Indian National Gamma Array in Beam Hall II at IUAC

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One of the themes for studying nuclear structure is to explore the "frontiers of nuclear structure". For heavy nuclei, the frontiers are defined by the extremes of (i) N/Z ratio corresponding to the structures of nuclei far from stability close to the drip lines, (ii) limits of mass and charge exploring the super-heavies and (iii) limits of angular momentum. The most outstanding feature of high-spin physics is that the de-excitation of a nucleus formed under extreme conditions can often be associated with specific nuclear deformations. Some spectacular examples of intrinsic states are superdeformed and hyperdeformed shapes corresponding to huge elongation of nuclear density, pear-like shapes characteristic of parity breaking in the intrinsic system and magnetic deformations represented by shears bands.

In this regard, an Indian National Gamma detector Array (INGA) consisting of 24 Compton suppresed Clover detectors (each detector having an intrinsic photo-peak efficiency $\sim 0.2\%$) with a total photopeak detection efficiency $\approx 5\%$ is being assembled at IUAC for doing experiments with LINAC beams in Beam Hall II (refer Table 1). INGA is a combined facility by the various Universities and Institutions in India for overall improvement in the resolving power of the array and to push the observational limits. The earlier INGA campaigns with less number of detectors (at TIFR in 2001, at IUAC in 2003 and at VECC in 2006) have led to a large number of publications in high spin spectroscopy.

For the identification of rare processes (observational limit $< 10^{-4}$) by gamma coincidences, it is essential to have a minimum of three fold $\gamma-\gamma-\gamma$ coincidences with the first transition selecting the nucleus of interest and the second selecting the band under consideration. For the selection of weak reaction channels in the presence of a strong contaminant, the combination of a charged particle array and a recoil mass separator provides complementary information about the two parameters Z and A. A new generation HYbrid Recoil mass Analyser (HYRA)[1] is being developed at IUAC to do additional A, Z selection. The proposed array, combined with HYRA, would have an observational limit $\sim 10^{-5}$.

All the Clover Germanium detectors will be cooled by a dedicated automatic liquid nitrogen filling system[2]. Both the Germanium detectors and the Anti-Compton shields will be powered (detectors and preamplifiers) by home made modules[3] while the signals from suppressed Clover detectors will be processed by home made Clover modules [4]. The signals will be digitised by the 8 channel 13 bit CAMAC ADC-814 developed in-house. Multi CAMAC crate based data acquisition CANDLE[5] will be used for collecting data from all the detectors. The detectors are arranged in two hemispherical structures (Fig. 1 and 2) each movable on precision rails by dedicated controlled motor. In the HYRA-INGA combination the forward structure will be removed and the back structure can be moved forward to HYRA target. The arrangement of detectors is shown in Table 1. The features of the INGA facility will be presented.

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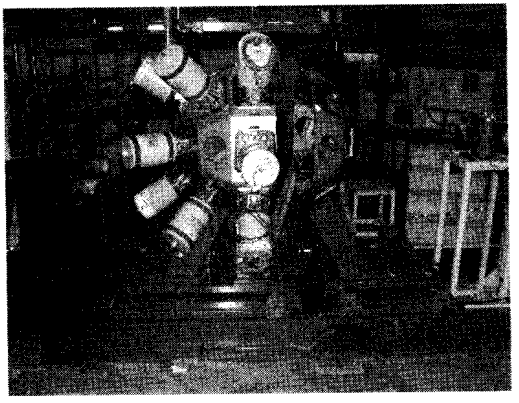

FIG. 1: INGA array under installation in Beam Hall II at IUAC.

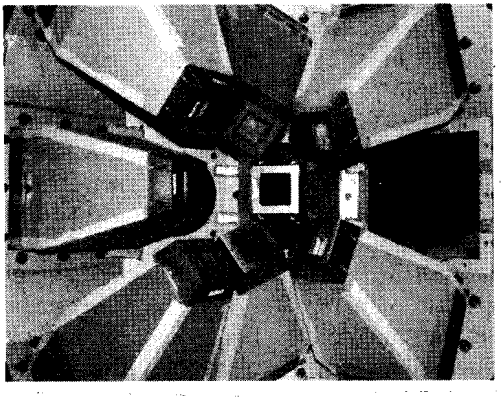

FIG. 2: Inside view of INGA array.

TABLE I: Arrangement of detectors in INGA array.

Angles of the detectors (θ ; ϕ) w.r.t. beam	**Number of detectors**
Forward hemisphere	
32° ; 0°, 90°, 180°, 270°	4 Clover/ACS
57° ; 45°, 135°, 225°, 315°	4 Clover/ACS
61° ; 0°, 90°, 180°	3 LEPS
Backward hemisphere	
90° ; 0°, 45°, 90°, 135°, 180°, 225°, 270°, 315°	8 Clover/ACS
119° ; 0°, 90°, 180°	3 LEPS
123° ; 45°, 135°, 225°, 315°	4 Clover/ACS
148° ; 0°, 90°, 180°, 270°	4 Clover/ACS

References

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