Developing a commercial production process for 500,000 targets per day – A key challenge for inertial fusion energy

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(Received on

Abstract. As is true for current-day commercial power plants, a reliable and economic fuel supply is essential for the viability of future Inertial Fusion Energy (IFE) power plants. While IFE power plants will utilize deuterium-tritium (DT) bred in-house as the fusion fuel, the "target" is the vehicle by which the fuel is delivered to the reaction chamber. Thus the cost of the target becomes a critical issue in regard to fuel cost. Typically six targets per second, or about 500,000/day are required for a nominal 1000 MW(e) power plant. The electricity value within a typical target is about $3, allocating 10% for fuel cost gives only 30 cents per target as-delivered to chamber center. Complicating this economic goal, the target supply has many significant technical challenges — fabricating the precision fuel-containing capsule, filling it with DT, cooling it to cryogenic temperatures, layering the DT into a uniform layer, characterizing the finished product, accelerating it to high velocity for injection into the chamber, and tracking the target to steer the driver beams to meet it with micron-precision at chamber center.