Design, Assembly and Test of a Positioning System for Beam-Tests*

C. Stüllein[1], *A. Oancea*[1], *J. Gebelein*[1], *S. Manz*[1], *and U. Kebschull*[1]

[1]Infrastructure and Computer Systems for Data Processing (IRI), Goethe-Universität, Frankfurt, Germany

Motivation

The correct alignment of devices under test (DUT) according to the beam is an important and time-consuming task in the setup of beam tests. It can be difficult to adjust the position of a DUT, especially if it is mounted in a simple rigid frame structure, since the structure has to be manually loosened. Particularly during an ongoing test, it is not possible to correct the position. But this may be necessary, if the initial alignment was bad or the beam moved since the setup. Another problem could be the (re)programming of FPGA's. Also if the design is made to be fault-tolerant (e.g. using TMR) the programming interfaces are not. So it would be desirable to move the DUT out of the beam for reprogramming.

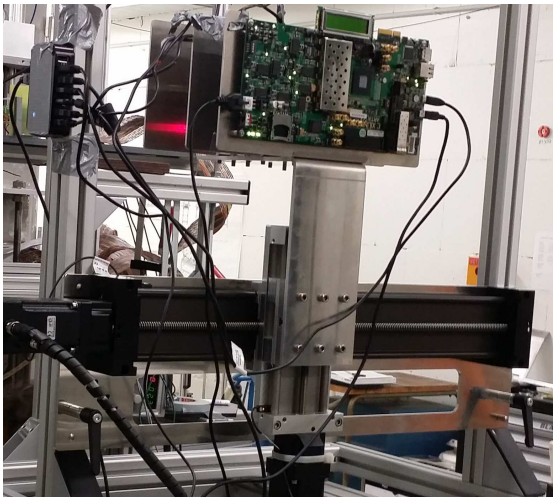

Figure 1: Photo of the stage assembled with a Xilinx eval board used in the test-setup for a SEM-Controller test [1]

Approach

For that purpose a remote-controlled Two-Axis positioning system (Figure 1) was developed. It consists of a 100mm z-axis attached to the moveable carriage of a 500mm x-axis. The whole x-axis can be additionally manually adjusted in height to meet the actual requirements. The z-axis carriage holds the carrier for several board-specific (or general purpose) frames. The axes are driven by two stepper motors (NEMA23 with up to 4A continuous current). The stepper drivers and the pulse controller are connected over cables long enough to be placed away from the stage. In the current version, the pulse controller provides a CAN interface and is capable to handle two stepper drivers and the limit switches (hall sensors) of the axes. The whole system is controlled by a Windows application with support for PS3/XBox wireless controllers as a simple interface for coarse and fine positioning.

Results

The setup has been tested at COSY, Juelich in December 2014. During a stress test with repetitive homing movements the current and different temperatures were measured and recorded. Also the required steps until reaching the limit switches were observed to check for step losses. The temperatures are shown in Figure 2. The combined overall current was around 1.8A with slow movement speeds and 2.5A at higer speeds.

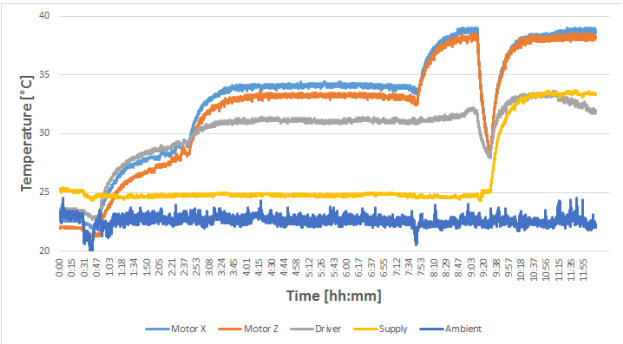

Figure 2: Temperatures during different stress tests. With permanent high speed movement the motor temperatures are just below 40°C at 22°C ambient temperature. The internal power supply was not used at the beginning.

Next Steps

One big functional improvement will be the design of an optional beam detector which allows for autotracking. An SRAM-based beam detector that will allow for autotracking is currently under development.

References

[1] A. Oancea, C. Stüllein, J. Gebelein, S. Manz, and U. Kebschull, "Implementation and Test of a Configuration Upset Mitigation Strategy for the CBM ToF ROB FPGA without a local Memory Storage", this CBM Progress Report

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