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Edge-Pumped Tm:Lu₂O₃ disk broadband laser amplifier design at 1 kHz

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We report on the conceptual design of an amplification chain based on Tm-doped gain medium [1], for solid-state, ultra-short CPA laser pulses, aiming at high-efficiency, kHz repetition rate, high peak power and kW-scale average power, with emission wavelength around 2 μm . A multi-pass configuration is presented, with three stages, with 4% doped Tm:Lu₂O₃ ceramic thin discs, lateral (edge) [3] pumping (EPDL) scheme with an output energy of >500mJ from an input energy pulse of 1 mJ. The modelling of multipass extraction (at the 1kHz rep rate) and thermal load is also studied and discussed.

[1] D.A.Copeland et al., "Wide-Bandwidth Tm-Based Amplifier for Laser Acceleration Driver", Proc. of SPIE Vol. 9729, 97290I, (2015) ·doi: 10.1117/12.2220010

[2] E.V. Ivakin et al., "Laser ceramics Tm:Lu₂O₃. Thermal, thermo-optical, and spectroscopic properties", Optical Materials 35 499–503 (2013). doi:10.1016/j.optmat.2012.10.002

[3] J. Vetrovec, et al., "2-micron lasing in Tm:Lu₂O₃ ceramic:initial operation", Proc. SPIE 10511, 1051103 (2018); doi:10.1117/ 12.2291380

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