Calibration results
==========
Normalized Residuals

Reprojection error (cam0): mean 0.29949472541616323, median 0.22725006028799163, std: 0.2680814104432474
Gyroscope error (imu0): mean 0.4497135549311922, median 0.36513163272318117, std: 0.3864656927296592
Accelerometer error (imu0): mean 0.4836704858784176, median 0.3332029585009049, std: 0.6112077319015459

Residuals

Reprojection error (cam0) [px]: mean 0.29949472541616323, median 0.22725006028799163, std: 0.2680814104432474
Gyroscope error (imu0) [rad/s]: mean 0.0019389973653587047, median 0.0015743116170196282, std: 0.0016662961384808384
Accelerometer error (imu0) [m/s^2]: mean 0.13102185179434783, median 0.09026159321434807, std: 0.16557050968144935

Transformation (cam0):

T_ci: (imu0 to cam0):
[[-0.99995074 -0.00114753 0.00985913 -0.06401138]
[-0.00985131 -0.0066336 -0.99992947 -0.04062056]
[0.00121285 -0.99997734 0.00662197 -0.08447708]
[0.   0.   0.   1.   ]]

T_ic: (cam0 to imu0):
[[-0.99995074 -0.00985131 0.00121285 -0.06430594]
[-0.00114753 -0.0066336 -0.99997734 -0.08481808]
[0.00985913 -0.99992947 0.00662197 -0.03942719]
[0.   0.   0.   1.   ]]

timeshift cam0 to imu0: [s] (t_imu = t_cam + shift)
-0.005463174969400067

Gravity vector in target coords: [m/s^2]
[-0.02684342 -9.7367206 -1.16789311]

Calibration configuration
==========

cam0

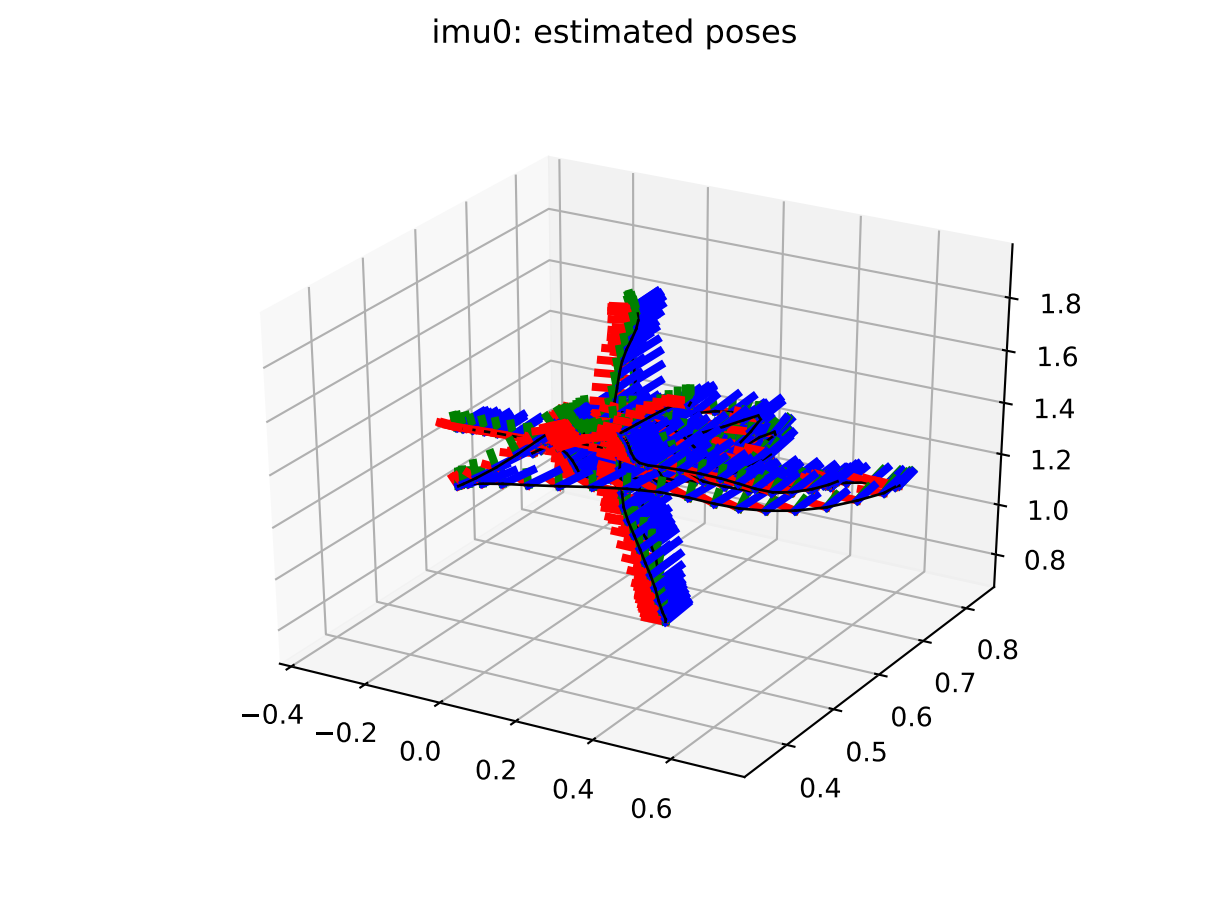
Camera model: pinhole
Focal length: [389.1458201515726, 389.4874154490492]
Principal point: [315.34538578231576, 245.13929995100375]
Distortion model: radtan
Distortion coefficients: [-0.34745438000640294, 0.12215219289504753, 0.0003565736103299981,
-0.0007521817923566013]
Type: aprilgrid
Tags:
Rows: 6
Cols: 6
Size: 0.088 [m]
Spacing 0.026399999999999996 [m]

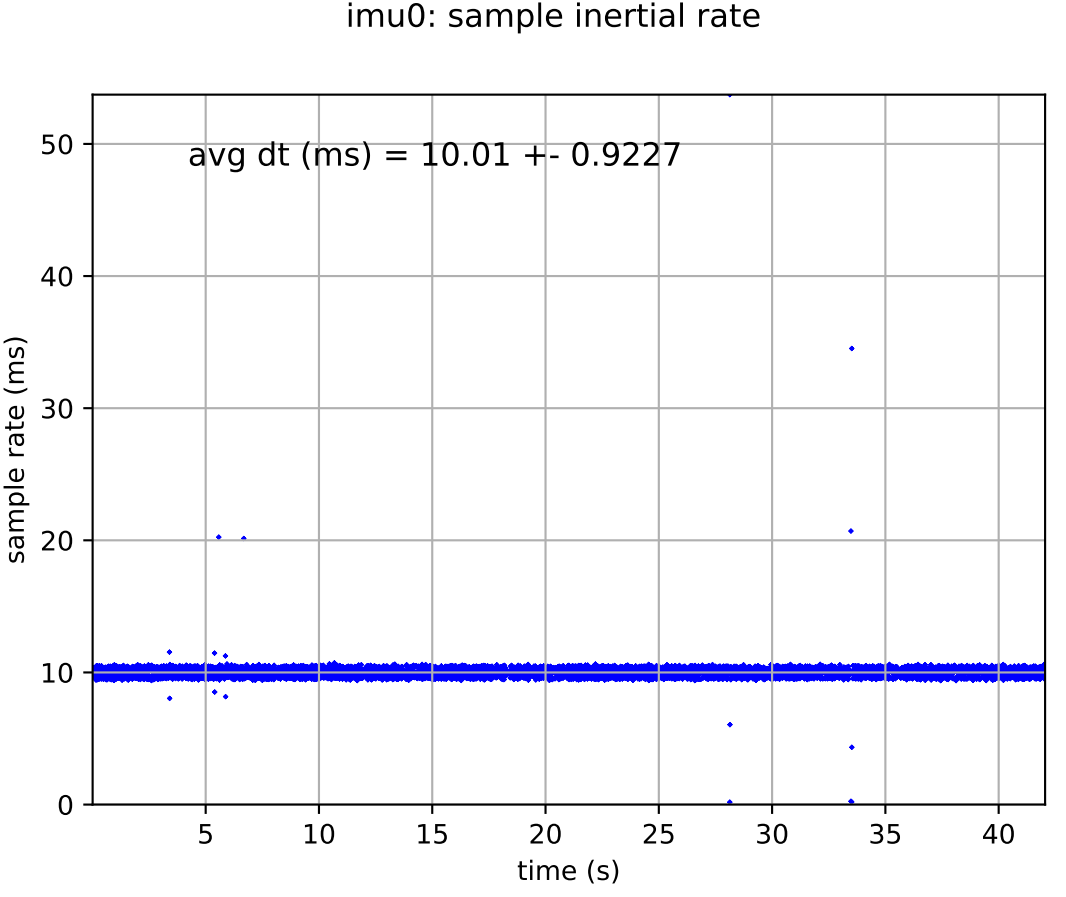
IMU configuration
==========

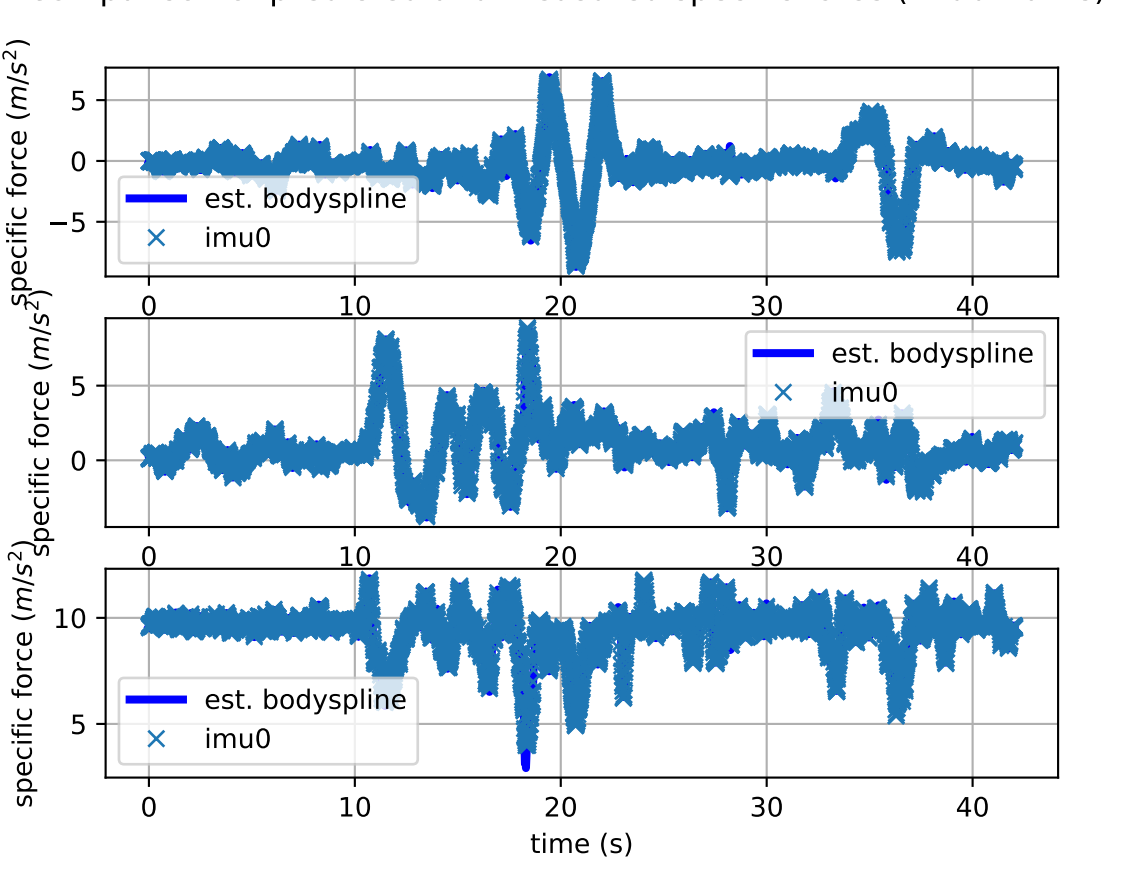
IMU0:

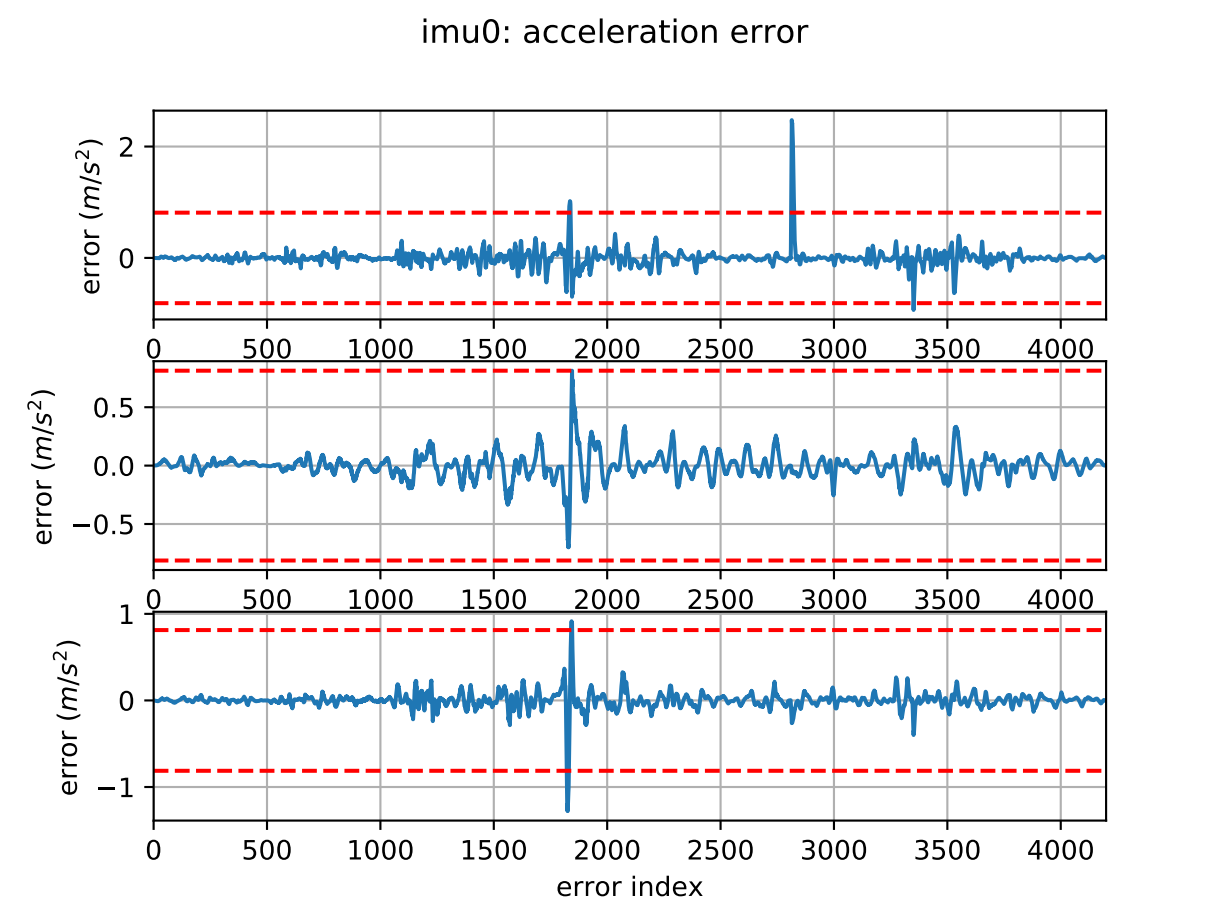
Model: calibrated
Update rate: 100
Accelerometer:
Noise density: 0.027089073164427782
Noise density (discrete): 0.2708907316442778
Random walk: 0.0026405437265548015
Gyroscope:
Noise density: 0.0004311627577370619
Noise density (discrete): 0.004311627577370619
Random walk: 5.5971879319209416e-05

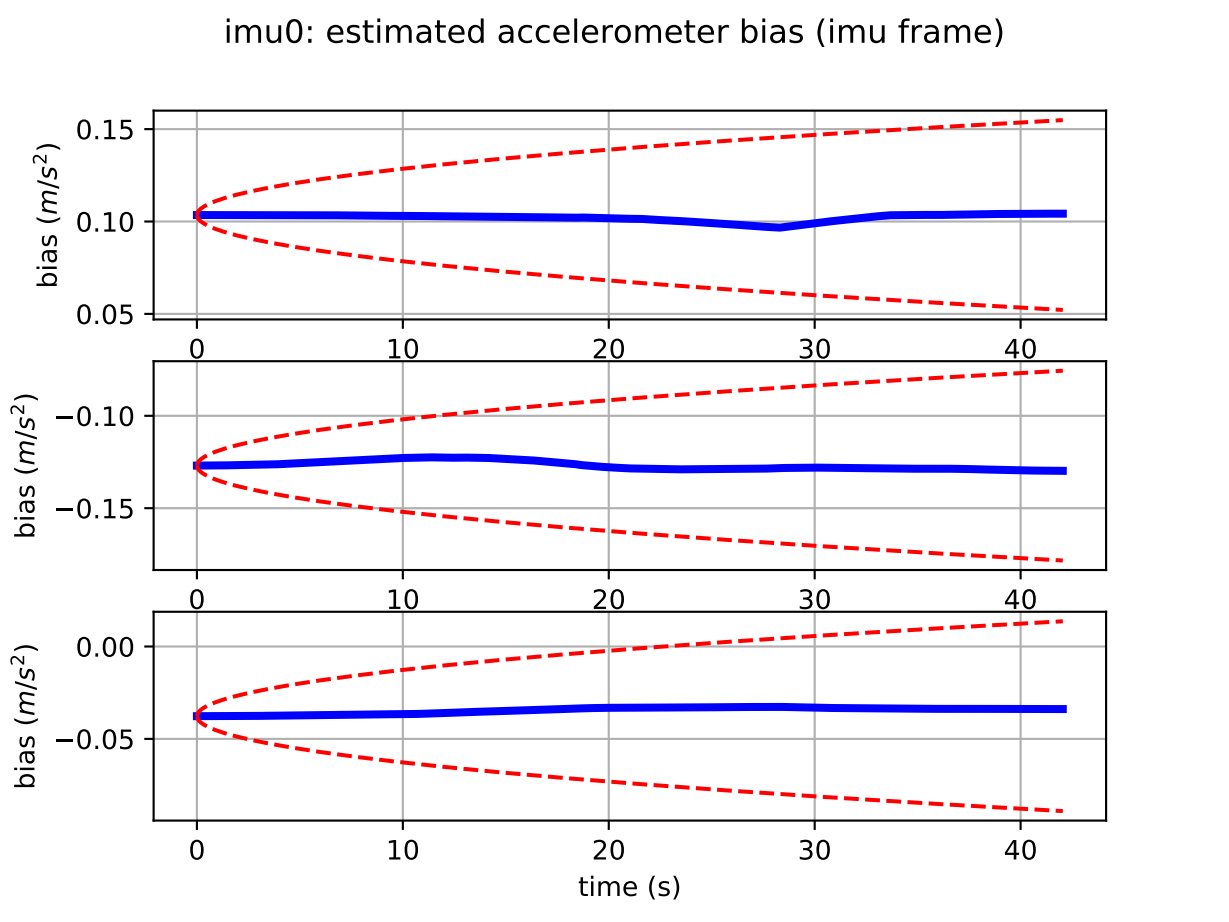
T_ib (imu0 to imu0)
[[1. 0. 0. 0.]
[0. 1. 0. 0.]
[0. 0. 1. 0.]
[0. 0. 0. 1.]]
time offset with respect to IMU0: 0.0 [s]

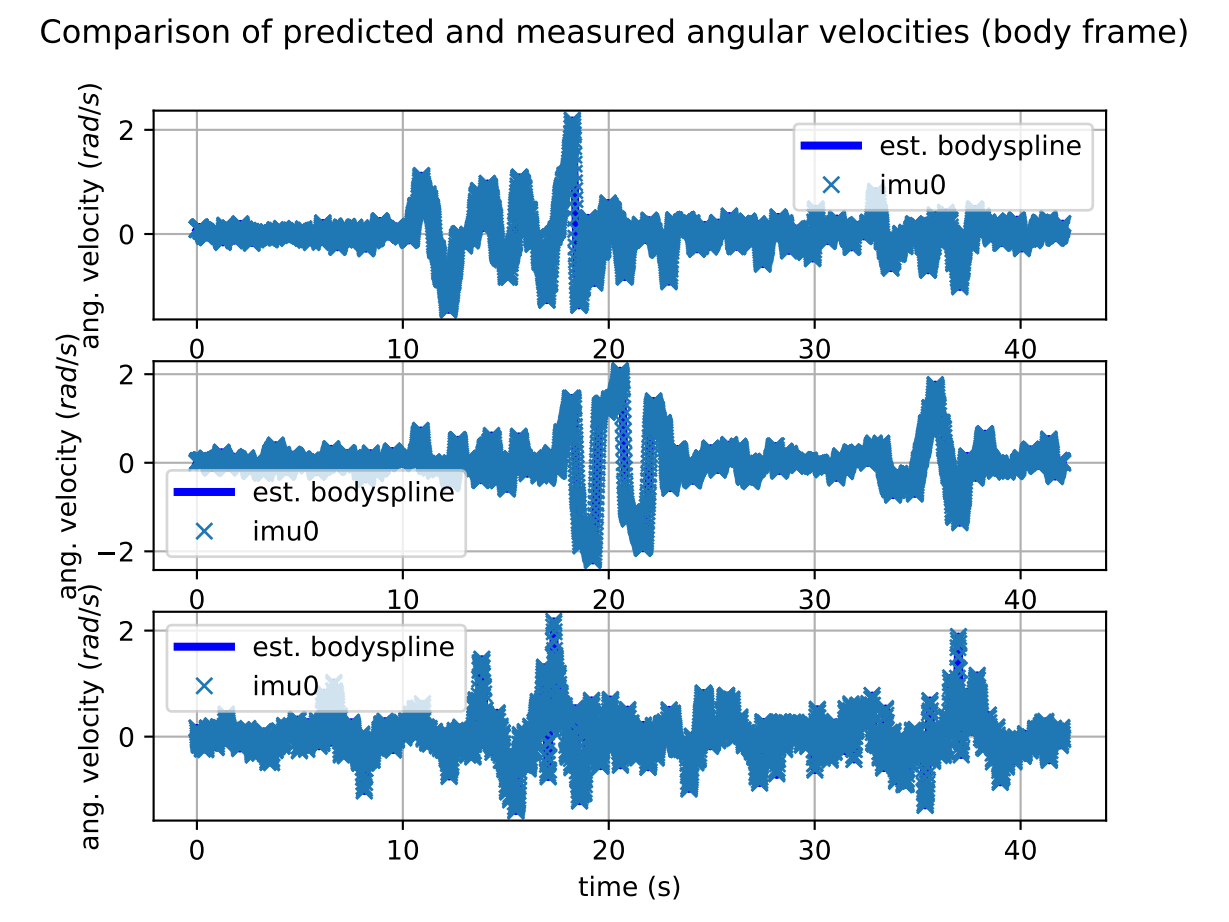

imu0: estimated poses
1.8
1.6
1.4
1.2
1.0
0.8
0.8
0.7
0.6
0.5
0.4
−0.4
−0.2
0.0
0.2
0.4
0.6

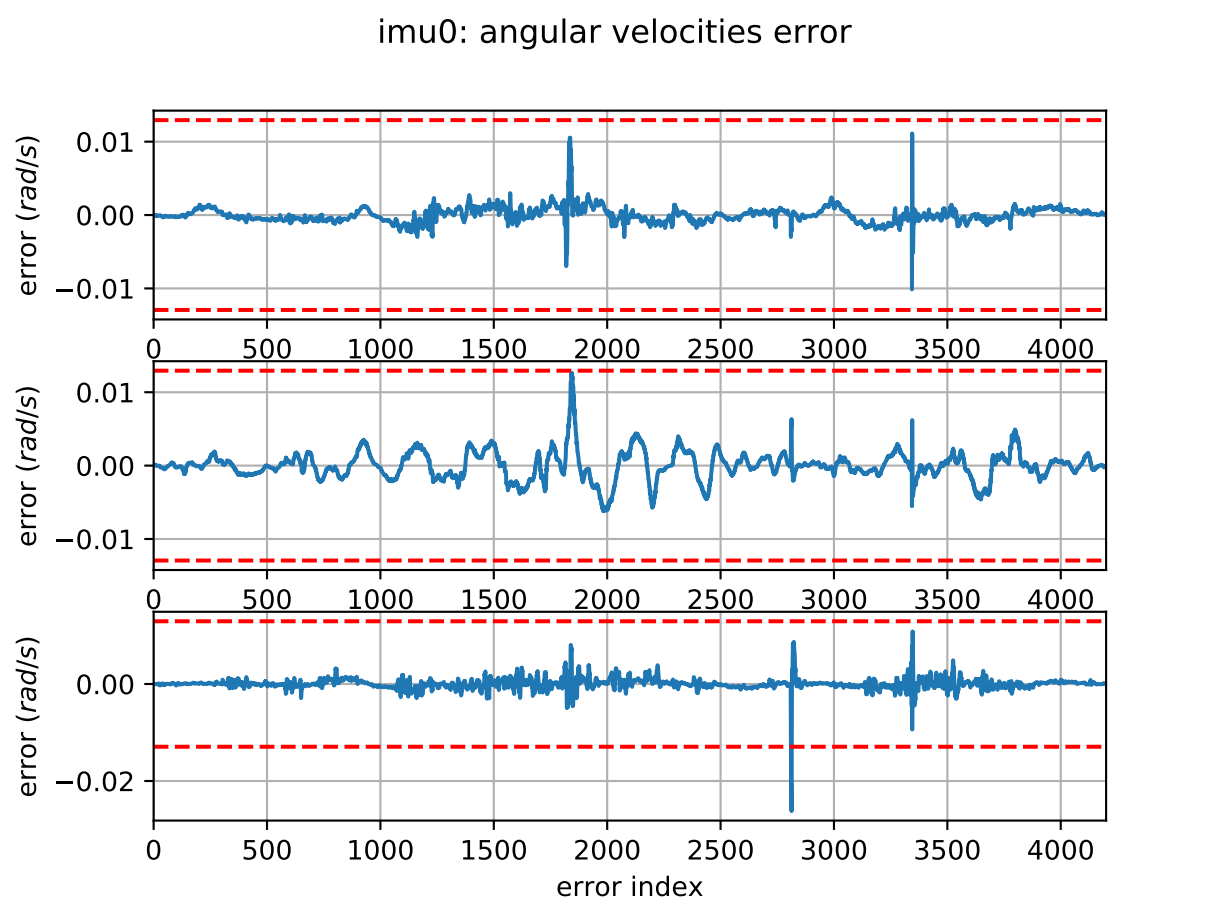

imu0: sample inertial rate
avg dt (ms) = 10.01 +- 0.9227
sample rate (ms)
time (s)
0
10
20
30
40
50
5
10
15
20
25
30
35
40

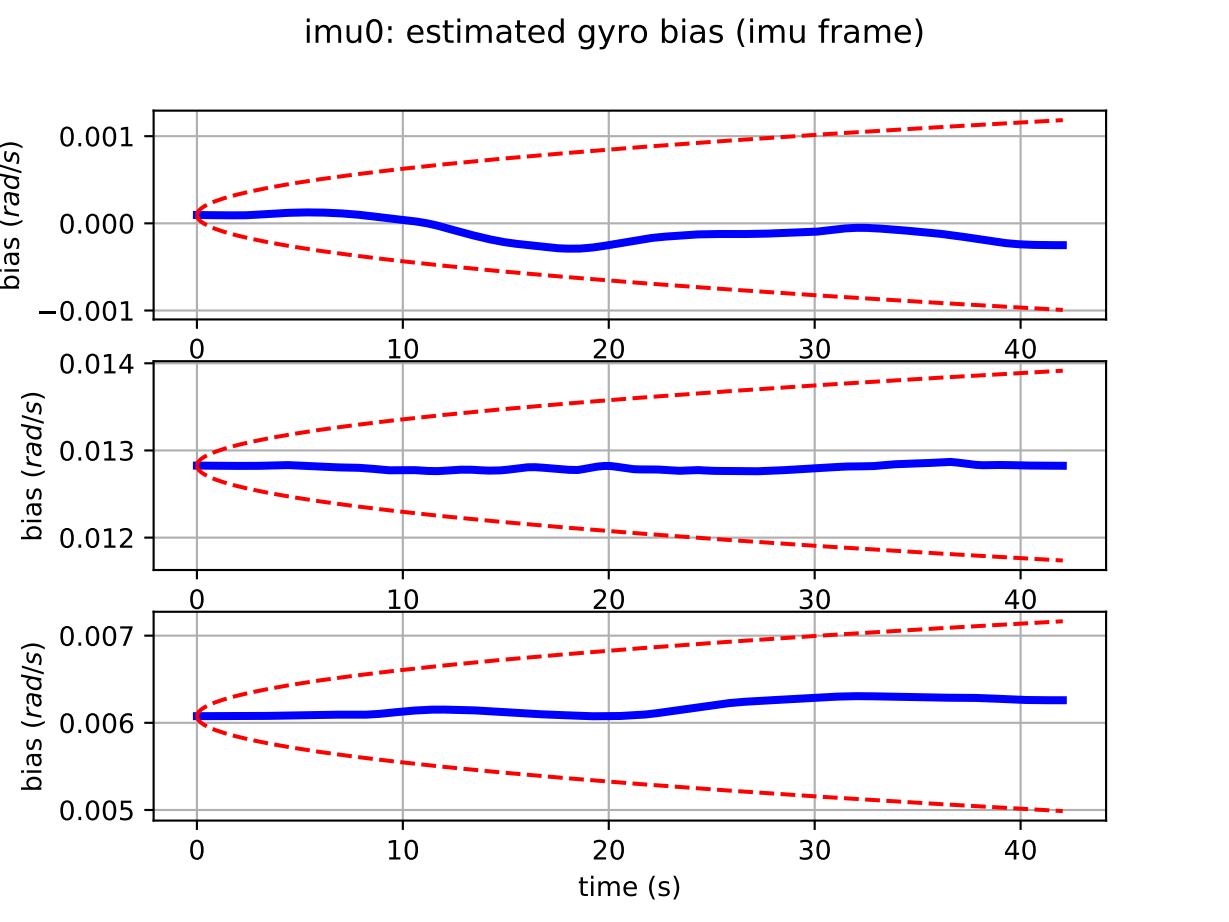

Comparison of predicted and measured specific force (imu0 frame)
specific force (m/s^2)
specific force (m/s^2)
specific force (m/s^2)
est. bodyspline
imu0
est. bodyspline
imu0
est. bodyspline
imu0
time (s)

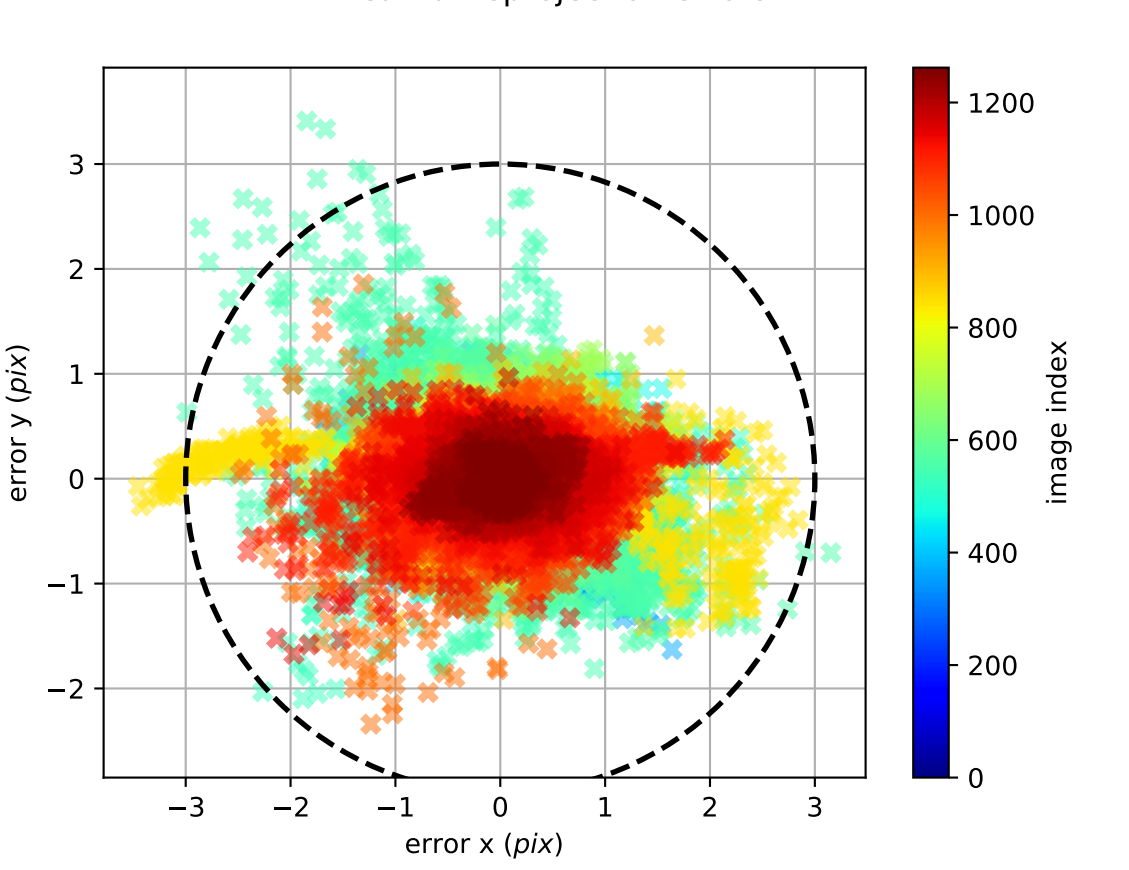

imu0: acceleration error
error (m/s^2)
2
0
0
500
1000
1500
2000
2500
3000
3500
4000
error (m/s^2)
0.5
0.0
−0.5
0
500
1000
1500
2000
2500
3000
3500
4000
error (m/s^2)
1
0
−1
0
500
1000
1500
2000
2500
3000
3500
4000
error index


imu0: estimated accelerometer bias (imu frame)
bias (m/s^2)
0.15
0.10
0.05
0
10
20
30
40
bias (m/s^2)
−0.10
−0.15
0
10
20
30
40
bias (m/s^2)
0.00
−0.05
0
10
20
30
40
time (s)


Comparison of predicted and measured angular velocities (body frame)
ang. velocity (rad/s)
est. bodyspline
imu0
2
0
−2
0
10
20
30
40
time (s)


imu0: angular velocities error
error (rad/s)
0.01
0.00
−0.01
0
500
1000
1500
2000
2500
3000
3500
4000
error (rad/s)
0.01
0.00
−0.01
0
500
1000
1500
2000
2500
3000
3500
4000
error (rad/s)
0.00
−0.02
0
500
1000
1500
2000
2500
3000
3500
4000
error index


imu0: estimated gyro bias (imu frame)
bias (rad/s)
0.001
0.000
−0.001
0
10
20
30
40
bias (rad/s)
0.014
0.013
0.012
0
10
20
30
40
bias (rad/s)
0.007
0.006
0.005
0
10
20
30
40
time (s)


cam0: reprojection errors
error x (pix)
error y (pix)
image index
−3
−2
−1
0
1
2
3
0
200
400
600
800
1000
1200