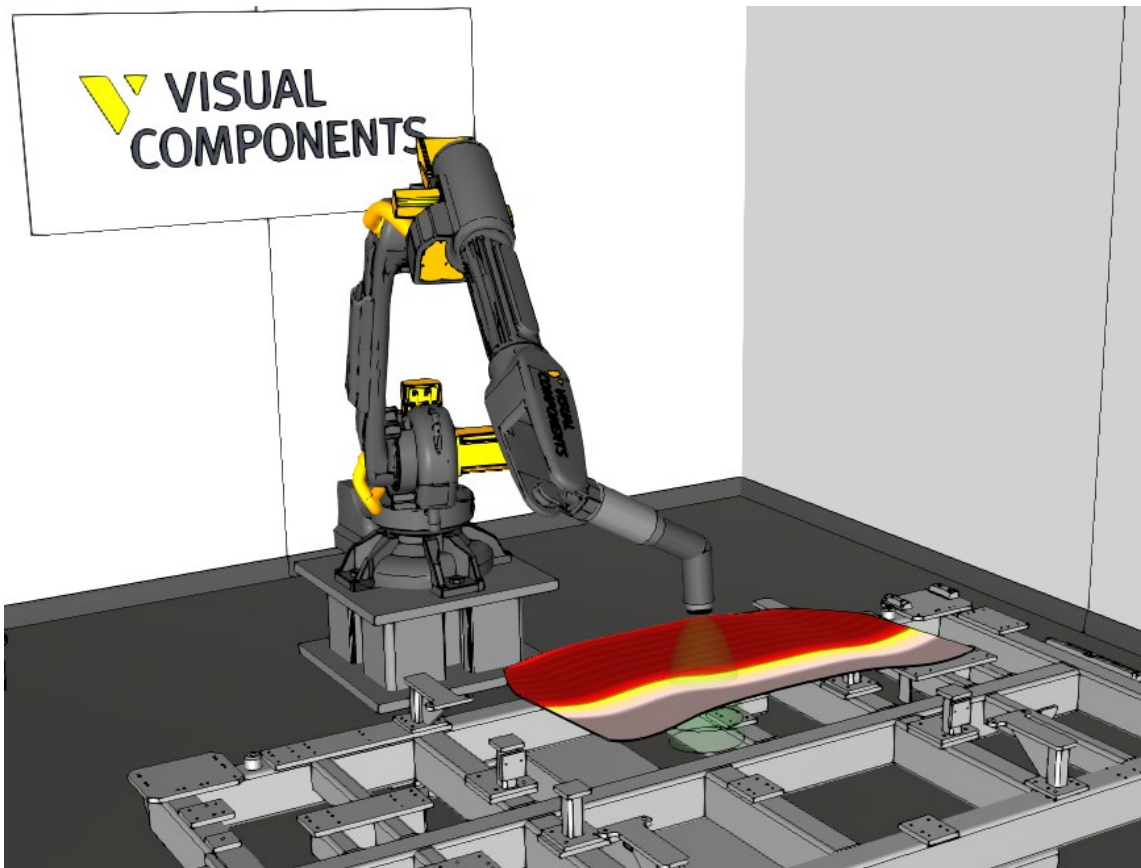# Paint tool setup for Robotics OLP

Visual Components 4.9 OLP | Version: July 10th 2024

Learn to setup paint and spray tools to simulate, visualize and analyze painting and spraying paths.

Use the ready layout in 4.9 eCatalog (Robot Spraying Cell with Multiple Tools (OLP).vcmx) to follow this tutorial. This layout has already been setup so that it works right away, but follow the instructions to create changes to this layout and learn to apply the topics to layout of your choice.

This document includes the following topics:

- Update painting and spraying tools for painting use
- Create and setup brushes
- Assign brushes to different robot tools
- Analyze the spray result

Contents

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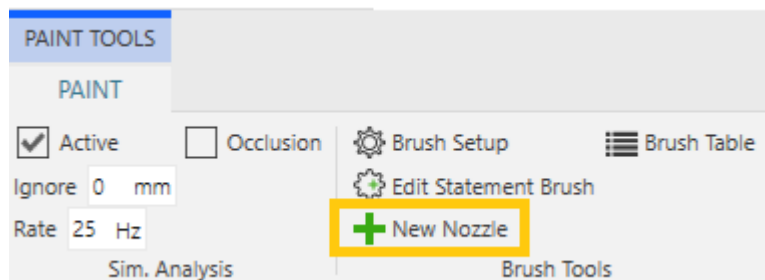© 2024 Visual Components Oy

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Nozzles

Every tool component the robot uses needs to have a nozzle applied. The nozzle acts as the origin and dispensing point for the spray, and it's usually located at the tip of the painting gun. Every tool that dispenses spray will need its own nozzle. If a tool has two dispensers, you must create two nozzles for it.

Create a nozzle

1. Go to the **PAINT** tab

   NOTE: The **PAINT** tab is only visible when you are on the **PROGRAM** tab, so switch to the **PROGRAM** tab first, then open the **PAINT** tab.

2. Select the **New Nozzle** tool from the tool ribbon under the **PAINT** tab.


The **Component Snap** window opens, allowing you to position the nozzle accurately.

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3. Snap the nozzle:

   a. Make sure the +Z is selected as the **Align axis** in the **Component Snap window**.

   b. Select a suitable snap option, for example, **Center** snap.

   c. Snap the coordinate frame component to the place where the paint will be dispensed from the tool.

The orientation of the resulting nozzle needs to be so that the blue Z-axis is pointing outwards of the nozzle.
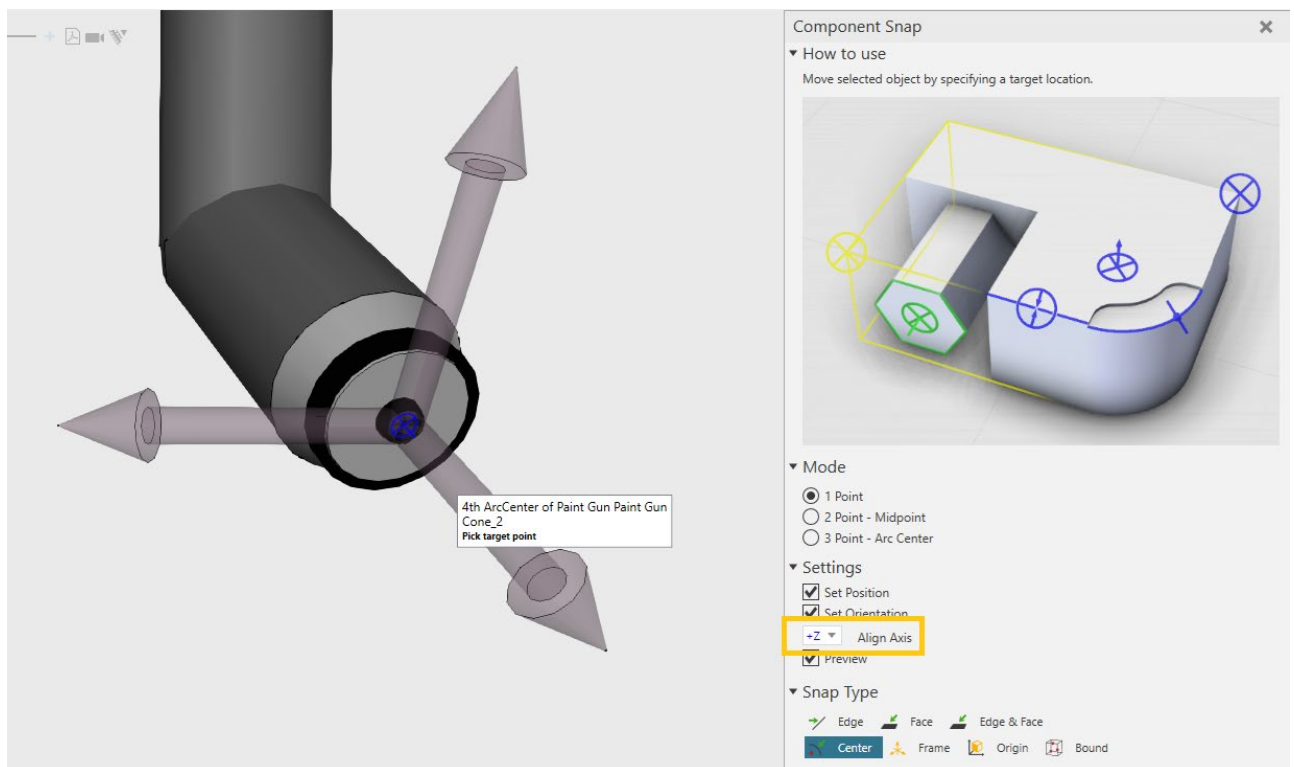

Tip! You can manually adjust the nozzle orientation afterwards using the component manipulation options.

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4. Attach the nozzle coordinate component to your tool so that it will follow the motion when the robot moves:

   a. Go to the **PROGRAM** tab.

   b. Select the **Attach** tool.
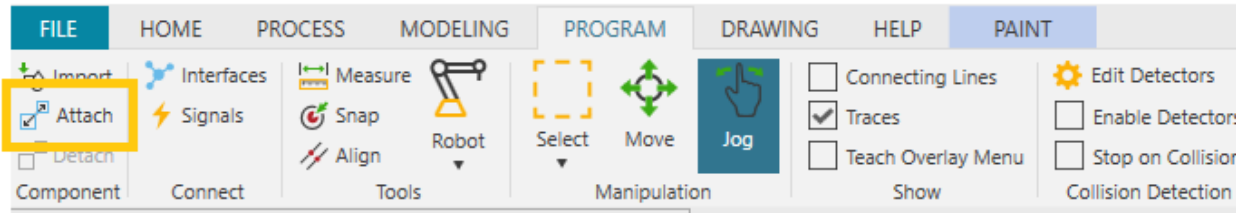
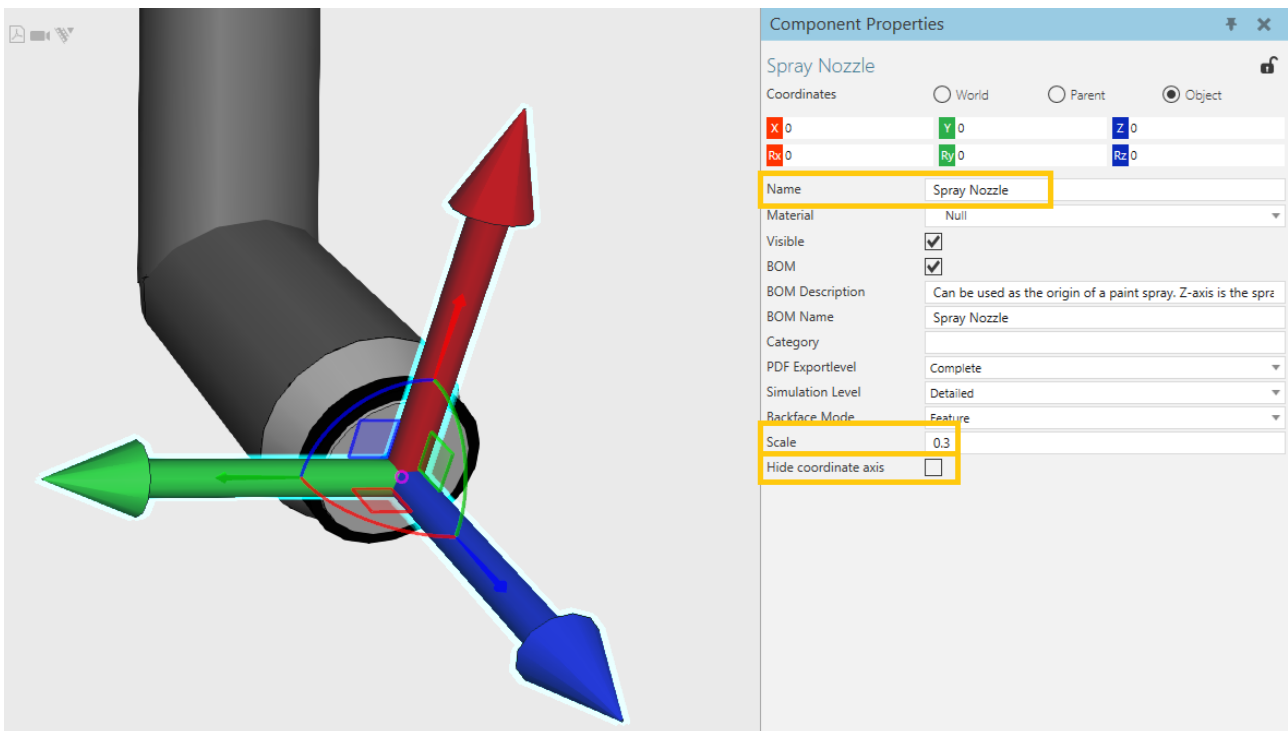   c. Pick the Paint Gun component to attach the nozzle to it.
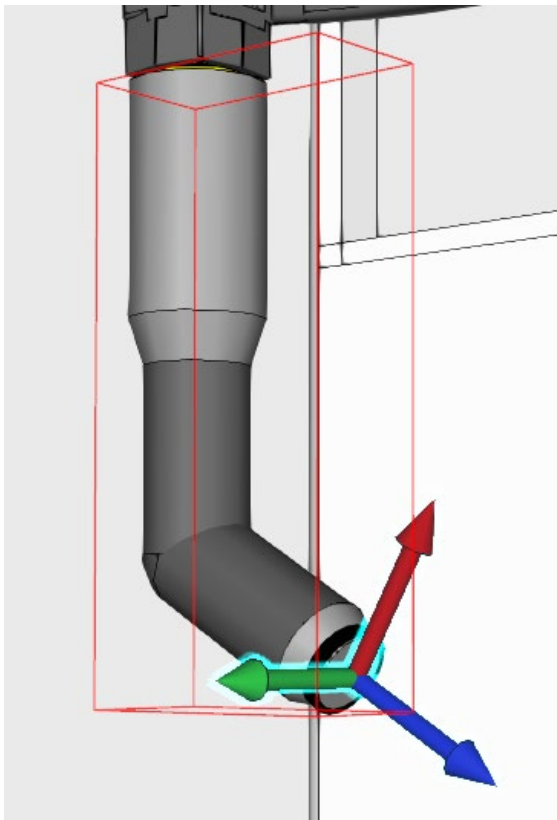
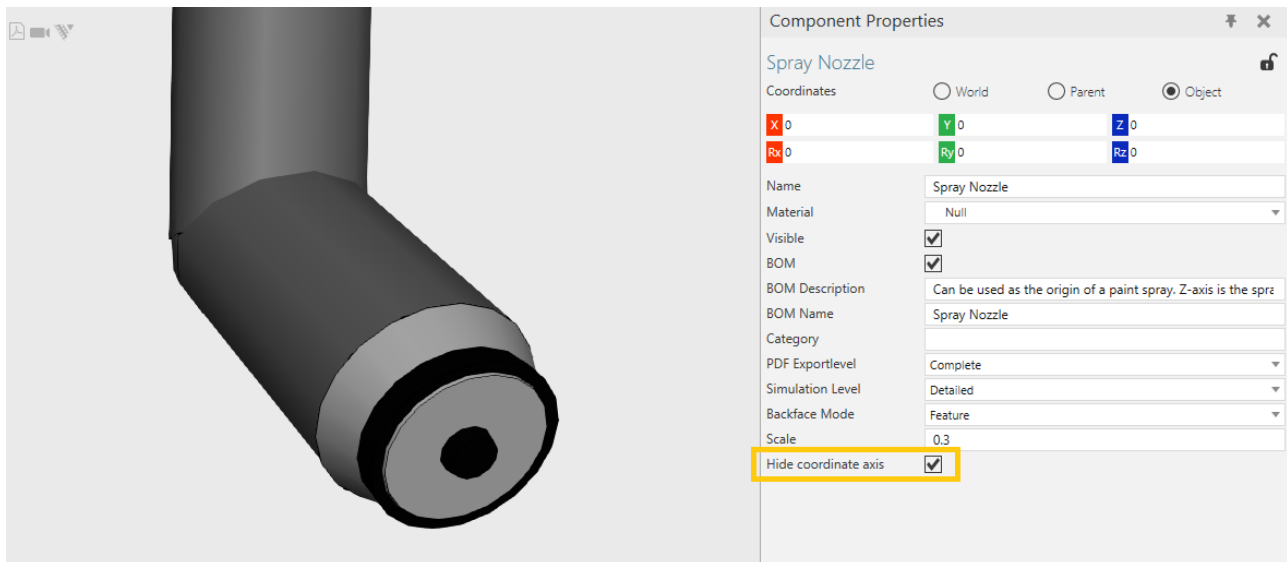**Tip!** You can attach the nozzle to any location within the layout where you want the spray to come out from. For example, in external spray tools, the tool itself is not mounted to a robot, so you can snap the nozzle to an external device and attach it there so it is not moved together with the robot.

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After attaching the nozzle to the component, you can re-orientate the Spray Nozzle component to an orientation of your liking. In case of a standard symmetrical spray, the Nozzle does not need to be re-oriented. If the spray is oval-shaped or asymmetric, you need to rotate the nozzle around the Z-axis so that the spray outline is facing the correct way. This can be done any time after nozzle creation, so test out your spray and see if there are any needs for modifications afterwards.

Finally, you can change the **Component Properties** which allow you to change the **Name** for the nozzle, **Scale** of the visible coordinate system and **Hide** the coordinate axis from view. Naming your nozzle in an intuitive way will help you to find the correct nozzle component when there are multiple inside the layout.

NOTE: You can hide the coordinate axis from **Hide coordinate axis** option, but do not toggle the **Visibility** off for the component! Otherwise, the spray outline will also be hidden during the simulation.

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After setting the preferred **Name** (**Spray Nozzle** in this tutorial) and **Scale** for the nozzle, you can hide the coordinate axis from the view so the spray is clearly visible. For troubleshooting later, you can come back to these options and unhide the coordinate axis if there is a need to verify where the spray is actually coming out from.

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Brushes

To visualize the spray outline, we need to create a brush. Brushes and sprays act as the visualizing elements that show us the correct accumulation of paint. In this chapter, we will go through the options for creating a brush and modifying brush parameters, but you can also use the existing brushes in the layout to see their visualization effect.

Selecting the correct brush

There are three options to choose from when creating a brush or a spray: **Spray (calibrated)**, **Spray (manual)**, and **Circular brush**.

If you already have an existing spray measurement that you need to fit, you can use the **Spray (calibrated)**. To use this spray, you need to run through the spray calibration measurement procedure to get the correct accumulation and outline for the spray. For more information on the spray calibration process, please contact support@visualcomponents.com.

Spray (manual) has simpler parameters for designing the outline of both stationary and moving spray. These options contain general settings that can be modified to do an initial analysis for spray coverage and rough accumulation.

Circular brush is used for surface process applications and will not be covered in this tutorial.

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Create a brush

1. Go to the **PAINT** tab.

2. Select the **Brush Setup** tool from the **Brush Tools**.
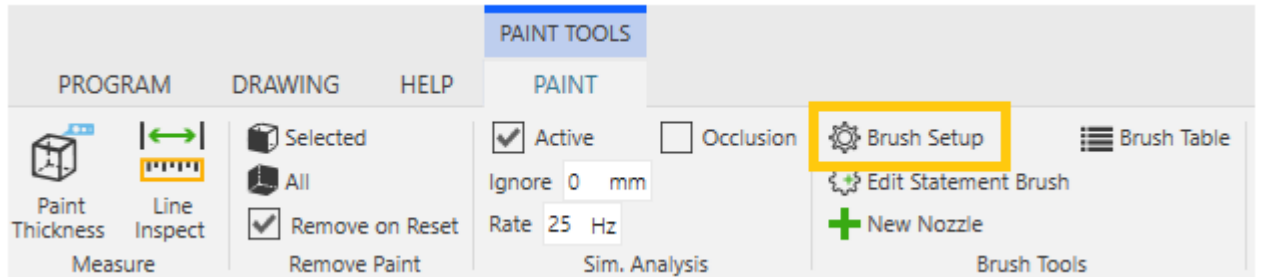

The **Brush Setup** window opens.

3. Select the desired brush type (**Spray (calibrated)**, **Spray (manual)** or **Circular brush**) from the **Create** drop-down menu and click + to create the brush.

In the next chapters, we will go through the options for the **Spray (calibrated)** and **Spray (manual)**.

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Spray (calibrated)

After creating a calibrated spray, the **Edit** and **General** fields will populate with spray data. You can now change the **Name**, **Flow rate** and **Efficiency** of the spray. **Min distance** and **Max distance** affect the visualization and accumulation of the spray from the origin of the used nozzle.
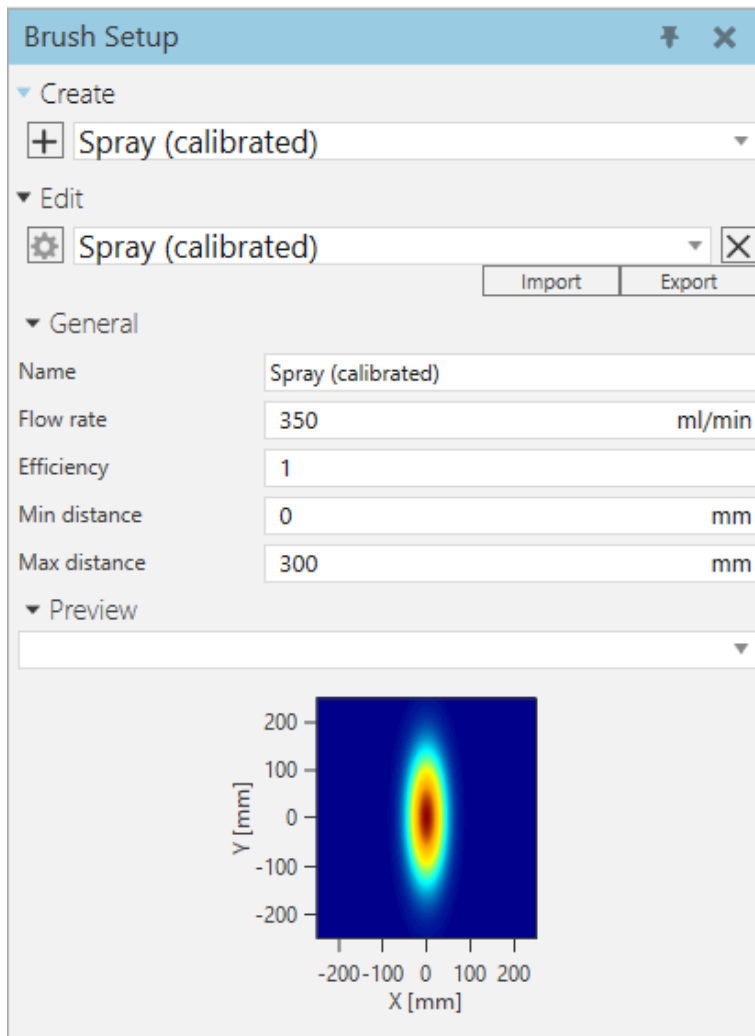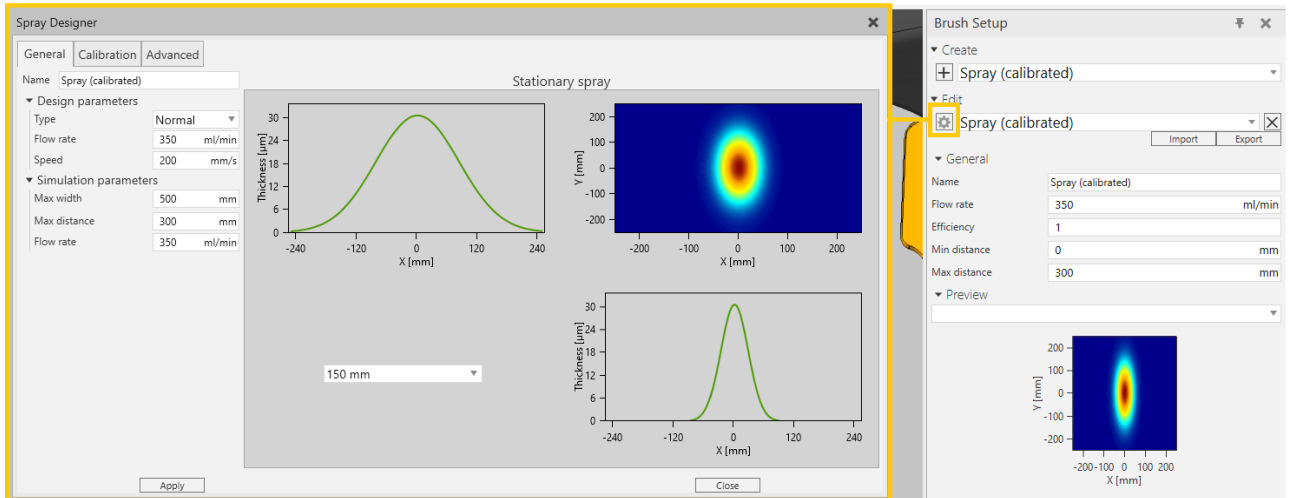

To improve the performance of the paint simulation, you can set the **Min distance** to be larger so that it starts to visualize the paint from a necessary height. Similarly, you can set the **Max distance** so that the spray accumulation ends at this distance from the nozzle origin.

NOTE: More information from these parameters can be found in the Help documentation.

For this tutorial, we will use the calibrated spray named **Spray (calibrated)** with default values.

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To access the calibration parameters for the spray, click the gear icon under **Edit** menu.

Set the parameters under the **General** tab according to your existing spray data. The **Design parameters** will affect how the imported measurements are fitted to a spray outline, and the **Simulation parameters** affect the spray simulation.

More information about these parameters can be found in the Help documentation. To learn more about spray calibration, please contact support@visualcomponents.com.
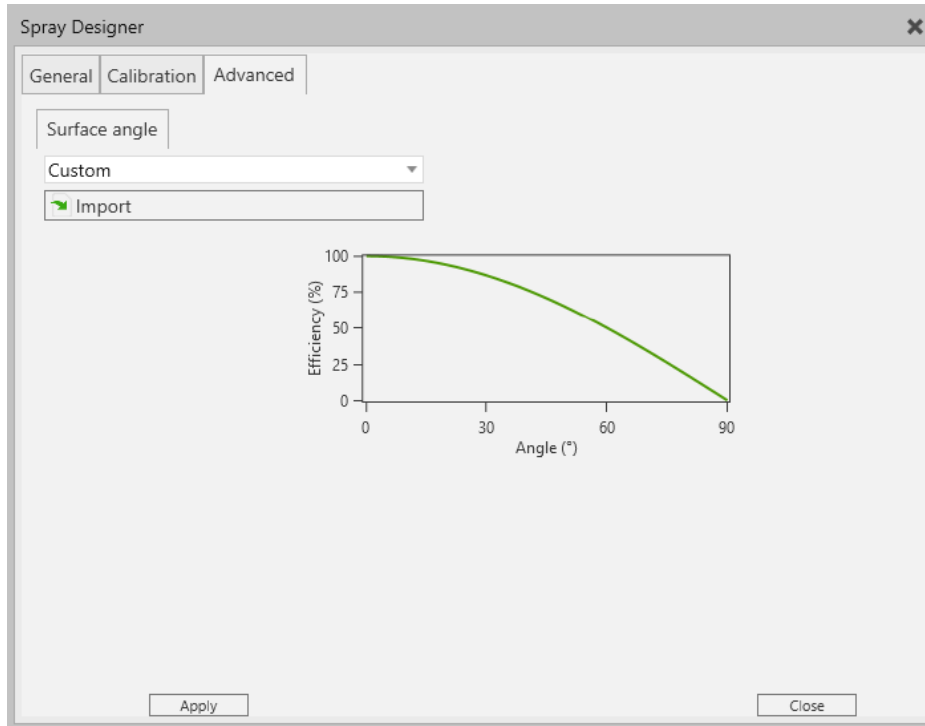
When a new calibrated spray is created, a set of standard parameters is set to the calibration fields to generate a default spray with generic calibration results that can be used for simulation.

Tip! Play around with the calibration variables to see how they affect the spray visualization.

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On the **Calibration** tab, you can fit the measurements to layers that will form the final outline for the spray. Import your measurement data for each layer to form the spray outline or use the default data to see the example layers and their properties.


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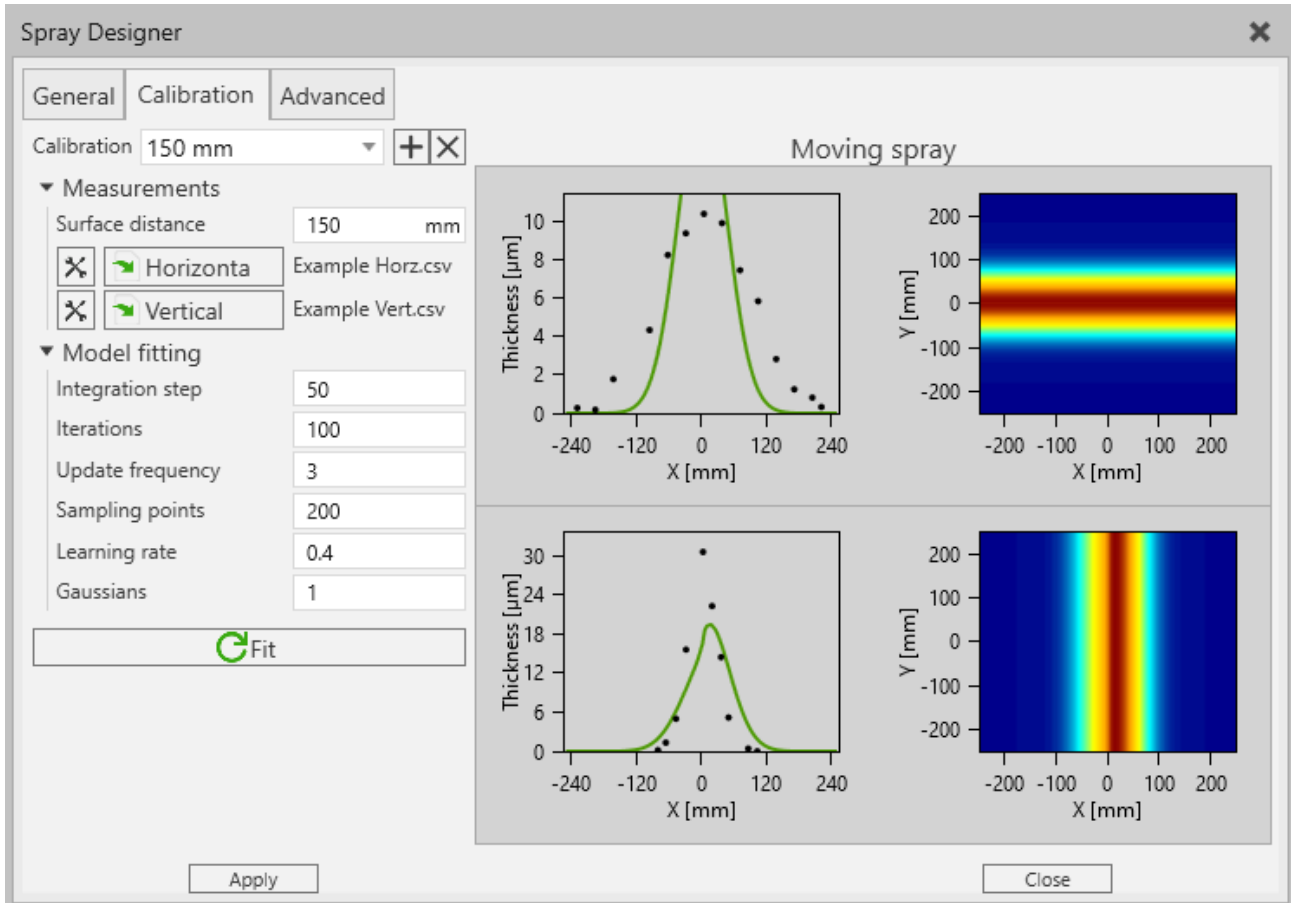
On the **Advanced** tab, you can modify the efficiency for the paint accumulation. If the spray adheres to the desired surface differently than expected, you can modify a custom function that represents the efficiency with regard to the surface angle relative to the spray.

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Spray (manual)

After creating a manual spray, the **Edit** and **General** fields will populate with spray data.
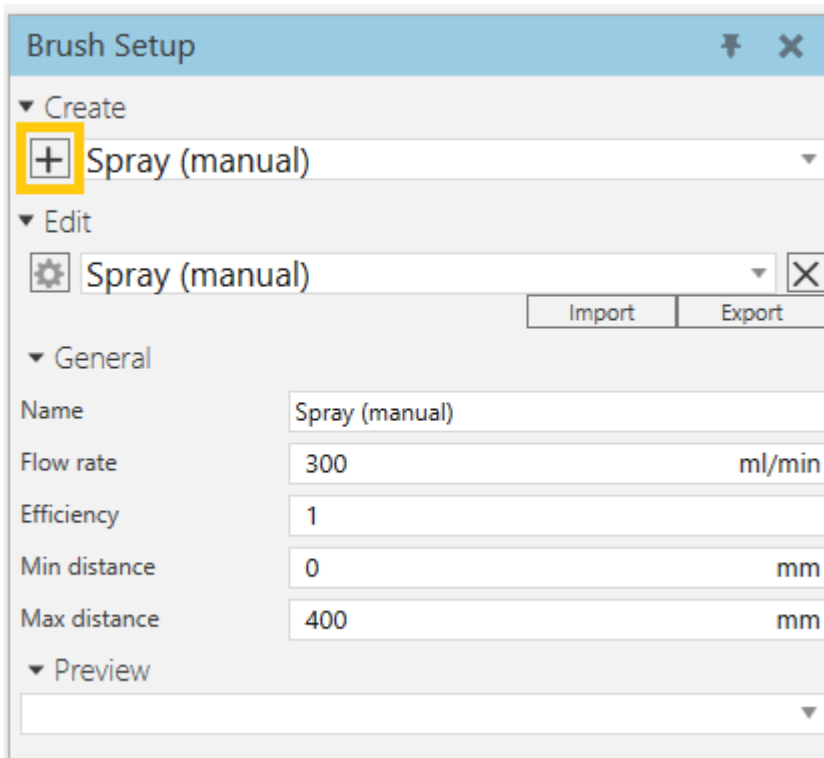
You can now change the **Name**, **Flow rate** and **Efficiency** of the spray. **Min distance** and **Max distance** affect the visualization and accumulation of the spray from the origin of the used nozzle.

To improve the performance of the paint simulation, you can set the **Min distance** to be larger so that it starts to visualize the paint from a necessary height. Similarly, you can set the **Max distance** so that the spray accumulation ends at this distance from the nozzle origin.
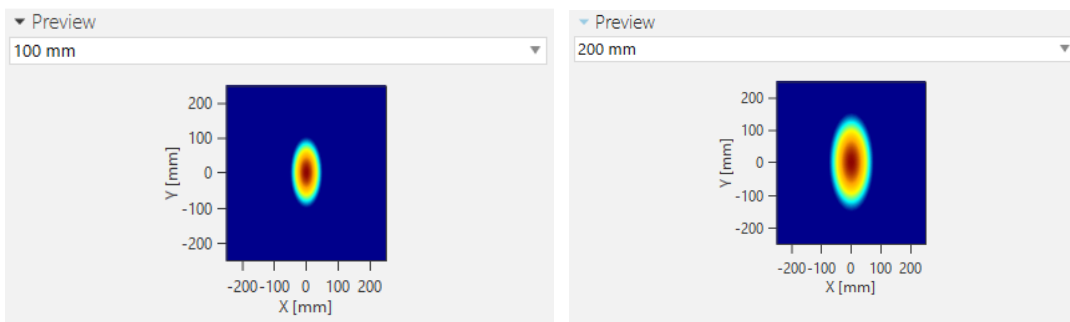
NOTE: More information from these parameters can be found in the Help documentation.

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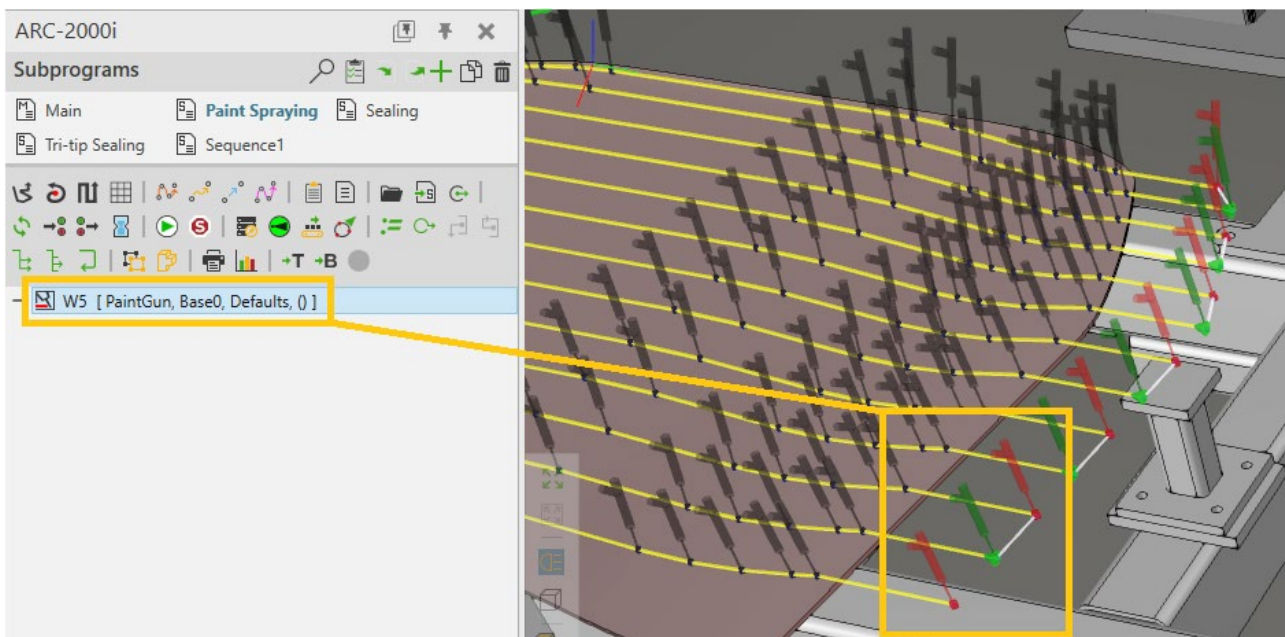Click the gear icon to open the **Spray Designer** for the manual spray.
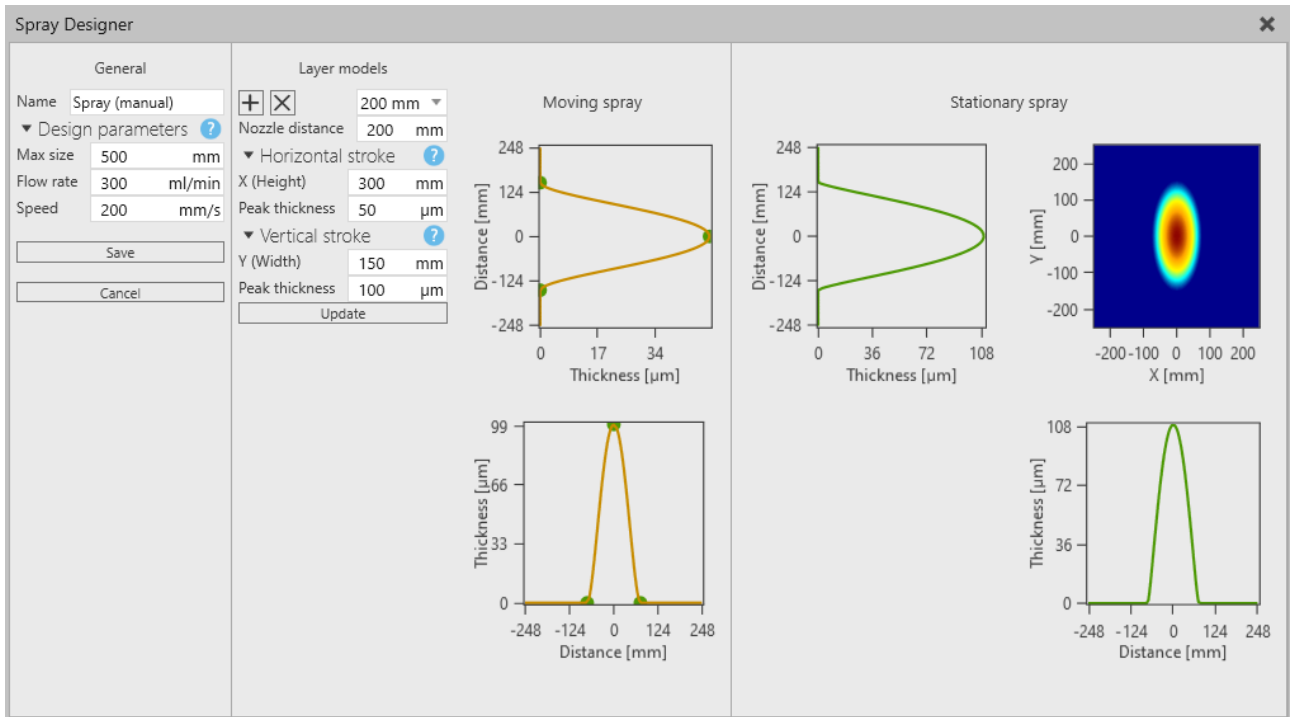
The **Spray Designer** allows you to model the spray layers one by one for the desired heights. For more information about the **Design parameters** and how to use them, see the **Spray Designer** section from the Help documentation. Add your desired layers and update the models to finalize a usable spray model. When you are finished with the model, click the **Save** button and close the designer window.

After creating layers for the spray, you can preview them from the **Brush setup** window. Below is an example of previews for two layers, one at 100mm and other at 200mm distance.

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Assign brushes to nozzles and statements

To enable the visualization of the brushes, they need to be assigned to nozzles and statements. When a brush is assigned to a statement, it will be visualized with a spray in the simulation. This visualization begins when the process **Start** point is reached on the path and stops at a process **End** point. The visualization starts from the nozzle's origin. In the 3D world, start points in path statements are displayed with a green tool outline, and End points with a red tool outline. See the existing path statements in **Program Editor** for reference.

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Brush table

A brush can be assigned to a nozzle in the **Brush table**. You can open the **Brush table** from the **PAINT** tab under the **Brush tools**.
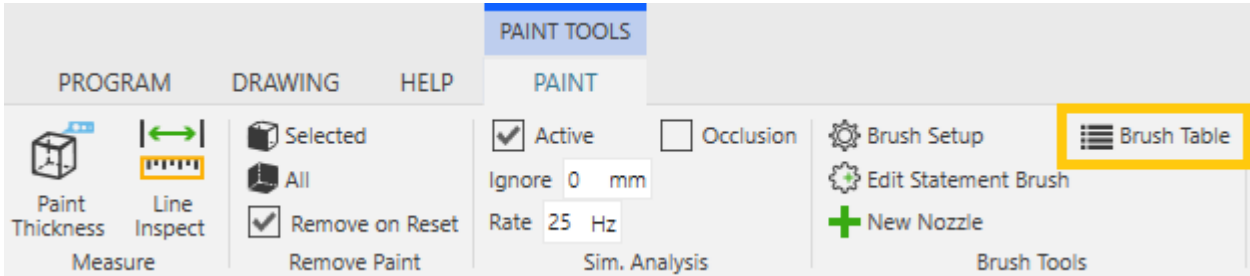
To assign a nozzle to a brush, you need to create a brush separately for turning spray on and off. A brush that turns a spray on needs to have a suitable **Name**, correct **Sim. Brush** and **Sim.applicator**.
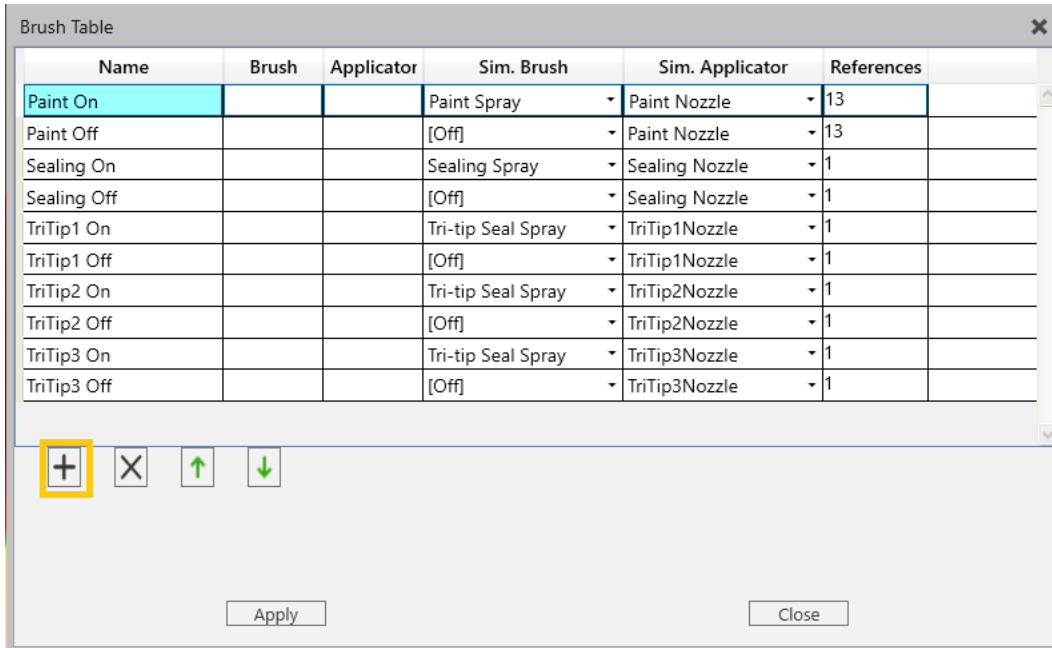
Name	Brush	Applicator	Sim. Brush	Sim. Applicator	References	
Paint On			Paint Spray	Paint Nozzle	13	
Paint Off			[Off]	Paint Nozzle	13	
Sealing On			Sealing Spray	Sealing Nozzle	1	
Sealing Off			[Off]	Sealing Nozzle	1	
TriTip1 On			Tri-tip Seal Spray	TriTip1Nozzle	1	
TriTip1 Off			[Off]	TriTip1Nozzle	1	
TriTip2 On			Tri-tip Seal Spray	TriTip2Nozzle	1	
TriTip2 Off			[Off]	TriTip2Nozzle	1	
TriTip3 On			Tri-tip Seal Spray	TriTip3Nozzle	1	
TriTip3 Off			[Off]	TriTip3Nozzle	1	

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To create a new brush to the list:

1. Click twice the **+** icon below to create two brush rows.

2. Apply the following settings for the rows you created:
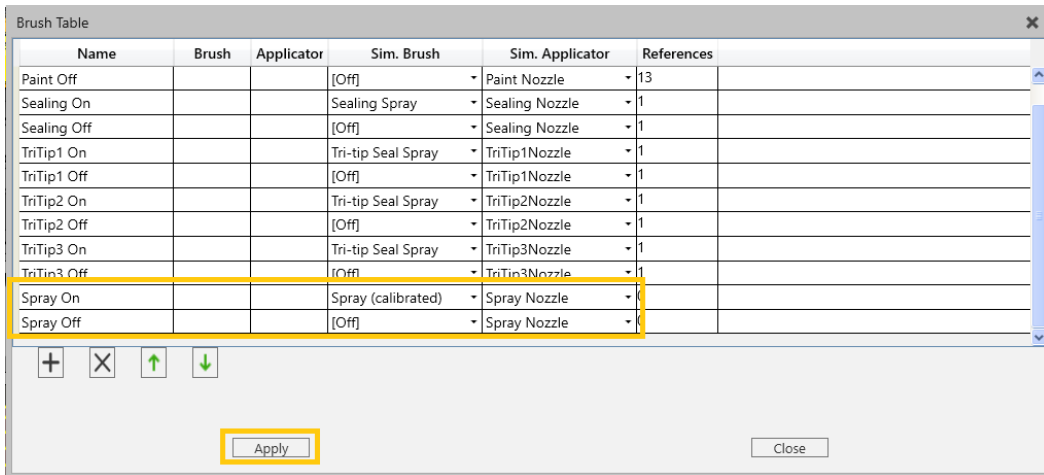
    a. Name the rows as **Spray On** and **Spray Off**.

    b. Select the **Sim. Brush** for **Spray On** to **Spray (calibrated)**.

    c. Select the **Sim. Brush** for **Spray Off** to **[Off]**.

    d. Select the **Sim. Applicator** for both to **Spray Nozzle**

    e. Click **Apply** to save the changes.

After setting the Brush table values, you are able to set the brushes for statements.

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Apply brush to statement

When creating a surface path, for example, a **Free path**, you can set the brush for the statement directly from the **Brush** section of the **Free path** creation menu.
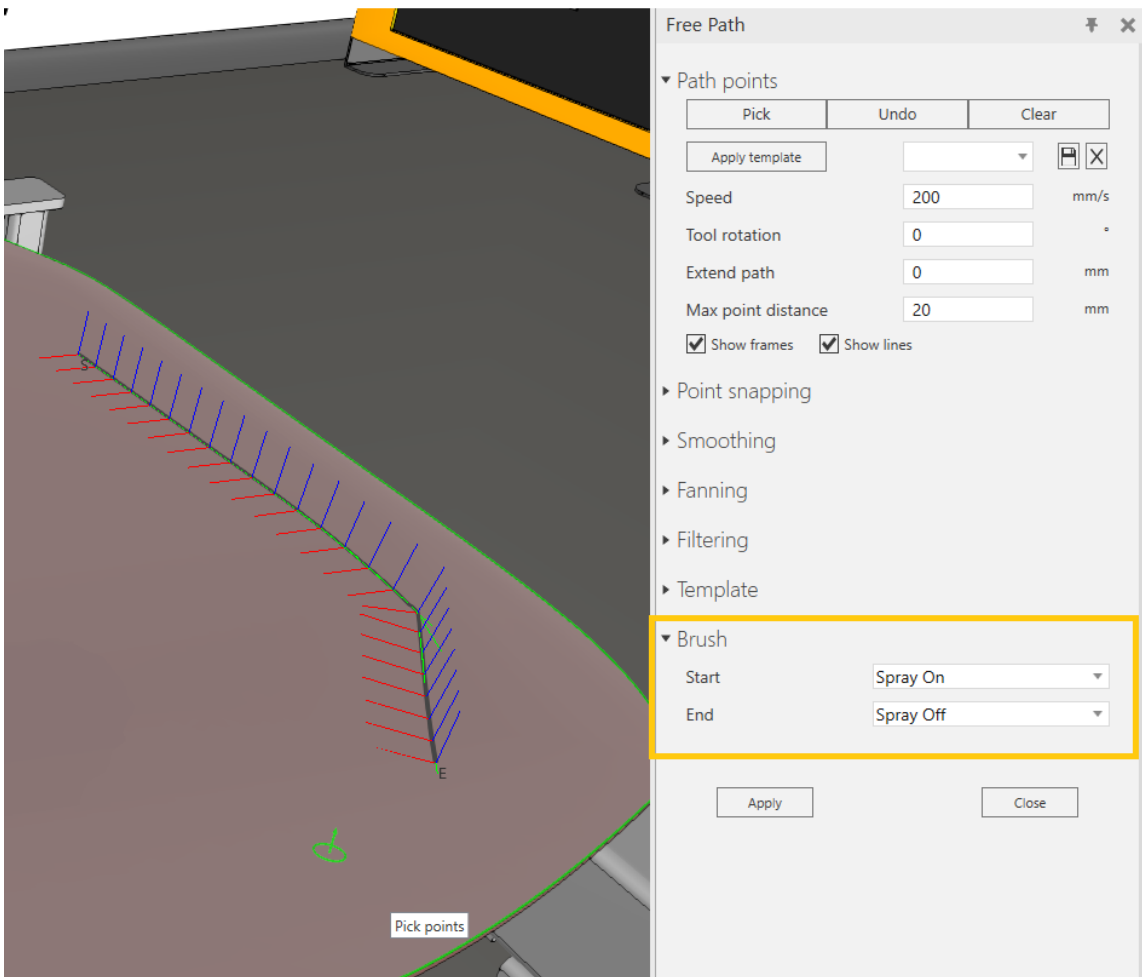
You can also use the **Edit Statement Brush** tool to assign brushes to existing statements:

1. Select one or more statements from the **Program Editor.**

2. Open the **Edit Statement Brush** tool.

3. Choose the correct **Start** and **End** brushes (**Spray On** and **Spray Off** in this case).

4. Click **Apply** to assign the brushes to the statement.

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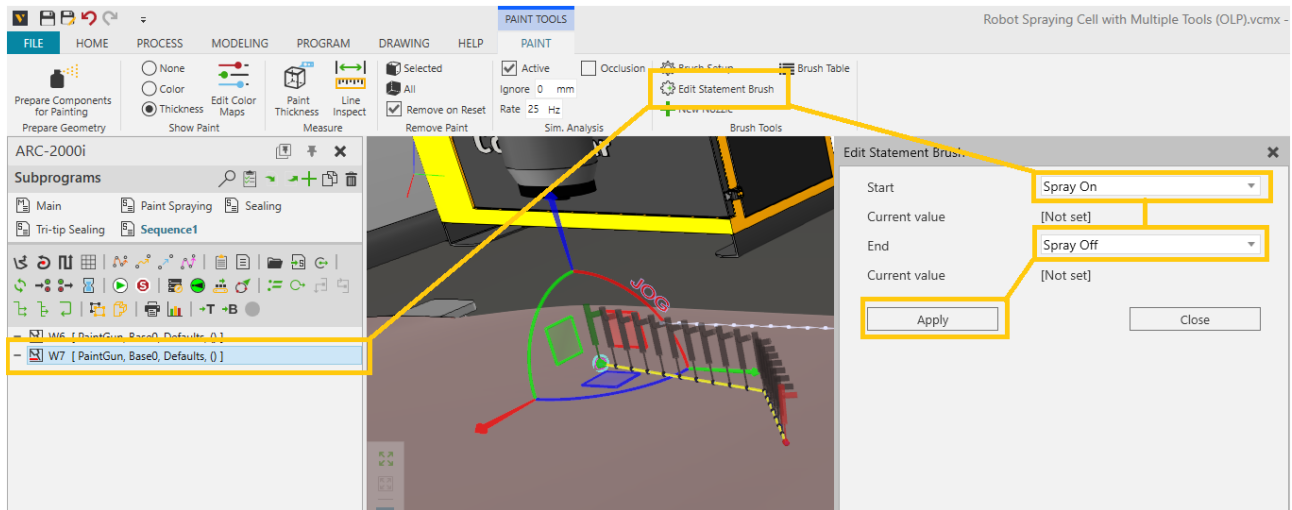
After this, you can visualize the result of the spray when running the simulation.

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Paint analysis

After creating a nozzle and a brush, linking them in the Brush table and assigning them to a statement, we are able to analyze the result of the spray we have created. To enable the spray analysis, the workpiece needs to be prepared first.
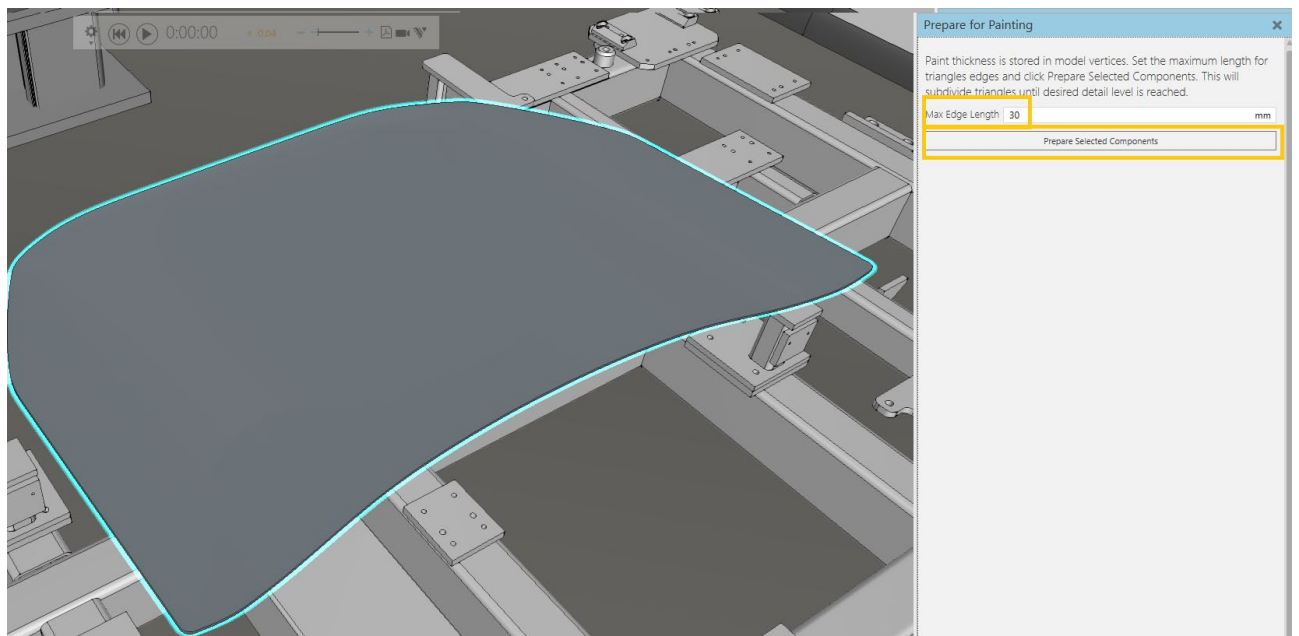
Prepare paint analysis

To simulate the spray accumulation on a surface, the workpiece surface needs to be meshed with a high quality. To improve the workpiece surface mesh, use the **Prepare Components for Painting** tool on the **PAINT** tab.
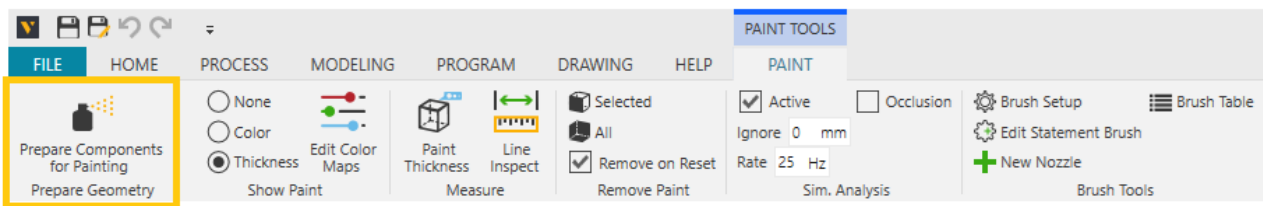
1. **Open the Prepare Components for Painting** tool.

2. Select the workpiece and choose a suitable **Max Edge Length** value.

   A usual value for this is between 10-30mm. If the **Max Edge Length** value is too small, it may affect the simulation performance, and if it's too high, the resulting spray quality may not be sufficient for analysis.


3. Click the **Prepare Selected Components** button.

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After preparing the workpiece component, you can set the 3D **Render Mode** to **All Edges Shaded** or **Wireframe** to see the result of the triangulation. If the result is not suitable, try a different value for the **Max Edge Length** and see the difference.

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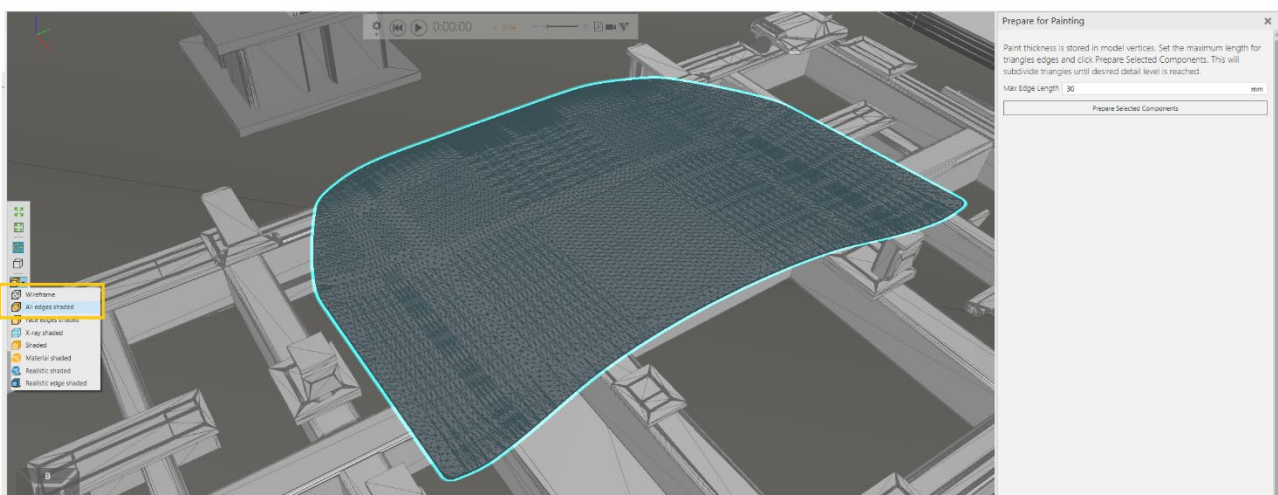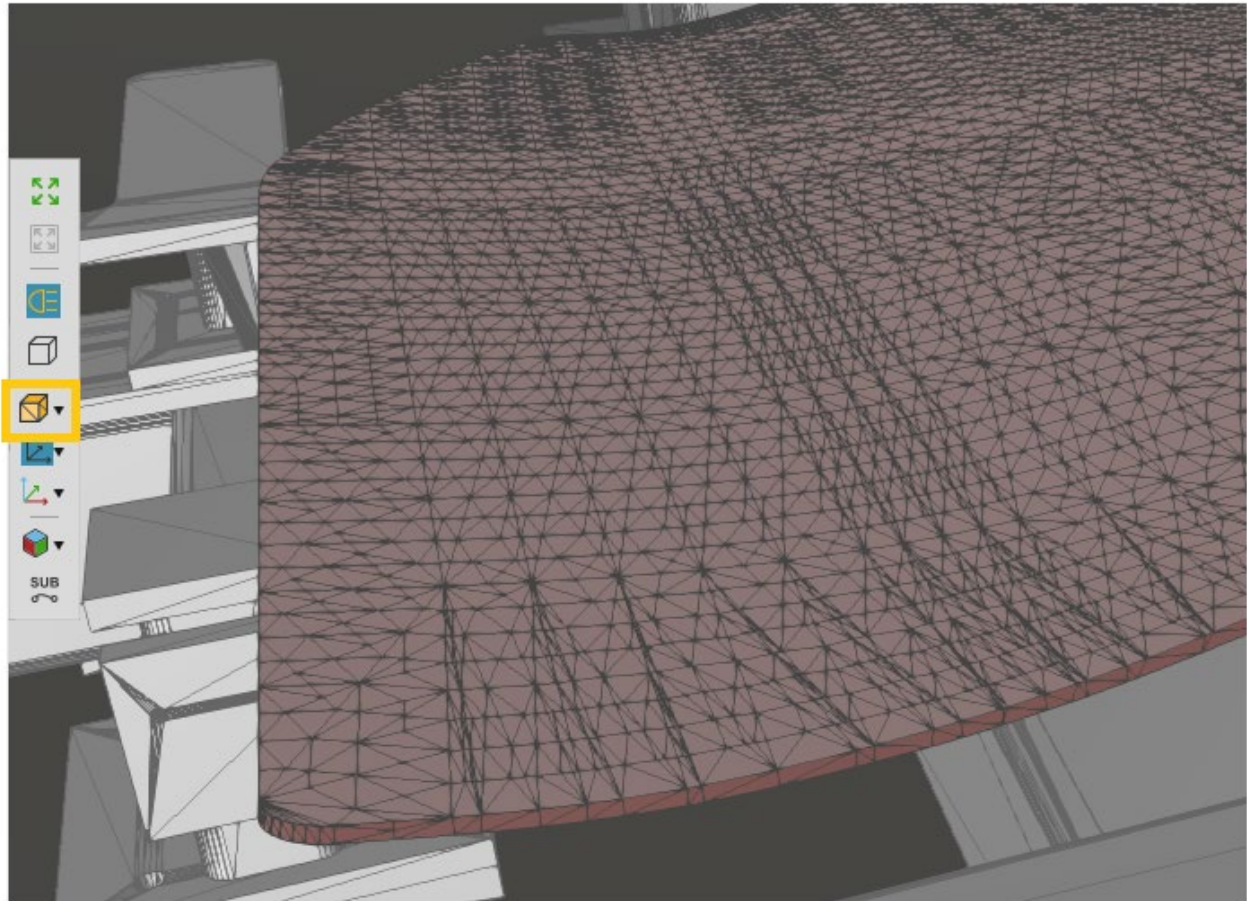
Simulation parameters and running simulations

To tune and modify the result of the spray accumulation, you can change the parameters that control the spray in simulation. Beside the brush parameters, you can also affect the simulation with the **Sim. Analysis** group in the PAINT tab.
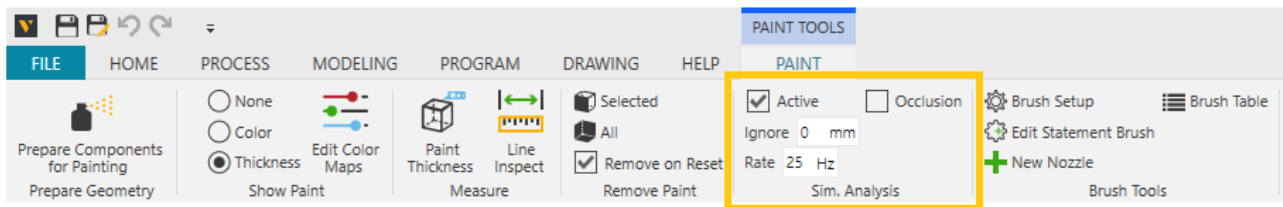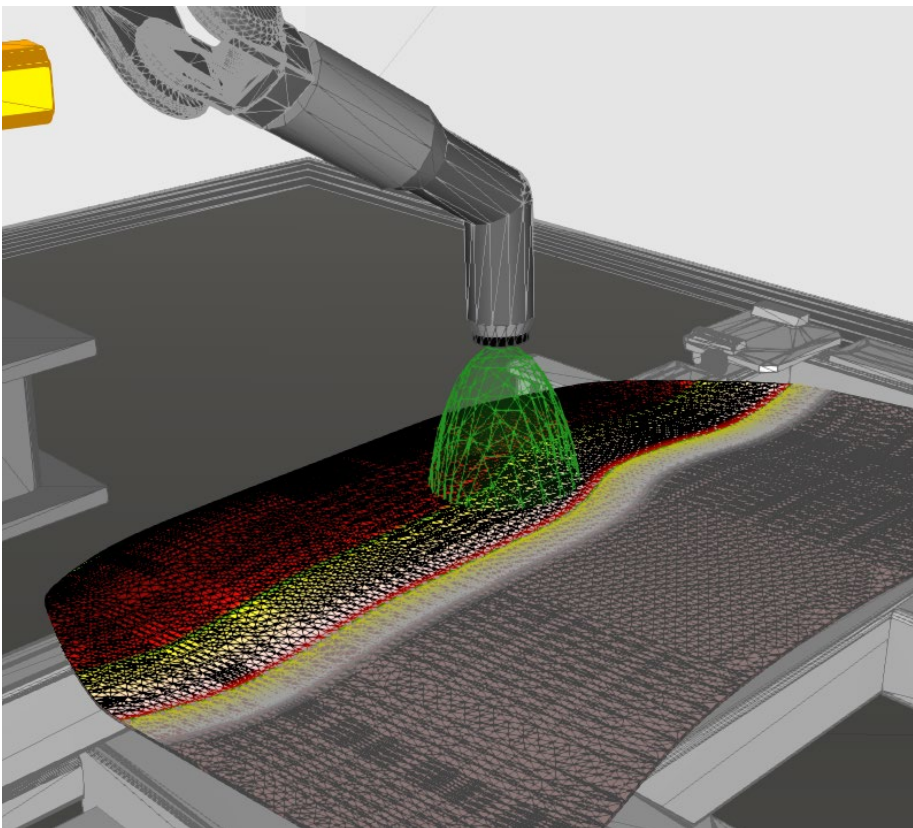

- **Active** toggles the paint simulation on and off.

- **Occlusion** is checking if there are obstacles in front of the spray that affect the accumulation of a spray to the desired surface. When enabled, sprays cannot pass through surfaces.

- With **Ignore** you can set the simulation to ignore smaller geometries than set value. Use value of 0 mm to include all sizes.

- **Rate** of spray refreshes during simulation affects on how many times the spray outline is updated during a simulation cycle (higher value means better quality, but requires more performance to run the simulation).

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When the simulation is running, you can see the example spray outline with a green color and the paint accumulation on the surface of the workpiece.
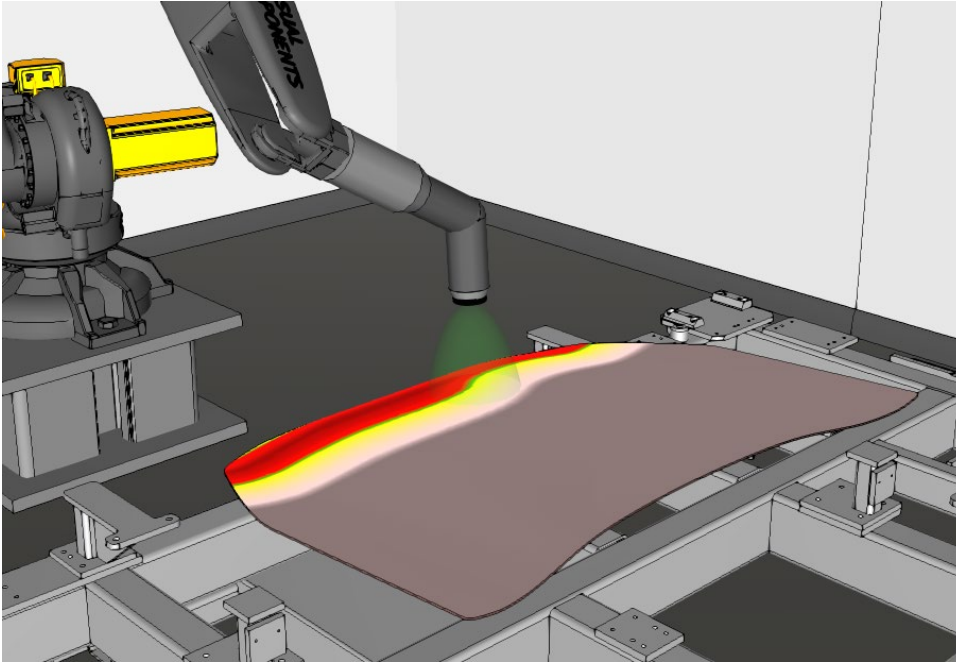
You can compare the spray visibility with different Render modes, to see how the mesh is affected by the spray and if the workpiece mesh is good enough to analyze the spray.


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Analysis of the spray

To analyze the thickness of the resulting spray, you can use **Color maps**, **Paint Thickness** and **Line inspect** tools.
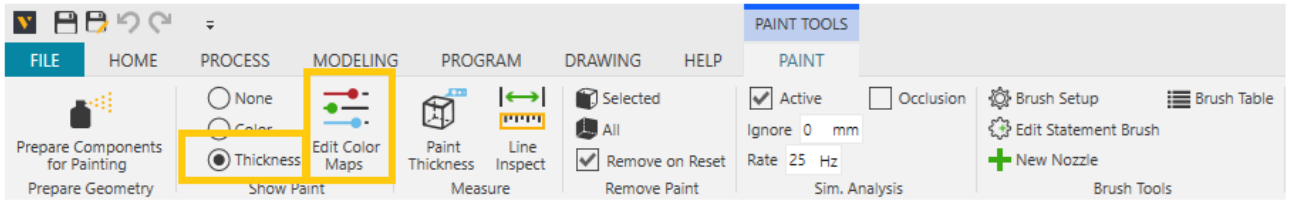
Color Maps

To visually show the result of the spray, you can select the **Color** option from **Show Paint** group and click **Edit Color Maps** to pick a color of your liking.
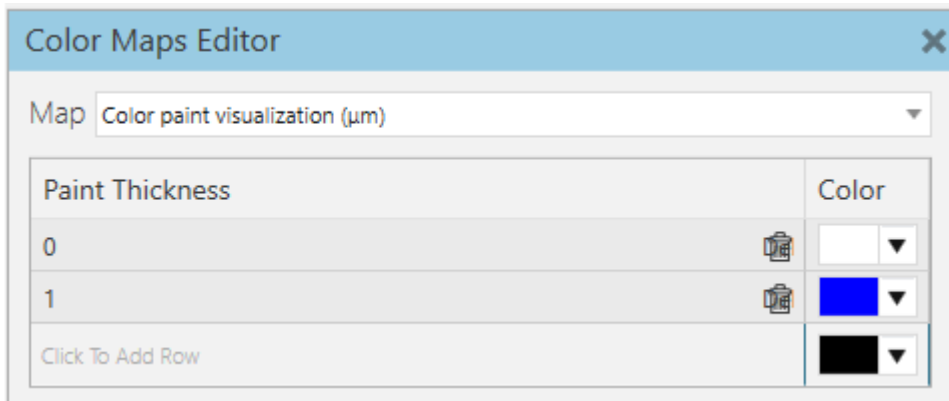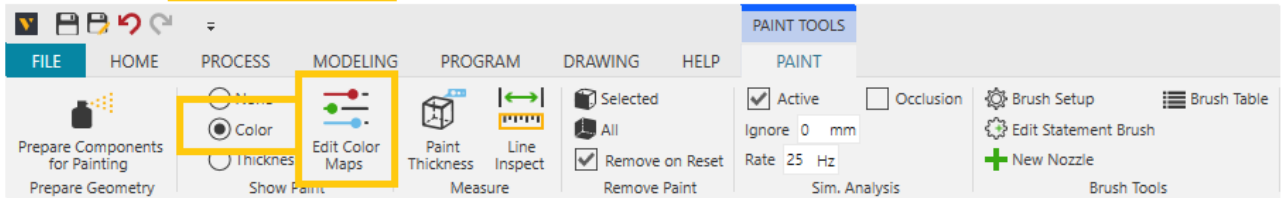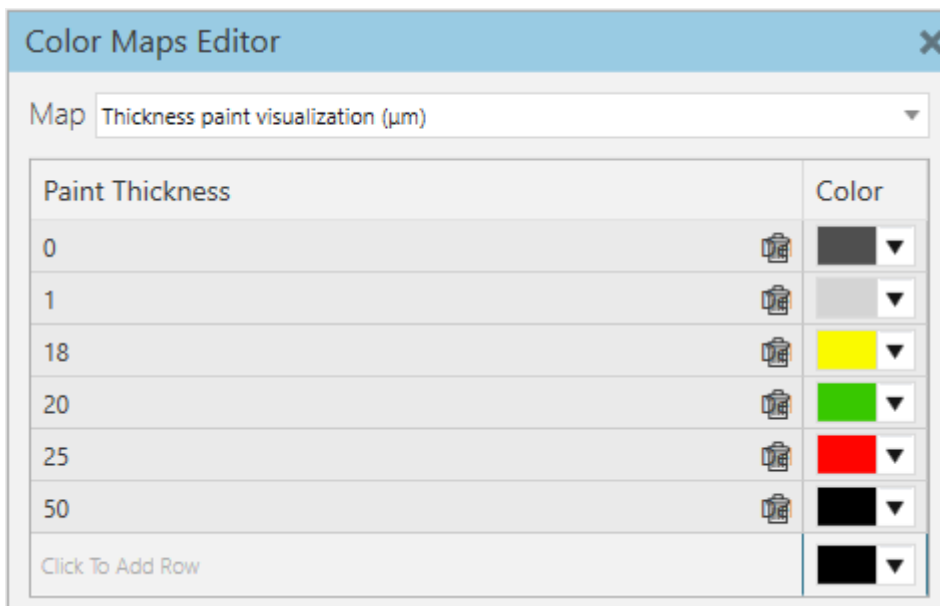

Here, the paint coloring is set to blue and the background will be white when there is no spray accumulation. Choose a color from the drop-down menu to change the color to your liking.
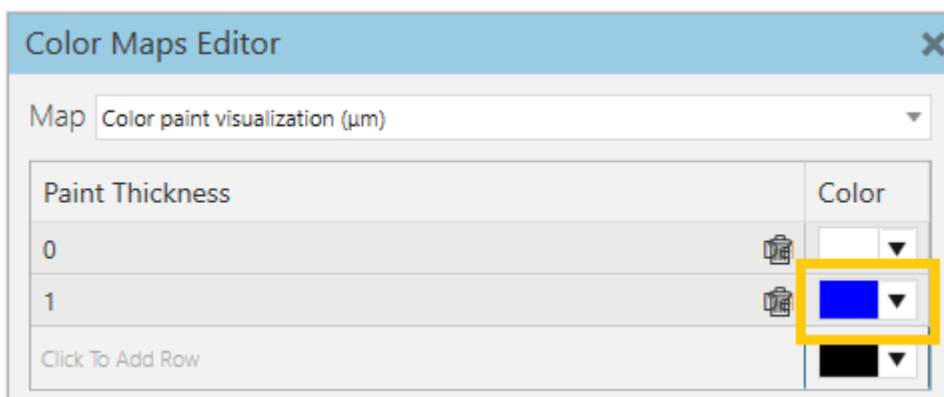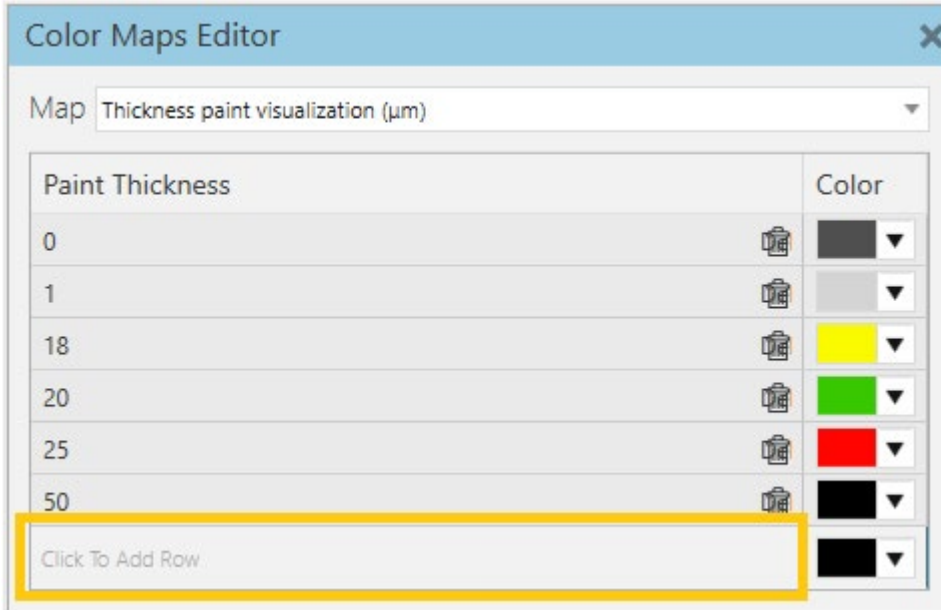
To visualize the thickness of the resulting spray, change the option to **Thickness** in the **Show Pain**t group and click **Edit Color Maps** to pick a color of your liking for a desired thickness level.
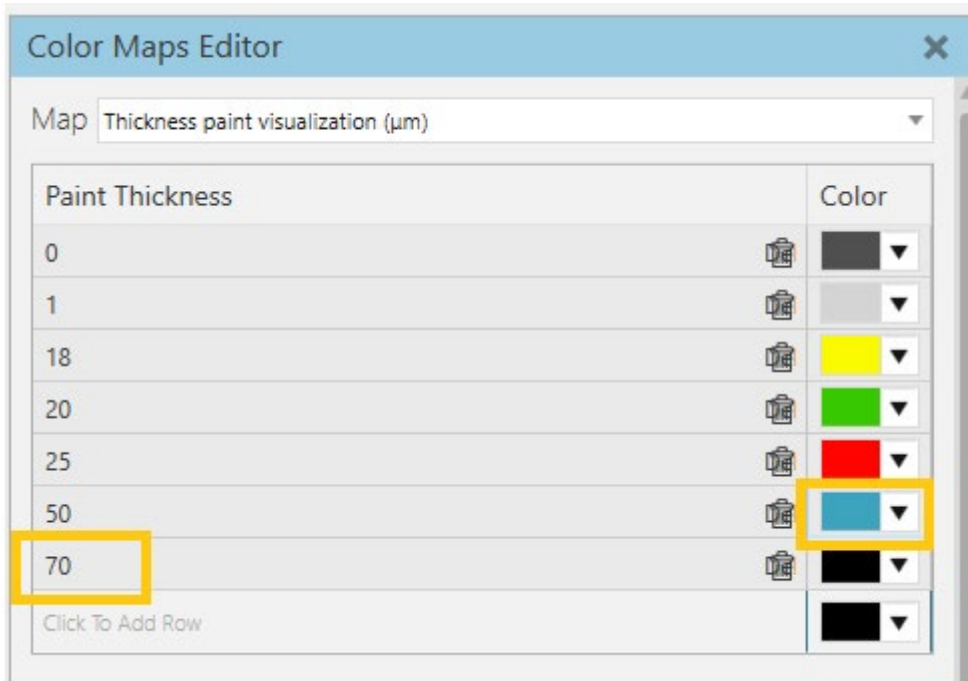

Now the **Color Maps Editor** will include coloring for different **Paint Thickness** levels. You can change the thickness values, delete a level or change a color for the level.

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To create a new thickness level, click the bottom row and type in a thickness limit of your liking.

Then, either assign a new color to it to differentiate it from the previous layer or change the previous layer coloring.

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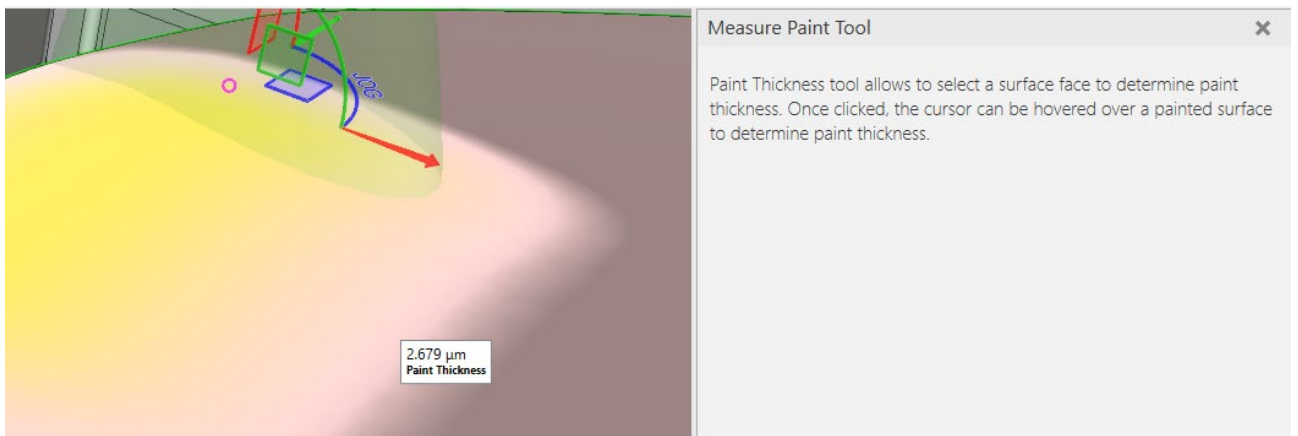
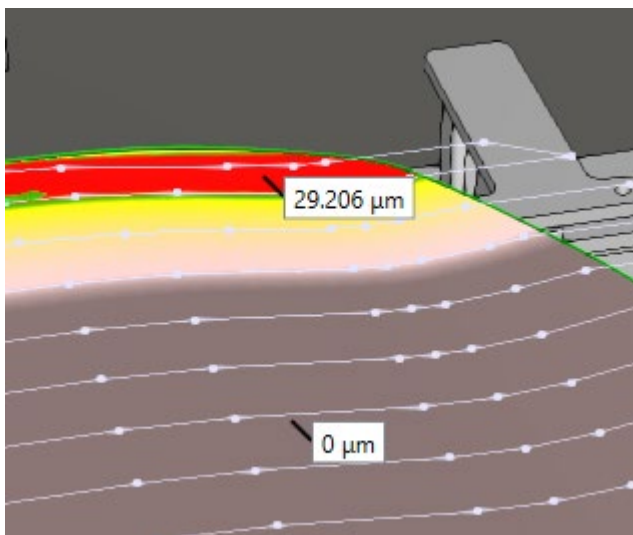| PAGE 27 OF 30 |

Paint Thickness

To inspect the paint thickness with cursor, select the **Paint Thickness** tool from the **Measure** group under **PAINT** tab.
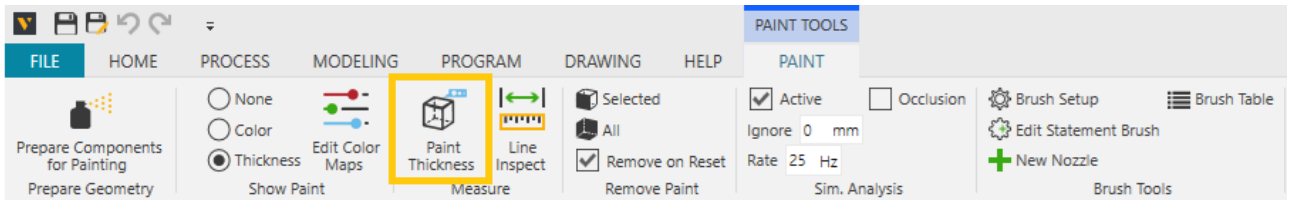
This allows you to click on a point on the surface where there is spray accumulation and see the spray thickness in the cursor location. Click on different points on the surface to see the accumulation.
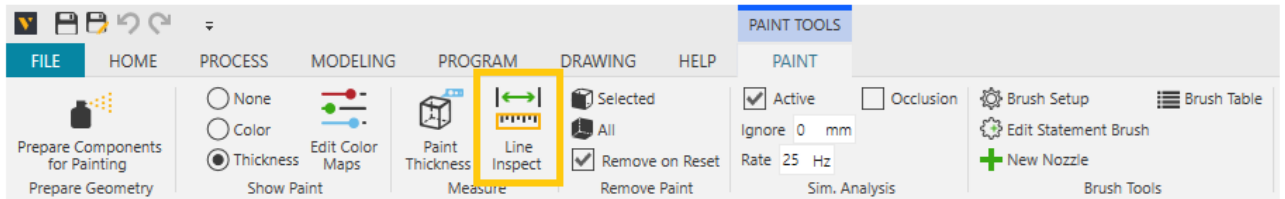

Tip! Click as many points on the surface as you need to find out the thicknesses.

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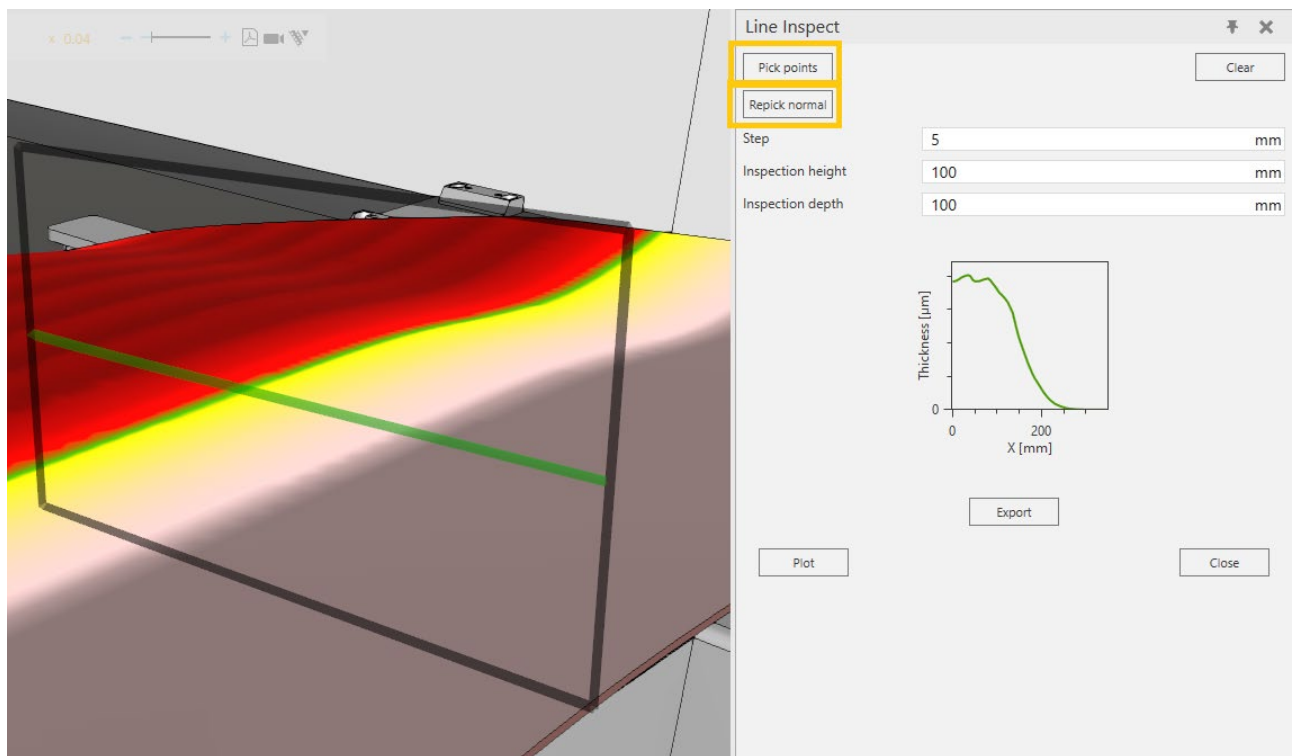© 2024 Visual Components Oy

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Line inspect tool

Use the **Line Inspect** tool from the **Measure** group under the **PAINT** tab to inspect the paint thickness with a continuous cross-section line.

To use this tool:

1. Open the **Line Inspect** tool from the **Measure** group under the **PAINT** tab.

2. Click the **Pick points** button.

3. Select two points from the surface.

   The inspection will done on a line between those two points.

4. Click the **Repick normal** button and assign a normal from the surface.

   This will calculate the accumulation on the surface in the correct direction.

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After selecting the correct normal, you can see the accumulation of the spray in the thickness diagram, which shows the spray thickness between the selected points and the distance between the points. You can further repick the points and the normal to inspect also from other parts of the workpiece.

There are three inspection parameters which you can modify:

- **Step** changes the inspection step length, so the bigger value there is, the coarser the inspection.

- **Inspection height** and **Inspection depth**, will define the height of the window where the inspection will be made.
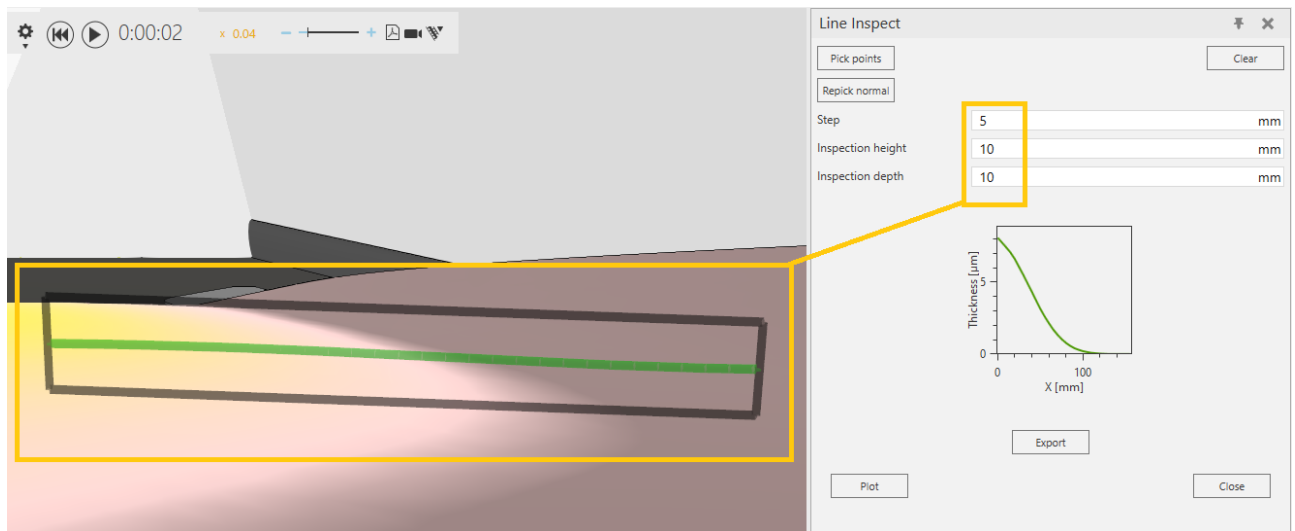
Tip! Change the Simulation analysis parameters to see what effect they have on the quality of the spray simulation and to the thickness analysis of the spray.

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