

# HPS (Heavy Photon Search)

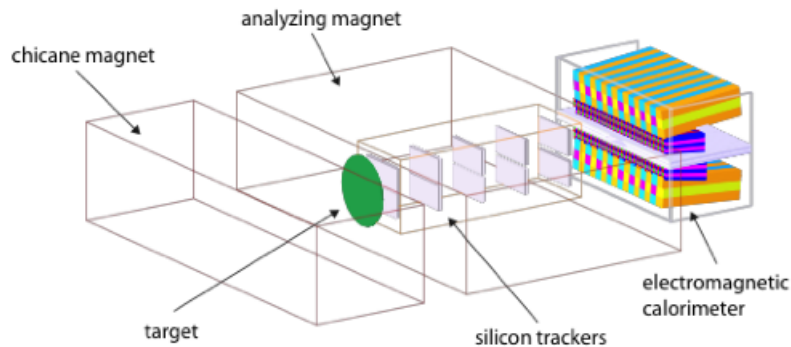
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## 1 Goal of experiment

The Heavy Photon Search (HPS) is a new experiment proposed to search for new heavy vector boson in the mass range of  $20\text{ MeV}$  to  $1000\text{ MeV}$ .

## 2 Experimental setup

Since they couple to electrons, heavy photons are radiated in electron scattering and can subsequently decay into narrow  $e^+e^-$  resonances which can be observed above the copious QED trident background. For suitably small couplings, heavy photons travel detectable distances before decaying, providing a second signature. The HPS experiment exploits both these signatures to search for heavy photons over a wide range of couplings and masses, using a new compact, large acceptance forward spectrometer, silicon microstrip vertex tracker,  $\text{PbWO}_4$  electromagnetic calorimeter (ECAL) for triggering, and muon system. The experiment will be positioned behind the CLAS detector in Hall B at Jefferson Lab, and run with 200-500 nA beams at 2.2 and 6.6 GeV on 0.125% – 0.25% X0 tungsten targets.



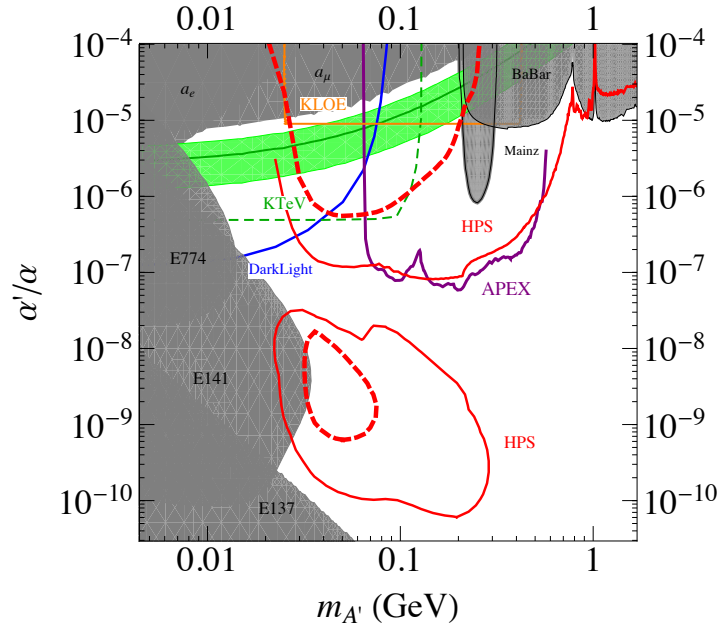
## 3 Accelerator or Lab Facility

The HPS experiment will run in Hall B at Jefferson Lab using the (nearly) continuous beam provided by the CEBAF accelerator. We plan to run at

currents up to 500 nA at 2.2 and 6.6 GeV and utilize beam spot sizes at the target of  $< 20\mu\text{m}$ .

## 4 Physics Reach

Our expected physics reach, shown below, covers two regions. The top region, shown as the solid red curve between  $0.02 - 1\text{GeV}$  and  $\alpha'/\alpha > 10^{-7}$ , comes from a pure "bump-hunt" search where we don't require a displaced vertex. In the bottom region,  $0.02 < m(A') < 0.2\text{GeV}$  and  $1 \times 10^{-10} < \alpha'/\alpha < 5 \times 10^{-7}$ , we search for a peak in the mass spectrum and a reconstructed vertex away from the target. The dashed red lines show the reach expected using our test apparatus (discussed below) with one week of



beam time.

## 5 Status and Schedule

The HPS experiment has been proposed and accepted by the Jefferson Lab Program Advisory Committee to run in the "12-GeV" era at JLAB, which is expected to start in 2015. The approval is contingent on a successful test run whose primary goal is to confirm our estimates of occupancies and trigger rates. This test run will also take place in Hall-B and will use scaled down

versions of the vertex tracker and calorimeter. The test will be performed in stages, with installation of the ECAL into the beamline taking place in Winter 2012 and the vertex tracker to be installed by March 2012.

## 6 Future Plans

There are currently no plans for an upgrade.

## 7 Collaborating Institutions and Collaborators

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## 8 Written Materials (e.g. references)

HPS Proposal:

[https://confluence.slac.stanford.edu/download/attachments/86676777/HPSProposal-FINAL\\_Rev2.pdf](https://confluence.slac.stanford.edu/download/attachments/86676777/HPSProposal-FINAL_Rev2.pdf)

HPS Test Run Proposal:

<https://confluence.slac.stanford.edu/download/attachments/86676777/HPSTestRunProposal-February18.pdf>