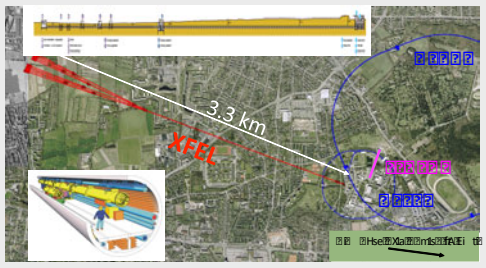
European XFEL

MicroTCA.4 at the European XFEL

Author et al.

The European XFEL



- The European XFEL is a research facility currently under construction in the Hamburg area, Germany. From 2015 on, it will generate extremely intense X-ray flashes to be used by researchers from all over the world.
- The X-ray flashes will be produced in a 3.4-kilometre-long facility. Most of it will be housed in tunnels deep below ground. Three sites provide access to the tunnels and the experiment stations.

Abstract

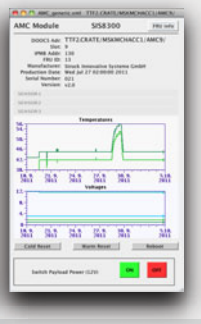
Several accelerator labs developed an extension for the MicroTCA standard together with industrial partners within the PICMG organization. This new MTCA.4 standard adds the required IO, clock and trigger capabilities to the telco dominated basic specifications. This paper describes the unique technology for high resolution and high performance front-end data acquisition and control. MTCA.4 provides comfortable sized Rear Transition Modules, high-speed serial communication, precision clock distribution and full management. This makes it an ideal choice for high precision analog IO in large installations. The European XFEL project is based on this new standard and several other labs are in a prototyping or evaluation phase.

MicroTCA.4 Crate

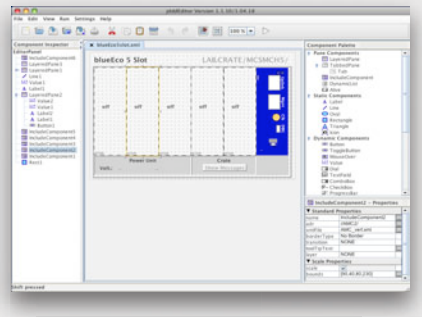
- Crate with 12 slots
- Power supply
- Cooling
- Shelf management
- Backplane
  - Full mesh for PCIe, Serial RapidIO, 10GbE, Infiniband
  - Ethernet switch
  - Clock distribution
  - Trigger lines
  - Update channel
- Rear transition modules

MicroTCA Crate Server

- Elma 12 slot MicroTCA crate
- SANBlaze
- Cooling
- Power supply
- Shelf management
- Backplane
- Rear transition modules



- AMC Module SIS8300
- FMC interface
- Temperatures
- Voltages
- Cold Reset
- Warm Reset
- Reboot
- Switch Payload Power (12V)



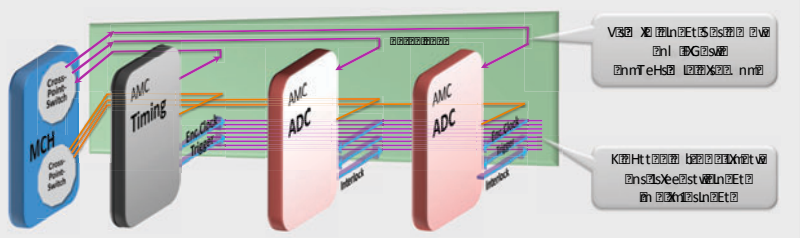
- Component Inspector
- Component Palette
- Property Grid
- Crate
- Power Unit
- Temperatures
- Voltages

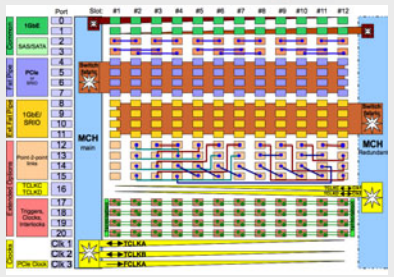
MicroTCA Crate Server

automatic configuration from IPMI

MicroTCA.4 Backplane

- Full mesh for PCIe, Serial RapidIO, 10GbE, Infiniband
- Ethernet switch
- Clock distribution
- Trigger lines
- Update channel
- Rear transition modules
- Management
  - Module management controller (MMC)
  - Shelf management controller (MCH)
  - Intelligent platform management interface (IPMI)
- Support for different backplane topologies
  - Standard defines full mesh, dual star, dual dual star
  - Custom backplanes are allowed
- Standard defines power supply, cooling, mechanical form factors





- Management and monitoring
  - Out of the box
  - Out of the box
  - Out of the box
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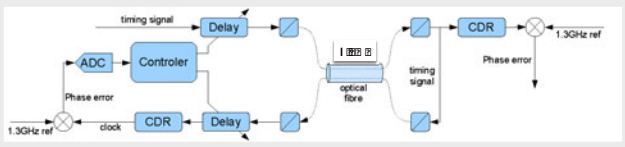
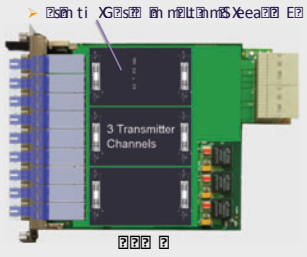
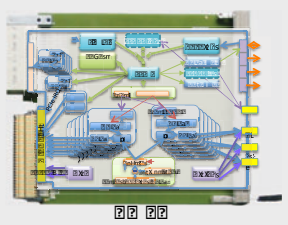
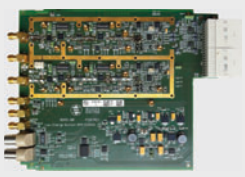
MicroTCA.4 Modules

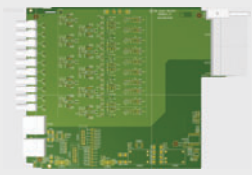
- Rear transition modules
  - Analog input
    - 14 bit, 125 MSPS ADC
    - Anti-aliasing filter
    - Programmable gain amplifier
  - Analog output
    - 16 bit, 800 kSPS DAC
    - Reconstruction filter
  - Digital IO
    - 8 channel, 3.3 V TTL
    - Interrupt capable
    - Bidirectional
- Timing receiver
  - Receives timing information from European XFEL timing system
  - Provides clock and trigger signals to the crate
  - Provides precise timestamps
- Carrier boards
  - Single width, mid size
    - Spartan 6 FPGA
    - Virtex 6 FPGA
  - Double width, full size
    - Virtex 6 FPGA
    - Kintex 7 FPGA
- Custom modules
  - Interlock module
  - Bunch arrival time monitor
  - Laser synchronization
  - Low level RF
  - Beam loss monitor
  - Motor control
  - Power supply control
  - Cryogenic control
  - Beam position monitor
  - Bunch compressor
  - Pump laser
  - Gun laser
  - Diagnostic
  - Machine protection

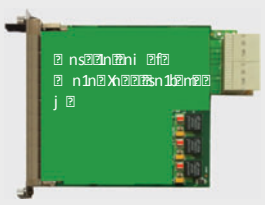


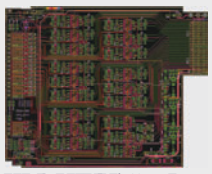


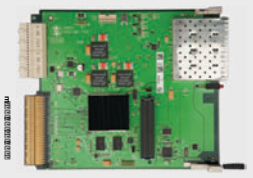


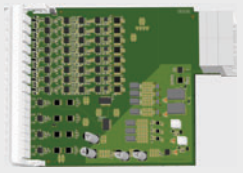


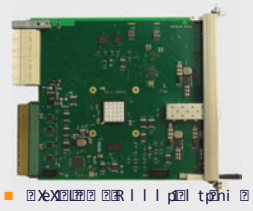


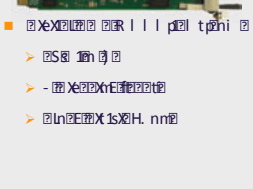


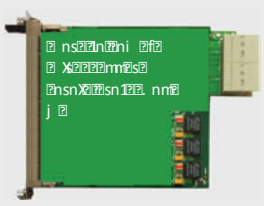












Conclusion

References

[1] Author et al., "Paper Title", Proceedings of ICALEPCS2011, Grenoble, France, 2011.