Optical Link for the FEB (declaration of interest)

U. Marconi,

I.N.F.N. Bologna, June 15th, 2012

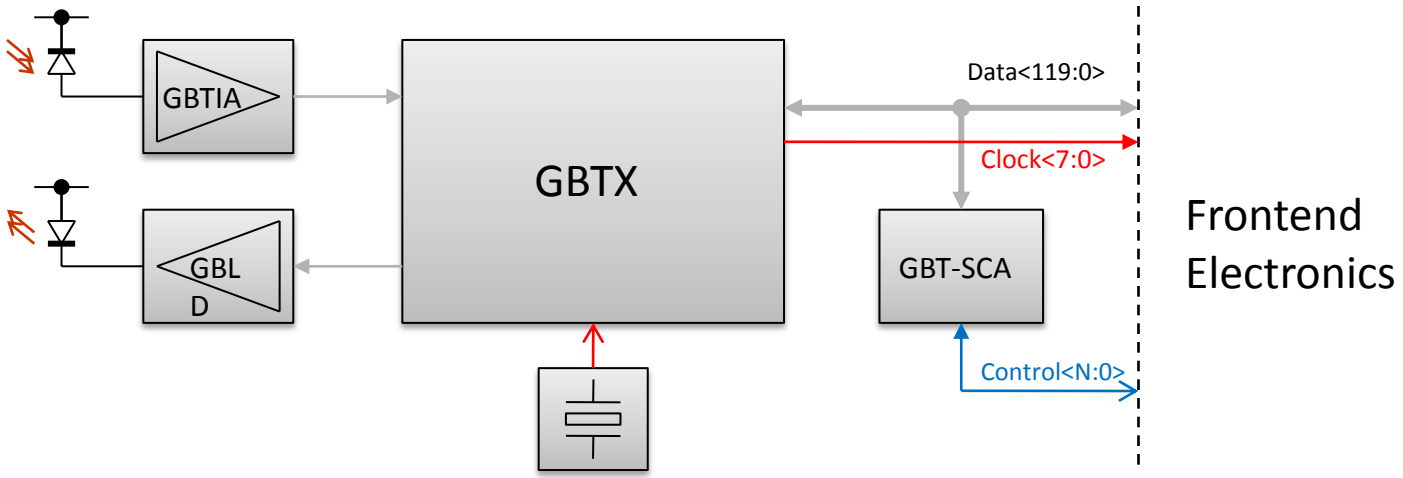
Preliminary information

- 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 now on scrutinized by the INFN Scientific Committee and 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.
- 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.
- The INFN interests to the LHCb upgrade project concern: electronics and trigger, MUON detector, RICH detector.
- Bologna in particular declared 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.

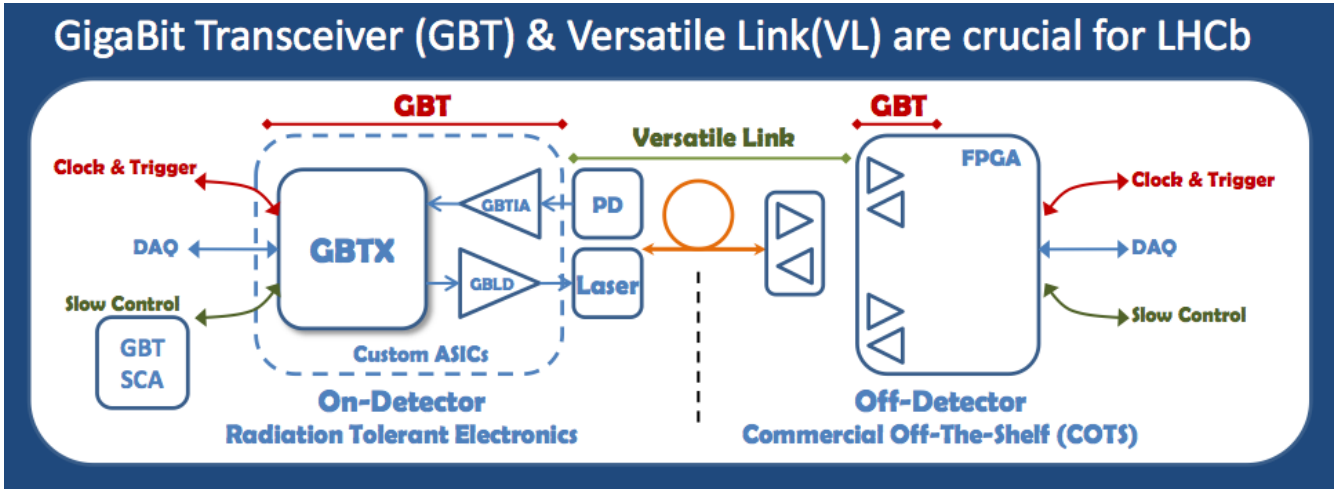
The GBT Chipset

- 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/gbtxSpecsV1.7.pdf



GBT & VL prototyping well advanced

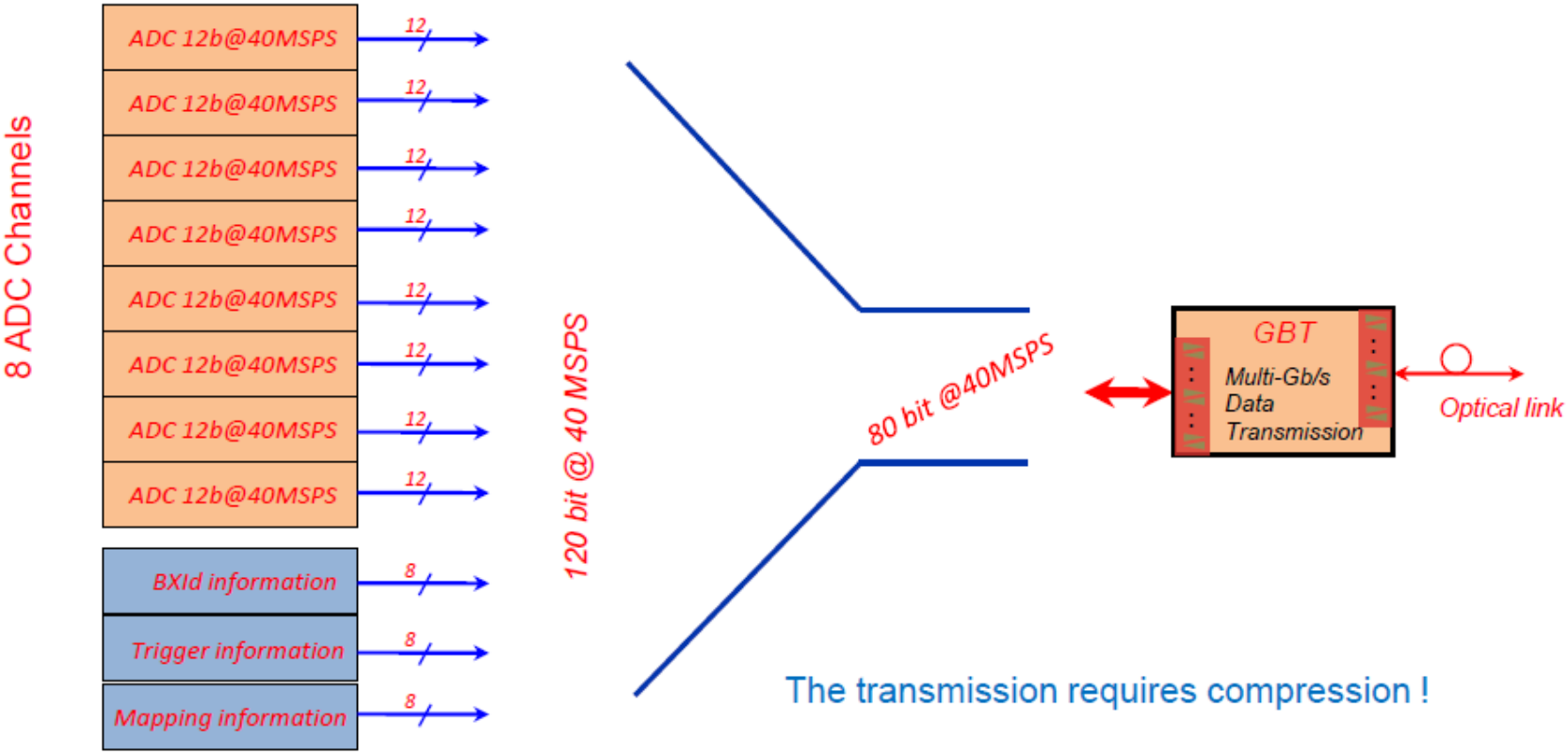
Next steps (2012):

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

Optical Mezzanine for the 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
- Begin studying the GBT : we need to study the documentation(*) and we need to know the release plans.
  - GBT provide bidirectional connections: to be used to distribute clock and commands to the FEB?
- Connections of the optical mezzanine to the hosting FEB board have to be defined.
- Modularity: number of GBT per mezzanine…

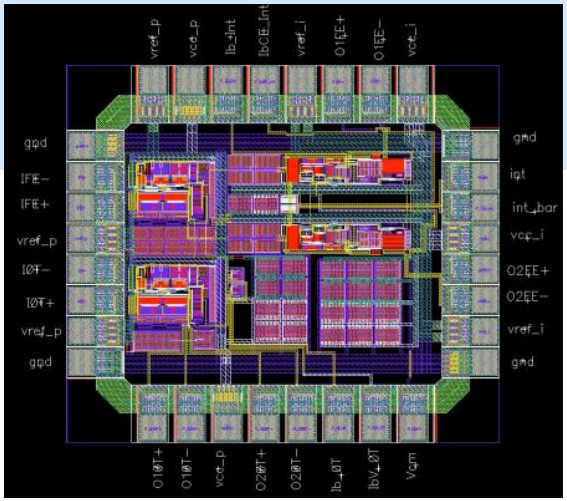
There was the question whether the GBT format could be extended to 112 bits



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/©/hadron separation later in HLT with the whole detector info.)
- <u>New FEE to compensate for lower gain and to allow 40 MHz readout:</u>
  - 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