

Automatic degrader changer

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The purpose of this project was to design, build and install a remote-controlled degrader changer for the tape transport system. The changer allows a more efficient use of beam time by reducing the time it takes for the experimenter to adjust the degrader thickness at the beginning of an experimental run. The changer consists of two thin wheels (0.0625 in) with radius 2.50 and 3.85 in. with 4 (previously 3) and 8 slots, respectively, for different degrader thicknesses. These wheels can be rotated to different positions by two independent stepper motors using Arduino UNO [1] microcontrollers interfaced with Processing software [2].

Previously, we reported [3] a final design based on the spatial restrictions of the experimental set up as well as a working set of codes for the microcontrollers and the graphical user interface (GUI). As of today, only one change was made to the 2.5 in. radius wheel, adding an extra slot for a degrader combination of aluminized mylar tape and a 0.25 mil thick aluminum foil. This change was also made to the GUI. Another change made to the GUI was the addition of functions to retain the position of the wheels (Fig. 1) even after the computer controlling it has been turned off, allowing more control over the wheels as well as providing a manual overwrite.

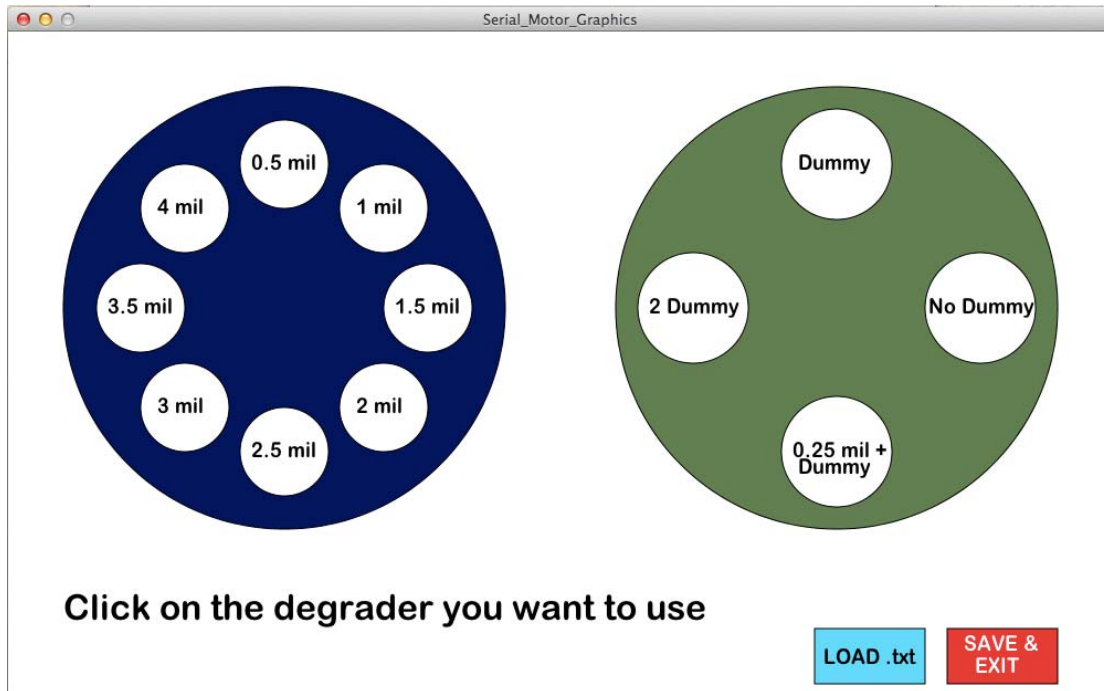


FIG. 1. Current GUI.

The extra slot added allows us to determine the beam implantation profile near the edges of the aluminized mylar tape. This profile is an important step in the experimental process to determine how the isotope of interest is being implanted as well as other impurities that may be stopped somewhere in the tape. Fig. 2 shows the implantation profile for a ^{42}Ti beam as a function of degrader thickness. It can be

seen in this particular profile that as the thickness of the degraders is increased more impurities get implanted and less ^{42}Ti is seen. The red points represent the measured values, while the blue, green and yellow lines represent the implantation of ^{42}Ti , ^{40}Sc and ^{38}Ca , which all had been identified at the focal plane of MARS.

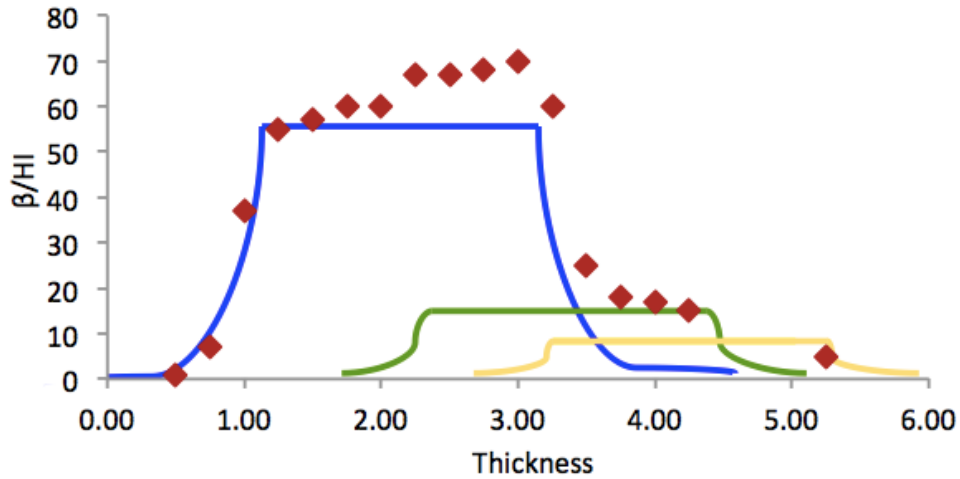


FIG. 2. Implantation profile for ^{42}Ti .

Currently, the automatic degrader changer has been built and installed. Tests have been made and improvements to design and GUI implemented. The degrader changer is fully functional and has already been used during experiments as shown by the data above. No further changes have been discussed or planned for the near future regarding this project as of now.

[1] <http://arduino.cc>

[2] <http://processing.org>

[3] M. Bencomo and J.C. Hardy *et al.*, *Progress in Research*, Cyclotron Institute, Texas A&M University (2012-2013), p. IV-31