

ISM working session, March 11 2013



EFDA

EUROPEAN FUSION DEVELOPMENT AGREEMENT

Task Force

INTEGRATED TOKAMAK MODELLING

Modelling of the OH Ramp-Down Phase of JET Hybrid Pulses Using JETTO with Bohm-gyro-Bohm (BgB) Transport

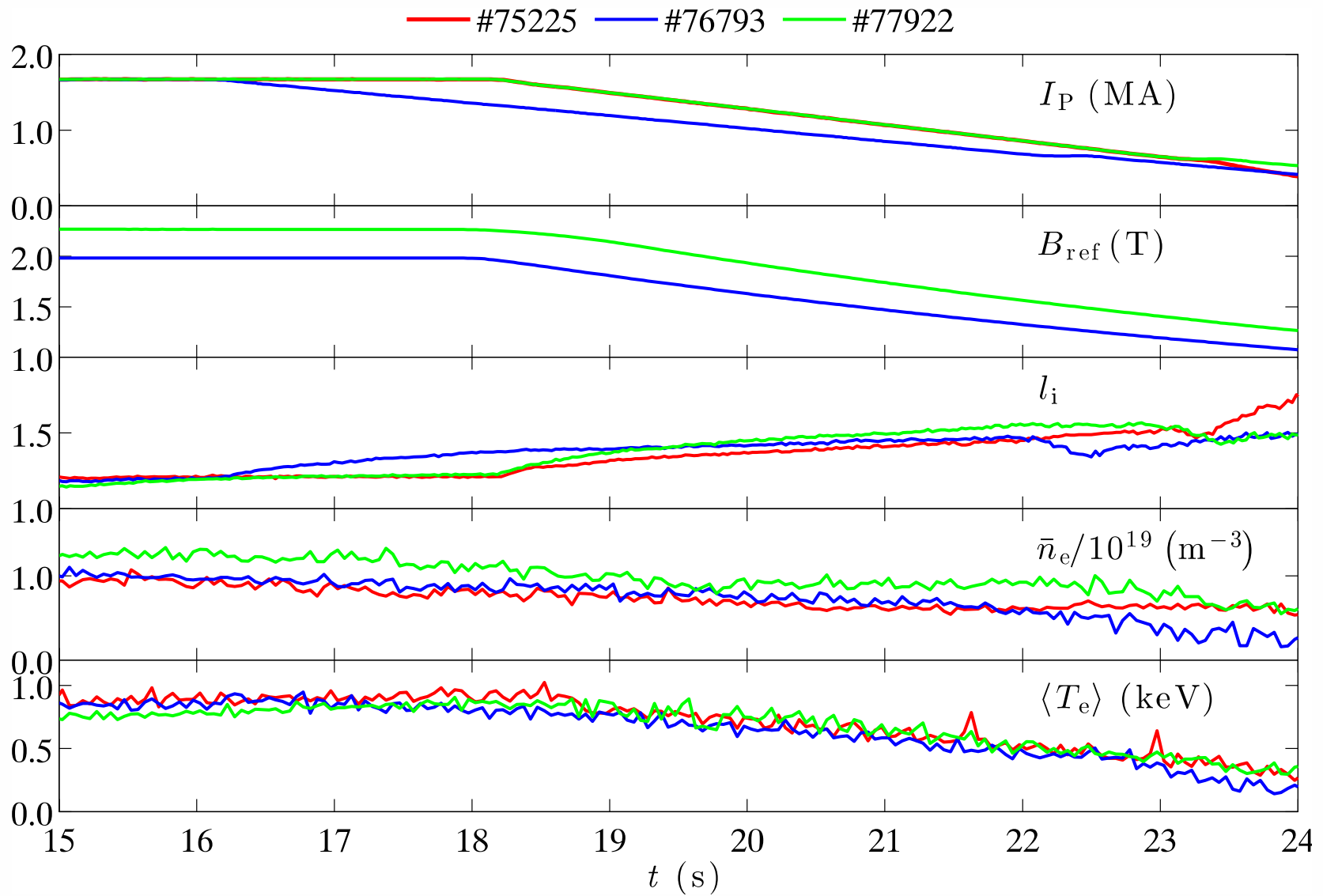
J. P. S. Bizarro, F. Kochl, I Voitsekhovitch,

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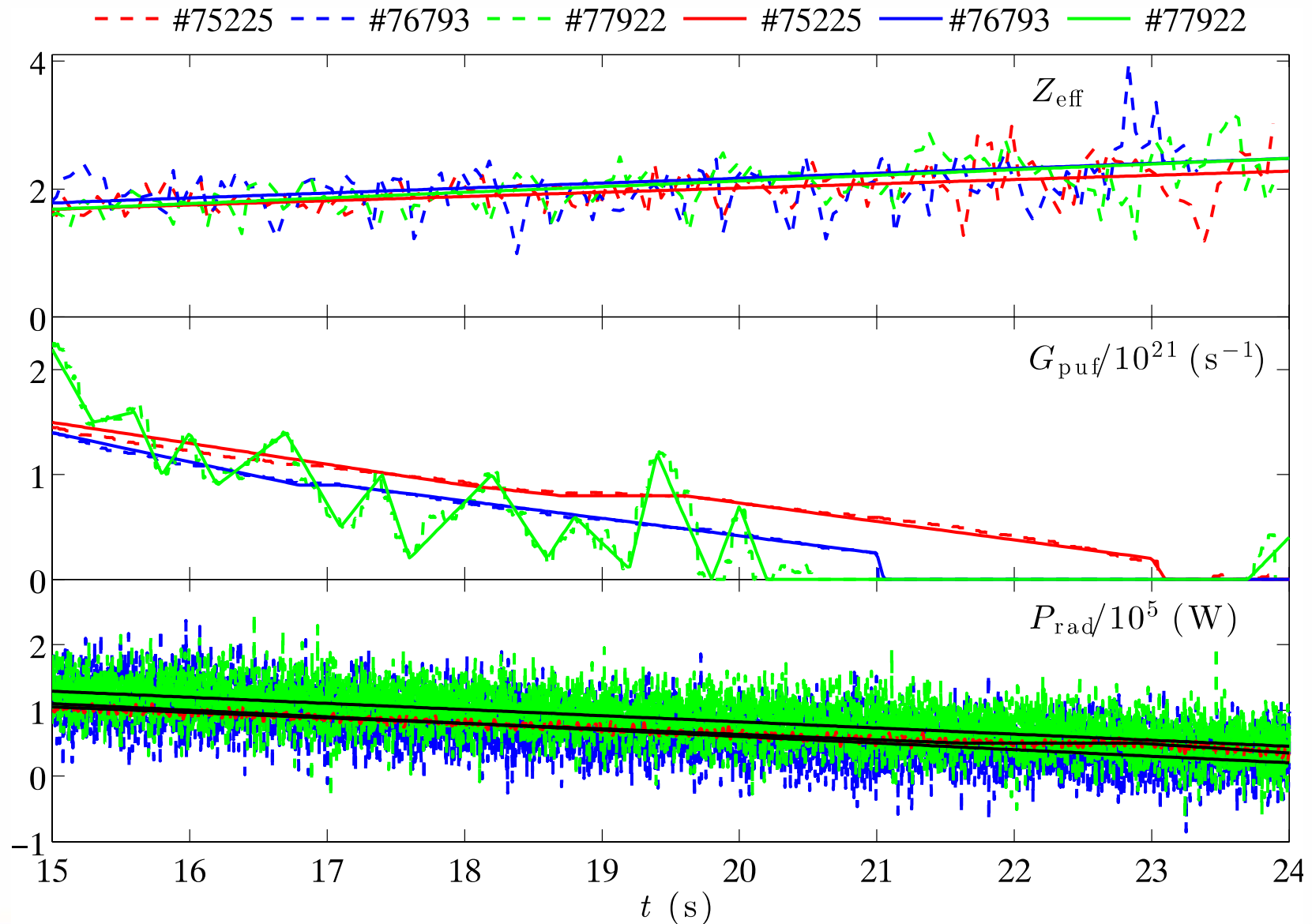
Experimental scenario

- 1. Three JET hybrid pulses have been chosen to model their OH ramp-down phases: shots #75225, #76793 and #77922**
- 2. Two different ramp rates (0.17 and 0.21 MA/s) combined with two different linear-average electron densities at the beginning of the ramp (0.8 and $1.1 \times 10^{19} \text{ m}^{-3}$)**
- 3. Small, frequent sawteeth until nearly the end of the ramp (with period $0.1 - 0.05 \text{ s}$ and inversion radius $0.25 - 0.3$)**

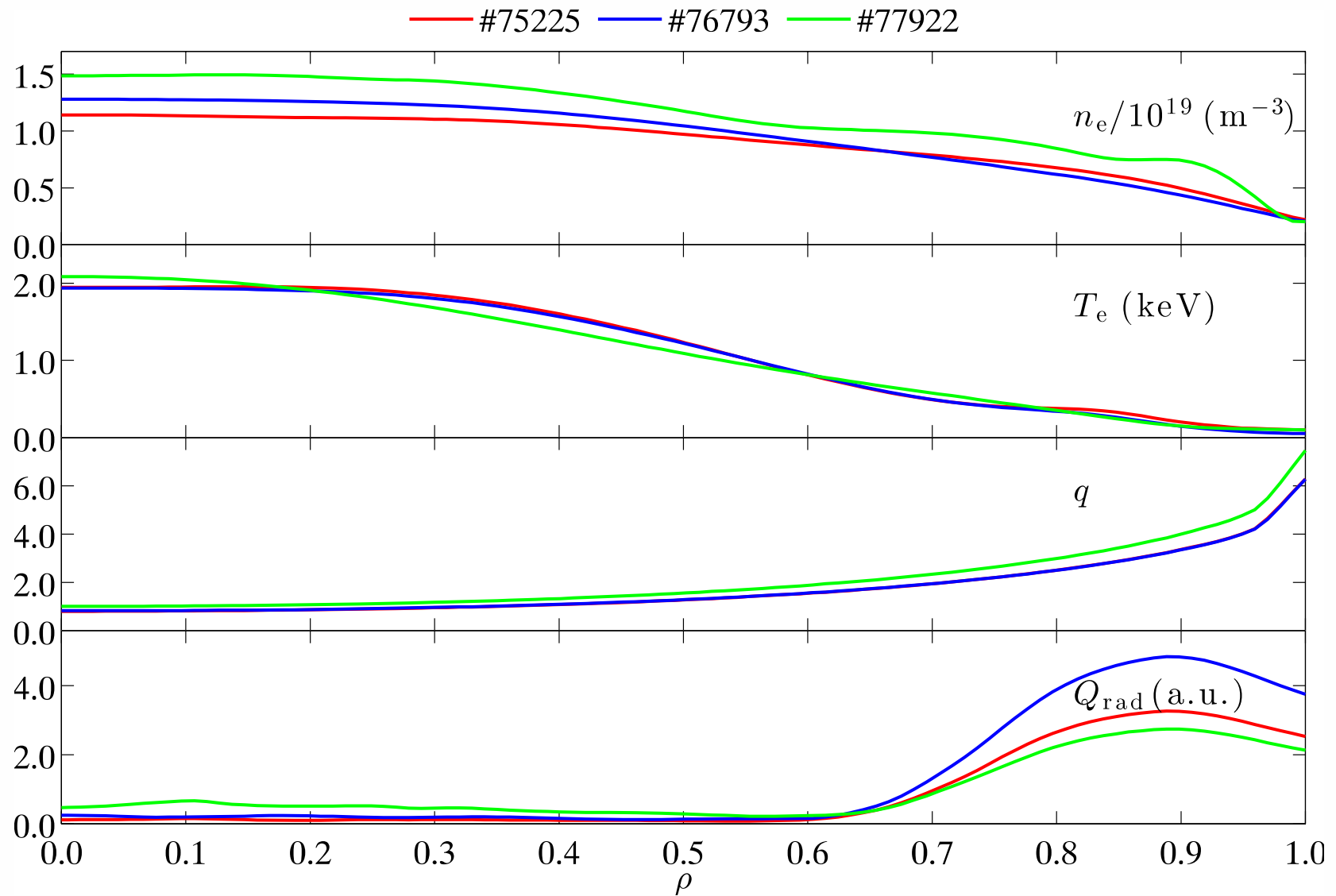
Time traces (experiment)



Time traces (experiment & input)



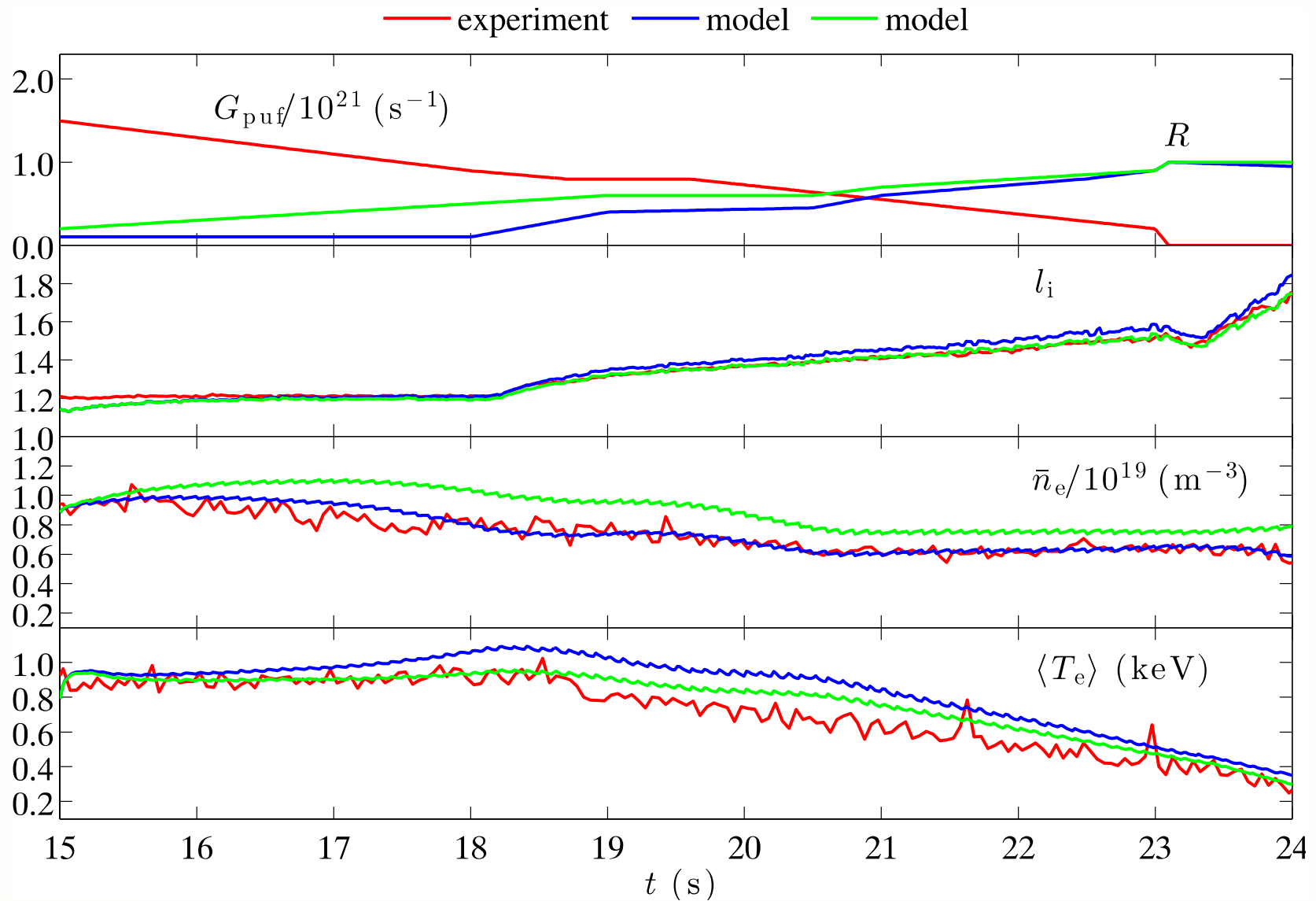
Initial profiles (experiment)



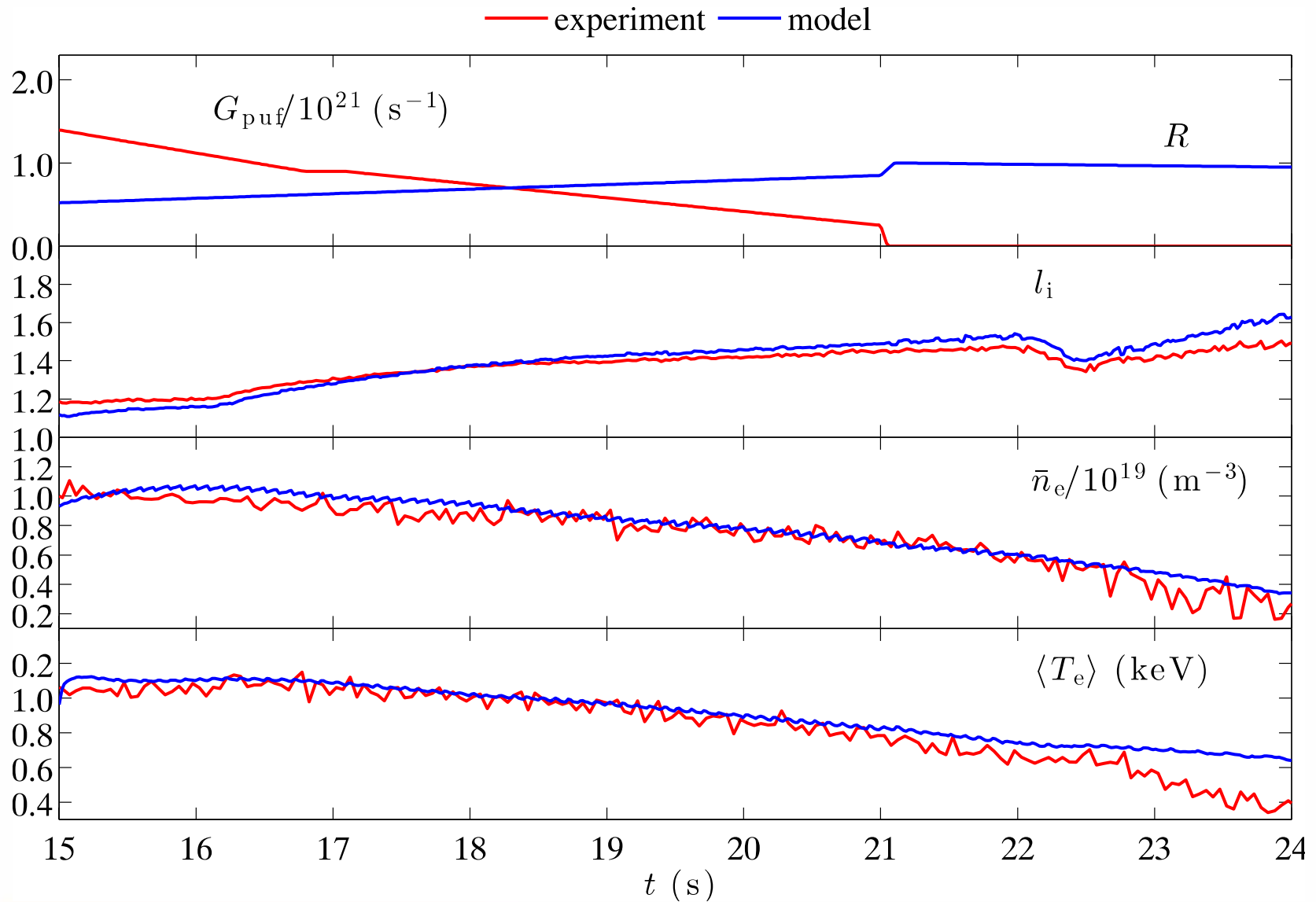
BgB JETTO modelling

- 1. Use the original L-mode BgB model**
- 2. Use as much as possible the experimental data to fix the JETTO input**
- 3. Try to follow the experimental time traces for average electron density and temperature by essentially tuning the particle sources (gas puffing and recycling)**
- 4. Carry out this exercise ‘playing’ only with recycling and taking the gas puffing rate into the chamber as measured**

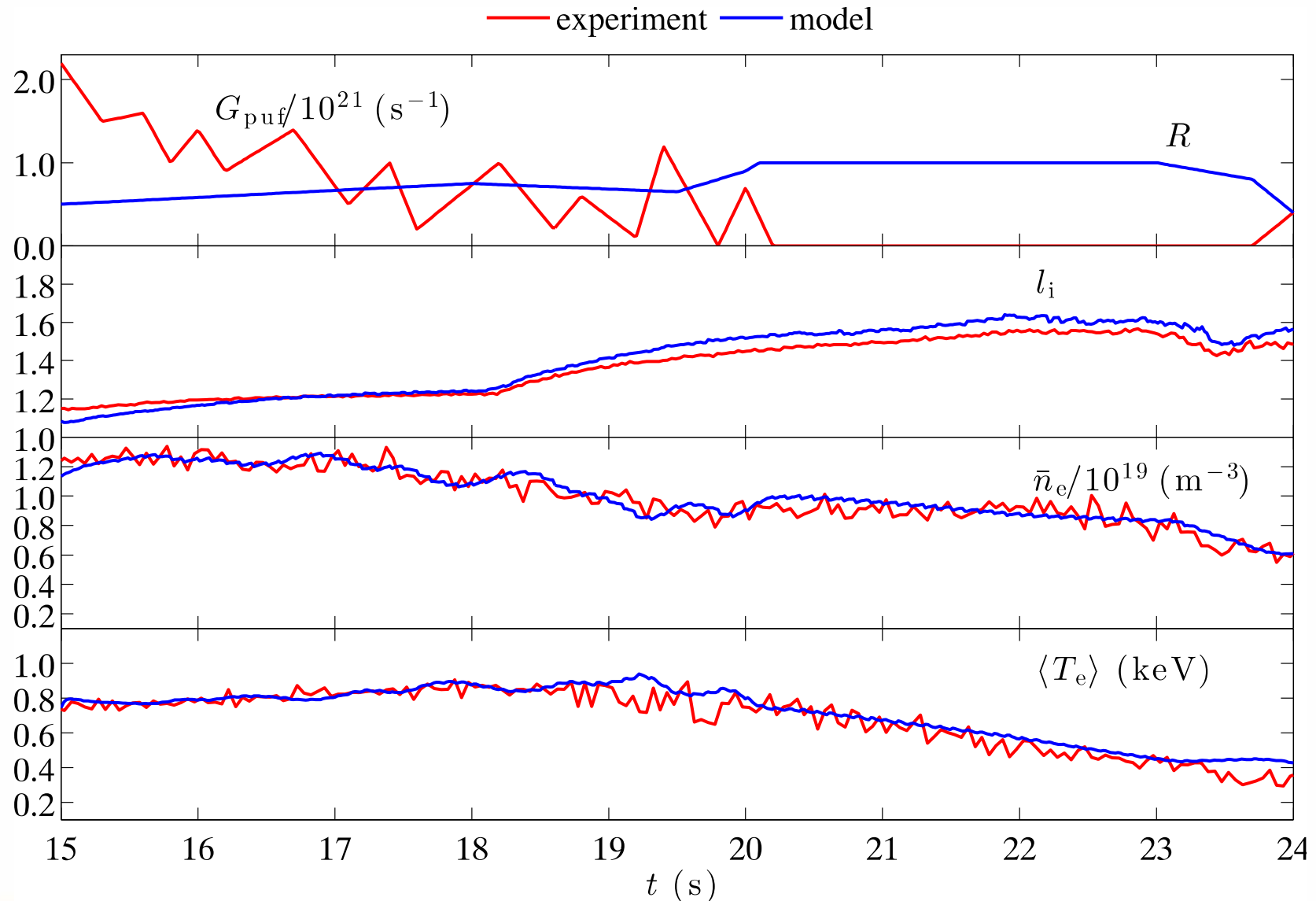
Model vs. experiment (time traces #75225)



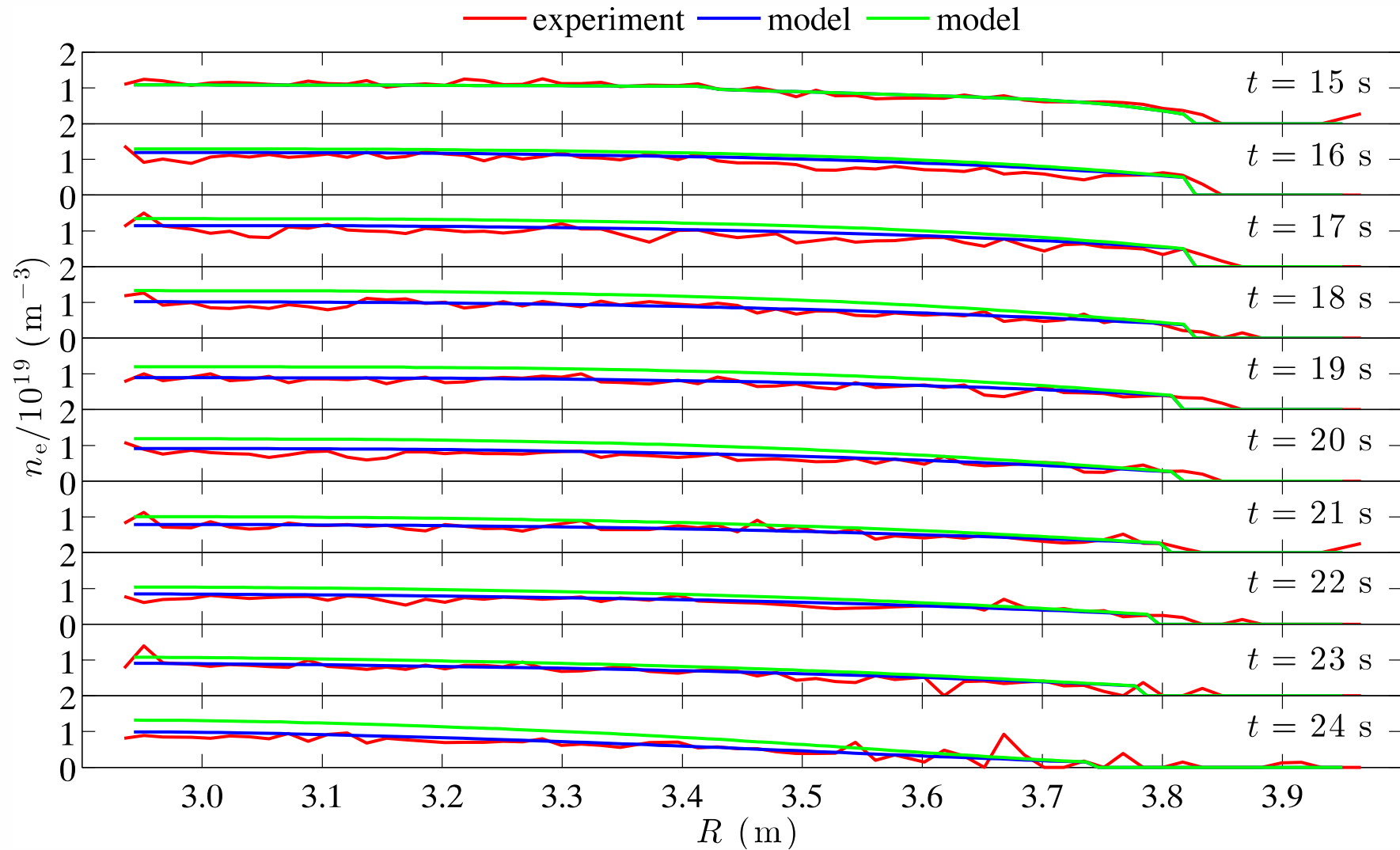
Model vs. experiment (time traces #76793)



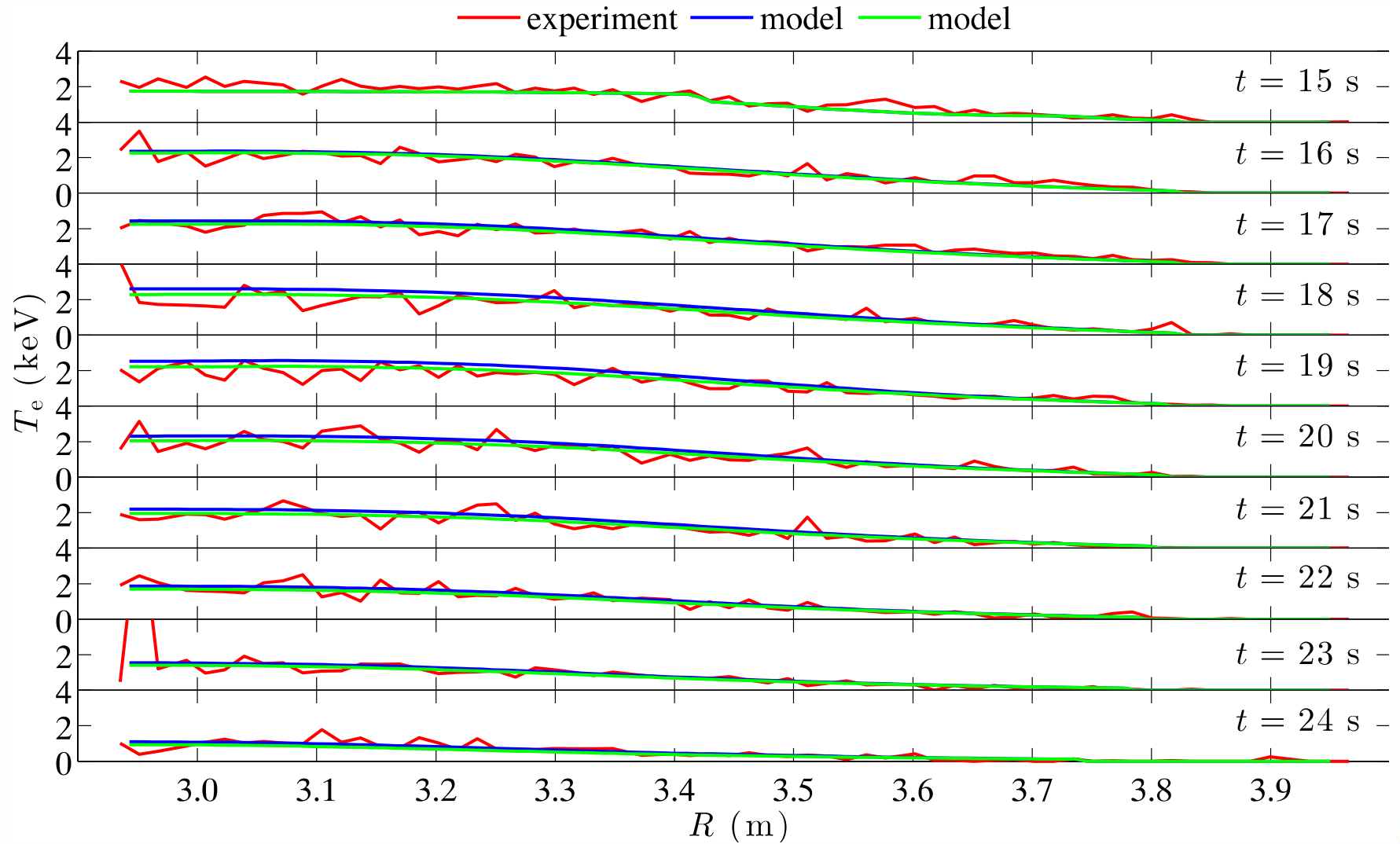
Model vs. experiment (time traces #77922)



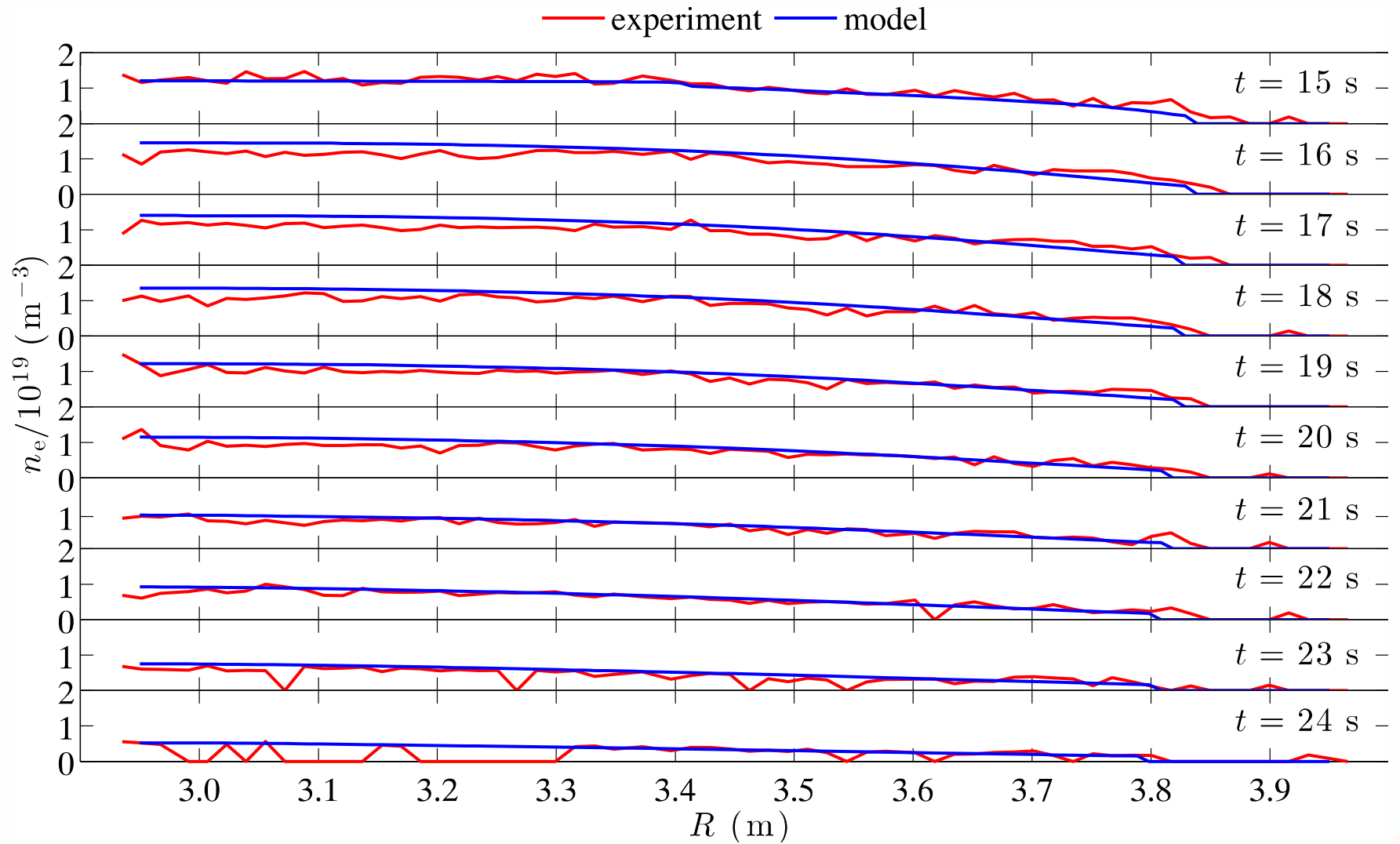
Model vs. experiment (density profiles #75225)



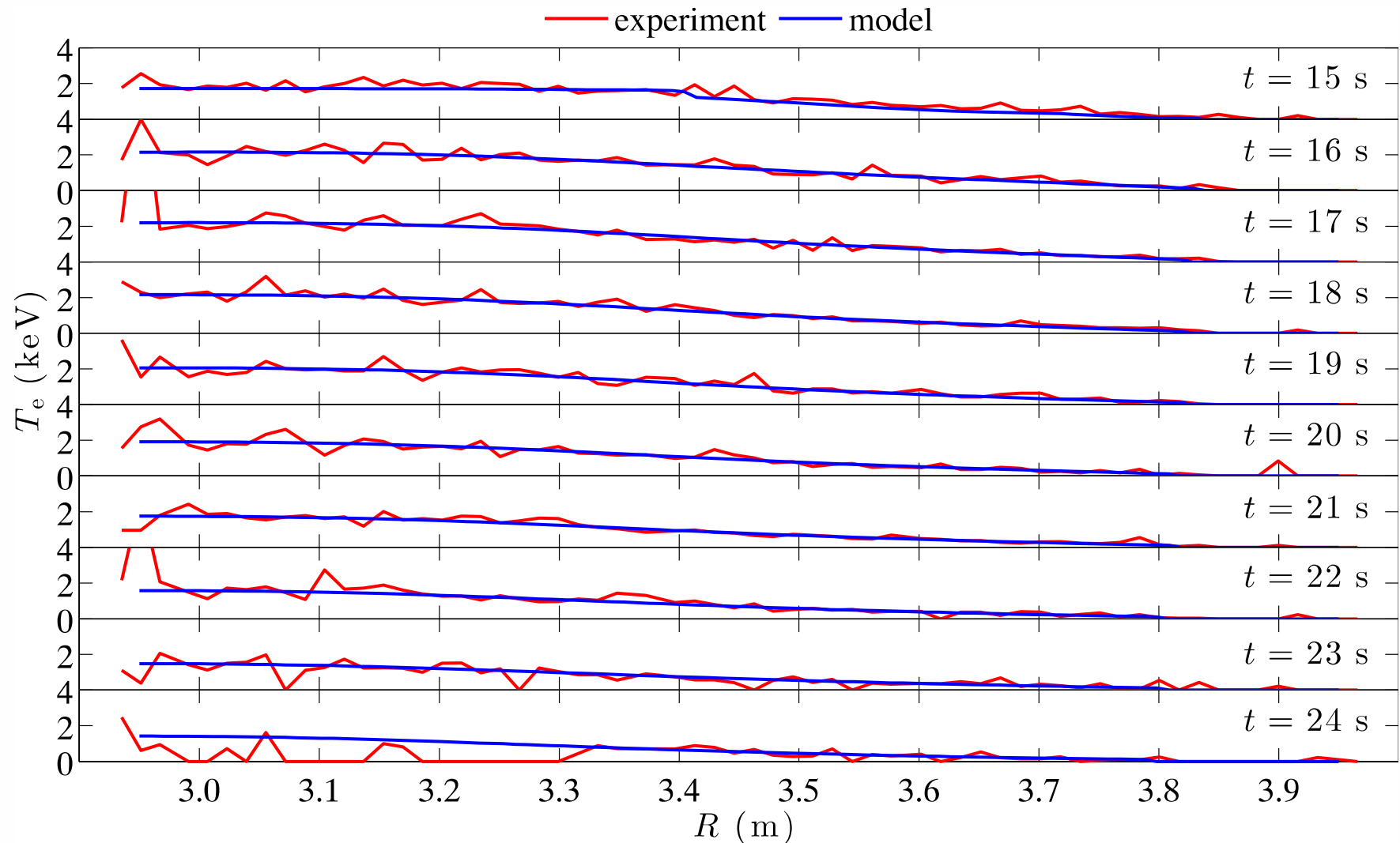
Model vs. experiment (temperature profiles #75225)



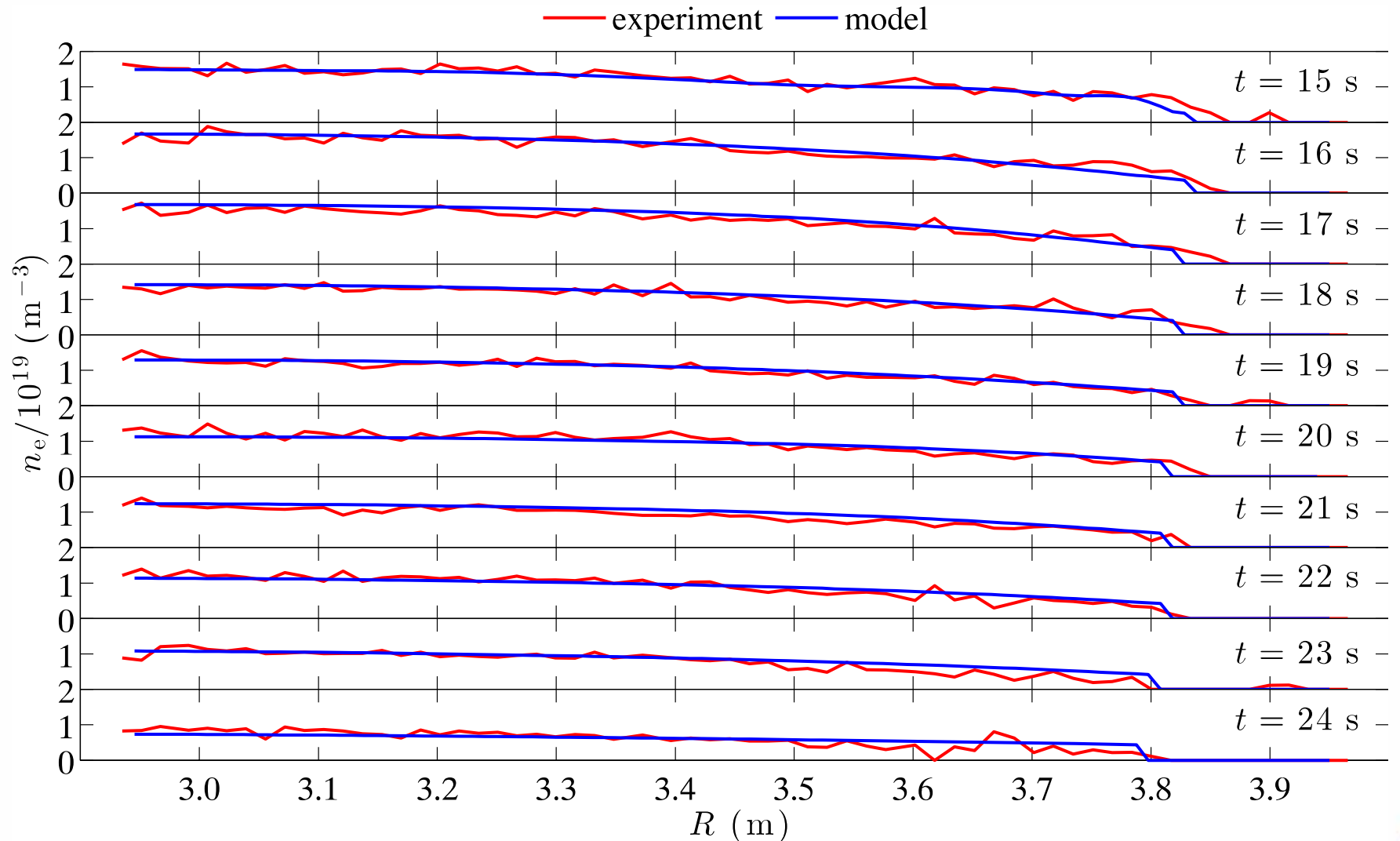
Model vs. experiment (density profiles #76793)



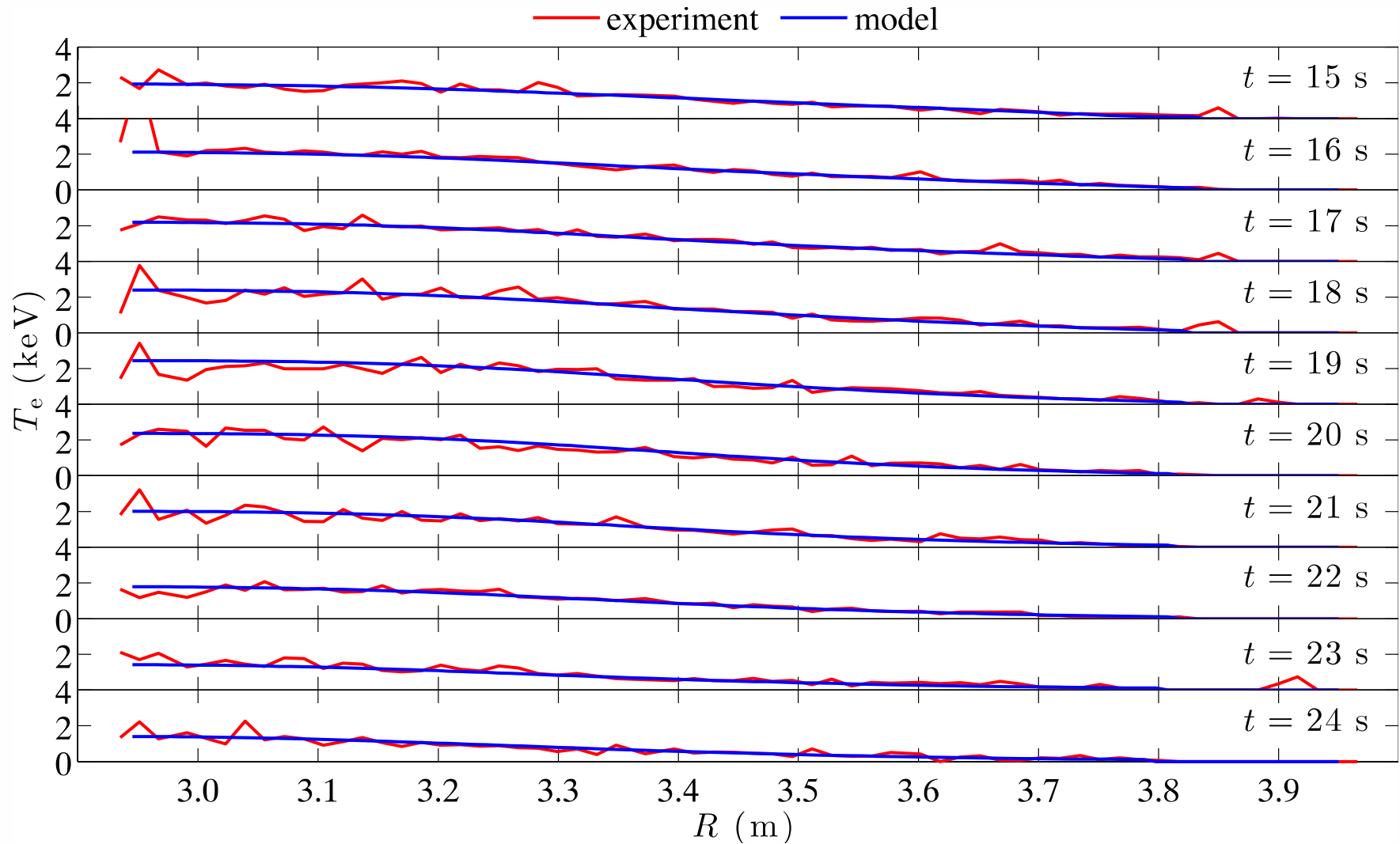
Model vs. experiment (temperature profiles #76793)



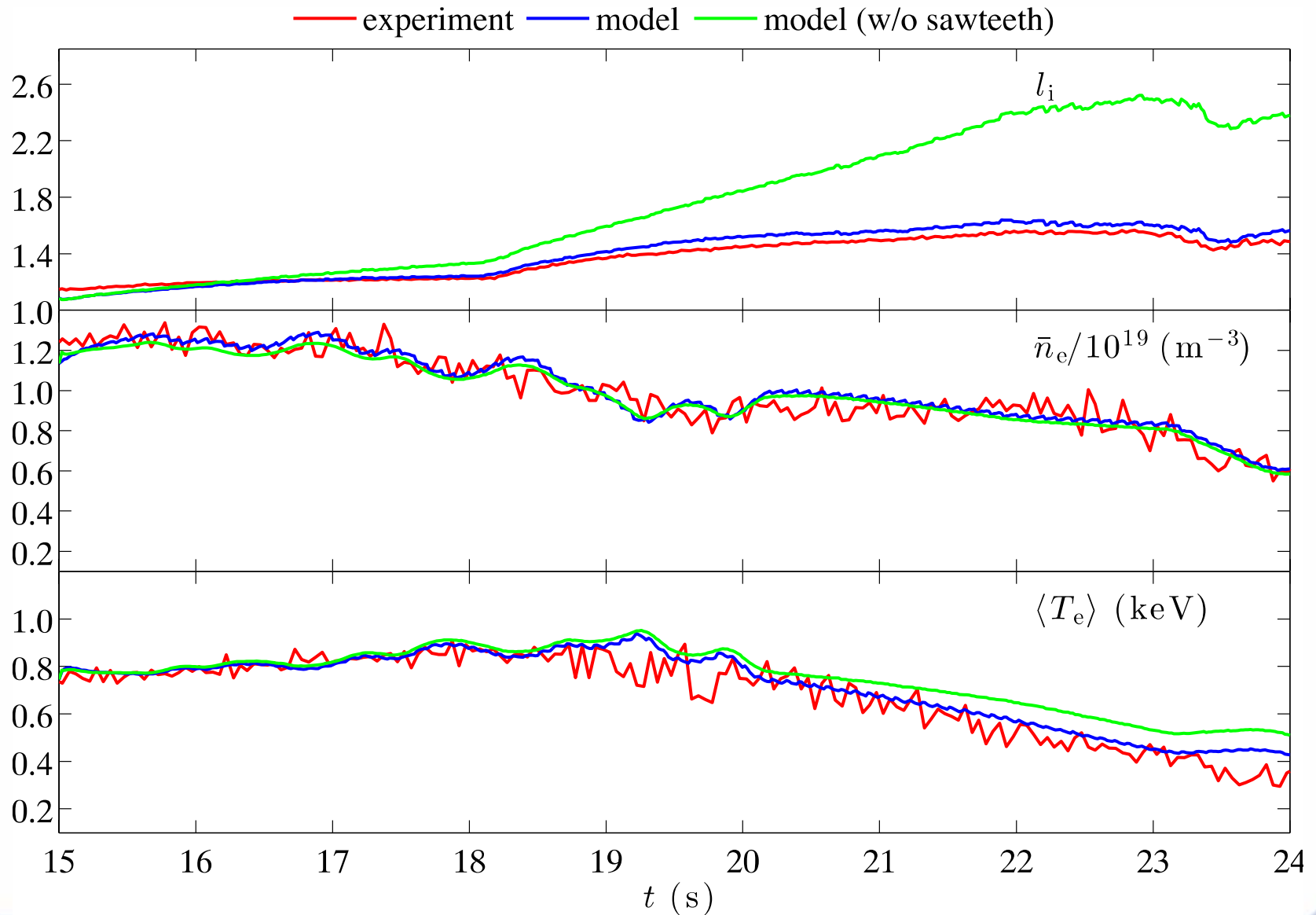
Model vs. experiment (density profiles #77922)



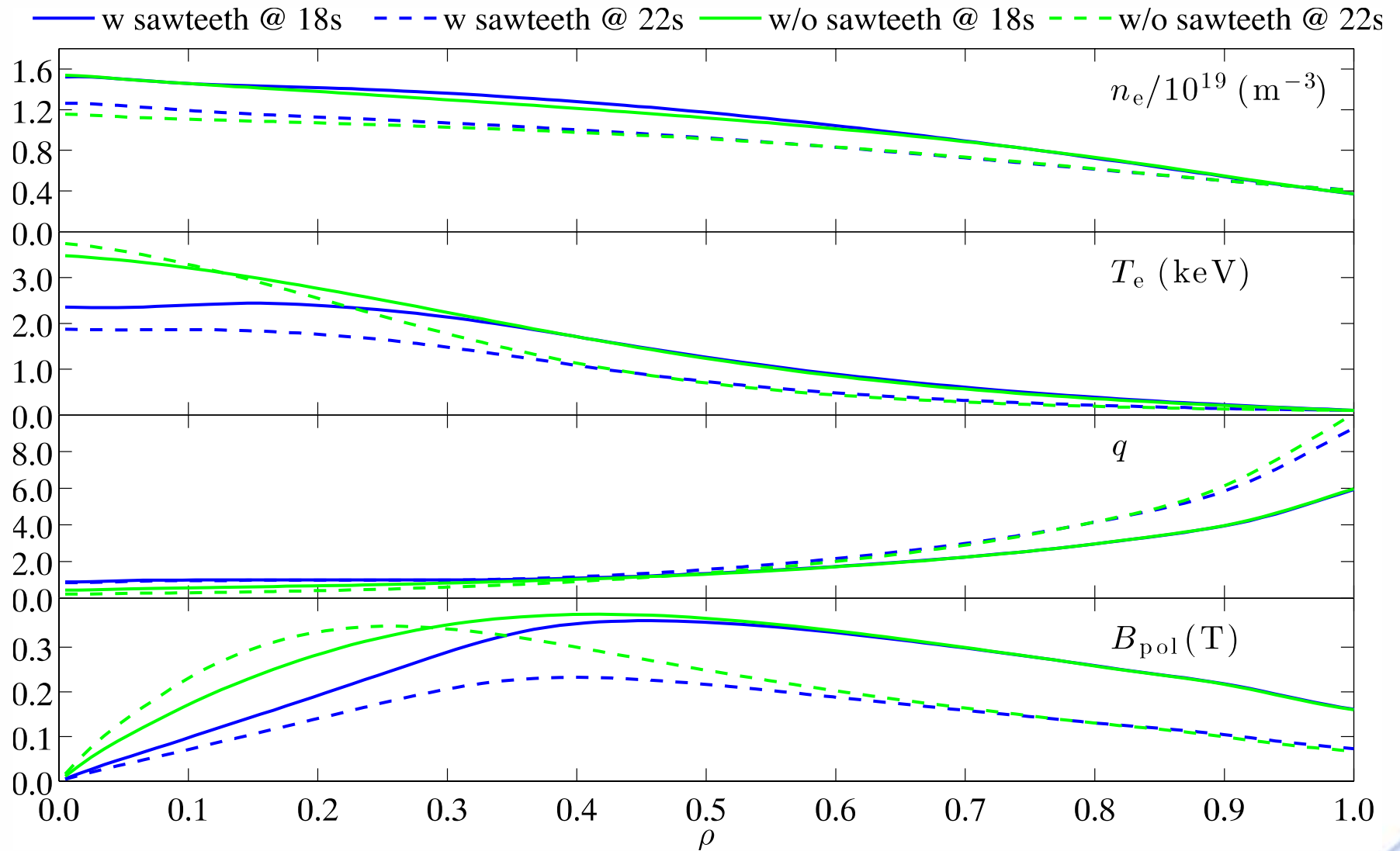
Model vs. experiment (temperature profiles #77922)



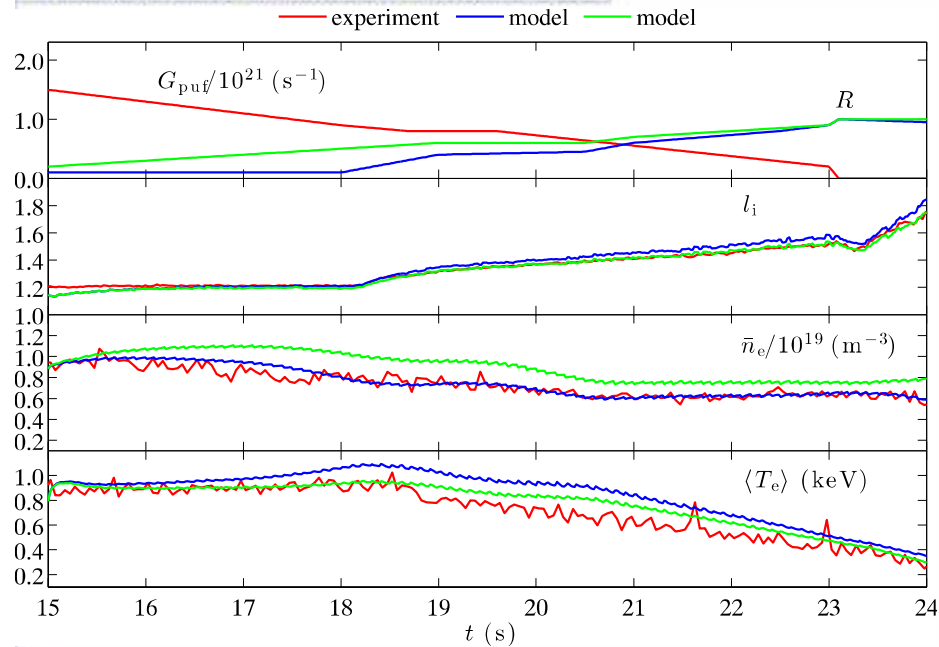
Sawteeth model (time traces #77922)



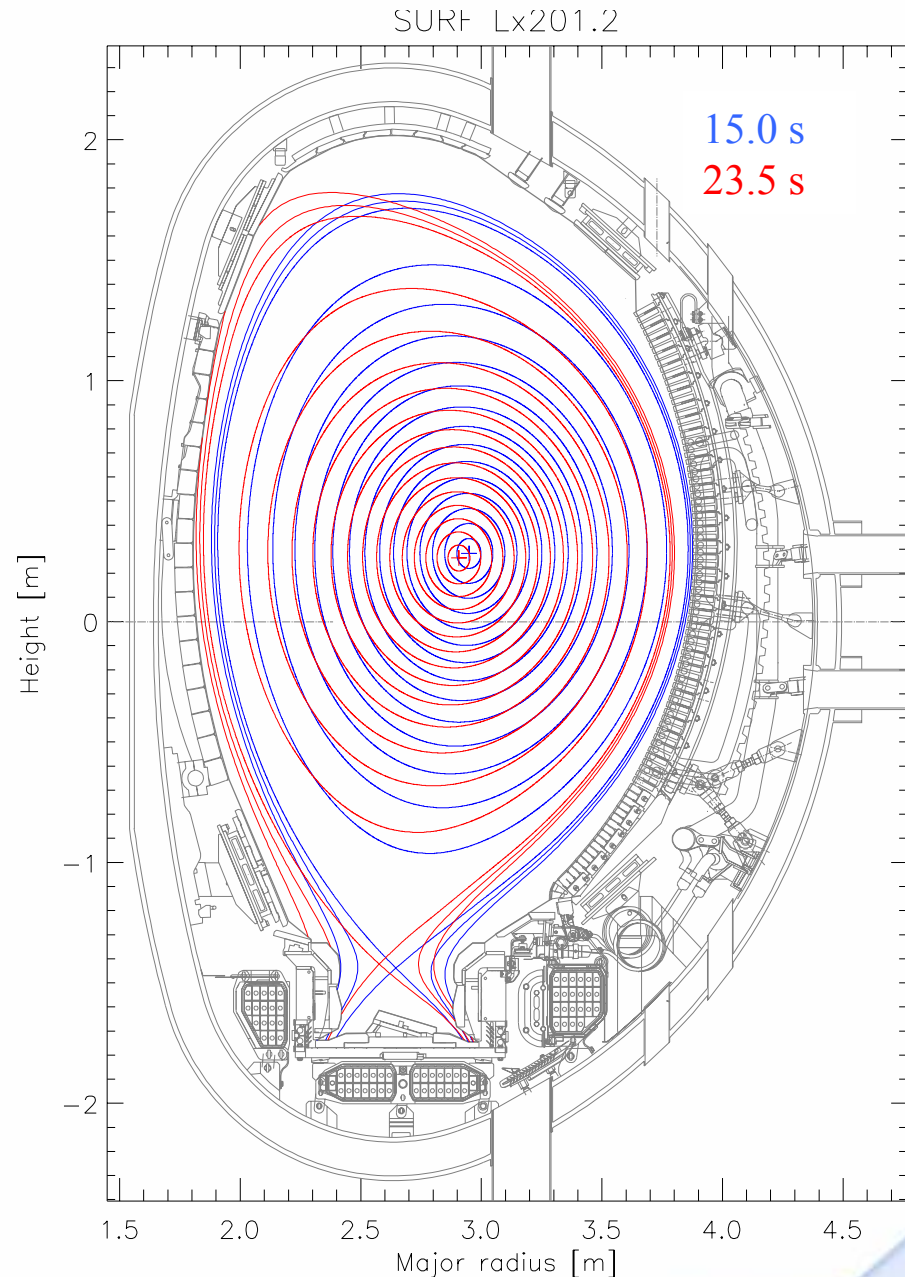
Sawteeth model (profiles #77922)



Recycling evolution (#75225)



Recycling increases at the end of the ramp, when the plasma approaches the wall (with no gas puffing, recycling value is physically meaningful)



Conclusions

- 1. Results of transport simulations for the OH ramp-down phase of JET hybrid pulses using JETTO with the BgB model agree well with experimental data**
- 2. Recycling has been the only tuning parameter, increasing towards 1 at the end of the ramp (consistently with the plasma approaching the wall)**
- 3. Density and temperature are very tightly linked (if one goes up the other goes down, and vice-versa)**
- 4. A sawteeth model appears to be needed to get good agreement between model and experiment (but further investigation is necessary)**