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A Bose-Einstein Condensate in a Box TODD MEYRATH, CHIH-SUNG CHUU, JAMES HANSSEN, GABRIEL PRICE, FLORIAN SCHRECK, MARK RAIZEN, Center for Nonlinear Dynamics and Department of Physics, University of Texas at Austin — We report experimental progress towards the quantum control of individual atoms from a Bose-Einstein condensate. Our system consists of a single one-dimensional BEC of rubidium-87 that is optically trapped in a crossed pair of Hermite-Gaussian TEM01 mode beams. Each beam is tightly focused in one direction and elongated in the other. The overlap of the two beams creates a narrow dark tube with mean transverse oscillation frequencies of 40kHz, comparable to what is obtained with optical lattices, but with a single condensate instead of many replicas. Axial confinement in our trap is provided by Gaussian beam end-caps producing a "particle-in-a-box" type geometry. At the smallest measured numbers of 300 atoms, we observe fragmentation of the condensate and have determined that it is due to slight variations in the optical potential along the axial direction. We have implemented an optical compensation scheme to flatten the axial potential. We have demonstrated single atom detection with nearly unit quantum efficiency and this setup is fully integrated with the new trap, paving the way for direct measurements of quantum atom statistics.

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