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P4.061 Steady-state magnetic diagnostic for ITER and beyond

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Magnetic measurements at long pulse magnetic confinement fusion devices require implementation of the true steady state magnetic field sensors in order to achieve required precision of plasma position measurement. Inductive sensors can suffer from a range of temperature gradient and radiation induced offsets which together with the intrinsic offsets of analogue integrators can lead to unwanted artificial drifts of their output signals.
This contribution will present overview of the several years long R&D programme dedicated to development and qualification of the outer vessel steady state magnetic sensors based on bismuth Hall sensors. The main results regarding sensor design and optimization, technology of manufacturing, results of number of qualification tests including neutron irradiation tests, measurements of sensitivity versus temperature and magnetic field will be briefly reviewed. Elaborated design of the sensors housing which include temperature measurement thermocouple in-situ recalibration feature will be presented. Concept of Hall sensor controller which integrates synchronous approach to detection, current spinning technique to eliminate planar Hall voltage and offset and use of high reliability electronic components to assure long term stability and high accuracy will be presented. Finally, the current status of the manufacturing of the diagnostics, including lessons learned, will be given.
Final part of the contribution will provide outlook of potential, challenges, requirements and new concepts of implementation of steady state magnetic sensors based on Hall effect in even more hostile environment of DEMO and future power reactors. The results of online investigation of Hall sensors based on gold nanofilms up to DEMO-relevant neutron fluences will be presented. New sensing materials like mixtures of bismuth and antimony/copper will be introduced.

Presenter: DURAN, Ivan (Tokamak Institute of plasma physics of the CAS)

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