EUROfusion

Topic 21: Filamentary transport in high-power H-mode conditions and in no/small-ELM regimes to predict heat and particle loads on PFCs for future devices

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Summary of the campaigns

- ✓ L-Mode experiment, Calendar week 17. It will constitute baseline scenarios to be replicated on the other MST1 devices. Operation without cryopumps
  1. Performed similar density ramps in an I_p scan at constant q_{95}
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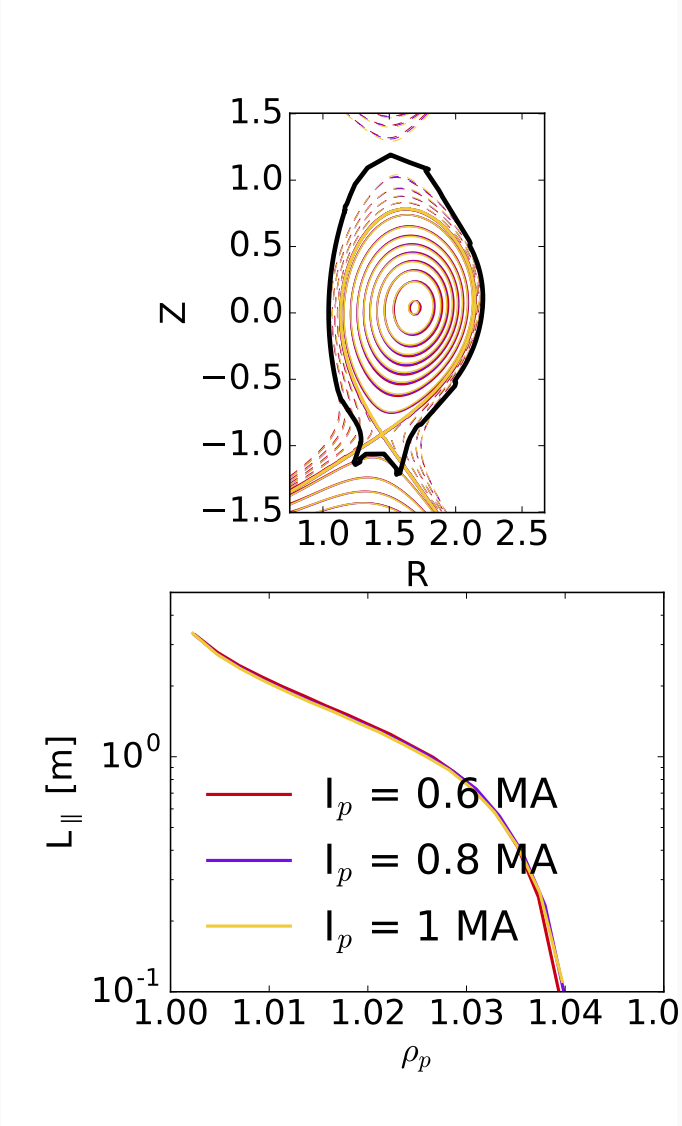
L-Mode analysis: I_p scan at constant q_{95}



- ✓ All the shots were performed in the so-called Edge Optmized Configuration (EOC) shape
- ✓ We matched correctly the shape and the $L_{||}$ here shown from outer divertor plate up to X-point

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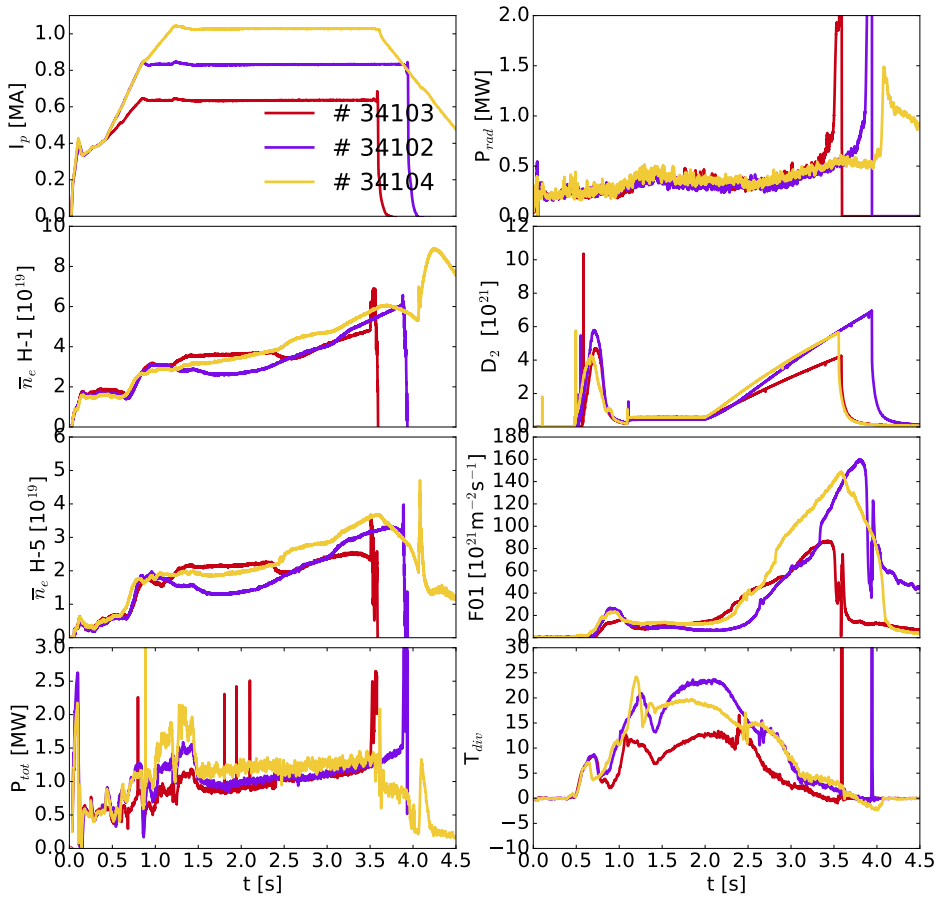

- ✓ The scan was performed with similar puffing rate (0.8-1 MA) whereas we reduced it at lower current to avoid early disruption
- ✓ The total power (Ohmic plus NBI) was kept constant throughout the scan
- ✓ We have comparable edge density, divertor neutral pressure and divertor temperature

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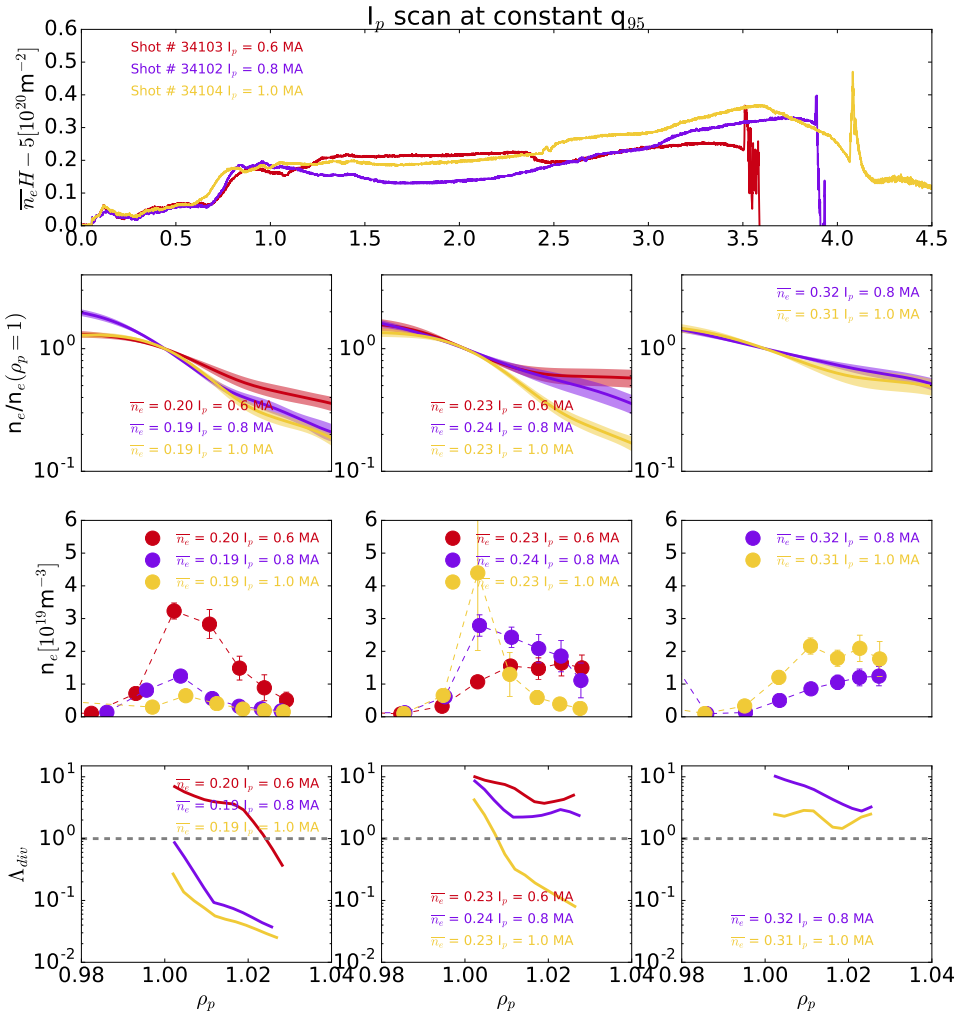
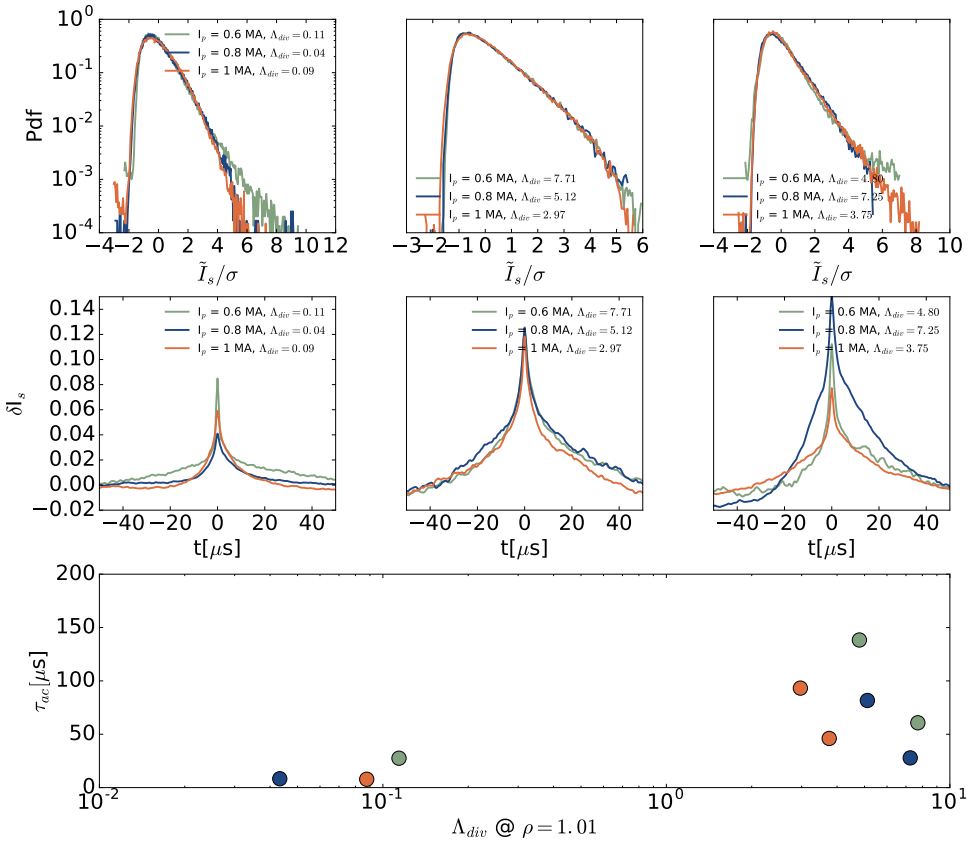


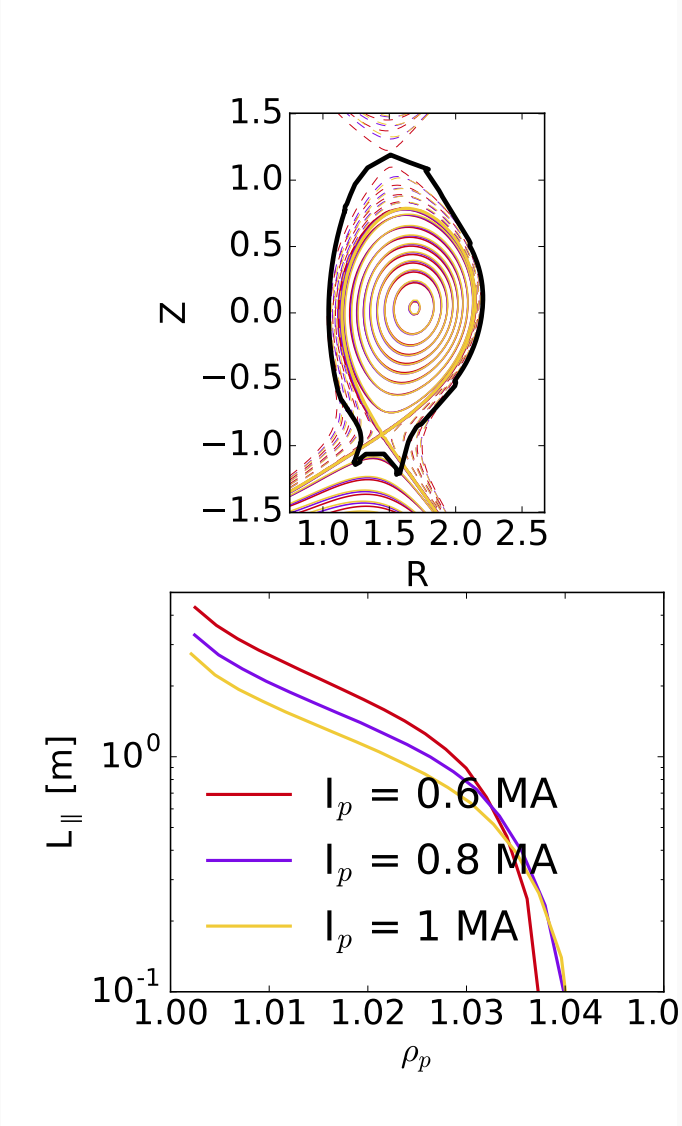
- ✓ At comparable edge density Upstream profiles are different with the tendency to develop shoulder easier at lower current
- ✓ Still need to provide detail evolution of edge profiles as a function of Λ_{div} which are different at different current although same $L_{||}$

L-Mode analysis: I_p scan at constant q_{95}



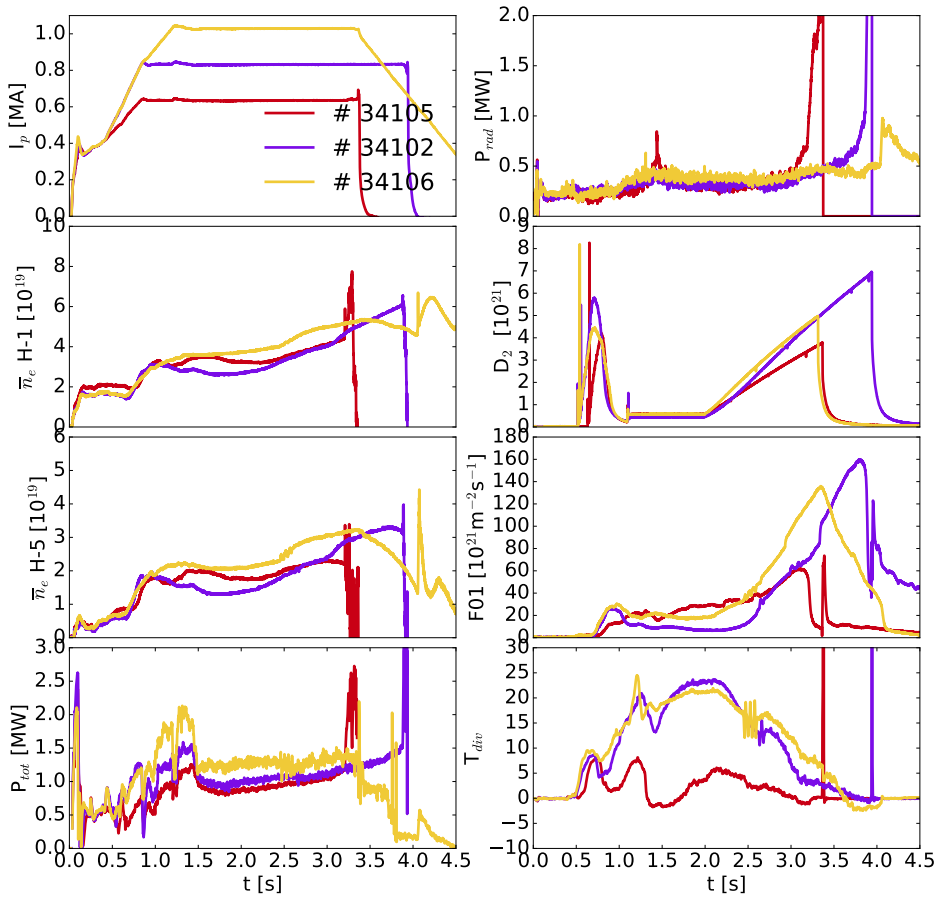
- ✓ No sensible difference of PDFs of J_{sat} at different current even though obtained at different values of Λ_{div}.
- ✓ Autocorrelation time τ_{ac} increases with Λ_{div} without sensible difference among the current

L-Mode analysis: I_p scan at constant B_t



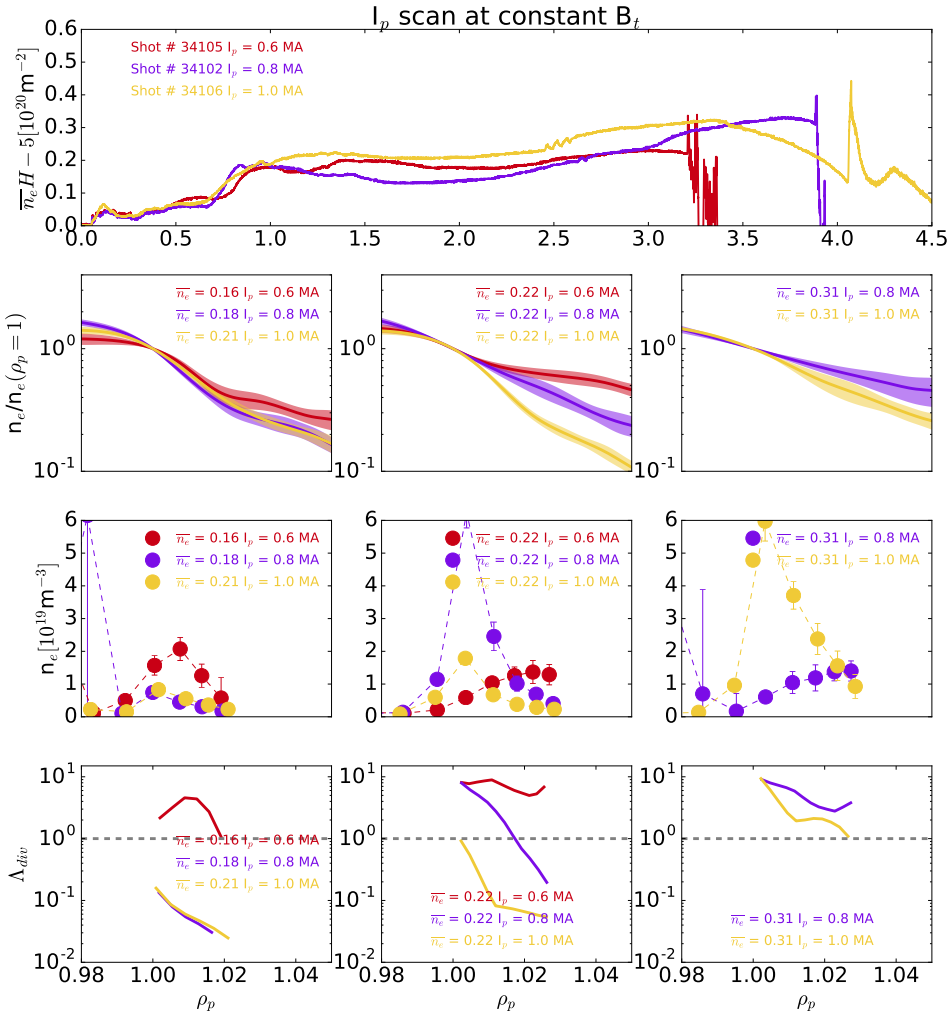
✓ We matched correctly the shape the parallel connection length $L_{||}$ is modified consistently

L-Mode analysis: I_p scan at constant B_t



- ✓ The scan was performed with similar puffing rate (0.8-1 MA) whereas we reduced it at lower current to avoid early disruption
- ✓ We have comparable edge density and divertor neutral pressure even though pressure increase earlier at higher current

L-Mode analysis: I_p scan at constant B_t



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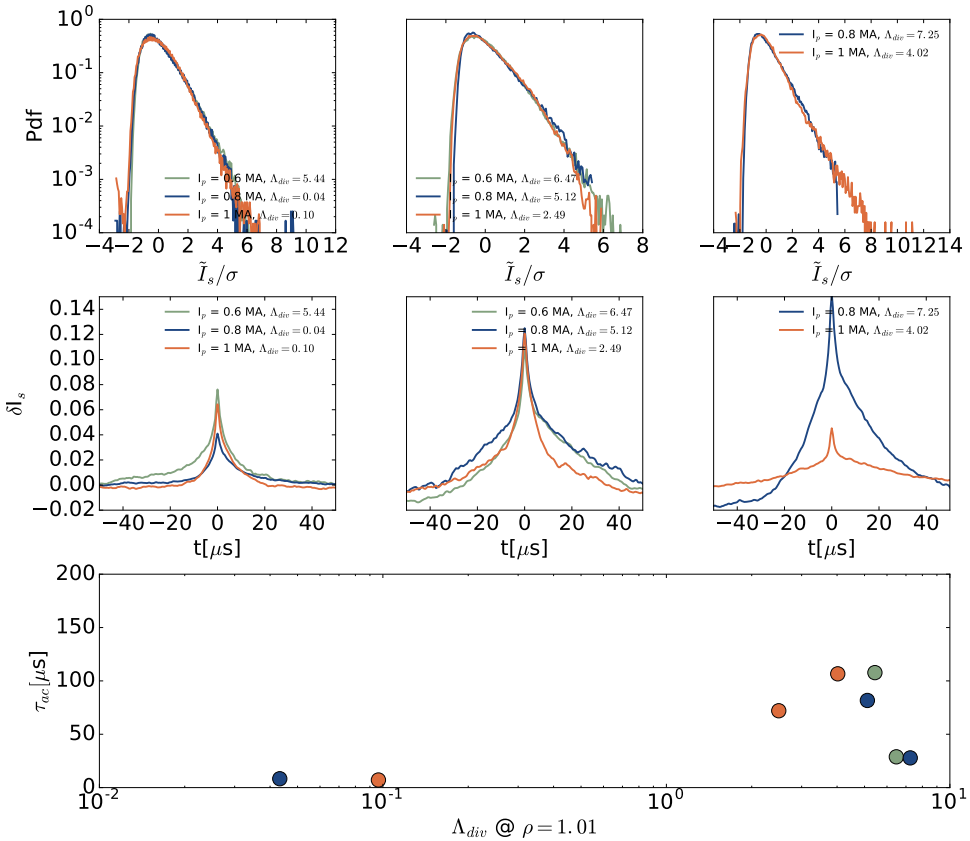
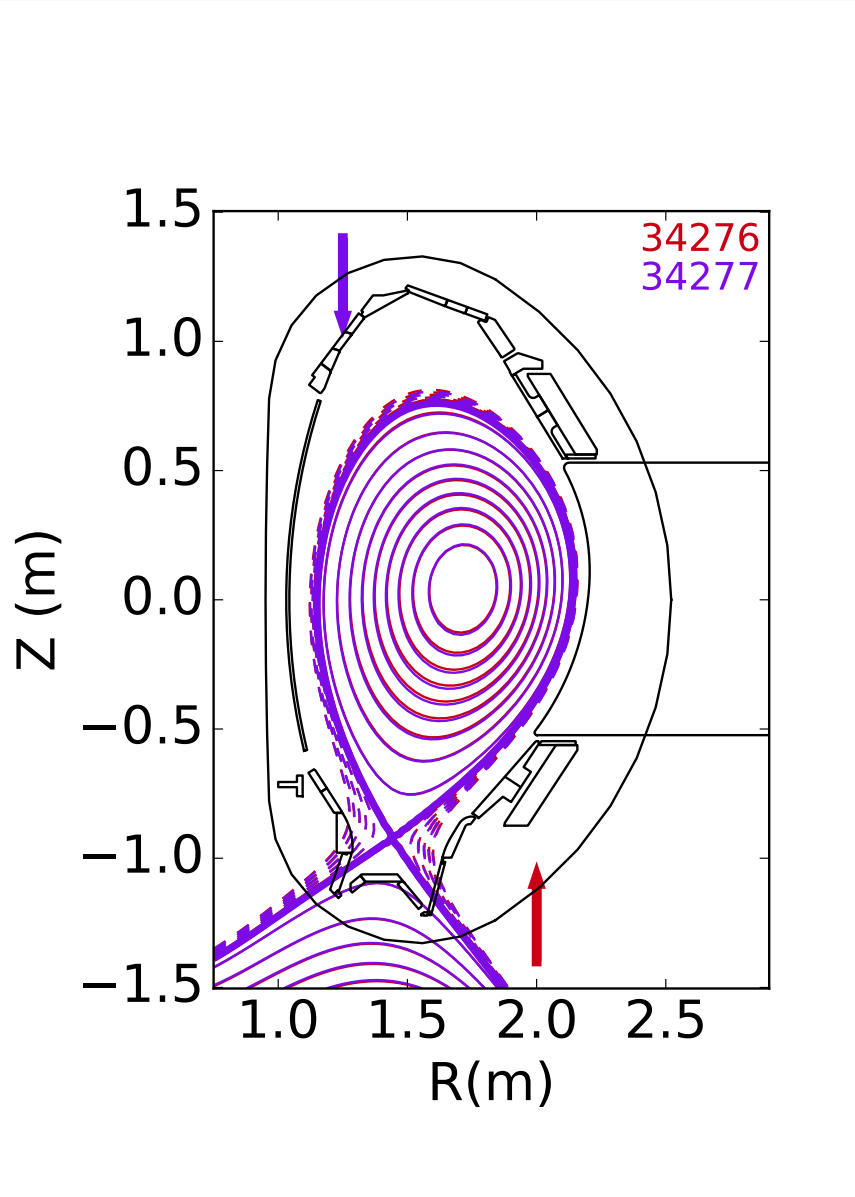


- ✓ No sensible difference of PDFs of J_{sat} at different current even though obtained at different values of Λ_{div}.
- ✓ Remarkable difference in the shape of typical structure, even though τ_{ac} follow usual trend apart from very last points. To be double-checked

H-Mode investigation: puffing location



- ✓ Similar puff from Lower and Upper divertor valves (we asked for divertor/midplane valves)

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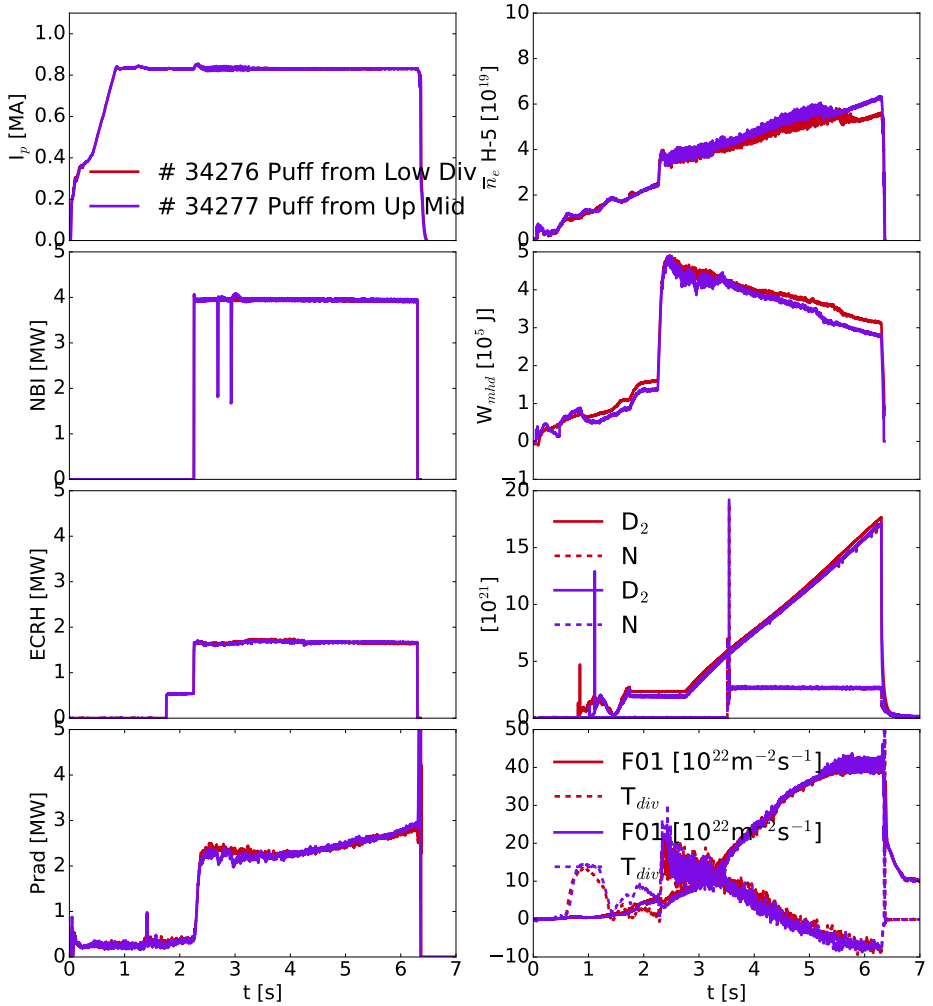

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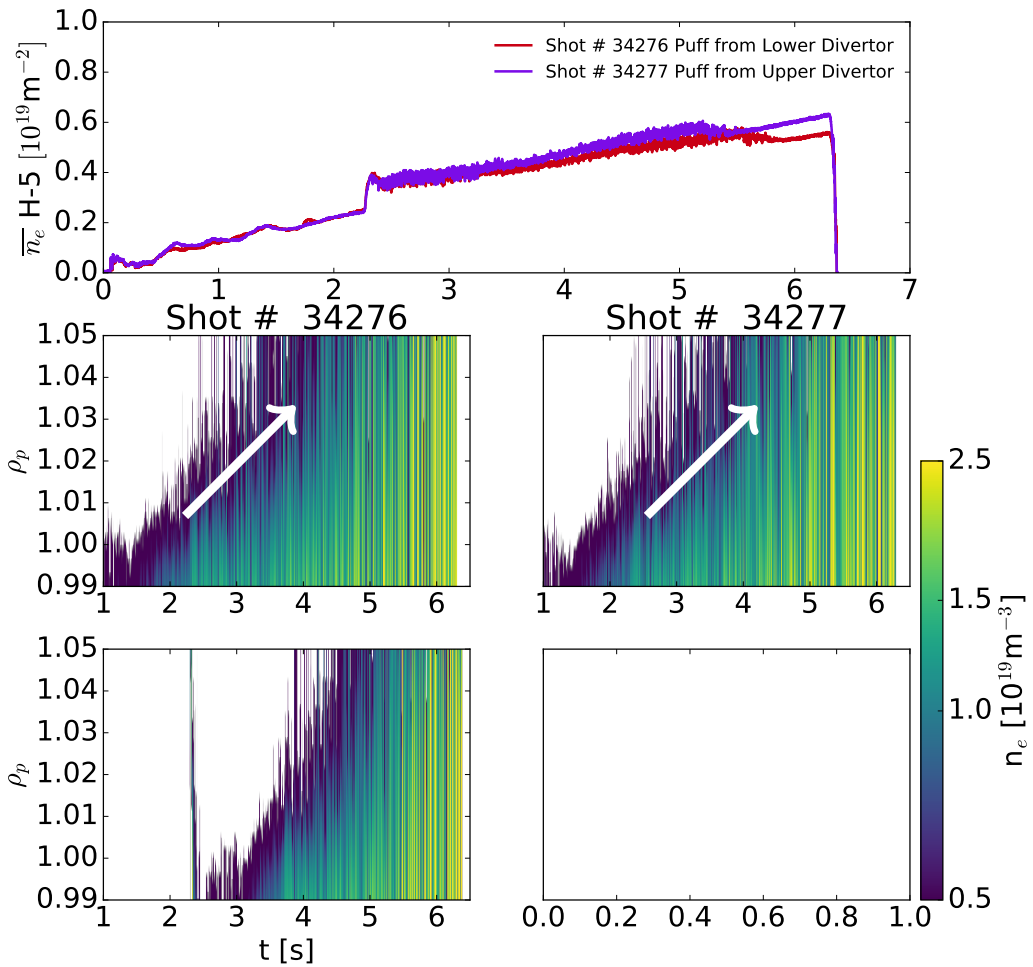

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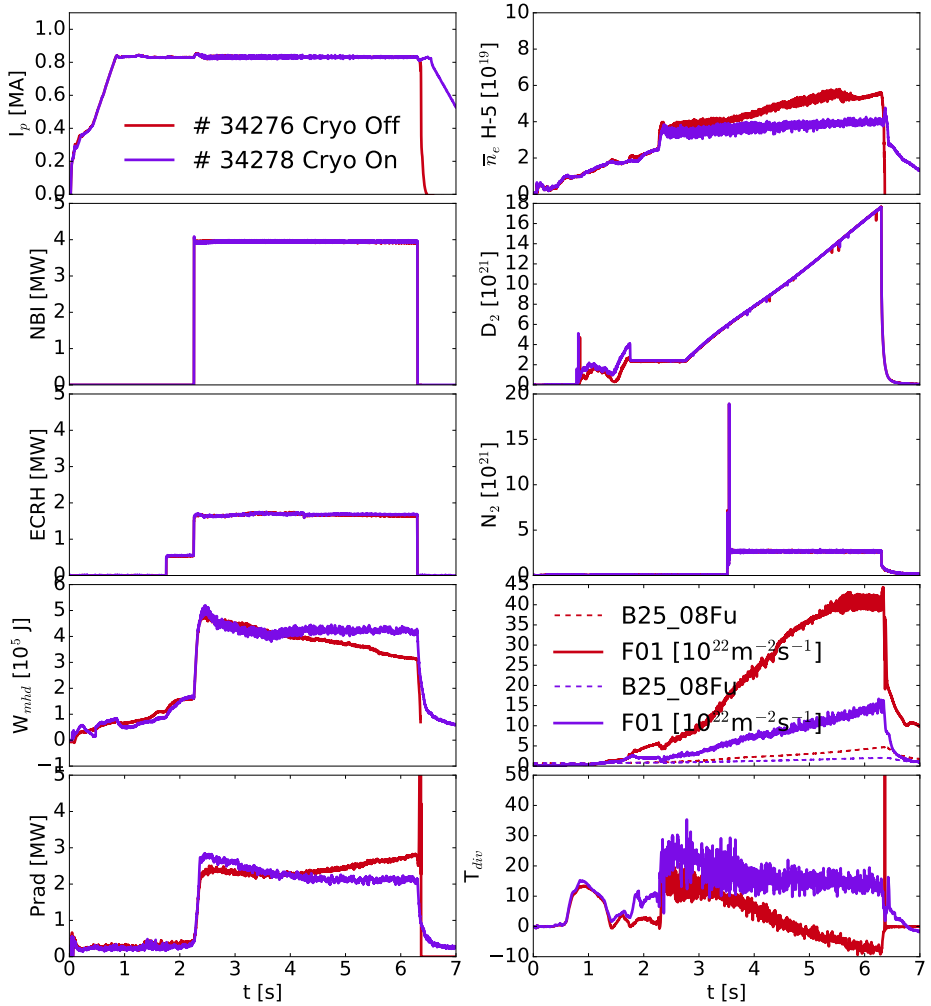
- ✓ Edge density profiles from Li-Beam evolution are pretty similar
- ✓ Similar behavior observed from RIC Antenna 4 for the available shot

Compare Similar fueling with/without cryopumps



- ✓ Same fueling but with cryo-pumps
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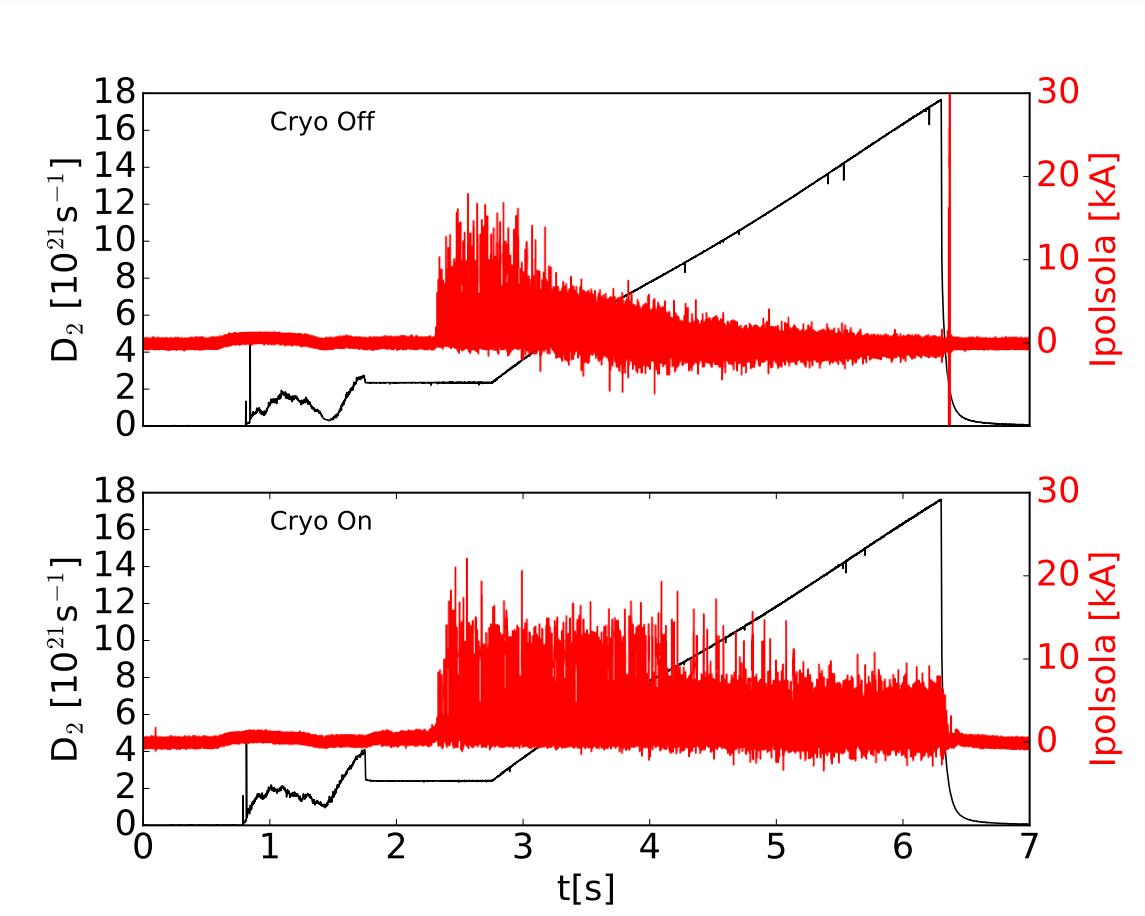

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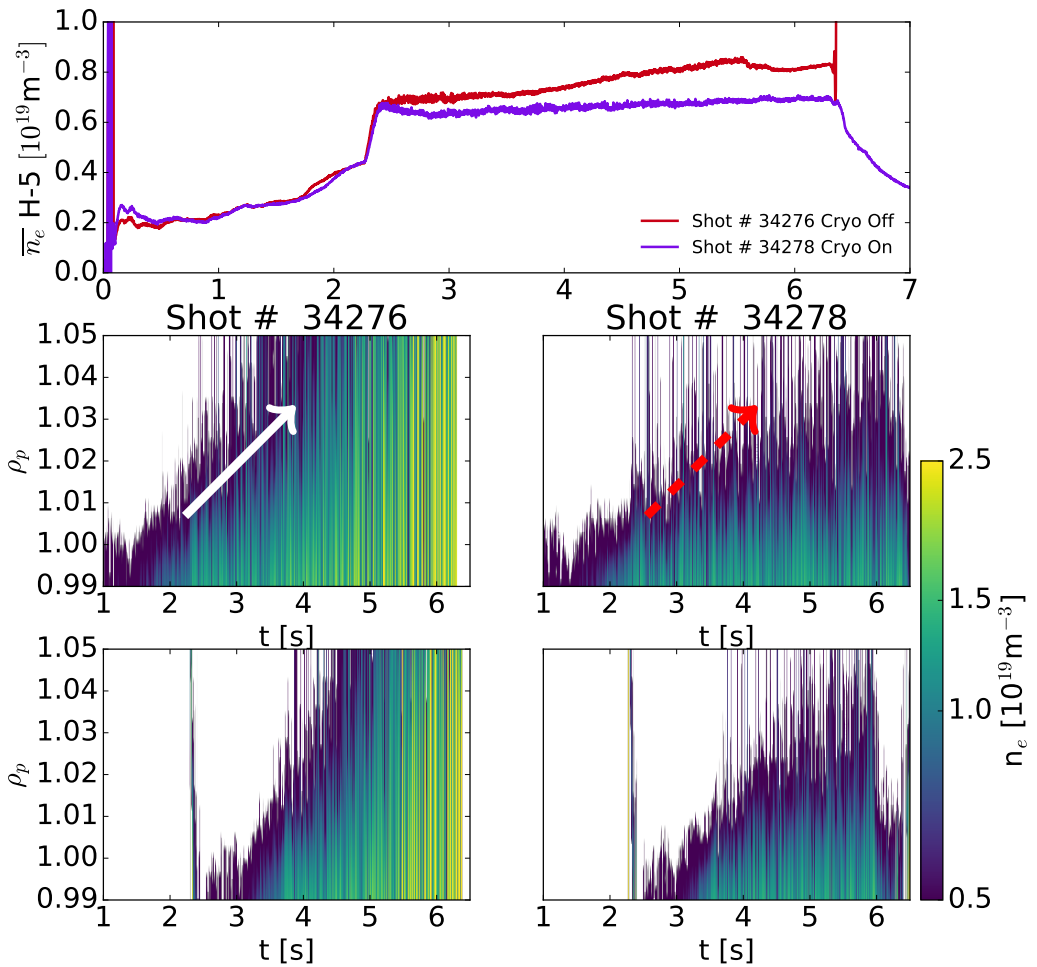

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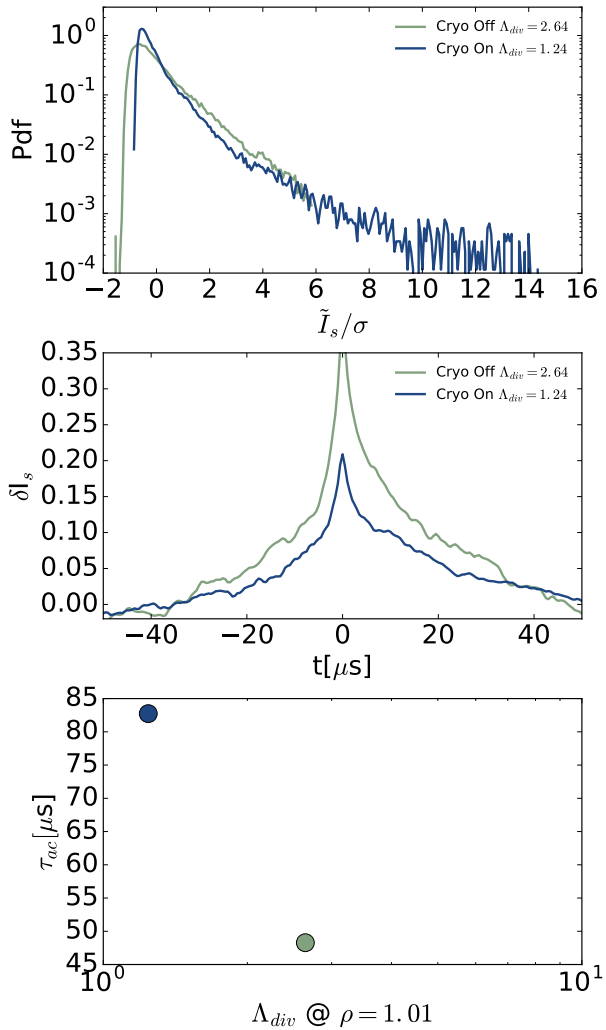

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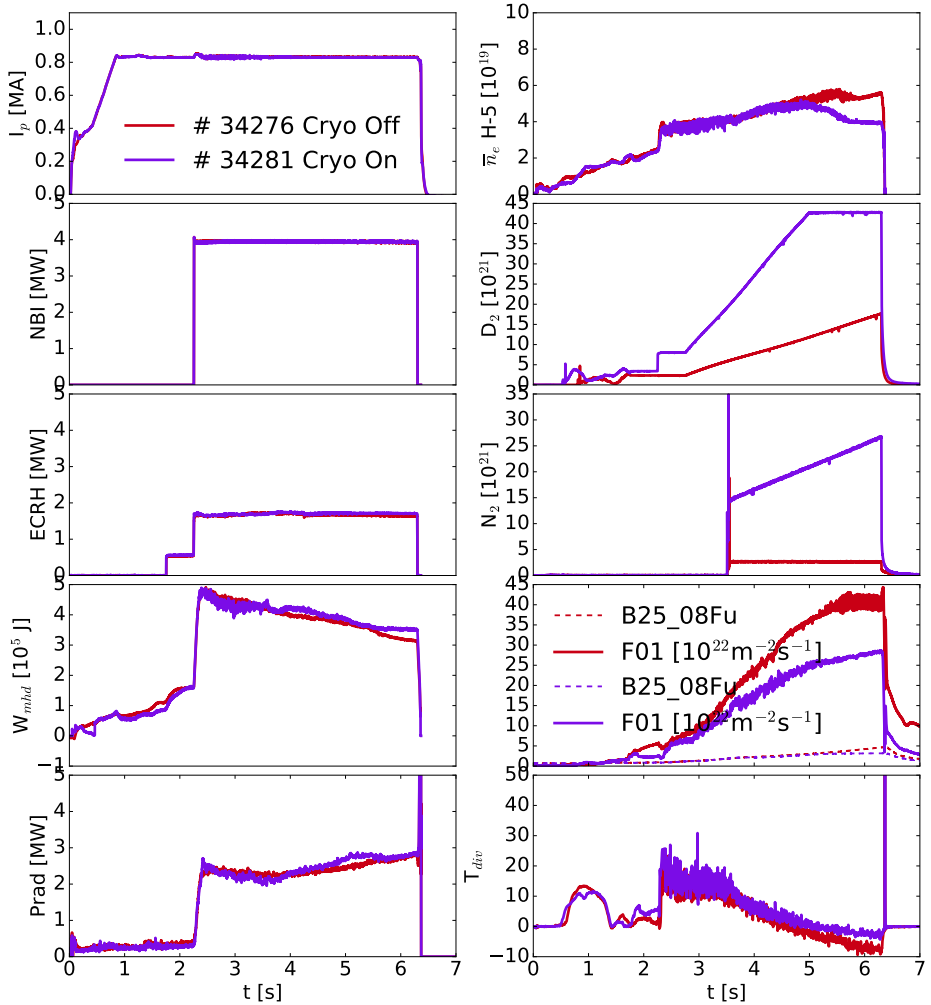
- ✓ Comparison of fluctuations during the plunge at higher density (ELM included) reveal differences in fluctuations. ELM resolved measurement to be properly done

Matching scenarios with cryo-pumps



4

- ✓ To match similar edge density and divertor pressure and to reach the same level of detachment we increase the fueling by almost a factor of 3, increasing also the rate. In addition to that we also increase substantially the N puffing. Degraded H-Mode reached earlier in density without the cryopumps

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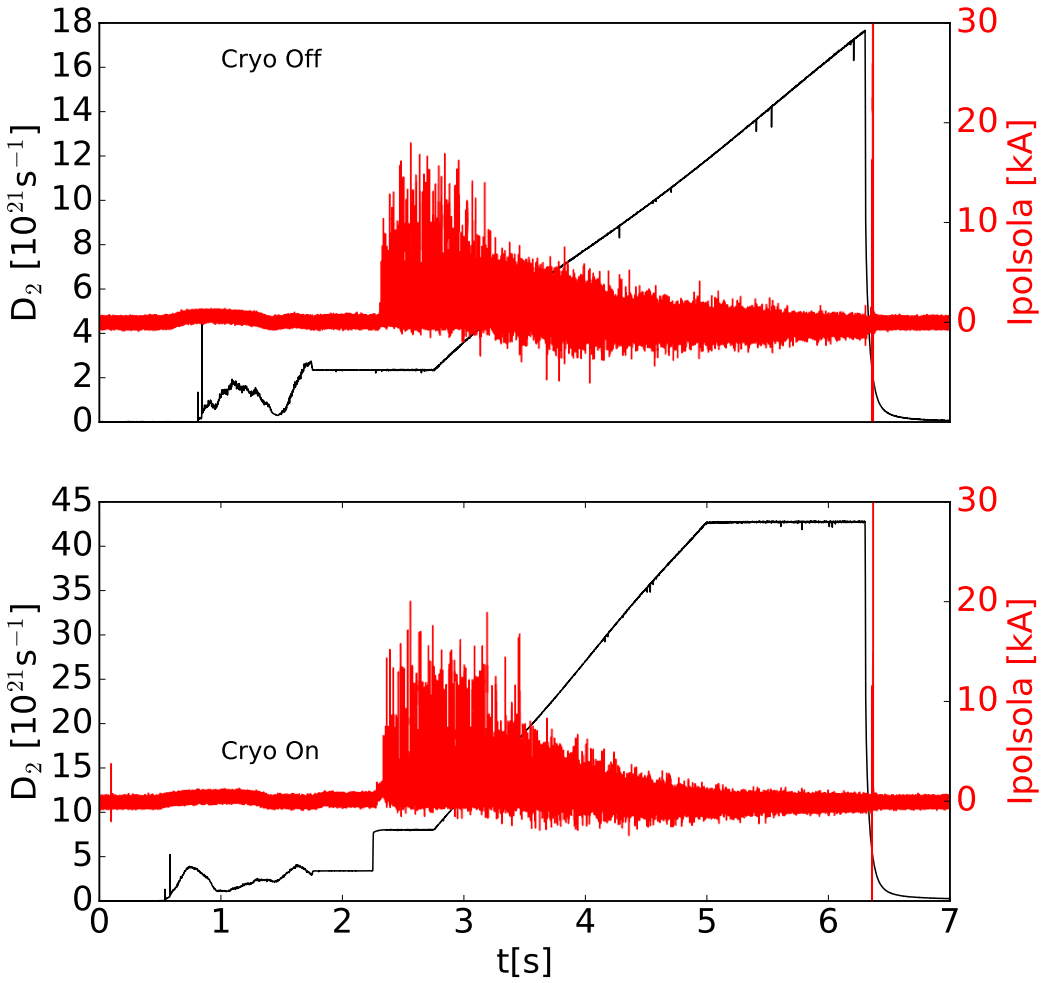

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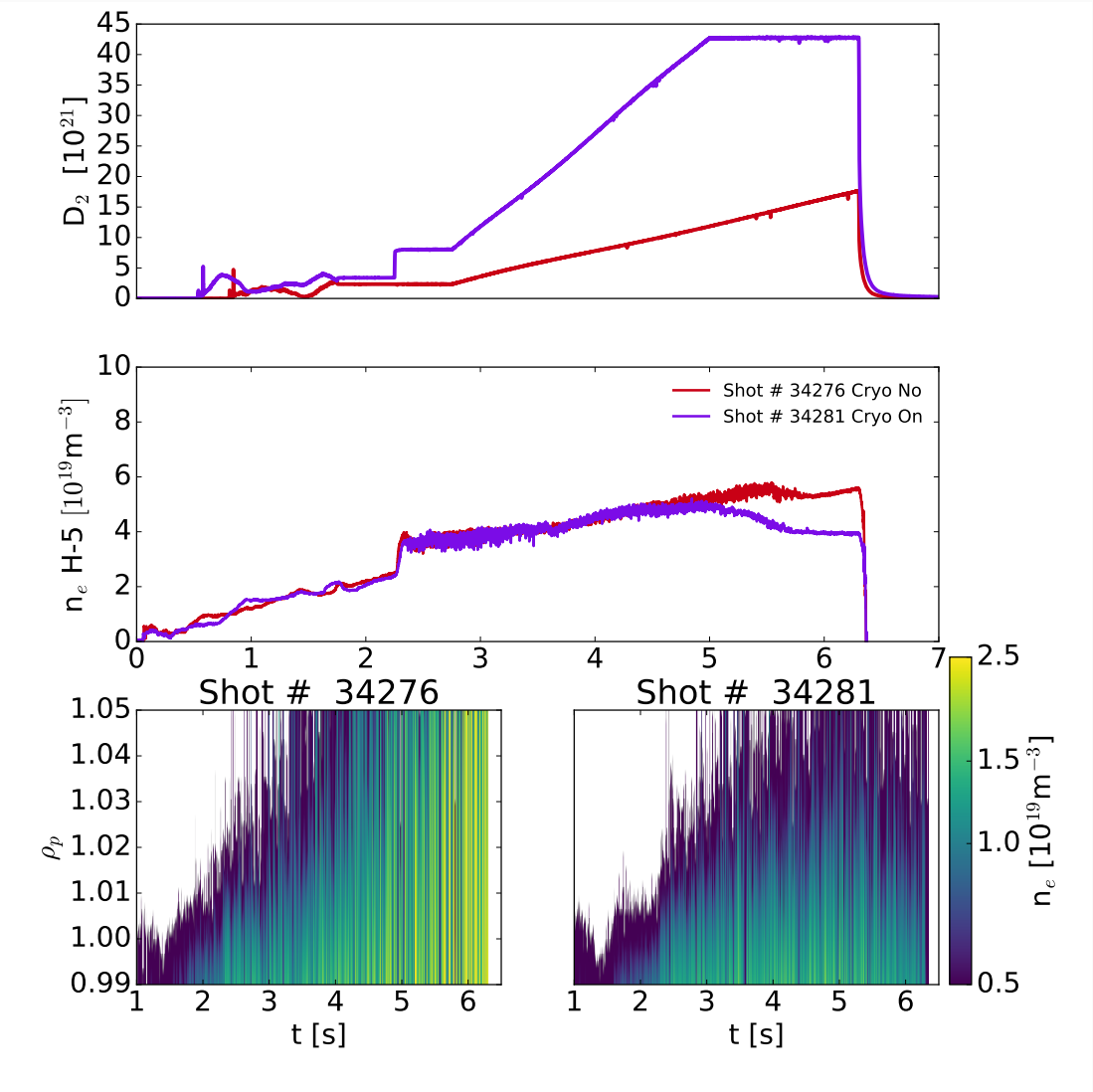

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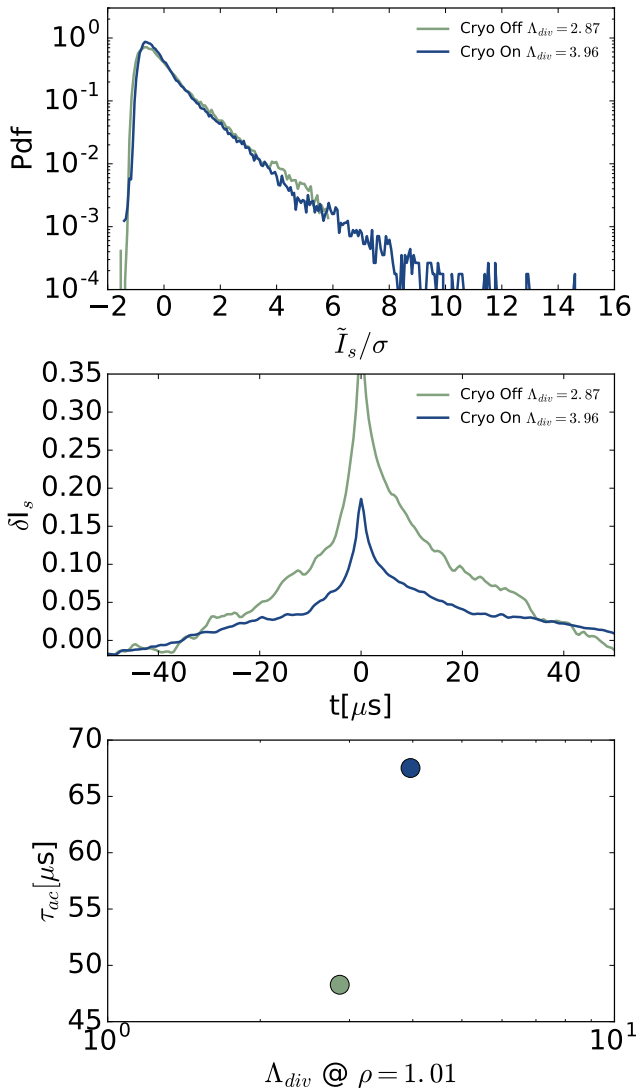

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- ✓ The shape of the PDF is rather similar with closer values of autocorrelation time at similar values of divertor collisionality. Not yet ELM resolved

What is missing

The analysis is still in progress and we are not ready yet to draw final conclusions. Among the future on going analysis we can list:

1. RIC profiles with possible poloidal variation among the antennas in particular in H-Mode. To be done
2. Li-Be ELM resolved profile variation with Λ_{div} To be done
3. Li-Be fluctuations To be done
4. Structures size and velocities in L-Mode In progress
5. Radiation front movement In progress
6. Evolution of divertor profiles from Spectroscopy In progres
7. Neutrals analysis from D_α camera combined with KN1D code for evolution of neutrals In progress
8. Fast-camera To be done