The Anticyclotron Project

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For trapping large numbers of antiprotons one needs an intermediate stage between the main source of antiprotons (like the Antiproton Decelerator or the former LEAR at CERN) of typically a few MeV energy and the trap which requires 10-100 keV antiprotons.

The anticyclotron project was started at CERN in 1990 based on the cyclotron trap developed at Karlsruhe and PSI/SIN for studying the pbar X-ray cascades in low-pressure gases. The anticyclotron is a small superconducting cyclotron with no RF field, operating in an inverse way: radial injection and --- after deceleration in a low pressure gas --- axial extraction. It was proposed to serve as a basic apparatus to provide an ultra-low energy antiproton beam at LEAR with a predicted transmission efficiency up to 20% using 0.3 mbar hydrogen as moderator gas [1-3].

The anticyclotron tests started at LEAR with 2 MeV antiprotons decelerating in a low--pressure gas and continued in the early 90's at PSI with 4 MeV negative muons with a thin Mylar foil in the median plane as a moderator medium, providing a 5-25 keV negative muon beam extracted with a 2% efficiency. Based on the experience with the original apparatus a new anticyclotron was designed [1] and built at PSI. It is used for precision pionic hydrogen measurements [4] as well as a source of low-energy negative muons [3, 5].

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[2] D. Horvath et al.: Nucl. Instr. Meth. B 85 (1994) 736.
[3] P. DeCecco et al.: Nucl. Instr. Meth. A 394 (1997) 287.
[4] D. Gotta: Prog. Part. Nucl. Phys. 52 (2004) 133.
[5] F. Kottmann et al.: Hyperfine Interactions 138 (2001) 55.