

## The stellarator W7-X on the way to long pulse operation

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The Wendelstein 7-X stellarator has a super-conduction coil system, to prove the steady state capabilities of optimized stellarators. After different steps with a limiter (OP1, starting December 2015) and two runs with inertially cooled divertors (OP1.2a, OP1.1b, up to December 2018) the device was completed to fulfill the steady-state capabilities:

- A High-Heat Flux Divertor (HHF) for steady state loads of 10 MW. Its surfaces are covered with CFC (carbon).
- To derive this power in steady-state, the Divertor and many other in-vessel have to be water-cooled continuously.
- To enhance the particle pumping from the divertor, 10 cryo-pumps have been installed behind the divertor targets.
- The divertor targets have to be observed continually components, in order not to be overloaded. Therefore IR-observation of all divertor targets is required, to end the heating of a discharge in time. This is the main safety measure to avoid problems with the HHF-Divertor.
- Further diagnostic system have been build up the coming phases.

The completing phase of W7-X took longer than expected, also due to the COVID-pandemie, but was finished in December 2021. Since then, the commission is running, especially the filling and balancing of the more than 600 cooling circuits. First Plasma experiments are scheduled to take place in November 2022.

In addition to these hardware update, also the organization of the plasma operation, the data acquisition and the control system were further improved.

This report will look backward to the OP 1.2a/b with plasma operation in an inertial divertor, and the corresponding restrictions, limiting the energy (Power times plasma duration) deposited in a discharge. Nevertheless, the effect of the optimized configuration of W-7X has already been proven.

After discussing the completing phase with the hardware discussed above we will present the first results from the commissioning and operation phase.

**Primary author:** BOSCH, Hans-Stephan (Max-Planck-Institute for Plasma Physics)

**Presenter:** BOSCH, Hans-Stephan (Max-Planck-Institute for Plasma Physics)

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