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1 Tandem and LINAC

The NPL tandem Van de Graaff accelerator chains ran 1869 hours between 9/1/98 and 8/31/99. The DEIS ran 356 hours and the SpIS ran 667. There were 28 experiment-days in which the LINAC and tandem were used together, and seven days when the tandem was used, with one of the external ion sources, as a tandem. Four of these were with light ions and three with heavy ions. There were 68 days of Tandem Terminal Ion Source (TIS) development or repair, and 46 days of TIS installation or removal or changing TIS ion species. The TIS/tandem was used a total of 70 days to deliver p, d, ^3He , or ^4He beams for use by an experimenter. There were 47 experiment-days during which the injector deck was used to generate C_{60} or LiF_3 clusters, which were then investigated without further acceleration.

We had 25 tank openings over the year. There were three scheduled openings for the installation or removal of the TIS, and seven to change the TIS ion species. There were 10 openings for ^4He ion source and column resistor gradient development. There were four openings for various repairs other than ion source, and one to replace the LE grid, which was found undamaged after all.

2 Accelerator tube

Our accelerator has spiral inclined field tubes with titanium planes manufactured by High Voltage Engineering Europa. This summer we had a vacuum accident with the terminal at 8.5 MV. A cold trap located about 2 meters upstream from the entrance to the accelerator tube overflowed which froze the o-ring seal. This seal leaked air and the vacuum in the accelerator tube reached about 200 mTorr.

After this accident the measured x-rays in the vicinity of tube #1 just outside of the tank was about 10 mR/hr. The activity started at a terminal voltage of about 7.8 MV. The x-rays were coincident with a time instability in

the pulses from our low energy buncher which makes phase-locking the buncher extremely difficult.

We examined the grid and found no visual indication of damage. We changed the grid anyway as was advised by other members of the accelerator community. This produced no noticeable change. We examined the tube from the outside and noticed no discoloration.

We examined the tube through the viewports on the tank and noticed glow discharges occurring in four regions. These emitted a faint blue glow and varied in intensity with time. We were unable to determine if they varied in intensity with x-ray output. The first three regions were close to the grounded end of tube #1 but past the low-gradient region where we use half value resistors. The fourth region was at the downstream end of tube #1 and extended about three tube sections.

We installed an aluminum boat attached to a nylon fish line that we ran from the low energy end to the midsection. The purpose of the boat was to short various tube planes. The boat spanned seven accelerator tube planes. When located over planes 80 to 86 the x-ray emission dropped by over an order of magnitude. We were able to transport heavy ion beams in this configuration and at the same time phase-lock our low energy buncher. We have installed half-value resistors between planes 82-83, 83-84, and 84-85. We have replaced the larger boat with one that spans only one gap. We hope to narrow our search to as small a region as possible and install half-value resistors in the offending gaps and those that are 180° away on the spiral tube.

3 LHe refrigerator

For the first time in 14 years of operation the cryogenics system experienced a significant ice blockage in the refrigerator delivery tube (RDT) which connects the helium refrigerator to the dewar. The one inch diameter inner tube of this vacuum-jacketed coaxial RDT carries mixed liquid and vapor helium to the dewar for phase separation, and it became partially blocked over the last year. The two inch diameter annular vapor-return was not compromised. The effect of this blockage was to reduce cooling capacity with our wet engine, though J-T cooling capacity was little affected. The blockage might have been air ice or water ice. Approximately 100 cc of water was pumped from the helium passages of the warmed refrigerator. An unmeasured but similar quantity of water was purged from the warmed RDT and dewar region. On 11 October the refrigerator was cold and idling, the RDT and dewar are still warm, and the cryostats are at liquid nitrogen temperature. Plans are to have the LINAC cold by 1 November.

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