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Pressurized Gas Beam Monitor for Extremely High Intensities

Cooperative Research and Development Agreement Final Report

CRADA Number: FRA-2015-0012

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Summary Report
October 2, 2016

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In accordance with Requirements set forth in Article X of the CRADA, this document is the final CRADA report, including a list of Subject Inventions, to be forwarded to the Office of Science and Technical Information as part of the commitment to the public to demonstrate results of federally funded research.

CRADA number: FRA-2015-0012

CRADA Title: Pressurized Gas Beam Monitor for Extremely High Intensities

Parties to the Agreement: MuPlus, Inc. and Fermi Research Alliance, LLC

Abstract of CRADA work:

The performance of a gas-filled RF resonator will be numerically simulated to evaluate the sensitivity of permittivity measurements and the effectiveness of calibration strategies. An entire resonator-hodoscope system will be designed and a demonstration test prepared.

Summary of Research Results:

1. The performance of a gas-filled RF cavity was numerically simulated to evaluate the sensitivity of permittivity measurements and the effectiveness of calibration strategies:

- The fundamental processes in the production of ions when a beam of ions passes through a gas
- Simulations of beam particles passing through a gas RF cavity
- Simulations of frequency shift in a RF cavity as a function of beam position
- Studies of RF energy consumption by the RF cavity as a function of beam position to determine position measurement sensitivity
- Studies of addition of electronegative dopants to the gas and their effects on mobility of the heavy ions in the RF cavity
- Simulated beam profiles after the LBNF target, including secondary particles produced
- Simulation of LBNF conditions, such as low primary beam energy, long target and empty target. The range covers the expected beam intensities in NuMI and LBNF.

2. An RF cavity-beam profile system was conceived with corresponding subsystem demonstration tests:

- including the RF source, waveguide, and data acquisition system -descriptions given above in this narrative
- experimental plans to utilize intense beam facilities, MTA, FTBF and NuMI at Fermilab for a Phase II SBIR Proposal

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In addition, we presented the first evaluation of this novel hadron monitor at IPAC 2015.

Related Reports, Publications, and Presentations:

IPAC 2015 paper MOPMA028

Subject Inventions listing:

NONE

Report Date: October 2, 2016

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