In ITER, a large fraction of ELM heat loads is expected on the divertor targets, the remaining arriving on the first wall. In view of lifetime issues for PFCs on ITER, it is important to determine what fraction of these ELM losses would be deposited on the first wall by filaments (compared to those on the divertor). Most tokamak devices have a relatively short SOL distance between the pedestal and the wall at the mid-plane. On JET, IR diagnostics clearly show filaments arriving at the wall with non-negligible energy. It could thus be assumed that filaments in ITER will propagate like filaments on MAST, travelling at constant radial speeds between the pedestal and the first wall (about 40cm). It will be demonstrated here that such assumptions should not be made without careful examination.

Simulations of ELMs using the code JOREK show that filament dynamics is affected by SOL parameters. For simulations of MAST, two extreme cases are observed: the first one involves filaments travelling at constant speed (several km/s) as far as the wall (as observed on fast-camera), and the second case involves filaments barely crossing the separatrix. However, the cases spanning between those two extrema do not simply give a progressive evolution – complex dynamics affects filaments outside the separatrix. For example, at low viscosity ($10^{-7}$ kg.m$^{-1}$.s$^{-1}$) filaments stop a few cm outside the separatrix, and combine poloidally to form a new density front, from which a new set of filaments starts. This peculiar dynamics, for instance, only appears below a certain viscosity threshold, and although it has never been observed experimentally, it hints at the existence of different SOL regimes.

This study determines which SOL conditions are responsible for different filament dynamics (as far as the MHD model of the JOREK code can tell). In particular, viscosity and resistivity have a measurable influence, and since those parameters are temperature dependent, a scan in SOL temperature is produced. Simulations used have total ELM energy losses close to experiments (> 5%), and divertor heat-fluxes that are in reasonable agreement with the IR-camera (with typical peak heat fluxes of the order of 10 MW.m$^{-2}$), as in [1].

![Time evolution of density in a simulation of MAST with low perpendicular viscosity ($\mu_\perp = 10^{-7}$ kg.m$^{-1}$.s$^{-1}$). The filaments cross the separatrix, stop after travelling a few cm, and combine poloidally to form a new density front, from which a new set of filaments is born, at a different poloidal location than the initial set.](image)