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Impementation of a multipass laser system on a free-free apparatus[1] B.N. KIM, C.M. WEAVER, N.L.S. MARTIN, University of Kentucky, B.A. DEHARAK, Illinois Wesleyan University — A free-free experiment investigates the emission or absorption of photons when an electron scatters from an atom in a laser field. For pulsed lasers of repetition rates of tens of hertz, and pulse durations of tens of nanoseconds, the experimental live-time is a few microseconds per year; typical experiments can take well over a week of continuous data taking. We have therefore developed and installed a multipass laser system on our free-free apparatus. The principal of the system is to use a Pockels cell to rotate the laser polarization 90° as the beam enters a circuit which passes through the electron-scattering interaction region and then returns to a polarizing beamsplitter cube (PBS) placed just before the (now deactivated) Pockels cell. The orientation of the PBS is such that the beam is reflected through 90° and therefore trapped in the circuit of path length 20 ns. Preliminary results are encouraging: the multipass system results in an increase of the free-free signal by a factor of 6.5, with a corresponding improvement in statistics from 3.6σ to 8.1σ, over a single pass system. We will present a progress report on this system and plans to install a similar one on a second free-free apparatus.

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