The Intensity Frontier Fellowship Research Proposal

Operation of Electrostatic Focusing Quadrupoles and Beam Dynamics Systematic Uncertainties

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The muon g-2 experiment E989 at Fermilab must run with minimal downtime to reach its statistical goals within the constraints of the overall operations of the machine. Smooth running of the Electrostatic Focusing System (ESQ) is absolutely critical to maintain uptime of the experiment. The design and construction of the ESQ system was connected with several technical and engineering challenges due to uniqueness of the system, stringent physics requirements and space constraints. These include requirements to deliver a pulsed high voltage (up to 32 kV voltage amplitude) with small pulse-to-pulse voltage variation, stable HV pulse flattop, short distances between high voltage and ground potentials, minimization of the amount of material used, etc. A number of compromises had to be made to satisfy conflicting requirements to the system. As a result, the system is fragile and requires great care in handling and operating. As Level-3 manager leading the R&D, refurbishment and upgrade of the ESQ system, my increased presence at Fermilab through Intensity Frontier Fellowship (particularly during run preparation and production data taking) to support the operation of ESQ will be of great benefit to the experiment. Since I have the expert knowledge of the system, my presence at Fermilab will assure minimal ESQ downtime.

Beam-dynamics systematics were the largest systematic in the Brookhaven g-2 experiment. It is critical that we keep these under control in E989. I am the analysis coordinator of Beam and Spin Dynamics of Stored Muons and acknowledged expert. The evaluation of beam-dynamics systematic uncertainties in E989 will require conducting special runs and analysis. Since I have the expert knowledge, I will direct the special runs for systematics studies and lead the analysis of spin and beam-dynamics systematic uncertainties. We are building a strong and sufficient team at Fermilab to accomplish the beam-dynamics studies that are needed. My increased presence at FNAL will assure that the team effort is synchronized and systematic effects are well studied and kept under control.