pCT Readout Electronics

Stave/RU Connections

Ola Grøttvik

November 7th 2017

ITS vs pCT RU Differences

ITS
- 1 RU per stave
- Support various stave types
- Dedicated power board
- 5m distance
- Significant radiation

pCT
- 1 RU per 10 staves
- Only IB staves
- RU supplies power
- 0.5-1m distance
- Manageable radiation

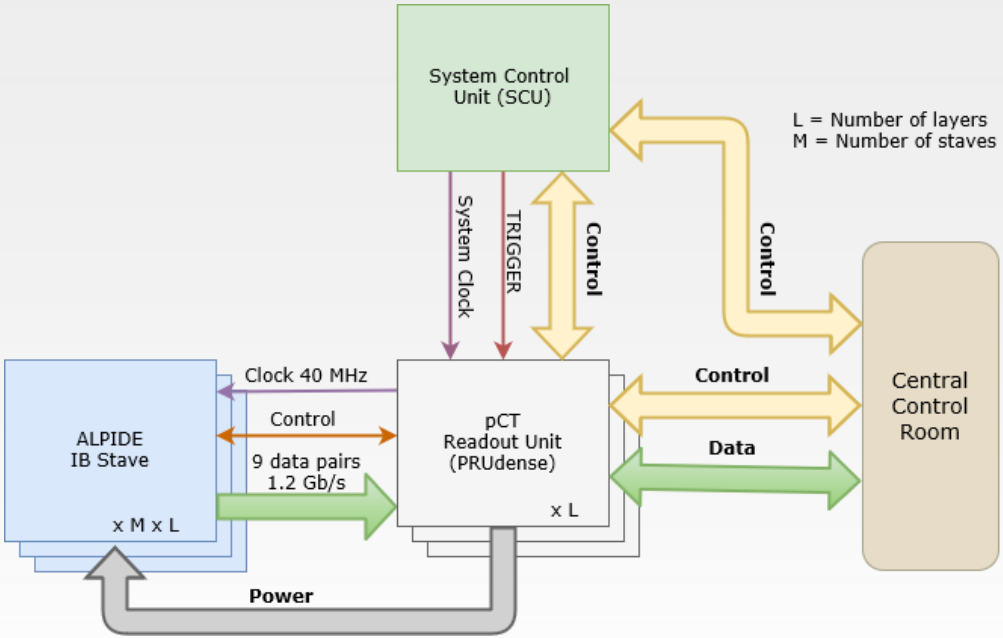
pCT Stave/RU Connection Overview

Each Stave:

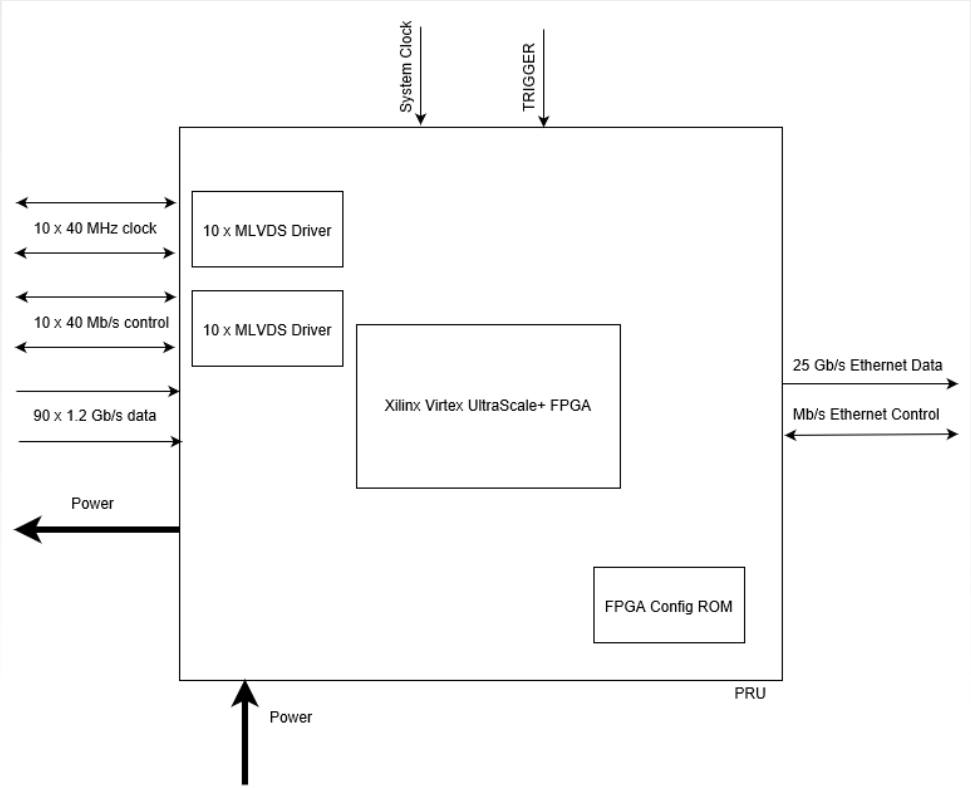
- 9 x 1.2 Gb/s LVDS (CMV = 0.9V)
- 1 x 40 Mb/s MLVDS
- 1 x 40 MHz Clock
- AVDD, DVDD, PVDD (1.8V, 1.656A est. max total[1]) + 3 x ground
- PWELL and SUB biases (Between -6V and 0V)
- If possible, combine signal and power in one connector on the RU

[1] ITS NUMBER, NEEDS CONFIRMATION FOR PCT, FROM GREINER, STAVE PRODUCTION READINESS REVIEW

pCT Readout System Overview



pCT Readout System Overview



Stave/RU Connection Alternatives

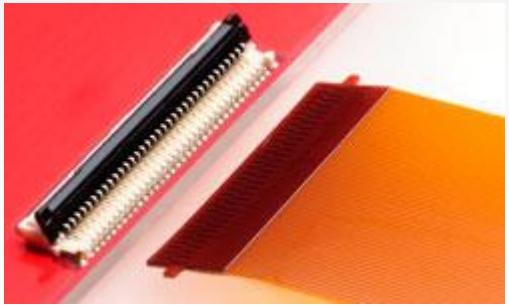
- Samtec Firefly Cable
  - Samtec UEC5 Connector on stave PCB
  - Samtec UEC5 Connector on RU PCB

Samtec UEC5 Connector

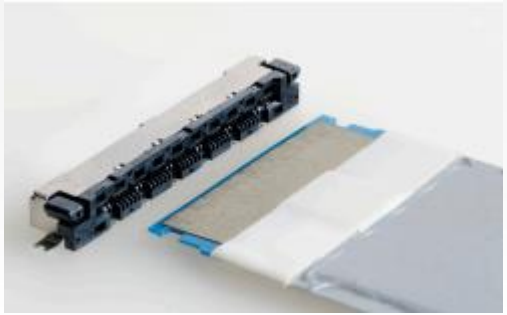
Samtec UCUE Cable

Stave/RU Connection Alternatives

- Flexible PCB as a cable
  - Directly bonded to stave
  - FPC Connector on RU PCB
  - FFC Connector on RU PCB



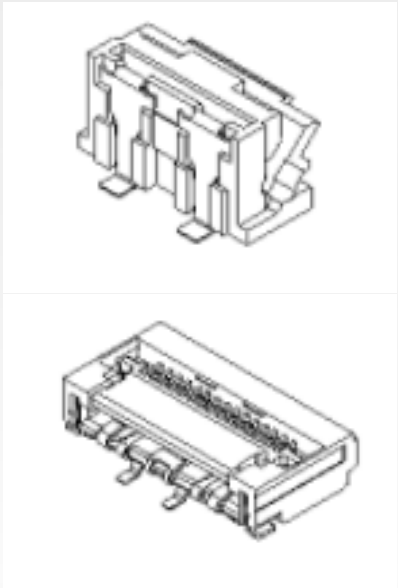
Molex FPC Connector



Molex LVDS FFC Connector

Stave/RU Connection Alternatives

- Premo-Flex LVDS cable,
  - max length from Molex: 0,6m
  - FFC Connector on stave PCB
  - FFC Connector on RU PCB



Molex LVDS FFC Connector

Molex LVDS FFC

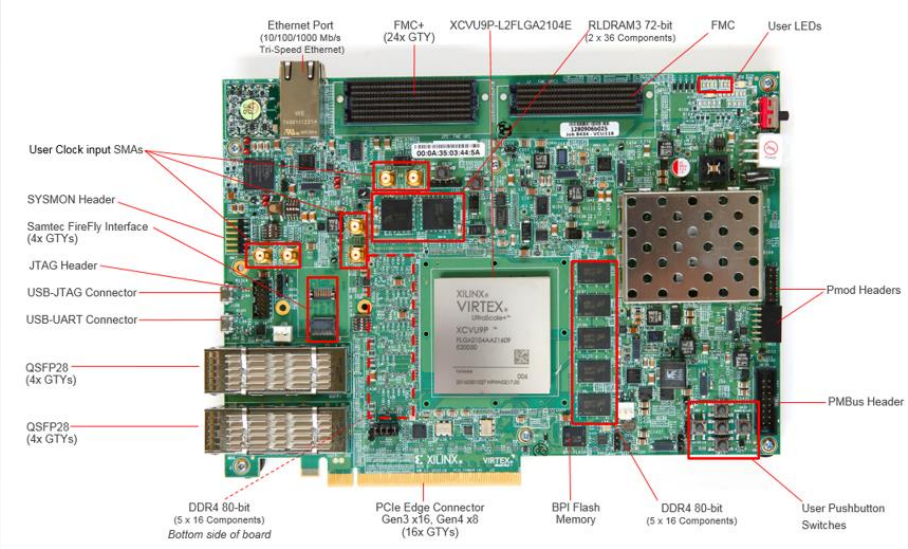
Evaluation

- Samtec Firefly Cable
  - 7dB Insertion Loss Point at 5.5Ghz, 1m
  - Customizable lengths, cost
  - Tested successfully on regular I/Os
  - Connector height: 3,46mm + cable height!
- Flex PCB as cable
  - More difficult/expensive to control impedance – degrading signal integrity
  - Max length 60 cm – includes length needed for chips?
- Molex LVDS cable
  - Do not specify dB loss, 100-Ohms-controlled impedance[1]
  - Non-custom part
  - Connector height: 2,3mm
- Virtex UltraScale+ FPGA
  - Linear equalization is available on differential I/O pins to overcome high-frequency losses through the transmission channel
  - Promising for testing cables other than Samtec Firefly

[1] HTTP://WWW.MOLEX.COM/MOLEX/NEWS/DISPLAY_NEWS.JSP?CHANNEL=NEW&CHANNELID=-8&OID=2041

Current work

- Developing FMC card for VCU118
- Allow for testing of signal integrity of various approaches
  - Continue Samtec testing with ALPIDE carrier card
  - Loopback of Molex LVDS
- Allow for testing and complete readout of mounted IB staves



UNIVERSITY OF BERGEN

Eco-Lighthouse®