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Single Flux Rope Dynamics in the Reconnection Scaling Experiment YAN FENG, J. SEARS, T.P. INTRATOR, T.E. WEBER, H. SWAN, K. GAO, Los Alamos National Laboratory — A magnetic flux tube threaded by current is a flux rope with helically twisted field lines. In the Reconnection Scaling Experiment (RSX) we use a plasma gun to generate a single flux rope with a choice of axial boundary conditions. If this flux rope is driven hard enough, i.e., when $J \cdot B/B^2$ is larger than the kink instability threshold, we measure a helically distorted kinked structure. Rather than exploding in an Alfvén time, this kink appears to saturate to a steady amplitude, helical, gyrating flux rope, which persists as long as the plasma gun sources the current. To understand it, we have experimentally measured three-dimensional profiles of various quantities of this flux rope. These quantities include magnetic field B, plasma density n and potential φ, ion flow velocity v_i, so that current density J, electron flow velocity v_e and electron pressure P_e can also be derived. The full set of these quantities allows us to analyze the single flux rope dynamics systematically. Besides gyrating, we also find the flux rope has a spin center, around which the $J \times B - \nabla P_e \neq 0$ suggesting that there should be other forces for the radial balancing. We also find that within about 30 cm distance from the plasma gun, there is a reverse current moving around with the flux rope.

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