2D Divertor Design Calculations for the National High-power Advanced Torus Experiment

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The National High-power advanced Torus Experiment (NHTX) [1,2] is a new machine under design at PPPL. This machine exploits the compactness of the ST concept to achieve levels of P/R (ratio of exhaust power to major radius) that are a factor of 2-4 times higher than currently planned long-pulse machines, including ITER. This will allow NHTX to study the integration of high-performance, long-pulse plasmas with a more reactor-relevant high heat flux plasma boundary. The expected divertor plasma characteristics in NHTX will be presented. These have been calculated using the SOLPS suite of 2D edge modeling codes [3]. Calculations have been performed over a range of input power and core plasma densities, and indicate that NHTX can achieve very high levels of heat flux at the divertor targets (peak values a factor of 10 higher than the ITER limit). Modeling indicates that the peak flux is only weakly dependent on the core density, divertor pumping efficiency, and achievable impurity radiation. However, the heat flux is strongly affected by the magnetic geometry at the divertor. By controlling the number of X-points and the level of flux expansion at the divertor targets, the peak heat flux can be changed by factor of 10 or more. Detailed calculations will be presented for different magnetic configurations of NHTX, showing the ability of the device to provide high heat fluxes for the testing of plasma facing components, as well as study heat flux control through its flexibility in divertor magnetic geometry.

[1] Menard, J. *et al*, "Physics Design of the National High-power Advanced Torus Experiment", PPPL Report No. 4252, July 2007.
[2] Neumeyer, C. *et al*, Proceedings of the 22nd IEEE/NPSS Symposium on Fusion Engineering, Albuquerque, New Mexico, June 17-22 ,2007, pp. 1-4.
[3] Schneider, R. *et al*, Contrib. Plasma Physics **46** (2006) 3.

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