Exp F03 high Temperature Plasmas

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Background

Since DT experiments on TFTR in 1996 it was detected a discrepancy between measurements of temperature by ECE(Electron Cyclotron Emission) and Thomson Scattering(TS). The difference appeared also in JET measurements with NBI heating.

Goals

Goal1:Resolving the discrepancy between measurements of temperature by ECE and Thomson Scattering at high electron temperature Te>6keV in discharges with pure electron heating.

Goal2: documenting the ECE vs TS temperature measurements on record high temperature discharges comparing the results with the theory of ECE emission.

References

V Krivenski , Electron Cylotron emission by non-maxwellian bulk distribution functions,
Fusion Engineering and Design 53(2001) 53

O Tudisco et al, ECH experiments during the current ramp-up in FTU ,
Proc 26° EPS Conf.Contr.Fusion Plasma Phys , 23J ,101-104(1999)

P Buratti et al, High Core electron confinement regimes in FTU with low or reversed
magnetic shear and high power density ECRH , Phys Rev Lett 82 , 560-563(1999)

C Sozzi et al , ITB formation with counter ECCD and LHCD and suprathermal ECCD experiments
On FTU in ITER relevant conditions , 2005 J.Phys.:Conf.Series 25, 198

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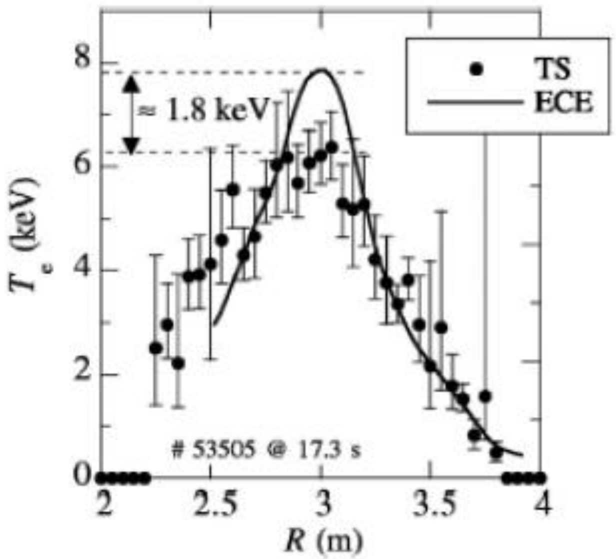

FIG. 3. Electron temperature profiles measured by Thomson scattering (LIDAR) and ECE (Michelson interferometer, second harmonic, X mode) for a plasma with ICRF+NBI heating ($P_{\mathrm{ICRH}}=5$ MW, $P_{\mathrm{NBI}}=3$ MW), showing the disagreement existing between the two measurements in the plasma core during strong auxiliary heating.

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Summary of the session 24/06/14

FTU control room physics summary	**Date 24/06/2014**
Experiment	Alta Te
RdO	F. Belli, B. Esposito
Exp. Coordinator	F. Orsitto , G. Granucci
PIC	M. Marinucci

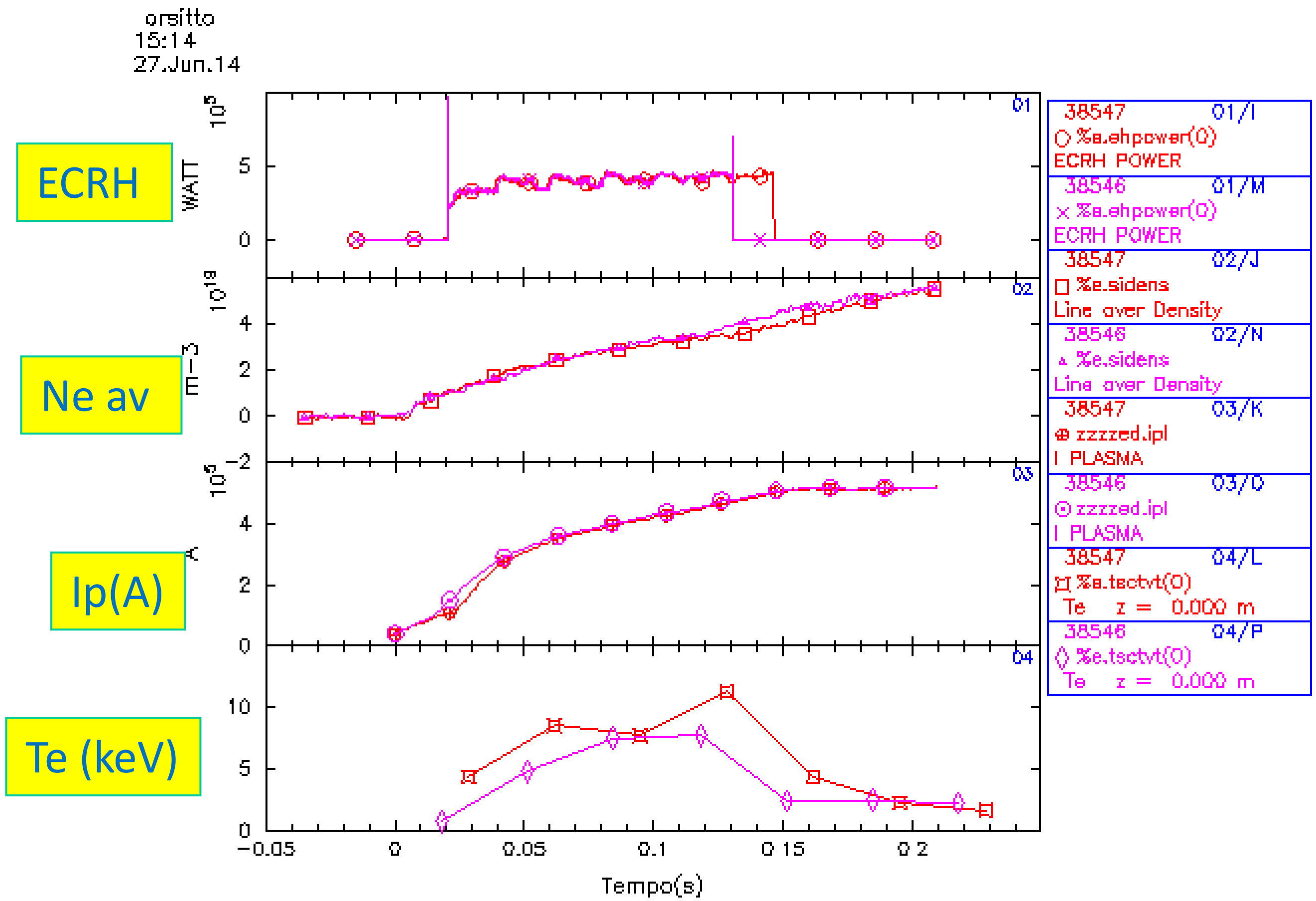
1. Number of shots done for the programme =2
2. **Point 1 of the shot list proposed and agreed : partially realized (dτ ECRH <<200ms)**

38543 ohmic reference

38546 ECRH 400kW t=20ms -132ms
Te_Thomson =7.69keV @ t=119ms

38547 ECRH 400kW t=20ms - 146.3ms
Te_Thomson =11.3keV @t=128ms

Traces 38546 & 7

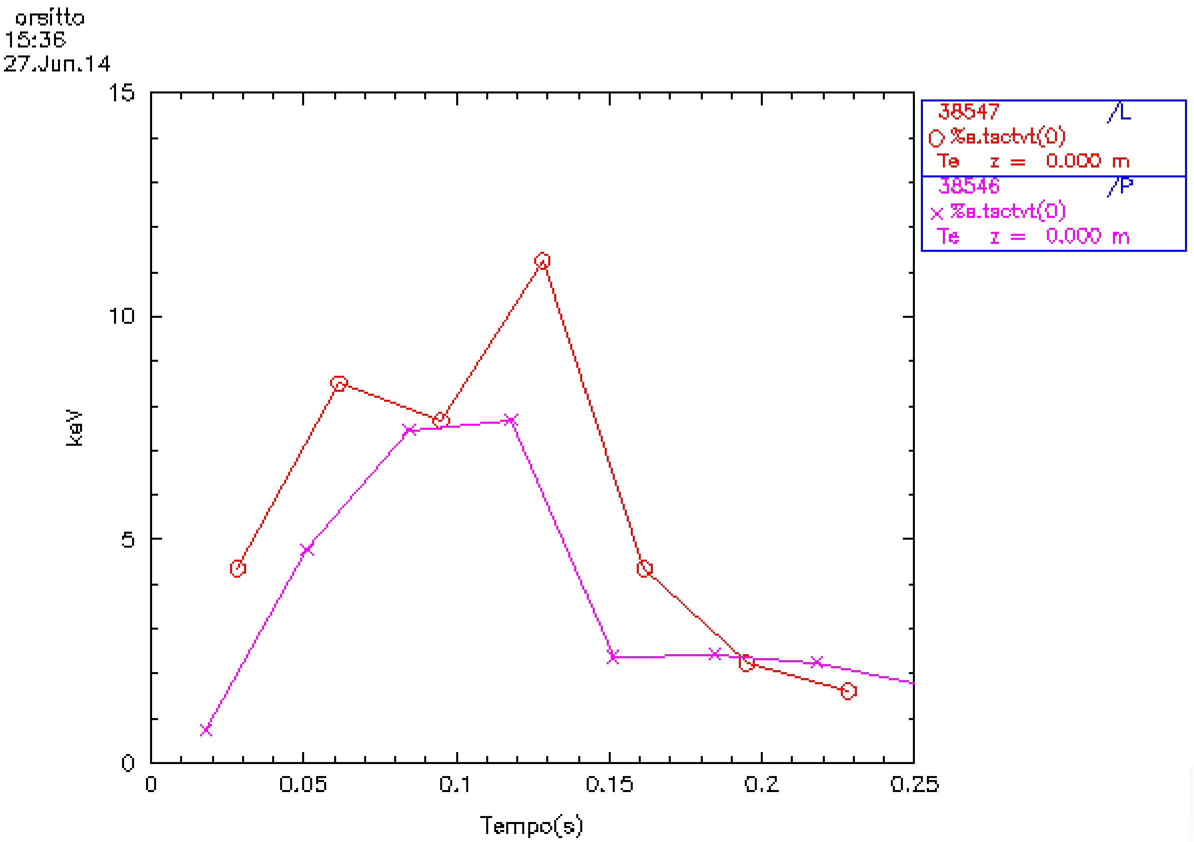


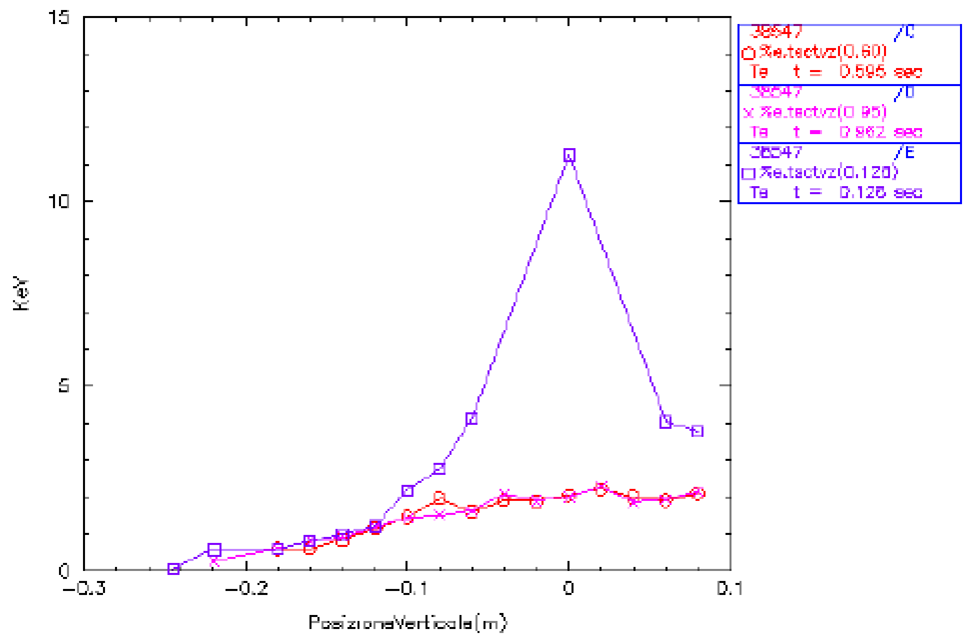
Shot# OK for the programme

38543 ohmic reference

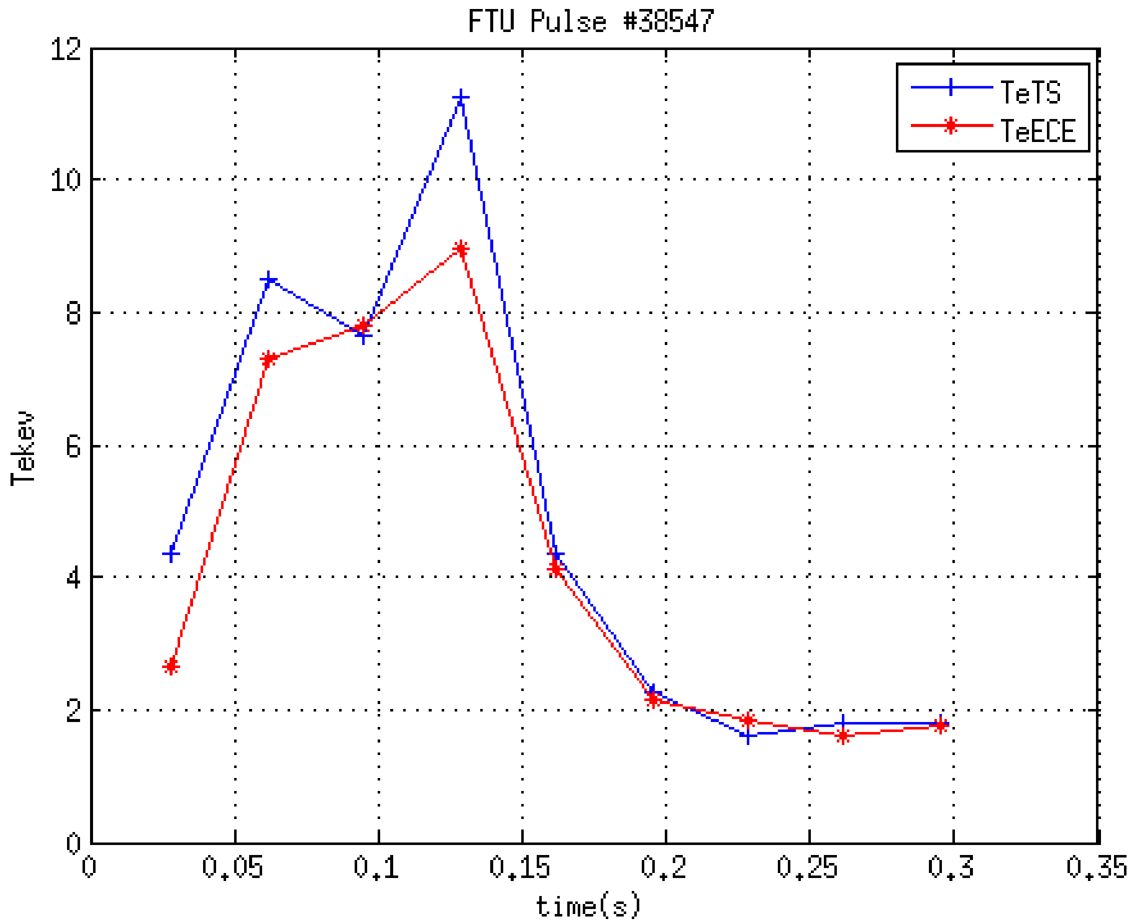
38546 ECRH 700kW t=20ms -132ms Te_Thomson =7.69keV @ t=119ms

38547 ECRH 700kW t=20ms - 146.3ms Te_Thomson =11.3keV @t=128ms

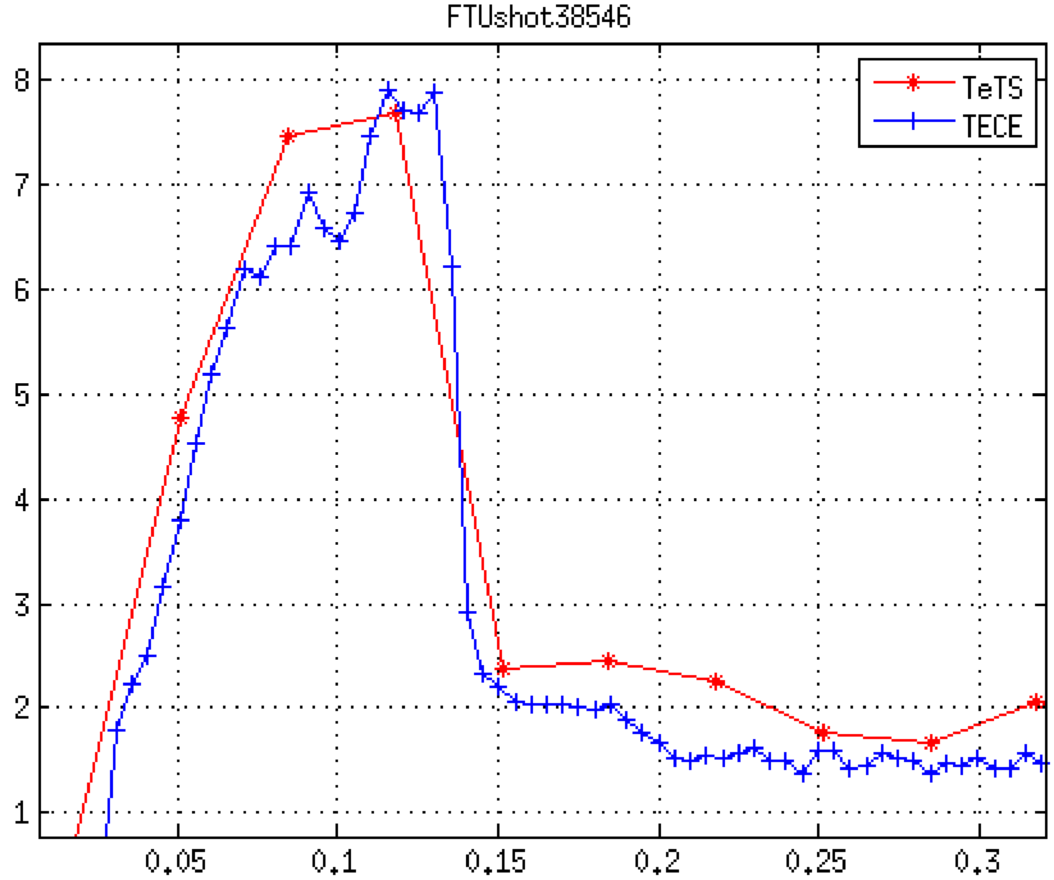




Internal Transport Barrier region Δz=[-8cmm;+8cm]
ITB @ z/a=1/4
The ITB develops in a time Δt=33ms



FTU Pulse #38547
TeTS
TeECE
Tekev
time(s)
0
2
4
6
8
10
12
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35



FTUshot38546
TeTS
TECE
8
7
6
5
4
3
2
1
0.05
0.1
0.15
0.2
0.25
0.3

ECRH on Current Ramp for high Te

Pulse list exp F04

Obiettivo : ottenere ECRH con deposizione on-axis e Te≥8keV
Strategia : shot riferimento #38547 , ritardare la riconnessione sulla q=2 di 10-20ms in maniera da favorire la crescita della temperatura.
Richiesti P_{ECRH}≥ 600kW.

A. riscaldamento centrale con tre gyrotrons
A1.riprodurre lo shot 38547, curare sempre che la scarica **sia ben centrata**, e **la posizione sia stabile. (2 shots)**

A2. Se si presenta la riconnessione (a t=0.07s) provare : gyrotron a 20° toroidali per allargare il profilo di Te e un altro per far salire la temperatura centrale.(2 shots)

A3. Se non viene ritardata la riconnessione (a t=0.07s) col metodo al punto 2 provare con una rampa piu' veloce anticipando il raggiungimento del flat top di Ip=530kA da t=0.169s a t=0.140s.(1 shot) , ma senza usare il metodo del punto 2 .(1 shots)

A4. Se non viene ritardata la riconnessione (a t=0.07s) nella scarica del punto 3 Ed usare il metodo del punto 2 .(1 shot) , e vedere se la riconnesisone veiene ritardata. (1 shot).

B. **Riscaldamento centrale con due gyrotrons per almeno 200ms , ed ECCD con un gyrotron**
B1. Partendo dal riferimento shot #38547 provare riscaldamento centrale con due gyrotrons ed il terzo gyrotron in anti current drive centrale (angolo toroidale ϕ= -10gradi, ref shot #26671) e ripetere i punti 1 e 2. Studiare la dinamica ed il ritardo della riconnessione.

C. Cambiare lo shot di riferimento : riprodurre lo shot #15020 (700kA)
Passare a riprodurre lo shot #15020 (700kA e profili bucati di temperatura) e ripetere i punti 1 , 2 e B1.

Summary and future work

Summary

1. Number of shots done for the programme =2
2. Point 1 of the shot list proposed and agreed : partially realized ($d\tau$ ECRH <<200ms)

Work to still be done

1. Point 1 of the shot list to be completed with $d\tau$ ECRH =200ms, and possibly PRF ≥700kW

2.Scan in time start of ECRH (3 shots) with $d\tau$ ECRH =200ms

3 . Se si presenta la riconnessione (a t=0.07s) provare : gyrotron a 20° toroidali per allargare il profilo di Te e un altro per far salire la temperatura centrale.(2 shots)

4. Se non viene ritardata la riconnessione (a t=0.07s) col metodo al punto 2 provare con una rampa piu' veloce anticipando il raggiungimento del flat top di Ip=530kA da t=0.169s a t=0.140s. ma senza usare il metodo del punto 2 .(1 shots)

5. Se non viene ritardata la riconnessione (a t=0.07s) nella scarica del punto 3 Ed usare il metodo del punto 2 .(1 shot) , e vedere se la riconnesisone veiene ritardata. (1 shot).