Status and plans of the ITER Pulse Design Simulator

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The ITER Pulse Design simulator (PDS) is an open-source tool being developed by ITER Organization to design, optimize and validate pulses before operating them on the machine. The ITER PDS uses the Integrated Modelling and Analysis Suite IMAS associated with the Muscle3 persistent actor framework for self-consistent coupling between models. The initial version of the PDS includes the NICE Free-Boundary Equilibrium (FBE) code coupled with the METIS or TORAX transport solvers. The approach adopted for the development of the ITER PDS is aligned with the strategy adopted for the development of the WEST flight simulator (NEST for Nice Environment for Simulated Tokamak), and the JT-60SA pulse design simulator. Several computational modes are already available, based on the NICE static inverse and evolutive direct modes. The evolutive mode provides an estimate of the magnetic flux consumption, essential to evaluate the capability to operate long pulses. It implies the use of magnetic controllers provided by the ITER Plasma Control System Simulation Platform (PCSSP), for the control of plasma shape, current and vertical stability. Several other models and workflows are being integrated within the PDS, e.g. for heating and current drive sources and control, or to describe the boundary plasma, allowing estimates of the peak divertor target heat flux in response to fuel injection and impurity seeding and upstream separatrix scrape-off layer parameters for core-boundary integration. The status and plans of the PDS project are presented here, together with the first results obtained with NICE-METIS and NICE-TORAX modelling, including comparison with the DINA FBE and transport code, for several scenarios of the Start of Research Operation (SRO) phase of the ITER Research Plan. The link with plasma operation is also made and discussed, through the qualification of the PDS tools on the WEST tokamak.