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Overview of the FTU Results

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Since the 2012 IAEA-FEC Conference, FTU operations have been largely devoted to runaway electrons (RE) generation and control, to the exploitation of the 140 GHz EC system and to liquid metal limiter elements. Experiments on RE have shown that the measured threshold electric field is larger than predicted by collisional theory and can be justified considering synchrotron radiation losses. A new RE control algorithm was developed and tested in presence of a RE current plateau, allowing to minimize the interactions with plasma-facing components and safely shut down the discharges. The experimental sessions with 140 GHz EC system have been mainly devoted to experiments on real time control of MHD instabilities using the new EC launcher with fast steering capability. Experiments with EC power modulation have confirmed the possibility to lock the sawtooth period to the EC period, with EC injection inside the q=1 surface, while experiments with central EC injection have shown the onset of 3/2 and 2/1 modes. EC assisted breakdown experiments have been focussed on ITER start-up issues, exploring the polarization conversion at reflection from inner wall and the capability to assure plasma start-up even in presence of a large stray magnetic field. A new actively Cooled Lithium Limiter (CLL) has been installed and tested. The CLL was inserted close to the last closed magnetic surface, without any damage to the limiter surface, and first elongated FTU plasmas with EC additional heating were obtained with the new CLL. Reciprocating Langmuir probes were used to measure the heat flux e-folding length in the scrape-off layer, with the plasma kept to lay on the internal limiter to resemble the ITER start-up phase. Density peaking and controlled MHD activity driven by Neon injection were investigated at different plasma parameters, and a full real-time algorithm for disruption prediction, based on MHD activity signals from Mirnov coils, was developed exploiting a large database of disruptions. New diagnostics were successfully installed and tested, as a gamma camera for RE studies and a diamond probe to detect Cherenkov radiation produced by fast electrons. Laser Induced Breakdown Spectroscopy measurements were performed under vacuum, so demonstrating the possibility to provide useful information on the fuel retention in present and future tokamaks, such as ITER.

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