

Component Architecture

External Fields

PlaneWave, GaussLaser

Faraday tensor: $F^{\mu\nu} =$

$$\begin{pmatrix} 0 & -E_x/c & -E_y/c & -E_z/c \\ E_x/c & 0 & -B_z & B_y \\ E_y/c & B_z & 0 & -B_x \\ E_z/c & -B_y & B_x & 0 \end{pmatrix}$$

Particle Dynamics

$$dx^\mu/d\tau = u^\mu$$

$$mdu^\mu/d\tau = F_{\text{total}}^\mu$$

$$u_\mu u^\mu = -c^2$$

Radiation Models

Landau-Lifshitz, Abraham-Lorentz

$$F_{\text{rad}}^\mu \propto F^{\mu\nu} F_{\nu\lambda} u^\lambda - \frac{1}{4} F_{\alpha\beta} F^{\alpha\beta} u^\mu$$

Composed System: Charged Particle

$$F_{\text{Lorentz}}^\mu = q F^{\mu\nu} u_\nu$$

$$F_{\text{total}}^\mu = F_{\text{Lorentz}}^\mu + F_{\text{rad}}^\mu$$

Components are swappable via MTK connectors