

Summary of proposal

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I am applying for a Fermilab Intensity Frontier Fellowship to spend 6 months (beginning April 1st 2020) at Fermilab and play a significant role during the development of the calibration infrastructure for the Mu2e detectors. I will co-ordinate the on-site efforts associated with installation of the calorimeter calibration source system. In parallel, I will continue my leading role in the development of calibration algorithms for both the tracker and the calorimeter. This work will greatly benefit from being able to interact with the experts based at Fermilab. Specifically, if awarded the Intensity Frontier Fellowship, I plan to dedicate equal fractions of my time to 3 complementary areas within the calibration effort:

1. **Co-ordinating to ensure timely delivery and on-site installation of Calorimeter Calibration Source System:** The in-situ calibration system for the calorimeter will use radioactive source for the determination of the absolute scale and a laser system for a monitor of the photo-sensor gains. Caltech is leading the development of the source calibration system. The source calibration system provides an absolute crystal-by-crystal calorimeter calibration on demand. Calibration is provided by a 6.13 MeV oxygen line. Low energy neutrons from a DT generator irradiate Fluorinert fluid (FC-770) outside the detector and the activated liquid is pumped through pipes to front faces of crystals. The calibration system and neutron generator will arrive on-site in 2020. It will be my job to collaborate with Mechanical Engineer throughout the installation process and ensure the system is efficiently installed and tested.
2. **Development of Calibration Framework For the Mu2e Calorimeter and maintenance of Offline software environment for the calorimeter:** Measurements from all calibration efforts must be combined in order for us to calibrate all crystals in both disks at a range of energy scales. I am developing the algorithm which will bring these calibration results together. In addition, I aim to make significant improvements to Offline infrastructure which communicates the calibration results. This will involve collaborating with calibration database and software experts at Fermilab.
3. **Development of Robust Framework For Cosmic Ray Muon based Alignment and Calibration of Mu2e Tracker:** I single-handedly developed, and will continue to maintain, the reconstruction software which will allow selection and reconstruction of high momentum cosmic muons for the purpose of calibration and alignment of the Mu2e tracker. I am now co-ordinating the effort to provide an in-situ alignment procedure for the internal elements of the tracker. I have formed a working group which will focus on the application and development of this cosmic muon reconstruction routine to the commissioning of the experiment. Being based on-site at Fermilab will help me to ensure swift communication between all groups now using this infrastructure and the on site calibration experts.

Mu2e is at a crucial point. The on-site installation of the Mu2e calorimeter and tracker will begin in 2020 with in-situ, beam-off calibration of both detectors beginning in 2021. Detector commissioning will continue throughout 2021-2022. During this period one important goal is to calibrate the detectors using cosmic ray muons. Before commissioning commences it is essential that we have well-validated schemes for calibration and alignment of the Mu2e detectors. During 2020 I will take a leading role in the development of such schemes.

To summarize, receiving an Intensity Frontier Fellowship would provide support for me to play a pivotal role in the Mu2e experiment during this very important time. I believe I am an excellent candidate for the fellowship. I am already developing many aspects of the Mu2e calibration framework, for both the tracker and the calorimeter. I want to make an active contribution to the experiment during the early stages of commissioning and being based at Fermilab would allow me to do this effectively. I want to ensure I develop a robust calibration platform which will benefit the experiment for many years. This is a crucial point in the lifetime of the experiment. In addition, I hope to promote and contribute to the intensity frontier while at Fermilab through my role in the early career network and as a student advisor. As an Intensity Frontier Fellowship I would also develop as an independent scientist, acquiring new skills and additional leadership and management skills.