

PERFORMING IMAGE REGISTRATION AT SUTTER PACIFIC HEART CENTERS WITH THE CARTOMERGE™ IMAGE INTEGRATION SOFTWARE MODULE

As more electrophysiologists use the CARTOMERGE™ Image Integration Software Module, they are refining the registration process to suit their particular techniques. This is one in a series of White Papers that have been prepared to share the experts' methods.

Dr. Steven Hao is Medical Director of Cardiac Electrophysiology at Sutter Pacific Heart Centers in San Francisco and Marin Counties, leading teams in electrophysiology laboratories at Marin General Hospital, California Pacific Medical Center, and St. Luke's Hospital. He has performed more than 150 cases with the CARTOMERGE™ Module. His registration technique was modified from the technique used by Dr. Andrea Natale at the Cleveland Clinic.

For a therapeutic procedure in the left atrium, Dr. Hao's team uses a dual transeptal approach, placing a NAVI STAR® Catheter and a LASSO® Circular Mapping Catheter in the left atrium and an AcuNav® intracardiac echocardiography probe in the right atrium. Under ultrasound and fluoroscopic guidance, they identify and acquire four landmark points: the superior and posterior aspect just outside the left superior pulmonary vein; the inferior posterior aspect outside the left inferior pulmonary vein; the superior posterior aspect outside the right superior pulmonary vein; and the posterior superior aspect outside the right inferior pulmonary vein.

"The key to CARTOMERGE™ Module registration," Dr. Hao says, "is to identify the most superior and posterior aspects of the cardiac structure that you're trying to register. Correct placement of the LASSO® Catheter in the pulmonary vein antrum is confirmed with direct real-time imaging with intracardiac echocardiography," he continued. "Placement of the NAVI STAR® Catheter adjacent to the LASSO® Catheter is confirmed fluoroscopically. We take the point at the superior or inferior posterior aspect in the pulmonary vein antrum." These precautions prevent the CARTOMERGE™ Module from allocating points to the wrong surface, Dr. Hao says, by defining the superior, inferior, posterior, and anterior locations.

After landmark registration, Dr. Hao isolates the pulmonary vein antrums using the LASSO® and NAVI STAR® Catheters. Surface registration after acquisition of 10 to 20 additional surface points in the posterior wall/pulmonary vein antrums results in an accurate map of the left atrium. "The posterior wall and the septum of the left atrium are stabilizing structures," Dr. Hao observes. "Registration of these structures is less likely than the anterior wall or appendage to be affected by movement caused by respiration or cardiac contraction. We would have difficulty if we tried to use other structures like the left atrial appendage or the mitral annulus for registration," Dr. Hao continued. "Registration with the CARTOMERGE™ Module after mapping the posterior wall of the heart provides accurate information of the structures anterior to the pulmonary veins, particularly the ridge between the left pulmonary veins and the left atrial appendage."

If Dr. Hao is mapping the right atrium, he registers with a lateral superior vena cava-right atrial juncture point, followed by a septal high-tricuspid angular point. Then, he chooses one tricuspid angular point, at either a 6 o'clock or 9 o'clock position. The right atrium presents some challenges, he said. It is generally more trabeculated than other structures, which may result in a lower-resolution CARTO™ XP System image than that obtained of other structures. In addition, CT acquisition is often not optimized for the right atrium. "Correct timing of CT imaging after the contrast bolus is critical for accurate images, Dr. Hao said. The CT image should be timed to when the maximum amount of contrast medium is in the structure to be registered, in order to get the most definition.

Using the range of views available, the CARTOMERGE™ Module is also useful, Dr. Hao said, for providing a three-dimensional view of the position of the catheter in the heart. He recommends the concurrent use of two different perpendicular or oblique views.

“The biggest challenge in the treatment of arrhythmias,” Dr. Hao concluded, “is to optimize the approach to the patient specific cardiac anatomy. If used properly, I believe that the CARTOMERGE™ Module can improve efficiency and confidence.”

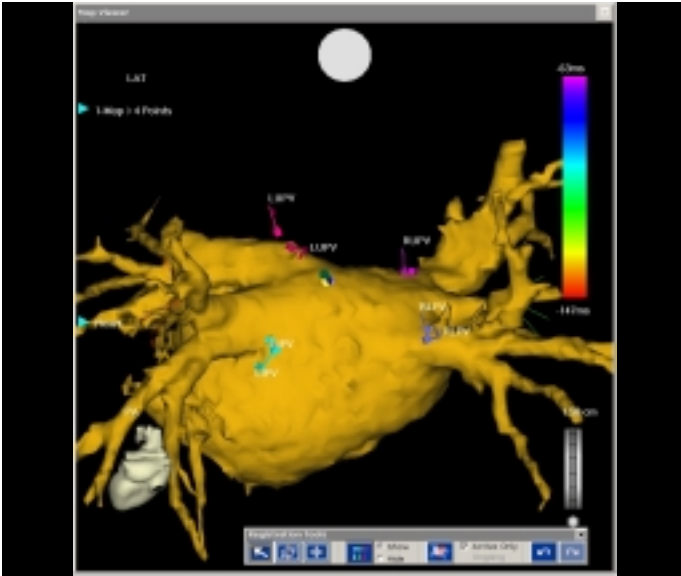


Figure 1. Landmark registration of the left atrium with acquisition of four points in the superior or inferior posterior aspects of the pulmonary vein antrums.

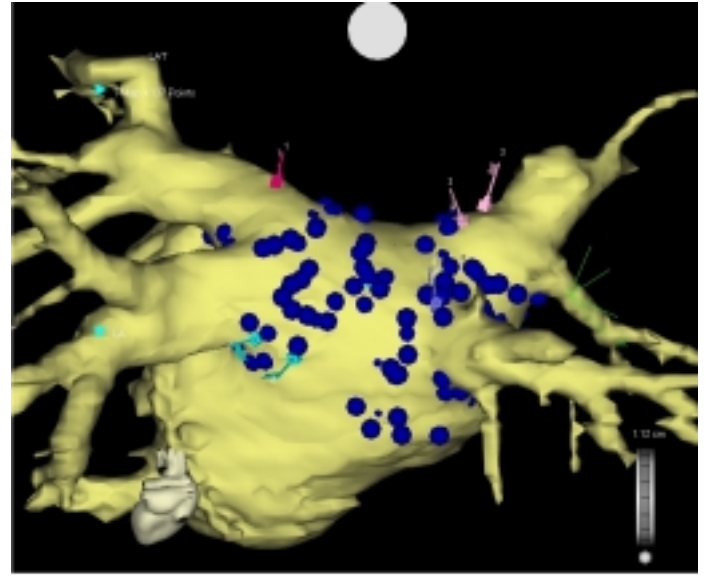


Figure 2. Accurate Landmark and Surface registration of the LA. Note minimal deviation of the landmark tags after surface registration.

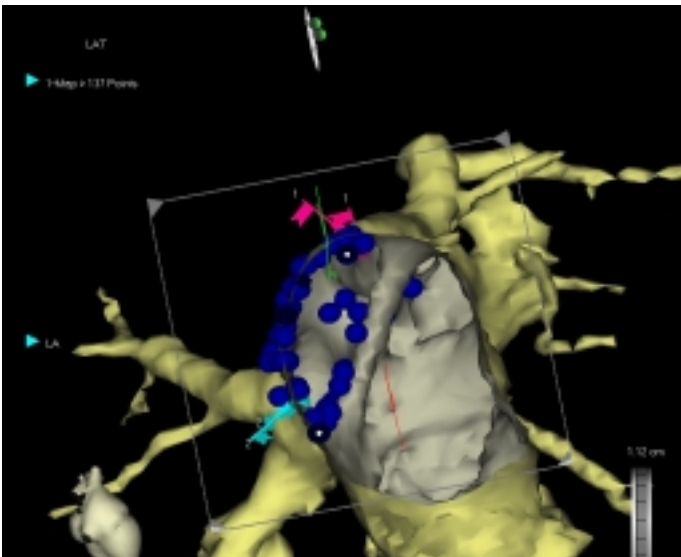


Figure 3. Endoscopic view of the left pulmonary veins.

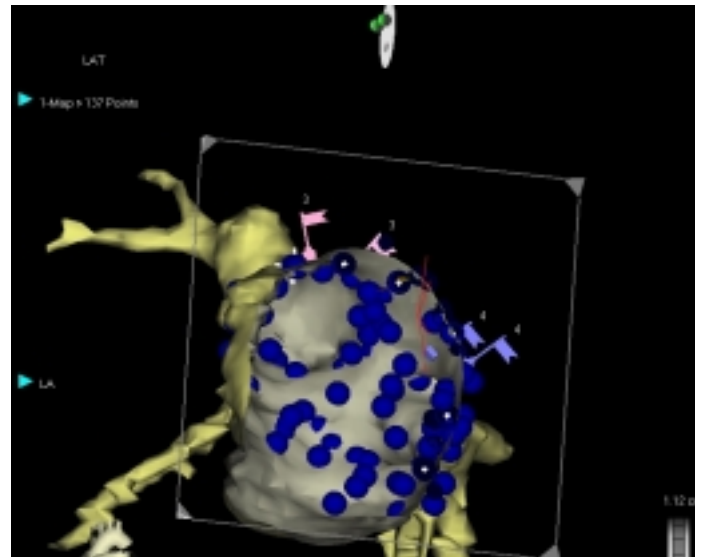


Figure 4. Endoscopic view of the right pulmonary veins.