



# A Software Package for the full GBT Chipset Lifecycle

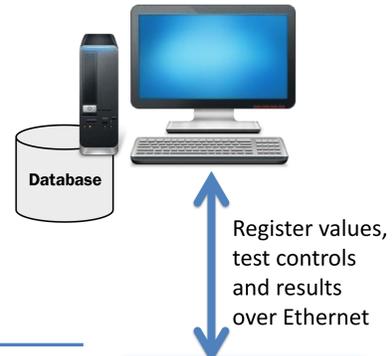
S. Feger, S. Baron, M. Barros Marin, P. Leita, P. Moreira, D. Porret, K. Wyllie

## Introduction

Presented is the software environment surrounding the GBTX chip. The GBTX is a high speed bidirectional ASIC, implementing radiation hard optical links for high-energy physics experiments. Having more than **300 8-bit configuration registers**, its complexity poses challenges addressed by a wide variety of software components. This software allows to characterize the device and keeps track of each GBTX by storing data for the **full GBT life cycle**, meaning from the production testing to the customization performed by the end-users. This innovative interconnection represents a very useful solution to provide a real **Quality Assurance** policy to the full GBT chipset production and allows the support team to conduct analysis immediately and quickly identify the source of problems if required.

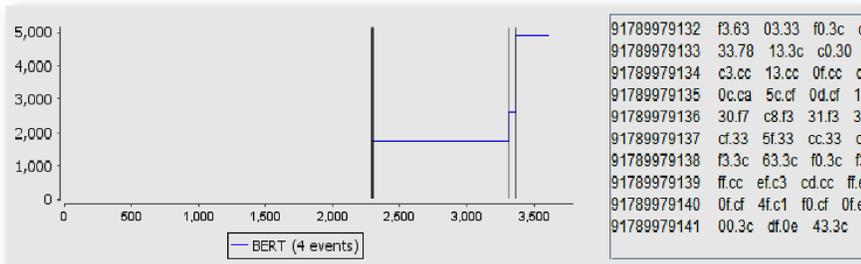
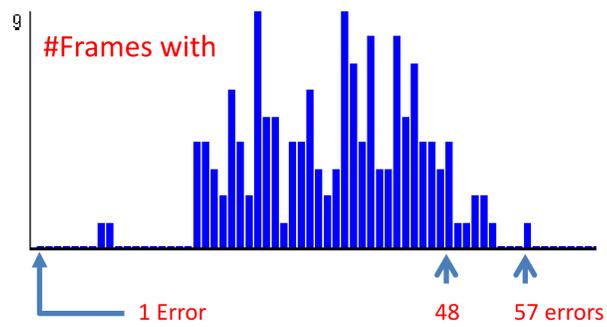
## Characterization

- A custom-made board called **Standalone Tester (SAT)** is the hardware basis for **testing** the GBTX. Besides the GBTX itself it holds a Commercial-Off-The-Shelf (COTS) FPGA. This FPGA collects test results by sending and receiving data to and from the GBTX. The tests are controlled from a computer that establishes an Ethernet connection to the FPGA. **Dedicated Java software** is deployed that allows sending and receiving configuration values, control information and data.
- Using a **local database** for **logging** test results and status information with the Java software proved to be ideal
  - High scalability and reliability at short development time
  - Allows conducting both **immediate on-site** and after-action **off-site analysis**

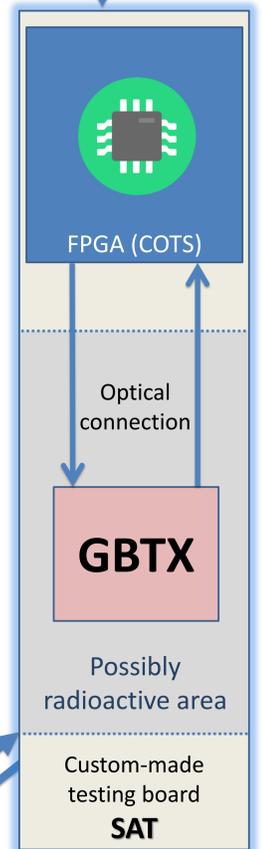


## SEU tests

- Single Event Upset (SEU)** tests are a method of verifying the functionality of a unit under irradiation. A standard measure for communication links is the **bit error rate (BER)**. The SEU testing is based on the same software and hardware components used for the characterization, with the GBTX being put under radiation.
- A **LiveViewer** constantly showing the latest test results received allows for the on-site testing team to adapt the testing strategy **on the spot**. Engineers are able to **interactively** understand the data and localise weak points needing attention. This is highly important as radiation tests are often done under strict time constraints, being frequently limited to a couple of hours.
- The viewer allows to comprehend test results with a **powerful attention to detail**: The graphic on the right hand side indicates the amount of frames encountered having a specific amount of bit errors contained in the frame.



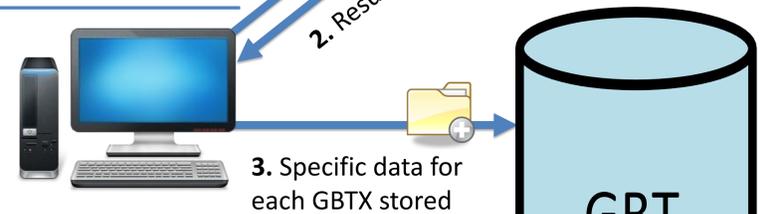
- The excerpt on the left shows a BERT run over time with marked jumps. Engineers can **interact** with the graphic, select an event and see the wrong frames associated.



- Further information regarding the SEU testing of the GBTX is found in *Test bench development for the radiation hard GBTX ASIC* (P. Leita)

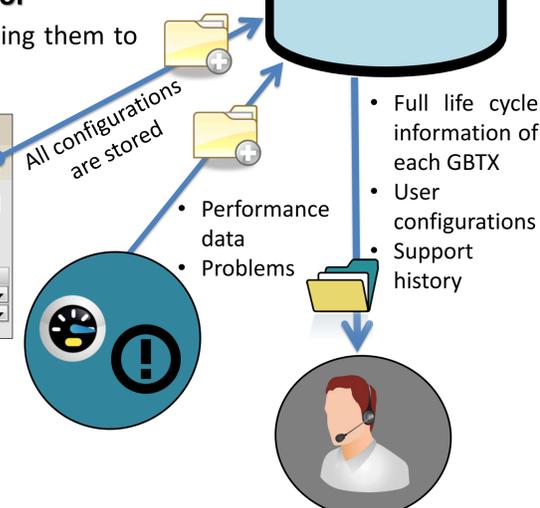
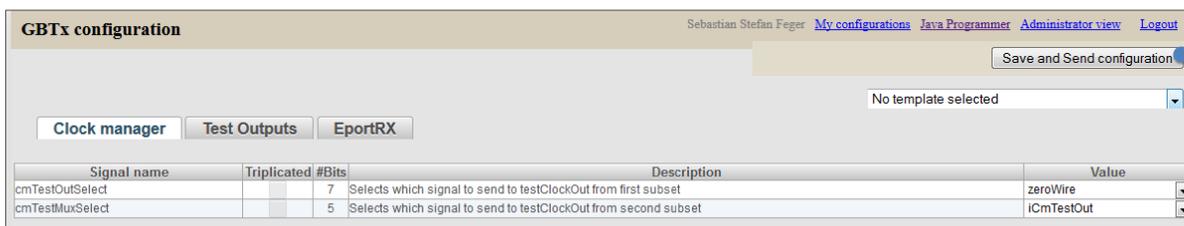
## Production test

- All previous testing efforts are **automated**, guaranteeing for fast and most complete testing of all functionalities
- Each GBTX is assigned a unique serial number during the test
- Specific results of each GBTX are stored in the **GBT-Database**



## Configuration

- Users are enabled to **create configurations** that fit their needs on a **dedicated GBT web site**
- A **Wizard** guides through each step of the configuration process. Completed configurations are send as XML files, enabling users to program the values with an additional programming tool available on the GBT site
- Templates, Descriptions, Default values and Tutorials underline the website's function as a **learning tool**
- All configurations are stored in the GBT-Database, giving users an overview of their efforts and allowing them to recall and edit previous ones



- The common database aggregating information from all stages of the life cycle of a GBT component, allows for a real **Quality Assurance** policy
  - The history of GBT components can be tracked
  - Users can be supported most effectively in case of questions and problems