

## Calibration results

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### Normalized Residuals

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Reprojection error (cam0): mean 0.141015842928, median 0.125185684829, std: 0.126044030632  
Reprojection error (cam1): mean 0.166999069361, median 0.153355187246, std: 0.115491960551  
Gyroscope error (imu0): mean 0.970890104447, median 0.893896459935, std: 0.488717373825  
Accelerometer error (imu0): mean 1.82758187346, median 1.55877035219, std: 1.3341732192

### Residuals

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Reprojection error (cam0) [px]: mean 0.141015842928, median 0.125185684829, std: 0.126044030632  
Reprojection error (cam1) [px]: mean 0.166999069361, median 0.153355187246, std: 0.115491960551  
Gyroscope error (imu0) [rad/s]: mean 0.00256759593264, median 0.00236398012938, std: 0.00129245188049  
Accelerometer error (imu0) [m/s^2]: mean 0.0480733939353, median 0.041002475612, std: 0.0350945890173

### Transformation (cam0):

-----  
T\_ci: (imu0 to cam0):

```
[[ 0.99986695 -0.01620327 -0.00188099 -0.03778137]
 [ 0.01619133 0.99984971 -0.00619728 0.00817552]
 [ 0.00198113 0.006166 0.99997903 0.00772258]
 [ 0. 0. 0. 1. ]]
```

T\_ic: (cam0 to imu0):

```
[[ 0.99986695 0.01619133 0.00198113 0.03762868]
 [-0.01620327 0.99984971 0.006166 -0.00883409]
 [-0.00188099 -0.00619728 0.99997903 -0.00774282]
 [ 0. 0. 0. 1. ]]
```

timeshift cam0 to imu0: [s] (t\_imu = t\_cam + shift)

0.0

### Transformation (cam1):

-----  
T\_ci: (imu0 to cam1):

```
[[ 0.99989105 -0.01456154 -0.00241926 0.07216329]
 [ 0.01454921 0.99988146 -0.00503772 0.00841687]
 [ 0.00249233 0.00500197 0.99998438 0.00851376]
```

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

T\_ic: (cam1 to imu0):

```
[[ 0.99989105  0.01454921  0.00249233 -0.07229911]
 [-0.01456154  0.99988146  0.00500197 -0.00740765]
 [-0.00241926 -0.00503772  0.99998438 -0.00829665]
 [ 0.      0.      0.      1.    ]]
```

timeshift cam1 to imu0: [s] (t\_imu = t\_cam + shift)  
0.0

Baselines:

-----  
Baseline (cam0 to cam1):

```
[[ 0.99999851  0.00164522 -0.00052809  0.10993524]
 [-0.0016446  0.99999798  0.00115648  0.0001703 ]
 [ 0.00052999 -0.00115561  0.99999919  0.00082066]
 [ 0.      0.      0.      1.    ]]
```

baseline norm: 0.109938432078 [m]

Gravity vector in target coords: [m/s^2]

```
[-9.80599095 -0.09418964 -0.04574641]
```

Calibration configuration

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cam0

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Camera model: pinhole

Focal length: [470.57998085970013, 470.81737359662117]

Principal point: [359.64961376216576, 250.26872216088455]

Distortion model: radtan

Distortion coefficients: [-0.2997493046323177, 0.09538277522623304, -3.949561182735437e-05, -0.00038735618688347717]

Type: checkerboard

Rows

Count: 11

Distance: 0.07 [m]

Cols

Count: 8  
Distance: 0.07 [m]

cam1

-----  
Camera model: pinhole  
Focal length: [467.48740166378445, 467.8730941261102]  
Principal point: [374.5918266022028, 235.4393912751647]  
Distortion model: radtan  
Distortion coefficients: [-0.2930320461754, 0.08501667468497115, 0.0002806281247626826, 4.076377343204238e-05]  
Type: checkerboard  
Rows  
  Count: 11  
  Distance: 0.07 [m]  
Cols  
  Count: 8  
  Distance: 0.07 [m]

IMU configuration

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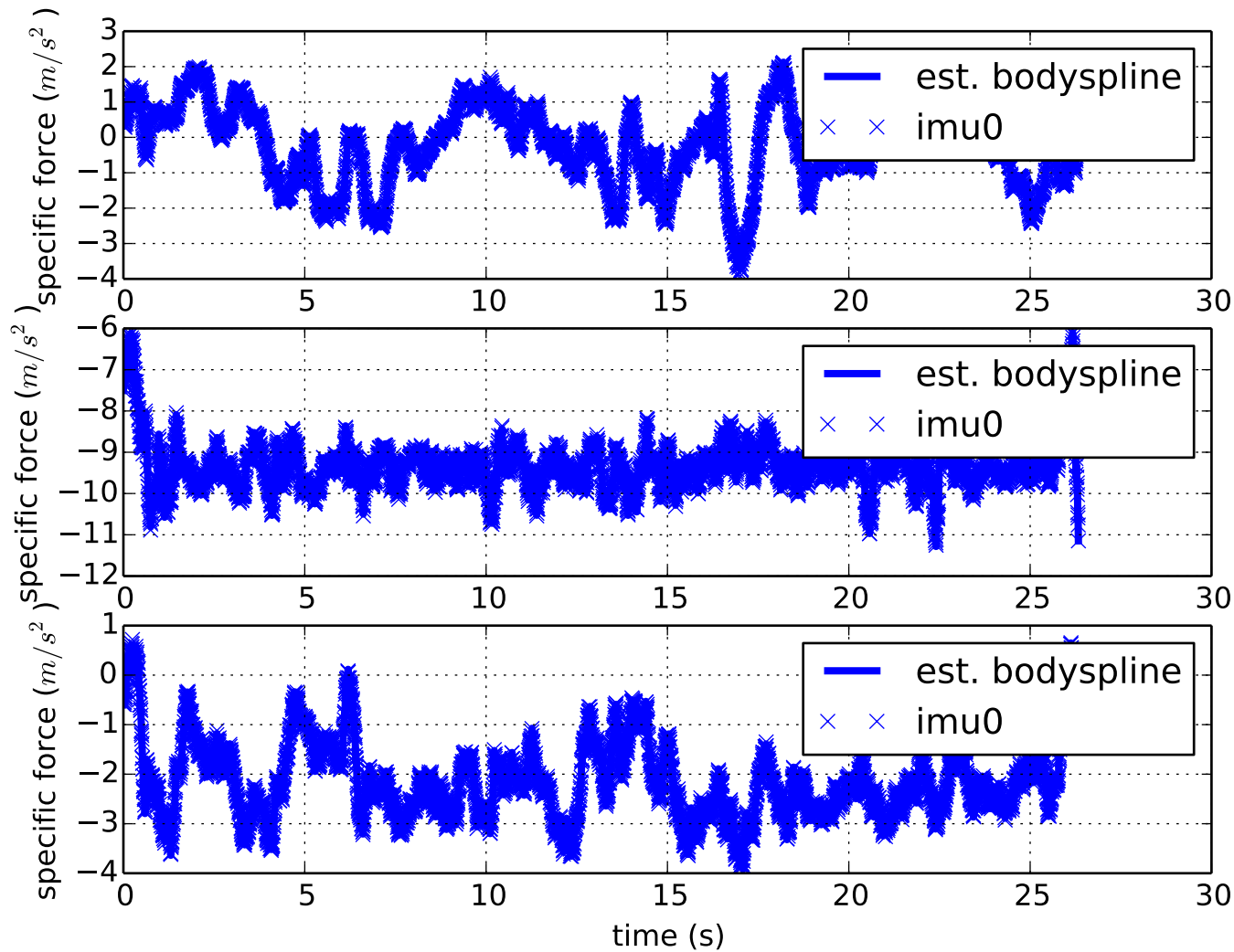
IMU0:

-----  
Model: calibrated  
Update rate: 200.0  
Accelerometer:  
  Noise density: 0.00186  
  Noise density (discrete): 0.0263043722601  
  Random walk: 0.000433  
Gyroscope:  
  Noise density: 0.000187  
  Noise density (discrete): 0.00264457936164  
  Random walk: 2.66e-05  
T\_i\_b  
  [[ 1. 0. 0. 0.]  
  [ 0. 1. 0. 0.]  
  [ 0. 0. 1. 0.]

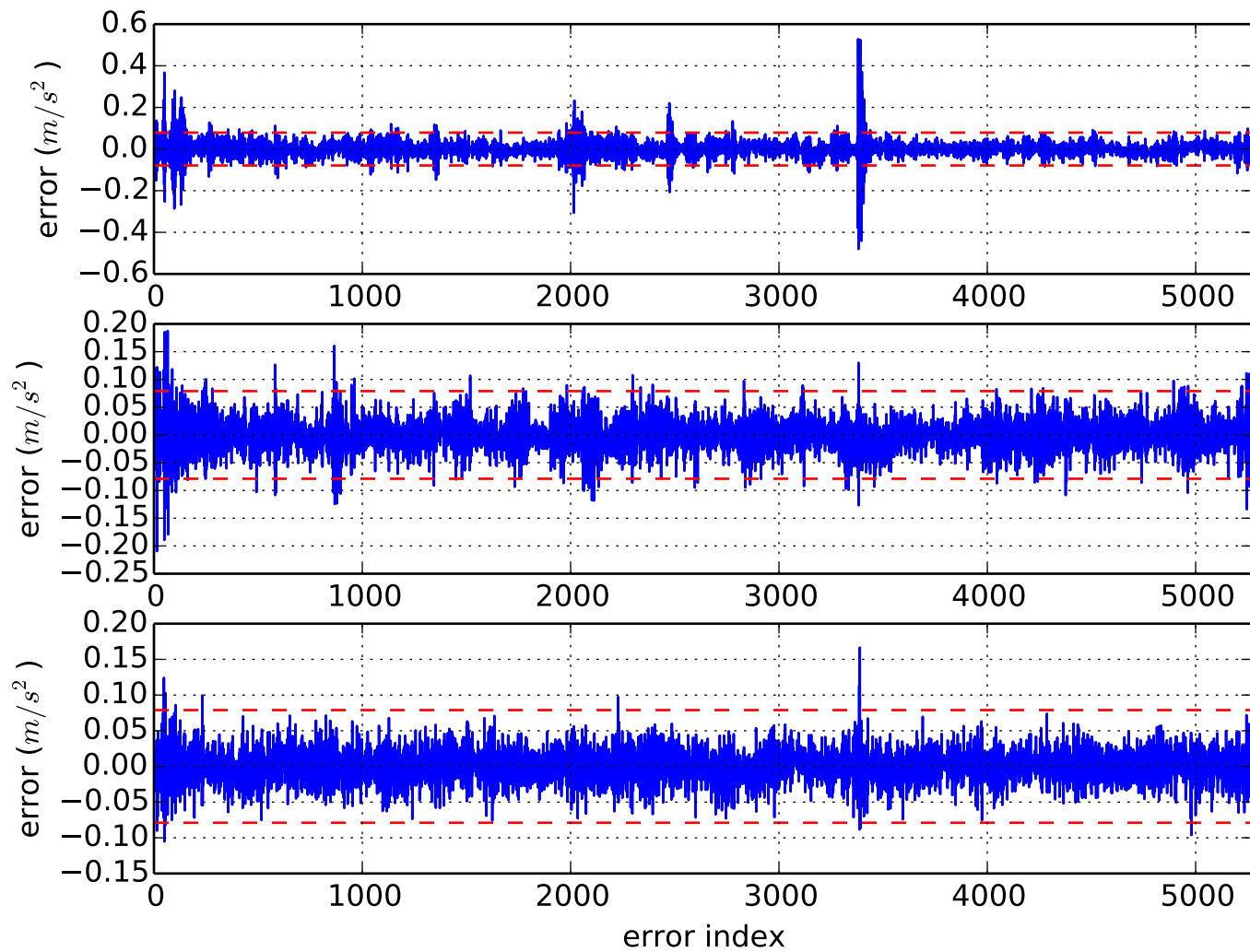
[ 0. 0. 0. 1.]

time offset with respect to IMU0: 0.0 [s]

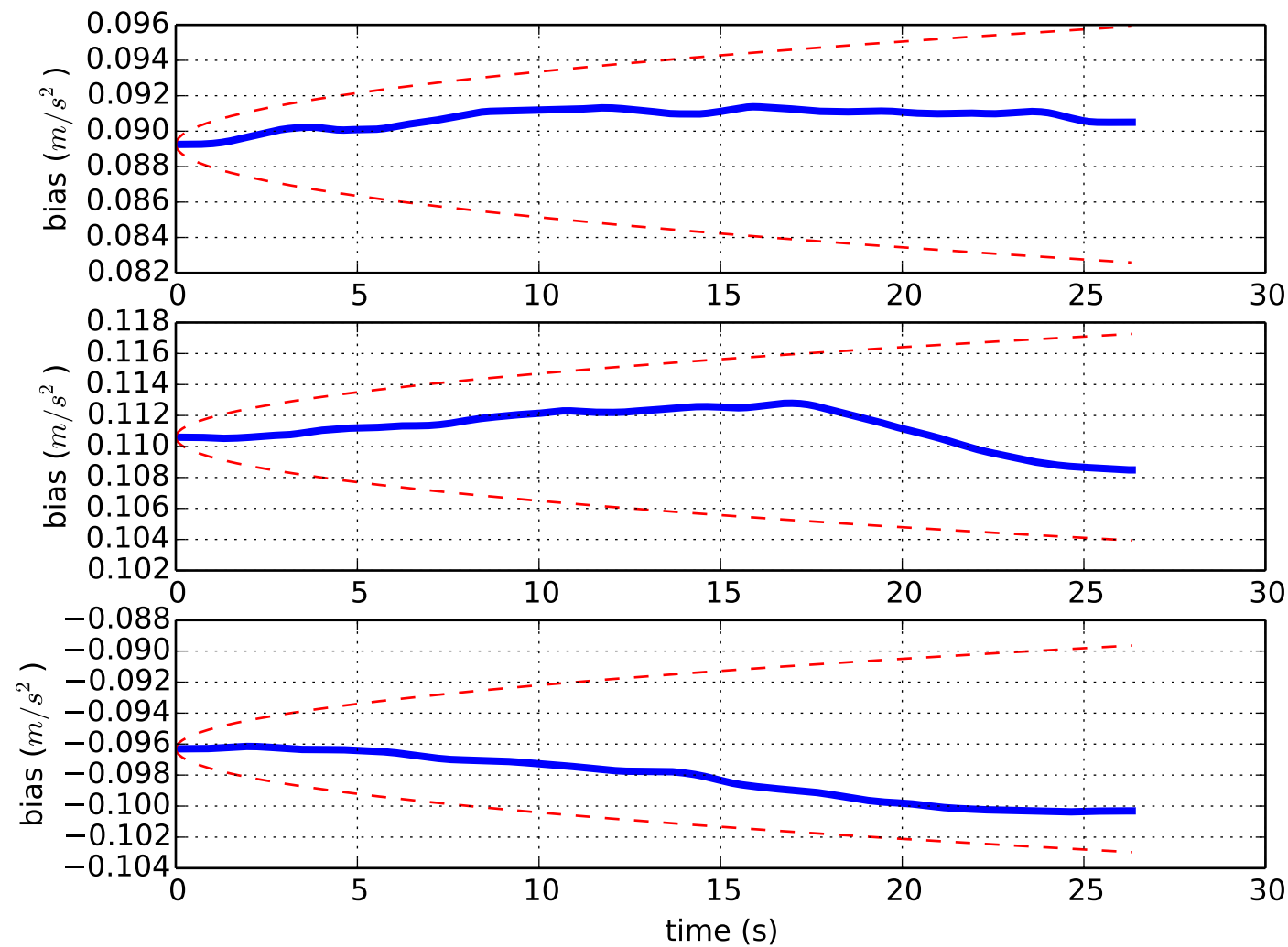
Comparison of predicted and measured specific force (imu0 frame)



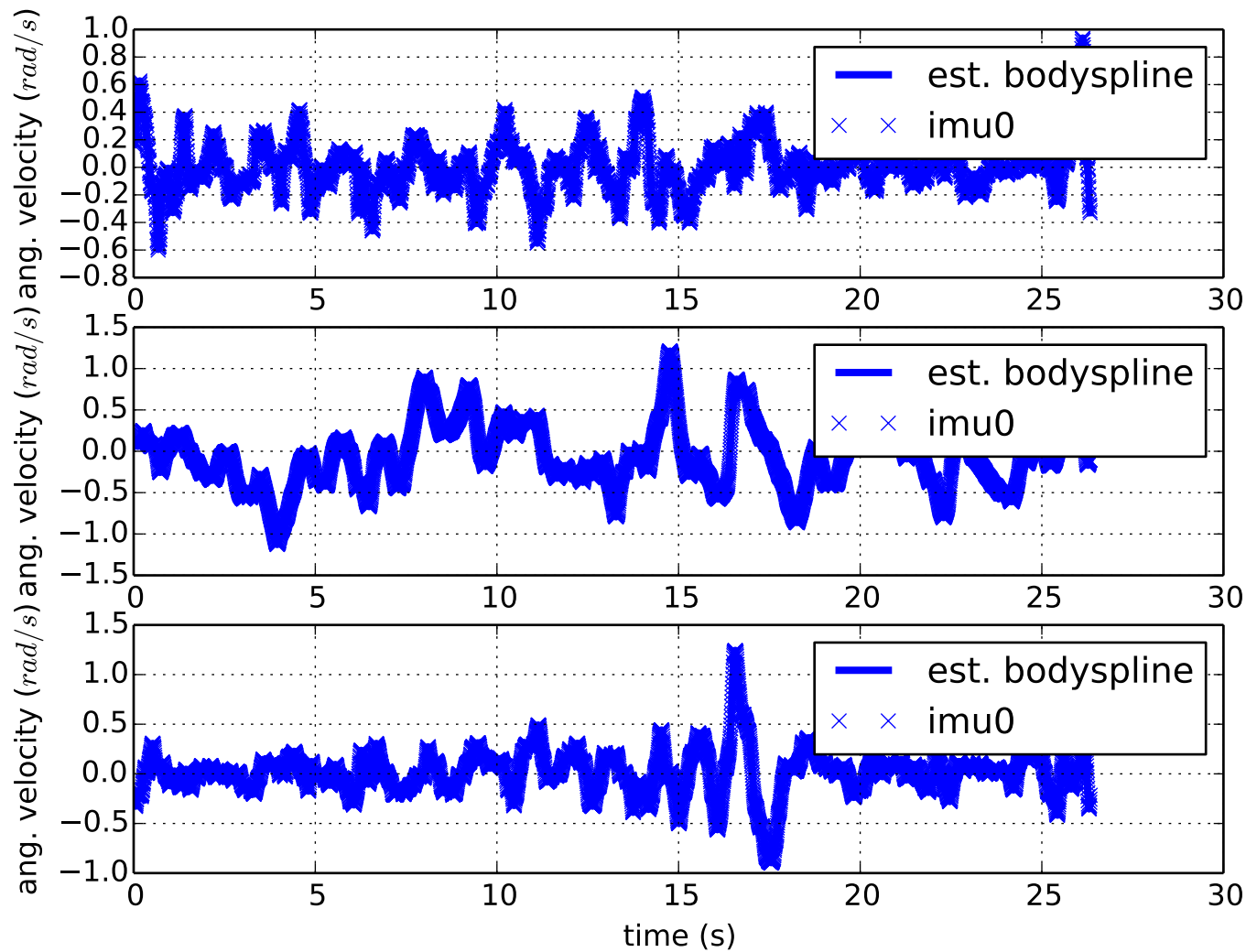
imu0: acceleration error



imu0: estimated accelerometer bias (imu frame)

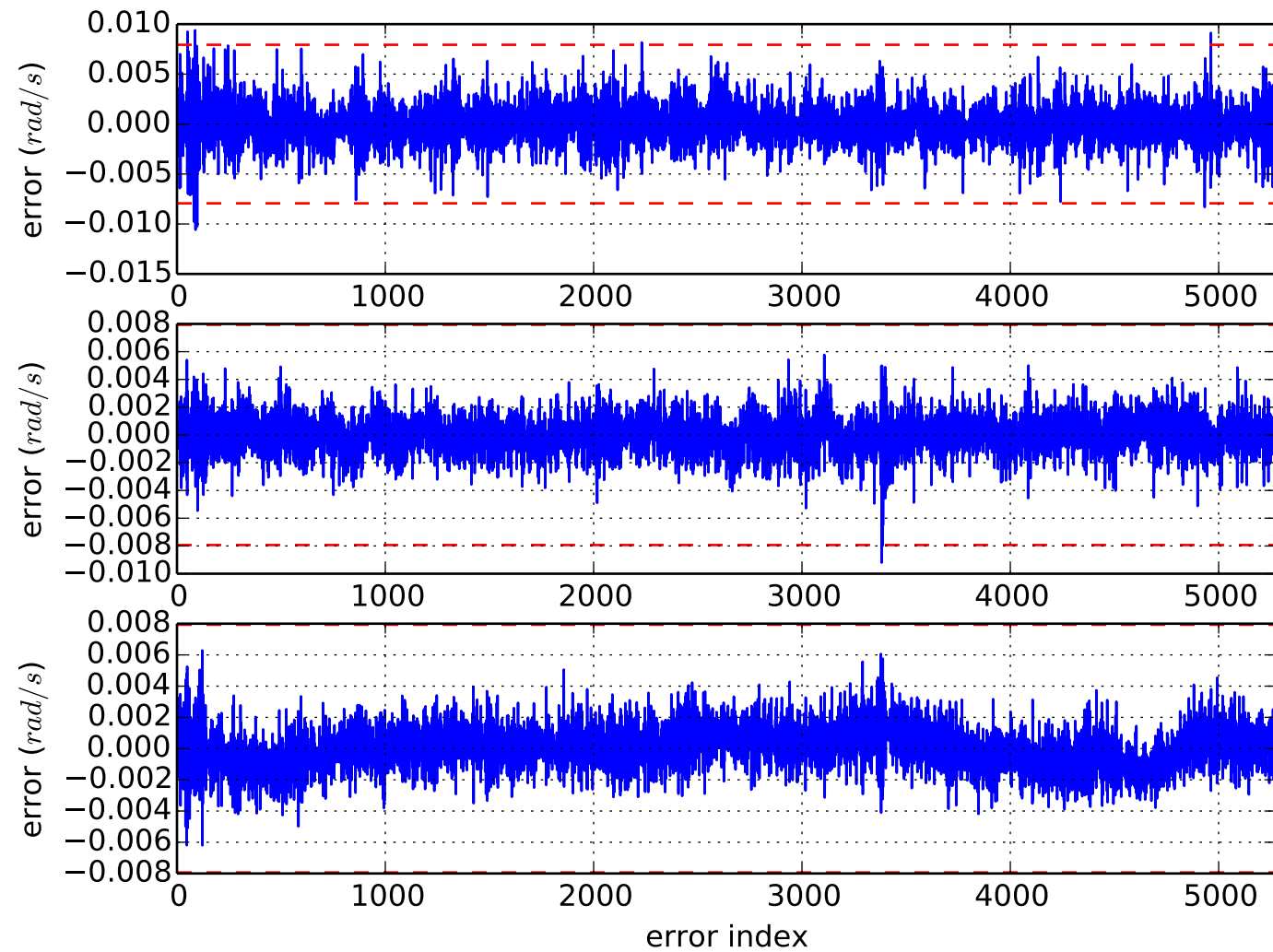


Comparison of predicted and measured angular velocities (body frame)

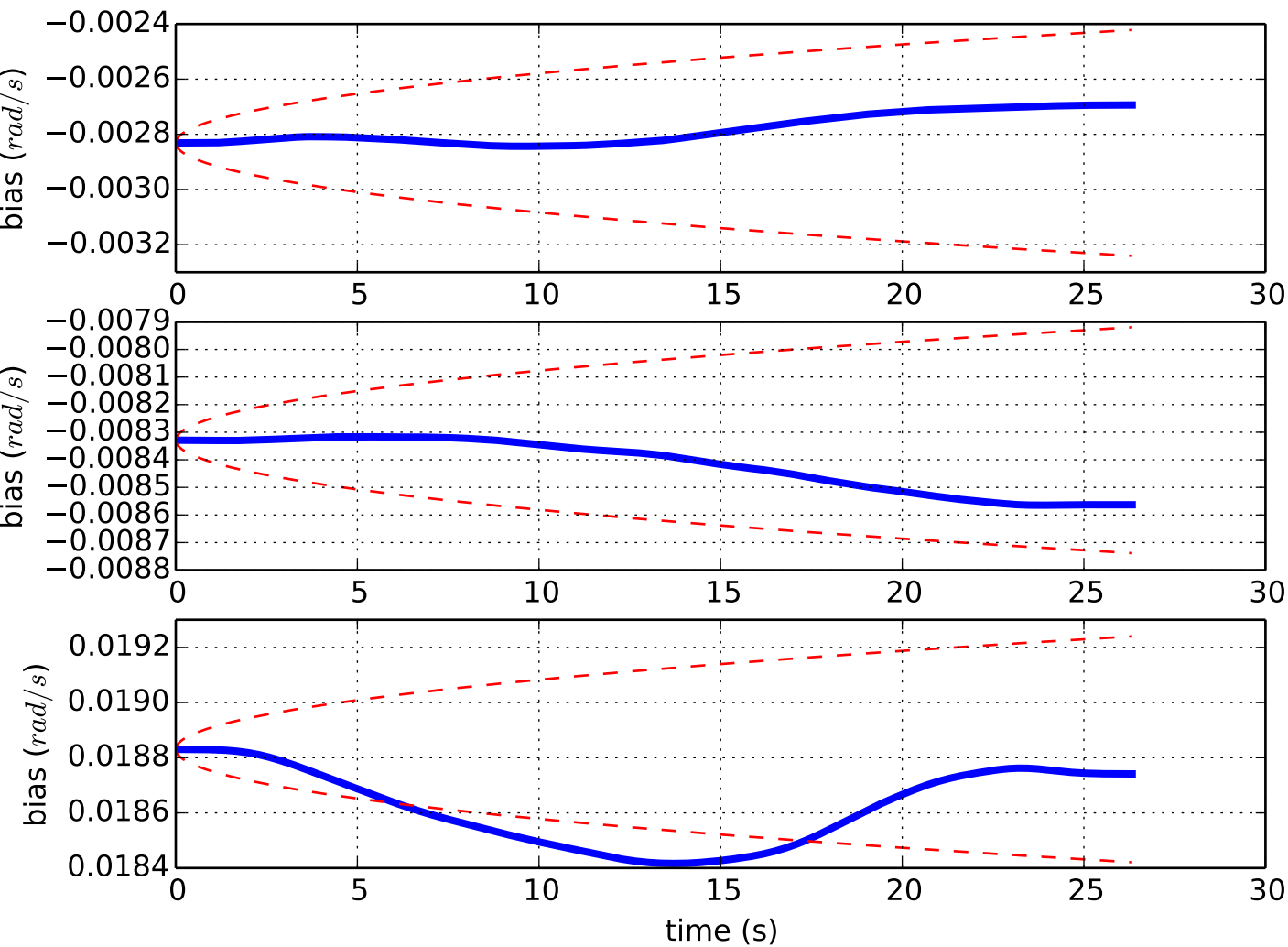




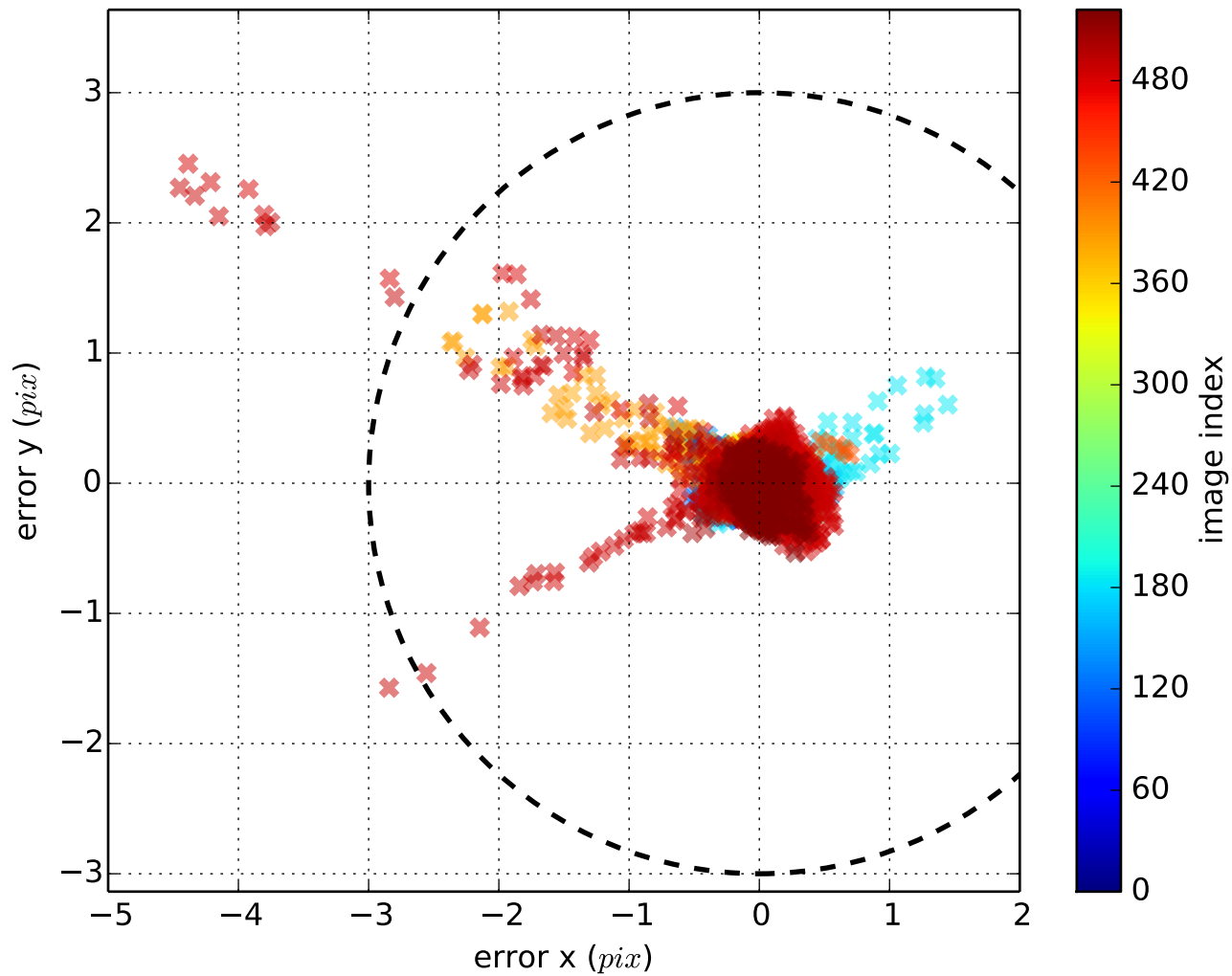
imu0: angular velocities error



imu0: estimated gyro bias (imu frame)



cam0: reprojection errors



cam1: reprojection errors

