# Gyrokinetic derivation and numerical implementation of $\delta B_\parallel$ in EUTERPE

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Global treatment of fully electromagnetic turbulence, including fluctuations $\delta B_\parallel$ in the parallel component of the magnetic field, is numerically challenging. Such fluctuations, however, are known to be important for quantitatively correct computations around the onset of the kinetic ballooning mode (KBM). Furthermore, a global description is also needed to resolve large-scale modes that are improperly treated by local gyrokinetic codes. A fully electromagnetic extension of the global nonlinear gyrokinetic code EUTERPE has been developed, which meets this need, and the first results have been obtained. Implementation of $\delta B_\parallel$ in EUTERPE is based on the perpendicular force balance approximation, which eliminates the need to resolve the numerically cumbersome compressional Alfvén waves, and on the long-wavelength approximation of the corresponding terms in the equations of motion. We present a rigorous derivation of the equations implemented in EUTERPE based on modern gyrokinetic techniques, discuss the approximations, and show first results of the numerical applications. This approach to fully-electromagnetic gyrokinetic simulations is complementary to the geometric particle in cell (GEMPIC) methods under development for the parallel symplectic formulation of the gyrokinetic theory in terms of the scalar potential $\phi$ and the vector potential $\mathbf{A}$.