Rutherford Laboratory

Technical leaflet

C.1

TARGET OPERATION IN THE 1.5 METRE CRYOGENIC BUBBLE CHAMBER

This operation of the bubble chamber with a target has been developed at the Rutherford Laboratory, in conjunction with C.E.R.N. In the study of nuclear interactions which occur when incoming beam particles collide with individual atomic nuclei of the liquid numerous secondary particles are produced. Some of these secondary particles suffer further collisions or decay spontaneously after an extremely short time. However in liquid hydrogen the distance travelled by gamma rays before conversion into electron-positron pairs allows them to leave the chamber. If a 'heavy liquid' is used then conversion of many gamma rays will occur within the visible region of the chamber.

To enable the interactions between the incoming particles and the nuclei of the liquid to be studied as well as the spontaneous decay of the secondary particles produced the use of sensitive targets has been developed, in conjunction with C.E.R.N. for operation in the Cryogenic Bubble Chamber.

The sensitive target, filled with hydrogen, is fitted along the centre of the chamber so that the incoming particles can transverse its entire length.

The chamber surrounding the target is filled with a liquid hydrogen/neon mixture.

The perspex target is 140 cm long, 40 cm high and 4 cm wide. The two ends used for restraining the target are of thick section while the rest of the target is made from 3 mm sheet bent round at the top and bottom to close the target; the ends of the sheet are glued together as is the sheet to the end sections.

Filling is accomplished by condensing pure hydrogen gas in the target and the chamber surrounding the target is filled with liquid hydrogen/neon mixture. When the target is completely filled with liquid hydrogen it is isolated from its control system by actuating a cryogenic valve in the supply line.

When the bubble chamber is pulsed the target pressure reproduces the pressure variations in the chamber as the flexible perspex walls deflect. By careful choice of the neon/hydrogen concentration and the chamber operating temperature and pressure simultaneous sensitivity can be achieved in the target and surrounding liquid.

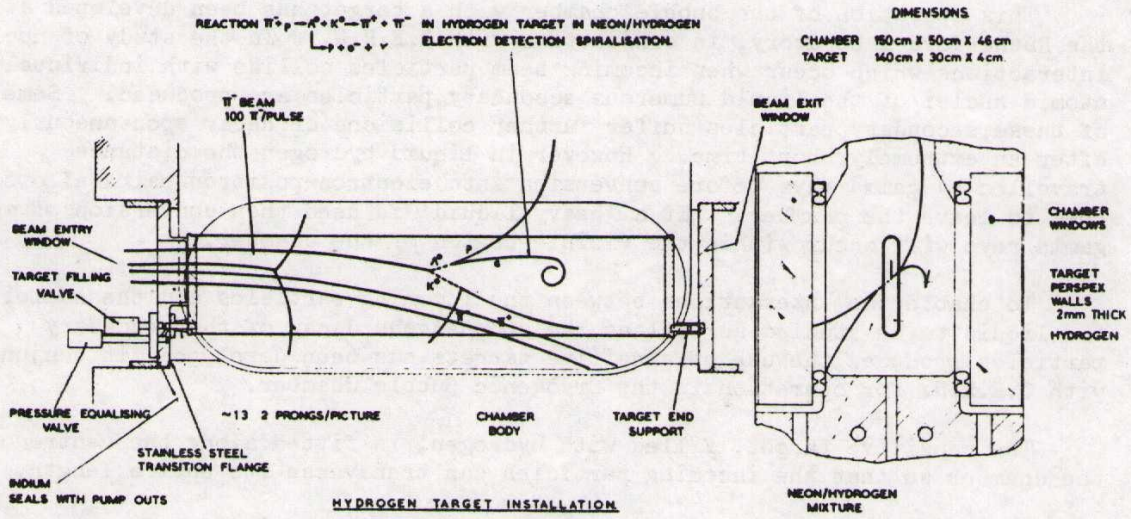
This new technique can widen the scope of experiments that may be performed in a bubble chamber because the advantages of a hydrogen chamber giving simple interactions can be coupled with high gamma ray detection efficiency in the dense neon/hydrogen mixture.

The conversion of the gamma rays into electron-positron pairs allows their direction and energy to be determined.

The technique can be extended further by filling the target with deuterium instead of hydrogen and using a 95 mole % neon/hydrogen mixture in the chamber.

For operation with hydrogen in the target the neon concentrate in the mixture surrounding the target can be chosen to suit the requirements of the experiments being carried out. Neon concentrate up to ~ 60 mole % can be used.

The 1.5 m. chamber is described in Technical Leaflet C2.1.



HYDROGEN TARGET INSTALLATION

Nimrod Division.

May 1970