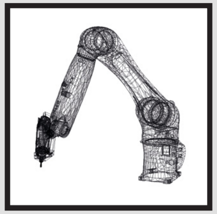
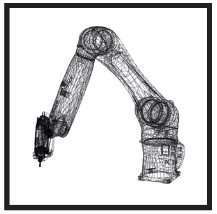
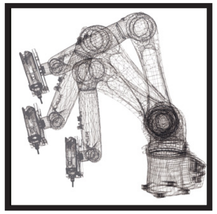
PHYSICAL ROBOTICS

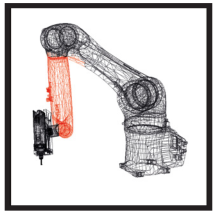




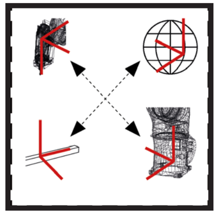
Hardware



Movement Basics



Movement Constraints

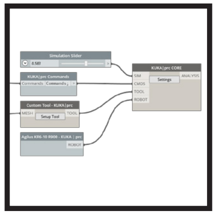


Process Aspects

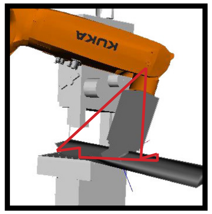
Production Execution

BASIC ROBOT PROGRAMMING

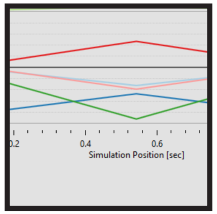
DYNAMO + PRC



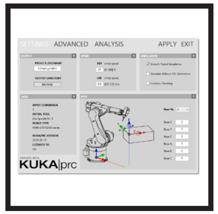
General Core



Toolpath generation



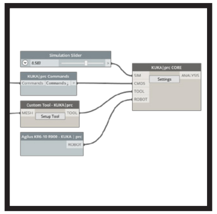
Simulation + Analysis



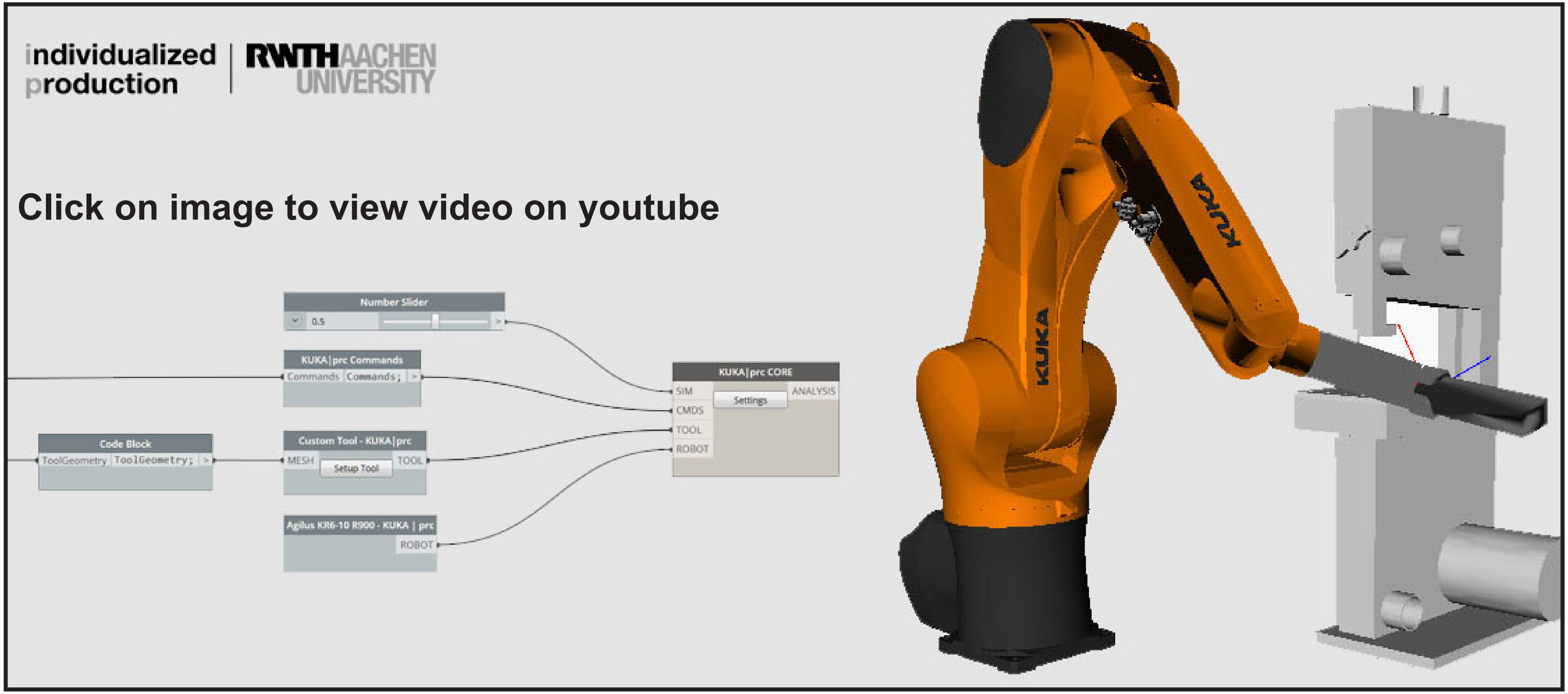
Transfer Setup Data

Export Program

GENERAL CORE



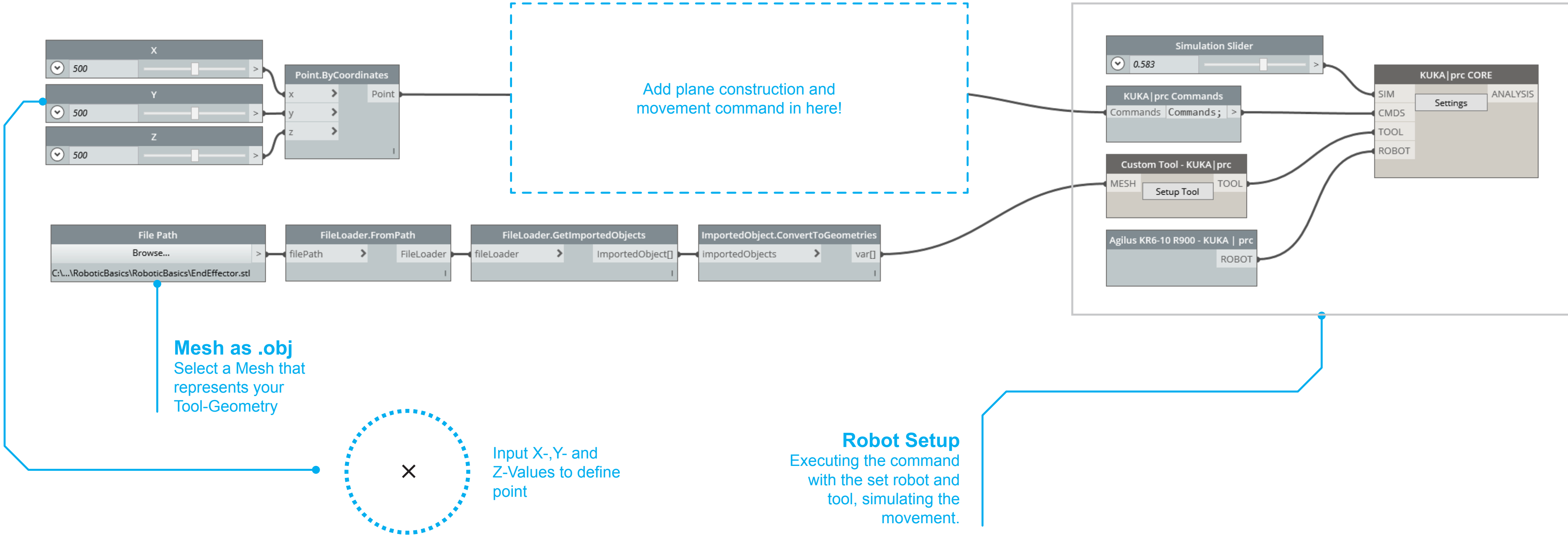
Learn about the digital representation of the robot hardware in KUKA|prc



Link: https://youtu.be/s1VvnMYnjhE

TOOLPATH GENERATION

How do you program robot movement? Why are planes so essential? Which commands are suitable what for?

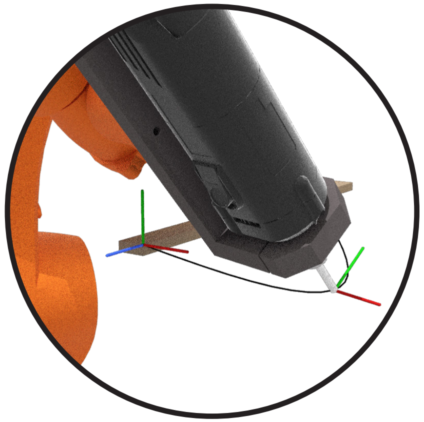


There are multiple ways in Grasshopper to construct planes. One very simple way of doing so is explained below:

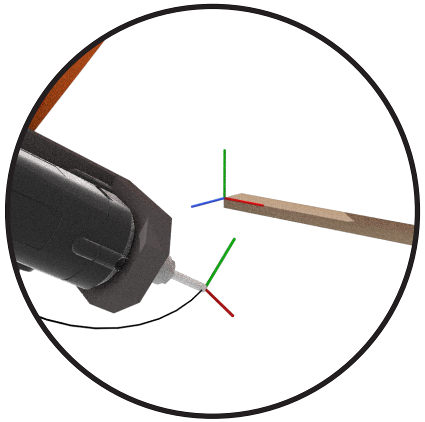
Use the predefined components to generate “standard” planes being the
xy-, xz-, and yz-plane.
If you use one of these components, a plane will show up at the origin of your Rhino viewport. To locate the plane at the spot where you want it to be, all you need to do is to change the origin of the chosen plane. You can do so by first creating a point or setting and selecting a point in Rhino and then plugging it into the only possible input of your chosen plane component. Now you can plug the plane component into any movement command and proceed as explained in the General Core Video to generate a robot program.

In this way, you have the flexibility of moving around the location of your plane but are bound to the 3 different orientations of the predefined planes.

Robot heading for
XY-plane

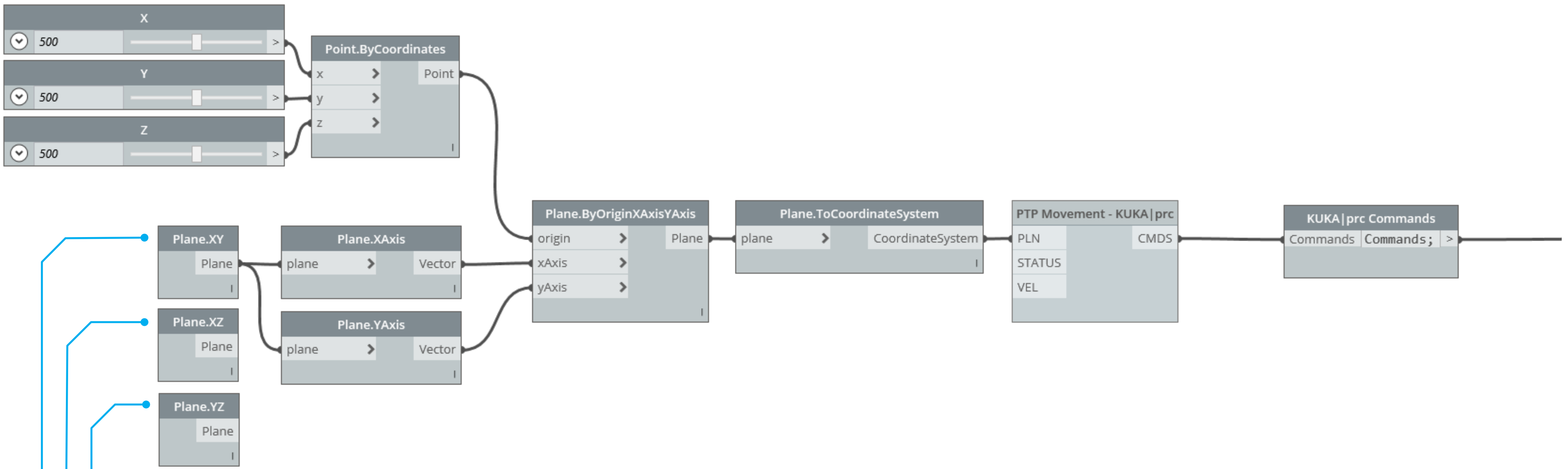


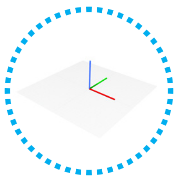
Robot heading for
XZ-plane



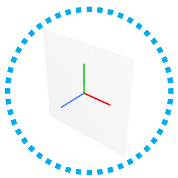
Robot heading for
YZ-plane

CONSTRUCT PLANES I XY XZ YZ

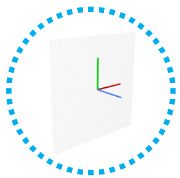




XY Plane
Creating a horizontal plane at the origin point as orientaton for the robot tool.



XZ Plane
Creating a vertical plane at the origin point as orientaton for the robot tool.



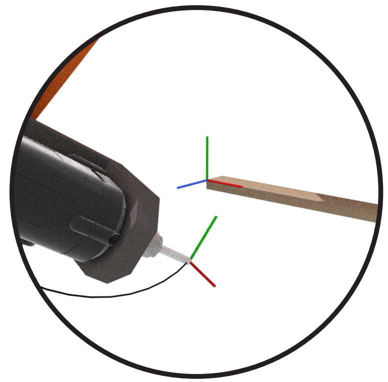
YZ Plane
Creating a vertical plane at the origin point as orientaton for the robot tool.

If it is not enough to choose a standard plane, you can go one step ahead and rotate such a plane in any pursued direction. Here you see how the 3 different planes are rotated in 3 different directions. But watch out: To be able to define the rotation direction again standard planes are used for spatial description. If you want to see the rotation in action, scroll to the video elements below. As always, there are multiple other ways of rotating a plane in GH - see transformation operations.

Rotation 0°

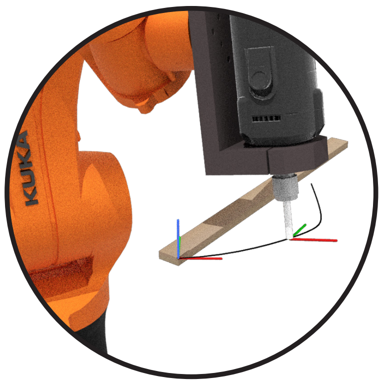
Robot heading for XY-plane

Robot heading for XZ-plane



Robot heading for YZ-plane

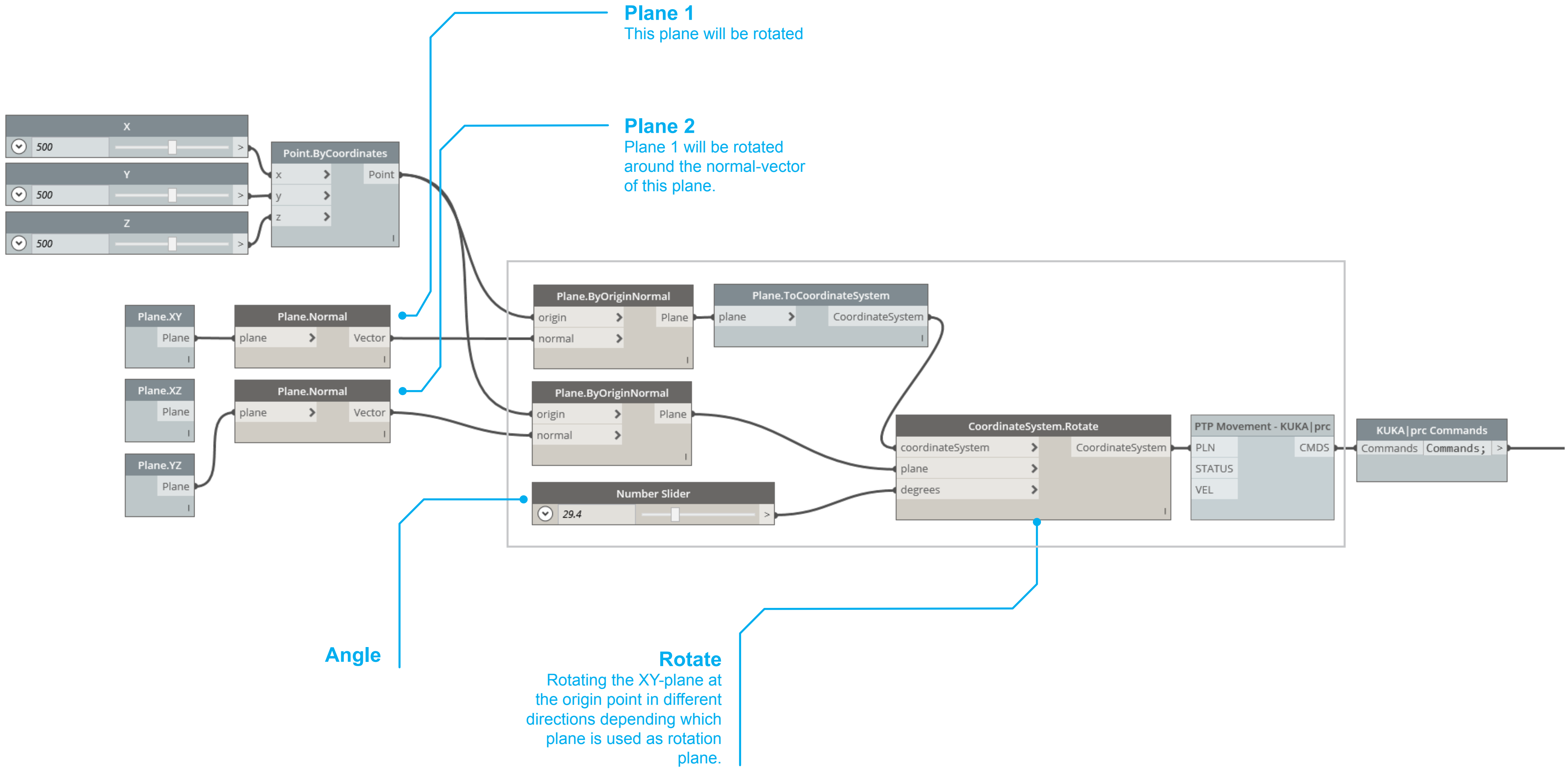
Rotation 35°

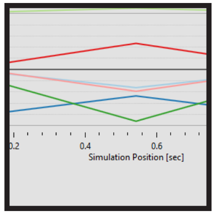


Robot heading for XY-rotated XY-plane

Robot heading for XZ-rotated XY-plane

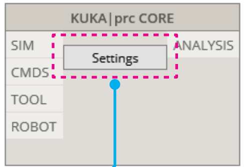
Robot heading for YZ-rotated XY-plane


Plane 1
This plane will be rotated
Plane 2
Plane 1 will be rotated around the normal-vector of this plane.
X
500
Y
500
Z
500
Point.ByCoordinates
x
y
z
Point
Plane.XY
Plane
Plane.Normal
plane
Vector
Plane.XZ
Plane
Plane.Normal
plane
Vector
Plane.YZ
Plane
Plane.ByOriginNormal
origin
normal
Plane
Plane.ToCoordinateSystem
plane
CoordinateSystem
Plane.ByOriginNormal
origin
normal
Plane
Number Slider
29.4
CoordinateSystem.Rotate
coordinateSystem
plane
degrees
CoordinateSystem
PTP Movement - KUKA|prc
PLN
STATUS
VEL
CMDS
KUKA|prc Commands
Commands
Commands;
Angle
Rotate
Rotating the XY-plane at the origin point in different directions depending which plane is used as rotation plane.

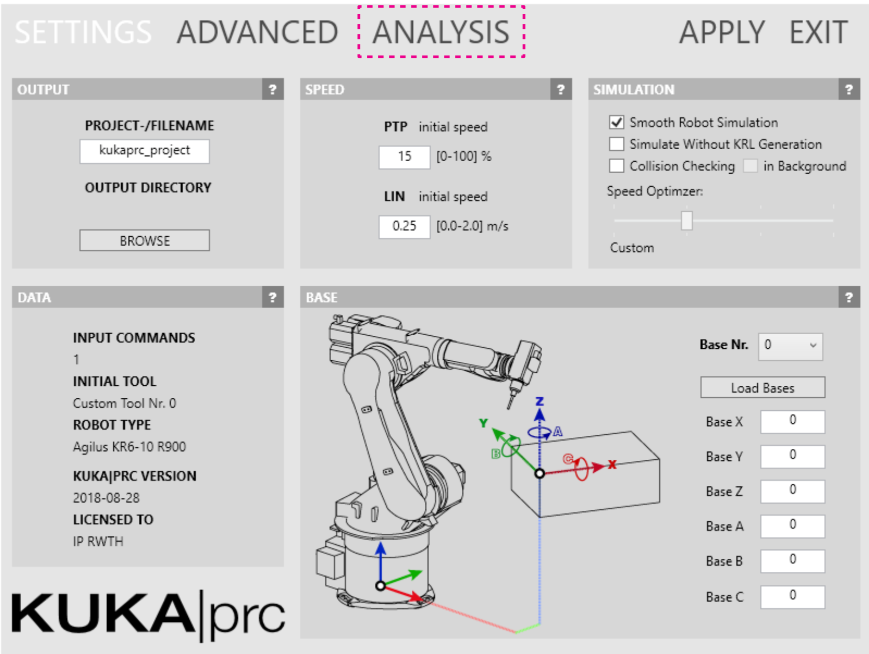


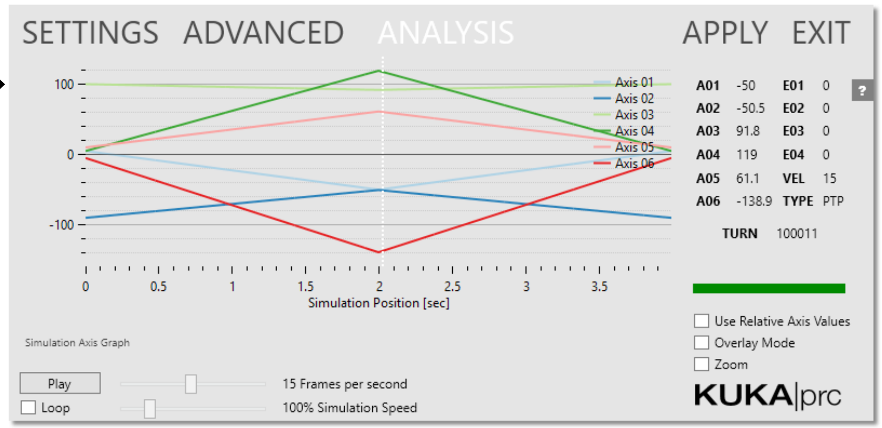
What does the simulation show? What can you learn from the analysis tool? How to you react on this information?

Analysis
Select Analysis tab on the top of the dialog box



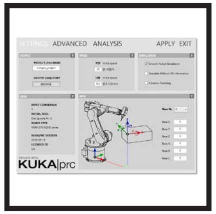
Settings
Click on settings on the KUKA I prc core component



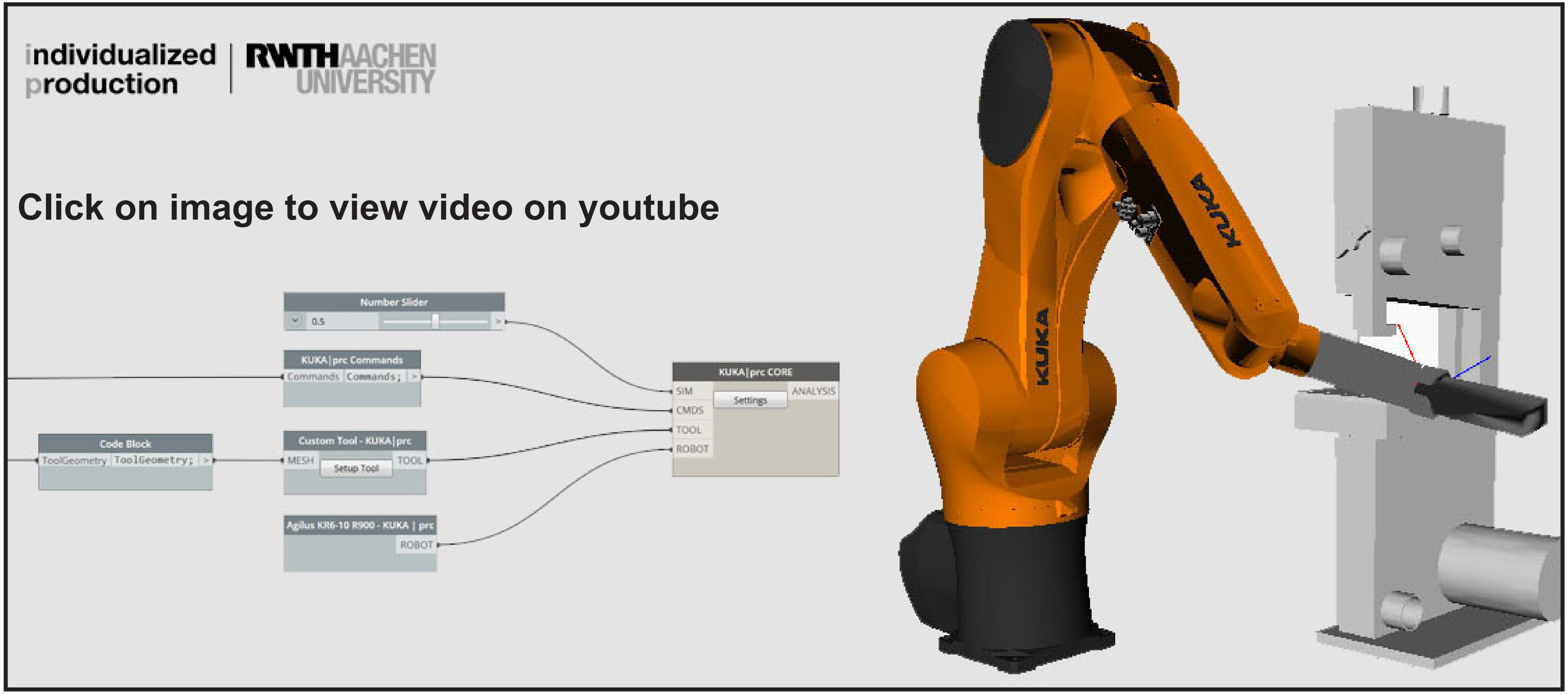


Use the following link to view sample simulation:
https://youtu.be/nqZkNJs1F3Q

TRANSFER SETUP DATA

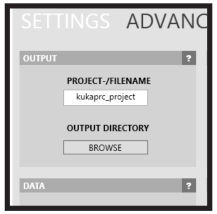


How do you transfer setup data of tool and base into the robot program? Where do you get the information from?

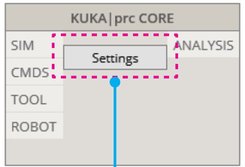


Link: https://youtu.be/A22PwFrZxxk

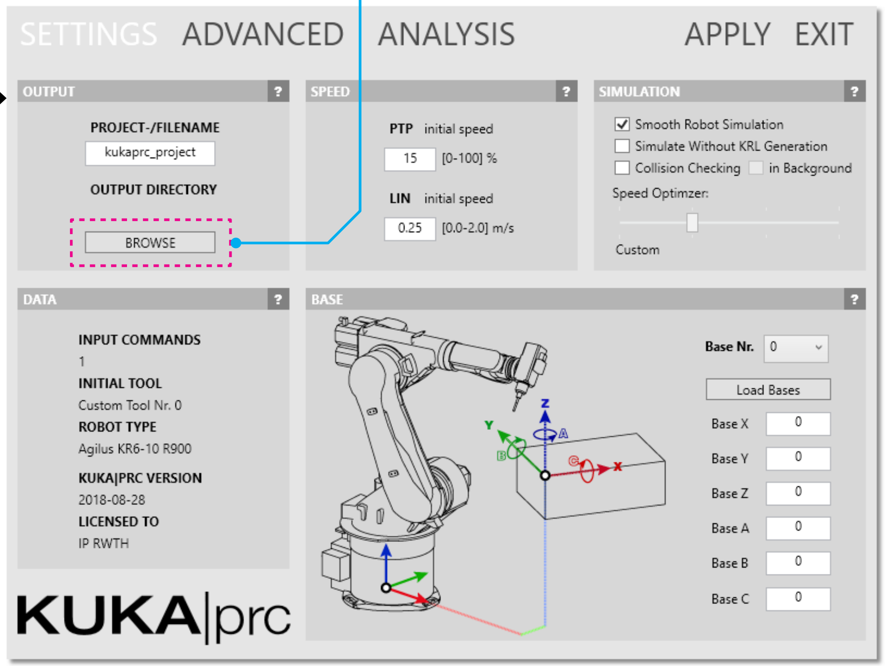
EXPORT PROGRAM



How do you export you robot program so it can be transferred to the robot?

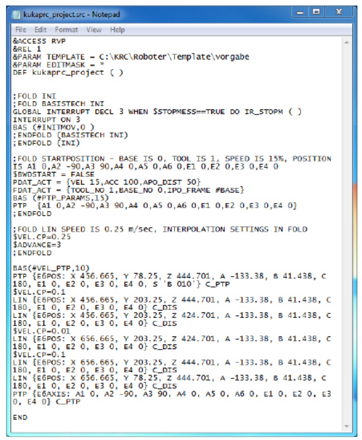


Settings
Click on settings on the KUKA I prc core component



Output
Select output directory and click apply. Exit application. The file will be continously updated as changes are made in the algorithm.

File
is exported at the selected output directory .src-format. To explore the contents of file open using notepad.



Export
transfer file to robot controller for production