ITER steady state magnetic diagnostic

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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.

Steady state magnetic diagnostic set on ITER is based on sixty Hall effect sensor units welded onto the outer vacuum vessel skin within three toroidally separated full poloidal arrays. Each sensor unit contains two Hall sensors with bismuth sensitive layer measuring horizontal and vertical magnetic field and the thermocouple monitoring Hall sensors temperature. Temperature monitoring of each sensor unit features the in-situ auto calibration feature provided by embedded indium capsule. Advanced electronic Hall sensor controller form essential part of this diagnostic system. It provides high noise immunity employing synchronous detection and automated offset and planar Hall voltage elimination by periodic switching of Hall sensor input and output terminals.

Proposed poster presentation will provide overview of present status of development, qualification, and manufacturing of the steady state magnetic sensors for ITER tokamak. Key results of the R&D programme spanning over several years and comprising neutron irradiation testing, measurement of Hall coefficient at high magnetic fields up to 12 T and high temperatures up to 220 °C, long term temperature cycling etc. will be presented. It will be shown that resulting steady state magnetic diagnostic will comply with ITER requirements in terms of performance as well as compatibility with operation in ITER environment.