

University of Washington Lab Report to SNEAP 2011

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Lab report of operations, service, and repairs at the FN tandem facility of CENPA (the Center for Experimental Nuclear Physics and Astrophysics) at the University of Washington for the years 9/30/2009-9/30/2011.

I. Tandem and ion sources

Two years have elapsed since CENPA last submitted a Lab Report to SNEAP. Between 9/30/09 and 9/30/10 the NPL tandem Van de Graaff accelerator chains ran 1380 hours, the DEIS ran 1157 hours and the SpIS ran 734 hours. Between 9/30/10 and 9/30/11 the chains ran 391 hours, the DEIS ran 420 hours and the SpIS ran 20 hours.

The tandem was used as a single ended machine with the terminal ion source (TIS) for a total of 61 days between 9/30/09 and 9/30/10 to deliver ^1H or ^2H beams for use by experimenters. The accelerator was run as an actual tandem for 55 days at voltages from 0.4 to 8.8 MV with the DEIS to produce beams of ^1H and ^2H . There were 68 experiment-days during which the injector deck, using either the DEIS or 860 SpIS, was used to deliver ^{21}Ne , ^{23}Na , ^{24}Mg , ^{27}Al , ^{28}Si , ^{32}S , and ^{33}S beams for ion implantation.

The following year there were 33 days when the accelerator was run as a tandem between voltages of 0.4 to 8.7 MV with the DEIS to produce beams of ^1H and ^2H . No ion implantations were done this year and the TIS was not used for any experiments.

Between 9/30/09 and 9/30/10 there were 49 days of development, repair, or modification for the sources or tandem. There were 23 days during which we trained crew members. Between 9/30/10 and 9/30/11 there were 25 maintenance days and 13 crew training days. The spiral inclined field tube #3 and the straight KN tube were swapped 3 times between 9/30/09 and 9/39/10 requiring 10 days of service. We had 9 tank openings between 9/30/09 and 9/39/10 and only 3 between 9/30/10 and 9/30/11. The tank openings were for tandem repairs and servicing, replenishing stripper foils and TIS gas, swapping beam tubes, or for changes in the gradient for the TIS.

Development of the DEIS for the production of positive ion beams of the noble gases was completed during 2010. An implantation of the rare isotope ^{21}Ne from natural abundance neon using this ion source was successful.

II. Accelerator based physics

Data taking on the measurements of (p,γ) resonances on ^{22}Na in the 190 to 650 keV proton energy range is complete. The absolute strengths of several resonances were found to be substantially larger than those previously reported. We have produced a 0.8 mCi $^{83\text{m}}\text{Kr}$ source for the Project 8 neutrino mass experiment prototype using 17.5 MeV protons incident on a $^{\text{nat}}\text{Kr}$ gas cell. An ongoing experiment will produce ^6He via the reaction $^7\text{Li}(d,^3\text{He})^6\text{He}$ by bombarding a molten lithium target with a high energy deuterium beam. During the 2011 spring quarter, CENPA offered an accelerator-based undergraduate research course for the first time. As part of this course, students were required to participate in a 3 hour crew training session in order to learn basic operation of our Van de Graaff. The students were then able to perform a simple Rutherford scattering experiment as well as investigate a resonance in the $^{27}\text{Al}(p,\gamma)^{28}\text{Si}$ reaction.