SIGNAL-TO-NOISE RATIOS IN NUCLEAR MAGNETIC RESONANCE IMAGING (NMR)

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The visual image signal-to-noise ratio has been shown to correlate well with a subjective impression of image quality and is an important measure of the ability to detect large, low contrast objects in a noisy background. Previous attempts to investigate the signal-to-noise ratio for NMR imaging have been inadequate and incorrect as researchers have mistakenly focused attention on only a single FID.

We calculate the visual image signal-to-noise ratio from first principles for both three-dimensional and planar excitation comparing several different Fourier space sampling geometries including polar and Cartesian sampling. The results indicate that three-dimensional excitation and data-acquisition has an important signal-to-noise ratio advantage over planar excitation and that Cartesian sampling produces a signal-to-noise ratio which is inferior to that of other methods if data is gathered consistently within the requirements of the Fourier sampling theorem in all strategies. The dependence of the signal-to-noise ratio on various physical parameters is discussed along with the implications for producing the best possible images.