PEP-39 Update from JET-ILW:

Configuration effects on L-H power threshold and H-mode

Emilia R Solano, E Delabie, L Frassinetti, S Saarelma, G Birkenmeier, N Vianello
JET L-H Transition Team, JET Contributors
SLs: F. Rimini, M. Tsalas, G Sips, I Nunes

GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA, INNOVACIÓN Y UNIVERSIDADES
Ciemat Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas
Laboratorio Nacional de Fusión Ciemat
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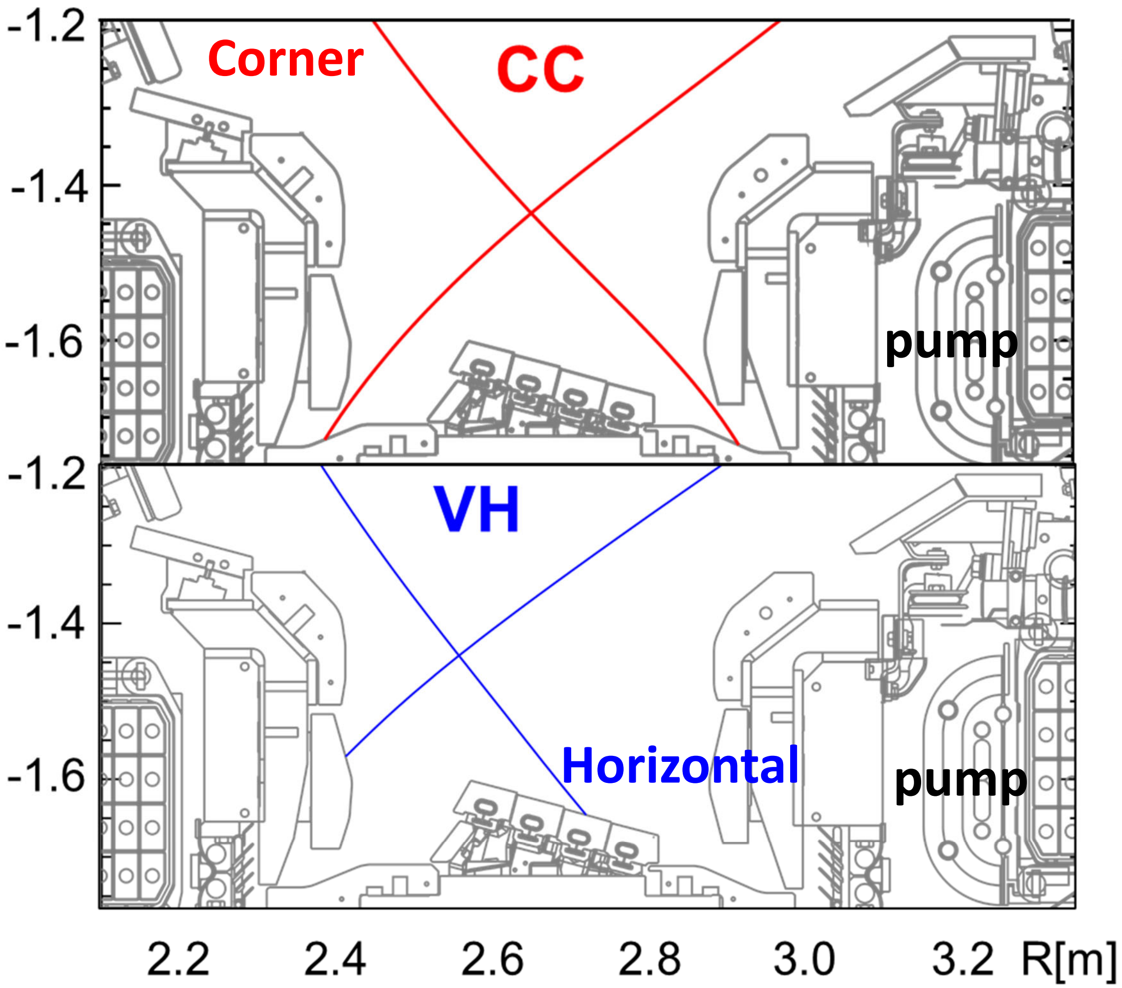
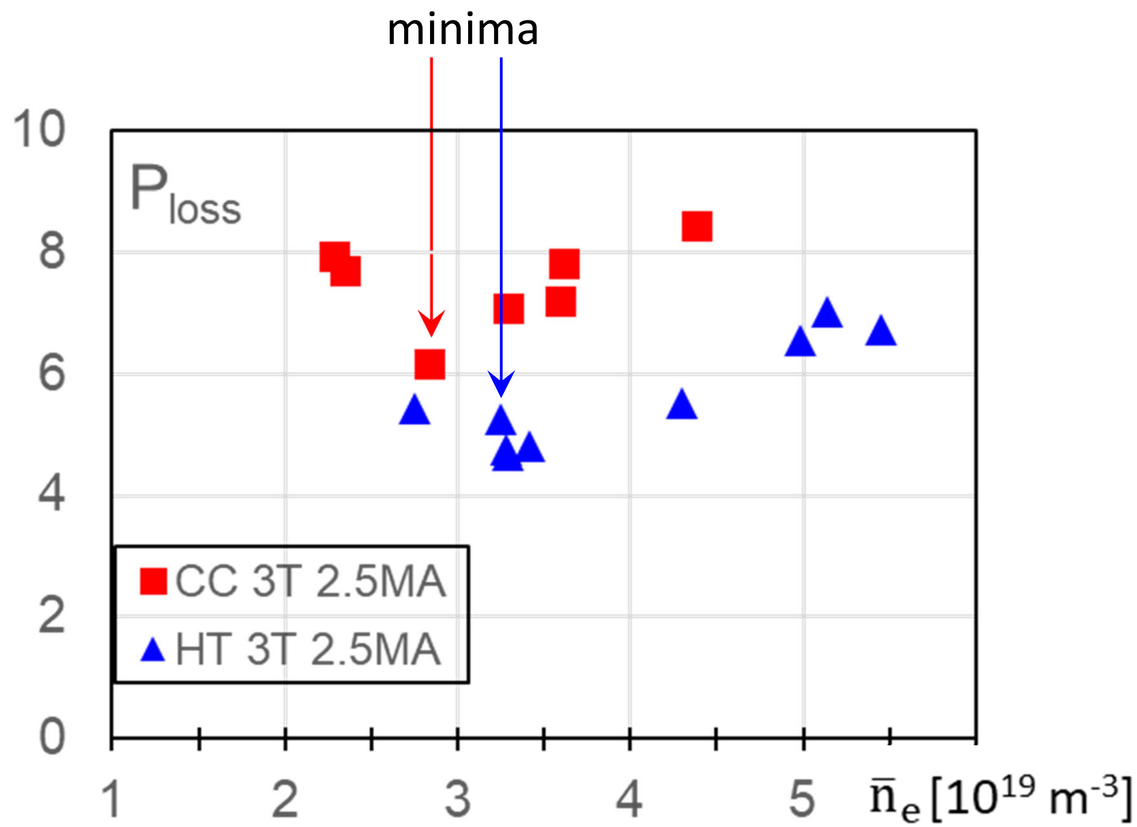
JET

In JET-ILW the divertor configuration affects $n_{e,min}$ and $P_{LH,min}$

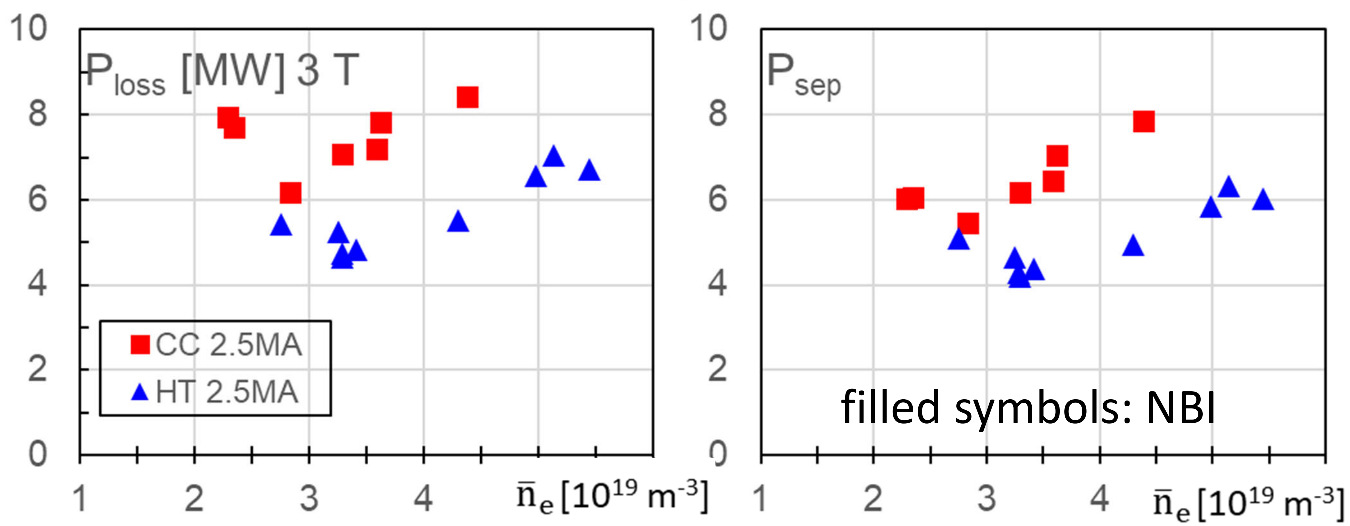




CC: Corner-**Corner**, or simply Corner, used in high performance shots

VH: Vertical-**Horizontal**, also named **Horizontal Target** or V5, low P_{LH} threshold

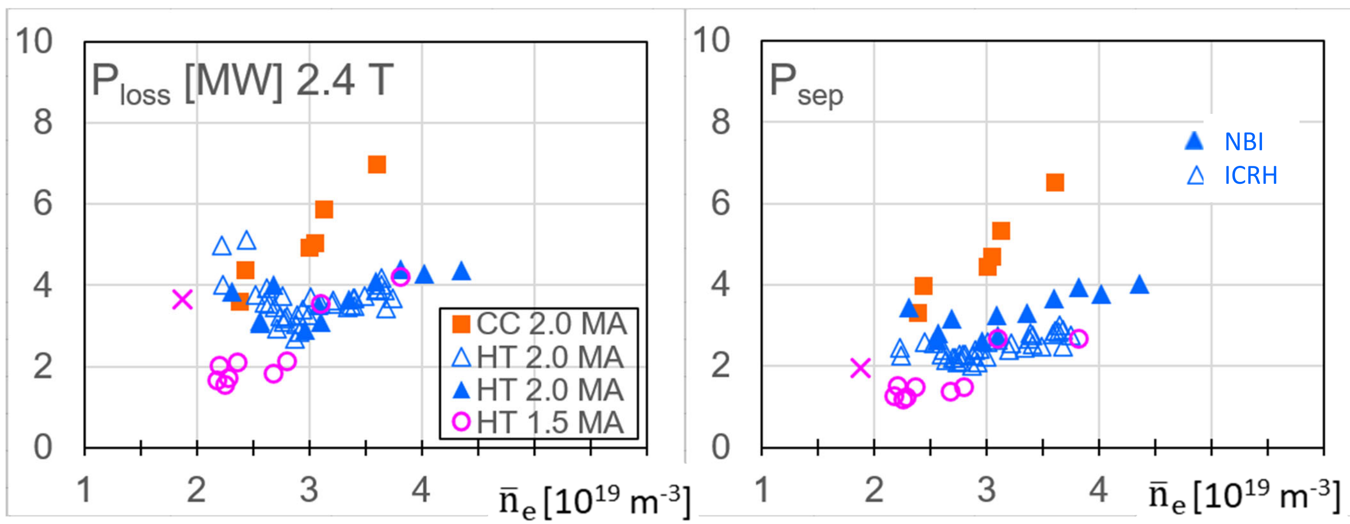
$\bar{n}_{e,min}$ & P_{LH} dependence on configuration and I_p (or B_{pol})

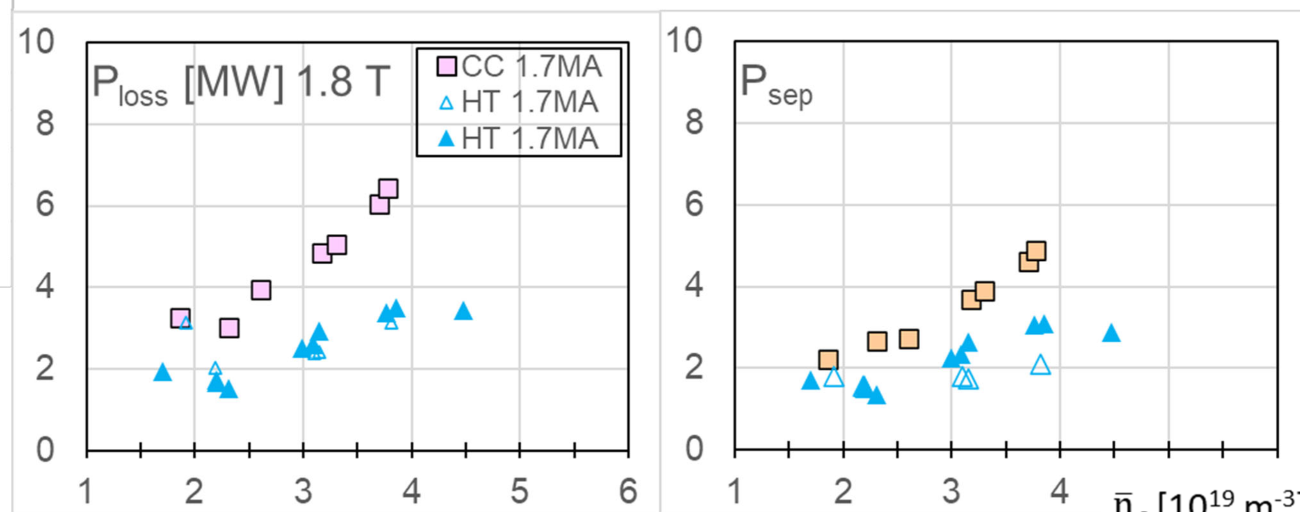


3.0 T	$\bar{n}_{e,min}$	$P_{loss,min}$	$P_{sep,min}$	$f_{GW,min}$	q_{95}
CC 2.5 MA	2.8	6.2	5.5	0.31	3.6
VH 2.5 MA	3.3	4.7	4.3	0.38	3.7

2.4 T	$\bar{n}_{e,min}$	$P_{loss,min}$	$P_{sep,min}$	$f_{GW,min}$	q_{95}
CC 2.0 MA	2.3	3.8	3.5	0.32	3.9
VH 2.0 MA	2.7	3.0	2.0	0.39	3.7
VH 1.5 MA	2.2	1.5	2.0	0.42	5.1

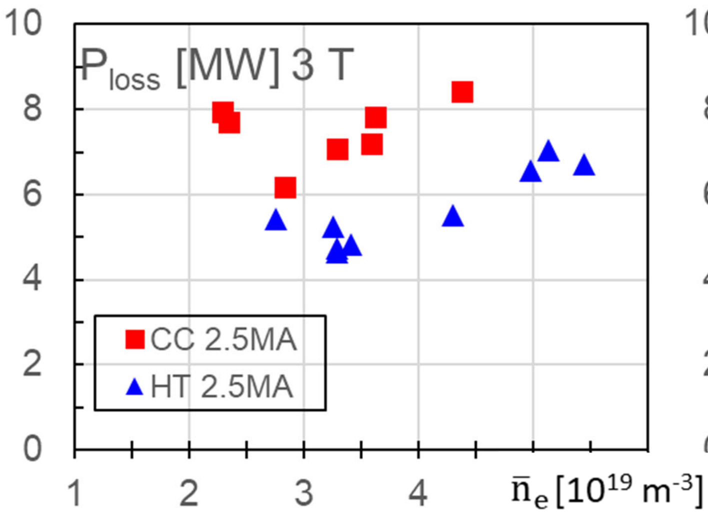
1.8 T	$\bar{n}_{e,min}$	$P_{loss,min}$	$P_{sep,min}$	$f_{GW,min}$	q_{95}
CC 1.7 MA	2.0	3.0	2.2	0.33	3.4
VH 1.7 MA	2.3	1.5	1.4	0.40	3.4

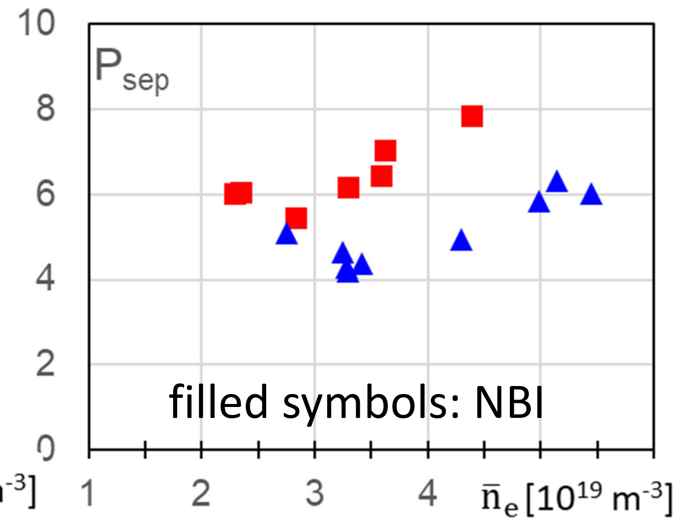




CC: $f_{GW,min}$ ~ 0.3
VH: $f_{GW,min}$ ~ 0.4

$\bar{n}_{e,min}$ & P_{LH} dependence on configuration and I_p (or B_{pol})





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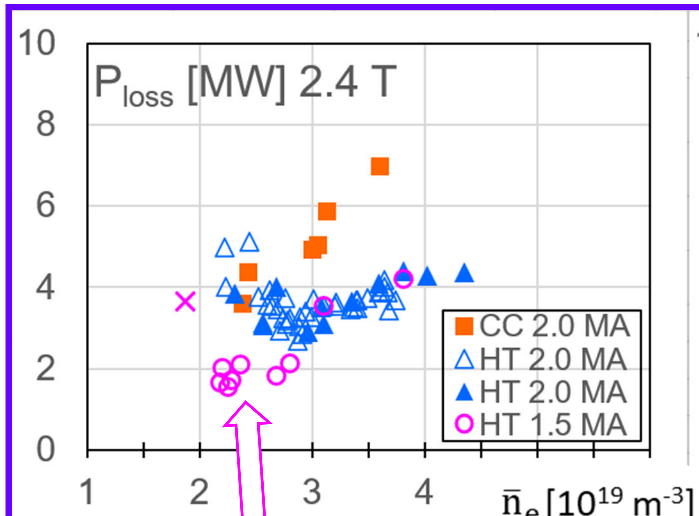
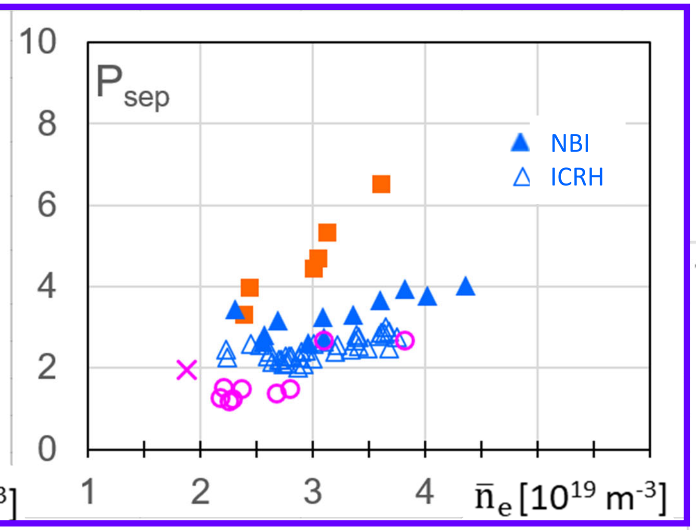
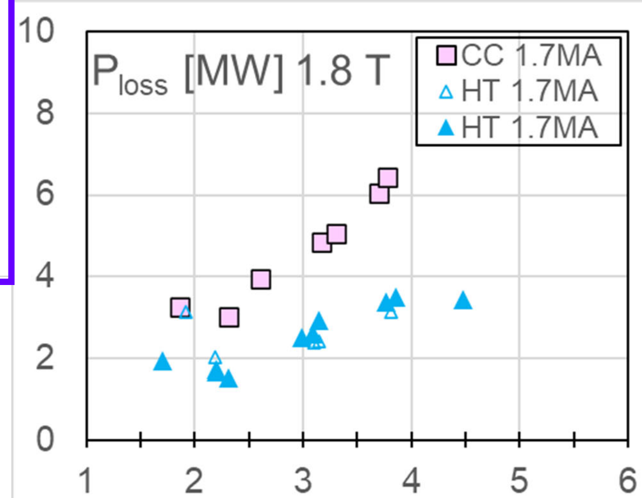
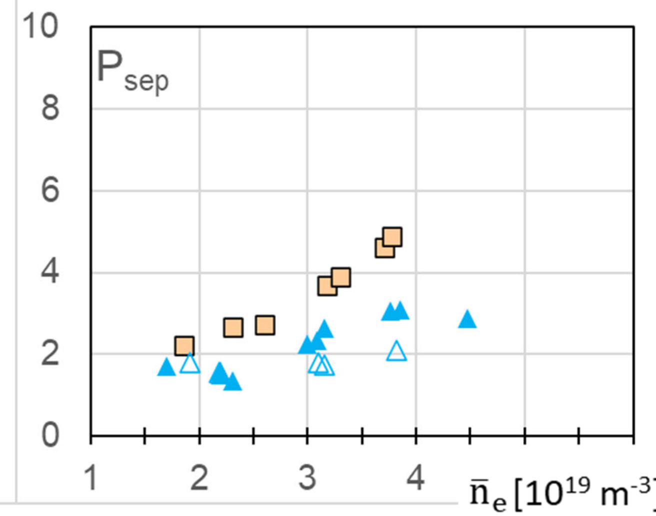




Lower I_p, higher q_{95}, reduces $\bar{n}_{e,min}$ and $P_{LH,min}$
Related to B_{pol} scaling of P_{LH}?

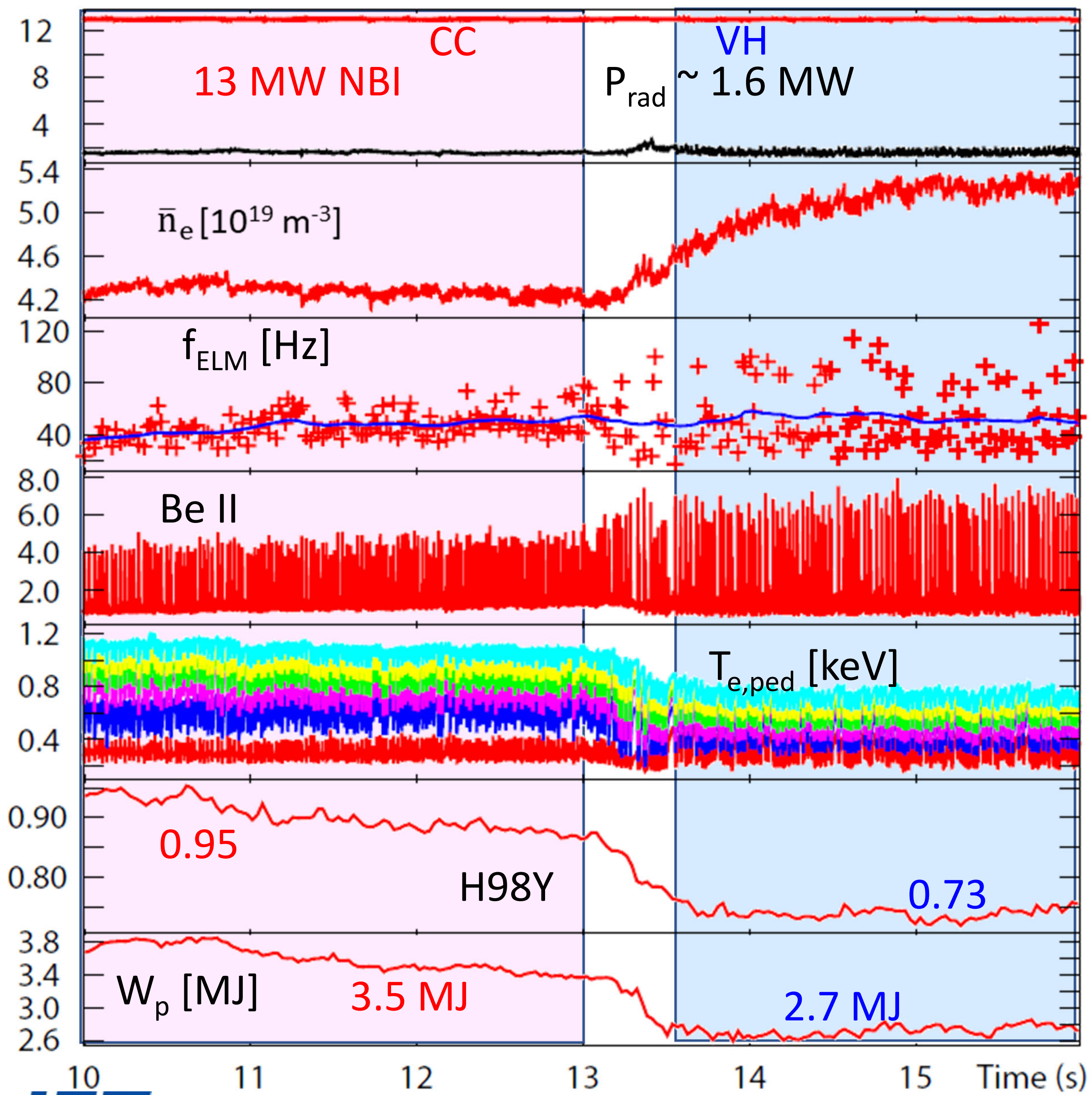




CC: $f_{GW,min}$ ~ 0.3
VH: $f_{GW,min}$ ~ 0.4

Configuration effect on H-modes: opposite behaviour!

JET 84647 2.3T 2 MA



At constant power and fuelling, change from CC to VH

CC H_{98} ~0.9

- good confinement in H-mode, despite higher P_{LH}
-
-
- $P_{NBI}+P_{Ohm}$=13.4 MW, P_{LH}=8.2, ratio= 1.6

GOOD H-MODE

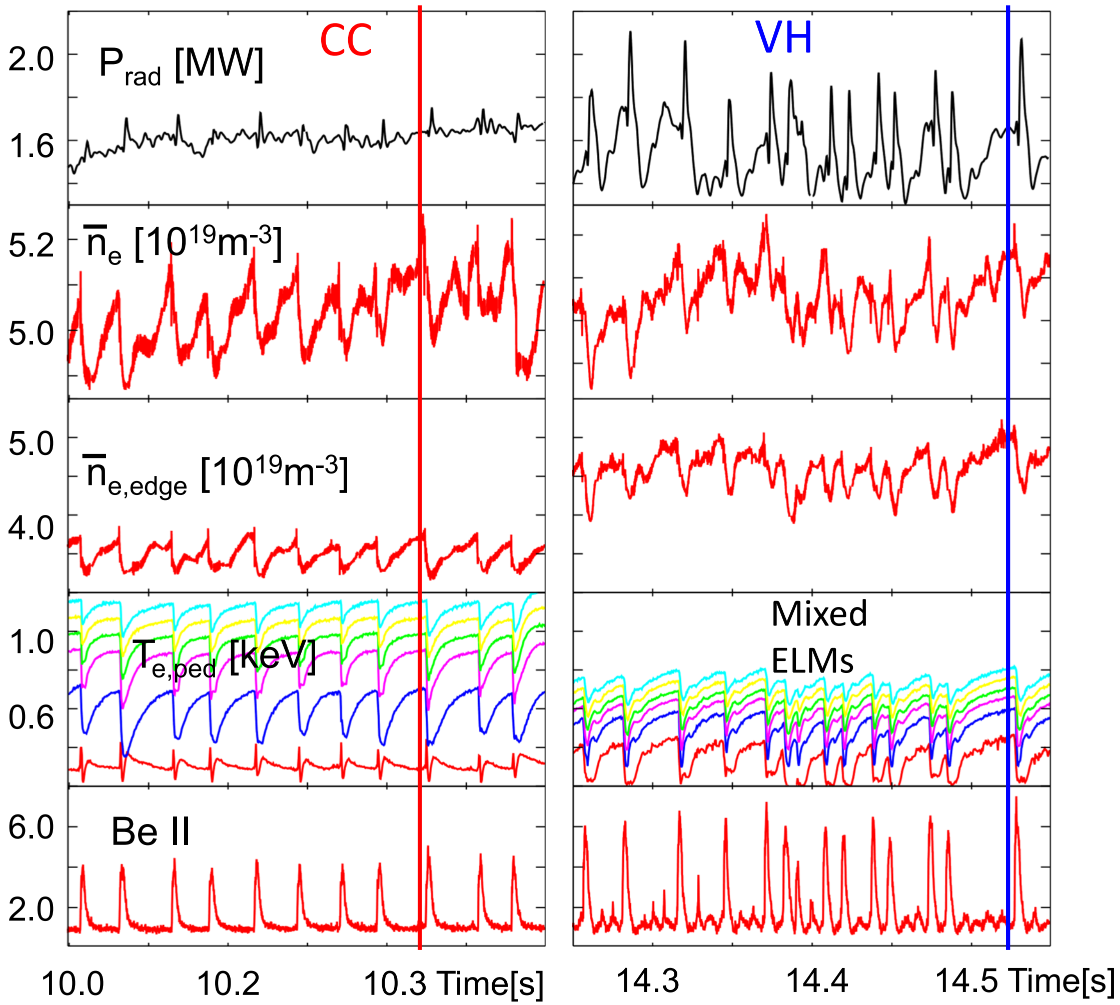
VH H_{98} ~0.70

- poor confinement in H-mode, despite lower P_{LH}
-
-
- $P_{NBI}+P_{Ohm}$=13.5 MW, P_{LH}=7.0, ratio= 1.9

POOR H-MODE

Higher ratio of heating power to P_{LH} doesn't correlate with good confinement if divertor configuration changes

Zoom into each phase



At constant power and fueling, change only strikes

CC H_{98} ~0.9

- good confinement
- higher $T_{e,ped}$, lower $n_{e,ped}$
- periodic large ELMs, peeling-ballooning unstable
- $P_{NBI}+P_{Ohm}$=13.4 MW, P_{LH}=8.2, ratio= 1.6

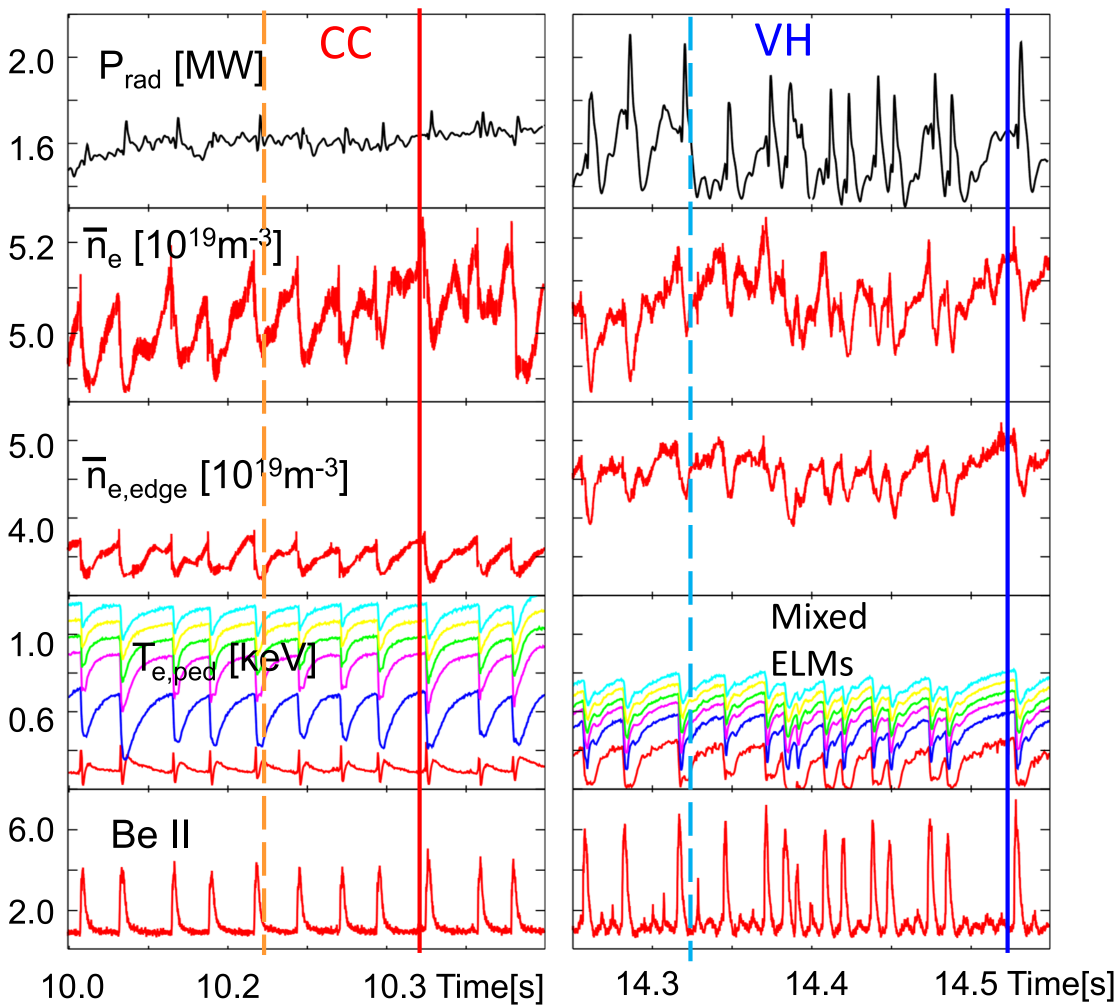
VH H_{98} ~0.70

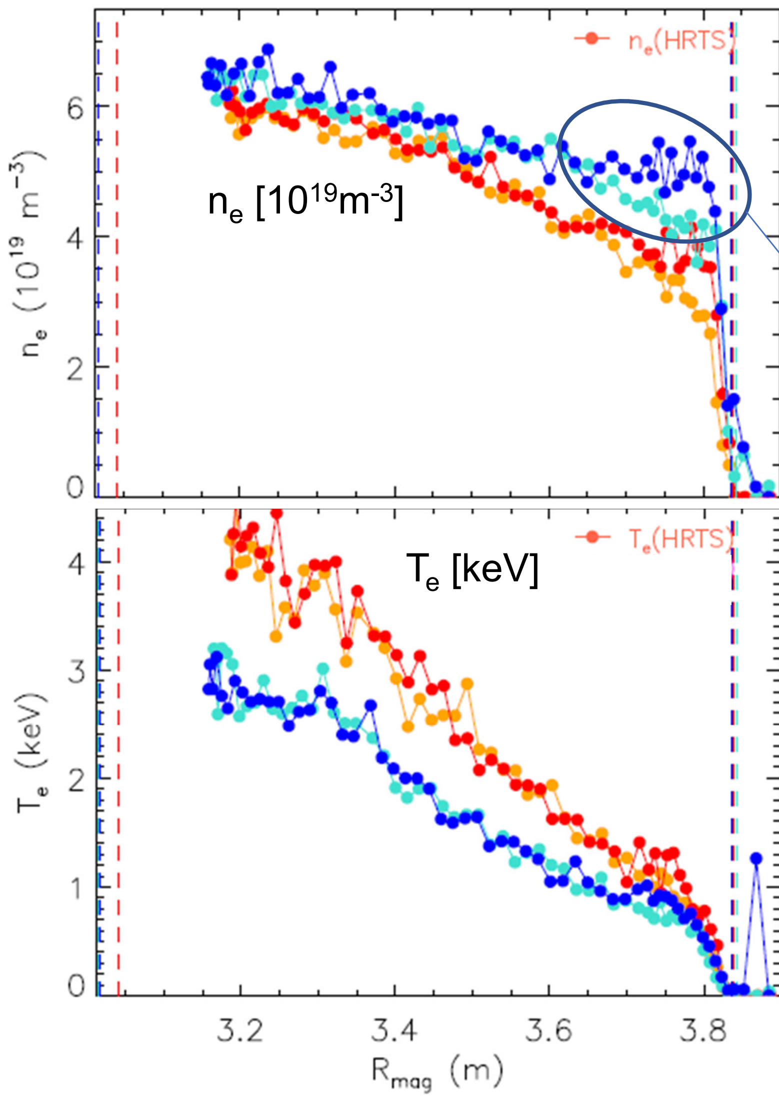
- poor confinement
- lower $T_{e,ped}$, higher $n_{e,ped}$
- Mixed ELMs, even the large ELMs are PB stable
- $P_{NBI}+P_{Ohm}$=13.5 MW, P_{LH}=7.0, ratio= 1.9

Higher ratio of heating power to P_{LH} doesn't correlate with good confinement if divertor configuration changes

Zoom in, Thomson Scattering profiles at single time slices (HRTS)

CC: good confinement associated to lower edge density, higher core temperatures





Select large ELM

Pre-ELM VH

Post-ELM VH

Pre-ELM CC

Post-ELM CC

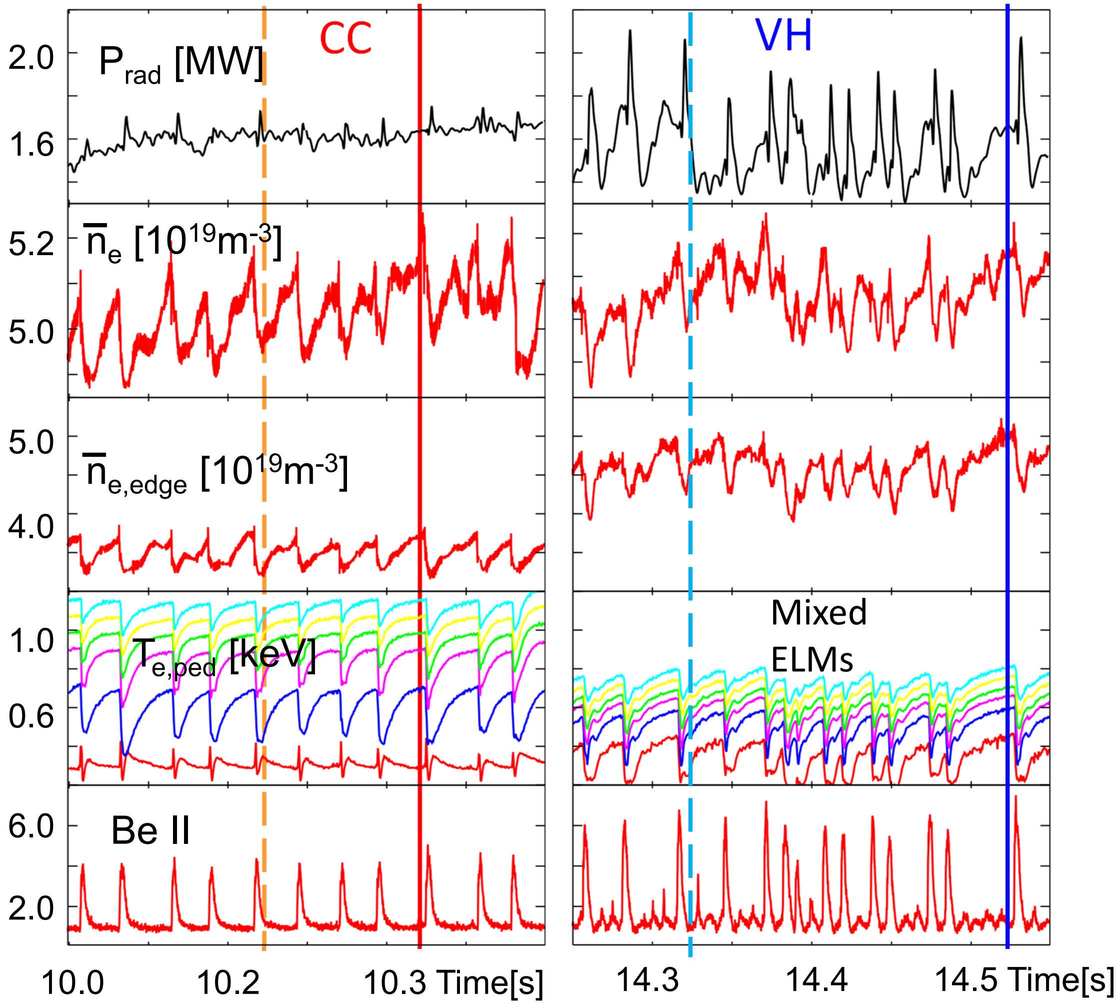
In VH:

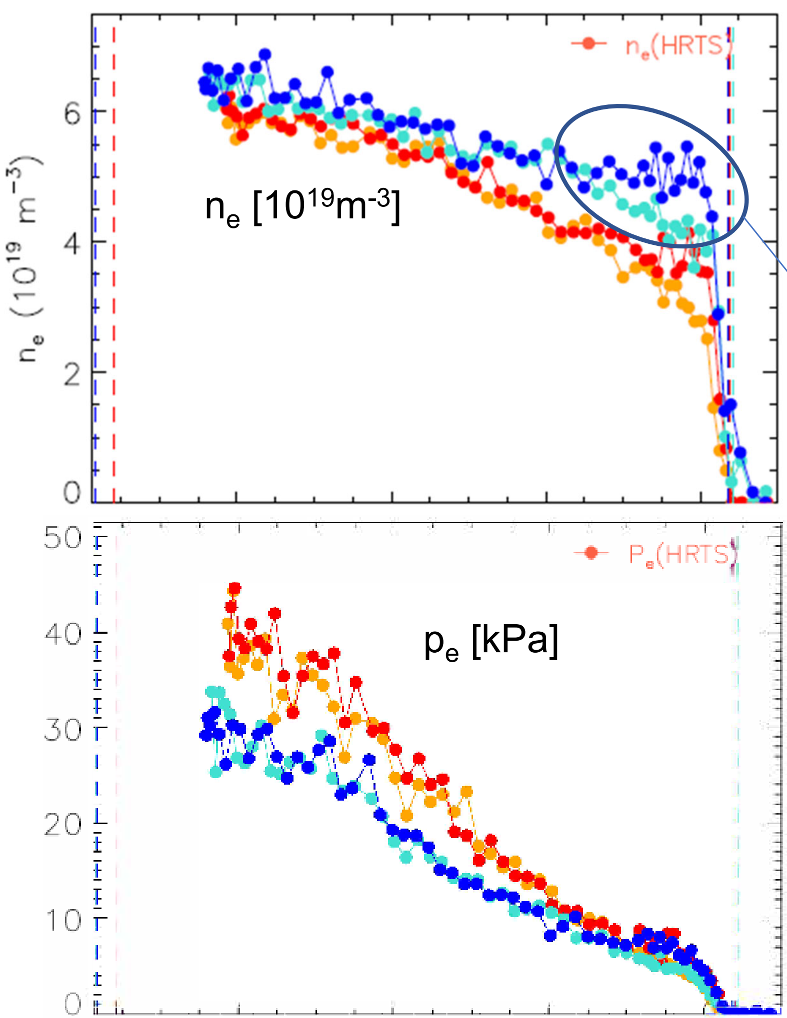
- larger ELM particle loss
- more frequent ELMs
  lower confinement

ELM analysis on-going

Zoom in, Thomson Scattering profiles at single time slices (HRTS)

CC: good confinement associated to lower edge density, higher core temperatures





Select large ELM
Pre-ELM VH
Post-ELM VH
Pre-ELM CC
Post-ELM CC

In VH:
- larger ELM particle loss
- more frequent ELMs
  lower confinement

MHD ELM analysis on-going.
So far VH stable, CC unstable to peeling-ballooning

Summary: divertor configuration effects at JET-ILW

- In JET plasma shape at active X-point (and divertor hardware) affect $\bar{n}_{e,min}$ and $P_{LH,min}$
- $\bar{n}_{e,min}$ and $P_{LH,min}$ lower at lower I_p (or B_{pol}) at fixed B_{tor}*

  explain in part better fit of P_{LH} multi-machine metal wall database with B_{pol} than with B_{tor}?

➡ Need additional data on I_p dependency of $\bar{n}_{e,min}$, P_{LH} at fixed B_{tor}, not (*only*) at fixed q_{95}

- Despite lower P_{LH} in VH configuration, better H-mode is observed in CC configuration

  P_{Heat}/P_{LH} is not a good predictor of ELMy regime or good confinement

For any planned fusion operating regime

establish access conditions (thresholds?) for good overall confinement

*** Remember also strong isotope dependence of $\bar{n}_{e,min}$ and $P_{LH,min}$**