Ion Cooler for TAMU-TRAP Facility

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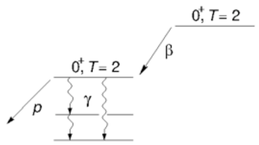
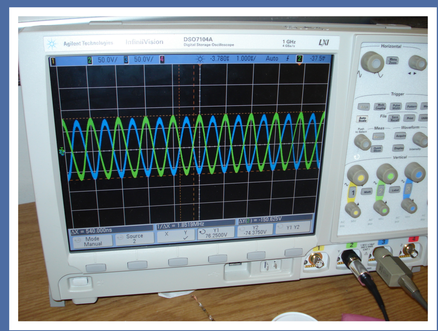
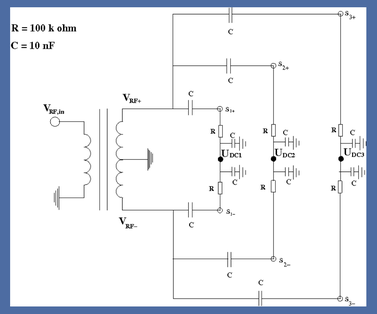
Introduction

One way to learn more about the weak interaction is to study the beta-neutrino correlation. This can be done by comparing the distribution of angles between the beta particle and and neutrino as they are ejected from the nucleus during T=2 beta-delayed proton decay. If the angular distribution does not match with predictions based on the current understanding of nuclear physics, it could be an indication of physics beyond the Standard Model.





Testing RF Voltages on Oscilloscope Showing Out of Phase Signals

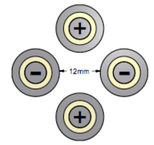


Circuit Diagram for Combining RF and DC

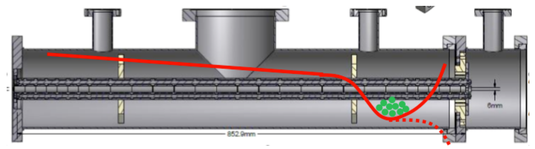
Radio Frequency Quadrupole

The Radio Frequency Quadrupole (RFQ) contains ^{4}He gas, which slows the particles down through collisions.

RF voltage applied to the four lengthwise rods keeps the particles centered. Rods opposite each other receive RF voltage in phase, while neighboring rods receive RF voltage 180° out of phase.



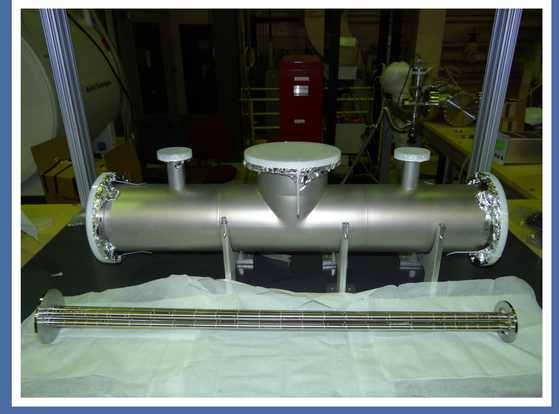
DC voltage on the rods guides the particles forward. Each of the rods are divided into 28 segments, allowing the DC voltage to be adjusted from 9V to 2V in small steps. At the end of the RFQ, the potential forms a valley, where the particles are trapped in groups before being released into the Penning trap.

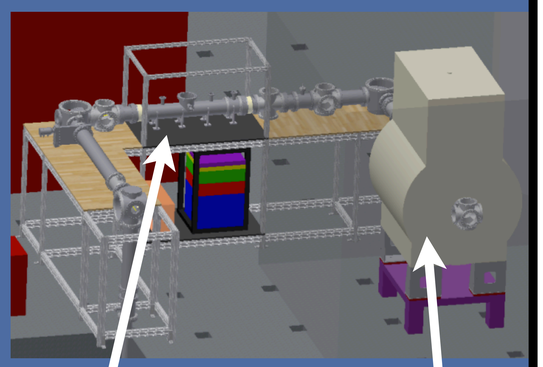


Progress

The segments have been assembled on the rods and the electronic components have been put together and tested. Next, the electronics will be fed through openings in the chamber and attached to the segments. Finally, the RFQ will be tested independently with an ion source before being placed in the beam line.

RFQ Chamber and Assembled Rods





Beam Line for TAMU-TRAP

RFQ

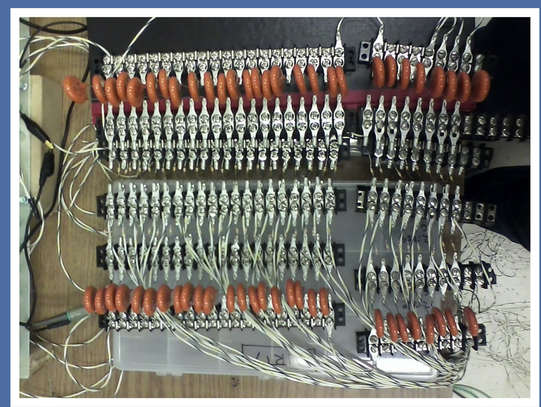
Penning Trap

TAMU-TRAP

Experiments studying the beta-neutrino correlation of ^{32}Ar have been done at other facilities, so we will begin with that isotope to check our accuracy. We will then do similar experiments on ^{20}Mg, ^{24}Si, ^{28}S, ^{36}Ca, ^{40}Ti, and ^{44}Cr, all of which follow the same T=2 decay and are expected to behave similarly.

Measurements will be taken within a Penning trap, which uses electric and magnetic fields to trap charged particles in three dimensions. The Penning trap only accepts groups of particles with a low velocity, so a RFQ Cooler / Buncher is a critical part of the new beam line.

RFQ Segments



Assembled Electronic Components

Acknowledgements

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