Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **428** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

(G*) Characterization and Calibration of the ALPHA-g Barrel Veto Detector

Thursday 10 June 2021 12:45 (10 minutes)

Since trapping the first cold antihydrogen atoms over 10 years ago, the ALPHA collaboration has established itself at the leading edge of antimatter science. Through a series of experiments located at the Antiproton Decelerator at CERN, the group has carried out a number of novel precision measurements, primarily on the spectral transitions of antihydrogen. ALPHA-g is the latest addition to the ALPHA experiment, a new apparatus which aims to measure the gravitational acceleration of antihydrogen at the 1% level.

After trapping and cooling a collection of antihydrogen atoms using established methods, ALPHA-g will perform a controlled and precise relaxation of some of the confining magnetic fields. The antihydrogen atoms will free-fall until they reach the walls of the trap, where they will annihilate. Reconstructing these annihilation vertices and times will allow ALPHA-g to determine the rate of gravitational acceleration.

ALPHA-g uses two main detector systems to observe these annihilations. A time projection chamber (TPC) allows for tracking of the annihilation products. A time-of-flight detector surrounding the TPC, called the Barrel Veto (BV), allows for much more precise timing measurements. The BV is composed of 64 bars of plastic scintillator which are instrumented with silicon photomultipliers. As well as providing timing and position data to complement the TPC, measuring time-of-flight will allow ALPHA-g to distinguish interactions occurring within the trap volume (annihilation events) from particles originating outside the experiment (cosmic rays).

Using a vertical slice set up at TRIUMF, I was able to characterize the cosmic ray background in the BV. Monte Carlo simulations show that a time resolution on the order of 100 picoseconds is required in order to reject cosmic ray background. I present the readout electronics for the BV, with special attention given to the calibration techniques used, and report on the progress to date on characterizing the time resolution of the detector.

Author: SMITH, Gareth William

Presenter: SMITH, Gareth William

Session Classification: R2-5 Theory III (DNP) / Théorie III (DPN)

Track Classification: Nuclear Physics / Physique nucléaire (DNP-DPN)