# A gyrotron-powered pellet accelerator for tokamak refueling

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**Abstract.** A novel pellet acceleration concept using microwave power from MW gyrotron sources has been developed that could pave the way for high-speed >3 km/s inner-wall pellet injection on ITER-class tokamaks. The concept is based on the principal of a gun, where a high-pressure propellant gas drives the projectile down the barrel. In the proposed concept, the high gas pressure is created by evaporative explosion of a composite "pusher" medium attached behind the deuterium-tritium (DT) fuel pellet. The pusher medium consists of small conducting particles e.g. Li embedded homogeneously in a $D_2$ ice slug, thus facilitating microwave energy absorption by dissipation of eddy currents flowing within the conducting particles only. Microwave power is delivered to the pellet-pusher module along a waveguide, which also functions as the pellet guide tube; and the power is transmitted through a transparent window/plug, which also absorbs the pellet recoil momentum during acceleration. A scaling law is derived which predicts that a pellet of mass $M_p$ accelerated over a distance $L$ reaches a velocity $v_p \cong (P_{wave}L/M_p)^{1/3}$, where $P_{wave}$ is the gyrotron power.