AUSTRALIAN NATIONAL UNIVERSITY

DEPARTMENT OF NUCLEAR PHYSICS

14 UD TANK OPENING REPORT # 87

8th to 10th SEPTEMBER 1999

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REASON FOR TANK OPENING

The machine had not really settled down since the recent opening of 24th August (TOR#86) and it was becoming increasingly difficult to run experiments. The log book showed that there had been more than 100 sparks recorded since the last opening. The decision to open up was just about made when the decision was taken out of our hands. Chain motor #2 failed right on the eve of a scheduled two week long CHARISSA run.

PUMP OUT 7-9-99

Pump out tank, open doors and start ventilation system.

SUMMARY OF WORK

8 to 10-9-99

This opening was performed with an air of urgency brought about by our feeling of commitment to the CHARISSA group who had traveled from the UK. Whilst all possible care would be taken short term reliability was of a higher priority than long term.

The platform was deployed and the initial cruise down the column found the LE end of the machine clean. It was noticed that there were not that many spark marks, considering that over 100 sparks had occurred. Since there were other more pressing problems spark marks were not counted at that stage.

One chain idler tyre in Unit 19, chain 3,had completely fragmented off the nylon wheel spreading, yet again, plastic particulates throughout the HE end of the machine. Further investigation found that many other tyres, particularly the second hand ones fitted last opening, were in various stages of similar degradation. There was no doubt that the cause of the sparking had been found.

The HV gap test found no other problems.

And so to work

Idlers had been ordered during tank opening 86 but were not due for weeks so David took on the task of trying to borrow new idlers from other Pelletron operators in Australia.

The fault in Chain motor 2 required diagnosis and the chain rivets required replacement. Both these tasks required staff to spend considerable time in the bottom of the tank. It was decided, many years ago, that for safety reasons the platform crew would not work above staff in the bottom of the tank. This requirement cost us some time but each team took full advantage when the other team left the tank for any reason.

The worst idlers were easily identified and removed in anticipation of borrowed stocks arriving.

Meanwhile the chain motor power supply conduit was found burned through near the motor junction box. George McEwan, the school electrician, was invited inside the tank (first visit inside for George) to help evaluate why this had happened and to repair the conduit and cabling.

Although there appeared to be adequate reason for the idlers failure, that being old age, it was deemed prudent also, to replace the old fashion round head chain rivets with flat ones. The flat head rivets had arrived subsequent to the last opening and are known to reduce peak fields at the idler to chain interface, a possible cause for the destruction of the old tyres.

Thankfully the eight new wheels allowed the eight worst appearing cases to be pensioned off, but many second hand idlers, that would normally be replaced, had to be left in the machine yet again. The one blonde wheel left in showed no sign of surface pitting and it was felt that it would last until new stocks arrived or at least for the duration of the CHARISSA run.

The chain motor wiring was completed, the chain rivets replaced and the idlers fitted and adjusted. The shafts were run and the terminal fiber optic link tested. The terminal was closed, charging and metering tests done, the usual wipe down with RBS and water, the HV gap test completed and then the tank was closed. During the wipe down, of the last few sections of the column, the spark mark count was remembered but it was too late to be accurate. It was estimated that between 10 and 20 had been wet and dry smoothed all being in the HE end.

CHAIN IDLERS

Those following the Tank Opening Reports would realise that the idlers were trying to tell us something back in June (TOR 85). The idlers on the down side of chain 3, particularly, and many others were showing signs of wear. The idlers have been so reliable during the last 15 years, bearing changes excepted, that they had been largely ignored. Whilst the subject of fitting new idlers was raised from time to time other projects had kept us fully amused.

The second round of idler failures reported on in TOR 86 prompted the ordering of 36 new idlers with plans to order the other half of the inventory during 2000. The first order of 36 new idlers had not arrived in time for this the third failure in as many months. It was thought that the two

other Pelletron laboratories in Australia would carry some spares and following up on this was seen as the only feasible plan because recycling our already tired and in most cases unserviceable second hand collection had got us into this mess.

David's urgent cry for help was answered with the prompt arrival of eight new idlers. Many thanks to Roland Szymanski at Melbourne University who sent four new idlers and both Kevin Thorpe and John Fallon at ANSTO who sent another four. It was soon apparent that eight new idlers would not quite be enough to inspire confidence that the machine would function for at least two weeks.

Once again all available second hand idlers were laboriously compared with those in the machine noting the various modes of degradation. As reported in TOR 86, the old blonde coloured idlers had failed and were thrown out. These seemed to have had brittle tyres. Further, it was noticed that the idlers that had failed this time were generally of a lighter brown, somewhere between blonde and the rest of the inventory that were darker brown. The lighter brown idlers were found to have the hardest tyres of all and those of that type were immediately ruled out This left the old darker brown idlers and only three were deemed suitable based, primarily, on tyre softness. Thus the eight new idlers and three very old ones were all that were available leaving many in the system judged to be borderline cases. It was felt, however, that the final somewhat sad, but hopefully, brave inventory would give at least two weeks service. This would satisfy the immediate experimental commitment, but hopefully, would allow operation until the next yet to be scheduled opening.

CHAIN MOTOR 2

Chain motor two had failed when the blue wire of the three phase 440 volt supply shorted to the metal conduit close to the motor junction box and the circuit breaker opened. It was proposed,

and accepted, that the reason for the failure was due to successive high voltage tank sparks weakening the cable insulation allowing the supply voltage to short out.

The most probable route for the spark energy was thought to be along the 60kV chain charging inductor wire. The 60kV charging supply shares the 3 phase motor supply feedthrough box at the tank wall. The metal divider between the 60kV and the 3 phase sections within the feed through box did not form a complete bulkhead. It left an opening that comprised approximately 20% of the available bulkhead area. The 60kV side of the bulkhead had many spark marks on its surface. These marks were evidence that machine spark energy traveled along the 60kV wire and discharged to ground. Ionization from these sparks caused the 3phase supply to also spark to ground within the feedthrough box. The bulkhead was extended so that it fully sealed off the two volumes, thus minimising the chance of the transmission of ionized air to the 3 phase wires within the feedthrough box.

Spark energy can also directly couple to the power conduit inside the machine. The failed spiral conduit was replaced with corrigated seamless conduit of the type that had proved itself in the erminal of the 14 UD. A new connection box was also installed over the tankwall feedthrough inside the tank. In future, conduit and box replacement will be done to the other two chain motors.

CHAIN LINK PINS

During the tank opening of June 99 (TOR 85) the screwed chain link pins were replaced with drive screw pins. The drive screws, in stock from the 1973 vintage, had rounded heads as opposed to the flat headed drive screws that have been in use for many years. Fitting the rounded head screws, as it turned out, was a backward step. The feeling was that, although there was no evidence of them touching the idlers, they ran so close that the field perturbations might cause

discharge between the rivet head and the idler. This was by no means universal as all chains had some round head rivets but the idler degradation was mainly confined to chain 3. It could be that the tyre material on the chain 3 idlers just happened to be in worse condition and that the other idlers would be afflicted at some time in the future.

That said, there were no sensible reasons other than time constraints, for not changing out the round head rivets for flat head ones during this opening. Flat head rivets had been ordered after the June opening and were on hand through the generosity and efficiency of Greg Norton at NEC.

The changeover went smoothly and was a factor in the feeling that the idlers would survive the immediate experimental demands and hopefully beyond.

INITIAL PERFORMANCE

The machine was conditioned from 12 MV to13.8 MV with no sparks on 11 September.

Experiments commenced and between 14 and16 of September. There were seven sparks at ~14.3 MV.

Between 17 and 25 September there were six sparks at ~14 MV.

The machine has run very well and, so far, continues to do so. Our hopes for two weeks operation have been eclipsed by nine weeks of excellent performance.