End of Semester Meeting

ADCS Team and friends

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Alvar Winquist, David Rodriques

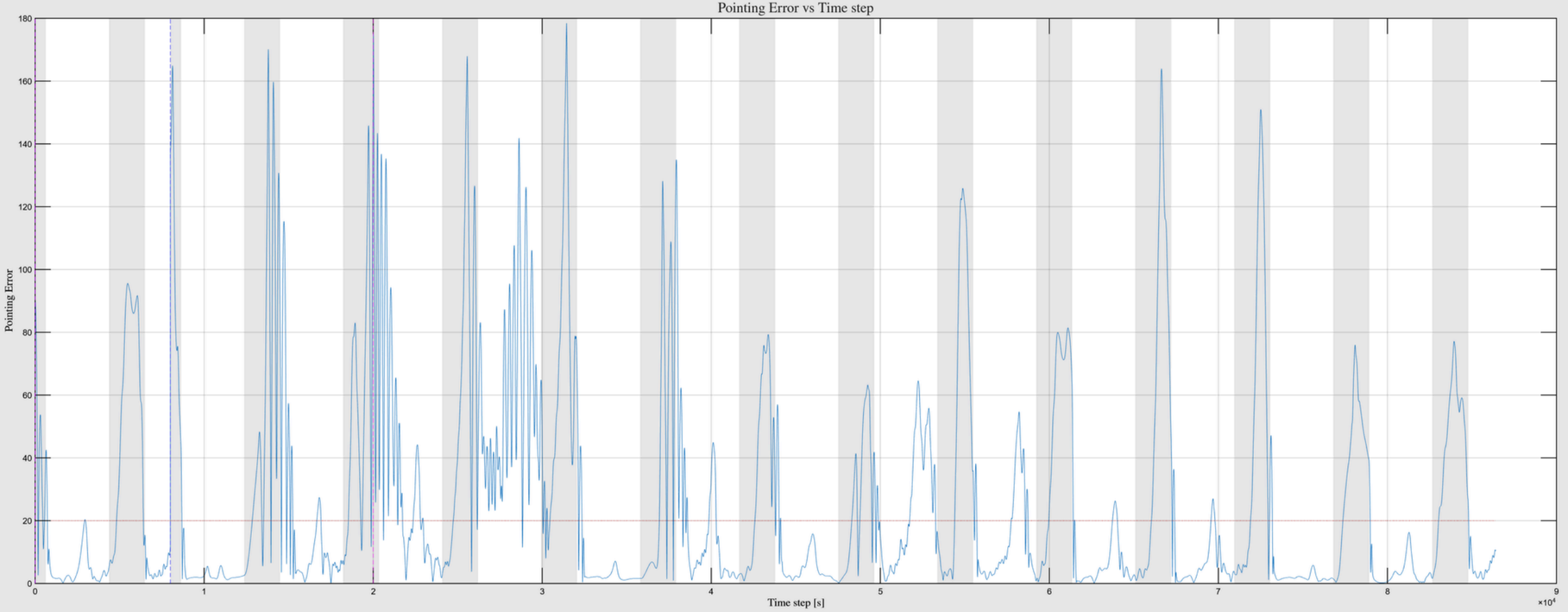
control tuning

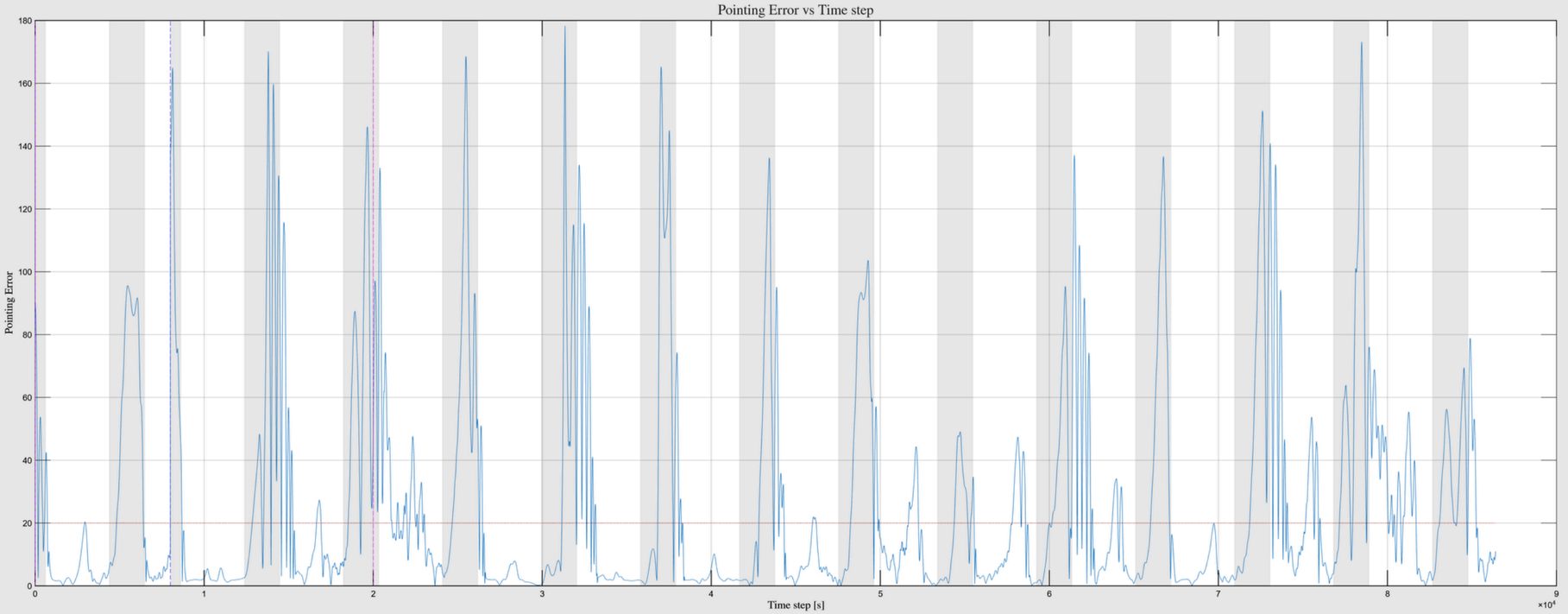
Abhinav, Ginnie, João, Rajesh

- found out different hardware leads to different simulations

intel

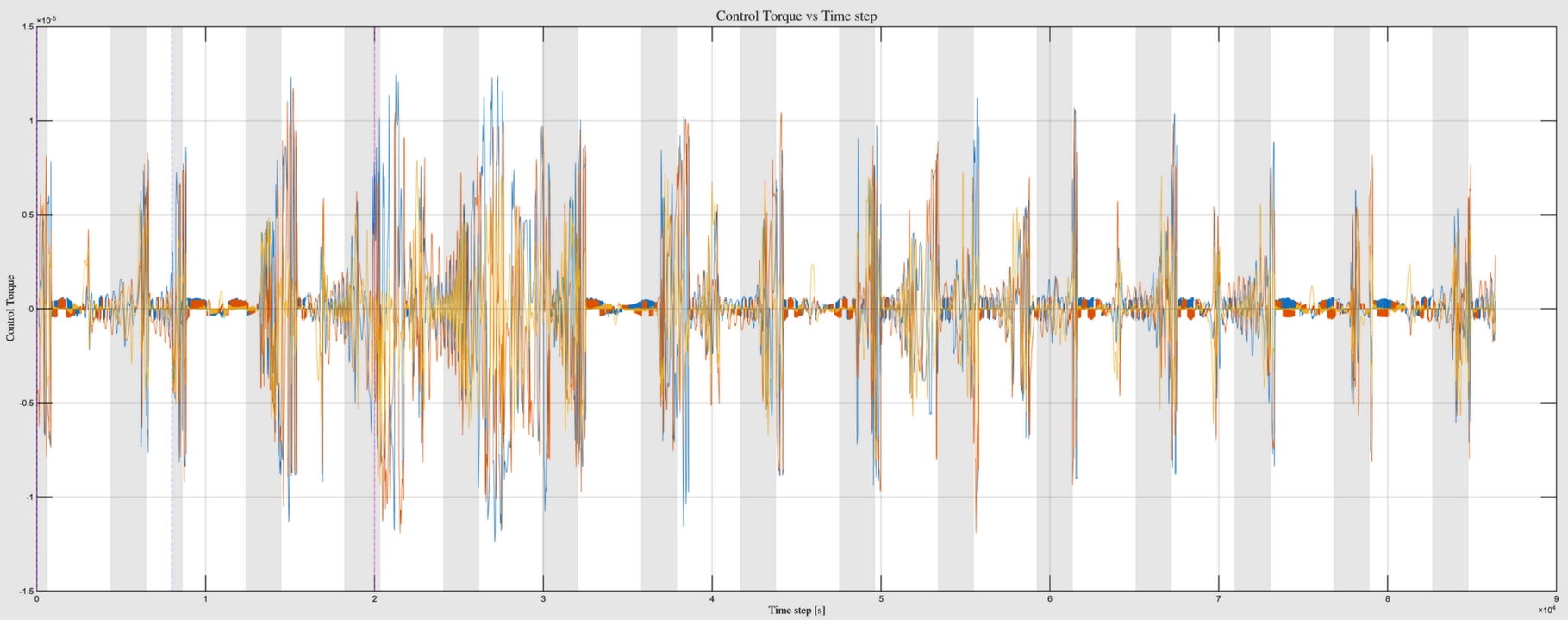
amd

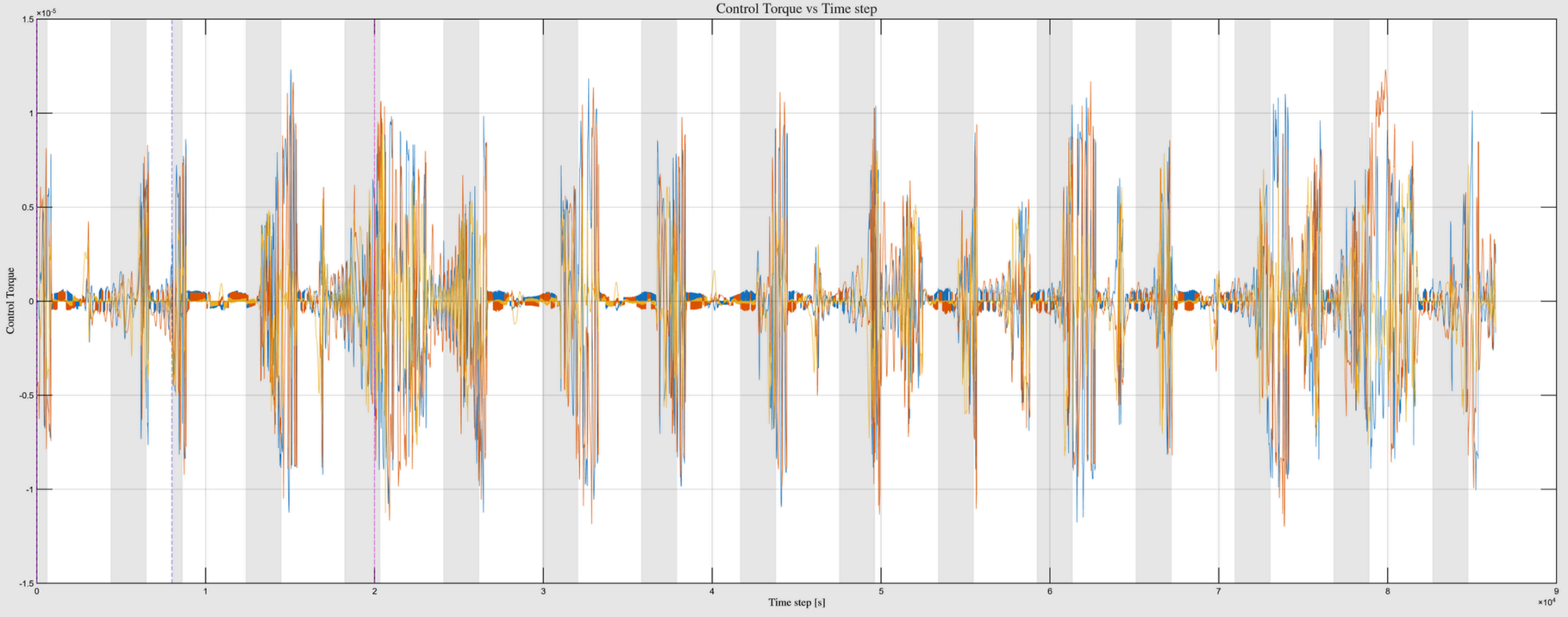

Pointing Error vs Time step
Pointing Error
Time step [s]
×10^4


Pointing Error vs Time step
Pointing Error
Time step [s]
×10^4

intel

amd


Control Torque vs Time step
×10^-5
1.5
1
0.5
0
-0.5
-1
-1.5
Control Torque
0
1
2
3
4
5
6
7
8
9
×10^4
Time step [s]


Control Torque vs Time step
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Control Torque
0
1
2
3
4
5
6
7
8
9
×10^4
Time step [s]

control tuning

Abhinav, Ginnie, João, Rajesh

- found out different hardware leads to different simulations
- solved housekeeping error

```
(...waiting in a loop for events...)

ADCS parameters Loading started
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ADCS parameters Loaded Successfully

**************************************
ADCSLoop_Initialize: Applying TLE reset for set 0
New TLE Data: inclination = 97.943000, RAAN = 250.633200, EPOCH_year = 17.000000, EPOCH_day = 172.0000
, EPOCH_dayfraction = 0.000000

--------------------------------------
ADCS housekeeping frame:              |
--------------------------------------
Time-stamp: 0-0-0-0-0-0

The magnetic input vector:

0
0
0

The inputvector to the sun:

0
0
0

The requested ADCS mode: -10
The given timestep definition: -1.000000

The TLE used:
B-star:              0.000000
Eccentricity:        0.001000
Epoch year:          17.000000
Epoch day:           172.000000
Epoch day-fraction:  0.000000
Inclination:         97.943000
Mean anomaly:        0.000000
Mean motion:         14.758960
Argument of perigee: 0.000000
Right ascension:     250.633200

The calculated ECI position:

0
0
0

The calculated ECI velocity:

0
0
0

The calculated ECI vector to the sun:

0
0
0

The calculated ECI magnetic field vector:

0
0
0

The calculated eclipse boolean: 255
The update number of the EKF7a: 0
The bias correction status: 0
The estimated quaternion:

0
0
0
0

The estimated angular rate:

0
0
0

The sum of the error covariance matrix: 0.0000000
The estimated magnetic bias:

0
0
0

Fatal error detected in frame: 0
The commanded dipole:

0
0
0

The expected control torque:

0
0
0

------------------------------------------------------
Error summary:
last error code detected: 2
Reason of last error: Time input out of bounds or incorrect
Total amount of errors: 2
------------------------------------------------------
```

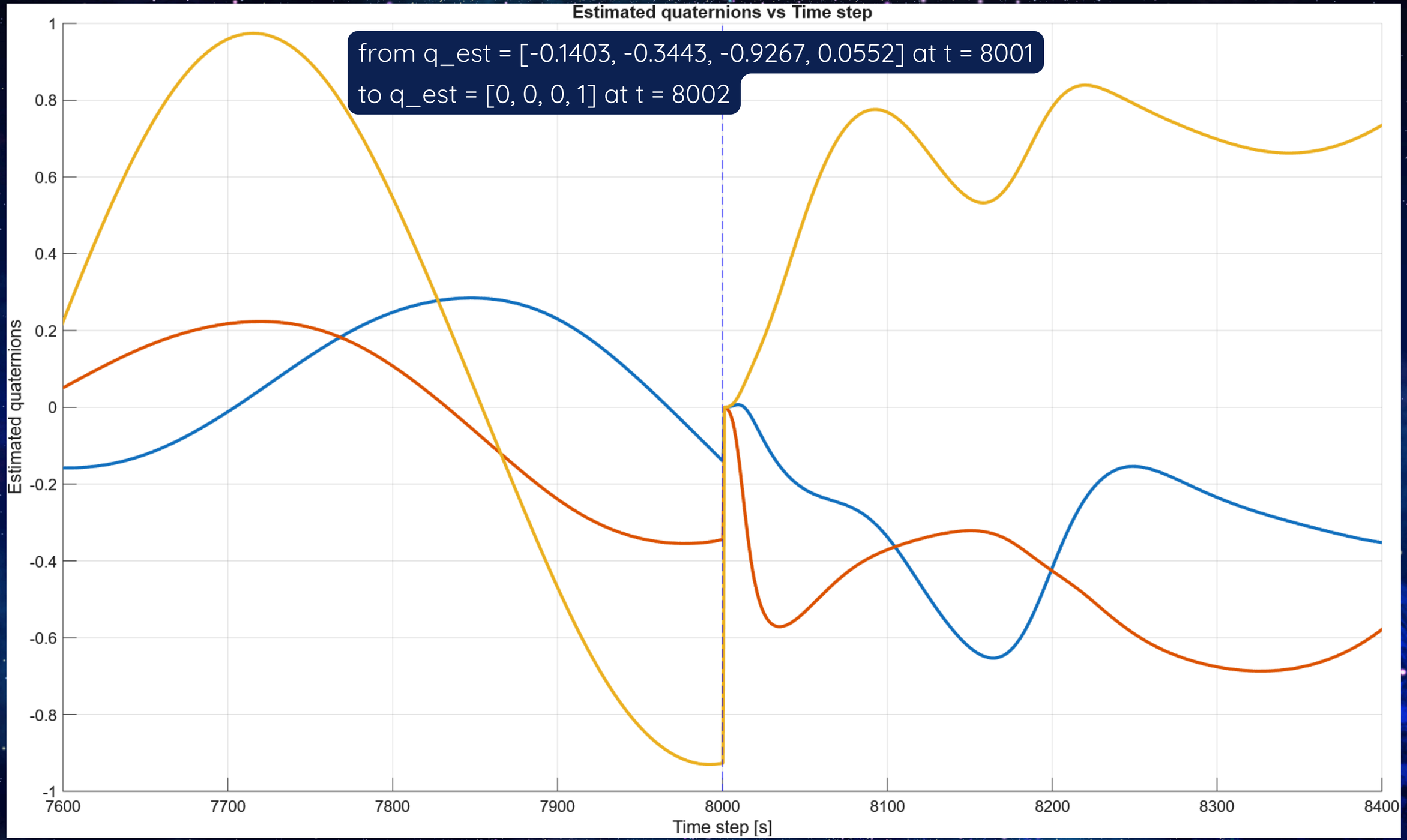
all of these values are set to deafult meaningless values and it just doesn't make a lot of sense to print this housekeeping frame here but this is correct. after ADCS_MAIN_adcs_service function is called, these values are updated

MOCK_GetCurrentTime(&now) function needs to be called

control tuning

Abhinav, Ginnie, João, Rajesh

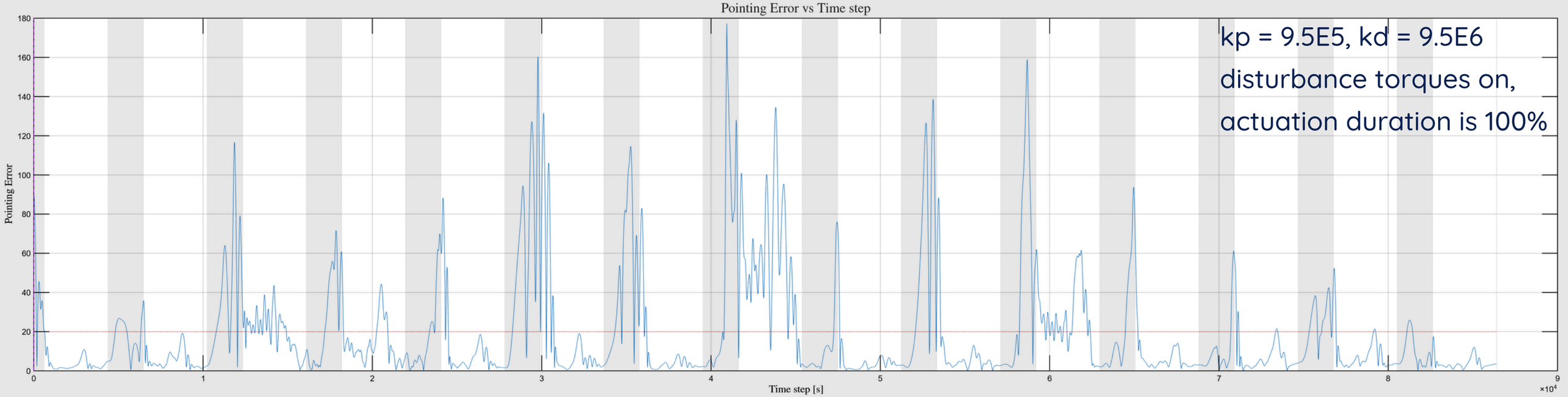
- found out different hardware leads to different simulations
- solved housekeeping error
- investigated pointing vector discontinuity


Estimated quaternions vs Time step
from q_est = [-0.1403, -0.3443, -0.9267, 0.0552] at t = 8001
to q_est = [0, 0, 0, 1] at t = 8002
Estimated quaternions
Time step [s]
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
7600
7700
7800
7900
8000
8100
8200
8300
8400

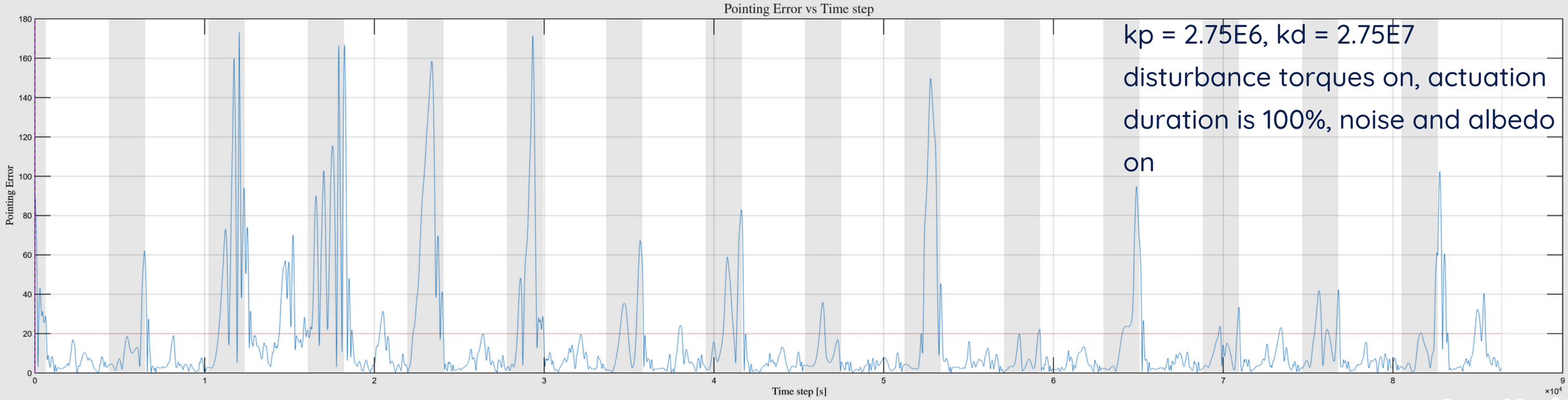
control tuning

Abhinav, Ginnie, João, Rajesh

- found out different hardware leads to different simulations
- solved housekeeping error
- investigated pointing vector discontinuity
- performed gain search to look for good parameters for the simulation
    - found two sets of gains where the pointing error in the sunlight is less than 20 degrees around 90% of the time and median error less than 10 degrees



kp = 9.5E5, kd = 9.5E6 disturbance torques on, actuation duration is 100%



kp = 2.75E6, kd = 2.75E7 disturbance torques on, actuation duration is 100%, noise and albedo on

control tuning

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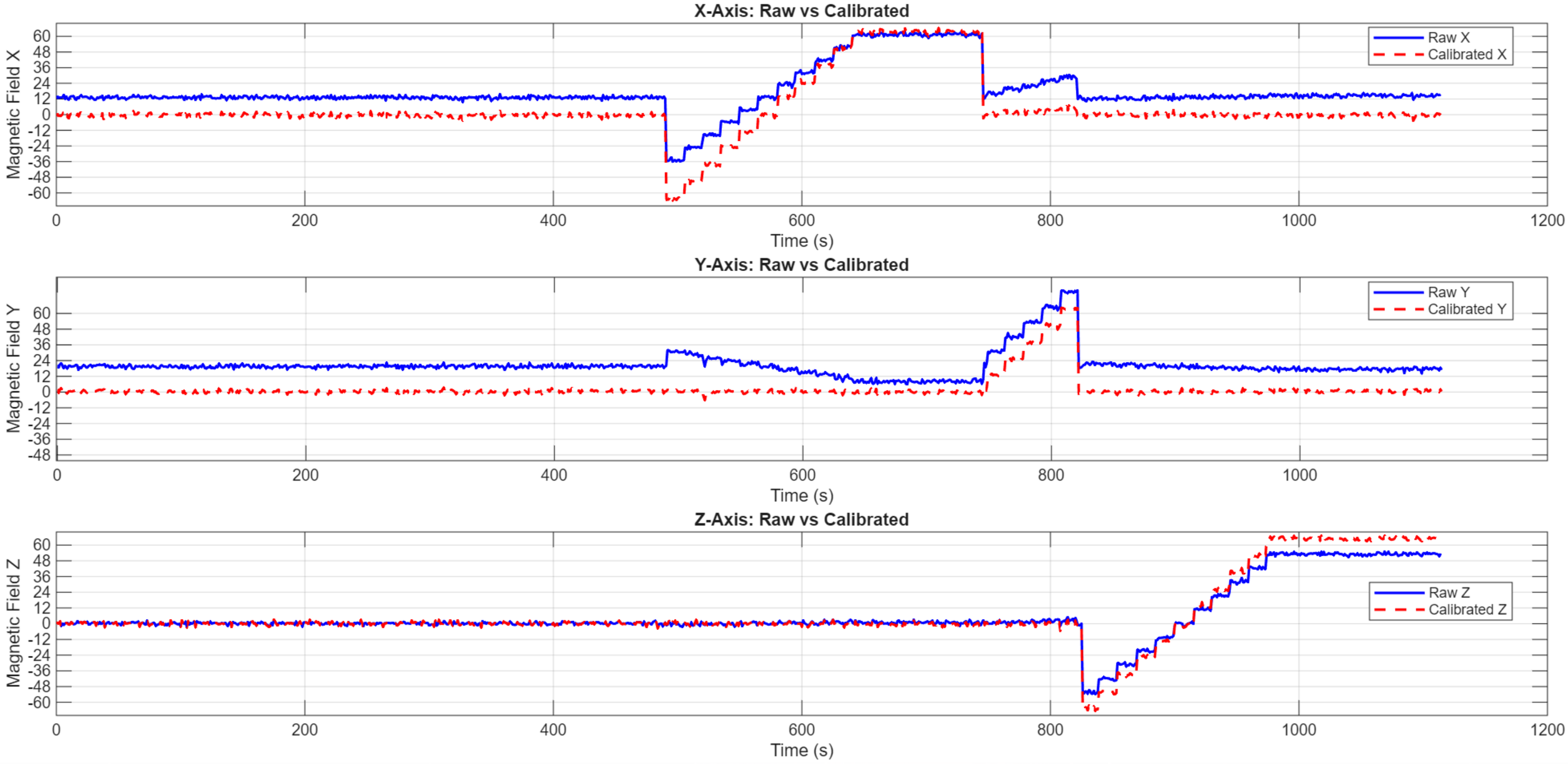
- found out different hardware leads to different simulations
- solved housekeeping error
- investigated pointing vector discontinuity
- performed gain search to look for good parameters for the simulation
- confirmed we are using the right inertia matrix
- moved albedo part from the main code to its own helper function
- gained understanding of the purpose of most helper functions
- started working towards running the simulation on obc to confirm choice of gains and similar parameters

magnetic calibration

Czarek, Ginnie, Utkarsha and friends

- finalised calibration procedure, pack list and plan for transportation to the facility
- dry run in Uppsala, where we experienced some problems with the coils - this needs to work for us to be able to do the calibration well but we have no control over this
- found out the code for calibration does not yield good skew matrix and bias vector and fixed it

Magnetometer Data: Raw vs Calibrated Comparison



Goals moving forward

1. Finalise simulation on OBC.
2. Verify the choice of gains and other parameters for control.
3. Adjust code on OBC for any additional functionalities.
4. Estimate how much time it takes for the simulation to “bounce back” after updating TLEs.
5. Validate step method calibration code.
6. Documentation of work done this semester.
7. When the time comes to schedule a date for final calibration in Uppsala, we need to reach out sometime in advance and make sure they fixed the coils.