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Upgrade of ASACUSA's Antihydrogen Detector

The goal of the ASACUSA experiment at CERN's Antiproton Decelerator is to measure the difference of the ground state hyperfine splitting of antihydrogen and hydrogen in order to test whether CPT invariance is broken.

The ASACUSA hodoscope is a detector consisting of two layers of 32 plastic scintillator bars and two layers of scintillating fibres, individually read out by silicon photo multipliers (SiPMs). If the antiproton of antihydrogen annihilates in the center of the hodoscope, particles (mostly pions) are produced and travel through the various layers of the detector and produce signals.

The hodoscope was successfully used during the last data taking period at CERN. The necessary time resolution to discriminate between particles travelling through the detector from outside and particles produced in the center of the detector was achieved due to the use of waveform digitizers. The disadvantage of this readout scheme with digitizers is the slow readout speed, which should be improved by at least one order of magnitude.

To improve the readout speed as well as time resolution, the wave form digitizers were replaced by TDCs reading out the digital time-over-threshold signal produced by the SiPM amplifier boards. The setup is currently under test and should be installed spring 2022.

Primary experiment

ASACUSA

Primary author: KRAXBERGER, Viktoria

Co-author: CHESNEVSKAYA, Svetlana (Austrian Academy of Sciences)

Presenter: KRAXBERGER, Viktoria

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