Status of GRETINA Project

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This report gives a summary of the status of the GRETINA project. Detailed reports of individual items will appear as separate contributions to this annual report.

In July 2005, GRETINA received the CD2A/3A approval. This allowed us to purchase three 4-crystal Ge detector modules. The order for the first module was placed in September and delivery is expected in November 2006. We follow the progress of the production closely via monthly phone or video conferences with the vendor.

We published the in-beam test results of prototype II [1]. The measured width of the gamma ray peak after Doppler correction, based on the position from signal decomposition and tracking, give a position resolution of 2 mm (RMS) in all three dimensions. This important result demonstrated that we can meet the functional requirement. In addition, we determined the main contribution to the position resolution is the uncertainty associated with the signal starting time (t_0). Thus, future improvement of the algorithm in t_0 determination could still improve the resolution.

The prototype II detector module was refurbished to have all the segments in good working condition, and new preamplifiers were installed. There are 18 segments with warm FET's, 18 segments with cold FET's, and the central channel has warm FET. Tests confirmed our estimations of the energy resolution of warm FETs; 1.1 keV at 60 keV (vs. 0.9 keV for cold). This validated our decision to use warm FET's for the production detector modules.

The mechanical design was completed this year. This included the support structure as shown in the figure, the liquid nitrogen filling system, and the target chamber. Finite element analyses were used in the design process to guarantee the required rigidity of the support structure. To ensure this design will fit the four potential sites (Cave 4C at 88" Cyclotron LBNL, FMA at ATLAS ANL, RMS at HRIBF ORNL, and S800 at NSCL MSU), we have worked closely with the staff of these institutions. We have collected 3D drawings of the experimental areas, as well as visited all the sites. We were able to meet the challenge of developing a common design which would position GRETINA at the ideal location of all the sites with minor modifications.

A workshop on signal decomposition was organized from May 31 to June 3 at FSU. Participants included GRETINA staff, and members of Majorana, AGATA, and TIGRESS collaboration. Recent world efforts in the development of signal calculation and decomposition were discussed, and data sets and programs from GRETINA R&D efforts were distributed to the participants. Currently, in addition to the LBNL effort, community participation included staff of ANL, FSU, members of Majorana at LBNL, and Tech-X supported by DOE SBIR.

We studied the preamplifier of the Ge detector supplied by the vendor, and determine its performance especially the rise time will meet our requirements. We completed the detector and electronics system grounding and shielding design, and produced a design document. Selected signal cables (individually shielded twisted pairs), and connectors (Radiall MMC series and AMP) were tested for their shielding performance. These results will aid our final selection of the cable and connector between the detector and the signal digitizer.

In computer software development, we have successfully carried out an end-to-end test, which demonstrated that the prototypes of all the software elements (i.e., event building, signal decomposition, tracking, data analysis, and data storage) required for the final system exist in an operational state and interoperate. We continued to improve data acquisition software by eliminating errors and added a new run control system. They make the detector testing jobs more reliable and easier to operate. We studied the factors controlling position resolution. These factors included grid size of base signal, t_0 of signal, and rise time of signal. In hardware, we have designed and purchased a prototype computer cluster (with 8 nodes). This farm will be used to develop and demonstrate parallelism in on-line data analysis, as well as to be used for data analysis.

Figure 1. Support structure for GRETINA. This structure has 21 possible positions for mounting the 7 modules. More than 7 modules are shown in this figure.

REFERENCES

[1] M.Descovich et al., Nucl. Inst. and Meth. in Phys. Res A 553, 535 (2005).