

CALORIMETER DESIGN-ASPECTS FOR NEUTRAL BEAM INJECTION ON W7-X

D. Holtum¹, M. Fröschle¹, B. Heinemann¹, T. Liebe², R. Nocentini¹,
R. Riedl¹, P. Rong¹, W. Schubert², A. Stäbler¹

¹ Max-Planck-Institut für Plasmaphysik, EURATOM Association, Postfach 1533, D-85740 Garching, Germany

² Fa. Xenos GmbH, Jugendstr. 2, D-81667 München, Germany

Corresponding author: holtum@ipp.mpg.de

The Wendelstein 7-X (W7-X) is a fusion plasma experiment (stellarator) under construction at Greifswald, Germany. One of the heating systems for W7-X, the NBI (neutral beam injection), will start with a heating power of 7 MW hydrogen and 10 MW deuterium. Operation is scheduled to start at the end of 2014. In a stage of further development the heating power could be doubled. To measure the heating power of the NBI and to condition the ion-sources, a calorimeter is mounted directly at the entrance of the torus duct. It is similarly designed as the calorimeter of the ASDEX Upgrade injectors at IPP in Garching, which is in operation since 1993. With the know-how from ASDEX Upgrade operation, the complete calorimeter was re-designed. Necessary improvements for the operation on W7-X are described in this presentation.

The assembly groups of the calorimeter are: the elevating device, the body and the support.

The distance between the measuring and the parking position is 1200 mm. The force for lifting including the vacuum forces is 30 kN. The main part of the body are the 24 panels in four sections, each section for one source. The permitted peak heat load on the surface of the panels is 24 MW/m². The calorimeter is lifted by a crane-motor with a steel rope and controlled positions and load-forces. The junction between vacuum and ambient pressure is ensured by bellows with a lifetime over 10000 cycles. There is a support on the bottom of the NBI-box to fix the measuring position of the calorimeter. It is a simple steel construction with centering elements (capture radius about 15 mm) and with four plane bearings.

The control is integrated locally or alternatively from the control center of the NBI via profi-bus. Measuring data are transmitted by optical fibres as a standard in the torus-hall. Main improved aspects concern i) the adapted slope of the winding drum at the lift, ii) an adjustable acceleration/deceleration ramp and integrated position sensors, iii) the improvements of panels in the body, iv) the accessibility for mounting panels, v) the water-distribution, vi) the centering of the body on the support to fix and reproduce the measuring position.

The supports and parts of the body have already been manufactured. The other parts should be finished/delivered in this year. The assembly including local control is planned in spring 2011, installation in the NBI-Box in 2013.

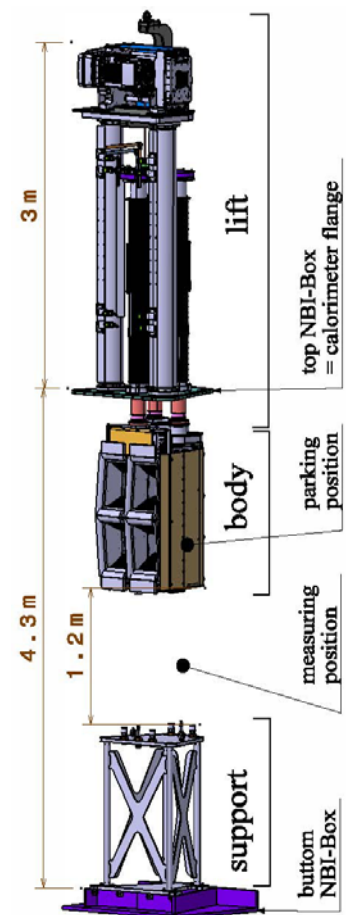


Figure 1: NBI-Calorimeter at W7-X