

GAMMA RAY MEASUREMENTS AT OMEGA WITH THE NEWEST GAS CHERENKOV DETECTOR “GCD-3”

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The newest Gas Cherenkov Detector (GCD-3) has been fielded at the Laboratory for Laser Energetics Omega Laser Facility and several unique gamma ray measurements have been conducted. The GCD-3 is a prototype of the “Super GCD”, which is one of 8 “transformative diagnostics” being implemented at the National Ignition Facility (NIF) in support of the quest for ignition.

Fusion reaction history measurements at Omega have been performed with the GCD-3 at the lowest GCD energy threshold to date, which has resulted in improved sensitivity versus previous GCD designs and greatly expanded the mission space of gamma ray generating reactions that may be studied. Gamma ray signatures will be presented from a variety of fusion reactions (D-³He, H-D, D-D) of interest for implosion diagnostics and nuclear astrophysics. Results from inelastic scattering of 14 MeV neutrons on samples of ¹²C and ¹³C will be presented, with the ¹³C signals compared with ¹²C signals to assess the feasibility of using ¹³C-doped plastic capsules to provide evidence of mix.

The GCD-3 also improves upon previous GCD measurements of Omega ICF implosion plastic shell ablator ρR [1] and has now been calibrated to measure ablator ρR of glass capsules. Planned experiments using GCD-3 ρR measurements in conjunction with charged particle energy loss and plasma condition (n_e , T_e) measurements to test existing plasma stopping power models will also be described.

[1] N. M. Hoffman, et al., Phys. Plasmas 20, 042705 (2013)