Overview of recent BOUT++ simulation and validation results[1]
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— A suite of two-fluid models has been implemented in BOUT++ for all ELM
regimes and fluid turbulence. A suite of gyro-fluid models is under development
for pedestal turbulence and transport. A suite of 3D neutral and impurity mod-
els is also under development for SMBI, recycling, gas puffing, and for sputtering
from RF antennas and divertor plates. Progress in several key areas of research
will be presented: upshift of PB instability thresholds due to background turbu-
lence; ELM power deposition on the divertor plates; identification of top pedestal
micro-turbulence zone for ELM spreading and pedestal peak gradient MHD zone
for ELM crashing For a ballooning-dominated equilibrium, we find that both pres-
sure gradient and pedestal density can control the transition from large ELMs to
small ELMs. Small elms can be either resistive or ideal P-B modes; the density
dependence of the Elm size is due to ion diamagnetic stabilization, not due to col-
lisionality. The flux limited expressions of parallel thermal diffusivities show weak
or no collisionality dependence, even in the SOL. A decrease of the ELM size with
density is a natural consequence for ballooning modes. For a peeling-dominated
equilibrium and for typical experimental scenarios with natural transition between
peeling dominated and ballooning dominated equilibria during the pedestal buildup,
the scaling characteristics of the ELMs size will also be presented.

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