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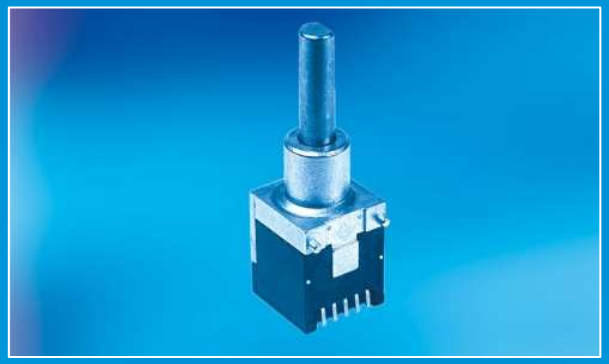
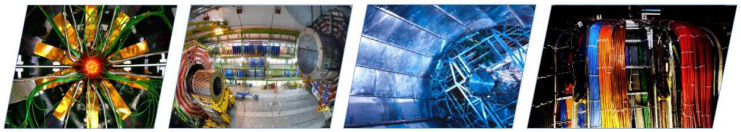


MTCA.4 system platforms



History of MTCA.4

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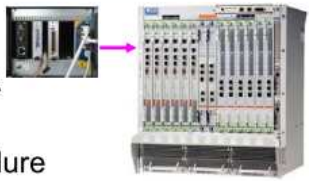
European XFEL **Evolution: VME → µTCA / ATCA**

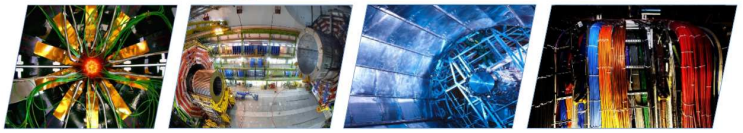
- VME is 27 years old:
  - Number of new developments is decreasing, sales are still constant
  - But, a lot of I/O modules are available
  - Bus technology has speed limitations
  - Wide busses create a lot of noise in analog channels
  - No standard management on crate level
  - No management on module level
  - So far no extension bus survived
  - One damaged bus line stops a whole crate
  - Address and interrupt misconfigurations are hard to find
  - ....

European XFEL **Evolution: VME → µTCA / ATCA**



- Scaleable modern architecture
  - From 5 slot µTCA … full mesh ATCA
- Gbit serial communication links
  - High speed and no single point of failure
  - Standard PCIe, Ethernet (, SRIO) communication
- Redundant system option
  - 99.999% availability is possible
- Well defined management
  - A must for large systems and for high availability
- Hot-swap
  - Safe against hardware damage and software crashes

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



History of MTCA.4

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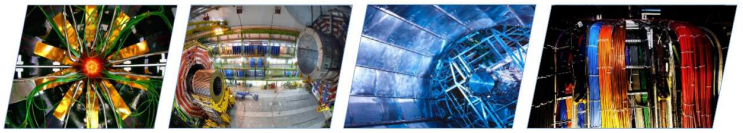
xTCA for Physics – Hardware Working Group

- µTCA rear transition modules – rear I/O for AMC
- Clock and trigger distribution (ATCA and µTCA)
  - Allow data Acquisition with ps stability
  - Guidelines for timing, synchronization and interlocks
- Define recommended AMC board sizes
- Specifications for ATCA RTM



MTCA specification

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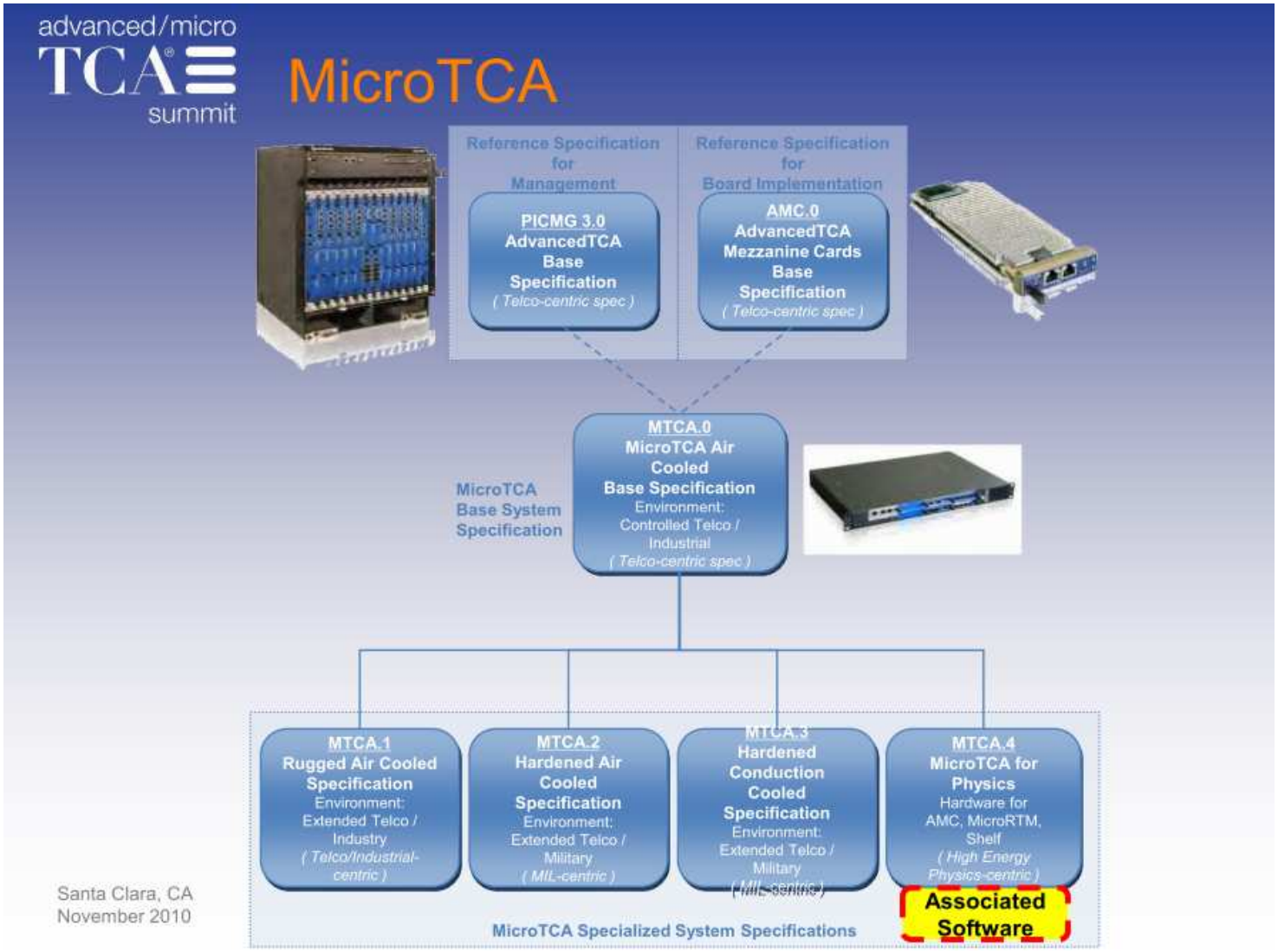

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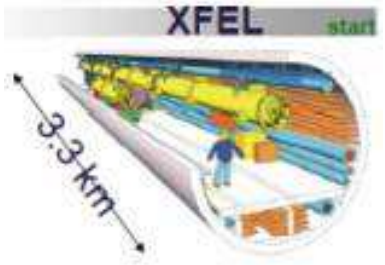
MTCA.4 environment

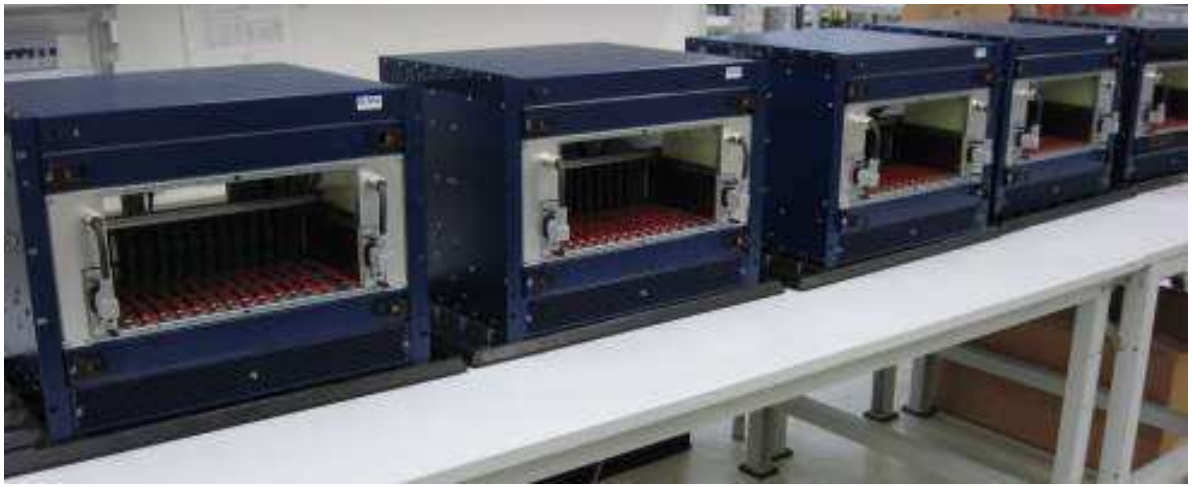
GEN II System platforms

Accessories

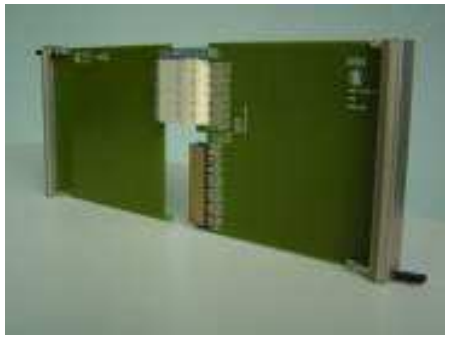
Challenges

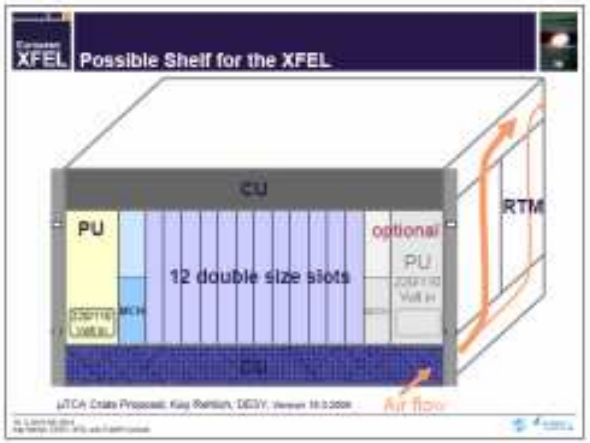
Example xTCA for physics



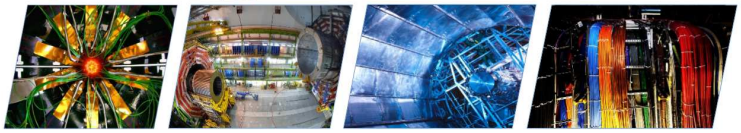


For the XFEL tube which is 3,3 km long, several decentralized data processors are used. These were accomodated in 19“ cabinets





Example
xTCA for physics



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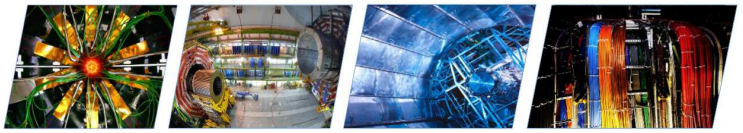
Flash Injector Rack Installation

- uTCA Prototype Front view

- uTCA Prototype Rear view



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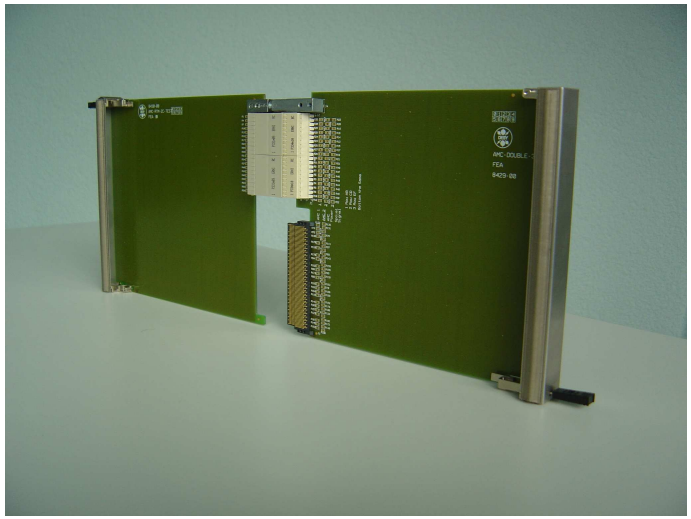
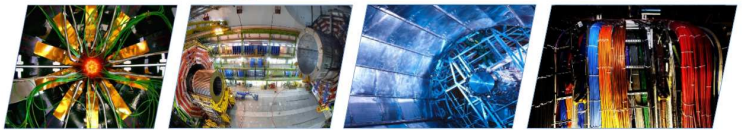
MTCA.4 history



From the idea to reality

source DESY HELMHOLTZ ASSOCIATION



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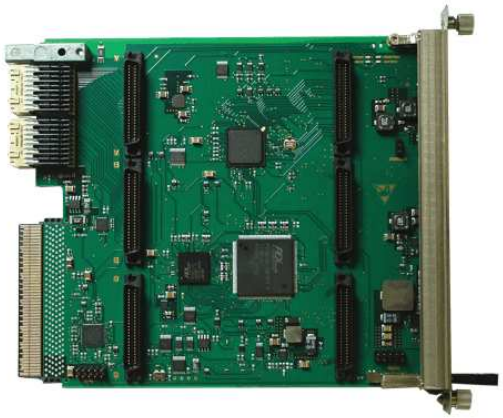
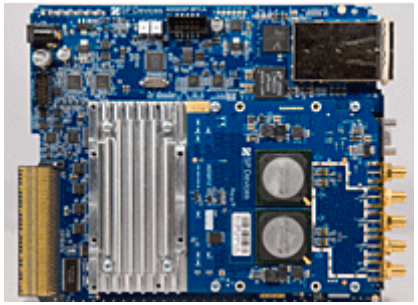
Board vendors

TAMC651 FPGA AMC for MTCA.4

TEWS TECHNOLOGIES



TAMC220 3 slot industry pqack carrier for MTCA.4

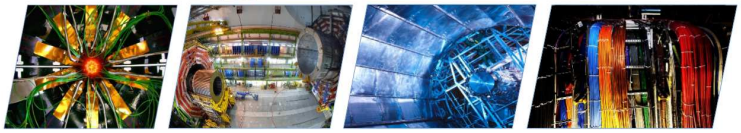


SP Devices
Signal Processing Devices

struck innovative systeme

DESY

HELMHOLTZ ASSOCIATION



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MTCA.4 history

new

µTCA for Physics *

SIS8300 10 channel 16-bit 125 MS/s µTCA for Physics Digitizer

ATCA and it's substandards like µTCA play an increasingly important role in the embedded world. Efforts of the PICMG workgroup xTCA for Physics to optimize the standard for next generation accelerators and experiments are well under way. The SIS8300 digitizer -under development for applications at the European XFEL e.g.- can be regarded as a demonstrator for the new standard.

Functionality

- 4 lane PCI Express connectivity
- 10 channels 125 MS/s 16-bit ADC
- 10 MS/s to 125 MS/s per channel sampling speed
- XC5VLX50T-3FFG1136C Xilinx
- 25 MSample buffer memory per channel
- AC and DC input stage
- ADC inputs through Rear Transition Module (RTM)
- internal, front panel, RTM and backplane clock sources
- two 16-bit DACs for fast feedback implementation
- high precision clock distribution circuitry
- programmable delay of dual channel digitizer groups
- Gigabit link port implementation to backplane
- twin SFP card cage for high speed system interconnects

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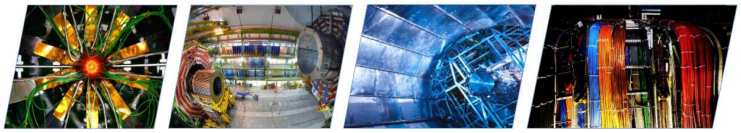
MTCA.4,
6 slot system platform



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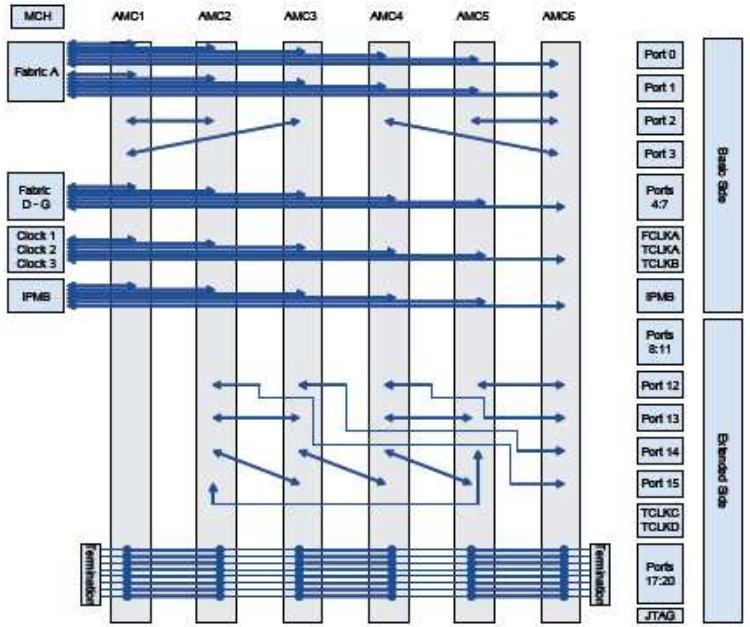
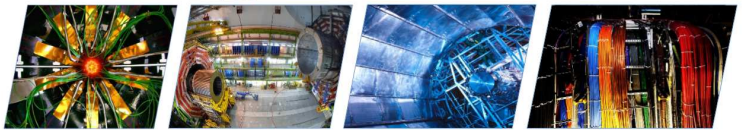
XTCA-6 Slot

- 6 mid size double units in front and rear
- PSU 300W / 600W
- 19" version possible





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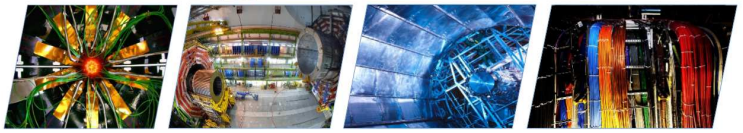
MTCA.4 environment

GEN II System platforms

Accessories

Challenges

Example
xTCA for physics



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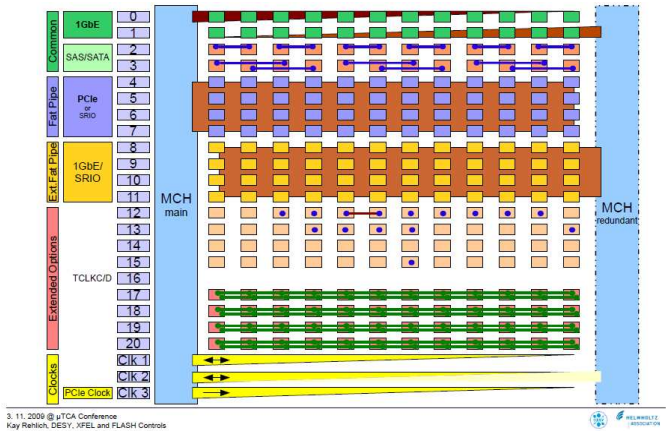
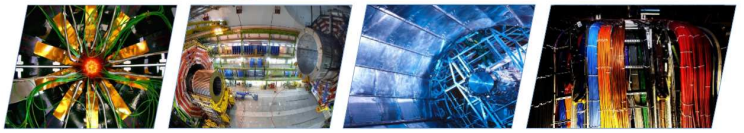


MTCA.4,
12 slot system platform



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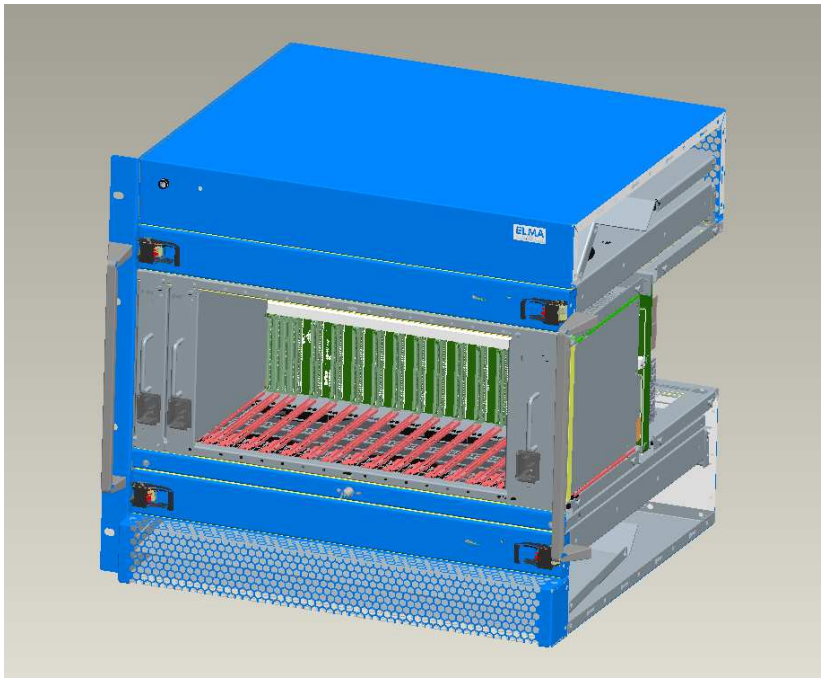
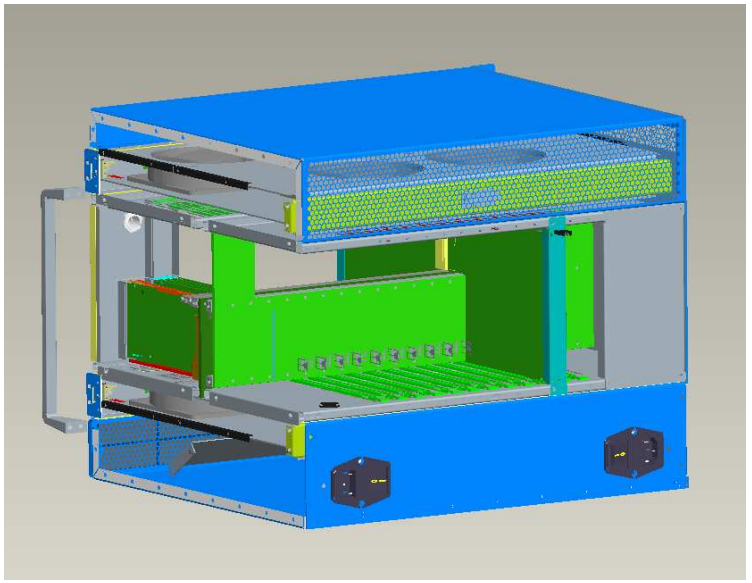
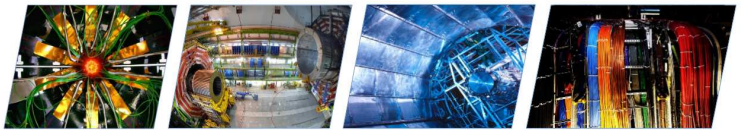
Different PSU Variants





MTCA.4,
12 slot system platform



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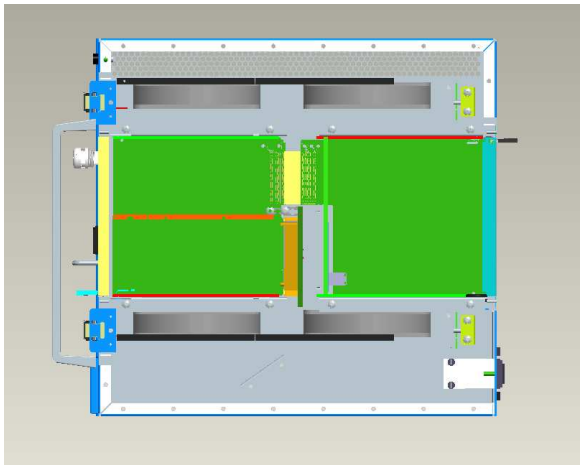
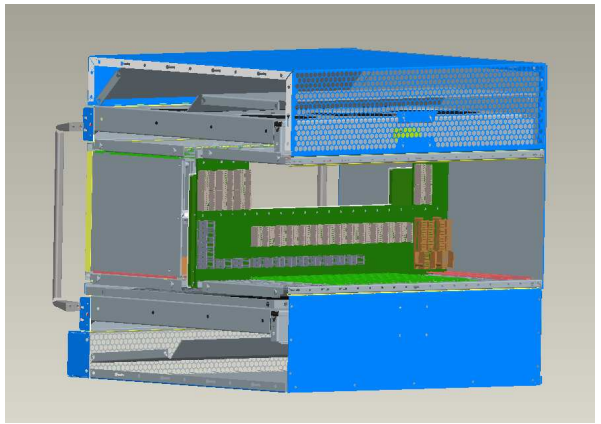
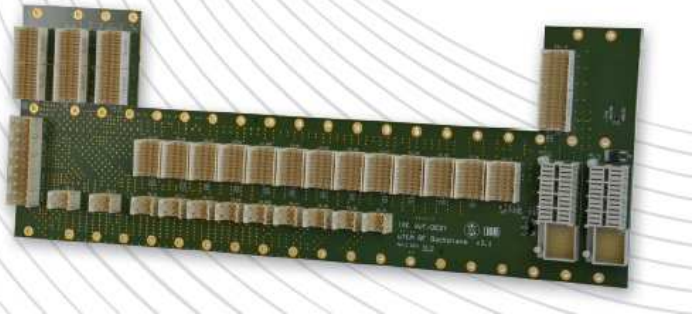
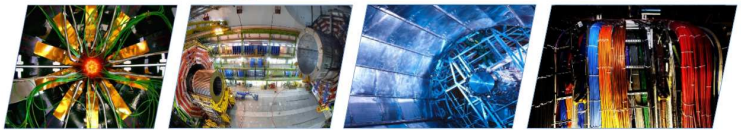




Special feature: DESY LLRF backplane

The new LLRF backplane from Deutsches Elektronen-Synchrotron (DESY) provides parallel connection of the signals from and to Rear Transition Modules. Elma offers this upgrade perfectly integrated upon request.





Backplane variants

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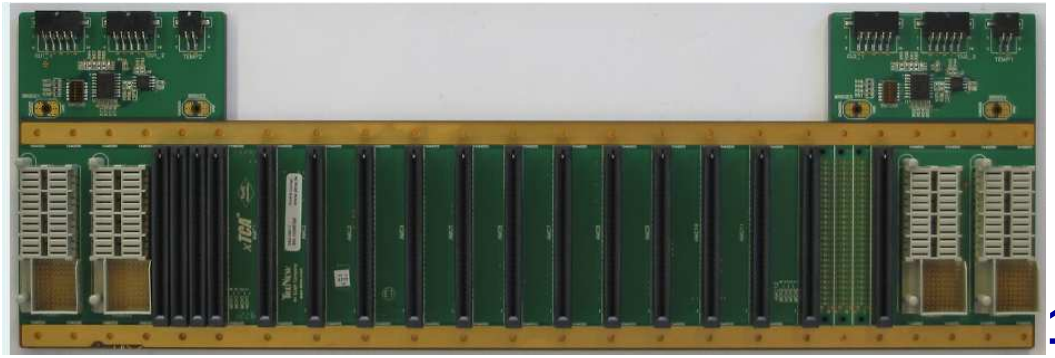
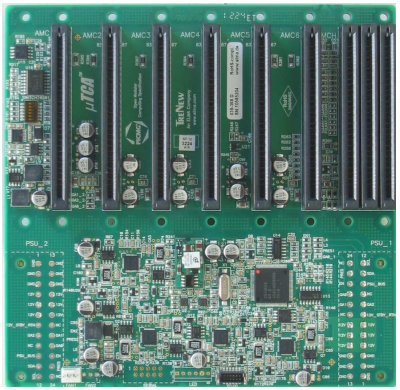
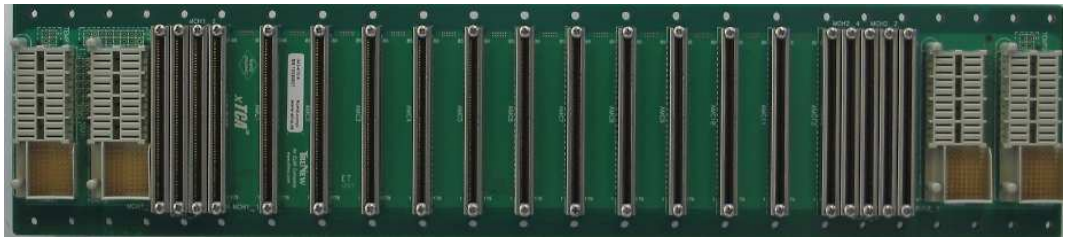
1x MCH



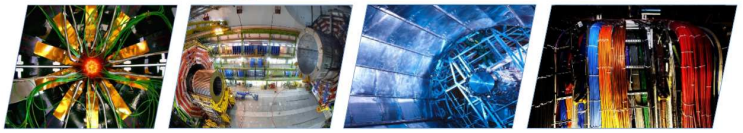
1,5x MCH

1x MCH





2x MCH



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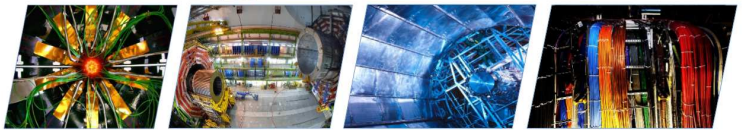
MTCA.4 environment

GEN II System platforms

Accessories

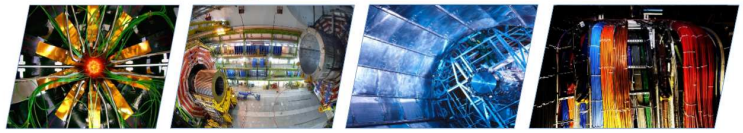
Challenges



Accessories

NAMC-EXT-RTM-F/R and NAMC-EXT-RTM-F-PS

Load boards front/rear



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Accessories

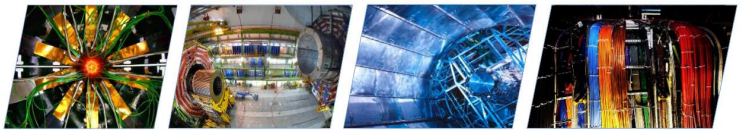
Input:

Input Voltage:	90 - 264Vac
Frequency:	47- 63Hz
Inrush Current:	≤35A
Efficiency:	84% typical at 115Vac, full load 88% typical at 230Vac, full load
Power Factor:	0.99 typical
Input Current	5.5A Typical at 1000W out and 230Vac 11A Typical at 1000W out and 110Vac
Input Protection:	Internal Line Fuse: Replaceable 12A 250Vac Normal- Blow
Brown – Out:	75 to 300Vac ,(power supply will not damaged at this input voltage range)
Input Connector:	IEC-320
Hold-up Time:	10mSec minimum at 1200W

Output Voltages & Currents:

Output	Output Voltage	Min. Load	Total Max. Load	Max. per Channel
V1 @ 220Vac	16 x 12Vdc	0	1200W / 98A	80W / 7.6A Max.
V1@ 100Vac	16 x 12Vdc	0	1000W / 81.6A	80W / 7.6A Max.
V2	16 x 3.3Vdc	0	12.5W / 3.8 A	200mA

Next generation MCHs



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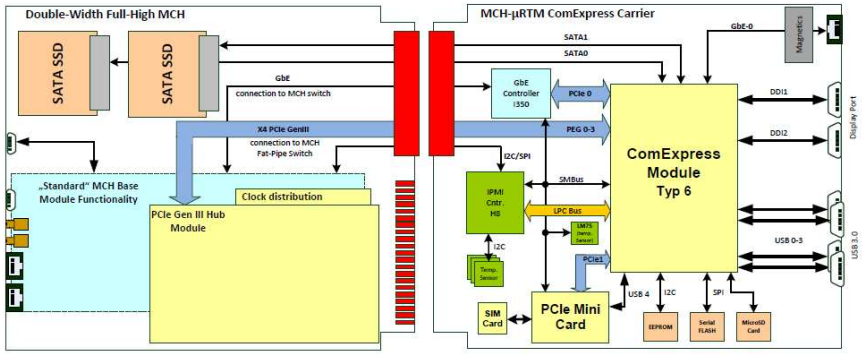

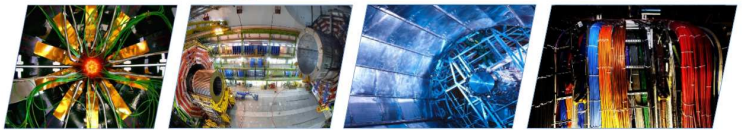

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MTCA.4 environment

GEN II System platforms

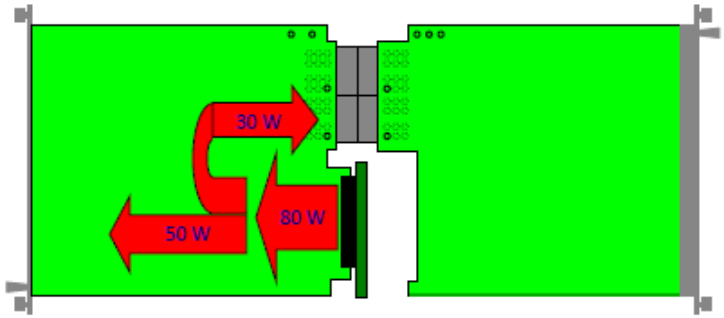
Accessories

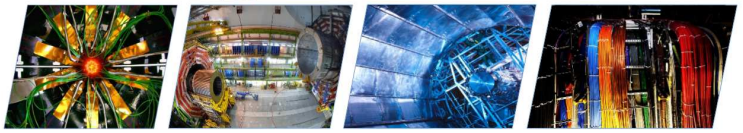
Challenges

Power budget

Front board and MicroRTM power requirements

- The total power for a slot (front board and RTM) is supplied through the front board AMC connector
- The MicroRTM power is supplied from the front board through the Zone 3 connectors
- Total available power for a slot is 80 Watts, the MicroRTM power is limited to 30 Watts
- The power required by the MicroRTM is subtracted from the power for the front board

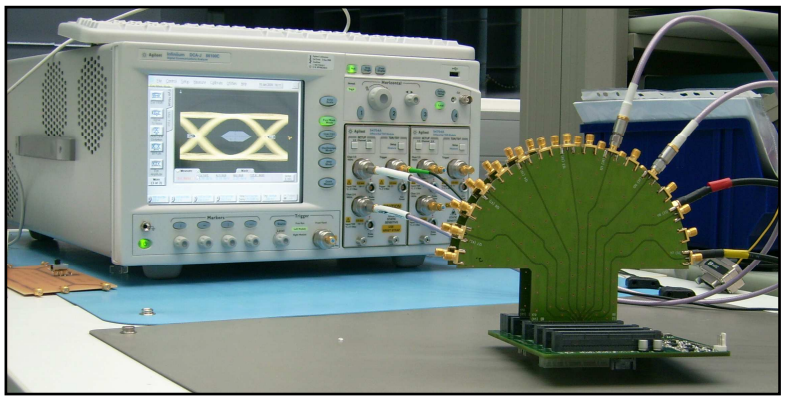


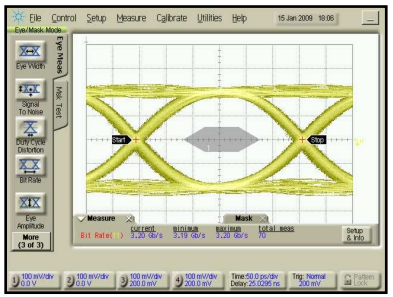


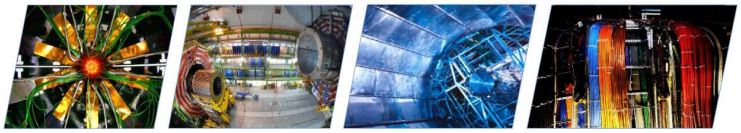
Research and Development: Signal integrity

PCIe 3rd gen @ 8 Gbps

Measurement of impedance characteristics and eye diagrams to evaluate the signal integrity and to determine the maximum data transfer rate of a transmission system.







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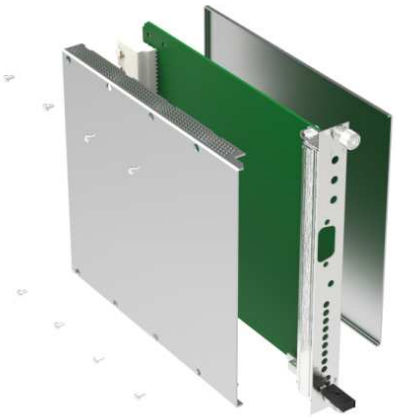
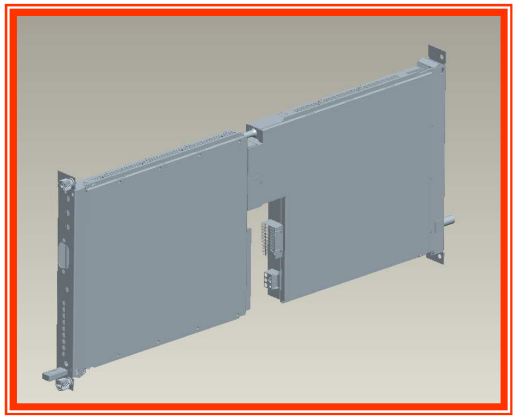
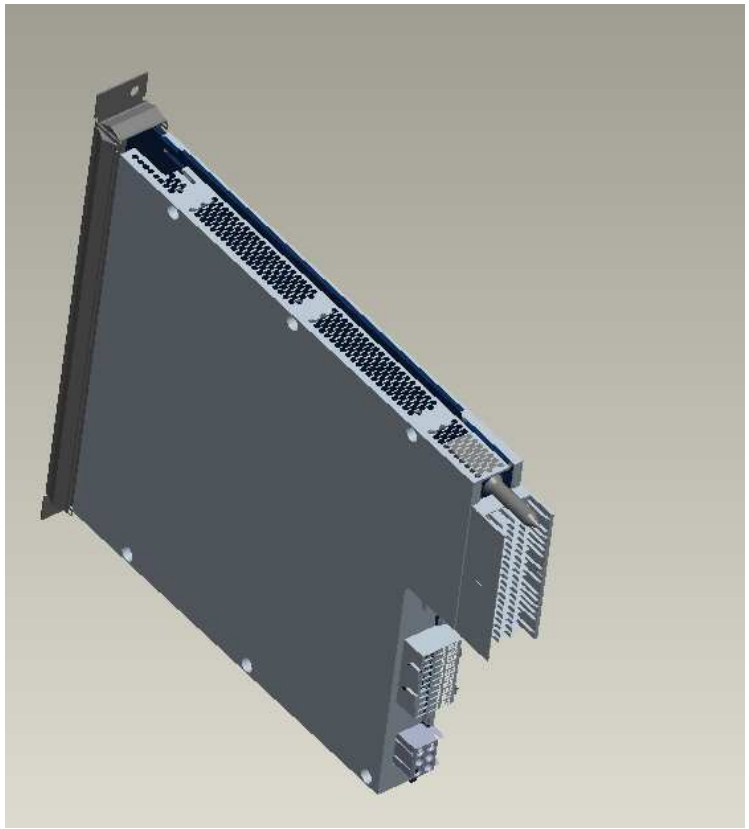
EMI shielding



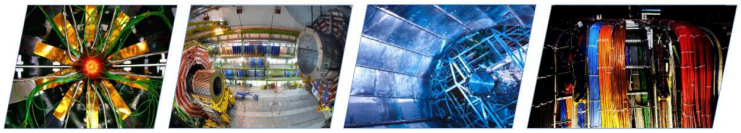


DESY

HELMHOLTZ ASSOCIATION



Increasing the EMI performance through EMI shelves



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Thank yor for your attention

- Aksel Saltuklar