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Upgrade of the NEPOMUC remoderator

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The neutron-induced positron source Munich (NEPOMUC) provides a monochromatic low-energy positron beam with an intensity of $> 1 \cdot 10^9 \text{ e}^+/\text{s}$ and a diameter of $\approx 10 \text{ mm}$. To create a small beam focus or sharp positron pulses of 100 ps the beam brightness needs to be enhanced by re-moderation.

Based on the experiences with the remoderator setup, we redesigned and extended the existing construction. The new design allows a replacement of the remoderator crystal within several minutes and enables, therefore, a systematic test of different remoderator materials. Additionally, it is possible to clean and anneal the crystal surface by heating in-situ through electric current.

With the remoderator upgrade it was possible to increase the re-moderation efficiency and to raise both, the brightness and intensity of the beam. The effects of the higher beam quality have been already detected in positron annihilation lifetime spectra obtained with the Pulsed Low-Energy Positron System PLEPS. Here, the new setup leads to sharper pulses of $\leq 100 \text{ ps}$ and a consequently better overall time resolution at a higher beam intensity. Moreover, from the increase of the brightness also other applications benefit, e.g. the Coincidence Doppler-broadening Spectrometer or the Scanning Positron Microscope, where an excellent phase space density of the beam is crucial to reach a high spatial resolution. The increased beam intensity will further reduce the measurement time of all instruments.

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