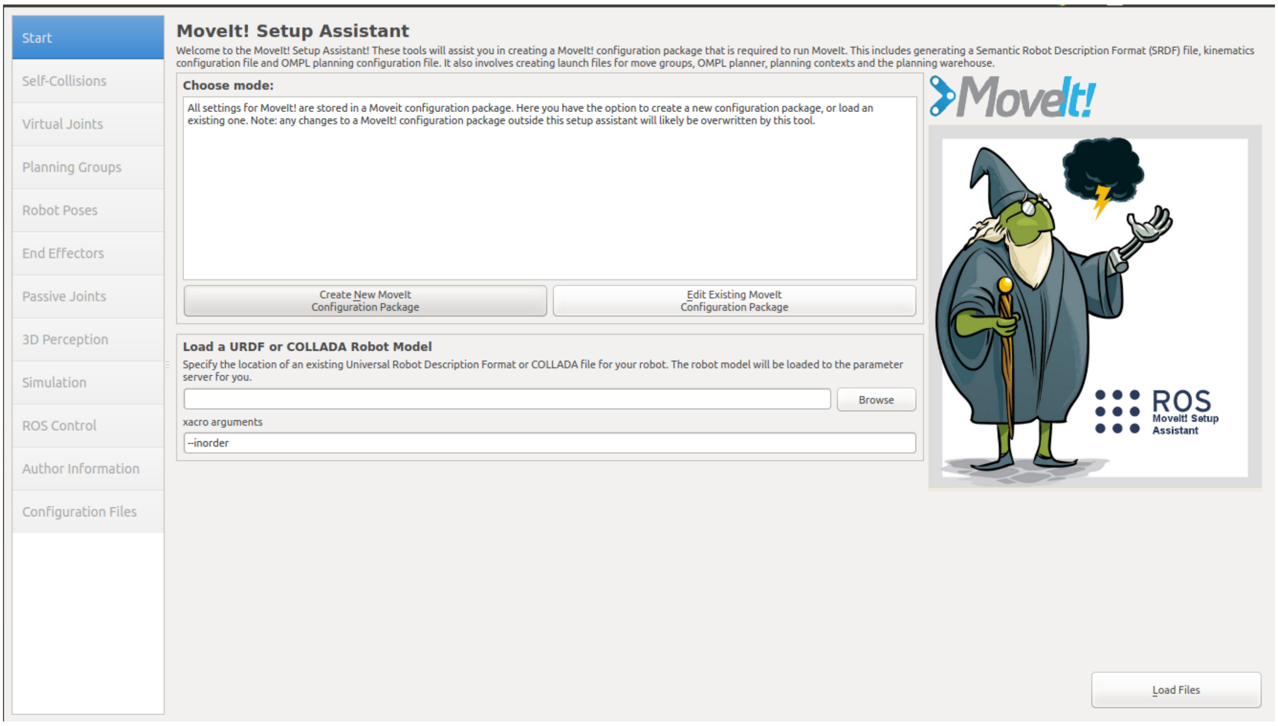
MoveIt Setup Assistant

moveit.picknik.ai/humble/doc/examples/setup_assistant/setup_assistant_tutorial.html



Overview

The MoveIt Setup Assistant is a graphical user interface for configuring any robot for use with MoveIt. Its primary function is generating a Semantic Robot Description Format (SRDF) file for your robot. Additionally, it generates other necessary configuration files for use with the MoveIt pipeline. To learn more about the SRDF, you can go through the URDF/SRDF Overview page.

Getting Started

MoveIt and ROS

- Follow the instructions for installing MoveIt first if you have not already done that.
- If you haven't already done so, make sure you have the Franka description package for Noetic:

```
sudo apt install ros-noetic-franka-description
```

- If you have the `panda_moveit_config` package already git-cloned from the *Getting Started* page, be sure to delete that now since this tutorial will teach you how to create it from scratch:

```
cd ~/ws_moveit/src
rm -rf panda_moveit_config
```

~~catkin clean panda_moveit_config~~

Step 1: Start

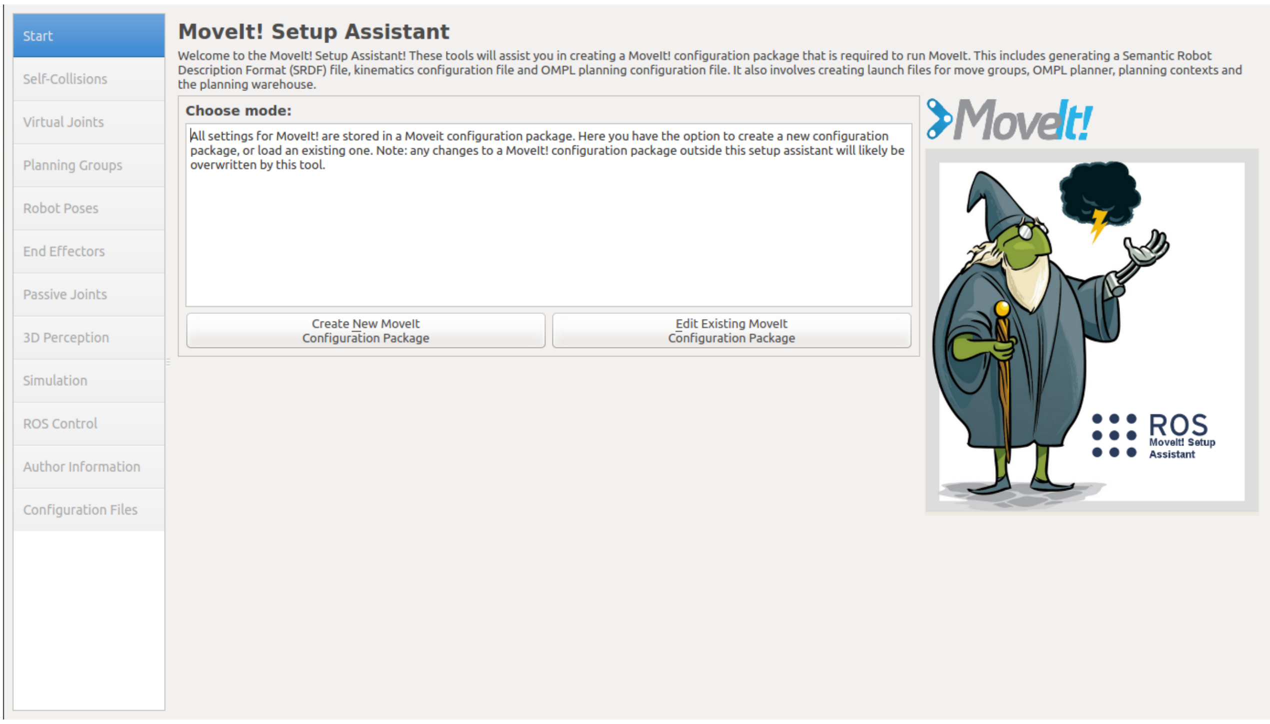
- To start the MoveIt Setup Assistant:

~~roslaunch moveit_setup_assistant setup_assist~~

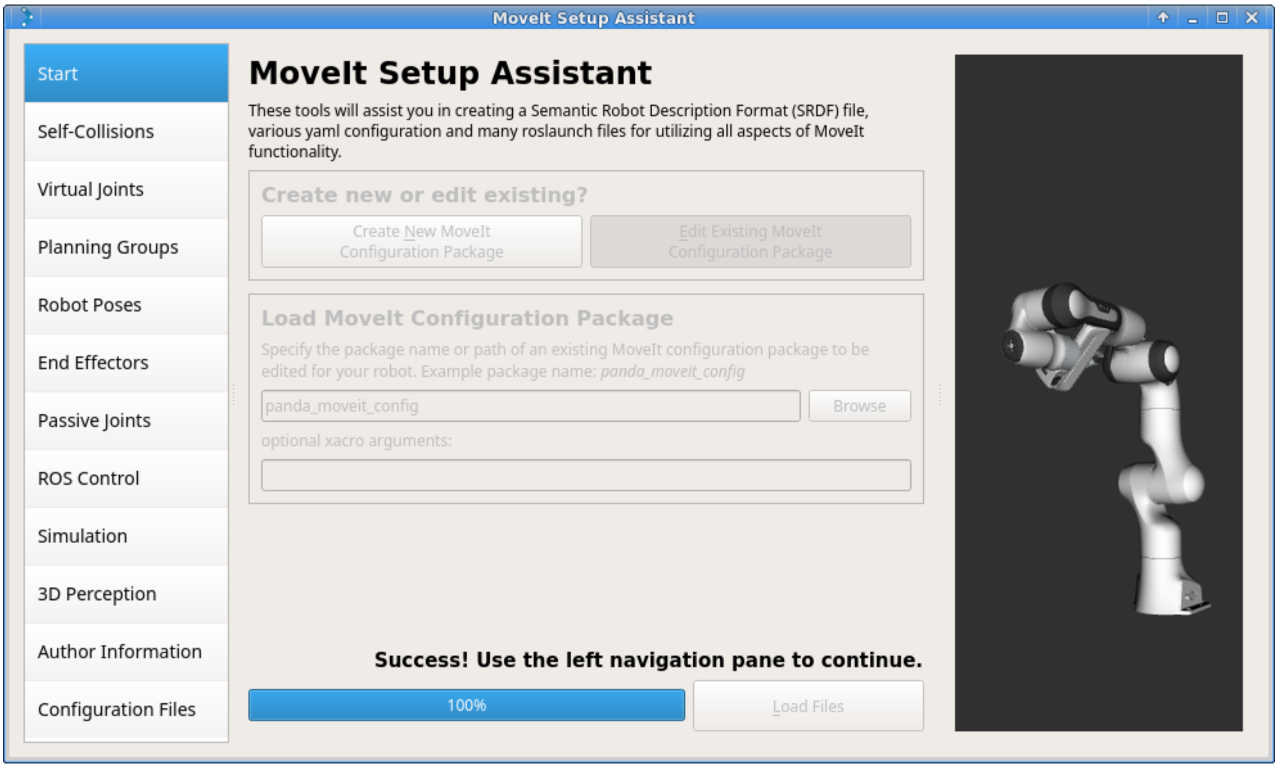
ros2 launch
moveit_setup_assistant
setup_assistant.launch.py

- This will bring up the start screen with two choices: *Create New MoveIt Configuration Package* or *Edit Existing MoveIt Configuration Package*.

- Click on the *Create New MoveIt Configuration Package* button to bring up the following screen:



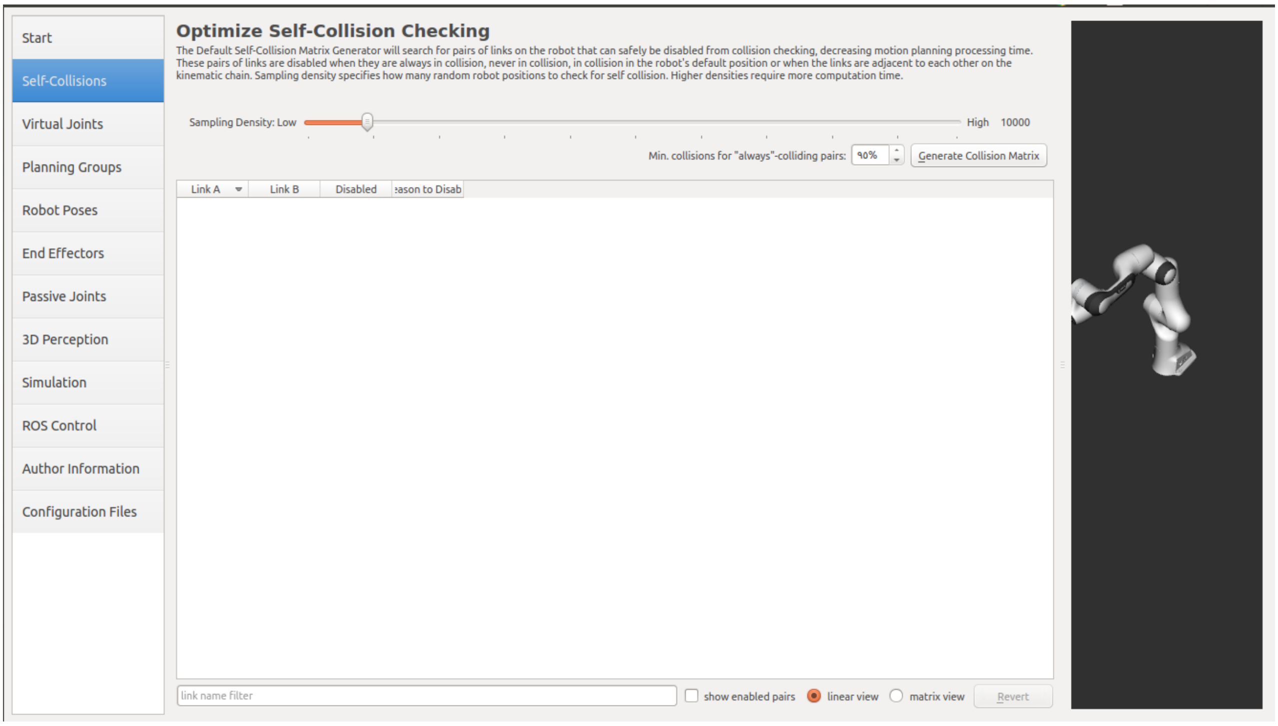
Click on the browse button and navigate to the *panda_arm_hand.urdf.xacro* file installed when you installed the Franka package above. (This file gets installed in /opt/ros/noetic/share/franka_description/robots/panda_arm_hand.urdf.xacro on Ubuntu with ROS Noetic.) Choose that file and then click *Load Files*. The Setup Assistant will load the files (this might take a few seconds) and present you with this screen:



Step 2: Generate Self-Collision Matrix_

The Default Self-Collision Matrix Generator searches for pairs of links on the robot that can safely be disabled from collision checking, decreasing motion planning processing time. These pairs of links are disabled when they are always in collision, never in collision, in collision in the robot's default position or when the links are adjacent to each other on the kinematic chain. The sampling density specifies how many random robot positions to check for self collision. Higher densities require more computation time while lower densities have a higher possibility of disabling pairs that should not be disabled. The default value is 10,000 collision checks. Collision checking is done in parallel to decrease processing time.

> Click on the *Self-Collisions* pane selector on the left-hand side and click on the *Generate Collision Matrix* button. The Setup Assistant will work for a few second before presenting you the results of its computation in the main table.



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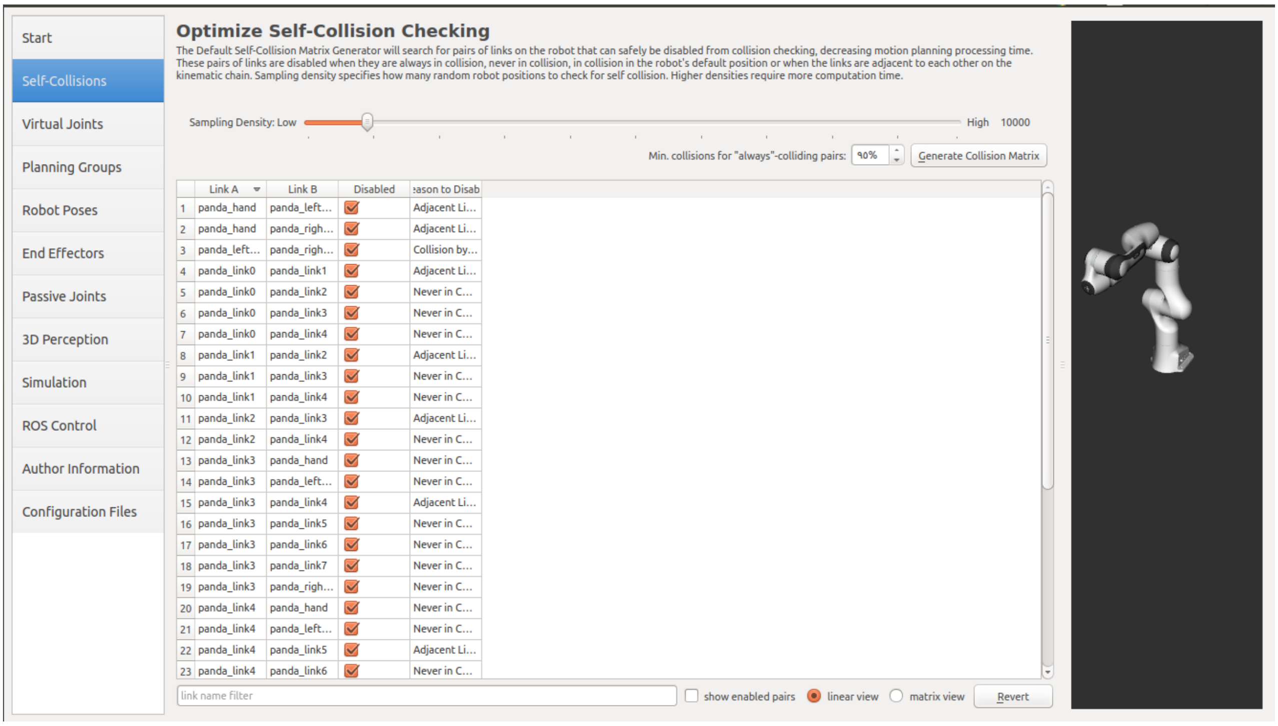
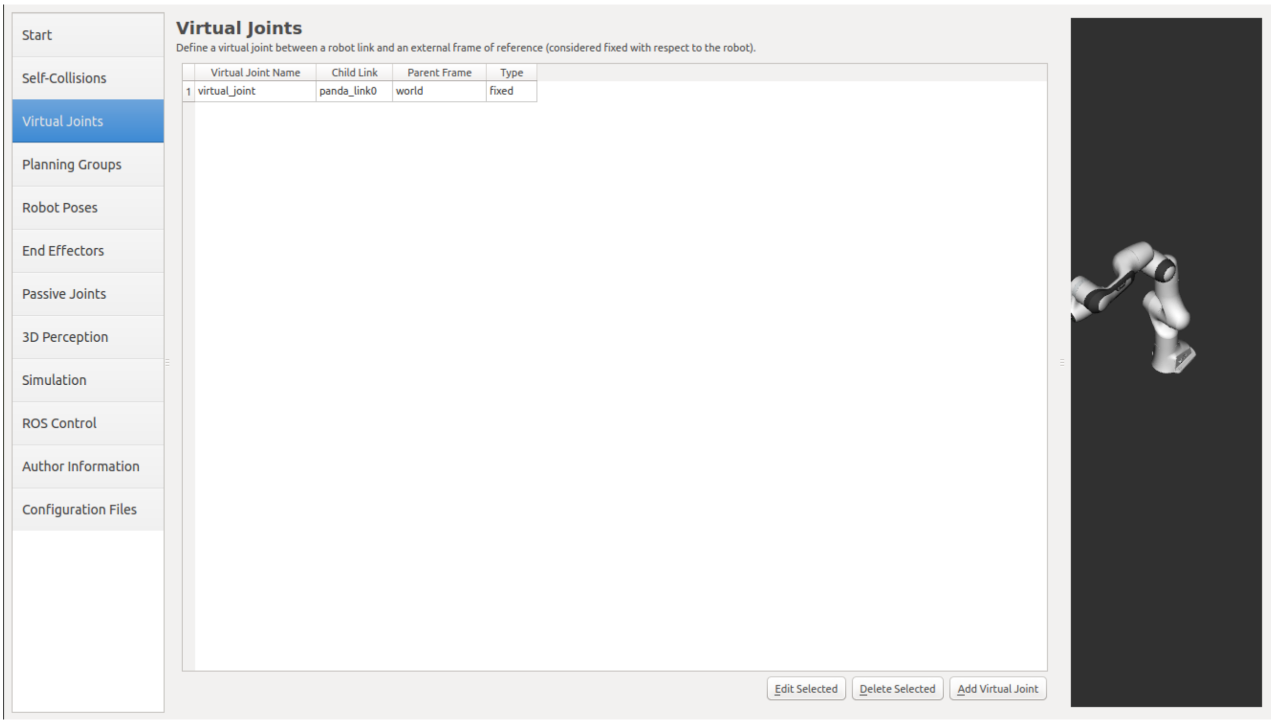


Step 3: Add Virtual Joints

Virtual joints are used primarily to attach the robot to the world. For the Panda we will define only one virtual joint attaching the *panda_link0* of the Panda to the *world* world frame. This virtual joint represents the motion of the base of the robot in a plane.

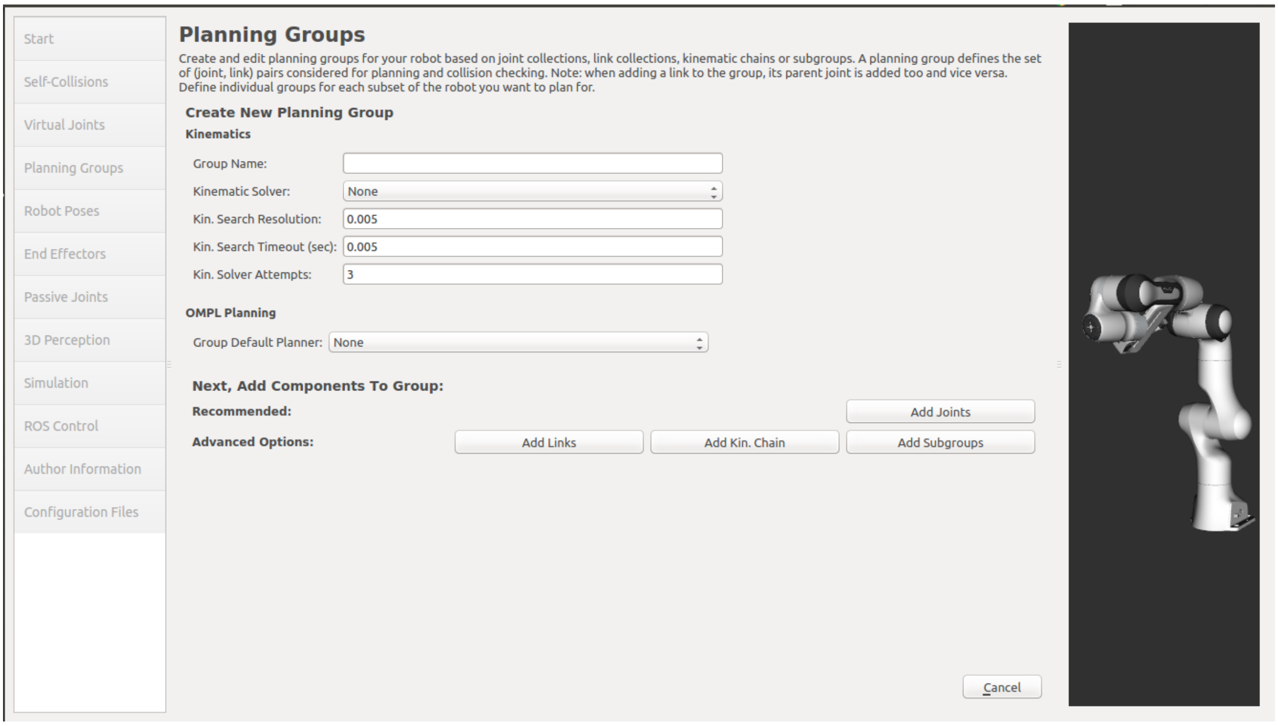
- Click on the *Virtual Joints* pane selector. Click on *Add Virtual Joint*
- Set the joint name as “virtual_joint”
- Set the child link as “panda_link0” and the parent frame name as “world”.
- Set the Joint Type as “fixed”.
- Click *Save* and you should see this screen:



Step 4: Add Planning Groups

Planning groups are used for semantically describing different parts of your robot, such as defining what an arm is, or an end effector.

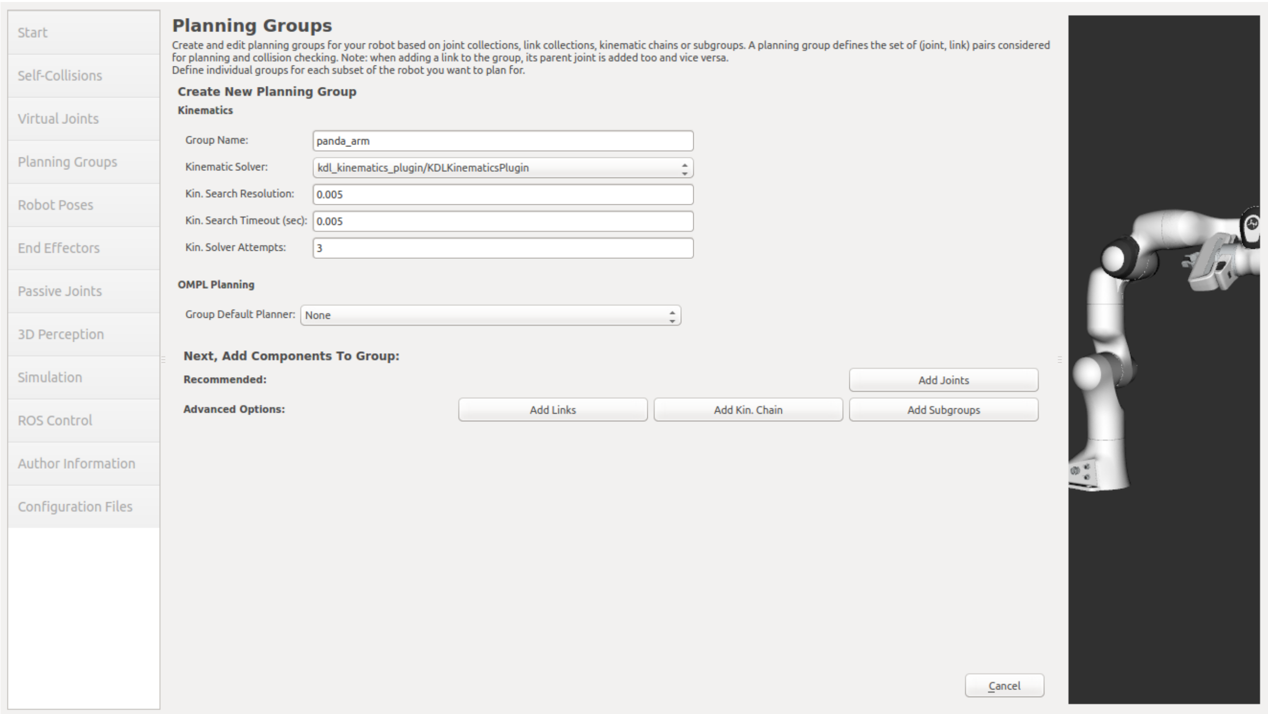
- Click on the *Planning Groups* pane selector.
- Click on *Add Group* and you should see the following screen:



Add the arm

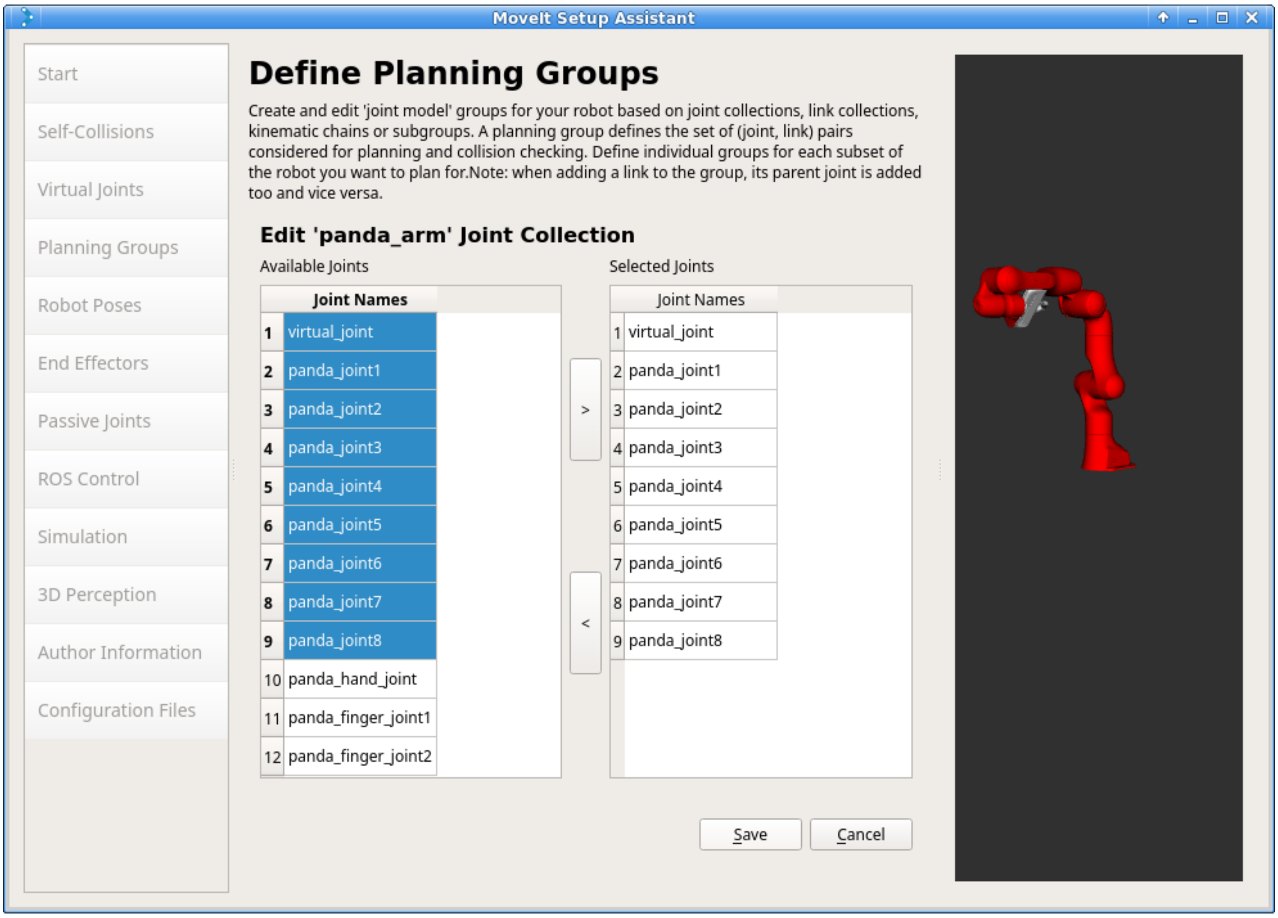
We will first add Panda arm as a planning group

- Enter *Group Name* as **panda_arm**
- Choose *kdl_kinematics_plugin/KDLKinematicsPlugin* as the kinematics solver. *Note: if you have a custom robot and would like a powerful custom IK solver, see* Kinematics/IKFast
- Let *Kin. Search Resolution* and *Kin. Search Timeout* stay at their default values.

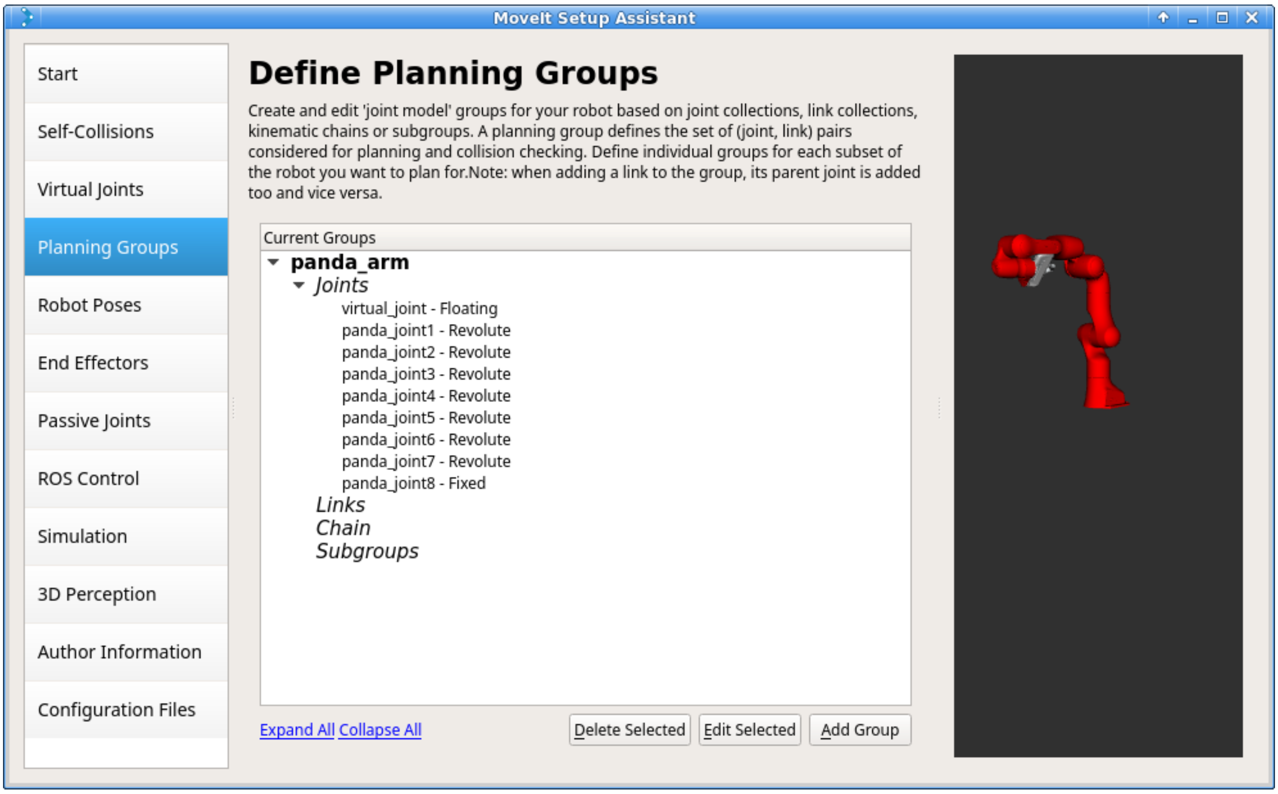


Now, click on the *Add Joints* button. You will see a list of joints on the left hand side. You need to choose all the joints that belong to the arm and add them to the right hand side. The joints are arranged in the order that they are stored in an internal tree structure. This makes it easy to select a serial chain of joints.

> Click on **virtual_joint**, hold down the **Shift** button on your keyboard and then click on the *panda_joint8*. Now click on the **>** button to add these joints into the list of selected joints on the right.



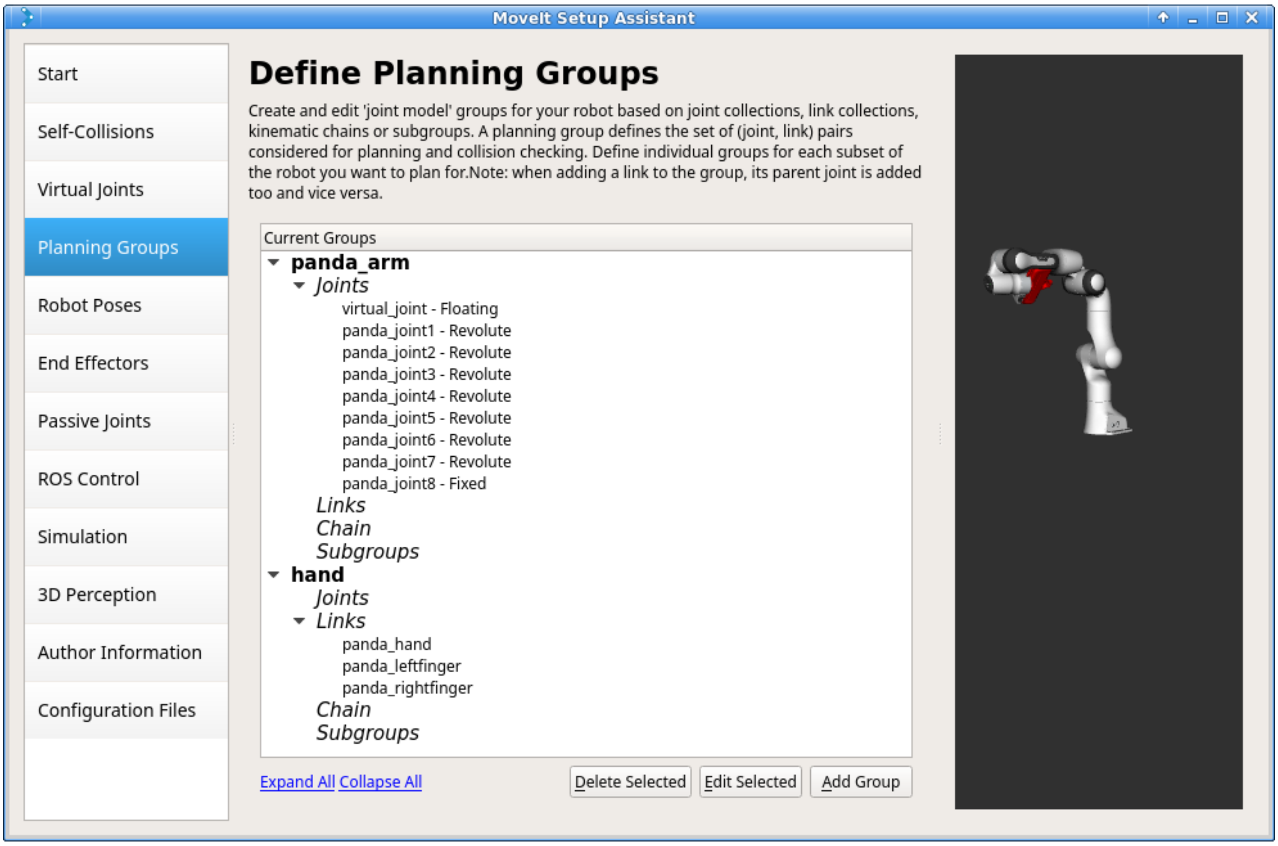
Click *Save* to save the selected group.



Add the gripper

We will also add a group for the end effector. NOTE that you will do this using a different procedure than adding the arm.

- Click on the *Add Group* button.
- Enter *Group Name* as **hand**
- Let *Kinematic Solver* stay at its default value; **None**.
- Let *Kin. Search Resolution* and *Kin. Search Timeout* stay at their default values.
- Click on the *Add Links* button.
- Choose **panda_hand**, **panda_leftfinger**, and **panda_rightfinger** and add them to the list of *Selected Links* on the right hand side.
- Click *Save*



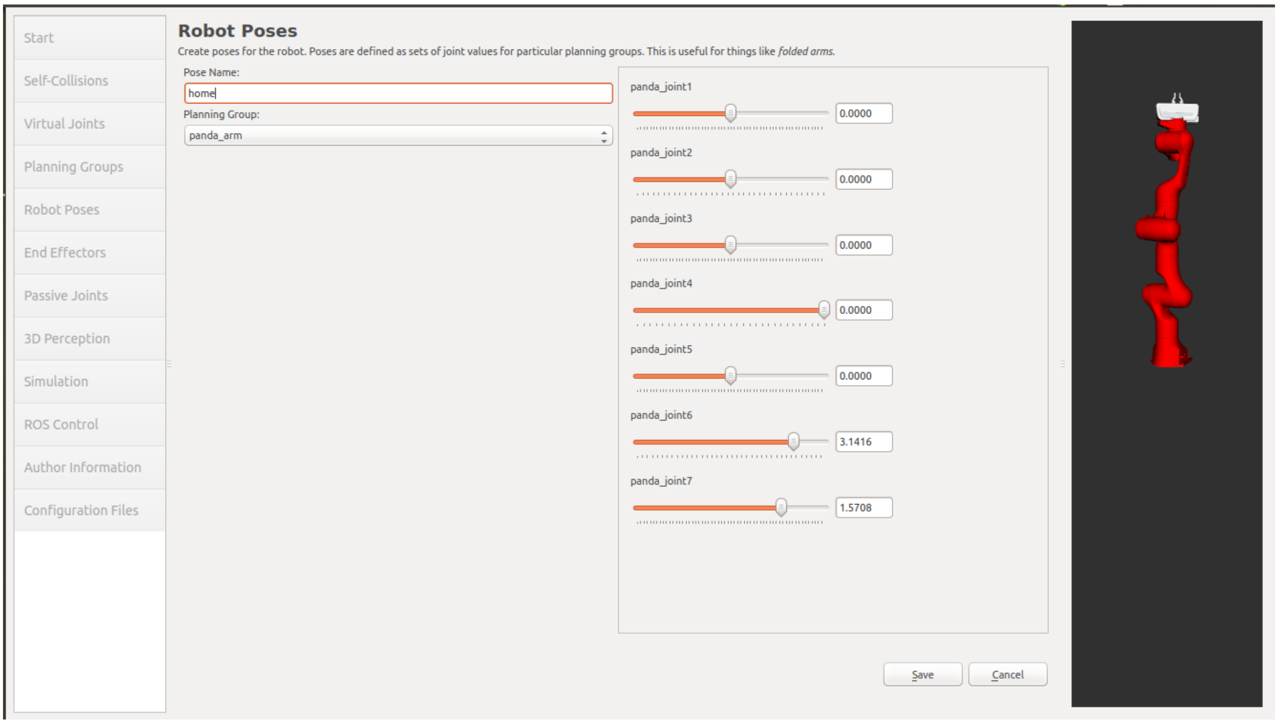
Step 5: Add Robot Poses_

The Setup Assistant allows you to add certain fixed poses into the configuration. This helps if, for example, you want to define a certain position of the robot as a **Home** position.

- Click on the *Robot Poses* pane.

- Click *Add Pose*. Choose a name for the pose. The robot will be in its *Default* position where the joint values are set to the mid-range of the allowed joint value range. Move the individual joints around until you are happy and then *Save* the pose. Note how poses are associated with particular groups. You can save individual poses for each group.

- **IMPORTANT TIP**: Try to move all the joints around. If there is something wrong with the joint limits in your URDF, you should be able to see it immediately here.



Step 6: Label End Effectors_

We have already added the gripper of the Panda. Now, we will designate this group as a special group: **end effectors**. Designating this group as end effectors allows some special operations to happen on them internally.

- Click on the *End Effectors* pane.

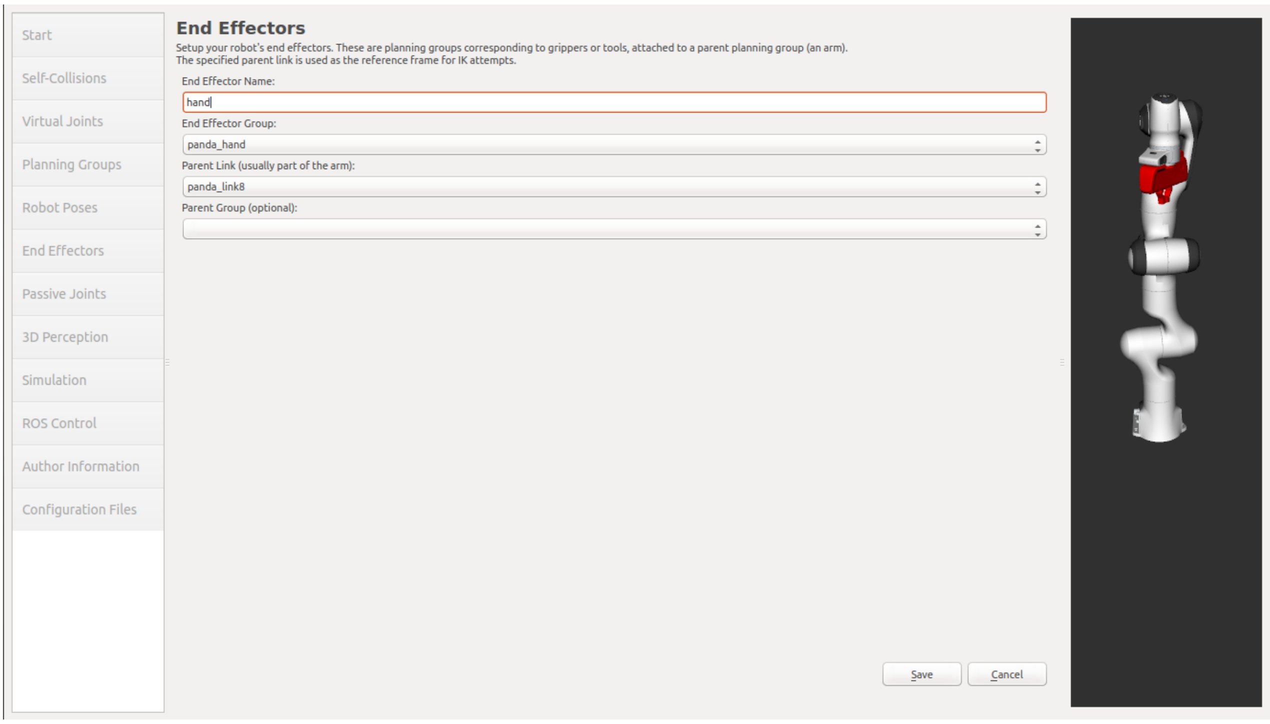
- Click *Add End Effector*.

- Choose **hand** as the *End Effector Name* for the gripper.

- Select **hand** as the *End Effector Group*.

- Select **panda_link8** as the *Parent Link* for this end-effector.

- Leave *Parent Group* blank.



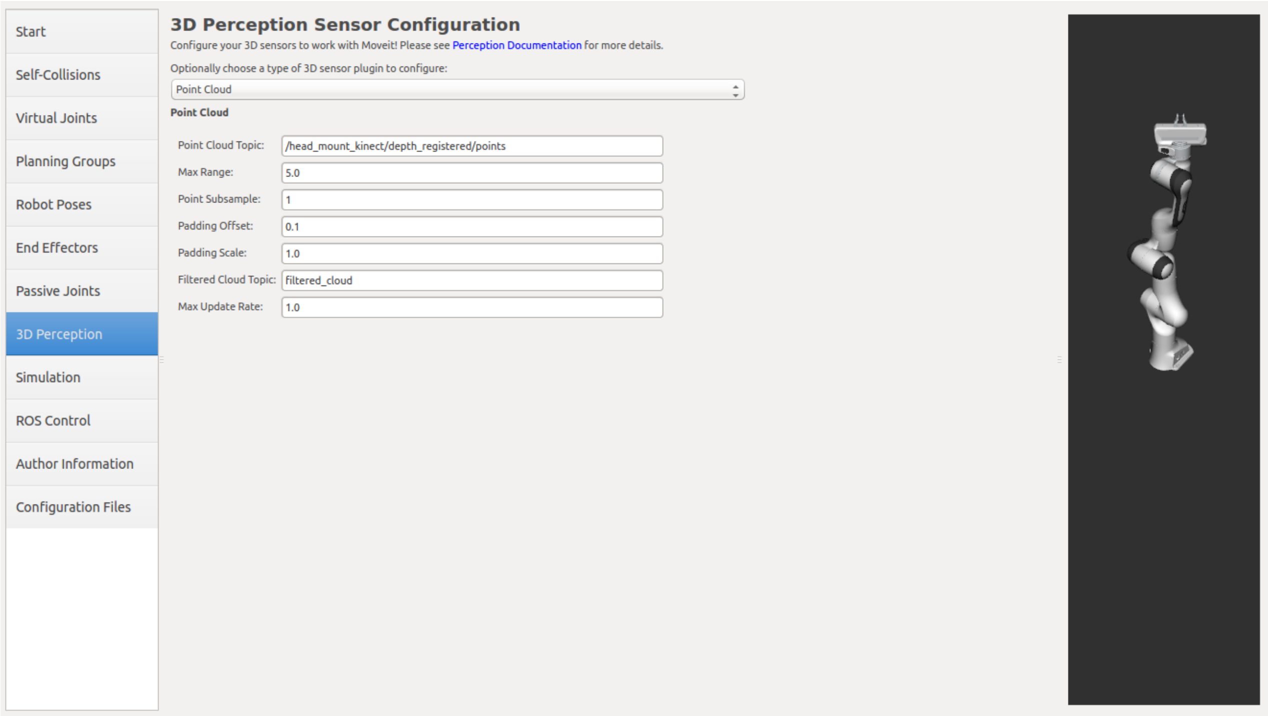
Step 7: Add Passive Joints

The passive joints tab is meant to allow specification of any passive joints that might exist in a robot. These are joints that are unactuated on a robot (e.g. passive casters.) This tells the planners that they cannot (kinematically) plan for these joints because they can't be directly controlled. The Panda does not have any passive joints so we will skip this step.

Step 8: 3D Perception

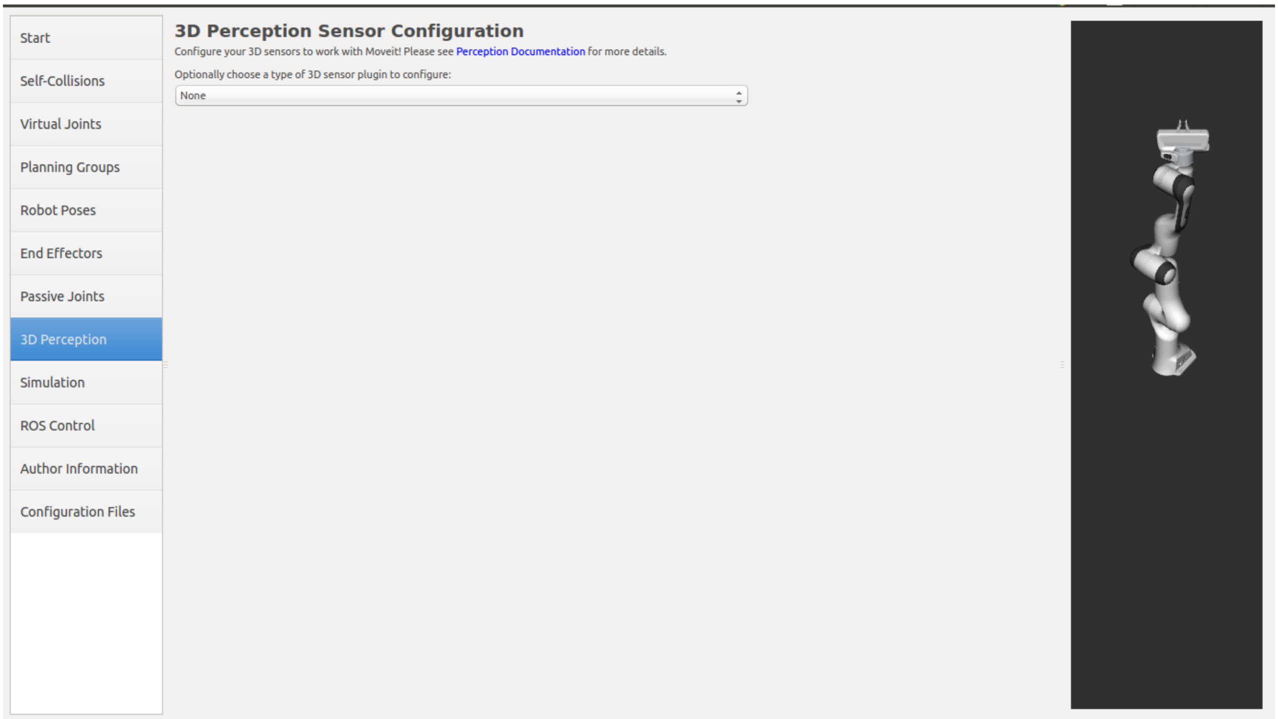
The 3D Perception tab is meant to set the parameters of the YAML configuration file for configuring the 3D sensors **sensors_3d.yaml**.

e.g. **point_cloud** parameters:



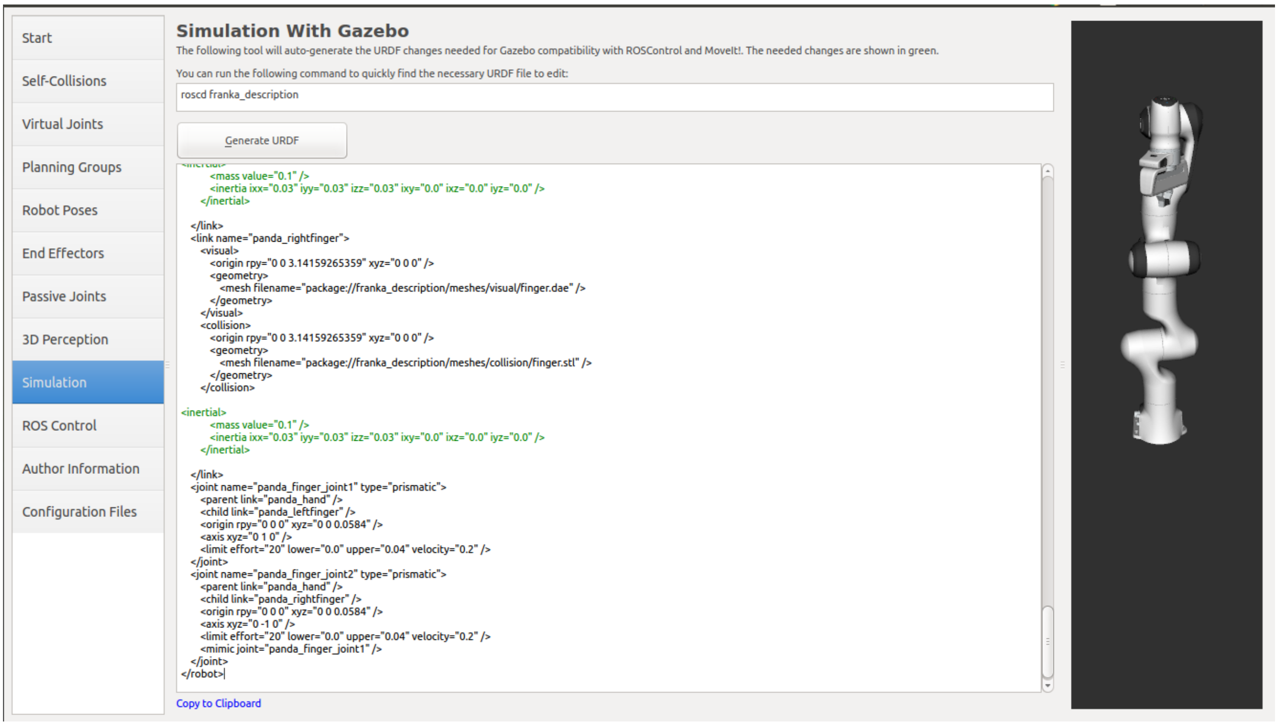
For more details about those parameters please see perception pipeline tutorial

In case of **sensors_3d.yaml** was not needed, choose **None**.



Step 9: Gazebo Simulation_

The Simulation tab can be used to help you simulate your robot with Gazebo by generating a new Gazebo compatible urdf if needed.



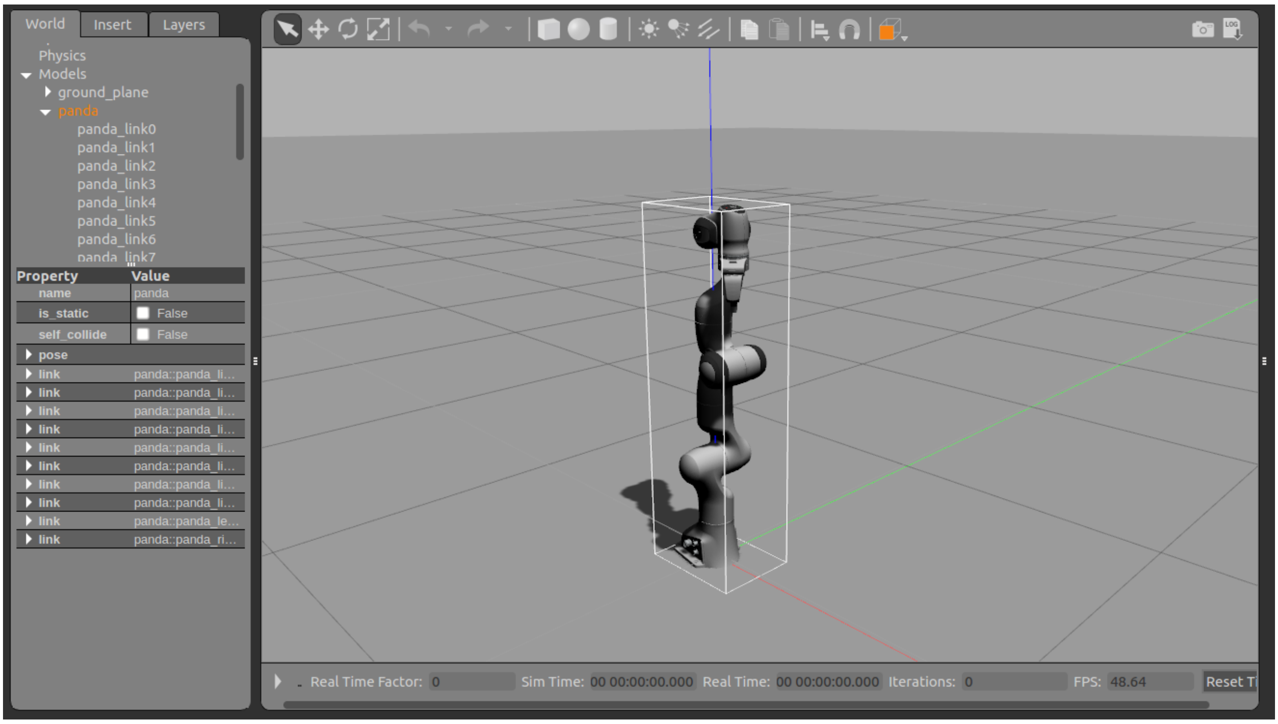
You can use the generated robot **urdf** to spawn the robot in Gazebo in the following way.

- Use rosrun to start gazebo empty world:

```
roslaunch gazebo_ros empty_world.launch paused:=true use_sim_time:=false gui:=true
throttled:=false recording:=false debug:=true
```

- Use rosrun to spawn the robot:

```
rosrun gazebo_ros spawn_model -file </path_to_new_urdf/file_name.urdf> -urdf -x 0 -y
0 -z 1 -model panda
```

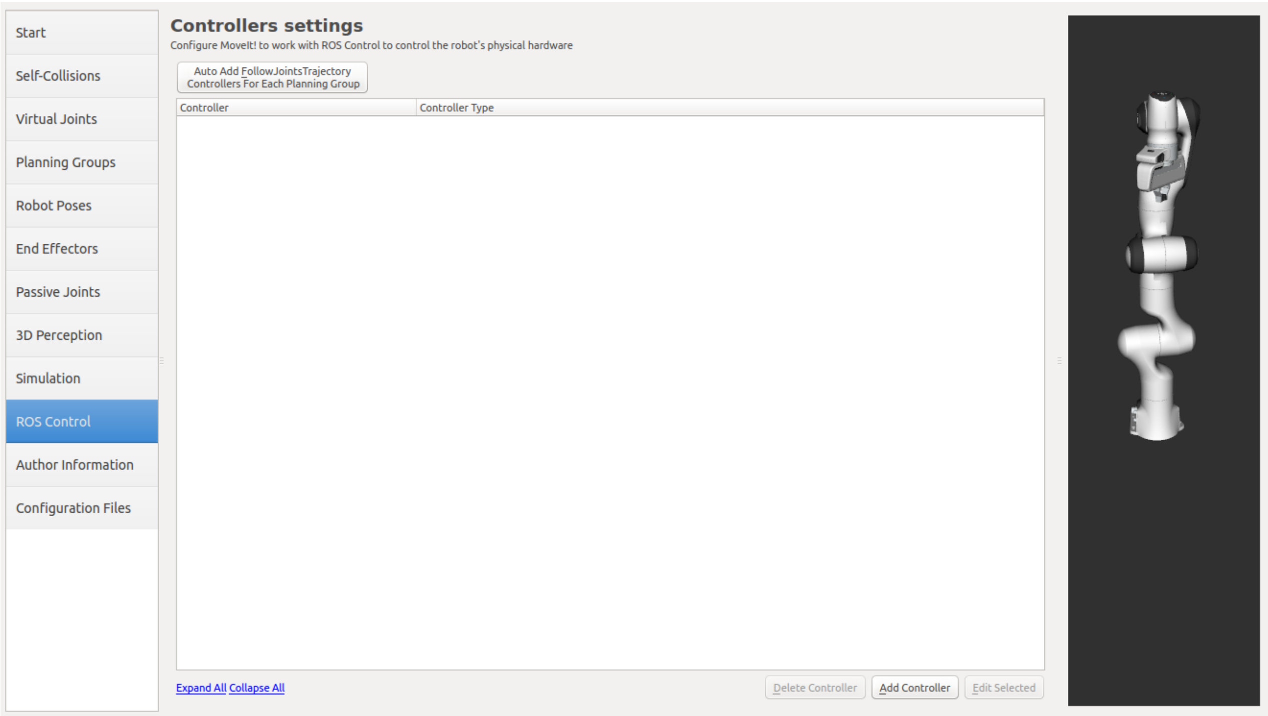


Step 10: ROS Control

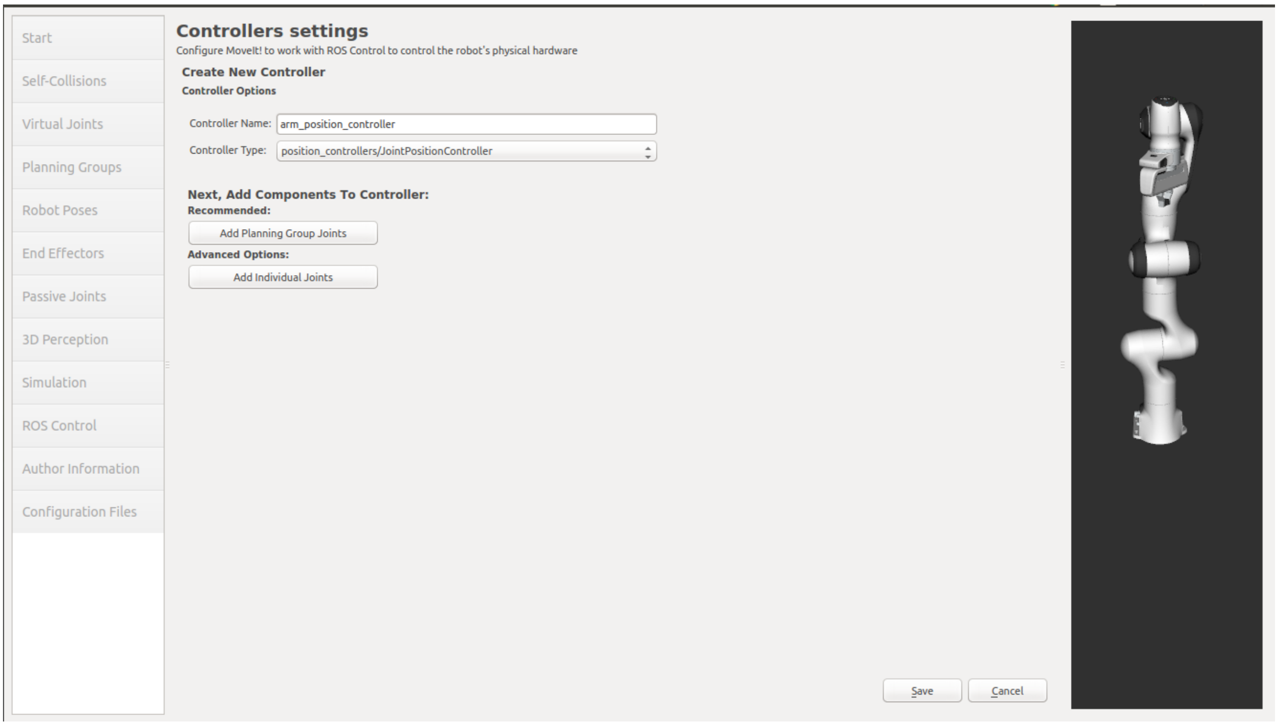
ROS Control is a set of packages that include controller interfaces, controller managers, transmissions and hardware_interfaces, for more details please look at ros_control documentation

ROS Control tab can be used to auto generate simulated controllers to actuate the joints of your robot. This will allow us to provide the correct ROS interfaces MoveIt.

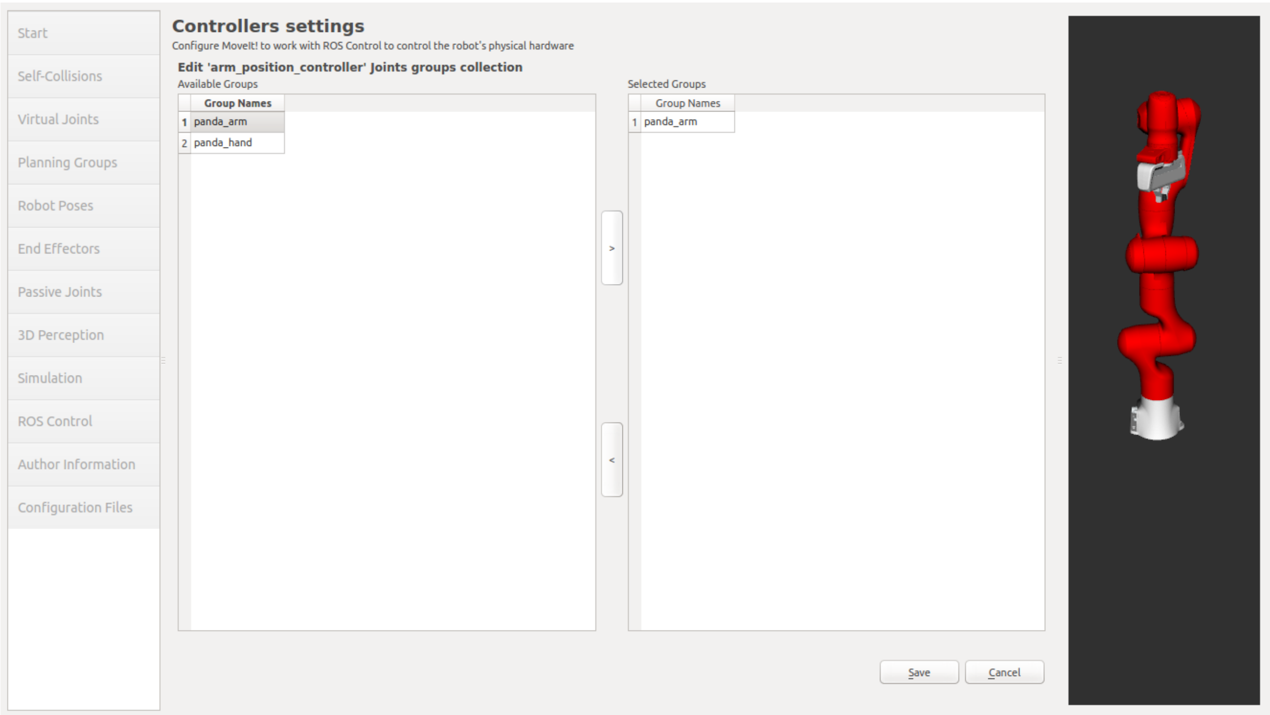
Click on the *ROS Control* pane selector.



- Click on *Add Controller* and you should see the following screen:
- We will first add Panda arm position controller
- Enter *Controller Name* as **arm_position_controller**
- Choose **position_controllers/JointPositionController** as the controller type
- Next you have to choose this controller joints, you can add joints individually or add all the joints in a planning group all together.
- Now, click on Add Planning Group Joints.



Choose panda_arm planning group to add all the joints in that group to the arm controller.



Click *Save* to save the selected controller.

Step 11: Add Author Information_

Catkin requires author information for publishing purposes

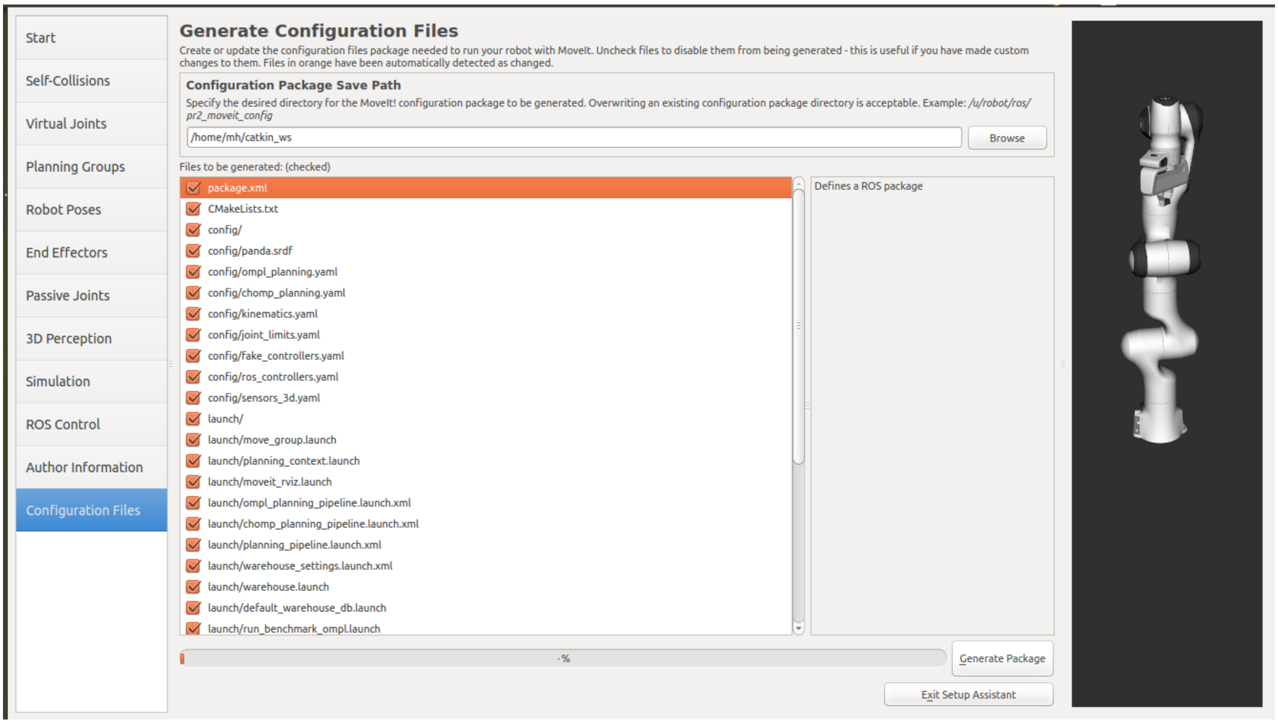
- Click on the *Author Information* pane.
- Enter your name and email address.

Step 12: Generate Configuration Files

You are almost there. One last step - generating all the configuration files that you will need to start using MoveIt

- Click on the *Configuration Files* pane. Choose a location and name for the ROS package that will be generated containing your new set of configuration files. Click browse, select a good location (for example, your home directory), click **Create New Folder**, call it “panda_moveit_config”, and click **Choose**. “panda_moveit_config” is the location used in the rest of the documentation on this wiki. This package does not have to be within your ROS package path. All generated files will go directly into the directory you have chosen.

- Click on the *Generate Package* button. The Setup Assistant will now generate and write a set of launch and config files into the directory of your choosing. All the generated files will appear in the Generated Files/Folders tab and you can click on each of them for a description of what they contain.



Congratulations!! - You are now done generating the configuration files you need for MoveIt

What’s Next

The MoveIt RViz plugin

Start looking at how you can use the generated configuration files to play with MoveIt using the MoveIt RViz Plugin.

Setup IKFast Inverse Kinematics Solver

A faster IK solver than the default KDL solver, but takes some additional steps to setup: Kinematics/IKFast

Additional Reading

See the URDF and SRDF page for more details on the components of the URDF and SRDF mentioned in this tutorial.