Future precision measurements on kaonic hydrogen and kaonic deuterium with SIDDHARTA

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After the most precise measurement on kaonic hydrogen performed up to now by DEAR at the DAΦNE collider of Laboratori Nazionali di Frascati in 2002, result presented at this meeting [1], a new precision measurement of kaonic hydrogen and kaonic deuterium is envisaged in the framework of the new SIDDHARTA project.

The objective of SIDDHARTA (SIlicon Drift Detector for Hadronic Atom Research by Timing Application) is the precision measurement of the K_α line shift and width, due to the strong interaction, in kaonic hydrogen and a similar measurement - the first one - in kaonic deuterium. The aim is a precision determination of the antikaon-nucleon isospin dependent scattering lengths. An accurate determination of the K^-N isospin dependent scattering lengths will place strong constraints on the low-energy K^-N dynamics, which in turn constraints the SU(3) description of chiral symmetry breaking [2]. Crucial information about the nature of chiral symmetry breaking, and to what extent the chiral symmetry must be broken, is provided by the calculation of the meson-nucleon sigma terms [3].

SIDDHARTA represents the natural continuation of DEAR taking advantage, however, of a completely newly designed setup which guarantees a near 4π solid angle coverage, and, as detector, silicon drift detectors (SDD) which exhibit the same performance of CCDs as far as efficiency and energy resolution is concerned, but can be triggered, thus allowing an increasing of the signal/background ratio of orders of magnitude.

The trigger is given by the entrance of the charged kaon in the target volume. The event can be identified and measured with high accuracy and low contamination by the use of a three-scintillator telescope, synchronized with the bunch frequency. First tests of a prototype SDD array, performed at the Beam Test Facility (BTF) of LNF, gave excellent results.

In addition to the precision kaonic hydrogen and deuterium measurements, in SIDDHARTA it is planned a measurement of kaonic helium and a feasibility study of sigmonic hydrogen.

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References

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