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Individual addressing of trapped ions using a MEMS beam steering system TAEHYUN KIM, CALEB KNOERNSCHILD, EMILY MOUNT, STEPHEN CRAIN, RACHEL NOEK, DANIEL GAULTNEY, PETER MAUNZ, JUNGSANG KIM, Duke University — Implementation of single-qubit and two-qubit quantum gates in a long linear chain of trapped ions generally requires the manipulation of qubits stored in individual ions using a set of laser beams. Individual addressing has been demonstrated with acousto-optic and electro-optic deflectors, by using the Zeeman shift due to a magnetic field gradient, and by separating the ions. Microelectromechanical system (MEMS) technology offers an alternative approach using micromirrors to focus laser beams on individual ions. Advantages of this approach are its broadband optical performance and scalability to more beams and multiple dimensions. We report progress towards integrating a MEMS beam steering system with an Yb ion trap experiment. The MEMS system will direct an ultraviolet beam with waist of $\sim$1.5μm at the ions across a 20μm range. For a designed ion separation of 4um this allows addressing up to 5 ions. The far-detuned laser will induce an AC Stark shift on a single ion in the chain, and the induced phase shift can be measured by Ramsey spectroscopy.

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