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PL9800642

4.2 New method for ambient dose equivalent measurement

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.

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4.3 Linear array of 32 ionization chamber for radiotherapy

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.

PL9800644

4.4 MCNP transport code installation

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.

PL9800645

4.5 Photon fields above an air-ground interface

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 source. Finally, the WIDMA3 code fixes the correlation between aerial data and the flux energy spectrum at positions near the air-ground interface. The WIDMA code system was written in Turbo Pascal 6.0 and runs on PC computers.

4.6 Interactions of proton and heavy ion beams with spallation targets

by V.S.Barashenkov[1)] and A.Polański.

A mathematical model of interactions of protons and heavy ions with a spallation target was developed. Using of inter- and intranuclear cascades (INC) a series of mathematical simulations was performed. Hadron production and heat generation initiated in uranium, thorium and lead targets by ions (H-2, He-4, C-12) [1-4] was calculated. However, the reliability of INC models is questionable in particular at energies above a few GeV where little data on hadron production exist [5]. The dependence of level density parameters on energy and on the type of interacting nuclei was considered while simulating the intranuclear cascades. At present we try to improve the parameters of the INC model. High energy particle propagation in a spallation target was calculated using Monte Carlo techniques taking into account: the decrease of energies of cascade particles due to the ionization process along their trajectories, decay of created pions, after cascade preequlibrium process, evaporation and fission of excited residual nuclei.

Ion-nucleus cross sections were calculated by means of phenomenological formulas [6]. Hadron-nucleus cross sections at energies E>10.5 MeV were interpolated using a library of estimated experimental data [6]. Low energy neutrons were calculated using the 26-group neutron data library [7]. The results were compared with calculated data for the proton-induced spallation source.

The number of neutrons with energies below 10.5 MeV from a surface of cylindrical lead target vs energy of incident proton is presented in Fig.1. As one can see, the peak is observed for incident proton energy about 1 GeV. A fall in neutron yield at energies less then 1 GeV is determined by energy ionization losses of primary protons. Neutron yield decrease at energies greater than 1 GeV is connected with competetive pion production. Therefore the optimal energy for generation of neutrons is about 1 GeV.

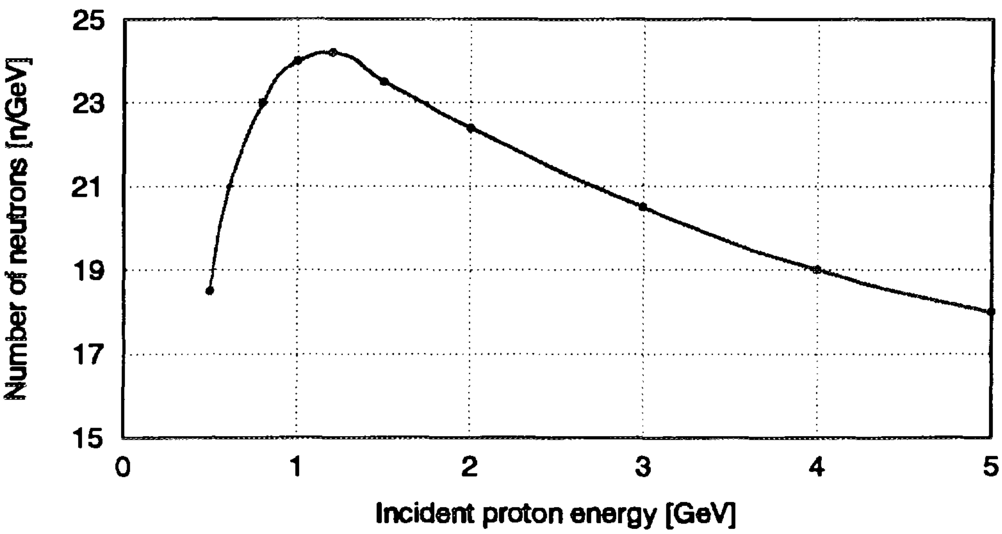

Fig.1 Number of low energy neutrons (below 10.5 MeV) per incident proton energy from surface of cylindrical lead target (d=20 cm,l=60 cm).

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