Erratum: "Prospects for measurement of rapid equilibrium changes and electron fluctuations using a high repetition rate Thomson scattering diagnostic" [Rev. Sci. Instrum. 74, 1653 (2003)]

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The yttrium aluminum garnet (YAG) laser rod thermal diffusion time reported in Sec. III of Ref. [1] is incorrect because the wrong value of κ, the thermal conductivity of YAG, was used in the calculation. The correct value of κ for undoped YAG at room temperature is 0.1 $W_{th}/cm\ ^\circ C$.[2] From the one-dimensional heat conduction equation, the thermal diffusion time in YAG can be roughly approximated as

$$\Delta t = \frac{\rho c}{\kappa}\Delta x^2,$$

where ρ is the 4.56 g/cm^3 density of YAG, c is the 0.59 $J/g\ ^\circ C$ heat capacity of YAG, and κ is as stated above. Taking Δx to be the 1 mm rod radius gives an approximate thermal diffusion time of 0.27 s, not the 2.7 s erroneously reported. This thermal diffusion time is then not much longer than the planned burst mode on-time (100 ms), and means that thermal gradients might begin to establish themselves in the laser rod during a burst on-time of this duration. Thus to operate this laser rod in a heat capacity mode (starting from a cold cavity configuration), the burst mode on-time would probably have to be reduced from 100 ms. Note, however, that the above approximation of the thermal diffusion time assumes efficient heat removal from the rod edge during the burst on-time. If such cooling were turned off during a burst, the establishment of thermal gradients would be delayed.

Since this paper was written, operation of a standard commercial Nd:YAG laser in heat capacity mode has been demonstrated for bursts of up to 15 ms duration.[3] A custom Nd:YAG/glass laser system with the capability for 20 ms bursts in heat capacity mode is being commissioned.[4]

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