Vertexing and number of degrees of freedom

1. Numbers of the degrees of freedom

The number of parameters of each components of vertexing:

vertex point : 3 (for example x, y and z)
each track : 2 (for example θ and ϕ to determine its direction)

The 2 of each track is given by tracking, the 3 of the vertex point is unknown. Hence, the number of degree of freedom (ndf) of vertexing are given by

$$D^0 \to K + \pi : -3 + 2 \times 2 = 1$$
$$D^0 \to K + 3\pi : -3 + 2 \times 4 = 5$$
$$D^+ \to K + \pi + \pi : -3 + 2 \times 3 = 3$$

π^0 does not add any ndf, but because mass constraint is used to reconstruct π^0, the constraint adds 1 ndf.

$$D^0 \to K + \pi + \pi^0 : -3 + 2 \times 2 + 1 = 2$$

Usually K_s is the same as a charged track, so it adds 2 ndf. But, if K_s vertex fit failed, the TreeFitter will then include the K_s fit in the D fit which adds one dof. Hence,

$$D^0 \to K_s^0 + \pi + \pi : -3 + 2 \times 3 = 3$$
or when K_s vertex fit failed : 4
$$D^+ \to K_s^0 + \pi : -3 + 2 \times 2 = 1$$
or when K_s vertex fit failed : 2