CERN
C3
BIBLIOTHEQUE

CERN/T/AET-1

C.E.R.N.

A.E. Taylor

Report on research work with the cyclotron at Gustaf Werner's Institute for Nuclear Chemistry in Uppsala during the period from April 1st to April 30th, 1953.

When I arrived at the Institute a new oscillator valve was being installed because in the previous one the filament has shorted to the grid. It is hoped, and first signs indicate, that the accelerating voltage will be higher than before and so produce a more intense internal proton beam. While this construction and testing was proceeding, some preliminary magnetic measurements were made concerned with the extraction of a fraction of the internal proton beam.

These measurements revealed at once what had been expected, namely that ordinary soft iron was not a suitable material with which to build the shielding channel. The very high magnetic field of 21 KG saturated the soft iron, and in order to obtain sufficient shielding prohibitive amounts of iron would have had to be used. Since other experiments are planned which involve placing large amounts of apparatus inside the vacuum tank, it is required to take the shielding channel out through an air-lock when these experiments are being carried out..This immediately limits the physical size of the shielding channel and its azimuthal position in the cyclotron. Calculations showed that with the largest channel permitted it was only possible to extract a fraction of the beam for scattering angles greater than 5^{o}. It was felt that this fraction might be too small and that if possible the shielding channel should be made from a cobalt-iron alloy which has a higher saturation value than ordinary soft iron. Until it is known whether a suitable alloy can be obtained, work on the extraction of the proton beam is temporarily suspended.

At the same time that these measurements and calculations were being made, apparatus was being designed for the

26 AOUT 1955

neutron experiments and some of it is now built. A small BF_3 ionization chamber has been obtained from Stockholm and has been tested with slow neutrons. Conditions have been found which suggest that its use as a neutron monitor will be quite reliable. However it has yet to be tried with the slowed down neutron beam produced by the cyclotron.

A triple coincidence circuit of the bridge type has been built using germanium diodes. This has given a minimum resolving time of 5×10^{-9} sec. However, since the only photo-multipliers available are the EMI 5311, a resolving time of 10×10^{-9} sec. must be used. This is necessitated by the long transit time of the electrons in these tubes. The longer resolving time should be quite adequate for the experiments which are immediately planned. The light-tight cases for the photo-multipliers and their associated circuitry are almost completed and it is hoped to test them by the end of the week. A large piece of plastic phosphor was obtained from Harwell and crystals for the counter telescope are being machined from it.

Attenuators for the neutron total cross section measurements have been ordered, including a quantity of heavy water from Norway. This latter has not yet arrived although some of the other attenuators have. It is proposed to concentrate in the first place on the determination of the cross section for deuterium as a function of energy. Whereas this is a useful experiment in itself, it will at the same time provide a variation in experimental conditions and hence additional training for the two students working with me.

Various other pieces of apparatus have been designed, including a sample changer for the neutron attenuators and delivery of these is awaited. A Be target of suitable size for producing the neutron beam has been obtained from Harwell.

There is one preliminary measurement to be made as soon as the cyclotron is working again and that is the determination of the background flux of fast neutrons at the position where the experimentalists are to work. This is a

health precaution. It is proposed to irradiate a fairly large crystal of plastic phosphor in this position and then count with a photo-multiplier the scintillations of the C^{11} activity produced in the crystal. By this means it is hoped that fluxes of 100 cm^{-2} $sec.^{-1}$ or lower can be detected.

Uppsala, May 5th, 1953.

A.E. Taylor.