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

Reprojection error (cam0):   mean 0.280122652216, median 0.238671450012, std: 0.210017490943
Gyroscope error (imu0):   mean 0.00019728021872, median 1.98889613973e-08, std: 0.00118281292589
Accelerometer error (imu0):   mean 0.000270539858494, median 0.000270614375881, std: 7.88402611826e-07

Residuals

Reprojection error (cam0) [px]:   mean 0.280122652216, median 0.238671450012, std: 0.210017490943
Gyroscope error (imu0) [rad/s]:   mean 4.04424448376e-06, median 4.07723708646e-10, std: 2.42476649807e-05
Accelerometer error (imu0) [m/s^2]: mean 8.65727547181e-07, median 8.65966002818e-07, std: 2.52288835784e-09

Transformation (cam0):

T_ci: (imu0 to cam0):
[[0.00811713 -0.99906913 0.04236737 0.00057117]
 [-0.1064118 -0.04299119 -0.99339231 0.00026136]
 [0.99428901 0.00355511 -0.10666171 0.00006829]
 [0.   0.   0.   1.   ]]

T_ic: (cam0 to imu0):
[[0.00811713 -0.1064118   0.99428901 -0.00004473]
 [-0.99906913 -0.04299119 0.00355511 0.00058163]
 [0.04236737 -0.99339231 -0.10666171 0.00024272]
 [0.   0.   0.   1.   ]]

timeshift cam0 to imu0: [s] (t_imu = t_cam + shift)
0.0

Gravity vector in target coords: [m/s^2]
[-0.84792693 -9.75848255 -0.4705966]

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

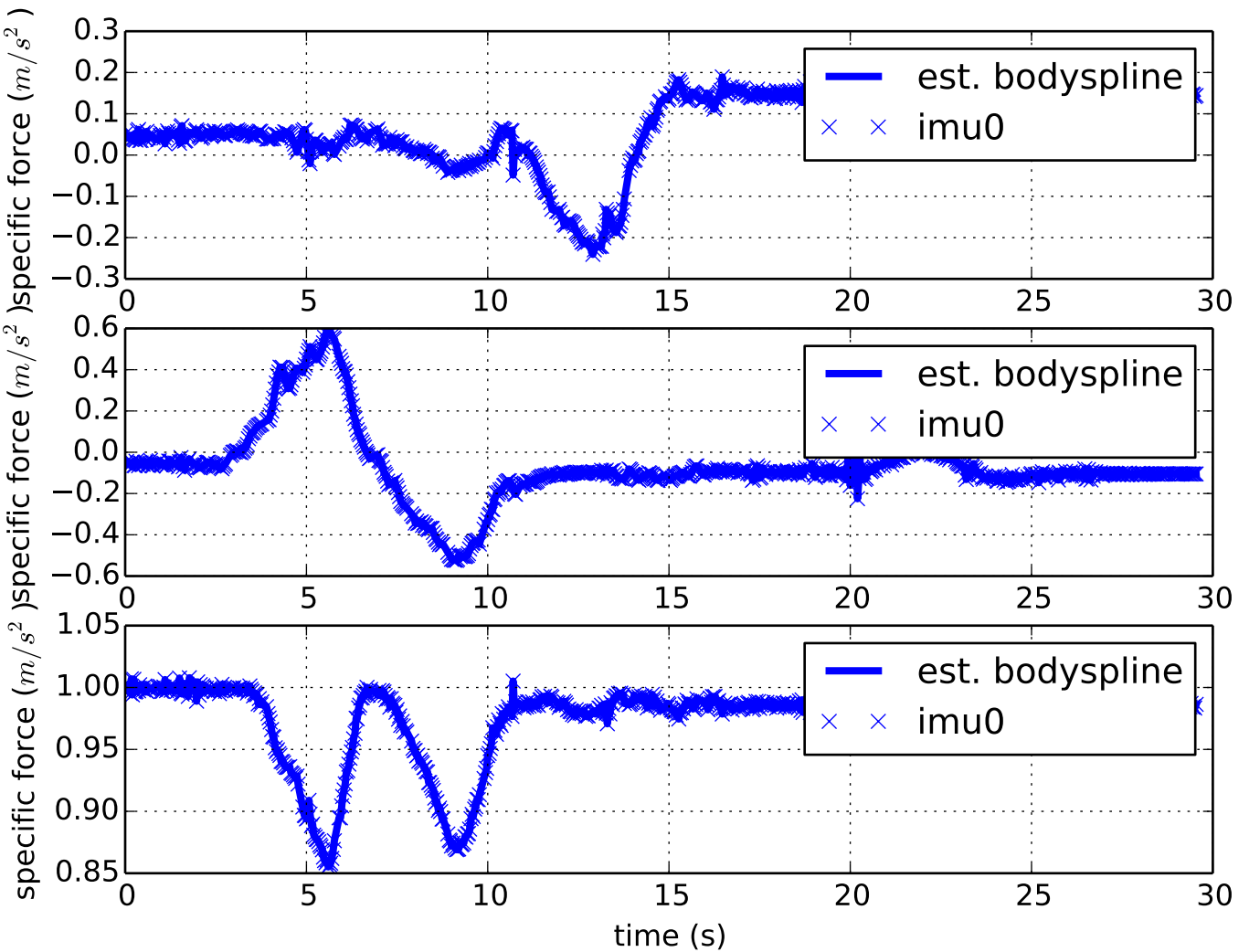
cam0

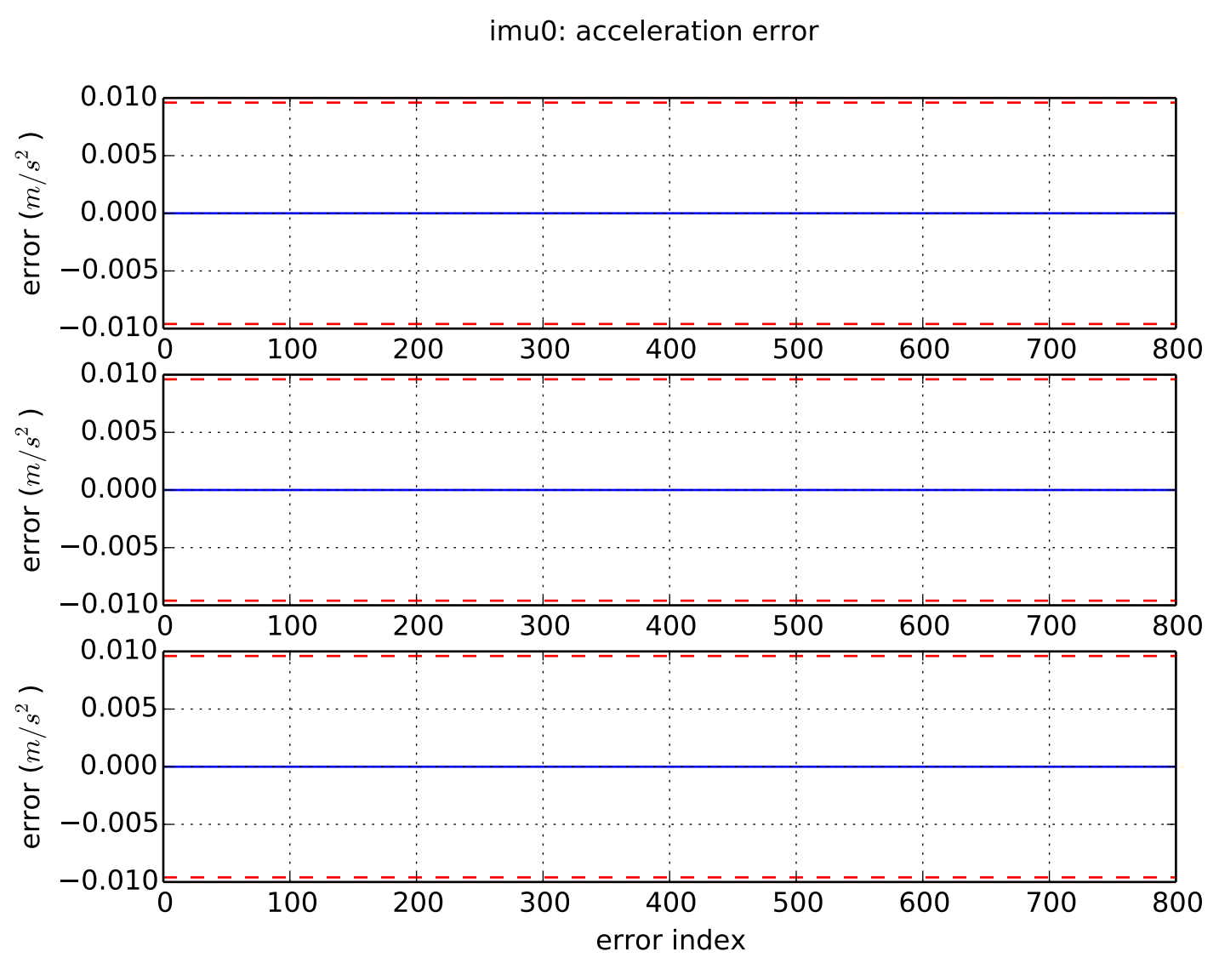
  Camera model: omni
  Focal length: [149.781, 149.6935]
  Principal point: [160.0177, 115.0287]
  Omni xi: 0.8731
  Distortion model: radtan
  Distortion coefficients: [-0.0578, 0.0052, -0.00030508, 7.2296e-05]
  Type: aprilgrid
  Tags:
    Rows: 6
    Cols: 6
    Size: 0.067 [m]
    Spacing 0.0199995 [m]

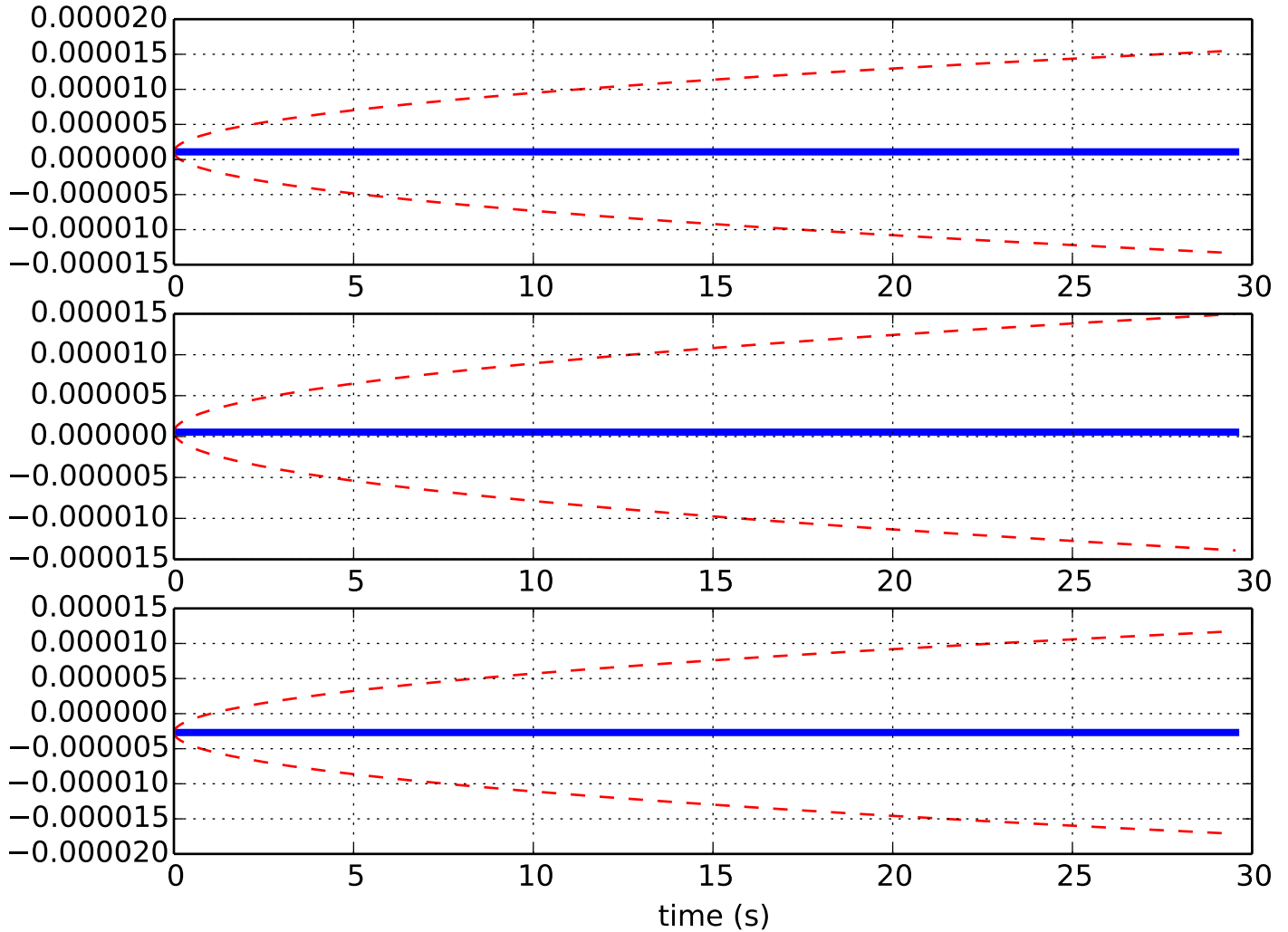
IMU configuration
==========

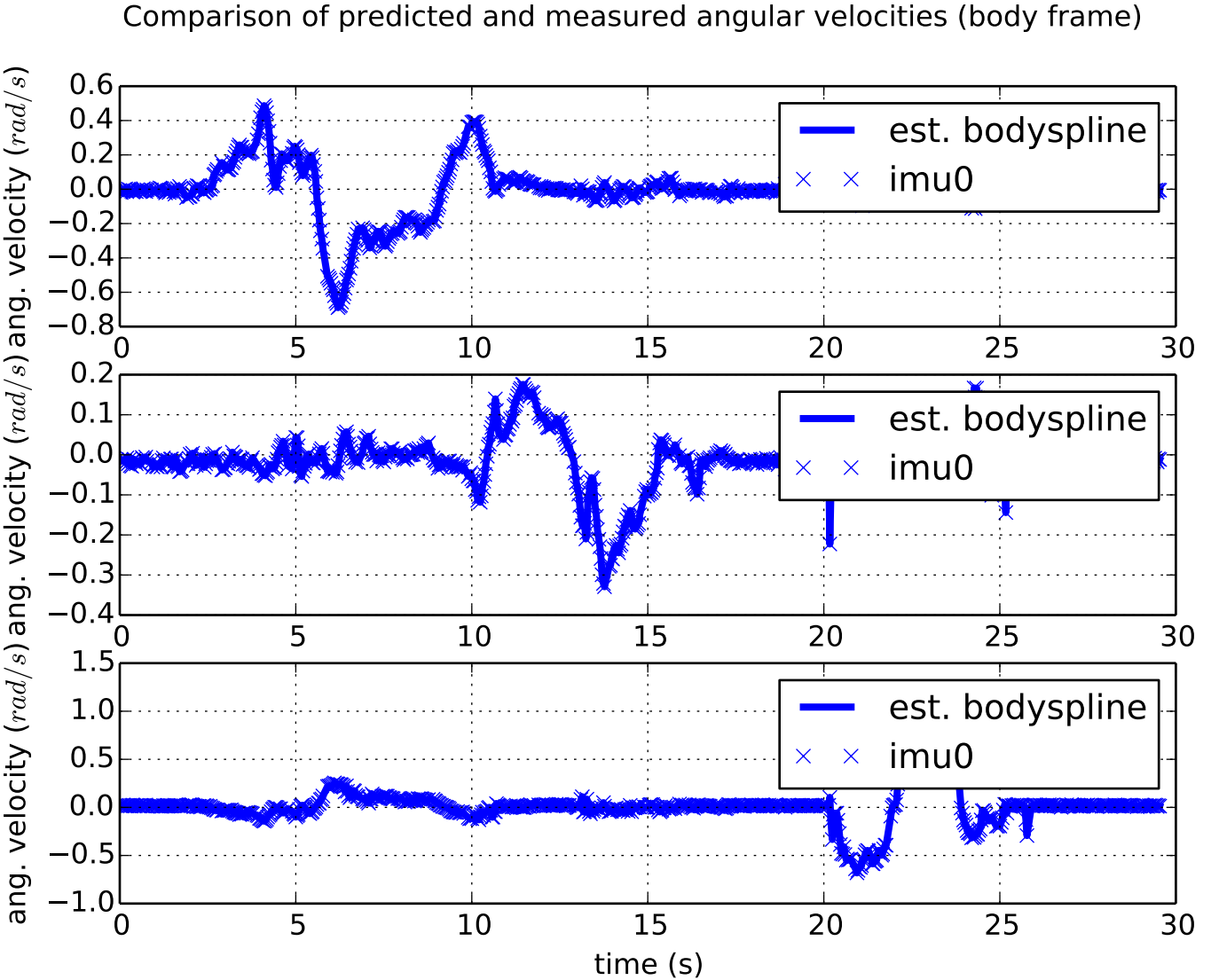
IMU0:

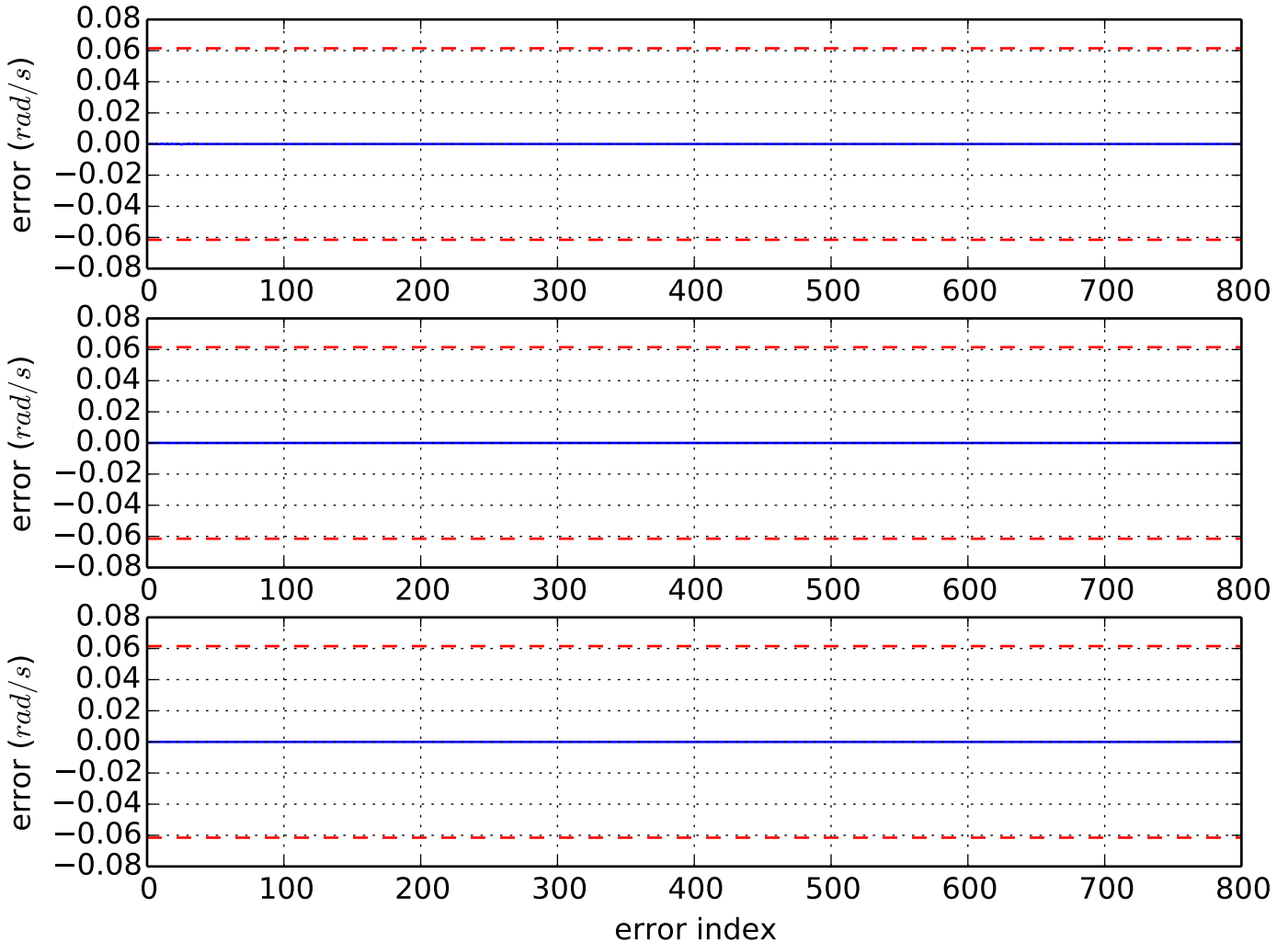
  Model: calibrated
  Update rate: 25
  Accelerometer:
    Noise density: 0.00064
    Noise density (discrete): 0.0032
    Random walk: 8.86e-07
  Gyroscope:
    Noise density: 0.0041
    Noise density (discrete): 0.0205
    Random walk: 5.7e-07
  T_i_b
    [[1. 0. 0. 0.]
     [0. 1. 0. 0.]
     [0. 0. 1. 0.]
     [0. 0. 0. 1.]]
  time offset with respect to IMU0: 0.0 [s]

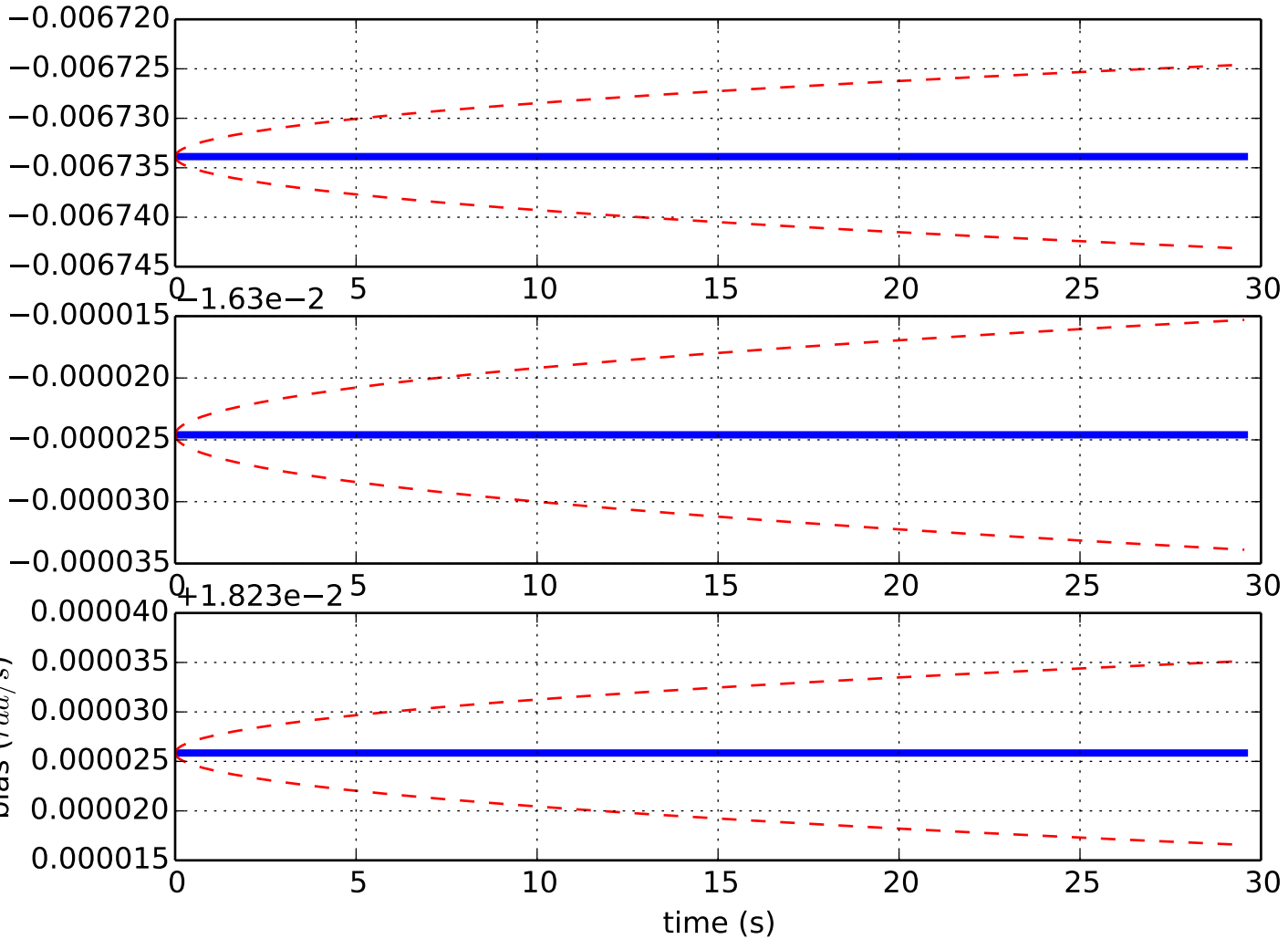

Comparison of predicted and measured specific force (imu0 frame)
specific force (m/s^2)
specific force (m/s^2)
specific force (m/s^2)
time (s)
est. bodyspline
imu0
est. bodyspline
imu0
est. bodyspline
imu0
0.3
0.2
0.1
0.0
−0.1
−0.2
−0.3
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
1.05
1.00
0.95
0.90
0.85
0
5
10
15
20
25
30

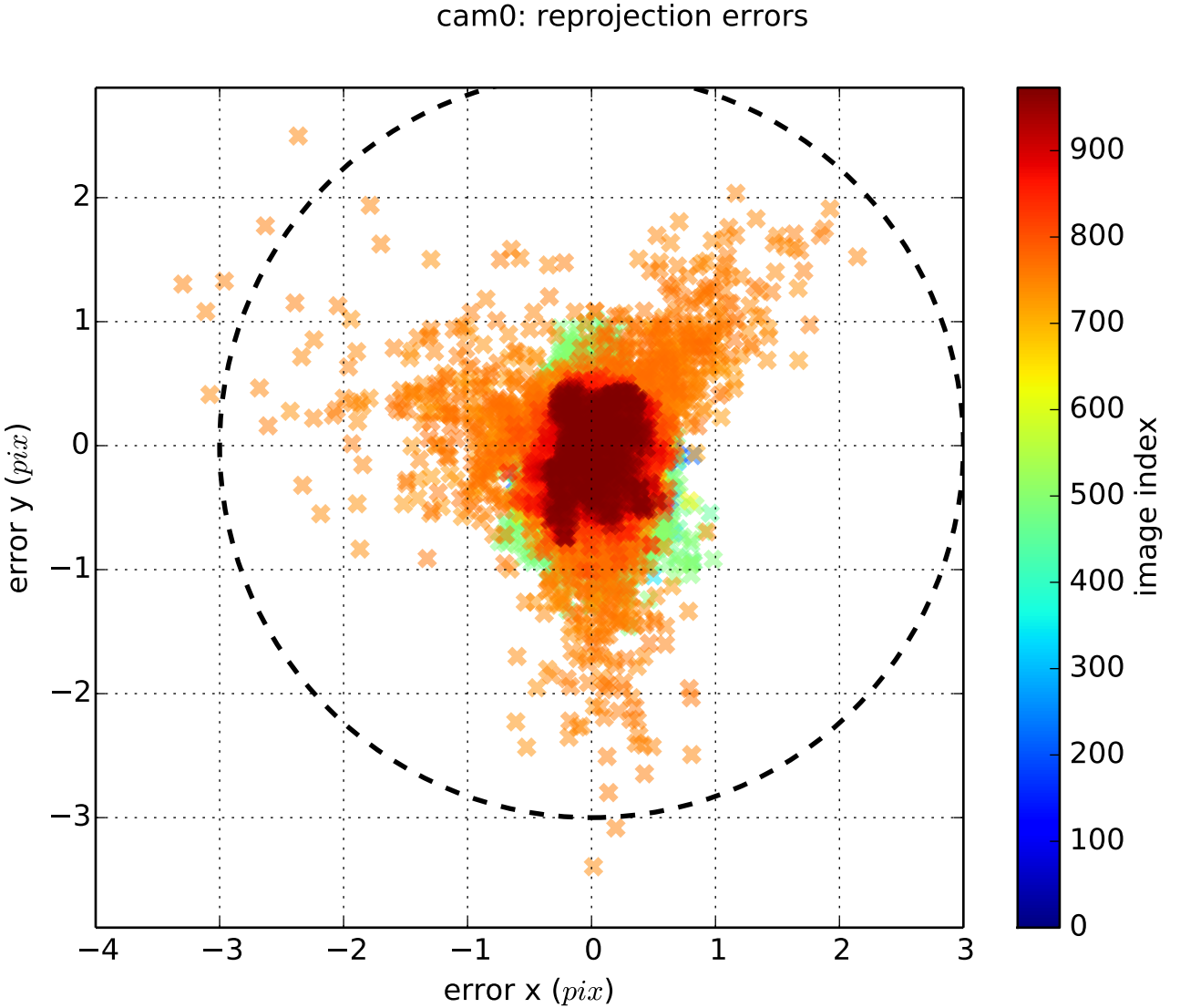

imu0: acceleration error
error (m/s^2)
0.010
0.005
0.000
−0.005
−0.010
0
100
200
300
400
500
600
700
800
error index


imu0: estimated accelerometer bias (imu frame)
0.000020
0.000015
0.000010
0.000005
0.000000
−0.000005
−0.000010
−0.000015
0
5
10
15
20
25
30
0.000015
0.000010
0.000005
0.000000
−0.000005
−0.000010
−0.000015
0
5
10
15
20
25
30
0.000015
0.000010
0.000005
0.000000
−0.000005
−0.000010
−0.000015
−0.000020
0
5
10
15
20
25
30
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)
0.08
0.06
0.04
0.02
0.00
−0.02
−0.04
−0.06
−0.08
0
100
200
300
400
500
600
700
800
error index


imu0: estimated gyro bias (imu frame)
−0.006720
−0.006725
−0.006730
−0.006735
−0.006740
−0.006745
0
5
10
15
20
25
30
−1.63e−2
−0.000015
−0.000020
−0.000025
−0.000030
−0.000035
0
5
10
15
20
25
30
+1.823e−2
0.000040
0.000035
0.000030
0.000025
0.000020
0.000015
0
5
10
15
20
25
30
time (s)


cam0: reprojection errors
error x (pix)
error y (pix)
image index
−4
−3
−2
−1
0
1
2
3
−3
−2
−1
0
1
2
0
100
200
300
400
500
600
700
800
900