Progress on the GOLIATH upgrade for the He6-CRES experiment

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The Gas Operated Large Ion-Bunch Atomic Trap for He6-CRES (GOLIATH) radiofrequency quadrupole (RFQ) was designed to be a large throughput ion trap to supply ion bunches to the He6-CRES experiment in order to combat energy dependent losses without sacrificing statistics. In preparation for upcoming commissioning tests for GOLIATH, the TAMUTRAP beamline has been altered into a test bench centered on the high voltage crate that houses the RFQ. These alterations include downsizing the beamline, removal of the TAMUTRAP RFQ, construction of GOLIATH, characterization of two new microchannel plates with delay-line position readout, and the design of their requisite mounts.

Reducing the size of the beamline as seen in Fig. 1 allows us to minimize losses due to space-charge and misalignments, while also reducing the load on our vacuum pumps. With the RFQ having

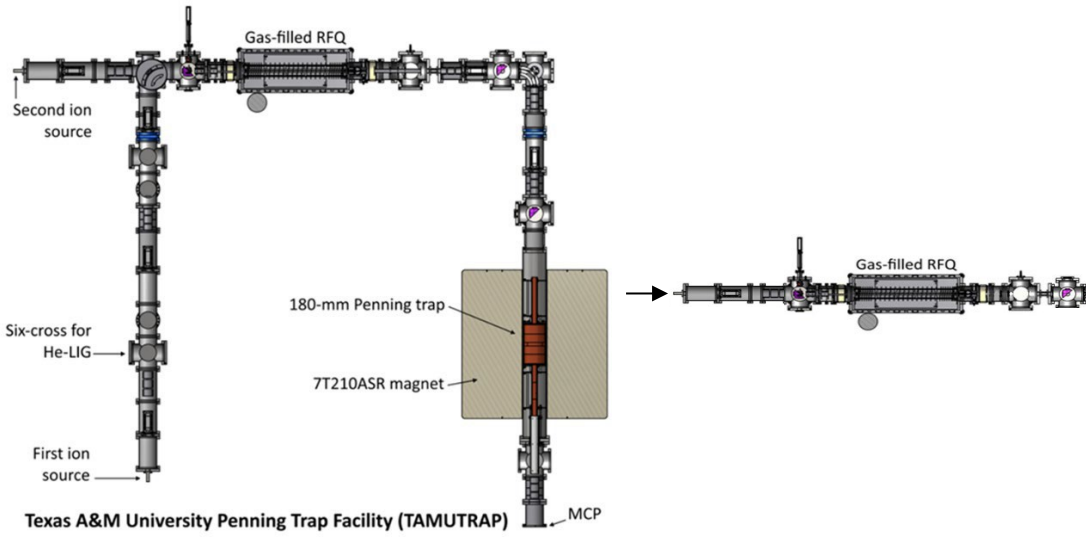

FIG. **1**. Aerial depiction of the TAMUTRAP beamline [1] (left) which has been repurposed to be the smaller GOLIATH test bench (right).

a very small acceptance window and no diagnostic tools until further down the beamline, the TAMUTRAP RFQ was removed and temporarily replaced with a Faraday cup to confirm beam acceptance. This works both in preparation for GOLIATH, which was designed to fit in the same box, despite being bigger in all aspects aside from the footprint as shown in Fig. 2.

Along with the design and alignment changes to the beamline, the detectors in use have been upgraded to 40 mm diameter delay-line anode MCPs for precision timing and position readout. With resolutions of 0.05 mm and 0.2 ns, these detectors will take an integral part in the commissioning of GOLIATH as we attempt to tune to the constraints of a radius of 3.17 mm and time spread of < 1 μs that will make it possible to trap in the upcoming Penning trap.

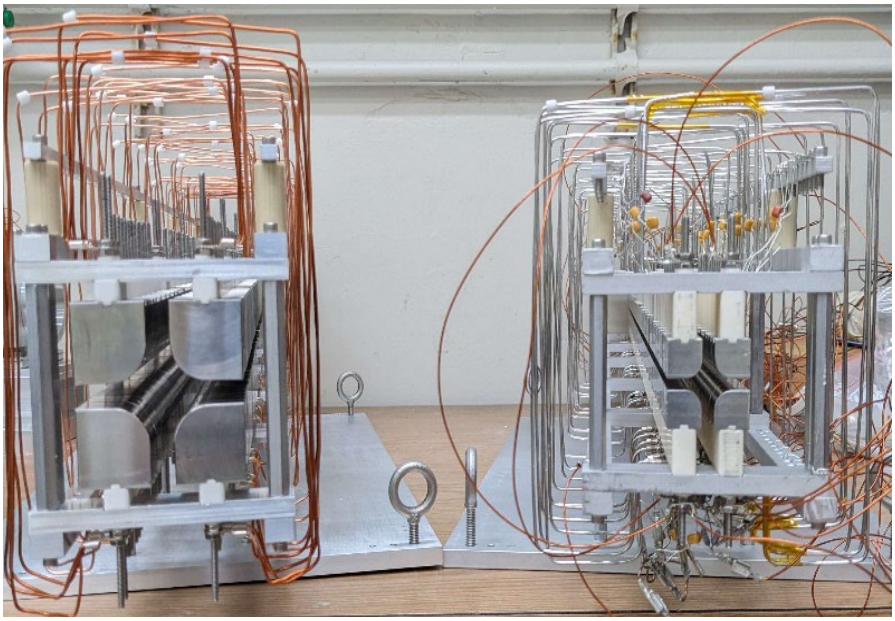

FIG. 2. GOLIATH (left) compared to the smaller TAMUTRAP RFQ (right).

With all components of GOLIATH gathered, commissioning tests are expected to take place this year. Following commissioning tests of GOLIATH at Texas A&M, it will be delivered to the University of Washington. Once there, the results of the tests will be crucial in the development of the beamline as we transition from a gaseous source to an ion source.

[1] V.S. Kolhinen *et al.*, *Progress in Research*, Cyclotron Institute, Texas A&M University (2019-2020), p. IV-101.