Challenges of using optical fibres for plasma current measurements during burning plasma operation of tokamaks

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Abstract

Plasma current measurements are essential for safe operation of magnetic fusion installation, which are considered as a future source of clean energy. In the present-day facilities these measurement are based on the use of various types of inductive sensors such as pick-up and Rogowski coils, saddle loops, etc. These sensors have different designs while sharing the same physical measurement principle that the signal is generated as a result of variation of the magnetic flux through the sensor loop. This approach can cause complications for future burning plasma installations, including ITER and DEMO. The steady-state operation regime combined with the presence of strong nuclear radiation will result in a significant measurement drift. To circumvent this problem, the Fibre Optics Current Sensor (FOCS), which operates on a different physical principle, will be installed in ITER and later on DEMO. The extremely harsh radiation environment during burning plasma operation results can also can compromise the FOCS performance. In the presentation we will explain challenges the FOCS will face and outline solution proposed to mitigate the adverse effects. These solutions will be illustrated using JET as an example, with emphasis on the D-T operation. This work has been carried out within the framework of the EUROfusion Consortium, funded by the European Union via the Euratom Research and Training Programme (Grant Agreement No 101052200 - EUROfusion). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the European Commission can be held responsible for them.

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