Production of cold antihydrogen for precision studies

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The proposed AEGIS experiment at the CERN antiproton decelerator will constitute the first-ever experimental test of the effect of gravity on antimatter. Its performance crucially depends on the temperature of the initial antihydrogen sample. Measurements by ATRAP and ATHENA have shown that antihydrogen produced with the nested-trap technique is much hotter than the temperature of the surrounding trap, a fact which is attributed to an unexpectedly high recombination rate which exceeds the cooling rate of antiprotons in a positron plasma. Therefore, novel schemes for antihydrogen recombination as well as for the pre-cooling of antiprotons are being considered and will be tested prior to the construction of the AEGIS apparatus. If demonstrated to be successful, such techniques will be applicable to a wide range of current and future precision antimatter experiments.