Maximising fusion power density in NBI driven systems

S. McNamara[1], S. Rose[1], M. Gryaznevich[1, 2]

[1]*Imperial College London, London SW7 2AZ, UK*
[2]*Tokamak Energy Ltd, Milton Park Oxfordshire OX14 4SA, UK*

Lead-author e-mail: sam611@ic.ac.uk

For a number of fusion applications such as component test facilities and fission-fusion hybrid schemes, fusion power density, not energy multiplication, is the primary measure of performance. It is well established that the fusion power density can be raised above the thermonuclear level via NBI and previous studies [*Jassby, D. L, Nuclear Fusion 15(3) 1975*] have shown that at fixed plasma pressure the fusion power density is inversely related to the energy multiplication factor, *Q*. However, this increase in fusion power density is driven by the increase in the NBI power required to sustain the plasma pressure. In all fusion devices, and particularly in compact STs, the applied power is strictly limited by the allowable internal wall and divertor power loadings. Therefore it is instructive to fix the NBI power and determine the effects of confinement on fusion power density. Both pure deuterium and deuterium-tritium systems are investigated, with discussion focused on practical devices conceivable with current technologies. It is demonstrated that, contrary to the fixed pressure case, under the constraint of fixed beam power fusion power density increases with *Q*.