# Concept of Tritium Breeding by T and Li Fusion Reactor Plasma

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This paper discusses the possibility of achieving direct T breeding by producing in a fusion reactor a Li plasma and by injecting T beams in the MeV energy range.

Efficient Tritium breeding in a fusion reactor blanket requires a neutron multiplier in order to make up for the lost neutrons.

In the standard scheme it is envisaged to use (n, 2n) reactions in Be or Pb to the rate of 5% of the total neutron rate.

In this paper it is shown that such a neutron increase could be obtained also by using the reaction $^{7}$Li (T; n, n, $\alpha$) $\alpha$ + 8.8 MeV where two neutrons and two alphas are produced from the interaction of the Tritons and $^{7}$Li nucleons. Breeding is thus achieved if the two neutrons produced are then used to breed T in the blanket, by $^{6}$Li (n, T) $\alpha$ . The full cycle then in this case is favourable, producing an excess T equivalent to a multiplication factor of 2.

The operational scheme requires that T is injected by NBI at an energy of around 5 MeV or that Li is accelerated by ICRF to MeV range. Analytic calculations show that the achievable power amplification factor is 3.5 when the full reaction breeding cycle is considered.

An ITER relevant simulation has been performed using JETTO code, which confirms the analytical calculations.

In this mode of operation a reactor would operate at relatively high temperature/low electron density regimes (Te ~ 50 KeV, ne ~ $0.5.10^{20}m^{-3}$) with a NB power of 200 MW or a similar value of ICRF.

In these conditions a T production rate of $2.4.10^{20}$ Tritons/s can be achieved. The plasma would have a 10-20% power losses due to bremsstrahlung, the conductive losses would be compatible with normal divertor operations.