

A compact plug-in module for LHC-like trigger emulation

Wednesday, 27 September 2006 16:20 (25 minutes)

A programmable random trigger emulation system has been built for use in high energy physics, nuclear physics or radiology experiments. The emulator is based on the generation of trigger time intervals using a true random bit generator. The system is able to work either as a stand alone trigger emulator or as a plug-in module for a trigger/readout system.

Summary

The requirement of a device emulating the arrival of particles on a particle detector is apparent in the construction phase of the corresponding readout electronics and DAQ system.

The emulator produces randomly generated trigger pulses with time intervals following an exponential distribution with programmable mean between 1 KHz and 1 MHz (trigger rate). The source of randomness is the avalanche effect on a transistor emitter-base diode biased by a digitally controlled voltage source.

Therefore, by changing the diode biasing the desirable trigger rate is obtained.

The output of the random generator is treated by a digital processing circuitry implemented in an FPGA.

The digital processing includes:

- emulation of experiment specific features e.g. the arrangement of the LHC bunches during the LHC operation cycle,
- trigger specific rules e.g. maximum consecutive triggers with minimum arrival times.

Burst of 1000 random triggers are recorded and can be played back. In addition to the random triggers, the system also supports fully programmable trigger generation in order to test other distributions. When working as a stand alone trigger generator, the system is controlled by a standard pc via the USB interface.

The system has been extensively evaluated. The output of the true random generator has been verified using the NIST battery of tests for random number

generators. Finally, the system has been calibrated in respect to the trigger rate.

Primary author: SIDIROPOULOS, Georgios (University of Ioannina)

Co-authors: Prof. MANTHOS, Nikolaos (University of Ioannina); Mr VICHLOUDIS, Paschalis (CERN)

Presenter: SIDIROPOULOS, Georgios (University of Ioannina)

Session Classification: Poster sessions