MicroTCA 4 Industry and Research

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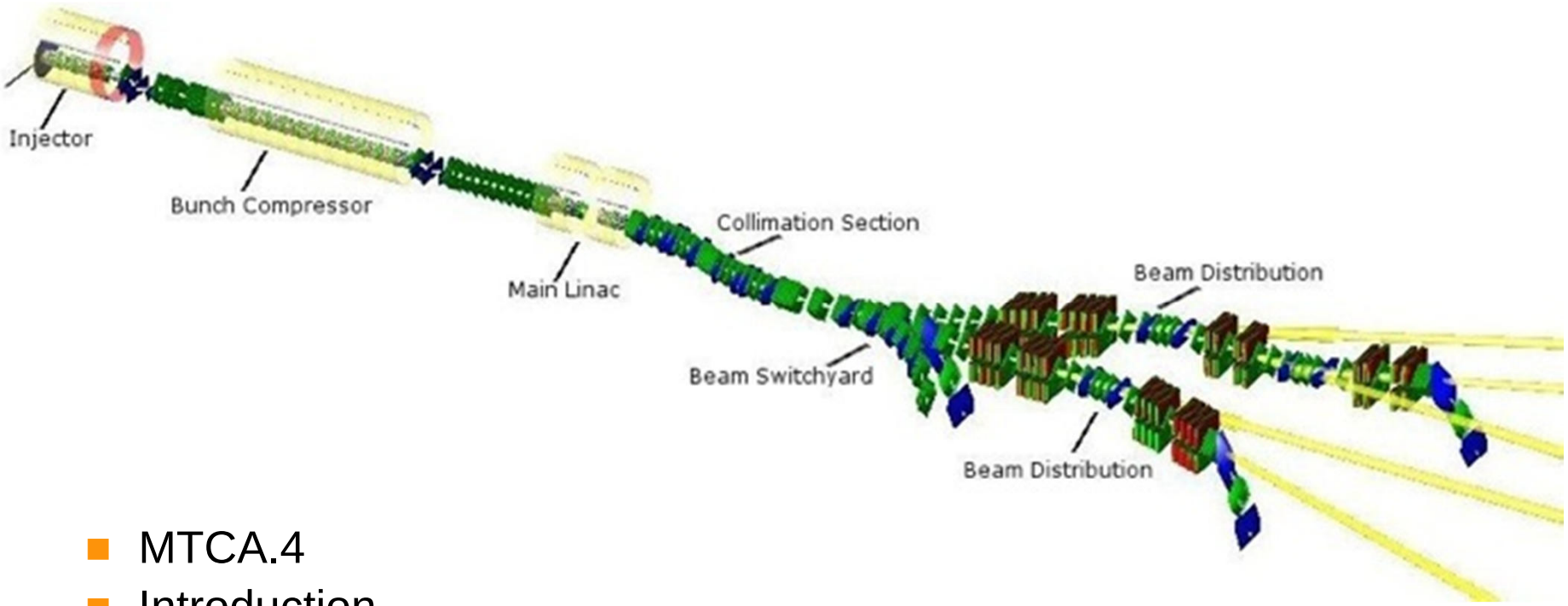
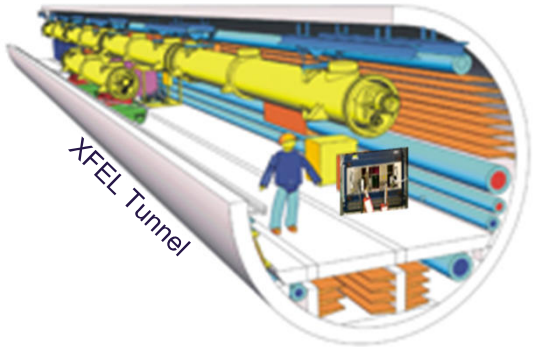
21. Aug. 2012

Motivation and Outline



- MTCA.4
- Introduction
- Key highlights
- The „Helmholtz Validierung-Fond“
- Conclusions



The XFEL will be Based on MTCA.4

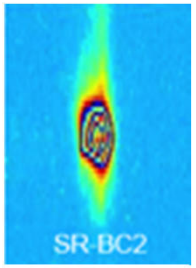
- Modular + modern architecture
  - Reusability + PCIe + Ethernet
- High availability
  - Redundant power and fan optional
  - Well defined management
- High performance:
  - Very low analog distortions
  - 4 lanes PCIe: 400 MB/s ... 3.2 GB/s

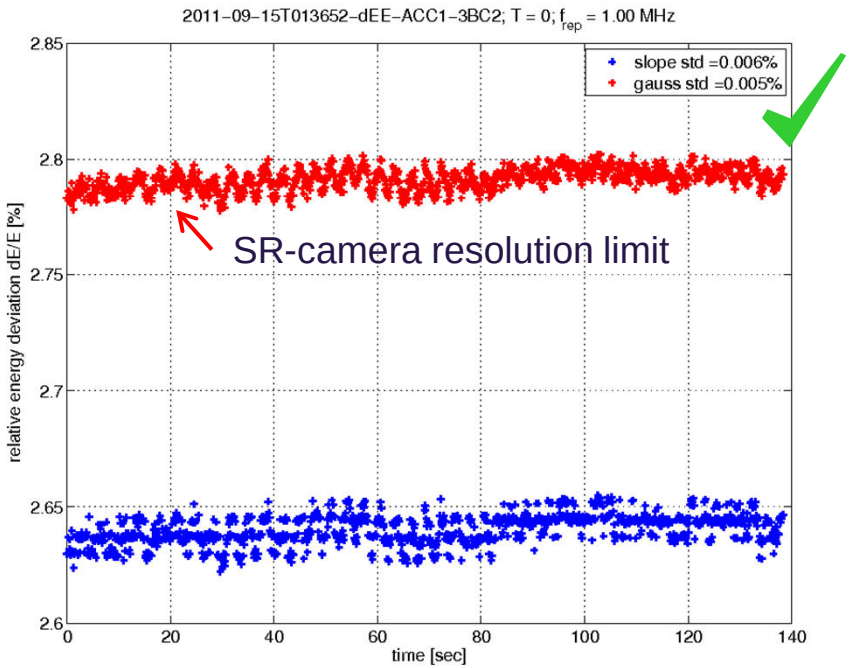
$$A = \frac{E[\text{Uptime}]}{E[\text{Uptime}] + E[\text{Downtime}]}$$

- Review meeting 12. 2007: XFEL will be based on xTCA
- XFEL fast electronics will be based on MTCA.4: > 200 Crates

First Results @ FLASH (Sept. 2011)

- On-crest energy stability :



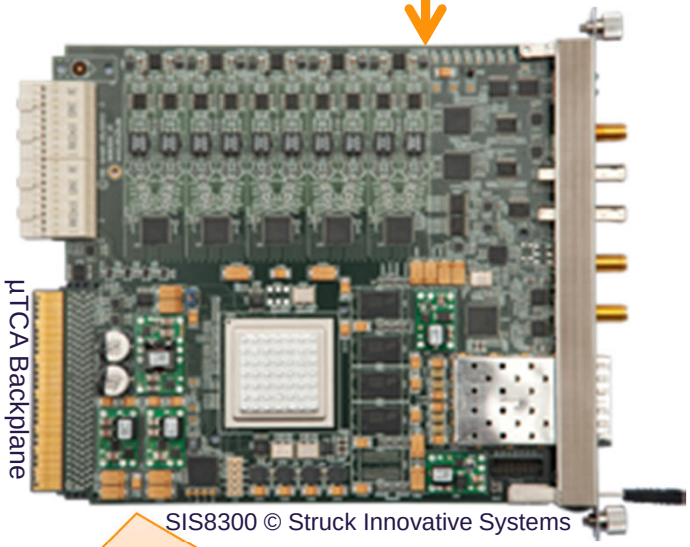


→ Energy stability dE/E= $5*10^{-5}$

XFEL Hardware Standard

- Key Feature of the MicroTCA.4 standard: Modularity
  - Double size Advanced Mezzanine Card (AMC) modules with complex FPGA and PCIe link to CPU
  - Rear Transition Modules for signal conditioning

DWC8300 © DESY



SIS8300 © Struck Innovative Systems

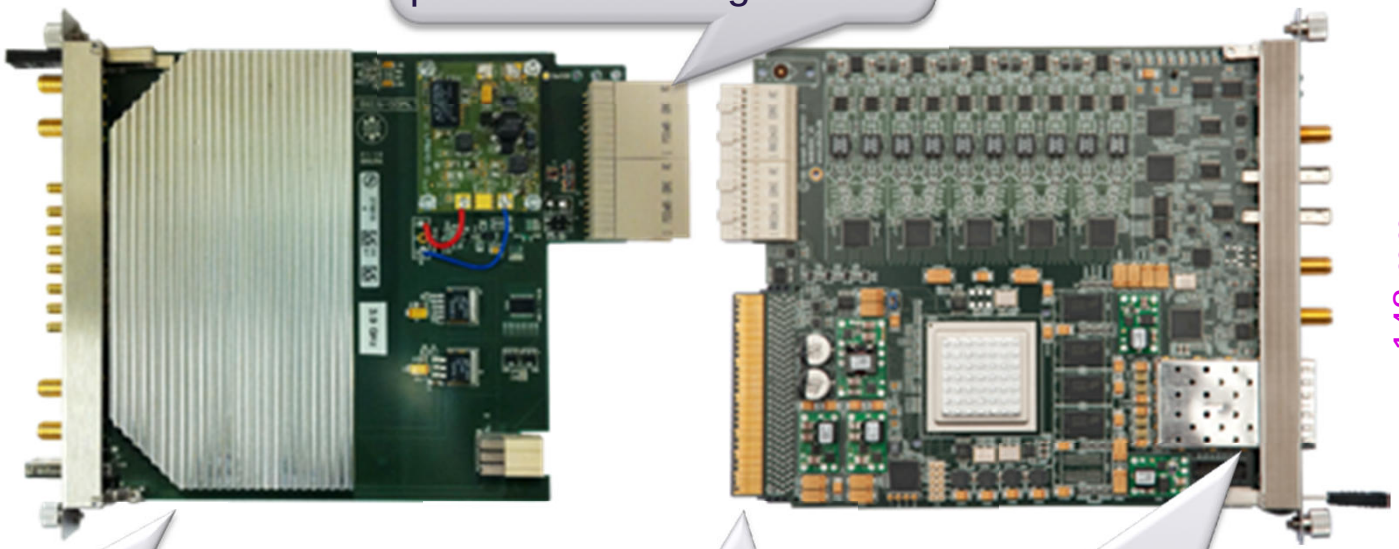
Different design skills required:
Complex RF or simple signal conditioning

Only a few versatile AMCs required,
Can follow Moore's law

PICMG MTCA.4

Connector:
Analog or digital signals, power and management

Cables from rear
e.g. SMA 1.3GHz



µRTM:
I/O adapter,
Application specific signal conditioning and cable adapters

AMC connector:
Ethernet and PCIe,
Clock and Trigger

Standard front AMC:
FPGA with high speed data links,

Digital AMC's and RTM's

RTM

- MPS Signal adapter

- ADC and DAC
  - 8 ch ADC 95 MSPS, 16bit
  - 8 ch DAC 16 MSPS, 16bit

- Test RTM

- Coupler Interlocks
- Beam Loss Monitors
- Toroid protection / readout
- Wire Scanner
- Clock & Trigger Contr. for Exp.

AMC

- DAMC2
  - Virtex 5
  - FMC
  - 4 * SFP
  - 100 in production

- TAMC651
  - Spartan 6
  - 1 SFP

Analog AMC's and RTM's

RTM

- 1,3 .. 3.9 GHz down converter

- 2 ch APD pulse stretcher

- BPM

- LEMO adapter SIS8900

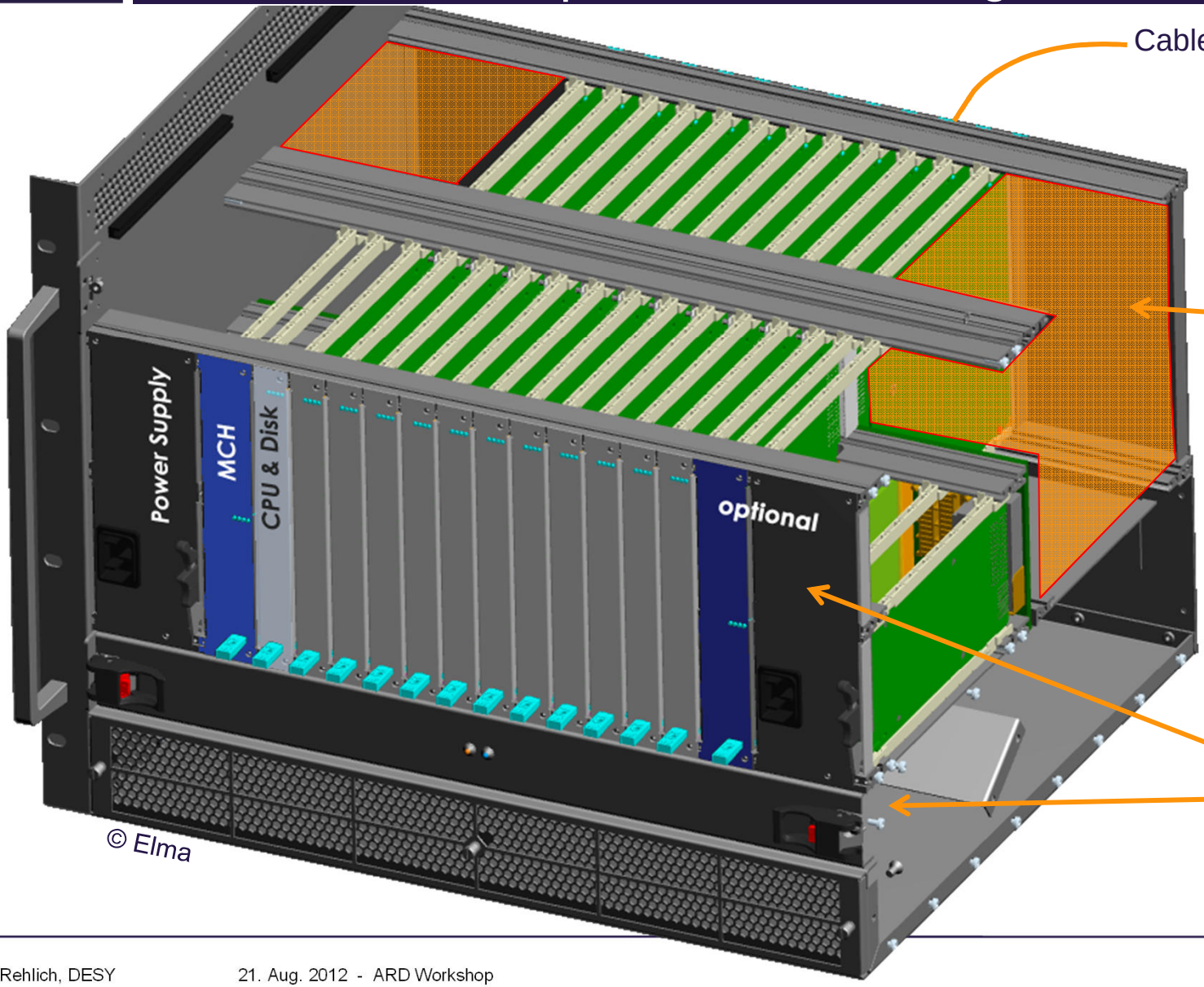
AMC

- 10 ch. 16 bit ADC
  - 125 MSPS
  - 2 ch DAC

- SIS8300
  - Virtex 5
  - 2 * SFP

- AMC520
  - Virtex 6
  - Dual core QorIQ

MicroTCA.4: Compact Modular Design



Cables from rear side

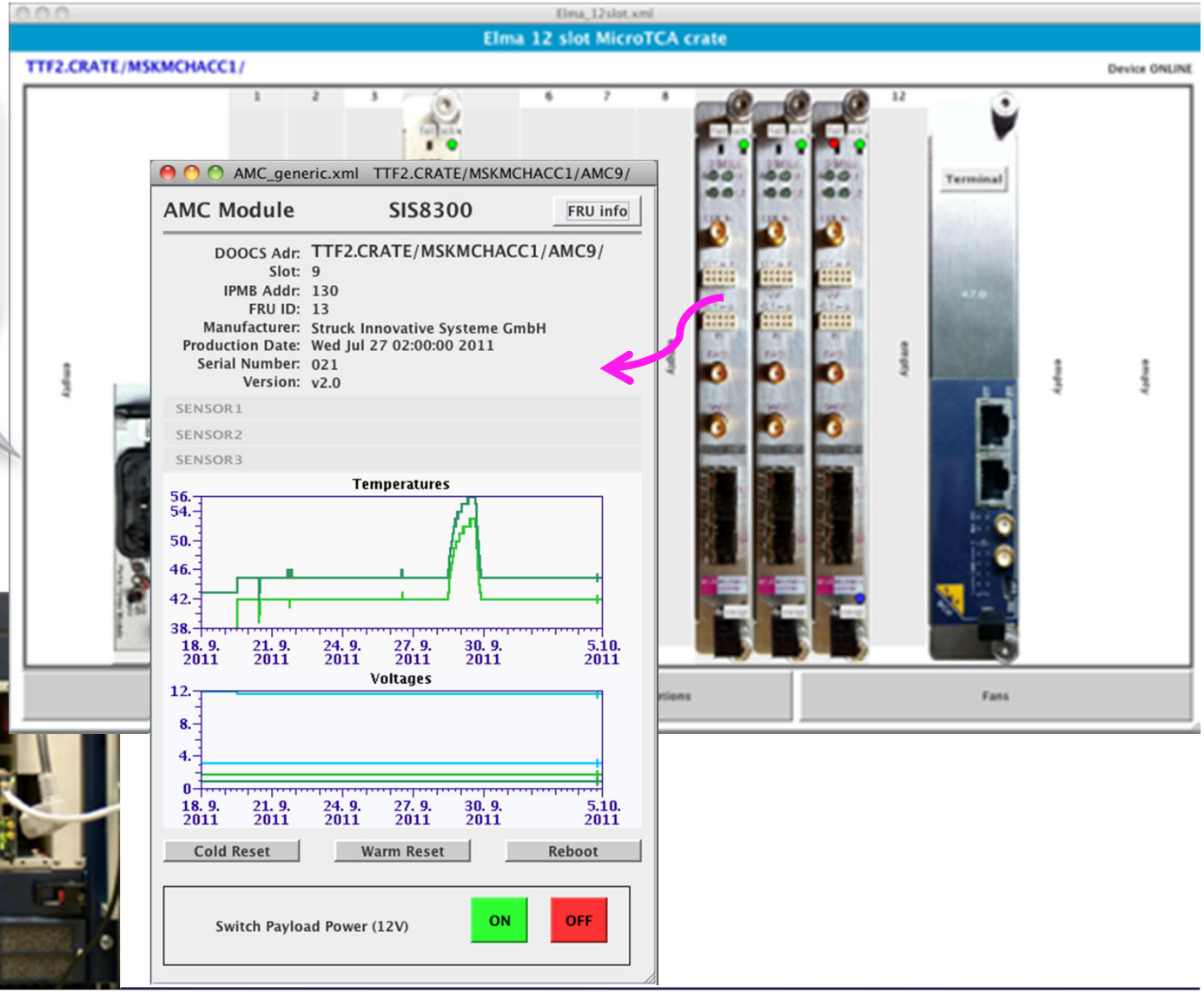
Space for ….

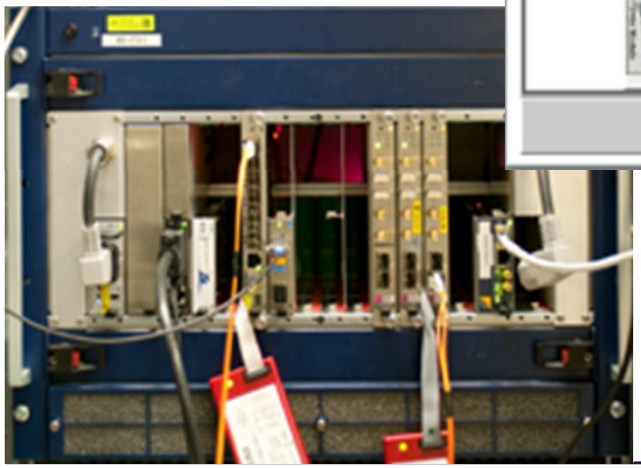
Redundant:
- Power
- Fan

MicroTCA Remote Management

Online status of modules:

- Is-inserted, fault, …
- Temperatures, voltages
- Reset, power on/off
- Act. Power consumption





Helmholtz Validierungs-Fond

MTCA.4 for Industry and Research

HELMHOLTZ | ASSOCIATION

DESY

struck innovative systeme

ELMA Your Solution Partner

N.A.I.

Schroff®

TEWS TECHNOLOGIES

AD-TE-C

THOMSON

4 Mio. €

Support from Helmholtz Association

- To foster industrialization of MicroTCA.4 incl. LLRF
- DESY designs → industry (licensing)
  - Cost and quality improvements
  - New modules to complete portfolio
- Supporting industry to
  - Add missing modules
  - Improve EMI with test environments and shielding
  - Gain new MicroTCA.4 applications in more markets
- Support for institutes and industry
  - Consulting: Help to start with MicroTCA
  - User guide and Web Site
  - Organization of workshops and contributing at exhibitions

- Project duration: mid 2012 … mid 2014

Conclusions

- MTCA.4 provides the essential features for high performance projects including:
  - State-of-the-art architecture
  - Modularity
  - High availability
- Successful system test of key MicroTCA modules (incl. 16 bit ADC) based on MTCA.4 standard
  - o Excellent performance
- MTCA 4 Industry and Research
  - A 4 000 000 € „Helmholtz Validierungs-Fond“ project has started
  - It is intended to foster MTCA.4

Thank you!