



# Rutherford Laboratory

## Technical leaflet

C.9

### THE HOUGH-POWELL DEVICE (H.P.D.)

The H.P.D. is a computer controlled flying spot digitiser for the fast analysis of bubble and spark chamber photographs. The machine will measure 30-50 events per hour giving coordinates to an accuracy of  $2 \times 10^{-6}$  metres.

The data from an experiment is presented in the form of two or more stereoscopic pictures recorded on negative film. The events to be measured are selected on scanning tables and roughly digitised on Image Plane Digitisers (I.P.D.'s). The paper tape output from the I.P.D.'s is used to prepare magnetic tapes of rough digitisings to control the H.P.D. computer program.

The film is then measured by the H.P.D. A mechanical-optical system produces a moving spot of light of high intensity which is projected simultaneously onto a reference grating and onto the film, accurately located in a gate. The spot of light moves in a fixed line in space and the film mounted on a hydraulically operated carriage is moved at right angles to the direction of the scan so that a T.V. type raster is passed over the film. The light passing through the film is collected by a photomultiplier which senses any dark trace on the film such as a track image. The position of the image in the direction of the spot motion is found by counting the position of the spot as it scans the reference grating. The position of the image in the direction of the carriage motion is found using a Ferranti Moiré Fringe grating system.

The machine has two separate measuring systems, as described above, allowing the film to be scanned either parallel or at right angles to the beam track direction. This enables tracks of all angles to be measured accurately.

To enable the rapid positioning of the interesting pictures in the measuring gate, the machine has a high performance film transport.

The digitising electronics records the coordinates of each point and transmits them to the DDP 224 and Orion computers via a small buffer memory.

The H.P.D. Computer program automatically controls the measurement of all the interesting pictures once the roll of film has been placed in the machine. The program receives the coordinates of all digitised marks on the film but considers only those points which fall within special roads set up from the rough digitised points of the interesting tracks. As the data is received from the machine the program reconstructs each track from the points within the track road and calculates a set of master points for each track.

This information is then used off line in the three dimensional geometrical reconstruction and kinematical analysis of each event.



### Machine characteristics

Light spot diameter	$10 \times 10^{-6}$ metres
Least count in the carriage direction	$2 \times 10^{-6}$ metres
Least count in the spot direction	$1.6 \times 10^{-6}$ metres
Carriage speed while measuring	4mm/sec
Maximum film transport speed	5 metres/sec
Maximum film transport acceleration	2g