

Background gamma rays in beam hall at IUAC

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Introduction

In gamma ray spectroscopy experiments especially, those in which count rate is low, the measurements of background gamma rays are very crucial. These measurements became even more important if singles measurements are done, e.g. study of decay products from various reactions. Indian National Gamma Array (INGA) and Heavy ion recoil analyzer (HIRA) are two major facilities at Inter University Accelerator Centre (IUAC) where some of these studies were done. We have measured the background gamma rays in the beam hall 1 and beam hall 2 at these experimental sites. The details of these measurements are presented below.

Experimental details

The gamma rays emitted from various radioactive nuclei presents in surroundings have been detected using HPGe clover detectors. The output signal from the charge sensitive preamplifier housed in the detector assembly fed to the inhouse built IUAC-INGA clover electronics modules [1]. Energy and efficiency calibration were done using radioactive source ¹⁵²Eu. The data was sorted and add-back spectrum were formed using the analysis program CANDLE [2].

Results and Discussion

In fig.1 and fig.2 the background gamma rays spectrum from INGA and HIRA target sites are shown respectively. In table.1 the observed gamma rays energies, their relative intensities (tentative error~10%), and possible sources with half-life are mentioned.

Table.1 Identified γ -rays energy & sources

INGA	Rel. Int.	HIRA	Rel. Int.	Element	Half-life
-	-	122.6	15.5	⁵⁶ Fe	-
239.5	49.4	238.8	18.4	²¹² Pb(t)	10.6m
296.5	11.2	295.6	11.4	²¹⁴ Pb(u)	26.8m
339.4	18.5	338.3	5.8	²²⁸ Ac(t)	6.15h
352.9	25.0	351.9	25.7	²¹⁴ Pb(u)	26.8m
511.4	38.0	511.3	43.5	Anh.	-
583.9	65.7	582.8	24.4	²⁰⁸ Tl(t)	3.05m
610.2	39.5	609.3	40.0	²¹⁴ Bi(u)	19.9m
727.7	18.4	727.4	4.44	²¹² Bi(t)	60.5m
-	-	810.4	29.2	¹⁸⁰ Au	1.17m
861.1	11.3	-	-	²⁰⁸ Tl(t)	3.05m
911.8	66.2	910.7	23.2	²²⁸ Ac(t)	6.15h
1120.6	16.2	1120.1	18.8	²¹⁴ Bi(u)	19.9m
1460.7	160	1460.6	48.7	⁴⁰ K	1E9y
1591.9	17.1	1592.1	2.54	-	-
1728.7	1.8	1729.1	1.18	²¹⁴ Bi(u)	19.9m
1764	18.5	2103.4	21.2	²¹⁴ Bi(u)	19.9m
2102.8	15.9	2103.4	2.4	-	-
2203.3	8.05	-	-	²¹⁴ Bi(u)	19.9m
2611.4	109	-	-	²⁰⁸ Tl	3.05m

Initially the background measurement was done only in INGA facility and it was found that ⁴⁰K, ²⁰⁸Tl, ²¹²Bi, ²¹⁴Pb and ²²⁸Ac are mainly present in the surrounding background. The 511 keV energy corresponds to the annihilation peak,

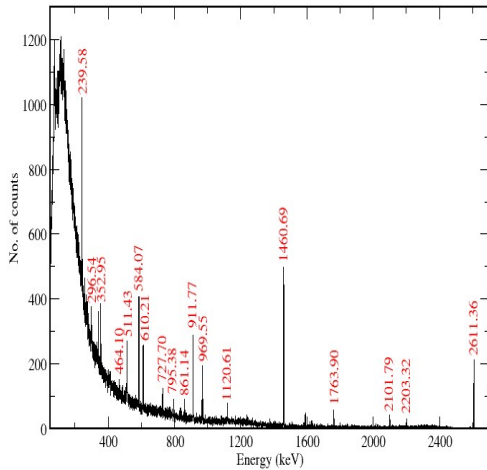


Fig. 1(a) Background from INGA target site

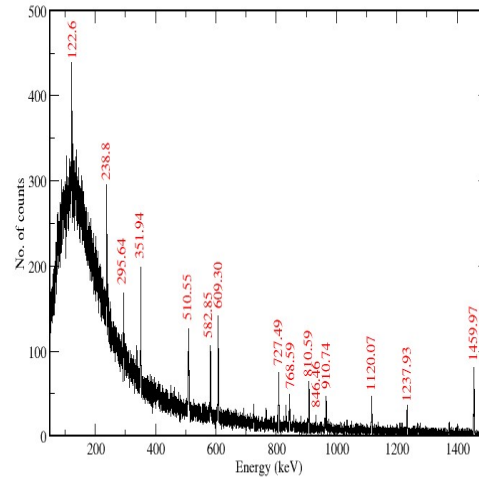


Fig.1(b) Background from HIRA target site

1592 keV and 2103 keV are single and double escape peaks of 2614 keV gamma ray. The 122.6 keV and 810.4 keV gamma rays are present in data taken from HIRA site but are not present in data from INGA site. Most of identified nuclide belongs to Uranium and Thorium series and were assumed to be present in the soil, rock, cement and concrete of the floor and shielding [3].

Acknowledgement

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