Fakultät für Medizin

Dokumenttyp: journal article

Autor(en) des Beitrags:
Delso, G; Fürst, S; Jakoby, B; Ladebeck, R; Ganter, C; Nekolla, SG; Schwaiger, M; Ziegler, SI

Titel des Beitrags:

Abstract:
The recently released Biograph mMR is the first commercially available integrated whole-body PET/MR scanner. There are considerable advantages to integrating both modalities in a single scanner that enables truly simultaneous acquisition. However, there are also concerns about the possible degradation of both PET and MR performance in an integrated system. This paper evaluates the performance of the Biograph mMR during independent and simultaneous acquisition of PET and morphologic MR data. The NEMA NU 2-2007 protocol was followed for studying the PET performance. The following measurements were performed: spatial resolution; scatter fraction, count losses, and randoms; sensitivity; accuracy of the correction for count losses and randoms; and image quality. The quality control manual of the American College of Radiology was followed for studying the MR performance. The following measurements were performed: geometric accuracy, spatial resolution, low-contrast detectability, signal-to-noise ratio, static field (B(0)) homogeneity, radiofrequency field (B(1)) homogeneity, and radiofrequency noise. An average spatial resolution of 4.3 mm in full width at half maximum was measured at 1 cm offset from the center of the field of view. The system sensitivity was 15.0 kcps/MBq along the center of the scanner. The scatter fraction was 37.9%, and the peak
noise-equivalent count rate was 184 kcps at 23.1 kBq/mL. The maximum absolute value of the relative count rate error due to dead-time losses and randoms was 5.5%. The average residual error in scatter and attenuation correction was 12.1%. All MR parameters were within the tolerances defined by the American College of Radiology. B(0) inhomogeneities below 1 ppm were measured in a 120-mm radius. B(1) homogeneity and signal-to-noise ratio were equivalent to those of a standard MR scanner. No radiofrequency interference was detected. These results compare favorably with other state-of-the-art PET/CT and PET/MR scanners, indicating that the integration of the PET detectors in the MR scanner and their operation within the magnetic field do not have a perceptible impact on the overall performance. The MR subsystem performs essentially like a standalone system. However, further work is necessary to evaluate the more advanced MR applications, such as functional imaging and spectroscopy.