AUSTRALIAN NATIONAL UNIVERSITY

DEPARTMENT OF NUCLEAR PHYSICS

14UD TANK OPENING REPORT No.57

26th February 1987
(1 day open.)

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REFERENCES: Earlier Tank Opening Reports are referred to by the notation (38/4) etc., meaning Report No. 38, page 4.
A glossary of terms and abbreviations is given at the end of the report.

1 Reason for tank opening

Voltage instabilities which prohibited operation above about 12 MV.

2 Preamble

The new presentation of the reports, beginning with this one, is a result of the older author's favourite computer and editor being forcibly retired from service on grounds of age and inadequacy. The move to a new computer, glowingly praised to possess a vastly superior editor, with the added lure of all the style gymnastics of a laser printer, was resolutely resisted until the last minute in the hope that something would turn up. It didn't.

The 14UD was last closed on 21st January. It behaved well until 24th February when glitches on the N.M.R. oscilloscope suggested that something was wrong along the column. Diagnostic tests with shorting rods indicated a failure, possibly of corona points, in Unit 26. The gas was taken out on 25th February.

3 Operational time

During the 36 days since the last closure, the 14UD operated for 553 hours. This was 68% of elapsed time, excluding the days for gas transfer (42/2).

4 The Tank Opening

4.1 Exploratory Tour

The reason for the failure of Unit 26 was immediately apparent: there was a cascade of the lower 5 column corona point assemblies. We have often found what we call 'drooped' assemblies when a loose screw allows an assembly to fall so that its needles rest on the one below. In a cascade, repeated sparking causes the needles to burn off completely, and screw brackets become so spark eroded as to allow the discs to hang almost vertically. We reported earlier, (53/2), a cascade of 9 point assemblies, and included photographs to emphasize how dramatic the effect is.

5 And so to work!

5.1 Charging system

1. **Chains:**
   We commented recently, (56/3), that our chain tensions of 215 lbs were significantly higher than the 80 to 120 lbs (35 to 55 kg) recommended by N.E.C. at the time of installation. During a recent phone call to N.E.C. Robert Rathmell confirmed that this is still the preferred range of chain tensions. He pointed out that the excessive chain tension we employed could have been a major contributing factor to the failure of the carbon loaded tyres reported earlier (56/2,3); indeed, similar tyres are operating excellently at McMaster with the N.E.C. recommended tension.

   For years we have adjusted chain tension by sliding two lead blocks, each weighing 22 lbs (10 kg) along the pivot system which has the chain motor on one end and a counterweight on the other. In the past, for a given chain, the lead blocks might be anywhere from slightly on the counterweight side of the pivot to as far forward as they could be on the motor side, which is under the shaft of the driving pulley. Occasionally we 'parked' the blocks over the pivot where they contributed nothing. Only one thing is really certain about our past movement of the blocks, and that is that we always sought to attain the condition in which the chains ran with least oscillation; no tension measurements were ever made. Since our discovery of the necessity for precise alignment of chain pulleys and stabilizing idlers (49/3; 52/3; 55/2) we are now sure that misalignment of them may have given rise to chain oscillations which we attempted to correct by varying tension; not surprisingly we found that greater tension led to smaller oscillations.

   On this occasion we set about evaluating chain performance with the tension in the recommended range. We found that, with known excellent alignment throughout the paths of our chains, the lead blocks could not only be removed from the extreme end of the motor side of the pivots, but could be placed at the far end of the counterweight on the other side of the pivot. With the blocks in this position, all three chains ran excellently for an estimated chain tension of 114 lbs (52 kg). We tack welded small trays on each counterweight to prevent the blocks from moving during operation.

2. **Idlers:**
   This being a one day opening, of 'find, fix and button up', we did not open the terminal, or any castings, consequently idlers were not checked.

5.2 Strippers.

1. **Foils:**
   As stated, the terminal was not opened, therefore no foils were renewed.

5.3 The column

1. **Points**
   All column points in the cascaded unit were renewed, but were installed on a different post, because of damaged brackets. We checked the voltage gradient on the tube points

in this unit since they were close witnesses to severe local sparking. Nevertheless, the alteration in gradient from that measured during the previous opening was small, a 3% r.m.s. change. No other points in the machine needed attention.

2. **Cleaning**
   The column was not blown with nitrogen, but we did tacrag. We don't know why we keep reporting this, because we always do it, and so should everyone else.

3. **Button-up**
   The charging tests gave our usual copy-book results with the new chain tension, and the doors were closed as early as about 2 p.m. Considering that we only began lowering the platform at 8.30 a.m. we feel that this must have been one of the most briskly efficient 14UD tank openings in the southern hemisphere so far.

6 Initial performance

Conditioning began, in the H.E. tube, at 13.59 MV. The machine retaliated because we did not lavish enough attention on it during the quick opening. Chain 2, which ran mechanically more quietly than any chain ever in the past, displayed jumps in current from 40 to 50 microamps. We tentatively attribute this to insufficient d.c. idler contact on a now slacker chain. We turned off Chain 2 and began to operate without it, although N.E.C. regards this as endangering a stopped chain.

Since then, the accelerator has been used consistently at about 13.5 MV with sparks every hour or so.

D.C.W.
T.A.B.
10 March 1987

Enclosures
Plots of particle masses accelerated, and operating terminal voltages.
NOTE: On the plot of terminal voltages we have drawn a horizontal line at 14 MV for easy reference to performance near the nominal voltage limit of the 14UD.

Glossary of terms and abbreviations:

The order in which an accelerated particle passes positions in the machine is used to number them, thus Unit 1 is the first unit and units 14 and 15 are each side of the terminal, Unit 28 is the last. Tube electrode 19/2/7 is Unit 19, tube section 2 and electrode 7.

- BDP or bdp - breakdown products.
- Conductivity cell - the breakdown product detector described 37/10.
- Vivalyme - assumed to be soda lime, CaO + NaOH

14UD log JANUARY 1987