1. Accelerator Mass Spectrometer

The primary instrument of PRIME Lab is the accelerator mass spectrometer housed in a 2900 m^2 building with 14 offices and 16 laboratory rooms. The AMS consists of a low-energy transport system, the accelerator, and the high-energy transport system (Figure 1). Presently, we have one injector on the low-energy system, however we are in the process of installing a second injector that will implement electrostatic switching between isotopes. The new injector should be operational in mid-2015. The existing injector consists of the ion source, lenses, injection magnet, lenses, and a gridded lens. Beam profile monitors are located after each beam waist to aid in tuning individual isotopes. The accelerator is an FN tandem accelerator. The center of the accelerator, called the terminal, is charged to the specified voltage by a NEC pelletron charging system, consisting of two rotating chains. The injected negative ions are accelerated to the terminal, where they stripped, either by a carbon foil or by argon gas, into an appropriate charge state. These ions are repelled from the terminal and accelerated again to ground at the exit of the tandem. The insulating gas used in the pressure vessel is approximately 80% N_2, 16% CO_2, and 4% SF_6. Over the last several years we have added SF_6 to improve the insulating properties of the gas. The high-energy system consists of quadrupoles, an analyzing magnet, a switching magnet, and an electrostatic analyzer. We have two operation beam-lines, one located on the 30° port (R30) of the switching magnet and the other located off the 45° port (R45). Our long-term plan is to use the GFM for ^{10}Be, ^{26}Al, ^{32}Si, ^{36}Cl, and ^{53}Mn. The GFM has been tested with ^{36}Cl. The R30 is presently used for ^{14}C, ^{41}Ca, and ^{129}I. The electrostatic analyzer on the R30 makes this beam-line ideal for ^{129}I and ^{14}C; tests will indicate which beam-line is best for ^{41}Ca.

2. Laboratories

a. Sample loading laboratory

Sample loading and storage is located in a 45 m^2 laboratory. Cathodes are loaded in a laminar flow hood used exclusively for this purpose.

b. Chemical preparation laboratories: ^{10}Be, ^{26}Al, ^{36}Cl, ^{129}I

PRIME Lab has two chemistry laboratories in the Wetherill Chemistry Building: one laboratory is used for halogen chemistries (Cl and I) and the other for extraction of Be and Al for quartz. We encourage visiting students to participate in all aspects of sample preparation and measurement. Students routinely come to PRIME Lab and are trained to prepare their own samples in our laboratory. We are exploring the possibility remodeling additional chemistry laboratory space near or in PRIME Lab and have asked the University to fund the air ducting systems needed to accommodate new hoods.

c. In-situ ^{14}C laboratory

The in-situ ^{14}C extraction systems are designed around a high-temperature tube furnace utilizing an ultra-high-purity (UHP) oxygen atmosphere at a pressure of approximately 50 to 60 torr. The tube furnace uses a mullite (60% Al_2O_3, 40% SiO_2) furnace tube. Mullite was selected as the tube material because it has been shown to provide quantitative yields with significantly smaller amounts of CO_2 than those observed in our samples. We have minimized the use of Viton, Teflon, and Kel-F components in the lines where possible to mitigate potential ^{14}C memory effects. We have recently automated both extraction systems, with NSF support. This advance minimizes the man-hours required for system operation,

increasing our sample throughput significantly. The extraction systems are designed and operated to prevent sample contamination problems. All vacuum pumping systems are oil-free to eliminate the possibility of pump oil contamination. This laboratory will also have a graphitization system dedicated to preparing AMS targets from in situ ^{14}C samples.

d. Conventional ^{14}C

PRIME Lab also operates a conventional ^{14}C processing and extraction laboratory, equipped to handle a wide range of organic and inorganic samples via combustion and hydrolysis techniques.

e. *Quantitative analysis*

PRIME Lab operates an ICP-OES. This instrument is used to obtain quantitative Al concentrations in quartz. It is also used for major element scans to determine the purity of quartz before proceeding to chemical separation of Be and Al.

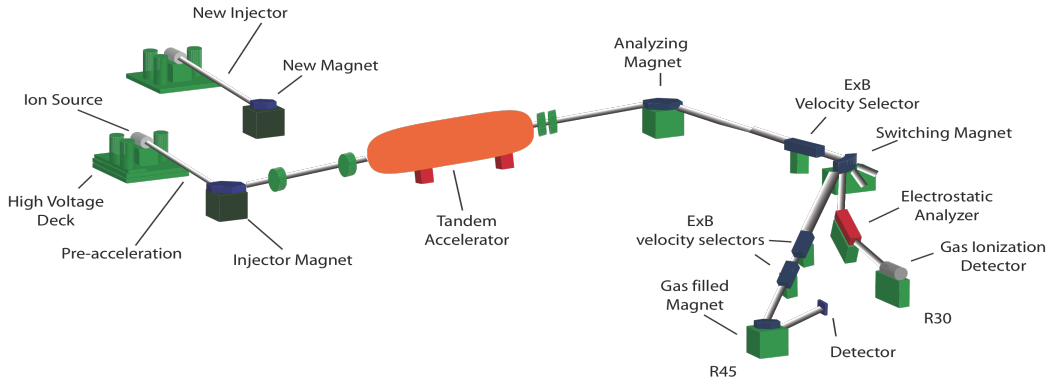
3. Other facilities

a. Machine shop

PRIME Lab has a well-equipped machine shop containing a computer-controlled mill, a lathe, several drill presses, a band saw, a tube-saw, and a variety of other power and hand tools. PRIME Lab has one full-time machinist. The Physics Department also has a well-equipped Faculty machine shop available for use by PRIME Lab personnel.

b. Electronics shop

PRIME Lab has a well-equipped electronics shop. This facility is used to repair malfunctioning equipment and to test new components. The Physics Department also has an electronics shop. We utilize this shop for the fabrication of custom electronic components. Routine repair of electronics components is done by PRIME Lab staff or in the Physics electronics shop. The Physics Department does employ an electronics engineerwhom PRIME Lab relies on for electronics support.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Detector
R45

Figure 1