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Design and characterisation of an antiproton deceleration beamline for the PUMA experiment

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We report on the design and characterization of an antiproton deceleration beamline, based on a pulsed drift tube, for the PUMA experiment at the Antimatter Factory at CERN. The design has been tailored to high-voltage (100 kV) and ultra-high vacuum (below 10^{-10} mbar) conditions. A first operation achieved decelerating antiprotons from an initial energy of 100 keV down to (3898 ± 3) eV, marking the initial stage in trapping antiprotons for the PUMA experiment. Employing a high-voltage ramping scheme, the pressure remains below 2×10^{-10} mbar upstream of the pulsed drift tube for 75% of the cycle time. The beamline reached a transmission of $(55 \pm 3)\%$ for antiprotons decelerated to 4keV. The beam is focused on a position sensitive detector to a spot with horizontal and vertical standard deviations of $\sigma_{\mathrm{horiz}} = (3.0 \pm 0.1)$ mm and $\sigma_{\mathrm{vert}} = (3.8 \pm 0.2)$ mm, respectively. This spot size is within the acceptance of the PUMA Penning trap.

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