Resonance Search for a Heavy Photon in the 2015 Engineering Run Data of the Heavy Photon Search Experiment

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The Heavy Photon Search (HPS) is a new experiment at Jefferson Lab that will search for a new $U(1)$ vector boson (“heavy photon”, “dark photon” or $A'$) in the mass range of 20-1000 MeV/c$^2$. An $A'$ in this mass range is theoretically favorable and may also mediate dark matter interactions. The $A'$ couples to the ordinary photon through kinetic mixing which induces their coupling to electric charge. Since heavy photons couple to electrons, they can be produced through a process analogous to bremsstrahlung radiation, subsequently decaying to narrow $e^+e^-$ resonances which can be observed above the dominant QED trident background. For suitably small couplings, heavy photons travel detectable distances before decaying, providing a second signature. Using Jefferson Labs high luminosity electron beam incident on a thin tungsten target along with a compact, large acceptance forward spectrometer consisting of a silicon vertex tracker and lead tungstate electromagnetic calorimeter, HPS will access unexplored regions in the mass-coupling phase space.

The HPS engineering run took place in spring of 2015 using a 1.056 GeV, 50 nA beam and collected 1165 nb$^{-1}$ (7.29 mC) of data. This talk will present the results of a resonance search for a heavy photon using the engineering run data.