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The radiation environment within the STEP fusion device

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The Spherical Tokamak for Energy Production (STEP) is the UK's major technology and infrastructure programme to build a prototype fusion powerplant that will demonstrate net energy, fuel self-sufficiency and a viable route to plant maintenance.

STEP will use high temperature superconducting (HTS) magnet technology within toroidal and poloidal field (TF and PF) coils to confine the plasma. The radiation environment inside STEP will be extreme, with approximately $5x10^{20}$, 14.1 MeV neutrons being released from the deuterium-tritium plasma every second. A significant amount of novel shielding is therefore required to ensure magnet lifetimes in the region of several full power years.

Utilising a Monte-Carlo approach, STEP has identified the main driver to lifetime uncertainties as the neutron fluence/damage limit. To reduce this uncertainty, research to better understand the neutron fluence/damage limits will be vital.

This talk will present an overview of the radiation environment in STEP, the current proposed magnet shielding solutions, the magnet lifetime assessment methodology and plans for magnet testing.

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