CRI board for CBM experiment

preliminary studies

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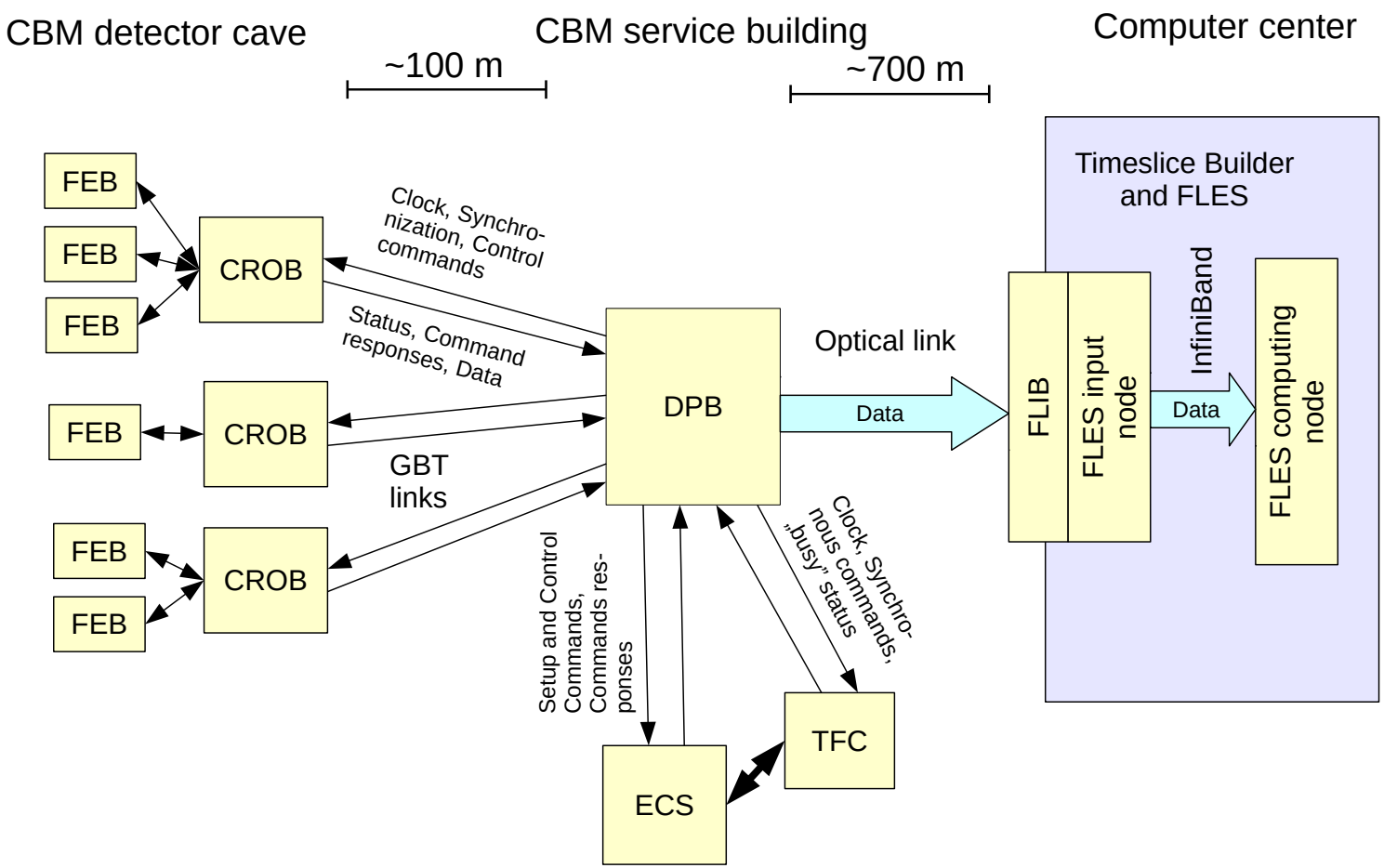
- The essential part of the experiment infrastructure is its readout chain, transmitting the data from the frond-end electronics (FEE) to the computer center.
- Common Readout Interface (CRI) is the main component of the newly proposed architecture of the readout chain.

Old DPB-based architecture of the readout chain



Disadvantages of the old architecture

- There were two layers of complex FPGA-based boards:
  - DPB in the service building
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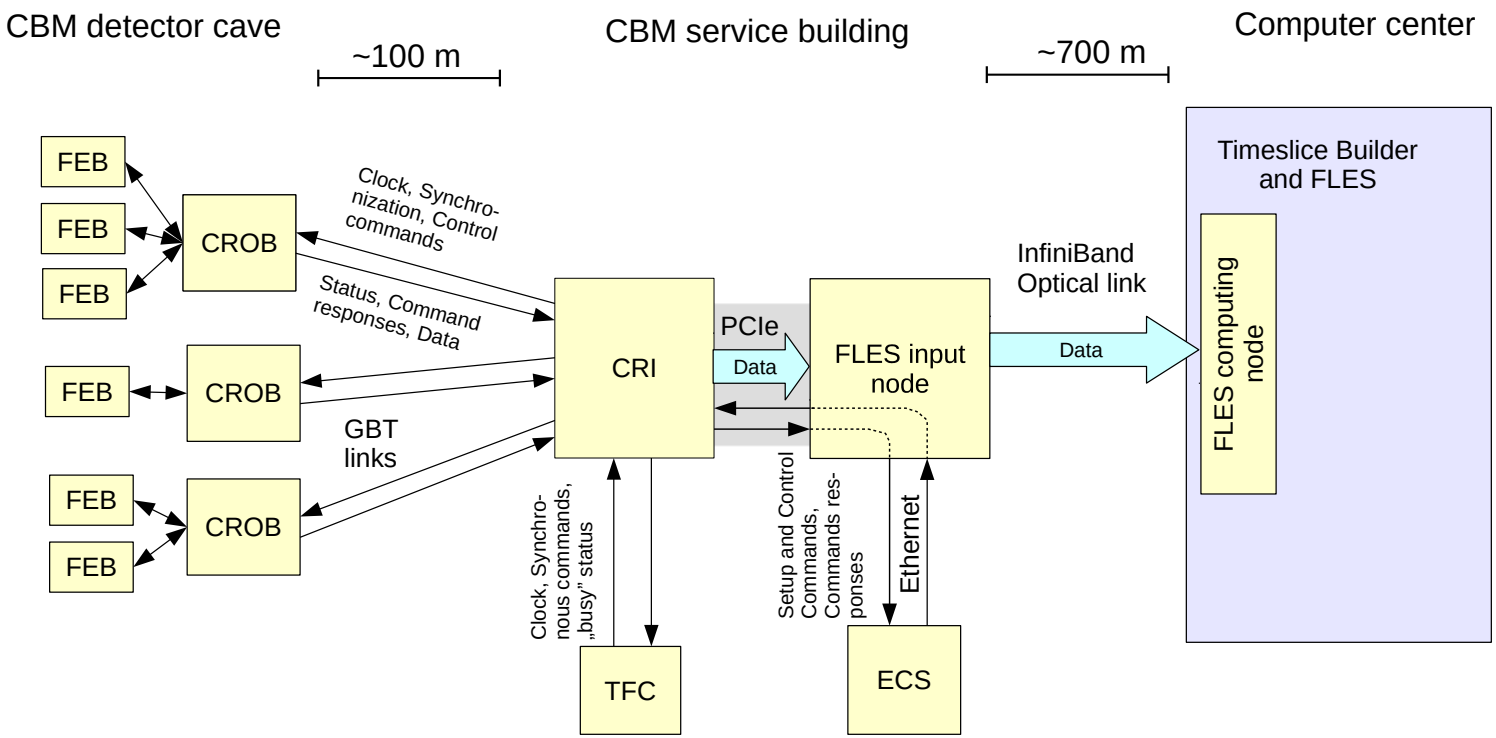
- New architecture was proposed
  - To reduce the costs by eliminating one layer of FPGA-based boards
  - To enable usage of the newest technologies available at the time when the system is built.

New CRI-based architecture of the readout chain



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- Availability of yet another multi-gigabit transceiver with the possibility to receive the Timing and Fast Control (TFC) signal transmitting the reference clock and synchronization signals (Pulse Per Second - PPS).

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- Possibility to implement the jitter cleaner for the reference clock, and availability of the configurable clock network allowing routing the cleaned reference clock to the GBT multi-gigabit transceivers.

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- Initially HTG-Z920 [7] was selected as a CRI candidate.

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- MGT resources
  - a PCIe x16 Gen3 Interface (using 16x GTH transceivers)
  - 16x GTY and 16x GTH transceivers that may be used as GBT link inputs.

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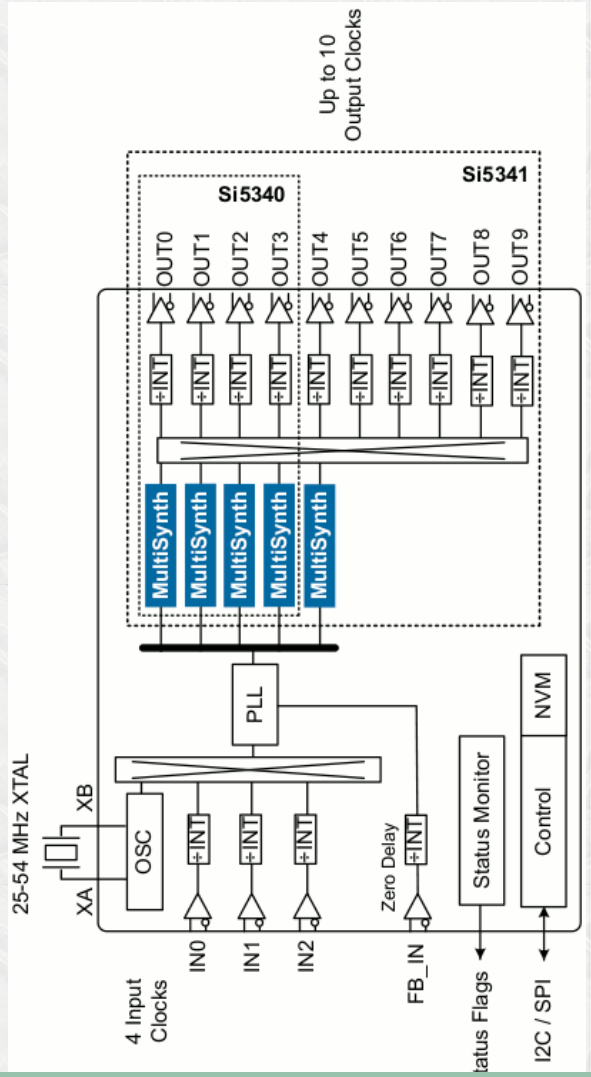
- HTG-Z920 is equipped with the Si5341 chip [8], that offers internal clock crosspoint enabling distribution of the same clock frequency to different quads.



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- 16 GTH transceivers connected to a Z-RAY connector (but currently available Z-RAY modules support only 12)
- It is not clear, if we can combine links from different quads
- It is not clear, if the TFC link may share quad with the GBT links

Possible link utilization

Possibility of quad sharing	TFC-GBT sharing possible	No	Yes	No	Yes
	CROB GBT links may be spread across quads	No	No	Yes	Yes
# of GBT links (# of CROB boards)	Only FMC+ module	9 (3)	12 (4)	12 (4)	15 (5)
	FMC+ and Z-RAY FireFly modules	18 (6)	21 (7)	24 (8)	27 (9)

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- If there is enough free space, the unused 3 GTH and 4 GTY transceivers may be connected to QSFP+ cages.
- After such modifications the HTG-Z920 board should be usable as a CRI-18 or CRI-24 for the CBM experiment (depending on a possibility to spread GBT links between quads).

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- After the above modifications synthesis and placement were possible

Results of synthesis and placement

Resource	Available	Used	% used
CLB LUTs	522720	375553	71.85%
CLB Registers	1045440	397984	38.07%
Block RAM Tiles	984	574	58.33%
URAM	128	0	0%
DSP48E2	1968	864	43.90%
Global clock buffers	940	93	9.89%
MMCM	11	2	18.18%
GTHE4_CHANNEL	32	25	78.13%
GTYE4_CHANNEL	16	16	100%

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- (From the last moment) It is still necessary to verify if HTG-Z920 is a better solution than the FELIX board from the cost point of view.

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