AUSTRALIAN NATIONAL UNIVERSITY

DEPARTMENT OF NUCLEAR PHYSICS

14UD TANK OPENING REPORT NO. 8

August 16 to 19 - (3 working days)

The tank was last closed on April 20 and the machine ran well for most of the 118 days between that date and this opening; however, there were troubles which will be discussed before the details of this opening are given.

REASON FOR THIS OPENING:

Broken chain.

In mid June the excessive lost charge effect, mentioned in earlier reports, returned, adversely affecting voltage control. The tank was pumped out and the triode needle system was withdrawn without the doors being opened; the needles were in excellent condition, nevertheless they were renewed and the mushroom was sandblasted and then given a high polish. After gassing up the lost charge problem had disappeared.

Early in July voltage tests were carried out on the 14UD. With no shorting rods in, i.e. with 14 live units at each end, the machine went to about 12.8 MV with minimum conditioning; then there was consistent sparking.

The spark pattern at both terminal and midsection was observed on T.V. and also with photographs taken with a pinhole camera which looked through a window in the bottom of the tank. It was clear that none of the sparks were going to the tank wall - they were occurring along the column itself; at each spark the volts went to zero.

In order to evaluate which part of the column was limiting high voltage operation, some units were shorted out. First H.E. units 22 to 28 were shorted and it was found that 6.4 MV on terminal was the limit, in other words half the 12.8 MV found for the full column; also the same type of sparking occurred with little or no conditioning.

The H.E. rods were removed and units 1 to 7 on the L.E. column were shorted. The machine started conditioning at about 6.5 MV and went slowly to above 7 MV with very few sparks; this result implied that the difficulty in holding voltage on the terminal is associated with longitudinal gradients on the H.E. column. The inner 7 units on both columns were not shorted because many of the roller type rod contacts on the castings have seized and offered so much resistance to 7 steel rods that the nylon rods were clearly in danger of breaking. The roller contacts are shortly to be replaced with a new ANU design.

After the tests Chain 3 became distinctly unstable with an onset of about 70 microamps for 22.3 kV on the inductors. This problem rectified itself after the chain was rested for a week.

Towards the end of July the lost charge problem arose again; there were 38 microamps of lost charge for 12 MV on the terminal. Looking for more obscure reasons than before it was considered possible that breakdown products, or small air contaminations in the SF6 were accumulating locally inside the needle enclosure itself.

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The 14UD does not have an open "mushroom" like that on the EN; a housing entirely encloses the needle system, except for the holes through which the needles protrude, and gas circulation might not be adequate. With terminal volts off, the needle system was driven fully in and out again a few times in the hope that this would flush the gas in the enclosure. As soon as volts were run up after this the lost charge fell to 8 μa. A slight recurrence later was cleared by the same procedure and it was considered that the cause of excessive lost charge had been found. The reason the problem, which has been with us on and off for over a year, never showed up in the first year or more of operation is believed to be because, in those days, there were far more tank openings and the gas in the enclosure was fully changed at each opening. When possible circulation holes would be drilled in the "mushroom".

RECENT PERFORMANCE:

For the past 118 days the 14UD has been run mostly in the voltage range 9.5 to 12.5 MV. There has been virtually no interruption of experimental time because of problems with the accelerator or either of the two ion sources used. 12.5 MV has been reached easily and maintained steadily.

ION SOURCES:

The lithium oven was formerly loaded with 5 sticks of natural lithium, 4 inches long and ½ an inch thick (Report No. 5, page 2). In order to accelerate ^{6}Li without changing the oven the lithium load has been changed to 2 sticks of natural and an equal amount of ^{6}Li. Good beams have been achieved: about 200 nA on the L.E. cup and 350 nA analyzed on the stop for both particles.

Because of different electrode configuration in the source when lithium is being accelerated, loading due to unsuppressed electrons required the installation of magnets on the lithium extraction electrode; these effectively eliminated loading on the 150 kV power supply.

The sputter source has been used on two or three stretches of about a week each and so far has been very reliable and steady, particles being changed with ease. The following beams have been used in experiments: Be; Mg; ^{16}O; ^{12}C; F; Cu; ^{6}Li; ^{7}Li.

The indium seal, enabling the inflection magnet to be rotated from source to source without undoing flanges below the magnet, worked without leaking for each change. It takes about half an hour to switch from one source to the other.

THE TANK OPENING:

Chain 2 broke after 7,360 hours of use and damage was as follows: 2 pellets were found in the terminal and a few odd ones on some other castings; a length of about 30 pellets was on casting 22 and most of the chain was on casting 28. In the terminal the 'down' inductor of Chain 2 had been turned and it had gouged into the rim of the pulley. A Chain 2 'down' idler in casting 25 was off. Both pulleys and all idlers for Chain 2 were removed, leaving only two chains for operation.

A Chain 1 idler in casting 22 had a tyre off; the 'down' d.c. idler of Chain 3 had come off and was lying in Unit 15. This failure was because the holding washer had worn and the idler had slipped over the head of the retaining screw. A Chain 3 idler in casting 22 had seized. All idlers changed were given new bearings.

Chains 1 and 3 were each shortened by 1 link.

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