

## Calibration results

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### Normalized Residuals

Reprojection error (cam0): mean 0.38059688716142576, median 0.3342805124239958, std: 0.24075407539104057  
Reprojection error (cam1): mean 0.37871194942691305, median 0.33823616699260095, std: 0.23097846896852453  
Gyroscope error (imu0): mean 10.641347445118596, median 8.302075338639288, std: 9.252735829708884  
Accelerometer error (imu0): mean 4.688916092715857, median 3.705160531935538, std: 5.365813397359572

### Residuals

Reprojection error (cam0) [px]: mean 0.38059688716142576, median 0.3342805124239958, std: 0.24075407539104057  
Reprojection error (cam1) [px]: mean 0.37871194942691305, median 0.33823616699260095, std: 0.23097846896852453  
Gyroscope error (imu0) [rad/s]: mean 0.021718104717719813, median 0.01694384498851008, std: 0.018884063950679143  
Accelerometer error (imu0) [m/s^2]: mean 0.10441128716821142, median 0.08250533228888979, std: 0.11948422032825169

### Transformation (cam0):

T\_ci: (imu0 to cam0):

```
[[ 0.99984339 0.00384771 0.01727392 0.06749982]
 [-0.00395386 0.99997348 0.00611531 0.00244604]
 [-0.01724993 -0.00618265 0.99983209 -0.00963697]
 [ 0.      0.      0.      1.      ]]
```

T\_ic: (cam0 to imu0):

```
[[ 0.99984339 -0.00395386 -0.01724993 -0.06764581]
 [ 0.00384771 0.99997348 -0.00618265 -0.00276528]
 [ 0.01727392 0.00611531 0.99983209 0.00845441]
 [ 0.      0.      0.      1.      ]]
```

timeshift cam0 to imu0: [s] ( $t_{imu} = t_{cam} + \text{shift}$ )  
0.005276293420904517

### Transformation (cam1):

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T\_ci: (imu0 to cam1):  
[[ 0.99996304 -0.00197763 0.0083668 -0.0057853 ]  
 [ 0.00193049 0.99998224 0.00563815 0.00390269 ]  
 [-0.0083778 -0.00562179 0.9999491 -0.01126239 ]  
 [ 0. 0. 0. 1. ]]

T\_ic: (cam1 to imu0):  
[[ 0.99996304 0.00193049 -0.0083778 0.0056832 ]  
 [-0.00197763 0.99998224 -0.00562179 -0.00397738 ]  
 [ 0.0083668 0.00563815 0.9999491 0.01128822 ]  
 [ 0. 0. 0. 1. ]]

timeshift cam1 to imu0: [s] (t\_imu = t\_cam + shift)  
0.0052874949148590065

Baselines:

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Baseline (cam0 to cam1):  
[[ 0.99994336 -0.00588013 -0.00887167 -0.07335241 ]  
 [ 0.00587523 0.99998257 -0.00057863 0.00105454 ]  
 [ 0.00887492 0.00052648 0.99996048 -0.00222615 ]  
 [ 0. 0. 0. 1. ]]  
baseline norm: 0.07339376101053686 [m]

Gravity vector in target coords: [m/s^2]  
[ 0.03167727 -9.79894068 -0.38494291 ]

Calibration configuration

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cam0

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Camera model: pinhole  
Focal length: [570.2853685428025, 570.392558866539]  
Principal point: [643.7740402561756, 352.15406124868457]  
Distortion model: equidistant  
Distortion coefficients: [-0.006653967541886213, 0.020600853988330572, -0.020287885857306343, 0.008036035530506101]  
Type: aprilgrid  
Tags:  
Rows: 7  
Cols: 10  
Size: 0.05 [m]  
Spacing 0.015 [m]

cam1

-----  
Camera model: pinhole  
Focal length: [569.4042979049723, 569.6243022920747]  
Principal point: [674.2867031698639, 358.73267428990766]  
Distortion model: equidistant  
Distortion coefficients: [-0.0076362901274004205, 0.017017094183703736, -0.01120672679925404, 0.0033305519599636183]  
Type: aprilgrid  
Tags:  
Rows: 7  
Cols: 10  
Size: 0.05 [m]  
Spacing 0.015 [m]

IMU configuration

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IMU0:

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Model: scale-misalignment  
Update rate: 200.0

Accelerometer:

Noise density: 0.0015745628142877553

Noise density (discrete): 0.022267680867740926

Random walk: 0.0001803395984376769

Gyroscope:

Noise density: 0.0001443146105286113

Noise density (discrete): 0.0020409167945815315

Random walk: 1.8841081859005185e-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:

[[ 1.02359661 0. 0. ]

[-0.00203727 0.99086795 0. ]

[-0.00017088 0.00014493 1.02721403]]

A [(rad/s)/(m/s<sup>2</sup>):

[-0.00013971 0.00009664 -0.00005221]

[ 0.00030136 0.00006036 -0.00012039]

[ 0.00006881 0.00003416 -0.00005172]]

C\_gyro\_i:

[[ 0.99998817 -0.0038101 0.00302376]

[ 0.00380211 0.99998928 0.002644 ]

[-0.0030338 -0.00263247 0.99999193]]

Accelerometer:

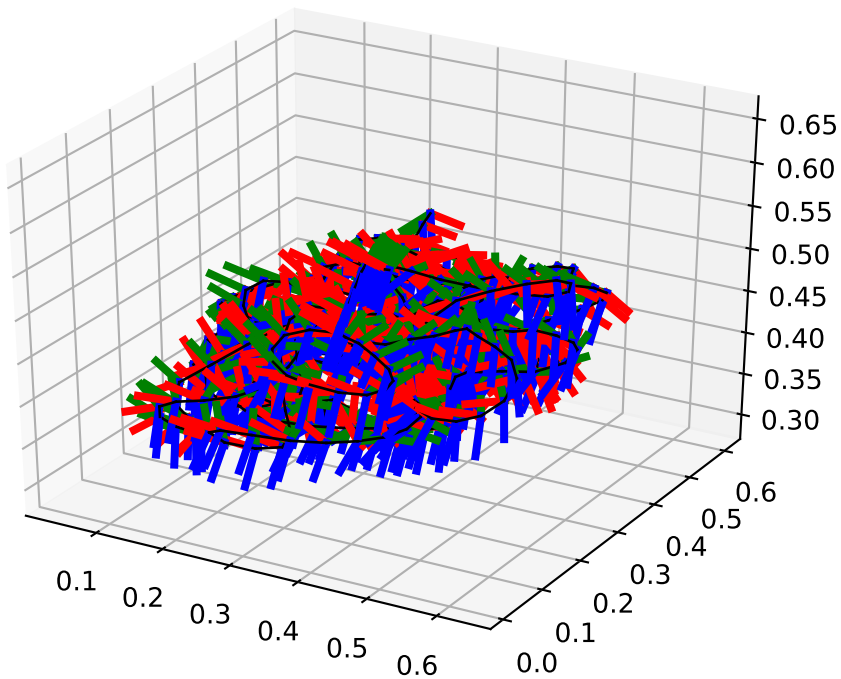
M:

[[0.99797973 0. 0. ]

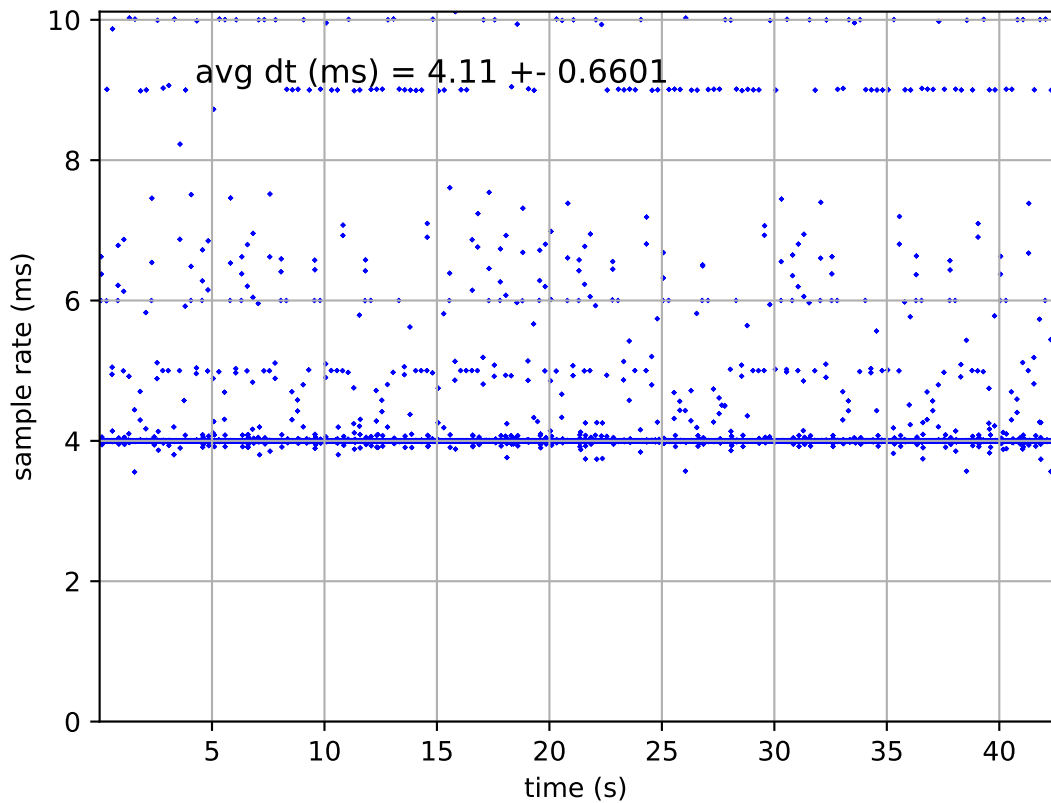
[0.00034368 0.99785988 0. ]

[0.00652441 0.00091354 0.99911544]]

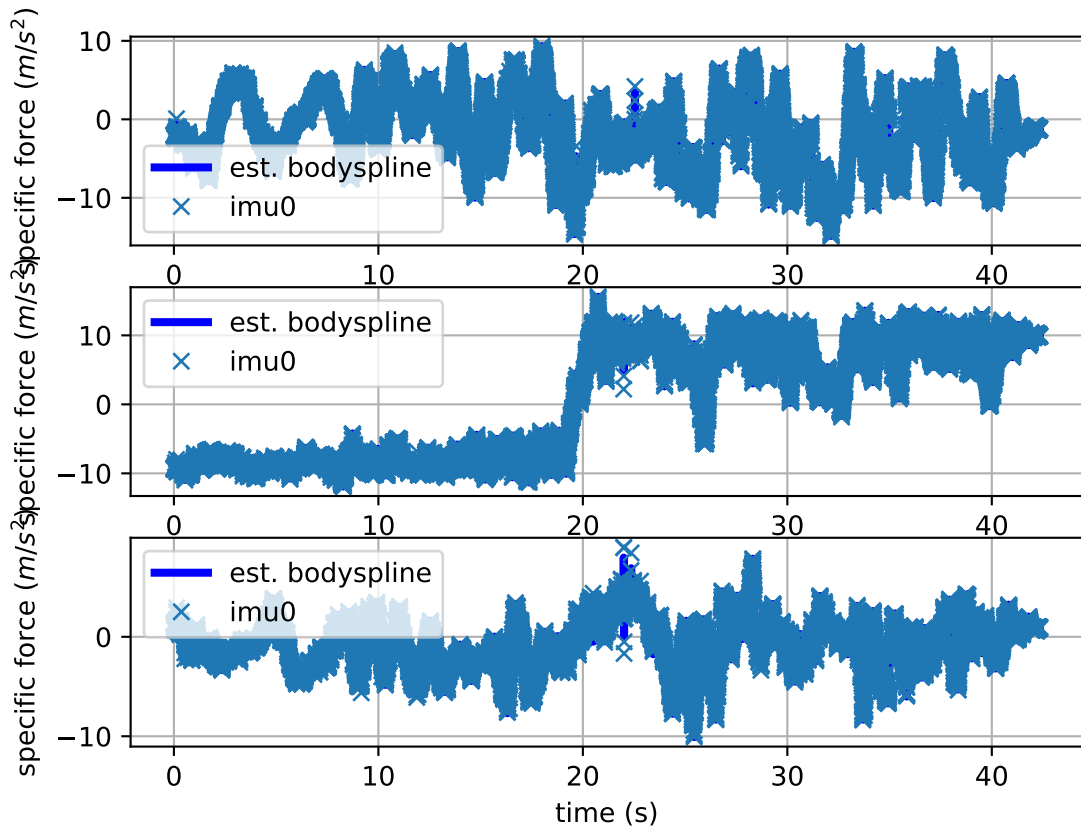
imu0: estimated poses



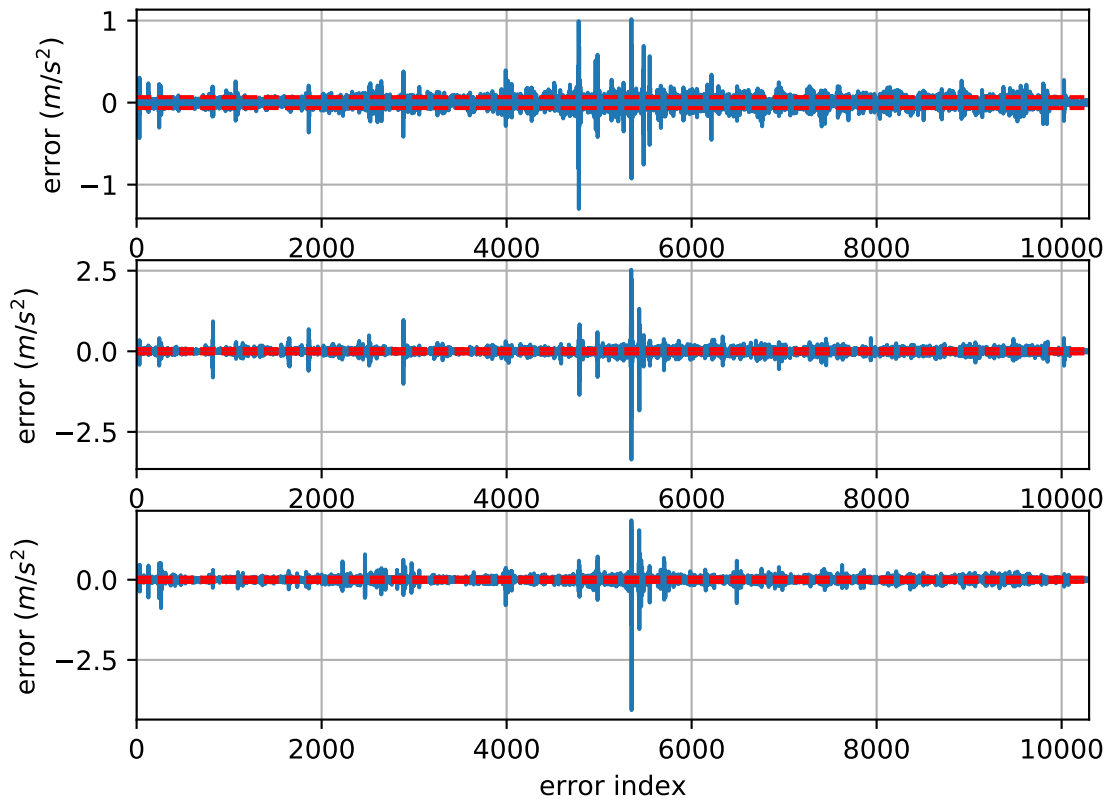
# imu0: sample inertial rate



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

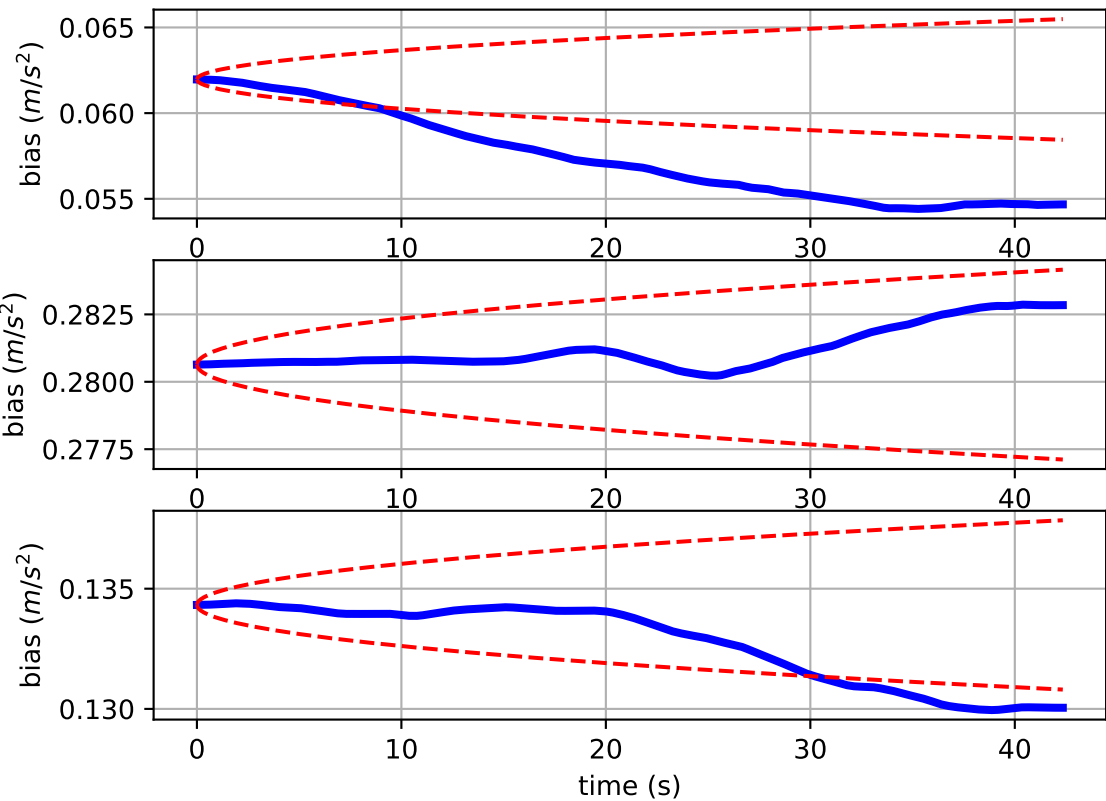


# imu0: acceleration error

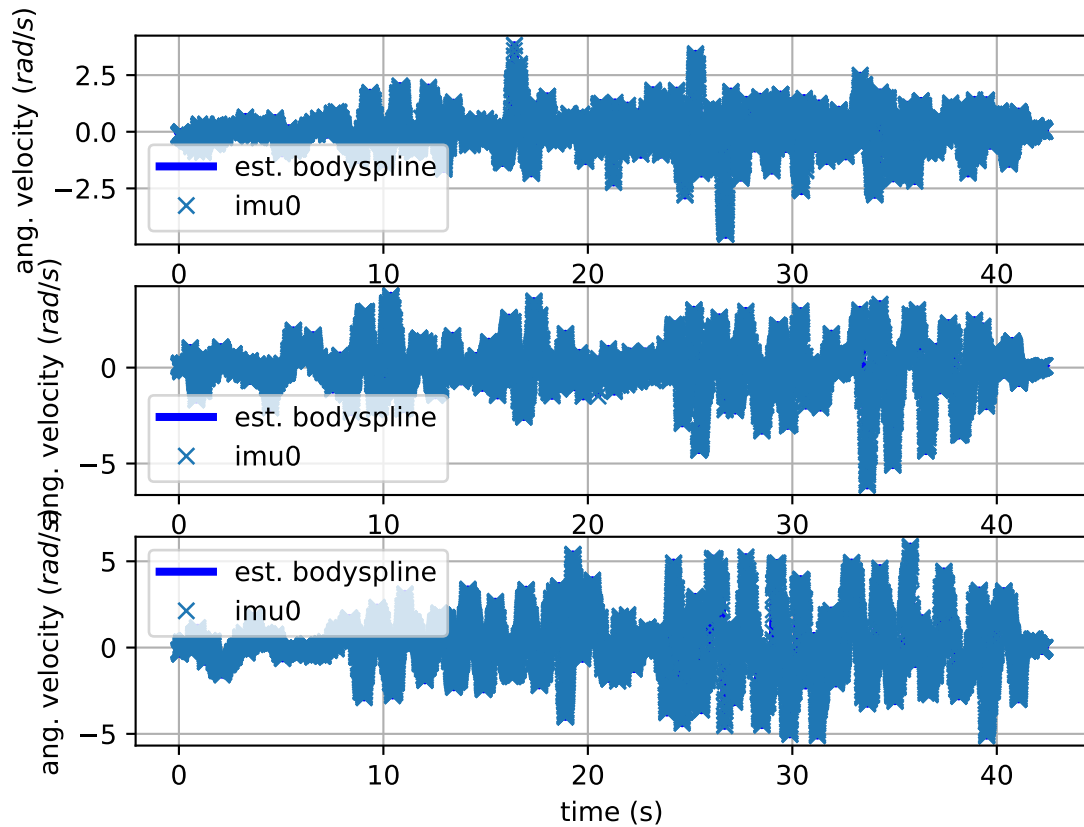




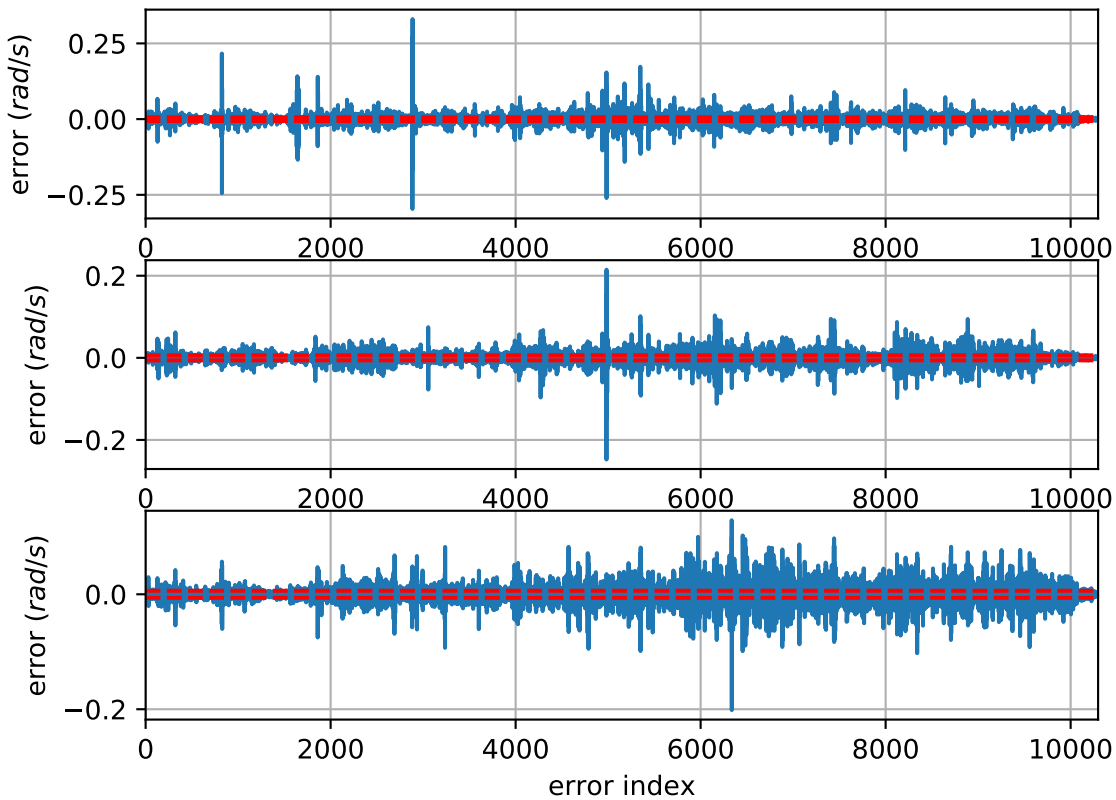
imu0: estimated accelerometer bias (imu frame)



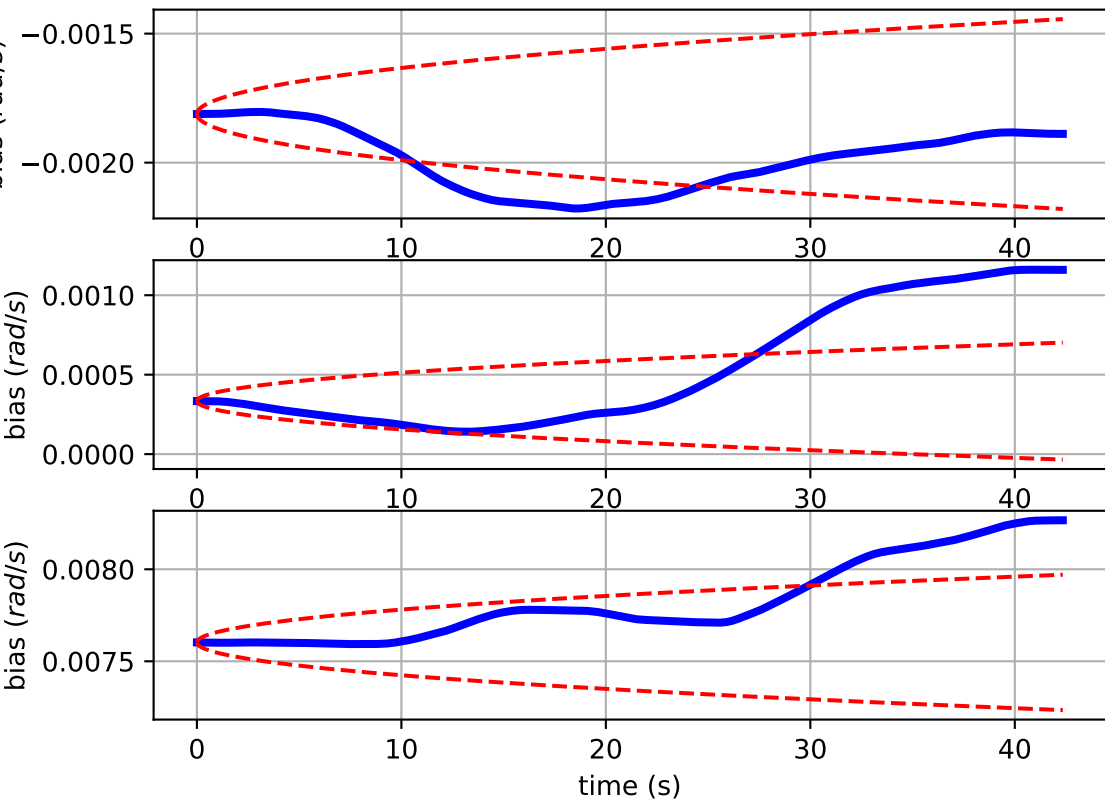
# Comparison of predicted and measured angular velocities (body frame)



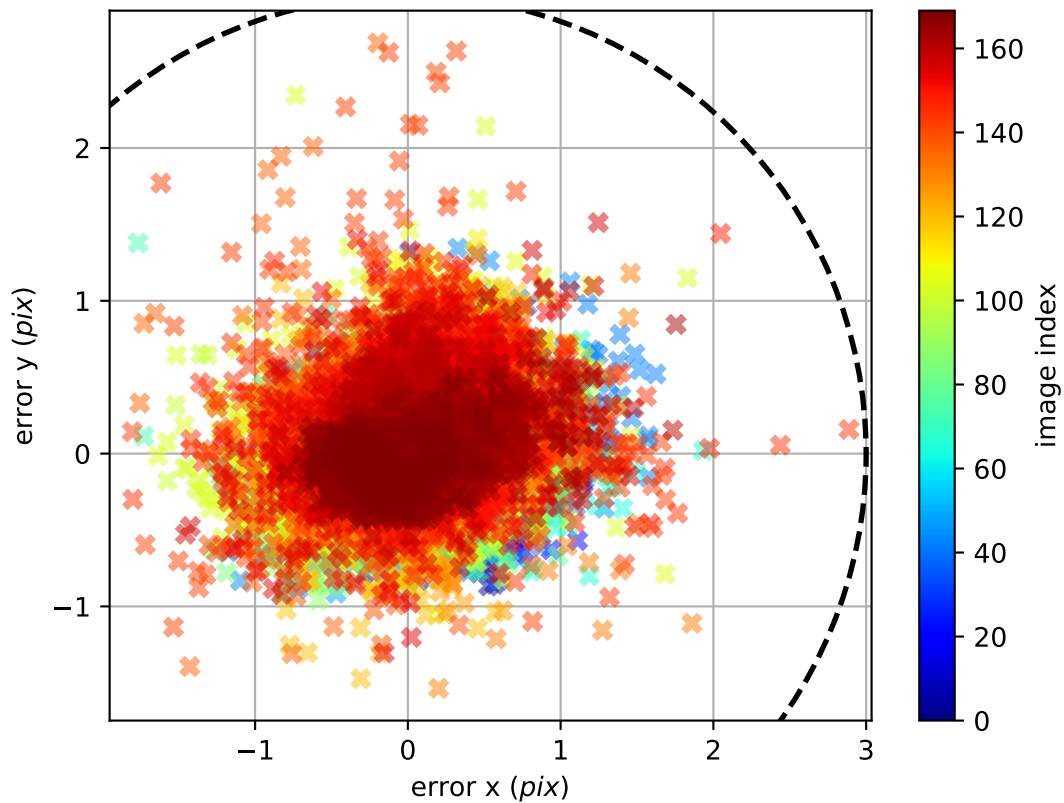
imu0: angular velocities error



imu0: estimated gyro bias (imu frame)



cam0: reprojection errors



cam1: reprojection errors

