Debatní sekce: Otázky kolem katetrizační ablace v různých indikacích

Predsieňové tachykardie po ablácii fibrilácie predsiení: ako ďalej ?

Peter Hlivák

OAKS NÚSCH a LF SZU,

Bratislava,

XVI. české a slovenské sympózium o arytmiách a kardiostimulácii, Ostrava, 11-13.11.2018

Vital Signs™ 226 166 05

08.11.2018 11:18:36

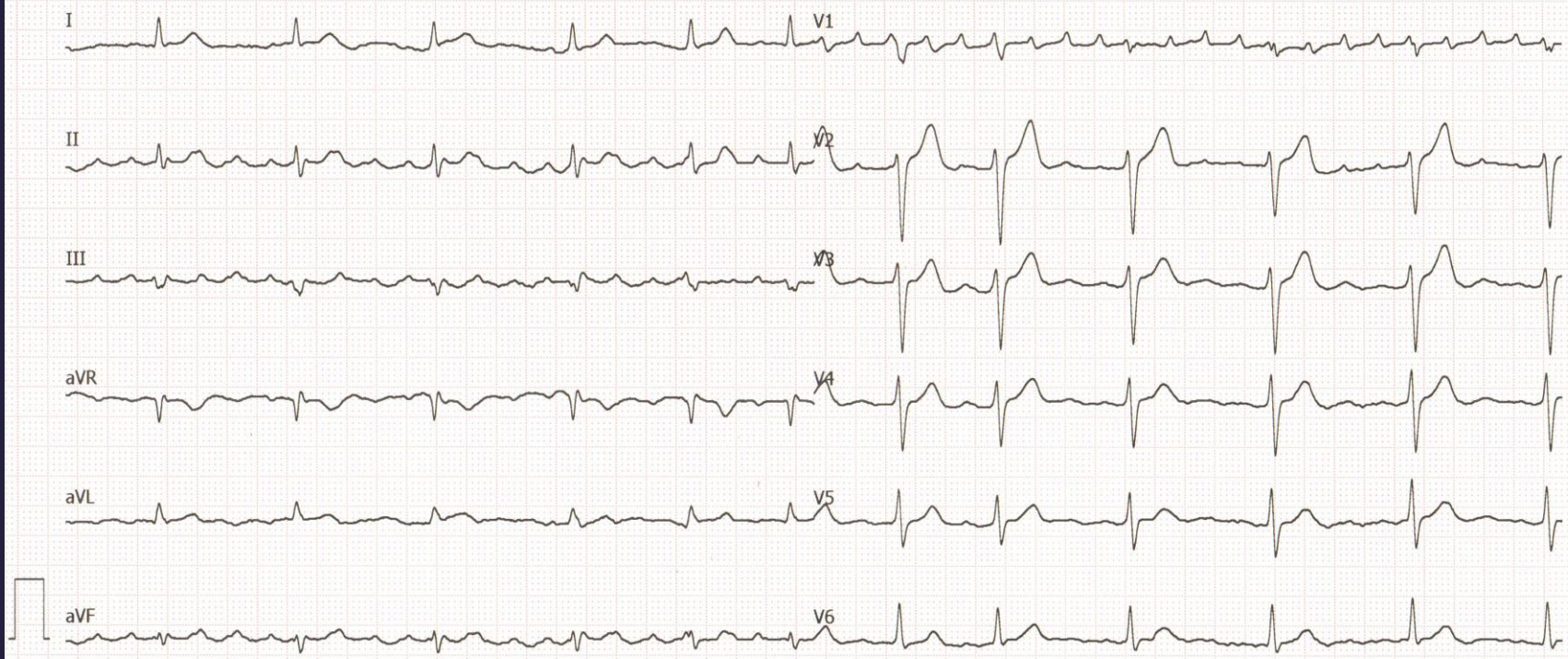
Lokalita:
Miestnosť:
Č. objednávky:
Indikácia:
Liek 1:
Liek 2:
Liek 3:

71 /min
-- / -- mmHg

115/80

QRS :	102 ms
QT / QTcBaz :	380 / 412 ms
PR :	- ms
P :	74 ms
RR / PP :	842 / 234 ms
P / QRS / T :	95 / -4 / 14 stupne

Technik:
Objed. lekár:
Odosiel. lekár:
Ošetr. lekár:



Nepotvrdené

GE MAC2000 1.1 12SL™ v241 25 mm/s 10 mm/mV ADS 0.56-20 Hz 50 Hz 2x5x6_25 1/1

Atrial tachycardias after AF ablation

- *"common enough" + very symptomatic* → all operators performing AF ablation should be skilled in mapping and ablating
- incidence depending on various factors
  - **predominant type of AF** before index procedure
  - **ablation strategy** of the 1st procedure:
    - 2.6% (PVI alone) – 31% (linear lesions)
    - less after cryobaloon

Gerstenfeld EP, et al. Circulation 2004;110(11):1351–1357.
Chugh A, et al. J Am Coll Cardiol 2005;46(1):83–91.
Chugh A, et al. Heart Rhythm 2005;2(5):464–471.
Deisenhofer I, et al. Europace 2006;8(8):573–582.
Kuck KH, et al. N Engl J Med 2016;374(23):2235–2245.

Clinical considerations (of ATs post AF ablation)

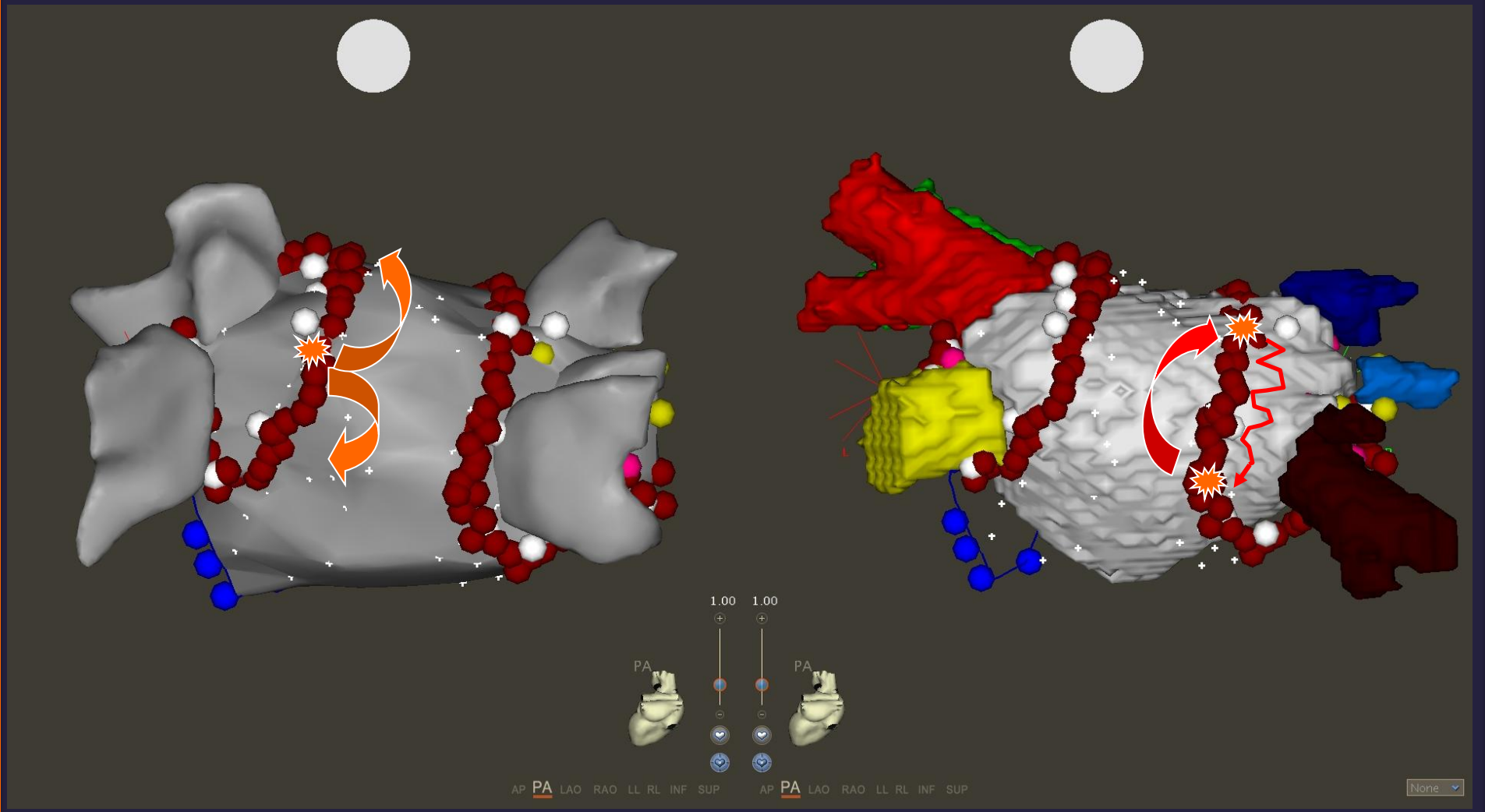
- **Eearly onset after** the index **procedure**
  - inducibility immediately after PVI (16,3%) or more extensive ablation (38%)[1]
  - > 80% ATs during first 2-4 weeks after AF ablation[2,3]
- **Multiple different arrhythmias** in the same patient
- Most commonly **persistent** (78 – 92%)[4]
- Frequent and important **symptoms refractory** to management with rate-controlling drugs (more symptomatic then original AF)
- **Limited** effect of **antiarrhythmic drugs**
- **High recurrence** rate **after cardioversion**
- Often **requirement** of at least one **subsequent ablation** procedure

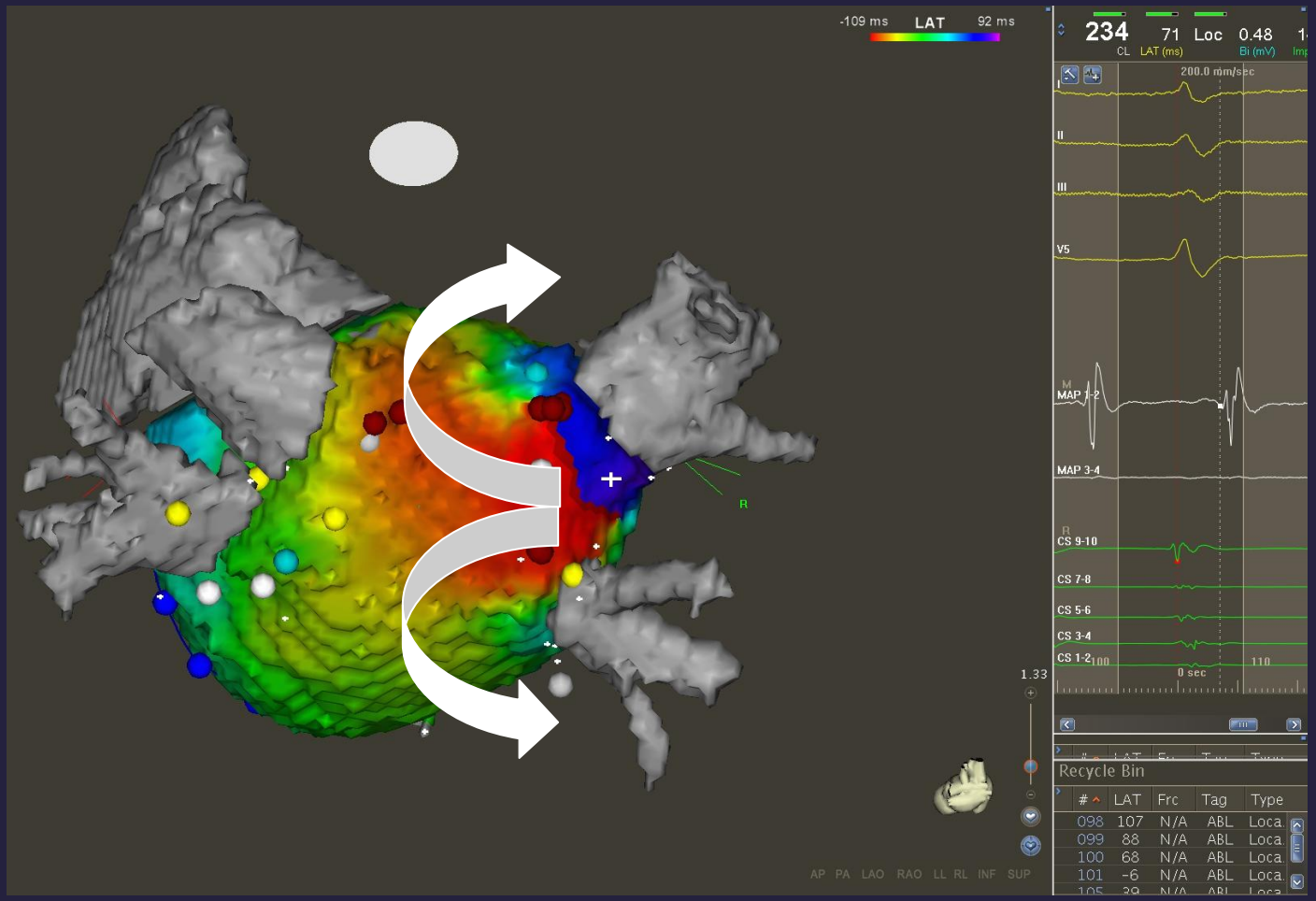
1.Daoud EG et al. *Journal of Cardiovascular Electrophysiology*, vol. 17, pp. 157–165, 2006.
2. Themistoclakis S et al. Heart Rhythm, vol. 5, no. 5, pp. 679–685, 2008.
3. Ouyang F et al. Circulation, vol. 111, pp. 127–135, 2005
4. Haissaguerre M et al. Journal of Cardiovascular Electrophysiology, vol. 16, pp. 1138–1147, 2005.

Atrial tachycardias

1. focal
2. small circuit ("microreentry")
3. macroreentry

Mechanism of ATs – „gap related“

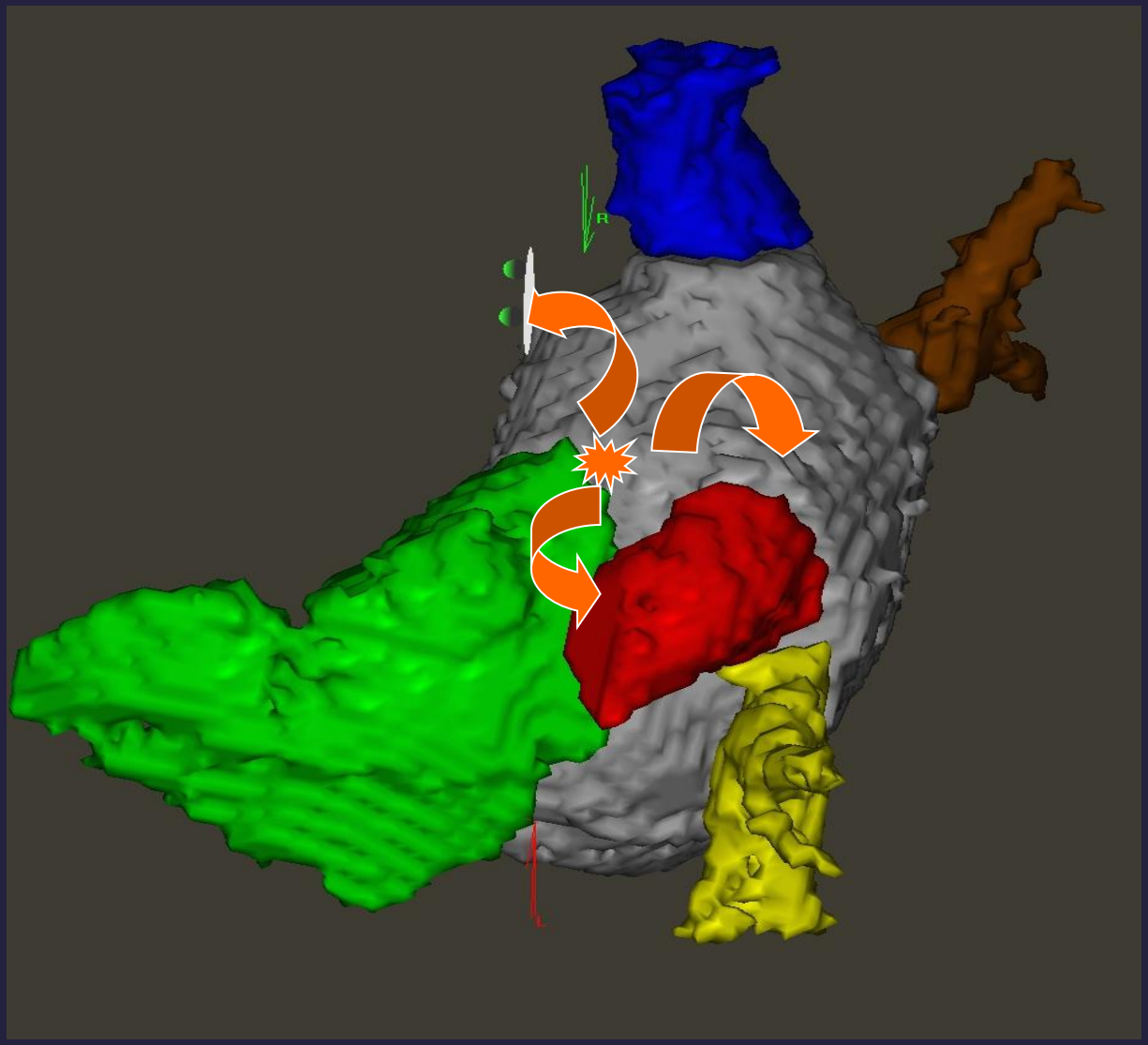



-109 ms
LAT
92 ms
234
CL
71
LAT (ms)
Loc
0.48
Bi (mV)
200.0 mm/sec
I
II
III
V5
MAP 1-2
MAP 3-4
CS 9-10
CS 7-8
CS 5-6
CS 3-4
CS 1-2
100
0 sec
110
1.33
Recycle Bin
LAT Frc Tag Type
098 107 N/A ABL Loca
099 88 N/A ABL Loca
100 68 N/A ABL Loca
101 -6 N/A ABL Loca
AP PA LAO RAO LL RL INF SUP

Macroreentrant AFL: gap related

Macroreentrant AFL: gap related

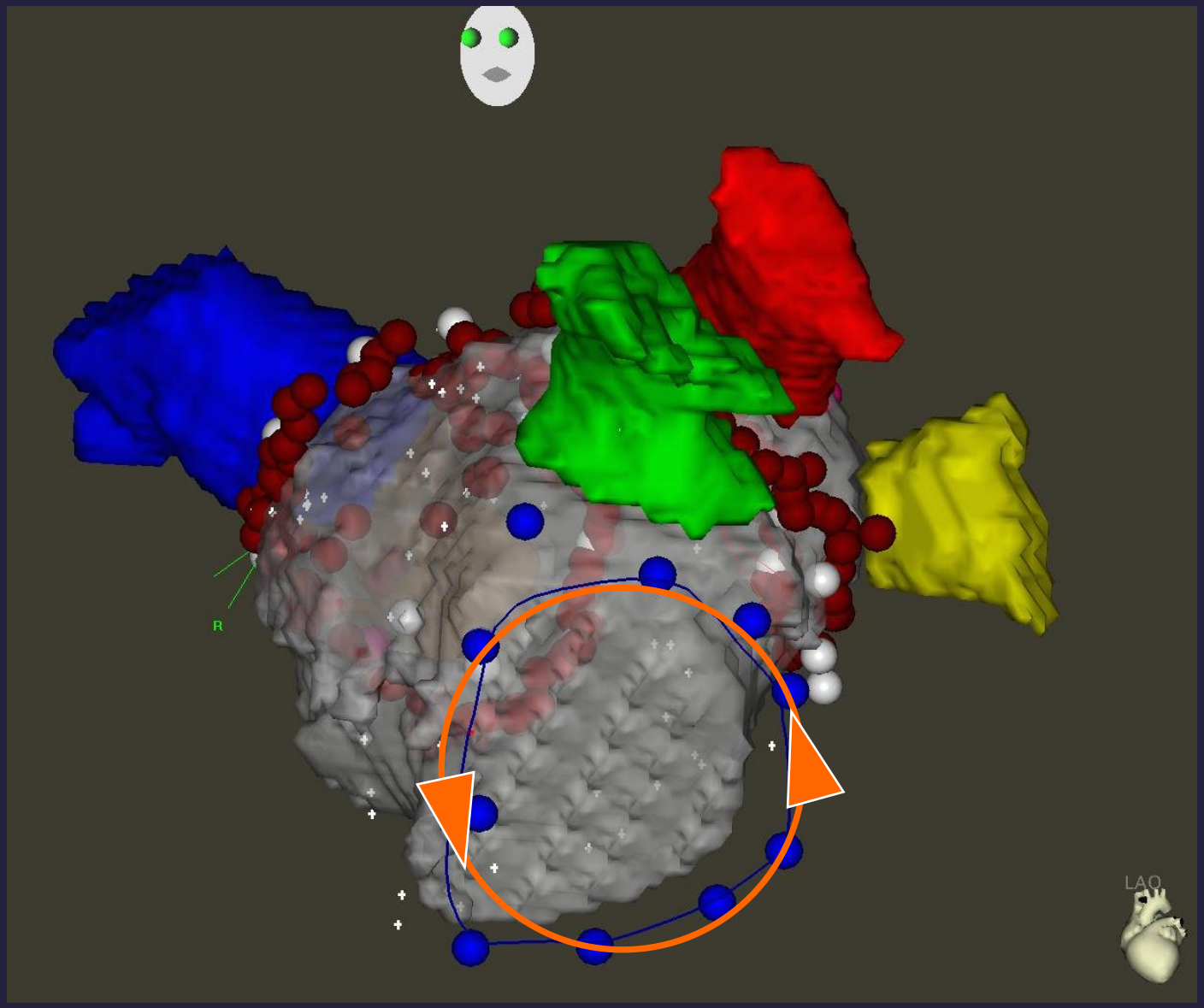
Mechanism of ATs – „non-gap related"



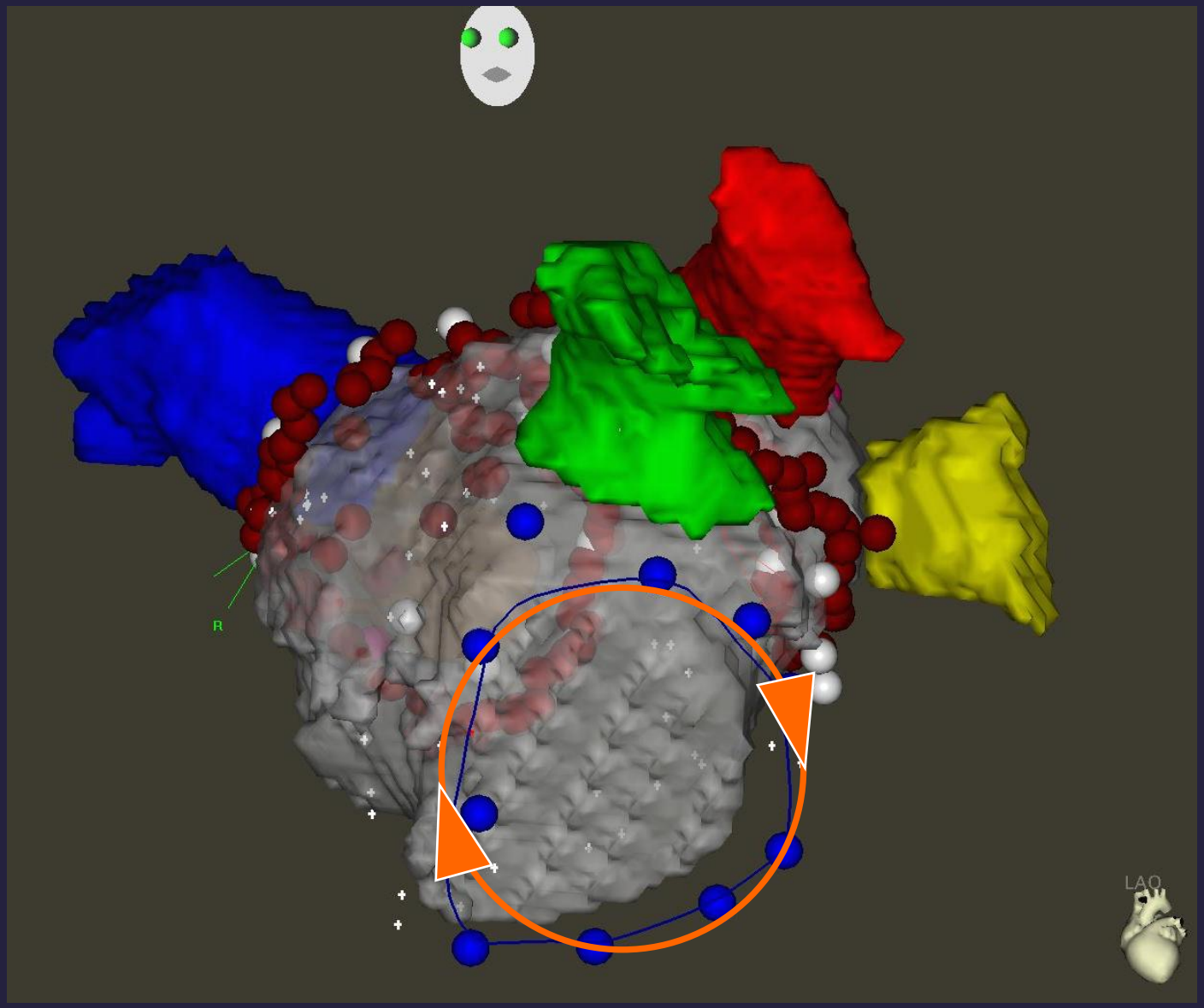
Macroreentry AT

- 2 sites ≥ 2 cm apart demonstrate entrainment with a PPI –tachycardia CL of 20 ms (i.e., within the circuit)
- **Typical AFL**
  - RA: CCW (common) and CW AFL (reverse common), lower-loop AFL, intraisthmus reentry
- **Atypical AFL**
  - prior atrial surgery or prior ablation for AF
  - RA: free wall reentry, upper-loop, crista terminalis, RA septum,
  - LA: type of circuit varies according to the nature of prior ablation and to the underlying structural heart disease
    - perimitral - or mitral isthmus-dependent or roof-dependent circuits
    - around regions of scar, double loop reentry

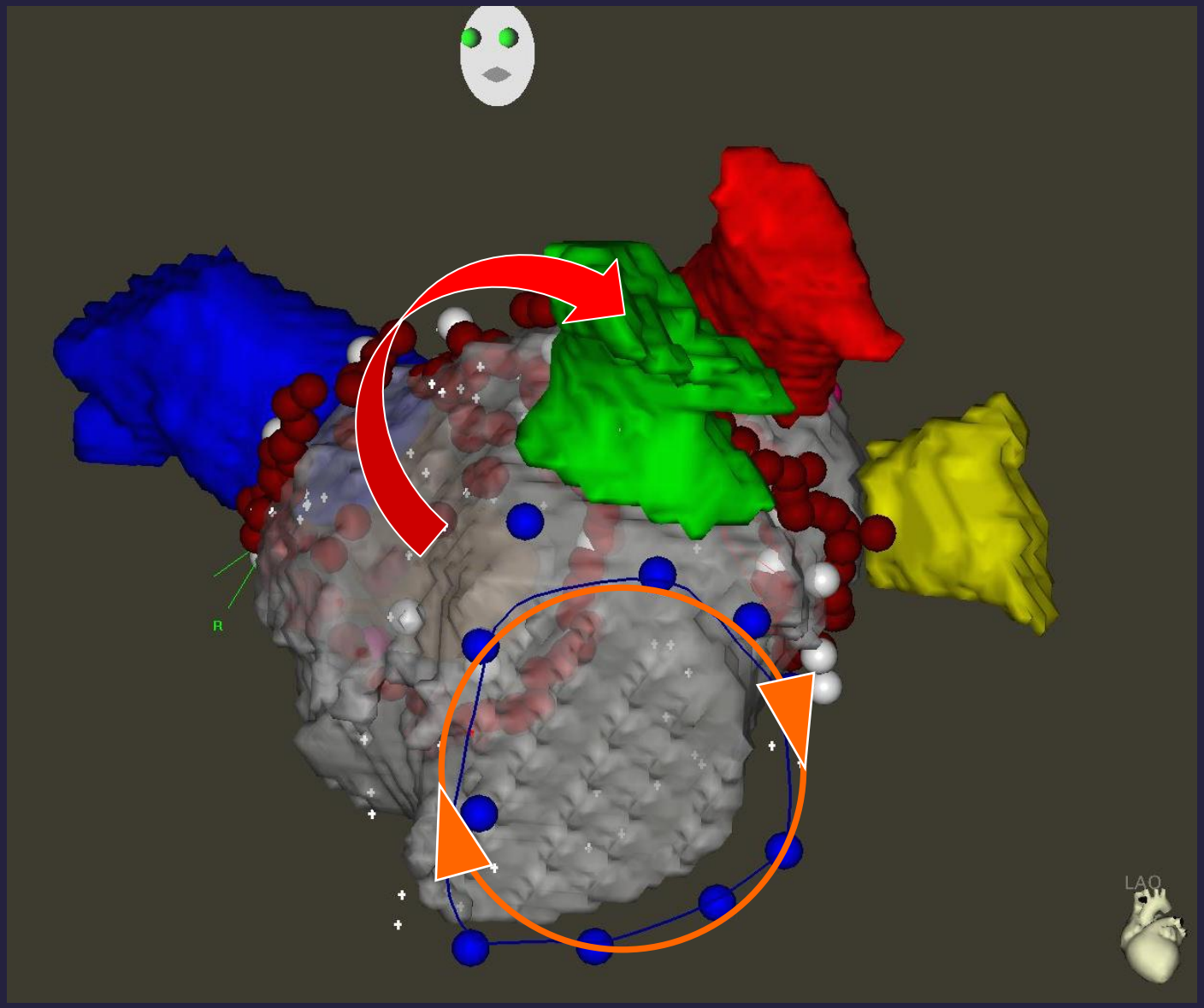
Atrial flutters after AF ablation



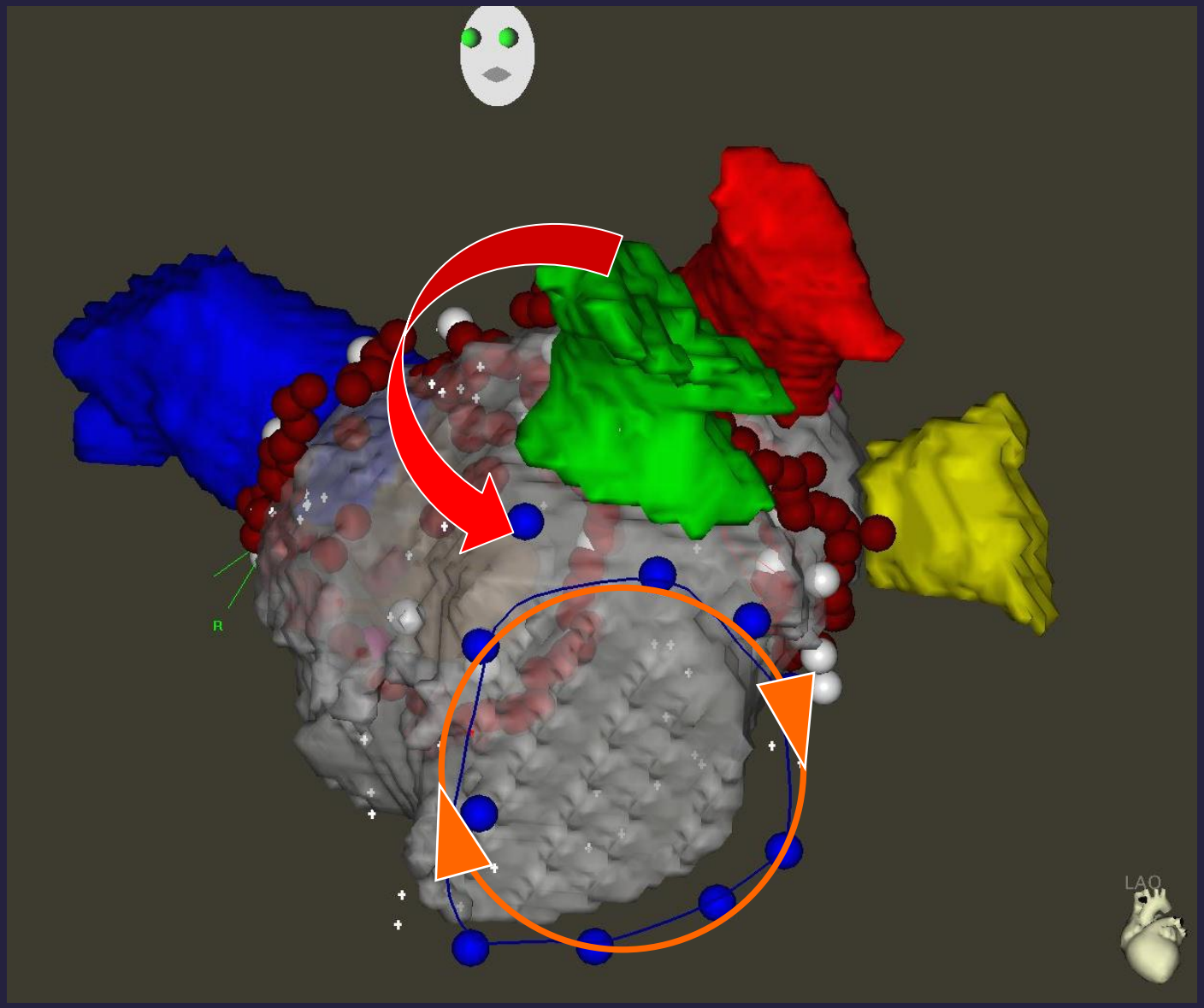
Atrial flutters after AF ablation



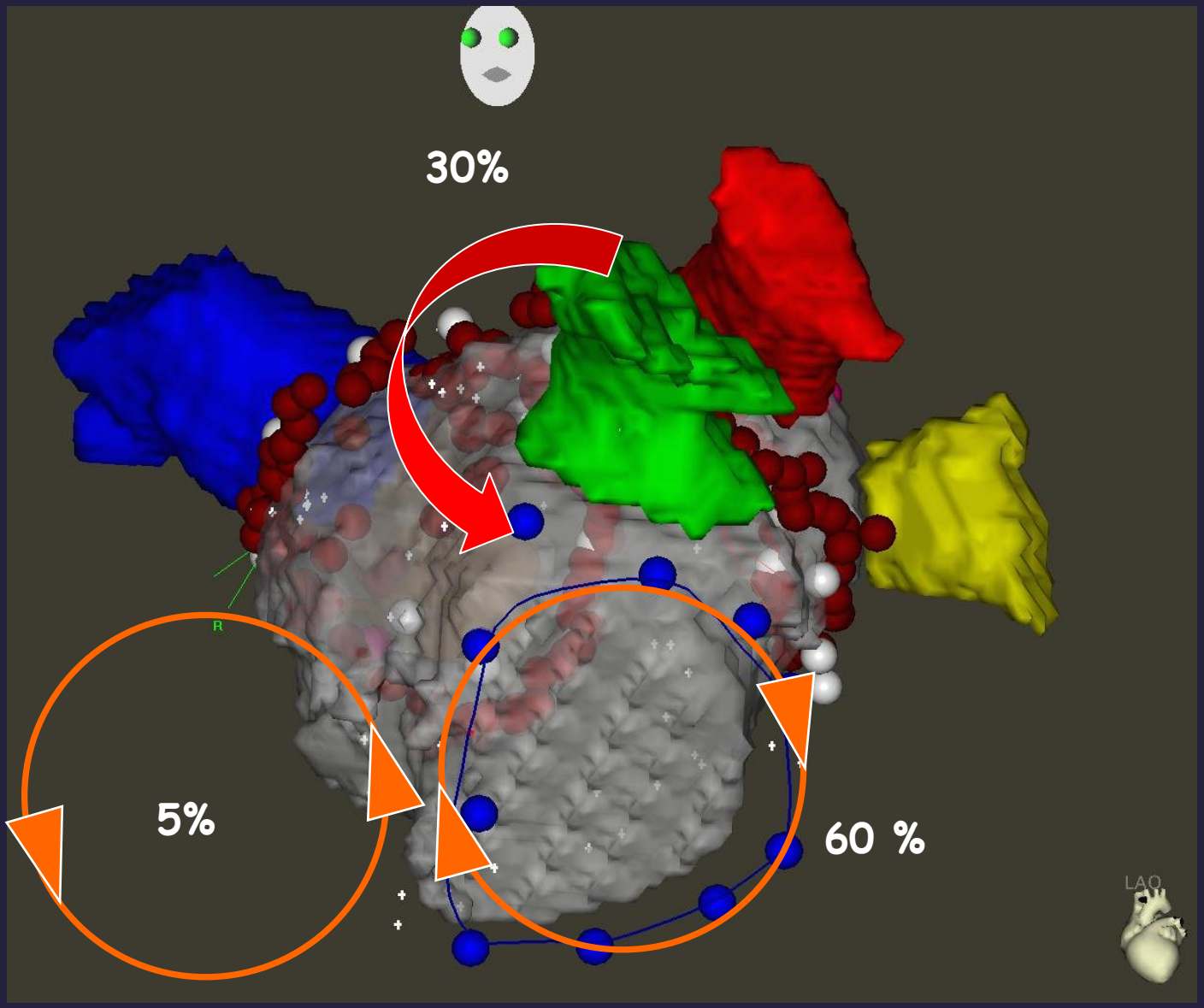
Atrial flutters after AF ablation



Atrial flutters after AF ablation



Atrial flutters after AF ablation



Veenhuyzen GD et al. PACE 2009; 32

Determining the location of the reentry circuit: role of the 12-lead ECG

- more extensive scarring (more extensive LA ablation or spontaneous → more limited interpretation of the 12- lead ECG
- clear isoelectric line in all 12 leads → focal AT ("trully focal" or microreentry)
- Typical CTI -dependent AFL frequently atypical appearance after prior LA ablation

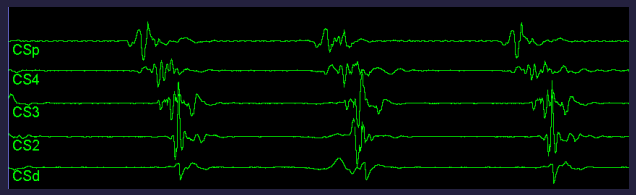
12-lead ECG: general rules

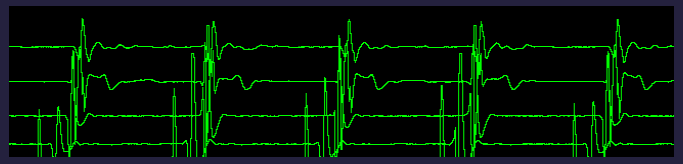
- Tachycardias arising near the PV ostia → inferior axis and positive F waves across the precordial leads
- "m"-shaped F-wave in lead V1 → left PV exit
- Right PV tachycardias → amplitude in lead II > III and a positive F wave in lead I
- Mitral annular flutter
  - similar appearance to left PV tachycardias
  - initial negative component in the precordial leads or amplitude in lead V2 less than that in V1 and V3 might be suggestive

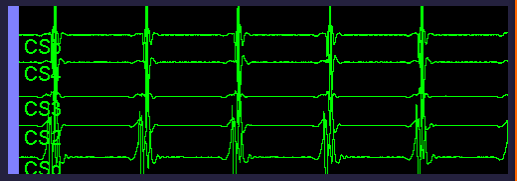
AT from RSPV

Flutter waves amplitude in lead II > III and a positive F wave in lead I

Initial step: check the CS activation





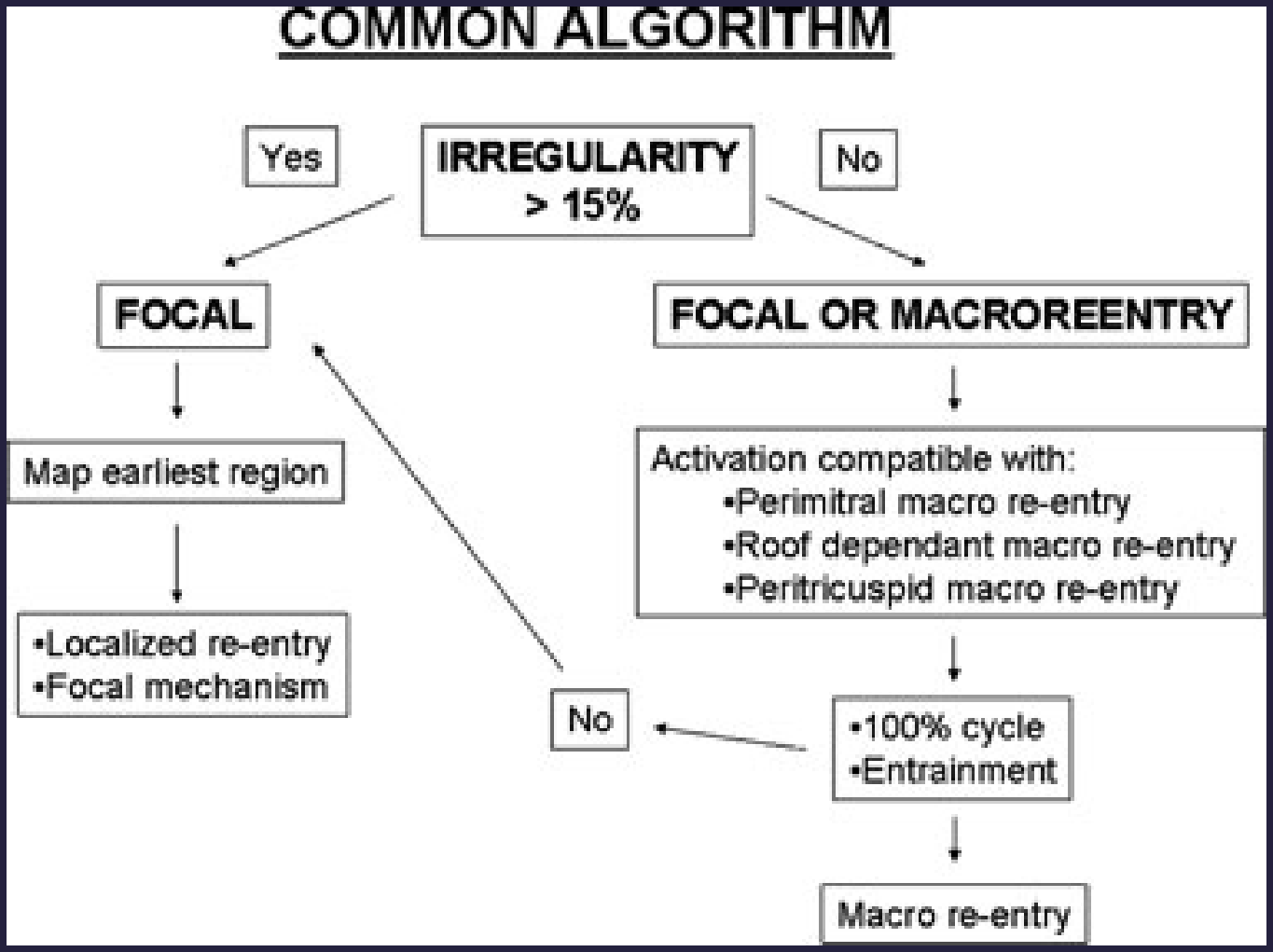


- CTI-dependent flutter
- right PV tachycardia
- counterclockwise mitral annular flutter

- Left PV tachycardia
- clock- wise mitral flutter

- roof-dependent flutter

Mappping of ATs after AF ablation



Knecht S et al. PACE 2009; 32:528-538

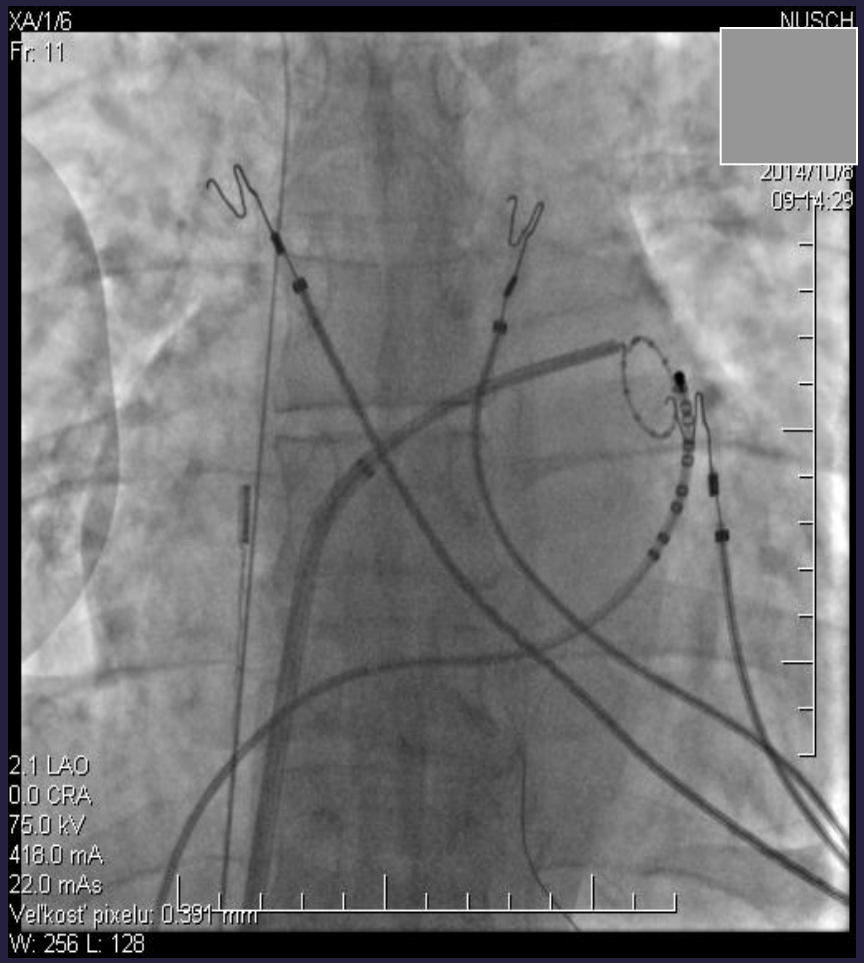
Practical approach to treat ATs post Afib ablation

- **To know the substrate and previous ablation strategy**
  - PVI alone
  - PVI + lines
  - PVI + CFAEs…
- Check the PVs → **PVI is the must !** (both triggers and critical isthmus)
- Check the lines → **checking for bidirectional conduction block is the must!** (gaps, zone of slow conduction…)

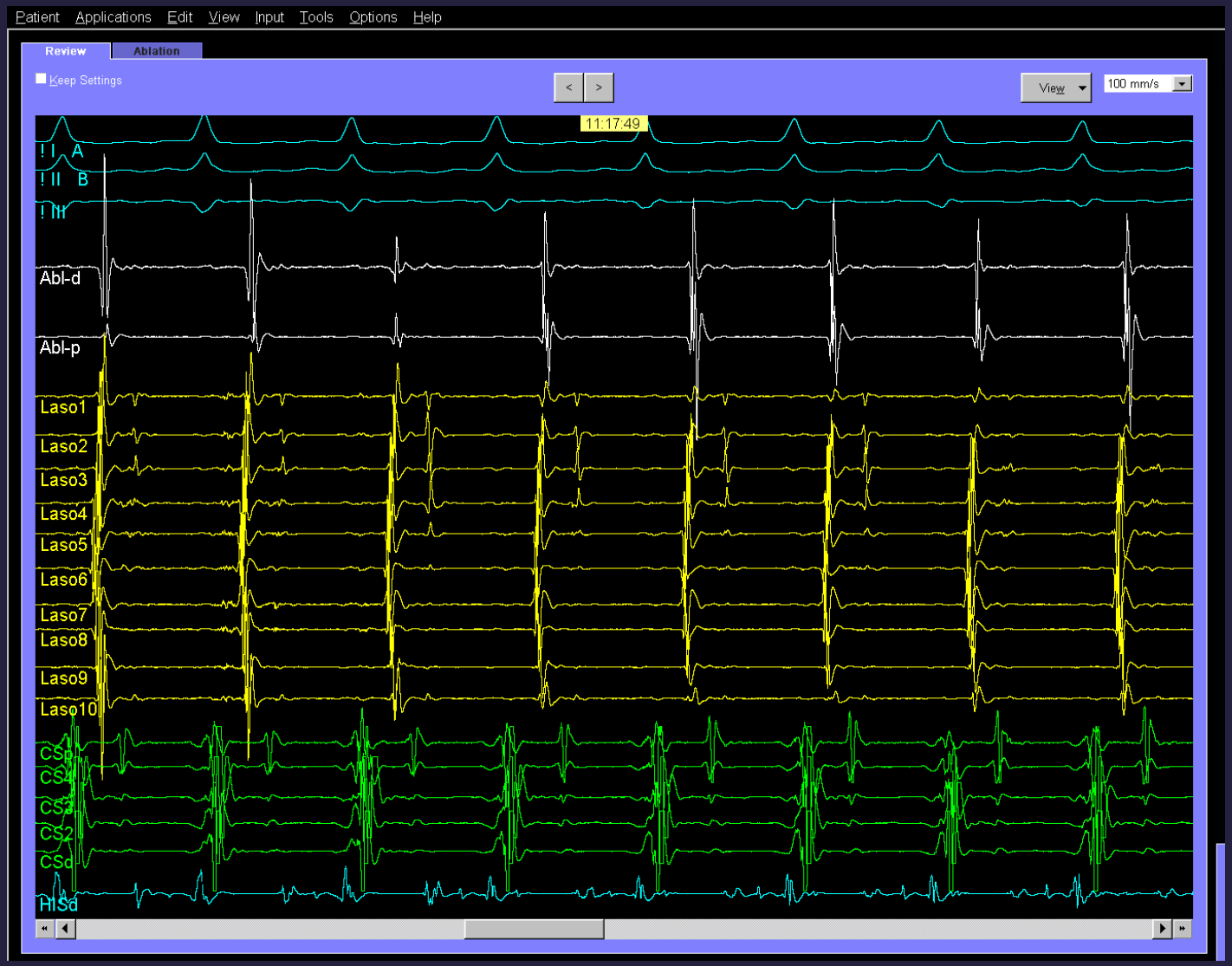
EKG


Patient Applications Edit View Input Tools Options Help
Review
Ablation
Keep Settings
View
25 mm/s
11:24:16
I A
II B
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6

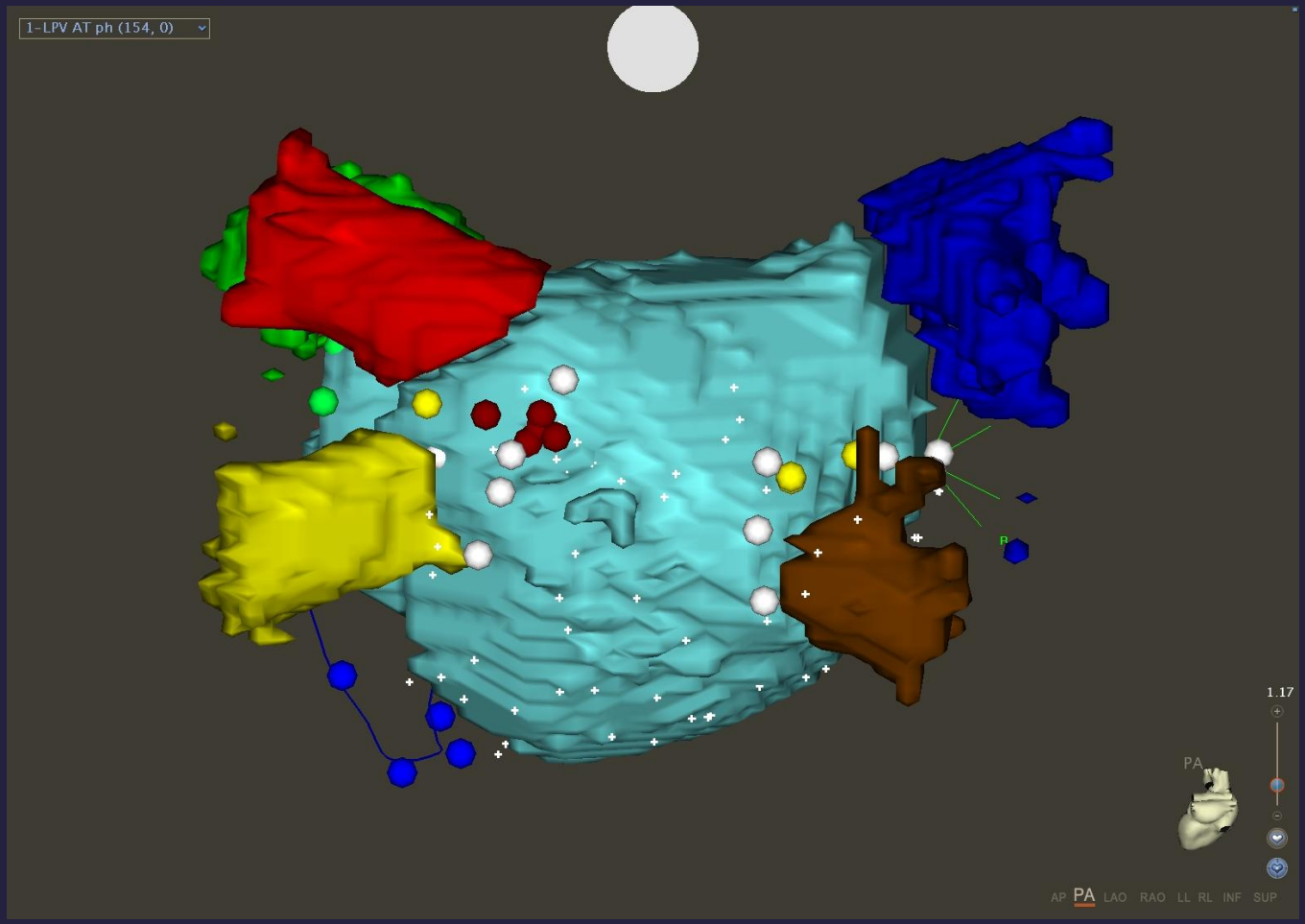
Laso v LIPV a LSPV



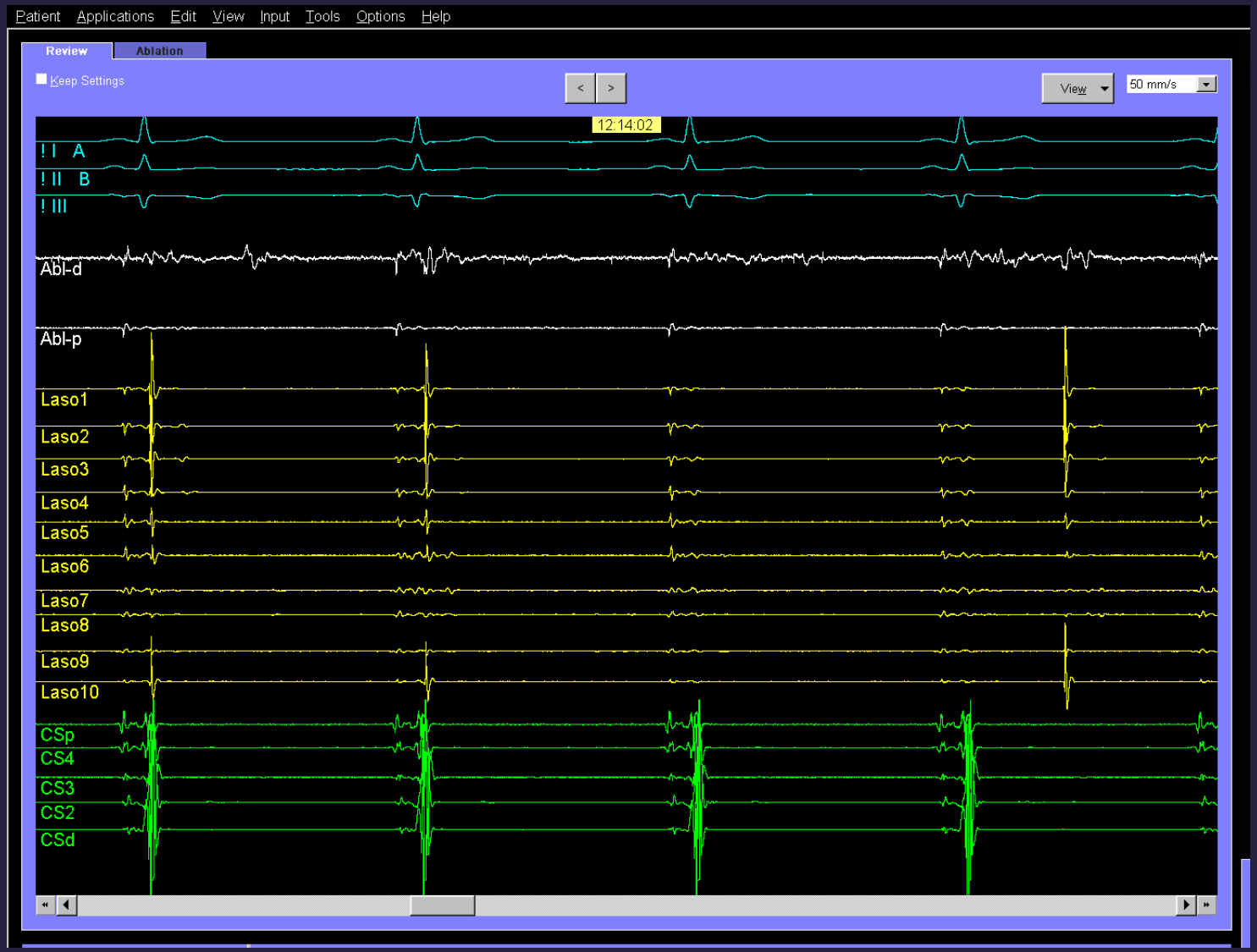
Laso v LIPV


Patient Applications Edit View Input Tools Options Help
Review
Ablation
Keep Settings
View
100 mm/s
11:17:49
I A
II B
III
Abl-d
Abl-p
Laso1
Laso2
Laso3
Laso4
Laso5
Laso6
Laso7
Laso8
Laso9
Laso10
CS1
CS2
CS3
CS4
CS5
HISd

3D mapa L'P



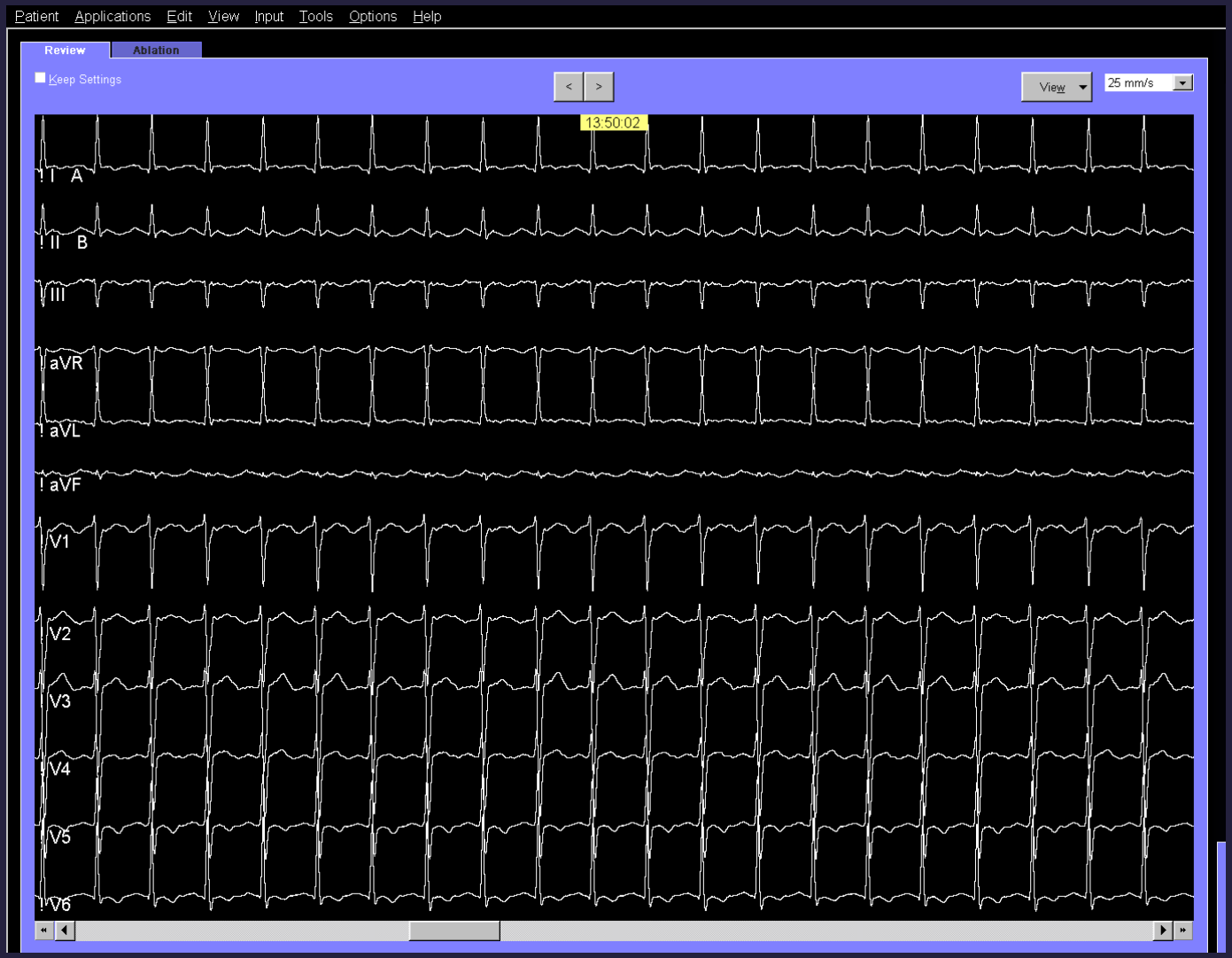
LPV isolation



AT from LSPV


Review 1: Page 5
50
I
II
III
V1
ABL d
ABL p
Ls 1,2
Ls 2,3
Ls 3,4
Ls 4,5
Ls 5,6
Ls 6,7
Ls 7,8
Ls 8,9
Ls 9,10
CS 9,10
CS 7,8
CS 5,6
CS 3,4
CS 1,2
13:30:58
13:30:59
13:31:00
13:31:01
13:31:02

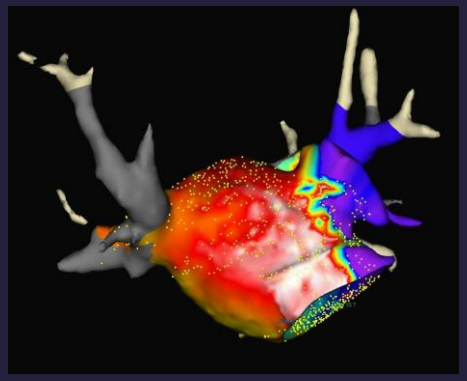
EKG


Patient Applications Edit View Input Tools Options Help
Review
Ablation
Keep Settings
View
25 mm/s
13:50:02
I A
II B
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6

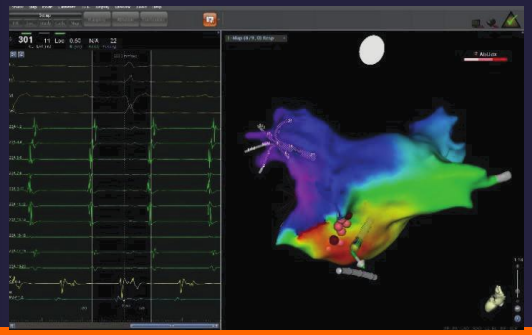
Mapping of ATs

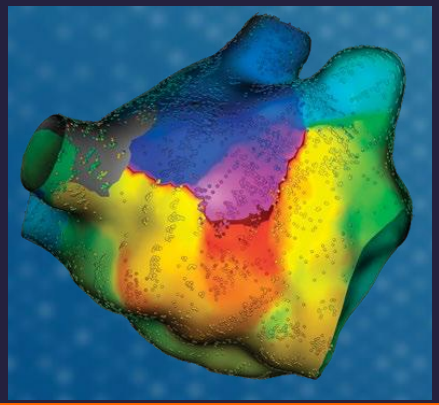
- Activation mapping
- Entrainment mapping

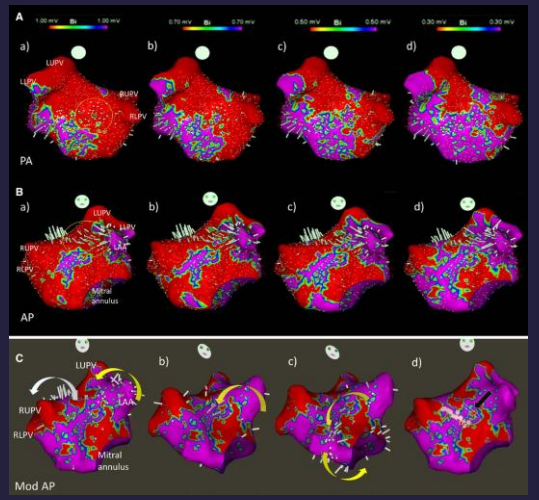
Activation mapping



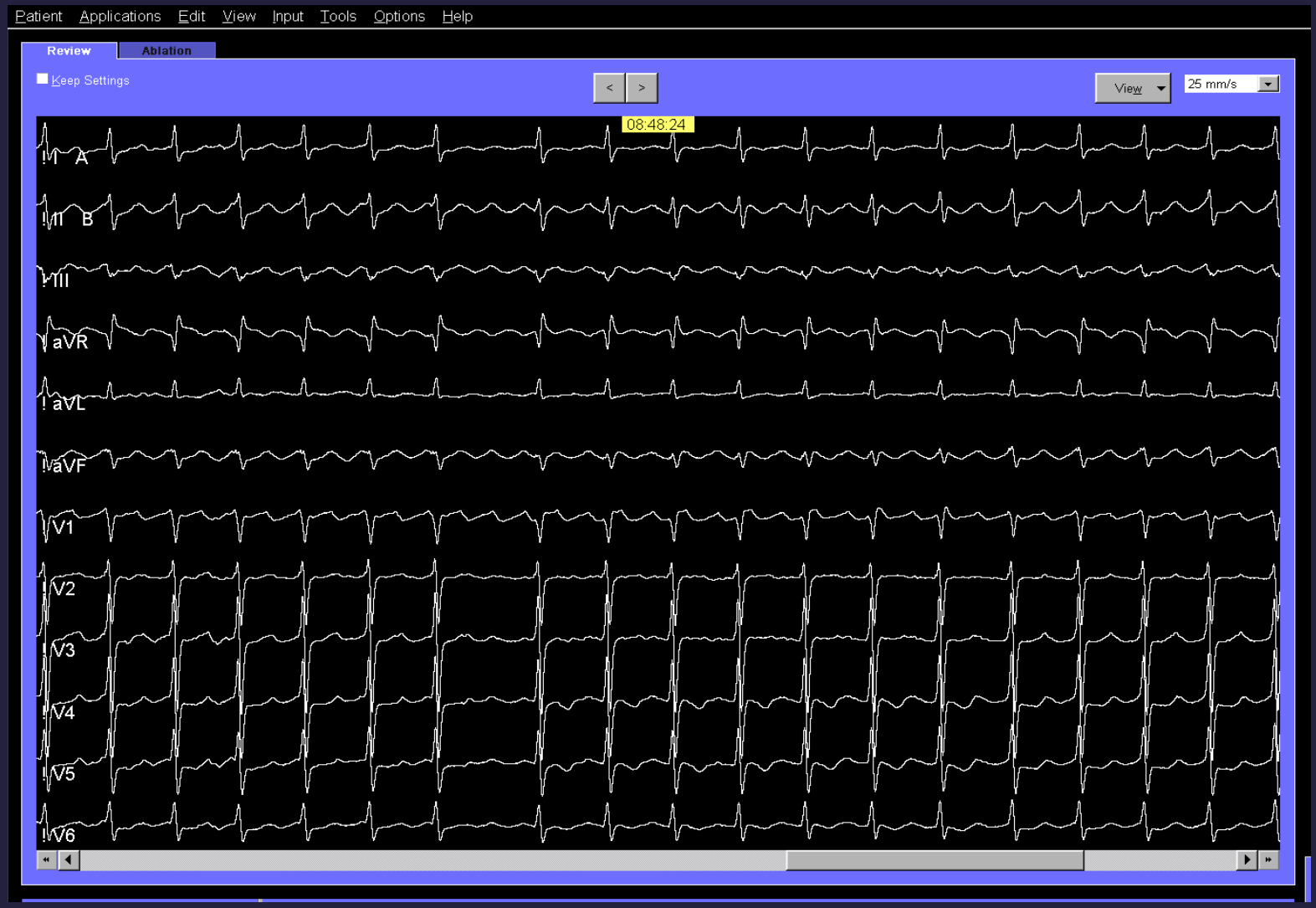
- conventional: sequentially
  - annotation manualy or automated
- Multipoint mapping
- (Ultra) High-density and automated mapping systems (Rhythmia, Ripple mapping…)
  - true clinical value still unknown

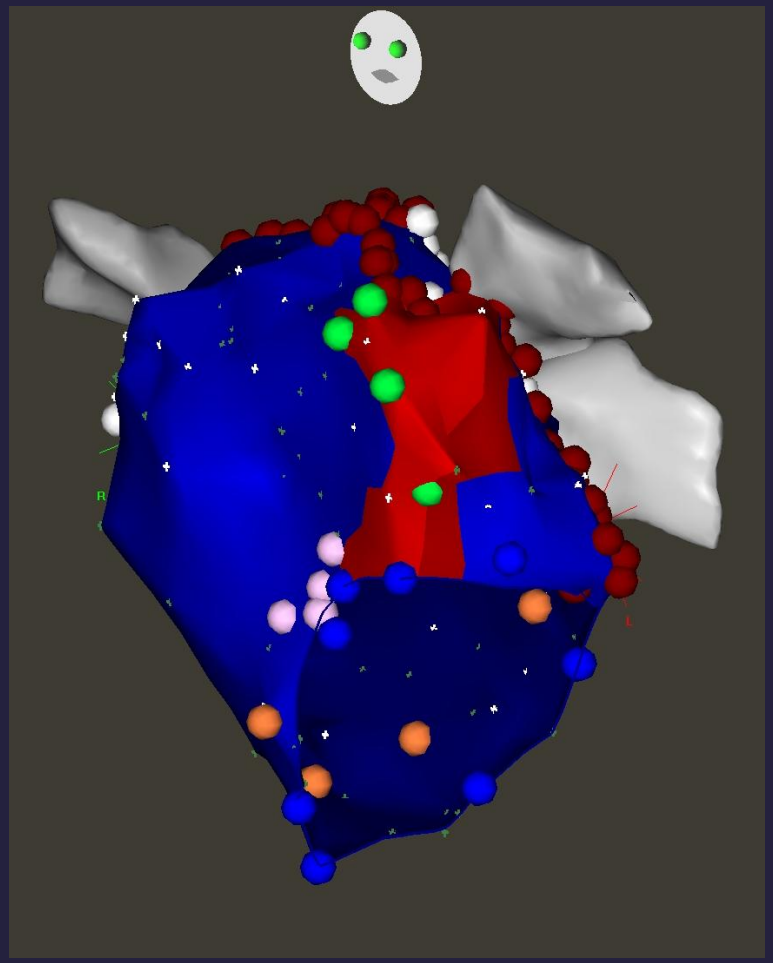


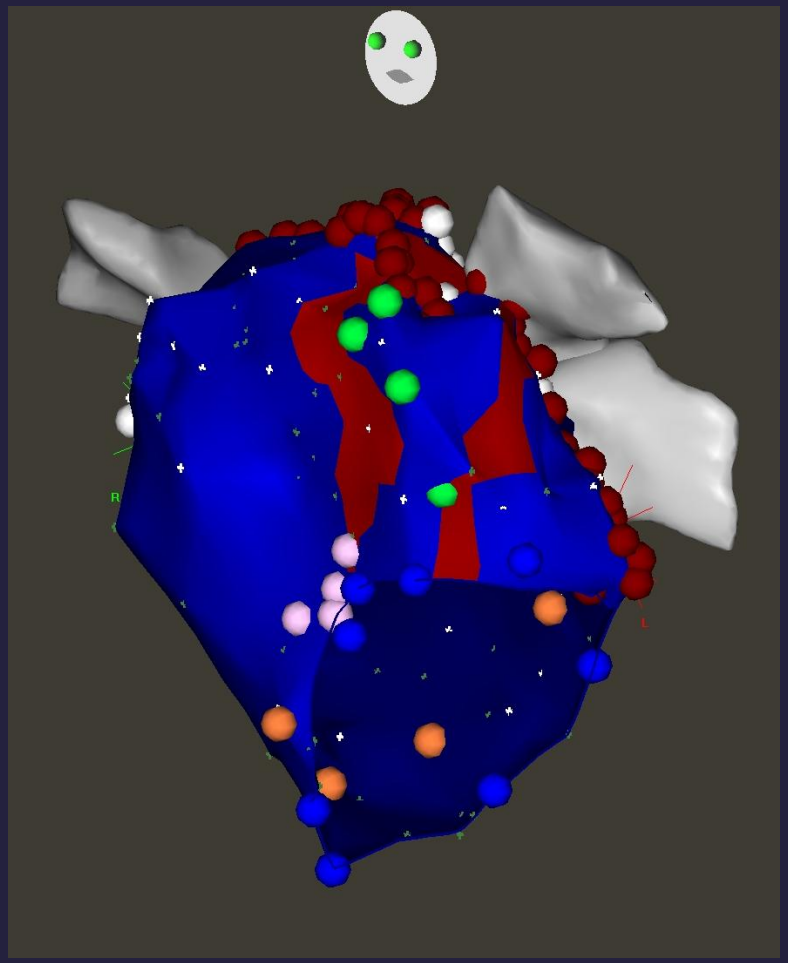


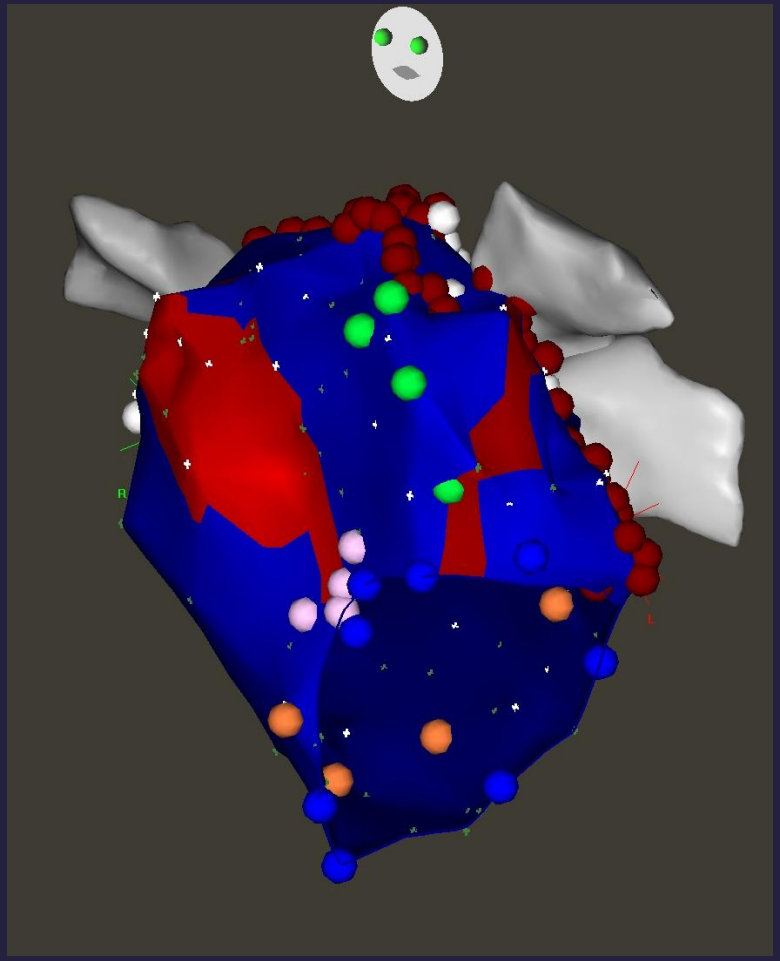


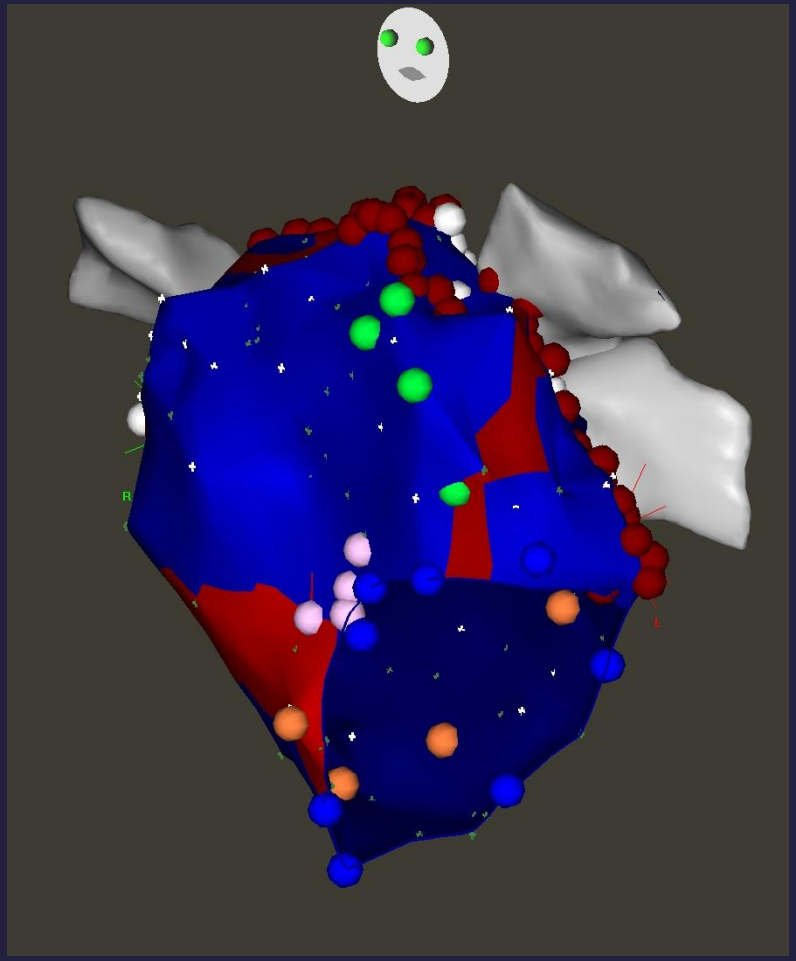
Perimitrálny AFL

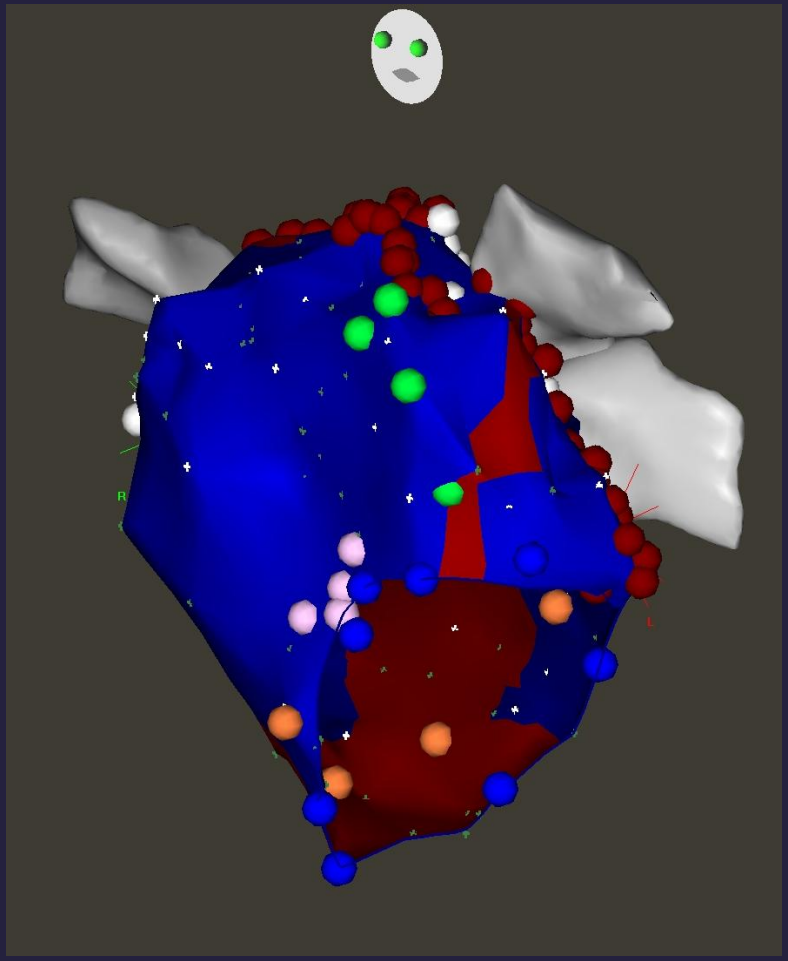


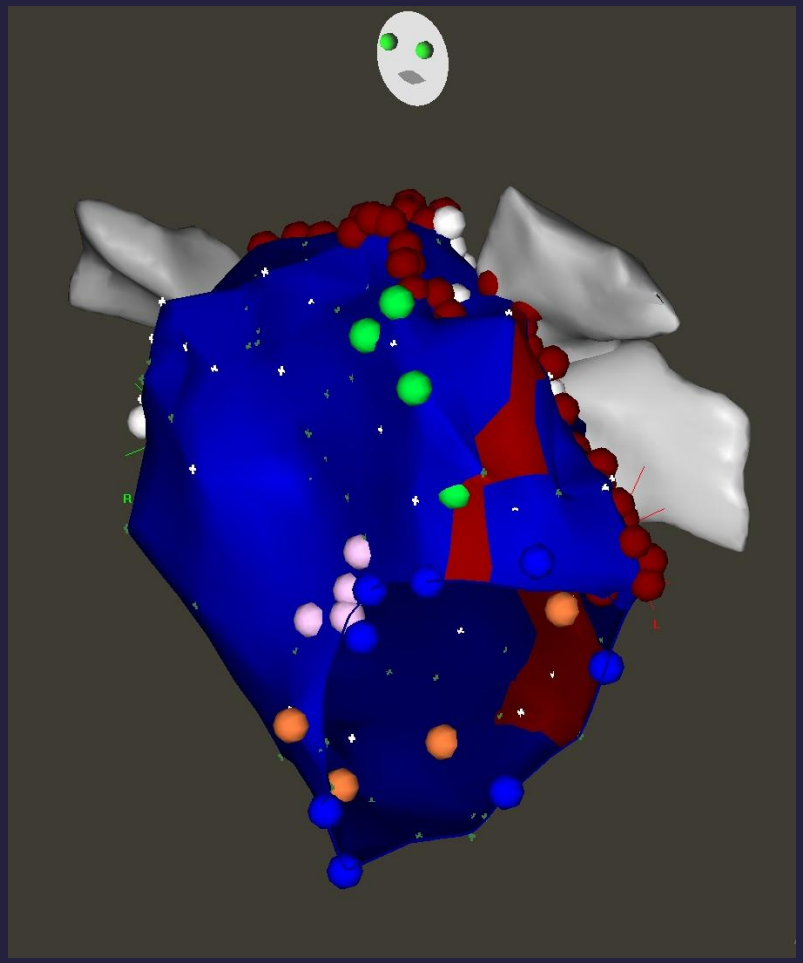


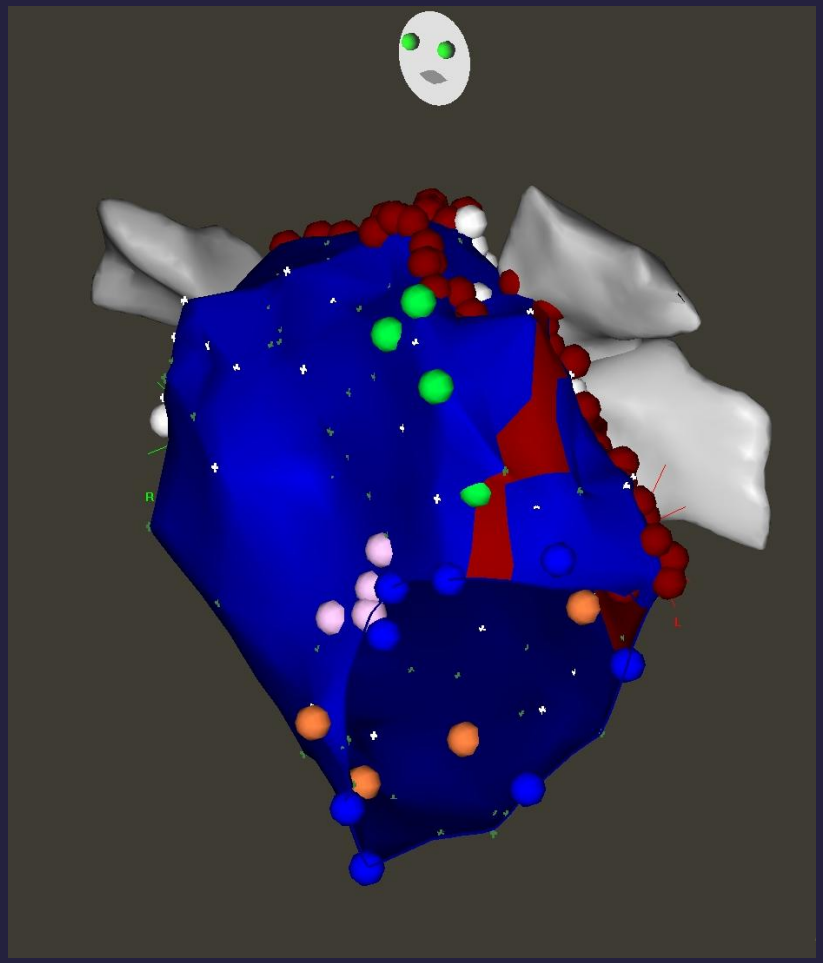


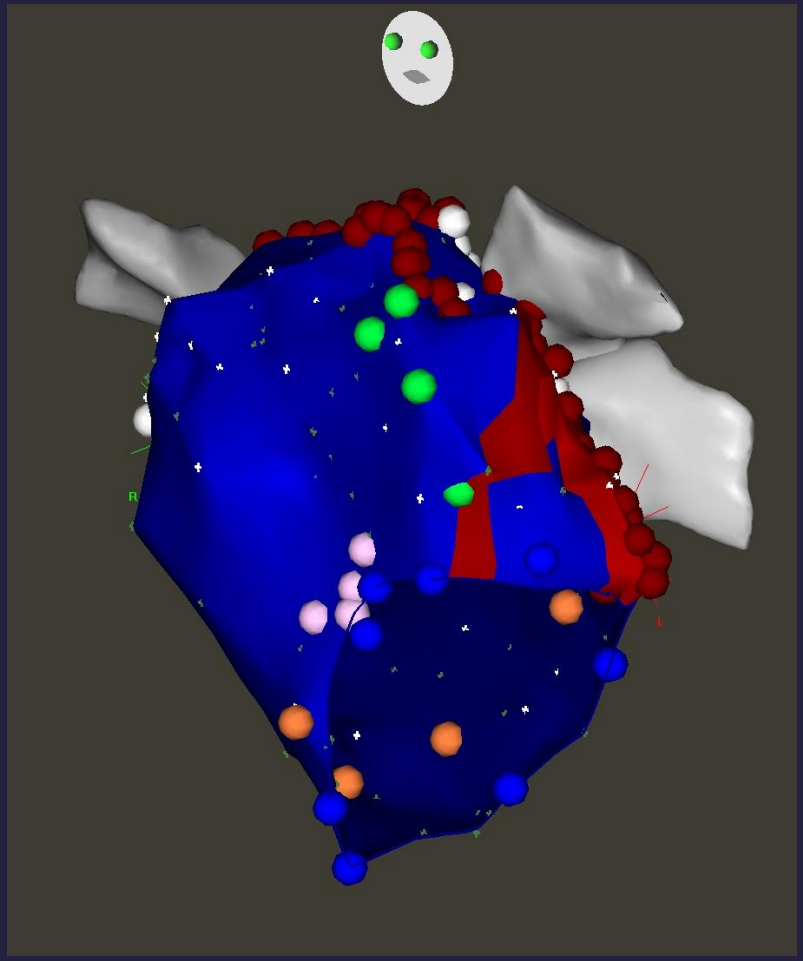


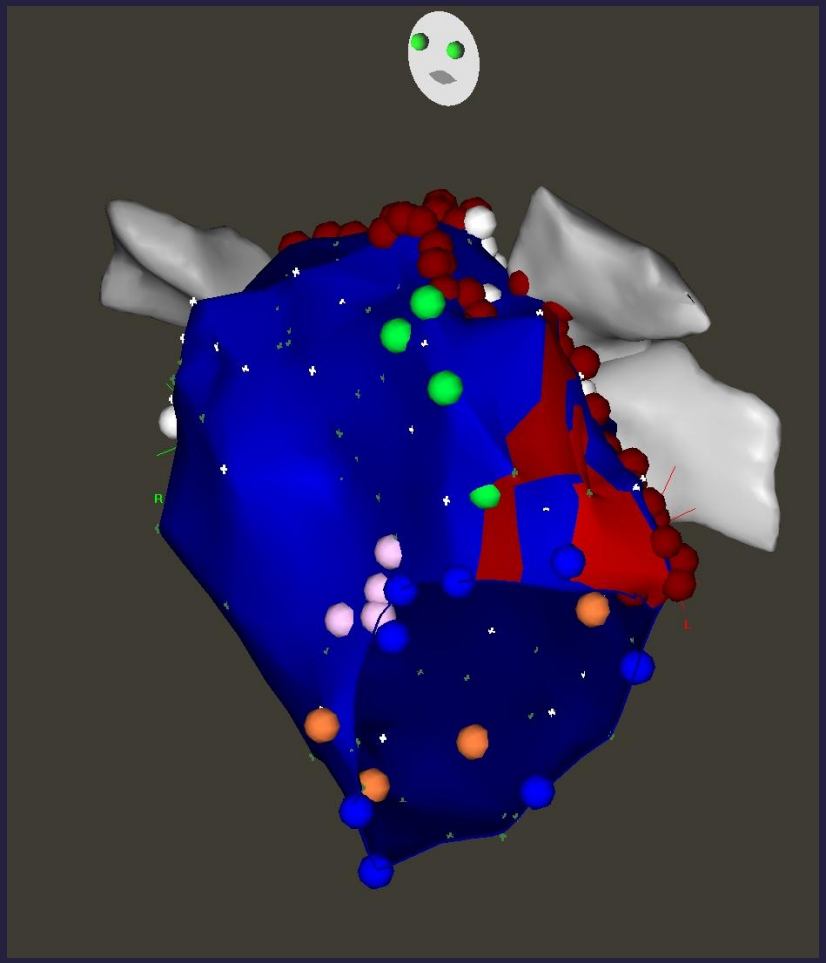


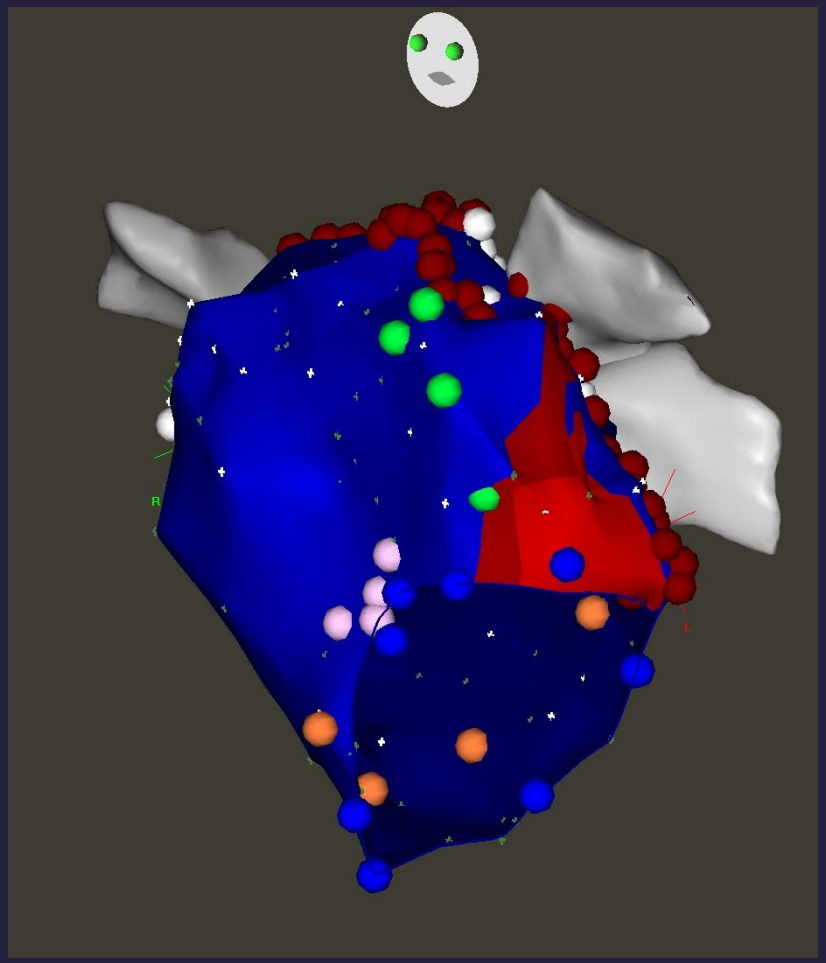












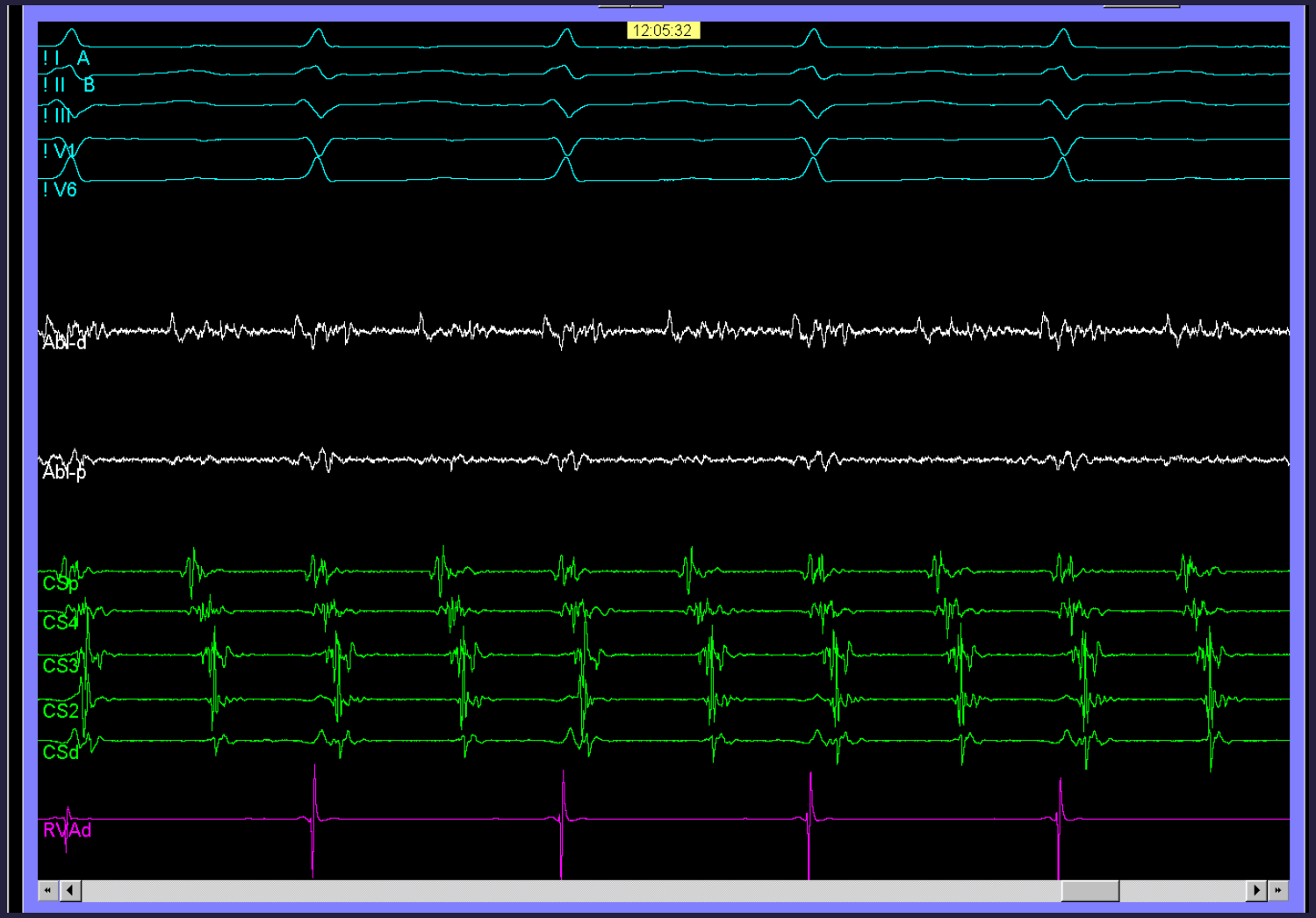
Entrainment mapping

- **stable reentrant circuit** → better and more accurate approach to localize
- **"gold standard"**→ more prefered for reentrant tachy
- fusion of the F wave difficult to interpret
- primary goal: identification of regions with a PPI within 20 ms of the tachycardia CL
- cave: pace at or near threshold !
- disadvantage: risk of termination or changing the tachycardia to different one or degeneration into Afib

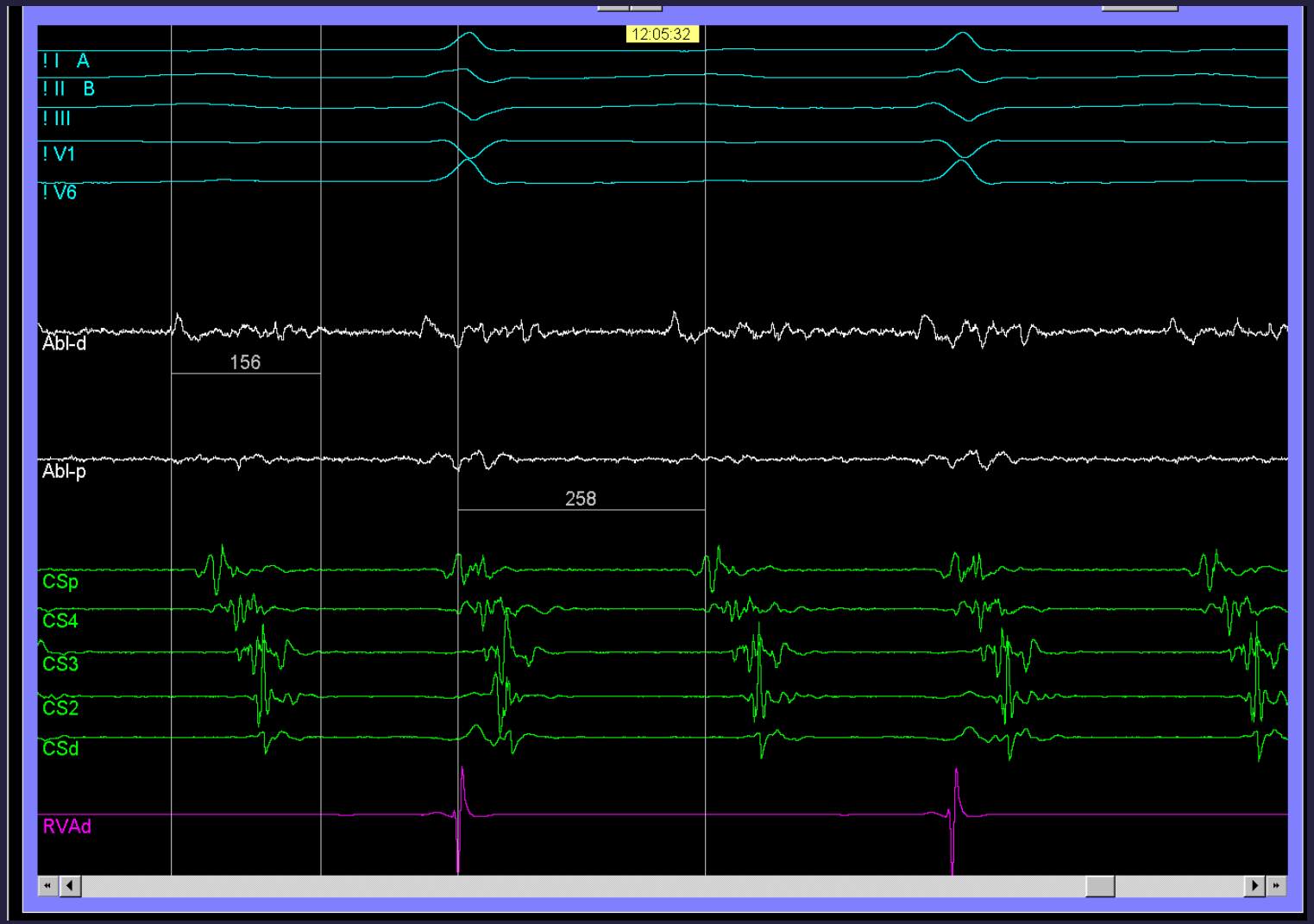
Ablation strategy

- **PV tachycardias**: usually 2 gaps in previous PVI line are present
- Macroreentrant tachy: ablation to connect anatomic obstacles
  - mitral annular flutter:
    - MA and LIPV (mitral isthmus)
    - anterior line (MA and LSPV or RSPV or roof line)
    - often epicardial ablation within the CS is required (ca in 80% of pts)
  - endpoint of linear ablation: proof of bidirectional block using pacing maneuvers rather than tachycardia termination
- After termination of the clinical tachycardia → always re-isolation of any reconnected PVs !

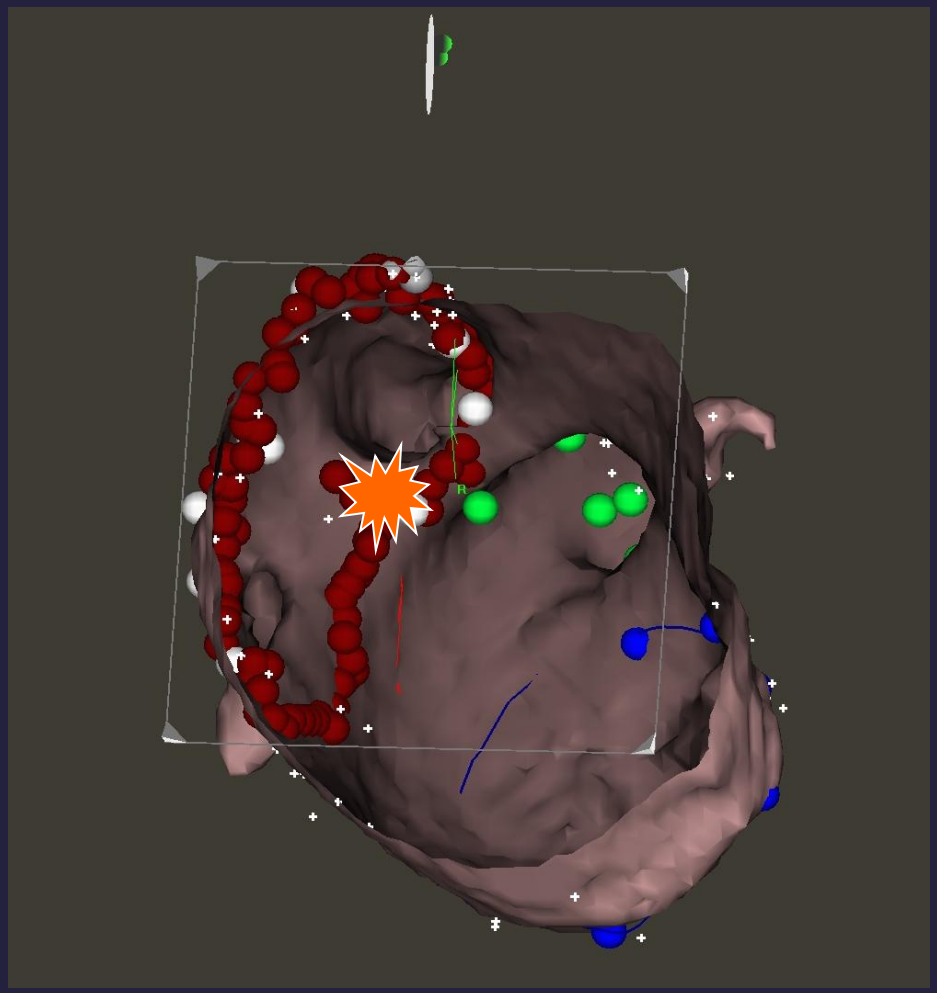
Earliest (fractionated) activity

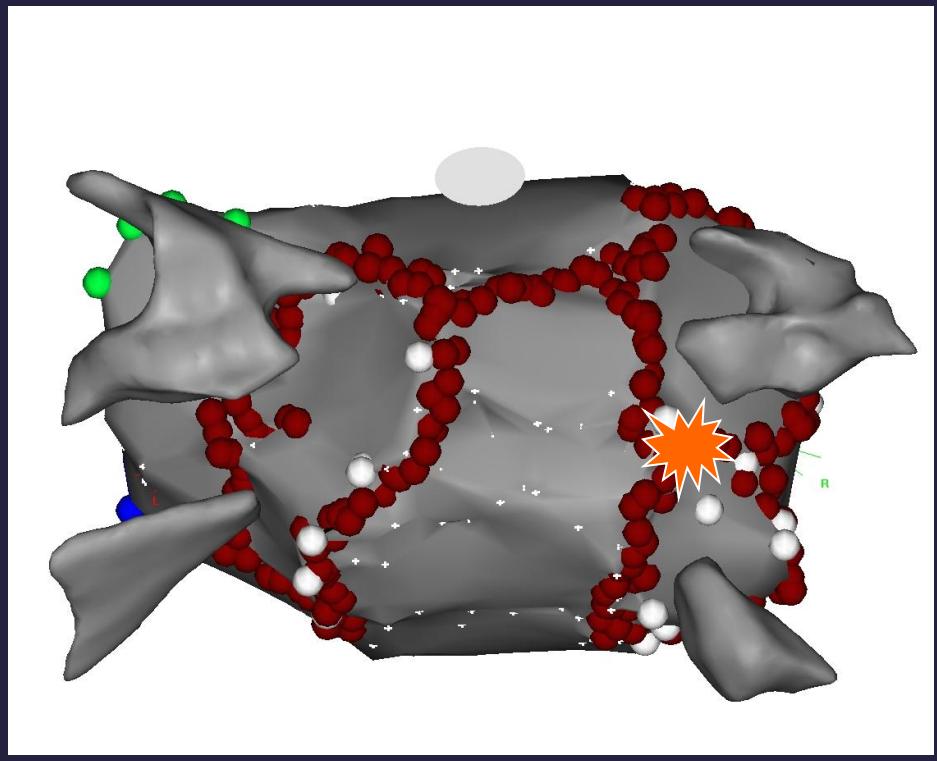


Earliest (fractionated) activity

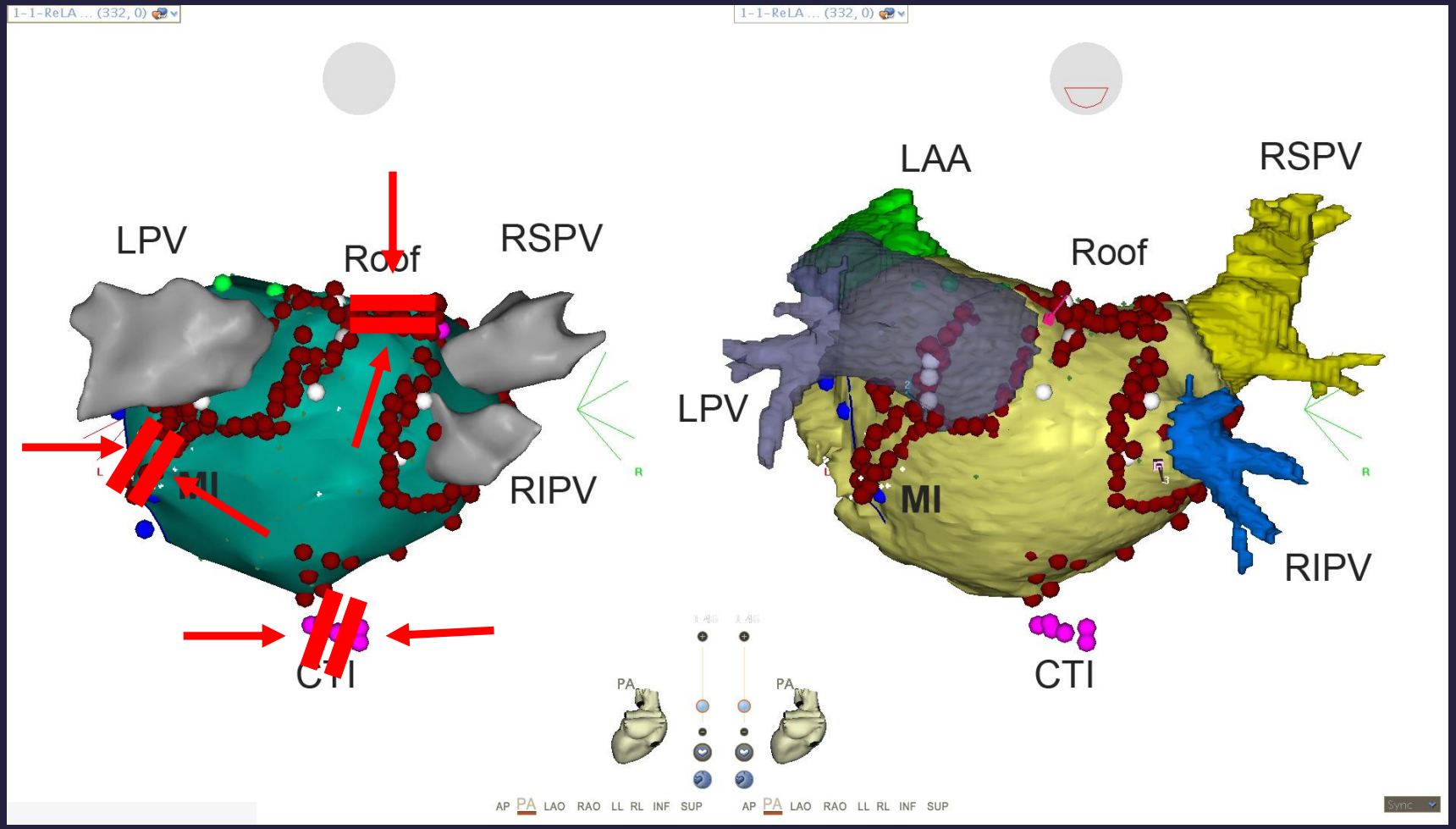


How to prevent post Afib AFL ?

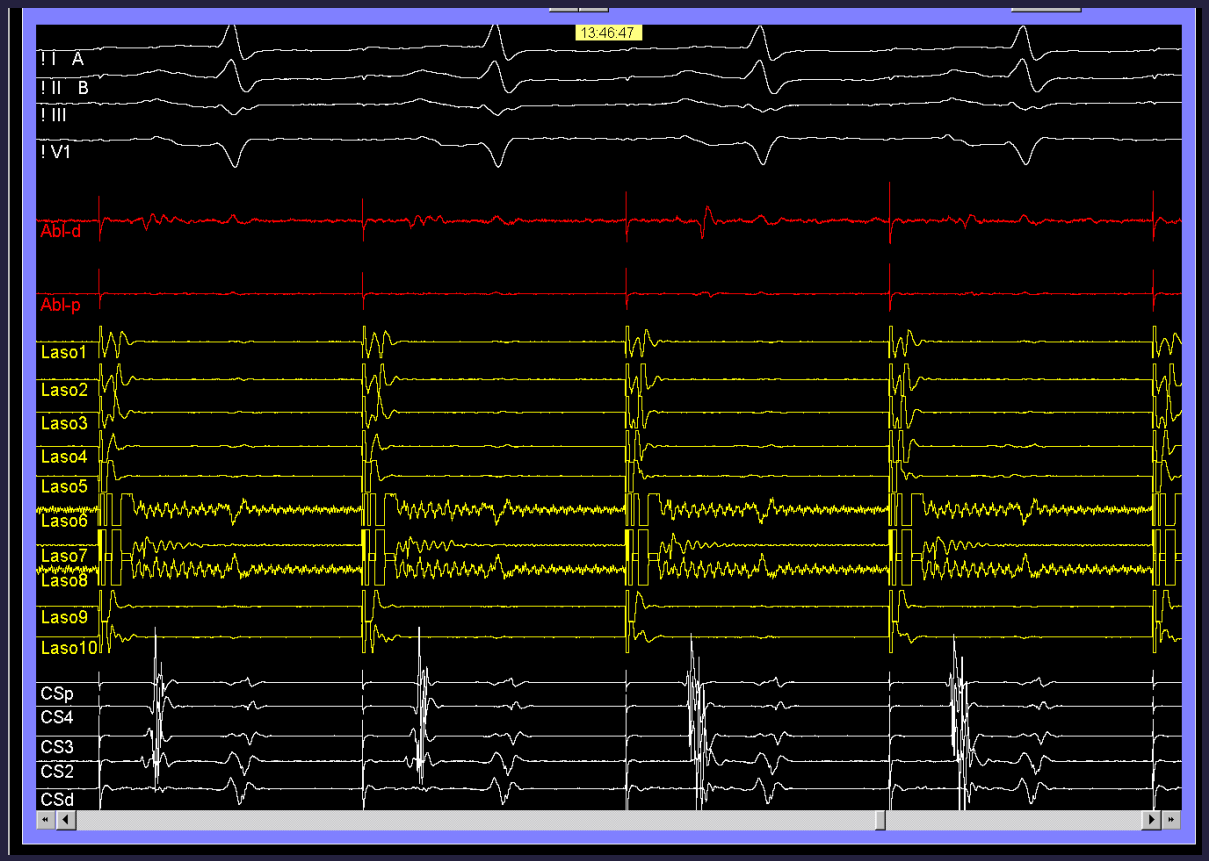




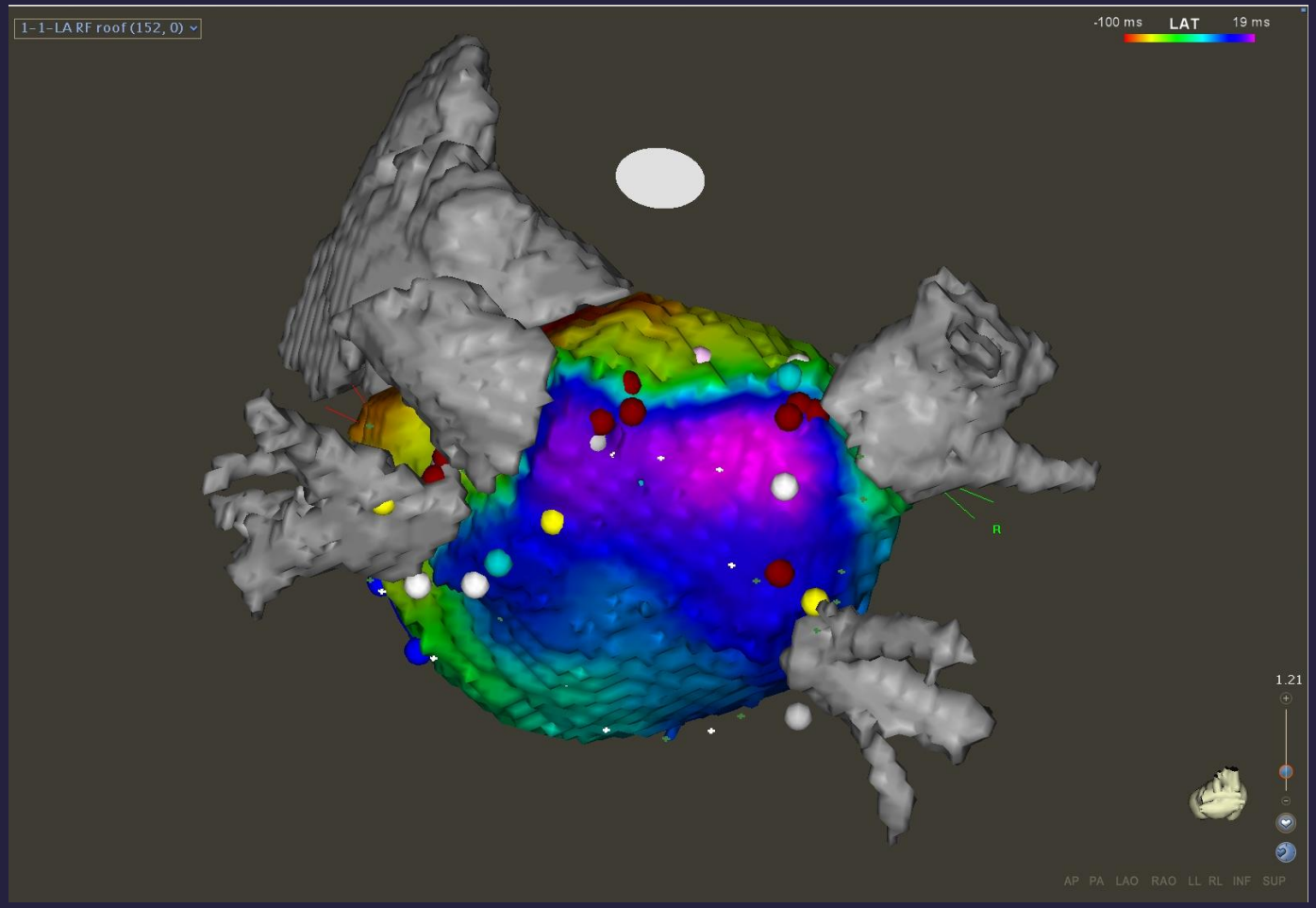
LA/RA Linear Lesions



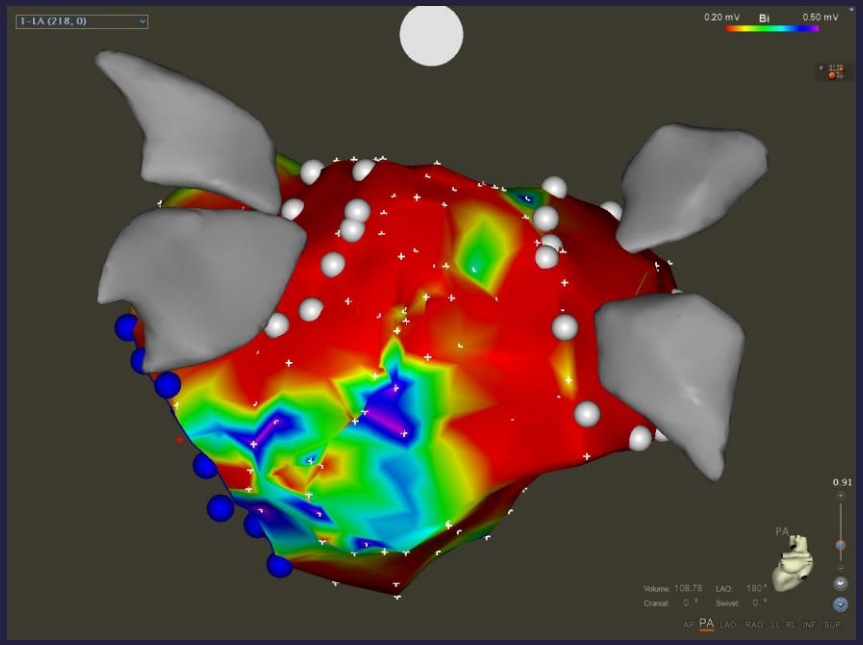
Blok na mitrálnom istme

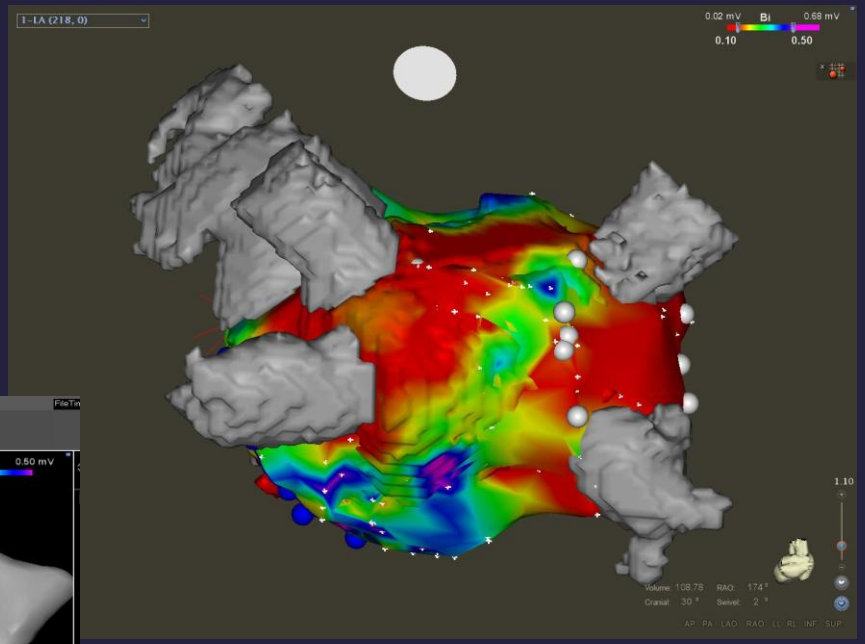


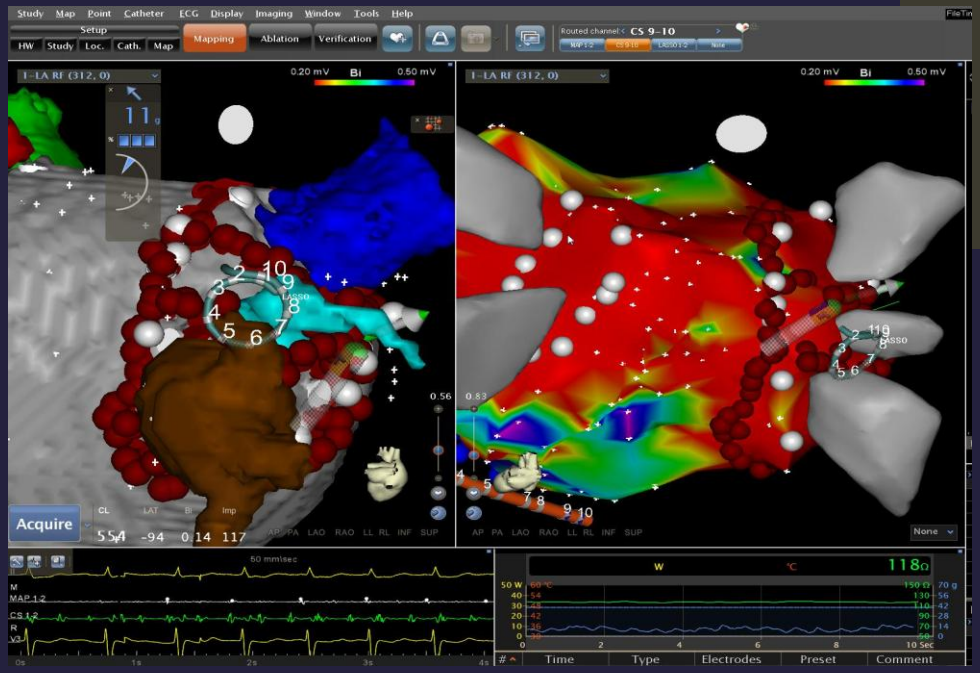
Roof block


1-1-LA RF roof (152, 0)
-100 ms
LAT
19 ms
R
1.21
AP PA LAO RAO LL RL INF SUP

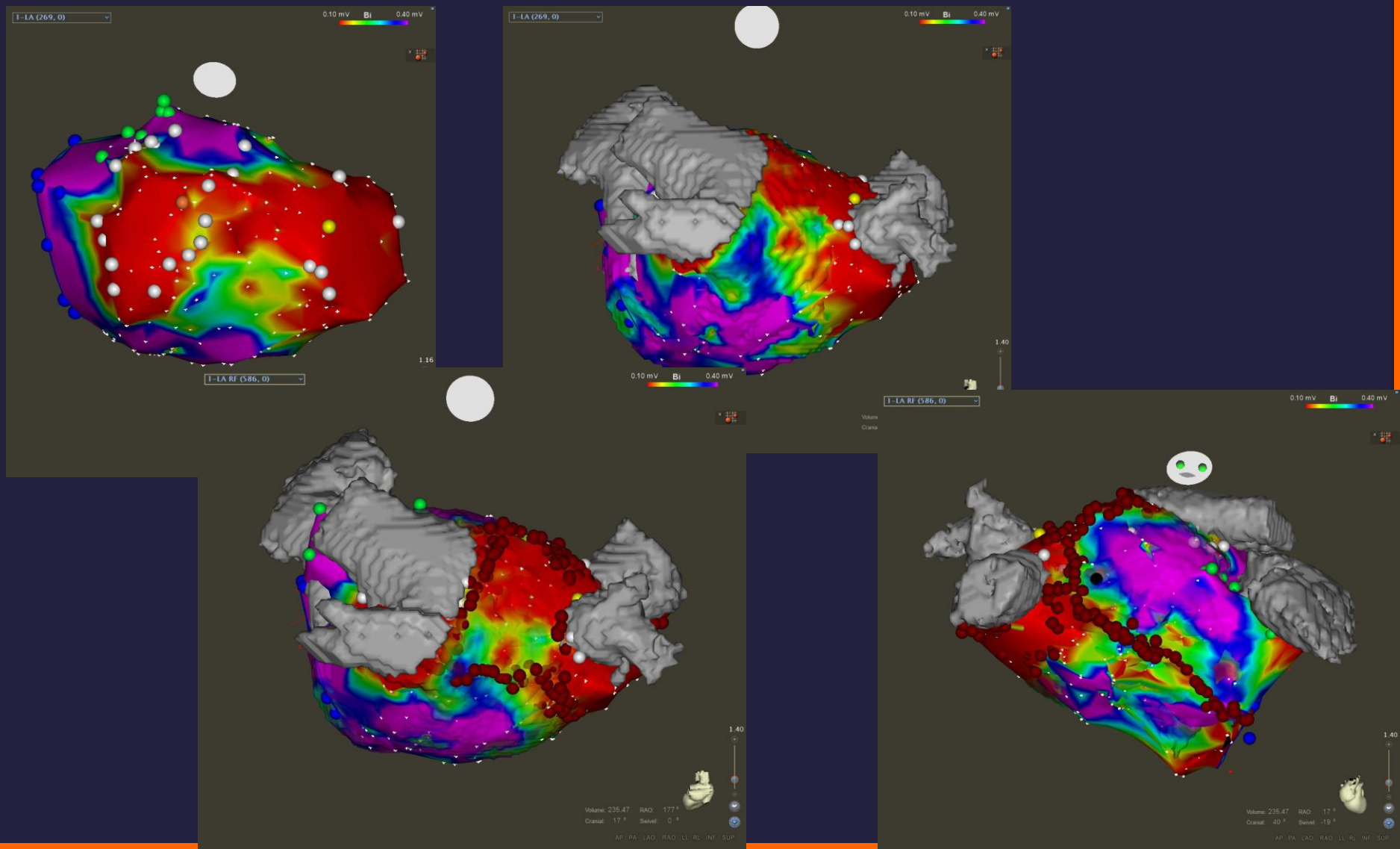
Pac. D.I., 65-r. žena, CHADS2VASc 2, AHT





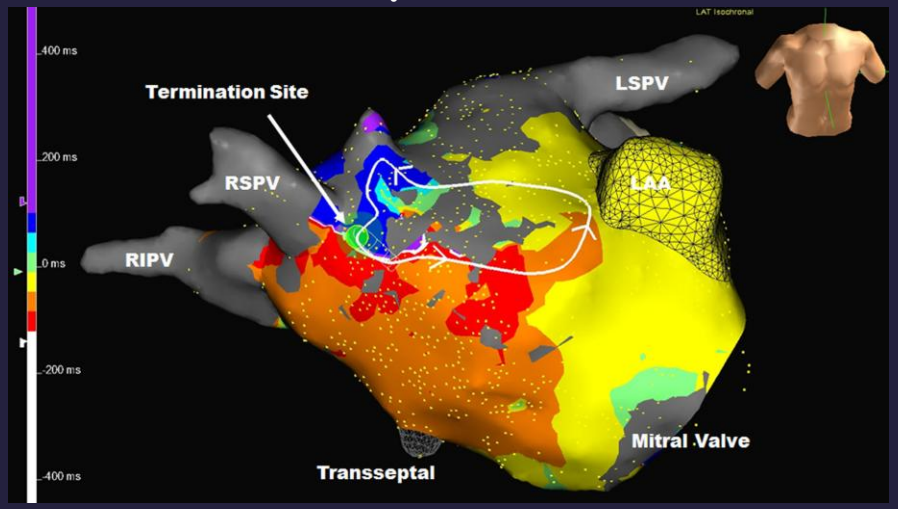


Pac. F.K, 63r. muž, AHT, st. RFA AD v 1995, CHA2DS2VASc: 1, EHRA III

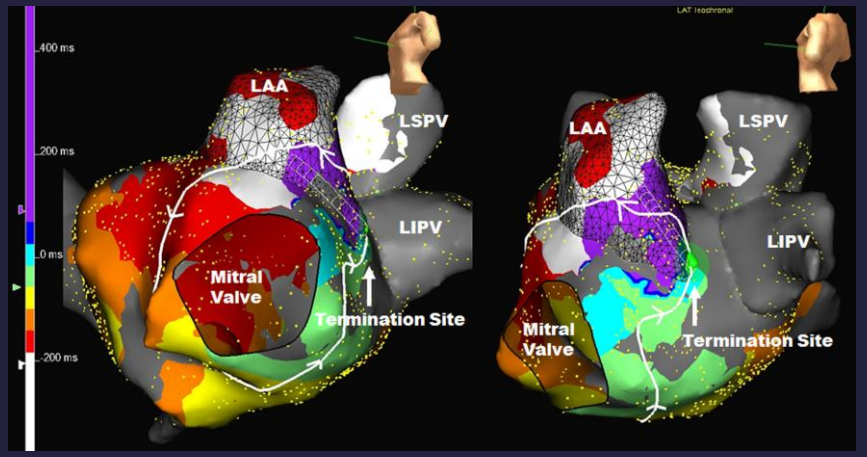


Ablation of atypical atrial flutters using ultra high density-activation sequence mapping

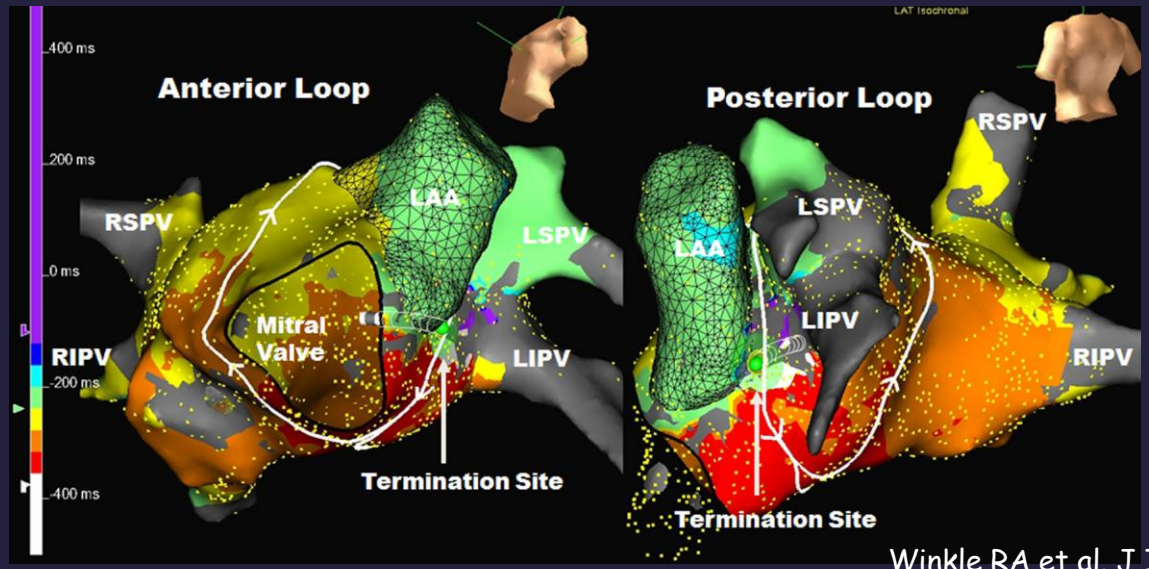
LA anteroseptal flutter



Complex mitral isthmus flutter

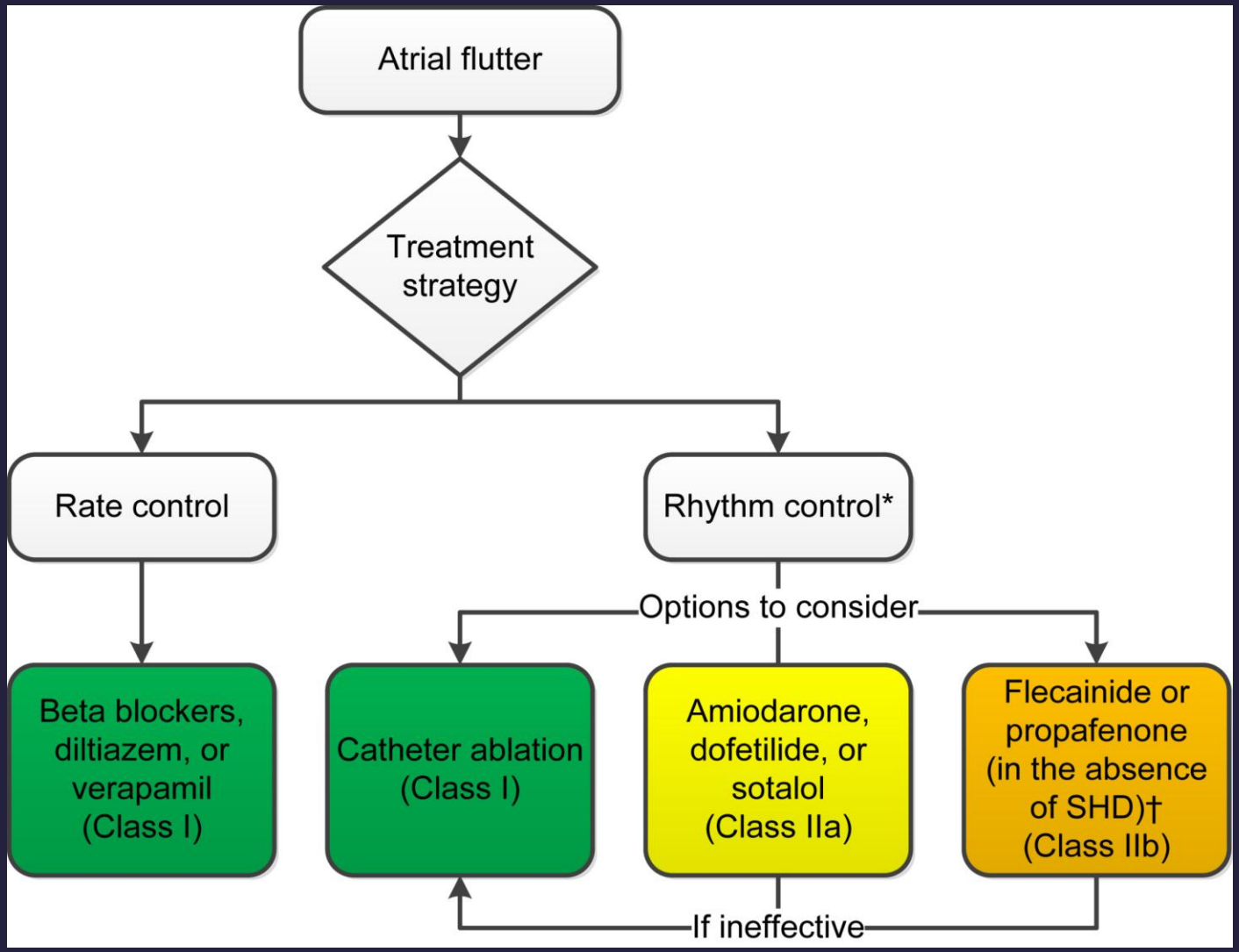


Double loop LA flutter



Winkle RA et al. J Interv Card Electrophysiol 2016

Ongoing Management of Atrial Flutter

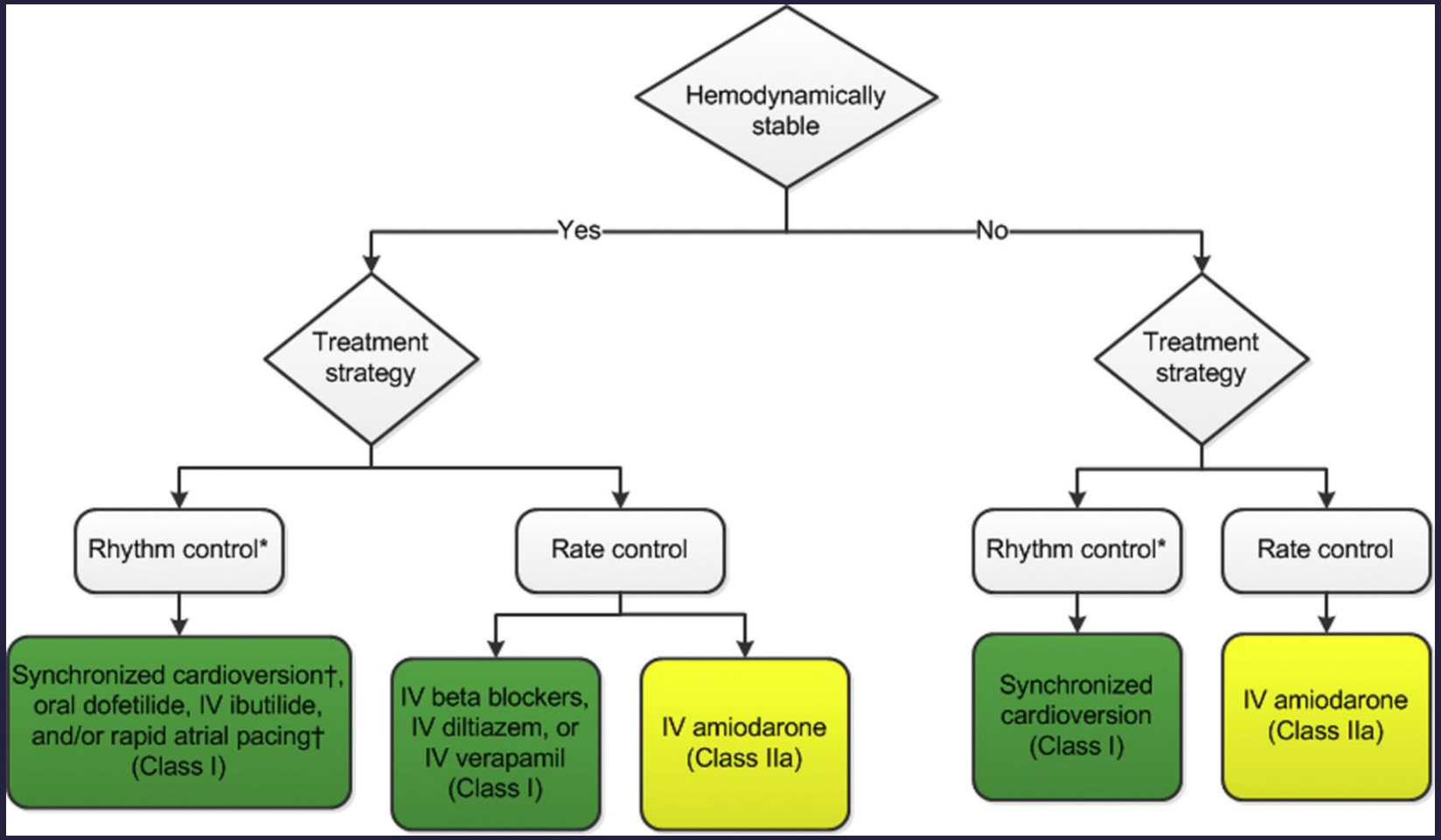


J Am Coll Cardiol. 2016;67(13):e27-e115.

Thank you for your attention

hlivakp@gmail.com

Acute Treatment of Atrial Flutter



*Anticoagulation as per guideline is mandatory.

†For rhythms that break or recur spontaneously, synchronized cardioversion or rapid atrial pacing is not appropriate.

J Am Coll Cardiol. 2016;67(13):e27-e115.

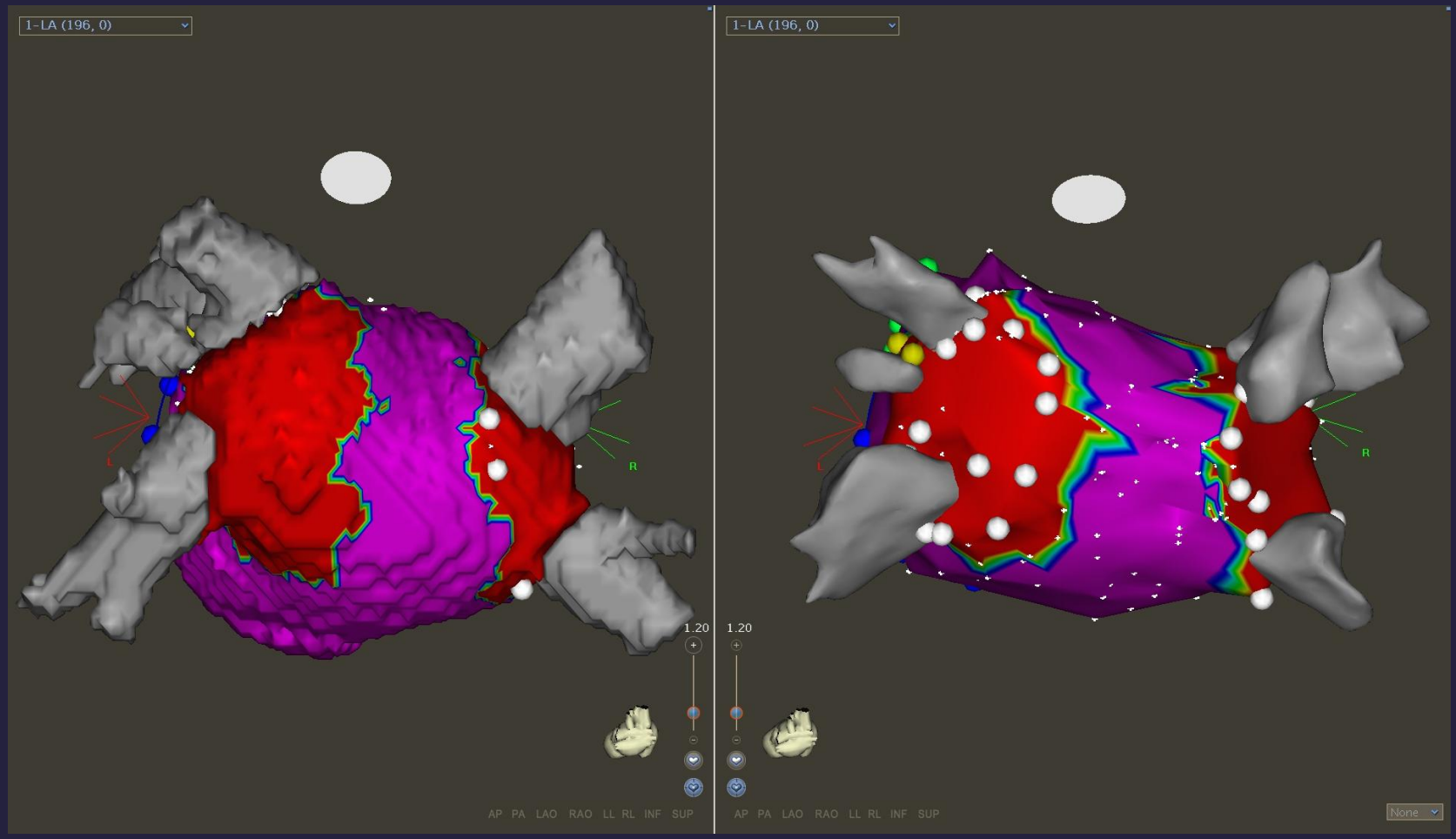
Non-Isthmus-Dependent Atrial Flutters: catheter ablation

Catheter ablation is useful in pts with recurrent symptomatic non-CTI-dependent AFL after failure of at least 1 antiarrhythmic agent (Class I)

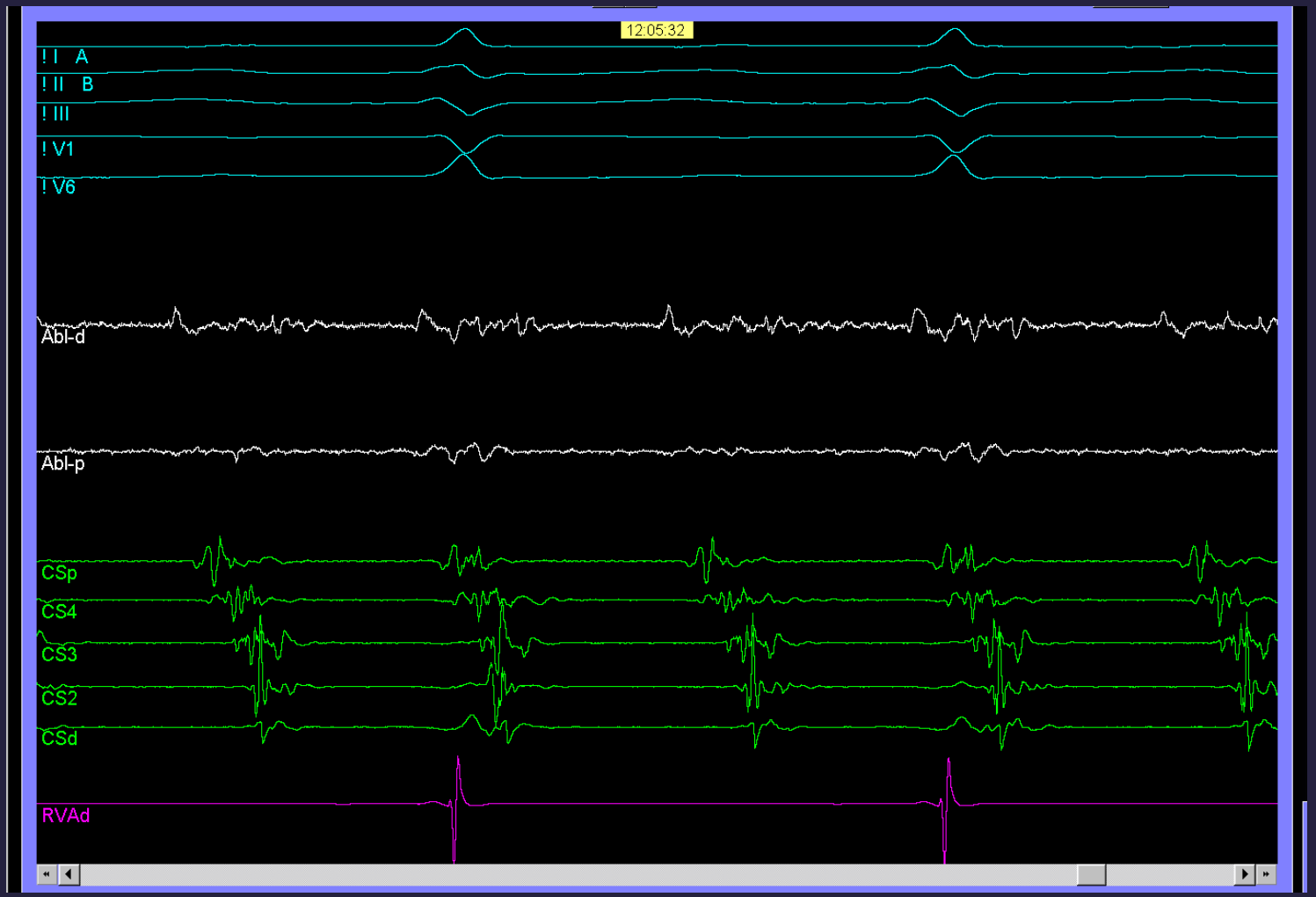
- No prospective RCTs have compared the efficacy or safety of AAD with CA
- In general, CA of non-CTI-dependent AFL is more difficult than ablation of CTI-dep. AFL
  - anatomic circuits are complex, often not anatomically defined, difficult to locate.
  - Knowledge of the prior surgical or ablation approach and detailed activation and entrainment mapping of the tachycardia are useful during attempts at ablation
  - location of the circuit determines ablation approach and risks.
- CA is reasonable in patients with recurrent symptomatic non-CTI-dependent AFL as primary therapy, before therapeutic trials of antiarrhythmic drugs, after carefully weighing potential risks and benefits of treatment options (IIa)

J Am Coll Cardiol. 2016;67(13):e27-e115.

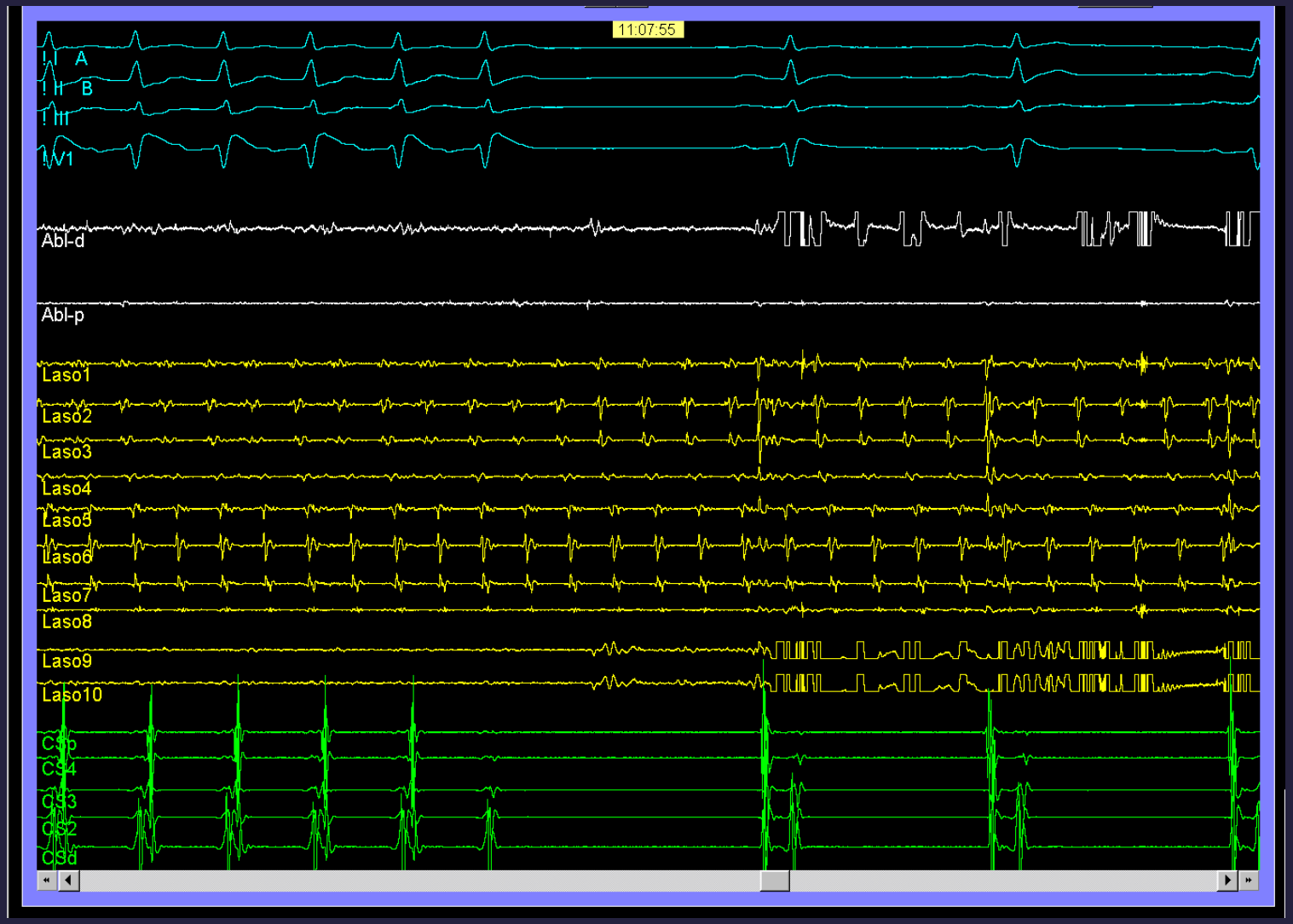
CARTO and CT merge



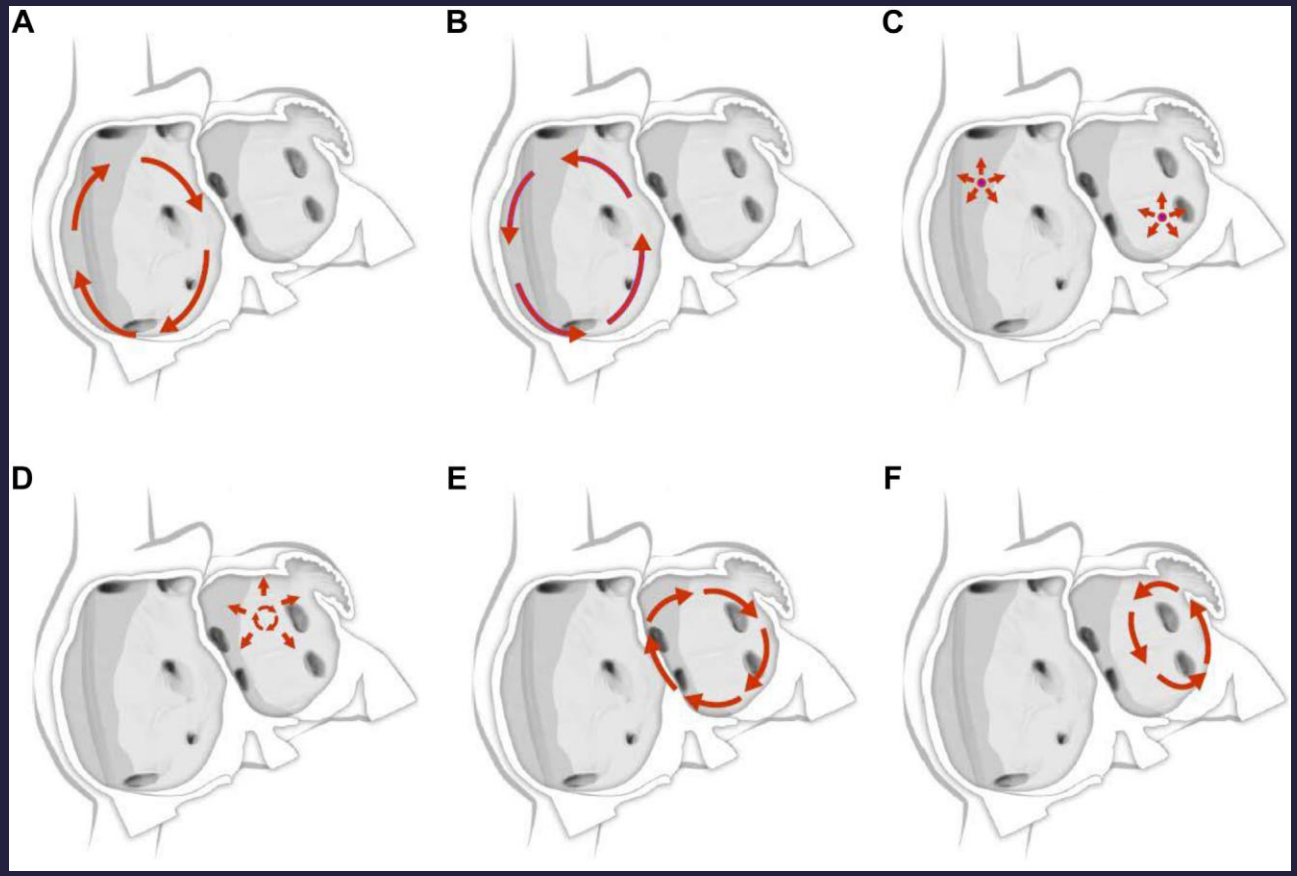
Earliest (fractionated) activity



AT in LPVs continues…



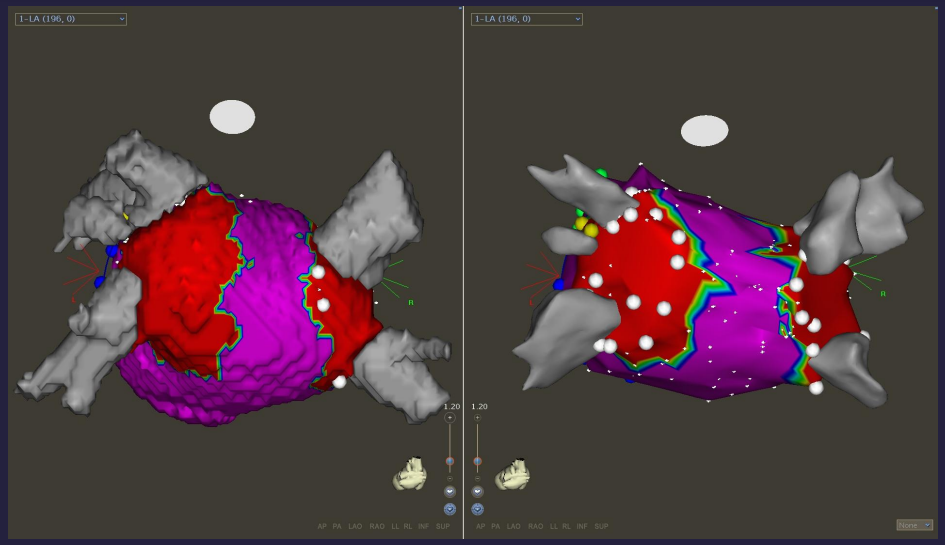
Mechanisms of atrial flutter and atrial tachycardia



A: Isthmus-dependent reverse common (clockwise) atrial flutter. B: Isthmus-dependent common (counter clockwise) atrial flutter. C: Focal atrial tachycardia with circumferential spread of activation of the atria (can arise from multiple sites within the left and right atrium). D: Microreentrant atrial tachycardia with circumferential spread of activation of the atria. E: Perimitral atrial flutter. F: Roof-dependent atrial flutter.

Calkins H et al. Heart Rhythm 2017

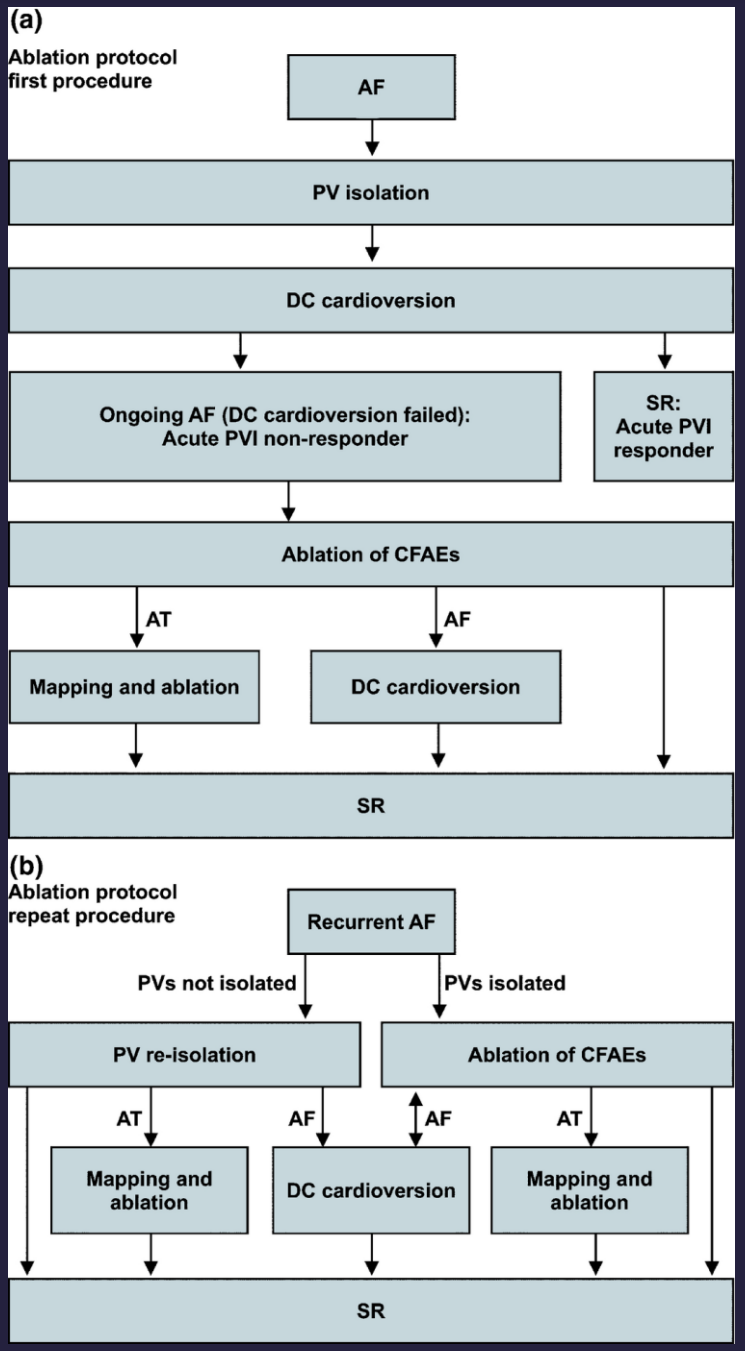
LACA-WACA-PVI



- Encircling lesions
  - eliminate PV triggers
  - may also eliminate "rotors" or "mother waves"
  - 20-30% of LA is excluded limiting area for circulating wavelets – critical mass ?
- Why is there 20-30% recurrence of AF? (If the triggers for paroxysmal AF have been eliminated)
  - Reconnection of the pulmonary veins
  - Non pulmonary vein triggers (e.g. Ligament of Marshall, CS…)

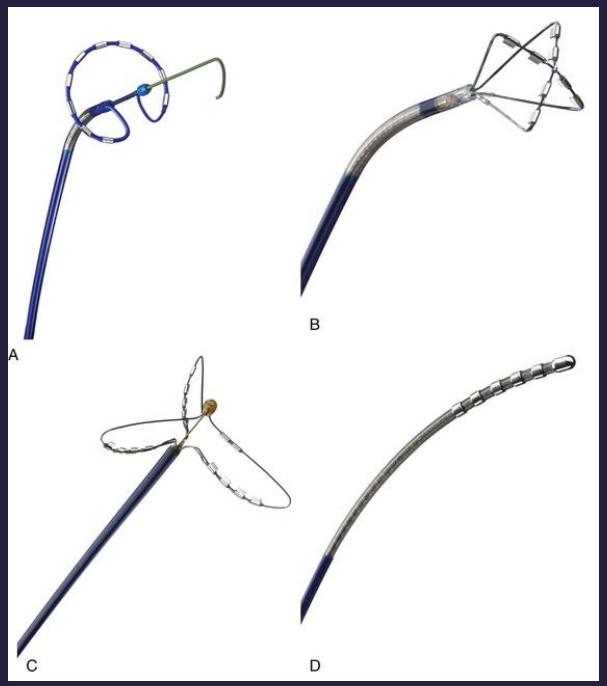
Persistent Afib ablation approaches

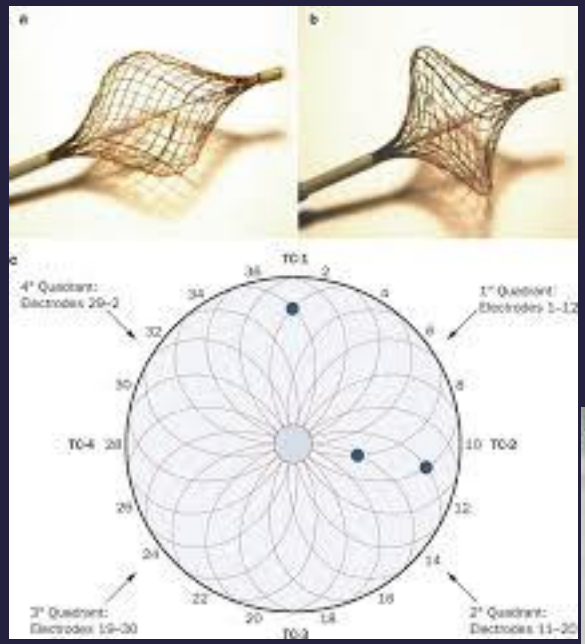
- Bordeaux stepwise approach
- Hamburg approach…

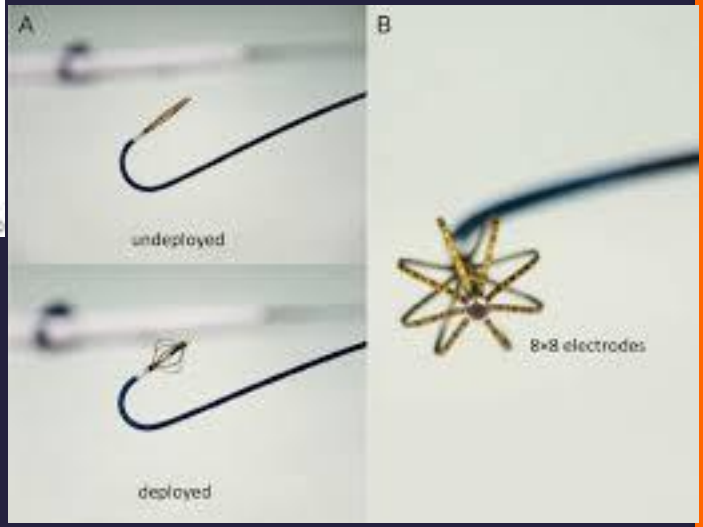


Journal of Internal Medicine 2016;5:439-448. DOI: 10.1111/joim.12488

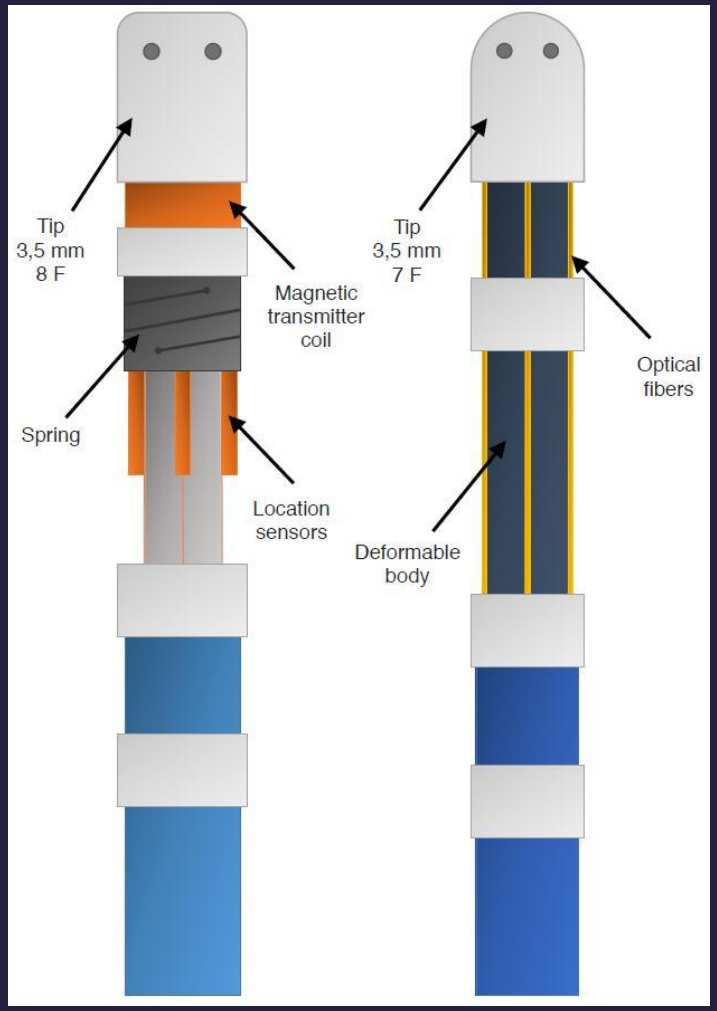
Multielectrode ablation catheters





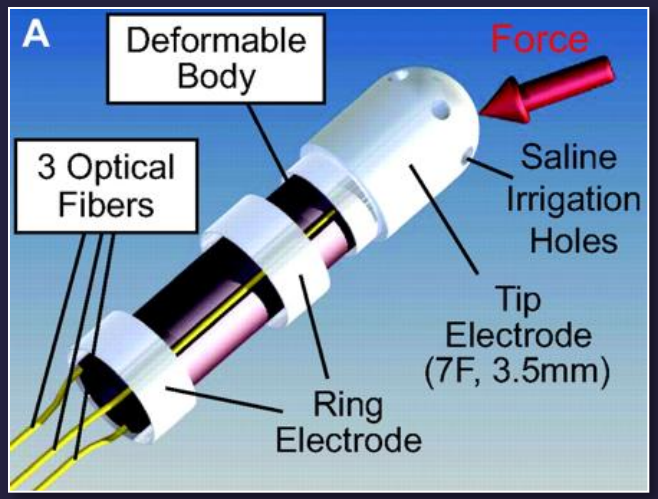


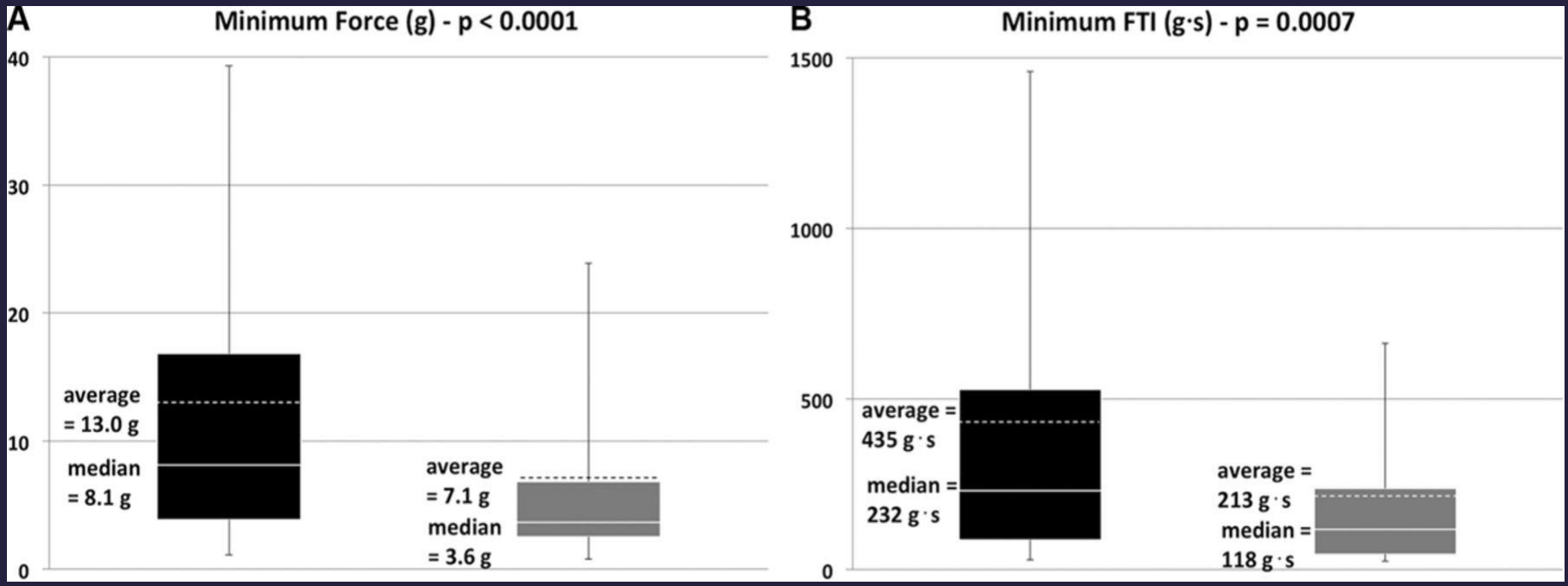
Electromagnetic (SmartTouch) vs fiber-optic (TactiCath Quartz) contact force catheters



Bourier F et al. J Cardiovasc Electrophysiol. 2016 Sep 22. [Epub ahead of print]

Force parameters discriminators for segments with isolation vs gaps (EFFICAS I)

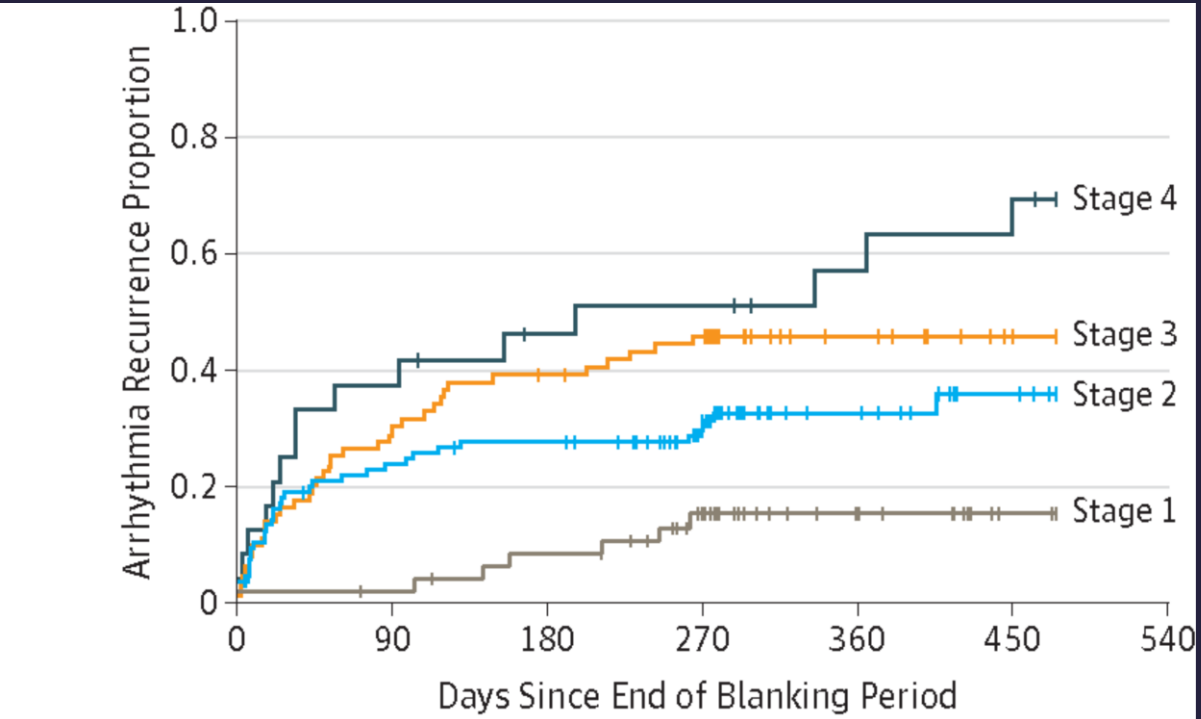




successful ablations gaps successful ablations gaps

Neuzil P et al. Circ Arrhythm Electrophysiol. 2013;6:327-333

Association of Atrial Tissue Fibrosis Identified by Delayed Enhancement MRI and Atrial Fibrillation Catheter Ablation The DECAAF Study



No. at risk						
Stage 4	24	15	11	10	7	6
Stage 3	80	56	47	41	19	12
Stage 2	107	79	74	58	26	15
Stage 1	49	47	43	33	13	4

Marrouche N et al. JAMA. 2014;311(5):498-506

Predictors of Success Following AF Ablation

- Predictors of a poorer outcome, at least in some studies, include

(1) non-PAF and particularly long-term persistent AF

(2)LV dysfunction

(3)sleep apnea and obesity

(4)increased LA size

(5)increased age

(6)hypertension

(7)LA fibrosis as detected by cardiac MRI

Calkins H et al. Heart Rhythm 2017, in press

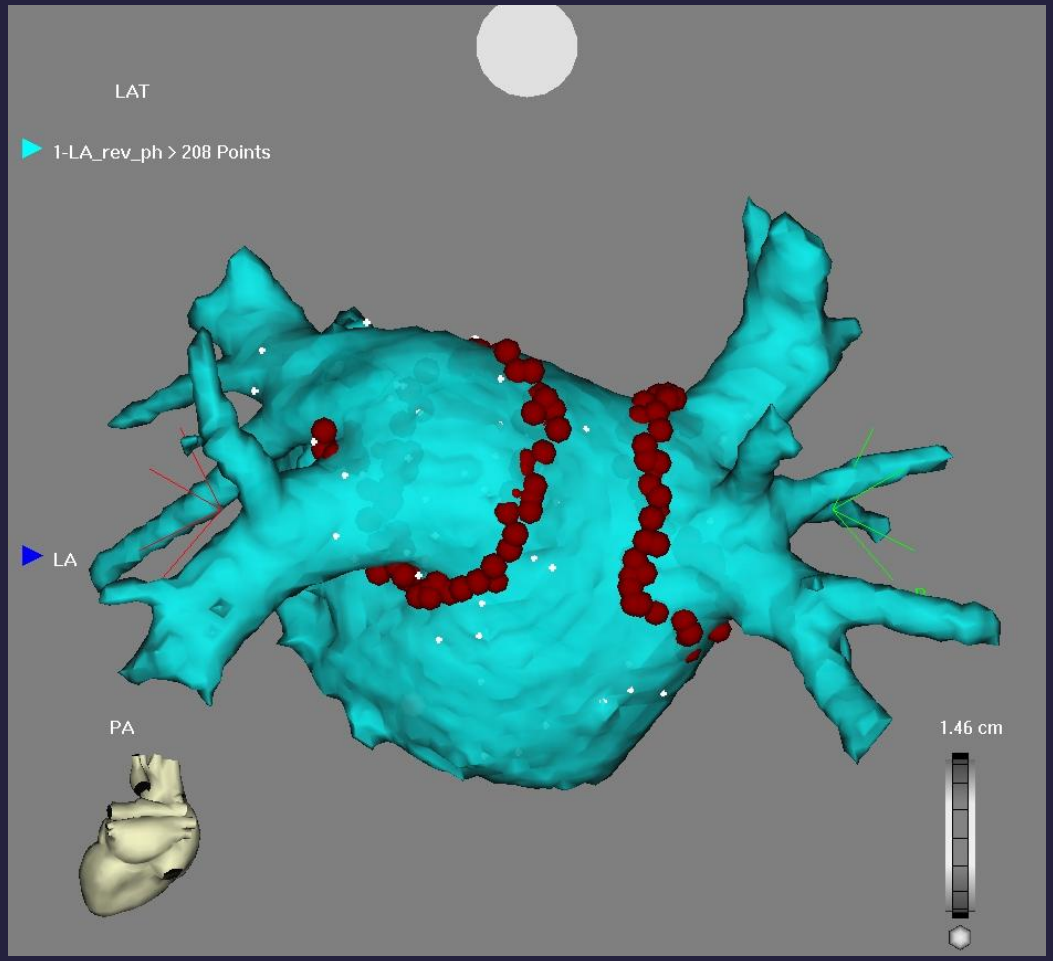
Prediktory neúspechu/horších výsledkov katétrovej ablácie FP

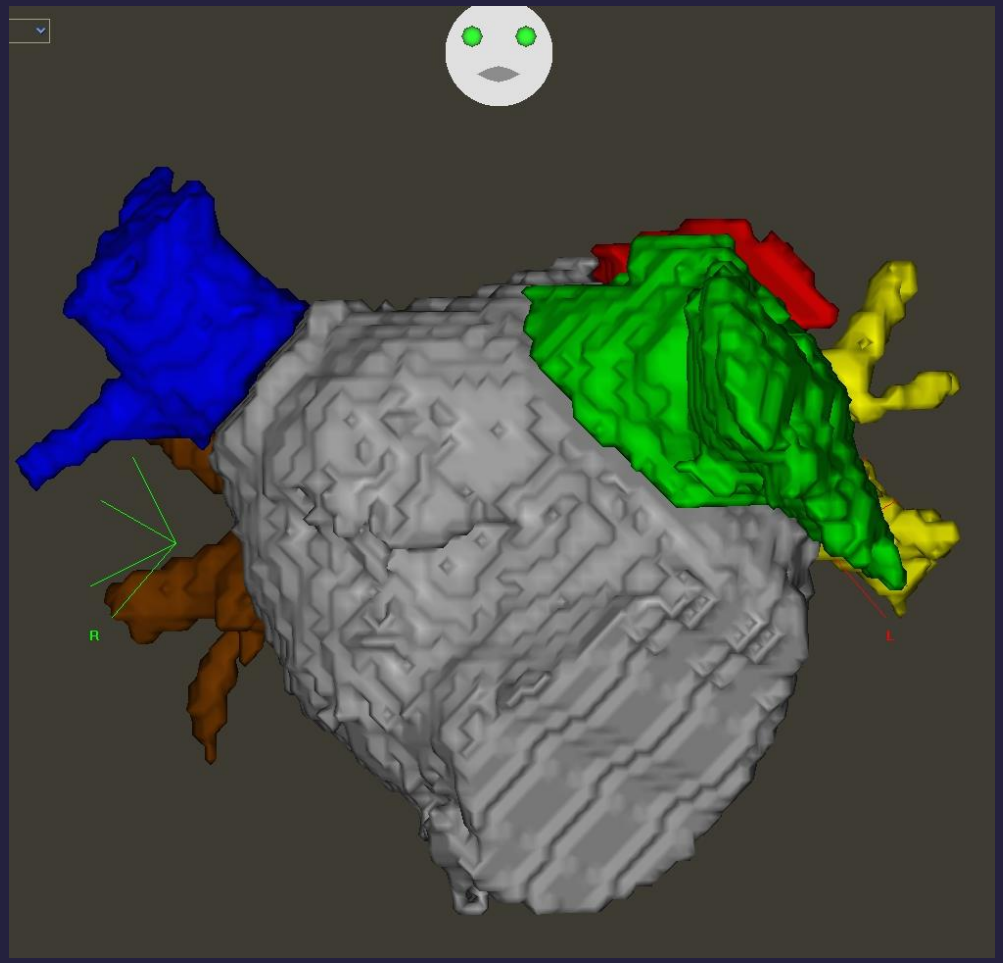
1. iná ako paroxyzmálna FP (predovšetkým dlhodobo perzistujúca FP)
2. syndróm spánkového apnoe
3. obezita
4. dilatácia ĽP
5. vyšší vek
6. hypertenzia
7. fibróza ĽP detegovaná pomocou MRI
8. nižšia EF ĽK

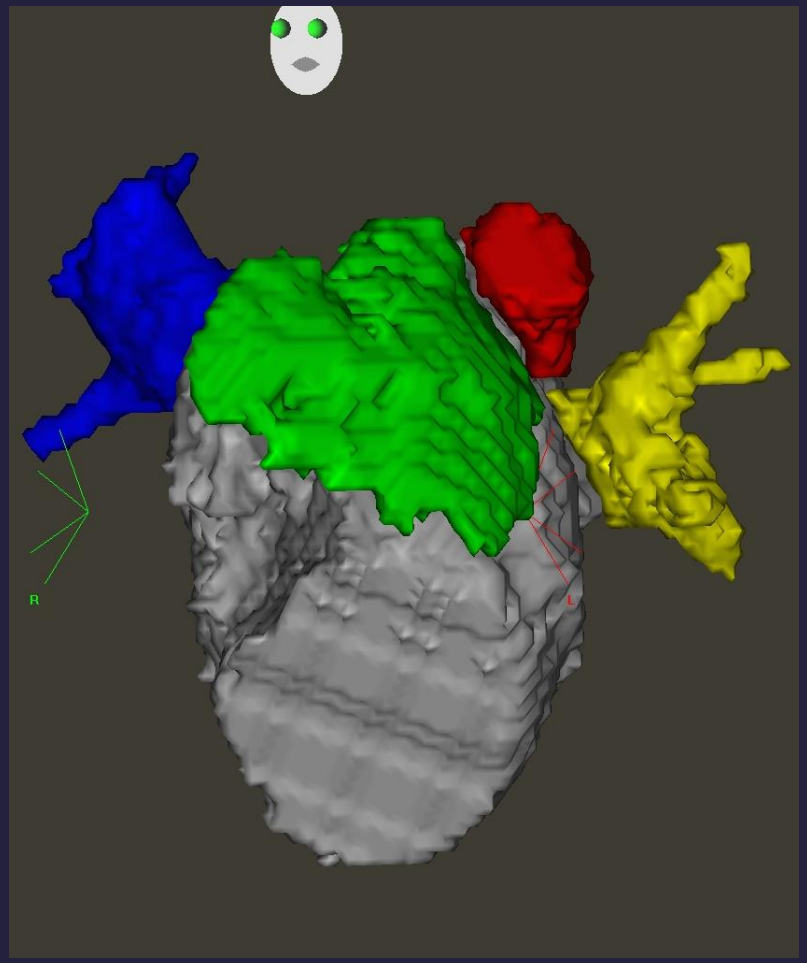
- **Systematický prehľad prediktorov rekurencií FP po katétrovej ablácii (Balk EM et al. JCE 2010)**
- **25 štúdií**
- **17 z nich študovalo EFĽK**
- **veľmi málo pac. malo EFĽK < 40%**
- **4 štúdie: exklúzia pac. s EFĽK < 45%**
- **5 štúdií: EFĽK prediktor**

Calkins H et al. Heart Rhythm 2017, in press

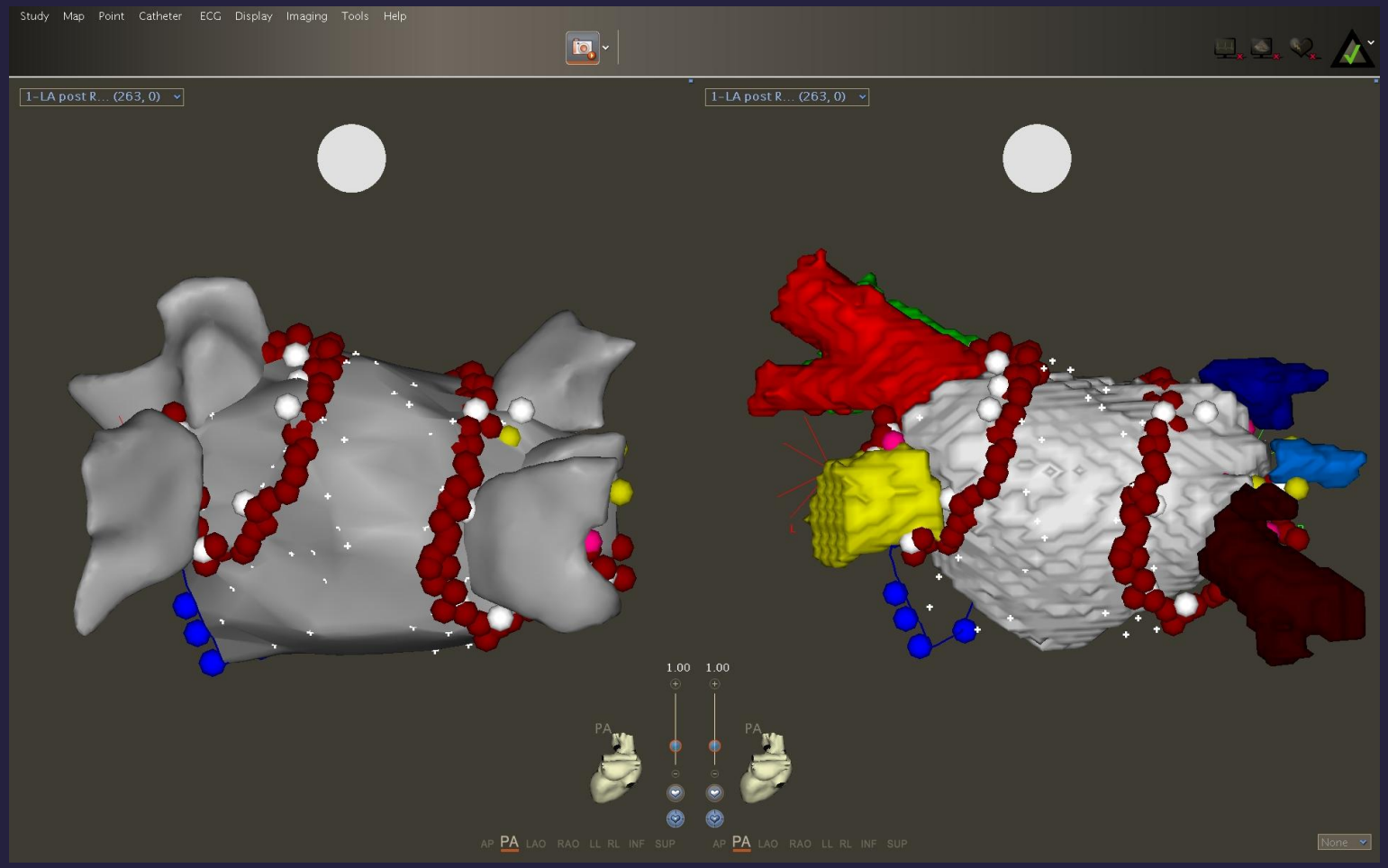
AF ablation - PVI



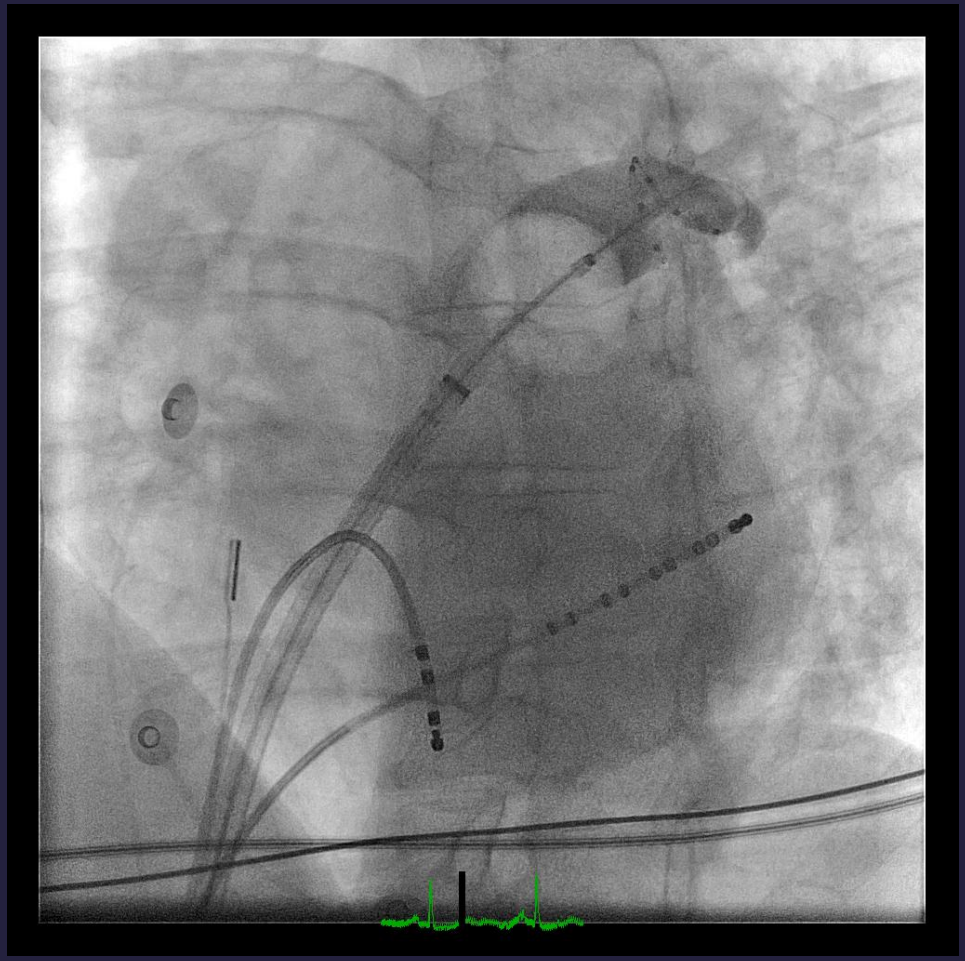

R
L


R
L

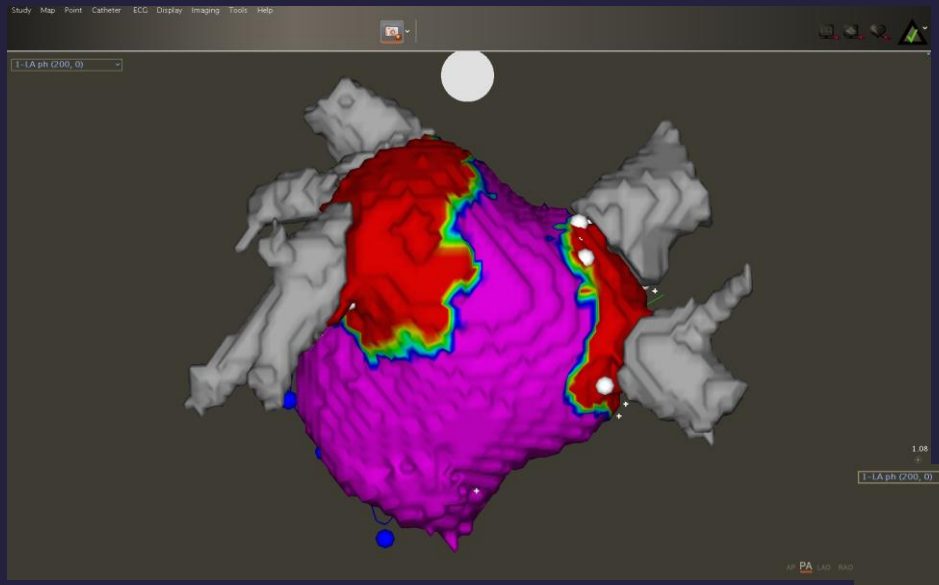
Izolácia pľúcnych žíl

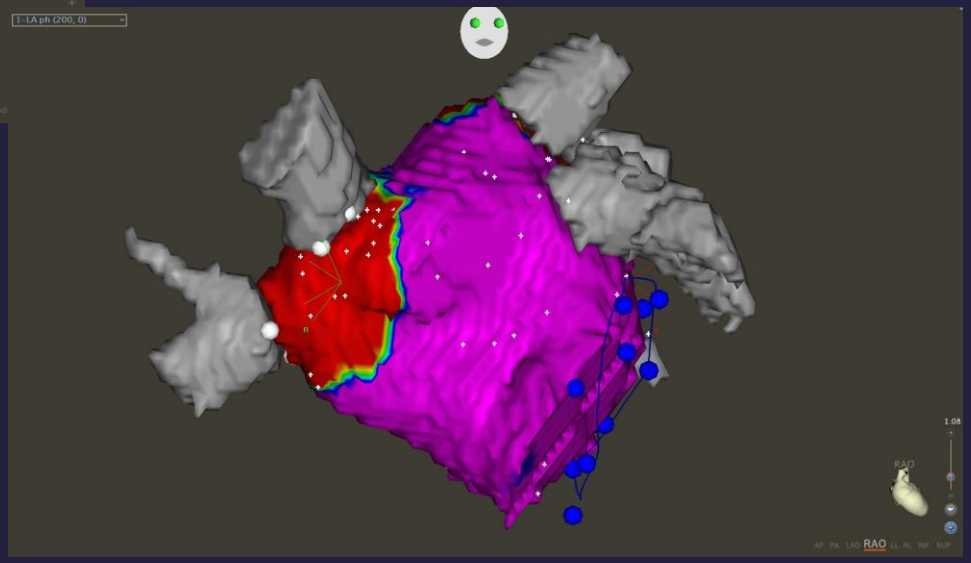


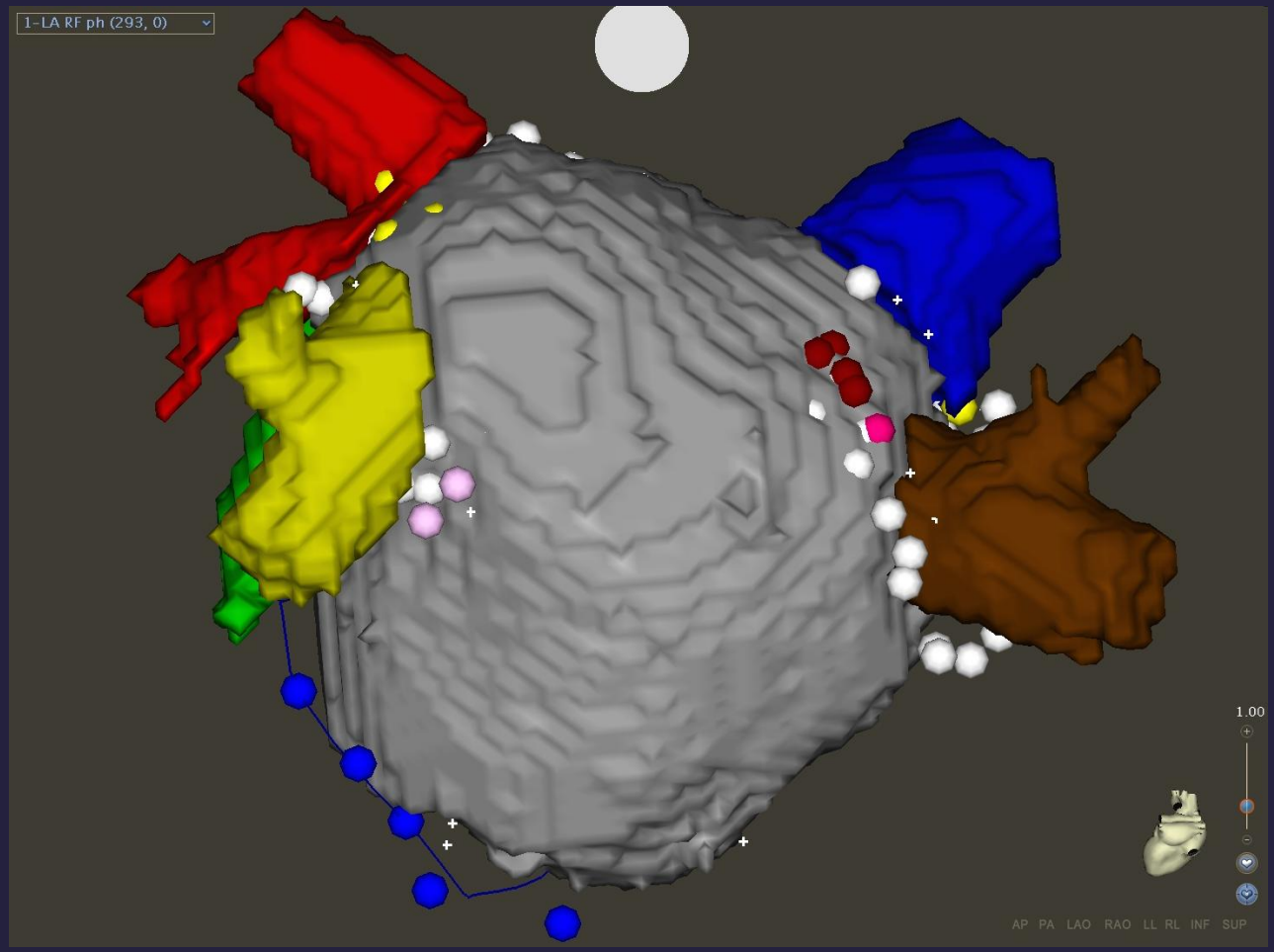
Kryo izolácia



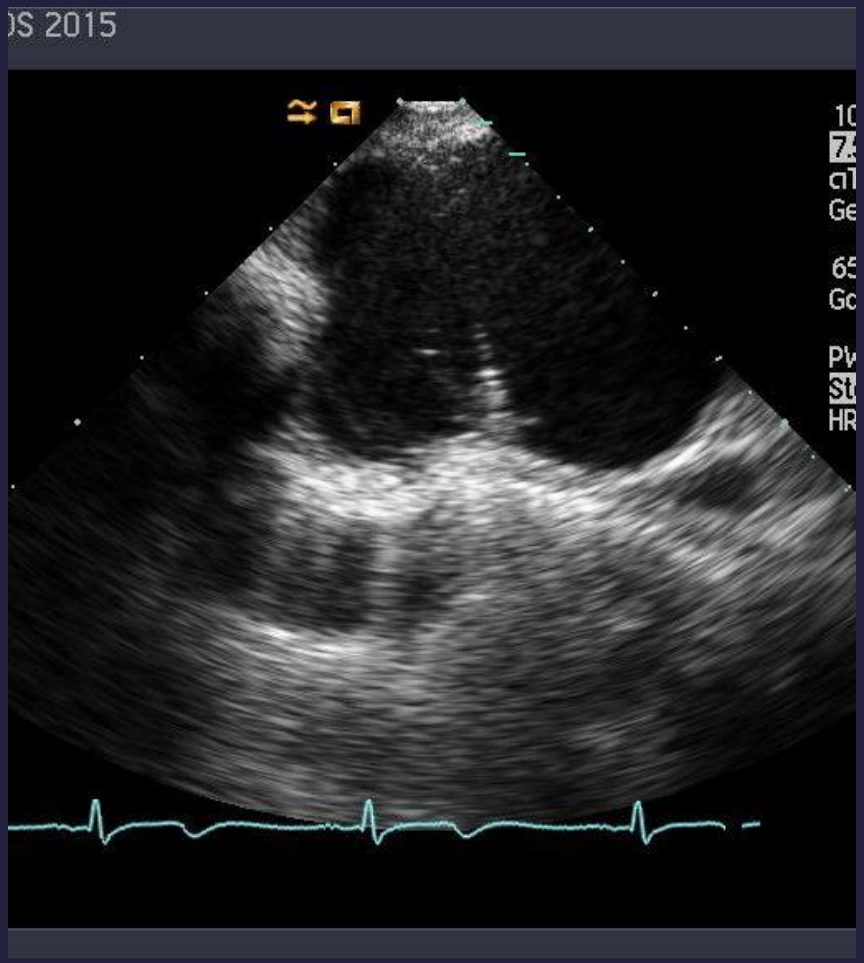
LA merge

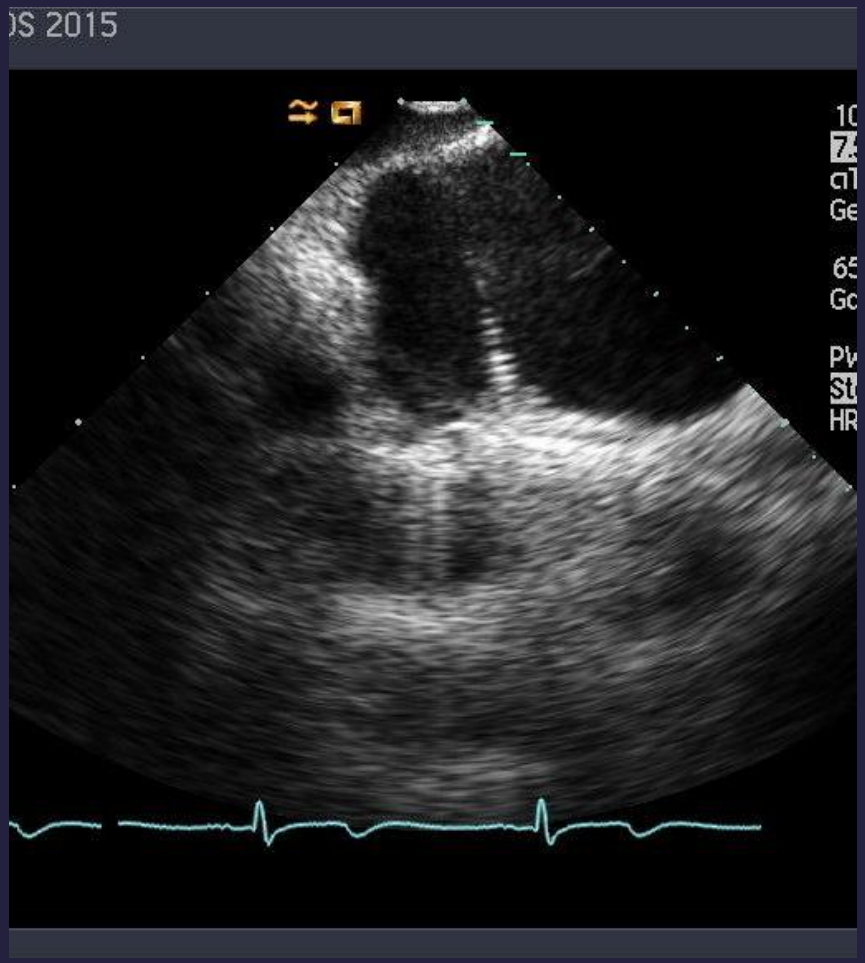

Study Map Point Catheter ECG Display Imaging Tools Help
1 - LA ph (200, 0)
1.08
1 - LA ph (200, 0)
AP PA LAO RAO


1 - LA ph (200, 0)
1.08
RAO
AP PA LAO RAO LL RL INF SUP

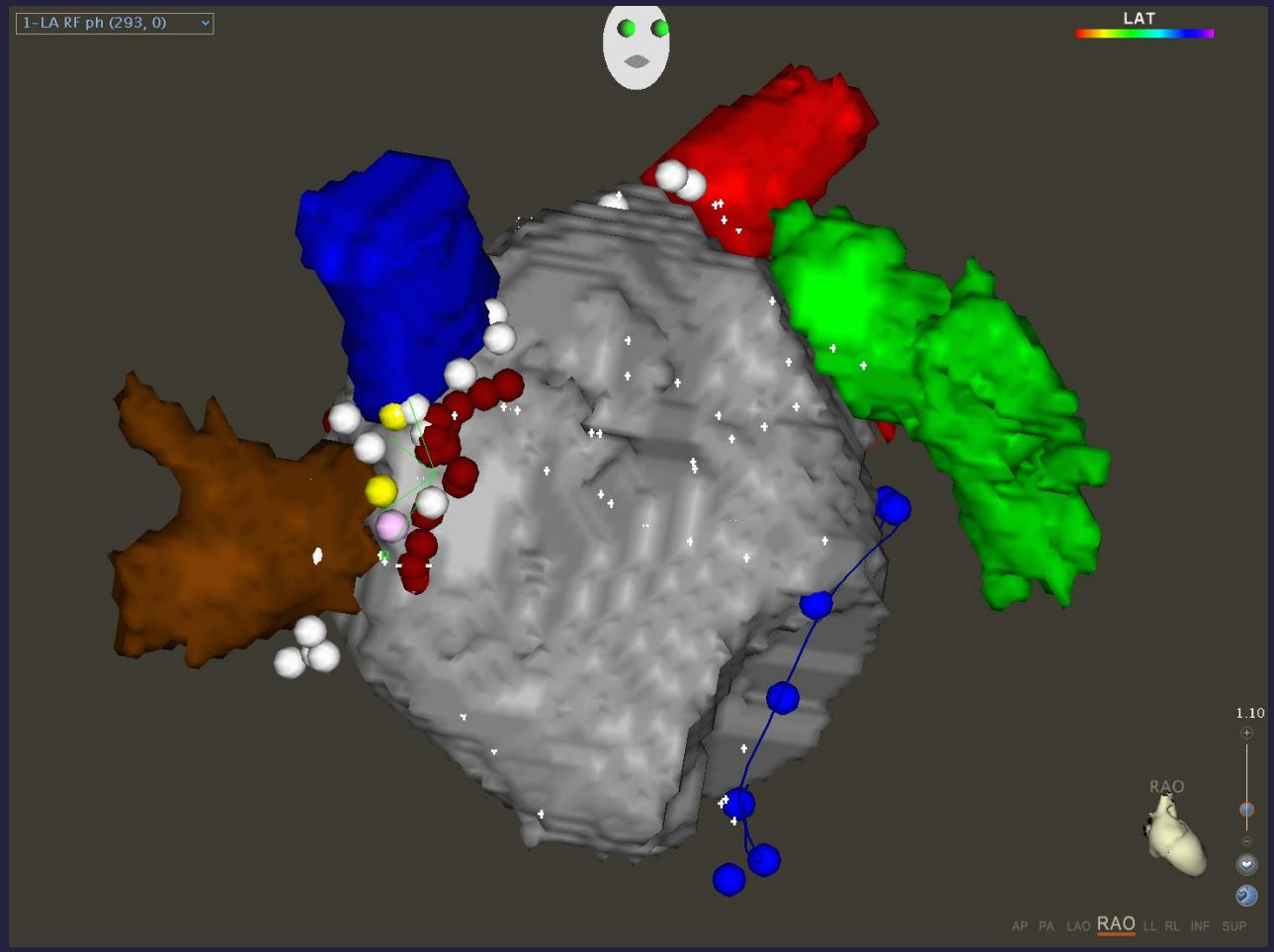

1-LA RF ph (293, 0)
1.00
AP PA LAO RAO LL RL INF SUP

ICE

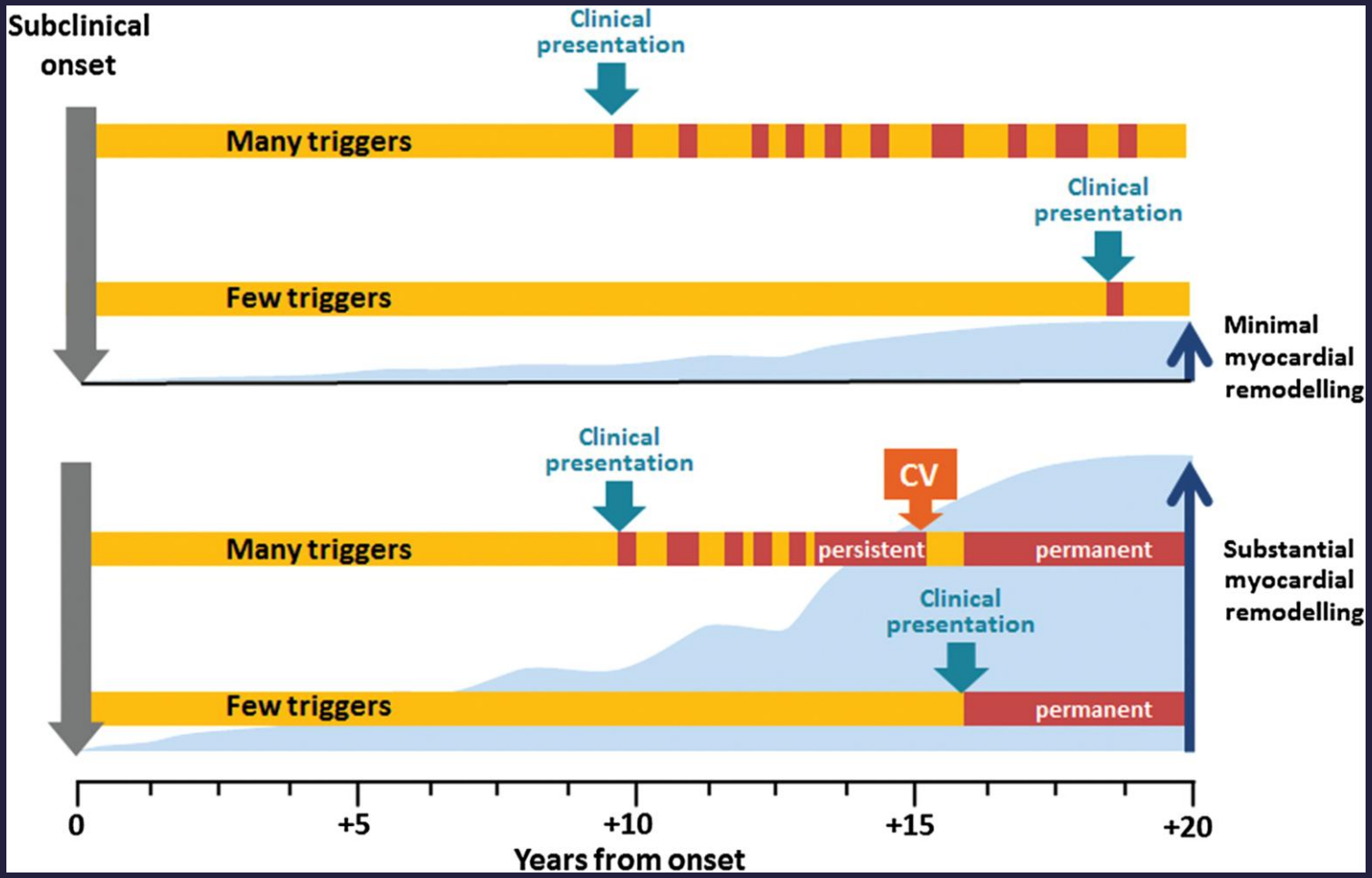




CARTO

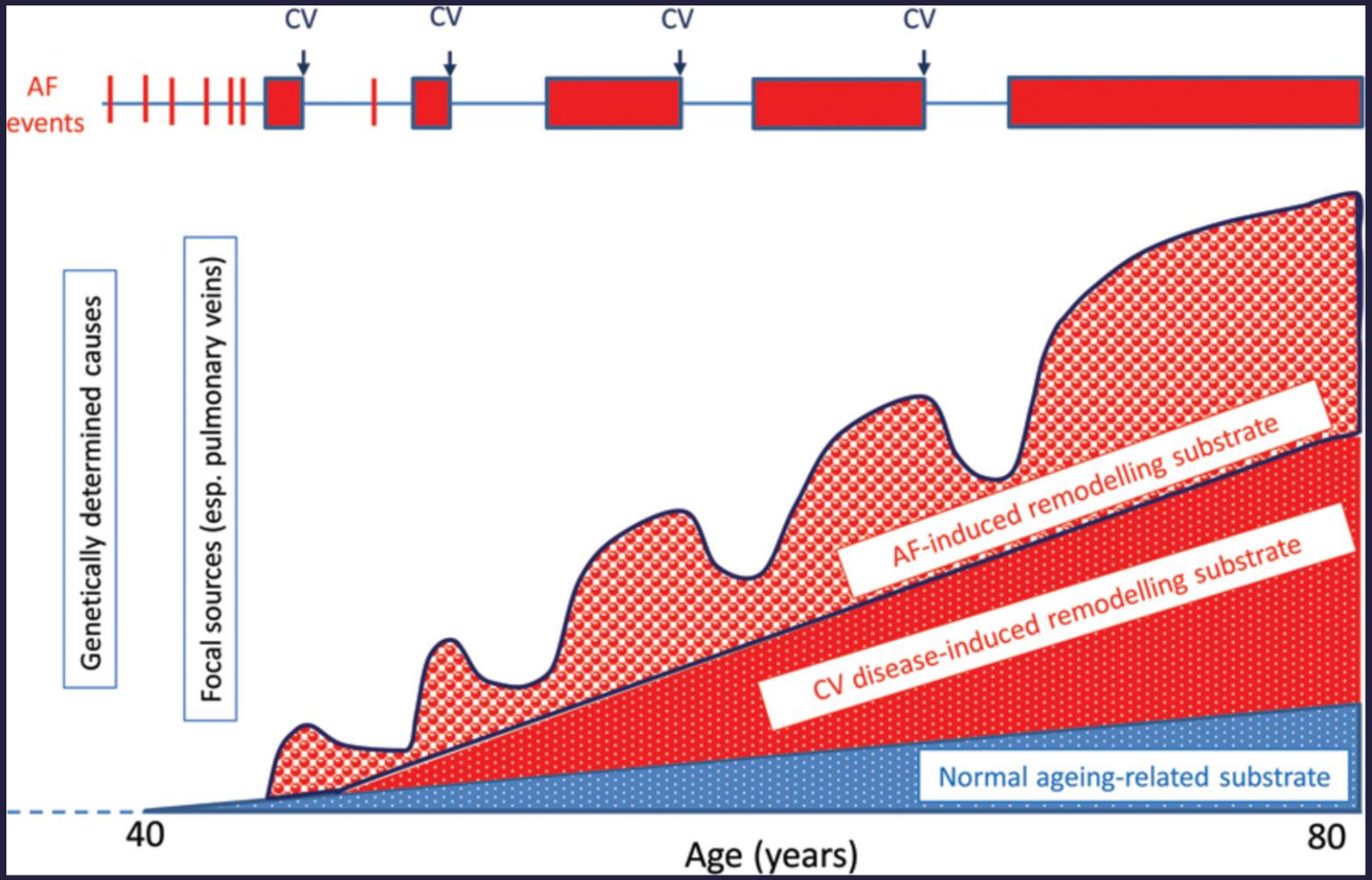


Different possible evolutions of AF in relation to substrate remodelling and trigger density



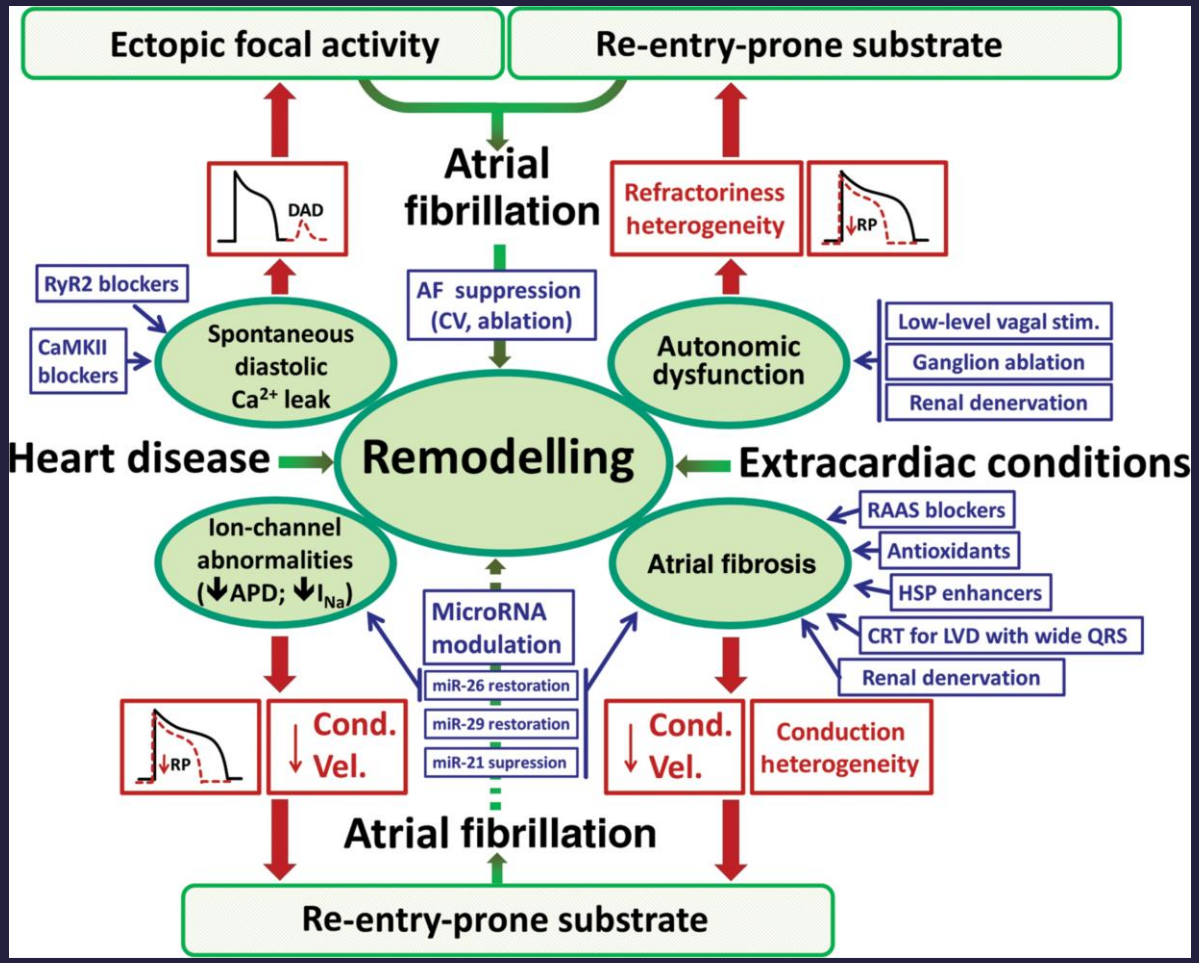
Eur Heart J. 2014;35(22):1448-1456

A conceptual model of atrial fibrillation events in relationship to underlying substrate



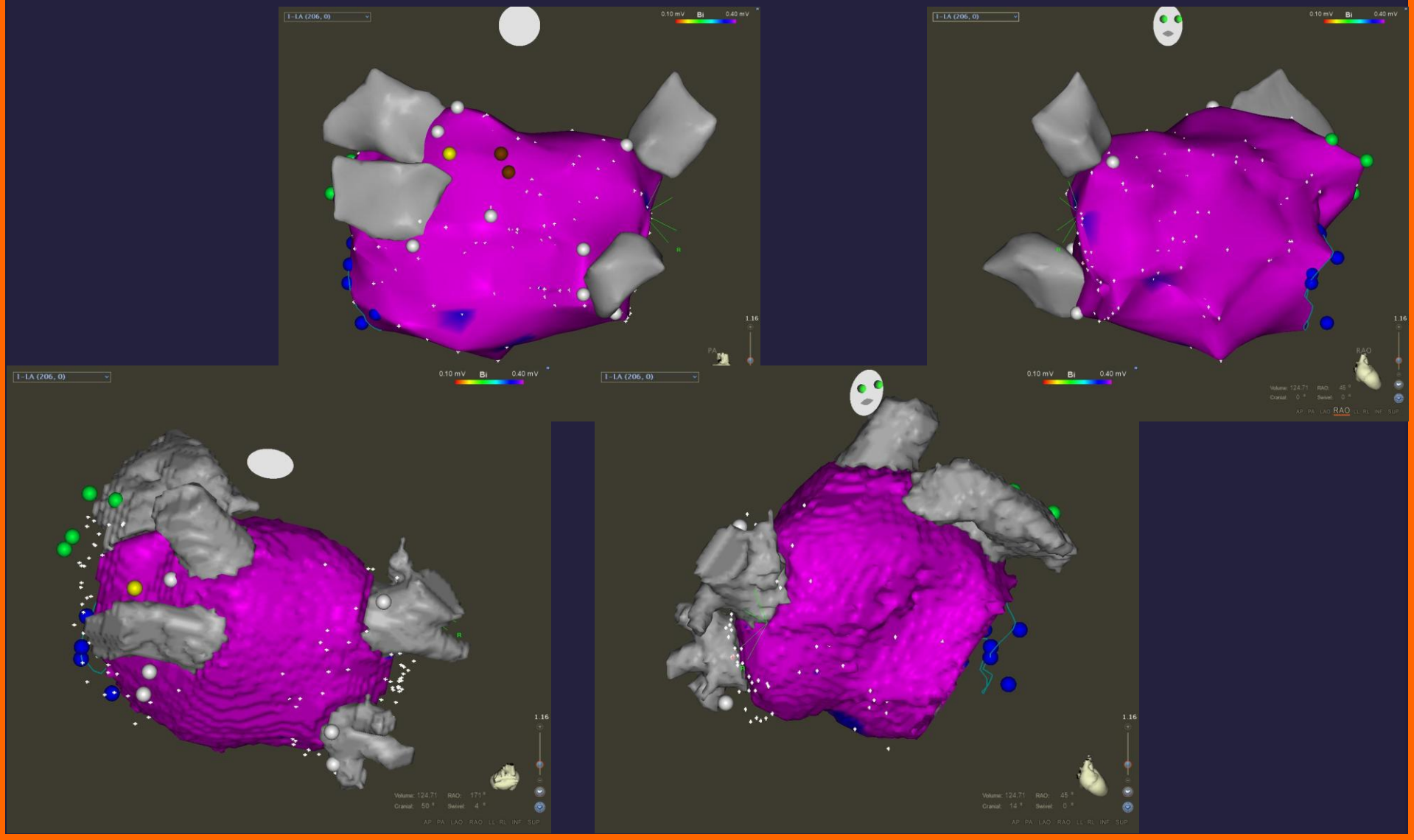
Eur Heart J. 2014;35(22):1448-1456

Basic mechanisms underlying AF-related remodelling and therapy

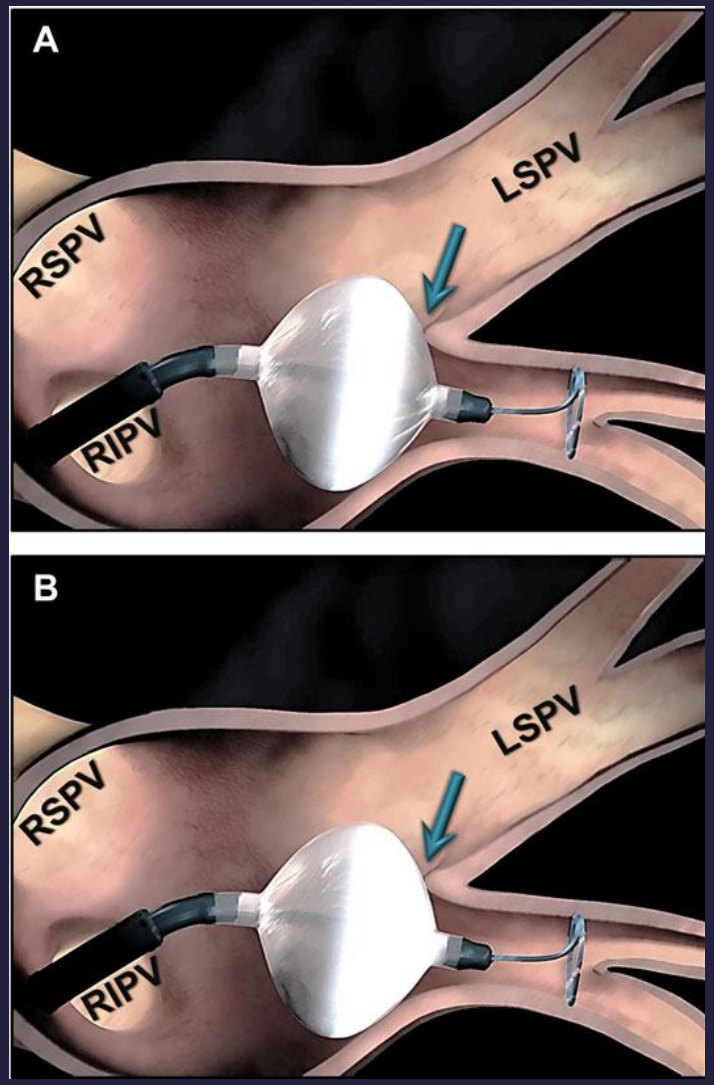


Eur Heart J. 2014;35(22):1448-1456

Pac. M.O, 41r. muž, dlhodobo perzistentá FP, CHA2DS2VASc: 1, EHRA III, EFĽK 30%

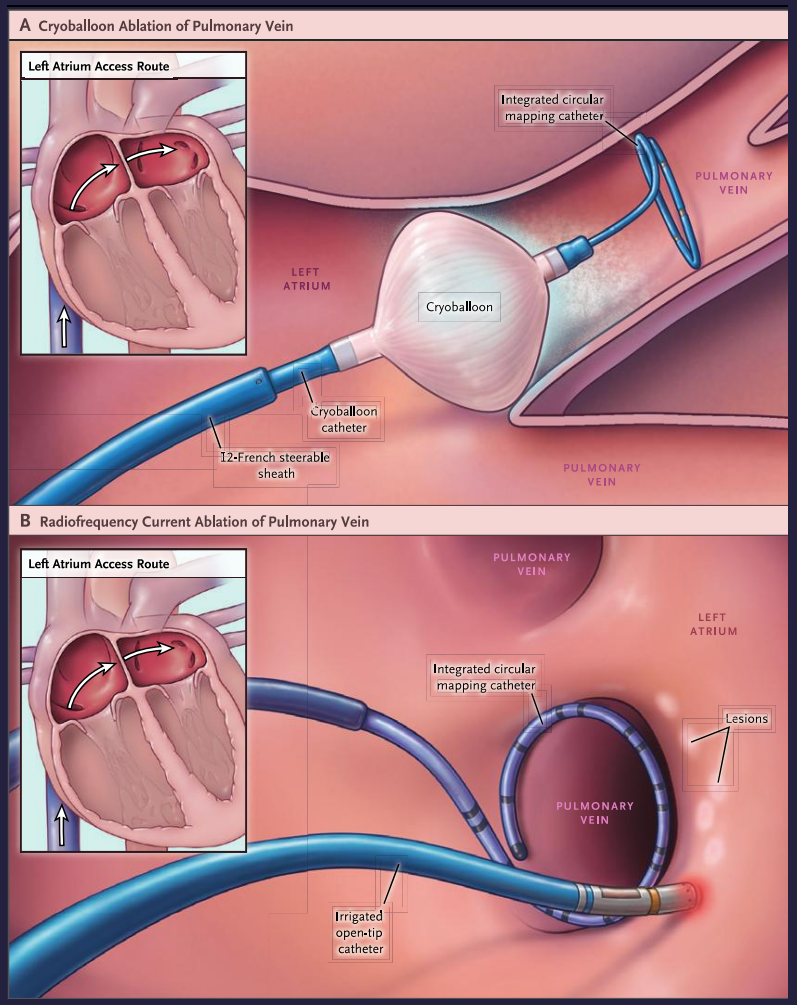


The 1st-generation vs the 2nd - generation cryoballoon ablation catheters



Aryana Aet al. JCE 2015; 26:832-839

Fire and ICE Trial



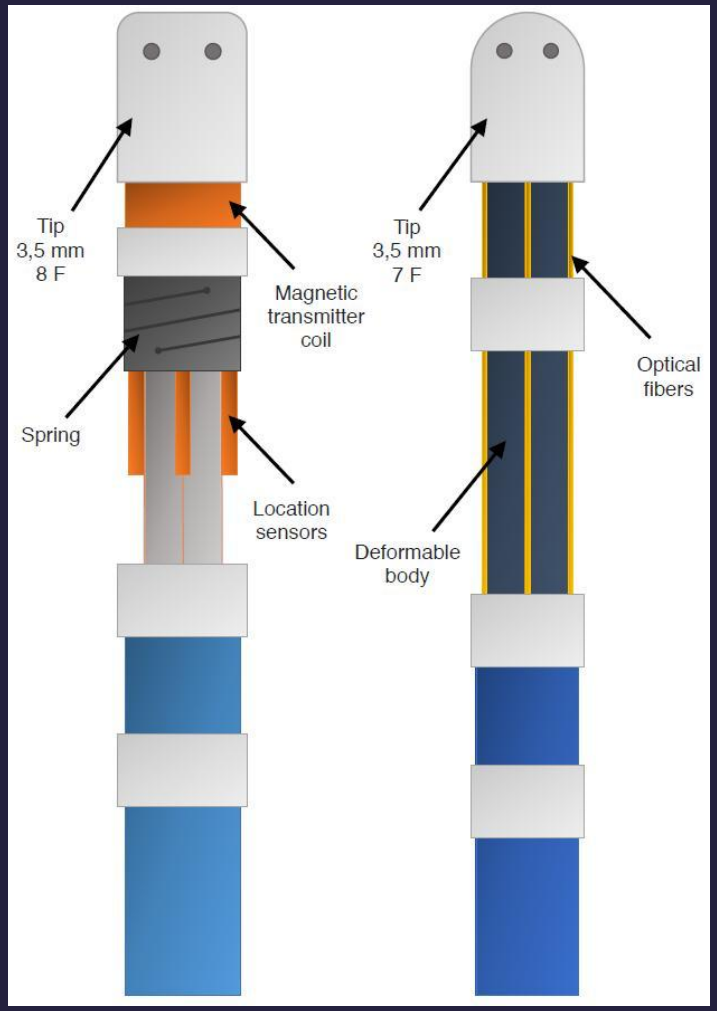
Kuck KH et al. N Engl J Med 2016;374:2235-45.

FIRE AND ICE
Safety

End Point	Radiofrequency Group (N=376)	Cryoballoon Group (N=374)	P Value*
	no. of patients (%)		
Primary safety end point†	51 (12.8)‡	40 (10.2)‡	
Death from any cause§	0	2 (0.5)¶	0.50
Stroke or TIA from any cause§	2 (0.5)	2 (0.5)	1.00
Atrial arrhythmia§‖	13 (3.5)	8 (2.1)	0.38
Atrial flutter or atrial tachycardia	10 (2.7)	3 (0.8)	0.09
Non–arrhythmia-related serious adverse events§	36 (9.6)	28 (7.5)	0.36
Groin-site complication**	16 (4.3)	7 (1.9)	0.09
Unresolved phrenic nerve injury††			
At discharge	0	10 (2.7)	0.001
At 3 months	0	2 (0.5)	0.25
At >12 months	0	1 (0.3)	0.50
Cardiac tamponade or pericardial effusion	5 (1.3)	1 (0.3)	0.22
Pulmonary or bronchial complication	4 (1.1)	2 (0.5)	0.69
Transient neurologic complication	3 (0.8)	1 (0.3)	0.62
Dyspnea	2 (0.5)	1 (0.3)	1.00
Gastrointestinal complication	2 (0.5)	1 (0.3)	1.00
Other, nonarrhythmia cardiac complications‡‡	0	3 (0.8)	0.12
Anxiety	0	1 (0.3)	0.50
Contrast media reaction	1 (0.3)	0	1.00
Contusion	1 (0.3)	0	1.00
Esophageal ulcer	0	1 (0.3)	0.50
Hematuria	1 (0.3)	0	1.00
Local edema	1 (0.3)	0	1.00
Atrioesophageal fistula	0	0	—
Pulmonary vein stenosis	0	0	—

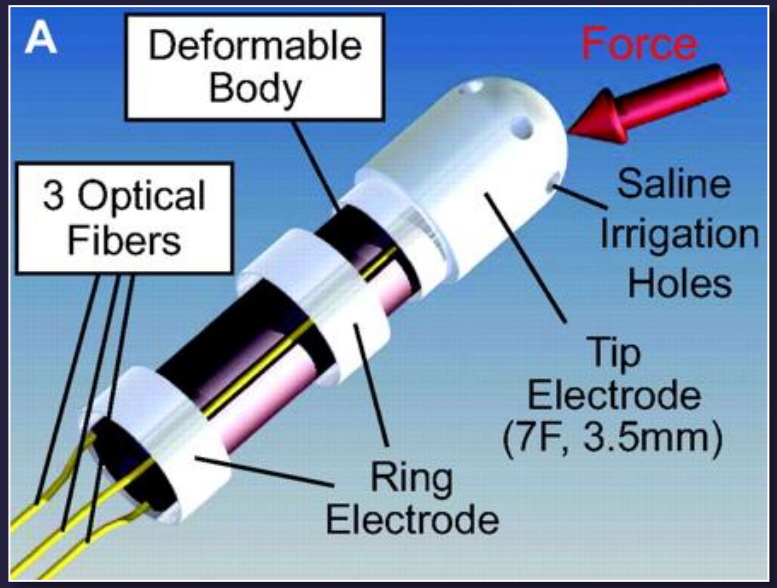
Kuck KH et al. N Engl J Med 2016;374:2235-45.

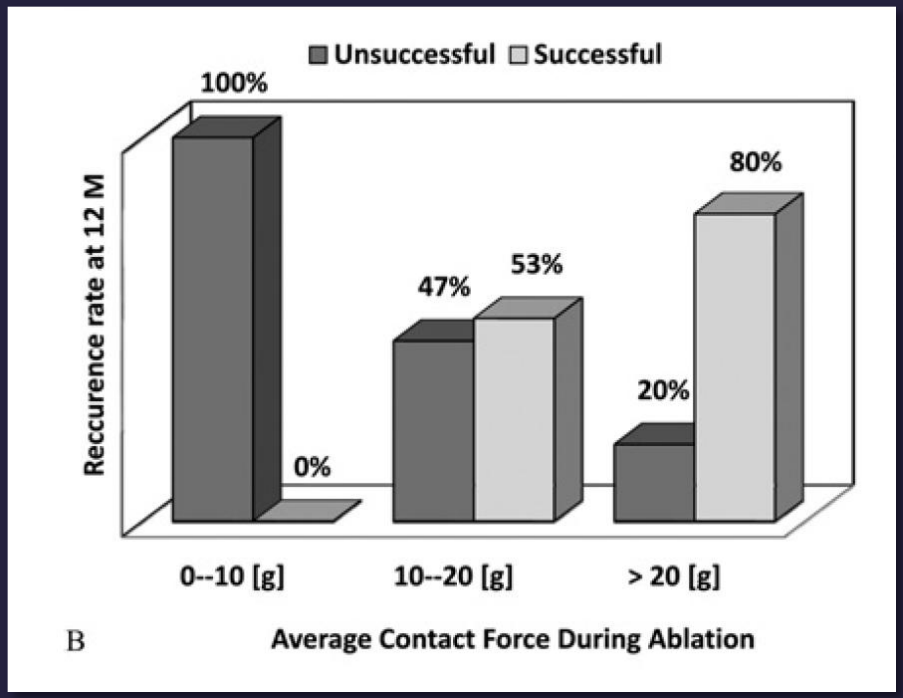
Electromagnetic (SmartTouch) vs fiber-optic (TactiCath Quartz) contact force catheters



Bourier F et al. J Cardiovasc Electrophysiol. 2016 Sep 22. [Epub ahead of print]

Contact Force

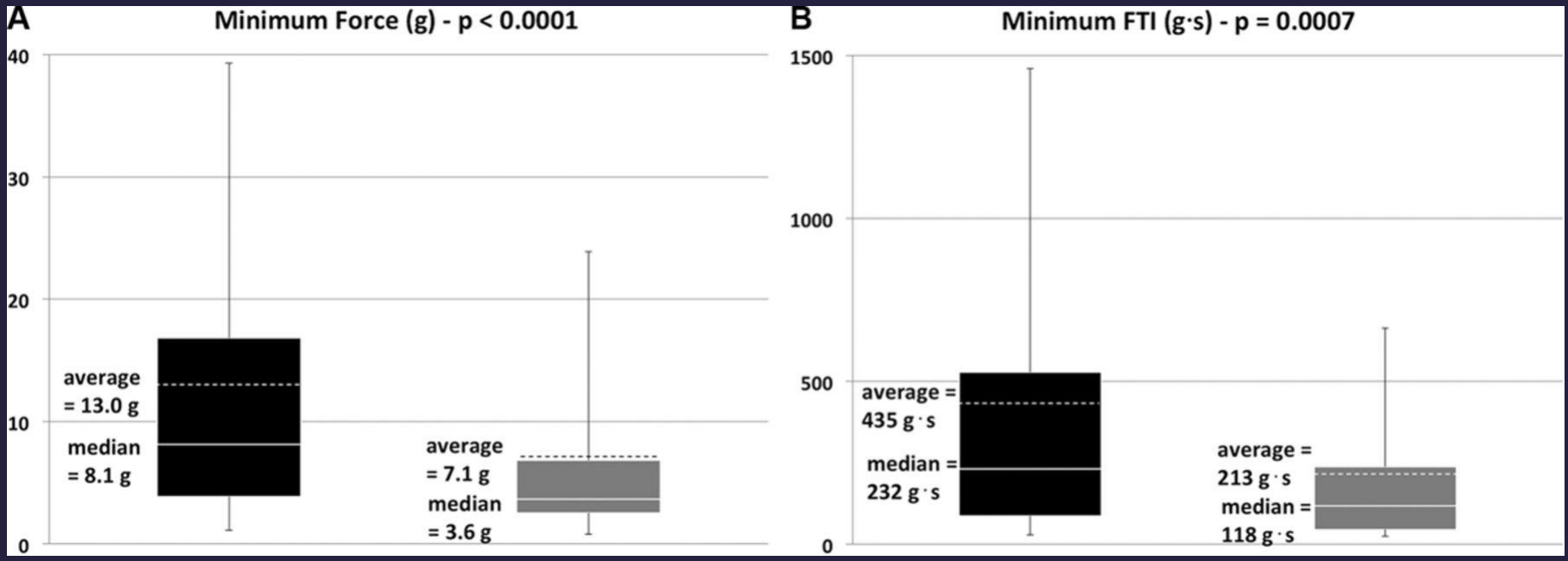




Technological Advances
Improved outcomes
Improved sustainability
Improved safety

Reddy VY et al. Heart Rhythm 2012; 9:1789 -1795

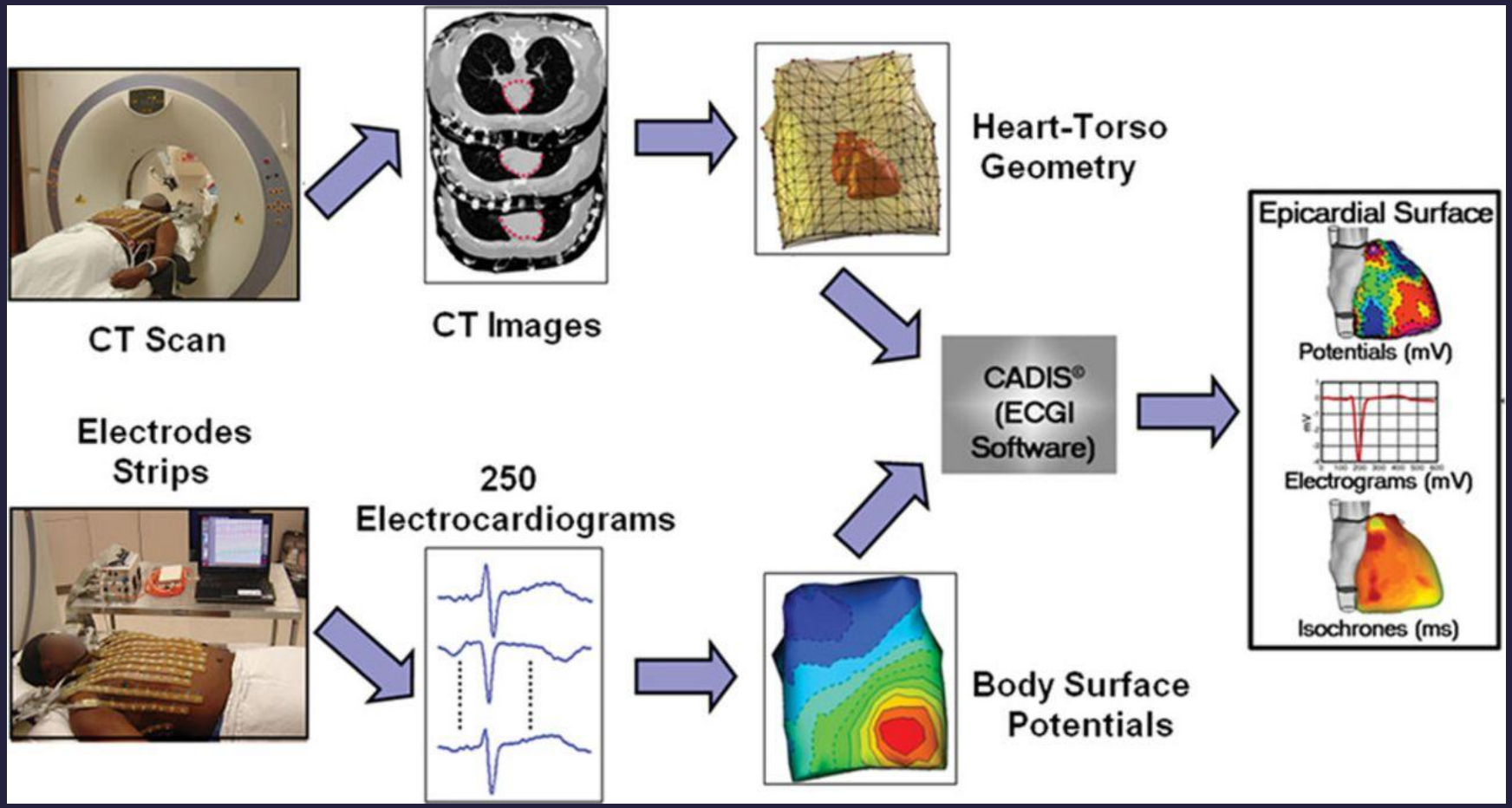
Force parameters discriminators for segments with isolation vs gaps (EFFICAS I)



successful ablations gaps successful ablations gaps

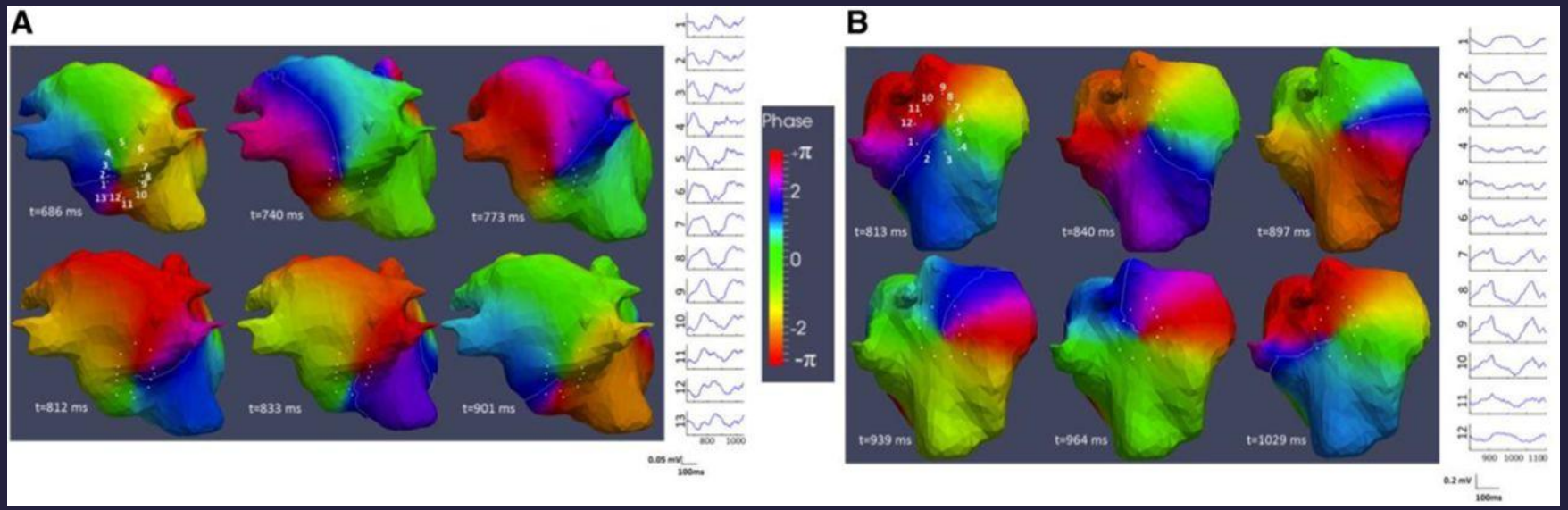
Neuzil P et al. Circ Arrhythm Electrophysiol. 2013;6:327-333

The electrocardiographic imaging (ECGI) procedure



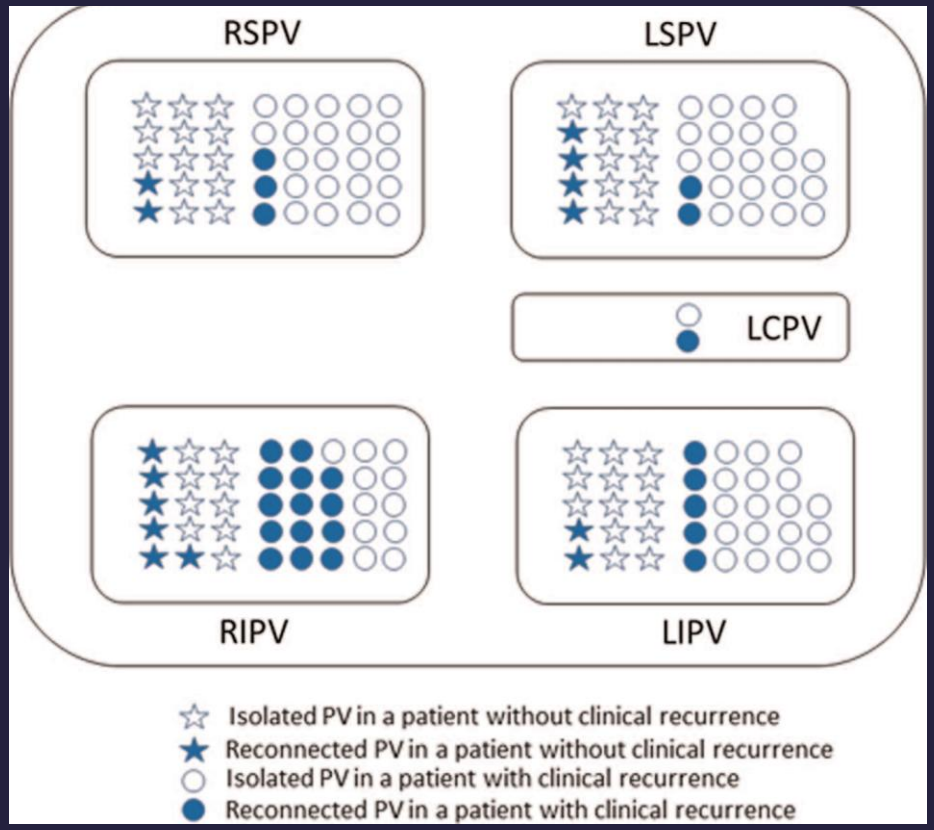
Yoram Rudy Circ Res. 2013;112:863-874

The phase maps of ≥1000-ms-long AF window show reentry events visualized intermittently in the right and left atria with their prephase electrograms on the right.



Haissaguerre M et al. Circulation. 2014;130:530-538

Evaluation of pulmonary veins during the 2nd procedure



- 158 PVs reevaluated at median of 6.0 months after the initial procedure.
- In total, reconnections detected in 39 PVs (24.7%) among 25 pts (62.5%).

Miyazaki S et al. Heart Rhythm. 2016 Sep;13(9):1852-7.

Reconnections vs Recurrence

	Recurrence (−)	Recurrence (+)	
N	15	25	*P* value
Period from initial procedure (months)	7.0 [5.0–9.0]	6.0 [3.5–9.0]	.314
No. of reconnected PVs			
Total	14/60 (23.3%)	25/98 (25.5%)	.758
LSPV	4/15 (26.7%)	2/23 (8.7%)	.138
LIPV	2/15 (13.3%)	5/23 (21.7%)	.513
RSPV	2/15 (13.3%)	3/25 (12.0%)	.902
RIPV	6/15 (40.0%)	14/25 (56.0%)	.327
LCPV		1/2 (50.0%)	

- No significant difference between those with and those without clinical recurrences with regard to:
  - clinical characteristics, procedural results, incidence of reconnections (25/98 vs 14/60, p = .758)
- The most common gap: RIPV bottom in both groups
- Non-PV foci (with AF initiation) identified in 10 of 25 patients with clinical recurrences (during 2nd procedure)

Miyazaki S et al. Heart Rhythm. 2016 Sep;13(9):1852-7.

One-size-fits-all?