

Industrial Robotics & Simulation

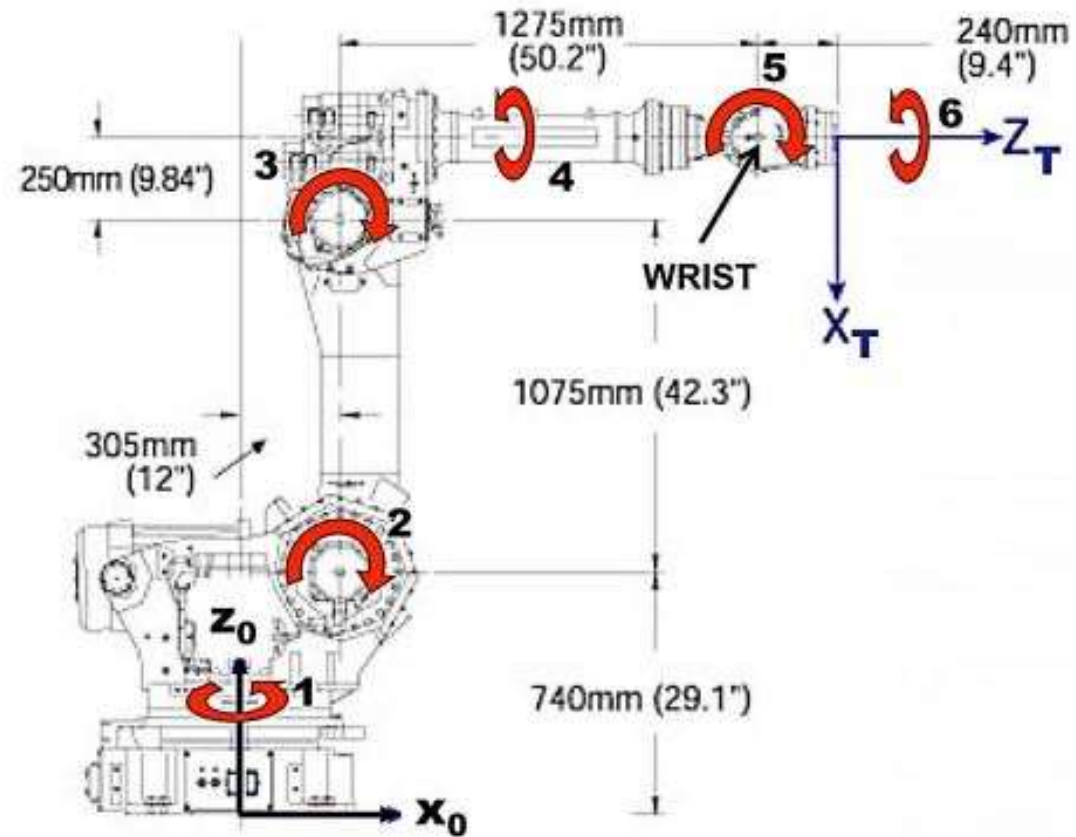
- Intro About Industrial Robots
- Types of Robotic Application
- Intro About Robotic Simulation
- Exploring Delmia V5 for BIW
- Evolution of Delmia
- Career Path & Job Opportunities

What is mean by Robot

A reprogrammable multifunctional manipulator designed to move materials, parts, tools or specialized devices through various programmed motions for the performance of a variety of tasks.

Degrees of Freedom or DOF

An industrial robotic arm is shown below:



Some of the industrial Robot Manufacturer



Traditional Applications of Robots

- **Spot Welding**
- **Rivet**
- **Arc Welding**
- **Coating & Dispensing**
- **Assembly**
- **Material Handling**
- **Packaging / Palletizing**
- **Machine Tending**
- **Body Shop**
- **Other Material Handling**
- **Material Removal**
- **Inspection**

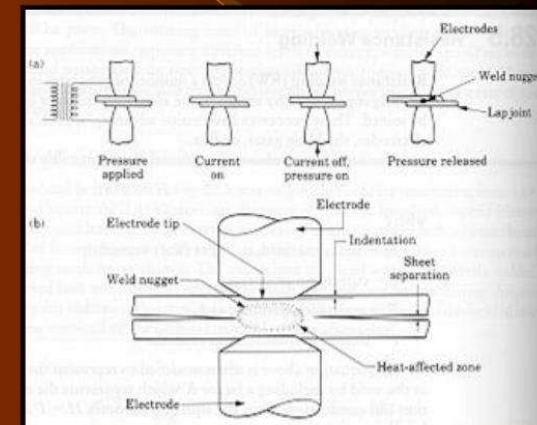
• Spot Welding

A form of **resistance welding**, **spot welding** is one of the oldest **welding** processes whereby two or more sheets of metal are **welded** together without the use of any filler material. The **welding** heat is generated by the electric current, which is transferred to the workpiece through copper alloy electrodes



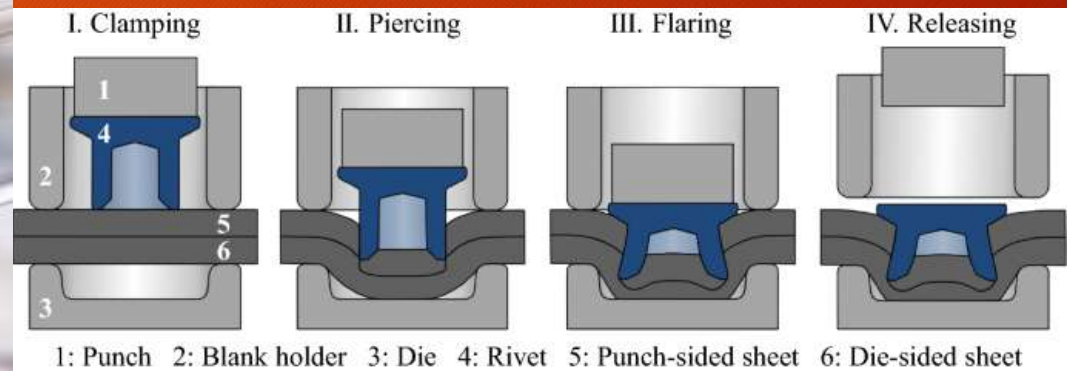
Resistance Spot Welding

- Two cylindrical electrodes contact an overlap of two sheet metals.
- Resistance heating combined with applied pressure creates the spot weld.
- Weld nugget is typically 6-10 mm in diameter and 60 –70% of the joint thickness.
- Currents range from 3000-40,000 A.
- Weld time is typically between 0.6 and 0.8 seconds.



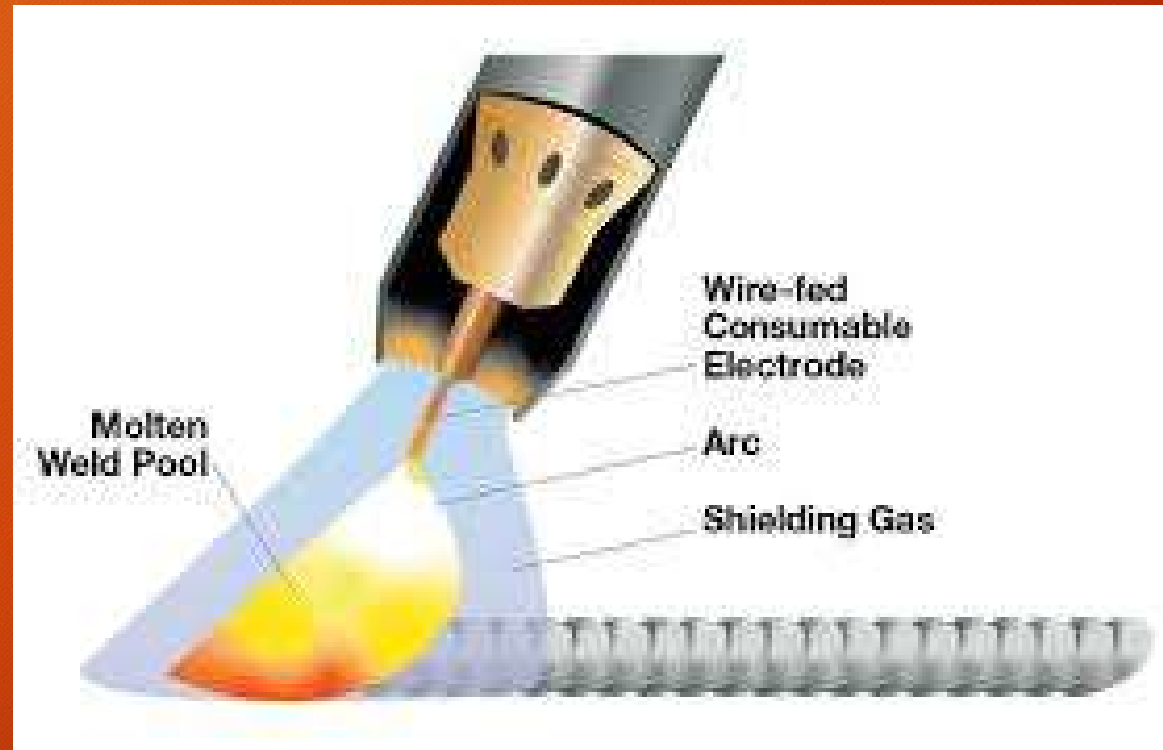
- **Rivet**

Self-piercing riveting (SPR) is a cold mechanical joining process used to join two or more sheets of materials by driving a rivet **piercing** through the top sheet or the top and middle sheets and subsequently lock into the bottom sheet under the guidance of a suitable die



- **Arc Welding**

Arc welding is a type of welding process using an electric arc to create heat to melt and join metals. A power supply creates an electric arc between a consumable or non-consumable electrode and the base material using either direct (DC) or alternating (AC) currents.



- **Material Handling**

Material handling (MH) makes use of the **robot's** simple capability to **transport** objects. By fitting the **robot** with an appropriate end of arm tool (e.g. gripper), the **robot** can efficiently and accurately move product from one location to another.



Body In white (BIW)

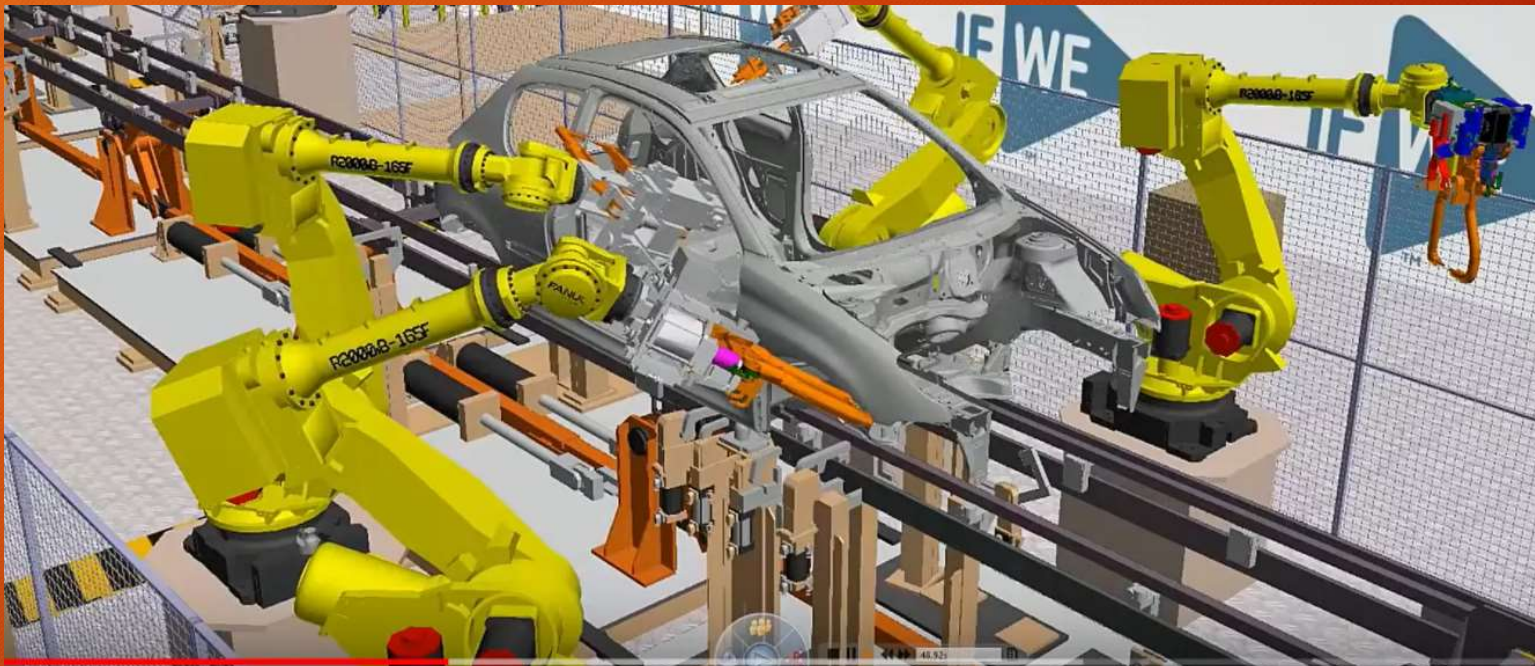
Body in white (BIW) is the stage in automobile manufacturing in which a car body's frame has been joined together, **that is before** painting and before the motor, chassis sub-assemblies, or trim (glass, door locks/handles, seats, upholstery, electronics, etc.) have been integrated into the structure.



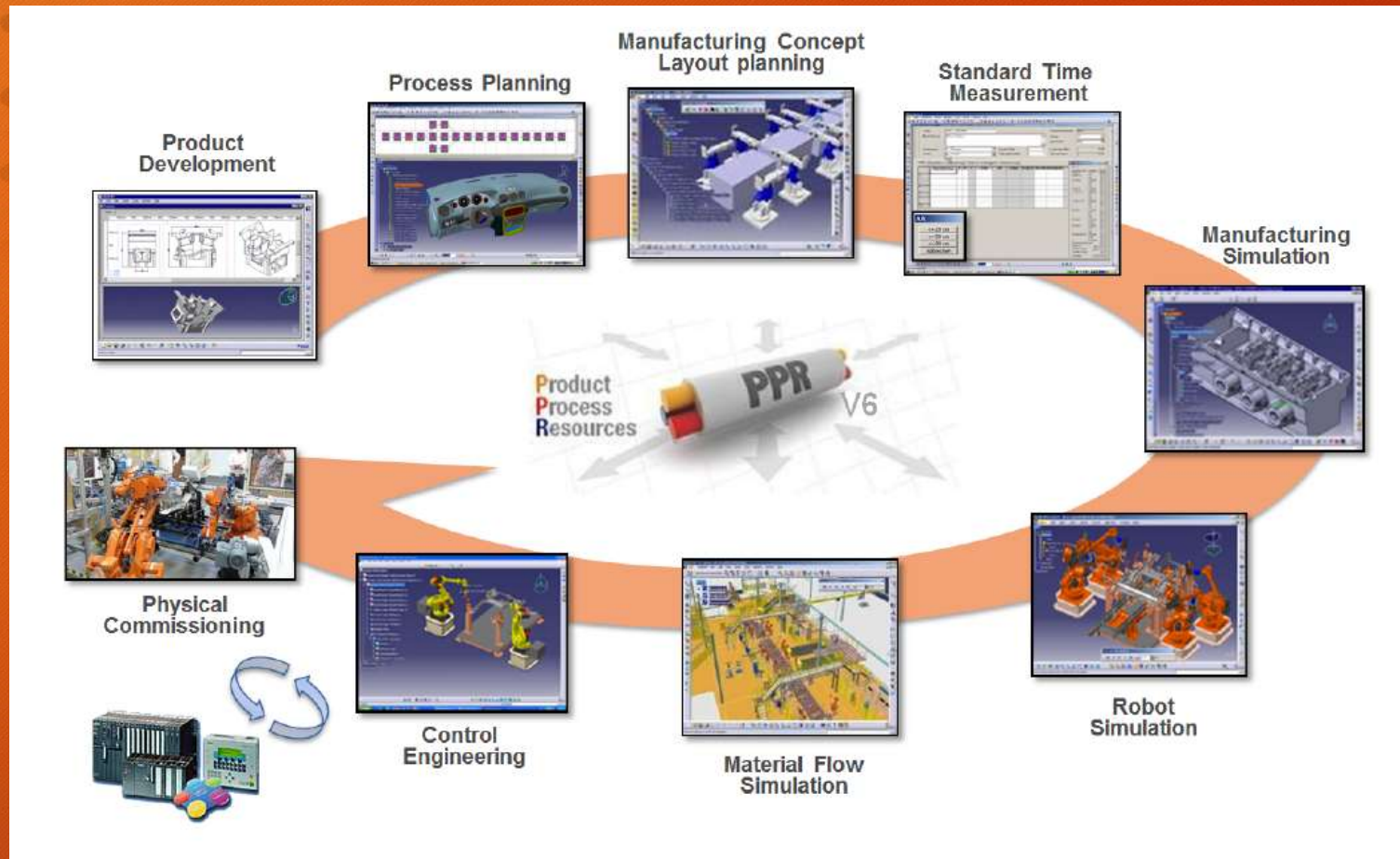
Introduction to Delmia V5 Robotic Simulation

Why Delmia V5 Simulation is used?.

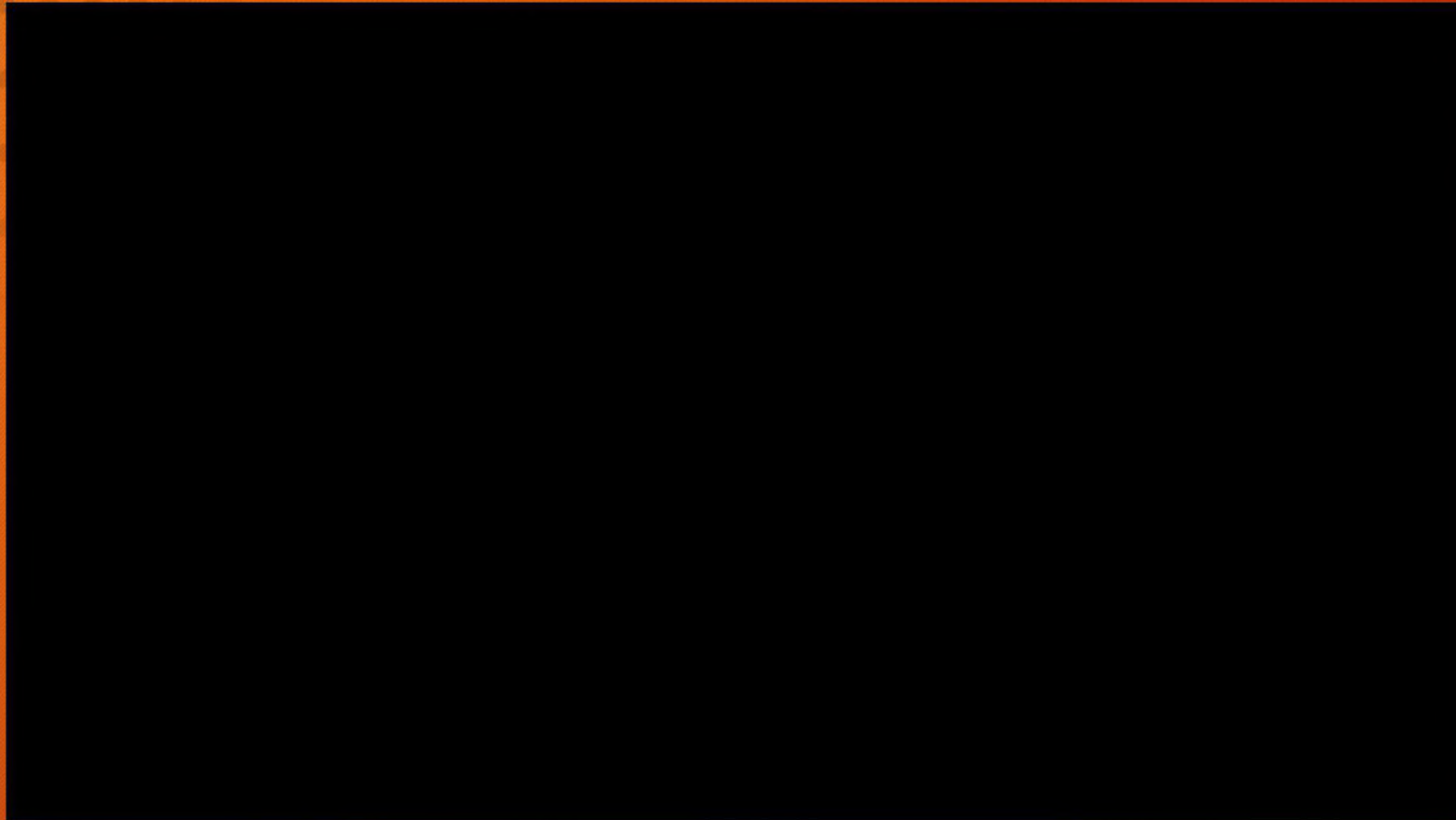
It is used to Planning of resources and simulation of the production flow of the factory, simulation of the movement of each industrial robot, off-line programming of industrial robots, programming of numerically controlled machines, analysis of work environment ergonomics, analysis of each part of the production plant.



The different phases of PLM from a DELMIA perspective



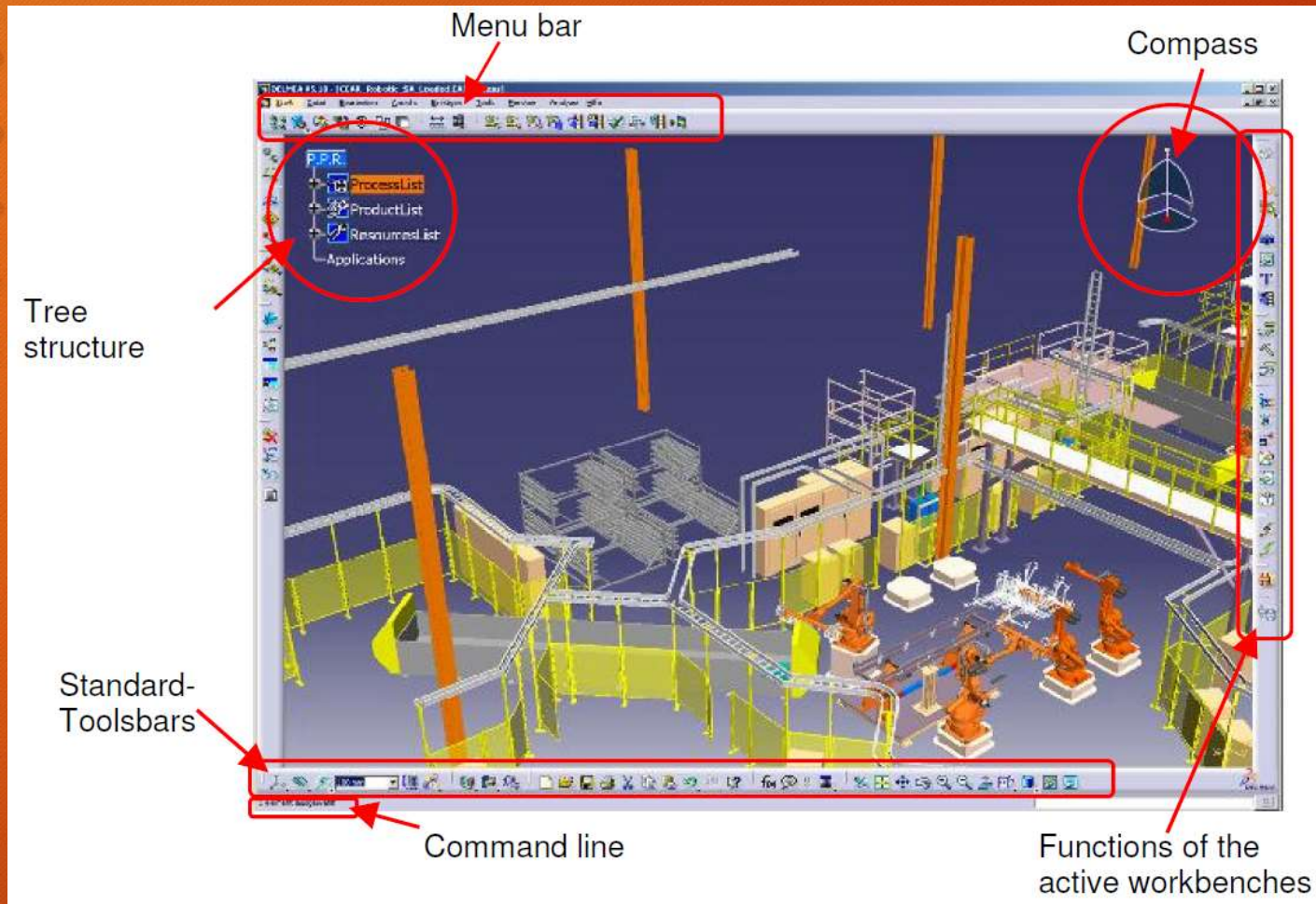
Robotic Simulation using DELMIA V5



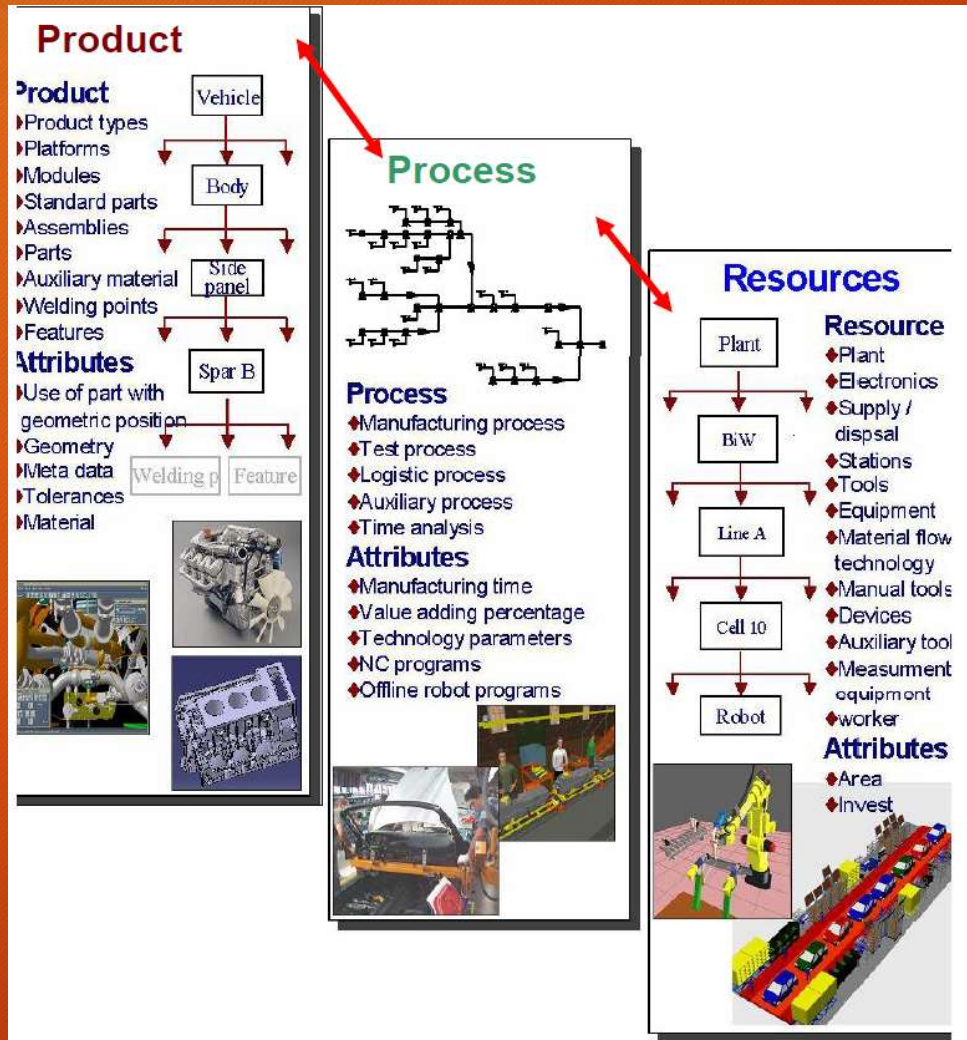
Basic Fundamentals in Robotic Simulation

- Basic Environment
- Study creation
- Selection Of Robots
- Collision detection
- Section cutting
- Robot Reach Analysis
- Defining kinematic devices
- Defining and simulating robotic spot welding
- Pneumatic and servo gun definition and usage
- Pedestal welding and Gun on robot path development
- Defining and simulating robotic continuous application
- Multi-robot simulation
- Video and picture output

User interface

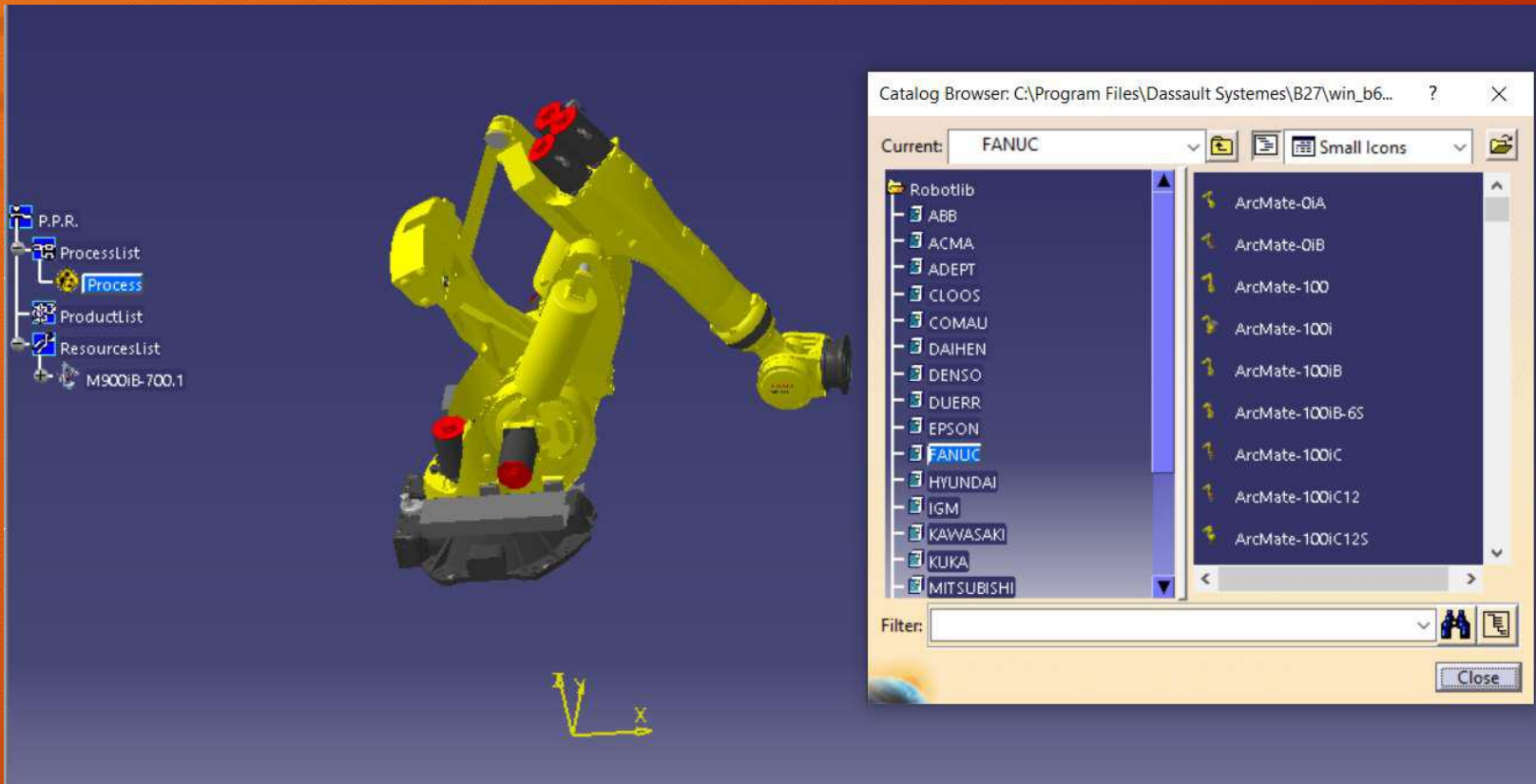


PPR Structure



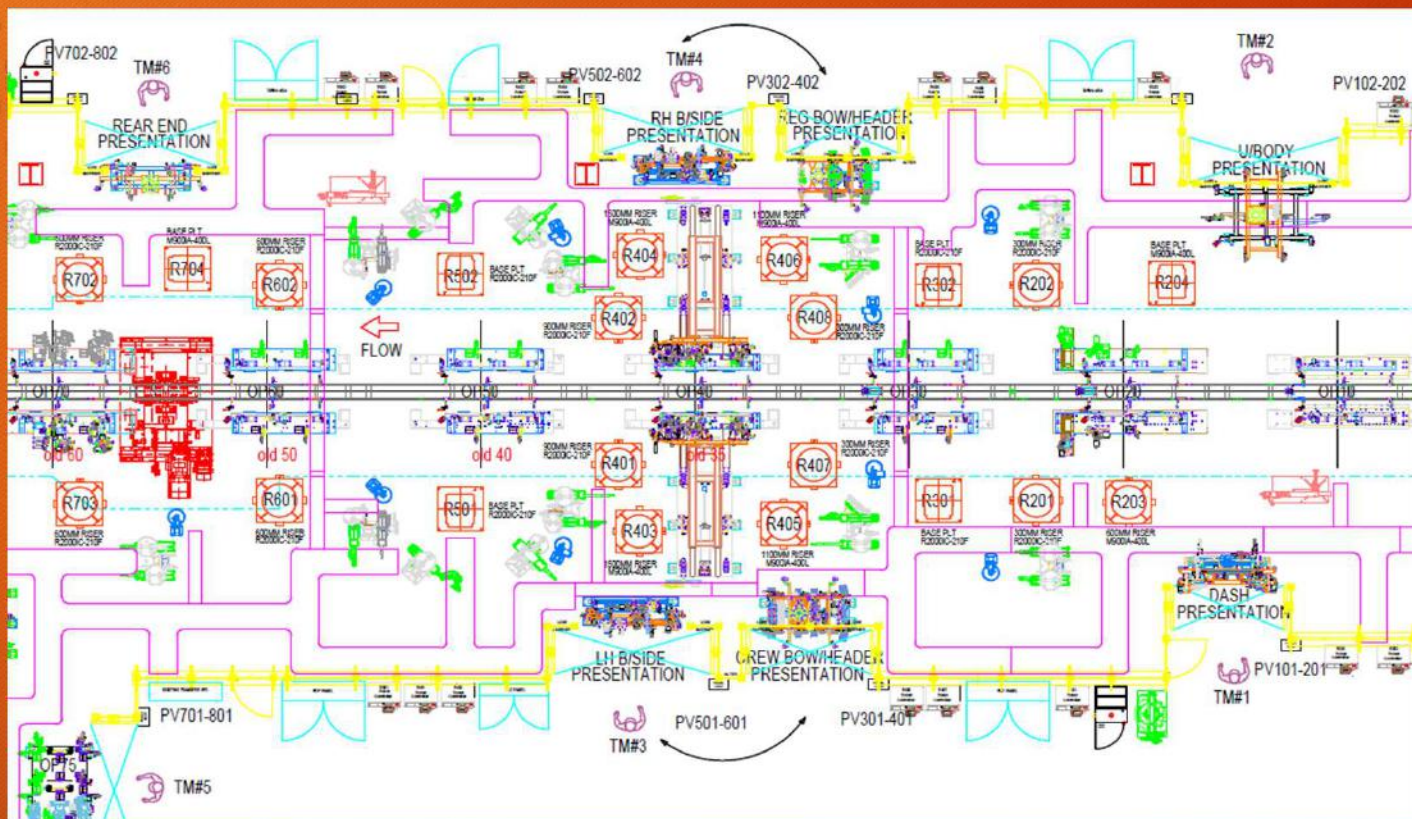
Selection Of Robots

By Considering the layout we have Select the Robot with correct specification with all available robot manufacturer.



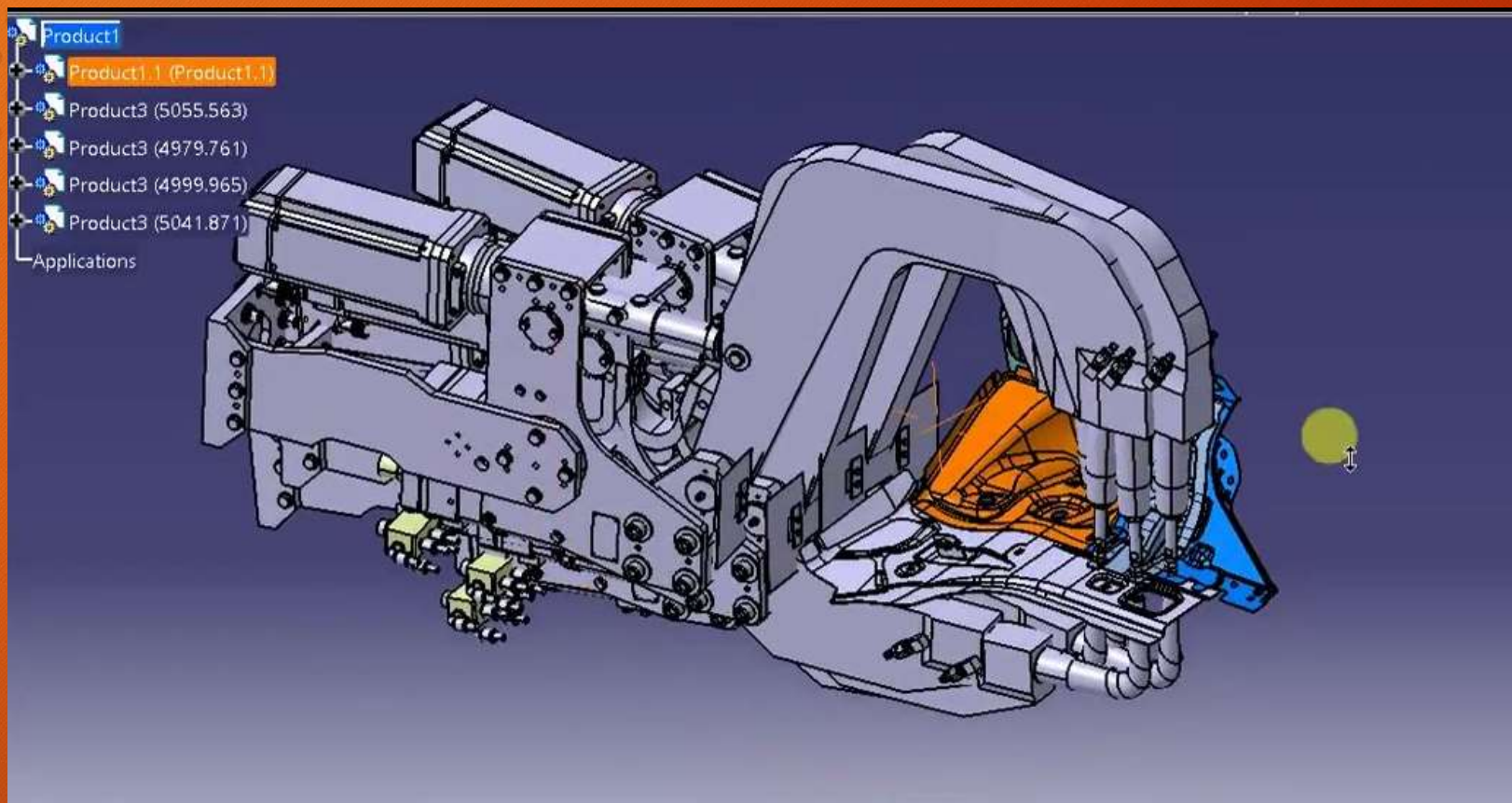
BIW layout

By Considering the layout we have position the number of robots in workcell, basic positioning of car panel and the reach of robots regards of spot welding, material handling, gluing etc.



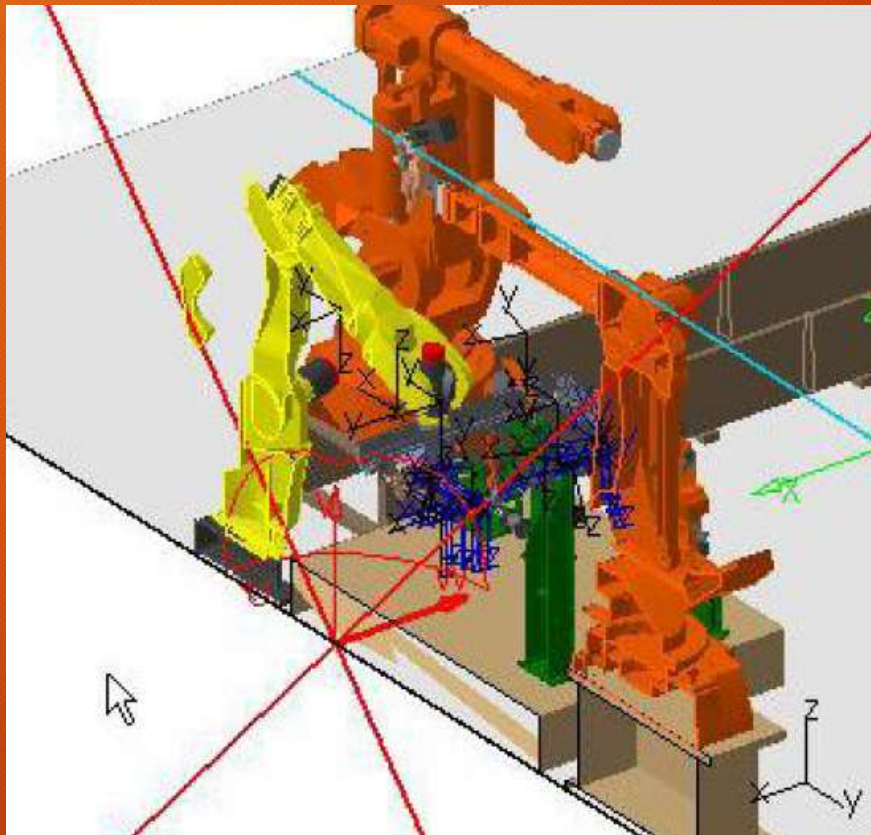
Product to Spot weld gun selection

In BIW After Freezing the spot process we have to proceed with gun selection, in this basically we will select the gun without collision with the car panel.



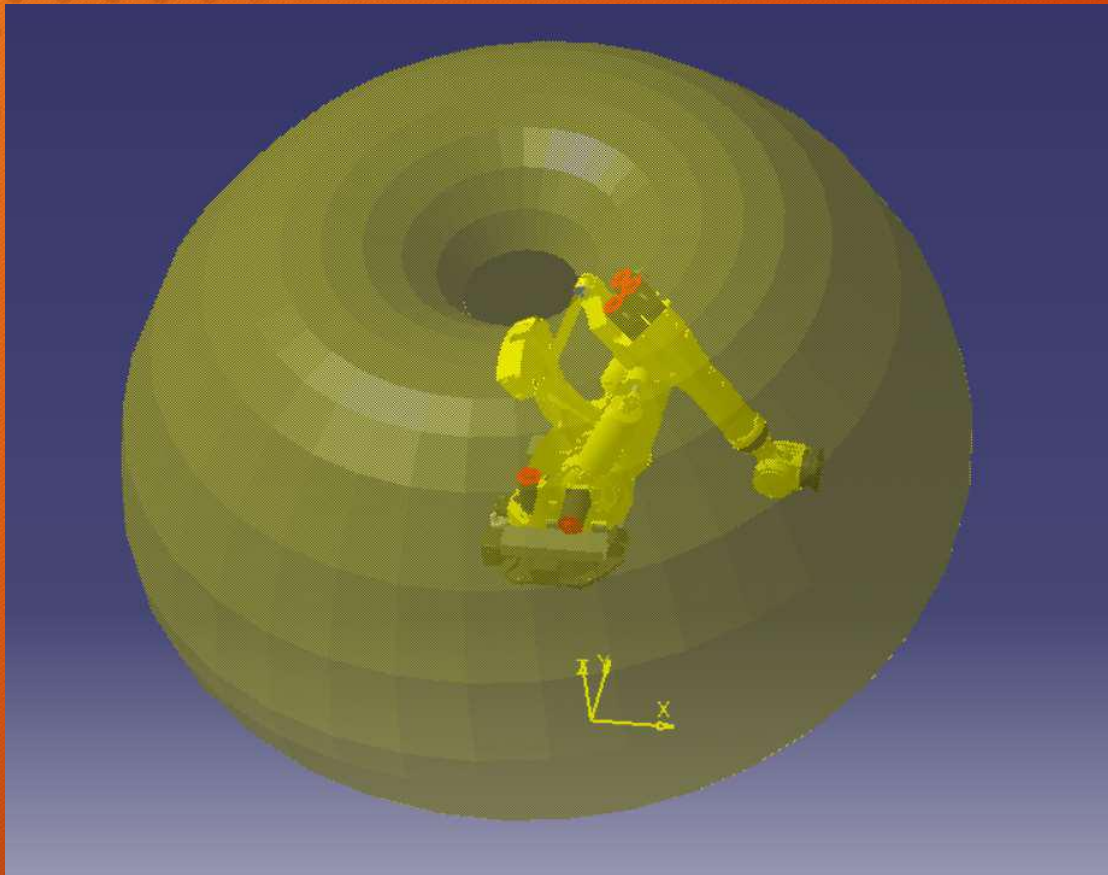
Sectioning for Gun, Car panel and Layout.

Sectioning helps in Spot weld gun selection or an initial report to the gun manufacturer regards the profile need for the spot gun. Also sectioning gives brief 2D layout.



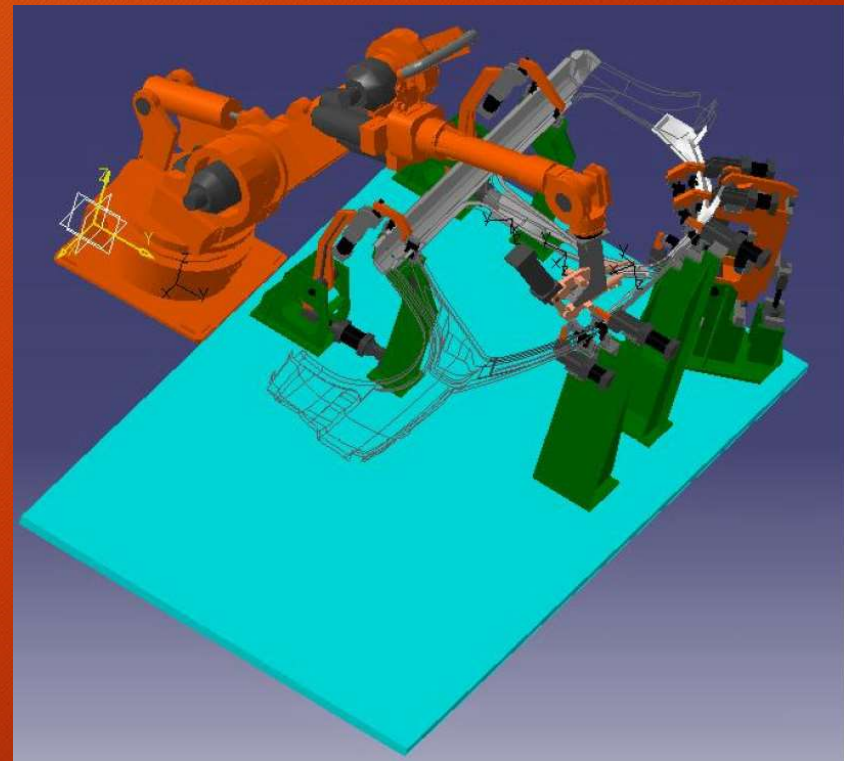
Robot Reach Analysis.

By Considering the Spot weld access or MH application of robot we will be performing the reach of robot and the positioning of robots with respect to fixture



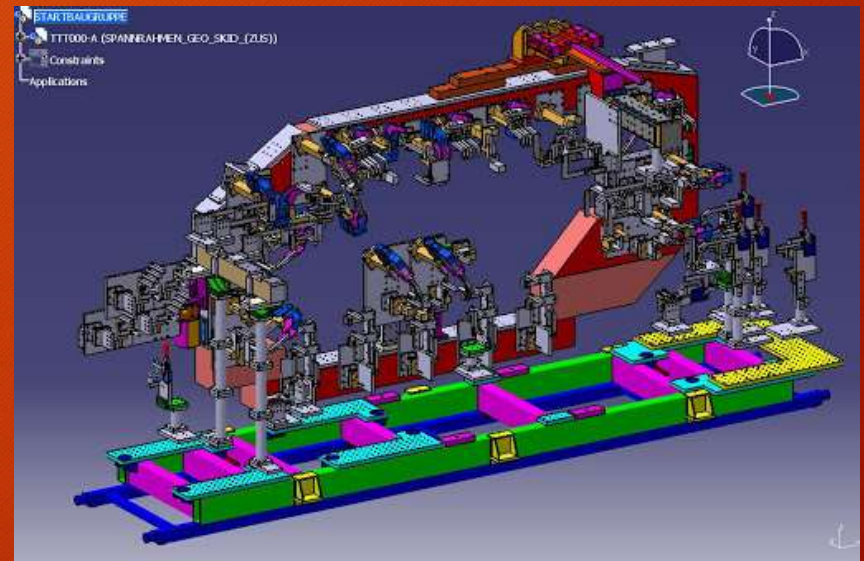
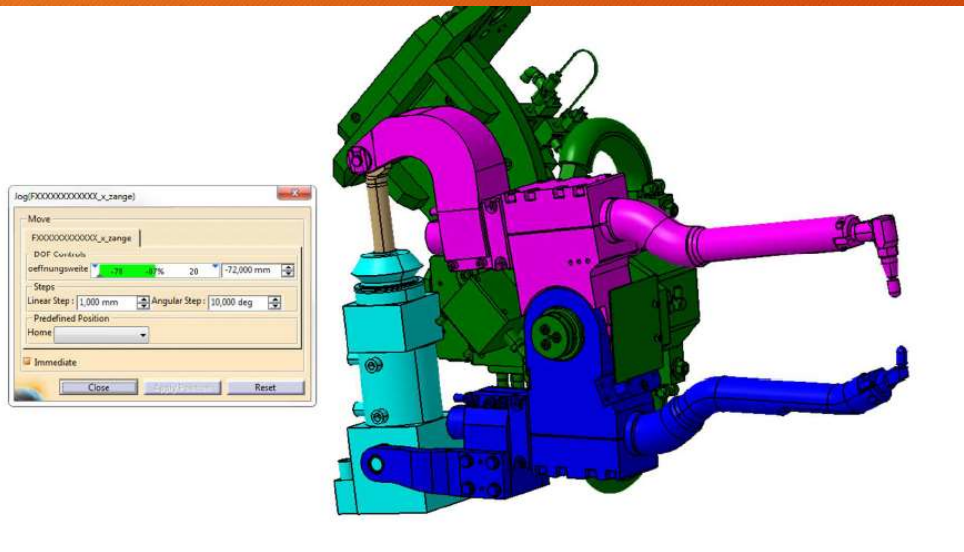
Fixture Collision Detection

After Design of fixture (Basic design) is completed, we will assign the fixture for collision detection and produce the PPT report to Fixture designers to clear of any clash \ collision



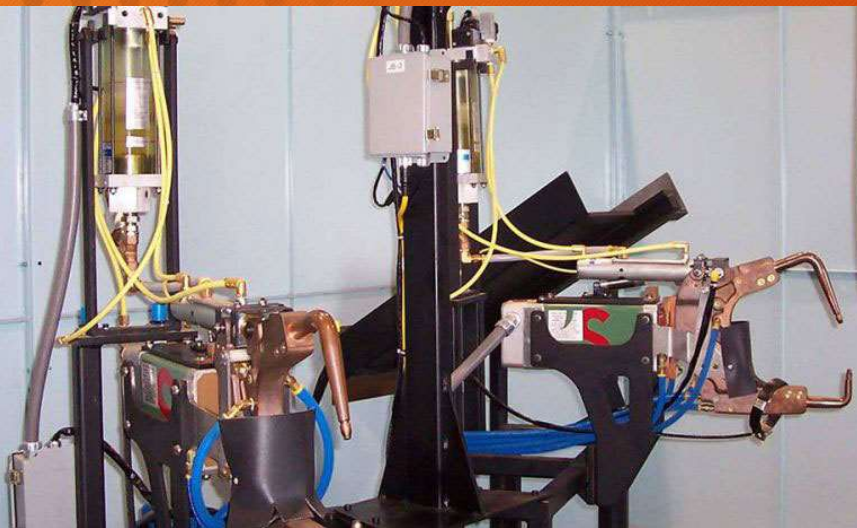
Kinematic Devices

Once the Fixture design is completed we will go for fixture kinematics, Gripper Kinematics and Spot gun kinematics (Servo\Pneumatic) for preparing basic robot simulation.



Remote TCP \ Pedwelding Functions in Delmia V5

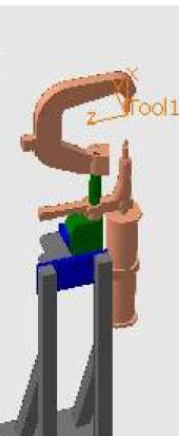
Definition of Robot RTCP or Remote TCP for robot held car panel for welding, gluing etc.



- WELDER_PEDISTAL (WELDER_PEDISTAL.1)
- ped_welder (ped_welder.1)
- Riser M (Riser M.1)
- Riser S (Riser S.1)
- IRB_6400_24_150.1
- IRB_6400_24_150.2
- IRB_6400_24_150.3
- S-420IS.1
- Plant Floor (Plant Floor.1)
- Weld Gun 1 (Weld Gun 1.1)
- Weld Gun 2 (Weld Gun 2.1)

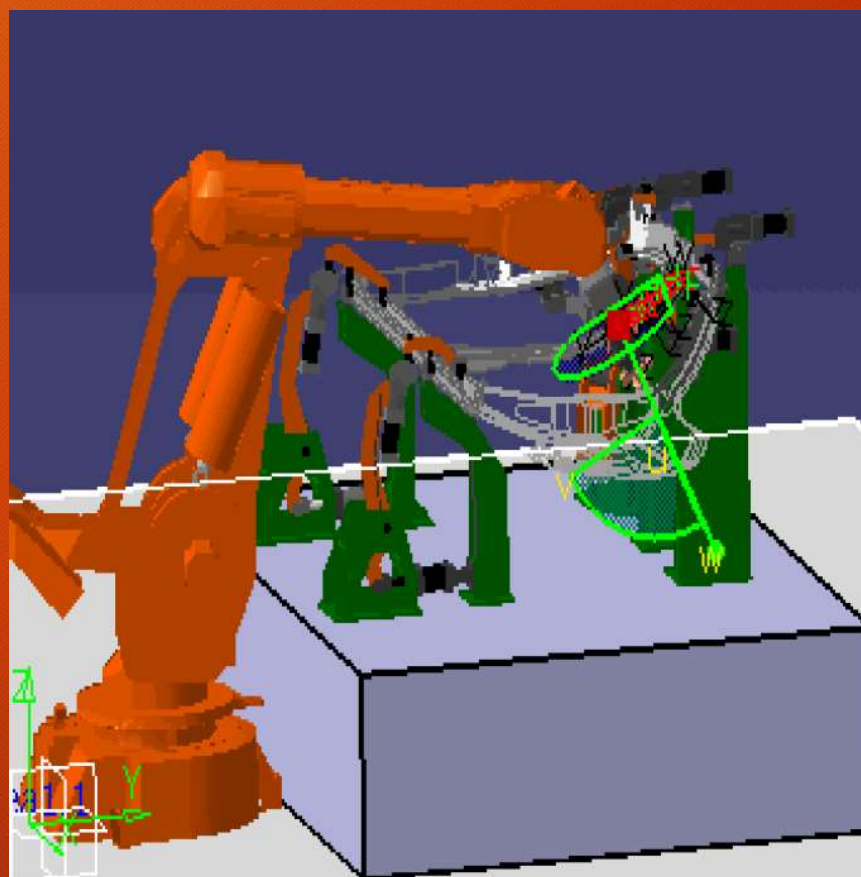
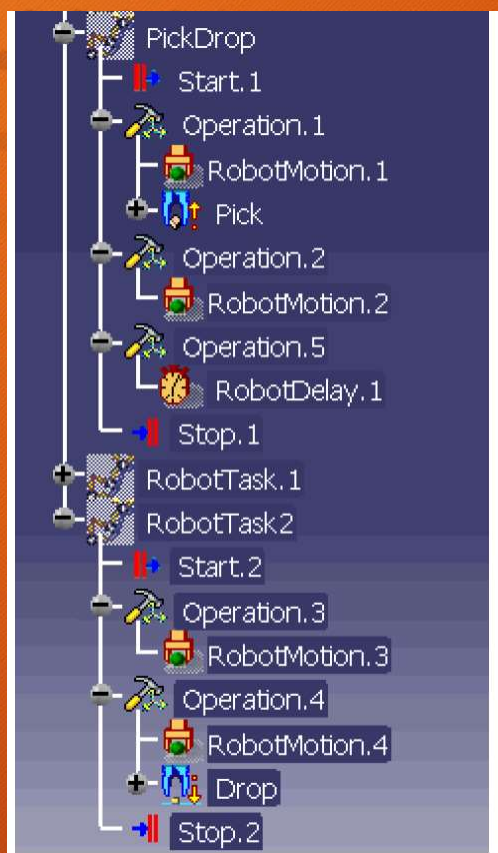
Robot Dressup

Robot Dressup	
Robot Dressup	
Robot	Device
Name: IRB_6400_24_150.3	Name: ped_welder.1
Snap Ref: Mount Plate	Snap Ref: Base Location
Tool Profile: New	TCP: Tool1
Mode	
<input type="radio"/> Snap	Orientation Step: 90 deg
<input checked="" type="radio"/> Fixed TCP	
<input type="checkbox"/> External Axes	
<input type="button" value="OK"/> <input type="button" value="Apply"/> <input type="button" value="Cancel"/>	



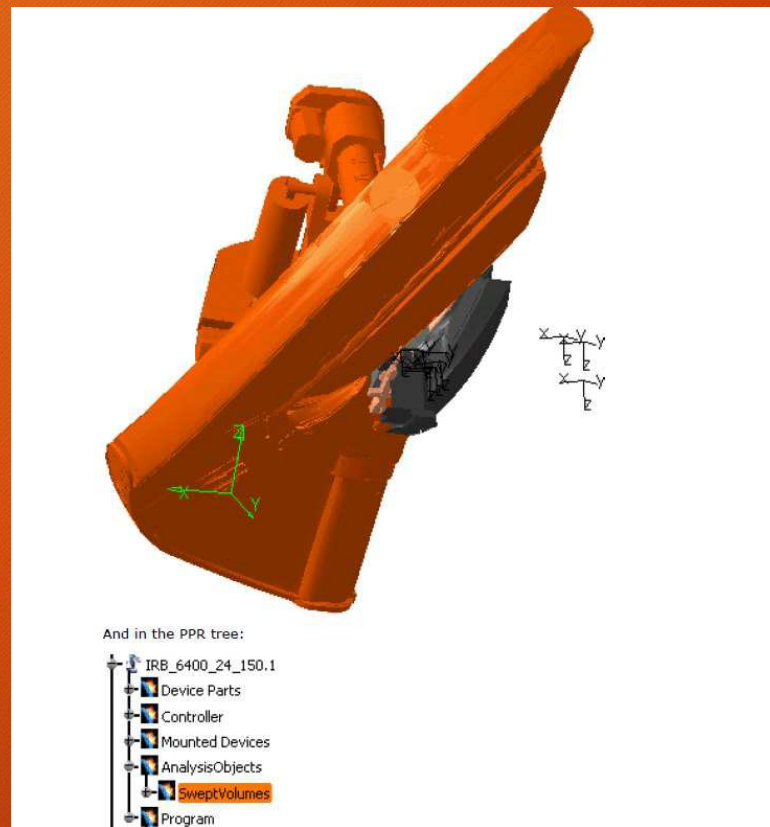
Robot Task definition

Robot Task definition provides detailed work task of the particular robot like MH or spot welding or ped welding ETC..

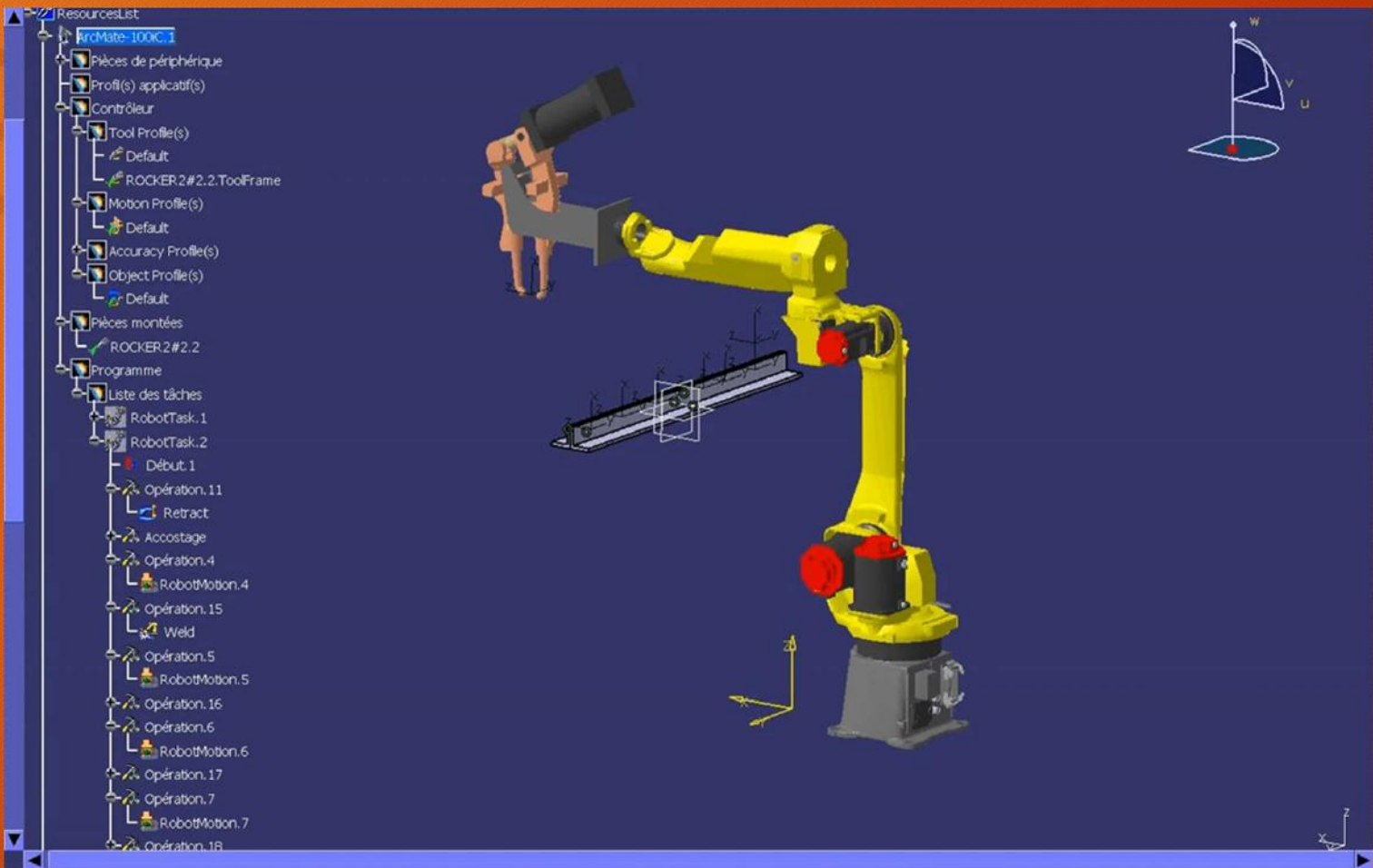


Robot Swept Volume

To create robot interference zones we have to provide robot swept volume to analyze the actual work zone of the robot and its interference. .

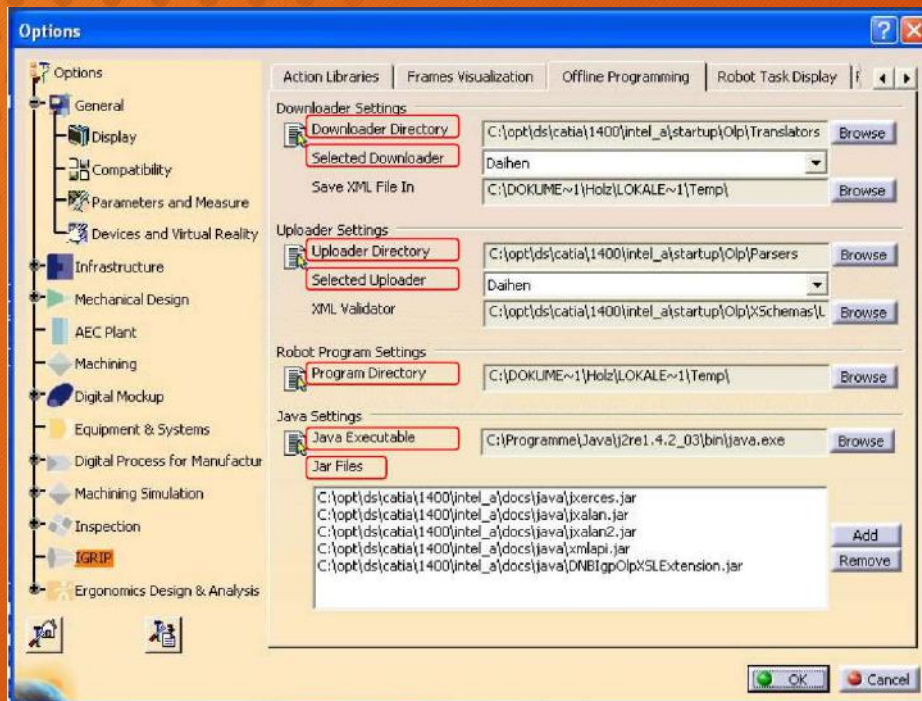


Simple Spot welding video using Delmia v5



Basics of Offline Programming

How Simulated workcell will be prepared for Offline Programming



```

PROC main()
  MoveJ *, v1000, fine, tool0;
  SetDO doOpenGripper, 0;
  WaitDI diGripperOpened, 0;
  MoveJ *, v1000, fine, tool0;
  SetDO doOpenGripper, 1;
  WaitDI diGripperOpened, 1;
  MoveJ *, v1000, fine, tool0;
  MoveJ *, v1000, fine, tool0;
  SetDO doOpenGripper, 0;
  WaitDI diGripperOpened, 0;
  MoveJ *, v1000, fine, tool0;
  MoveJ *, v1000, fine, tool0;
  SetDO doOpenGripper, 1;
  
```

Note: Only Basics of Offline Programs

Evolution in Delmia

- Deneb Robotics was a company founded by Scott Walter, Jay Harrison, Nathan Yoffa, and Rakesh Mahajan in 1985
- Delmia Acquired Deneb Robotics Igrid and new release of software in late 2000
- July 2013 - The Dassault Systems Apriso acquisition is completed
- Release of 3D experience for complete PLM solution

Career Path & Job Opportunities

KG IT Services

BIW welding jobs in Indian OEM's where fixture design and process engineering departments are available in the companies itself

1. www.tatamotors.com; India's number one Commercial Vehicle Manufacturer. India's number 3 (2017) car manufacturer
2. www.marutisuzuki.com; India's number one Car Manufacturer
3. www.mahindra.com; Indian largest utility vehicle manufacturer
4. Bharat Benz, Chennai; A German OEM having India specific brand Bharat Benz
5. Volvo Eicher Commercial Vehicle, Indore; A Joint Venture between Volvo a Swedish and Eicher an Indian OEM
6. Renault Nissan, Chennai; A French and Japan joint venture Multinational company's Indian Subsidiary
7. Ford India, Chennai; USA OEM Subsidiary
8. Force Motors, Pune; Indian OEM having utility vehicle product range
9. GM, Talegaon; USA OEM Subsidiary. Now stopped production for Indian market. Exporting to US market only
10. FIAT, Pune; Italy Bases OEM's Indian Subsidiary
11. Mercedes Benz Technology Center, Bangalore; German OEM'S Technical Center
12. Piaggio, Baramati; Italian 3 /4 Wheeler Passenger and Good Carrier making Indian Subsidiary.

Tier 1 where BIW /Process Engineers executing process work following companies

1. Cosma Magna - Pune, Sanand
2. JBM, Delhi
3. Bentler, India
4. Autoline, Pune
5. KLT Group, Mumbai

Tier 1-BIW Welding spot welding fixture/Arc welding Fixture design suppliers from India

1. www.comau.com, Pune; India
2. Wooshin India, Pune; India
3. Tata Automation Ltd (TAL), Pune; India
4. ThyssenKrupp India, Pune; India
Having a division doing BIW fixture design and Engine assembly line
5. Dran Classic, Pune; India
6. Valiant TMS, Pune; India
7. Lean Automation, Pune; India
8. Hirotec, Coimbatore; India
9. ABB, Bangalore; India
10. Neel-Metal Products Ltd, Gurgaon
11. Faith Automation Systems & Tooling Pvt Ltd, Pune
12. Rhytemsoft, Nashik; India
13. Toolcon, Pune; India
14. SKH Ytec, Sanand; India
15. www.chropynska.cz. Recently started in India

Rolling Hemming Suppliers

1. www.kuka-systems.com - Augsburg, Germany
2. www.edag.de, Fulda Germany
3. www.comau.com
4. Wooshin Korea
5. ABB China
6. EBZ Germany
7. Stafuen Engineering, Germany
8. ThyssenKrupp Germany
9. Hirotec, Japan

Career Path & Job Opportunities

KG IT Services

Engineering Service companies in India

1. EDAG Engineering and Design, Gurgaon
 2. EBZ, Gurgaon
 3. Expert, Gurgaon; India
 4. TATA Technologies, Pune; India
 5. L& T Engineering Service, Baroda; India
 6. Onward Technologies, Pune
 8. Ranal Engineering Services, Bangalore earlier now AllyGrow Technologies
 9. www.augentech.com; Bangalore
 10. 3D CAD, Bangalore
 11. ENSCI, Bangalore
 12. Geometric Software- Engineering Services, Bangalore might have changed to HCL Technologies
 13. RLE India, Bangalore
- Doing business in Product design and BIW also
14. Group of Engineers, Hyderabad
 15. Moldtek, Hyderabad
 16. General Motors Technical Center, Bangalore
 17. Mercedes Benz Technical Center, Bangalore
 18. TCS(Tata Consultancy Services), Pune; India
 19. COSMA-Magna, Gurgaon;India
 20. Vehma Cosma Bangalore; India
 21. Moldtek, Hyderabad; India
 22. Creative Synergies (CSG), Bangalore-Pune; India
 23. Quest Global India, Bangalore; India
 24. Tecosim, Bangalore-Pune; India
 25. www.vdlsteelweld.com/, Pune;India
 26. www.magnus-global.com; India
 27. EASI, Bangalore; India. Recently started in Pune; India
 28. www.oasisserve.com

Worldwide BIW Line Builders/ Design Houses

1. KUKA, Augsburg, Germany
2. Comau, Italy
3. Thyssenkrupp Nothelfer, Germany
4. EDAG-FFT, Fulda, Germany
5. Wooshin, Korea
6. Hokuto, Japan
7. Genix, Korea
8. www.vdlsteelweld.com
9. www.abb.com
10. www.ebz-gmbh.de
11. www.staufenengineering.de
12. www.hls-group.com
13. www.des-ign.co.za
14. www.valiantcorp.com
15. www.kuka-systems.com/usa/en/
16. www.ogihara.co.jp
17. www.audiplanung.de
18. www.chropynska.cz