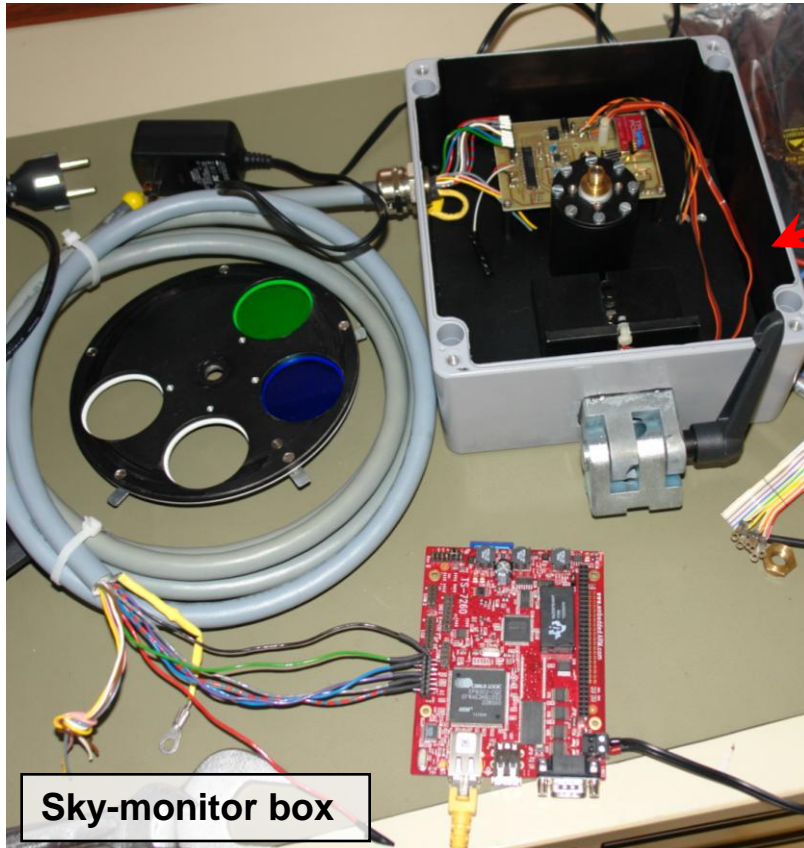
**Top: Supports for soldering**  
**Center: Final cables**  
**Bottom: Support for twisting**





# CTA Site Search – Weather Stations

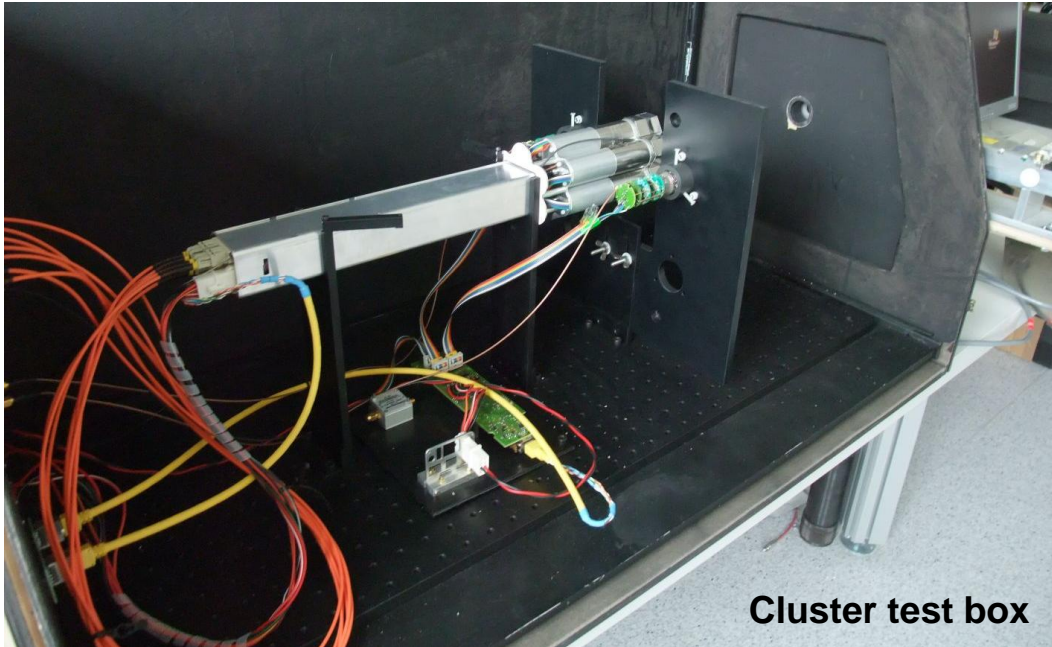
- Production of 3 stations
- Stations are taking data at their final locations



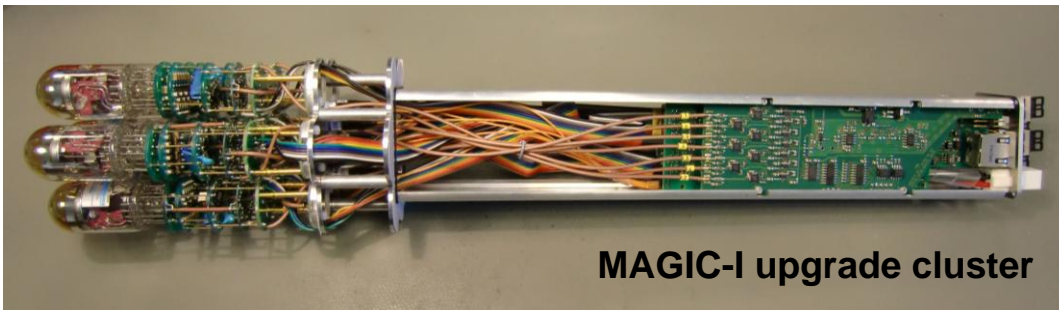


# MAGIC-I Camera Upgrade: Clusters

- Production & testing of 170 clusters
- Automated test setup



Cluster test box



MAGIC-I upgrade cluster



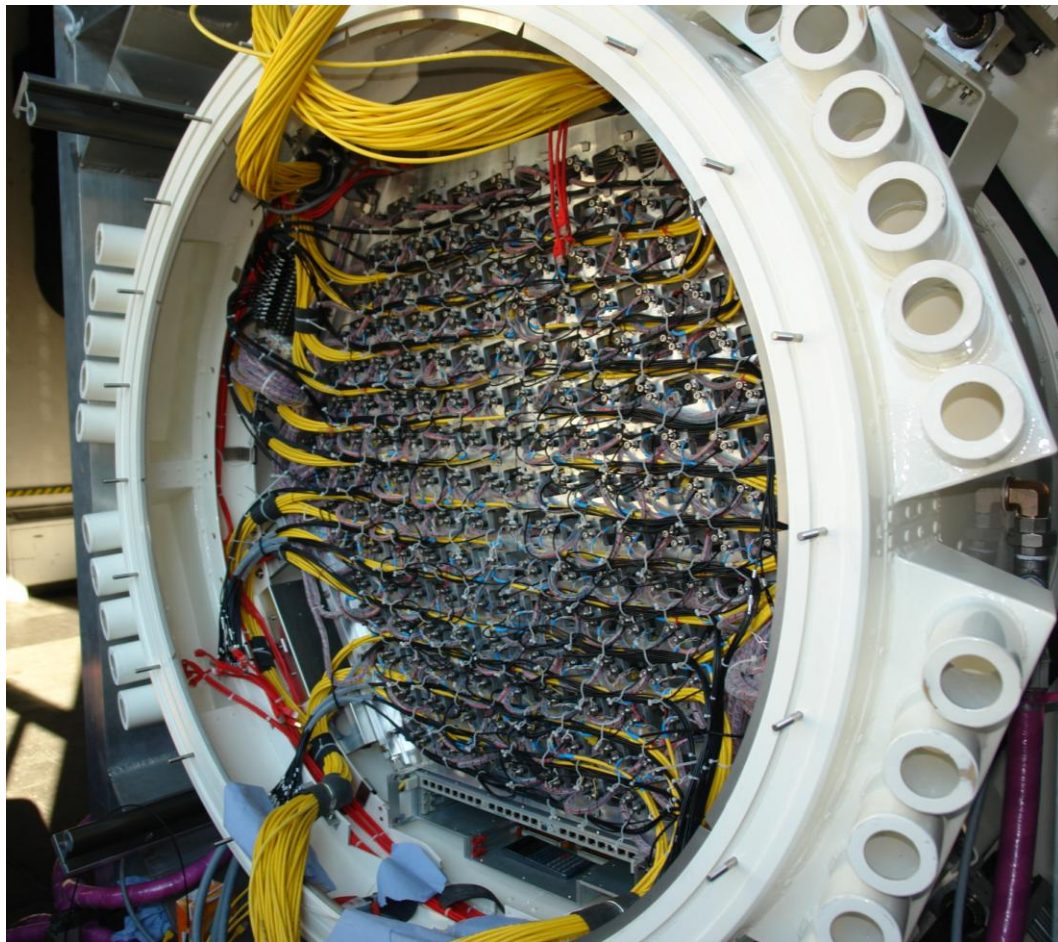
Pile of packed clusters ready for shipping



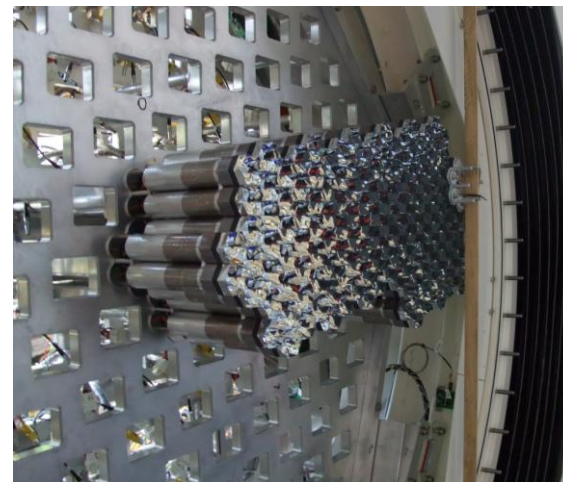
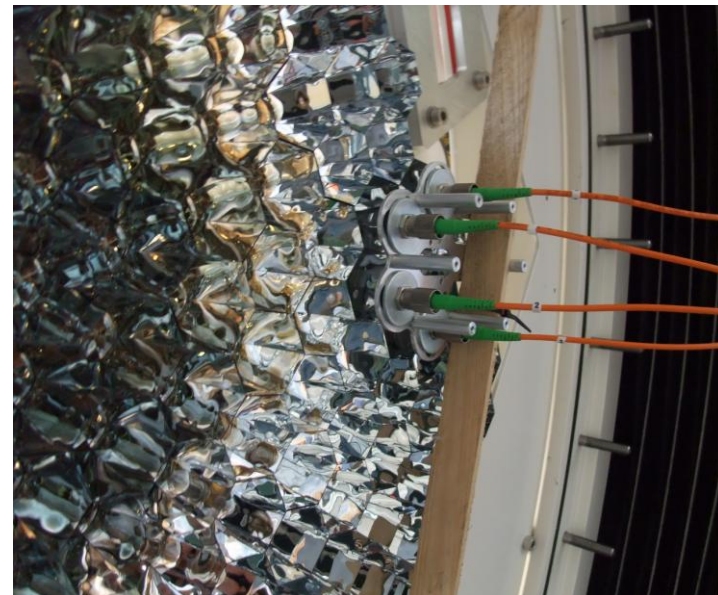


# MAGIC-I Camera Upgrade: Wiring and Testing

- Wiring of power, slow control, test pulser
- Partial test with clusters



Back side

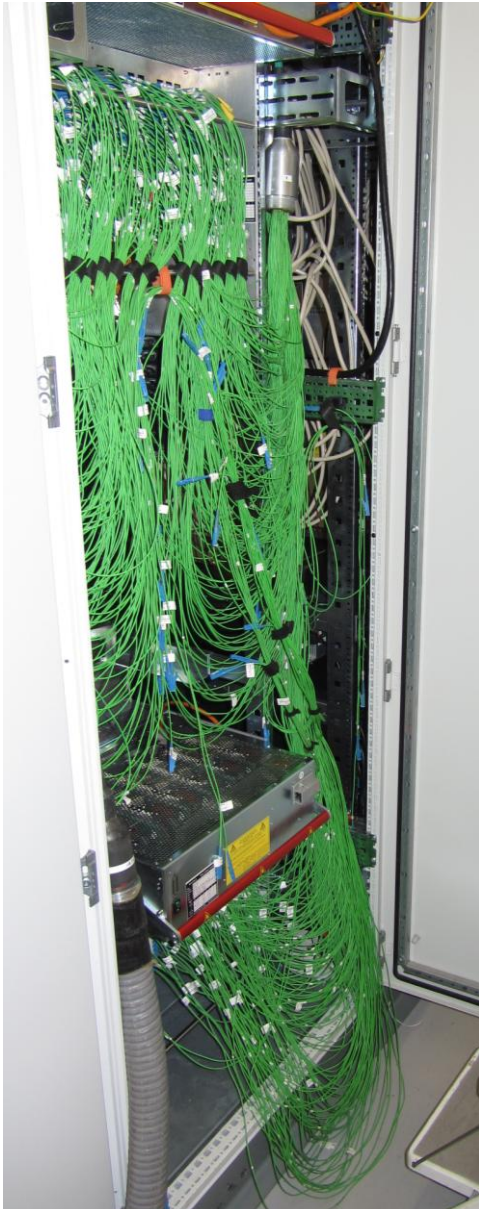


Test using light pulses





# MAGIC I and II Maintenance



- Left: Adaptation of M-I fibers for new readout system
- Top: Improvement of pulse injection in M-II camera: new board + changed resistor

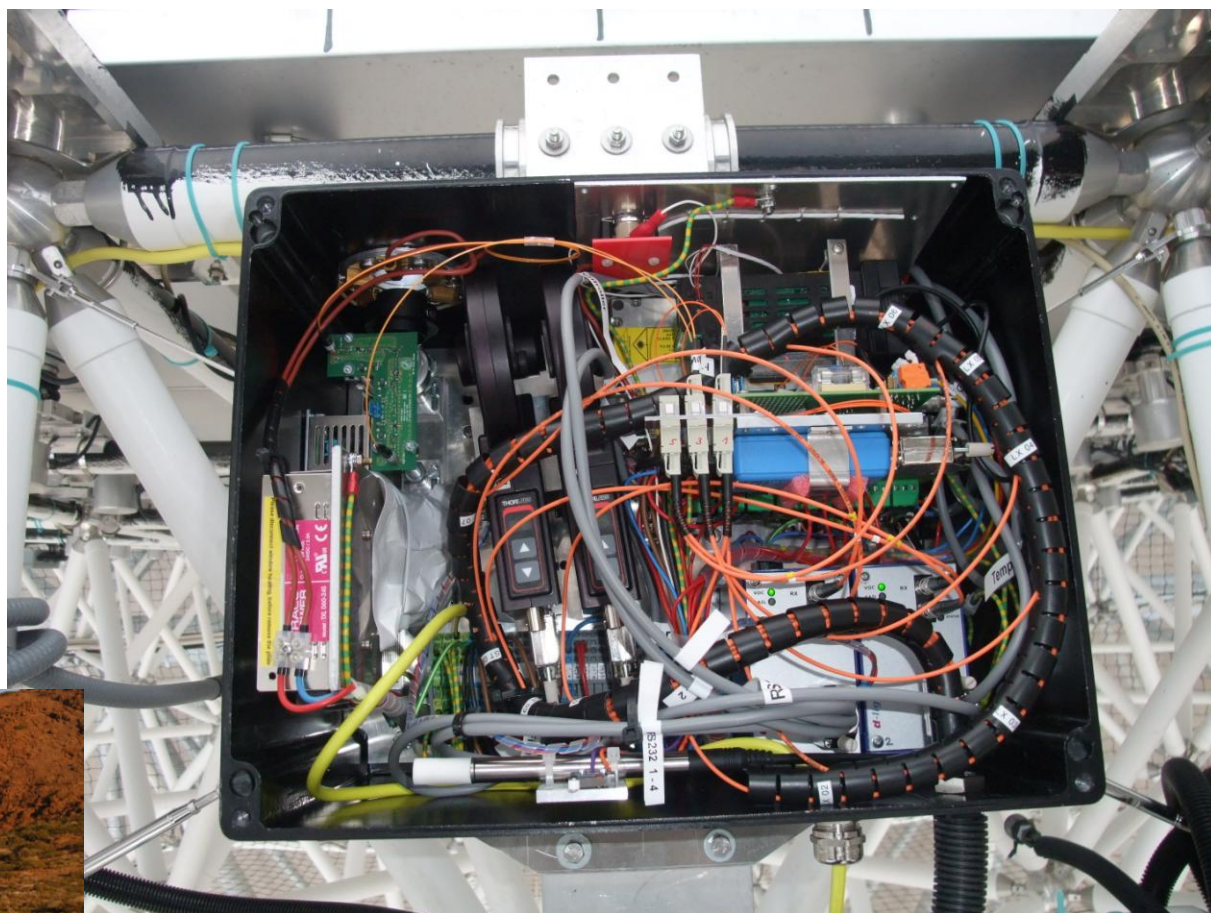




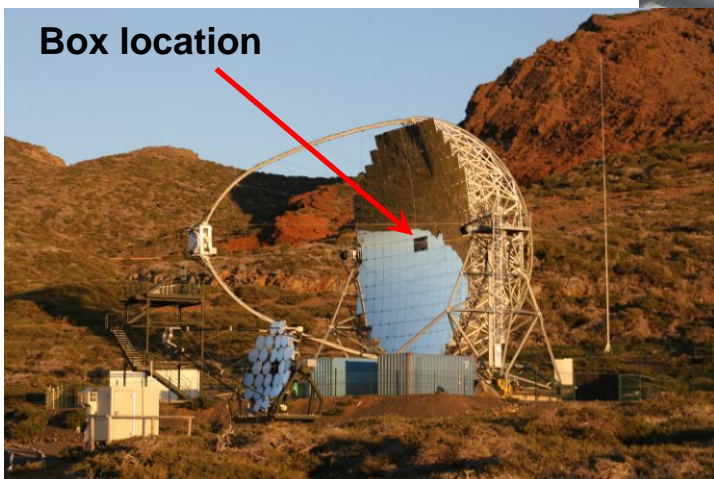


# MAGIC – New Calibration System

- Detailed characterization on automated test setup
- Reproduction of working prototype
- Some minor improvements
- Installation of box 1 / 2 in May / November



Box location



Calibration box 1 “la caja loca” installed on the M-I telescope in May 2011





# Acknowledgement

**Thanks a lot to all the people who do the work!**

## Anlagenelektronik (EA)

- Alexander Fischer
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- Eveline Linhardt
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- Michael Reitmeier
- Ronald Maier
- Trung-Si Tran

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- Jörg Habring
- Markus Fras
- Michael Hanzl
- Miriam Modjesch
- Sara Hoffmann
- Werner Haberer

## Apprentice Workshop

- Engelbert Modjesch
- Rainhard Kastner
- All apprentices!

## Head of Division

- Olaf Reimann

## Secretary

- Martina Kielas

