

## Calibration results

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### Normalized Residuals

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Reprojection error (cam0): mean 0.3110333439, median 0.25062486267, std: 0.222088228827  
Reprojection error (cam1): mean 0.307017959725, median 0.24849668099, std: 0.218059204839  
Gyroscope error (imu0): mean 0.494388739202, median 0.342883429809, std: 0.546775787346  
Accelerometer error (imu0): mean 0.722082754693, median 0.488051495645, std: 0.818072126595

### Residuals

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Reprojection error (cam0) [px]: mean 0.3110333439, median 0.25062486267, std: 0.222088228827  
Reprojection error (cam1) [px]: mean 0.307017959725, median 0.24849668099, std: 0.218059204839  
Gyroscope error (imu0) [rad/s]: mean 0.00381473560675, median 0.00264571080394, std: 0.00421895747112  
Accelerometer error (imu0) [m/s^2]: mean 0.0244814177275, median 0.0165468465487, std: 0.0277358312911

### Transformation (cam0):

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

```
[[-0.03048322 -0.99944782 -0.0132219 -0.00299091]
 [ 0.04658067  0.01179321 -0.99884491 -0.04492468]
 [ 0.9984493 -0.0310639  0.04619546 -0.10483462]
 [ 0.          0.          1.          ]]]
```

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

```
[[-0.03048322  0.04658067  0.9984493  0.1066735 ]
 [-0.99944782  0.01179321 -0.0310639 -0.00571602]
 [-0.0132219 -0.99884491  0.04619546 -0.04006945]
 [ 0.          0.          1.          ]]]
```

timeshift cam0 to imu0: [s] ( $t_{\text{imu}} = t_{\text{cam}} + \text{shift}$ )

0.000206596592983

### Transformation (cam1):

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T\_ci: (imu0 to cam1):  
[[-0.0342335 -0.99932833 -0.01307465 -0.05259329]  
[ 0.04665675 0.01147003 -0.99884513 -0.04504094]  
[ 0.9983242 -0.03480398 0.04623276 -0.10476125]  
[ 0. 0. 0. 1. ]]

T\_ic: (cam1 to imu0):  
[[ -0.0342335 0.04665675 0.9983242 0.1048867 ]  
[ -0.99932833 0.01147003 -0.03480398 -0.05568745]  
[ -0.01307465 -0.99884513 0.04623276 -0.04083316]  
[ 0. 0. 0. 1. ]]

timeshift cam1 to imu0: [s] (t\_imu = t\_cam + shift)  
0.000211756813957

Baselines:

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Baseline (cam0 to cam1):  
[[ 0.99999295 -0.00032036 -0.00374137 -0.05000902]  
[ 0.00032069 0.99999994 0.00008599 -0.00010629]  
[ 0.00374134 -0.00008719 0.999993 0.00007991]  
[ 0. 0. 0. 1. ]]  
baseline norm: 0.0500092001217 [m]

Gravity vector in target coords: [m/s^2]  
[-0.08579852 -9.80617443 -0.00213782]

Calibration configuration

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cam0

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Camera model: pinhole  
Focal length: [426.8825036040236, 429.4438220039055]  
Principal point: [424.9969624435153, 245.6695137338236]  
Distortion model: radtan  
Distortion coefficients: [5.48324010490589e-05, -4.385406935558303e-05, -0.00020332907329503183, 0.00016572677706572472]  
Type: aprilgrid  
Tags:  
Rows: 6  
Cols: 6  
Size: 0.0625 [m]  
Spacing 0.01875 [m]

cam1

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Camera model: pinhole  
Focal length: [427.7800095351429, 430.3491378636911]  
Principal point: [426.5920875648096, 246.406737303008]  
Distortion model: radtan  
Distortion coefficients: [0.0005335379318268691, -0.000402842600031004, -0.00013349069613134934, 0.00028898590369644847]  
Type: aprilgrid  
Tags:  
Rows: 6  
Cols: 6  
Size: 0.0625 [m]  
Spacing 0.01875 [m]

IMU configuration

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IMU0:

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Model: calibrated  
Update rate: 200.0

Accelerometer:

Noise density: 0.00239736738977

Noise density (discrete): 0.033903894766

Random walk: 0.00023355513442

Gyroscope:

Noise density: 0.000545608182807

Noise density (discrete): 0.00771606491868

Random walk: 3.62583983465e-05

$T_{ib}$  (imu0 to imu0)

[ [ 1. 0. 0. 0.]

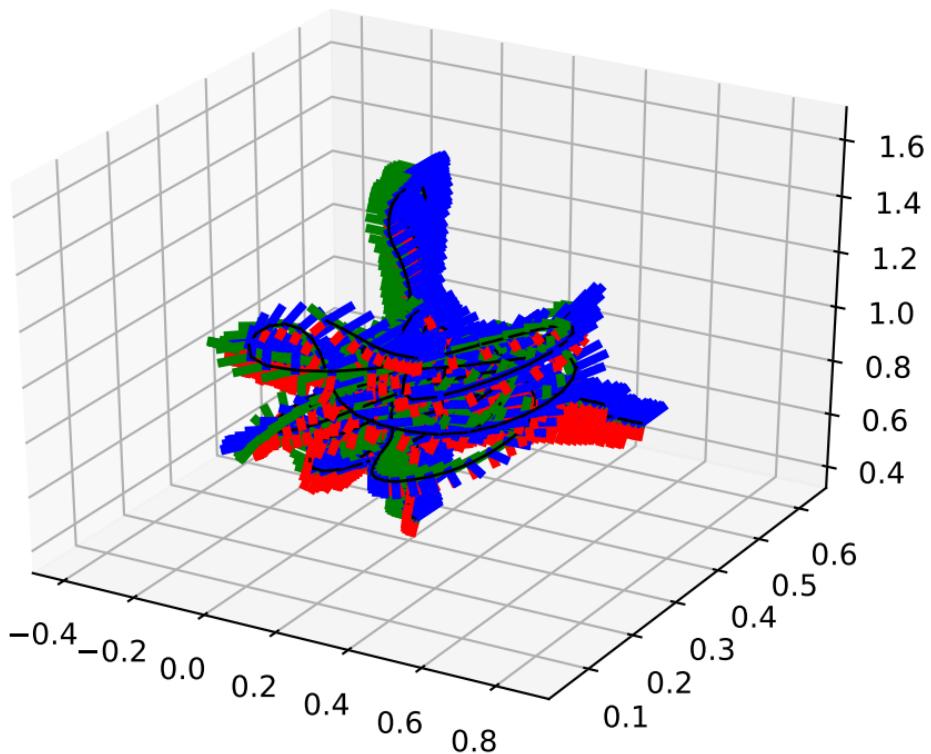
  [ 0. 1. 0. 0.]

  [ 0. 0. 1. 0.]

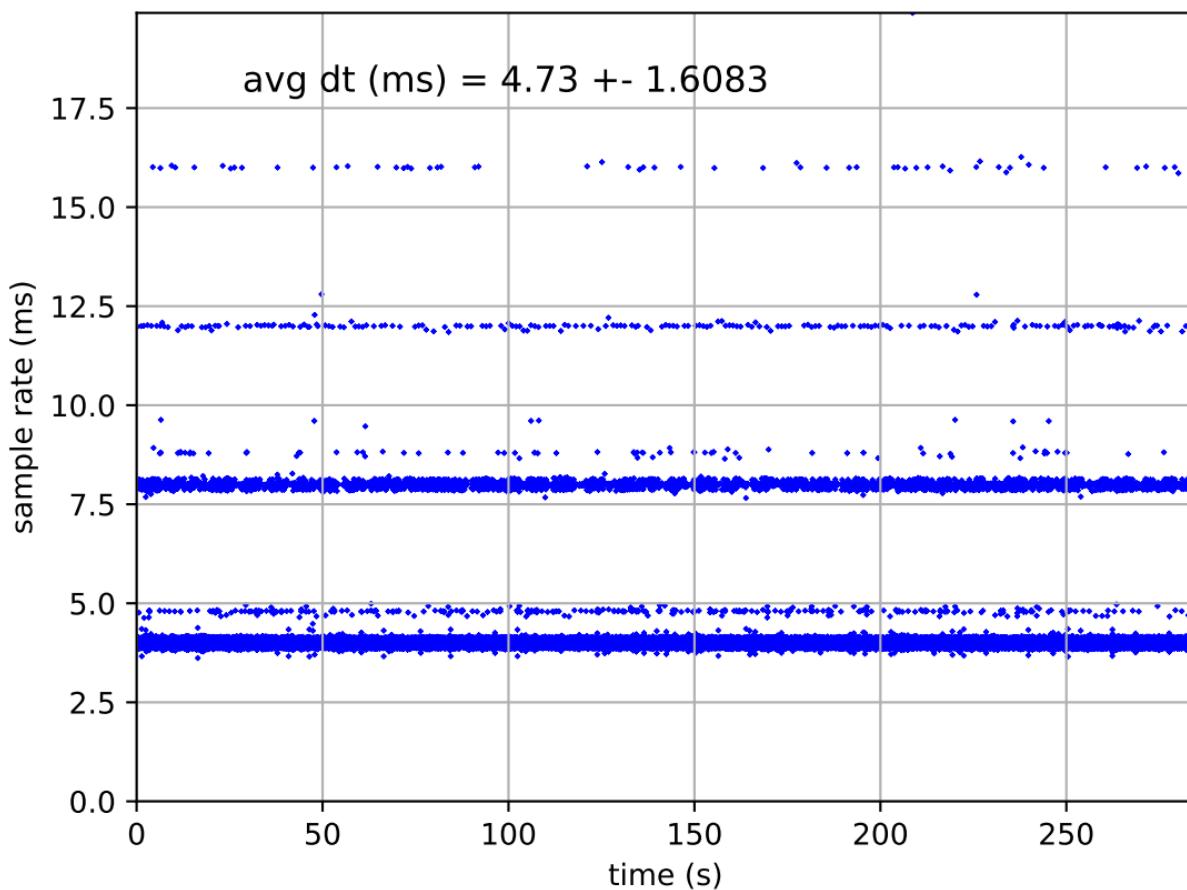
  [ 0. 0. 0. 1.]]

time offset with respect to IMU0: 0.0 [s]

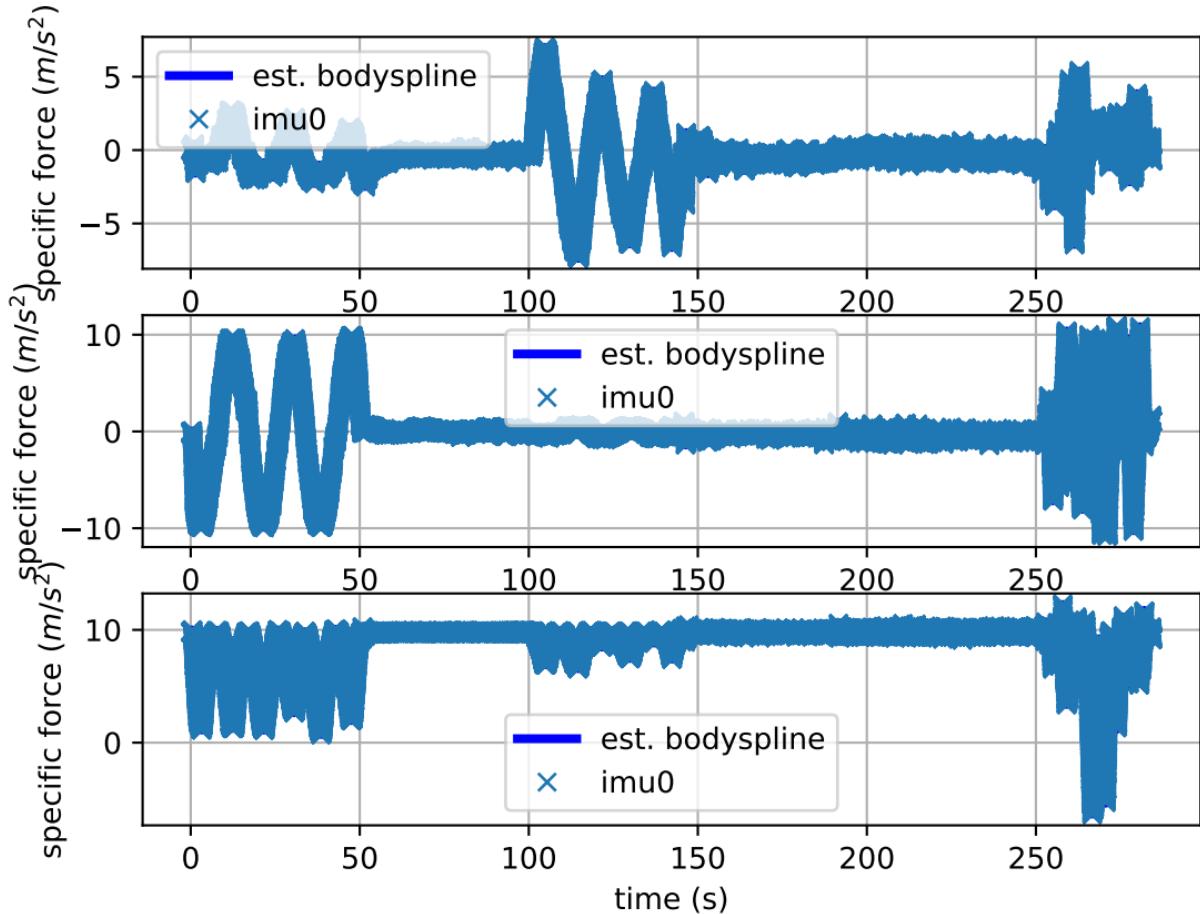
imu0: estimated poses



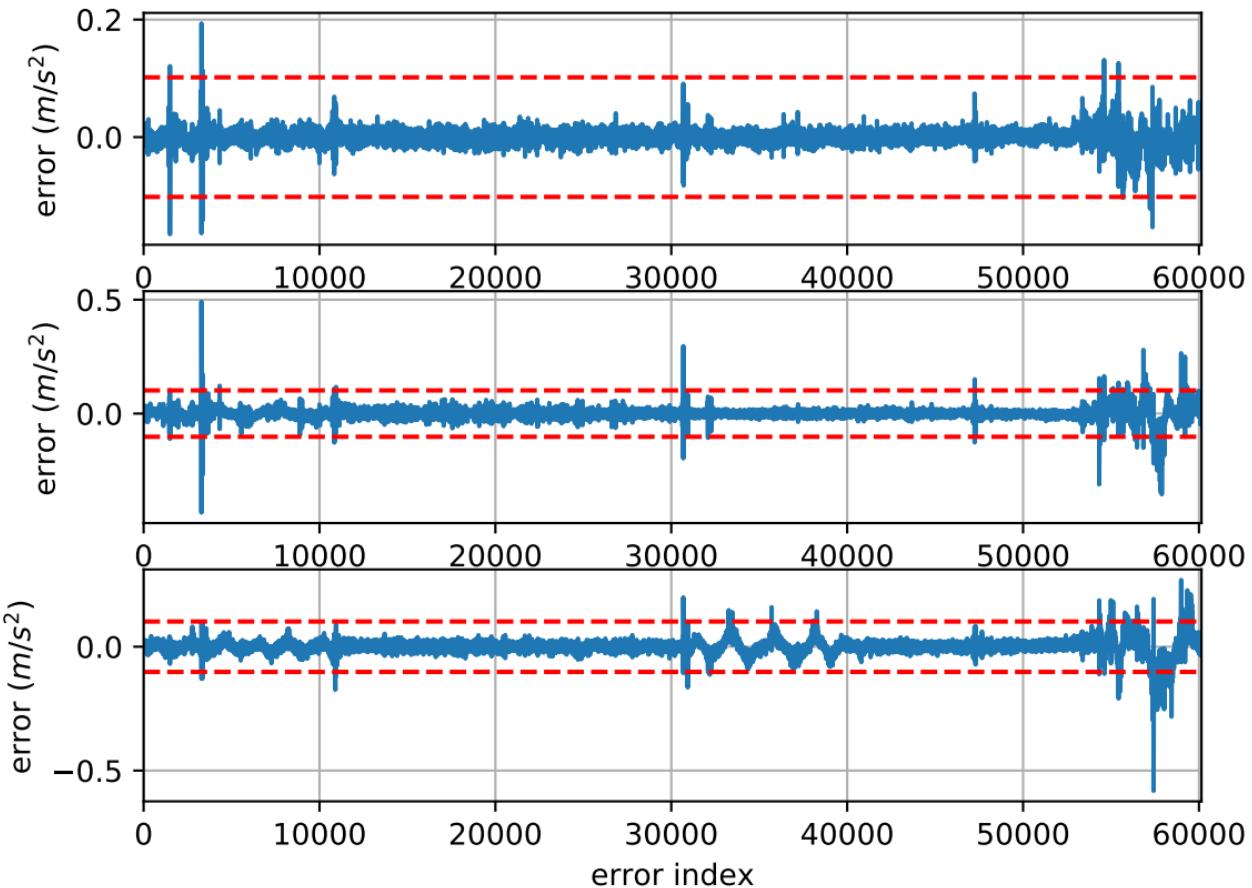
# imu0: sample inertial rate



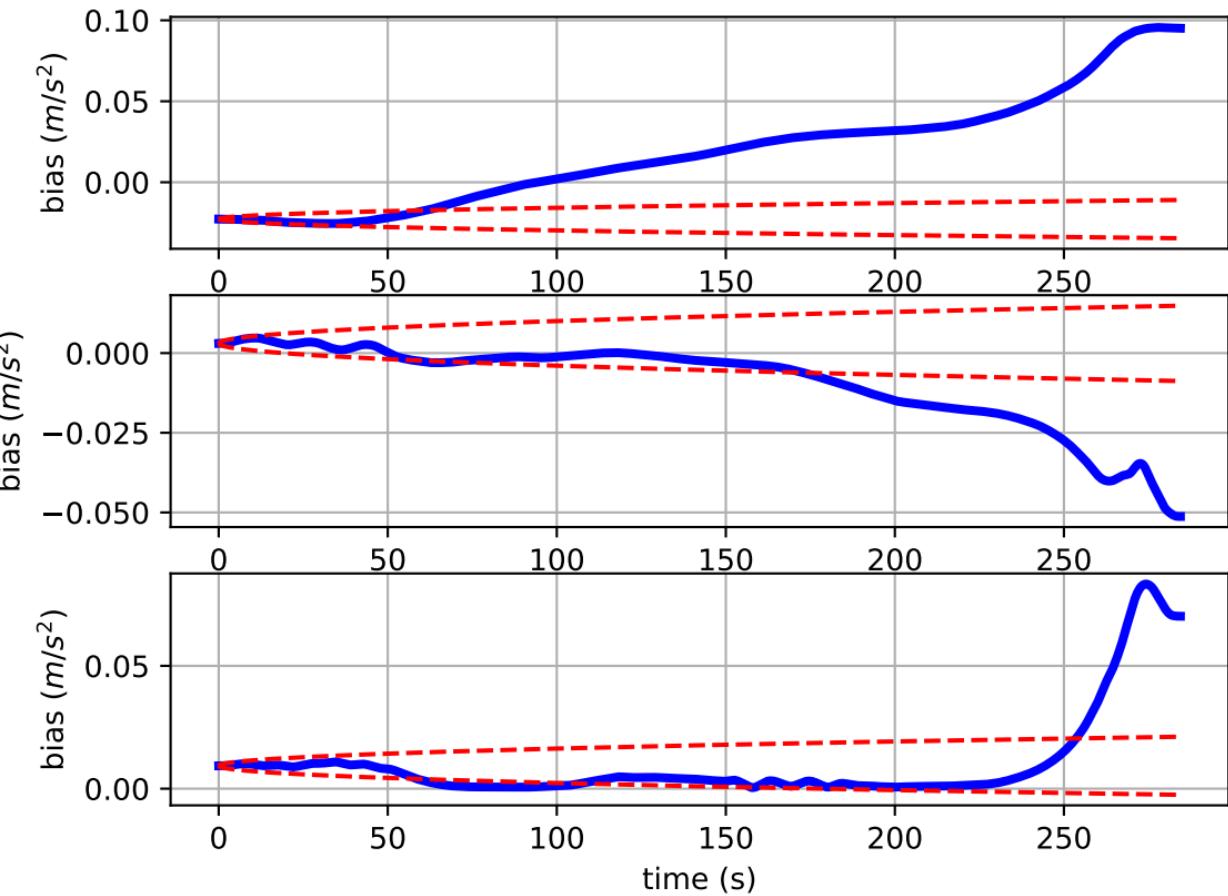
# Comparison of predicted and measured specific force (imu0 frame)



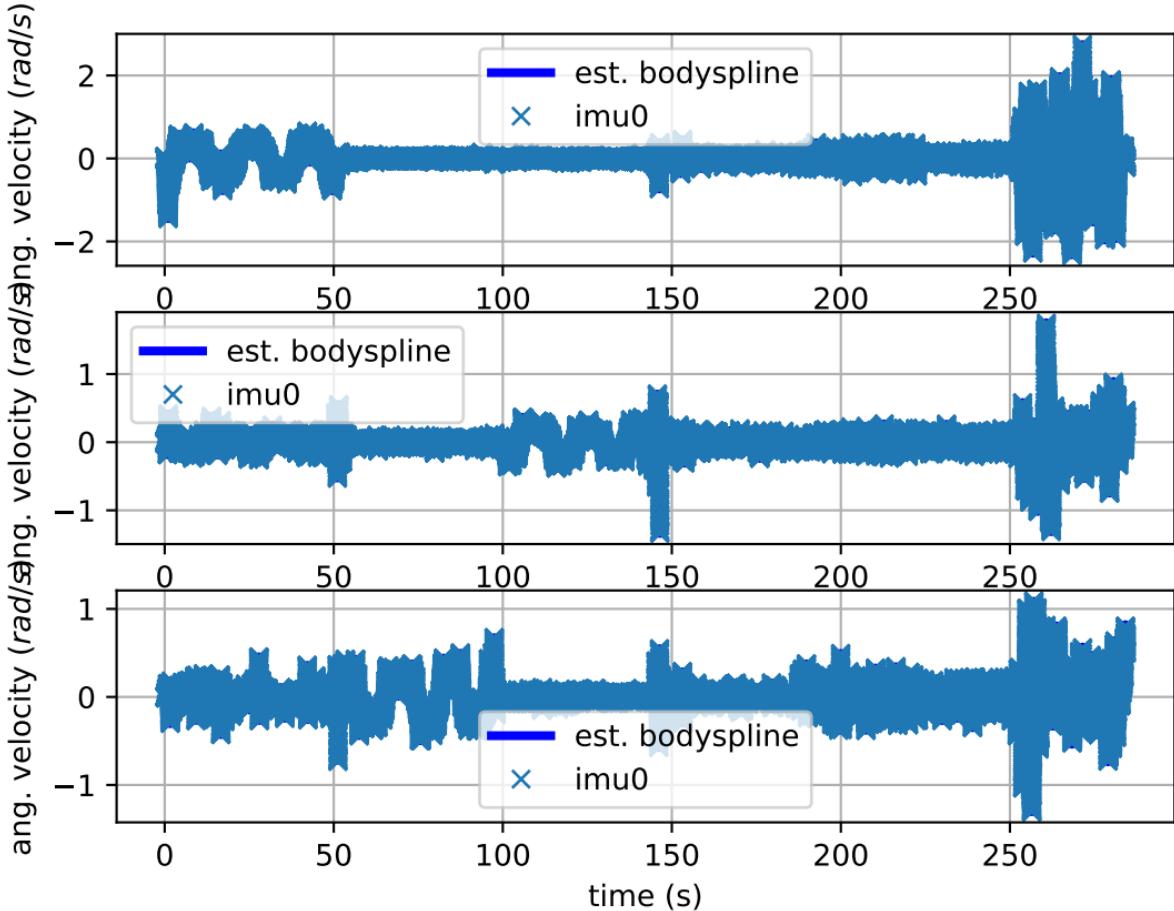
# imu0: acceleration error



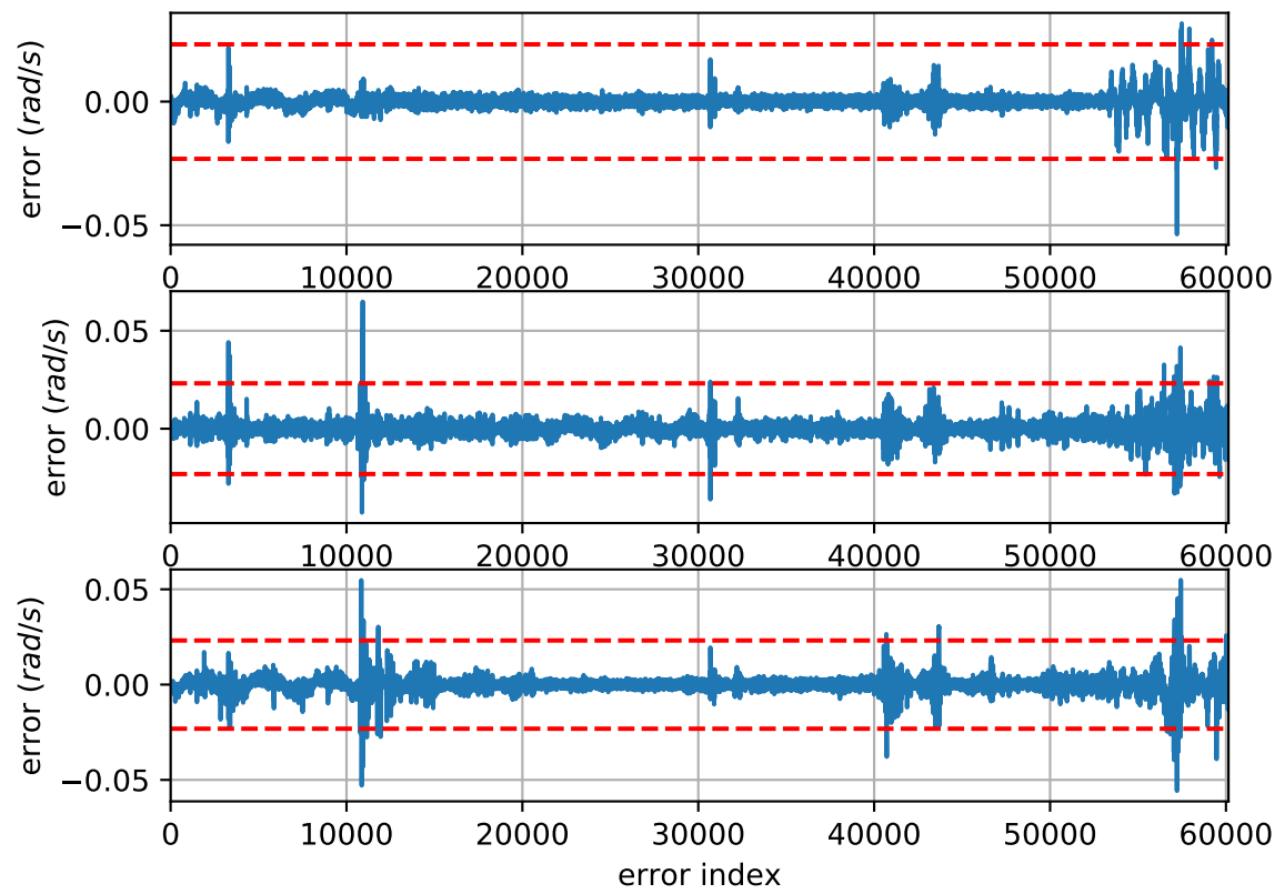
# imu0: estimated accelerometer bias (imu frame)



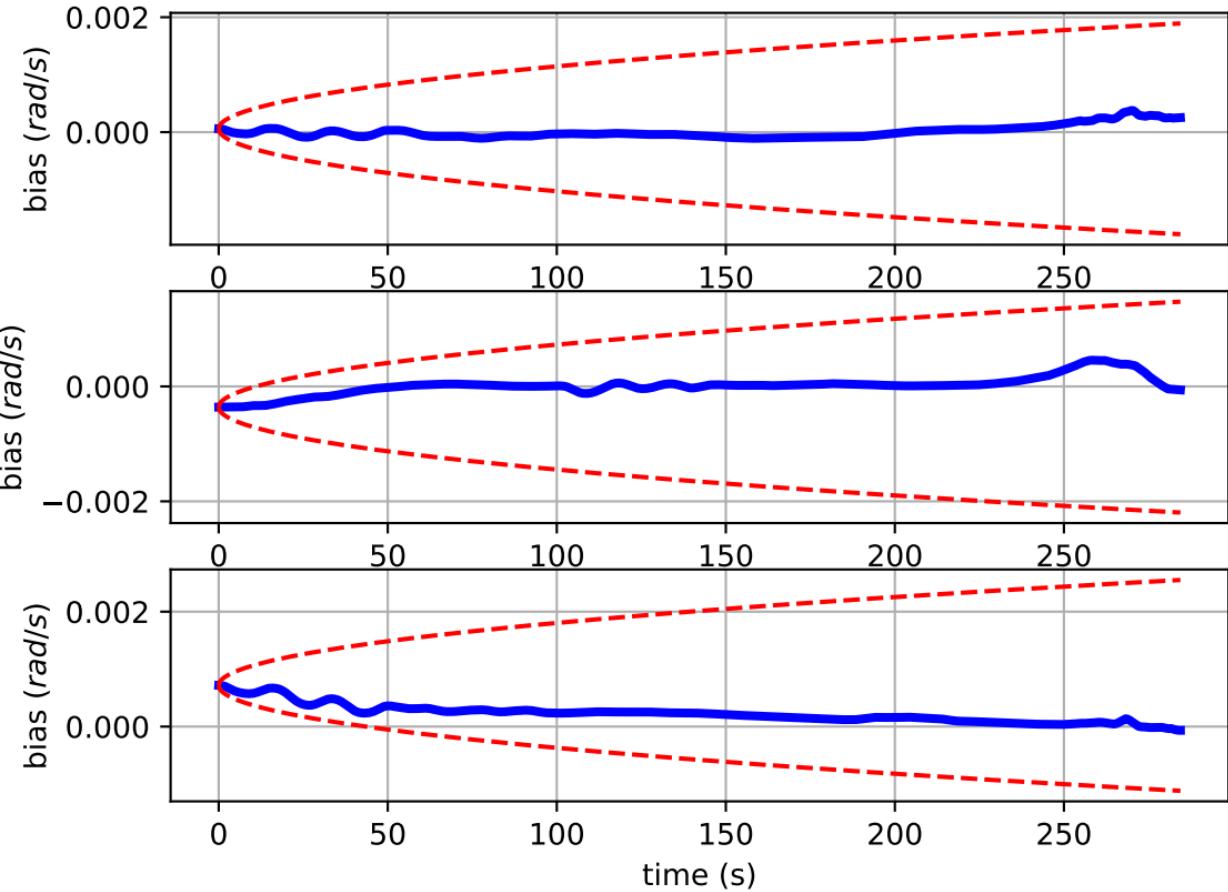
# Comparison of predicted and measured angular velocities (body frame)



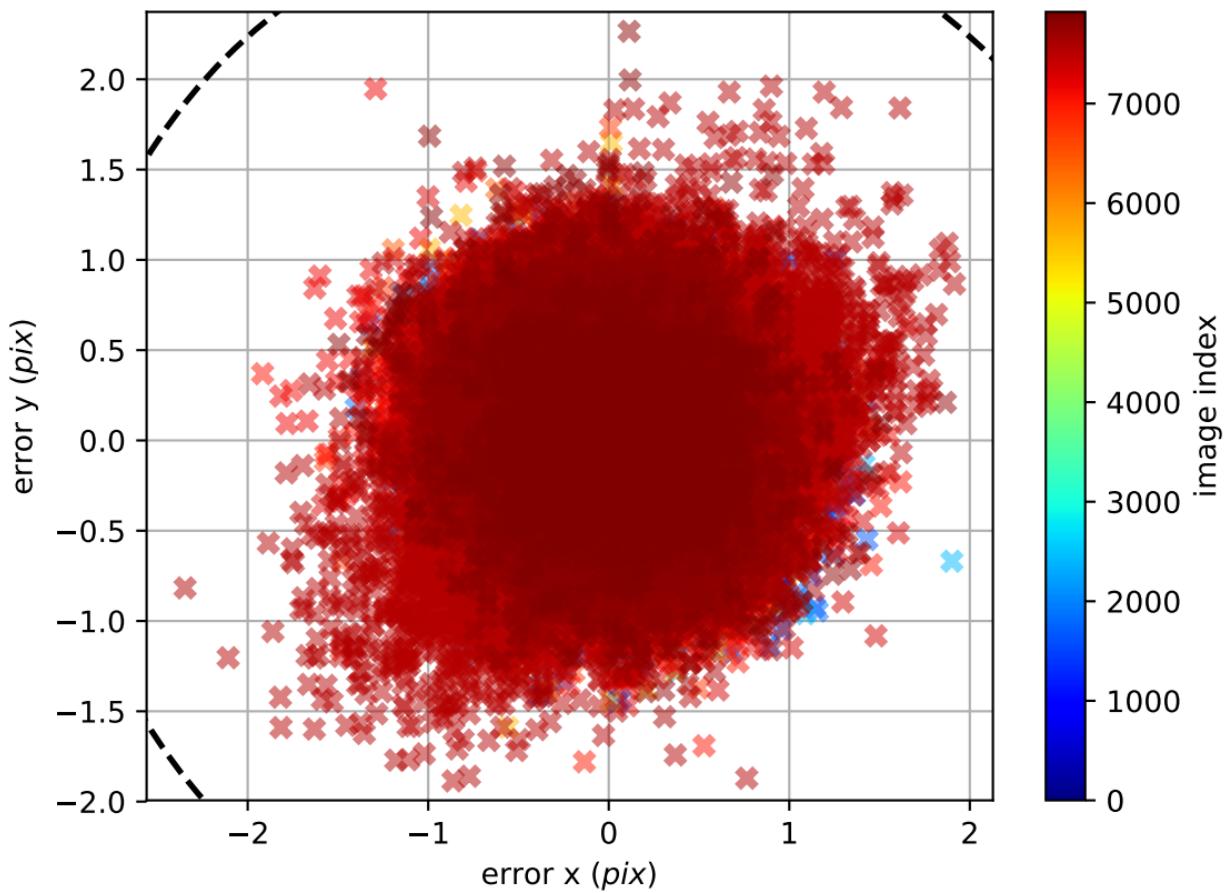
# imu0: angular velocities error



# imu0: estimated gyro bias (imu frame)



cam0: reprojection errors



cam1: reprojection errors

