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The new Total Reflection High-Energy Positron Diffractometer at NEPOMUC

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It has been shown that Total Reflection High-Energy Positron Diffraction (TRHEPD) is an ideal technique to precisely determine the crystalline structure of the topmost and immediate subsurface layers. Novel materials such as topological insulators or 2D materials can be investigated to determine not only the surface structure, but also the substrate spacing and potential buckling.

We developed a novel TRHEPD apparatus, which is now connected to the high-intensity positron source NEPOMUC at the FRM II. During the first beamtime in spring 2020, it was possible to magnetically guide the positron beam to the experiment, test the electrostatic acceleration up to 15keV and map the direct beam using a micro channel plate (MCP) assembly. We obtained a parallel beam suitable for diffraction with a diameter of less than 4mm. We also tested the optional twofold remoderation device in front of the TRHEPD setup that reduces the beam diameter to about 1mm. These values are in excellent agreement with our simulations. For the next beamtime, we plan to record the first diffraction pattern of a Si(111)-(1x1) hydrogen-terminated surface to benchmark the setup. Recent experimental results will be presented at the meeting.

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