

## Collaboration Questionnaire -- Instrumentation for FRIB

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- 1) What is the primary physics motivation and experimental capability of the proposed instrument and why is this important for FRIB science?

Data acquisition is critical to the success of almost every experiment at FRIB. Data acquisition system(s) for FRIB should provide sufficient readout capacity so experiments are not artificially limited in count rate. They should be very reliable and easy to set up so that beam time is maximized. FRIB data acquisition should provide comprehensive online monitoring and analysis systems so that experiments can be monitored and optimized to meet the physics goals. Because of the great diversity of proposed instruments, the many detector and experiment collaborations should come together to implement data acquisition with as many common elements as possible in one structure that FRIB can support.

- 2) What are the unique capabilities of this device that are not available in existing equipment? Is this instrument stand alone or is it to be used (solely or partially) in conjunction with other instruments. Could it be used at NSCL or other laboratories before FRIB?

Data acquisition will be changed over the next 10 years by the widespread use of new readout technologies, such as digital signal processing and ASICs, as well as new processor and storage technologies. Data acquisition at FRIB should support the detector readout technologies coming in the next 10 years, and the wider community that will be using the facility.

- 3) Describe the instrument in some detail – how does it meet the scientific requirements and what are the (estimated) performance specifications? Be brief but as detailed as you can. Is the design fixed or are multiple options still being discussed and encouraged?

Data acquisition at FRIB has to meet the needs of the many groups using the facility. It needs the flexibility to integrate instruments as complex as GRETINA or as simple as a silicon telescope. Data acquisition generally consist of three components; readout, slow controls and online analysis tools. Depending on requirements, this list may also include event builders and software-implemented triggers to couple different experimental subsystems. Both performance characteristics and design are not fixed, as the requirements for FRIB detector systems are not yet available. Most important is for the community to now decide on a basic philosophy for data acquisition at FRIB. Is data acquisition a common resource for all detector systems or is it different for each detector system? If different, how will detector systems be combined into one experiment?

- 4) What is the current stage of development of your project?

This project is in its initial stages, that of analysis to understand the requirements of the devices being proposed for FRIB, as well as the needs of the user community for data acquisition.

- 5) What is the approximate cost of the project: discuss possible sources of funding.

The data acquisition system has not been specified to the point where cost can be determined. We do not yet have a source of funding. In the culture of nuclear physics, data acquisition is typically provided as a part of facility construction and operation or as part of detector construction, or sometimes as a hybrid of the two. To fund this development separately, we will have to explore the collaboration of the detector developments with the data acquisition development, how DOE and NSF will support it and how FRIB will maintain it.

- 6) Please provide a brief list of collaborators and institutions. Spokesperson(s) provide contact info.

Members of the NSCL, ANL, ORNL and LBNL are participating in the workgroup.  
Robert Varner, varnerrl@ornl.gov  
Ron Fox, fox@nscl.msu.edu  
Ken Teh, teh@phy.anl.gov  
Mario Cromaz mcromaz@lbl.gov  
Other collaborators will be added as the process develops.

- 7) Please can you outline how your collaboration has been developing your project and how you are growing your collaboration (How many meetings? Participants?, Circular mailings? Have you a web-site?)

This project is just getting started. Our plan is to use the FRIB Equipment meeting to begin the requirements gathering, as well as to start forming data acquisition collaborations.

- 8) Did you consider alternative designs? What alternatives were considered? How did you arrive at a final design?

The detector working groups must give input based on the designs of their detector systems. We will also analyze the needs and intentions of the user community. Analysis of these requirements will lead to designs that will evolve to the final design.

- 9) What existing equipment exists in the US Community that has similar goals and characteristics, even if inferior in performance.

The other low energy labs, ANL ORNL, NSCL, LBNL have data acquisition systems. There is a common data acquisition system, CODA, at JLAB. There are several other acquisition systems in use within the community. Commercial data acquisition systems are available, as well as open source frameworks from which data acquisition systems could be constructed.