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2.46 Neutron measurements at the ELISE neutral beam test facility and implications for neutron based diagnostics at SPIDER

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Along the route to the development of a neutral beam injector for ITER, the Padua based SPIDER and MITICA facilities will make use of neutron diagnostics to quantify the homogeneity of the neutral beam profile by measurements of the map of the neutron emission from the beam dump with ad hoc developed Gas Electron Multipliers (GEM). Neutrons are here born from beam target reactions between the beam and the deuterium ions previously adsorbed in the dump. In order to aid the interpretation of the diagnostic data, we have used the ELISE neutral beam test facility for a dedicated experiment on neutron emission from beam-target reactions in a range of parameters approaching that of SPIDER. A calibrated liquid scintillator detector has been employed to monitor neutron emission from a defocused beam and at increasing power densities on the dump. Compared to calculations based on the so called "local mixing model", the experimental results show a discrepancy exceeding the statistical accuracy of the measurements and which increases as a function of the power density. The data are used to derive an empirical correction for applications to neutron measurements at SPIDER, where a liquid scintillator detector is now planned for installation as a monitor to complement the main GEM diagnostics.

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