The evaluation of synchrotron radiation in SAD is done usingbased on “kinematical method”:

Let $\boldsymbol{q}$ denote the orientation vector of the momentum of a particle:

$$\boldsymbol{q} = \left(\frac{p_x}{p}, \frac{p_y}{p}, \frac{p_z}{p}\right) ,$$
$$p_z = \sqrt{p^2 - p_x^2 - p_y^2} .$$

Suppose a particles traverses a section (1, 2) of an accelerator component, then the orientation changes from $\boldsymbol{q}_1$ to $\boldsymbol{q}_2$. Th
the radius of curvature ρ_r are approximated, assuming a uniform bending, by:

$$\sin|\phi| = |\boldsymbol{q}_2 \times \boldsymbol{q}_1| ,$$
$$\rho_\mathrm{r} = \frac{\mathtt{L}_{12} - z_2 + z_1}{|\phi|},$$

where $\mathtt{L}_{12}$ is the nominal length of the component between 1 and 2, and $z_{1,2}$ are the values of longitudinal coordinate
locations 1 and 2.

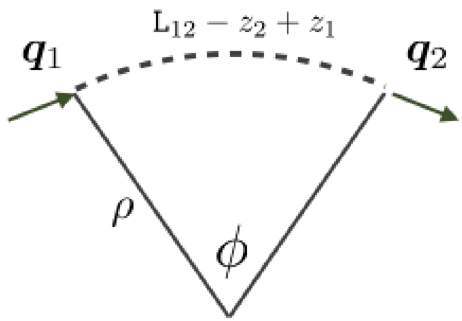

Figure 1: The kinematical method for synchrotron radiation.

By knowing ϕ and ρ_r as well as the momentum of the particle, we can derive all information about the emission of synch
can use a classical formula with uniform bending).

- Thus the synchrotron radiation can be handled *by a single routine for any type of component*, such as multipoles,
  even including electric field, without knowing the details of the field.
- A component is sliced so that $N_\gamma \lesssim 1$.
- Not only the radiation itself, its derivatives by phase space coordinates can be obtained kinematically using the t
  derivatives are used to evaluate the damping and excitation matrices.
- In the region where the field is not uniform, such as the `F1` region of a `BEND`, a special treatment for ρ_r is applied.
- This method may be applied for a *spin motion* if the longitudinal filed is taken care properly.