LHCD during JET current ramp up

E. Barbato, I.Voitsekhovitch

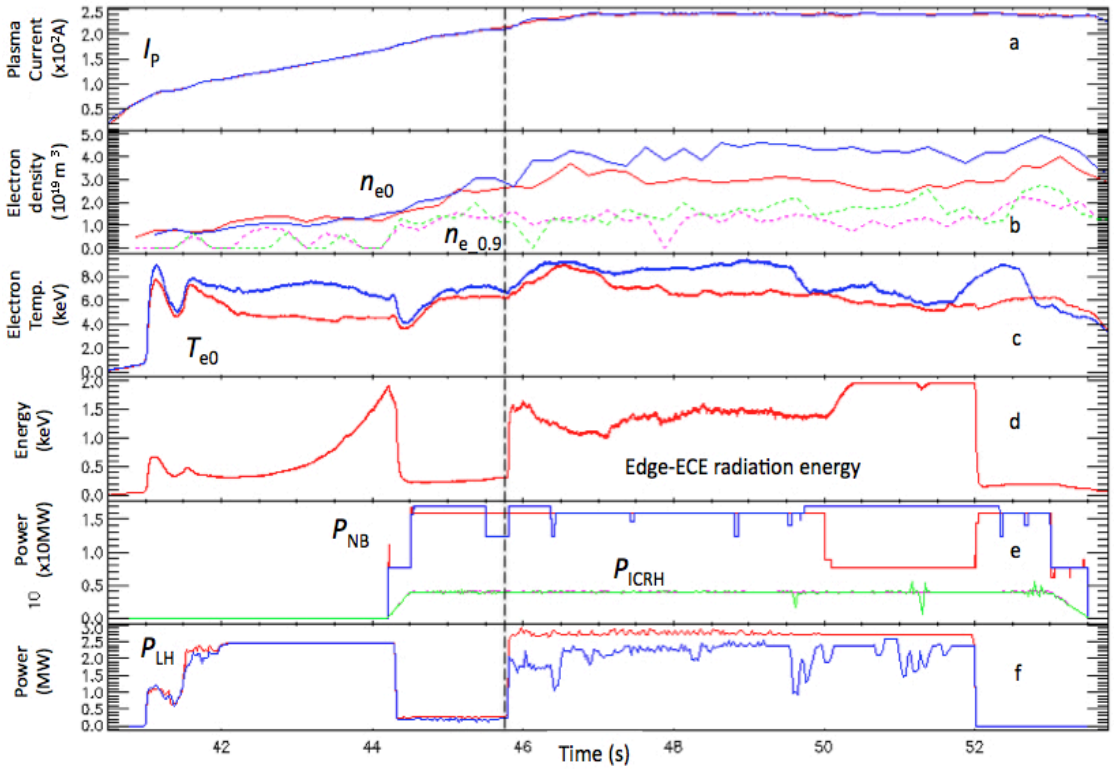
Aims

- *Have a simulated reference discharge (from JET)* useful to LHCD simulations in JT60_SA current ramp-up scenario
  - *(Is LHCD useful to JT60_SA scenarios? In case, to which extent?)*
- Simulate a JET discharge with additional heating in the flat-top (NBI+ICRF)
  - 1 step: Find the time evolution of the q-profile using ASTRA/FRTC in the interpretative mode.
  - 2 step: Have also a predictive simulation of the discharge
  - 3 step: Predictive simulation of JT60_SA

we are here

Choosing the JET discharge, also looking at the LHCD physics

- 53430 red lines (disregard blue lines)



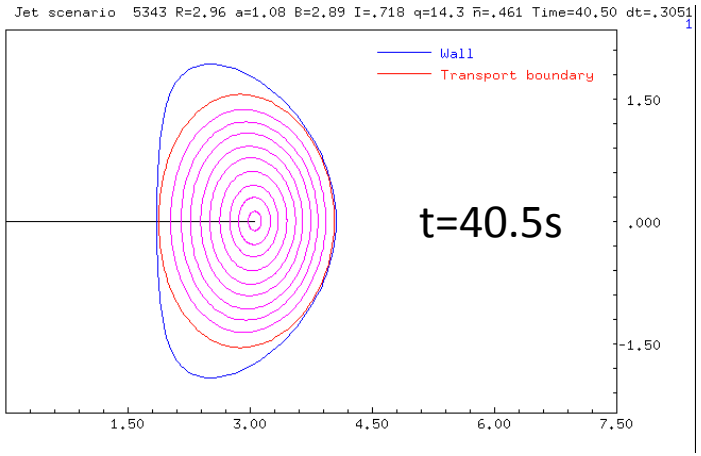
PLH=2.5MW
very early

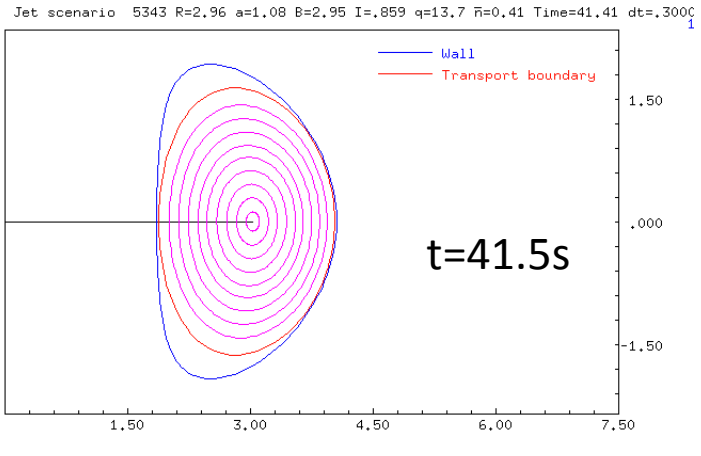
PNBI=15 MW
PICRF=5MW
at t >44s

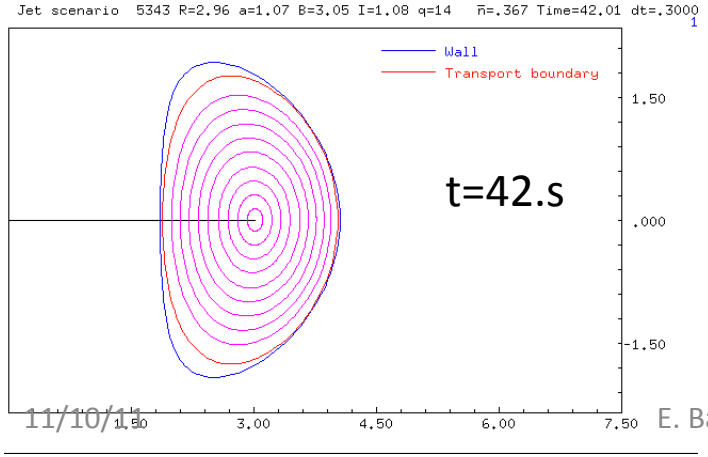
ECE signal starts to increase t~43 s, 1.5 sec after P_{LH} has turned on.

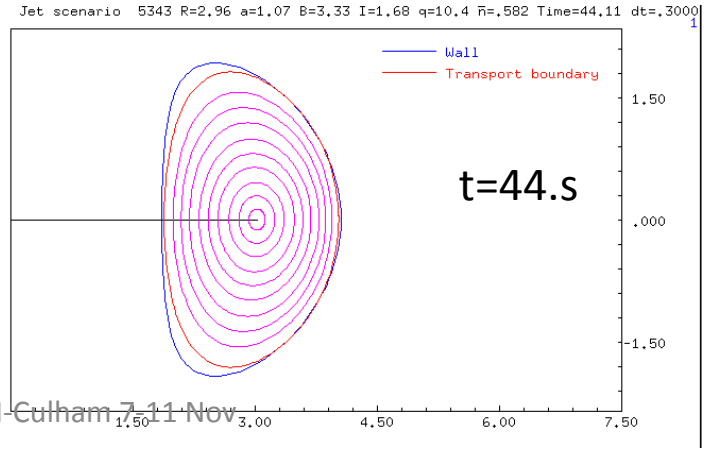
Astra/FRTC simulation

- *Equilibrium over time*

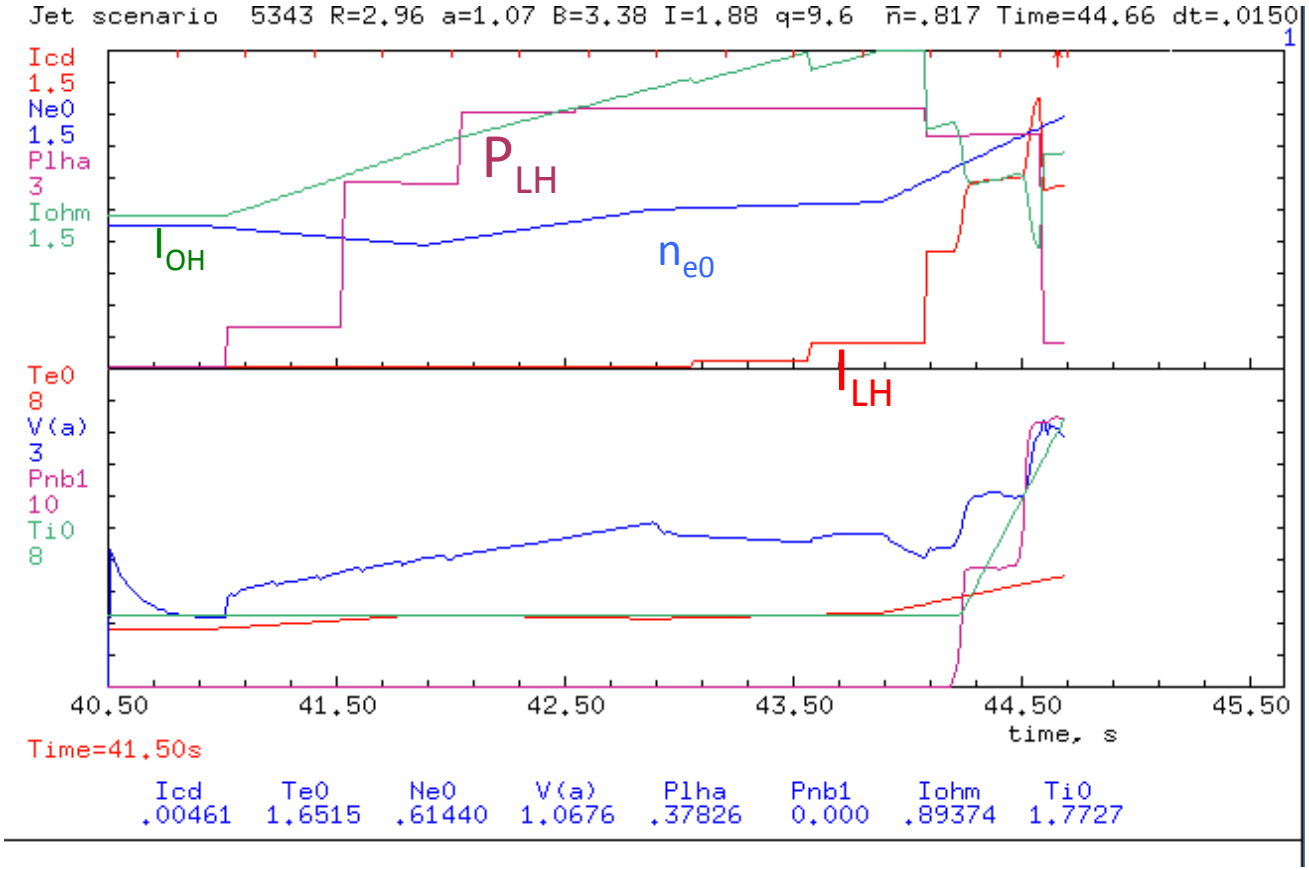






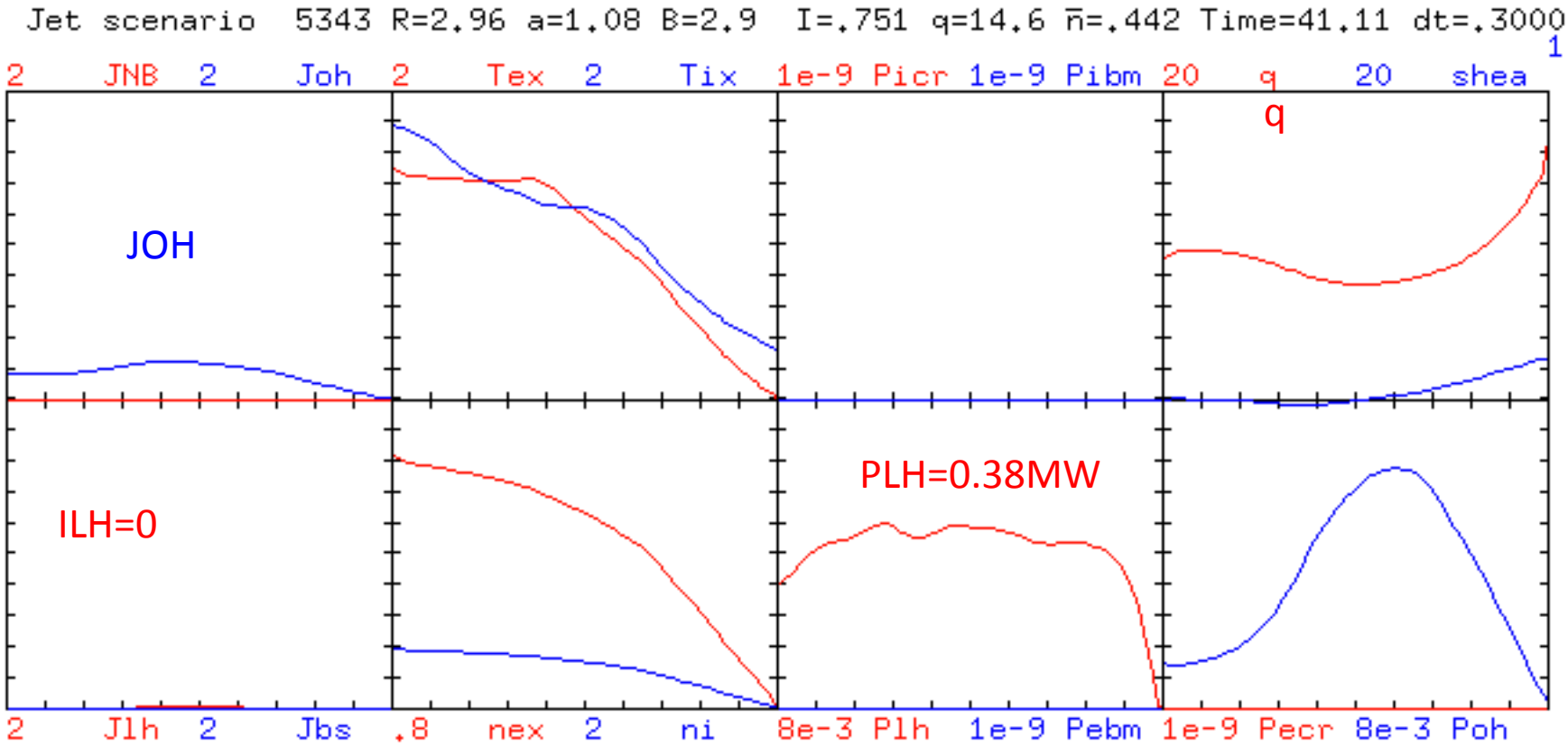


The ramp-up phase

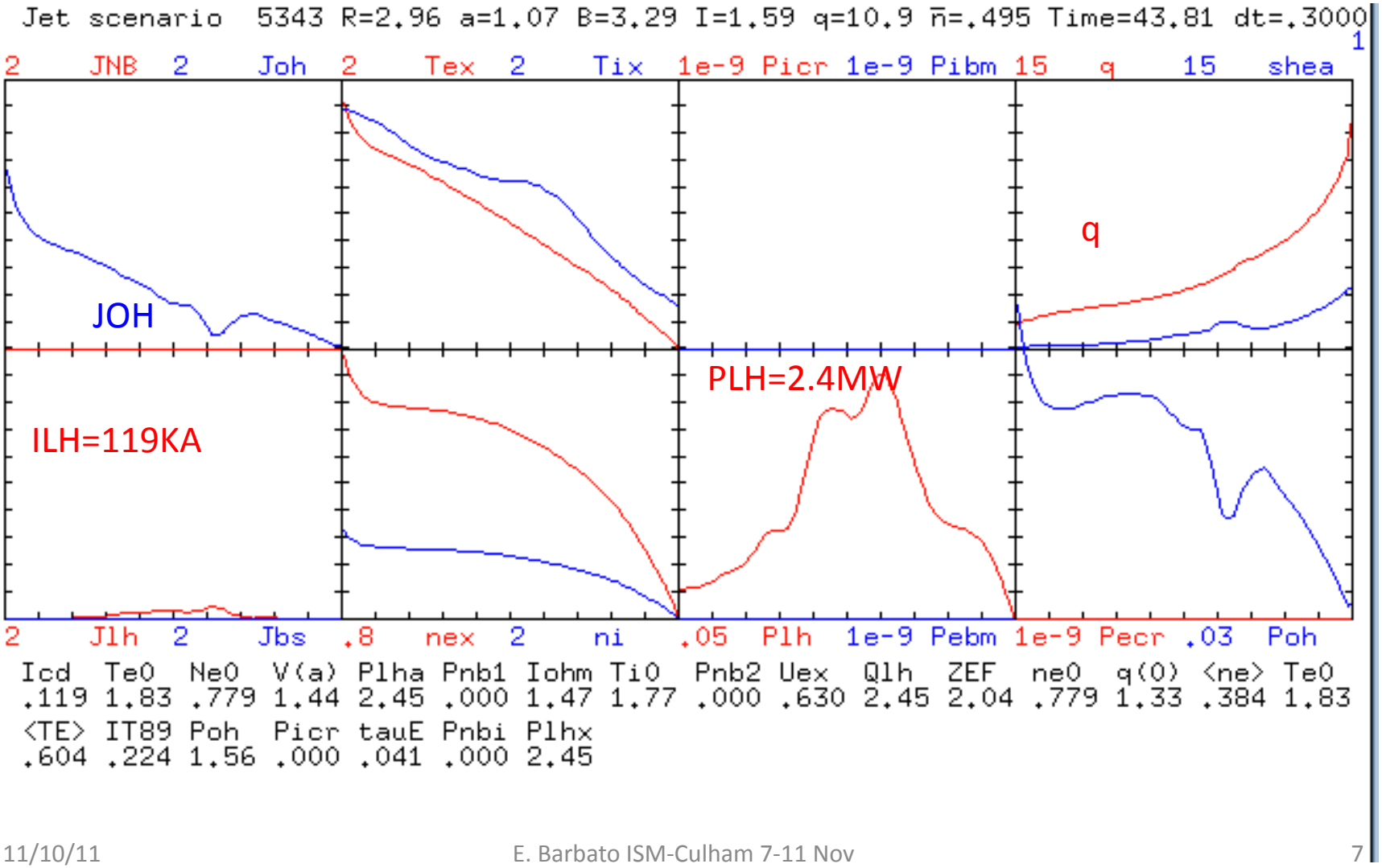


I_{LH} starts to increase t~ 43sec, 1.5 after P_{LH} has turned on.
nicely in agreement with ECE signal!

Profiles during the early stage of the current rump up (t=41 s): cold and dense plasma at this stage



t=43.8s


Jet scenario 5343 R=2.96 a=1.07 B=3.29 I=1.59 q=10.9 n̄=.495 Time=43.81 dt=.3000
2 JNB 2 Joh 2 Tex 2 Tix 1e-9 Picr 1e-9 Pibm 15 q 15 shea
JOH
q
ILH=119KA
PLH=2.4MW
2 Jlh 2 Jbs .8 nex 2 ni .05 Plh 1e-9 Pebm 1e-9 Pecr .03 Poh
Icd Te0 Ne0 V(a) Plha Pnb1 Iohm Ti0 Pnb2 Uex Qlh ZEF ne0 q(0) <ne> Te0
.119 1.83 .779 1.44 2.45 .000 1.47 1.77 .000 .630 2.45 2.04 .779 1.33 .384 1.83
<TE> IT89 Poh Picr tauE Pnbi Plhx
.604 .224 1.56 .000 .041 .000 2.45

Comments I

- *Collisional absorption of LHW power nicely accounts for LHCD experimental results on FTU at high density [*]*
  1. cold edge: No LHCD into the plasma
  2. hot edge: LHCD observed into the plasma

  Simulations accordingly show

  1. collisional absorption prevents any tail formation into the plasma
  2. collisional absorption does not prevent landau damping into the plasma.

[*] E. Barbato,Nucl. Fusion 51 (2011) 103032 http://stacks.iop.org/0029-5515/51/103032):

Comments II

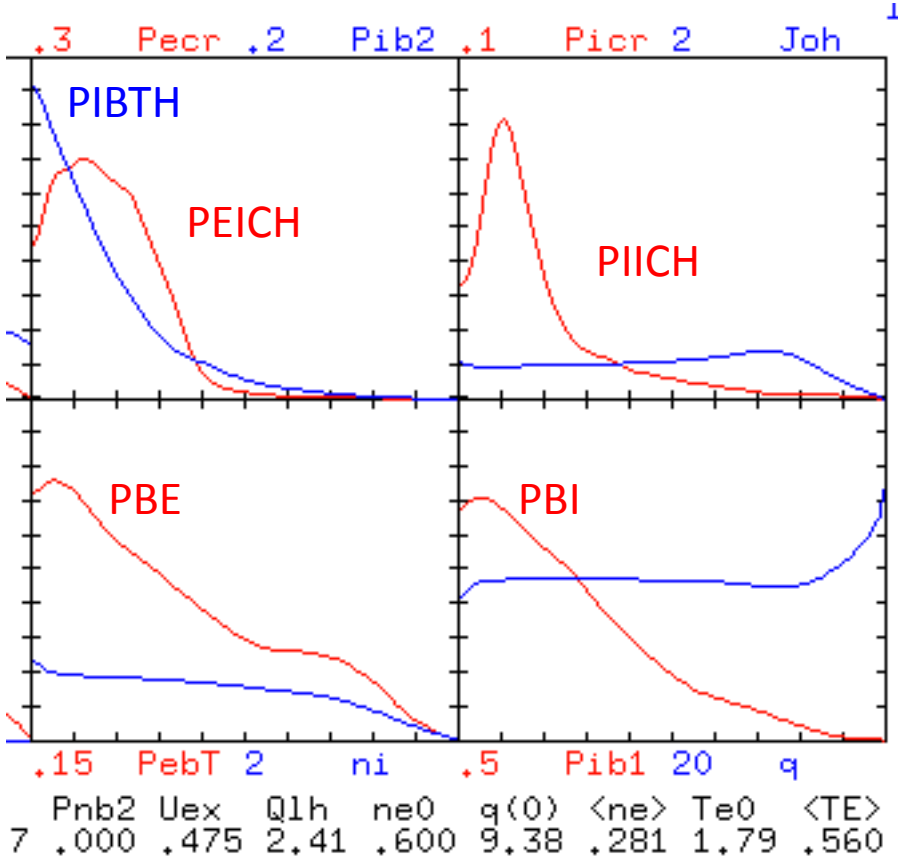
- Collisional absorptions of LHW power *seems to be important* also in the the early phase of the analyzed JET discharge

- It could account for the slowly growing ECE signal in this discharge.

How do we proceed with the simulation during the flat top?

- TRANSP run (already done) provide PICRF (e and i) to ASTRA
- Comparison of q profile from ASTRA and TRANP
- Comparison of the NBI part from ASTRA and TRANSP
- Complete the simulation

DATA from TRANSP run are starting to be provided to ASTRA



Plans

- *Proceed with the steps to JT60_SA predictive simulation.*

- *Look at other JET discharges where collisional absorption could be important*