

Correlation Chemical Shift Imaging with Sparse-FFT and Real-time Motion and Shim Correction

Ovidiu C. Andronesi¹, Lixin Shi², Haitham Hassanieh², Wolfgang Bogner³, Borjan Gagoski⁴, Aaron Hess⁵, Dylan Tisdall¹, Andre van der Kouwe¹, Dina Katabi², and Elfar Adalsteinsson²

¹MASSACHUSETTS GENERAL HOSPITAL, HARVARD MEDICAL SCHOOL, BOSTON, USA; ²ELECTRICAL ENGINEERING AND COMPUTER SCIENCE, MIT, CAMBRIDGE, MA;

³MEDICAL UNIVERSITY VIENNA, AUSTRIA; ⁴BOSTON CHILDREN'S HOSPITAL, HARVARD MEDICAL SCHOOL, BOSTON, MA; ⁵UNIVERSITY OF OXFORD, UK.

I. INTRODUCTION

In-vivo 2D Correlation Spectroscopy (COSY) allows the unambiguous assignment of metabolites in localized regions from brain or other organs.

Two major artifacts limit the quality of in-vivo 2D COSY:

- 1) motion artifacts due to subject movement
- 2) ringing artifacts due to truncation of t1 dimension.

Here, we show that we can improve in-vivo 2D COSY by:

- 1) sparse sampling of t1 dimension based on sparse Fourier (sFFT) transform [1,2]
- 2) real-time motion correction, shim update and reacquisition (ReShMoCo) [3]

II. METHODS

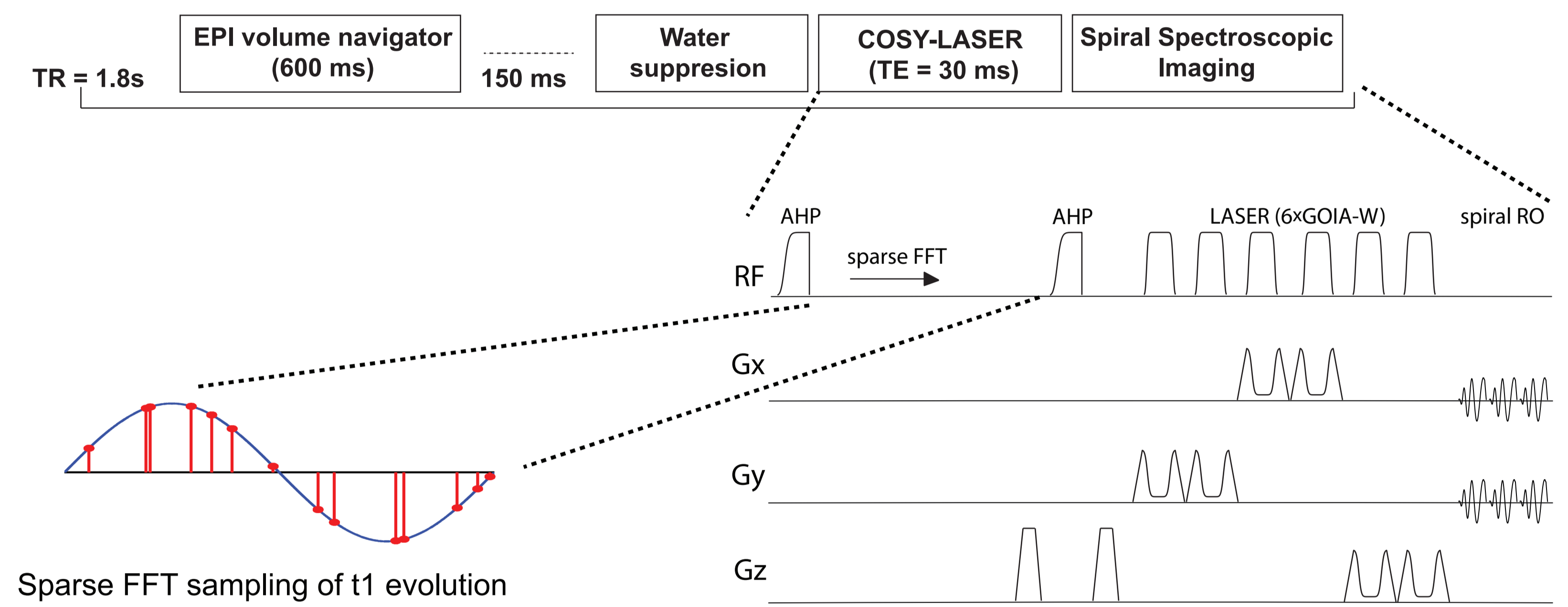


Figure 1. Pulse sequence for Correlation Chemical Shift Imaging [4] with sparse t1 sampling and real-time motion correction. A dual echo EPI volume navigator is played in each TR before spectroscopy. Multivoxel spectral localization is obtained with adiabatic low power GOIA-W(16,4) pulses and spiral readout gradients.

III. RESULTS

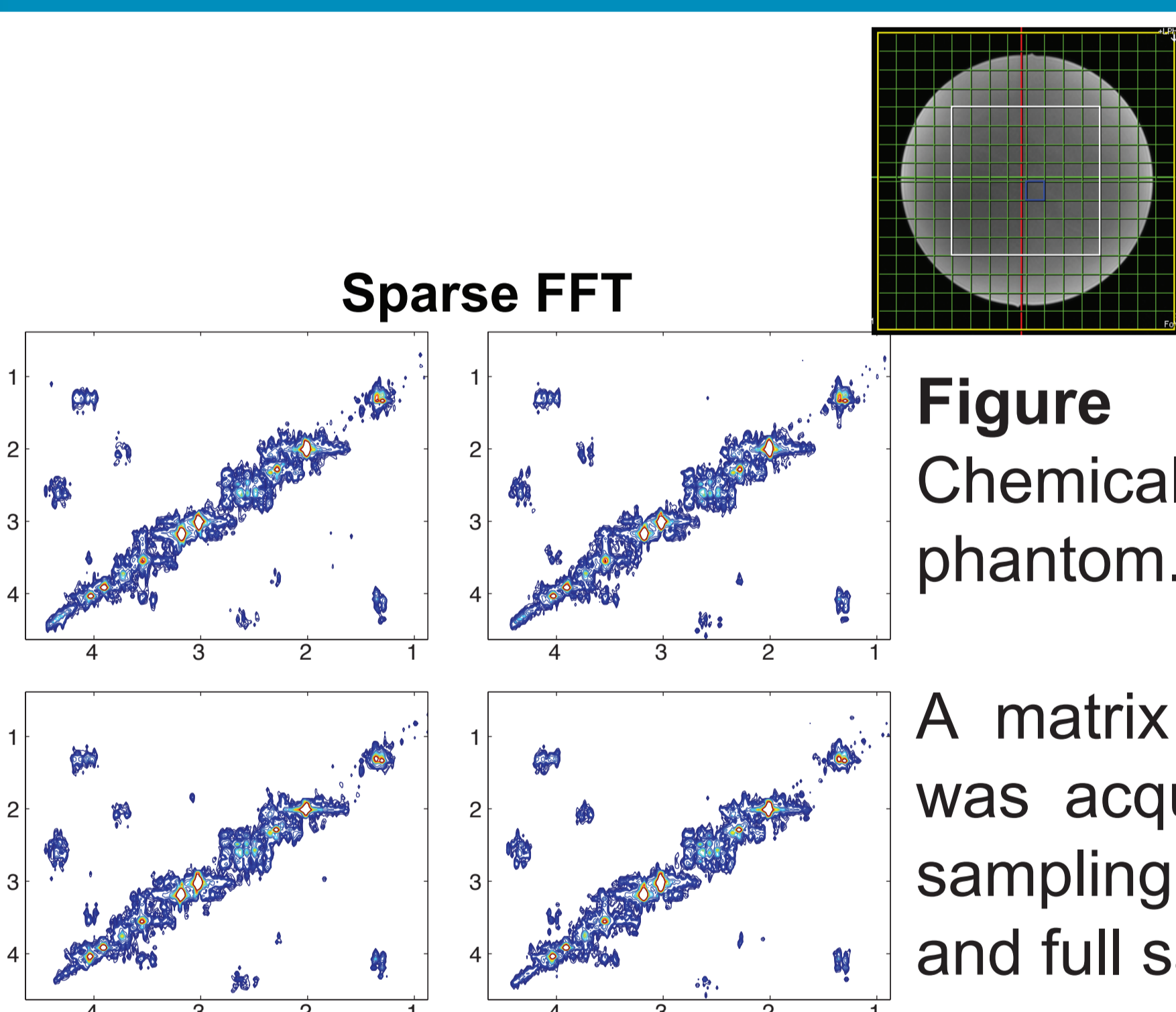


Figure 2. Correlation Chemical Shift Imaging in phantom.

A matrix of 16x16 voxels was acquired with sparse sampling of t1 dimension and full sampling.

Sparse FFT:

72 sparse points have been acquired from 0 ms to 209 ms t1 evolution.

FFT:

72 consecutive points have been acquired from 0 ms to 60 ms t1 evolution.

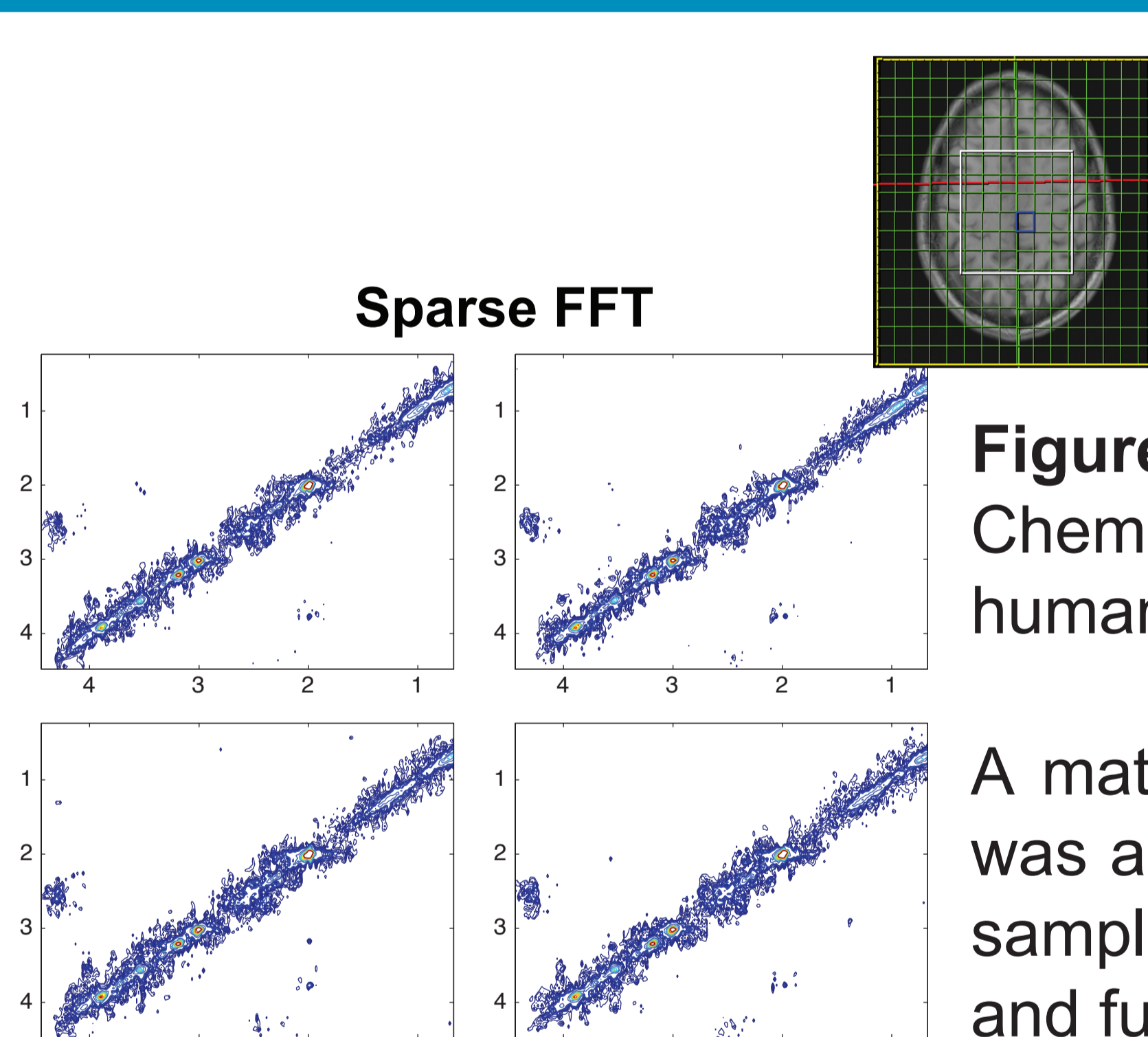


Figure 3. Correlation Chemical Shift Imaging in human brain.

A matrix of 16x16 voxels was acquired with sparse sampling of t1 dimension and full sampling.

Sparse FFT:

72 sparse points have been acquired from 0 ms to 209 ms t1 evolution.

FFT:

72 consecutive points have been acquired from 0 ms to 60 ms t1 evolution.

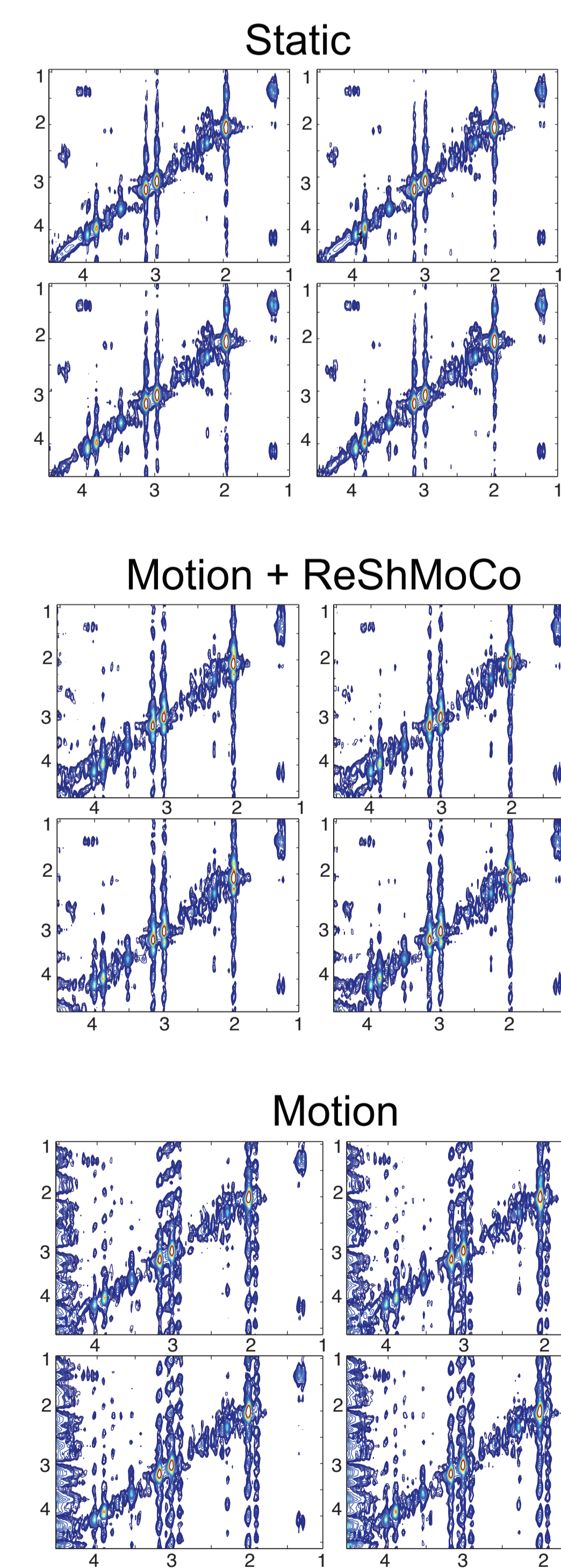


Figure 4. Motion correction of Correlation Chemical Shift Imaging in phantom.

Static: spectra acquired without moving the phantom.

Motion + ReShMoCo: spectra acquired during phantom movement with motion correction.

Motion: spectra acquired during phantom movement, no correction was performed

V. CONCLUSIONS

- > Sparse FFT reduces the t1 ringing artifacts observed in localized COSY.
- > Motion correction reduces the artifacts associated with subject movement.
- > Their combination provides robust acquisition of COSY in clinical applications.

REFERENCES: [1] Hassanieh H et al, Symposium on Theory of Computing 2012; [2] Shi L et al, Proceedings of ISMRM, 2013, #2019; [3] Bogner W et al, NeuroImage, 2013, 88C:22-31; [4] Andronesi OC et al, NMR Biomed, 2012, 25:195.

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