



EUROfusion

Topic 2 I: TCV experiment KoM

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- ✓ 2017 **objectives** listed after the General Planning Meeting
 1. Provide cross-machine **L-Mode** shoulder dependence on current both at constant B_t and at constant q_{95}
 2. Establish robust scenario for density shoulder profile in H-mode and establish dependence on fuelling/neutral profiles/divertor condition
 3. Study the role of ELM regimes, neutral compression, and particle density in filamentary transport and related shoulder formation.
 4. Identify the contribution of collisionality and seeding on filamentary transport and related shoulder formation.
 5. Determine the effect of filaments and shoulder formation on target heat loads in different Hmode plasmas.
- ✓ We have a total number of **# 23 Shots** split into two operational window. Calendar week 24 (12.06-16.06) and Calendar week 43 (23.10-27.10)



- ✓ 15 people listed in the team for TCV experiment

EPFL: H. De Oliveira, R. Maurizio, B. Labit, C. Tsui, K. Verhaegh, H. Reimerdes, C. Theiler

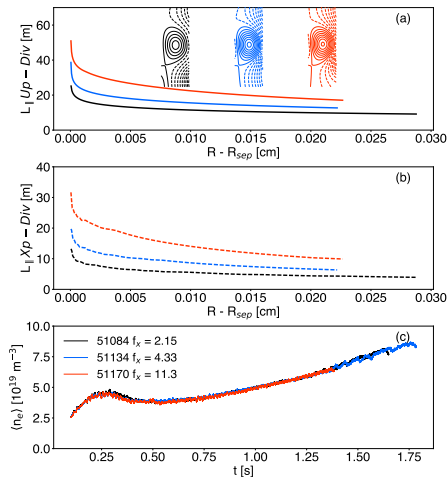
DTU: J.J. Rasmussen and V. Naulin

RFX: N. Vianello, M. Spolaore, M. Agostini

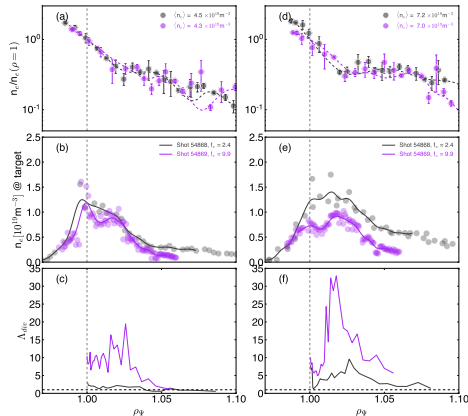
OEAW: B. Schneider, S. Costea, R. Schrittwieser

CCFE: F. Militello

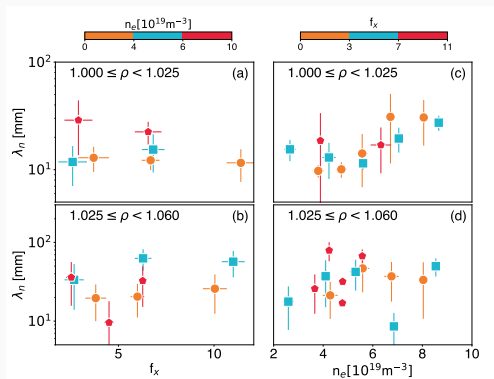
JSI: J. Kovacic



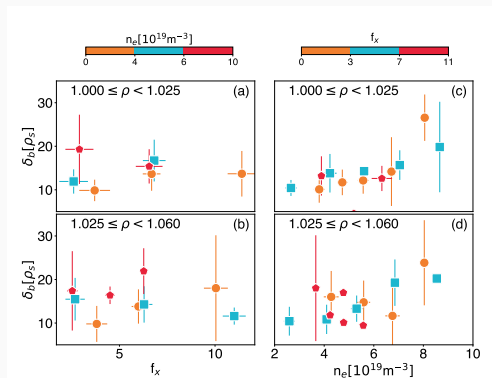
- ✓ Performed a series of L-Mode shots with density ramp and different poloidal flux expansion to check L_{\parallel} effect



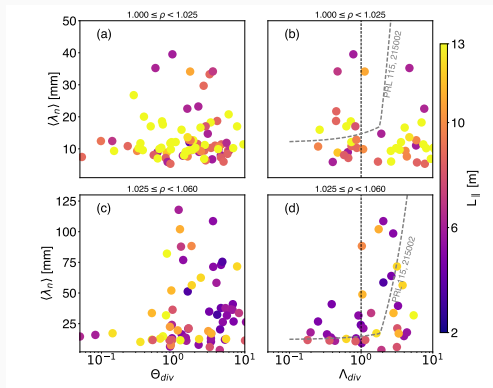
- ✓ Upstream profiles at same densities but different Λ_{div} (well above 1 all along the profiles) are similar. Weak effect of parallel connection length modification



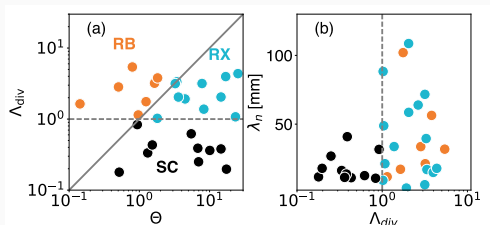
- ✓ Density decay length λ_n modified strongly with increasing density in the near SOL region



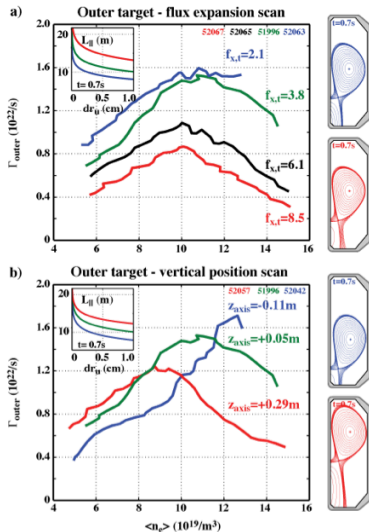
- ✓ Blob size increases with density independently from the Flux expansion



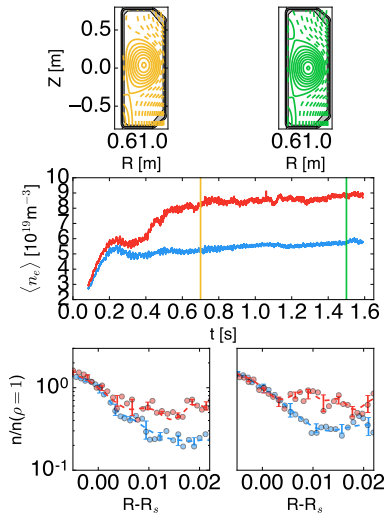
- ✓ In the Far SOL the decay length scales with divertor collisionality but examples with high Λ_n and steep profile clearly exists



- ✓ Steep profile clearly seen in the Sheath-connected regime. Unclear if Resistive ballooning and resistive X-point blobs behaves differently



- ✓ Change in the Flux expansion does not change detachment density threshold, whereas divertor leg length has a clear impact (*Theiler, NF17 and Reimerdes IAEA 2016*)



- ✓ Also any differences observed between single and double null. Major modification only induced by density increase



The first shots are needed in order to have comparable scenario between all the machines

✓ Current scan at constant q_{95}

1. Reference shot is # 54867, $I_p=240$ kA, $q_{95}=3.5$, $B_t = 1.41$ T with the same density ramp (Do we need a density ramp? can we go directly at high density as in # 53516? and repeat the shot at low density?)
2. Repeat Shot # 1 with $I_p=180$ kA (20% decrease similarly to AUG) with the same q_{95} and adjusting the toroidal field
3. Repeat Shot # 1 with $I_p=300$ kA (20% increase similarly to AUG) with the same q_{95} and adjusting the toroidal field. In case this causes a transition into Ohmic H-Mode we might think to perform the shot in reverse B_t . This eventually needs additional shots at lower current as well. Why not operate all the shots in Reverse B_t ?

✓ Current scan at constant B_t

4. $I_p=180$ kA, $B_t = 1.41$ as in shot # 1
5. $I_p=300$ kA, $B_t=1.41$ as in shot # 1



- ✓ Divertor leg length/ $L_{parallel}$ scan
 - 6. Repeat # 1 at $Z = +23$.
 - 7. Repeat # 1 at $Z = -10$
- ✓ This can have issues in terms of probe operation because of shadowing effect.
- ✓ Double Null. Repeat the current scan at constant q_{95} in DN configuration in order to provide suitable comparable scenario with foreseen MAST-U operation
 - 8. Repeat the density ramp of # 1 in DN configuration $I_p = 240\text{kA}$
 - 9. Repeat density ramp of shot # 2 in DN configuration $I_p = 180\text{ kA}$
 - 10. Repeat density ramp of shot # 2 in DN configuration $I_p = 300\text{ kA}$



The NBI heated plasma is still a partially uncovered scenario for TCV. We have a good reference shot # 53352 with a good type-I Elmy regime. We propose to use the 3 shots for proper scenario development

- I 1. Repeat # 53352 same setting. 1 MW NBI power 0.4 s starting at 0.8s. At 0.82s start a density ramp keeping the same rate as in # 1. Power ramp down from 1.2 second in order to check ELMy regime. **We need a good monitoring of divertor condition and modification**
- I 2. The second shot will depend on # I 1. We will need to adjust the fueling rate accordingly. Include N seeding **check for appropriate reference from past experiment**
- I 3. Repeat # I 2 with best trade off between seeding and fueling

The hypothesis to reach ECRH high density H-Mode is limited, to my knowledge, to operation in vertically shifted plasma and X3. Can be explored in W23



- ✓ Fast Camera
- ✓ DBS radial localization
- ✓ Neutrals from gauges. D_α calibrated camera to be used together with **KN1D** code
- ✓ Fast reciprocating probe. Can it work with radially spaced I_s measurements?
- ✓ Do we miss something in L-Mode which is worth to be done?
- ✓ Do we have experience of nitrogen seeded NBI heated discharge?
- ✓ Do we have other references for high density H-Mode operation?