Short Range:

Calculate with CST directly to get wake potential.

Long Range:

Method1: Calculate with CST or ACE3P for a very long time

Method2: Calculate the eigen-frequencies to get R, Q, for each mode, then reconstruct the wake potential by inverse Fourier Transformation of the Z(.

To get that, we need the wake function (wake potential of delta bunch) of a resonator, which can be found by the Fourier Transformation of the impedance of the resonator:

About Transverse:

We have two ways of calculate the transverse impedance.

* First is directly from the definition:

And can be calculated from the integration of the transverse force across the cavity directly.

* The second way is to calculate the gradient of longitudinal potential. The relation between the and can be derived be Panofsky-Wenzel Theorem.

Starting from the change of momentum:

If we take partial derivative against time and assume is constant,

We know that ,

Substitute in,

Second term is zero, and

Therefore,

Assume sinusoidal field,

Or we can write the deflecting voltage in terms of the gradient of the longitudinal voltage,

Hence, the transverse impedance can be written as,