

Proposal for lab : RF data transmission for particle detectors

Giulio Dellacasa, Giovanni Mazza

INFN Torino

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- Modern HEP experiments are characterized by very high data throughput due to detector higher granularity and beam higher luminosity.
- High speed serial links are mandatory in order to cope with the high data rate with an acceptable material budget.
- (De)Serializers, PLLs and differential current drivers/receivers are key components of a high speed data transmission
- The lab will consist of short lessons on RF data transmission base concepts interleaved with "hands on" activity.
- Case study will be the 1.28 Gb/s CMS LiTE-DTU, the 5.12 GHz LpGBT PLL, the 5.12 GHz RD53 PLL prototype and the 5 Gb/s GBLD laser driver.

Lesson topics

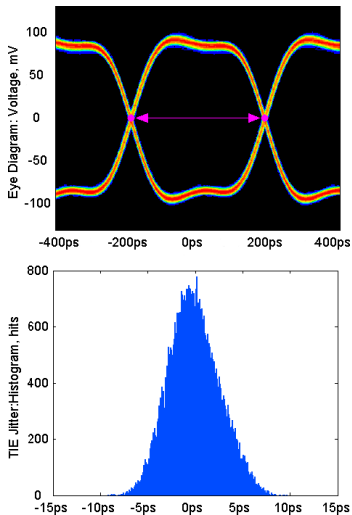
- Serial data transmission key component : Tx, Rx, (de)serializer, PLL
- Pre-emphasis and filtering
- Eye diagram, BER
- Jitter observables : periodic jitter, cycle jitter, TIE jitter
- Jitter decomposition : random, periodic, data dependent, duty cycle distortion
- ~1.5 h

"Hands on" lab topics

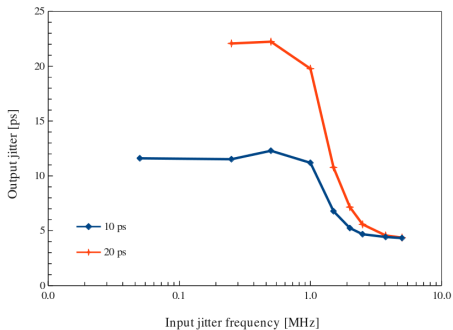
- Characterization of a clock signal : random jitter, periodic jitter
- Characterization of a periodic signal : ISI
- Effect of pre-emphasis
- Test of a PLL
- ~1.5 h for 4-5 participants per working position (1-2)

- Keysight Technologies 81133A 3.35 GHz Pulse Pattern Generators
- Agilent N5980A Serial BERT : 3.125 Gb/s
- Tektronix DPO 70604 : 5 GHz bandwidth, 25 GS/s
- LeCroy waveProHD 804 : 8 GHz bandwidth, 25 GS/s, 12 bits resolution

Examples of measurements



Measurement of jitter rejection on a 5.12 GHz LC-PLL designed at INFN Torino



People involved

- Giulio Dellacasa [INFNTo, staff]
- Giovanni Mazza [INFNTo, staff]
- PhD student [tbc]