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Fast Ion Transport in a Surface Electrode Trap[1] SUSANNA L TODARO, DANIEL H SLICHTER, National Institute of Standards and Technology Boulder, DAVID J WINELAND, University of Oregon, ANDREW C WILSON, DIETRICH LEIBFRIED, National Institute of Standards and Technology Boulder —
In the 'quantum CCD' architecture for scalable trapped ion quantum computation [1,2], ion qubits are transported between trap zones dedicated to memory, readout, or gate operations. In most prior quantum CCD experiments, ion transport between zones has been performed on timescales much longer than those of typical laser-driven gate operations, representing substantial time overhead. Reducing this overhead by transporting ions faster will in general leave the ions in a higher motional state, requiring substantial recooling before subsequent gate operations. Fast transport with minimal final motional excitation has been demonstrated by transporting in an integer number of ion motional periods [3,4]. However, this scheme has only one parameter (the duration of the transport) that can be tuned to optimize performance experimentally. We report experimental results towards fast ion transport with low net motional excitation in a cryogenic surface-electrode trap using a new scheme offering increased tunability, which may help to transport multiple ions.
[1] Wineland et al., J. Res. NIST 103, 259 (1998) [2] D. Kielpinski, C. Monroe, and D. J. Wineland, Nature 417, 709 (2002) [3] A. Walther et al., PRL 109, 080501 (2012) [4] R. Bowler et al., PRL 109, 080502 (2012)

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