The GRETINA Spectrometer

GRETINA is a first-generation, HPGe-based, gamma-ray tracking detector. It uses highly segmented Ge crystals to provide position and energy information on each gamma-ray interaction point. This capability enables precise event-by-event Doppler correction of events from the position of the first interaction point, which allows the array to maintain spectroscopic resolution for sources with high recoil velocity. It also allows GRETINA to track the path of the incident gamma-ray through the detector and reject events that only partially deposit their energy in the array. This removes the need for active suppression and allows GRETINA to be scaled out to much higher efficiency than existing arrays.

GRETINA is a movable device and has recently completed its first physics campaign at NSCL The spectrometer is now beginning a physics program at ATLAS. The current detector configuration is 7 detector modules with each module consisting of 4 large-volume HPGe crystals. The total solid angle converge is approximate 1pi steradians and the efficiency is 6.6% total and 5.0% tracked at 1.3 MeV. The maximal data rate is 20000 gamma/s which reflects the large data rates and computational complexity involved in locating interaction points in real time. During the Argonne campaign we expect to add two additional quad detectors, Q2, a detector module which is being repaired, and Q9, a newly procured detector module. Once characterized, installed and instrumented these will provide additional efficiency to the array.

GRETINA has been interfaced with a with range of auxiliary detector systems including the S800 at NSCL, CHICO at ANL, and the BGS at LBNL. Interfacing of GRETINA to an auxiliary detector system occurs at three levels: timestamp synchronization, readout, and run control. Timestamp synchronization can be done by direct readout of GRETINA's 48-bit timestamp via the newly developed Myriad card, or by simple clock/sync signals shared between the two acquisition systems. Readout can be done independently, with data merging between the auxiliary detector and GRETINA based on timestamps completed offline. The auxiliary detector system can also send data over the network directly to GRETINA's global event builder allowing real time construction of events which eases the analysis task and allows for better online monitoring. Similar to readout, run control can either be done independently, or in concert with GRETINA through an EPICs based control system.

A focused development effort continues to expand the performance envelope of the spectrometer. As stated above, two additional quad detector modules have been procured outside the original scope of the project and a third will probably follow this year. This will provide significant efficiency improvements to the array. Furthermore, work on signal decomposition and

energy summing between segments continues with an aim to improve peak-to-total and rate performance respectively.