OAK RIDGE 25URC TANDEM ACCELERATOR*
1999 SNEAP LAB REPORT

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RIB PROJECT:

A major milestone was reached in the end of October 1998, when an experimentally-useful ^{17}F beam ($t_{1/2}$=64.5 s) of $3x10^4$ ions per second (ips) was delivered to experimenters at the astrophysics endstation. A beam of ~8 μA of 44 MeV deuterons incident on a target of thin fibers of HfO_2, together with an aluminum vapor feed, produced a beam of $Al^{17}F^+$ ions which, after first-stage mass analysis and breakup/charge exchange in Cs vapor, yielded $4x10^7$ ips F^- off the RIB platform. The ^{17}F produced for this first useful experiment had only slight contamination of ^{17}O (<1%), but the breakup of the molecular AlF introduced a large energy spread and the large emittance of the beam probably resulted in some transmission loss through the tandem.

A new negative surface ionization source was installed and was used for most of the 1119 hours of ^{17}F production in FY 1999. This source has been used to deliver $2x10^5$ ips of ^{17}F (with ~3 μA incident deuterons) but it can be highly contaminated with more than ten ^{17}O for every ^{17}F. A pure ^{17}F beam of this magnitude has been obtained by using post-stripping to produce fully stripped fluorine ions with greater efficiency being obtained for the higher accelerated beam energies.

Ion source development continues both at the UNISOR facility and at two ion source test stands. The next priority for RIB development is the production of a ^{56}Ni beam. Because of the long lifetime and the highly refractory nature of Ni, the beam will not be produced by conventional ISOL techniques, but rather in a multi-sample sputter source, in which a target can be bombarded with Oak Ridge Isochronous Cyclotron (ORIC) beam for a period comparable with its half-life, and then rotated to a position where the activity can be exposed to a sputter beam for production of a ^{56}Ni negative-ion beam. This 'batch mode' source is designed so that one production target can be exposed to ORIC beams while another is simultaneously being sputtered. The batch mode source has produced stable beam on the RIB injector platform. Other development activities are primarily focused on a uranium carbide/reticulated vitreous carbon fiber target for production of neutron-rich beams by fission and a liquid germanium target system for production of proton-rich isotopes of As, Ga, and Se.

OPERATION:

During FY 1999, the 25URC provided approximately 2800 hours of beam on target for the experimental program and RIB development. No new beams were

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accelerated this year but we did accelerate ^{9}Be which we had not done for a long time. In the present ESH atmosphere, this run generated quite a lot of cleaning and monitoring of the ion source before it was returned to routine operation. Operation for the experimental program was at terminal potentials from 3.11 MV to 21.3 MV. Twelve tank openings were required during the year, two scheduled for general maintenance and ten unscheduled. Four of the unscheduled openings were just after a regular maintenance opening and were caused by persistent, small leaks in the terminal vacuum system. These leaks were finally found by changing our leak hunting procedure to provide more pumping speed. The leak detector was placed directly after a turbo pump which was pumping on the system. This extra pumping speed allowed the response time of the leak detector to be greatly improved in order to pinpoint these small leaks. The other unscheduled openings were caused by electronic failures, actuator mechanical failures, and one due to broken shorting rods.

During the year, several improvements were made to increase reliability and the 50 kV quadrupole in our low energy tube was repaired. A new stable-ion-source bias supply was installed to replace the old 550 kV supply which had been prone to frequent transistor failures. The new supply, a Glassman 400 kV, has performed very well and the ripple is actually less, which should improve beam stability. A purchase of 18,700 pounds of SF_6 was made, which should increase the voltage level that can be obtained on the terminal. ORIC has had many improvements also, which include replacing ancient power supplies and upgrades in controls

The control system has again been changed. The VISTA system was plagued by crashes (generally in the middle of the night) and has just been replaced by an EPICS control system. Beam time was again only minimally impacted by the change. A beam has been completely tuned with the new EPICS system, but more time will be needed to get all the kinks out. This quick changeover was made possible by doing the majority of debugging during maintenance periods. The EPICS system has been running for several weeks with no crashes.

FUTURE PLANS:

A turbo pump with controller, purchased from NEC, will be installed in the next scheduled tank opening to implement a recirculating gas stripper. The focus for future plans is to increase the transmission of radioactive ion beams.