plates [38] or 10 mm lead plates [39]; resolutions σ/E of $0.34/\sqrt{E}$ and $0.44/\sqrt{E}$ were obtained for these cases (E in GeV). The former was shown to be linear to within 2% over three orders of magnitude in energy, with approximately Gaussian signal distributions.

<u>dE/dx resolution in argon.</u> Particle identification by dE/dx is dependent on the width of the distribution. For relativistic incident particles with charge e in a multiple-sample Ar gas counter with no lead [40],

$$\left.\frac{dE}{dx}\right|_{\mathrm{FWHM}} \Big/ \left.\frac{dE}{dx}\right|_{\text{most probable}} = 0.96\,N^{-0.46}\,(xp)^{-0.32}\ , \qquad (12.15)$$

where N = number of samples, x = thickness per sample (cm), p = pressure (atm.). Most commonly used chamber gases (except Xe) give approximately the same resolution.

<u>Free electron drift velocities in liquid ionization chambers</u> [41–44]. Velocity as a function of electric field strength is given in Fig. 12.2 of the full *Revew.* It ranges from 1 to 10 μm/ns, depending on the liquid and the field strength.

12.8. Measurement of particle momenta in a uniform magnetic field [45]

The trajectory of a particle with momentum p (in GeV/c) and charge ze in a constant magnetic field $\vec{B}$ is a helix, with radius of curvature R and pitch angle λ. The radius of curvature and momentum component perpendicular to $\vec{B}$ are related by

$$p\cos\lambda = 0.3\,z\,B\,R\ , \qquad (12.16)$$

where B is in tesla and R is in meters.

The distribution of measurements of the curvature $k \equiv 1/R$ is approximately Gaussian. The curvature error for a large number of uniformly spaced measurements on the trajectory of a charged particle in a uniform magnetic field can be approximated by

$$(\delta k)^2 = (\delta k_{\mathrm{res}})^2 + (\delta k_{\mathrm{ms}})^2\ , \qquad (12.17)$$

where $\delta k =$ curvature error

$\delta k_{\mathrm{res}} =$ curvature error due to finite measurement resolution

$\delta k_{\mathrm{ms}} =$ curvature error due to multiple scattering.

If many (≥ 10) uniformly spaced position measurements are made along a trajectory in a uniform medium,

$$\delta k_{\mathrm{res}} = \frac{\epsilon}{L'^2}\sqrt{\frac{720}{N+4}}\ , \qquad (12.18)$$

where $N =$ number of points measured along track

$L' =$ the projected length of the track onto the bending plane

$\epsilon =$ measurement error for each point, perpendicular to the trajectory.