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Total Reflection High-Energy Positron Diffractometer at NEPOMUC

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Total Reflection High-Energy Positron Diffraction (TRHEPD) has been established as an ideal technique to determine the atomic positions of the topmost and immediate subsurface crystalline structure with highest accuracy. 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. However, up to now, there is just one TRHEPD setup available worldwide, which is located at the Slow Positron Facility (SPF) at the accelerator KEK in Japan.

We developed a new positron diffractometer coupled to the high-intensity positron source NEPOMUC at the research reactor FRM II. For the TRHEPD experiments, we plan to use the continuous, remoderated NEPOMUC beam, which has an intensity of ~ $5\cdot10^7$ e+/s. The setup features an additional transmission-type remoderator using a 100 nm thin Ni (100) foil to optionally further enhance the brightness. After the e+ beam passes a magnetic field termination, it is electrostatically focused and accelerated up to 30keV energy. We simulated the e+ trajectories to optimize the system for different beam energies and for both, remoderated and twofold remoderated beam. After the twofold remoderation, we expect a slightly converging beam with a diameter of ~1mm on the MCP. The characterization of the e+ beam and first experimental results are expected for the next reactor cycle in winter 2019.

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