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Generation and investigation of spinpolarized electron bunches and GaAs-photocathode cleaning and performance studies at the S-DALINAC

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A source of polarized electrons has recently been implemented at the superconducting Darmstadt electron linear accelerator S-DALINAC. Photo-emission from strained layer superlattice-GaAs (SSL) and bulk-GaAs photocathodes are obtained from using either 3 GHz modulated diode lasers at 780 nm and 405 nm or a short-pulse Ti:Sapphire laser system at 780 nm with the possibility of frequency doubling to 390 nm to achieve a high degree of polarization or a high quantum efficiency, respectively.

Measurements were done with varying laser pulse lengths and electron bunch lengths from 90 ps to 40 ps using a pulse stretcher system and a single-mode optical fiber. The electron bunch length was determined using a chopper rf cavity and a slit system. The dependence of the electron polarization from the rf phase was studied over the electron bunch both for SSL and bulk cathodes.

To enhance the availability and performance of the polarized source with respect to quantum efficiency, a separate atomic-hydrogen cleaning system for the cathodes is presently being set up which will allow one to treat cathodes after several Cs-O activation cycles and to optimized preparation procedures.

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