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A novel table-top device for the single-atom detection of Carbon-14[1] FRED W. MEYER, ERNST GALUTSCHEK, ORNL — Carbon-14 labeled compounds are widely used in the pharmaceutical industry, e.g., as tracers to determine the fate of these compounds *in vivo*. The sensitivities of most present methods are inadequate to permit utilization of sufficiently small quantities of ^{14}C to avoid the issues of radioactive waste and contamination, both of which are unacceptable for environmental, health and safety, and financial reasons. A new compact ^{14}C detection apparatus has recently been developed that uses low-energy multicharged carbon beams with charge state of +3 or higher to eliminate molecular isobar interference at mass 14. After magnetic selection of the desired charge state, the ion beam, which will still be dominated by ^{14}N multicharged ions of the same charge state, is directed to an insulator single-crystal surface at grazing incidence, where efficient negative ion formation takes place without appreciable energy loss of the scattered ions. Two stages of electrostatic analysis spatially separate the desired $^{14}C^{-}$ ions from scattered neutrals and other background prior to their detection on a two-dimensional position-sensitive detector (2-D PSD). Unique characteristics of the apparatus are its small size, low cost, high efficiency (i.e., throughput), and ease of sample preparation, in comparison with the conventional AMS approach. Initial test results using large-area LiF and KBr single crystal targets will be presented.

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