"Demonstrating a Cost-Effective Target Supply for Inertial Fusion Energy"*

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The target for an Inertial Fusion Energy (IFE) power plant introduces the fusion fuel to the chamber, where it is compressed and heated to fusion conditions by the driver beams. The "Target Fabrication Facility" (TFF) of an IFE power plant must supply about 500,000 targets per day. The targets are injected into the target chamber at a rate of 5-10 Hz and tracked precisely so the driver beams can be directed to the target. The feasibility of developing successful fabrication and injection methodologies at the low cost required for energy production (about \$0.25/target, about 10^4 less than current costs) is a critical issue for inertial fusion.

To help identify major cost factors and technology development needs, we have utilized a classic chemical engineering approach to the TFF. We have identified potential manufacturing and handling processes for each step of production, and have evaluated the raw materials, labor force, cost of capital investment, and waste handling costs for providing 500,000 direct-drive radiation preheat targets per day. We have prepared preliminary equipment layouts, and determined floor space and facility requirements. The purpose of this is not to provide a final plant design, rather to show that production of targets at the required throughput rates and at low cost is feasible. The analyses assume an "nth-of-a-kind" TFF and utilize standard industrial engineering cost factors. Statistical sampling of target batches will be performed at various process steps to avoid unnecessary further processing of reject targets. The results indicate that the installed capital cost is about \$100M and the annual operating costs will be about \$20M, for a cost per target of about \$0.16 each.

These cost analyses assume that the process development is accomplished to allow scaling of current laboratory methods to larger sizes, while still meeting target specifications. A development program is underway at various laboratories to support this scaleup. The program includes development of methods to produce foam shells by microencapsulation, measurements and analyses of permeation filling of the shell with DT fusion fuel, studies of cryogenic fluidized beds for layering of the fuel, and construction of a precision injection and tracking system to demonstrate that proper placement of the final cryogenic target can be accomplished. This paper summarizes the development work underway to show the feasibility of a cost-effective direct-drive target supply for Inertial Fusion Energy.

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