

# Influence of Coil Channel Phasing on the Quality of Prostate Spectroscopy

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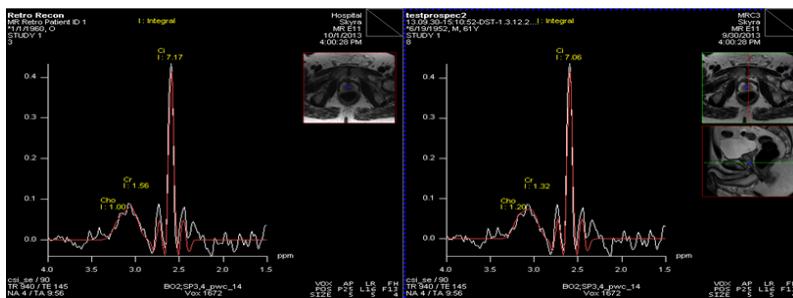
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**Target Audience:** Radiologists.

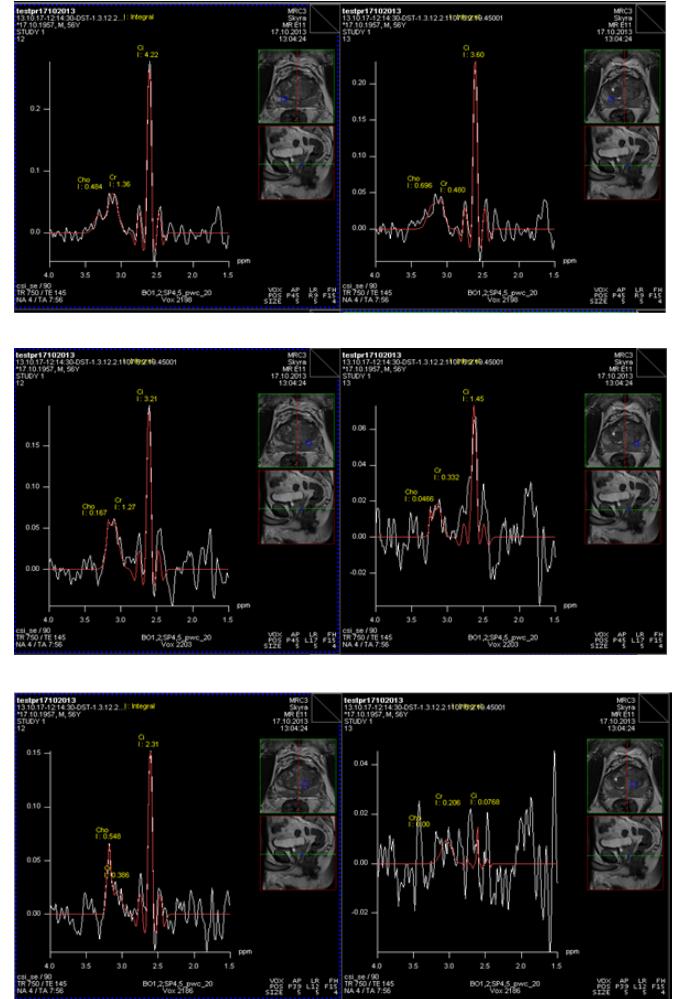
**Purpose:** 3D Chemical Shift Imaging (CSI) is a very promising technique for prostate MR examination. It allows the quantification of citrate, choline and creatine and helps diagnose and stage prostate cancer [1, 2]. With the use of phased-array coils for prostate spectroscopy, phasing the signals coming from different channels in order to achieve a constructive summation is a crucial step in order to maximize signal-to-noise ratio and to obtain the required spectral quality that allows the use of the data in clinical routine examinations. In this study, we propose to compare two coil channel phasing techniques in the context of prostate spectroscopy: phasing using the phase of the first point of the FID signal [3] and phasing using pre-scan data [4].

**Methods:** A 3D CSI PRESS sequence is used for MR spectroscopy imaging of the prostate following the measurement technique proposed in [5]. The following parameters are used: TR = 750ms, TE = 145ms, bandwidth = 1300 Hz, 512 acquired points, nominal voxel size = 7mm x 7mm x 7mm, weighted k-space acquisition, k-space Hamming filtering, which resulted in a measurement time of 8 min. MEGA pulses are used for lipid and water suppression. In one measurement, MEGA pulses were used only for lipid suppression and reduced water saturation with a CHESS scheme was performed, resulting in a longer TR (940ms) and a measurement time of 10 min. An automated dual-echo GRE-based shimming was used. The pre-scan is a sagittal 3D GRE measurement with the following parameters: TR = 2ms, TE = 0.7ms, FOV = 50cm x 50cm x 50cm, matrix size = 32 x 32 x 64, elliptical scanning. Four volunteers underwent the prostate spectroscopy measurements on a 3T scanner (MAGNETOM Skyra, Siemens Healthcare, Erlangen, Germany). The data were reconstructed using the two above-mentioned techniques: for the first technique, the phase of the first point of the FID of each coil channel is used as a phase reference. For the second technique, the complex surface coil pre-scan data are interpolated at every voxel of the 3D CSI volume using a trilinear interpolation. The phase information of the body coil is not used. Since the spectroscopy signals are complex-conjugated to invert the frequency axis, the same is done for the pre-scan data. The resulting phase information is used for phase correction before channel combination. The channels are also weighted using the sensitivity estimated based on the pre-scan data originating from the surface coils as well as from the body coil.

**Results and Discussion:** The obtained results show that the quality of prostate spectroscopy data depends heavily on the phasing technique. As expected [Fig. 1], when the water saturation is efficient, the phase information of the first point of the FID is not reliable enough to phase the coil channels, it may in some voxels lead to a reasonable quality as shown in the top row of Fig. 1, but may significantly degrade the quality of the spectra (SNR, line-width) as shown in the middle and bottom rows. The phase information provided by high SNR pre-scan data leads to a robust phasing of the channels and to an increased reliability and quality in prostate spectroscopy. Please note that the important aspect is the phase shift between different channels for a constructive combination and that even though the pre-scan phasing may introduce a global zero-order phase, this is corrected in a straightforward post-processing step. When reduced water saturation is used, the phasing techniques perform in an equivalent manner [Fig. 2]. In that case, the residual water signal is indeed sufficient to phase the coil channels, but this may be at the expense of spectral quality (baseline) and measurement time.



**Fig. 2:** Measurement with reduced water saturation. Left: phasing using pre-scan data. Right: phasing using the first point of the FID signal. With reduced water saturation, the phasing techniques perform in an equivalent manner.



**Fig. 1:** Spectra from three different voxels for the same volunteer measurement. MEGA Water and Lipid saturation was applied. Left (resp. right) is the result of the phasing using pre-scan data (resp. first FID point). Pre-scan phasing is more reliable when efficient water saturation is used.

## References:

- [1] Kurhanewicz J. *et al.* Urology 1995.
- [2] Heerschap A. *et al.* Anticancer Res 1997.
- [3] Brown MA. *MRM* 2004.
- [4] Schäffter T. *et al.* *MRM* 1998.
- [5] Scheenen T. *et al.* *Radiology* 2007.