Methods: In Compressed Sensing (CS), setting the regularization parameter $\lambda$, i.e. the trade-off between data consistency and penalization, has been a widely studied topic in MRI. Nowadays, $\lambda$ is a fixed number that penalizes the whole reconstructed image. However, the current approach is not always accurate in MRI. To improve the traditional framework for image reconstruction, we propose a CS technique with variable weight, which penalizes the pixels of the recovered image according to their magnitude [1]. Pixels are sorted in descending order according to its magnitude and are penalized with a non-increasing sequence of regularization parameters. The main contribution of this work is in high order images, e.g. volumetric brain images, where choosing a variable weight may lead to poor sparse representation, when the ideal image is sparse [1]. Herein, we present quantitative susceptibility map (QSM) reconstructions in in-vivo data, where the Sorted Compressed Sensing (SCS) produced results that demonstrate it is feasible to reconstruct high quality images. The proposed method produced gains up to 3-4 dB with respect of traditional CS.

Results: For numerical susceptibility reconstruction we computed the signal-to-error ratio (SER) of SCS and CS, reporting 27.3 dB and 23.7 dB respectively (numerical maps not shown). For in-vivo data we used a field map with 200 iterations of dipole fitting. For image display we present only the first $10^6$ sorted coefficients of optimal $\lambda$ in Fig.1(a). To appreciate the structure of all the coefficients of $\lambda$ (approx. $4 \cdot 10^6$ coefficients), a log-log plot is presented in Fig.1(b). Fig.2, illustrates the axial view of the $\chi$ map reconstructions using CS and SCS techniques. For numerical phantom and noisy in-vivo field maps using CS and SCS techniques. For numerical

Conclusion: We have presented a new reconstruction framework tailored for MRI, which demonstrated in the in-vivo dataset an increase in image quality with respect of traditional CS. And in the numerical phantom gains of 3-4 dB were produced by SCS over CS.
