

## Calibration results

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### Normalized Residuals

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Reprojection error (cam0): mean 0.201318672222, median 0.185632276591, std: 0.111328831778  
Reprojection error (cam1): mean 0.222154039995, median 0.19765745656, std: 0.156081057969  
Gyroscope error (imu0): mean 2.15765728445e-05, median 1.35679522303e-06, std: 0.000212812863252  
Accelerometer error (imu0): mean 1.51915605751e-07, median 5.37700164473e-09, std: 4.4251634433e-06

### Residuals

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Reprojection error (cam0) [px]: mean 0.201318672222, median 0.185632276591, std: 0.111328831778  
Reprojection error (cam1) [px]: mean 0.222154039995, median 0.19765745656, std: 0.156081057969  
Gyroscope error (imu0) [rad/s]: mean 9.58547171725e-07, median 6.02761260101e-08, std: 9.45428959671e-06  
Accelerometer error (imu0) [m/s^2]: mean 1.08854340088e-07, median 3.85286266541e-09, std: 3.17082793451e-06

### Transformation (cam0):

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T\_ci: (imu0 to cam0):

```
[[-0.99999478 -0.0014457 -0.00288898  0.00001517]
 [ 0.00146433 -0.99997809 -0.00645491 -0.00001125]
 [-0.00287958 -0.00645911  0.99997499 -0.00014027]
 [ 0.          0.          1.          ]]]
```

T\_ic: (cam0 to imu0):

```
[[-0.99999478  0.00146433 -0.00287958  0.00001478]
 [-0.0014457 -0.99997809 -0.00645911 -0.00001213]
 [-0.00288898 -0.00645491  0.99997499  0.00014024]
 [ 0.          0.          1.          ]]]
```

timeshift cam0 to imu0: [s] ( $t_{\text{imu}} = t_{\text{cam}} + \text{shift}$ )  
0.000244095775258

### Transformation (cam1):

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T\_ci: (imu0 to cam1):  
[[-0.99999836 -0.00129141 0.00127086 0.0647993 ]  
[ 0.00128423 -0.99998333 -0.00562914 0.0000663 ]  
[ 0.00127811 -0.0056275 0.99998335 -0.00010516]  
[ 0. 0. 0. 1. ]]

T\_ic: (cam1 to imu0):  
[[ -0.99999836 0.00128423 0.00127811 0.06479925]  
[ -0.00129141 -0.99998333 -0.0056275 0.00014939]  
[ 0.00127086 -0.00562914 0.99998335 0.00002318]  
[ 0. 0. 0. 1. ]]

timeshift cam1 to imu0: [s] (t\_imu = t\_cam + shift)  
0.000755191696036

Baselines:

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Baseline (cam0 to cam1):  
[[ 0.99999134 -0.00018115 0.00415874 0.06478472]  
[ 0.00017772 0.99999964 0.0008263 0.00007766]  
[ -0.00415889 -0.00082555 0.99999101 0.00003516]  
[ 0. 0. 0. 1. ]]  
baseline norm: 0.0647847711711 [m]

Gravity vector in target coords: [m/s^2]  
[ 9.8043581 -0.10241149 0.1802696 ]

Calibration configuration

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cam0

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Camera model: pinhole  
Focal length: [287.45363681338114, 287.95458556927554]  
Principal point: [419.84649408998547, 400.59213584692725]  
Distortion model: equidistant  
Distortion coefficients: [-0.009072791815875204, 0.05409554257822231, -0.05186574179054281,  
0.010784112218234278]  
Type: aprilgrid  
Tags:  
Rows: 6  
Cols: 6  
Size: 0.0312 [m]  
Spacing 0.00959999976 [m]

cam1

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Camera model: pinhole  
Focal length: [288.0000646057747, 288.61205510998934]  
Principal point: [420.44303313786514, 386.9065821859718]  
Distortion model: equidistant  
Distortion coefficients: [-0.009452971230576446, 0.05803581182512474, -0.060236306196430084,  
0.015460717808769944]  
Type: aprilgrid  
Tags:  
Rows: 6  
Cols: 6  
Size: 0.0312 [m]  
Spacing 0.00959999976 [m]

IMU configuration

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IMU0:

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Model: calibrated  
Update rate: 200.0

Accelerometer:

Noise density: 0.0506673699898

Noise density (discrete): 0.716544818093

Random walk: 0.00238846124584

Gyroscope:

Noise density: 0.003141347841

Noise density (discrete): 0.0444253672087

Random walk: 9.83708665485e-05

$T_{ib}$  (imu0 to imu0)

[ [ 1. 0. 0. 0.]

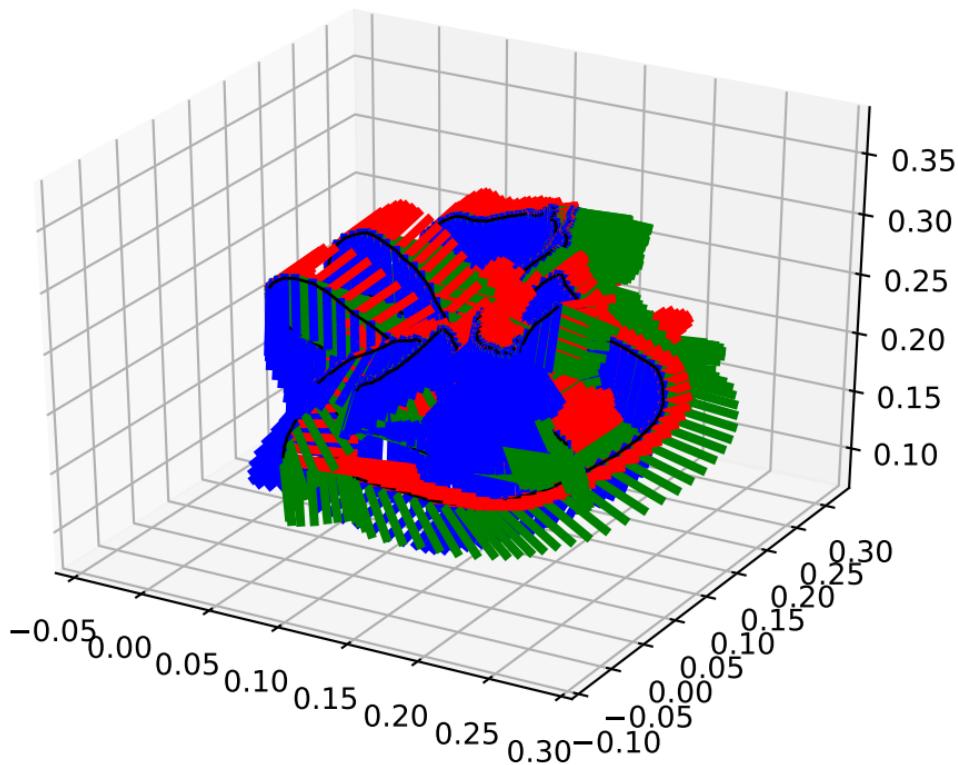
  [ 0. 1. 0. 0.]

  [ 0. 0. 1. 0.]

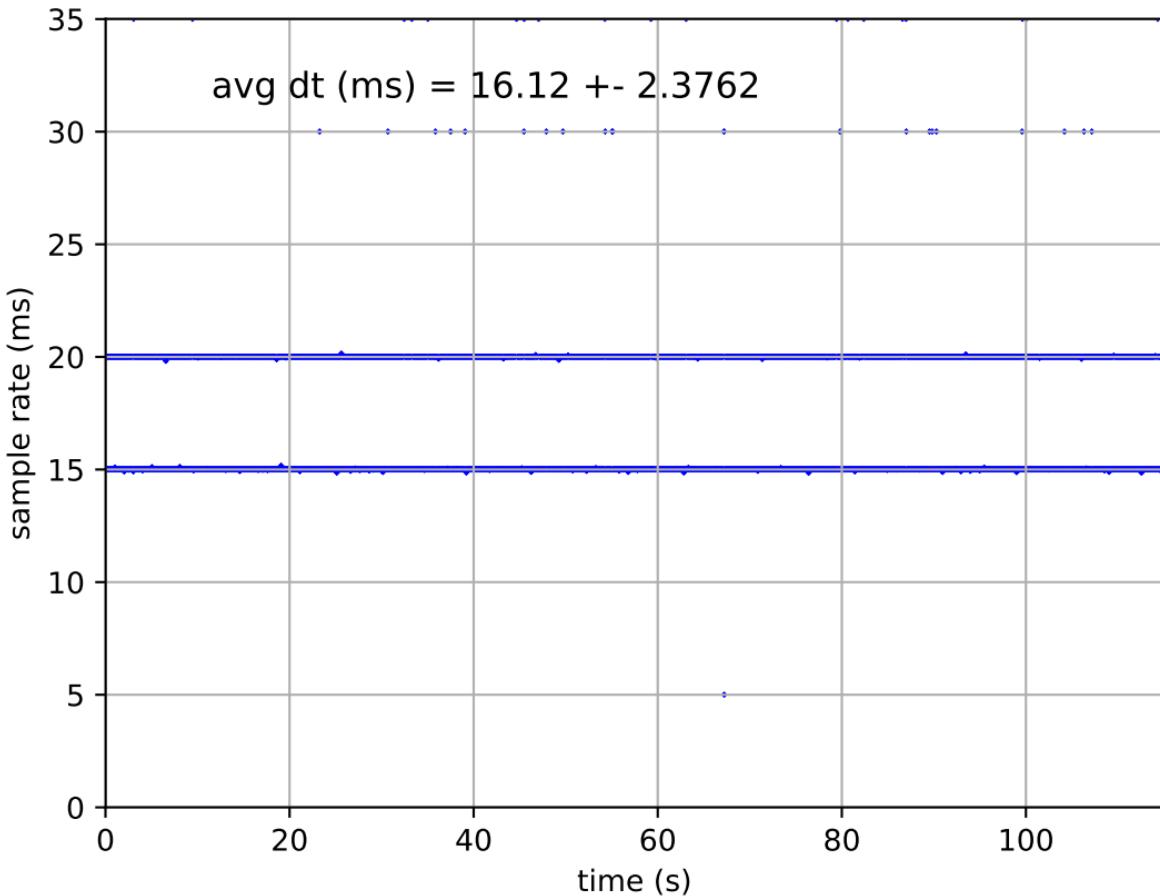
  [ 0. 0. 0. 1.]]

time offset with respect to IMU0: 0.0 [s]

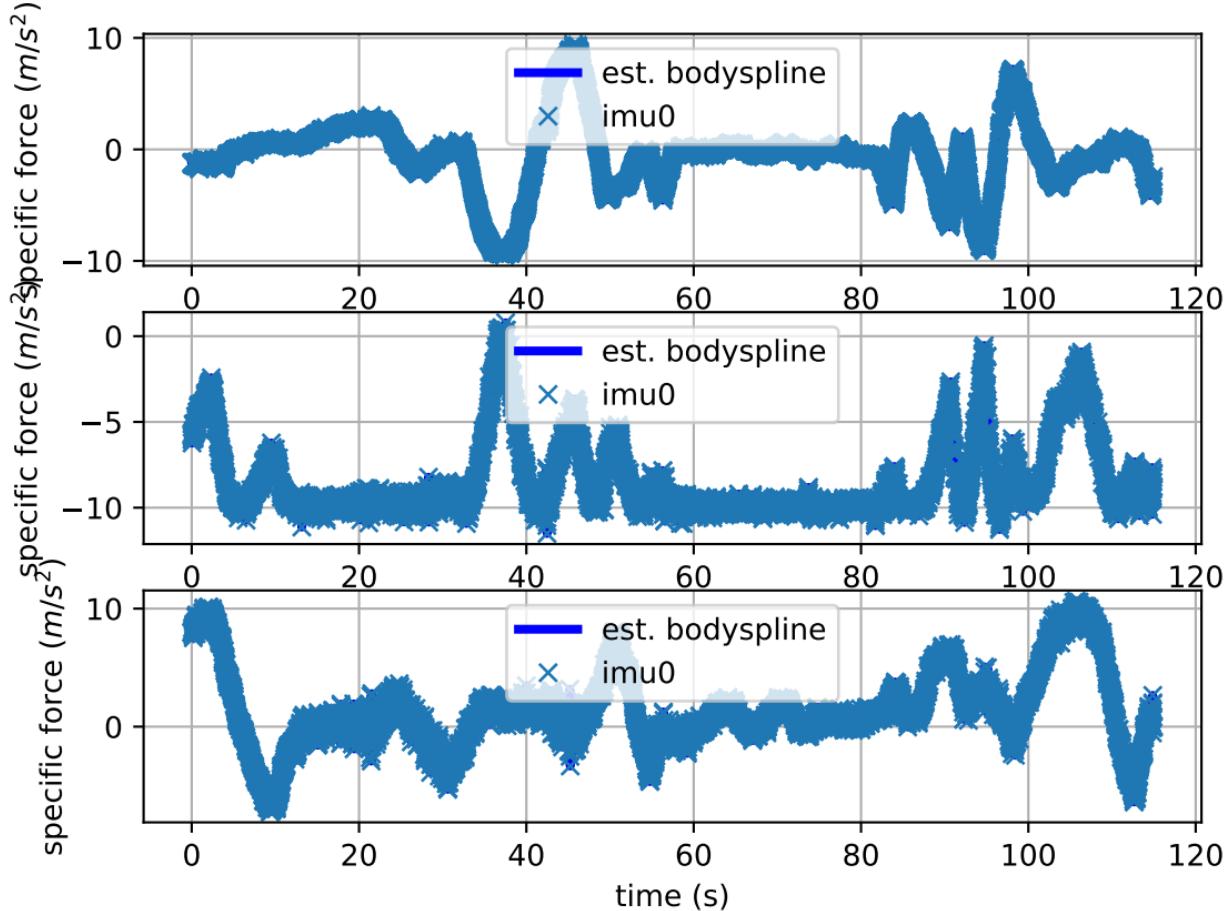
imu0: estimated poses



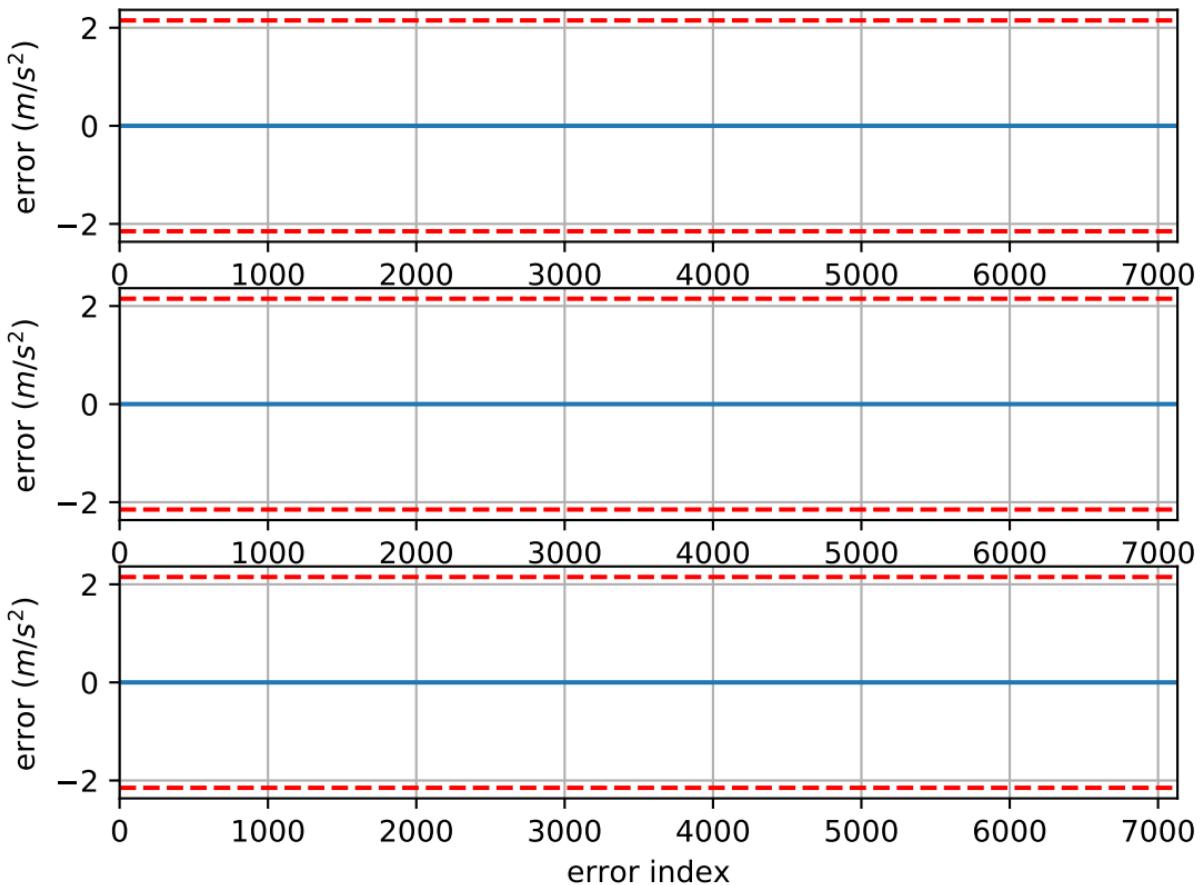
# imu0: sample inertial rate



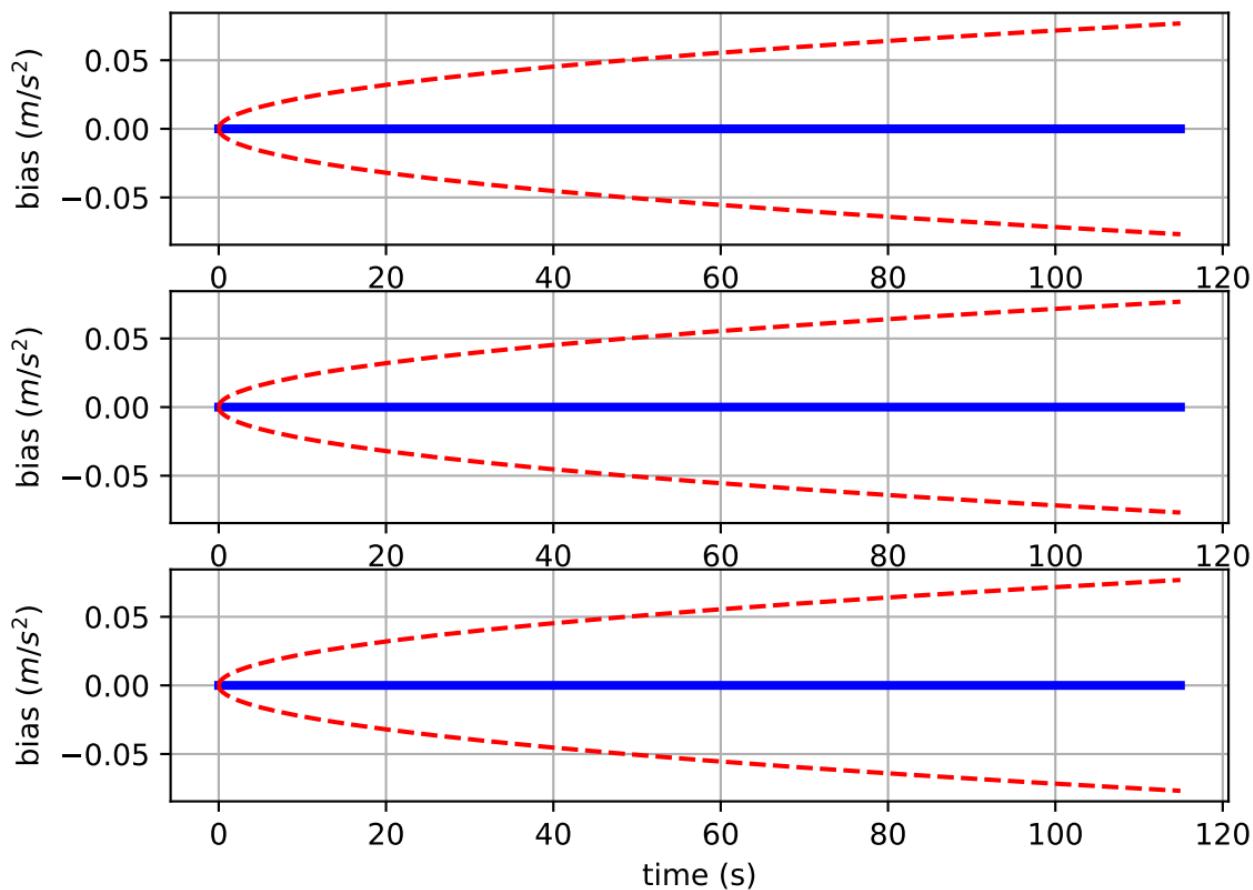
# Comparison of predicted and measured specific force (imu0 frame)



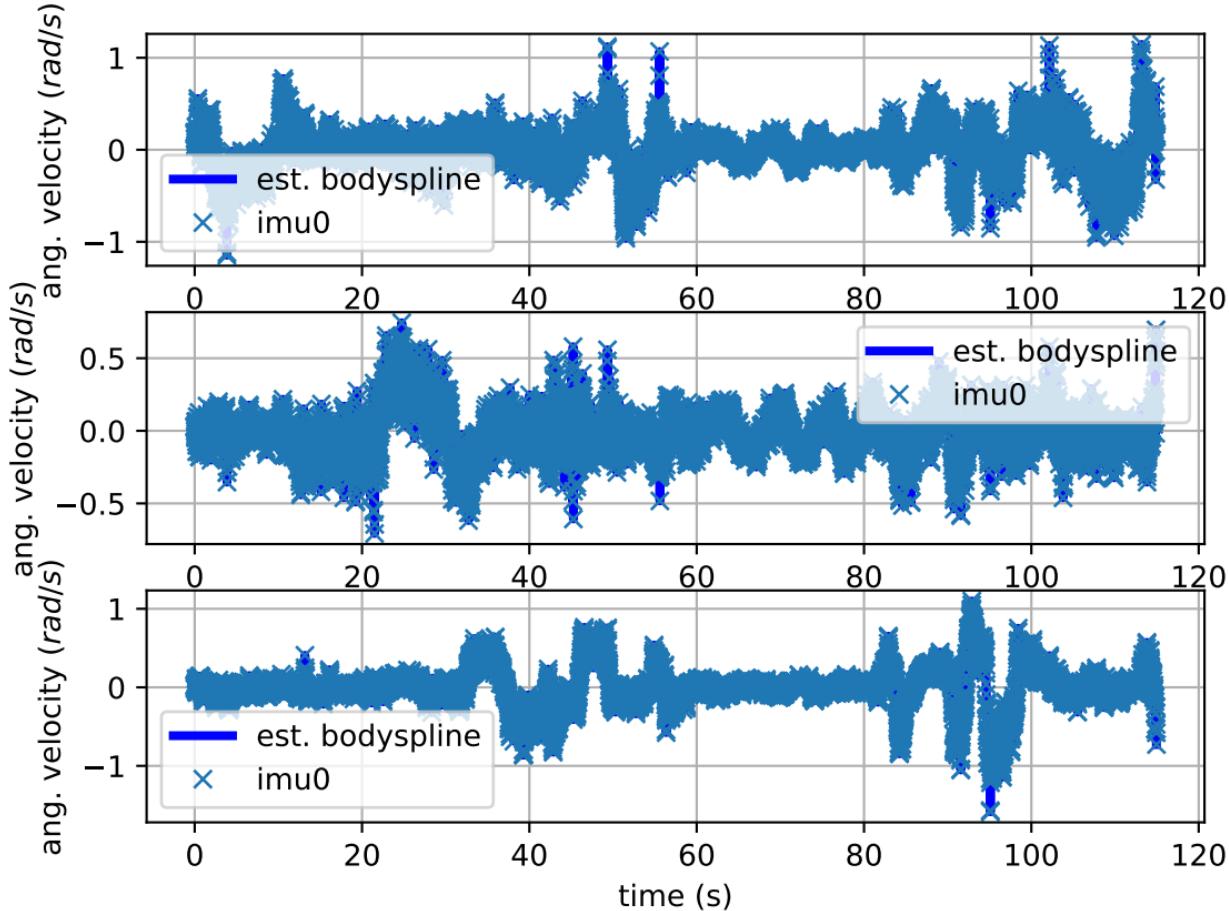
# imu0: acceleration error



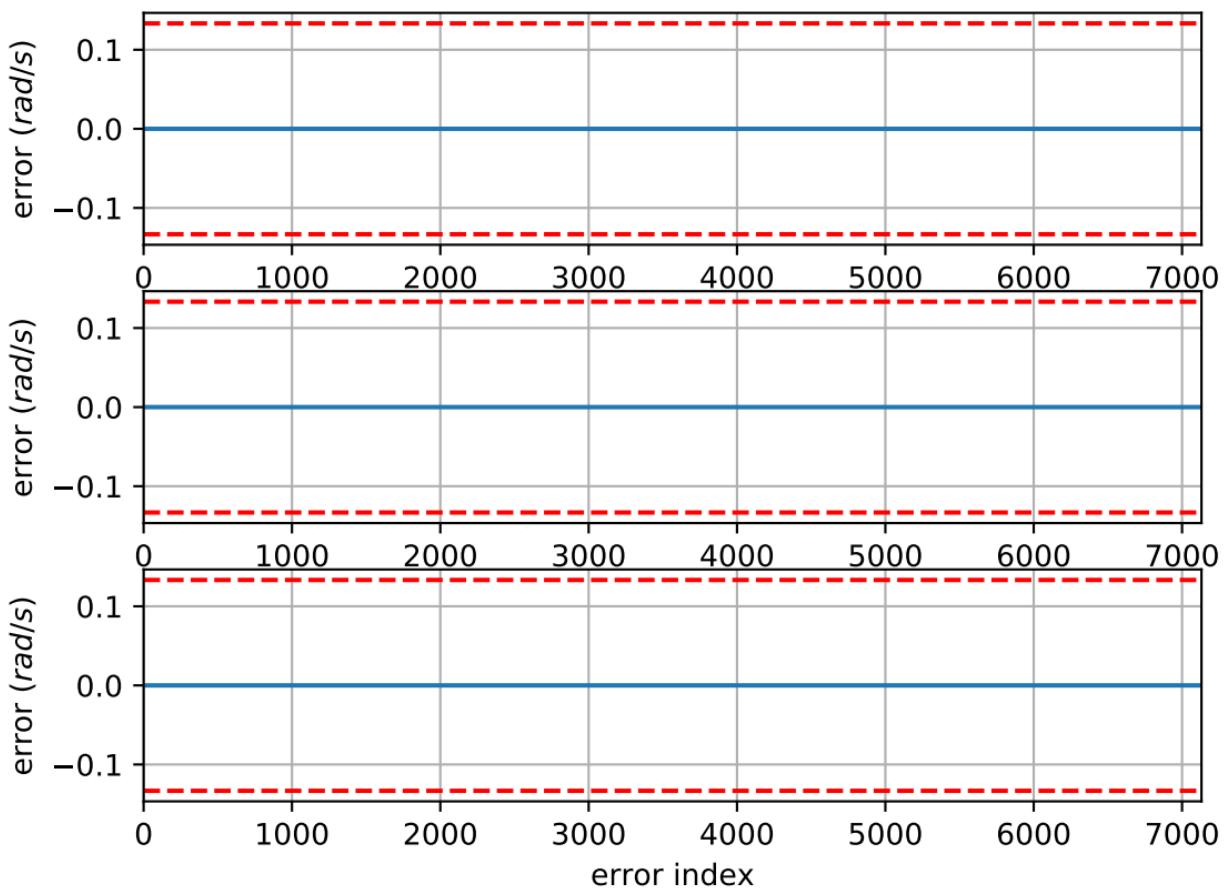
# imu0: estimated accelerometer bias (imu frame)



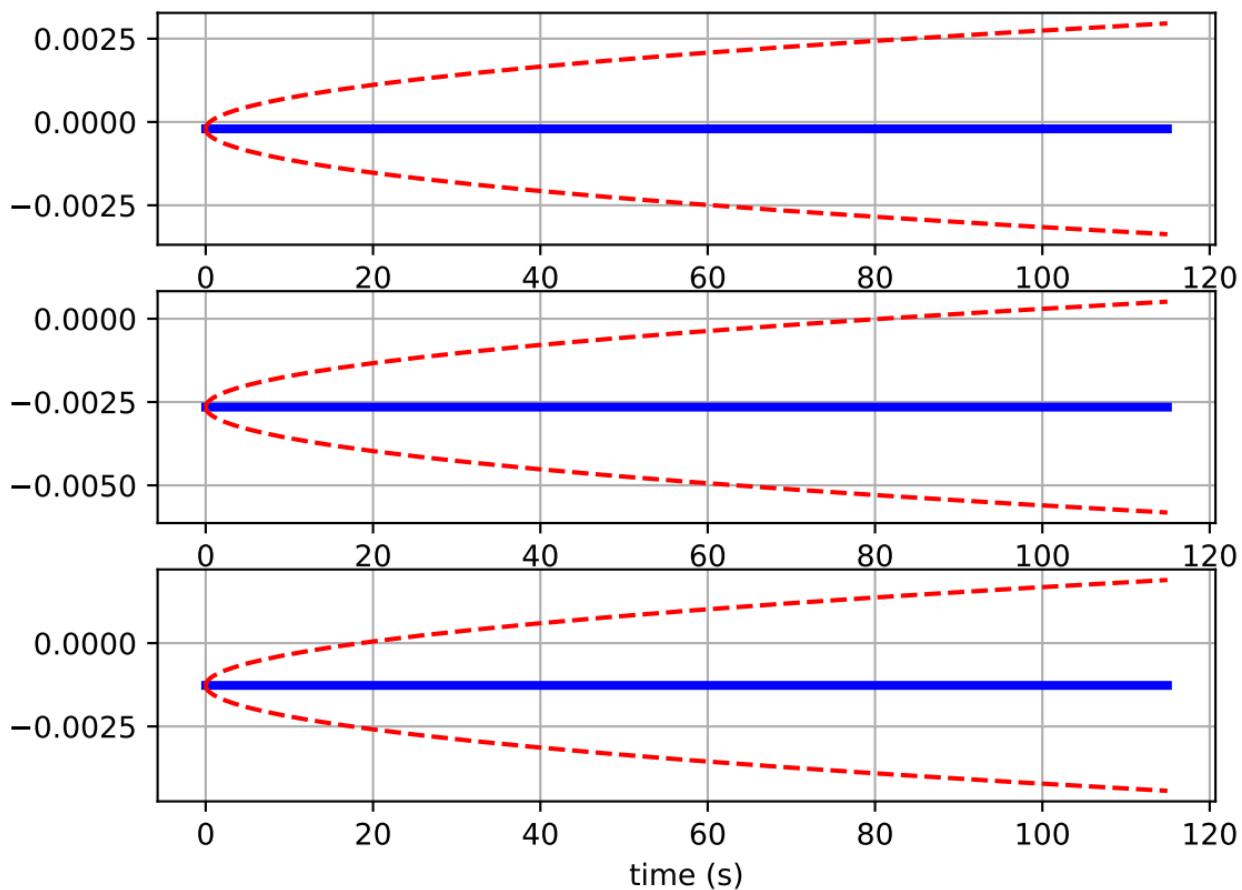
# Comparison of predicted and measured angular velocities (body frame)



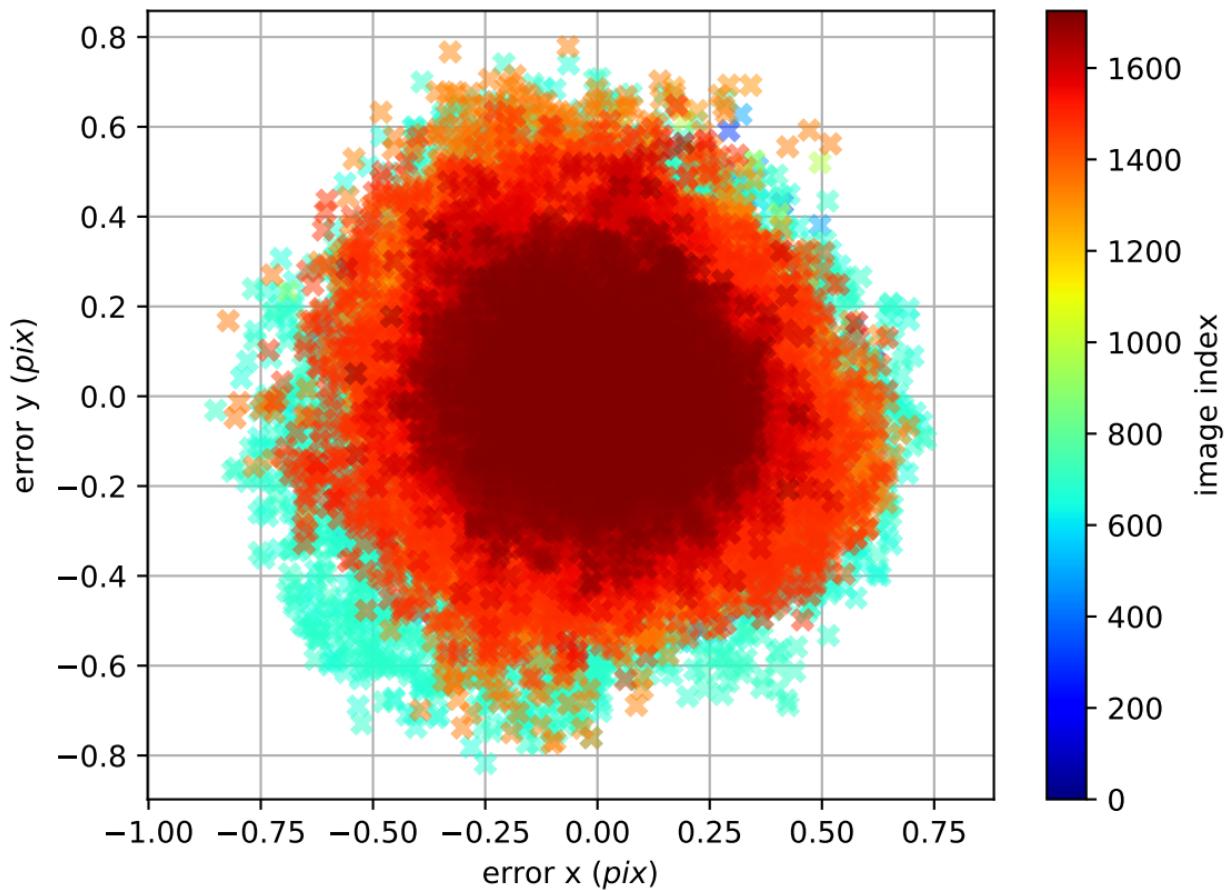
# imu0: angular velocities error



# imu0: estimated gyro bias (imu frame)



cam0: reprojection errors



cam1: reprojection errors

