INVESTIGATING THE HOHLRAUM RADIATION PORPERTIES THROUGH THE ANGULAR DISTRIBUTION OF THE RADIATION TEMPERATURE

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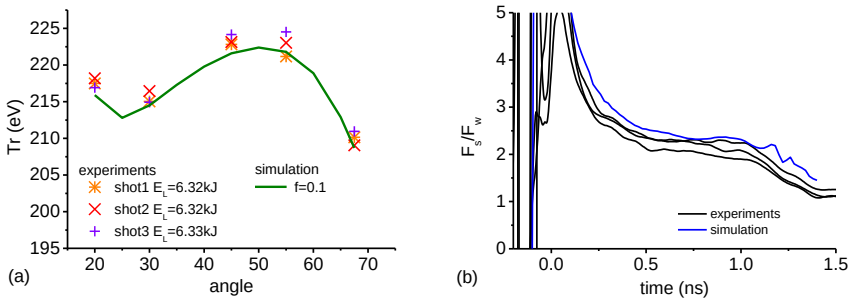
The symmetric radiation drive is essential to the capsule implosion in the indirect drive fusion, but is hard to achieve due to the non-uniform radiation flux inside the hohlraum. The radiation drive on the capsule is often indirectly estimated by the radiation temperature from the laser entrance hole (LEH). However, the energy deficit between the measured hohlraum radiation temperature and ablator implosion velocity suggests that more effort should be made to use the measured radiation temperature to estimate the drive on the capsule. In this work, the non-uniform hohlraum radiation properties are studied experimentally by measuring the angular distribution of the radiation temperature (ADRT) from the LEH and numerically by the two-dimensional multi-group radiation transfer simulations. It is found that the variation of the measured radiation temperature is over 6eV between different view angles for both vacuum and gas-filled hohlraums due to the non-uniform radiation flux inside the hohlraum. The delicate experiments further shows that the radiation flux of the laser-irradiated hot spot region is over twice higher than that of the re-emitted wall region [H. S. Zhang et al., Phys. Plasmas 21, 112709 (2014).], which induces the variation of the ADRT. The agreement of the ADRT between the experiments and simulations indicates that the x-ray emission of the blow-off plasmas is insignificant for current experimental parameters. It is also found that the ADRT is sensitively dependent on the axial position of the hot spot, which can be further used to estimate the axial motion of the hot spot without perturbing the hohlraum environment. The inferred hot spot motion in the gas-filled hohlraum is more significant than that in the vacuum hohlraum. Our study shows that the measurement of the ADRT is an effective way to investigate the hohlraum radiation properties and gives more constraint to the hohlraum simulation modeling.



Panel (a) shows the peak radiation temperature at different view angle relative to the hohlraum axis. The simulation result with electron flux limiter f=0.1 agrees with the experiments very well. Panel (b) shows the time evolution of the hot spot brightness, i.e., the ratio of the radiation flux between the hot spot and the re-emitted wall region.