

A compact scintillating fibre detector add-on for ASACUSAs hodoscope

Tuesday, 12 September 2017 18:00 (1 hour)

The ASACUSA collaboration at CERN's Antiproton Decelerator aims to measure the ground-state hyperfine splitting of antihydrogen using a spectroscopy method as a means to test CPT symmetry. The Rabi-type setup consists of an antiproton accumulator, a positron source, and a mixing trap functioning as antihydrogen source and a spectroscopy apparatus made out of a microwave cavity and a superconduction sextupole magnet, terminating in a tracking detector [1].

In previous beamtimes, this detector was made up out of a central BGO crystal and two layers of scintillating bars parallel to the beam direction [2][3]. This setup allowed measurements of the point of annihilation and the energy deposited as well as the angle of escaping π -mesons. Moreover, as the bars are read out on both sides a coarse position resolution in beam direction was also achievable using timing information.

For 2017's beamtime the detector was modified to allow a more precise spatial resolution in the beam direction by incorporating two additional layers of scintillating fibers perpendicular to the existing scintillating bars. The additional layers provide a spatial resolution in the order of millimeter which allows for an efficient discrimination of cosmic background as well as advanced tracking of the products of annihilation reactions. This contribution covers the design and construction of this upgrade to ASACUSAs detector as well as the results of preliminary performance studies.

[1] E. Widmann et al. "Measurement of the hyperfine structure of antihydrogen in a beam". In: (Jan. 2013). arXiv: 1301.4670v1. url: <http://arxiv.org/abs/1301.4670v1> (cit. on p. 1).

[2] Y. Nagata et al. "The development of the antihydrogen beam detector and the detection of the antihydrogen atoms for in-flight hyperfine spectroscopy". In: *Journal of Physics: Conference Series* 635.2 (2015), p. 022061. url: <http://stacks.iop.org/1742-6596/635/i=2/a=022061> (cit. on p. 1).

[3] C. Sauerzopf et al. "Annihilation detector for an in-beam spectroscopy apparatus to measure the ground state hyperfine splitting of antihydrogen". In: (June 2016). url: <http://www.sciencedirect.com/science/article/pii/S0168900216305630> (cit. on p. 1).

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