

# Bug ID S-32: Time Step Bug

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## 1. Problem

The time steps for the CSV output files are uneven for some intervals. For example, when a time interval of 1.0 is chosen, the times in the CSV file are 0,1.1,2,3,4,5.1 etc but they should be 0,1,2,3,4,5 etc instead.

## 2. Solution

Make the time steps even by using a small epsilon number to compensate for rounding errors.

## 3. Modified file list

- org.simBio.sim.analyzer.csv.CsvMaker
- org.simBio.sim.gui.CsvDialog

## 4. Code explanation

### 4.1. org.simBio.sim.analyzer.csv.CsvMaker

A small epsilon number was added to CsvMaker.java to compensate for rounding errors in the calculations.

```
private double epsilon = 0.000001;
```

The original version of CsvMaker had the following code:

```
if ( t < nextTime) return;
```

This resulted in uneven time steps in the CSV output file, such as the following, produced from matsuoaka\_et\_al\_2003/model.xml, where dtMin = 0.1, dtMax = 0.1, and the interval = 1.0:

```
time (ms), simulation/model/cell/Vm, simulation/model/cell/Na,
simulation/model/cell/K
0.0, -85.9575, 4.925761, 143.1837
1.1, -85.9559, 4.925753, 143.1838
2, -85.9552, 4.925746, 143.1838
3, -85.9547, 4.925739, 143.1838
4, -85.9544, 4.925731, 143.1838
5.1, -85.9543, 4.925723, 143.1839
```

In the modified version, the epsilon value is subtracted from nextTime in the comparison:

```
if ( t < nextTime - epsilon ) return;
```

After this code change the CSV output file has even time steps:

```
time (ms), simulation/model/cell/Vm, simulation/model/cell/Na,
simulation/model/cell/K
0, -85.9575, 4.925761, 143.1837
1, -85.956, 4.925754, 143.1838
2, -85.9552, 4.925746, 143.1838
3, -85.9547, 4.925739, 143.1838
4, -85.9544, 4.925731, 143.1838
5, -85.9543, 4.925724, 143.1839
```

## 4.2. org.simBio.sim.gui.CsvDialog

The same kind of time step bug occurred in the CSV files created using the menu option File -> Export to CSV. This was fixed by adding an epsilon value to CsvDialog and changing code in the csvMaker method from this

```
if ( nextTime > time) { continue; }
```

to this

```
if ( nextTime - epsilon > time) { continue; }
```