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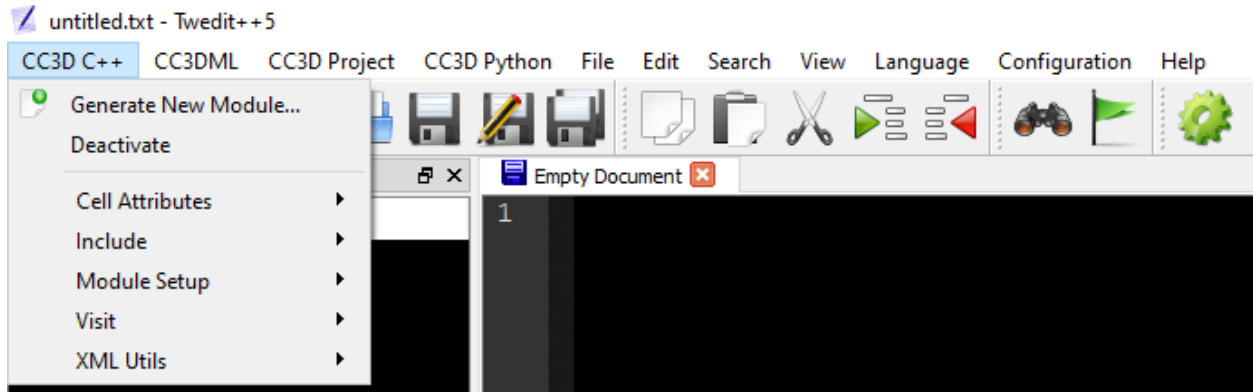
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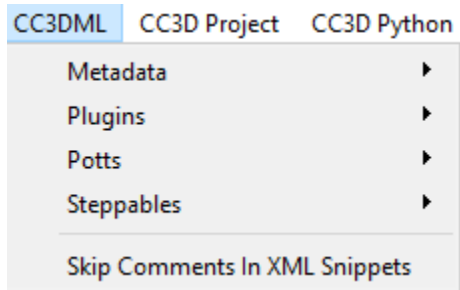
# Twedit++ Menu Options

## CC3D C++



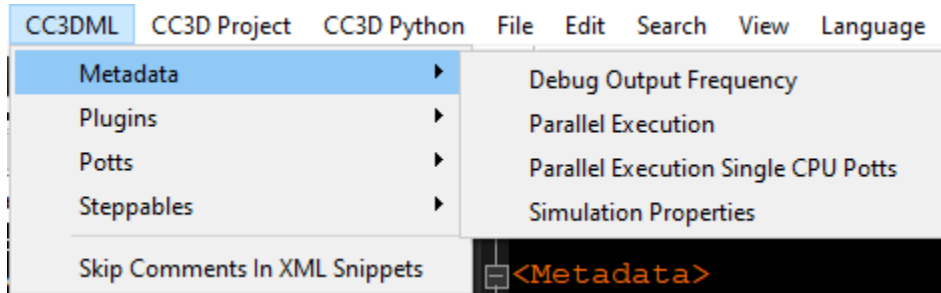
Commands to help with creating and linking to a new module written in C++.

## CC3D DML



XML snippets for loading / configuring CompuCell3D

## Metadata



### Debug Output Frequency:

How often energy calculation / spin flip data is printed to console

### Parallel Execution:

Use multiple cores/threads to execute

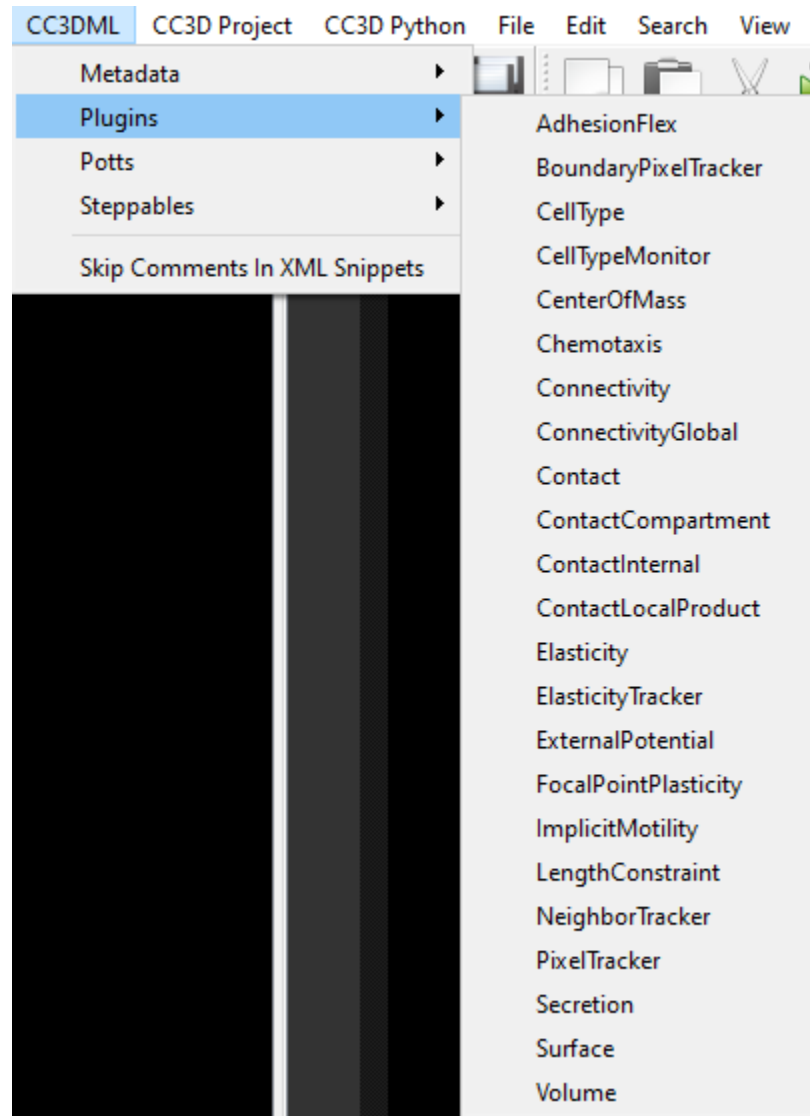
### Parallel Execution Single CPU Potts:

Parallelize everything but the Potts algorithm (avoids issues with big cells on parallelized Potts)

### Simulation Properties:

Pastes code block that includes everything above

### Plugins



XML snippets to load and configure all available plugins

### AdhesionFlex

Determines adhesion energy through molecular expression quantities

### BoundaryPixelTracker

Enables tracking of cells' boundary (surface) pixels

### CellType

Determines cell types

### CenterOfMass

Enables cell center of mass tracking

### Chemotaxis

Enables chemotactic directional movement

### Connectivity / ConnectivityGlobal

Avoids cell fragmentation

### Contact / ContactCompartment / ContactInternal / ContactLocalProduct

Determines contact energies between cell types

### Elasticity

### ElasticityTracker

### ExternalPotential

Allows application of forces to cells (e.g. gravity)

### FocalPontPlasticity

Allows creation of links between cells, applying forces between them. The default force is a spring force.

### ImplicitMotility

Makes cells more motile with the default behavior, also has a “persistent motility” mode that makes cell movement more directional.

### LengthConstraint

Constrains cell length, changing the cell aspect ratio

### NeighborTracker

Allows tracking and iteration through cells’ neighbors

### PixelTracker

Enables tracking of cells’ pixels

### Secretion

Enables cells secretion / absorption of chemicals

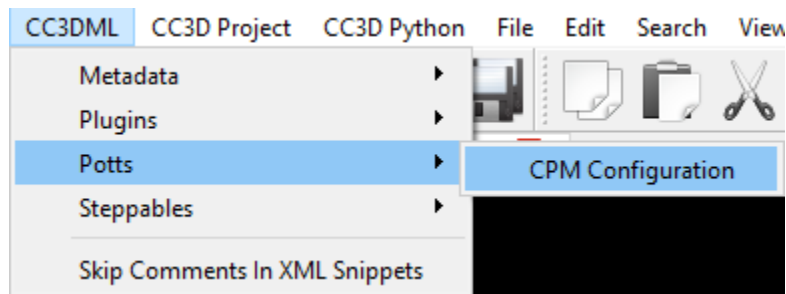
### Surface

Constrains cell surface (3D) / perimeter (2D)

### Volume

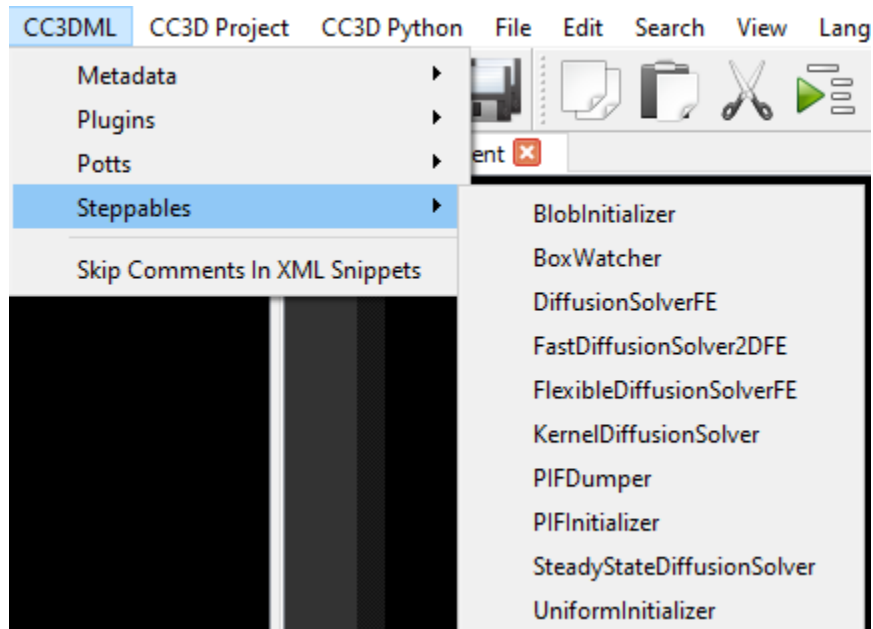
Constrains cell volume (3D) / area (2D). Without it cells will disappear.

## Potts



Configuration of the Cellular Potts algorithm (lattice size, temperature, flip distance)

## Steppables



XML snippets to load and configure all available steppables.

### [BlobInitializer](#)

Initializes cells in a circular zone.

### [UniformInitializer](#)

Initializes cells in a rectangular zone.

### [BoxWatcher](#)

Minimizes simulation area under watch to a box around the cells (intended to make simulation faster).

### [DiffusionSolverFE / FastDiffusionSolver2DFE / KernelDiffusionSolver / SteadyStateDiffusionSolver](#)

Diffusion solvers, DiffusionSolverFE is the default and recommended. SteadyStateDiffusionSolver will iterate diffusion until the steady state is reached each time-step.

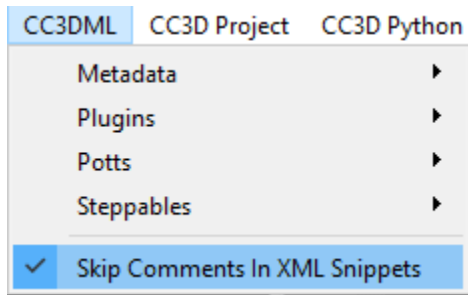
### [PIFDumper](#)

Creates (dumps) a cell lattice configuration file at specified intervals.

## PIFInitializer

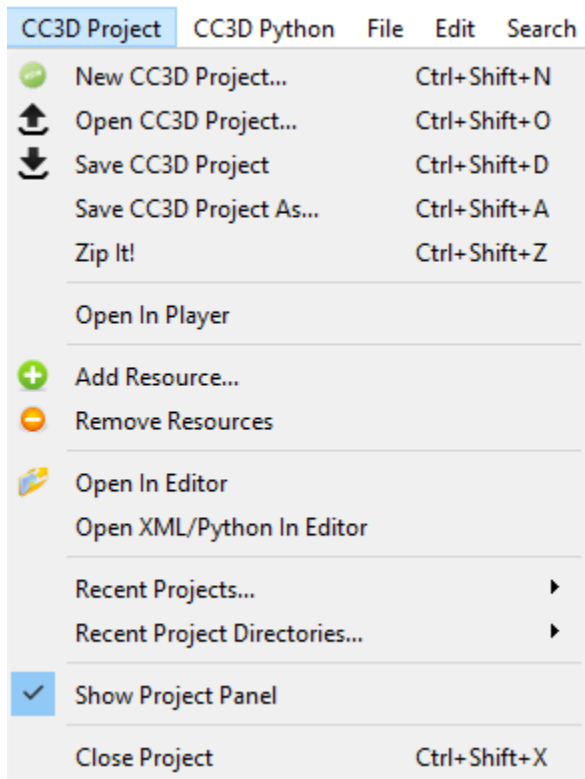
Initializes cell lattice from a PIF file.

## Skip Comments in XML Snippets



Toggle-able option, skips printing of commented out lines when pasting XML snippets (configuration options that are commented out *will also not* be printed)

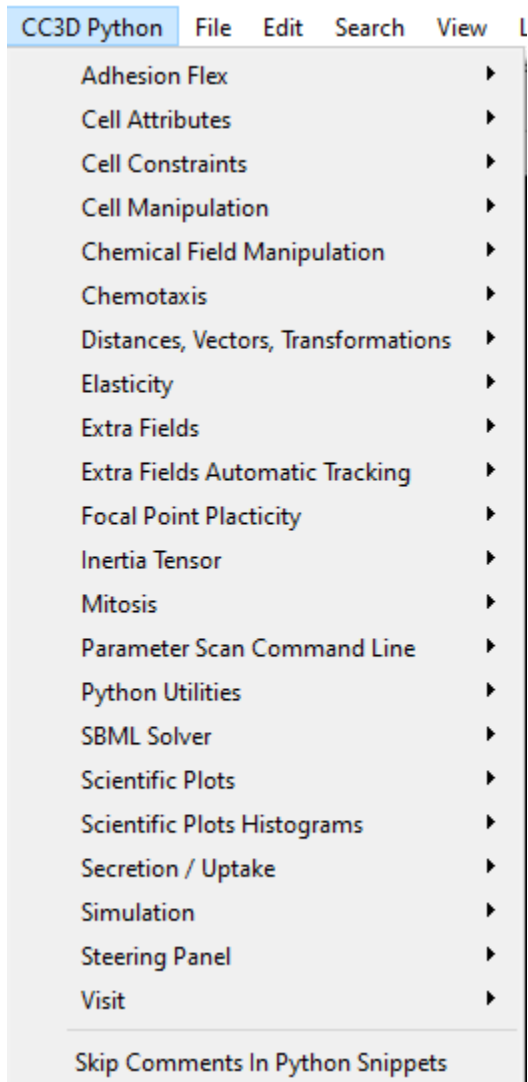
## CC3D Project



General project file editing of the whole project, *i.e.* the `.cc3d` file and all files used by the simulation. Add/Remove Resource adds or removes files that the project will use (all listed in the `.cc3d`), as python scripts, initial concentration files, cell spatial-configuration files (`.pif`).

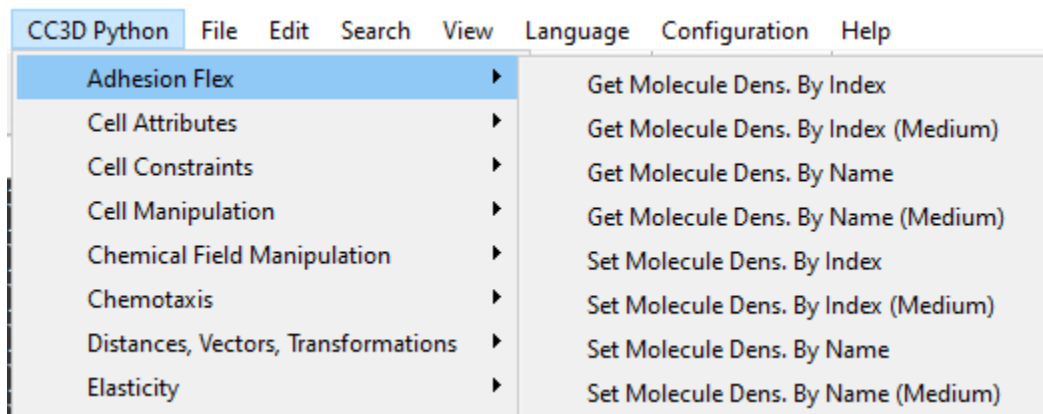


## CC3D Python



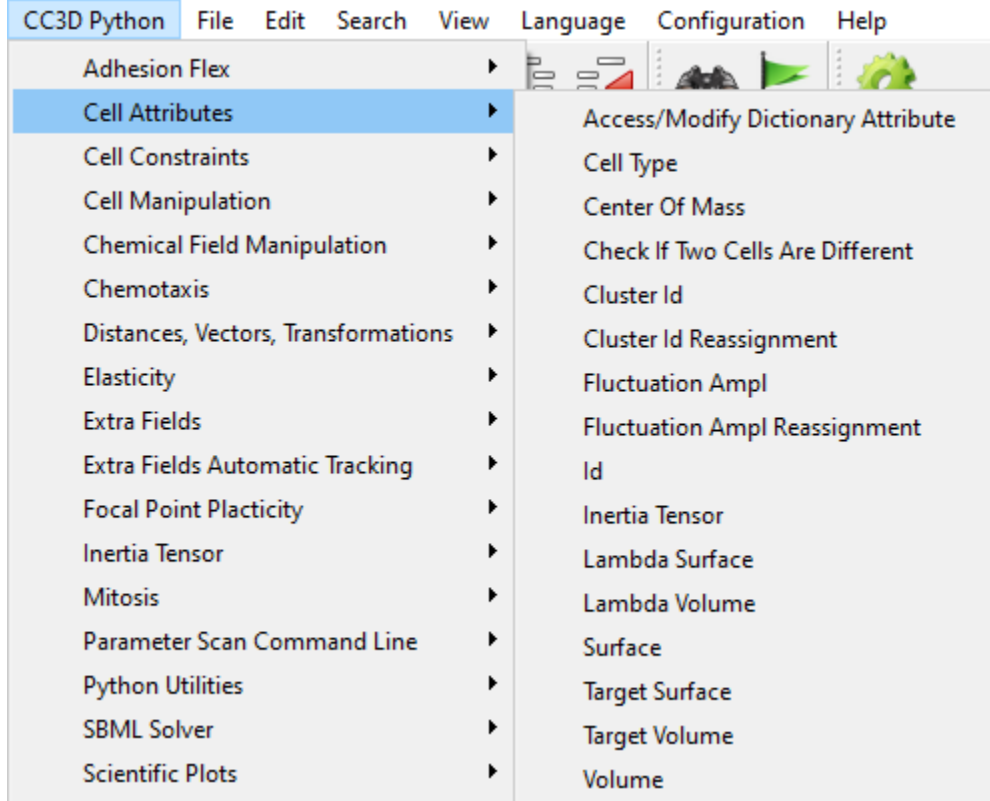
Python snippets for CompuCell3D python functions

### Adhesion Flex



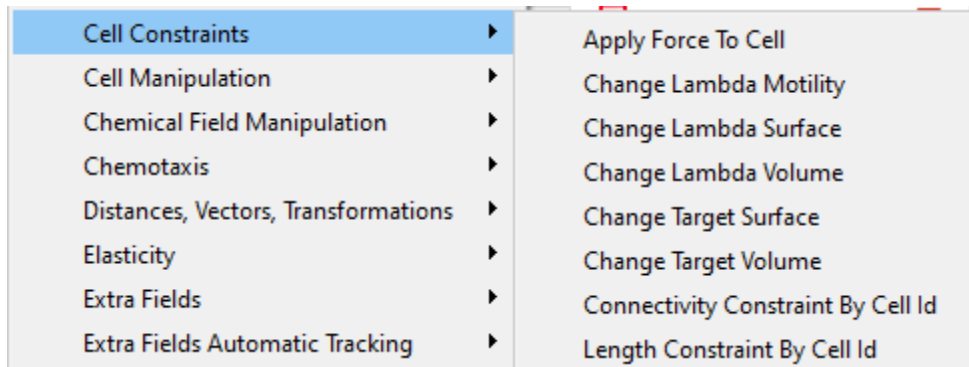
Access/Change attributes of Adhesion Flex Plugin (cell based, should most likely be used in a loop over cells). Contact molecules with medium need to be set in a slightly different manner, they are separated because of it.

### Cell Attributes



Access / Change cell attributes. Most likely be used in a loop over cells.

### Cell Constraints



Access / Change energy constraints (plugin parameters) applied to the cell. Most likely be used in a loop over cells.

## Cell Manipulation

|                                     |   |                        |
|-------------------------------------|---|------------------------|
| Cell Manipulation                   | ▶ | Create Cell            |
| Chemical Field Manipulation         | ▶ | Create Cell (detailed) |
| Chemotaxis                          | ▶ | Delete Cell            |
| Distances, Vectors, Transformations | ▶ | Fetch Cell By Id       |
| Elasticity                          | ▶ | Get Cell At a Pixel    |
| Extra Fields                        | ▶ | Move Cell              |

Create/Delete Cells. Access a particular cell (by position or ID). Move whole cell (teleportation).

## Chemical Field Manipulation

|                                     |   |                              |
|-------------------------------------|---|------------------------------|
| Chemical Field Manipulation         | ▶ | Get Field Max Value          |
| Chemotaxis                          | ▶ | Get Field Min Value          |
| Distances, Vectors, Transformations | ▶ | Get Field Reference          |
| Elasticity                          | ▶ | Get Field Value              |
| Extra Fields                        | ▶ | Modification (aka secretion) |
| Extra Fields Automatic Tracking     | ▶ | Set Field Value              |
| Focal Point Placticity              | ▶ | Write To Disk                |

Use the field name for operations. Get field max/min values. Get a reference to the field (create an alias). Get/Set the concentration (field values). Save the field values to a file.

## Chemotaxis

|                                     |   |                     |
|-------------------------------------|---|---------------------|
| Chemotaxis                          | ▶ | By Cell Id (Define) |
| Distances, Vectors, Transformations | ▶ | By Cell Id (Modify) |

When doing chemotaxis by cell ID first you need to attach chemotactic capabilities to the cell (Define). The parameters can then be changed (Modify).

## Distance, Vectors, Transformations

|                                     |   |   |
|-------------------------------------|---|---|
| Distances, Vectors, Transformations | ▶ | Distance Between Cells                              |
| Elasticity                          | ▶ | Distance Between Cells (Invariant)                  |
| Extra Fields                        | ▶ | Distance Vector Between Cells                       |
| Extra Fields Automatic Tracking     | ▶ | Distance Vector Between Cells (Invariant)           |
| Focal Point Placticity              | ▶ | Distance Vector Between Points                      |
| Inertia Tensor                      | ▶ | Distance Vector Between Points (Invariant)          |
| Mitosis                             | ▶ | Distance Vector Between Points (Invariant, Integer) |
| Parameter Scan Command Line         | ▶ | Hex: Cartesian 2 Hex                                |
| Python Utilities                    | ▶ | Hex: Hex 2 Cartesian                                |
| SBML Solver                         | ▶ | Numpy: Numpy Array To Point3D                       |
| Scientific Plots                    | ▶ | Numpy: Point3D To Numpy Array                       |
| Scientific Plots Histograms         | ▶ | Vector Norm   |

Functions to calculate distances, manipulate coordinates (transforming a square lattice coordinate to a hexagonal lattice one, for instance). Define a vector point in a way CompuCell3D (Point3D) understands versus Numpy array.

## Elasticity

|                                 |   |                       |
|---------------------------------|---|-----------------------|
| Elasticity                      | ▶ | Add New Elastic Link  |
| Extra Fields                    | ▶ | Modify Existing Links |
| Extra Fields Automatic Tracking | ▶ | Remove Elastic Link   |

Manipulate elastic links (spring forces) between cells.

## Extra Fields & Extra Fields Automatic Tracking

|                                  |   |   |
|----------------------------------|---|---|
| Extra Fields                     | ▶ | Scalar Field Cell Level - Clear (step fcn.)       |
| Extra Fields Automatic Tracking  | ▶ | Scalar Field Cell Level - Create (__init__ fcn.)  |
| Focal Point Placticity           | ▶ | Scalar Field Cell Level - Example                 |
| Inertia Tensor                   | ▶ | Scalar Field Cell Level - Write (step fcn.)       |
| Mitosis                          | ▶ | Scalar Field Pixel Level - Clear (step fcn.)      |
| Parameter Scan Command Line      | ▶ | Scalar Field Pixel Level - Create (__init__ fcn.) |
| Python Utilities                 | ▶ | Scalar Field Pixel Level - Example                |
| SBML Solver                      | ▶ | Scalar Field Pixel Level - Write (step fcn.)      |
| Scientific Plots                 | ▶ | Vector Field Cell Level - Clear (step fcn.)       |
| Scientific Plots Histograms      | ▶ | Vector Field Cell Level - Create (__init__ fcn.)  |
| Secretion / Uptake               | ▶ | Vector Field Cell Level - Example                 |
| Simulation                       | ▶ | Vector Field Cell Level - Write (step fcn.)       |
| Steering Panel                   | ▶ | Vector Field Pixel Level - Clear (step fcn.)      |
| Visit                            | ▶ | Vector Field Pixel Level - Create (__init__ fcn.) |
| Skip Comments In Python Snippets |   | Vector Field Pixel Level - Example                |
|                                  |   | Vector Field Pixel Level - Write (step fcn.)      |

|                                 |   |  |
|---------------------------------|---|--|
| Extra Fields Automatic Tracking | ▶ | Track Scalar Cell Attribute (__init__)                 |
| Focal Point Placticity          | ▶ | Track Scalar Cell Attribute Custom Function (__init__) |
| Inertia Tensor                  | ▶ | Track Vector Cell Attribute (__init__)                 |
| Mitosis                         | ▶ | Track Vector Cell Attribute Custom Function (__init__) |

Create and use “extra fields”. Used to visualize cell attributes (including any added to a cell dictionary). If the attribute is a scalar a heat map will be made from the values and the cells will be colored accordingly. In the case of a vector attribute a vector will be overlaid on the cell and its color will be a heat map of the magnitudes.

## Focal Point Plasticity

|                             |   |   |
|-----------------------------|---|---|
| Focal Point Plasticity      | ▶ | Create Anchor                                     |
| Inertia Tensor              | ▶ | Create FPP Link                                   |
| Mitosis                     | ▶ | Create FPP Link (Within Cluster)                  |
| Parameter Scan Command Line | ▶ | Delete Anchor                                     |
| Python Utilities            | ▶ | Delete FPP Link                                   |
| SBML Solver                 | ▶ | Delete FPP Link (Within Cluster)                  |
| Scientific Plots            | ▶ | Get Lambda for FPP Link (Within Cluster)          |
| Scientific Plots Histograms | ▶ | Get Target Distance for FPP Link (Within Cluster) |
| Secretion / Uptake          | ▶ | Properties  |
| Simulation                  | ▶ | Properties (Within Cluster)                       |
| Steering Panel              | ▶ | Set Anchor Parameters                             |

Functions to manipulate Focal Point Plasticity Plugin parameters and of the links themselves.

## Inertia Tensor

|                |   |             |
|----------------|---|-------------|
| Inertia Tensor | ▶ | Information |
| Mitosis        | ▶ | Semiaxes    |

Accessing information from the Tensor of Inertia.

## Mitosis

|                                  |   |   |
|----------------------------------|---|---|
| Mitosis                          | ▶ | 1. Clone Attributes Parent -> Child             |
| Parameter Scan Command Line      | ▶ | 1. Clone Cluster Attributes Parent -> Child     |
| Python Utilities                 | ▶ | 2. Compact updateAttributes                     |
| SBML Solver                      | ▶ | 2. Compact updateAttributes for clusters        |
| Scientific Plots                 | ▶ | Child on the Left of the Parent                 |
| Scientific Plots Histograms      | ▶ | Child on the Right of the Parent                |
| Secretion / Uptake               | ▶ | Child/Parent Random Relative Position           |
| Simulation                       | ▶ | Clone Attributes (Flexible)                     |
| Steering Panel                   | ▶ | Divide Cells Along Major Axis (Example)         |
| Visit                            | ▶ | Divide Cells Along Minor Axis (Example)         |
| Skip Comments In Python Snippets |   | Divide Cells Along Normal To Vector (Example)   |
|                                  |   | Divide Cells Along Random Axis (Example)        |
|                                  |   | Divide Cluster Along Major Axis (Example)       |
|                                  |   | Divide Cluster Along Minor Axis (Example)       |
|                                  |   | Divide Cluster Along Normal To Vector (Example) |
|                                  |   | Divide Cluster Along Random Axis (Example)      |

Snippets and examples for using mitosis (cell division) functions. For options with numbers, only one of a particular number should be used, in the numeric order, and at least one of each number is usually required.

## Parameter Scan Command Line

|                             |   |  |
|-----------------------------|---|--|
| Parameter Scan Command Line | ▶ | 1. Run Parameter Scan Using Player (Windows) |
| Python Utilities            | ▶ | 1. Run Parameter Scan With No GUI (Windows)  |
| SBML Solver                 | ▶ | 2. Run Parameter Scan Using Player (Linux)   |
| Scientific Plots            | ▶ | 2. Run Parameter Scan With No GUI (Linux)    |
| Scientific Plots Histograms | ▶ | 3. Run Parameter Scan Using Player (OSX)     |
| Secretion / Uptake          | ▶ | 3. Run Parameter Scan With No GUI (OSX)      |

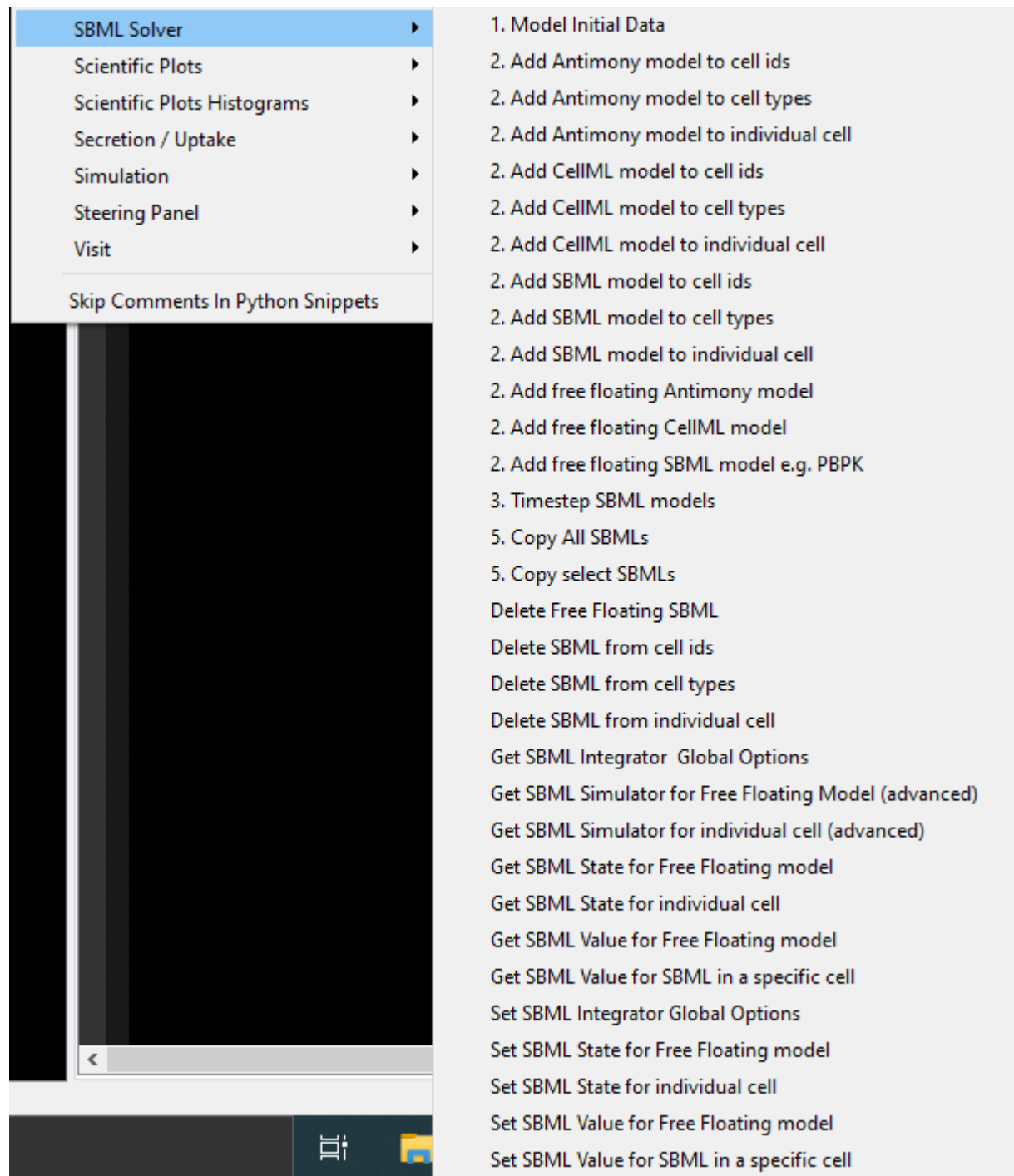
These are intended for use in a .bat (Windows) or .sh (Linux, Mac) file, not in python code. Has the snippet for calling CompuCell3D's parameter scan. For options with numbers, only one of a particular number should be used, in the numeric order, and at least one of each number is usually required.

## Python Utilities

|                             |   |  |
|-----------------------------|---|--|
| Python Utilities            | ▶ | Fetch Steppable By Class Name                        |
| SBML Solver                 | ▶ | Get Dir Of Current File                              |
| Scientific Plots            | ▶ | Get FullPath Of Current File                         |
| Scientific Plots Histograms | ▶ | Import os  |
| Secretion / Uptake          | ▶ | Open File In Simulation Output Directory             |
| Simulation                  | ▶ | Open File In Simulation Output Directory (low-level) |
| Steering Panel              | ▶ | Set Simulation Output Directory (main Python script) |

Several python utility snippets, like fetching a pointer to another steppable, getting the directory of the simulation file, setting the output directory.

## SBML Solver



|                                  |   |   |
|----------------------------------|---|---|
| SBML Solver                      | ▶ | 1. Model Initial Data                                 |
| Scientific Plots                 | ▶ | 2. Add Antimony model to cell ids                     |
| Scientific Plots Histograms      | ▶ | 2. Add Antimony model to cell types                   |
| Secretion / Uptake               | ▶ | 2. Add Antimony model to individual cell              |
| Simulation                       | ▶ | 2. Add CellML model to cell ids                       |
| Steering Panel                   | ▶ | 2. Add CellML model to cell types                     |
| Visit                            | ▶ | 2. Add CellML model to individual cell                |
| Skip Comments In Python Snippets |   | 2. Add SBML model to cell ids                         |
|                                  |   | 2. Add SBML model to cell types                       |
|                                  |   | 2. Add SBML model to individual cell                  |
|                                  |   | 2. Add free floating Antimony model                   |
|                                  |   | 2. Add free floating CellML model                     |
|                                  |   | 2. Add free floating SBML model e.g. PBPK             |
|                                  |   | 3. Timestep SBML models                               |
|                                  |   | 5. Copy All SBMLs                                     |
|                                  |   | 5. Copy select SBMLs                                  |
|                                  |   | Delete Free Floating SBML                             |
|                                  |   | Delete SBML from cell ids                             |
|                                  |   | Delete SBML from cell types                           |
|                                  |   | Delete SBML from individual cell                      |
|                                  |   | Get SBML Integrator Global Options                    |
|                                  |   | Get SBML Simulator for Free Floating Model (advanced) |
|                                  |   | Get SBML Simulator for individual cell (advanced)     |
|                                  |   | Get SBML State for Free Floating model                |
|                                  |   | Get SBML State for individual cell                    |
|                                  |   | Get SBML Value for Free Floating model                |
|                                  |   | Get SBML Value for SBML in a specific cell            |
|                                  |   | Set SBML Integrator Global Options                    |
|                                  |   | Set SBML State for Free Floating model                |
|                                  |   | Set SBML State for individual cell                    |
|                                  |   | Set SBML Value for Free Floating model                |
|                                  |   | Set SBML Value for SBML in a specific cell            |

Several functions to set up (load) an SBML model, access it's reactions/variables states, time step it, and so on. For options with numbers, only one of a particular number should be used, in the numeric order, and at least one of each number is usually required.



## Scientific Plots

|                             |   |   |
|-----------------------------|---|---|
| Scientific Plots            | ▶ | 1. Setup (start fcn)                                  |
| Scientific Plots Histograms | ▶ | 2. Add Data Points (step fcn)                         |
| Secretion / Uptake          | ▶ | 3. Refresh Plots (unnecessary, deprecated - step fcn) |
| Simulation                  | ▶ | Erase Plot (step fcn)                                 |
| Steering Panel              | ▶ | Save Plot As A PNG File                               |
| Visit                       | ▶ | Save Plot As Data (text file)                         |

Functions to set up (line/scatter) plots, add data points, save the plots, erase the plotted points. For options with numbers, only one of a particular number should be used, in the numeric order, and at least one of each number is usually required.

## Scientific Plots Histograms

|                             |   |                                   |
|-----------------------------|---|-----------------------------------|
| Scientific Plots Histograms | ▶ | 1. Add Histogram Plot (start fcn) |
| Secretion / Uptake          | ▶ | 2. Add Histogram (step fcn)       |
| Simulation                  | ▶ | Save Plot As A PNG File           |
| Steering Panel              | ▶ | Save Plot As Data (text file)     |

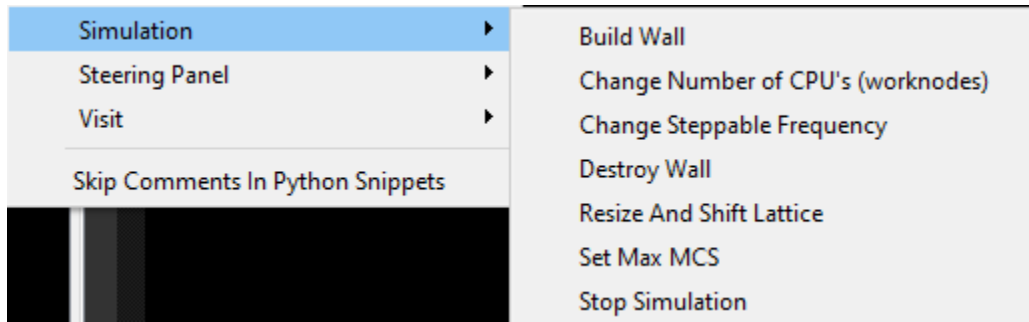
Functions to set up histogram plots, add data points, save the plots. For options with numbers, only one of a particular number should be used, in the numeric order, and at least one of each number is usually required.

## Secretion / Uptake

|                                  |   |   |
|----------------------------------|---|---|
| Secretion / Uptake               | ▶ | Secrete Inside Cell                                 |
| Simulation                       | ▶ | Secrete Inside Cell At Boundary                     |
| Steering Panel                   | ▶ | Secrete Inside Cell At Boundary On Contact With     |
| Visit                            | ▶ | Secrete Inside Cell At COM                          |
| Skip Comments In Python Snippets |   | Secrete Inside Cell Constant Concentration          |
|                                  |   | Secrete Outside Cell At Boundary                    |
|                                  |   | Secrete Outside Cell At Boundary On Contact With    |
|                                  |   | Uptake Inside Cell                                  |
|                                  |   | Uptake Inside Cell At Boundary                      |
|                                  |   | Uptake Inside Cell At Boundary and On Contact With  |
|                                  |   | Uptake Inside Cell At COM                           |
|                                  |   | Uptake Outside Cell At Boundary                     |
|                                  |   | Uptake Outside Cell At Boundary and On Contact With |

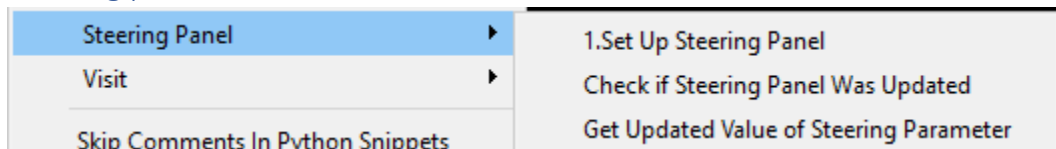
Functions to do secretion / uptake. Uptake is linearly saturated (*i.e.*, grows linearly and then saturates at a constant). Secretion / uptake can be performed over the whole volume of the cell, at its center of mass (COM), at its boundary outside or inside the cell (when selecting “at the boundary” you can also specify that the cell needs to be in contact with another cell of a particular type or with medium).

## Simulation



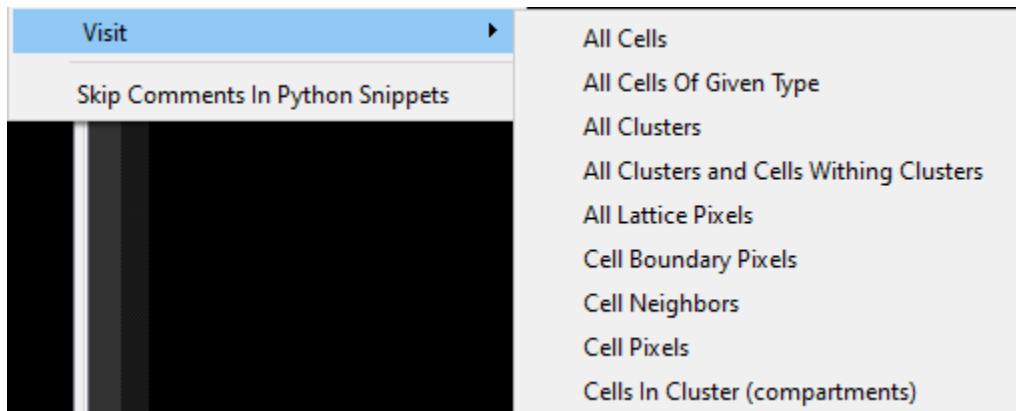
Functions to change how many CPUs or work nodes the simulation should use, how often a steppable should be called, change the lattice size, set how long the simulation should run for (number of time-steps), to stop the simulation early. It also has a function to create (and one to destroy) a border around the simulation lattice (a wall), it is intended to be used with a "frozen" cell. It is useful to do this when using non-periodic boundary conditions so that you can set the contact energy with the border.

## Steering panel











Functions to set up a floating window in CC3D's player to be used as a steering panel. It can be used to control parameters during run-time graphically. For options with numbers, only one of a particular number should be used, in the numeric order, and at least one of each number is usually required.

## Visit










Creates loops over cells, or only a certain type of cells, or cell's neighbors, or cell clusters etc.



## File

| File  | Edit                       | Search | View | Language | Configurat   |
|---|----------------------------|--------|------|----------|--------------|
|  | New                        |        |      |          | Ctrl+N       |
|  | Open...                    |        |      |          | Ctrl+O       |
|  | Save                       |        |      |          | Ctrl+S       |
|  | Save As...                 |        |      |          |              |
|  | Save All                   |        |      |          | Ctrl+Shift+S |
|   |                            |        |      |          |              |
|   | Rename...                  |        |      |          |              |
|  | Close Tab                  |        |      |          | Ctrl+W       |
|   | Close All Tabs             |        |      |          |              |
|   | Close All But Current Tab  |        |      |          |              |
|   | Delete from disk           |        |      |          |              |
|   |                            |        |      |          |              |
|  | Print...                   |        |      |          | Ctrl+P       |
|   |                            |        |      |          |              |
|   | Recent Documents...        |        |      |          | ▶            |
|   | Recent Directories...      |        |      |          | ▶            |
|   |                            |        |      |          |              |
|  | Exit                       |        |      |          | Ctrl+Q       |
|   | Switch To Tab On The Left  |        |      |          | Ctrl+1       |
|   | Switch To Tab On The Right |        |      |          | Ctrl+2       |




## Edit

| Edit  | Search                | View | Language | Configuration |                                |
|---|-----------------------|------|----------|---------------|--------------------------------|
|  | Copy                  |      |          |               | Ctrl+C                         |
|  | Paste                 |      |          |               | Ctrl+V                         |
|  | Cut                   |      |          |               | Ctrl+X                         |
|   |                       |      |          |               |                                |
|   | Block Comment         |      |          |               | Ctrl+/<br>Ctrl+Alt+/<br>Ctrl+Z |
|   | Block Uncomment       |      |          |               | Ctrl+Alt+/<br>Ctrl+Z           |
|  | Increase Indent       |      |          |               | Tab                            |
|  | Decrease Indent       |      |          |               | Shift+Tab                      |
|   |                       |      |          |               |                                |
|   | Convert to UPPER case |      |          |               | Ctrl+Shift+U                   |
|   | Convert to lower case |      |          |               | Ctrl+U                         |
|   | Convert EOL           |      |          |               | ▶                              |
|   |                       |      |          |               |                                |
|  | Undo                  |      |          |               | Ctrl+Z                         |
|  | Redo                  |      |          |               | Ctrl+Y                         |

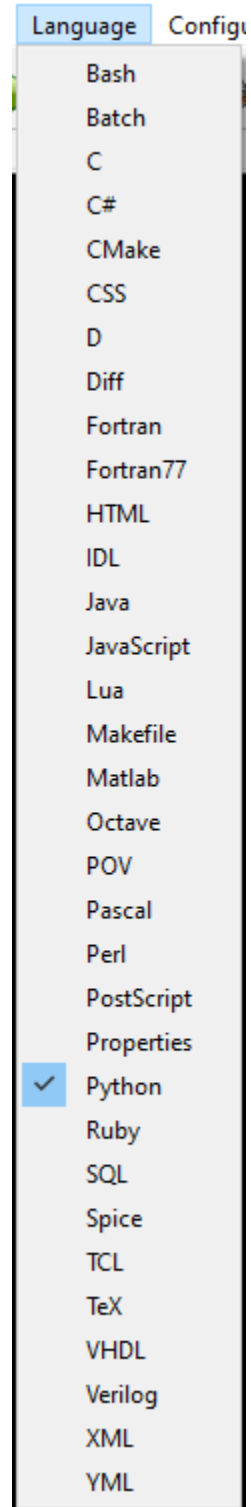
## Search

|   | Search                   | View | Language | Configuration | Help         |
|---|--------------------------|------|----------|---------------|--------------|
|  | Find...                  |      |          |               | Ctrl+F       |
|   | Find Next                |      |          |               | F3           |
|  | Toggle Bookmark          |      |          |               | Alt+F2       |
|   | Go To Next Bookmark      |      |          |               | F2           |
|   | Go To Previous Bookmark  |      |          |               | Shift+F2     |
|   | Delete All Bookmarks     |      |          |               |              |
|   | Go To Line...            |      |          |               | Ctrl+G       |
|   | Go To Matching Brace     |      |          |               | Ctrl+]       |
|   | Select To Matching Brace |      |          |               | Ctrl+Shift+] |

## View

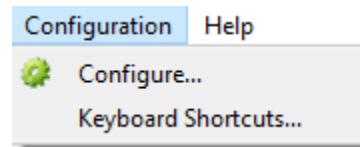
|   | View                       | Language | Configuration | Help |              |
|---|----------------------------|----------|---------------|------|--------------|
|  | Close Tab                  |          |               |      | Ctrl+W       |
|  | Zoom In                    |          |               |      | Ctrl+Shift+= |
|  | Zoom Out                   |          |               |      | Ctrl+-       |
|   | Wrap Lines                 |          |               |      |              |
|   | Show Whitespaces           |          |               |      |              |
|   | Show EOL                   |          |               |      |              |
| <input checked="" type="checkbox"/>   | Show Tab Guidelines        |          |               |      |              |
| <input checked="" type="checkbox"/>   | Show Line Numbers          |          |               |      |              |
|   | Toggle Fold All            |          |               |      |              |
|   | Show Find in Files Results |          |               |      |              |

## Language



Defines the syntax of the currently selected window for syntax highlighting etc.

## Configuration



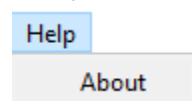
### Configure:

Change editing configurations, change the style of Twedit++ (color scheme)

### Keyboard Shortcuts:

Change keyboard shortcuts

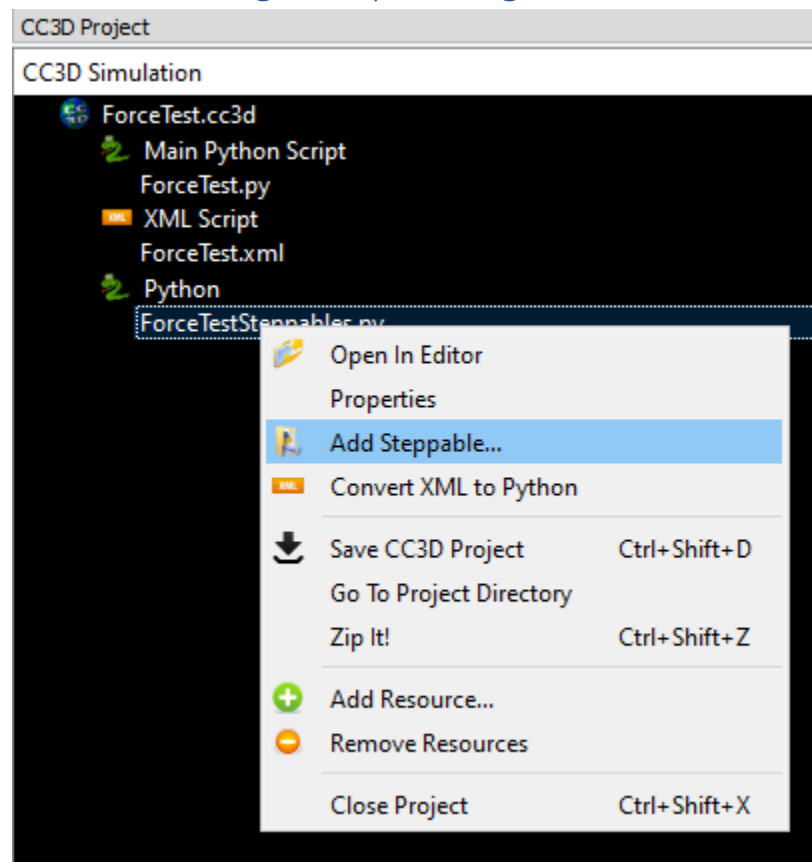
## Help



### About:

Returns the Twedit++ version number and other information.

## Left hand navigation panel right-click



Of note:

#### Add Steppable:

Opens a window to configure and add a new steppable to the steppables file. Both it and the “main python script” will have code pasted in, so both must be saved.

#### Convert XML to python:

This converts an xml + python model into an all python version. The xml model specification file is replaced by the equivalent model specification in python.