Comparison of measured time resolved hohlraum radiation temperature with data produced by RALEF II-Code

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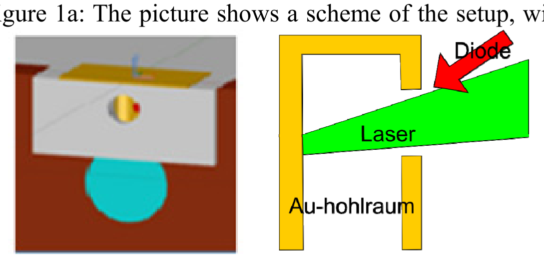
For indirect homogeneous heating of low-Z triacetate-cellulose (TAC) foam targets, used in experiments on ion energy loss in plasma, a large (Ø > 1 mm) soft X-ray source with a Planckian equivalent radiative temperature of 30 to 50 eV is required. In this temperature region soft X-rays are effectively absorbed by low Z low density polymer layers. More energetic radiation above 1 keV passes through the 200 μg/cm^2 TAC-layer without attenuation giving no input into the process of foam heating.

The experiments have been supported by RALEF II simulations, made by S. Faik from University Frankfurt. One important data, the hohlraum temperature show a heating during the shot of the laser in the first ns, it leads to a peak temperature of about 70 eV. After some additional Nanoseconds the Temperature in the hohlraum is homogenized and stays nearly constant for a long (>10 ns) while (see figure 2a).

Figure 1a: The picture shows a scheme of the setup, with



a view in the Au-Hohlraum from the same position as the X-ray-diode.
Figure 1b: The scheme shows the laser and the diode, using the same hole for heating and diagnostic.

The temperature in experiment was measured by X-ray-diodes. The X-ray-diodes are composed once of a carbon and second of an aluminium cathodes, a grid with and a filter. The combination of different filters allow measuring the absolute photon flux in different parts of the hohlraum spectrum and deduce a time-history of the hohlraum temperature radiation. dows for different wavelength (see Figure 2).

According to earlier experiments [1,2], we can assume a short time of 5-7 ns after the beginning of the laser pulse of X-ray imission and reemission. After this homogenisation the radiation fits to the normal hohlraum radiation. Folding the this radiation with the filters and the electron efficiency of the cathodes leading to different currents, produced by the X-ray diodes (see Figure 2).

The described measurement assumes an absolute calibrated X-ray-diode, like the one we had. For a better verifiability and a second method, we use a second X-ray-diode, with different filers. On this way it was possible to compare the two signals in a proportional, witch not necessary needs absolute calibrated X-ray-diodes.

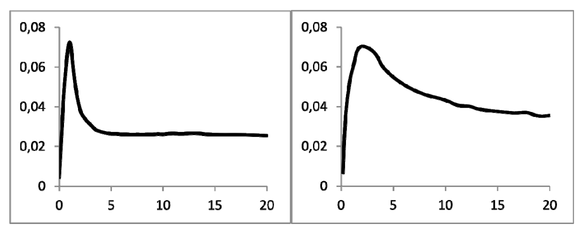


Figure 2a: Simulated temperature [k eV], time resolved [ns] integrated over a line across the hohlraum. Figure 2b: Measured temperature [keV], time resolved [ns] integrated over the view line to the rear wall.

The simulated data (see figure 1) shows a very small peak in the first ns, an a flat temperature after the 5th ns. The measured curve is some eV higher in the temperature, after the homogenisation. This may be caused by the fact, that the X-ray-diode views a part of the laser spot. The important parameter, the long lasting temperature, is reached in the simulation and the measurement, and both fit together.

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References

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