Overview of GRETINA project

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GRETINA has made progress in all areas of the project. A summary is given here. Detailed reports of individual items will appear as separate contributions to this annual report.

In February 2004, GRETINA passed the CD1 Review and received CD1 approval. This allowed us to start design work. A memorandum of understanding (MOU) with Oak Ridge National Laboratory was signed allowing the design of the liquid nitrogen system to begin. The MOU with Washington University for the target chamber and MOU with Argonne National Laboratory for trigger electronics and software components were also signed.

The 3-crystal prototype detector module was received in early June 2004, and a number of tests [1] have been completed: 1) tests to assess its compliance with specifications, 2) a singles scan to determine the crystal segmentation, 3) end-to-end measurements using a ^{60}Co source, and 4) an in-beam measurement to determine position resolution.

Following a detailed study of detector module design alternatives, we decided to use warm FETs and 4-crystals per cryostat [2]. The main advantages of this design are its cost effectiveness, higher reliability and serviceability, as well as simpler geometry.

From a simulation study, the effects of neutron damage on the pulse shape and position resolution were determined. The results indicate that the effect on the position resolution is small compared with the effect on the energy resolution.

An in-beam test of prototype II was carried out at the 88-Inch Cyclotron in July 2003. Using an improved version of the signal decomposition program, we performed Doppler shift correction on a subset of the data, and achieved a 14 keV energy resolution for the 2055 keV gamma-ray line. Comparing with simulations, this indicates a position resolution of 2.4 mm RMS in all three dimensions, consistent with the expected position resolution. Simulation results indicated that the main contribution of the position resolution is the uncertainty associated with the starting time of the signal [3].

For the mechanical system, the design requirements document has been completed and reviewed, and the conceptual design of the support structure started. A scanning table for testing of the three-crystal detector prototype has been built, and is in use. A target chamber has been fabricated for the in-beam test of the three-crystal detector module carried out in CAVE 4C of the 88-inch Cyclotron.

We produced and tested twenty units of the version II digitizer modules and they were in use in a prototype data acquisition system for testing the 3-crystal detector module [4].

The computing requirements document for the project was developed. The data acquisition software for detector tests was upgraded in a number of areas. The data readout speed increased substantially to about 8 MB/sec and CPU utilization was improved from 80% to 60% in the VME computer.

Three working group meetings were held in 2004. A workshop organized by the GRETINA Detector Working group took place at ORNL, on March 17-19 and included discussions and presentations regarding the mechanical support structure for the detectors. Effects of different detector designs on the mechanical system configuration were considered and discussed. Possible alternate support designs were explored and discussed with particular emphasis on the beam line configurations at the various installation locations.

A workshop on electronics requirements was held at Argonne National Laboratory on July 24-25. It gave the opportunity for the engineering team to interact with the user community, and an action item list was generated. A workshop on computer software was held at Lawrence Berkeley National Laboratory on June 22-23. In this meeting the status of the software development was presented, the software requirements were discussed, and an action plan for future work was generated.

A draft of Activity Hazard Document was written and a technical safety review meeting was held to review hazards associated with GRETINA.

REFERENCES

[1] "Test of the GRETINA 3-crystal prototype detector: I. Acceptance" and Test of the GRETINA 3-crystal prototype detector: II. characterization" in these annual reports.

[2] "Design of the GRETINA detector module" in these annual reports.

[3] "In-beam measurement of the position resolution of a highly segmented coaxial Ge detector" in these annual reports.

[4] "Data Acquisition System for the GRETINA Prototype Module" in these annual reports.