STUDENT GUIDE

Student Notes:

DELMIA V5 Training
Foils

V5 Robotics

Version 5 Release 19
October 2008

EDU_DEL_EN_ROB_FF_V5R19

Student Notes:

About this course

Objectives of the course

Upon completion of this course you will learn how to:

- **Prepare the working environment**
- **Build the layout**
- **Create tags and robot tasks**
- **Optimize the simulation**

Design Philosophy

This course is designed based on a process or task-based approach to training. Instead of focus on individual features and functions, this course emphasizes the process and procedure to complete a particular task. Using case studies to illustrate these processes, you will learn the necessary commands, options, and menus in the context of completing a design task.

Targeted audience

New DELMIA V5 Users with Simulation, Industrial or Mechanical responsibilities.

4 days

Prerequisites

Students attending this course should have experience with V5 Fundamentals and Mechanical Engineering.

Student Notes:

Table of Contents (1/2)

Student Notes:

Table of Contents (2/2)

Student Notes:

V5 Robotics Specialist (1/2)

About this Course

Introduction

Robotics helps manufacturing engineering departments define and manage manufacturing processes. It not only defines the number and sequence of steps to obtain a specific state of a product, but also is able to associate the tools, right methods and data to perform tasks.

This specialist course in Robotics will introduce you to the initial aspects of preparing an environment to carry out Robotic activity. The assumption is that the software is going to be used in a stand alone mode, not connected to the Manufacturing Hub and not using other DELMIA software such as Process Engineer. Other courses will address the interface of the Hub and additional software configurations.

The exercises in every module are for learning Robotics and will further help in understanding the activity. However, in the interests of maintaining the project focus, not every feature and function available in Robotics will be used or addressed. It is suggested that you access the on-line documentation that comes with the software installation to further explore functionality.

Student Notes:

V5 Robotics Specialist (2/2)

About this Course

Course Design Philosophy

This course is designed based on a process- or task-based approach to training. Rather than focus on individual features and functions, this course emphasizes the process and procedure to complete a particular task. By using case studies to illustrate these processes, you will learn the necessary commands, options, and menus within the context of completing a design task.

Target audience

The target audience for this course are new DELMIA V5 Users with Simulation, Industrial or Mechanical responsibilities.

Prerequisites

Students attending this course should have the following experience:

- V5 Fundamentals
- Mechanical Engineering Experience

Licenses

You should have the following DELMIA Licenses installed on your computer in order to do the exercises, Case Study, and Master Project.

- R19 SP1 or higher software
- R19 AP2 license
- R19 AEC Plant license
- R19 MHMC-SB (Human Builder) shareable Product license

72 hours

Student Notes:

V5 Robotics Specialist

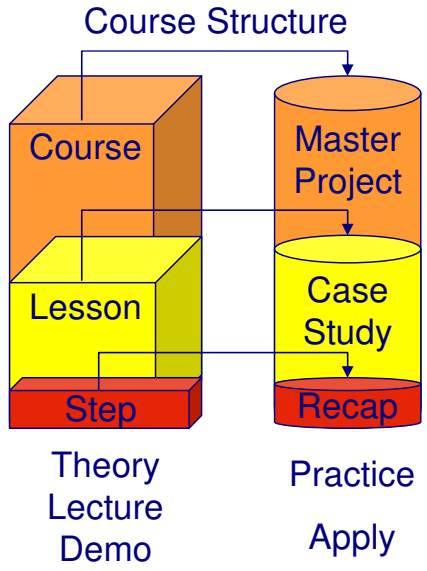
About the Student Guide

Using the Student Guide

This student guide is intended to be used in a classroom environment under the guidance of a certified DELMIA instructor. These and/or other examples and case studies may be demonstrated by the instructor.

Course Structure

This course is designed to offer initial instruction in the use of the software following a process driven orientation. Thus, the lecture material will be followed at intervals by discreet practice (recap) exercises. Each lesson will introduce a Case Study that will be the complete lesson exercise. The Master Project will be introduced at the beginning of the course and revisited at appropriate stages of lessons to offer the opportunity to apply the learning in a larger, sequenced, context.



Feedback

Dassault Systemes gladly accepts feedback and suggestions on its courseware. Send your feedback by mail or e-mail:

- **E-Mail**: education@ds-fr.com

V5 Robotics Specialist

Conventions used in the Student Guide

The following typographic conventions are used in the student guide:

- **Bold text** within a sentence denotes options selected from the DELMIA menu bar.
- **Bold Red text** denotes the name of a tool, icon, button, or window option.
- *Italic text* within a sentence is used to apply emphasis on key words.
- Numerical lists are used in sequential lists, such as the steps in a procedure.
- Lower-case alphabetical sub-lists are used in sequential sub-lists, as for steps in an exercise procedure.
- (2b) identifies areas in a picture that are associated with steps in a sequential list, such as in an exercise.
- Upper-case alphabetical lists are used in non-sequential lists, as for a list of options or definitions.
- Text enclosed in < > brackets represents the names of keyboard keys that must be pressed.
- Text enclosed in [ ] brackets identifies text that must be entered into a text field of a DELMIA dialog box or prompt.
- Information specific to AP2 license is marked with P2 symbol

Example page:

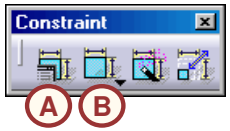
Use the following steps to create a new document in CATIA:

1. Click **Start > Mechanical Design > Part Design**.
2. Create new part.
   a. Click **File > New**.
   b. Select **Product** from the New window.
   c. Select **OK**.

   d. Press <CTRL> + <S> to save the document.
   e. Enter [my first document] as the document name.

You can create the following profile types:

A. User Defined Profiles
B. Pre-Defined Profiles
C. Circles



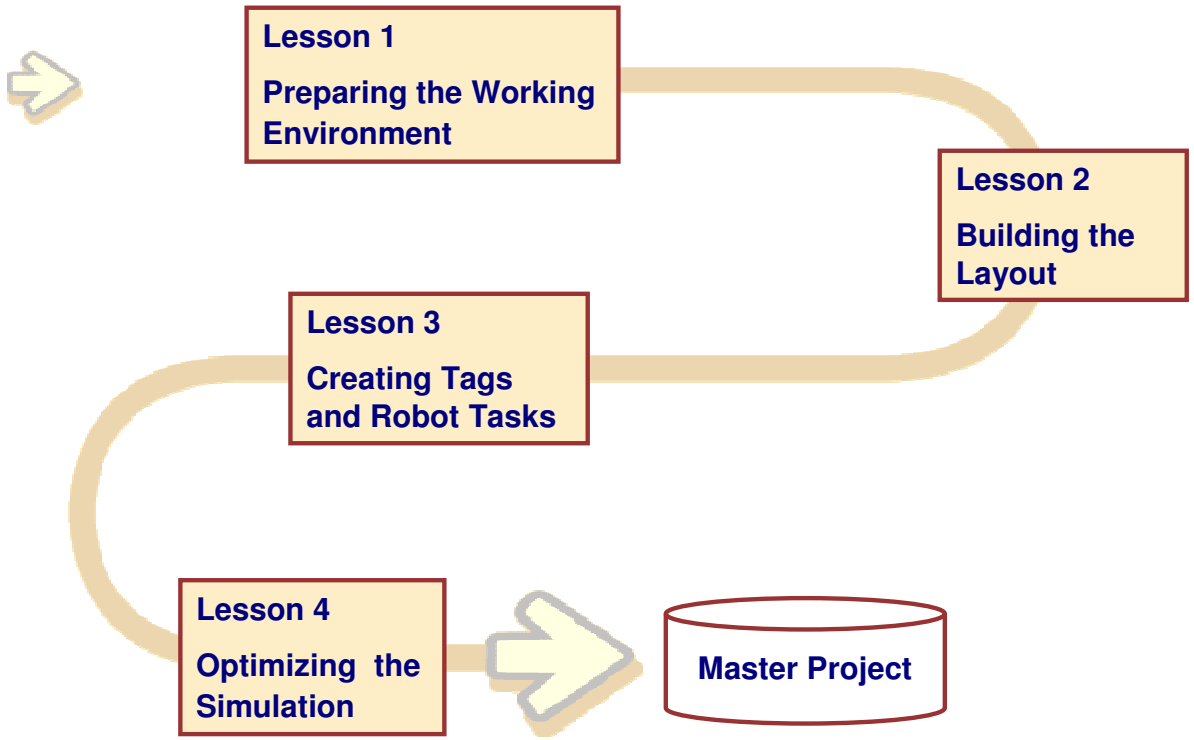
Student Notes:

Student Notes:

V5 Robotics Specialist

Stages in the Course Process

The course is divided into lessons. Each lesson is part of the process for creating a Project. Within each lesson the material is explained in steps that are necessary to complete that portion of the project. The Case Study at the end of each lesson will give you practice in building that part of a project. The Master Project at the end of the course will present you with a new set of data on which to practice on your own.



Student Notes:

V5 Robotics Specialist

Course Master Project

The course Master Project presents the opportunity to apply the learning that was presented in the lessons in a larger, less directed context. It is intended for you to synthesize your learning across multiple lessons. You will be presented with the Master Project at the end of the course and, perhaps, at appropriate stages after groups of lessons. The Master Project will provide you with a general set of expected outcomes and procedures but not explicit directions.

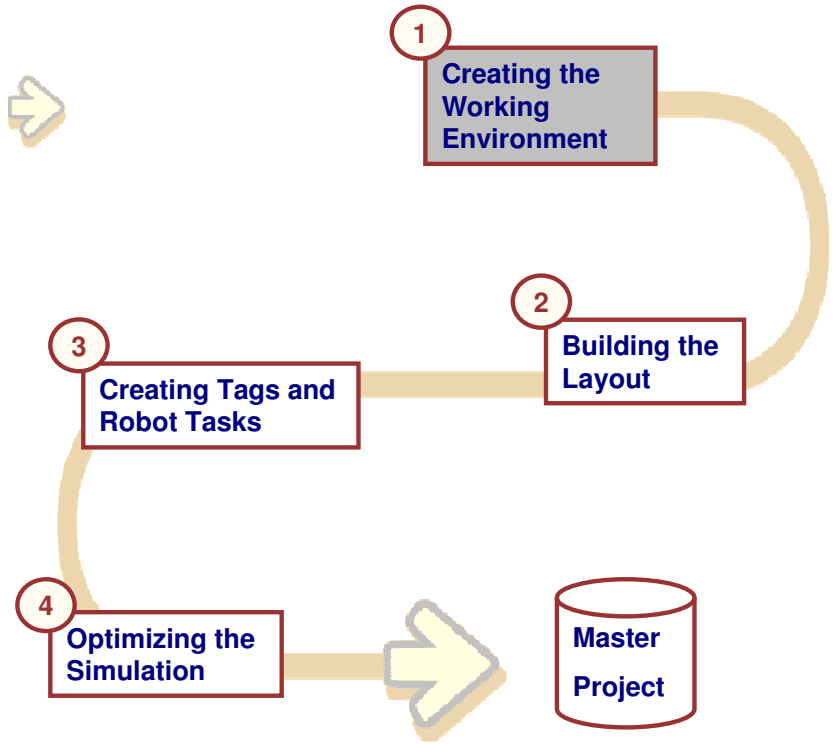
In support of the Master Project, each lesson in this course contains a case study, which helps to explain and practice the skills and concepts covered in the lesson.

Within the lesson, smaller recap exercises help you to practice the individual skills you will need.

Student Notes:

Creating the Working Environment

The first step in working with the DELMIA V5 software is to set the options that best reflect the needs and conditions of your particular work style and environment. For purposes of this course, you will set options as defined in this lesson in order to create a uniform working environment.



You will use the following Steps to complete this Lesson:

- Set Options

Duration: 1 hours

Student Notes:

Workbenches and Toolbars used in this Lesson

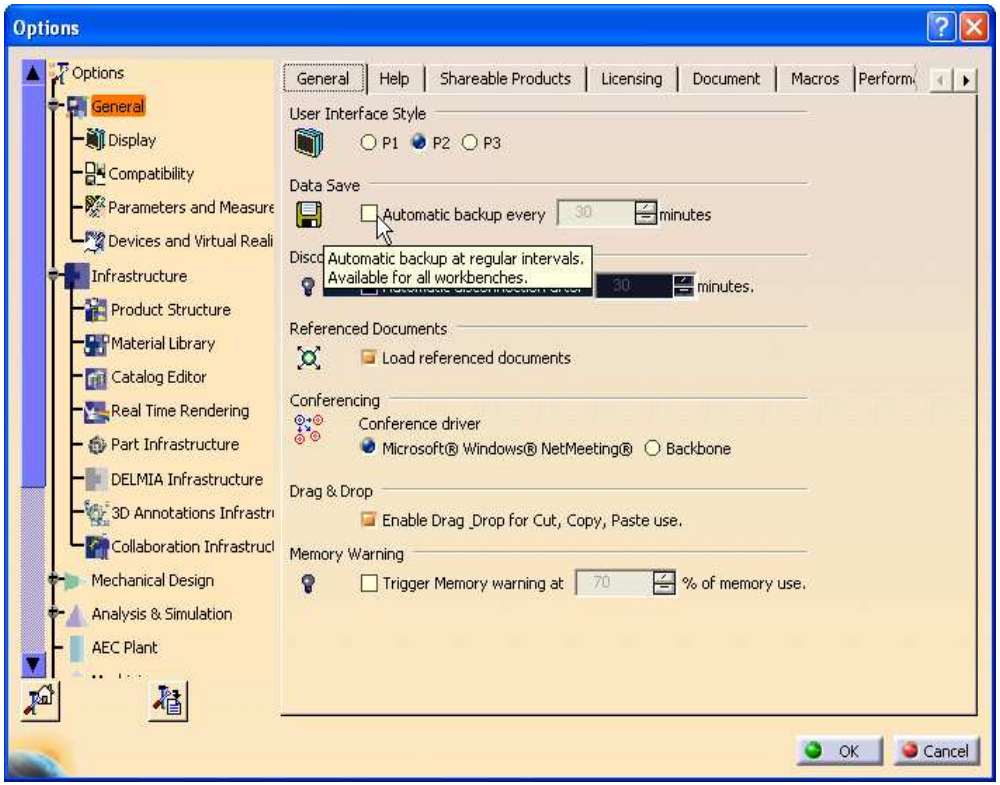
There are no workbenches or toolbars used in this lesson.

Student Notes:

Stages in the Process

The following steps will be used to help you learn how to prepare the environment.

1. Step 1: Set Options



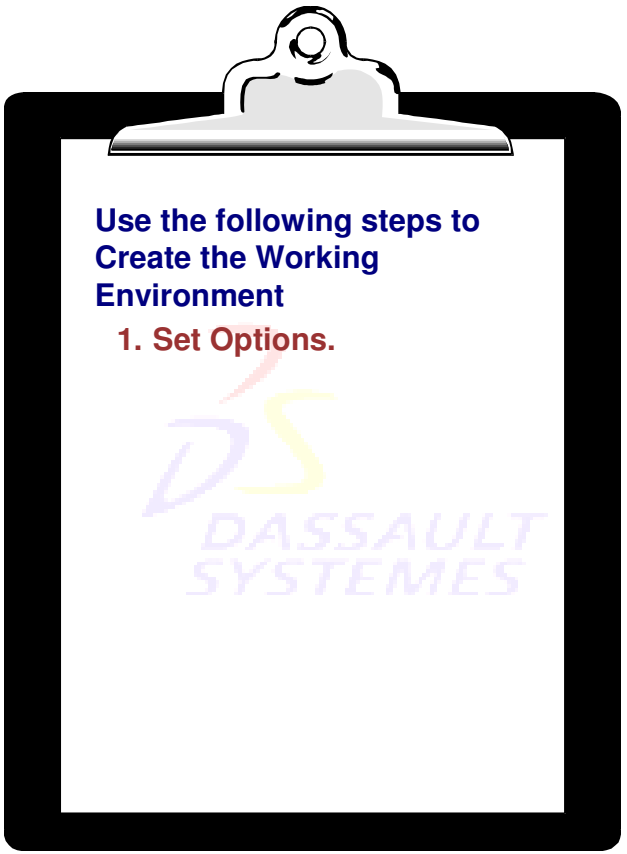
Student Notes:

Step 1: Set Options

The Dassault Systemes family of software offers unprecedented power and flexibility to its users. However, because of this ability, the software must be configured to fit the user's needs.

The first step in preparing the working environment to set the Options in the software. In this section, you will learn how to set some of the options that are especially useful for robotic simulation projects.

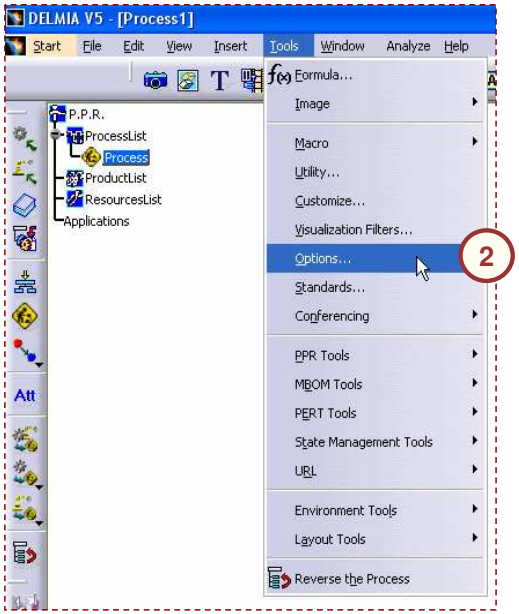
Note: Introductory courses will introduce you to the many of the options of the software.



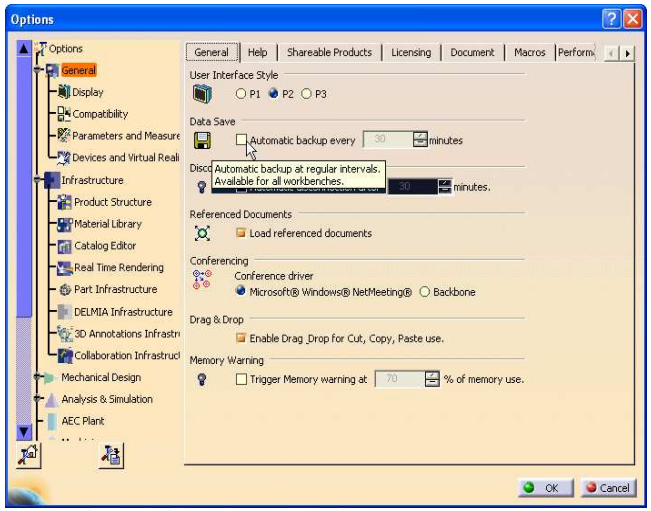
Student Notes:

Setting Options

1. Launch **DELMIA V5.**
2. When the environment opens, click on **Tools > Options.**



You will see the Options Dialog box.



3. In the following exercise, set the working environment options as directed.

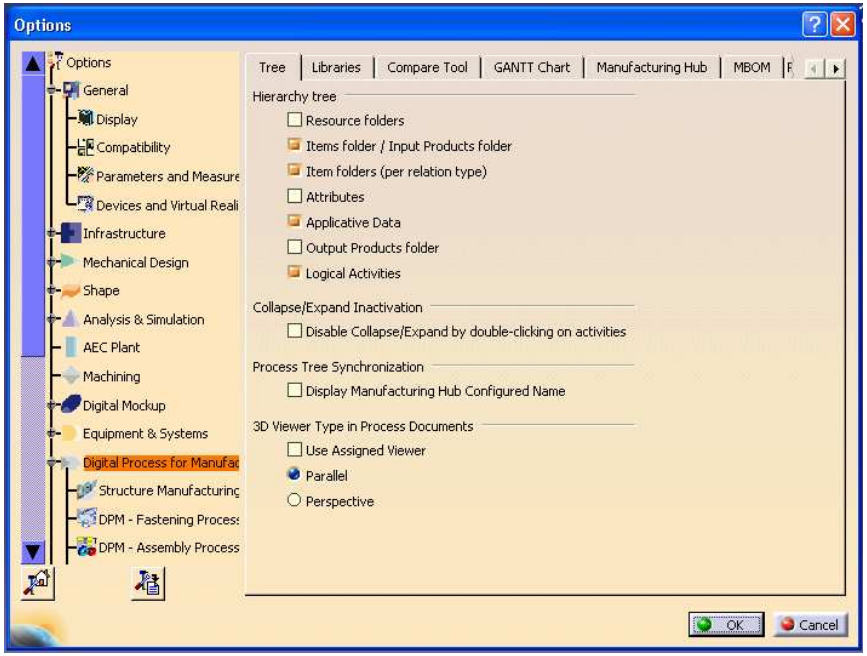
Student Notes:

Lesson 1: To Sum Up

This module has introduced you to the basic actions necessary to create a virtual world for the simulation study. Not every simulation requires the construction of a world, however, where there are physical, human, or mechanical resources interacting with the product, these items form critical factors for a complete simulation analysis

To review, you have:

- ✓ Set the necessary Options for the project
  - ✓ Set Options



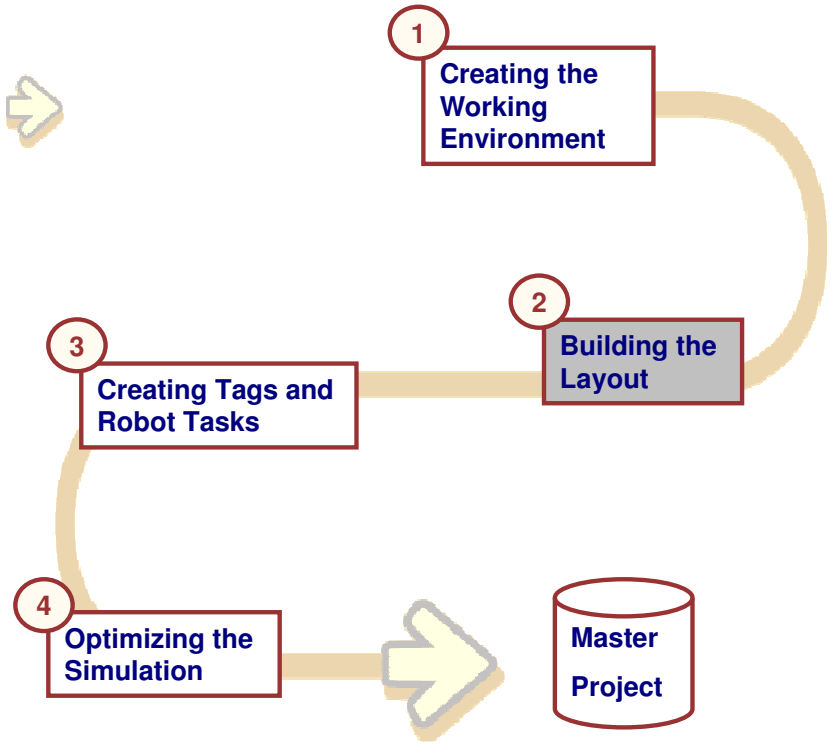
Student Notes:

Building the Layout

One of the first steps in building a simulation is to set up a working environment that best reflects the needs and desired outcomes in your context. Once the environment is prepared, construction of the 3D Layout of a virtual world can begin. Bringing in plant layout items, resources and product are all items relevant to the virtual world.

You will use the following Steps to complete this Lesson:

- Position and Manipulate the Compass
- Inserting Products and Resources
- Snap and Attach

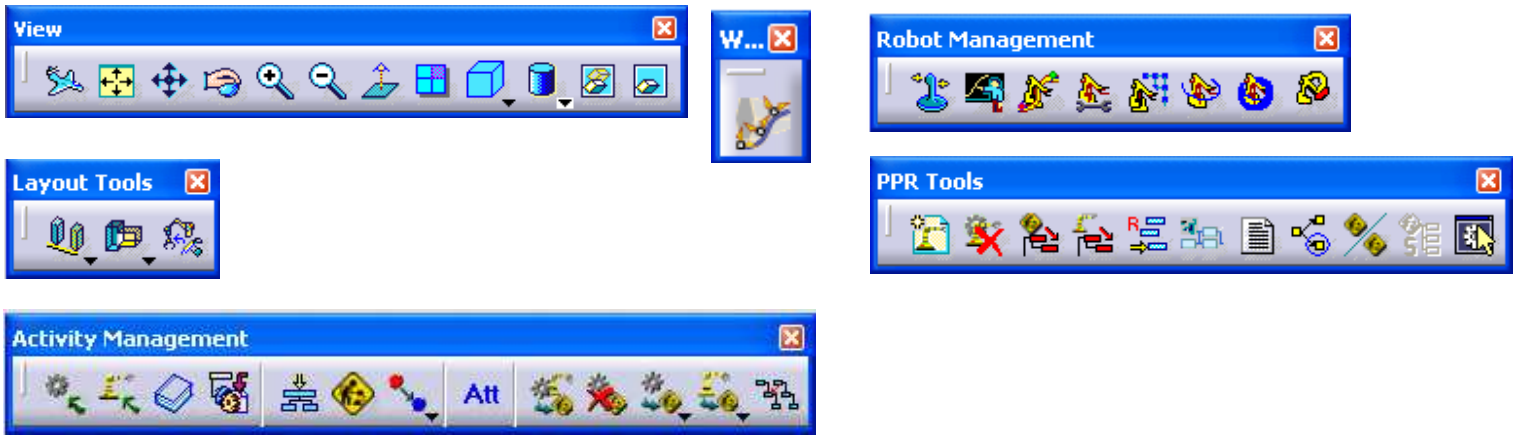


Duration: 2 hours

Student Notes:

Workbenches and Toolbars used in this Lesson

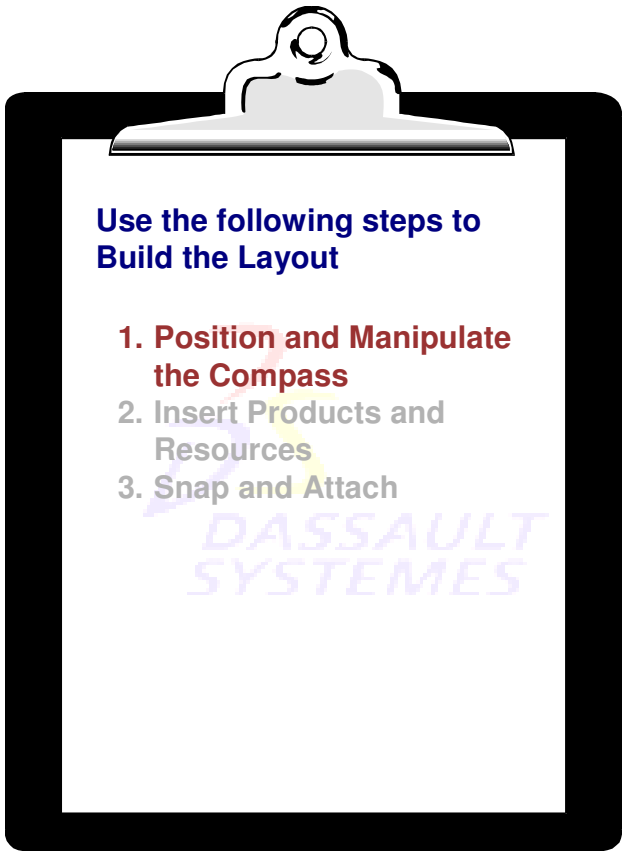
These are the Workbenches and Toolbars that are used in this lesson.



Student Notes:

Step 1: Position and Manipulate the Compass

It is best to move each item to its approximate final position before inserting another resource. For items intended to be placed relative to another item (like a plant floor), at least one coordinate will be critical. For the plant floor example, all items must be at "0 on the Z axis."



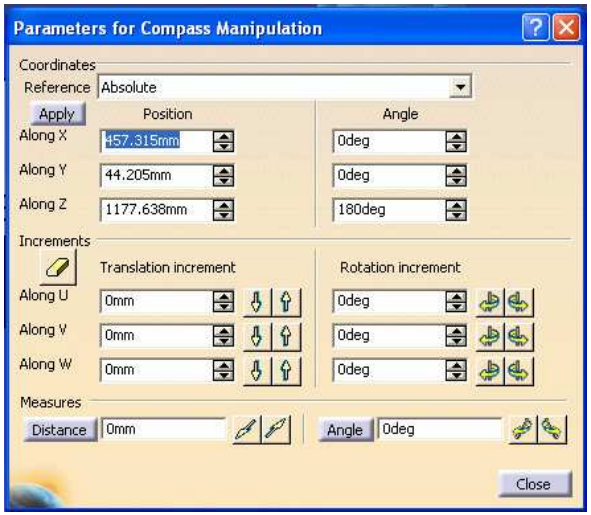
Student Notes:

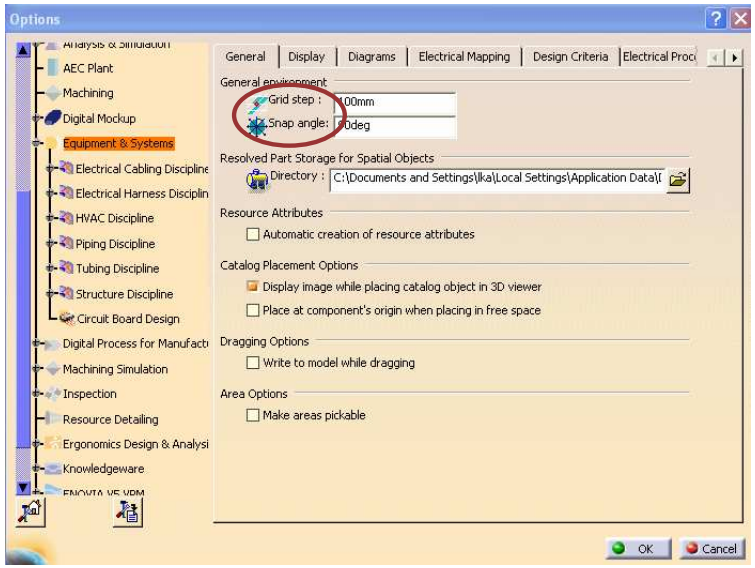
Position and Manipulate the Compass

Items can be manipulated using the bounding box. This technique will permit movement anywhere in the world according to the increment size set in the Tools / Options / Equipment & Systems / General / Grip Step.

OR

The “Snap Compass to Object” function can be used. The Parameters for Compass Manipulation box can refine the positioning even further.





Student Notes:

Position and Manipulate the Compass

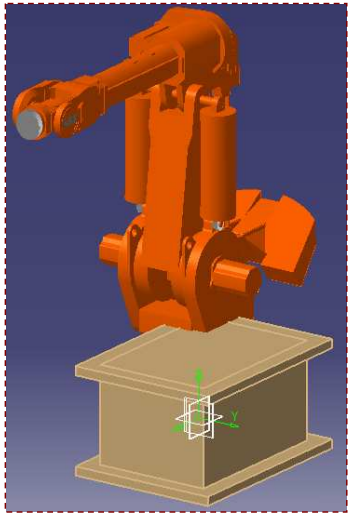
Using the Manipulation Bounding Box

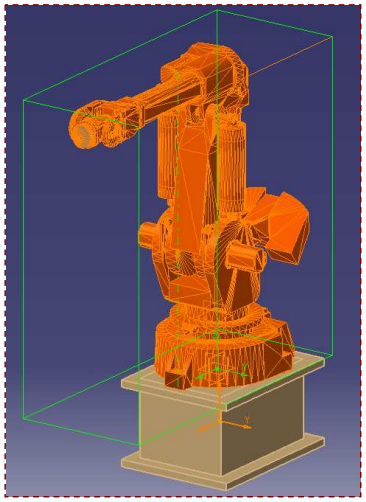
1. To move an object using the bounding box,
   click on the item in the PPR tree.

2. When the bounding box is highlighted around the item (usually green), point the cursor to one of the lines of the bounding box. Click and hold, and then move the item in the direction permitted by the box. Let go of the cursor when this movement is complete.

   If additional movements are necessary, grab another side of the bounding box and move in the direction permitted by that axis.

3. Complete the grabbing and moving until the item is positioned correctly.





NOTES: 1.Remember that the final placement of the item is defined by the grid size set in Tools/Options as noted earlier.
2. Remember that items in reference to a floor must all be at 0 on the Z axis.

Student Notes:

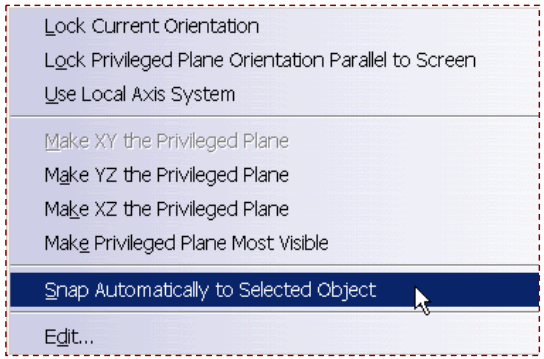
Position and Manipulate the Compass

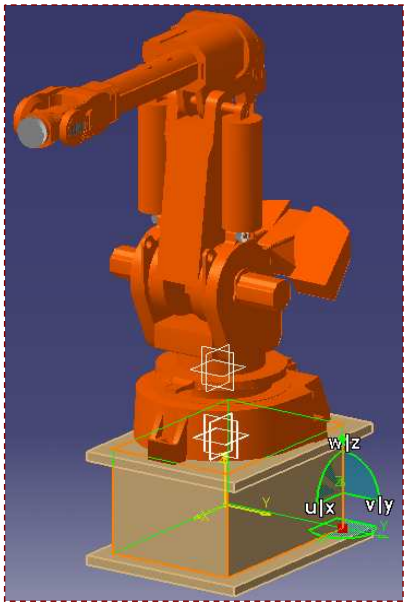
Snapping Automatically to Selected Object

1. To move an object using the Compass, right click on the compass and select Snap Automatically to Selected Object.

2. Click on the object to be manipulated.

   The compass moves to the object and the bounding box appears.





3. Grab and hold the axis of the compass that will move or rotate the object in the desired direction.

4. Repeat the grabbing and moving until the object is in the desired location.

5. Right click on the compass and click “Snap Automatically to
   Selected Object” again to toggle off this function and permit the
   compass to be moved back into the world.

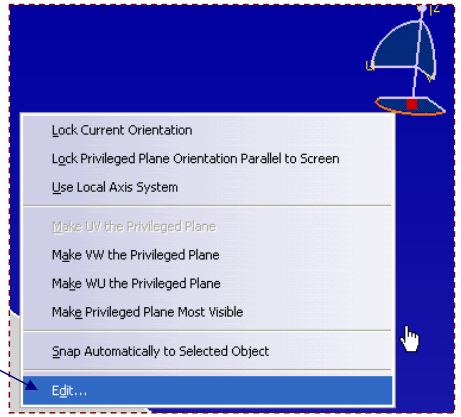
Student Notes:

Position and Manipulate the Compass

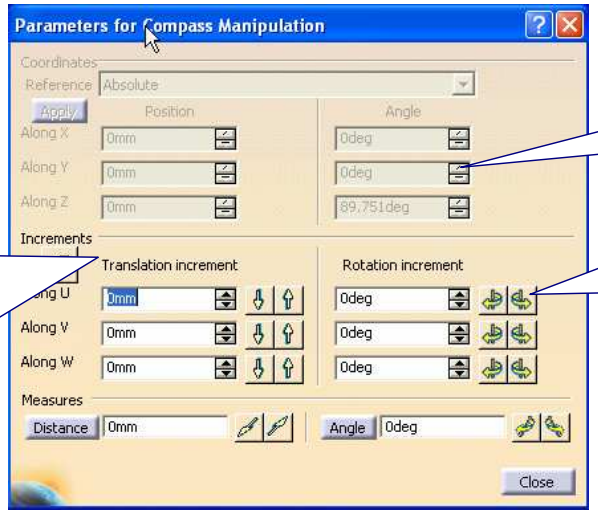
Editing Positions

The positioning of objects can sometimes be more quickly and efficiently accomplished by defining the parameters for compass manipulation. These settings will cause the compass (and thus the object) to move in these predefined increments.

To access this function, right click on the compass and click Edit.



This capability is useful if objects need to be at a certain angle relative to another object, or for speed of placement.



Setting the Translation increments will cause the compass to move along the selected axis in the pre-defined amount

When snapped to the selected object, the coordinates of the object will be reflected in the top of the box.

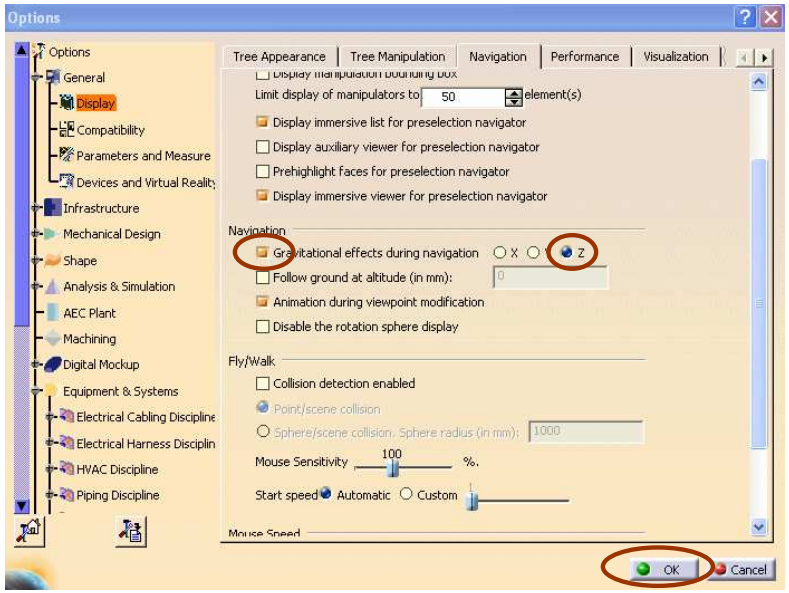
Setting the Rotation increments will cause the compass to rotate about the selected axis in the pre-defined amount.

EXAMPLE: Setting 90 deg along W axis will cause a right angle movement on that axis.

Student Notes:

Position and Manipulate the Compass

For viewing ease, keep the rotation of the mouse relative to the floor. To do this, select the Tools / Options / Display / Navigation tab. In the Navigation section, activate the Gravitational effects during navigation option and select the Z (axis) option.



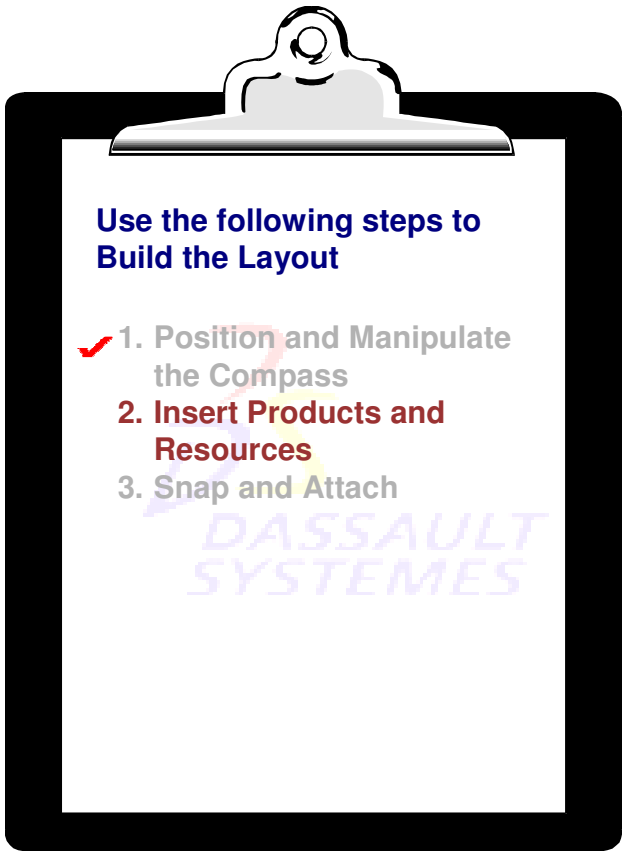
Click OK.

This setting should have already been set, this is just a reminder to show why and where it is to be set.

Student Notes:

Step 2: Insert Products and Resources

The insertion of products and resources depend on how you wish to use them in your process. The end result of the process should be the creation of a finished product consisting of the products listed in the product branch of the PPR tree. The resources used in the process to create the final product should be listed in the resource branch of the PPR tree.

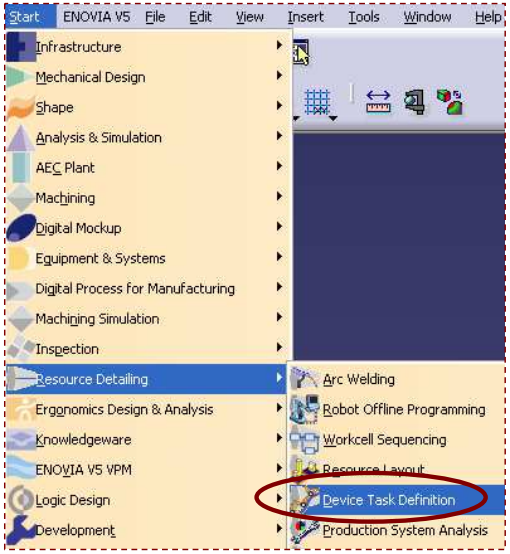


Student Notes:

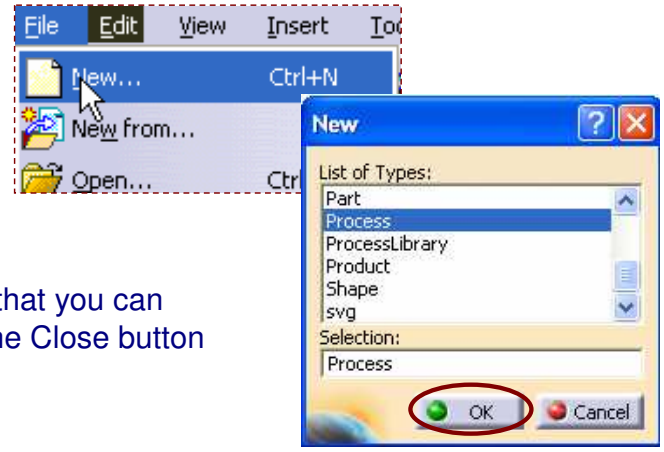
Insert Products and Resources

Start a New Process

1. On the main menu bar, click Start / Resource Detailing / Device Task Definition.



2. To create a new project, select File / New. The New dialog box appears.



3. Scroll down to select Process and click OK.

A new Process window opens (Process 2). This shows that you can run two different projects at the same time. Then click the Close button for Process 2.

NOTE: Only one process needs to be opened.

Student Notes:

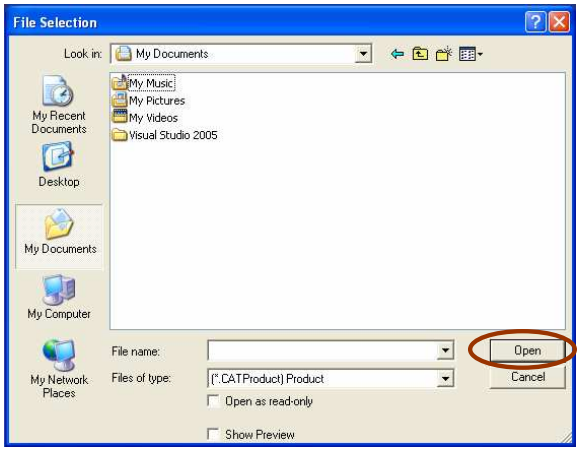
Insert Products and Resources

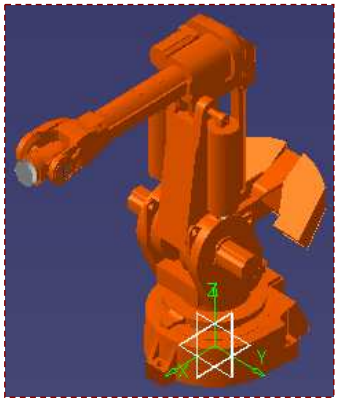
Inserting a Resource

1. Click Insert / Insert Resource from the main menu bar.

   Or

   Click on Insert Resource command on Activity Management toolbar.
   The File Selection dialog box appears.





2. Select the appropriate product from the Project Data folder and click Open.

3. To insert a product, follow the same method as the one above, but select Insert Product instead of Resource.

NOTE: Resources and products should be placed in their appropriate place in the PPR tree.

Student Notes:

Insert Products and Resources

Mounting a Device Using Set Tool

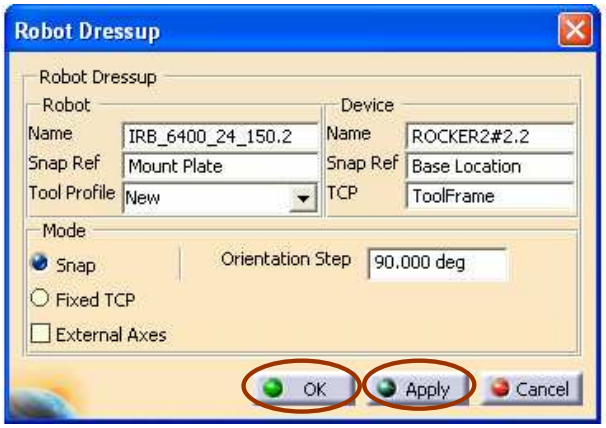
1. Click the Set Tool icon from the Robot Management toolbar.

2. The Robot Dressup dialog box appears. Select a robot from the PPR tree for Name under Robot area.

3. Select a tool or weld gun from the PPR tree for Name in Device area. Click on Apply.

4. Re-orientate the end effecters on the robot, if need be, using the compass to manipulate to desired or appropriate orientation.

5. When completed, click OK.



Example:

Incorrect

Correct

NOTE: Clicking on Apply snaps the weldgun to the faceplate and then waits for you to make adjustments, if any. Click OK after making adjustments.

Student Notes:

Insert Products and Resources

Removing a Resource

It is possible to remove resources or products after insertion and the method is as follows:

1. Select the resource or product to be removed either from the PPR tree or the 3-D view.

2. Click on the Remove from PPR command from the PPR Tools toolbar.

The item selected will disappear from the PPR tree and the geometry.

NOTE: The removing of products and resources can only be accomplished on the top elements in the product or resource lists.

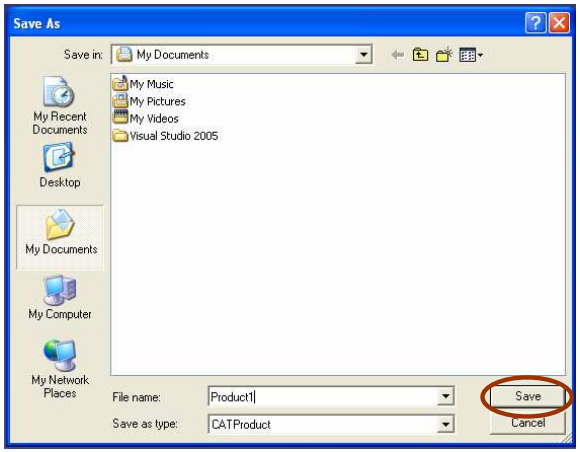
Student Notes:

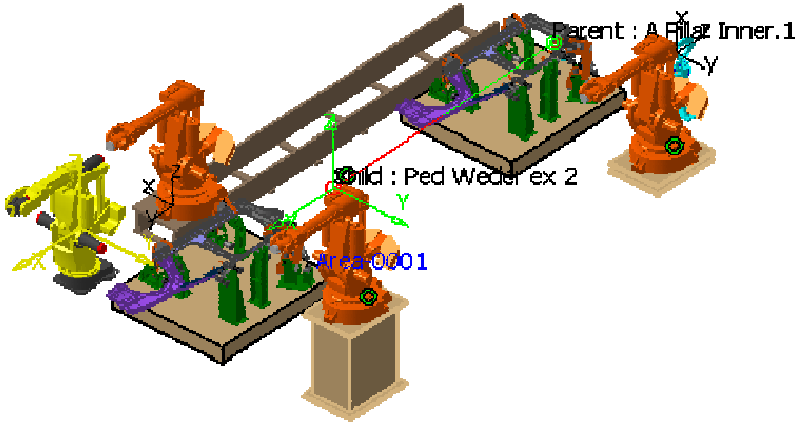
Insert Products and Resources

Using the Save As Function

To save, in the main menu select File / Save As, and save in the appropriate folder.

Example:

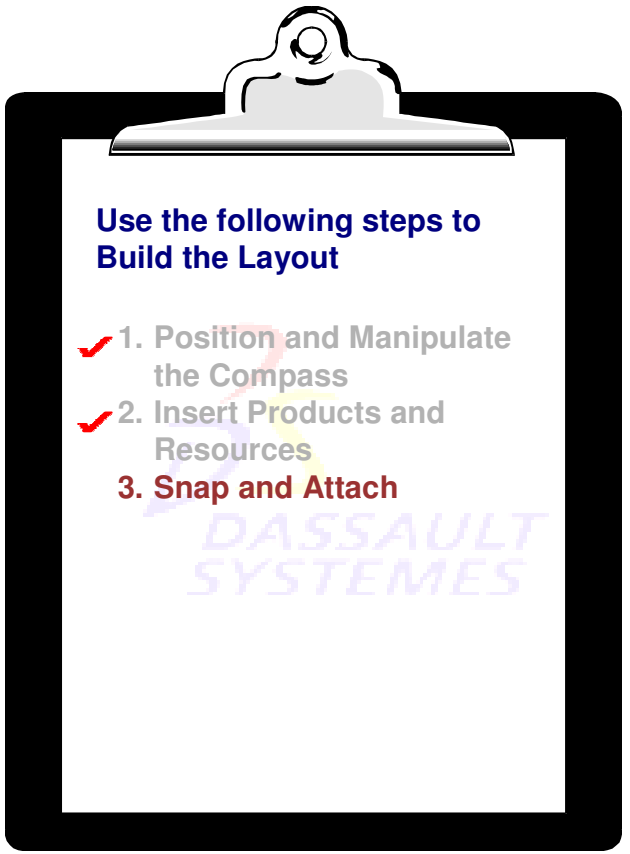




Student Notes:

Step 3: Snap and Attach

The completion of a layout includes placing and attaching other various resources and assigning them to their appropriate parent parts. This is done for the robots and other resources which sit on or depend on other resources for full functionality. The snap function allows for placement and the child selection allows the parent child relationship to be selected.

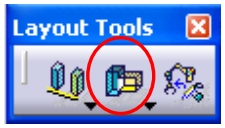


Student Notes:

Snap and Attach

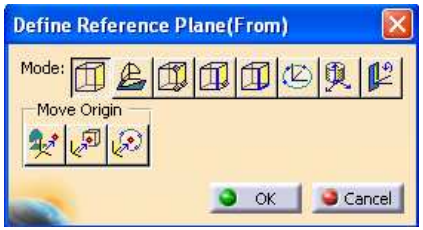
Using the Snap Icon

1. In the Layout Tools toolbar, click the Snap icon.
   The Snap Options dialog box appears.

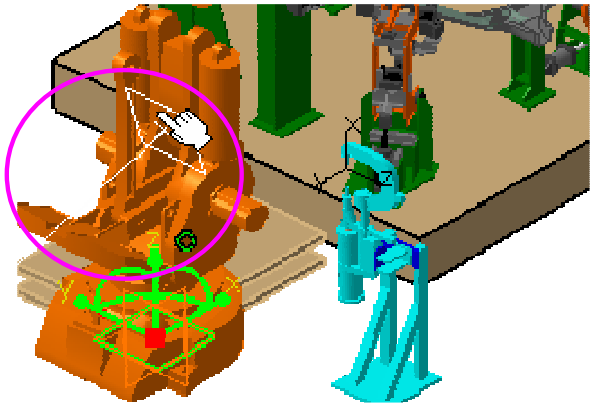


2. Select a resource from the PPR Tree to be moved.
   The Define Reference Plane (From) dialog box appears and a green compass is displayed showing the resources current orientation.

   As the mouse pointer is moved, a small white rectangle is displayed to show the selectable planes.



Example:



3. Move the white rectangle and line to the desired plane and orientation and click the left mouse button. The green compass moves to this location and orientation.

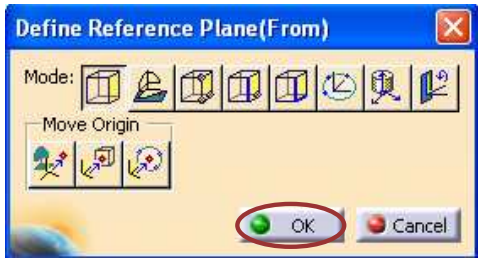
NOTE: Skip this step if the green compass is initially in the desired location and orientation.

Student Notes:

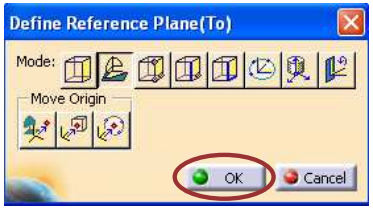
Snap and Attach

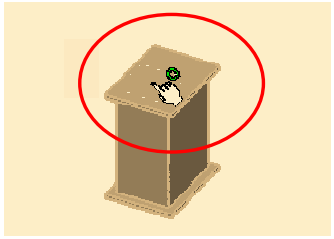
Define Reference Plane (from) / Snap Options

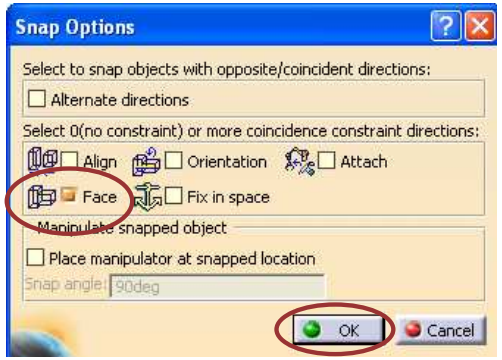
1. Click OK in the Define Reference Plane (From) dialog box.
   Then select the object for the resource to be snapped.
   The Define Reference Plane (To) dialog box appears.



2. Orientate the rectangle and the line as shown in the image.
   Click using the left mouse button, and then click OK in the dialog box.
   The Snap Options dialog box appears.







3. In the Select field, choose Face and click OK.
   The resource should now be sitting on the object.

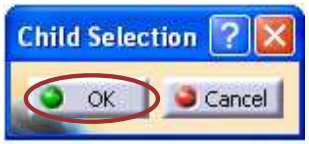
Student Notes:

Snap and Attach

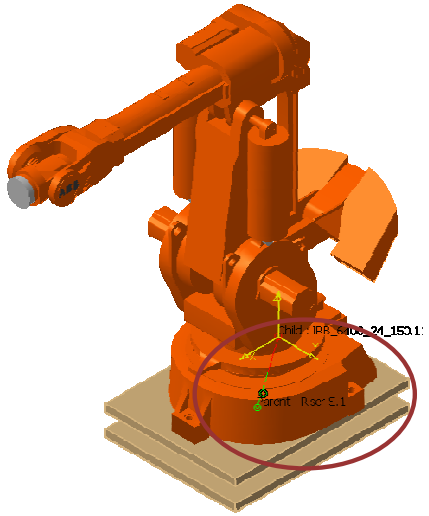
Attach / Child Selection / Hide Attachments

1. In the Layout Tools toolbar, select the Attach icon. The system prompts to select the parent first, select the Object and then select the resource.
   The Child Selection dialog box appears.

2. Select OK. The Parent – Child relationship appears.



3. It is possible to Hide or Show this relationship. To hide it, right-click on the text, and select Hide / Show from the contextual menu.

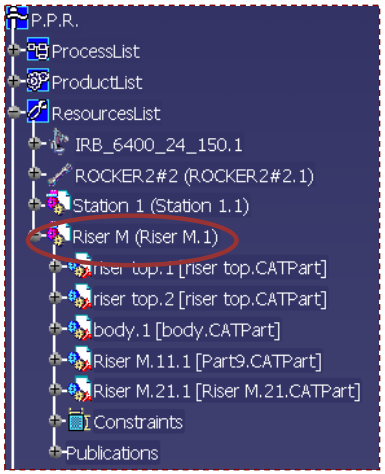


Student Notes:

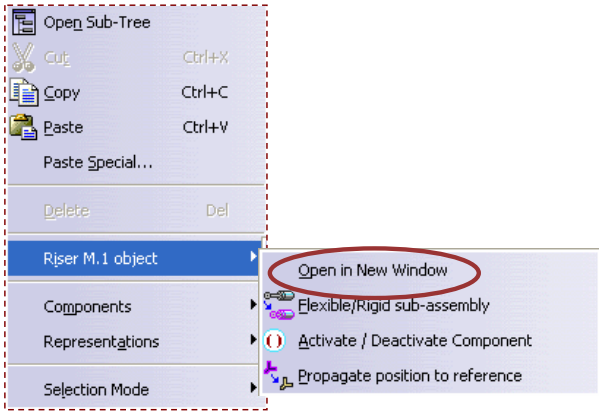
Snap and Attach

Editing the Height of a Robot Riser

1. Double-click on the Riser, which is displayed in the ResourcesList in the PPR tree.
   This will take you to a Assembly Design workbench.



2. Right-click on the Riser, and point to Riser object and click on Open in New Window.

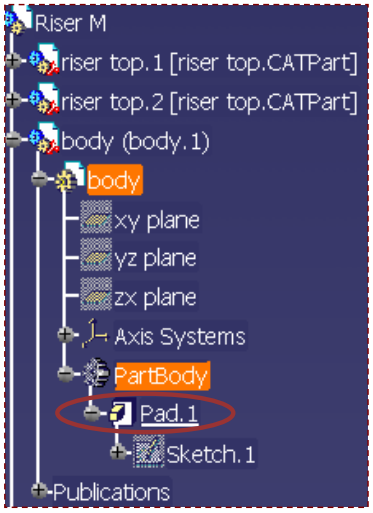


This opens the Riser in a new window.

Student Notes:

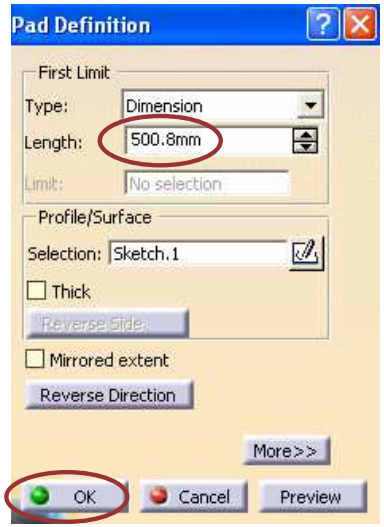
Snap and Attach

3. Double click on body to expand the tree structure under Riser as shown in the image here.

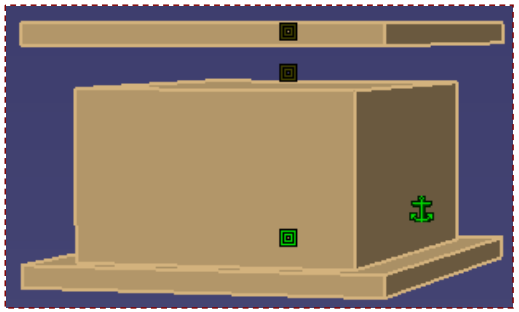


4. Double-click on Pad. The workbench changes to Part Design.

5. Double-click on Pad. You will see Pad Definition dialog box.



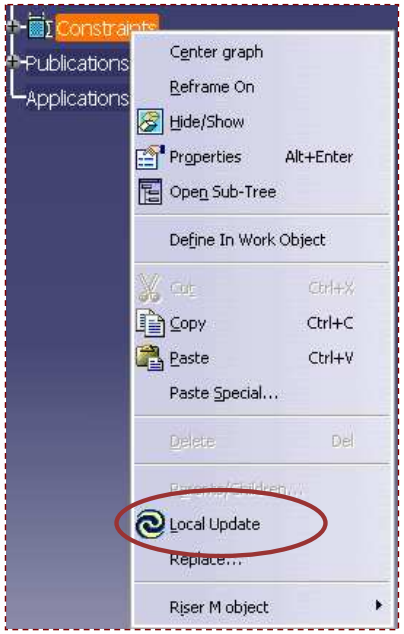
6. Enter the height you want in the Length field, and click OK. You can see that the height of the Riser's body is altered to the entered value.



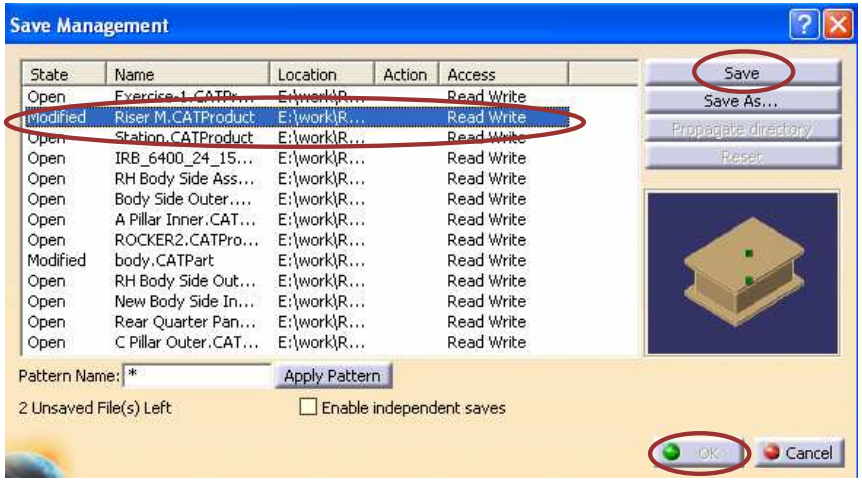
Student Notes:

Snap and Attach

7. Right-click on Constraints in the PPR tree, and click on Local Update.
   The riser to gets attached to the Riser body.

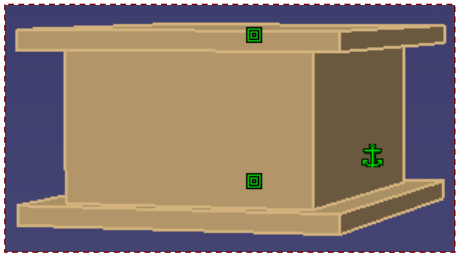


8. To save the changes made, click on File/Save Management.
   You will see Save Management dialog box.



9. Select the riser that you have edited and click on Save.

10. Click on OK in the Save Management dialog box. This saves the changes made.

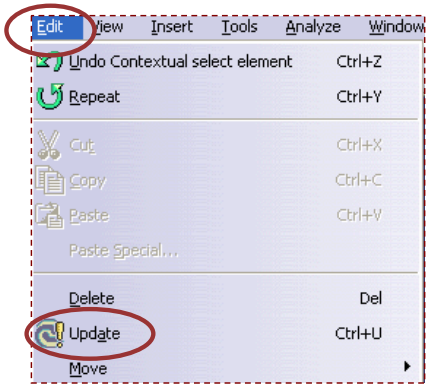


Student Notes:

Snap and Attach

11. Close the CATProduct window.
    You will see the CATprocess window in the Assembly Design work bench.

12. Click on Edit/Update to update the changes made to the Riser.



13. Double-click on the word PROCESS in the PPR tree.
    This is to return to Device Task Definition workbench.

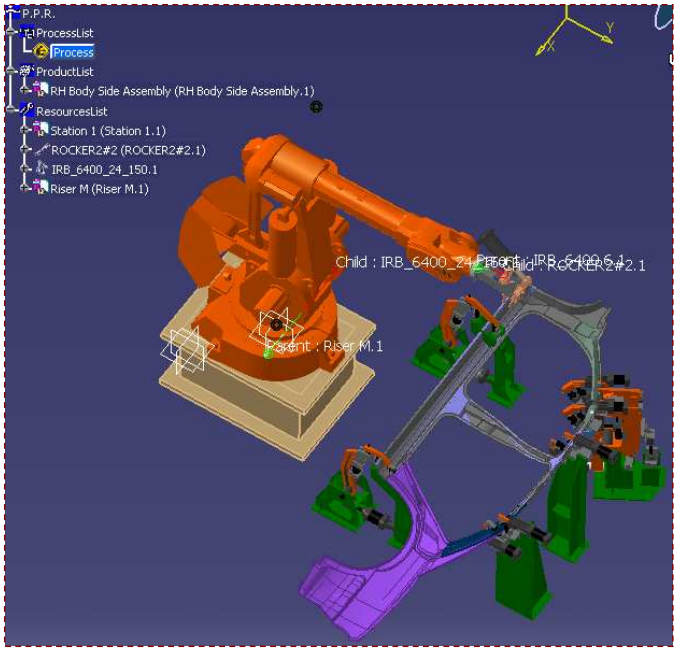
Student Notes:

Lesson 2: To Sum Up

This module introduced the first step in building a simulation, i.e. to set up a working environment that best reflects the needs and desired outcomes in your context. Later procedure to bring in resources, products, and few basic tasks were discussed.

To review, you have:

- ✓ Positioned and Manipulated the Compass
  - ✓ Used the Manipulation Bounding Box
  - ✓ Snapped Automatically to Selected Object
  - ✓ Edited Positions
- ✓ Inserted Products and Resources
  - ✓ Started a New Process
  - ✓ Inserted a Resource
  - ✓ Mounted a Device using Set Tool
  - ✓ Removed a Resource
  - ✓ Used the Save As Function
- ✓ Snapped and Attached
  - ✓ Used the Snap Icon
  - ✓ Defined the Reference Plane
  - ✓ Used Attach and Child Selection
  - ✓ Editing the Height of a Robot Riser



Now it is time to apply this learning using the Case Study

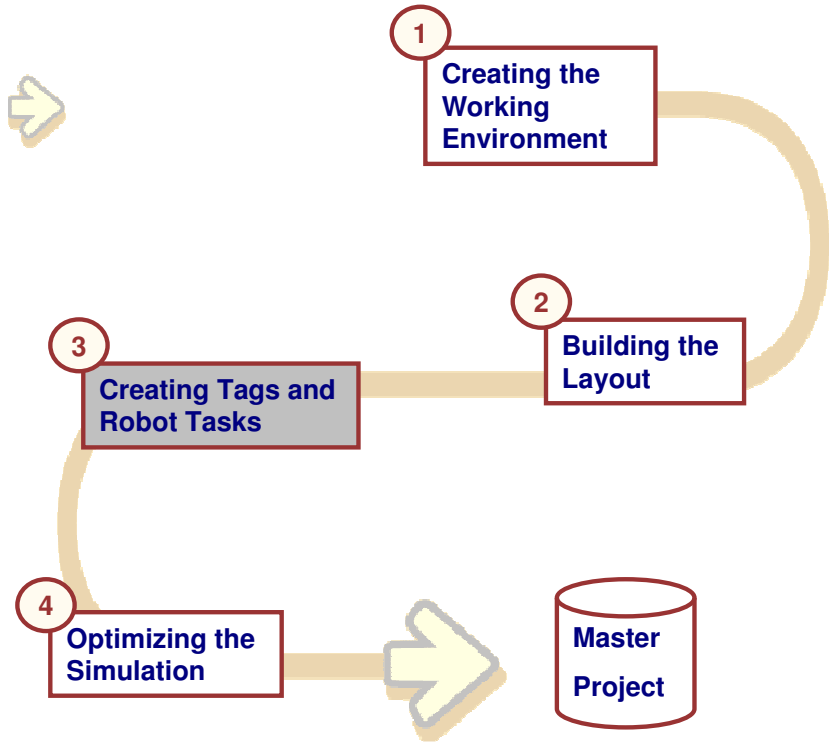
Student Notes:

Creating Tags and Robot Tasks

Tag points are created to give the robot a path to follow to perform the job at hand. The job may be welding, adhesions, or other tasks. The tag points need to be stored some where and this is where Robot Tasks come in. A robot task is a storage area for multiple tag points or groups.

You will use the following Steps to complete this Lesson:

- Create Tags
- Create Robot Tasks
- Move a Robot
- Run a Robot Process
- Create Robot Tasks and Weld Gun Action



Duration: 2 hours

Student Notes:

Workbenches and Toolbars used in this Lesson

These are the Workbenches and Toolbars that are used in this lesson.

Device Task Definition

Workcell Sequencing

Student Notes:

Step 1: Create Tags

Tags are created to ensure that the robot has a path to follow. By creating tag points a path is created, this path can be numbered and named. The path can then be reordered after the path is created or in the middle of the process.

Student Notes:

Create Tags

Creating a New Tag Group

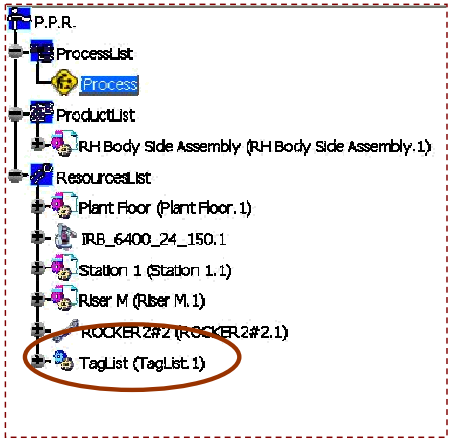
1. Click on Start/ Resource Detailing/ Device Task Definition to load Device Task Definition workbench in V5.

2. To create a New Tag Group, click on the New Tag Group icon from the Tag toolbar.

3. The default name is acceptable but it can be given any name you wish.

The Tag Group dialog box appears.

4. Click OK.
The tag group is created and is placed in the Resource List of the PPR tree as shown.



Student Notes:

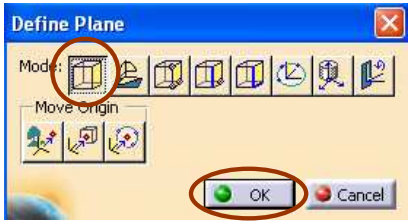
Create Tags

Creating New Tags

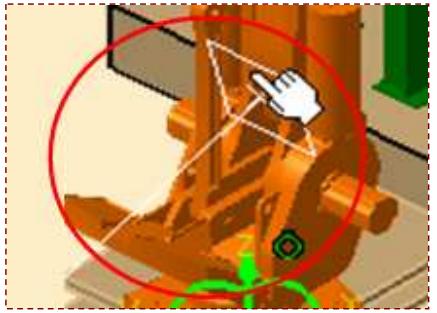
To create New Tags a group must first be created, once the group has been created a new tag can be added to the group.

1. Click the New Tag icon from the Tag toolbar.

2. Select the Tag Group from the PPR tree to place the tag.
   The Define Plane dialog box appears.



3. Click on Define Plane and using the define plane white bounding box, select a position for the tag to be placed, and then click OK.



The tag is created and can be viewed by zooming in the area where it was placed.

Student Notes:

Create Tags

Renaming a Tag Group

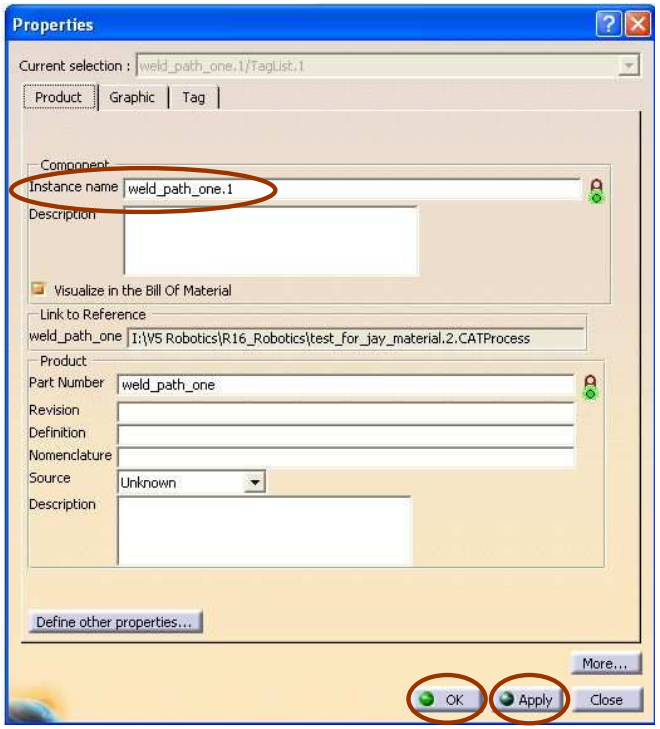
Tags and the tag groups can be renamed in order to separate it into many different tags and groups for viewing ease.

1. Tag groups can be renamed by right-clicking on the group in the PPR tree and selecting Properties. The Properties dialog box appears.

2. Type a name under Instance name to rename the tag group.

3. Click Apply. The name changes in the PPR tree.

4. Click Close or OK to close the dialog box.



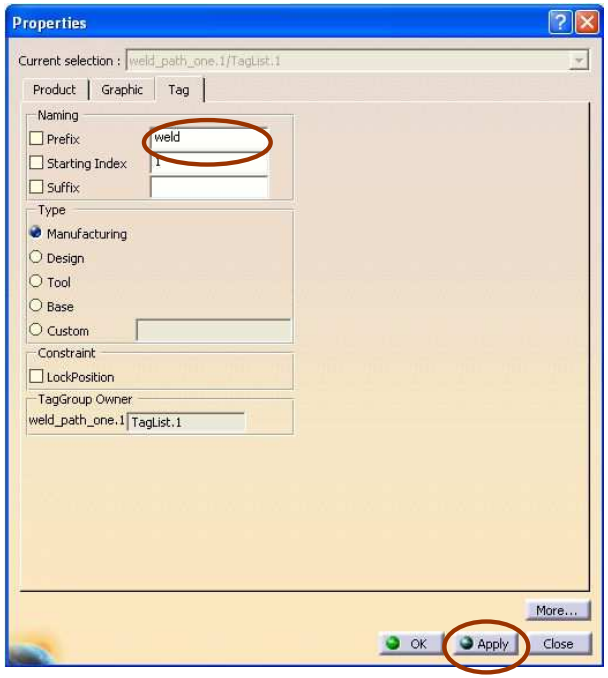
Student Notes:

Create Tags

Renaming Tags

Tags can be renamed using the same method.

1. Right-click on the tag in the PPR tree and then select Properties from the text box.
   The Properties dialog box appears.
2. Click Tag in the Properties dialog box.
3. Under Naming, the name of the tag can be changed to your preference.
4. Click Apply. The name is changed and it is updated automatically in the PPR tree.
5. Click Close or OK to close the dialog box.



Student Notes:

Step 2: Create Robot Tasks

This user friendly function makes programming robots less cumbersome. This provides the ability to take the fastener points assigned to a process activity and reuse them for creating a robot task. Based on the amount of fasteners assigned prior to selecting this powerful function, this generates operations that robots use in a matter of seconds. A task is a linear sequence of activities called operations, each operation can contain a motion and a set of actions.

Student Notes:

Create Robot Tasks

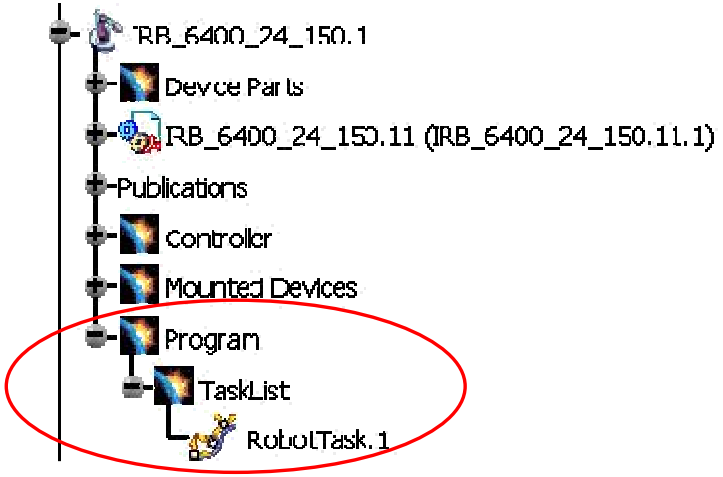
Creating a New Robot Task

1. To create a new robot task, click on New Robot Task from the Sequence toolbar.

2. The task must be associated with a robot, so select the appropriate robot for the task.

The task is automatically placed in the PPR tree under the Robot in the Program section.

Once the Robot Task has been created it can be populated with tasks and operations.



Student Notes:

Create Robot Tasks

Adding Tags to the Task

Adding tags to the robot task can be done using the Add Tag icon from the Sequence toolbar.

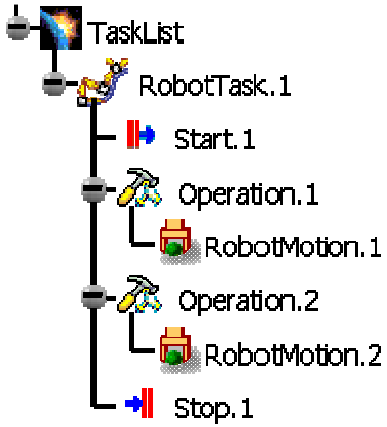
1. Click the Add Tag icon from the Sequence toolbar.

2. Select the robot task to associate the tags with.

3. Select tag group to be placed in the robot task.

The operations are completed automatically and are displayed under the Robot Task in the PPR tree.

Example



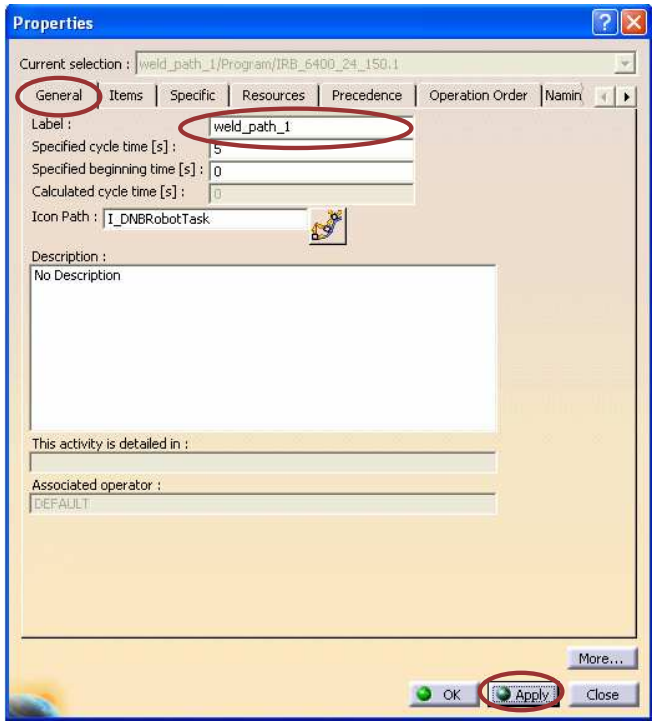
Student Notes:

Create Robot Tasks

Renaming Tasks and Operations

Tasks and operations may need to be renamed in order to keep the process easy to read and understand.

1. Right-click on the Operation or Task that needs to be renamed.
2. Click on Properties from the menu and under the General tab the names can be changed.
3. Click on Apply.



Student Notes:

Step 3: Move a Robot

Using Teach and Jog are two methods of performing the same task. The task being to move a robot, a robot can be moved to create a tag point or for various other reasons. Teach and Jog are both used to move a robot. Utilizing the Teach Pendant it is possible to add tags to the robot path. This is useful when a tag point has been missed or if one is incorrectly placed.

Use the following steps to Create Tags and Robot Tasks

1. Create Tags ✓
2. Create Robot Tasks ✓
3. **Move a Robot**
4. Run a Robot Process
5. Create Robot Tasks and Weld Gun Action

Student Notes:

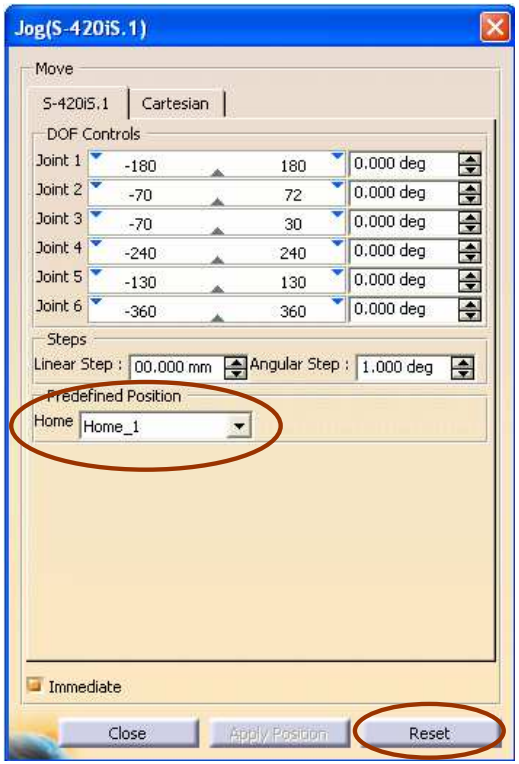
Move a Robot

Moving Using Jog Panel

Jogging can be done using the Jog a Device icon from the Robot Management toolbar.

1. Click the Jog a Device icon, then select the device to be moved. The Jog Panel appears.

   Using the panel, there are multiple ways to jog the device.



2. One way is by using the Predefined Positions, the panel comes with one default position Home_1.

   Selecting this will move the device back to the original home position.

   OR

   Another way to return the device to the home position is by clicking the Reset button.

Student Notes:

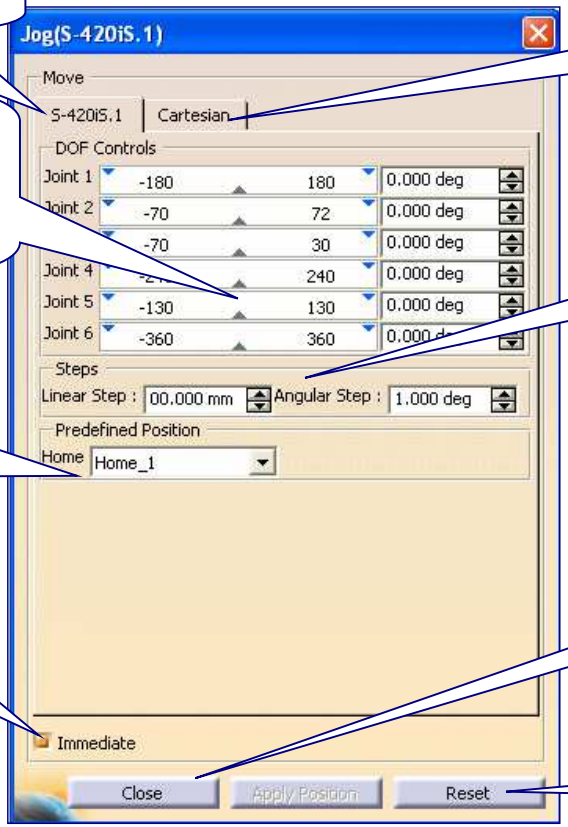
Move a Robot

The device can be moved using Joint Motion.

Each Joint can be moved independently utilizing the arrows or the degree arrows.

Predefined Home Positions can be set and accessed here.

Highlighting this button makes the changes immediate.



Cartesian Motion can also be used to jog devices.

Linear and Angular Step size can be set using these buttons.

This button closes the Jog Panel.

Returns the device to the default position.

Student Notes:

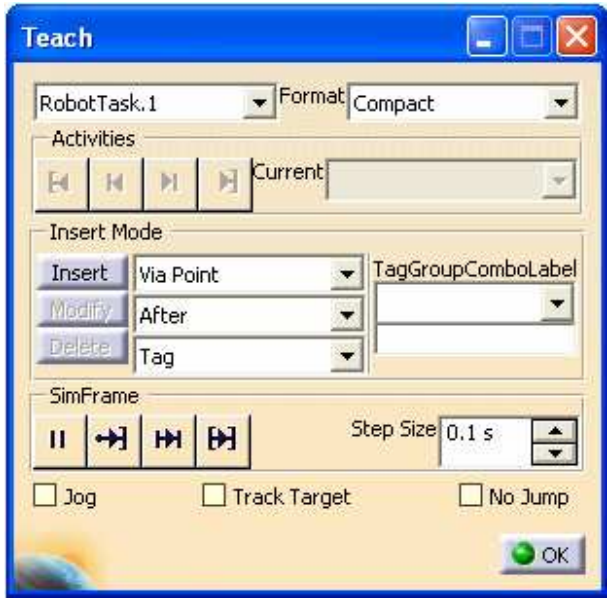
Move a Robot

Moving Using Teach Command

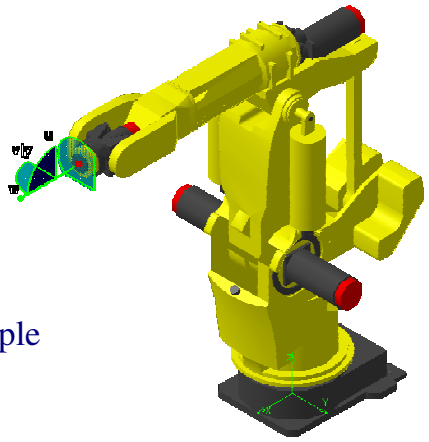
Moves can be made and set by using the Teach command.

1. Select the Teach a Device icon from the Robot Management toolbar.

2. Select the Robot to teach from the PPR tree. The Teach dialog box appears.



3. The robot can be moved using the Compass that attaches to the end of the robot.

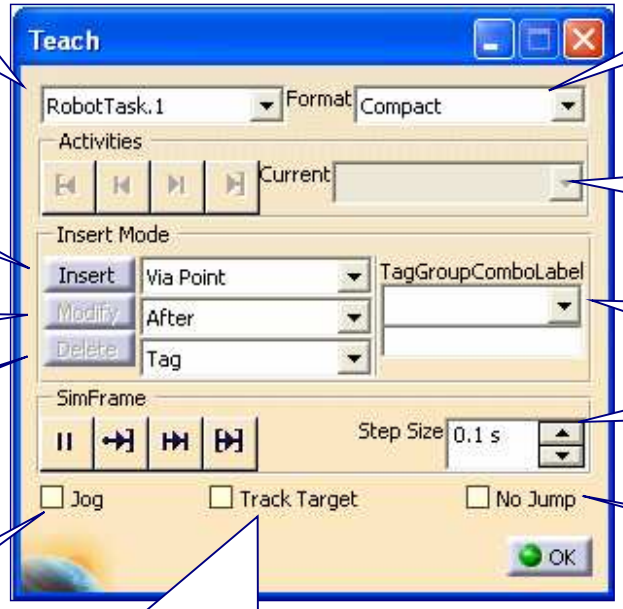


Example

Student Notes:

Move a Robot

Moving Using Teach Command (continued)



Select the Different Tasks associated with the robot

Choose between Table and Compact Format

Process and VIA points can be inserted using this feature

Select between the Operations inside of the Task Selected

This button lets to modify a point.

Shows the name of the Tag Group selected

Step size can be set here

Allows you to Delete Points

Sets the robot to Jump or No Jump

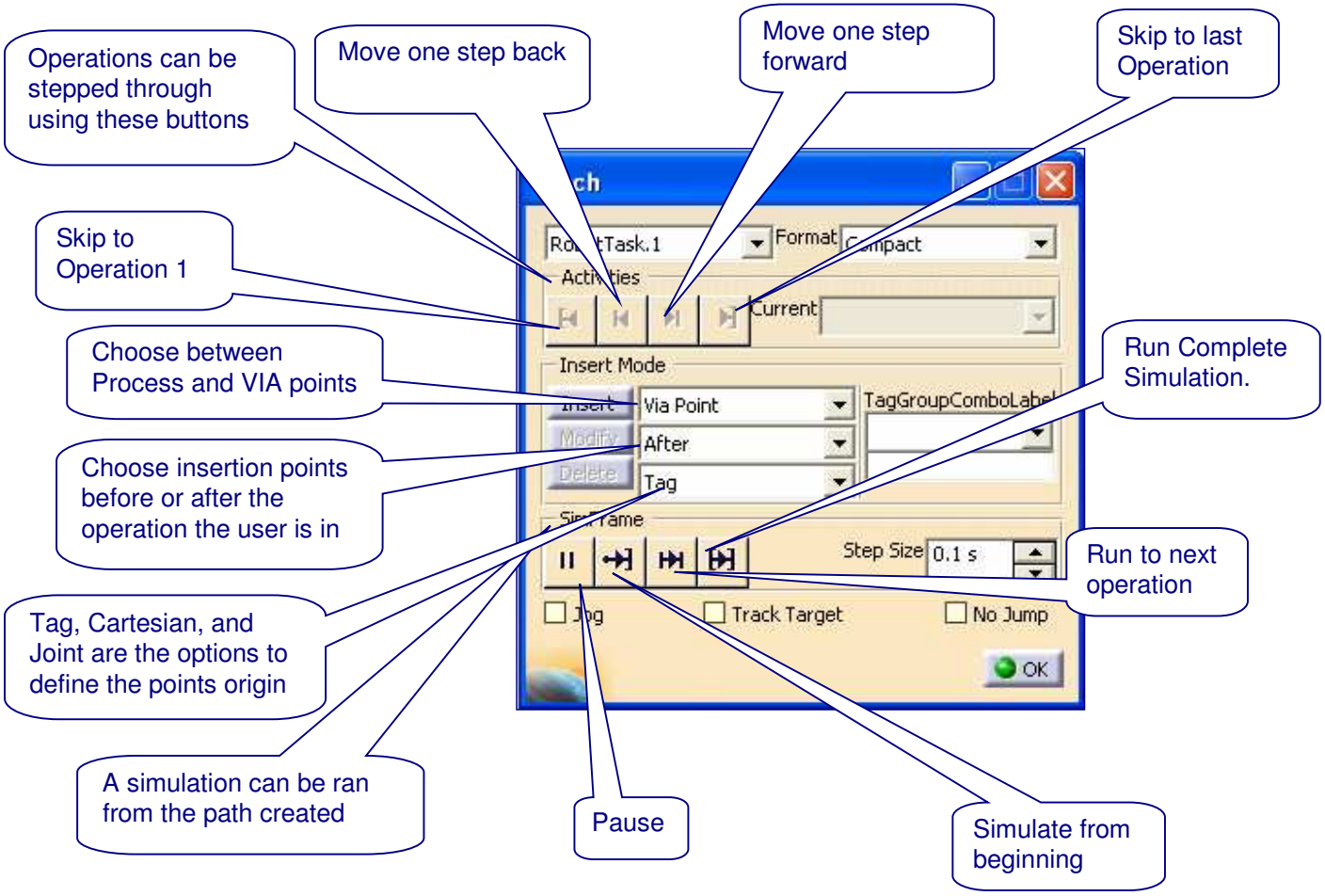
This button opens the Jog Panel

Highlighting this will allow you to see a line representing the path the robot moves from point to point

Student Notes:

Move a Robot

Moving Using Teach Command (continued)



Student Notes:

Move a Robot

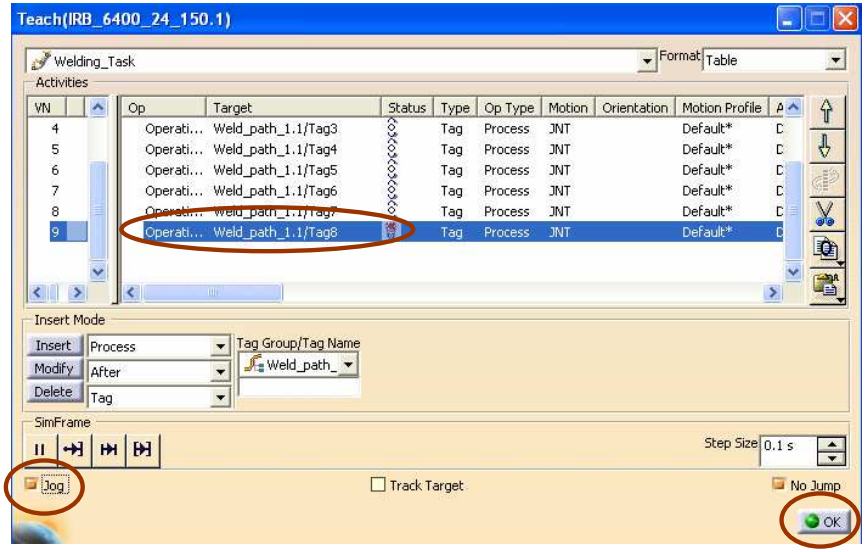
Adding Tags Using Teach Command

Tags can be added to the path using the Teach command.

1. Click on Teach a Device icon on the Robot Management toolbar, and then click on the robot. You will see Teach dialog box.

2. Select Table from the drop menu for Format field.
   You will see Teach dialog box in a table format.

3. Select the operation at the desired insertion point.



Student Notes:

Move a Robot

4. Select the Jog check box in the Teach dialog box, and jog the robot to move to the desired position.

5. Use the pull down menu under Tag Group/Tag Name to select the tag group in which you want the new tag to appear.

6. Using the previous pages as a reference make selections as needed. (i.e. Tag, Cartesian, Joint, Before, After, etc…).

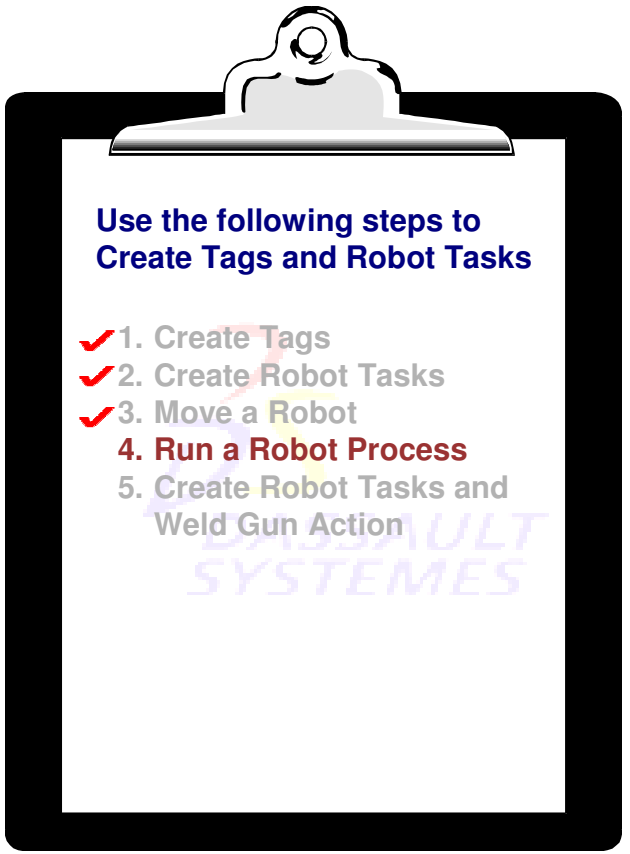
7. Click the Insert button and click OK.

The tag is created and can be modified or reordered as needed using the Teach command.

Student Notes:

Step 4: Run a Robot Process

A single robot process can be created and ran in a matter of minutes, which depends on number of activities the robot is about to do. The most important thing to remember is to save the initial state when a simulation is going to run. Finally using process simulation the task can be seen by selecting this single command.



Student Notes:

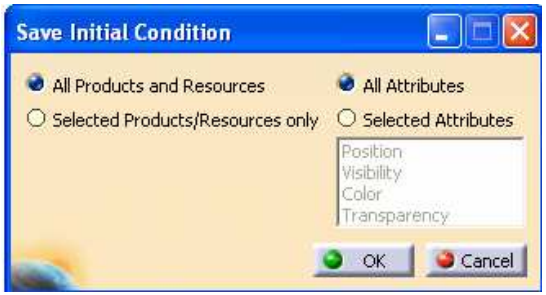
Run a Robot Process

Saving Initial State

The state in which a process begins is called the initial state.

To save a process in this state, click the Save Initial State icon from the Simulation toolbar.

The Save Initial Condition dialog box appears.



After Initial State has been set, it can be restored at any time by using the Restore Initial State icon from the Simulation toolbar.

The Restore Initial Condition dialog box appears.

The default selections are acceptable.

You can set up the Environment in the proper positions and using this icon the positions will all be saved.

Student Notes:

Run a Robot Process

Using Task Simulation

To run the tasks created, select the Robot Task to run from the TaskList of the PPR tree.

Click on the Robot Task Simulation icon from the Simulation toolbar.

The Simulation Controls Tools and Process Simulation toolbars appear.

Click the play button and watch the task run.

Click the Red X to close the toolbar after the task has finished running.

Student Notes:

Step 5: Create Robot Tasks and Weld Gun Action

In order to run the simulation of the activities with their assignments, a robot task must be created. The robot task created actually creates the relationship between the resource and the process activity. Weld gun actions are created to simulate the action a real welder gun would make. This is done to ensure there are no clashes between the products and the resources (parts / fixtures and robots).

The main reason for creating weld gun actions is to create a more realistic simulation to better analyze the process being recreated. This is done so any adjustments that need to be made to the process can be made now before the process is implemented.

Student Notes:

Create Robot Tasks and Weld Gun Action

Create a Robot Task

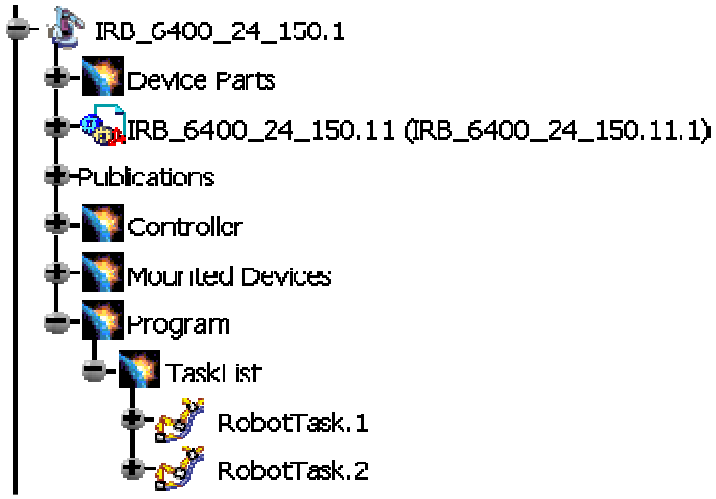
The method for creating a robot task is as follows:

A. Click on Create a Robot Task icon from the Sequence toolbar.

B. Select the Activity (Spot Gluing.1) where the robot task is to be created from the PPR tree.

C. The Robot Task is automatically created in the Program section of the Robot PPR List.

Example



Student Notes:

Create Robot Tasks and Weld Gun Action

Setting the Active Task

In order to simulate a work-cell, the task have to be activated. This is done by setting an active task.

In order to set an Active task, the Workcell Sequencing workbench must be opened. (Start / Resource Detailing / Workcell Sequencing)

Using the procedure shown below, an active task can be set:

A. Click on Set an Active Task icon from the Resource Program toolbar.

B. Select the Activity or the task to be set.

C. The task is set to active automatically.

D. There is no way to see if the task has actually been set except to run the simulation.

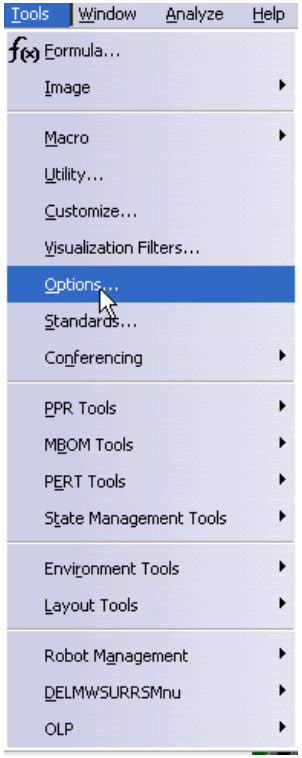
Student Notes:

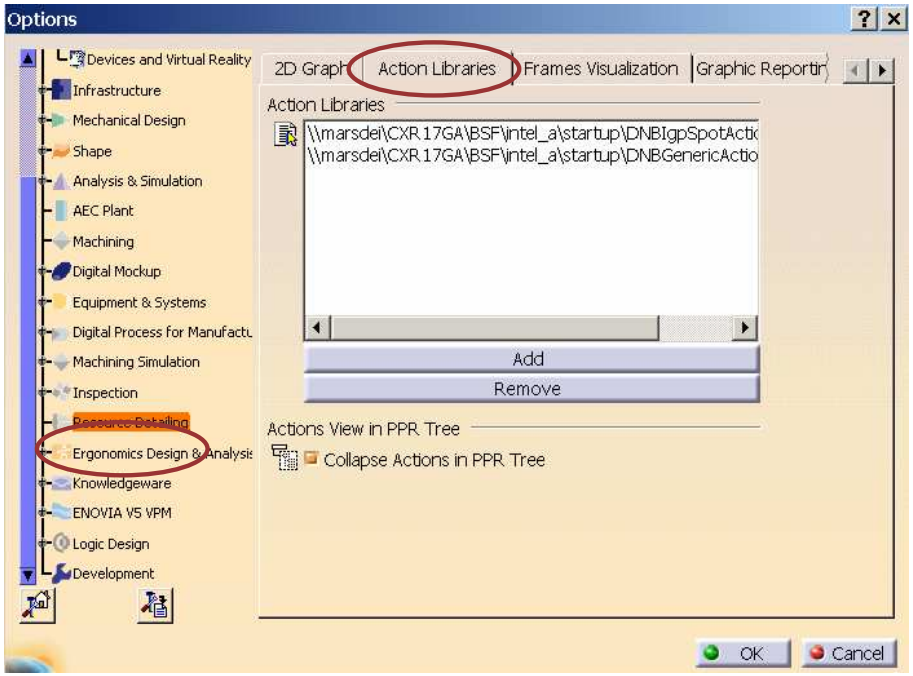
Create Robot Tasks and Weld Gun Action

Creating Weld Gun Action

In order to create Weld Gun Actions, a toolbar must be inserted into the workbench. To insert the toolbar, you must set the paths to DNBIgpSpotActionLib.act, and DNBGenericActionsLib.act files in the ActionLibraries page. The procedure to do this is as follows:

Click on Tools / Options / Resource Detailing / Action Libraries tab.





Student Notes:

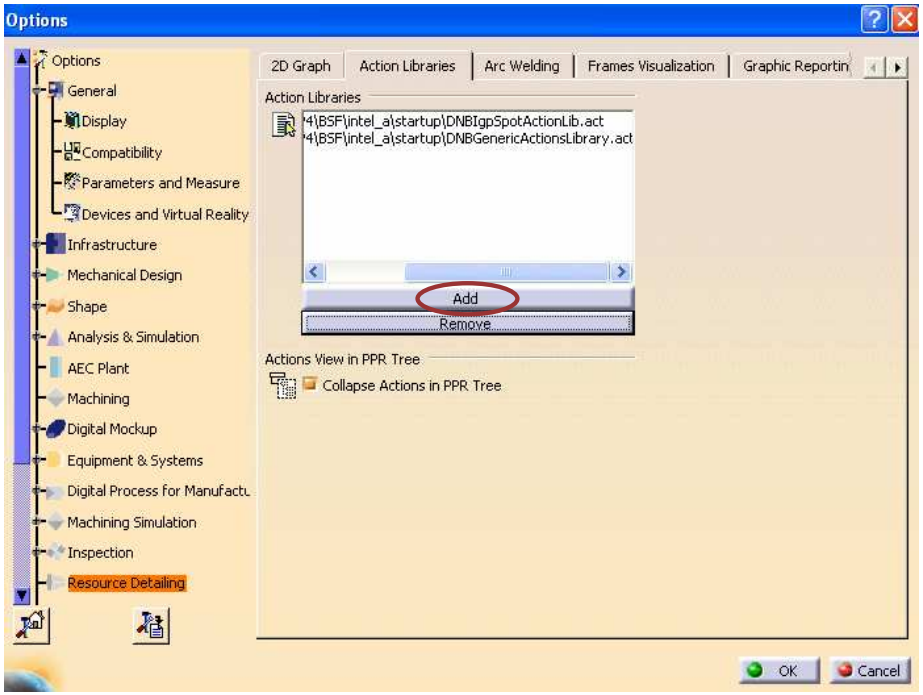
Create Robot Tasks and Weld Gun Action

Click the Add button on the Action Libraries page.

The File Selection dialog box appears, navigate to the appropriate files as shown.

The path is as follows:
D:\\ Program Files \ Dassault Systemes \ R17SP4 \ intel_a \ startup \ DNBIgpSpotActionLib.act
D:\\ Program Files \ Dassault Systemes \ R17SP4 \ intel_a \ startup\ DNBGenericActionsLib.act

After finding the file, click Open on the File Selection dialog box. The toolbar is inserted automatically.



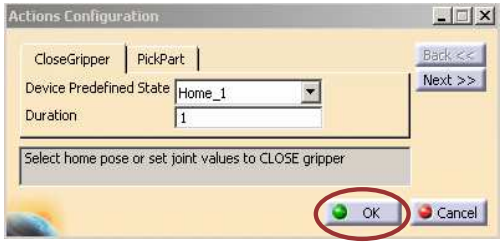
Student Notes:

Create Robot Tasks and Weld Gun Action

To create a retract action for the weld gun, Click on Retract Action icon from the Spot Weld Action toolbar, and select the Robot Motion under the task it is to be inserted.

The Option dialog box appears, select where it is to be inserted (before or after) and click OK.

The Actions Configuration dialog box appears. Notice that when the predefined states (Home Positions) are selected, the weld gun moves to that position. Select the appropriate home position and click OK.



To create a weld gun action, click on the Weld Action icon, and select the robot motion to place the weld gun action. The Option dialog box appears. Select an option from the dialog box and click OK.

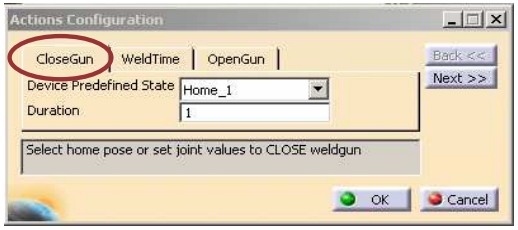
Student Notes:

Create Robot Tasks and Weld Gun Action

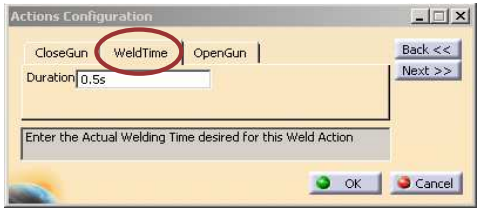
The Actions Configuration dialog box appears. Under the CloseGun tab, select the appropriate position.

The position in which the Weld Gun can perform the task correctly.

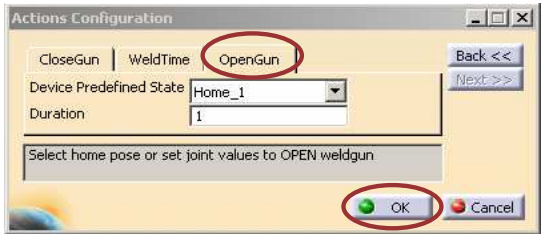
For Example: If Home position 3 were close then that would be the correct choice for a weld action.



Under the WeldTime tab, set the time for the weld to be completed.



Under the OpenGun tab, select the appropriate home position and click OK.



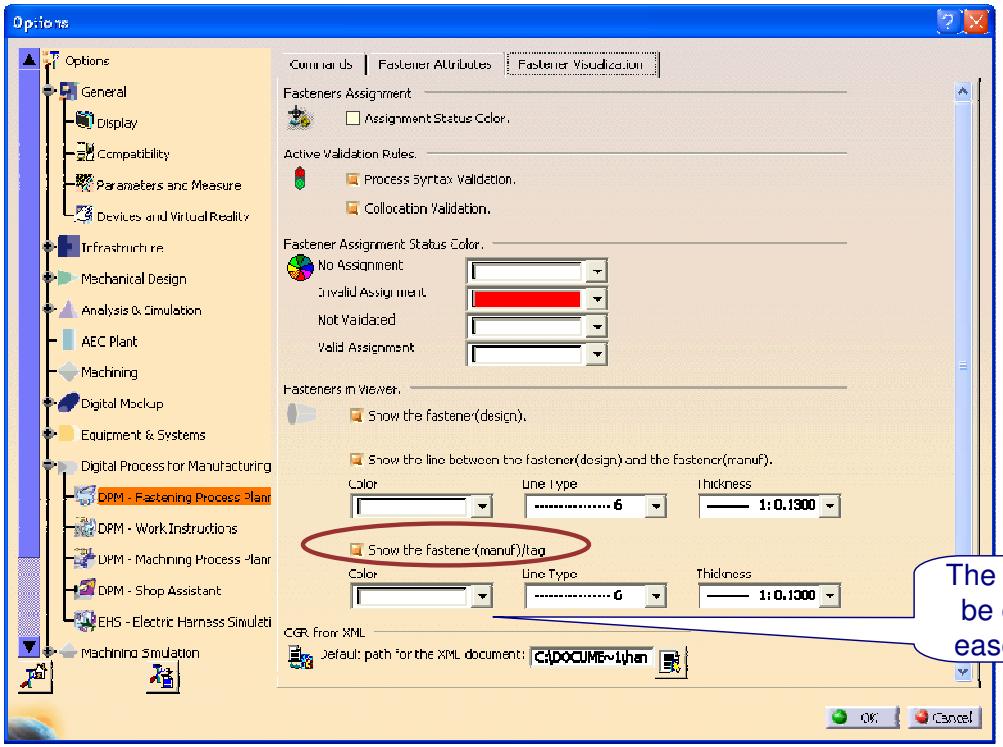
This sets the gun movements for closing, welding, and semi-open.

Student Notes:

Create Robot Tasks and Weld Gun Action

Jogging to Weld Points

In the Tools / Options / DPM Fastening Process Planner / Fastener Visualization turn on the Show Fastener (Manuf) tag. This will make the tags and their coordinates visible.



This step has already been completed this is a reference to show why and when it happens.

Student Notes:

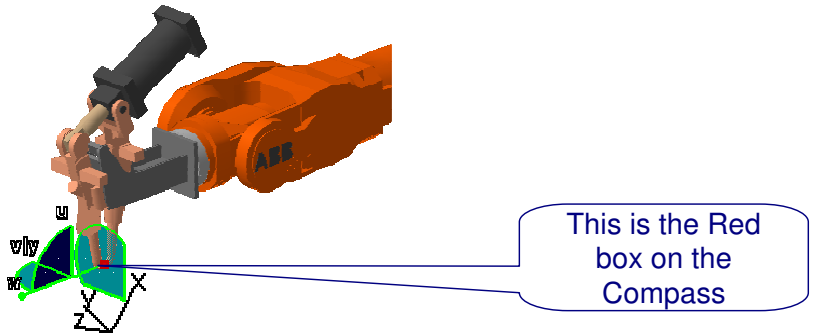
Create Robot Tasks and Weld Gun Action

Using the Robot Management toolbar, click the Jog a Device icon, and select the robot to jog to the weld point.

The Jog dialog box appears.

Notice the orientation of the compass on the weld gun. This will be compared to the orientation of each weld.

Using the Compass it is possible to grab the red box of the compass and place it on a tag point or fastener position in the 3D view.



This is the time to check tags and fasteners to make sure the orientation is correct.

Student Notes:

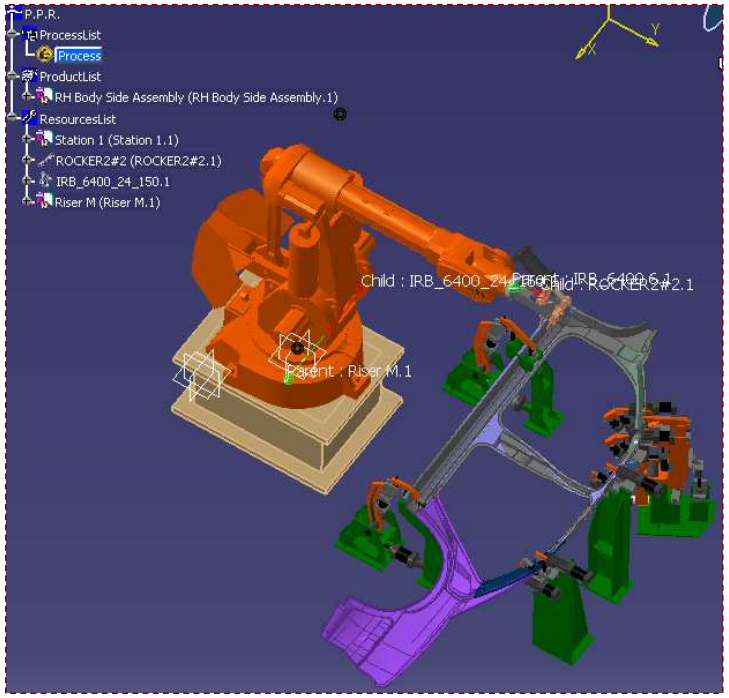
Lesson 3: To Sum Up

This module introduced you to the procedure of creating tags and robot tasks. These are essential to give the robot a path to follow to perform its job. Later adding tags using Teach pendant, using Jog panel and running single task simulation was discussed.

To review, you have:

- ✓ Created Tags
  - ✓ Created a New Tag Group
  - ✓ Created New Tags
  - ✓ Renamed a Tag Group
  - ✓ Renamed Tags
- ✓ Created Robot Tasks
  - ✓ Created a New Robot Task
  - ✓ Added Tags to the Task
  - ✓ Renamed Tasks and Operations
- ✓ Moved a Robot
  - ✓ Moved Using Jog Panel
  - ✓ Moved Using Teach Command
  - ✓ Added Tags Using Teach Command
- ✓ Run a Robot Process
  - ✓ Saved Initial State
  - ✓ Used Task Simulation
- ✓ Created Robot Tasks and Added Weld Gun Actions
  - ✓ Created a Robot Task
  - ✓ Set an Active Task
  - ✓ Created Weld Gun Actions
  - ✓ Jogged to Weld Points

Now it is time to apply this learning using the Case Study



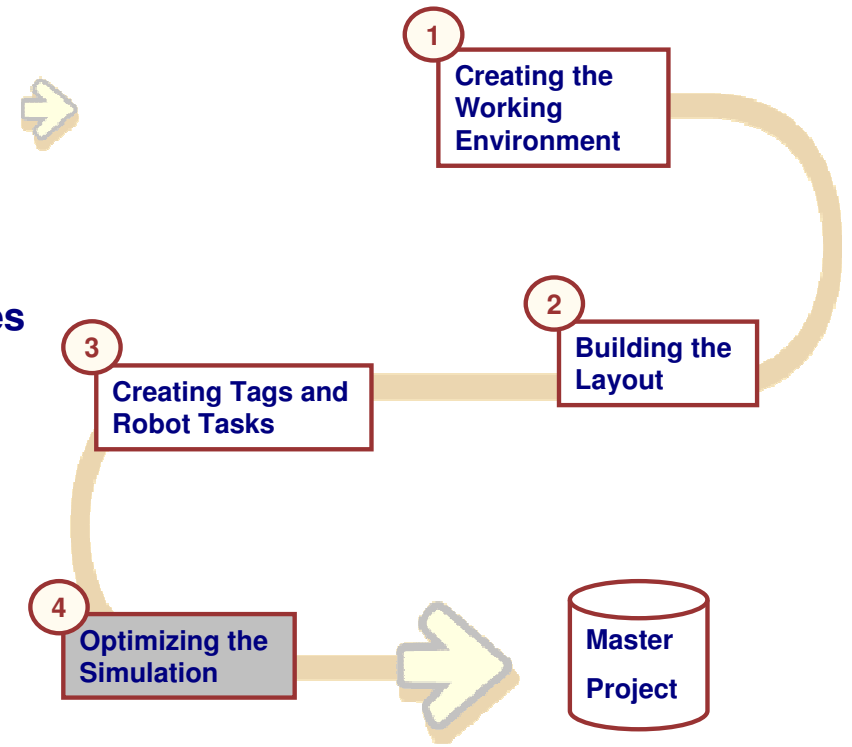
Student Notes:

Optimizing the Simulation

Using the different functions available in the V5 R17 environment a Simulation can be Optimized for peak performance. Some of the key elements regarding optimization will be shown in the next few sections to help you understand these functions and the ability of the V5 R17 Software better. The functions included in this module are listed below for quick reference.

You will use the following Steps to complete this Lesson:

- Robot Task Analysis
- Mapping and Monitoring IOs
- Multiple Resource Simulation
- Creating Robot Controller Profiles



Duration: 2 hours

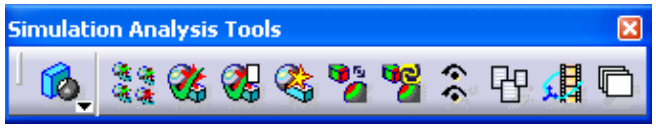
Student Notes:

Workbenches and Toolbars used in this Lesson

These are the Workbenches and Toolbars that are used in this lesson.

Device Task Definition

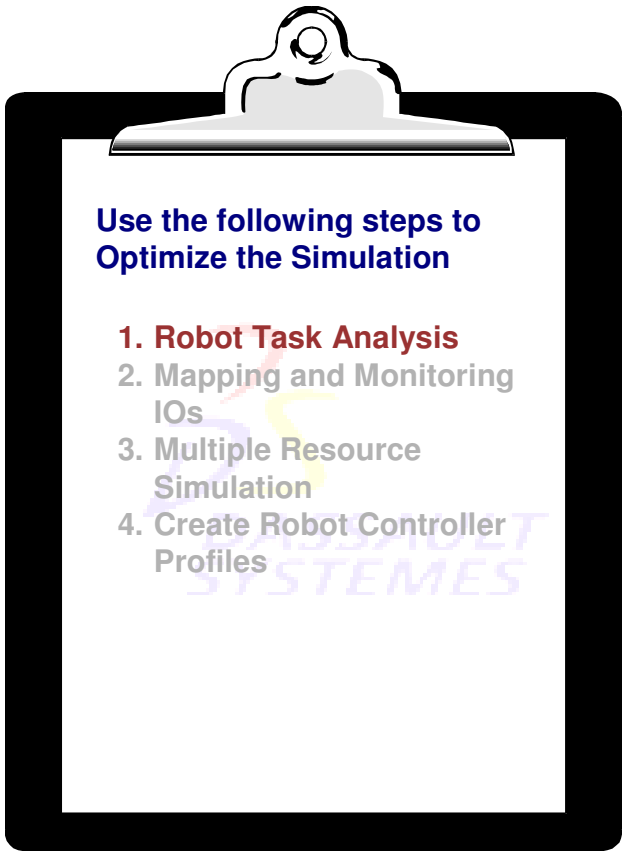
Workcell Sequencing



Student Notes:

Step 1: Robot Task Analysis

Robot task analysis has many different meanings because of the various methods used for analyzing the multiple tasks and configurations of tasks, which are provided in any multitude of scenarios. You can analyze tasks for collisions, clashes, or even perform a weld study analysis to determine the correct cycle time for a certain type of weld.



Student Notes:

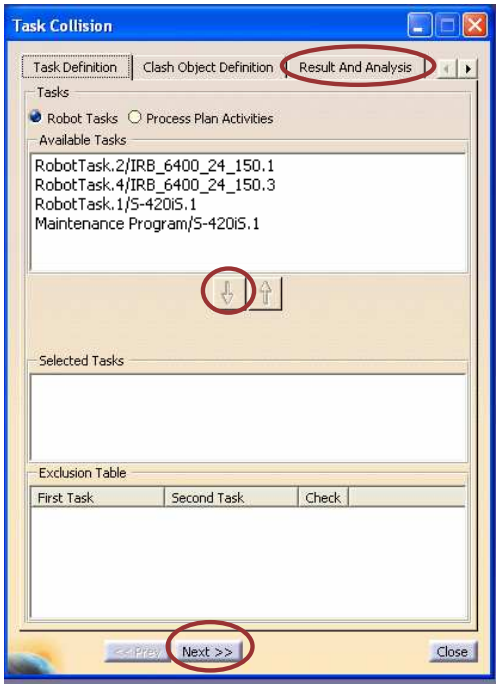
Robot Task Analysis

Using Automatic Task Collision

Switch to Workcell Sequencing workbench.

1. To create an interference zone for a welding robot, click Automatic Task Collision Analysis from the Interference Zones Toolbar.

The Task Collision dialog box appears with all the robot tasks.



2. Select a robot task and then another (by holding down Ctrl). The last selection made will be managing the I / O's that will be automatically created.

3. Click the down arrow to select the tasks.

4. In order to set up the state of the I / O's, click on the Next button.

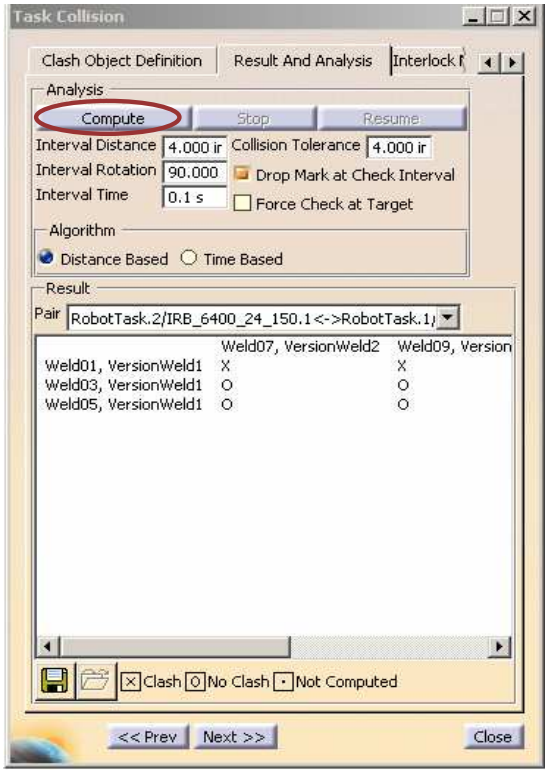
5. Then click the Result and Analysis tab.

Student Notes:

Robot Task Analysis

6. To finish the I / O's setup:

   A. Set the Interval Distance
   B. Set the Collision Tolerance
   C. Set the Interval Rotation
   D. Check the the Drop Mark box at Check Interval button
   E. Click on the Compute button



7. In the geometry window, the robots step through the programs and places a Square (Collision Marker) where there is interference. (i.e. the drop mark or collision point)

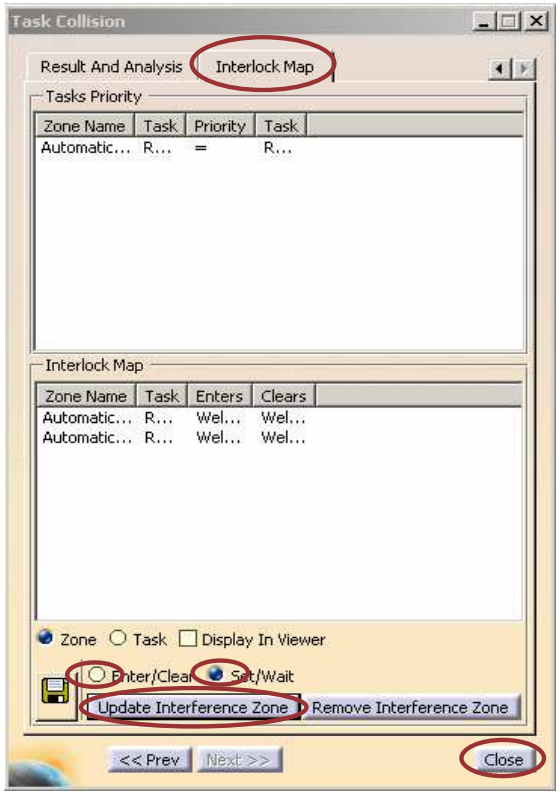
When the computation is done, the scroll bar can be used to review the results for each of the positions.

Student Notes:

Robot Task Analysis

8. To Import all of the I / O's waits and sets in the robot task:

   A. Select the Interlock Map tab
   B. Select the Set / Wait button
   C. Click the Update Interference Zone bar
   D. Then click Close



9. For the interference zones to be set between the robots, follow through the same procedures, but select the Enter/Clear Button, then click Update Interference Zone.

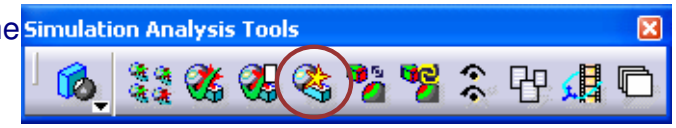
10. Run the simulation to view the new process.

Student Notes:

Robot Task Analysis

Using Clash Analysis

1. To check the simulation for clashes or crashes, Click the Clash icon from the Simulation Analysis Tools toolbar. The Check Clash dialog box appears.



2. The name can be changed to your need. Select the type in the Type field and from the drop down the option select Between two selections.

3. For the selections, Selection.1 is activated, select the appropriate resources. Select the components from the PPR Tree. As they are selected they will become highlighted.

4. Click in the Selection 2 field and select the part or assembly and the appropriate station.

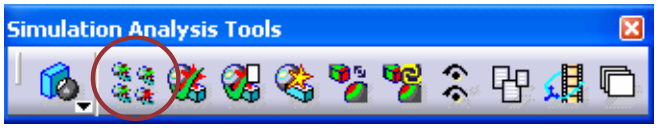
5. When finished, click on Apply.

6. The Check Clash dialog box opens displaying all of the results and conflicts. This is reviewed later, click on Apply to review the Check Clash (Results) dialog box. Click on OK when done.

Student Notes:

Robot Task Analysis

7. To analyze the configuration, select the Analysis Configuration icon. The Analysis Configuration dialog box appears.

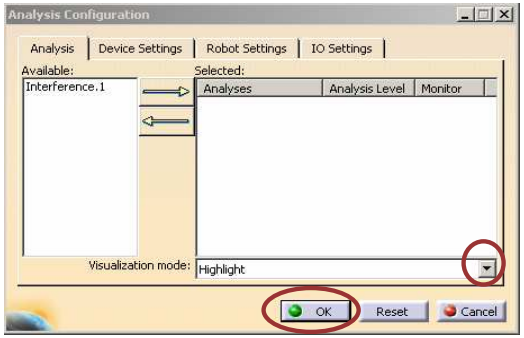


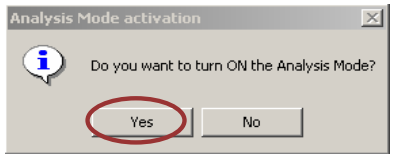
In the Analysis Configuration dialog box the available clashes are shown.

8. Select the clash and use the arrow over to place it under Selected category.

9. Select the type of analysis mode that is to be used from the pull down menu and it will become highlighted.

10. Click on OK. The Analysis Mode activation box appears, select Yes.





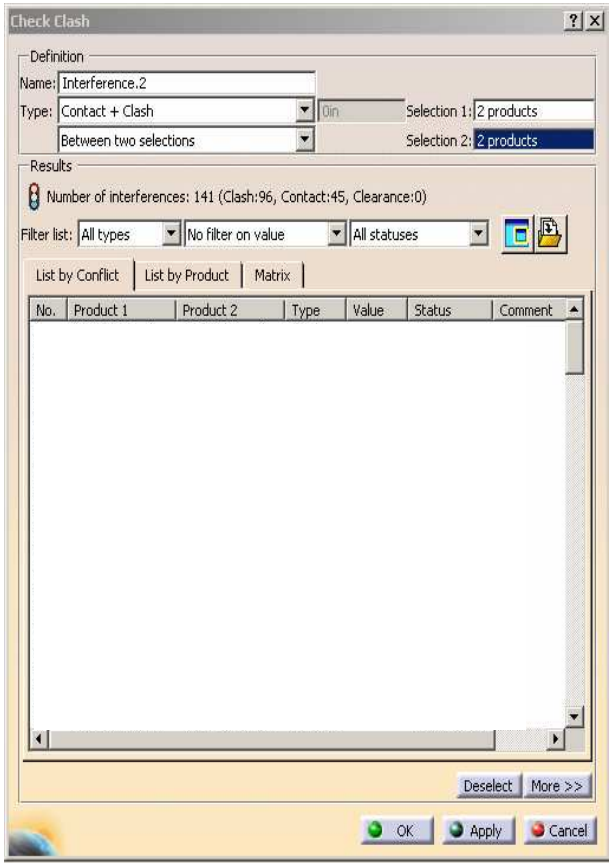
11. Using the Robot Task Simulation icon, it is possible to run through the path again.

Student Notes:

Robot Task Analysis

12. In some situations, the data may need to be exported for a report or some other need (ie. for Manager Reviews). If this data is to be exported, click on the Export As icon from the dialog box and then click save.

NOTE: It is possible to choose the directory the files are saved, use the appropriate location for all saved files.

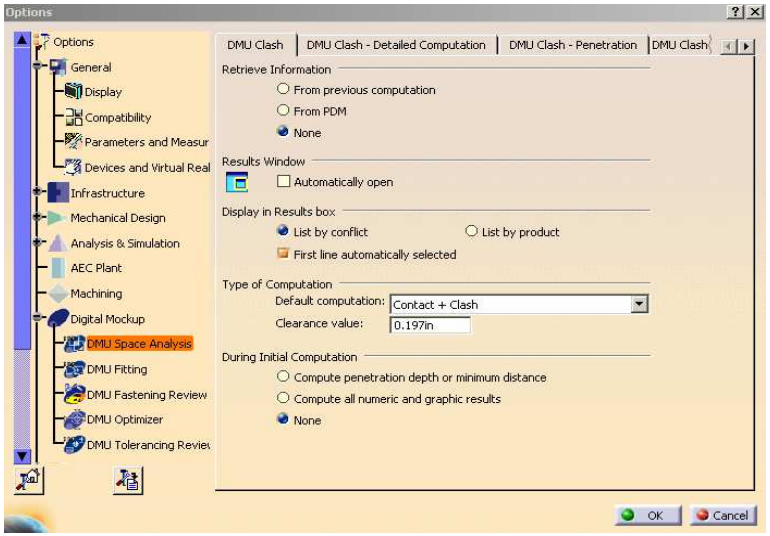


Student Notes:

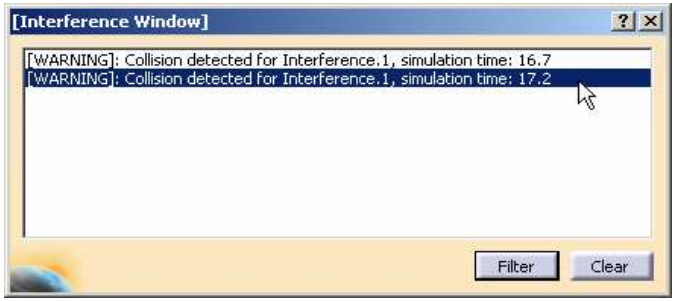
Robot Task Analysis

This procedure describes how to turn on a view to see the violation in a preview window and access additional data about the violation. You can temporarily halt the simulation to observe the violation and then return to the simulation. This option works for dynamic clash analysis also.

13. The Tools / Options / Digital Mockup / DMU Space Analysis / DMU Clash options must be set so that in the Display in Results Box section, the First line automatically selected is checked.



14. First a simulation must be running. From the Interference window, select a portion of the collision to be seen.

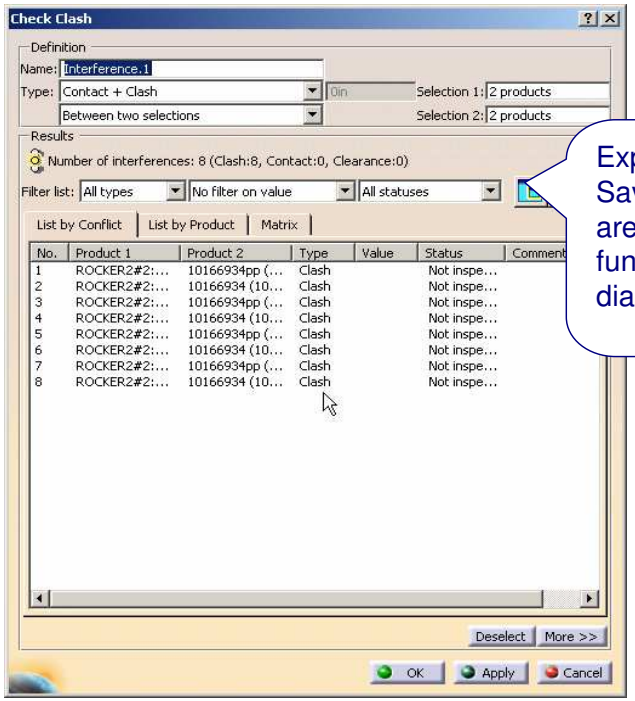


Student Notes:

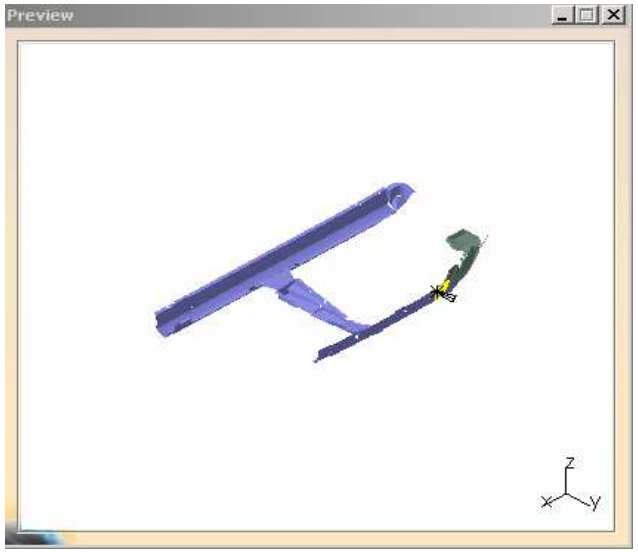
Robot Task Analysis

15. Run the simulation again. When a collision appears, click on the warning and the simulation halts.

16. The Check Clash dialog box appears. Select the clash to view by double-clicking it. The preview window appears. To return to the simulation, click the OK button in the Check Clash dialog box, then click the run button on the Process Simulation player.



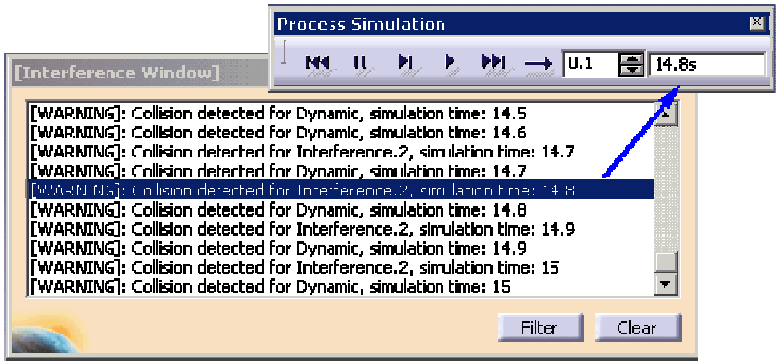
Export As and Save Functions are additional functions in this dialog box.



Student Notes:

Robot Task Analysis

When a line is selected in the Interference Window, the process simulation player shows the same time as the one in the Interference Window.



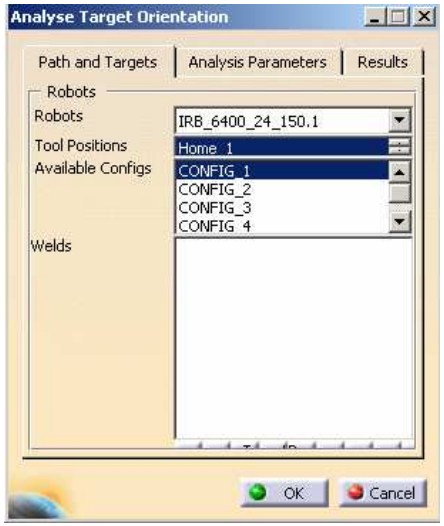
If the simulation is ended by deselecting the Process Simulation command or by closing the Process Simulation player, then the interference window becomes grayed out. The preview window and the clash check dialog box are saved in the applications node of the PPR tree.

Student Notes:

Robot Task Analysis

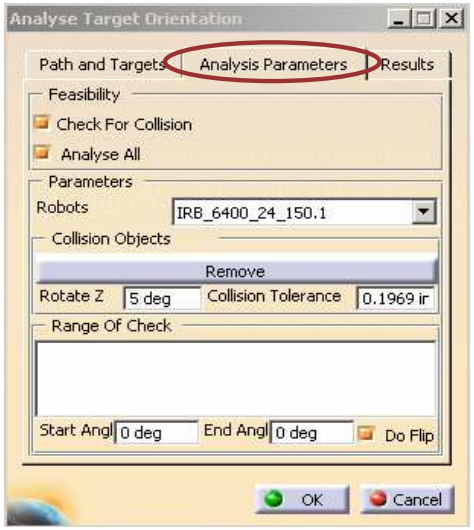
Creating Weld Study Analysis

1. To create a Weld Study Analysis, click Analyze Welds for Robot icon from the Tool Selection Assistant toolbar. Then select a Welding activity. This automatically selects the weld items in the geometry or PPR tree. Select the weld or Tag group(s) that is a target for analysis. The target(s) appears in the dialog box.



2. To add objects to the Collision check, click the Analysis Parameters tab. Then click in the Collision Objects box, and select a component to be checked from the PPR Tree.

3. Delete any target by selecting the line containing the target and then clicking the Remove button.

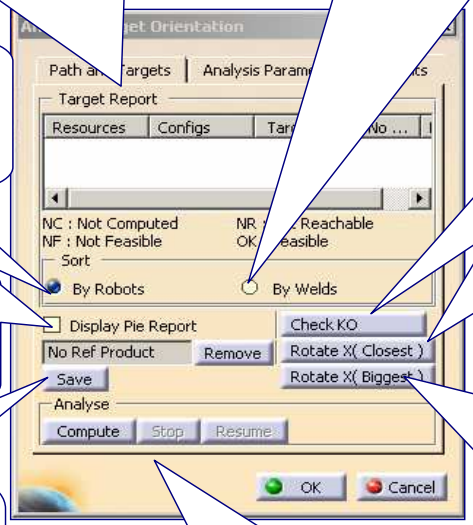


NOTE: For more information on the Analyze Target Orientation dialog box see the on-line docs.

Student Notes:

Robot Task Analysis

4. To complete and view the Results of the Collision Analysis, click the Results tab.



Target Report: This frame provides feedback from the analysis. For each robot and target for an activity, a status will appear after computation.

Sort By Welds: by checking this option, the table is sorted by fastener or target name.

Check KO: This button is active if at least one fastener is unfeasible.

Sort By Robots: The default presentation of the data is sorted by robot name.

Rotate Closest: The Axis jumps to the middle of the nearest feasible area. This option minimizes the changes of orientations for the welds, and can be checked at any time after the analysis has been performed.

Display Pie Report: Displays the results on the viewer in pie form.

Rotate biggest: The Axis jumps to the middle of the biggest feasible area. This option minimizes the risk of collision for the robot, and can be checked at any time after the analysis has been performed.

Save: This opens a Save window. The computation data shown in the target report frame is saved in a .txt file.

Compute / Stop / Resume: These buttons control the progress of the analysis.

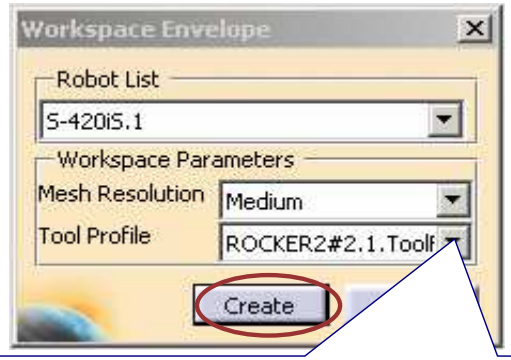
Student Notes:

Robot Task Analysis

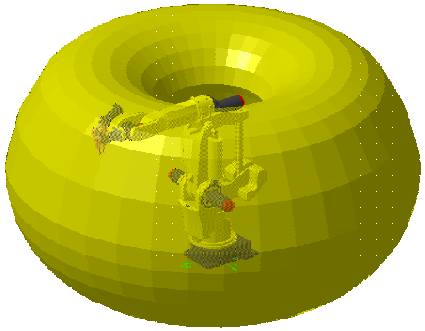
Creating Workspace Envelope

1. To create a Work Envelope, click Create Workspace Envelope icon from the Robot Management Toolbar. The Workspace Envelope dialog box appears.

2. Select the robot to create the workspace envelope on.

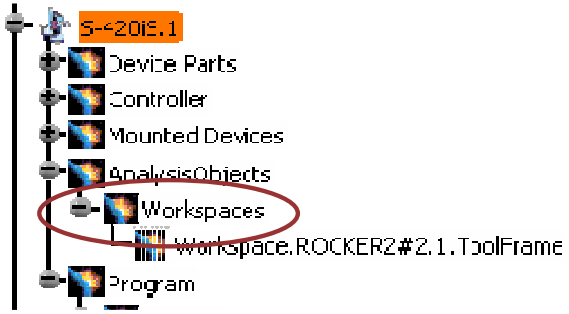


3. Click on the Create button and the Work Envelope is automatically created around the robot.



The pull down menus can be used to select the desired tool profile and mesh resolution. The available mesh resolutions are coarse, medium , and fine.

The Envelope also appears in the PPR tree, as Workspaces under AnalysisObjects.



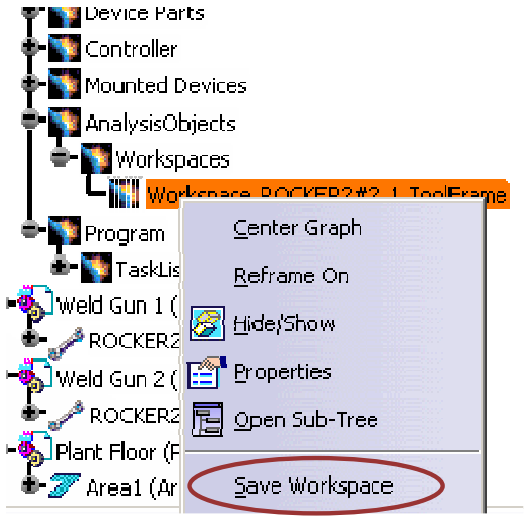
Student Notes:

Robot Task Analysis

Saving Workspace Envelope

1. To save the Workspace, right-click the workspace, the contextual menu appears.

2. Select Save Workspace. This creates a .cgr file to contain the workspace data.



NOTE: Robots with fewer than three joints are not considered.

Workspace generation is limited to devices whose first three positioning joints fall into one of the eight generic type arm kinematics classes:

- Cartesian
- SCARA
- Cylindrical
- Block
- Articulated
- Spherical
- Pendulum

It is possible to do a Hide / Show after the workspace is saved.

Student Notes:

Step 2: Mapping and Monitoring IOs

IO Mapping is a static representation of the IO connections within one or more robot tasks, and IO Monitoring is a dynamic representation of the IO connections as the robot simulation takes place. This section explains how to view IO mapping and IO connections. The connections set up using Automatic Task Collision will also be reviewed.

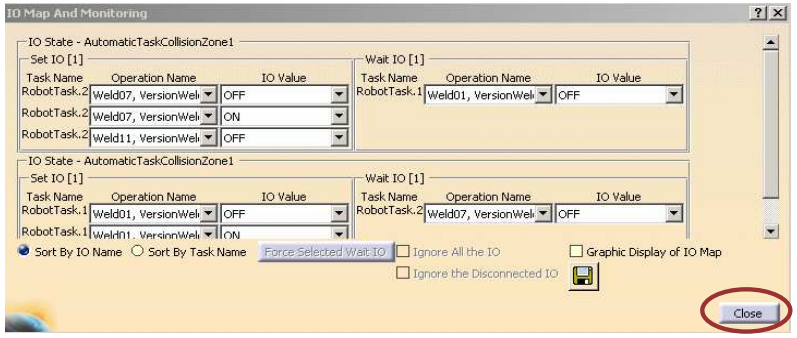
Student Notes:

Mapping and Monitoring IOs

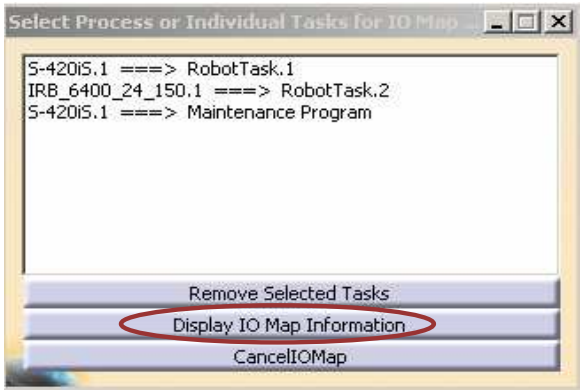
Map and Monitor IO

1. In order to map the IOs, click the IO Map and Monitoring icon from the IO Management toolbar. The Select Process or Individual Tasks for IO Map… dialog box appears.
2. Select the the process or tasks that needs to be checked.
3. To view the information, click the Display IO Map Information bar.
4. If multiple tasks appear in the dialog box and you decide not to view them all, select the tasks to remove and click on the Remove Selected Tasks button.

The tasks can be sorted by the task name or by the IO name.



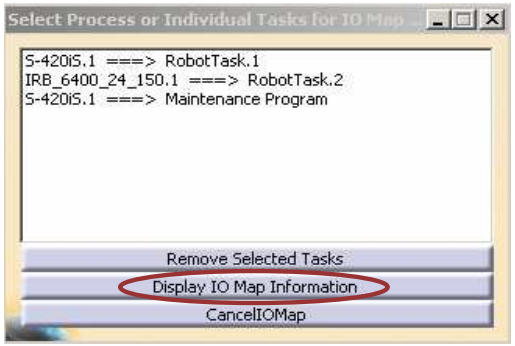
When completed, exiting can be done by selecting the IO Map and Monitoring icon again, or by using the Close button from the dialog box.



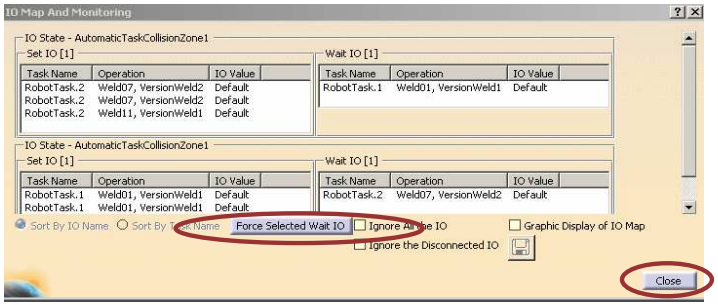
Student Notes:

Mapping and Monitor IOs

5. To use IO Monitoring:
   A. Click the IO Map and Monitoring icon
   B. Click on the process or tasks to be checked
   C. Then select the display IO Map Information button from the Select Process… dialog box
   D. Next select the Process Simulation icon from the Simulation Toolbar
   E. Finally Run the simulation using the Process Simulation toolbar.



As the simulation runs, the Force Selected Wait IO button becomes active, which enables a force selected wait for IOs to release waiting.



6. Click on Close when completed.

Student Notes:

Mapping and Monitoring IOs

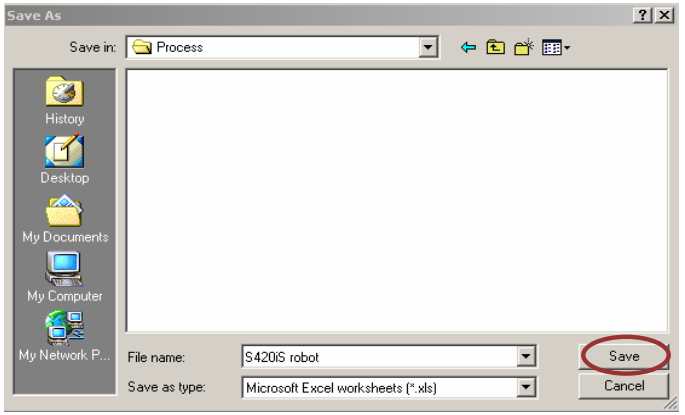
Exporting IO Information

1. In order to Export IO Information, click the Export IO Info icon from the IO Im(Export) toolbar.
   The Export IO Information dialog box appears.

2. Select the Resource Option and the Export Option as desired and click OK.

3. The Save As window appears. Type in a name, and save it to the appropriate folder.

4. To view the data, open the file just created and the IO data will appear as a text file or an Excel Spreadsheet depending on the save method chosen.

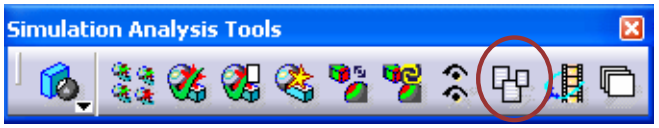


Student Notes:

Mapping and Monitoring IOs

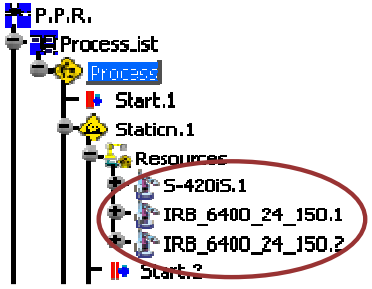
Creating Data Readouts and Generating Documentation

1. To create a Data Readouts for selected resources, click on the Data Readout icon from the Simulation Analysis Tools toolbar.



2. Then select the Display icon from the Options toolbar that appears after the first selection.

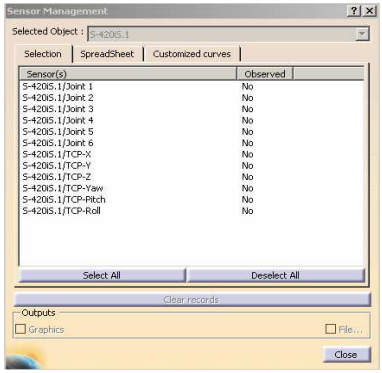
3. For data readout creation, a resource must then be selected from the Resource list of the PPR tree.



4. To view more of the data relating to the resource, deactivate the Display icon in the Options toolbar and activate the Sensor icon.

5. To modify the data, use the Select All and change the Observed section so each one says Yes rather than No.

6. Using the Simulation toolbar click Process Simulation.

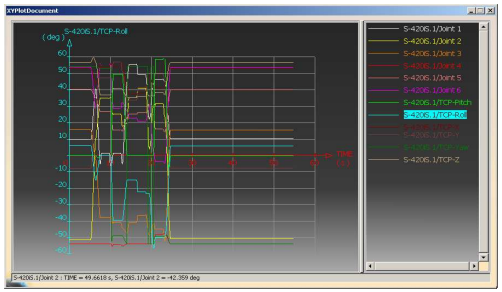


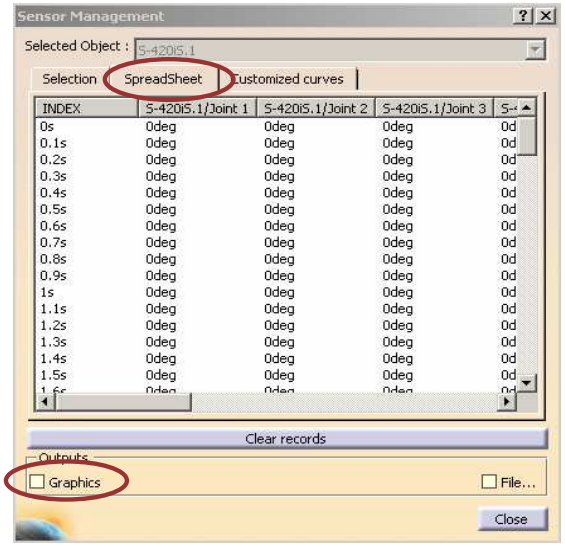
7. Now select Run from the Process Simulation toolbar in order to view the changes.

Student Notes:

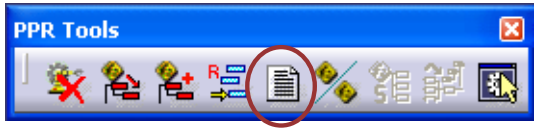
Mapping and Monitoring IOs

8. To view the changes in Spreadsheet form, click the SpreadSheet tab from the dialog box.
9. To view the data graphically, select the Graphics button from the Outputs section of the dialog box.

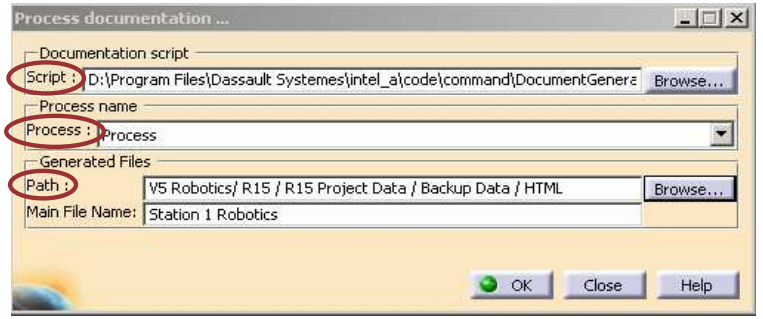




10. If documentation is needed for the project, click Generate documentation icon from the PPR Tools toolbar.



11. The Process documentation dialog box appears, make selections appropriately for the Script, Process, and Path.

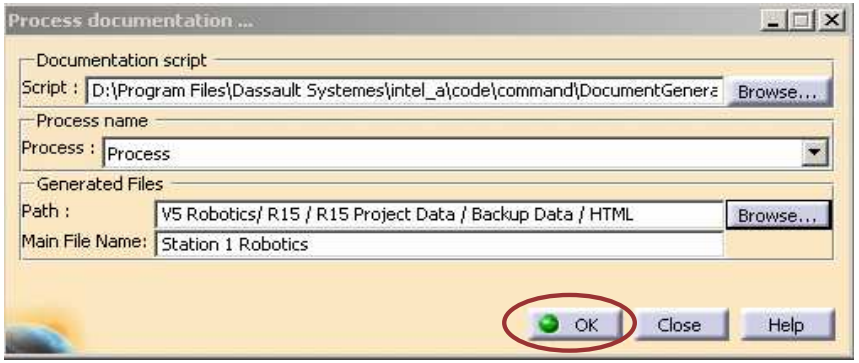


This document can then be saved to the appropriate place.

Student Notes:

Mapping and Monitoring IOs

12. To start the Script, click on OK.

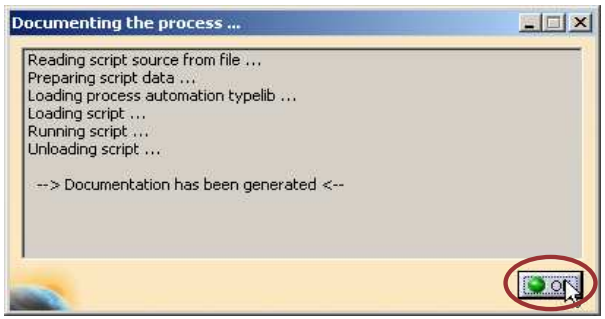


13. The Documenting the process dialog box appears, showing the document is being created.

14. Once the documentation has been generated, click OK.

15. To view the files, go to the directory they are saved in, and click Open.

16. Close all windows when finished with the review.



Student Notes:

Step 3: Multiple Resource Simulation

The Multiple Resource Simulation command enables you to select tasks associated with more than one resource (e.g. multiple robots or stations) and simulate those tasks simultaneously, even though the tasks run sequentially in the process document.

A PERT Chart is a project management tool used to schedule, organize, and coordinate tasks within a project. A Pert Chart presents a graphic representation of the process flow. It allows for modification of the process plan in a dynamic and friendly manner. It is a useful tool for visualizing and re-structuring the sequence of operation of the process. Since simulation is a 3D representation of the manufacturing process, the Pert Chart can easily re-sequence the process.

The order in which the activities are linked will be reflected in the PPR Tree. It is also possible to use the Pert Chart for Parallel Running which is when two tasks run in unison.

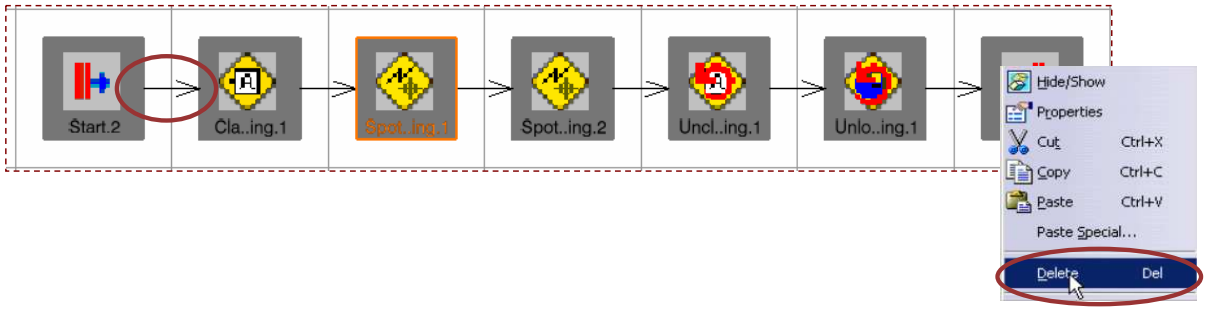
Student Notes:

Multiple Resource Simulation

Using PERT Chart for Parallel Running

1. To open the Pert Chart, click the Open Pert Chart from the Data Views toolbar.
   The command prompt asks for a Process or Activity, select one.

   The Pert window opens showing the process activity flow of the process or activity chosen.
   Notice the links between them.



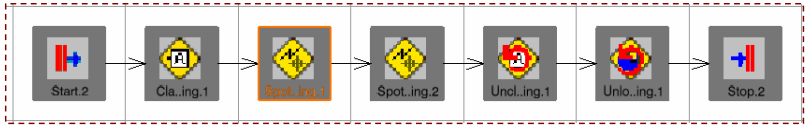
2. To delete a link, right-click on it and select delete from the text window or on the keyboard.

   Moving the activities around to see what is the best way to optimize the sequence of events is possible using this window.

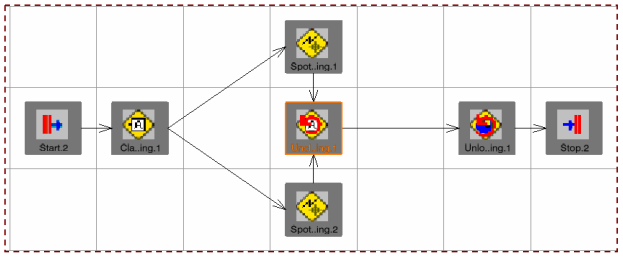
Student Notes:

Multiple Resource Simulation

3. In the Activity Management toolbar, click on Link the selected activities and select the one that was deleted and create a new process plan for the activity.



Start



Finish

4. Close this window.

5. Run the Process to see what changes have taken place in the process.

Student Notes:

Multiple Resource Simulation

Performing Multiple Resource Simulation

To use the Multiple Resource Simulation tool, the Workcell Sequencing workbench needs to be opened. (Start / Resource Detailing / Workcell Sequencing)

1. Click on the Multi Resource Simulation icon from the Simulation toolbar to access multiple resource simulation.

This command serves as a lead into the Process Simulation command. Once invoked, the Multiple Resource Simulation dialog box appears.

All the robots in a simulation will be shown in the dialog box.

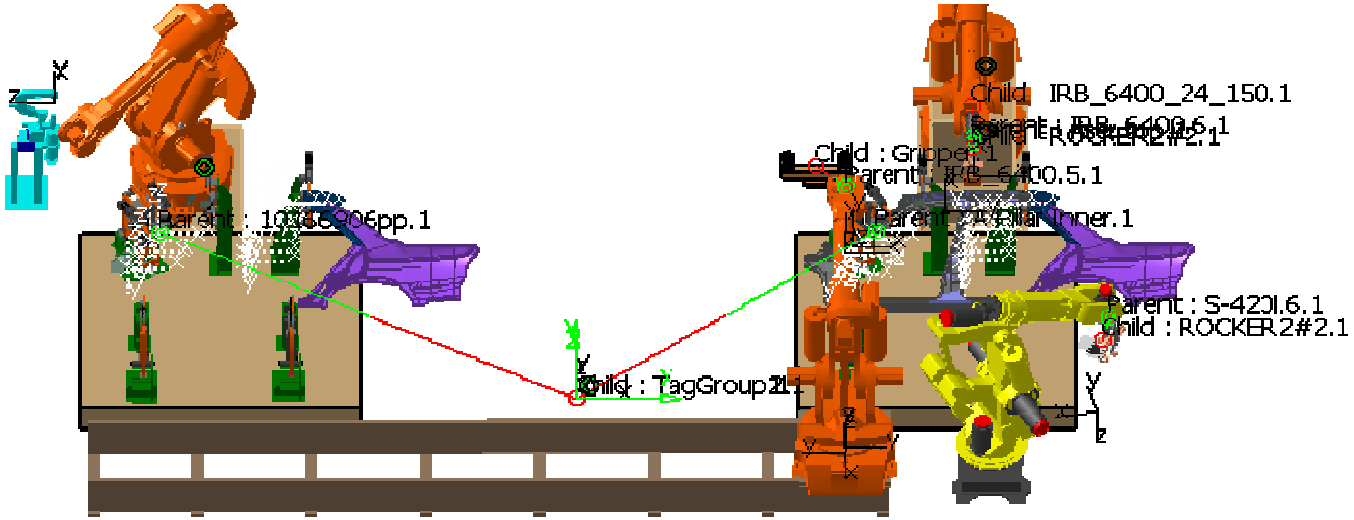
The dialog box also lists all the resources in the PPR tree that have tasks associated with them. Using the pull down menus, tasks can be selected to run simultaneously. (Remember that NONE is an option for each of the resources pull down menu).

Student Notes:

Multiple Resource Simulation

2. Once the tasks are selected, clicking on the OK button will make the toolbars associated with the Multi Resource Simulation dialog box appear.

Using these toolbars the simulation can be viewed.



Student Notes:

Step 4: Create Robot Controller Profiles

The software uses default settings for the Motion and Accuracy profiles to optimize cycle time and increase the accuracy of robots as they perform their operations. The purpose of a motion file is to specify speed and acceleration values for the robot.

One type of profile may set speed and acceleration parameters appropriate to a particular kind of move (e.g. moving to a weld point), while another may set those parameters in a way appropriate to a different kind of move (e.g. a via point).

An accuracy profile can be created using the Create and Edit Accuracy profile command. The purpose of the accuracy profile is to define the accuracy of a desired trajectory. When corner rounding is desired, you can select between two different algorithms to affect it.

Student Notes:

Create Robot Controller Profiles

Create Motion Profile

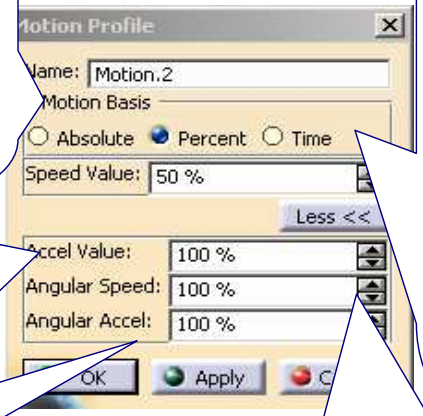
1. To add a new motion profile, click the Motion Profile icon from the Robot Controller toolbar, then select a robot. The Motion Profile dialog box appears. The Motion Profile will be created automatically and placed under Motion in the PPR tree.

2. To edit this profile, double-click on the profile just created. The Motion Profile dialog box appears.

Absolute: Means that the speed value is the average speed the robot uses.

Percent: Means that the robot will move at a specified percent of its maximum speed.

Time: Means that you provide a set time for the robot motion, and the robot calculates its speed to perform the move within that time.



Absolute:
- Straight line motion, this speed specifies absolute TCP linear speed.
- Joint-interpolated motion, this value is divided by the maximum TCP linear speed to obtain the percentage of maximum joint speed.

Percent:
- Straight line motion, specifies percentage of maximum TCP linear speed.
- Joint-interpolated motion, specifies percentage of maximum joint speed.

Time: The programmed duration of the move.

Straight line motion, the percentage of the Maximum TCP rotational speed.

Joint-interpolated motion, the percentage of the maximum joint acceleration.

Straight line motion, the percentage of the Maximum TCP rotational speed acceleration.

Straight line motion, the percentage of the Maximum TCP rotational speed

Student Notes:

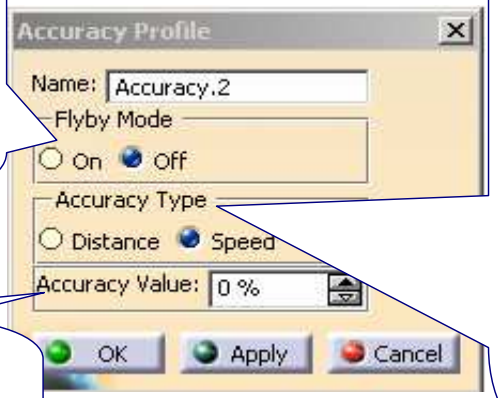
Create Robot Controller Profiles

Create Accuracy Profile

1. To add a new Accuracy Profile, click the Accuracy Profile icon from the Robot Controller toolbar, then select a robot. The Accuracy Profile dialog box appears.
2. To edit this profile, double-click on the profile just created. The Accuracy Profile dialog box appears.

Selecting On: means that the robot moves near, but will not stop at a specific target (i.e., there will be no declaration; the target is a via point).

Selecting Off: means the robot will stop at the point.



Distance:As it moves near its target, the robot will move within a virtual sphere that has the target point as its center.

Speed: The speed represents the extent to which the robot decelerates as it rounds the corner. A speed of 0% enables the robot to move exactly to the target point; a speed of 100% means the amount of corner rounding will be very large.

Radius of targets surrounding sphere: The accuracy value represents the radius of the sphere.

Percentage of Deceleration: A percentage of the deceleration speed at which corner rounding should begin.

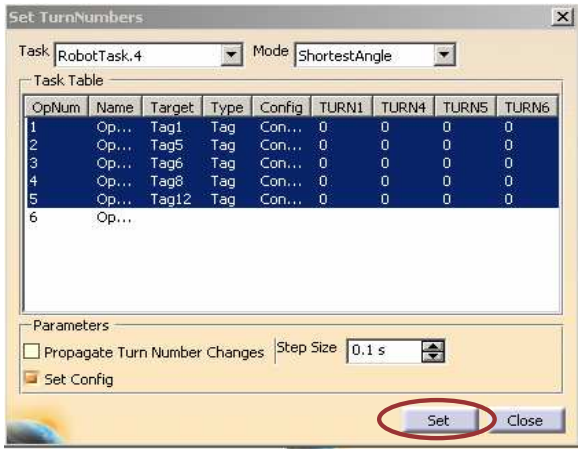
Student Notes:

Create Robot Controller Profiles

Setting Turn Numbers

1. Switch to Device Task Definition workbench, and click the Set Turn Numbers icon on the Sequence toolbar. Click on a robot to have the turn numbers set.

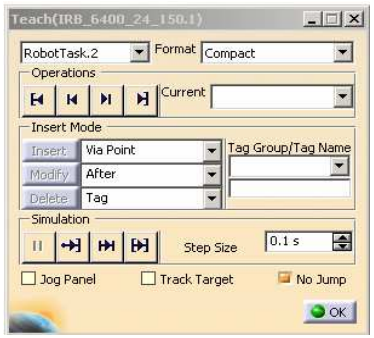
The Set Turn Numbers dialog box appears with the Cartesian Target Type selected. The default settings are usually acceptable.



2. To complete the setting, click on Set on the dialog box.

3. To run through the path, select the Teach a Robot icon from the Robot Management toolbar.

The Teach dialog box appears.



4. By using the Simulation or Operation tabs the path can be viewed to see the corrections.

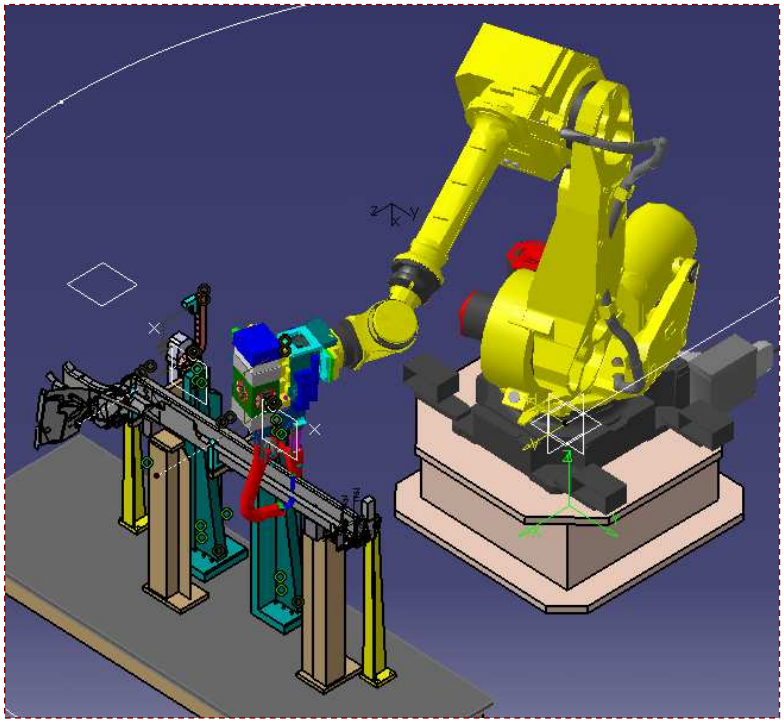
Student Notes:

Lesson 4: To Sum Up

This module introduced you to some of the key functions that can be used to optimize a simulation. It is using these tasks you can obtain peak performance.

To review, you have:

- ✓ Used Robot Task Analysis
  - ✓ Used Automatic Task Collision
  - ✓ Used Clash Analysis
  - ✓ Created a Weld Study Analysis
  - ✓ Created a Workspace Envelope
  - ✓ Saved a Workspace Envelope
- ✓ Mapped and Monitored IOs
  - ✓ Mapped and Monitored IOs
  - ✓ Exported IO Information
  - ✓ Created Data Readouts and Generated Documentation
- ✓ Used Multiple Resource Simulation
  - ✓ Used the PERT Chart for Parallel Running
  - ✓ Performed Multiple Resource Simulation
- ✓ Created Robot Controller Profiles
  - ✓ Created Motion Profiles
  - ✓ Created an Accuracy Profile
  - ✓ Set Turn Numbers



Now it is time to apply this learning using the Case Study

Course Summary

DELMIA V5 Robotics offers a scalable, easy to use solution for tooling definition, workcell layout, robot programming, and workcell simulation. It is much more than a basic offline programming system. It can capture the underlying philosophy of and intent of the robot programmer allowing the company to capture and reuse best practices, leverage programming knowledge, and automate the repetitive work of robot programming.

V5 Robotics is ideally suited for work in the Automotive Industry, specifically robot spot welding and material handling operations. It can be extended for use in other domains as well.

Student Notes: