Separation of one- and two- track events in scintillators

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If two protons in the exit channel from a reaction like pp→ppη' have similar momenta, their trajectories may be so close in the magnetic separator, that the drift chambers in the COSY-11 experimental setup [1] can not resolve them. Therefore, an analysis via the energy loss in the scintillation detectors has to be used. An energy

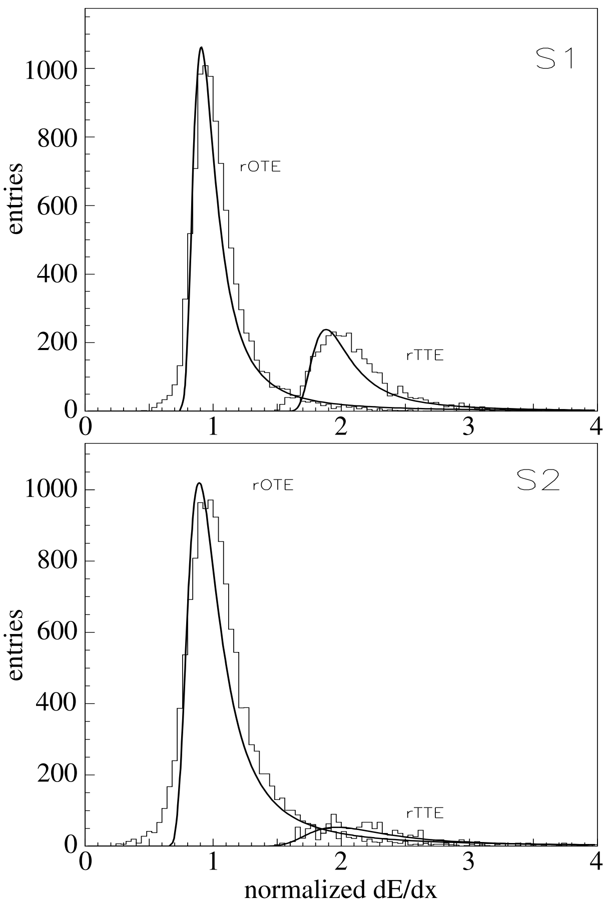

Fig. 1: The energy loss distributions for one (rOTE) and two particles (rTTE) passing through one element of the scintillator hodoscopes S1 and S2, respectively, accumulated for $\beta = 0.75$ and shown with fitted Landau functions.

loss spectrum in thin scintillators is well described by the Landau distribution; Fig. 1 shows such distributions for the scintillation detectors S1 and S2 in COSY-11. The higher (lower) peak denotes the response when one particle (rOTE) (two particles (rTTE)) passed through the scintillator. Both spectra were accumulated for $\beta = 0.75$ values.

The analitic function describing the Bethe-Bloch formula in the range $0.69 < \beta < 0.97$ was found on the basis of the position of the maximum of the energy loss distribution (the most probably energy loss) for several values of β. The result is shown in Fig. 2.

Figure 3 presents the energy loss distribution for different values of β. To some extent, in each case the rTTE curves are superimposed by rOTE. In order to distinguish

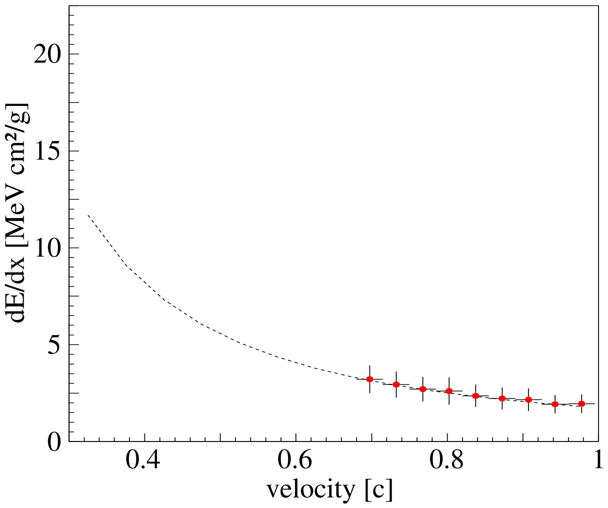

Fig. 2: Energy loss as a function of velocity $\beta = \frac{v}{c}$.

- via an energy loss analysis - between one and two particle hits, the knowledge of β is necessary. In the presented

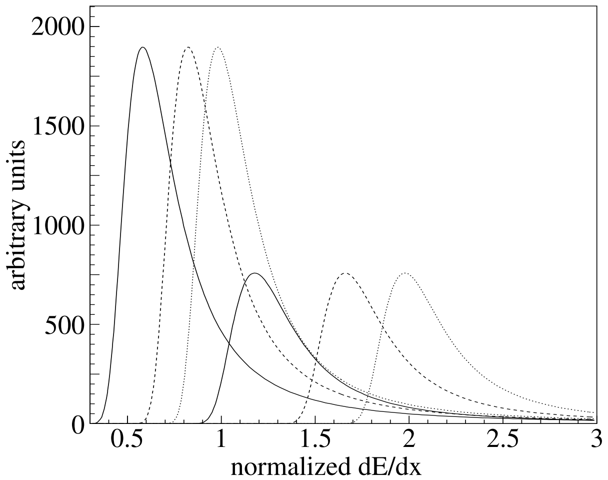

Fig. 3: The energy loss distributions for one and two protons with β = 0.92, 0.86, and 0.74 each.

example, as shown in Fig. 1, the ratio in counting rate between rOTE and rTTE is 16% and 3% for S1 and S2, respectively. The smaller the ratio, the worse the separation between both cases. Here, if one makes a cut at 1.75 in the rTTE part of the spectrum the contamination of rOTE is 7% for S1 and 85% for S2.

References:

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