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10.54 The Neutron Camera Upgrade for MAST Upgrade

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A Neutron Camera (NC) was used on the Mega Ampere Spherical Tokamak (MAST) to measure the DD neutron emissivity along four collimated lines of sight, two on-axis and two off-axis, all viewing the plasma in tangential direction. The encouraging results obtained suggested that an upgraded NC for MAST-U would provide fundamental information for the study of fast ion physics. This work describes the design choices and characteristics of the NC Upgrade (NCU) system. These have been obtained on the basis of MAST-U simulated scenarios using TRANSP/NUBEAM in combination with engineering constraints. Detectors efficiency, collimators' diameter and length and the magnetic and radiation shielding have been determined using finite element tools (COMSOL) and MCNP, respectively. The final NCU design consists of six, equatorial sight lines with a spatial resolution of 6 cm. The expected statistical uncertainty on the neutron count rates is 10% with a time resolution (integration) of 1 ms. Full plasma coverage can be obtained by moving the NCU in between plasma discharges. Off-axis lines of sight are not available in the present design but are briefly discussed as they are considered for a future upgrade.

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