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Formation of a micrometer positron beam at the Scanning Positron Microscope

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Positron annihilation lifetime spectroscopy (PALS) is a powerful tool in a wide range of material science. To investigate inhomogeneous defect distributions, e.g. close to fatigue cracks or dispersive alloy, with PALS a monochromatic pulsed positron beam of variable energy with a diameter in the range of 1 μm and a pulse width of 150 ps FWHM is needed.

In order to achieve this beam quality the Scanning Positron Microscope (SPM) was developed and built at the Universität der Bundeswehr München. The limit of low count-rates and corresponding exceedingly long measurement times is overcome transferring the SPM to the intense positron source NEPOMUC at the MLZ in Garching. To connect the SPM to NEPOMUC a special interface has been constructed.

A new developed positron radio frequency elevator has been tested, which is the final step of the SPM interface. The elevator compensates the loss of potential energy, lost by the implantation of the positron remoderation processes. Since the elevation does not influence other beam parameters, the brightness and the time structure of the positron beam is conserved. This device allows also keeping both, the source and the sample, at the same electrical potential.

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