Multichannel Data Acquisition Systems for Physics Applications

Plasma Temperature and Property Measurement Based on Thomson Scattering Method for Tokamak Nuclear Fusion Reactors

Application Overview

A powerful diagnostic method to measure the temperature of hot plasma in applications such as Tokamak reactors is to scatter electro-magnetic radiation from the plasma. This method is attractive since it does not disturb the process in the reactor and can also determine detailed information about the distribution function of electrons and ions in the plasma.

Applications includes: Thomson scattering signals from "sensors" are placed around the Torus of a Tokamak and fed to multiple synchronized channels (up to 160) of high speed waveform digitizers.

Solution Description

- U1063A, 8-bit, 1 GS/s, 250 MHz , cPCI/PXI digitizers.
- Complete system includes multiple U1091AC50 5-slot crates.
- U1091AK08 fiber optic interfaces.
- Up to 40 digitizers (160 channels) in some applications.

Key Features and Added Value

- High speed, high fidelity measurements.
- High channel density.
- Easy multi-channel synchronization of clock and trigger (AS bus) between all the modules.
- High speed data transfer (PCI bus).
- High duty cycle for successive measurements (Tokamak shots), only 5 ms retention.
- Low power consumption.
- Complete modular system in compact a footprint .
- Non-perturbing test method requires only the access of laser beams to the plasma.

Key Requirements

- The high speed and high channel density achievable with Agilent's digitizer-based solution, along with the non-perturbing nature of the testing make this diagnostic method for hot plasma attractive.
- In addition, the synchronization of all channels provided by AS bus is critical to measure plasma properties at the same time around the Torus.

*ITER is a new collaboration financed globally with many collaborators worldwide. A lot of physics funding will find its way to the ITER collaboration in years to come. One should be on the look out to discover the various pockets of ITER activity, as much of those funds will be spent domestically in the various collaborative programs.

Resources

- U1063A, 8-bit, cPCI digitizer brochure: http://cp.literature.agilent.com/litweb/pdf/5989-7470EN.pdf
- Article "Physics Plasma Temperature Measurement": http://cp.literature.agilent.com/litweb/pdf/5989-7126EN.pdf
- Data Converter product selection guide: http://cp.literature.agilent.com/litweb/pdf/5989-8038EN.pdf
- Digitizers website: **www.agilent.com/find/embedded-digitizers**

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