Building a Remote-Controlled Valve and Pump Module for Performing Multi-Column Extraction Chromatographic Separations

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Cancer is one of the leading causes of death worldwide. Terbium (Tb) isotopes stand out with great potential for use in both cancer therapy and imaging. Specifically, ^{161}Tb, which exhibits beta particle and Auger-electron emissions, has shown the potential to replace ^{177}Lu in targeted radionuclide therapy. A challenge in production of the ^{161}Tb isotope lies in its isolation from neighboring lanthanides Gadolinium (Gd) and Dysprosium (Dy). The focus of this study is to build a remote-controlled valve and pump module to perform multi-column extraction chromatographic separations for ^{161}Tb purification from commercially available systems. The framework of the module was constructed from ready-made plastic enclosures modified to accommodate the attachment of hardware (PTR-28487-C/ PW-12850-T, Bud Industries). Fluidic logic and flow rate was determined through a serial configuration of solenoid flipper valves (6724, Bürkert Fluid Control System) and variable voltage peristaltic pumps (WPM1-P3AA-WP/ WPM1-P3BA-WP, Welco). The valves and pumps were controlled using transistor-transistor logic (TTL) signals generated by a National Instruments USB-6008 Multifunction I/O device, coupled with a custom designed circuit. Data from custom-built scintillation and Gieger-Mueller radiation detectors was acquired and logged through use of the digital counter inputs of the USB-6008s. LabView software was written to automate control of hardware components and perform the acquisition and analysis of chromatogram data.

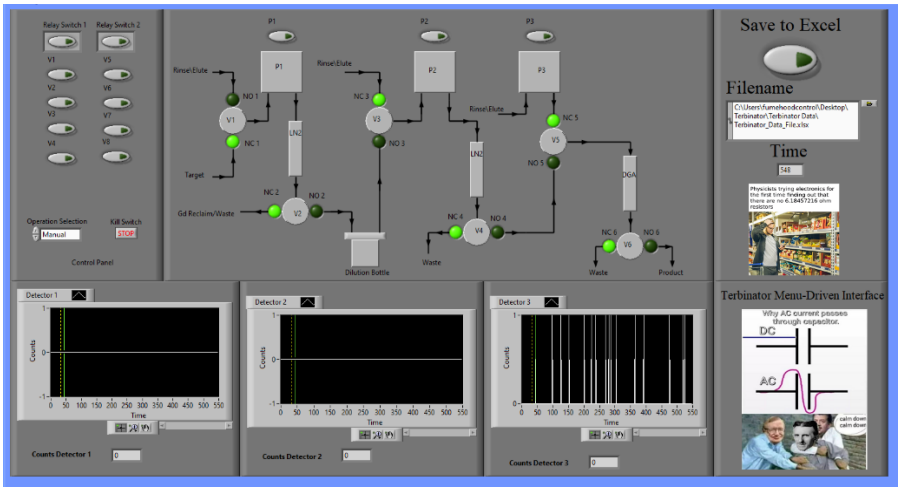

Figure 1. LabVIEW GUI for Multi-Column Extraction Module