in the temperature evolution (Eqs. 5,6) including numerical dissipation.

On the other hand, gyrocenter densities n_e and n_i have to be set to obey relaxation relations that allow the vorticity to freely evolve into equilibrium. This is achieved by freezing the zonal component of the sum $n_e + \tau_i n_i$, where $\tau_i = T_i/T_e$, as the density part of the pressure during the equilibration phase, but allowing the difference (i.e., vorticity) to evolve freely. This ensures that the contribution of densities to the total pressure is zonally frozen through the relation

$$\frac{\partial}{\partial t}(n_e + \tau_i n_i) = S_e + \tau_i S_i - \langle S_e + \tau_i S_i \rangle \tag{53}$$

while the densities relax regarding to

$$\frac{\partial n_e}{\partial t} = S_e - \frac{1}{1+\tau_i}\langle S_e + \tau_i S_i \rangle \tag{54}$$

and

$$\frac{\partial n_i}{\partial t} = S_i - \frac{1}{1+\tau_i}\langle S_e + \tau_i S_i \rangle \tag{55}$$

The numerical solution of the equilibration phase, starting directly from realistically steep pedestal profiles $T_0(r)$, into steady state is delayed by long, weakly damped global geodesic Alfvén oscillations. Convergence is expedited by ramping up all of the gradients gradually from zero to prescribed value over the first $\Delta t = \tau_r = 50\ a/c_s$ of the run by

$$\frac{\partial T}{\partial t} = S_T - \langle S_T \rangle + \frac{1}{\tau_r} T_0(x). \tag{56}$$

This pre-processing equilibration phase is run until convergence with reduced perpendicular resolution (n_x, n_y, n_z)=(64 × 4 × 32), and without the ExB and magnetic flutter nonlinearities, which allows establishment of the 2D structure in a smooth manner. Then, the resolution is increased to the nominal values (64 × 512 × 32), and a random turbulent bath with relative amplitude $10^{-4}\ \rho_s/L_\perp$ is added to the background pedestal profiles inside the closed flux surface region. This procedure reduces transient Alfvénic and geodesic acoustic ringing and prepares a reproducible initial state. However, the following sudden release of the nonlinearities also leads to transient oscillations. Depending on parameters, these may still be present at the onset of the instabilities, and can obscure a clean view on the nonlinear growth rates, which will be relevant for the discussion below on diagnosing linear or explosive instability.