Enhanced confinement after multi-pellet injection into neutral beam injection heated plasmas in the stellarator TJ-II

K. J. McCarthy[1*], I. García-Cortés[1], A. V. Melnikov[2,3,4], N. Panadero[1], E. Ascasíbar[1], M. Drabinskiy[2], L. G. Eliseev[2], T. Estrada[1], J. Hernández-Sánchez[1], P. Khabanov[2], A. S. Kozachek[5], M. Liniers[1], S. E. Lysenko[2], D. Medina-Roque[1], P. Medina[1], M. A. Ochando[1], J. L. de Pablos[1], I. Pastor[1], C. Toledo[6], B. van Milligen[1] & TJ-II team[1]

[1]*Laboratorio Nacional de Fusión, CIEMAT, Madrid, Spain*
[2]*National Research Centre 'Kurchatov Institute', Moscow, Russian Federation*
[3]*National Research Nuclear University 'MEPhI', Moscow, Russian Federation*
[4]*Moscow Institute of Physics and Technology, Dolgoprudny, Moscow region, Russian Federation*
[5]*Institute of Plasma Physics, NSC KIPT Kharkov, Ukraine*
[6]*Facultad de Ciencias Físicas, Universidad Complutense de Madrid, Madrid, Spain*

Pellet injection (PI) is used to achieve deep and efficient core plasma fuelling in magnetic confinement machines. Moreover, improved plasma performance associated with pellet fuelling has been described in many devices [1, 2], a common characteristic being a clear increase in post-injection energy confinement when compared to discharges fuelled by recycling and/or gas puff. Although, several explanations have been put forward, the origins of such improvements are still under investigation.

Cryogenic PI is performed on TJ-II, a heliac-type stellarator fitted with numerous standard and singular diagnostics [3], *e.g.*, a 2-channel Doppler reflectometer, a dual HIBP system, a high-resolution Thomson scattering system. In TJ-II, an enhanced confinement mode is seen after PI into neutral beam heated discharges. In addition to increased core particle density, the diamagnetic energy content rises by up to 40% with respect to reference discharges for a single large pellet while energy confinement, as determined with a diamagnetic loop, is significantly enhanced compared to ISS04 predictions [4]. In similar discharges, the injection of a pellet train further enhances the energy content and energy confinement time, showing very peaked density profiles that broaden towards the edge after small pellets are injected off-axis. These scenarios are found to depend on target n_e and on the post-injection deposition profile, which is characterized by increased density gradients, enhanced negative E_r's that extend from the edge region to the core as seen by the HIBPs and Doppler reflectometer, and by reductions in density and plasma potential fluctuations in the plasma core. Here, experiments performed with balanced and unbalanced NBI heating as well as with single and multiple injections are presented and the resultant improved plasma performances are presented and discussed.

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