

## Calibration results

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### Normalized Residuals

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Reprojection error (cam0): mean 0.295064596618, median 0.244377771104, std: 0.202883781099

Reprojection error (cam1): mean 0.289026658415, median 0.238706995287, std: 0.200007774327

Gyroscope error (imu0): mean 0.415914542179, median 0.37491421105, std: 0.241392883186

Accelerometer error (imu0): mean 0.331609572626, median 0.259039208438, std: 0.278765680486

### Residuals

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Reprojection error (cam0) [px]: mean 0.295064596618, median 0.244377771104, std: 0.202883781099

Reprojection error (cam1) [px]: mean 0.289026658415, median 0.238706995287, std: 0.200007774327

Gyroscope error (imu0) [rad/s]: mean 0.00143423261088, median 0.00129284776857, std: 0.00083241509971

Accelerometer error (imu0) [m/s^2]: mean 0.0276265720332, median 0.021580695921, std: 0.023224118928

### Transformation (cam0):

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T\_ci: (imu0 to cam0):

```
[[-0.00889837 -0.99987574  0.01301217 -0.00587532]
 [-0.03567361 -0.01332183 -0.99927474 -0.03724942]
 [ 0.99932388  0.00842773 -0.03578772 -0.10431663]
 [ 0.          0.          1.          ]]
```

T\_ic: (cam0 to imu0):

```
[[-0.00889837 -0.03567361  0.99932388  0.10296956]
 [-0.99987574 -0.01332183  0.00842773 -0.00549166]
 [ 0.01301217 -0.99927474 -0.03578772 -0.04087921]
 [ 0.          0.          1.          ]]
```

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

0.00284041850798

### Transformation (cam1):

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T\_ci: (imu0 to cam1):  
[[ 0.00954507 -0.999871 0.01291806 -0.05589547]  
[-0.03553179 -0.01324963 -0.99928071 -0.03728548]  
[ 0.99932296 0.0090792 -0.03565367 -0.10432004]  
[ 0. 0. 0. 1. ]]

T\_ic: (cam1 to imu0):  
[[ 0.00954507 -0.03553179 0.99932296 0.10345812]  
[-0.999871 -0.01324963 0.0090792 -0.05543514]  
[ 0.01291806 -0.99928071 -0.03565367 -0.04025599]  
[ 0. 0. 0. 1. ]]

timeshift cam1 to imu0: [s] (t\_imu = t\_cam + shift)  
0.00284065947437

Baselines:

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Baseline (cam0 to cam1):  
[[ 0.99999979 0.00007091 0.00064967 -0.04994975]  
[-0.00007101 0.99999999 0.00014255 -0.00002161]  
[-0.00064966 -0.0001426 0.99999978 -0.00001256]  
[ 0. 0. 0. 1. ]]  
baseline norm: 0.0499497519732 [m]

Gravity vector in target coords: [m/s^2]  
[-0.07406809 -9.80624936 -0.02025746]

Calibration configuration

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cam0

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Camera model: pinhole  
Focal length: [420.3849483748887, 422.37201899494823]  
Principal point: [426.48058028849005, 235.79239332081772]  
Distortion model: radtan  
Distortion coefficients: [0.0011872547552499587, -0.0006795410975125896, -0.0004668300496499715, 0.00029842304640345055]  
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: [420.44955459342043, 422.4025482760406]  
Principal point: [426.6360719046911, 235.6621048332724]  
Distortion model: radtan  
Distortion coefficients: [0.0012936412253883945, -0.0005862040343975327, -0.0005600980319221272, 0.0001589004381851821]  
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: 0.00589094466451

Noise density (discrete): 0.0833105383974

Random walk: 0.0015493911698

Gyroscope:

Noise density: 0.000243837495952

Noise density (discrete): 0.00344838293791

Random walk: 0.00014858758326

$T_{ib}$  (imu0 to imu0)

[ [ 1. 0. 0. 0.]

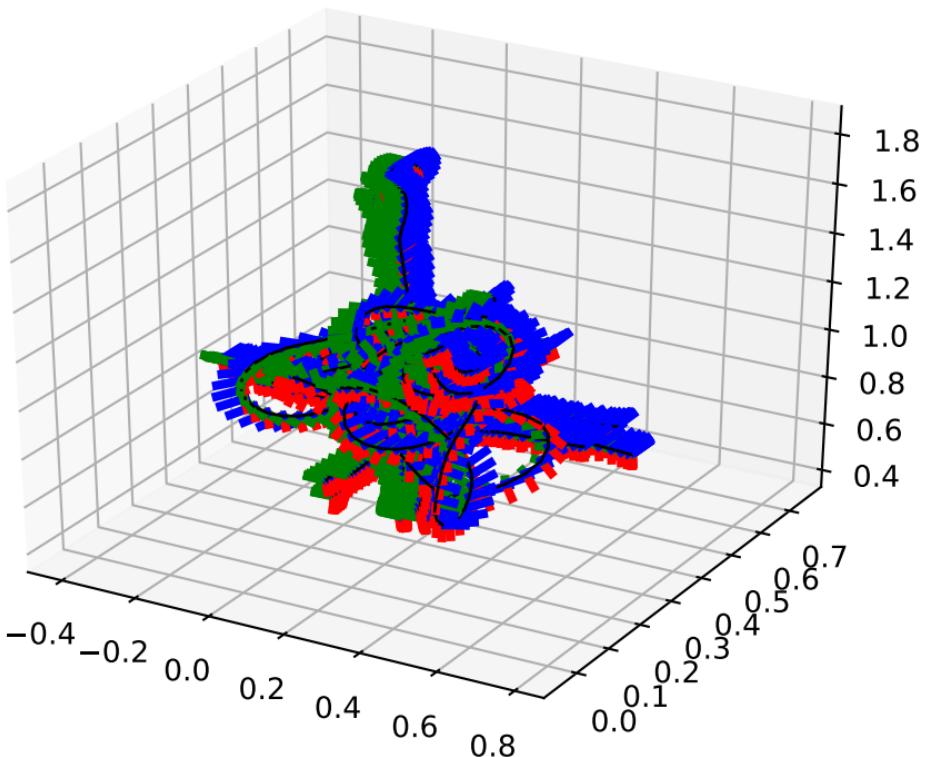
  [ 0. 1. 0. 0.]

  [ 0. 0. 1. 0.]

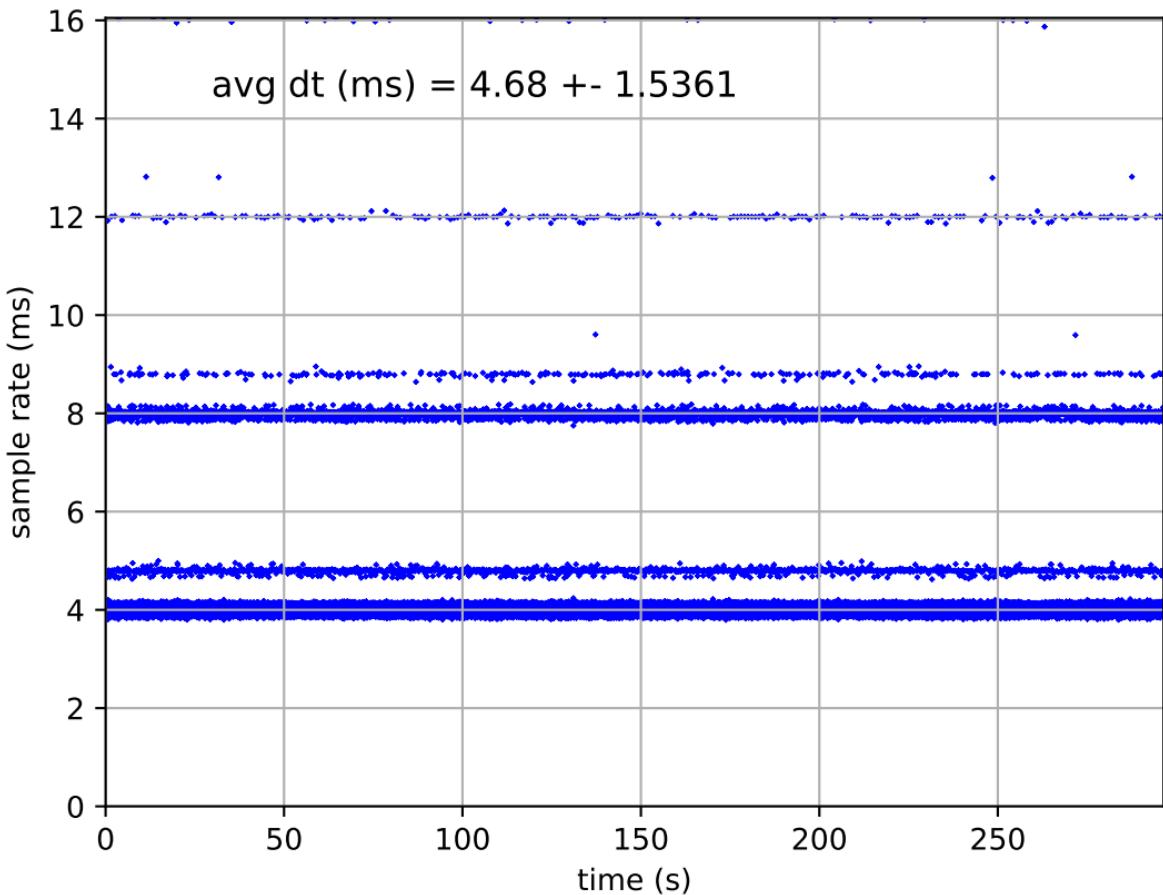
  [ 0. 0. 0. 1.]]

time offset with respect to IMU0: 0.0 [s]

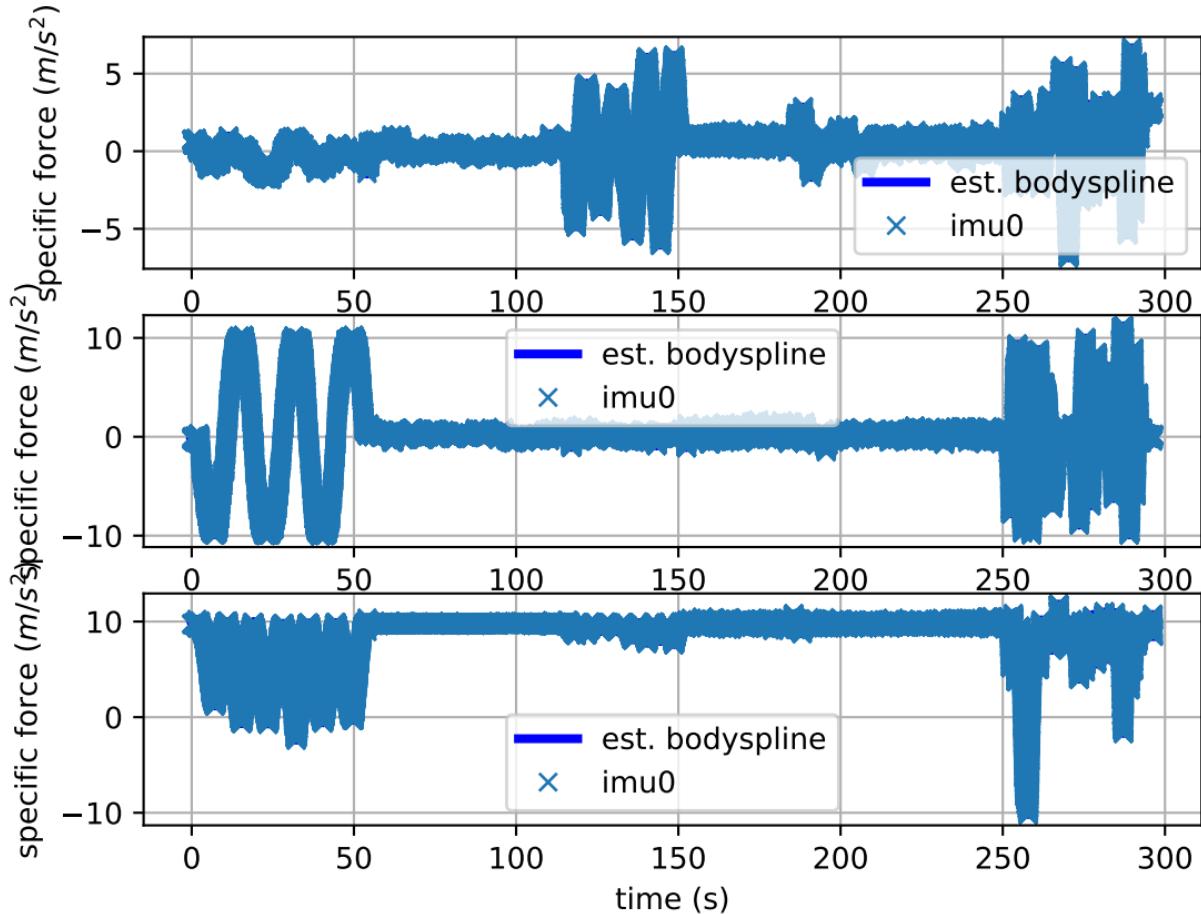
imu0: estimated poses



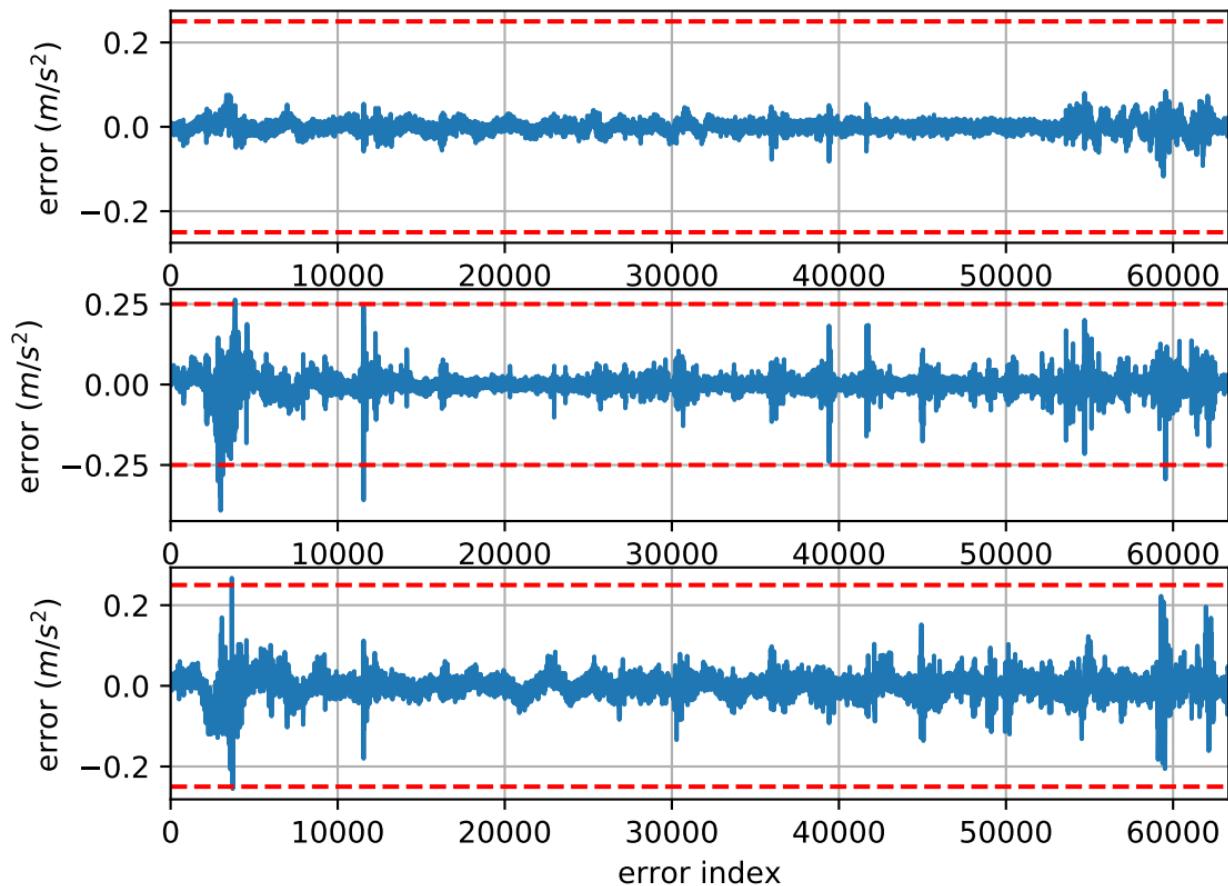
# imu0: sample inertial rate



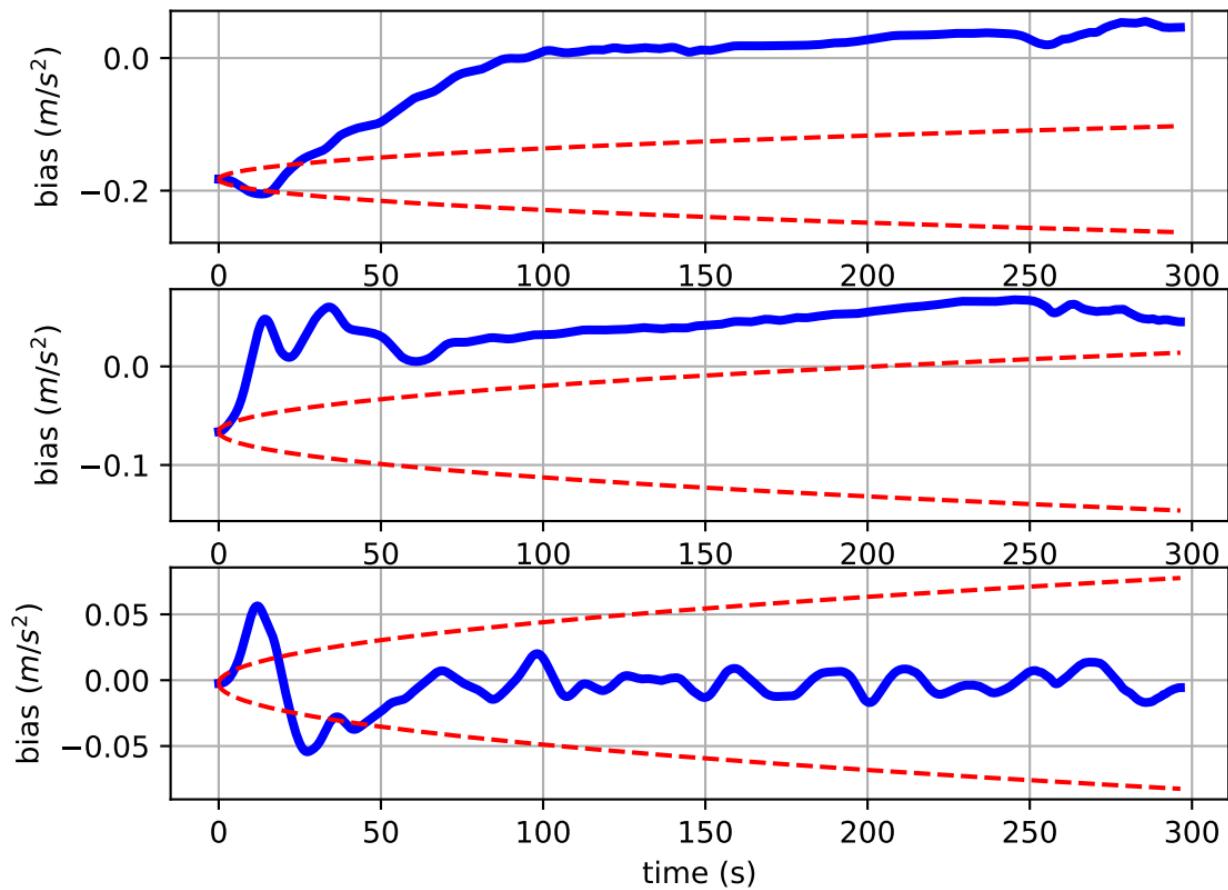
# Comparison of predicted and measured specific force (imu0 frame)



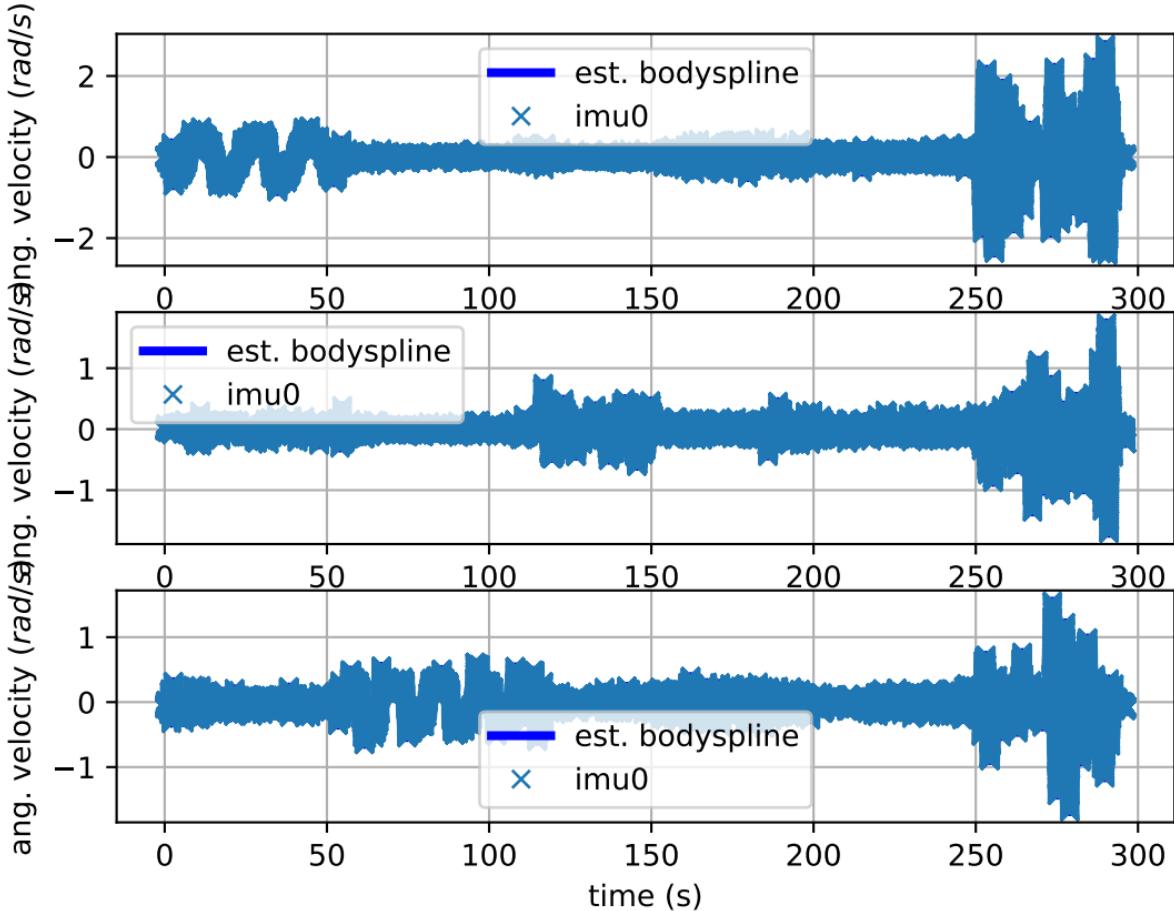
# imu0: acceleration error



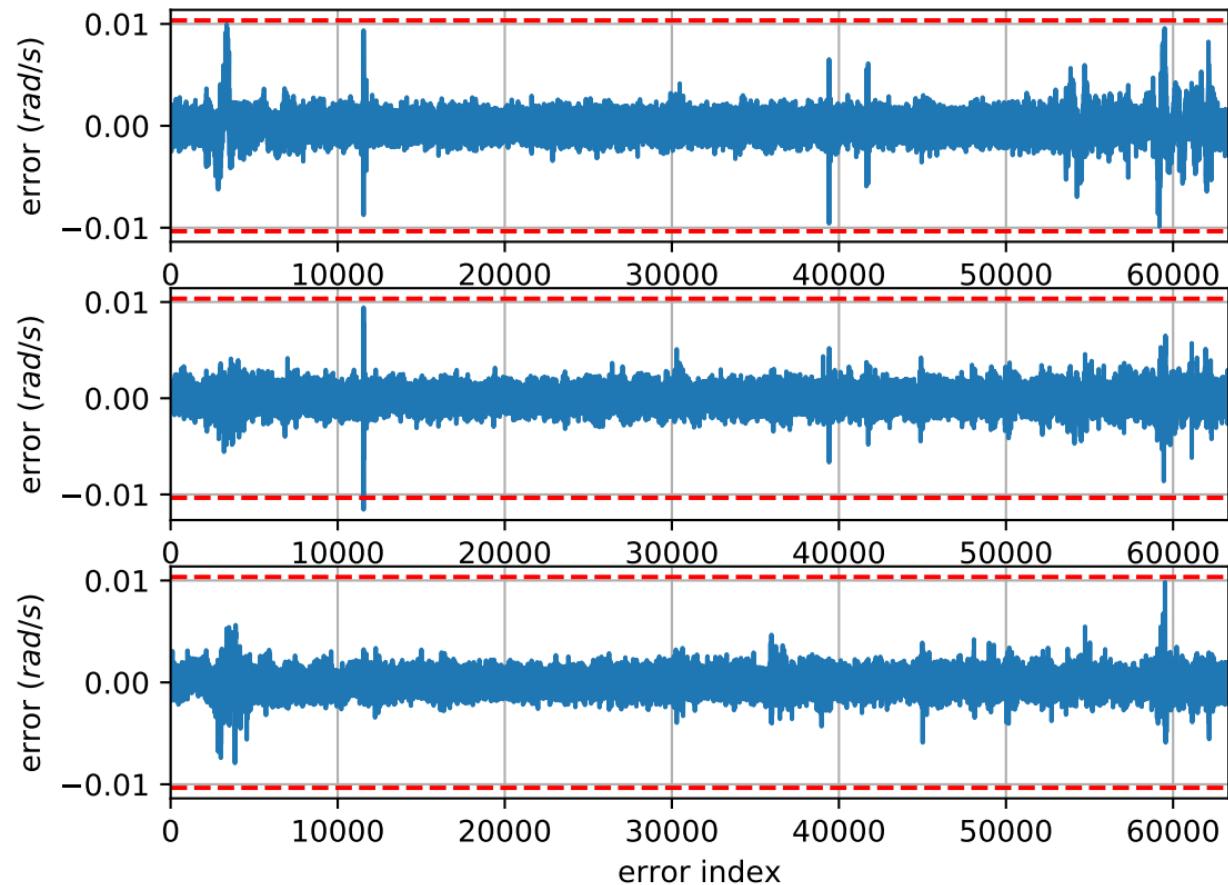
# imu0: estimated accelerometer bias (imu frame)



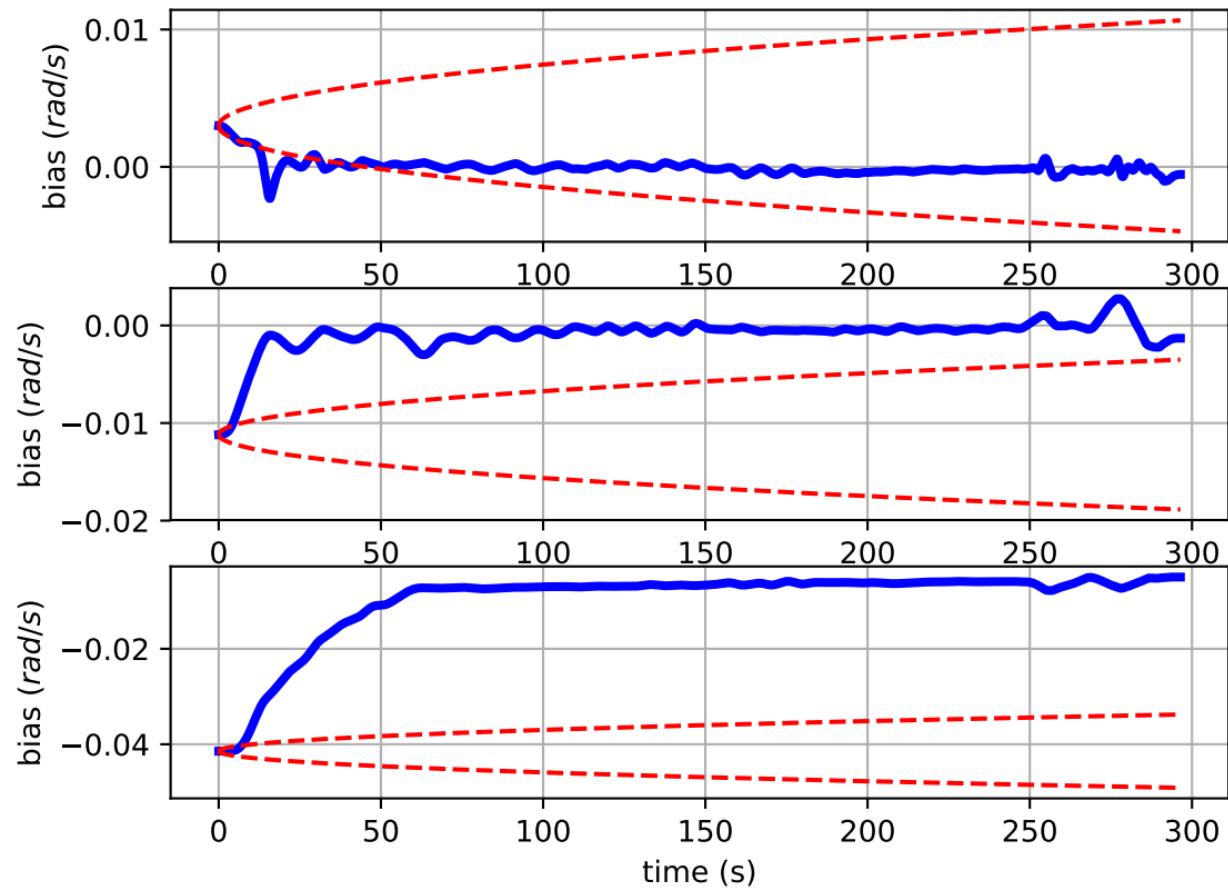
# Comparison of predicted and measured angular velocities (body frame)



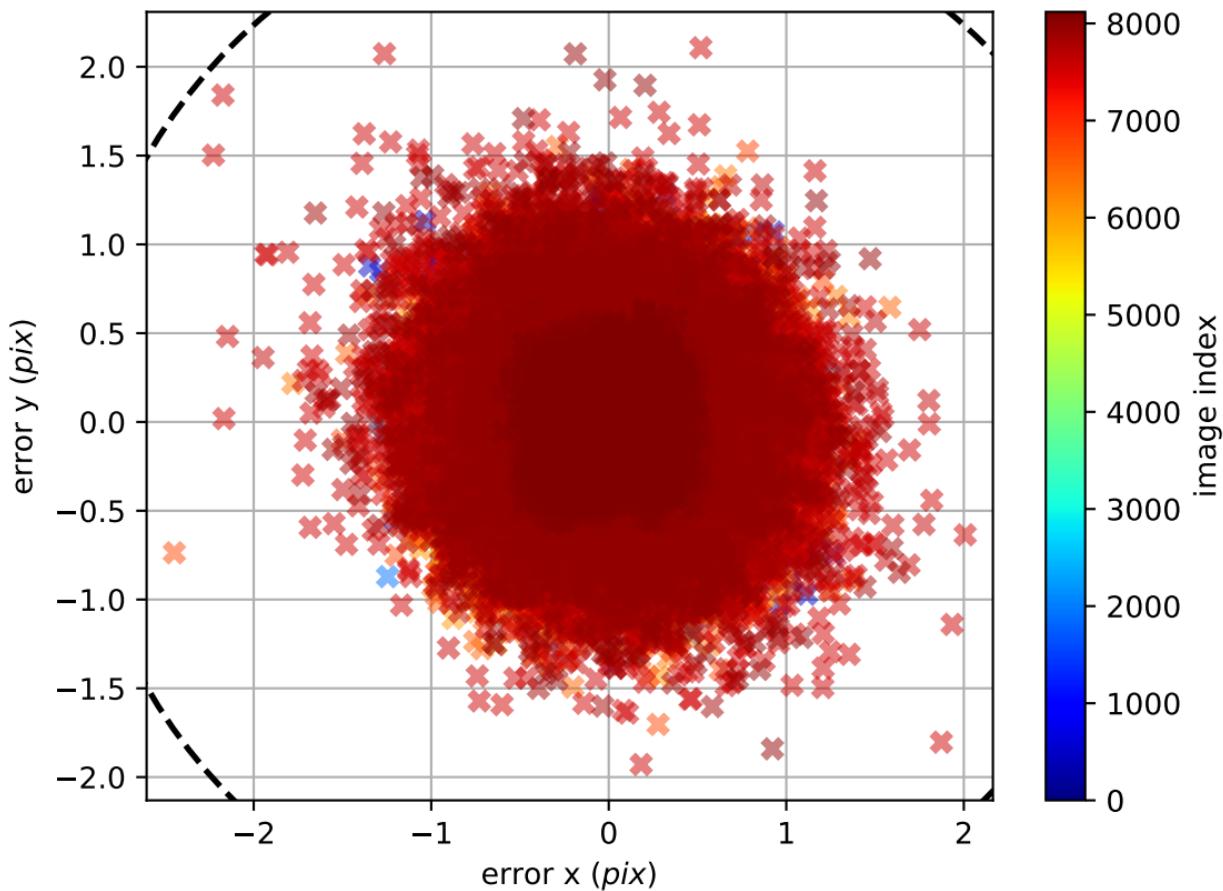
# imu0: angular velocities error



# imu0: estimated gyro bias (imu frame)



cam0: reprojection errors



cam1: reprojection errors

