



## Topic 2I Experiment and analysis

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presented by N. Vianello on behalf of MST I-Topic 2I scientific team

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- ✓ Relation between downstream divertor conditions and up-stream SOL profiles is not well understood. Influence of SOL blob structures on shoulder formation and divertor conditions is key element towards predictive capabilities. Joint effort within the EUROfusion framework to address this issue on all the MSTI devices (AUG, TCV and MAST-U)



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A series of deliverables were foreseen by 2017 program

1. Cross-machine L-Mode shoulder dependence on current both at constant  $B_t$  and at constant  $q_{95}$ .  
Rationale: disentangle the effect of current and parallel connection length
2. Establish robust scenario for density shoulder profile in H-Mode and establish dependence on fuelling/neutral profiles/divertor condition
3. Fluctuations measurement on AUG to study filamentary transport under high-power H-Mode conditions and under different plasma configurations (SN, DN)
4. Study the role of ELM regimes, neutral compression and particle density in filamentary transport and related shoulder formation
5. Identify the contribution of collisionality and seeding on filamentary transport and related shoulder formation
6. Determine the effect of filaments and shoulder formation on target heat loads in different H-mode plasmas

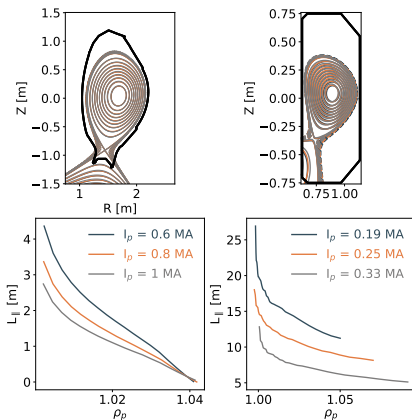


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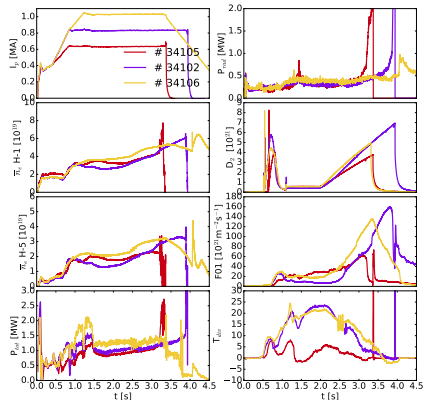
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Remember this is still a work in progress



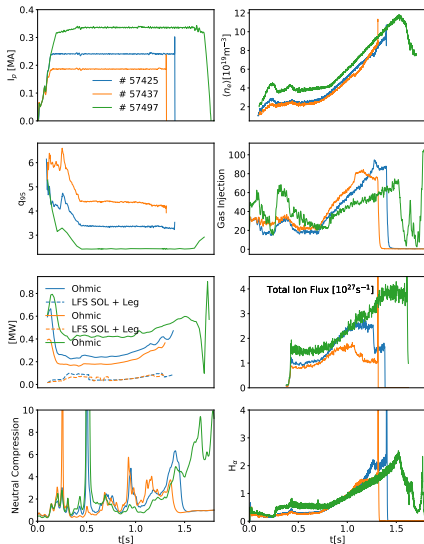
- ✓ Shape matched in within the single scan done for each of the machine
- ✓ The scan implies a modification of the  $L_{||}$ . There is a factor of 5 difference between the two machines due to the very long outer divertor leg of TCV

# Current scan at constant $B_t$ in L-Mode plasma



- ✓ AUG: Fueling reduced only at lower  $I_p$  to avoid earlier disruption. Similar neutral pressure in the subdivertor region reached. NBI additional power added to keep power in the SOL approximately constant

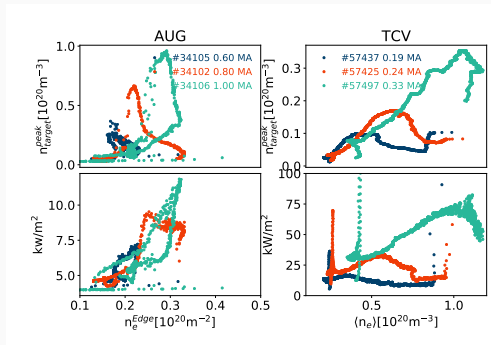
# Current scan at constant $B_t$ in L-Mode plasma



- ✓ TCV: Ohmic heating only. Similar neutral compression reached and  $D_\alpha$  radiation from the floor. Ion flux rollover reached in all the three current, although marginally at 330 kA

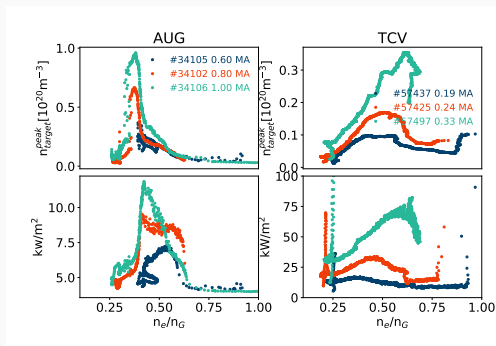


# Current scan at constant $B_t$ in L-Mode plasma



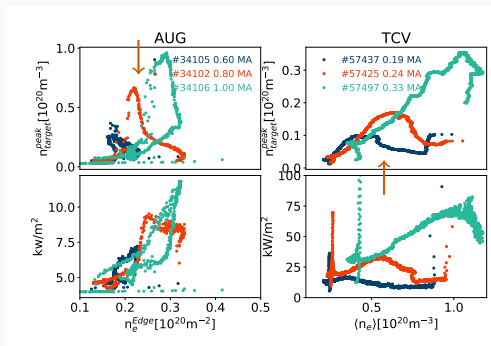
- ✓ In both the machines both the peak target density and the radiation close to divertor target exhibit rollover at increasing density with increasing current

# Current scan at constant $B_t$ in L-Mode plasma



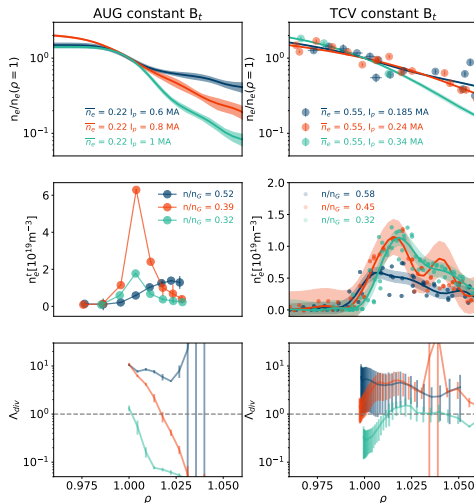
- ✓ Whenever considered as a function of Greenwald fraction the behaviors at different currents almost reconciled for AUG but not for TCV

# Current scan at constant $B_t$ in L-Mode plasma

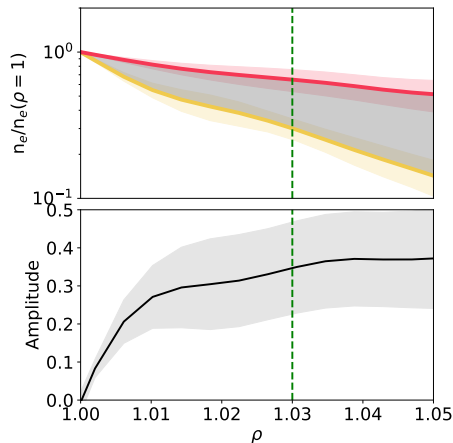


- ✓ We now consider the Target and upstream profiles at the same level of densities

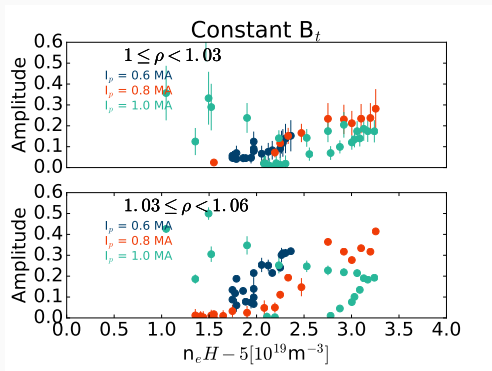
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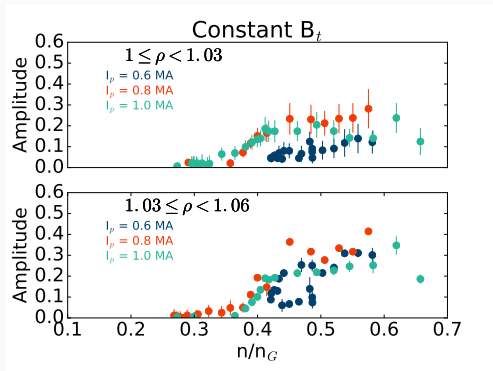
- ✓ We now consider the Target and upstream profiles at the same level of densities
- ✓ For both AUG and TCV flattening of normalized upstream profile reached **earlier in density at lower current**. For both the machine the increase of  $\lambda_n$  reached for larger values of  $\Lambda_{div}$



- ✓ Quantifying profile evolution using the **shoulder amplitude metric** introduced by Wynn and Lipschultz for JET (Wynn *et al.* 2018).
- ✓ **Amplitude is the difference between normalized upstream density profiles**
- ✓ Distinguishing behavior on the near and far SOL

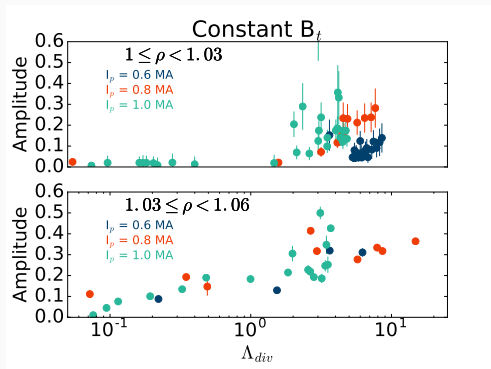


- ✓ Amplitude evolve faster in density at lower current in the far SOL



- ✓ Amplitude evolve faster in density at lower current in the far SOL but once evolution vs greenwald fraction is considered the evolution is equivalent between different current.
- ✓ Still some inconsistency at lower current in agreement with different detachment evolution

# Current scan at constant $B_t$ in L-Mode plasma



- ✓ Amplitude evolution still reconciled in AUG if considered as a function of local evolution of  $\Lambda_{div}$