# Temporal evolution in fissile systems: Development of OpenMC(TD) for Monte Carlo simulation with individual precursors

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OpenMC(TD) [1] is a modified version of the Monte Carlo (MC) transport code OpenMC [2] that explicitly incorporates the time dependence arising from delayed neutron emission. Unlike conventional MC codes based on 6- or 8-group precursor structures [3], OpenMC(TD) simulates individual precursors weighted by their importance $I_i$:

$$I_i = \frac{CY_i\, P_{n,i}}{\nu_d}, \tag{1}$$

where $CY_i$ is the cumulative yield, $P_{n,i}$ the delayed neutron emission probability, and $\nu_d$ the total delayed neutron production. The numerical challenges associated with the different time scales of prompt and delayed neutrons are addressed through four techniques: splitting the simulation time into time steps, forced decay [4], population control via the combing technique [5], and branchless fission [6]. In addition, the current version incorporates optimizations for parallel execution. The code was verified in monoenergetic and energy-dependent systems, achieving excellent agreement with analytical solutions. Experimental validation is planned at the RECH-1 reactor of the Chilean Nuclear Energy Commission, through time-dependent flux measurements following controlled reactivity insertions.

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