Experimental Results from STs and their Relevance to a Next Step Burning Plasma ST.

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Results from MAST, NSTX, Pegasus, START and other STs have already demonstrated some of the predicted advantages of this concept. They include high values of β_t (up to 40%) and β_N (4 – 6) achieved simultaneously; good confinement ($H_{H98(y,2)}$ ~ 1.2 – 1.4 and H_{89P} up to 2); high-density operations with Greenwald number up to 1.6; enhanced vertical stability and resilience to disruptions; good (probably anomalous) ion heating; good SOL properties; reduced volt-seconds consumption. These encouraging results already satisfy some of the requirements for a next step burning plasma ST device. In many areas contribution from conventional aspect ratio tokamak studies provide important information for this next step ST, and vice versa.

For example, the present International Confinement Database has little data at low-aspect ratio and does not include data on the low central shear regimes, which are natural to STs. The results of the studies in STs have already started to contribute to important transport issues: scalings, H-mode characteristics and thresholds, ITB formation, ExB effects, low shear effects, fluctuations and turbulence, etc. However, the base-line regime for a ST burning plasma device may have significant differences to the ELMy sawtoothing plasma, which is suggested as a base-line regime for ITER, and more work is required to create a physics basis for a burning plasma ST device. This mainly includes investigations of the target plasmas with profiles and geometry similar to that assumed for the burning plasma ST on the present devices, both experimentally and with numerical modelling.

In the talk, a review of the main experimental results from MAST in confinement, divertor and stability areas will be presented and the relevance of these results to a burning plasma ST will be discussed. Some suggested extensions of the present experimental operation space toward the burning plasma ST regime will be proposed.

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