EUROfusion

Overview of TCV shots for proposal detachment at low toroidal field

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”Long leg” configuration in both field directions

Configuration with longer leg (compared to TCV-X21), detachment reached more easily.

Start from:

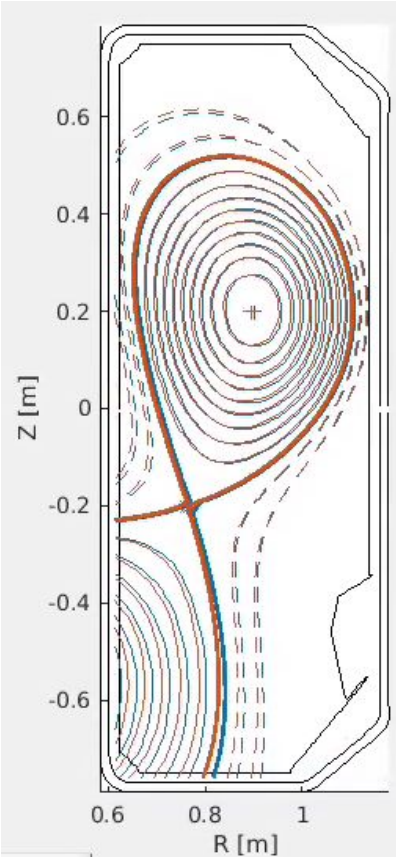
- Long leg stable configuration at low field (FF #74565, RF #66125)

Add:

- Density ramp

Results:

- 3 good shots in Reversed Field (#76142, #76143, #76190)
- 2 good shots in Forward Field (#76186, #76187)
- 2 good shots with leg moved for RDPA (RF #77043, FF #77044)



using =	LIUQE.M	LIUQE.M
shot =	76142	76186
t =	+1.123	+1.123
I_p [MA] =	+0.160	-0.167
B_θ [T] =	+0.951	-0.950
l_i =	+1.000	+1.045
W_{MHD} [MJ] =	+0.005	+0.005
β_t [%] =	+0.675	+0.646
β_N =	+0.899	+0.830
vol =	+1.299	+1.302
κ =	+1.598	+1.596
δ =	+0.327	+0.331
δ top =	+0.156	+0.155
δ bot =	+0.498	+0.508
q_{95} =	+3.159	+3.080
area =	+0.237	+0.239
R_{ax} =	+0.902	+0.896
Z_{ax} =	+0.202	+0.202
gap_{in} =	+0.033	+0.028
gap_{out} =	+0.030	+0.034
a =	+0.224	+0.225

Diagnostics measurements different for different shots

# Shot	B_t [T]	I_p [kA]	Δt_{ramp} [s]	f_{GW} max	Diagnostics
76142	0.95	160	[1.00 ; 1.48]	0.65	Standard, VIR, MANTIS, DSS
76143	0.95	160	[1.00 ; 1.58]	0.60	Standard, VIR, MANTIS, DSS
76190	0.95	160	[0.90 ; 1.61]	0.61	Standard, VIR, HIR, MANTIS, DSS
77043	0.95	160	[1.00 ; 1.48]	0.57	Standard, VIR, HIR, MANTIS, DSS, RDPA
76186	-0.95	-160	[1.00 ; 1.76]	0.63	Standard, VIR, HIR, MANTIS, DSS
76187	-0.95	-160	[0.95 ; 1.75]	0.64	Standard, VIR, HIR, MANTIS, DSS
77044	-0.95	-160	[0.90 ; 1.53]	0.59	Standard, VIR, HIR, MANTIS, DSS, RDPA

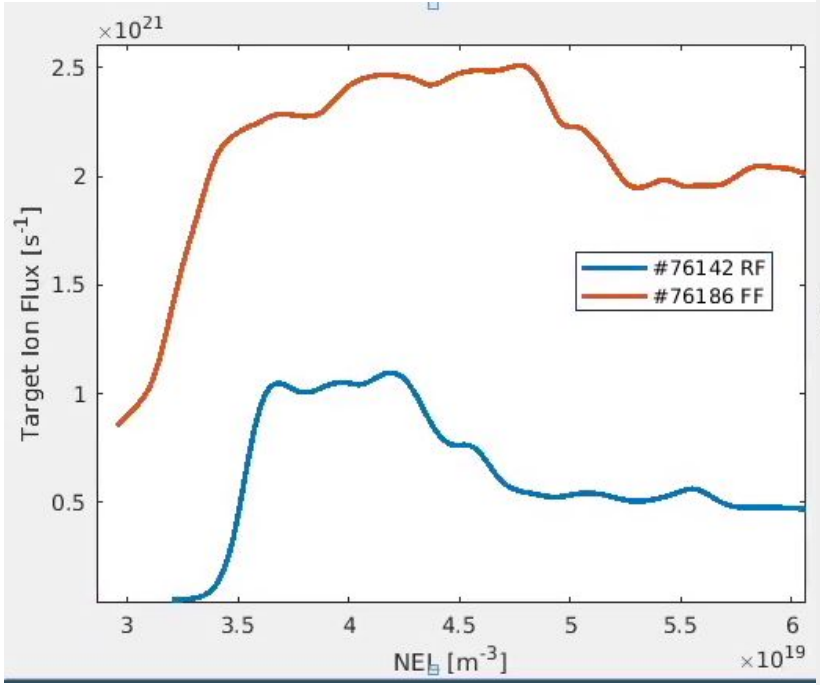
Standard = Langmuir Probes, Thomson, FIR

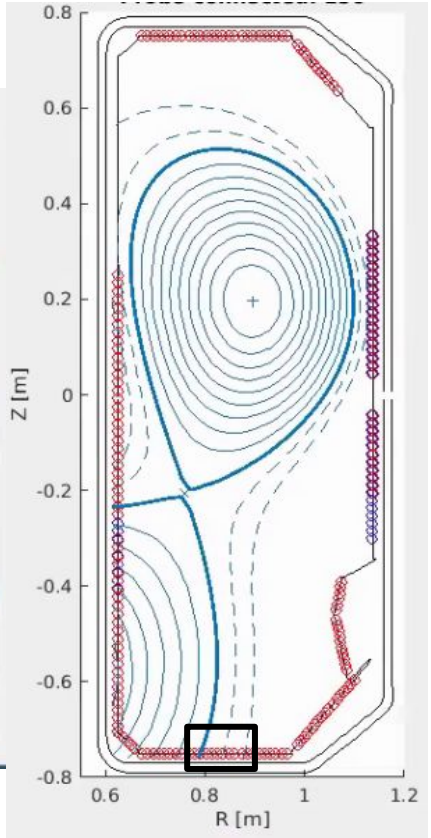
Others = Vertical/Horizontal InfraRed (VIR/HIR), Multispectral Imaging System (MANTIS), Divertor Spectroscopy System (DSS), Reciprocating Divertor Probe (RDPA)

LP shows roll-over of flux vs line density

First analysis with Langmuir Probes at outer target.

- Three phases with increasing density:
  1. Fast increase
  2. Steady state
  3. Decrease → roll-over
- In Forward field higher flux at same density



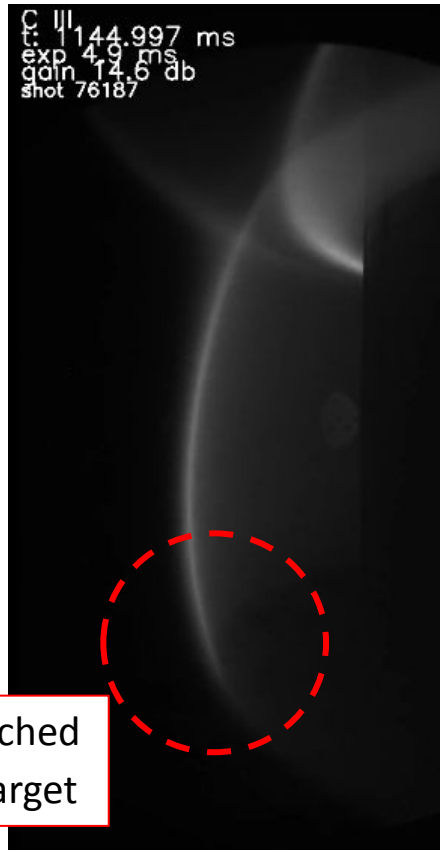


MANTIS shows movement of CIII front

CIII emission identifies plasma temperature ≃ 7eV

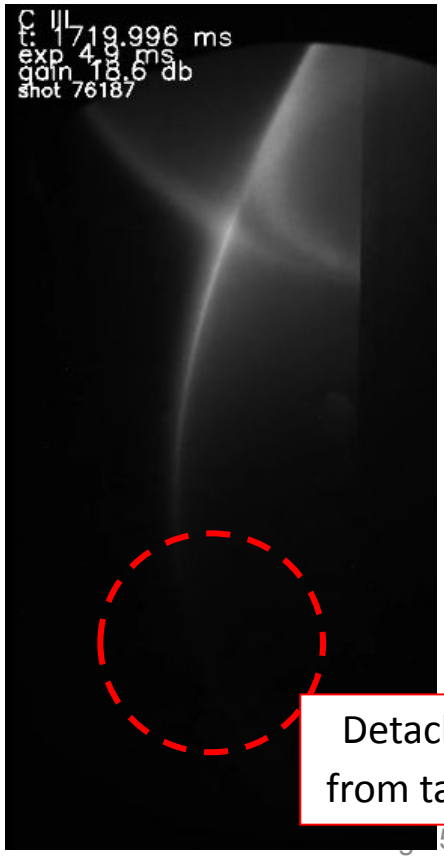
Movement of emission front from target ⟶ target cooling

Before density ramp



Attached to target

End of density ramp

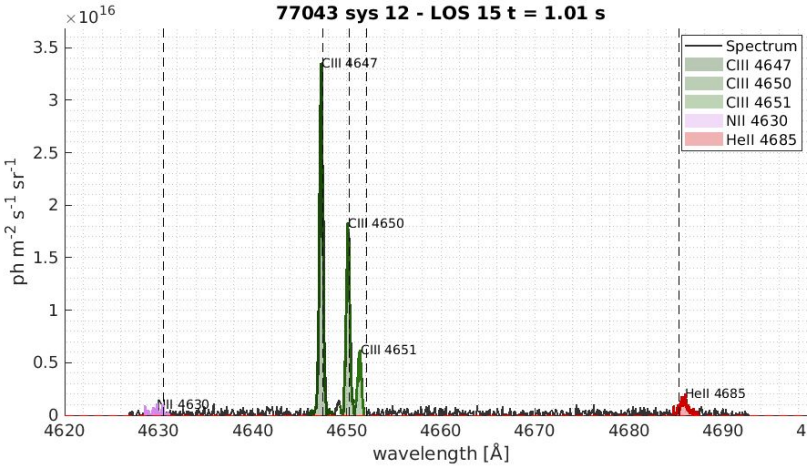


Detached from target

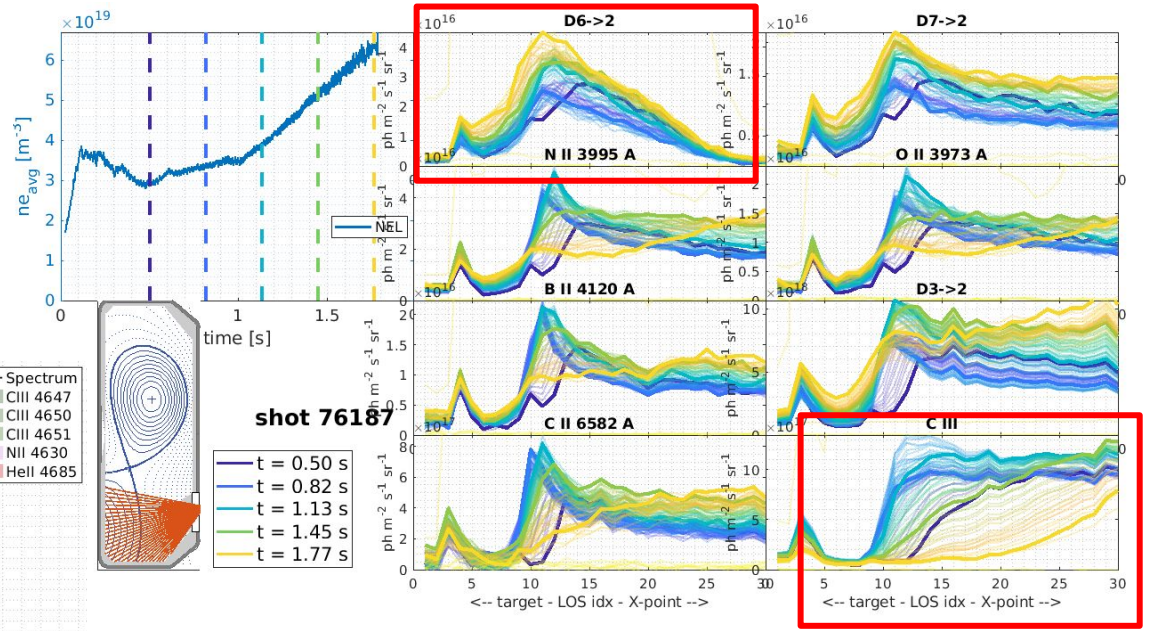
DSS shows decrease of ionization close to target

DSS identifies impurities and D lines emission in all divertor volume

Main TCV impurities: N, C, O, B



Increase of D lines: more recombination?



Decrease of all impurities emission along leg

Future analysis

- Evaluate correct outer and inner target fluxes, with LP and Infrared cameras
- Evaluate divertor volume temperature, density and plasma potential with the RDPA, comparing with LP and IR (at target)
- Compare divertor conditions with DSS line emission measurements, try to extrapolate molecular activated recombination intensity