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OAK RIDGE 25URC TANDEM ACCELERATOR

1991 SNEAP LAB REPORT*

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OPERATION:

As a result of continued budgetary reductions, operation during this year was limited in two significant ways: The operating schedule was constrained to a five-day-up-two-day-down cycle and the Oak Ridge Isochronous Cyclotron (ORIC) was not operated as an energy booster. A total of 3535 hours of beam "on target" was provided with 26 ion species ranging from ^{1}H to ^{117}Sn. Two of these species, ^{6}Li and ^{117}Sn, were produced for the first time. Especially notable beams provided for the experimental program included 500-MeV ^{58}Ni and 630-MeV ^{117}Sn. Voltage performance of the tandem accelerator continued to be good with scheduled operation at potentials up to 24.3 MV.

Of the 13 tank openings which occurred during this period, three were planned for scheduled maintenance and ten were required for repair of various problems. By far the most interesting problem was a vacuum leak which occurred near a weld which joins a Kovar flange to a stainless steel vacuum housing in the low-energy side of the upper major dead section. This leak is believed to be due to crystal growth, and resulting porosity, which occurred due to overheating of the Kovar material as it was welded during fabrication. The leak, which required four tank openings to find and repair, is believed to have been present for many years. It was repaired, in situ, by coating with epoxy.

IMPROVEMENTS:

A new terminal foil stripper mechanism, which has the capability of moving foils in a 6-mm-diameter circle transverse to the beam, was installed in January. With this mechanism, foils can be moved continuously at a speed of about one revolution per minute or can be fixed at any desired angular position. In practice, we find that for most foils, the beam transmission efficiency of the accelerator is a strong function of the angular position of the foil; each foil has good and bad spots. Furthermore, we find that foils which initially give a transmission efficiency which is more or less independent of angle soon develop less homogeneous properties so that the transmission efficiency

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becomes more angle-dependent. Thus, while we had expected to use this stripper mechanism in a continuous rotation mode, we have, in practice, used it to select successive good spots on a given foil. The consequent improvement in effective foil lifetime is believed to be at least a factor of two. The initial operation of this mechanism was plagued by a defective NEC belt in which the foil frame clips were improperly spot welded to the belt. This belt has just been replaced by a new belt, also provided by NEC, in which the foil frame clips are riveted to the belt.

In cooperation with NEC, we have successfully tested an inexpensive, simple prototype voltage grading resistor design in two different 24-inch modular units of the accelerator. Ninety-six of these resistors have been in service since January 1991. After 3226 hours of charging chain operation, no damage or significant change in resistance has been observed as a result of the 67 full-column sparks, mostly above 20 MV, which occurred during this period.

A new ORNL-designed and fabricated terminal potential stabilizer system has been installed and commissioned. This system is expected to be easier to maintain and will provide more flexible control of the accelerator.

FUTURE DIRECTIONS:

In the past year, we have been working actively on the radioactive ion beam concept which was discussed at last year's SNEAP. In this scheme, light-ion beams produced in the ORIC impinge on an ISOL-type target mounted on a 300-kV platform. The resulting short-halflife radioactive atoms are converted into negative ions by either direct surface ionization or charge exchange and injected into the tandem accelerator where they are accelerated to energies appropriate for nuclear physics research. At this time, design and construction is in progress on a system which will be used for the testing and development of ISOL-type negative ion sources using light-ion beams produced with the ORIC. As part of this effort, the ORIC has been re-equipped with an internal ion source and work is in progress to develop techniques which will allow light ion beams to be extracted from the ORIC with high efficiency and minimal activation.

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