On the other hand, studies on the response stability of this detector in SQS regime are under way.

[02/09/03 - Poster]

Characterization of topographical effects in specters RBS

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Spectrometry RBS is one of the methods of characterization of used samples more, being possible to get information such as thickness and composition of the same ones. Recently, it comes being carried through studies that aim at its use for the study of topographical characteristics, as the roughness, as described in the book text of Chu (1978), Bill and Edge (1980), Shorin and Sosnin (1992). Metzner (1997) established that the form of specter RBS can be influenced by distribution of heights of the surface, p(h), considering incidence and backscattering with regard to normal. The objective of the present work is to expand this model for different angles out of the normal, what it will be made by means of simulations and experiments with models standard (periodic roughness) and samples with random roughness. For the simulation of p(h) was developed a code in C++ in had been gotten the distributions of corresponding heights the regular profiles of roughness, in the cases quadratic and to triagular. The experimental study, it was developed from the model considered for Metzner for attainment of p(h) from specter RBS gotten experimentally and analyzed the light of one simulated by the RUMP, being that the analyzed sample was a composed film for Sn and in two situations: with and without baking, and its surfaces were analyzed through Atomic Force Microscopy (AFM). The analysis for attainment of p(h) was made from a set backscattering angles, that were possible thanks to a mobile system of detectors, developed for such purpose.

[02/09/03 - Poster]

Neutron Flux Spectrum Assessment in an Am-Be Neutron Irradiator

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A small neutron irradiator prototype is being developed at IPEN's facilities (Instituto de Pesquisas Energéticas e Nucleares - Brazil) so that it can be used outside the reactor premises. Basically, this prototype consists of a $1200mm$ long cylinder with $985mm$ diameter (filled with paraffin) with two Am-Be sources ($\sim 600GBq$ each) arranged in the longitudinal direction of its geometric center. The material to be irradiated can be positioned in different positions at a radial direction of the cylinder between the two $AmBe$ sources. The development of appropriate nuclear instrumentation to perform neutron activation analyses using fast neutrons can be useful to perform neutron dosimetry, to investigate materials outside the reactor premises and for detector testing. The use of this irradiator presents the advantage of supplying a stable neutron flux for long periods, so that it eliminates the need of using standard materials in quantitative analyses. This way induced activity measurements in the irradiated material become agile, practical and economic. To establish the prototype specifications, the neutron flux distribution was calculated using the MCNP-4C. In order to validate these results for a wide range of energies, measurements with activation foils were performed, and the agreement between the experiments and the MCNP simulation is discussed.

[02/09/03 - Poster]

On the Origin of the Satellites Peaks in Alpha Particle Spectra

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The widespread study on silicon diodes performance in the spectrometry of charged particles is due to the possibility of their use as a research tool both in laboratory and in industrial applications as the measurement of the isotopic ratios between chemical elements. In order to employ this technique in studies related to reactor fuel elements and their properties after irradiation, we have been studying the response of silicon diodes for alpha spectrometry.
The devices studied during this work were: a S3590-06 PIN photodiode (*Hamamatsu*) and an implanted silicon diode (type $Al/n^+/p/n/Al$) manufactured at CERN. The diodes were housed inside a stainless steel vacuum chamber and its electric leads were connected to the charge sensitive preamplifier (based on an integrated circuit A250 from *Amptek*) whose output was further amplified and shaped and finally fed to a multichannel analyzer.
In order to verify the performance of the S3590-06 photodiode (which bears two guard rings) for heavy charged particle spectrometry, several energy spectra were recorded using a 5.5kBq mixed alpha source of ^{239}Pu, ^{241}Am and ^{244}Cm. The experimental results showed that, even at room temperature and without reverse bias, the alpha particles of the principal group of each isotope were observed. Even though the good influence of the bias voltage on photodiode energy resolution was evidenced (FWHM = 17.4keV for the 5.486Mev line from ^{241}Am), the results revealed some unexpected low intensity peaks spaced about 200keV below each of the three main peaks.
The origin of these satellites peaks were firstly thought to be due to incomplete charge collection in weak electric fields around the edges of the diode, near the guard ring region. So, one should expect that the relative intensity of

these satellites peaks would increase with the number of guard rings of the diode. Having in mind this perspective, we carried on some alpha spectra using a new silicon diode, manufactured at CERN, which enabled us to select from one to ten guard rings. Surprisingly, even when ten guard rings were connected to the ground, the relative intensity of these peaks were about 1% compared to the true peaks.
This behavior indicates that the true cause of these spurious satellites pulses might be not only associated with the weak electric fields around the guard ring region but also with changes on the entrance window absorption near the edge of the diodes. Further steps are needed to clear up this problem.

[02/09/03 - Poster]

Two-parameter analysis of the temporal behaviour of resistive detectors

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A computer program was developed to analyse the data acquired from cathode resistive detector by the data acquisition system **Gonk**. The output signal produced by these detectors decays with time due to the increase of the charge accumulated on the detector cathode which diminishes the effective high tension applied between detector-cathode and -anode. This decay depends on the glass material which is made the cathode and varies also with the measured count rate.
This acquisition system gets the data from the device driver and then builts and displays a two-dimensional matrix (energy × time histogram) representing the data.
The data was adjusted by least squares minimum method to a gaussian function whose centroid follows two exponential decay, as:

$$F(x,t) = \frac{A}{\sqrt{2\pi s^2}} e^{-\frac{1}{2}\left(\frac{x-x_c}{s}\right)^2} + d \tag{1}$$

where

$$x_c = x_c(t) = x_{c0} + a_1 e^{-b_1 t} + a_2 e^{-b_2 t} \tag{2}$$

is the centroid of the gaussian peak,

$$s = s(t) = s_{c0} + s_1 e^{-s_2 t} + s_3 e^{-s_4 t} \tag{3}$$

the standard deviation, and a_1, b_1, a_2, b_2, s_{c0}, s_1, s_2, s_3, and s_4 are parameters, d is a constant related to a possible flat background, A to counts, and x is position in the channel axis.
The results for a detector of 36.10 mm diameter, 1.16 thickness, $1.5\times10^{11}\ \Omega\ cm$, $k = 5(\rho\epsilon = 0.066s)$, 50μ diameter stainless stell anode, gas mixture P-10, 4 kHz count rate, ^{109}Cd radioactive source, and 120 s counting time are

$x_{c0} = 144(1)$ $A = 298(27) \times 10\ count \cdot s^{-1}$
$a_1 = 162(3)$ $a_2 = 37(3)$ $b_1 = 0.130(5)s^{-1}$ $b_2 = 0.021(3)s^{-1}$
$s_{c0} = 20.9(2)$ $s_1 = 15.6(14)$ $s_2 = 0.077(8)$
$\chi^2 = 0.72$

These values for b_1 and b_2 correspond to decay times of $7.7(30)s^{-1}$ and $48(7)s^{-1}$, respectively.

[02/09/03 - Poster]

Semi-empirical Compton Scattering Profile for Large Volume Germanium Detectors

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One of the main continuous component of the response function (RF) for germanium detectors is the Compton scattering occurring in the germanium crystal, due to the detection of gamma radiation. The other continuous components are the incomplete charge collection due to the escape of secondary electrons and the escape of bremsstrahlung photons. The description used for single Compton scattering in semi-empirical response function treatments shows a good agreement between experimental values and theoretical models[1-2]. On the other hand the multiple Compton scattering, double and triple, still presents some disagreement[2]. In some applications of the RF good precision and accuracy are needed, in order to determine, for example, the transition intensities and energies of photons lying in the Compton region (photon detection is represented by peaks in the spectrum). In addition,