1. Define a probability distribution over the space of tunable parameters for the electric field. This distribution represents your prior belief about the likely values of the parameters before you have seen any data. You can choose any distribution that makes sense based on your knowledge of the problem. For example, you could choose a uniform distribution over a reasonable range of values for each parameter.
2. Simulate the quantum system for a fixed number of time steps using the current values of the electric field parameters.
3. Calculate the overlap between the resulting wavefunction and the reference wavefunction.
4. Define a likelihood function that measures how well the observed data (the overlap) agrees with the predictions of the model (the simulated wavefunction). For example, you could use a normal distribution with mean equal to the predicted overlap and some fixed standard deviation to model the likelihood.
5. Use MCMC to sample from the joint posterior distribution of the parameters given the observed data. At each step of the MCMC chain, propose new values of the parameters using the prior distribution, and accept or reject the proposal based on the likelihood of the proposed values given the observed data. The acceptance probability can be computed using the Metropolis-Hastings algorithm.
6. After running the MCMC chain for a sufficient number of iterations, compute the posterior distribution of the parameters and use it to estimate the posterior mean or maximum a posteriori (MAP) estimate of the optimal parameters that maximize the overlap with the reference wavefunction.
7. Validate the results by checking the convergence of the MCMC chain, assessing the sensitivity of the posterior distribution to the choice of prior, and comparing the predicted overlaps for the estimated parameters with the actual overlaps obtained from simulations.