

# Verification of the Electron Temperature Measurements at NSTX

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- There exists a discrepancy between the electron temperatures from Thomson scattering, the X-ray Pulse Height Analysis System and the X-ray crystal spectrometer. For instance,  $T_e^{\text{Thomson}} = 500$  eV;  $T_e^{\text{PHA}} = T_e^{\text{XCS}} = 720$  eV for shots 105885-105890 (*see* Figs. 1, 2).
- An increase of the electron temperature by 40% would have a significant effect on the NSTX power balance. A verification of the electron temperature measurements is therefore important.
- A systematic comparison of the  $T_e$  diagnostics, for different plasma parameters, is planned for the upcoming NSTX run.

### Te-Thomson vs Te-XCS from n=3 Satellites/Resonance Line

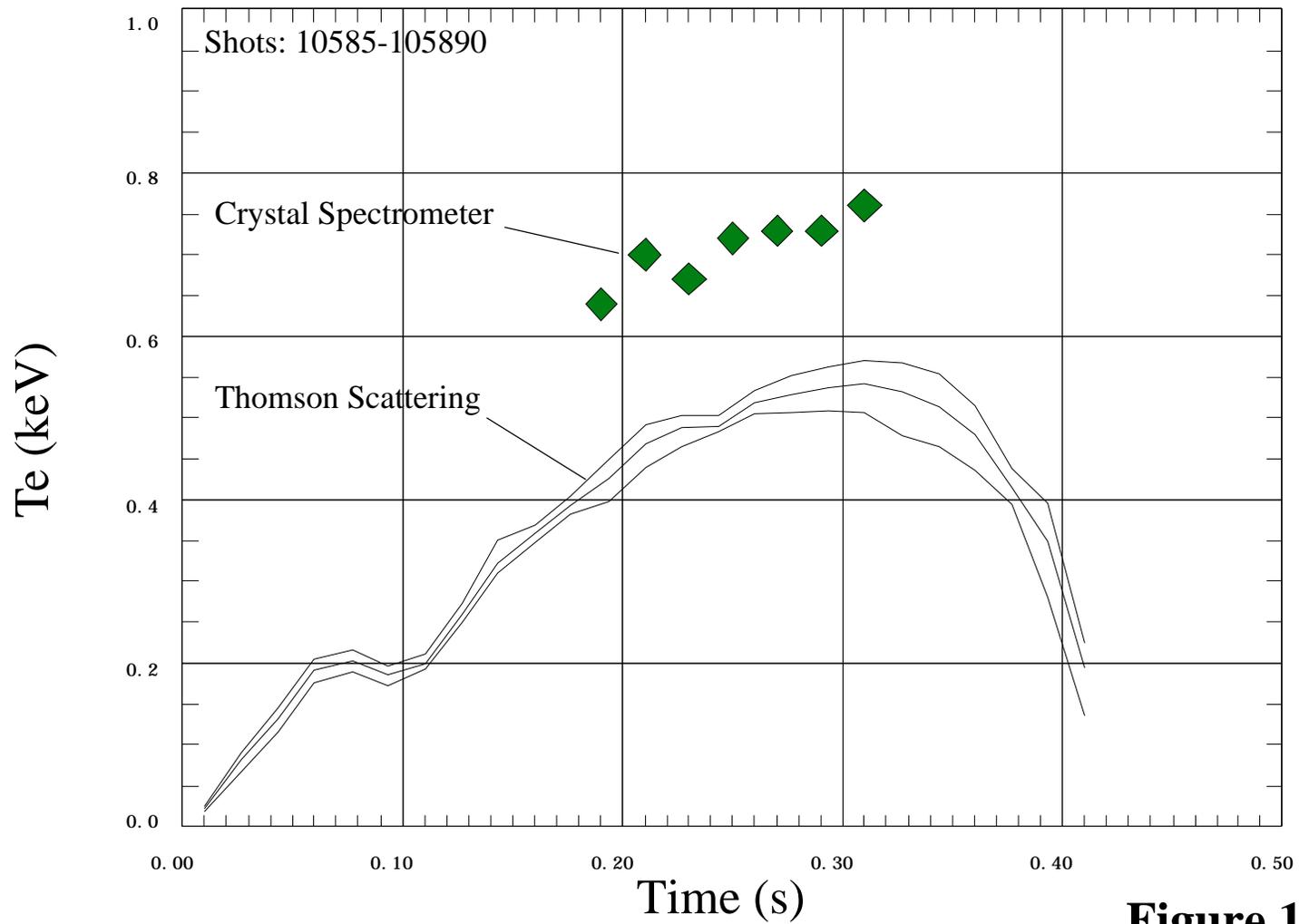
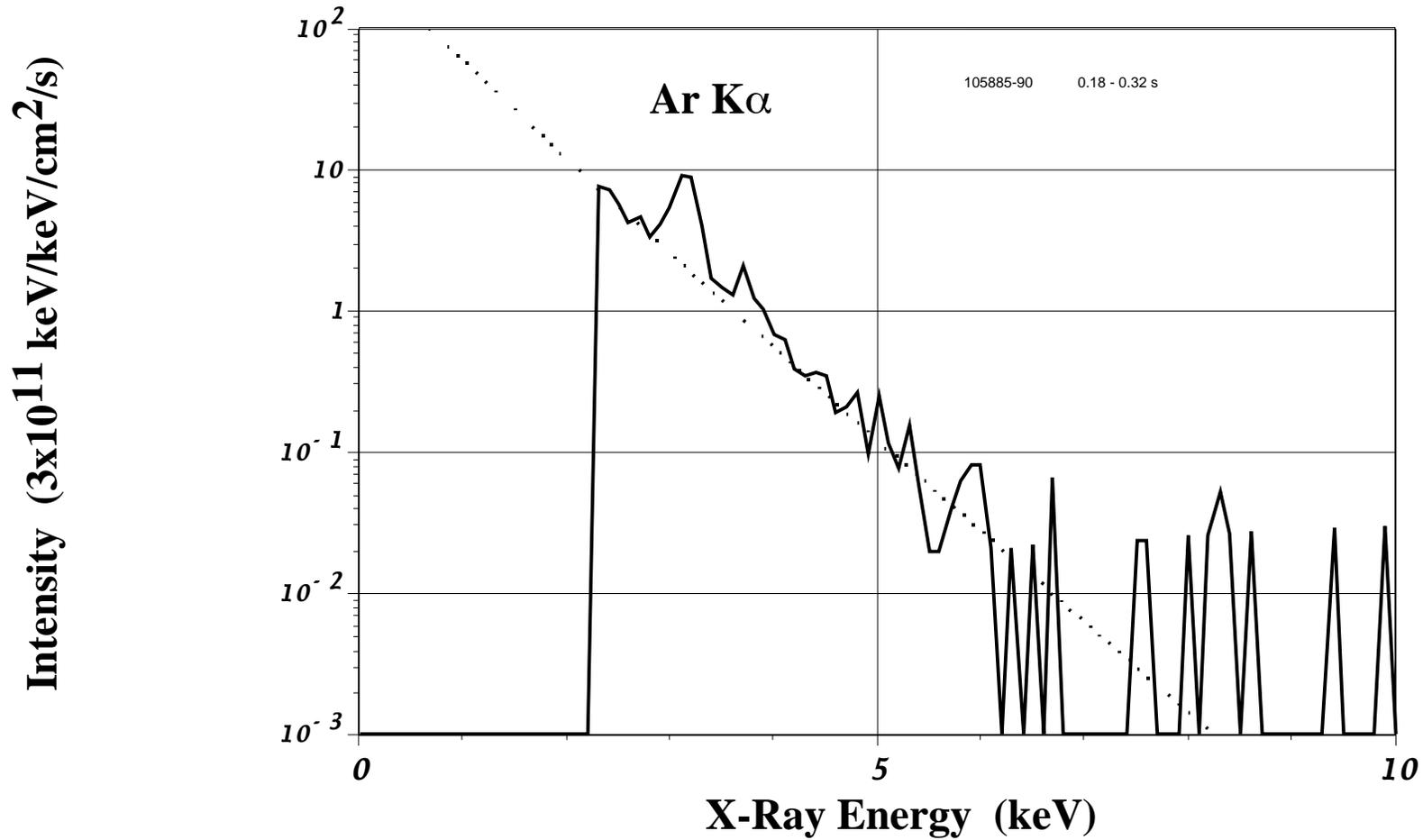


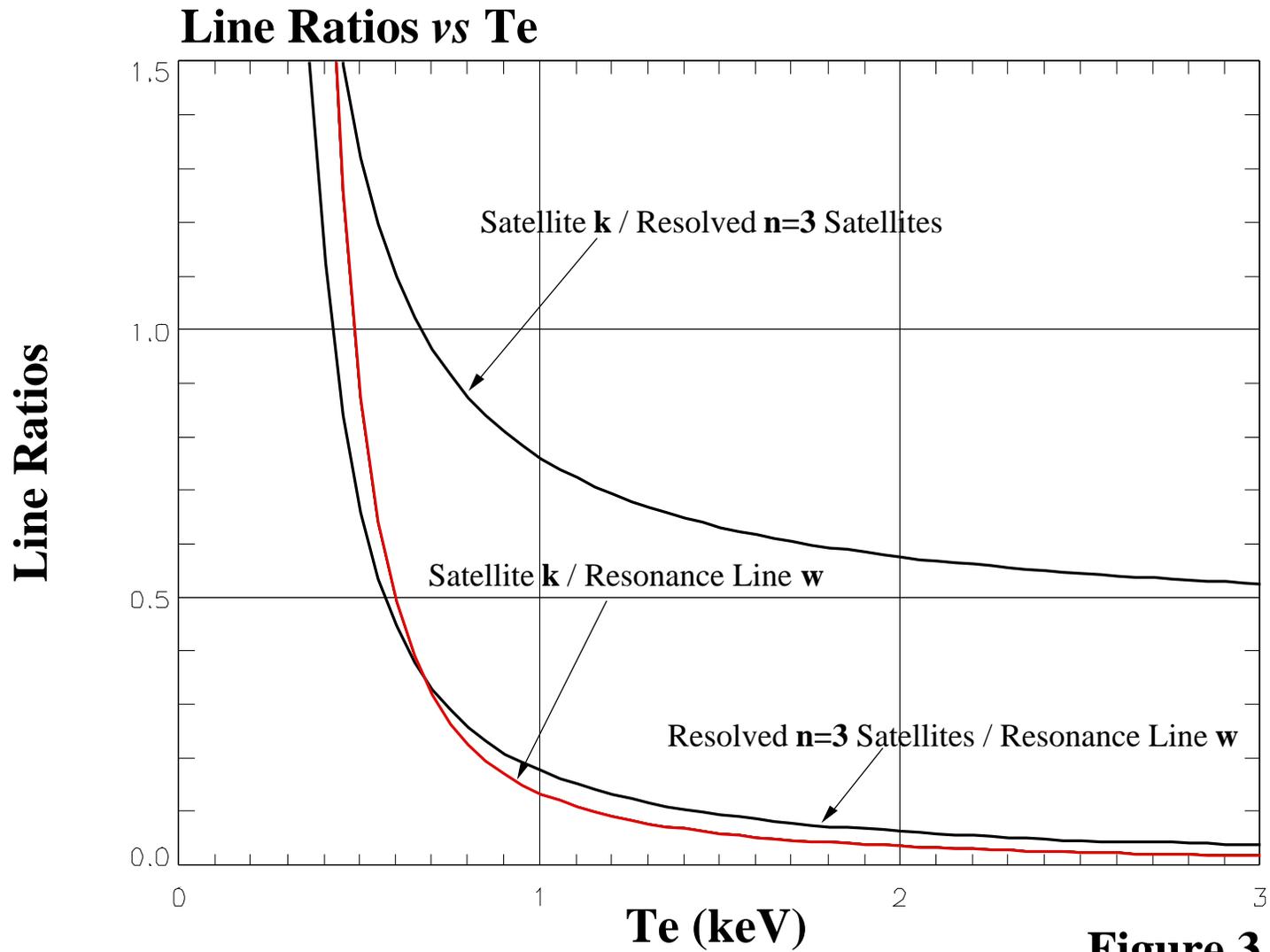
Figure 1

## Argon K Lines Are Excited at a Temperature of 0.72 keV

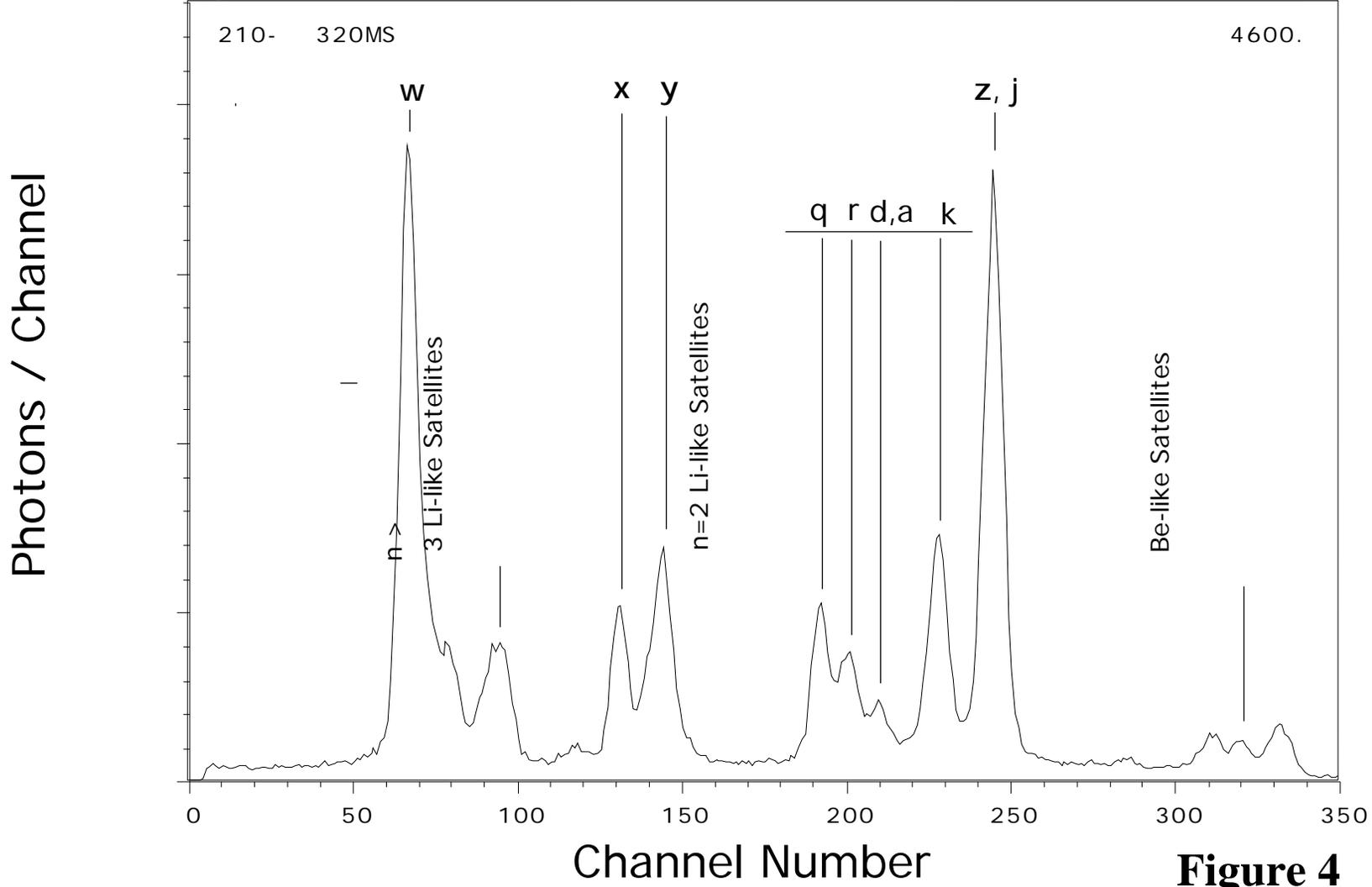


**Figure 2**

- The electron temperature  $T_e^{\text{XCS}}$  obtained from the X-ray crystal spectrometer is determined from the ratios of the  $1s^2 \ ^1S_0 - 1s2p \ ^1P_1$  resonance line and the associated dielectronic satellites  $1s^2 \ nl - 1s2p \ nl$  of helium-like argon ArXVII.
- These line ratios are a very sensitive electron temperature diagnostic for  $0.5 < T_e < 2 \text{ keV}$  (*see* Fig.3)
- An accumulated raw data spectrum of ArXV – ArXVII from shots 105885 – 105890 with negligible statistical error and a least squares fit comparison with the theory of Vainshtein are shown in Figs. 4 and 5, respectively.



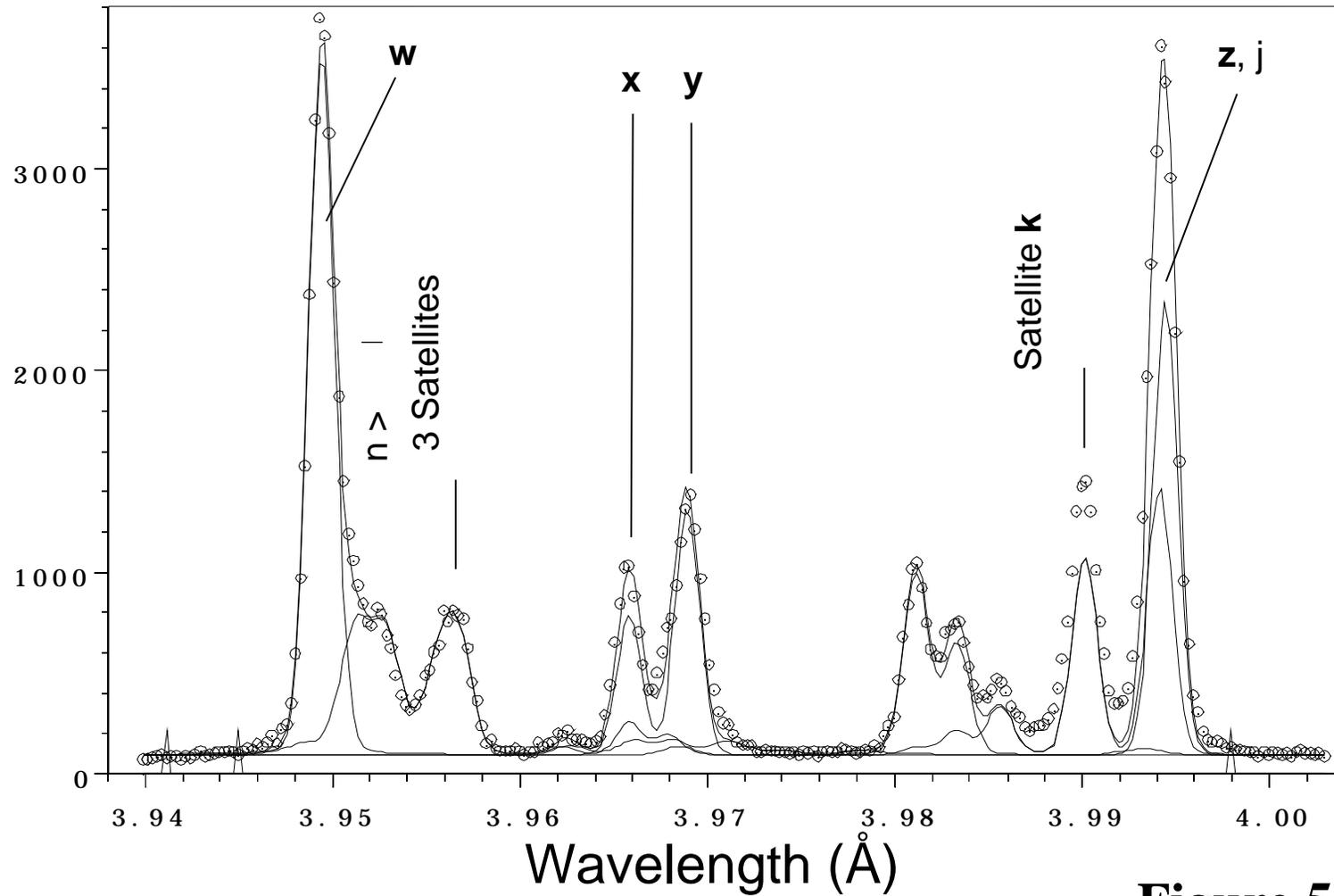
Spectrum of ArXV - ArXVII from shots: 105885 - 105890



**Figure 4**

Te from least squares fit to  $n \geq 3$  Satellites (*Theory Vainshtein*)

Te = 0.72 keV ; Ti = 0.43 keV



**Figure 5**

## Experimental Proposal for Te Comparison

A Te comparison of the different diagnostics is planned for the following conditions:

- (1) ohmic shots with  $I_p = 300, 500$  and  $800$  kA at  $0.45$  tesla
- (2) shots with auxiliary HHFW heating for  $I_p = 500$  kA and  $0.45$  tesla
- (3) shots with 1 source (A or B) of NBI (similar to shot 106382)

An issue of particular interest is whether the  $Te^{XCS}$  and the  $Te^{PHA}$  data are affected by the tail of the electron energy distribution.

