

## Calibration results

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### Normalized Residuals

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Reprojection error (cam0): mean 19.6209166553, median 20.0520755716, std: 8.42655648842  
Reprojection error (cam1): mean 21.4547200528, median 21.2456832438, std: 9.81479714306  
Gyroscope error (imu0): mean 3.29042184736, median 2.4215713868, std: 4.14952401541  
Accelerometer error (imu0): mean 3.98602674706, median 3.55797228366, std: 2.19323546341

### Residuals

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Reprojection error (cam0) [px]: mean 19.6209166553, median 20.0520755716, std: 8.42655648842  
Reprojection error (cam1) [px]: mean 21.4547200528, median 21.2456832438, std: 9.81479714306  
Gyroscope error (imu0) [rad/s]: mean 0.349001940185, median 0.25684643231, std: 0.440123485499  
Accelerometer error (imu0) [m/s^2]: mean 0.84556396285, median 0.754759898714, std: 0.465255500675

### Transformation (cam0):

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T\_ci: (imu0 to cam0):  
[[ 0.99732449 -0.07272771 -0.00738524 0.01583157]  
[ 0.07255304 0.99712921 -0.02166532 0.01797883]  
[ 0.00893971 0.02107154 0.999738 0.04081152]  
[ 0. 0. 0. 1. ]]

T\_ic: (cam0 to imu0):  
[[ 0.99732449 0.07255304 0.00893971 -0.01745847]  
[-0.07272771 0.99712921 0.02107154 -0.01763578]  
[-0.00738524 -0.02166532 0.999738 -0.04029439]  
[ 0. 0. 0. 1. ]]

timeshift cam0 to imu0: [s] (t\_imu = t\_cam + shift)  
0.011493716052484513

### Transformation (cam1):

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T\_ci: (imu0 to cam1):

[ 0. 0. 0. 1. ]]

T\_ic: (cam1 to imu0):

[[ 0.9974004 0.07137414 0.00990863 0.0924445 ]  
[-0.07156347 0.9972297 0.0202878 -0.02520144]  
[-0.00843315 -0.02094416 0.99974508 -0.04135094]  
[ 0. 0. 0. 1. ]]

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

0.024934396139477212

Baselines:

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Baseline (cam0 to cam1):

[[ 0.99999877 0.00118911 -0.00102243 -0.1101676 ]  
[-0.00118838 0.99999904 0.00071255 -0.00032166]  
[ 0.00102327 -0.00071134 0.99999922 0.00012079]  
[ 0. 0. 0. 1. ]]

baseline norm: 0.11016813405151582 [m]

Gravity vector in target coords: [m/s^2]

[-0.17775699 -8.23692329 -5.31882695]

Calibration configuration

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cam0

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Camera model: pinhole

Focal length: [461.487246372674, 460.1113992557959]

Principal point: [356.39105303227853, 231.15719697054647]

Distortion model: equidistant

Distortion coefficients: [-0.0016509958435871643, 0.02437222940989351, -0.03582816956989852, 0.019

Type: aprilgrid

Tags:

Spacing 0.0069 [m]

cam1

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Camera model: pinhole

Focal length: [462.4318044040118, 461.1780497604126]

Principal point: [377.0119530476368, 226.49966248854923]

Distortion model: equidistant

Distortion coefficients: [-0.0009362378060020789, 0.018833308358932984, -0.030558453797100132, 0.0

Type: aprilgrid

Tags:

Rows: 6

Cols: 6

Size: 0.023 [m]

Spacing 0.0069 [m]

IMU configuration

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IMU0:

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Model: calibrated

Update rate: 450

Accelerometer:

Noise density: 0.01

Noise density (discrete): 0.212132034356

Random walk: 0.0002

Gyroscope:

Noise density: 0.005

Noise density (discrete): 0.106066017178

Random walk: 4e-06

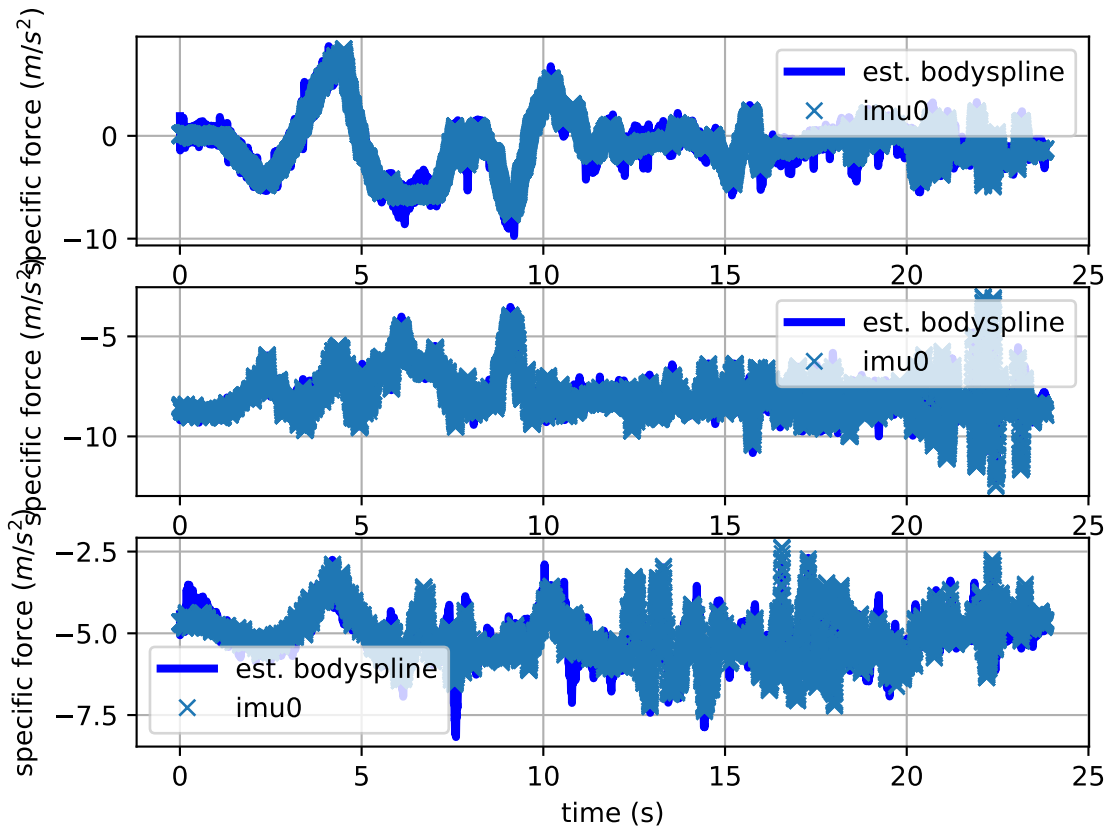
T\_i b

[[1. 0. 0. 0.]

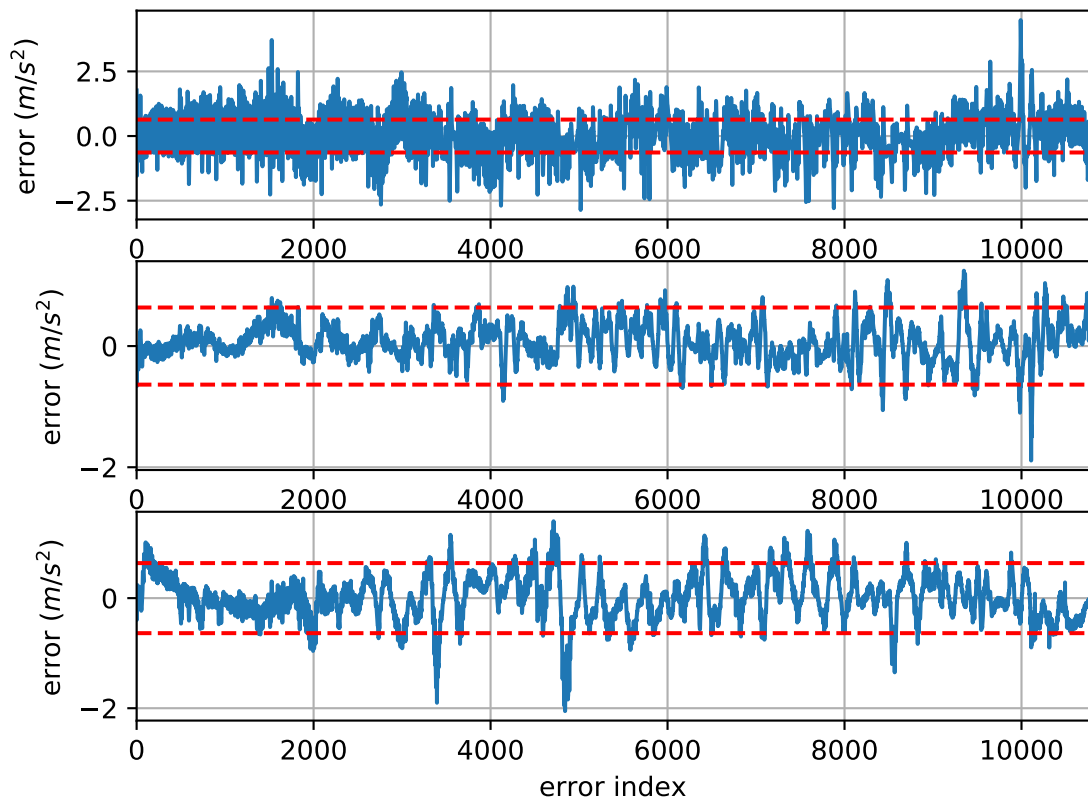
[0. 1. 0. 0.]



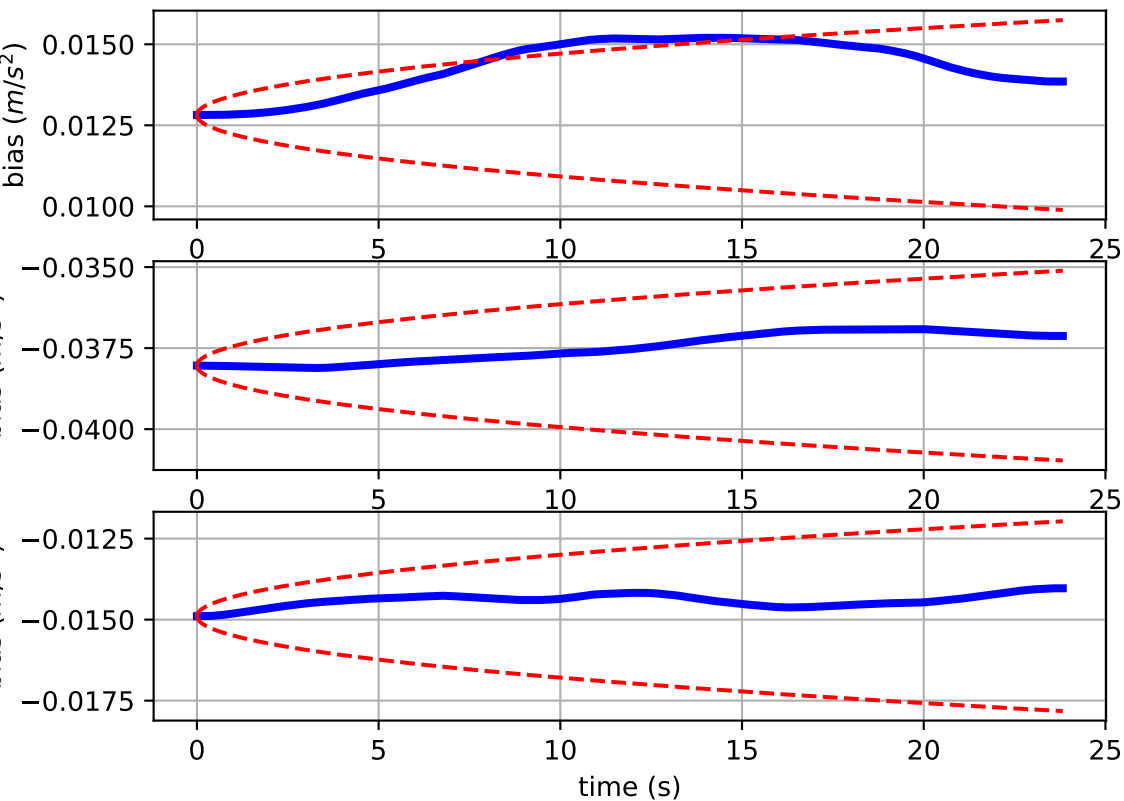
Comparison of predicted and measured specific force (imu0 frame)



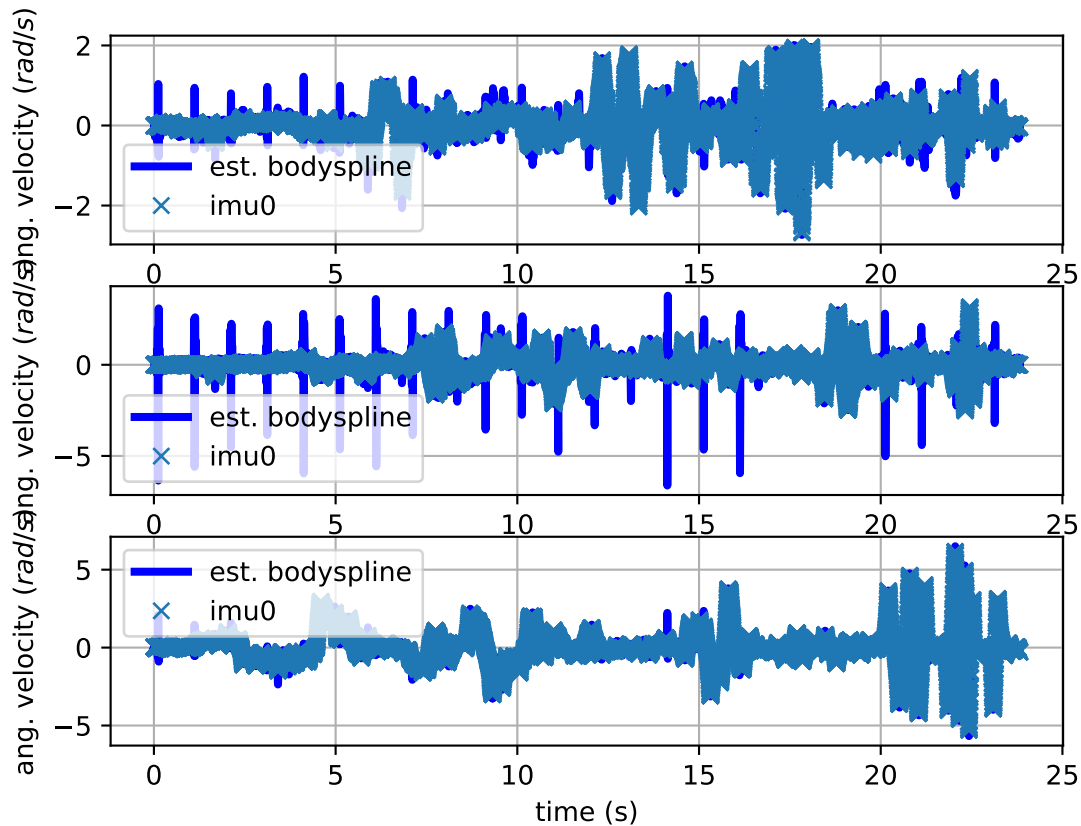
imu0: acceleration error



imu0: estimated accelerometer bias (imu frame)

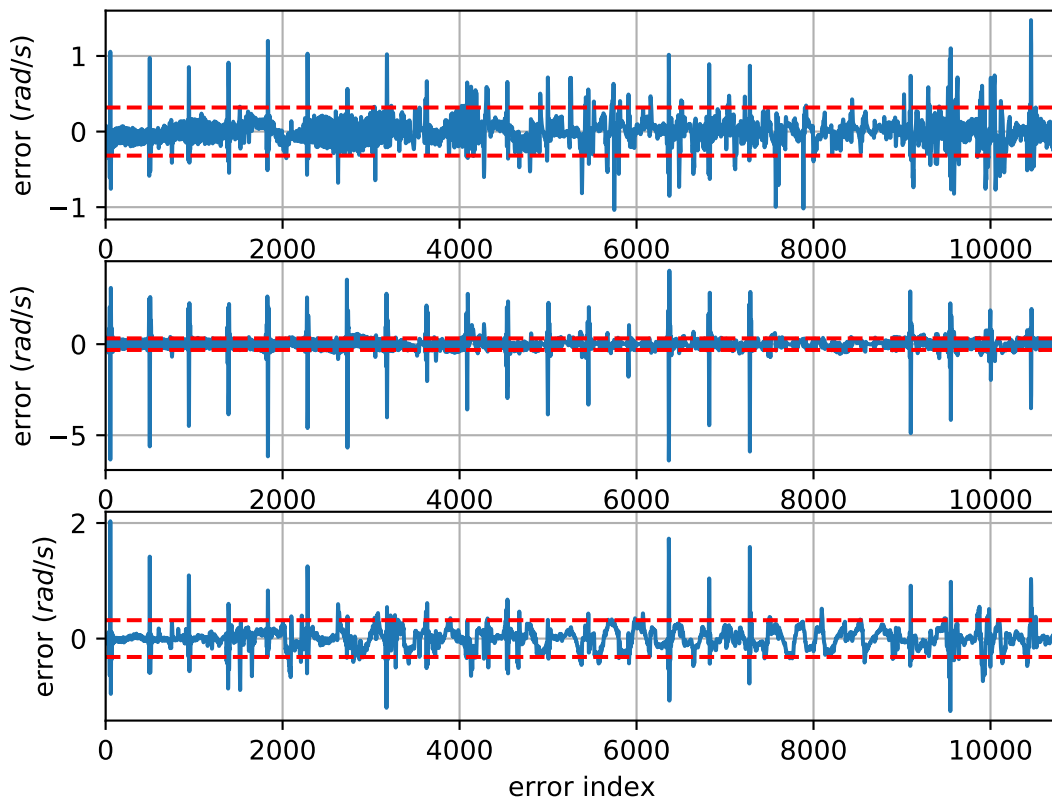


# Comparison of predicted and measured angular velocities (body frame)

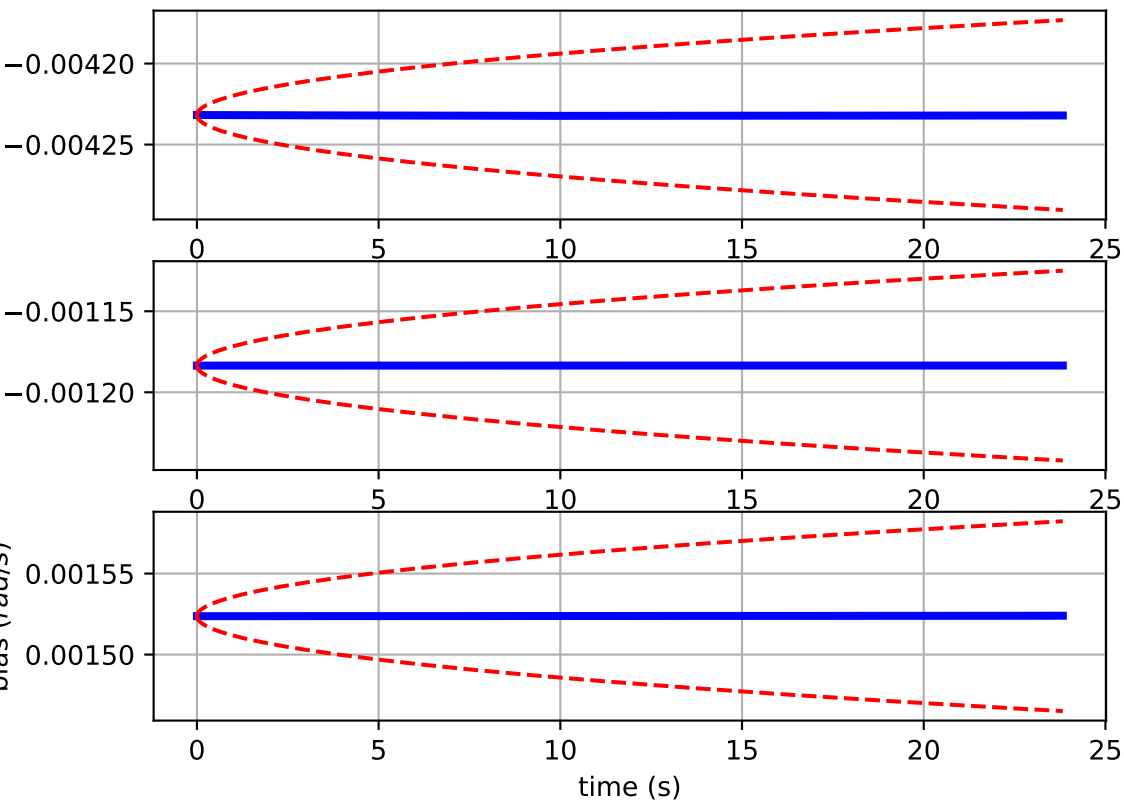




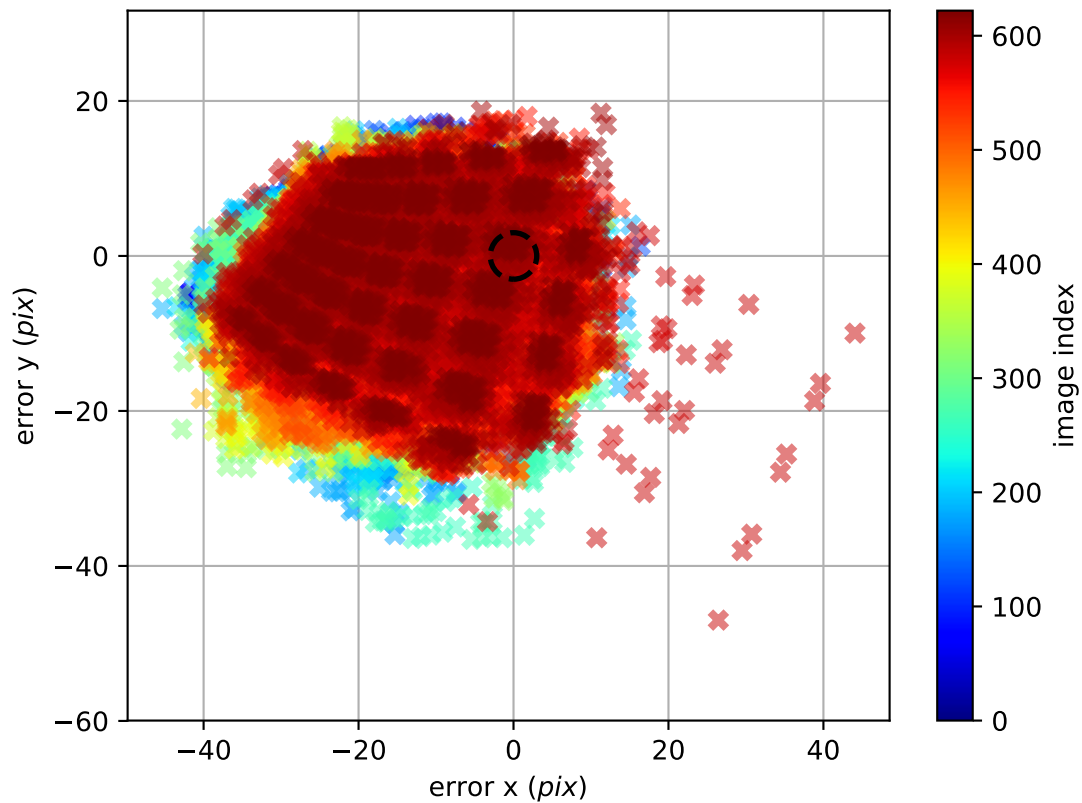
imu0: angular velocities error



imu0: estimated gyro bias (imu frame)



cam0: reprojection errors



cam1: reprojection errors

