In analysing the inelastic scattering the experimental physicist has several tools at his command. He can examine the fragments that are ejected as a result of the disintegration process, or he can examine the loss of energy of the incident electron during the scattering process; it is this loss in energy which presumably corresponds to the energy of creating and propagating the 'ejecta' from the proton. Most of the relevant information regarding the electron scattering process was obtained by experiments that looked only at the scattered electron.

If we assume that the proton has constituents that are point-like, or at least have a radius very much smaller than that of the proton itself, then an inelastic scattering process can be envisaged as the totality of elastic electron scattering from each of these point-like constituents. This is shown in fig. 8. One can easily derive geometrical relations between the direction and energy of the incident and scattered electron under a number of plausible assumptions. Specifically, by arguments exactly analogous to those applied to X-ray scattering by the atom, one can show by simple mathematics that the energy and angle distribution of the outgoing electron should be a product of two factors. The first factor is the distribution corresponding to scattering from a single, point-like object. This first factor can be calculated with confidence from theory, since the forces governing the interaction between an electron and a point-like charged object are almost purely electromagnetic. In essence, electron scattering is thus "exploring unknown structures with known forces". The second factor, again called the 'form factor', is a function characteristic of the distribution of the point-like objects within the proton. As long as the basic model of the process is correct (i.e., scattering occurs from point-like objects coupled by forces that can absorb transverse momenta up to a specified limit), then the form factors should depend only on a certain dimensionless ratio defined by the kinematics of collision. This ratio can be identified with the fraction of the momentum within the proton which is carried by the struck point-like object. The assumption made here is that binding among these objects is negligible in considering their motion.

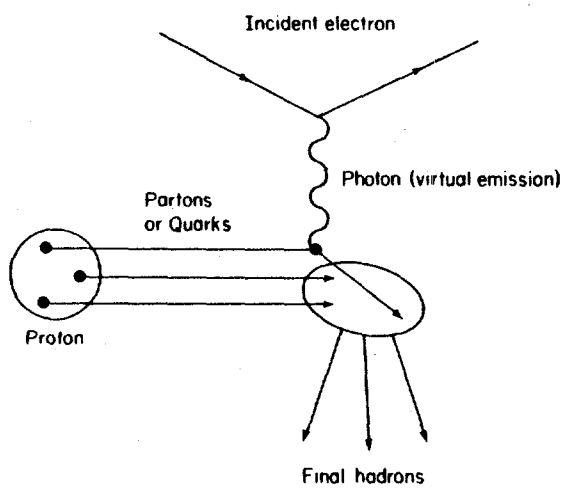

Fig. 8. Diagram of the deep inelastic electron scattering process on the proton. It is assumed that protons are composed of three partons or quarks. The electron 'virtually' emits a photon during the scattering process which interacts with one of the three partons. The three partons interact after the scattering process and recombine, forming a combination of final hadrons.