

Calibration results

Normalized Residuals

Reprojection error (cam0): mean 0.3400994459049692, median 0.2444075509786121, std: 0.46307689361093024
Gyroscope error (imu0): mean 0.5973910606012377, median 0.4253476807026314, std: 0.5849134671691698
Accelerometer error (imu0): mean 0.39452366766362434, median 0.30716093966300273, std: 0.2914746976093342
Gyroscope error (imu1): mean 0.6086680726246684, median 0.43592274783085694, std: 0.5924390060417193
Accelerometer error (imu1): mean 0.5355537644808246, median 0.41745823260483084, std: 0.3945343876622548
Gyroscope error (imu2): mean 0.7794539568422957, median 0.5533687099783721, std: 0.6982526700516697
Accelerometer error (imu2): mean 0.554510822791303, median 0.41448359653794387, std: 0.48190202430498774

Residuals

Reprojection error (cam0) [px]: mean 0.3400994459049692, median 0.2444075509786121, std: 0.46307689361093024
Gyroscope error (imu0) [rad/s]: mean 0.002575727771362979, median 0.001833940790088098, std:
0.0025219290354220564
Accelerometer error (imu0) [m/s^2]: mean 0.10687280498438308, median 0.08320705167785467, std:
0.07895779409118717
Gyroscope error (imu1) [rad/s]: mean 0.0025938070467095824, median 0.001857661911308958, std:
0.002524647731217886
Accelerometer error (imu1) [m/s^2]: mean 0.1071468145571222, median 0.08351975618659911, std:
0.07893344361464001
Gyroscope error (imu2) [rad/s]: mean 0.01601539337598066, median 0.011370033463125628, std:
0.014346955440459577
Accelerometer error (imu2) [m/s^2]: mean 0.056776768567405864, median 0.04243927849263604, std:
0.04934230060361919

Transformation (cam0):

T_ci: (imu0 to cam0):

```
[[-0.49580412 -0.86843165 -0.00217925  0.04340677]
 [-0.01709623 -0.00725159 -0.99982755 -0.03359027]
 [ 0.86826608  0.49575588 -0.01844227 -0.08935565]
 [ 0.          0.          1.          ]]]
```

T_ic: (cam0 to imu0):

```
[[-0.49580412 -0.01709623  0.86826608  0.05548895]
 [-0.86843165 -0.00725159  0.49575588  0.08175082]
 [-0.00217925 -0.99982755 -0.01844227 -0.03513781]
 [ 0.          0.          1.          ]]]
```

timeshift cam0 to imu0: [s] (t_imu = t_cam + shift)
-0.008318215811686893

Gravity vector in target coords: [m/s^2]
[-0.08497433 -9.8060929 0.04176546]

Calibration configuration

cam0

Camera model: pinhole

Focal length: [393.2565959647056, 392.92684998747586]

Principal point: [322.0897044999218, 249.5044963204575]

Distortion model: radtan

Distortion coefficients: [-0.3408151621858311, 0.10718859710475025, -0.0011731330500286794,
-0.00047061925564046954]

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)

$\begin{bmatrix} 0.99999998 & 0.00012061 & -0.00012782 & -0.00019167 \end{bmatrix}$

$\begin{bmatrix} -0.00012059 & 0.99999998 & 0.00014533 & -0.00027237 \end{bmatrix}$

$\begin{bmatrix} 0.00012784 & -0.00014532 & 0.99999998 & -0.00034648 \end{bmatrix}$

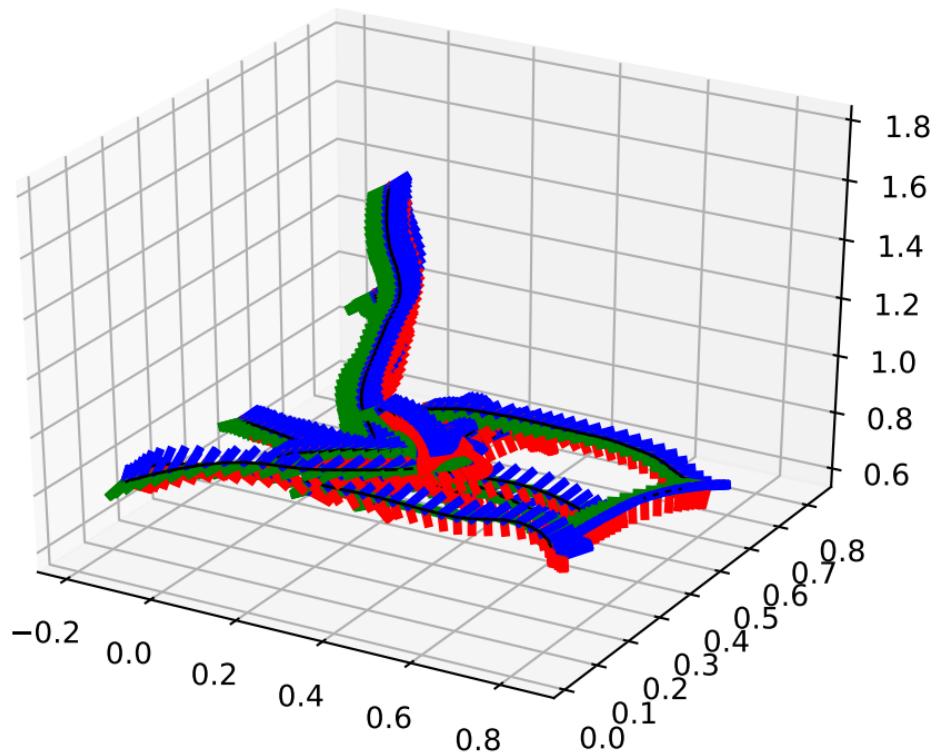
$\begin{bmatrix} 0. & 0. & 0. & 1. \end{bmatrix}$

time offset with respect to IMU0: 0.0 [s]

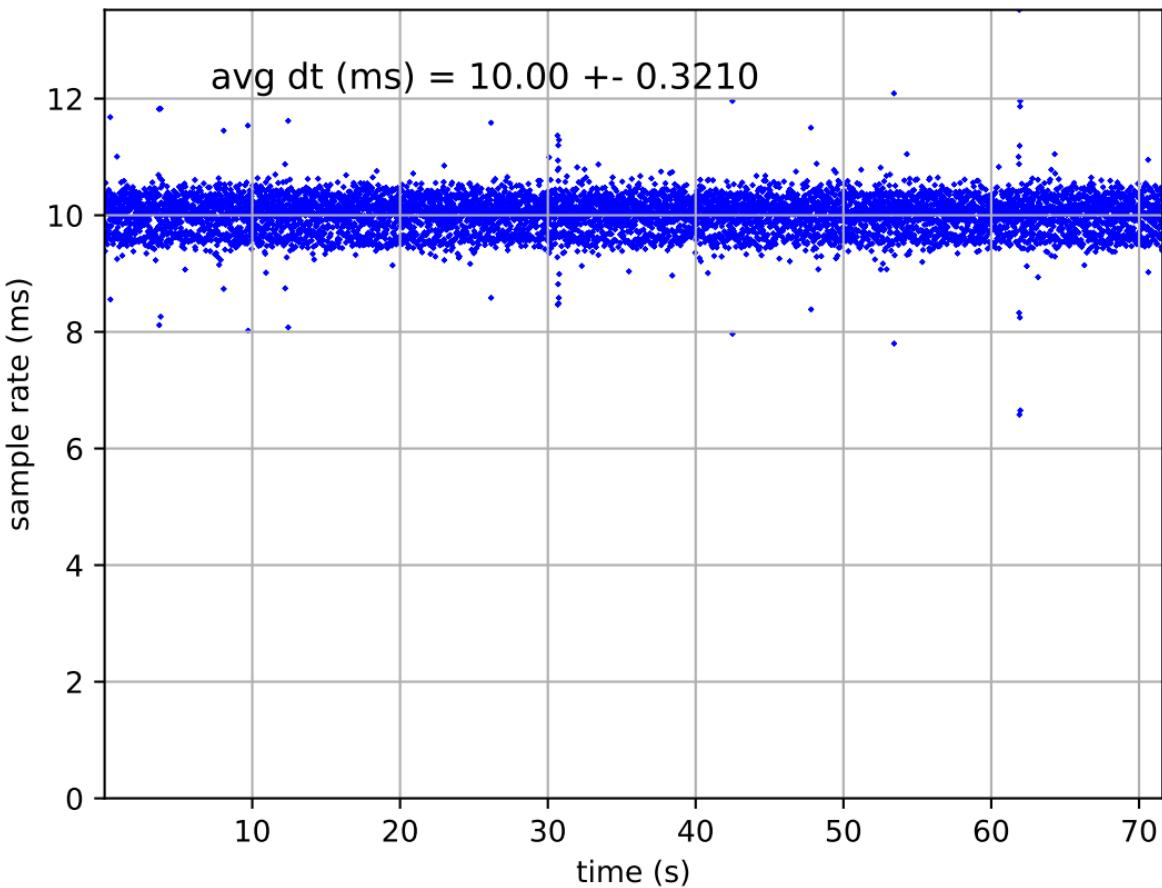
IMU2:

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)
[[-0.0023481 -0.99992304 0.01218223 0.02209158]
[-0.01567013 -0.01214397 -0.99980347 -0.08178148]
[0.99987446 -0.00253854 -0.01564041 -0.05398843]
[0. 0. 0. 1.]]
time offset with respect to IMU0: 0.0 [s]

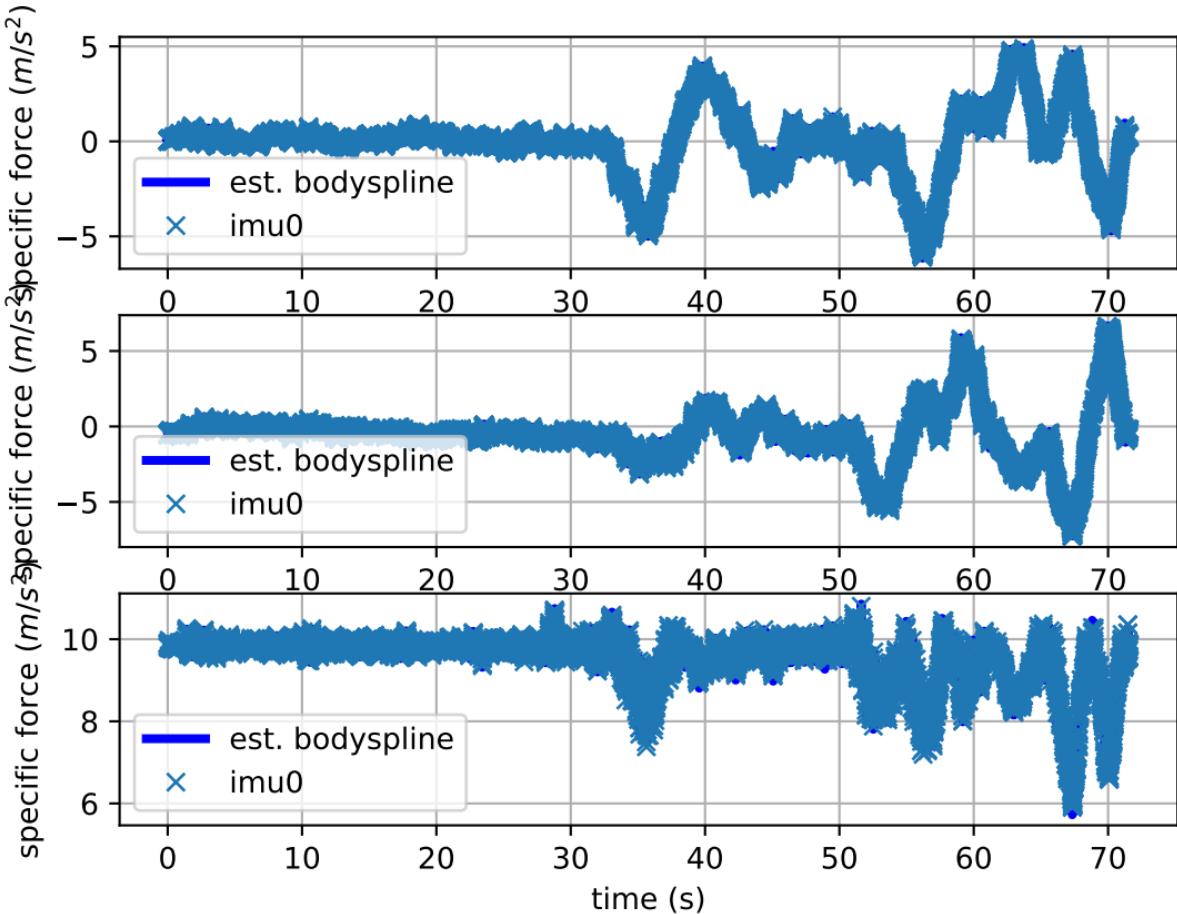
imu0: estimated poses



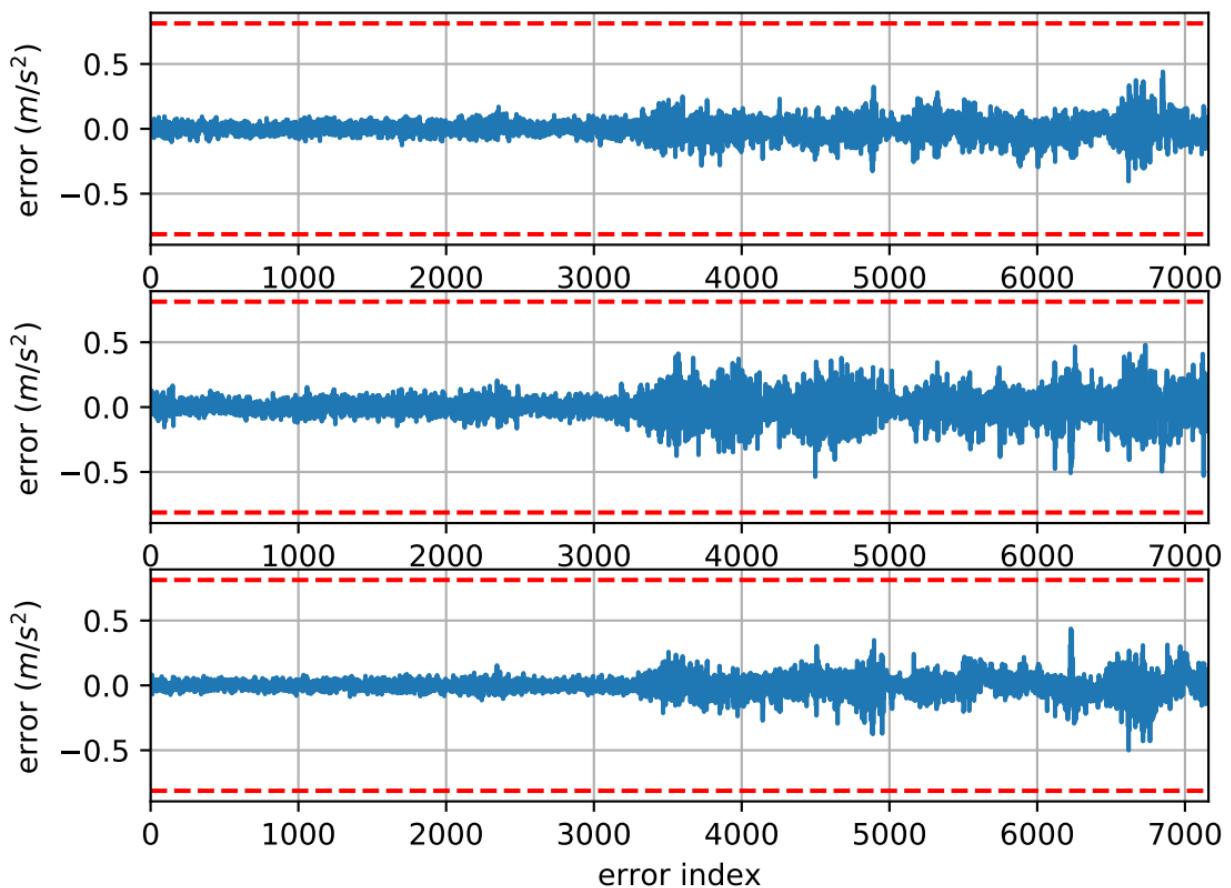
imu0: sample inertial rate



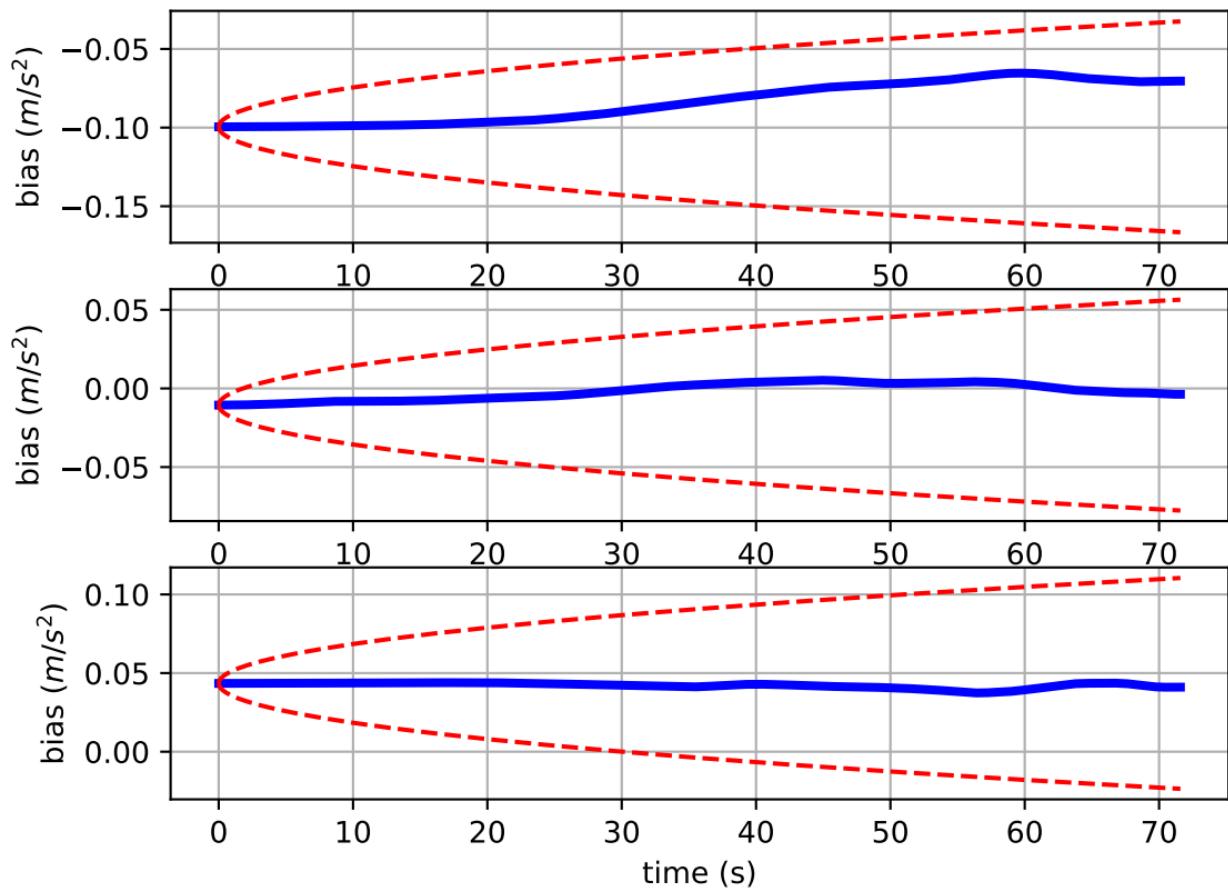
Comparison of predicted and measured specific force (imu0 frame)



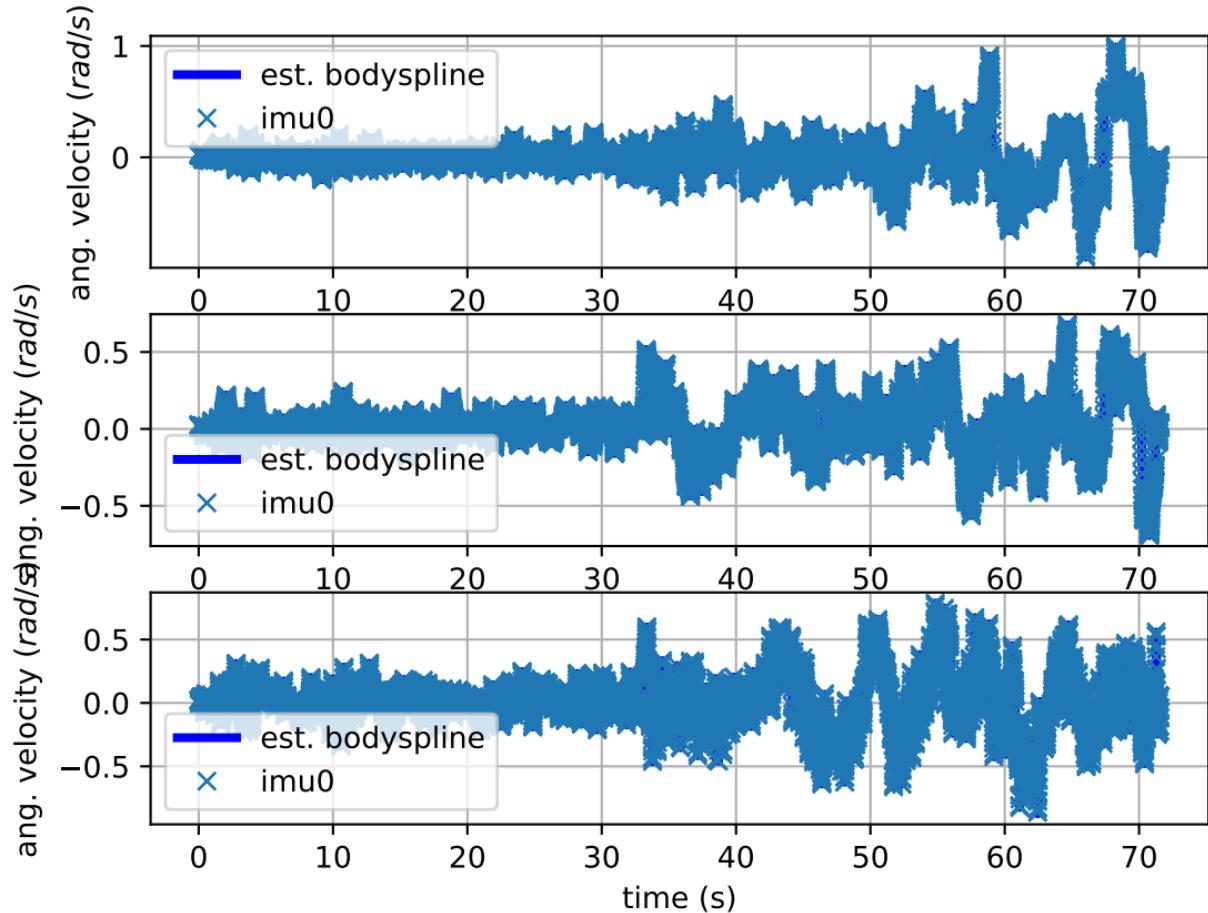
imu0: acceleration error



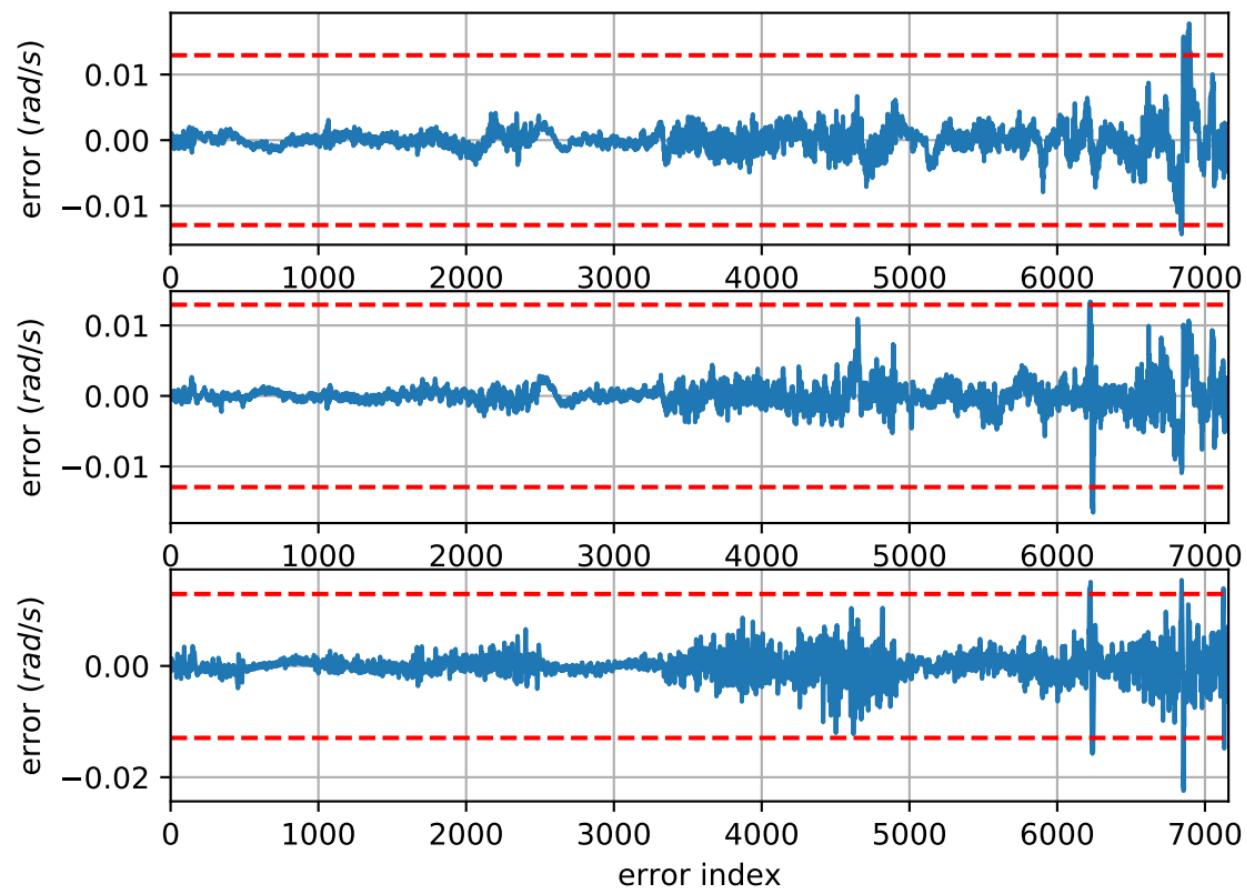
imu0: estimated accelerometer bias (imu frame)



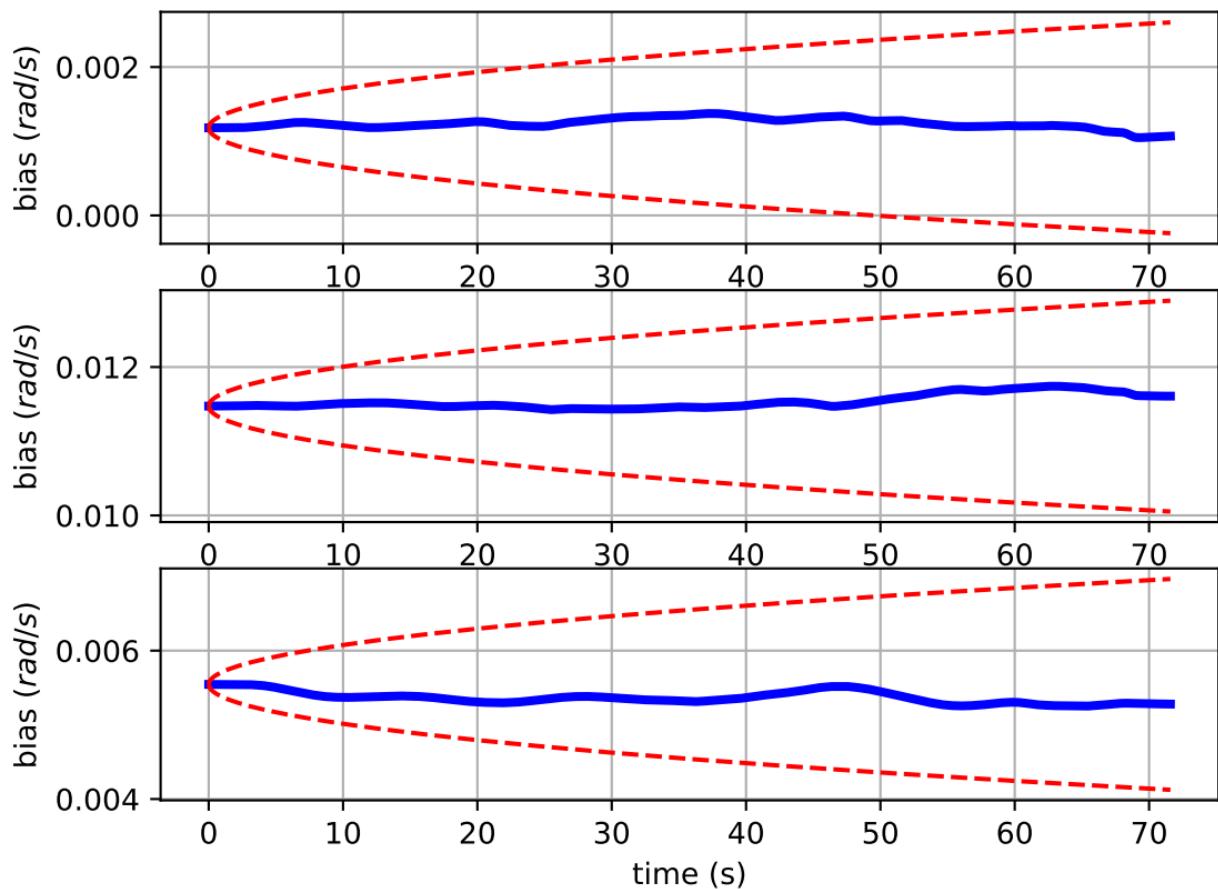
Comparison of predicted and measured angular velocities (body frame)



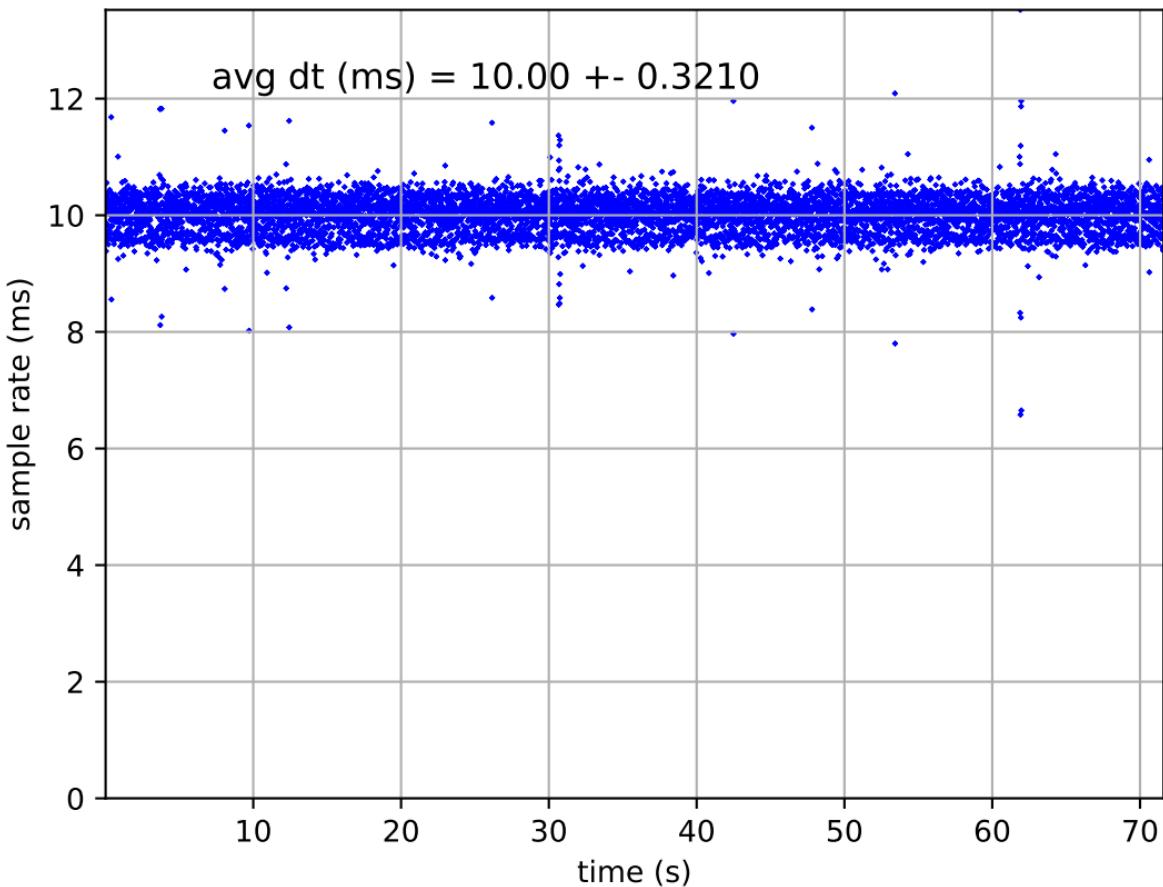
imu0: angular velocities error



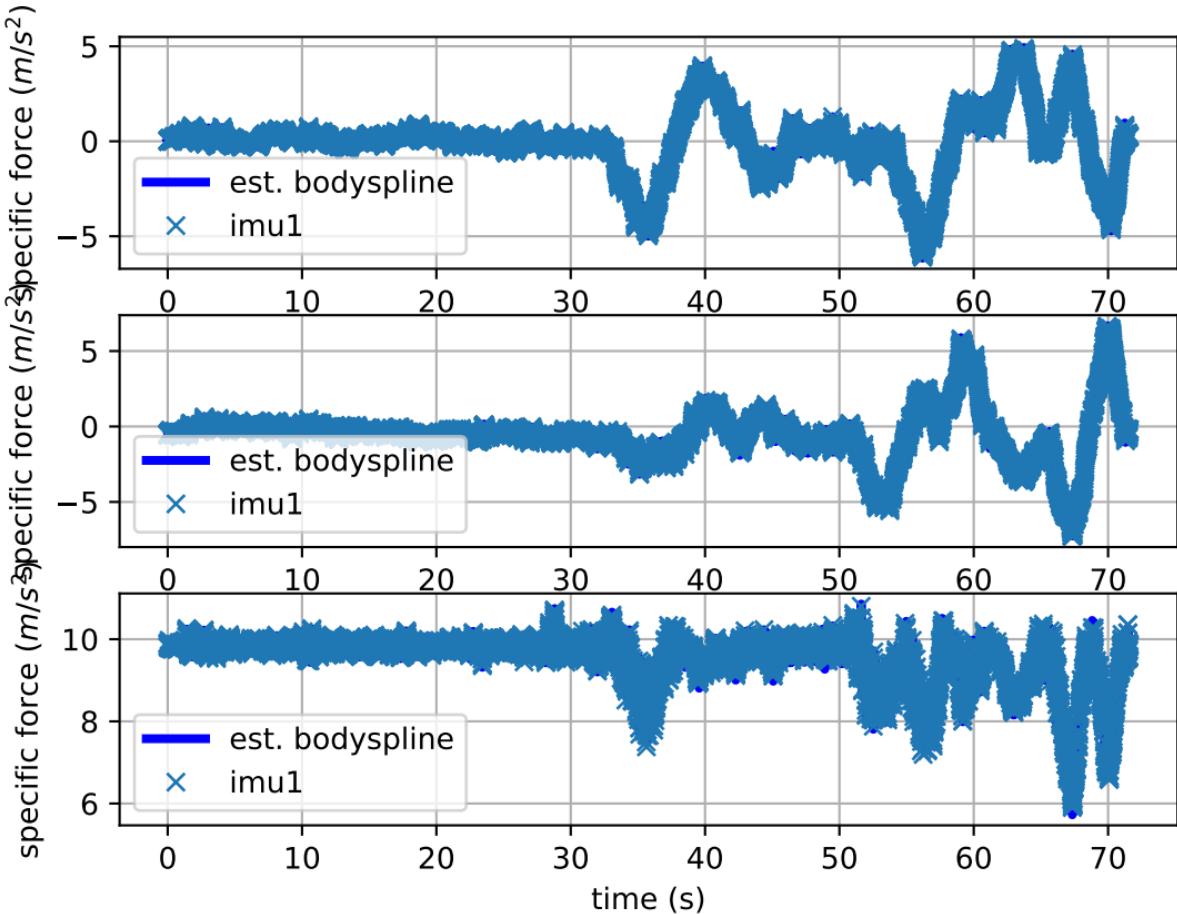
imu0: estimated gyro bias (imu frame)



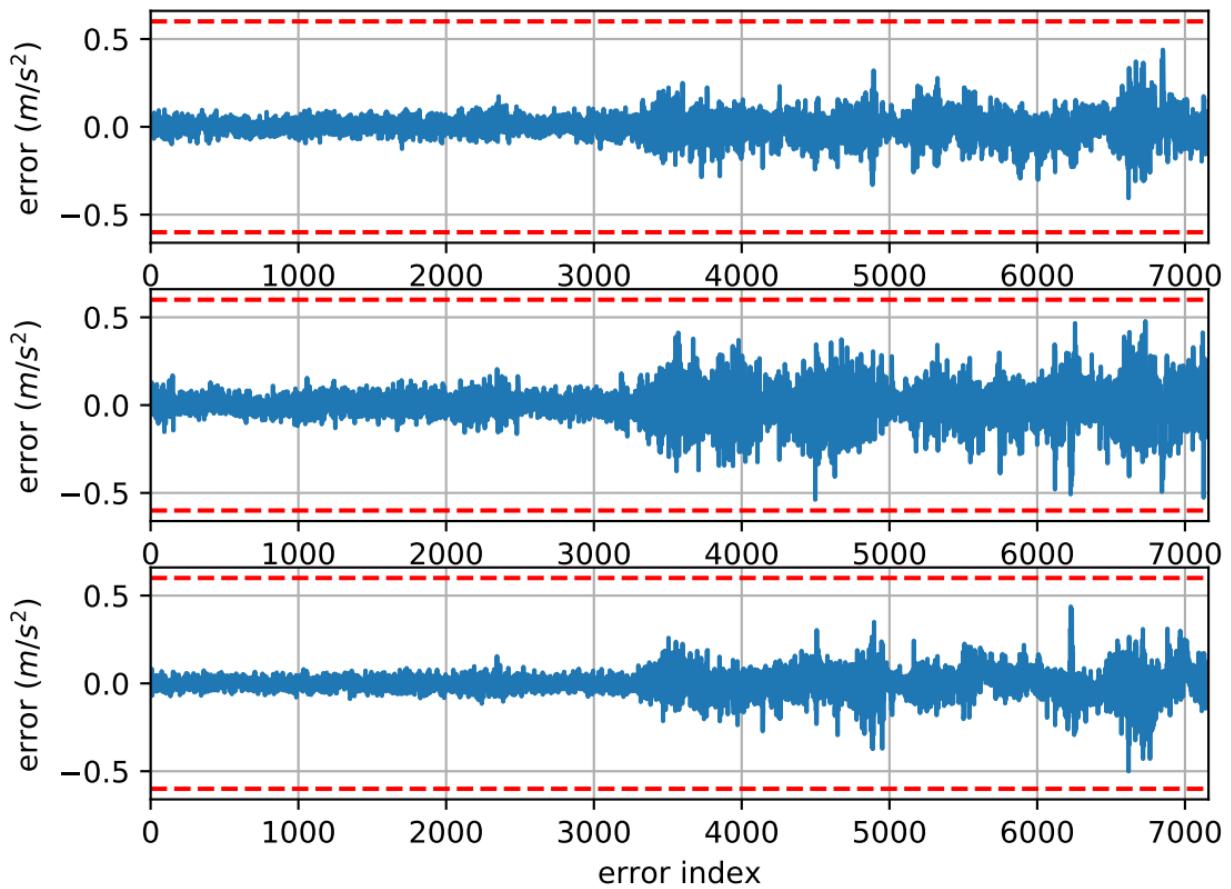
imu1: sample inertial rate



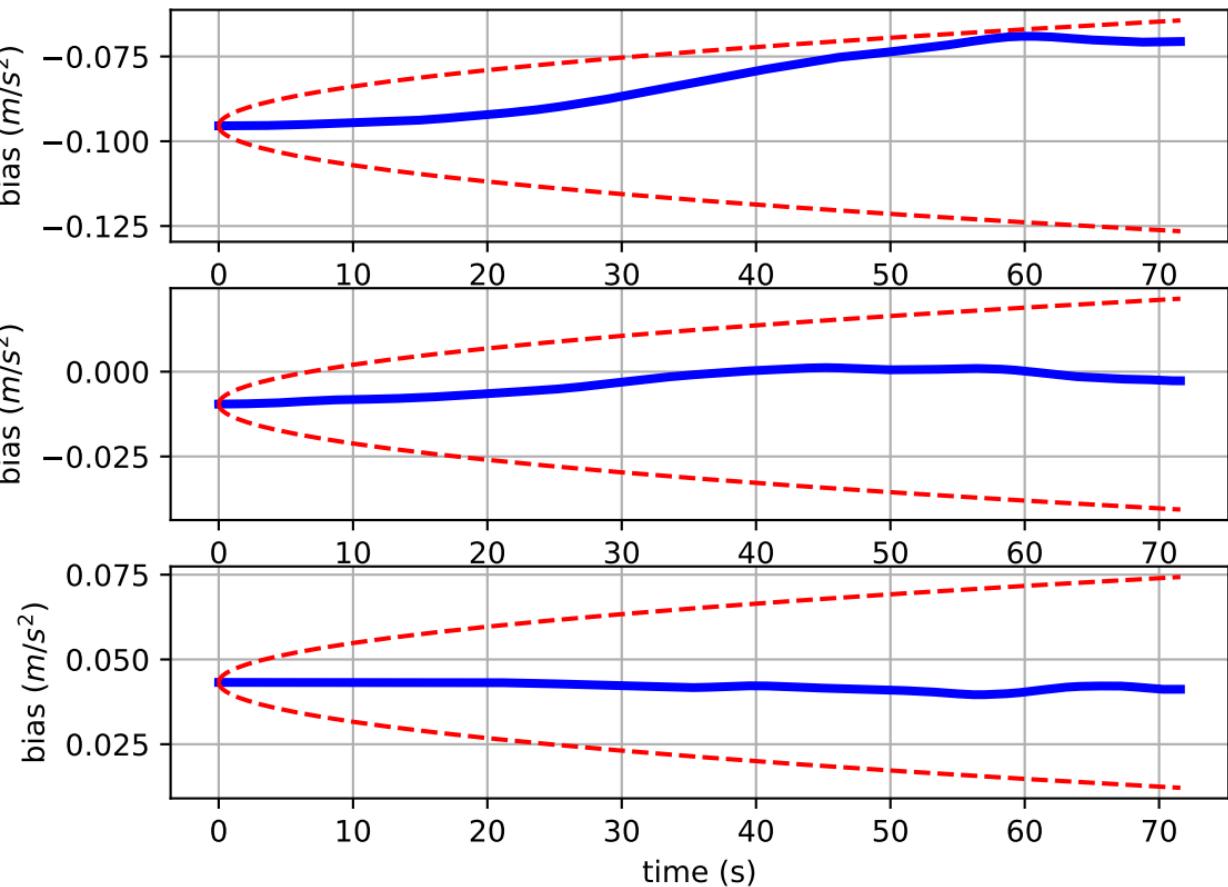
Comparison of predicted and measured specific force (imu0 frame)



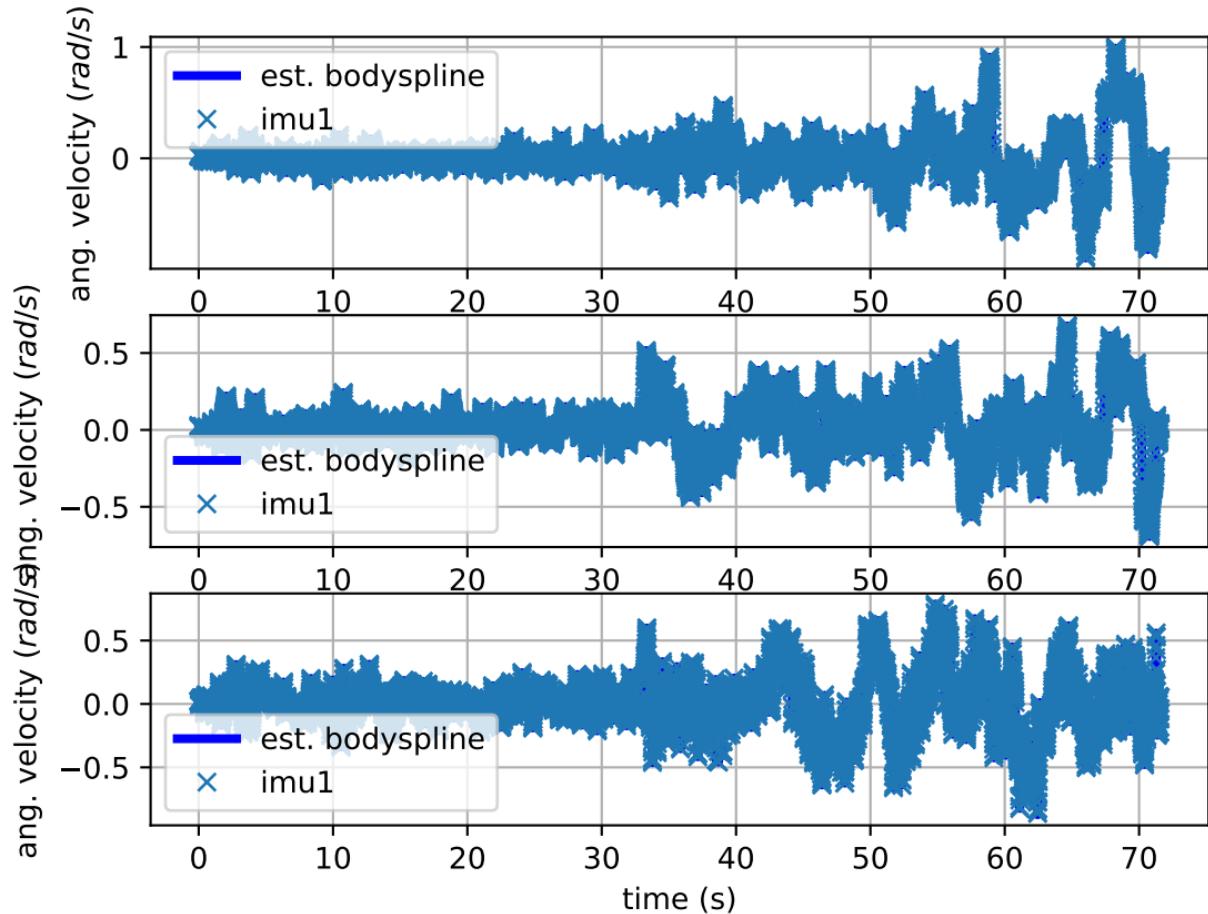
imu1: acceleration error



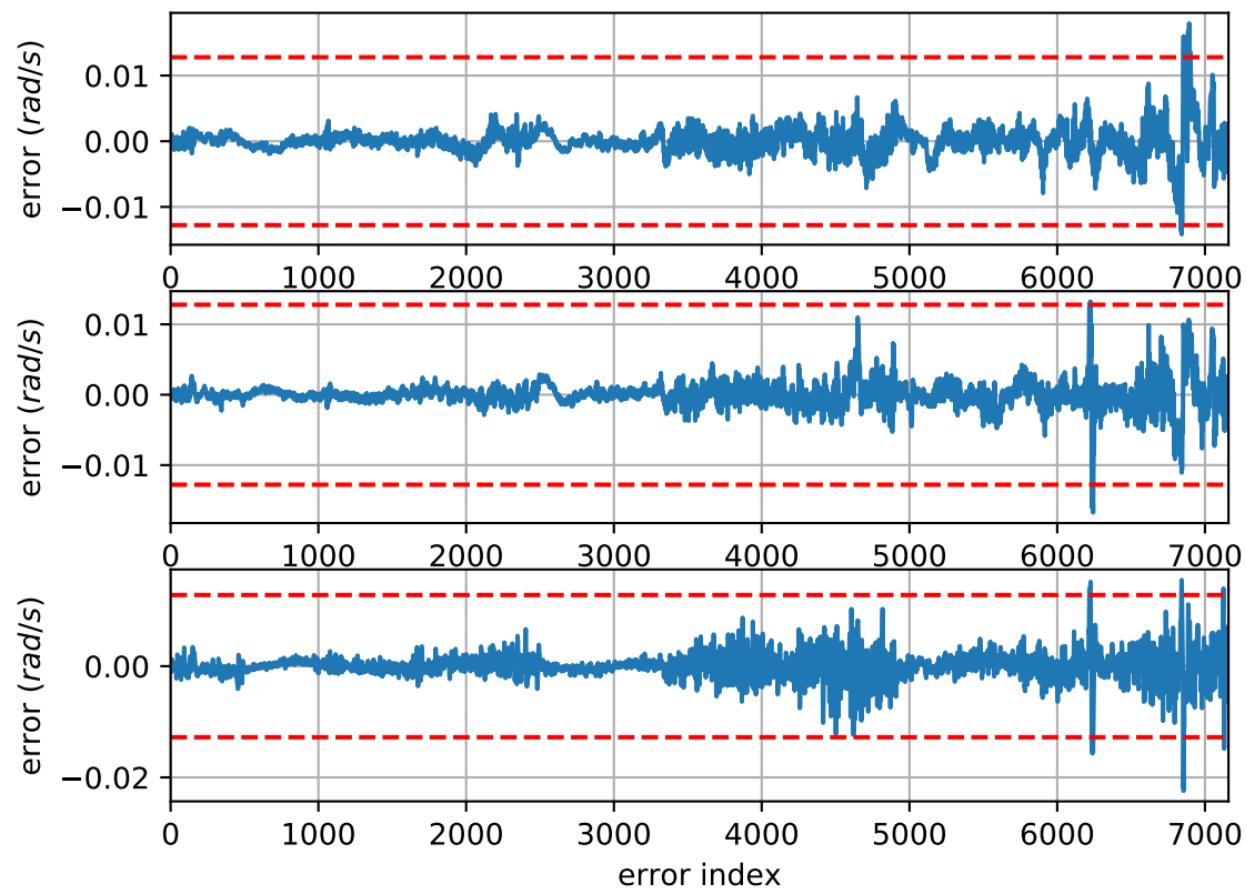
imu1: estimated accelerometer bias (imu frame)



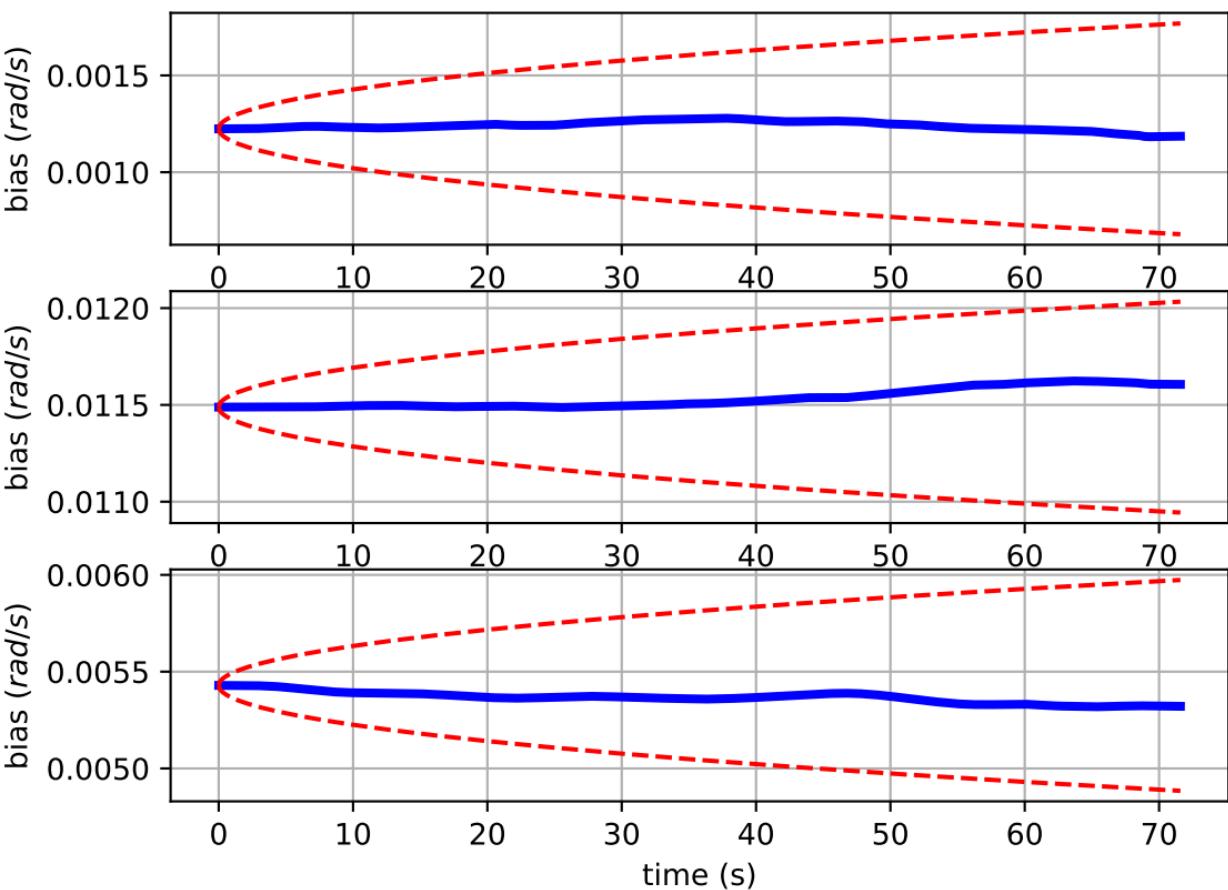
Comparison of predicted and measured angular velocities (body frame)



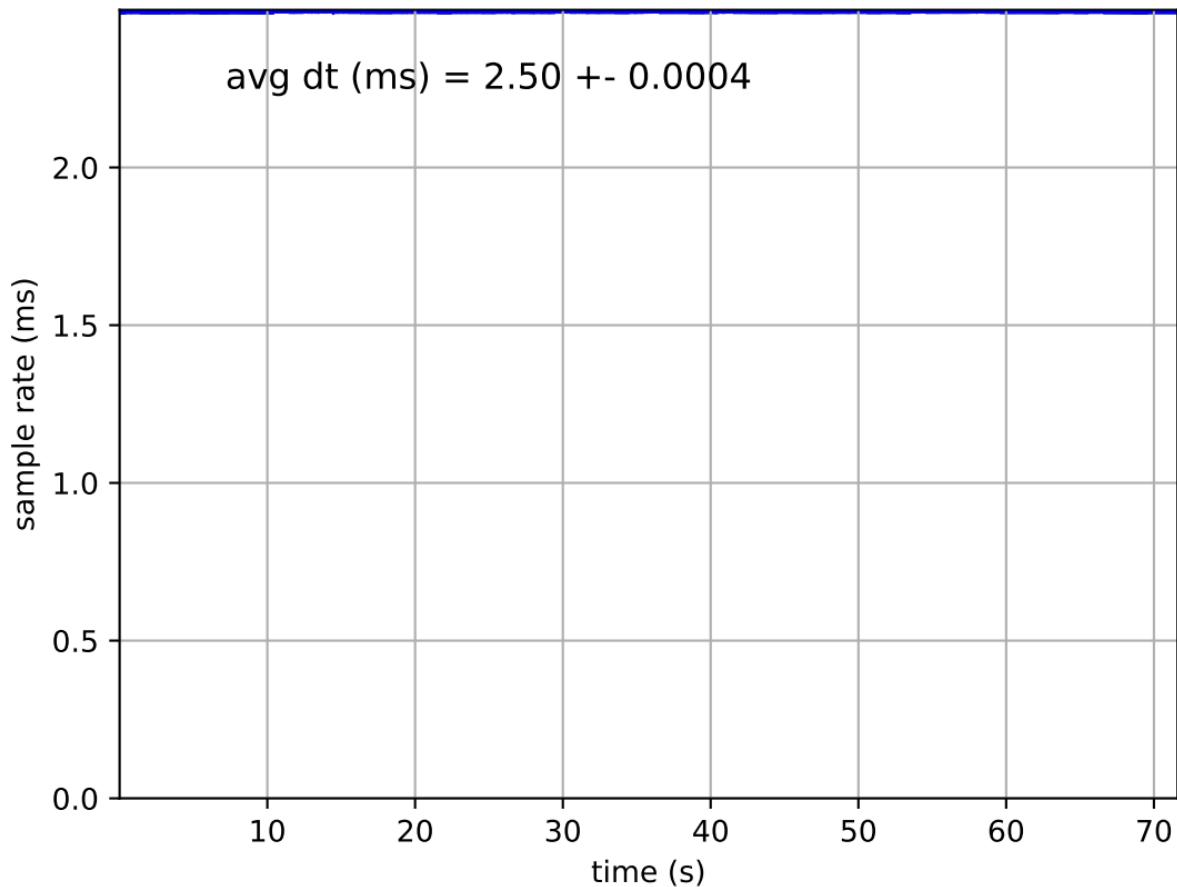
imul1: angular velocities error



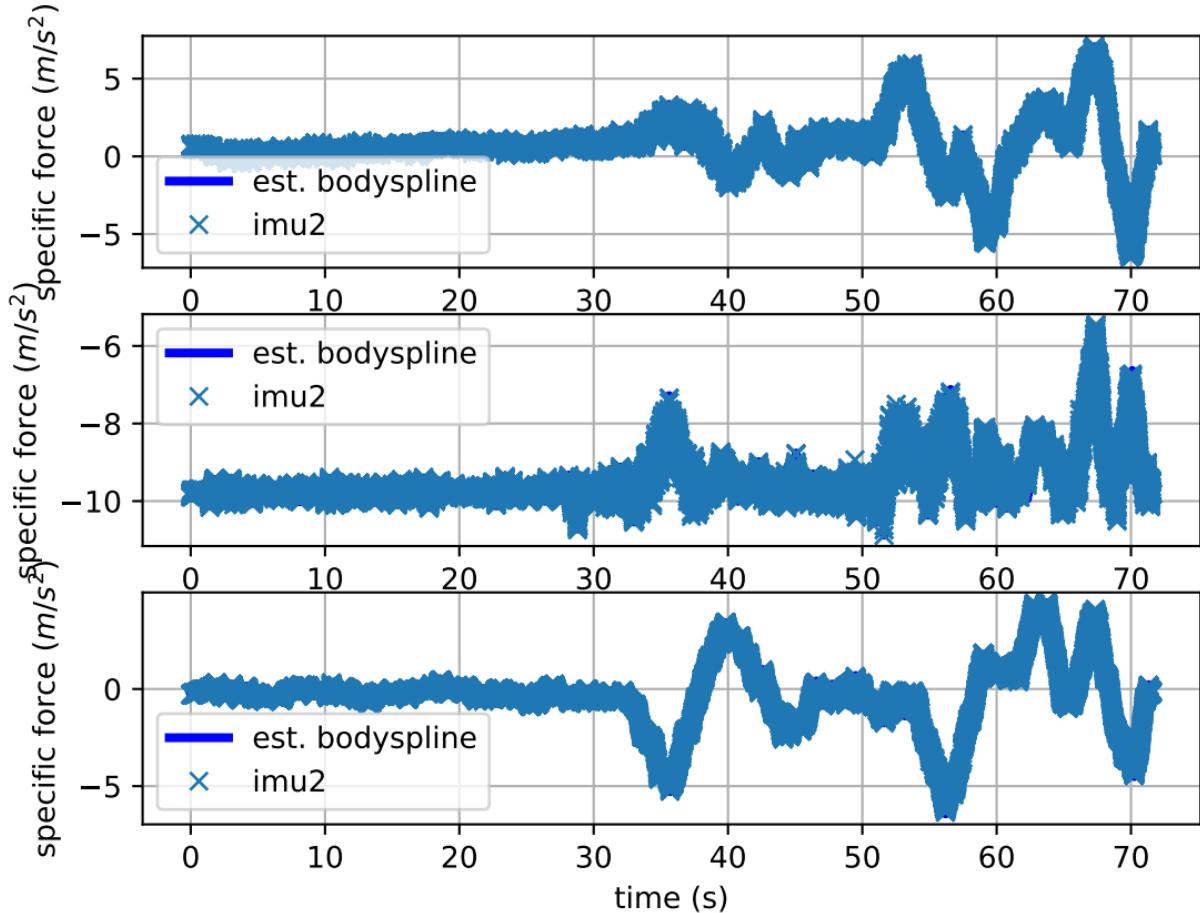
imu1: estimated gyro bias (imu frame)



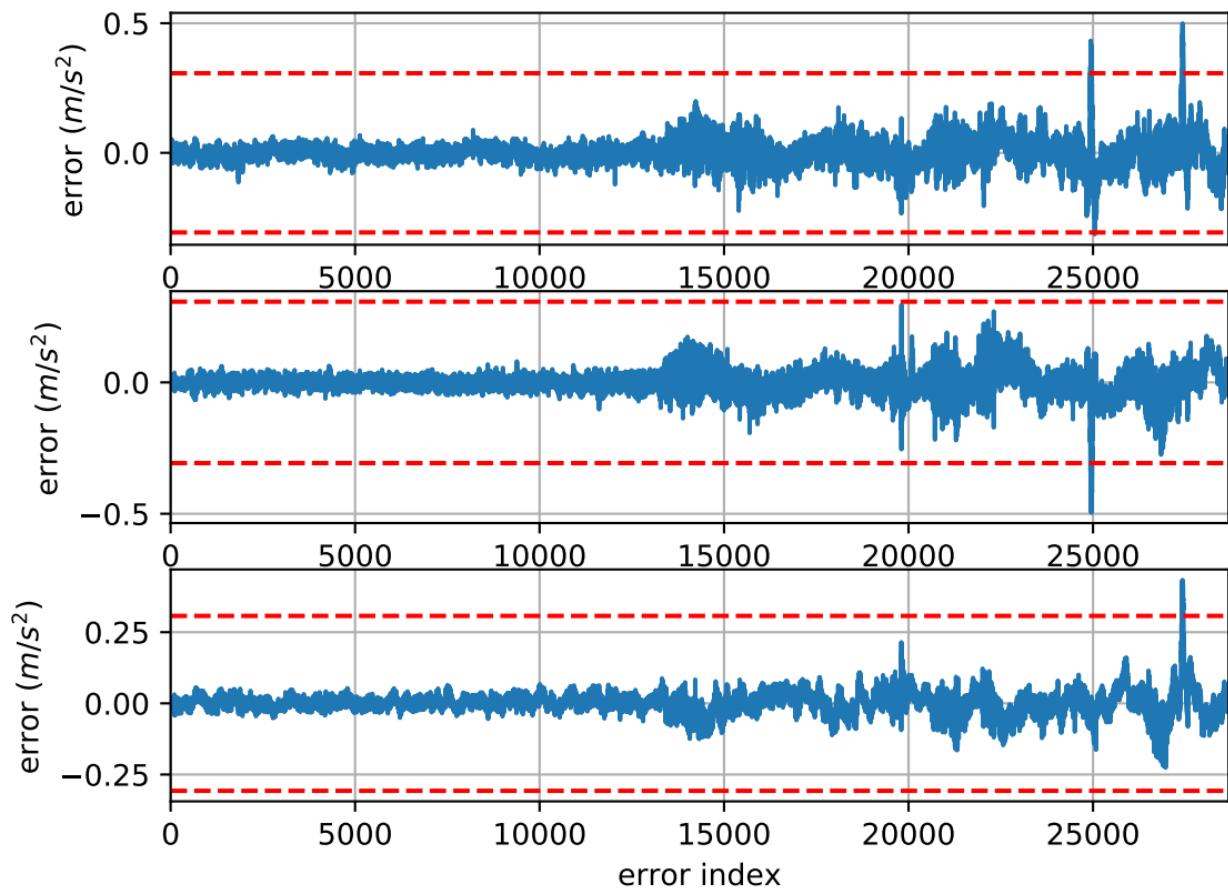
imu2: sample inertial rate



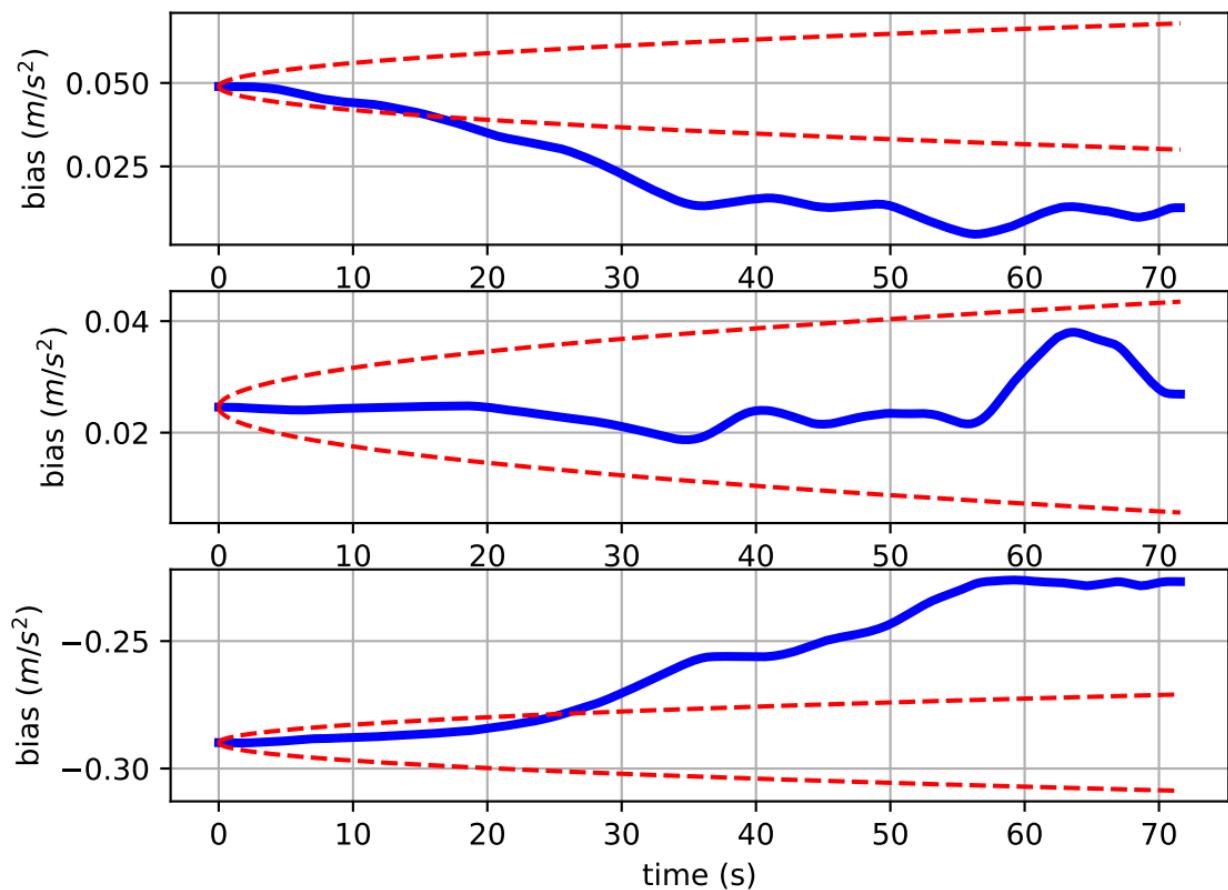
Comparison of predicted and measured specific force (imu0 frame)



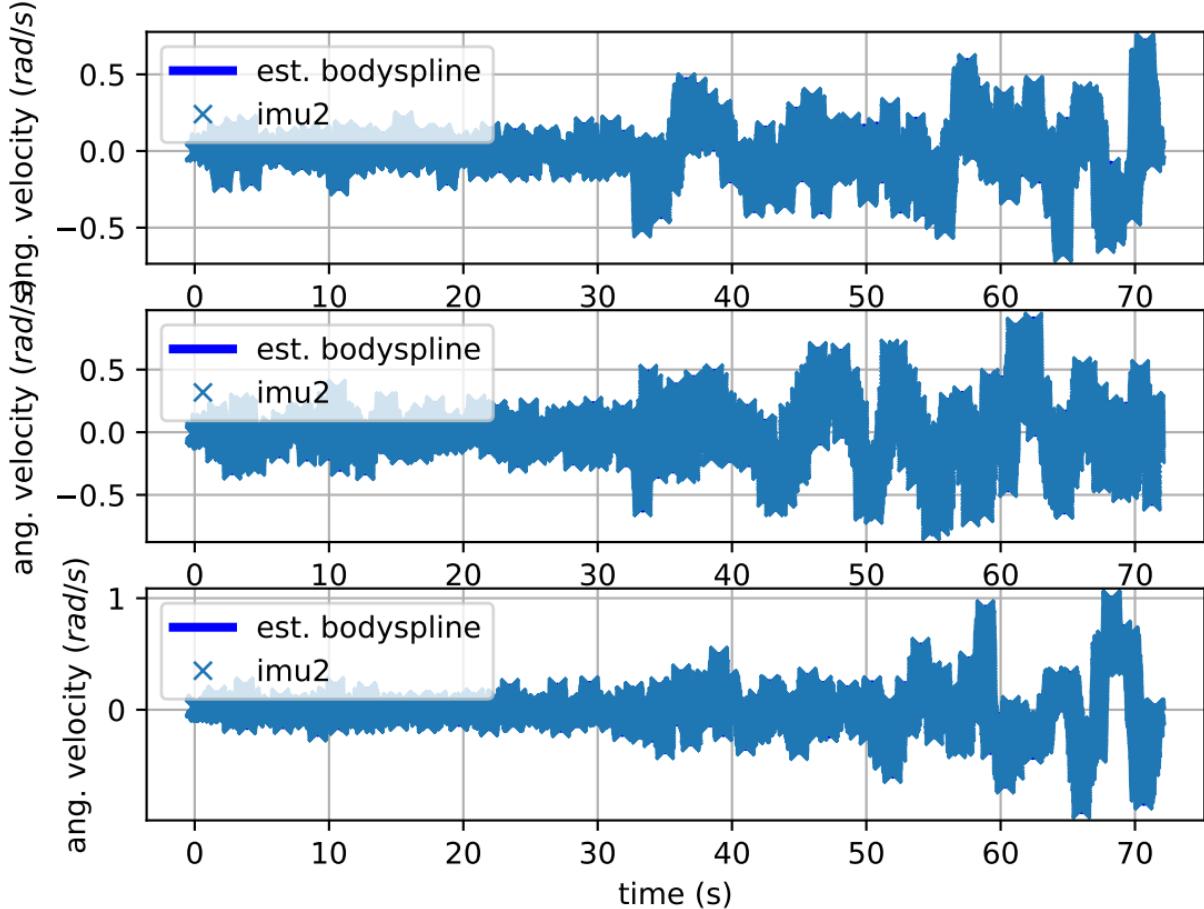
imu2: acceleration error



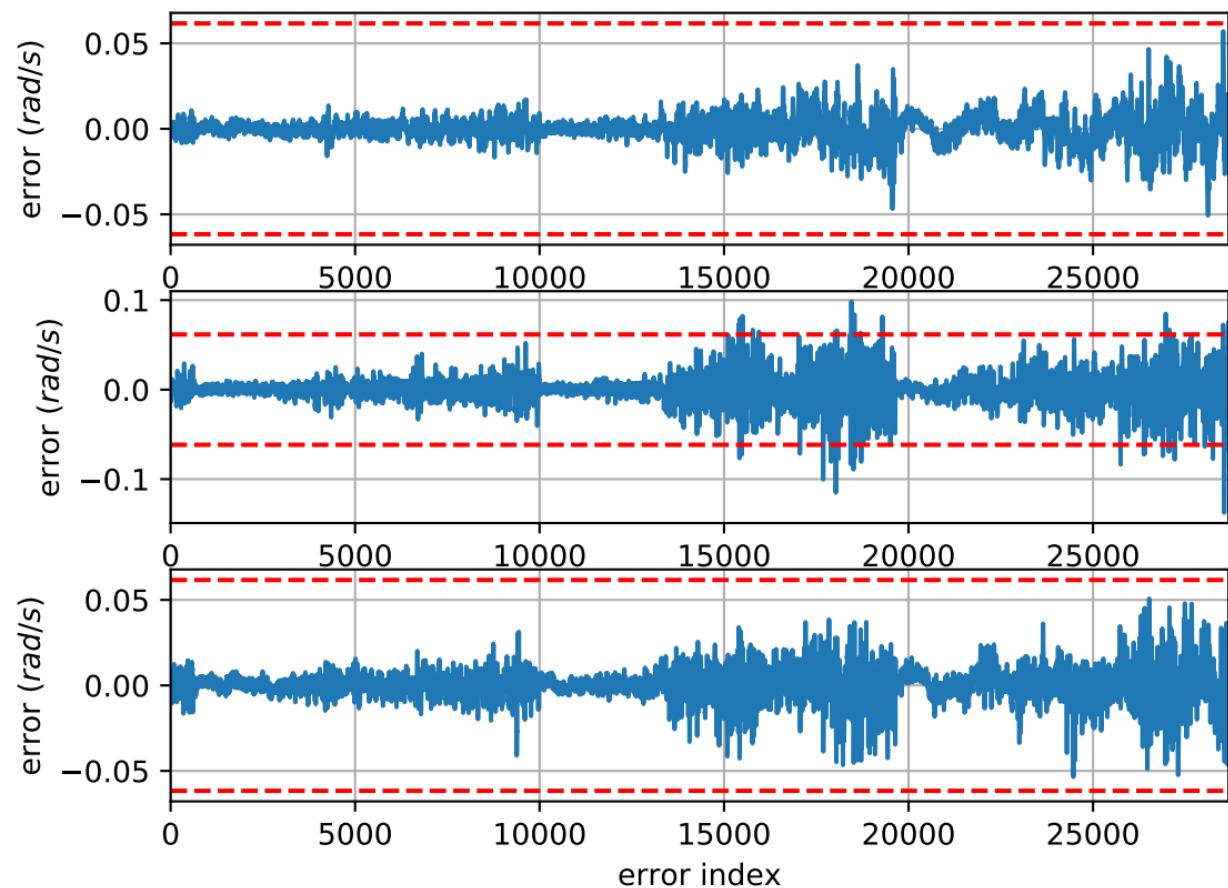
imu2: estimated accelerometer bias (imu frame)



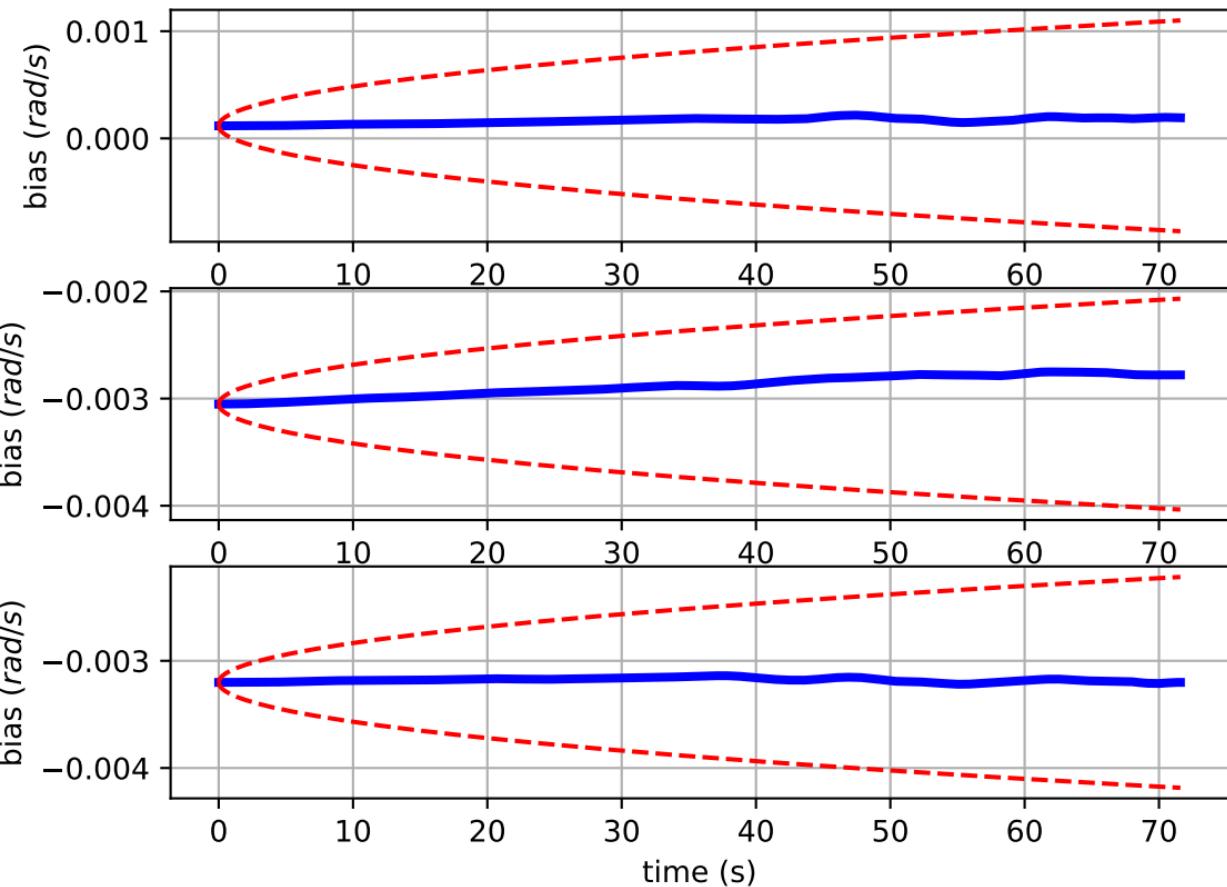
Comparison of predicted and measured angular velocities (body frame)



imu2: angular velocities error



imu2: estimated gyro bias (imu frame)



cam0: reprojection errors

