

TANDEM ACCELERATOR OPERATION

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During this two-year reporting period, the tandem accelerator provided 4,625 hours of beam-on-target for the scheduled experimental program, RIB ion source development, and commissioning of new equipment, primarily the RMS and the DRS. Two stable beams (^{64}Zn and ^{14}N) and two radioactive beams (^{67}Ga and ^{69}As) were accelerated for the first time during this period. Table 1 shows a listing of all beams provided by the tandem accelerator during FY 1997 and FY 1998. Operation for the experimental program has been at terminal potentials from 2.57 MV to 22.6 MV. A major operational accomplishment during FY 1997 was the completion of training and certification of four new operators.

New charging chains were installed in October 1996 to replace the existing charging chains. 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 21,522, 66,727, and 43,588 hours, respectively, for chains 1, 2, and 3. Unfortunately, the new chains were defective and exhibited very rapid wear of the pellet surfaces. After only 2,620 hours of operation, one of the new chains broke, apparently because of a mechanical defect unrelated to the pellet wear. However, when National Electrostatics Corporation (NEC) saw a portion of the broken chain with pellet surface wear, they concluded that the erosion problem was an improper plating which was much too soft and had completely worn away. We calculate that about four pounds of metal (based on the amount worn away from each pellet) was deposited in the machine during these 2,620 hours. Negotiations with NEC to rectify the problem were concluded and the defective chains were replaced in December 1997. These new chains are plated properly and have performed very well since installation.

Reliability of the tandem accelerator during FY 1997 was very poor largely due to the problems with the defective chains. Thirteen tank openings were required during this year with only three being scheduled. Four of the unscheduled openings were directly or indirectly caused by problems with the defective chains. In fact, sparking caused by the chain problems could have contributed to other tank openings required to repair electronics. FY 1998 saw better reliability with only six tank openings, half of which were scheduled.

The 1970's-vintage Perkin-Elmer computers were retired after a new Vista-based control system was developed and installed. There was minimal negative impact on accelerator operations due to the changeover; all installation and testing was done in parallel with normal scheduled maintenance.

Table 1. Tandem beams provided in FY97 and FY98

| Ion Species | Energies (MeV) | Ion Species | Energies (MeV) |
|------------------|----------------|-------------------|----------------|
| ¹ H | 15 to 40 | ⁵⁰ Cr | 230 to 290 |
| ² H | 22 to 35 | ⁵⁴ Fe | 200 to 315 |
| ¹² C | 3.3 to 40 | ⁵⁸ Ni | 90 to 315 |
| ¹⁴ N | 6.97 to 15 | ⁶⁴ Zn | 305 to 315 |
| ¹⁶ O | 12 to 75 | ⁶⁷ Ga | 160 |
| ¹⁷ O | 9 to 65 | ⁶⁹ As | 160 |
| ²⁸ Si | 97 to 230 | ⁷⁰ Ge | 120 to 370 |
| ³² S | 50 to 120 | ⁷⁴ Ge | 326 |
| ⁴⁰ Ca | 130 to 160 | ⁷⁵ As | 230 to 300 |
| ⁴⁸ Ti | 133.3 | ⁸⁰ Se | 90 to 150 |
| | | ¹²⁰ Sn | 125 |

Table 2. Tandem hours FY97 and FY98

| Activity | Hours |
|---|-------|
| Beam on target | 4625 |
| Conditioning | 482 |
| Tank Openings | 3528 |
| Maintenance outside the tank | 321 |
| Machine tuning, development, training, etc. | 3236 |
| Scheduled shutdown | 5328 |