Triangle Universities Nuclear Laboratory[1]
Report to SNEAP 2011

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Tandem Operation

The TUNL FN tandem accelerator was operated 146 days for 1565 hours at terminal potentials ranging from 0 .7 MV to 6.3 MV during the period 8/1/2010 to 7/30/2011. Beams accelerated during this period include unpolarized protons and deuterons and also ^{4}He, The terminal operating potential during the reporting period is shown graphically in figure 1.

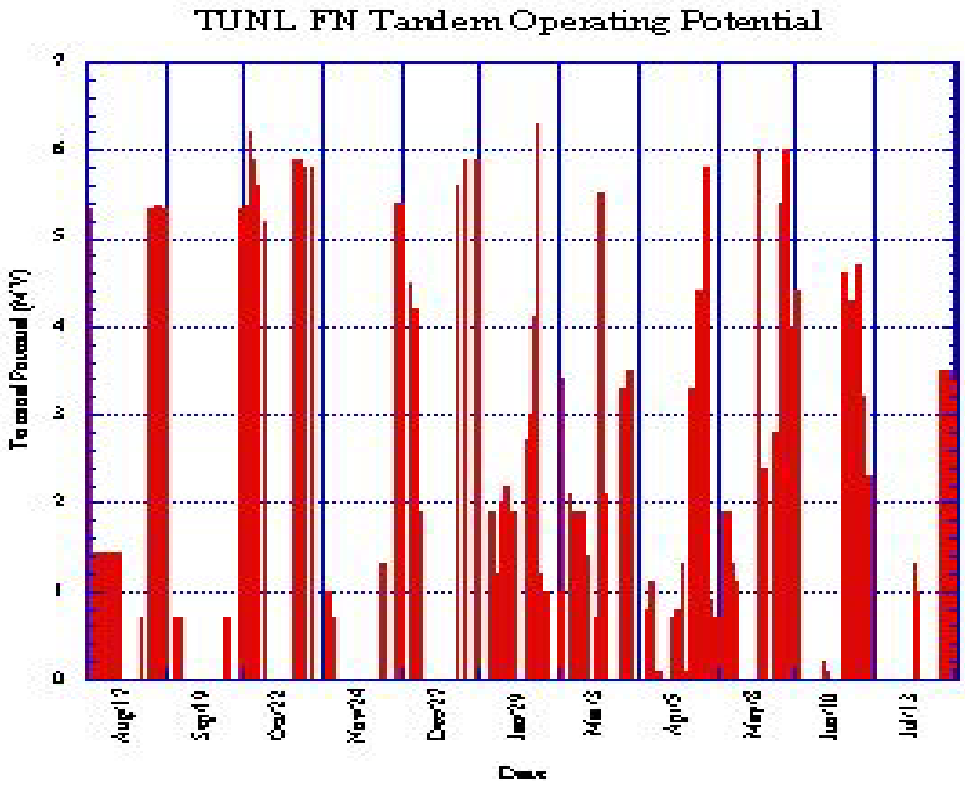

Figure 1 The TUNL FN Tandem Operating Potential

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An opening of the tandem was made on May 3, 2011 for routine maintenance. No bad column resistors were found at this opening. A new set of 75 stripper foils was installed. After closing the box, a short was discovered with one of the terminal steerers and the vacuum had to be broken to remove and clean the feed through.

The Pelletron charging system was inspected and all idlers were replaced as some grease was leaking from the bearings. The chain motors were greased, the tension on the low-energy drive belt was adjusted, as was the tracking of the terminal alternator belt. The corona needles were cleaned and the corona shield was replaced. A slow-start module was installed in the Pelletron motor control center for the low-energy chain. This module permits the chain speed to ramp up over a ten second period, reducing the stress on this old chain. An order was placed in July for a replacement for the low-energy chain. It will be installed next spring during the annual maintenance of the tandem. The tandem was closed on May 16 and evacuated overnight by the Kinney vacuum pump, which was rebuilt in 2010 after failing while evacuating the tandem tank. Tandem operations resumed the next day.

Measurements were made during the opening for brackets to support a new design idler pulley. This deep grooved pulley would replace the three existing idlers on each run of the chain. It is hoped that the lifetime of the bearings in this manufactured pulley will greatly exceed those of the existing idlers. A photograph of this pulley is shown below in figure 2.

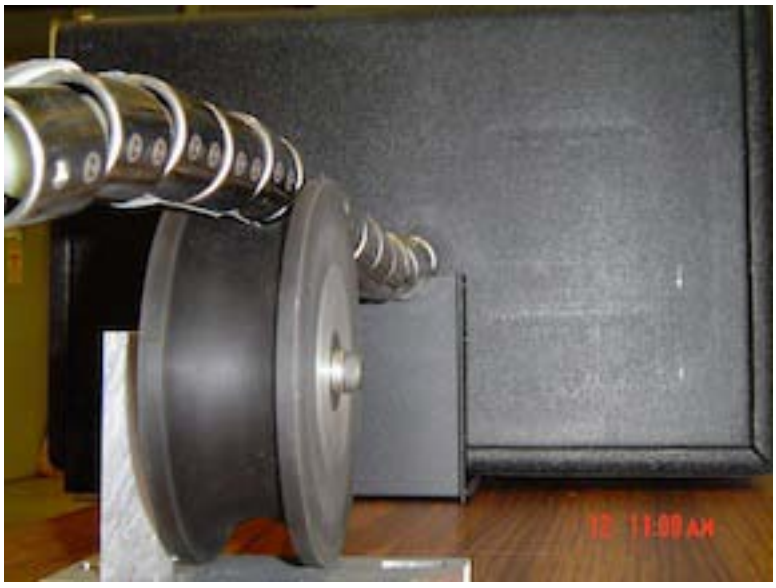

Figure 2 The New Pelletron Idler Pulley Prototype

Testing of this prototype is planned for Fall/Winter 2011 using a spare drive and terminal pulley and an old chain. If successful, we hope to install these pulleys at the annual maintenance next spring.

The LENA JN Accelerator (1 MV) was operated for 567 hours this past year. No belt replacements have been required and ion source bottles last about one year between exchanges. Proton currents of up to 350 μA have extracted (85 on target) with this source configuration. Plans are being made to install a Helium gas supply and to produce He+ beams for experiments in the coming year. The terminal voltage stabilizer (TVS) has been modified extensively in order to improve performance. A generating voltmeter feedback loop has been added to provide dc stability when not in slit control. Also, a capacitive pickoff has been installed and a feedback loop utilizing this error signal is being debugged. The reengineered TVS is interfaced through LabView to the accelerator and beam transport control program.

The LENA ECR operated for 1083 hours this past year and has delivered a record 2.1 mA of protons to target. We are planning to purchase a new 200 kV, air insulated, electron suppressed accelerating tube in the next year. This is necessary to improve the beam optics, resulting in better transmission to the target chamber and reducing the electron loading in the acceleration tube.

Laboratory Projects

Direct Extraction Ion Source

The off-axis Direct Extraction Negative Ion Source (DENIS) continues to be continues to be the most utilized of our three ion sources with 7500 hours logged since January 2010. Stable operations at 25-30μA of analyzed beam on the low energy cup are normal. **These intensities are required for pulsed operation.** High laboratory humidity problems have mostly been corrected which caused some arcing problems last year.

A new well-regulated extractor power supply has been ordered to replace the unregulated power supply presently used. Installation will occur this fall. All local controls were repositioned to improve operator access and convenience in tuning the source. Plans are being developed to install fiber optic links for the various power supplies and vacuum gauges on the ion source platform. This will permit remote monitoring of the ion source parameters in the

control room and possibly remotely via a web link. It is hoped that in the near future, we will be able to also control the ion source via LabView as are most of the beam transport elements now.

Helium Exchange Ion Source

The TUNL Helium exchange source has operated for a significant number of hours this past year, producing beams of ^{4}He- via it's Sodium charge exchange canal of 1-2 microamperes to the tandem low-energy cup. A NEC BPM-80 beam scanner was installed at the exit of the charge exchange box this summer to permit the properties of the beam to be observed for the development of a chopping system for this ion source. This scanner will be removed to make room for a parallel plate chopper to be installed this fall.

Safety system Improvements

Several changes were made to safety systems in the tandem accelerator laboratory this year. The major change involved installing a true search system for the high-energy bay area – which is a designated "High Radiation Area". This electronic system includes five search stations strategically placed throughout the tandem high-energy bay at locations where the operator conducting the search is able to view all areas where researchers may be working. The five stations must be visited in order, along a designated route, during a four-minute interval in order for the search to be satisfied. Any entries into the area during the search will cause the search to reset. This requires the operator to escort the second person out and to initiate a new search. Any entries after the search is satisfied will interrupt the beam at the ion sources and will again require a new search be completed before tandem operations can resume.

The required fifteen-second audible warning has been automated so that the operator must no longer have to perform this task. A digital announcer is triggered when to operator requests that the injection beam stop be withdrawn.

Video cameras have also been installed in the high-energy bay and all target areas to permit the operator to view all of these areas simultaneously at the tandem console.

Pneumatic Transfer System

The installation of the pneumatic transfer system between the tandem Neutron-Time-of Flight room and the Phytotron Carbon-11 research station was completed in November. This system will be used to transport short-lived radio-nuclides such as Nitrogen-13 ($t_{1/2}$ = 9.9 min) underground between buildings without exposure to personnel, in about ten seconds.