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P4.052 Shutter systems for various diagnostics at the Wendelstein 7-X stellarator

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Shutter systems for various diagnostics at the Wendelstein 7-X stellarator
K. Höchel, R. Laube, C. Brandt, M. Otte, M. Schülke and the W7-X Team
Max-Planck-Institut für Plasmaphysik, Greifswald, Germany

The stellarator experiment Wendelstein 7-X (W7-X) has completed the first two operational phases. During the last operation phase OP1.2a in 2017 a maximum energy limit of 80 MJ within a 24 s discharge was achieved. However, in future operation phases stationary plasma discharges with a length of up to 30 min and an energy limit of 18 GJ are planned. High energy fluxes from the plasma and high energy stray radiation from the heating systems reach the wall protecting elements and the wall. Therefore, many diagnostics need a dedicated shutter system for protecting sensitive components.

The presentation gives an overview of the shutter systems for three different in-vessel diagnostics: the vacuum magnetic flux surface diagnostic, the bolometer and the soft X-ray multi camera tomography system (XMCTS). In addition the shutter systems have also the function to enable measurements of the signal-to-noise ratio and to compensate for temperature drifts (dark measurements), which are especially expected for the long pulse discharges. The local environment and the individual boundary conditions of these shutter systems resulted in sophisticated design solutions.

The following difficulties have been solved: low outgassing in vacuum, movement of mechanical parts under high vacuum conditions, compatibility with a bake-out temperature of 150°C, resistance against 140 GHz microwave stray radiation, low perturbation of the magnetic field by the metallic components (low permeability) and functionality of the shutter system in high magnetic fields of up to 3 T. Furthermore, the choice of the materials is restricted due to the need of low cobalt content (low activation). All shutter systems have been successfully used in the first operational phases.

Presenter: HÖCHEL, Klaus (E5 Max-Planck-Institut für Plasmaphysik Teilinstitut Greifswald)

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