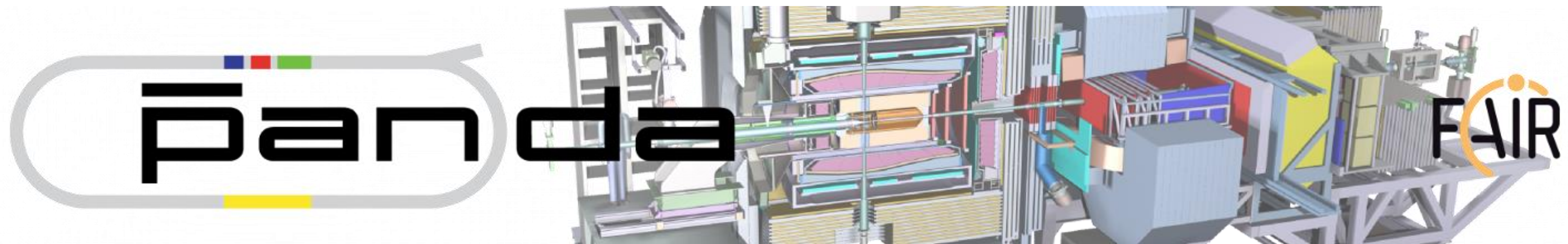
RUHR UNIVERSITÄT BOCHUM RUB

Preparation and commissioning of the sensor modules for the PANDA Luminosity Detector

by Niels Boelger

10.10.2022



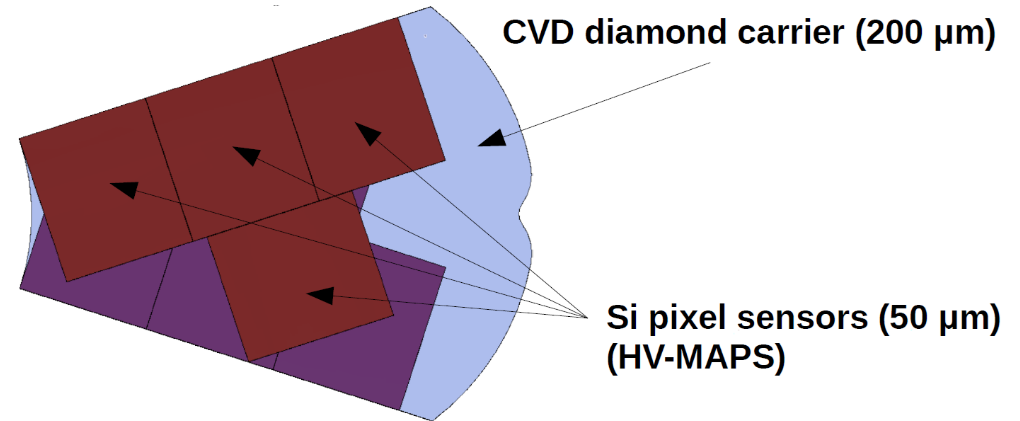
Sensor Modules

For the final detector

1 module with 8 HV-MAPS per diamond wafer (four on each side)

5 modules form 1 half-plane

Total number of 320 sensors

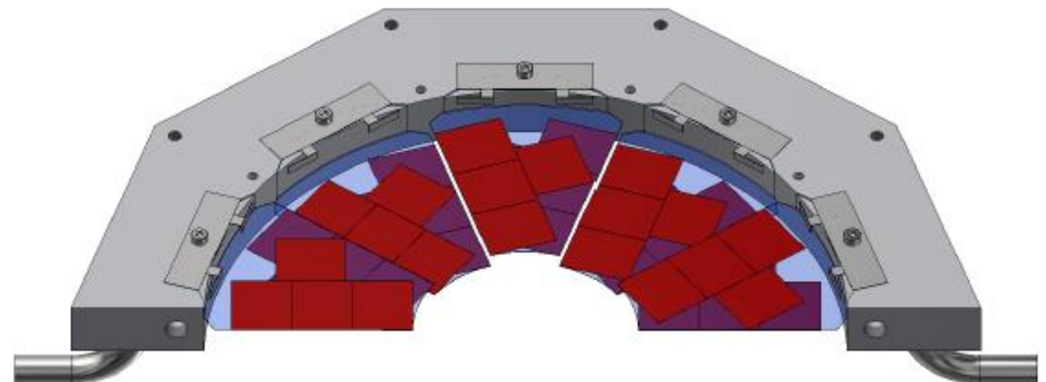


For the prototype

1 module with 4 HV-MAPS per diamond wafer (only on one side)

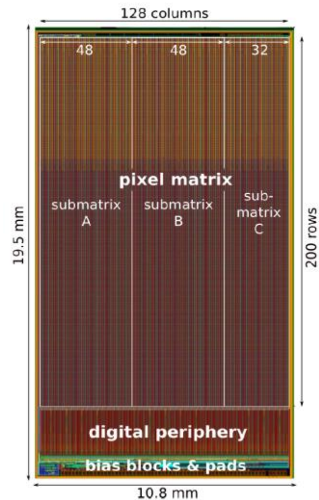
1 module per plane

16 sensors overall



MuPix sensors for the LMD

MuPix8



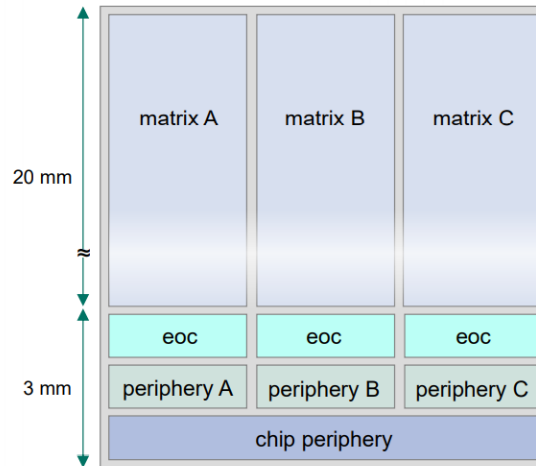
128 x 200 pixels

Single pixel size: 80 x 80 µm²

Sensor size: 1 x 2 cm²

Setting up the sensor module assembly

MuPix10



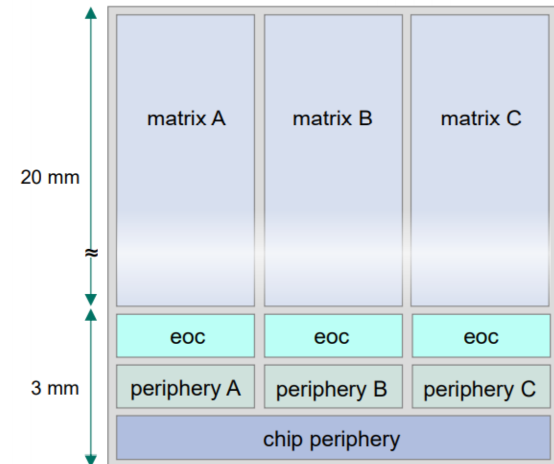
256 x 200 pixels

Final sensor size

Setting up DAQ

Sensors for LMD prototype

MuPix11



MuPix10 with bugfixes

First sensors tested in Heidelberg

Sensors for final LMD

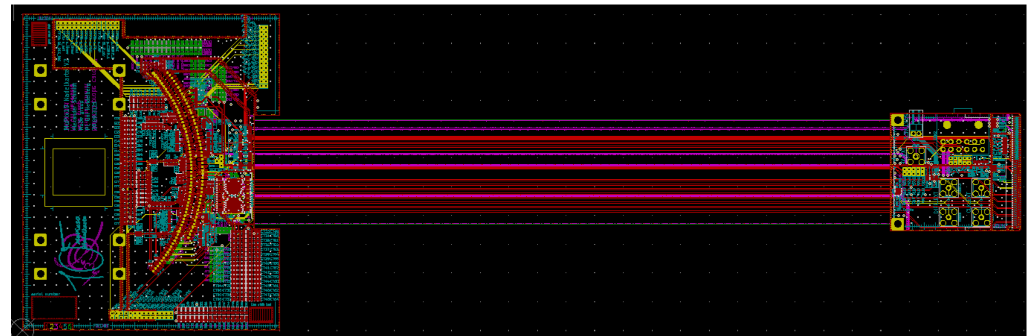
Sensor module assembly

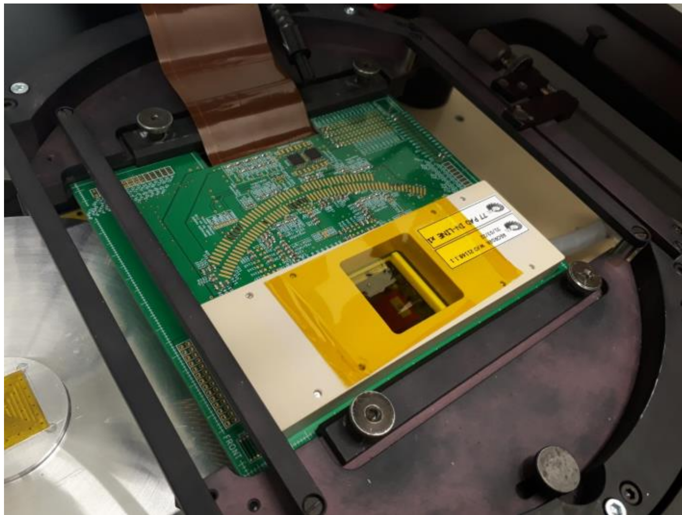
1. Test MuPix via probecard
2. Bond selected MuPixes to aluminum flexcables
3. Test MuPix-flexcable units via cable link
4. Glue MuPix-flexcable units on diamond wafer
5. Test complete sensor module

RUHR UNIVERSITÄT BOCHUM RUB

Development of MuPix10 Probecard v2

- 2Ri-2F-2Ri PCB
- Assembly of SMD-Parts and 77-Pad In-Line needles (PTSL)
- Based on MuPix8 Probecard with 62-Pad In-Line and Mupix10 Probecard v1 with 114-Pad In-Line

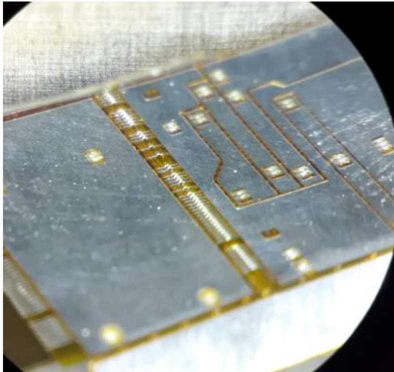


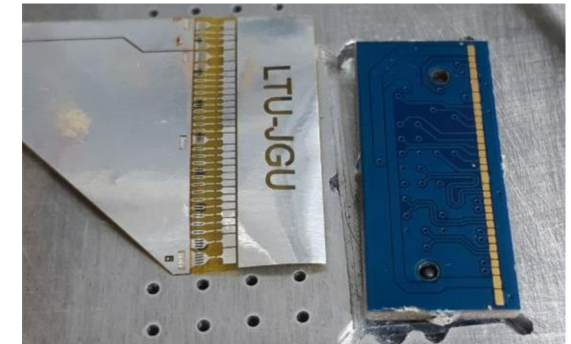


RUHR UNIVERSITÄT BOCHUM RUB

Prototype: Assembly of sensor modules

MuPix-flexcable units





Aluminum flexcable from LTU in Ukraine

MuPix and plug attached via TAB-bonding to flexcables

First sucessfully bonded MuPix8-flexcable unit
→ ready for testing

Stress test of mechanical stability

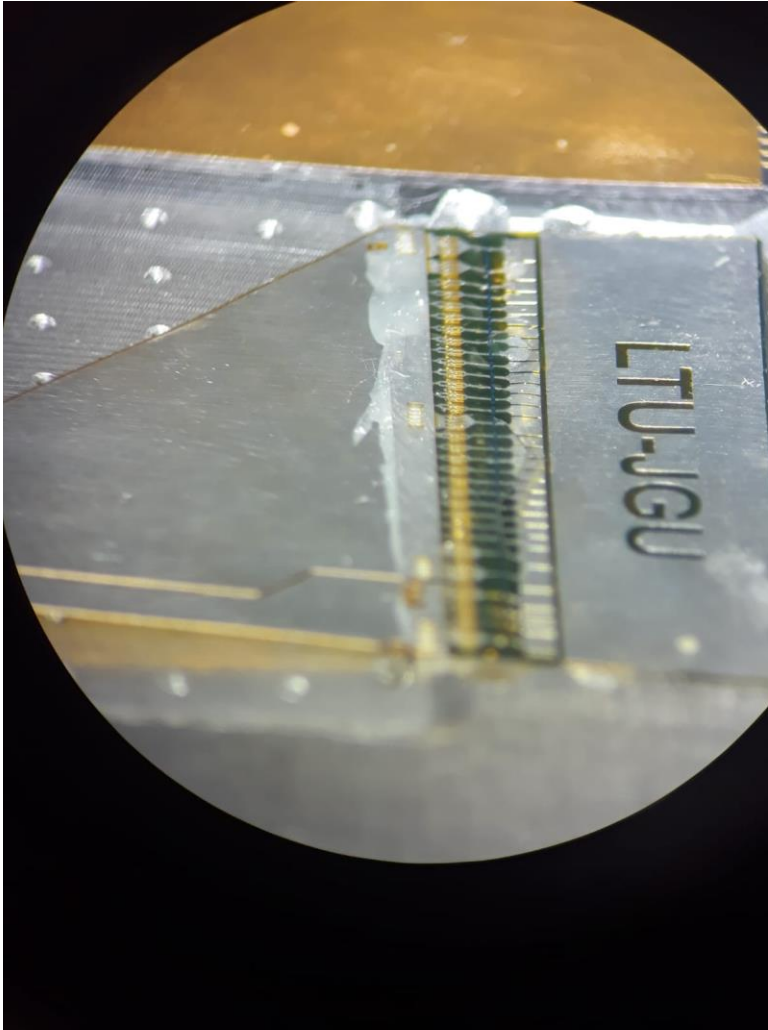
Sensor – Cable connection
→ stable

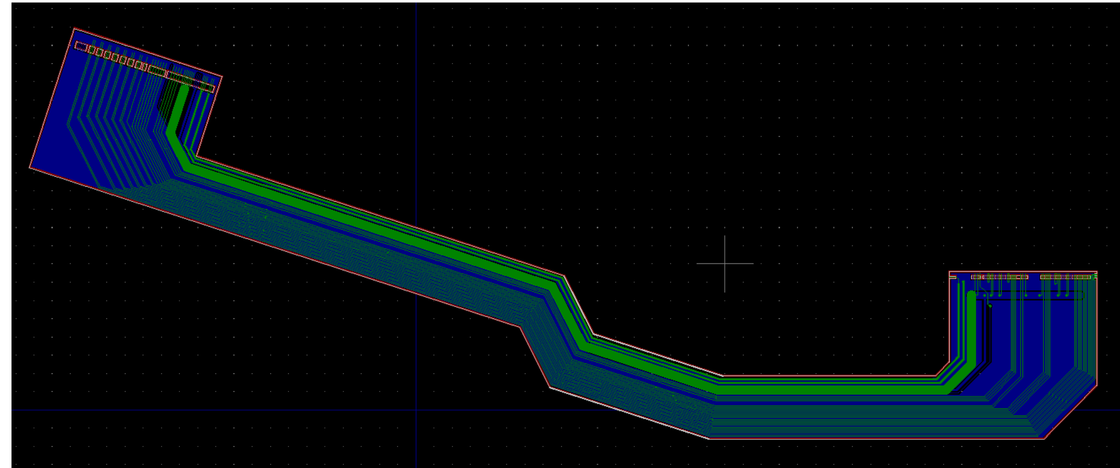
Cable – Plug connection
→ broken
→ needs redesign

RUHR UNIVERSITÄT BOCHUM RUB

Prototype: Assembly of sensor modules

Aluminium Flex Cable





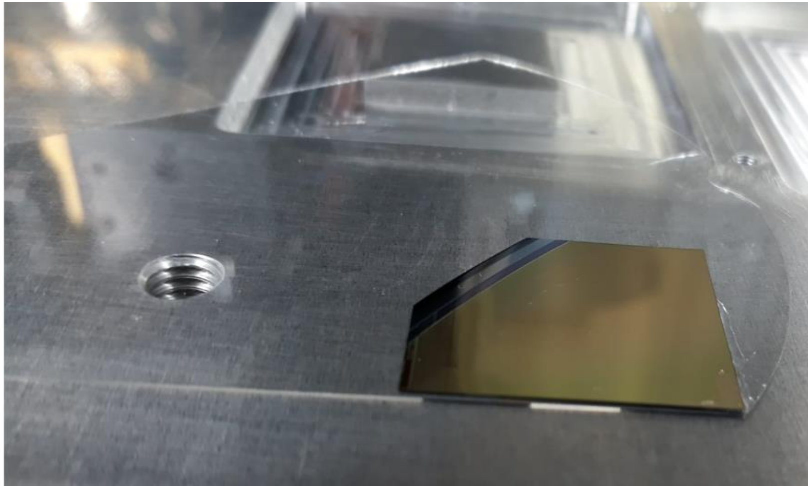
Flexcables for MuPix10 designed

Improved design based on MuPix8 flexcables

Improving mechanical stability by additional space for gluing on plug side

→ sent to CERN and LTU

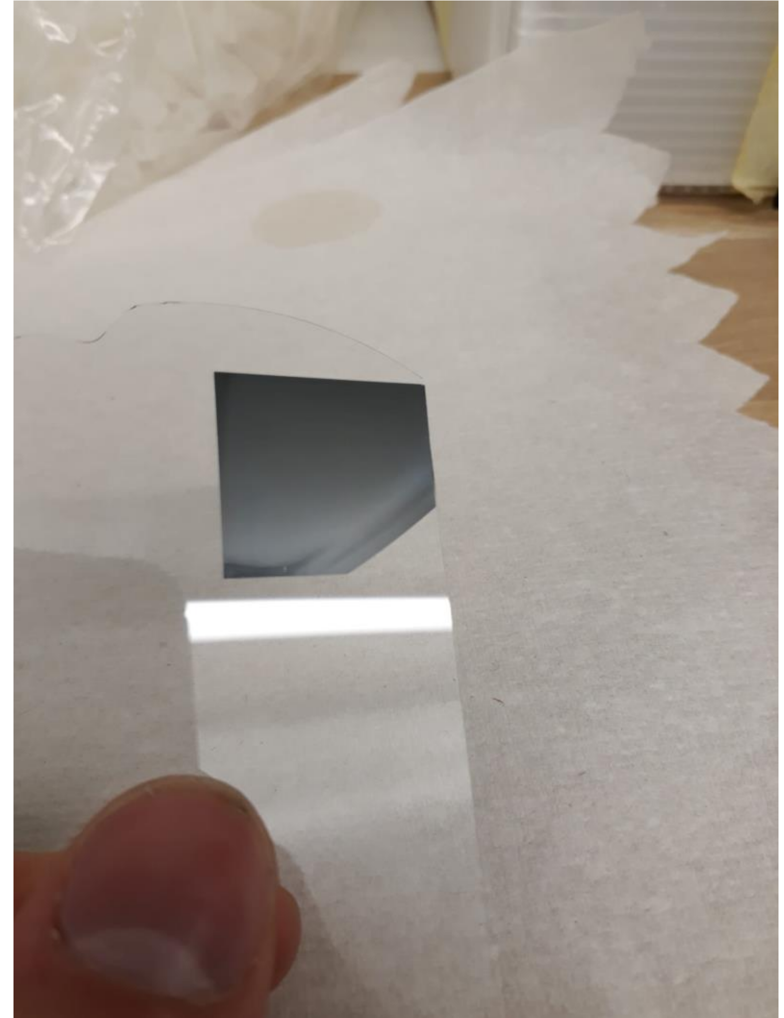
Glueing process



Testing the glueing process with transparent glas wafers and broken sensors

Glue: Epoxy Formulation 247

- low viscosity
- stays flexible until -45 °C
- Hardening at 65 °C for 120 h



RUHR UNIVERSITÄT BOCHUM RUB

Glueing on diamond

Gluing onto diamond fragments

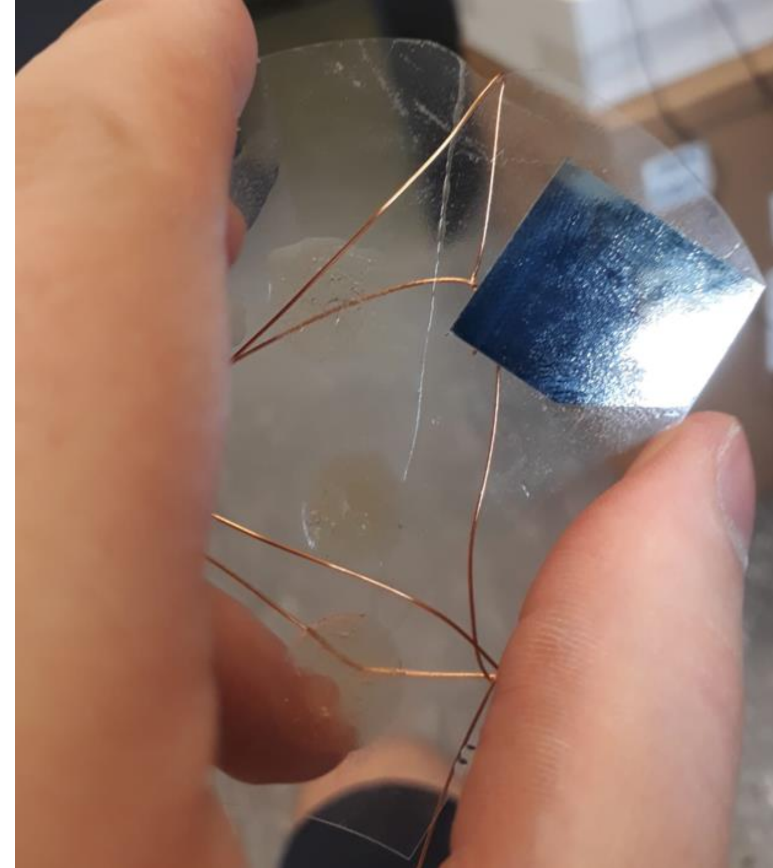
MuPix much cheaper than diamond wafer

Removing MuPix from diamond carrier with a scalpel works well

RUHR UNIVERSITÄT BOCHUM RUB

Thermal and vacuum stress tests

In vacuum chamber at 0.1 mbar: 100 cycles of heating up to 20 °C (1h) and cooling down to ≈ -15 °C (1h)



Glue passed 24h test in LN_2 (-196 °C)

RUHR UNIVERSITÄT BOCHUM RUB

Sensor Laser-Setup

CNC milling machine, featuring a green 100 mW industrial laser for reproduceable sensor tests

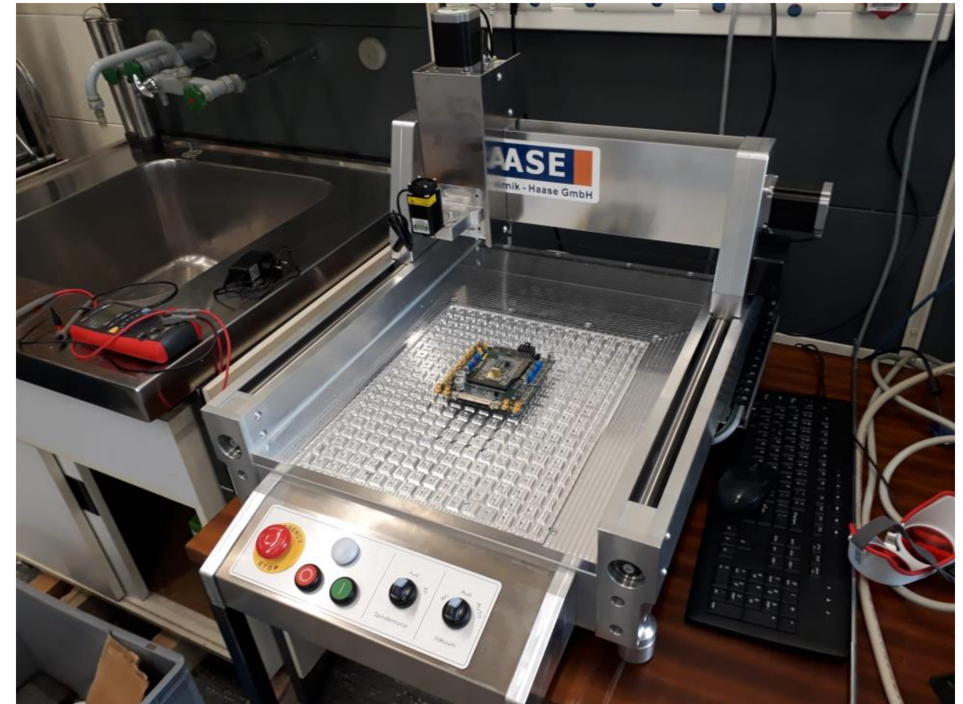
- Intransparent safety box
- Supporting plate for sensorboard and sensor modules

- MTO-Laser M-33A532-100-G
- 532 nm (green)

Sensor Laser-Setup

CNC milling machine, featuring a green 100 mW industrial laser for reproduceable sensor tests

- Intransparent safety box
- Supporting plate for sensorboard and sensor modules



- MTO-Laser M-33A532-100-G
- 532 nm (green)

Summary

MuPix8-flexcable units ready for testing with new DAQ

MuPix10 Probecard v2 ready for testing

Glue Epoxy Formulation 247 fits the requirements

Sensor Laser-Setup ready for testing

Next steps

1. Testing MuPix8-flexcable unit via cable link
2. Getting MuPix10 running with new DAQ
3. Testing MuPix10 via probecard
4. Setting up the glueing procedure for 4 MuPix-flexcable units onto diamond