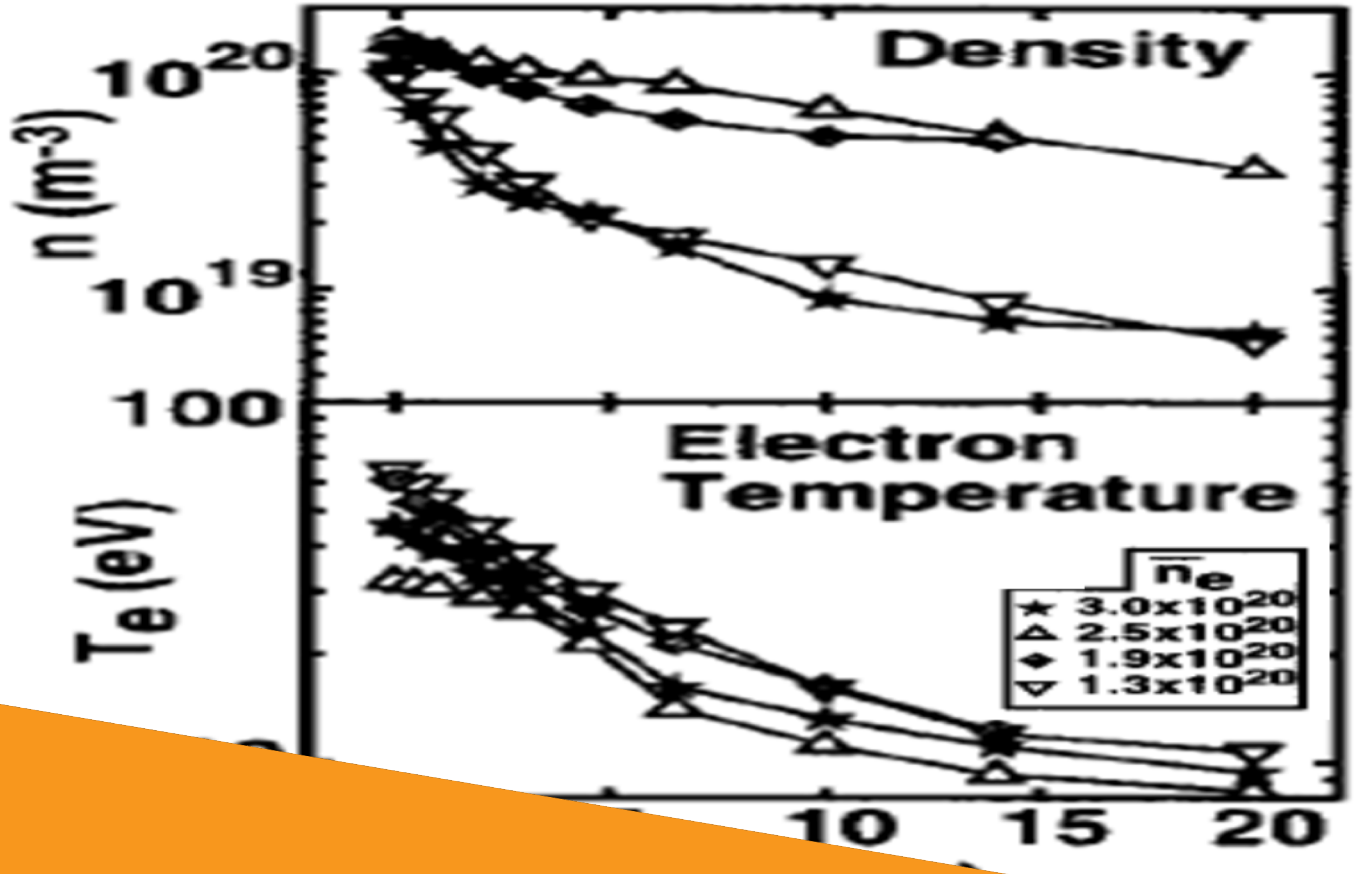

UK Atomic Energy Authority

Density Broadening – what we know and statistical modelling

F. Militello

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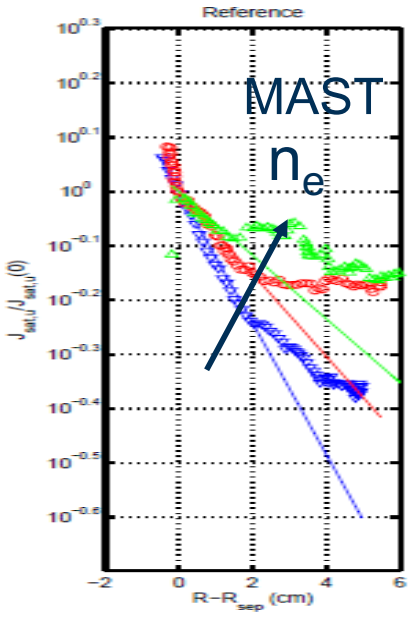
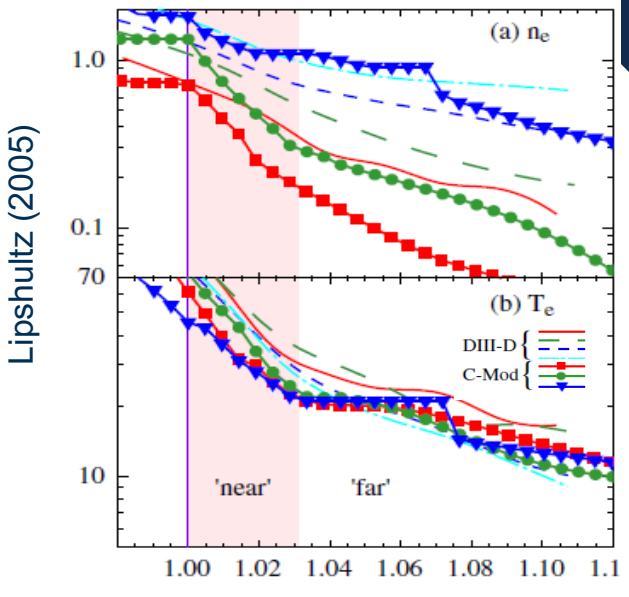
Universality of density response

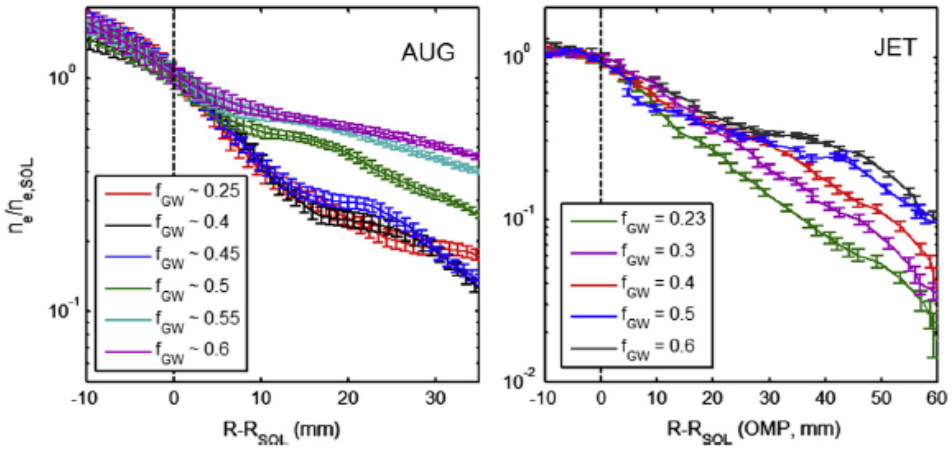


Militello(2015)

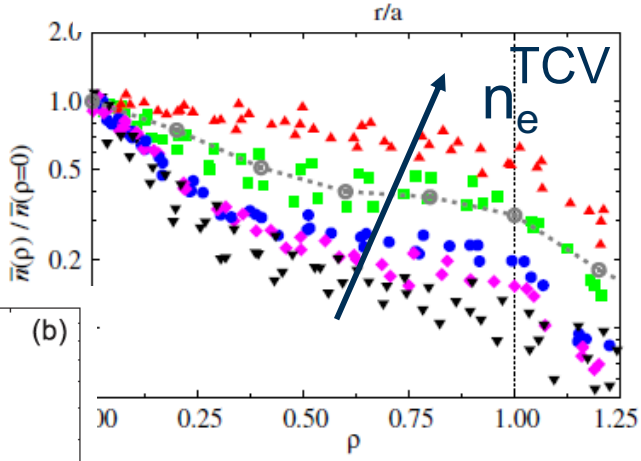
All machines see this effect.

Not dependent on details of the divertor (or of the machine).

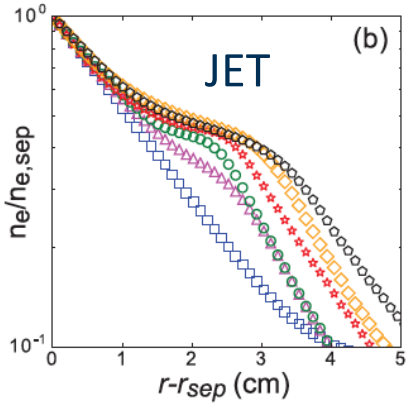




Carallero (2015)

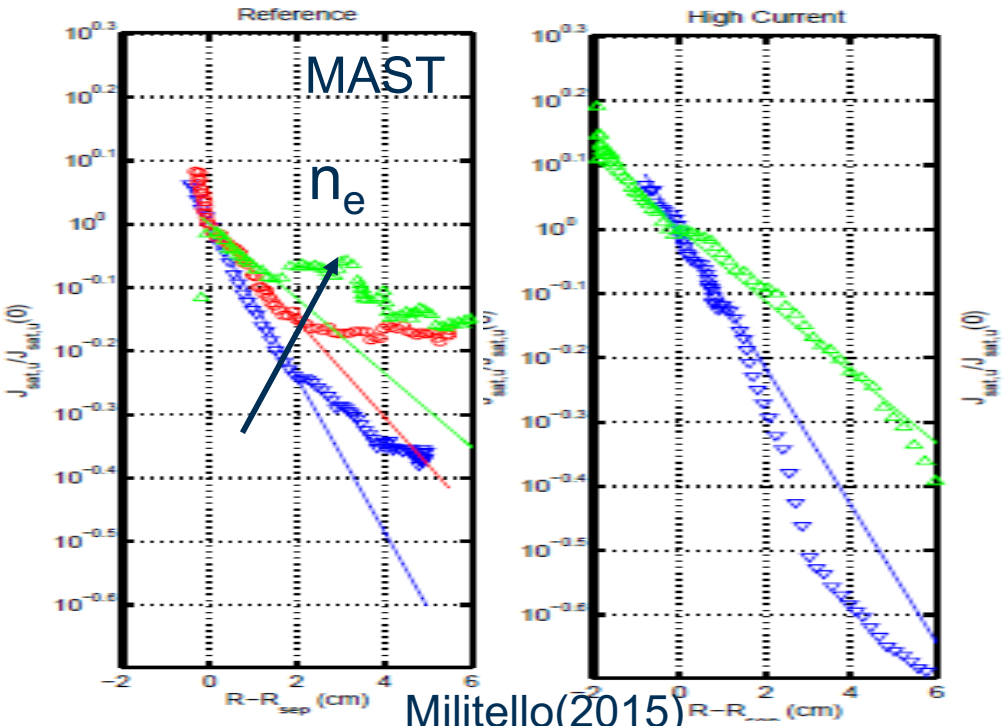


Garcia (2007)



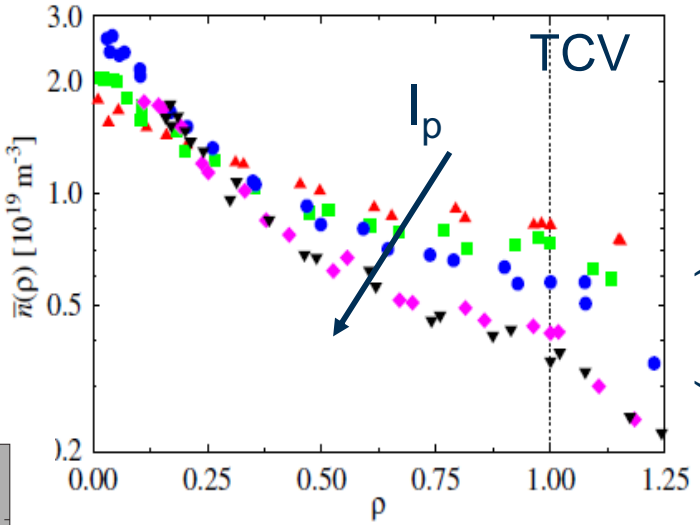
Wynn (2017)

Current effect

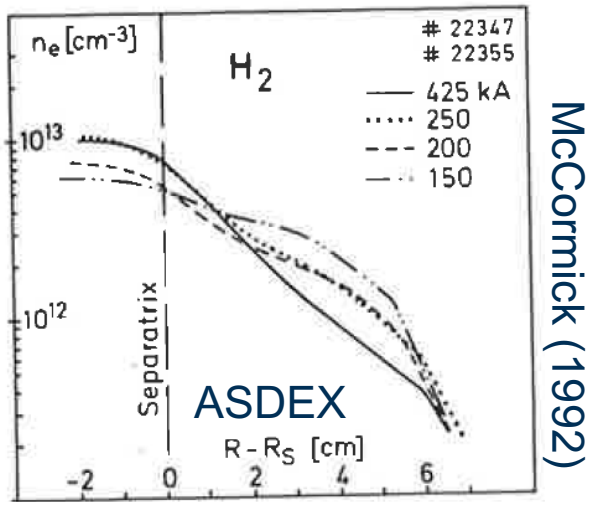


Militello(2015)

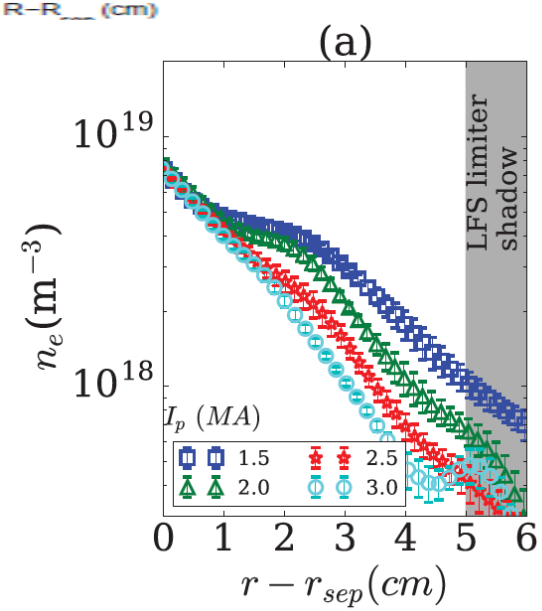
Effect of plasma current was less investigated, but the trends are clear.



Garcia (2007)

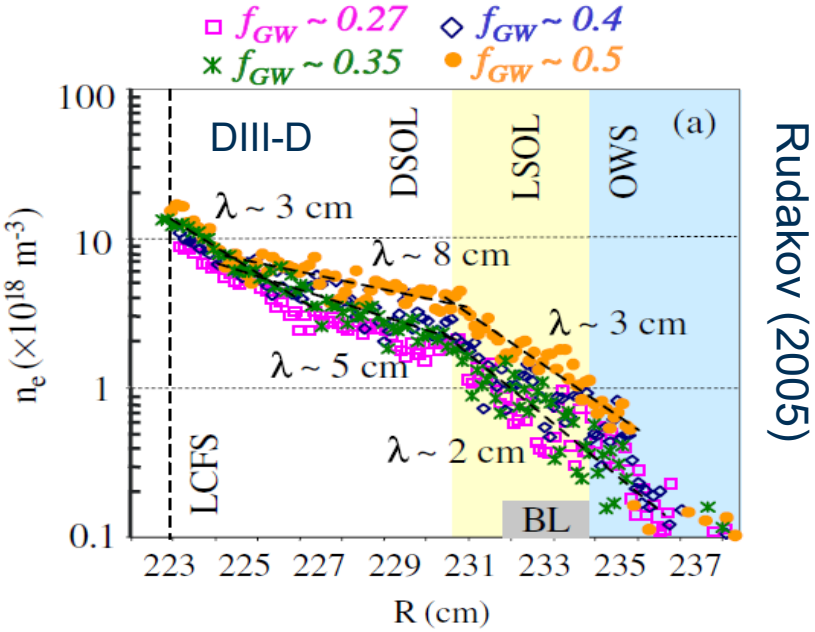


McCormick (1992)

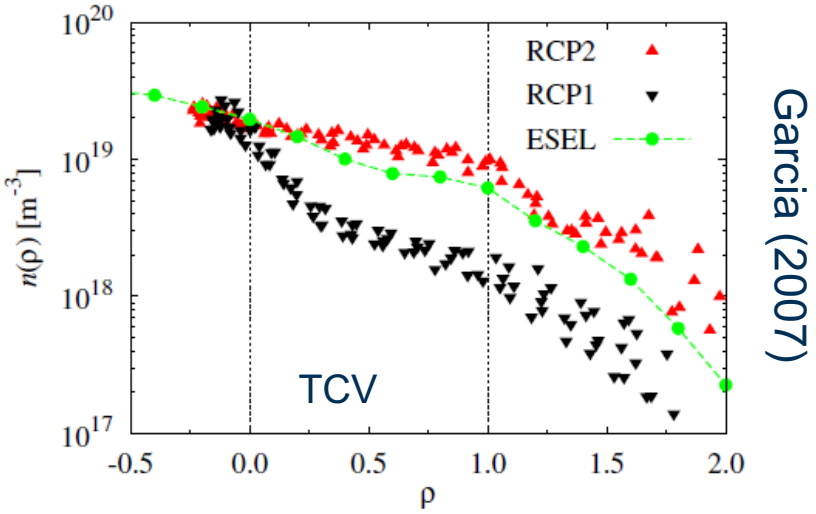


Wynn (2017)

Effect of the connection length



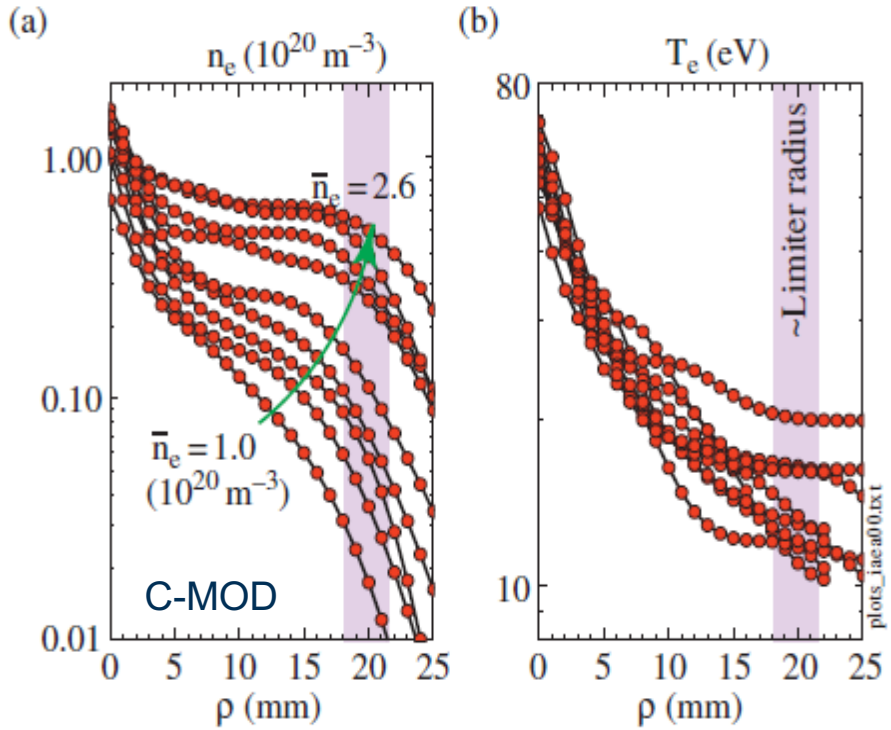
Rudakov (2005)



Garcia (2007)

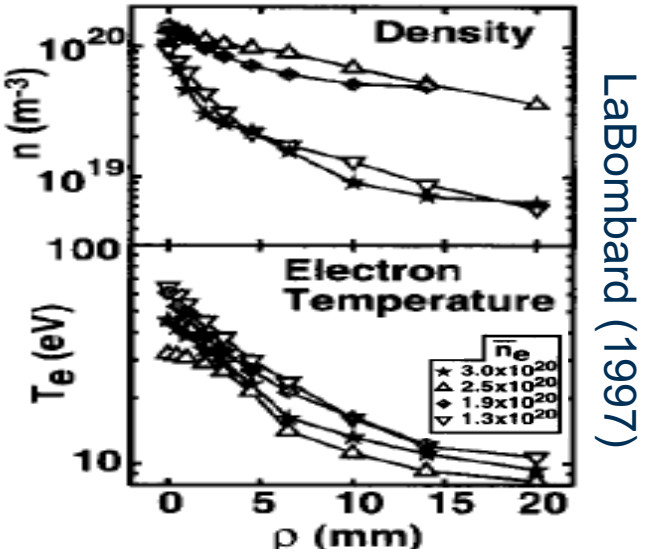
Reduction of connection length due to limiters affects gradients.

Consistent with current scans.

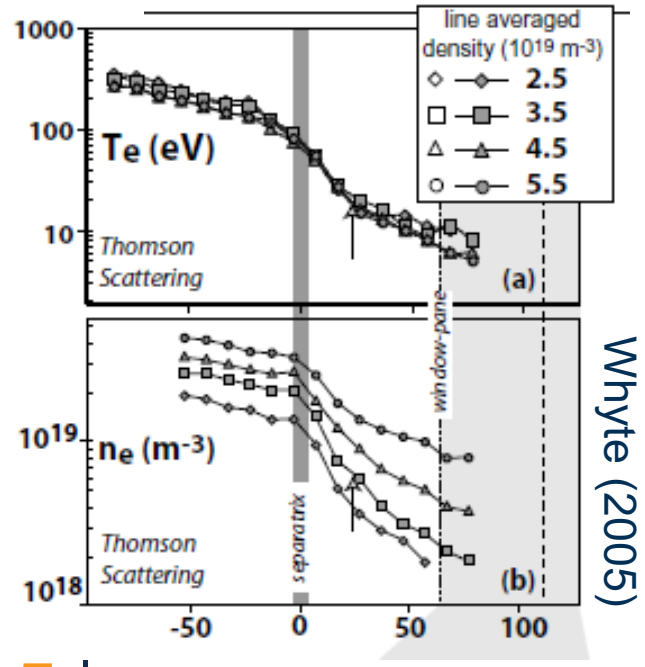


Lipshultz (2002)

A comment on the Temperature

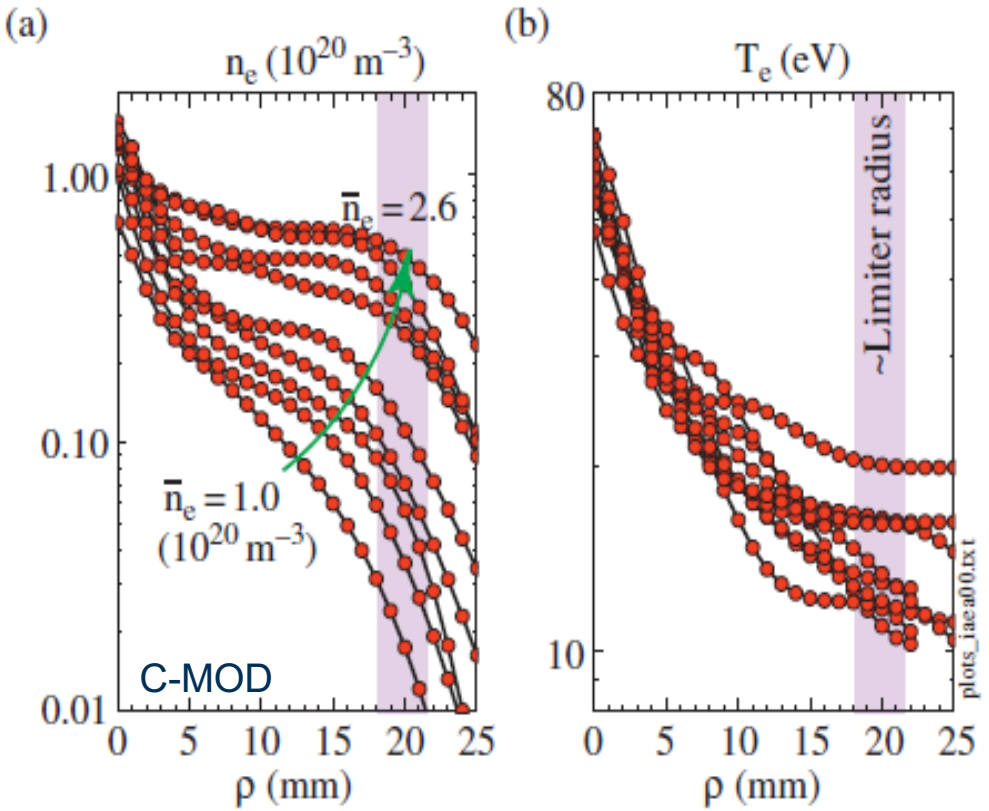


LaBombard (1997)



Whyte (2005)

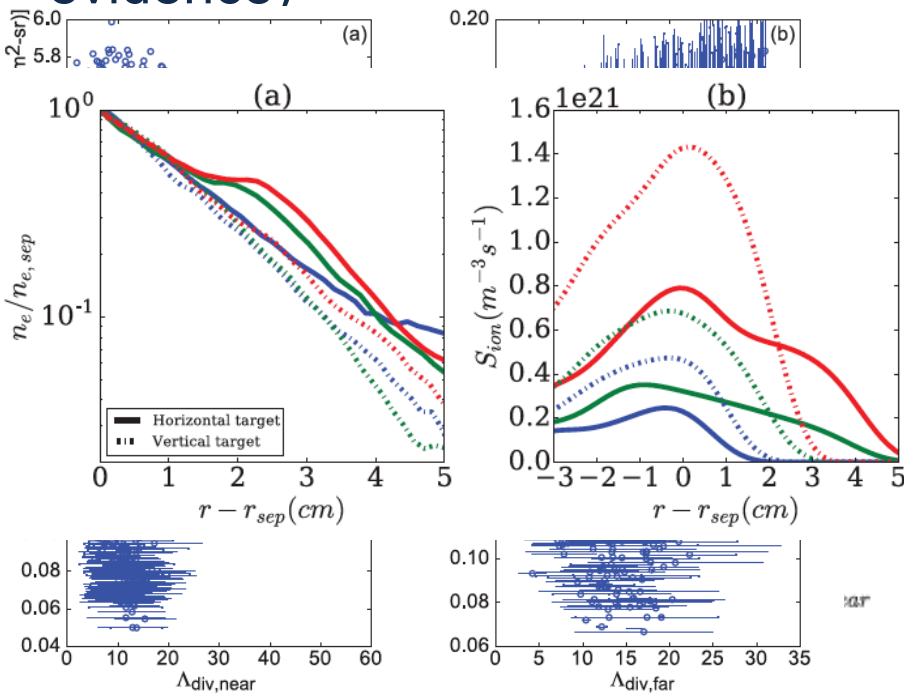
The electron temperature profile is unaffected by the density scan. (not always…)



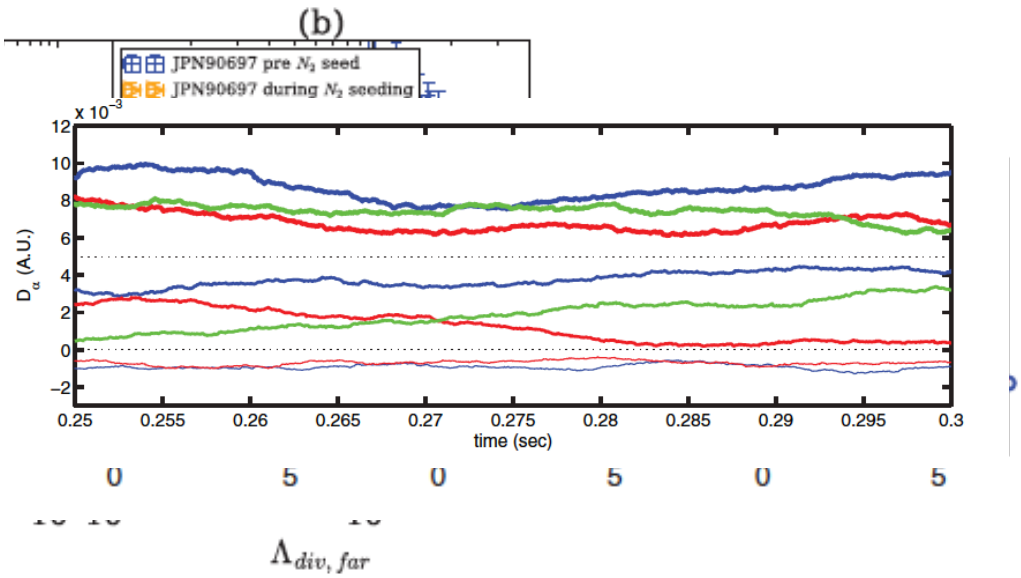
Lipshultz (2002)

Non-universal observations and new ideas

- Enhanced wall recycling/ionisation (suggested in C-mod, but not validated in JET and MAST)
- Collisionality (only in horizontal D2 in JET and AUG)
- Detachment (not on JET and MAST but maybe TCV?)
- Effect of divertor neutrals (clogging of the divertor, suspected but no hard evidence)

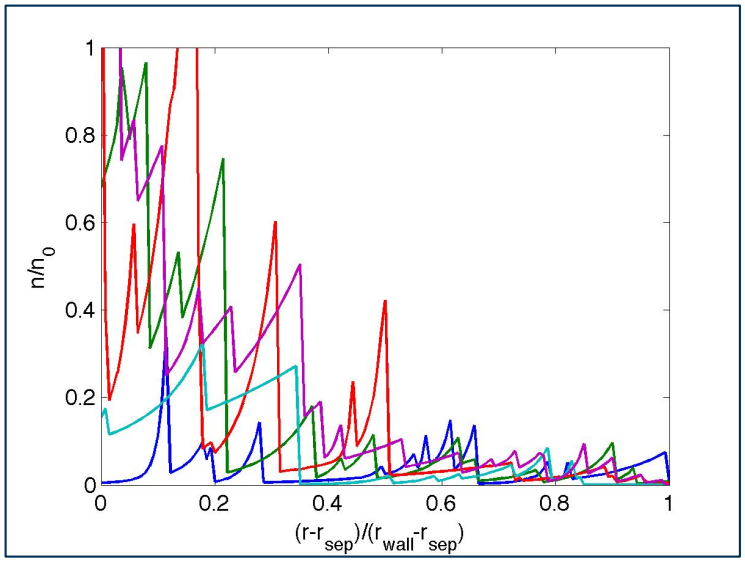


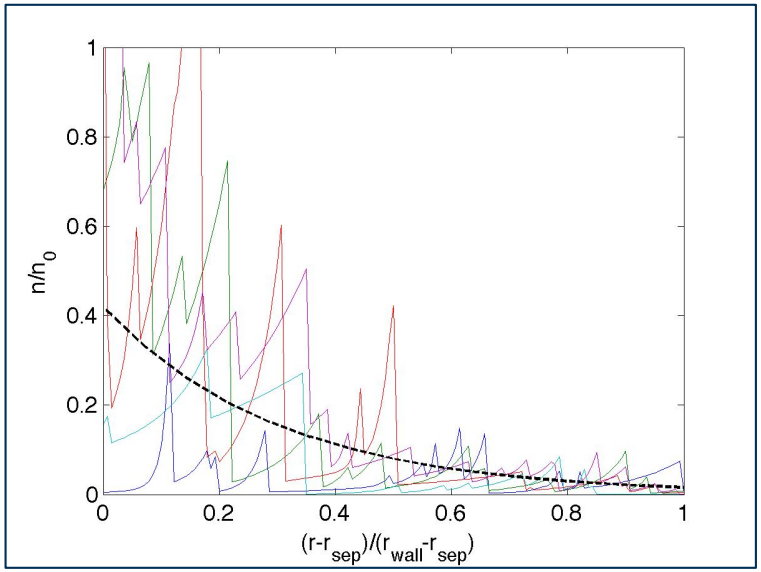
Wynn NF (2017)



Militello PPCF (2016)

Statistical Framework





First, we impose shape, radial and torodial motion and draining of the filament

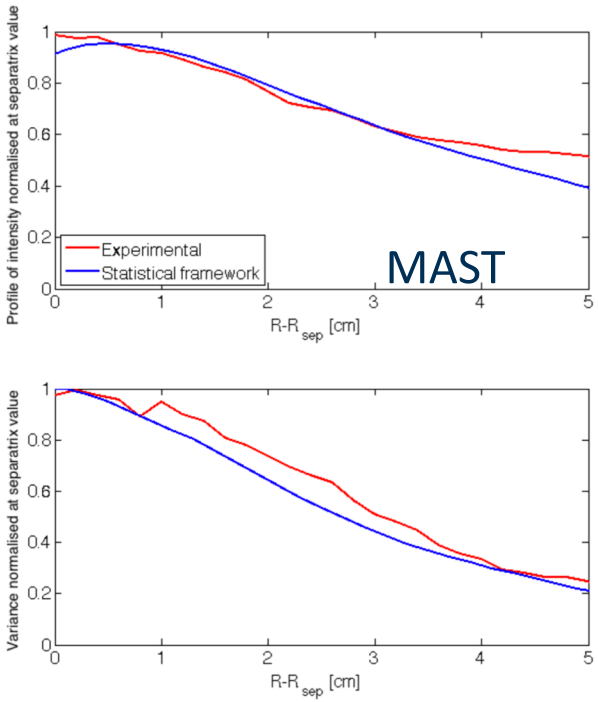
Next, we follow many filaments with given statistical properties

A time history of the filament motion can be captured in a statistical sense

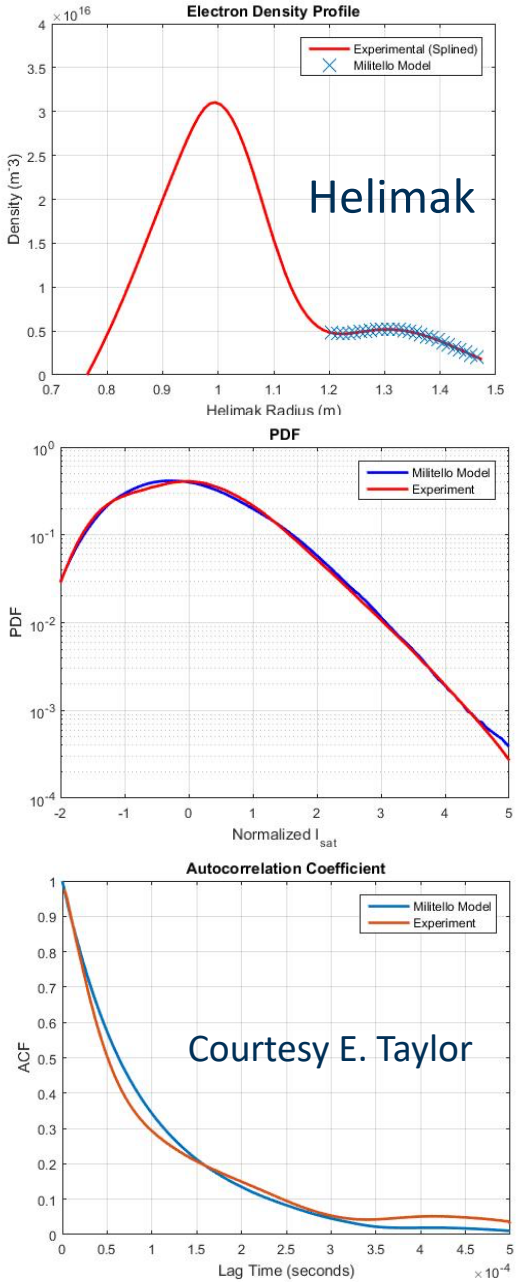
Finally, we time average the filament motion and we obtain mean profiles.

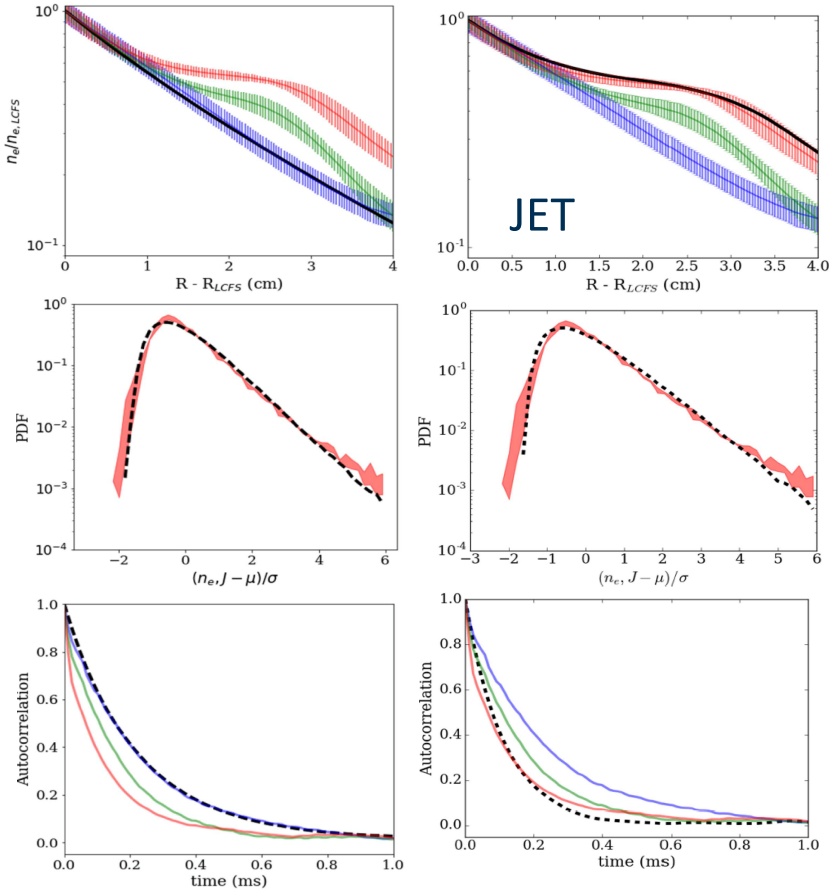
Militello, NF Letters and PPCF (2016) PoP (2018)

Experimental validation of the model



Militello PoP (2018)





Walkden PPCF (2017)