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Preliminary Neutronics assessments of the Collective Thompson Scattering Diagnostics

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The Collective Thomson Scattering (CTS) diagnostic for ITER will probe variations in the alpha-particle velocity distribution by directing a 1MW 60GHz gyrotron beam into the plasma while monitoring the backscattered microwaves. Through the use of waveguides and mirrors these microwaves are transmitted to the diagnostics building for detection.

Large cut-outs of the ITER blanket are required to inject the gyrotron beam and to extract the signal, leading to challenges in providing sufficient shielding of the equatorial port plug #12 where the CTS diagnostic will be placed.

The diagnostics system is developed in a partnership between DTU and IST and has recently passed the System Level Design. Neutronics efforts focus on supporting the system design. In order to reduce computational efforts and allowing for parametric investigations a simplified MCNP model, called Torus, has been developed and benchmarked against the generic DGEPP model, which serves as our baseline.

The Torus model is applied in parameter studies of the CTS diagnostic and provides a useful aid for the engineering design. Examples are shown, including calculation of the shutdown dose-rates for various options of shielding in the region close to the port plug backplate.

In addition, a simplified geometry of the CTS-system capturing only the main features of the design has been implemented into the DGEPP model. The resulting fast neutron fluxes and shutdown dose rates in the region close to the backplate are benchmarked against earlier estimates calculated by IO.