4D-MRI based on Body Area (BA) Surrogate and Sagittal Image Acquisition

Fig. 1. Workflow of extracting breathing signals from sagittal MR images using the BA surrogate. BA (white area) was determined for each image. In practice, only the middle section (grey area) was used for BA calculation. For each image slice, an individual breathing curve was generated by plotting the BA as a function of image acquisition time.

Fig. 2. Breathing signals of 5 subjects obtained from single slice sagittal cine-MR images.

Fig. 3. Breathing signals (pre-normalization) obtained from multiple slice cine-MR images. Imaged sagittal planes were indicated by red vertical lines (half body).

Fig. 4. Sketch of the phantom design. Objects within the dashed line were placed inside of the MR scanner, and the motion motor was placed outside the MR scanner.

Fig. 5. 10-phase 4D-MRI images of a cylindrical gel phantom in (a) axial, (b) coronal, and (c) sagittal planes. Images were acquired in sagittal planes (thus it has high resolutions). Blurring effects in (a) and (b) caused by reconstruction.

Fig. 6. Breathing signals (pre-normalization) obtained from simulated multiple slice acquisition of 4D-XCAT phantom. Imaged sagittal planes were indicated by vertical lines.

Fig. 7. Comparison between the original 10-phase 4D-XCAT phantom images (a) and the simulated 10-phase ‘4D-MRI’ images of the 4D-XCAT phantom (b). Dashed lines were added for better visualization of motion. Minimal sorting artifacts were observed in certain phases of the simulated ‘4D-MRI’ images, as indicated by red arrows.