

## Calibration results

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### Normalized Residuals

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Reprojection error (cam0): mean 0.305115037981, median 0.220667067997, std: 0.281368337133  
Reprojection error (cam1): mean 0.229906526375, median 0.170614480475, std: 0.217368624527  
Gyroscope error (imu0): mean 0.000153019553023, median 3.43768848555e-05, std: 0.000587987029  
Accelerometer error (imu0): mean 0.000507487085942, median 0.000341867398537, std: 0.00095836861

### Residuals

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Reprojection error (cam0) [px]: mean 0.305115037981, median 0.220667067997, std: 0.281368337133  
Reprojection error (cam1) [px]: mean 0.229906526375, median 0.170614480475, std: 0.217368624527  
Gyroscope error (imu0) [rad/s]: mean 5.42924932413e-07, median 1.21971784115e-07, std: 2.086222392  
Accelerometer error (imu0) [m/s^2]: mean 1.79097362336e-05, median 1.20648487504e-05, std: 3.382180

### Transformation (cam0):

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T\_ci: (imu0 to cam0):

```
[[ 0.01510883 -0.9998546  0.00790561 -0.00149122]
 [ -0.06353187 -0.0088505 -0.99794056  0.00173231]
 [ 0.99786543  0.01457546 -0.06365635 -0.00024801]
 [ 0.          0.          0.          1.          ]]
```

T\_ic: (cam0 to imu0):

```
[[ 0.01510883 -0.06353187  0.99786543  0.00038007]
 [-0.9998546 -0.0088505  0.01457546 -0.00147206]
 [ 0.00790561 -0.99794056 -0.06365635  0.00172475]
 [ 0.          0.          0.          1.          ]]
```

timeshift cam0 to imu0: [s] ( $t_{imu} = t_{cam} + \text{shift}$ )

0.158407712408

### Transformation (cam1):

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T\_ci: (imu0 to cam1):

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

T\_ic: (cam1 to imu0):

```
[[ 0.01594784 -0.07024379 0.99740236 0.00303182]  
 [-0.99984023 -0.00917448 0.01534069 -0.20057466]  
 [ 0.00807306 -0.99748766 -0.07037888 0.00302217]  
 [ 0.      0.      0.      1.    ]]
```

timeshift cam1 to imu0: [s] ( $t_{imu} = t_{cam} + \text{shift}$ )

0.157228735656

Baselines:

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Baseline (cam0 to cam1):

```
[[ 0.99999963 -0.00022054 0.00082677 -0.19912355]  
 [ 0.0002261  0.99997732 -0.00673115 -0.00034623]  
 [-0.00082527 0.00673133 0.999977  0.00050082]  
 [ 0.      0.      0.      1.    ]]
```

baseline norm: 0.199124479741 [m]

Gravity vector in target coords: [m/s<sup>2</sup>]

[-0.06892344 -9.77976902 -0.72096491]

Calibration configuration

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cam0

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Camera model: ds

Focal length: [320.68691207839925, 319.53241563373956]

Principal point: [712.4831301001125, 536.0268018436429]

DS xi: -0.194493738587

DS alpha: 0.594820040481

Distortion model: none

Distortion coefficients: []

Cols: 5  
Size: 0.15 [m]  
Spacing 0.0450015 [m]  
Low-id 25

cam1

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Camera model: ds  
Focal length: [321.30891626217385, 320.188130296608]  
Principal point: [685.4812832654545, 563.8660806216003]  
DS xi: -0.194352160245  
DS alpha: 0.595566320323  
Distortion model: none  
Distortion coefficients: []  
Type: aprilgrid  
Tags:  
  Rows: 5  
  Cols: 5  
  Size: 0.15 [m]  
  Spacing 0.0450015 [m]  
  Low-id 25

IMU configuration

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IMU0:

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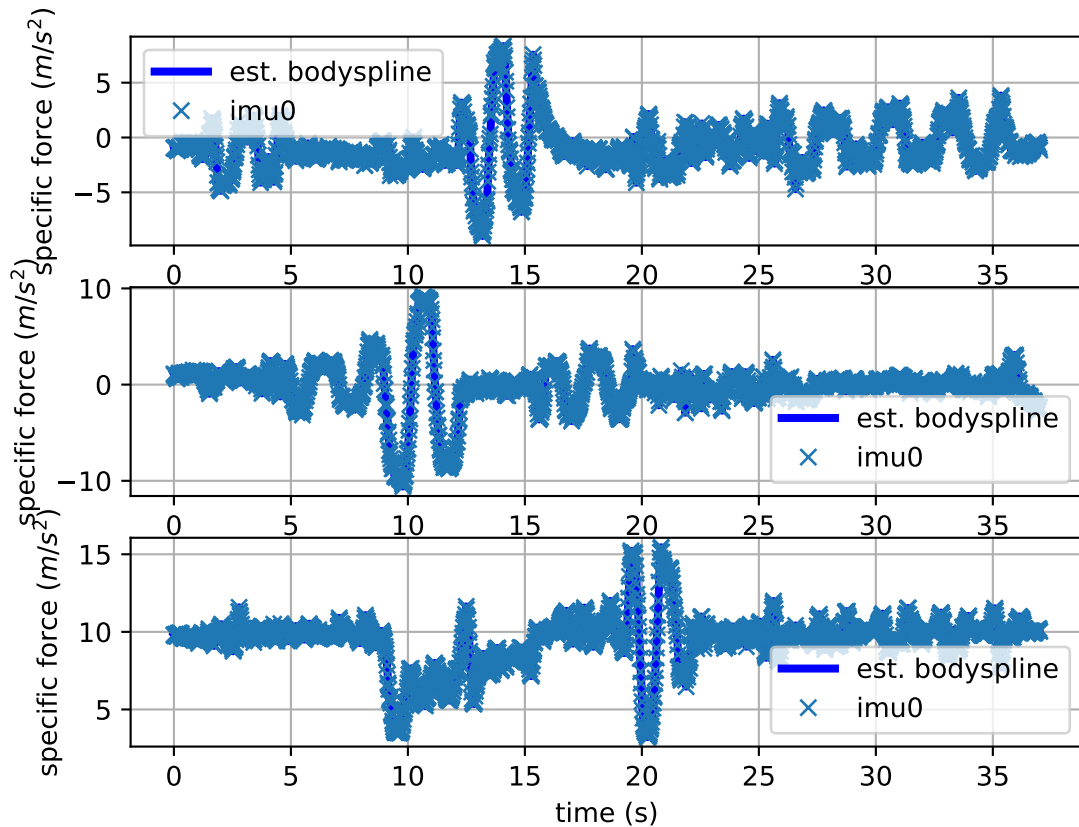
Model: calibrated  
Update rate: 360.0  
Accelerometer:  
  Noise density: 0.00186  
  Noise density (discrete): 0.0352910186875  
  Random walk: 0.000433  
Gyroscope:

T\_i\_b

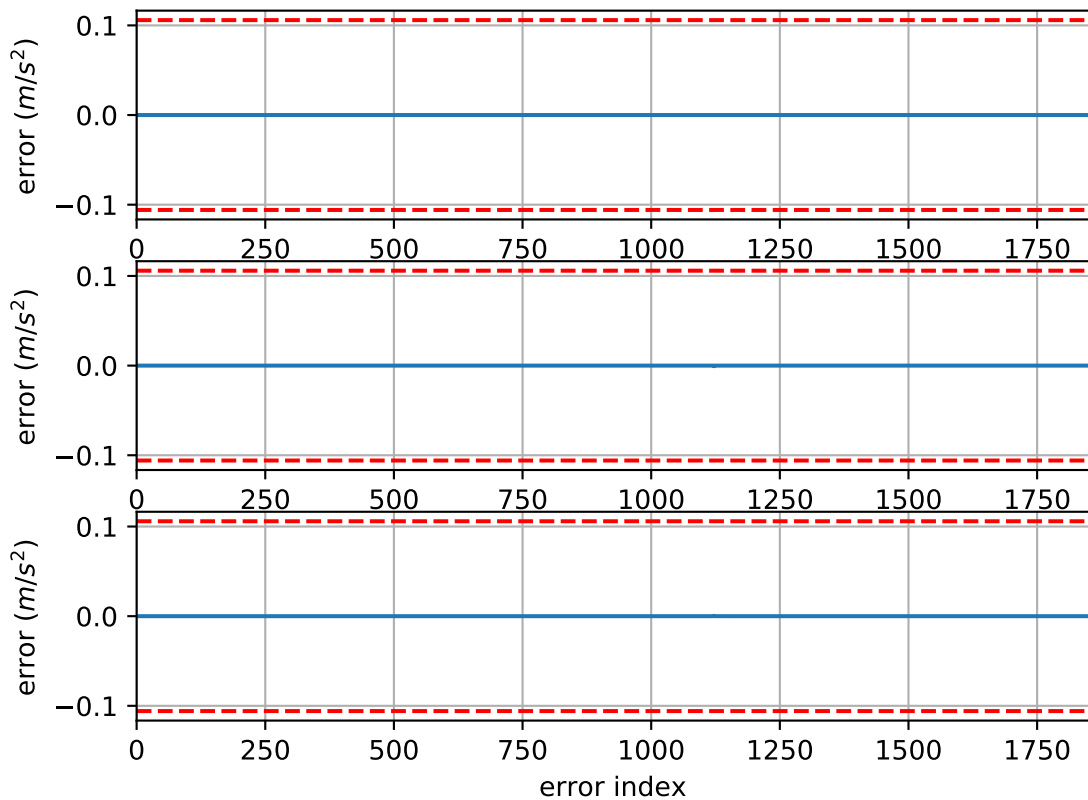
```
[[ 1.  0.  0.  0.]  
 [ 0.  1.  0.  0.]  
 [ 0.  0.  1.  0.]  
 [ 0.  0.  0.  1.]]
```

time offset with respect to IMU0: 0.0 [s]

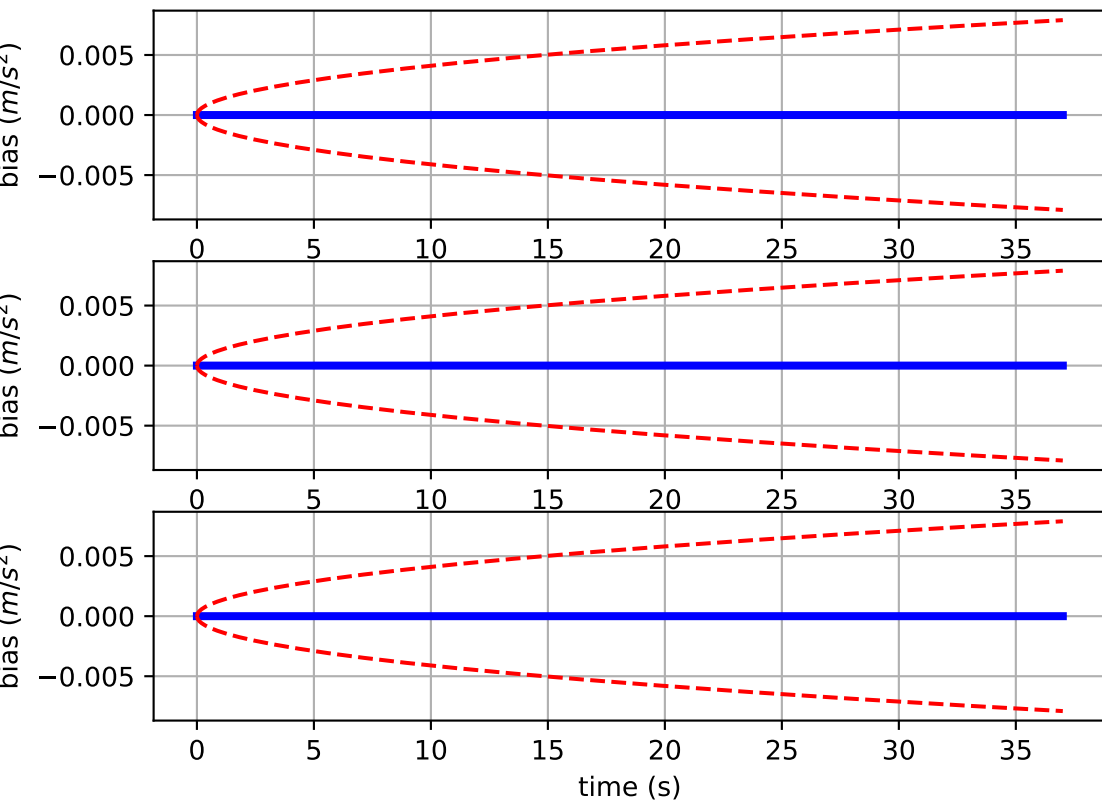
Comparison of predicted and measured specific force (imu0 frame)



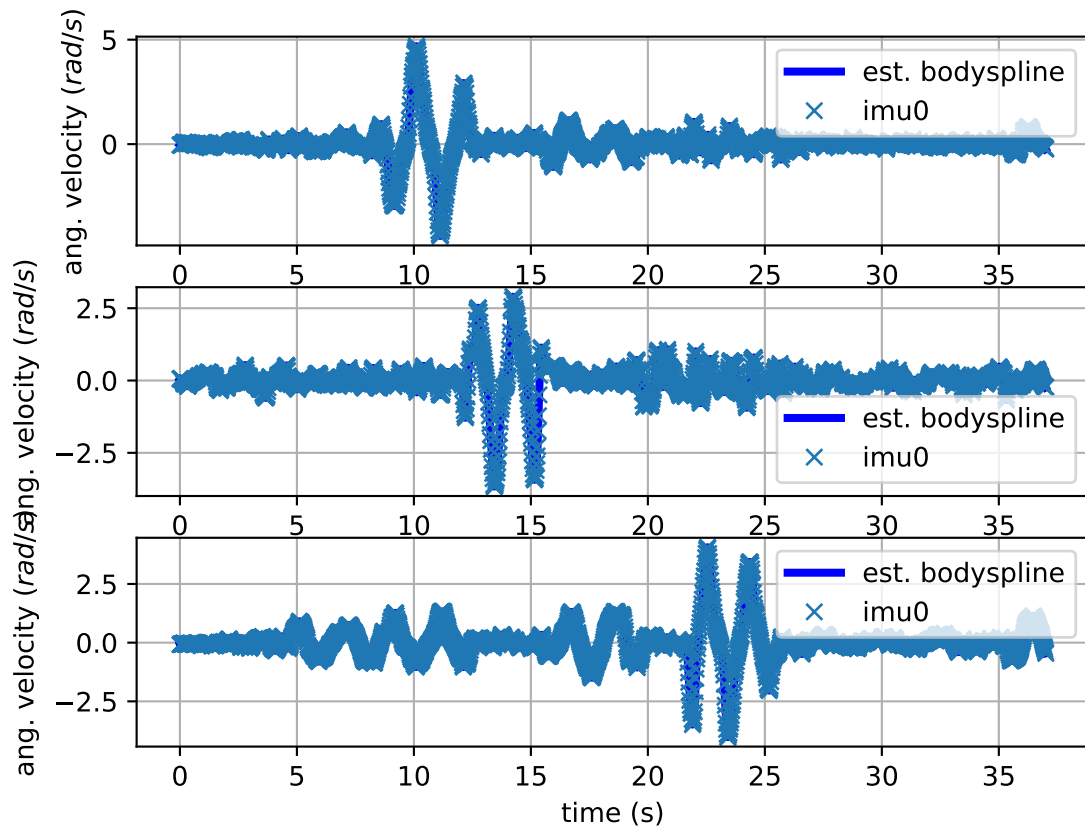
imu0: acceleration error



imu0: estimated accelerometer bias (imu frame)

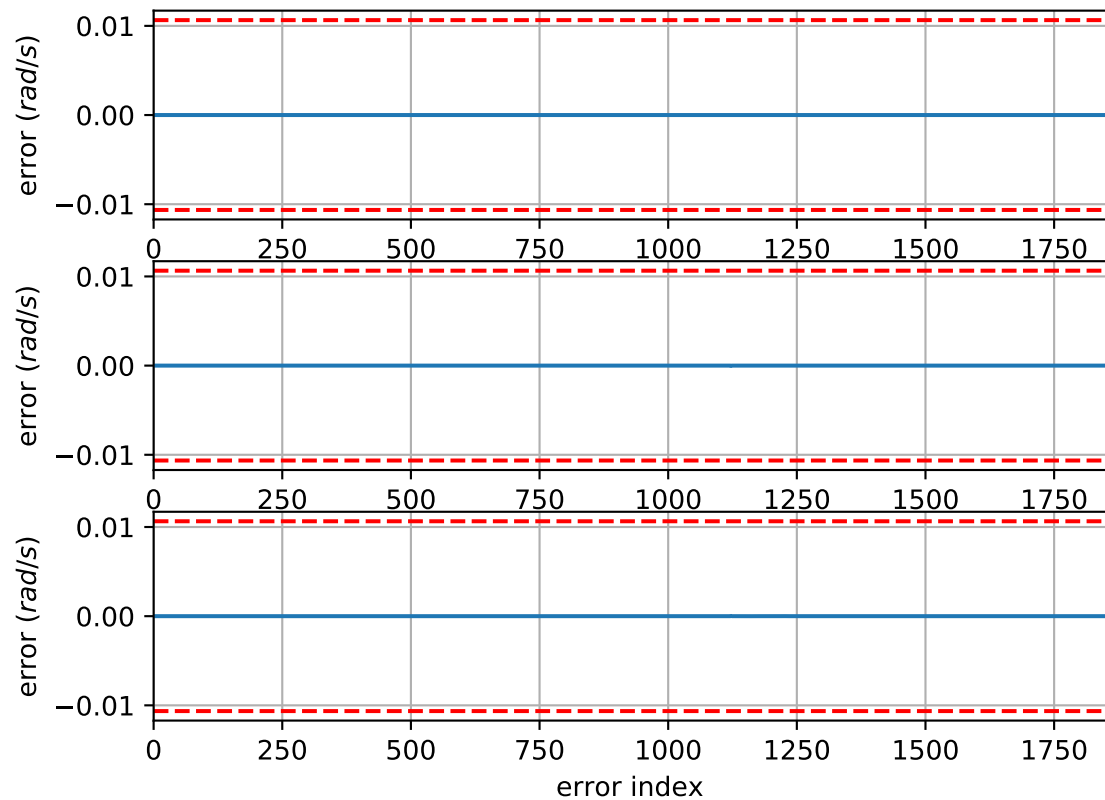


Comparison of predicted and measured angular velocities (body frame)

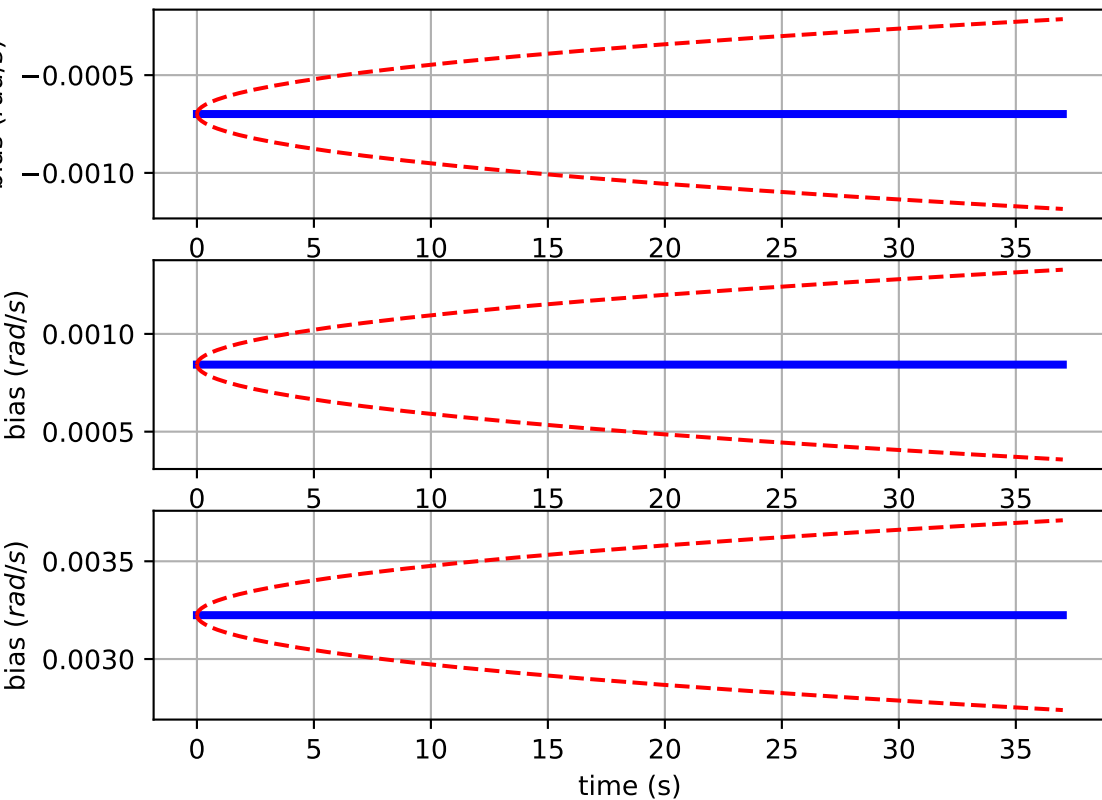




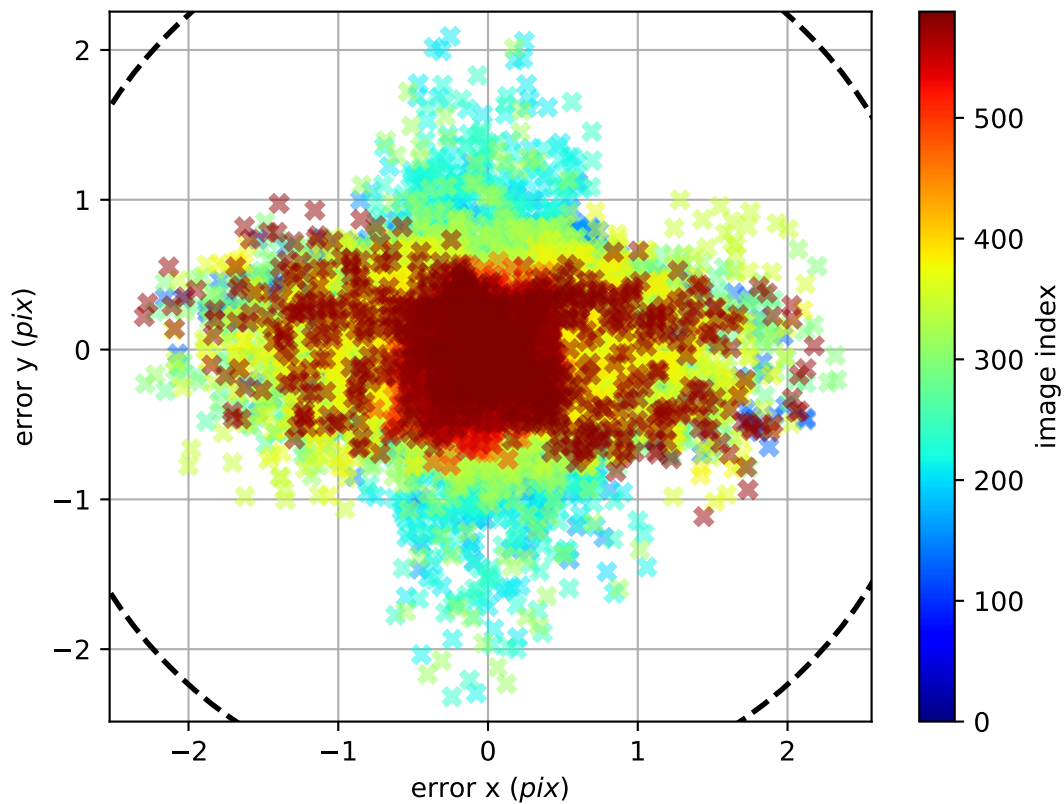
imu0: angular velocities error



imu0: estimated gyro bias (imu frame)



cam0: reprojection errors



cam1: reprojection errors

