Vibration Stress Testing Report

This report presents the results of a systematic stress test conducted on standard Luxonis devices. The purpose of this test was to assess the performance parameters of focus, stereo depth, and camera angles under controlled conditions before and after conducting the vibration test according to **EN 60068-2-6:2008** standard.

Three distinct tests were conducted to evaluate the camera's capabilities:

1. Focus Test: Aimed to compare the focus of the sensors on ISO12233 board before and after the testing.
2. Camera Angles Test: Assessed if the cameras physically moved after the vibration tests were performed.
3. Stereo Depth Test: Aimed to compare on-device depth before and after the vibration tests on the camera were performed to check for any regressions.

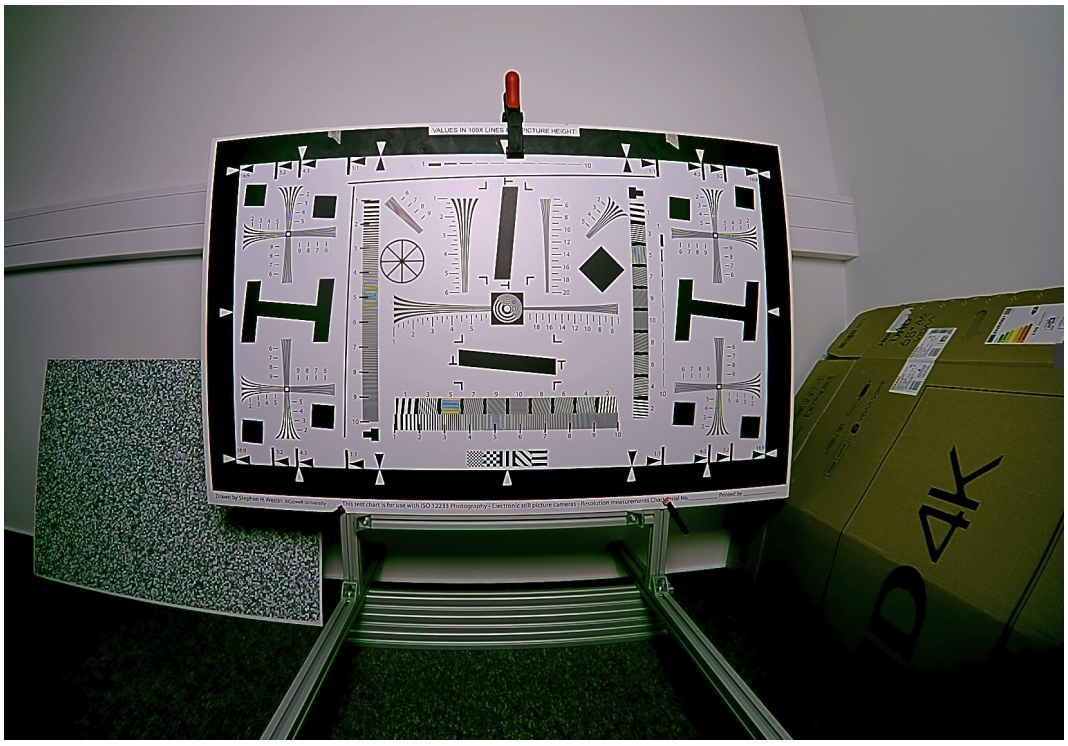
Tests were conducted on three cameras, OAK-D-PoE, OAK-D-Pro-PoE and OAK-D-Pro.

All raw data that was collected before and after the tests can be found here:
https://drive.google.com/drive/u/1/folders/12HoYvBfmX9uCz0zJWjkGNyeQOLf9-bh8

Focus testing

Focus tests were performed by mounting the camera 1 meter away from the target ISO12233 in consistent lighting conditions both before and after the stress tests were performed.

Results were checked visually per-camera per-sensor on the image recordings which can be found here.



Above is an example picture of the focus board capture.

Results for focus testing

OAK-D-PoE

RGB	PASS
CAM_B - LEFT	PASS
CAM_C - RIGHT	PASS

OAK-D-Pro

RGB	PASS
CAM_B - LEFT	PASS
CAM_C - RIGHT	PASS

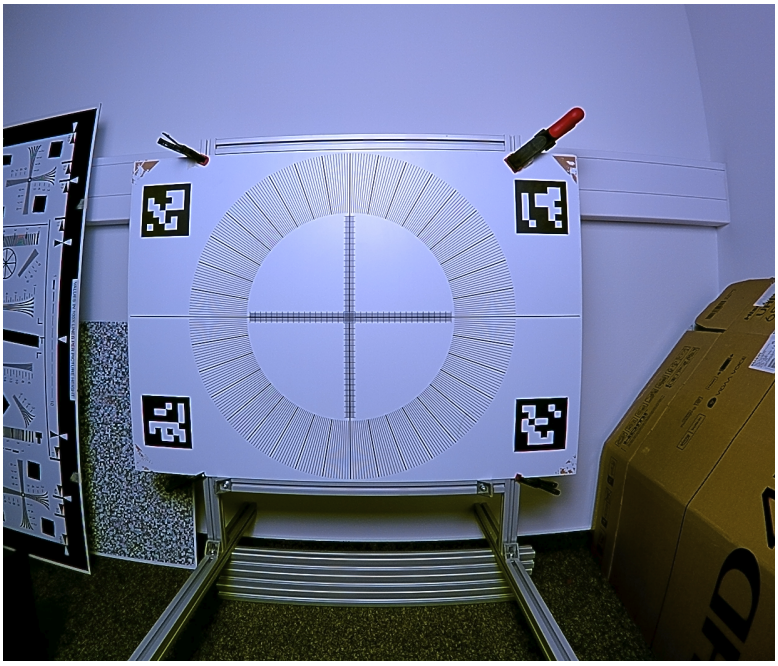
OAK-D-Pro-PoE

RGB	PASS
CAM_B - LEFT	PASS
CAM_C - RIGHT	PASS

No cameras had no visible degradation in the focus of the lenses after being in the vibration chamber.

Angle testing

Angle tests were conducted to assess any relative movement between the sensors by evaluating their rotation in relation to each other; such changes are of paramount importance. Without recalibration following these rotational movements, the efficacy of stereo matching can be significantly compromised.

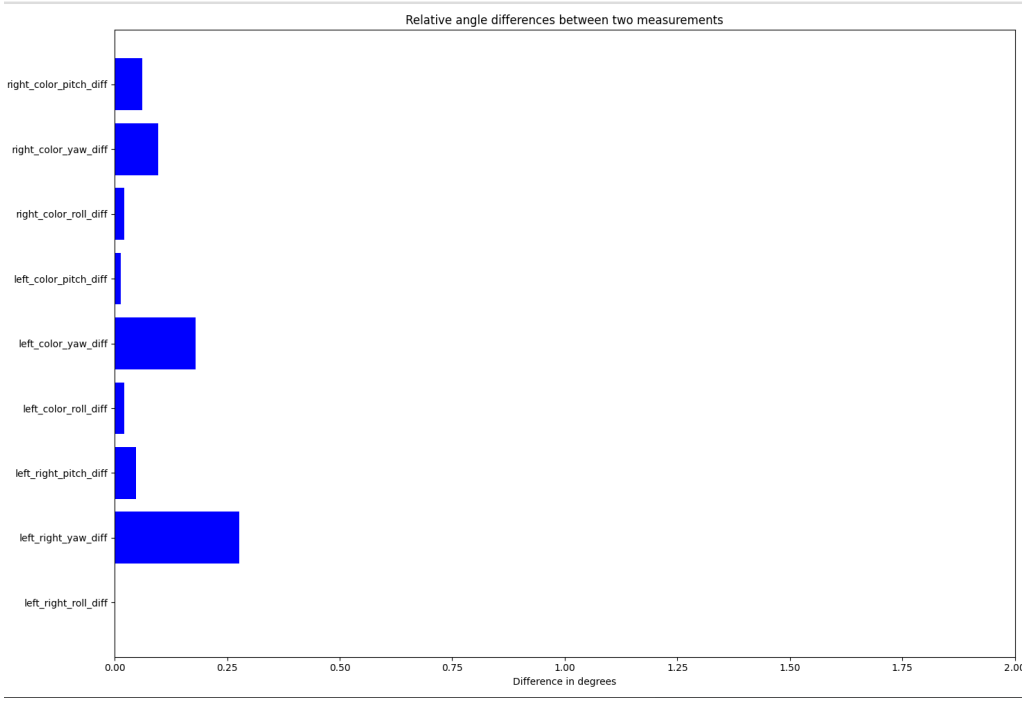


Board used for angle tests.

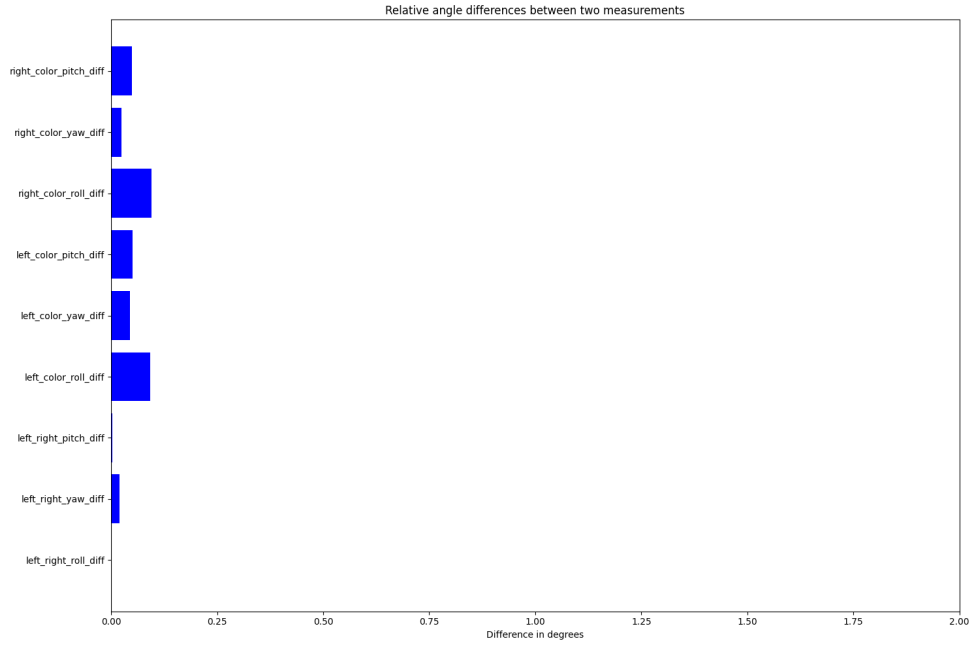
Results for angle testing

The tests were run twice for each device before stress testing in succession, to see how repeatable the measurements are. Because of discrete resolution and noise, the tests seem to be repeatable in the 0.5 degree range, meaning that even running the test in succession with the same unit and in the same environment gives us differences up to half a degree.

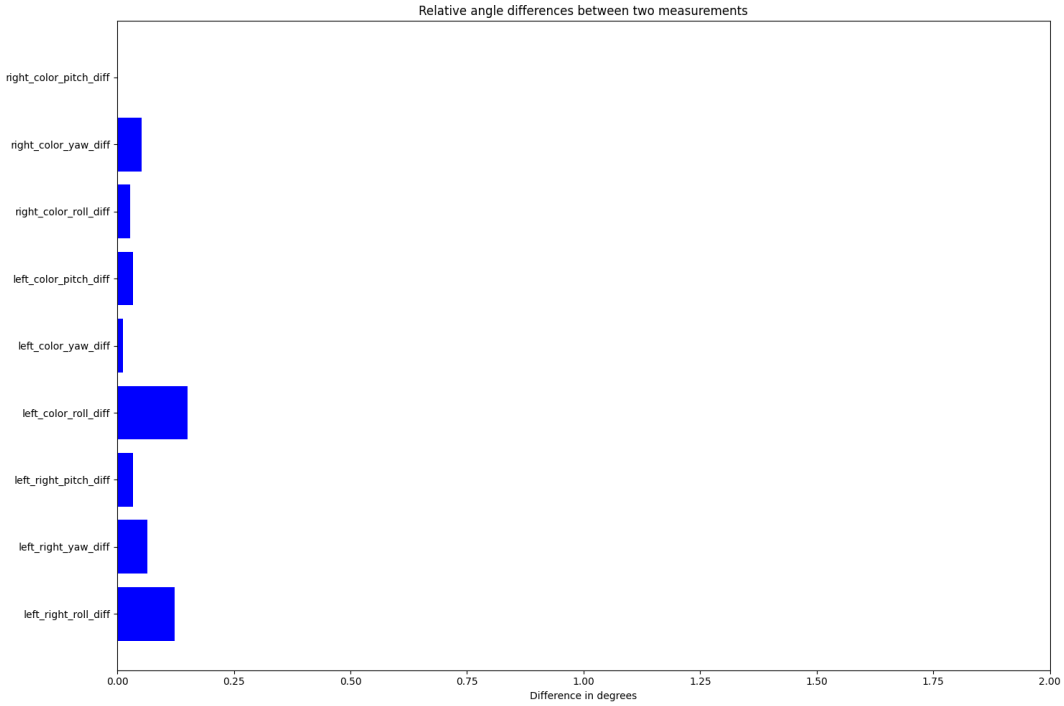
OAK-D-PoE



OAK-D-Pro



OAK-D-Pro-PoE



In successive tests, all three cameras showed differences that were as low as when comparing a single unit twice with no tests being run in between. This suggests that the sensors did not undergo significant movement relative to each other within the detectable limits of the test.

Depth testing

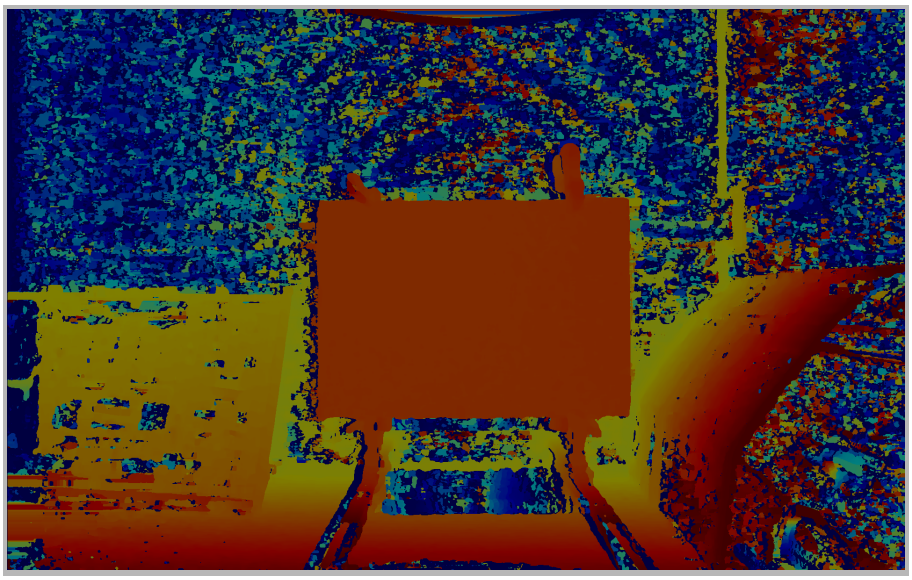
The purpose of depth testing was to check if the depth degraded after the cameras were tested on the vibration desk. It was done on a noise pattern that was mounted in front of the camera .

Results for the depth testing

The true distance of the noise pattern compared to the camera was 1 meter.

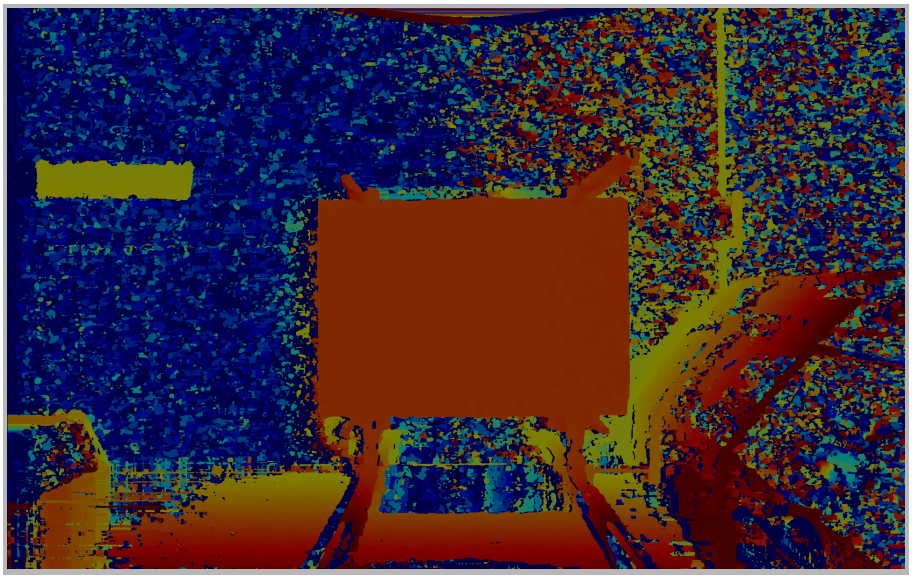
Camera ID 7:

Before vibration testing:
Z accuracy: **-1.37%** of GT (avg distance: 986.19mm)
Median distance: -986.32mm
Median distance error: -1.37%
Average distance: 986.19mm
Spatial noise: 13.86 mm
Subpixel spatial noise: 1.27 px
Fillrate: 100.00%



Depth before vibration testing

After:
Z accuracy: **-1.45%** of GT (avg distance: 984.52mm)
Median distance: -985.51mm
Median distance error: -1.45%
Average distance: 984.52mm
Spatial noise: 15.74 mm
Subpixel spatial noise: 1.44 px
Fillrate: 100.00%



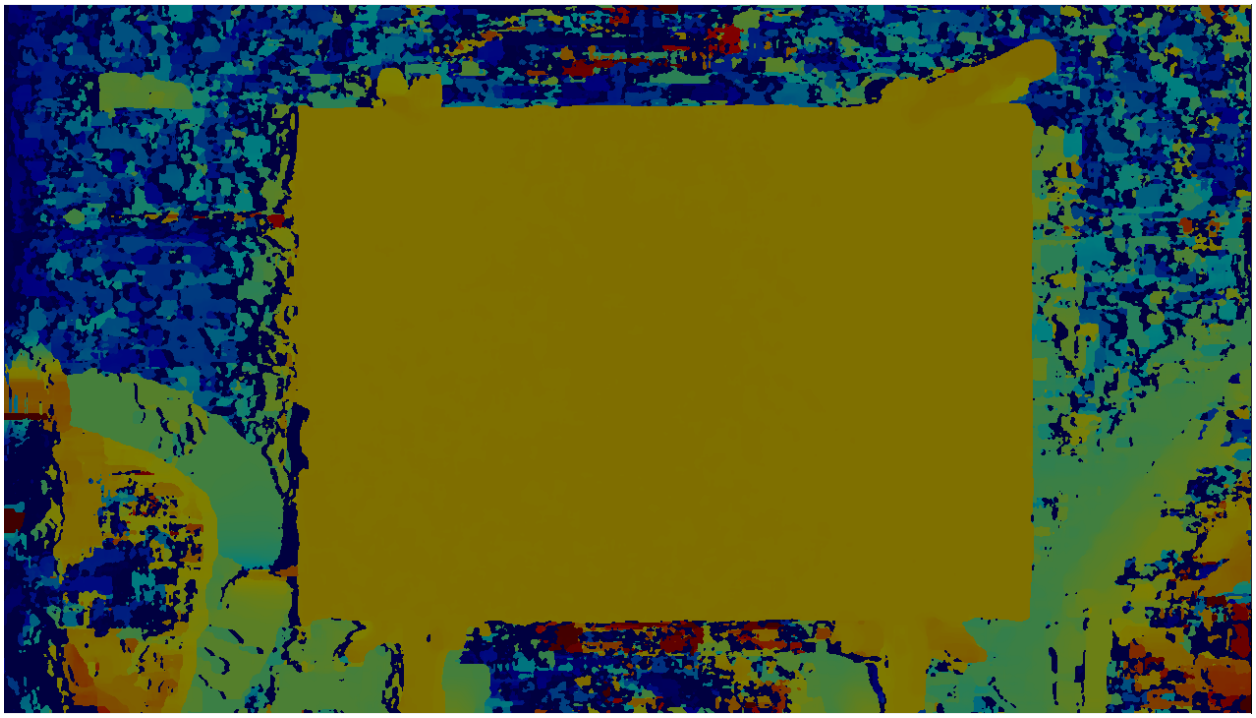
Depth after vibration testing

OAK-D-PoE:

Before vibration testing:
Z accuracy: 4.06% of GT (avg distance: 1041.72mm)
Median distance: 1040.61mm
Median distance error: 4.06%
Average distance: 1041.72mm
Spatial noise: 41.71 mm
Subpixel spatial noise: 2.53 px
Fillrate: 100.00%

Depth before vibration testing

After:
Z accuracy: 4.06% of GT (avg distance: 1040.17mm)
Median distance: 1040.61mm
Median distance error: 4.06%
Average distance: 1040.17mm
Spatial noise: 40.19 mm
Subpixel spatial noise: 2.44 px
Fillrate: 100.00%



Depth after vibration testing

OAK-D-Pro:

Before:
Z accuracy: 5.14% of GT (avg distance: 1051.66mm)
Median distance: 1051.41mm
Median distance error: 5.14%
Average distance: 1051.66mm
Spatial noise: 52.43 mm
Subpixel spatial noise: 2.99 px
Fillrate: 100.00%

After:
Z accuracy: 4.72% of GT (avg distance: 1046.83mm)
Median distance: 1047.16mm
Median distance error: 4.72%
Average distance: 1046.83mm
Spatial noise: 47.33 mm
Subpixel spatial noise: 2.75 px
Fillrate: 100.00%

OAK-D-Pro:

Before:
Z accuracy: 1.23% of GT (avg distance: 1011.23mm)
Median distance: -1012.35mm
Median distance error: 1.23%
Average distance: 1011.23mm
Spatial noise: 11.75 mm
Subpixel spatial noise: 0.74 px
Fillrate: 100.00%

After:
Z accuracy: 2.56% of GT (avg distance: 1026.76mm)
Median distance: 1025.58mm
Median distance error: 2.56%
Average distance: 1026.76mm
Spatial noise: 27.25 mm
Subpixel spatial noise: 1.57 px
Fillrate: 100.00%

All cameras have **little to no depth degradation** after being subjected to the vibration tests detectable by our testing method.

Conclusion

All three cameras have **passed** all three tests and didn't show no detectable degradation after being subjected to vibration stresses.