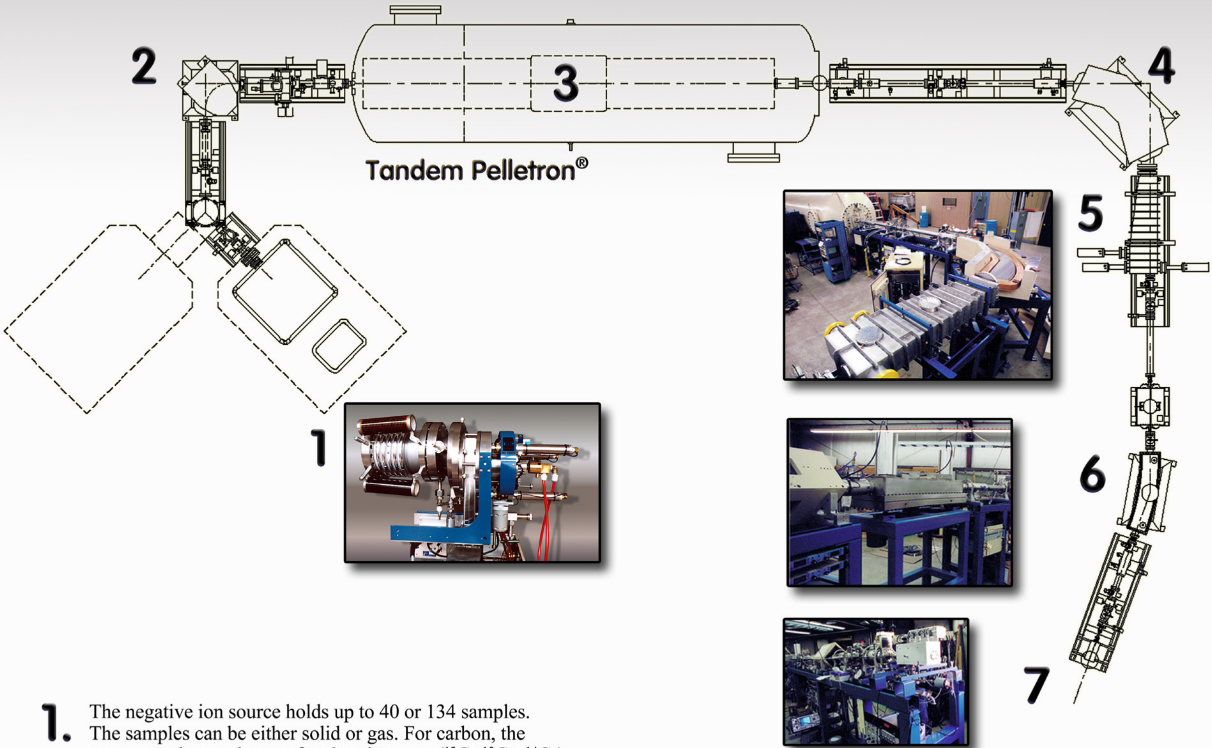
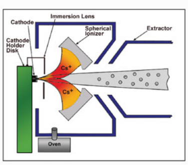
Accelerator Mass Spectrometer

AN INSTRUMENT FOR RAPID ANALYSIS OF RARE ISOTOPES & TRACE ELEMENTS



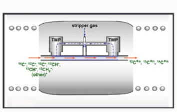
1. The negative ion source holds up to 40 or 134 samples. The samples can be either solid or gas. For carbon, the source produces a beam of carbon isotopes ($^{12}C^-$, $^{13}C^-$, $^{14}C^-$) and negatively charged molecules. This source is also suitable for studies with other radioisotopes.



The ionizer produces a cesium beam which strikes the cooled sample surface. As particles from the sample are sputtered through the cesium, negative ions are formed.

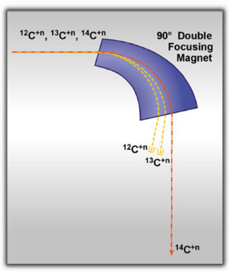
2. The 90° magnet injection system sends individual isotopes into the accelerator sequentially by biasing the insulated magnet chamber. The voltage on the chamber is changed many times per second. Simultaneous injector systems are also available which separate the isotopes for mass selection and recombines them prior to acceleration.

3. The tandem Pelletron accelerates the negative ions to the positive terminal. In the terminal, stripper gas interacts with the negative ion beam to break up all molecules and produce positive ions. The positive ions then exit the positive terminal and are accelerated a second time to the very high energies.



In the high voltage terminal, negatively charged ions and molecules enter the gas stripper assembly and positively charged ions exit. The stripper gas is recirculated in order to maintain the best possible vacuum conditions in the acceleration tube.

4.



The positive ions are accelerated into the 90° mass/energy analysis magnet which separates the isotope beams for measurement.

The ions entering the magnet are separated according to mE/q^2; the ion mass multiplied by its energy divided by the square of the charge.

5. The offset Faraday cup assembly measures the abundant isotopes, ^{12}C and ^{13}C, which are deflected more than the heavier, rare isotope, ^{14}C. The same principle holds for beryllium, aluminum, iodine, chlorine and other beam species.

6. The rare isotopes are transported through a 20° electrostatic deflector to filter out any other possible interfering ions for an overall system sensitivity of better than 1 out of 10^{15}. Interfering background levels are reduced to a few parts in 10^{16}.

7. The detector counts the rare isotope and a computer calculates the fraction of rare isotope in each sample. In this way, ratios of $^{12}C/^{14}C$ and $^{13}C/^{14}C$ are measured. Precisions of better than 0.3% are routinely obtained.

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