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Analysis of non-inductively high-performance discharges

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EAST research program aims at achieving steady-state long-pulse operations, which have been obtained with fully non-inductively current drive and heating, maintaining around zero loop voltage for nearly the entire plasma current flat-top in about 60s at EAST shot #67341 recently. Based on the analysis of non-inductive current fractions, high βp is desirable in order to sustain steady-state high performance discharges on EAST in the near future. The effect of bootstrap current relates to the nonlinear component of vertical magnetic field judged by Maxwell equations. Furthermore, the quasi-linearity relationship in flat-top phase between vertical magnetic field and line-averaged plasma density lays the theoretical basis for radial compression. An increase in magnetic strength will allow high density, high beta, high bootstrap current fraction and high fusion gain to be reached, offering an attractive regime for compressed plasma to approach the Lawson parameter, especially for steady state operation of the designed CFETR —Chinese Fusion Engineering Testing Reactor. Existing limitations of EAST tokamak are analyzed for accommodating and simulating the high-performance discharges.

Index Terms—EAST tokamak, non-inductive current drive, high beta, vertical magnetic field, compressed plasma

Eligible for student paper award?

Yes

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