BioMatrix Beat Sensor – the Technologist's Perspective

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Introduction

We frequently perform cardiac MRI at our facility in Bremen – a private MRI, PET-MRI, and CT imaging center which has been an international reference site for Siemens Healthineers for many years.

We run the cardiac MRI examinations on all of our five MRI scanners: We have a 3T MAGNETOM Lumina, a 3T MAGNETOM Skyra, a 1.5T MAGNETOM Altea, a 1.5T MAGNETOM Avanto^{fit}, and a Biograph mMR PET-MR system.

Time is often a challenge, as the exams require us to perform multiple preparatory tasks. These include establishing venous access; preparing the patient's skin with an abrasive gel; shaving men's chest hair; and applying four ECG electrodes to ensure a stable trigger signal, which also needs some waiting/learning time before the patient goes into the magnet.

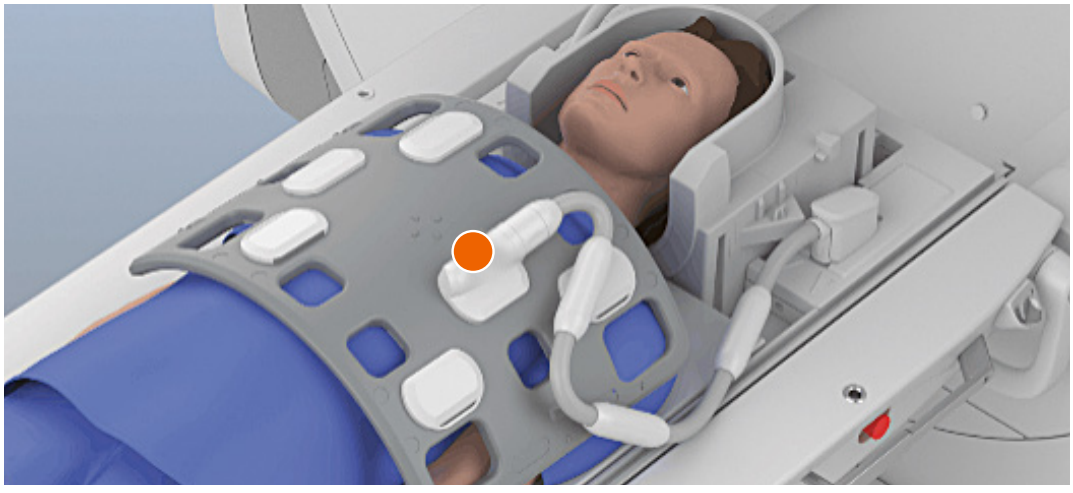
In light of this, we were very curious when our MAGNETOM Altea received a test version of the new *syngo* XA51 software. This allowed us to try the BioMatrix Beat Sensor, which is integrated into the BioMatrix Body 12 coil.

The technology removes the need for ECG electrodes, which means we technologists have a much easier and faster workflow when it comes to patient preparation.

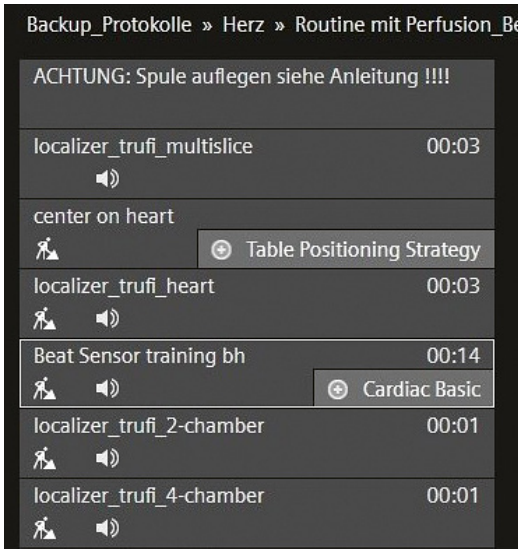
BioMatrix Beat Sensor workflow

Make sure the coil is positioned correctly with the Beat Sensor over the heart (Fig. 1). That's it!

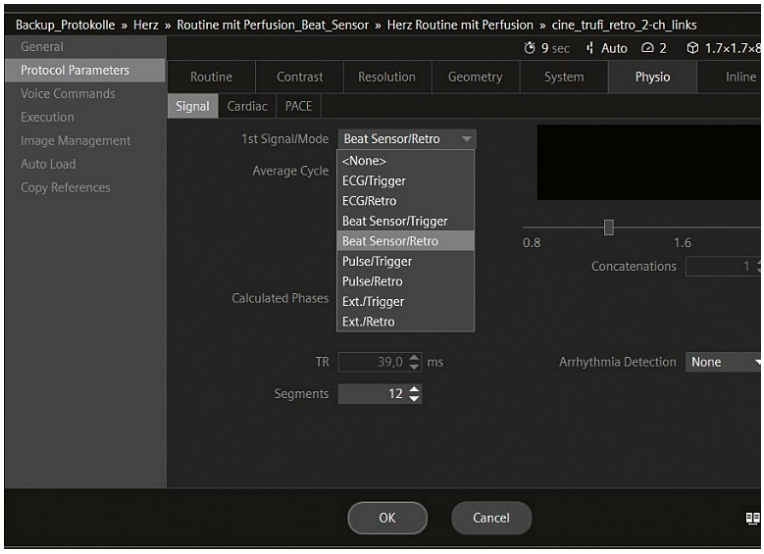
Right from the beginning, we used only the Beat Sensor for triggering. The protocol requires an additional



1 Positioning of the Beat Sensor which is integrated into the BioMatrix Body 12 coil.



2 Beat Sensor training.



3 Selecting the trigger source.

training step (Fig. 2), which we set manually after the heart localizer.

This training step can be done during breath-hold or in free breathing. After the training, the Beat Sensor signal appears and can be used for physiological triggering.

You need to select the desired trigger source in the cardiac protocols (Fig. 3).

We use the myExam Cardiac Assist workflow, which means we just have to choose the correct trigger source at the beginning, and all subsequent protocols are adapted accordingly. If you don't have the myExam Cardiac Assist workflow, I recommend saving special Beat Sensor protocols, in which the trigger source is already correctly selected. This will minimize the need for manual changes during the scanning process.

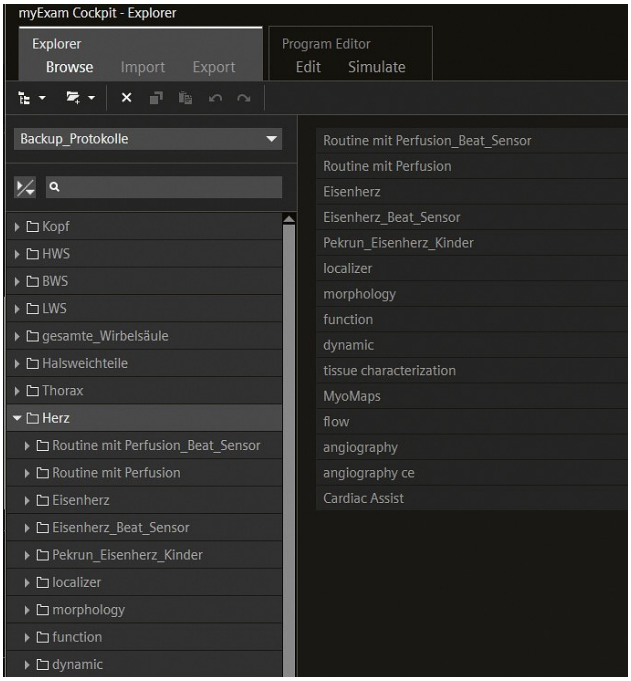
So for our team, we can easily select the right program – including Flow, T1/T2 mapping, thalassemia, and LGE – without needing to select the Beat Sensor as the trigger every time (Fig. 4).

Challenges

Of course, we compared the standard ECG trigger with the Beat Sensor trigger in a few cases with additional measurements. There was almost no difference in image quality and robustness of triggering, except with T1-weighted TSE, where the ECG-triggered sequences showed a slightly better dark-blood suppression. For all other sequences, the two methods appeared to be identical.

So far, we have examined between 50 and 80 cardiac MRI patients with the Beat Sensor. The exams have addressed a variety of different clinical questions and different types of patients, aged between 11 and 83 years. Another area in which we found no difference was between obese or thin patients – the signal remained stable in both cases.

Just once, at the very beginning of our test period, we were running in a signal change during the cardiac examination. In that case, we repeated the Beat Sensor training step, after which the signal was stable again.

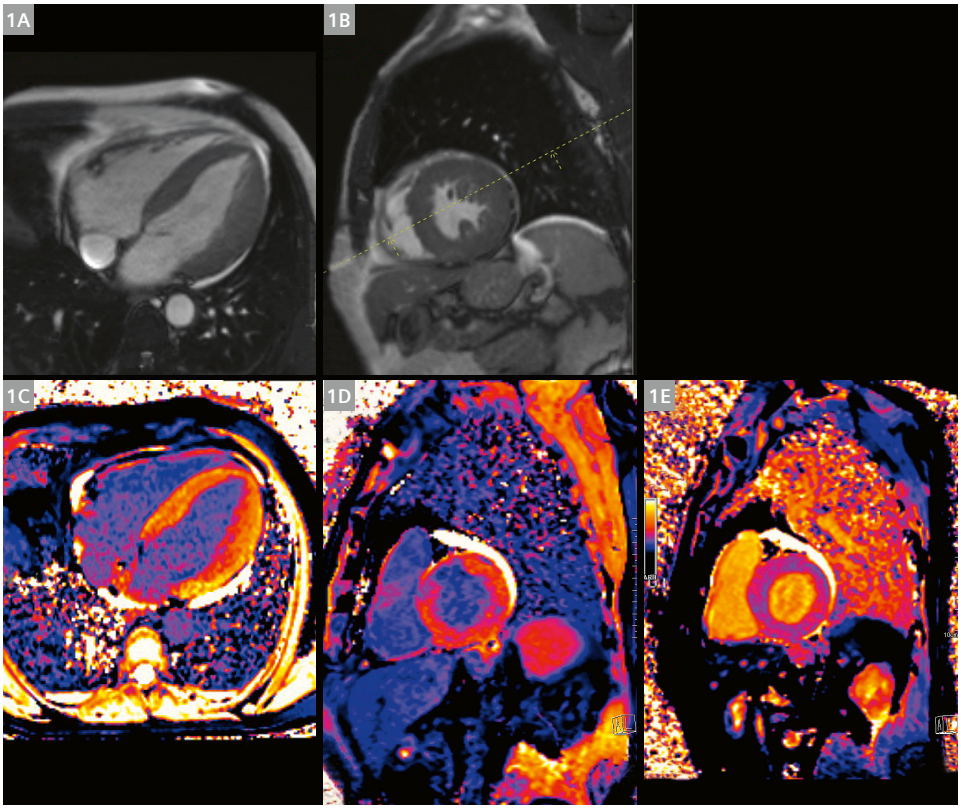


4 Pre-set protocols for various clinical questions.

Case examples

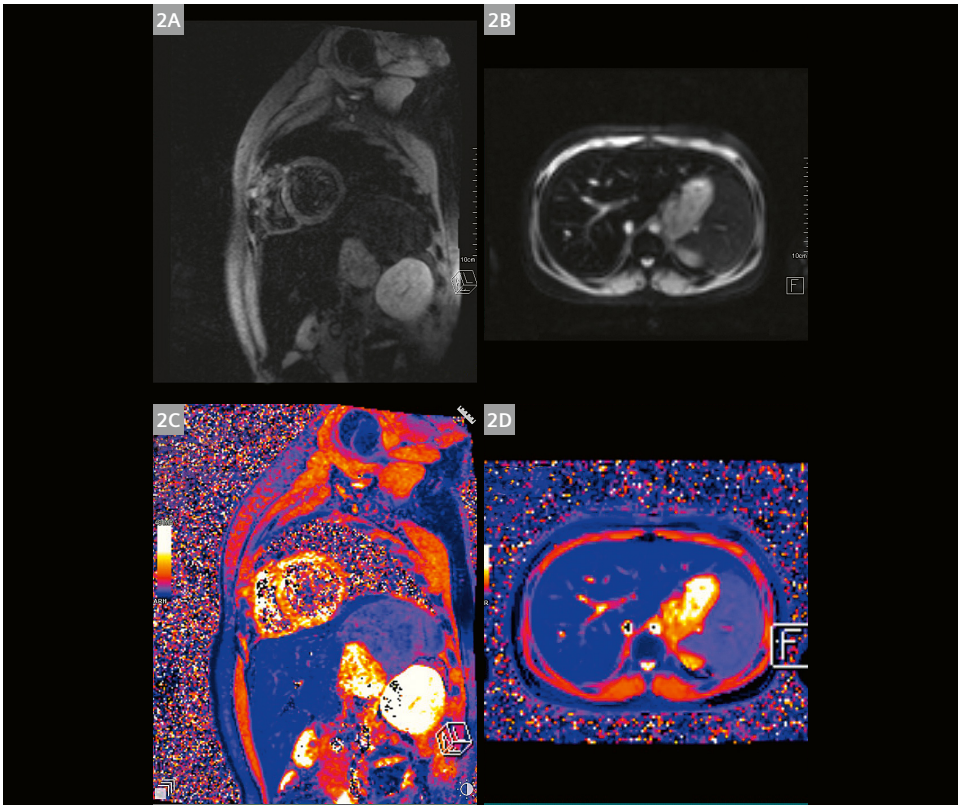
Case 1

57-year-old male patient with hypertrophic cardiomyopathy; mid-myocardial fibrosis.
(1A) Cine 4-chamber view;
(1B) Cine short axis view;
(1C–E) T1-maps



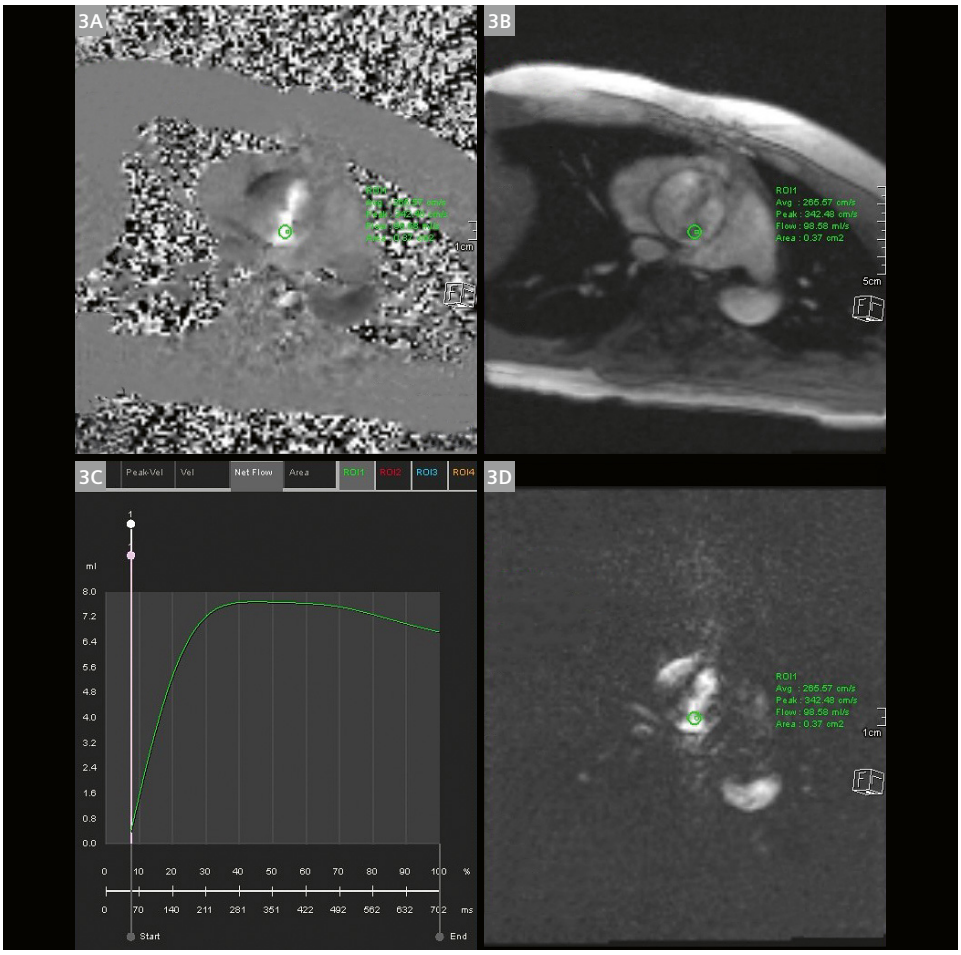
Case 2

11-year-old female patient with homozygous thalassemia and high ferritin. Pathological iron accumulation in the liver; no cardiac involvement.
(2A, B) T2* source images;
(2C, D) Color maps



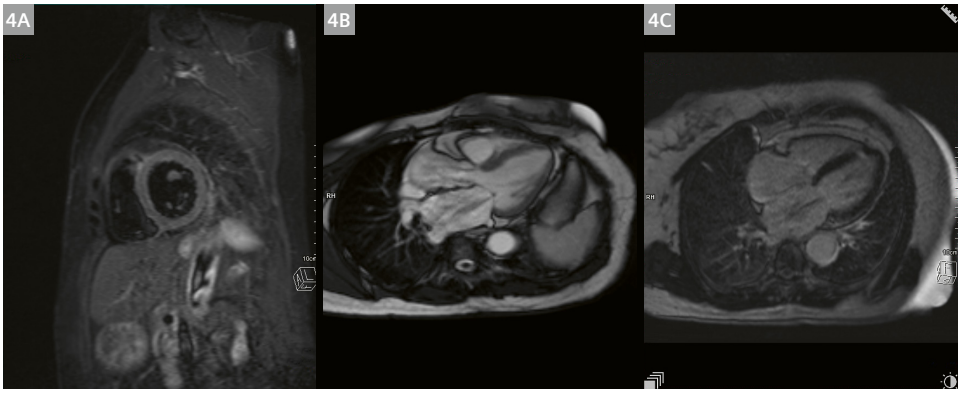
Case 3

30-year-old female patient with mixed aortic valve disease with valvular stenosis.
(3A) Through-plane phase contrast image, Venc 350 ml/s;
(3B) Magnitude image;
(3C) Flow curve;
(3D) Planning Cine



Case 4

75-year-old female patient with myocardial fibrosis, and with tricuspid, mitral, and aortic insufficiency.
(4A) STIR short-axis view;
(4B) Cine 3-chamber view;
(4C) LGE 4-chamber view



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