New Results at JLab Describing Operating Lifetime of GaAs Photo-guns

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Polarized electrons from GaAs photocathodes have been key to some of the highest impact results of the JLab/CEBAF science program over the past 30 years, including. During this time, various studies have given insight into improving the operational lifetime of these photocathodes in DC high voltage photo-guns, notably while using lasers with spatial Gaussian profiles typically 0.5-1 mm FWHM and with cathode voltages typically 100-130 kV.

In this contribution, we report new results in three areas related to improving operating lifetime of GaAs photo-guns. First, new simulation results are presented describing the anticipated benefit of increasing the operating lifetime by increasing the area of the laser illumination well beyond 1 mm FWHM. Second, new experimental results are presented describing the behavior of operating lifetime on the accelerating gap voltage of the photo-gun up to 180 kV. Third, new calculations are presented offering an explanation which conforms to the experimental observations for the continual improvement in operating lifetime as quantum efficiency worsens, both with bulk and strained-superlattice GaAs/GaAsP photocathodes.

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