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Multi-pulse compensation sequences for quantum information processing with trapped ions S. CHARLES DORET, Georgia Tech Research Institute, TRUE MERRILL, KENNETH BROWN, Georgia Institute of Technology, ALEXA HARTER, Georgia Tech Research Institute — Now that the basic components of a trapped ion quantum information processor have all been demonstrated, many recent experiments have focused on scaling systems to larger numbers of qubits to permit the execution of classically intractable quantum algorithms/simulations. Microfabricated surface electrode ion traps offer one avenue for scaling to more qubits, allowing for the stable trapping of long chains of many ions. However, the small spacing between ions required for strong coupling makes the single-qubit laser addressing needed for arbitrary gate operations extremely challenging. Although such addressing is possible using tightly focused lasers, focusing requires cumbersome multi-element lenses and is highly sensitive to pointing instabilities. Transporting the target ion away from its neighbors is another option but is time consuming and may cause motional heating. Multi-pulse passband compensation sequences offer an appealing alternative that can simultaneously correct for errors in pulse amplitude and duration while reducing the effects of laser bleed-through on to neighboring ions. Here we report on experimental progress toward the use of such pulse sequences for individual addressing of $^{40}Ca^{+}$ ions without the use of complicated optics.

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