# Fast ion transport during large scale saturated MHD activity

D Pfefferlé[1], J P Graves[1], W A Cooper[1]
[1] *École Polytechnique Fédérale de Lausanne (EPFL),*
*Centre de Recherches en Physique des Plasmas (CRPP), CH-1015 Lausanne, Switzerland*

The work focuses on the accurate numerical evaluation of fast particle trajectories in the presence of 3D magnetic fields. The equations of motion implemented in the VENUS-LEVIS code are general in the choice of coordinates and field representation albeit following a strict Hamiltonian formulation. To decide between guiding-centre or full-orbit tracing, an estimation of the spatial variation of the magnetic field is proposed, not only taking into account gradient and curvature terms but also the local shear of the field lines. This is particularly relevant for the case of the helical core equilibrium where the inner kinked flux surfaces are compressed against the outer axisymmetric mantle and where parallel current peaks. In analogy, the simpler situation of $\boldsymbol{B}(x, y, z) = B_0[\sin(kx)\boldsymbol{e_y} + \cos(kx)\boldsymbol{e_z}]$ is considered, for which full orbits and lowest order drifts are obtained analytically. Fast particle redistribution in MAST helical core configuration is discussed, noting that co-passing particles bunch up in the region where the flux surfaces are uncompressed. Simulations are also applied to fast particle losses induced by resonant magnetic perturbations (RMPs) and plasma rotation.