

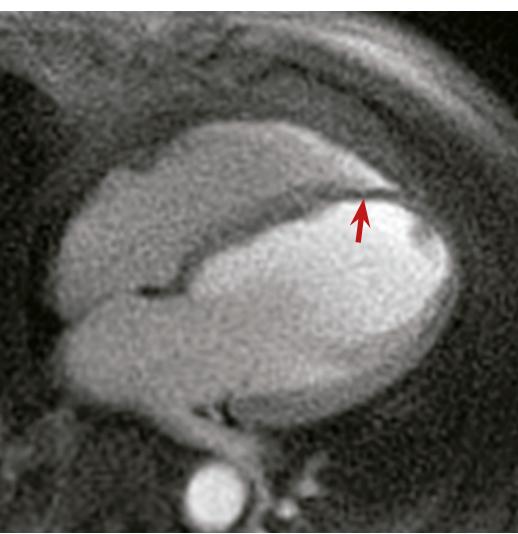
CARDIAC MRI PACKAGE



A New Approach to Cardiac MRI



Breath-hold phase-sensitive DE with hyperenhancement



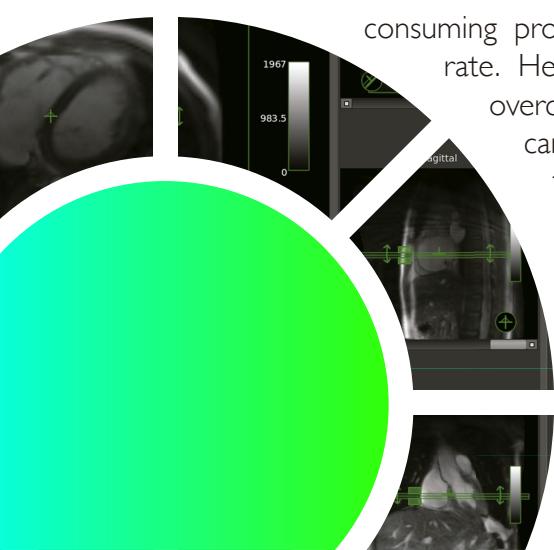
Time-course study during free breathing with an abnormal uptake

At HeartVista™, we believe that performing a cardiac MRI (CMR) exam should be fast, reliable, and simple. For this reason, we have created the HeartVista Cardiac Package, an advanced MRI software suite that allows existing scanners to push the boundaries of MRI and extend the benefits of CMR to a broad base of patients.

Comprehensive MRI Apps

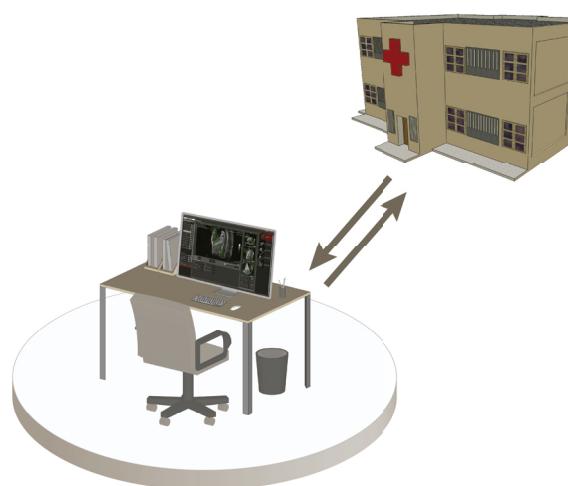
The HeartVista Cardiac Package represents the latest advances in CMR, a common test for evaluating ischemia, ventricular and valvular function, myocardial viability, and arrhythmic diseases[†]. With our comprehensive list of proprietary “Apps”, clinicians have access to advanced acquisition and reconstruction methods that provide robust solutions to cardiac MRI. In addition, HeartVista’s modern interface, which leverages the needs of cardiac MRI, creates a novel and intuitive workflow designed to address the specific needs of cardiac MRI.

The HeartVista Cardiac Package is an accessory to GE MRI systems. It includes cutting-edge traditional, accelerated, and free-breathing approaches with the ease of prescribing on real-time images. These fast Apps were designed to improve the patient experience while providing the best possible images. Accelerated Apps reduce breath-hold times by applying efficient readouts and parallel imaging. Free-breathing Apps use motion compensation or real-time acquisitions. They may enable the imaging of patients who cannot sufficiently hold their breath or who suffer from arrhythmia.

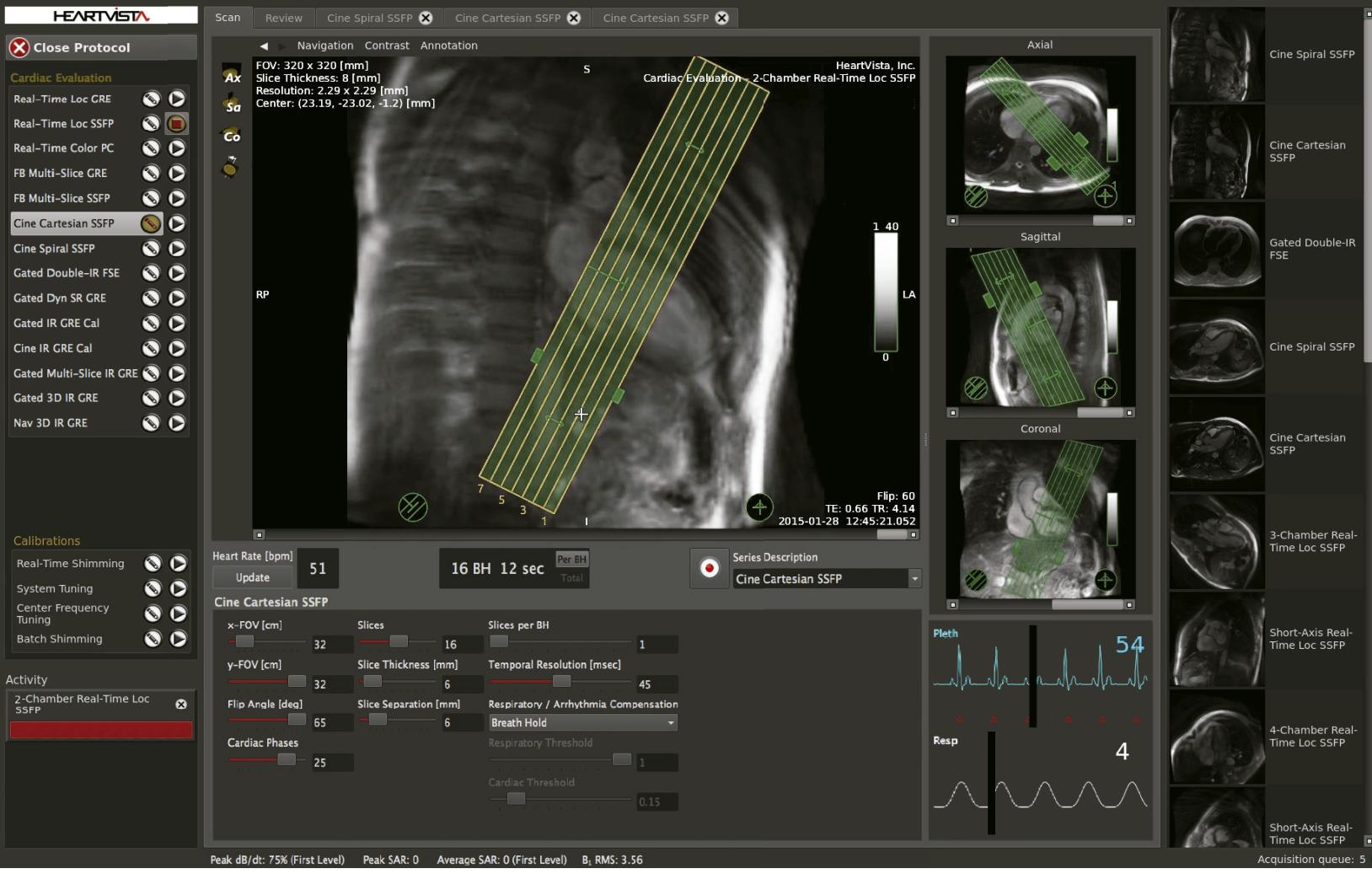


Versatile Protocols

Cardiac MRI exams are often inconclusive due to time-consuming protocols or a patient's irregular heart rate. HeartVista's Apps were developed to overcome these common issues. Protocols can be customized with a variety of traditional, accelerated, and free-breathing Apps to **meet the needs of the patient and exam time constraints**.



Use the clinic network to connect remotely to the scanner



HeartVista interface, prescribing the FB Multi-Slice SSFP App on top of Real-Time Loc SSFP images as they are acquired and displayed

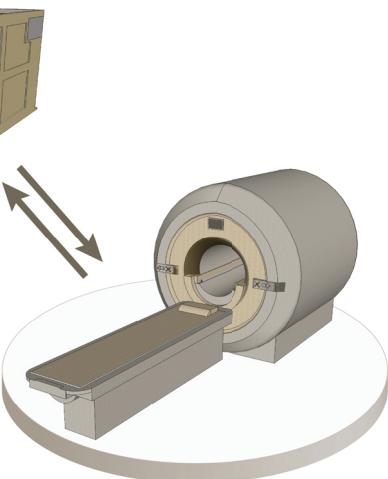
Integrated Workflow

The HeartVista Cardiac Package system seamlessly connects to the GE MRI system, simply appearing in the GE protocol as an additional pulse sequence. This sophisticated integration saves all DICOM images in the GE database and allows the system operator to easily switch, within a single examination, between GE and HeartVista.

The interface was designed to be intuitive and to provide a **smooth and natural workflow** using smart functions (such as click and drag commands) by incorporating real-time imaging throughout the entire diagnostic process.

Remote Capabilities

Safely connect to the HeartVista platform from any remote location within the clinical network. The remote connections allow physicians to **monitor scans live or assist with the scanner control** to train technicians or modify current, clinical slice prescriptions.

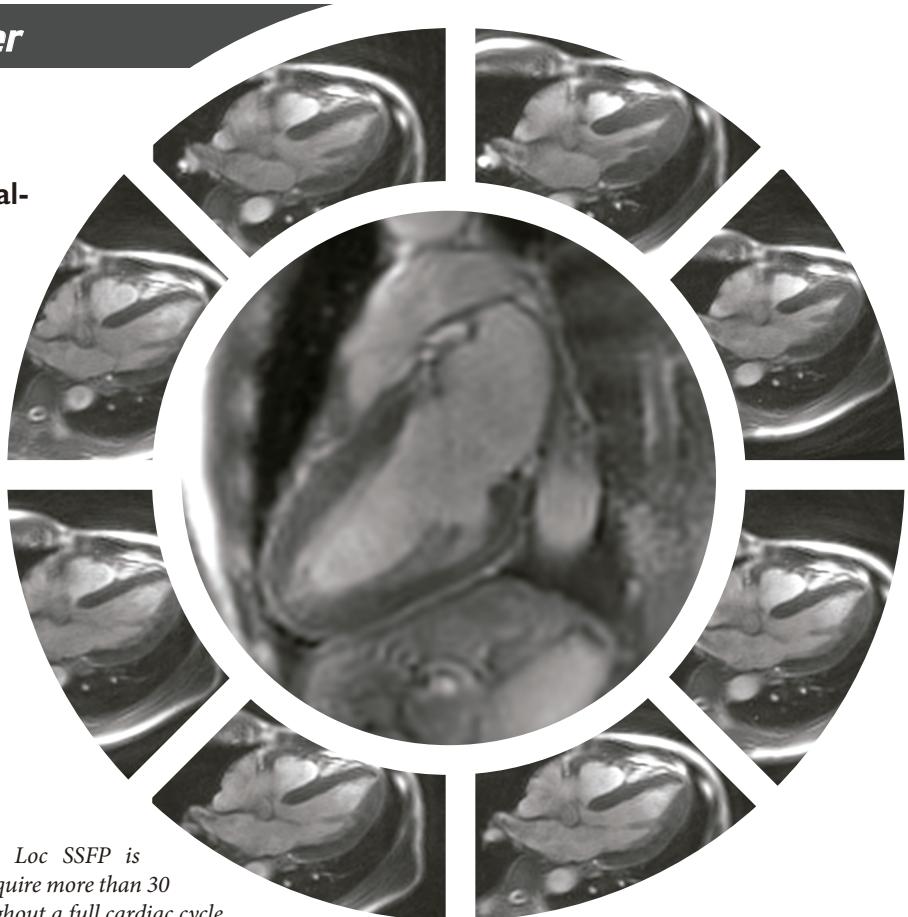


Fast • Reliable • Simple

Real-Time and Free-Breathing Acquisitions

Real-Time Localizer

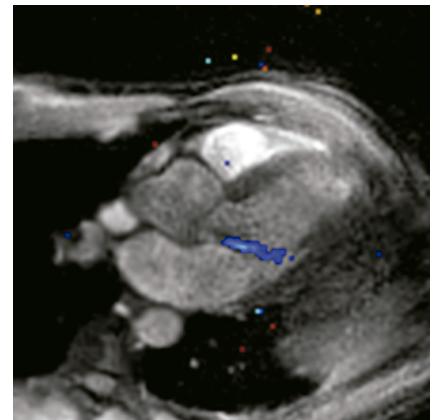
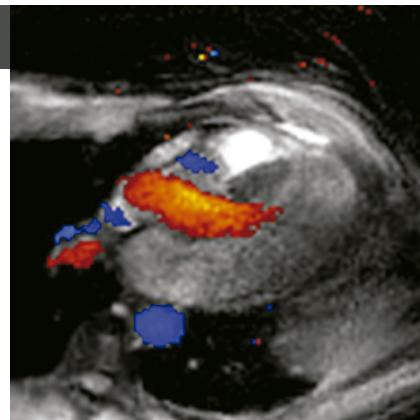
The HeartVista Cardiac Package is a **real-time-based imaging platform**. SSFP and GRE real-time Apps do not require breath-holding or cardiac gating. The scan plane can be adjusted on the fly and the images used to prescribe slices, bookmark scan planes, or detect and track transient events. These Apps record more than 30 frames per second (fps) to capture fine temporal details. Slices can be interactively prescribed at any scan plane relative to the real-time images and the user can switch between different Apps with a single button click.



Real-Time Loc SSFP is used to acquire more than 30 fps throughout a full cardiac cycle

Flow

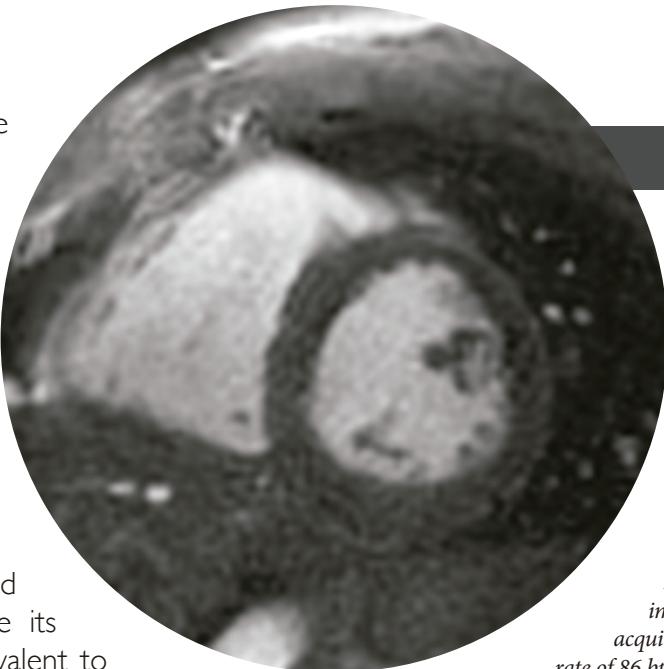
Real-Time Color PC is a novel App that allows users to evaluate blood dynamics on any plane in real time. Colored phase-contrast maps are thresholded and overlaid on the corresponding anatomical images to provide a quick and easy means to discern flow patterns. The slice position and parameters (such as flow direction and VENC) can be adjusted on the fly with instantaneous feedback. The results can be saved as composite, colored images or as separate magnitude and phase images for optional offline analysis.



The real-time colored velocity maps overlaid on anatomical images during (left) systole and (right) diastole demonstrate aortic regurgitation.

HeartVista™ includes multiple Apps for assessing cardiac function or visualizing cardiac motion that can accommodate varying patient capabilities.

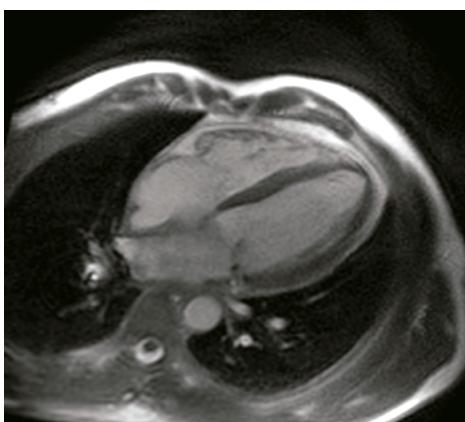
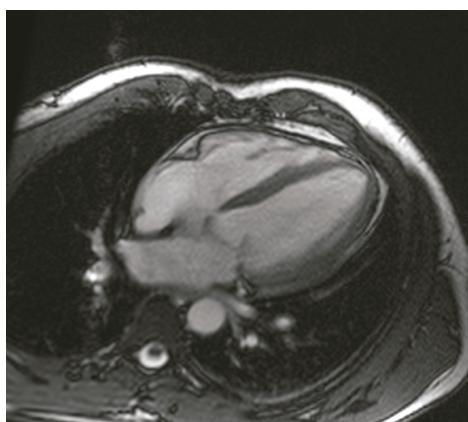
The **new, state-of-the-art HART™ Apps** acquire images in real time, eliminating all reliance on breath-holds and steady cardiac rhythms, while requiring only 2 heartbeats per slice to acquire. Advanced parallel imaging is used to create its high spatial resolution that is equivalent to standard breath-hold sequences.



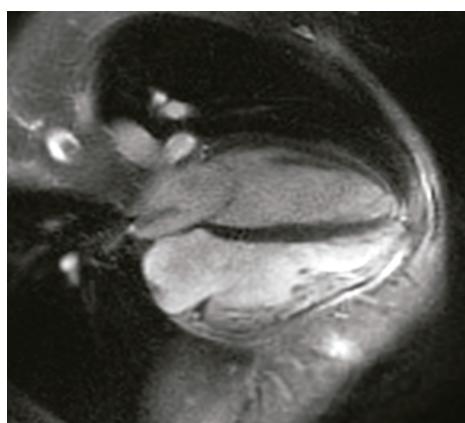
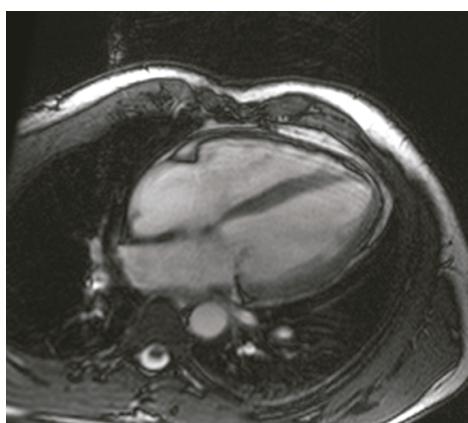
Function

High-resolution
Acquisition in
Real
Time

A stack of 13 short-axis images required 18 seconds to acquire on this patient with a heart rate of 86 bpm using HART SSFP



(Left) Cine Cartesian SSFP and (right) Cine Spiral SSFP are acquired during short breath-holds



(Left) Cine Cartesian SSFP with free-breathing selected and (right) HART SSFP can be acquired during free-breathing

Breath-Hold

Cine Cartesian SSFP (left) and Cine Spiral SSFP (right) are fast, high-resolution Apps that produce images throughout the cardiac cycle. Cine Cartesian SSFP can usually acquire 1 or 2 slices per breath-hold, while Cine Spiral SSFP can often acquire 2 or 3 slices per breath-hold, depending on the patient's abilities.

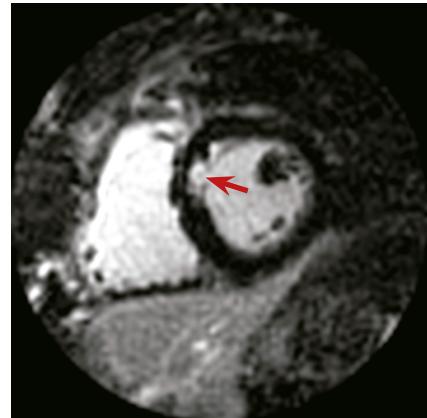
Free-Breathing

In addition to the new HART APPs, the Cine Cartesian SSFP has a free-breathing option (left) which uses motion correction to acquire the same high-resolution images as the breath-hold sequence described above.

Reliable Apps To Meet Your Needs

Gadolinium Enhancement

HeartVista's™ delayed enhancement Apps are designed to meet your clinical needs. Choose from a variety of free-breathing or breath-held Apps for measuring myocardial viability or calculating appropriate inversion times.



Hyperenhancement can be observed in the (left) multi-slice delayed enhancement App with phase-sensitivity and 3 slices acquired per breath-hold, and (right) 3D delayed enhancement, where a volume with full ventricular coverage was acquired in one breath-hold

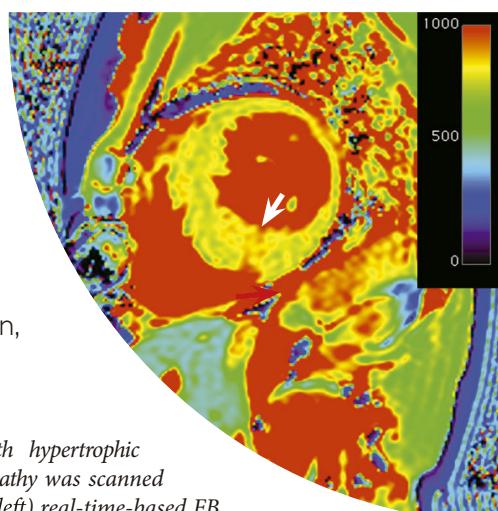
Breath-Hold

The Multi-Slice DE GRE and Single-BH 3D DE GRE Apps can be used to assess myocardial viability of patients with scar tissue. The Multi-Slice DE GRE App acquires high-resolution images with asymmetric fov and optional fat suppression or phase-sensitive reconstruction. The Single-BH 3D DE GRE App can acquire a slab covering the entire ventricle in one breath-hold. The inversion time can be easily determined within a short breath-hold using the Cine DE Cal App.

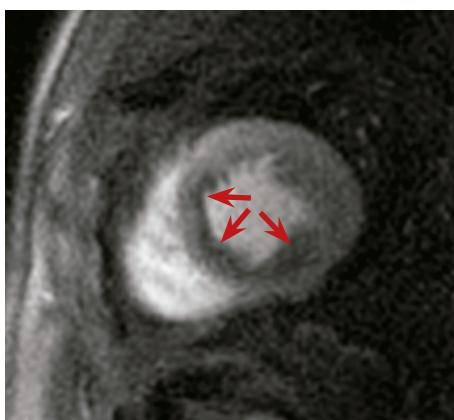


Free-Breathing

FB DE SSFP is a single-shot delayed enhancement technique that provides a robust DE imaging option for patients with irregular cardiac rhythm or who cannot hold their breath. This App acquires a single image per heartbeat in real time, and it can be used to acquire a multi-slice stack or to determine appropriate inversion times with an easy-to-use slider bar during free-breathing. Nav 3D DE is a pencil-beam navigated App that is suitable for DE applications requiring whole-heart coverage with isotropic resolution.



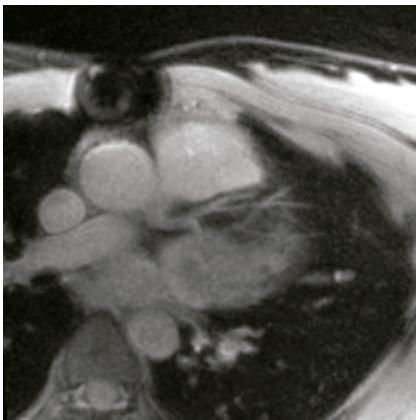
Time-Course



Time-Course GRE is a multi-slice App that is optimized for stress and time-course studies. This spiral-based App has high temporal resolution, acquiring up to 7 slices per heart beat.

An abnormal uptake was demonstrated on this Time-Course GRE study where 5 slices were acquired per heartbeat

Patient with hypertrophic cardiomyopathy was scanned using (top left) real-time-based FB DE SSFP, (top right) Multi-Slice DE with phase-sensitivity, (bottom left) Cardiac T1 Map[‡], and (bottom right) Cardiac T2* Map[‡]



Angiography

Gated 3D MRA GRE

This 3D, ECG-gated, MRA App allows the user to visualize contrast-enhanced vasculature. The Real-Time Loc GRE can be used to monitor the arrival of the contrast bolus in real time prior to running Gated 3D MRA GRE.

Gated High-Res GRE

This ECG-gated, non-contrast-enhanced App can be used to visualize small anatomic structures such as the proximal coronary arteries with sub-millimeter resolution. A single stack of slices can cover the whole heart and only requires a single breath-hold to acquire.

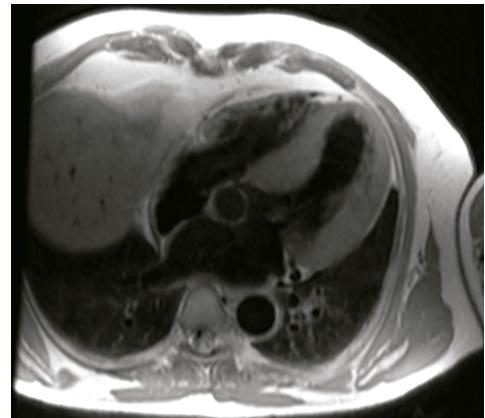
Advanced Tissue Characterization

Cardiac T1, T2, & T2* Map

Quantify cardiac health with these new Apps. Cardiac T1 Map are calculated using multiple inversion times. T1 mapping has been shown to be beneficial for diagnosing diffuse myocardial fibrosis[†].

Cardiac T2 Map[‡] is calculated by acquiring images with varying T2 preparation times, used for detecting myocardial edema[†].

Cardiac T2* Map collects multiple gradient echo images with differing echo times to estimate the T2* decay, a characteristic often used to measure iron levels.



The breath-hold black blood App provides T2-weighted images with great blood suppression

Black Blood

The black blood Apps have T2-weighted, double inversion-recovery sequences with blood suppression, which can be useful for visualizing the walls of the cardiac chambers or blood vessels. A third inversion can be added to the breath-hold App to suppress fat. The single-shot FSE App can rapidly acquire images during free-breathing.

About HeartVista™

HeartVista is an NIH and venture capital funded medical device company dedicated to the development of advanced MRI technologies with a focus on cardiovascular disease and MRI research. The company was founded by a group from the Magnetic Resonance Systems Research Lab at Stanford University, a research center that has made significant contributions to the advancement of MRI. The founders of HeartVista are driven to surpass the significant barriers they encountered when trying to construct efficient advanced MR applications using available technologies. They have developed an MR operating system and a design environment for the development of advanced imaging applications, offering ease-of-use and flexibility in building this highly integrated, real-time cardiac magnetic resonance imaging software suite.

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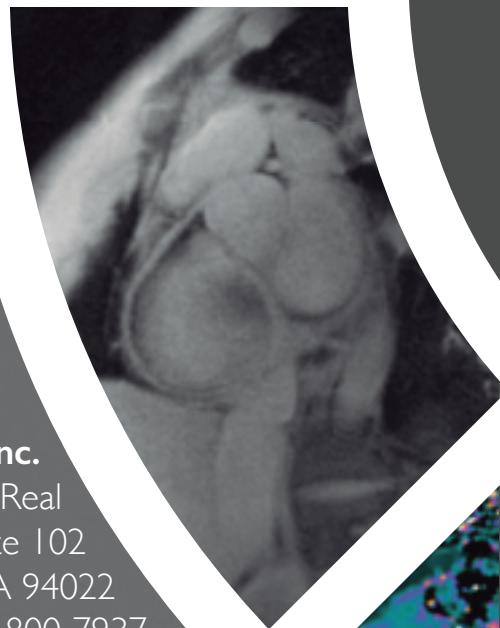
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‡ The color overlays for the Cardiac T1 Map, Cardiac T2 Map, and Cardiac T2* Map images were generated by Osirix.

* Cardiac T2 Map product feature is currently Works-in-Progress. Device availability following FDA 510(k) pre-market clearance and/or additional CE Marking.

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