There is a great need for non-invasive diagnostics for charged particle beams such as particle accelerators and high-current discharge experiments. Compton scattering of a pulsed laser beam by a high-current electron beam can be used to diagnose the energy and angular distributions of the electrons. Unfolding of the signals from multiple optical detectors (IR, visible, UV, and X-ray) can enable reconstruction of energy and angle profiles. The relativistic calculations present great challenges. DOE/NV/25946–1420 (Received January 31, 2012)