Contribution ID: **39** Type: **Poster**

Picosecond Timing System Based on White Rabbit for Scientific Facilities

Monday, 28 October 2024 16:55 (2 hours)

The timing system is a crucial component in scientific facilities like particle accelerators and laser ignition installations. It ensures that all subsystems within these facilities share a common time reference, enabling coherent operation and accurate tracking of events throughout the machine's operation. Additionally, the timing system generates discrete triggering events and periodic signals required by various subsystems and can also be used for radiofrequency distribution across the facility.

This work presents the architecture of a timing system under development by Safran Electronic & Defense Spain SLU, which is based on White Rabbit technology for the distribution of synchronized triggers. The design and implementation of the hardware, which is FPGA-based, will be discussed in detail.

The timing system offers complete configurability of triggering parameters, including direction, pulse count, pulse rate, pulse period, and delay, with a resolution on the order of 5 picoseconds. White Rabbit technology provides sub-nanosecond accuracy and picosecond precision, along with features such as automatic link calibration. The performance metrics achieved by this system will be highlighted in this work.

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Session Classification: Poster Session I (Synchronization and Timing)

Track Classification: Timing