

Abstract Submitted
for the CAL09 Meeting of
The American Physical Society

Development of a Compact Neutron Generator to be Used For Associated Particle Imaging Utilizing a RF-Driven Ion Source YING WU, UC Berkeley — The development of a prototype compact neutron generator for the application of associated particle imaging (API) to be used for explosive and contraband detection will be presented. The API technique makes use of the 3.5 MeV alpha particles that are produced simultaneously with the 14 MeV neutrons in the deuterium-tritium (${}^2\text{D}({}^3\text{T},\text{n}){}^4\alpha$) fusion reaction to determine the direction of the neutrons and reduce background noise. This method determines the spatial position of each neutron interaction and requires the neutrons to be generated from a small spot in order to achieve high spatial resolution. In this work an axial type neutron generator was designed and built with a predicted neutron yield of 10^8 n/s for a $50\ \mu\text{A}$ D/T ion beam current accelerated to 80 kV. It was shown that the measured yield for a D/D gas filled generator was 2×10^5 n/s, which scales to 2×10^7 n/s if a D/T gas fill is used. The generator utilizes an RF planar spiral antenna at 13.56 MHz to create a highly efficient inductively coupled plasma at the ion source. Experimental results show that beams with an atomic ion fraction of $> 80\%$ can be obtained with only 100 watts of RF power in the ion source. A single acceleration gap with a secondary electron suppression electrode is used in the acceleration column, to suppress secondary backscattered electrons produced at the target. Initial measurements of the neutron generator performance including the beam spot size and neutron yield under sealed operation will be discussed, along with suggestions for future improvements.

Abstract APS

Date submitted: 22 Oct 2009

Electronic form version 1.4