AUSTRALIAN NATIONAL UNIVERSITY

DEPARTMENT OF NUCLEAR PHYSICS

14UD TANK OPENING REPORT NO.18

August 16th to 23rd, 1979 (8 days open; 6 working days)

PREAMBLE:

The 14UD was last closed on July 5th and, during the 41 days from then until this tank opening, the machine itself has been troublefree apart from a few ailments such as aging foils and output from the sputter source rather below standard for some beams. Because several bearings were known to be bad in the upper shaft it was left off for most of the time.

Vacuum in both LE and HE ends of the machine has remained in 10^{-8} range with no beam, rising to only about 4×10^{-7} under running conditions in spite of the fact that there had been no pumping in the mid-section or upper terminal.

A shutdown was scheduled for the upper bearings to be changed and a new set of terminal foils to be put in. Other work would be to carry out tests on the various vacuum pumps in the tank and determine what will need to be done later when the tube is opened. Though the chains appeared to behave well since modifications to the oilers were made last time, the serious dryness might not have been cured in which case further effort would be necessary.

THE TANK OPENING

CHAINS:

The chains were all found to be moist with oil, likewise rims of all three driving pulleys. The oil reservoirs were half empty and there was very little oil on the floor of the tank. It was concluded that the modifications (Report 17, page 2) had basically solved the problem, but that more efficient devices could be contrived. The reservoirs were topped up and the oilers tested and adjusted individually. Two pellets were removed from Chains 1 and 3 and all chains were then oiled by hand.

All stabilizing idlers were examined and no bad bearings or tyres were discovered. Two d.c. idlers in the terminal needed replacement contact springs.

BEARINGS:

All bearings were changed in the upper shaft, having operated for over 9,600 hours. Two of these bearings, reported last time as 'very noisy' were found to be in extremis. That they should have survived the few brief occasions on which the upper shaft was run speaks eloquently of the precision of the assessment which allowed them to remain in.

Work went well on the upper shaft and it was suggested in the darkroom that, since the bearings of the lower shaft had been in for 3,700 hours, there would be a deal of sense in changing them. The sense was pondered for a while, and then conceded; thus, for less than an extra day's platform time, every bearing in the machine was renewed. When the lower bearings were removed, there were found to be two types, hitherto believed to be identical apart from the colour of their seals. Those with black seals were in distinctly poorer condition than those with brown seals. Enquiries established the black seals were NSK bearings, 6010 VVC VA2 and the brown seals NSK 6010 DDU CVA2, the difference being that the brown ones were hermetic seals which prevented grease being exuded and dust from entering. The black seals had a small air gap. The indication was clearly that 3,700 hours is the limit for black seals but some healthy and enjoyable life lay ahead of the bearings with brown seals, if only they had been allowed to live it.

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VACUUM:

Inside the 14UD there is a 10 litre/sec ion pump at the LE midsection, the terminal and the HE stripper. At the midsection is a sublimer pump with the option of either of two sublimers. In the terminal are two sublimer pumps, each with the option of one of twelve sublimers. There is no sublimer pump at the HE stripper. For several months vacuum indication at the midsection and terminal has been under suspicion and no sublimers have been renewed in the machine since 1976.

A portable ion pump supply, fed from a mains extension lead, was connected to the ion pump in the terminal, and indicated 0.6 mA, corresponding to about 3×10^{-6} torr. One of the sublimers of the lower pump was fed from a portable supply until it drew 40 amps. The ion pump current rose to 1.4 mA (about 5×10^{-6}) and remained at that value after the sublimer current was reduced to 33 amps, and even some time after the sublimer was turned off altogether. The pump body was cooled with a fan. In order to check the ion pump a supply was connected to the pump in the LE midsection where the current was low on the 1 microamp range, (about 2×10^{-8}) and a digital meter on a long lead gave a parallel reading on the platform at the terminal. One by one the sublimers in the lower pump were run up to 40 amps, but none produced a change at the midsection. We then repeated the procedure with the sublimers in the upper terminal pump and were relieved to get an immediate response from the first one tried. Not only did the midsection pressure rise, it also fell again after a while and the sublimer appeared to be pumping. This sublimer was designated as a "real outgasser" and was held as an example to the others. However, only one of the remaining sublimers in the upper pump responded, and that very timidly. Believing that sublimers in almost any condition should outgas to some extent when heated we reluctantly came to the conclusion that either we were wrong, or that all our terminal sublimers but one were worse than 'in almost any condition'. Connections were arranged so that the lower pump was left on the timid outgasser and the upper pump on the real outgasser. Repeating the performance at the midsection we found a hopeless sublimer and a real outgasser, which we left switched in. All observations in the terminal established that the 10 litre/sec ion pump was performing at something between suspect and useless; accordingly the primary to its power supply was disconnected. When the time comes a new pump will be put in. Perhaps it is worth stating that an observer in the Control room, who could see the indication of the LE and HE pumps outside the tank, reported that, during these tests, LE pressure fluctuated a bit around 2.5×10^{-8} and the HE a bit around 6×10^{-8}. These observations were, of course, simultaneous with the ion pump currents seen in the tank. It appears, from two points of view, that there was very little outgassing when any of the sublimers was turned on.

Loss of conditioning through letting the tube up to atmospheric pressure is minimized, but not completely eliminated, by doing so with almost intolerable slowness, and the following pump-down must be at least no faster; consequently we did not open any of the sublimer pumps for the only truly conclusive test: the visual effect of a sublimer on the naked eye. However, definite plans have been afoot for some time and new outer flanges, with 12 feedthroughs and a menorah of sublimers, are under construction. When the day comes the insides of the pump bodies will be examined and either they will be cleaned in situ with a wire brush and a vacuum cleaner, which was how we were taught to do it by NEC, or we shall remove the pump bodies and clean them to 'new pin' condition by the method devised at ANU and described in detail in Report No.5, page 5 with attendant warnings about hazards.

It is interesting to note that specific mention is made of the condition of the sublimers at that time; quote: "A new sublimer was put in the midsection pump and two new ones in each of the terminal pumps. The remaining sublimers were in very good condition". This means that 10 of the sublimers in each of our upper and lower terminal pumps are the original "installation" ones and have been touched

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by none but an NEC hand (not officially, at least). The resident author admits surprise at this, having vaguely assumed that all sublimers were changed when the pumps were cleaned in 1976. The co-author, absent at Oak Ridge, would undoubtedly have remembered in minute detail what had been done, without recourse to ancient issues of this report.

STRIPPERS:

The terminal foils were to be changed, requiring the ANU (Weisser) valve to be closed and isolate both sides of the tube from the stripper unit; this, in turn, demanded that no foil holder should be in position. Unfortunately the foil changer actuator had been operating inconsistently for some time and a formula had to be devised in order to get the one blank on the foil chain at the place where the valve would close. Since the absence of a foil does not necessarily mean the absence of a foil holder, the beam measurements did not determine the situation. After some bit of discussion in the darkroom it was eventually decided to avoid multiples of the number of foil positions, of which there were several credible versions, and turn the foil chain backwards until zero appeared on the foil counter. In any case it was probable that a foil holder accidentally in position would be pushed off the chain by the closing valve, and only jam in the seat if it fell on the lower stripper canal. The foils were turned to zero and the valve was closed. Nitrogen was let into the stripper volume and a leak to the tube was immediately apparent. The nitrogen was calmly vacsorbed out, the valve opened and adjusted, and then closed again. This time it did not leak. When the foil assembly was taken out it was clear that there had been a foil holder in position; it had been knocked out and was lying on the floor of the stripper. The blank was somewhere in the stripper housing and at least fifty positions from nominal zero.

A new load of foils was put in, including, for the first time, 40 foils prepared by the cracking of ethylene. The number of operations to cycle the foil chain exactly was counted twice with great precision and a new number, 268, has replaced 270 for the time being. This time 6 blank places were left and the unit was inserted on the third blank and the counter set to zero.

POINTS:

As usual tube and column corona assemblies appeared to be no worse than at the previous opening. We never measure the length of needles, but finger their points in the cheerful belief that this is a measure of their effectiveness. When the voltage performance of the machine is excellent there seems little justification in expending considerable effort to improve matters. Even so, we shall possibly arrange to have a spare set of point assemblies available.

CLEANING:

The column has hitherto been cleaned by a team of four men, five if four appear to create insufficient confusion. One man trails a vacuum cleaner in one hand and a nitrogen line in the other and proceeds clockwise round the column, blowing it; the other three or four men avoid the first as well as they are able and tac-rag at the same time. Since the vacuum cleaner lead and gas line will only go round the column twice before it is necessary to reverse direction and unwind, all performers get completely out of phase about every ten minutes, and time is wasted expressing viewpoints. On this occasion one man had the platform to himself and blew the column; then four others went in, took a quadrant each, and tac-ragged. The entire operation went with unprecedented smoothness.

CHARGING TESTS:

These were copybook. The doors were closed and roughing begun at 5.30 p.m. when a general assessment of work took place.

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MISCELLANEOUS:

The gas handling system received attention. The recirculator blower was serviced and a number of alumina balls from the dryer were found in the blower housing. Some had hit the blower and a coating of alumina dust was found in the pipework and housing. It appears that a mishap in operation of the dryer controls during the past 18 months was the reason for the occurrence. A filter will be installed in case the same thing happens again.

MACHINE PERFORMANCE:

The 14UD was run up to determine approximate voltage performance. The first spark occurred at 12.75 MV. A beryllium beam (which happened to be running on test) was analyzed and eerie stability, as usual, was apparent. The machine was put into scheduled operation without voltages in excess of 13 MV being required and no efforts were made to determine the limit of conditioning.

ION SOURCES

Lithex source:

Since two longstanding leaks have been eliminated, and the base pressure of the source improved, performance with helium has been significantly better.

Sputter source:

Indifferent performance experienced recently led to the source being completely stripped, and all components capable of withstanding the process were sandblasted. Both sublimers in the source pump were found to be wrecked and they evoked mental images of the 26 sublimers in the machine. However, the clean source, with good cones and good vacuum, was still not at peak performance. Response to the einzel lens was abnormal and led us to look at the grid component of the einzel through the telescope always set up to study the shape and colour of the frit. No-one could see the grid and, since only one person was prepared to assert categorically that, if it was there, it could actually be seen in the telescope, dismantling valves, pumps and upsetting alignment was not entered into lightly. The dismantling went ahead, and the grid was there, but with a large hole burnt through the middle, to the profound relief of the solitary asserter. The strands of the grid removed were 0.004" thick and all we had to replace it with was 0.009" of a closer mesh. The source was closed and pumped on a Friday and over the weekend adequate oxygen beams were readily forthcoming, and they responded normally to einzel control. After the weekend a fluorine beam in excess of 10 microamps came easily, also responding to the einzel. Difficult beams have yet to be tried.

T.A. Brinkley

September 3rd, 1979.

David Weisser is at Oak Ridge until December.

14UD SCHEDULE - 9/7/79 - 11/8/79

MONTH	DATE	DAY	GROUP	LINE	
JULY	9	MON	ECK, CLARK, OPHEL, NURZYNSKI	5	^{7}Li
	10	TUES			
	11	WED	ENGLAND, ATWOOD, LILLEY, OPHEL, CLARK	5	^{18}O
	12	THURS	LILLEY, ENGLAND, ATWOOD, CLARK, OPHEL	5	$^{12}C/^{16}O$
	13	FRI			
	14	SAT			
	15	SUN	NEWTON, SIE, GALSTER, HINDE, CONLEY	1	^{19}F
	16	MON			
	17	TUES	LILLEY, ENGLAND, ATWOOD, CLARK, OPHEL	5	$^{12}C/^{16}O$
	18	WED			^{13}C
	19	THURS	SPEAR, ZABEL, BAXTER, HINDS	6	^{32}S
	20	FRI			(^{30}Si?)
	21	SAT			
	22	SUN			
	23	MON	ENGLAND, ATWOOD, LILLEY, OPHEL, CLARK	5	^{28}Si
	24	TUES			
	25	WED	ATOMIC COLLISIONS	7	Cu
	26	THURS	BAXTER, SPEAR, ZABEL, HINDS	5	^{4}He
	27	FRI			LITHEX
	28	SAT			
	29	SUN	CLARK, HEBBARD, OPHEL, NURZYNSKI	5	^{7}Li
	30	MON			SPUTTER
	31	TUES	NEWTON, SIE, GALSTER, HINDE, CONLEY	6	^{19}F
AUG.	1	WED			
	2	THURS	ENGLAND, ATWOOD, LILLEY, OPHEL, CLARK,	5	^{58}Ni
	3	FRI	KELLY		^{18}O
	4	SAT			
	5	SUN	~~ATOMIC COLLISIONS~~	7	Cu
	6	MON	Kennedy		
	7	TUES	DRACOULIS, FEWELL	1	^{16}O
	8	WED			
	9	THURS			
	10	FRI	~~NURZYNSKI, HEBBARD, CLARK, OPHEL~~	~~5 or 6~~	~~^{16}O, ^{24}Mg~~
	11	SAT			
		SUN			
	13	MON			
	14	TUES			
	15	WED	GAS OUT		
	16	THURS			
	17	FRI			

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