reactor are explored in Section IV. Conclusions are outlined in Section V. Appendix A contains discussion of the details of the measurement techniques used in the impurity measurements. Appendix B contains a discussion of the interpretation of perturbative transport coefficients of trace and bulk species.

II. DESCRIPTION OF THE EXPERIMENT AND RESULTS

A. Plasma Description

Both the L-mode and Supershot plasmas had a toroidal field of 4.8 T, a plasma current of 1.0-1.1 MA, and 12-13 MW of balanced neutral deuterium beam injection. The plasma major radius was 2.45 m, and the minor radius was 0.80 m. Typical electron density, electron temperature, and ion temperature profiles for both the L-mode and Supershot are shown in fig. 1. The electron density was measured by a ten-channel infrared interferometer, and electron temperature was measured by electron-cyclotron emission and Thomson scattering. Ion temperatures were measured by charge exchange recombination spectroscopy (CHERS)[15], viewing the 5292 Å (n = 8-7) line of C^{5+} excited by charge exchange recombination of C^{6+} with heating beam neutrals. $Z_{eff}(r)$ was measured both with a tangentially viewing visible bremsstrahlung (VB) array and with radial profiles of C^{6+}, normalized to the central VB value, obtained with CHERS (carbon is the dominant impurity in most TFTR discharges). The central line-integrated electron density is shown in fig. 2 for the Supershot. A 24 ms helium puff was introduced into the plasma about halfway into the neutral beam pulse, resulting in a small perturbation in the line-averaged electron density (< 5%). The drop in T_e after the puff was less than 3% at all radii. For the iron measurements, iron was injected with the laser blowoff technique during the electron density flattop. For these plasmas, the density perturbation following iron injection was less than 1%. The prompt perturbation on the electron temperature after iron injection was less than 3% for the L-Mode and less than 1% for the Supershot.

For the L-Mode, data from eight nearly identical discharges were averaged together so as to improve statistics of the helium transport and electron transport data. For the Supershot, fourteen nearly identical plasmas were used. Smaller ensembles were averaged together for the iron data. For the purpose of comparison with local electrostatic turbulence-based models and for reproducibility, the plasmas used in the transport analysis were chosen to be as free as possible of MHD activity, with the exception of small sawteeth