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Principle of Silicon based microdosimetry

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Silicon detectors are being studied as microdosimeters since they can provide sensitive volumes of micrometric dimensions. They can be applied for assessing single event effects in electronic instrumentation exposed to complex fields around high-energy accelerators or in space missions. When coupled to tissue-equivalent converters, they can be used for measuring the quality of radiation therapy beams or for dosimetry. The use of micrometric volumes avoids the contribution of wall effects to the measured spectra. Further advantages of such detectors are their compactness, cheapness, transportability and a low sensitivity to vibrations. Anyway, the following problems should be solved when a silicon device for microdosimetry: i) the sensitive volume has to be confined in a region of well-known dimensions; ii) the electric noise limits the minimum detectable energy; iii) corrections for tissue-equivalency should be made; iv) corrections for shape equivalency should be made when referring to a spherical simulated site of tissue; v) the angular response should be evaluated carefully; vi) the efficiency of a single detector of micrometric dimensions is very poor and detector arrays should be considered. Several devices are being proposed as silicon microdosimeters, based on different technologies (telescope detectors, silicon on insulator detectors and arrays of cylindrical p-n junctions with internal amplifications), in order to satisfy the issues mentioned above.

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