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

Reprojection error (cam0): mean 0.142975755445, median 0.130686487357, std: 0.0817972217348
Reprojection error (cam1): mean 0.139113383779, median 0.129061976876, std: 0.0768758604603
Gyroscope error (imu0): mean 0.0947751091435, median 0.0827736498659, std: 0.0609365033876
Accelerometer error (imu0): mean 0.363001590633, median 0.285683155402, std: 0.341485432021

Residuals

Reprojection error (cam0) [px]: mean 0.142975755445, median 0.130686487357, std: 0.0817972217348
Reprojection error (cam1) [px]: mean 0.139113383779, median 0.129061976876, std: 0.0768758604603
Gyroscope error (imu0) [rad/s]: mean 0.0067016122363, median 0.00585298091238, std: 0.00430886147672
Accelerometer error (imu0) [m/s^2]: mean 0.0513361772636, median 0.0404016992912, std: 0.0482933329317

Transformation (cam0):

T_ci: (imu0 to cam0):
[[0.01678099 0.999859   -0.00061786 0.06848108]
 [-0.99985906 0.01678129 0.00048923 -0.01473317]
 [0.00049953 0.00060957 0.99999969 -0.00377717]
 [0.   0.   0.   1.   ]]

T_ic: (cam0 to imu0):
[[0.01678099 -0.99985906 0.00049953 -0.01587839]
 [0.999859   0.01678129 0.00060957 -0.06822188]
 [-0.00061786 0.00048923 0.99999969 0.00382669]
 [0.   0.   0.   1.   ]]

timeshift cam0 to imu0: [s] (t_imu = t_cam + shift)
4.51519830511e-05

Transformation (cam1):

T_ci: (imu0 to cam1):
[[0.01559152 0.9998771 -0.00163971 -0.04170026]
 [-0.99987769 0.0155935   0.00120252 -0.01513889]
 [0.00122794 0.00162076 0.99999793 -0.00357582]

```
 [ 0.          0.          0.          1.        ]]

T_ic:  (cam1 to imu0):
[[ 0.01559152 -0.99987769  0.00122794 -0.01448248]
 [ 0.9998771   0.0155935   0.00162076  0.041937  ]
 [-0.00163971  0.00120252  0.99999793  0.00352564]
 [ 0.          0.          0.          1.        ]]

timeshift cam1 to imu0: [s] (t_imu = t_cam + shift)
4.8827165325e-05

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:  0.110168134052 [m]


Gravity vector in target coords: [m/s^2]
[-0.06347196  8.78206242 -4.36345893]


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

cam0
-----
  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, 0.019860839087717054]
  Type: aprilgrid
  Tags:
    Rows: 6
    Cols: 6
    Size: 0.088 [m]
```
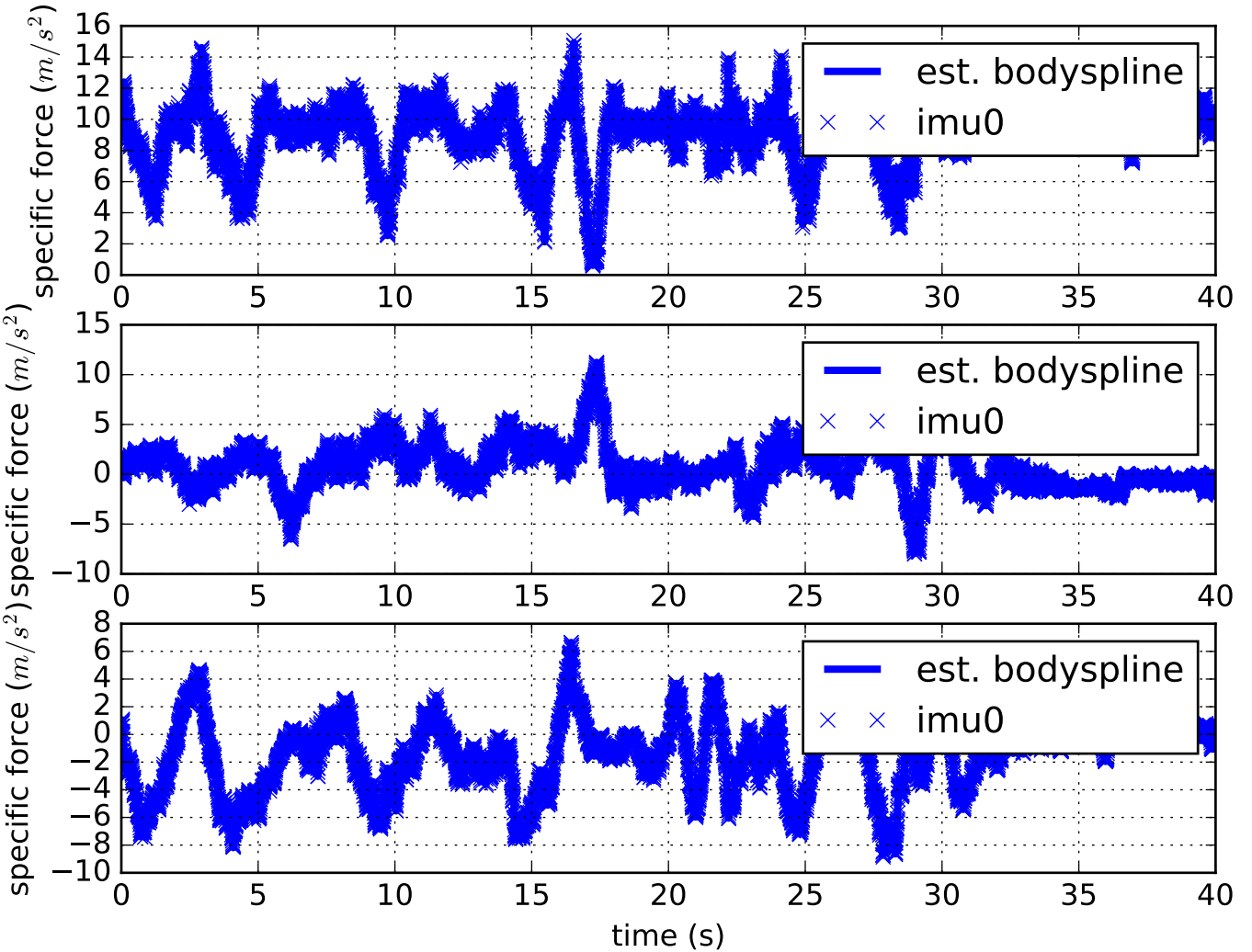
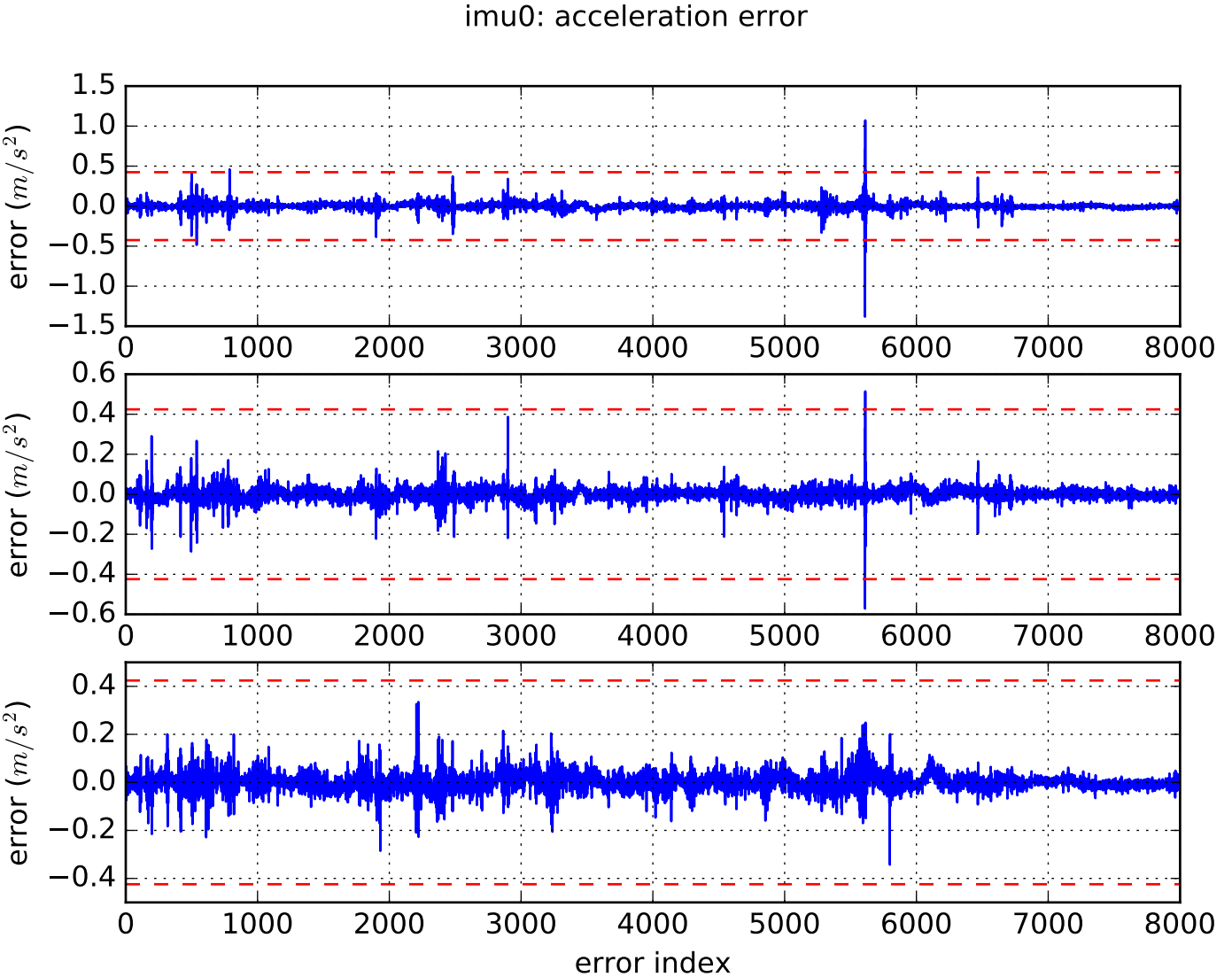
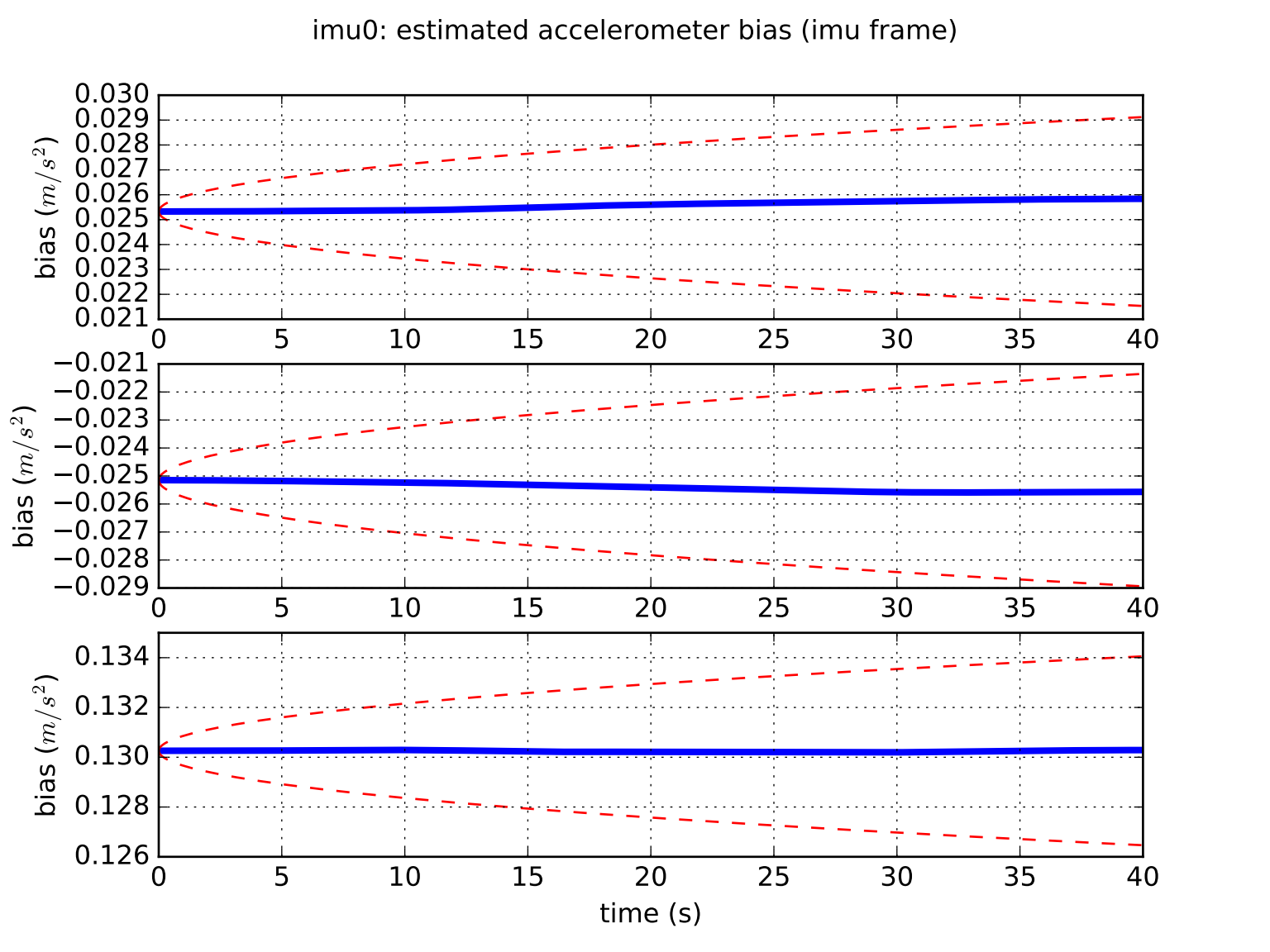
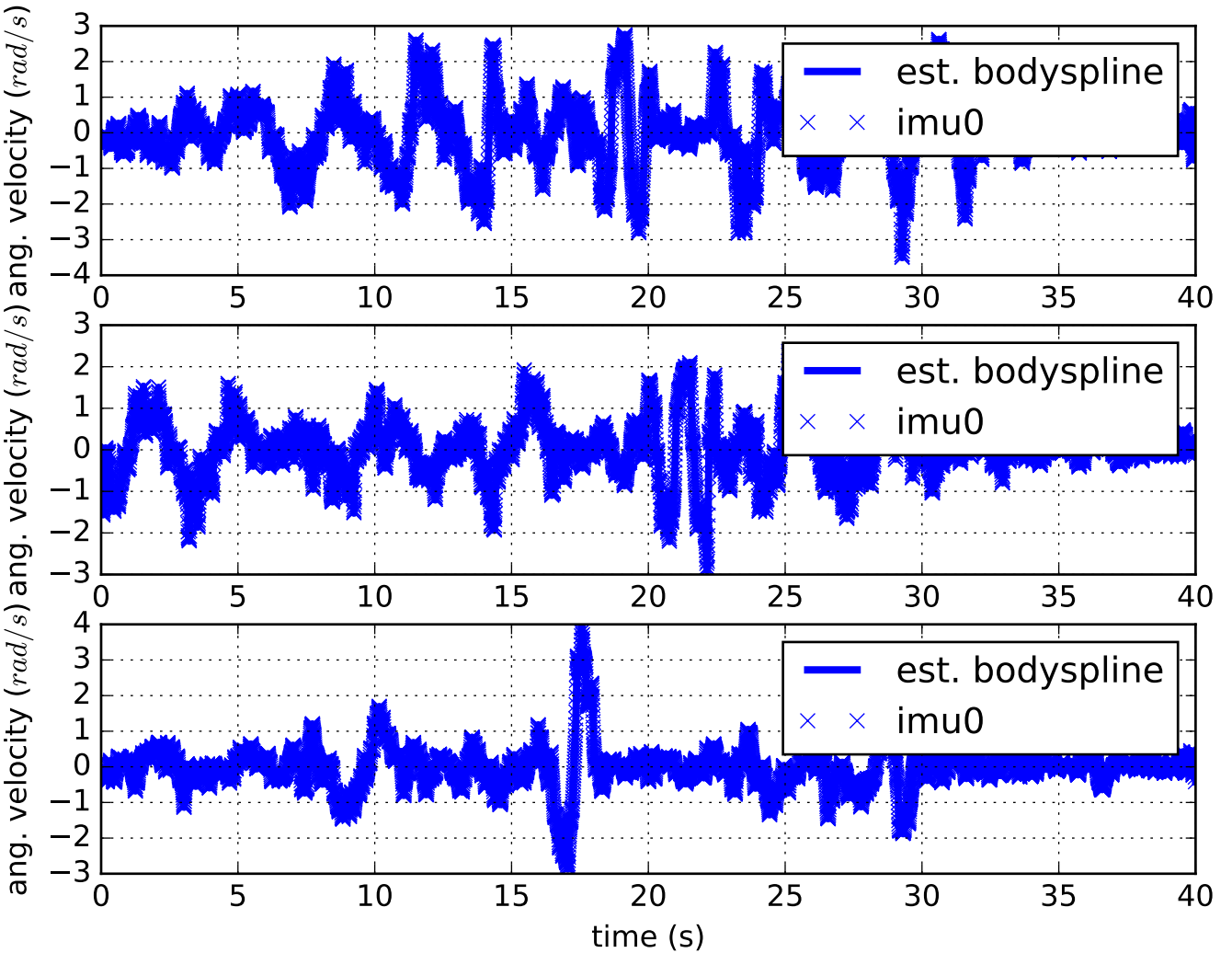
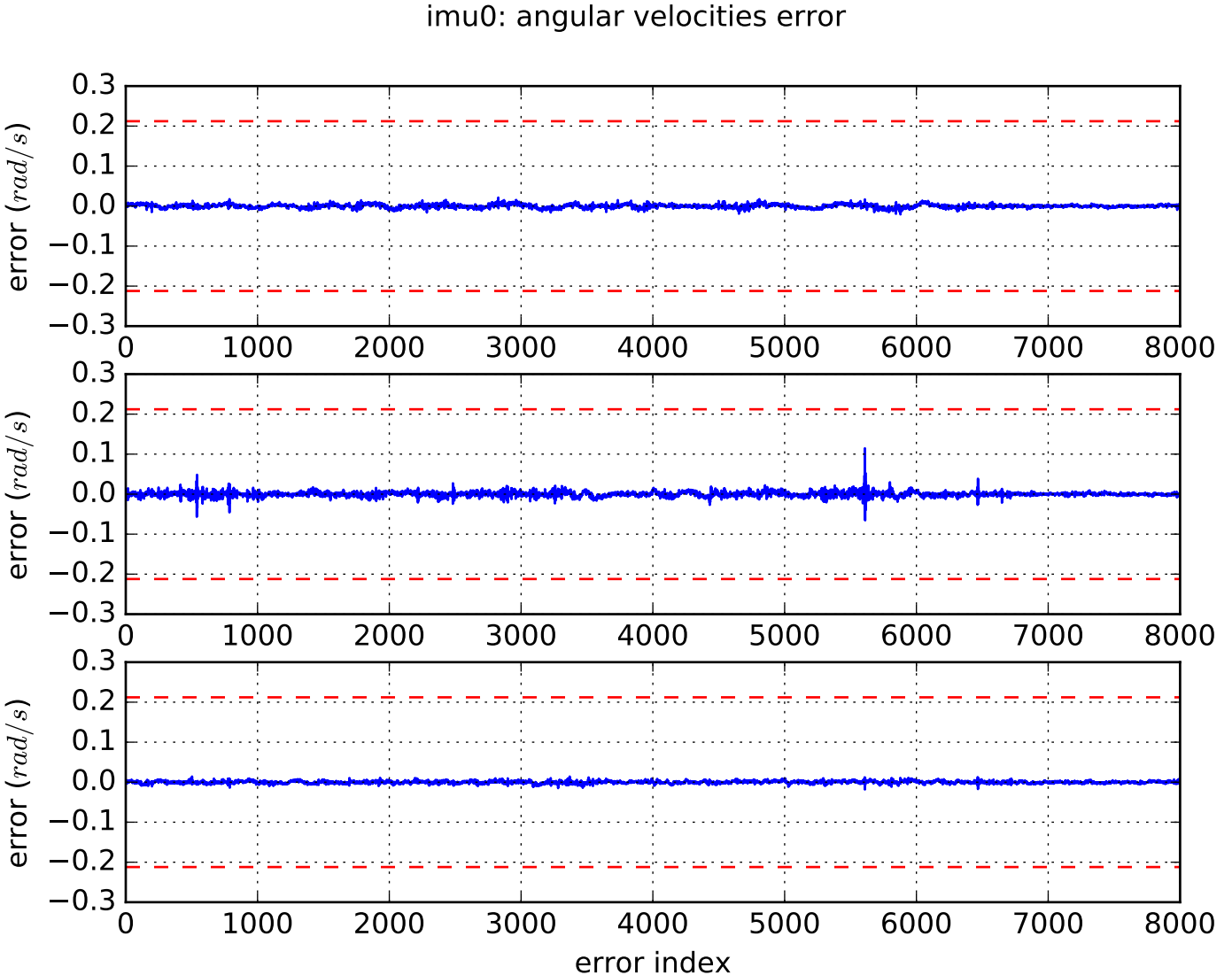

```
    Spacing 0.0264 [m]


cam1
-----
  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, 0.01955083559432553]
  Type: aprilgrid
  Tags:
    Rows: 6
    Cols: 6
    Size: 0.088 [m]
    Spacing 0.0264 [m]



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

IMU0:
----------------------------
  Model: calibrated
  Update rate: 200.0
  Accelerometer:
    Noise density: 0.01
    Noise density (discrete): 0.141421356237
    Random walk: 0.0002
  Gyroscope:
    Noise density: 0.005
    Noise density (discrete): 0.0707106781187
    Random walk: 4e-06
  T_i_b
    [[ 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]
```

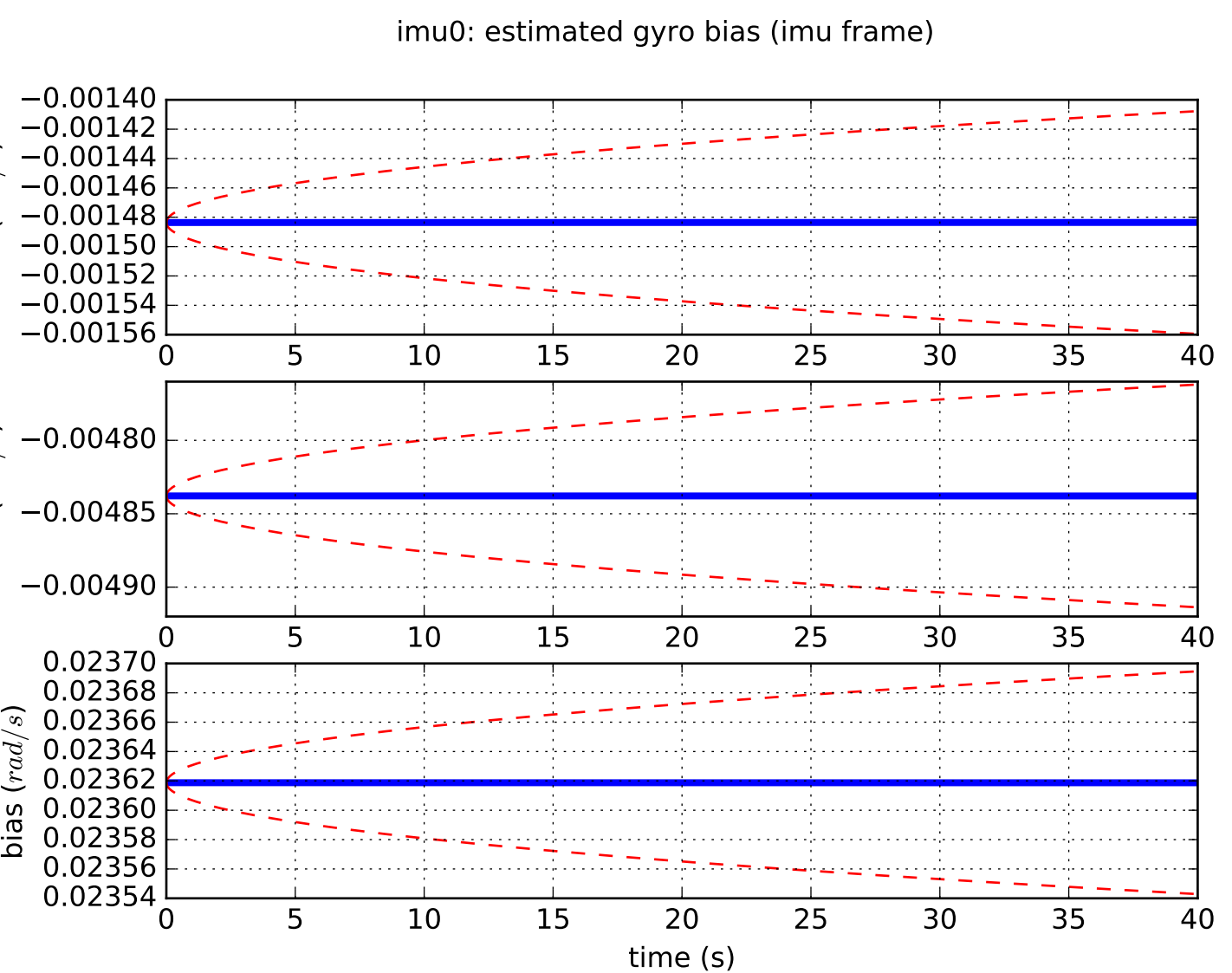

Comparison of predicted and measured specific force (imu0 frame)
specific force (m/s^2)
specific force (m/s^2)
specific force (m/s^2)
time (s)
est. bodyspline
imu0
est. bodyspline
imu0
est. bodyspline
imu0

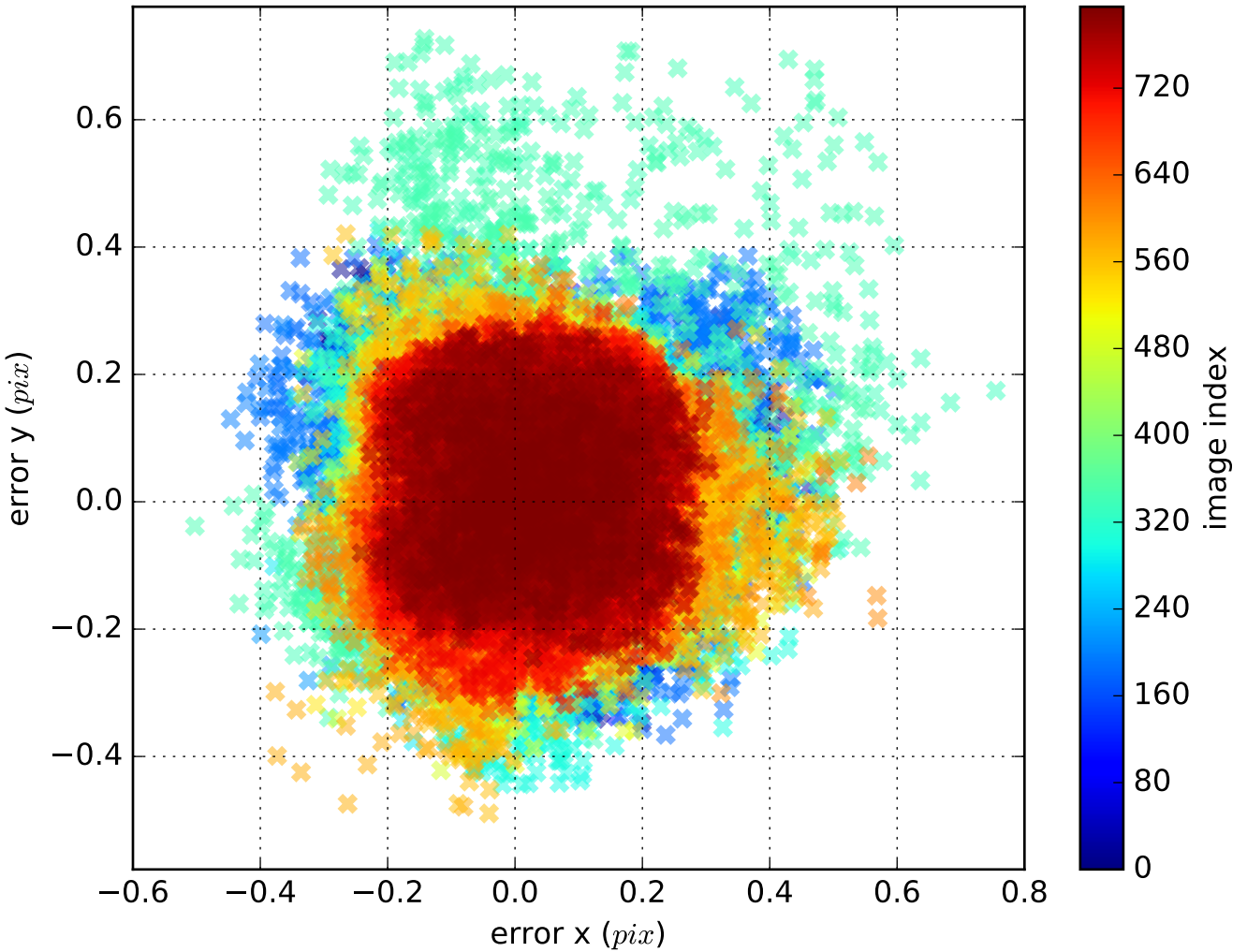

imu0: acceleration error
error (m/s^2)
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
0
1000
2000
3000
4000
5000
6000
7000
8000
error (m/s^2)
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
0
1000
2000
3000
4000
5000
6000
7000
8000
error (m/s^2)
0.4
0.2
0.0
−0.2
−0.4
0
1000
2000
3000
4000
5000
6000
7000
8000
error index

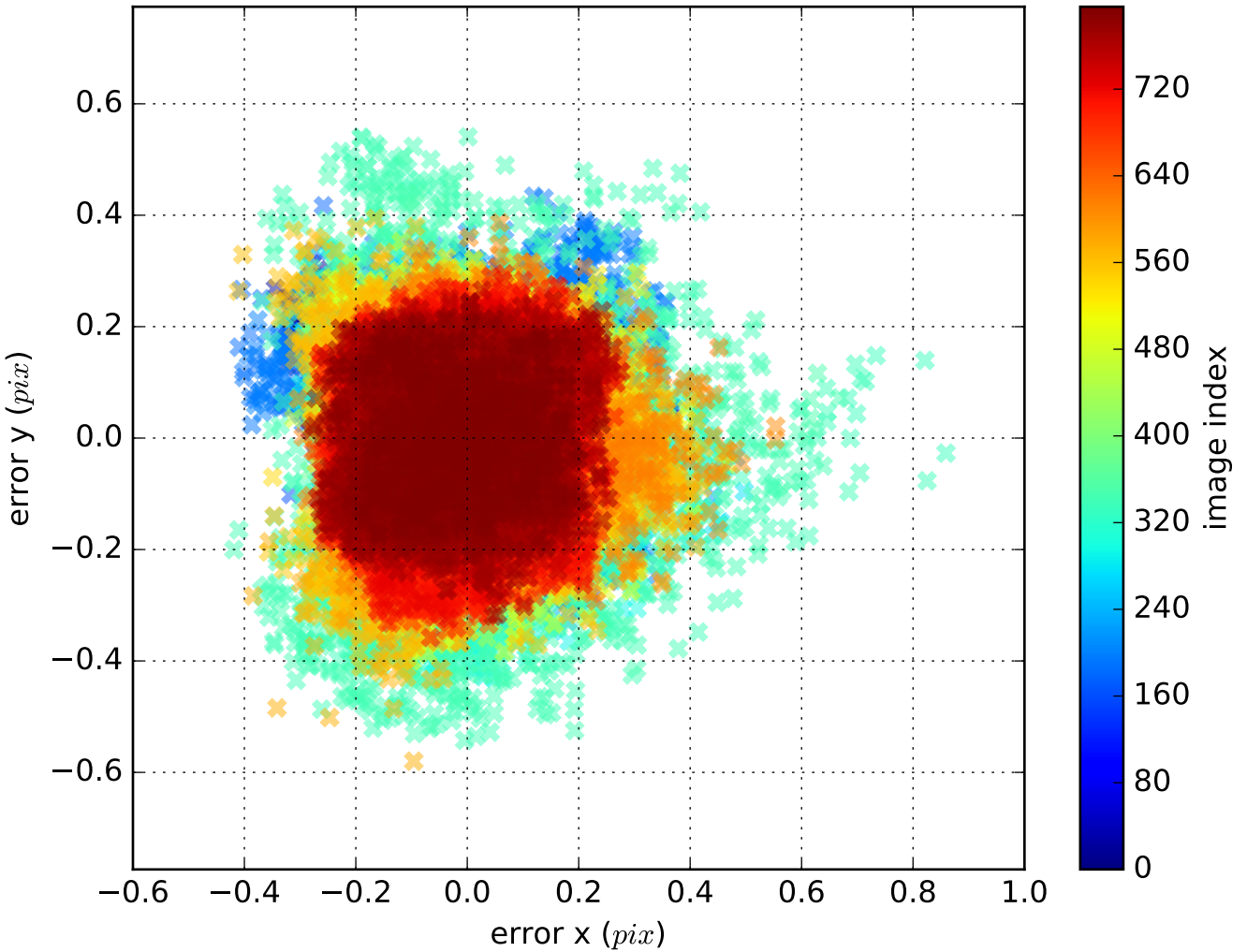

imu0: estimated accelerometer bias (imu frame)
bias (m/s^2)
0.030
0.029
0.028
0.027
0.026
0.025
0.024
0.023
0.022
0.021
0
5
10
15
20
25
30
35
40
bias (m/s^2)
−0.021
−0.022
−0.023
−0.024
−0.025
−0.026
−0.027
−0.028
−0.029
0
5
10
15
20
25
30
35
40
bias (m/s^2)
0.134
0.132
0.130
0.128
0.126
0
5
10
15
20
25
30
35
40
time (s)


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


imu0: angular velocities error
error (rad/s)
0.3
0.2
0.1
0.0
−0.1
−0.2
−0.3
0
1000
2000
3000
4000
5000
6000
7000
8000
error index


imu0: estimated gyro bias (imu frame)
−0.00140
−0.00142
−0.00144
−0.00146
−0.00148
−0.00150
−0.00152
−0.00154
−0.00156
−0.00480
−0.00485
−0.00490
0.02370
0.02368
0.02366
0.02364
0.02362
0.02360
0.02358
0.02356
0.02354
0
5
10
15
20
25
30
35
40
bias (rad/s)
time (s)


cam0: reprojection errors
error x (pix)
error y (pix)
image index
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
−0.4
−0.2
0.0
0.2
0.4
0.6
0.8
720
640
560
480
400
320
240
160
80
0


cam1: reprojection errors
error y (pix)
error x (pix)
image index
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
−0.6
−0.4
−0.2
0.0
0.2
0.4
0.6
0.8
1.0
720
640
560
480
400
320
240
160
80
0