# Coordination Of Time-Dependent Simulation Parameters Using COMSOL Application Builder

Paul Belk, Ph.D. [1], Anna Harrington, Ph.D.[1]

[1]Boston Scientific

## Abstract

The COMSOL Application Builder can tie a custom user interface to application-specific Java code. This functionality can be used to automatically coordinate changing model characteristics across multiple model nodes. A simple user interface can therefore allow simultaneous specification of multiple simulation parameters, for example, changing boundary conditions and simulation evaluation times, and so greatly simplify the specification of individual simulation runs. While critical for allowing novice users to perform COMSOL simulations, this capability is also of great value to sophisticated COMSOL users, especially given the "add-in" capability for using Application Builder forms in the Model Builder interface.

In a time-dependent simulation, the model must be re-evaluated when external simulation factors change. These factors may include variable boundary conditions or variable material parameters. Often, even the time scale of the change is unpredictable, making it inconvenient to specify simulation evaluation times and functional characteristics such as smoothing parameters.

We demonstrate a simple application interface that allows for advanced timing of user-specified current pulses in a battery simulation. While the COMSOL Application Builder allows for a straightforward user interface, the power of the approach is the Java Method code behind the application. This code calculates ideal time-dependent simulation parameters and seamlessly integrates them into the overall simulation, including display of results. The code takes user-specified tabular inputs (e.g., number of pulses, current amplitude, pulse duration, etc.) to generate a customized piecewise current function, and to specify coordinated evaluation times for optimum simulation speed. An optimized graphical display allows for automatic zooming into pulse regions of interest.

The application builder provides an automated approach to modeling a wide range of time scales with irregularly changing boundary conditions, while eliminating the tedious and error-prone process of manually coordinating study time parameters when specifying simulations.

## Figures used in the abstract

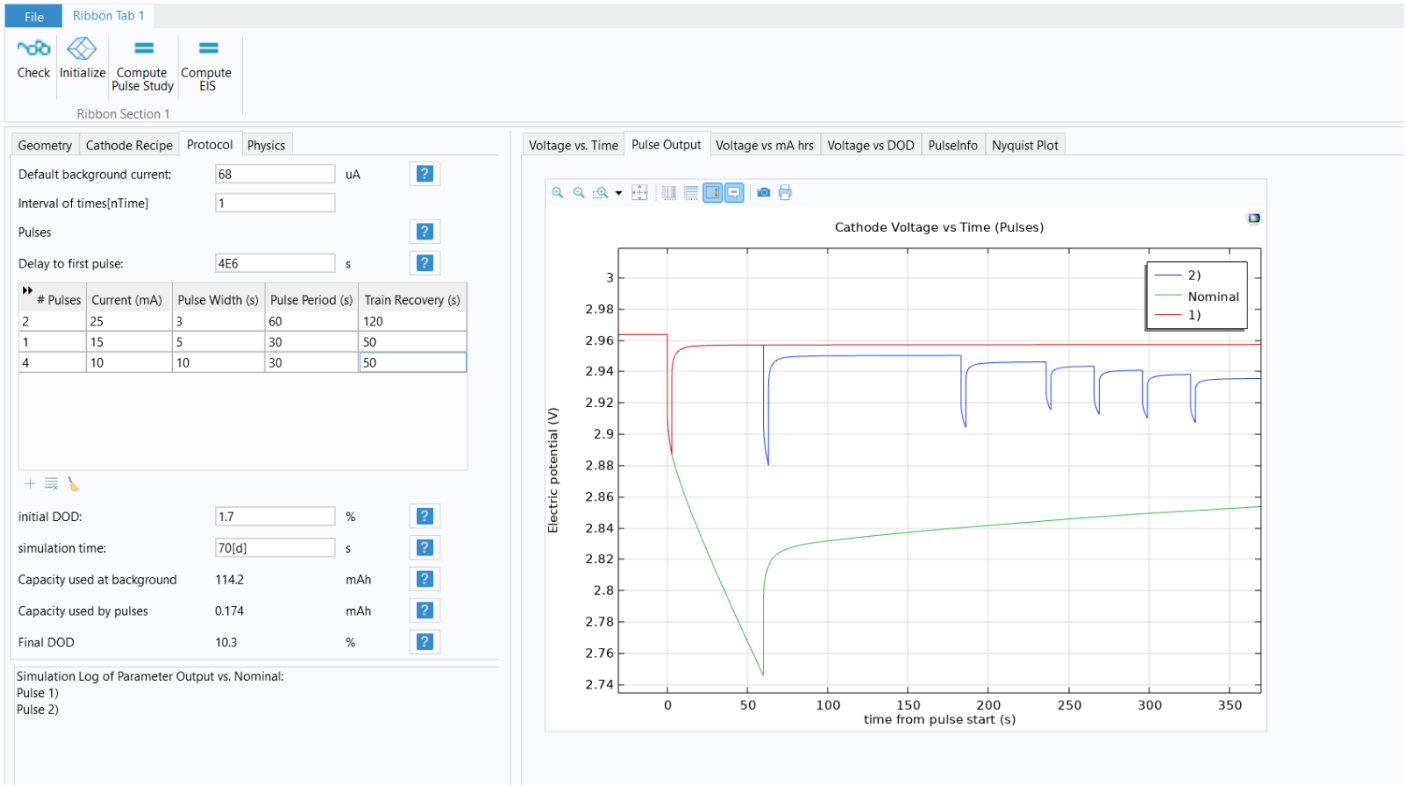


**Figure 1** : UI screen showing 3 battery simulations. Current pulses are specified for third simulation. Pulse spacing, duration and amplitude are all irregular.

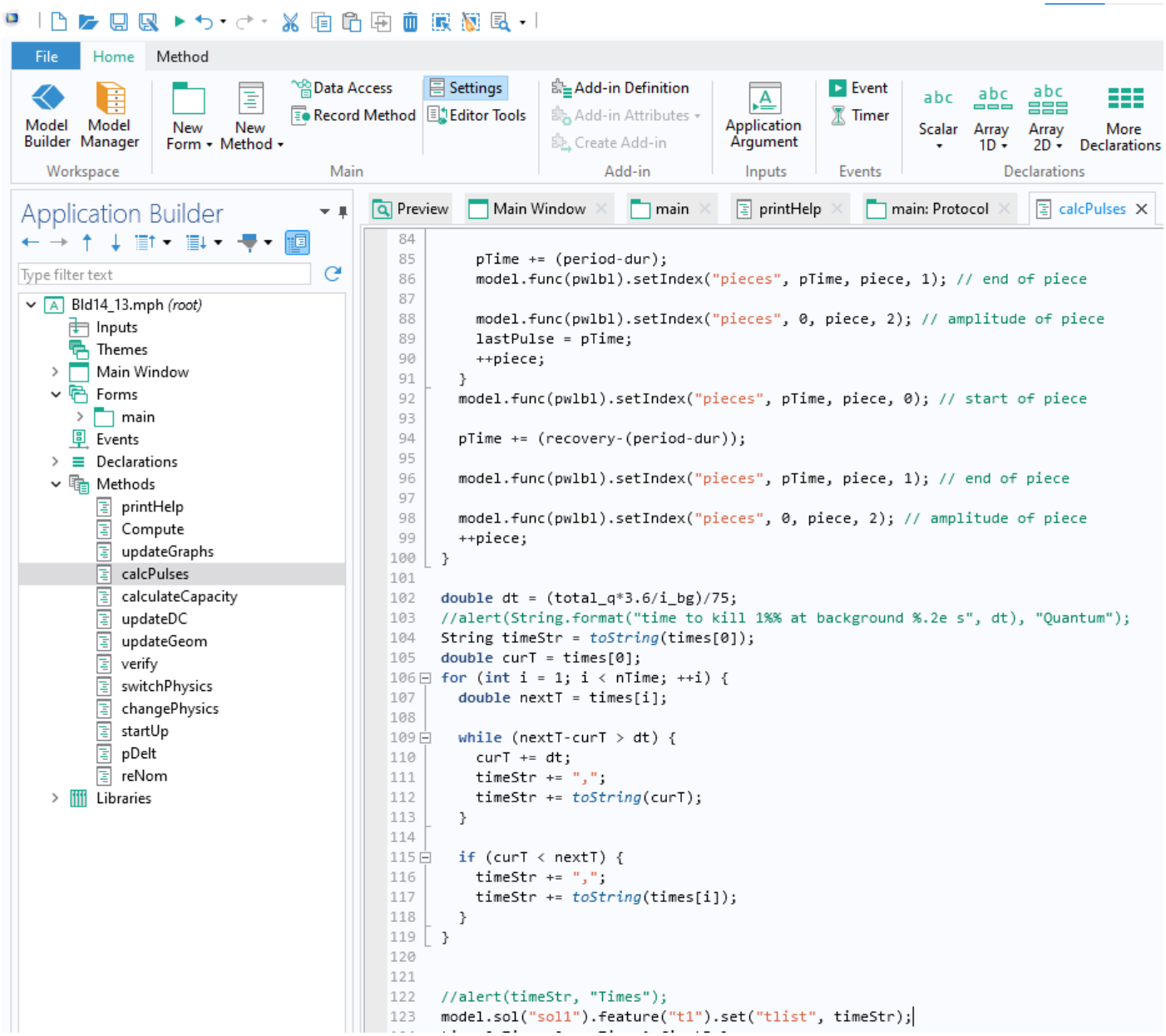


**Figure 2** : Application Builder interface showing Java code that calculates current pulse function, while also providing coordinated evaluation times.