Abstract

Controlled nuclear fusion aims to obtain energy using confined particle collision inside a nuclear reactor. This gas of ionized particles (basically deuterium and tritium, heavier isotopes of hydrogen) are kept at high temperatures also known as Plasma, the fourth state of matter. Due to the high temperatures and type of confinement used (magnetic, inertial or gravitational) various types of instabilities occur and require a set of procedures carried out by the control and acquisition systems throughout the process a particular fusion experience.

Control and acquisition systems most commonly used nowadays in nuclear fusion are based in the ATCA (Advanced Telecommunication Computer Architecture) specification introduced by the PICMG (Peripheral Interconnect Component Manufacturer Group) group to cover the requirements of telecommunications infrastructures which demands support for a large amount of data with high data transfer speeds and ensures high availability, high reliability, hardware components maintenance and system redundancy.

Controlling the plasma demands efficiency so it is necessary that electronic systems collect large amounts of information, process and analyze them to take critical decisions in real time, store data for later analysis, produce reports either of the experiment itself or the hardware components involved, correct anomalies, detected and identify shortcomings and notify the operator of the decisions taken, modifications introduced and how were handled.

For everything to work perfectly and compliant with requirements, it is important to that instrumentation integrates monitoring mechanisms through hardware and management software to check hardware components health by reading sensors, trigger proper actuators in time, update required system databases with inventory of hardware components in use and in maintenance, collect, test and storage data, update firmware and installed software modules, configure and handle system alarms in order to detect, predict and prevent possible emergency and failures occurrences to ensure system safety operation, experiment behavior control, equipment, facilities, people and environment protection.

The present work aims to develop a monitoring and hardware management application for an ATCA system compliant with ITER (International Thermonuclear Experiment Reactor) specification and standards.