THE UTILIZATION OF A CYCLOTRON CV-28 IN BASIC AND APPLIED NUCLEAR RESEARCH AND IN AN EXPERIMENTAL ACCELERATOR DRIVEN SYSTEM ZERO POWER LEAD SUB CRITICAL FACILITY

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The IPEN CV-28 cyclotron is a compact, isochronous, multi-particle radiation source where protons, deuterons, $^3He^{++}$ and alpha can be accelerated with variable energies up to 24, 14, 36, and 28 MeV respectively. Discussion among the Brazilian Community interested in the utilization of accelerators into basic and applied research is resulting in a cooperative program or research network. with three main legs: R&D in Basic Applied Nuclear Physics and Engineering, Products and Services (e.g. radioisotopes), and an ADS (Accelerator Driven System) as an innovative neutron source which can be used to realize research in waste transmutation and energy production This paper will describe the CV-28 and the needed strategies to have it fully operational, and utilized in the areas above described. The present community interest are: low energy cross sections nuclear reactions, charged particle activation analysis, hydrogen implantation for angular correlation studies, excitation function determination, helium embrittlement in structural reactor materials, radiation damage in metals and alloys, thin layer activation (TLA), beam monitoring, target development, new routes and new radioisotopes production and study of fission fragments induced by deuterium into uranium target. On the other hand there are many other possibilities such as neutron radiography, Rutherford back scattering (RBS), elastic recoil detection analysis (ERDA), particle induced X-ray emission (PIXE), perturbed angular distribution, Mösbauer spectroscopy and material modification with energetic beams. Besides these applications, which will be reviewed in the paper, a conceptual design of a zero power Lead U/Th Metallic Fuel Sub critical Facility which utilizes an accelerator beam into a target (Be, Li) to produce the external neutron source will be presented. This facility will be used for the Reactor Physics studies of ADS, allowing starting research in such innovative system. The core will consist of a square lead block with holes containing the fuel elements and cooled by air. Calculations will be performed by using LAHET and MCNP-4C code systems to obtain some reference parameters, such as source term (target), k_{eff} and flux distribution.

Determination Of The Gamma-Ray Linear Attenuation Coefficient Of Irregular Soil Samples By The Application Of The Two Media Method.

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In several situations of nuclear applications, the knowledge of the gamma-ray linear attenuation coefficient for irregular samples is necessary, as occurs in soil physics and geology. This work presents the validation of a methodology for the determination of the linear attenuation coefficient (μ) of irregular shape samples, in such a way that it is not necessary to know the thickness of the considered sample. With this methodology it was studied irregular soil samples (irregular field samples) of Londrina region, north of Paraná. It was employed the μ determination equation for the two media method. It consists of the μ determination through the reduction of a gamma-ray beam by soil samples sequentially immersed in two different media, with known and appropriately chosen attenuation coefficients. For a comparison, the theoretical value of μ was calculated by the product of the mass attenuation coefficient, obtained by the Win-Xcom program, and the measured value of the density of the sample. This program uses the chemical composition of the samples and it supplies a table of the mass coefficient attenuations versus the photon energy. To verify the validity of the two media method, pome stone samples of thickness 2,49cm it were used. Using this kind of porous sample, μ was determined by the simple transmission method, for which it was obtained $\mu = 0,1472 \pm 0,0014 cm^{-1}$, and for the two media method using the media marble powder and sand it was obtained $\mu = 0,1443 \pm 0,0025 cm^{-1}$. For the media marble powder and mica it was obtained $\mu = 0,1435 \pm 0,0031 cm^{-1}$, and for the media sand and mica, $\mu = 0,1437 \pm 0,0033 cm^{-1}$. With the results, for the attenuation coefficients and their respective deviations, it was possible to compare the two methods. In this way we conclude that the two media method is a good tool for the determination of the linear attenuation coefficient of irregular materials, particularly in the study of soils samples.

CESIUM-137 DISTRIBUTION IN TROPICAL FRUIT TREES

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In 2001, a study based on the environmental consequences of the radiological accident in Goiânia (Brazil) was made by our group (1,2). Measurements of the Cesium-137 concentration in some tropical fruits samples were performed. Different fruit trees cultivated on the same Cesium-137 distribution profile in the soil showed significantly different values of specific activity for their fruits samples.