Tritium in Inertial Fusion: Extrapolation to Ignition Machines

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OMEGA at the Laboratory for Laser Energetics routinely fields DT targets to investigate implosion physics in preparation for the ignition campaigns on the National Ignition Facility (NIF) at Lawrence Livermore National Laboratory (LLNL). NIF stands on the cusp of history, poised to make a credible attempt at igniting a DT plasma later this year. Laser MegaJoule (LMJ), another ignition machine, is under construction in southern France. These facilities rely or will rely on *in-situ* tritium facilities to handle tritium feedstock and to treat effluent streams. Inertial fusion energy (IFE) reactors will need to operate at higher repetition rates and will handle significantly larger tritium throughputs.

OMEGA has infrastructure to compress DT gas to 1000 bar, condense the gas to ice inside plastic microspheres, and field those targets at cryogenic temperatures. These targets contain up to 0.25 Ci each. Unburnt tritium and tritiated effluent streams are processed in tritium cleanup systems to ensure releases to the environment comply with IAEA emission guidelines. NIF will rely on a neighboring tritium-charging facility remote to the NIF building but located on the LLNL premises. Targets filled with approximately 10 Ci each will be transported to NIF in specially designed cases. As in the OMEGA case, unburnt tritium and tritiated effluent streams will be processed onsite to ensure emissions do not exceed IAEA guidelines. LMJ will follow the NIF's example, relying on a remote tritium charging facility and onsite effluent processing equipment.

IFE power reactors will require throughputs on the order of several kilograms of tritium annually. Target production and filling will play a critical role in the viability of these reactors. This paper will discuss the handling of tritium at both facilities and extrapolate to IFE reactors.

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