The primary position variables are (x, y, s), where x and y are the displacements along the normal and binormal vectors, $\boldsymbol{n}$ and $\boldsymbol{b}$, respectively. Let $\boldsymbol{t}$ denote the tangential vector along s, then $\boldsymbol{n}$, $\boldsymbol{b}$, $\boldsymbol{t}$ consist a right-handed system.
The action in t is expressed by

$$S = \int L_t c dt \,, \tag{2}$$

$$L_t = -\frac{mc}{p_0}\sqrt{1 - \dot{x}^2 + \dot{y}^2 + (1 + x/\rho)^2 \dot{s}^2} + a_x \dot{x} + a_y \dot{y} + (1 + x/\rho) a_s \dot{s} \,, \tag{3}$$

where p_0 and $(a_x, a_y, a_z) = e(A_x, A_y, A_z)/p_0$ are the design momentum and the normalized vector potentials, respectively, and $\dot{}$ denotes the derivative by ct. SAD's coordinate only has the radius of curvature ρ in the local x-s plane. Note that ρ is the curvature of the coordinate system, not that of the orbit. The transverse vector potentials (a_x, a_y) are non-zero only in the solenoid region, where $1/\rho$ is zero.
Currently SAD does not handle the electrostatic potential.
As SAD uses s for the independent variable instead of t, the Lagrangean L for s is written as

$$L = L_t \frac{dct}{ds} \,, \tag{4}$$

$$= -\frac{mc}{p_0}\sqrt{c^2 t'^2 - x'^2 + y'^2 + (1 + x/\rho)^2} + a_x x' + a_y y' + (1 + x/\rho) a_s \,, \tag{5}$$

where $'$ is the derivative by s.