Short Course 3
Semiconductor Strip, Pixel and Voxel Arrays

Saturday, October 16, 14:00 - 18:00 Room Cesarea

Instructors: Lothar Strüder and Gerhard Lutz

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Short CV: Experiments in particle physics since 1964. Introduction of semiconductor detectors in particle physics since 1979. New detector concepts and principles. Microelectronics. Author of a book on semiconductor detectors.

Course Contents

The measurement of ionizing radiation like optical photons, X- and γ-rays on one side and electrons, protons, α or other massive particles on the other side is of great interest in many fields of basic science (e.g. astrophysics, high energy physics), applied science (e.g. material analysis, medical imaging, synchrotron research) and industrial science (e.g. X-ray fluorescence analysis, quality control). Semiconductor detectors, in particular with the introduction of new concepts and principles have very strongly improved the measurement capabilities.

This half day course intends to review the basic physics of semiconductor devices used as detectors as well as for integrated electronics. A short treatment

of further signal processing electronics will be given. Resulting implications for front-end electronics will be discussed.

The basic physical limitations of the measurement precision will be derived from physical concepts. Special emphasis will be given to the physical limits of position resolution, energy resolution, time resolution, the quantum efficiency and the 'cleanliness' of spectra. Basic effects affecting the long-term stability under various experimental boundary conditions will be discussed.

We will concentrate on pn-junction type detectors as single and double sided silicon strip detectors, pin and pad detectors, silicon drift detectors, charge coupled devices and active pixel sensors. The impact of those detectors on readout and data aquisition strategies will be derived from the intrinsic detector properties and the specific application and its primary measurement goal.

For all detector types examples of applications will be presented. A textbook (G. Lutz, Semiconductor Radiation Detectors, Springer) will be supplied and is part of the registration fee.