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Surface-electrode ion traps and technologies for scalable quantum information processing S. CHARLES DORET, JASON M. AMINI, KENTON R. BROWN, CHRIS SHAPPERT, DAVID LANDGREN, ARKADAS OZAKIN, HARLEY HAYDEN, C.-S. PAI, CURTIS E. VOLIN, Ga Tech Research Institute, LISA M. LUST, Honeywell International, ALEXA W. HARTER, Ga Tech Research Institute — As experiments in quantum information processing with trapped ions progress from few to many ion-qubits, it is imperative that trap designs and technologies keep pace. Surface-electrode traps offer one path to scaling experiments to large numbers of ions, but they will require the integration of many trapping zones and associated interconnects. We have developed a new trap ("Satellite") with separated loading, storage, and computation regions connected by a newly-designed X-junction. The storage regions feature inter-digitated control electrodes, allowing storage of up to twenty ions in each zone with only a moderate increase in the trap's lead count. Even so, future traps of increasing complexity will create challenges for experimental control. With this in mind, we are developing in-vacuum electronics [1] to reduce requirements for external control systems and simplify vacuum feedthrough requirements. We have also demonstrated co-trapping of $^{40}Ca^{+}$ / $^{171}Yb^{+}$ and are exploring strategies, both theoretically and experimentally, for sympathetic cooling of dual-species ion chains.

[1]In collaboration with Honeywell International

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