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Polarization-Independent Photon Quantum Memorywith Variable Time Delay MICHELLE VICTORA, JIA JUN WONG, PAUL KWIAT, BRADLEY CHRISTENSEN, University of Illinois - Urbana, KEVIN MCCUSKER, University of Notre Dame, MICHAEL GOGGIN, Truman State University, NICK LARACUENTE, AUSTIN GRAF, University of Illinois - Urbana — A variable time delay photon quantum memory has many applications in quantum computation and communication. For instance, it provides precise synchronization of qubits, highly desirable in a quantum repeater architecture. Here, we are in the process of demonstrating a high-efficiency "digital" photon storage system using multiple optical cavities to create variable storage times. These cavities have delay times of 12.5 ns, 125 ns, and 1.25 μs, with capabilities for multiple photon storage in various degrees of freedom [i.e., polarization, timing, spatial modes, etc.]. The free-space storage cavity system benefits from the availability of low-loss dielectric coatings, in order to attain higher transmission and larger optical bandwidth than current photon quantum memories based on fiber optic loops, atomic vapors, or solid-state media.

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