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Study of ITER First Plasma Initiation using a 3D Electromagnetic Model

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The First Plasma initiation will be more challenging in ITER than in present tokamaks:

- high value of stray magnetic field produced by 1.5 MA of eddy currents induced in the vacuum vessel and by 70 MA of currents in the central solenoid,
- low value of the toroidal electric field (0.3 V/m),
- high volume of the initial gas (1700 m^3) and high content of impurities.

A carefully tuned scenario of the PF system operation will be essential to assure successful plasma initiation.

This paper presents first results of the design and simulation of PF scenario of the First Plasma initiation taking into account 3D model of the conducting structure.

In this scenario at the breakdown (3D model of the conducting structure):

- connection length > 2000 m in the region with minor radius 1.8 m (B_p < 2 mT),
- breakdown conditions: 1) $\int \alpha dl > 1$, 2) $E \times B_t / B_p > 1000$ V/m, 3) $\int E dl > 1000$ V are fulfilled in a large fraction of the vacuum vessel (integrations are performed along field lines from “wall to wall”).