

Calibration results

Normalized Residuals

Reprojection error (cam0): mean 0.35164997031214495, median 0.2758938274978507, std: 0.38263769243299417
Gyroscope error (imu0): mean 0.5508316845238014, median 0.4265025866902543, std: 0.45949432588633965
Accelerometer error (imu0): mean 0.4018299839775261, median 0.3160111169819242, std: 0.30536465466143403
Gyroscope error (imu1): mean 0.5625790245246701, median 0.43825940954821296, std: 0.4668987065914352
Accelerometer error (imu1): mean 0.5443842466111419, median 0.427748773741917, std: 0.41380220289776415
Gyroscope error (imu2): mean 0.6911399224268491, median 0.5034558196082608, std: 0.6354461873293337
Accelerometer error (imu2): mean 0.5593694999502881, median 0.40894376646292374, std: 0.5748566935175848

Residuals

Reprojection error (cam0) [px]: mean 0.35164997031214495, median 0.2758938274978507, std: 0.38263769243299417
Gyroscope error (imu0) [rad/s]: mean 0.0023749810814823347, median 0.0018389203145936035, std: 0.0019811684071368643
Accelerometer error (imu0) [m/s^2]: mean 0.10885201835628049, median 0.0856044826869589, std: 0.08272045471953808
Gyroscope error (imu1) [rad/s]: mean 0.0023974009871270386, median 0.0018676194725822464, std: 0.0019896643338531707
Accelerometer error (imu1) [m/s^2]: mean 0.10891350558614393, median 0.08557855733045194, std: 0.08278830406541357
Gyroscope error (imu2) [rad/s]: mean 0.014200810244588023, median 0.010344476319188693, std: 0.013056474433172243
Accelerometer error (imu2) [m/s^2]: mean 0.05727425207405917, median 0.04187205124089572, std: 0.058859997146630934

Transformation (cam0):

T_ci: (imu0 to cam0):

```
[[-0.9999065  0.00095687  0.01364072 -0.06743569]
 [-0.01364745 -0.00741463 -0.99987938 -0.02301204]
 [-0.00085561 -0.99997205  0.007427  -0.06023924]
 [ 0.          0.          0.          1.        ]]
```

T_ic: (cam0 to imu0):

```
[[-0.9999065 -0.01364745 -0.00085561 -0.06779498]
 [ 0.00095687 -0.00741463 -0.99997205 -0.06034366]
 [ 0.01364072 -0.99987938  0.007427  -0.021642 ]
 [ 0.          0.          0.          1.        ]]
```

timeshift cam0 to imu0: [s] (t_imu = t_cam + shift)
-0.009385852580947361

Gravity vector in target coords: [m/s^2]
[0.03861705 -9.80616309 0.07808358]

Calibration configuration

cam0

Camera model: pinhole

Focal length: [392.7352416807462, 392.46761004151523]

Principal point: [320.3231925591704, 237.24499769351658]

Distortion model: radtan

Distortion coefficients: [-0.32772350969262365, 0.09163684502591998, 0.0008697162603619496,
0.00033763553008746424]

Type: aprilgrid

Tags:

Rows: 6

Cols: 6

Size: 0.088 [m]

Spacing 0.02639999999999996 [m]

IMU configuration

IMU0:

Model: calibrated

Update rate: 100

Accelerometer:

Noise density: 0.027089073164427782

Noise density (discrete): 0.2708907316442778

Random walk: 0.0026405437265548015

Gyroscope:

Noise density: 0.0004311627577370619

Noise density (discrete): 0.0043116275773706185

Random walk: 5.5971879319209416e-05

T_{ib} (imu0 to imu0)

$\begin{bmatrix} 1. & 0. & 0. & 0. \end{bmatrix}$

$\begin{bmatrix} 0. & 1. & 0. & 0. \end{bmatrix}$

$\begin{bmatrix} 0. & 0. & 1. & 0. \end{bmatrix}$

$\begin{bmatrix} 0. & 0. & 0. & 1. \end{bmatrix}$

time offset with respect to IMU0: 0.0 [s]

IMU1:

Model: calibrated

Update rate: 100

Accelerometer:

Noise density: 0.02000673352767714

Noise density (discrete): 0.2000673352767714

Random walk: 0.001224627431466927

Gyroscope:

Noise density: 0.0004261447516911305

Noise density (discrete): 0.004261447516911304

Random walk: 2.14534407581717e-05

T_{ib} (imu0 to imu1)

$\begin{bmatrix} 1. & -0.00002219 & -0.00007469 & 0.00058255 \end{bmatrix}$

$\begin{bmatrix} 0.00002219 & 0.99999999 & 0.0001003 & 0.00026673 \end{bmatrix}$

$\begin{bmatrix} 0.00007469 & -0.0001003 & 0.99999999 & -0.00116703 \end{bmatrix}$

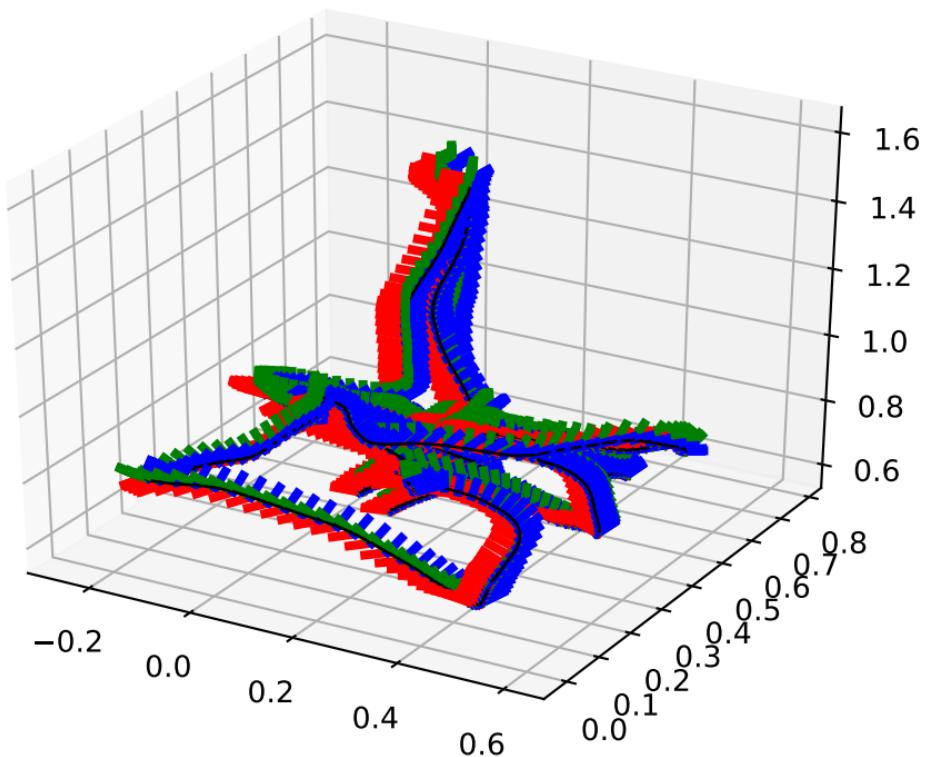
$\begin{bmatrix} 0. & 0. & 1. & 0. \end{bmatrix}$

time offset with respect to IMU0: 0.0 [s]

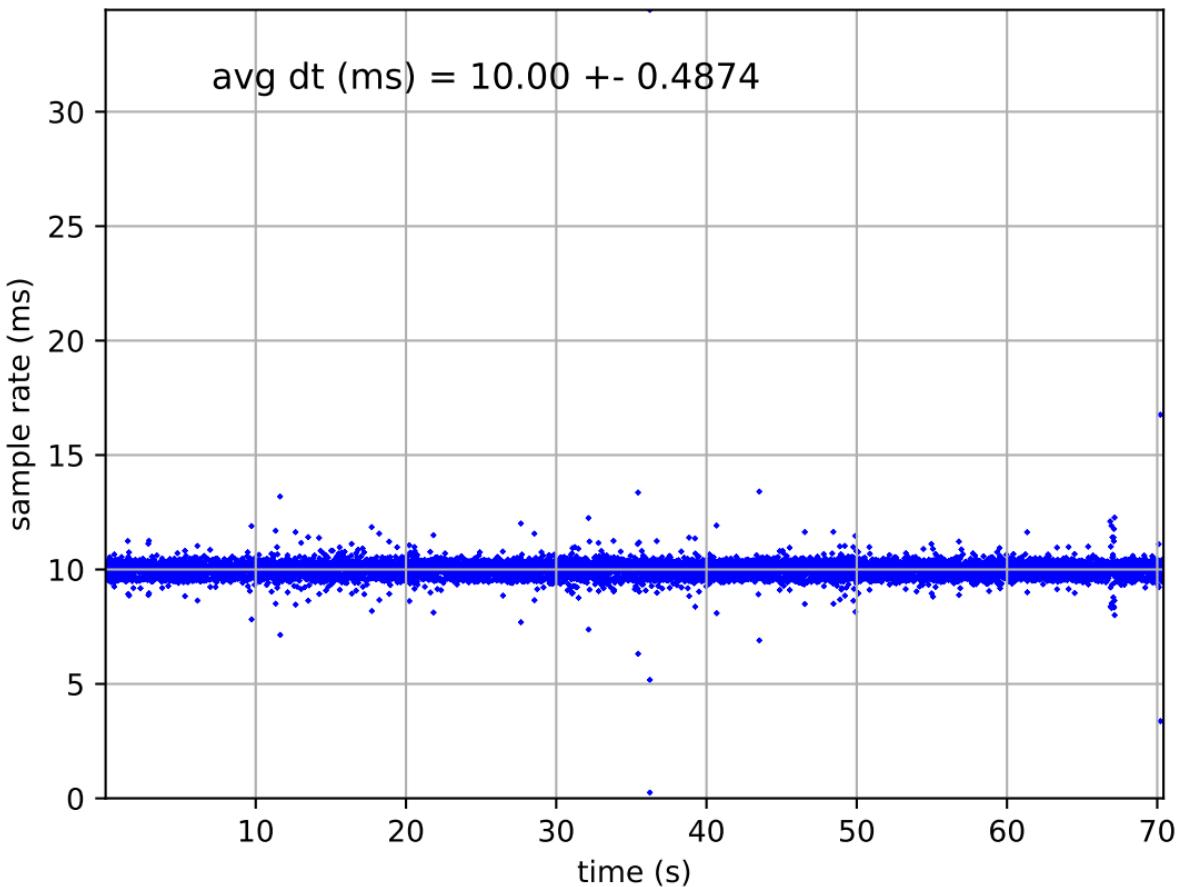
IMU2:

Model: calibrated
Update rate: 400
Accelerometer:
Noise density: 0.005119536556707974
Noise density (discrete): 0.10239073113415947
Random walk: 0.0007446449364276494
Gyroscope:
Noise density: 0.0010273469802412588
Noise density (discrete): 0.020546939604825173
Random walk: 3.8743601798420855e-05
 T_{ib} (imu0 to imu2)
[[-0.00028605 -0.99997094 0.00761883 0.02083544]
[-0.01688863 -0.00761292 -0.99982839 -0.07457199]
[0.99985734 -0.00041467 -0.01688596 -0.05576502]
[0. 0. 0. 1.]]
time offset with respect to IMU0: 0.0 [s]

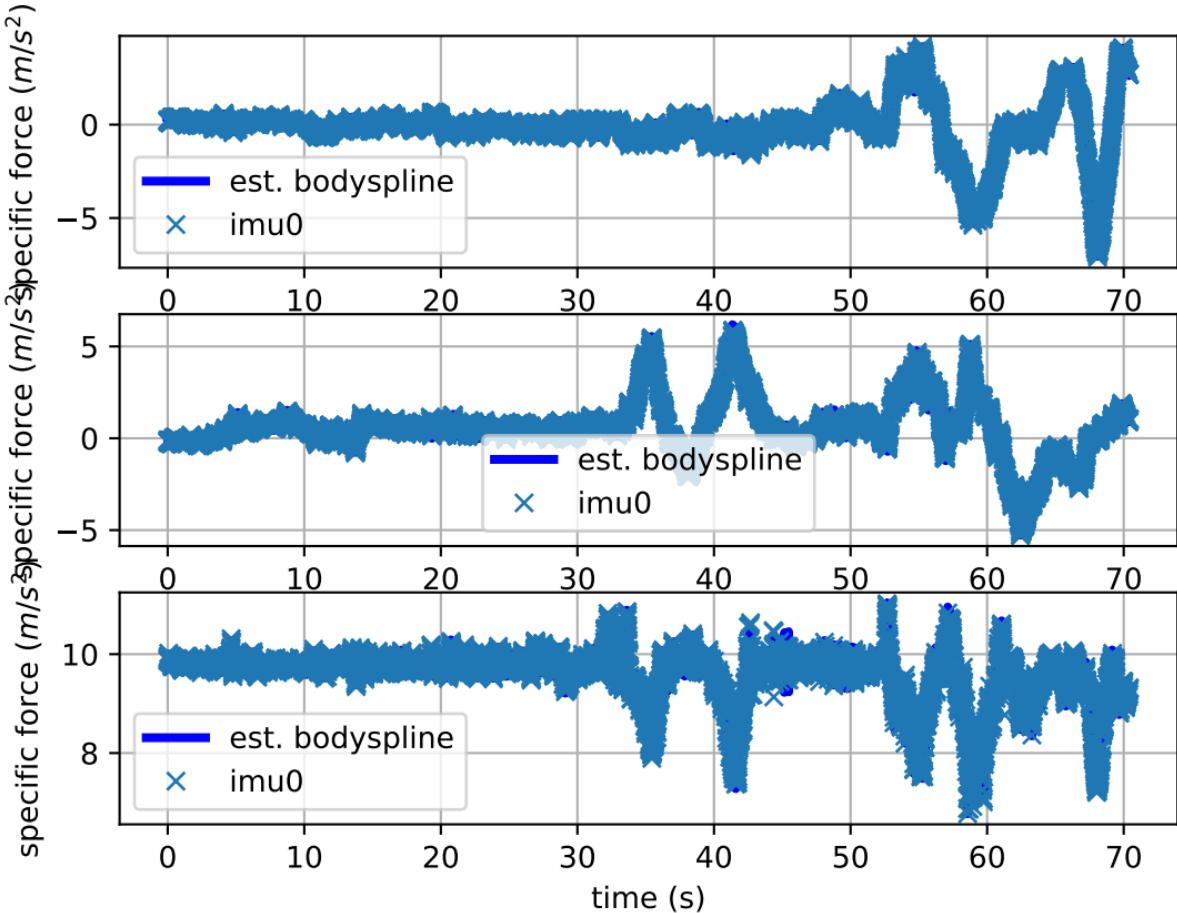
imu0: estimated poses



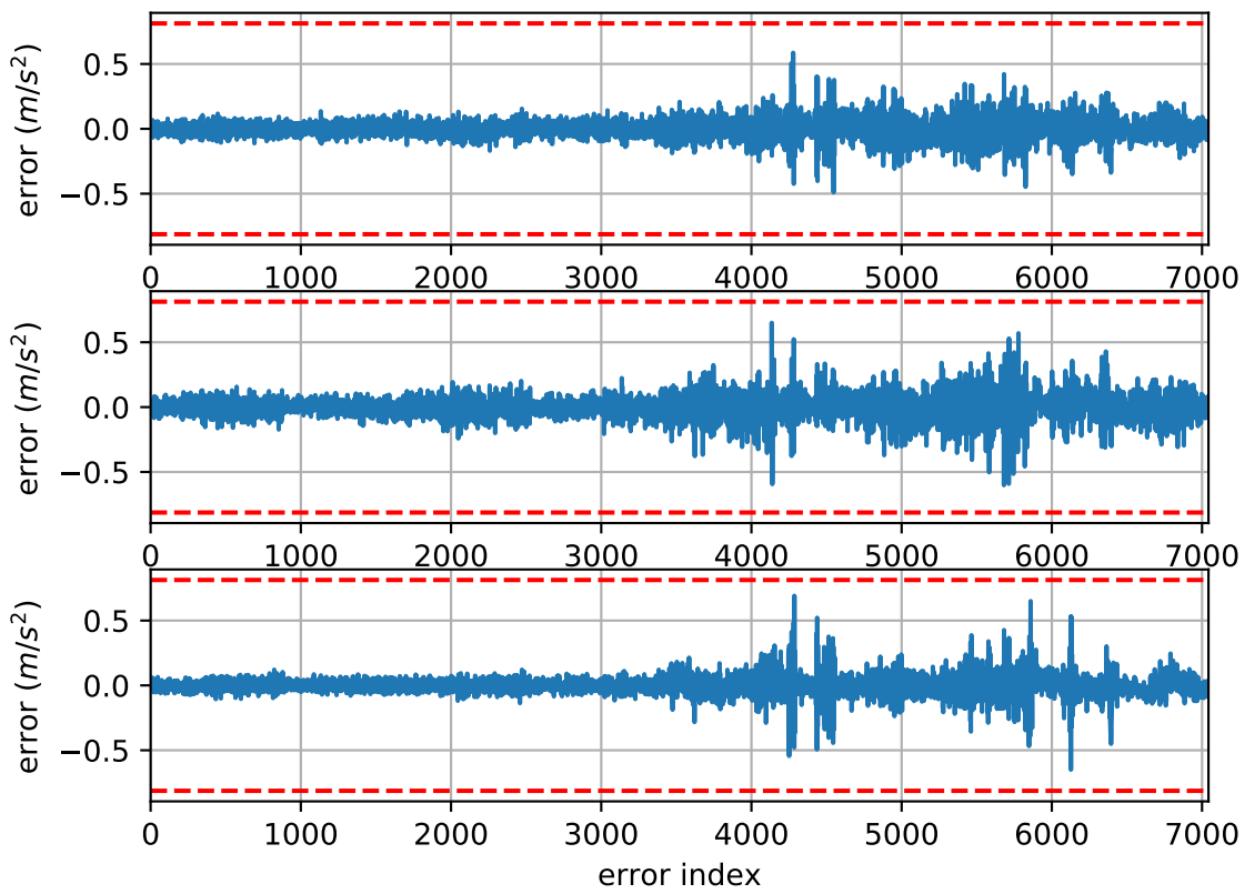
imu0: sample inertial rate



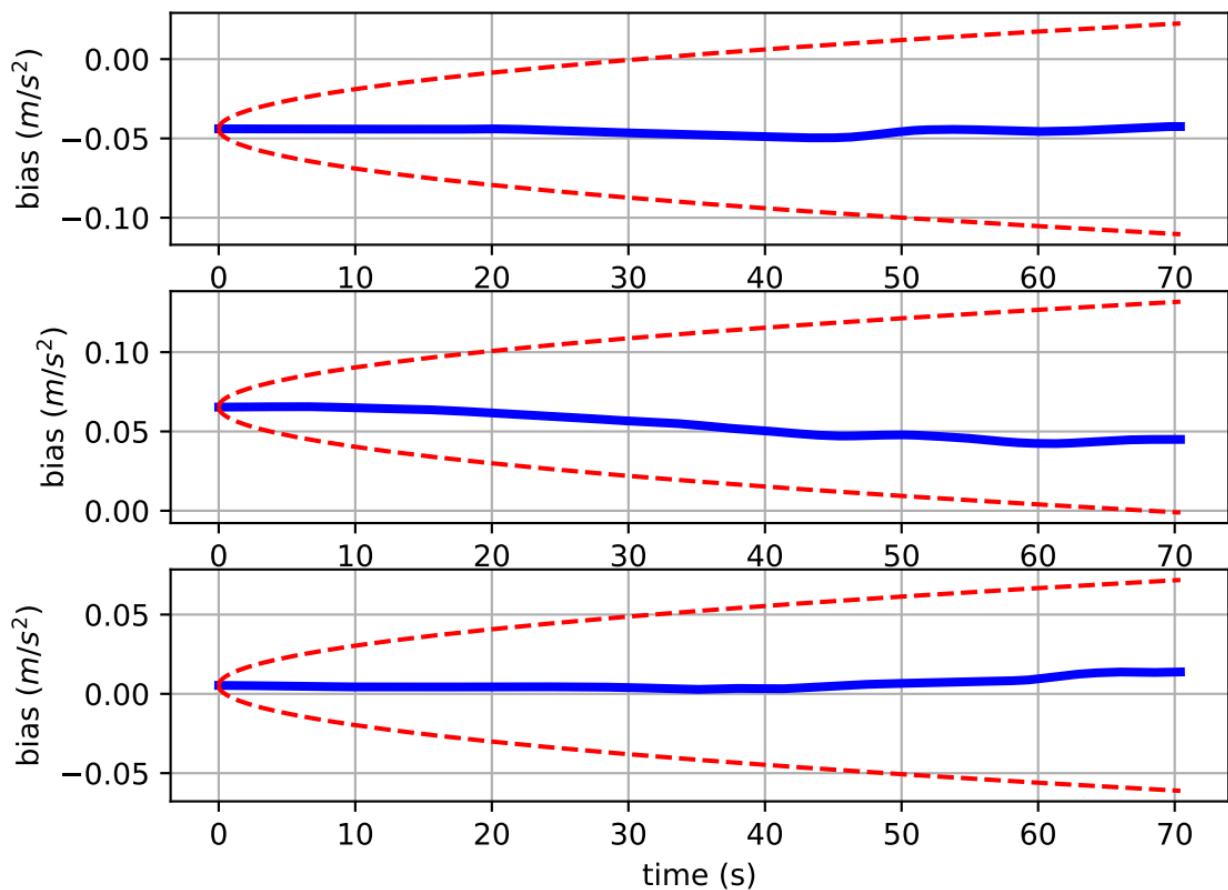
Comparison of predicted and measured specific force (imu0 frame)



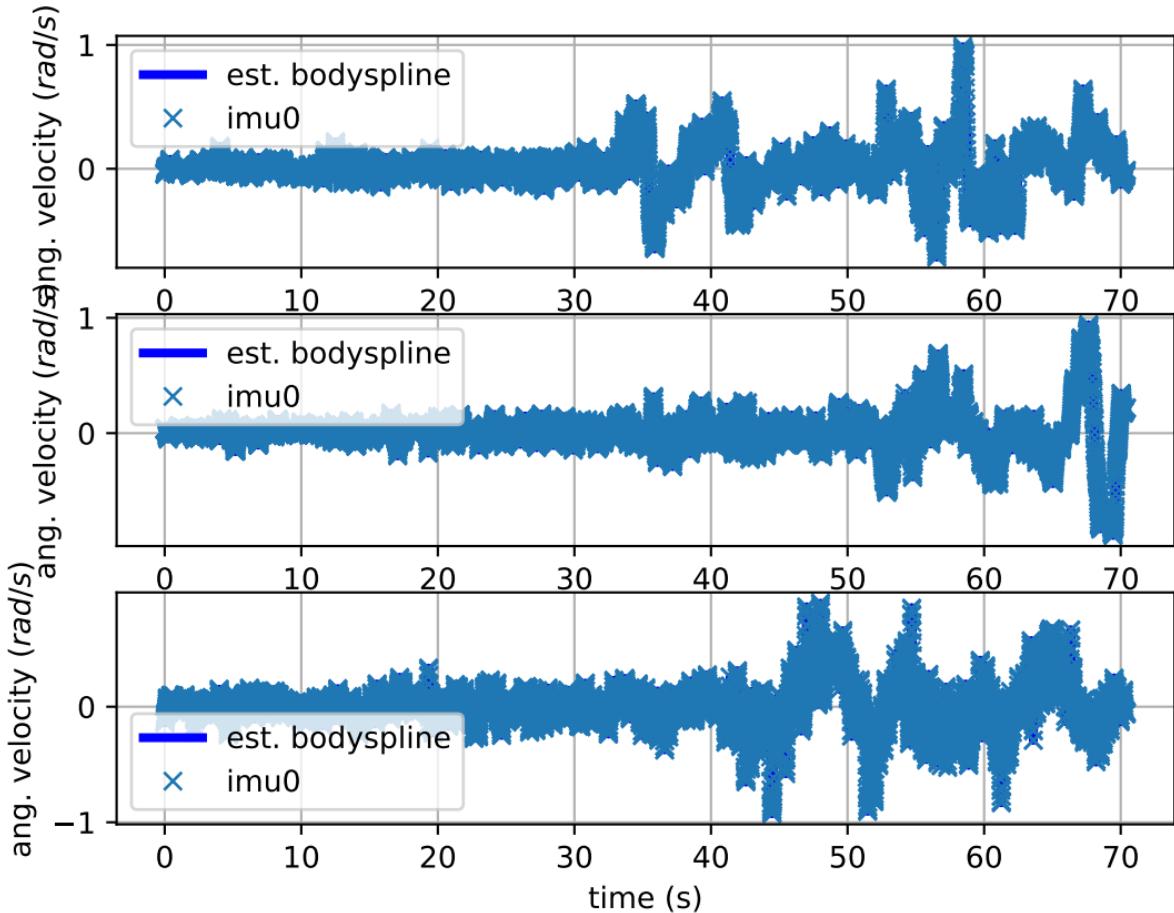
imu0: acceleration error



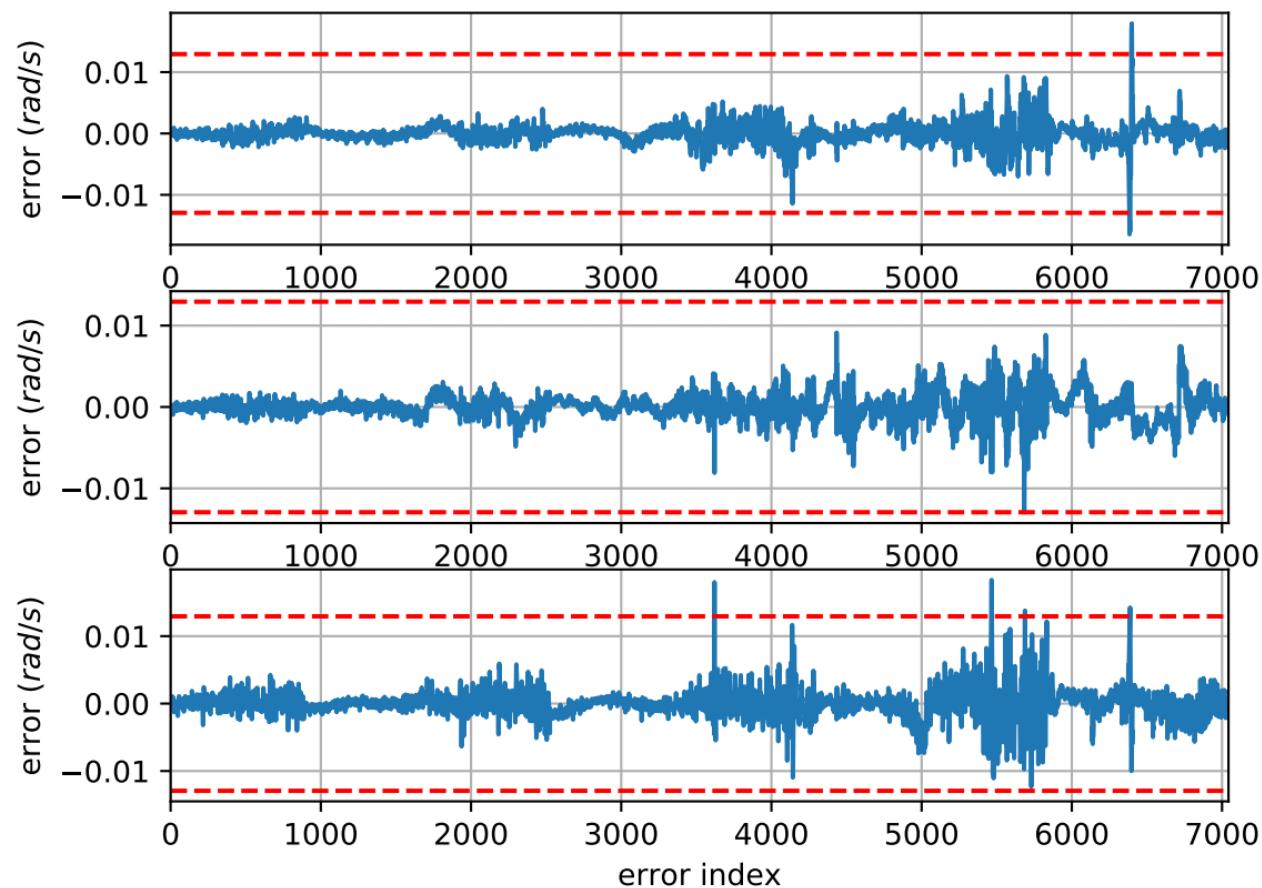
imu0: estimated accelerometer bias (imu frame)



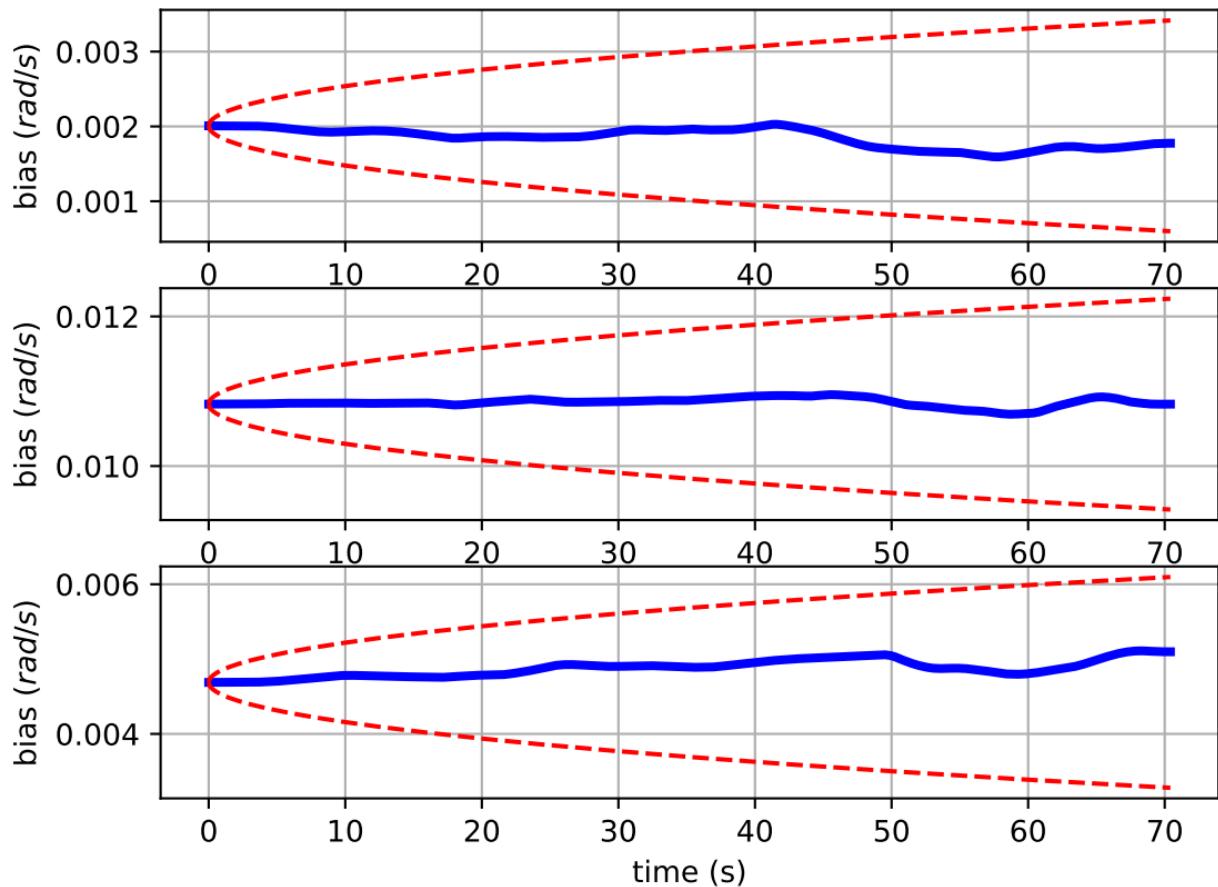
Comparison of predicted and measured angular velocities (body frame)



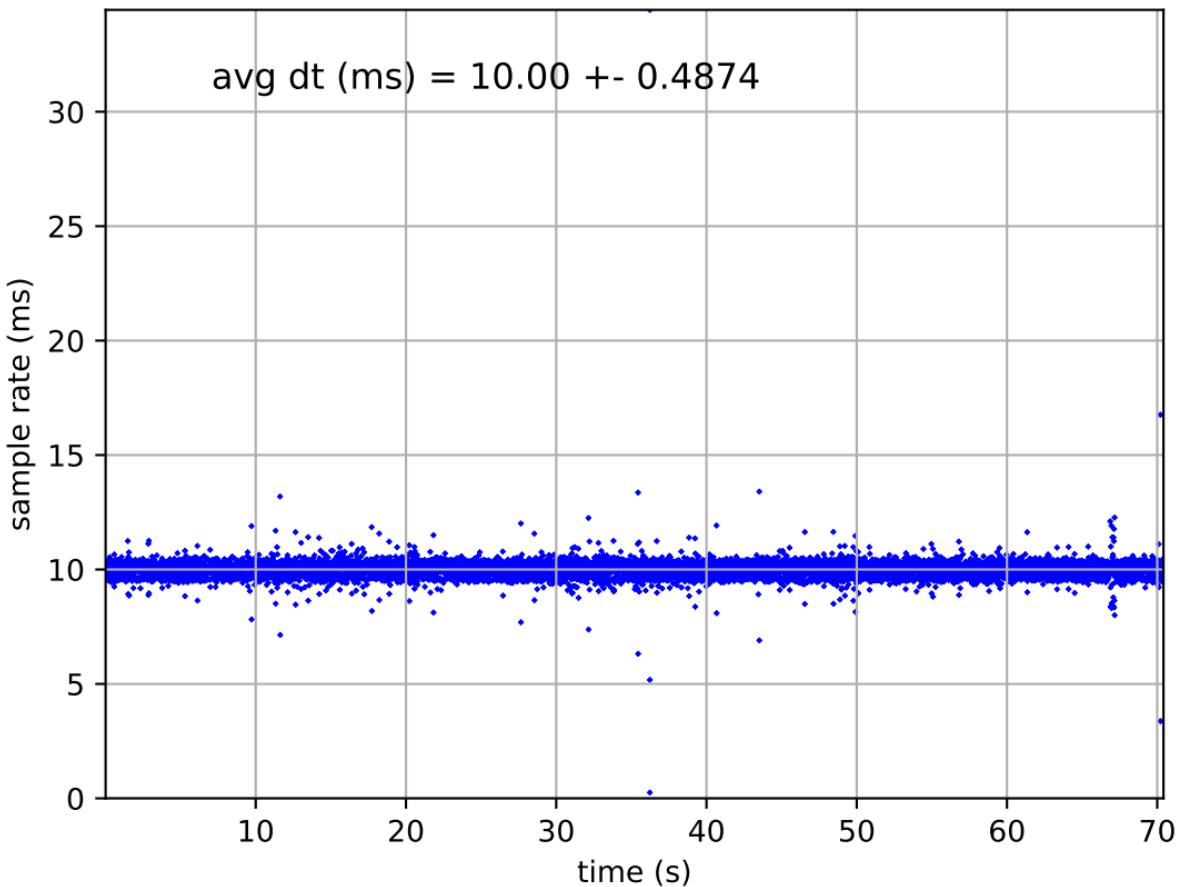
imu0: angular velocities error



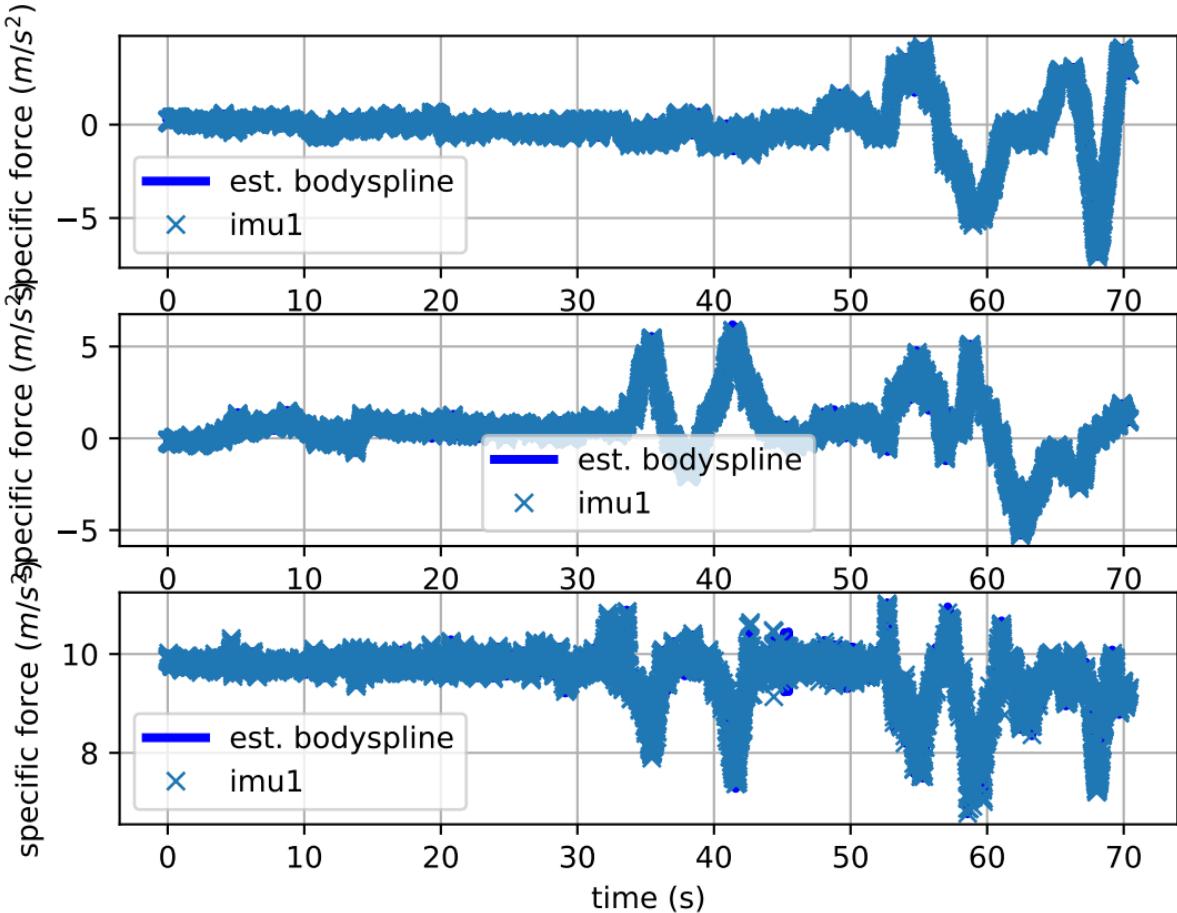
imu0: estimated gyro bias (imu frame)



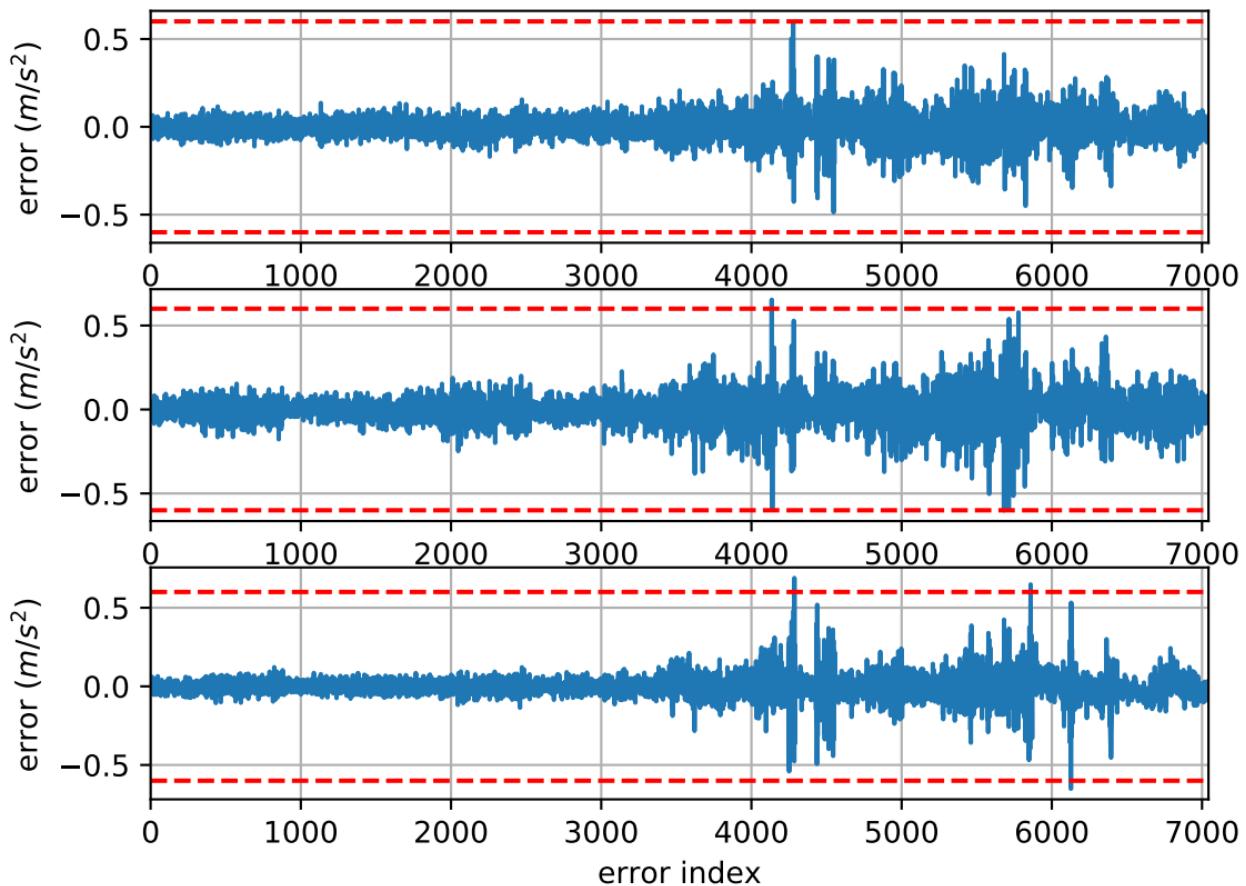
imu1: sample inertial rate



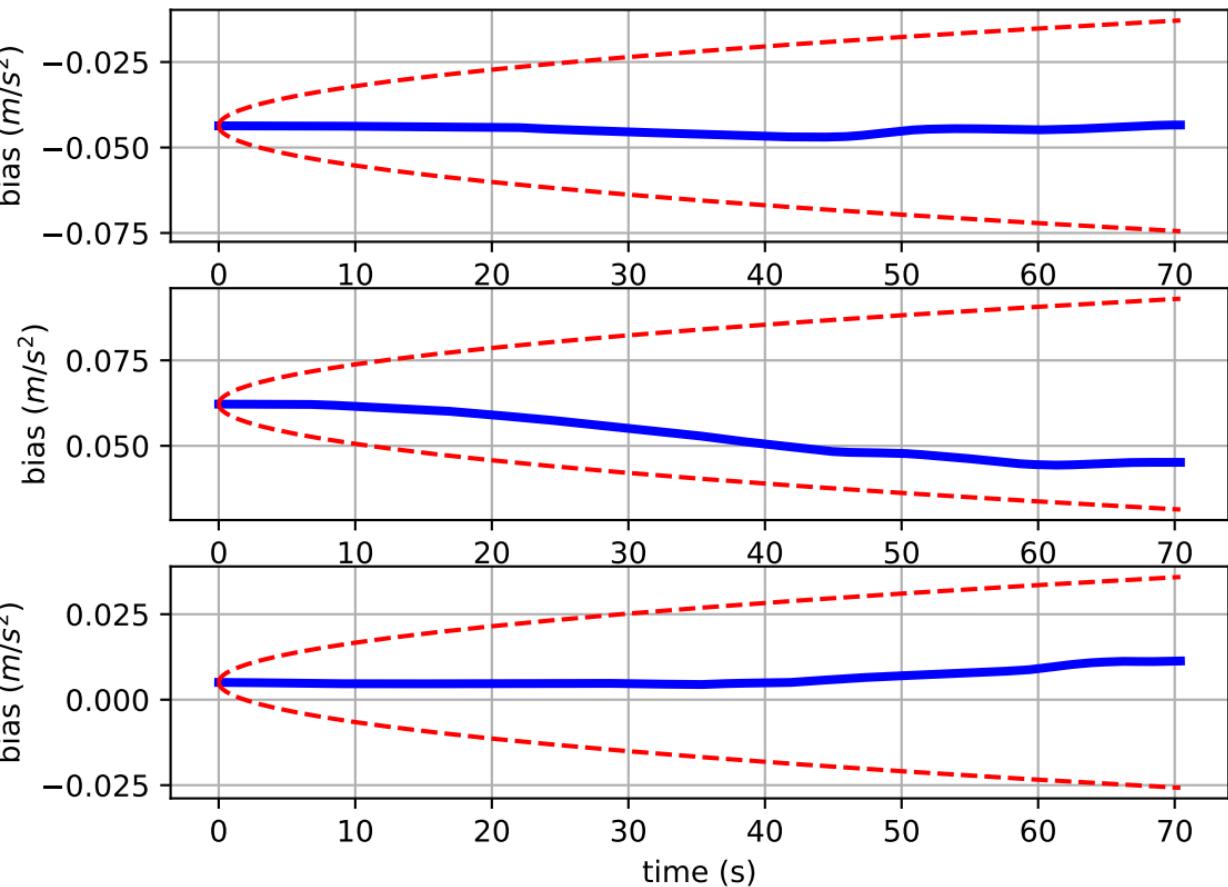
Comparison of predicted and measured specific force (imu0 frame)



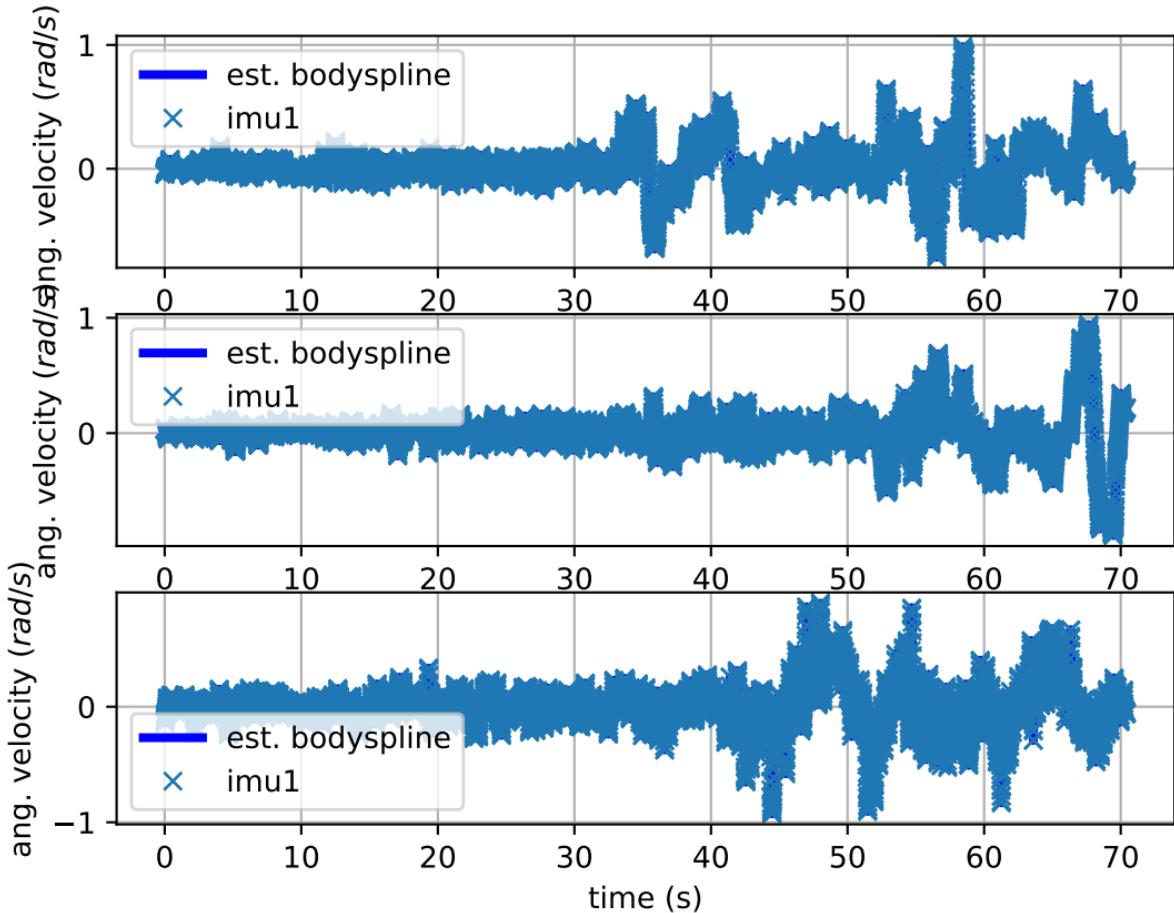
imu1: acceleration error



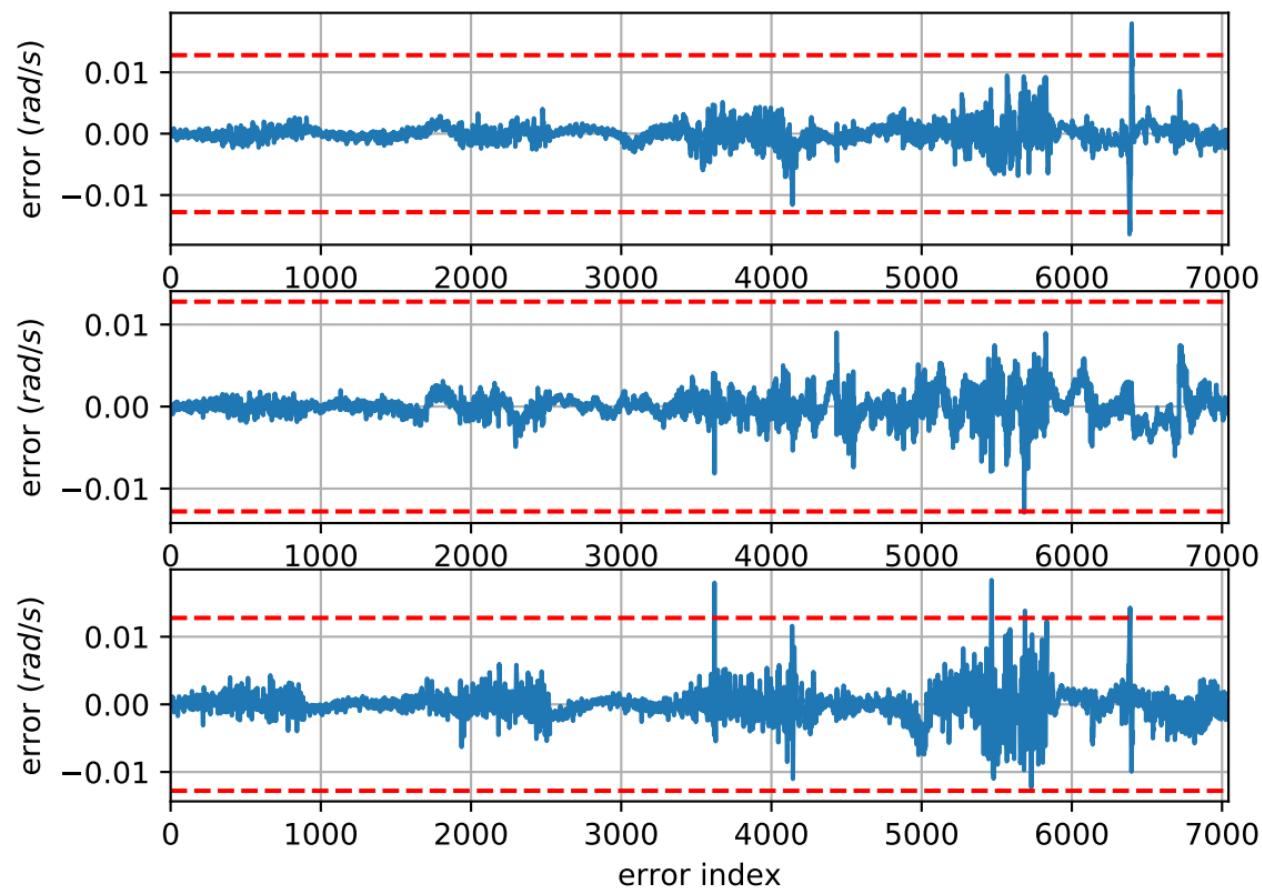
imu1: estimated accelerometer bias (imu frame)



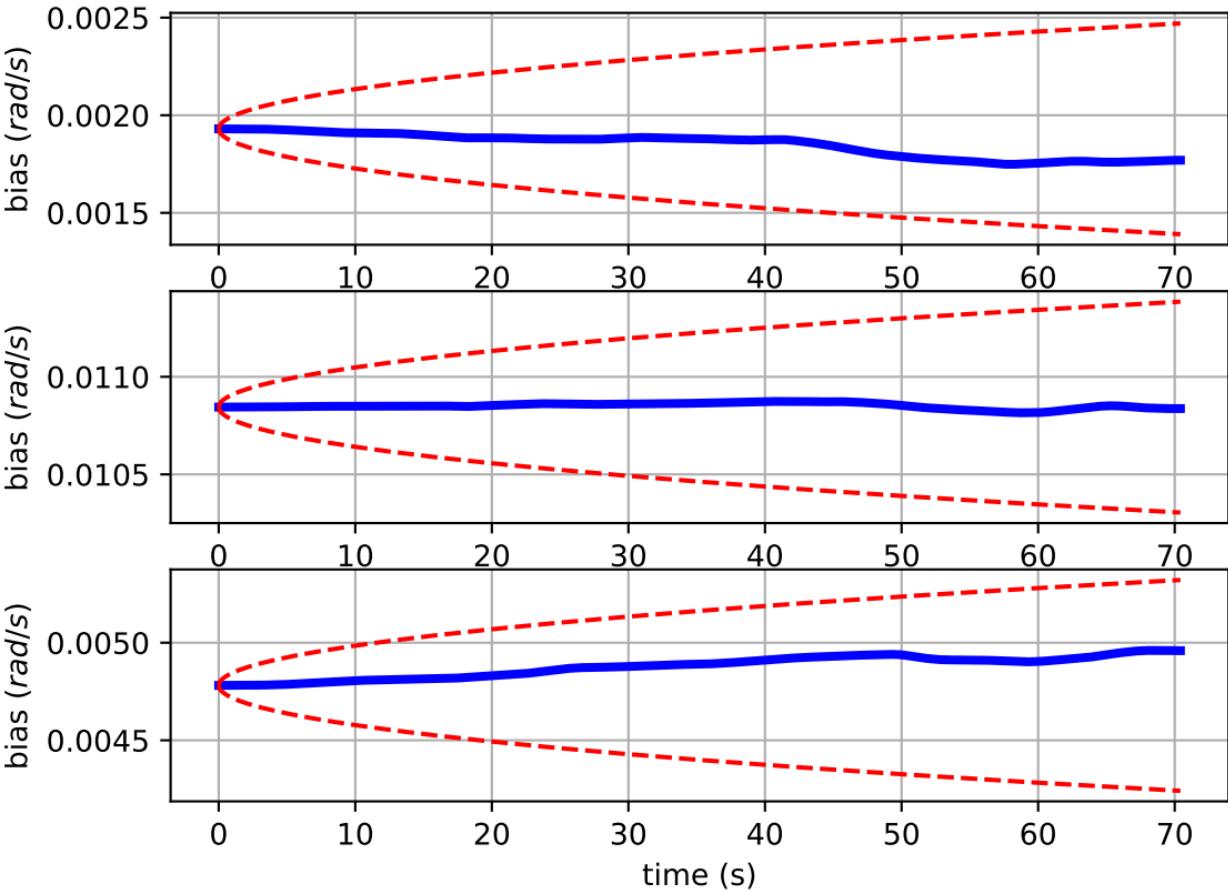
Comparison of predicted and measured angular velocities (body frame)



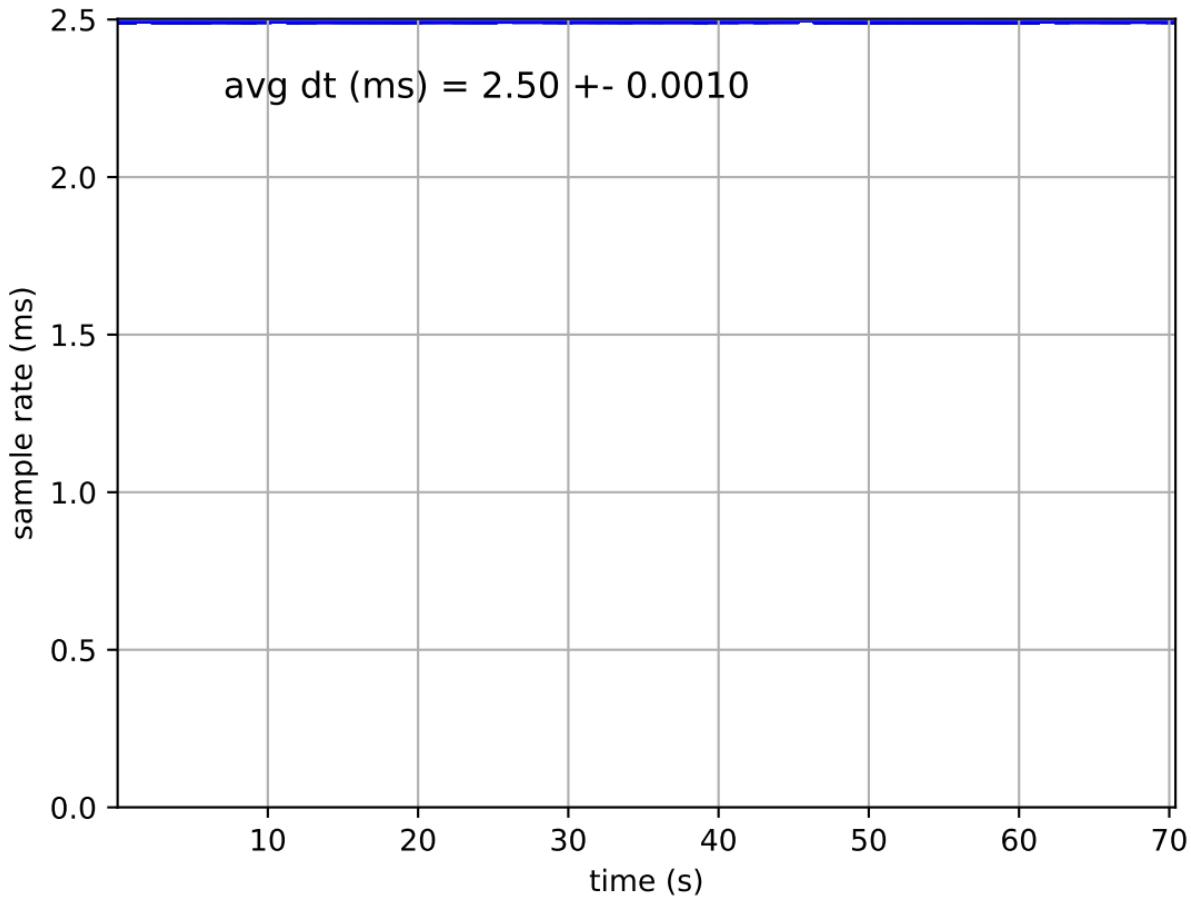
imul: angular velocities error



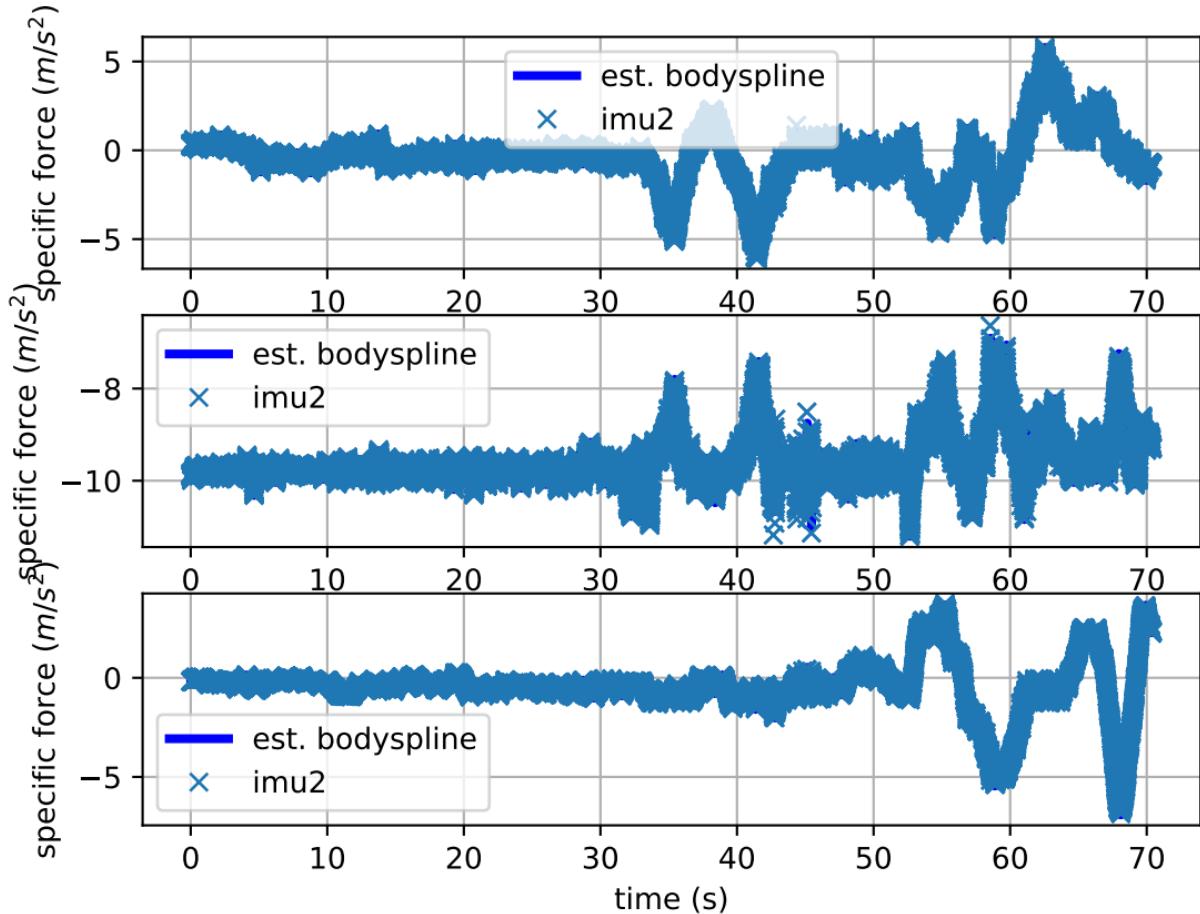
imu1: estimated gyro bias (imu frame)



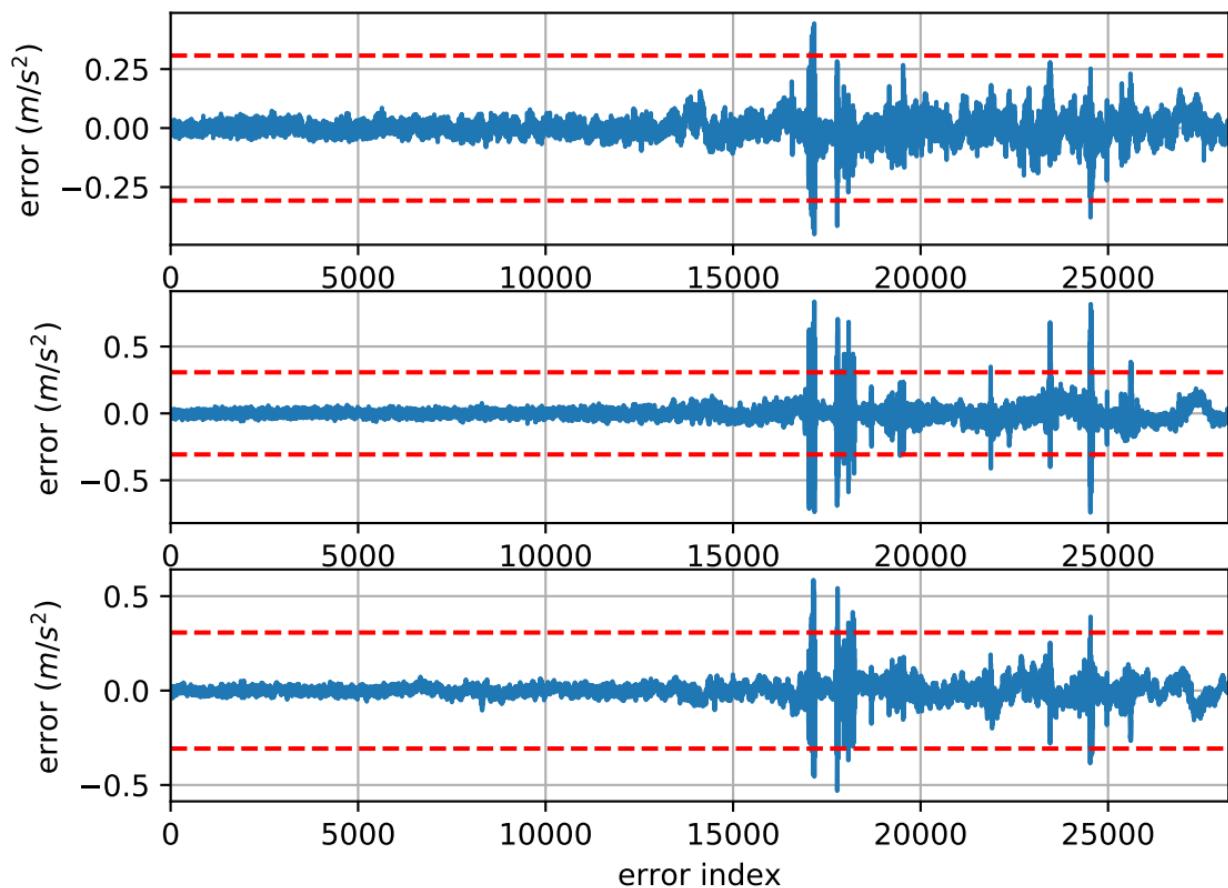
imu2: sample inertial rate



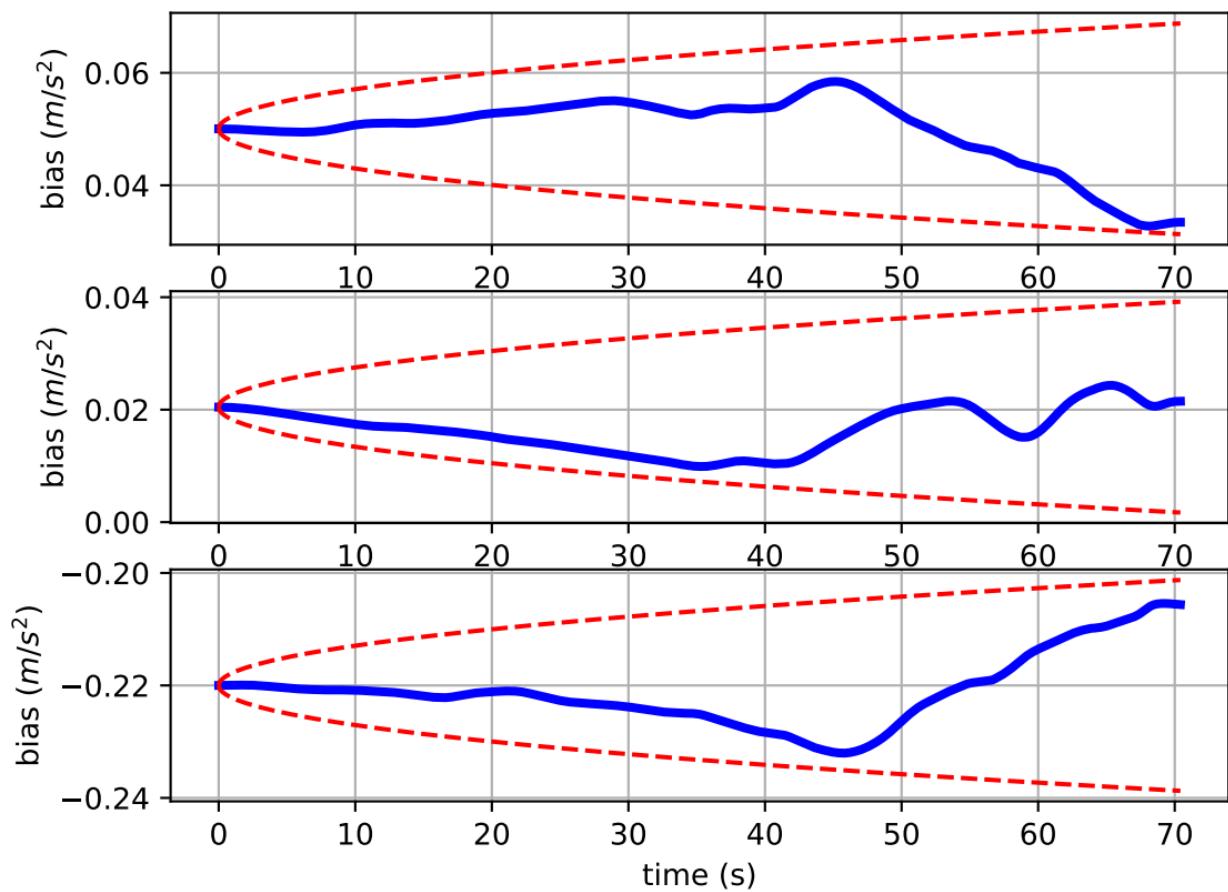
Comparison of predicted and measured specific force (imu0 frame)



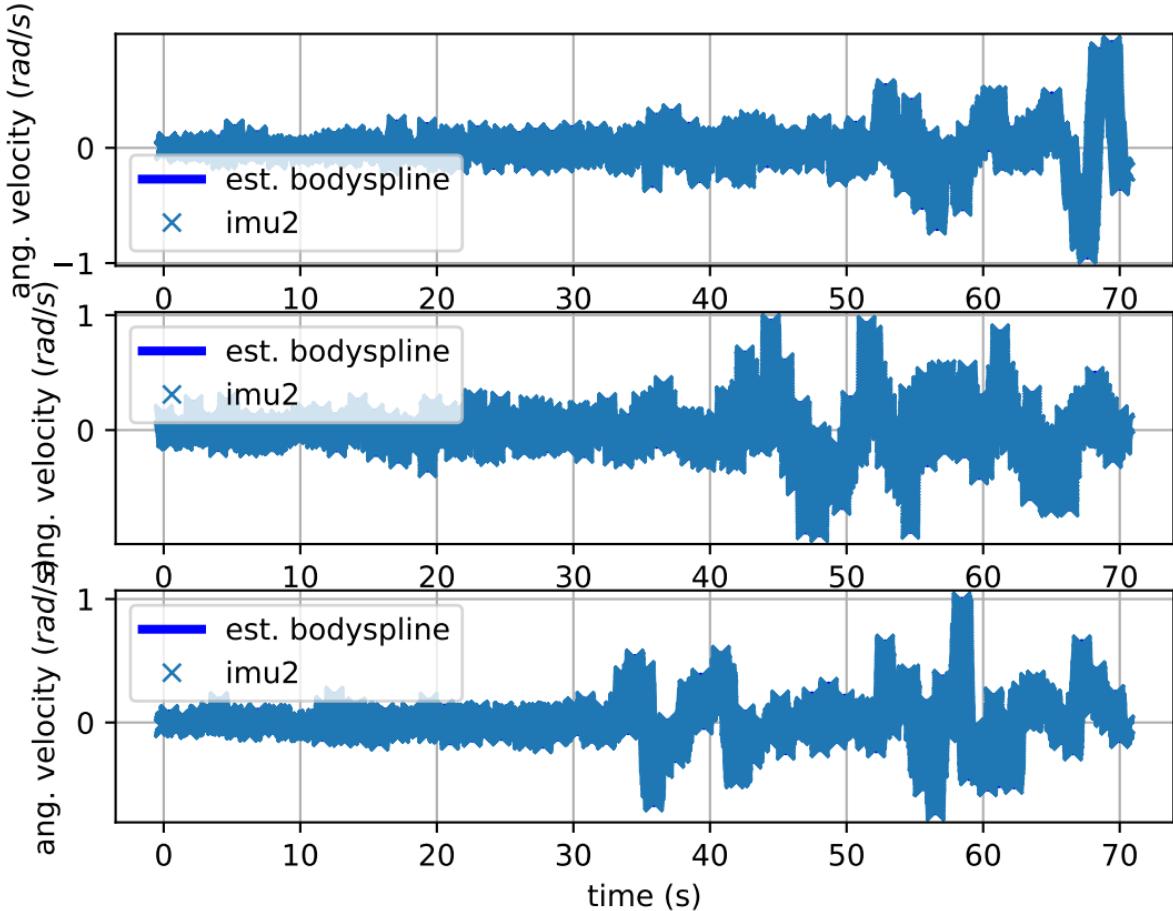
imu2: acceleration error



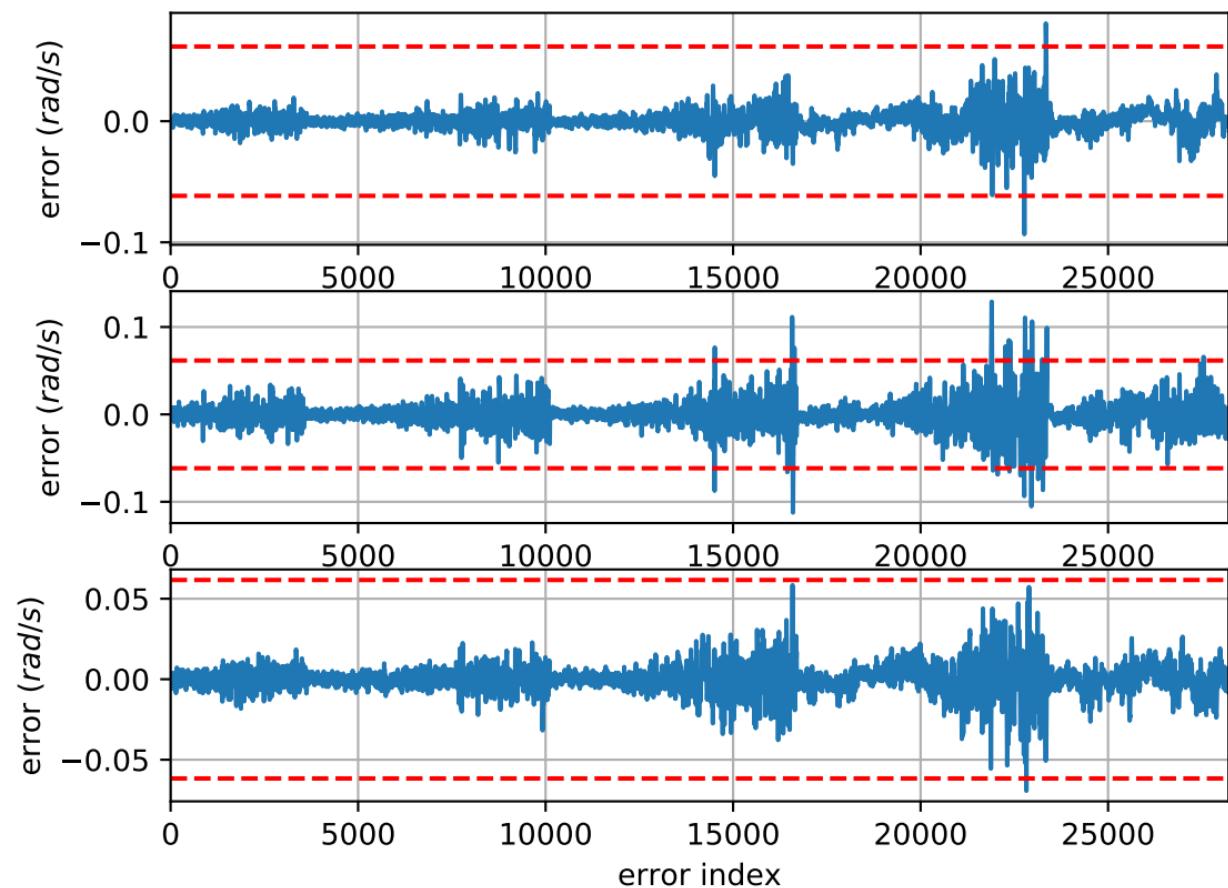
imu2: estimated accelerometer bias (imu frame)



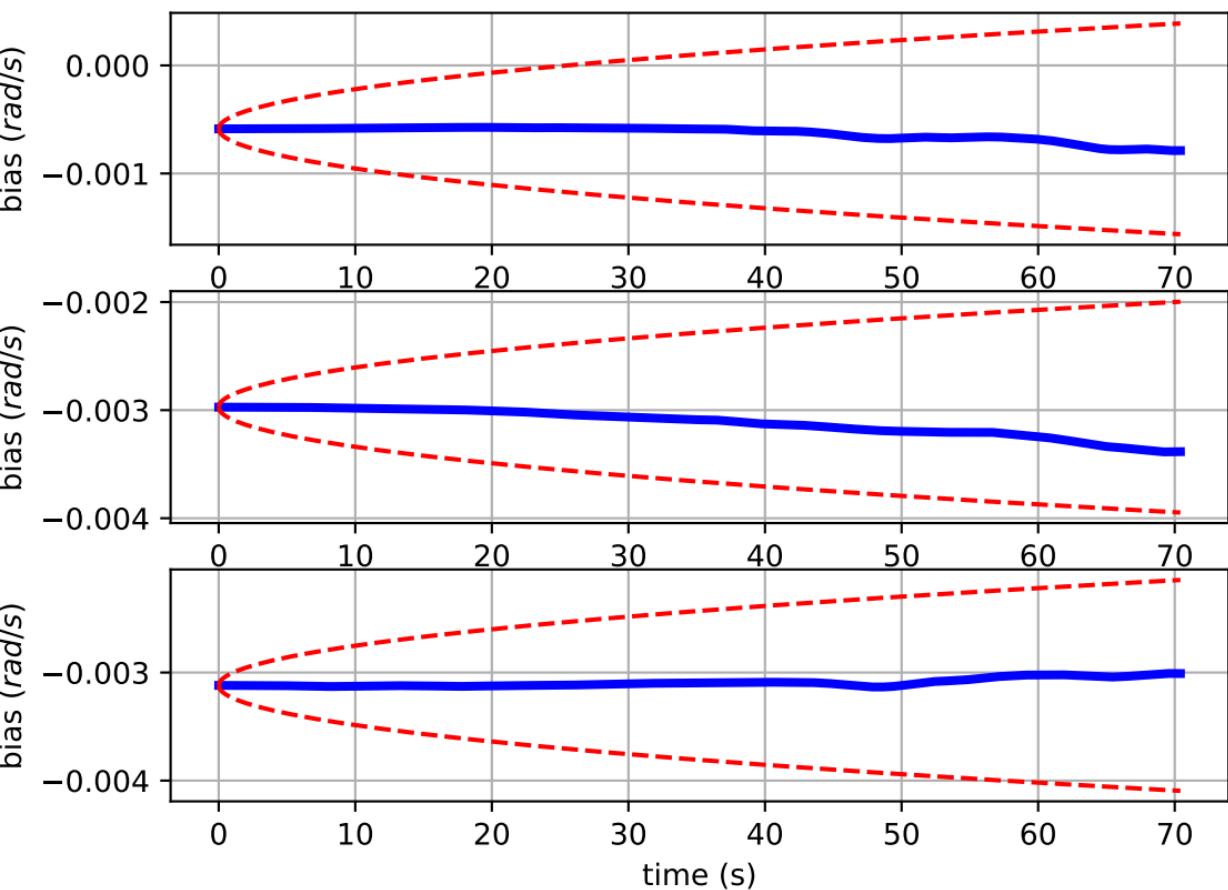
Comparison of predicted and measured angular velocities (body frame)



imu2: angular velocities error



imu2: estimated gyro bias (imu frame)



cam0: reprojection errors

