

SAMURAI-Si – a status report

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Last year a TWL (Texas-Washington-Louisiana) collaboration was established with groups from Washington University in St. Louis, MO (prof. LG Sobotka), Louisiana State University in Baton Rouge, LA (prof. J. Blackmon) and TAMU-Commerce in Commerce, TX (prof. C. Bertulani) to study the **“breakup of loosely bound nuclei at intermediate energies for nuclear astrophysics and the development of a position sensitive microstrip detector system and its readout electronics using ASICs technologies”**. The activities are planned also in collaboration with a group (prof. Motobayashi) from the RIKEN Nishina Center for Accelerator-Based Science in Wako, Japan. The microstrip detector is envisaged to be placed between the target and the entry into the SAMURAI spectrometer [1], a complex device under construction at the Radioactive Ion Beam Facility (RIBF) of RIKEN. The US side of the collaboration is financed by DOE and we name the construction part of it the SAMURAI-Si collaboration. This is a brief status report of the latter.

The goal is to build a detector system that can give simultaneously the angles of motion of the proton and the heavy core resulting from the dissociation of a projectile moving at up to 350 MeV/u. The solution accepted now is to use Si multi-strip detectors to determine the x, y positions at two locations, separated by a distance. The main problems that occur are:

- the size of detectors and the position resolution required. These set the number of channels to be handled. The current accepted design parameters are: detectors to cover a diameter of about 10 cm and a 0.75 mm resolution in both x and y directions.
- a very large dynamic range (energy losses from 2-300 keV for protons to 600 MeV for HI). This sets the design parameters of the electronics used.

Discussions at four meetings (in St. Louis, College Station and Wako) between the members of the collaboration determined initially the main lines of the work and then considered the results and problems of the various solutions proposed.

We are considering testing different silicon strip detectors, both double-sided and single-sided, made by Micron Semiconductors Ltd or by Hamamatsu Co.

Due to the large number of channels involved it was decided that we will use an ASIC solution for the handling of the detector signals. The electronics is based on the HINP16 chip, the electronics environment and the software developed at WU with their S. Illinois University collaborators [2]. Before the final product, to be installed at RIBF, a 512 channels system (named TABS) will be developed and tested at TAMU. A number of steps were taken here at TAMU, at WU and LSU, to have compatible equipment and installed software that would enable and facilitate tests of various parts of the equipment. It was determined that in order to meet the requirement of the very large dynamic range a new revision (rev 4) of the HINP16 chip must be designed and made and/or external CSA must be made. The WU group is working on the former, while our Japanese colleagues are working on two different solutions of the latter.

In order to streamline the choice and design process, a number of simulations of the detector system were made.

In the next three reports, progresses on these above topics are presented in more detail.

[1] Large-Acceptance Multi-Particle Spectrometer SAMURAI Construction Proposal, version 2010.

[2] G.L. Engel *et al*, Nucl. Instrum. Methods Phys. Res. **A573**, 418 (2007).