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FPGA for single-molecule recycling in a nanochannel SULTAN BEHERY, BO WANG, BRIAN K. CANFIELD, LLOYD M. DAVIS, University of Tennessee Space Institute — Single-molecule (SM) trapping and detection experiments are important in studying biophysical processes on the molecular level. As an SM is too small for optical trapping, prolonged observation requires measurement of the position and active feedback to counteract diffusion. In previous work, a custom-built Field Programmable Gate Array (FPGA) circuit board was developed for SM detection and real-time electrokinetic trapping in a fused silica nanochannel. The FPGA was used as part of a feedback system to control the voltage for electrokinetic movement of solution along the nanochannel in response to the time stamps of individual photons from the excited SM. Other researchers have since shown that alternating the flow in a nanochannel can be used to recycle an SM through a stationary laser focus for repeated observations and that the times between each passage yield a measurement of the molecule's diffusion. Improved measurements could be obtained by use of an FPGA for more precisely timed flow control. Therefore, we are now adapting the FPGA for SM trapping to use algorithms tested in a Monte Carlo simulation of SM recycling in an attempt to extend existing capabilities. This presentation discusses the custom-built FPGA board, algorithms, and ongoing nanochannel experiments.

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