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JT-60SAプラズマにおける制御範囲の評価とシナリオ開発

Assessment of the range of controls in JT-60SA plasmas and scenario development

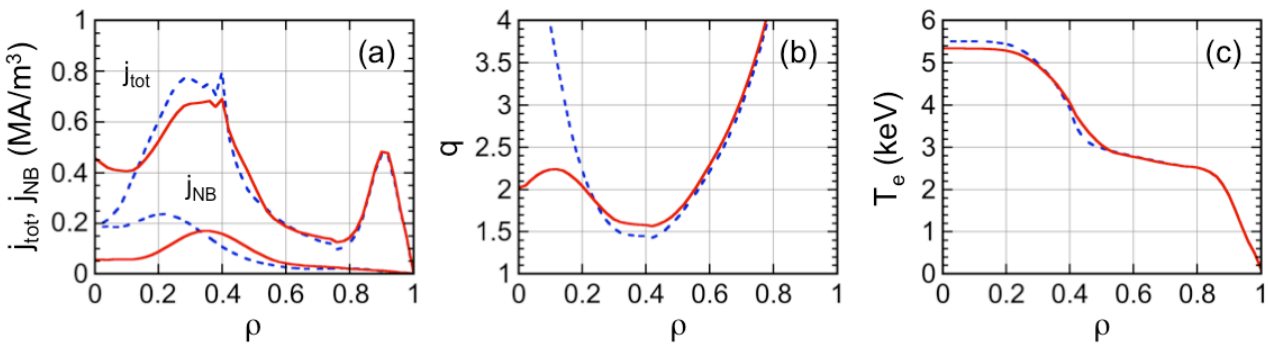
井手俊介[1], 相羽信行[1], BOLZONELLA Tommaso[2], CHALLIS Clive[3], 藤田隆明[1], GIRUZZI Gerardo[4], JOFFRIN Emmanuel[4], 濱松清隆[1], 林伸彦[1], 本多充[1], 星野一生[1],川島寿人[1], 栗田源一[1], 松永剛[1], 宮田良明[1], 仲野友英[1], 清水勝宏[1], 白石淳也[1], 鈴木隆博[1], 武智学[1], 浦野創[1]

[1]原子力機構, [2]RFX　イタリア, [3]CCFE　英国, [4]CEA IRFM　フランス

IDE Shunsuke[1], AIBA Nobuyuki[1], BOLZONELLA Tommaso[2], CHALLIS Clive[3], FUJITA Takaaki[1], GIRUZZI Gerardo[4], JOFFRIN Emmanuel[4], HAMAMATSU Kiyotaka[1], HAYASHI Nobuhiko[1], HONDA Mitsuru[1], HOSHINO Kazuo[1], KAWASHIMA Hisato[1], KURITA Gen-ichi[1], MATSUNAGA Go[1], MIYATA Yoshiaki[1], NAKANO Tomohide[1], SHIMIZU Hatsuhiro[1], SHIRAISHI Junya[1], SUZUKI Takahiro[1], TAKECHI Manabu[1], URANO Hajime[1]

[1]JAEA, [2]RFX Italy, [3]CCFE UK, [4]CEA IRFM France

One of the main goals of JT-60SA project is to achieve steady-state sustainment of a high normalized pressure (β_N) plasma, which is required in the ITER steady-stat operation and DEMO. Plasma control plays a key role to accomplish this goal. Assessment of capabilities in controlling key plasma parameters to access and sustain a high β_N plasma in JT-60SA has been carried out using predictive simulations by using TOPICS with emphasis on controllability with actuators, including not only heating and current drive but also fueling and pumping system. It is confirmed that the safety factor profile, which is believed to play an important role for confinement improvement, can be prepared appropriately at the plasma current ramp-up phase in a wide extent within capability of the installed ECRF system. At the flat-top of a high pressure and high bootstrap current plasma, it is also confirmed that the installed NB system can modify the safety factor profile and the confinement property within the planned capabilities. In the figure shown is the result in which upper N-NB (more on-axis) is switched to lower N-NB (more off-axis) in a 2.3MA high β_N plasma. With the switch-over of N-NB, q_{min} is raised from below 1.5 to above 1.5, this could have impact on the MHD stability and the ITB foot shifts outward. It is confirmed that impurity seeding in the SOL and the divertor region can maintain the heat flux within the divertor heat tolerance keeping the separatrix density level acceptable.



(a) The total and NB driven current profiles just before the N-NB beam line switch over (dashed lines) and 10 s after the switch over (solid lines). The q profile (b) and the electron temperature profile (c) just before (dashed line) and 10 s after (solid line) the switch over.