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Control-Oriented Core-SOL-Divertor Model to Address Integrated Burn and Divertor Control Challenges in ITER[1] VINCENT GRABER, EUGENIO SCHUSTER, Lehigh University — Burn control in ITER will require careful regulation of the core-plasma's density and temperature while guaranteeing safe operation of the divertor. Satisfying performance objectives in the plasma core is challenging due to the core's sensitivity to both the conditions and the requirements in the scrape-off-layer (SOL) and divertor regions. First, SOL-divertor conditions determine the strength to which deuterium-tritium recycling fuels the core. This could be particularly important in ITER where there might be limits on the level of tritium that can be supplied externally. Second, the SOL-divertor conditions prescribe the intensity to which intrinsic impurities (W and He) and puffed impurities (needed to achieve detachment) pollute the plasma core. Third, the ability to maintain some level of detachment depends strongly on the separatrix density and the power flowing into the SOL from the core. Clearly, core-control objectives will need to be balanced with divertor-control objectives. In this work, the phenomena outlined above are described by using a control-oriented core-SOL-divertor model. The model consists of three components: (1) the energy and density transport equations of the core-plasma, (2) neutral particle balances in the divertor region, and (3) a two-point model that relates the plasma conditions at some upstream separatrix position to that at the divertor target. Using this core-SOL-divertor model, the coupled burn and divertor control challenges faced by ITER can be investigated.

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Vincent Graber
Lehigh University

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