

Program to adjust the calibration parameter during drift and create runwise input file for INGASORT, CANDLE and LAMPS

Anuj^{1*} and Suresh Kumar¹

¹Department of Physics & Astrophysics, University of Delhi, Delhi - 110007, INDIA

1. Introduction

During last two decades, nuclear high-spin phenomena have been the subject of interest in both experimental and theoretical points of view. Fusion evaporation reactions became the primary tool to populate high spin states in nuclei using Indian National Gamma Array(INGA) setup [1–3]. After 2008, INGA setup is moving among national accelerator facilities i.e, IUAC, TIFR and VECC. The experiments performed in these facilities creates a large amount of data and different Data Acquisition System(DAQ) such as CANDLE, PIXIE [1, 2] etc used for the sorting of the data. In addition, these experiments creates large number of data files with finite number of energy and timing parameters(e.g, 96 energy and 24 timings signals at IUAC, New Delhi). In order to analyse the data, INGA user community are using different program such as CANDLE, LAMPS and INGASORT to create different type of matrices. Users have to learn each program to create input files for the execution of these programs to generate different type of matrices(All vs All, DCO, Polarisation etc). It is evident that one has to devote sufficient months for the calibration, drift correction and gain matching, importantly to create input files for the programs used to generate matrices at different facilities.

In this work, a program is written to take care of drift correction and generation of input files for different runs with a

*email ID: anujsih10@gmail.com

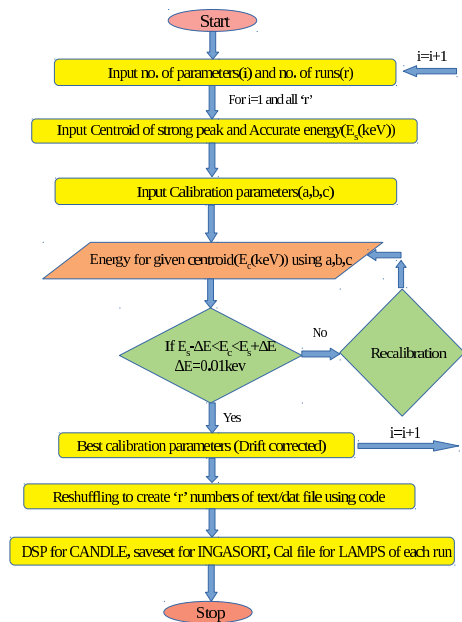


Figure 1: Flowchart of the method.

motivation to reduce the time and optimize the calibration parameters to a standard energy. The working methodology of program is shown in Fig. 1 and the program is tested on the data of INGA [3] spectrometer at IUAC, New Delhi.

Important highlights of program:

- Calculation of centroid of peak (presently using DAMM software but in future new code will be provided).
- Standard energies are obtained by calibrat-

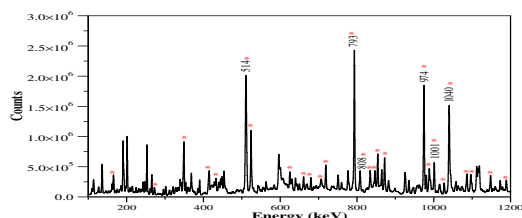


Figure 2: Projection Spectrum of coincidence data obtain for $^{76}\text{Ge}(^{12}\text{C}, 4n)^{84}\text{Sr}$ at 58 MeV. The gamma-rays belong to the ^{84}Sr nuclus are labelled by *.

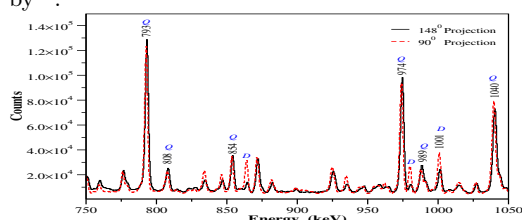


Figure 3: The spectrum shows the projection of asymmetry matrix to obtain the DCO ratios values, red dotted line for 90° and black solid line for 148°

one week. The error/correction can be rectified at any time or at any stage.

2. Results:

Figure 2 and 3 are results of the matrix that obtained from the above mentioned method. The quadrupole (Q) and Dipole (D) nature of the gamma-ray transition is marked in Figure 3.

In future, we are looking for a automatic program from raw calibration to matrix formation.

Acknowledgement:

One of the author(Anuj) acknowledges the financial assistance provided by CSIR, in the form of Junior research fellowship(09/045(1597)/2018-EMR-I).

References

- [1] R. Palit *et al.*, Nucl. Instrum. Methods Phys. Res. A **680**, 90(2012).
- [2] S. Das *et al.*, Nucl. Instrum. Methods Phys. Res. A **893**, 138(2018).
- [3] S. Muralithar *et al.*, Nucl. Instrum. Methods Phys. Res. A **622**, 281 (2010).
- [4] H.W. Muller and J. W. Tepel, Nucl. Data Sheets **27**,339 (1979).
- [5] J. B. Ball *et al.*, Phys. Rev. C **8**, 1438 (1973).
- [6] D. C. Montague *et al.*, Z. Phys. **261**, 155 (1973).
- [7] K. Ogawa, Phys. Lett. **45B**, 214 (1973).
- [8] A.Dewald *et al.*, Phys. Rev. C **25**, 226 (1982).
- [9] S.Chattopadhyay *et al.*, Phys. Rev. C **50**, 93 (1994).

ing one of the clover detector, having best resolution. χ^2 minimization is adopted for the selection.

- Input file to provide the information of the parameters(energy and timings signals active during the experiment).
- Drift correction and new calibration parameters are calculated for desired sensitivity ($E \pm \Delta E$, where ΔE can be controlled e.g, $\Delta E = 0.01\text{keV}$) and program is optimized to take care of all parameters and all runs in a given experiment.
- Choice to create different matrices e.g, All vs All, DCO and Polarisation etc., the input files will be generated for CANDLE, INGASORT, PIXIE(TIFR & VECC) and LAMPS.

With this program, we are able to do calibration, gain matching, drift correction and matrix formation within