AbstractID: 9270 Title: Simple description of detector volume effect by means of cumulants.

Purpose:
We show a simple, and conceptually very general, description of the detector volume effect in 1-D profile measurements. This effect has been described by fitting the profile to a known function or assuming a simple form for the detector response function. In this work no assumption is made on the shape of these functions.

Method and Materials:
The only assumption is the detector response function (kernel) to be translationally invariant. This allows to establish that the spatial derivative of the convolution of the true profile with the kernel is the convolution of the spatial derivative of the true profile with the kernel (spatial derivative commutes with kernel convolution). This trick provides a method to use the set of integrable functions instead of sigmoid shape functions with no Fourier transform.

Results:
When applied to Erf(x) profile and Gaussian kernel, this allows to re-derive in a simpler way the Garcia-Vicente equation[$(\text{measured profile width})^2 = (\text{true profile width})^2+(\text{detector width})^2$](eq 8, in F. Garcia-Vicente et al, Phys. Med. Biol. 45 (2000) 645–650).
When applied to any arbitrary profile function and arbitrary kernel, the Garcia-Vicente equation emerges as the simplest case of an infinite, albeit simple, tower of algebraic equalities that may allow deconvolution of profiles without the use of Fourier Inversion, by means of cumulants.

Conclusion:
This description explains why Gaussian kernel performs better than others, when used in profile deconvolution. Although this method is only applied here to profile deconvolution, by means of its generality, it may be found useful in other areas where deconvolution is needed, such as Radiosurgery and IMRT.

Conflict of Interest (only if applicable):
None.