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# (G*) Accelerated 2D Multislice MRI with Hyperpolarized 129Xe in Human Lungs

*Monday 19 June 2023 15:00 (15 minutes)*

**Introduction:** It has recently been shown<sup>1,2</sup> that combining Compressed-Sensing with the Stretched-Exponential Model (SEM) can significantly increase SNR of accelerated/undersampled MR images. The reconstruction uses an exponentially decaying signal trend across a group of images assumed to represent the decaying density of resonant isotope in lungs after each wash-out breath. This decaying signal trend can be induced artificially to ensure the reconstruction : previous work was done using a specific averaging pattern<sup>1,2</sup>, but this signal decay can be a result of decaying hyperpolarized (HP) xenon polarization in a set of back-to-back acquisitions.
**Method:** In-vitro MRI was performed at 74mT on a phantom with 45mL of HP <sup>129</sup>Xe (35% polarization): 3 sets of 10 undersampled images each were acquired (acceleration factor of 7), only refilling the phantom with fresh hyperpolarized xenon gas between sets. To ensure adequate sampling of the centre of k-space, the Fast-Gradient-Recalled-Echo (FGRE) sequence was modified for centric-out trajectory in both phase-encode and readout directions.
Seven coronal slices (30mm) of 9 undersampled (AF=7) 2D human lung images were acquired at 3T with 1L of inhaled HP <sup>129</sup>Xe (33% polarization, 30/70 <sup>129</sup>Xe/<sup>4</sup>He), all acquired in one breath-hold (1s/slice, 7s total scan time). The previously used averaging pattern was applied before the reconstruction, and the SNR was fitted to the SEM using the Abascal method.<sup>3</sup>
**Results:** The signal of the phantom images followed the expected exponential decay trend. The reconstructed human lung images saw around 5x higher SNR compared to the original non-averaged images.
**Conclusion:** Although the signal decay of the phantom images followed the expected trend, the reconstruction was not able to be performed: this was caused by unexpected low frequency RF interference presenting as a consistent spike in k-space, confusing the reconstruction algorithm. The source of this interference and possible solutions are under investigation. The prospectively undersampled lung images show improved SNR within a single breath-hold: to remove the artefacts, a lung dataset will be assembled to train the artefact removal neural network<sup>2</sup> developed previously on undersampled lung reconstructions.
**References:**
1 Perron et al. ISMRM (2021); **2** Perron et al. ISMRM (2022); **3** Abascal et al. IEEE Trans Med Imaging (2018).

## Keyword-1

Lung MRI

## Keyword-2

Hyperpolarized 129Xe

## Keyword-3

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