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Kymogram–based Cardiac CT Image Reconstruction

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Deine Zauber binden wieder
Was die Mode streng geteilt;
Alle Menschen werden Brüder,
Wo dein sanfter Flügel weilt.

–An die Freude, Johann Christoph Friedrich Schiller–

PREFACE BY THE EDITOR

Cardiac imaging with X-ray computed tomography (CT) has gained wide acceptance in clinical cardiology and radiology over the last years. The fundamental requirement was an improvement of temporal resolution. In addition to the introduction of scanners with shorter rotation times, this was achieved by the introduction of phase-correlated image reconstruction, which was developed at the IMP in the years 1995 to 1997. The necessary information about the cardiac motion phase is generally taken from a concomitant electrocardiogram (ECG) recording.

The goal of the dissertation by Dirk Ertel was the optimization and validation of alternatives to using an ECG: the derivation of a synchronization signal which reflects the cardiac motion function directly. The extraction of a respective function, the so-called "kymogram", from the CT data is a non-trivial task; different approaches and implementations are being presented and discussed. It is shown conclusively that the kymogram function in many cases yields results equivalent to those obtained with the ECG function, sometimes worse, sometimes better. Thus it offers an alternative to ECG recording and a backup solution in cases where the ECG is corrupted or not available.

But it also offers an interesting additional feature: The prediction of the optimal reconstruction phase which is given by the period of least motion shown in the kymogram motion function, an information which is not provided by the ECG signal.

A number of clinical studies have been completed so far, and they show promising results. Broader experience is certainly still needed. But there is hope that this novel approach will find acceptance.

Willi A. Kalender, Ph. D. Editor

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