Positron Production and Storage for Antihydrogen Production

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Antihydrogen is the simplest stable antiatom which can be produced at low energies. A sample of antihydrogen amenable to precision spectroscopic investigation would provide a stringent test of CPT symmetry and may provide a path to physics beyond the standard model.

The ASACUSA collaboration employs a cryogenic double cusp trap for mixing antiprotons and positrons, which serves as an antihydrogen source for inflight spectroscopy [1, 2]. Antiprotons are provided by the Antiproton Decelerator at CERN. Positrons from a radioactive ^{22}Na source with an activity of currently 0.51 GBq are slowed down to a few eV using a neon rare-gas solid moderator and accumulated in a Surko-type buffer gas trap. Typically, 6×10^6 positrons are accumulated within 30 s and transferred into the double cusp trap for mixing.

In this poster, the apparatus and methods used to produce, trap, accumulate, and condition positrons will be discussed. Planned new developments in positron temperature measurement and cooling will be shown, which will be important for improving the mixing efficiency. Calculations show that hydrogen production is optimal with a high density, low temperature positron plasma [3], encouraging recombination via three-body and radiative processes.

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[1] E. Widmann et al., Hyperfine Interactions 215, 1 (2013)
[2] N. Kuroda et al., Nature Communications 5 3089 (2014)
[3] B. Radics et al., Phys. Rev. A 90, 3 (2014)