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OAK RIDGE 25URC TANDEM ACCELERATOR*

1997 SNEAP LAB REPORT

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RIB Project

The Holifield Radioactive Ion Beam Facility (HRIBF) was dedicated on December 12, 1996, with a formal ceremony followed by a reception and tour. This dedication marked the culmination of the reconfiguration, started in the middle of 1992, and the beginning of full-time operation as an international user facility. Although construction and commissioning are finished, development continues on ion sources and better methods to produce new and more intense radioactive ion beams (RIBs).

The first RIB experiment, Coulomb excitation of ^{69}As, was completed on June 6, 1997. During the time period from June 1-6, ^{69}As and ^{67}Ga were provided for seventy-six hours with a maximum of 1.5 x 10^6 particles/sec at the experimental station. Four μA of primary beam, 42 MeV protons from the Oak Ridge Isochronous Cyclotron (ORIC), was on the ^{70}Ge target to produce this maximum beam. The experimenter was not set up to use this much beam, so most of the run was done at reduced levels. A second RIB experiment, again using ^{69}As beam, was attempted on 9/9/97. Although a beam of about 10^5 particles/second was successfully tuned to the Recoil Mass Spectrometer, the intensity produced by the RIB injector ion source was inadequate to complete the experiment.

Operation

During FY 1997, the 25URC has provided approximately 1850 hours of beam on target for the experimental program and commissioning of new experimental equipment. In addition to the radioactive beams mentioned above, ^{64}Zn (using ZnO as the source feed) was accelerated for the first time. Operation for the experimental program has been at terminal potentials up to 22 MV and the machine is conditioned to 24 MV. Thirteen tank openings were required during the year, two scheduled for general maintenance and eleven unscheduled. During the first scheduled tank opening, beginning in October 1996, we installed three new charging chains. Four of the unscheduled openings were directly or indirectly caused by problems with these new chains. The remaining unscheduled openings were required by the following: failed communication components (four openings), belt deterioration due to failed bearings on a terminal georator, sparking from a cable mistakenly left hanging from the terminal, and spark damaged diagnostic electronics.

DISCLAIMER

Commissioning of the Daresbury Recoil Separator (DRS) was begun this year and should be finished by January 1998. This device, which will be used for astrophysics research, was procured from the Daresbury laboratory and moved into an existing experimental room at HRIBF. Providing beam for this device is a real challenge for the 25URC, because very low energies are required (typical beams necessary for commissioning are 4-12 MeV ^{12}C). Needless to say, the accelerator optic and beam transport systems were not designed for operation at very low terminal potentials. In fact, the original specification only required continuous terminal potential control from 7.5 to 25 MV! Transmission is still relatively poor at V_T~3MV and additional accelerator development time will need to be scheduled in the next year to understand the problems and improve beam transmission.

A major operational accomplishment this year was the completion of training and certification of four new operators. These new operators allow us to be able to operate safely for RIB runs which require operation of ORIC, the RIB injector, and the 25URC accelerator. We are now operating twenty-four hours a day, five days a week.

Chain Problems

On October 14, 1996 we opened the tank to perform some general maintenance and to install three new chains which had been received from NEC in July. The decision to replace the chains was based on our two previous chain failures which occurred after about 40,000 and 60,000 hours of operation. The old chains, which had served admirably, had 21522, 66727, and 43588 hours respectively for chains 1, 2, and 3. As suggested by NEC, we ran the chains for about 100 hours, did final adjustments, and finally started using the chains with the tank pressurized on December 5. On December 9, we had to go back into the machine because of loss of charging on chain 1. This loss was caused by dirty insulators at the pickoff wheels in the terminal and it appeared that there was some metal in the oily film that we cleaned off. After closing up again, we experienced some erratic charging which could be lessened by oiling the chains (no we do not have anti-static sheaves). In February, we had to go back in the tank because of the erratic charging. Once inside, a large amount of black residue, apparently a mix of oil and metal powder, was found throughout the column. Consultation with NEC led us to believe this was normal for new chains and would quickly clear up once the new chain "roughness" was polished off. We closed up again, but in subsequent openings we still had lots of black residue and the chains exhibited rapid wear of the pellet surfaces. At the present rate of wear, the lifetime of the chains is estimated to be only about 5000 hours. After 2620 hours operation, during a conditioning exercise, chain 2 broke apparently because of a mechanical defect. During talks with NEC, we mentioned the wear on the chains and they requested a portion to inspect. NEC concluded that the problem was an improper plating which was much too soft and had completely worn away. As a matter of fact, we calculate that about four pounds of metal (based on the amount worn away from each pellet) was deposited in the machine during

these 2620 hours. We received a new section of chain to repair our broken chain which was then reinstalled. Although quite a few pellets still have minor damage, the repaired chain has not exhibited any further problems. Negotiations with NEC to rectify the problem have concluded and the defective chains are expected to be replaced in early 1998.

Future Plans

A change to the VISTA control system, advertised for some time, will finally be done this year. Otherwise, we will work on improving transmission and stability for low energy runs and implementing other changes which will improve our ability to provide pA radioactive beams. Radioactive beams ^{17}F, ^{18}F, and ^{56}Ni will be the primary focus for RIB development.

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