SINGLE SHOT ULTRAFAST ELECTRON DIFFRACTION

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The time resolution of ultrafast electron diffraction experiment is primarily limited by the electron pulse duration. The radio frequency (rf)-guns are known to be capable of creating sub-picosecond pulses of relativistic electrons. We performed both experimental and computational studies off electron diffraction using the rf-gun at the Gun Test Facility located at the Stanford Linear Accelerator. The copper photocathode of the rf-gun is illuminated by the 1mm diameter beam from a quadrupled Nd:Glass laser beam at 263 nm, with a pulse width of 2 ps. The electrons scatter from a piece of 160 nm thick aluminum foil placed at 0.755 m from the photocathode, which subsequently get detected 4.7 m downstream. We observed the diffraction pattern obtained with a single electron pulse of 2 pC (10^7) electrons) and having a duration of 500 fs. Our simulations show that by reducing the laser pulse duration and the charge per pulse the time resolution of 100 fs is readily attainable.