

The upgrade of the ASACUSA scintillating bar detector

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The ASACUSA collaboration (Atomic Spectroscopy And Collisions Using Slow Antiprotons) has been performing experiments with low energy antiprotons at the CERN Antiproton Decelerator (AD) for 20 years. Among the other projects, the "cusp trap" group aims at the study of the ground-state hyperfine structure of antihydrogen to test the antimatter properties against the matter ones.

The antiprotons from the AD are slowed down and mixed with positrons in a double cusp trap in order to form antihydrogen. Due to the strong gradients of the magnetic field the antihydrogen atoms are polarized and the so-called "low-field seekers" will flow along the beamline where the Rabi resonance method is used to measure the hyperfine transitions.

Several detectors are needed along the trap and the beamline to monitor each experiment step. The scintillating bar detector is placed close to the mixing trap and detects pions emerging from the antiproton annihilation to reconstruct the annihilation vertex position. It is composed of ~1 square meter planes of scintillating bars readout by WLS fibers and multianode PMTs for a total of 500 channels. A major upgrade of the light readout system is ongoing: the PMTs will be replaced by 1x1 mm² SiPMs and the front-end electronics will be changed accordingly. The needed acquisition rate is 1 kHz. The upgrade will improve the efficiency and uniformity in the collection of light since the performance of the detector was degraded over time due to the delicate fiber-PMT coupling.

In this contribution all the commissioning phases and the expected performances will be described. In the preliminary tests the light yield of a single bar has been measured with cosmic rays, then the fiber-SiPM coupling system has been validated and the front-end electronics adapted for the new signal source. The internal mechanical structure has been adapted as well and the final assembly is ongoing. The installation in the experimental area will be described too.