STATISTICS ADD-ON

RELATED FILES
SetupStatisticsAddOn.exe
LogisticsLayout.vcm

Description
Introduction to the Statistics Add-On for 3DCreate©.

NOTE! You must have administrative privileges in order to install Statistics Add-On, as well as a licensed copy of 3DCreate© and a commercial license key for the Statistics Add-On.

INTRODUCTION

THE PRESENT DOCUMENT INTRODUCES THE STATISTICS ADD-ON FOR 3DCREATE©. THE STATISTICS ADD-ON IS A TOOL FOR ANALYSING VISUAL COMPONENT SIMULATION MODELS. IT PROVIDES THE ABILITY TO SET UP SIMULATION EXPERIMENTS, DEFINE HOW DATA IS GATHERED AND HOW RESULTS CAN BE BEST DELIVERED IN EITHER CHART FORMAT OR AS INPUT FOR A SPREADSHEET PROGRAM.

OVERVIEW

The Statistics Add-on is used to collect and analyze information from the simulation environment and present it in a concise form. During the simulation run, the system automatically collects statistical data from the layout and the individual components, storing a full statistical history. The data can be viewed using:

• Grid view - Displays all the statistical parameters and their values
• Graphs - It displays statistics parameters using a chart representation
• Reports - Writing data to text files for further analysis with 3rd party tools (i.e. spreadsheet software tools).
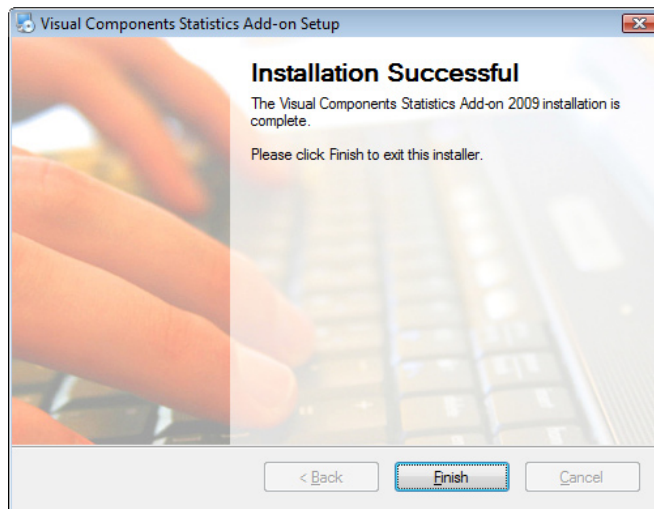
INSTALLATION

1. **Double-click the** *SetupStatisticsAddOn.exe* **file from its location in the current computer. The following dialog box will appear.**
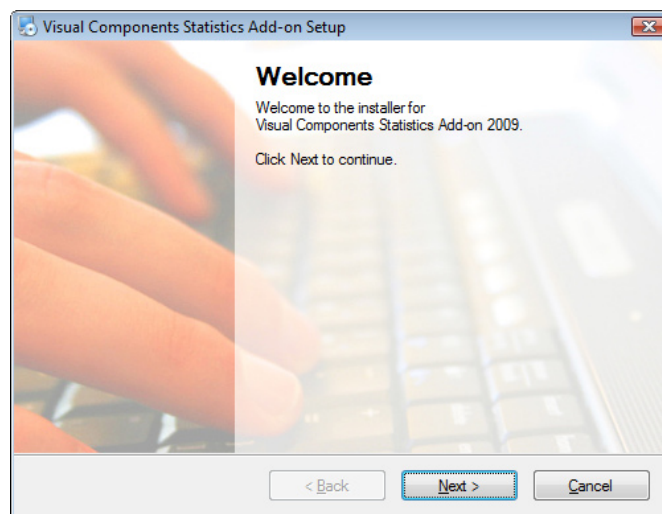
2. **Click on 'Next' to start the installation procedure. The license agreement will apppear. If you agree with the license agreement, select the right box, and click on 'Next'. If you do not agree, you can cancel the installation procedure.**
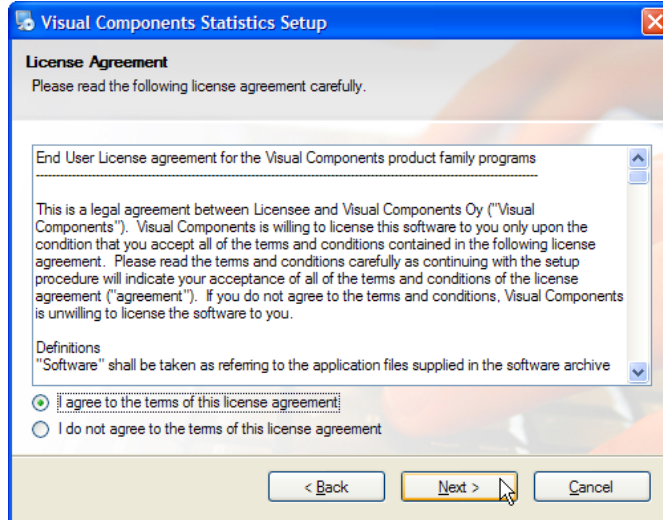
3. After the license agreement, a progress bar will indicate the status of the installation process. Once the process is done, the following dialog box will appear signaling a successful installation.


**4. Click on 'Finish' to end the installation process.**

GRAPHICAL USER INTERFACE

The Statistics Add-on provides six different tabbed pages, each with its own functionality.

- Settings page - The settings page provides the basic information that Statistics Add-on needs to be able to run properly

- System page - It displays system (layout) statistics

- Component page - It displays individual component statistics
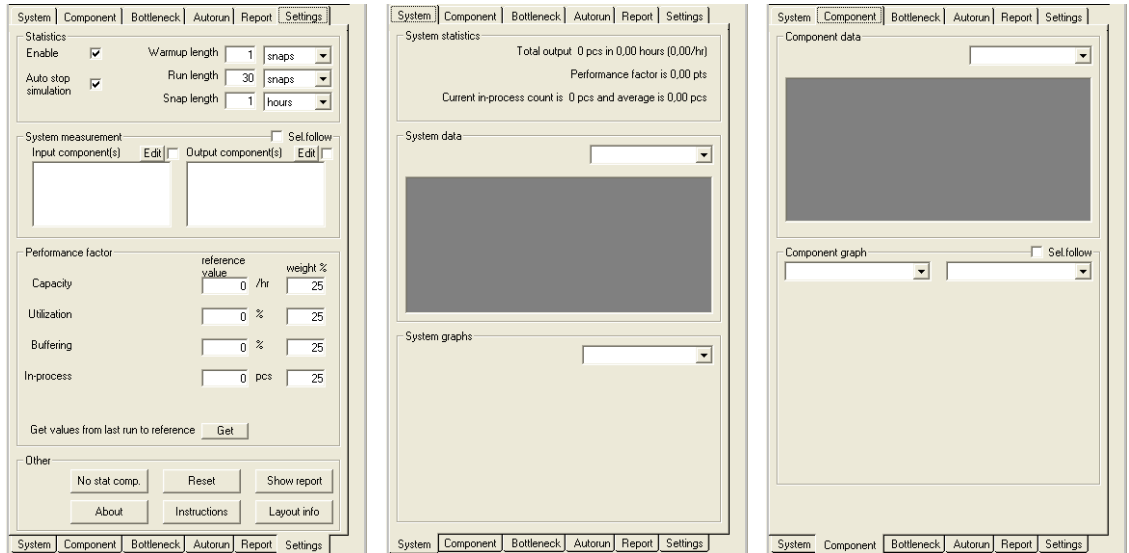
- Bottleneck page - The bottleneck analysis displays both the machine and the buffer bottlenecks

- Autorun page - It allows the user to define the settings for the components in the current layout. The user can run test simulation by defining their warm-up and run lenghts.

- Reports page - It displays the final reports after the simulation run has ended.
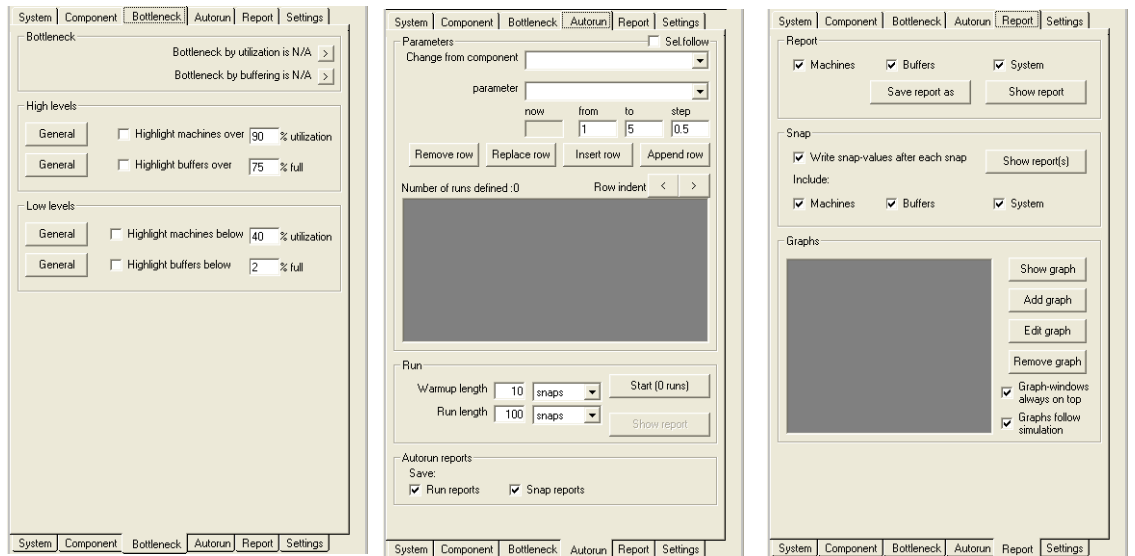
STATISTICAL ANALYSIS OF A LOGISTICS LAYOUT

1. Make sure the world is clear of objects by selecting 'New' from the main toolbar.

2. Load the layout by selecting *LogisticsLayout.vcm* **from the tutorials section at** http://www.visualcomponents.com/support **or from the eCAT**, under 'Local File System / Shared Models/ Statistics Add-On'

A component has to have been created with statistical parameters for it to function with the add-on, otherwise no information will be collected by the Statistics Add-on. The current layout has been preloaded with some statistical information for it to function properly.

The layout should look as follows. The user could run the model to see the actual simulation. This does not affect the statistics add-on.
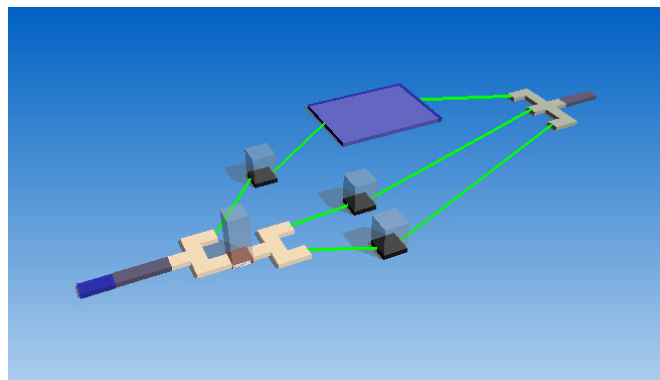
3. Go to the 'Statistics' tabbed page, and enable the add-on on the 'Settings' page if it's not enabled already.
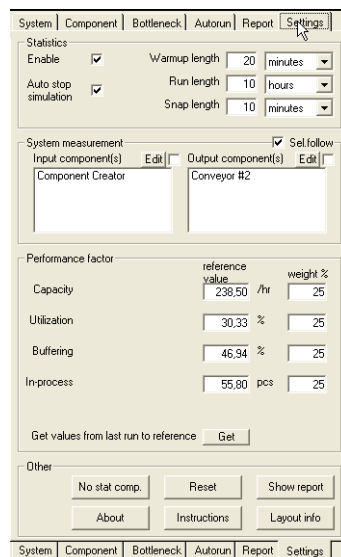
The 'Settings' page should look as follows.

The 'Warmup Lenght' is 20 minutes, and the 'Snap lenght' is 10 minutes. The settings can be changed to seconds, minutes, hours, days or snaps. A snap is a predetermined interval in simualtion time where the Statistics Add-on takes a snapshot of the simulation. In this case, every 10 minutes.

The Input and Output components have already been chosen, but can be changed from the 'Edit' button, which displays a list of all available components in the layout. It will only show the components that have statistical properties built in.

The performance factors for each of the statistical data (Capacity, Utilization, Buffering and In-process) are preloaded with the layout information.

4. Go to the 'Autorun' tabbed page. The page has been prefilled with the information of the previous run.

As it can be seen from the page, the 'FlowConnector #10' has been selected, and its 'Path: Capacity' parameter. This will allows the statistics add-on to modify that specific parameter.

To test this capability of the statistics add-on, open the drop down menu to see all the

available components. When a components selection has been made, the parameters are automatically loaded for that specific component.

If the 'Sel.Follow' checkbox has been checked, the user is able to select any component form the 3DWorld and the parameters will also be loaded automatically. Please select the 'FlowConnector #10'.
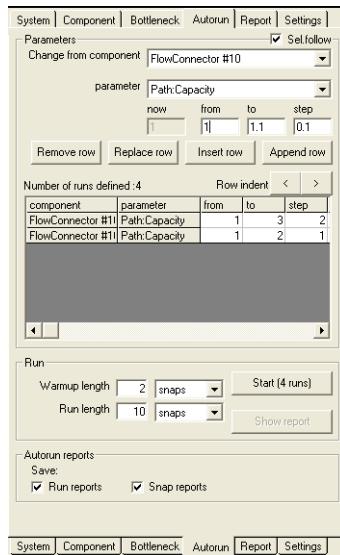
For this example, the 'FlowConnector #10' has been selected and the 'Path:Capacity' parameter. The values shown in the row below are the current value, and the values it will hold once the simulation is running. The user is able to change the 'From', 'To' and 'Step' values as she sees fit. In the picture, the values have a step of .1, and changes from 1 to 1.1.

The use of the buttons are as follows:

- Remove row - removes the last row in the list
- Replace row - replaces the last row with the values set in the options set above
- Insert row - inserts a row at the top of the list
- Append row - appends a row to the last place of the list

For the current example, we must define at least two different rows of values. The already defined values are:

- From 1 to 3, with a step of 2
- From 1 to 2, with a step of 1

The parameters for the run are:

- Warm up lenght - 2 snaps
- Run lenght - 10 snaps

Now the simulation is ready to run, so press the 'Start (4 runs)' button. There will be 4 runs because the system will run the base information for each row (Capacity of 1), and the changed parameter (Capacity of 2 and 3).

The simulation will run four times to a total time of 2:00:00 hrs., since each snap is 10 minutes (defined in the settings tabbed page), a total of 12 snaps is 240 minutes, equals two hours.
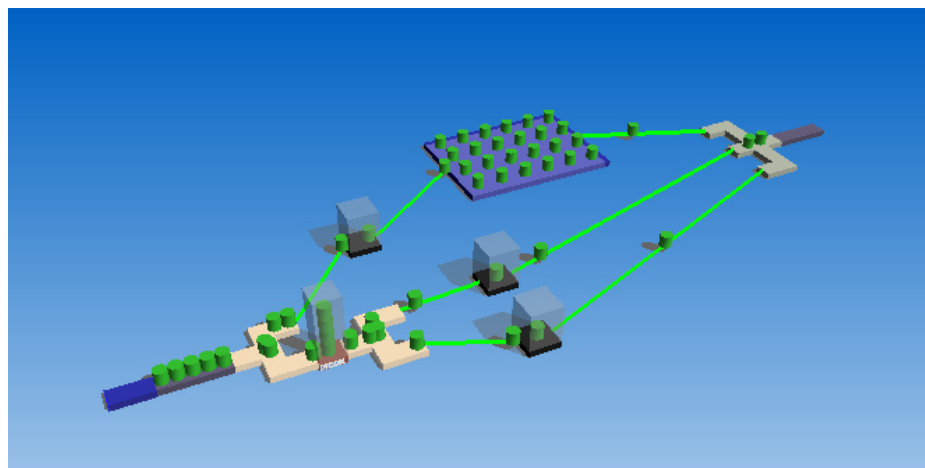
5. Analysis of results

Once the simulation has run to the end, we can analyse the results. Click on the 'Show reports' button, and the system will open a text file called *StatisticsAutorun_.txt*. The content of the file can be imported to a spreadsheet program, such as Microsoft Excel or OpenOffice Calc. Simply select all the contents and paste them into the first cell of the worksheet. After some editing for proper

Simulation report:	Created Date and Time								
	Total run length	1,67 hours	10 snaps						
	Warmup length	0,33 hours	2 snaps						
	Snap length	0,17 hours							
	Input components	Component Creator							
	Output components	Conveyor #2							
Autorun system statistics:									
	PF_Parameters:	Reference	Weight%						
	Capacity	238,5	25						
	Utilization	30,33	25						
	Buffering	46,94	25						
	In-process	55,8	25						
PerformanceFactor	Capacity	Utilization	BufferUtilization	InProcess	Leadtime	UtilBottle	BufferBottle		RunID
0,4903934	240,5	30,58	46,7	55	Process	AreaBuffer	1:1:1:FlowConnector #10/Path:Capacity=1		
5,662232	297,5	36,45	40,47	53,4	Process	Buffer	2:1:2:FlowConnector #10/Path:Capacity=3		
-0,104322	244	31,15	47,29	55,4	Process	AreaBuffer	3:2:1:FlowConnector #10/Path:Capacity=1		
2,028321	270	33,86	44,54	55	Process	Buffer	4:2:2:FlowConnector #10/Path:Capacity=2		

viewing, the results should look as follows:

The first rows are filled the information of the simulation run, as well as the statistics parameters that were set in the settings page.

The important results are the last four rows, which hold the results of each of the four simulation runs.

The first column holds the performance factor. This can be read as follows:

• If the performance factor is equal to zero, the run is equal to the base information.
• If the performance factor is less than zero, the run performed worse than the base data.
• If the performance factor is higher than zero, it reflects the improvement over the base data.

It can be clearly seen that the second row of the results is the best performer. This correlates to the 'FlowConnector #10' capacity to be 3. This in turn results in the higher overall capacity, which is the second column of the results.

6. Bottleneck analysis

The statistics add-on is capable of performing an automatic analysis of the bottleneck(s). Select the 'Bottleneck' tabbed page.
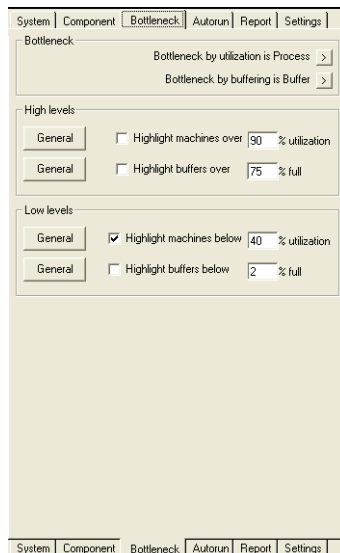

The Bottleneck section already has identified the component named 'Process' to be the utilization bottleneck, and it can be identified by clicking on the '>' button. Red lines appear surrounding the component. The buffering bottleneck has been identified as 'Buffer', and can identified in the same way as previously mentioned.

The High levels can be highlighted by selecting the combo box. The values can be changed by the user. In this case, there are no components with utilization higher than 90%. The highest utilization for a component is 33%. If you highlight the buffers with utilization above 75%, it will show three components.

If you highlight the low levels of machine utilization, all three process points will be highlighted, because all of them have a lower utilization than 40%. Values can be changed as the user wishes to test different values and see which components contribute to those results.

7. Statistical Graphs

The statistical add-on offers the capability of providing several graphs of a variaty of components and parameters. In the 'System' tabbed page you are able to choose from machine and buffer statistics, as well as the system graphs, which are updated according to the selection of parameters.
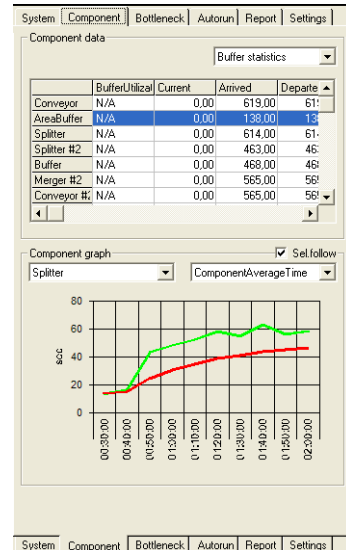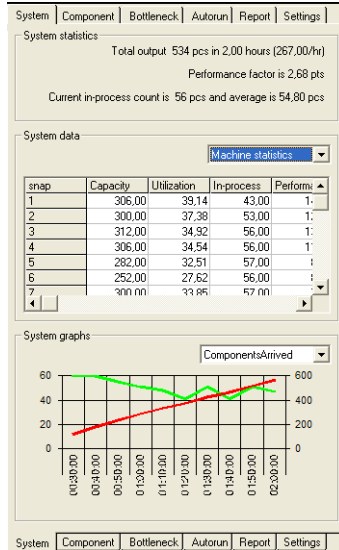
The 'Component' tabbed page shows all the related statistics for every component in the layout. These are also updated as the user selects the right component and parameter to analyze.

In the 'Report' tabbed page, the overall simulation graph and reports can be reviewed. In this example, the report is incomplete, due to the run lenght defined in the settings page. The simulation only runs for two hours each time, and the total run lenght was defined as 10 hours.

The snap report can be seen and imported to a spreadsheet program as done previously with the simulation run reports.

Click on the 'Show graph' button to display the following graph - 'System versus components'. The graph can be modified with a different type by righ-clicking on the graph. In adition, the legend visibility can be toggled in the context sensitive menu.