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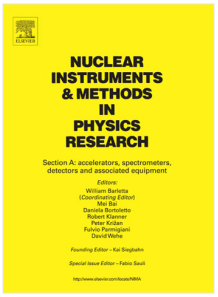

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N. Buzarbaruah, S.R. Mohanty, E. Hotta

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A Study on Neutron Emission from a Cylindrical Inertial Electrostatic Confinement Device

N. Buzarbaruah[1], S.R. Mohanty[1*], E.Hotta[2]

[1]Centre of Plasma Physics-Institute for Plasma Research, Nazirakhat, Sonapur, Assam, India

[2]Tokyo Institute of Technology, 4259-J2-35 Nagatsuta, Midori-ku, Yokohama 226-8502, Japan

Abstract:

The adaption of new generation portable neutron sources has been increasingly marked in a wide range of research fields compared to the large-scale neutron generators. In this context, we have successfully demonstrated some of the essential parameters required for the emission of 2.45 MeV DD fusion neutrons from a steady state portable linear neutron source based on inertial electrostatic confinement scheme. The parameters that control the production of neutrons are the working pressure of the fuel gas, applied voltage, measured current and cathode geometries. The neutrons emitted from the source are confirmed using neutron monitor, bubble dosimeters, nuclear track detectors and He-3 proportional counter. Presently, the device produces neutrons up to the order of ~ 10^6 n/sec at discharge voltage ranging from -60 kV to -80 kV and discharge current of 20 mA to 30 mA.

I. Introduction:

In the present world, artificial neutron sources play a crucial role in paving the way for various potential applications. The portable or tabletop neutron sources are relatively inexpensive alternatives to the nuclear reactors [1, 2]. The neutrons produced from such sources are used in different fields of science such as electronics industries, medicinal fields, homeland security and other research areas [3-5]. Lawrence Berkeley National Laboratory (LBNL) and Adelphi Technology Inc. are the pioneers for the development of a series of high yield neutron generators using D-D (deuterium fuel) reactions in an axially symmetric device [6].

Inertial electrostatic confinement (IEC) fusion scheme is one of the most favorable techniques for production of continuous and pulsed neutrons compared to other schemes like plasma focus, Z-pinch, accelerator-based etc. Researchers have analyzed various schemes for IEC devices that could deliver a stable source and could significantly increases the neutron