Rutherford Laboratory

Technical leaflet

Spark Chambers

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The Spark Chamber provides a means of visualising tracks of charged particles. Measurements of these tracks are made either by photographing them and subsequently measuring the photographs, or by using television techniques for scanning the spark chamber directly. The latter technique obviously lends itself to a direct coupling between the spark chamber and a computer, thus by-passing all manual stages in the analysis of tracks. In the so called sonic spark chamber positional information of the tracks is obtained by measuring the propagation time of the sound wave emitted by the spark. Recently spark chambers have been constructed with their earthy electrodes in the form of an array of parallel and regularly spaced wires each coupled to a Ferrite memory core. The memory cores provide a record of those wires which have been struck by sparks. Information on these cores is read directly into a computer for analysis.

The main virtue of the spark chamber technique is that the device has to be triggered to yield information on the location of tracks. This means that, by associating a suitable set of scintillation counters with a spark chamber array, and by choosing an appropriate logical combination of signals from the scintillation counters to trigger the spark chambers, it becomes possible to select, for instance, certain rare processes for observation in spite of the presence of a large background of uninteresting events.

By using a low D.C. clearing field between the electrodes it is possible to sweep ions from old tracks out of the dielectric quite quickly without causing breakdown. By this means the effective memory time of the spark chamber can be limited to be less than one microsecond. Such a chamber can then be placed in a position where it may be traversed by say a million charged particles per second and yet it can be made to yield the track of the last particle to traverse it, to the exclusion of all others.

It is possible to arrange for a spark chamber to be completely deionised within a millisecond or so after the occurrence of a spark, so that it can be used in a situation in which, up to say, a thousand events per second have to be recorded.

It is mainly these three properties of process selectivity, short memory and short recovery time which have contributed to the successful use which has been made of spark chambers in the last six years or so.

Experiments involving a direct coupling of spark chambers to computers are still at a relatively early stage of development, but the excellent results obtained so far indicate that this technique is likely to be of great importance in the near future.