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A LIQUID DEUTERIUM TARGET REFRIGERATED BY LIQUID HYDROGEN

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The target described here (fig. 1) draws some of the already published works of M. Littauer[1]) and R. Wilson[2]).

Vacuum insulation is used and the evaporating hydrogen cools the copper radiation shields and the deuterium heat exchanger. The transfer tube leading from the liquid hydrogen dewar is a permanent part of the target and its vacuum space connects with that of the target.

A small over-pressure in the dewar raises the liquid hydrogen into the two chambers. As in the target of Wilson no vacuum pump is necessary after roughing down while the target is warm, since cold hydrogen condenses the residual gas and the pressure drops, from about 10^{-3} Torr, to about 10^{-5} Torr.

The levels of the liquid hydrogen and deuterium are monitored by two movable carbon resistors and the level of the hydrogen is maintained by a pressure system like that used by Littauer. The time necessary to cool the assembly and to condense the deuterium gas is 1 hour. The rate of condensation is monitored by a manometer. The cell 310 cc in volume, is supplied by a reservoir of 340 lt. capacity in which the gas is originally at a pressure of 1120 Torr. The final pressure, when the cell is full of liquid deuterium, is 300 Torr.

The evaporation rate of liquid hydrogen is 0.15 lt/hour and this loss must be supplied from the dewar to keep the cell full, while in the first hour the consumption is 1.5 lt. of hydrogen.

To empty the cell of deuterium the hydrogen is drawn down and a current is passed dissipating two watts in the carbon resistor. One hour is necessary to evaporate all deuterium through the 1 cm i.d.

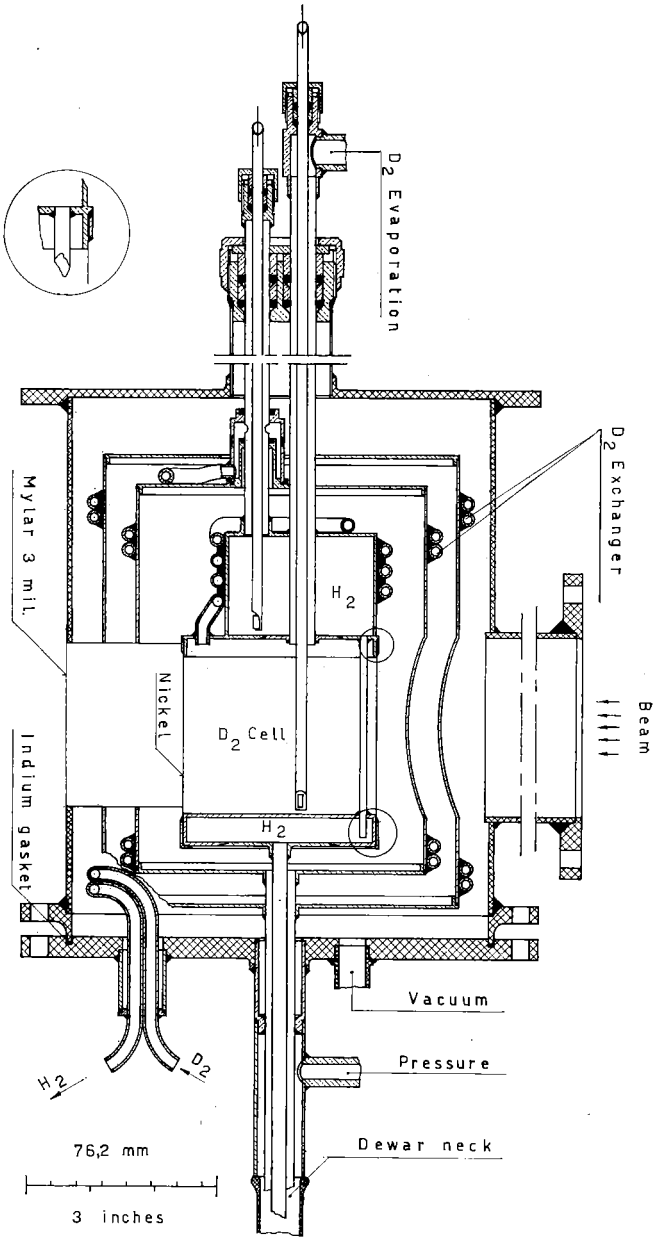

Fig. 1. Sketch of liquid deuterium target.

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[1]) M. Littauer, Rev. Sci. Instr. **29** (1958) 179.

[2]) R. Wilson, Rev. Sci. Instr. **29** (1958) 732.

tube connected to the top of the cell. This tube contains a non-return valve and leads back to the deuterium reservoir, thus the condensation takes place only through the exchanger and the evaporation principally through the large tube.

The cell is a cilinder 7 cm o.d. and 7 cm in height; its axis is perpendicular to the beam of X-rays passing through it from the synchrotron.

This cilinder is made of 0.03 mm walled nickel sheet with the overlapped edge, top and bottom soft soldered as shown in fig. 1.

The two concentric copper radiation shields and the outer vacuum chamber are cut away on the sides through which the X-rays beam and the photoproduced particles pass.

The copper shields on these sides are replaced by aluminium foil 0.01 mm thick, the cut away sides of the outer vacuum chamber are replaced with 3 mil mylar.