AN INTEGRATED GYROTRON CONTROLLER

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The ECRH system of W7-X consists of 10 independent gyrotron modules. Each module consists of one gyrotron and its periphery such as power supplies, cooling plants and distributed PLC systems. The fast real-time control functions such as the timing of the two high voltage supplies, trigger pulses, protection, modulation and communication with the central control of W7-X, is implemented in an integrated controller which is described in this paper.

As long-term maintainability and sustainability are an issue for nuclear fusion experiments, an FPGA-based design has been chosen which is exclusively based on free (in the sense of freedom) software and configuration code. The core of the controller consists of a real-time Java virtual machine (JVM) [1] that provides the TCP-IP connectivity as well as more complicated control functions and which interacts with the gyrotron-specific hardware. Both the gyrotron-specific hardware and the JVM are implemented on the same FPGA which is the main component of the controller.

All 10 controllers are currently completed and operational. All parameters and functions are accessible over the network. Due to the open, FPGA-based design, most hardware modifications can be made over the network as well. The paper discusses the capabilities of the controllers and their integration into the central W7-X control.
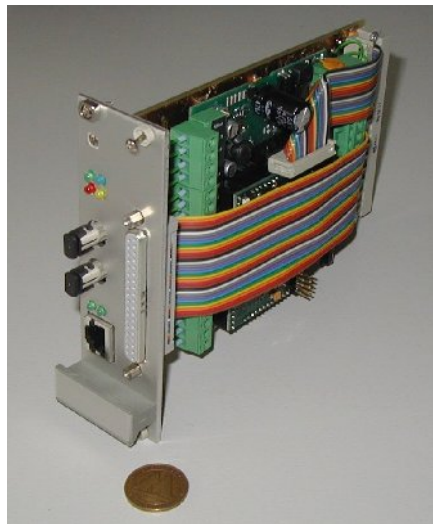

Figure 1: The gyrotron controller

[1] M. Schoeberl, A Java Processor Architecture for Embedded Real-Time Systems, *Journal of Systems Architecture,* Vol. 54/1--2 , pp. 265-286