Development of multipurpose high speed bidirectional optical interface for BM@N experiment based on radiation hardened BMTI FPGA

Alexander Chepurnov

SINP MSU

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FO interfaces around us

Telecom

SONET/SDH

(Payload 0.05-38.486 Mbit)

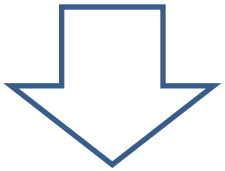
LAN

FO Ethernet interfaces

(10- 10.000 Mbit)

High energy physics

- ??
- S-link (1995) **->** HOLA (2 Gbit/s)
- HOTlink over FO (400 Mbit/s)
- **GBTx (4.8 Gb/s)**



WAN + Global telecom

(OTN) Optical Transport Network

DWDM over single mode fiber

2- 10 (40-100) Gbit

over single λ from 80 (40) channels

GBT project/chipset originals

The GigaBit Transceiver (GBT) architecture and transmission protocol was proposed at CERN for data transmission in the physics experiments on SLHC.

Due to the high beam luminosity, the experiments will **require high data rate links** and electronic components tolerate **high radiation doses**. The GBT ASICs address this issue implementing a radiation-hard bi-directional 4.8 Gb/s optical fiber link between the control/DAQ room and the detector.

Rad-hardness components

There are export restrictions !

GBTX ASIC – GigaBit Transceiver
GBT-SCA ASIC - Slow Control Adapter
VTRX/VTTX – Versatile Link Transceiver and Twin Transmitter

No restrictions to use, also with rad-hard. FPGA!

GBT IP:
FGPA implementation of GBT transceiver, SLVDS receiver, e-Link port etc.

GBTxxx user/developers club

Experiments

LHCb (Muon Detector Upgrade)

ATLAS (Tile Calorimeter System)

ALICE (TOF Readout)

CBM (STS)

BM&N - ??

GBTX/ GBT-SCA
radiation hard ASICs

GBT-FPGA project/ team

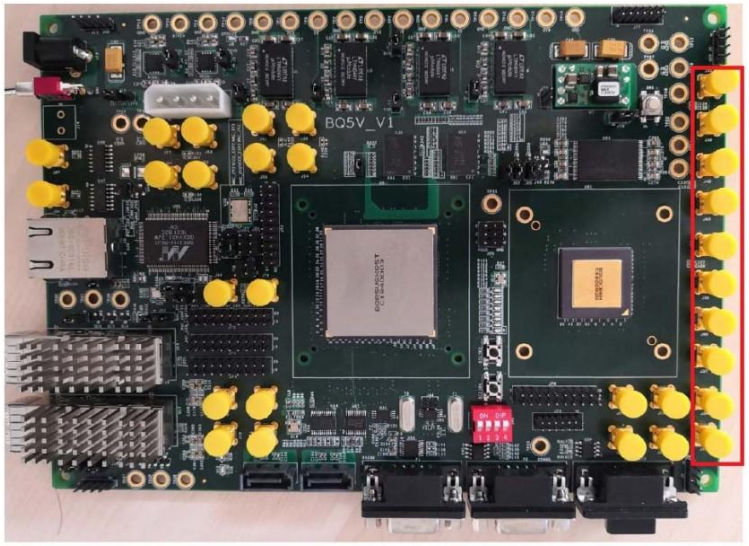
Radiation hardened FPGA from BMTI

BQ5V series FPGA Members

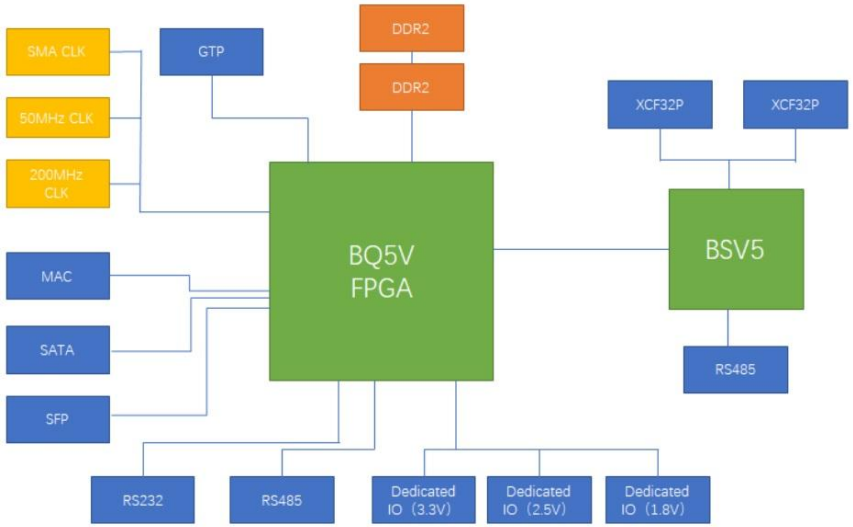
Device	System Gates	CLB			DSP48E Slices	Block RAM Blocks (Kb)	CMTs	EndpointBlocks for PCI Express	Ethernet MACs	Max GTPs	Max I/O Pads	Package
		Array Row x Col.	Slices	Maximum Distributed RAM Kbits								
BQ5V SX35T	3.5M	80 x 34	5440	520	192	3024	2	1	4	8	360	BGA665
BQ5V SX50T	5M	120 x 34	8160	780	288	4752	6	1	4	12	360	BGA665
BQ5V SX95T	9.5M	160 x 46	14,720	1,520	640	8,784	6	1	4	16	640	CCGA1136
BQ5V SX240T	24M	240 x 78	37440	4200	1056	18576	6	1	4	24	960	BGA1738
BQ5V LX155T	15.5M	160 x 76	24320	1640	128	7632	6	1	4	16	680	CCGA1738

- For “R” radiation hardness version:
- TID (total ionizing dose) >= 150K Rad (Si), Latch-up immune to LET >= 90MeV cm2/mg
- Certified to CAST

BQ5V FPGA starter kit

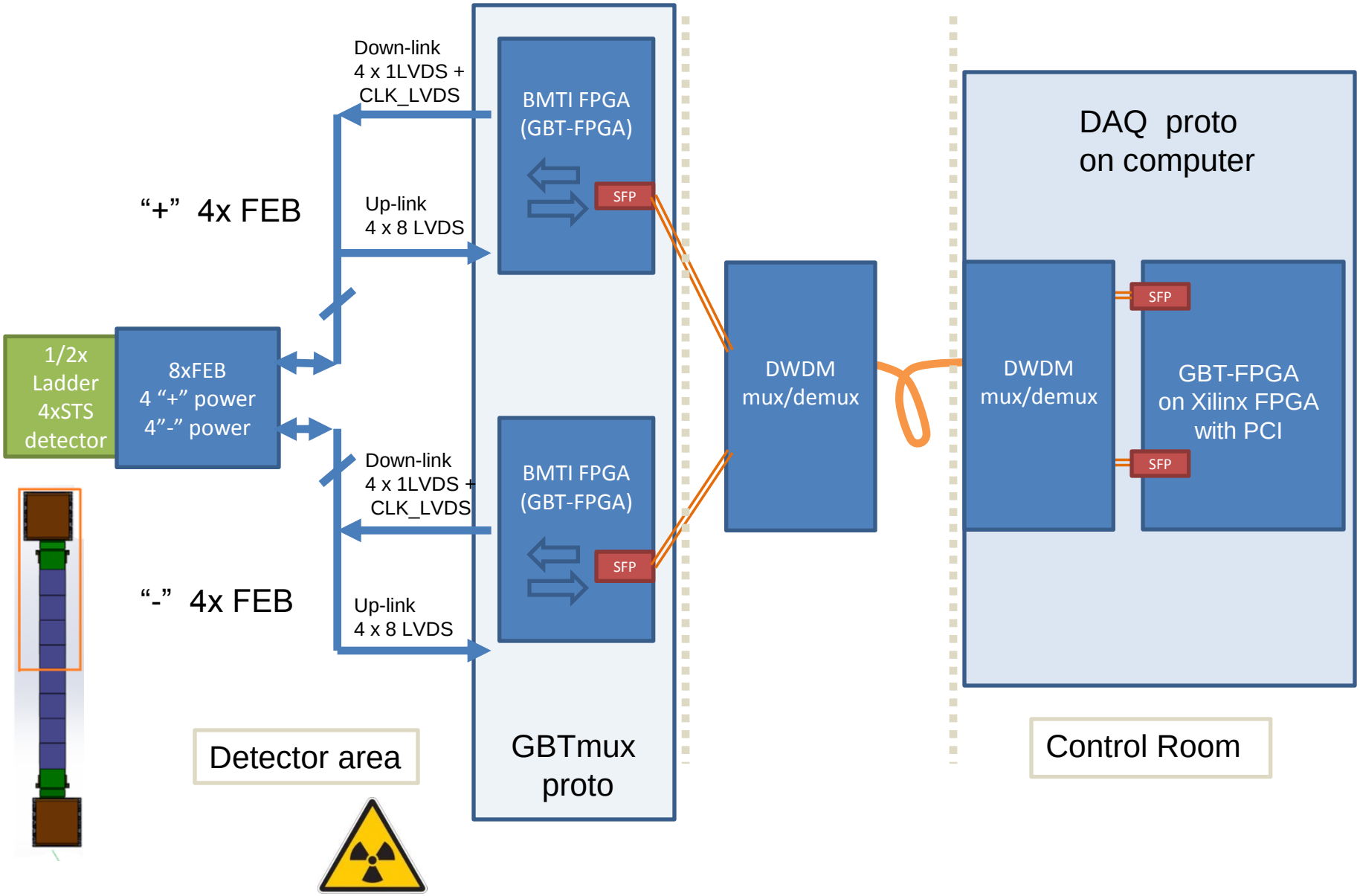


- ISE Design Suit Compatible
- GTP Transceivers have been tested
- at 3.2 Gbit/s via coaxial cables
- SFP data transmission testing is in progress
- BMTI tech support is quick and useful



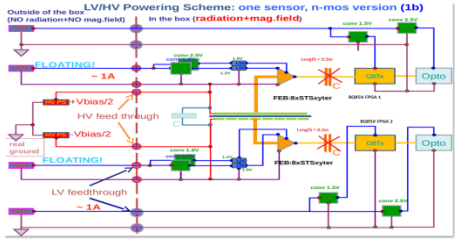
BQ5V FPGA Family Evaluation Board Block Diagram

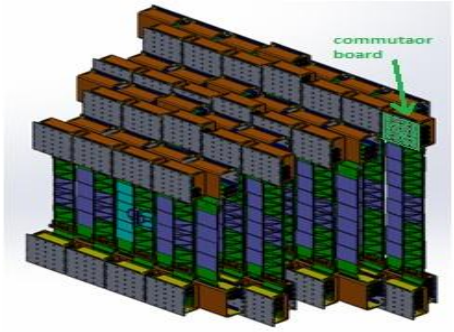
DAQ prototype for STS BM@N

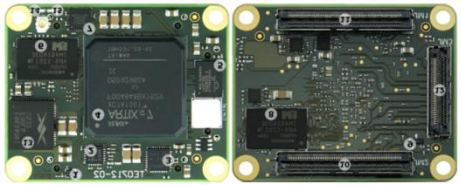


To do for DAQ proto test bench :

- FEB board redesign
- To design GBTmux board
  (2 BMTI FPGA BQ5V and SFP FO links)
- To develop GBT-FPGA implementation for BQR5V
- To test DWDM mux/demux
- To select and install GBT-FPGA with PCI interface and personal computer







From FPGA to ASIC with BMTI

Successful development of GBT-compatible DAQ hardware based on BMTI FPGA based can be extended in the direction of rad-hard GBTX BMTI ASIC development


THANK YOU FOR YOUR ATTENTION !