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Tracing the run-flip motion of an individual bacterium BIN LIU, School of Engineering, Brown University, MICHAEL MORSE, JAY TANG, Department of Physics, Brown University, THOMAS POWERS, KENNETH S. BREUER, School of Engineering, Brown University — We have developed a digital 3D tracking microscope in which the microscope stage follows the motion of an individual motile microorganism so that the target remains focused at the center of the view-field. The tracking mechanism is achieved by a high-speed feedback control through real-time image analysis and the trace of the microorganism is recorded with submicron accuracy. We apply this tracking microscope to a study of the motion of an individual Caulobacter crescentus, a bacterium that moves up to 100 microns (or 50 body lengths) per second and reverses its direction of motion occasionally by switching the rotation direction of its single helical flagellum. By tracking the motion of a single cell over many seconds, we show how a flip event occurs with submicron resolution and how the speed of a single cell varies over time and with the rotational rate of the flagellum. We also present statistics for the run-reverse dynamics of an ensemble of cells.

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