21st International Conference on Computing in High Energy and Nuclear Physics **CHEP2015** Okinawa Japan: April 13 - 17, 2015

Contribution ID: **510** Type: **oral presentation**

The Heavy Photon Search Experiment Software Environment

Monday, 13 April 2015 18:15 (15 minutes)

The Heavy Photon Search (HPS) is an experiment at the Thomas Jefferson National Accelerator Facility (JLab) designed to search for a hidden sector photon (A') in fixed target electroproduction. It uses a silicon microstrip tracking and vertexing detector inside a dipole magnet to measure charged particle trajectories and a fast electromagnetic calorimeter just downstream of the magnet to provide a trigger and identify electrons. As the first stage of this project, the HPS Test Run apparatus was constructed and operated in 2012 to demonstrate the experiment's technical feasibility and to confirm that the trigger rates and occupancies were as expected. The full detector is currently being installed and will be commissioned starting in November, 2014. Data taking is expected to commence in the spring of 2015.
The HPS experiment uses both invariant mass and secondary vertex signatures to search for the A'. The overall design of the detector follows from the kinematics of A'production which typically results in a final state particle within a few degrees of the incoming beam. The occupancies of sensors near the beam plane are high, so high-rate detectors, a fast trigger, and excellent time tagging are required to minimize their impact. The trigger comes from a highly-segmented lead-tungstate crystal calorimeter located just downstream of the dipole magnet. The detector was fully simulated using the flexible and performant Geant4-based program slic (abstract 445, this conference). Simulation of the readout and the event reconstruction itself were performed with the Java-based software package org.lcsim (abstract 445, this conference).. The simulation of the detector readout includes full charge deposition, drift and diffusion in the silicon wafers, followed by a detailed simulation of the readout chip and associated electronics. Full accounting of the occupancies was performed by overlaying the expected number of beam backgrounds. Track, cluster and vertex reconstruction for both simulated and real data will be described and preliminary comparisons of the expected and measured detector performance will be presented.
We will begin with an overview of the physics goals of the experiment followed by a short description of the detector design. We will then describe the software tools used to design the detector layout and simulate the expected detector performance. Finally, the event reconstruction chain will be presented.

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Session Classification: Track 2 Session

Track Classification: Track2: Offline software