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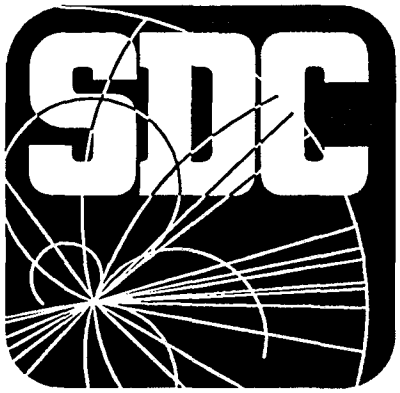

SDC
SOLENOIDAL DETECTOR NOTES

SPATIAL RESOLUTION OF A SINGLE SCINTILLATING FIBER OF CIRCULAR CROSS-SECTION

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SPATIAL RESOLUTION OF A SINGLE SCINTILLATING FIBER OF CIRCULAR CROSS-SECTION*

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ABSTRACT

With the simplifying assumption that the detection probability of a normally-crossing, minimum-ionizing particle is directly proportional to the length of the chord traversed, the rms deviation for a single circular scintillating-fiber position detector of diameter d is shown to be $d/4 = 0.25d$. This value is slightly smaller than $d/\sqrt{12} = 0.28d$ obtained for a rectangular detection-probability distribution.

It is well known that the spatial resolution of a one-dimensional detector of extent d is $d/\sqrt{12}$. This quantity is the rms deviation of a probability distribution which is constant across the detector's extent and is zero elsewhere. While this value has been applied in discussions of the spatial resolution of scintillating-fiber tracking detectors, it is not really applicable to detectors employing circular fibers since the detection probability is *not* constant across a fiber diameter. The purpose of this note is to obtain a more appropriate value.

Consider a scintillating fiber of diameter d subject to normally-crossing, minimum-ionizing particles, as shown in Fig. 1. As discussed in Refs. 1 and 2, even in this special case the detection probability is not easily expressed as a function of the crossing position coördinate, x. However, for the purpose of this

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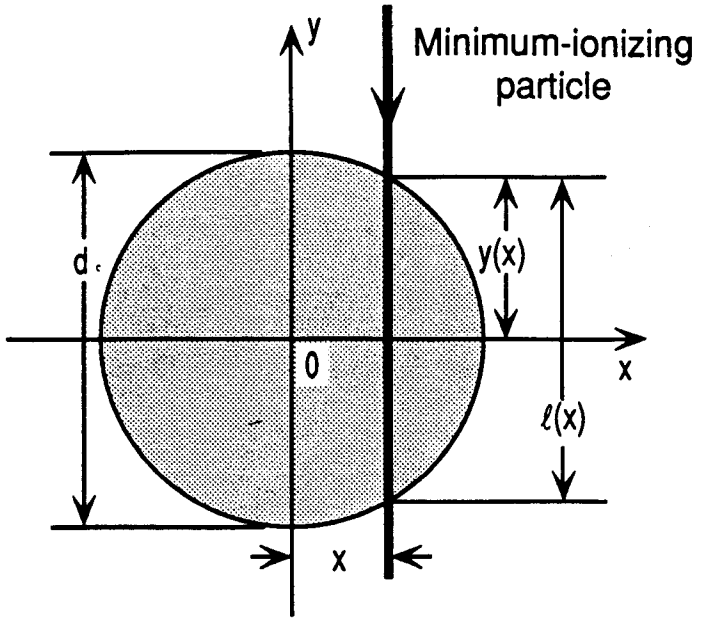

Figure 1. Minimum-ionizing particle normally crossing a circular scintillating fiber.

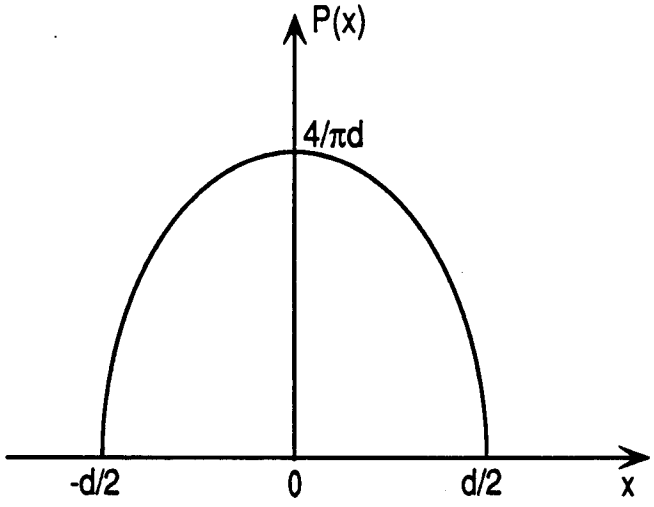

Figure 2. Detection probability distribution for the assumptions made in the text.