

SMI-2023: 14th International Conference on Stopping and Manipulation of Ions and Related Topics



Contribution ID: 70

Type: **contributed talk**

Printed Circuit Boards for Ion Transport at the FRS Ion Catcher

Monday, 8 May 2023 17:20 (20 minutes)

Multi-layer printed circuit boards (PCBs) are dielectric substrates with a thin metal layer glued together. With the current PCB manufacturing processes, metallic 2D planar structures can be tailored with fine resolution (<75 μm) at a relatively low cost. These structures can be used to transport ions by applying the proper potential to the different planar electrodes. There is a wide variety of PCB-to-PCB and cable-to-PCB connectors, PCB mounting hardware, etc... making the use of several PCBs to create a 3D planar structure possible. Moreover, the PCB can also allocate, besides the electrodes which generate the electric field for ion transport, all the needed electronic components (resistors, capacitors...) to generate those electric fields, making it a monolithic structure easy to work with.

In the FRS Ion Catcher, several structures using PCB technology were designed and manufactured to transport ions in different environments, characterized by pressures ranging from low vacuum to atmospheric and temperatures ranging from cryogenic to room temperature. Those structures are mainly PCB radio frequency (RF) carpets. In the future, a PCB-based radio frequency quadrupole (RFQ) designed at the University of Edinburgh will be used at the FRS Ion Catcher.

A review of the different PCB-based ion transport structures used in the FRS Ion Catcher group and plans and developments covering fine-pitch RF Carpets, a PCB-based RFQ, and a testing chamber for future ion transport developments will be presented.

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Session Classification: Plenary Session 2