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

Reprojection error (cam0):   mean 0.134219954494, median 0.12829689393, std: 0.0660671840205
Gyroscope error (imu0):   mean 0.0952240528817, median 0.0676565057239, std: 0.0860682433406
Accelerometer error (imu0):   mean 0.378146671905, median 0.214663397307, std: 0.514532565958

Residuals

Reprojection error (cam0) [px]:   mean 0.134219954494, median 0.12829689393, std: 0.0660671840205
Gyroscope error (imu0) [rad/s]:   mean 0.00673335735247, median 0.00478403739888, std: 0.00608594385109
Accelerometer error (imu0) [m/s^2]: mean 0.0534780151975, median 0.0303579887817, std: 0.072765893306

Transformation (cam0):

T_ci: (imu0 to cam0):
[[-0.99992106 0.00737756 0.01017094 0.04596007]
 [-0.01243936 -0.69538091 -0.71853368 -0.03925586]
 [0.00177165 -0.71860348 0.69541779 -0.04599319]
 [0.   0.   0.   1.   ]]

T_ic: (cam0 to imu0):
[[-0.99992106 -0.01243936 0.00177165 0.04554961]
 [0.00737756 -0.69538091 -0.71860348 -0.06068771]
 [0.01017094 -0.71853368 0.69541779 0.00331037]
 [0.   0.   0.   1.   ]]

timeshift cam0 to imu0: [s] (t_imu = t_cam + shift)
0.0040597491644

Gravity vector in target coords: [m/s^2]
[-0.03104273 -9.61162657 -1.94527475]

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

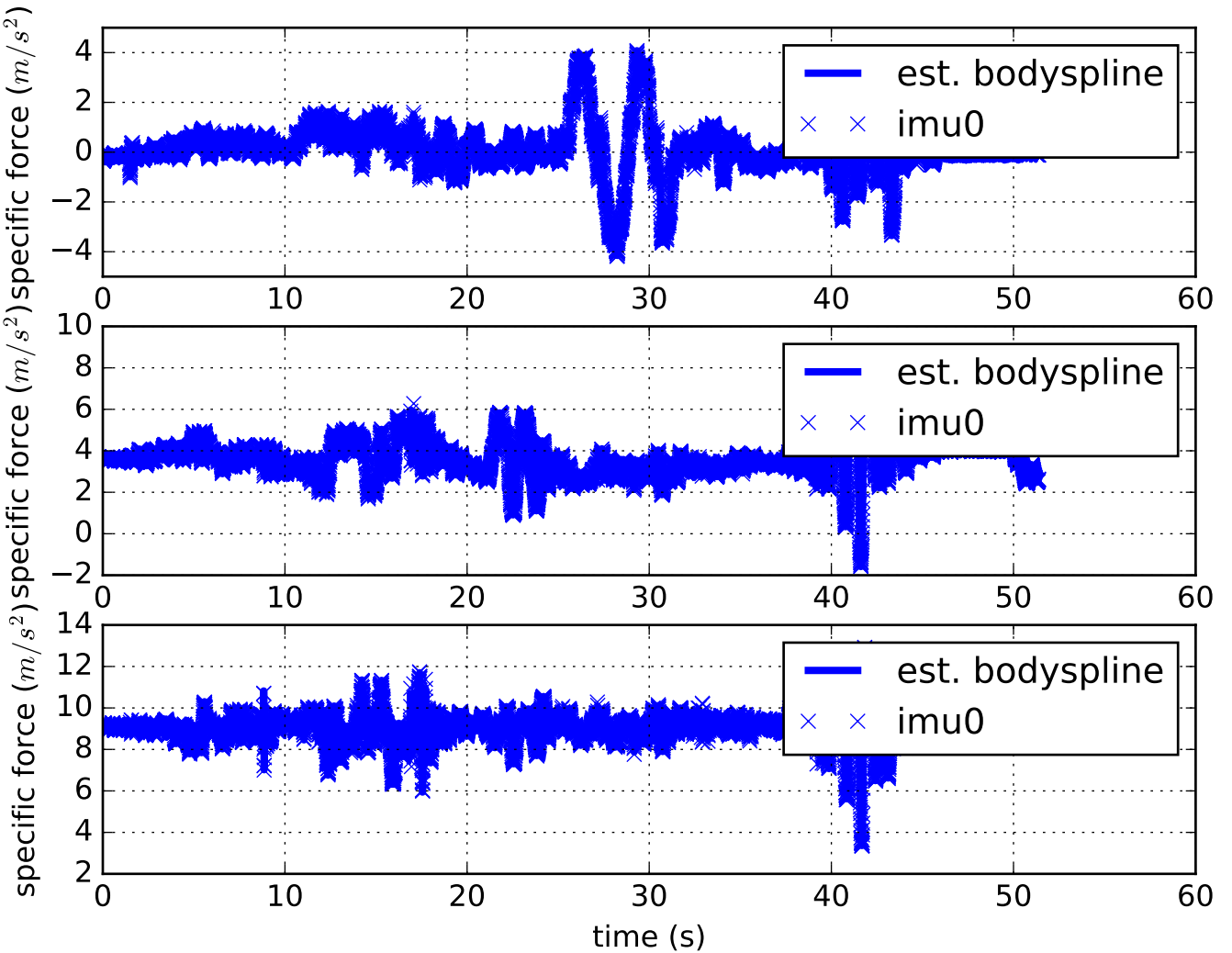
cam0

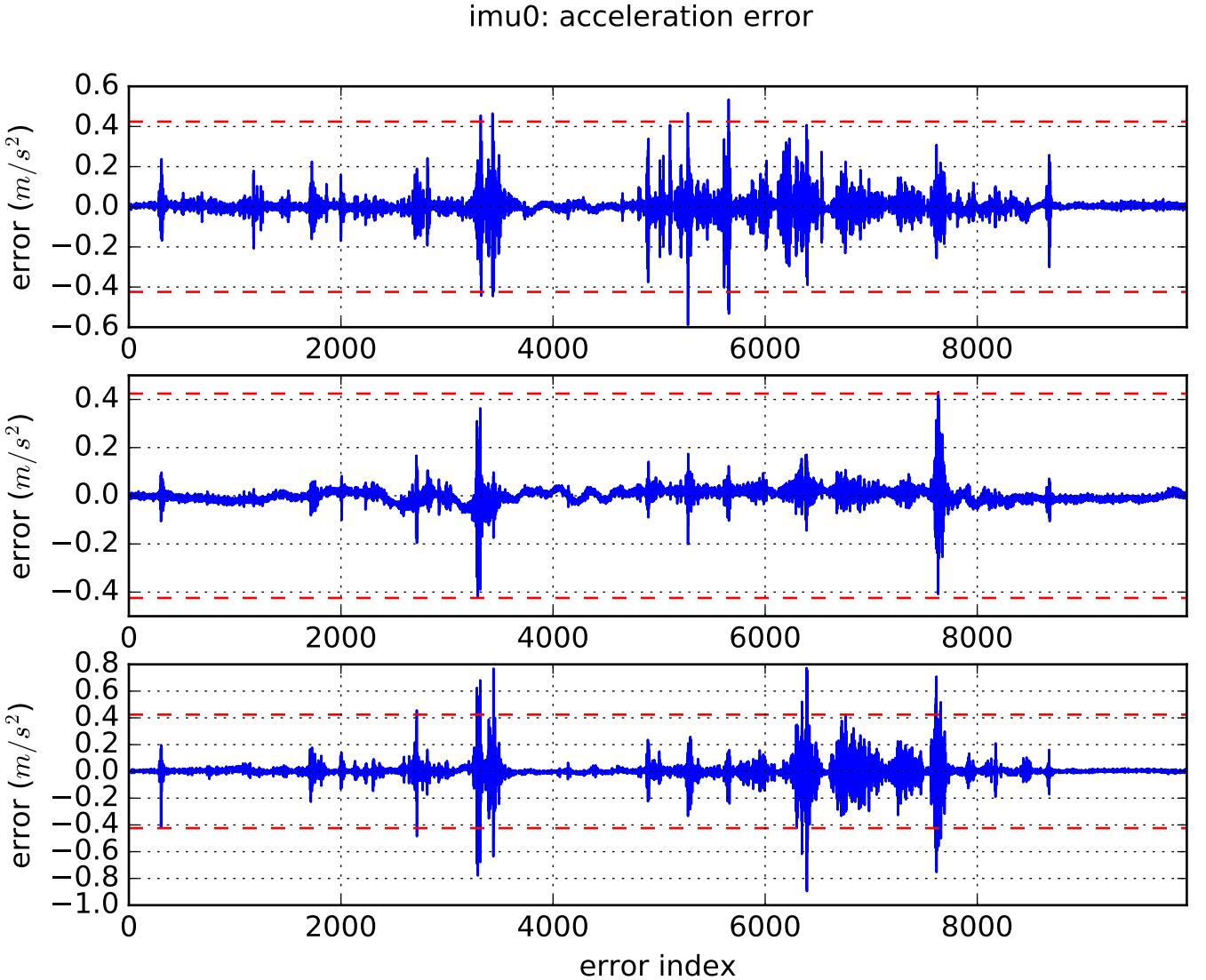
  Camera model: pinhole
  Focal length: [695.8014423211335, 703.2550985209633]
  Principal point: [405.71108272944616, 248.97501513134145]
  Distortion model: equidistant
  Distortion coefficients: [0.4431184118668466, 1.228503777075885, -10.007688137460061, 19.32555855139353]
  Type: aprilgrid
  Tags:
    Rows: 6
    Cols: 6
    Size: 0.083 [m]
    Spacing 0.0249 [m]

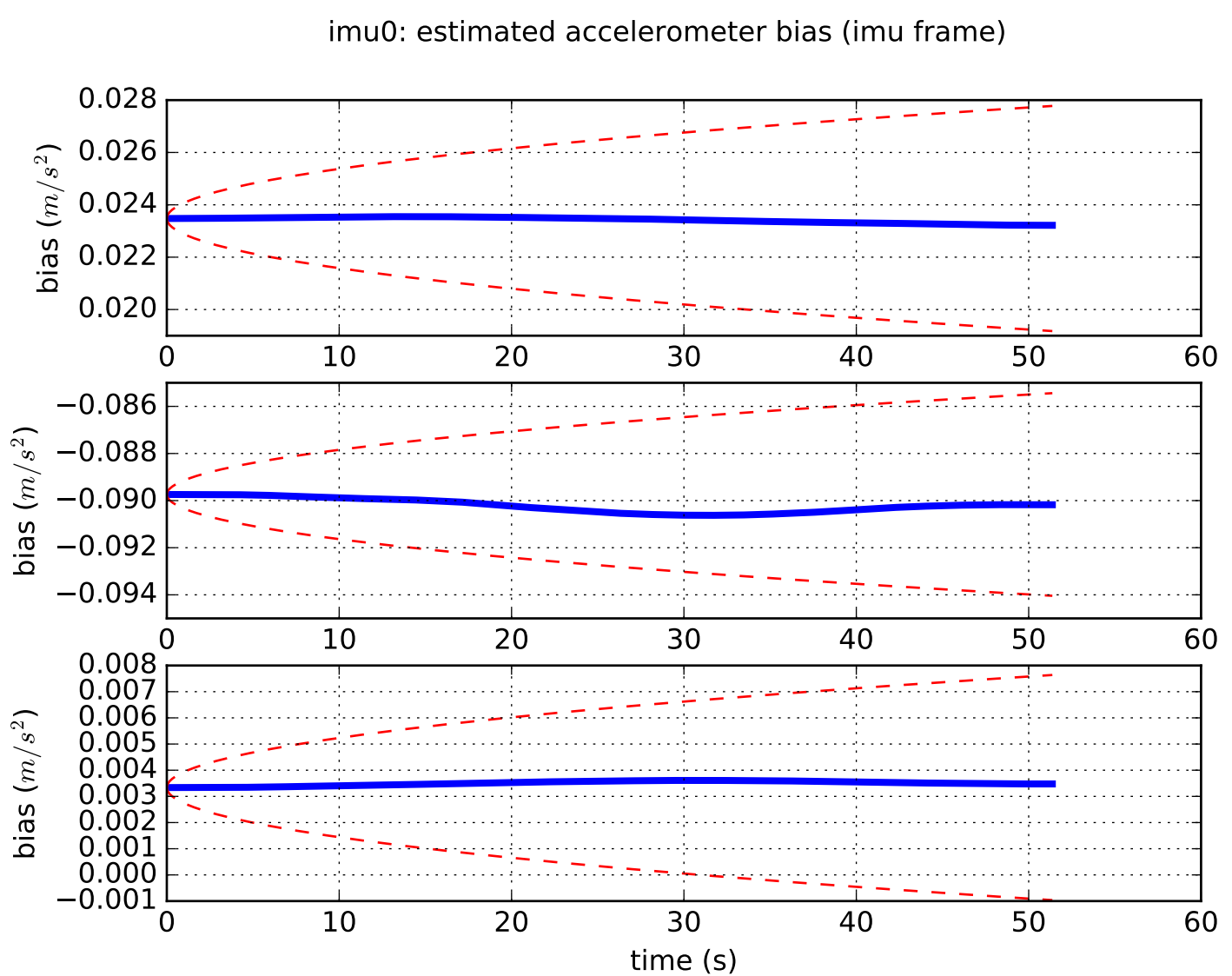
IMU configuration
==========

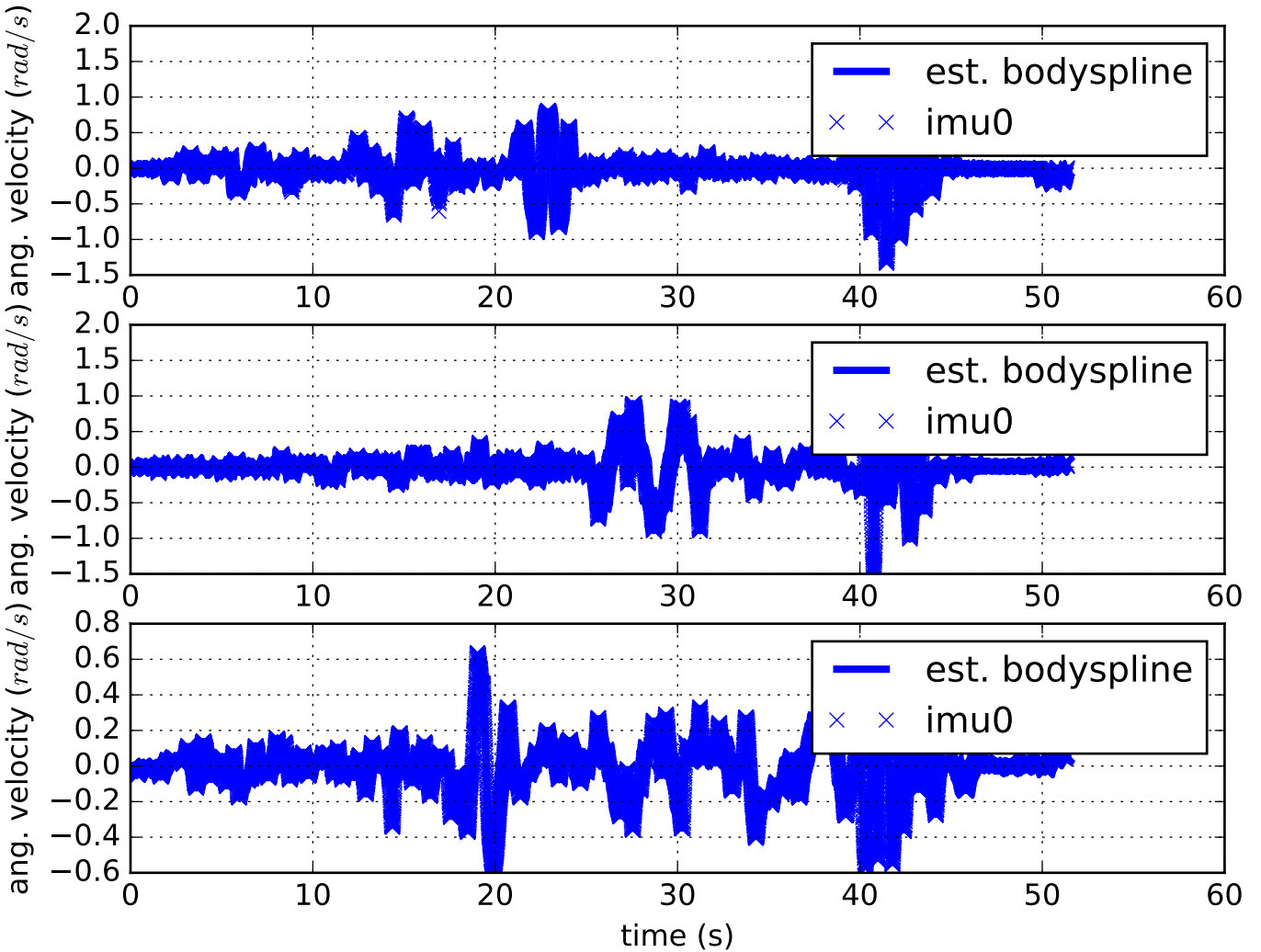
IMU0:

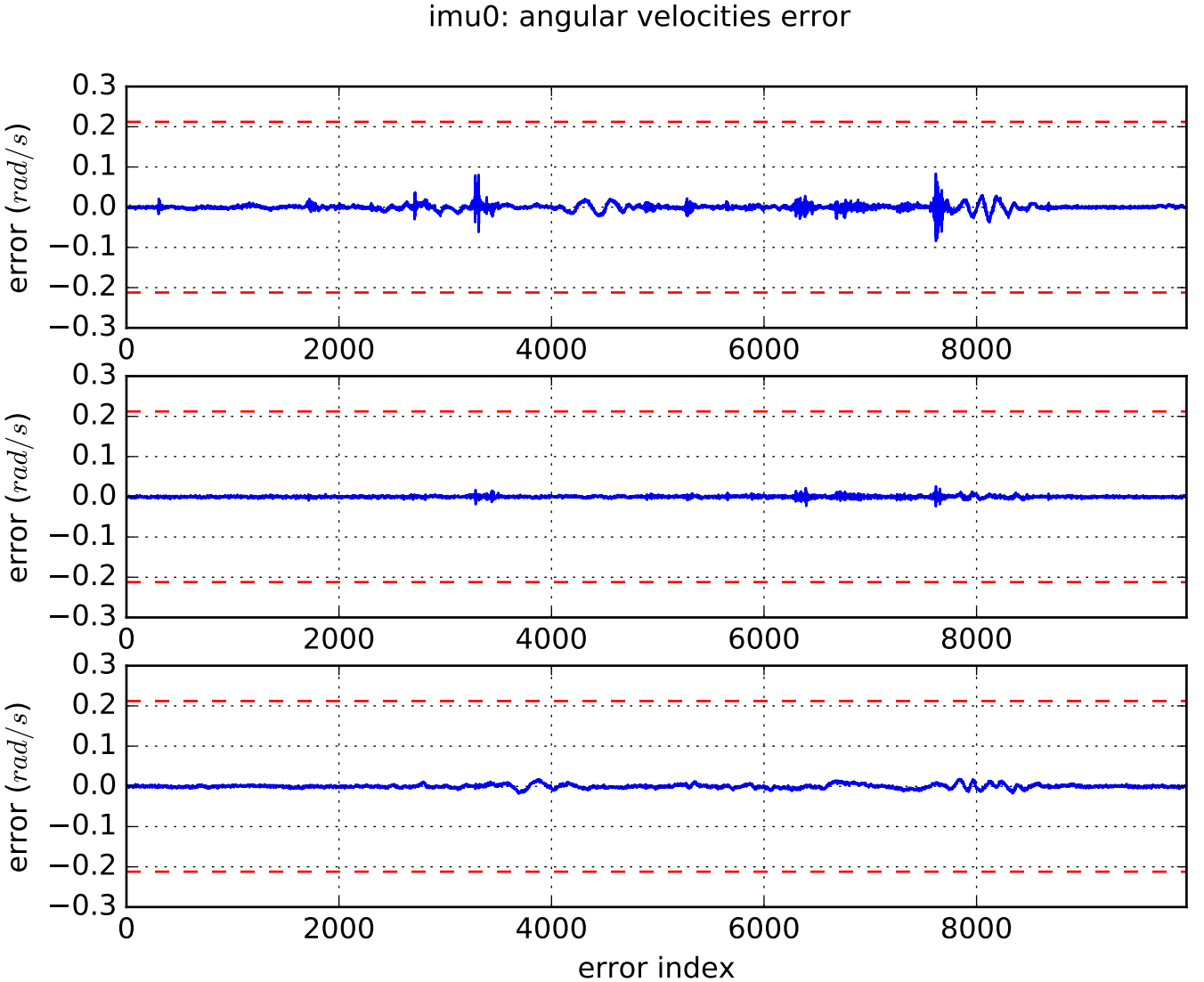
  Model: calibrated
  Update rate: 200.0
  Accelerometer:
    Noise density: 0.01
    Noise density (discrete): 0.141421356237
    Random walk: 0.0002
  Gyroscope:
    Noise density: 0.005
    Noise density (discrete): 0.0707106781187
    Random walk: 4e-06
  T_i_b
    [[1. 0. 0. 0.]
     [0. 1. 0. 0.]
     [0. 0. 1. 0.]
     [0. 0. 0. 1.]]
  time offset with respect to IMU0: 0.0 [s]

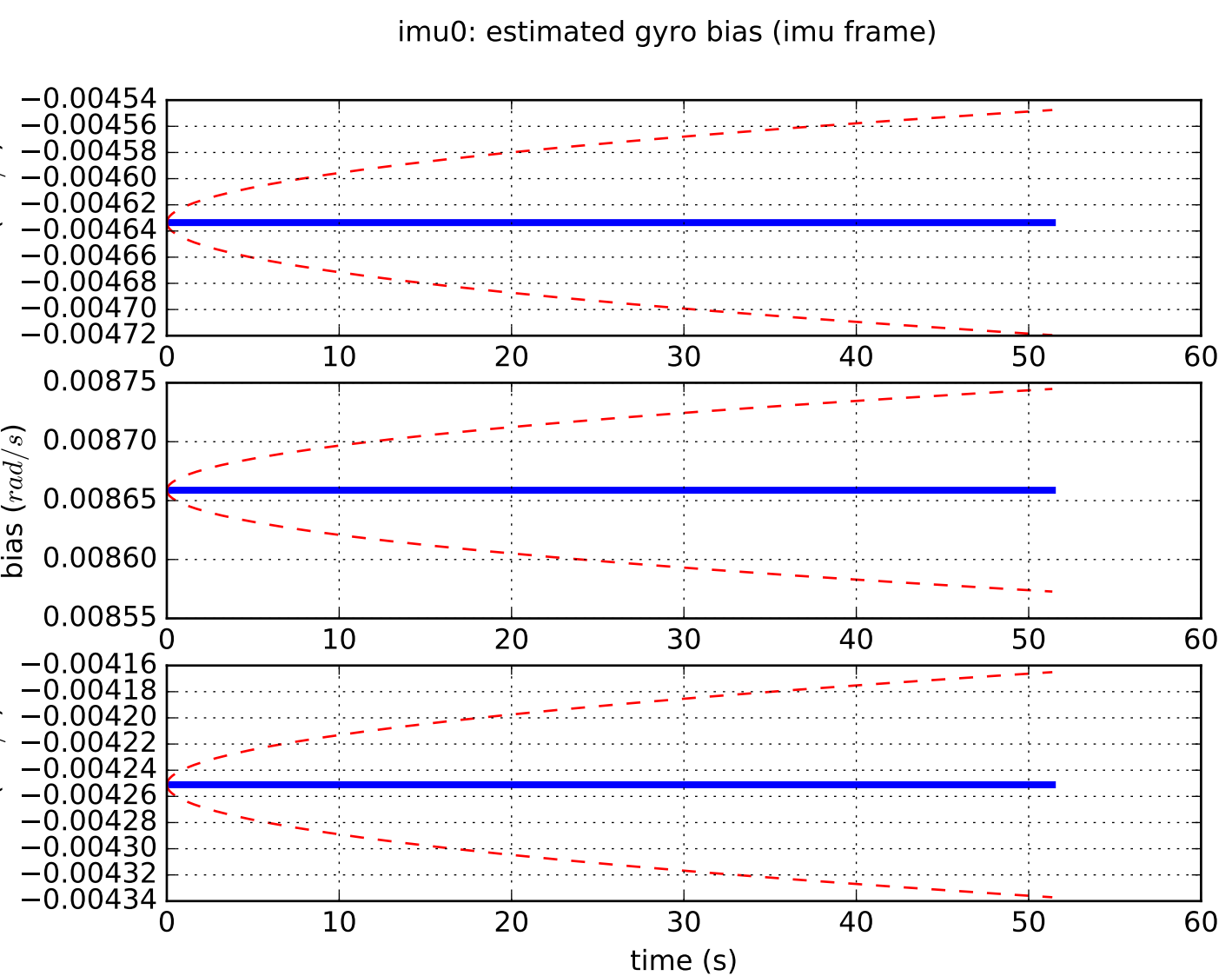

Comparison of predicted and measured specific force (imu0 frame)
specific force (m/s^2)
est. bodyspline
imu0
time (s)

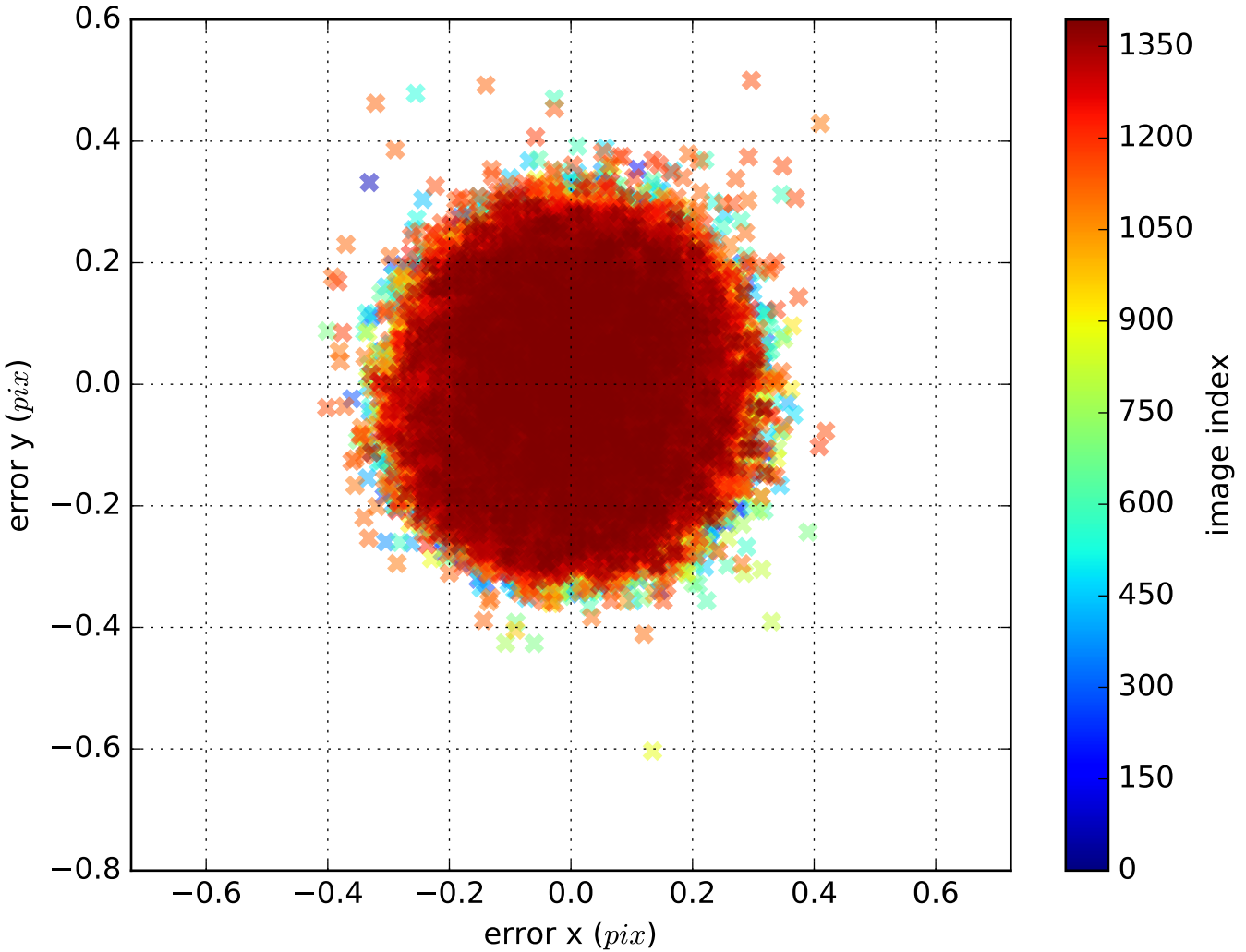

imu0: acceleration error
error (m/s^2)
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
0
2000
4000
6000
8000
error (m/s^2)
0.4
0.2
0.0
−0.2
−0.4
0
2000
4000
6000
8000
error (m/s^2)
0.8
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
−0.8
−1.0
0
2000
4000
6000
8000
error index


imu0: estimated accelerometer bias (imu frame)
bias (m/s^2)
0.028
0.026
0.024
0.022
0.020
0
10
20
30
40
50
60
bias (m/s^2)
−0.086
−0.088
−0.090
−0.092
−0.094
bias (m/s^2)
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0.000
−0.001
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
2000
4000
6000
8000
error index


imu0: estimated gyro bias (imu frame)
bias (rad/s)
time (s)
−0.00454
−0.00456
−0.00458
−0.00460
−0.00462
−0.00464
−0.00466
−0.00468
−0.00470
−0.00472
0.00875
0.00870
0.00865
0.00860
0.00855
−0.00416
−0.00418
−0.00420
−0.00422
−0.00424
−0.00426
−0.00428
−0.00430
−0.00432
−0.00434
0
10
20
30
40
50
60


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
−0.8
−0.6
−0.4
−0.2
0.0
0.2
0.4
0.6
1350
1200
1050
900
750
600
450
300
150
0