

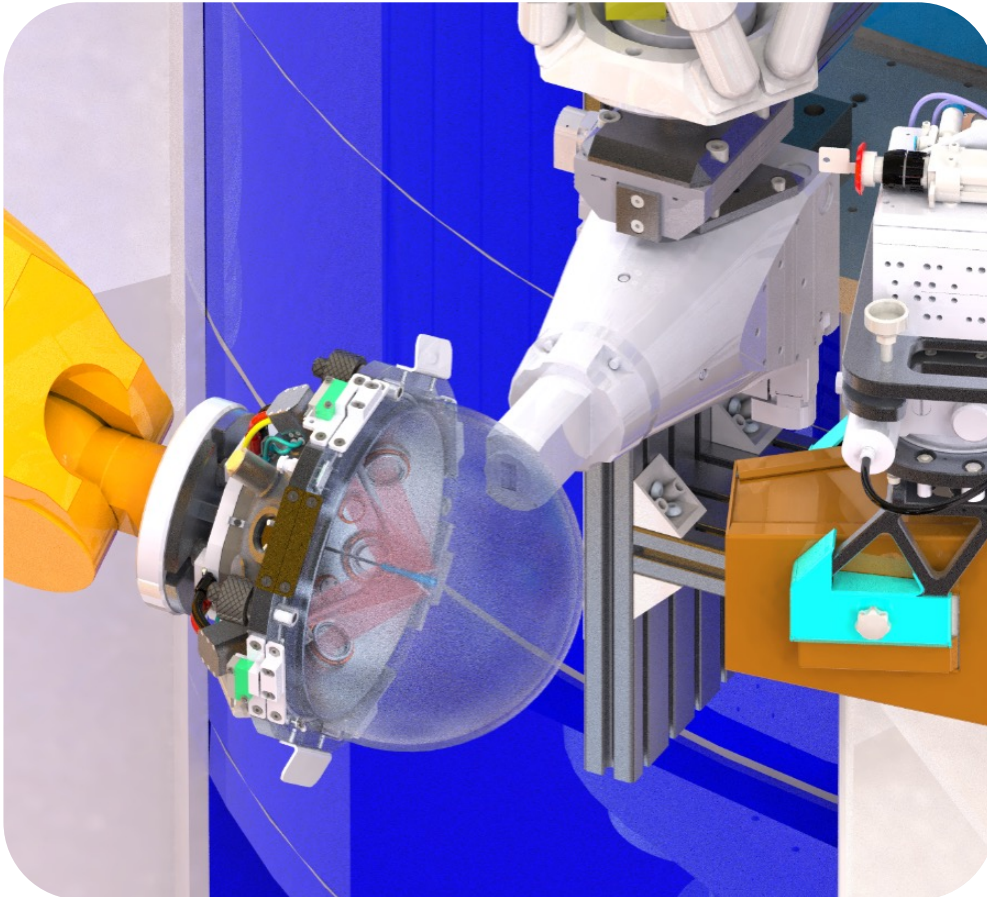
New laser furnace for the **STRESS-SPEC** instrument

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MLZ is a cooperation between:

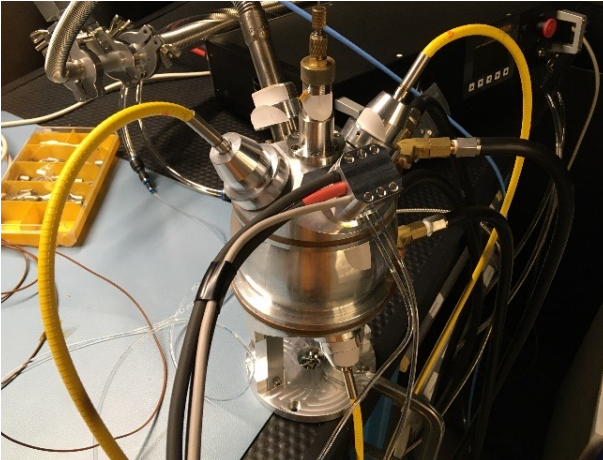
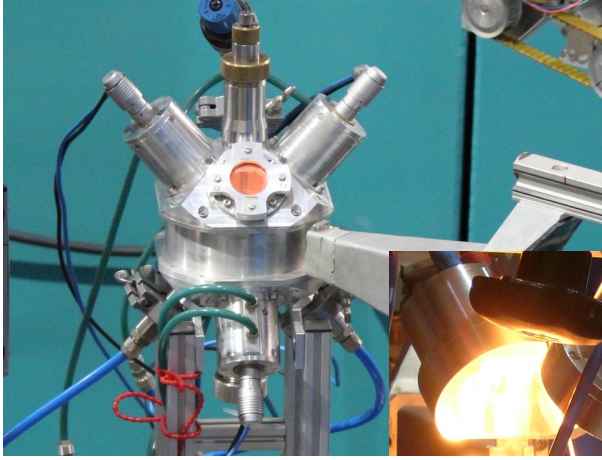
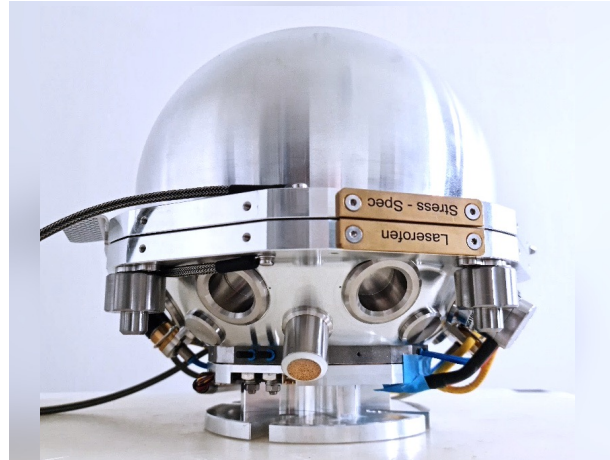
Explore material properties at high temperatures: Laser furnace for 6-axis-robot



Concept image

- BMBF-project RAPtOr: Use 6-axis robot as main sample manipulator during diffraction experiments which allows high positional flexibility
- Robot needs dedicated sample environment due to limited weight of around 30 kg and its movement capabilities
- High temperature furnace for e.g. texture measurement, phase transitions

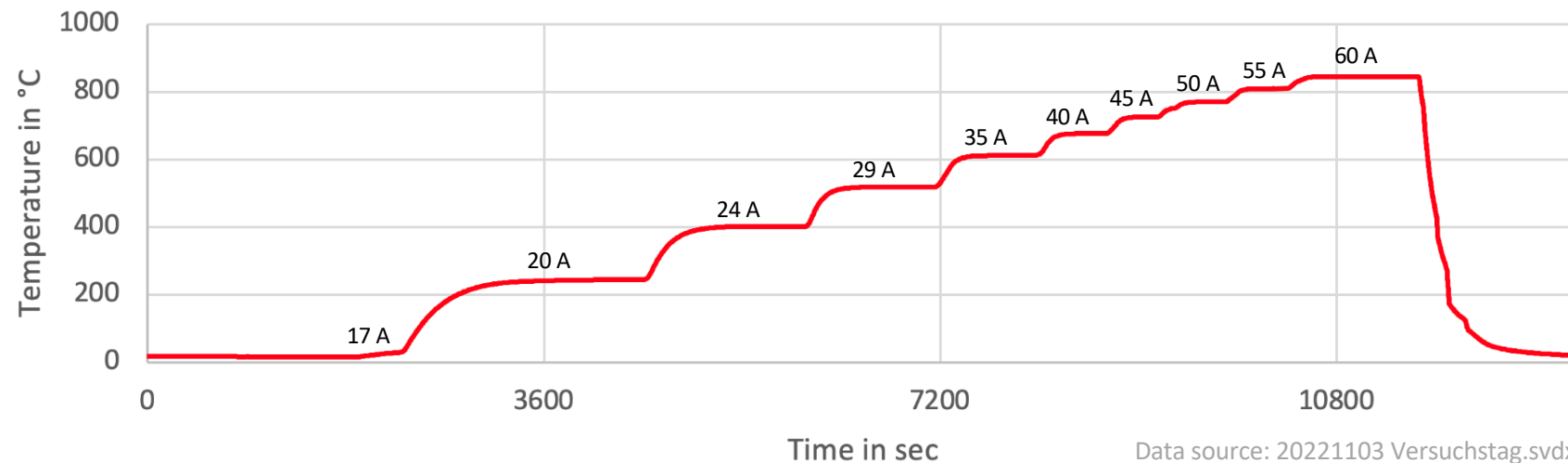
The new laser furnace enhances previous furnace designs in terms of thermal response time and user safety.

FRM II Laser fiber furnace	UTG mirror furnace	New Stress-Spec Laser Furnace
Diode laser in electronic rack, Laser fibers as guides	Halogen Lamps, Directly heats up sample	Diode laser, Directly heats up sample
		
<ul style="list-style-type: none"> ⊕ High temperatures possible ⊕ Different laser sources available ⊖ laser fiber has limited bending radius > 50 cm → difficult to use with a robot ⊖ Fiber break is dangerous for user 	<ul style="list-style-type: none"> ⊕ Cheap light source ⊕ Safe for user ⊖ Temperature < 1000 °C ⊖ High thermal mass 	<ul style="list-style-type: none"> ⊕ Low thermal mass ⊕ High positional flexibility ⊕ Temperature up to 1200 °C ⊕ Cupola design allows high acceptance angle for neutrons ⊕ Modular design ⊖ Expensive light source

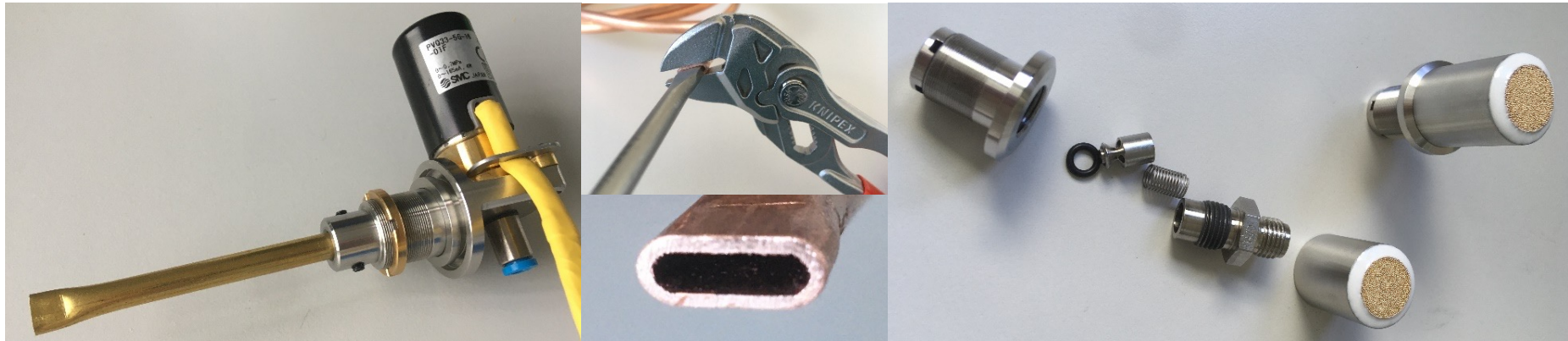
Initial test shows directly heating the sample with diode laser is feasible



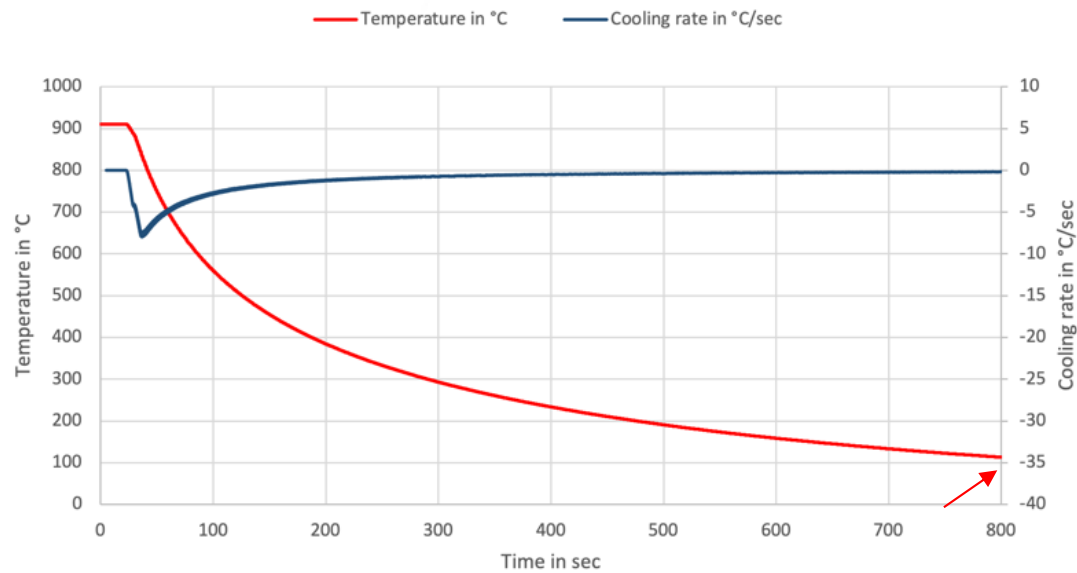
Step-up with 1 diode



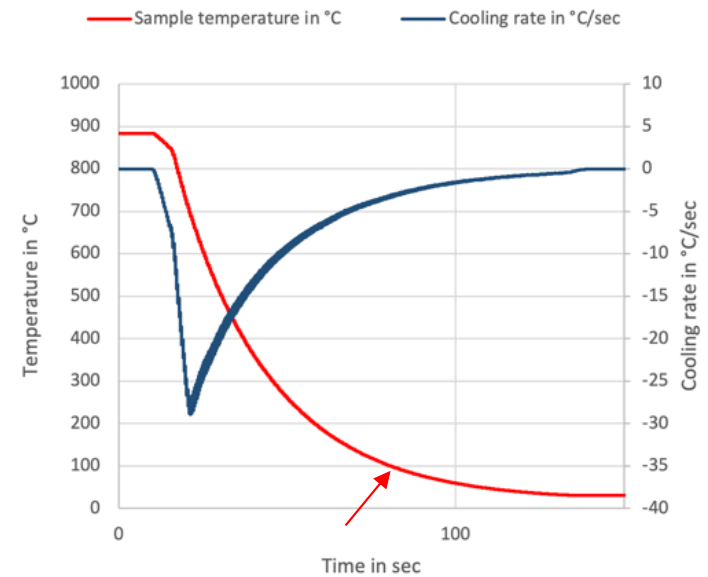
Active gas cooling is approx. 10 times faster than vacuum cooling



Sample cool down in vacuum



Sample cool down with forced convection



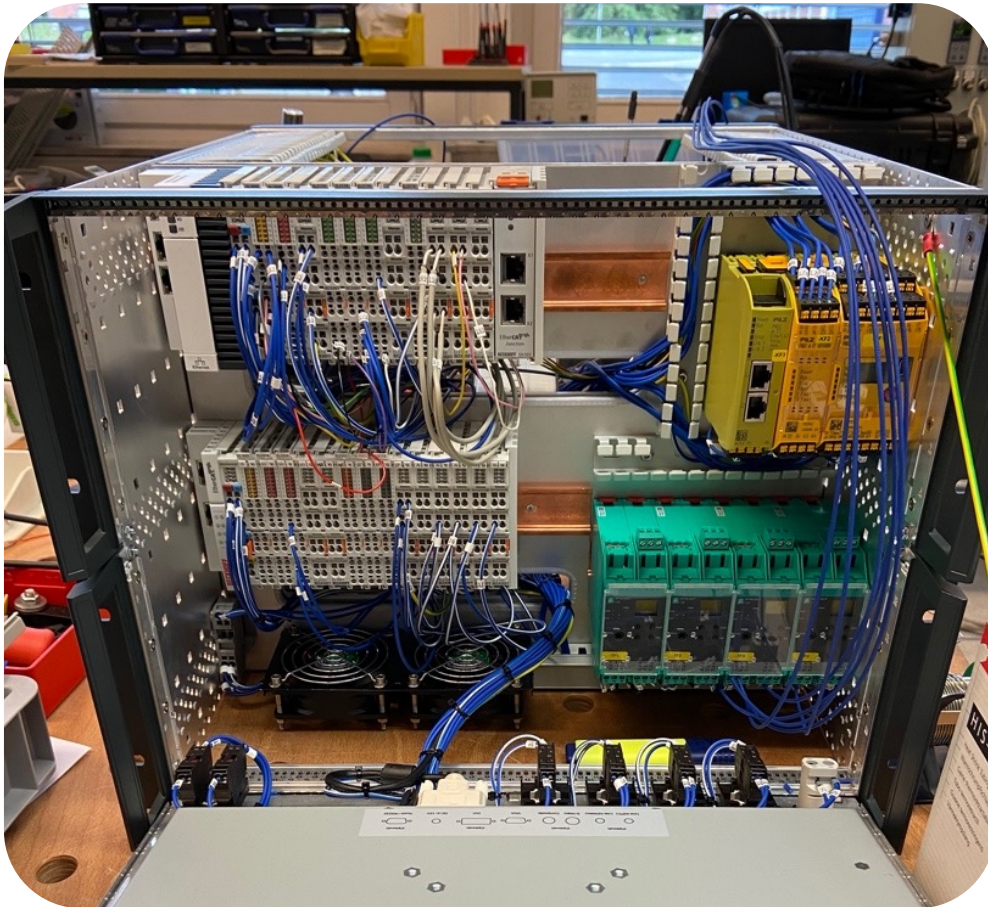
Data source: 20221103 Versuchstag.svdX

Electronic rack is versatile and can be adapted to other sample temperature chambers



- Developed with requirements from FRM II sample environment → modular concept, which will/can be used for other SE equipment
- Control rack designed and manufactured by Helmholtz-Zentrum hereon GmbH
- Complies with EU Machinery Directive 2006/42/EC

High user safety standards are engaged



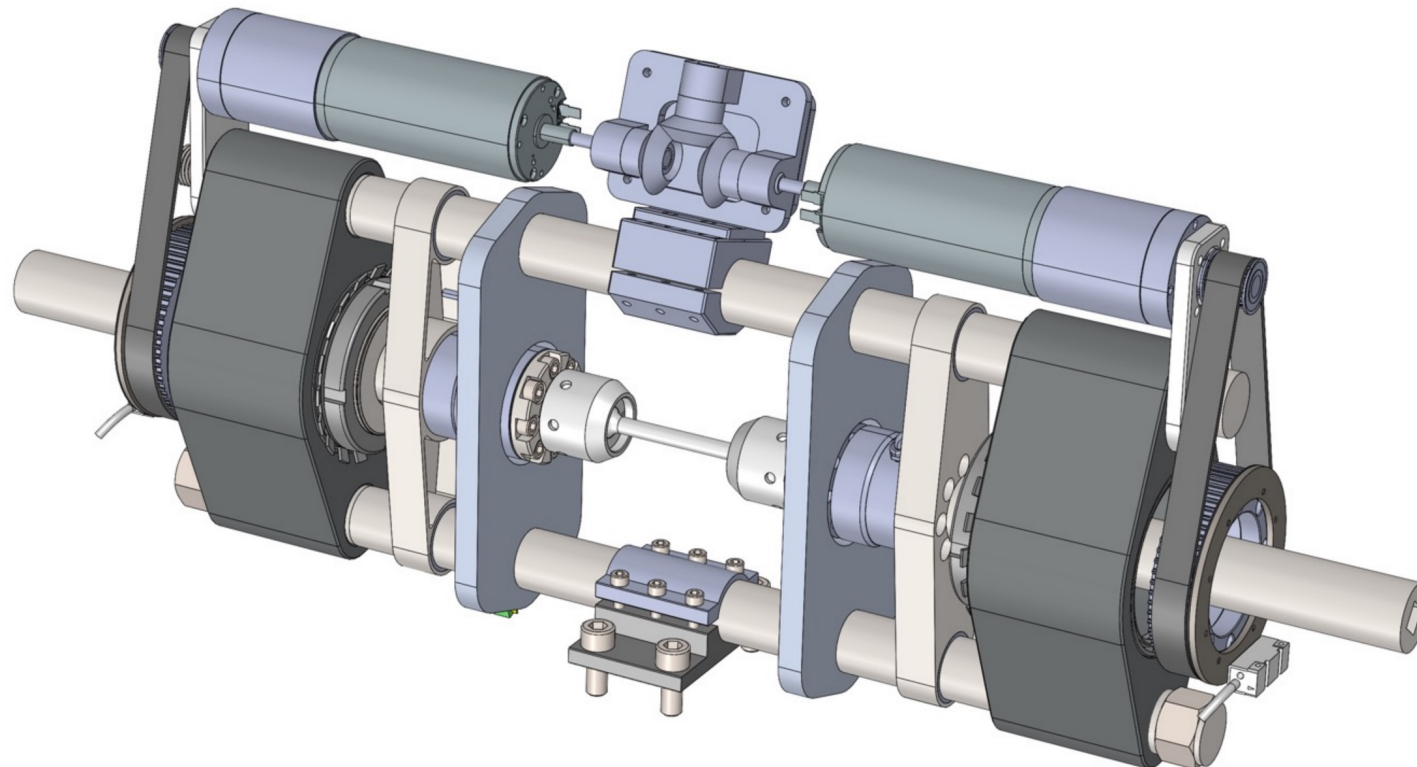
- Safety functions are monitored with PILZ-controller and Pepperl+Fuchs temperature converter
- Risk analysis with SISTEMA: Safety Integrity Software Tool for the Evaluation of Machine Applications

Some improvements are planned.

- Current problem needs to be resolved: Water cooling randomly shuts down
- To-do: Tunable sample holder
- **MOST IMPORTANTLY:** Laser furnace needs commissioning with neutrons!

Outlook: Compact strain testing rig for robot (50 kN).

General structure and drive train designed. Needs further design.



Robot weight limit: 30 kg!

Movement from both sides to keep the gauge volume in focus.

Thank you for your attention.

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