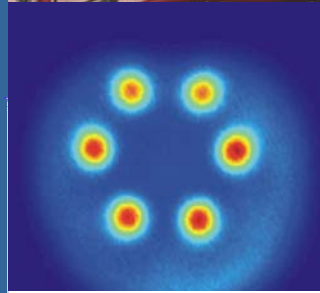
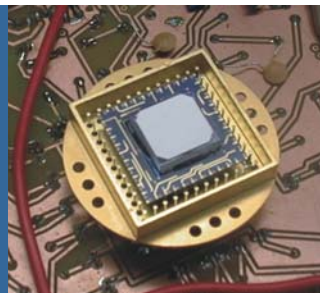
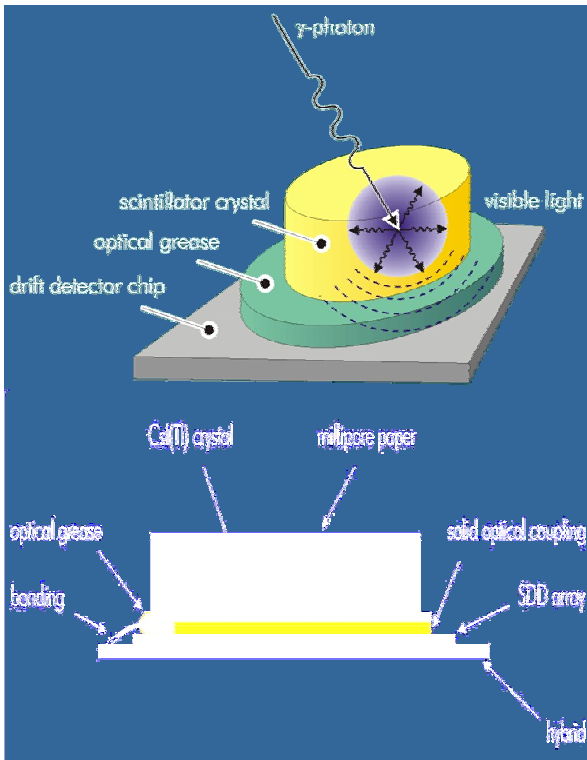


Silicon Drift Detectors (SDDs) have been coupled to scintillators to simultaneously measure position energy and time of the incident radiation. High photon quantum efficiency and low noise amplification make silicon drift detectors suitable for the light detection of scintillators like CsI(Tl) or LSO etc. The segmentation of the SDDs allows for a precise reconstruction of the light centroid of the incident X-rays and hence a space point measurement of the position of the interaction within the scintillating crystal.

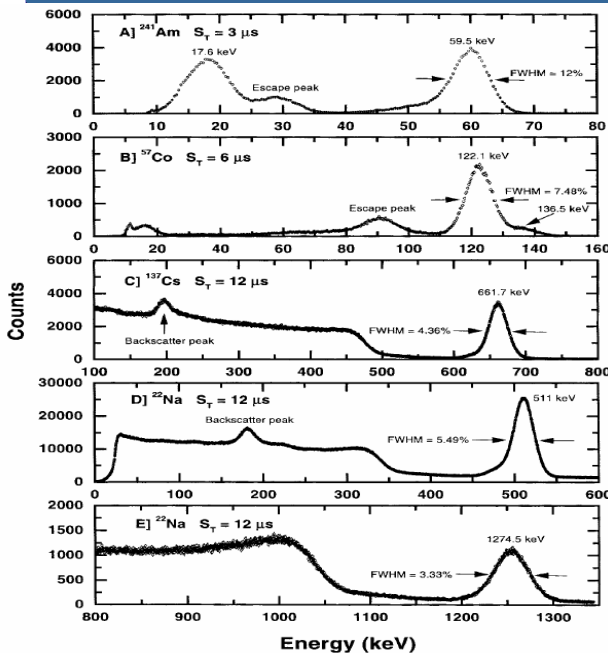


Top left: A scintillator is coupled to a light sensitive silicon drift detector with the help of optical grease.

Center left: The scintillator is covered with millipore paper for the diffuse reflection of the generated optical photons. Typically 20 electrons are produced for every keV of deposited X-ray energy in the scintillating crystal (here: CsI(Tl)).

Top right: photograph of a 19-cell SDD coupled to a CsI(Tl) crystal with a total area of approx. 1 cm². The detectors were operated at room temperature.

Bottom left: X- and Gamma ray spectra recorded with the above described set-up. From top to bottom: 59.5 KeV (FWHM = 12%), through 122,1 keV (FWHM = 7.5 %), 511 keV (FWHM = 5.5%), 661.7 keV (FWHM = 4.3 %) and 1274.5 keV with a FWHM = 3.3 % only. This result is superior than the actual best value taken with a photomultiplier readout of CsI(Tl) light.



Bottom right: A pinhole grid with 6 holes around a circle with a diameter of 3 mm and a hole diameter of 200 μm was illuminated with X-rays of 144 keV energy. The light distribution of all 19 cells were used to find the centroid of the scintillator light. As can be seen in the figure, this was done with unprecedented success. The position of the holes was measured with a spatial resolution of better than 200 μm (FWHM).

The described techniques are equally useful for applications in basic science, medicine, life science and material research. Actual projects are related to astrophysics and medicine. SIEMENS medical is studying the concept for the replacement of photomultiplier tubes in Anger cameras. The experimental work was done by C. Fiorini, A. Longoni from Politecnico di Milano, Italy, funded by INFN.

References: C.Fiorini et al., NIMA 512, pp 265 - 272, 2003