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Adaptive Automated Activation Procedure for GaAs Photocathodes*

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Photo-electron sources utilizing GaAs-based photocathodes are used to provide high-brightness and high-current beams of possibly spin-polarized electrons for accelerator applications such as free-electron lasers (FELs) and energy recovery linacs (ERLs). These cathodes require a thin surface layer consisting of cesium and an oxidant in order to achieve negative electron affinity (NEA) for efficient photoemission. The layer is deposited during the so-called activation procedure, whose behavior greatly influences the resulting quantum efficiency of the photocathode and robustness of said layer. It is therefore of great interest to optimize and standardize this process to provide easily reproducable, high-performance GaAs-photocathodes. An automatization of the activation procedure can streamline this process, making it independent from expert input for operational use in an accelerator. At the Institute for Nuclear Physics at Technische Universität Darmstadt, a dedicated test stand for Photo-Cathode Activation, Test and Cleaning using atomic-Hydrogen (Photo-CATCH) is available for GaAs photocathode research. The components of its activation chamber are remote-controlled using a combination of EPICS and python. This contribution will present recent studies of an adaptive automated activation procedure at Photo-CATCH. Following the co-deposition scheme with Cs and O2, several automated activations have been performed. A good reproducibility of quantum efficiency has been observed, comparable to manual activations.

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