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Status and performance of the ALPHA-g detectors

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The ALPHA-g experiment at CERN's Antiproton Decelerator recently published the first direct measurement of the gravitational free fall of antihydrogen [Nature 621, 716–722 (2023)]. The anti-atoms were produced and trapped in a magnetic-minimum trap and slowly released by ramping down the upper and lower solenoidal coils. One of crucial prerequisite for experiment sensitive to gravitational force is a detector system capable of localization of antihydrogen annihilation products (typically 3 to 4 charged pions) with sufficient vertical precision, while suppressing the rate of cosmic ray background.

Because of the required length and available space between cryostats (detector height $>2.3\text{m}$ and radius between 10.6cm and 24.3cm), radial time projection chamber was chosen as a tracking detector and a thin barrel scintillator detector was installed around it for time of flight discrimination. This contribution will describe the design, commissioning and performance of both detectors, their readout electronics and reconstruction. Recent improvements in calibration and background suppression with multivariate analysis will also be shown.

Primary experiment

ALPHA

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