Ablation des tachycardies atriales post-ablation de FA

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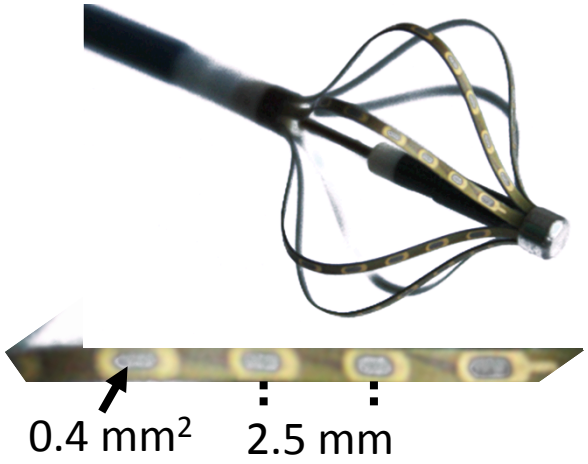
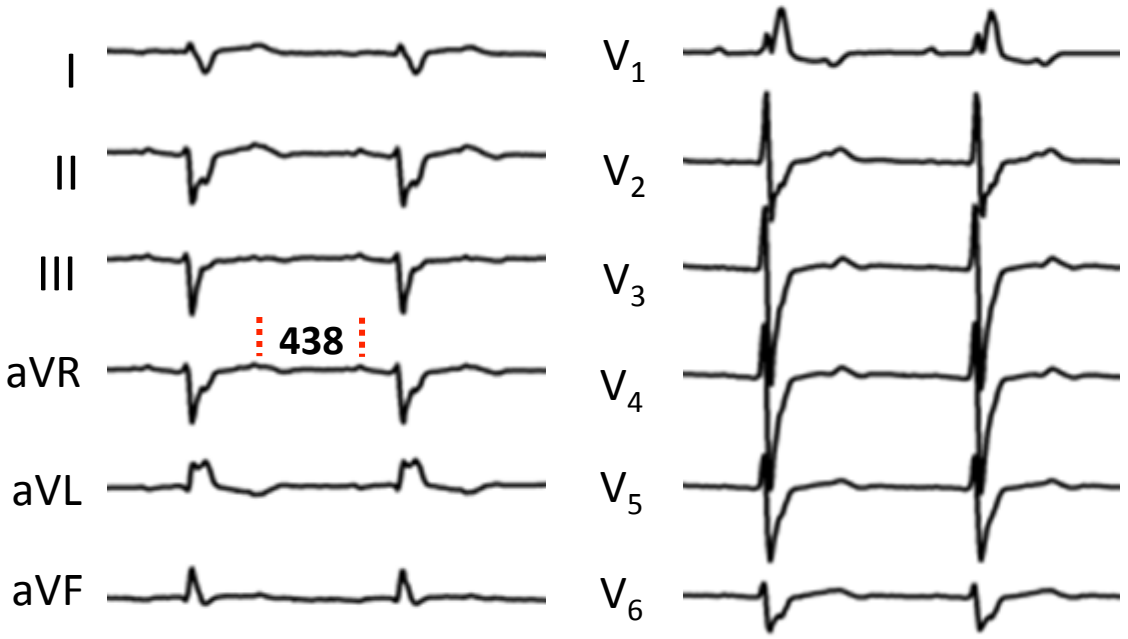
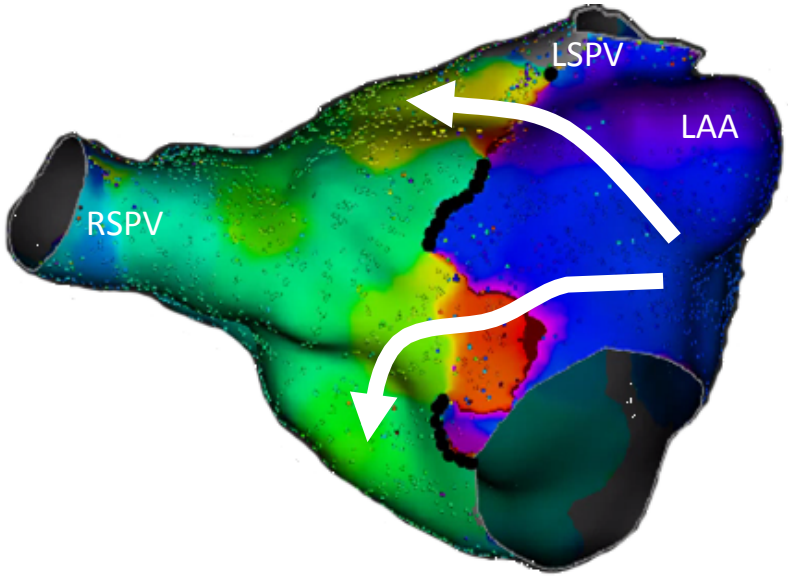
Left flutter post AF ablation – where is the gap (critical isthmus) ?

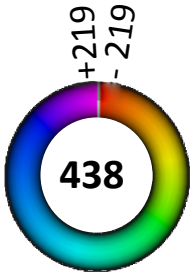
Male, 80 years :

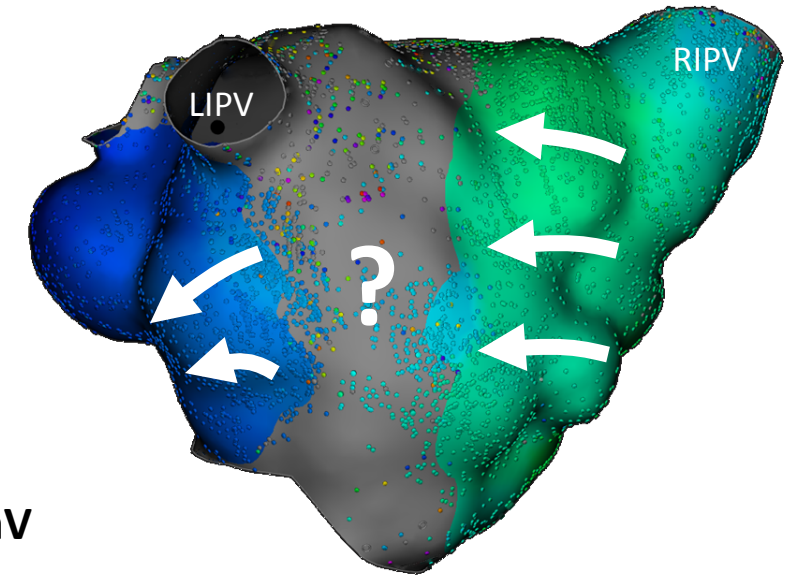
- 2 previous atrial ablations (AF and AT, last procedure 14 months ago)
- CPVI + mitral line + roof line + ICT







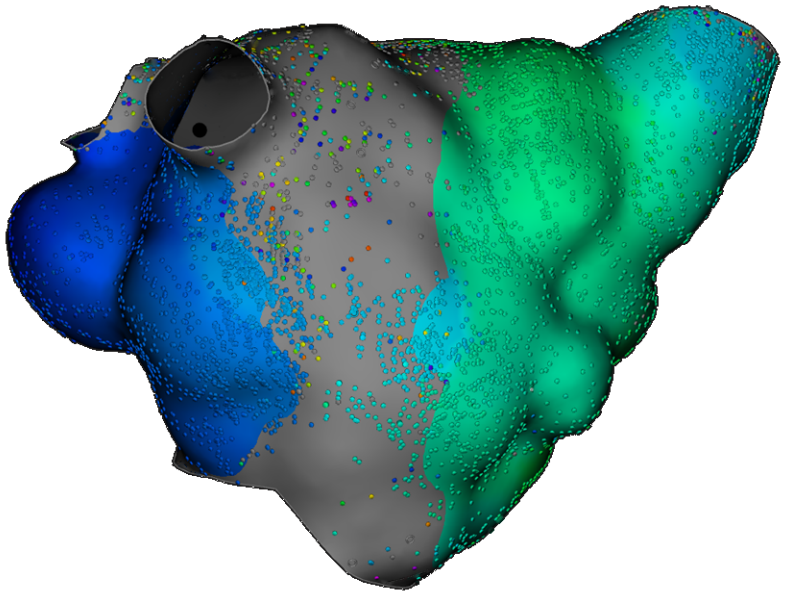




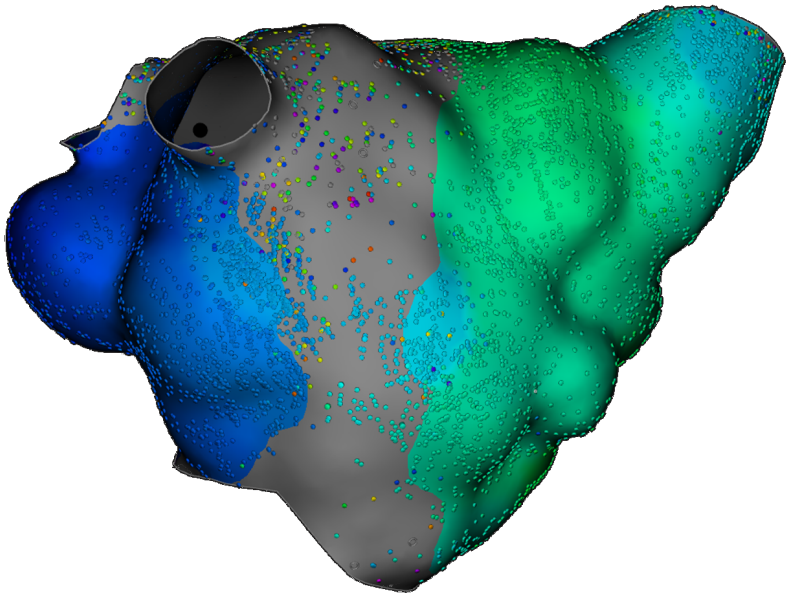
Scar ≤ 0.05 mV

Left flutter post AF ablation – where is the gap (critical isthmus) ?

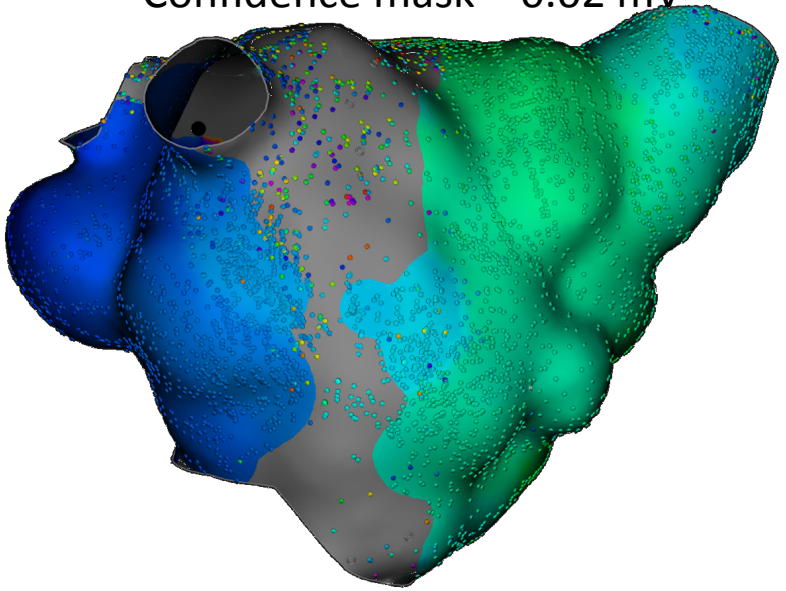
Confidence mask = 0.05 mV



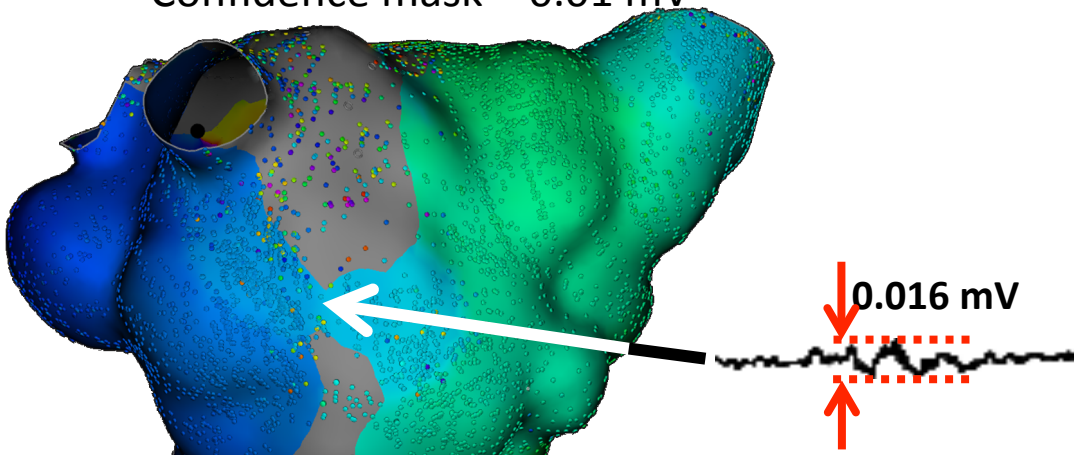
Confidence mask = 0.03 mV



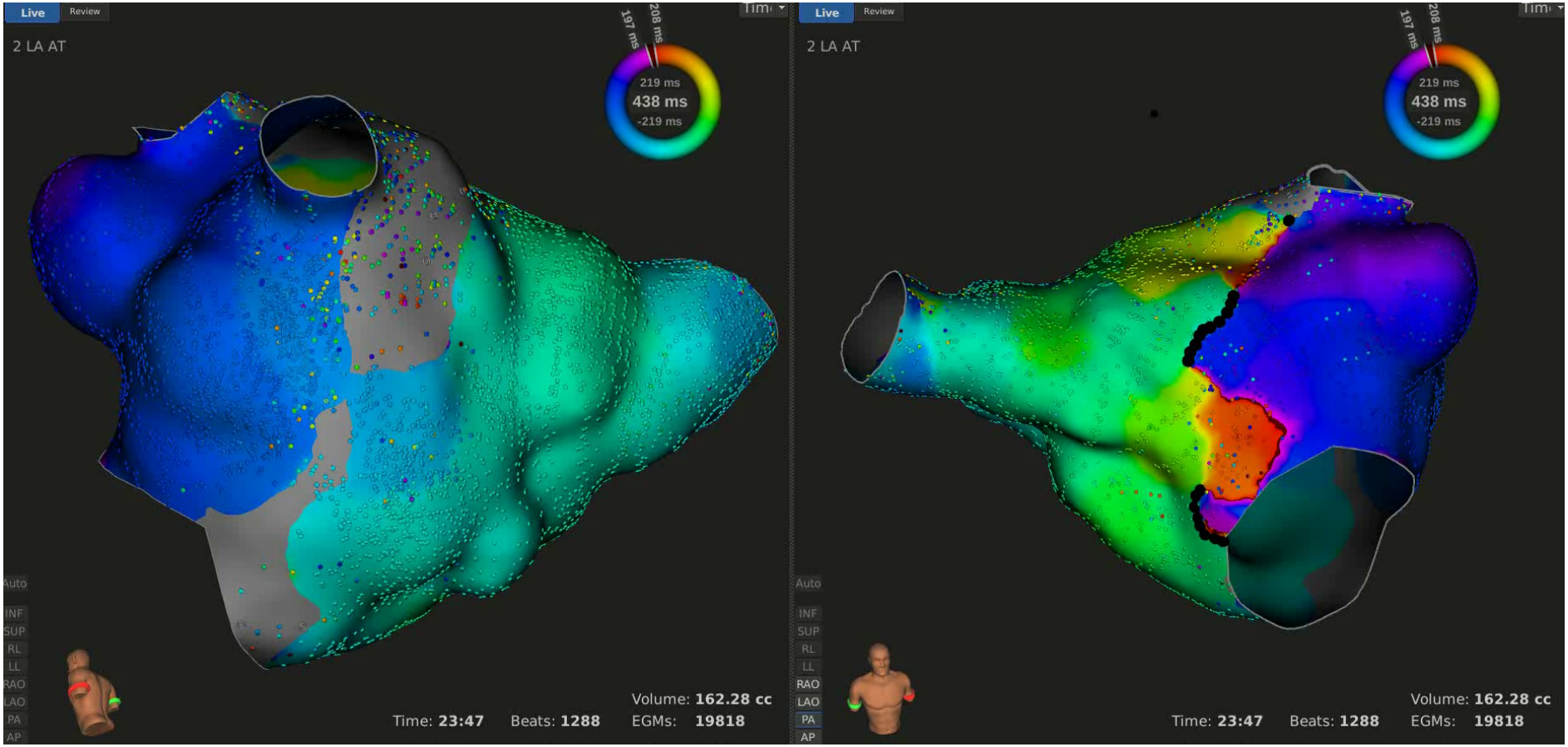
Confidence mask = 0.02 mV



Confidence mask = 0.01 mV



Left flutter post AF ablation – where is the gap (critical isthmus) ?



Where is the critical isthmus – Monaco series

Patient population

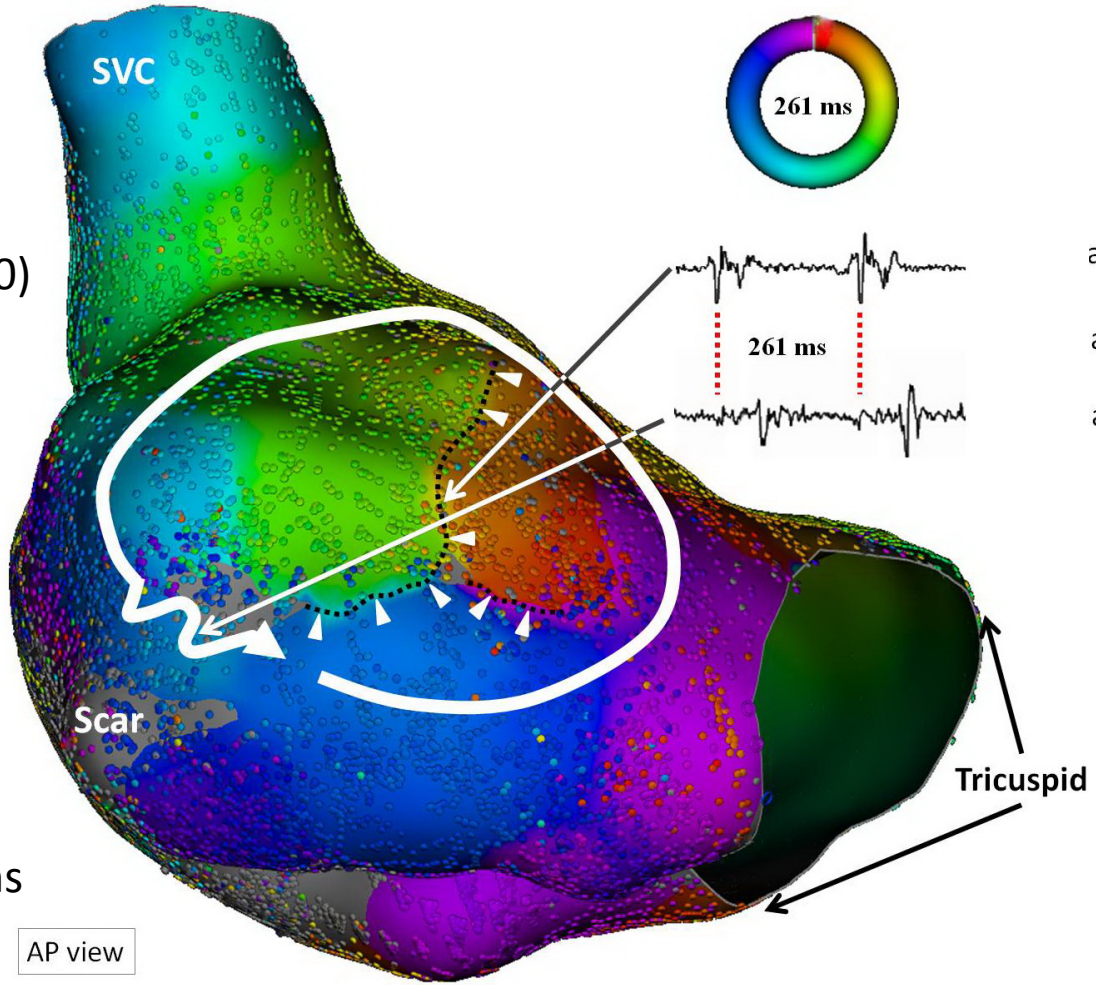
Population:

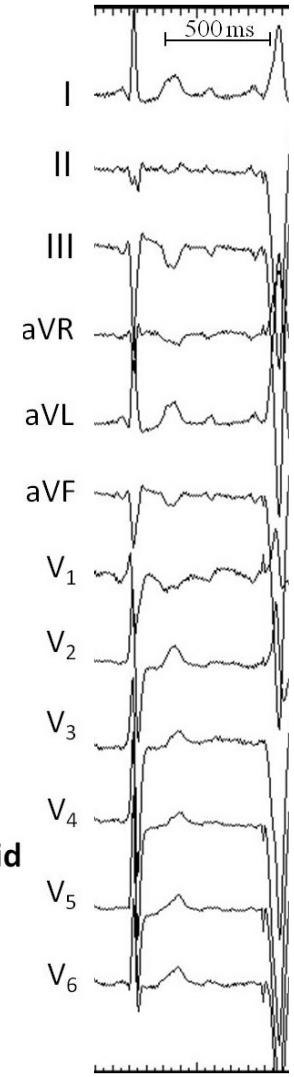
- 33 iatrogenic scar-related AT in 19 patients (69 ± 8 years, 33% women)
- Mean CHA_2DS_2Vasc = 2.2 ± 1.15
- LA volume (scanner) = 135 ± 30 ml

History :

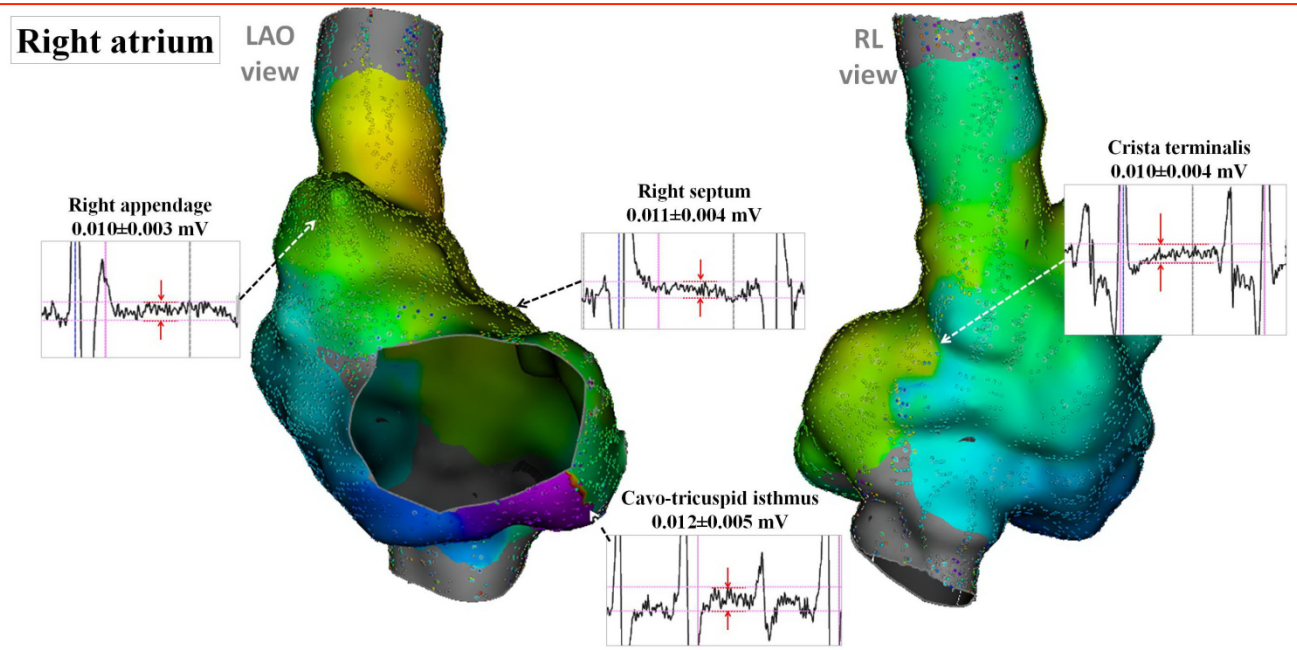
- 78% post AF ablation
  - CPVI (10)
  - CFAE LA (13) + RA (10)
  - roof line (11)
  - mitral line (11)
  - RF inside the CS (6)
  - RF around VCS (8)
  - CTI (22)
- 22% (n=7) post surgical mitral valve repair (with adjunct maze in 2)

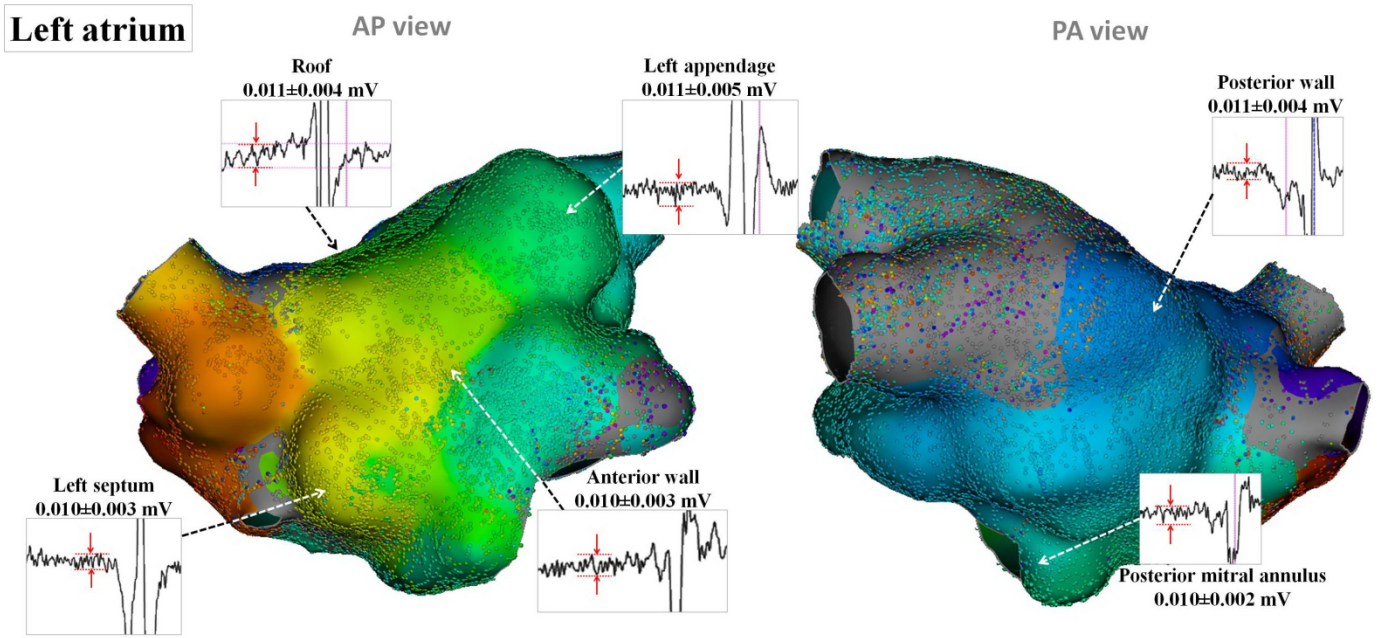
Timing of AT: 32±42 months
median 11 (2 to 216)





Noise assessment

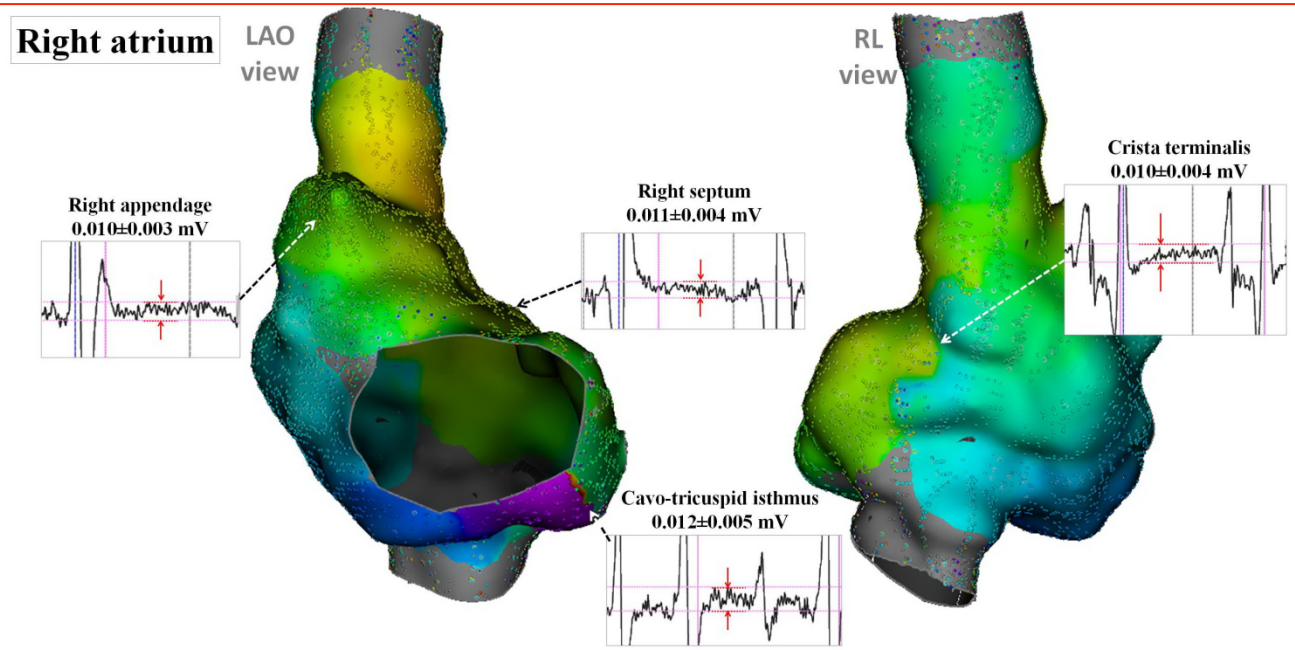


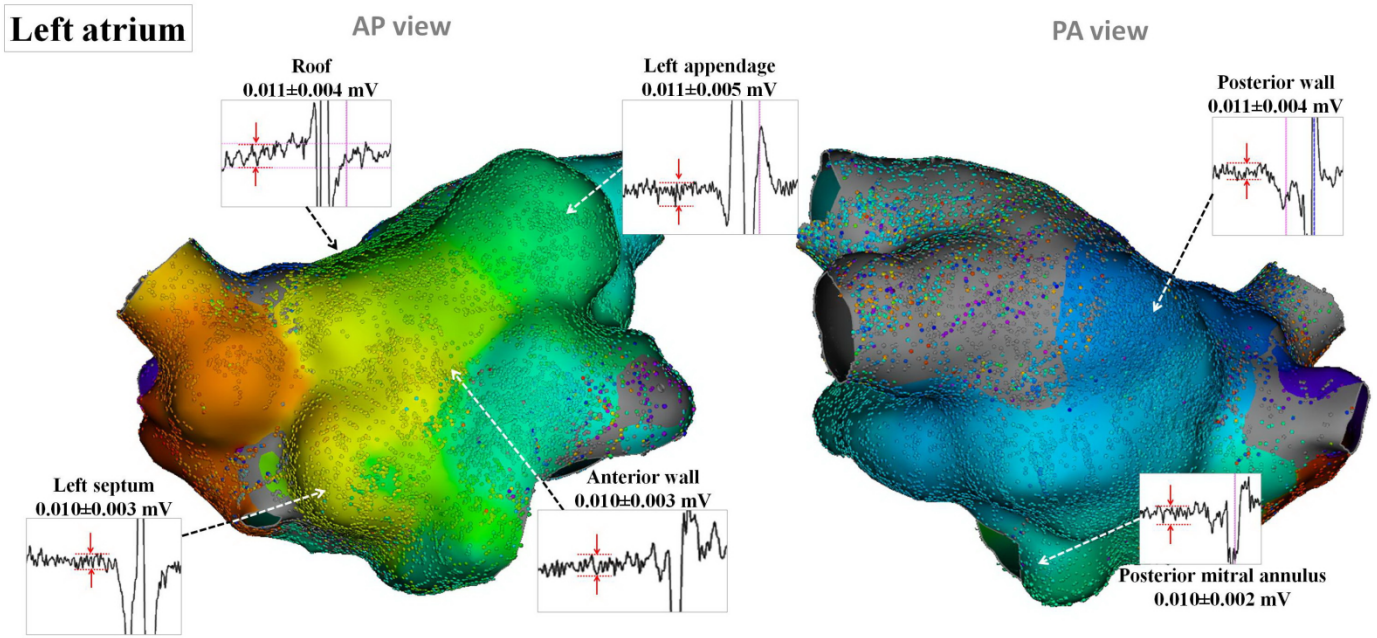


Noise (mV)	
Orion	0.011±0.004

1. Latcu DG et al, Heart Rhythm 2016; 13(5): S233
2. Latcu DG et al, abstract 96P-21, Cardiostim EHRA Europace 2016

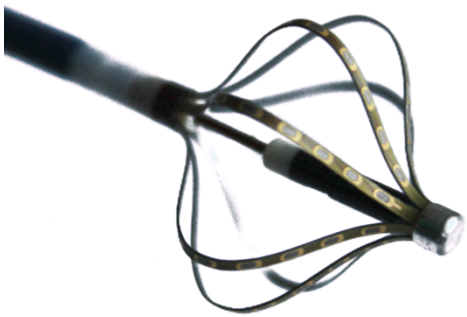
Noise assessment





Noise (mV)

Orion	0.011±0.004
Standard catheter (2-2 mm)	0.016±0.019
ECG	0.02±0.01
p=0.00009	



Orion bipolar noise: 10 ÷ 12 µV

1. Latcu DG et al, Heart Rhythm 2016; 13(5): S233
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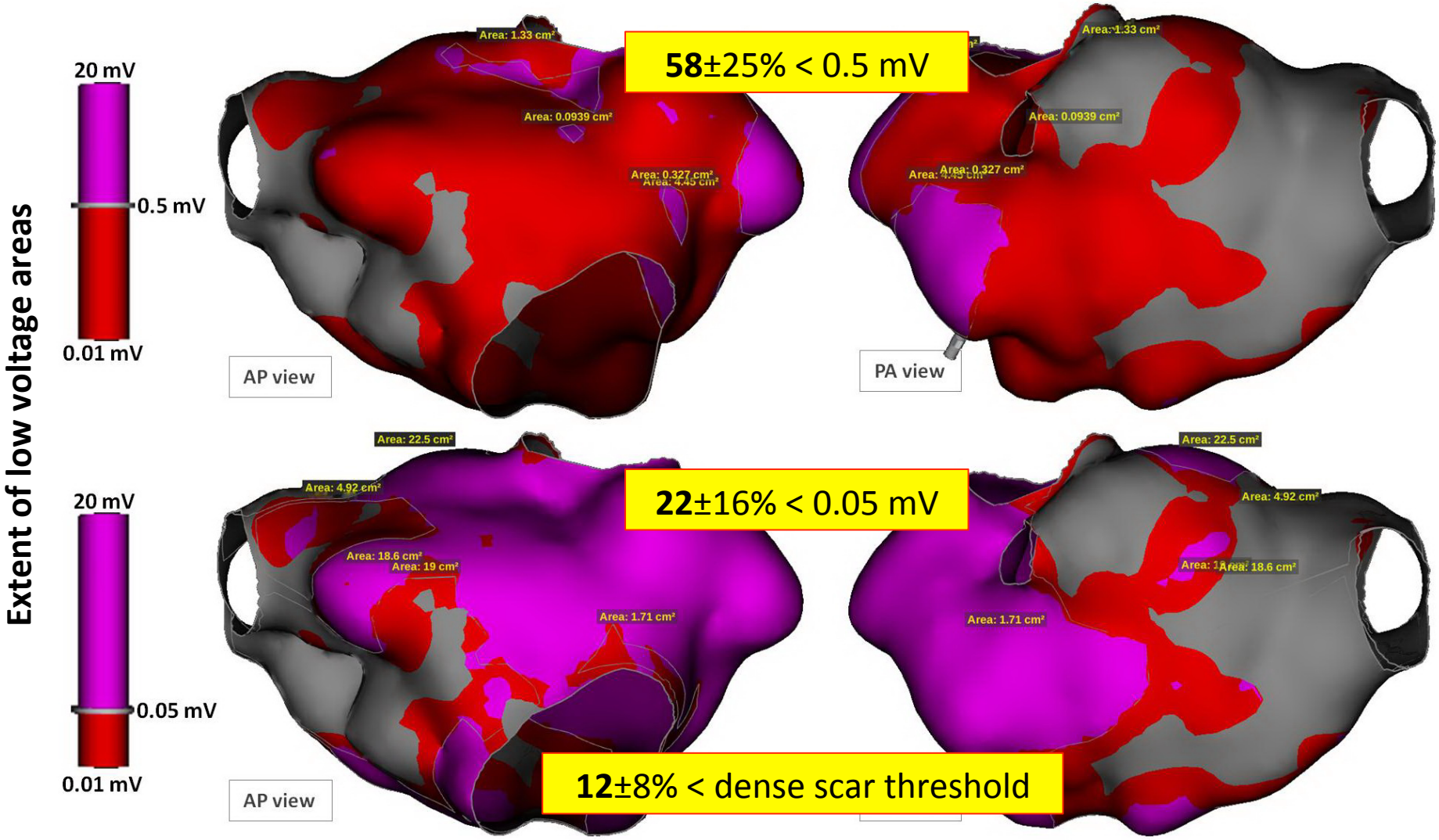
AT: voltage mapping

- All acquired electrograms (EGM) were automatically annotated.
- Scar thresholding was performed whenever necessary to visualize the entire circuit.
- LA maps volume = 151±35 ml ; LA maps surface = 129±27 cm^2
- Scar threshold was established at 0.016±0.009 mV (median 0.015).



AT: activation mapping

- 25684 ± 14276 points / map in 20±8 min
- These points were situated within 3.3 ± 1.1 mm (2 to 5) from the shell
- Beat number: 2286± 1380 (9% of the EGM number)
- Cycle length 289±79 ms (201 to 532 ms)

UHD:
209±128 points/cm^2

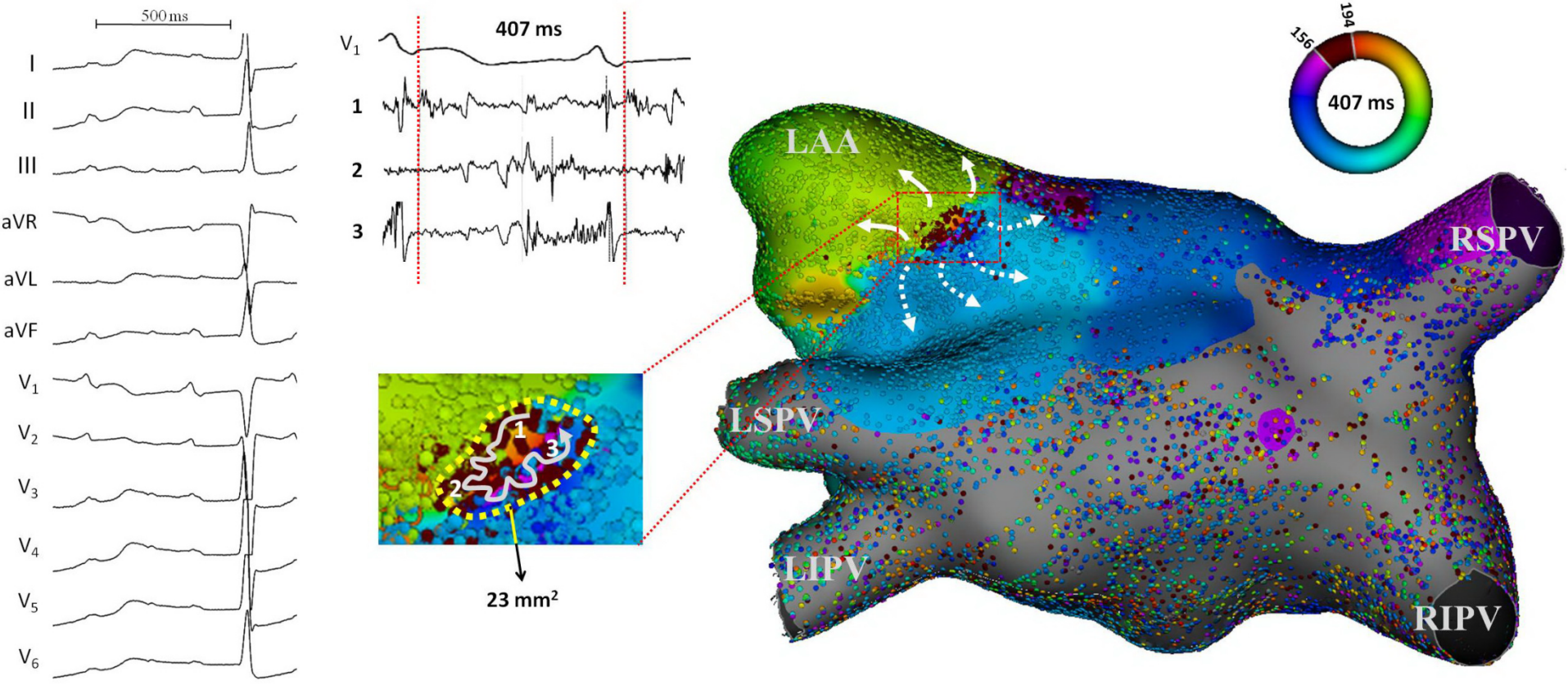
- Activation maps (both RA and LA) were studied for each AT. Right or left origin was rapidly diagnosed based on the degree of CL coverage or by localizing the earliest activation site during simultaneous display of both cavities in case of focal arrhythmias.
- **Wavefront propagation was visualised by following a 10 ms window of activation slowly advanced along the timescale; no entrainment manoeuvres were performed.**

Macroreentry = AT propagating around a **central obstacle** (scar or anatomical structure – e.g. a valve or PV ostia), with a **≥ 90%** coverage of the CL within the chamber of origin

Type of AT (n=33)	Chamber (n)	Circuit / origin (n)
Macrorentry (26)	LA (24)	Perimitral flutter (7)
		Roof-dependent (6)
		Dual loop reentry (4)
		Reentry using the VOM (2)
		AW rentry (2)
		Left septal reentry (2)
		PV reentry (1)
	RA (2)	Free wall reentry (1)
		CTI –dependent (1)
Microrentry (4)	LA (3)	AW /LAA
	RA (1)	CS ostium
Focal (3)	LA (3)	RSPV / LAA

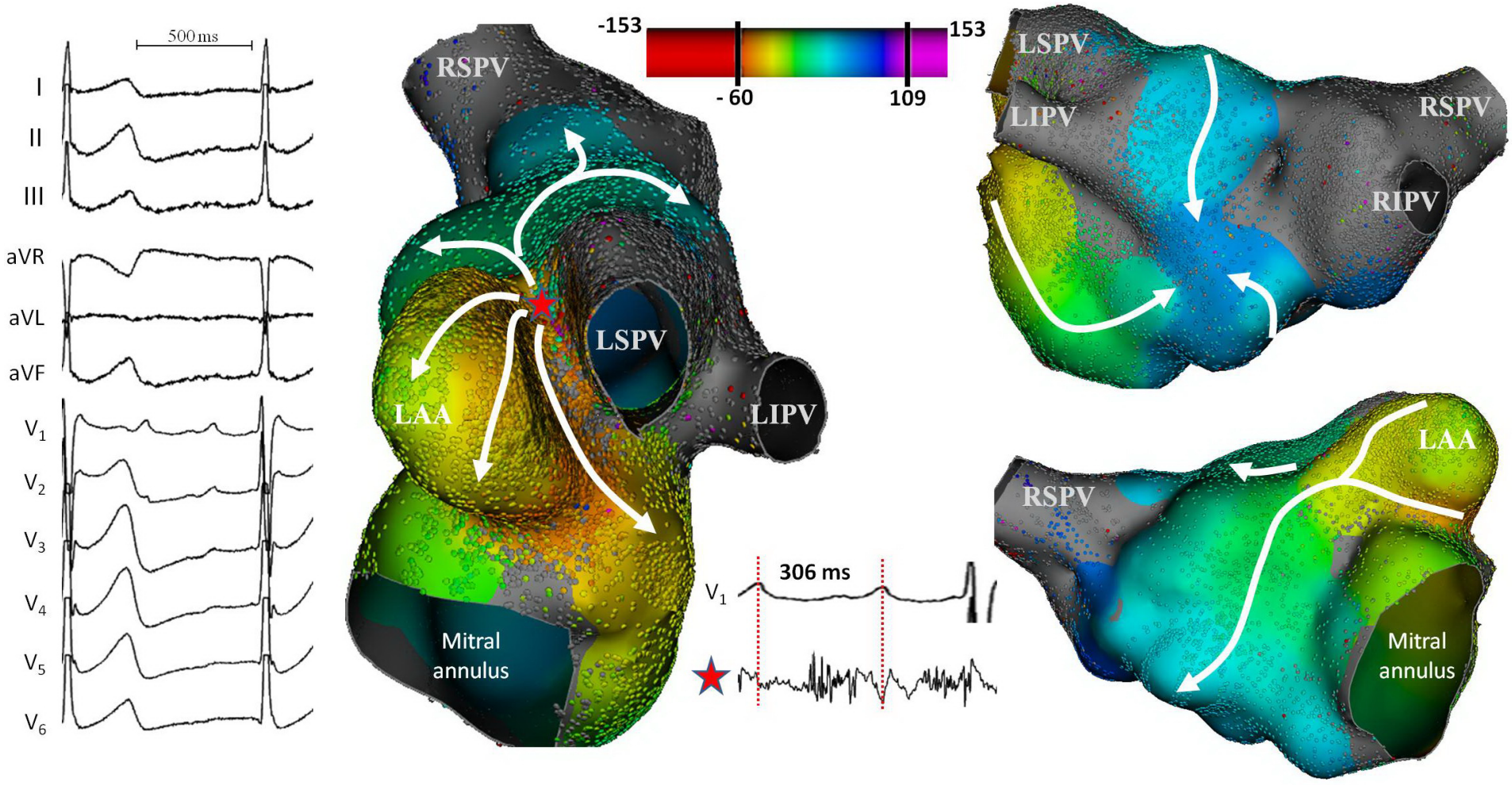
AT: activation mapping

Microreentry = **no** clearly distinguishable central obstacle (no central dense scar) and potentials over a small area covered **≥ 90%** of the CL, with a centrifugal activation of the rest of the atria



AT: activation mapping

Focal AT = AT without coverage of the CL (**<90%**) and a centrifugal activation of the chamber from the earliest activation site.

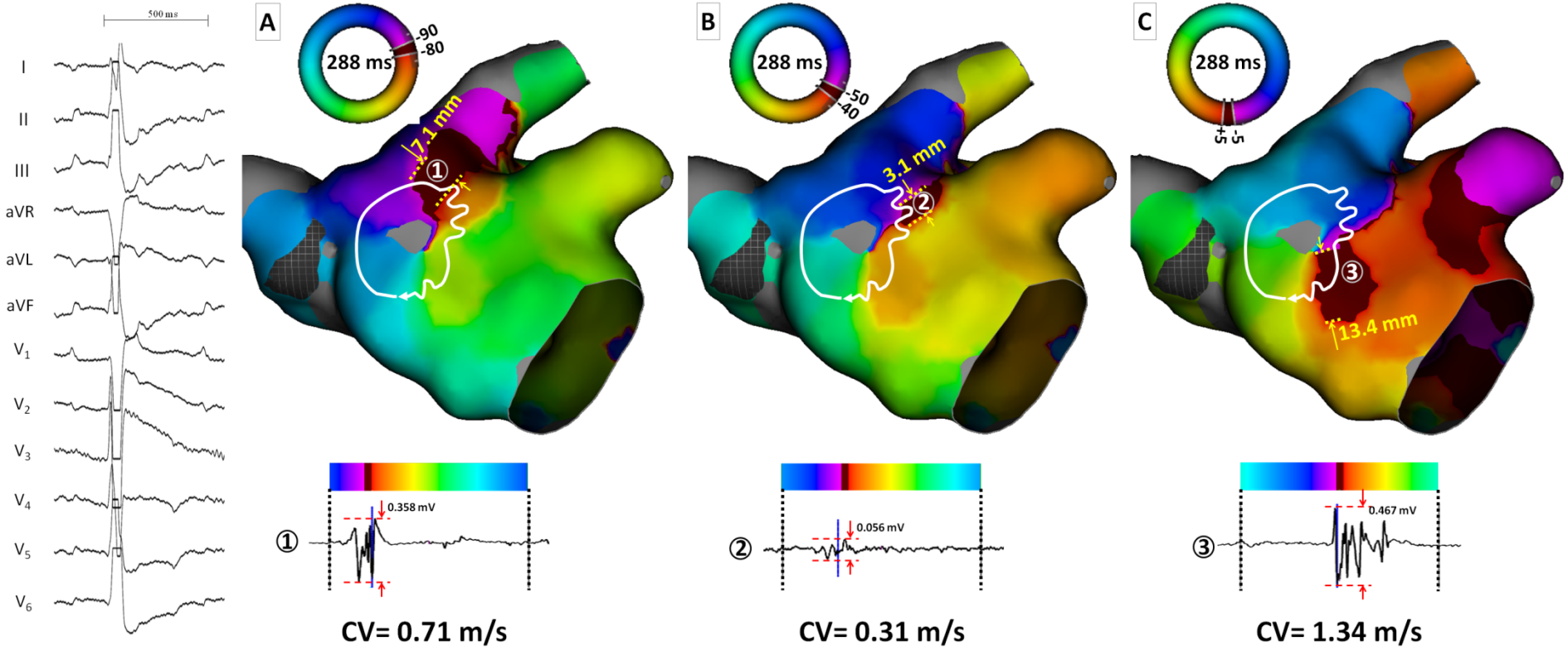


Critical isthmus characteristics

Critical isthmus = site of narrowing and/ or slowing of the wavefront; targeted with ablation

Bipolar EGM of CI regions of reentrant AT were analyzed for:

- amplitude
- duration
- conduction velocity (CV) = $\frac{\text{inter-point distance on the atrium shell}}{\Delta \text{ LAT}}$

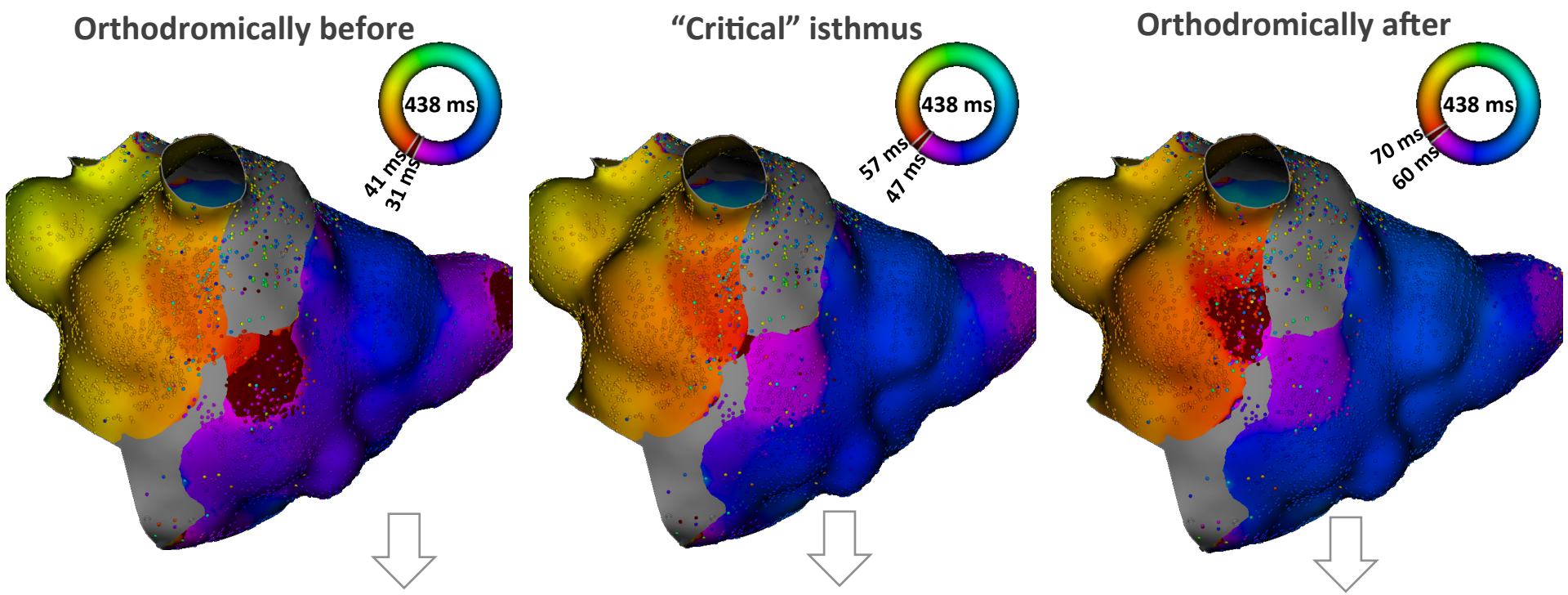


Latcu DG et al, Heart Rhythm 2016; 13(5): S287

Latcu DG et al, abstract 189-4, Cardiostim EHRA Europace 2016

Critical isthmus characteristics

Where to ablate ? = How to find the "critical" isthmus ?



Amplitude (mV)	0.62 ± 0.93	**0.08 ± 0.11**	0.80 ± 1.59	*p < 0.001*

- In 13 cases (50%) bipolar EGM amplitude at the level of the CI was <0.05 mV
- in 7 AT (27%) it was <0.03 mV (NB: noise 0.011 mV and dense scar <0.016 mV)

- Maximal duration of bipolar EGM at the level of the CI = 100±63 ms (35±18% of the CL)

Latcu DG et al, Heart Rhythm 2016; 13(5): S287

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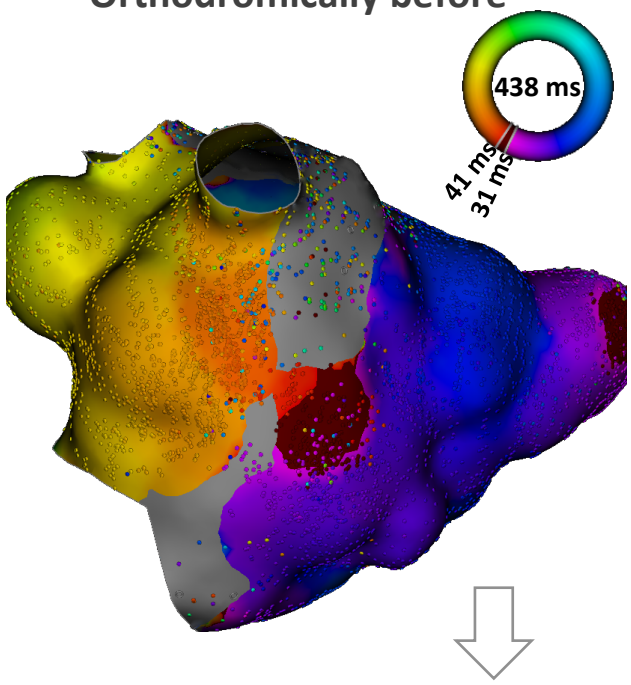
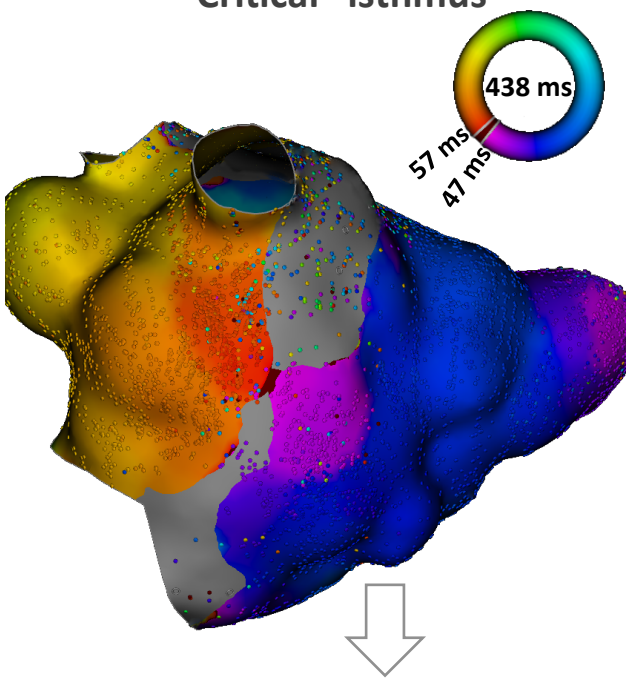
Critical isthmus characteristics

Where to ablate ? = How to find the "critical" isthmus ?

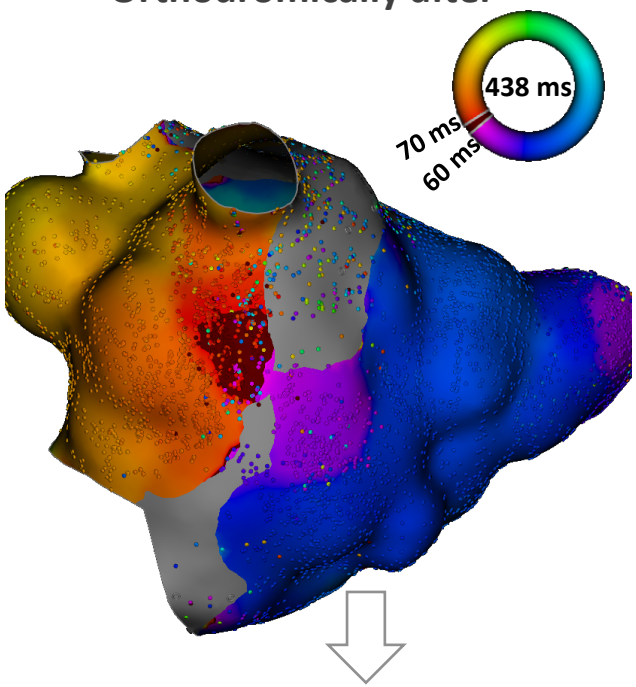
Orthodromically before



"Critical" isthmus



Orthodromically after



Amplitude (mV)	0.62 ± 0.93	**0.08 ± 0.11**	0.80 ± 1.59	*p < 0.001*
Conduction velocity (m/s)	1 ± 0.49	**0.27 ± 0.19**	1 ± 0.73	*p < 0.001*

Latcu DG et al, Heart Rhythm 2016; 13(5): S287

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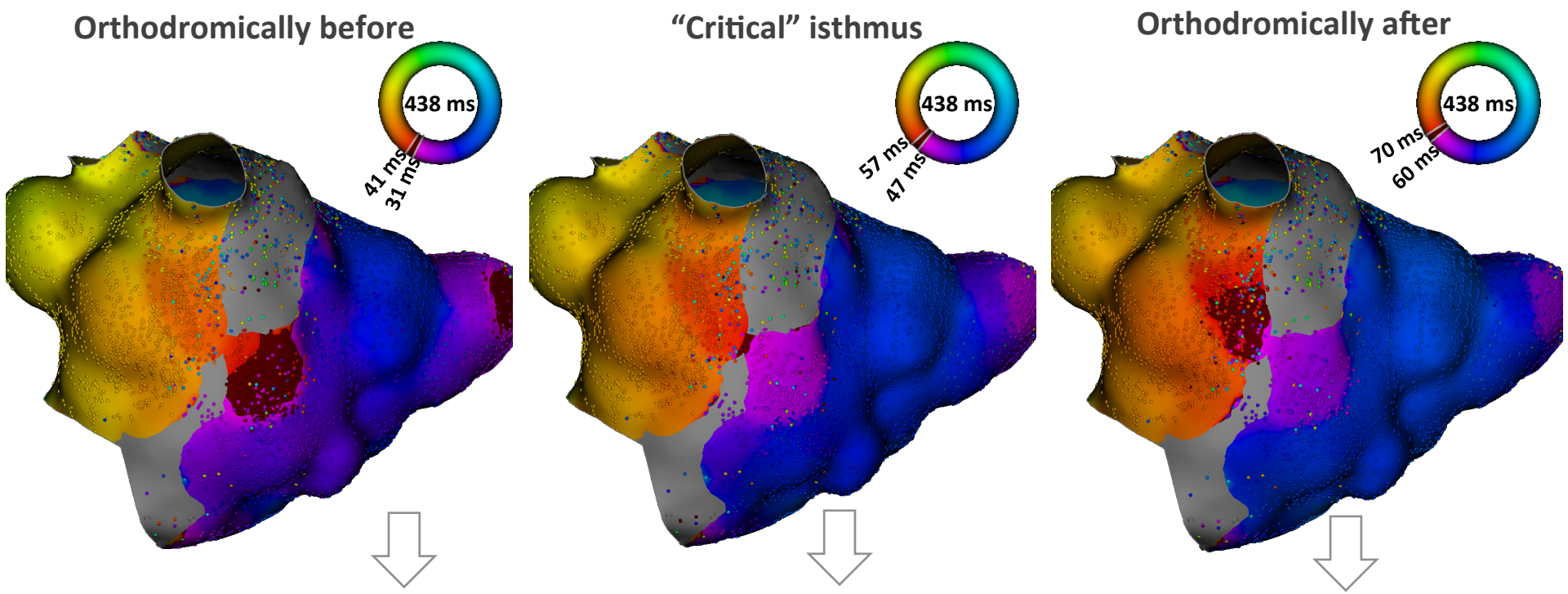
Critical isthmus characteristics

Where to ablate ? = How to find the "critical" isthmus ?



	Orthodromically before	"Critical" isthmus	Orthodromically after	
Amplitude (mV)	0.62 ± 0.93	**0.08 ± 0.11**	0.80 ± 1.59	*p < 0.001*
Conduction velocity (m/s)	1 ± 0.49	**0.27 ± 0.19**	1 ± 0.73	*p < 0.001*

Ablation at the chosen isthmus based on activation mapping alone (no entrainment mapping)

AT termination: 97% (1 failure – PMF – MI epi-endocardial ablation)

No complications occurred.

Latcu DG et al, abstract 18PW-4. Cardiostim EHRA Europace 2016

Circulation: Arrhythmia and Electrophysiology

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Original Article

Selection of Critical Isthmus in Scar-Related Atrial Tachycardia Using a New Automated Ultrahigh Resolution Mapping System

Decebal Gabriel Laţcu, MD; Sok-Sithikun Bun, MD; Frédéric Viera, MD; Tahar Delassi, MD; Mohammed El Jamili, MD; Alaa Al Amoura, MD; Nadir Saoudi, MD

Background—Accurate activation mapping of reentrant scar-related atrial tachycardias (AT) allows efficient radiofrequency ablation by targeting the critical isthmus (CI). We aimed to assess the electrophysiological properties of CI channels during mapping with the IntellaMap Orion basket and the Rhythmia system.

Methods and Results—We prospectively studied 33 AT (post– atrial fibrillation ablation or surgical mitral valve repair). The noise of bipolar electrogram (EGM) was systematically measured at 10 prespecified sites, as well as on a standard catheter and on the surface ECG. Bipolar EGM of CI regions were analyzed for amplitude, duration, and conduction velocity. The isthmus region to be targeted was chosen based solely on propagation. For each AT, 25 684±14 276 EGMs were automatically annotated. Noise of the Orion EGM was 0.011±0.004 mV, lower than that of a standard catheter (0.016±0.019) and surface ECG (0.02±0.01; $P<0.05$). For reentrant AT, within the CI, bipolar EGM amplitude (0.08±0.11 mV) and conduction velocity (0.27±0.19 m/s) were lower than those orthodromically before (0.62±0.93 mV; 1±0.49 m/s) and after (0.80±1.59 mV; 1±0.73 m/s) the isthmus ($P<0.001$ for all). In 97% of AT, ablation at the CI resulted in AT termination. No complications occurred.

Conclusions—This new automated ultrahigh resolution mapping system produces low noise and allows accurate diagnosis of AT circuits. CI on reentrant scar-related AT showed much lower EGM amplitude with a significantly slower conduction velocity than the surrounding parts of the circuit. Ablation of the areas of slow conduction resulted in a high acute success. (*Circ Arrhythm Electrophysiol*. 2017;10:e004510. DOI: 10.1161/CIRCEP.116.004510.)

Key Words: atrial tachycardia ■ atrial fibrillation ■ critical isthmus ■ iatrogenic ■ mapping

Merci