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The Trigger- Time-Event-System for Wendelstein 7-X: Overview and first Operational Experiences

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The superconducting stellarator Wendelstein 7-X (W7-X) started plasma operation in December 2015 after the commissioning phase of the machine. The main technical and diagnostic systems have been finished successfully.

The timing system is an important part of the Control, Data Acquisition and Communication systems of W7-X. Its main function is to synchronize all clocks of the control and data acquisition systems with sufficient accuracy. In addition, the timing system offers a wide range of functions for sending, receiving and processing event messages, time capturing, pulse generation, and sending as well as receiving trigger signals. Derived from these main functions the timing system is named Trigger-Time-Event (TTE)-system.

The TTE-system is hierarchically structured. The central device of the TTE-system is a part of the W7-X central control system. The local devices of the TTE-system are part of the control systems for technical (e.g. ECRH heating system, superconducting magnet system) or diagnostic (e.g. laser diagnostics, spectrometer) components.

The connection between the central device and all local devices is made via an optical network (TTE-network).

The first version of the TTE-system is in routine operation at the W7-X experiment. Since 2004 it has been used for the commissioning of the control and data acquisition components, and also for the stellarator WEGA. Furthermore, we finished a prototype of the second version of the TTE-system. The main contributions of the second version of the TTE-system are the extension of functionalities (e.g. bidirectional optical communication in TTE-network, future-proof communication with control systems using Ethernet), improvement of reliability, and the increase of the time resolution (up to 10 ns).

The commission of the second version of the TTE-system is still going on and planned to be finished end of 2016. The development project of the ITTEV2-device, a new version of hardware for the local TTE-systems, is finished successfully.

Starting with an introduction of the TTE-system of W7-X, this contribution describes the main features of the TTE-system. The actual state of the TTE-system and the network topology will be presented. Actual hardware developments for the central TTE-device and the TTE-network are described. Finally, first experiences of W7-X operational phase OP1.1 related to the TTE-system are discussed.

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