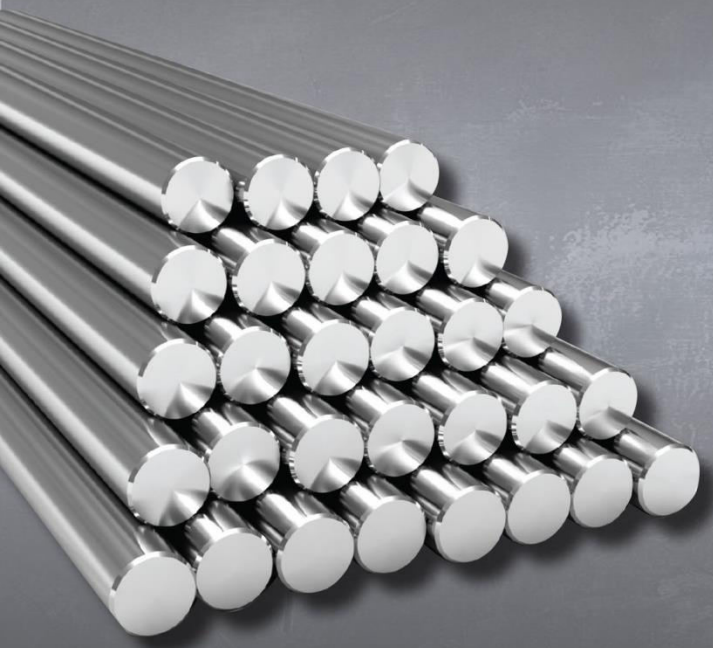
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RUHR-UNIVERSITÄT BOCHUM

RUB

DESIGN OF A LOCKING DEVICE FOR AN SMA DRIVEN FEED AXIS

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LPS
LEHRSTUHL
FÜR PRODUKTIONSSYSTEME

DFG

SPP 1476
Kleine Werkzeugmaschinen

Agenda

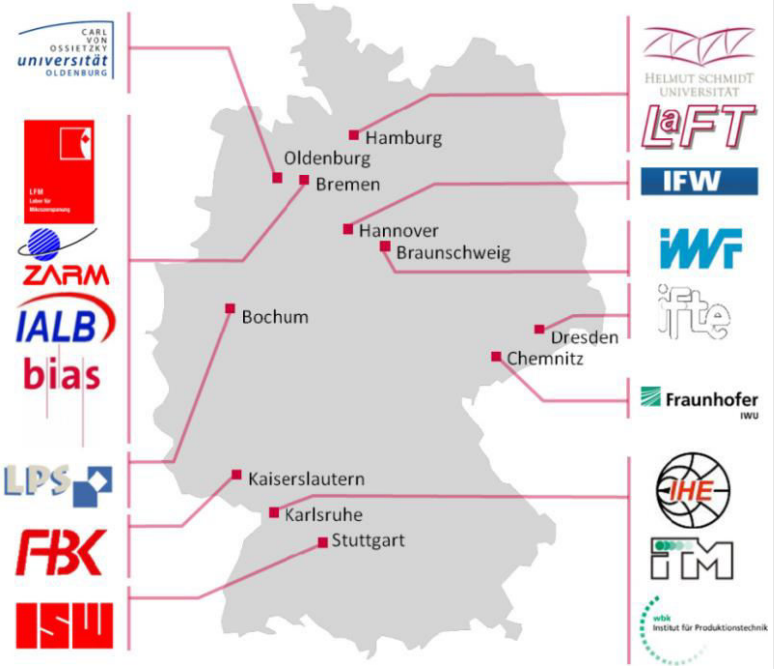
- **Introduction**
- Experimental setup
- Experimental results
- Conclusion and Outlook

Introduction: research project

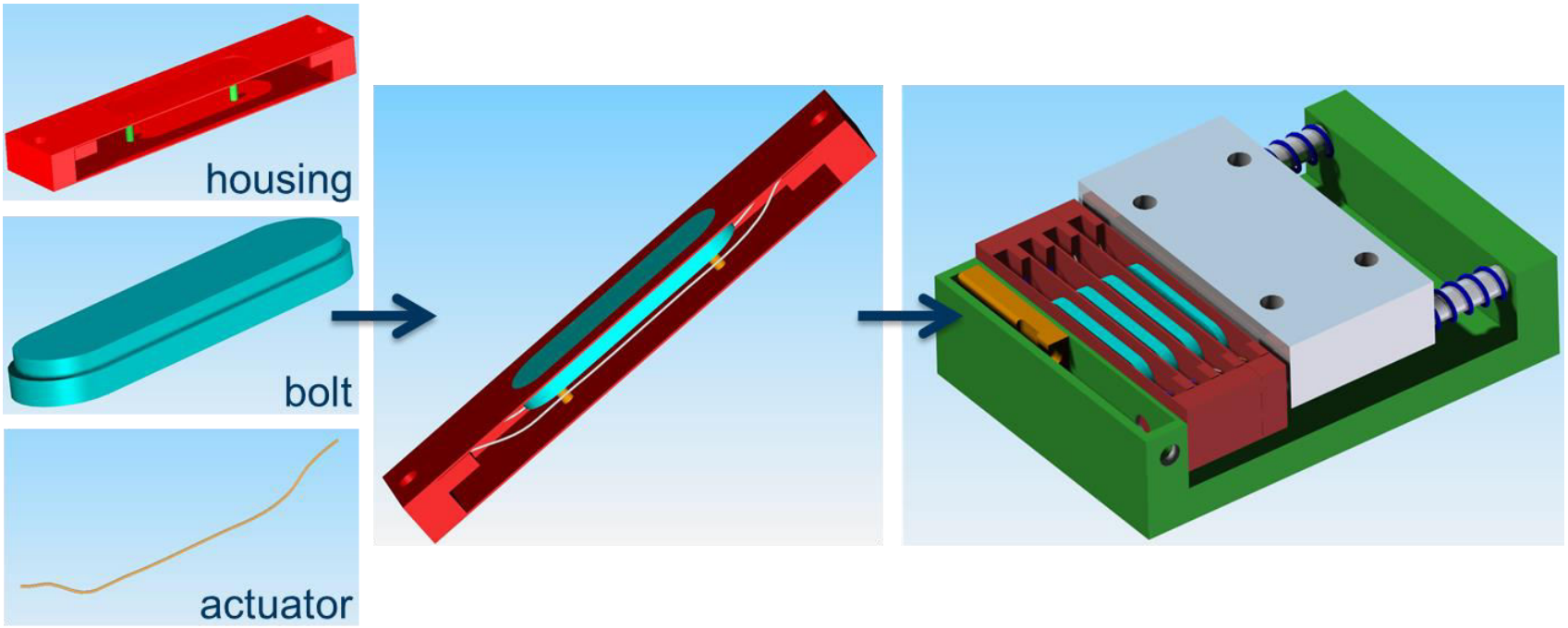
DFG priority program 1476:

“Small machine tools for small work pieces”

- Innovative actuation and tool modules for a configurable machine tool
- Focus on micromachining, part size less than 10x10 mm²
- Wide range of parts and materials
- Advantages over current systems:
  - High flexibility in placement
  - Fewer parts and less material needed
- 11 universities, 16 individual projects

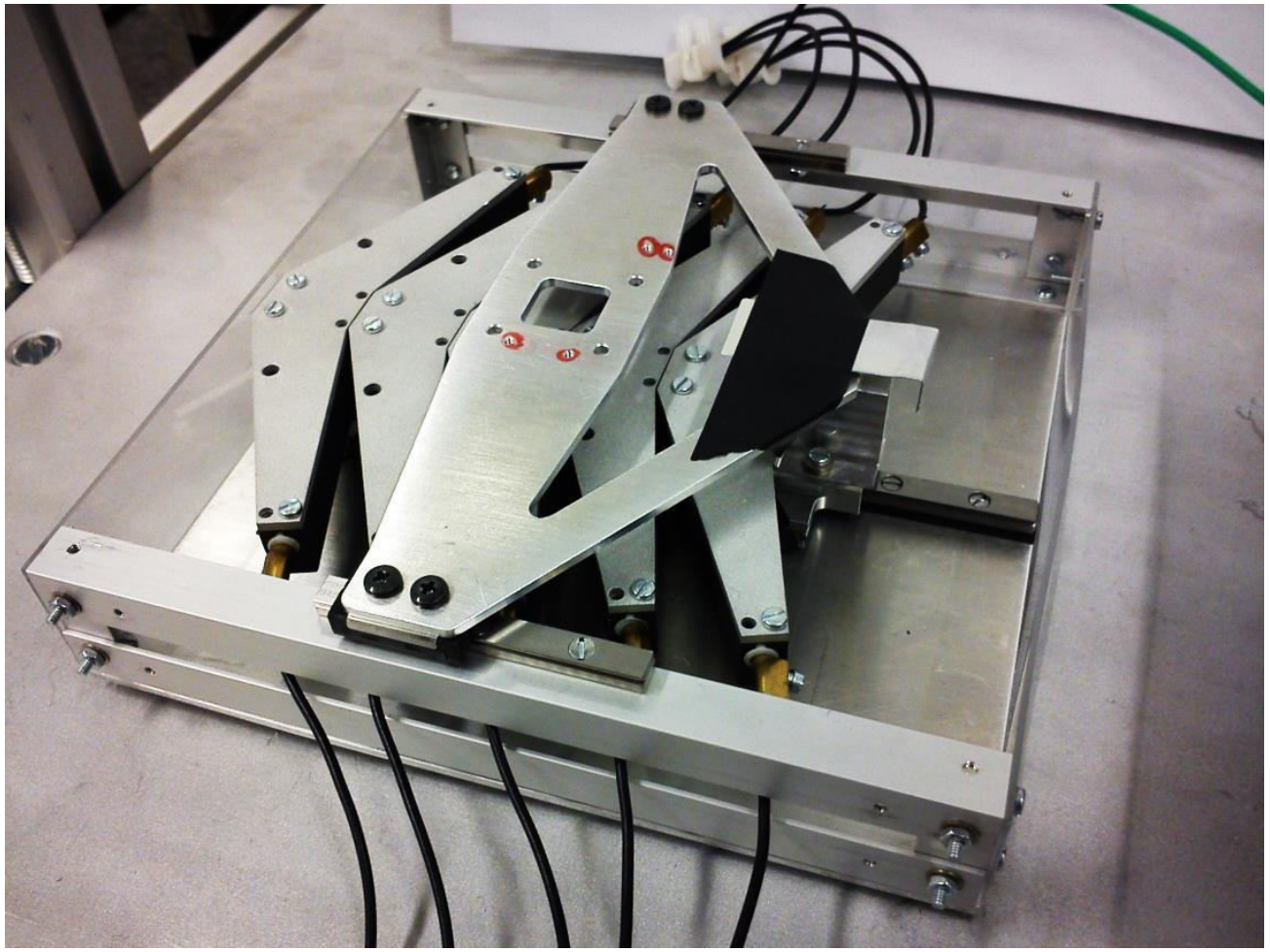


Introduction: basic concept



- Modular SMA wire actuators
- Cost effective through standardization
- Combinable to create a 3-axis machine

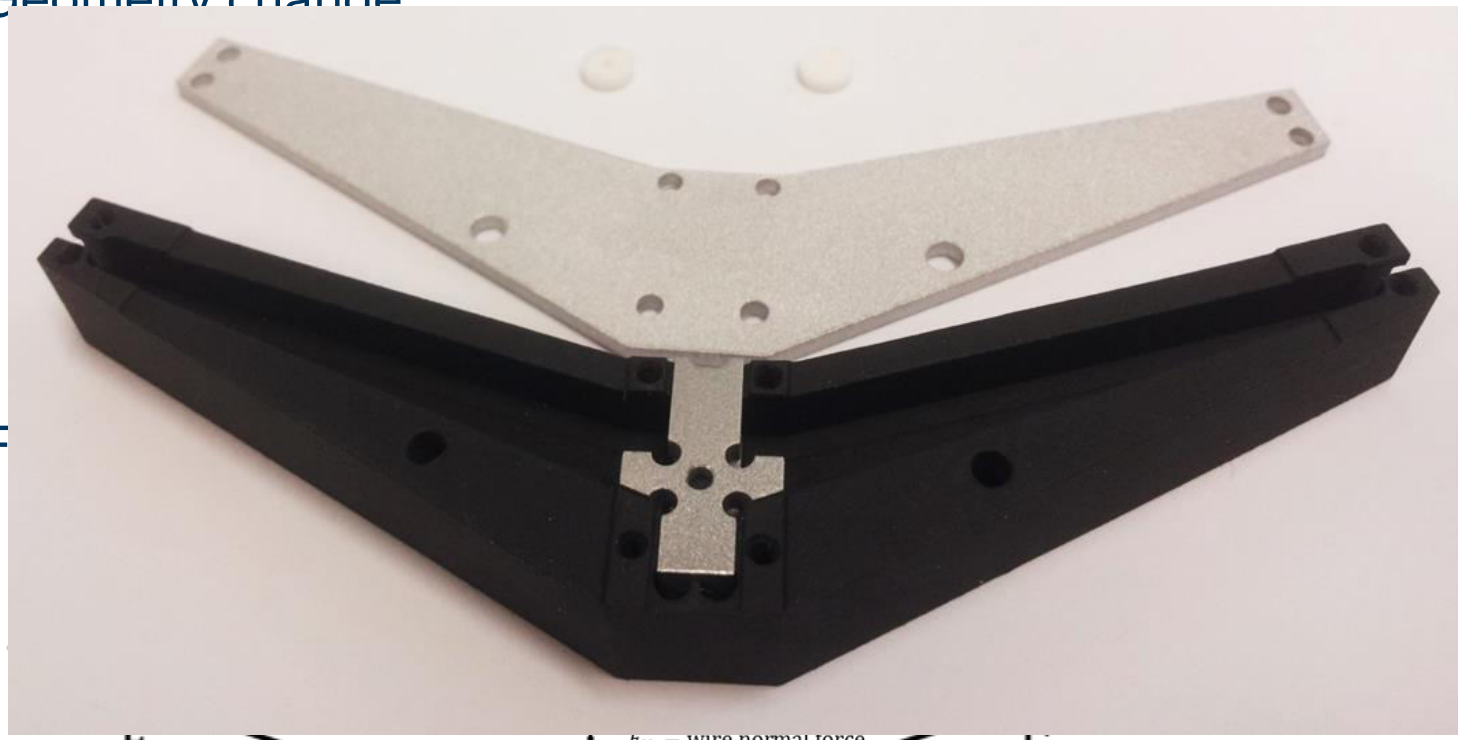
Introduction: feed axis

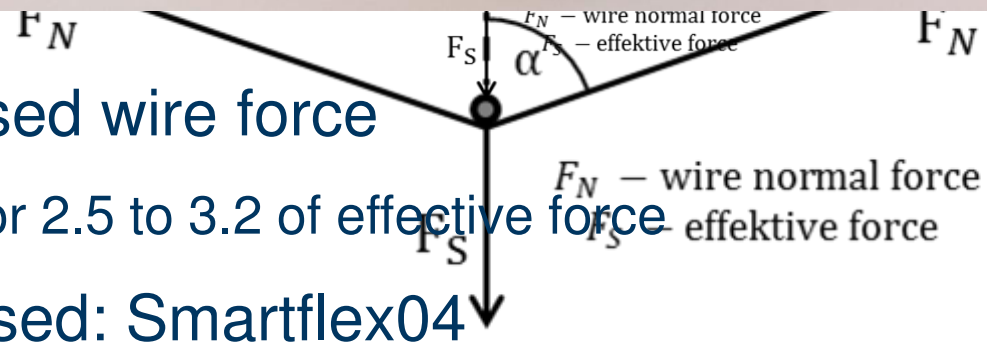


- Serial arrangement
- Shared resetting spring
  - increasing spring force

Introduction: actuator

- Shape memory actuator
  - Geometry change
  - F
- Increased wire force
  - Factor 2.5 to 3.2 of effective force
- Wire used: Smartflex04

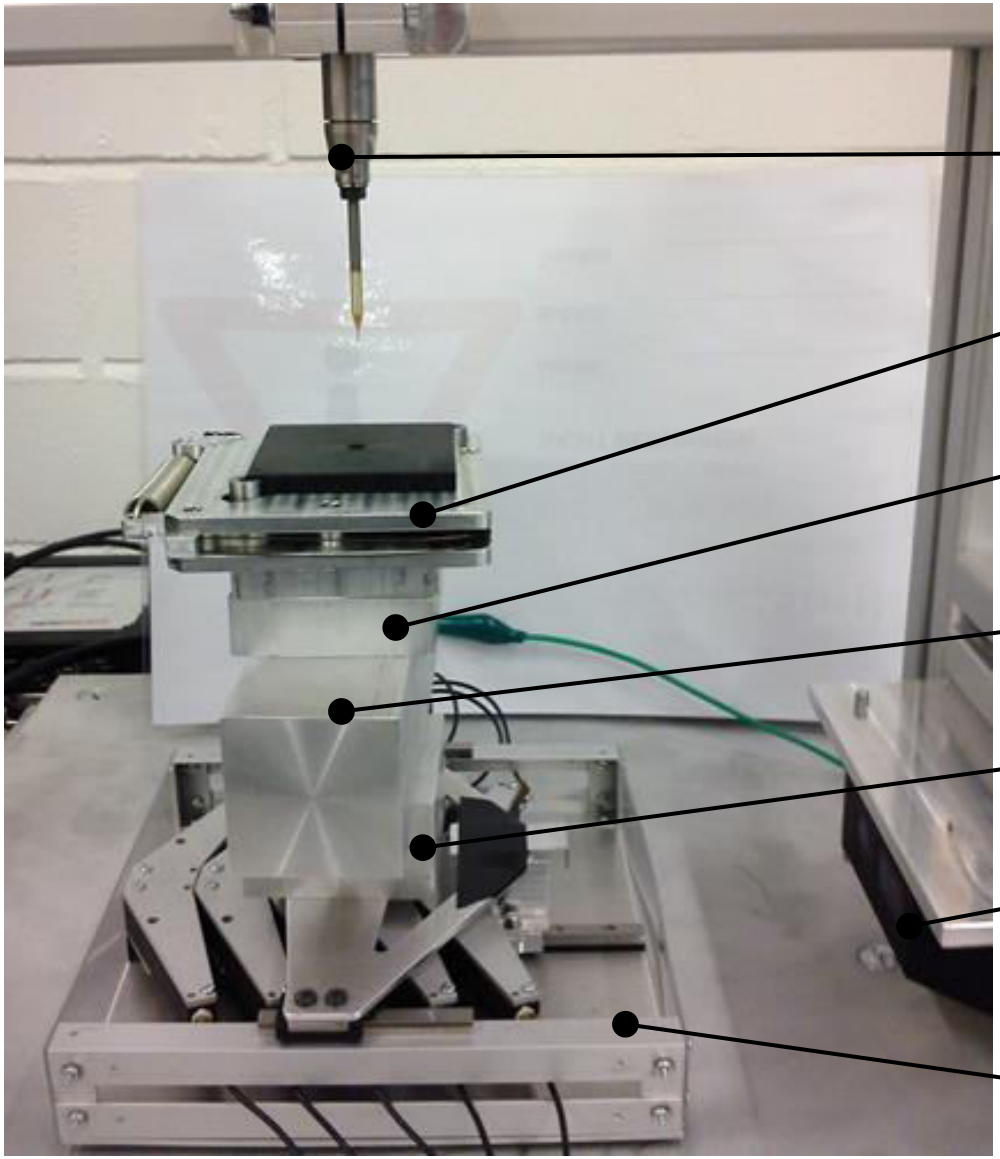




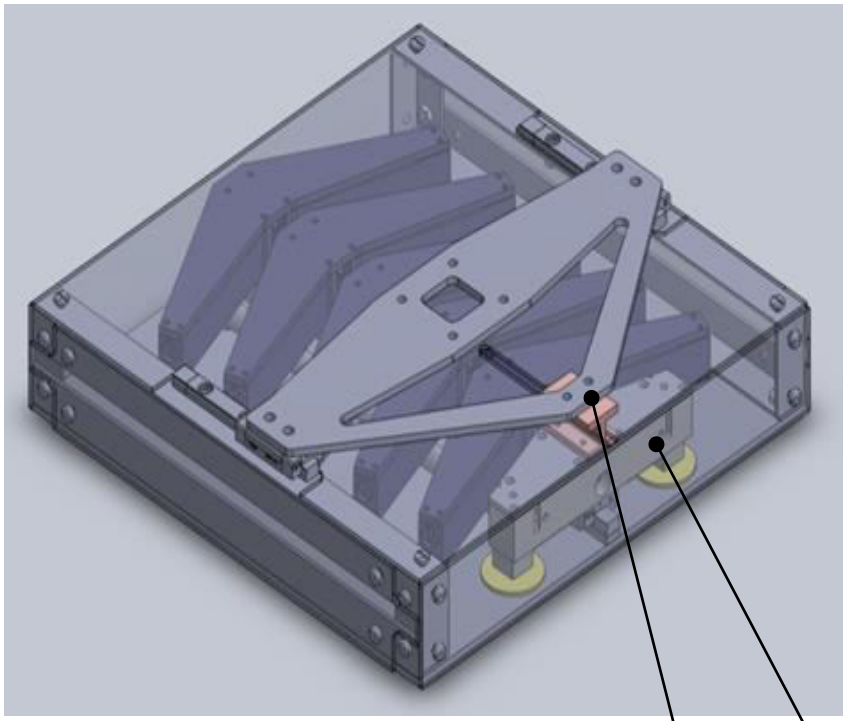
Agenda

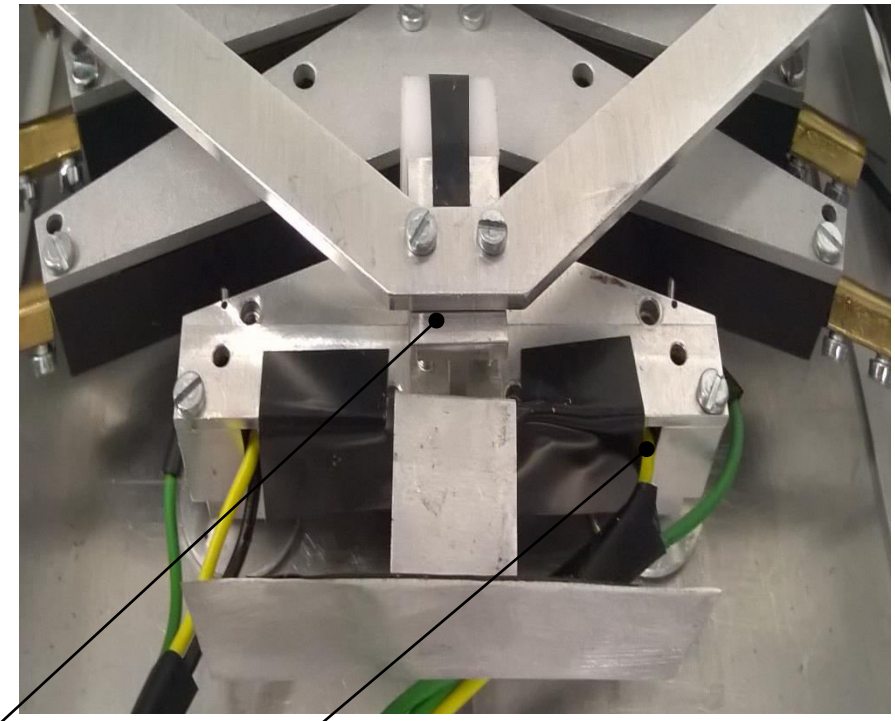
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Experimental setup



Experimental setup: latching device



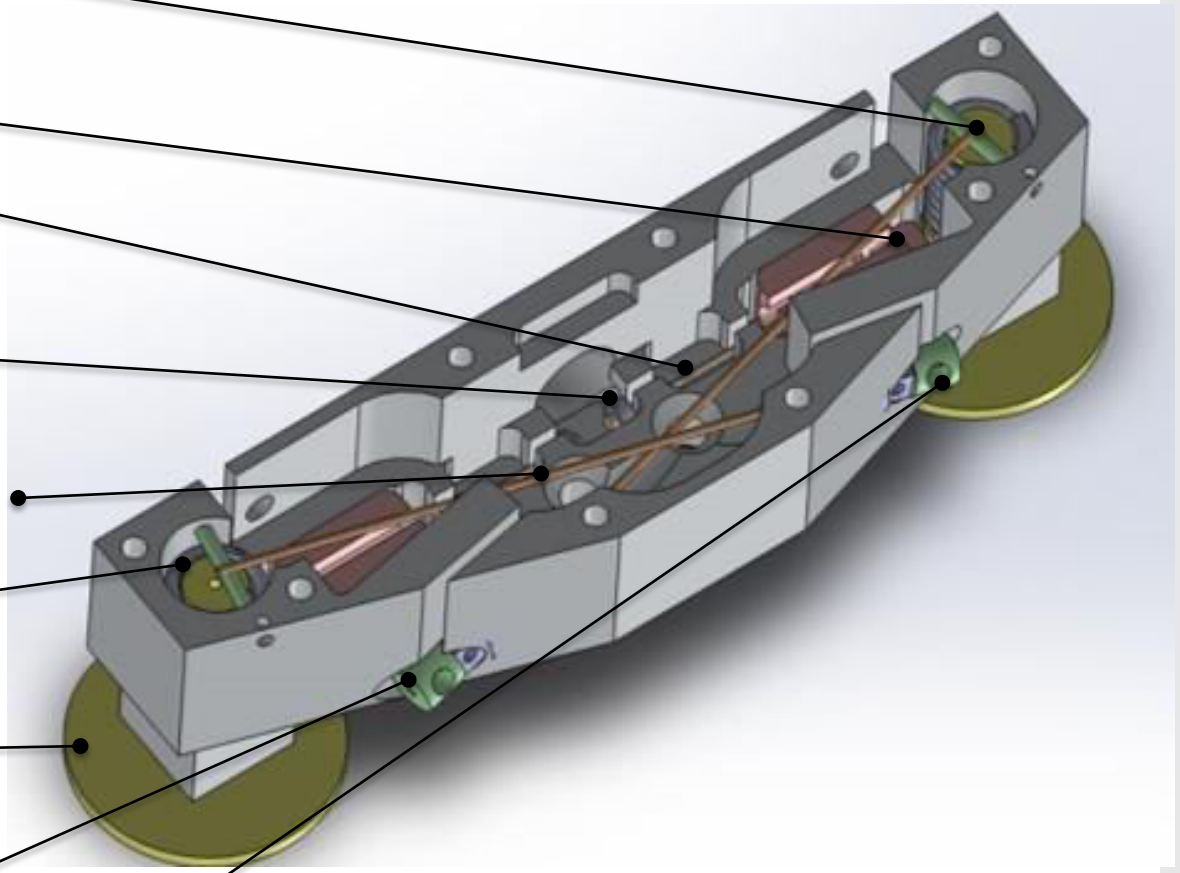


brace

latching device

Experimental setup: latching device

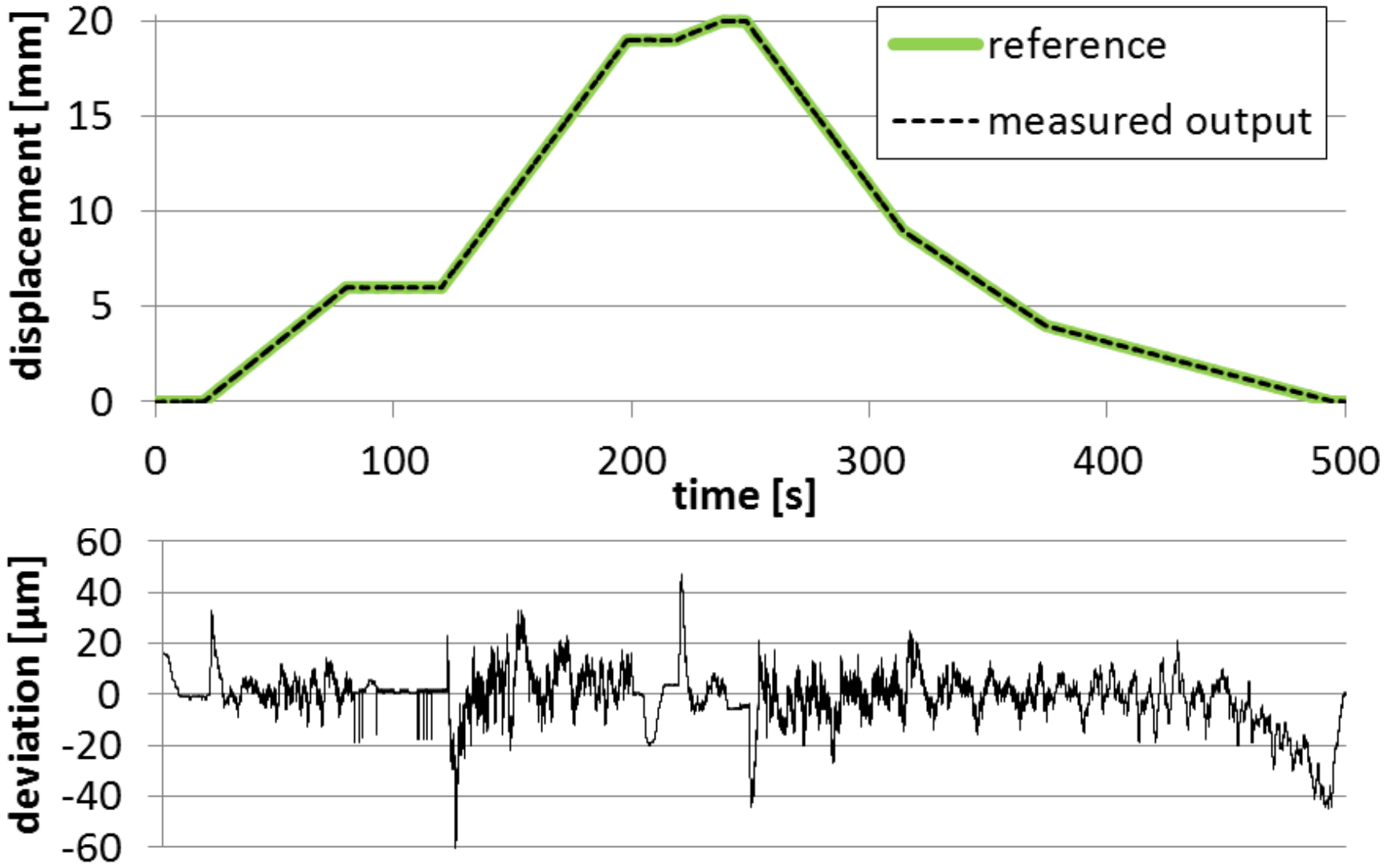
guide roller
lock bar
lock bar actuator
ceramic isolation
Break pad actuator
break spring
brake pad
SMA-wire clamp
SMA-wire spanner



Agenda

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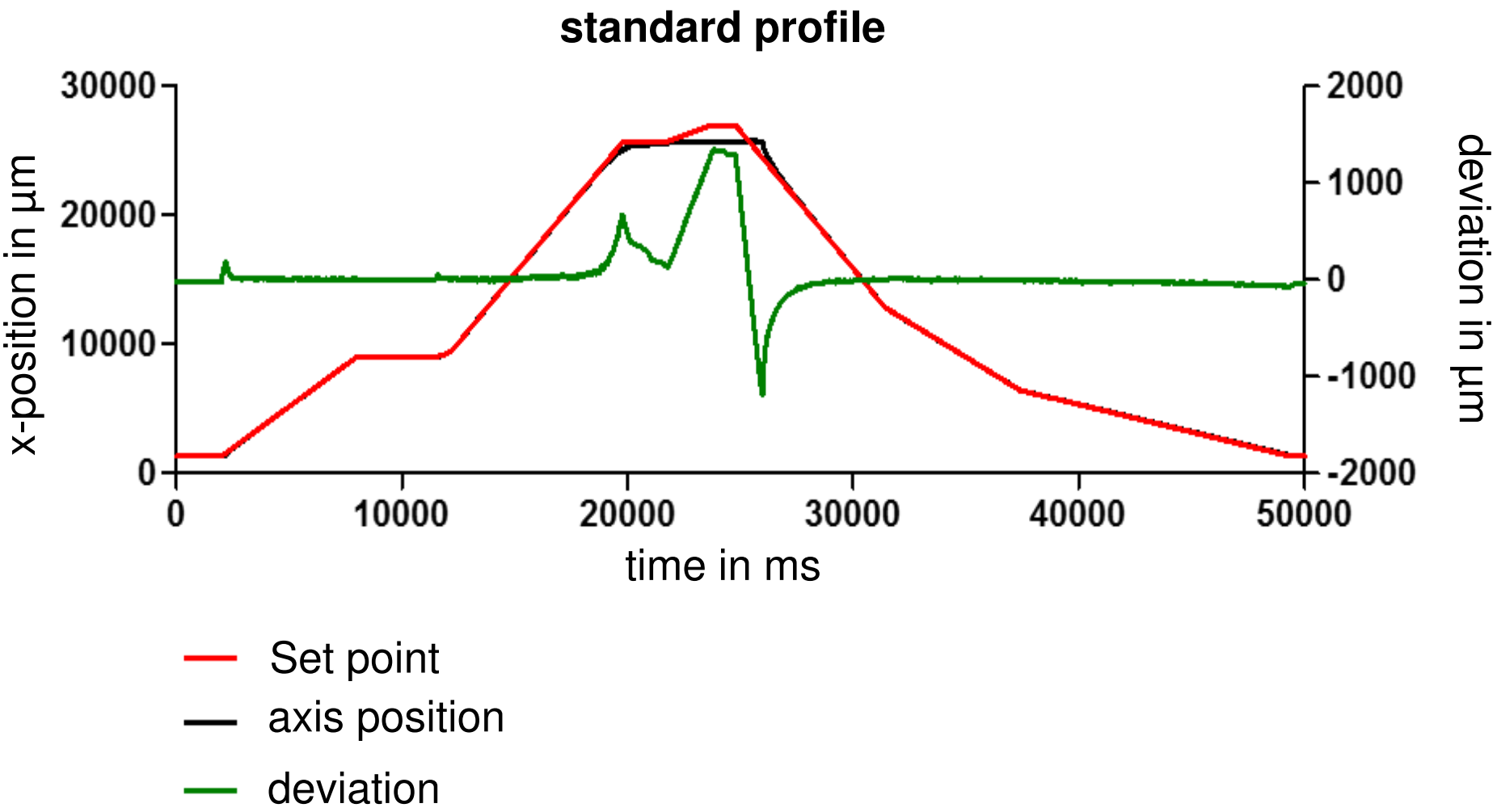
Results: Closed-loop control



Average error: -5 µm

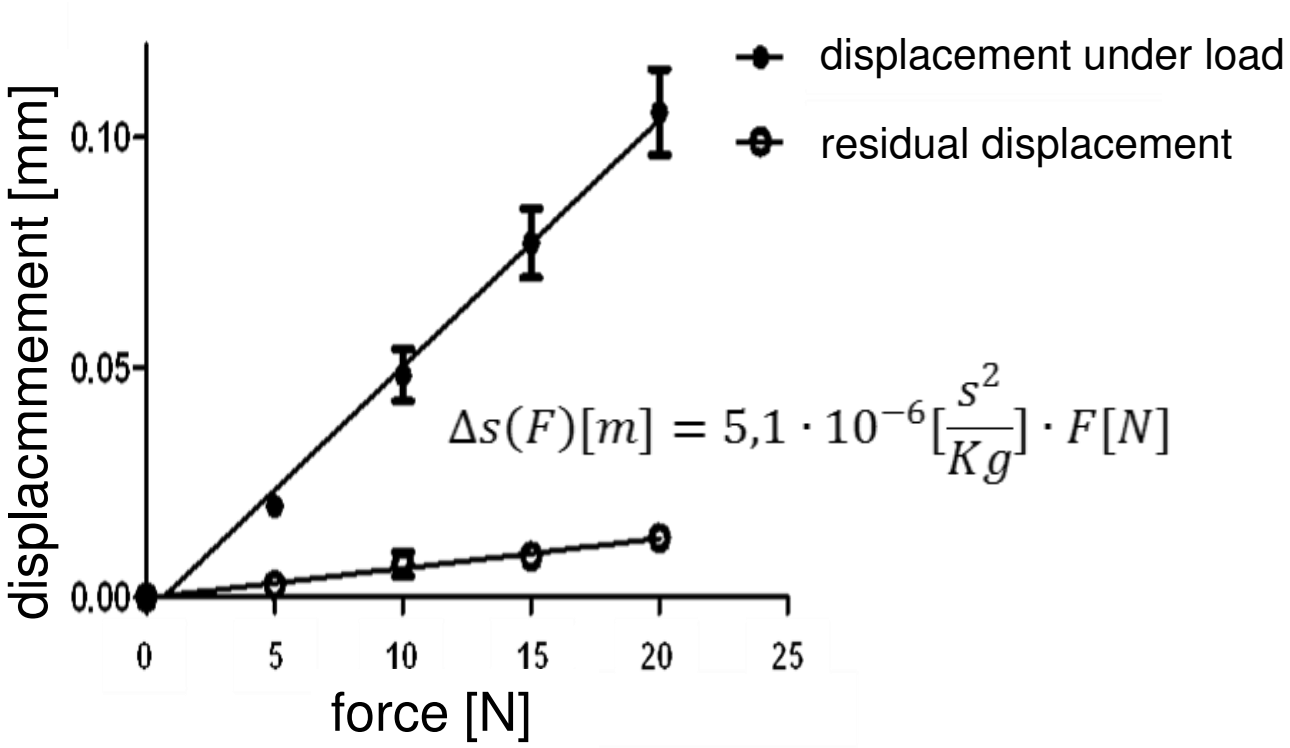
standard deviation: 18 µm

Results: Standard profile with integrated latching device



Experimental results

- Unchanged positioning accuracy with latching device
- Maximum load of 20 N
  - 0.1 mm displacement under load
  - 0.01 mm residual displacement



Agenda

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Conclusion and Outlook

- latching actuator matches the requirements of a small machine tool axis
- prevents the prolonged activation of the SMA-Wires in the axis actuators while maintaining a position
- control of the latching device can easily be integrated into the existing setup

- a revised construction of both the axis assembly and the latching device can increase the properties of the friction surface
- The stiffness of the axis itself needs to be improved as well to cope with the force generated by the latching device


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Thank You!
Jan Pollmann