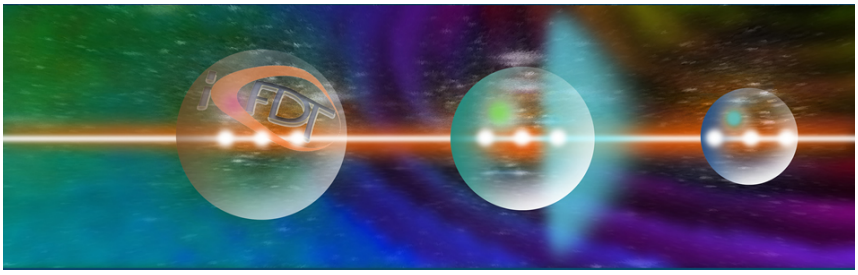

Contribution ID: **61** Type: **Talk**

High availability control and data acquisition for fusion experiments

Friday, 5 October 2018 18:00 (20 minutes)

Near steady-state operation of plasmas in fusion machines controlled by systems with high acquisition channel density require much reduced downtime (High Availability or HA). To achieve adequate HA for scalable, high performance systems, various techniques can be applied:
• Serviceability - remote hardware management, modules hot-swap, modularity, firmware update support;
• Fault detection and mitigation;
• Redundancy - sensor level, system level, software/firmware level, scalable redundancy schemes (1 + 1 up to N + M);
• Resilience to errors, EM fields and neutrons;
• Transposition of sensitive hardware from hazardous radiation locations;
• Time-stamping (absolute time applicable standards: IEEE-1588, White Rabbit and IRIG), synchronization and real-time event management embedded on the acquisition hardware;
• Choice of instrumentation standards, based on Modularity, Expandability, Hardware Management capability, embedded HA schemes, data processing/transfer capability;
• Software - "universal"common device driver layer supporting the above mechanisms/methods; high performance and Computational power techniques to process real-time complex algorithms (e.g. in GPU, FPGA); centralized hardware management including firmware updating methods.
An overview of the application of these techniques in prototypes of systems targeting current and future fusion experiments will be presented, including the hardware, gate-ware and software development details.

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Session Classification: Diagnostics for fusion reactors