

# The Silicon Vertex Tracker for the Heavy Photon Search Experiment

*Per Hansson Adrian<sup>1</sup>, on behalf of the HPS Collaboration*

<sup>1</sup>SLAC National Accelerator Laboratory, Menlo Park, CA, USA

The Heavy Photon Search (HPS) is a new, dedicated experiment at Thomas Jefferson National Accelerator Facility (JLab) to search for a massive vector boson, the heavy photon (a.k.a. dark photon,  $A'$ ), in the mass range 20-500 MeV/ $c^2$  and with a weak coupling to ordinary matter. An  $A'$  can be radiated from an incoming electron as it interacts with a charged nucleus in the target, accessing a large open parameter space where the  $A'$  is relatively long-lived, leading to displaced vertices. HPS searches for these displaced  $A'$  to  $e^+e^-$  decays using actively cooled silicon microstrip sensors with fast readout electronics placed immediately downstream of the target and inside a dipole magnet to instrument a large acceptance with a relatively small detector. With typical particle momenta of 0.5-2 GeV/ $c$ , the low material budget of 0.7%  $X_0$  per tracking layer is key to limiting the dominating multiple scattering uncertainty and allowing efficient separation of the decay vertex from the prompt QED trident background processes. Achieving the desired low-mass acceptance requires placing the edge of the silicon only 0.5 mm from the electron beam. This results in localized hit rates above 4 MHz/mm<sup>2</sup> and radiation levels above  $10^{14}$  1 MeV neutron equivalent dose. Hit timing at the ns level is crucial to reject out-of-time hits not associated with the  $A'$  decay products from the almost continuous CEBAF accelerator beam. To avoid excessive beam-gas interactions the tracking detector is placed inside the accelerator beam vacuum envelope and is retractable to allow safe operation in case of beam motion. This contribution will discuss the design, construction and first results from the first data-taking period in the spring of 2015.