High intensity polarized beam photogun to drive a positron source

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A photogun to generate high intensity, high polarization electron beam with unprecedented kC lifetime is being envisioned at JLab for the proposed Ce+BAF polarized positron source. The positron source will require > 1 milliampere CW with > 90% polarization electron beam at 120 MeV. To be practical for a user program, a photogun operating at 1 milliampere should deliver ~ 2 kC high polarization beam for a month without intervention. The limiting factor is ion-back bombardment of the delicate strained super lattice photocathode. The number of ions can only be reduced by improving vacuum in the accelerating anode-cathode gap and biasing the anode. Additionally, the ion induced damage can be spread out by illuminating the photocathode with larger laser spot sizes. Earlier tests of this approach resulted in improved lifetime, but was limited by the photogun electrode size. The envisioned photogun design will incorporate large electrodes to accommodate unprecedented large laser spot sizes shifted as far as possible from the photocathode electrostatic center, and large conical insulators to operate at > 300 kV for beam capture into a SRF booster.

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