

## ***Interactive comment on “Spatio-temporal encoding by quadratic gradients in magnetic resonance imaging” by Sina Marhabaie et al.***

**Anonymous Referee #2**

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Summary: This paper describes a method to accomplish spatiotemporal-encoded (SPEN) MRI using a quadratic field gradient. Although this work shows qualitatively that this approach is feasible, the quality of the images shown are not particularly impressive, and the lack of any quantitative comparisons with conventional SPEN MRI, leave much to be desired. In addition, the proposed method is not novel since others have used quadratic encoding gradients in MRI.

Specific comments:

1. Line 54-55: “quadratic encoding gradients have not yet been applied to spatio-temporal encoding (SPEN) methods that normally use chirp pulses”. A more accurate statement might be: The spatiotemporal dependence of MR signals encoded with non-linear gradients was previously noted (eg, see Zaitsev et al, Magn Reson Med

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73:1407–1419, 2015), although that work did not explicitly describe the phenomenon in the context of SPEN.

2. Eqn 3: I believe the intended meaning of  $\Delta k$  here is different from the conventional  $\Delta k$  used in describing Fourier-encoded MRI, in which  $1/\Delta k$  specifies the FOV. To avoid confusion, the authors might want to make this difference clear or use a different variable. The current description of  $\Delta k$ , “relevant range of k-space coordinate”, is a bit ambiguous.

3. Figs 4a-c, 5a-c, and 6a-d: There are very noticeable artifacts in the SPEN images. The authors should comment on the potential sources of these.

4. Figs 4d-f and 5d-f: These images are distorted due to the background quadratic field, but it is difficult to assess the distortion without a reference image nearby.

5. Methods and Fig 7: The authors should specify which version of RASER was used and provide more of the relevant parameters. What was the duration of the chirp pulses? Were they standard chirp pulses or some variant like HS20? Was a blipped or continuous gradient used in the spatiotemporal-encoded direction? If the latter, was the phase correction (Eqn 1) provided in the paper by Chamberlain et al used? The vertical banding and jaggedness of the vertical edges of the object suggests the post-processing procedures were not optimal.

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