value preceding the puff. The particle confinement time before the helium puff is calculated from the particle balance equation using the brightness of the $D_\alpha$ line (6562 Å) to provide the wall source. After the helium puff perturbation the particle confinement time based upon the $D_\alpha$ emission is the same as the value before the puff. The solution of the particle balance equation provides the electron particle flux, $\Gamma_e(r,t)$, as a function of plasma radius and time. The local transport coefficients are then the coefficients in a linear multiple regression with $\Gamma_e$ as the dependent variable[1]:

$$\delta\Gamma_e = (\partial\Gamma_e/\partial\nabla n_e)\delta\nabla n_e + (\partial\Gamma_e/\partial n_e)\delta n_e, \tag{3}$$

where the symbols $\delta\nabla n_e$ and $\delta n_e$ refer to the perturbed electron density gradient and density, respectively, and $\partial\Gamma_e/\partial\nabla n_e$ and $\partial\Gamma_e/\partial n_e$ are the transport coefficients. The coefficients $\partial\Gamma_e/\partial\nabla n_e$ and $\partial\Gamma_e/\partial n_e$ have the units of particle diffusivity and convection. Because these coefficients are not necessarily the steady state coefficients and may be nonlinear (e.g. $\partial\Gamma_e/\partial\nabla n_e$ and $\partial\Gamma_e/\partial n_e$ are functions of either $\nabla n_e$ or $n_e$) the coefficients are left as the terms in the Taylor series expansion. This regression is applied at each radius over the time of the density perturbation to produce transport coefficients as a function of plasma radius. In fact, the regression is applied to the total parameters instead of the perturbed parameters, because regression analysis removes the steady state component of the dependent and independent variables and makes fits based upon the change of the parameters. This was verified by completing the regression analysis on the total and the perturbed variables and exactly the same coefficients were obtained. Previously, the regression was applied to the equation $\delta\Gamma_e/n_e = (\partial\Gamma_e/\partial\nabla n_e)\delta\nabla n_e/n_e + (\partial\Gamma_e/\partial n_e)$.[17] However, it was observed that for small electron density perturbations, $n_e$ and $\nabla n_e$ are decorrelated parameters compared to the quality of the regression fits and thus they may be treated as independent variables. Using both terms results in better fits and does not include the overall residue from the fits in the coefficient $\delta\Gamma_e/n_e$ The electron diffusivity inferred from the perturbation is noted here as $D_e^p \equiv -\partial\Gamma_e/\partial\nabla n_e$. This may be quite different from the steady-state diffusivity (see Section II.C.1 and Appendix B).

### 2. *Power and Particle Balance Analysis*

Beam energy deposition and thermal heat fluxes were calculated using the transport code TRANSP using experimentally measured radial profiles of plasma parameters