Short update on particle transport modelling following EPS conference (ideas on how to proceed)

L. Garzotti, C. Bourdelle, J. Citrin, F. Köchl, J. Lönnroth, S. Moradi, V. Parail,
I. Voitsekhovitch, P. Belo, J. Bizarro, G. Corrigan, the EU-ITM ITER Scenario Modelling group and EFDA-JET contributors*

Simulations

- **JETTO fully predictive (ne,Ti,Te, but no rotation).**
- **Bohm/gyro-Bohm transport model.**
- **Four discharges analysed high/low power (18/10 MW), high low triangularity:**
  - 77922 high power, high delta
  - 75225 high power, low delta
  - 75590 low power, high delta
  - 74641 low power, high delta
- **Strategy:**
  - match plasma parameters at top ETB (adjust χ and D inside ETB)
  - match evolution of average density (adjust R)
  - tune D in the core (if necessary) to match density peaking

Plasma parameters

Shot	I_p [MA]	B_T [T]	P_{NBI} [MW]	β_N	δ	H_{98}
77922	1.7	2.3	17	3.1	high	1.37
75225	1.7	2.0	18	3.2	low	1.35
75590	1.3	1.7	10	2.9	high	1.38
74641	1.7	2.0	9.3	1.8	low	1.00

Summary of results

Shot	Time (s)	γ_{Exp}	γ_{Sim}	S(0)	χ/D (ETB)
77922	7.5-8.0	1.36	1.40	2.0	5.0
75225	6.0-6.5	1.59	1.58	1.5	7.5
75590	5.8-6.3	1.42	1.45	1.0	15.0
74641	6.0-6.5	1.52	1.51	1.0	15.0

Summary so far

- **High power shots exhibit core particle higher core particle diffusivity (factor 1.5, 2) with respect to standard Bohm/gyro-Bohm transport model.**
- **Low power shot exhibit higher χ/D inside ETB with respect to high power shots.**
- **In no cases an inward particle pinch had to be invoked to explain the observed level of density peaking.**
- **Triangularity does not seem to be playing a major role (density pedestal height?).**
- **GLF23 simulations (see Irina's paper) also predict density over-peaking. Agreement recovered if ExB stabilisation term is reduced).**
- **QuaLiKiZ analysis of fluxes not conclusive (no clear prediction that an outward particle pinch, which would explain the extra flattening of the density profile, should exist).**

Statement in EPS paper

- ***"The reasons for an increased core particle diffusivity are not clear yet. However, one could speculate that, at the lower shear and higher β characteristic of the hybrid scenario, ion temperature gradient (ITG) modes are stabilized and other modes become dominant, resulting in higher particle fluxes. Linear and non linear analysis with the GYRO gyrokinetic code [5] that can test this hypothesis is under way, but it is at a too early stage to draw conclusions on this point."***

Proposals to proceed

- **Hypothesis** (from EPS paper): at β_N~3 something changes in the particle/energy transport. Some evidence (77922) that KBM become important (GYRO simulations).
- Extend GYRO simulations to all four shots to see whether there is any difference between shots with and without enhanced core particle transport. Possibly non linear simulations to analyse the fluxes.
- Also, deploy GS2 to complement GYRO. (Or vice versa).
- Statistical study at low collisionality to see whether the spread in density peaking depends on β_N.and whether the high β_N shots are actually hybrid scenarios. From preliminary discussions with a few people it looks like this might not be the case but worth doing it thoroughly?
- Connect with Irina's work on rotation.
- Compare with baseline scenario at same I_p/B_T

Actions

- **Set up a working group before/during the ISM workshop in November at JET with the interested people.**
- **Identify who can do what.**
- **A preliminary written text exists already. If the analysis is conclusive it would be easy to produce a journal publication.**