xTCA for COMPASS (and Belle II)

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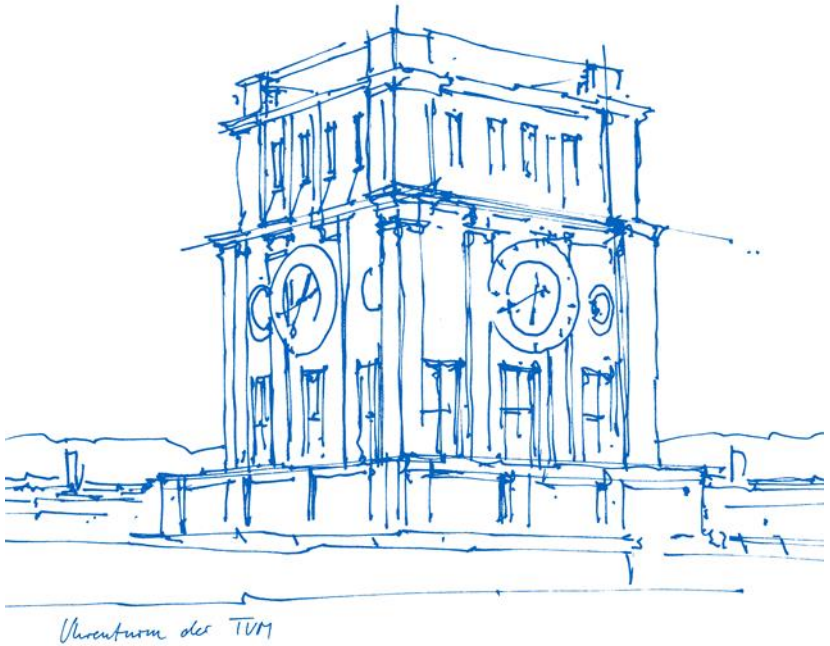
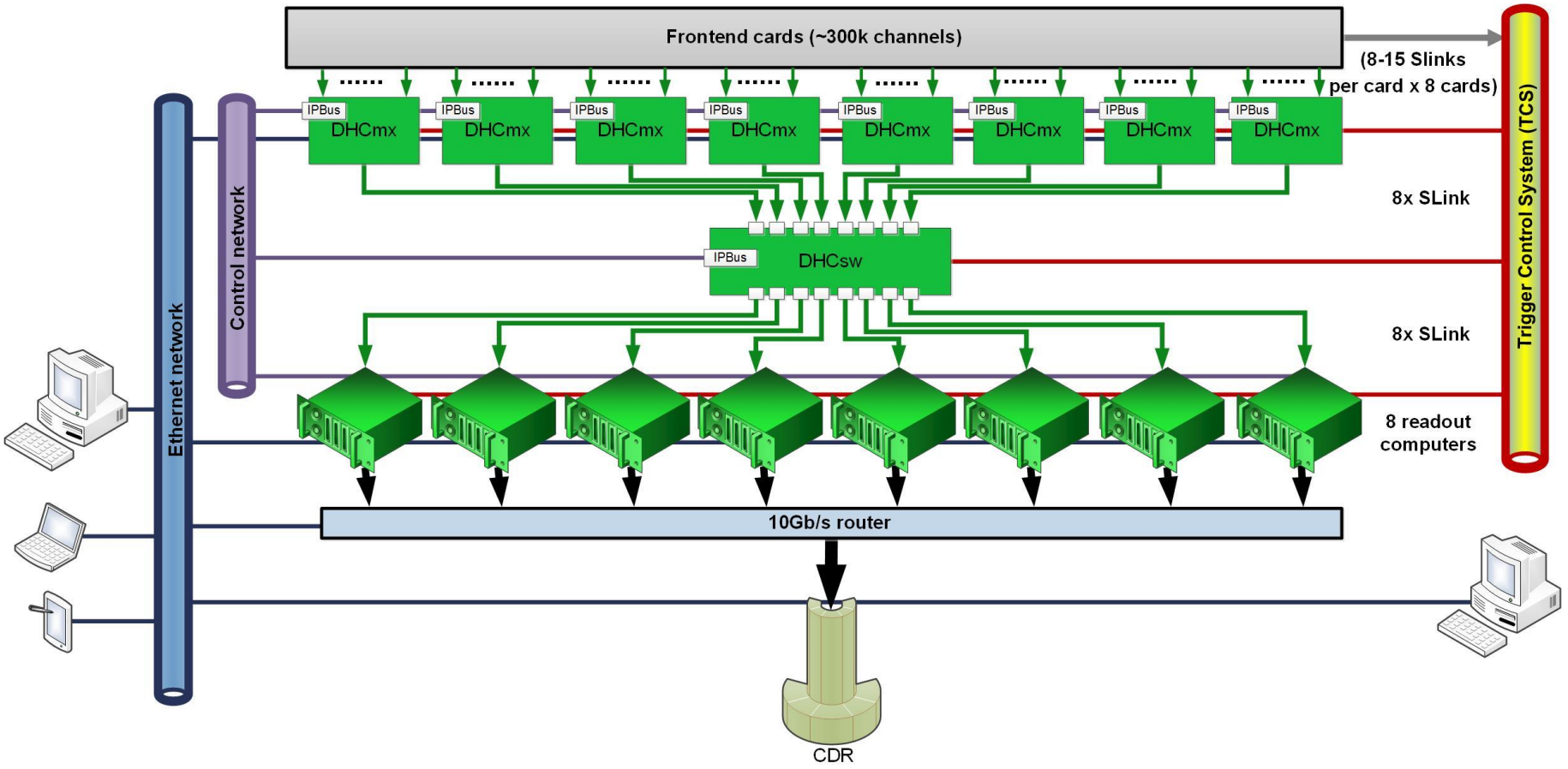


Application in COMPASS: DAQ



The DHH AMC card

Communication via:

- Ethernet IPBUS
- 16x2.00 Gbps HOLA Slink
- TCS

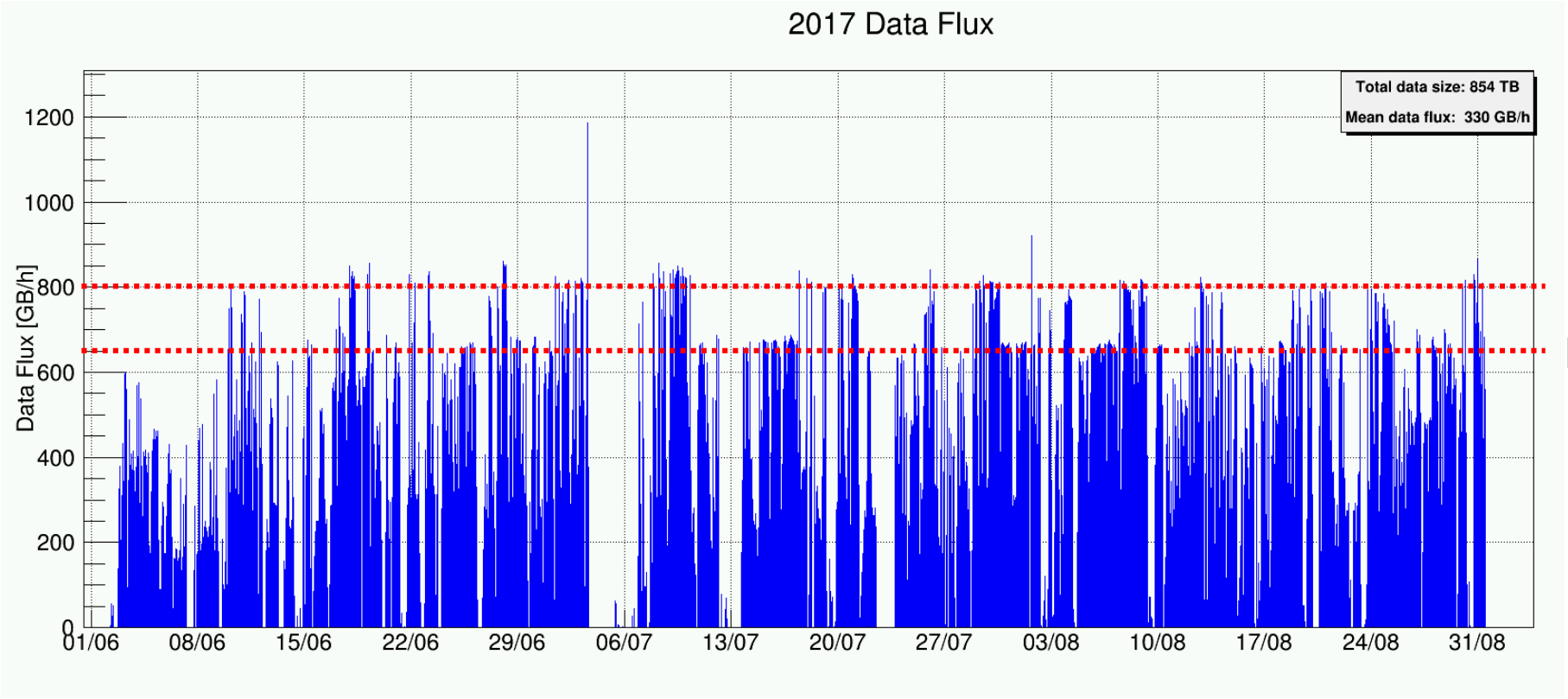
Data buffering:

- 4GB DDR3 Memory
- => 1GB/s sustained rate

Current setup

Intermediate solution:
AMC-cards on VME carriers

Current setup

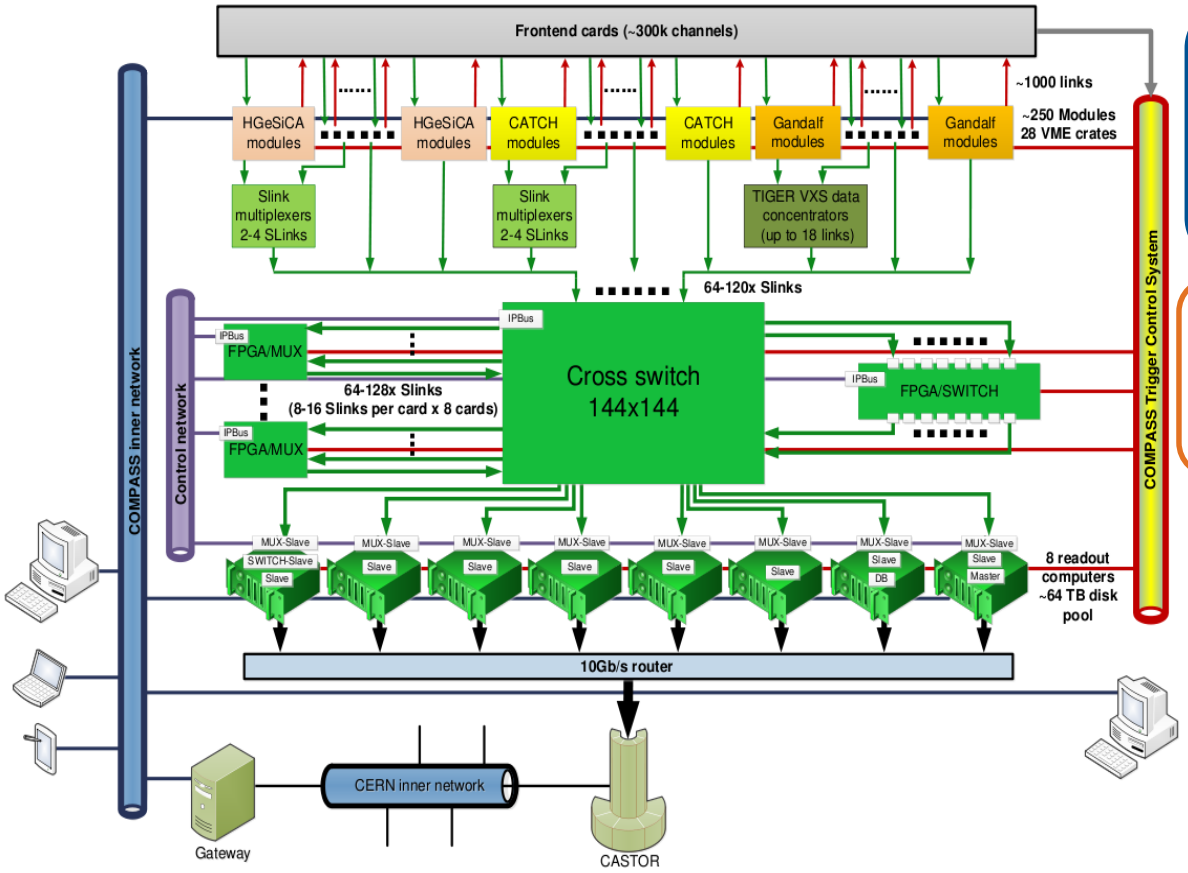


System Uptime > 99%

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



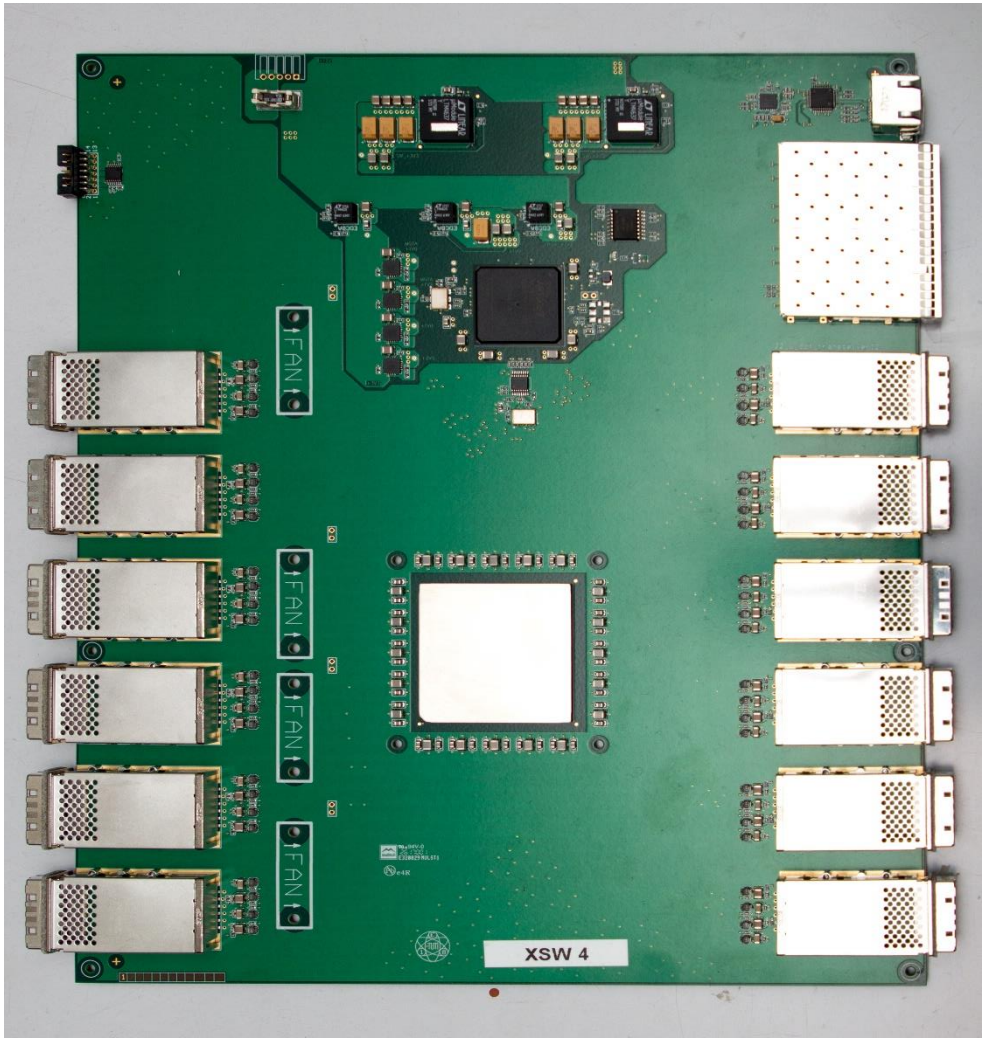
Advantages:

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

ATCA backplane not flexible enough even full mesh

⇒independent crosspoint switch

The crosspoint switch

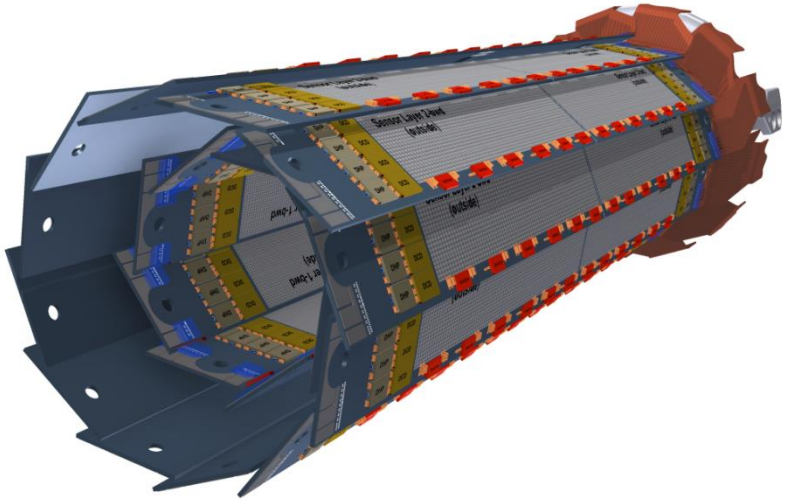


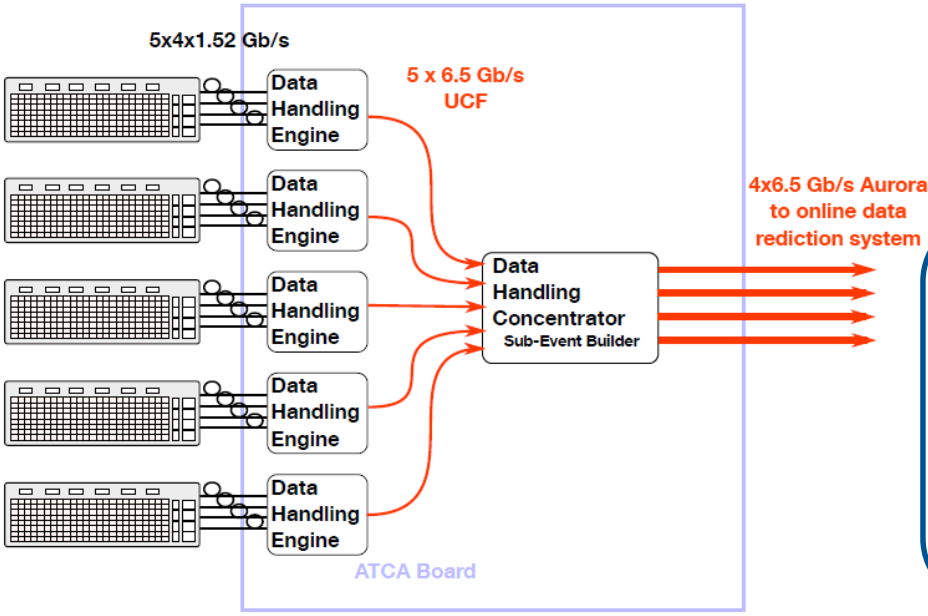
Features:
- 12 CXP cages
- Artix-7 controls indivual connections

Housing
- Does not fit in any form factor
- Custom case + power supply
- Directly mounted into 19” rack

Application at BelleII: PXD readout

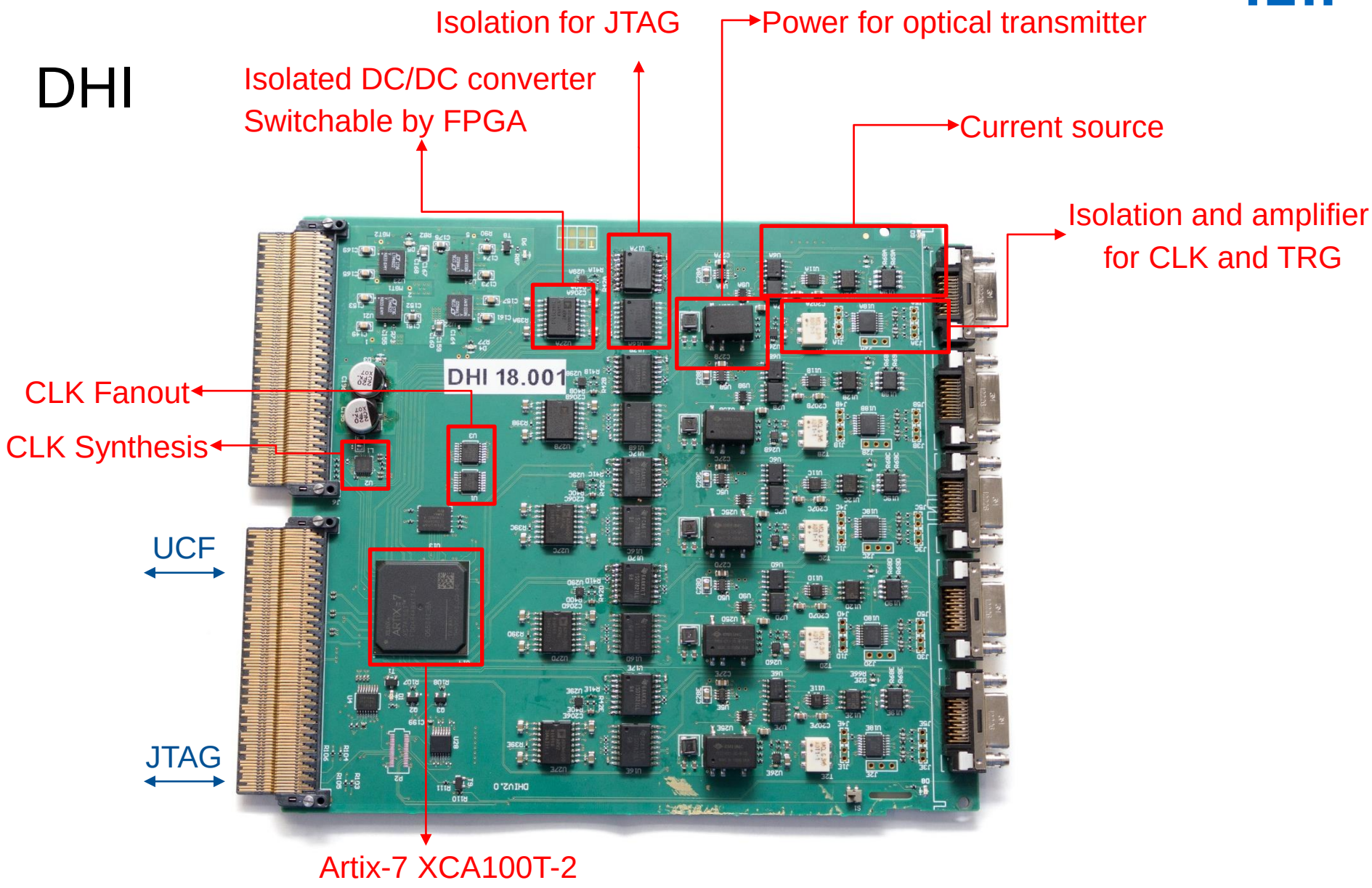
40 half leaders
- Each 4x1.52 GB/s
- Each connect to one DHE card
- DHC multiplexer card
- DHI control card



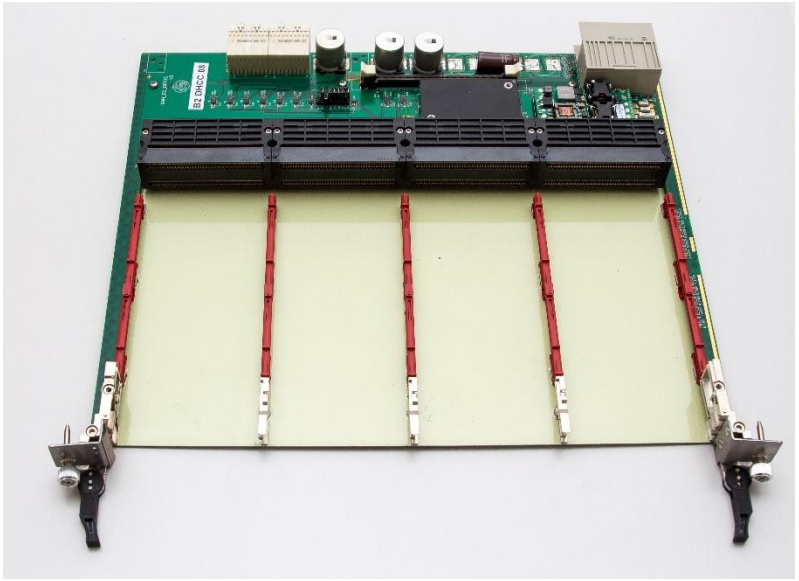


Interconnection:
- 1 highspeed link
- Custom UCF protocol multiplexes
  - Trigger
  - Data
  - Ethernet (IPBus)

DHI

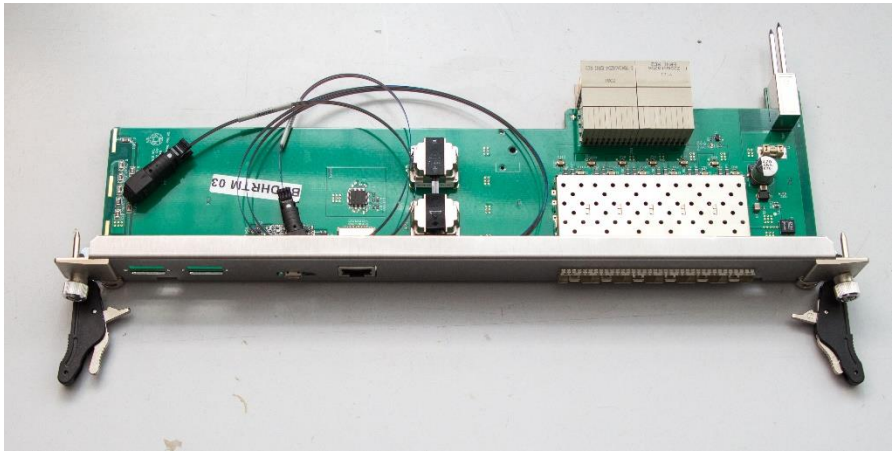

Isolation for JTAG
Power for optical transmitter
Isolated DC/DC converter
Switchable by FPGA
Current source
Isolation and amplifier
for CLK and TRG
CLK Fanout
CLK Synthesis
UCF
JTAG
Artix-7 XCA100T-2
DHI 18.001

Application at BelleII: PXD readout



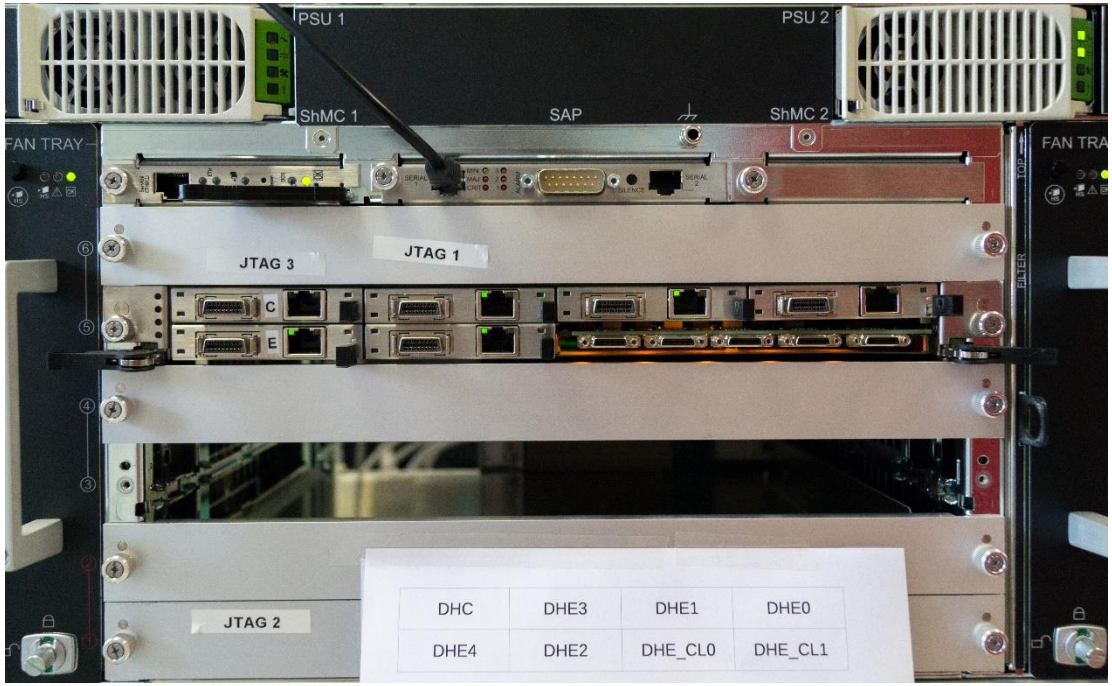
Interfaces to the outside:

- 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

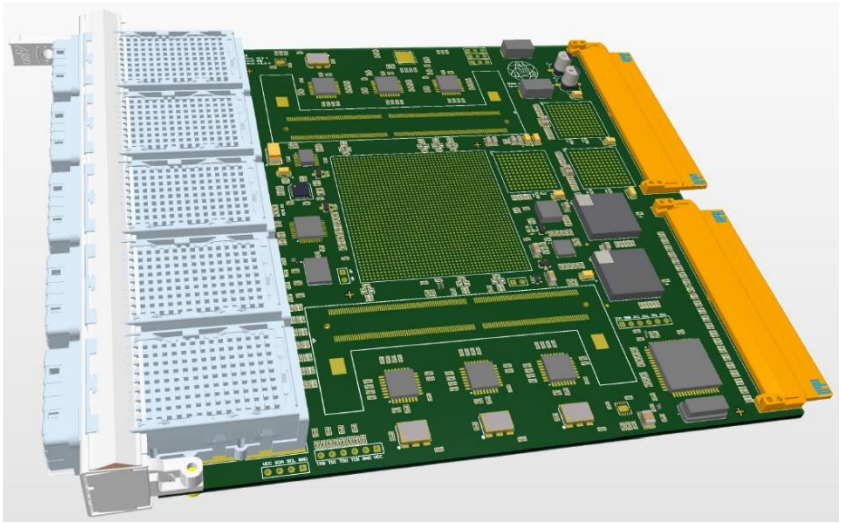
Conclusion

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