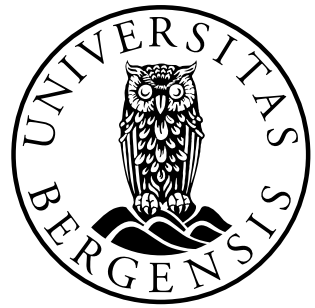


Department of Physics and Technology

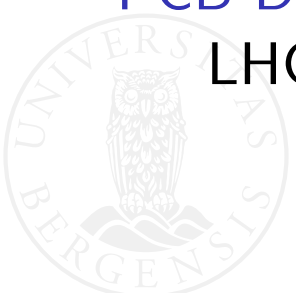
Master Thesis

Interface Design for the Gigabit Transceiver Common Readout Unit

Anders Østevik

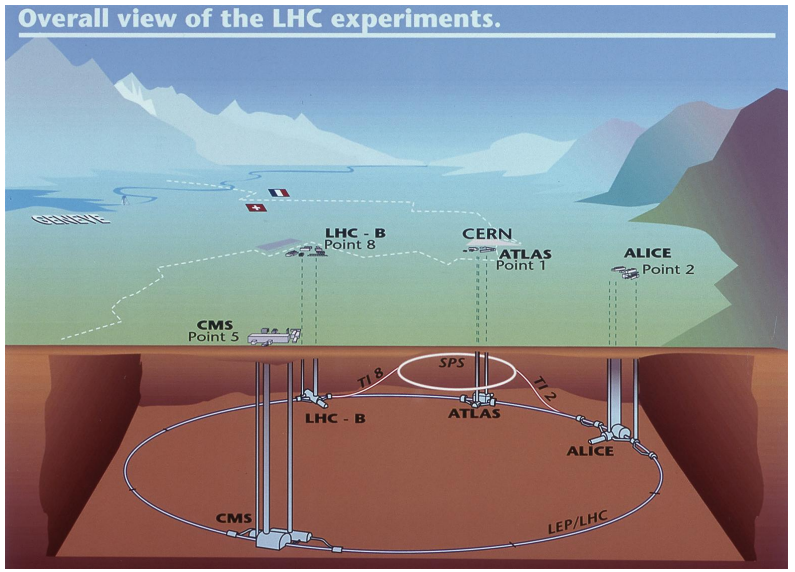
June 2016

Overview



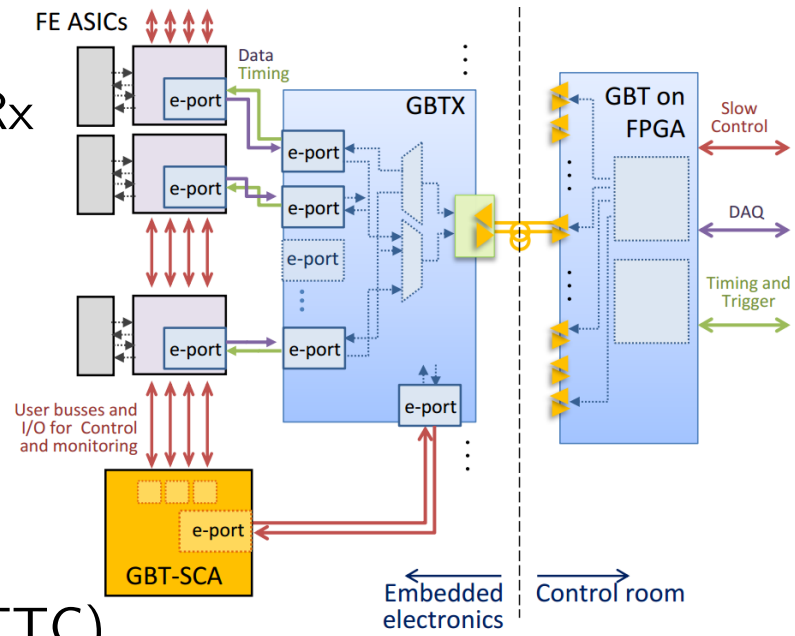
LHC Upgrade

- Large Hadron Collider (LHC)
  - Particle accelerator
  - 27 km circular tunnel
  - 13 TeV
- High-Lumiosity LHC
  - 10x beam lumiosity
  - Increase in radiation and amount of data
  - $\rightarrow$ Gigabit Transceiver



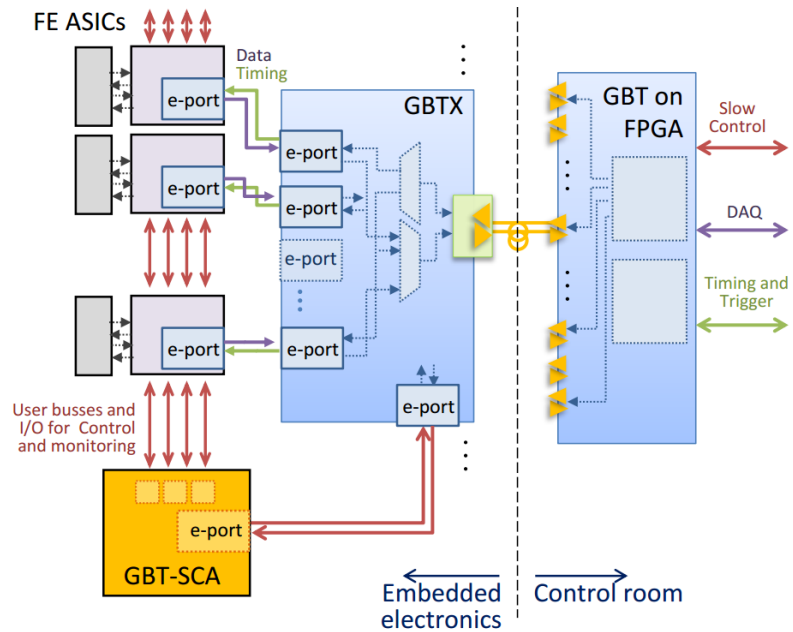
Gigabit Transceiver System

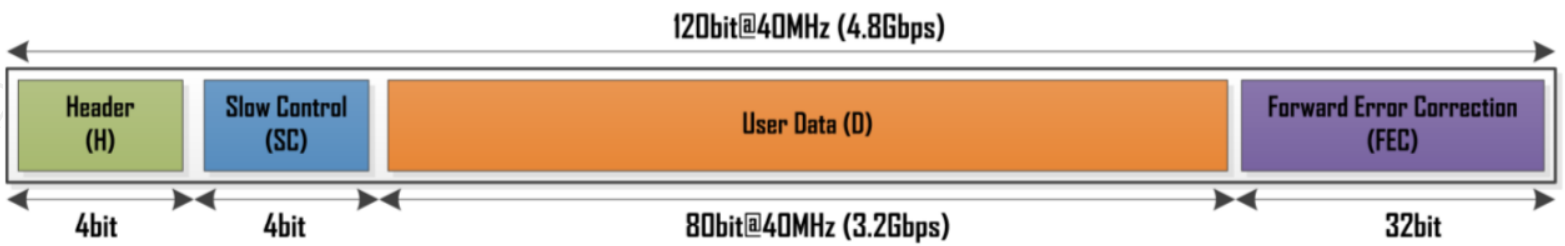
- On-detector - Custom ASICs
  - GBTx, GBT-SCA, VTTx/VTRx
  - E-links
- Off-detector - Control room
  - CRU (FPGA)
  - $>$ 4.8 $\mathrm{Gbit/s}$ transceivers
  - GBT-FPGA
- Optical communication
  - Timing and Trigger Control (TTC)
  - Data Acquisition (DAQ)
  - Slow Control (SC)



Gigabit Transceiver System

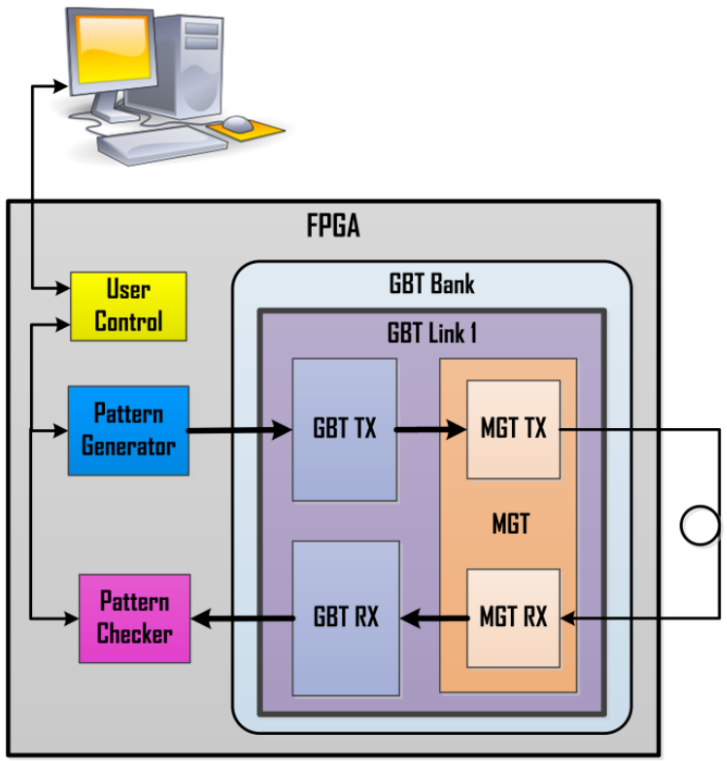
- Encoding modes
  - GBT-Frame
  - 8B/10B
  - Wide-Bus



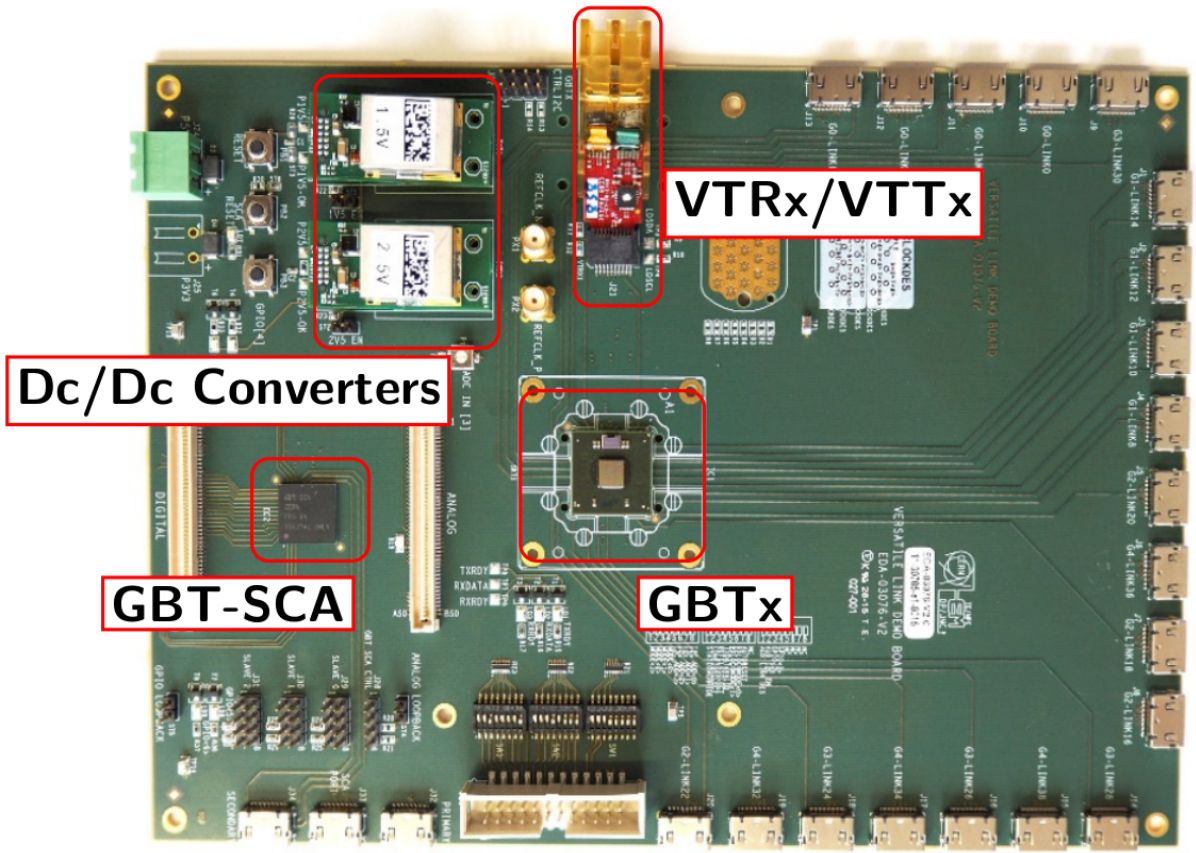


GBT-FPGA

- Firmware library for Altera/Xilinx FPGAs
- GBT Link
  - "Standard", "Latency-Optimized"
  - GBT Rx, GBT Tx, GBT MGT
- GBT-example Design



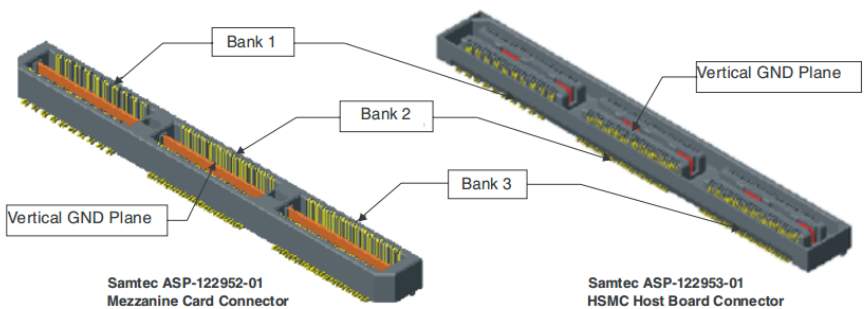
Versatile Link Demo Board



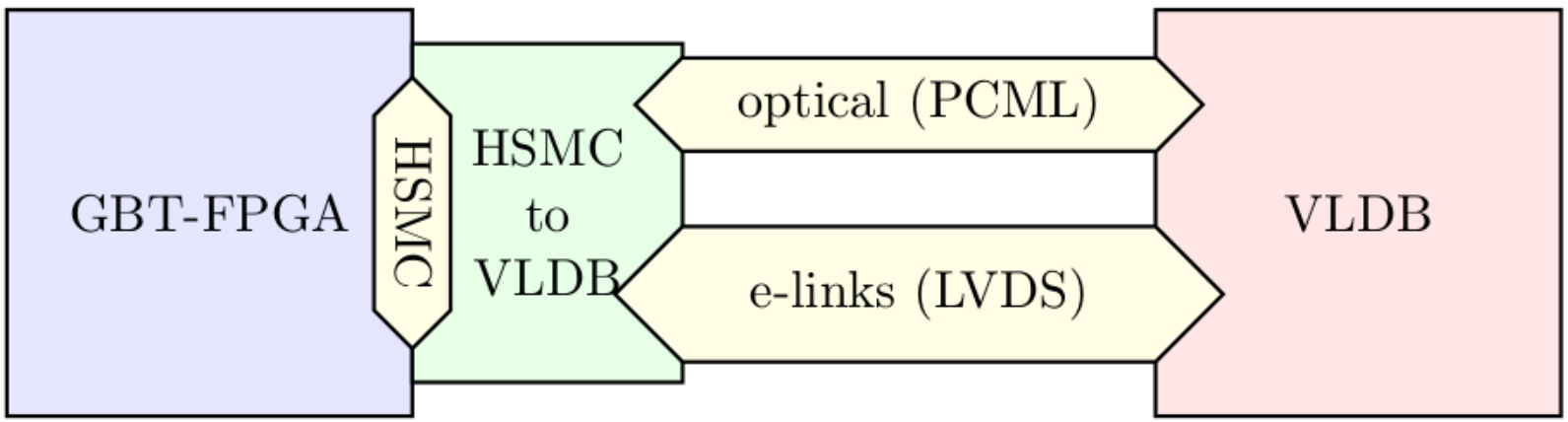
Primary Objective

- Design a CRU control interface software
  - Serial communication between PC and CRU
- Design a HSMC-to-VLDB PCB
  - Connection between CRU and VLDB

PCB Design


Bank 1
Bank 2
Bank 3
Vertical GND Plane
Vertical GND Plane
Samtec ASP-122952-01
Mezzanine Card Connector
Samtec ASP-122953-01
HSMC Host Board Connector

PCB Design



Blocks of Highlighted Text

Block 1

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Integer lectus nisl, ultricies in feugiat rutrum, porttitor sit amet augue. Aliquam ut tortor mauris. Sed volutpat ante purus, quis accumsan dolor.

Block 2

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Block 3

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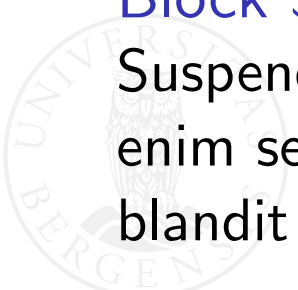

Multiple Columns

Heading

1. Statement
2. Explanation
3. Example

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Table

Treatments	Response 1	Response 2
Treatment 1	0.0003262	0.562
Treatment 2	0.0015681	0.910
Treatment 3	0.0009271	0.296

Table : Table caption

Theorem

Theorem (Mass–energy equivalence)

$E = mc^2$

Verbatim

Example (Theorem Slide Code)

```
\begin{frame}
\frametitle{Theorem}
\begin{theorem}[Mass--energy equivalence]
$E = mc^2$
\end{theorem}
\end{frame}
```

Figure

Uncomment the code on this slide to include your own image from the same directory as the template .TeX file.

Citation

An example of the `\cite` command to cite within the presentation:

This statement requires citation [Smith, 2012].

References

John Smith (2012)
Title of the publication
Journal Name 12(3), 45 – 678.

Thank you!