Because of light scattering, it is difficult to use optical imaging technology for imaging of targets embedded in high-speed rocket fuel spray, biological tissue and so on directly. When the light incidents into a turbid medium, the photons transmitted could be divided into the scattering components and the ballistic components, which have different directions of propagation, optical paths, polarizations and coherent states. The direct scattering imaging methods take advantage of some gating techniques to limit the light collection of the scattering photons and select the ballistic photons for imaging because the ballistic photons carry the almost imaging information. Femtosecond optical Kerr gated ballistic imaging technique is a high time-resolved direct scattering imaging method, which is suitable for the moving objects hidden in the turbid media.

For imaging of an object hidden behind a turbid media using the optical Kerr gated ballistic imaging method, the boundaries of the images were blurred due to the high frequency components were filtered by the photoinduced transient aperture in the Kerr medium. In order to solve this problem, we proposed a femtosecond heterodyned optical Kerr gated ballistic imaging method. In traditional optical Kerr gate, the polarization direction of the polarizer is horizontal, and the polarization direction of the analyzer is vertical, but the polarization direction of the analyzer is rotated at a small angle from the vertical direction in heterodyned optical Kerr gate. When the heterodyned optical Kerr gated ballistic imaging method was used, the high spatial frequency components of the object could be effectively compensated. The experimental results show that when compared with traditional optical Kerr gated imaging, the heterodyned optical Kerr gated imaging system provided higher image sharpness and higher spatial resolution.