Variation of particle control with changes in divertor geometry

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Abstract. Recent experiments on DIII–D point to the importance of two factors in determining how effectively the deuterium particle inventory in a tokamak plasma can be controlled through pumping at the divertor target(s): (1) the divertor magnetic balance, i.e., the degree to which the divertor topology is single-null (SN) or double-null (DN), and (2) the direction of the of $B\mathrm{x}\nabla B$ ion drift with respect to the X-point(s). Changes in divertor magnetic balance near the DN shape have a much stronger effect on the particle exhaust rate at the inner divertor target(s) than on the particle exhaust rate at the outer divertor target(s). The particle exhaust rate for the DN shape is strongest at the outer strike point opposite the $B\mathrm{x}\nabla B$ ion particle drift direction. Our data suggests that the presence of $B\,\mathrm{x}\nabla B$ and $E\mathrm{x}B$ ion particle drifts in the scrapeoff layer (SOL) and divertor(s) play an important role in the particle exhaust rates of DN and near-DN plasmas. Particle exhaust rates are shown to depend strongly on the edge (pedestal) density. These results have implications for particle control in ITER and other future tokamaks.