

## Calibration results

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### Normalized Residuals

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Reprojection error (cam0): mean 0.42887367190955406, median 0.3023838990974178, std: 0.5188763212572749  
Gyroscope error (imu0): mean 0.7176466824544075, median 0.5359631461779127, std: 0.685713764501979  
Accelerometer error (imu0): mean 0.43576059648441706, median 0.33984111913323706, std: 0.3381822257148119  
Gyroscope error (imu1): mean 0.7301838812727324, median 0.5477590295935704, std: 0.6944092763600921  
Accelerometer error (imu1): mean 0.5908577943229975, median 0.45978391770218546, std: 0.45743066773750934  
Gyroscope error (imu2): mean 0.7696989957164092, median 0.5649507696162102, std: 0.6621111591925614  
Accelerometer error (imu2): mean 0.663413065991954, median 0.507371325866256, std: 0.5614632911732318

### Residuals

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Reprojection error (cam0) [px]: mean 0.42887367190955406, median 0.3023838990974178, std: 0.5188763212572749  
Gyroscope error (imu0) [rad/s]: mean 0.0030942252268789587, median 0.002310873481515009, std: 0.0029565423772093544  
Accelerometer error (imu0) [m/s^2]: mean 0.11804350680341064, median 0.09205980940481277, std: 0.09161043055297567  
Gyroscope error (imu1) [rad/s]: mean 0.003111640287738344, median 0.002334246356527266, std: 0.0029591886864648908  
Accelerometer error (imu1) [m/s^2]: mean 0.11821134443771278, median 0.0919877432177906, std: 0.09151693476811769  
Gyroscope error (imu2) [rad/s]: mean 0.01581495877887965, median 0.011608009343003772, std: 0.013604357999610343  
Accelerometer error (imu2) [m/s^2]: mean 0.06792734887087057, median 0.05195012101195382, std: 0.057488636888218675

### Transformation (cam0):

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T\_ci: (imu0 to cam0):  
[[ -0.99987072 0.00543643 -0.01513233 0.06582894]  
[ -0.01506544 -0.01214151 -0.99981279 -0.03466236]  
[ -0.00561914 0.99991151 -0.01205804 -0.07423918]  
[ 0. 0. 0. 1. ]]

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

[[ -0.99987072 -0.01506544 -0.00561914 -0.06675979]  
[ 0.00543643 -0.01214151 0.99991151 0.07345388]  
[ -0.01513233 -0.99981279 -0.01205804 -0.03455491]  
[ 0. 0. 0. 1. ]]

timeshift cam0 to imu0: [s] (t\_imu = t\_cam + shift)  
-0.012207202802123937

Gravity vector in target coords: [m/s^2]  
[-0.01378365 -9.80652296 -0.01844712]

#### Calibration configuration

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cam0

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Camera model: pinhole

Focal length: [393.9474439639647, 393.5941398248612]

Principal point: [315.28951460976816, 246.10731150441086]

Distortion model: radtan

Distortion coefficients: [-0.3326070585938689, 0.09642274930465562, 0.00010666290873203003,  
-0.0003221970539606729]

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:

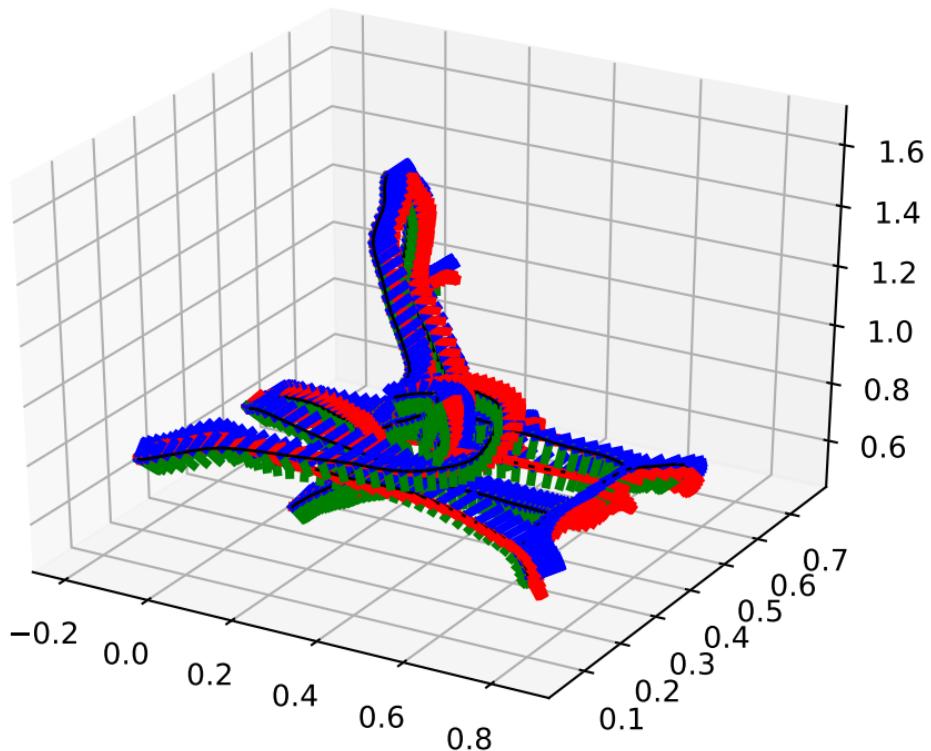
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Model: calibrated  
Update rate: 100  
Accelerometer:  
Noise density: 0.02000673352767714  
Noise density (discrete): 0.2000673352767714  
Random walk: 0.001224627431466927  
Gyroscope:  
Noise density: 0.0004261447516911305  
Noise density (discrete): 0.004261447516911304  
Random walk: 2.14534407581717e-05  
 $T_{ib}$  (imu0 to imu1)  
[[ 0.99999999 0.00007594 -0.00011367 -0.00046139]  
[-0.00007594 1. 0.000016 0.00002628]  
[ 0.00011367 -0.00001599 0.99999999 0.00004565]  
[ 0. 0. 0. 1. ]]  
time offset with respect to IMU0: 0.0 [s]

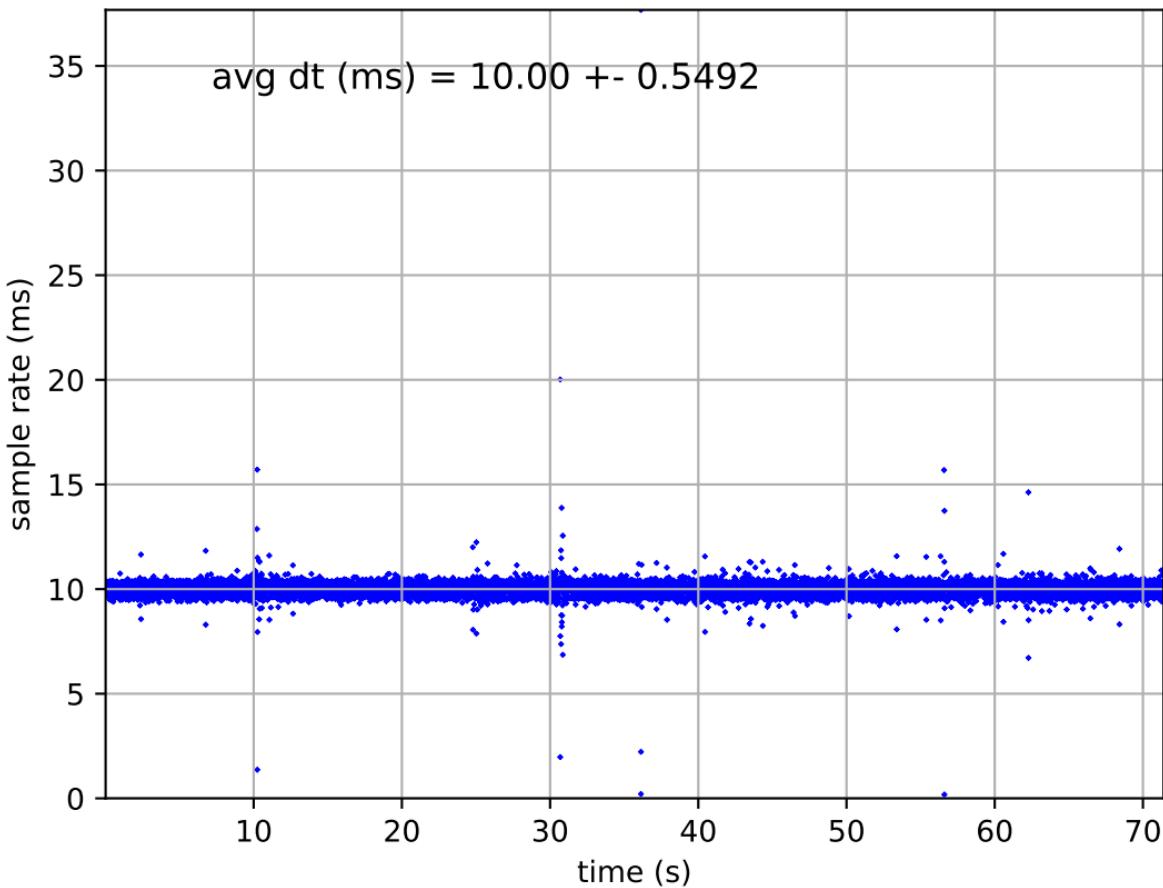
IMU2:

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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)  
[[-0.00471741 -0.99995 0.00881709 0.02043871]  
[-0.01506279 -0.00874514 -0.99984831 -0.07761794]  
[ 0.99987542 -0.0048495 -0.01502078 -0.05434457]  
[ 0. 0. 0. 1. ]]  
time offset with respect to IMU0: 0.0 [s]

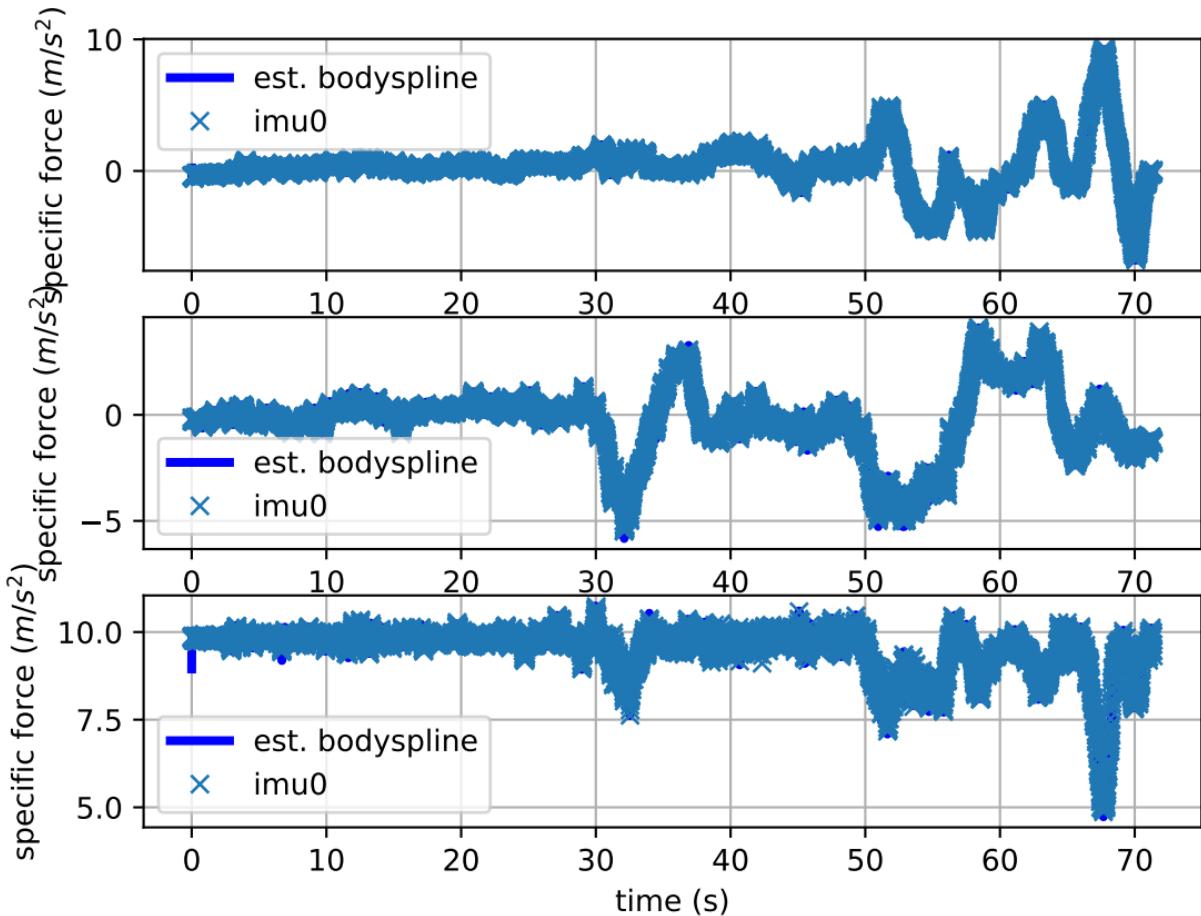
imu0: estimated poses



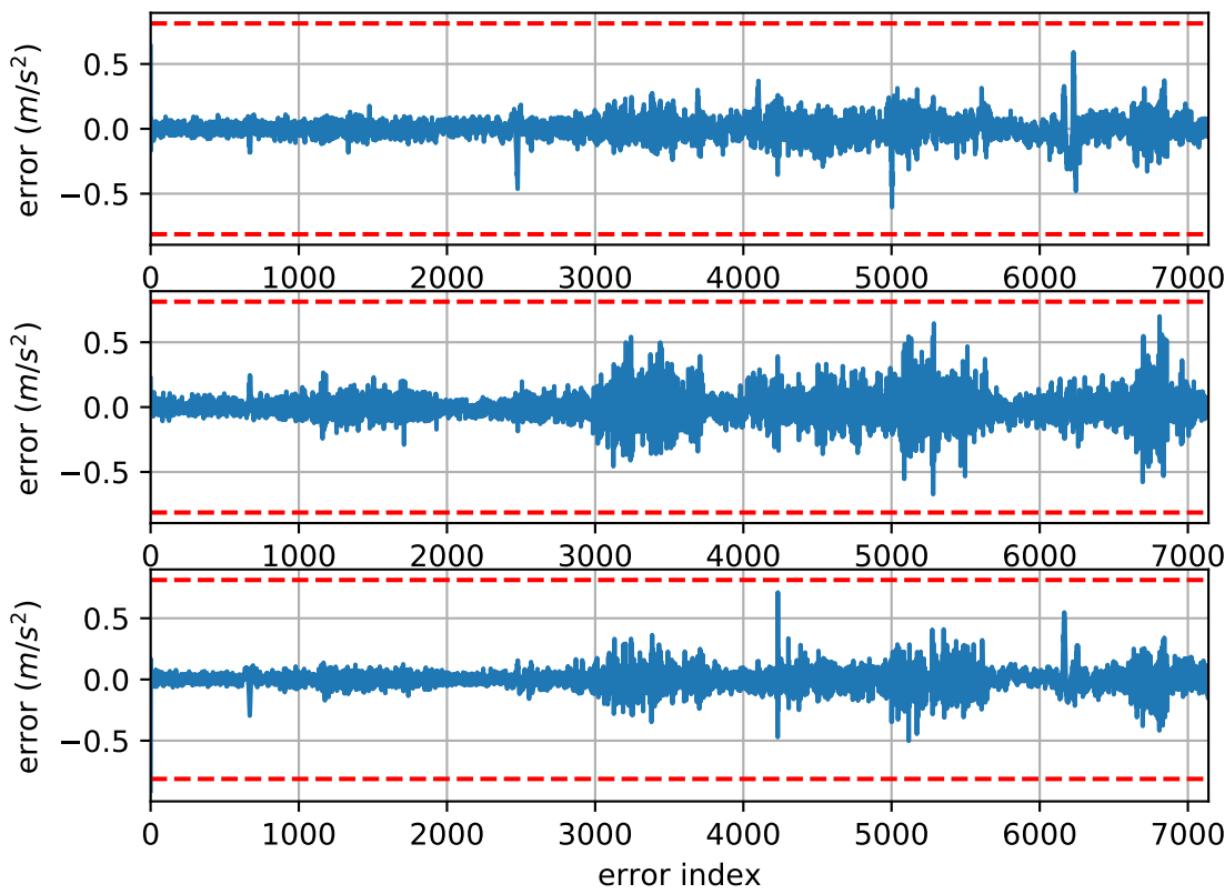
# imu0: sample inertial rate



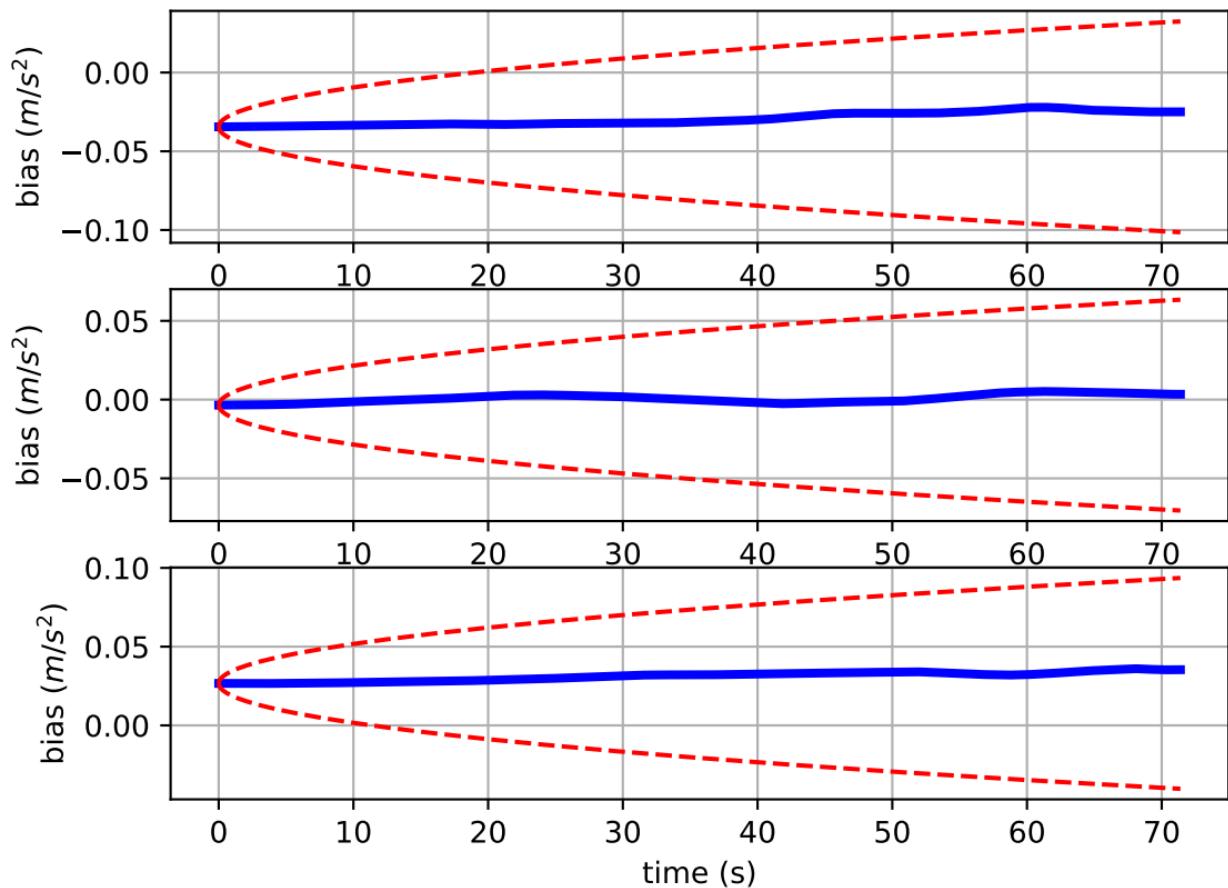
# Comparison of predicted and measured specific force (imu0 frame)



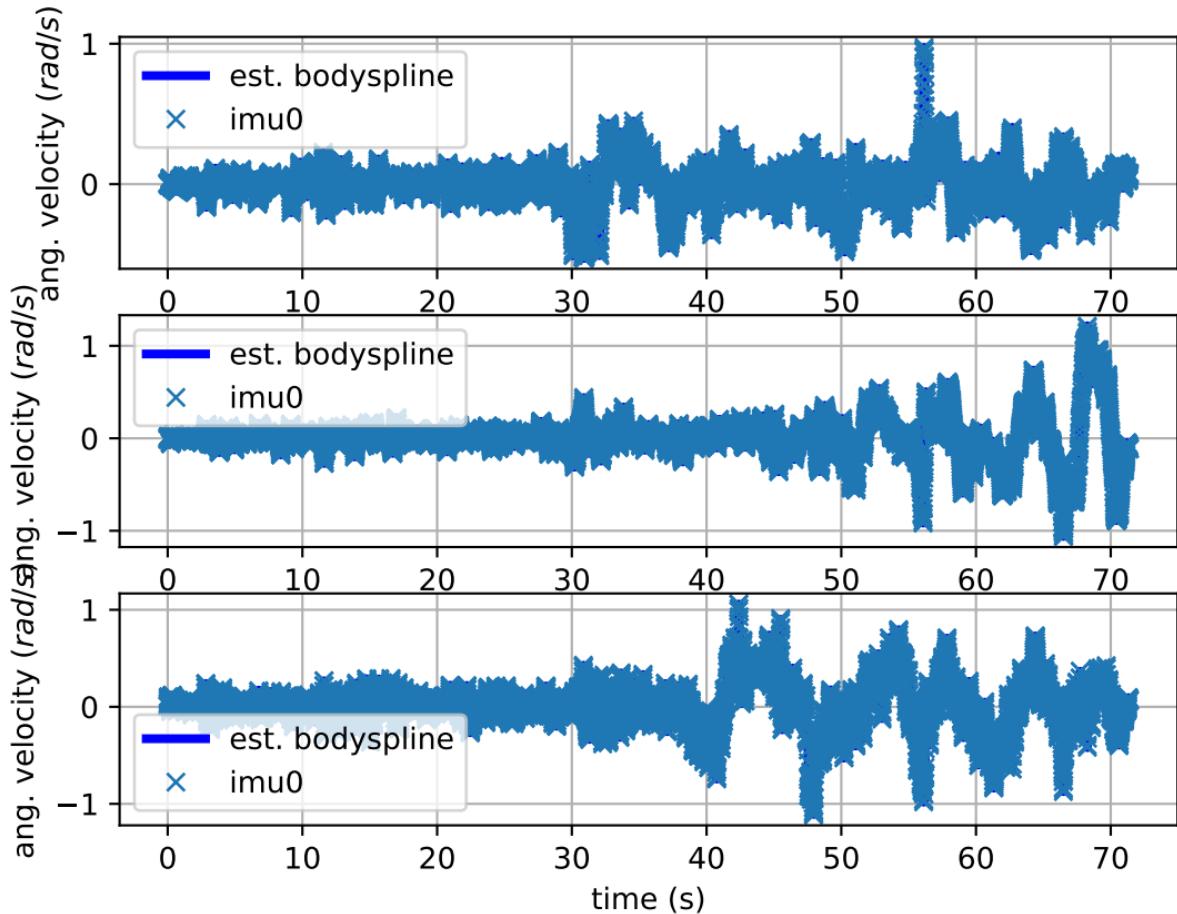
# imu0: acceleration error



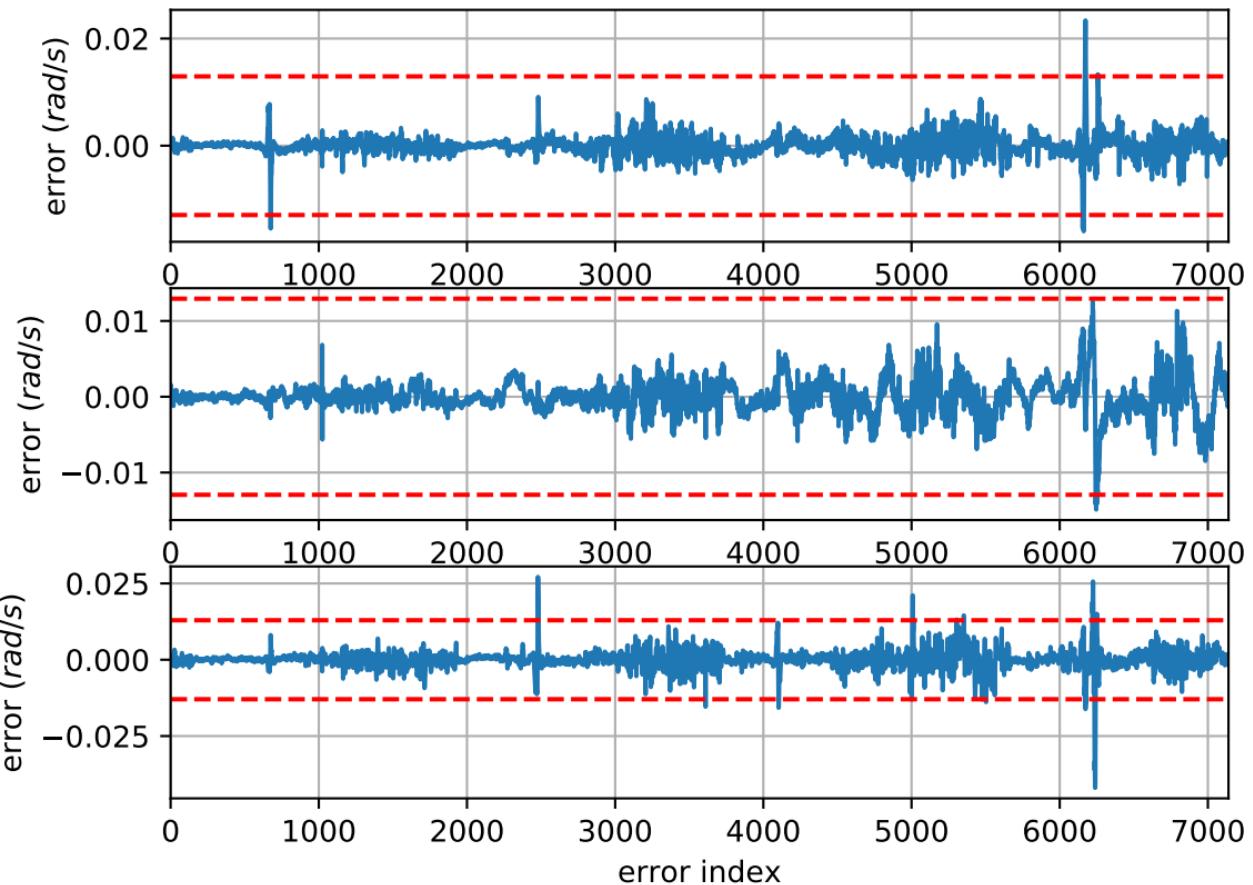
# imu0: estimated accelerometer bias (imu frame)



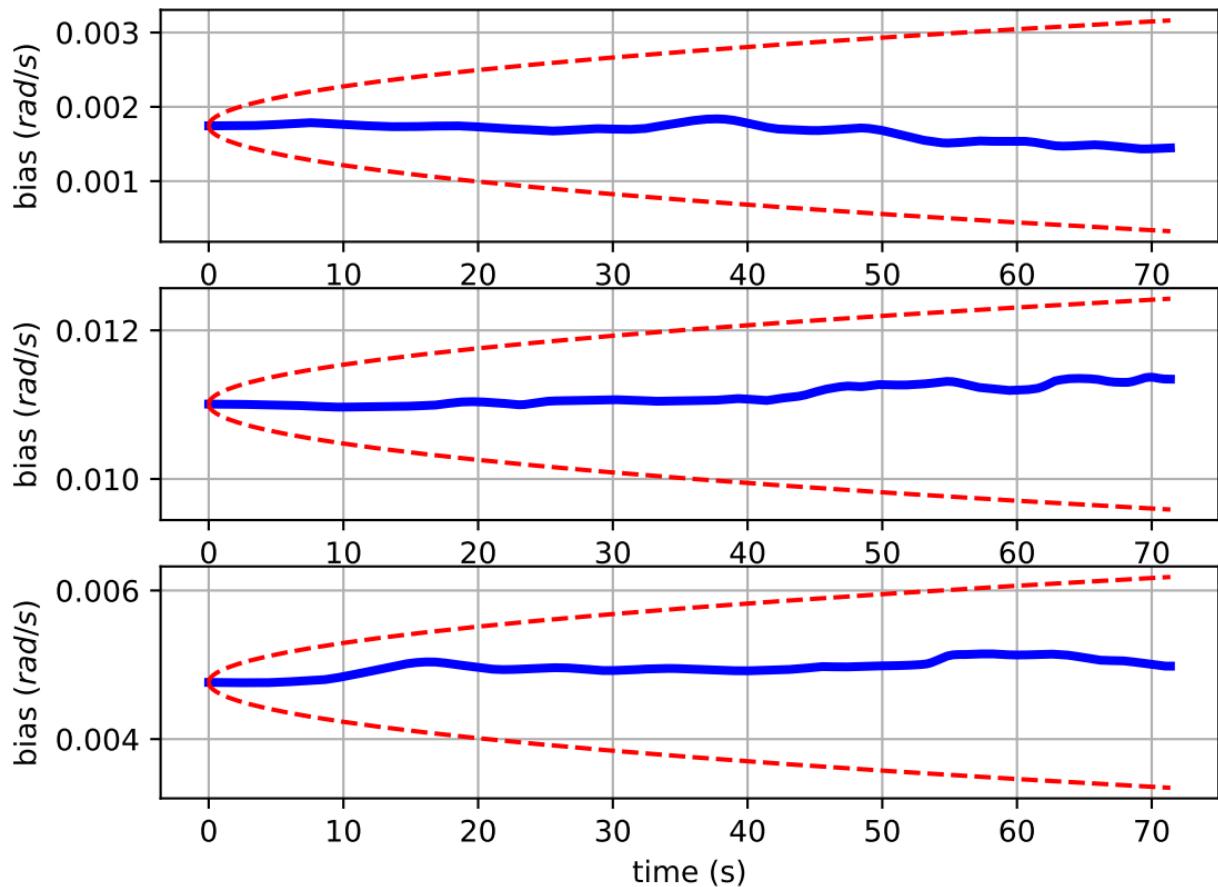
# Comparison of predicted and measured angular velocities (body frame)



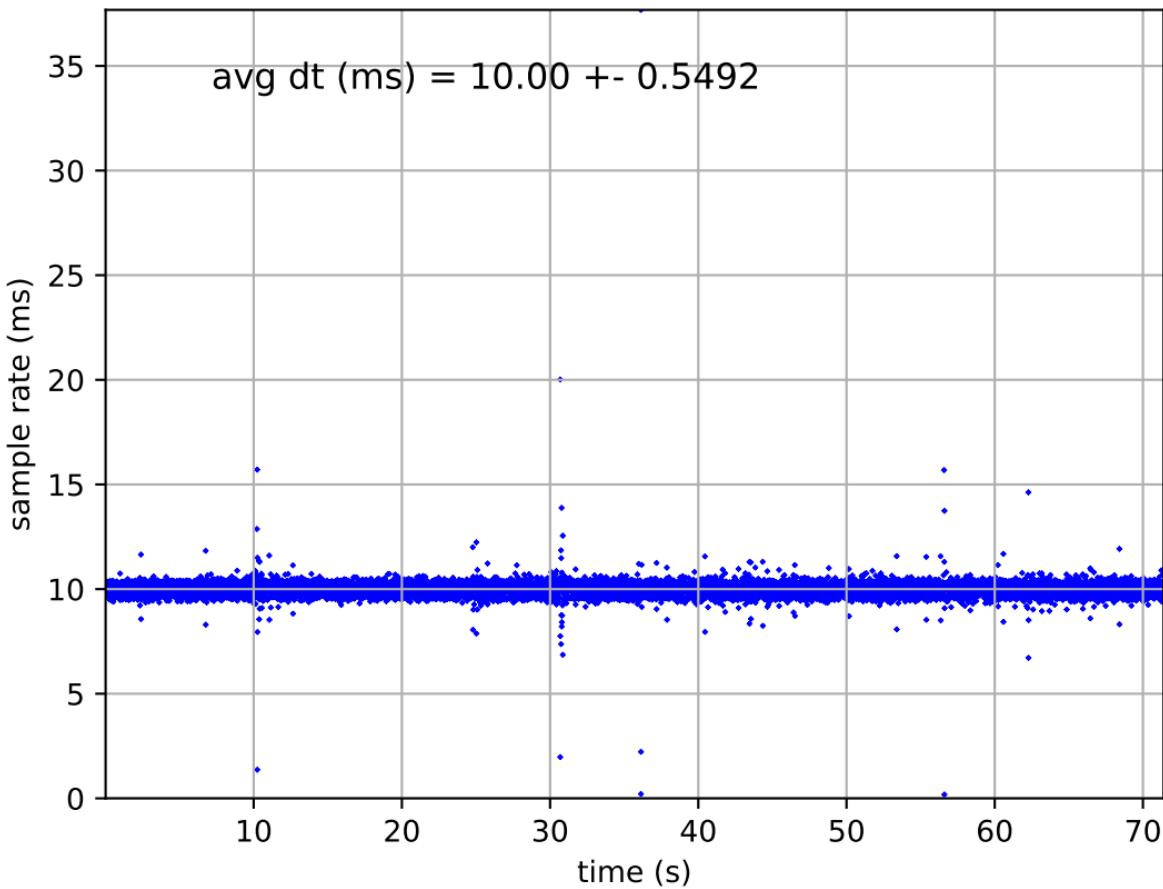
# imu0: angular velocities error



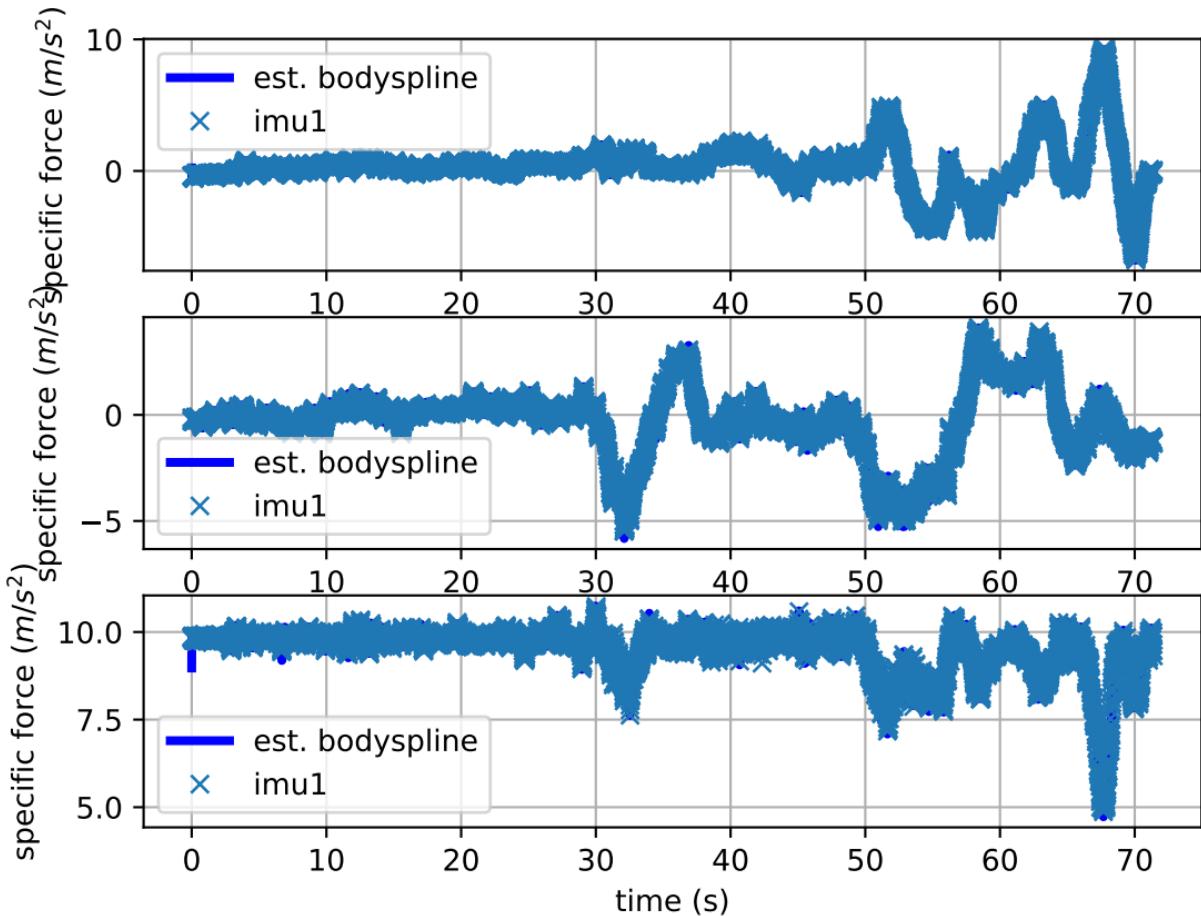
# imu0: estimated gyro bias (imu frame)



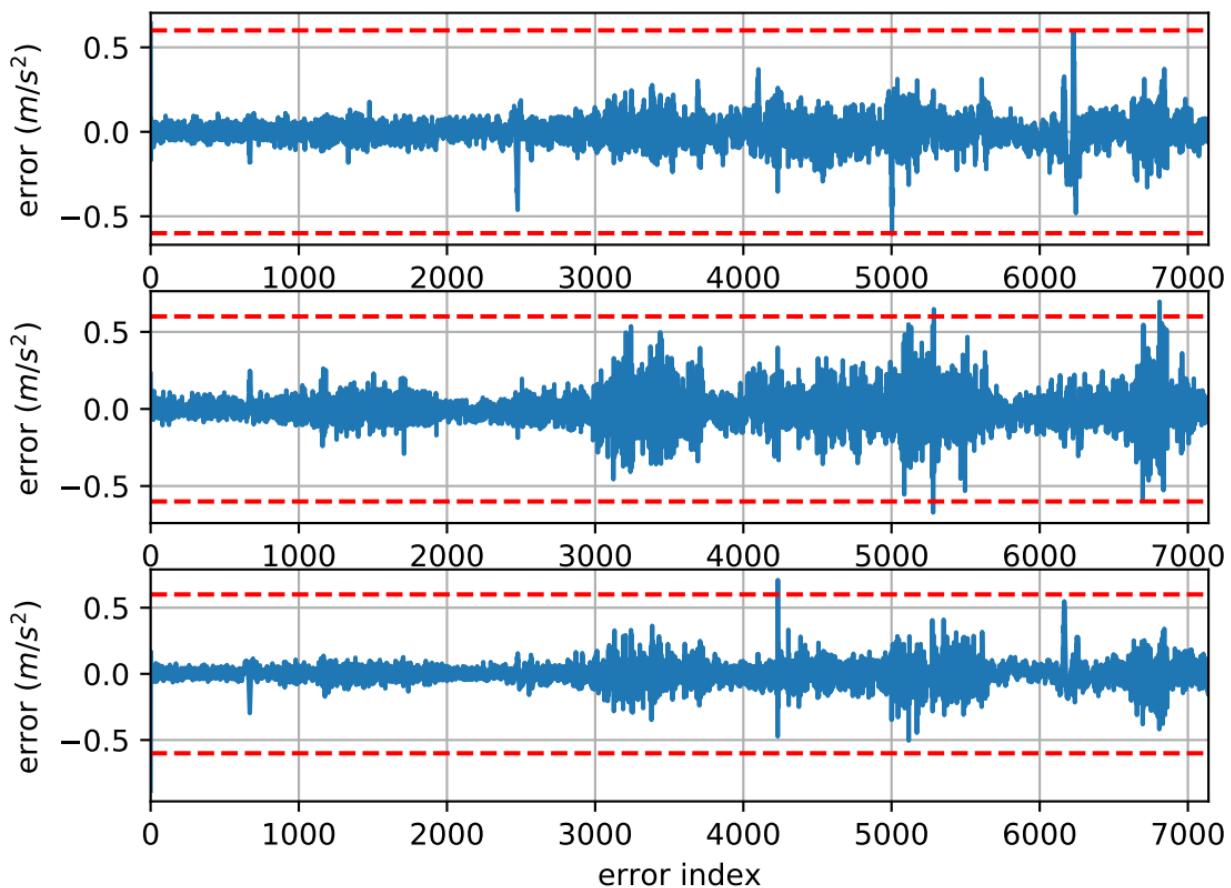
# imu1: sample inertial rate



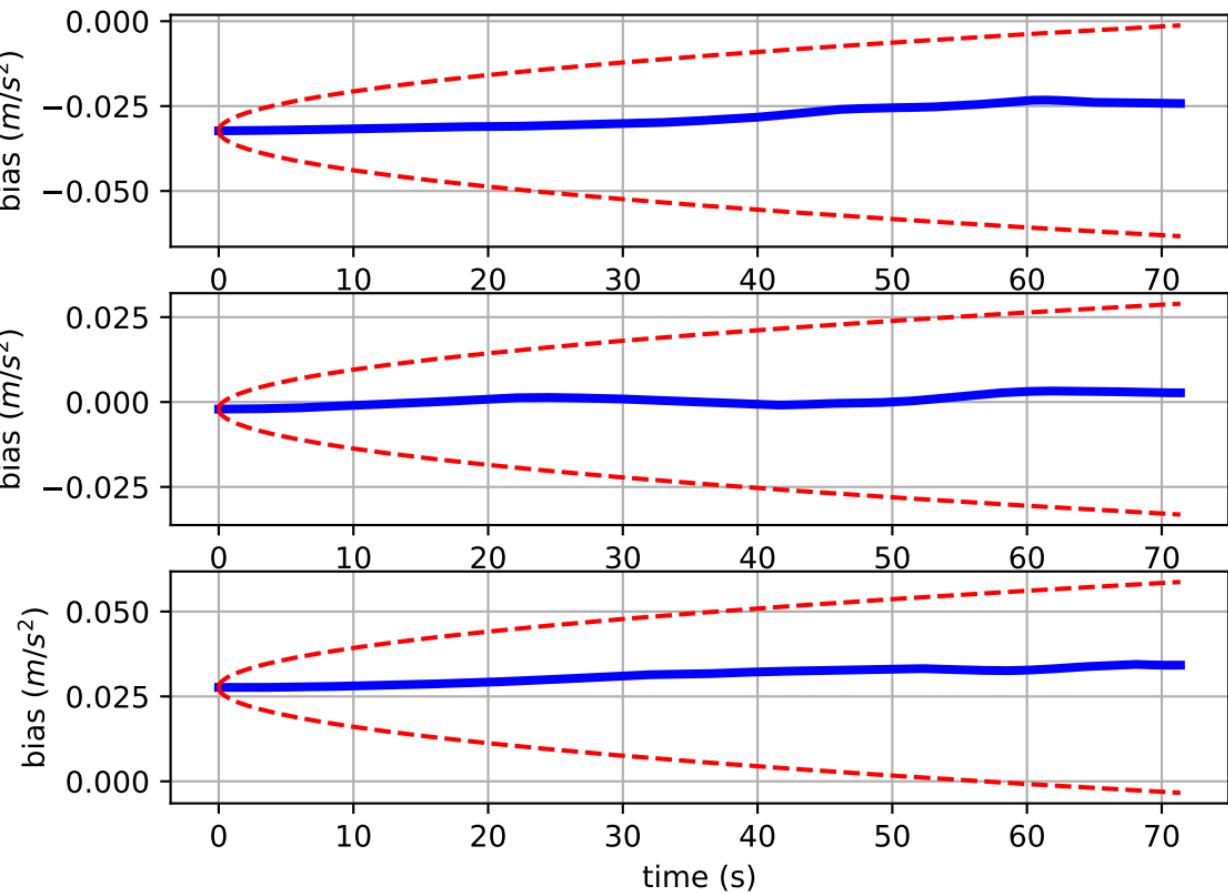
# Comparison of predicted and measured specific force (imu0 frame)



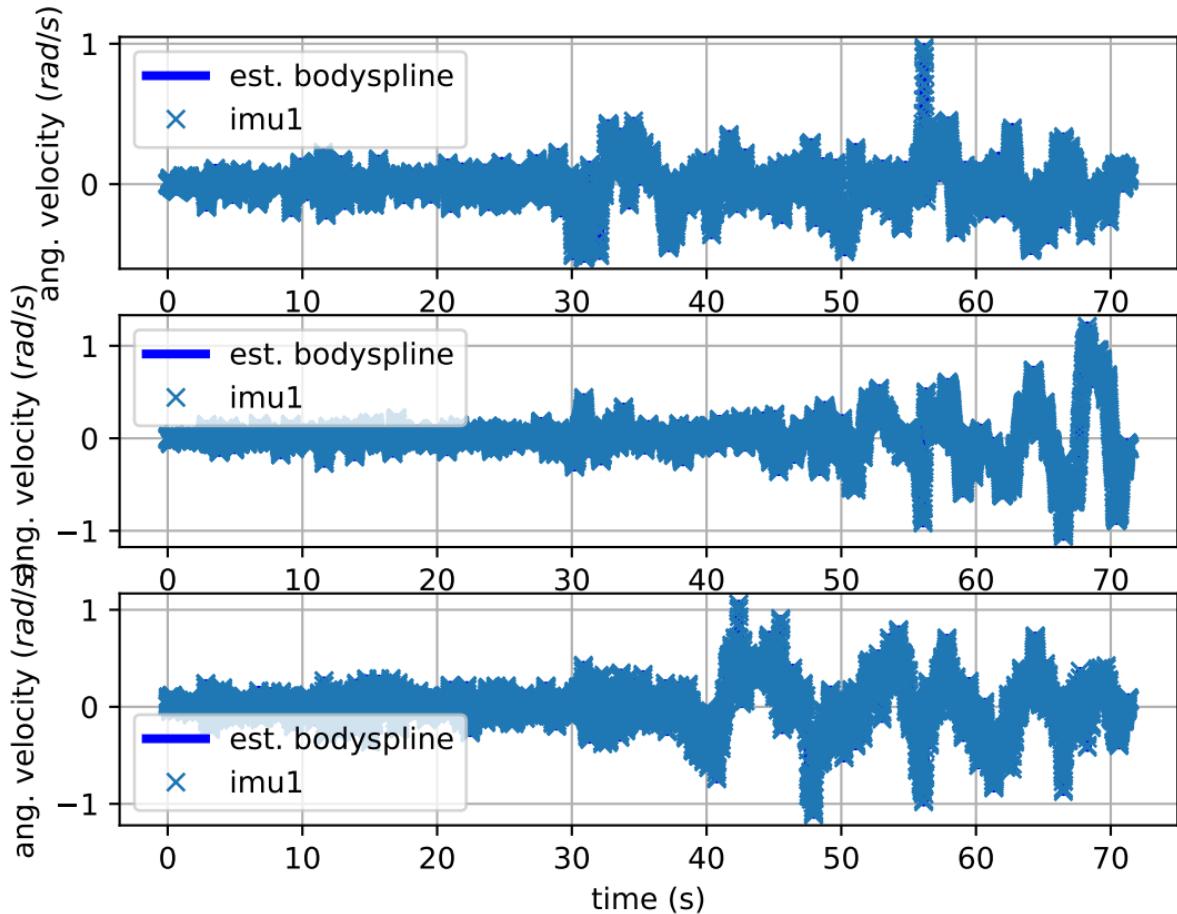
# imu1: acceleration error



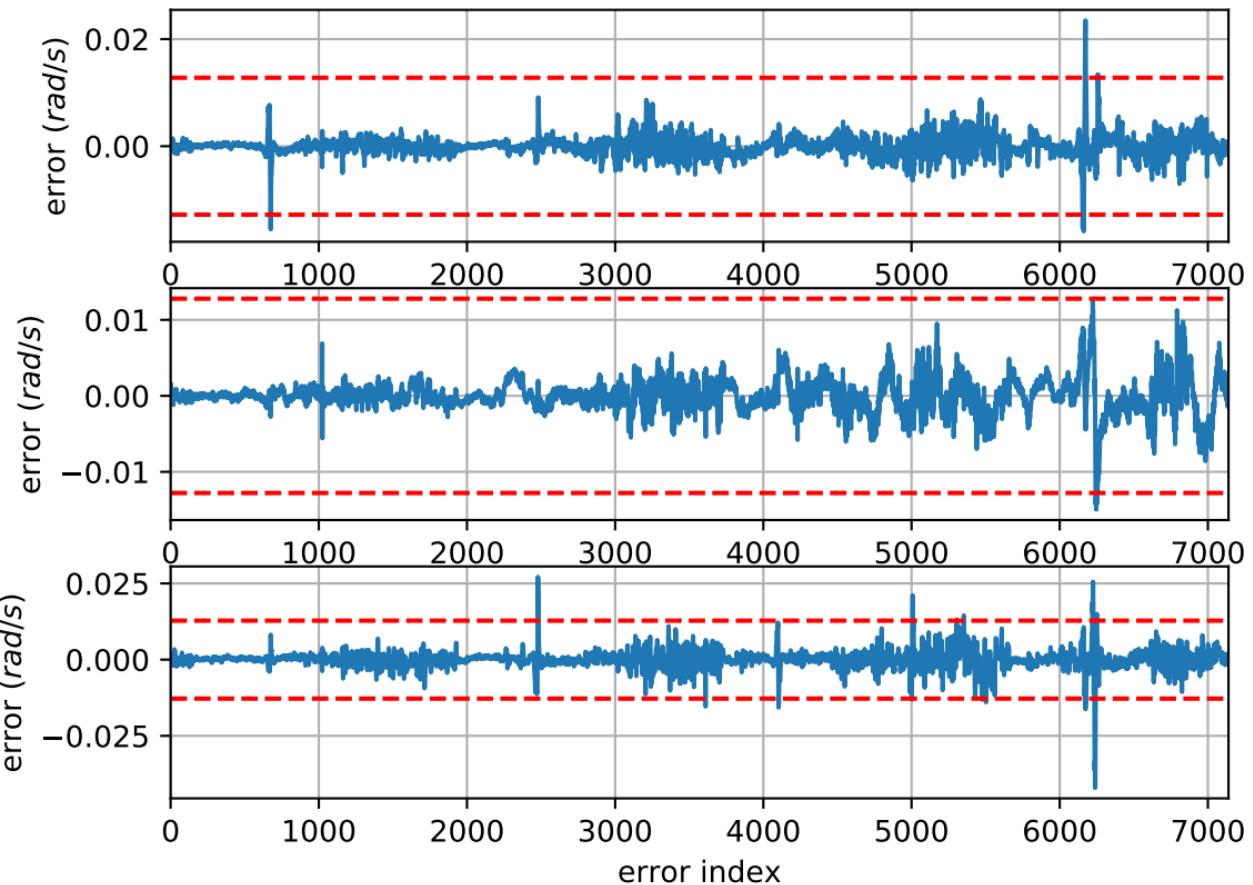
# imu1: estimated accelerometer bias (imu frame)



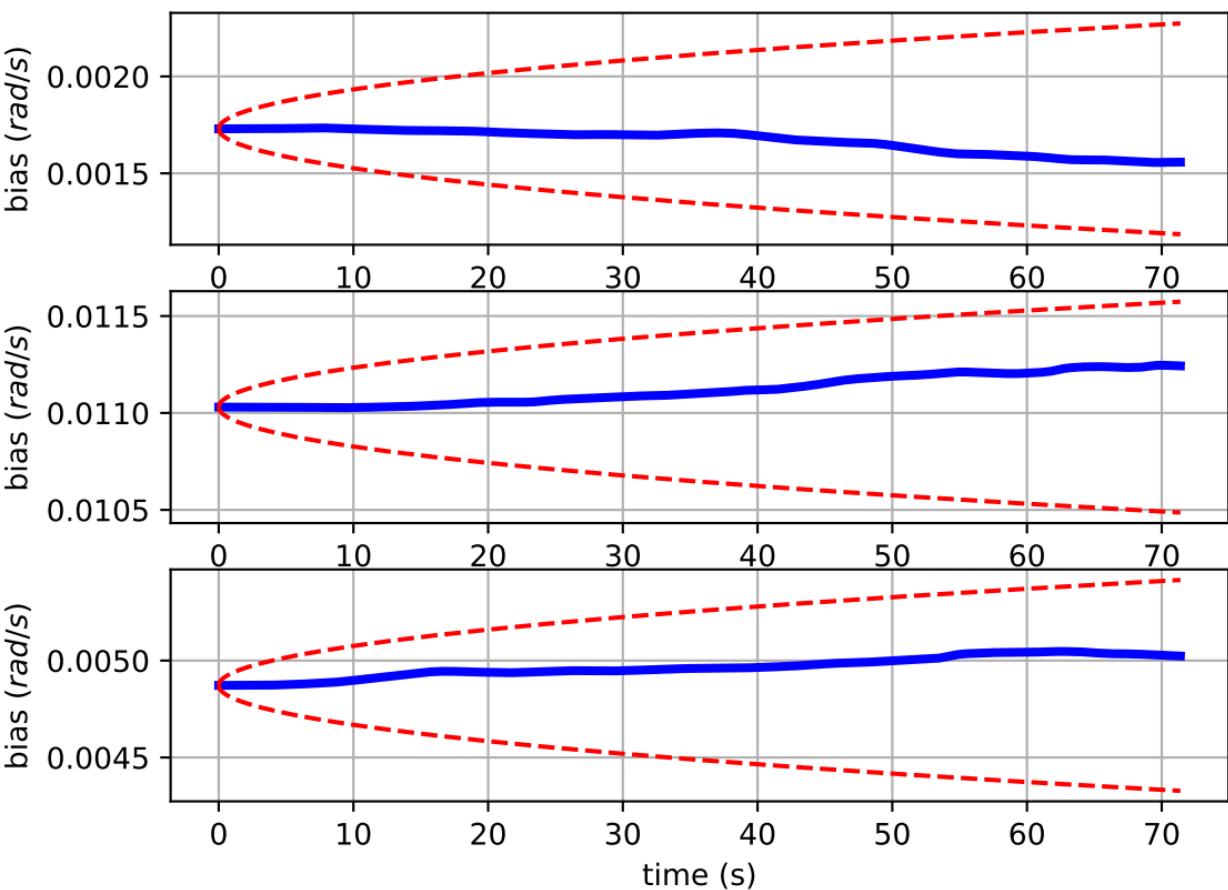
# Comparison of predicted and measured angular velocities (body frame)



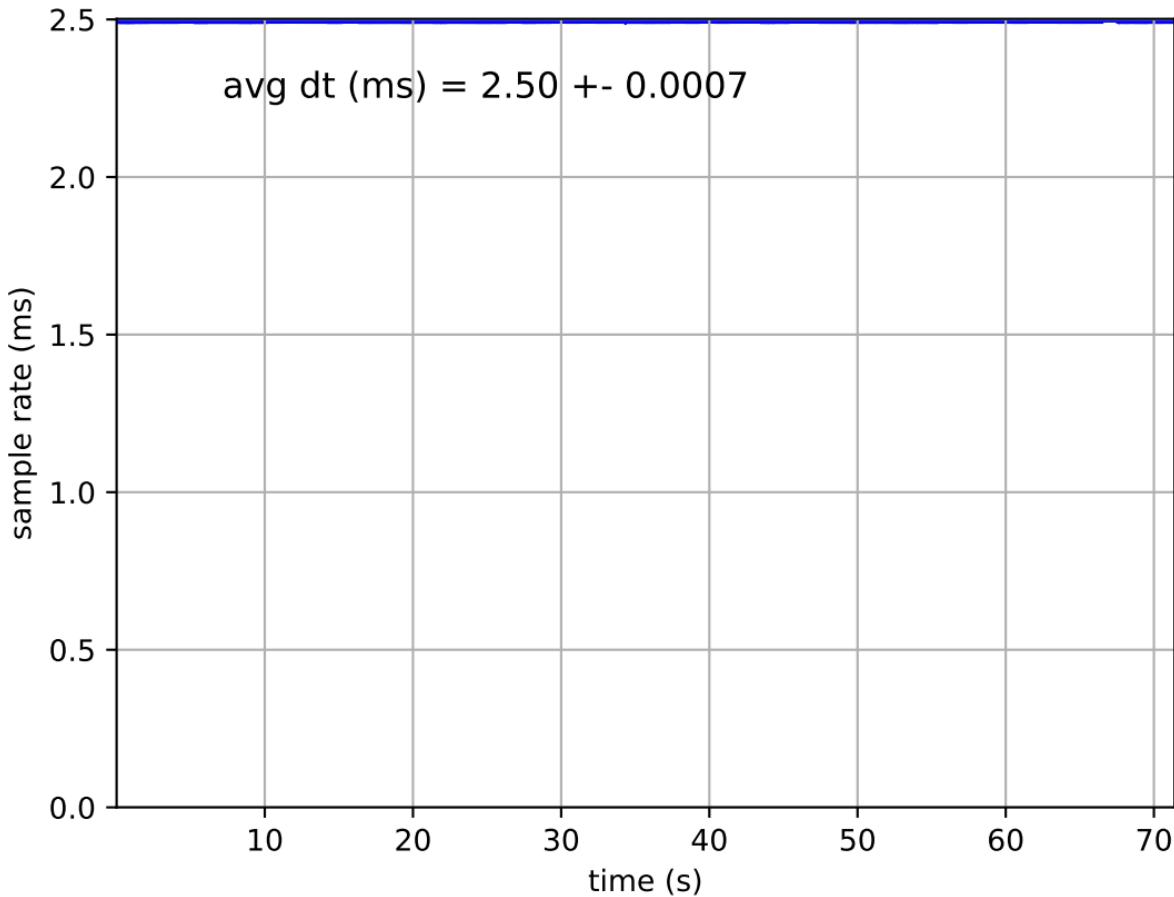
# imu1: angular velocities error



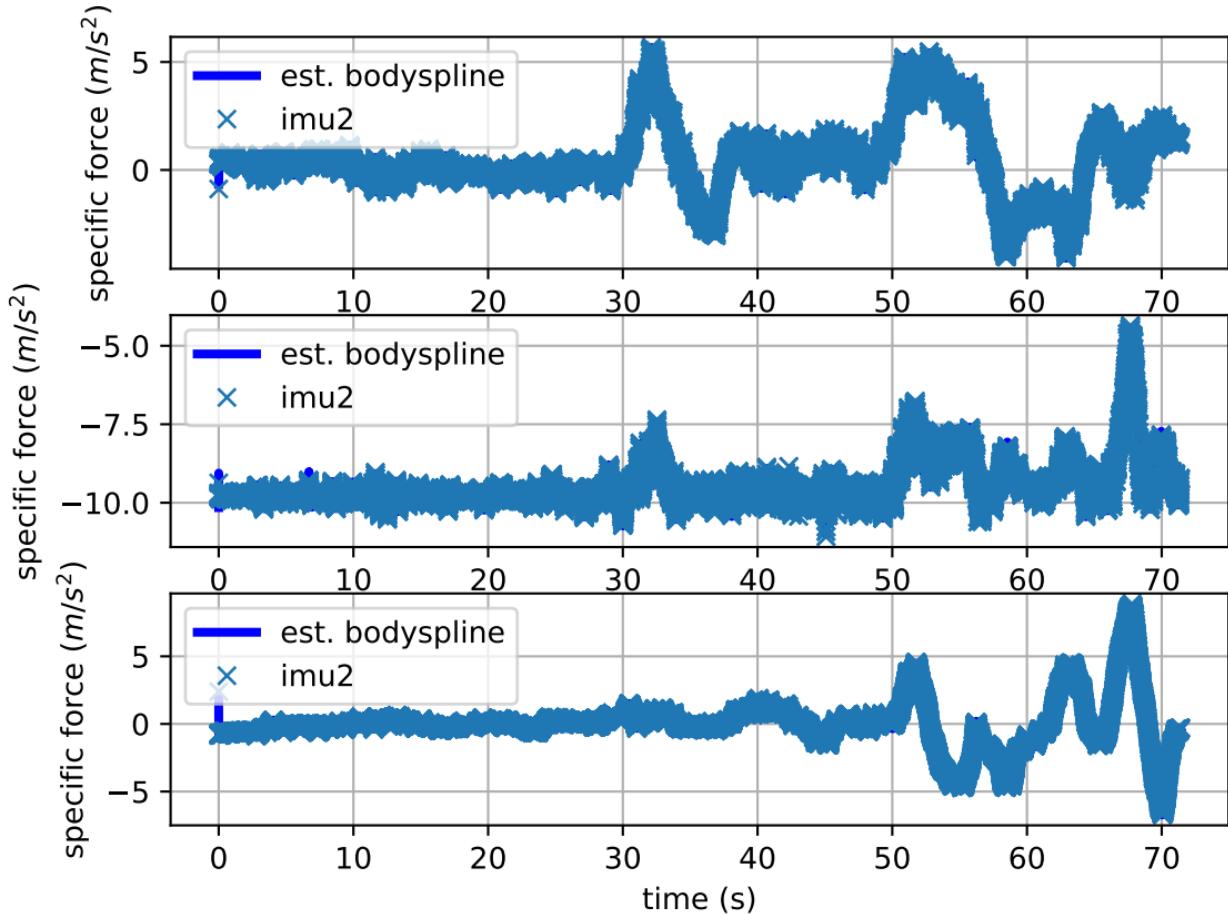
imu1: estimated gyro bias (imu frame)



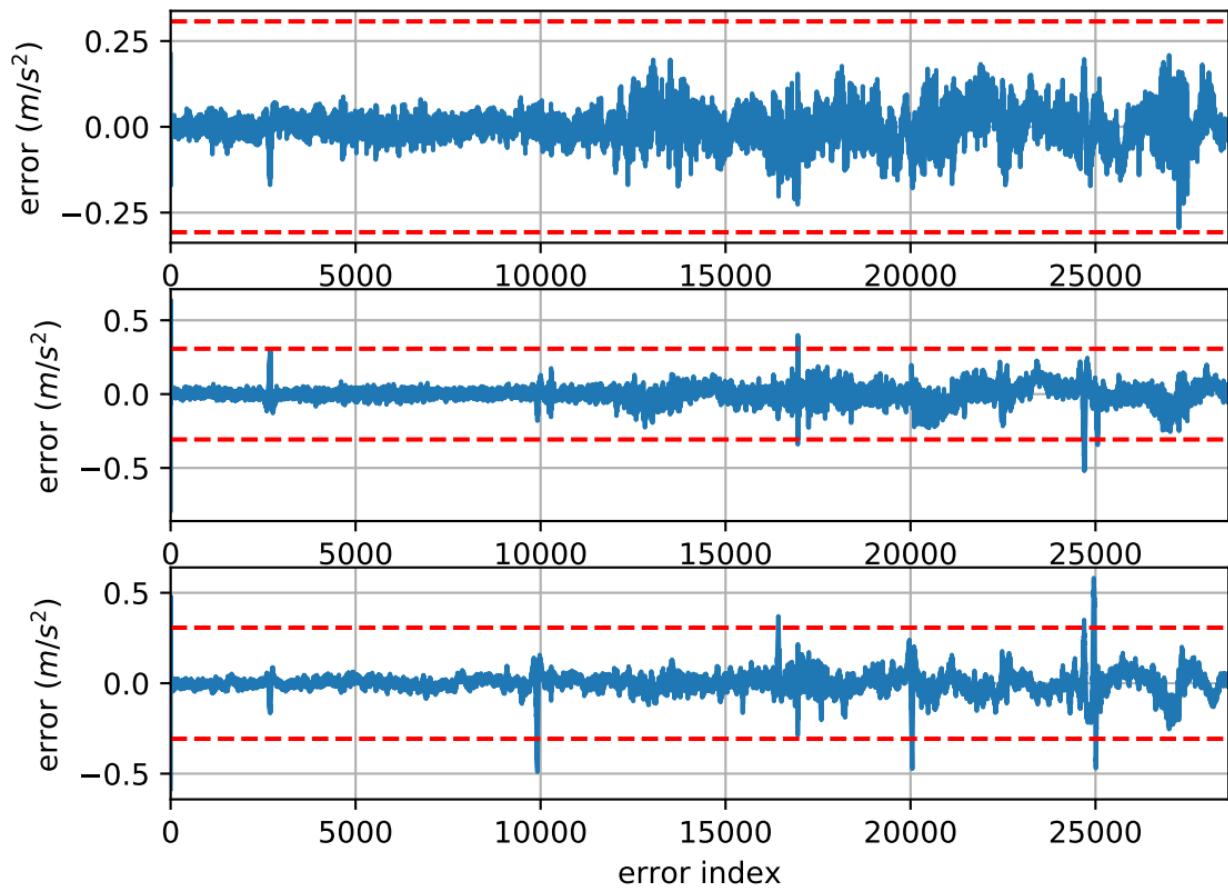
## imu2: sample inertial rate



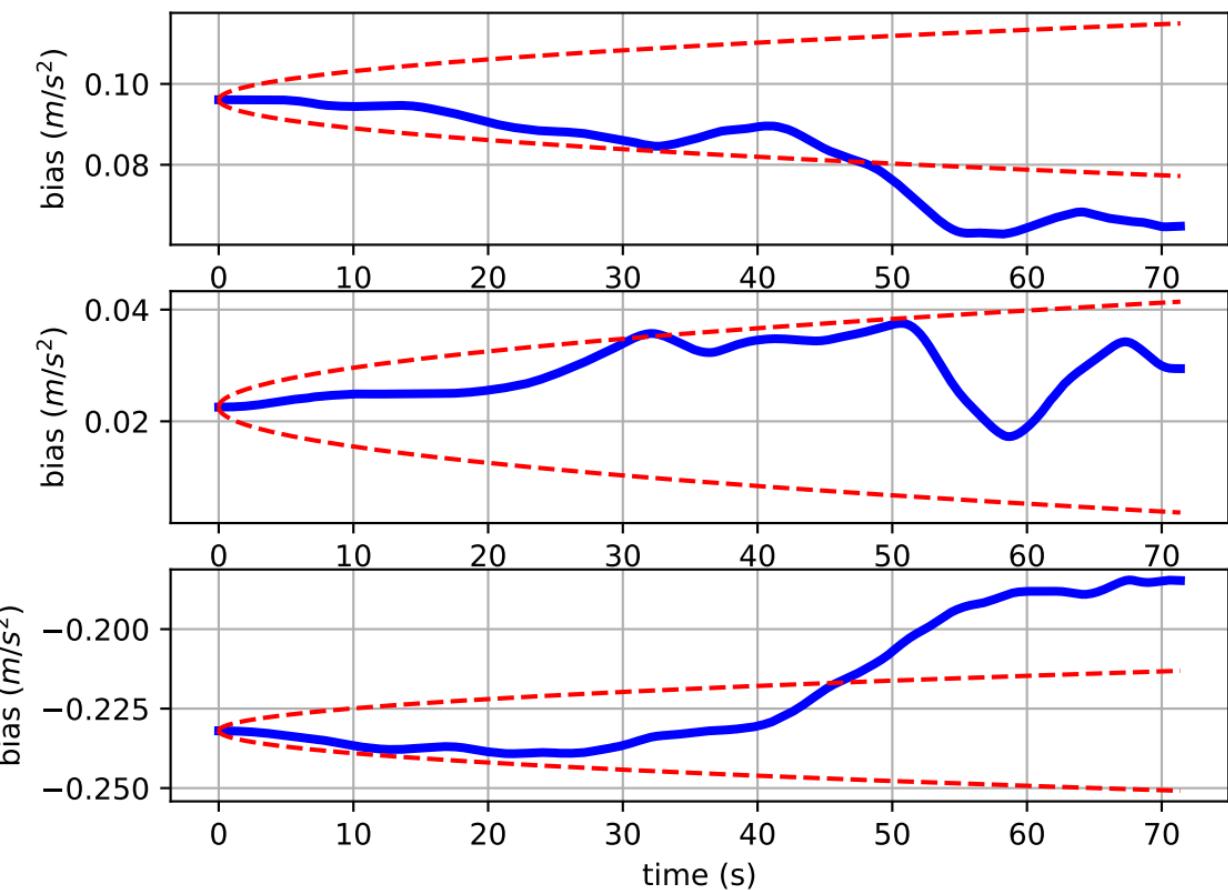
# Comparison of predicted and measured specific force (imu0 frame)



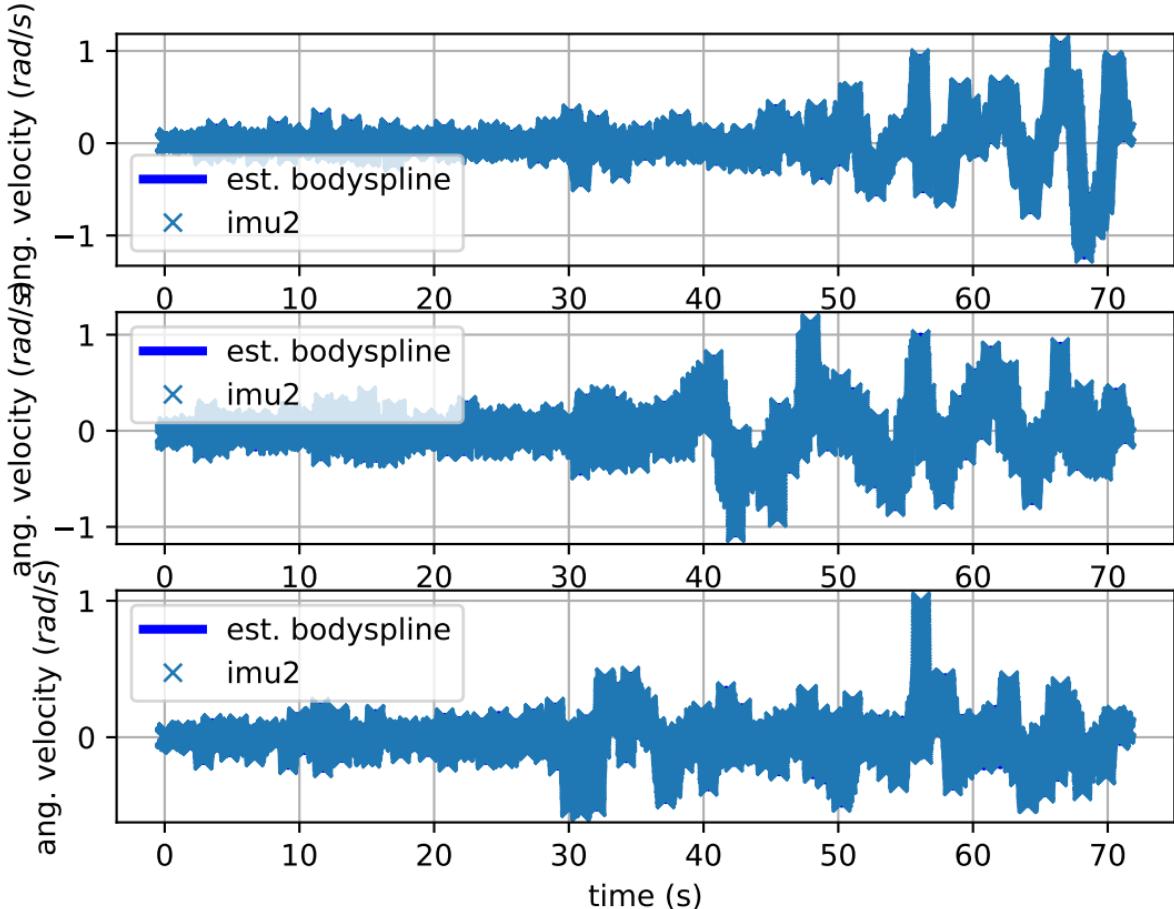
## imu2: acceleration error



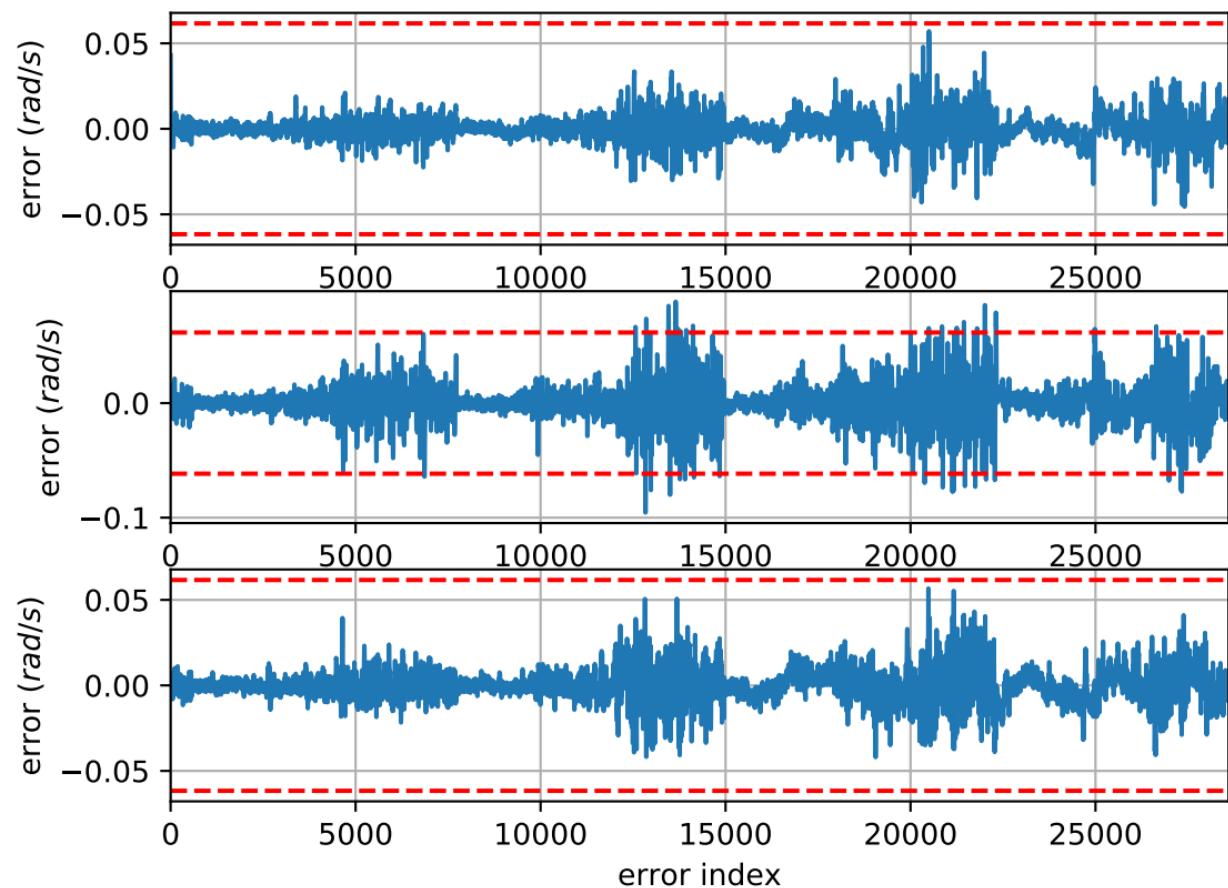
# imu2: estimated accelerometer bias (imu frame)



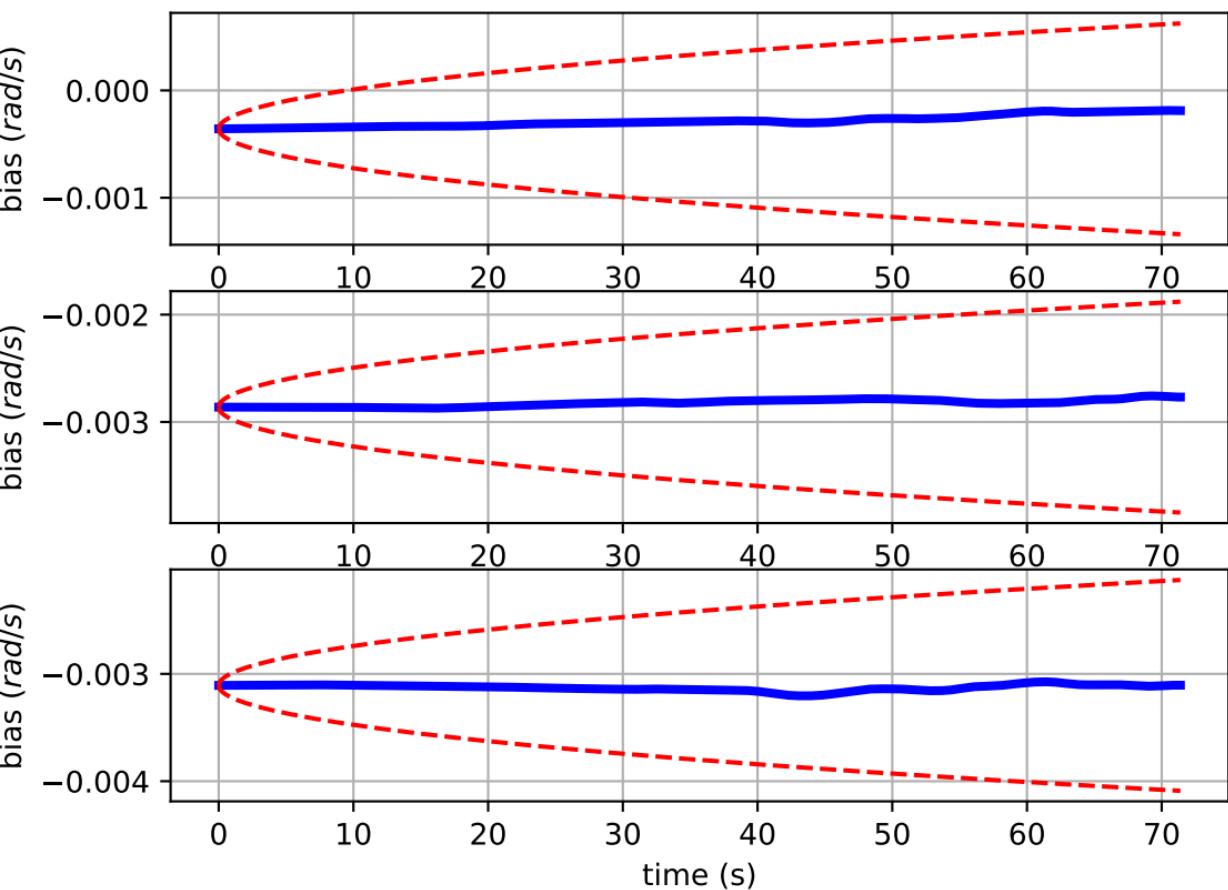
# Comparison of predicted and measured angular velocities (body frame)



## imu2: angular velocities error



## imu2: estimated gyro bias (imu frame)



cam0: reprojection errors

