Topic 21 Experiment and analysis

presented by N. Vianello on behalf of MST1-Topic 21 scientific team

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Scientific team

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Motivation and deliverables

- ✓ 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 MST1 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 mesurement 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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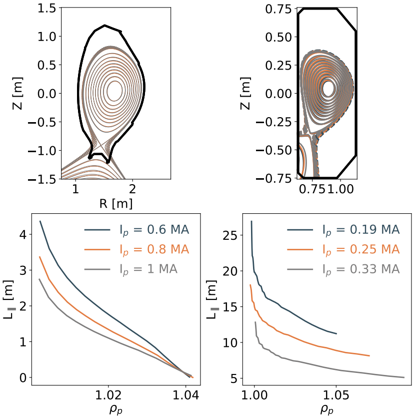
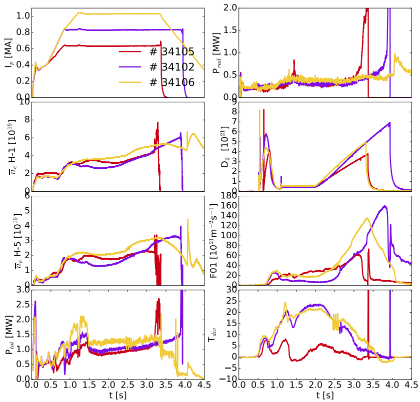
Remember this is still a work in progress

Current scan at constant B_t in L-Mode plasma



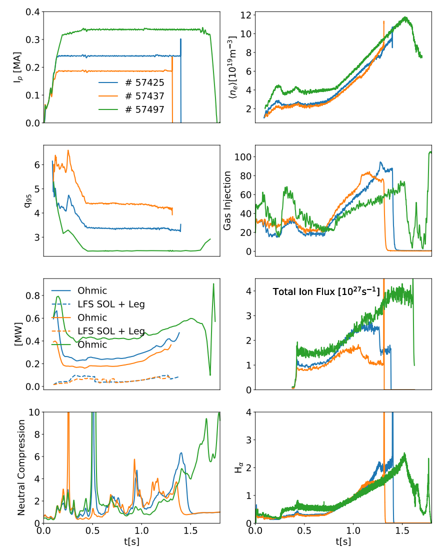
- ✓ Shape matched in within the single scan done for each of the machine
- ✓ The scan implies a modification of the $L_\parallel$. AUG exhibit a parallel connection length which is 5 times smaller then TCV

Current scan at constant B_t in L-Mode plasma



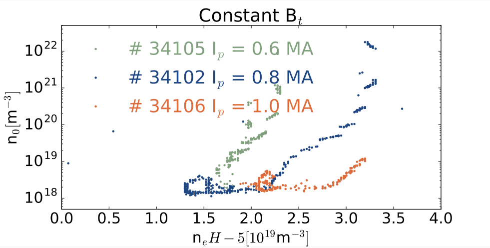
- ✓ AUG: Fueling reduced only at lower I_p to avoid earlier disruption. Similar neutral pressure in the subdivertor region reached. NBI additional power added to keep power in the SOL approximately constant

Current scan at constant B_t in L-Mode plasma



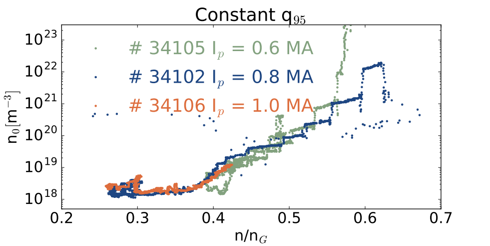
✓ TCV: Ohmic heating only. Similar neutral compression reached and D_α radiation from the floor. Ion flux rollover reached in all the three current, although marginally at 330 kA

Current scan at constant B_t in L-Mode plasma



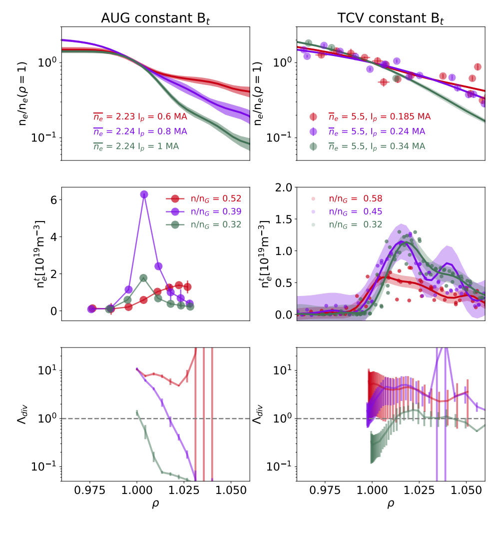
- ✓ Divertor neutral density estimated starting from D_α calibrated camera and using electron density and temperature from LP data. Neutral density increases earlier in edge density at lower current

Current scan at constant B_t in L-Mode plasma



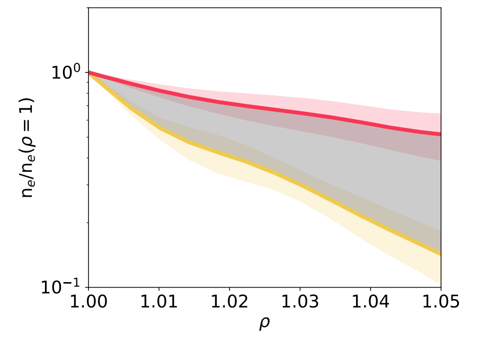
✓ Neutrals behavior reconciled whenever comparison considered as a function of Greenwald fraction

Current scan at constant B_t in L-Mode plasma



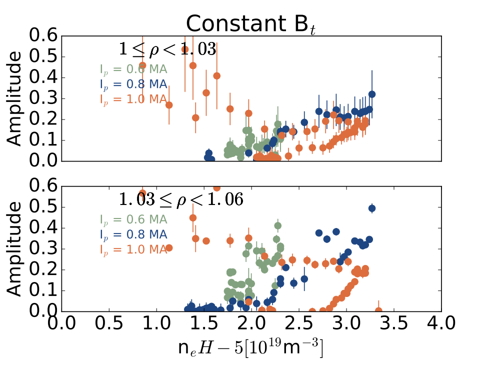
- ✓ For both AUG and TCV flattening of normalized upstream profile reached earlier in density at lower current. For both the machine the increase of λ_n reached for larger values of Λ_{div}

Current scan at constant B_t in L-Mode plasma



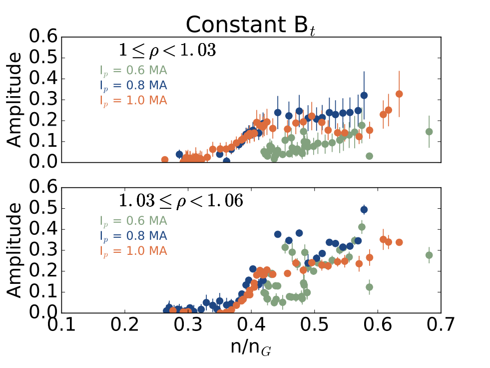
✓ Quantifying profile evolution using the shoulder amplitude metric introduce by Wynn and Lipschultz for JET. Amplitude is the difference between normalized upstream density profiles

Current scan at constant B_t in L-Mode plasma



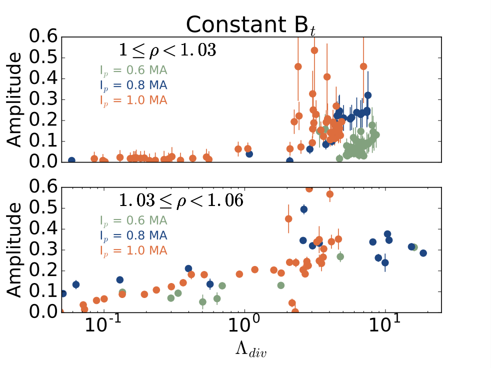
- ✓ Amplitude evolve faster in density at lower current in the far SOL

Current scan at constant B_t in L-Mode plasma



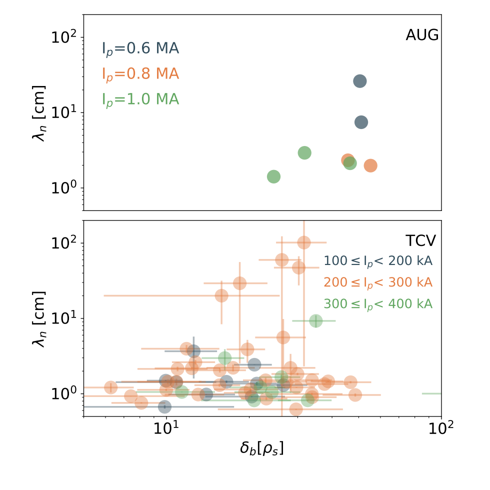
- ✓ Amplitude evolve faster in density at lower current in the far SOL but once evolution *vs* greenwald fraction is considered the evolution is equivalent between different current

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 Λ_{div}

Current scan at constant B_t in L-Mode plasma



✓ For both AUG and TCV λ_n increases with blob size without significant difference within the current explored