QUANTITATIVE COMPARISON OF PARTIAL FOURIER RECONSTRUCTION ALGORITHMS IN MRI AT 7T

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Montesinos P[1], Rodríguez-Ruano A[1], Benito M[1], Santa Marta C[2], Vaquero JJ[1], Desco M[1]
1Medicina y Cirugía Experimental, Hospital General Universitario Gregorio Marañón, Madrid, Spain
2Dept. Física Matemática y Fluidos, UNED, Madrid, Spain

Introduction: Partial Fourier reconstruction algorithms are well known and widely applied since years ago. However, there is no comparative assessment available at high fields (~7T), where artefacts and phase shifts are stronger than those observed at low fields. In this work we present a quantitative comparison at 7T of the most common partial Fourier reconstruction algorithms: conjugate synthesis with phase correction, Margosian method [1], homodyne reconstruction [2], POCS algorithm [3] and iterative homodyne reconstruction [4].

Methods: Experiments were performed on a Bruker Biospec 70/20 scanner using a linear coil resonator. Sphere phantom images were acquired using a RARE sequence (RARE_factor=8, TE/TR=14/4875 ms, FOV=8x8 cm). A full k-space with a matrix size=256x256 and a partial k-space with an acceleration factor of 53.125% were acquired. Raw data were exported to a standard PC workstation (2.40 GHz, 4 GB 64-bit OS). All the reconstruction algorithms were implemented in the IDL language. Stopping criteria for iterative algorithms was the mean-squared error between successive iterations. Image quality was assessed by SNR, ghost level and 95-5% slope measurements.

Results: Figure 1 shows reconstructed images. Ringing and blurring are especially conspicuous in images B and C. Table 1 compares SNR, ghost level, contrast and computing time for the different reconstruction methods.

	SNR/mm3	Ghost level (%)	95% Slope	Computing time (ms)
Full k-space	2554.03	1.134	733.83	7.15
Zero filling	3874.83	1.068	584.02	7.15
Conjugate synthesis	2573.17	1.067	568.80	50.5
Margosian method	4019.83	0.795	512.72	45.8
Homodyne reconstruction	2387.48	0.956	498.71	61.4
POCS	2764.50	1.063	513.03	302.4
Homodyne iterative	4020.17	0.787	498.71	141.2

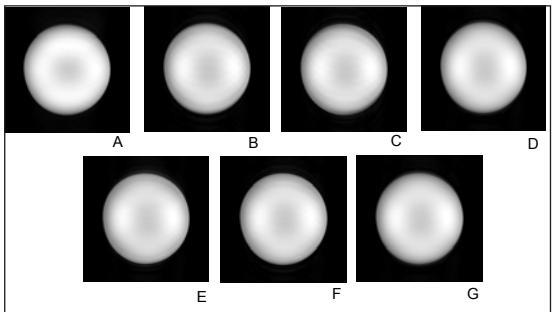

Figure 1. (A) Full k-space. (B) PF with zero filling. (C) conjugate synthesis. (D) Margosian. (E) homodyne reconstruction. (F) POCS. (G) homodyne iterative.

Conclusions: Zero filling, conjugate synthesis and POCS show high ghost level while homodyne reconstruction is a medium-quality algorithm. Comparing with zero filling, homodyne iterative reconstruction and Margosian method considerably improve SNR, and ghost level. Opposite to previous works at lower fields, at 7T with phantom images Margosian method perform better than POCS and conjugate synthesis. Margosian appears to be a fast reconstruction algorithm with good image quality and low computing time.

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