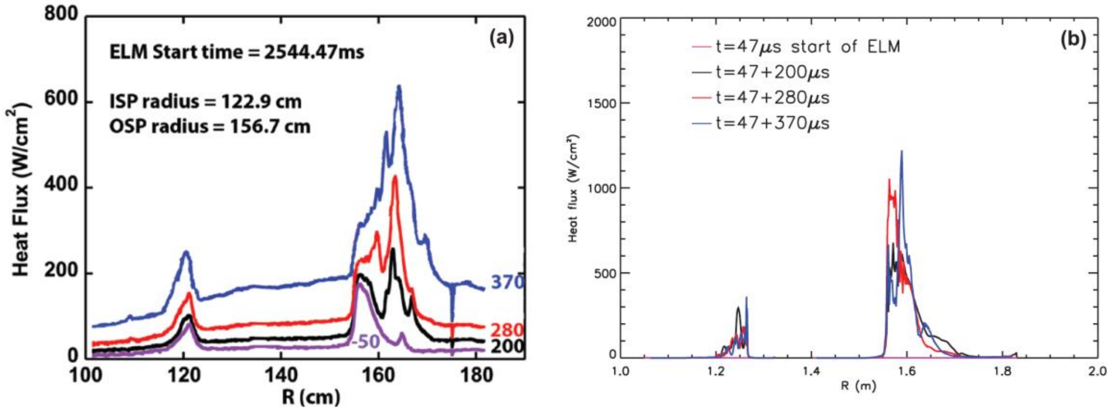
Divertor heat flux simulations in ELMy H-mode discharges of EAST and other tokamaks

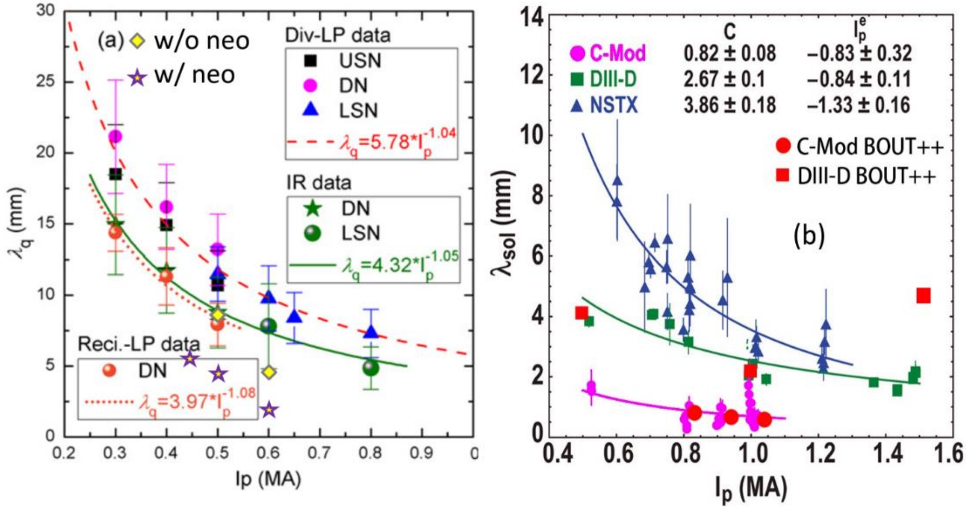
T. Y. Xia[1,2], B. Chen[3,2], T.F. Tang[4,2], B. Gui[1,2], X.T. Xiao[1,2], X. Q. Xu[2], D. H. Li[1], Z. Zheng[1] and EAST Team[1]

[1]ASIPP, [2]LLNL, [3]USTC, [4]DUT

- Six-field two-fluid model in BOUT++ framework is used for the heat flux simulations:
  - Self-consistent turbulent transport
  - Flux limited thermal conduction
  - Neoclassic transport as diffusion terms
  - Sheath boundary conditions on targets
- Validations with DIII-D ELMy H-mode #144382: similar time evolution, narrower width, twice amplitude.



Left: heat flux profiles on targets during ELM burst on DIII-D. Right: Simulated heat flux profiles [1].



(a) The comparison between simulated SOL width λ_q with EAST experimental statistics. The simulated λ_q shows the similar trends to Ip, but the amplitude is more than half smaller than the measurements. (b) The simulated SOL width compared with multi-machine results.

- H-mode discharges on EAST, DIII-D and C-Mod with different Ip for the SOL width λ_q scaling simulations.
  - Similar trend of λ_q to I_p.
  - Half of the experimental amplitude on EAST: no RF heating effects on edge topology.
  - Good agreement with multi-machine scaling [3] in the range of $0.45MA<I_p<1MA$.
  - Neoclassic transport is important for the low I_p case.

[1] T.Y. Xia and X.Q. Xu, Nucl. Fusion 55, (2013) 113030.
[2] L. Wang, H.Y. Guo, G.S. Xu et al., Nucl. Fusion 54 (2014) 114002.
[3] M.A. Makowski et al, Phys. Plasmas 19 (2012) 056122.