xTCA for COMPASS (and Belle II)

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Application in COMPASS: DAQ
The DHH AMC card

Communication via:
- Ethernet IPBUS
- 16x2.00 Gbps HOLA Slink
- TCS

Data buffering:
- 4GB DDR3 Memory
- => 1GB/s sustained rate
Current setup

Intermediate solution:
AMC-cards on VME carriers
Current setup

2017 Data Flux

System Uptime > 99%

Average data rate: 91.7 MB/s
Average over stable beam periods: 250 MB/s
What will be the next step

Interconnect all front-ends and all DAQ modules via Crosspoint switch

Advantages:
- Simplifies load balancing
- Possibility for changeover in case of failures

ATCA backplane not flexible enough even full mesh ⇒ independent crosspoint switch
The crosspoint switch

Features:
• 12 CXP cages
• Artix-7 controls individual connections

Housing
• Does not fit in any form factor
• Custom case + power supply
• Directly mounted into 19” rack
**Application at BelleII: PXD readout**

40 half leaders
- Each 4x1.52 GB/s
- Each connect to one DHE card
- DHC multiplexer card
- DHI control card

**Interconnection:**
- 1 highspeed link
- Custom UCF protocol multiplexes
  - Trigger
  - Data
  - Ethernet (IPBus)
DHI

- Isolation for JTAG
- Power for optical transmitter
- Current source
- Isolation and amplifier for CLK and TRG
- Isolated DC/DC converter
  Switchable by FPGA
- CLK Fanout
- CLK Synthesis
- UCF
- JTAG
- Artix-7 XCA100T-2
Application at BelleII: PXD readout

Interfaces to the outside:
- DHE 20 optical fibers via RTM
- DHC via RTM:
  - 4x 6Gb/s to DAQ (ONSEN)
  - Belle2 Time distribution
  - Ethernet (IPBus/UDP ro)
- DHI via front-panel to detectors
  - Clock / trigger
  - JTAG
Usage of ATCA

- No interconnection between carriers
- Only power and cooling used

**Power:**
- Main Consumer DHC
  - Many links + Memory
  - Consumption ~30 W
- Each DHE ~10 W
- DHI ~10 W
- Total 90 W per carrier
- Up to 200 W available

**Cooling:**
- Fan speed at 50%
- DHC 68°C
- DHE 40°C
- DHI 60°C
Conclusion

ATCA infrastructure useful
ATCA backplane is not suited for our applications

Future

5 DHE + 1 DHC ⇒ 1 Kintex Ultrascale XKCU095

- Frontpanel interfaces: 60x16Gbs
- AMC connector: 15x 16Gbs
- 32GB memory
- Data throughput: 10 GBs