

Validation of the Fenix ASDEX Upgrade flight simulator

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Fenix [1] is the ASDEX Upgrade (AUG) flight simulator based on the 1-D ASTRA transport code coupled with the 2-D SPIDER equilibrium solver [2] and Simulink (simulation platform from MATLAB). Fenix is designed to simulate, prior every discharge, the entire discharge starting from ramping the Toroidal Field coils (TF), plasma start-up, flat-top and ramp down and finishing with ramping down the TF coils. Currently, controllers for position, shape, fuelling and heating are implemented in the same manner as the controllers used at AUG. A model of the Poloidal Field coils and their corresponding power supplies is also included, as well as basic models of heating actuators such as Electron Cyclotron Resonant Heating, Neutral Beam Injection and fuelling using either pellets or gas.

For a first assessment of the quality of simulation models, Fenix simulations have to be validated against already executed discharges. This contribution compares the measured behaviour of various ASDEX Upgrade discharges with their corresponding Fenix simulations. It also describes the implementation of more realistic gas valve and heating actuator models.

[1] F. Janky, et al., ASDEX Upgrade flight simulator development, accepted for publication, Fusion Engineering and Design (2019)

[2] E. Fable, et al., Novel free-boundary equilibrium and transport solver with theory-based models and its validation against ASDEX Upgrade current ramp scenarios, Plasma Physics and Controlled Fusion 55 (2013) 124028.

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