

## Calibration results

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### Normalized Residuals

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Reprojection error (cam0): mean 0.5454642969281848, median 0.49077978868529987, std: 0.3155927714833584  
Reprojection error (cam1): mean 0.5360711725120484, median 0.4714974362280986, std: 0.3298317316692951  
Gyroscope error (imu0): mean 1.082020763931668, median 0.952431226153517, std: 0.8361166793062609  
Accelerometer error (imu0): mean 2.1494669402439066, median 1.8017262590578722, std: 1.4664760931479333

### Residuals

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Reprojection error (cam0) [px]: mean 0.5454642969281848, median 0.49077978868529987, std: 0.3155927714833584  
Reprojection error (cam1) [px]: mean 0.5360711725120484, median 0.4714974362280986, std: 0.3298317316692951  
Gyroscope error (imu0) [rad/s]: mean 0.012872259218753988, median 0.011330597378312433, std:  
0.00994686145767317  
Accelerometer error (imu0) [m/s^2]: mean 0.23790482379059105, median 0.19941659029722264, std:  
0.1623108176271298

### Transformation (cam0):

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T\_ci: (imu0 to cam0):  
[[-0.99975123 -0.00164188 0.02224363 0.01059575]  
[ 0.00169 -0.99999627 0.00214441 -0.00062996]  
[ 0.02224002 0.00218147 0.99975028 -0.00687912]  
[ 0. 0. 0. 1. ]]

T\_ic: (cam0 to imu0):  
[[-0.99975123 0.00169 0.02224002 0.01074717]  
[-0.00164188 -0.99999627 0.00218147 -0.00059756]  
[ 0.02224363 0.00214441 0.99975028 0.00664307]  
[ 0. 0. 0. 1. ]]

timeshift cam0 to imu0: [s] (t\_imu = t\_cam + shift)  
0.00509615089032946

### Transformation (cam1):

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T\_ci: (imu0 to cam1):  
[[-0.9998575 -0.00380925 0.01644616 -0.05170587]  
[ 0.00375374 -0.99998716 -0.00340456 -0.00059821]  
[ 0.01645892 -0.00334234 0.99985896 -0.00695533]  
[ 0. 0. 1. ]]

T\_ic: (cam1 to imu0):  
[[-0.9998575 0.00375374 0.01645892 -0.05158178]  
[-0.00380925 -0.99998716 -0.00334234 -0.00081841]  
[ 0.01644616 -0.00340456 0.99985896 0.00780268]  
[ 0. 0. 1. ]]

timeshift cam1 to imu0: [s] (t\_imu = t\_cam + shift)  
0.0050738590507307425

Baselines:

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Baseline (cam0 to cam1):  
[[ 0.99998084 0.00215474 -0.00580311 -0.06233999]  
[-0.00218667 0.99998247 -0.00550167 0.00001706]  
[ 0.00579115 0.00551425 0.99996803 -0.00013432]  
[ 0. 0. 1. ]]  
baseline norm: 0.06234013360020185 [m]

Gravity vector in target coords: [m/s^2]  
[-0.07268009 -9.80586043 -0.0907839 ]

Calibration configuration

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cam0

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Camera model: pinhole  
Focal length: [280.04528976261827, 279.13548477347115]  
Principal point: [422.5761859739201, 398.2108536093846]  
Distortion model: equidistant  
Distortion coefficients: [-0.007702729727046101, 0.0564526464269237, -0.05420016469620549,  
0.011600128750413994]  
Type: aprilgrid  
Tags:  
Rows: 6  
Cols: 6  
Size: 0.088 [m]  
Spacing 0.026399999999999996 [m]

cam1

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Camera model: pinhole  
Focal length: [280.1113364969218, 278.95813286171233]  
Principal point: [422.7967106458211, 397.1114350269903]  
Distortion model: equidistant  
Distortion coefficients: [0.003681625225816193, 0.03279753460951982, -0.03578694646545048,  
0.007066835836207297]  
Type: aprilgrid  
Tags:  
Rows: 6  
Cols: 6  
Size: 0.088 [m]  
Spacing 0.026399999999999996 [m]

IMU configuration

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IMU0:

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Model: scale-misalignment  
Update rate: 200.0

Accelerometer:

Noise density: 0.00782631782

Noise density (discrete): 0.11068084804486235

Random walk: 0.003530287405478416

Gyroscope:

Noise density: 0.00084120953

Noise density (discrete): 0.01189649926123497

Random walk: 7.269783693712976e-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]

Gyroscope:

M:

[[ 0.97462983 0. 0. ]

[-0.00205943 0.96974618 0. ]

[ 0.00135452 0.00732685 0.99314079]]

A [(rad/s)/(m/s^2)]:

[[ 0.0001947 -0.0008038 -0.00086284]

[ 0.00151016 0.00021543 0.0004645 ]

[ 0.00107852 -0.00070173 -0.00045741]]

C\_gyro\_i:

[[ 0.99996279 0.00155407 -0.00848565]

[-0.00153932 0.99999729 0.00174496]

[ 0.00848834 -0.00173183 0.99996247]]

Accelerometer:

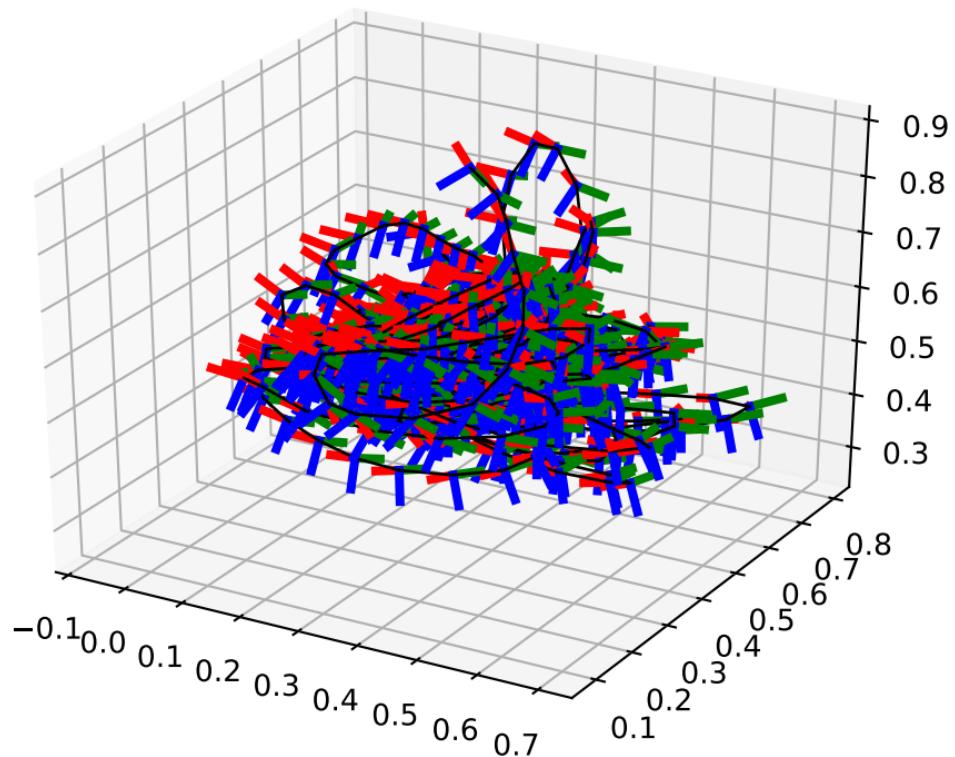
M:

[[ 0.98407147 0. 0. ]

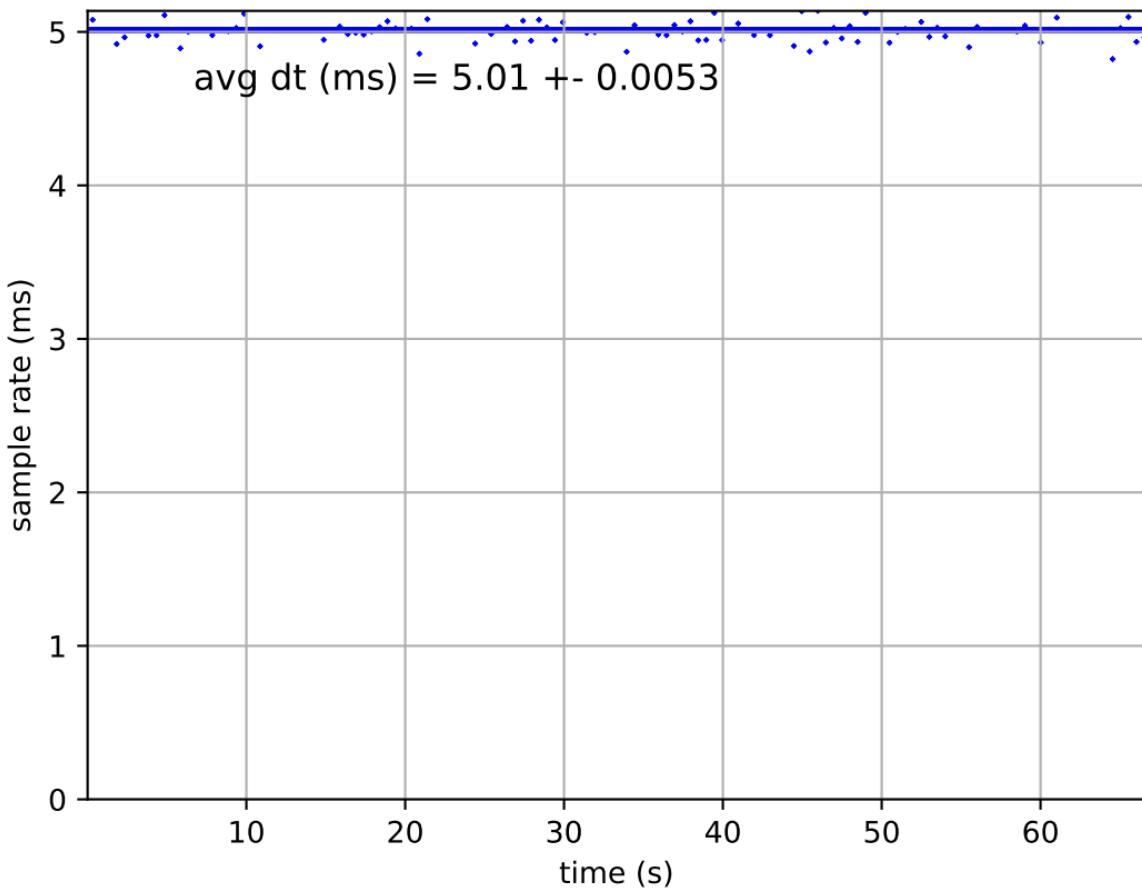
[ 0.00644184 0.98278076 0. ]

[ 0.03037147 -0.0022912 0.96650329]]

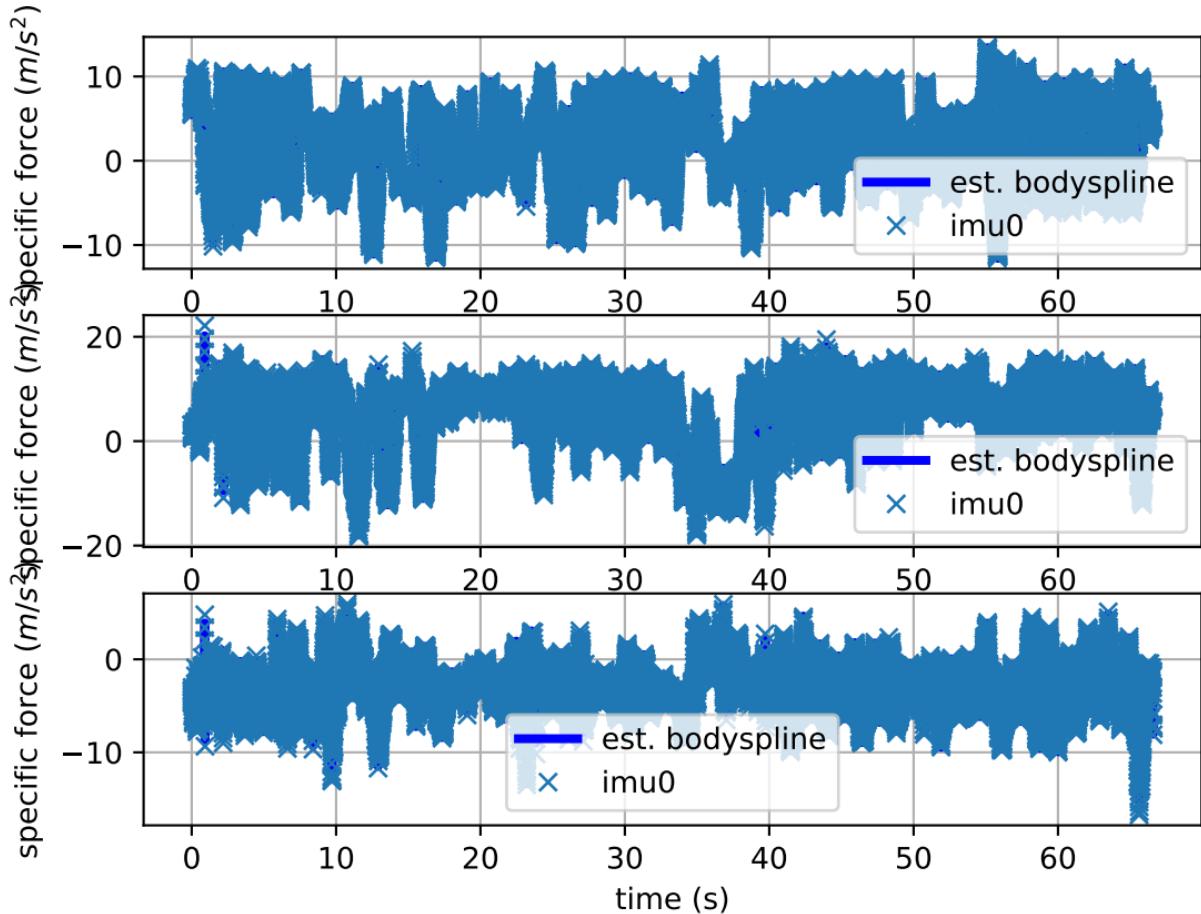
imu0: estimated poses



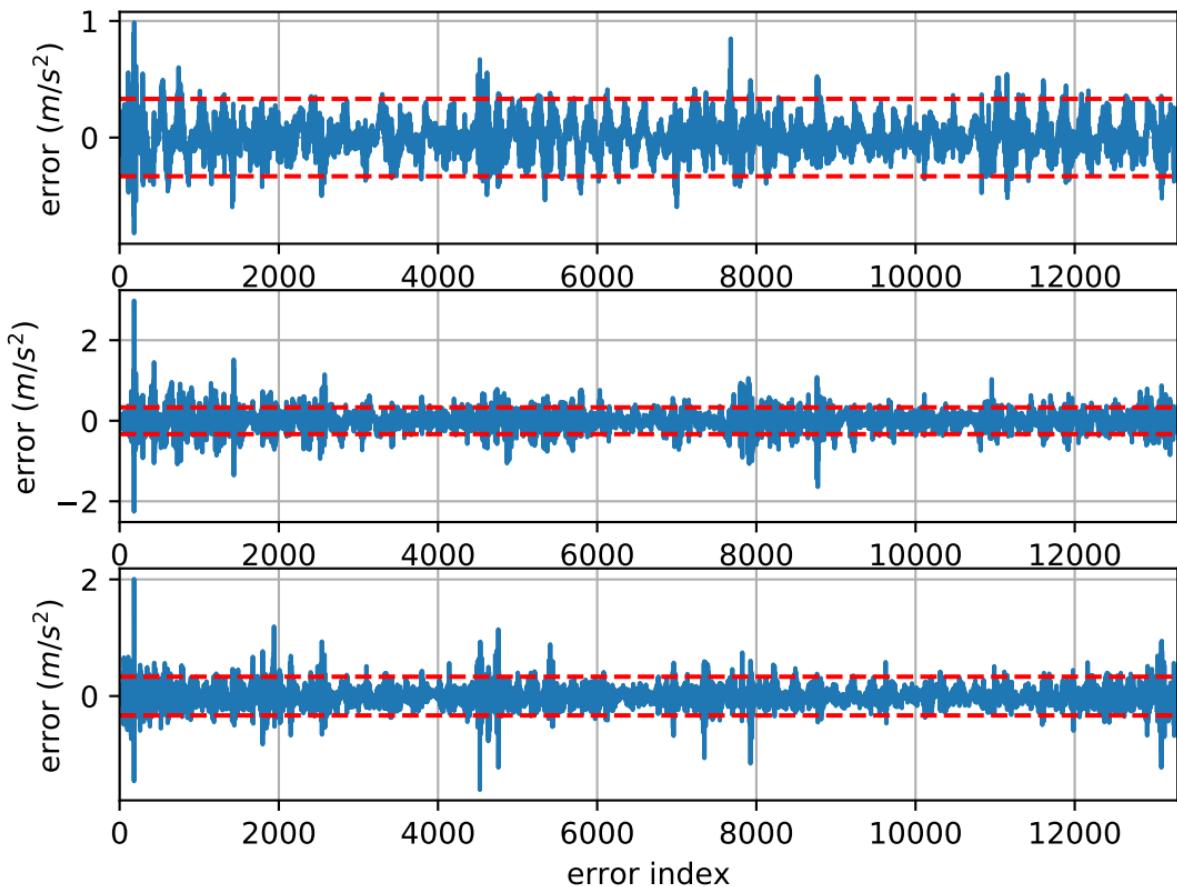
# imu0: sample inertial rate



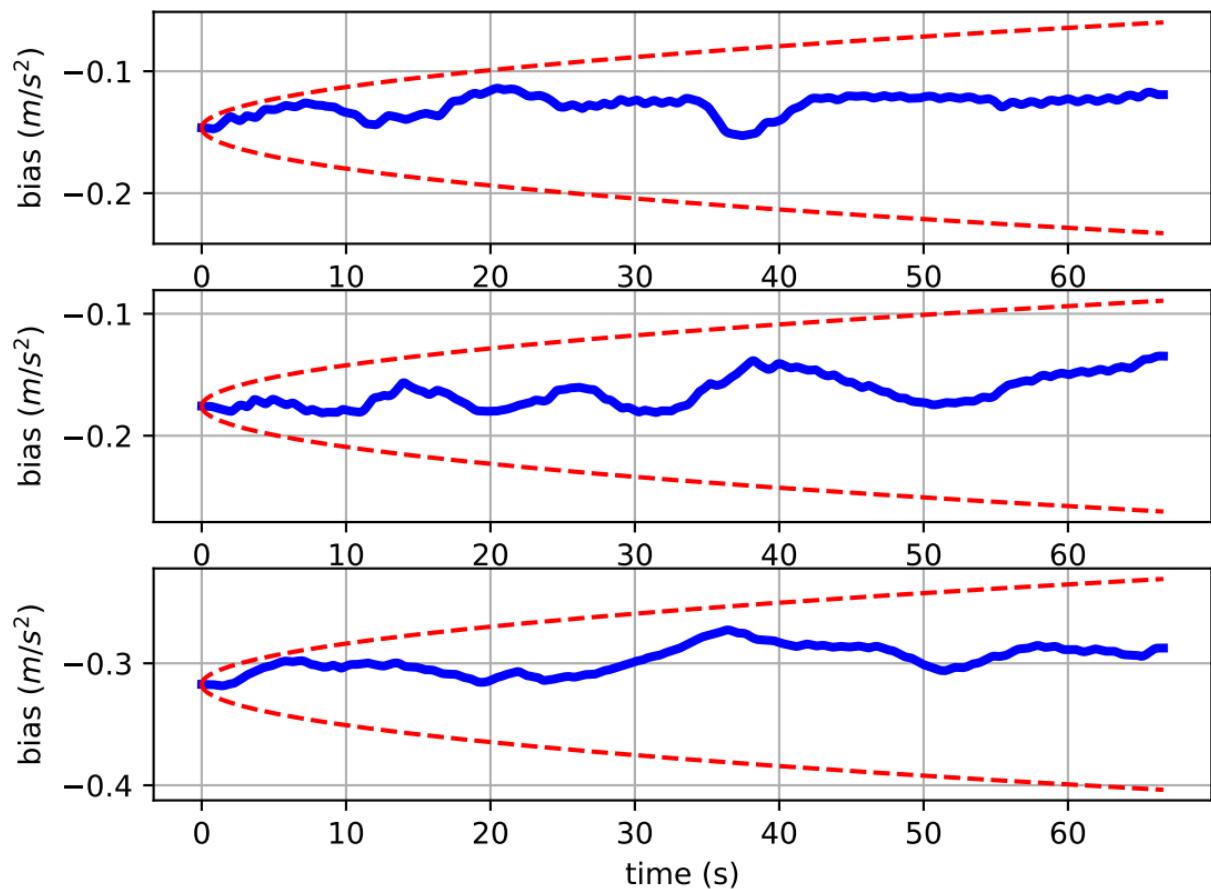
# Comparison of predicted and measured specific force (imu0 frame)



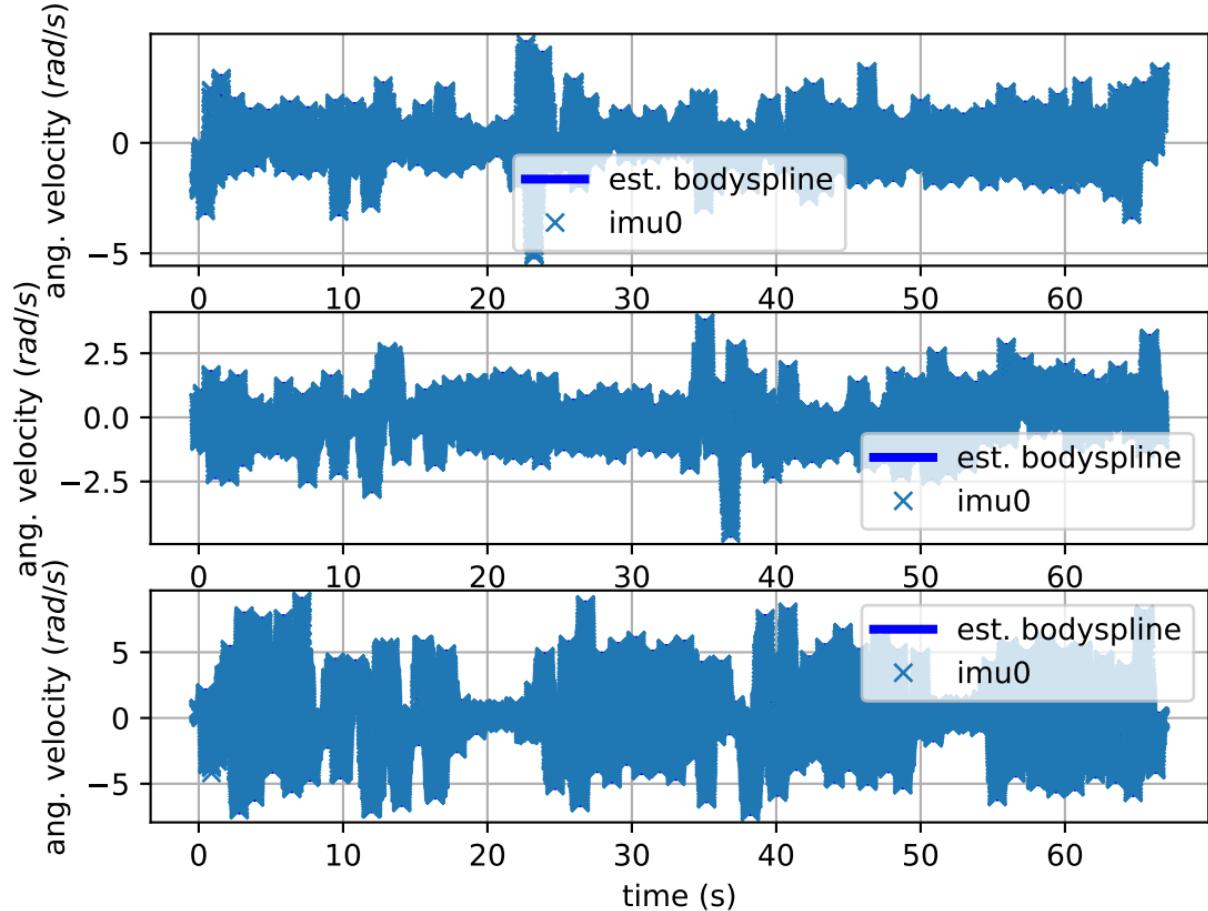
# imu0: acceleration error



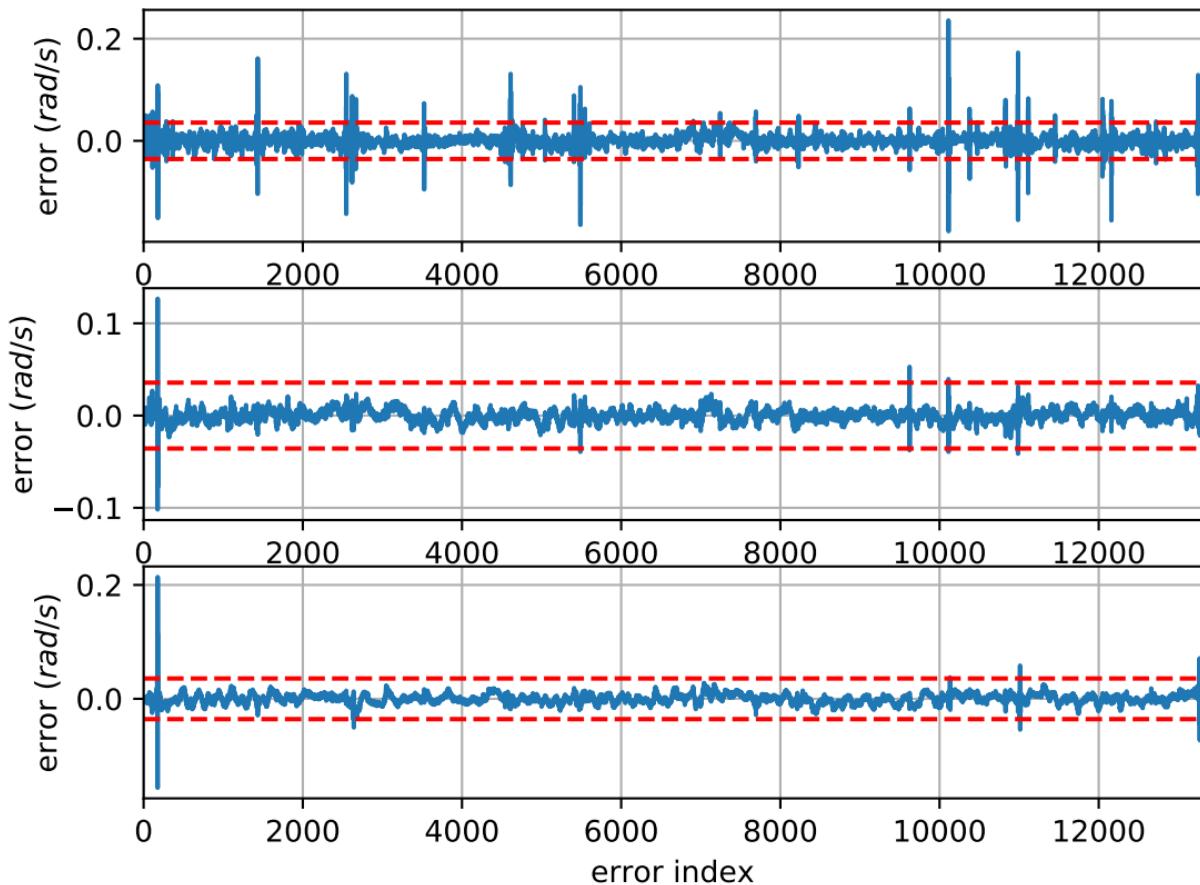
# imu0: estimated accelerometer bias (imu frame)



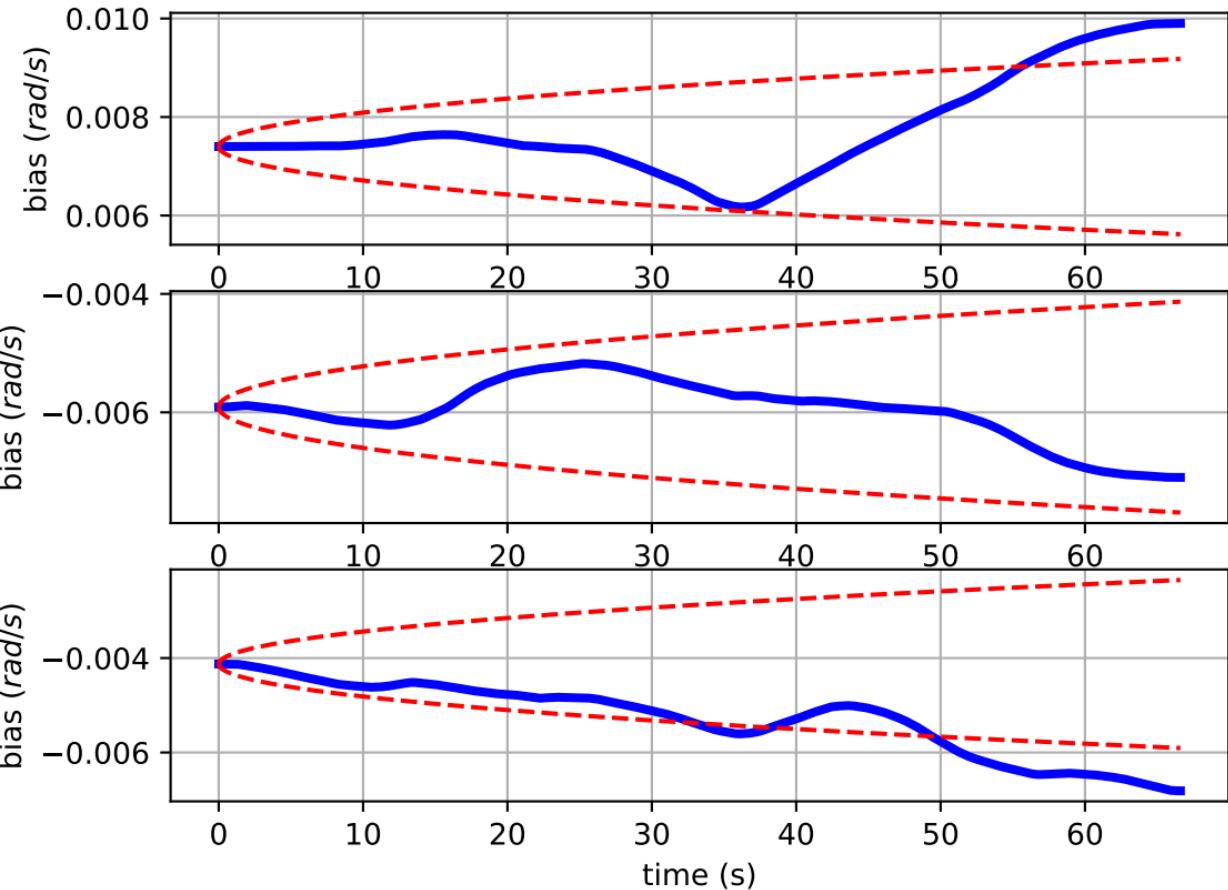
# Comparison of predicted and measured angular velocities (body frame)



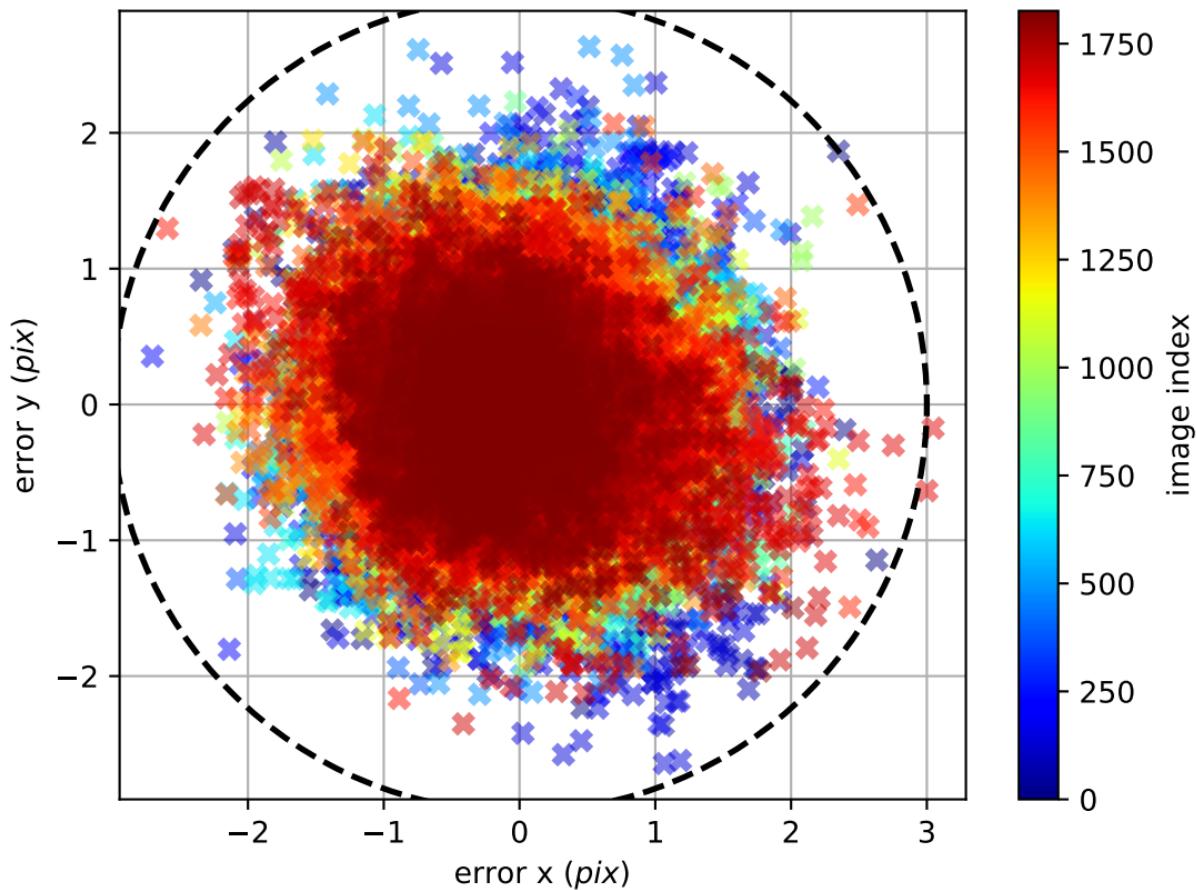
# imu0: angular velocities error



# imu0: estimated gyro bias (imu frame)



cam0: reprojection errors



cam1: reprojection errors

