

Approccio all'alcolizzazione del Marshall nell'era della PFA

Come sta cambiando il trattamento e come potrebbe evolversi

ANDREA ROSSI

Fondazione Toscana G.Monasterio Pisa/Massa



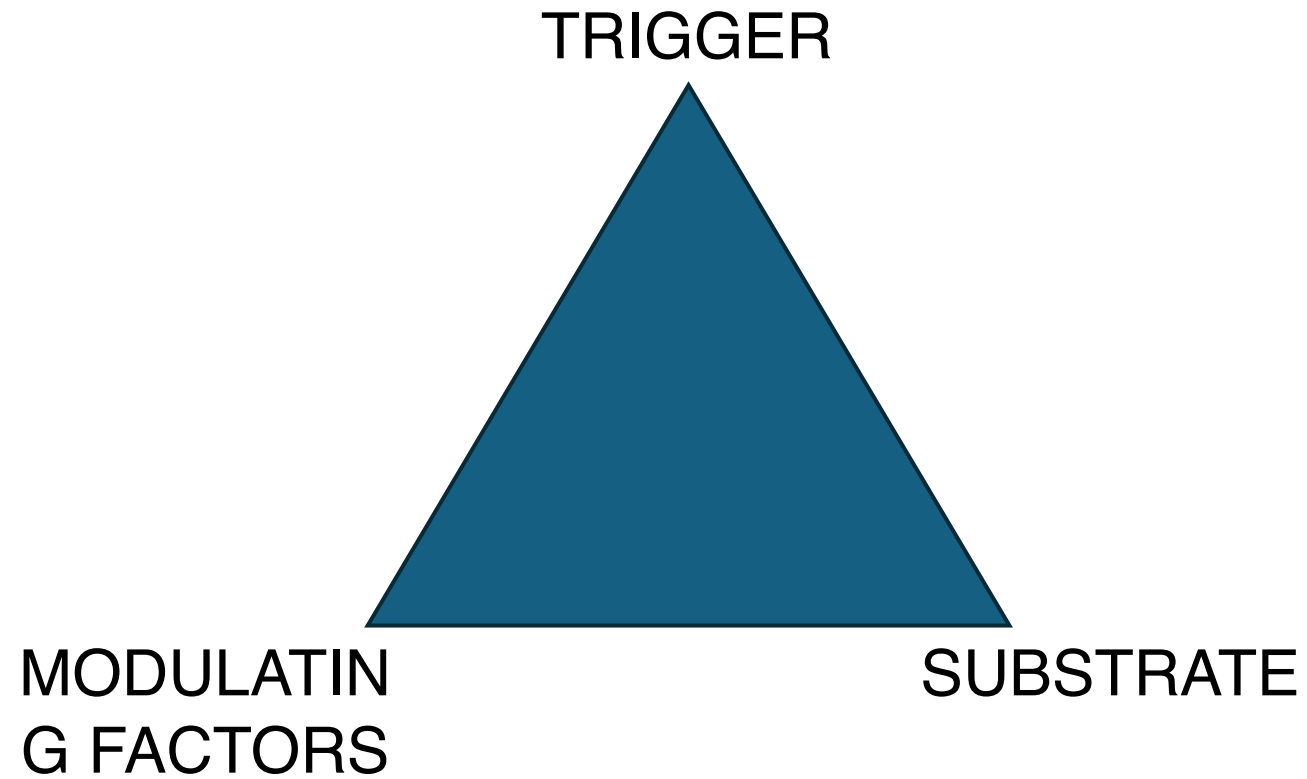
No disclosures.



The HOLY GRAIL about Ablation Technology

- Effectiveness
- Safety
- Low cost
- Fast

ABLATION THERAPY of AF

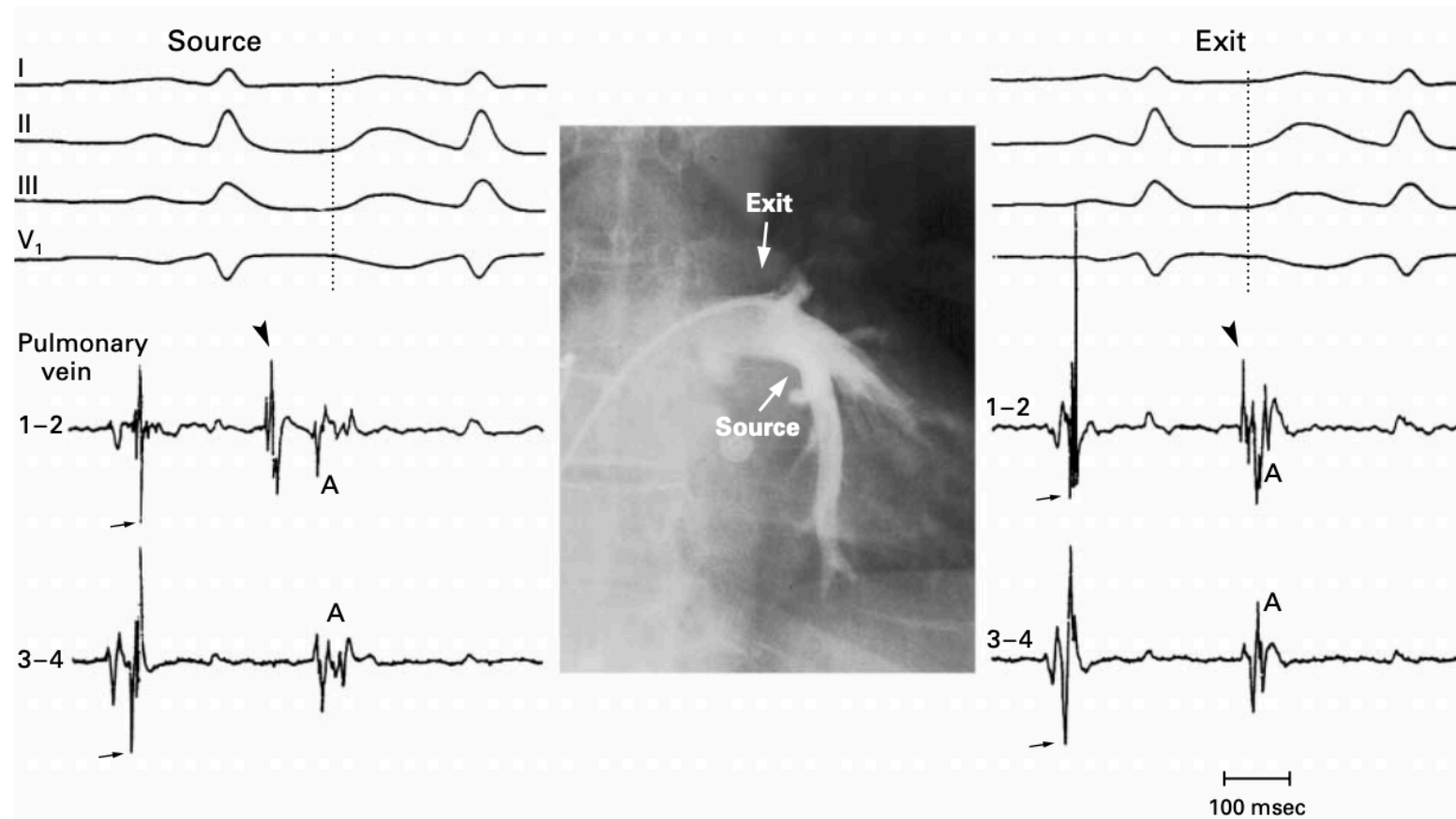


Philippe Coumel
1935-2004

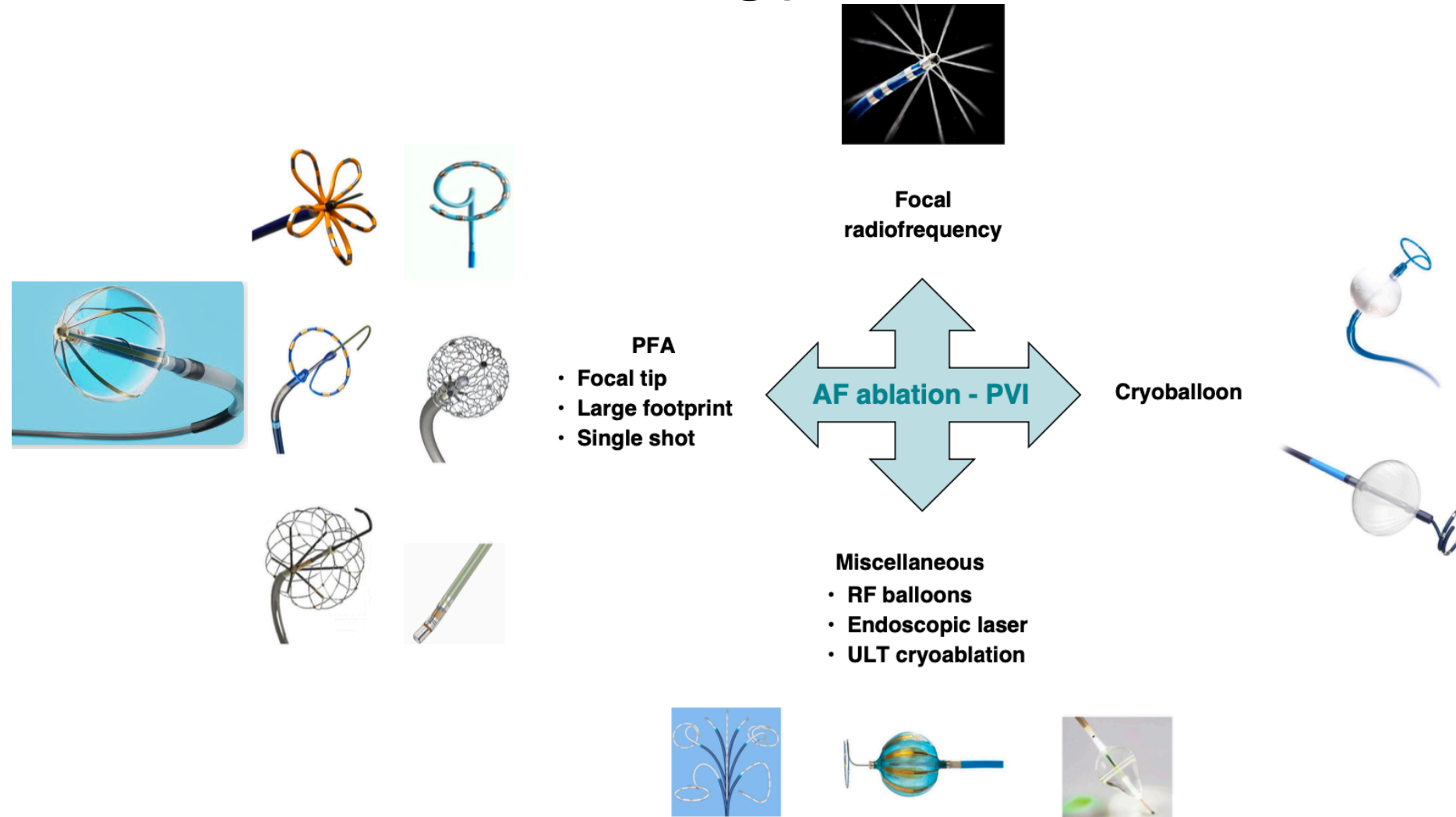
SPONTANEOUS INITIATION OF ATRIAL FIBRILLATION BY ECTOPIC BEATS ORIGINATING IN THE PULMONARY VEINS

**SPONTANEOUS INITIATION OF ATRIAL FIBRILLATION BY ECTOPIC BEATS
ORIGINATING IN THE PULMONARY VEINS**

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GILLES QUINIOU, M.D., STÉPHANE GARRIGUE, M.D., ALAIN LE MOUROUX, M.D., PHILIPPE LE MÉTAYER, M.D.,
AND JACQUES CLÉMENTY, M.D.

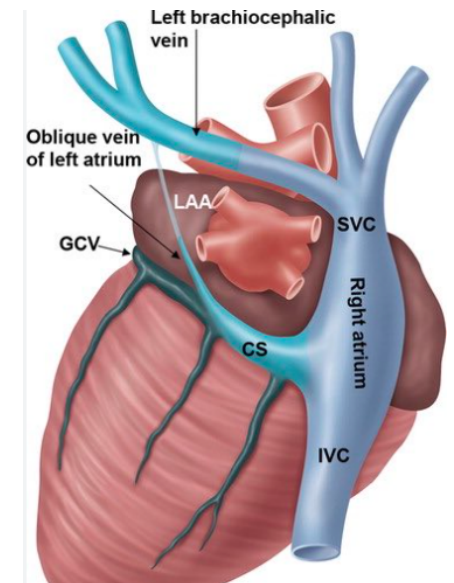
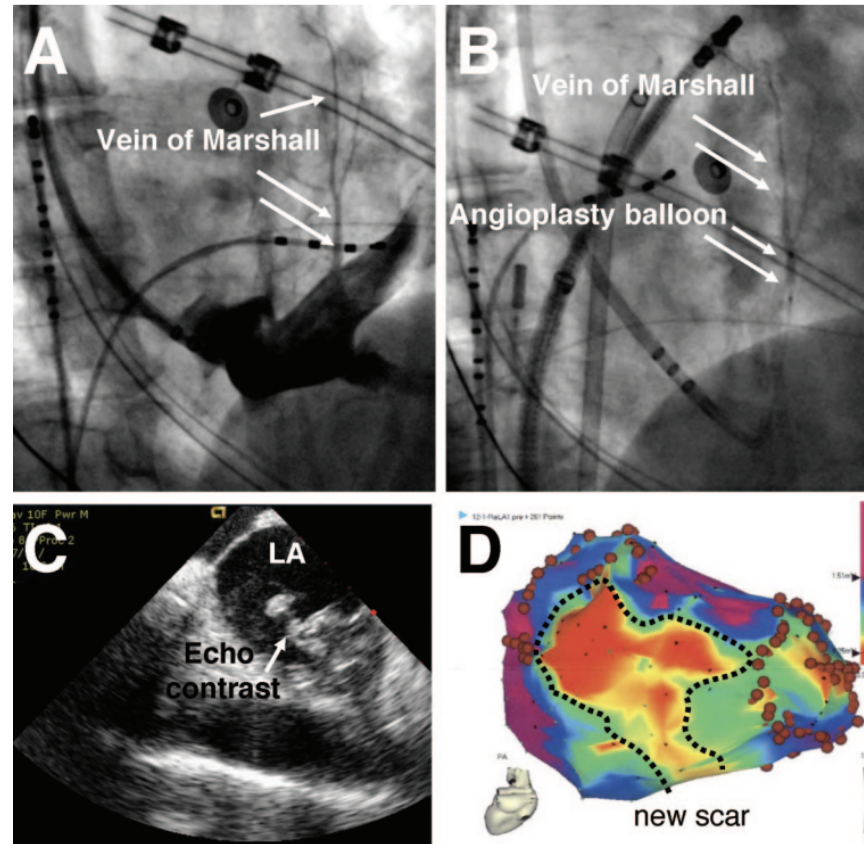


Devices and Energy for PVI ablation



Vein of Marshall Alcohol Ablation

«Ethanol infusion in the VOM achieves significant left atrial tissue ablation, abolishes local vagal responses, and is feasible in humans.»



Vein of Marshall fits with «Coumel Triad»

- ✓ Atrial myocardial tissue surrounding VoM supports focal activities or stable reentries priming AF or stable arrhythmias
- ✓ The epicardial region along the VoM contains autonomic parasympathetic and sympathetic innervation implicated in AF triggering
- ✓ VoM is involved as substrate in post-AF ablation tachycardias in the 30-40% of cases.

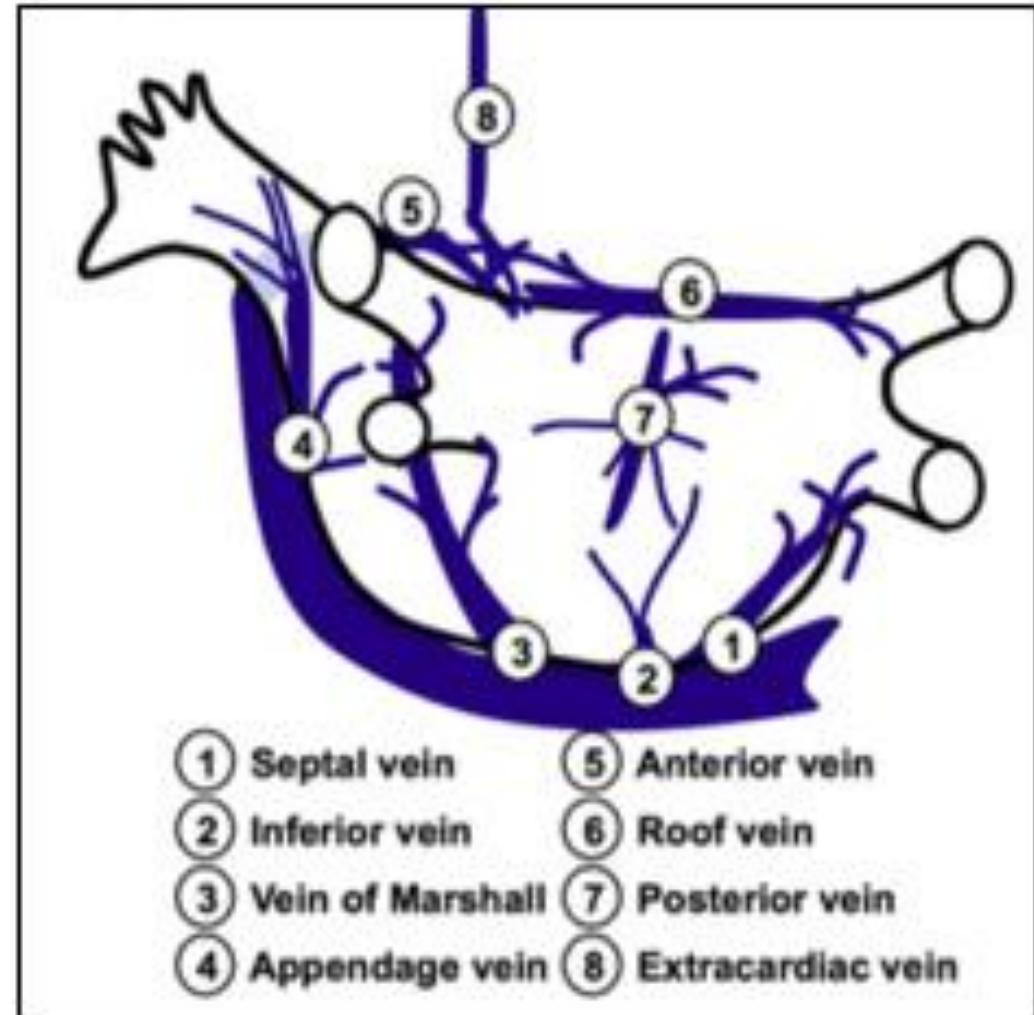
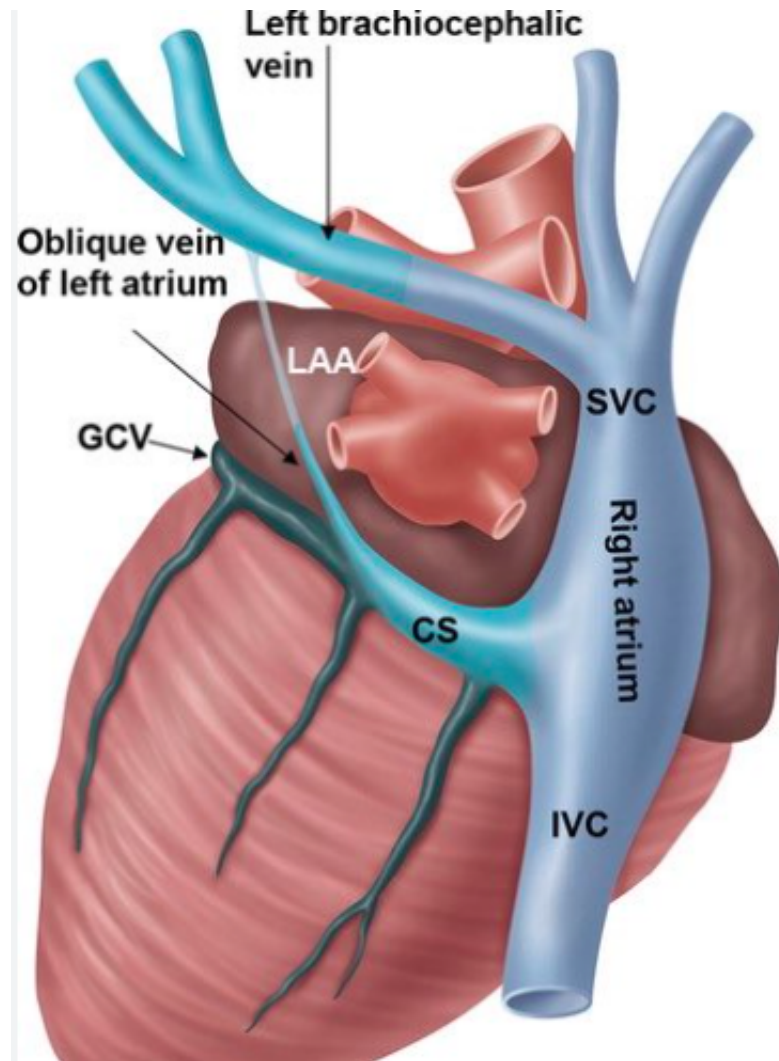
Rossi et al. Vein of Marshall Ethanol Infusion in Setting of Atrial Fibrillation Ablation DOI: <http://dx.doi.org/10.5772/intechopen.105593>

Lee SH et al. JACC 2005

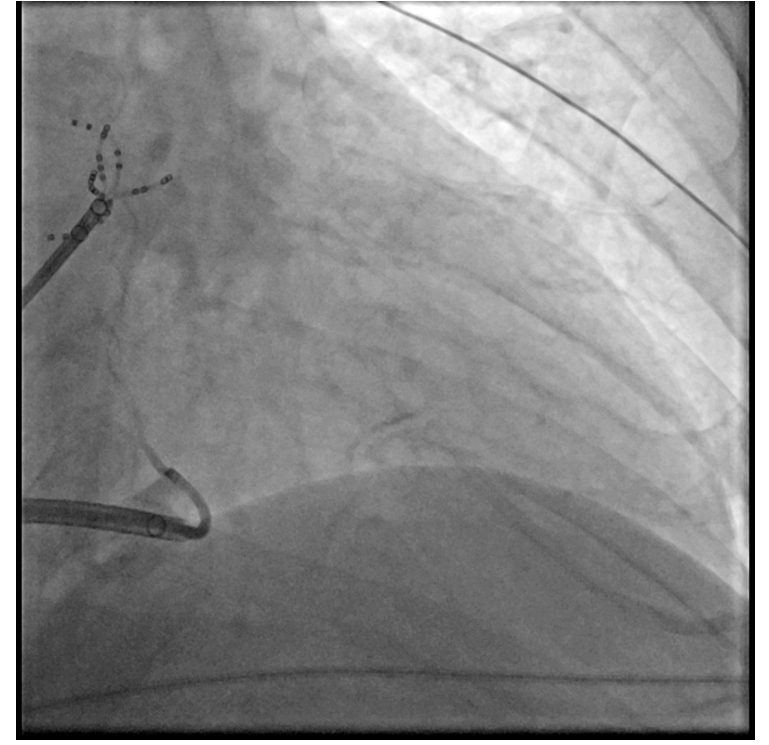
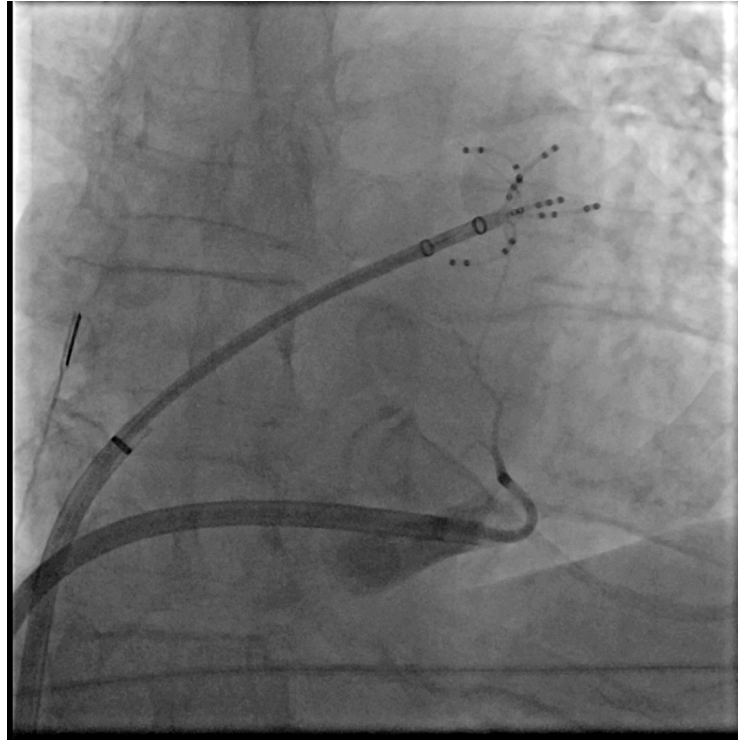
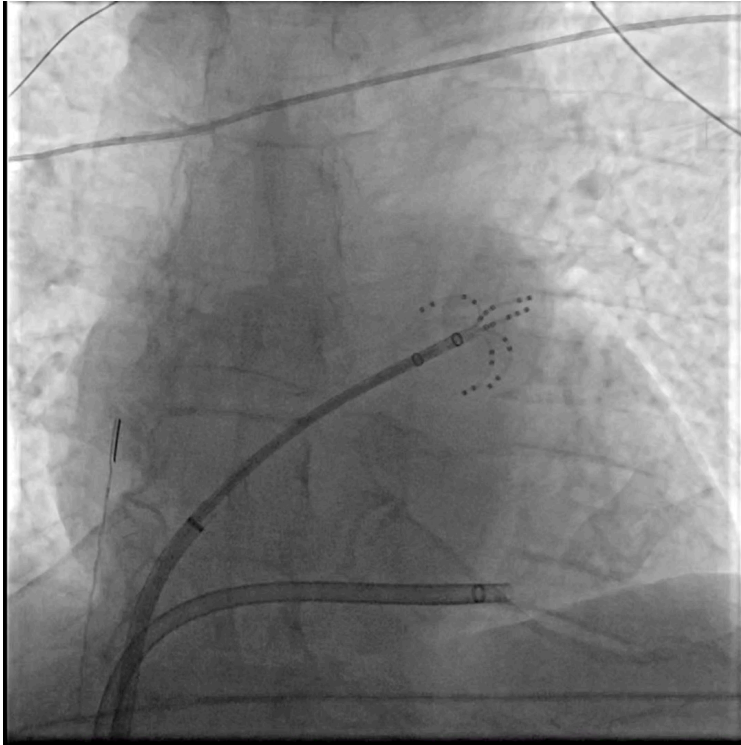
Baez-Escudero J et al. JACC 2014

Vlachos et al. Heart Rhythm 2019

VOM - Anatomy



Senography and VOM Mapping



VoM-EI and Contrast Staining Formation



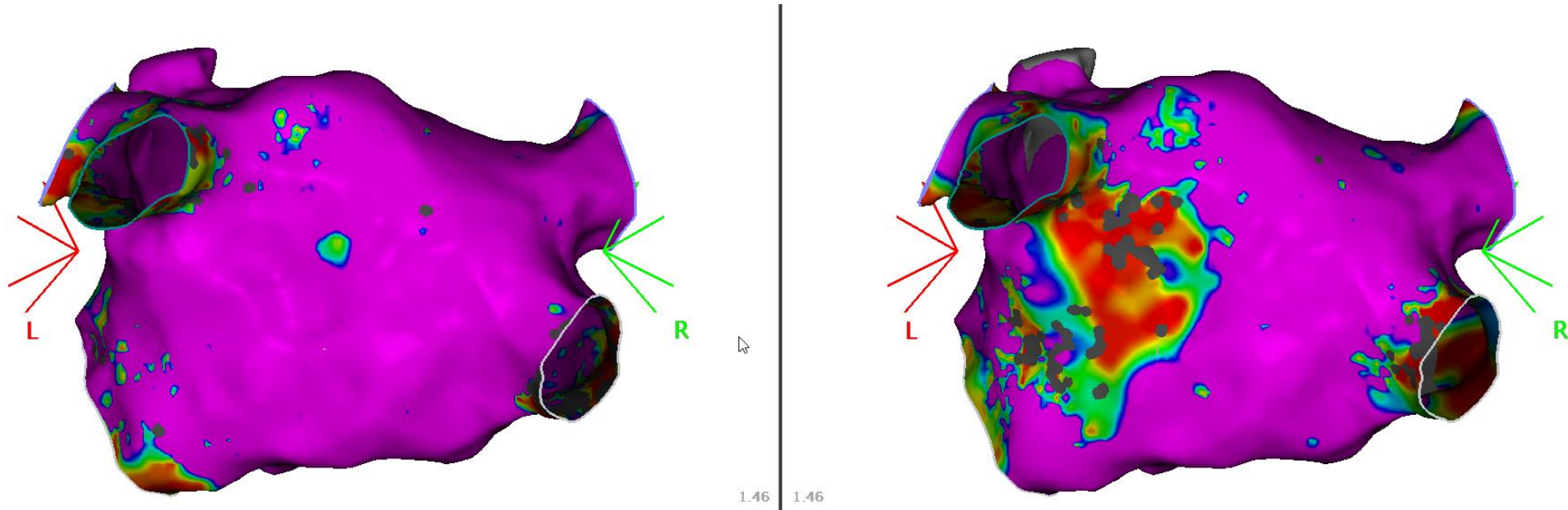
Ethanol 4 cc



Ethanol 10 cc

Bipolar voltage Remap

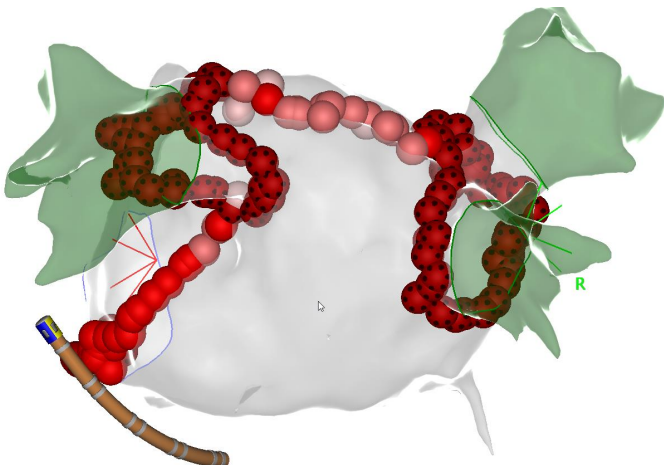
Newly-formed lesion after VoM-EI assessment



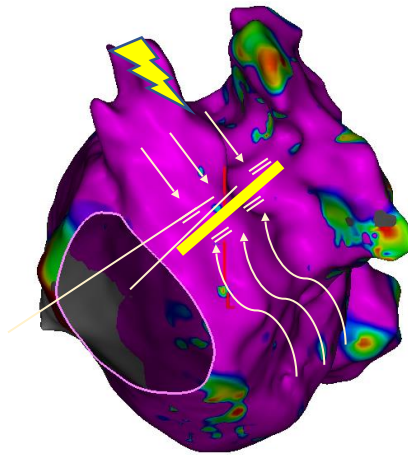
Bipolar LA map pre VOM-EI

Bipolar LA map post VOM-ETHO

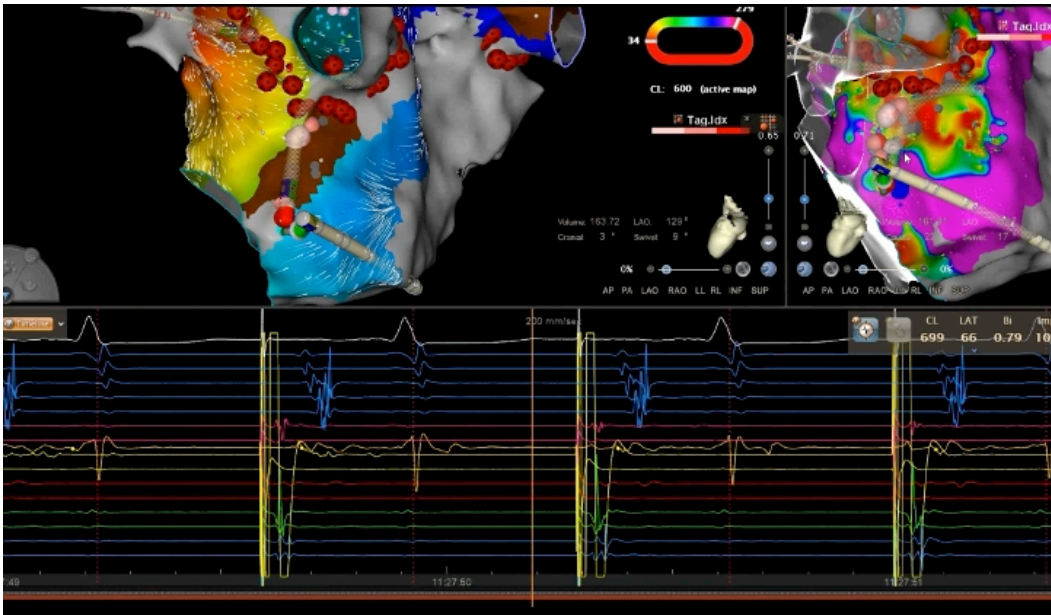
Bidirectional block validation across lines



PVI and lines creation



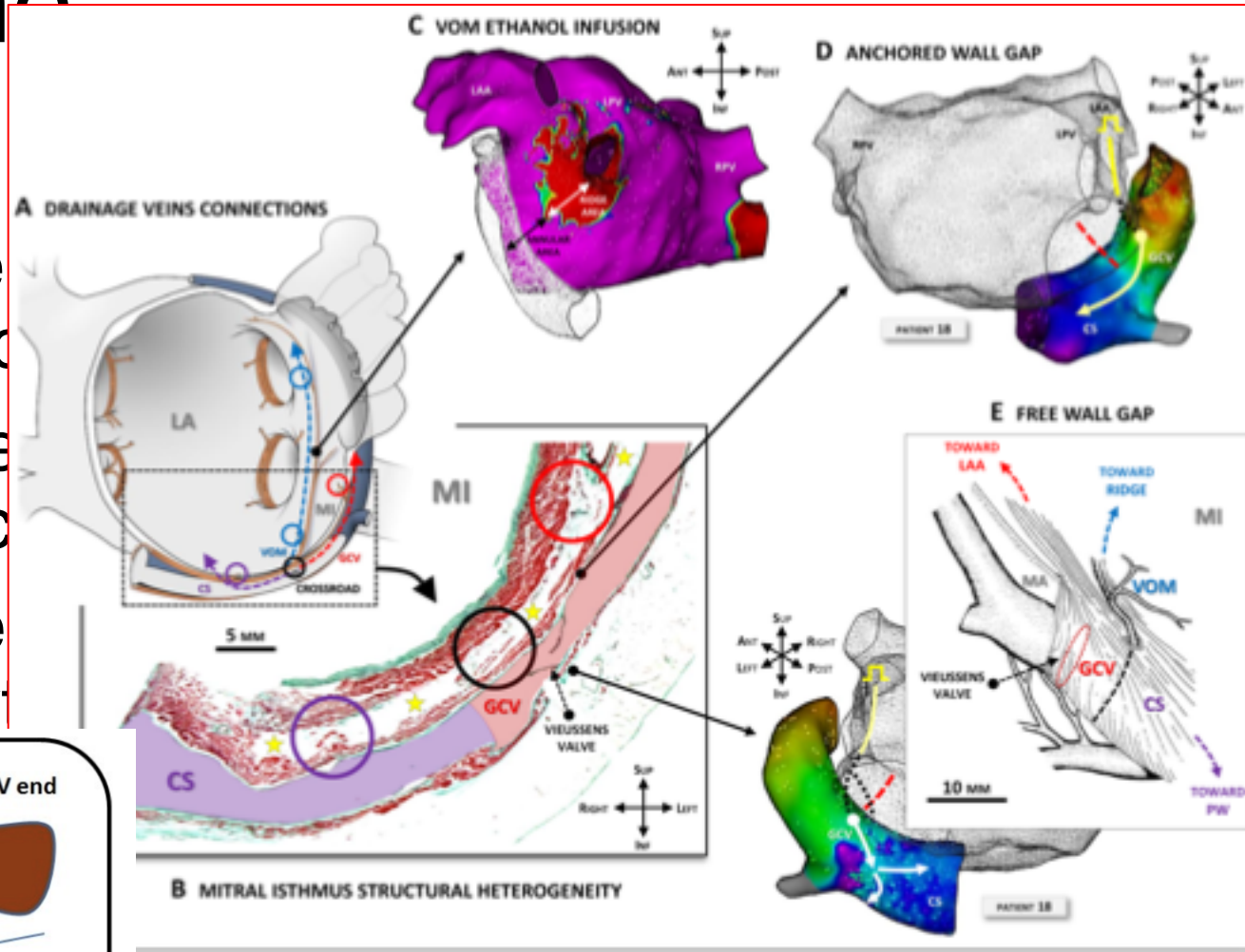
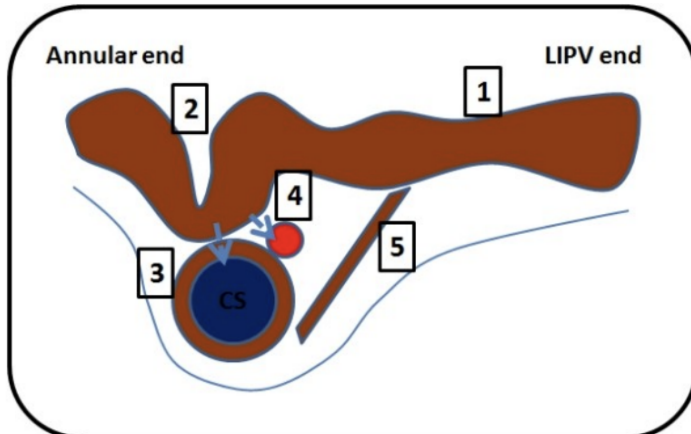
Lines validation during LAA pacing



Mitral block demonstration by
prox-to-dist CS activation
during LAA pacing

Mitral line

- Septal-ante
- interatrial co
- Anterior line
- normal mec
- ML in poste
- in sinus rhy



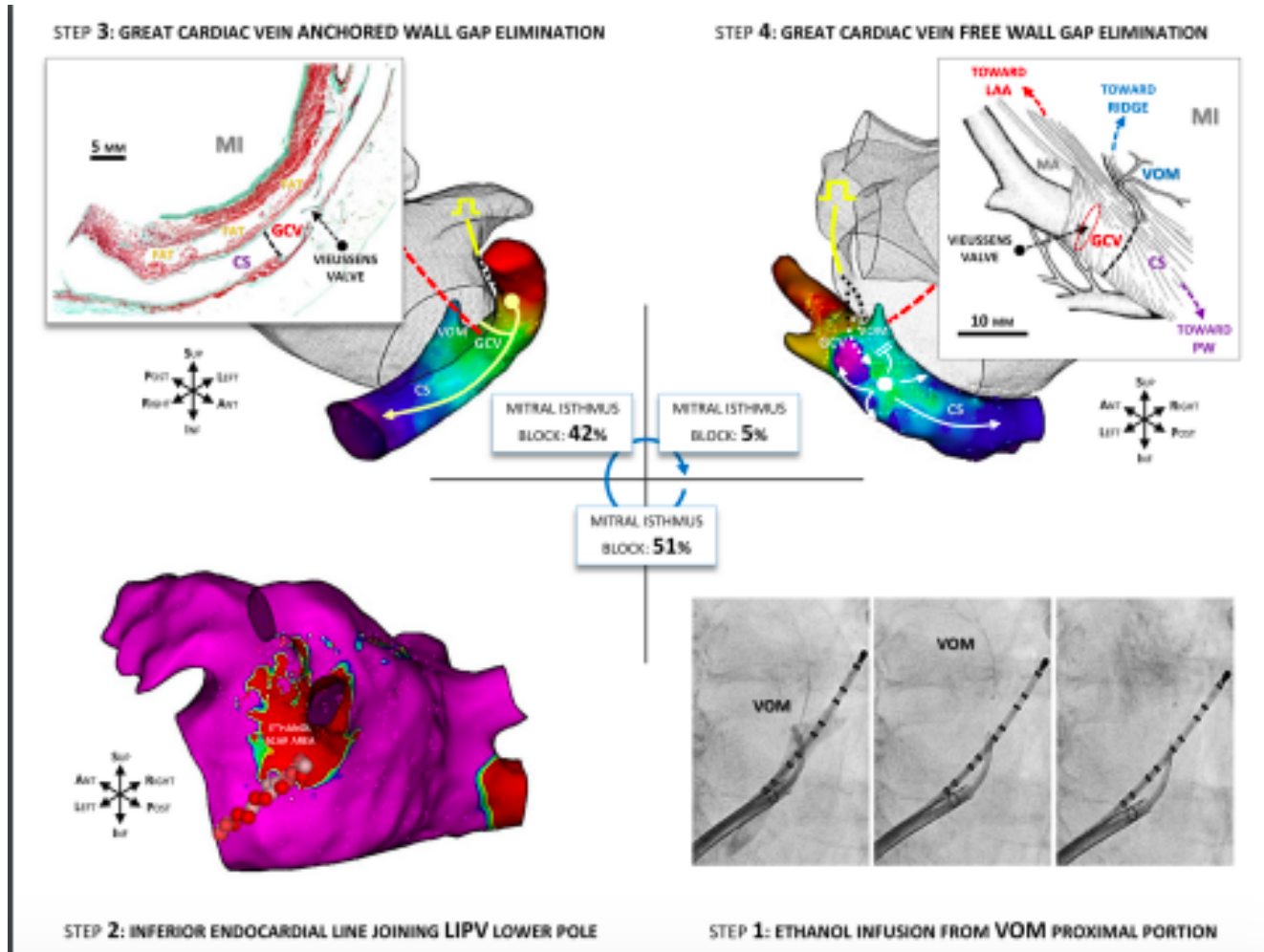
ue to
mpairment of
collision area

Pambrun, HR 2021

Wonk et al. Indian PEJ 2012

Mitral line completion after VOM-ETHO

Procedural steps



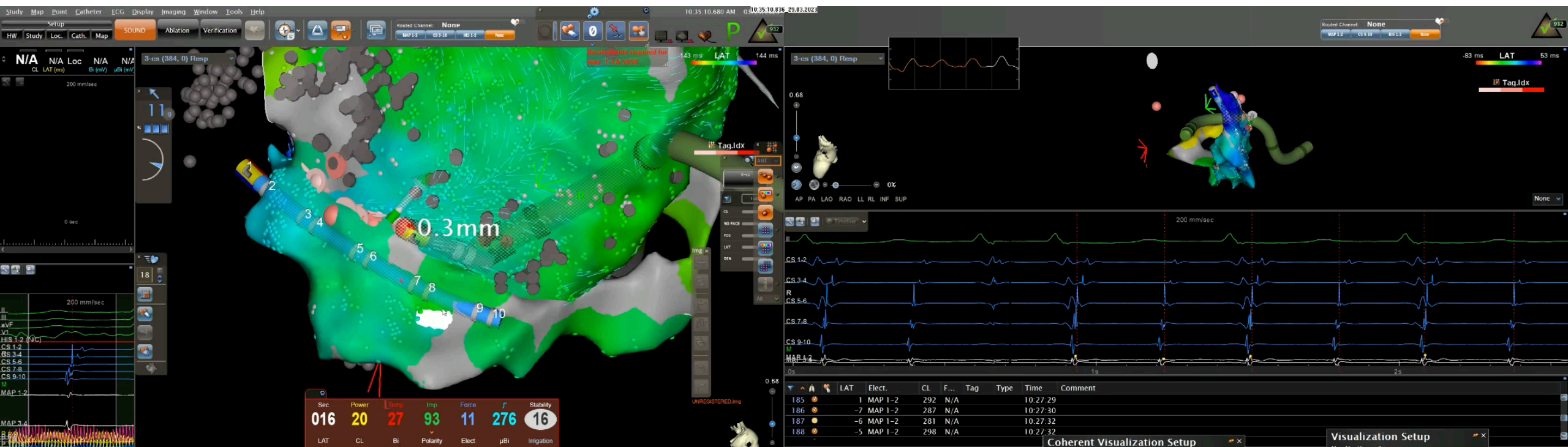
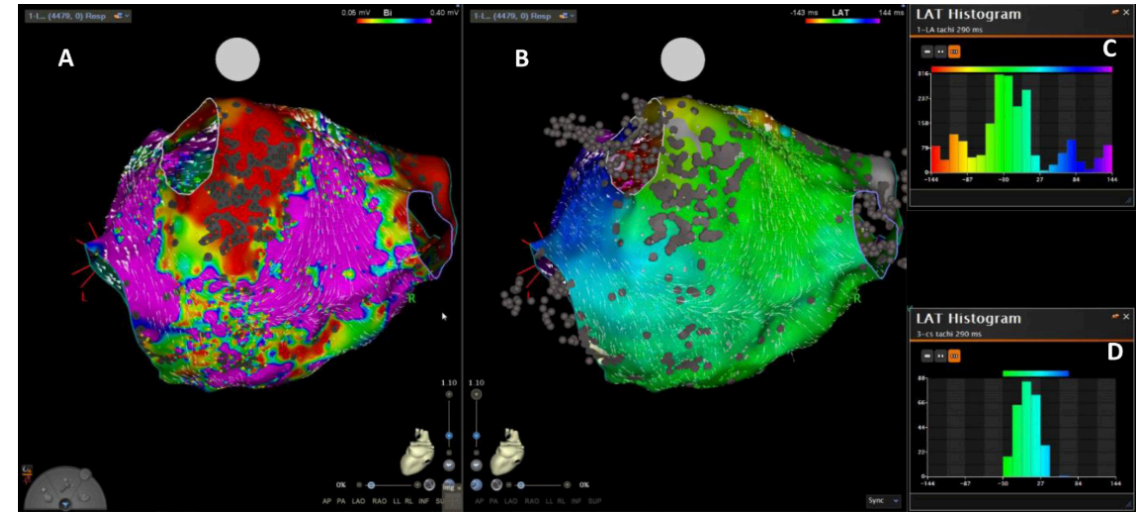
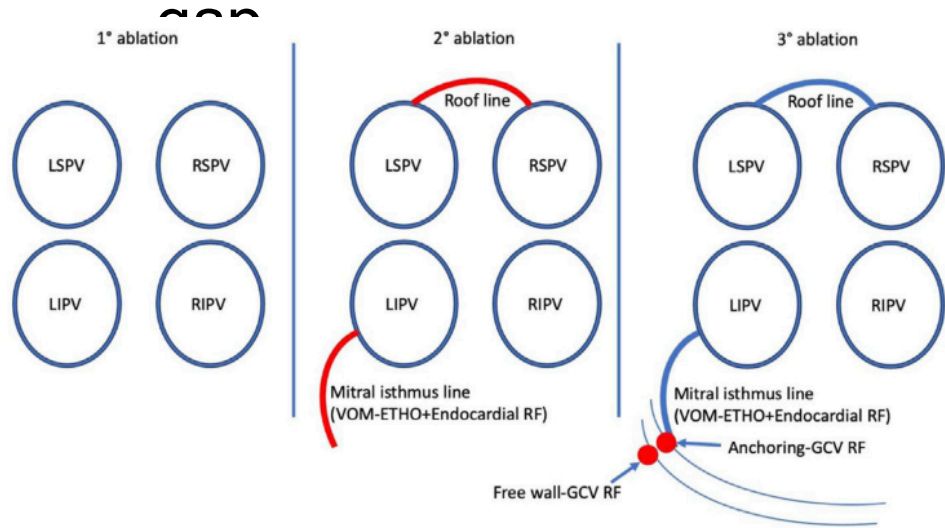
Post VOM-ETHO:

50%: ML done after endo lesions

42%: ML done after GCV-anchor lesions

5%: ML done after GCV free wall gaps elimination

Mitral Flutter Termination eliminating Anchor/Free Wall-GCV epicardial



Mitral Line block validation





Roderick Tung ✓

@DrRoderickTung



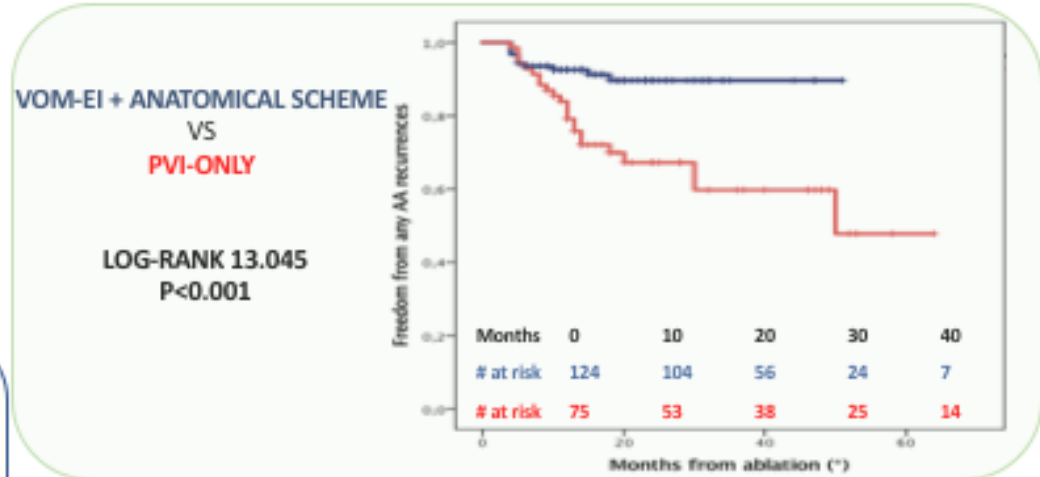
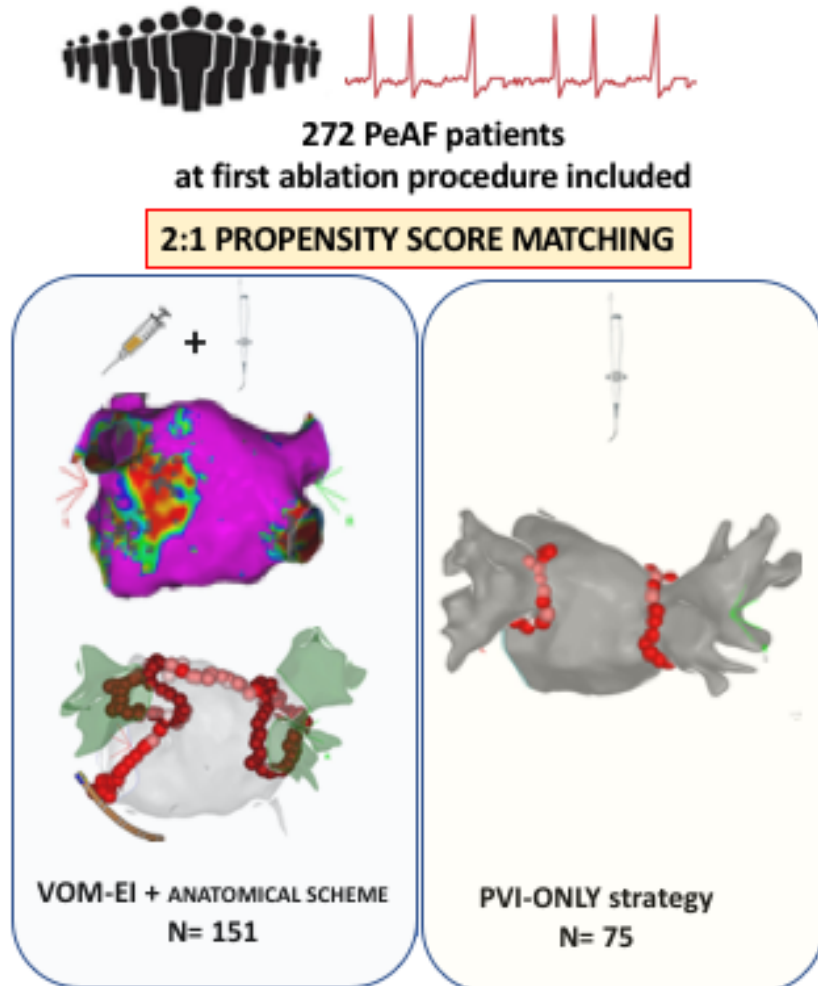
PVI+ is the one area where RCTs have been unable to supercede anecdotes – because operator bias is so powerful.

Only two randomized trials have shown efficacy beyond PVI (CONVERGE and VENUS), yet only a minority have adopted. And multiple PWI studies show no systematic benefit when applied widely, yet the majority continue to do so in persistent patients.

The time is ripe for personalization targeting individual mechanisms, as one size has been proven to not fit all.

VENUS, PROMPT-AF, MARSHALL-PLAN demonstrated an incremental benefit of VOM-alcohol combined with a predefined anatomical scheme in PeAF populations.

VOM-EI+anatomical ablation scheme in PeAF

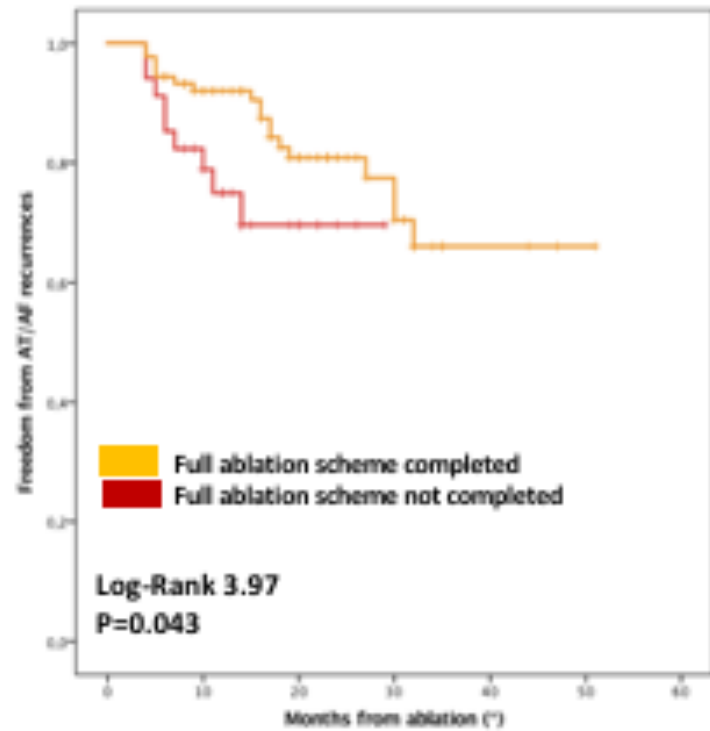


VOM-EI COHORT: KAPLAN-MEIER UNIVARIATE SURVIVAL ANALYSIS

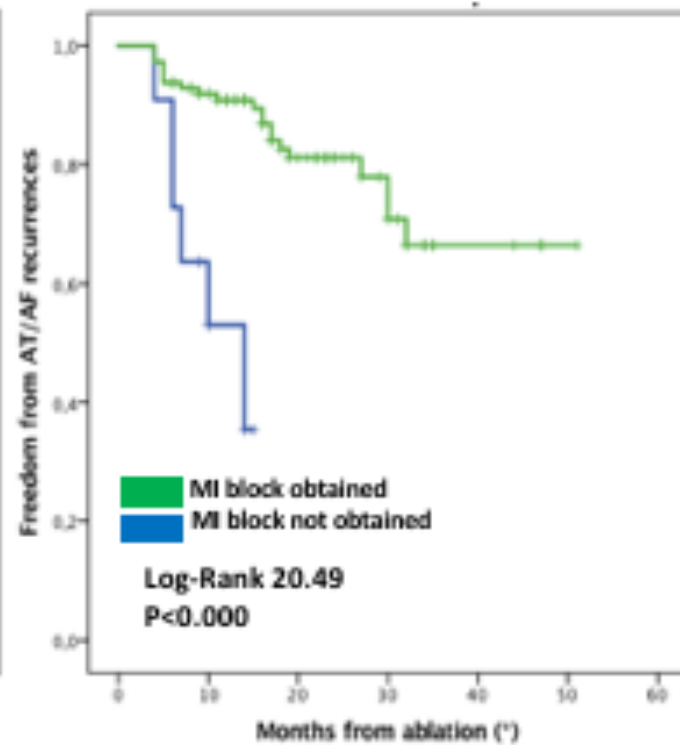
PREDICTOR	LOG-RANK	P-value
Bidirectional Mitral Block	20.49	0.000
Longlasting-PeAF duration Phenotype	4.32	0.039
Full Anatomical Scheme Validation	3.97	0.043

VOM-EI COHORT: MULTIVARIATE COX PROPORTIONAL HAZARD ANALYSIS

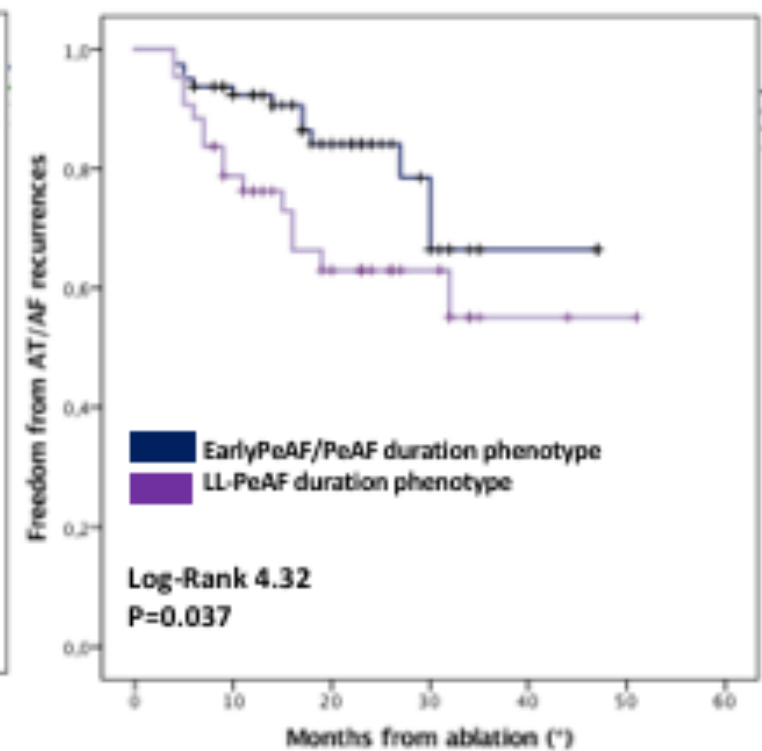
PREDICTOR	HR (P-value)	95% CI
Bidirectional Mitral Block	0.114 (<0.001)	0.041–0.321
Longlasting-PeAF duration phenotype	2.685 (0.012)	1.240–5.812



Months	10	20	30	40
Scheme completed	70	41	21	7
Scheme not completed	23	6	1	1



Months	10	20	30	40
MI block obtained	91	52	22	5
MI block not obtained	6	0	0	0



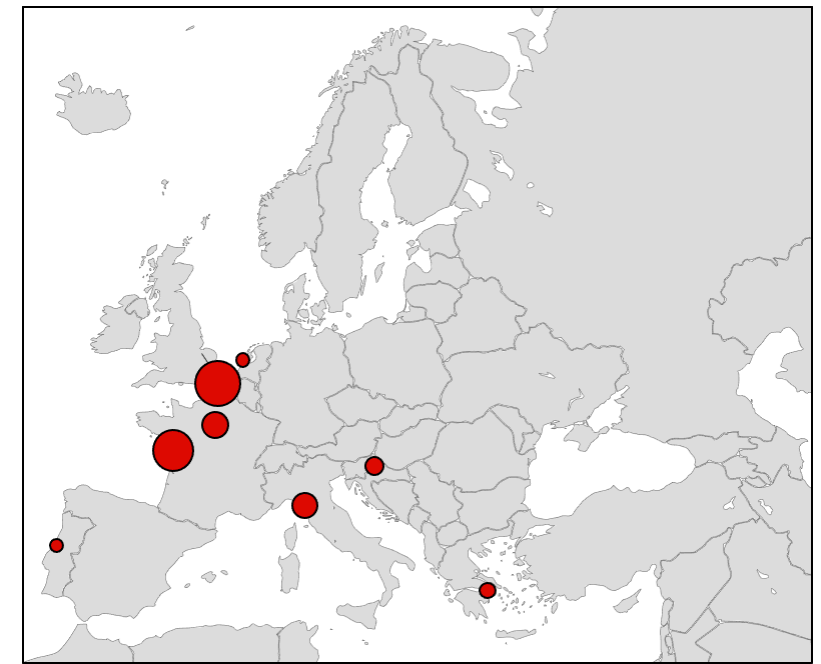
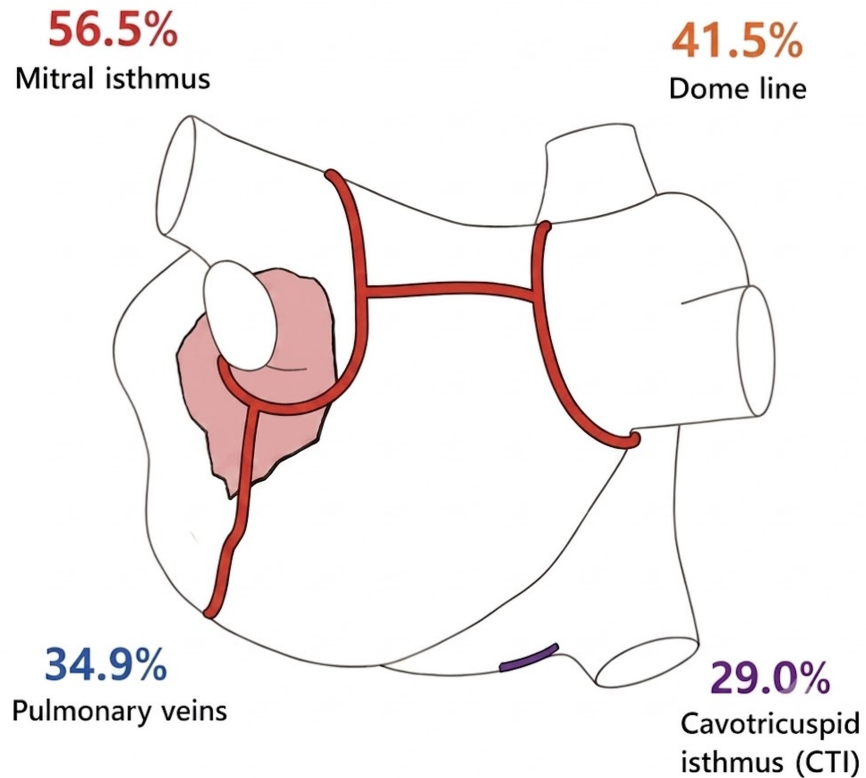
Months	10	20	30	40	50
EarlyPeAF/PeAF	66	34	13	3	0
LL-PeAF	31	18	9	2	1

Importance of **LESION SET COMPLETENESS** and
MITRAL LINE BIDIRECTIONAL BLOCK

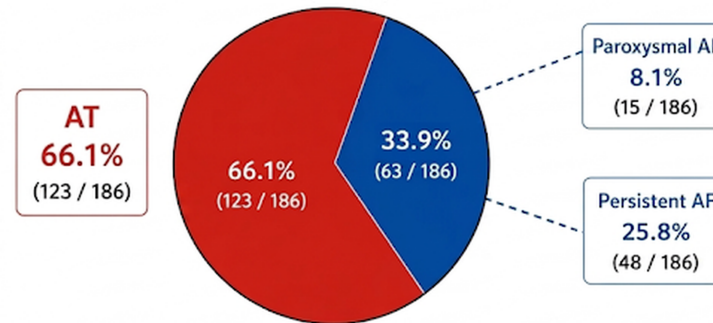
Late arrhythmic recurrences after VOMEI+anatomical ablation scheme in PeAF population.

REVOM Multicenter Registry.

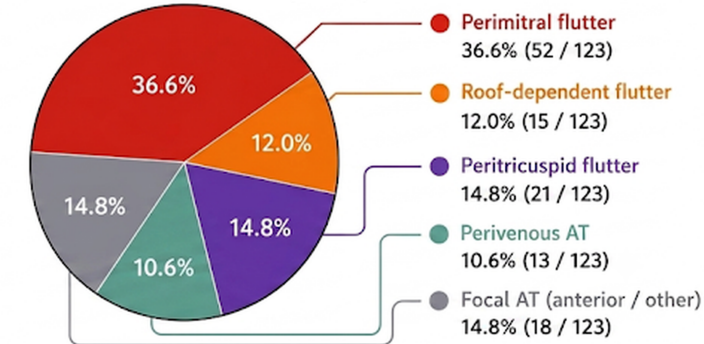
Site of conduction recovery
at repeat ablation (n = 186)



OVERALL ARRHYTHMIA PHENOTYPES AT RECURRENCE
(n = 186)

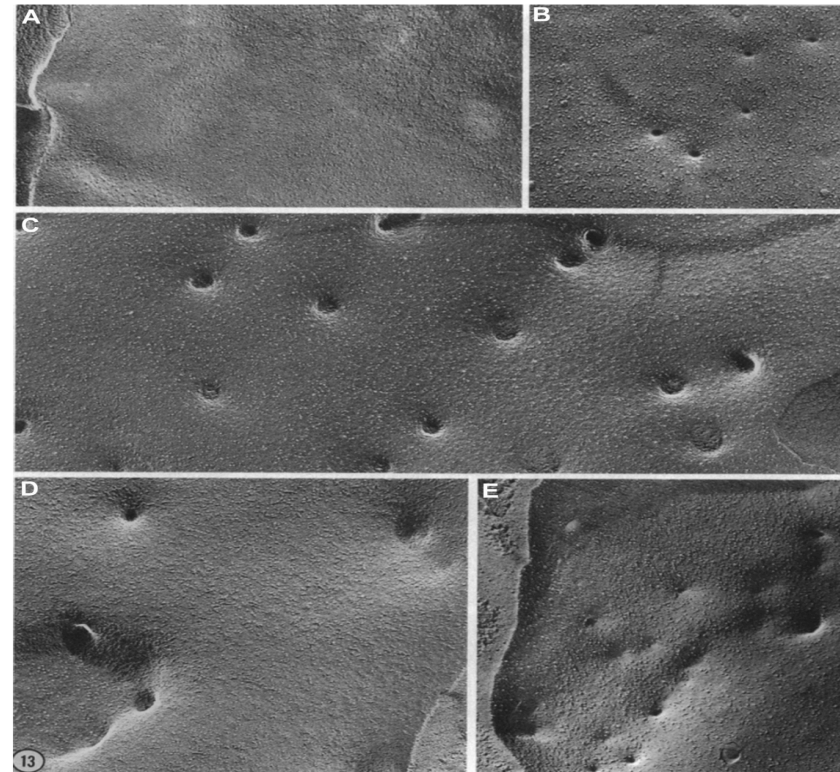
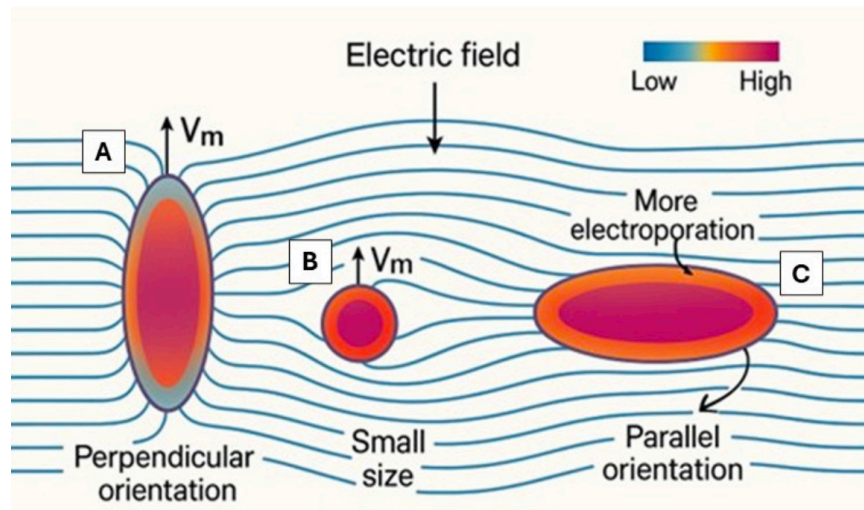
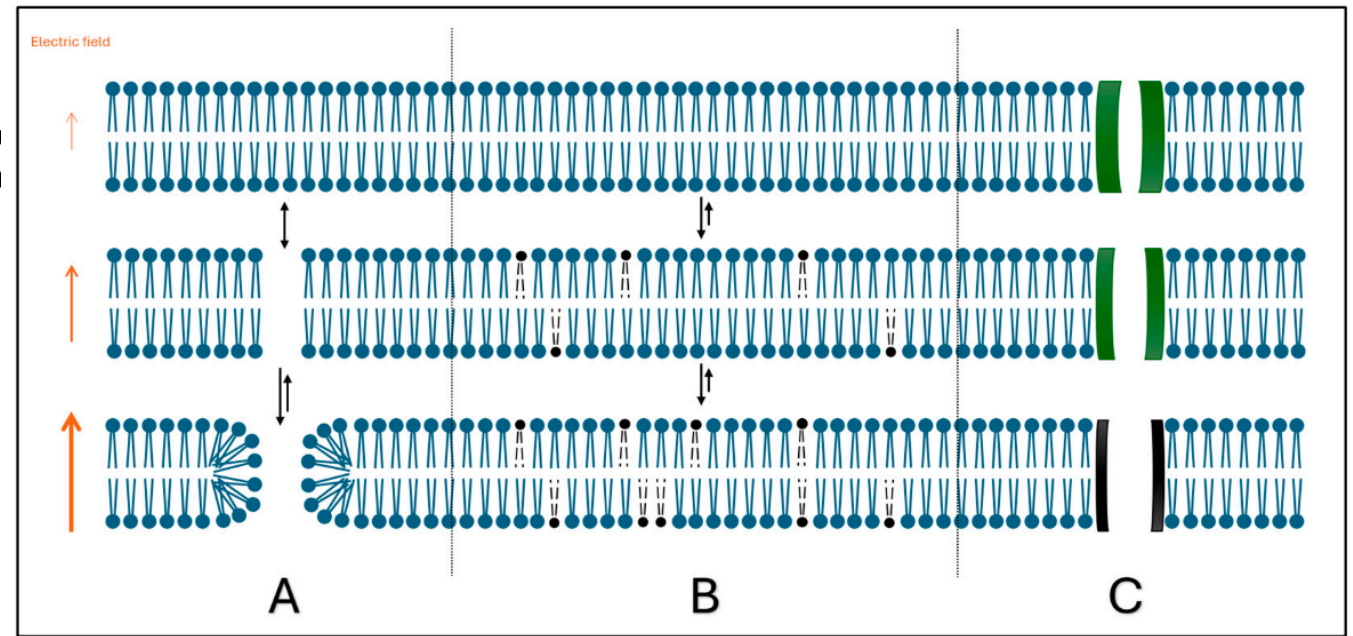
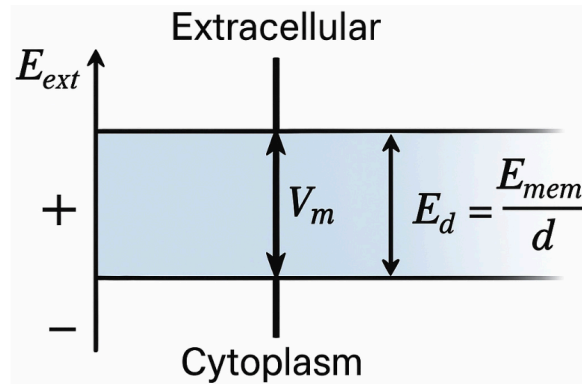


AT SUBTYPES AT RECURRENCE
(n = 123)

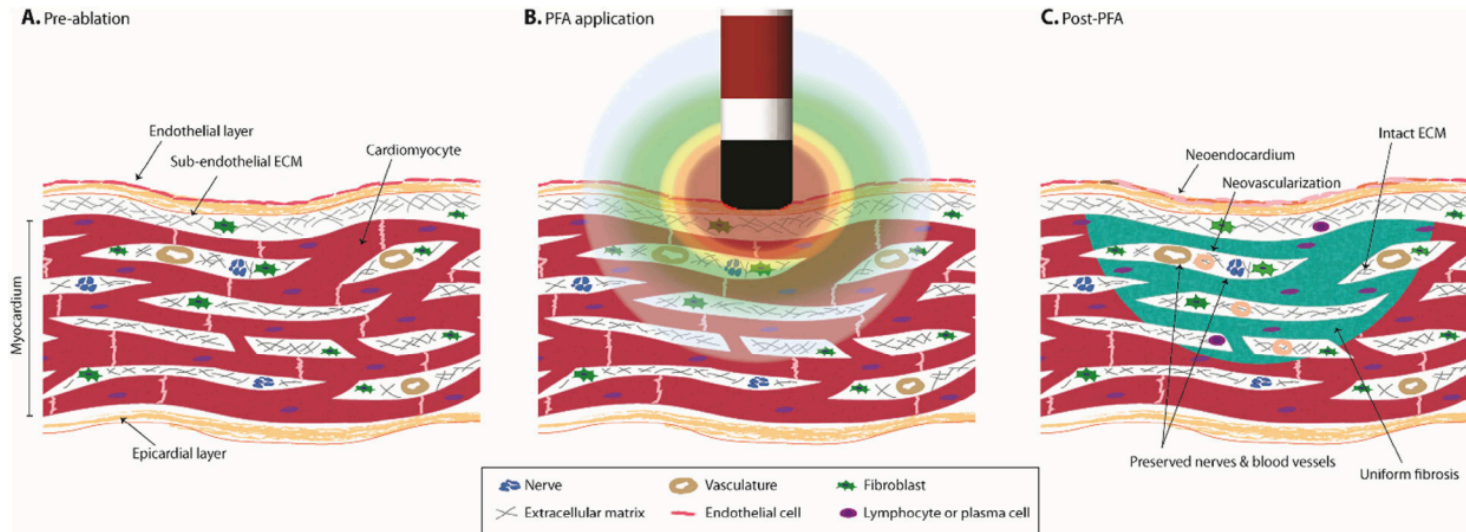
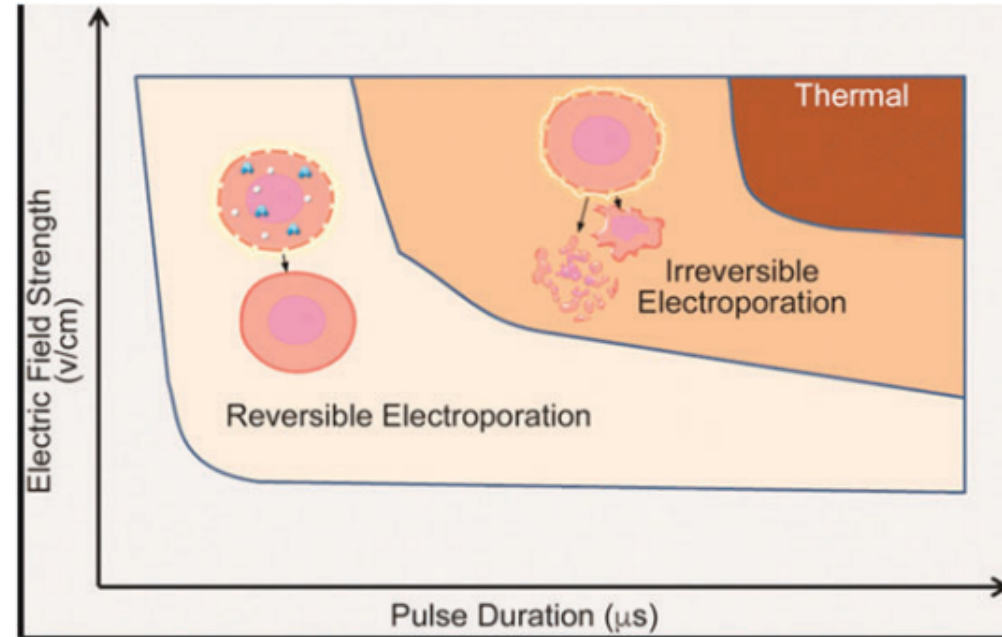
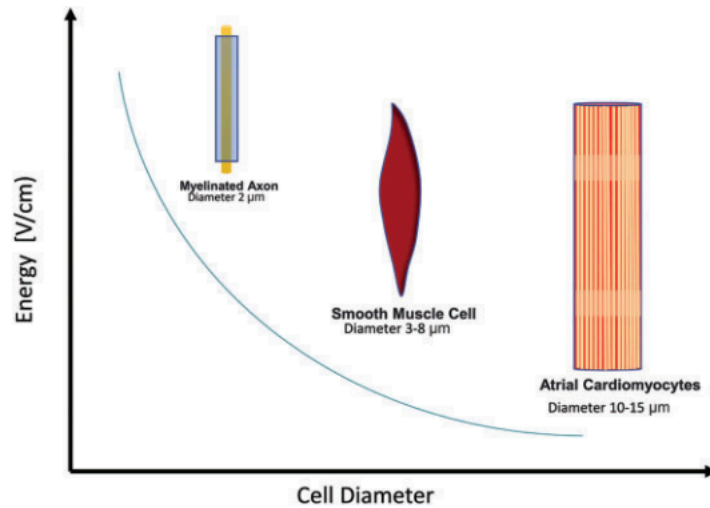


Submitted paper

Pulsed Field Ablative

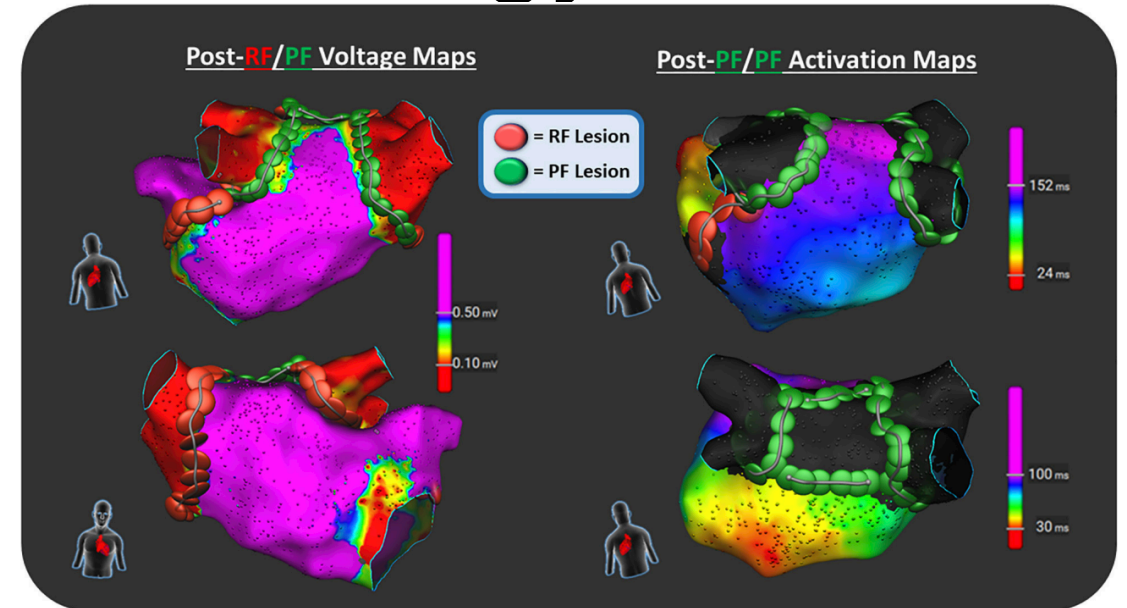
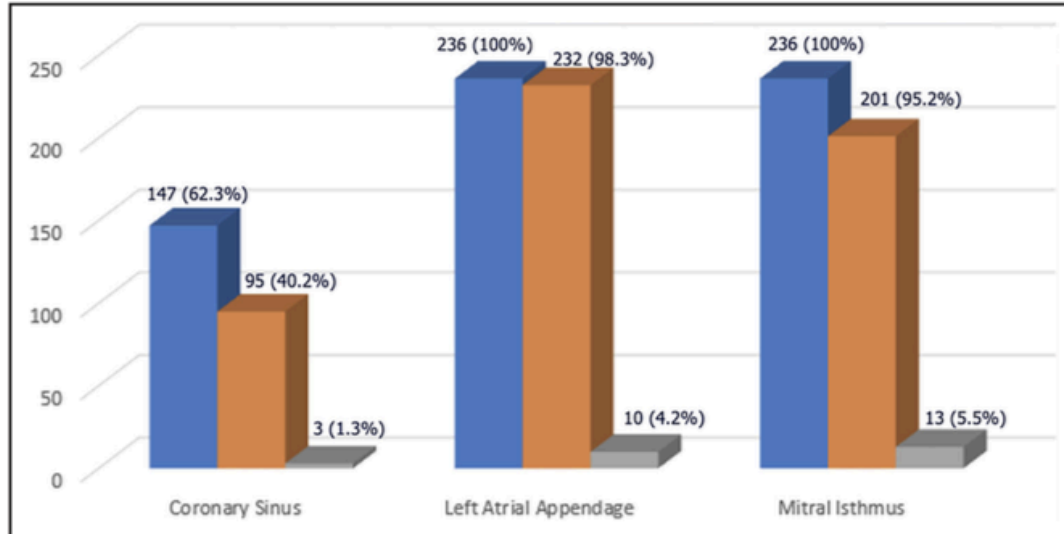


Pulsed Field Ablatic



Sugrue A, Europace
2022
Garfott K, PACE 2025

PFA-based «beyond PVI strategy»



Posterior Mitral line

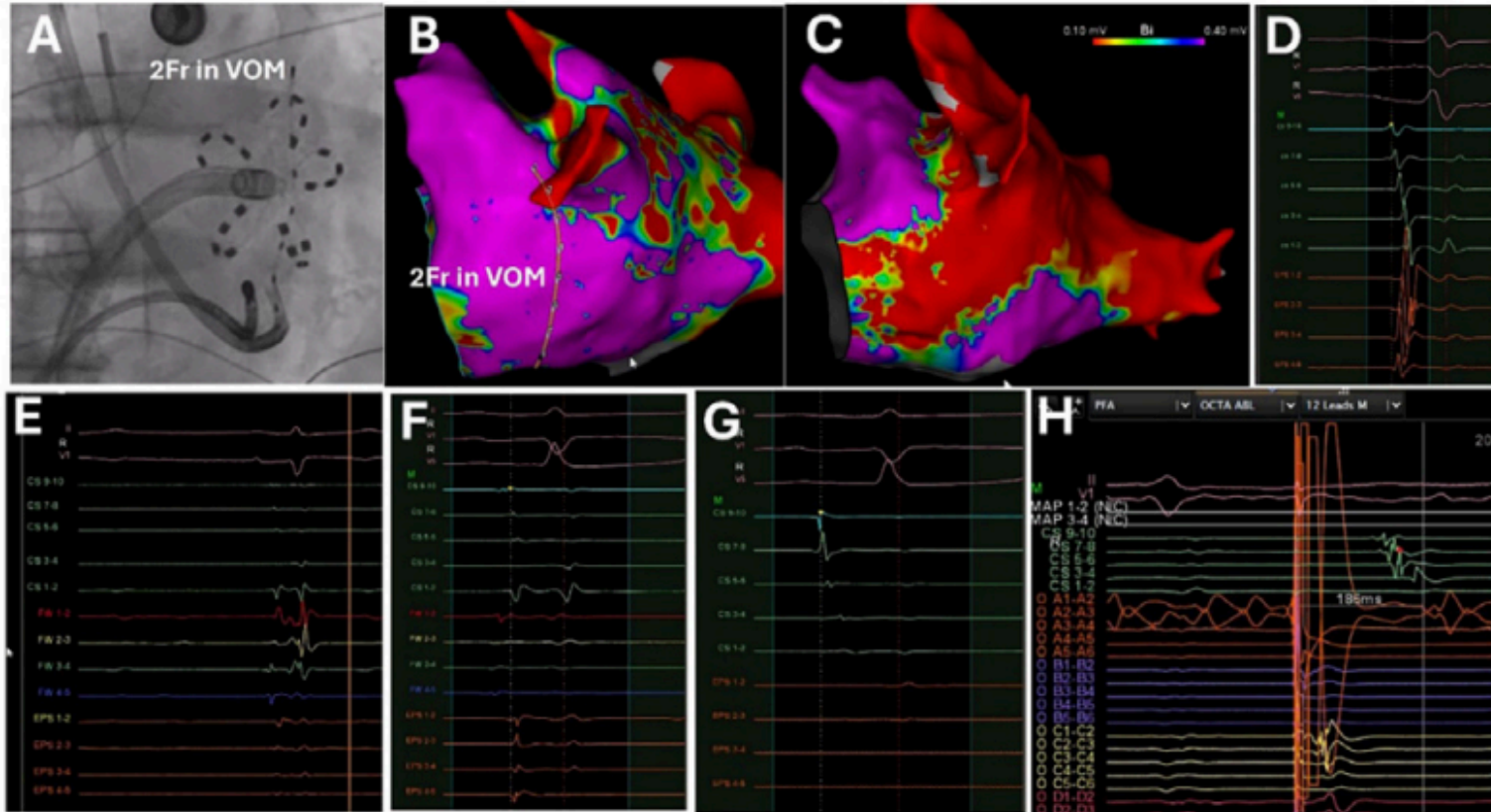
Acute bid block 100%

3-months remap: **32% recovery**

**HIGH RATE OF TARGET RECONNECTION
AT TIME OF REDO ABLATION**

La Fazia et al. Circulation AE
2025
Reddy V et al. JACCEP 2023

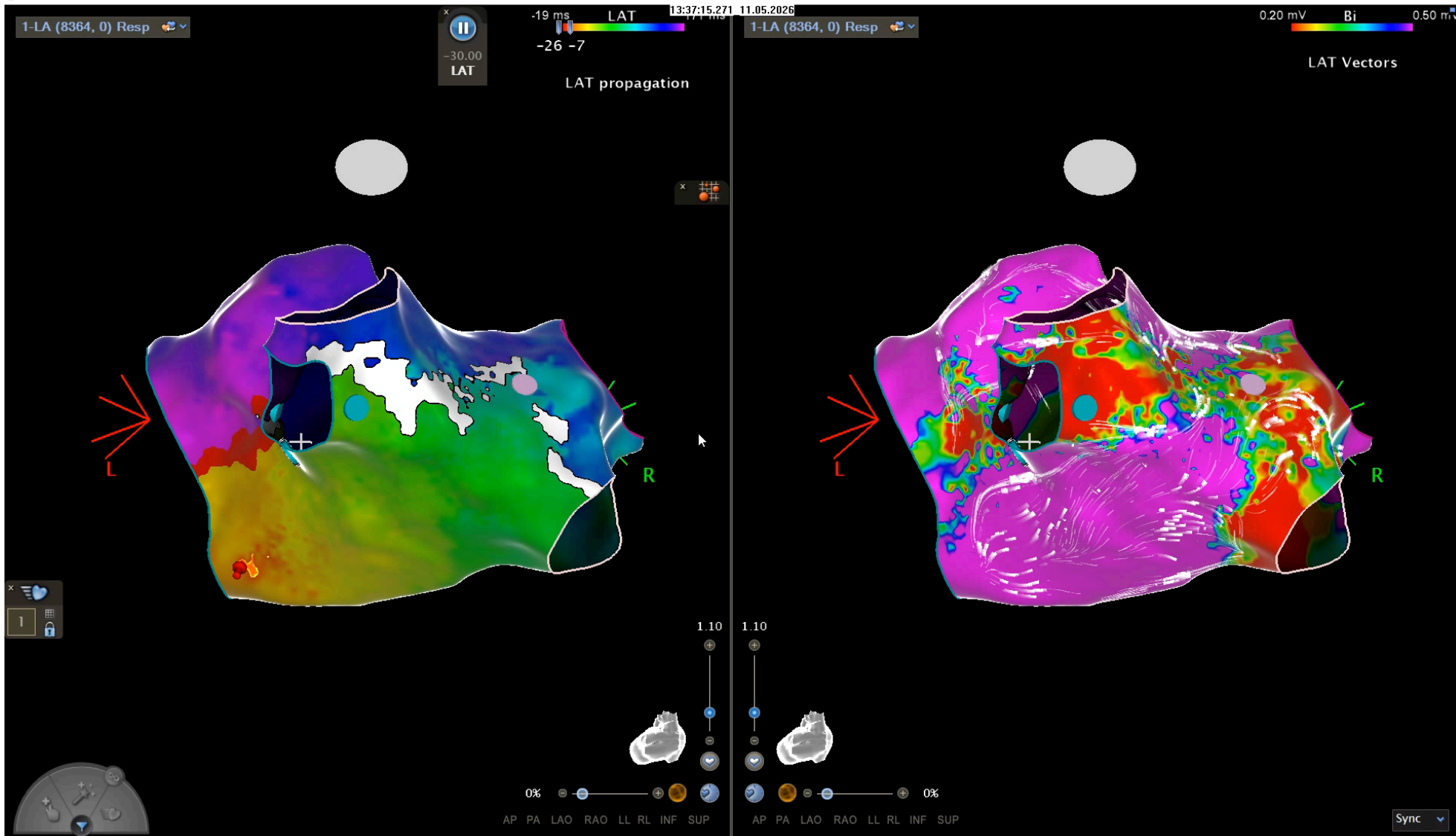
PFA of the Mitral Isthmus

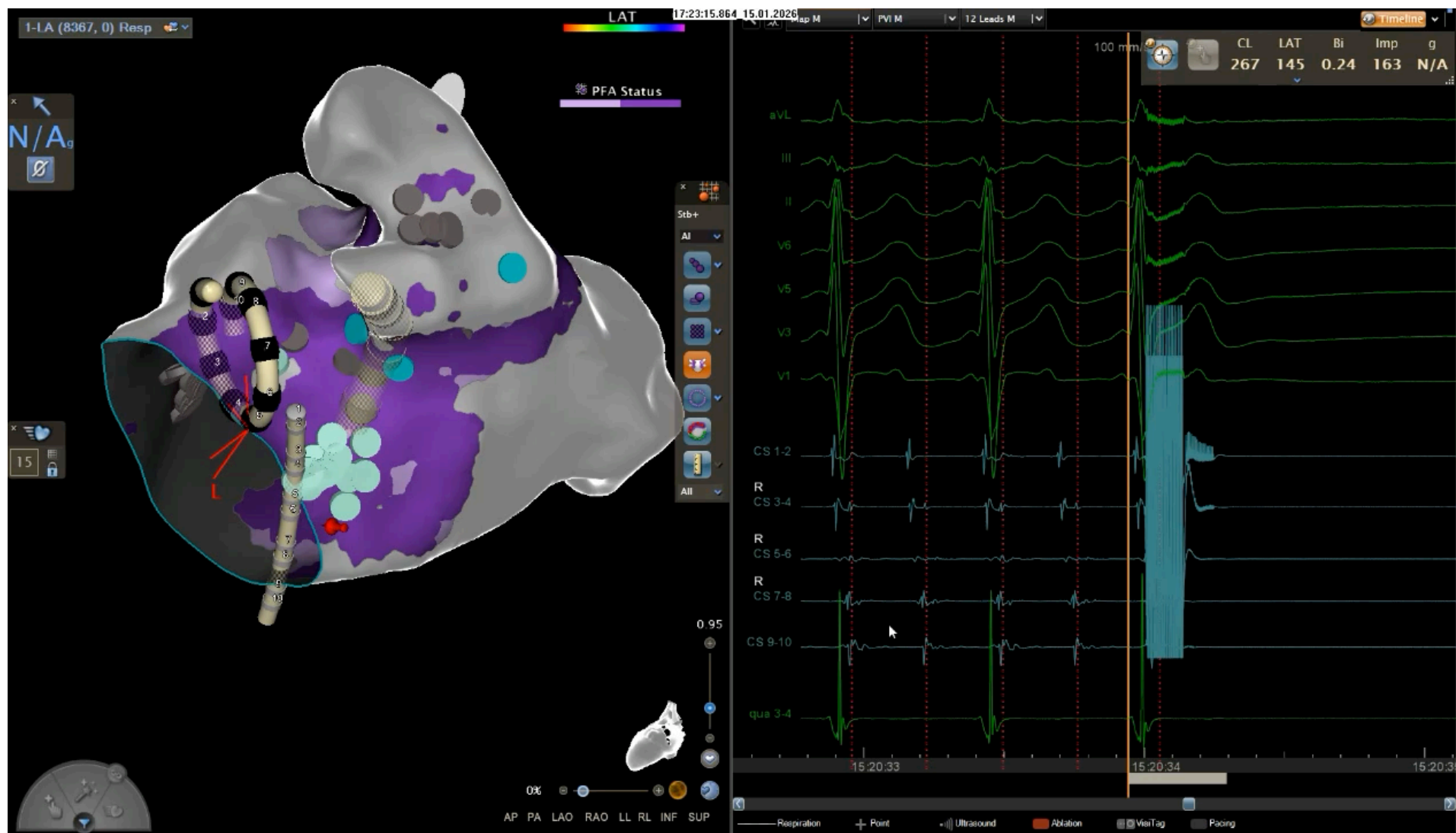


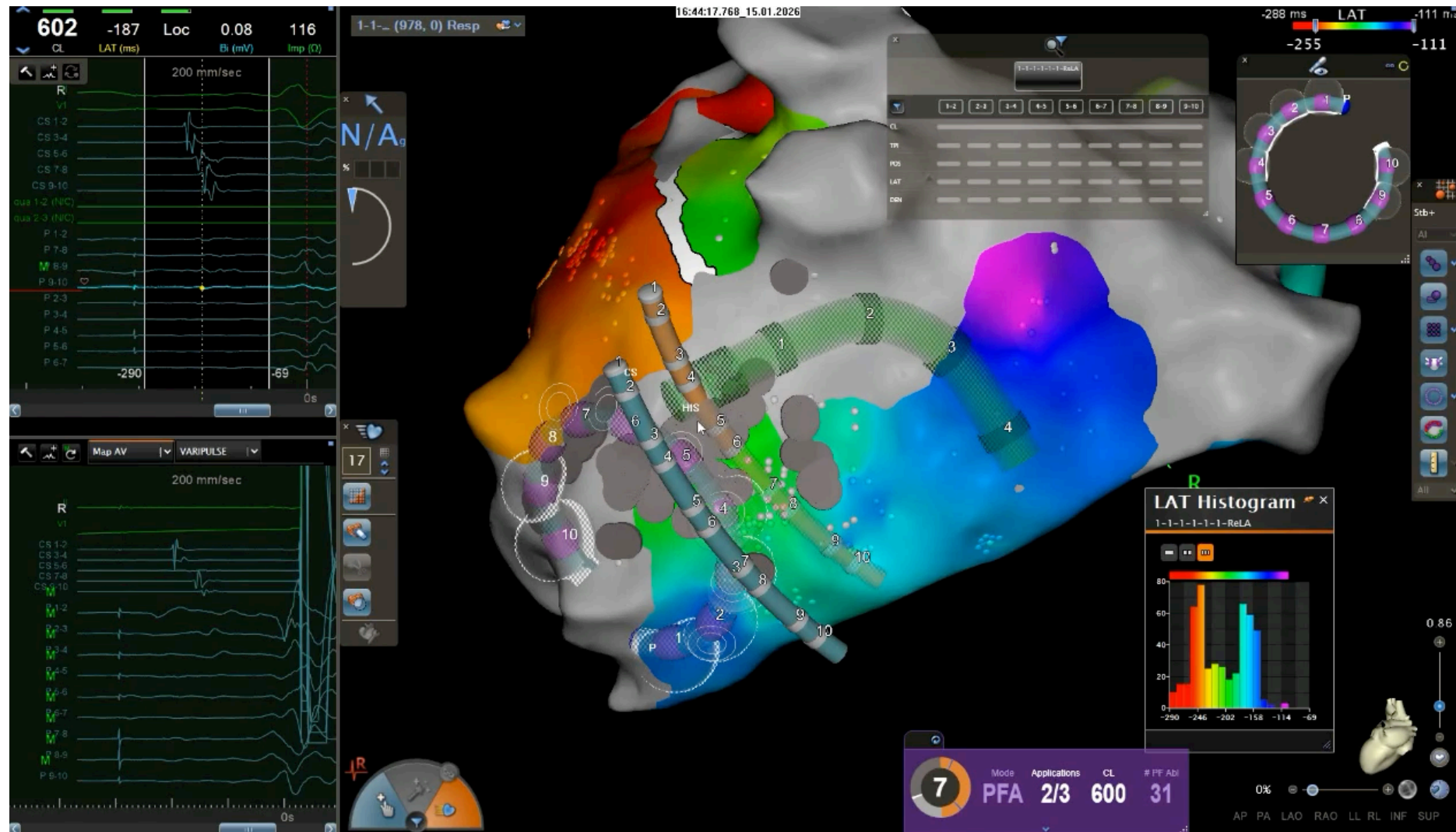
Epicardial completion approaches (via VOM-ethanol) is still necessary to complete mitral isthmus block despite endocardial PFA.

- Forty patients with AF were included.
- PFA led to a complete endocardial line in all patients.
- VOM electrograms epicardial to the MI line were abolished in 9/40 patients and only attenuated in 31/40 (including initial EGM abolition and time dependent recovery).
- **MI-PFA alone led to MI block in 11/40 patients.**
- In 29 patients epicardial ablation via VOM ethanol
- PFA in the CS (1/40), or both (10/40) was required to achieve MI block.
- Post ethanol recordings from the VOM showed complete absence of epicardial EGMs.

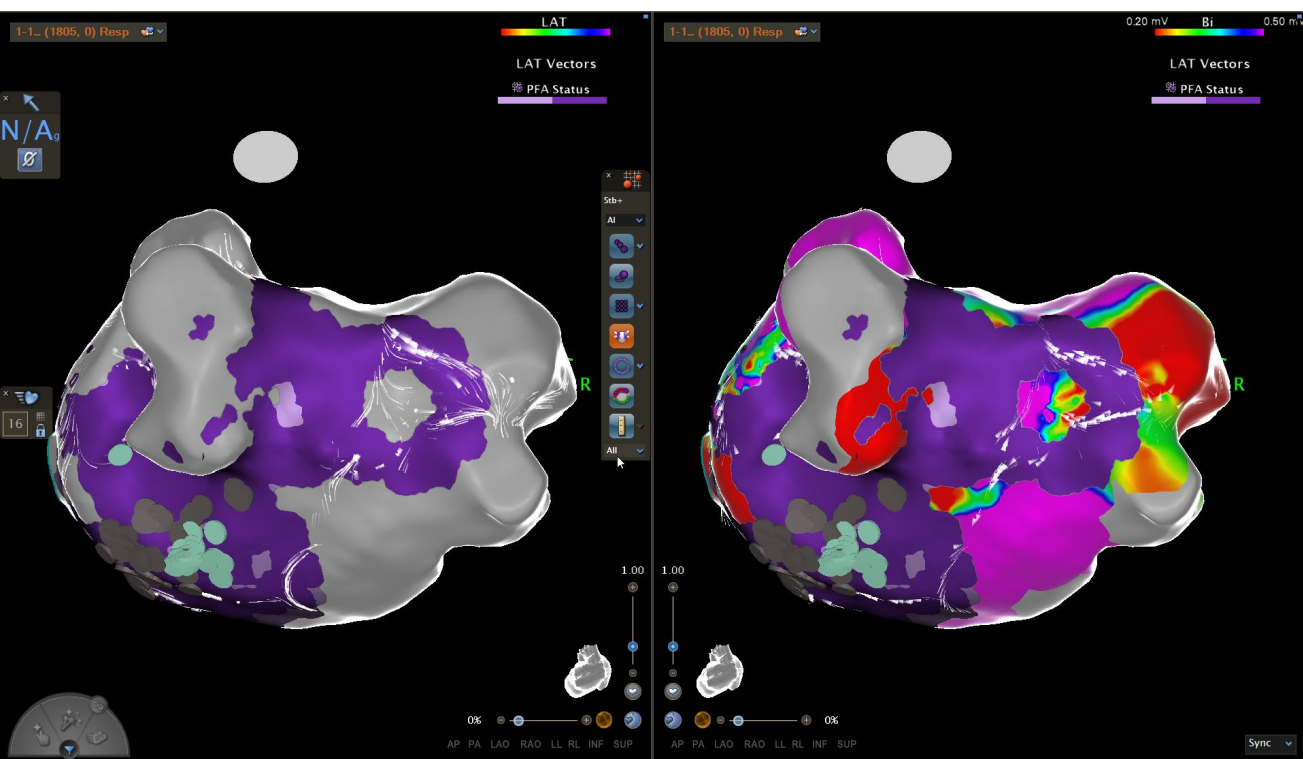
Post-RF Mitral Flutter – VOMEI failure (non-identification of VOM)



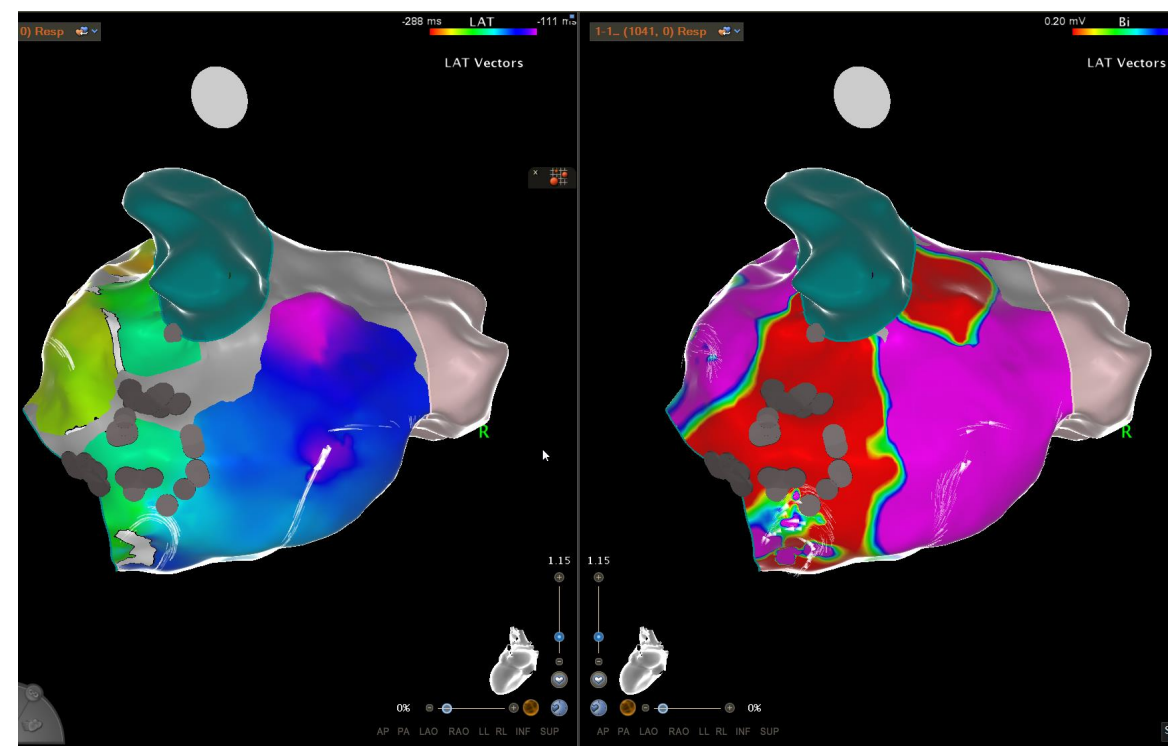




No bidirectional mitral-line block despite endocardial PFA applications

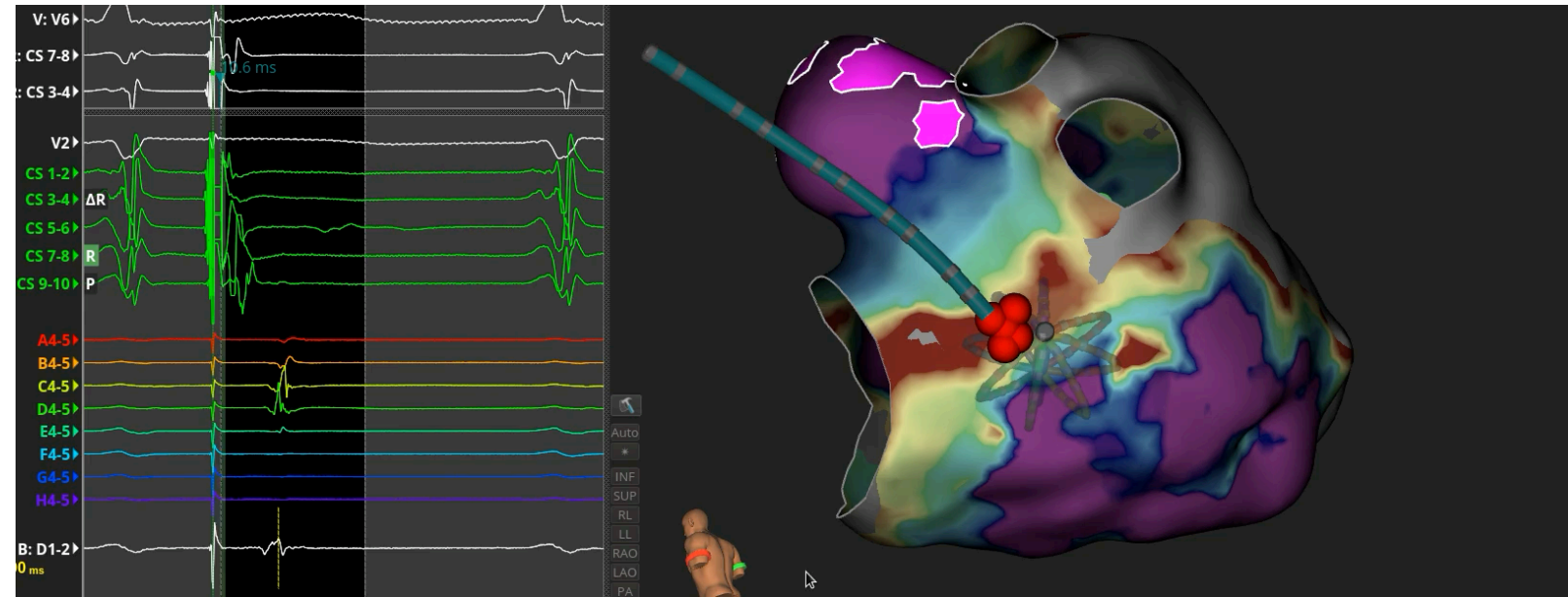
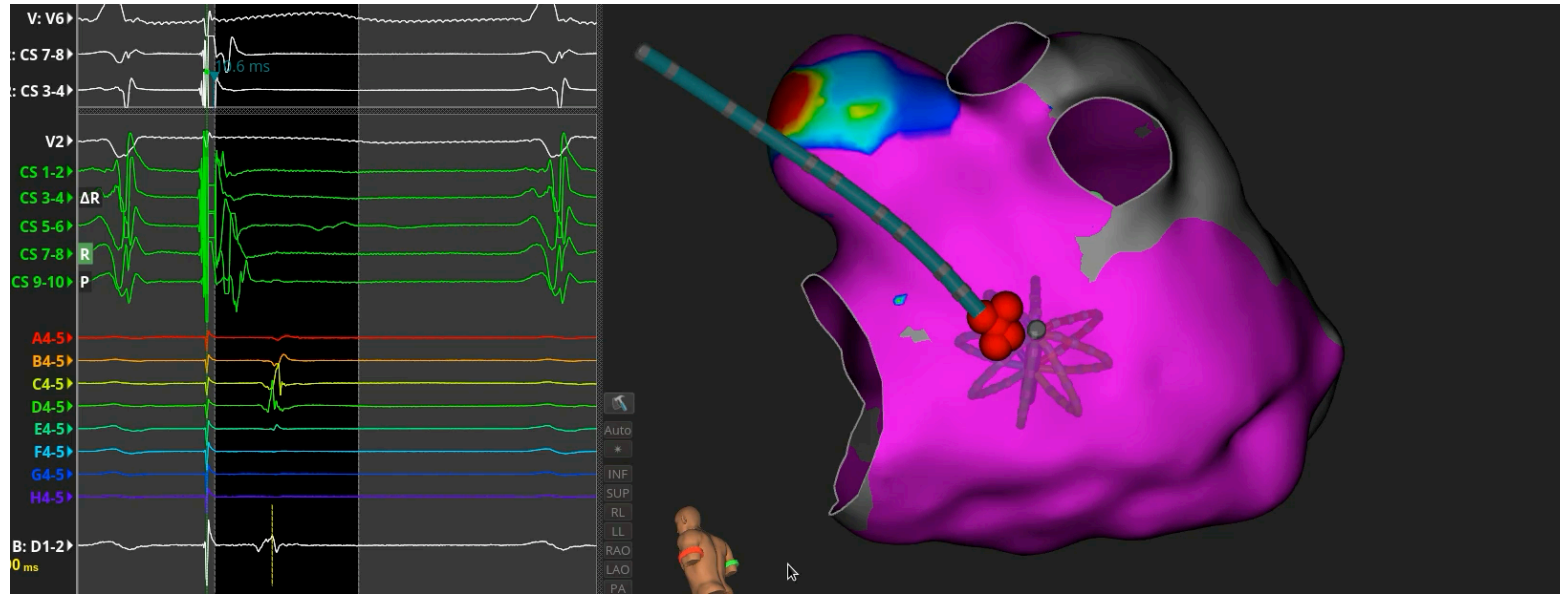


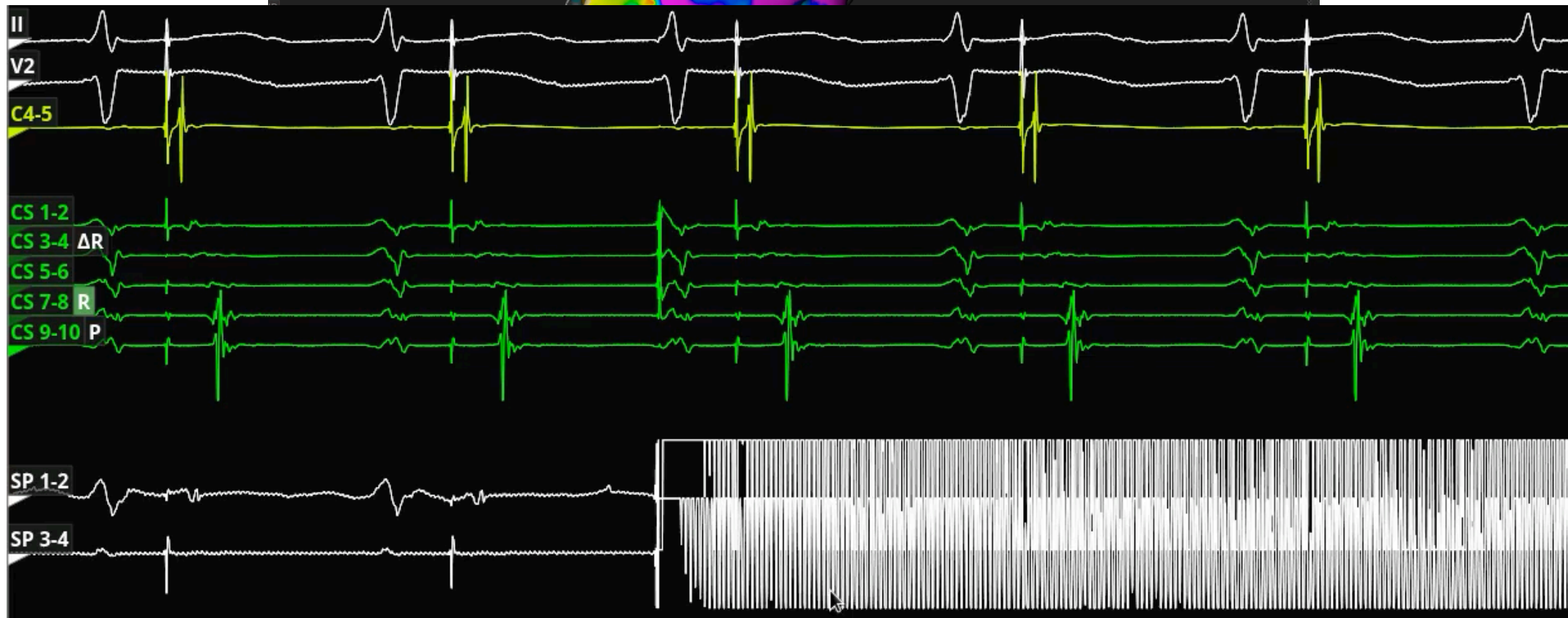
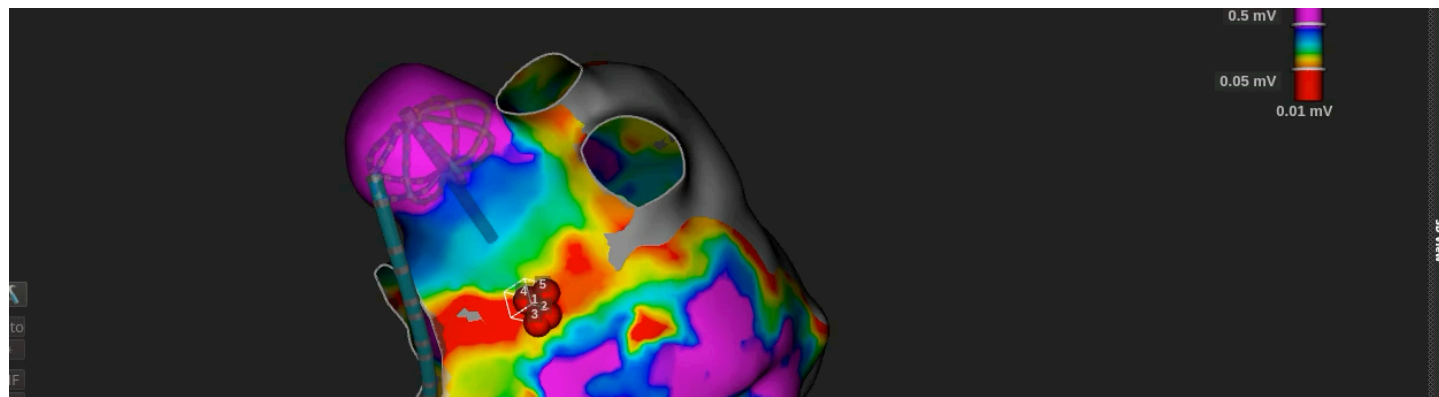
FINAL LESION SET

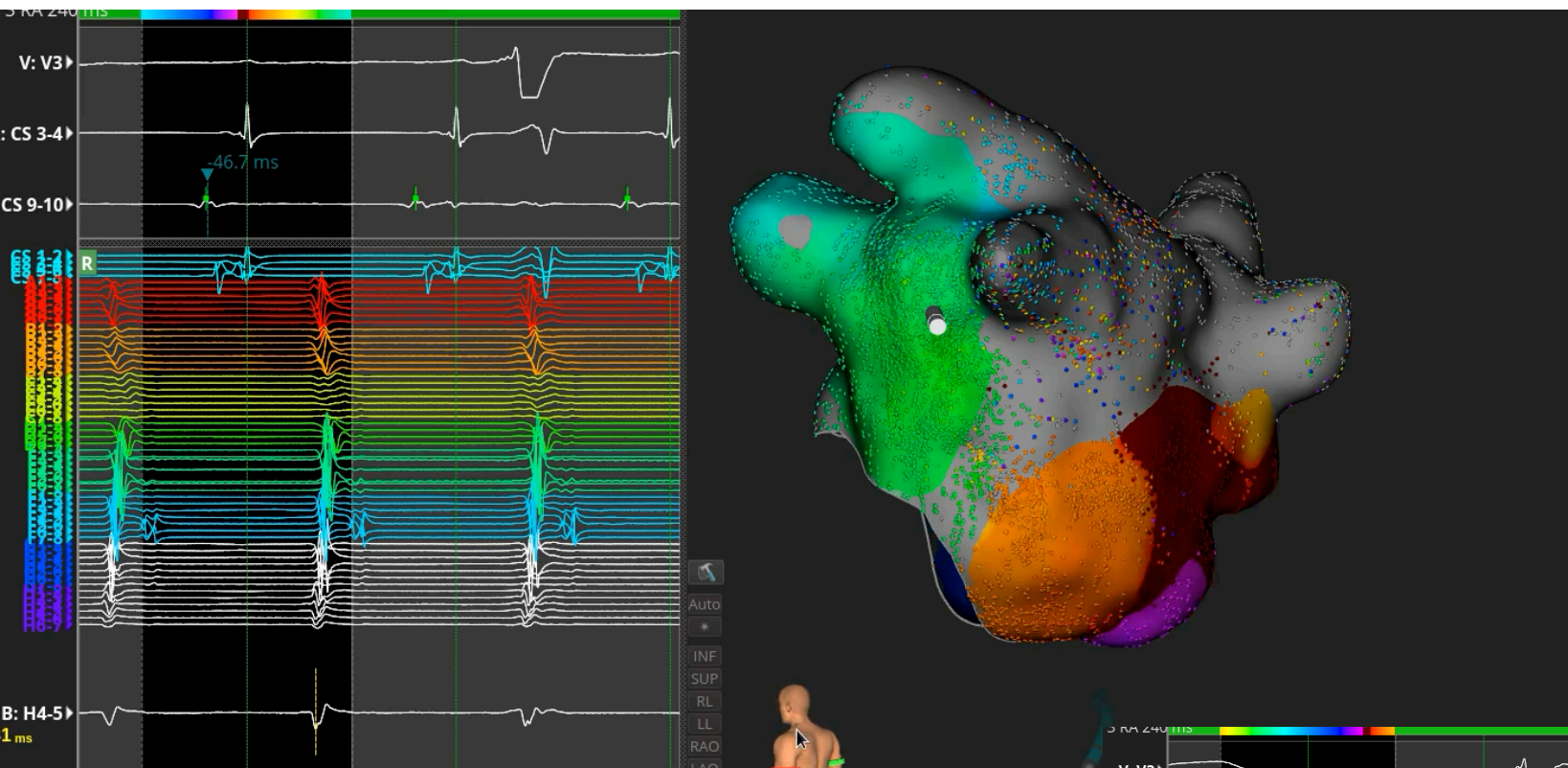


FINAL ACTIVATION MAP (during LAA pacing)

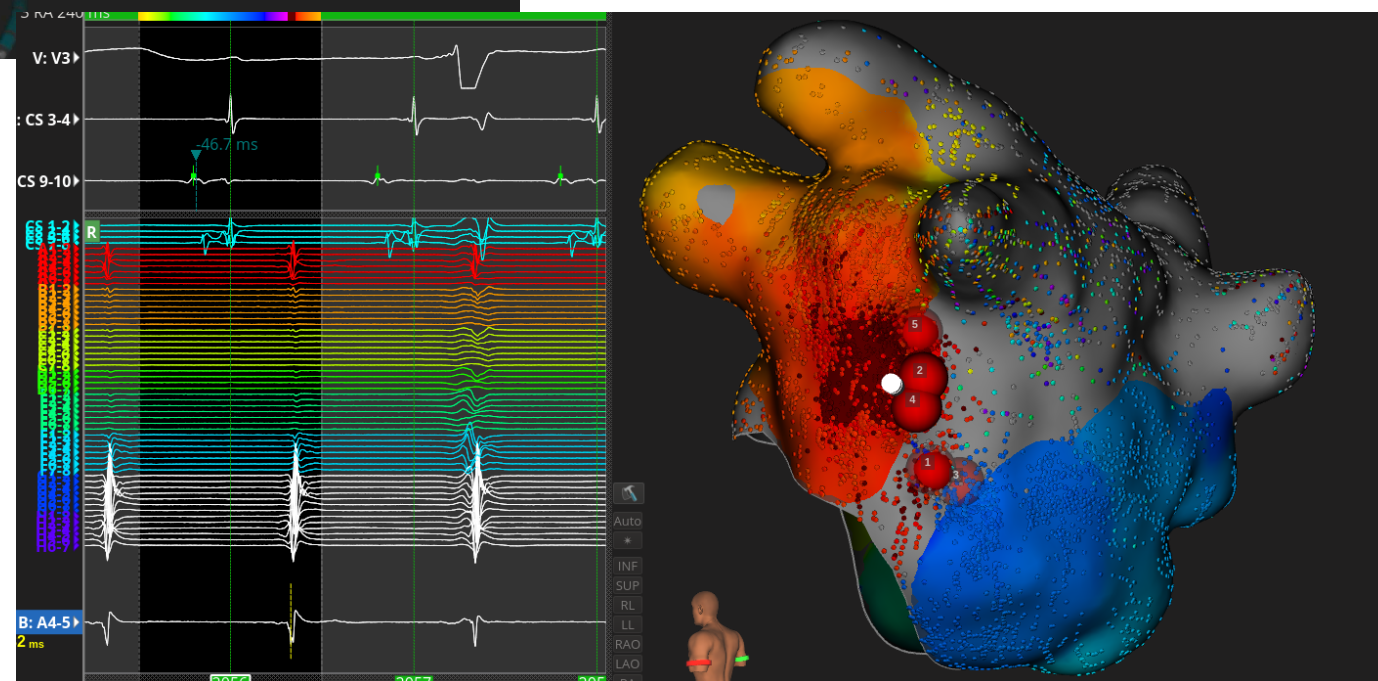
PFA-based approach on Mitral-line gaps

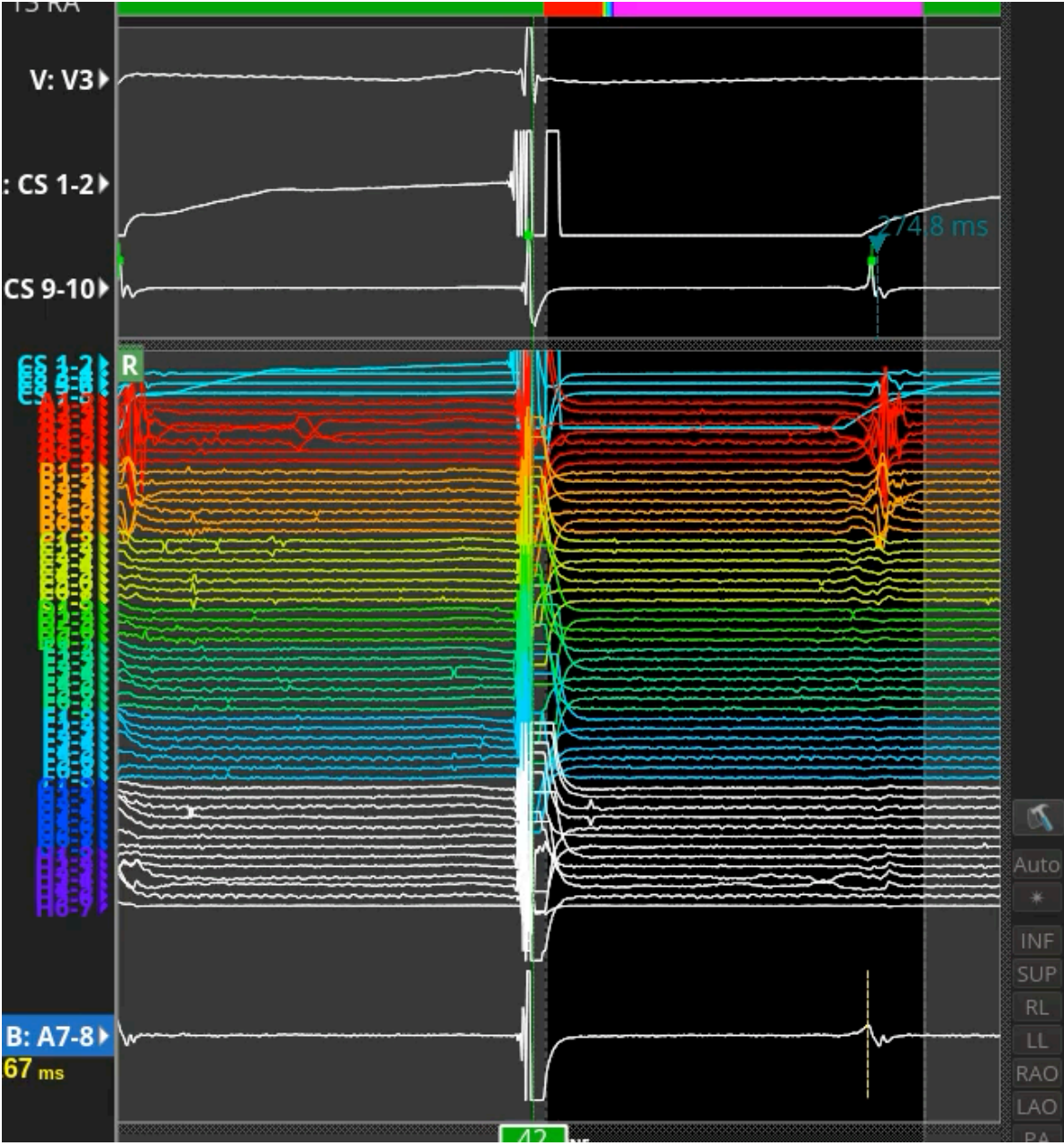




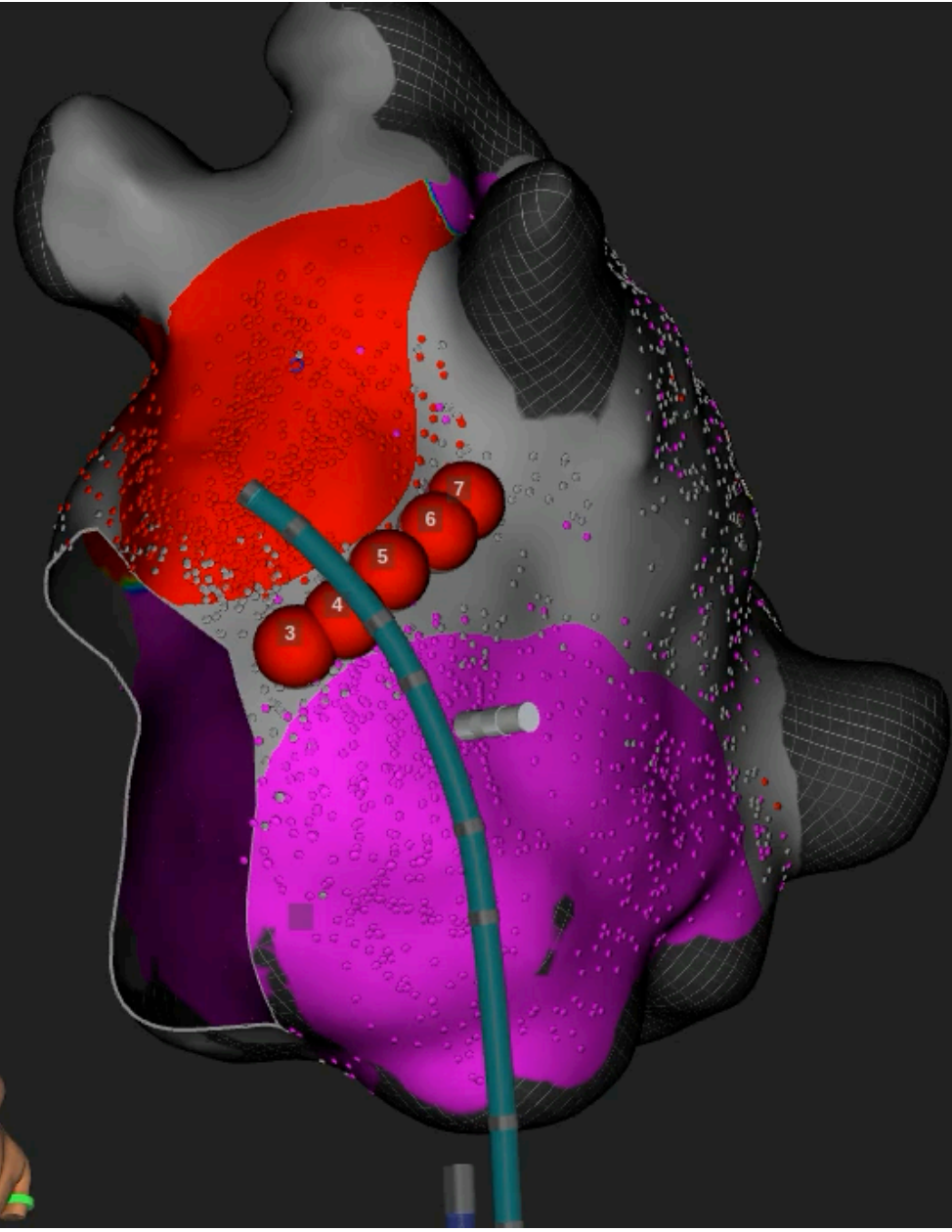


PFA for Mitral-Line Gaps – Case 2

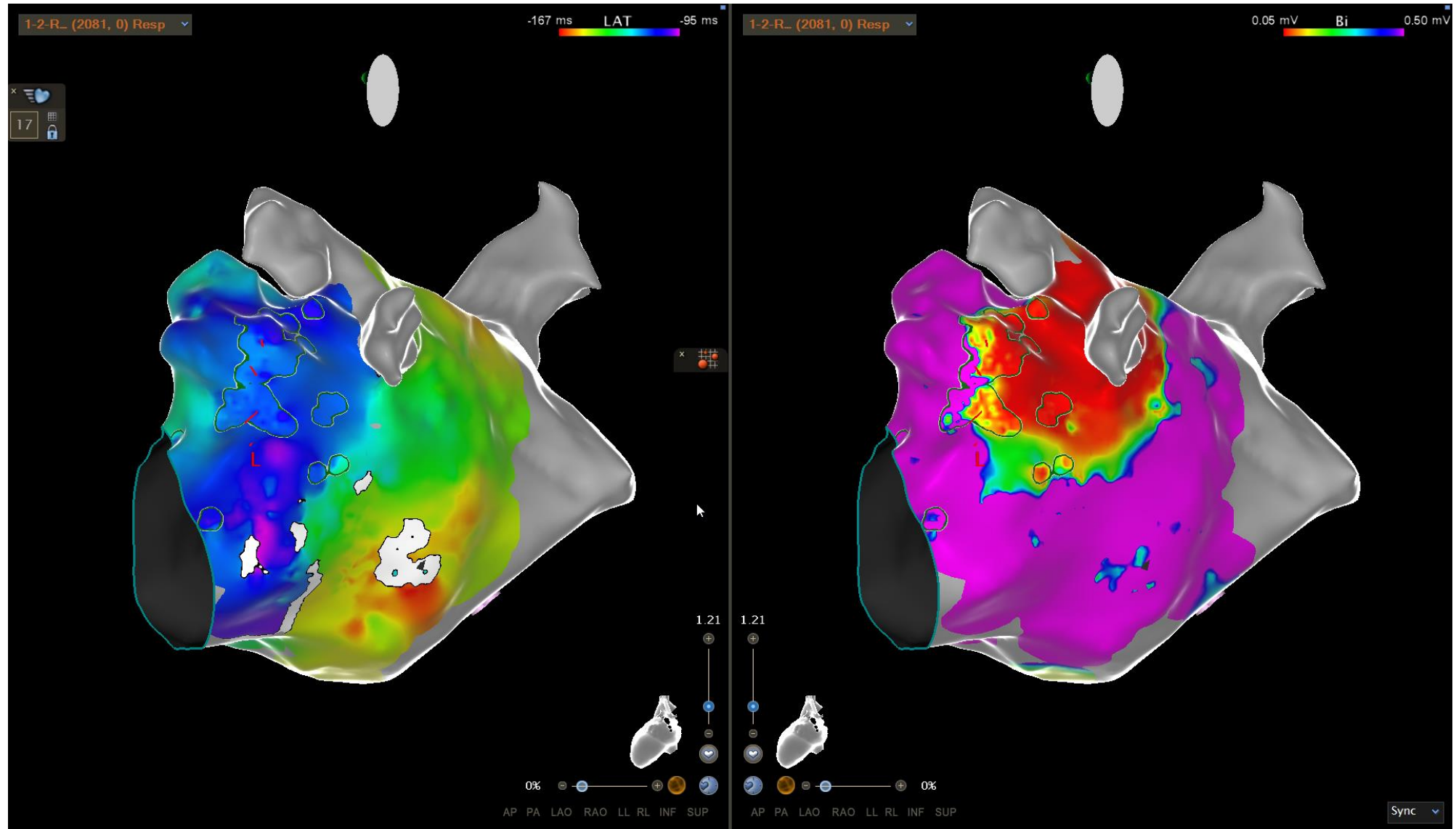




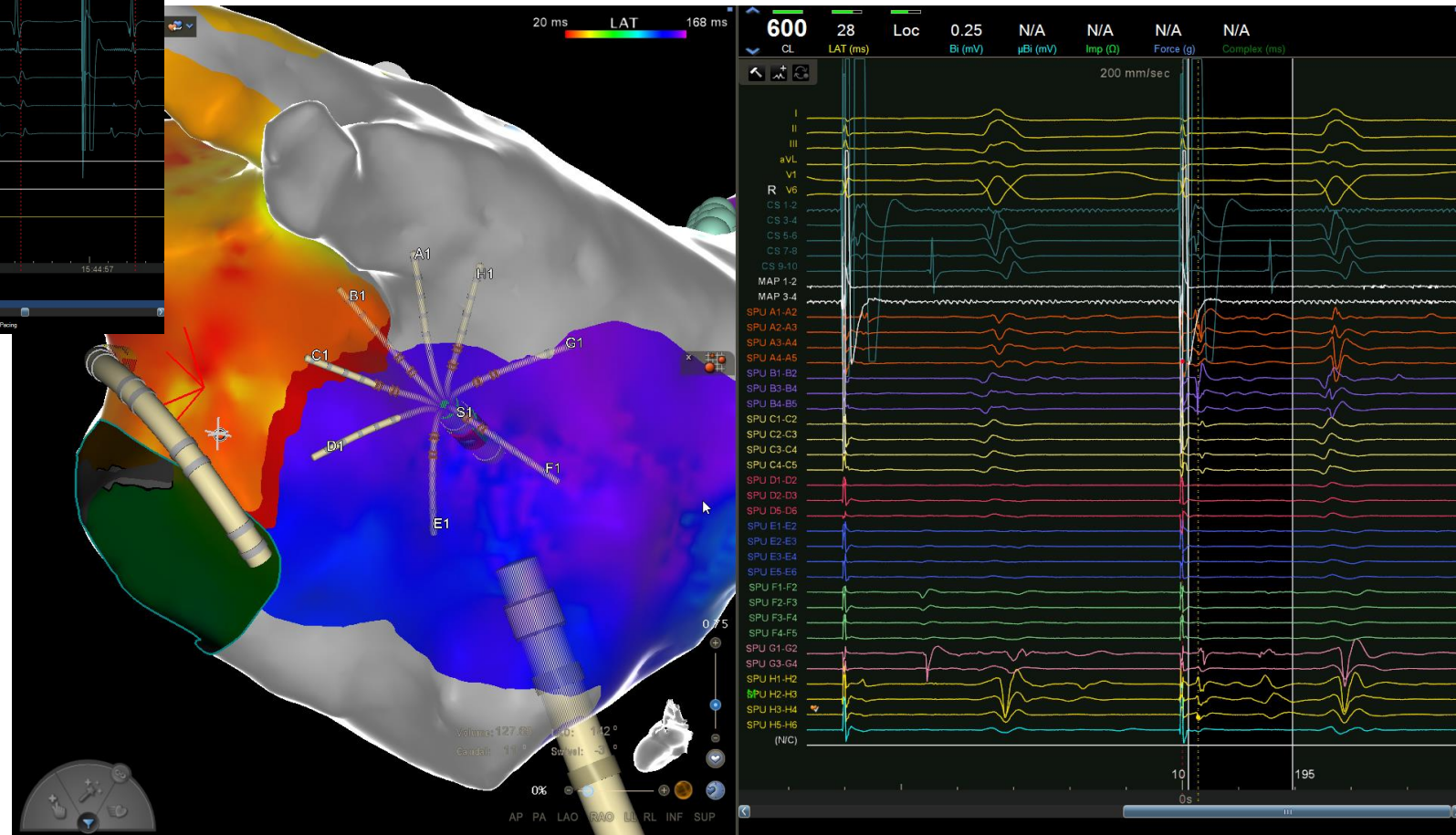
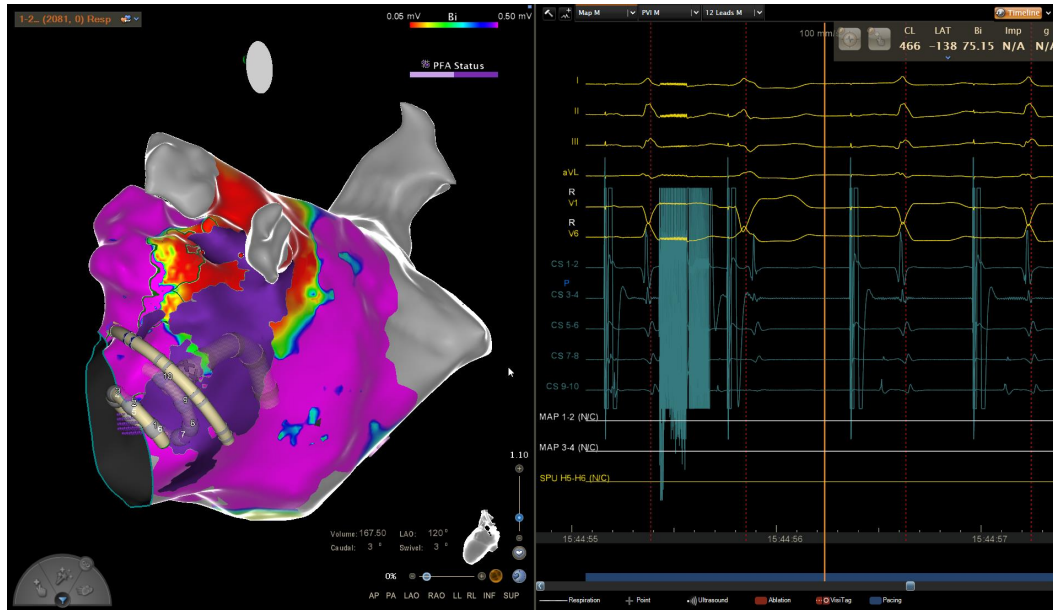
Auto
INF
SUP
RL
LL
RAO
LAO
RA

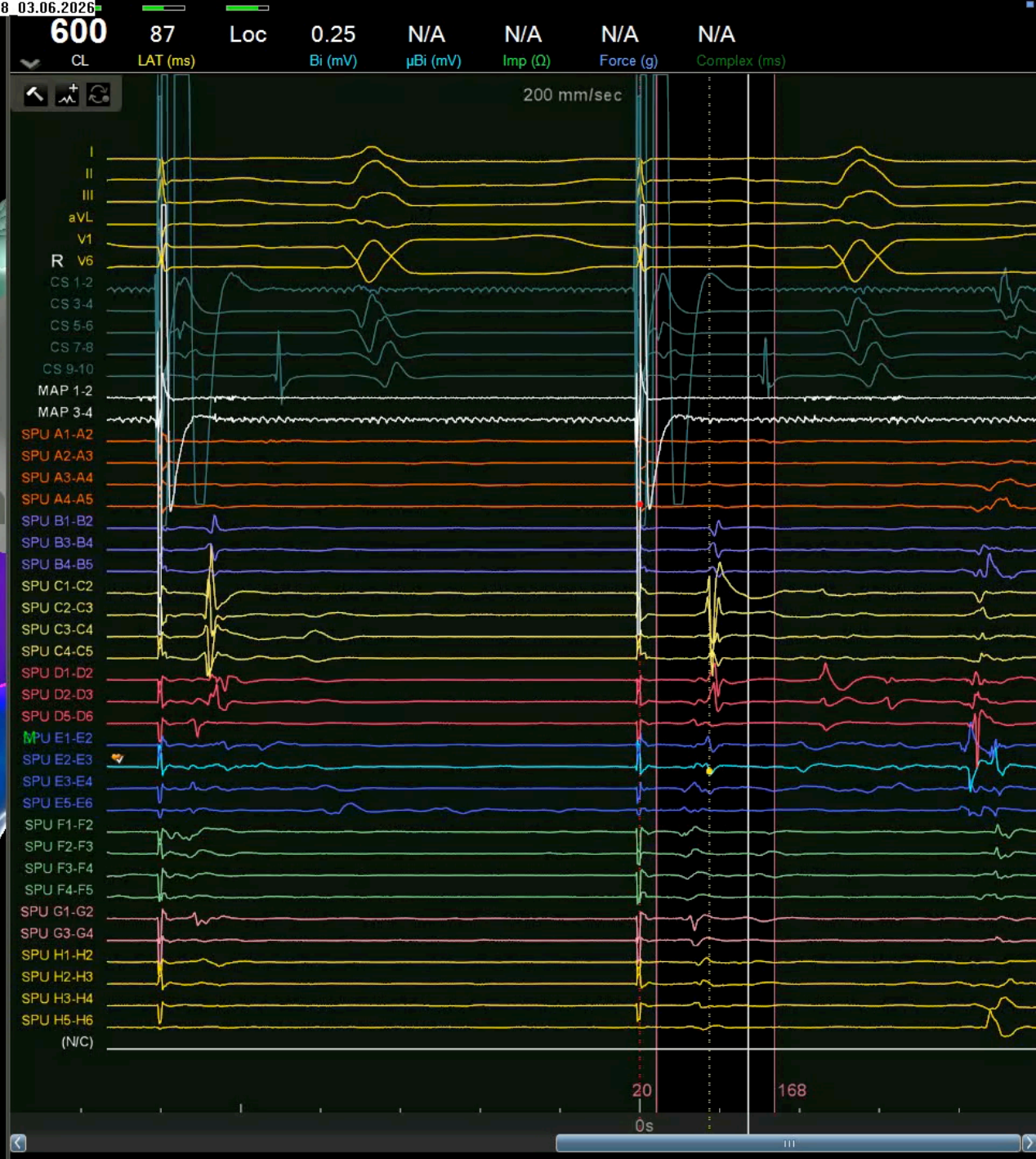
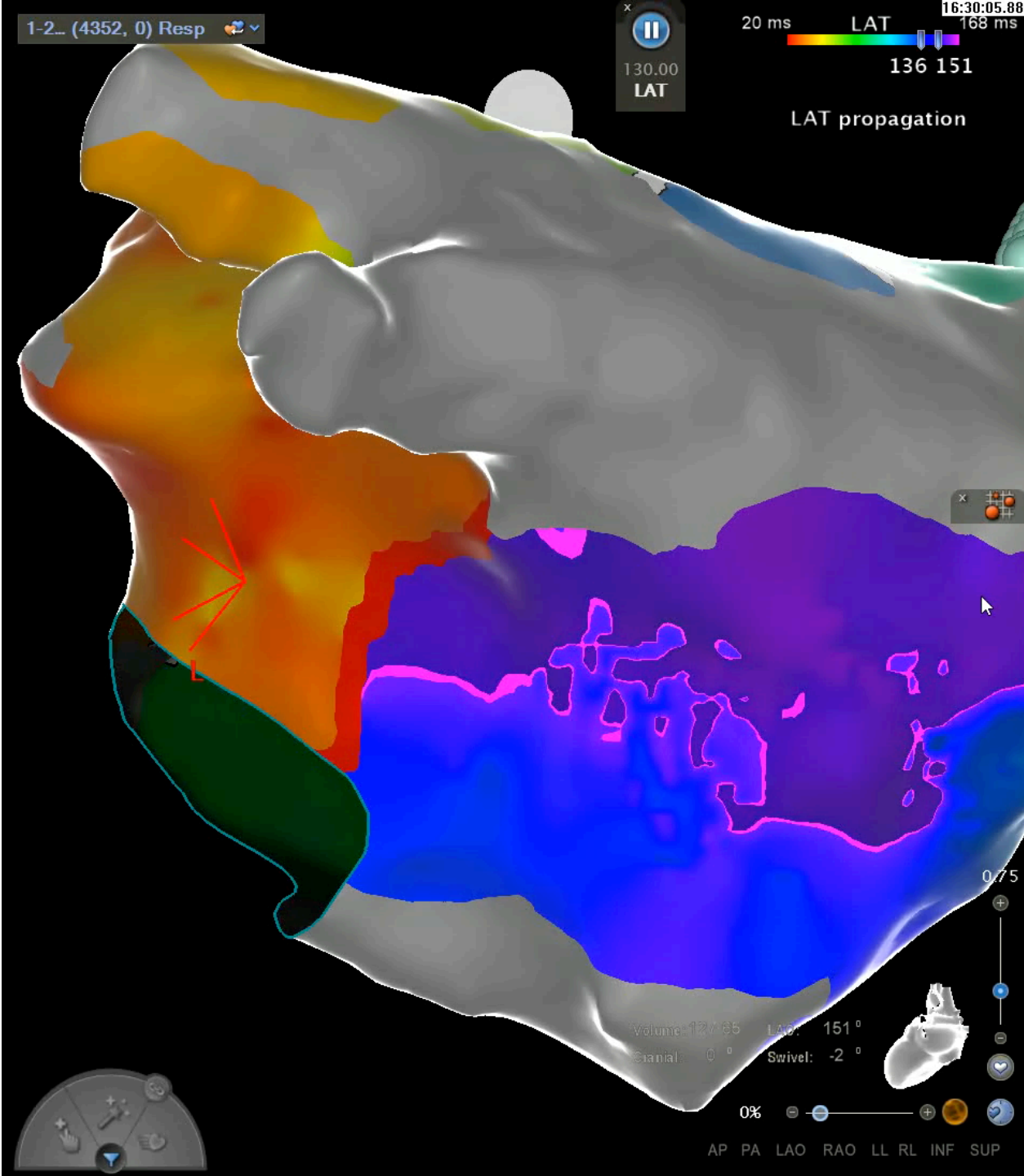


PeAF and Mitral Flutter – VOMEI + PFA-based anatomical scheme

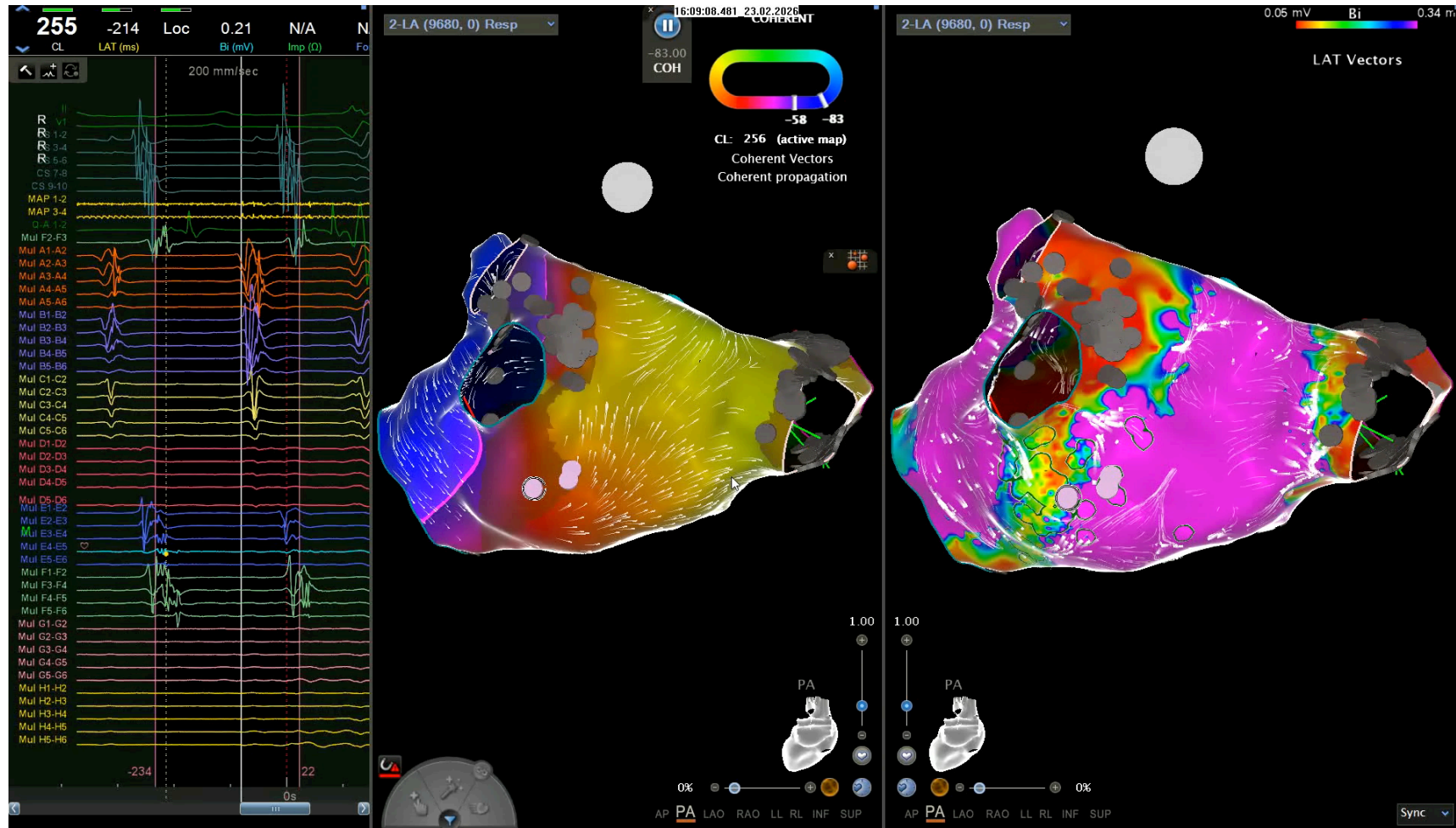


Mitral Block Validation

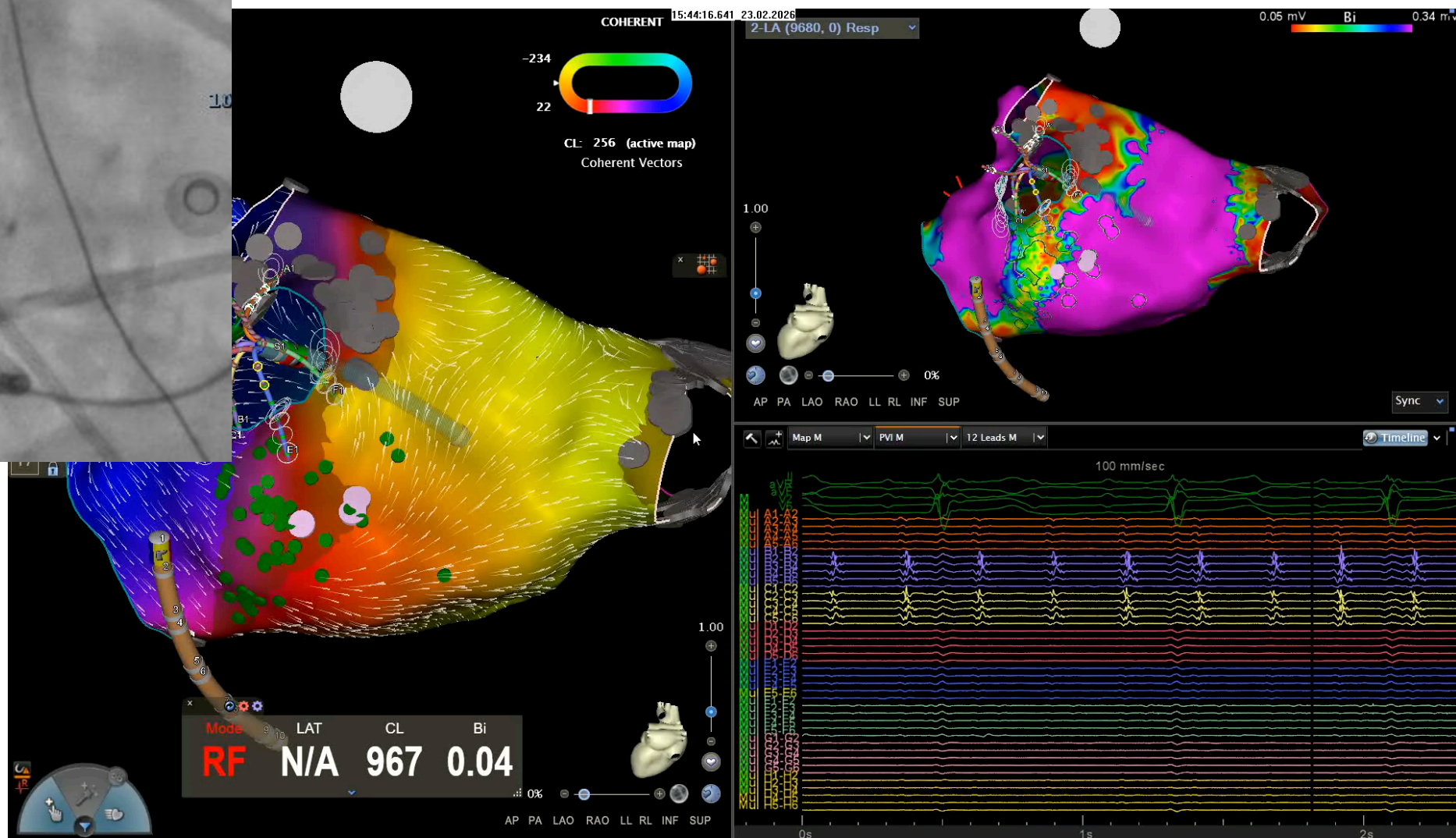
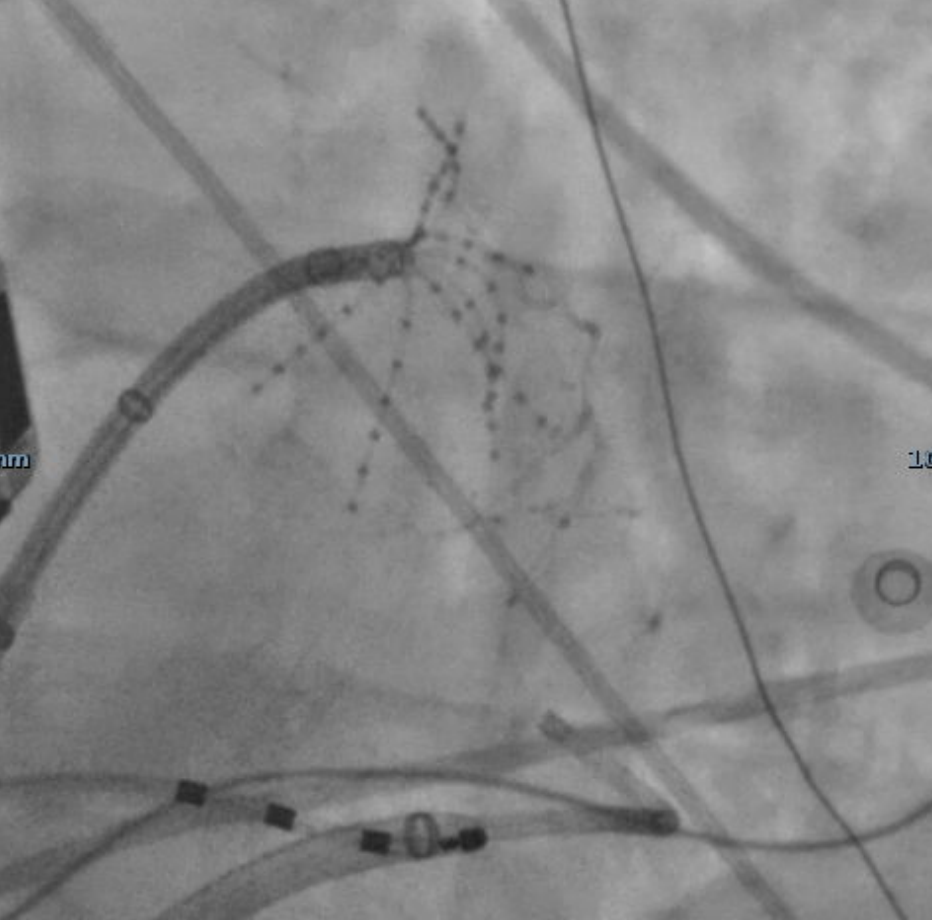




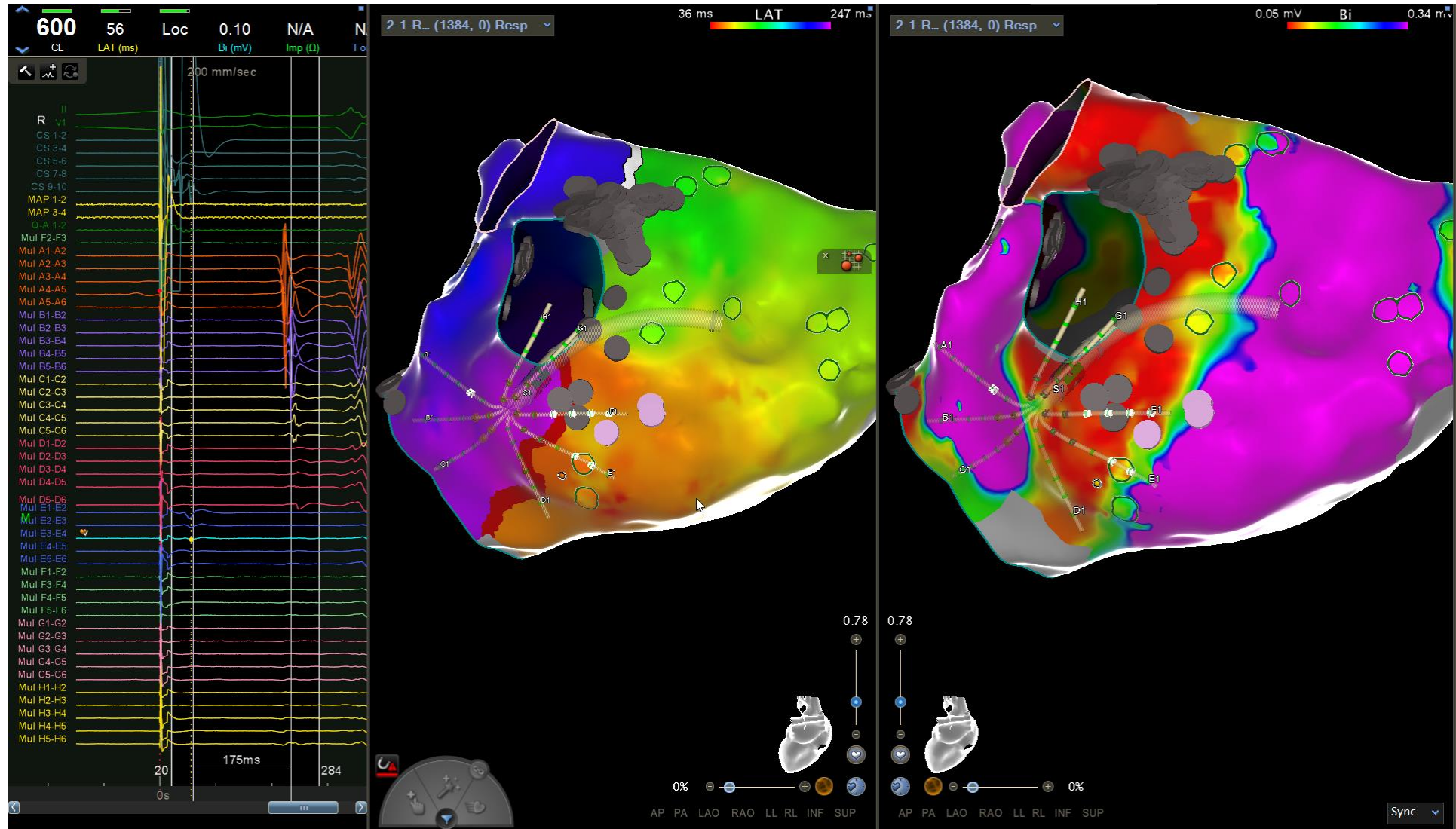
Mitral flutter recurrence post PFA-based ablation with anatomical scheme in a patient with PeAF and mitral flutter



Acute flutter termination **during** **alcohol infusion into the VOM**



Bidirectional mitral-line block validation during LAA-pacing



Conclusions

- **Current-generation PFA systems do not seem to be able to adequately address the arrhythmogenic potential of the VOM**
- **A hybrid approach incorporating PFA, RFA, and EIVOM may be useful in approaching selected patients with persistent AF**
- **Reassessment of the value of this adjunctive therapy will be necessary in the future (PFA technology is rapidly changing, VOM-alcohol need time technical complexities)**



Fondazione
Monasterio
la ricerca che cura

