INTRODUCTION
Both of these cases were classic cavotricuspid isthmus dependent atrial flutters. The first was a de novo ablation, and was fairly straightforward. In the second we present a redo case where Rhythmia was used to identify gaps in previously ablation lines.

CASE 1 - De Novo Atrial Flutter Ablation
Case Introduction and History
The patient presented with what looked electrocardiographically like classic atrial flutter, but in the clockwise direction.

Rationale for Rhythmia Mapping System
In this straightforward case, we used the Rhythmia Mapping System to gain familiarity with the system’s features and functionality. Interestingly though we were able to use the capability of Rhythmia to assess linear block after ablation in this case. The validation (‘V’) or vMap shown below contributed to the outcome of the case.

Rhythmia Mapping Procedure
We began by making an activation map of the right atrium (RA) with the Rhythmia™ Mapping System with the patient in atrial flutter. The map was created in just under 7 minutes and contained 6,744 electrograms. It showed that the activation was moving down the septal side of the RA and up the lateral wall clockwise around the tricuspid valve (Figure 1).

Due to the large number of points the Rhythmia Mapping System collects, the system allowed us to change the view of the activation wavefront depending on what we wanted to focus on. In figure 2 below, we created a very narrow wavefront that when propagated, allowed us to view the wavefront passing through the isthmus.
A narrow band of activation (Figure 3) passing through the cavotricuspid isthmus clockwise underneath the tricuspid valve easily and convincingly showed the wave of depolarization through the cavotricuspid isthmus in atrial flutter before ablation. You can see the area of the isthmus between the tricuspid annulus and inferior vena cava – flutter line. We used drag lesions with a perfusion catheter, and made lesion tags each time the catheter stopped for 5-10 seconds (Figure 4).

**Figure 3.** RA activation map (left) and voltage map (right)

**Figure 4.** View of Activation (left) and Voltage (right)

**Case Outcome**

Since the system has the ability to quickly collect large quantities of data points, we quickly created what is called a validation map or vMap post-ablation. This entailed creating another map to confirm lines of block or rapidly identify gaps in ablation lines. Figure 5 shows a vMap create during coronary sinus pacing after the ablation line was complete. You can see antegrade activation to one side of the line and retrograde activation around the tricuspid valve to the other side of the line, indicating that we had block across the line.

**Figure 5.** Post Ablation vMap confirming block. Dynamic review also confirms double potentials across the ablation line
Another unique feature of the system is dynamic review and the virtual roving probe. Both allowed us to quickly review any data point on the map. This is especially useful since the Rhythmia system collects a large volume of data. From the review screen, among other things, we looked at individual electrograms at any point on the map, we can reviewed annotation timing, and saw rejected or accepted data points. In this case, to confirm the block, we passed a dynamic probe down the ablation line and saw a line of nicely formed double potentials (Figure 5).

This was a very straightforward case. We successfully terminated the tachycardia and confirmed block across the cavitricuspid isthmus with pace mapping from the Rhythmia Mapping System. We made several maps during the case. The initial map contained 6744 EGMs and took 6 minutes and 49 seconds to create. The post ablation vMap contained 10690 EGMs and took 5 minutes and 5 seconds to make.

**CASE 2 - Redo Atrial Flutter Ablation**

**Introduction**

We’ve just highlighted an example of block across a cavitricuspid isthmus line. Now we’ll look at our second case using the Rhythmia Mapping System in the presence of recurrent counterclockwise cavitricuspid dependent atrial flutter. Figure 6 shows this patient’s voltage map on the right and an activation map on the left. These maps were created in just 9:37 and contain 9,100 EGMs. These very high-definition maps show us quite a different situation from the previous case. The voltage map shows a mix of high and low voltage areas in the cavitricuspid isthmus area.

![Figure 6. Counterclockwise atrial flutter activation and voltage maps](image)

If you look at the wave of activation in the propagation map, you see a narrow band of activation that seems to pass through two of the higher voltage areas in the voltage map (Figure 7).

![Figure 7. Activation and Voltage Maps showing band of activation passing through high voltage areas](image)

A couple of lesions placed where the activation is clearly breaking through terminated the flutter (Figure 8). Then, we quickly and easily, created another vMap using pace mapping to confirm that we had successfully created the cavitricuspid isthmus conduction block just as we did with the previous case (Figure 8).
This case illustrates how the Rhythmia system can accurately identify gaps in linear lesions from previous procedures. In this case, the original ablation line was made several weeks prior, and now with the Rhythmia system, we can clearly see a gap in that line. Precise identification of gaps in ablation lines using very high density contact maps greatly simplifies completion of ablation lines in both right and left atrial flutter cases.

**CONCLUSION**

This review focused on the use of Rhythmia in common right atrial flutter. The system showed utility in both cases. However, in the second case, having a high density voltage and activation map of the cavotricuspid isthmus for the counterclockwise redo atrial flutter guided lesion placement to the area of breakthrough. The confirmation of block across linear lesions by intelligently annotating the true activation on both sides of the linear lesion is one of the areas where Rhythmia really shines. While the Rhythmia system is often associated with complex procedures, it also has utility in the more common procedures because of its ability to quickly verify lines of block and identify existing gaps.
RHYTHMIA™ MAPPING SYSTEM

INTENDED USE/INDICATIONS FOR USE
The Rhythmia™ Mapping System and accessories are indicated for catheter-based atrial and ventricular mapping. The system allows real-time visualization of intracardiac catheters as well as display of cardiac maps in a number of different formats. The acquired patient signals, including body surface ECG and intracardiac electrograms, may also be recorded and displayed on the system’s display screen.

CONTRAINDICATIONS
There are no known contraindications.

WARNINGS AND PRECAUTIONS
The use of the Rhythmia Mapping System in conjunction with radio frequency ablation and other medical devices, as a part of the diagnosis and treatment of cardiac arrhythmias, may pose a risk of adverse events, such as cardiac perforation and arrhythmias (new and/or exacerbation of existing arrhythmias) that may require additional intervention. Do not operate the Rhythmia Mapping System near flammable anesthetics. System operation near flammable anesthetics may cause an explosion that could cause injury or death to the patient or user. All devices that are connected to the Rhythmia Mapping System must meet IEC 60601-1 requirements and any other relevant safety standards. When connected to other devices, the combined systems’ configuration must meet the IEC 60601-1 safety standards. The use of the Rhythmia Mapping System with accessories and devices that do not comply with relevant standards may reduce the safety of the system, cause equipment damage or system malfunction, or harm to the patient or user. Only stimulators that are certified for IEC 60601 should be used with the Rhythmia Mapping System. Do not connect life-sustaining pacing through the Rhythmia Mapping System. The system is not intended to provide life-sustaining pacing and should not be used as such. In case of need for emergency pacing, or any failure of the system, paravascular mapping, directly connect the desired paced channel to the stimulator. The Rhythmia Mapping System is only designed to route the stimulation signal to the desired channel. To start or stop stimulation, always use the controls on the external stimulator. Use the Rhythmia Mapping System only with one of the following RF ablation generators: Maestro 3000™, Stockert™, or IBI™. Do not use the system with other RF ablation generators. Compatibility with other RF ablation generators has not been demonstrated. Do not apply RF energy larger than 150W to ablation catheters that are connected to the Maestro 3000™ RF generator and the Rhythmia Mapping System. Do not apply RF energy larger than 70W to ablation catheters that are connected to the Stockert™ RF generator or the Rhythmia Mapping System. Do not apply RF energy larger than 50W to ablation catheters that are connected to the IBI RF generator and the Rhythmia Mapping System. To reduce the risk of electric shock or equipment damage, do not clean the Rhythmia Mapping System when it is plugged in, turned on, or connected to a patient. Cleaning the system while it is in use and connected to a power source may cause injury or death to the patient or user. To reduce the risk of electric shock, assure that any ECG cables and electrodes are not in contact with any other conductive parts, including ground. To reduce the risk of electric shock during defibrillation, assure that the exposed connector tips on the ECG output box are covered at all times with the protective, non-conductive material provided. Do not use the ECG output box if the protective cover is damaged (see ECG Output Box). The system generates electrical impedance fields as part of its normal operation. Do not use other systems that also generate electrical impedance fields in the same procedure, as this may interfere with the system’s normal operation and reduce the quality of catheter localization, and signals. Magnetic Localization System Do not operate the Localization Generator within 200 mm of installed cardiac implantable electronic devices (CIEDs). Doing so may affect pacemaker, temporarily suspend tachycardia therapy, or delay, or lead to patient discomfort. Signal Station The minimal electric shock, connect the Signal Station only to mains with a protective ground (earth) connection. Use only a functioning, properly tested supply mains (earth) connection to power the Rhythmia Mapping System. The use of a faulty, ungrounded supply mains increases the risk of electric shock and system malfunction. To minimize the risk of electric shock, prior to the use of the Rhythmia Mapping System, connect the equipotential socket (located on the Signal Station rear panel) to a common ground. This connection grounds the Rhythmia Mapping System and must remain connected at all times (see Signal Station Setup in the DFU). The Signal Station requires a dedicated, 24V DC power supply, which is provided by Boston Scientific with the Signal Station. To reduce the risk of Signal Station damage, use only the power supply provided by Boston Scientific for use with the Signal Station. To reduce the risk of Signal Station damage, do not disconnect or reconnect the Signal Station to its power supply while the Signal Station is turned on. To minimize potential exposure to water or liquid, prevent fluids from entering air vents. Do not place beverages or containers of water or liquid directly on or near the Signal Station or any other system components. Do not block the air vent on the Signal Station during Signal Station use. Blocking the air vent during Signal Station use can cause the Signal Station to overheat, which may affect system operation. Use only a flat stable surface to hold the Signal Station and Signal Station-related accessories. Workstation To minimize potential exposure to water or liquid, do not place beverages or containers of water or liquid directly on or near the Workstation or other system components. Use only a flat stable table to hold or transport the Workstation and Workstation-related accessories. To prevent loss of data, frequently back up the data by archiving copies no longer needed for immediate access. Cables Use only the ECG cables supplied by Rhythmia™ Medical for use with the Rhythmia Mapping System. ECG cables provided by Rhythmia Medical are designed and tested to protect the Signal Station from defibrillation energy. Using other ECG cables may cause serious damage to the system hardware. Prior to using the Rhythmia Mapping System, inspect all external connections and cable connectors. Make sure all connections are secure. Tighten any loose connections prior to using the system. Do not use excessive force when connecting or disconnecting cable connectors. Excessive force can damage the connectors, which may cause system malfunction. Do not kink or sharply bend cables. Kinks and sharp bends can damage the cables, which may cause system malfunction. To minimize the risk of damage, store unused system cables in a clean, dry, and secure location, consistent with storage guidelines (see Equipment Storage & Transporting in the DFU). Electrical Never use ungrounded electrical outlets to power any system components. Do not use extension cords or adapters for ungrounded outlets. Using ungrounded outlets, extension cords, or adapters may cause equipment damage, system failure or malfunction. Body Surface Electrodes Use care when attaching the body surface electrodes to lead connectors. To minimize the risk of electric shock, make sure that electrodes and lead connectors do not contact one another or ground. To prevent low quality signals from body surface electrodes, properly prepare the skin prior to attaching the electrodes. Do not use excessive gel as this may lead to shorts between different electrodes. Environmental Do not immerse any cable connectors in water or liquid. Immersion in water or liquid may damage connectors, which may cause system malfunction. Magnetic Localization System Manually disabling the Localization Generator disables all catheter visualization and localization capabilities, including impedance tracking. Do not place the Localization Unit (SCU or Sensor Interface Unit (SIU)) within 1m of the Localization Generator. Doing so may lead to inaccurate tracking. Localization Generator Main generator only with one of the following RF ablation generators: Maestro 3000™, Stockert™, or IBI™. Do not use the system with other RF ablation generators. CAUTION: Federal law (USA) restricts this device to sale by or on the order of a physician. Rx only. Prior to use, please see the complete "Directions for Use" for more information on Indications, Contraindications, Warnings, Precautions, Adverse Events, and Operator’s Instructions. All cited trademarks are the property of their respective owners. CAUTION: The law restricts those devices to sale by or on the order of a physician. Indications, contraindications, warnings and instructions for use can be found in the product labeling supplied with each device. Information for the use only in countries with applicable health authority product registrations. Information not intended for use or distribution in France.

Boston Scientific does not have any catheters approved for the treatment of atrial fibrillation.