Runaway Electron experiments at COMPASS in support of the EUROfusion ITER physics research

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Research into generation, confinement and mitigation of Runaway Electrons (REs) in tokamaks presents one of the key tasks of the fusion energy development due to the risk of damage of the ITER plasma facing components by post-disruption RE beams. Two major groups of experiments aimed at improved understanding and control of REs were carried out on the COMPASS tokamak. In the first group, the effects of Massive Gas Injection (MGI, Ar or Ne, $\sim 10^{20}$ particles) and impurity seeding ($\sim 10^{19}$ particles) were studied systematically. The observed phenomena include generation of the post-disruption RE beam, current conversion from plasma to REs, and formation and decay of RE filaments. Studies of the penetration of impurity gas puff into RE dominated discharges complement this work. Differences between Ar and Ne penetration into the RE beam were mainly attributed to their ionisation potentials and atomic masses in accordance with spectral measurements. A distinctive drop of the background plasma temperature and electron density was observed following an additional deuterium injection into the RE beam. This change slowed down the RE current dissipation significantly. The second group of experiments was focused on the role of the magnetic field in the physics of REs. In particular, the RE currents formation and decay were studied depending on the plasma elongation, magnetic field strength, feedback on plasma current and, most importantly, on multiple sources of the magnetic field perturbations. Special attention was given to the effects of the Resonant Magnetic Perturbation (RMP) on the RE current formation and decay. The benefit of the RE experiments on COMPASS was reinforced by diagnostic enhancements (fast cameras, Cherenkov detector, vertical ECE etc.), the loop voltage control and the modelling efforts (for example, the CODE and the MARS-F codes). The current status of the art in the RE studies on COMPASS will be given in the framework of results achieved in the coordinated EUROfusion RE research programme. Major challenges linked to the planned RE research shall be outlined.