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

Reprojection error (cam0): mean 0.36154872567025753, median 0.3061146243939346, std: 0.25133781685307777
Reprojection error (cam1): mean 0.40842198329925494, median 0.35480947498420795, std: 0.2686796129076511
Gyroscope error (imu0): mean 0.784264328091226, median 0.6869942543616226, std: 0.4979725273682337
Accelerometer error (imu0): mean 1.5580469380005528, median 1.1700083649529924, std: 1.640863194333673

Residuals

Reprojection error (cam0) [px]: mean 0.36154872567025753, median 0.3061146243939346, std: 0.25133781685307777
Reprojection error (cam1) [px]: mean 0.40842198329925494, median 0.35480947498420795, std: 0.2686796129076511
Gyroscope error (imu0) [rad/s]: mean 0.0021166552003537226, median 0.0018541324767974293, std: 0.0013439807242701114
Accelerometer error (imu0) [m/s^2]: mean 0.031123039625690928, median 0.023371707114005397, std: 0.03277735026591772

Transformation (cam0):

T_ci: (imu0 to cam0):
[[0.99983705 0.01441438 -0.01086774 0.01691018]
[-0.01420986 0.99972476 0.01866756 0.00378241]
[0.01113383 -0.01851009 0.99976668 0.01245686]
[0.   0.   0.   1.   ]]

T_ic: (cam0 to imu0):
[[0.99983705 -0.01420986 0.01113383 -0.01699237]
[0.01441438 0.99972476 -0.01851009 -0.00379454]
[-0.01086774 0.01866756 0.99976668 -0.01234079]
[0.   0.   0.   1.   ]]

timeshift cam0 to imu0: [s] (t_imu = t_cam + shift)
-0.03665532392994529

Transformation (cam1):

T_ci: (imu0 to cam1):
[[0.99988216 0.01417   -0.00590628 0.00802129]
[-0.01405608 0.9997225   0.01890377 0.00374016]
[0.00617251 -0.01881853 0.99980386 0.0125582]
[0.   0.   0.   1.   ]]

T_ic: (cam1 to imu0):
[[0.99988216 -0.01405608 0.00617251 -0.00804529]
[0.01417   0.9997225 -0.01881853 -0.00361646]
[-0.00590628 0.01890377 0.99980386 -0.01257907]
[0.   0.   0.   1.   ]]

timeshift cam1 to imu0: [s] (t_imu = t_cam + shift)
-0.036756171010613785

Baselines:

Baseline (cam0 to cam1):
[[0.99998766 -0.00015233 0.00496533 -0.00894995]
[0.00015116 0.99999996 0.00023791 -0.00004777]
[-0.00496537 -0.00023716 0.99998764 0.00018635]
[0.   0.   0.   1.   ]]
baseline norm: 0.00895202173455035 [m]

Gravity vector in target coords: [m/s^2]
[0.14942146 -9.80512045 -0.0755589]

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

cam0

Camera model: pinhole
Focal length: [620.070096090849, 618.2102185572654]
Principal point: [325.29844703787114, 258.48711395621467]
Distortion model: radtan
Distortion coefficients: [0.14669700865145466, -0.2735315348568459, 0.007300675413449662, -0.003734002028256388]
Type: aprilgrid
Tags:
Rows: 6
Cols: 6
Size: 0.021 [m]
Spacing 0.00651 [m]

cam1

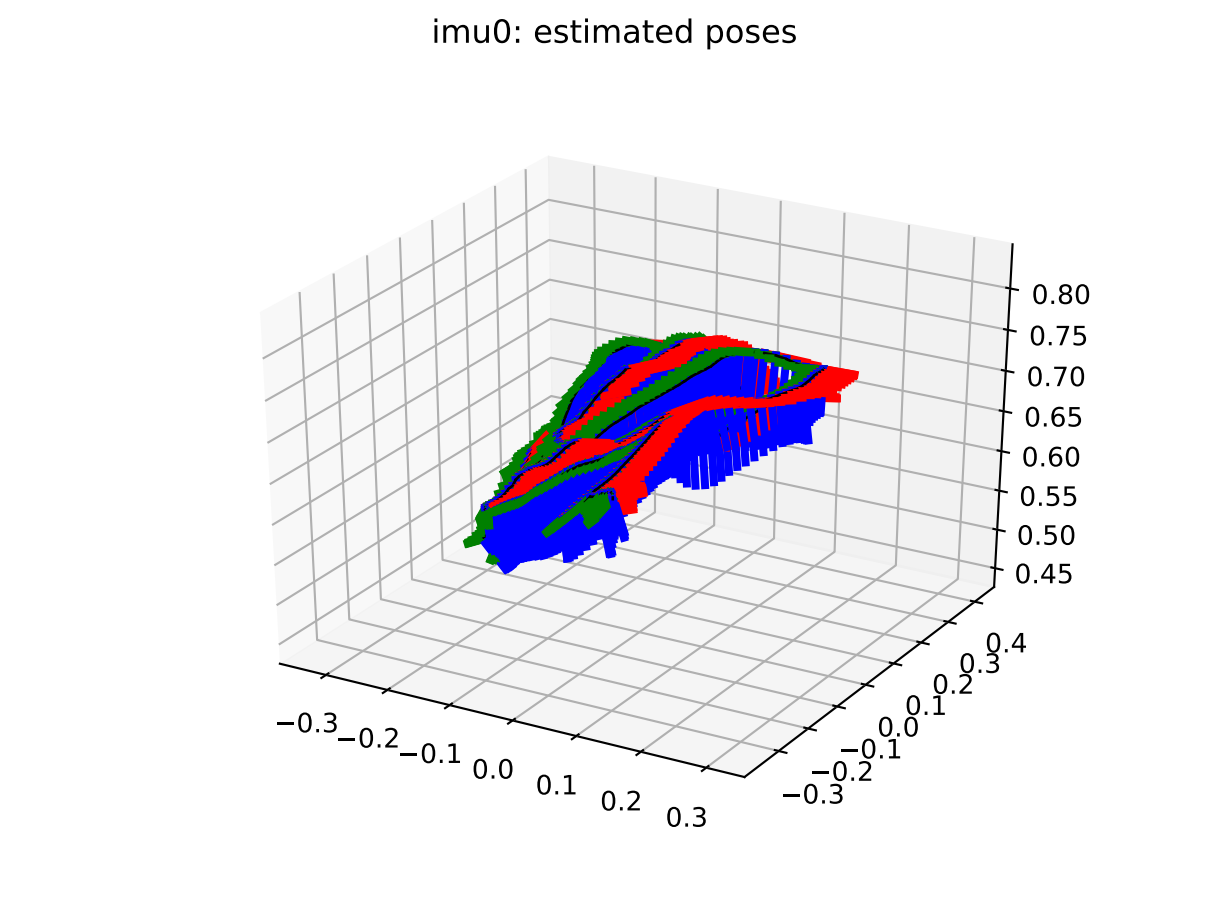
Camera model: pinhole
Focal length: [620.7205430589681, 618.5483414745424]
Principal point: [322.27715209601246, 258.3905254657877]
Distortion model: radtan
Distortion coefficients: [0.14148691116416337, -0.2629226797735833, 0.007081189200014749, -0.005510333236654425]
Type: aprilgrid
Tags:
Rows: 6
Cols: 6
Size: 0.021 [m]
Spacing 0.00651 [m]

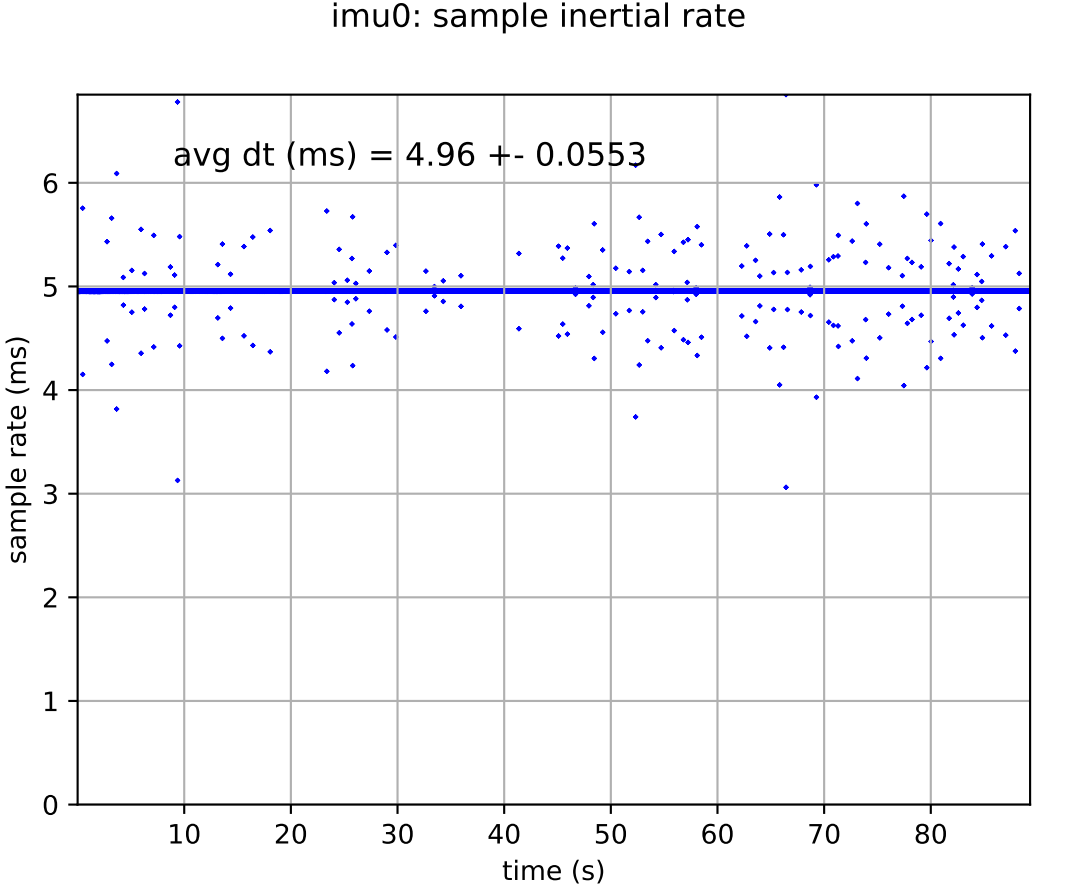
IMU configuration
==========

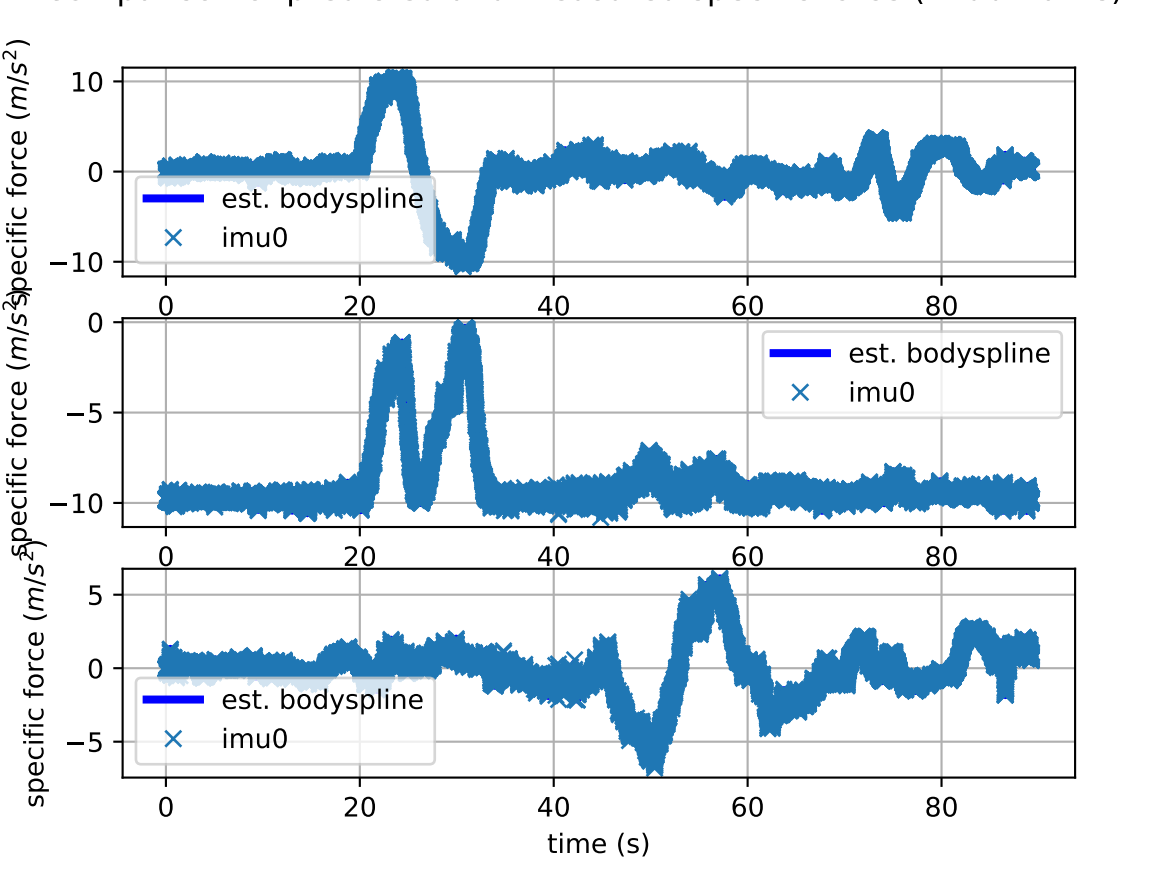
IMU0:

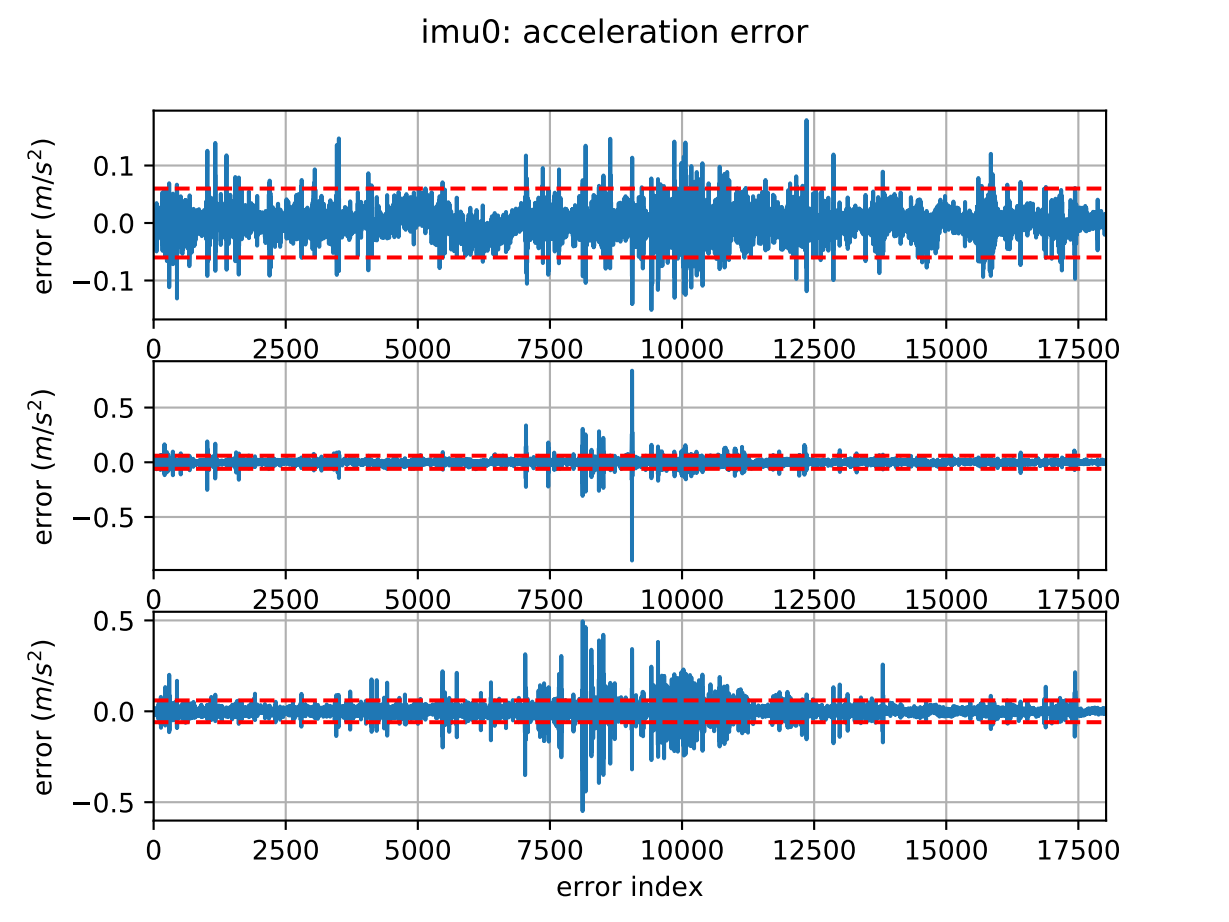
Model: calibrated
Update rate: 200.0

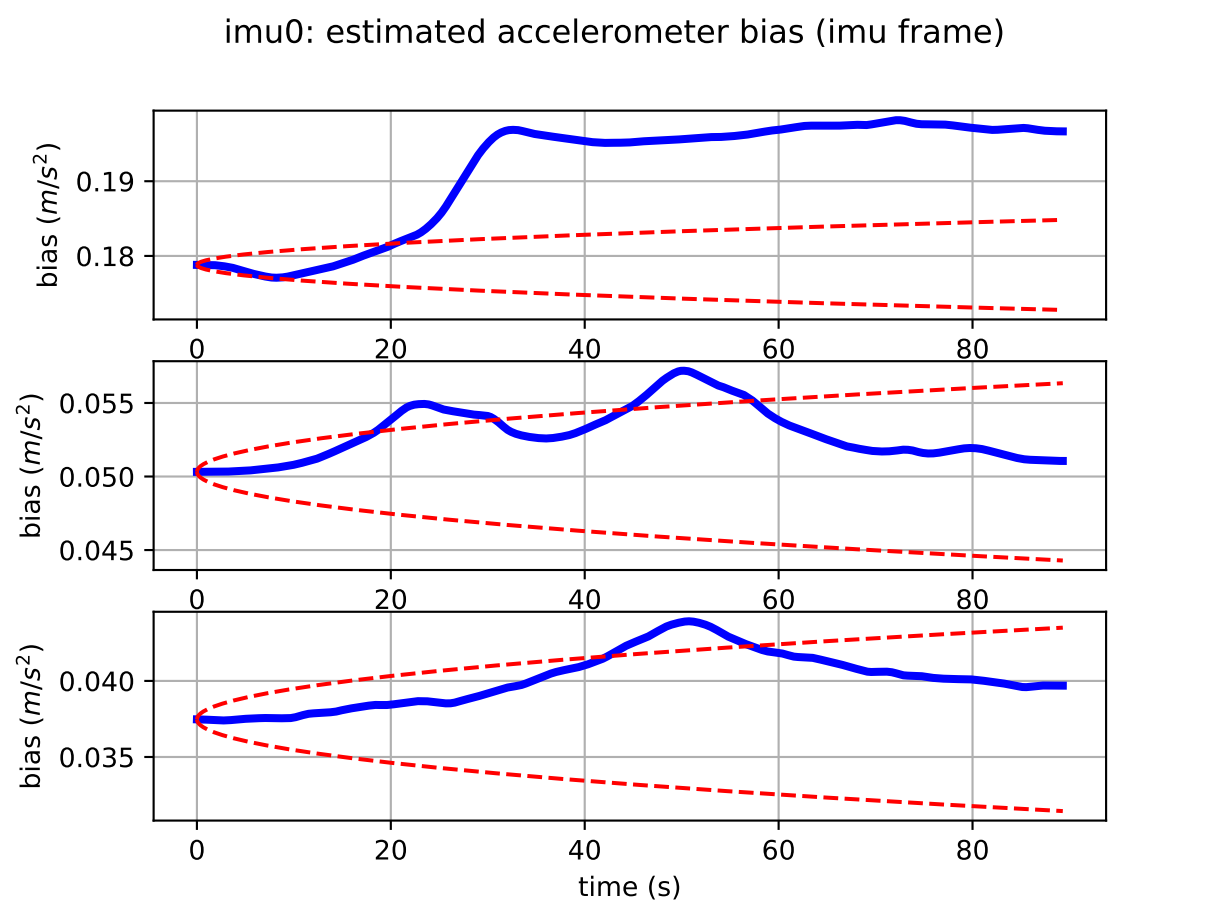
Accelerometer:
Noise density: 0.001412493541350285
Noise density (discrete): 0.019975675229419752
Random walk: 0.0002126313815515883
Gyroscope:
Noise density: 0.00019084142832896903
Noise density (discrete): 0.00269890536205481
Random walk: 1.299081499255472e-05
T_ib (imu0 to imu0)
[[1. 0. 0. 0.]
[0. 1. 0. 0.]
[0. 0. 1. 0.]
[0. 0. 0. 1.]]
time offset with respect to IMU0: 0.0 [s]

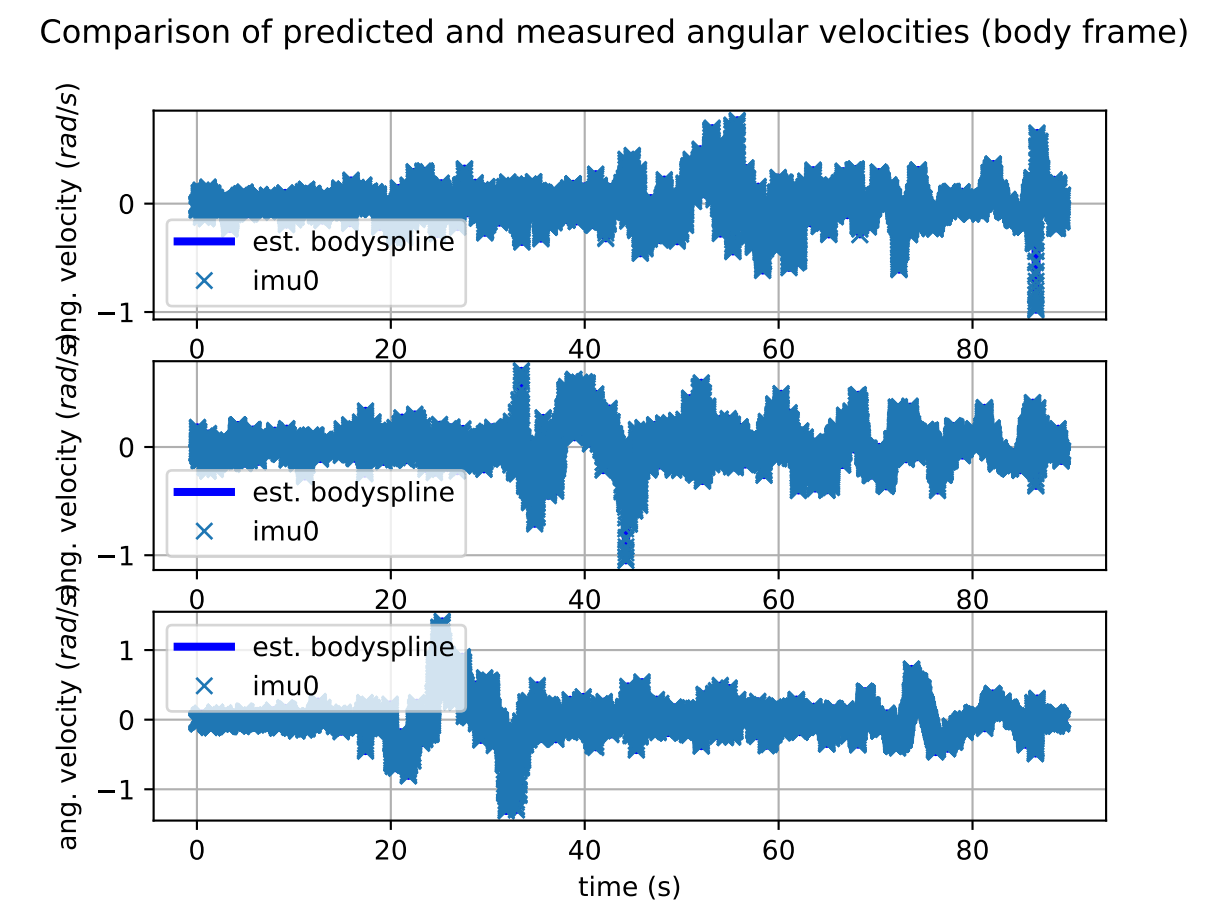

imu0: estimated poses
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.4
0.3
0.2
0.1
0.0
−0.1
−0.2
−0.3
−0.3
−0.2
−0.1
0.0
0.1
0.2
0.3

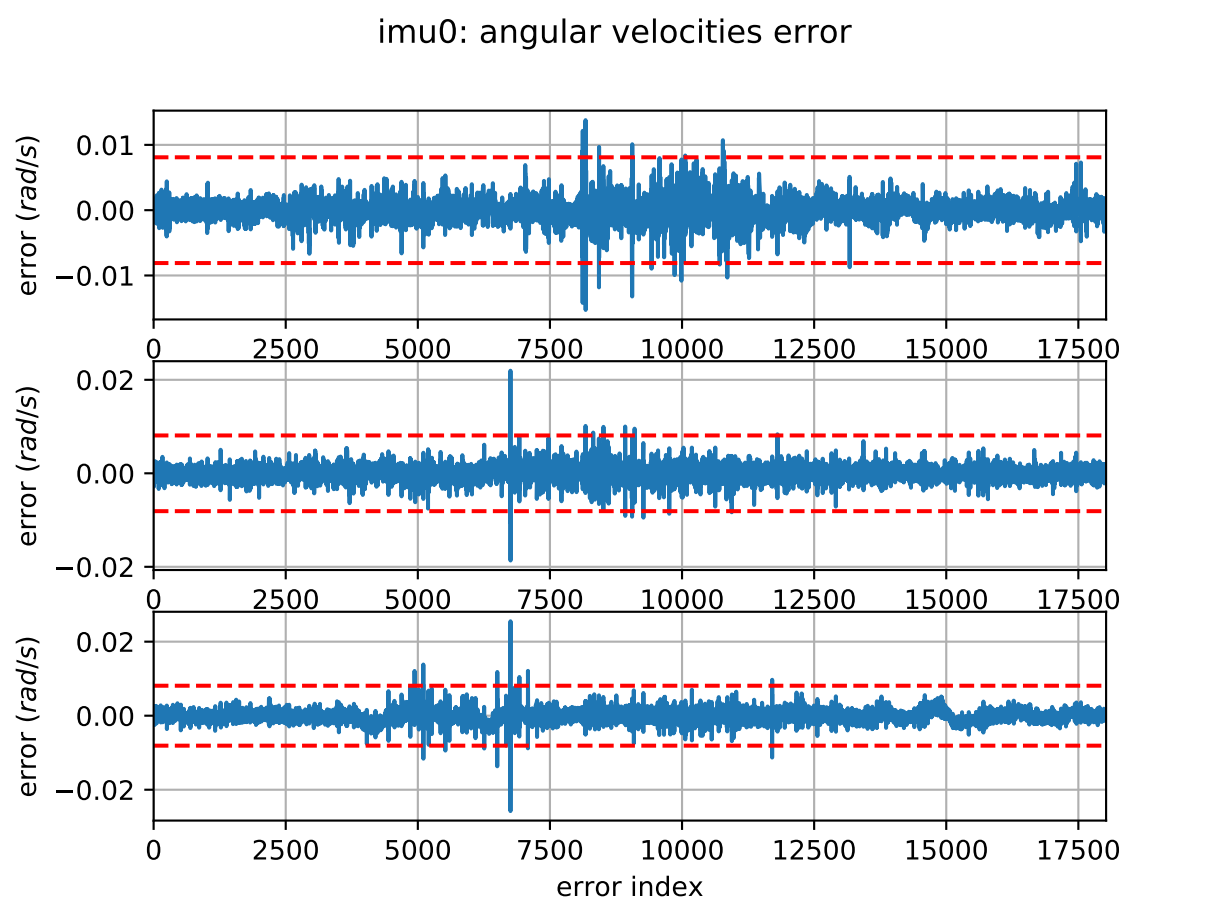

imu0: sample inertial rate
avg dt (ms) = 4.96 +- 0.0553
sample rate (ms)
time (s)
0
1
2
3
4
5
6
10
20
30
40
50
60
70
80

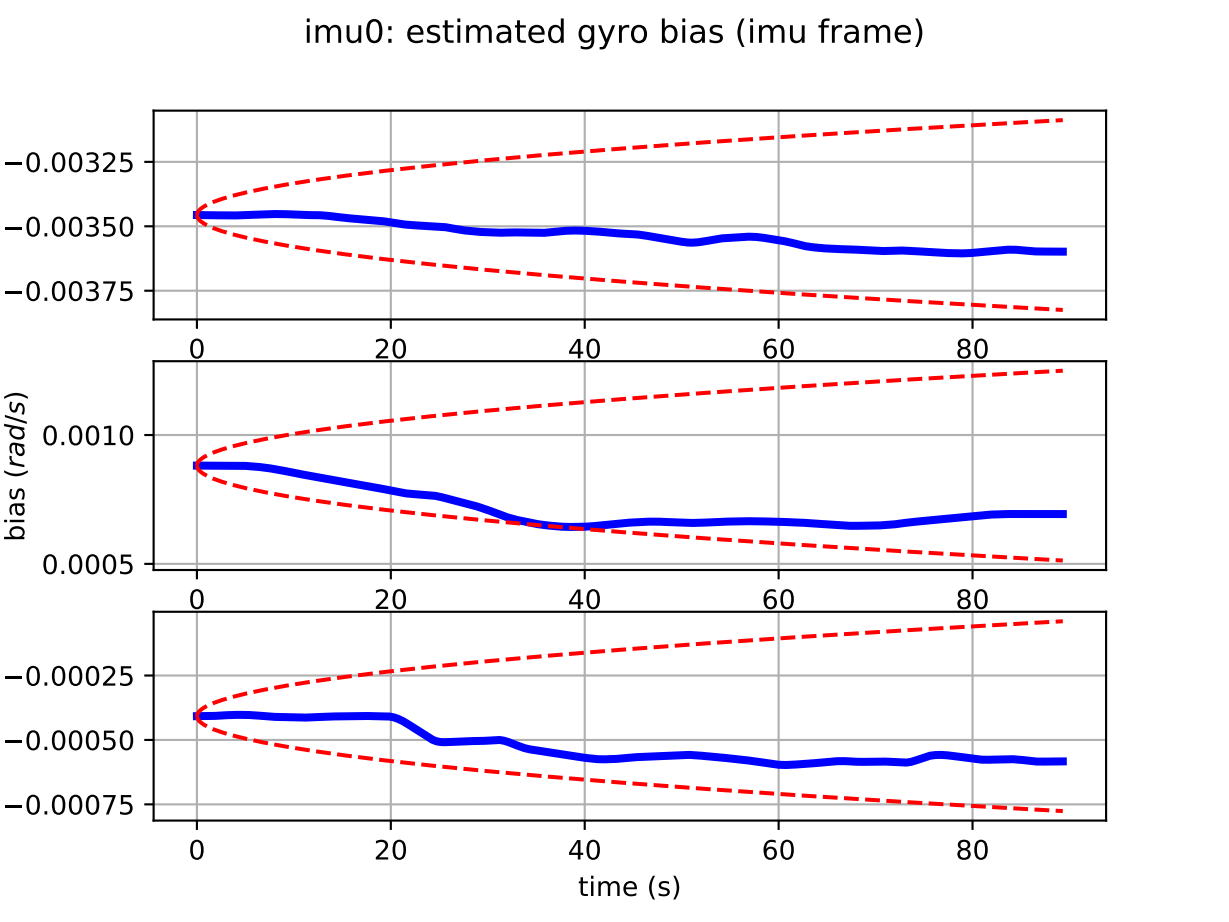

Comparison of predicted and measured specific force (imu0 frame)
specific force (m/s^2)
specific force (m/s^2)
specific force (m/s^2)
est. bodyspline
imu0
est. bodyspline
imu0
est. bodyspline
imu0
10
0
−10
0
−5
−10
5
0
−5
0
20
40
60
80
time (s)

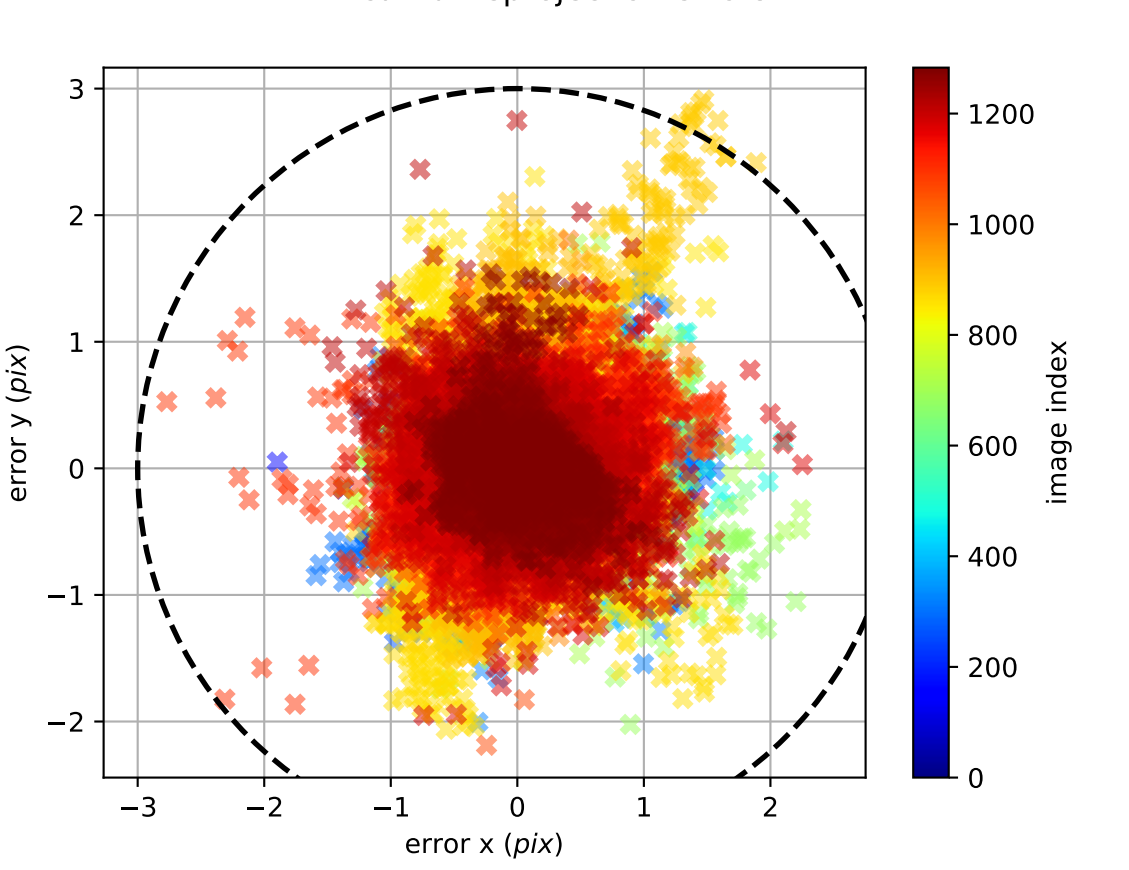

imu0: acceleration error
error (m/s^2)
0.1
0.0
−0.1
0
2500
5000
7500
10000
12500
15000
17500
error (m/s^2)
0.5
0.0
−0.5
0
2500
5000
7500
10000
12500
15000
17500
error (m/s^2)
0.5
0.0
−0.5
0
2500
5000
7500
10000
12500
15000
17500
error index

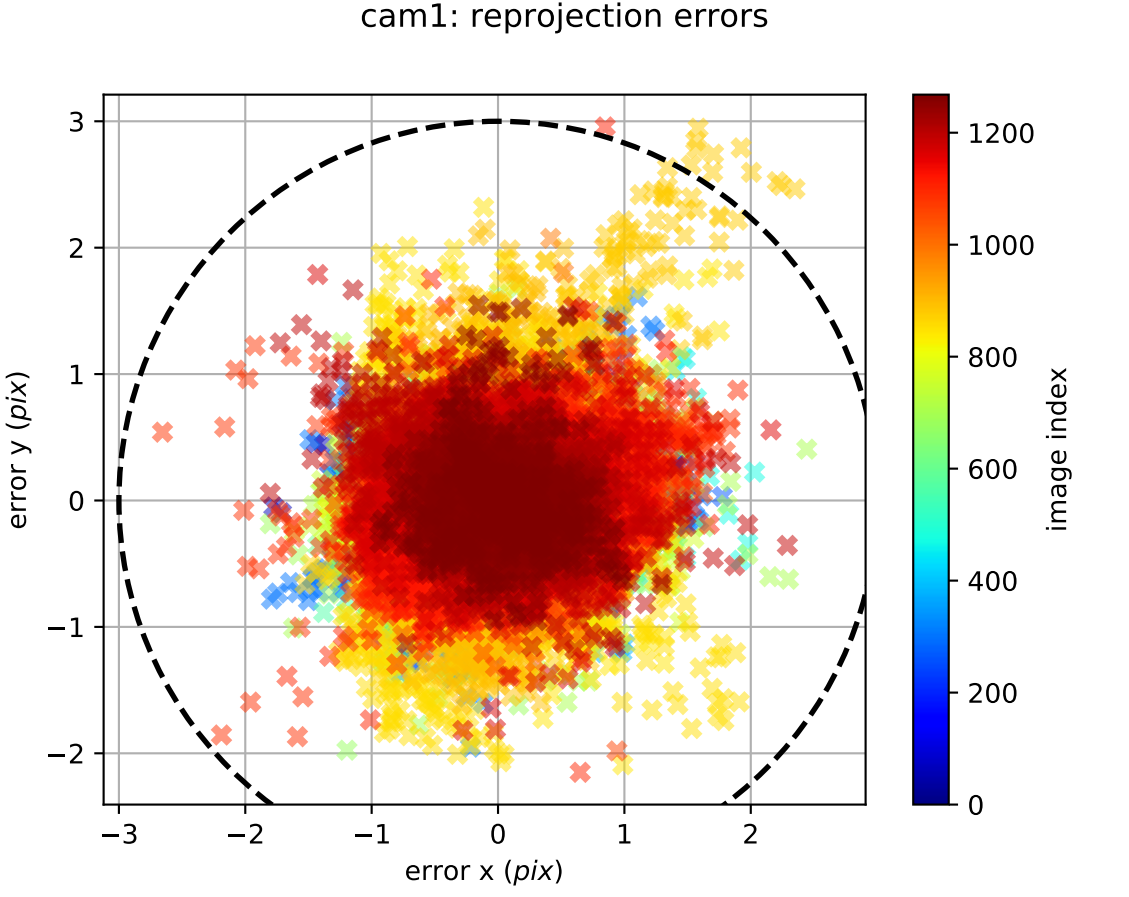

imu0: estimated accelerometer bias (imu frame)
bias (m/s^2)
0.19
0.18
0
20
40
60
80
bias (m/s^2)
0.055
0.050
0.045
0
20
40
60
80
bias (m/s^2)
0.040
0.035
0
20
40
60
80
time (s)


Comparison of predicted and measured angular velocities (body frame)
ang. velocity (rad/s)
est. bodyspline
imu0
time (s)


imu0: angular velocities error
error (rad/s)
0.01
0.00
−0.01
0
2500
5000
7500
10000
12500
15000
17500
error (rad/s)
0.02
0.00
−0.02
0
2500
5000
7500
10000
12500
15000
17500
error (rad/s)
0.02
0.00
−0.02
0
2500
5000
7500
10000
12500
15000
17500
error index


imu0: estimated gyro bias (imu frame)
−0.00325
−0.00350
−0.00375
0.0010
0.0005
−0.00025
−0.00050
−0.00075
0
20
40
60
80
bias (rad/s)
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


cam1: reprojection errors
error x (pix)
error y (pix)
image index
3
2
1
0
−1
−2
−3
1200
1000
800
600
400
200
0