Using CAD in layouts

Visual Components Essentials 4.3 | Version: June 2021

This tutorial will introduce different ways how imported CAD models can be used in layouts without any modeling work

In this tutorial, you will go through:

- General information from CAD importing
- 2D factory layout
- Static objects in the production environment
- Point clouds
- Machine and resource visualization
- Products in simulation
- Machine structures (ColDetection)
- Robot tools and pedestals

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General information from CAD importing

Most commonly used CAD formats can be imported into Visual Components. Importing can be done by drag-and-dropping files from windows explorer/file manager into the 3D window in Visual Components or from the Import > Geometry tool. If the file is drag-and-dropped into the world, the previous (or default) setting for importing that specific CAD format is used.

When importing tool is used, dialog is opened for user.
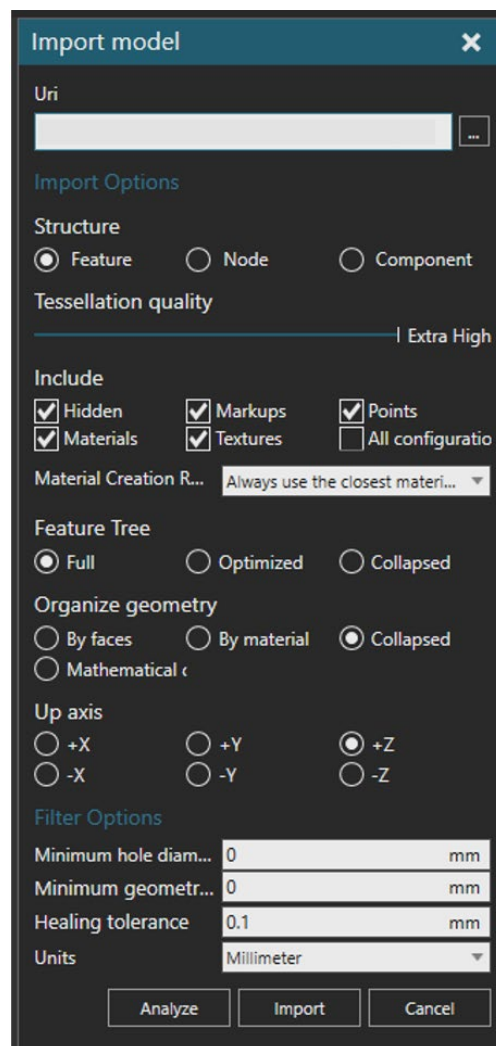
Before you import a CAD file, you should clean up the geometry of the file in a CAD editor. Import settings in Visual Components Premium 4.3 can clean up and fix certain issues with imported CAD files.
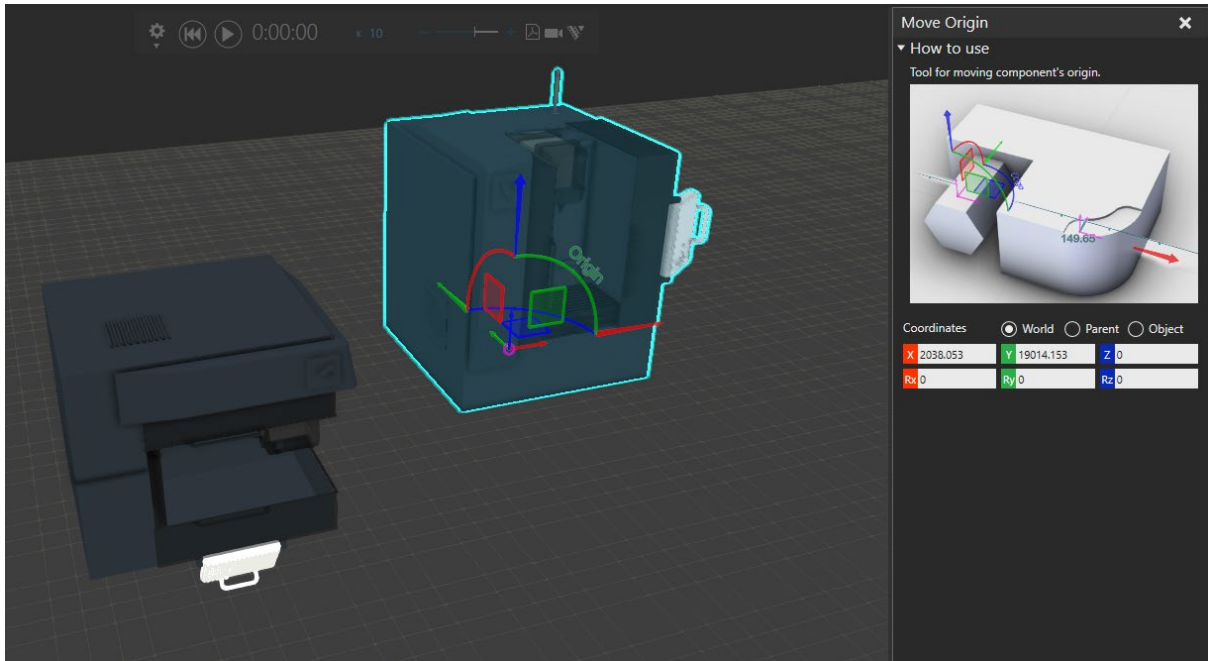
After importing, please check that the CAD model is in correct orientation and scale. After fixing the orientation with Move-tool, the component's origin should be moved into a logical position with the Move Origin -tool (e.g., in case of machinery, the origin should be located into the bottom of the machine Z axis pointing up).
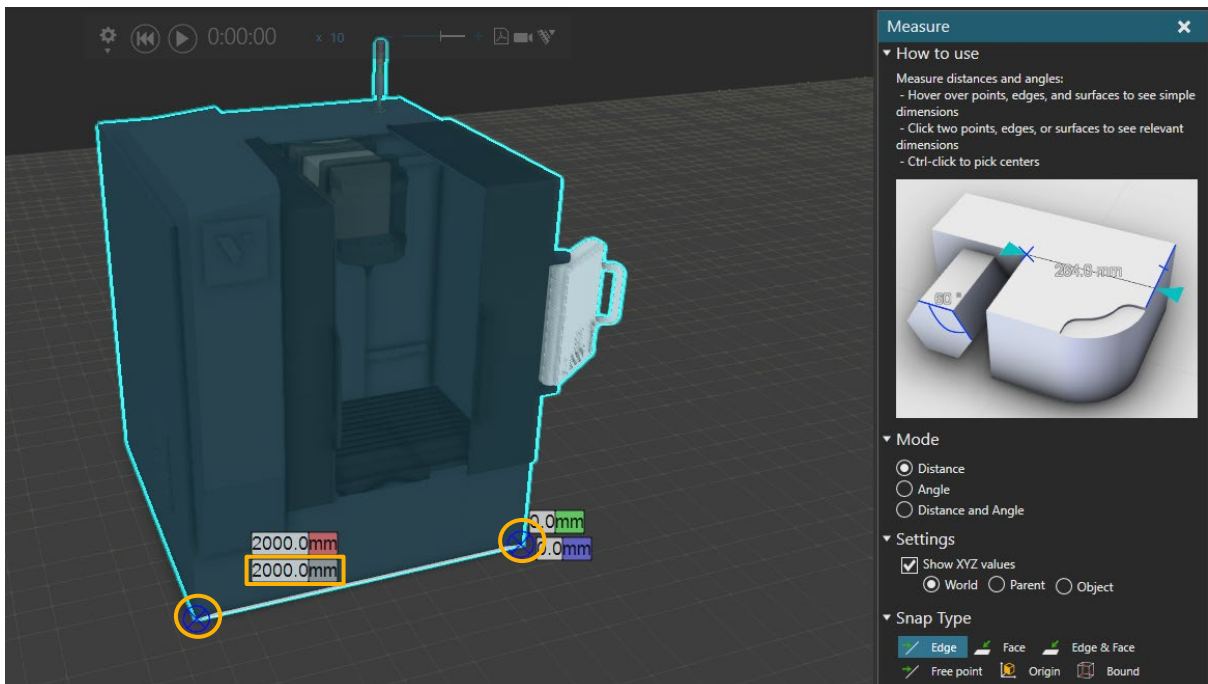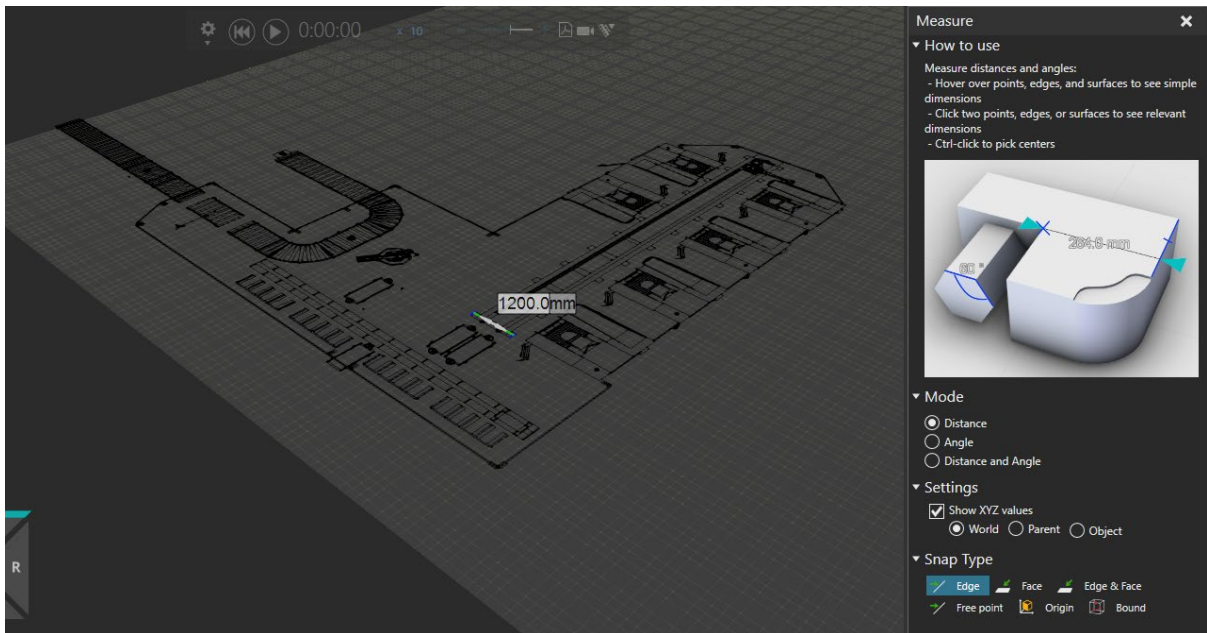

Scale can be verified by measuring knows the distance from the imported model.

In addition to geometry clean-up, it is recommended to import only necessary information as unnecessary details may affect simulation performance (like Collision Detection).

Some CAD models can contain material/color information, while some models are imported without any materials. If no materials are imported, then Material -property can be used to define components' primary color.
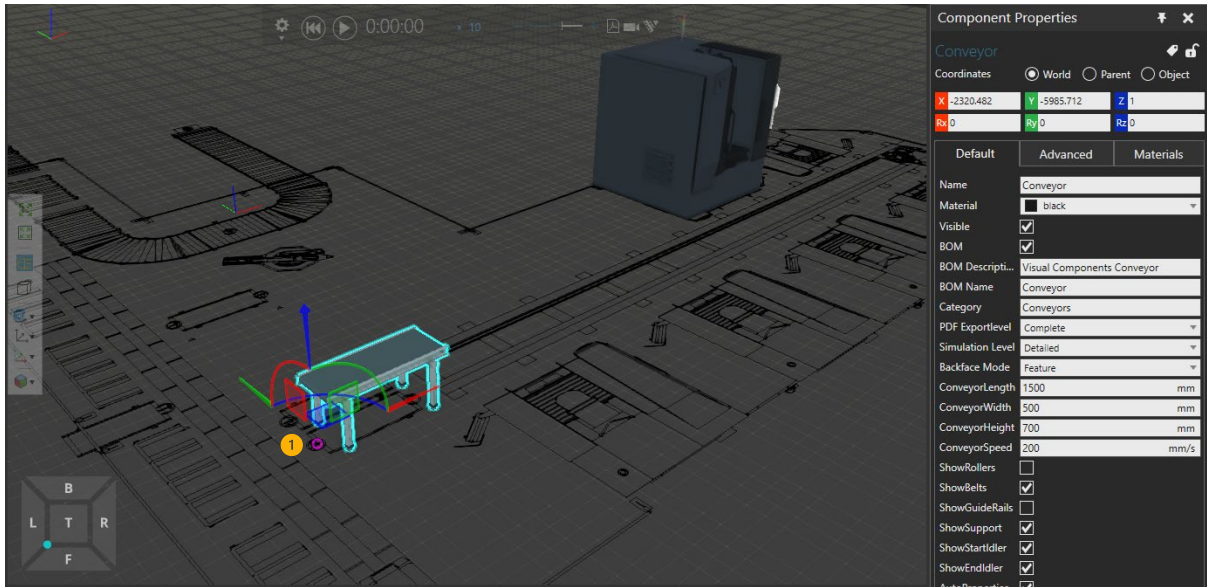
2D factory layout

One of the most common uses for CAD data in simulation is importing the 2D factory layout into the 3D world. Layouts are commonly in DXF / DWG format.

After importing, please check that the CAD model is in the correct orientation and in the correct scale. Scale can be verified by measuring knows distance from the imported model.
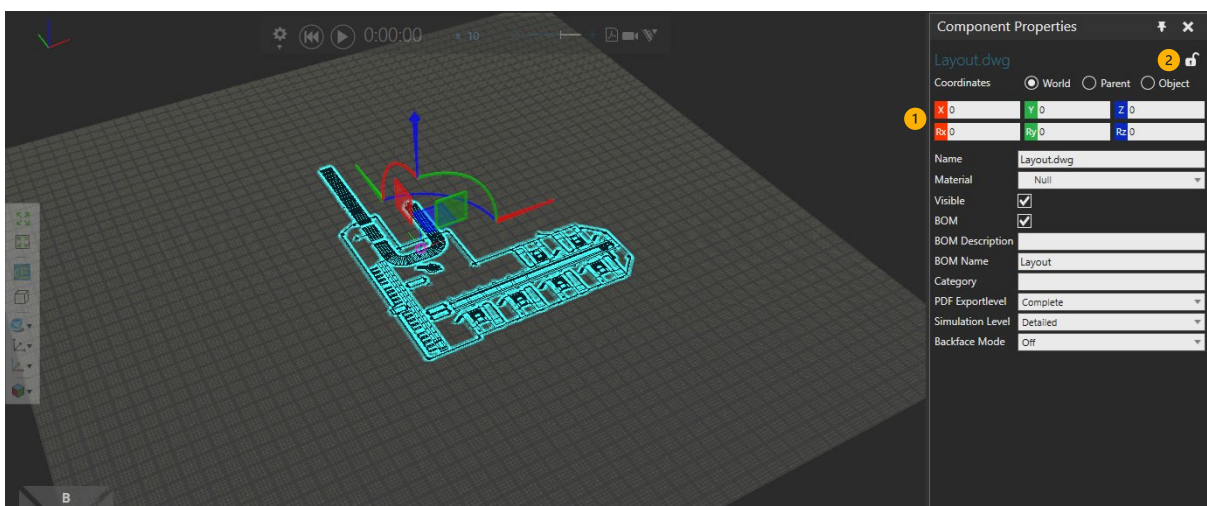

It is recommended to center the layout into the middle of the world (①) and, if necessary, lock the imported component (②) so that it is not moved accidentally.

When factory layout is in place, other imported components or components from eCat can be located on top of the layout. In addition, Move -tool can snap a component (①) in the layout if the component's position needs to be accurate.

Static objects in the production environment

Factories are crowded places, and many structures, machines, and objects affect the production environment even though they do not directly affect the (simulated) manufacturing process. Examples of these "static objects" are e.g., walls and pylons that define where/how resources can move around the production environment (obstacles) and features that make the environment in simulation recognizable.
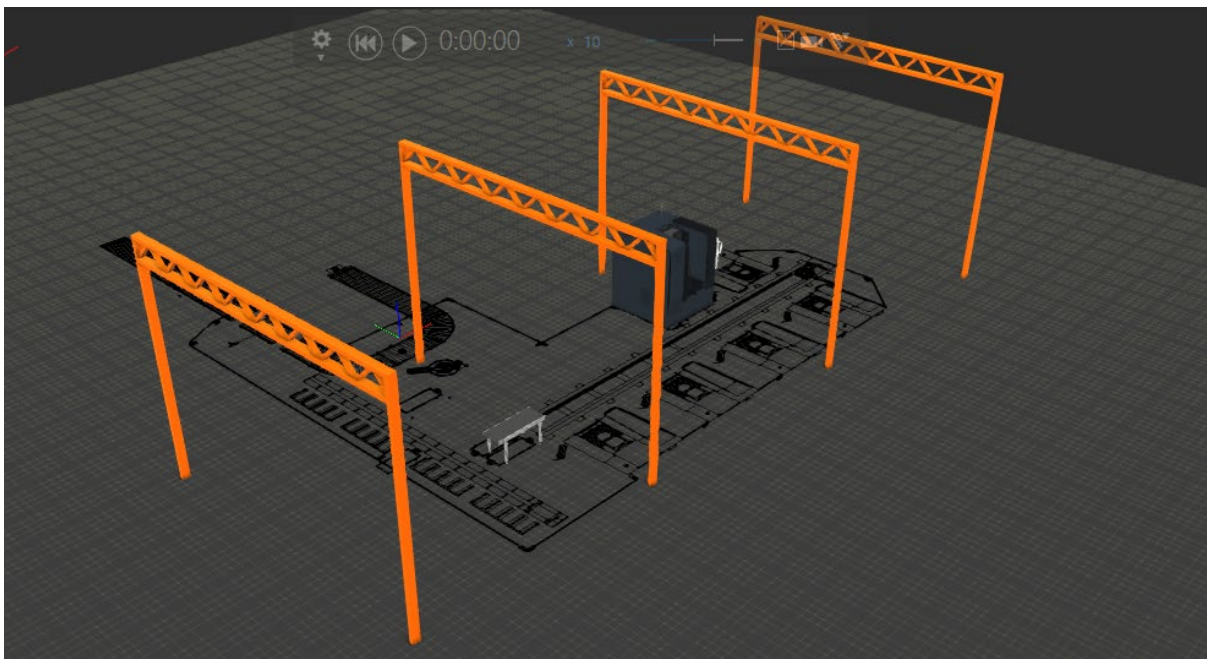
For example, pillars are imported into the layout. Even though the component does not affect the simulation directly, it defines the space and makes the "factory" recognizable to the audience.
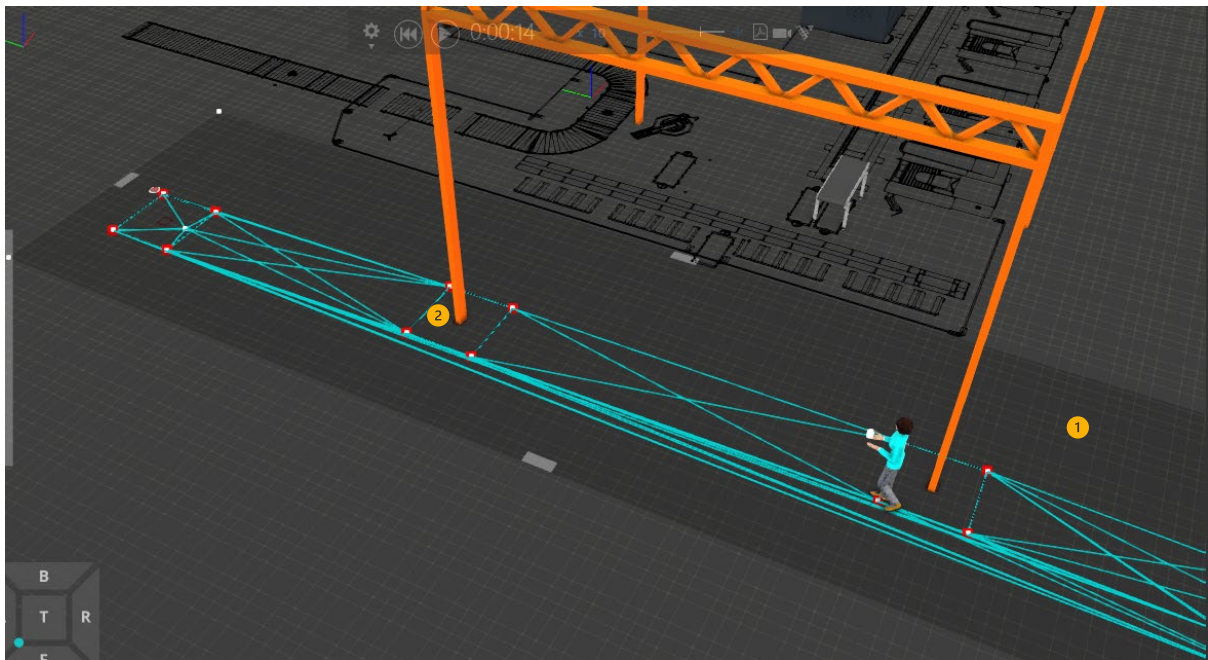
Factory layout may define where operators may walk (where the pathways (①) are located), and static objects can be used as obstacles (②) to operator movements.

Point clouds

Point clouds can be used in the same way as factory layouts and static objects. They define the space where the system needs to be designed and distances can be measured from point cloud points into other objects.
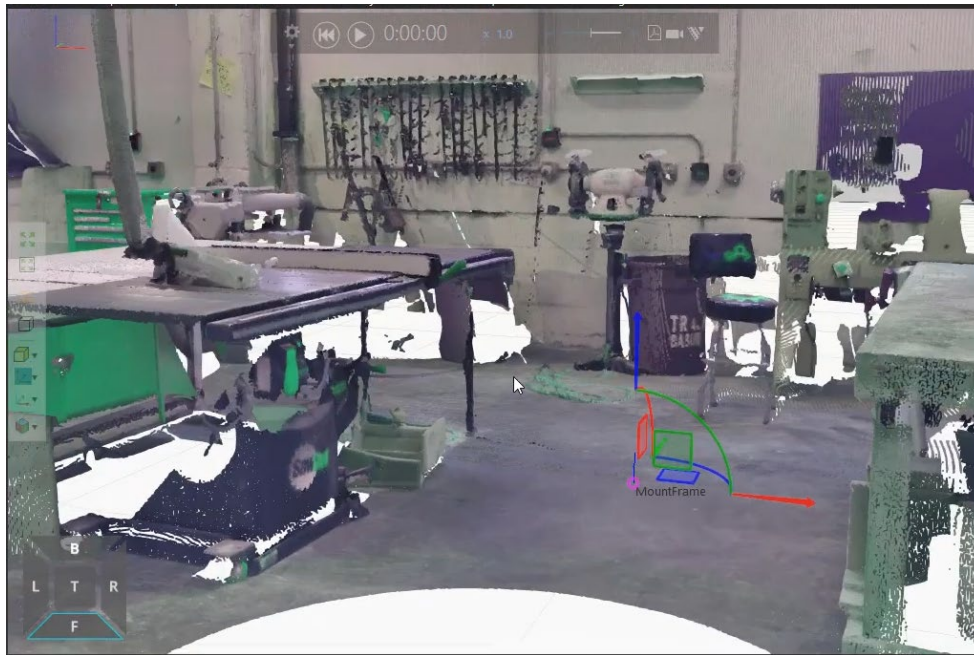
# Machine and resource visualization

Imported CAD models can be used to visualize simulation models, like machinery and resources, even the CAD model itself is static. Imported models can be located on top of the simulation models from eCat, that contain the simulation logic.
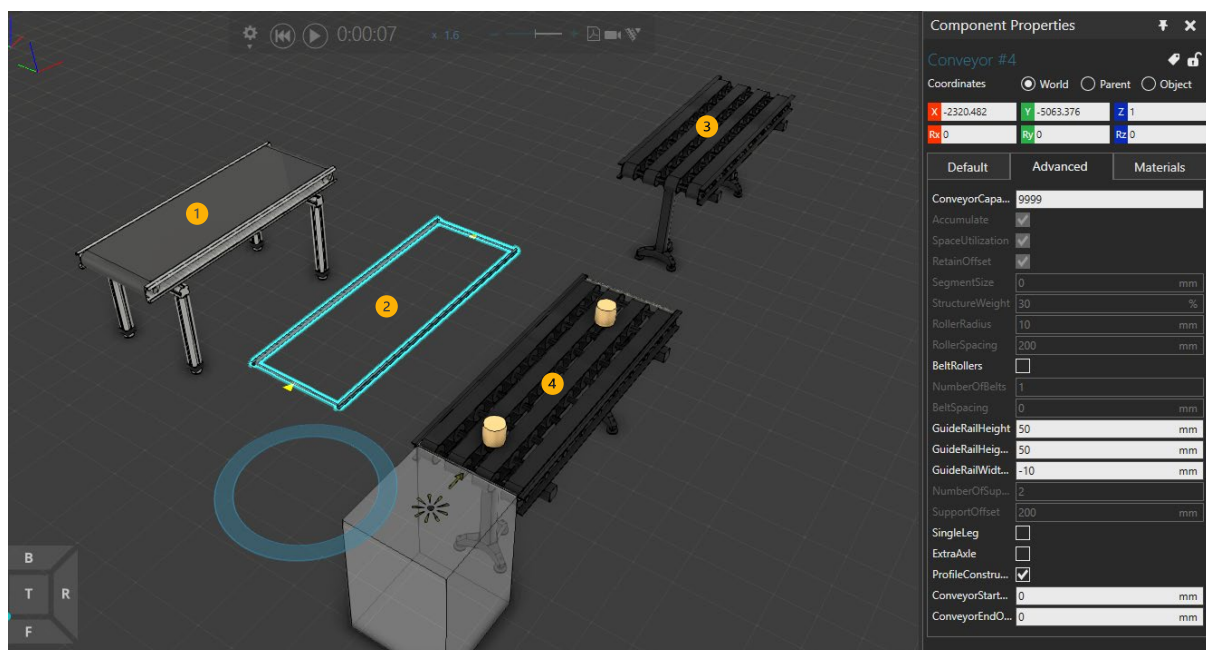
For example, in the above image, the conveyor (①) is taken from the eCat, and its properties are changed to strip the appearance of the conveyor to "minimal" (②). The CAD model is imported (③) and by locating CAD model on top of the stripped eCat conveyor (④). We achieve the appearance of the imported conveyor model but still use simulation logic from the eCat conveyor.
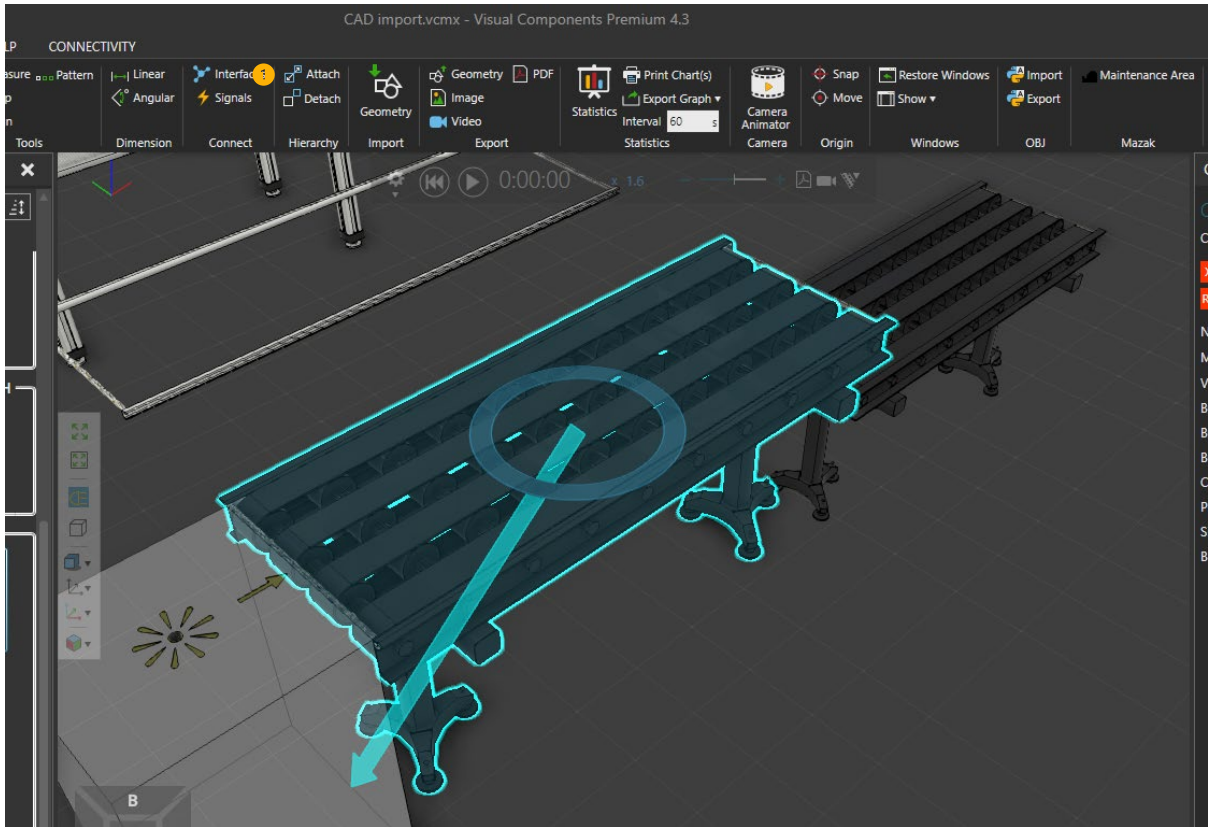
Attach -tool (①) can be used to attach the CAD model into the conveyor model, so that they stay together when the conveyor is moved and snapped to e.g., another conveyor.
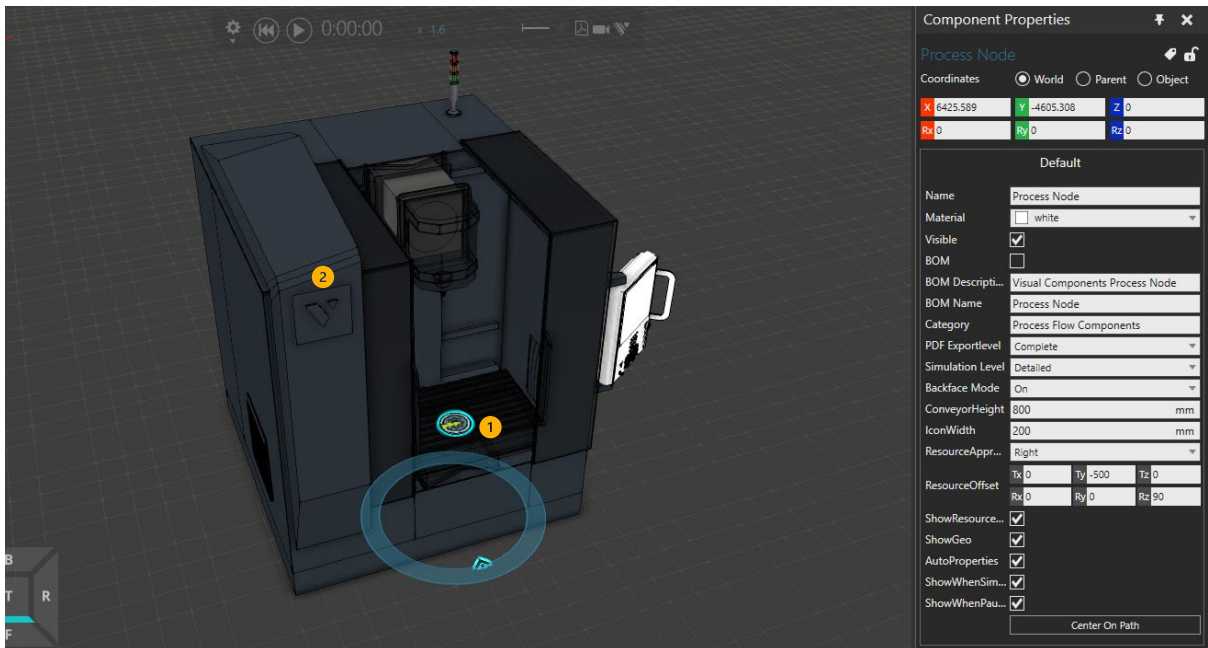
Another example is that the CAD model is used as the machine's visualization. In this case, Process Node (①) can be located inside the machine (②), and process can be attached to the imported machine model. Then, in process simulation, the process node's logic defines how the machine behaves.

Resources can have tools to be used in the simulation environment. CAD files could be imported and attached to the mobile robots and used as top modules or only for visualization purposes. After attaching the model on the mobile robot, you can define the transport frame location (below image). These extra top/side modules are mostly static models but still could be used, e.g., in collision detections.
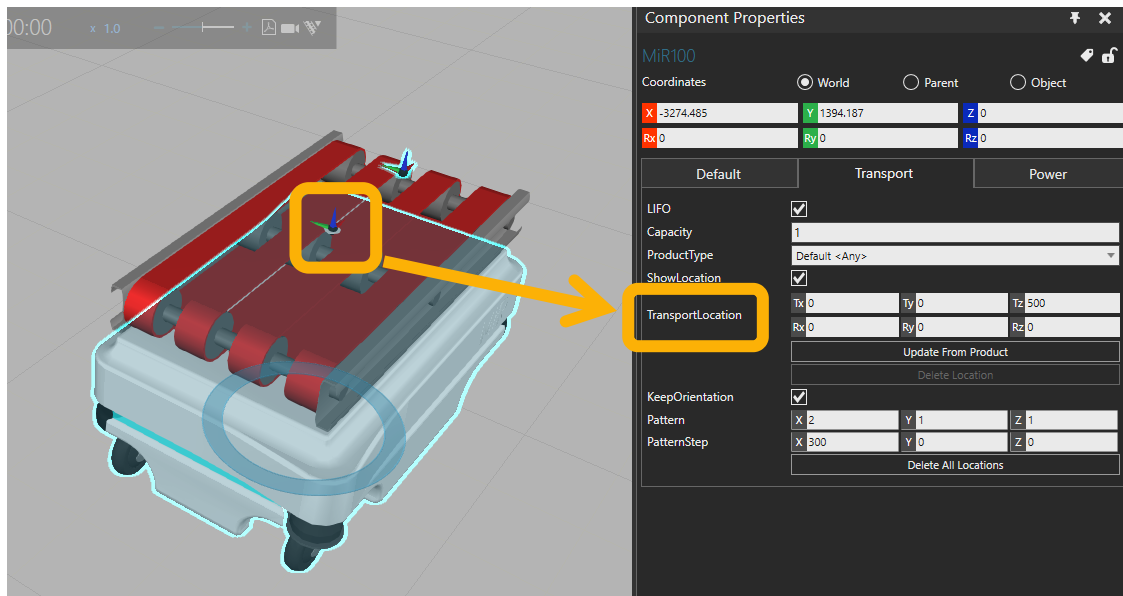

Products in simulation

CAD models can be used directly as products and parts in simulation (as dynamic components created by feeders and statements).

After importing CAD model that will be used as a dynamic component in simulation, components origin needs to be defined. When the component moves in simulation, its origin is used to locate the component in processes, on conveyors and in assemblies.
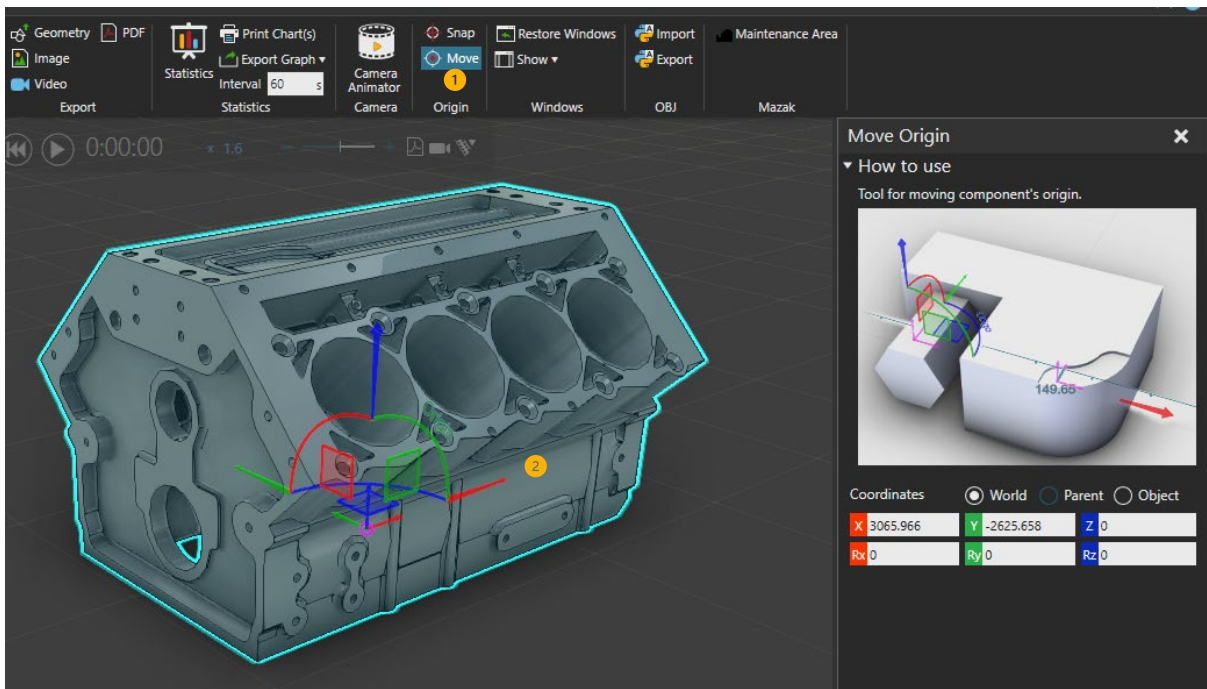
Move origin -tool (①) can be used to define the location of the origin. The origin should be located in a logical place in the component. If the component is on a conveyor, components origin is used to place the component onto a conveyor, and origins positive X-axis (②) is used as the direction of travel.
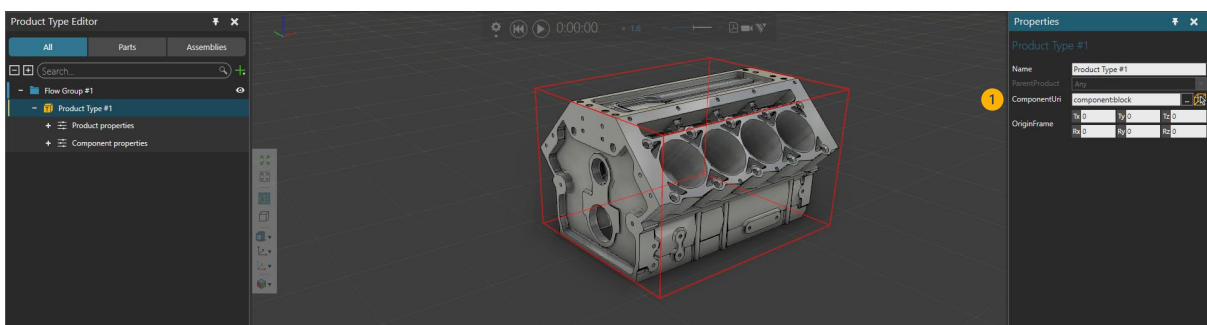

In process modeling, CAD model can be associated (①) to a new product type.
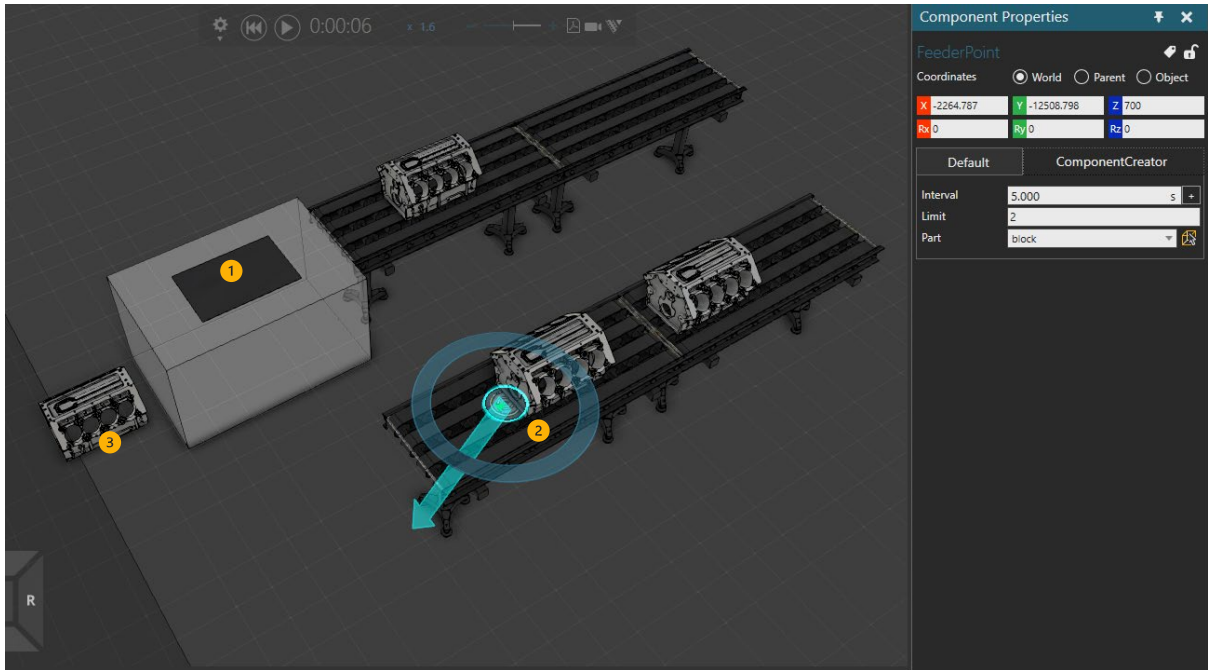
Pattern feeder (①) and Feeder point (②) from eCat can use imported CAD model (3)
directly.

Machine structures

On machinery and robotics, application-specific process cells are common. These structures
can be imported into the 3D world, and components from eCat, like robot arms, can be
located on top of these CAD models.
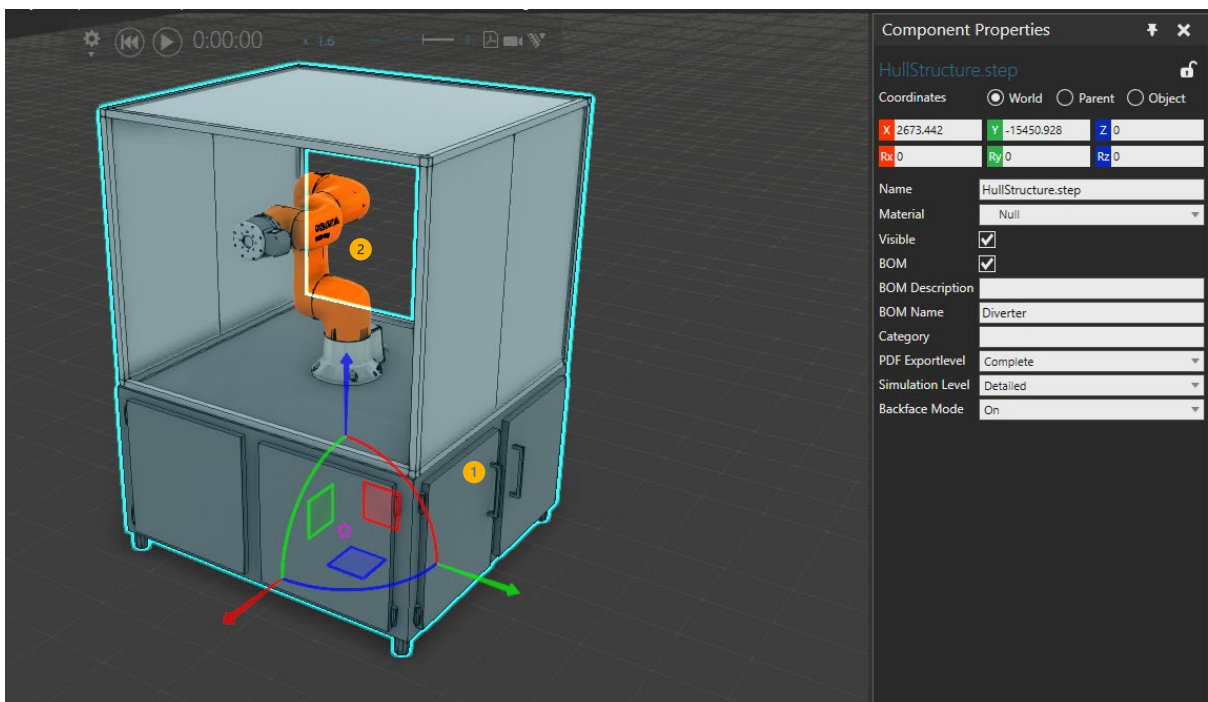
Imported machine structure (①) and robot arm from eCat (②) attached to it.
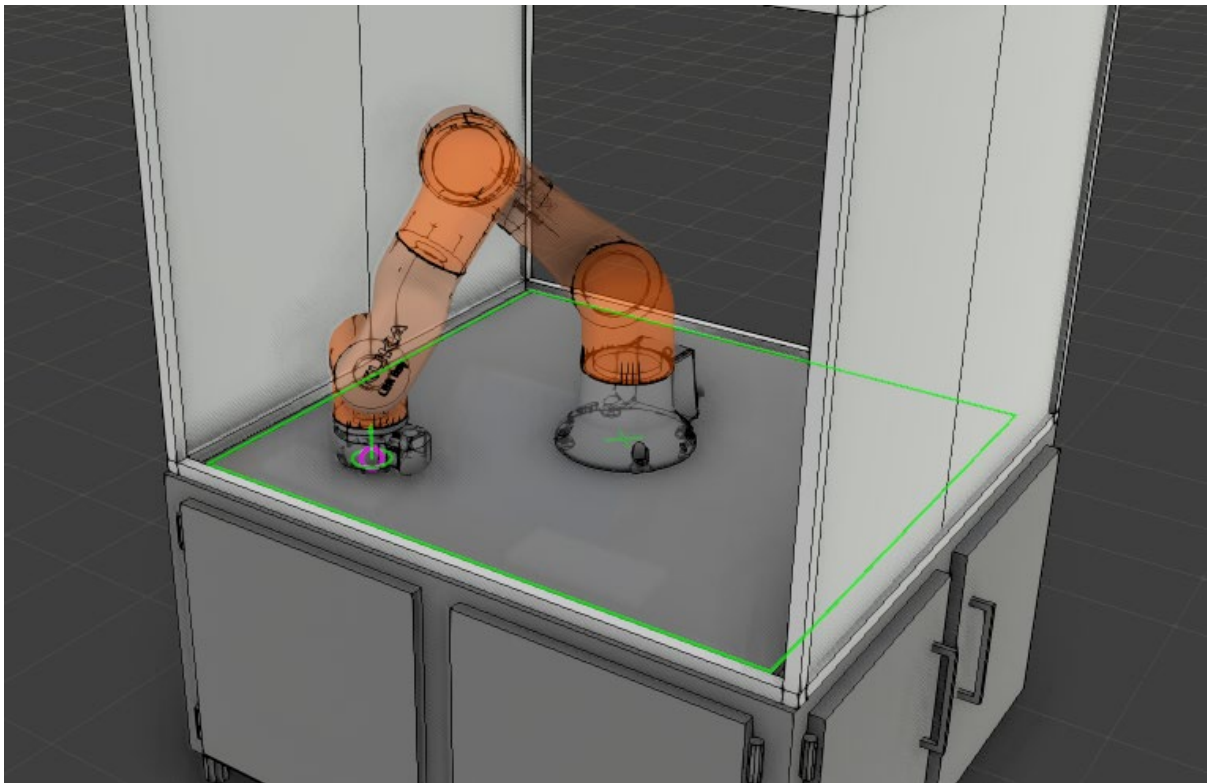
Even machine's structure is only a "static" model, other components and tools can snap to its surface. For example, in this case, robot's TCP can be snapped to the surface of an imported CAD model while teaching the robot.
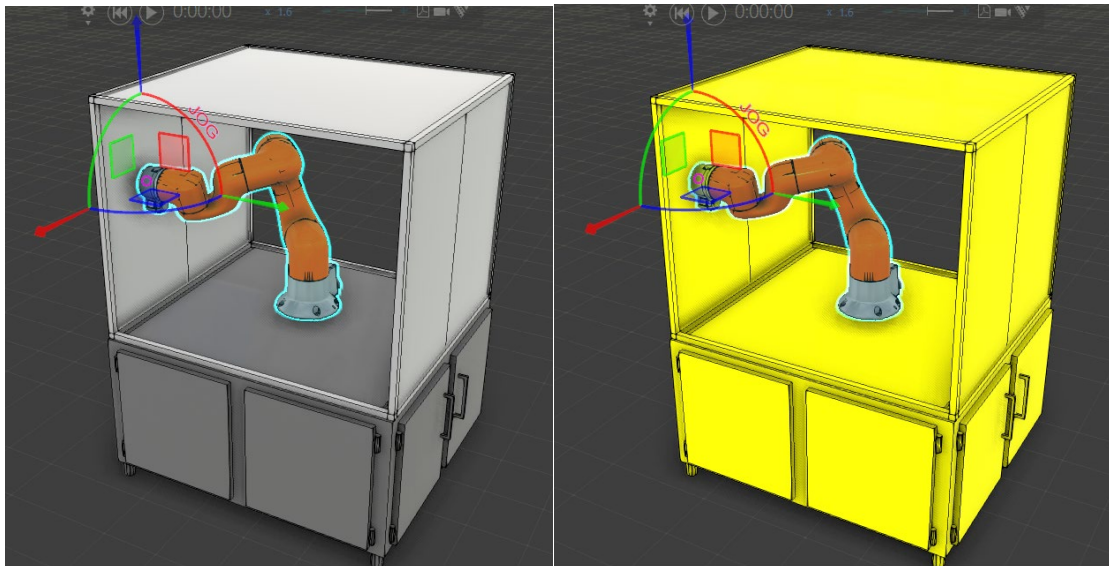

Also, collisions can be detected between components, regardless that they are imported CAD models or components from eCat.

Robot tools and pedestals

The imported CAD model can be used in robotics as a machine hull structure (previous example) and as a pedestal and tool.
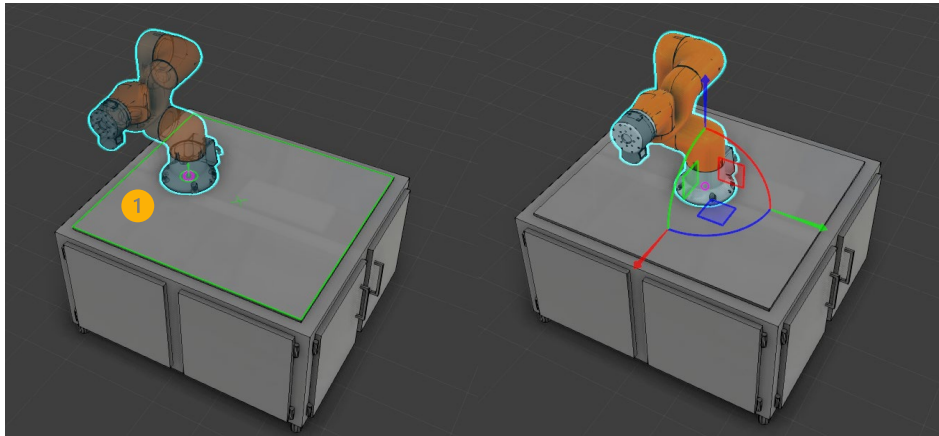

Robots can be placed accurately onto imported CAD models (using snap) because geometry's topology is detected from moving/snapping, in this case, the center of the surface (①).
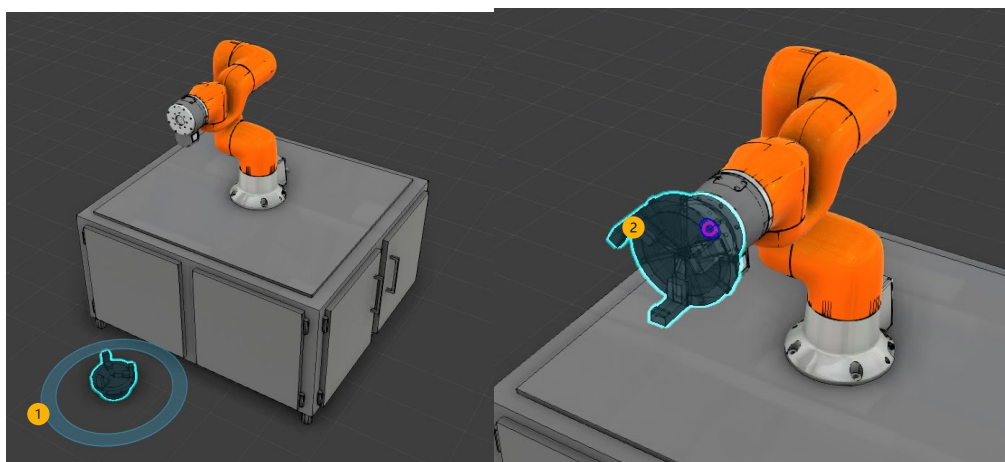
Robot (end of arm) tools can be imported (①) and (after relocating component origin if necessary) located with move/snap into robot arms mounting plate (②).
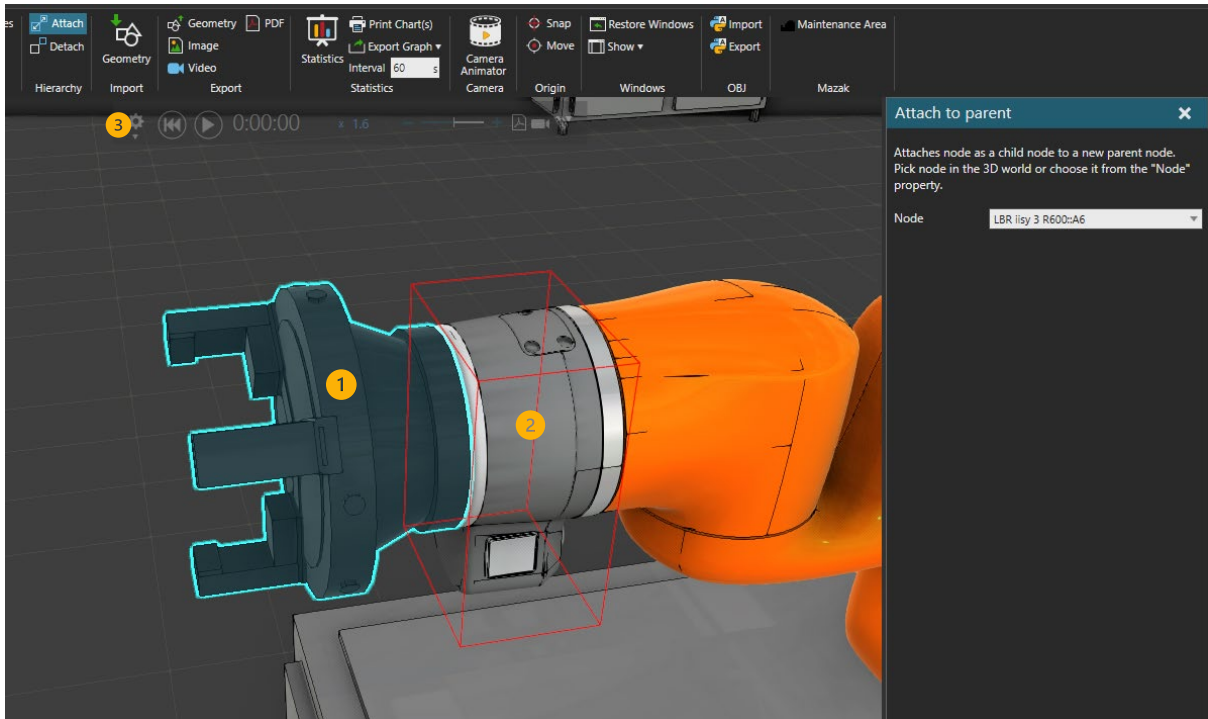
The imported tool (①) is attached to the robot's mounting plate node (②) with Attach tool (3). So now, when the robot moves, the tool will follow.
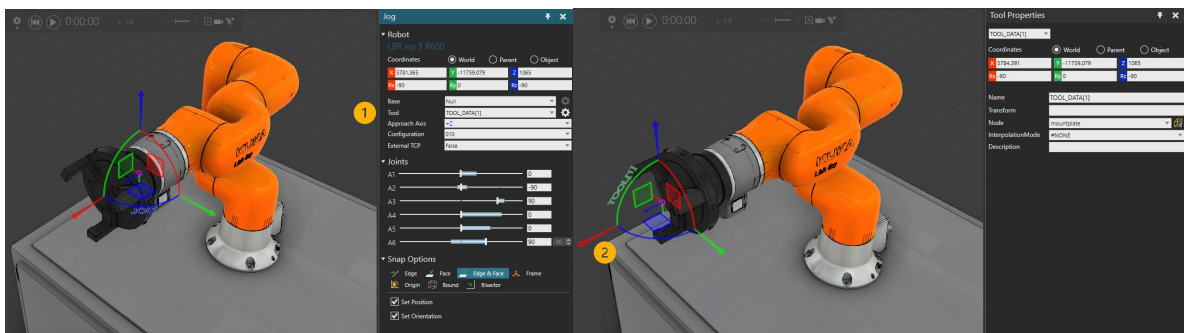
On the Program tab, the robot's tool's TCP position (①) can be moved (②) to reflect the (static) tools working position.