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Plasma shape and fueling dependence on the small ELM regime in TCV and AUG

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A series of experiments has been conducted at AUG and TCV to disentangle the role of fueling, plasma triangularity and closeness to a double null (DN) configuration for the onset of the small ELM regime. At AUG, the role of the SOL density has been revisited. Indeed, it turns out that a large density SOL is not a sufficient condition to achieve the type-II (small) ELM regime. This has been demonstrated with a constant gas fueled plasma close to DN which has been progressively shifted down, relaxing therefore the closeness to DN at constant. As the plasma is moved down, Type-I ELMs are progressively restored, finally being the unique ELM regime. It is observed that not only the pedestal top profiles are unchanged, but also the SOL profiles remained unaffected by transition from Type-II to Type-I ELMs. We conclude that the separatrix density is not the unique key parameter and it is hypothesized that the local magnetic shear, modified by the closeness to DN, could play an important role. A small ELM regime with good confinement has been achieved at TCV, a full carbon machine featuring an open divertor. A systematic scan in the fueling rate has been done for both medium and high triangularity shapes. For the latter case, a configuration close to a DN configuration, the stored energy and the pedestal top pressure increase by 5% and 30% respectively compared to the medium triangularity case. For both shapes, as the D2 fueling is increased, the Type-I ELM frequency decreases and small ELMs are observed in between large ones. Finally for the high triangularity, at the maximum fueling rate, the large ELMs are fully suppressed and only the small ELMs remain. As observed in JET and AUG, the pedestal pressure degrades with increasing fueling, up to 40% for the high triangularity scenario, although the stored energy remains almost unchanged. It is also observed that, for both shapes, the density at the separatrix increases with the fueling rate, reaching $n_{e,sep}/n_G$ ˜0.3 at $n_{e,av}/n_G$˜0.75. The small ELM regime at TCV is associated with a coherent mode at about 30 kHz seen by the magnetic probes located at the outboard midplane. The outer target heat loads from IR tomography are reduced by more than a factor of 5 when transiting towards the small ELM regime.

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