

## Calibration results

---

### Normalized Residuals

---

Reprojection error (cam0): mean 0.222526234853, median 0.201933482058, std: 0.135788154358  
Reprojection error (cam1): mean 0.222369603322, median 0.199164428835, std: 0.135568758619  
Gyroscope error (imu0): mean 0.0577959781696, median 0.049411347016, std: 0.0365148302017  
Accelerometer error (imu0): mean 0.0694121788996, median 0.0596983126909, std: 0.0429932087809

### Residuals

---

Reprojection error (cam0) [px]: mean 0.222526234853, median 0.201933482058, std: 0.135788154358  
Reprojection error (cam1) [px]: mean 0.222369603322, median 0.199164428835, std: 0.135568758619  
Gyroscope error (imu0) [rad/s]: mean 0.0138689400763, median 0.0118569324814, std: 0.008762235851  
Accelerometer error (imu0) [m/s<sup>2</sup>]: mean 0.0981636447938, median 0.0844261634583, std: 0.0608015788

### Transformation (cam0):

---

T\_ci: (imu0 to cam0):

```
[[-0.99997132  0.0058103 -0.00485875  0.01158247]
 [-0.00579817 -0.99998005 -0.00250661  0.00431404]
 [-0.00487322 -0.00247836  0.99998505 -0.00370334]
 [ 0.          0.          0.          1.        ]]
```

T\_ic: (cam0 to imu0):

```
[[-0.99997132 -0.00579817 -0.00487322  0.0115891 ]
 [ 0.0058103 -0.99998005 -0.00247836  0.00423748]
 [-0.00485875 -0.00250661  0.99998505  0.00377037]
 [ 0.          0.          0.          1.        ]]
```

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

0.00375789941071

### Transformation (cam1):

---

T\_ci: (imu0 to cam1):

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

T\_ic: (cam1 to imu0):

```
[-0.99999849 -0.00063482  0.00161911 -0.05234279]
[ 0.0006314 -0.99999758 -0.00210603  0.00411451]
[ 0.00162045 -0.002105   0.99999647  0.00380118]
[ 0.      0.      0.      1.      ]]
```

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

```
0.00378499434012
```

Baselines:

-----

Baseline (cam0 to cam1):

```
[[ 0.9999656  0.00516271  0.00649207 -0.06393177]
[-0.00516526  0.99998659  0.00037648 -0.00016348]
[-0.00649004 -0.00041    0.99997886  0.00007245]
[ 0.      0.      0.      1.      ]]
baseline norm: 0.0639320191672 [m]
```

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

```
[-0.01017206 -9.59525717 -2.02468746]
```

Calibration configuration

=====

cam0

----

Camera model: pinhole

Focal length: [290.7304838204764, 289.601145219177]

Principal point: [418.73226600517444, 398.3632230501782]

Distortion model: equidistant

Distortion coefficients: [-0.007072736031358906, 0.06422182211539766, -0.08643019035086855, 0.0330

Type: aprilgrid

Tags:

Spacing 0.006 [m]

cam1

=====  
Camera model: pinhole

Focal length: [289.09499279944896, 287.6113616705111]

Principal point: [412.6846257613642, 399.3636379941044]

Distortion model: equidistant

Distortion coefficients: [0.05453275710007573, -0.15942220855883305, 0.21575024019926148, -0.10092

Type: aprilgrid

Tags:

Rows: 6

Cols: 6

Size: 0.02 [m]

Spacing 0.006 [m]

IMU configuration

=====

IMU0:

-----  
Model: calibrated

Update rate: 200.0

Accelerometer:

    Noise density: 0.1

    Noise density (discrete): 1.41421356237

    Random walk: 0.003

Gyroscope:

    Noise density: 0.016968

    Noise density (discrete): 0.239963757263

    Random walk: 0.0019393

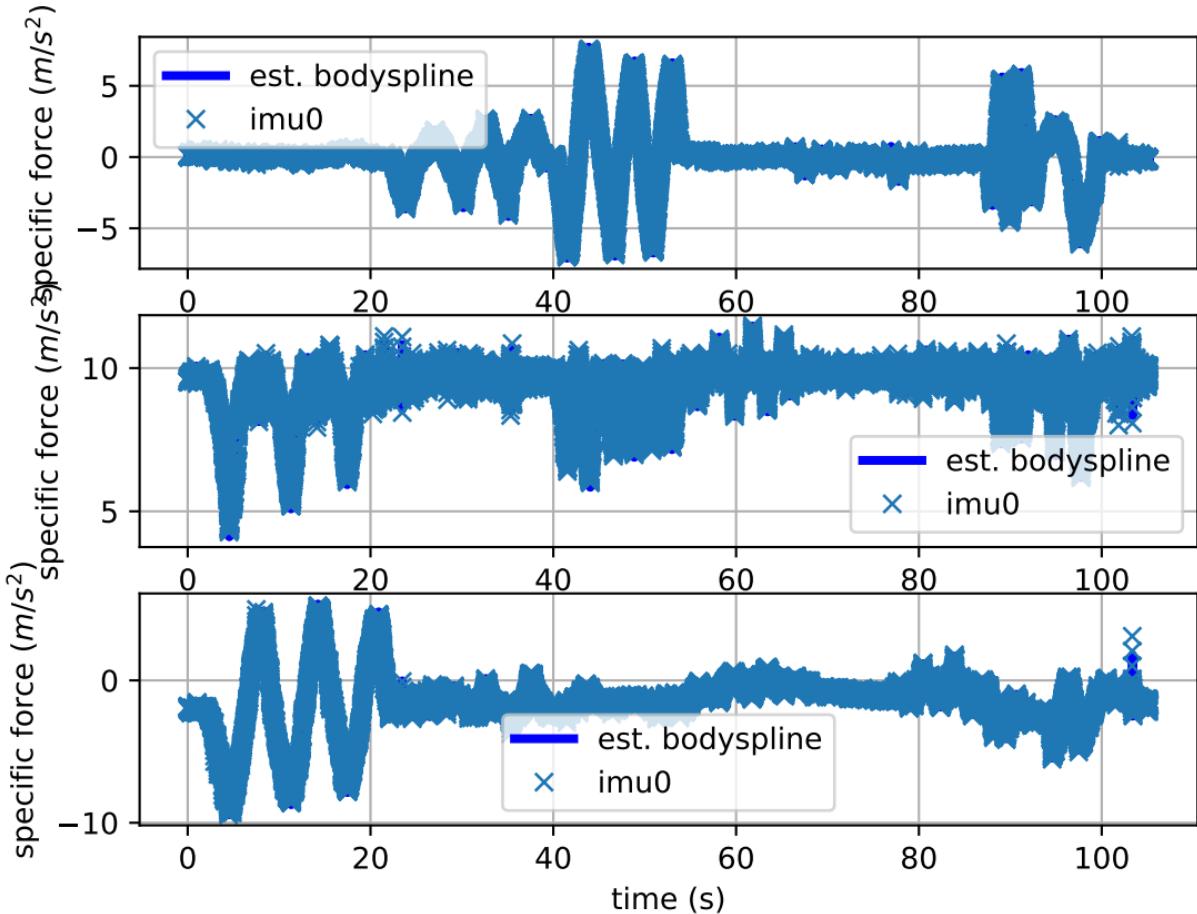
T\_i\_b

[[ 1. 0. 0. 0.]

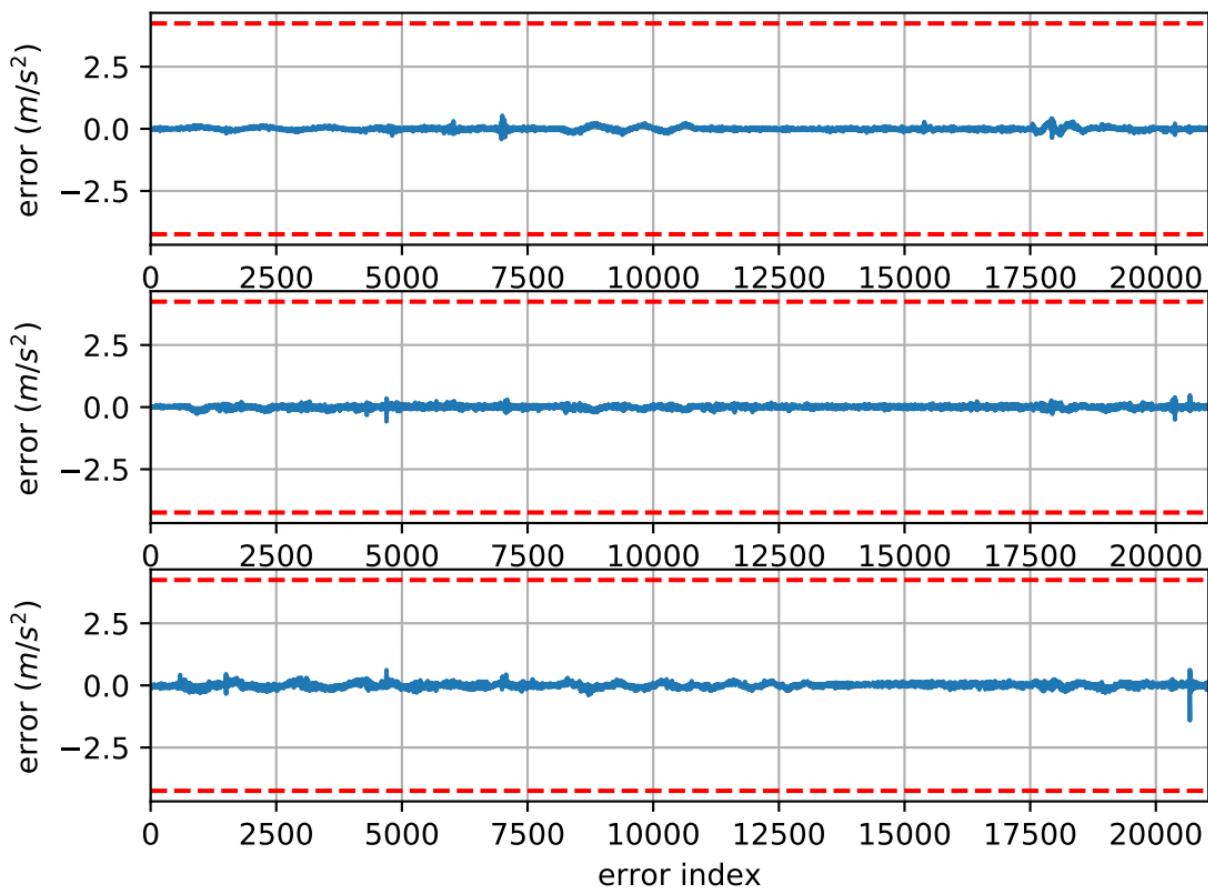
[ 0. 1. 0. 0.]



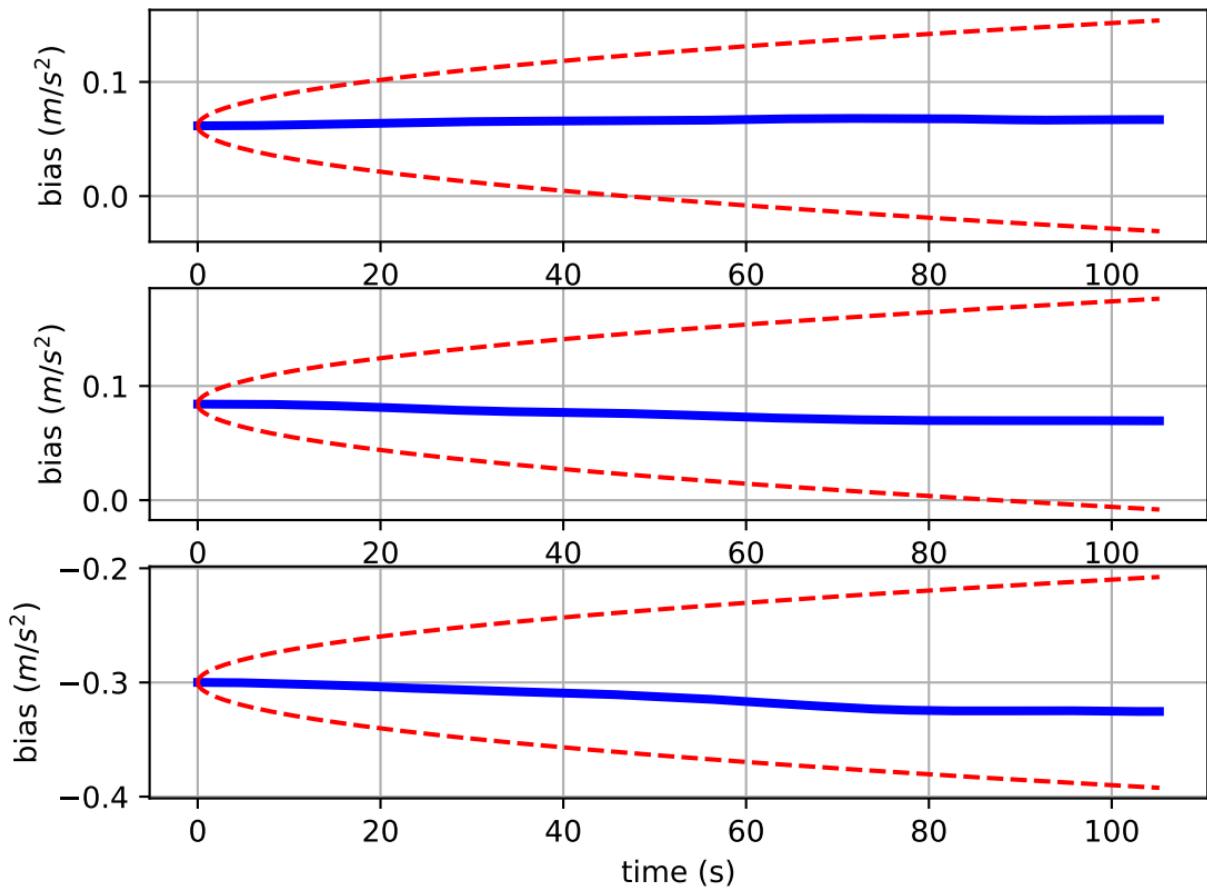
# Comparison of predicted and measured specific force (imu0 frame)



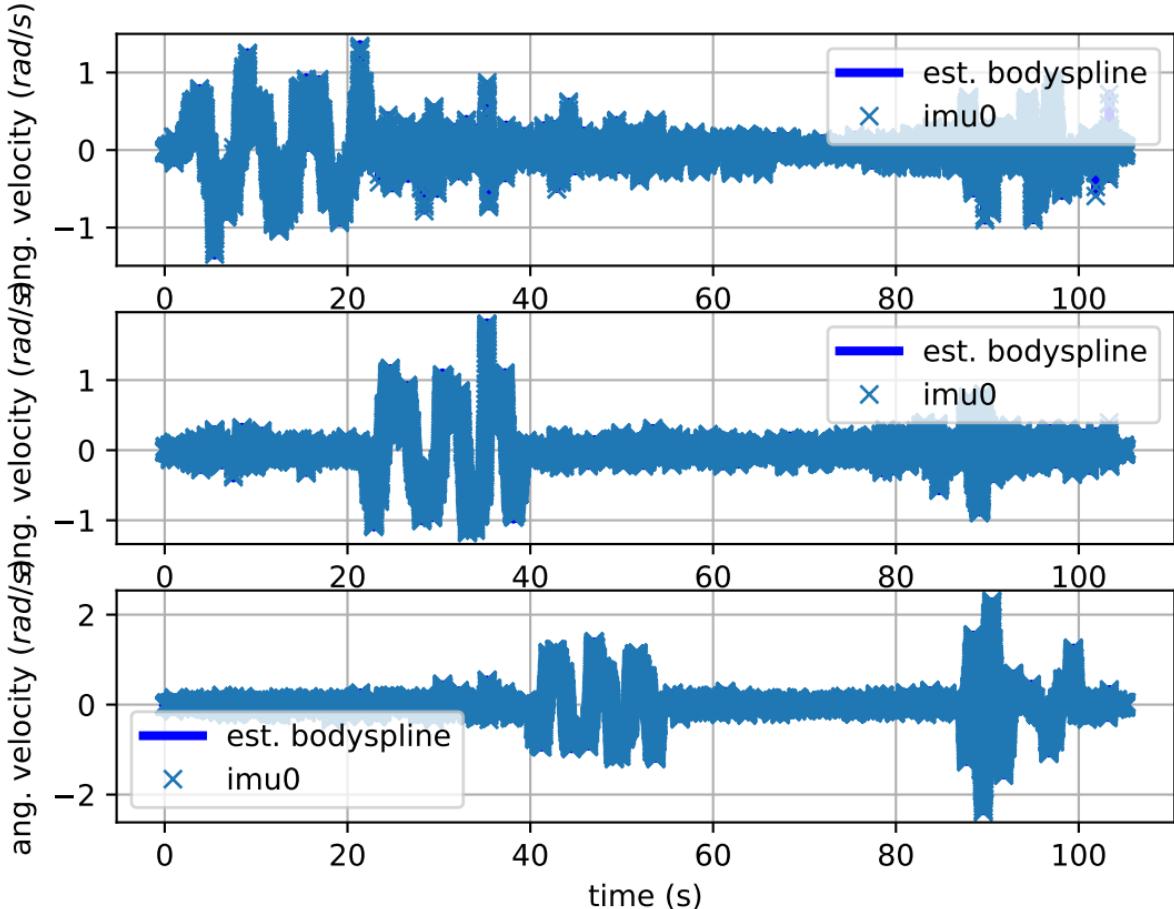
# imu0: acceleration error



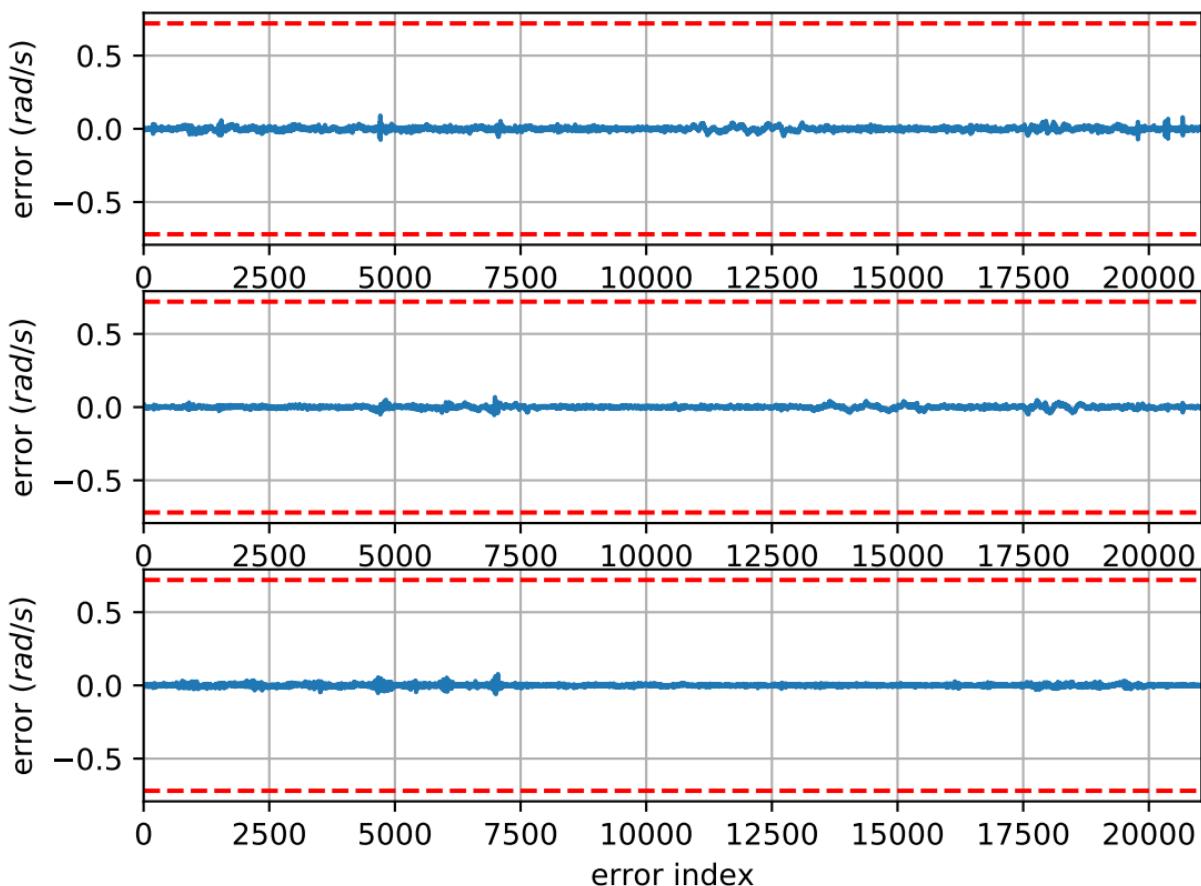
# imu0: estimated accelerometer bias (imu frame)



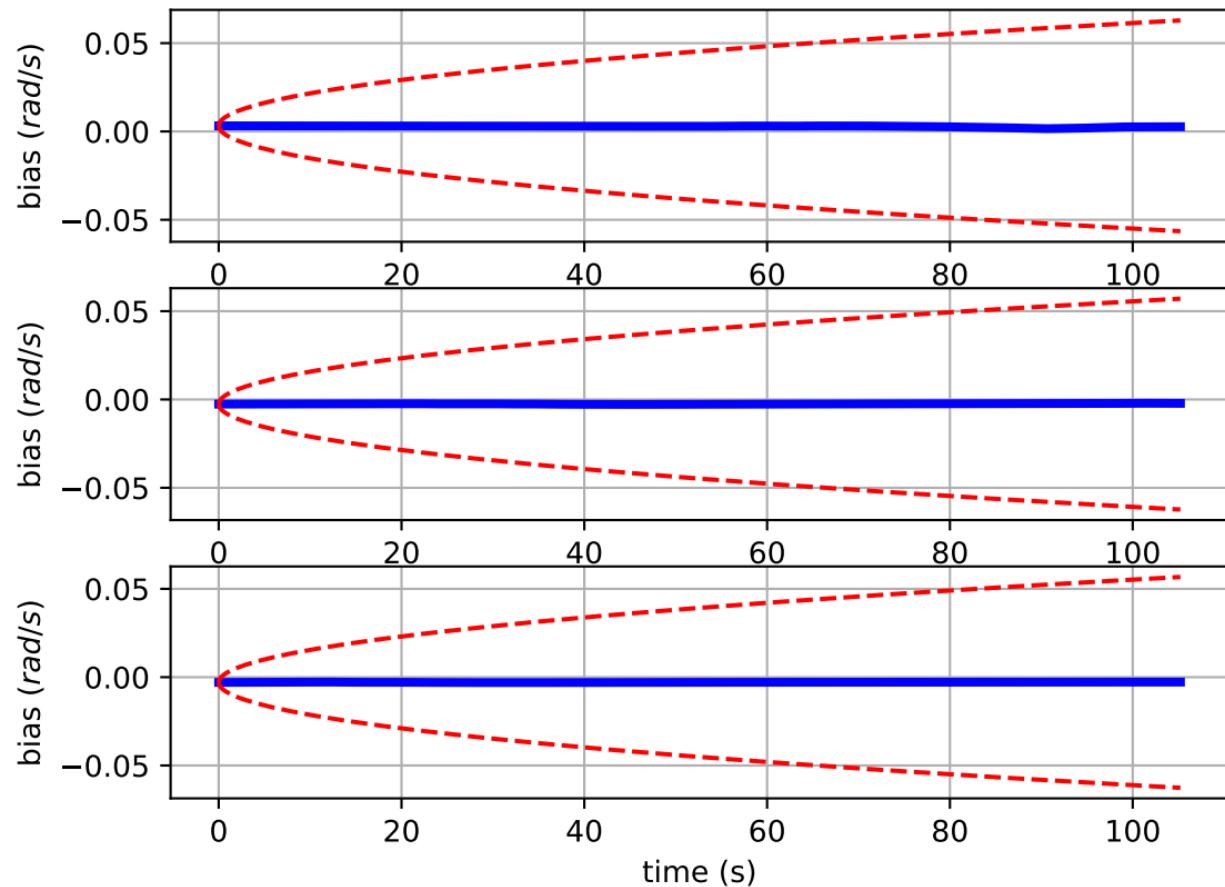
# Comparison of predicted and measured angular velocities (body frame)



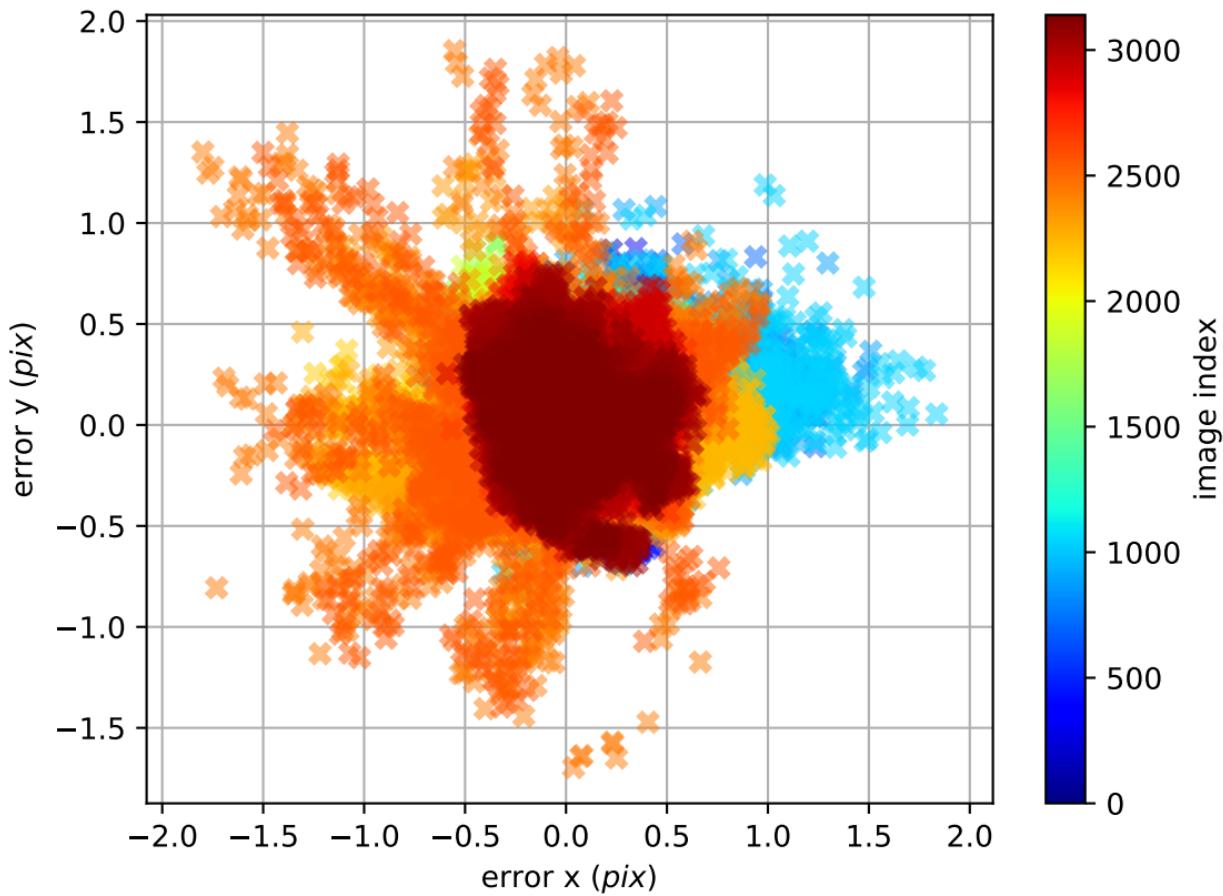
# imu0: angular velocities error



# imu0: estimated gyro bias (imu frame)



cam0: reprojection errors



cam1: reprojection errors

