REPORTS ON RESEARCH

4.1 Ionization measurements in nanometre size sites with JET COUNTER

by S.Pszona

Attempts to find an experimental method which is able to characterize the interaction pattern of radiation with different quality at nanometre size sites started in the early 70-ies [1-3]. This approach was based on a differential pumping technique for simulating nanometre sizes (SNS) and single ion counting. It has been quickly learnt that with this technique SNS of less than 1nm can be achieved. To overcome this barrier the pulsed flow of gas through an orifice instead of constant flow has been devised [4]. The practical implementation of this concept appeared difficult. Just recently, the differential pumping technique is revived by a group from Legnaro and Rehavot [5]. Another approach using a pulsed expanded flow of gas, JET COUNTER, (JC), has been proposed by Pszona and Gajewski [6] for studying the delta electron spectra escaping from nanometre sites when irradiated by charged particles. By this method a nondirect estimate of the mean value of restricted LET for low energy electrons was obtained. In this first JET COUNTER, presented at the 11-th Microdosimetry Symposium, the gas jet expanded to a large dimension of an interaction chamber. In the present paper a description of a modified JET COUNTER is presented.

The principle of the operation of the modified JET COUNTER, is explained in Fig. 1. A simulated nanometre - size, SNS, is obtained by a short lasting gas jet (nitrogen in this case). This jet is created due to a pulse-operated valve, PZ, which injects gas from a volume, R, over a valve, through a nozzle with a 1 mm diameter orifice to an interaction chamber, IC, below a nozzle. The interaction chamber is a cylinder, dia. 10 mm, made of tissue equivalent plastic or other material when a secondary particle equilibrium spectrum of incoming radiation has to be investigated. The ions created at the specific volume of this chamber during the gas flow, are removed from that volume by an electric field created by a grid, G. The ions are then guided in an electric field Eh to a counting device, CH2. The effective thickness of a SNS is controlled by a gas pressure inside chamber R as well as by the electrical parameters of valve PZ. The scaling procedure applied for the SNS needs to have an electron gun, EG, as well as the electron counting detector, CH1 are installed inside the device.

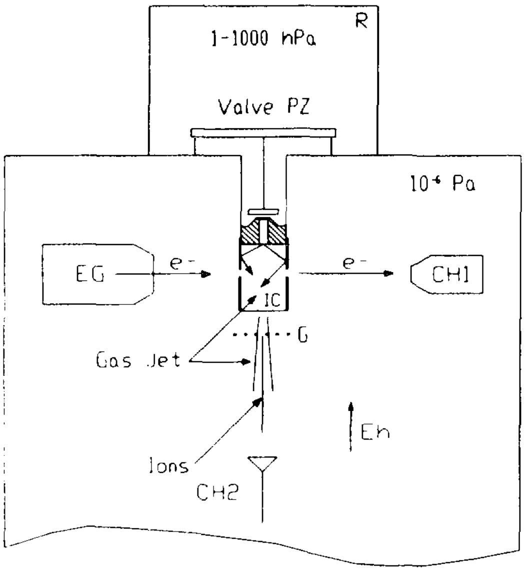

Fig 1 Schematic view of the modified Jet Counter. G - grid, IC - interaction chamber EG - electron gun, CH1 and CH2 - channeltrons

The modified JET COUNTER differs from the previous one in the build of the interaction chamber IC. In modified JC an interaction chamber has a cylindrical shape made of TE material which provides the particle equilibrium, necessary for dosimetric experiments, especially for photons and neutrons. Special attention has been paid to the scaling procedure for the 2 - 10 nm dia. cylindrically shaped SNS. For this purpose a 100eV electron beam generated by EG enters through a slit to the IC chamber, crosses a SNS and exits through another slit to a channeltron, CH1, where electrons are detected. The effective thickness of the nitrogen volume has been derived from the known Rao [7] transmission function and taking the Groswendt [8] data for practical range of 100eV electrons equal to 3,2 nm in unit density scale. The 2 nm SNS corresponds to an attenuation of 0.55 which is attained at 42 Torr of nitrogen in R chamber. Presented at 12 Symposium on Microdosimetry, Oxford, 1996.

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4.2 New method for ambient dose equivalent measurement

PL9800642

by S.Pszona

A new method for measuring of the ambient dose equivalent in mixed neutron - gamma fields has been devised [1]. It has been shown that the moderator technique, used up to now only for neutron monitoring can be adjusted for monitoring both gamma and neutron radiation. The relative response to photons of a device consisting with a ^{3}He proportional counter placed inside a 203mm diameter polyethylene sphere has been evaluated. It has been shown that the relative response to gamma radiation is within 30% acceptable limits in the energy range from 50 keV to 10 MeV.

[1] S.Pszona, Radiat. Prot. Dosim., 1996, 70, 132.

4.3 Linear array of 32 ionization chamber for radiotherapy

PL9800643

by A.Dudziński, J.Kula, S.Marjańska and S.Pszona

A linear array of detectors composed of 32 flat ionization chambers has been assembled together with an electronic system. Ionization currents of the chambers are amplified by the charge amplifiers and through the multiplexers fed to a 12 bit ac converter. The reading and controlling process as are operated by a 537 microcontroler. The later one is operated by a PC. The whole system is now under tests.

4.4 MCNP transport code installation

PL9800644

by K.Wincel

Due to the current state of the art of neutron, photon and electron calculations, a new version of MCNP executable and cross section data libraries were installed on PC-Pentium computer. MCNP.EXE file was replaced by MCNP6.EXE, which allows calculations of large problems. In a new executable the MDAS parameter is 6000000 and it requires at least 32 MB of RAM memory. Also significant sources of cross section data for use with MCNP code were adopted. These data are MCNPDAT and MCNPDAT6 from RSICC Data Library Collection. A standard set of sample problems and some examples proposed in "Training Course on the Use of MCNP in Radiation Protection and Dosimetry" (Italy, Bologna, 1996) were run.

4.5 Photon fields above an air-ground interface

PL9800645

by K.Wincel and B.Zaręba

The work is part of the program which aim's to carry out a methodology of aerial monitoring of a contaminated area. In order to correlate aerially measured data with a quantitative assessment of ground level gamma-ray spectrum the WIDMA code system was developed. The WIDMA code system consists of SGLIB data set, WIDMA1, WIDMA2 and WIDMA3 numerical codes. The SGLIB library includes angular and energy gamma-ray distributions in air up to 2000 meters above the ground. The SGLIB library was calculated for three cases of the gamma source distribution using the ANISN transport code. The first case was the plane source placed on the ground surface. The second and the third ones were volumetric distributed sources. The purpose of the volumetric source was to imitate of fallout migration to the ground and fallout material storage on the trees in the case of a wooded area. For each type of source six energy groups, in the range from 0.2 MeV to 5.0 MeV were assumed. Basing on SGLIB data set, the WIDMA1 code calculates the gamma-ray spectra for required flight altitude and given energy distribution and type of gamma-ray source. The WIDMA2 code allows us to perform calculations of absorbed doses, mean energy of gamma-ray, gamma-ray density flux and doses buildup factors in the air above a given gamma