

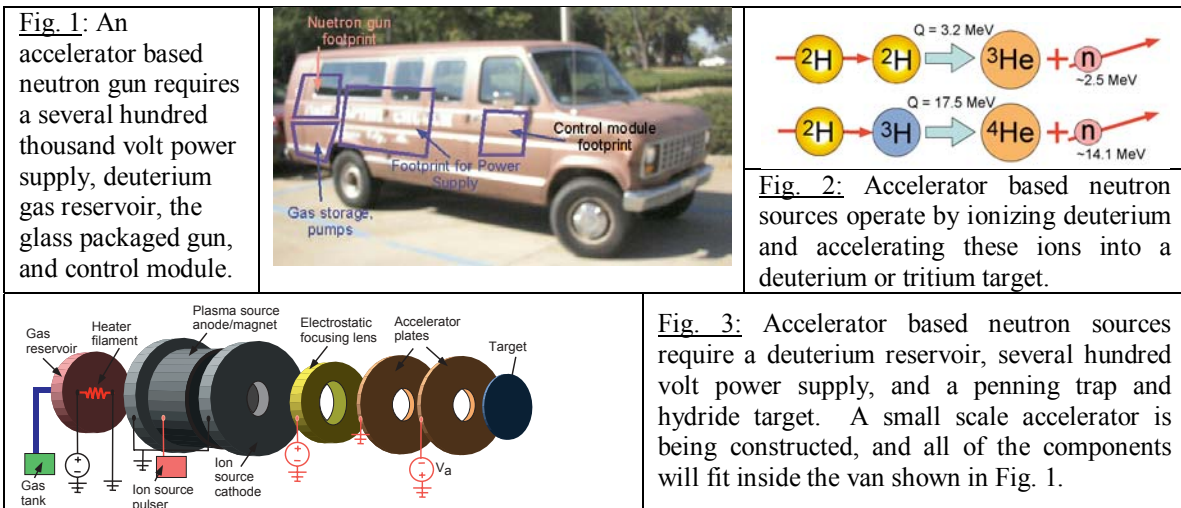
NEUTRON GUN UP MY RIDE

Kathleen Thornhill, Charlton Hill, Sobia Awan, Joshua Brown and Chester G. Wilson¹
Department of Electrical Engineering/Institute for Micromanufacturing, Louisiana Tech University

Why Build a Neutron Gun? Perhaps one of the greatest threats to homeland security is the possibility of a nuclear weapon being smuggled into the country by terrorists or a rogue nation. Fissionable material emits neutrons, and very little else does, so one good strategy is to build neutron detectors, which our group is doing. One problem with that strategy is that the neutron flux from fission packages is pretty low, so long integration times are required to positively detect these devices. However, when a neutron flux is imposed on weapons grade uranium, sub-threshold nuclear fission occurs, and many more neutrons are emitted. So if you fire a neutron gun at a container, and detect a lot more neutrons, there is a nuclear package in that container.

Why Build A Neutron Gun in a Van? Current high flux neutron sources are constructed in large buildings. Smaller tube based and isotope systems exist, but the flux is very low. A van sized neutron generator would provide a mobile, medium flux reactor, allowing robust field detection. So our design target is for all components to fit in a Ford E350, which has been donated to this project (Fig. 1).

How Does it Work? Accelerator based neutron generators operate by ionizing hydrogen isotopes, and accelerating them onto isotope rich targets. Neutrons, and a fusion product are created (Fig. 2). Most accelerators contain some common components (Fig. 3): 1) A gas reservoir loaded with deuterium, 2) A method to release the gas, 3) A plasma based ion source, most frequently a magnetic penning-type trap, which relies on $E \times B$ field confinement, 4) Electrostatic focusing lenses, 5) Accelerator plates, biased to as high as 110 kV, and 6) A hydride metal target, which stores deuterium or tritium. A miniaturized version of these larger accelerators is being constructed at Louisiana Tech by an all-undergraduate electrical engineering senior design team.



¹ Corresponding author: P.O. Box 10137, Ruston, LA 71272, USA; Tel: (318)-257-5140, Fax: 257-5104, E-mail: chester@latech.edu