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Oral_26: Multi-Channel Synchronized Data Acquisition Techniques for Plasma Diagnostics

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High-performance data acquisition is an essential part of plasma fusion diagnostics instruments. Typically, the measurement is conducted using a pulsed laser that generates repeated pulses that are shone into the plasma. Some of the laser light is scattered off free electrons in the plasma resulting in spectral expansion. Digitizers enable measurements of the scattered photons in a time domain by sampling at the speed of 10^9 Sa/s. Synchronizing (even) hundreds of channels is a challenge for modern digitizers to distribute the trigger signal and capture the data simultaneously in reference to the laser. The most common solution is to use passive impedance matched splitters to fan out a trigger signal in a star pattern. However, this solution does not scale with the number of digitizers in the system—eventually, the trigger signal is attenuated, and the trigger edge is distorted, which results in a precision loss. To address these issues a special daisy-chain triggering system was developed. The trigger signal is passed from one device to the next using the SYNC IN/OUT connectors. However, a common time frame is needed to keep track of the trigger point across all devices. A system consisting of several chassis must use an external source provided to each chassis through cables of equal length. The first device in the daisy chain is designated as the master device and the other as consecutive slave devices. The trigger signals in consecutive digitizers are delayed precisely by the 10MHz reference period. In turn, this means that each slave device will have to record data before its perceived trigger point to capture data around the true trigger point. When the data is retrieved, following a successful acquisition, the trigger information from the slave devices is adjusted with the trigger information from the master device. This technology was tested in the Joint European Torus (JET).

Disclaimer: the technology was developed by Teledyne Signal Processing Devices Sweden AB and the related products and materials belong to the company.

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