Rutherford Laboratory

Technical leaflet

P3 Experiment: A search for Multipion Resonances in the Process $\pi^- + p \rightarrow \begin{pmatrix} n+x \\ p+x \end{pmatrix}$

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The purpose of this experiment is to study the properties of the f° meson resonance. It is 1.4 times heavier than a proton, and has a life-time of approximately 10^{-23} seconds. The experiment will investigate the decay modes of the f°. The results will help to identify which classification of particles it is related to in the symmetry theories that have evolved in the past two years.

The f° will be produced in the interaction of an energetic negative pion with a stationary hydrogen nucleus (proton). The interaction in question produces an f° and a neutron. The f° decays too quickly to be detected, but the neutron is detected in a large counter array. The decay products of the f° have long life-times. They are detected by an array of spark chambers situated near the hydrogen target. The spark chambers can measure the direction of these decay particles to a high accuracy. The event can then be reconstructed by analysis in a computer and the decay products of the f° can be identified.

All the spark chambers are of the Sonic type, that is the spark position is detected by a sound ranging technique. Four microphones are mounted in each chamber (one in each corner). The microphones are cylindrical in shape, $\frac{1}{4}$-inch diameter and $\frac{1}{4}$-inch long. The experiment requires 26 chambers of various sizes, hence a total of 104 microphones. All the microphone measurements are transferred automatically to a magnetic tape in the experimental control room. While the experiment is proceeding, the data on this tape can be transmitted directly (via a cable link) to the ORION-DDP224 computer system situated in Building R.1. The data is analysed and the results can be presented back in the control room either on a typewriter or on an oscilloscope display. This technique of "on-line" analysis of data assists the experimenter in detecting any faults that may occur in the equipment as well as analysing the physics of the experiment.