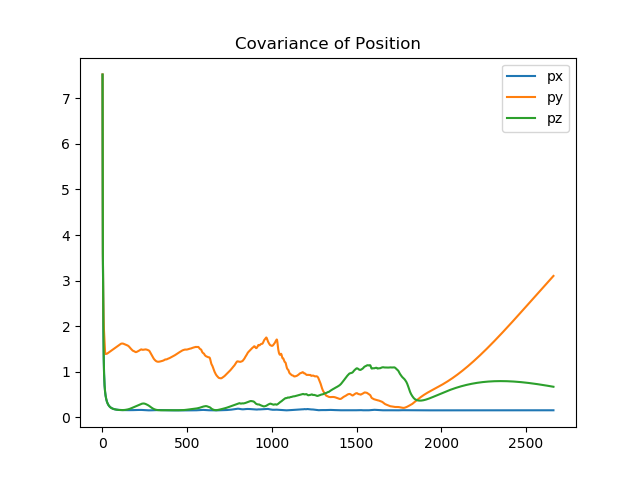
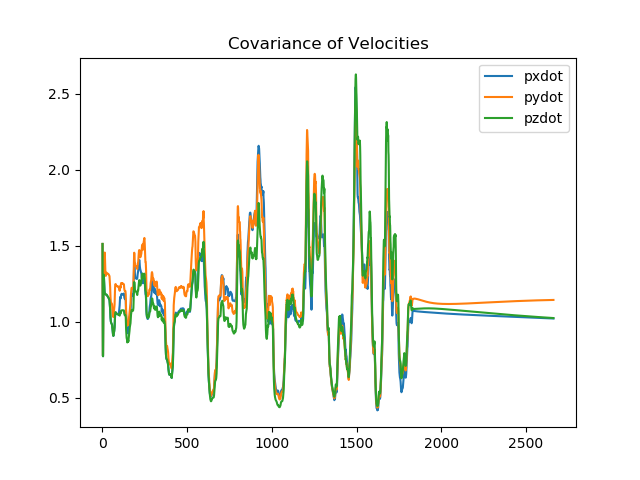
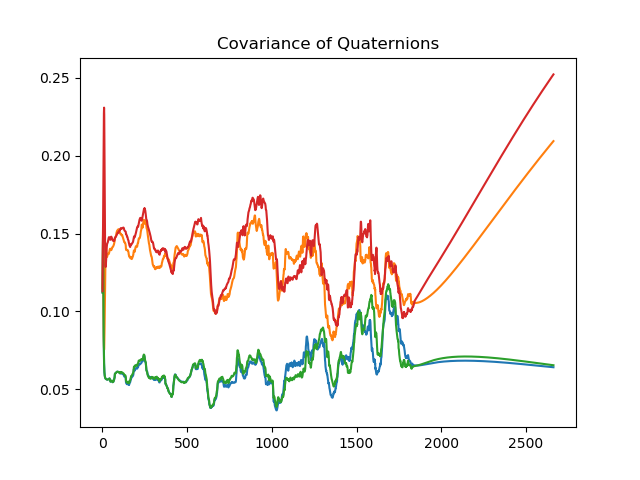
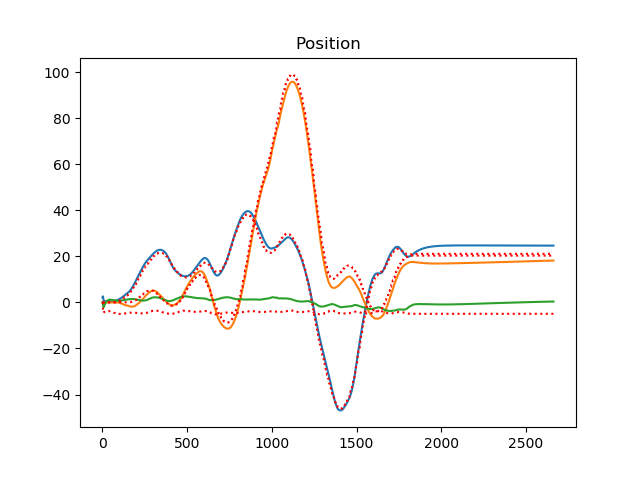
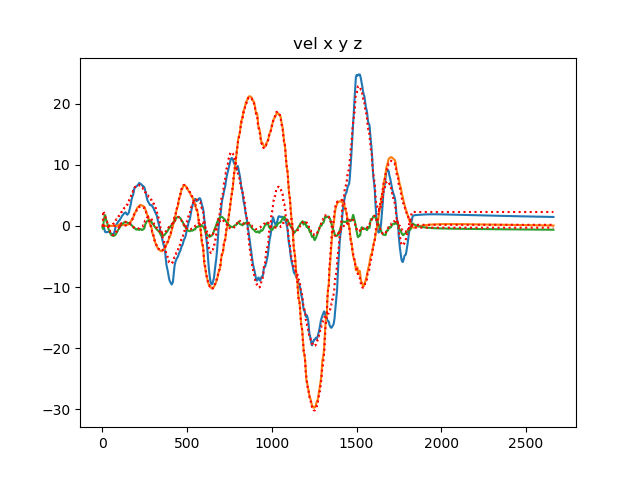
Q1

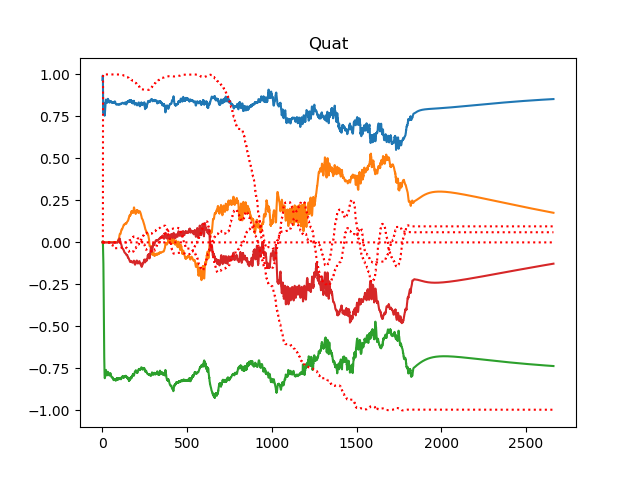


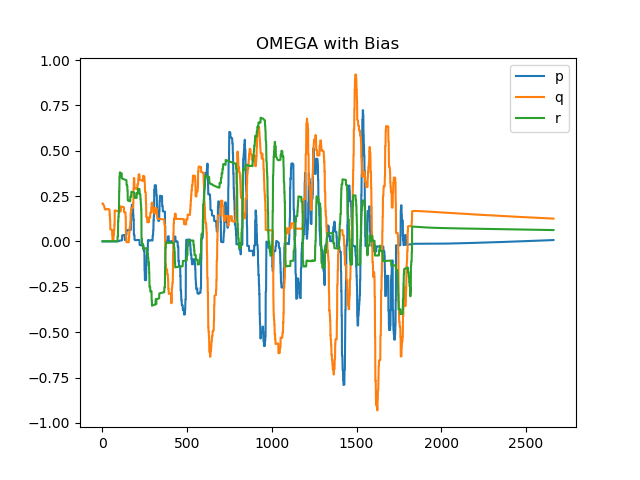


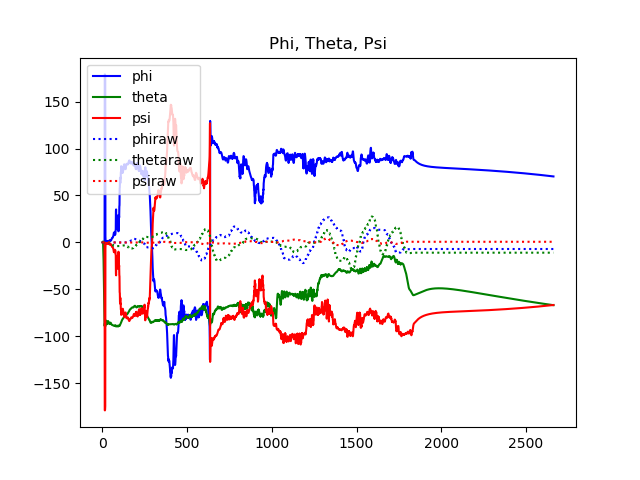


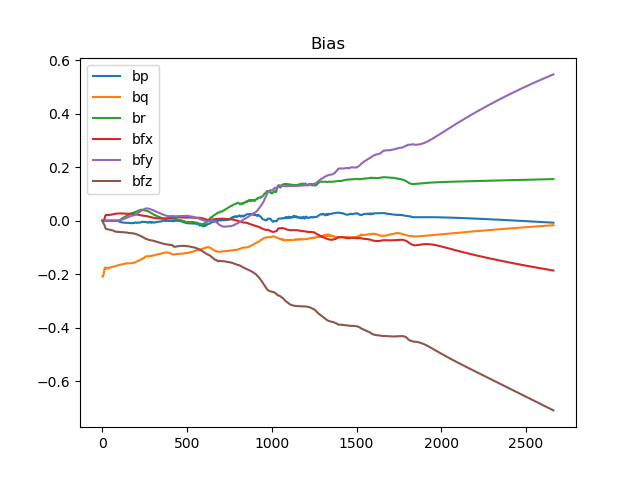


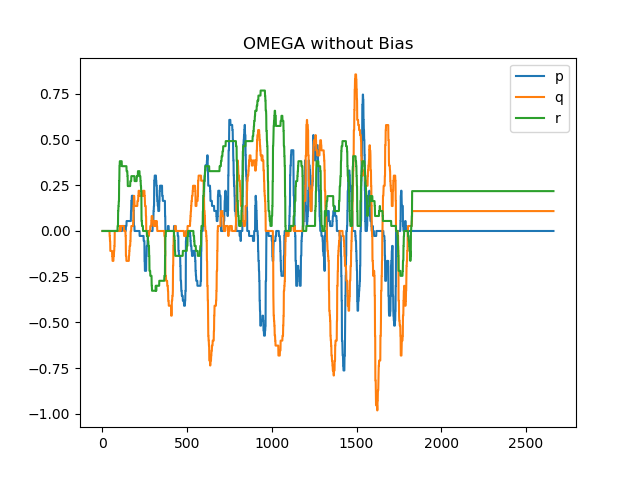


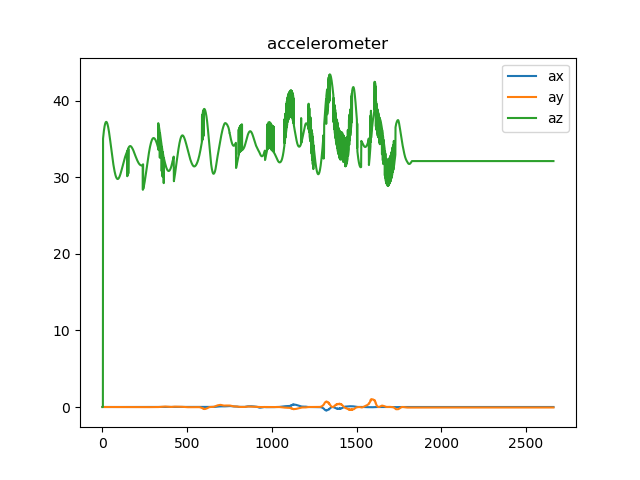






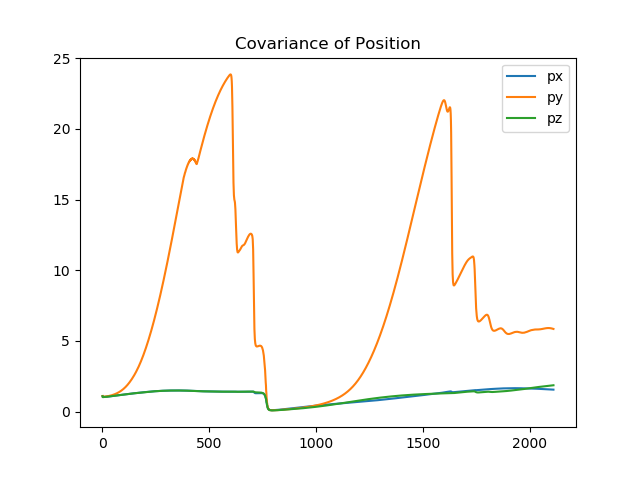


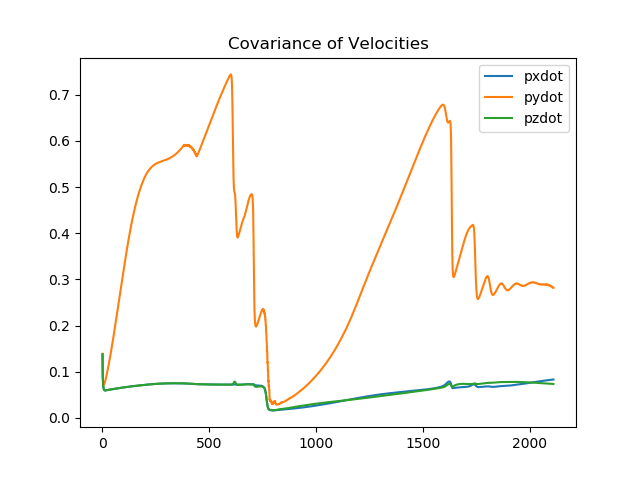


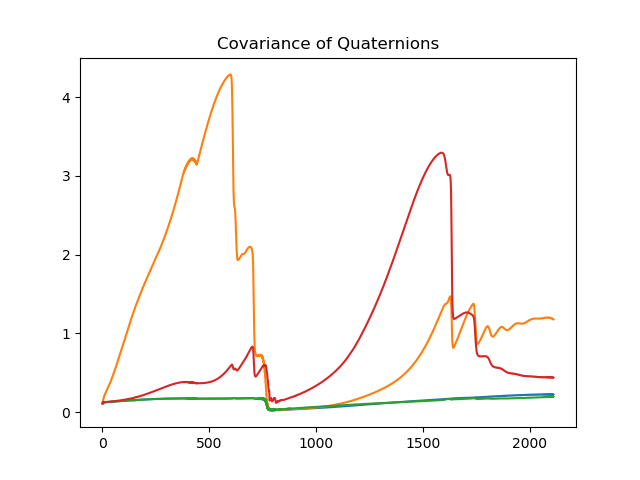


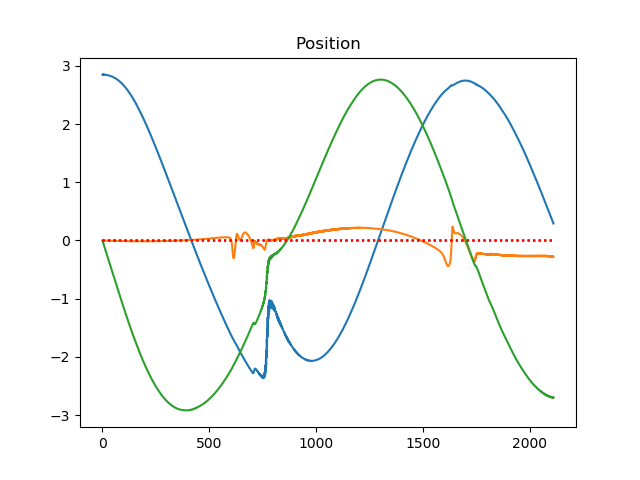
Q2

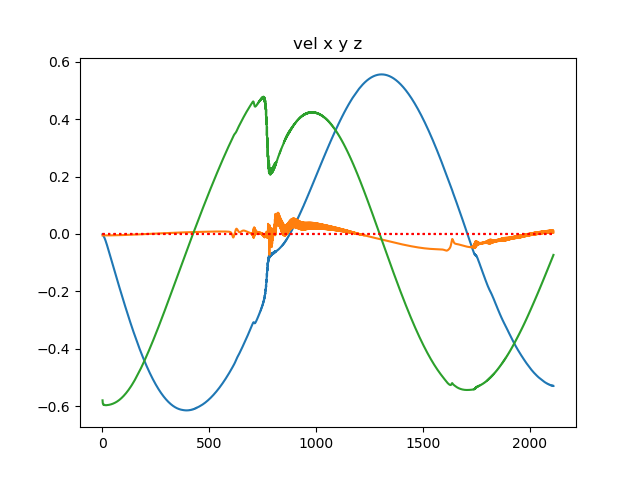
𝑅=[.1 .1 .1 .1 .1 .1]

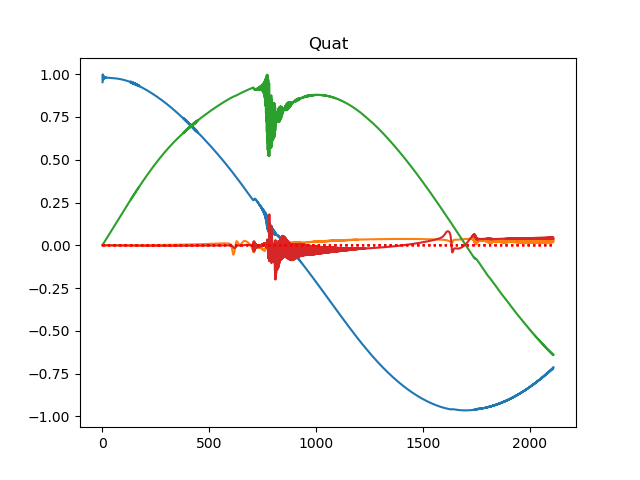


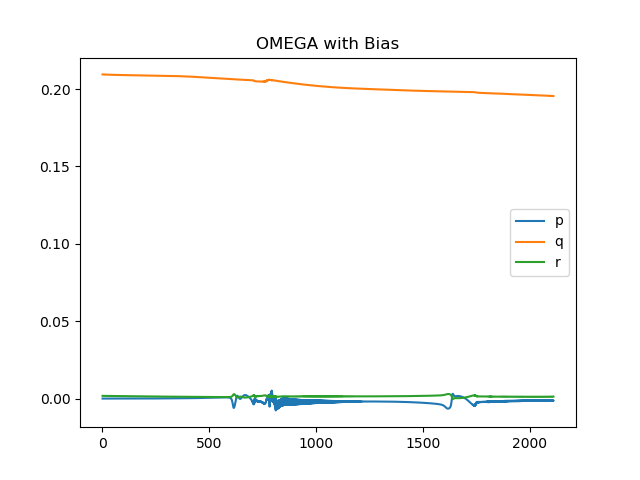


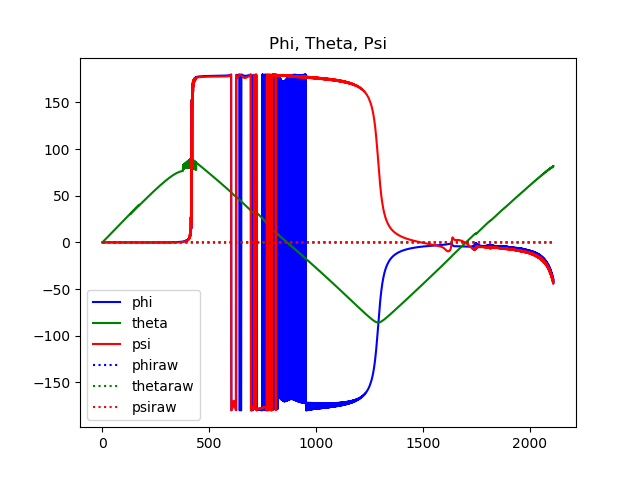


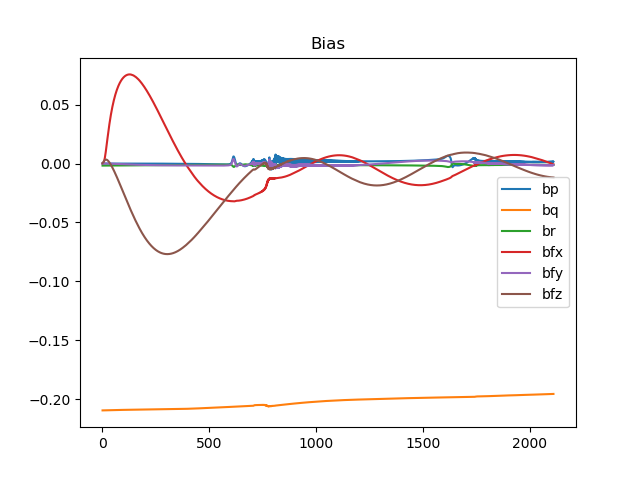


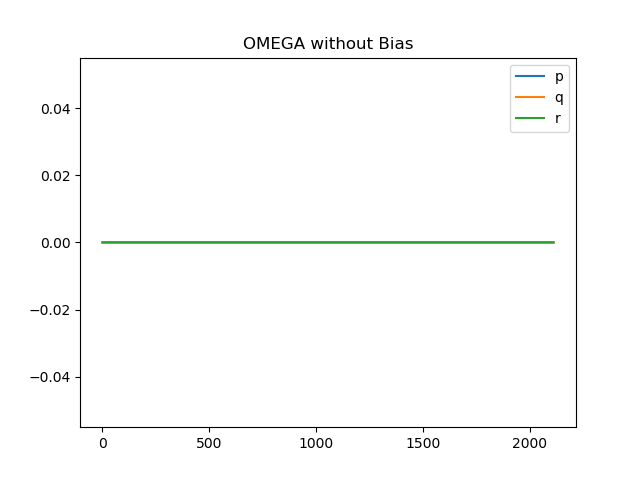


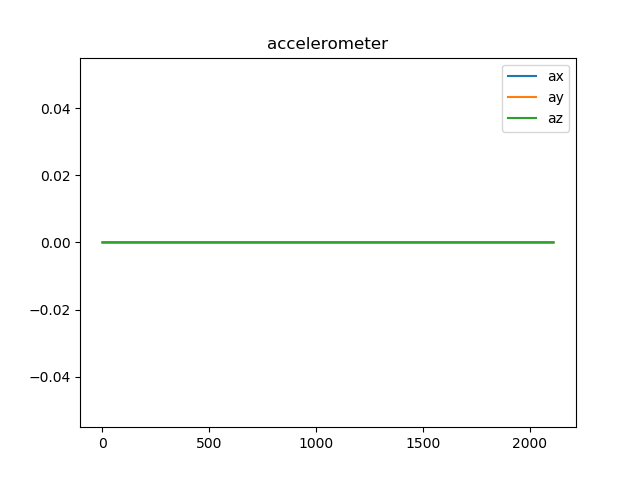






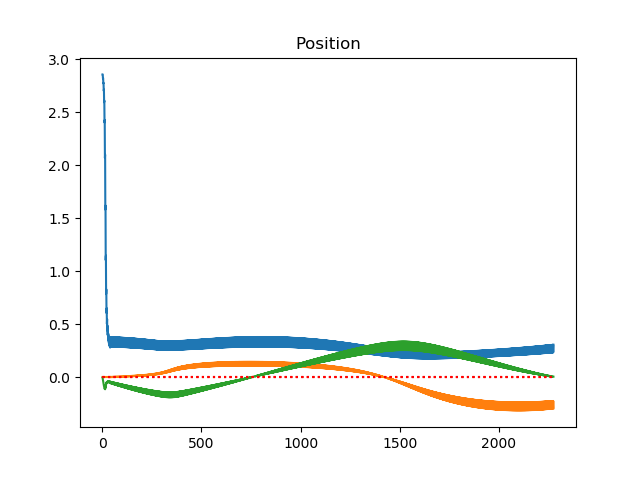
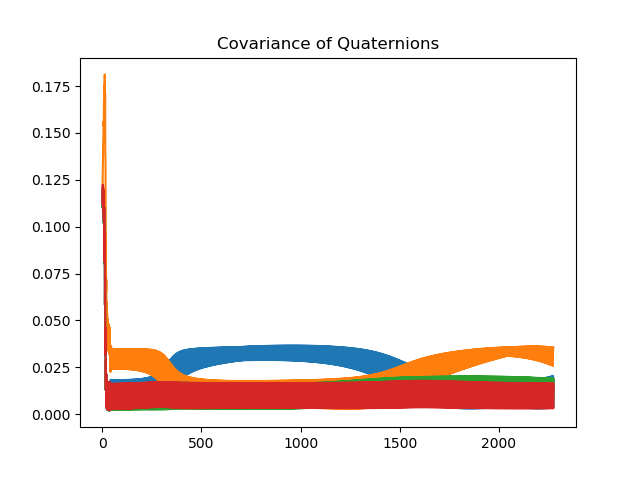
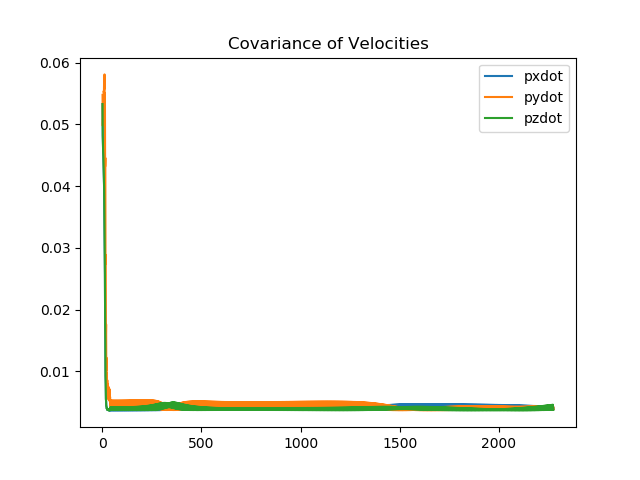
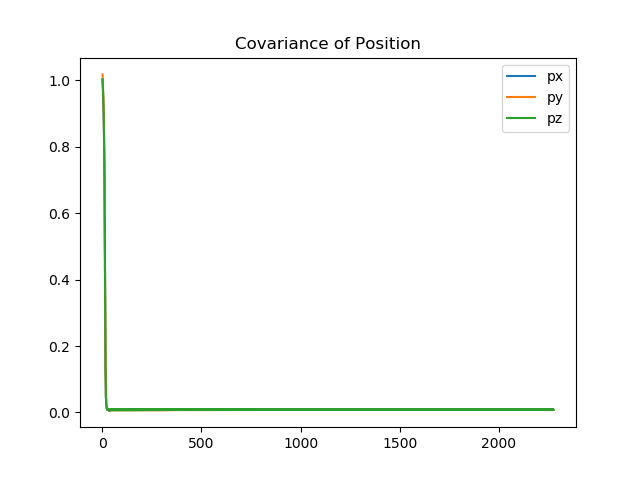


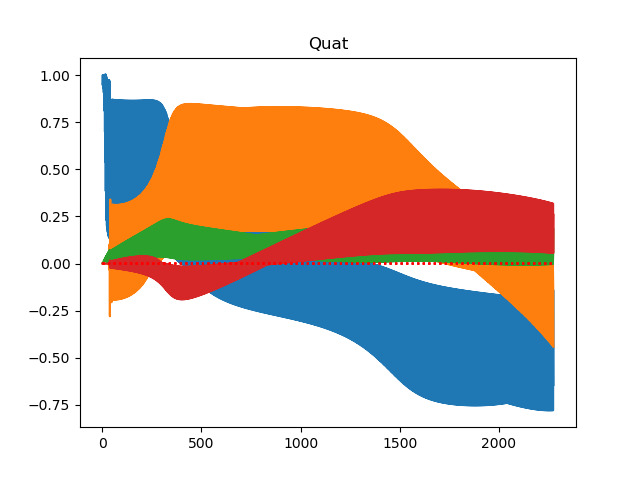
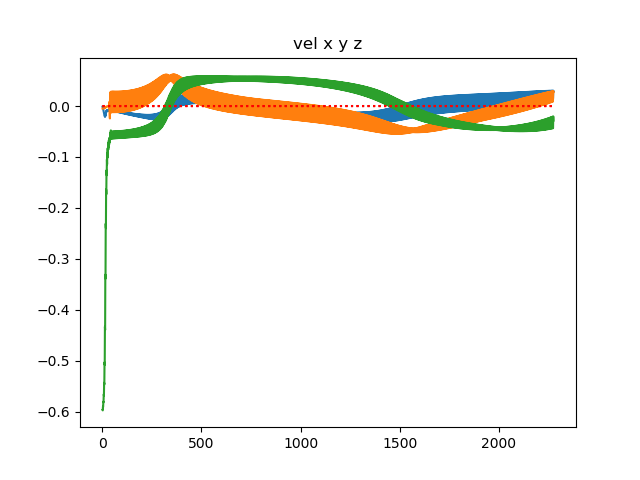


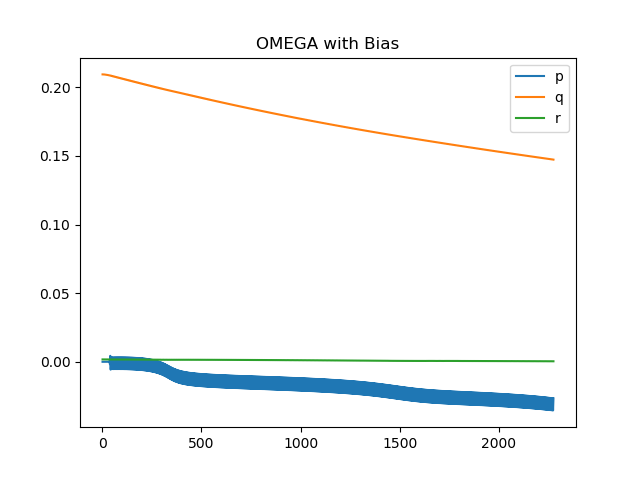


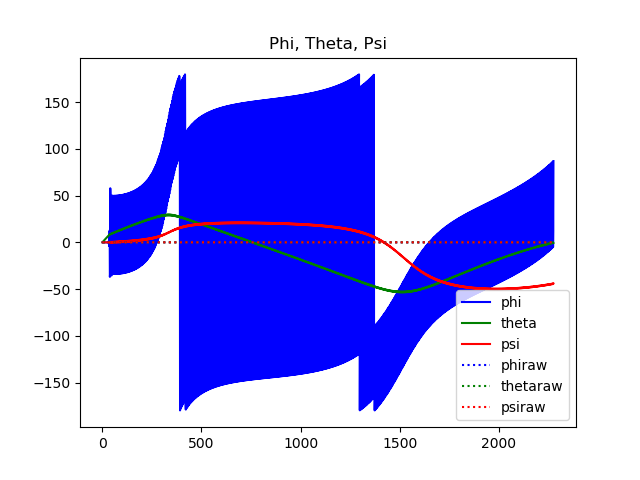
As we decrease the value of R, the estimation error of quaternion is much smaller than the situation in Q1, but estimation errors of position and velocity do not have obvious change. And the covariance of quaternion, velocity and position are smaller than the situation in the Q1.

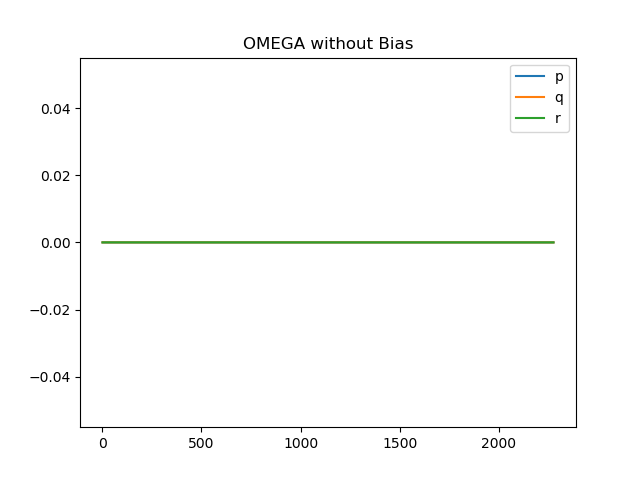
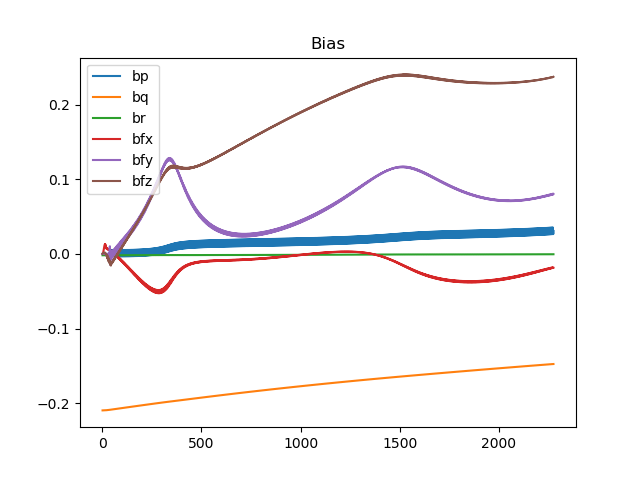
𝑅=[.01 .01 .01 .01 .01 .01]

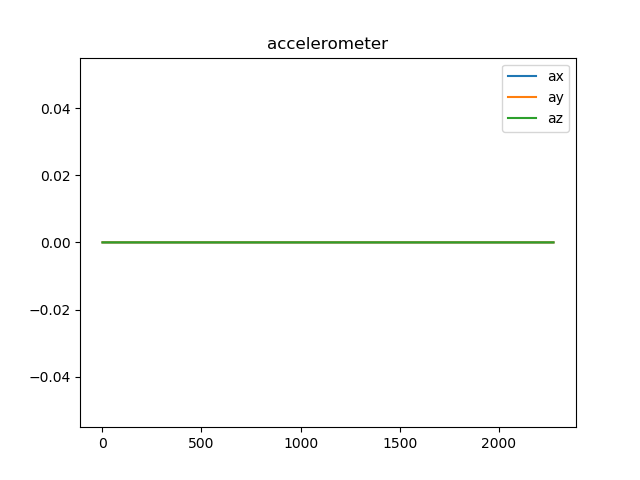






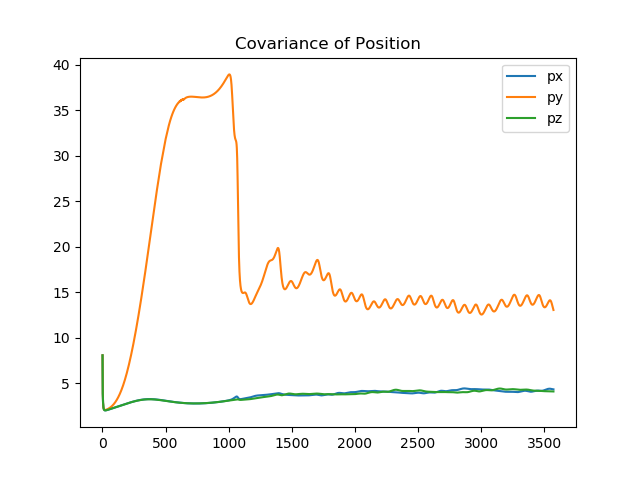


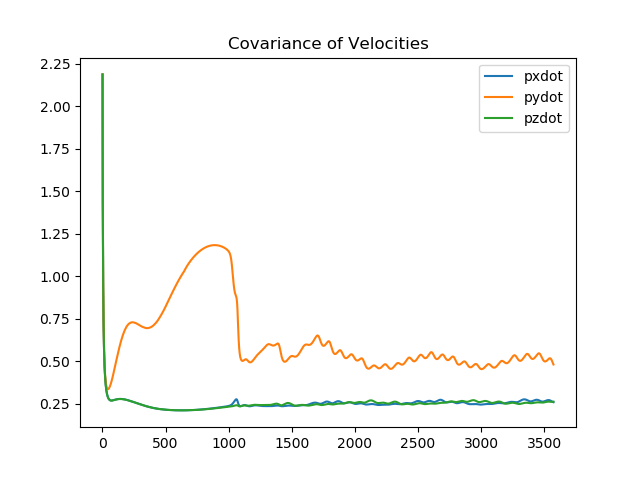


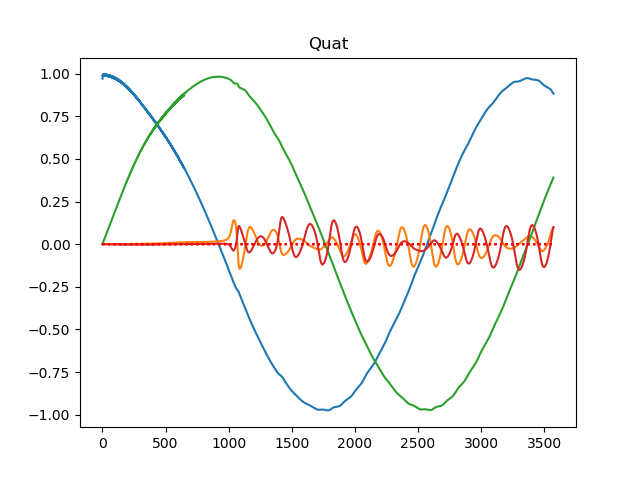
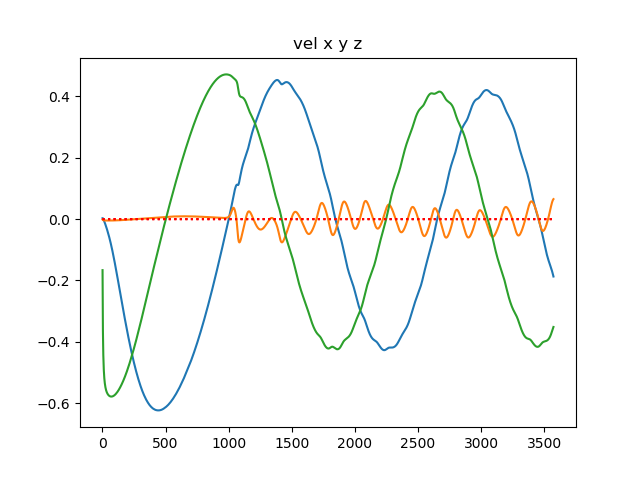
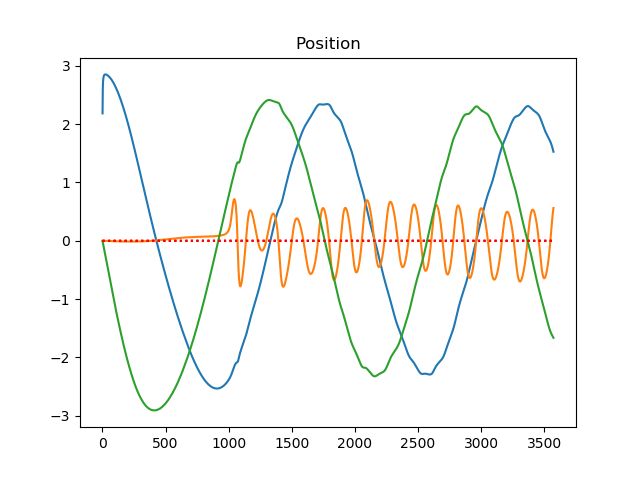
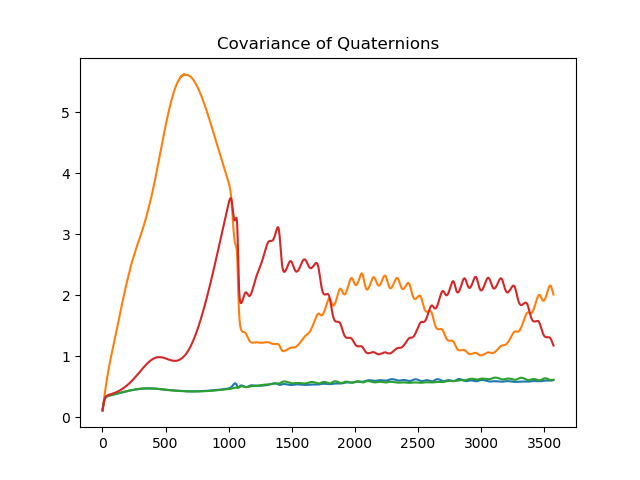


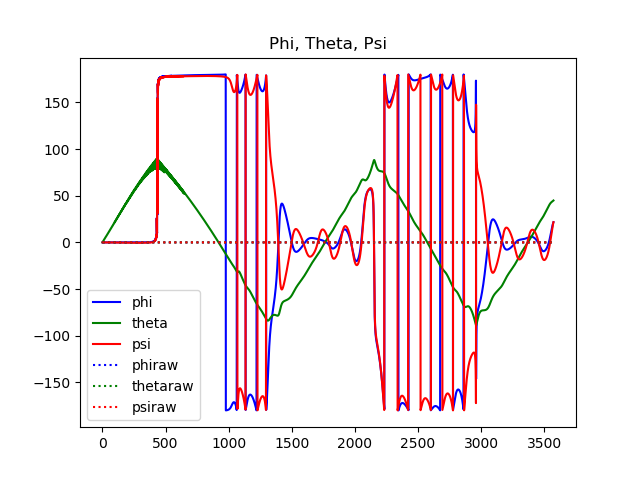
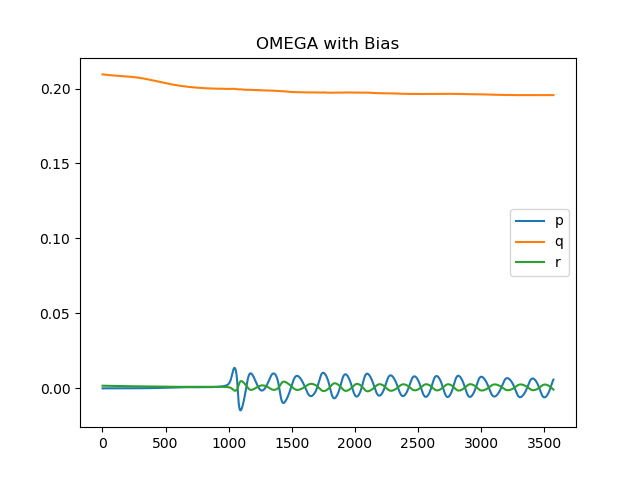
This time the R is too small and it vibrate a lot, since it is so close to the singular value.

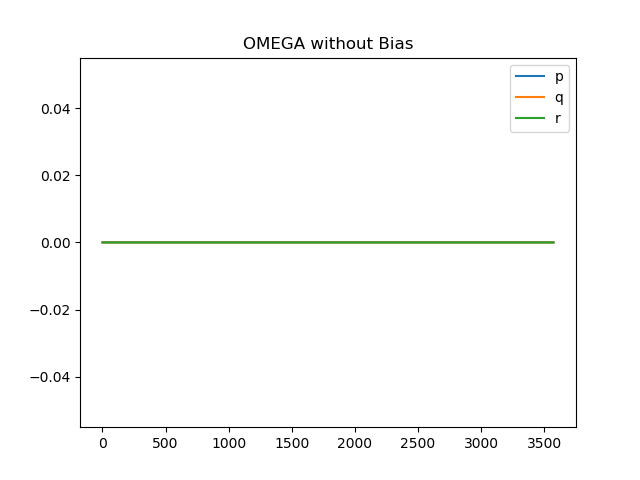
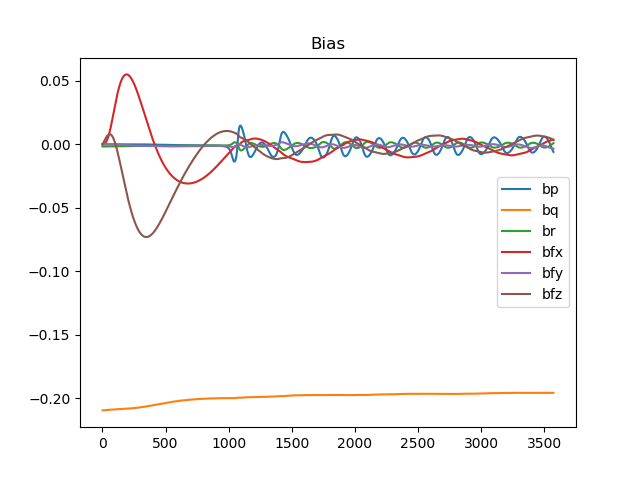
𝑅=[10 10 10 8 8 8]

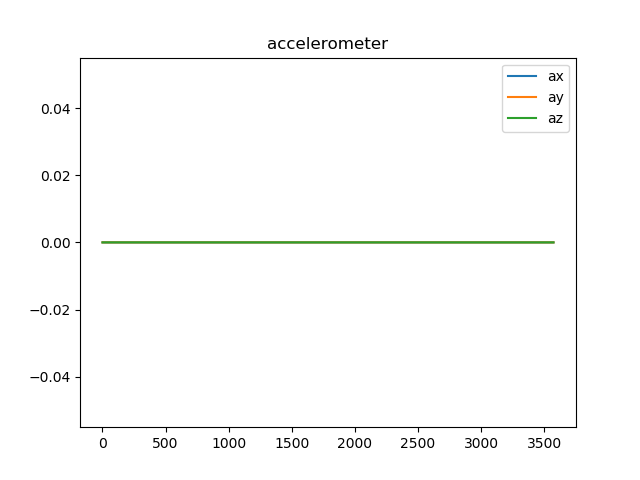






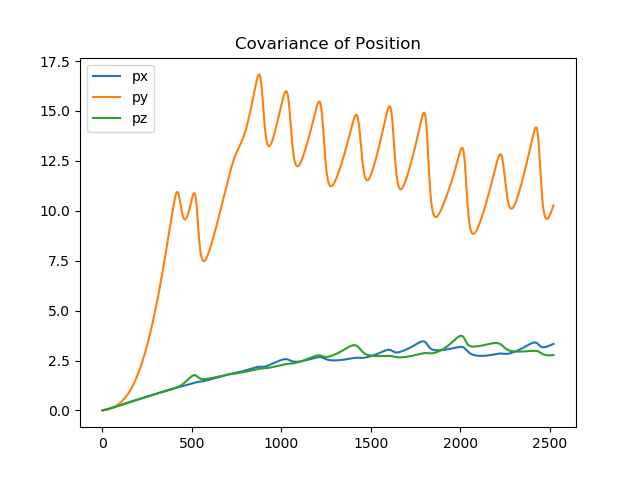


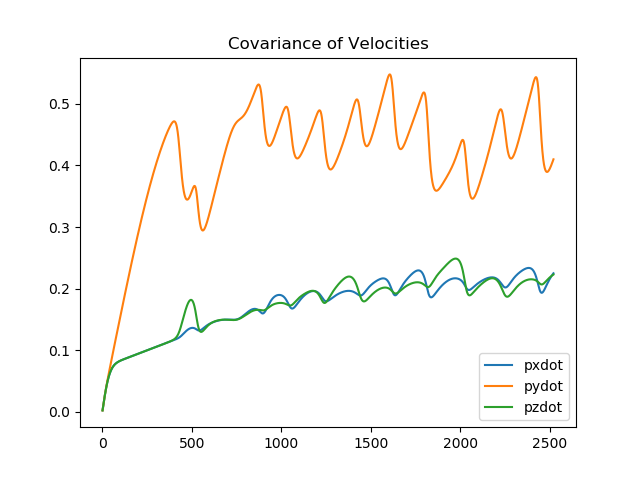


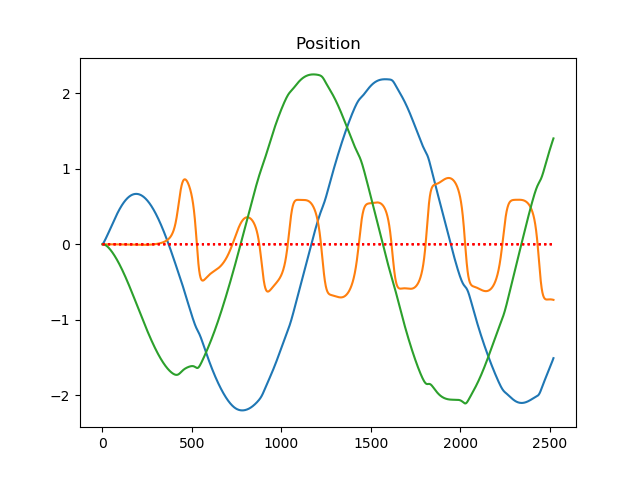
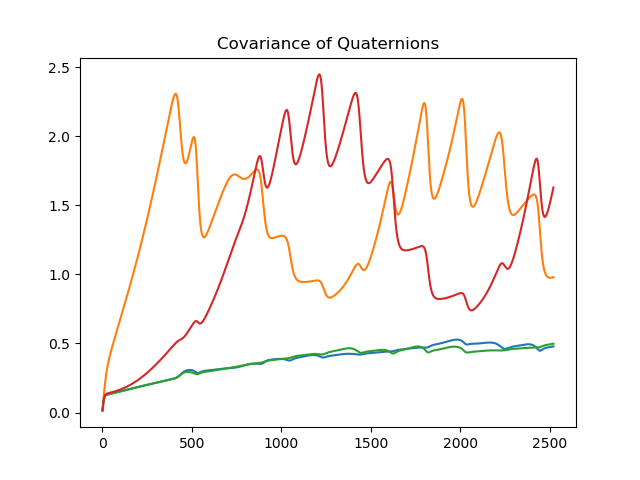


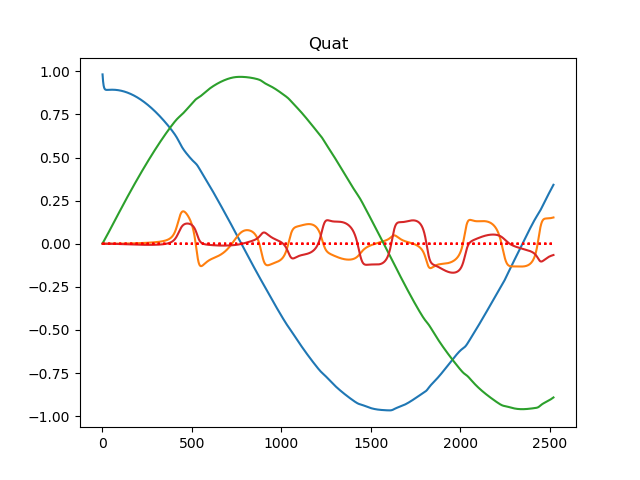
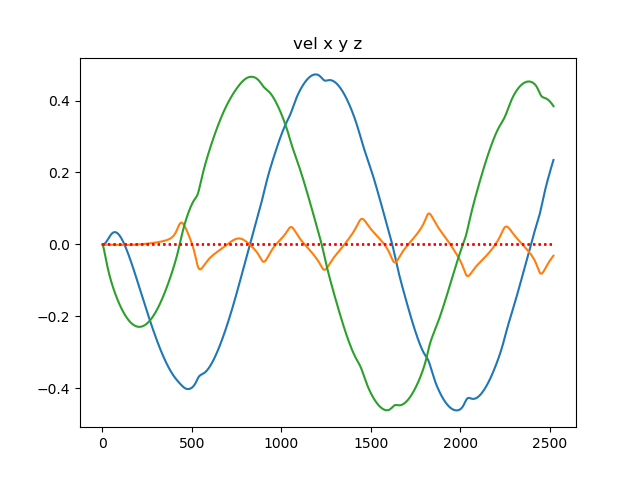
Estimation error of quaternion, position and velocity do not have obvious change. But the covariance of quaternion, velocity and position are little bigger than the situation in the Q1.

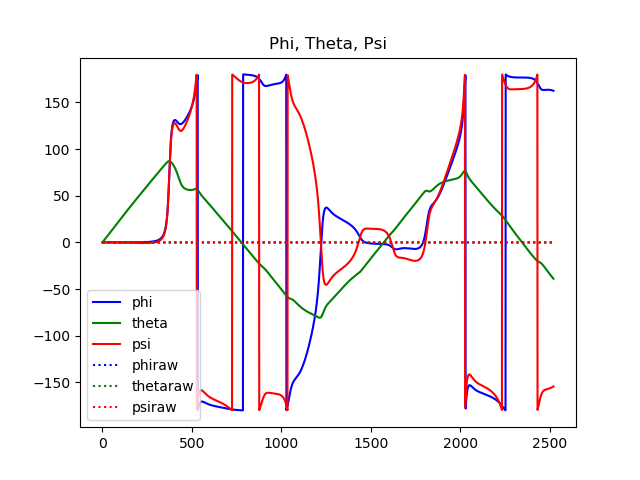
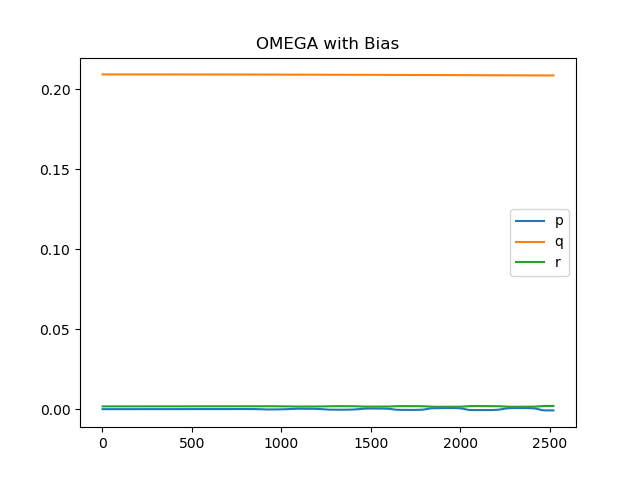
𝑄=0.0001∗𝑄𝑜𝑟𝑖𝑔𝑖𝑛𝑎𝑙

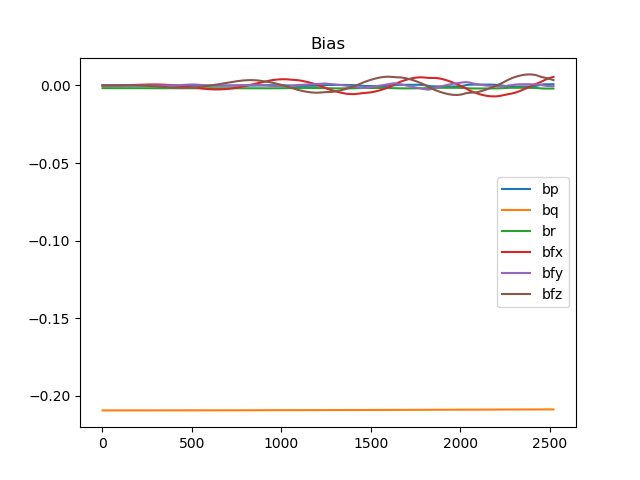


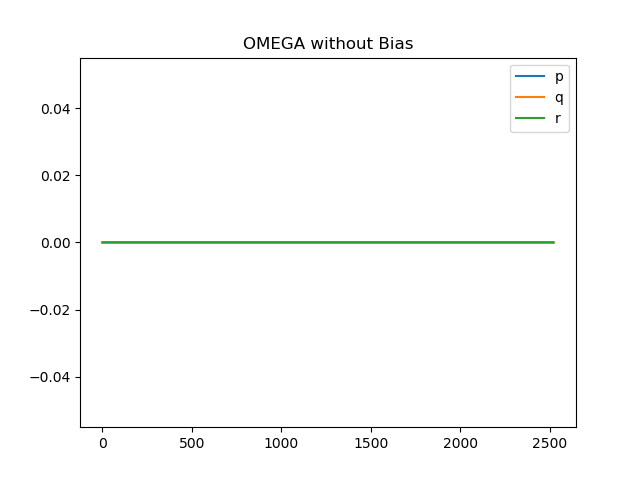


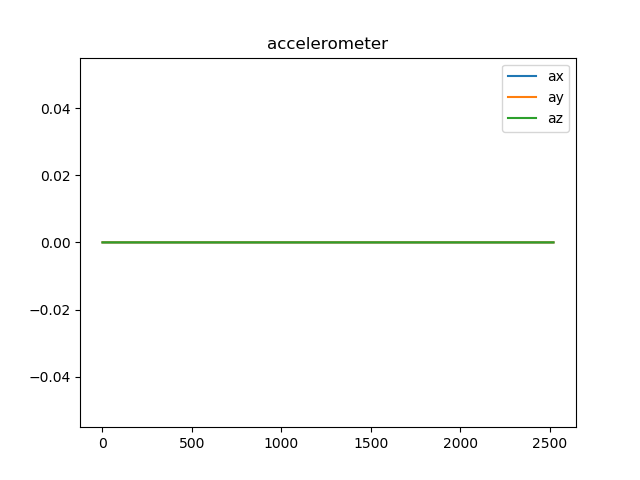






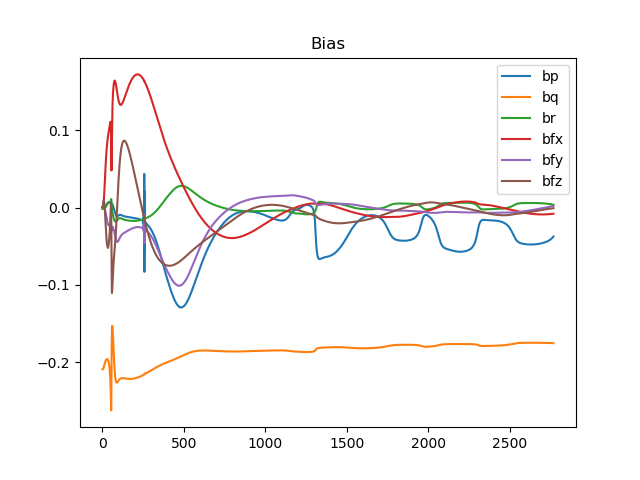
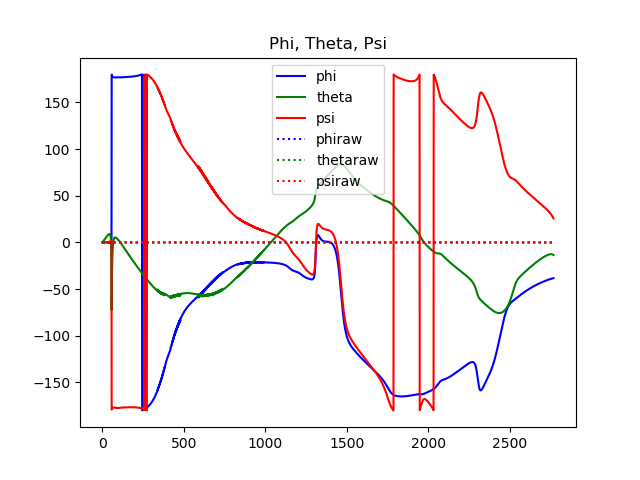
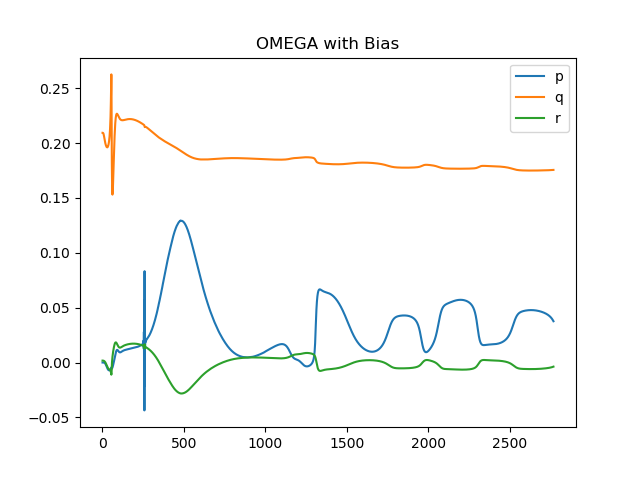
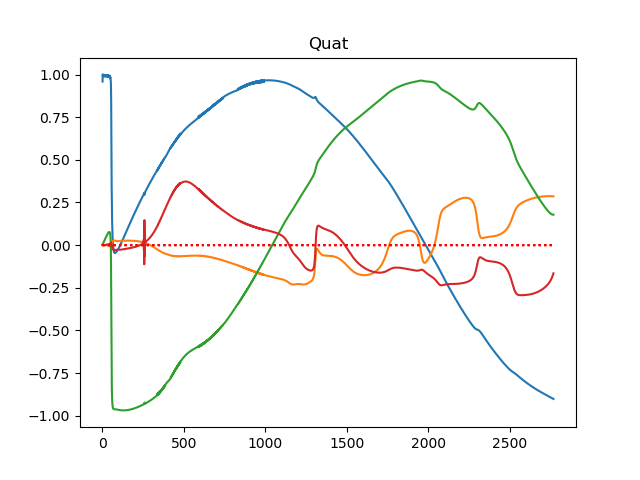
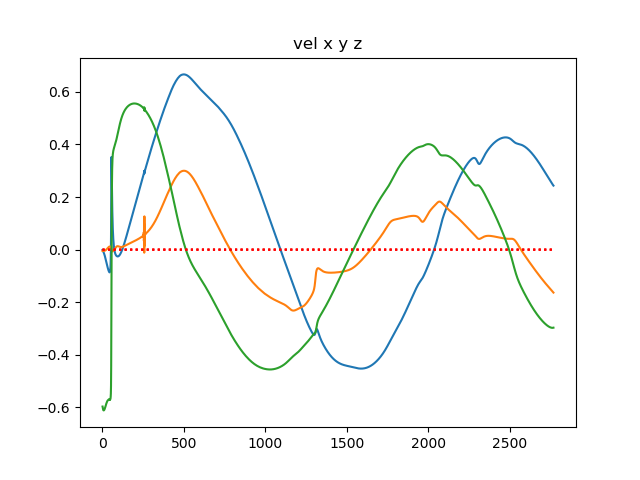
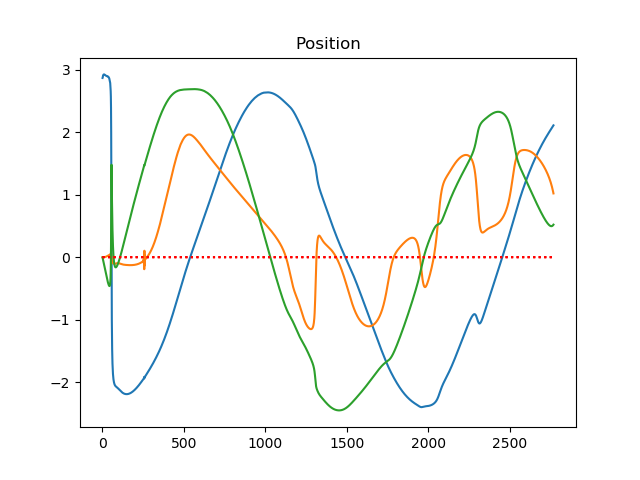
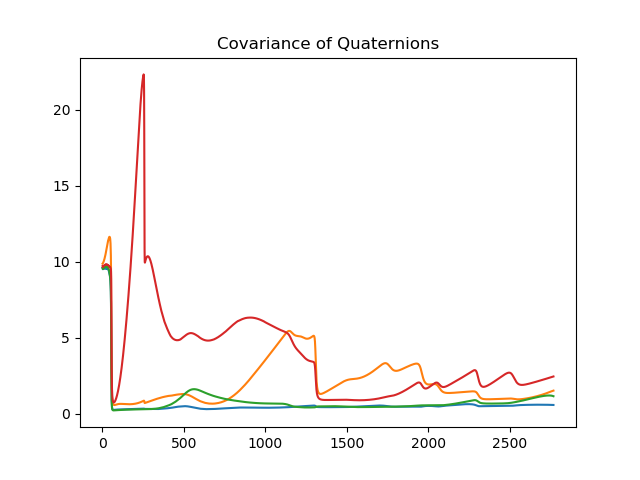
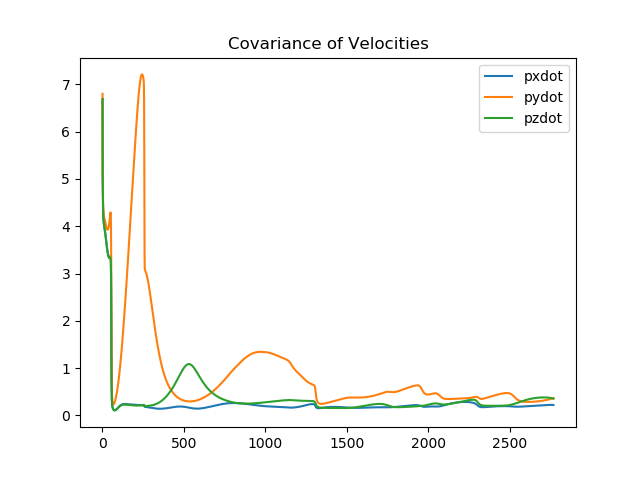
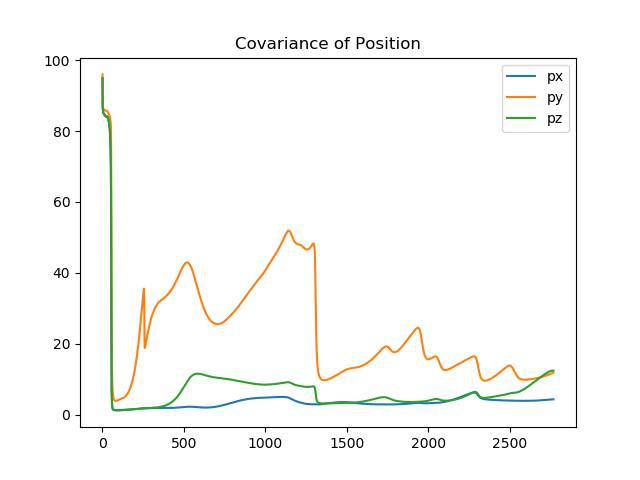


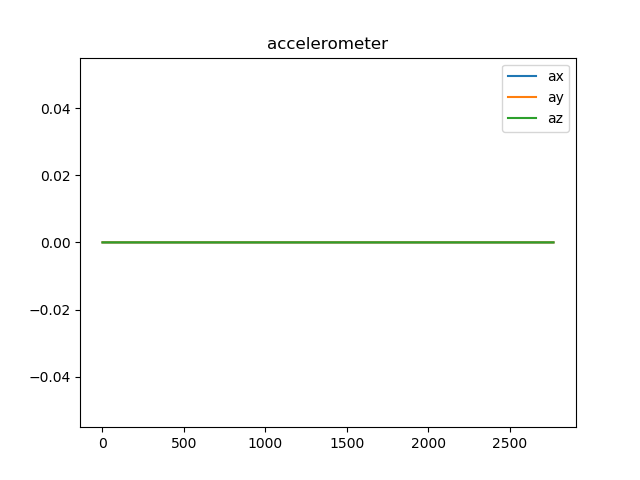
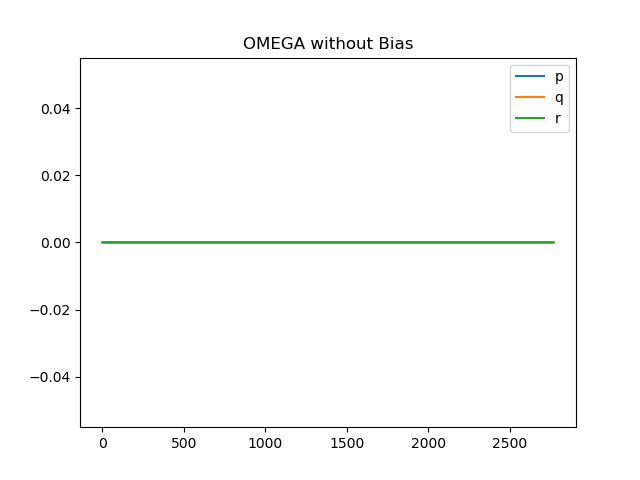




Estimation error of quaternion is smaller than the situation in Q1, and estimation errors of position do not have obvious change, but estimation errors of velocity is a little bigger than the situation in Q1. And the covariance of quaternion, velocity and position are almost zero which are much smaller than the situation in the Q1.

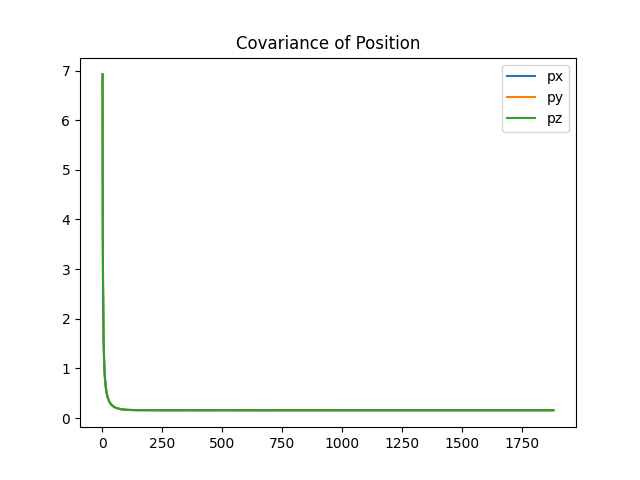
𝑄=100∗𝑄𝑜𝑟𝑖𝑔𝑖𝑛𝑎𝑙

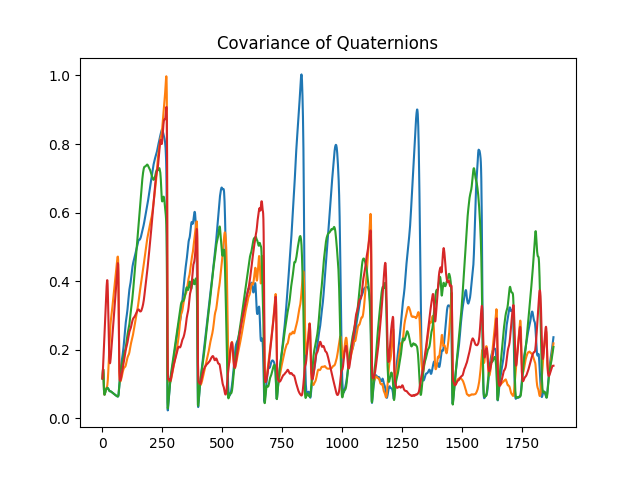


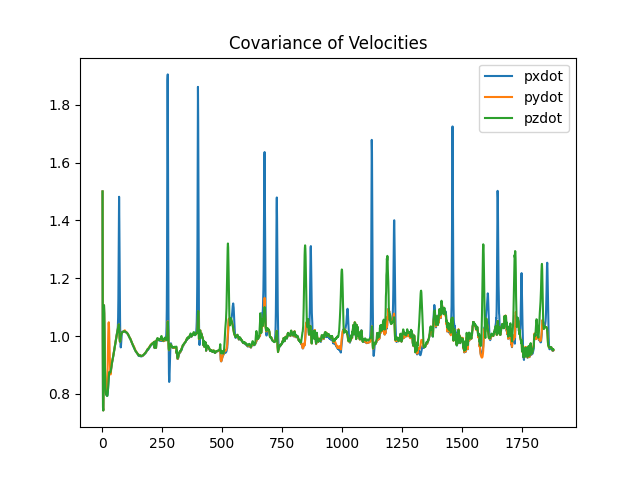


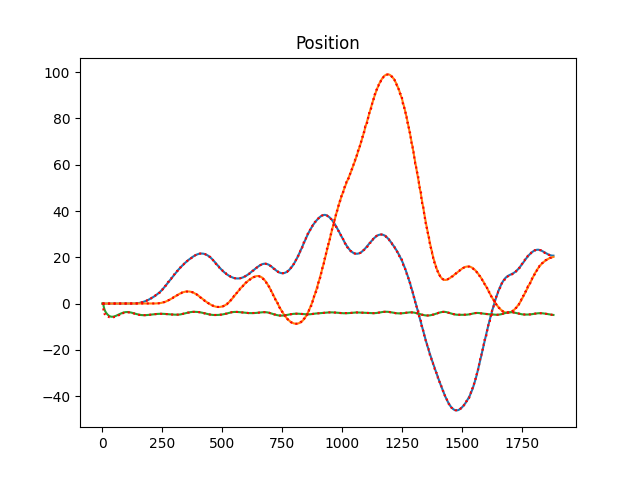
Estimation error of quaternion, position and velocity are much bigger than the situation in the Q1. And the covariance of quaternion, velocity and position are also much bigger than the situation in the Q1.

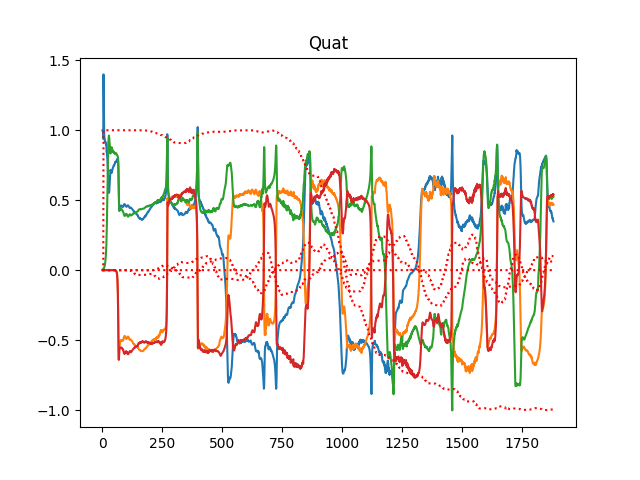
Q3

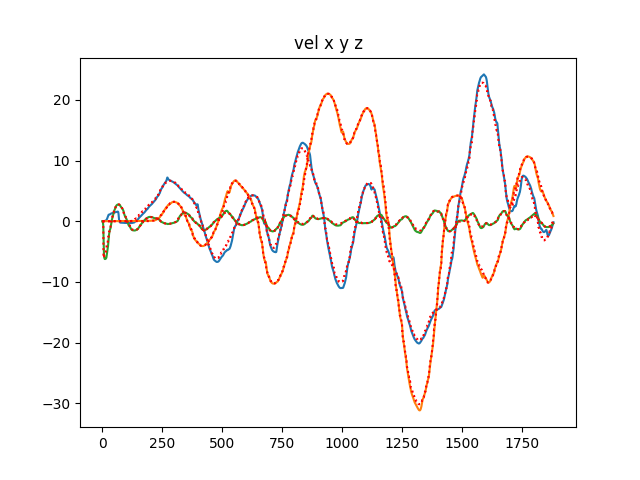












As we set rgps = [0, 0, 0], it won’t have influence on the position estimation, but will have influence on attitude estimation since yaw angle is not observable with accelerometer and gyroscope. So the GPS should not be mounted at CG.