

## Calibration results

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### Normalized Residuals

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Reprojection error (cam0): mean 0.638455433650764, median 0.45787696401848704, std: 0.5980322004369577  
Gyroscope error (imu0): mean 0.9057308120037458, median 0.6854307522748555, std: 0.7139668900869962  
Accelerometer error (imu0): mean 0.4650848162442732, median 0.3694090568372971, std: 0.34780912739909786  
Gyroscope error (imu1): mean 0.9217001987806941, median 0.6994299859123332, std: 0.7233856846380087  
Accelerometer error (imu1): mean 0.6312008809990313, median 0.5035456127698683, std: 0.4711779657388853  
Gyroscope error (imu2): mean 0.8054629863498896, median 0.5452923746169661, std: 0.7687310223428921  
Accelerometer error (imu2): mean 0.680827618755799, median 0.5754998928817674, std: 0.4484899626810748

### Residuals

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Reprojection error (cam0) [px]: mean 0.638455433650764, median 0.45787696401848704, std: 0.5980322004369577  
Gyroscope error (imu0) [rad/s]: mean 0.003905173946709634, median 0.0029553221338861563, std: 0.00307835933262863  
Accelerometer error (imu0) [m/s^2]: mean 0.12598716614905564, median 0.10006948968267801, std: 0.09421826899369944  
Gyroscope error (imu1) [rad/s]: mean 0.003927777023430644, median 0.002980584176719421, std: 0.003082670129569826  
Accelerometer error (imu1) [m/s^2]: mean 0.12628267828582668, median 0.10074302893717653, std: 0.09426732004650866  
Gyroscope error (imu2) [rad/s]: mean 0.016549799334453306, median 0.011204089488226508, std: 0.015795069888434914  
Accelerometer error (imu2) [m/s^2]: mean 0.06971043766073505, median 0.058925854799794626, std: 0.045921215185247145

### Transformation (cam0):

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T\_ci: (imu0 to cam0):  
[-0.001052 -0.99989997 -0.01410453 0.03841098]  
[-0.0350624 0.01413275 -0.99928519 -0.08804642]  
[ 0.99938457 -0.00055671 -0.03507377 -0.07950676]  
[ 0. 0. 0. 1. ]]

### T\_ic: (cam0 to imu0):

[[-0.001052 -0.0350624 0.99938457 0.07641112]  
[-0.99989997 0.01413275 -0.00055671 0.03960721]  
[-0.01410453 -0.99928519 -0.03507377 -0.09023032]  
[ 0. 0. 0. 1. ]]

timeshift cam0 to imu0: [s] (t\_imu = t\_cam + shift)  
0.022161585567642448

Gravity vector in target coords: [m/s^2]  
[-0.09198057 -9.80573323 0.0869384 ]

#### Calibration configuration

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cam0

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Camera model: pinhole

Focal length: [601.3186411971056, 601.2768853467267]

Principal point: [333.27919850528497, 255.8812824984572]

Distortion model: radtan

Distortion coefficients: [0.09664591489773028, -0.17898409622328165, 0.0018507932894134427,  
0.0021781167451163197]

Type: aprilgrid

Tags:

Rows: 6

Cols: 6

Size: 0.088 [m]

Spacing 0.02639999999999996 [m]

#### IMU configuration

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IMU0:

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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)  
[[1. 0. 0. 0.]  
[0. 1. 0. 0.]  
[0. 0. 1. 0.]  
[0. 0. 0. 1.]]  
time offset with respect to IMU0: 0.0 [s]

IMU1:

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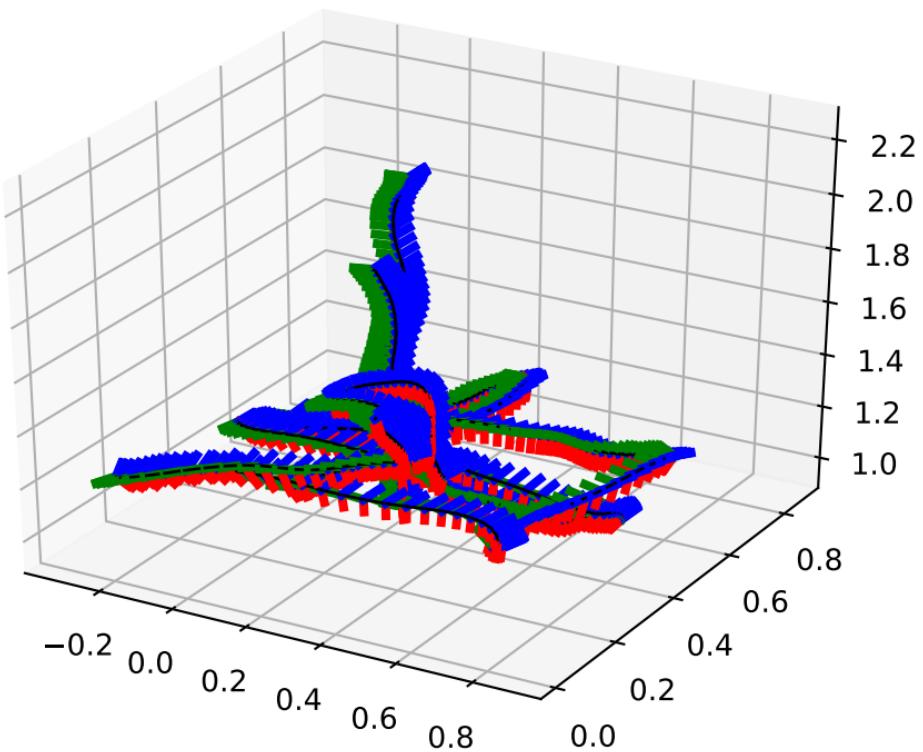
Model: calibrated  
Update rate: 100  
Accelerometer:  
Noise density: 0.02000673352767714  
Noise density (discrete): 0.2000673352767714  
Random walk: 0.001224627431466927  
Gyroscope:  
Noise density: 0.0004261447516911305  
Noise density (discrete): 0.004261447516911304  
Random walk: 2.14534407581717e-05  
 $T_{ib}$  (imu0 to imu1)  
[[ 0.99999999 0.00009132 -0.00007408 -0.00008347]  
[-0.00009131 0.99999999 0.00013174 -0.0002923 ]  
[ 0.00007409 -0.00013173 0.99999999 0.00013351]  
[ 0. 0. 0. 1. ]]  
time offset with respect to IMU0: 0.0 [s]

IMU2:

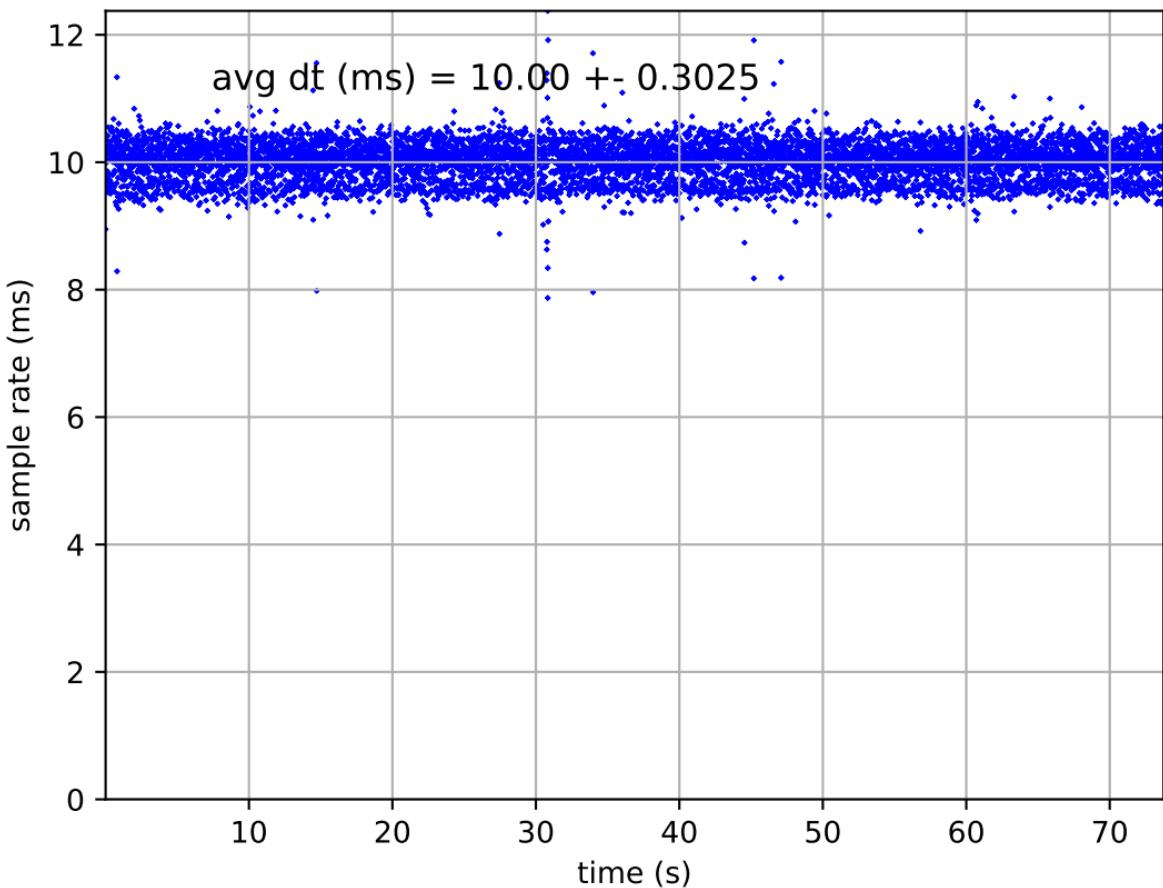
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Model: calibrated  
Update rate: 400  
Accelerometer:  
Noise density: 0.005119536556707974  
Noise density (discrete): 0.10239073113415947  
Random walk: 0.0007446449364276494  
Gyroscope:  
Noise density: 0.0010273469802412588  
Noise density (discrete): 0.020546939604825173  
Random walk: 3.8743601798420855e-05  
T\_ib (imu0 to imu2)  
[[-0.00355198 -0.99992381 0.01182171 0.02193905]  
[-0.019449 -0.01175047 -0.9997418 -0.07728539]  
[ 0.99980454 -0.00378099 -0.01940578 -0.05377713]  
[ 0. 0. 0. 1. ]]  
time offset with respect to IMU0: 0.0 [s]

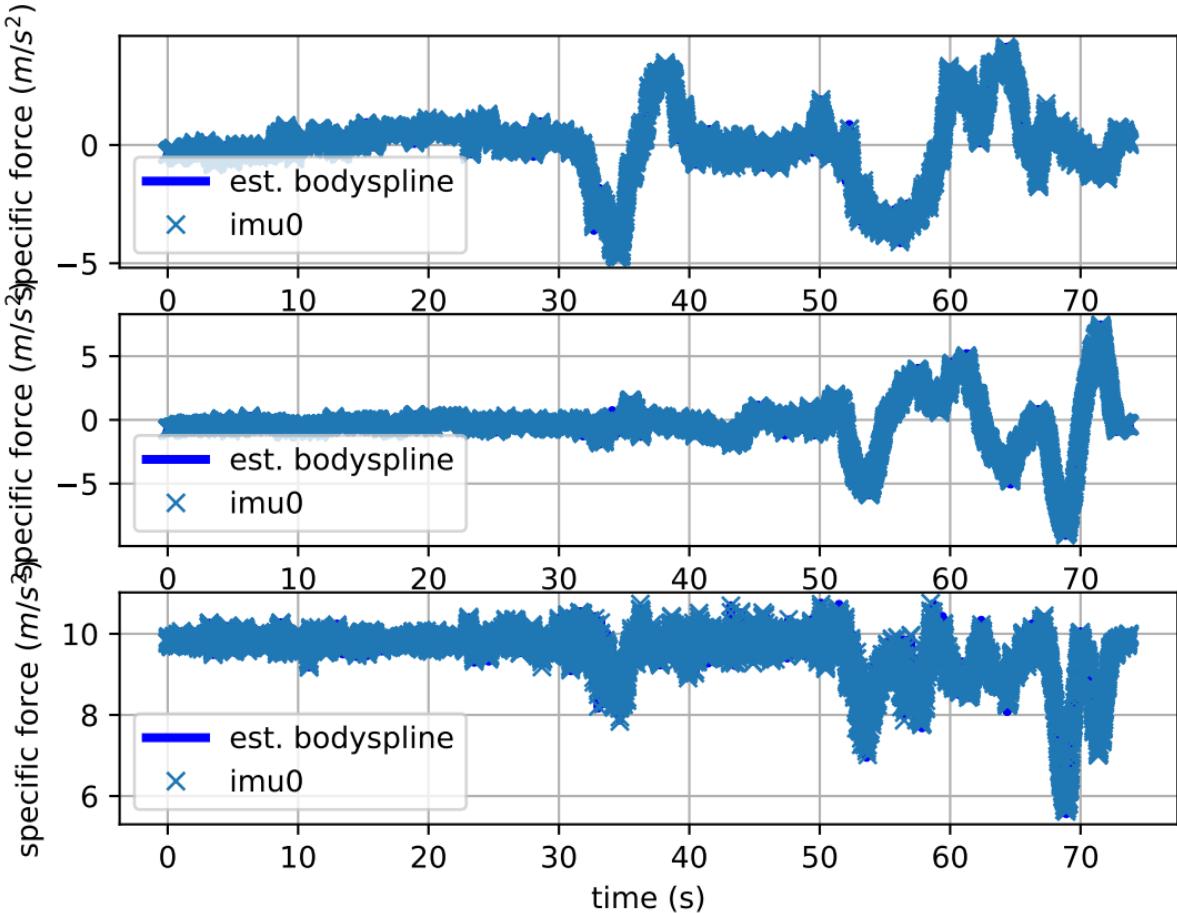
imu0: estimated poses



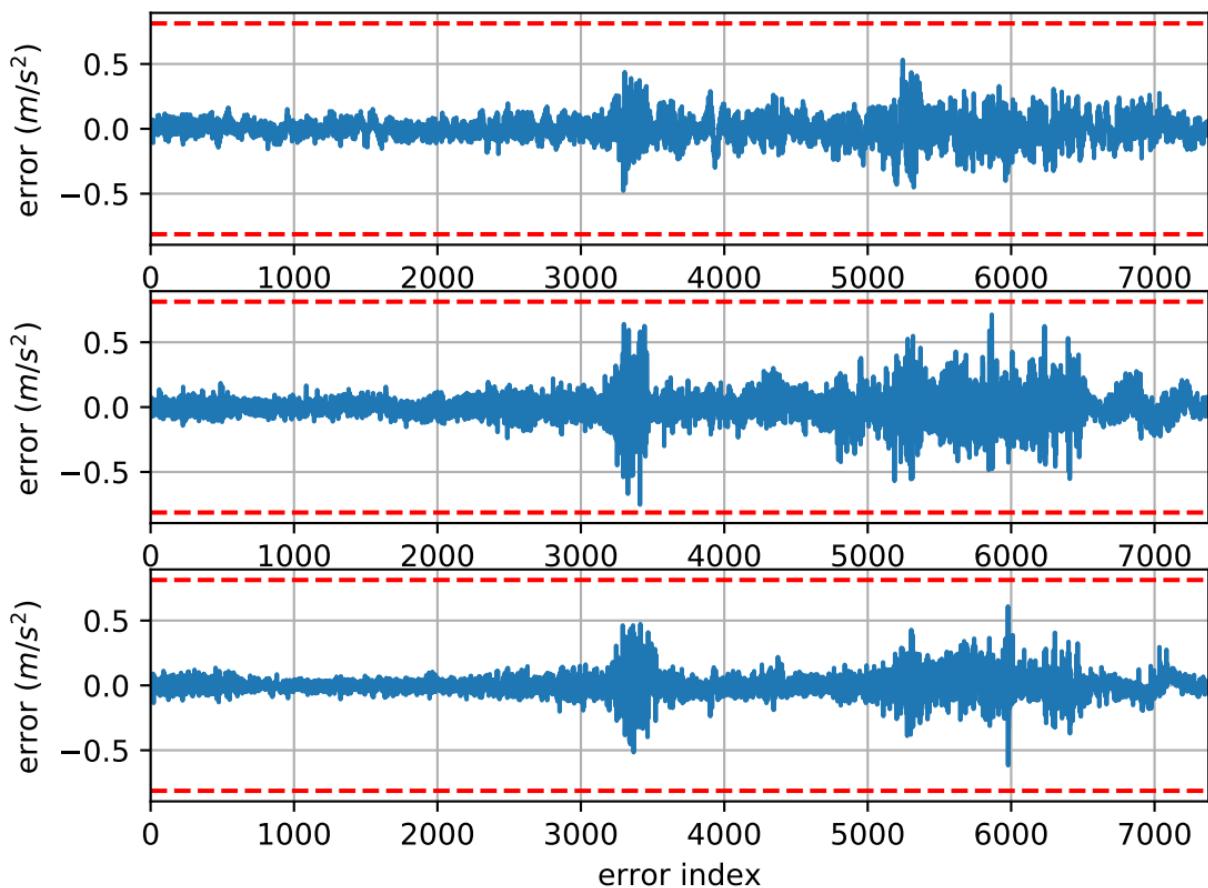
# imu0: sample inertial rate



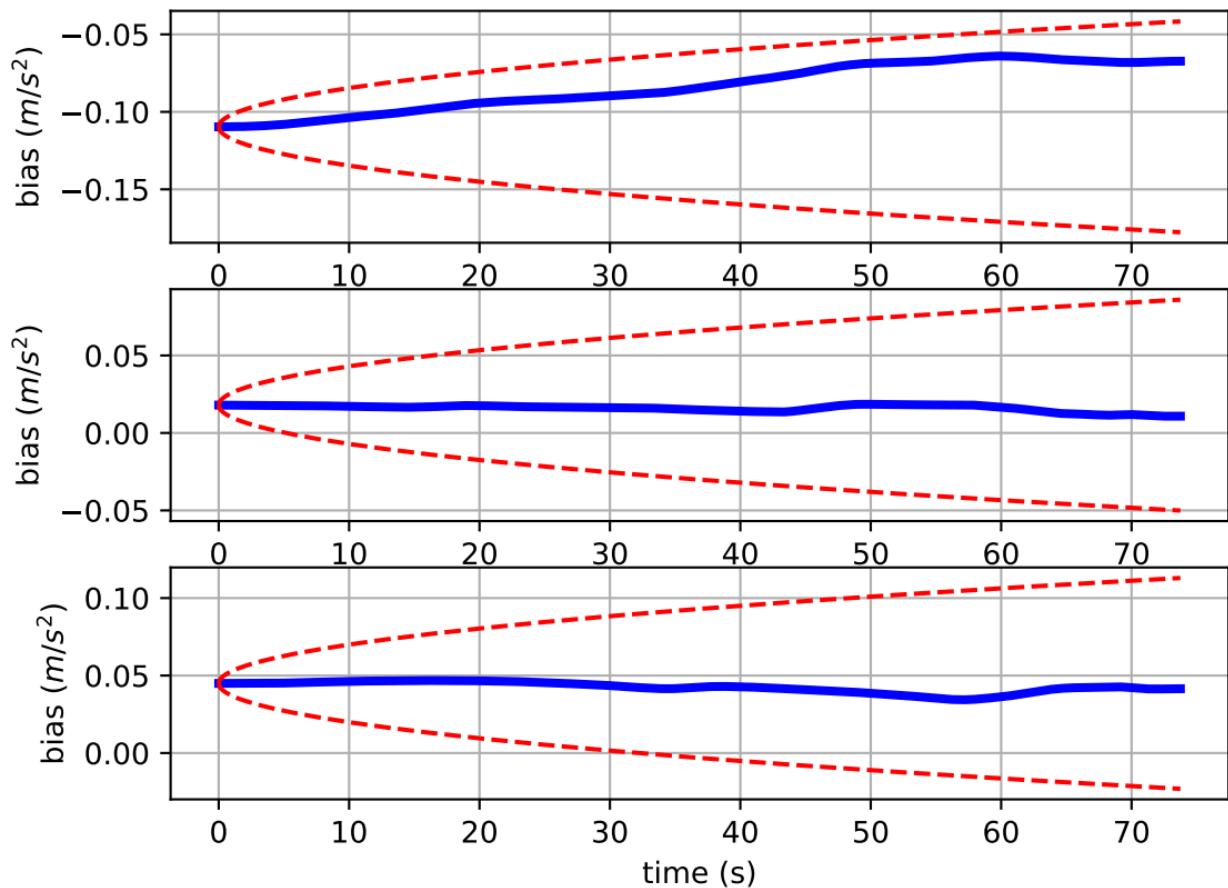
# Comparison of predicted and measured specific force (imu0 frame)



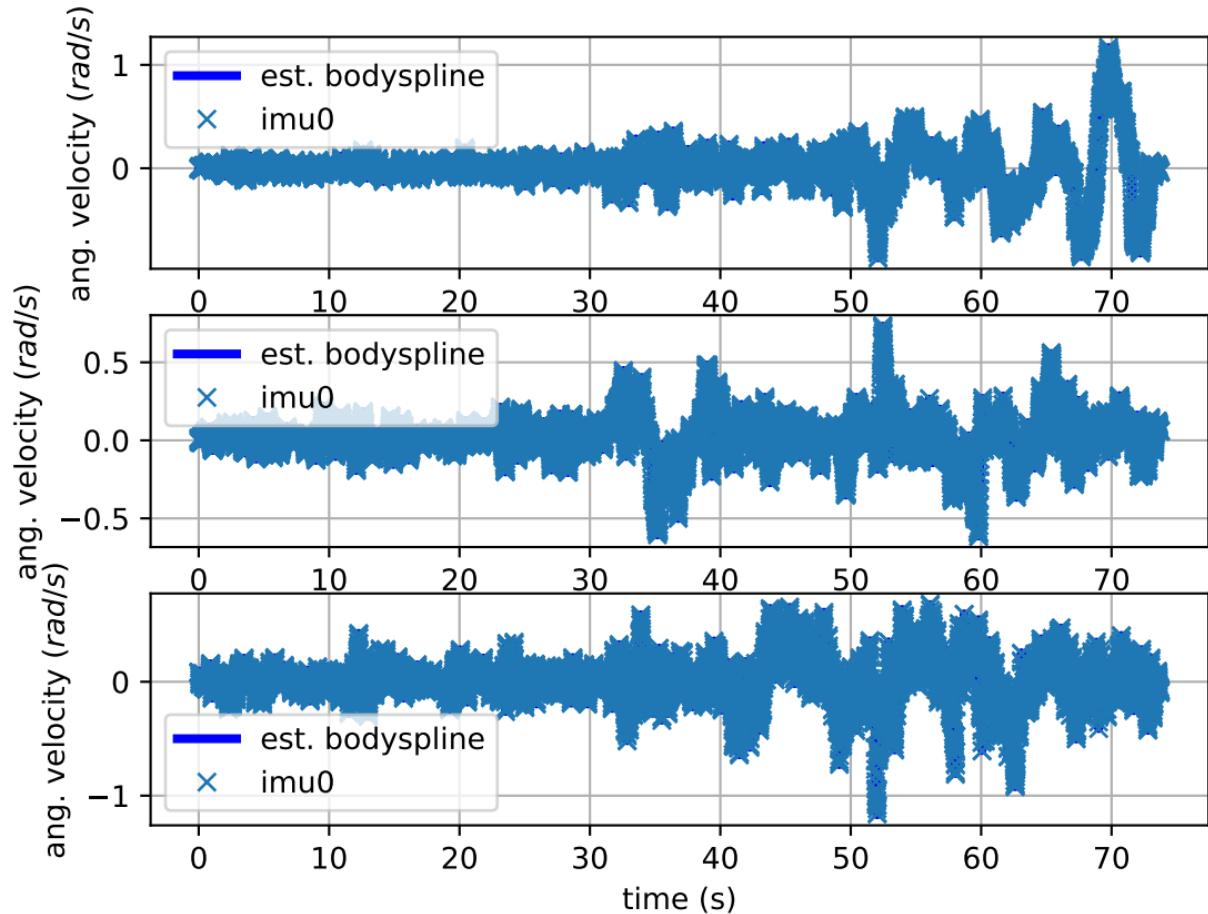
# imu0: acceleration error



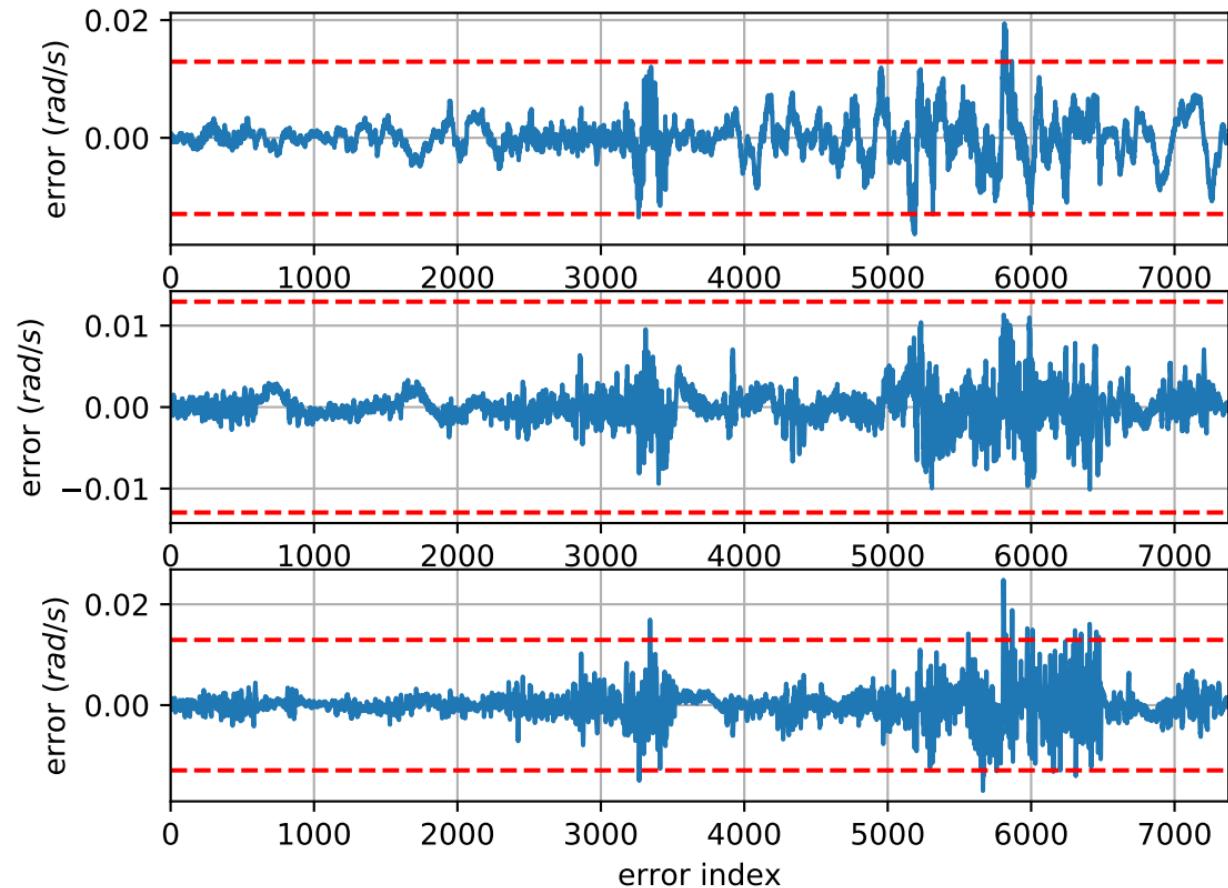
# imu0: estimated accelerometer bias (imu frame)



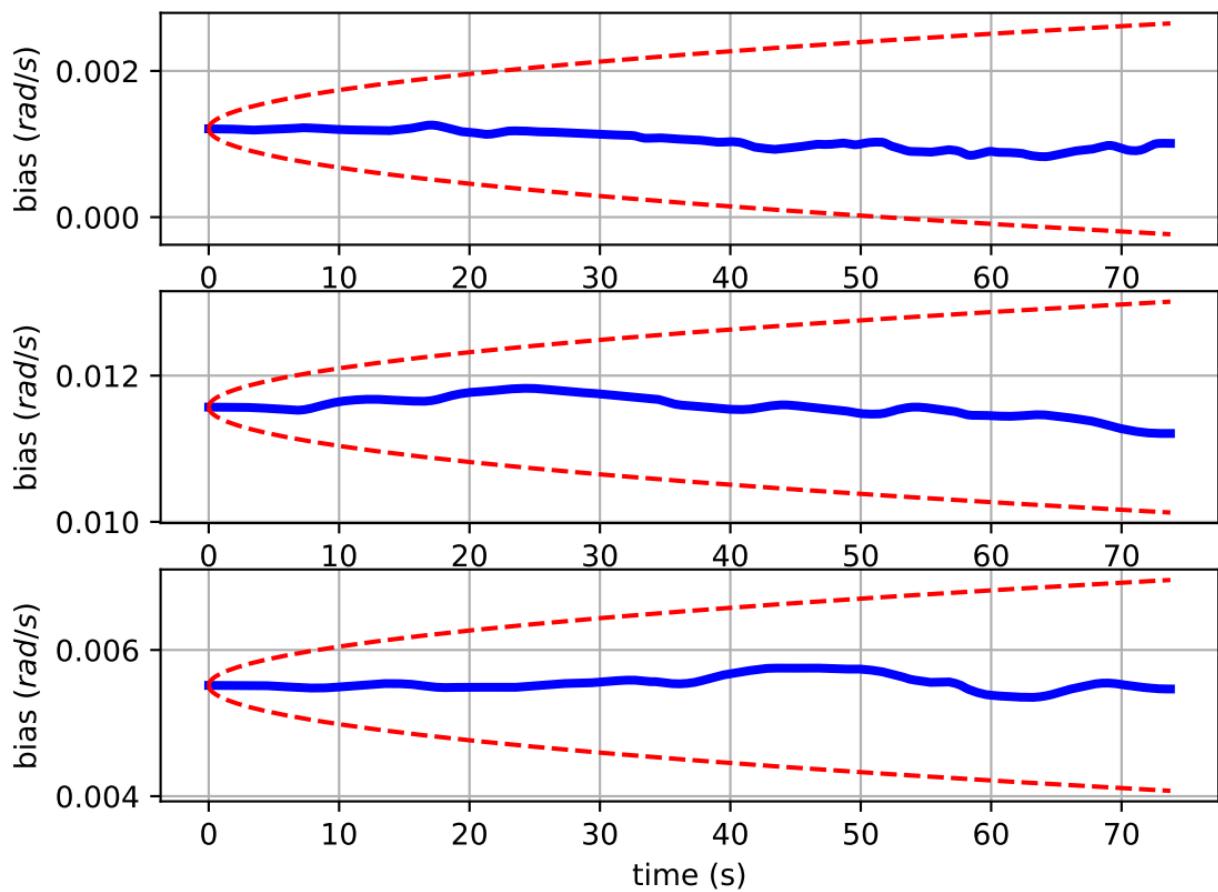
# Comparison of predicted and measured angular velocities (body frame)



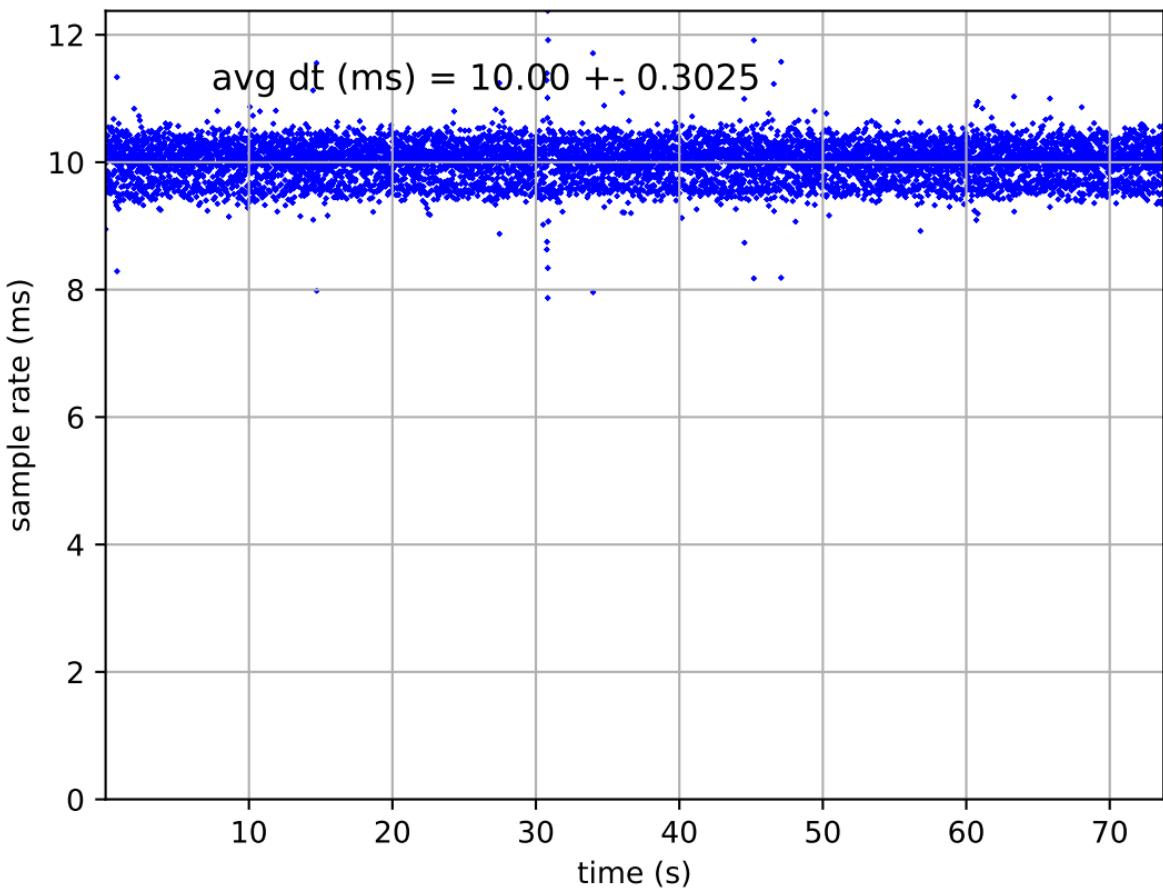
# imu0: angular velocities error



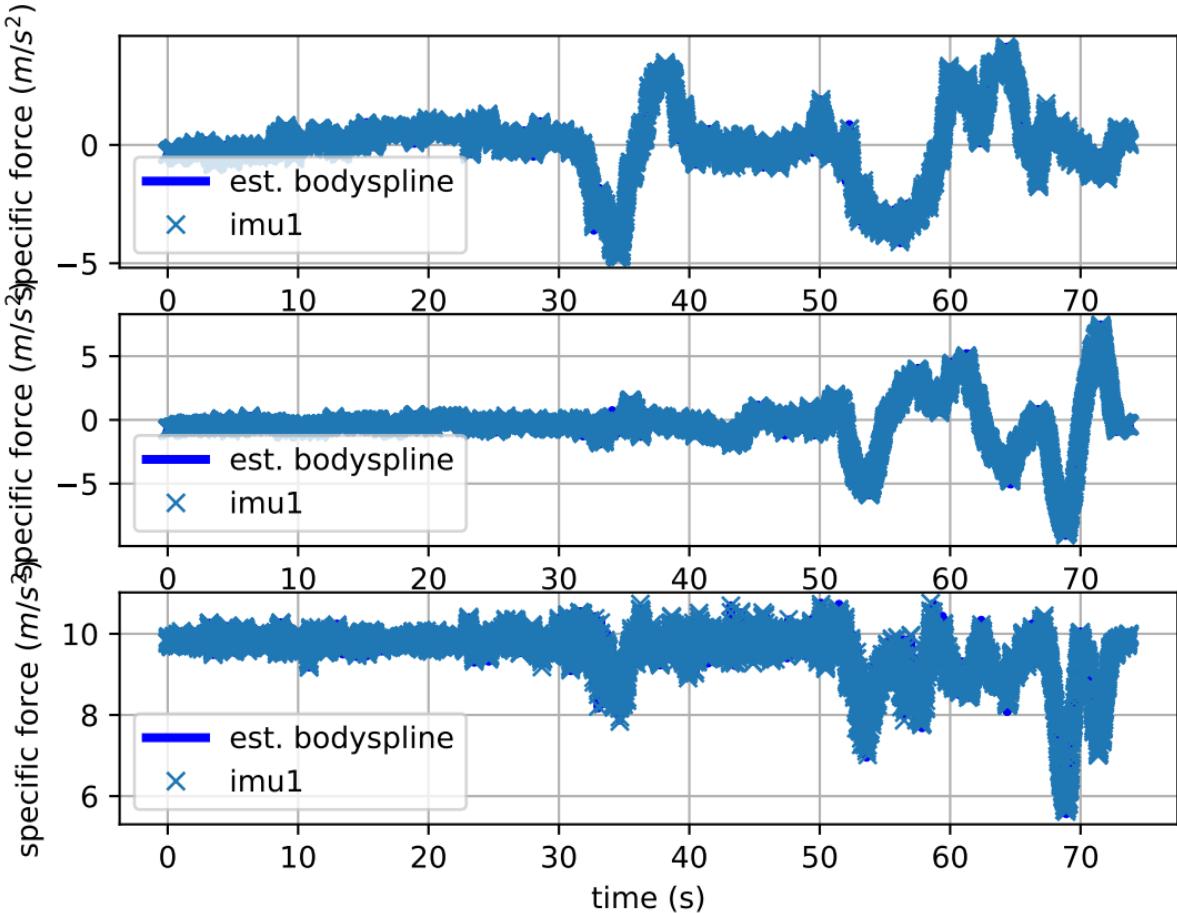
# imu0: estimated gyro bias (imu frame)



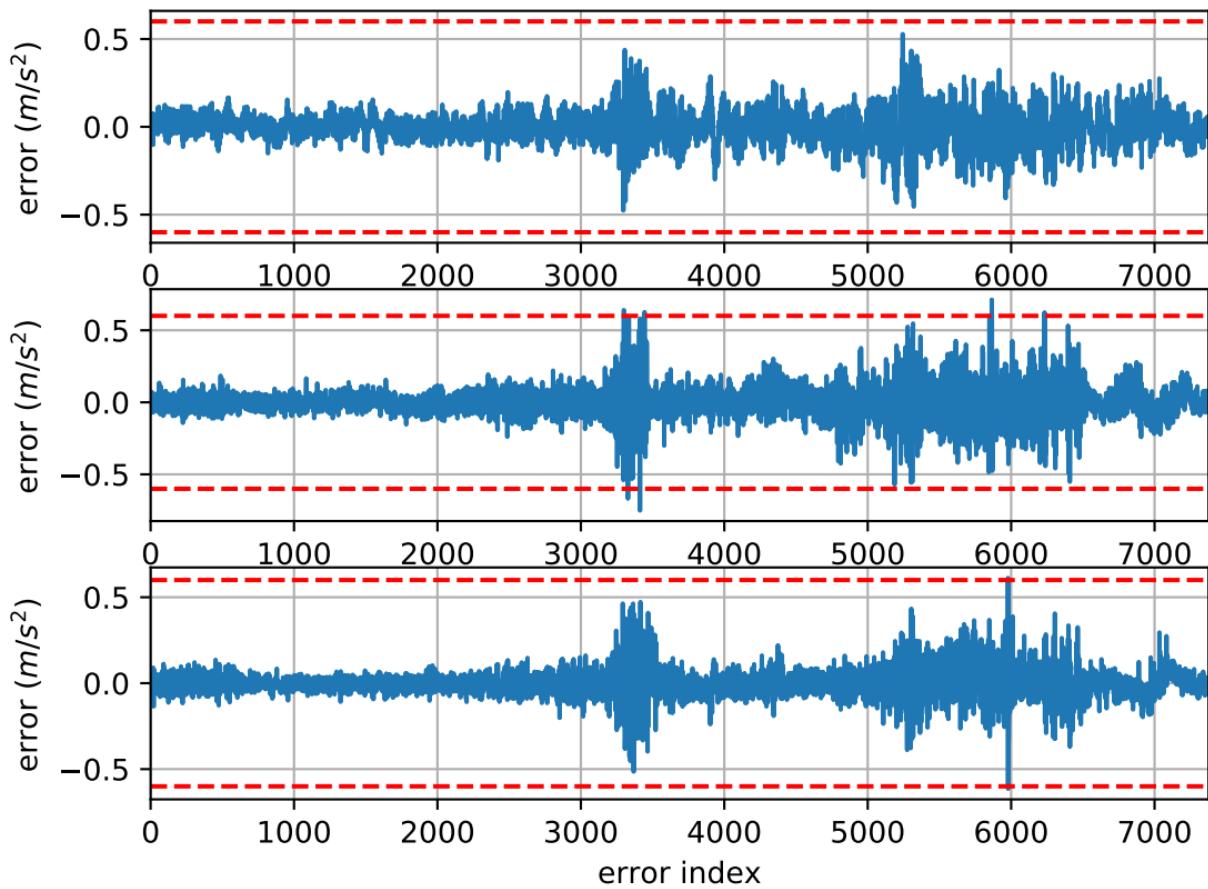
# imu1: sample inertial rate



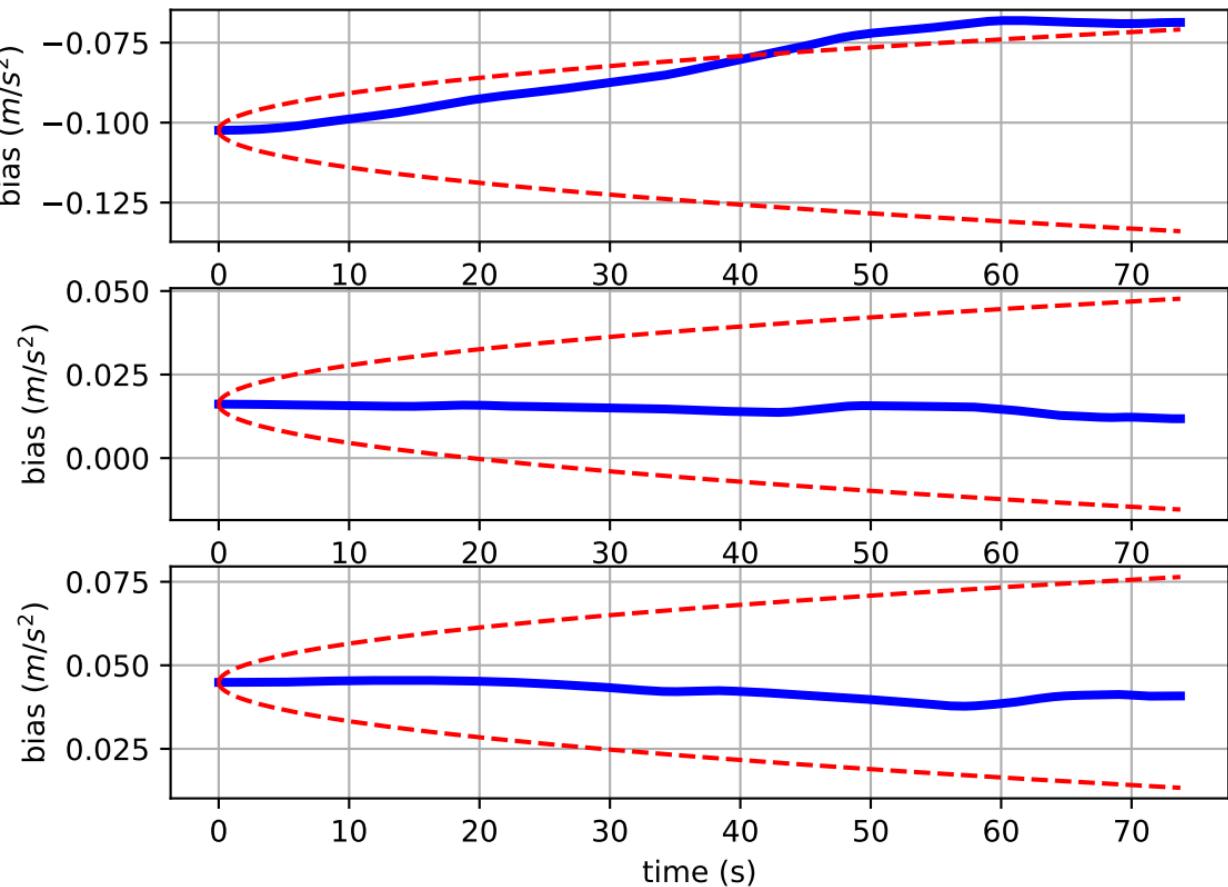
# Comparison of predicted and measured specific force (imu0 frame)



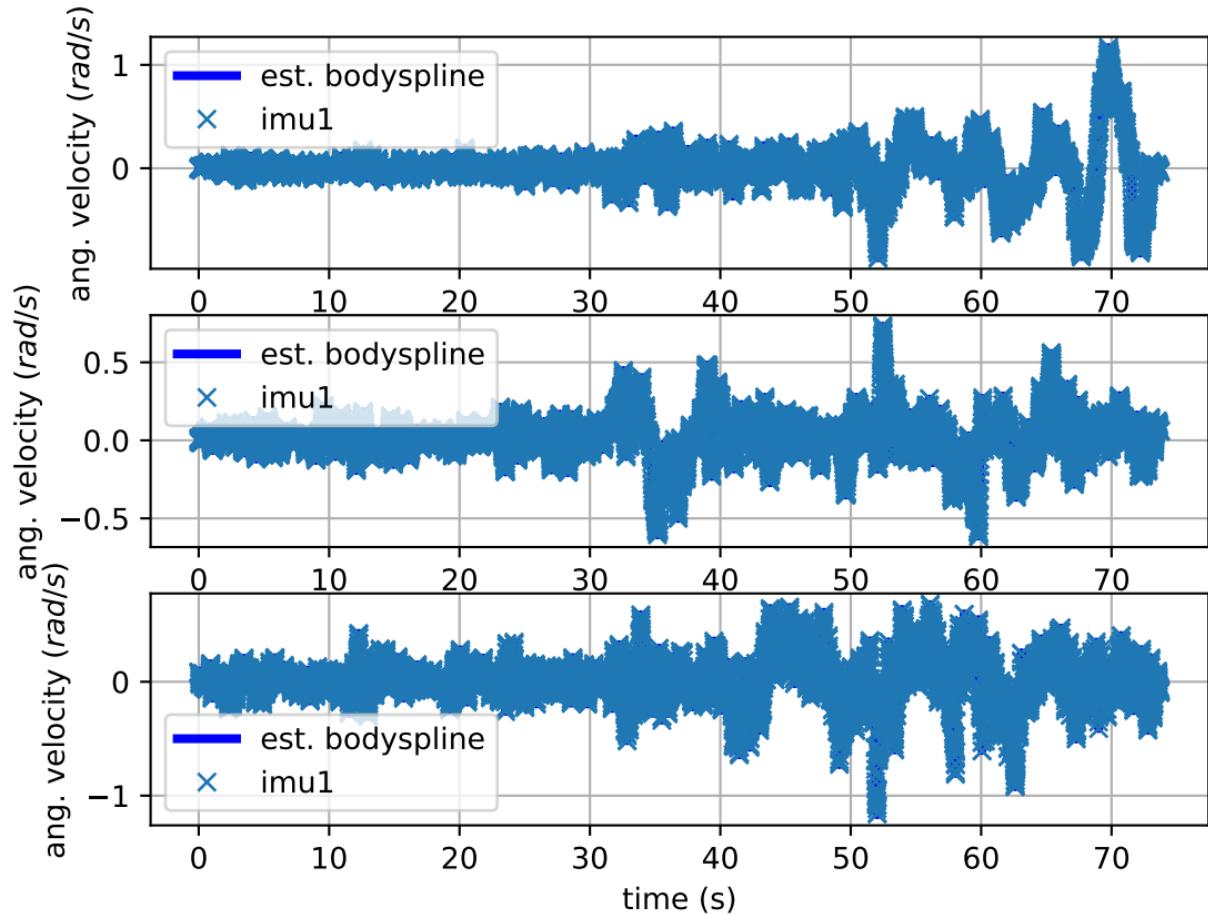
# imu1: acceleration error



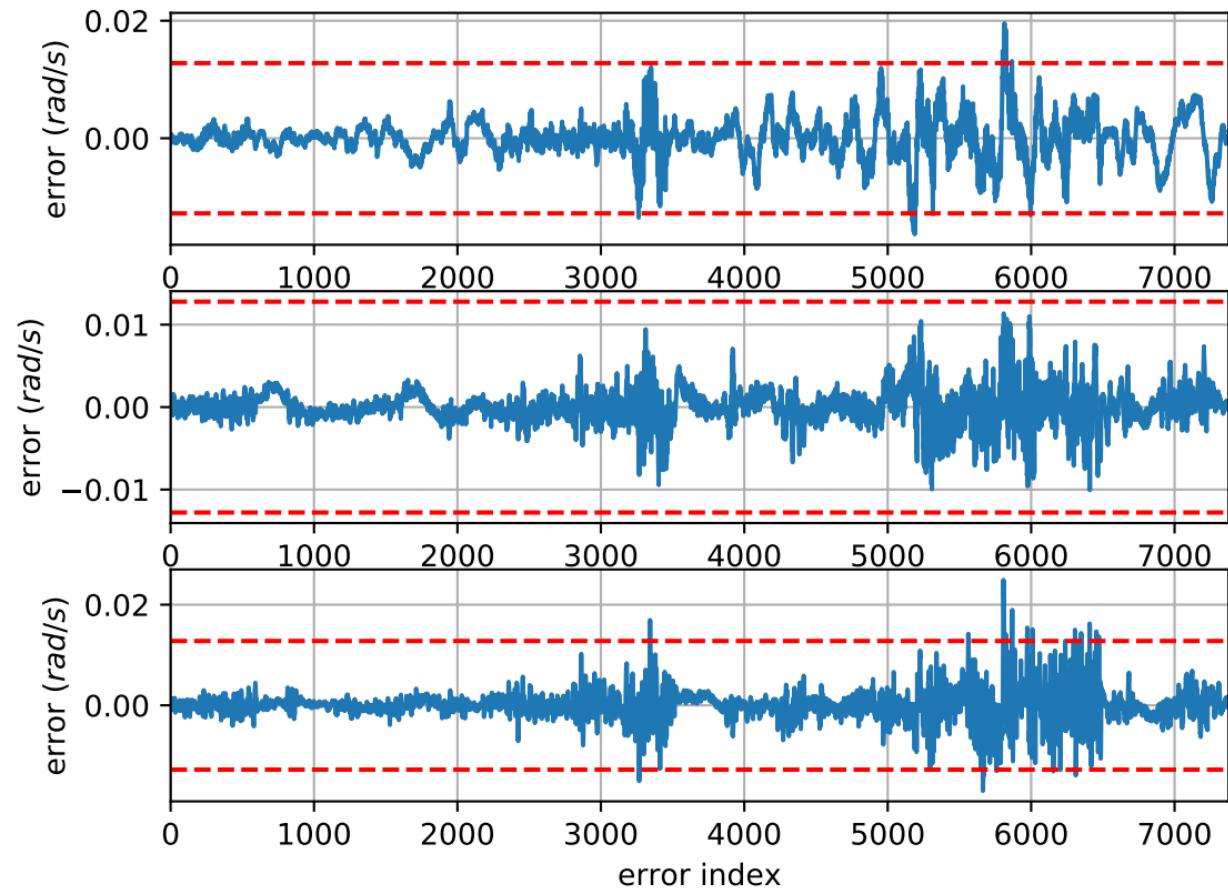
# imu1: estimated accelerometer bias (imu frame)



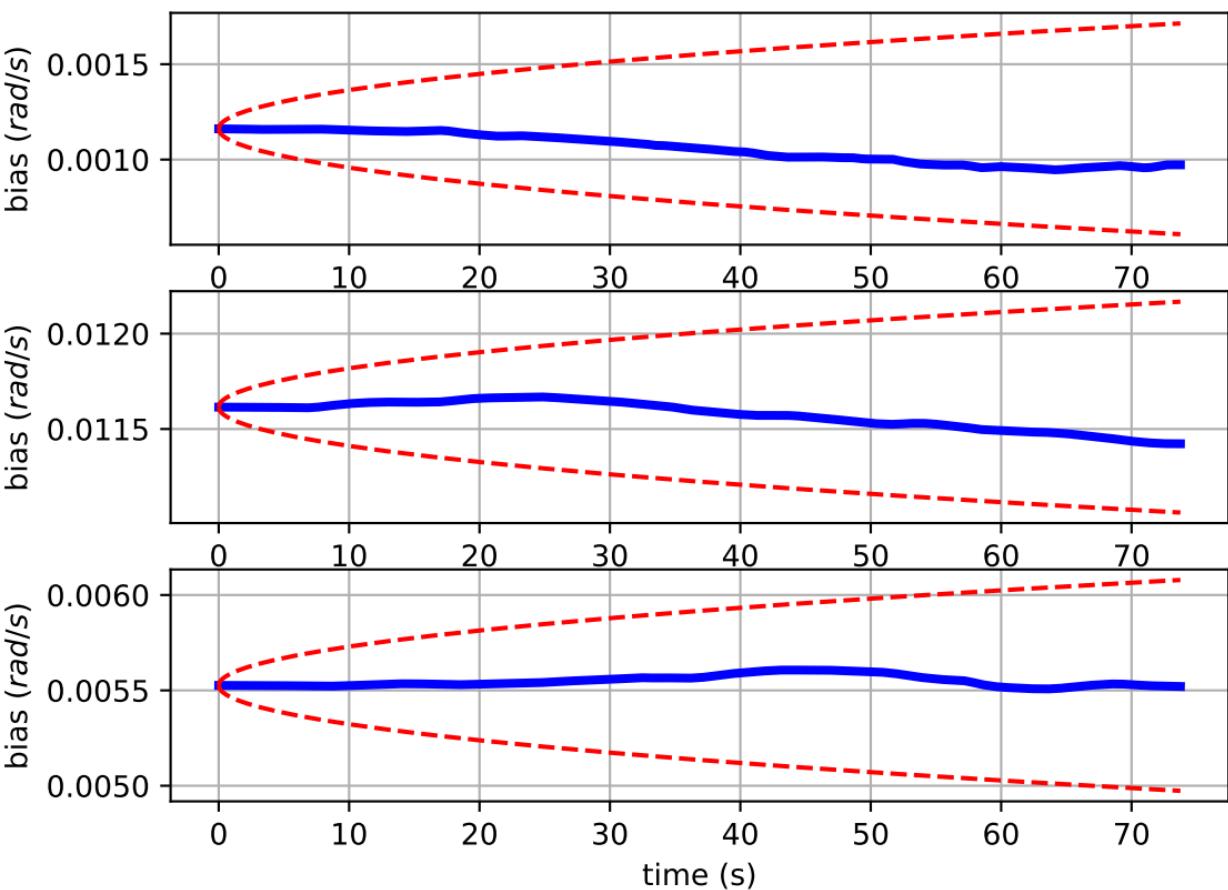
# Comparison of predicted and measured angular velocities (body frame)



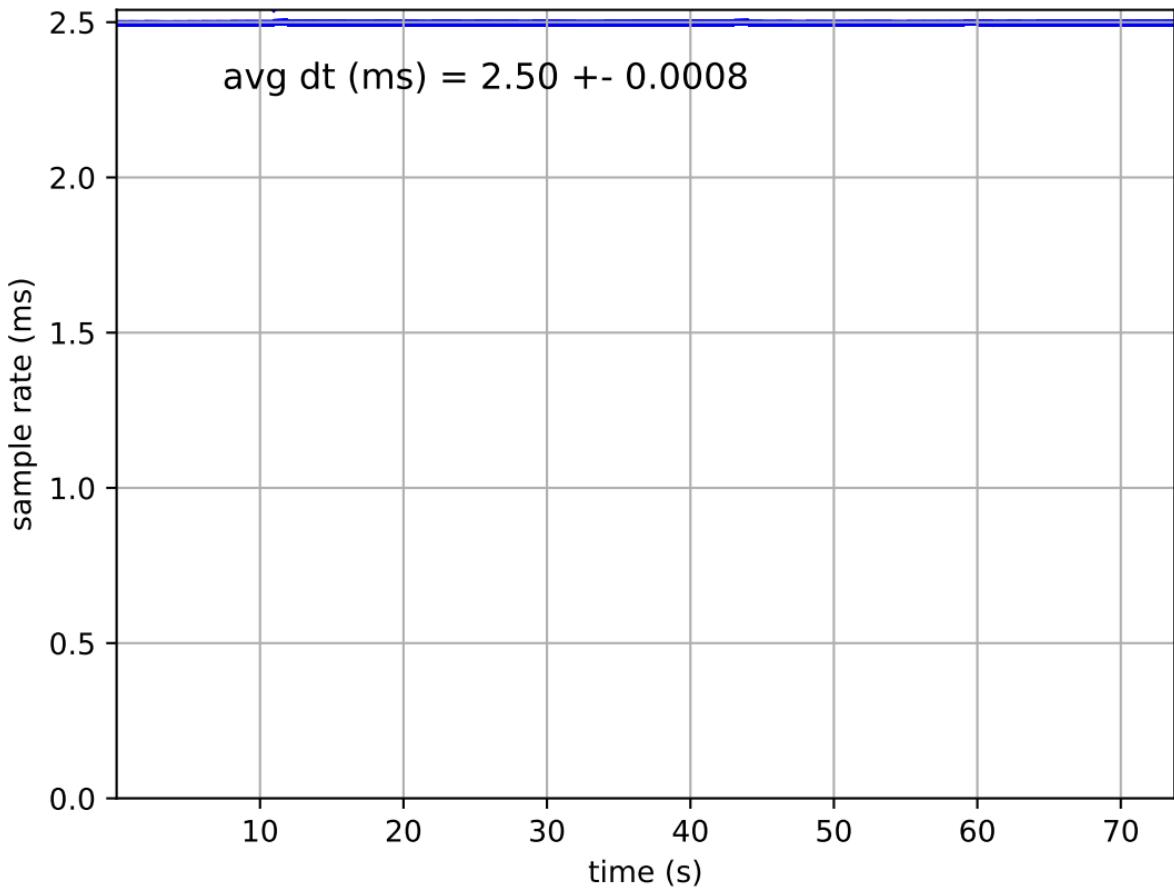
# imu1: angular velocities error



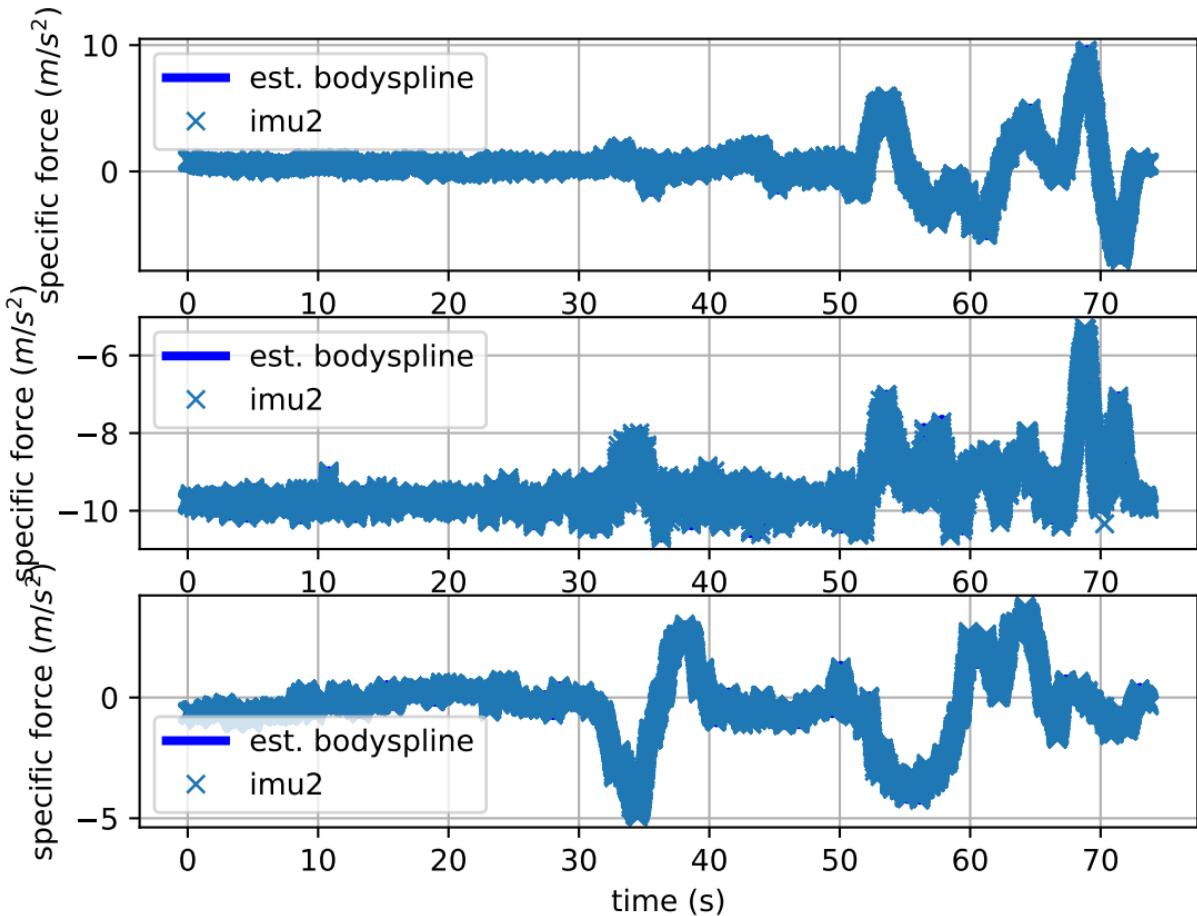
# imu1: estimated gyro bias (imu frame)



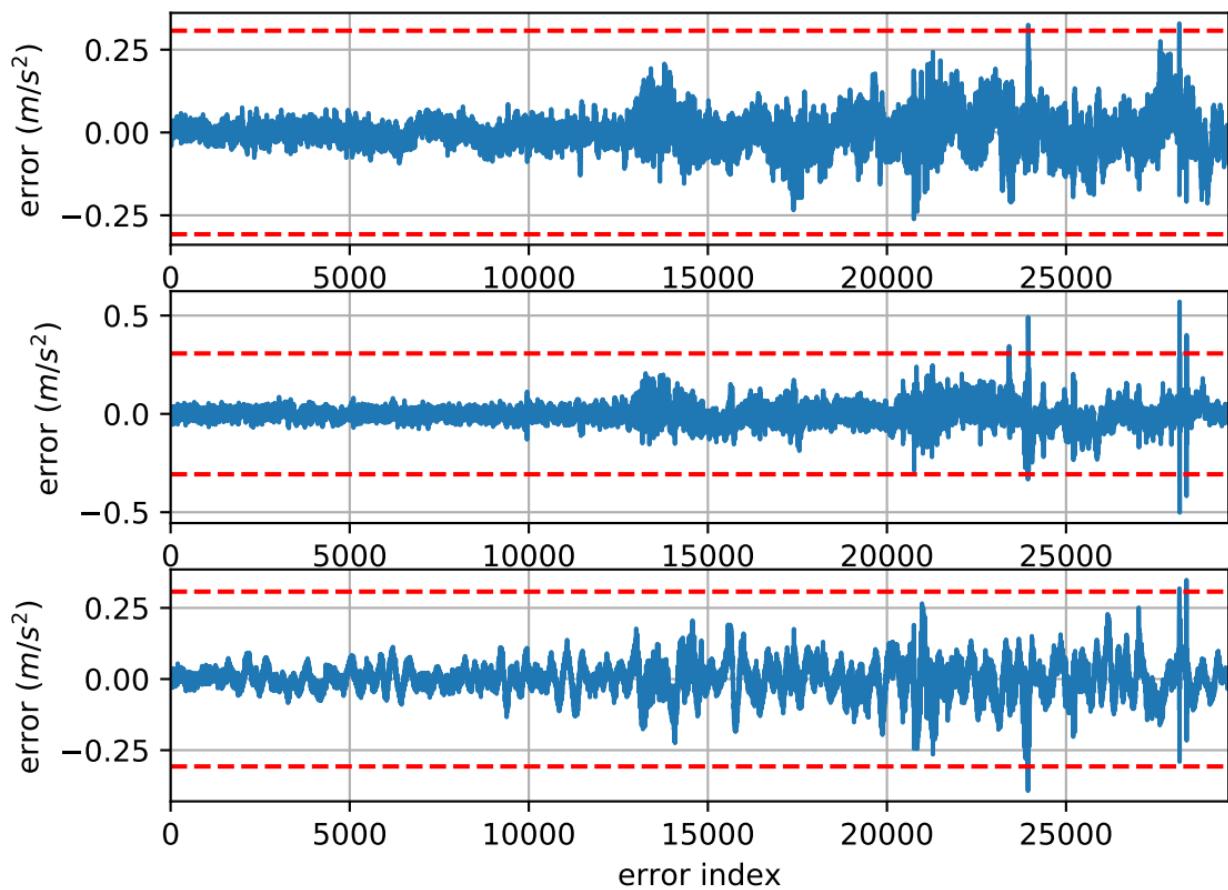
## imu2: sample inertial rate



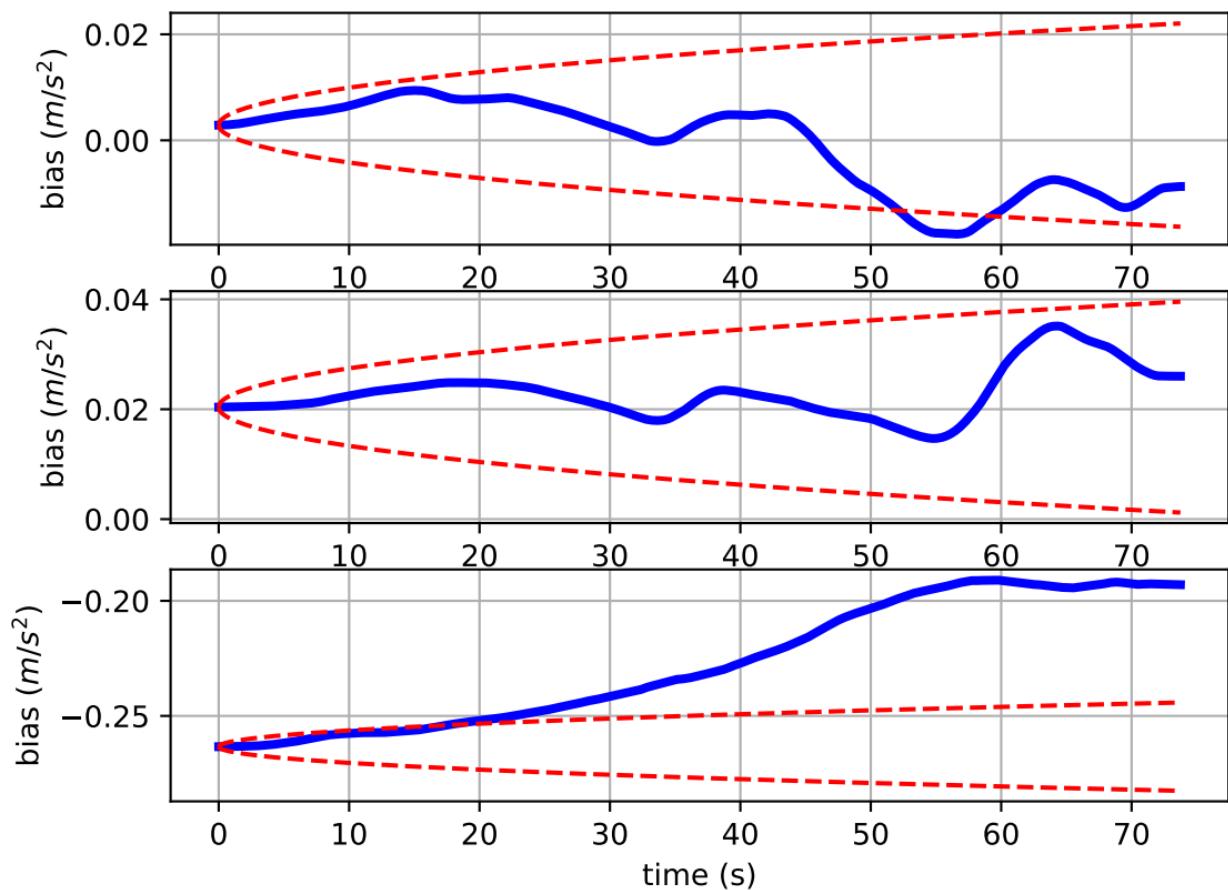
# Comparison of predicted and measured specific force (imu0 frame)



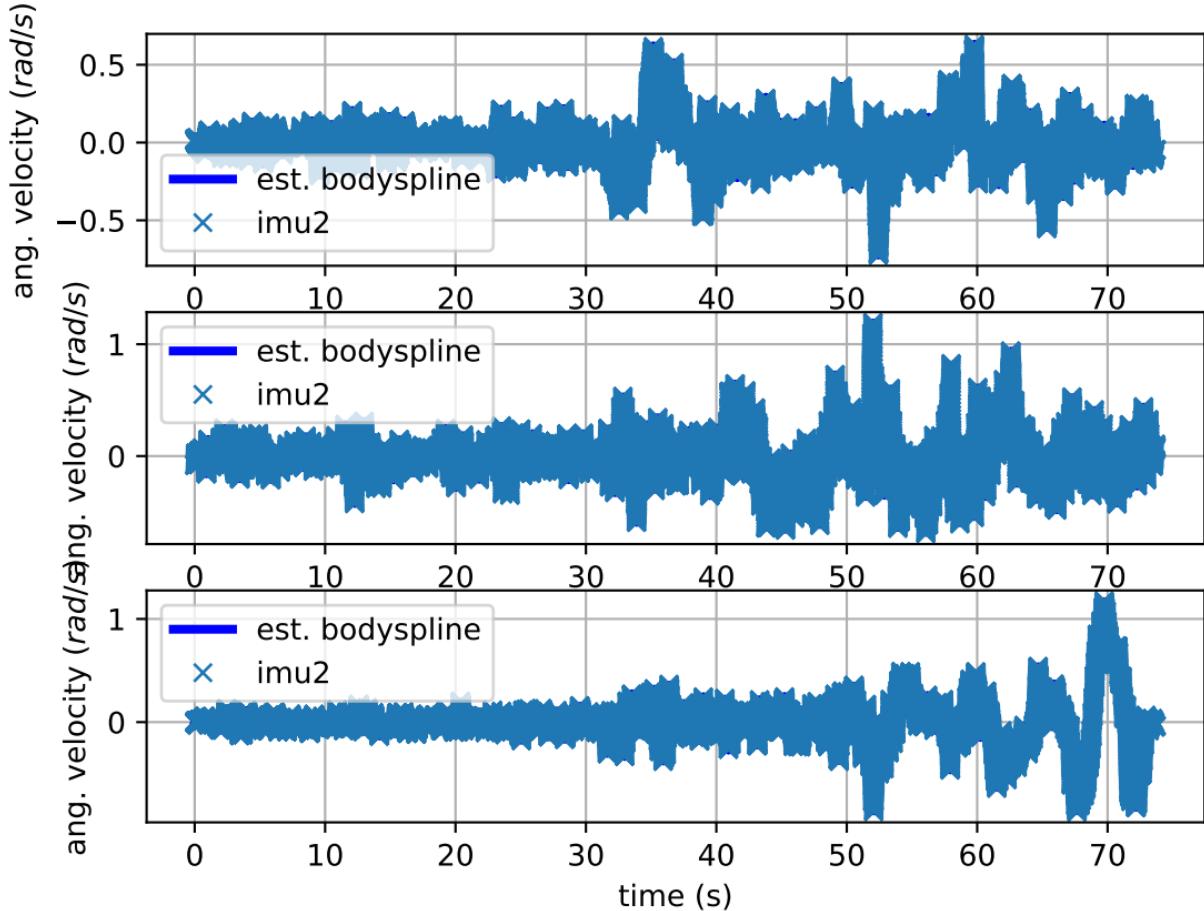
## imu2: acceleration error



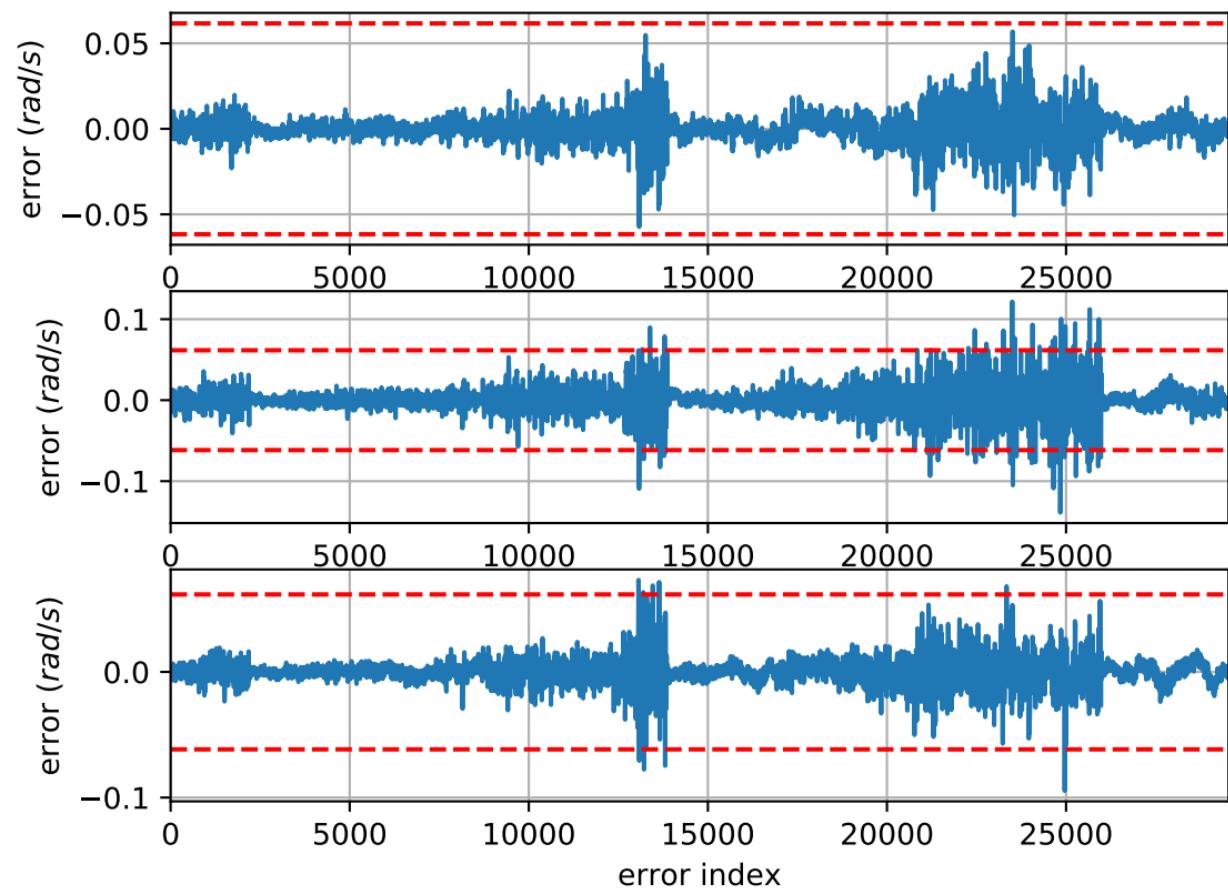
# imu2: estimated accelerometer bias (imu frame)



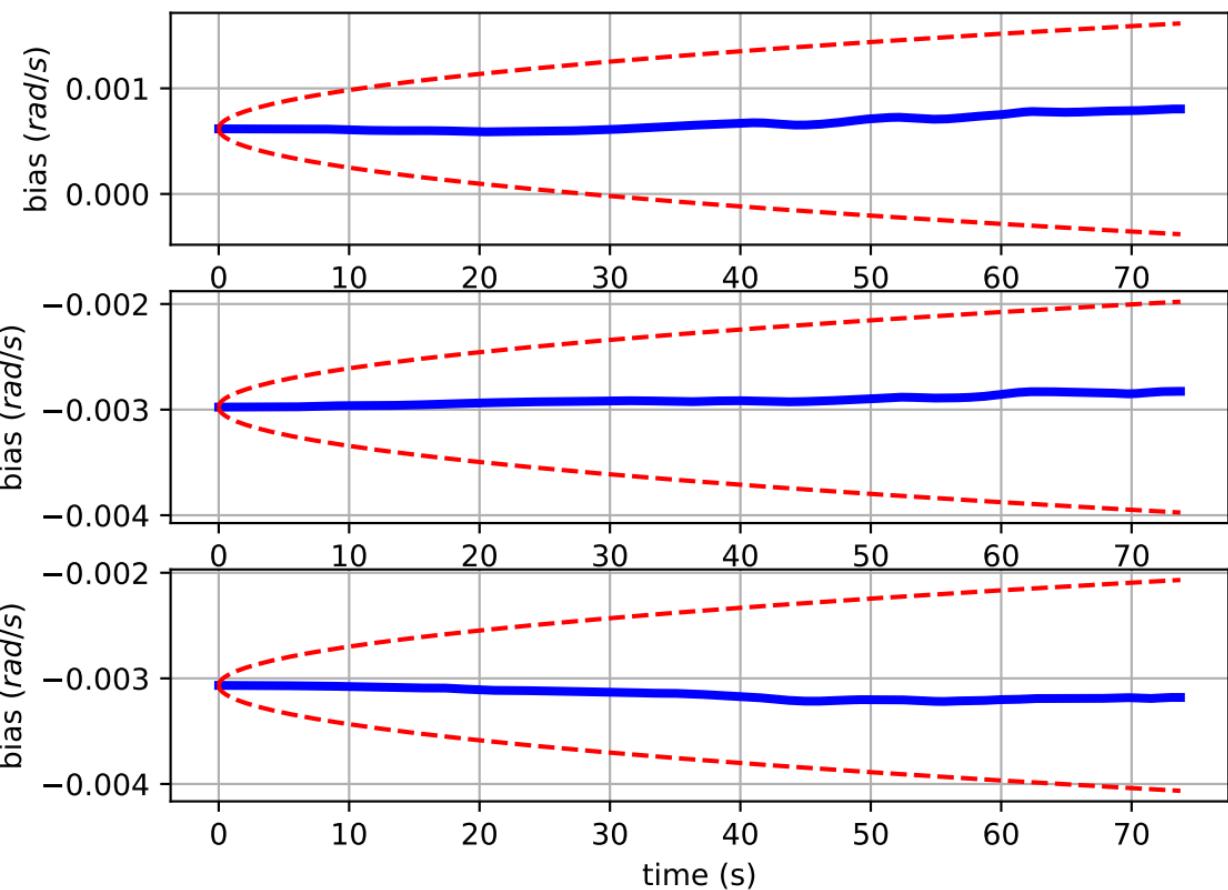
# Comparison of predicted and measured angular velocities (body frame)



## imu2: angular velocities error



## imu2: estimated gyro bias (imu frame)



cam0: reprojection errors

