Radial electric field : GYSELA and experiments comparison

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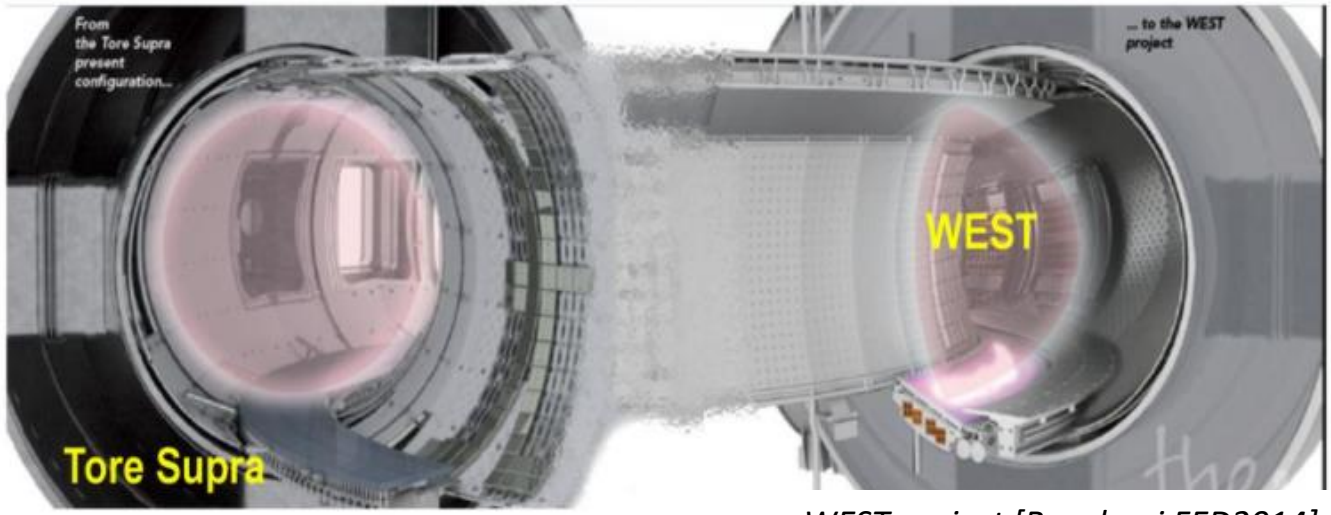
Experimental framework of our TSVV contribution

Initial comparison based on a **TORE SUPRA** discharge, in **L-mode**, at **high collisionality, RF heated plasma** => **ITG dominated** ⟹ **WEST discharges**



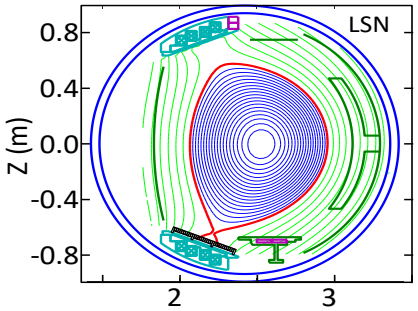
MAIN DIFFERENCES :

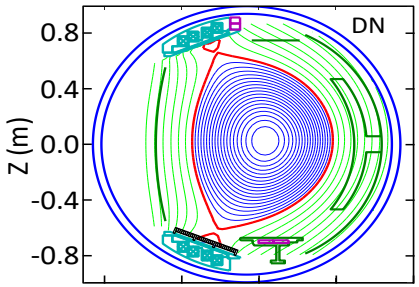
- **Larger aspect ratio A~5 (A~3 for TS)**
- **X-point (limiter for TS)**
- **Slightly lower ripple ~3% (6% in TS)**

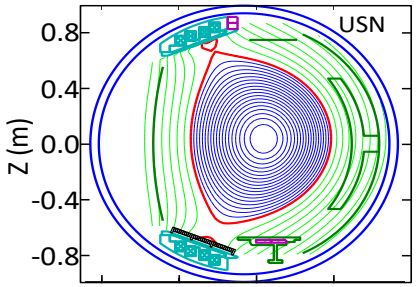
WEST project [Bucalossi FED2014]
WEST physics basis [Bourdelle NF2015]

WEST configuration :

$\boldsymbol{B \times \nabla B}$





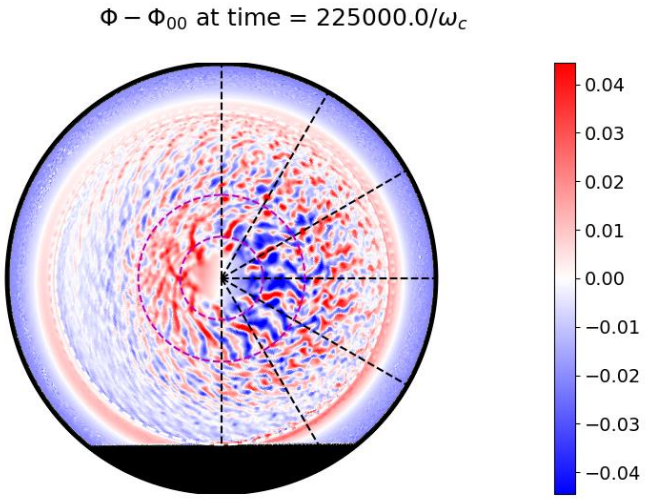


Initial comparison EXP - GYSELA

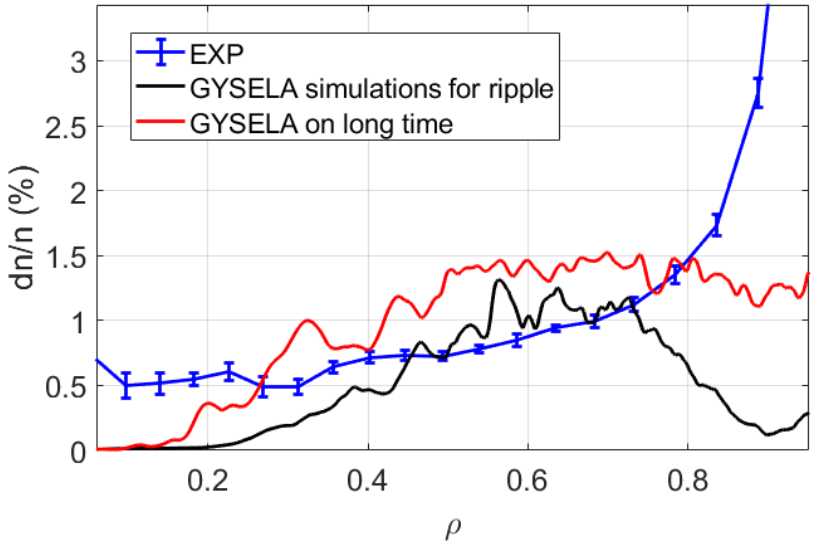
GYSELA simulations :
Flux driven simulations with
adiabatic electrons

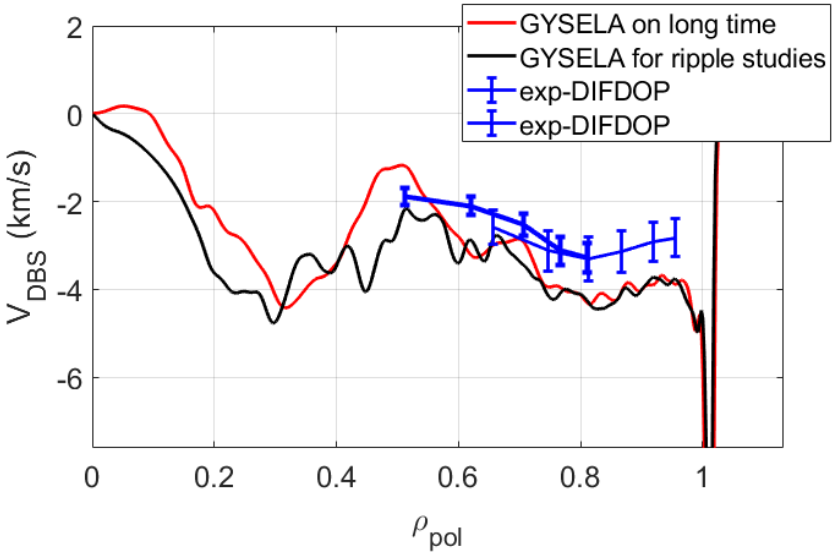
Limiteur : poloidally localized toroidal limiter

ρ* = 1/250



DM_TS45511_TEEXP_D___A250__LIM_BOT__T0_AE

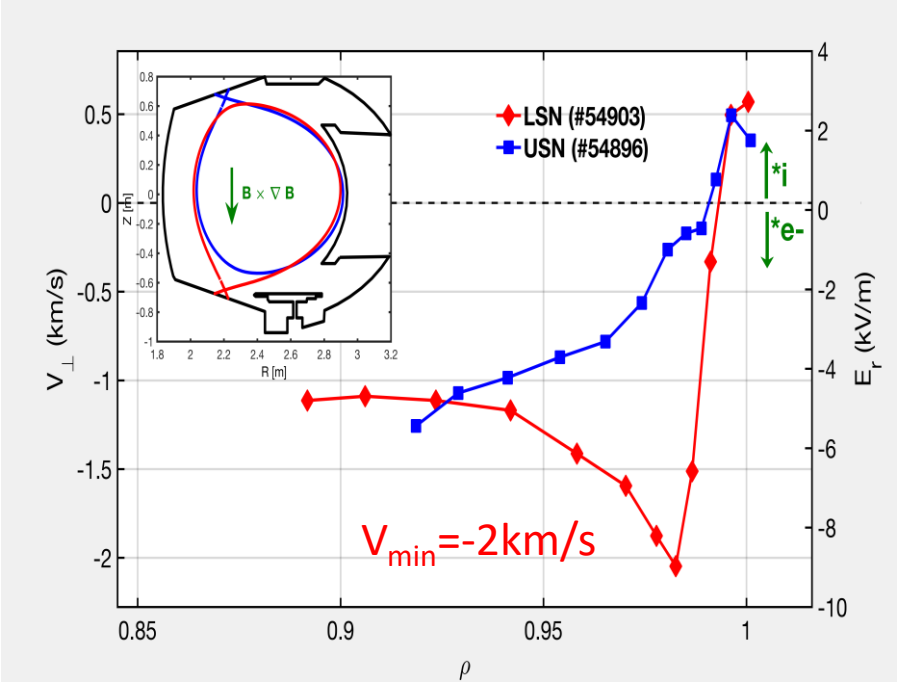




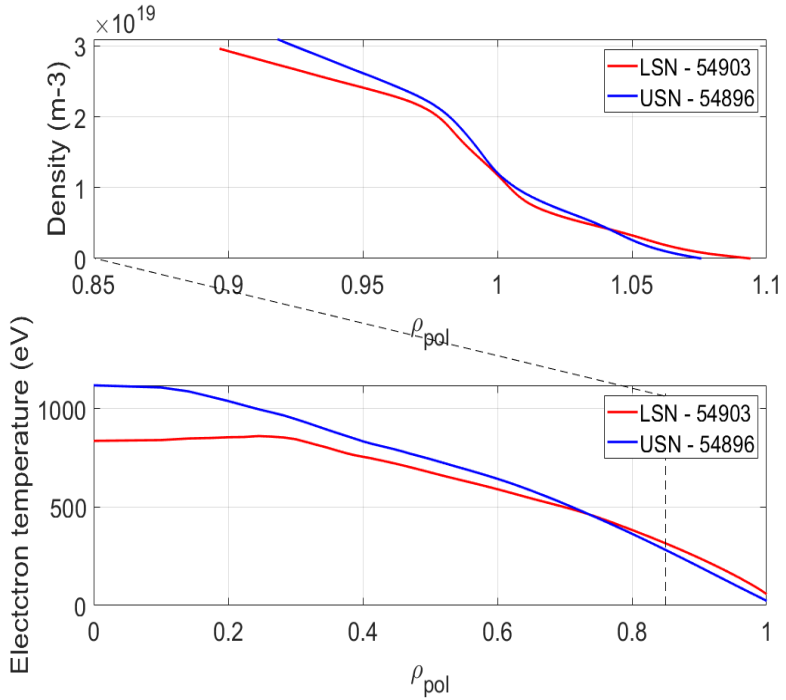
Radial shear of Er stronger in LSN configuration

In **low power** & **low plasma current** discharges, **no well in the Er profile in USN** while the profile exhibits a moderate but clear well just inside the separatrix in LSN

Ohmic discharges @ Ip = 400kA (i.e. q95 = 5)



while density and temperature profiles are similar

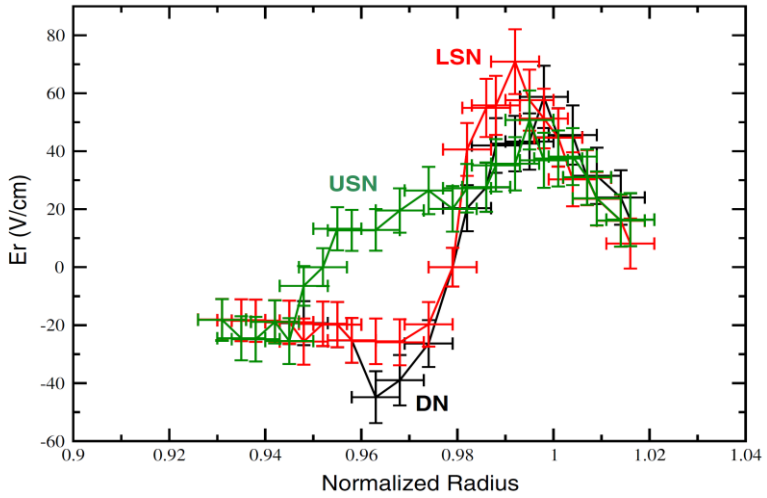


This observation is **consistent** with the common belief that LSN (magnetic drift toward X point) is a **favourable configuration**

Similar observations on AUG, MAST and Tore Supra

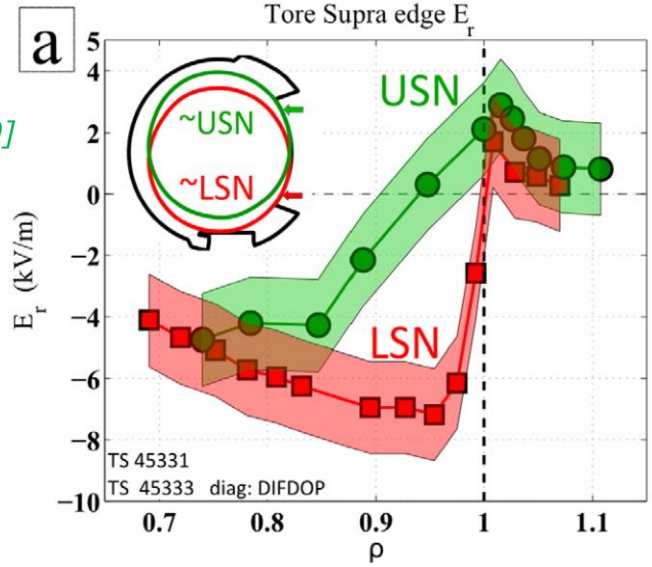
USN configuration
(= unfavorable) exhibits a less negative Er

ASDEX Upgrade *[Schirmer, NF 2006]*

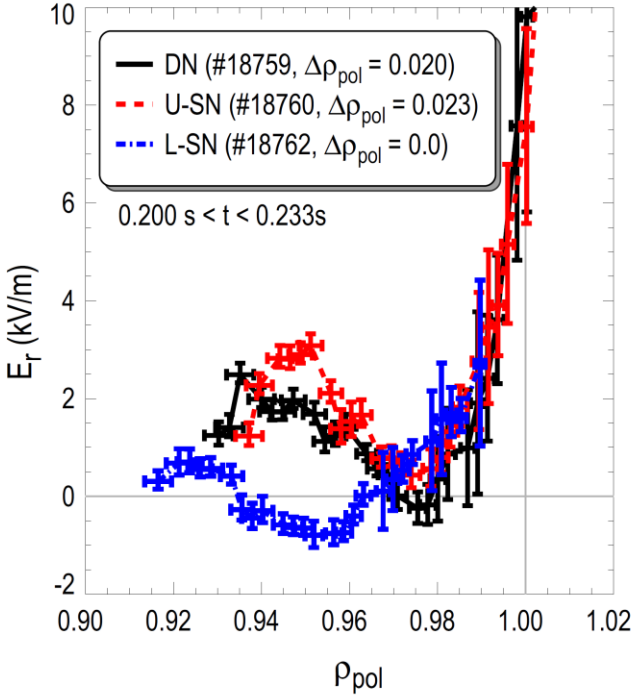


Tore Supra

[Hennequin, EPS2010]

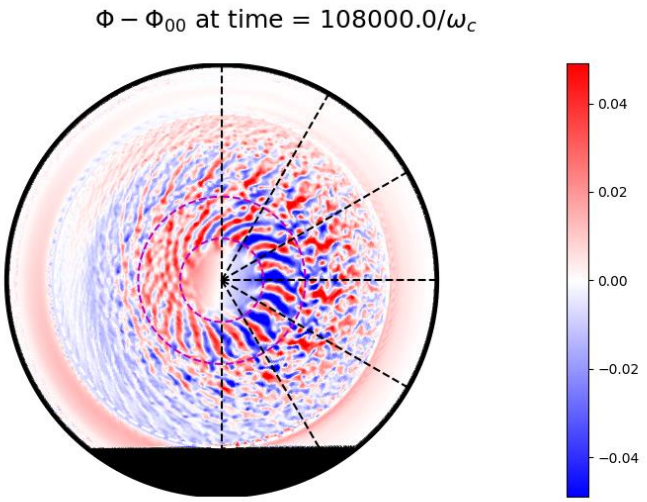


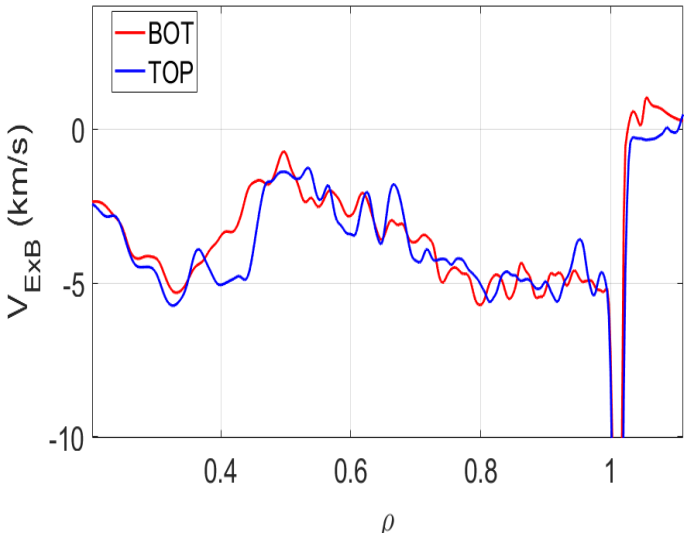
MAST *[Meyer, JoP 2008]*

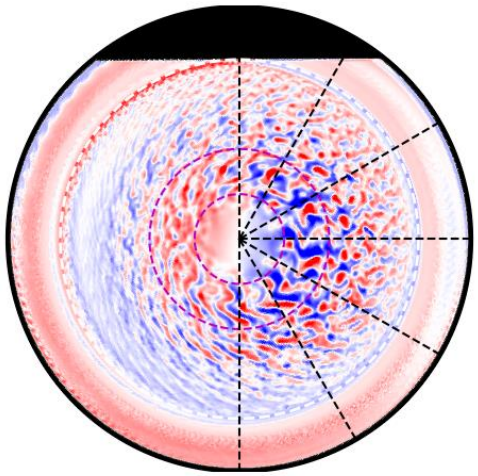


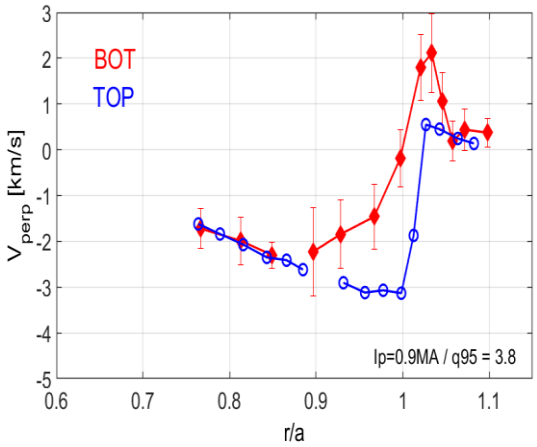
Universal in **L-mode plasmas** ?
X-points vs contact point
Different aspect ratio from 1.5 to 5

Similar simulation with limiter at the top









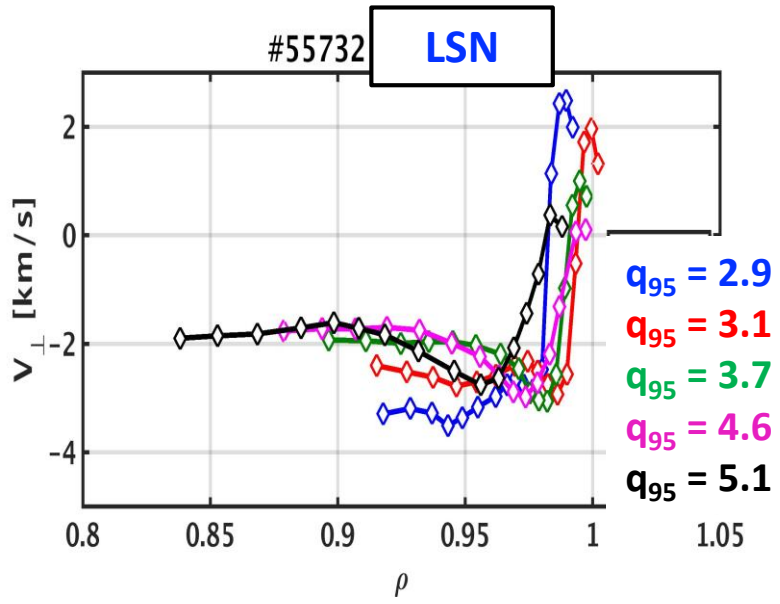
EXPERIMENTS ON TORE SUPRA

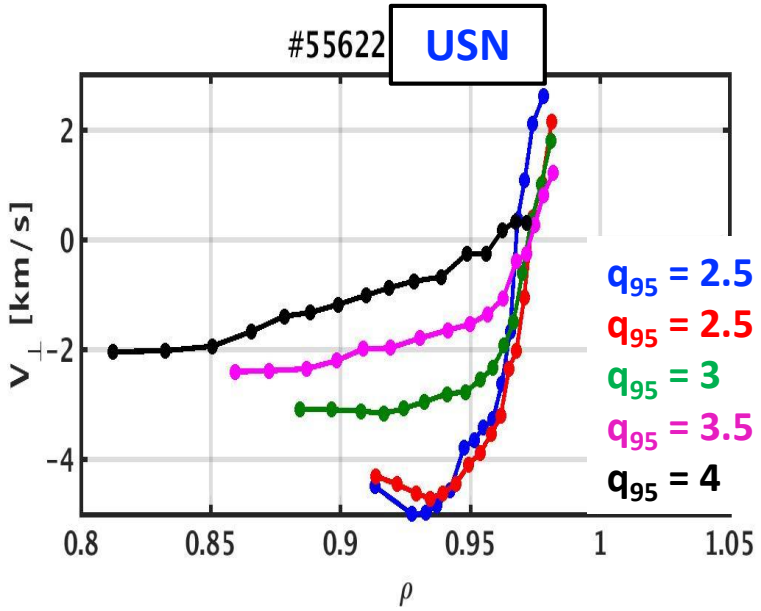
- **Stronger density gradient & higher T** in GYSELA
- **Slight difference in q profile** => exp.

q/Ip affect strongly the Er profile at the edge

Impact of the plasmas current depends on the magnetic conf.

Experiments performed to study the impact of plasma current on both configurations





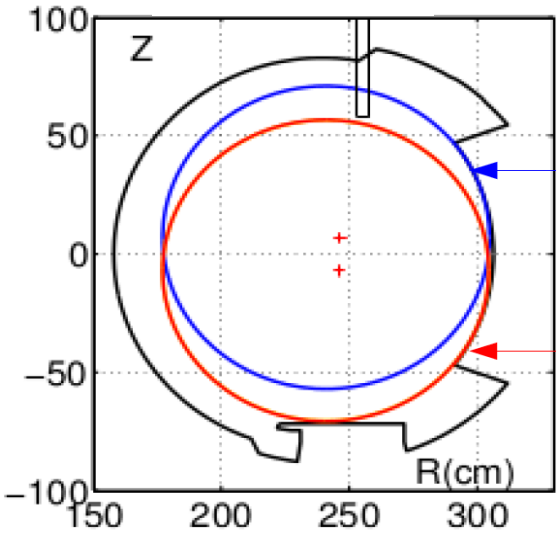
⇒ The velocity profile forms **a well when increasing the plasma current in USN**

⇒ A weaker effect is observed in LSN

⇒ Leading to an **opposite situation** = **USN more "favorable" in WEST ?**

Experimental evidence of the influence of Ip / q in the Er profile

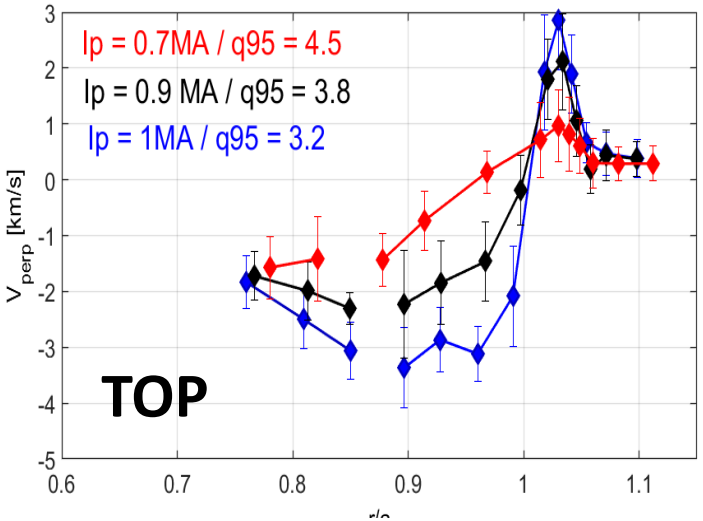
Similar behavior already observed in Tore Supra

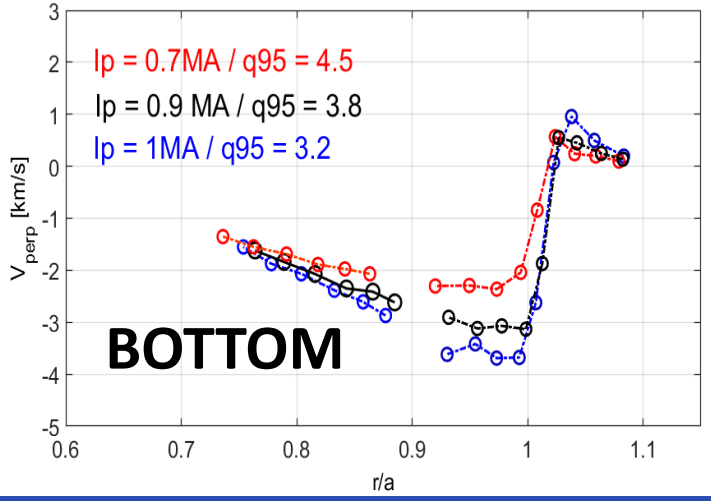


Contact point :

at the top
(TS 45322)

at the bottom
(TS 45323)

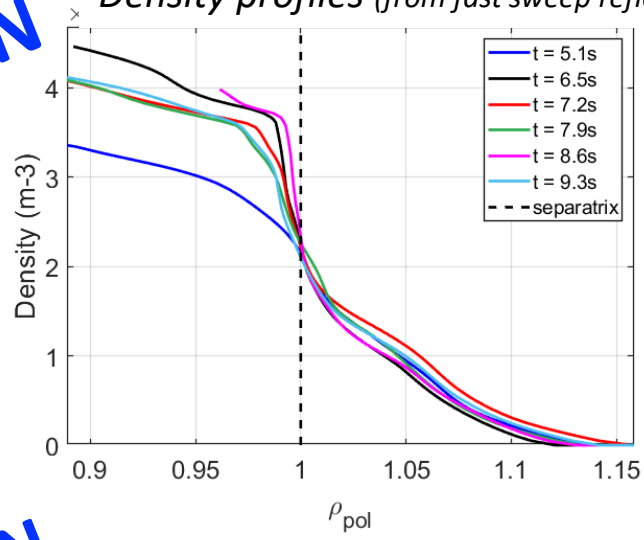




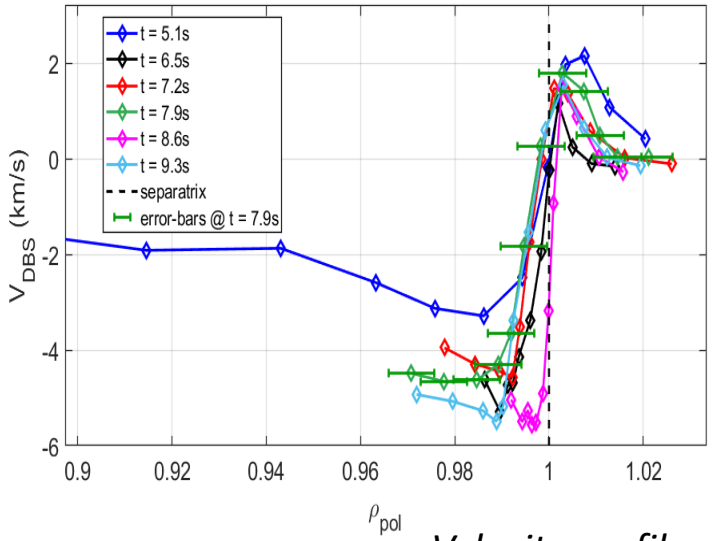
When reaching the L-H transition…

LSN

Density profiles (from fast sweep reflectometry)

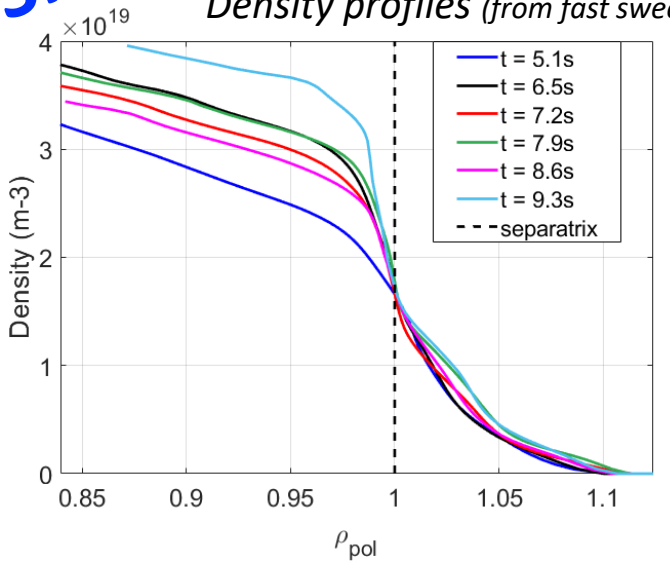


Velocity profiles (from DBS)

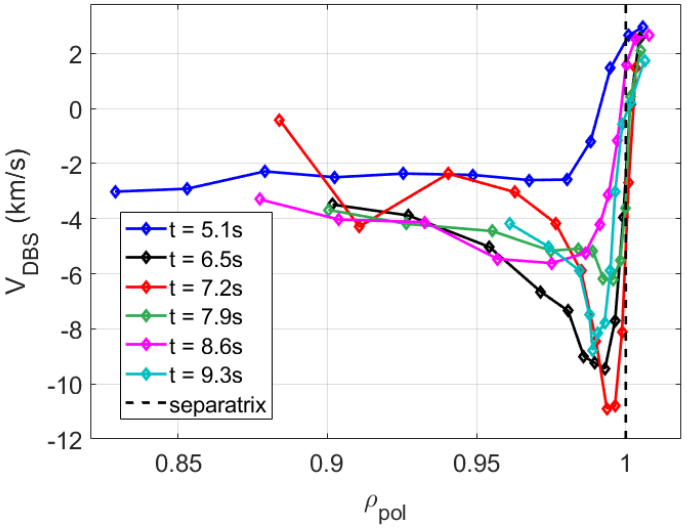


USN

Density profiles (from fast sweep reflectometry)



Velocity profiles (from DBS)



Future work

- Launch simulations for a reference **WEST discharge**

=> Both for GYSELA & SOLEDGE3X

- Evolution with : **safety factor** (in progress for Tore Supra), **injected power** and **collisionality**

- Evaluation of the contribution on the flow coming from :
  - **Ripple** (see Varennes'talk)
  - **Turbulence**

  } **GYSELA & SOLEDGE3X**

  - **Orbit losses ->** possible collaboration with R. Brzozowxki and P. Cano Megias

- Comparison of two magnetic configurations :

upper limiter versus **lower limiter**

+ hope for WPTE experiments !