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Oral_15: Development of Nuclear Detectors for Tokamak Harsh Environments

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Fusion and hybrid fusion-fission reactors (HFFR) are characterized by having intense neutron and gamma fluxes and high working temperature. This is particularly relevant for the breeding blanket region (BB) whose environment results very hostile to nuclear detectors to be used to monitor/measure fundamental nuclear parameters like e.g. neutron/gamma fluxes and spectra, tritium production, etc. furthermore, these experimental quantities need to be compared with the prediction from the calculation tools used for the BB design so providing information about the affordability of the tools.
Presently no detectors are ready for being hosted in the harsh environment of the BB and R&D activity is needed to develop and test the detectors. Some important lessons about the detectors can be learned from past activities carried out in the EU, devoted to studying and realizing nuclear detector prototypes for the European Test Blanket Modules (TBM) of ITER. Amongst the other, these studies pointed out the need for intense neutron source, appropriate calibration facilities closely reproducing the expected working environments for testing the prototypes and accurate simulation of the proposed detectors. Simulation allows to mimic and thus foresee the response and performances of the detectors under the expected working conditions as well as to compare the prediction to the experimental tests in the calibration facilities.
To mention that the experience gained so far for ITER-TBMs can be helpful also to study and develop nuclear detectors for hybrid fusion-fission reactors (HFFR). Indeed, despite the difference, TBMs/BB of fusion devices and the breeding blanket of HFFR reactors experience a number of similarities in terms of radiation level, temperature and nuclear quantities to be measured, so the lesson learned for ITER-TBM can be very helpful to study and develop nuclear detectors to be used in hybrid reactors.
In this paper the results so far achieved at ENEA Frascati in developing nuclear detectors for the ITER-TBM as well as the many issues not yet solved are highlighted and the possible follow up to HFFR instrumentation discussed.

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