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Runaway Electron Control in FTU

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Runaway electrons (RE) are highly energetic electrons that might gain energy up to 20-30MeV (FTU). Runway electron beam can be harmful for plasma facing components: its low pitch angle allows the deposition of a high amount of energy on small areas yielding serious and deep damages of the vessel structure. For Tokamakas such as ITER, RE beams current should be around 11-13 MA and an impact with the vessel would irreparably damage the machine.
We have proposed a new tool in the FTU plasma control system (PCS) for position and Ip ramp-down control of disruption-generated runaway electrons and first experimental results are discussed.
The RE hybrid control algorithm switches among three phases: 1) in the Ip pre-quench phase the currents in the poloidal coils used for the radial control of the plasma are optimized by a dedicated algorithm called Current Allocator; 2) when the Ip quench is detected (on-line) the system performs actions to improve the radial control in case of formation of a RE plateau; 3) at the onset of the RE plateau, which is detected on-line by dedicated algorithms, the Ip is ramped down and the RE beam position is controlled, by means of real-time (RT) diagnostic signals (magnetics, neutrons), in such a way to minimize the interactions with the plasma facing components and safely shut down the discharge.
This algorithm was tested in dedicated low density plasma discharges in which a significant RE population is generated during the Ip flat top and Ne gas is injected to induce a disruption: the rapid variation of the resistivity and the increased loop voltage at the disruption accelerate the pre-existing RE population and lead, in some cases, to the formation of a RE current plateau. The effectiveness of the RE hybrid control algorithm in this phase will be discussed as well as the possible improvements including code portability to other devices.

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