



Contribution ID: 212

Type: Mini Oral and Poster

## A 20 Gbps Data Transmitting ASIC with PAM4 for Particle Physics Experiments

Monday 12 October 2020 16:22 (1 minute)

**Abstract:** We present the design and test results of a data transmitting ASIC, GBS20, for particle physics experiments. The goal of GBS20 will be an ASIC that employs two serializers each from the 10.24 Gbps lpGBT SerDes, sharing the PLL also from lpGBT. A PAM4 encoder plus a VCSEL driver will be implemented in the same die to use the same clock system, eliminating the need of CDRs in the PAM4 encoder. This way the transmitter mezzanine module, GBT20, developed using the GBS20 ASIC, will have the exact lpGBT data interface and transmission protocol, with an output of 20.48 Gbps over one fiber. With PAM4 embedded FPGAs at the receiving end, GBT20 will halve the fibers needed in a system and better use the input bandwidth of the FPGA. A prototype, GBS20.v0 is fabricated using a commercial 65 nm CMOS technology. This prototype has two serializers and a PAM4 encoder sharing the lpGBT PLL, but no user data input. An internal PRBS generator provides data to the serializers. GBS20.v0 is tested up to 20.48 Gbps. With lessons learned from this prototype, we are designing the second prototype, GBS20.v1, that will have 16 user data input channels each at 1.28 Gbps. We will present the design concept of the GBS20 ASIC and the GBT20 module, the preliminary test results, and lessons learned from GBS20.v0 and the design of GBS20.v1 which will be not only a test chip but also a user chip with 16 input data channels.

### Minioral

Yes

### IEEE Member

No

### Are you a student?

Yes

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**Session Classification:** Poster session A-01

**Track Classification:** Front End Electronics and Fast Digitizers