**Statement of Work**

Scientists and technicians at Jefferson Lab will perform a full characterization of Diffracted Bragg Reflector (DBR) superlattice photocathodes in a high voltage DC photogun, and compare performance with non-DBR conventional superlattice photocathodes used at CEBAF.

**Photocathodes types we’ll compare**

#1 – SVT superlattice – what we use at CEBAF, lots of existing data to pull from

#2 – SVT DBR – if one exists, have to check

#3 – Sandia DBR – expecting two to four 3” wafers fabricated

**Milestones & Schedule**



**Tasks**

* **Photocathode preparation** steps include,
  + **mounting** – photocathodes will be diced in a GN2 clean box, mounted to vacuum degassed moly pucks using an indium foil and tantalum retaining cap,
  + **vacuum installation** – pucks will be transported to CEBAF in “suitcase” vacuum chamber and stored in the photogun Preparation chamber after mating to an intervening baked load-lock vacuum chamber,
  + **NEA activation** – pucks will be heated in the Preparation chamber (<1 E-11 Torr) initially to remove the arsenic protective layer and a second time >350 C prior to activation, using SAES Cs alkali stirps and NF3 gas via a precision leak valve.
  + **High voltage chamber** – activated pucks will be moved into the photogun high voltage chamber (<2 E-12 Torr) within 5 minutes of completed activation.
* **Low voltage photocathode measurements** – at low-bias voltage and with 780 nm light,
  + Eng Labor – 0 pw
  + Materials – 0 k$
  + **quantum efficiency** will be measured across the surface of the photocathode using circularly polarized light,
  + **analyzing power** will be measured by illuminating photocathode with linearly polarized light aligned to both anisotropic directions of the cathode,
  + **surface charge limit** will be measured by recording supply photocurrent as a function of incident laser power.
* **High voltage beam measurements** – at high-bias voltage >130 kV and with 780 nm light of 250 MHz repetition rate and pulse width 50 ps the following measurements will be made
  + Eng Labor – 0
  + Materials – 0 k$
  + **surface charge limit** will be measured again by measuring both power supply and Faraday cup current as a function of incident laser power,
  + **transverse emittance** will be measured, using a conventional lens-drift-profile method,
  + **temporal profile** of bunches will be measured, using a cavity-slit-ammeter method,
  + **electron spin polarization** will be measured, using a precision Mott scattering polarimeter,
  + **photocathode lifetime** will be measured, using an ultra-high vacuum beam line and operating with a steady and sustained beam intensity >1 mA.