

Case Study LiverLab

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Measurement data of a 22-year-old male volunteer with elevated liver fat signal, acquired on a 3T MAGNETOM Skyra system, were processed with the *syngo* MR E11A* implementation of LiverLab*.

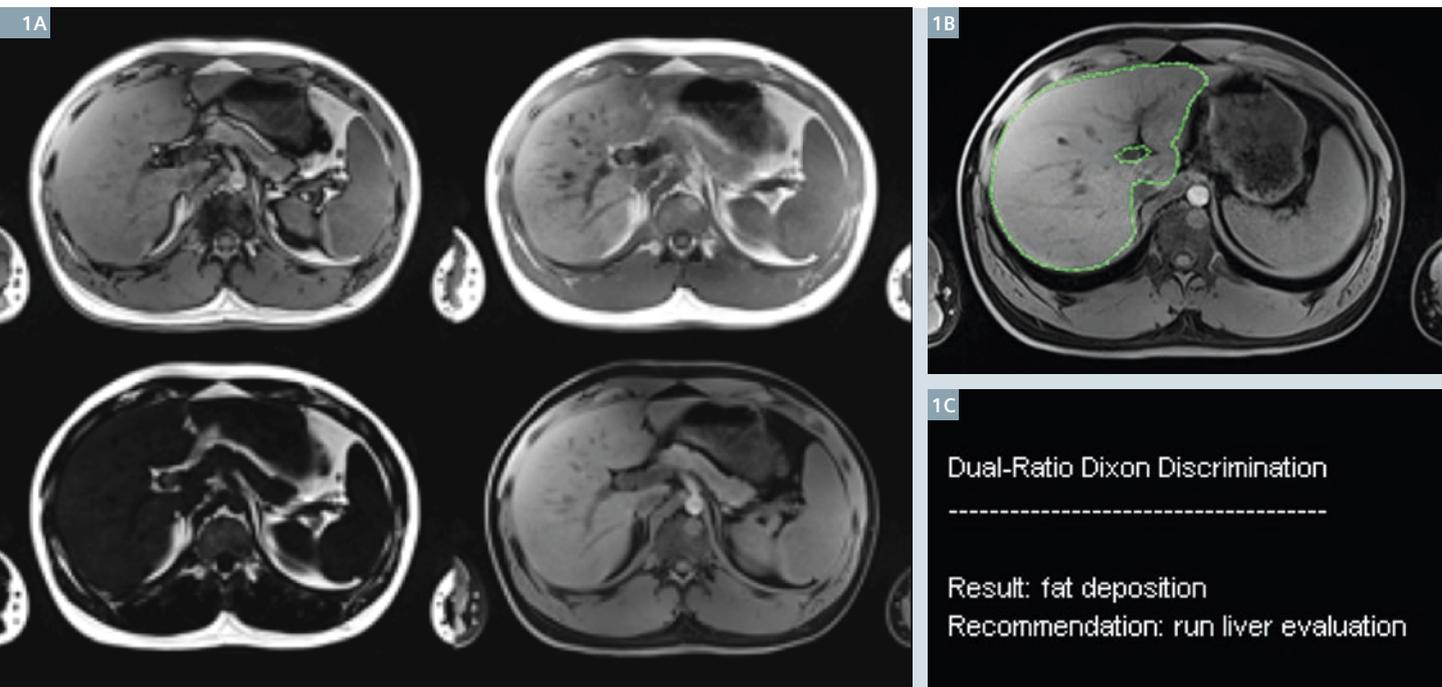
The measurement program includes a regular opposed-phase / in-phase two-point Dixon protocol with water/fat separation. The First look Dixon processing first performs a liver segmentation on the water series, and then a voxel classification according to the dual-ratio Dixon signal discrimination [1]. This leads to the conclusion of fat deposition and the recommendation to run additional quantification (Fig. 1).

The *syngo* MR E11A Abdomen Dot framework uses this recommendation to implement a decision point,

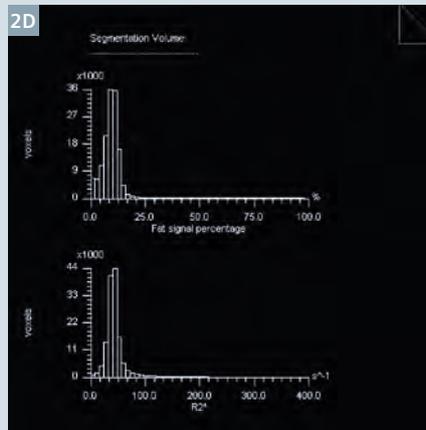
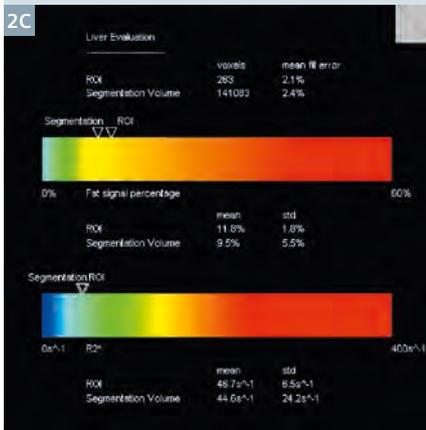
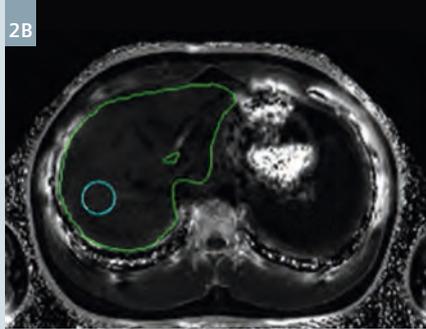
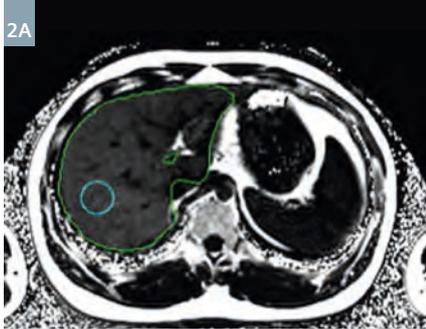
through which the user can add the quantification protocols to the measurement queue. In addition, the Dot engine allows specifying an inline region-of-interest (ROI) during protocol planning. The multi-echo VIBE Dixon [2] produces inline parameter maps of fat signal percentage (proton density fat fraction, PDFF) and effective $R2^*$, with overlays of the liver segmentation region and pre-planned ROI. Statistics (mean, std) of PDFF and effective $R2^*$ over the ROI and segmentation region are calculated inline, and are output as a report sheet, showing values both in text form and as color bars. Likewise, histograms are produced for PDFF and effective $R2^*$ over the segmentation region (Fig. 2).

A HISTO (high-speed T2-corrected multi-echo single voxel spectroscopy, [3]) protocol was also run, with 5 TEs ranging from 12 to 72 ms, and a voxel of size $3 \times 3 \times 3 \text{cm}^3$. The HISTO inline processing integrates over the water and fat parts of the spectrum for the individual echoes, and performs a T2 relaxation correction. Results include a fat signal percentage and the $R2$ of water ($R2_{\text{water}}$), which are displayed in textual and color bar formats. A spectrum of the shortest TE and a list of quantification values for the individual echoes are added for quality control of the signal fitting. The inline analysis for this case reveals similar findings as the multi-echo VIBE Dixon (Fig. 3).

*WIP, the product is currently under development and is not for sale in the US and other countries. Its future availability cannot be ensured.

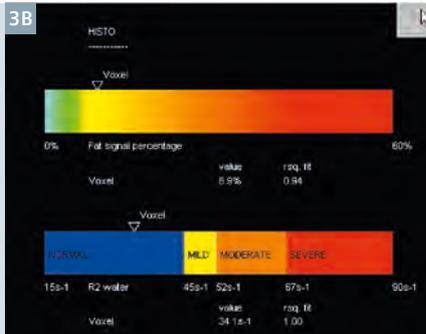
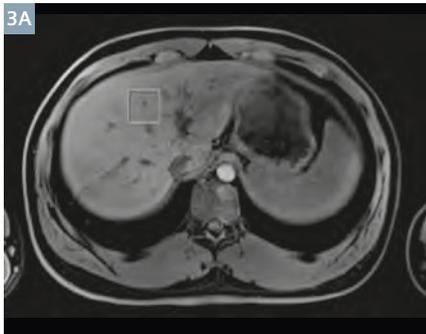


1 First look Dixon (Screening Dixon) results: (1A) opposed-phase, in-phase, fat, and water images, (1B) liver segmentation, (1C) report sheet.



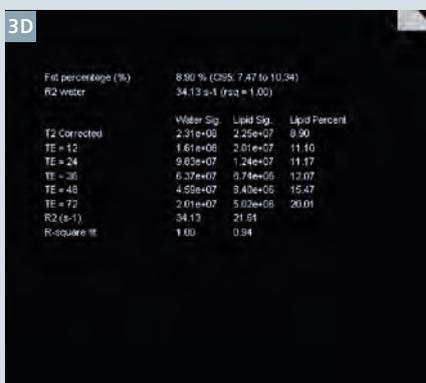
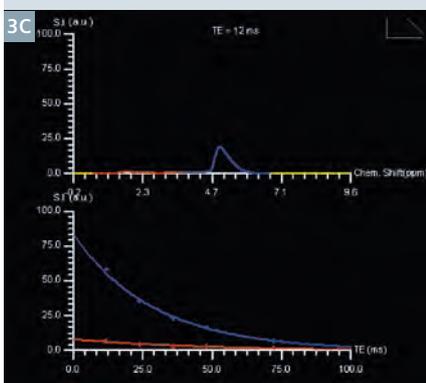
2

Multi-echo Dixon results: **(2A)** PDFF and **(2B)** effective R2* maps with overlays of the inline liver segmentation region (green) and inline ROI (cyan). **(2C)** Inline statistics (mean, std) of PDFF and effective R2* over ROI and segmentation region as text and color bar. The mean ROI values are fat signal percentage 11.8% and effective R2* 46.7 s⁻¹. **(2D)** Histograms of PDFF and effective R2* over the segmentation region.



3

HISTO results: **(3A)** Voxel location (from the spectroscopy task card), **(3B)** report sheet. The values are fat signal percentage 8.9%, R2_{water} 34.1 s⁻¹. **(3C)** Spectrum at shortest TE, **(3D)** list of individual echo values. For comparison, a manually drawn ROI on the multi-echo Dixon parameter maps, co-localized with the HISTO voxel position shown in A), reveals PDFF 8.9%, and effective R2* 44.3 s⁻¹.



References

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