

The Blue Database for High-Fold Analysis

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Data analysis is one of the more challenging aspects of performing experiments with large HPGe gamma-ray spectrometers arrays such as Gammasphere. During an experiment, approximately 10^9 coincidence events, corresponding to nuclear de-excitations within the array, are recorded to magnetic tape. These coincidence events typically consist of 4 to 8 gamma-ray energies, as well as detector ID's, relative times, and information from auxiliary detectors. Traditionally, analysis of this data required one to repeatedly scan these data tapes to produce gated histograms. This time consuming process often discouraged full analysis of these data sets.

To address this problem we have developed *Blue* [1], an adaptive multi-key database for the storage and analysis of high-fold datasets. The query system of this database offers the flexibility of traditional tape sorting with performance characteristics approaching that of histogram based systems. Tables 1 and 2 illustrate the performance characteristics of *Blue* with a large Gammasphere dataset which populated high-spin states of $^{167,168}\text{Yb}$.

Several improvements made to the database this year have allowed analysis of wider variety Gammasphere experiments. The primary improvement is that the database has been extended to handle auxiliary data such as detector IDs and relative times. This allows one to apply the database to DSAM (Doppler Shift Attenuation Measurement) and isomer analysis. A second related improvement is the introduction of a new stream interface which gives the experimenter the flexibility of including cuts on auxiliary data when performing queries on the database without sacrificing performance. Additionally there have been many minor improvements which have decreased query times and reduced the programs memory footprint.

| fold | events | partitions | file size (Mb) |
|------|-------------|------------|----------------|
| 4 | 484,433,680 | 183,250 | 1,222 |
| 5 | 679,915,975 | 265,604 | 2,367 |
| 6 | 342,207,055 | 141,872 | 1,593 |
| 7 | 146,831,752 | 66,567 | 865 |
| 8 | 55,548,476 | 28,404 | 396 |

Table 1: Number of coincidences, partitions and file sizes for the Yb test case for folds 4 to 8.

| fold | counts in histogram | events read | time (s) index | time (s) data |
|------|---------------------|-------------|----------------|---------------|
| 4 | 22,273 | 554,404 | 2.32 | 1.70 |
| 5 | 80,408 | 5,504,029 | 3.52 | 16.12 |
| 6 | 92,988 | 10,086,546 | 1.77 | 37.23 |
| 7 | 79,452 | 10,207,402 | 0.85 | 44.95 |
| 8 | 53,799 | 7,866,068 | 0.50 | 41.11 |

Table 2: Number of coincidences which match a 3-fold gate on channels 412-417, 435-440, 457-463 corresponding to three transitions of the ground state band of ^{168}Yb . Wall clock time to read the database index and to carry out the query is also given.

The *Blue* database is used by the local nuclear structure group to carry out analysis of Gammasphere experiments and has recently been adopted by a number of Gammaspheres's university users.

[1] Accepted to NIM **A**