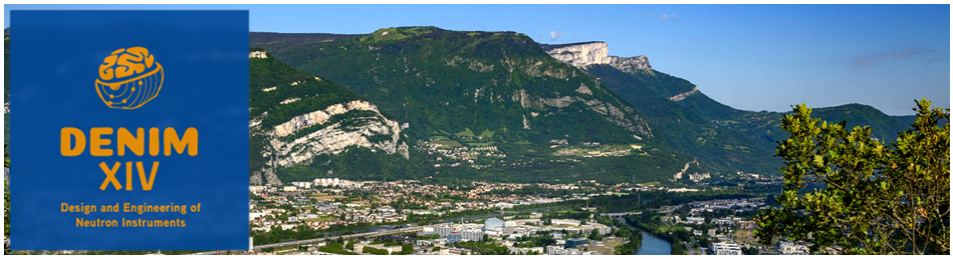

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Using an Industrial Robot for High-Precision Sample Manipulation at the Neutron Diffractometer STRESS-SPEC

Wednesday, 22 October 2025 14:14 (1 minute)

Materials and components with intricate geometries, such as from additive manufacturing (AM), require highly flexible sample positioning systems during diffraction experiments. The STRESS-SPEC group at Heinz Maier-Leibnitz Zentrum (MLZ), Germany, has pioneered the use of industrial robots [1, 2] to enhance sample handling and positioning at neutron diffractometers. While these robots may easily position the sample in the desired directions and orientations, their absolute accuracy of up to ±0.5 mm has been insufficient for this type of precise local measurements. To allow accurate full strain tensor determination and centering of local texture measurements, a positioning accuracy within 10% of the gauge volume size is required, with may be as small as 1 mm^3 on modern neutron diffractometers [3]. To address this limitation, we have upgraded the STRESS-SPEC robotic system with an optical metrology setup that actively tracks and corrects the sample position with a spatial accuracy of better than 50 µm. Here we will present the complete measurement process chain for this improved sample positioning system.

Furthermore, a versatile laser furnace with a large neutron acceptance angle for temperatures up to 1200℃ and a lightweight tensile testing machine are currently being built to be mounted on the robot flange. Together with the optical feedback system, the most common experimental scenarios can then be covered in a semi-automated measurement environment.

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