Control of fuel target implosion non-uniformity in heavy ion inertial fusion

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Reducing the non-uniformity of fuel implosion is one of issues to achieve ignition in inertial fusion targets, and has been studied by various mitigation mechanisms [1, 2]. The non-uniformity is caused by several factors. The Rayleigh-Taylor instability (RTI) is one of them.

One way to reduce the non-uniformity is the RTI growth mitigation proposed in [1], in which a controlled vibration of the implosion acceleration perturbation δg reduces the RTI growth significantly. We propose to realize the mitigation mechanism by vibrating foot and main pulses of the heavy ion beams (HIBs) (see Fig.1). Each HIB has its vibration phase depending on the HIB axis position (see Fig. 2) in order to produce the controlled δg to mitigate the implosion non-uniformity.

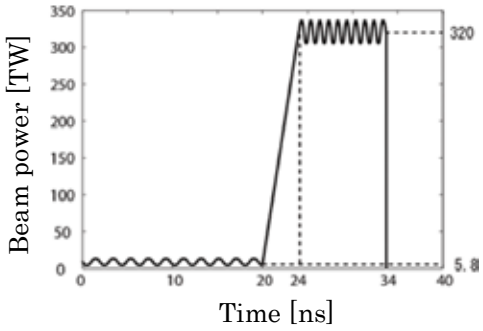

Fig. 1 Beam power vibration

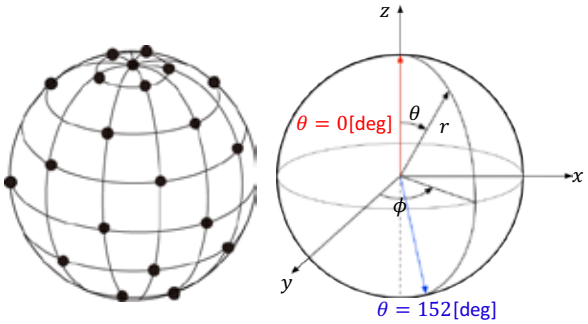

Fig. 2 HIBs illumination scheme

The target shell is accelerated by the 32 HIBs with the controlled δg, which induces a small controlled implosion acceleration vibration (see Fig.3) The vibrating acceleration reduces the implosion non-uniformity (see Fig.4). Figure 5 represents the mode of the ion temperature at the DT layer. It is shown that vibration HIBs reduce especially the largest mode of the "Mode 2".

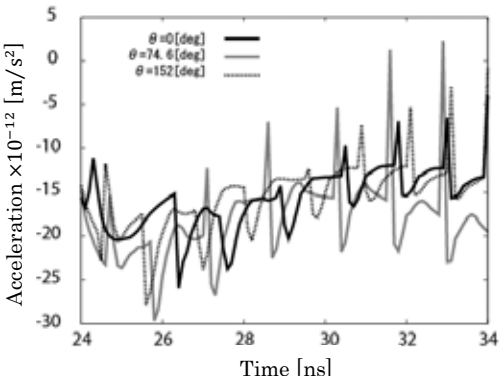

Fig. 3 Acceleration of each θ position

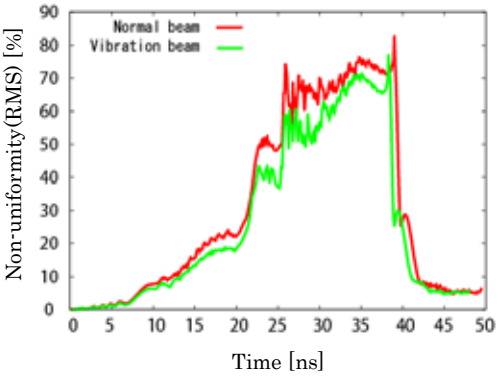

Fig. 4 Non-uniformity of pressure at DT layer

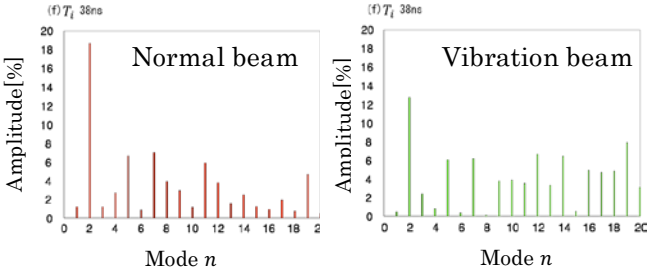

Fig. 5 Mode of ion temperature at DT layer

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