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Development of Beam Profile Monitor for Antiproton Annihilation Cross Section Measurements by the ASACUSA Collaboration

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ASACUSA will attempt to measure the A-dependence of the antiproton-nucleus annihilation cross sections for the first time in the energy region where it is expected to deviate significantly from the Aˆ(2/3)-law established at higher energies, using CERN's Antiproton Decelerator and ASACUSA's radio-frequency quadrupole decelerator, the combination of which provides 100-ns-long pulses each containing ˜10ˆ7 antiprotons. The instantaneous flux of antiprotons is too high to distinguish individual particles, which makes the controlled rejection of backgrounds difficult. One way to avoid this problem is to assure all antiprotons to strike only the target, not the surrounding target frame or vacuum pipe.

In order to satisfy this requirement, we developed a beam profile monitor based on the secondary electron emission, and measured destructively 30-mm-diameter spatial profiles of pulses containing > 6*10ˆ4 antiprotons* *with an active area of 40*40 mmˆ2 and a resolution of 4 mm at the target position. One can determine where charged particles strike by measuring the positive charge induced by electrons which they release. Features of this method are that it can be directly placed in the high vacuum unlike gas detectors, the structure can be simple, and it can be lightweight and low cost. This monitor consisted of cathode micro wires of 20-μm diameter, and 20*20 segmented anode pads arranged in a checker-board pattern on a four-layered electric board of thickness t = 2 mm made of an FR4-type glass epoxy.

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