



IAEA FEC 201

Contribution ID: 299

Type: Poster

Reduction of CS flux consumption during plasma current ramp-up on DEMO reactor

Friday, 21 October 2016 14:00 (4h 45m)

Reduction of magnetic flux consumption of a central solenoid (CS) during a plasma current ramp-up phase is investigated using an integrated modeling code suite (TOPICS). It is shown that 27% of the CS flux can be saved in DEMO reactor by 50 MW of EC heating at $\rho \sim 0.5$. The plasma beta is kept low in this scenario. If a safety factor profile should not be a strongly reversed shear profile in order to avoid MHD instabilities, reduction of CS flux consumption is limited below 13% regardless of the electron density. This limitation can be relaxed if the heating profile becomes broad using multiple EC rays. Possibility of more advanced current ramp-up scenarios with no CS flux consumption has already been demonstrated for JT-60SA. As a result, requirement on heating and current drive sources, the plasma beta, a safety factor profile and a pressure profile are clarified when CS flux consumption is reduced by 10-100%.

Paper Number

EX/P8-38

Country or International Organization

Japan

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Session Classification: Poster 8

Track Classification: EXC - Magnetic Confinement Experiments: Confinement