THE AUTHORS' REPLY

The point raised by Drs. Sear and Dean is certainly a valid one, i.e., that if one does unidirectional scanning, relatively long space constants can be used, and (as our theoretical curves demonstrate) a greater increase in frequency response is realized by using a digital ratemeter to achieve film contrast enhancement. However, these long space constants are not applicable to conventional bidirectional scanning because of the relative displacement between scan lines, as the authors pointed out. Moreover, unidirectional scanning has not been generally accepted by clinicians because of the added time consumed in the already slow process of rectilinear scanning. Also it must be remembered that the system described by Drs. Sear and Dean in their letter uses a constant pulse rate. Such a system relies entirely on the light source intensity (or changes in color) to achieve film contrast and spatial resolution; hence the time constant effect is much more important than in a conventional scanning system in which film contrast is achieved by changes in counting rate as well as modulation of the light intensity.

The purpose of our preliminary work was to determine whether or not any practical advantage resulted from using a digital ratemeter in a conventional bidirectional scanning system. We found little discernible improvement aside from the ease of setup as explained in our note; albeit, because of the short space constants dictated by bidirectional scanning. There is no doubt that if unidirectional scanning could be accomplished without significant time loss, more of the theoretical advantage of the digital ratemeter could be realized.

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CONTRAST EFFICIENCY AND FWHM

Two papers have recently been published in the *Journal of Nuclear Medicine* (*1,2*) which refer to methods adopted for the expression of the resolution characteristics of focused collimators. We would like to comment on each of these papers. First, we believe that Fig. 1 of the paper by Rollo and Schulz is incorrectly labeled. Curves A and C are interchanged when referring to the legend for that figure, since it seems unlikely that the line-spread function would improve as the scattering contribution increases.

Rollo and Schulz claim that the MTF of a collimator "does not provide an intuitive index of the performance of the system for general classes of inputs or a quantitative index of the change in performance for system changes which vary the MTF curve". We find no fault with this statement, but the authors then imply that they will present such an index themselves. We have been unable to find any further reference to such a simple index.

If we interpret the paper correctly, the contrast efficiency to which the authors refer is the result of a transform involving the line-spread function and the counting-rate profile of various sizes of spherical lesions. Mallard, Wilks, Corfield, and Flook (*3*) performed similar transforms using disk sources which give rectangular count profiles.

We contend that the contrast efficiency is certainly no easier to obtain than the MTF and that its ease of interpretation is open to doubt. The authors have demonstrated very clearly that they obtain better results if the transform involves a better MTF. The generality of the MTF concept is lost as soon as one applies this transform process to specific objects such as the Rollo and Schulz spheres or the Mallard et al disks.

In particular, since contrast has been defined here as the absolute ratio of the counts in two areas without consideration of statistical error (or of the noise in the scan), the result illustrated in Fig. 8 is not unexpected. This figure shows that if the system were to be optimized by maximizing contrast efficiency, then, for all lesions and counting rates, the best collimator is that with the smallest radius of view. This suggests that contrast efficiency is not a useful parameter to describe a system.

If, as the authors suggest, a more quantitative index is required, we would suggest some combined function, such as the product of the plane source sensitivity and the square of the MTF. This type of function can be a very useful means of comparison between collimators (*4*) and is merely an extension of the general MTF concept—not a restriction of it to any particular shape of source.

The second paper by Tsialas and Hine is of concern to us because it tends to advocate the use of the FWHM of line-source response functions. We