

Research statement summary for the Intensity Frontier Fellowship IFFELLOW_2018_1

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I am applying for a Fermilab Intensity Frontier Fellowship to spend one year at Fermilab and provide a leading contribution to the construction of the Mu2e electromagnetic calorimeter. If awarded the Intensity Frontier Fellowship, I will focus on the following topics:

- 1) I will work on a thorough campaign of tests to validate the performance of the calorimeter front-end, digitizing system (DIRAC) and DAQ. The tests will have to prove the compatibility between the calorimeter and the Mu2e DAQ systems before boards mass production can be started. The stability and reliability of many challenging hardware components and firmware features will have to be tested. Since the Fermilab DAQ group is responsible of the entire system architecture and the design of all the modules employed for data acquisition, including slow control and clock distribution to all sub-detectors, and all the necessary hardware systems are available only at Fermilab, performing the tests at Fermilab is the only viable option.
- 2) Calorimeter operation in vacuum has required the design of a dedicated cooling system for the detector electronics. This operational condition has impacted also boards design. The DIRAC printed circuit board has been designed to favor power dissipation through the edges, but also an external thermal plate has to be placed in contact with the electronic components of the board to transfer the dissipated power to the crate which hosts the board. The crate has an internal circuit flowing a cooling fluid. All the tests of the cooling system will be performed in a thermo-vacuum chamber we have designed and built at INFN and transferred to Fermilab to test the SiPM mass production. SiPM tests will be concluded within this year and the chamber will be available in 2019 to test the DIRAC cooling.
- 3) The 10% - scale calorimeter prototype named Modulo-0 and built in 2017 by INFN to perform a testbeam, will be moved from Italy to Fermilab in the fall this year. Module-0 is the only detector prototype available to test the performance and compatibility of the “full chain”, i.e. crystal, SiPM, front-end electronics, the DIRAC and the entire DAQ system. We plan to use cosmic rays and possibly organize a test beam at Fermilab.