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Short_Oral_31: A new hard X-ray spectrometer for runaway electron measurements in tokamaks

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Runaway electron generation remains one of the major challenges to the success of high-current tokamaks. Investigation of runaway electron physics is a crucial step towards developing effective prediction, avoidance, and mitigation strategies to reduce the impact of these dangerous events. Valuable information on the runaway electron distribution function can be obtained performing spectral analysis of the bremsstrahlung radiation emitted in the interaction between the runaway beam and the post-disruption plasma. Measurement of this radiation is challenging and requires dedicated instruments.

This work presents REGARDS, a novel portable hard X-ray spectrometer optimised for bremsstrahlung radiation measurement from runaway electrons in fusion plasmas. The detector is based on a 1"x1"LaBr3:Ce scintillator crystal coupled with a photomultiplier tube. The system has an energy range exceeding 20 MeV with an energy resolution of 3% at 661.7 keV. The detector gain is stable even under severe HXR flux (gain shift below 3% with a HXR counting rate in excess of 1 MCps). The high performance of the system enables unprecedented studies of the time-dependent runaway electron energy distribution function. Examples from recent runaway electron physics experiments performed at the ASDEX Upgrade and COMPASS tokamaks are shown.

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