

The Heavy Photon Search Experiment at Jefferson Lab

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Abstract

The Heavy Photon Search (HPS) is a new experiment at Jefferson Lab searching for massive U(1) vector bosons (also known as heavy photons, dark photons, or A') with a weak effective coupling to electric charge. The heavy photon is motivated as part of a “hidden sector” model of dark matter, where it would mediate the self-interaction of dark matter and the interaction of dark and ordinary matter. HPS is sensitive to heavy photons of mass 10–500 MeV with coupling strength ϵ^2 of 10^{-5} – 10^{-10} .

The HPS experiment is designed to produce heavy photons in a process analogous to bremsstrahlung using an electron beam on a fixed target, and detect decays to e^+e^- pairs with two signatures (invariant mass resonance and displaced decay vertex). The detector is a compact, large-acceptance forward spectrometer comprising a silicon microstrip tracker for momentum measurement and vertexing and an electromagnetic calorimeter for triggering on e^+e^- .

Precise beamline controls, high-rate trigger and DAQ, and good time resolution are needed for a detector that comes within 0.5 mm of the beam and is sensitive down to ± 15 mrad from the beam plane, and must cope with the intense beam background in this environment. A low-mass tracker and clean track reconstruction are needed for the best sensitivity.

This talk will describe the HPS experiment and its current status after test, commissioning, and engineering runs.