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14.11 High resolution gamma-ray spectrometer with MHz capabilities for runaway electron studies at ASDEX Upgrade

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On the quest for an improved understanding of the physics of runaway electrons, there is need to develop diagnostic methods that can provide access to their distribution function. Spectral measurements of the bremsstrahlung spectrum in the gamma-ray energy band are a means to gain insight on confined and escaped runaways as they lose energy in the event of a sudden termination of the plasma discharge. Benefiting from advances in the technology of high counting rate gamma-ray spectrometers, we have developed a high resolution gamma-ray spectrometer with MHz capabilities for runaway electron measurements in disruptions at ASDEX Upgrade. The detector views the plasma along a partially collimated radial line of sight and determines the energy spectrum of the impinging radiation by pulse height measurements with a fast digitizer and dedicated reconstruction algorithms. A deconvolution method is then used to infer the runaway electron distribution function from the gamma-ray spectrum. In this work we describe the main features of the detector and we present examples of measurements of the runaway distribution function in disruption mitigation experiments by means of massive gas injection or magnetic perturbations at ASDEX Upgrade.

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