Progress toward making spin squeezed states with ions in a Penning-Malmberg trap.\textsuperscript{1} N. SHIGA, W.M. ITANO, J.J. BOLLINGER, NIST, Boulder, CO 80305 — We describe plans and summarize initial progress towards making spin squeezed states with a few tens to \(\sim 1000\) \(^9\)Be\(^+\) ions in a Penning-Malmberg trap. We use the ground-state electron spin-flip transition, which in the 4.5 T magnetic field of the trap has a transition frequency of 124 GHz, as the ion qubit. With a 30 mW Gunn diode oscillator we have observed Rabi flopping rates as high as \(\sim 1\) kHz. We will summarize experimental progress on realizing projection noise limited spectroscopy on this transition, which is a prerequisite for demonstrating spin squeezing. For entangling the ions we plan to use a generalization of the few ion qubit phase gate developed at NIST \textsuperscript{2} to generate an \(\exp(i\chi J_z^2t)\) interaction between all of the ion qubits. This interaction can be implemented on a single plane of ions \textsuperscript{3} with a motional sideband, stimulated Raman transition.

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