

## Calibration results

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### Normalized Residuals

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Reprojection error (cam0): mean 2.1080386866599587, median 1.707054700247669, std: 4.39741342001  
Reprojection error (cam1): mean 2.0178707999763503, median 1.6358700065926572, std: 1.58735009001  
Gyroscope error (imu0): mean 2.2024128676638366, median 1.8006662074163826, std: 1.51343768361  
Accelerometer error (imu0): mean 3.184769154578532, median 2.268581467209623, std: 2.76954869905

### Residuals

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Reprojection error (cam0) [px]: mean 2.1080386866599587, median 1.707054700247669, std: 4.39741342001  
Reprojection error (cam1) [px]: mean 2.0178707999763503, median 1.6358700065926572, std: 1.58735009001  
Gyroscope error (imu0) [rad/s]: mean 0.005381509844063374, median 0.004399857566834101, std: 0.0010768361  
Accelerometer error (imu0) [m/s^2]: mean 0.10191261294651303, median 0.07259460695070794, std: 0.0010768361

### Transformation (cam0):

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T\_ci: (imu0 to cam0):

```
[[ 0.20491452 -0.93836219 -0.27836386 -0.18719575]
 [ 0.17218276 0.31452284 -0.93350334 -0.20284996]
 [ 0.96351603 0.14335893 0.22602009 0.30889114]
 [ 0.         0.         0.         1.        ]]
```

T\_ic: (cam0 to imu0):

```
[[ 0.20491452 0.17218276 0.96351603 -0.22433517]
 [-0.93836219 0.31452284 0.14335893 -0.15613877]
 [-0.27836386 -0.93350334 0.22602009 -0.31128525]
 [ 0.         0.         0.         1.        ]]
```

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

0.013429007190913361

### Transformation (cam1):

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T\_ci: (imu0 to cam1):

[ 0. 0. 0. 1. ]]

T\_ic: (cam1 to imu0):

[[ 0.18057353 0.17643334 0.9676076 -0.25319879]  
[-0.9412175 0.31654741 0.11792947 -0.03113413]  
[-0.28548699 -0.93202415 0.22322223 -0.27431558]  
[ 0. 0. 0. 1. ]]

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

0.012782112373362825

Baselines:

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Baseline (cam0 to cam1):

[[ 0.99967431 0.00156031 -0.02547223 0.13342292]  
[-0.00144053 0.99998782 0.00472007 -0.00002076]  
[ 0.02547929 -0.00468184 0.99966439 0.00493448]  
[ 0. 0. 0. 1. ]]

baseline norm: 0.13351413896676573 [m]

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

[ 2.65506463 -9.28080635 1.72791444]

Calibration configuration

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cam0

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Camera model: pinhole

Focal length: [1713.9143864069194, 1731.0495429117157]

Principal point: [307.32895208006624, 250.9605778429886]

Distortion model: equidistant

Distortion coefficients: [0.39966946154803484, 0.463531463471755, 144.48847522150243, -2417.061665

Type: aprilgrid

Tags:

Spacing 0.012485000000000001 [m]

cam1

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Camera model: pinhole

Focal length: [1738.7909891212125, 1747.9754745146804]

Principal point: [366.02468479684694, 238.9106672375295]

Distortion model: equidistant

Distortion coefficients: [0.20651699541056007, 0.2957692962102138, 44.9944228499361, -359.45420148]

Type: aprilgrid

Tags:

Rows: 4

Cols: 3

Size: 0.055 [m]

Spacing 0.012485000000000001 [m]

IMU configuration

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IMU0:

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Model: calibrated

Update rate: 400.0

Accelerometer:

Noise density: 0.0016

Noise density (discrete): 0.032

Random walk: 0.0002509

Gyroscope:

Noise density: 0.00012217304763960306

Noise density (discrete): 0.002443460952792061

Random walk: 3.398854185333757e-05

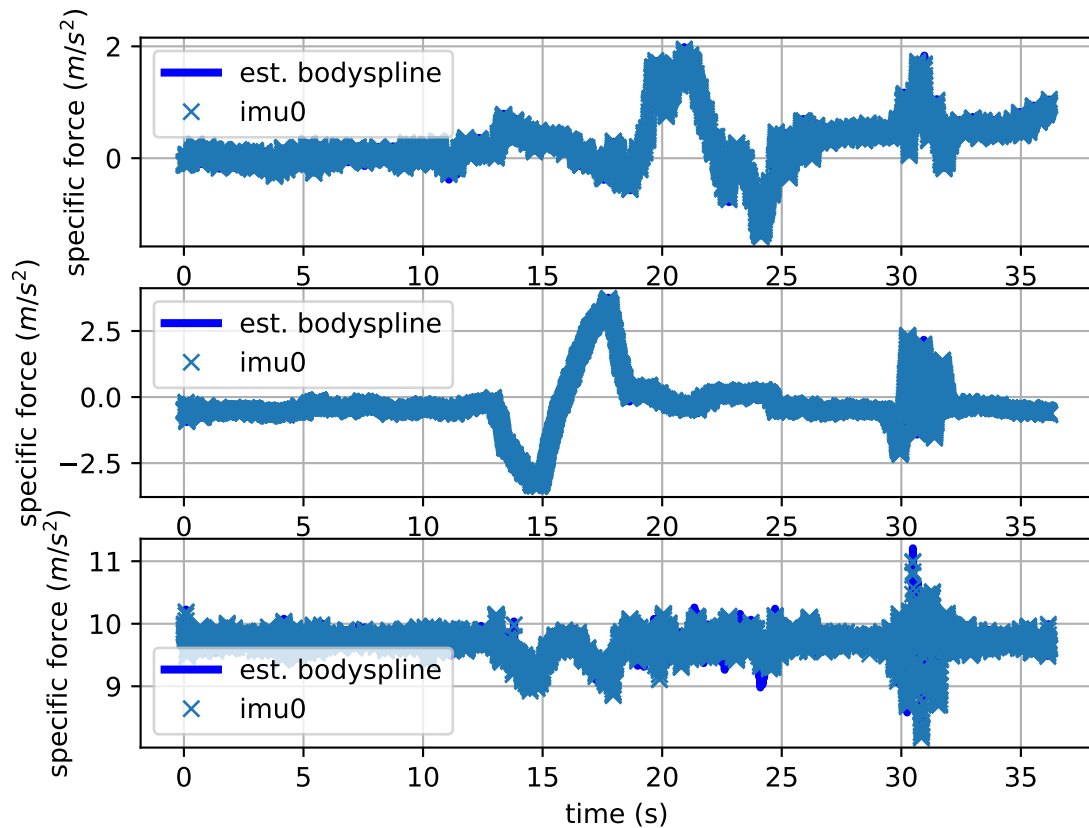
T\_ib (imu0 to imu0)

[[1. 0. 0. 0.]

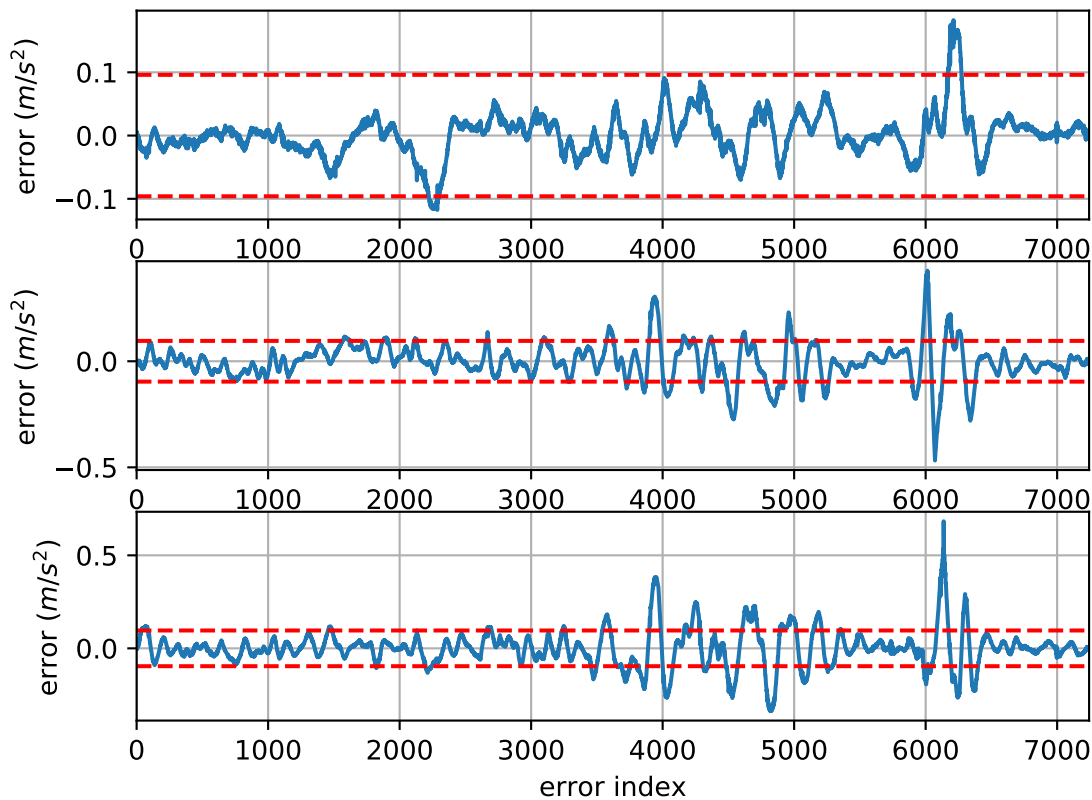
[0. 1. 0. 0.]

[0. 0. 1. 0.]

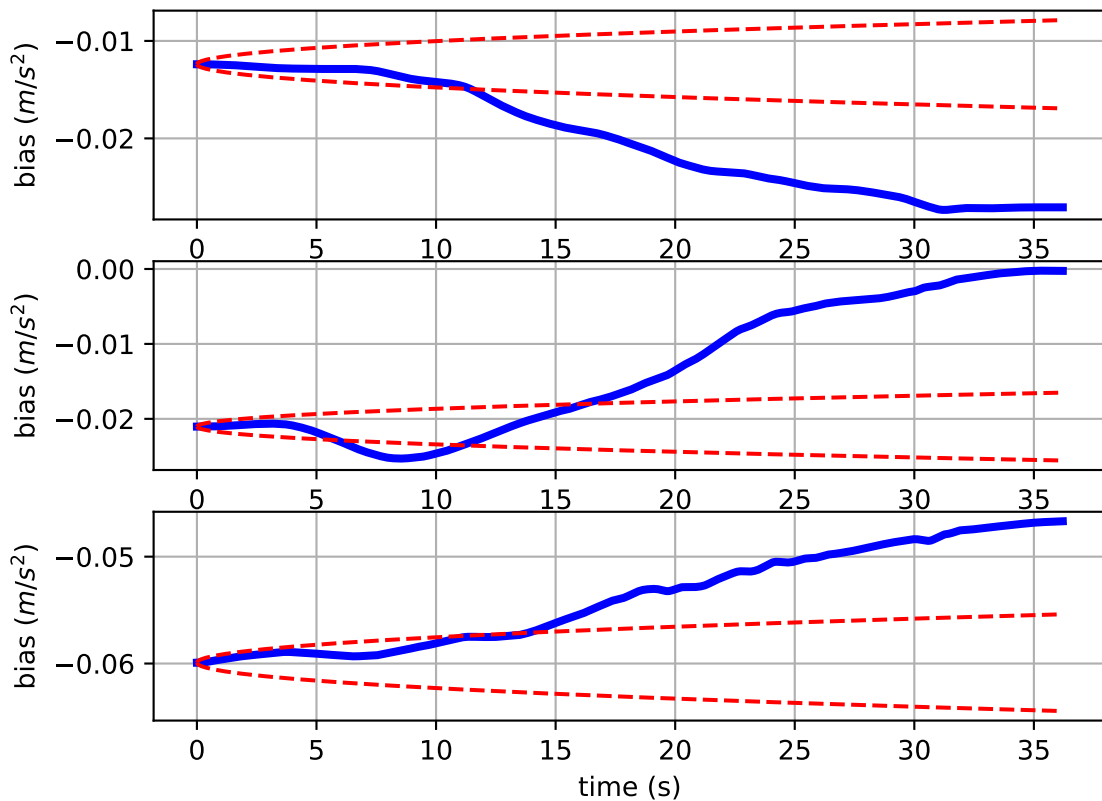
Comparison of predicted and measured specific force (imu0 frame)



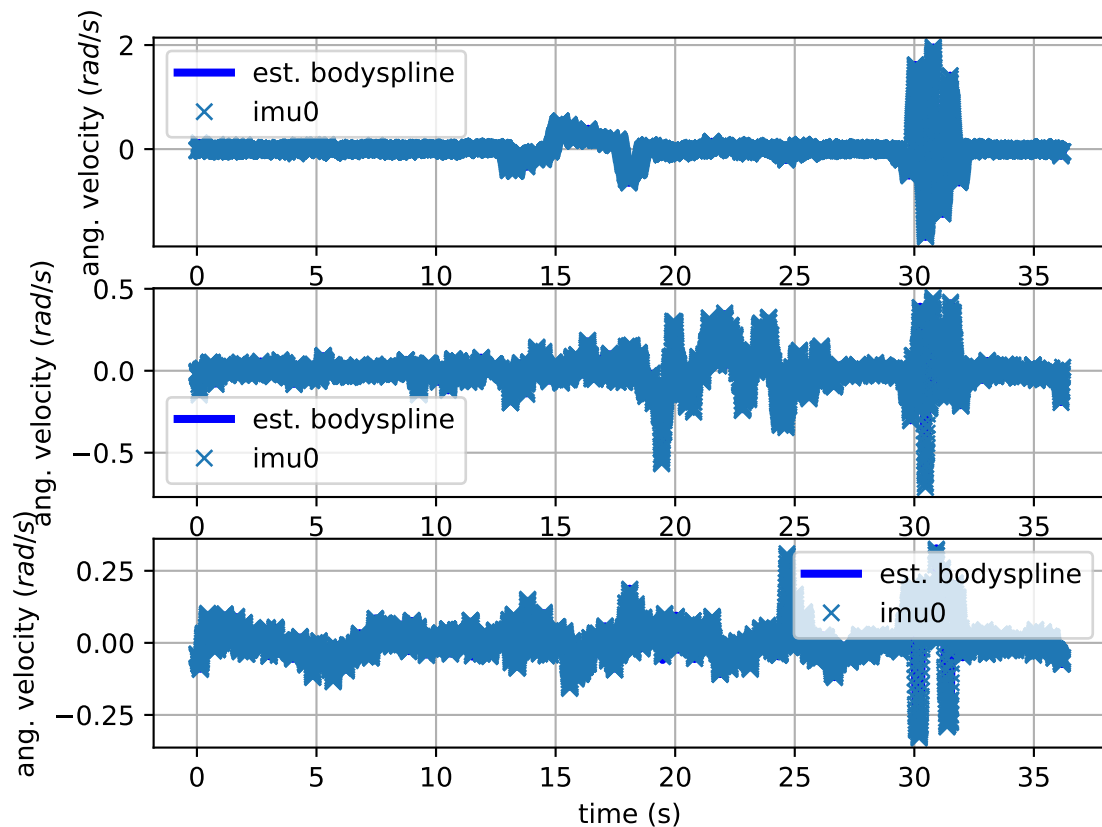
imu0: acceleration error



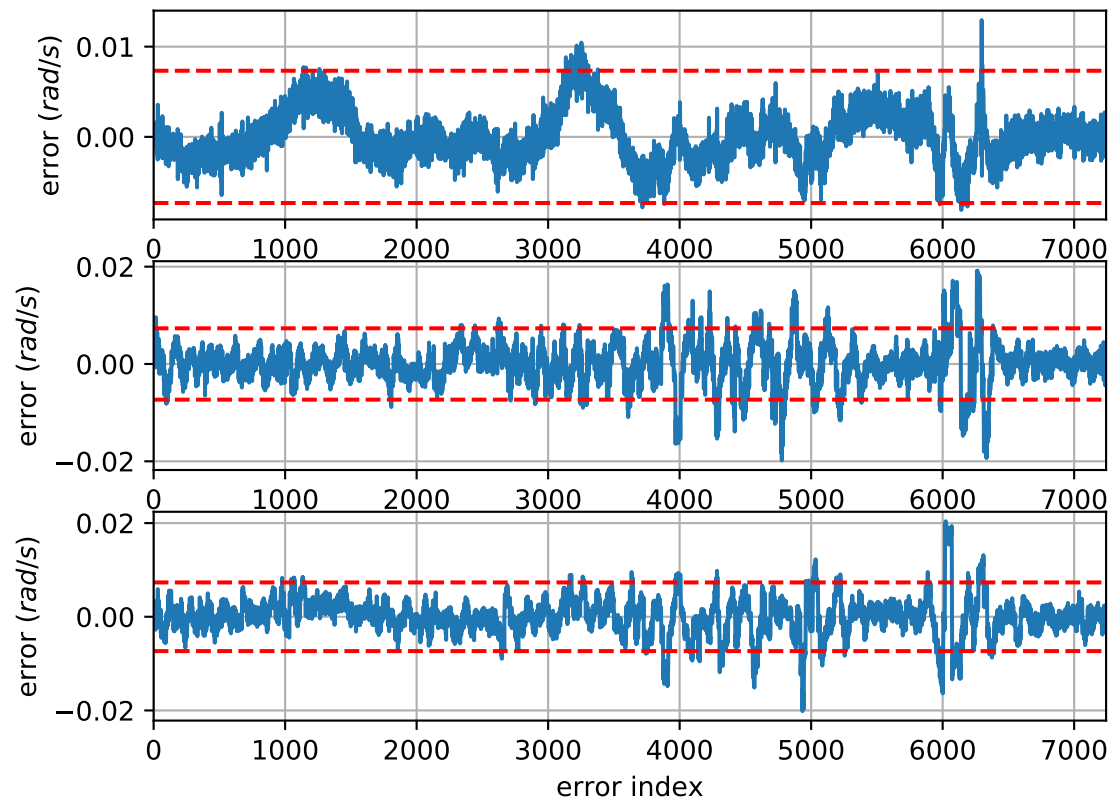
imu0: estimated accelerometer bias (imu frame)



Comparison of predicted and measured angular velocities (body frame)

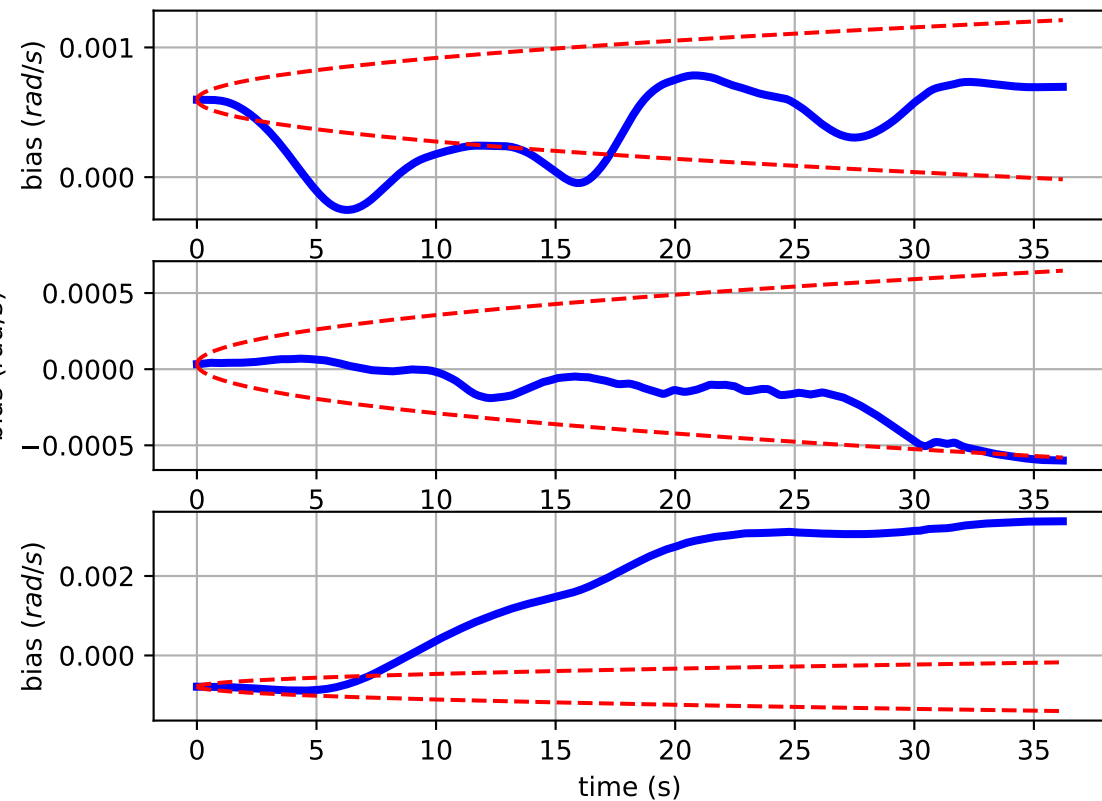


imu0: angular velocities error

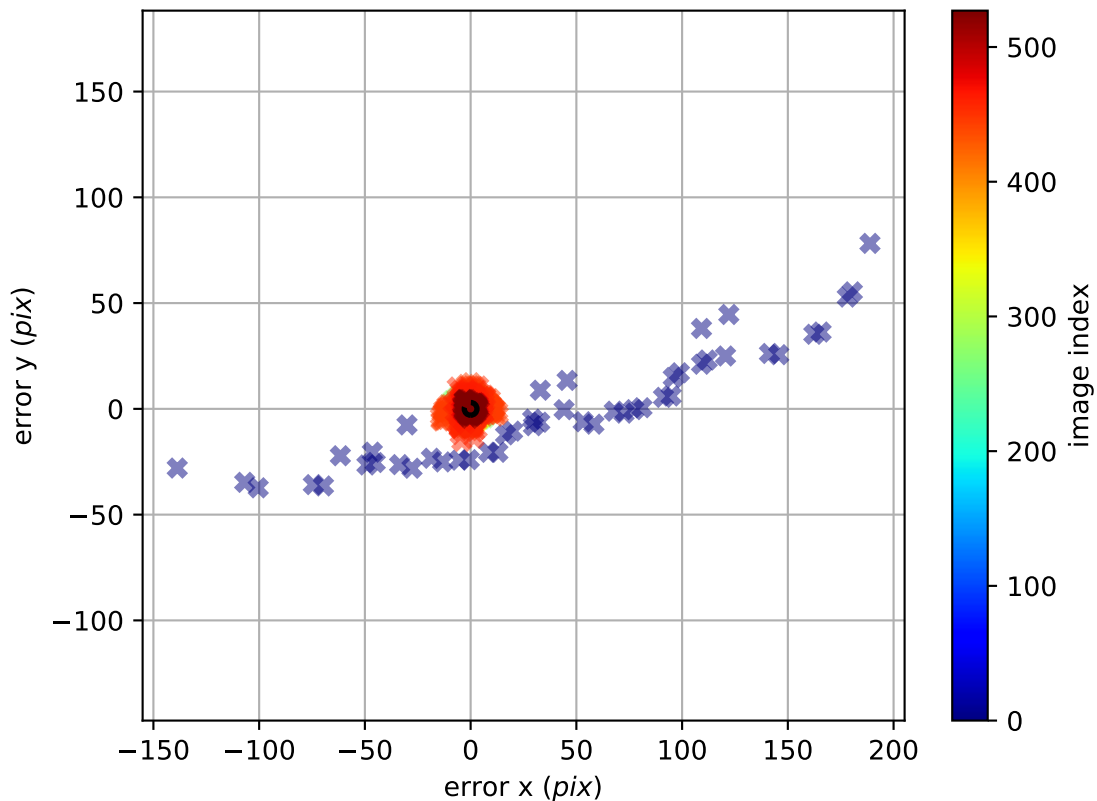




imu0: estimated gyro bias (imu frame)



cam0: reprojection errors



cam1: reprojection errors

