Purpose: To devise a generalized, object-independent method for uniform acquisition of projections from 3D pulsed electron paramagnetic resonance imaging (EPRI) experiments so that intermediate images approximating the final image may be reconstructed from an incomplete set of projections.

Methods: Projection directions for 3D pulsed EPRI experiments can be represented as points on a hemisphere. A new technique is developed to divide the hemisphere into sectors of equal area and sample the projection points such that the standard deviation of the number of these points per sector is minimized. These sectors are defined by number of divisions in azimuthal and polar angles. Images of a cylindrical phantom were obtained using the current polar-azimuthal raster scheme as well as this new uniform sampling scheme with different hemisphere divisions for comparison of rapidity of convergence to the final image. The mean square difference between intermediate images and the final image was the metric compared.

Results: The uniform-sampling method produces intermediate images that converge to the true final image more rapidly. An image reconstructed from half projection data is 44.6% closer to the final image than an image reconstructed from half projection data using the polar-azimuthal raster method.

Conclusions: A novel method is developed to uniformly sample projection data for 3D pulsed EPRI that is independent of the object and produces intermediate images converging to the fully sampled image more rapidly than those from a polar-azimuthal raster sampling scheme. This method can be implemented to allow the user to view the image being created while acquiring projections so that problems with the scan become evident earlier without the need to wait for the entire scan to finish. This new scheme also gives better temporal resolution with the addition of minor artifacts by under sampling projections and requiring less imaging time.