

Optical Links Proposal

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I.N.F.N. Bologna, July 26th, 2012

Preliminary information

- The plan for the LHCb upgrade had been presented to the INFN management by May the 28.
 - Interest, cost and timeline as defined in the FTDR.
- The project will be scrutinized by the INFN Scientific Committee. The approval is expected by July 2013.
 - Budget for the upgrade will depend on the evolution/destiny of the other INFN project related to flavor physics.
- The INFN interests to the LHCb upgrade project concern: Electronics and trigger, MUON detector, RICH detector.
- Bologna declared to INFN its interest to contribute to electronics projects.
- The INFN Bologna Director supports our participation to the upgrade project and personnel of the INFN electronics engineering team available to support the LHCb activities.
- Funds will be available to the LHCb upgrade for R&D in 2013. Requests have to be presented to the INFN high-energy committee by September 2012.

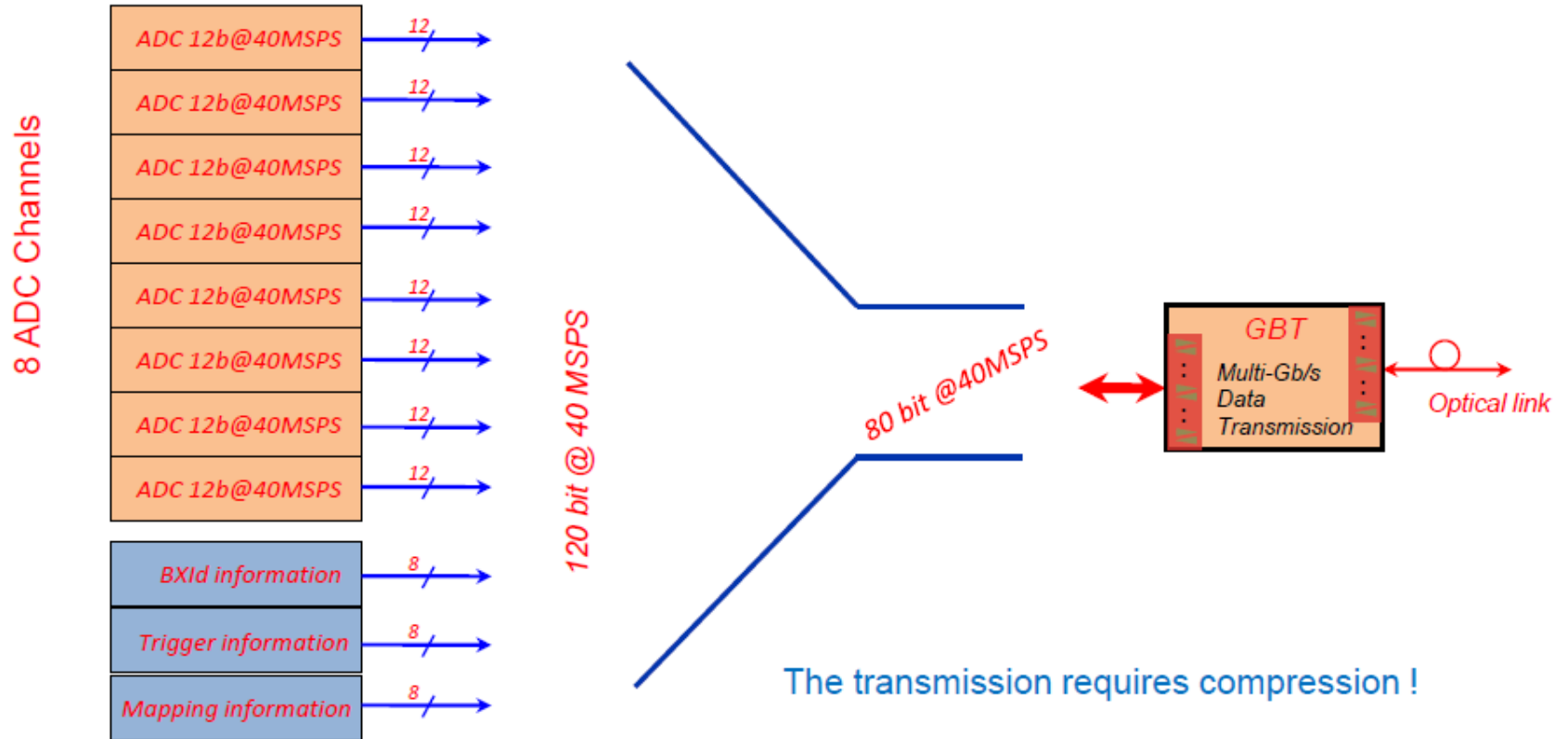
Optical Mezzanine for the CALO FEB

- “A FEB is 32 channels 4 optical link GBT”
- ECAL: 96 boards on each side.
- HCAL: 27 boards on each side.
- Total number of link: ~ 1000
- GBT use: unidirectional.
- Connections of the optical mezzanine to the hosting FEB to be defined...
- Modularity to be defined: number of GBT per mezzanine...

Optical Mezzanines

- The construction of the optical link mezzanines, at the moment is a project limited to the CALO system, which could be extended to other sub-detectors of LHCb.
- In case, before September we should define the different mezzanine types and, more important, evaluate the cost to be quoted in the document to the INFN management for funding requests.

There was the question whether the GBT format could be extended to 112 bits

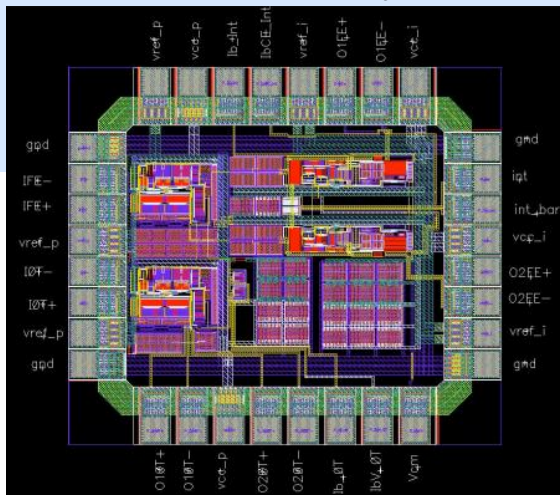


Calorimeters Upgrade

- ECAL and HCAL remain
 - Keep all modules & PMTs
 - Radiation tolerance of inner modules being assessed @ LHC tunnel
 - Reduce the PMTs gain by a factor 5 to keep same <current>
- PS and SPD might be removed (under study)
 - (e/c/hadron separation later in HLT with the whole detector info.)
- New FEE to compensate for lower gain and to allow 40 MHz readout:
 - Analogue part: ASIC or Discrete* components solutions (keeping noise ≤ 1 ADC cnt (ENC < 5-6 fC))
 - Digital part: prototype board to test FPGAs (flash/antifuse) for:
 - Radiation tolerance
 - Packing of Data @ 40 MHz



ASIC prototype

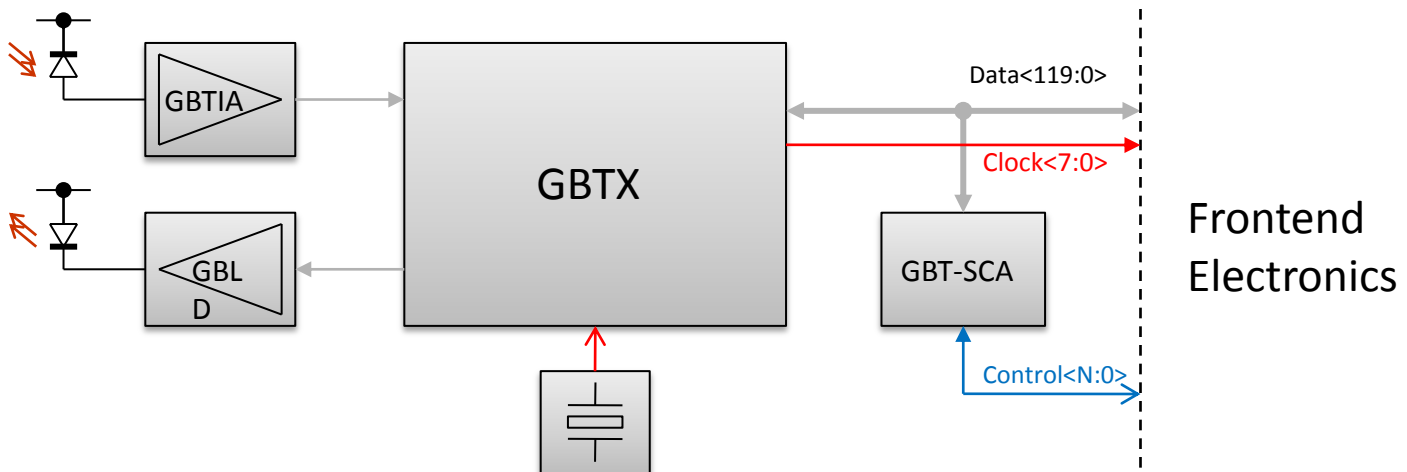


New digital electronics prototype



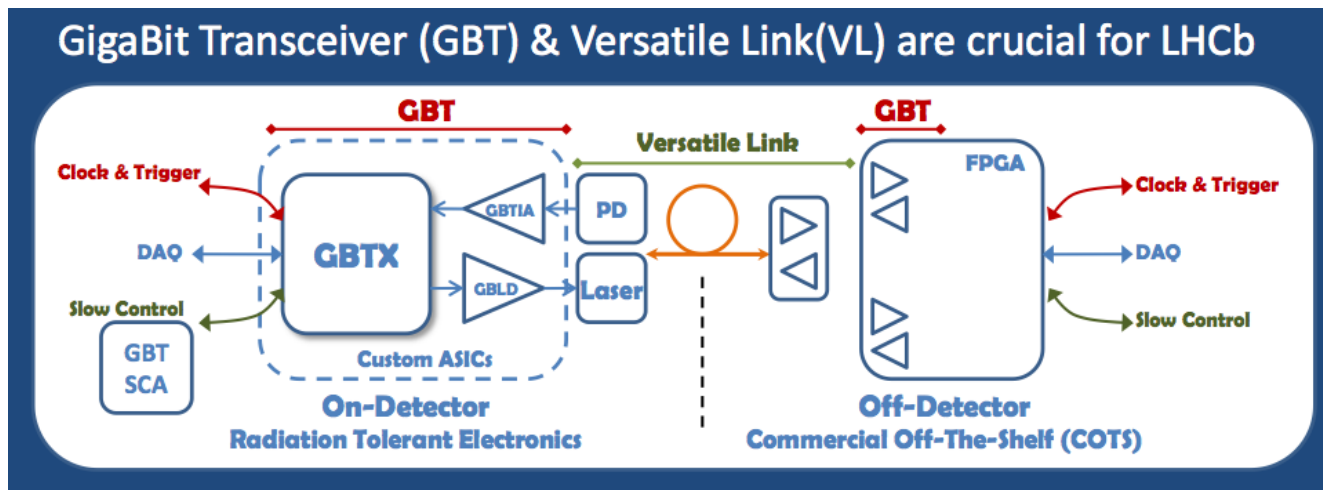
The GBT Chipset

- Radiation tolerant chipset:
 - GBTIA: Transimpedance optical receiver
 - GBLD: Laser driver
 - GBTX: Data and Timing Transceiver
 - GBT-SCA: Slow control ASIC
- Supports:
 - Bidirectional data transmission
 - Bandwidth:
 - Line rate: 4.8 Gb/s
 - Effective: 3.36 Gb/s
- The target applications are:
 - Data readout
 - TTC
 - Slow control and monitoring links.
- Radiation tolerance:
 - Total dose
 - Single Event Upsets



GBT is complex!!! Please read specs:

<https://espace.cern.ch/GBT-Project/GBTX/Specifications/gbtSpecsV1.7.pdf>



GBT & VL prototyping well advanced

Next steps (2012):

- Tune VL to LHCb requirements:
LHCb contribution required for testing & interfacing to front-end prototypes
- Implement GBT in LHCb prototypes (eg GBT mezzanine)