
Report of the Electronics Division

Project Review 2012



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



Outline

- Projects in 2012
- Manpower
 - Distribution in 2012
 - Requests for 2013/14
- Status of some selected projects
 - Contribution of electronics division
 - Impressions in pictures
- Additional activities



Projects in 2012

- 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 sum trigger (EE, EP)

- Minor Projects

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

Groups

EA: Elektronikanlagen

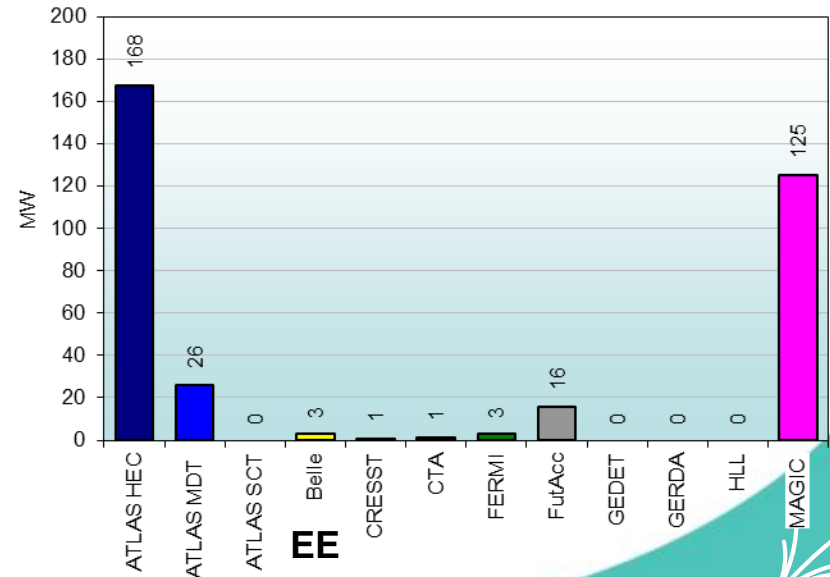
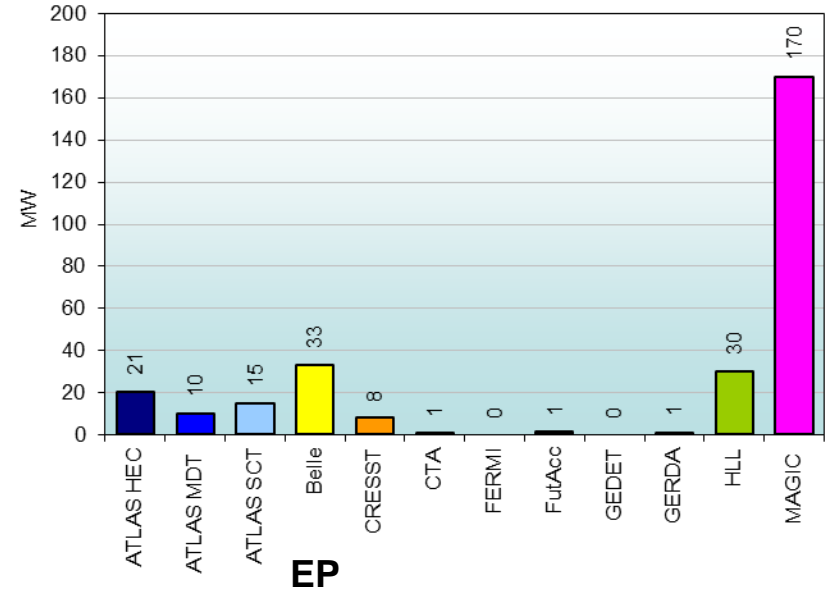
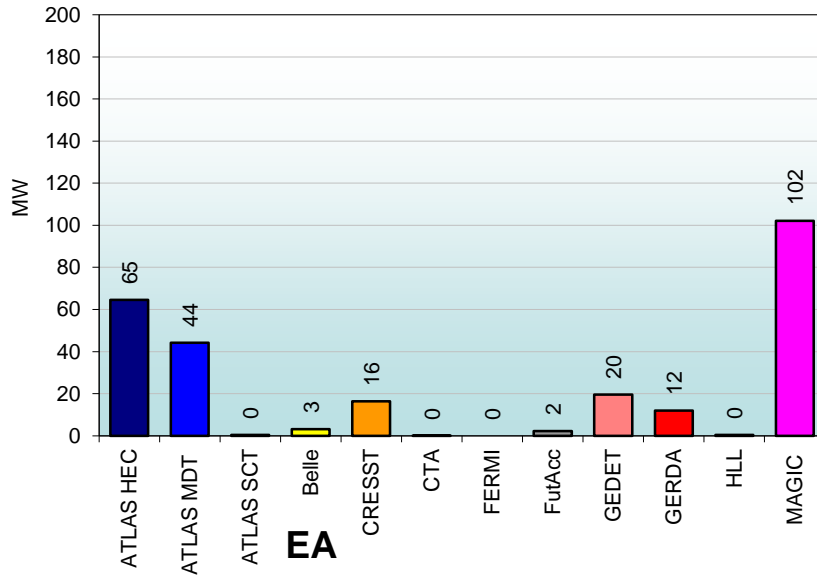
EE: Elektronikentwicklung

EP: Elektronikproduktion



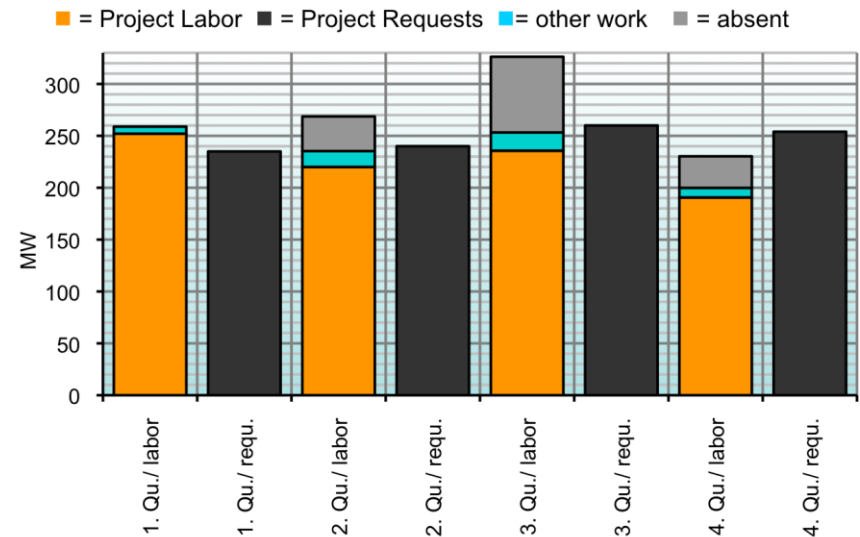
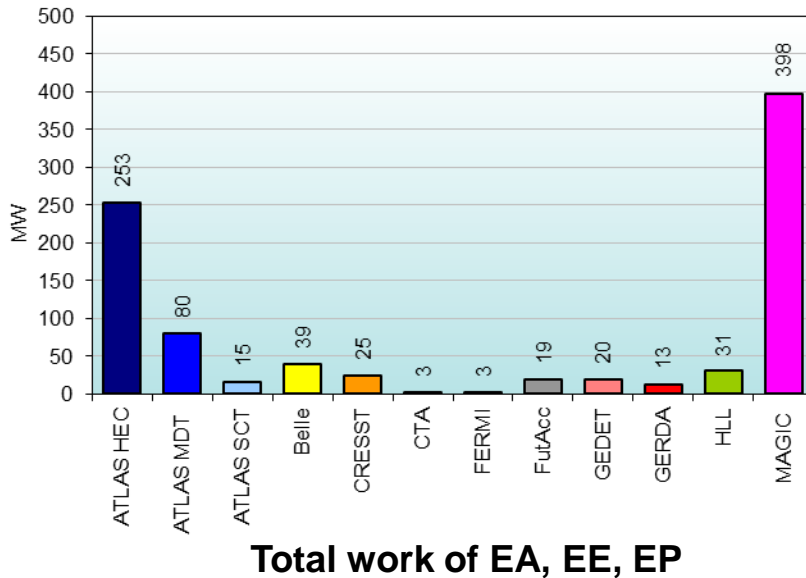
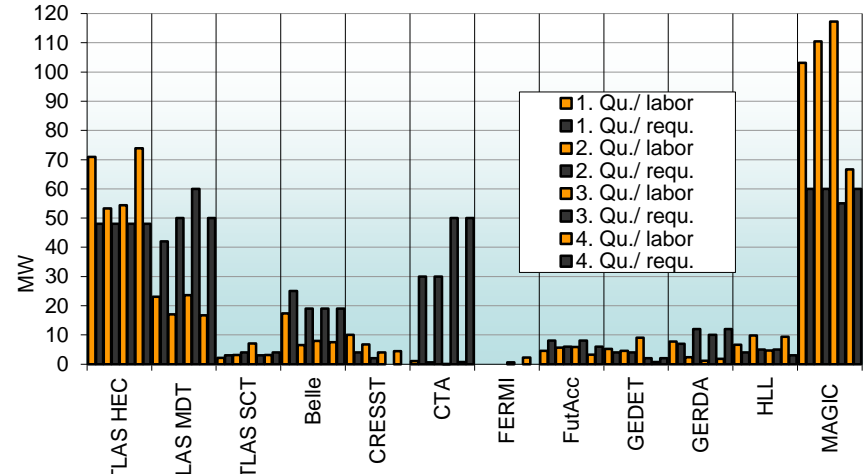
Work of Individual Groups in 2012

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

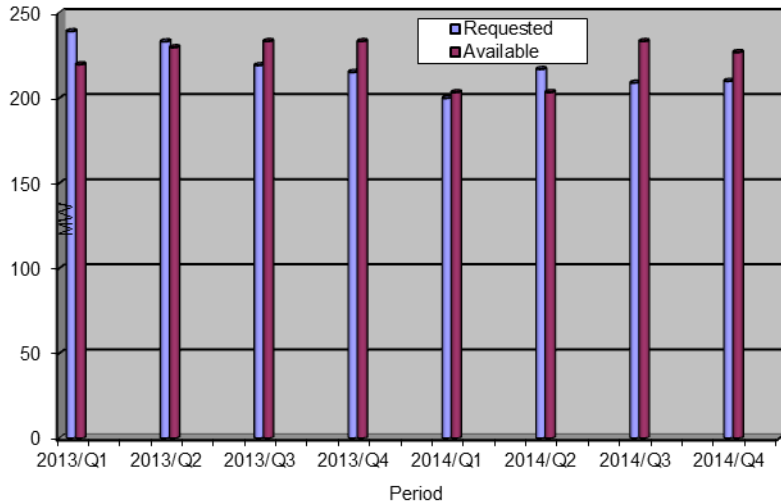


Comparison of Work & Request 2012

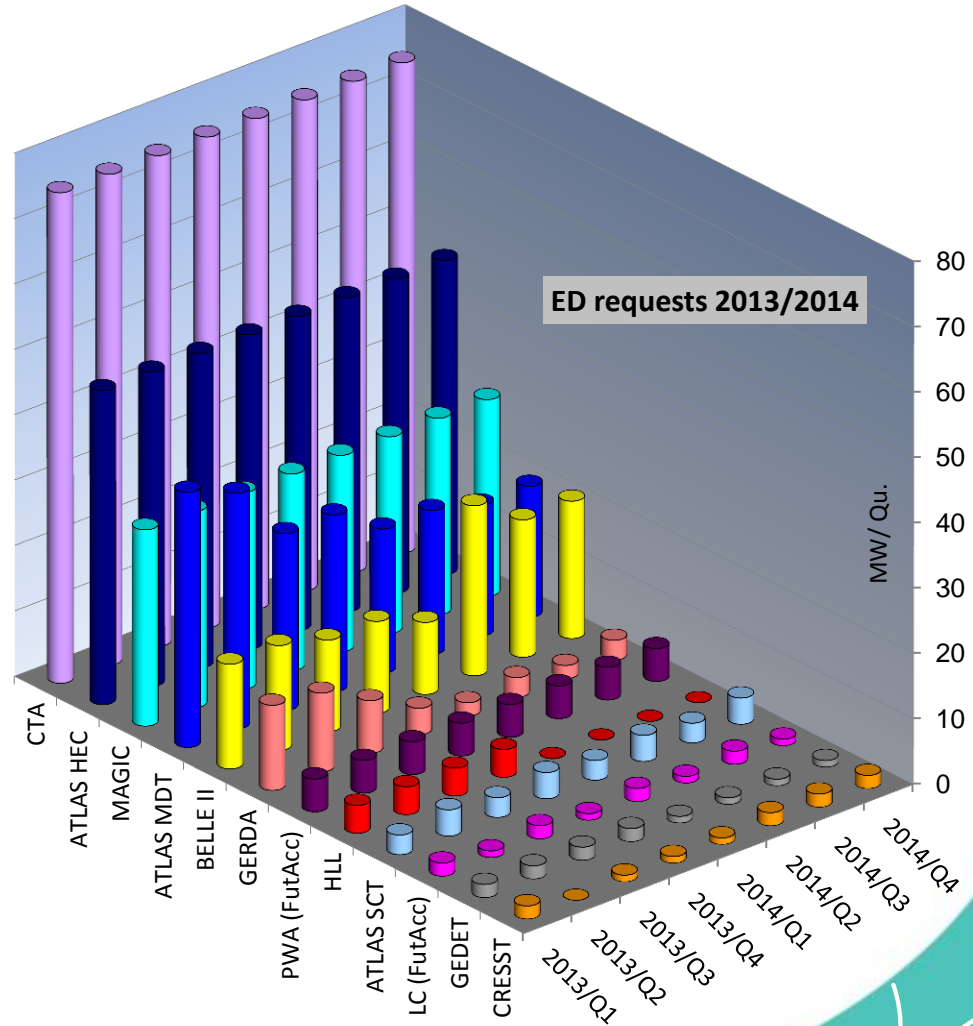
- January – November in MW (man-week)
- December is missing => lower bars for 4th quarter
- Shift of manpower from CTA to MAGIC



Requests for 2013/14



- Biggest projects in 2013/14:
 - MAGIC / CTA
 - ATLAS MDT
 - small chambers
 - new front-end electronics
 - ATLAS HEC
 - ASIC design & test
 - High-reliability LV system
 - Belle-II
- Demands are larger than available resources!

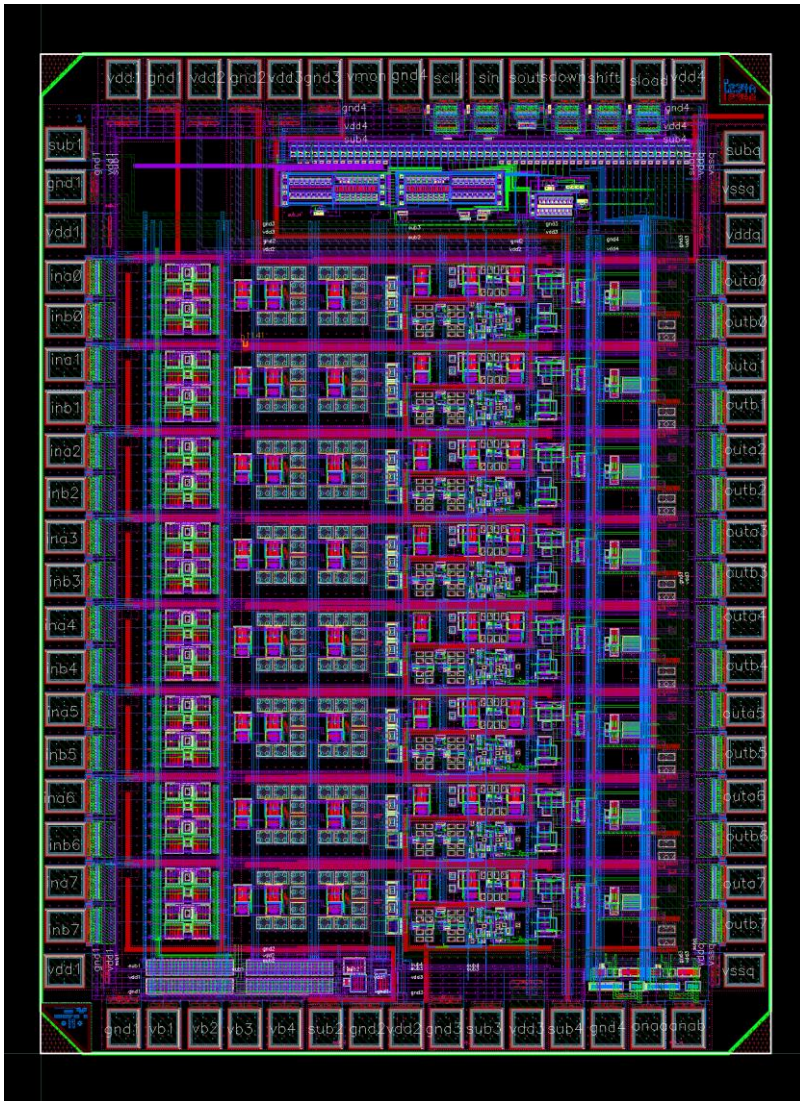


Requests for 2013/2014

Project	2013/Q1			2013/Q2			2013/Q3			2013/Q4			2014/Q1			2014/Q2			2014/Q3			2014/Q4		
	EE	EA	EP	EE	EA	EP	EE	EA	EP	EE	EA	EP	EE	EA	EP	EE	EA	EP	EE	EA	EP	EE	EA	EP
ATLAS HEC	38	10		38	10		38	10		38	10		38	10		38	10		38	10		38	10	
ATLAS MDT	17	15	7	17	15	4	17	7	3	17	7	3	17	2	3	17	2	3	17		3	17		3
ATLAS SCT			3			4			3			4			3			4			3			4
BELLE II		2	14		2	14			14			14		2	9		2	24			21			21
CRESST		1	1					1			1			1			1	1		1	1		1	1
CTA	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
GEDET	1	1		1	1		1	1		1	1		1			1			1			1		
GERDA	2	11			12		2	6			4		1	1			3		1	1				3
HLL			4.3			4.3			4.3			4.3												
LC (FutAcc)		1	1	1				1	1	1				1	1	1				1	1	1		
MAGIC	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
PWA (FutAcc)	3	2		3		2	3	2		3		2	3	2		3		2	3	2		3		2
General																								
Sum	96	78	65	95	75	63	96	63	60	95	58	62	95	54	51	94	54	69	95	50	64	94	50	66
Available MW (Permanent)	56	55	52	56	55	52	56	55	52	56	55	52	56	55	52	56	55	52	56	55	52	56	55	52
Available MW (Temp.)	26	10	20	36	10	20	30	20	20	30	20	20	20	10	10	20	10	10	30	20	20	24	20	20
Total Available MW	83	65	72	93	65	72	86	75	72	86	75	72	76	65	62	76	65	62	86	75	72	80	75	72
Difference Available - Requested	-13	-13	7	-2	-10	9	-10	12	12	-9	17	10	-19	11	11	-18	11	-7	-9	25	8.2	-14	25	6.2
Work Load (%)	116	120	90	103	115	88	111	84	83	110	77	86	125	83	82	123	83	111	110	67	89	118	67	91



ATLAS MDT: ASD2 V3 – New ASIC



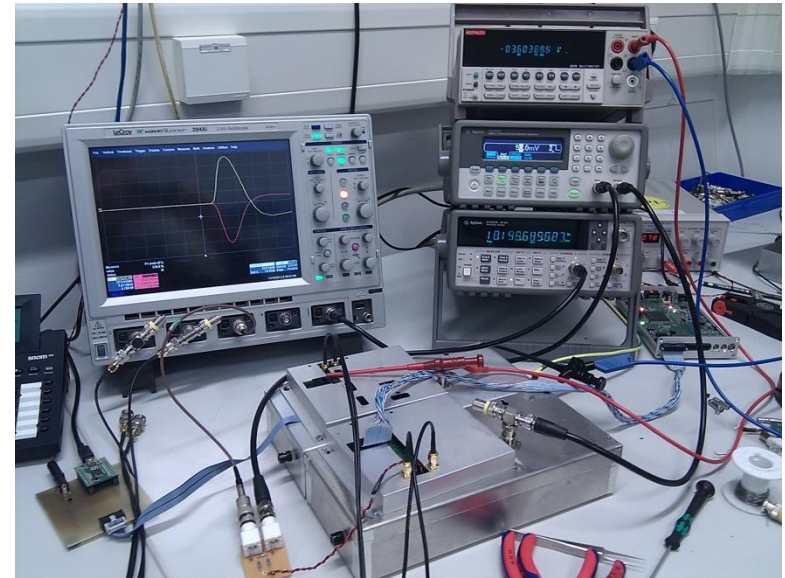
- IBM 130 nm rad-hard CMOS technology
- 60 dB amplifier + digital processing
- Third iteration designed at MPI
- Fixed self-triggered oscillation issue
- Number of channels raised from 4 to 8
- Full function implemented except calibration capacitors
- Design finished and submitted to MOSIS in May, 40 chips received in September
- 4 chips bonded and tested: All of them are basically working!
- Detailed characterization started and ongoing.

Amplifier-Shaper-Discriminator: Chip Layout

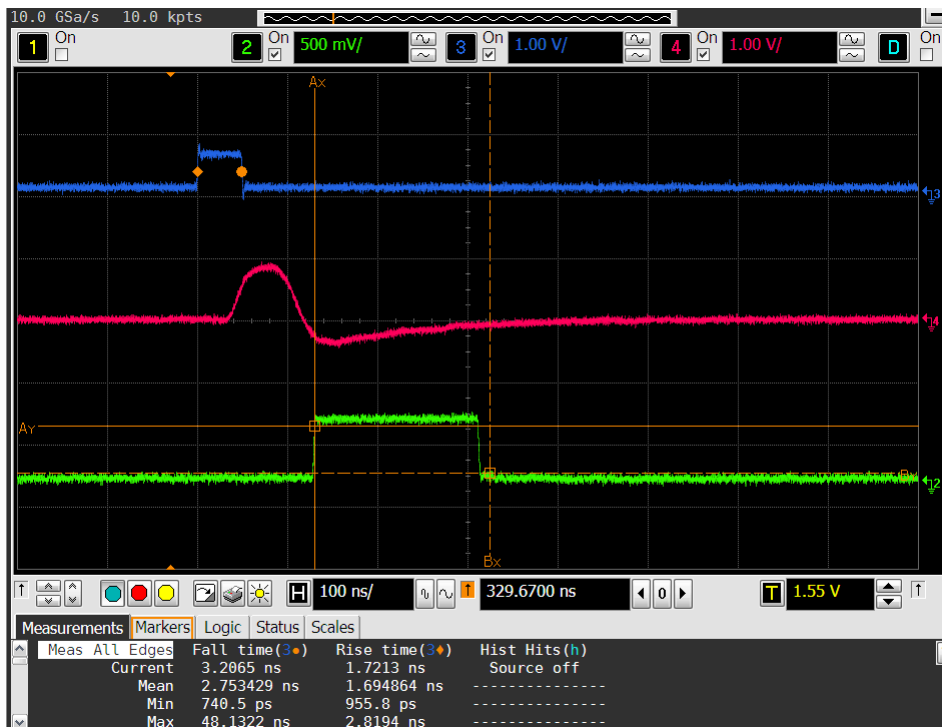


ATLAS MDT: ASD2 V3 – Testing

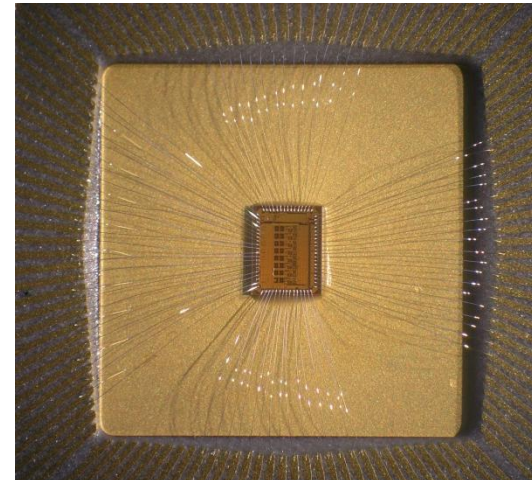
- Digital interface fully working
- Analogue monitor signal reasonable
- Digital circuit in principle working:
ToT mode and ADC mode



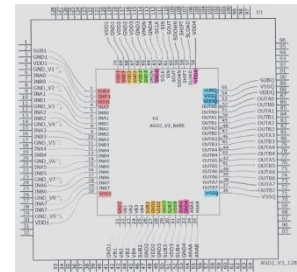
Setup with shielded ASD2 V3 test board



Pulse response: analogue (red), digital (green)



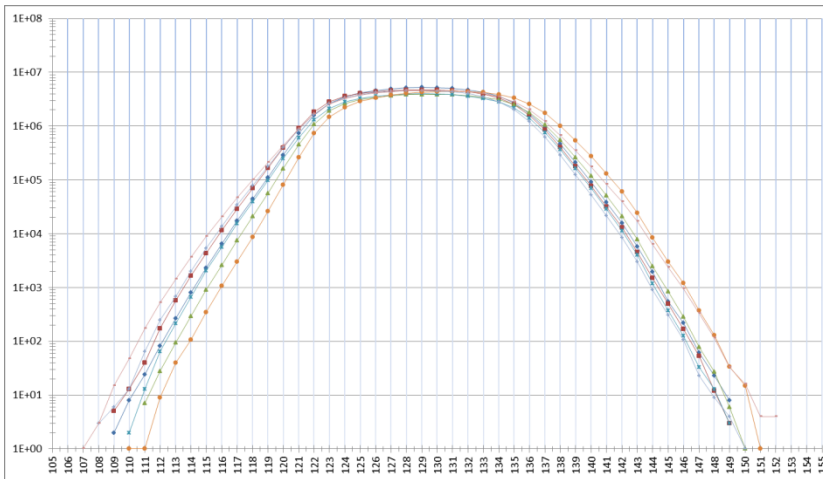
Bonded die in housing



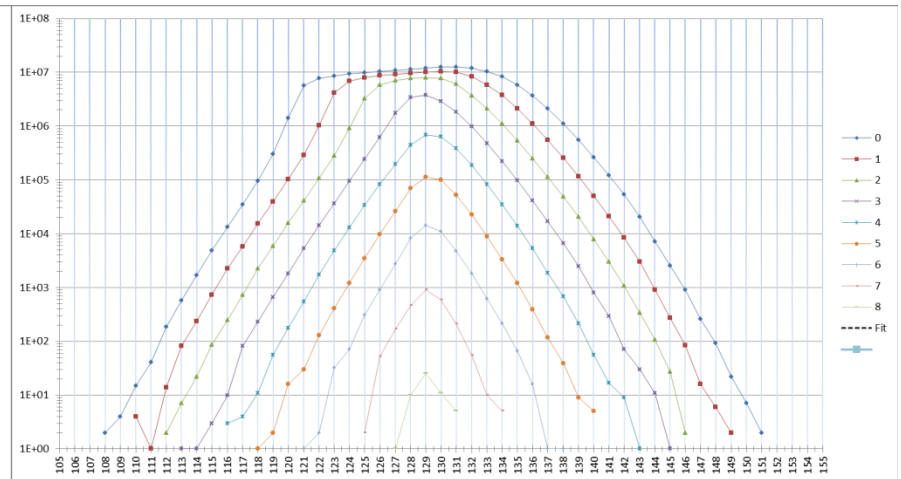
Bonding plan



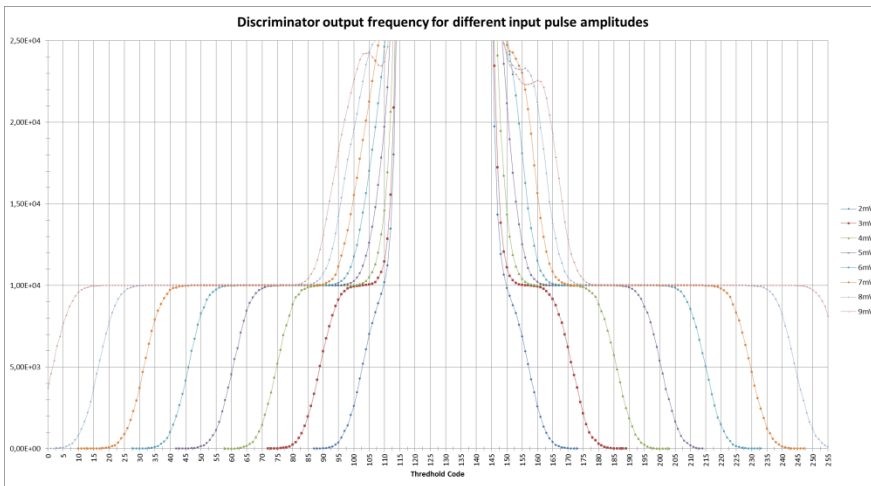
ATLAS MDT: ASD2 V3 – Measurement Results



Uniformity of threshold among channels



Scan over hysteresis values



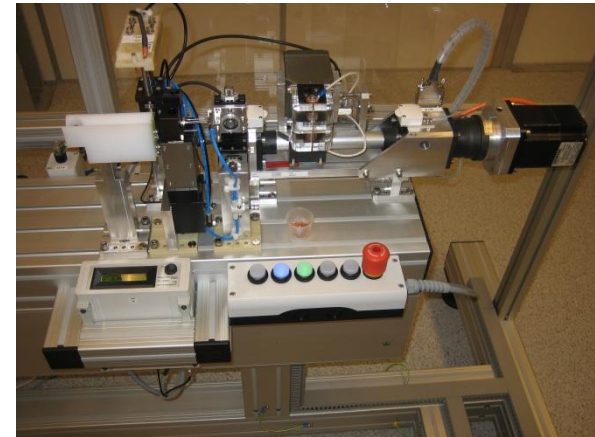
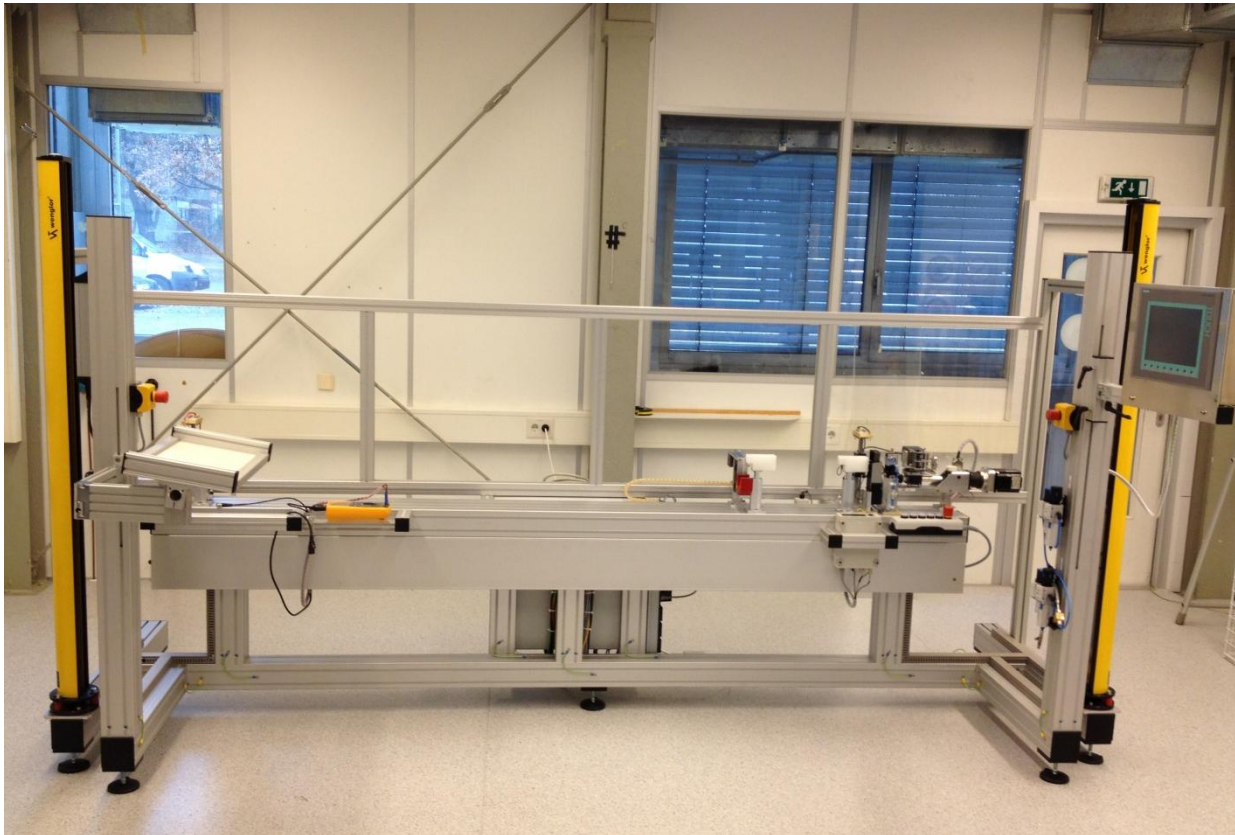
Noise rate against different threshold settings

- Uniformity among channels OK
 - Good linearity of threshold and hysteresis values
 - Some asymmetry around center
 - Quantitative effects to be understood
- ⇒ Cross-check with simulation
- ⇒ Investigation ongoing



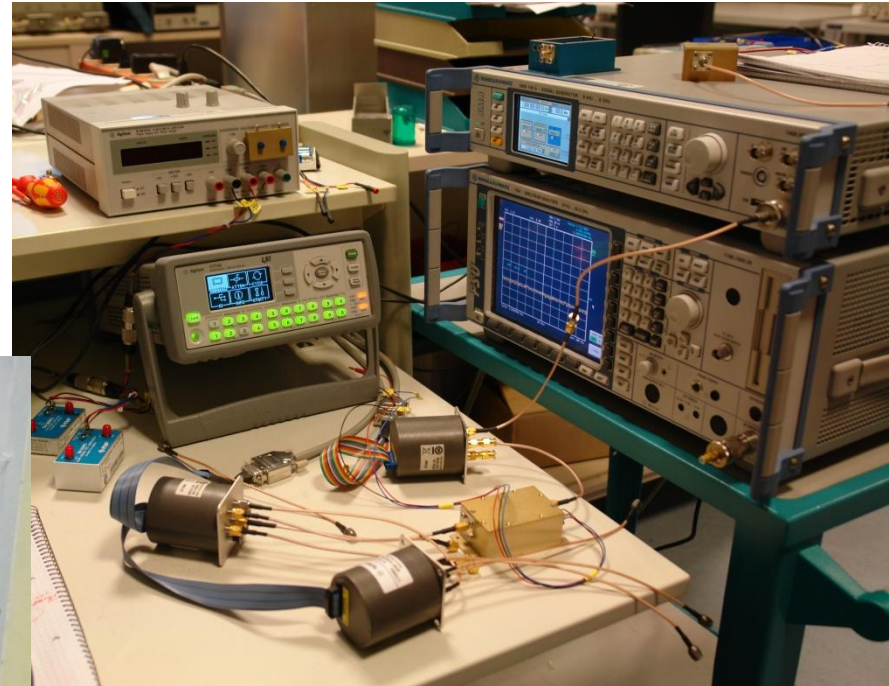
ATLAS MDT: Small Tubes (ϕ 15 mm)

- 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



ATLAS HEC: Measurement Setup

- Mobile setup for radiation tests
 - 62 channels => 31 devices
 - S-parameter measurement
 - Radiation test 11th to 16th Dec.
 - Used for warm and cold

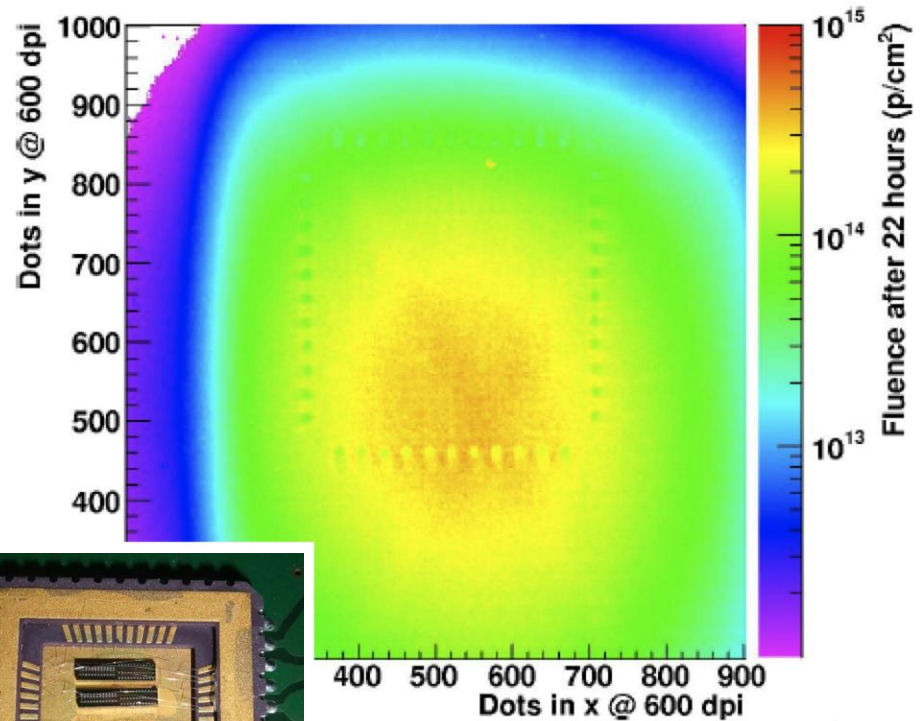
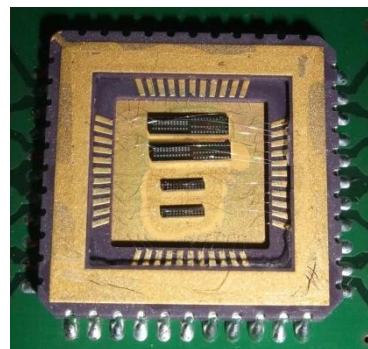
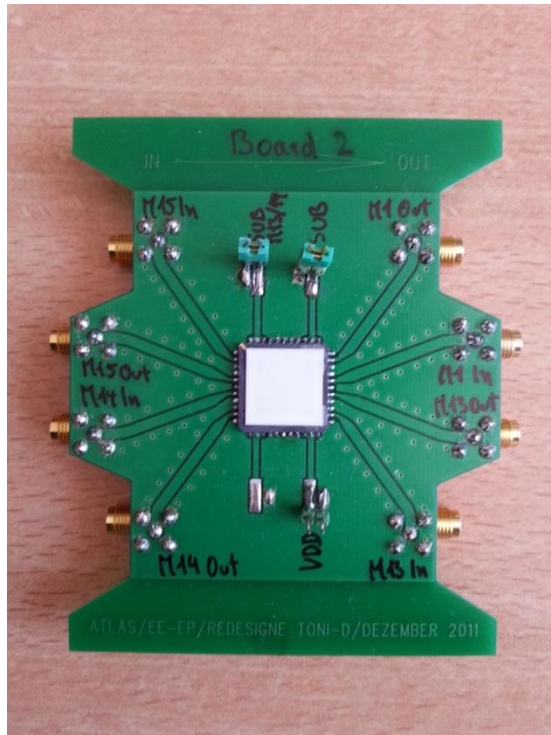


- Noise measurement setup
 - Low, middle and high frequency range
 - Software development for automatic measurement ongoing



ATLAS HEC – Radiation Testing

- Second Test Chip (IHP 250nm SiGe) for new cold pre-amplifier radiation testing and parameter extraction
- Detailed radiation and cold tests of current BB96 amp – very good models

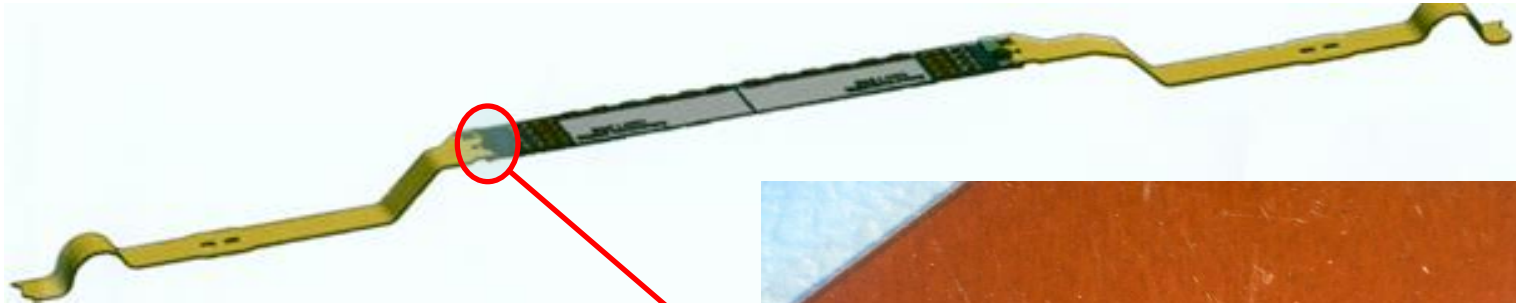


- Digital components (PAL16R8, PAL16L8) for rad-hard low voltage supply

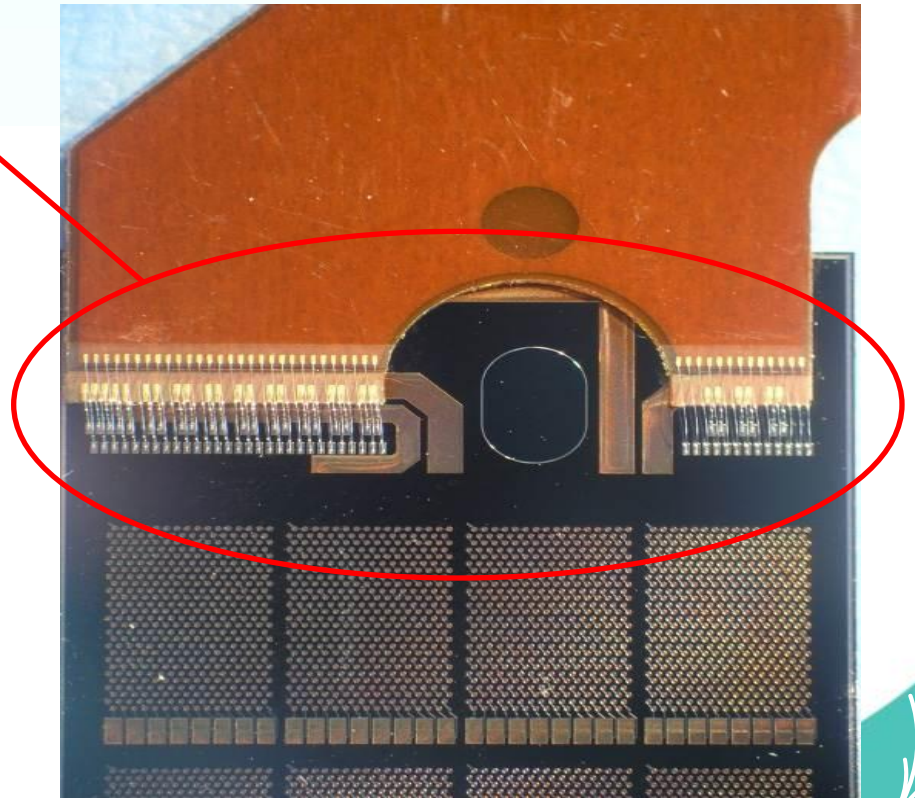


BELLE II

- Feasibility studies / Fabrication techniques for the Belle Detector Barrel done by EP Department



- Kapton and Silicon Solder Connection (Sn42Bi58)
- Test of connection for shorts
- Wire Bonding and Test
- Glob Top (Bond Encapsulation)
- Bond connections re-tested



MAGIC – Camera Upgrade Preparation

- Camera Verification Testing, Readiness Review
- Planning, Organization, and Installation of the MAGIC I Upgrade Camera (Major involvement of the EA Group)



WBS Element	Start	End	Duration	Responsible	Status
MAGIC I Upgrade	217 Tage	Mo 17.03.11	Mo 06.07.12	EA	Completed
Camera Support Structure / Adapter & Cooling Partition	217 Tage	Mo 17.03.11	Mo 06.07.12	EA	Completed
Design and Organization (Print Part)	18 Tage	Mo 17.03.11	Fr 09.03.11	EA	Completed
Production (Print Part)	18 Tage	Mo 21.03.11	Fr 09.03.11	EA	Completed
Assembly at La Palma (Print Part)	11 Tage	Mo 07.03.11	Mo 19.03.11	EA	Completed
Design and Organization (Mechanical Part)	18 Tage	Mo 06.03.12	Fr 03.03.12	EA	Completed
Production (Mechanical Part)	18 Tage	Mo 19.03.12	Fr 02.03.12	EA	Completed
Assembly at La Palma (Mechanical Part)	11 Tage	Mo 07.03.12	Mo 20.03.12	EA	Completed
Exchange of Camera	18 Tage	Di 14.06.12	Di 26.07.12	EA	Completed
Preparation Works	8 Tage	Di 14.06.12	Fr 15.06.12	EA	Completed
Emptying of Cooling System	2 Tage	Di 14.06.12	Fr 15.06.12	EA	Completed
Cleaning of Mirrors	2 Tage	Di 14.06.12	Fr 15.06.12	EA	Completed
Strapping Cables from old Camera and old Shell	2 Tage	Mo 18.06.12	Fr 22.06.12	EA	Completed
Disassembly of old Cooling System	3 Tage	Mo 18.06.12	Fr 22.06.12	EA	Completed
Parallel Works	18 Tage	Di 14.06.12	Mo 04.07.12	EA	Completed
Camera Exchange	18 Tage	Di 14.06.12	Mo 04.07.12	EA	Completed
Cabling of Lower Mirror (incl. Mirror of Support Structure of Shell) (Mech)	8 Tage	Di 14.06.12	Mo 04.07.12	EA	Completed
Assembly of Upper Mirror	3 Tage	Di 14.06.12	Di 19.06.12	EA	Completed
Cabling of Upper Mirror	4 Tage	Di 14.06.12	Di 19.06.12	EA	Completed
Camera Works	18 Tage	Di 14.06.12	Mo 04.07.12	EA	Completed
Camera Installation	8 Tage	Di 14.06.12	Fr 15.06.12	EA	Completed
Installation of Cooling System	4 Tage	Mo 18.07.12	Di 24.07.12	EA	Completed
Mechanical Works	2 Tage	Mo 18.07.12	Di 24.07.12	EA	Completed
Electrical Works	2 Tage	Mo 18.07.12	Di 24.07.12	EA	Completed
Commissioning	2 Tage	Mo 23.07.12	Di 24.07.12	EA	Completed
Finalizing of Remaining Works on Camera	2 Tage	Di 24.07.12	Di 24.07.12	EA	Completed
Installation of Mirror	3 Tage	Di 24.07.12	Di 24.07.12	EA	Completed
Remaining Mechanical Works	3 Tage	Di 24.07.12	Di 24.07.12	EA	Completed



MAGIC – Camera Upgrade Implementation



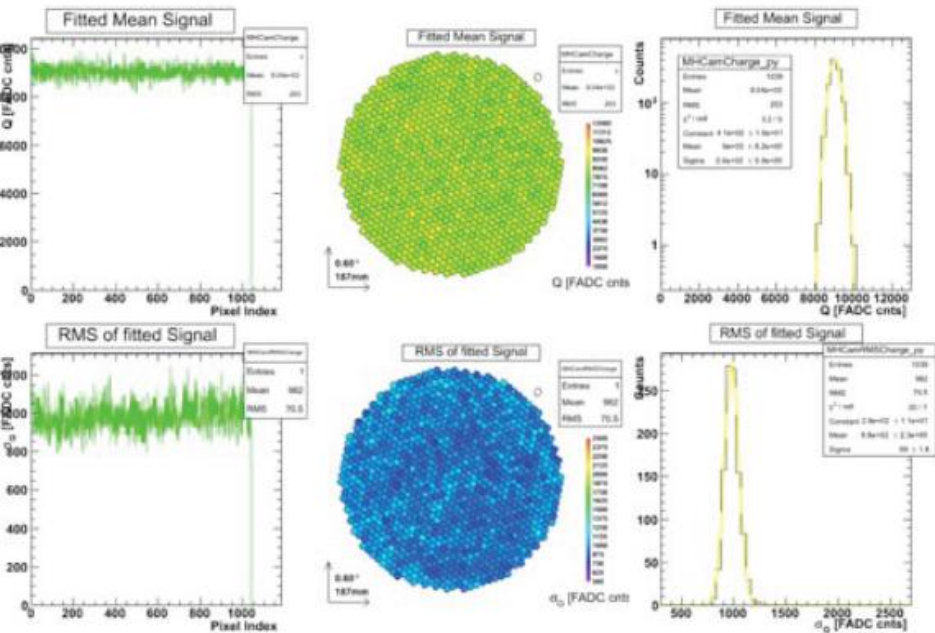
- Removal of old M1 Camera and Cabling
- Installation of new Upgrade Camera
- Up to 8 Technicians and Engineers from ED in June/July @ La Palma



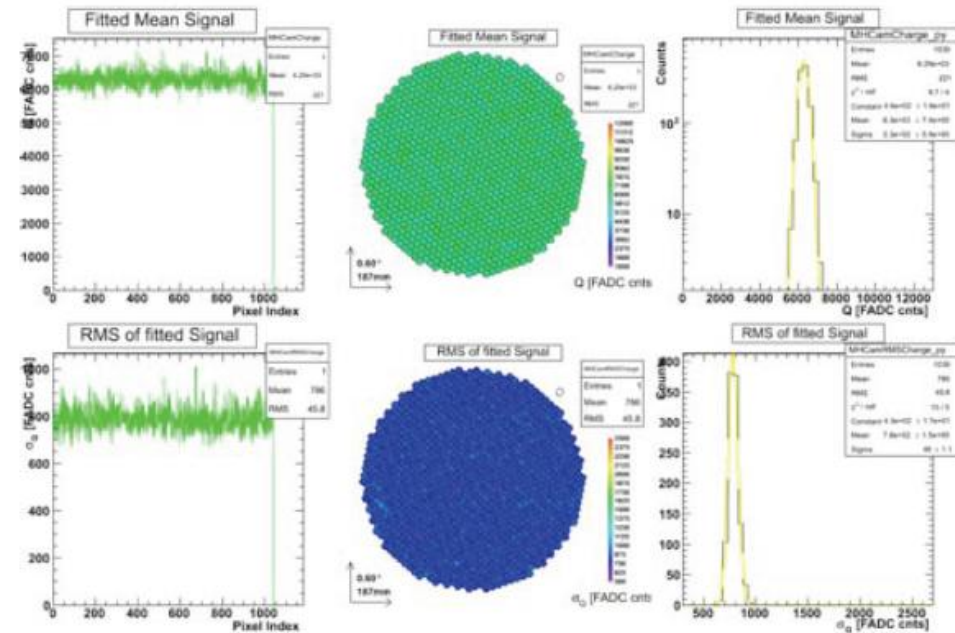
MAGIC – Camera Upgrade Results

- Concurrent Refurbishing of M2 Camera
- After commissioning, all 2078 channels in the two cameras are operational(!)

MAGIC-I

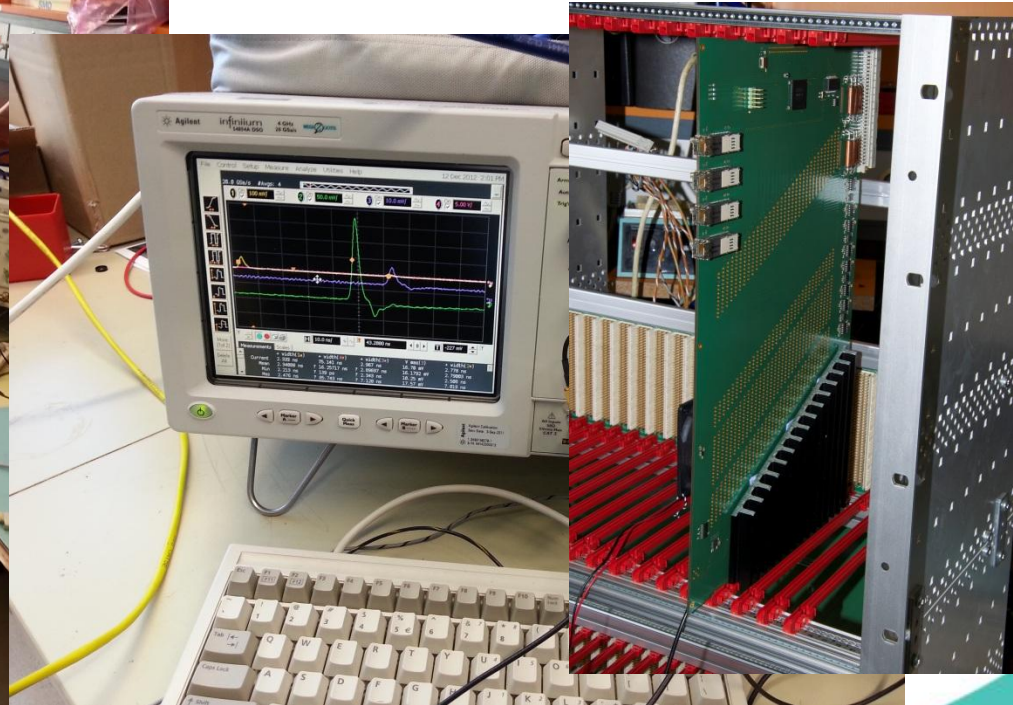


MAGIC-II



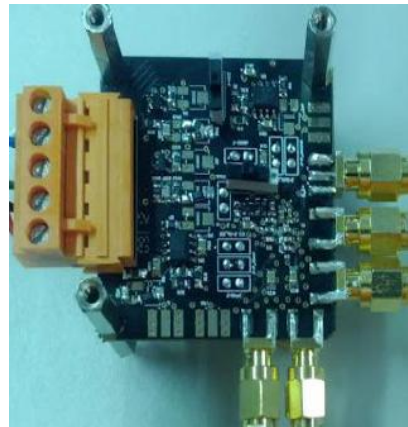
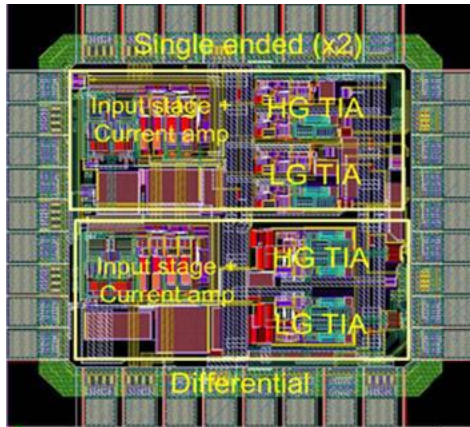
MAGIC – Sum Trigger II

- Noise reduction scheme has potential to improve MAGIC trigger performance
- Electronic delay, amplitude, and sum of over 1k channels
- Hardware and resource intensive



CTA – Design Investigation

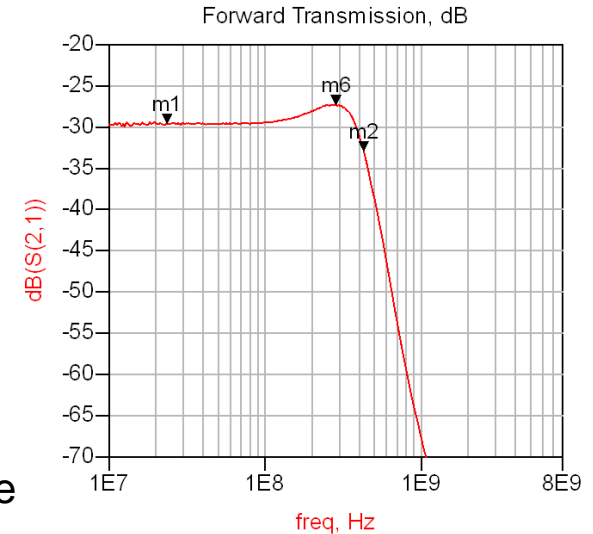
- S-Parameter Characterization of PACTA Preamplifier Chip (Designed by UABarcelona)



m6
freq=282.8MHz
dB(S(2,1))=-27.313
Max

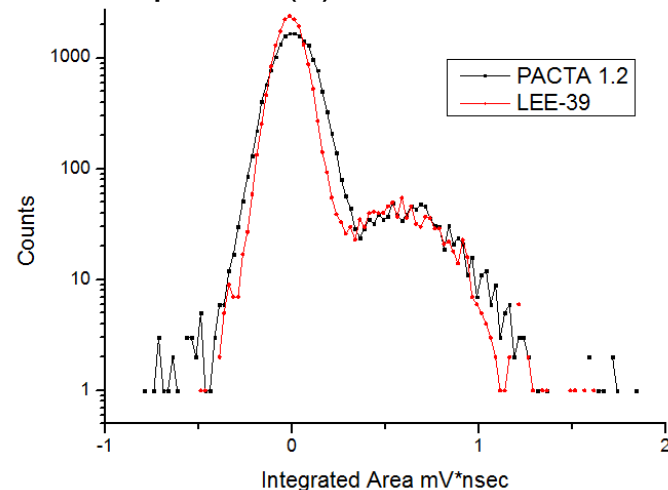
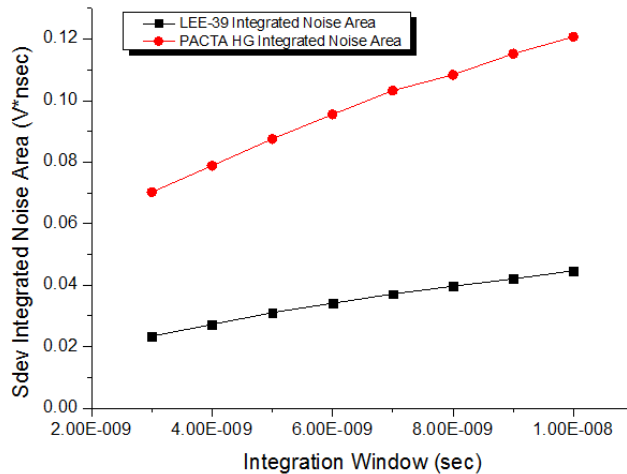
m1
freq=23.46MHz
dB(S(2,1))=-29.602

m2
freq=428.3MHz
dB(S(2,1))=-32.945



- Comparison between OTS and ASIC Preamplifier Performance

- Integrated Noise (R), Single Photoelectron Spectra (L)



Miscellaneous

- Support of Public Outreach Activities
 - Open House Day
 - Group Tours
 - Foyer Exhibits including the Cloud Chamber
- Class Instruction for the MAGIC Hardware School
- Supervision of Internships



Electronics Division

- Conclusion:
- A lot was going on in 2012
- Plenty to do in 2013/2014
- Thanks for your attention!

