1.0 Wireless, Hand-Held Data Acquisition System for Imaging Detector (Year 2)

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Project Status

This second year thus far has seen progress toward the details of a prototype design and implementation. Originally deemed unreachable due to budget limitations, the emerging availability of polytungsten components manufactured in a 3D printing process has allow us to move our goal beyond the bench-top demonstration and pursue the goal of a functional prototype. Toward that end the activities have been focused on design for procurement of long lead time elements and the detailed design of electronics to fit within a prototype hand held package.

Compact modular arrays of SiPMs were identified and procurement of these long lead time items has been initiated. A method of interconnection utilizing a polyamide PCB was developed and a "flex-circuit" design has been designed that eliminates the need for connectors at the SiPM module interface. The design of the front end electronics is underway with a focus on the packaging of the electronics into a compact volume. A sodium iodide segmented scintillator module has been designed and procurement started for its fabrication. Currently we are awaiting the final drawing package for approval. The final dimensions of the design will drive the dimensions of the prototype housing.

Housing design has also been pursued with the development of a concept that will allow interchangeable collimators and a mixture of both plastic and polytungsten body parts that minimizes weight while providing necessary gamma radiation shielding and allows for good RF signal range. The inductive coupled battery charging allows the design of a sealable housing that would facilitate chemical sterilization. A plastic concept model of the housing has been made on our 3D printer to help in visualizing some of the fit and assembly issues.

Firmware for the programmable logic and software for the CPU have been in development as well during this period. Firmware for the programmable logic portion is being written in VHDL and more than half of the modules by number have been completed. Testing of those modules is ongoing. Software for the CPU and RF section

Project Plan

We expect to continue with the development of firmware and software for testing the data path. As components for the system are fabricated and arrive assembly will proceed with incremental testing. A student from the Science Undergraduate Laboratory Intern program for this coming summer will be assigned to the project and is expected to contribute to software development and testing.. The project is reasonably well-suited to provide an engaging and challenging multi-disciplinary experience for a student, and the intern's time is without cost to the program.

Original project milestones and status/expectations to date:

Month 1-4	Technology Review (DAQ, RF, PWR)	Complete
Month 4	Preliminary Technology Selection	Complete
Month 6	Acquisition of Candidate Subsystems	Complete
Month 10	Initial Data Acquisition System Tests	Complete
Month 12	Data Stream Test of RF Subsystem	Complete
Month 12	Bench top Demonstrations	Completed 8/2014 ~ 9/2014
Month 18	Acquisition of Detector Elements	In Progress
Month 20	Firmware, Software, Integrated Testing	3/2015 – 6/2015
Month 24	Demonstrations	7/2015 – 9/2015

Budget

Funds from the first period of performance have been allocated reasonably close to the original Phase 2 plan. The flex PCB and the main PCB are not yet complete and those costs for fabrication and assembly are remaining as expected subcontract costs. The fabrication of the polytungsten parts is also remaining in subcontract costs. Software and firmware development will continue as a large part of the effort in the remaining months of the period of performance. With an intern from the SULI program, the PI is expected spend additional supervisory time on the project.

No budget reallocations appear to be required.

Publications

none

Workshops/Conferences

none