Lab Report to SNEAP 2006

J. Hendriks
Tandetron Accelerator Laboratory
University of Western Ontario
London, Ontario, Canada

Operations

The 1.7 MV Tandetron accelerator (model 4117-HC) at UWO has proved to be a very reliable machine used for experimental studies of ion beam modification and analysis. Over the past year, the accelerator has operated at 1.7 MV with no tank sparks. However, some conditioning is required if it has not been used above 1.3 MV for a period of time.

The main failures occurring over the last year have been in the vacuum pumps. We have had two of the three Pfeiffer TPU-510 turbo pumps fail over the last 12 months. The first failed after an unscheduled power outage in December 2005. The turbo pump spun down instantaneously due to a worn valve seal in the backing roughing pump. Pneumatically actuated valves were installed between the turbo pumps and the roughing pumps to prevent this type of failure in the future. The second turbo pump failed in August 2006, also after another unscheduled power outage. Both pumps were sent to Can-Vac to be rebuilt. These pumps are becoming a concern since they are no longer supported by Pfeiffer.

Over the past year, we have also experienced a large number of roughing pump failures which have been attributed to the change in roughing pump oil supplier. After our Physics Stores switched suppliers, all the roughing pumps began to fail within a few months. The oil was breaking down under the heat of normal pump operations. All but two pumps had to be disassembled, cleaned and rebuilt. As a result, we have switched back to Kurt Lesker TKO 19 oil.

A failure in our Neslab heat exchanger caused one of the cooling lines to blow on our high energy analyzing magnet. The heat exchanger pumps were repaired; a flow indicator and Proteus flow switch were added to the magnet interlock to prevent any damage to the magnet in future cooling failures.

In the ion sources, there was a recurring arcing problem in the duoplasmatron source and a failure of the sputter source target high voltage power supply.

The duoplasmatron extraction gap was replaced with a spare to remove the arcing problem, but the source output dropped by 30% even after the injector was realigned. This problem requires further investigation.

The Glassman high voltage power supply used for the sputter source target supply failed due to a burnt connector on the printed circuit board. The connector was replaced and the supply was reinstalled on the source.

Usage

Figure 1 shows a summary of the different beams that have been run during the period September 2005 to August 2006.

Bromine and Rubidium were added to our list of different beams that have been run on the UWO Tandetron Accelerator. The Rubidium target was made from a rubidium carbonate and produced only 50nA of Rb^- from the source, but this intensity was sufficient to complete our single low dose implant. The Bromine target was made from potassium bromide mixed with silver powder. This mixture produced ~3uA of Br^- from the source but the beam was very unstable.

Beam Species	Number of Days Run
Arsenic	0.5
Boron	4
Bromine*	0.5
Carbon	7
Gold	11
Helium	29
Hydrogen	30
Iodine	8
Nitrogen	13
Oxygen	1
Phosphorus	3
Rubidium*	0.5
Silicon	14
Silver	2
Tellurium	0.5
Total	**124**

Figure 1: Beam Usage (Sept. 2005- Aug. 2006)
* First time species

Upgrades and Modifications

The requirement that all Class II Accelerator Facilities in Canada be licensed under the Canadian Nuclear Safety Commission (CNSC) necessitated some modifications to the Tandetron Accelerator to bring the accelerator in compliance with these CNSC regulations. The interlock system was changed to add 2 Emergency Stop Buttons, an Accelerator *ON* Status Light at the lab entrance and a 30s audible alarm before power is turned on to the accelerator.

The accelerator control computer was upgraded from a PIII 800 running Windows 98 to an Athlon XP 2000+ running Windows XP. As a result, a new PCI Group 3 fiber optic loop controller was purchased to replace the old ISA card. The control software was upgraded from a Wonderware Intouch program to a Labview 7.1 program integrated with Microsoft Access database. Each analog input and output has calibration, alarm and ramp values which are stored in a database and can be modified within the Labview program. All settings and readings are logged to another database which can be referenced for client billing, reports, searching for previous settings and estimating beam parameters for quotes.

An intermittent Faraday cup was installed in front of the 941 RBS channeling goniometer. This Faraday cup is used to sample the beam current for charge integration. This technique has proved to provide a more accurate method of beam current integration than the previous method of integrating the charge directly from the sample stage. The default duty cycle is ~75% consisting of a 1s sampling time and 3s on the target; these dwell time values and duty cycle can be modified in the data acquisition software. The time constant for the Faraday cup is derived from one of the counters on a National Instruments PCI-6602. This counter drives a transistor and relay to power a pneumatic solenoid which rapidly moves the Faraday cup in and out of the beam.