



A Difficult case of VT

Venice Arrhythmias 2015

Discussant: Andrea Natale

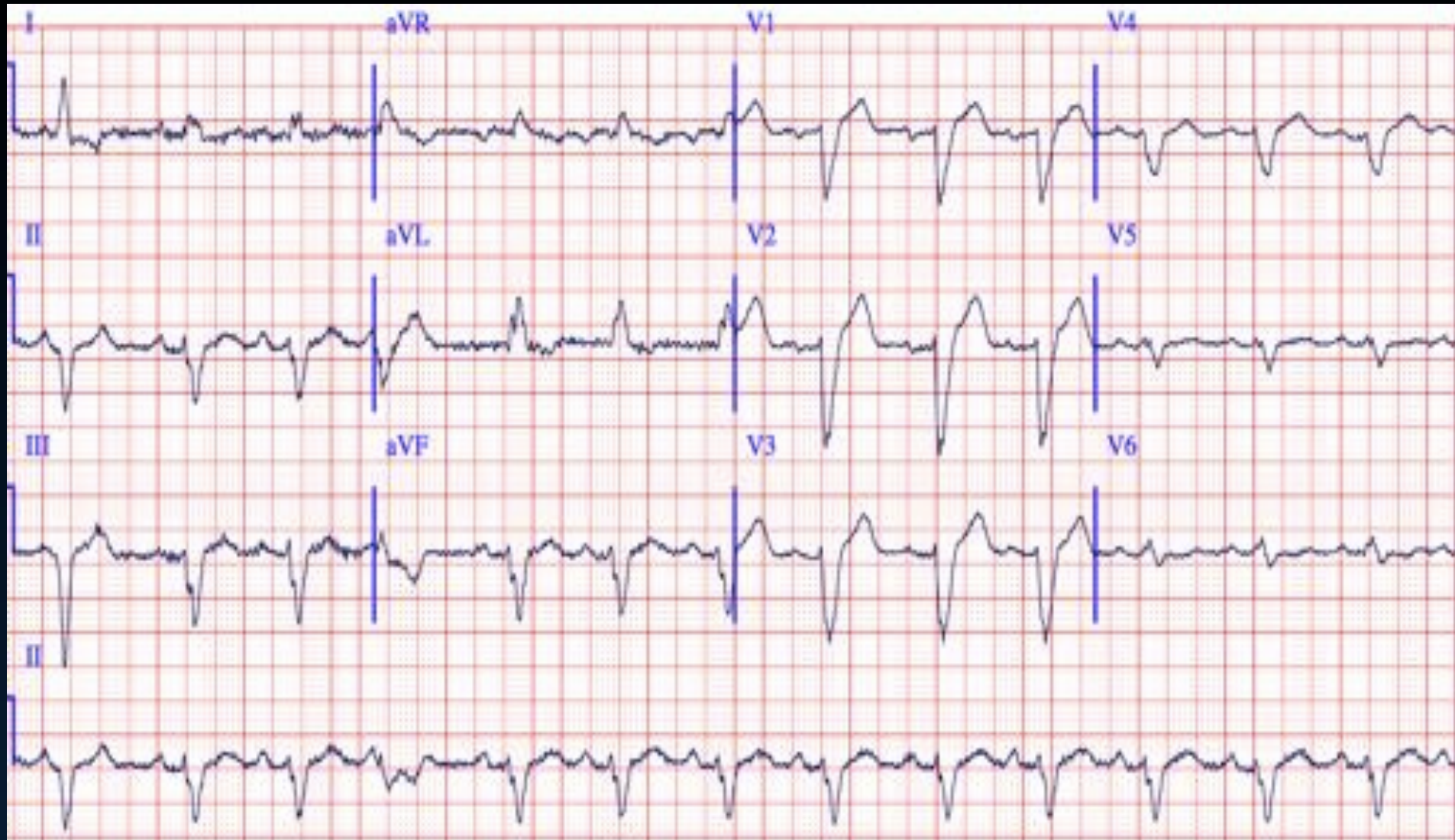
Elad Anter, MD

*Director, Experimental Electrophysiology Laboratory
Associate Director, Clinical Electrophysiology Laboratory
Assistant Professor of Medicine, Harvard Medical School
Beth Israel Deaconess Medical Center – Boston, MA*

Clinical Presentation

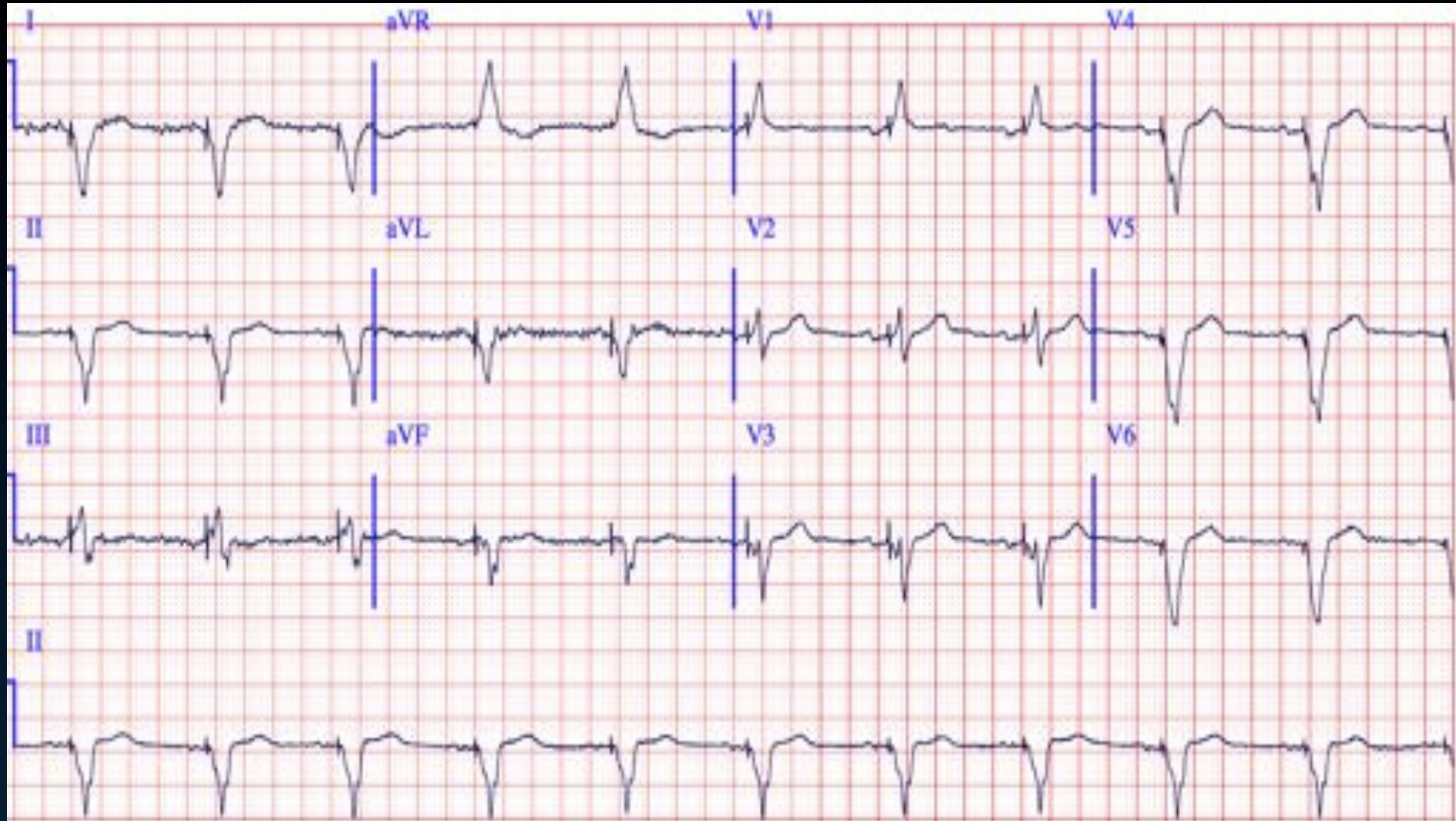
- 67-year-old man
- Chronic mixed cardiomyopathy (LVEF 25%, NYHA II)
 - LAD infarct 1996 (LVEF 45%; NYHA I)
 - 10 years later developed progressive LV dysfunction
 - LVEF from 45 -> 25% and new LBBB
 - VF arrest in 2012 -> CRT-D
 - Recurrent MMVTs requiring ICD shocks (>3 distinct EGMs)
 - Continue to have sustained VTs on chronic amiodarone therapy (400 daily)

Baseline ECG

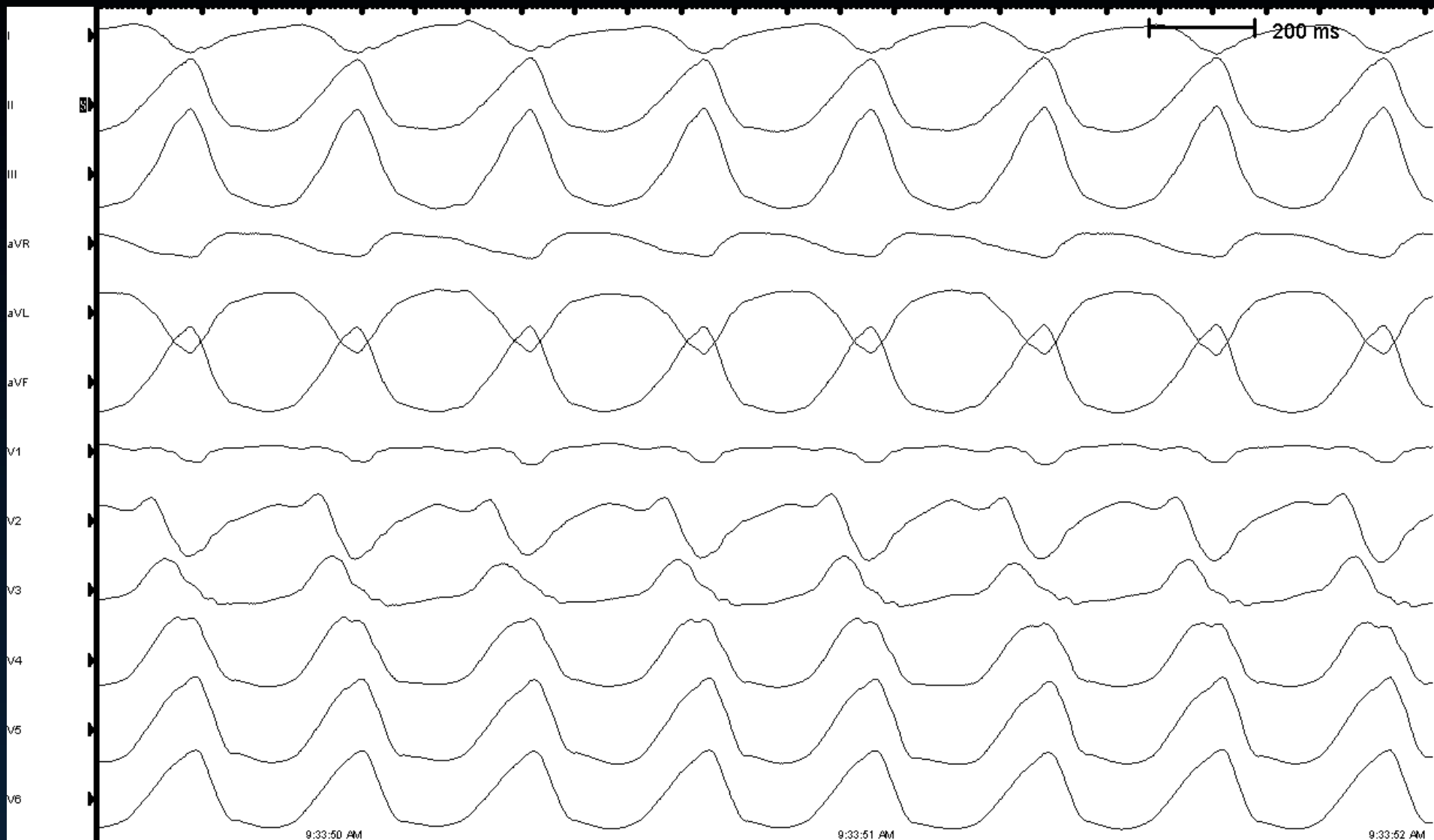


ECG after CRT

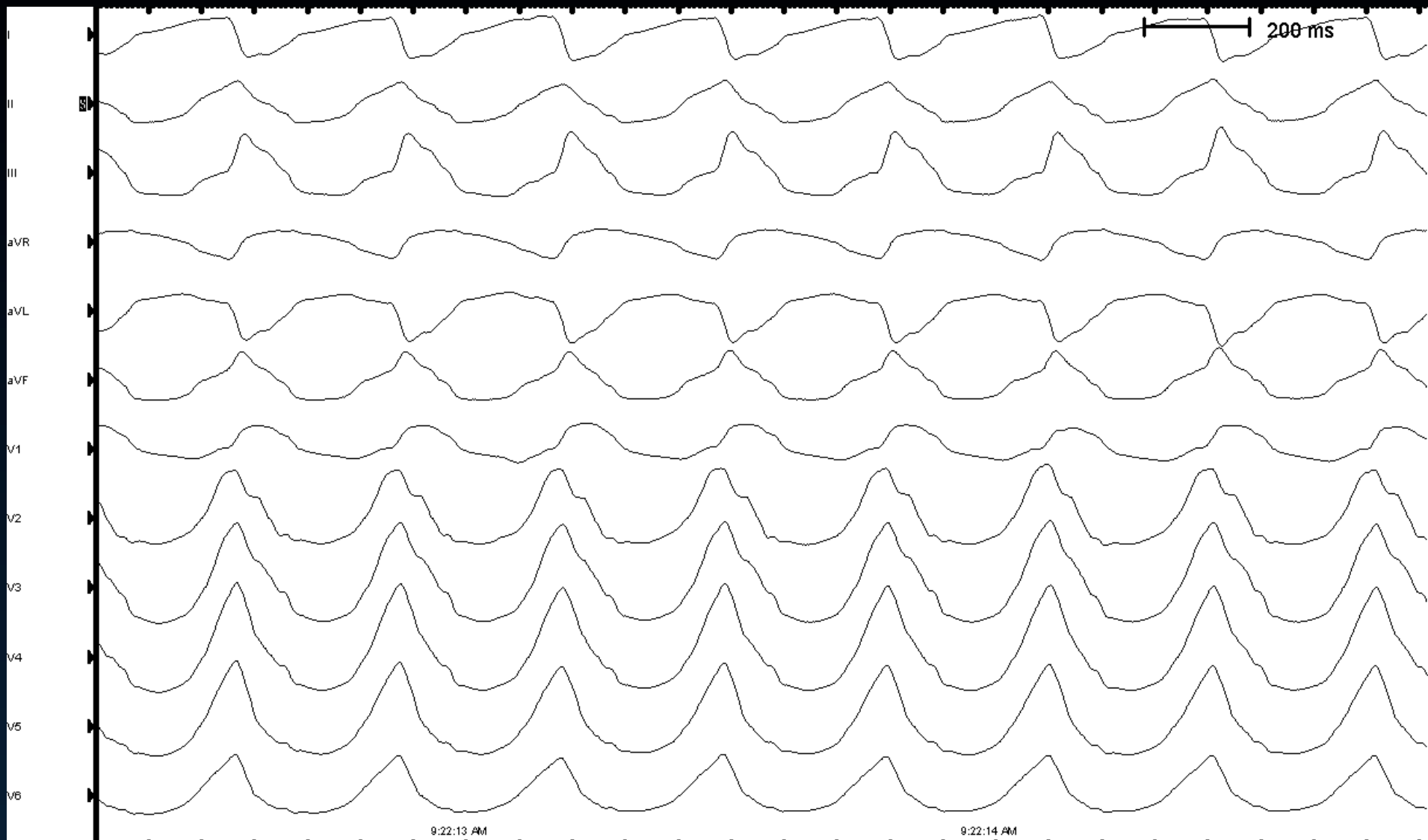
(No change in HF symptoms)



VT-1 induced with ES from RVA (TCL 320ms)



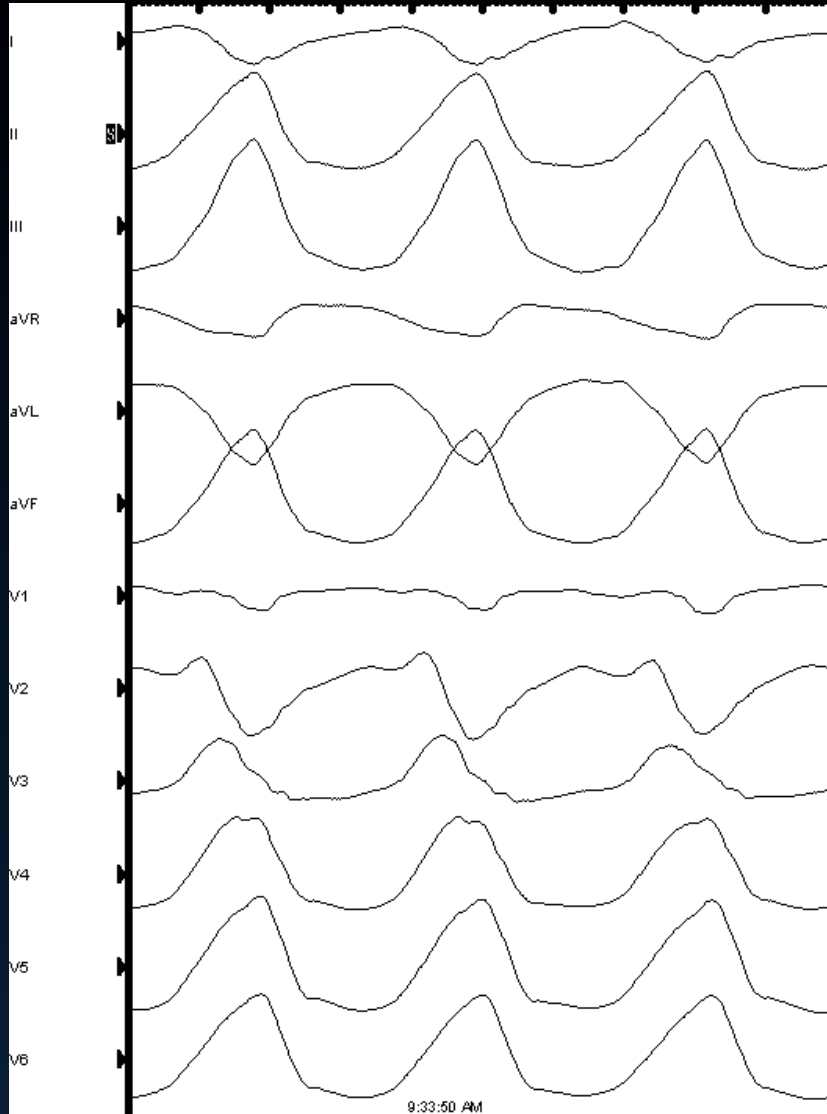
VT-1 induced with ES from RVA (TCL 305ms)



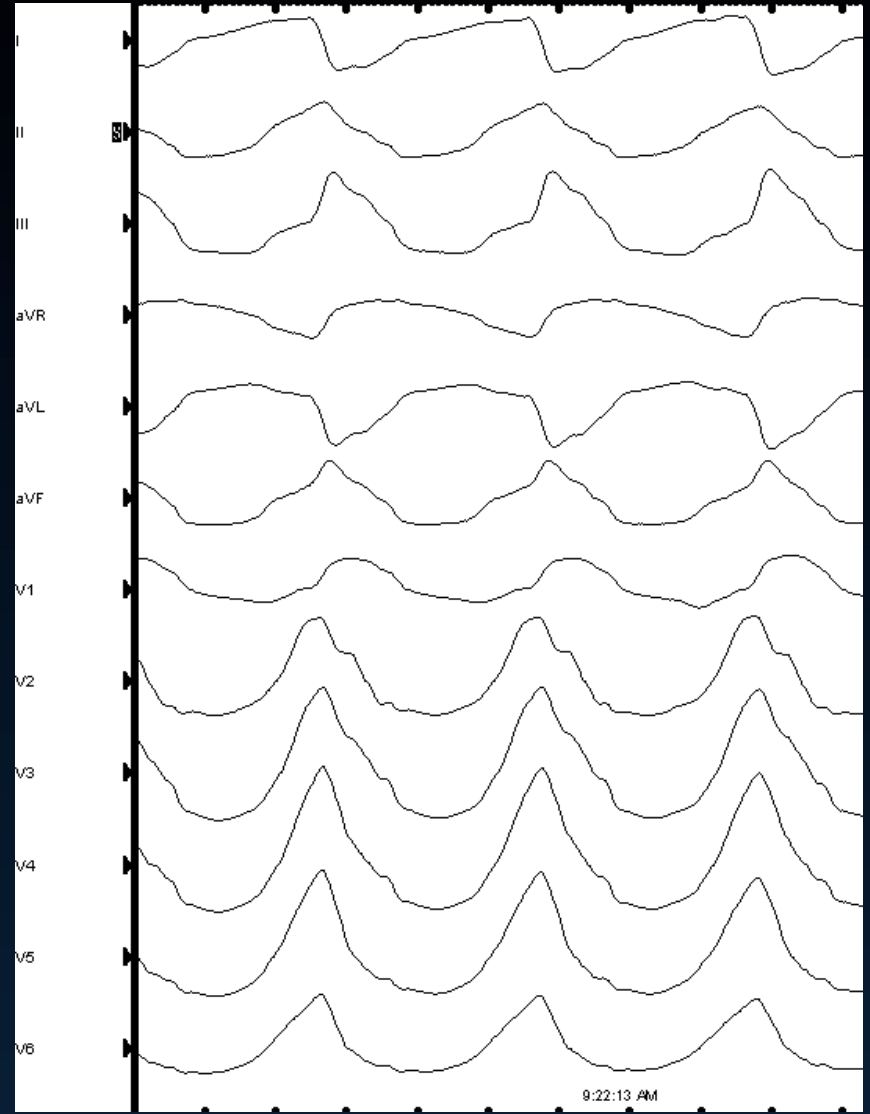
Two inductions with 2 MMVTs

(Both non-tolerated, failed ATP –DCCV)

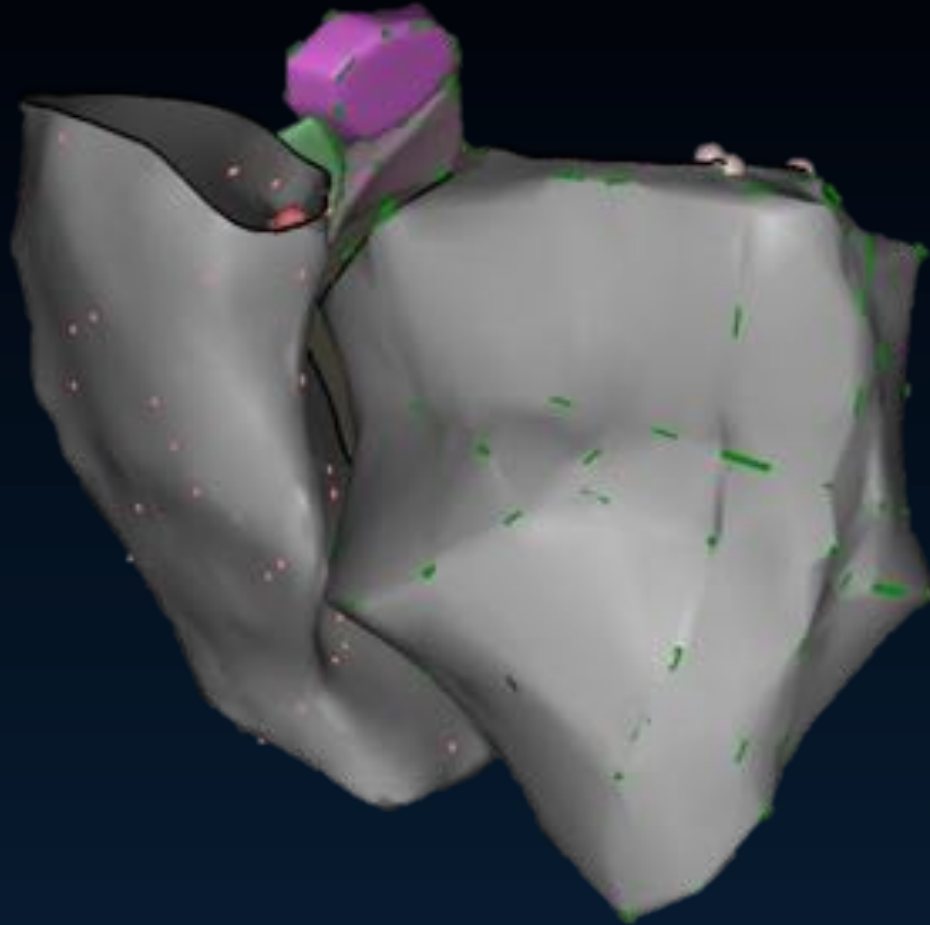
VT-1



VT-2

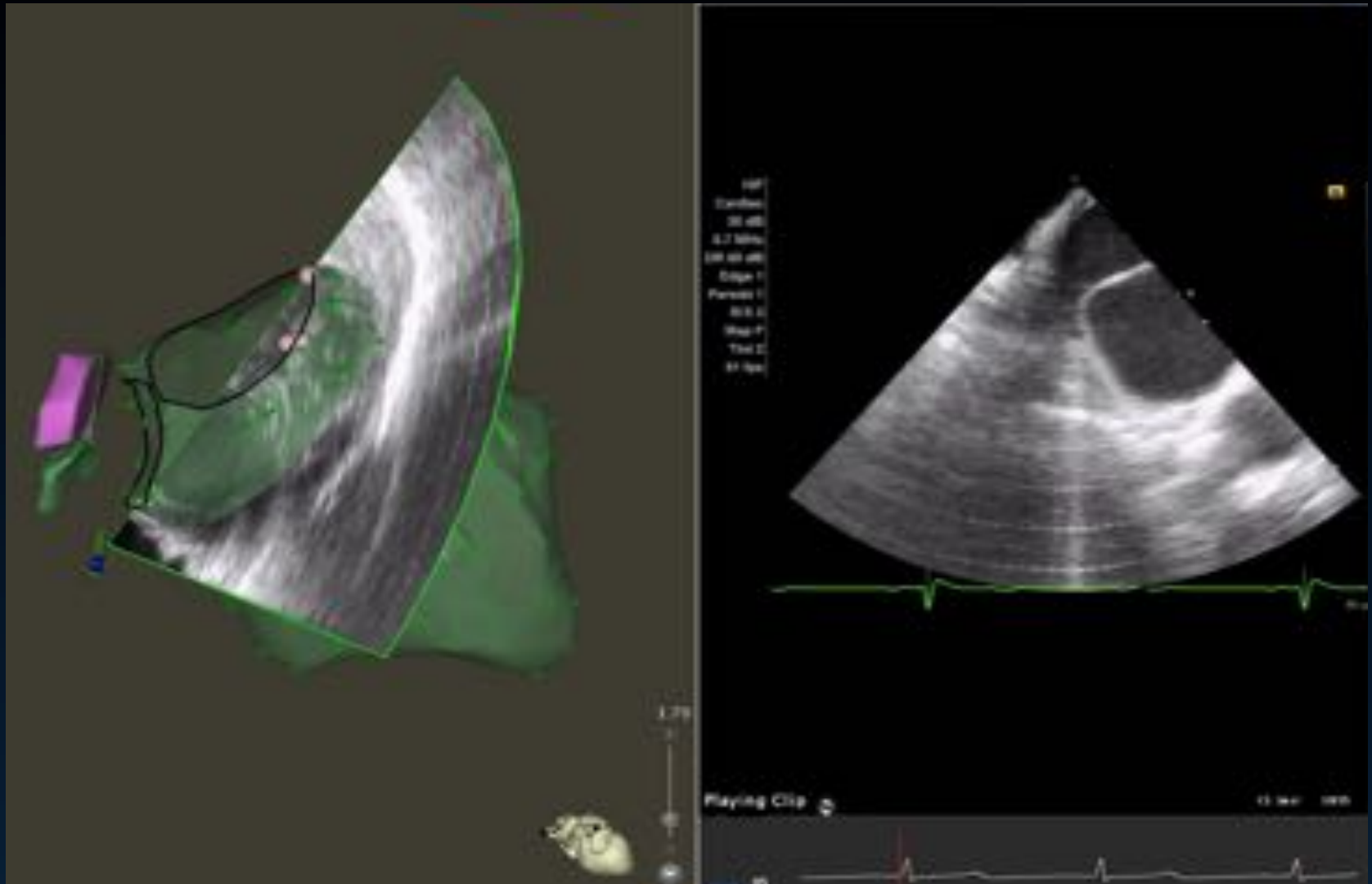


Carto Sound shell

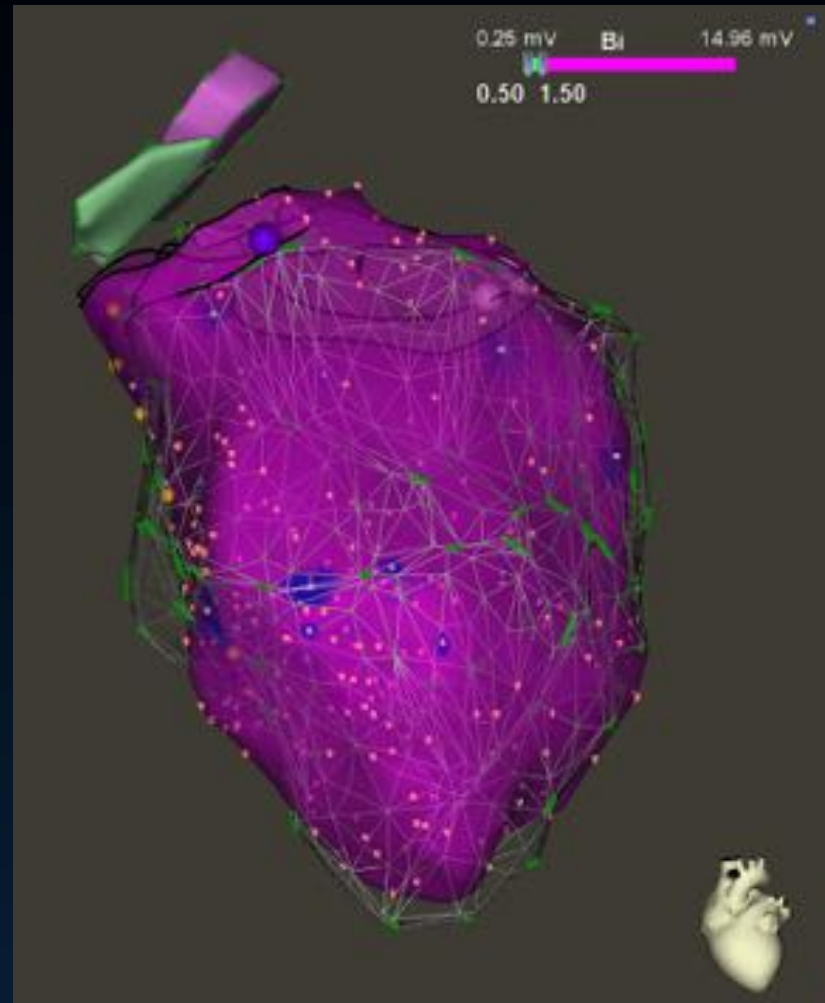
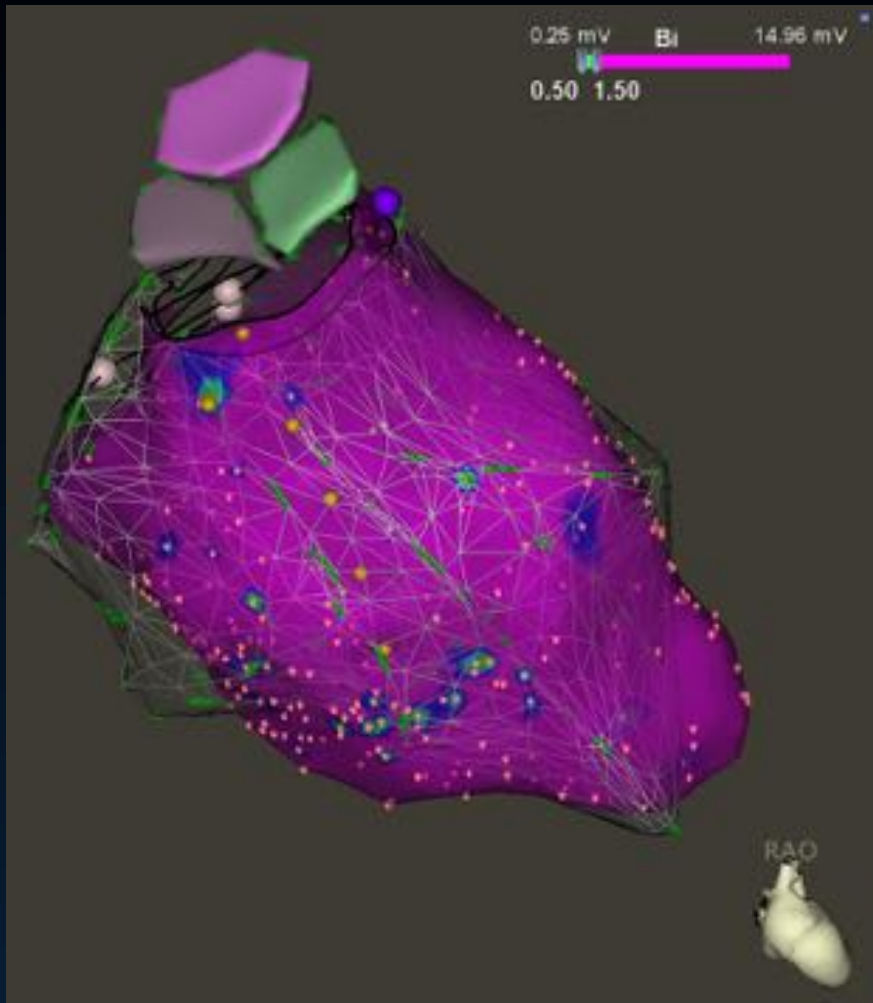


Carto Sound shell

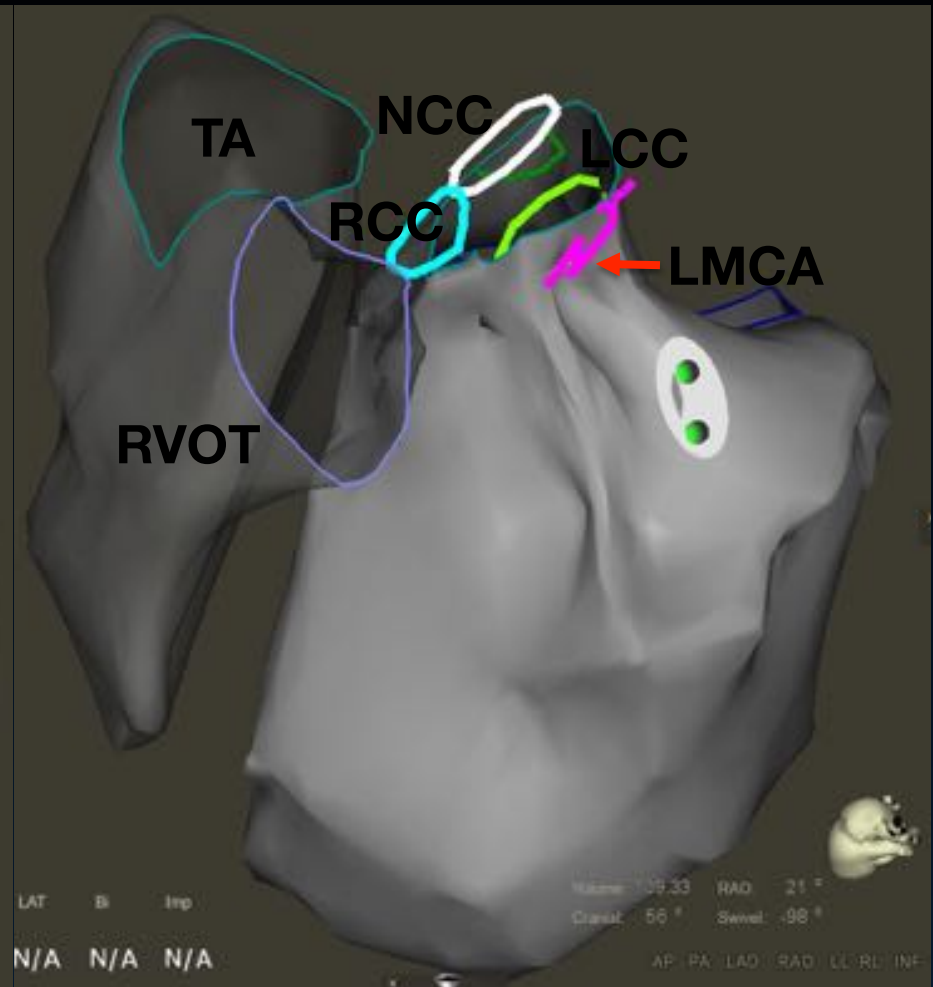
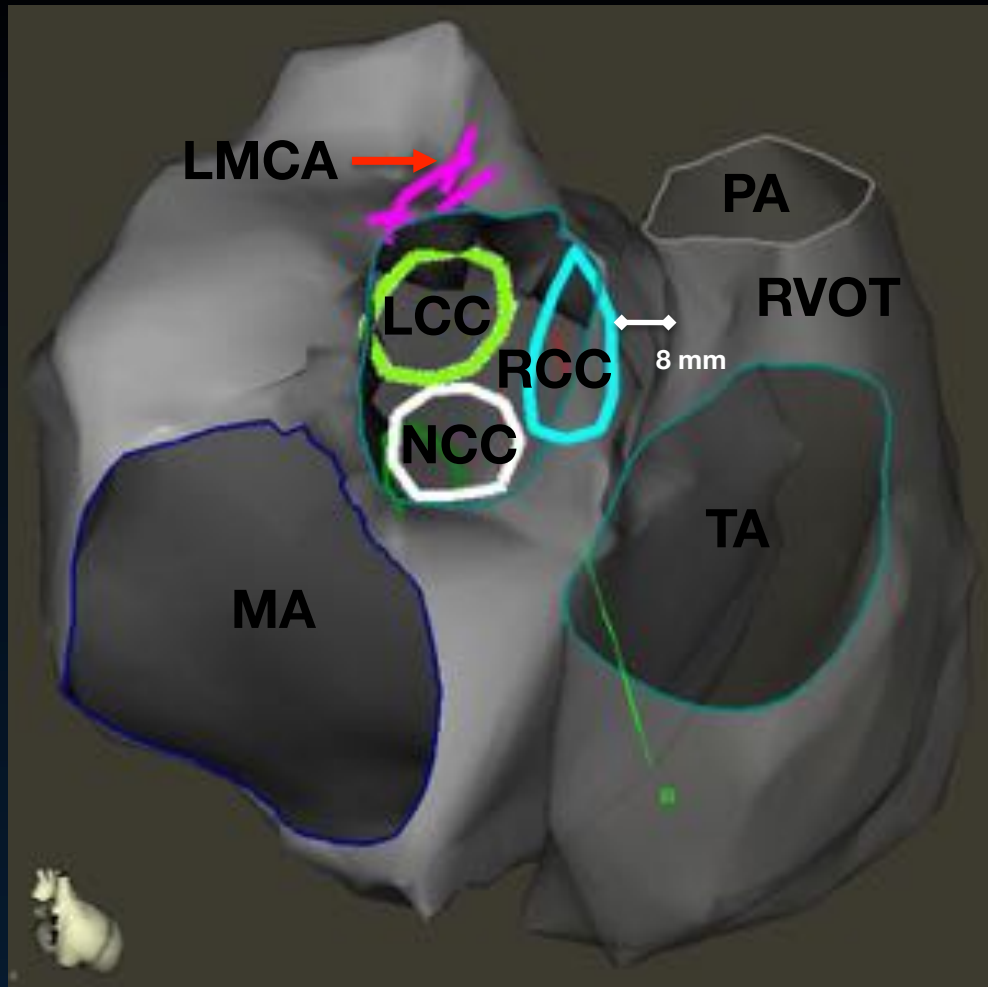
(focus on ventricular OT and AMC)



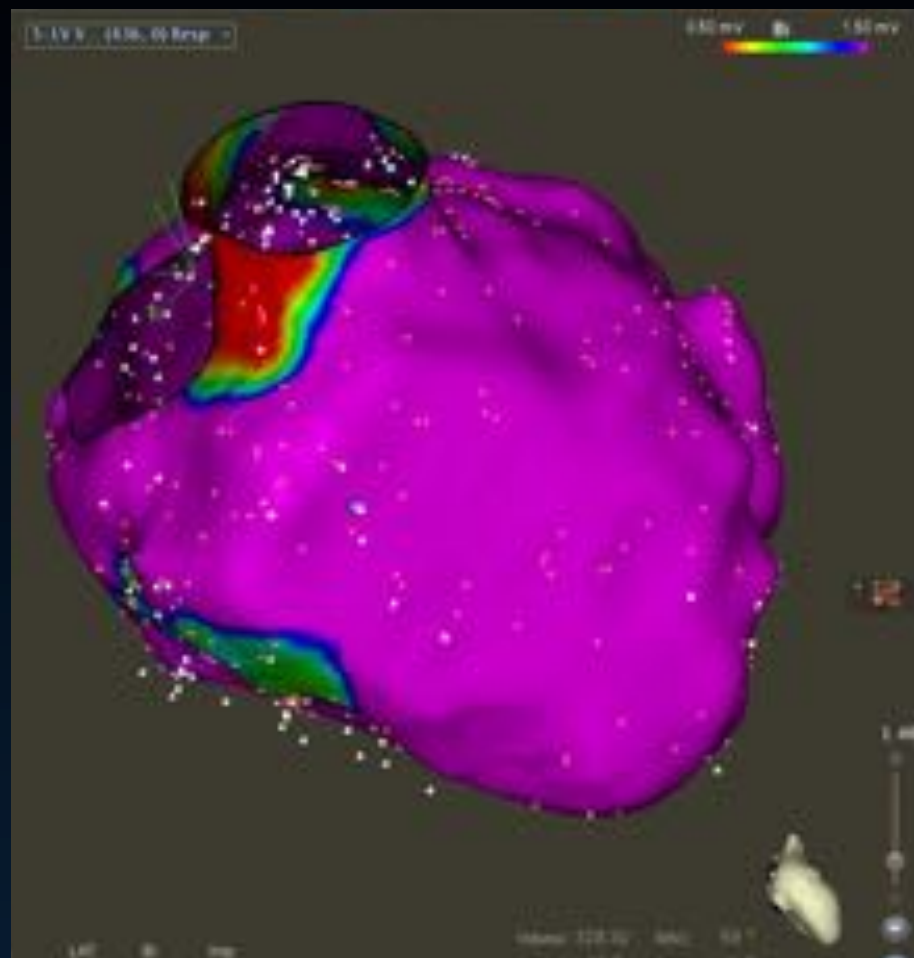
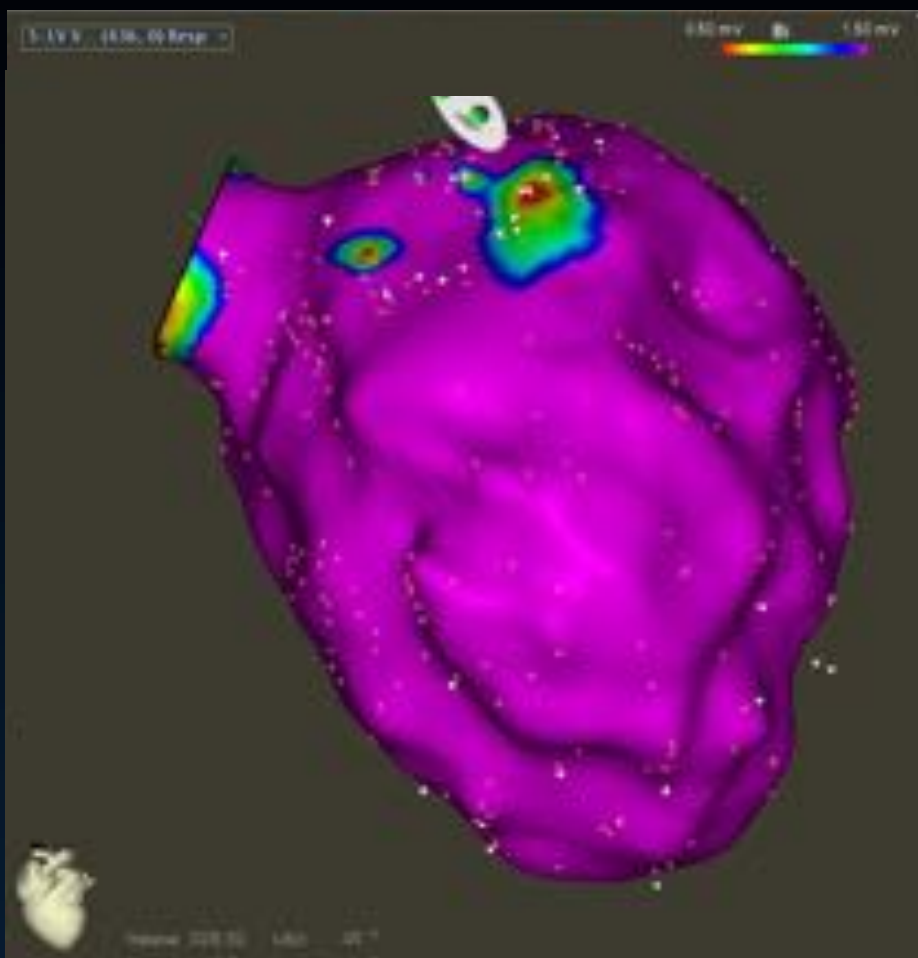
Carto Sound Shell



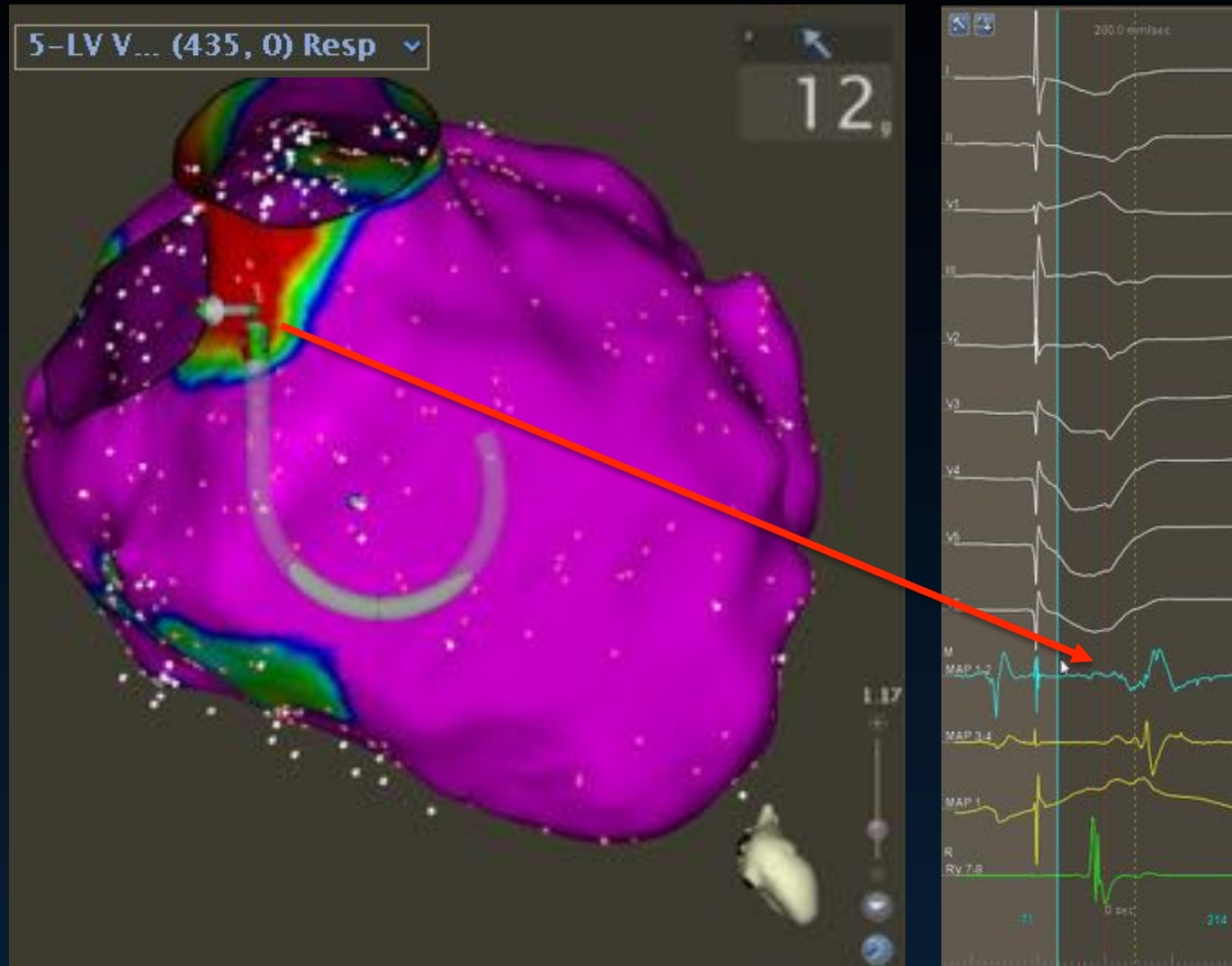
Carto Sound Shell



LV Endocardial Bipolar Voltage Map

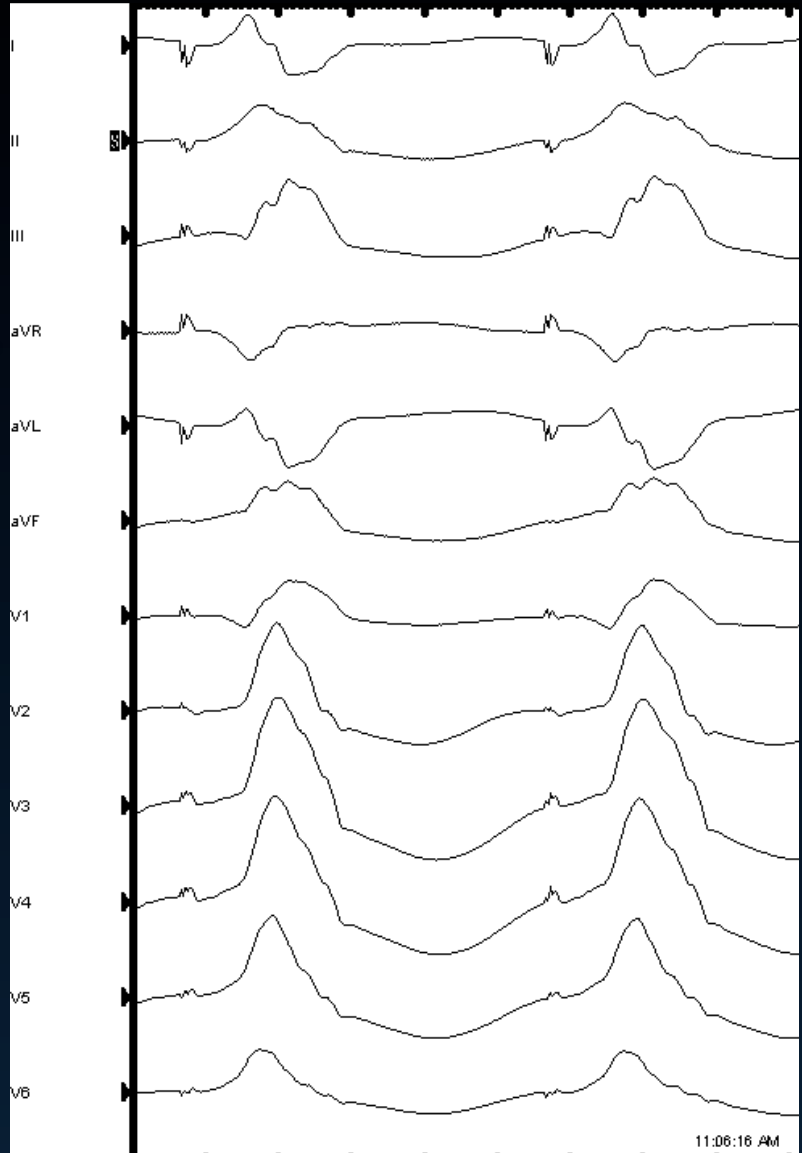
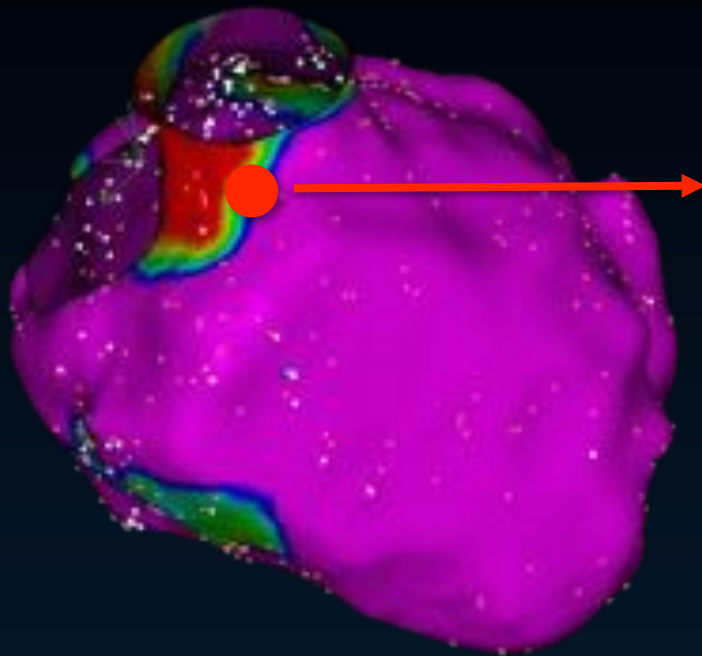


LV Endocardial Bipolar Voltage Map

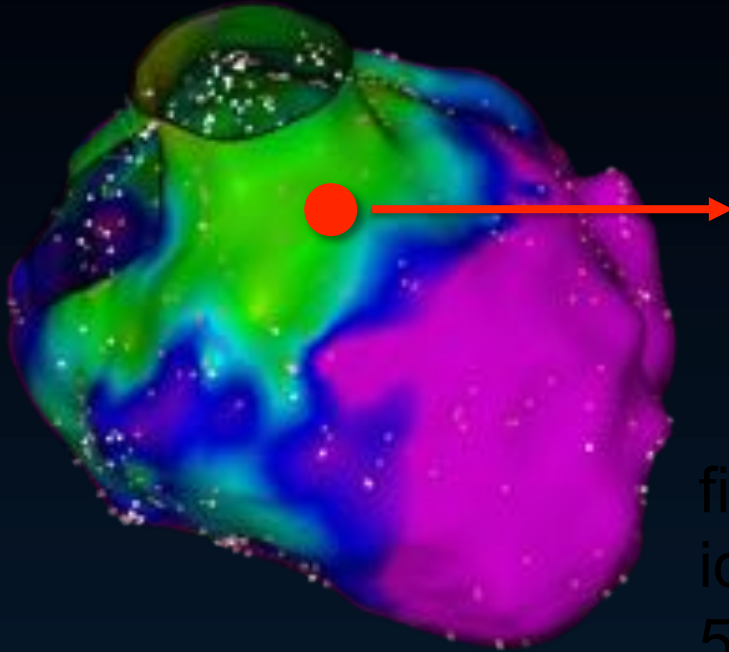


Pace Map VT 2

VT 2

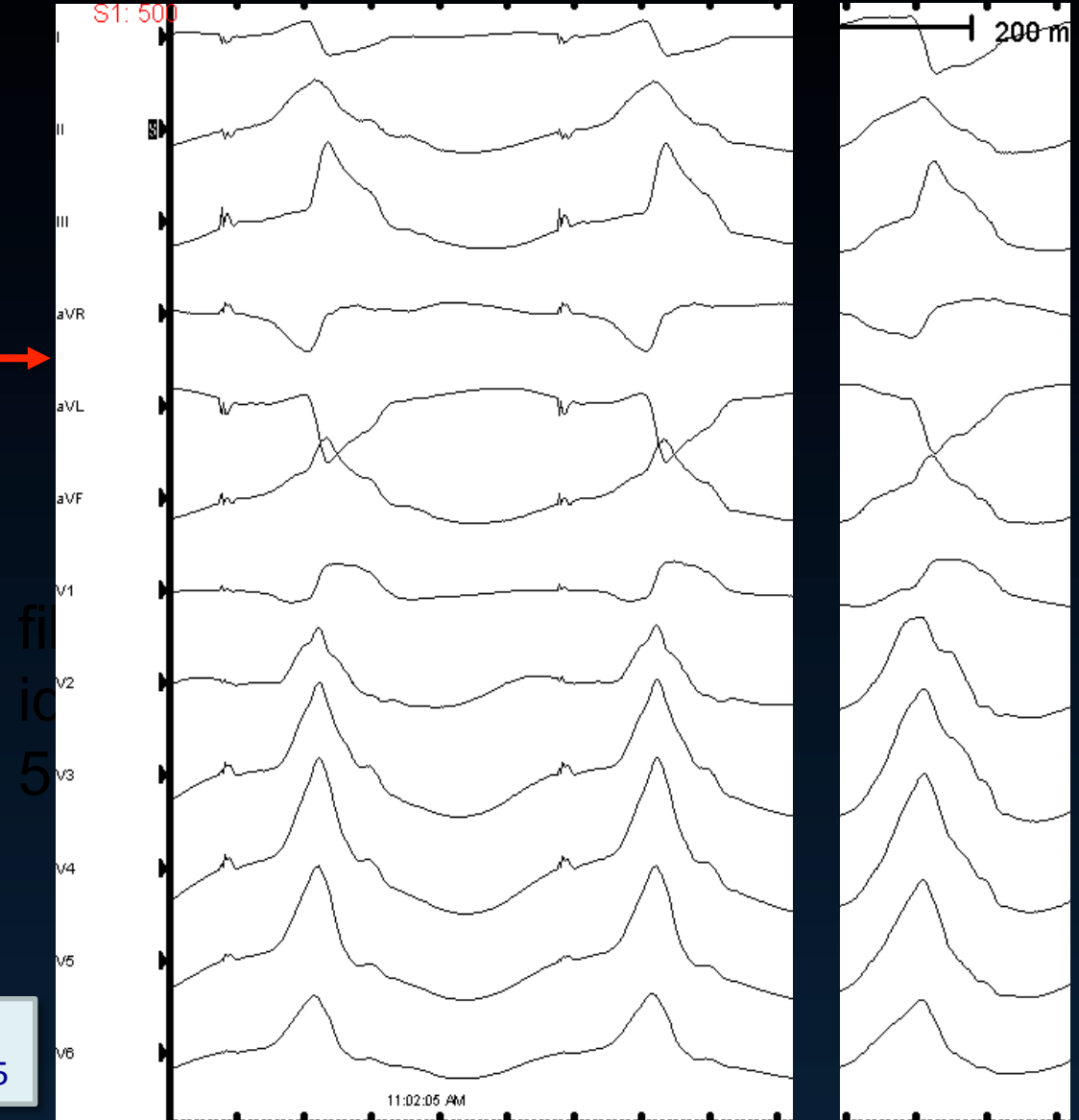


Unipolar 0 - 8.3mV



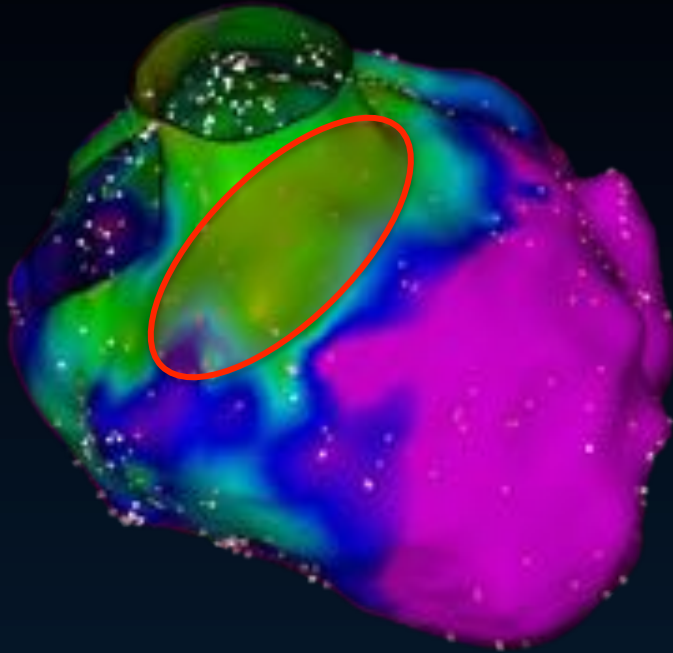
Pace Map VT 2

VT 2



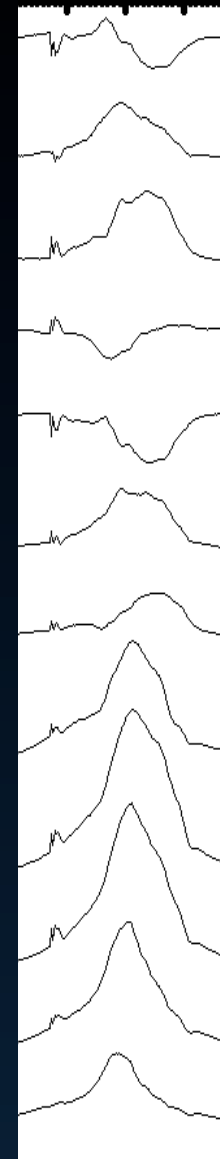
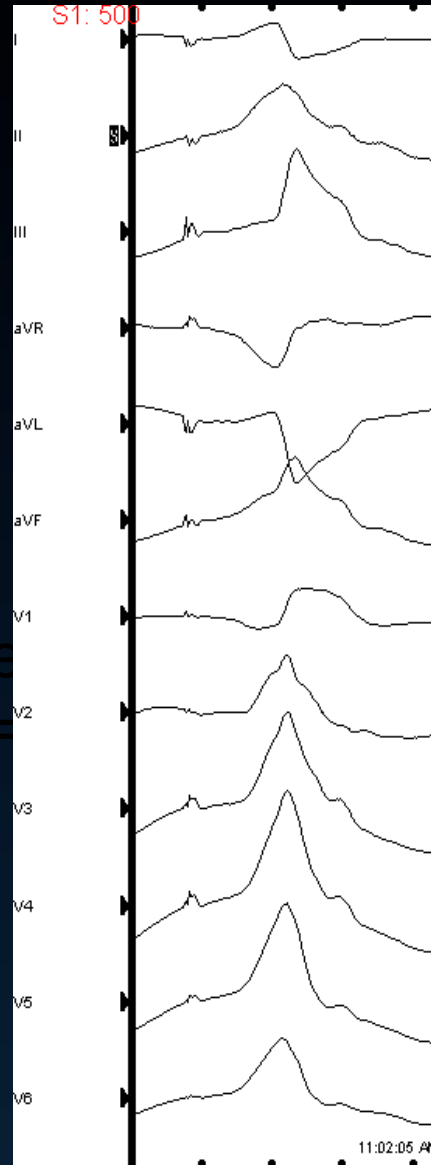
Hutchinson, MD et al
Circ Arrhythm Electrophysiol. 2011; 4:49-55

Unipolar 0 - 8.3mV



Pace Maps VT 2

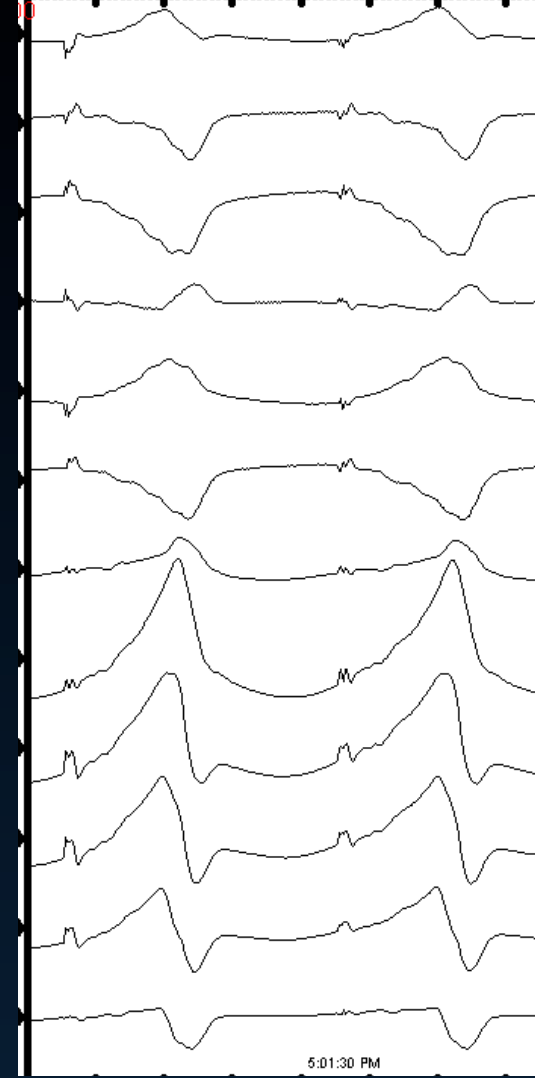
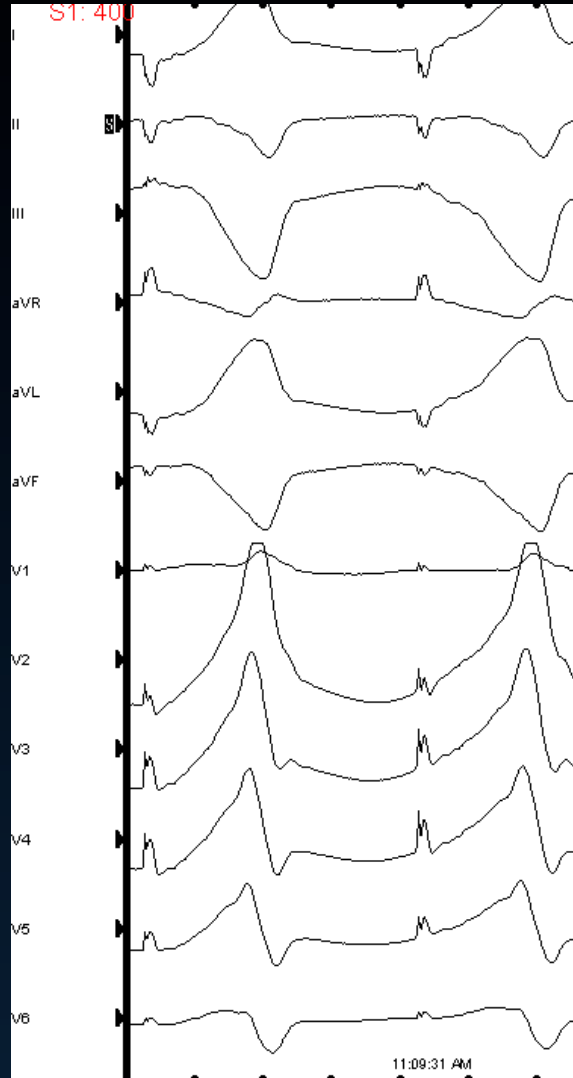
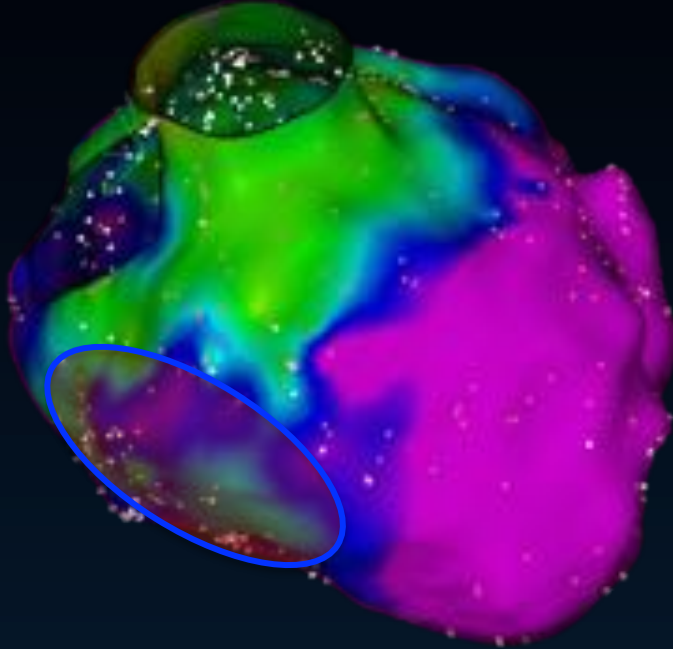
VT 2



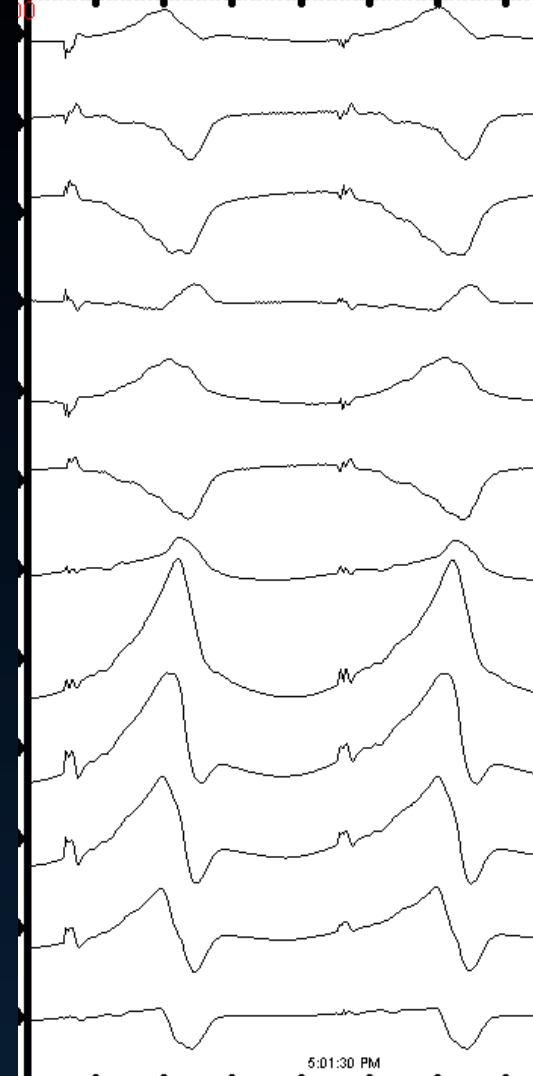
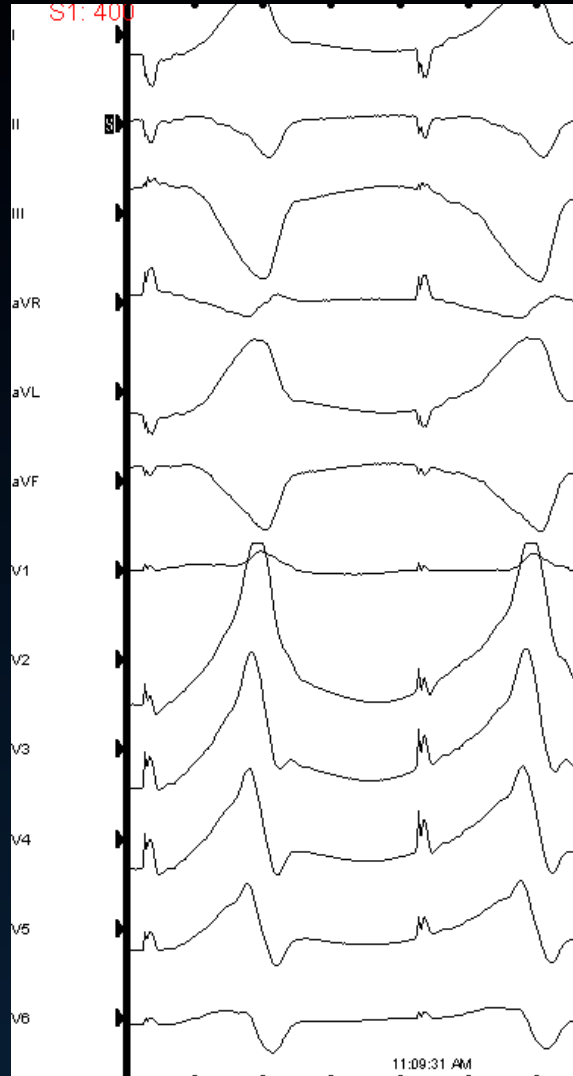
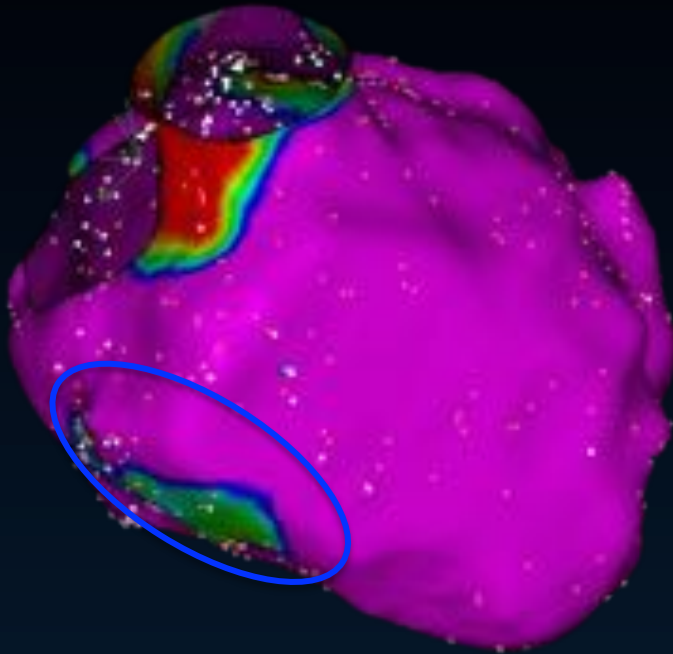
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Pace Maps from inferior septum

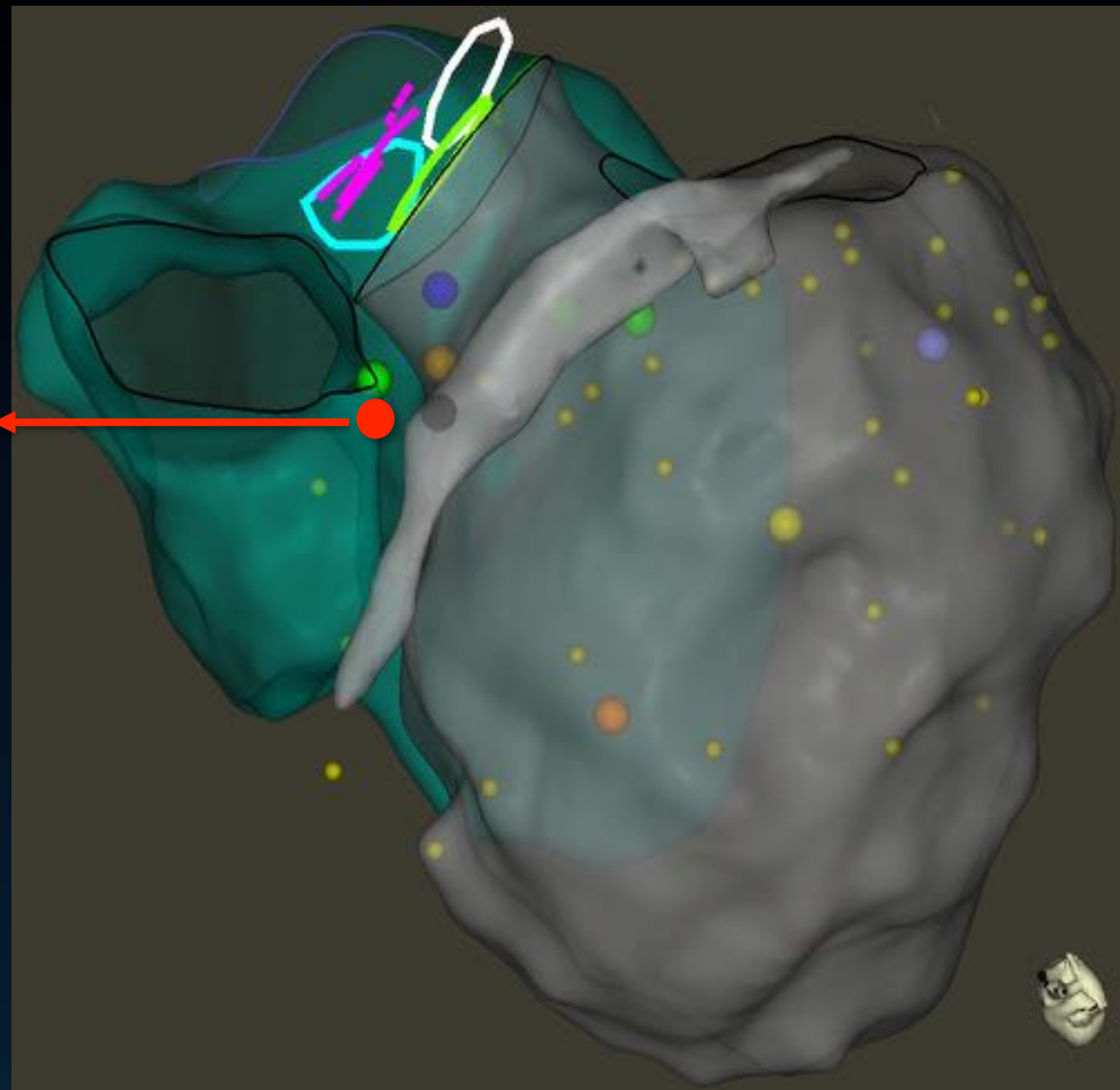
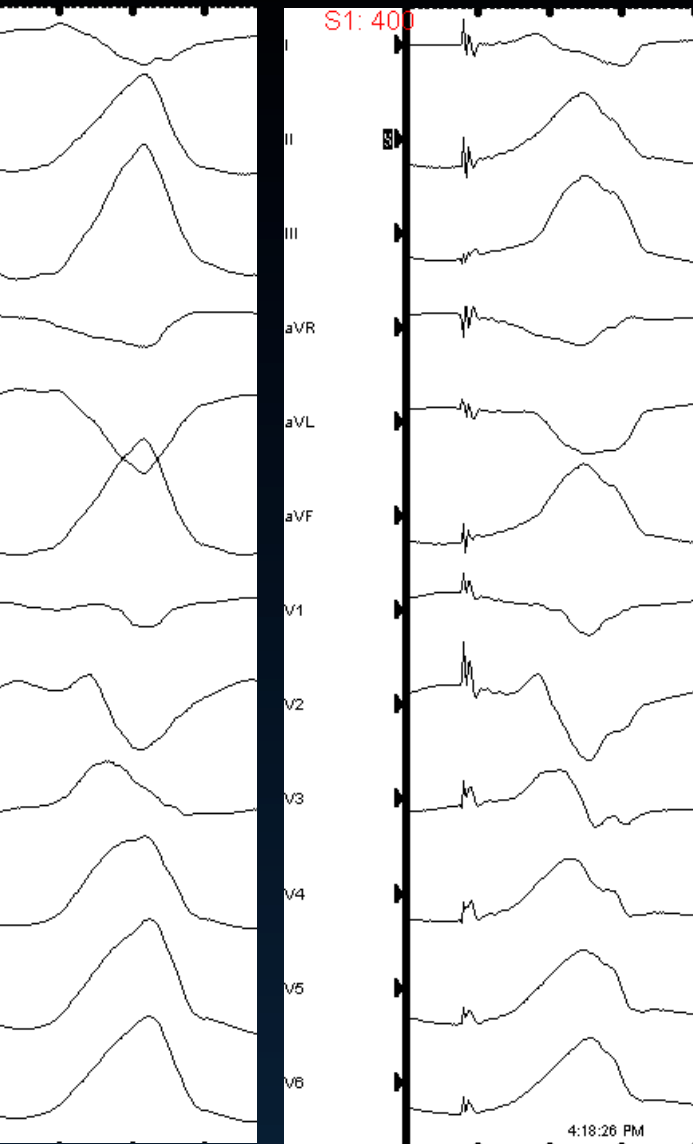
Unipolar 0 - 8.3mV



Pace Maps from inferior septum

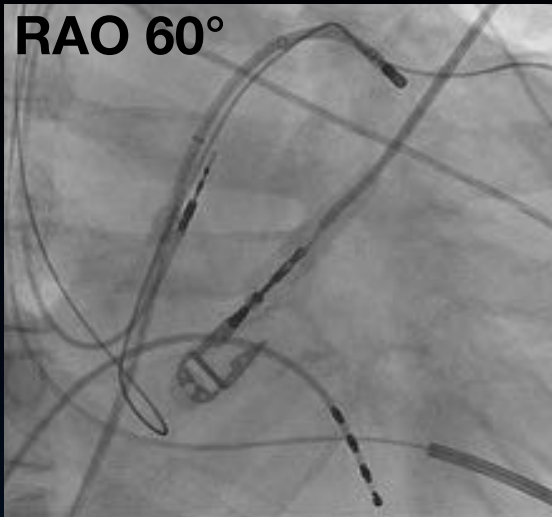


Pace Map VT-1

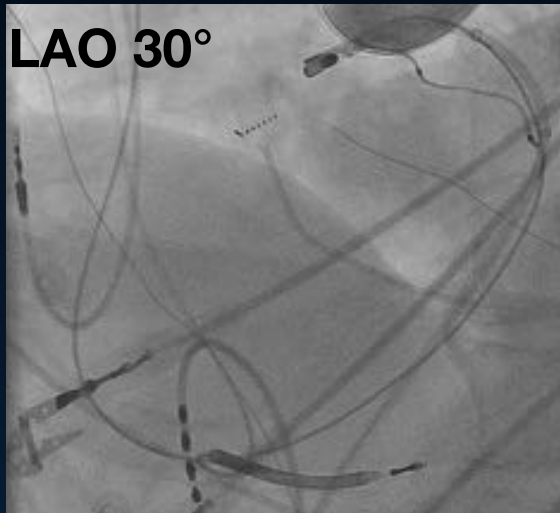


Pace Map VT-1 from AIV

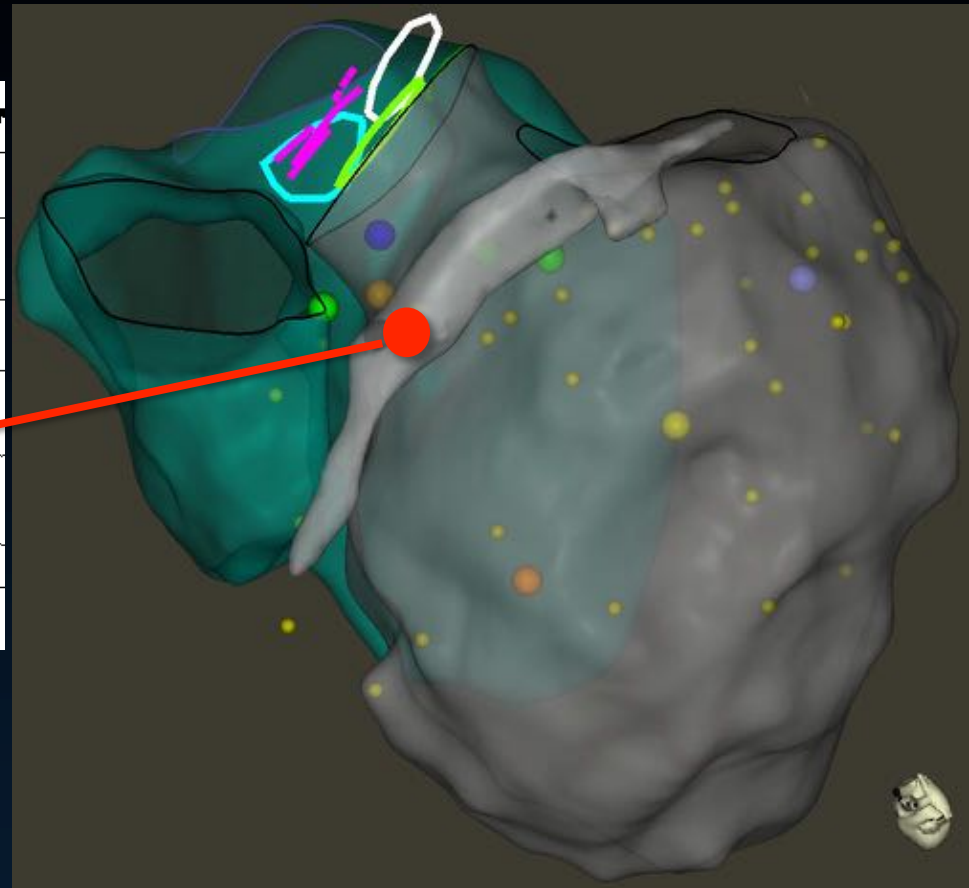
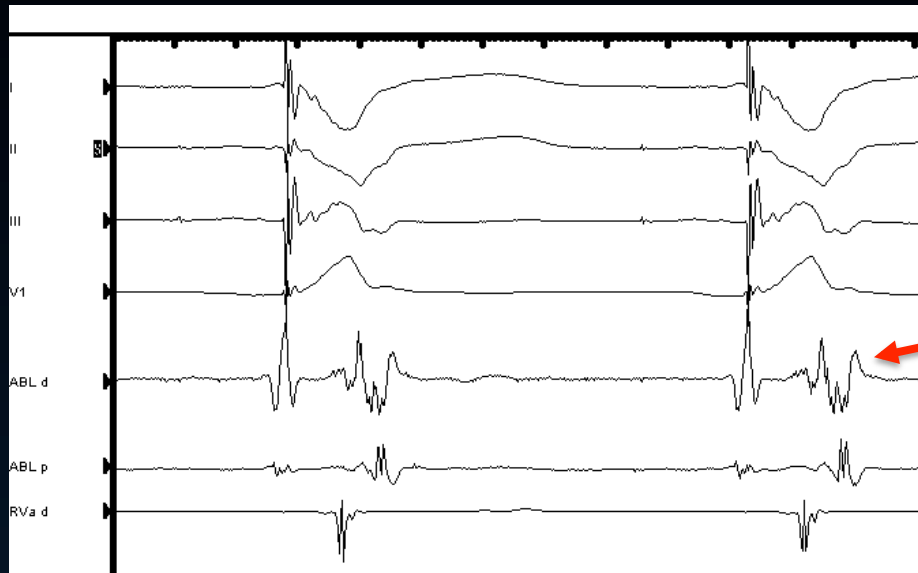
RAO 60°



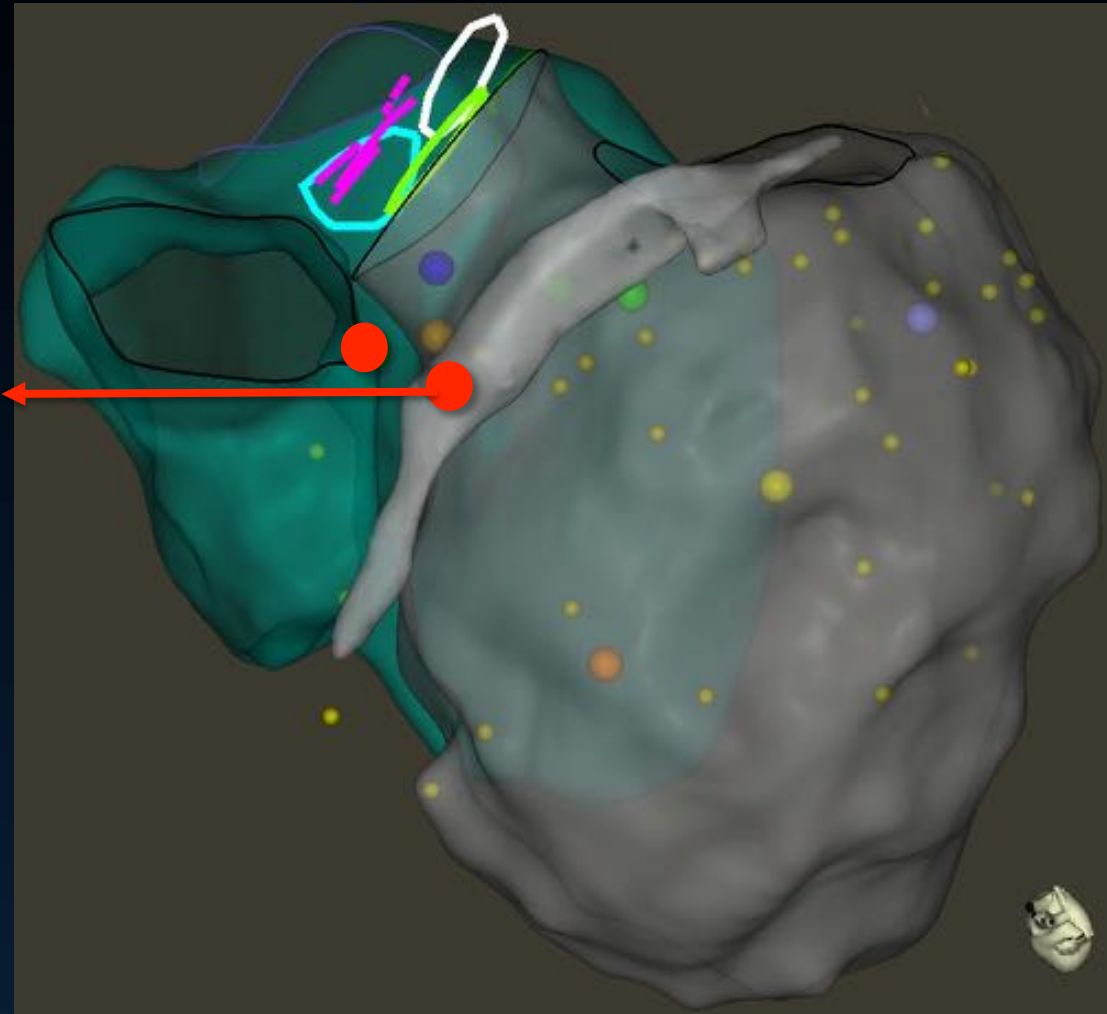
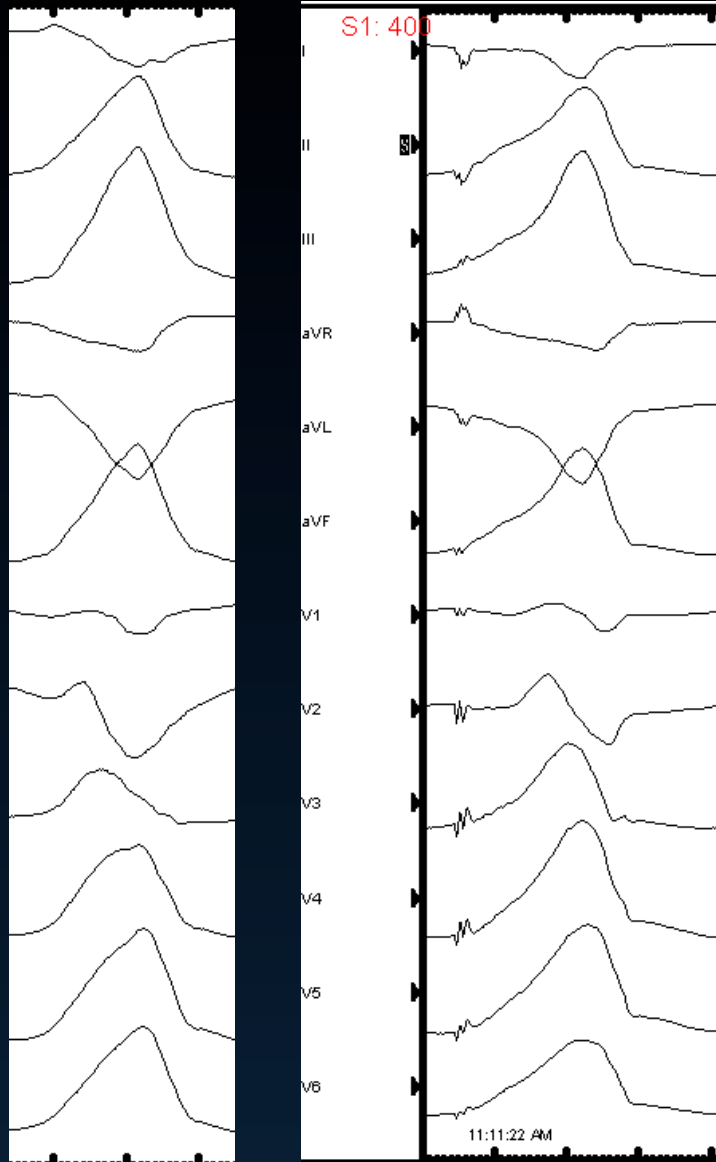
LAO 30°



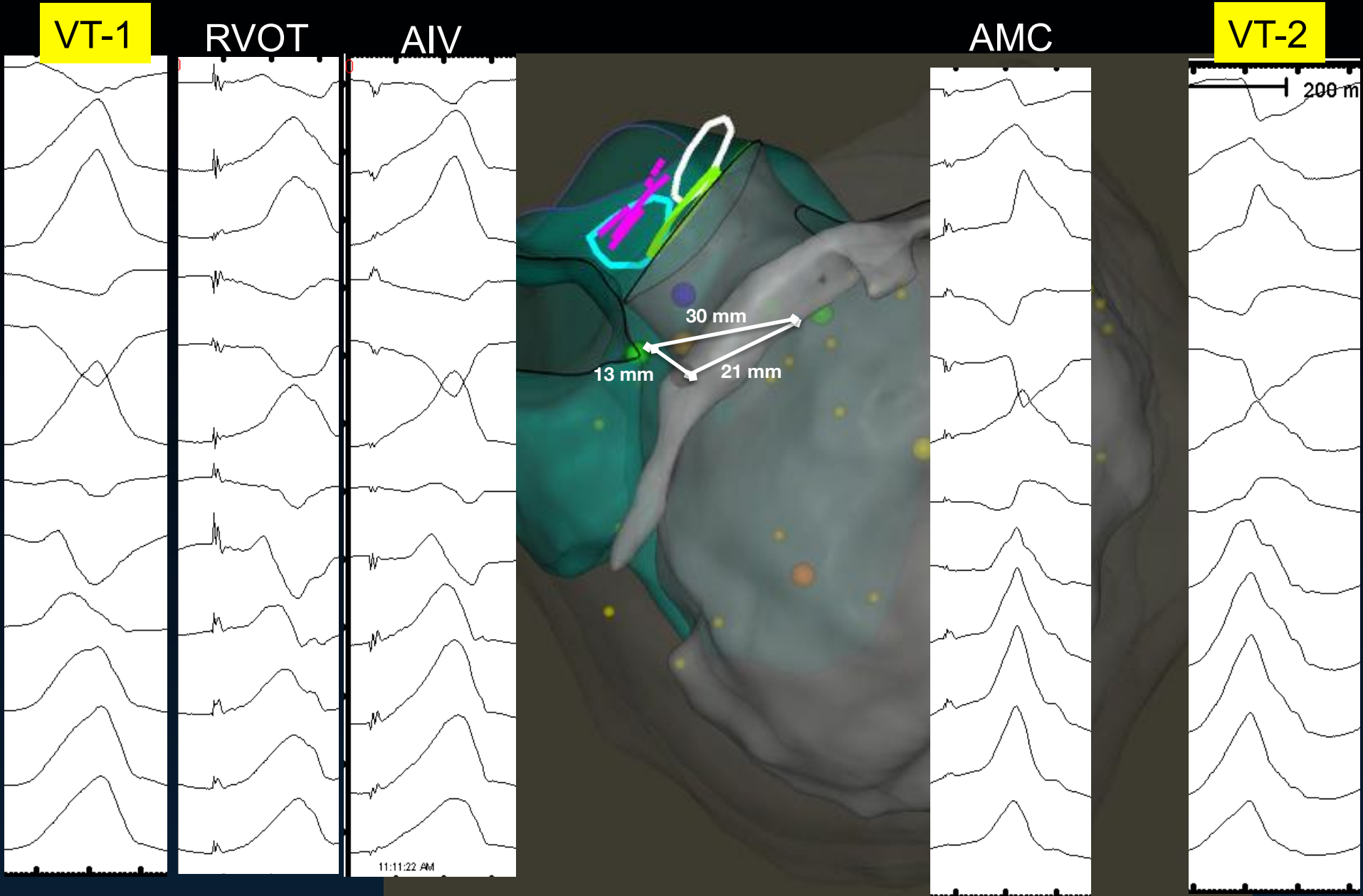
Pace Map VT-1 from AIV



Pace Map VT-1 from AIV



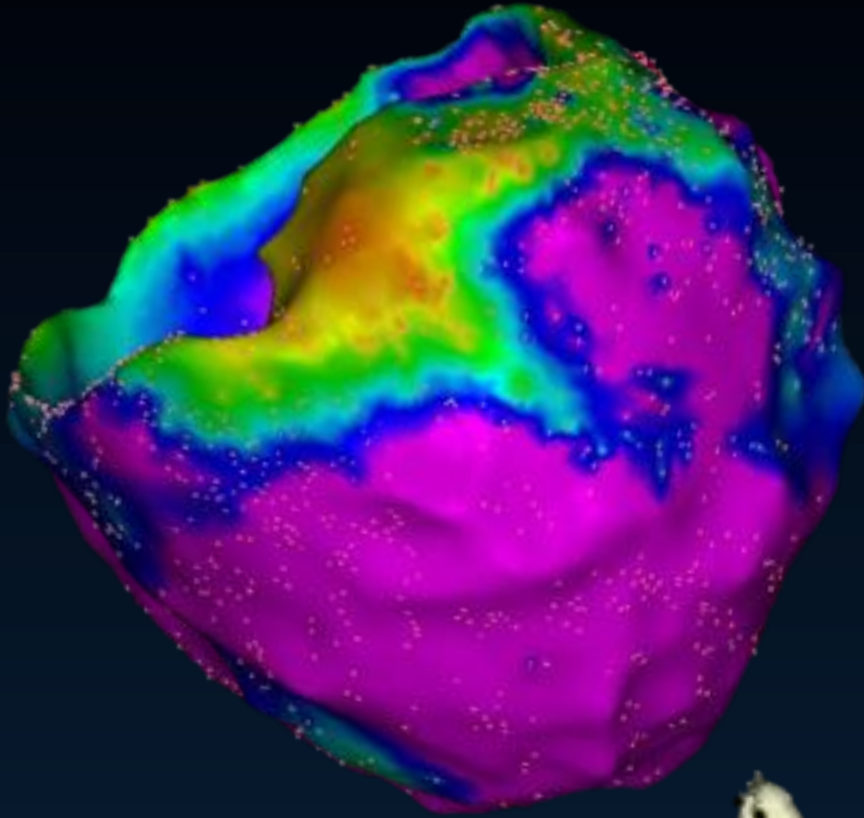
Data from Pace Maps



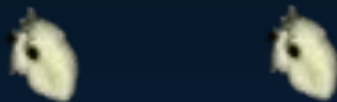
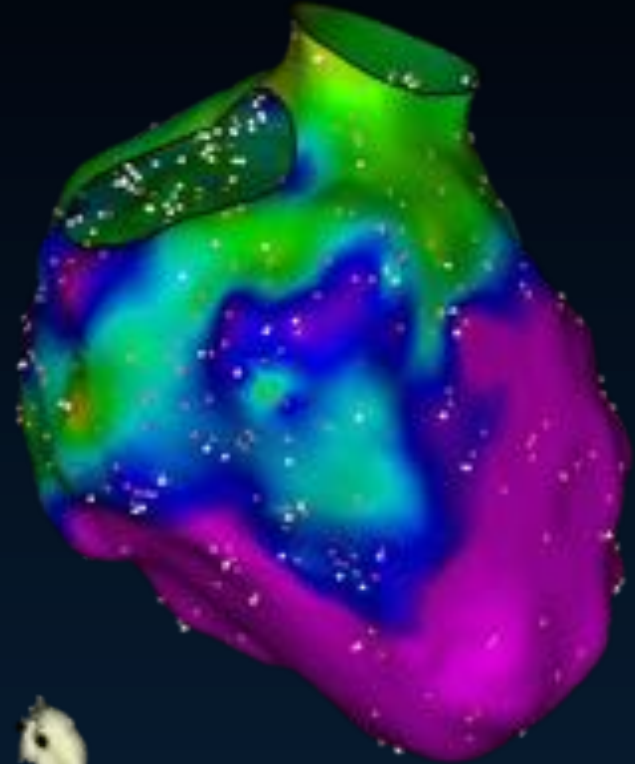
Epicardial Voltage Map

Mapped with DecaNav, >2,000 points

Epi Bipolar 0.5 - 1.8mV



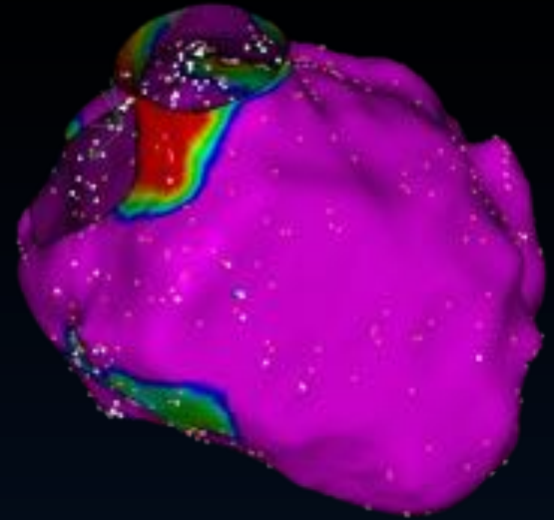
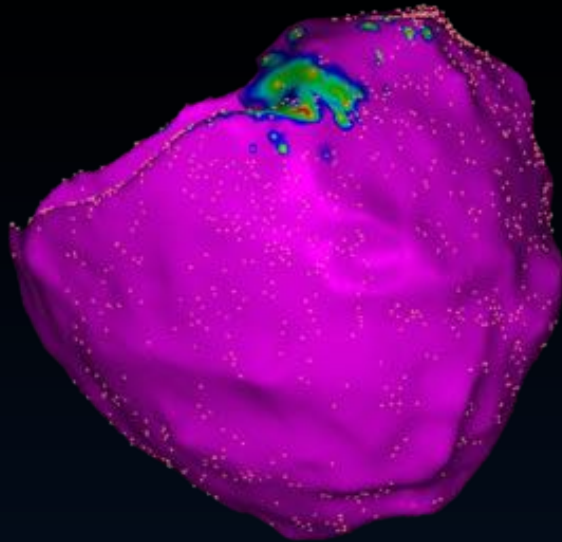
Endo Unipolar 0 - 8.3mV



Epicardial

Endocardial

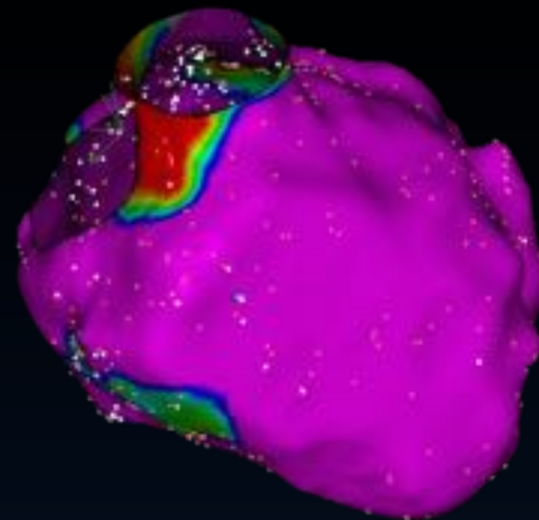
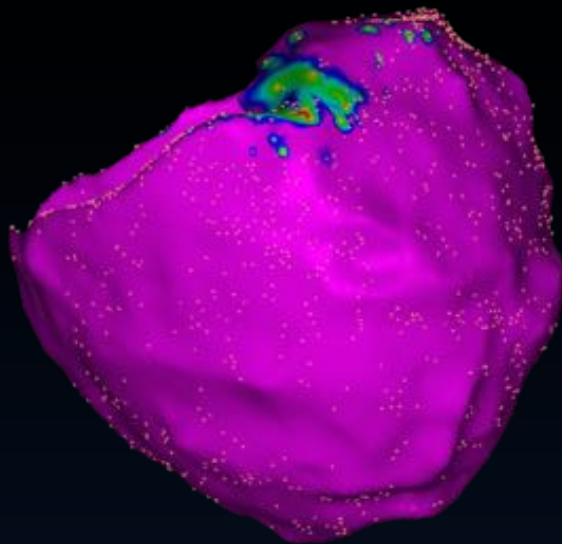
Bipolar



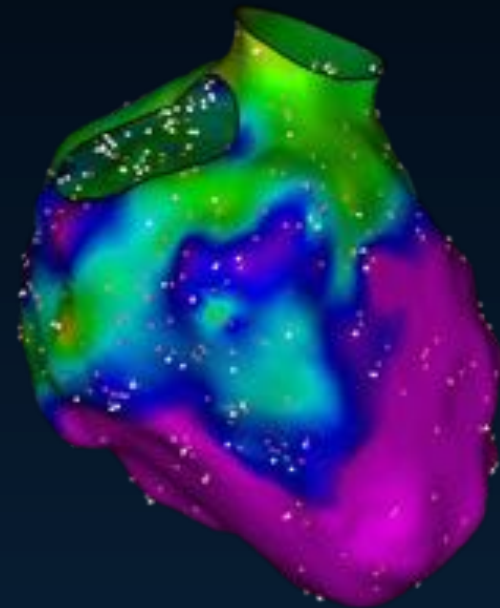
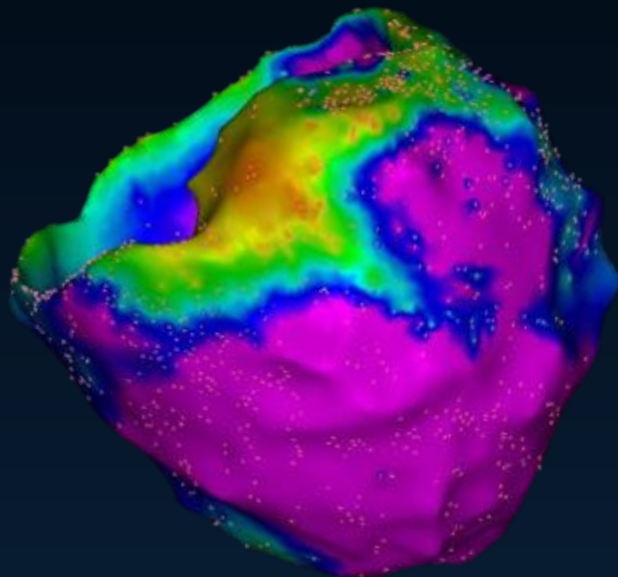
Epicardial

Endocardial

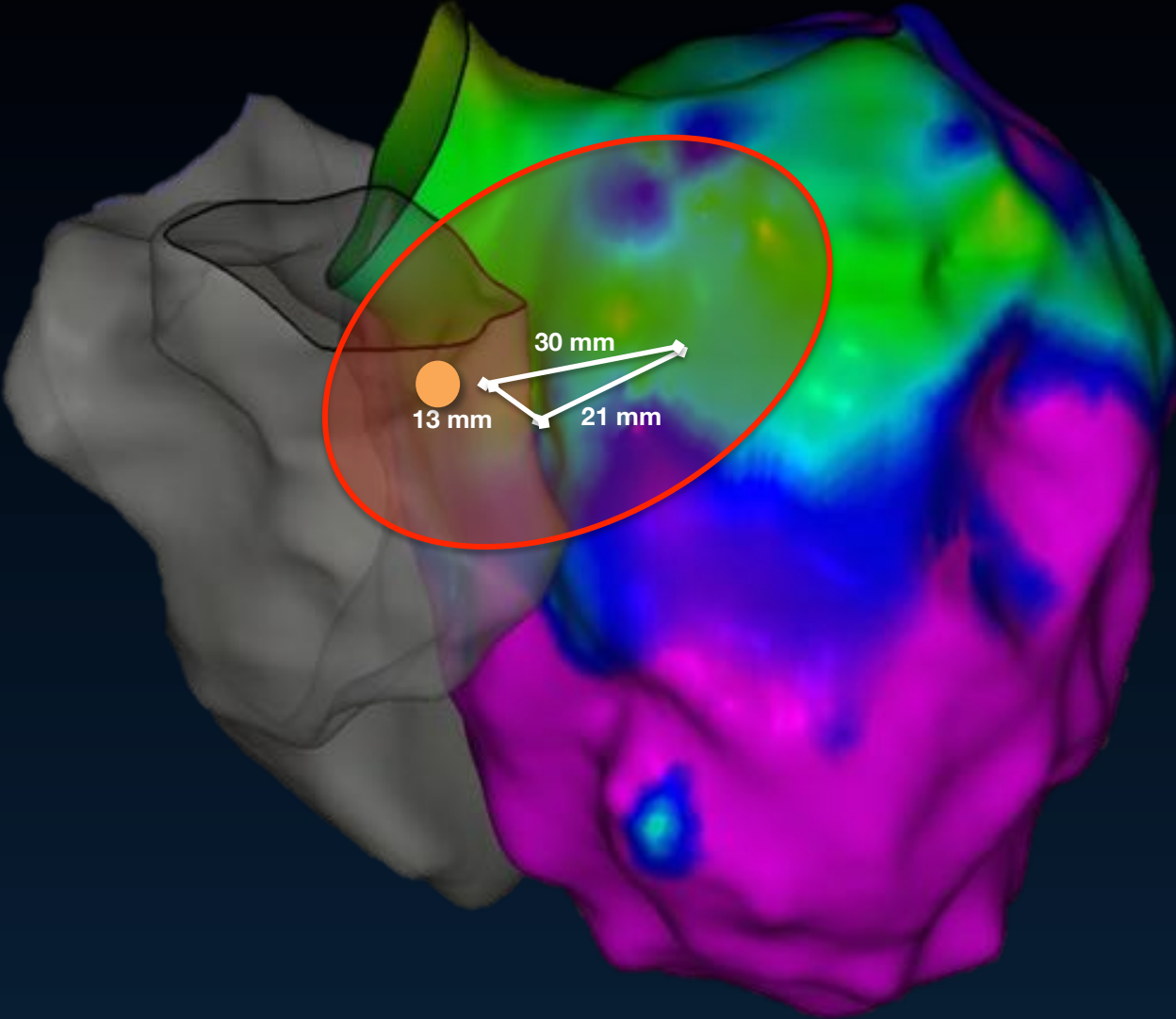
Bipolar



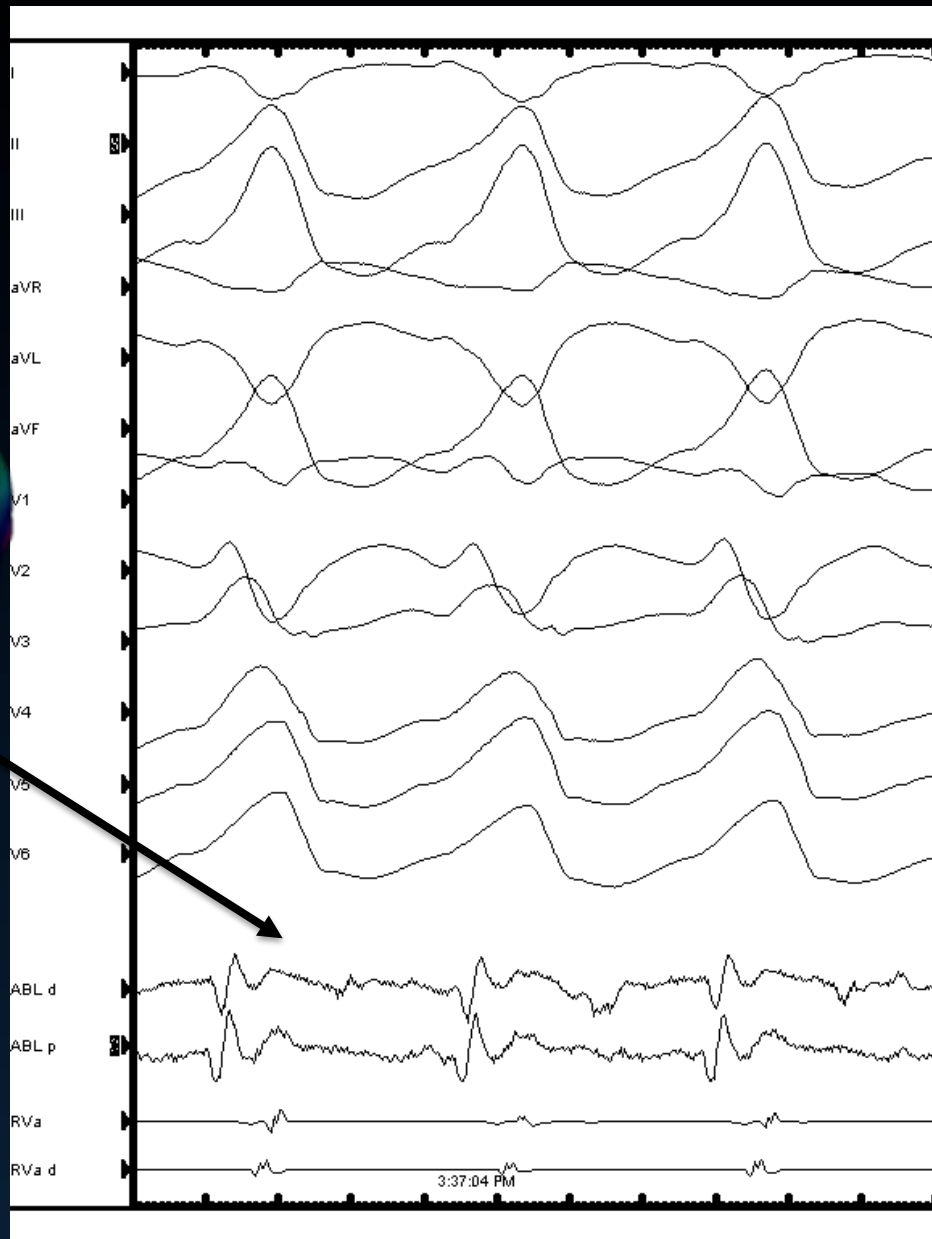
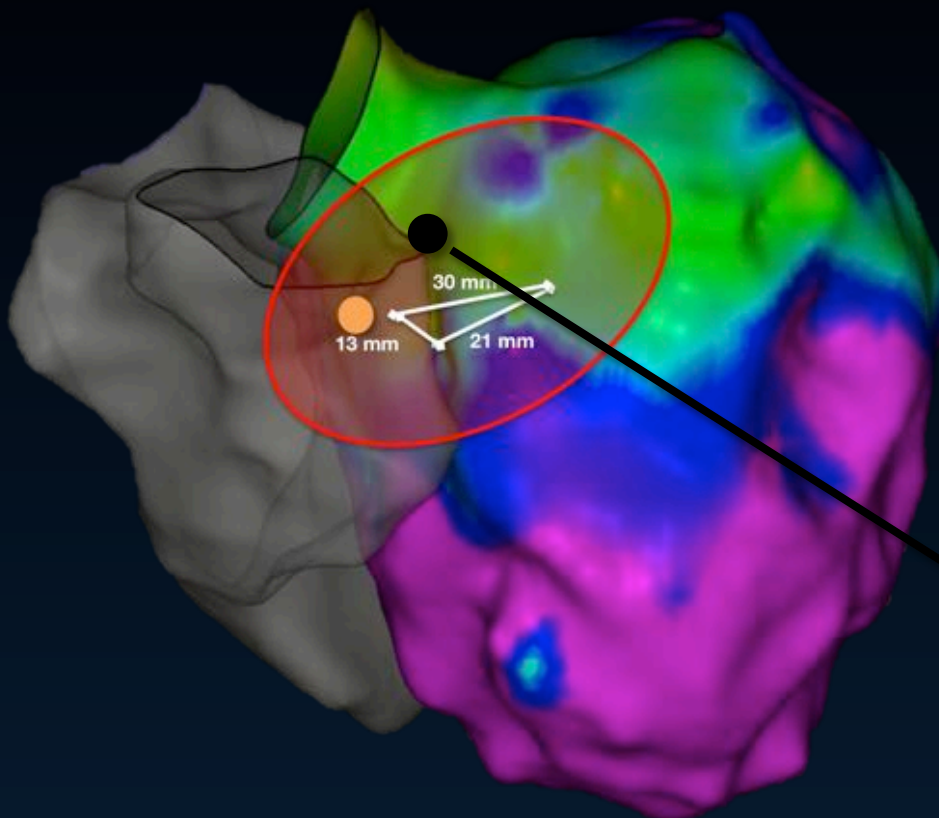
Unipolar



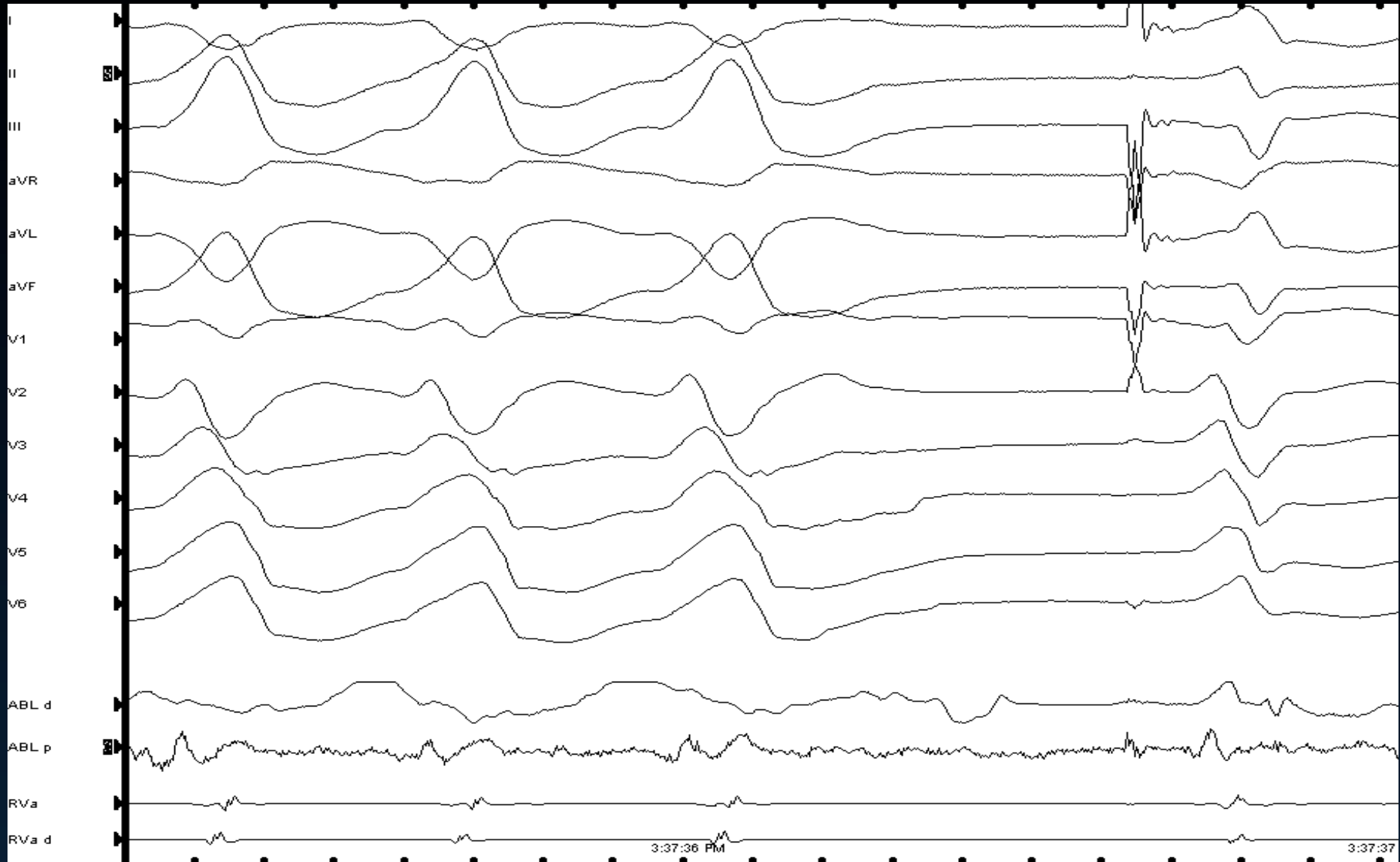
Core Isolation of entire LV outflow around AMC



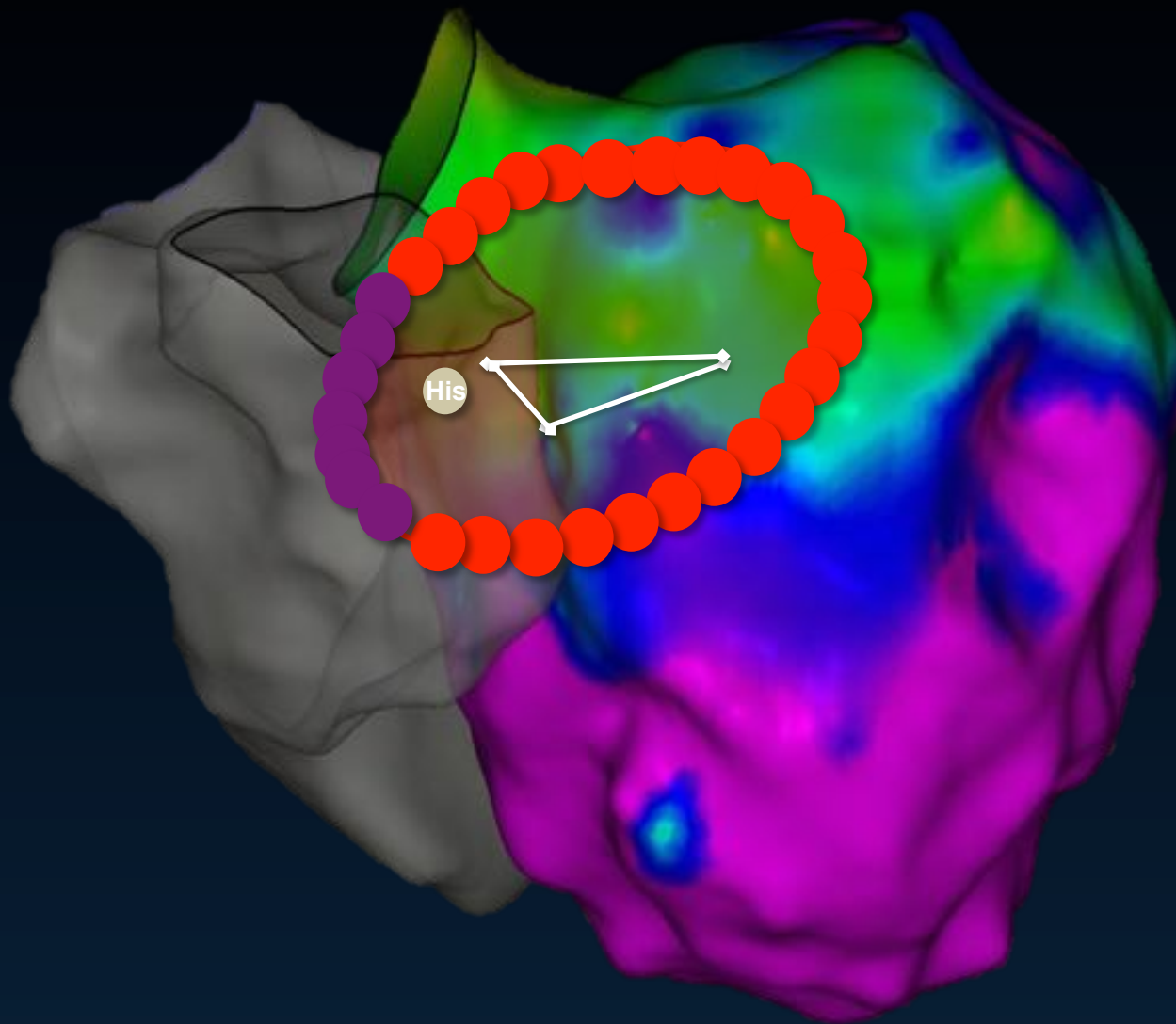
MDP during VT-1 at R/L junction



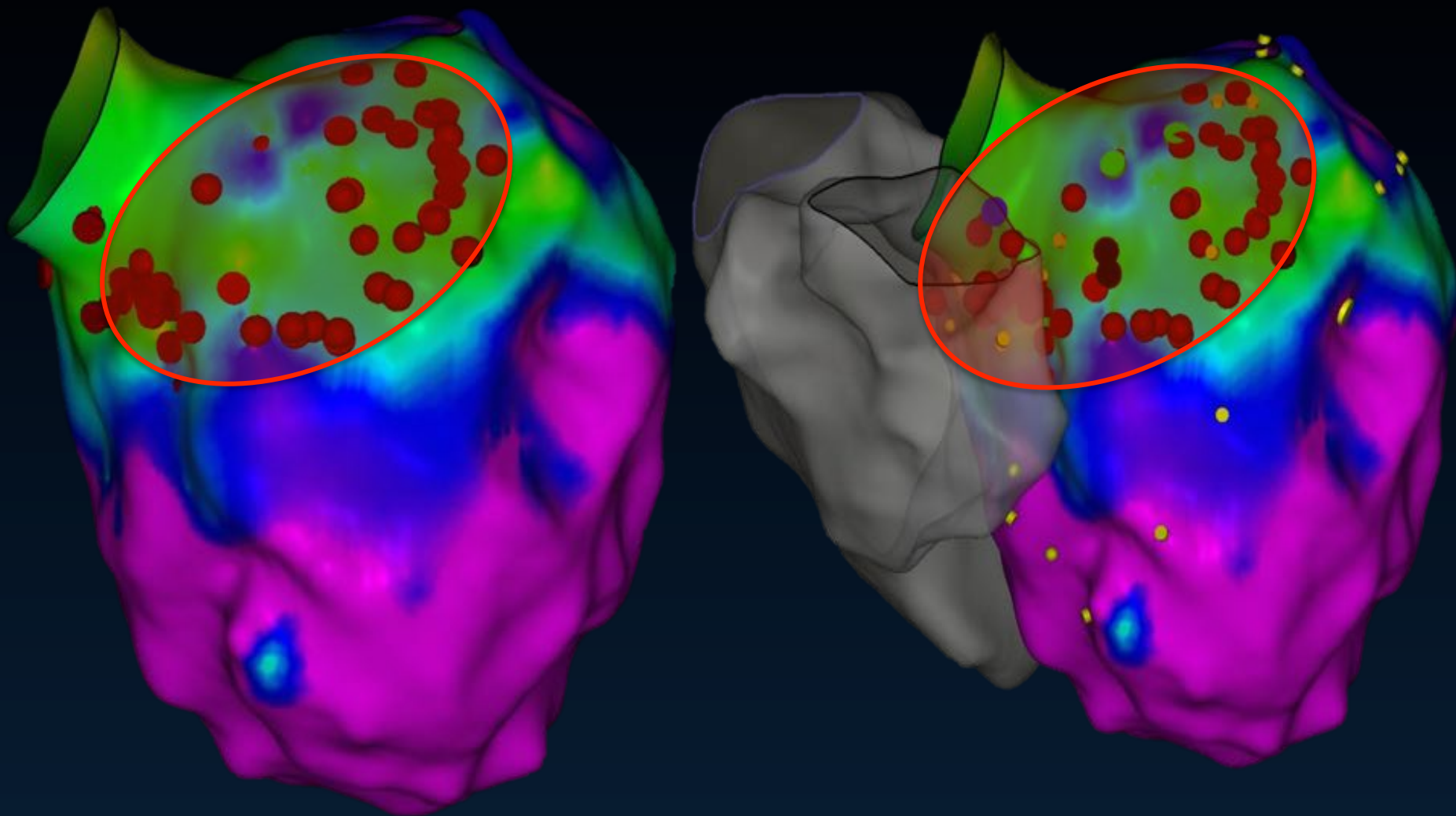
Terminates after 29 seconds of RF



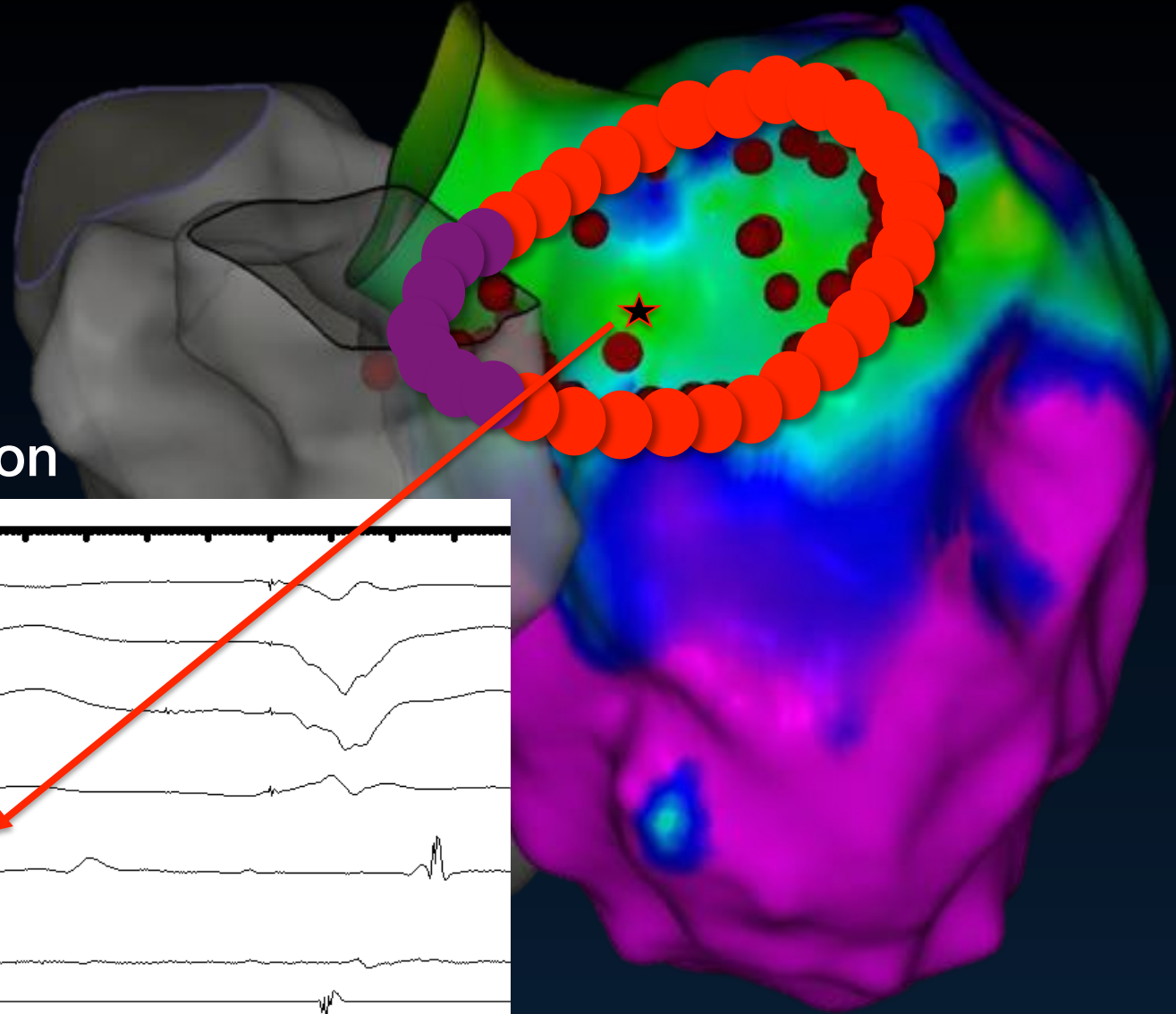
Core Isolation



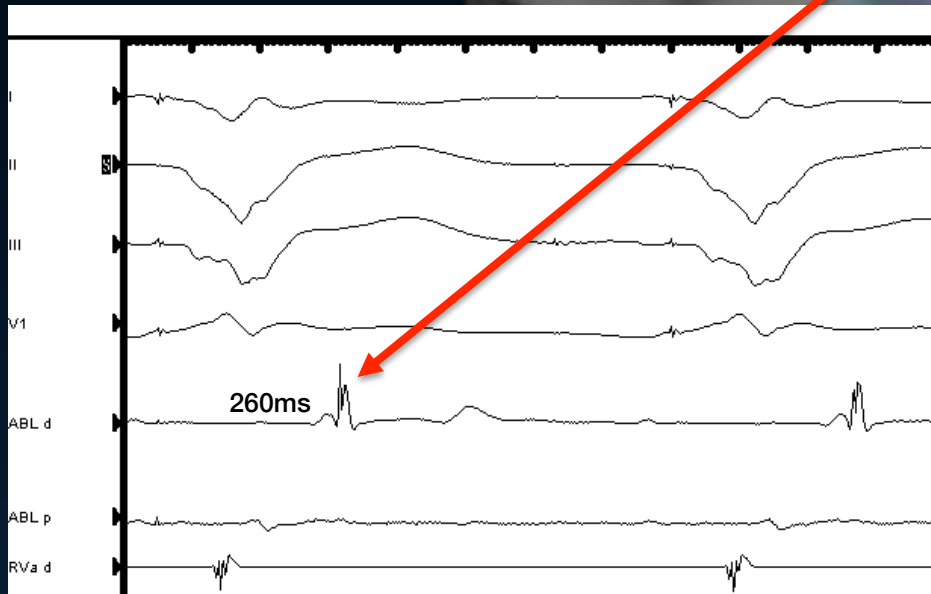
Core Isolation strategy



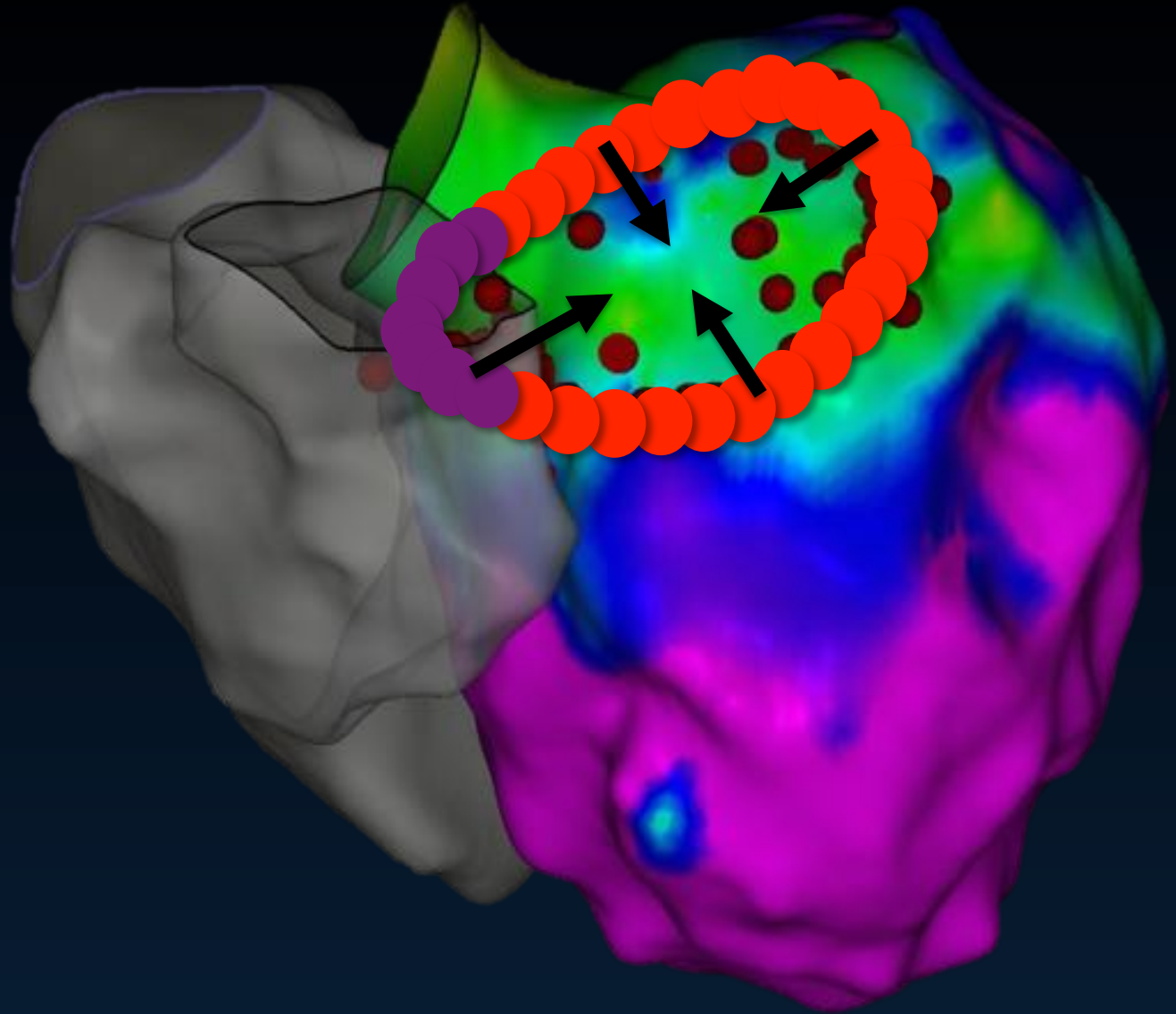
Core Isolation of entire LV outflow around AMC



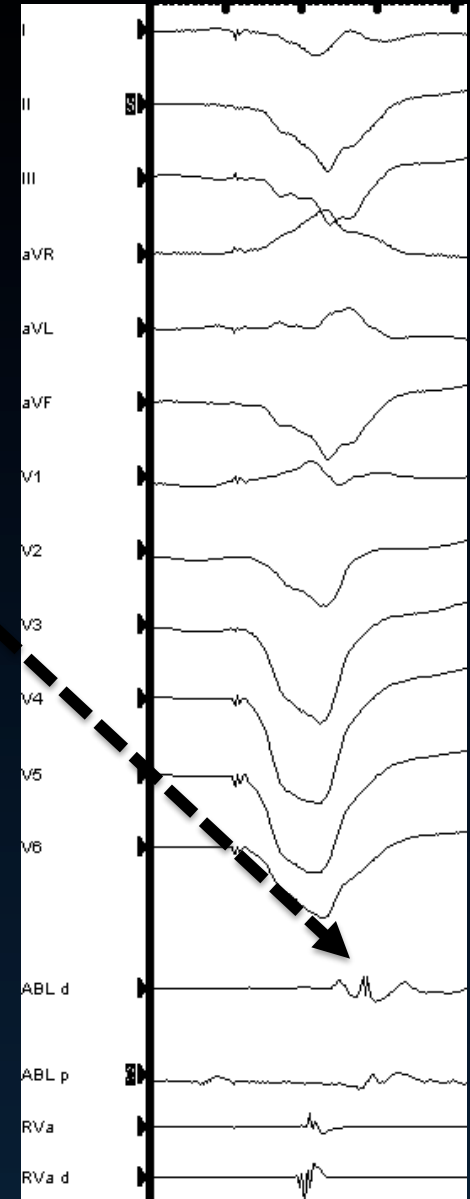
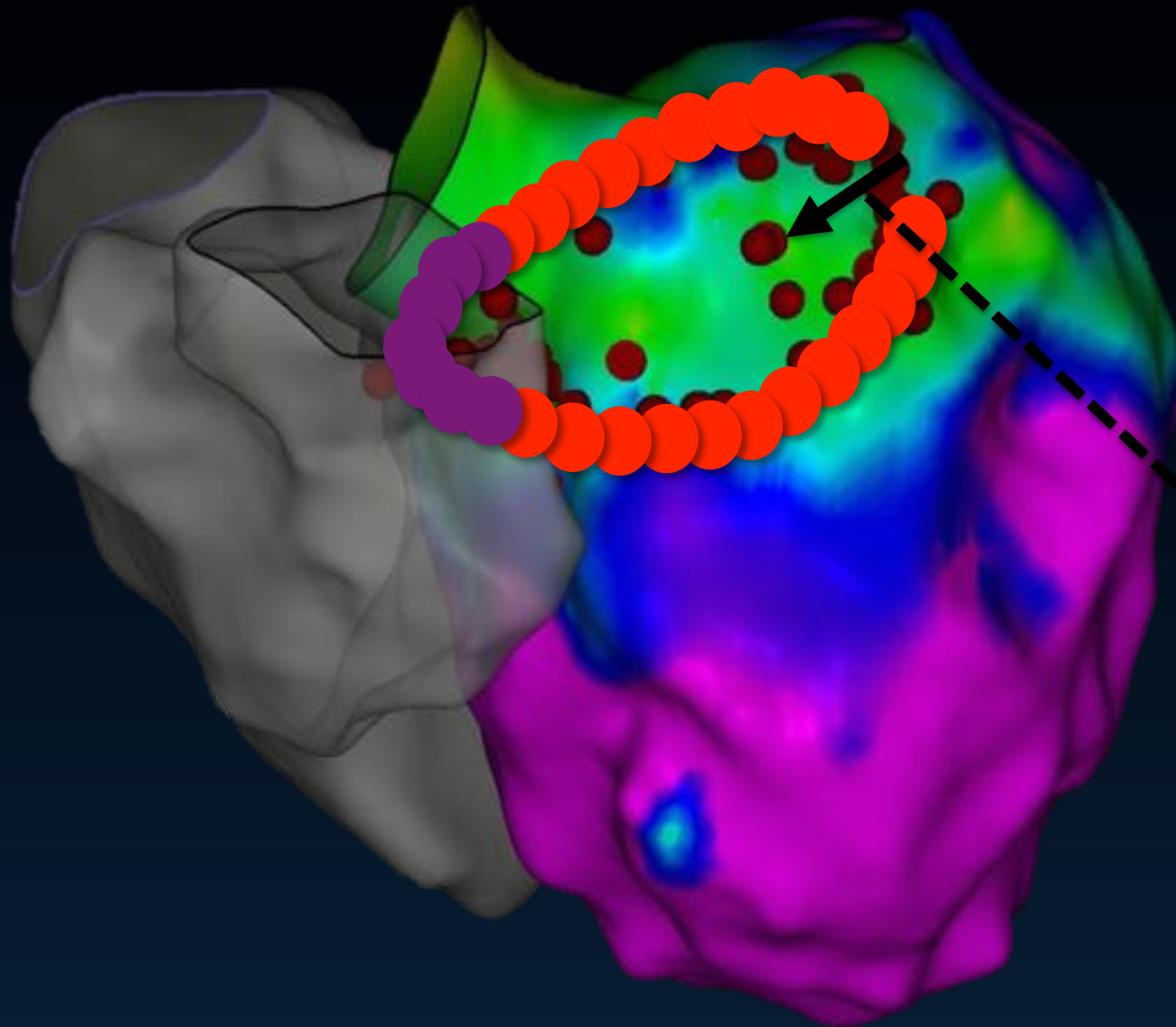
Post-Ablation



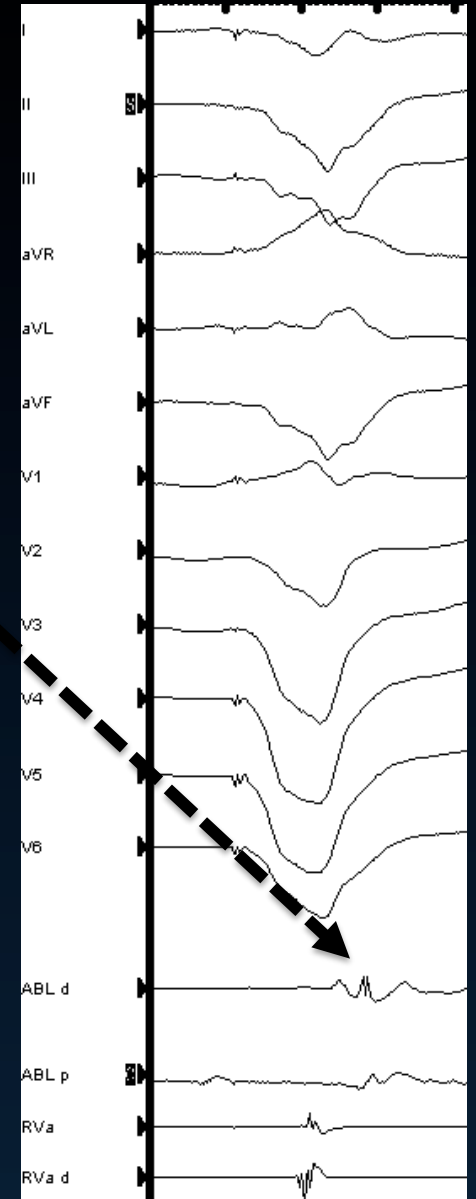
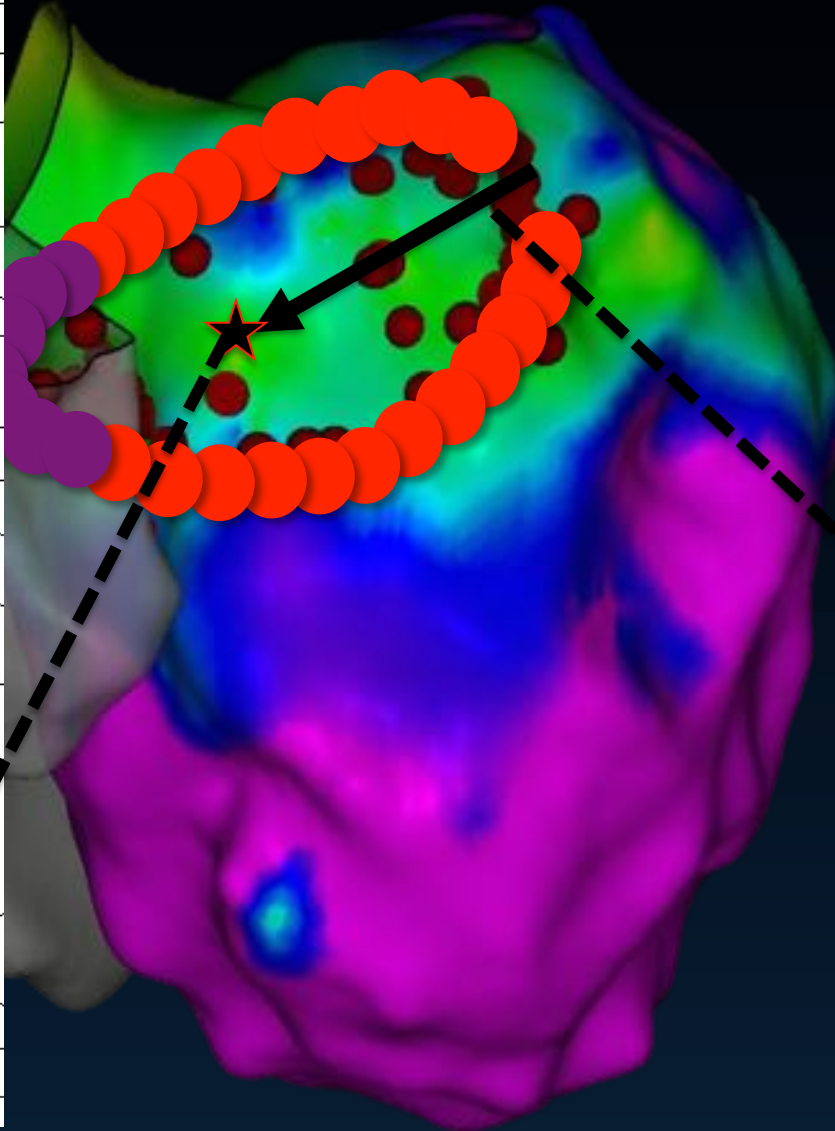
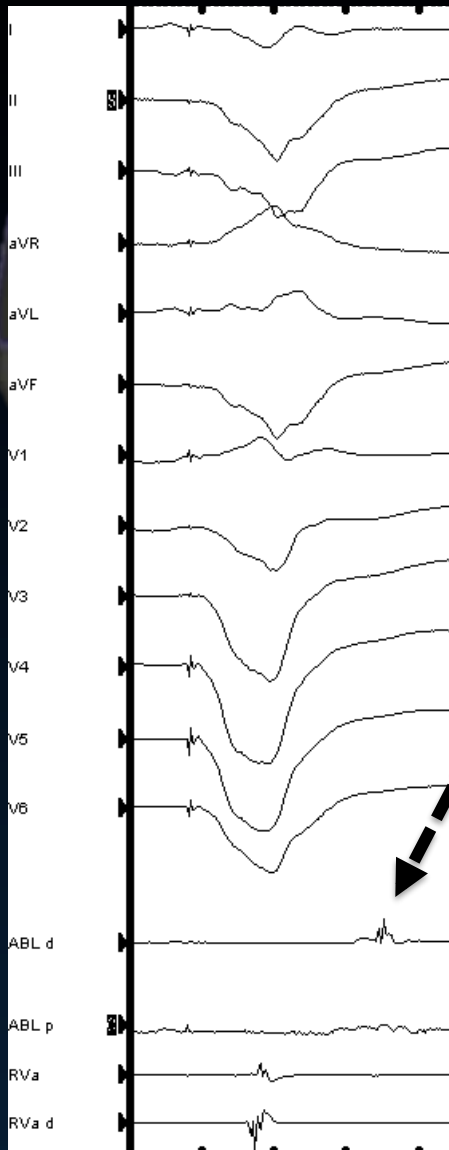
Core Isolation: Identifying the leak



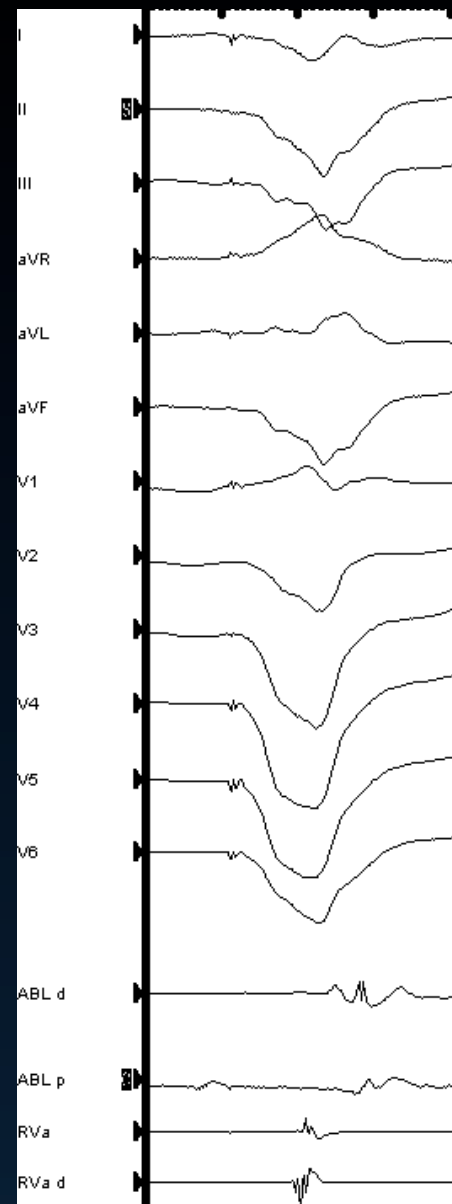
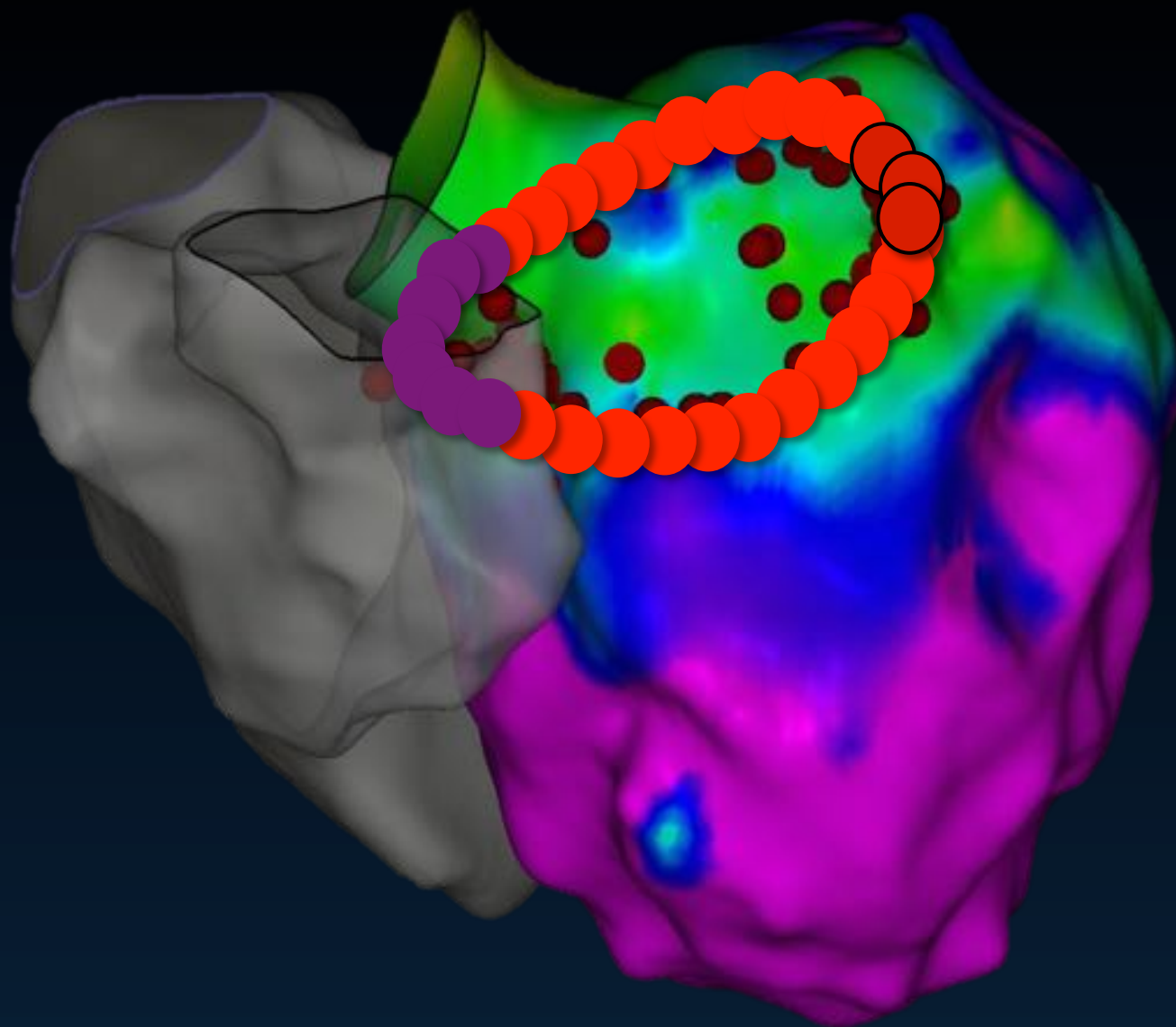
Core Isolation of entire LV outflow around AMC



Core Isolation of entire LV outflow around AMC

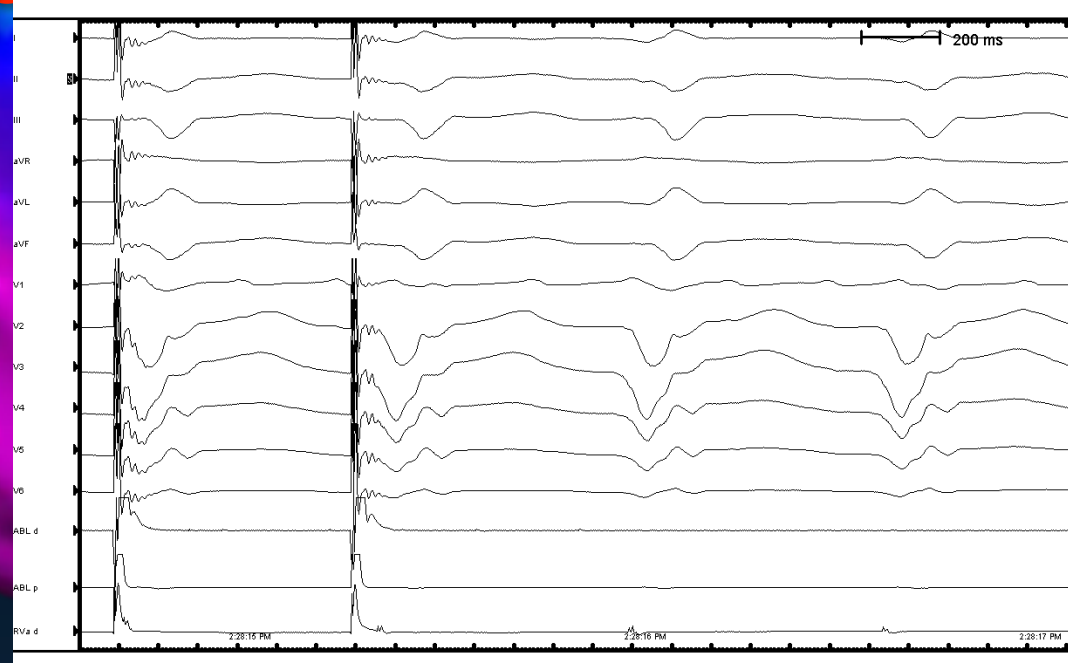
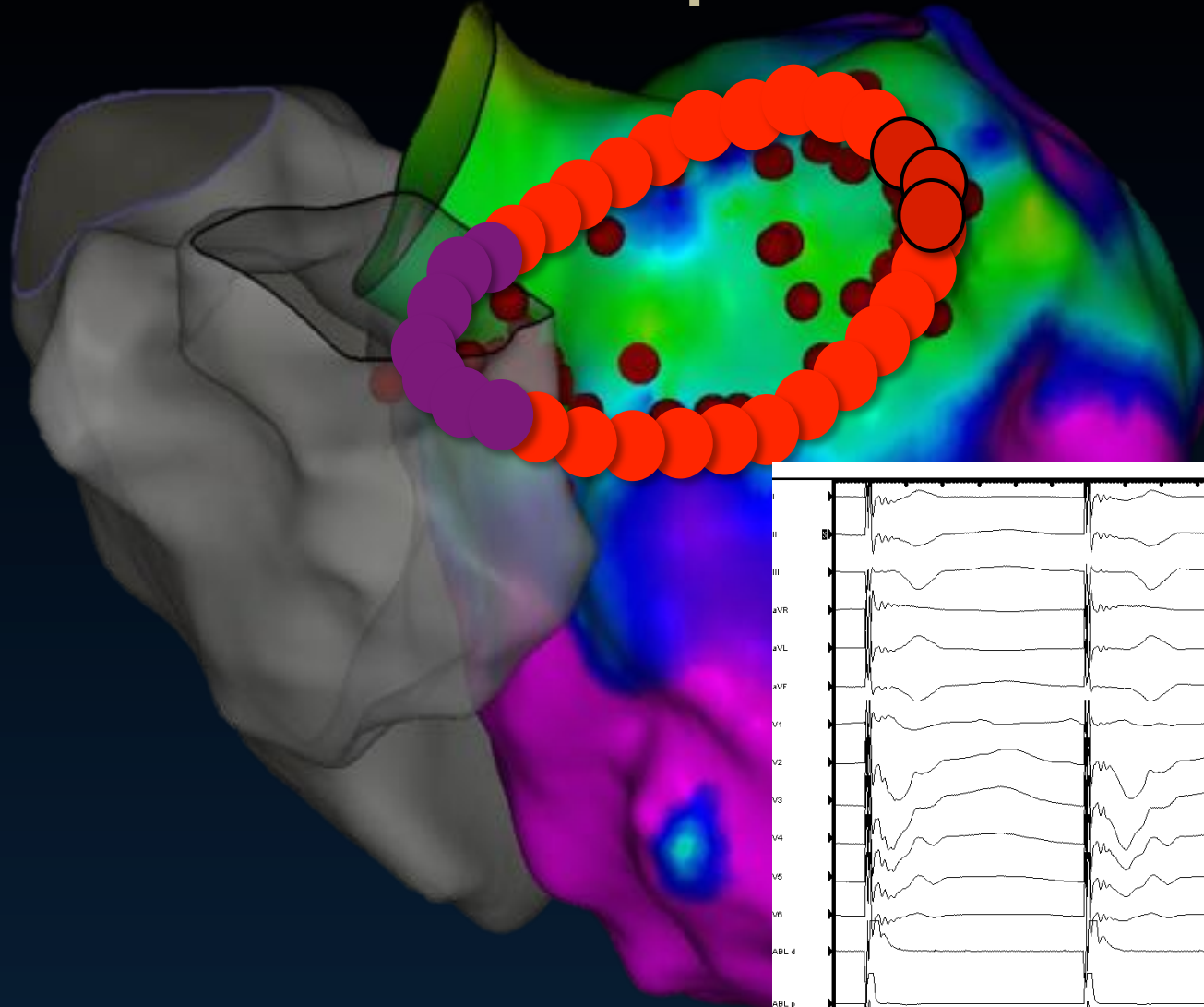


Core Isolation of entire LV outflow around AMC

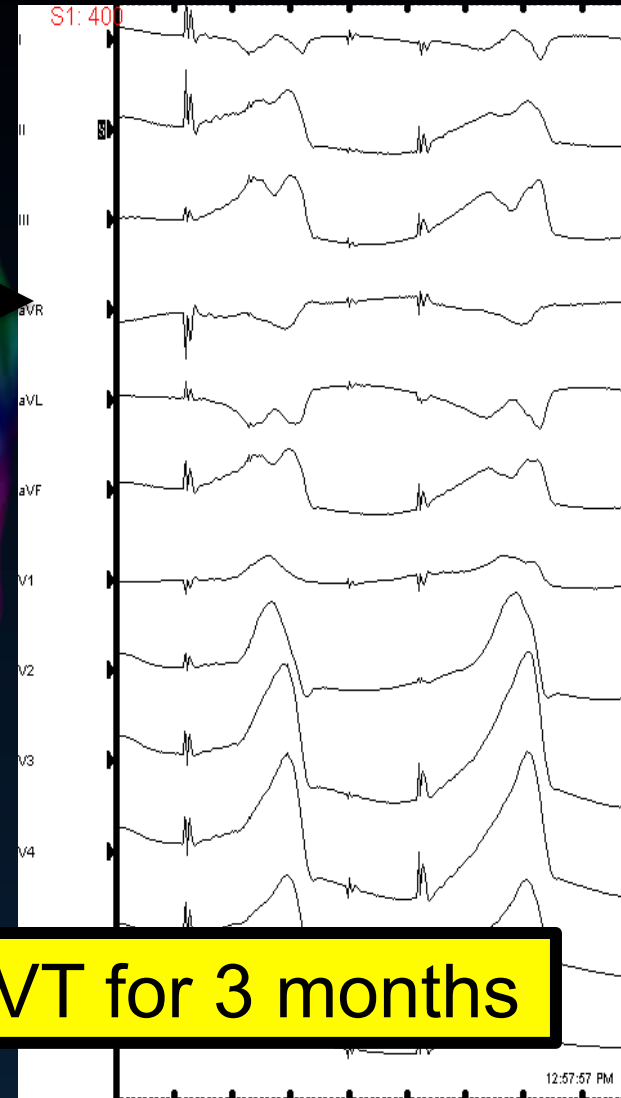
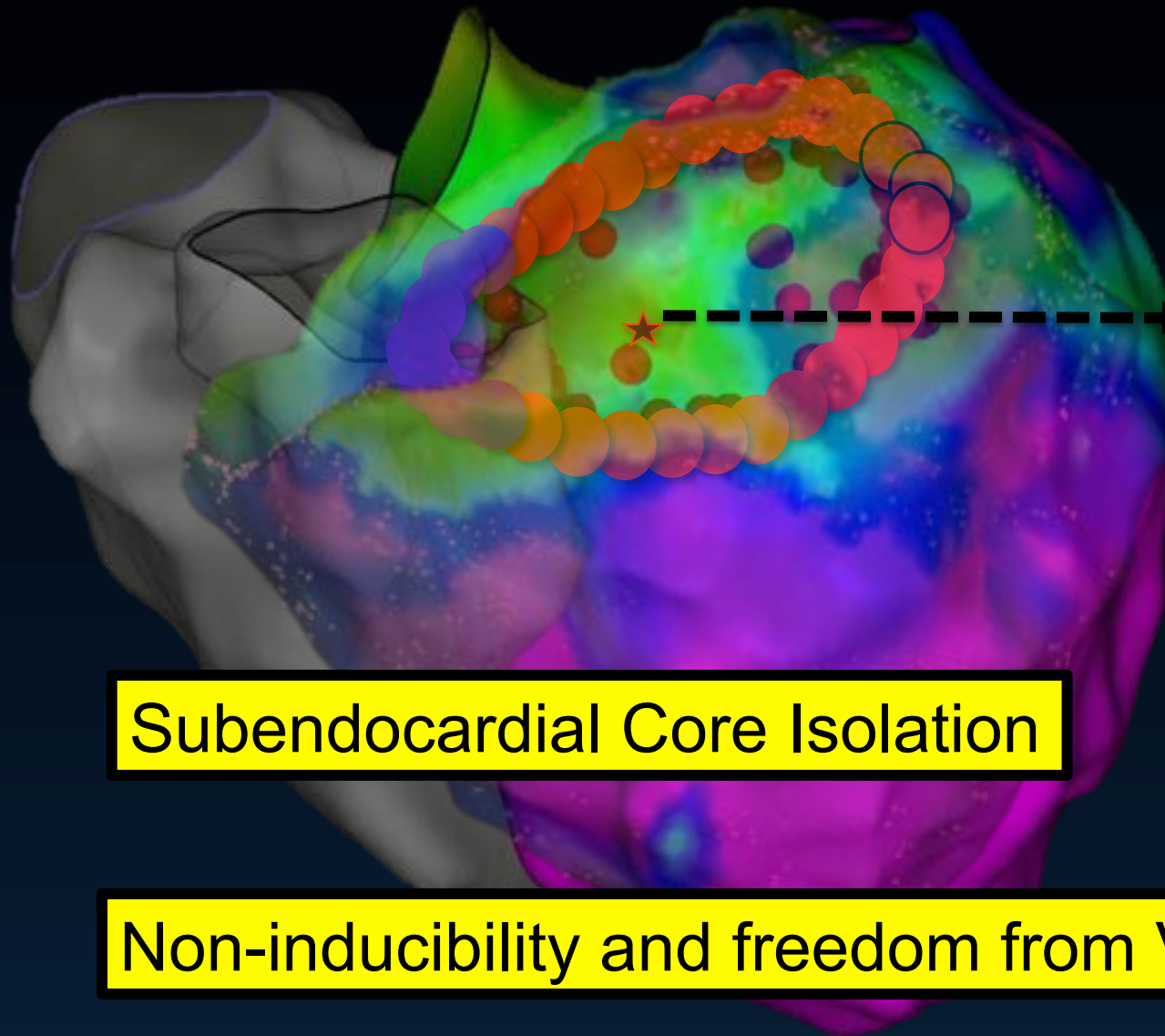


Entrance block

Lack of capture at 20mA@5ms



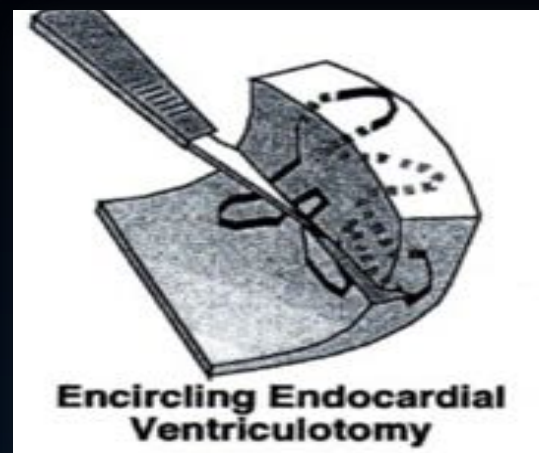
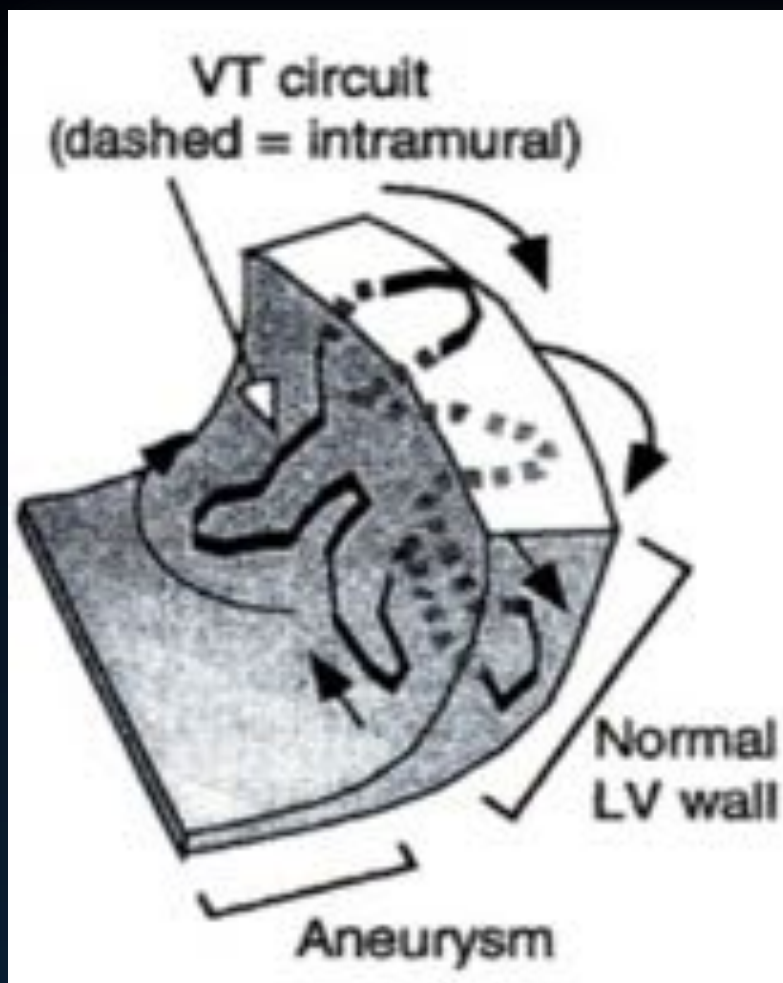
Capture at the opposing epicardial surface



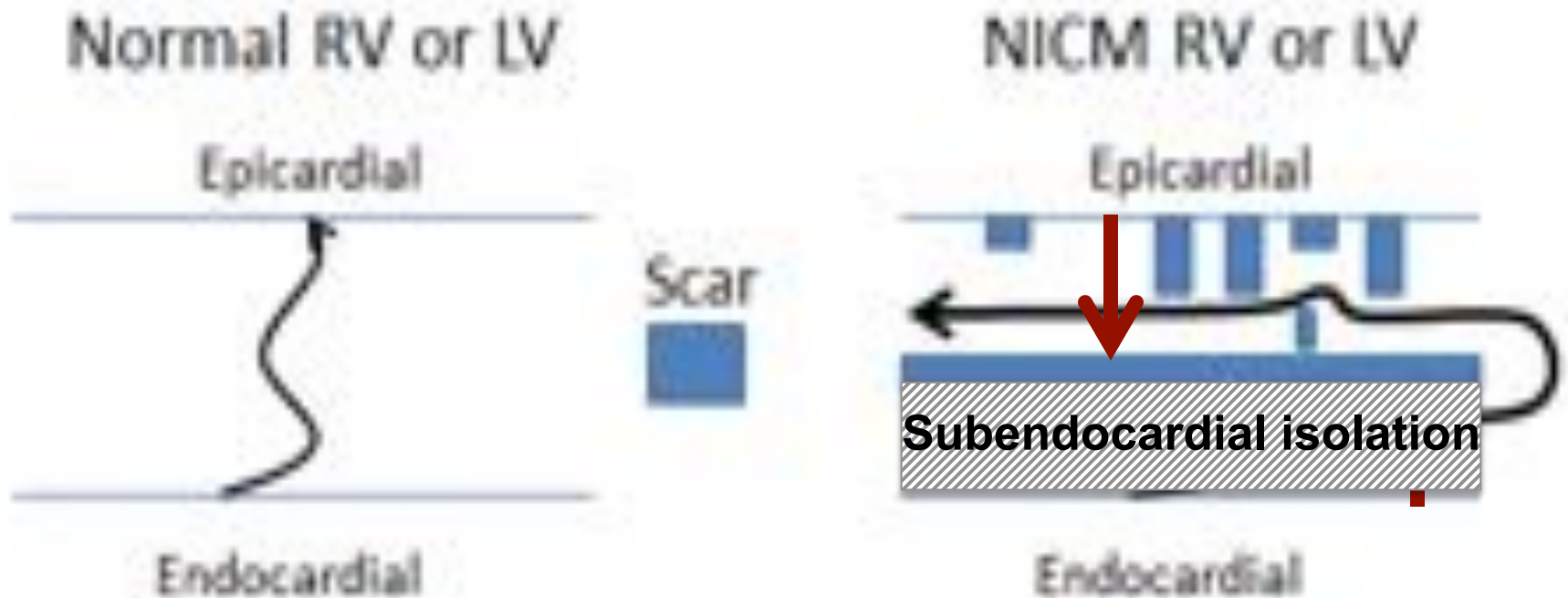
Subendocardial Core Isolation

Non-inducibility and freedom from VT for 3 months

Does isolation of the core needs to be transmural ?



Does isolation of the core needs to be transmural ?



A. Transmural Activation

Core Isolation as VT endpoint

Core Isolation of Critical Arrhythmia Elements for Treatment of Multiple Scar-Based Ventricular Tachycardias

Wendy S. Tzou, MD*; David S. Frankel, MD*; Timothy Hegeman, DO;
Gregory E. Supple, MD; Fermin C. Garcia, MD; Pasquale Santangeli, MD;
David F. Katz, MD; William H. Sauer, MD; Francis E. Marchlinski, MD

Background—Radiofrequency ablation of multiple or unmappable ventricular tachycardias (VTs) remains a challenge with unclear end points. We present our experience with a new strategy isolating core elements of VT circuits.

Methods and Results—Patients with structural heart disease presenting for VT radiofrequency ablation at 2 centers were included. Strategy involved entrainment/activation mapping if VT was hemodynamically stable, and voltage mapping with electrogram analysis and pacemapping. Core isolation (CI) was performed incorporating putative isthmus and early exit site(s) based on standard criteria. If VT was noninducible, the dense scar (<0.5 mV) region was isolated. Successful CI was defined by exit block (20 mA at 2 ms) within the isolated region. VT inducibility was also assessed. Forty-four patients were included (mean age, 63; 95% male; 73% ischemic cardiomyopathy; mean left ventricular ejection fraction, 31%; 68% with multiple unstable VTs [mean, 3+2]). CI area was 11+12 versus 55+40 cm² total scar area. Additional substrate modification was performed in 27 (61%), and epicardial radiofrequency ablation was performed in 4 (9%) patients. CI was achieved in 37 (84%) and led to better VT-free survival (log rank $P=0.013$).

Conclusions—CI is a novel strategy with a discrete and measurable end point beyond VT inducibility to treat patients with multiple or unmappable VTs. The CI region can be selected based on standard characterization of suspected VT isthmus surrogates thus limiting ablation target size. Exit block within the isolated area is achievable in most and may further improve long-term success. (*Circ Arrhythm Electrophysiol.* 2015;8:353-361. DOI: 10.1161/CIRCEP.114.002310.)

Summary

- The use of unipolar voltage (endocardial and epicardial) enhances our ability to identify abnormal substrate “scar” that is further away from the recording electrodes
- Normal bipolar endocardial and epicardial voltage coupled with abnormal endocardial and epicardial unipolar voltage may suggest a midmyocardial substrate
- Isolation of the arrhythmogenic core may not require transmural lesions formation as lesions only have to reach the existing layer of midmyocardial scar
- Core isolation may be a feasible alternative endpoint for VT ablation