

## Calibration results

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### Normalized Residuals

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Reprojection error (cam0): mean 0.388923147778, median 0.264369178334, std: 0.343392370986

Reprojection error (cam1): mean 0.342846663461, median 0.23665727975, std: 0.310529610126

Gyroscope error (imu0): mean 0.00089394181024, median 0.000176537893821, std: 0.0042962962622

Accelerometer error (imu0): mean 0.00128002445762, median 0.000376557811003, std: 0.002867272920

### Residuals

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Reprojection error (cam0) [px]: mean 0.388923147778, median 0.264369178334, std: 0.343392370986

Reprojection error (cam1) [px]: mean 0.342846663461, median 0.23665727975, std: 0.310529610126

Gyroscope error (imu0) [rad/s]: mean 2.11451537758e-06, median 4.17579854678e-07, std: 1.016238910

Accelerometer error (imu0) [m/s^2]: mean 3.01155780362e-05, median 8.85940583001e-06, std: 6.745932

### Transformation (cam0):

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T\_ci: (imu0 to cam0):

[[ 0.03796577 -0.99914942 -0.01609438 -0.00187197]

[-0.0025269 0.01600994 -0.99986864 0.00943099]

[ 0.99927585 0.03800146 -0.00191692 -0.00323896]

[ 0. 0. 0. 1. ]]

T\_ic: (cam0 to imu0):

[[ 0.03796577 -0.0025269 0.99927585 0.00333152]

[-0.99914942 0.01600994 0.03800146 -0.00189829]

[-0.01609438 -0.99986864 -0.00191692 0.00939341]

[ 0. 0. 0. 1. ]]

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

-0.00189713301242

### Transformation (cam1):

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T\_ci: (imu0 to cam1):

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

T\_ic: (cam1 to imu0):

```
[[ 0.0423793  0.00381219  0.99909432  0.00999611]
 [-0.99896156  0.01690386  0.04230917 -0.20032907]
 [-0.01672726 -0.99984985  0.0045246  0.00710895]
 [ 0.          0.          0.          1.        ]]
```

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

-0.0023078246896

Baselines:

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Baseline (cam0 to cam1):

```
[[ 0.99999004  0.00062466  0.00441868 -0.19854538]
 [-0.00065279  0.99997951  0.00636843  0.00104472]
 [-0.00441462 -0.00637125  0.99996996  0.00174722]
 [ 0.          0.          0.          1.        ]]
```

baseline norm: 0.198555811716 [m]

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

[ 0.21161572 -9.79404699 -0.44753241]

Calibration configuration

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cam0

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Camera model: ds

Focal length: [317.8934243211125, 316.74040434458345]

Principal point: [711.4512180423142, 532.1002815372327]

DS xi: -0.201054855448

DS alpha: 0.592604788381

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: [317.3426194634644, 316.19320923591545]  
Principal point: [697.1121214328483, 567.6903247112139]  
DS xi: -0.204265873352  
DS alpha: 0.592414489899  
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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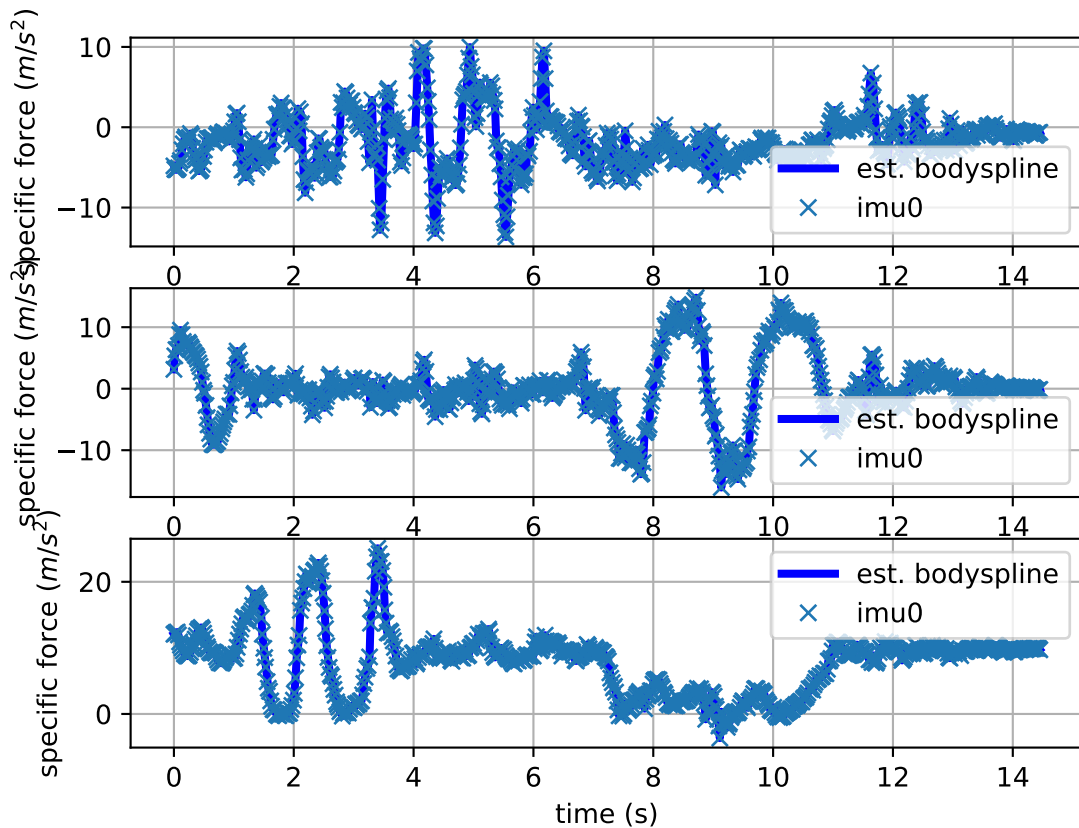
Model: calibrated  
Update rate: 160.0  
Accelerometer:  
  Noise density: 0.00186  
  Noise density (discrete): 0.0235273457917  
  Random walk: 0.000433  
Gyroscope:

T\_i\_b

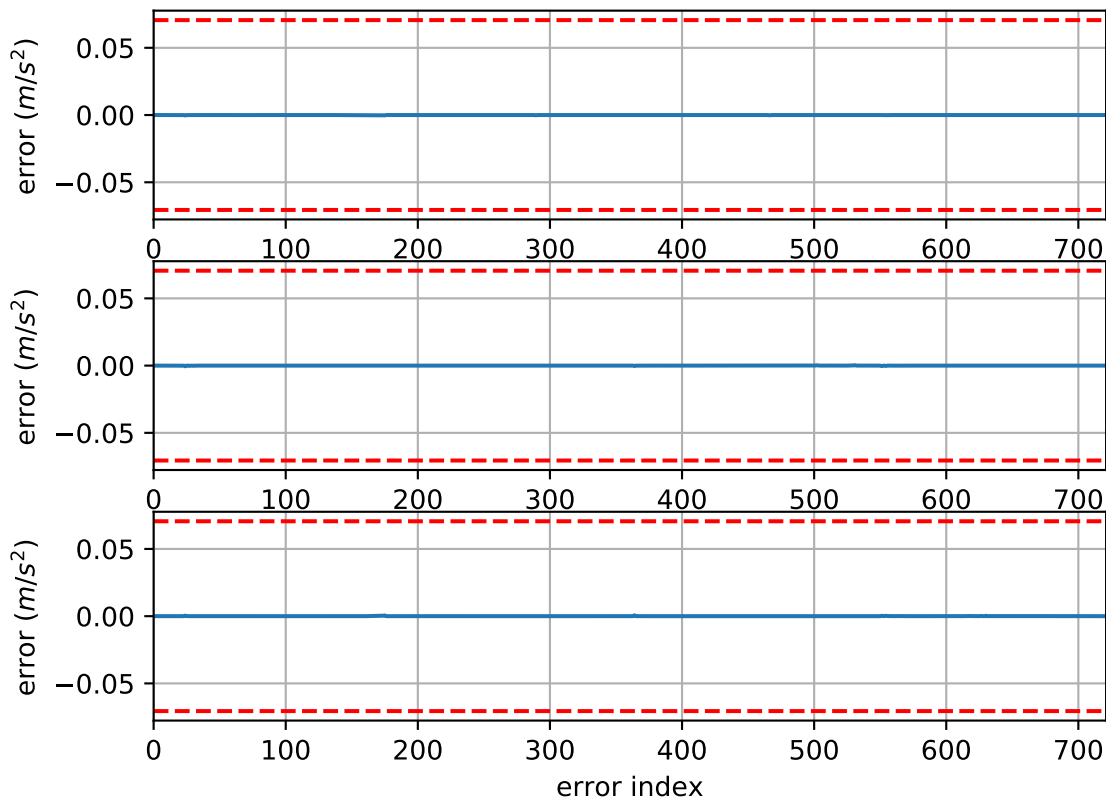
```
[[ 1.  0.  0.  0.]  
 [ 0.  1.  0.  0.]  
 [ 0.  0.  1.  0.]  
 [ 0.  0.  0.  1.]]
```

time offset with respect to IMU0: 0.0 [s]

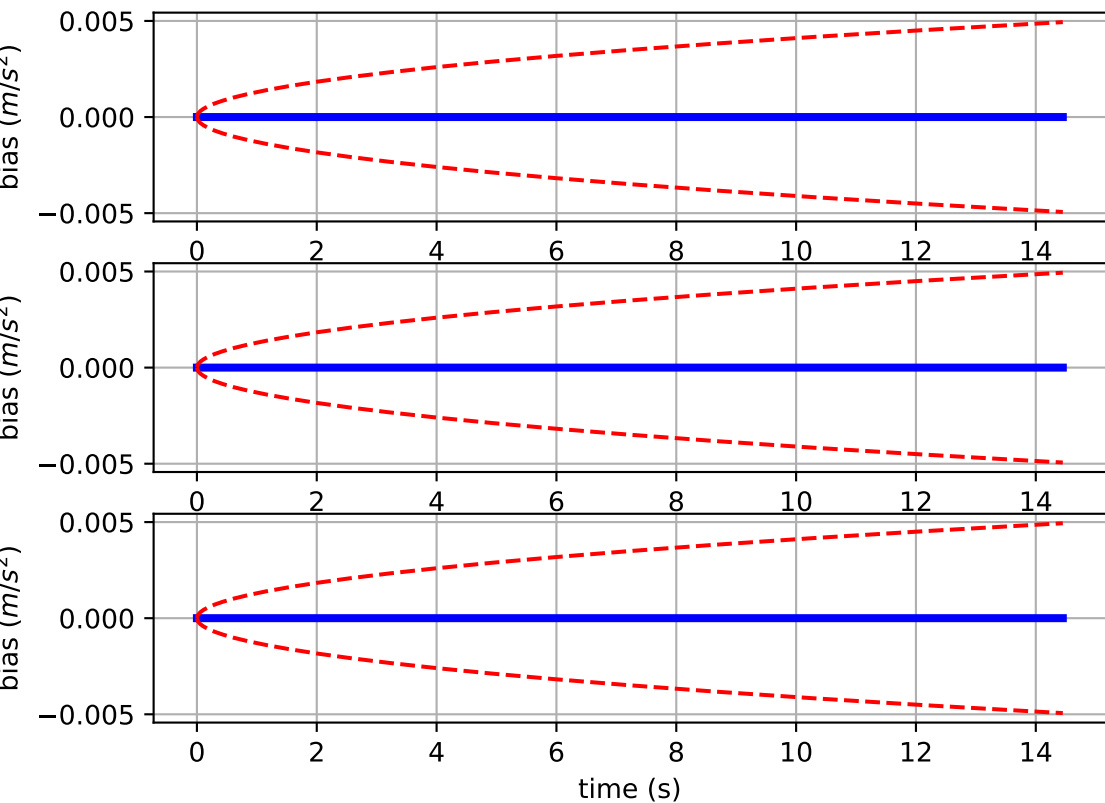
Comparison of predicted and measured specific force (imu0 frame)



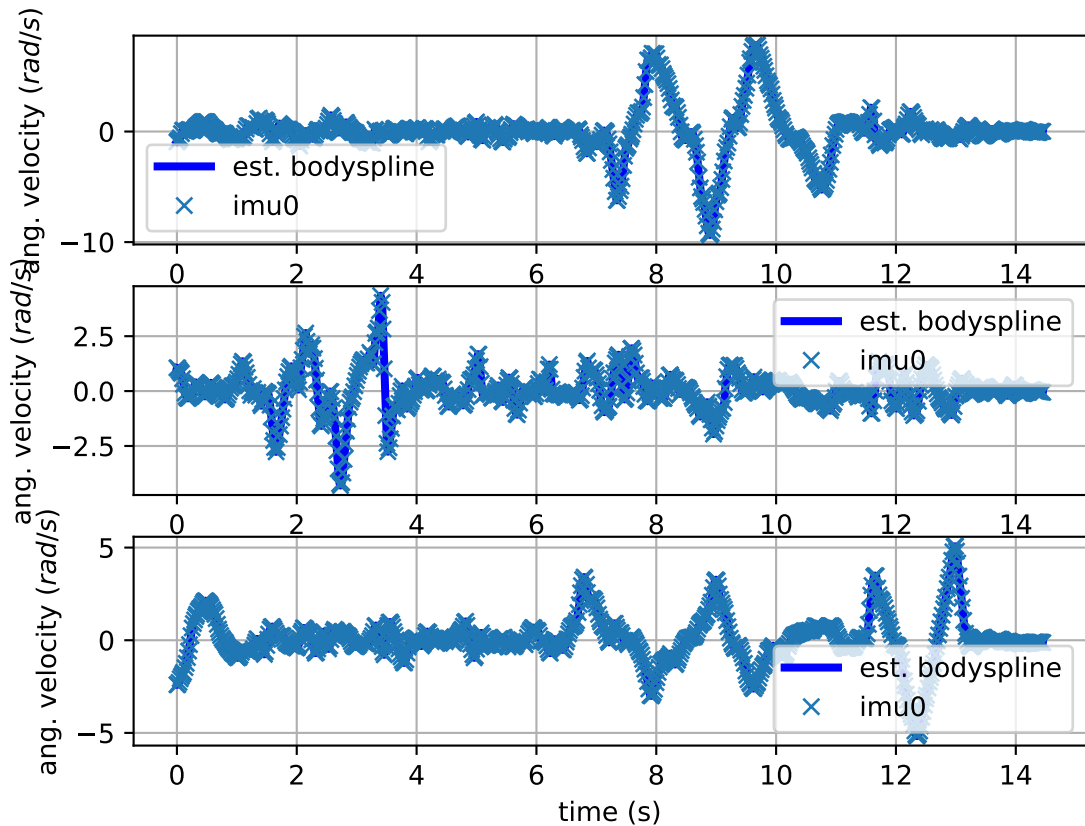
imu0: acceleration error



imu0: estimated accelerometer bias (imu frame)

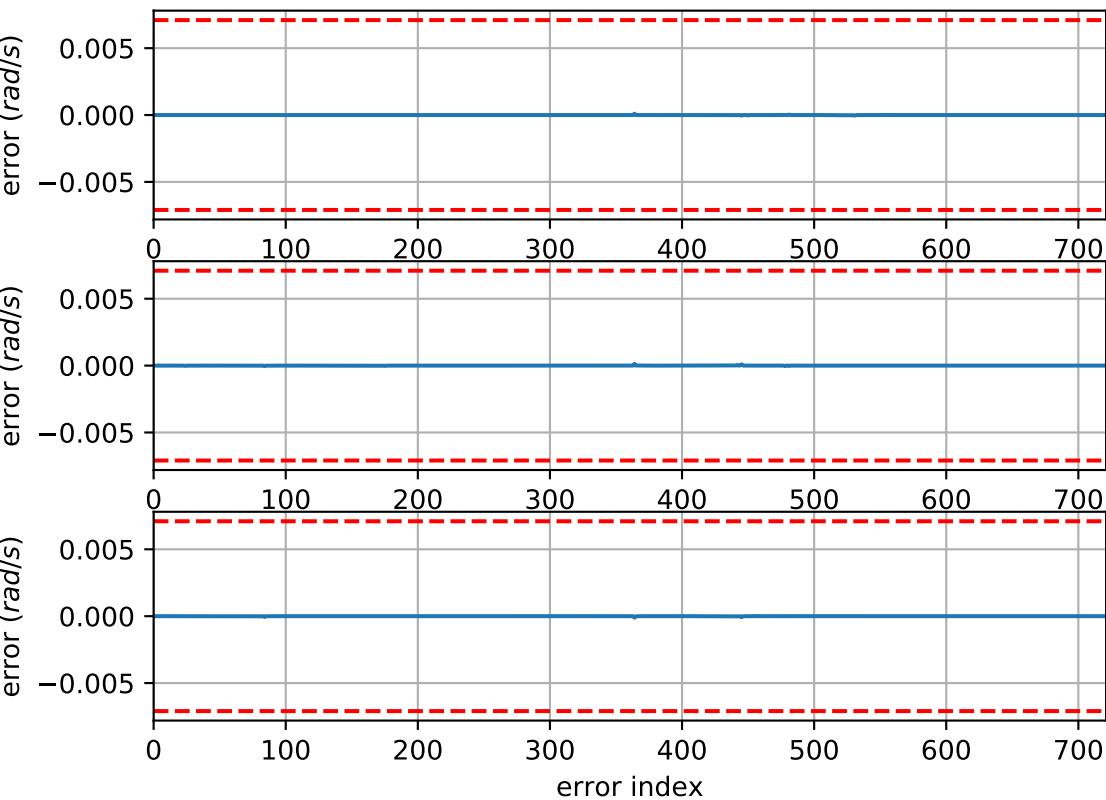


Comparison of predicted and measured angular velocities (body frame)

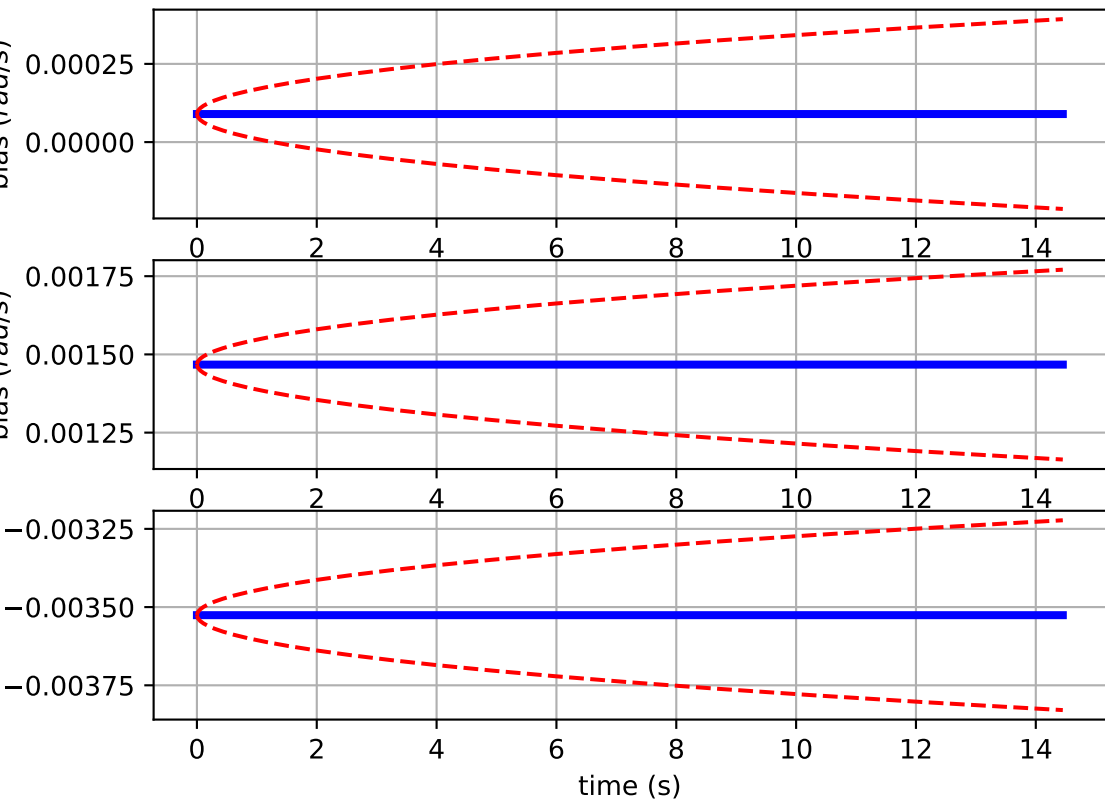




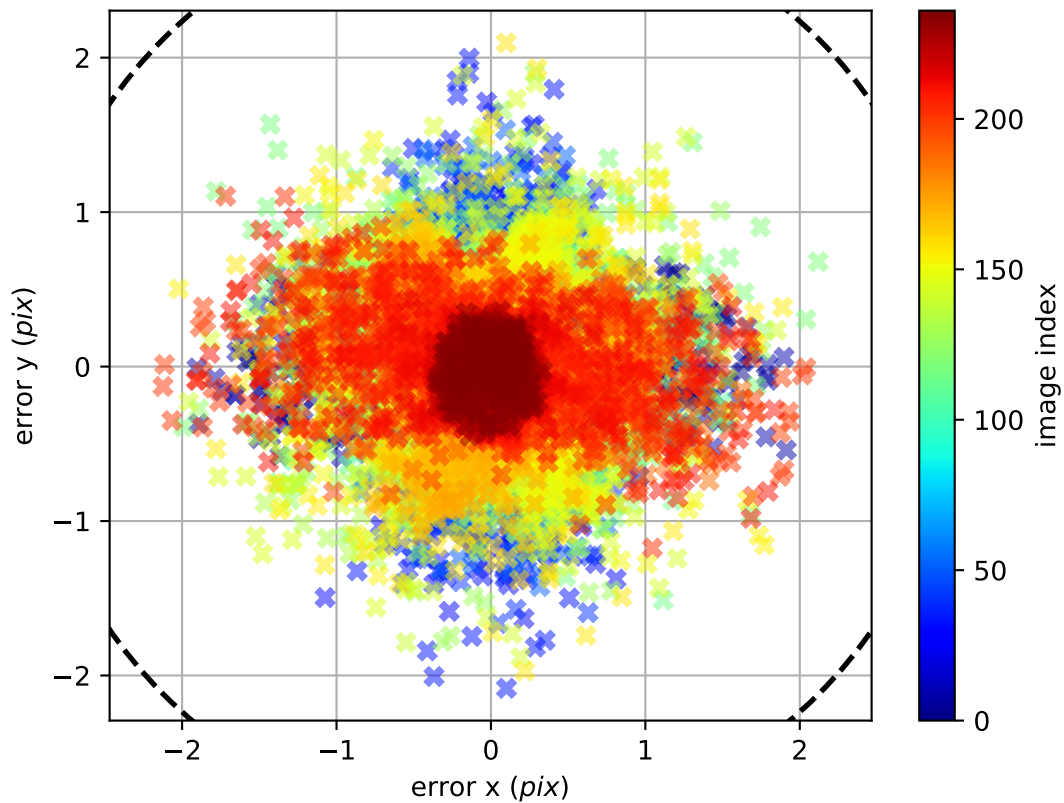
imu0: angular velocities error



imu0: estimated gyro bias (imu frame)



cam0: reprojection errors



cam1: reprojection errors

