

Real time tomography on the ISTTOK Tokamak

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Tomography is one of the promising systems to be used for real-time plasma control. All systems connected to the tokamak ISTTOK are currently migrating to a real-time, event-driven basis, to allow a flexible plasma control according to physics studies. With this in mind, a new tomography diagnostic was developed to serve as a secondary input to a multiple input/multiple output (MIMO) controller, which sends feedback to control the plasma position.

This real-time tomography diagnostic has been developed at CFN and is composed of three 10-pixel arrays located on the top, bottom and equatorial sides of the tokamak. Each array's signals are fed to a PCI board that has a FPGA and a DSP for real-time analysis of the data. All data is carried to one FPGA and is processed using an algorithm based on a fast fitting with minimum squares of Zernicke polynomials. A tomographic image is created at an expected rate of 125 kHz to pick up ISTTOK MHD activity that is typically around of 80 kHz. Suitable filters in various wave-lengths can be used.

The identification of the parameters for real-time control are feed on the ISTTOK event network at a rate of 1ms and used for plasma equilibrium control.