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Performance of Silicon-Drift Detectors in kaonic atom X-ray measurements

Large-area Silicon Drift Detectors (SDDs) were used for the first time for precision spectroscopy of kaonic atom X-rays in the SIDDHARTA experiment for the study of strong interaction at low-energy. These measurements were performed at the DAFNE electron–positron collider (LNF, Italy) using gas targets of hydrogen, deuterium, helium-3, and helium-4. The excellent performance of the SDD devices under beam conditions will be described as well as the background suppression capability using the time correlation between the kaonic X-rays and the back-to-back correlated K+K- pairs produced by DAFNE. Finally an overview of the methodology to extract the energy position and the broadening of the X-ray line will be given.

Summary (Additional text describing your work. Can be pasted here or give an URL to a PDF document):

Large-area silicon drift detectors (SDDs) (3 x 1cm2 per chip) were newly developed for the kaonic atom X-ray spectroscopy measurements in the SIDDHARTA experiment. The goal of the SIDDHARTA experimental program was the precise determination of the energy and width of kaonic atom X-rays with small yield, but with high X-ray background conditions at the DAFNE electron-positron collider. Therefore, the developed SDDs have to have good energy resolution, timing capability and large X-ray detection area.

The SDDs were installed at the interaction point of the DAFNE collider surrounding an cryogenic target cell. To achieve the required energy resolution (150 eV at 6 keV) the SDDs were cooled to 170 K. They provided the expected excellent background suppression using the time correlation between the kaonic X-rays and the back-to-back correlated K+K- pairs produced by DAFNE. Using gas targets of hydrogen, deuterium, helium-3, and helium-4, these kaonic atom X-ray lines were successfully measured.

The first, very successful application of SDDs for kaonic atom X-ray spectroscopy will be described, during data taking periods from 2008 to 2009, for a total of more than 12 months. A good stability in terms of high background beam conditions and long time measurements was found.

Primary author: Dr ISHIWATARI, Tomoichi (Stefan Meyer Institut f. subat. Phys., Wien)

Presenter: Dr ISHIWATARI, Tomoichi (Stefan Meyer Institut f. subat. Phys., Wien)