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Current diffusion analysis on JET hybrid shots

J. Garcia

Current evolution in hybrids

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- Comparison between TRANSP and CRONOS with experimental data has been done
- It has not been done in a systematic way but we have already some good simulations
- Several shots were chosen in the framework of different hybrid scenarios analysis

High triangularity hybrid shot

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E. Joffrin et al.
IAEA 2010

CURRENT EVOLUTION AND ANALYSIS

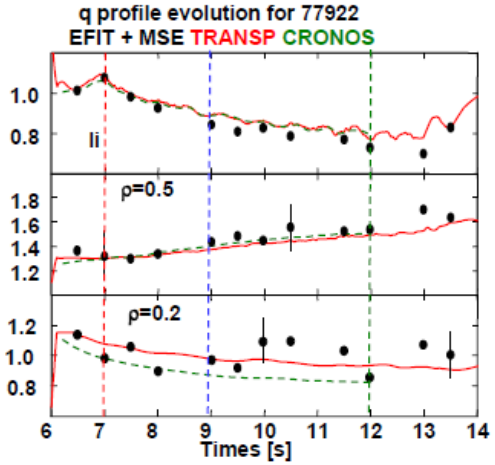

Fig 5a: li and q evolution at ρ=0.2 and 0.5 from EFIT + MSE (dots) and predicted by CRONOS (green dashed) and TRANSP (red) using the same initial conditions. Note that no anomaly is found with respect to the neoclassical theory in contrast to AXDEX Upgrade and DIII-D results.

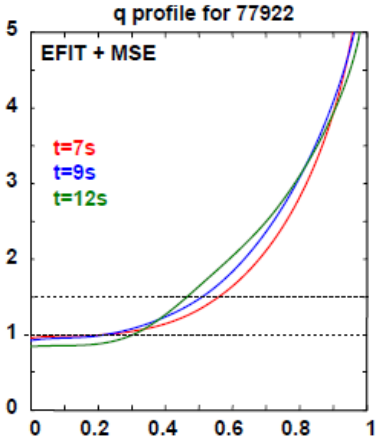

Fig 5a: evolution of the q profile inferred from constrained EFIT+MSE. The Ip overshoot has the effect to "broaden" profile between 0.4 and 0.7 and a larger area of low magnetic shear is obtained in the core.

- Li is identical for both codes
- At ρ=0.5 both codes give identical results, which agree with experimental data
- At ρ=0.2 the results are very similar for both codes. They follow experimetnal data except for some points
- Sawteeth not included in the simulations

Low triangularity hybrid shot

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J. Hobirk,
et al. to be published

- Experiment and simulation agree when MSE EFIT is taken as initial condition

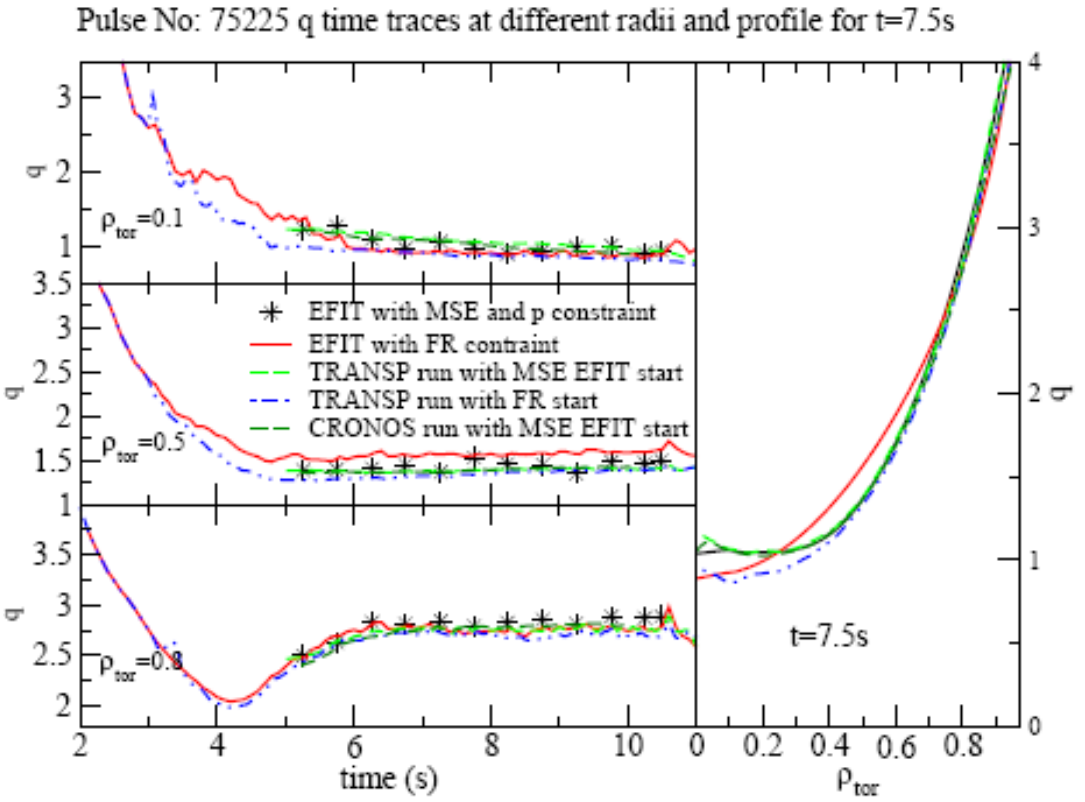
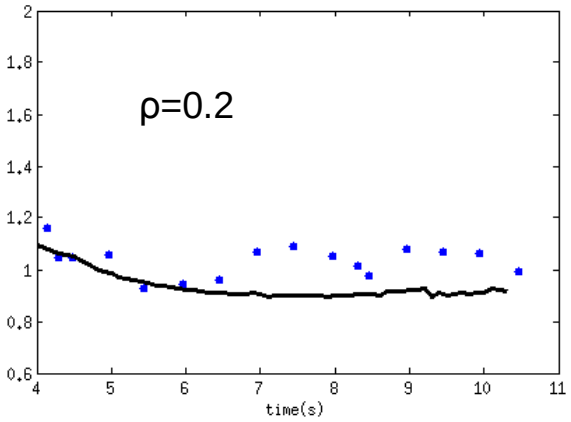
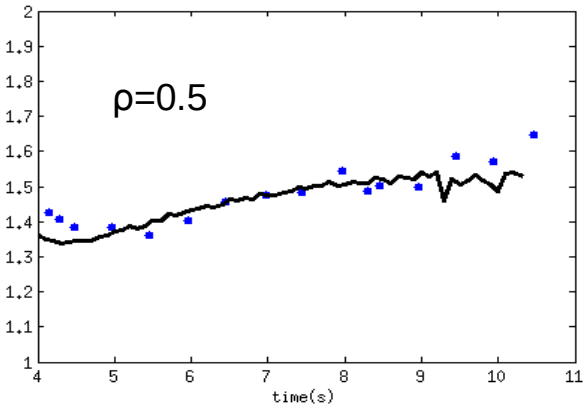
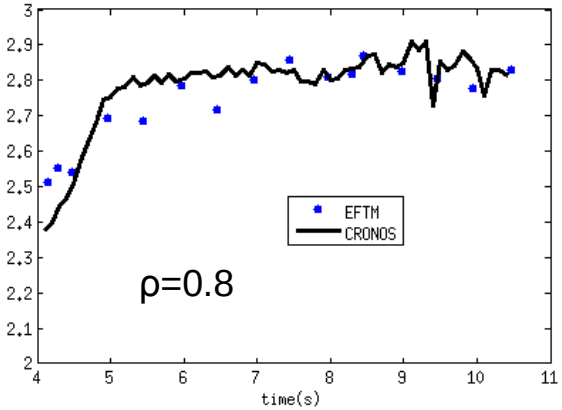


Figure 8. Time traces of q at different ρ_{tor} for a low triangularity discharge. The q-profile is modified using a current ramp down. MSE and pressure constrained equilibrium in black, a Faraday rotation in a dashed red line, an interpretative TRANSP calculation starting from a Faraday rotation q-profile at $t = 3$s in a dash dotted blue line and an interpretative TRANSP calculation starting from a MSE q-profile at $t = 5.26$s in a green dashed line are plotted.

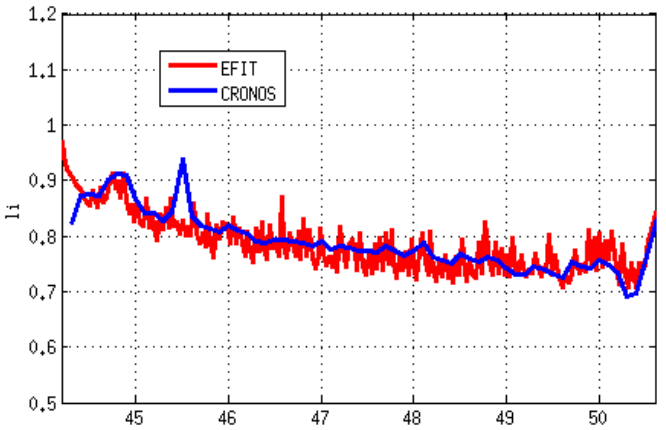
Shot 76858



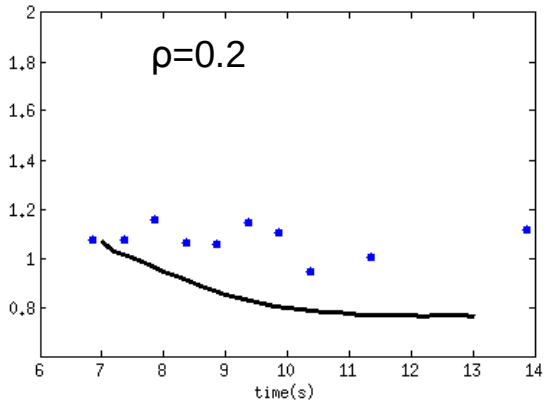


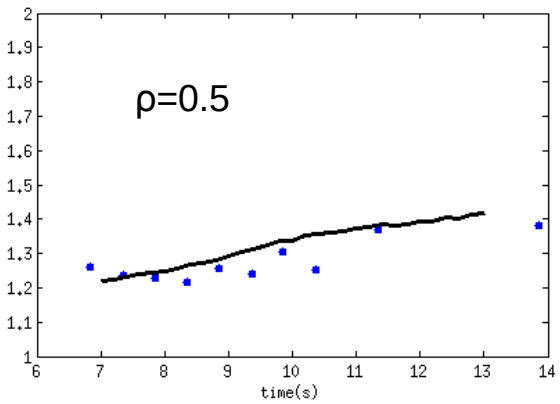


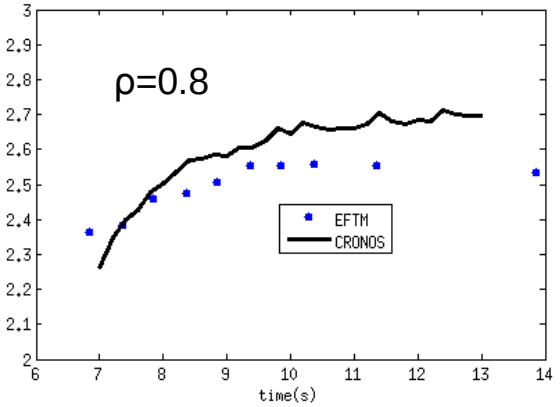
- Li is identical to EFIT
- Same trend as for shot 77922:
- Good q profile simulation compared to EFTM
- Some MHD event at ρ=0.2



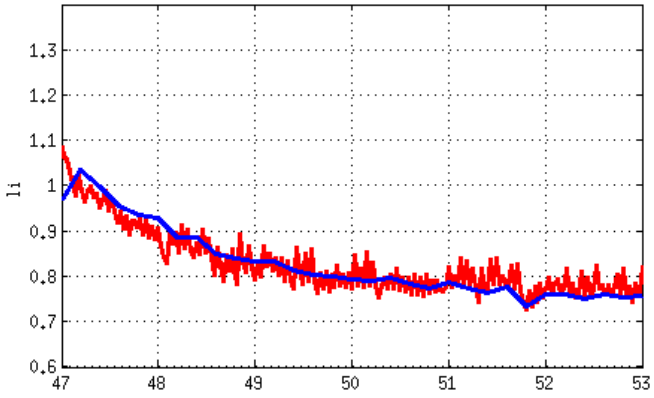
Shot 77933



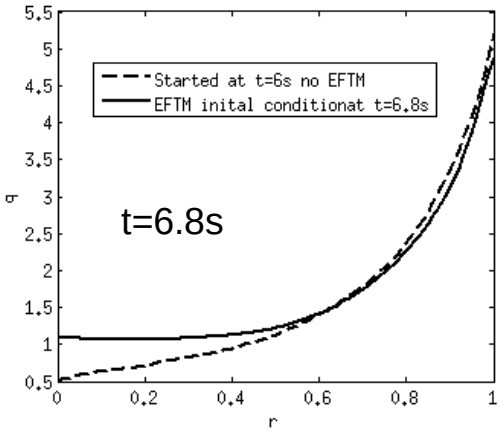


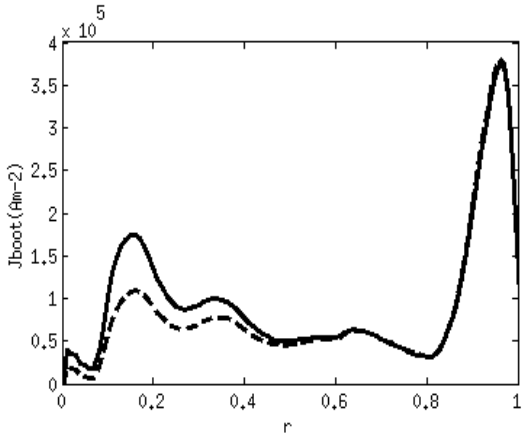


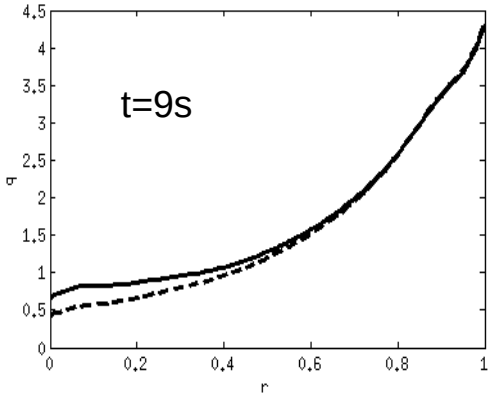
- Li is identical to EFIT
- Some more deviation than in previous shots
- For ρ =0.5 and ρ =0.8 it is reasonable good and the trend is ok
- Need to check CRONOS simulation

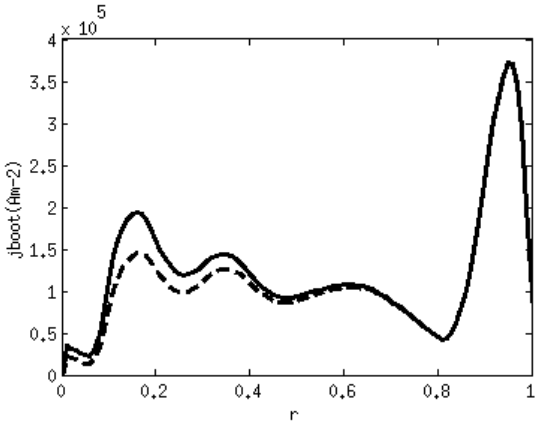


Shot 77933 role of bootstrap current









- Significant differences on the bootstrap current profile due to q profile
- If the initial condition is significantly wrong this can lead to different simulation results or to take a long time to have the same final result
- The non-linear interplay between the q profile and the bootstrap current can have some impact

Summary and perspectives

- General trend shows that current evolution is neoclassical
- Results of TRANSP and CRONOS in agreement (shots 77933 and 76858 to be compared)
- Initial conditions are important. Using initial q profile from EFTM is essential
- Extend some simulation to check whether with initial EFTM and with non-EFTM the final result is the same one
- Analyze the role of bootstrap current dependence on q
- Summarize results and try to publish a short paper
- Could we add ASDEX data?