Formation and termination of particle transport barrier in LHD

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In the Large Helical Device (LHD), a fairly peaked density/pressure profile is formed in so-called super dense core (SDC) plasmas [1] by ice-pellet fuelling in the core region. Steep density gradient is observed in the core (averaged minor radius < 0.6), whereas the temperature profile is flat there. Particle diffusivity outside the barrier region (mantle region) is larger than the diffusivity in the core. This difference makes the SDC-type peaked profile. The peaking of the profile is terminated by large-scale collapse events (core density collapse). The cause of this event is supposed to be MHD instabilities. The unstable region of the so-called high-n ballooning mode, which is expected in the helical devices where the 3D effects are dominant, agrees well with the parameter region with large-scale collapse events [2]. The radial extent of this mode, estimated by the Hn-bal code, is localized around the foot of the diffusion barrier. Pre-cursor oscillations just before collapse event are observed in that region. However, the mechanism how a well-localized MHD mode triggers a global collapse has not been understood well. The effects of resonant/non-resonant perturbed magnetic field on the barrier formation and on the collapse events will be also discussed.

[1] R. Sakamoto, et. al., Fusion Sci. Tech, **58** (2010) 53
[2] S. Ohdachi, et. al., Contrib. Plasma Phys. **50** (2010) 552