Research and Development of Landmine Detection System by a Compact Fusion Neutron Source

Kiyoshi Yoshikawa[1], Kai Masuda[2], Hisayuki Toku[3], Kazunobu Nagasaki[4], Toshiyuki Mizutani[5], Teruhisa Takamatsu[6], Masaki Imoto[7], Yasushi Yamamoto[8], Masami Ohnishi[9], Hodaka Osawa[10], Eiki Hotta[11], Toshiyuki Khono[12], Akitoshi Okino[13], Masato Watanabe[14], Kunihito Yamauchi[15], Morimasa Yuura[16], Seiji Shiroya[17], Tsuyoshi Misawa[18], and Takamasa Mori[19]

[1]*Institute of Advanced Energy, Kyoto U., Uji, Kyoto, Japan, kioshi@iae.kyoto-u.ac.jp,*
[2]*masuda@ iae.kyoto-u.ac.jp,* [3]*toku@iae.kyoto-u.ac.jp,*[4]*nagasaki@iae.kyoto-u.ac.jp,*
[5]*toshiyuki@iae.kyoto-u.ac.jp,*[6]*teruhisa@iae.kyoto-u.ac.jp,*[7]*masaki@iae.kyoto-u.ac.jp,*
[8]*yasushi@iae.kyoto-u.ac.jp,*
[9]*Dept. of Elec. Engng, Kansai U., Suita, Osaka, Japan, onishi@ipcku.kansai-u.ac.jp,*
[10] *osawa@plasma.ee.kansai-u.ac.jp*
[11]*Dept. of Energy Sciences., Tokyo Inst. of Technol., Yokohama, Japan, ehotta@es.titech.ac.jp,*
[12]*kohno@es.titech.ac.jp,* [13]*aokino@es.titech.ac.jp,* [14]*watanabe@es.titech.ac.jp,*
[15] *yamauchi@hotta.es.titech.ac.jp*
[16]*Pulse Electronic Engineering Co.,Ltd., Noda, Chiba 278-0016, Japan, yuura@peec.co.jp*
[17] *Inst. of Res. Reactor Inst., Kyoto U., Kumatori, Osaka, Japan, shiroya@kuca.rri.kyoto-u.ac.jp,*
[18]*misa@kuca.rri.kyoto-u.ac.jp*
[19] *JAERI., Tokai Est., Tokai, Nakagun, Ibaragi Japan, mori@mike.tokai.jaeri.go.jp*

Current results are described on the research and development of the advanced anti-personnel landmine detection system by using a compact discharge-type fusion neutron source called IECF (Inertial-Electrostatic Confinement fusion). It is urgently requested to clean up the lands contaminated by a huge amount of anti-personnel and tank landmines to resume the peaceful citizen lives in more than 60 countries as soon as possible. However, due to the modern landmines made of all plastics tend to hinder quick clearance work by the deminers, since the conventional landmine detectors, like metal detectors, are never effective enough to such plastic mines.

This study started by making use of the technique for BNCT (Boron Neutron Capture Therapy) for cancer treatment in Japan as one of the viable and advanced detection methods of landmines in the international Afghanistan reconstruction program, i.e., detection of backscattered neutrons to identify hydrogen anomaly, and of specific-energy neutron captured γ-rays by hydrogen and nitrogen atoms to identify landmine explosives.

For this purpose, various studies were made, such as a new ion production scheme, i.e., magnetron discharge, for drastic improvement of neutron yields more than 10^8 n/s in pulsed operation including R&D of robust power source, as well as analyses of envisaged detection system with multi-sensors to show promising and practical features for landmine detection in Afghanistan.

Goal of Project

Detection thru neutron-related reactions, able to identify LM with an Innovative IEC neutron sourc

Constituents and Location

A remote-controlled vehicle with a compact fusion neutron source and multi-sensing system