

Mambo Mini Drone Experiment Documentation

Related work

- [L1 Adaptive Augmentation for Geometric Tracking Control of Quadrotors Paper](#)
 - [Experimental demo of paper](#)
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Hardware and Software Requirements

Hardware

- [Mambo Parrot Mini Drone](#)
- Micro USB type-B cable
- [Bluetooth Low Energy \(BLE\) 4.0](#)
- [Vicon Motion Capture System](#) with accessories
 - 4 pearl markers(reflective markers) - Size: 9.5mm Sphere, Base: 17mm hard plastic
 - marker fixing tape
 - calibration stick
- Host PC that collects, processes, and sends the data from cameras
- Personal computer - a notebook with windows 10

Software

- [MATLAB and SIMULINK](#) 2021b with packages - installed on a personal computer
 - [Simulink Support Package for Parrot Minidrones](#)
 - [MATLAB Support Package for Parrot Drones](#)
 - [Simulink Coder](#)
 - Aerospace Toolbox
 - Aerospace Blockset
 - [Vicon DataStream SDK 1.11.0](#) - installed on a personal computer
 - [Vicon Tracker 3.9](#) - installed on Host PC
 - [Visual Studio 2017 C++ Compiler](#) - installed on a personal computer
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Prepare Matlab and Add-ons

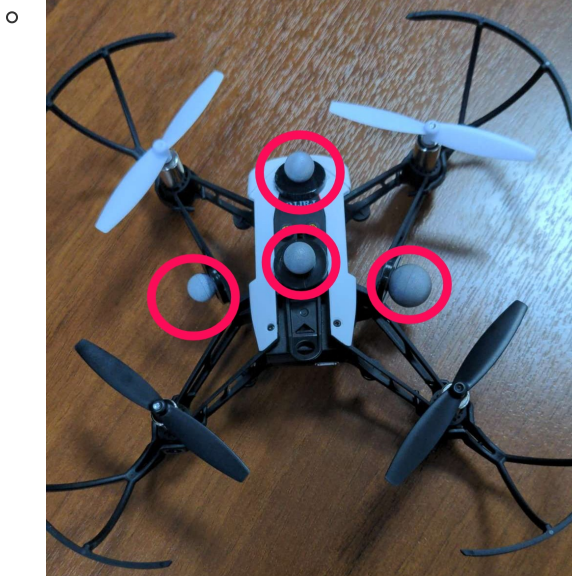
1. Download the MATLAB and SIMULINK - if you don't have a MATLAB license or can't purchase it download the 2020b version of MATLAB using this [link](#).
 - Wait until it downloads the "Matlab 20b-20211218T112432Z-002.zip" .zip folder and the "Matlab99R2020b_Win64.iso" .ios file (It may take a while depending on your internet speed).
 - Extract "Matlab 20b-20211218T112432Z-002.zip" zip file. Go to "Matlab 20b-20211218T112432Z-002 - > Matlab 20b -> Matlab909Win" folder and follow the instruction of "_ReadmeWin.txt" file(it is in Russian, you may need translate it into English - use google translate). In step 4 when you "Select Products" select all products except "Matlab Parallel Server".
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After it finishes the installation restart your computer and go to "C:\Program Files\Polyspace\R2020b\bin" and run matlab.exe.

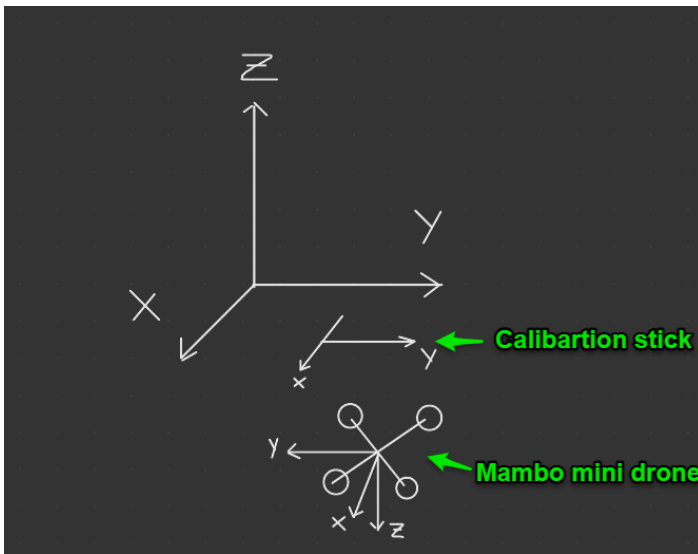
2. Go to MATLAB "Add-on Explorer", search and install
 - [Simulink Support Package for Parrot Minidrones](#)
 - [MATLAB Support Package for Parrot Drones](#)
 - [Simulink Coder](#)
 3. Download the Vicon data stream SDK from this [link](#)
 - Unzip the "ViconDataStreamSDK_1.11.0_128037.zip" and "ViconDataStreamSDK_1.11.0.128037h__Win64.zip"
 - Then go to the "Win64" folder and run the "ViconDataStreamSDK_1.11.0.128037h__x64.msi" file.
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Vicon System Setup

1. Stick 4 markers on the drone as shown in the picture below



- **Note:** Make sure that markers are placed asymmetrically
2. Turn on the Vicon system and start the calibration process
 - Clean the mask
 - Calibrate using calibration stick
 - Set origin
 3. Create an object to track
 - Put the drone inside the Vicon tracking system
 - Align the drone axis with the Vicon's axis. To do so you will need to place the drone as shown in the picture below. Drone's and Vicon's X-axis should have the same direction, but Z, Y axes should have opposite direction
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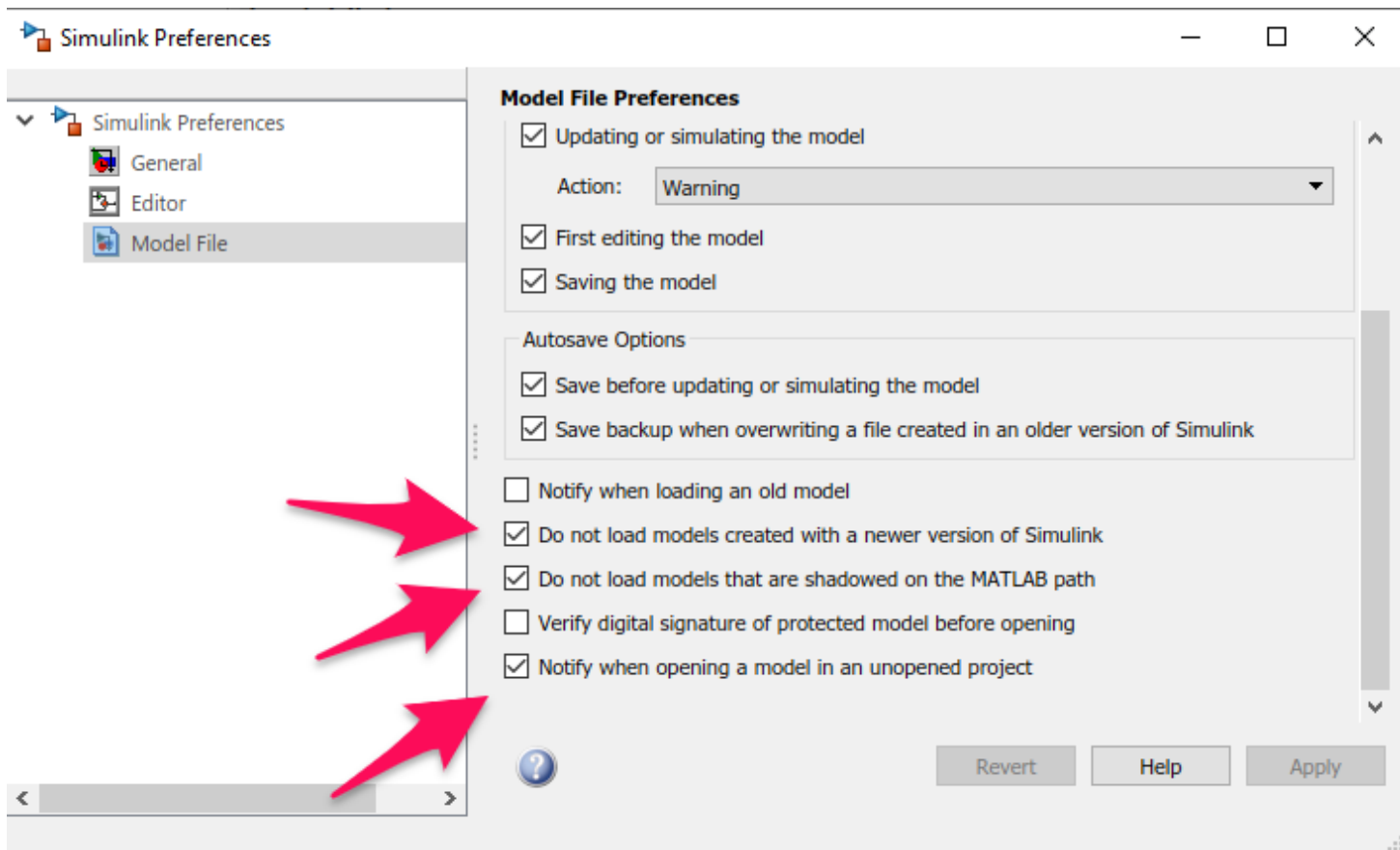


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Drone Position Data Stream to Simulink

1. Download and install Visual Studio Community 2017 (version 15.9)
 - o Open Matlab and run "mex -setup" in the command window
 - o Click on "mex -setup C++" and choose "Visual Studio 2017 C++" compiler
2. Download and install Vicon DataStream SDK 1.11.0 on your personal computer
3. Create an empty folder and open it in Matlab on your personal computer. Copy and paste the following files in the folder
 - o From the host computer - go to "Programs\Vicon\Tracker 3.9\Simulink\DSSDK\SingleObject" copy all files from this directory.
 - o On your personal computer - go to "Program Files\Vicon\DataStream SDK\Win64\CPP" copy and paste all files.
4. Open "TrackerObject.cpp" file via Matlab
 - o Search for "pMyClient->Connect("localhost:801");" line
 - o Change localhost to your Vicon computer's IP address (for example 192.168.0.107)
 - o You can check the IP address by running the "ipconfig" command in the CMD of the host computer
5. Run "mex TrackerObject.cpp ViconDataStreamSDK_CPP.lib" in command window
6. Connect host computer to your personal computer via ethernet cable(LAN cable)
7. Make sure that Tracker is streaming the data
 - o Note: You need to put an object inside the Vicon system
8. In Matlab go to "HOME > Preferences > Simulink > Open Simulink Preferences > Model File" and enable following options
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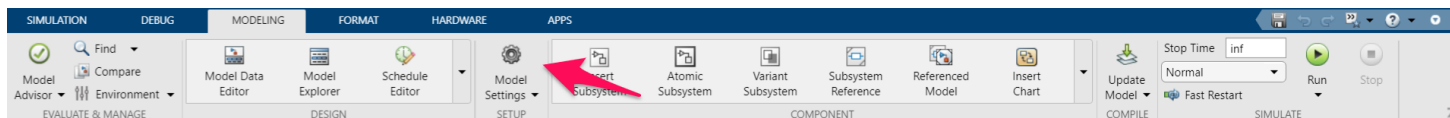


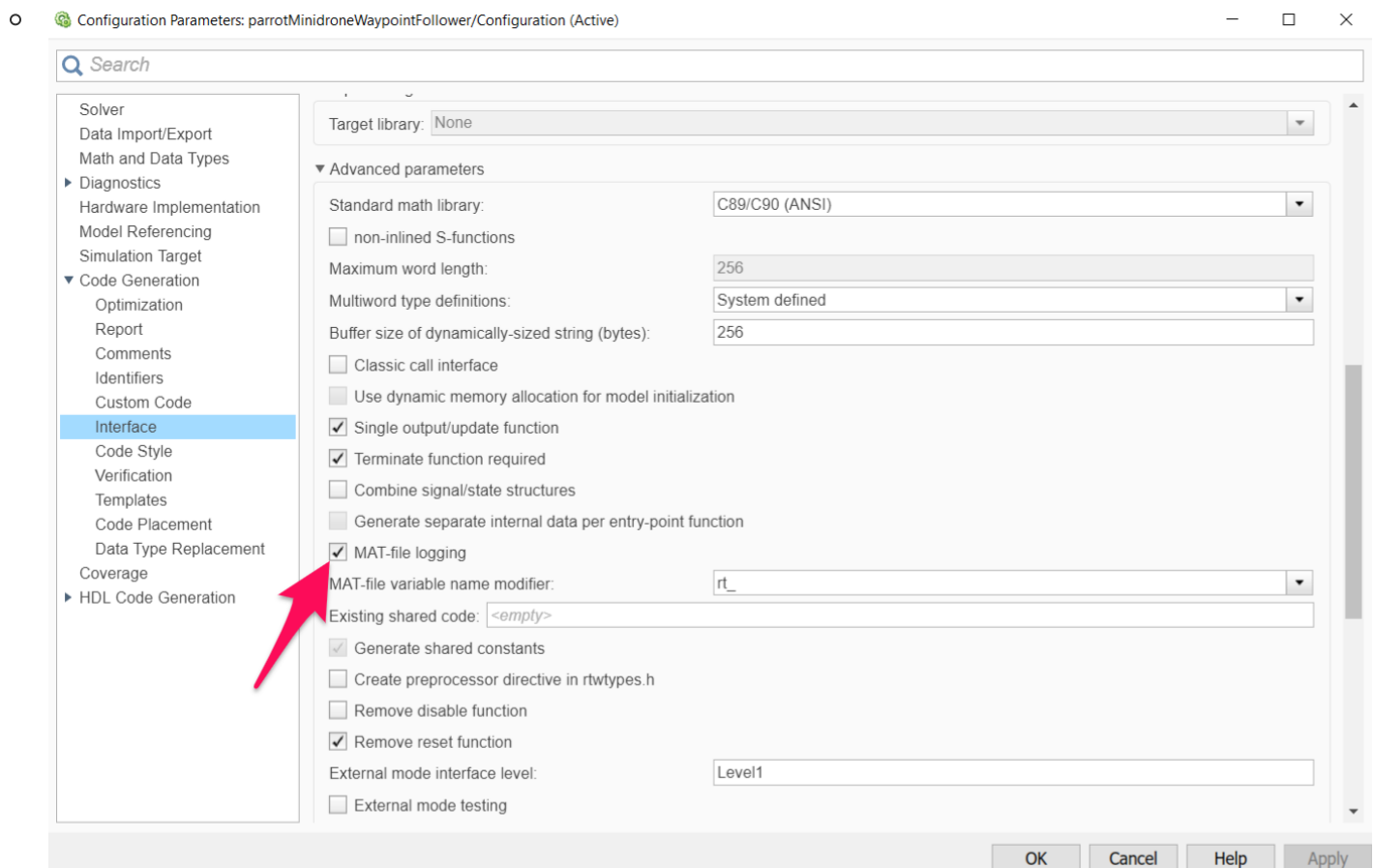
9. Open the "DSSDK_TrackerSingleObject.mdl" Simulink model from Matlab
 - In SIMULATION set Stop Time to "inf"
 - Click on the arrow under the "Run" button and open "Simulation Pacing". Enable "Enable pacing to slow down simulation", make sure that "Simulation time per wall clock second" is set to 1
10. Click the "Run" button to check
 - Displays the data
 - Move around the drone(in XYZ directions) and make sure that coordinates are changing in the right way.

* Useful link - <https://www.youtube.com/watch?v=fpAKToBQ1hQ>

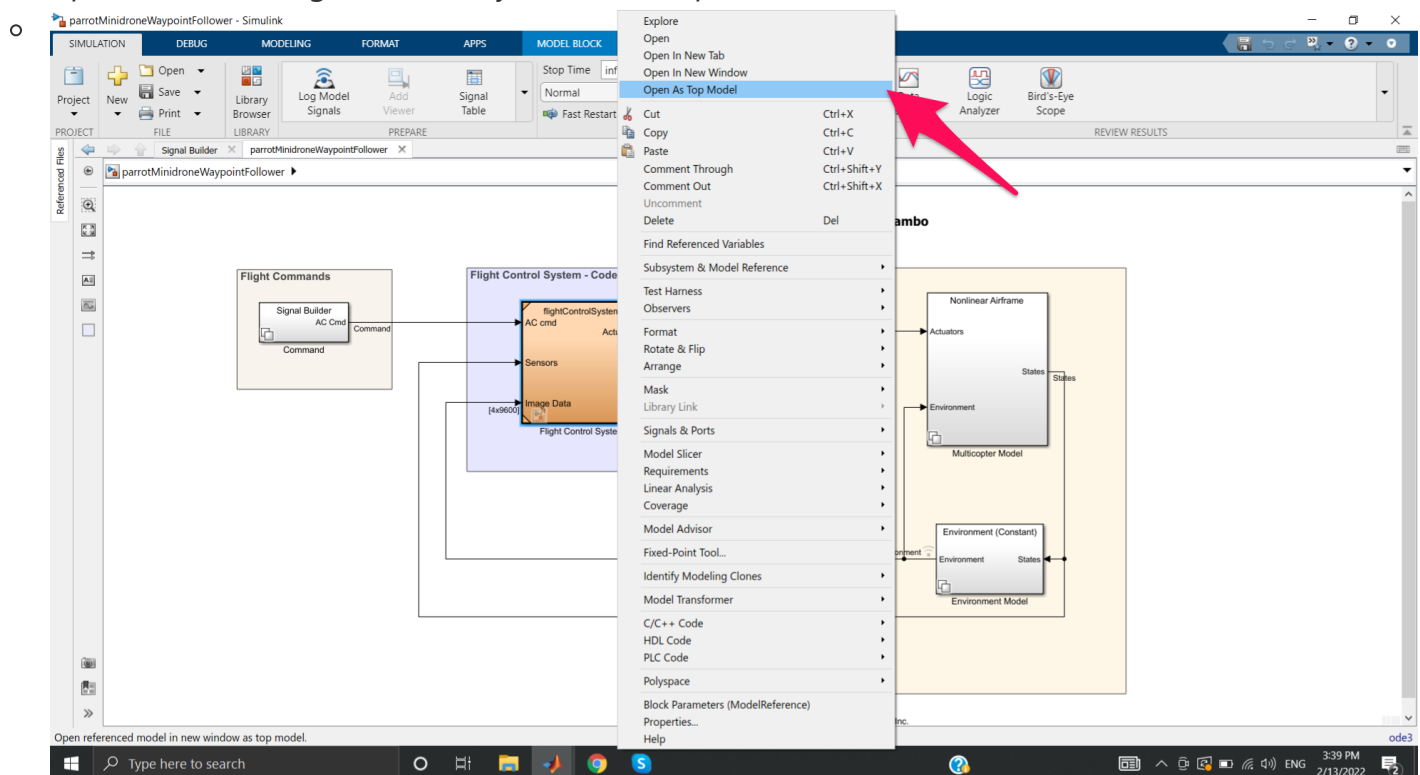
Model and Mambo Parrot Mini Drone Setup

1. Connect Mambo mini drone to the personal computer
 - [Download USB Bluetooth adapter drivers](#)
 - Follow the instruction(Step 1-4) of this [link](#) to connect mambo to the personal computer
2. Run the "[Spin the Motors of a Parrot Minidrone without Flying the Drone](#)" example to check connection and hardware
3. Enable data logging of Mambo mini drone and Simulink coder features
 - Open "Modeling Settings" in Simulink, go to "Code Generation/Interface/Advanced parameters" and enable "MAT-file logging"



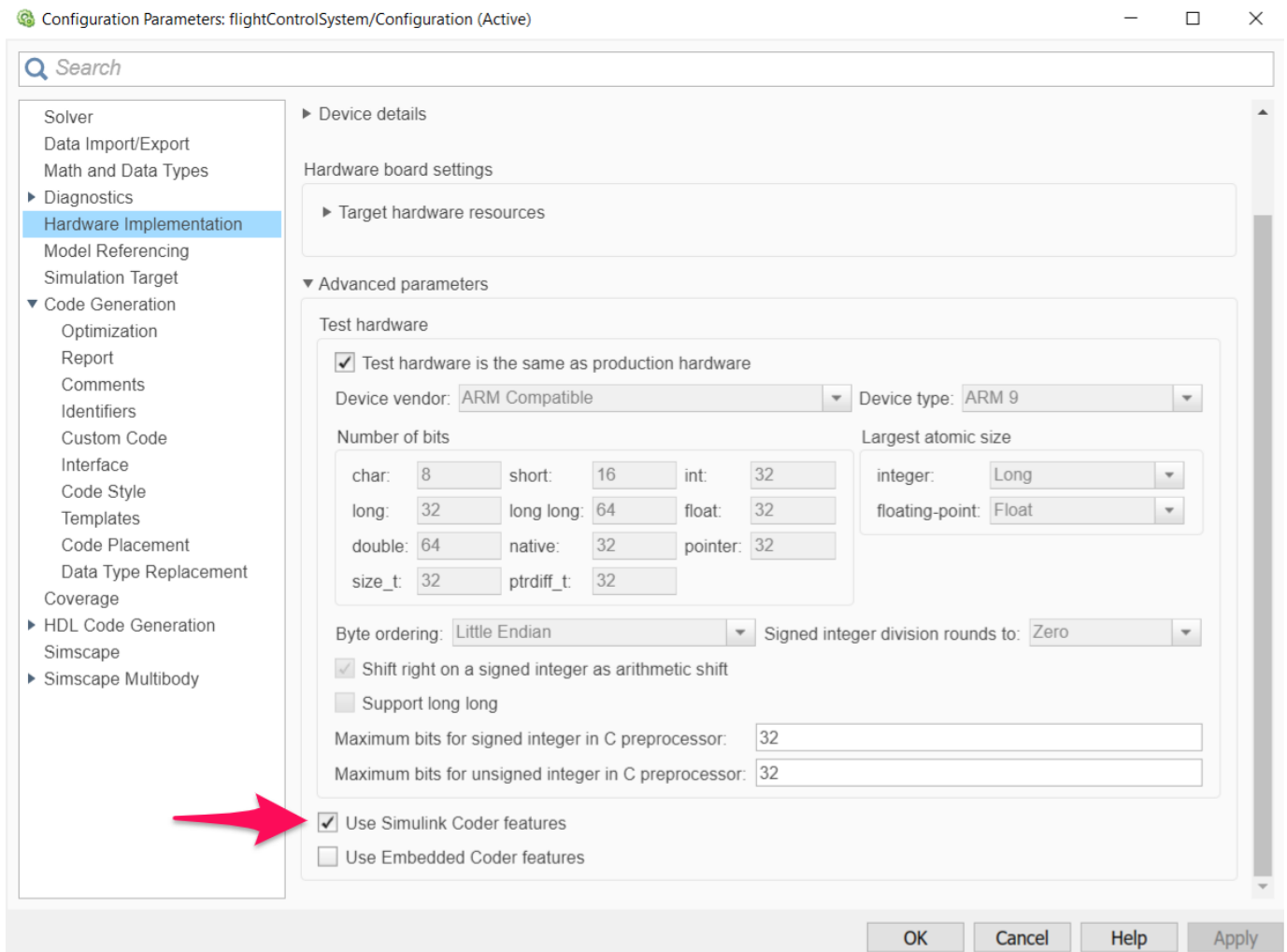


- Open the main "Flight Control System" as a top model



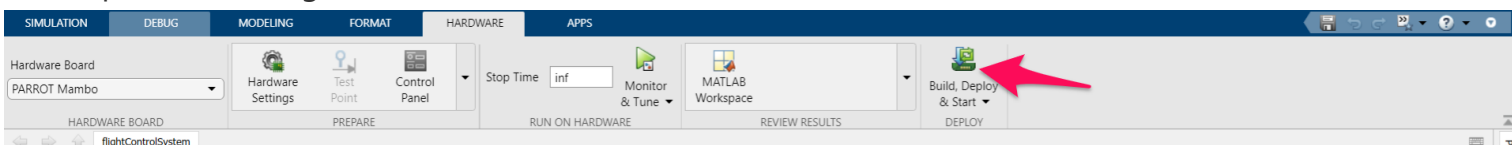
- Open the main "Hardware Settings", go to "Hardware Implementation/Advanced parameters" and enable "Use Simulink Coder features"



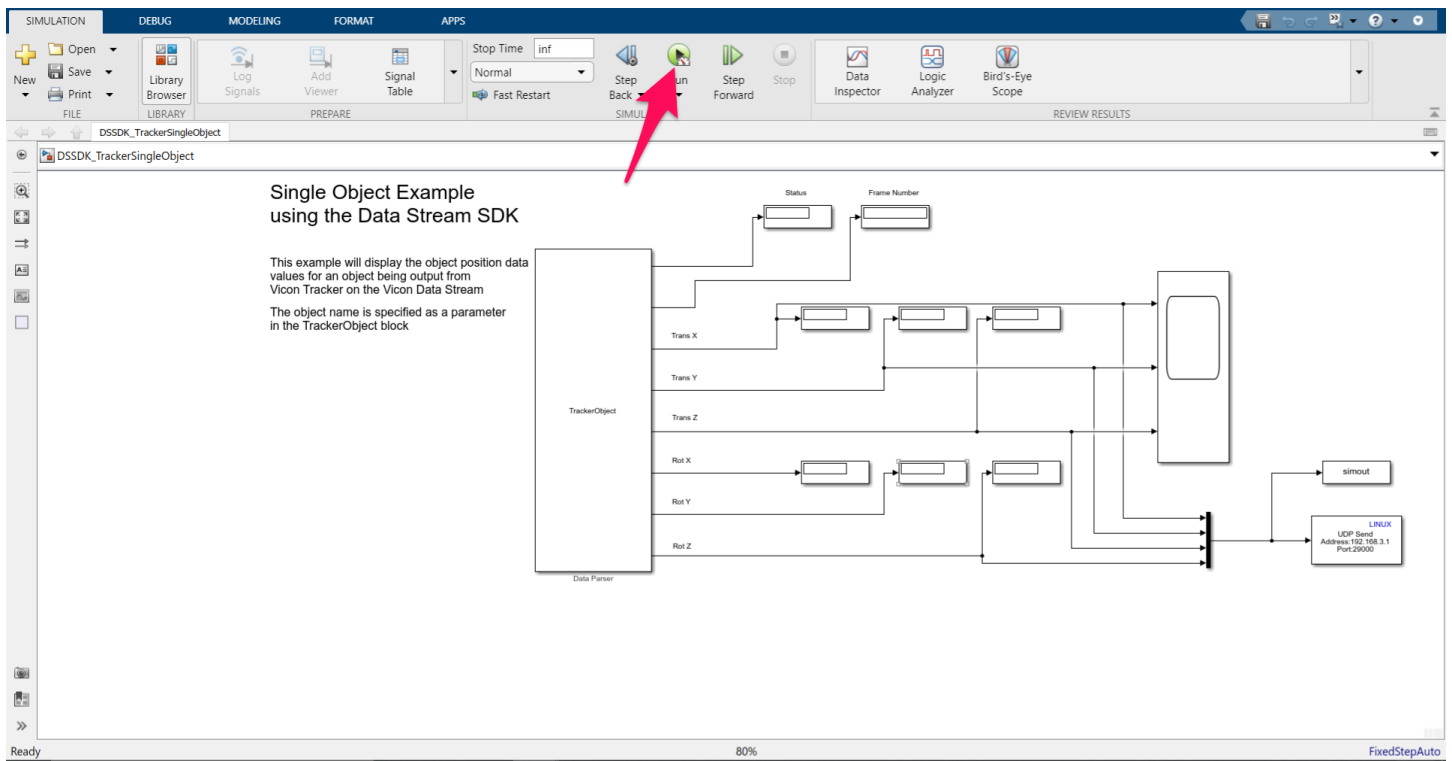


Running the experiment

1. Make sure the drone is connected to the personal computer
2. Choose the model of the flight(L1 On or L1 Off), choose flight trajectory, and press "Build, Deploy & Start". It will open "Parrot Flight Control Interface"



3. Run the program that receives the Vicon data and sends it to the drone



4. Click on the "START" button on "Parrot Flight Control Interface"
5. After the flight is finished press the "STOP" and then press the "MAT File" button to save logged data