

New Tools for Improving Radiofrequency AF Ablation

Eric Lim, Consultant electrophysiologist, NHCS, August 2022

 [ericlim1975](#)  eric.lim.t.s@singhealth.com.sg / erictslim@gmail.com

Non-exhaustive 15-minute discussion on:

- Contact force sensing catheters
- Indices of ablation lesion delivery and effectiveness
- High density mapping catheters

PV reconnection is a key reason for failure of AF ablation

Multiple factors needed to achieve durable PVI

Under operator control - includes

- Contact force
- Duration of contact
- Stability of contact
- Power delivery

Not under operator control – patient factors – includes

- Thickness and composition of tissue
- Local blood flow

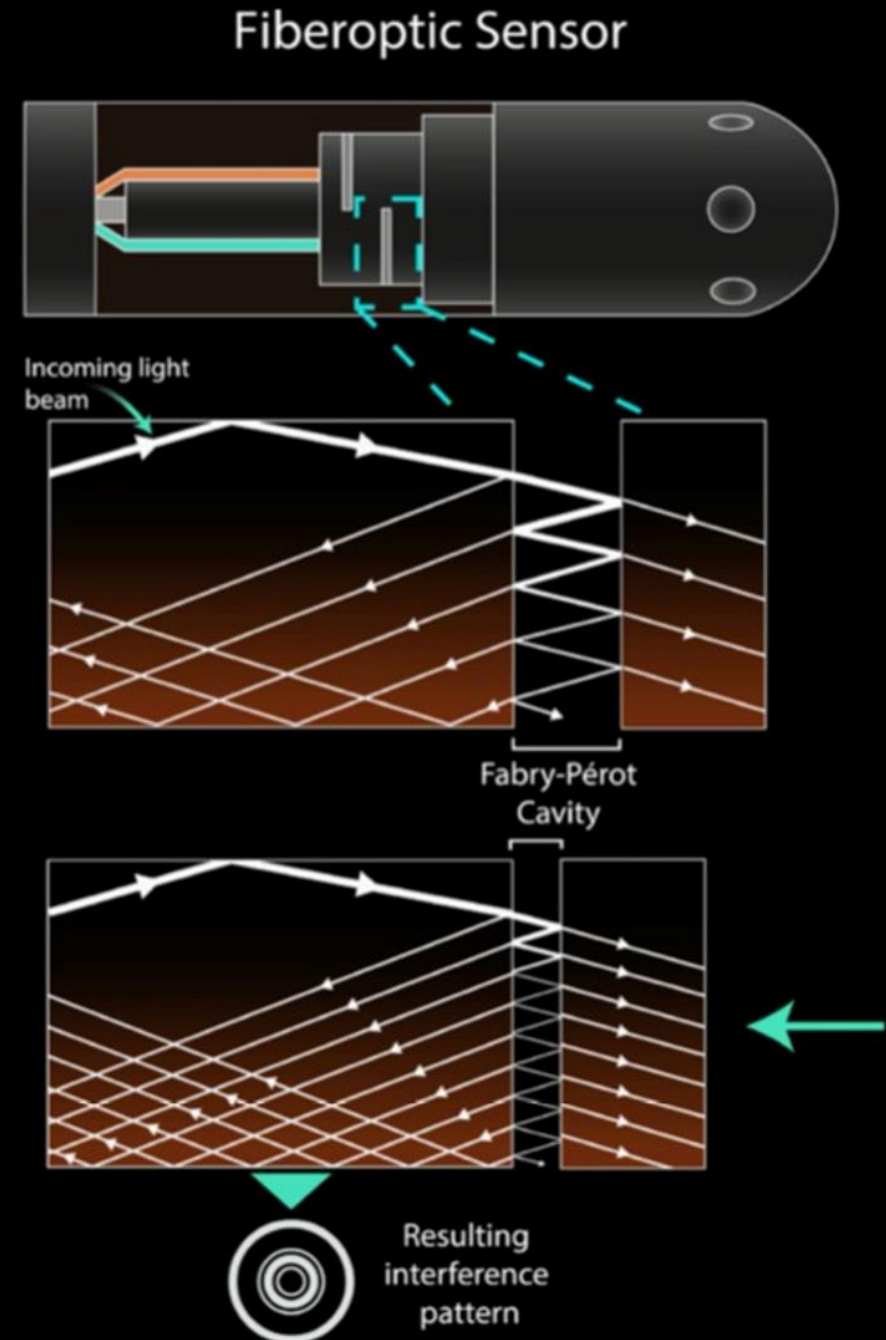
Contact-force sensing catheters

Available technologies on the market:

- Thermocool Smart Touch, Biosense Webster – Spring-based
- Tacticath, Abbott Medical – Fiber-optic based
- Stablepoint, Boston Scientific – Spring-based; also measures local impedance

Tacticath CF catheter

- Abbott Medical
- Ensite Precision, Ensite X
- Fabry-Perot interferometer: force on distal tip alters length of air cavity chamber, changing interference pattern of light
- Real time CF measurements
- Resolution $< 1g$



Initial Studies of Spring-based and Fibre-optic based CF Ablation Catheters

	Type of AF	Follow Up	CF Goal	N	Success	P value	Comments
Fiberoptic Sensor							
Reddy 2015 ¹ (TOCCASTAR)	PAF	12 mos	None	146 134	67.8% 69.4%	N/A	Noninferiority study. Success rate 75.9% with CF>10g.
Wakili et al. 2014 ²	PAF+PERS AF	12 mos	10g				
Wutzler et al. 2014 ³	PAF+PERS AF	12 mos	None				
Reddy et al. 2012 ⁴ (TOCCATA)	PAF	12 mos	None				ted
Spring-Based Sensor							
Andrade et al. 2014 ⁵	PAF	12 mos	5-5				
Jourda et al. 2014 ⁶	PAF	12 mos					
Natale et al. 2014 ⁷ (SMART-AF)	PAF	12 mos	None	160	72.5%	N/A	Success was 81% in those treated within selected working ranges
Providencia et al. 2014 ⁸	PAF	19 mos	>22g <22g	50 50	96% 80%	P=0.04	Success was 80% in those treated with <22g (p=0.04)
Marijon et al. 2013 ⁹	PAF	12 mos	10g	30 30	89%* 64%	P=0.04	Prospective, nonrandomized.

Early observational studies suggest knowledge of CF can:

- Improve first pass PV isolation rates
- Reduce procedure times
- ?Improve clinical outcomes

Summary of Randomized Controlled Trials in CF Ablation in AF

First Author, Year (Trial Name) (Ref. #)	Number of Patients/Groups	Type of AF, Ablation Methodology	Design	AF Outcomes	Other Outcomes
Kimura et al., 2014 (12)	CF+, n = 38; CF-, n = 38	<ul style="list-style-type: none"> 74% PAF PVI + check for dormant conduction with ATP + isoprenaline 	<ul style="list-style-type: none"> Single center Physicians had performed minimum of 5 CF ablation procedures prior to trial THERMOCOOL SMART-TOUCH both arms CF+ target 10-20 g vs. CF- no display 	No difference in freedom from AA >30 s after single procedure (\pm AAD): CF+ 95%, CF-84%	CF+ vs. CF- had: <ul style="list-style-type: none"> Higher mean CF Shorter procedure time Shorter fluoroscopy time Fewer residual conduction gaps on completion of anatomic ring
Reddy et al., 2015 (TOCCASTAR) (15)	CF catheter, n = 150; non-CF catheter, n = 150	<ul style="list-style-type: none"> PAF PVI, 30-min wait, elimination of isoprenaline-induced triggers 	<ul style="list-style-type: none"> Multicenter No prior experience with CF needed CF with TactiCath system (Abbott) No CF target given Non-CF with CARTO (Biosense Webster) 	No difference in freedom from AA, single procedure, off AADs CF+ 68%, CF- 69%	<ul style="list-style-type: none"> When CF was optimal ($\geq 90\%$ ablations with ≥ 10 g), freedom from AF/AT or flutter was higher in CF vs. non-CF group (75.9% vs. 58.1%, $p = 0.02$) Choice of mapping system likely influenced results: operators with far below-average experience with the EnSite system had significantly lower success than those with average or above-average experience
Nakamura et al., 2015 (13)	CF+, n = 60; CF-, n = 60	<ul style="list-style-type: none"> 67% PAF PVI + CTI \pm SVC isolation 	<ul style="list-style-type: none"> Single center Physicians with variable experience with CF THERMOCOOL SMART-TOUCH both arms CF+ target 20 g vs. CF- no display 	No difference in 12-month freedom from AA >30 s after single procedure (\pm AAD): CF+ 90%, CF- 88%	CF+ vs. CF- had: <ul style="list-style-type: none"> Fewer acute PVRs Shorter procedure time Higher mean CF
Conti et al., 2017 (TOUCH-AF Trial) (11)	CF+, n = 62 vs. CF-, n = 62	<ul style="list-style-type: none"> PeAF PVI + roof line 	<ul style="list-style-type: none"> Single center All physicians had prior experience with CF; THERMOCOOL SMART-TOUCH both arms CF+ target 10-40 g vs. CF- no display 	No difference in 12-month freedom from AA >30 s after single procedure off AADs (CF+ 60%; CF- 63%)	<ul style="list-style-type: none"> CF+ vs. CF- had: <ol style="list-style-type: none"> No difference in median CF Less time spent in CF range 5-10 g Acute reconnection less common only in LIPV Gaps associated with less CF, FTI vs. gaps No difference in RF time
Pedrote et al., 2016 (119)	CF+, n = 25; CF-, n = 25	<ul style="list-style-type: none"> PAF PVI with Visitag both groups 30-min wait + ATP 	<ul style="list-style-type: none"> Single center THERMOCOOL SMART-TOUCH both arms CF+ targets were CF >10 g 75% of the time, stability 1.5 mm for ≥ 10 s CF-targets: no CF displayed but stability 1.5 mm for ≥ 10 s 	No difference in 12-month freedom from AAs after single procedure, off AADs (CF+ 84%, CF- 75%)	CF+ vs. CF- had: <ul style="list-style-type: none"> Higher CF in left but not right PVs Shorter procedural and fluoroscopy time Higher acute PVI at anatomic completion of ring
Ullah et al., 2016 (16)	CF+, n = 59; CF-, n = 58	PAF PVI 60-min wait \pm adenosine	<ul style="list-style-type: none"> Multicenter THERMOCOOL SMART-TOUCH both arms CF+ target 5-40 g vs. CF- no display Each RF to be ≥ 20 s at each site with each ablation showing bipolar EGM amplitude >80%, or until amplitude <0.1 mV 	No difference in 12-month freedom from AA after single procedure, off AADs (CF+ 49%, CF- 52%)	CF+ vs. CF- had: <ul style="list-style-type: none"> Greater proportion within CF range 5-40 g Lower rate of acute PVR No difference in procedure, fluoroscopy, or ablation time
Borregaard et al., 2017 (83)	CF+, n = 25; CF-, n = 25	PAF or short-lasting PeAF 20-min wait \pm adenosine	<ul style="list-style-type: none"> Single center THERMOCOOL SMART-TOUCH both arms CF+ target 10-40 g vs. CF- no display 	No difference in 12-month freedom from AF after single procedure (\pm AAD): CF+ 48%, CF- 64%	CF+ vs. CF- had: <ul style="list-style-type: none"> No difference in mean CF, ablation, fluoroscopy, procedure time, or acute PVR <p>Patients without recurrent AF had lower proportion of ablation time with CF <10 g than recurrent AF patients</p>

No difference in clinical outcomes associated with CF?

CLOSE targets (small ostial circles with figure of eight due to carina)

Posterior (25-35W): >400 AI or >300 AI if oesophageal heating >39°

Anterior (35-45W) : >550 AI

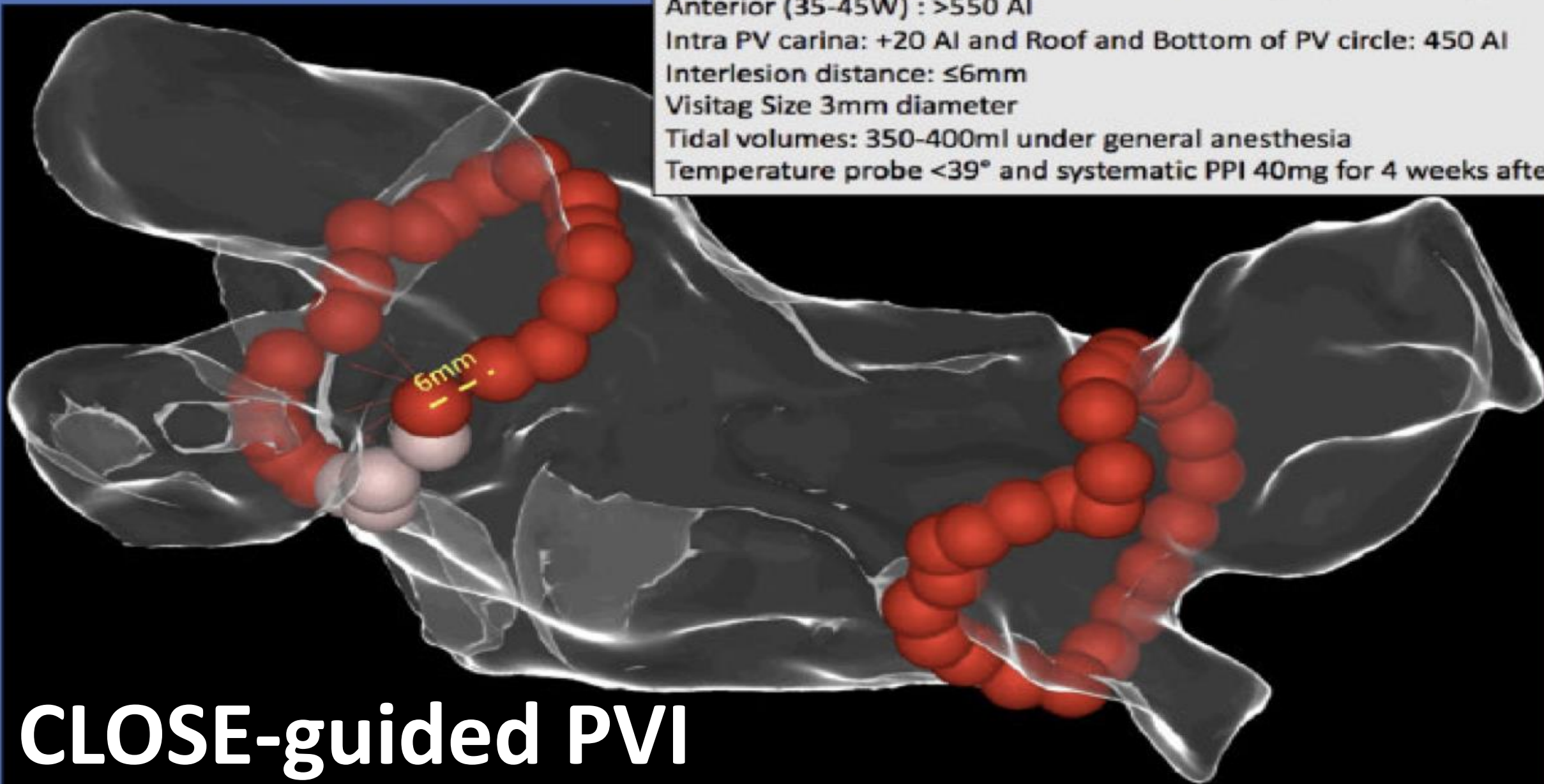
Intra PV carina: +20 AI and Roof and Bottom of PV circle: 450 AI

Interlesion distance: ≤6mm

Visitag Size 3mm diameter

Tidal volumes: 350-400ml under general anesthesia

Temperature probe <39° and systematic PPI 40mg for 4 weeks after

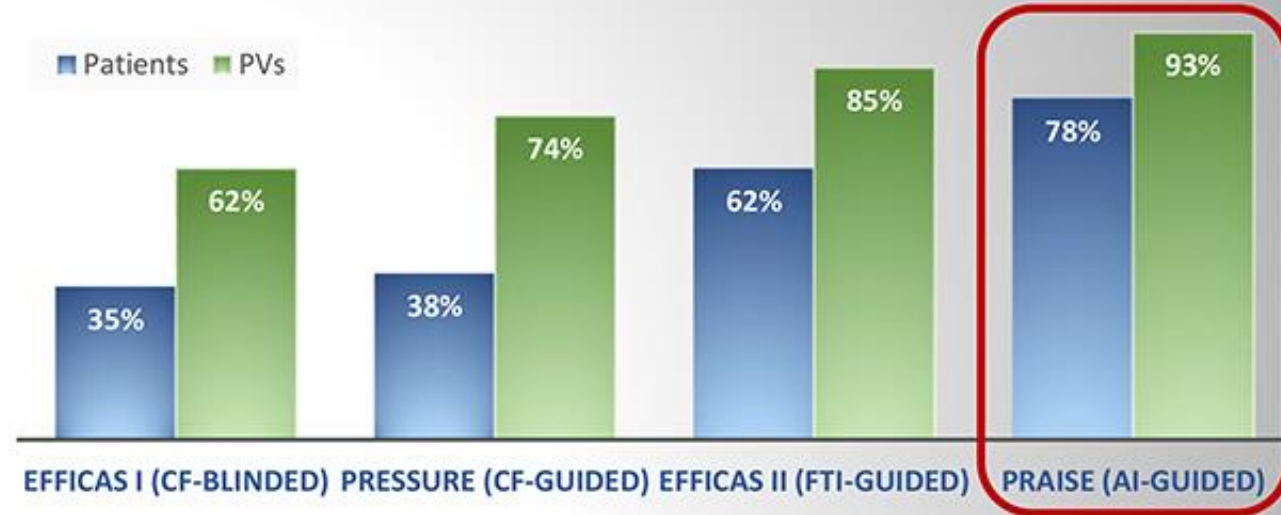
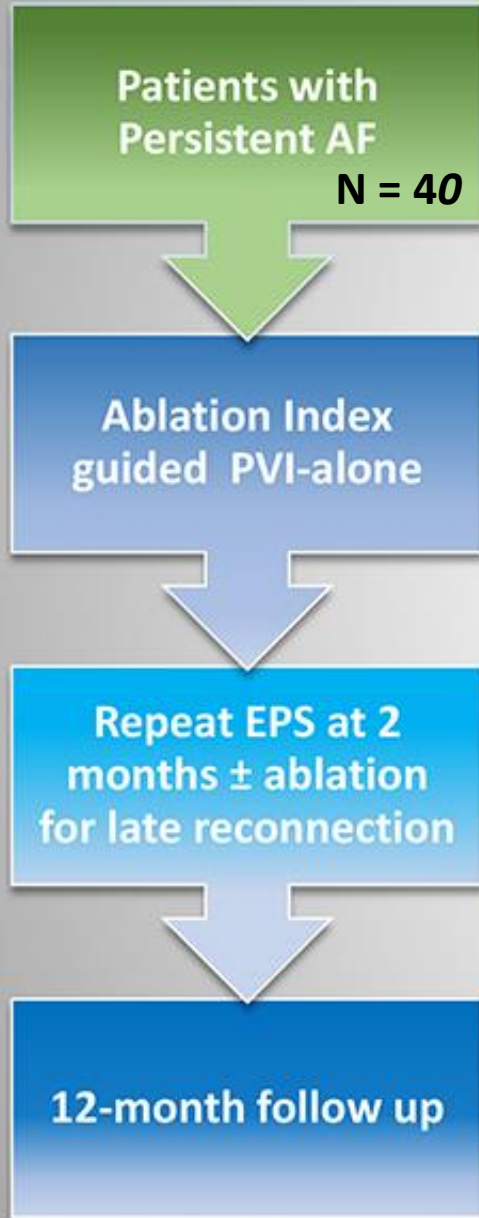


CLOSE-guided PVI

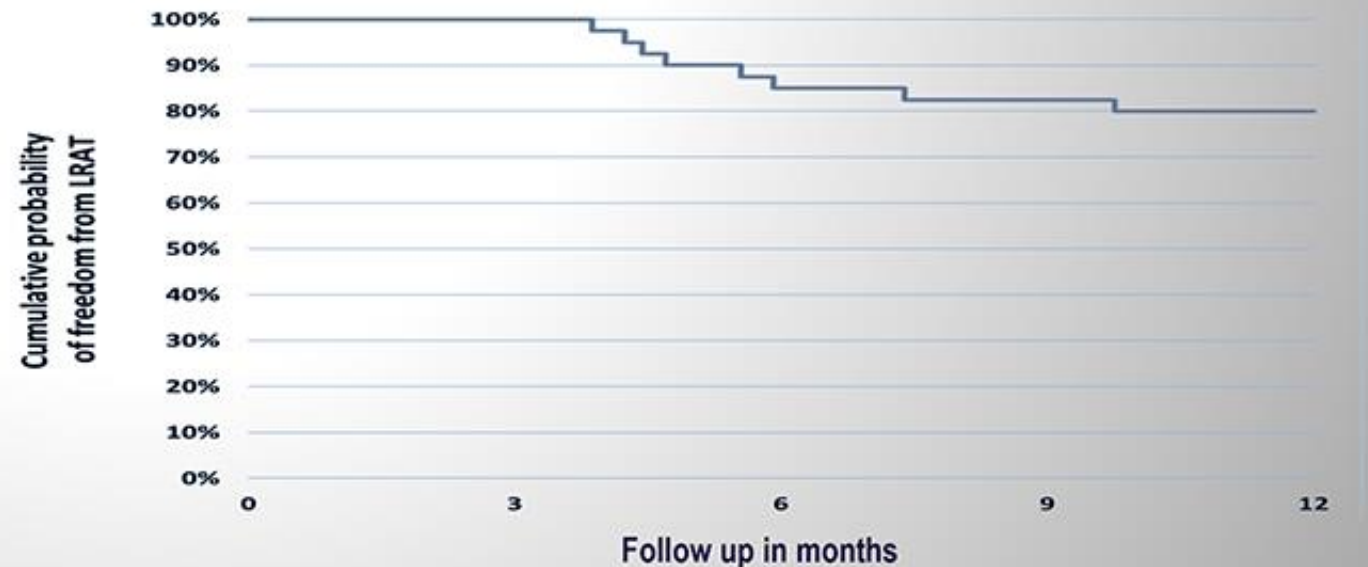
PRAISE STUDY

Hussein et al. Circ AE 2018

Durable PVI in 93% PVs with Ablation Index guided ablation



80% Freedom from arrhythmia at 12-months with PVI-alone



PVI using AI vs. CLOSE protocol with a surround flow ablation catheter

Berte B et al. Europace 2020

Single center non-randomized prospective study

- **N = 215 consecutive patients** [AI: 121 (paroxysmal: n = 97), CLOSE: n=94 (paroxysmal: n=74)]
- **PVI duration similar but first pass isolation was higher in CLOSE vs. AI** [left veins: 90% vs. 80%; $P < 0.05$ and right veins: 84% vs. 73%; $P < 0.05$].
- **Twelve-month off-AAD freedom of AF/AT was higher in CLOSE vs. AI** [79% (paroxysmal: 85%) vs. 64% (paroxysmal: 68%); $P < 0.05$].
- **Major complications were similar** (CLOSE: 2.1% vs. AI: 2.5%; $P = 0.87$).

Prospective single arm observation study

- 143 PAF from US, Japan, Europe
- De-novo PVI with RF ablation
- Mean LSI achieved for all lesions analyzed
- Follow-up 3-6 months, 12 months

Results

- Mean achieved LSI 4.9
- First-pass success 76%
- $LSI \geq 5$ resulted in shorter procedure, RF and fluoro times compared to low LSI (<5)
- At 12 months, 99.3% were free from procedure- or device-related SAE
- 95.7% (35% on anti-arrhythmic drugs) were free from recurrence and/or repeat ablation

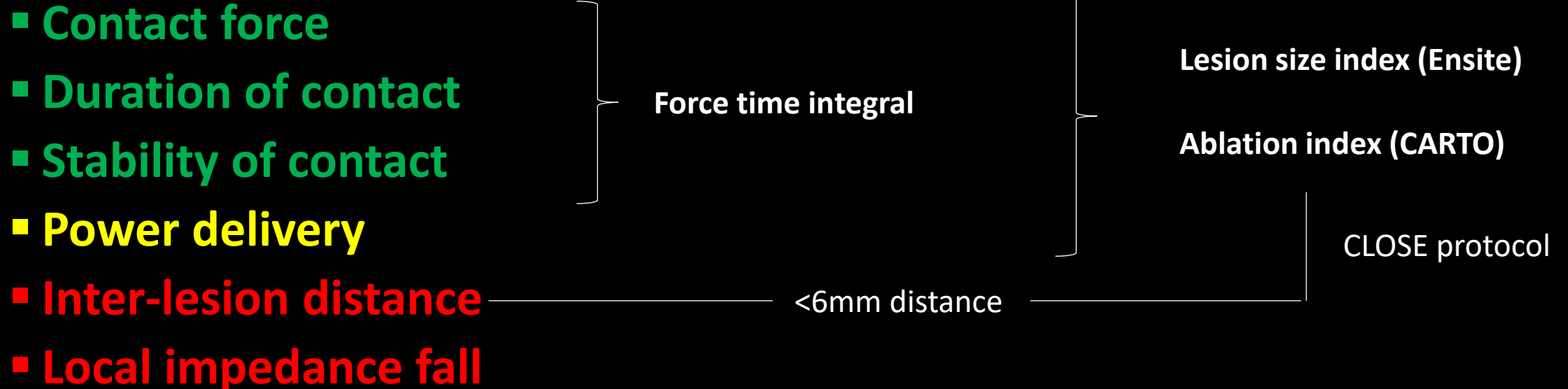
My Conclusions

CF is here to stay

But availability of contact force sensing alone does not improve outcomes

It has to be correctly and diligently used by the operator, incorporated into indices of RF lesion formation

Factors affecting RF lesion formation include:



High density mapping catheters in AF ablation

Traditional option is the circular mapping catheter (Lasso)

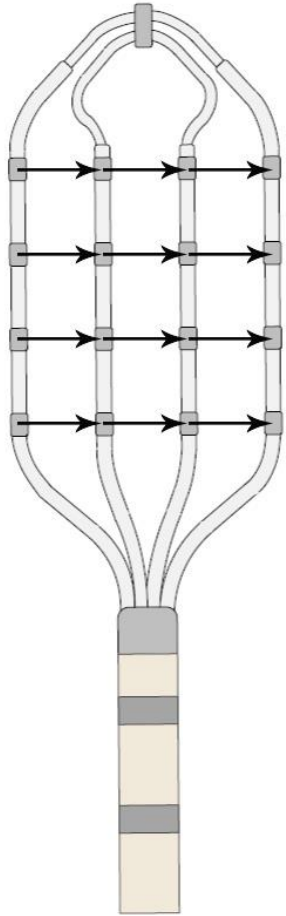
New catheter designs incorporating more and smaller, closely-spaced electrodes may have advantages

- Pentaray, Optrell (Biosense Webster) – CARTO 3
- HD Grid (Abbott Medical) – Ensite Precision, X
- Orion (Boston Scientific) – Rhythmia HDx

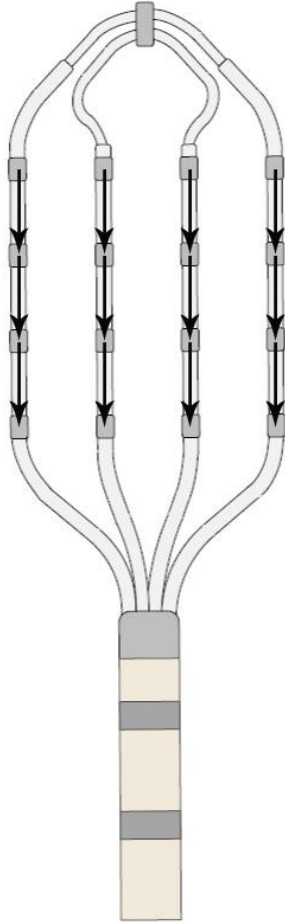
Qualities of the HD Grid

1. Records high quality electrograms
2. Partially corrects for wavefront directionality (unique feature)
3. Easy to maneuver and safe
 - Easy to obtain good contact and to know when you have good contact
4. Gives good distribution of points

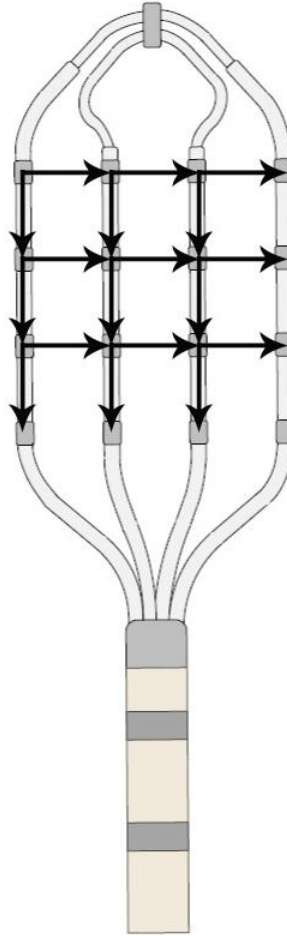
Different bipolar configurations for HD Grid Catheter



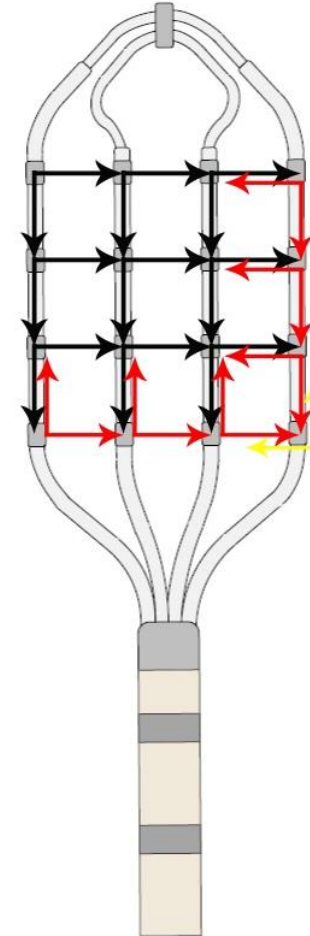
Horizontal
Configuration
12 electrograms



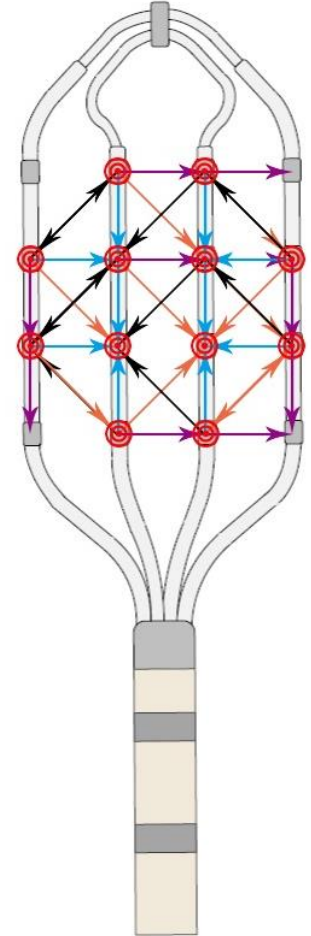
Vertical
Configuration
12 electrograms



HD Wave
Configuration
18 electrograms

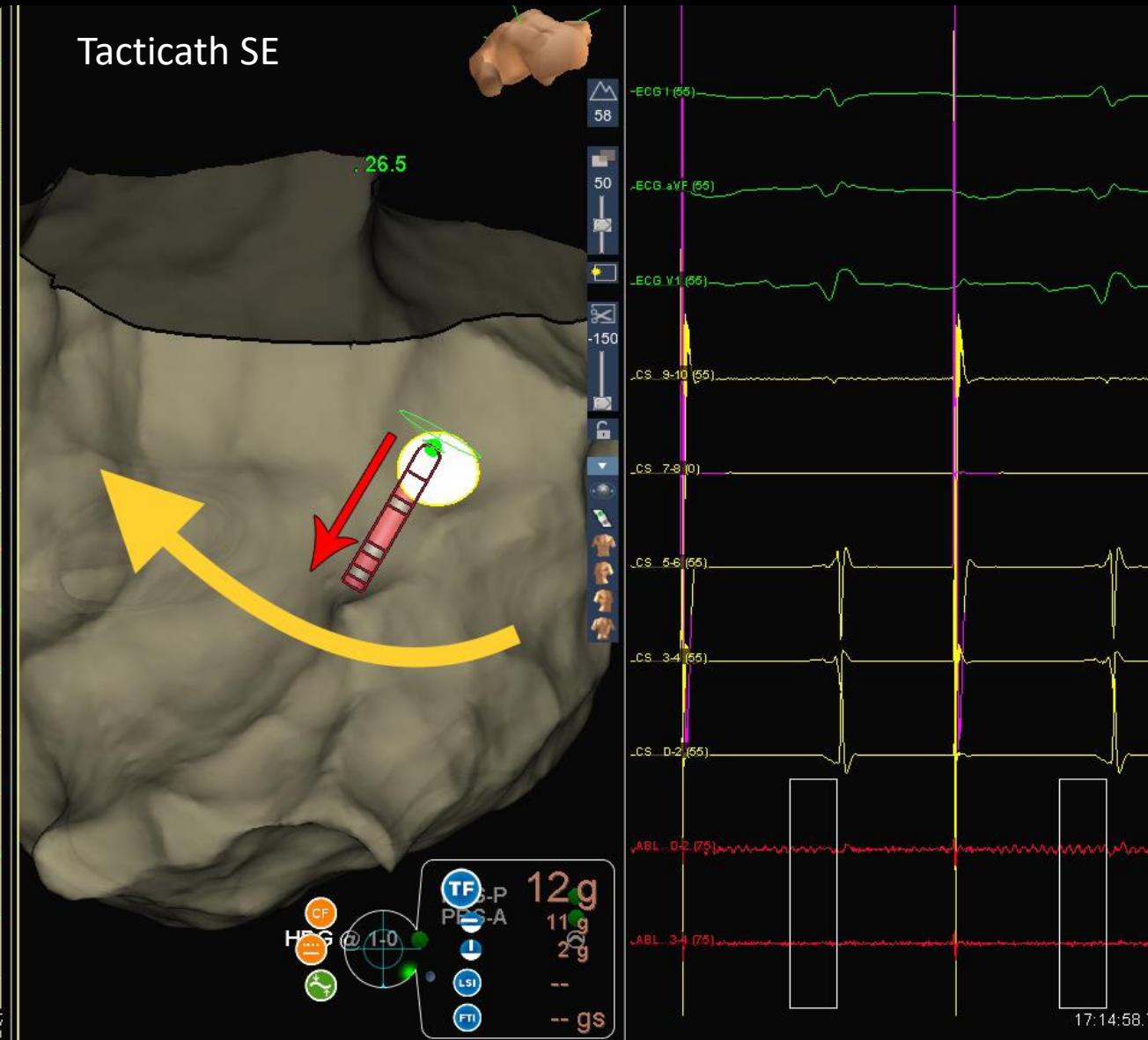
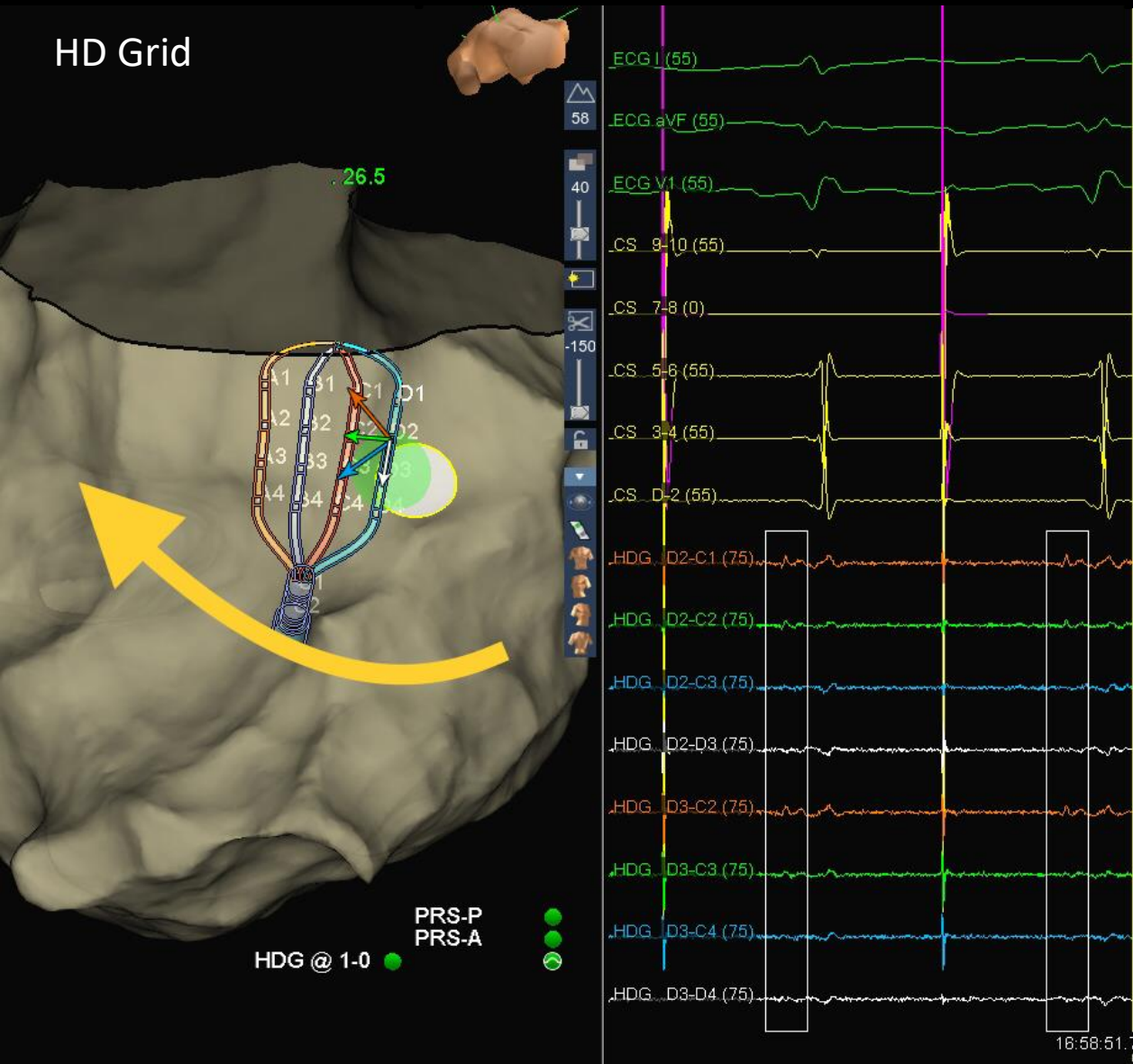


32 electrograms
configuration



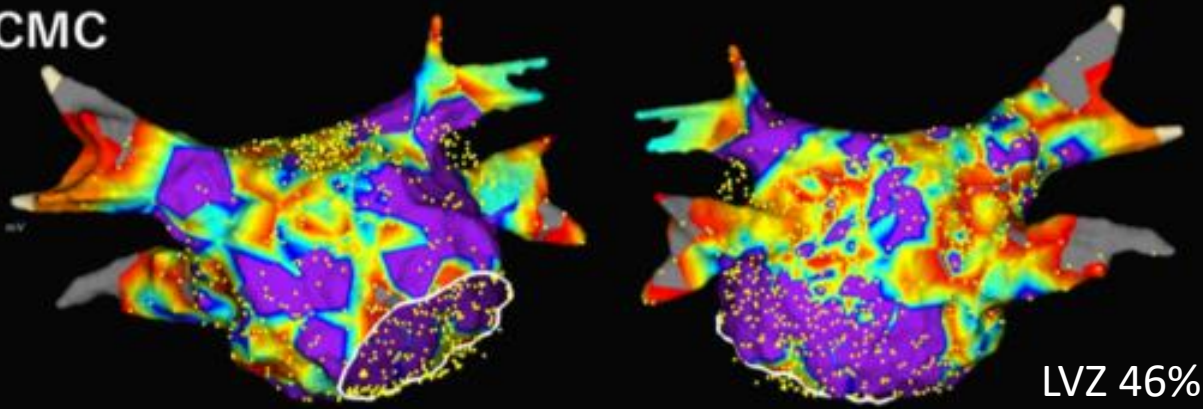
48 electrograms
configuration

Directionality matters: Assessment of CTI line



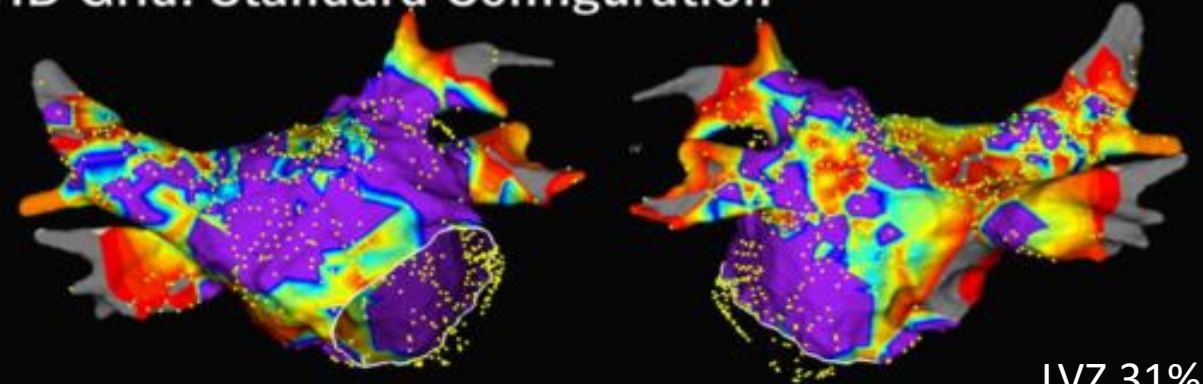
Sinus rhythm maps

CMC



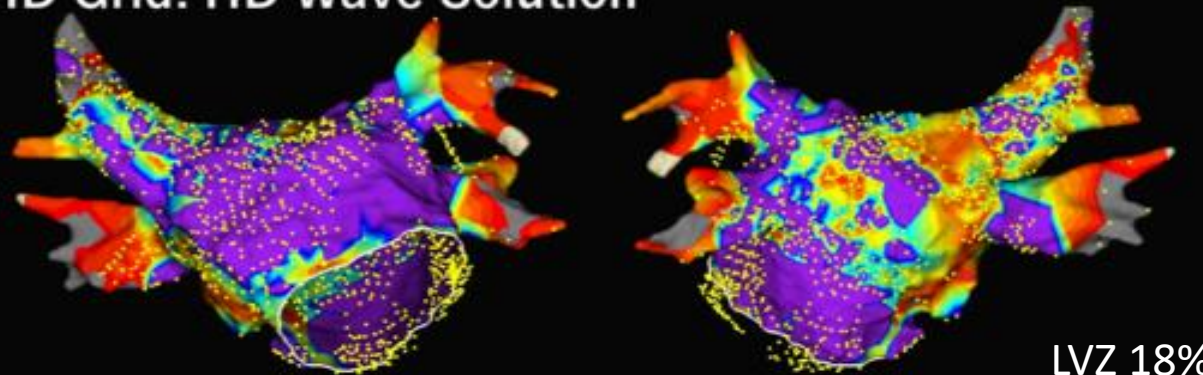
LVZ 46%

HD Grid: Standard Configuration

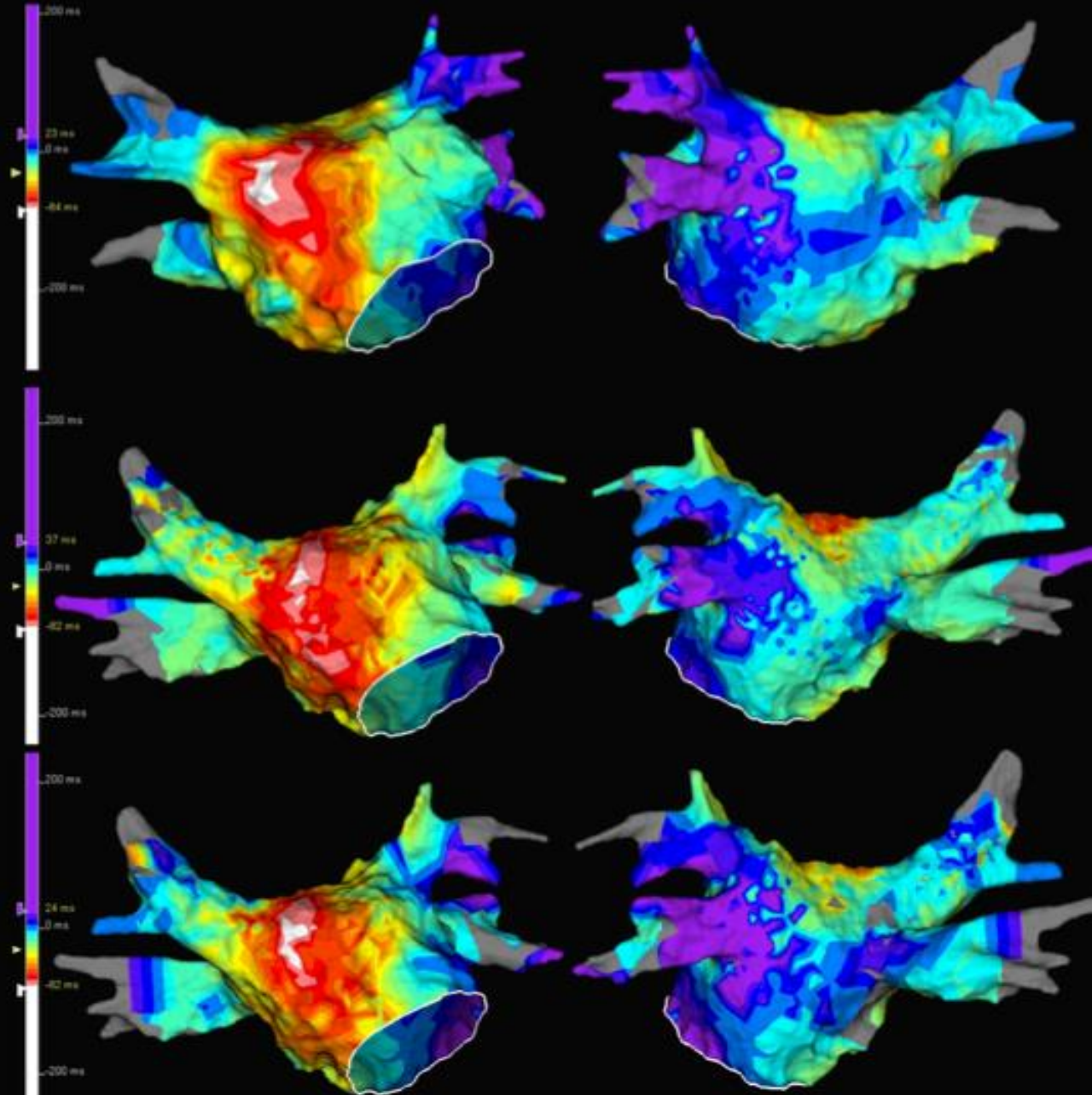


LVZ 31%

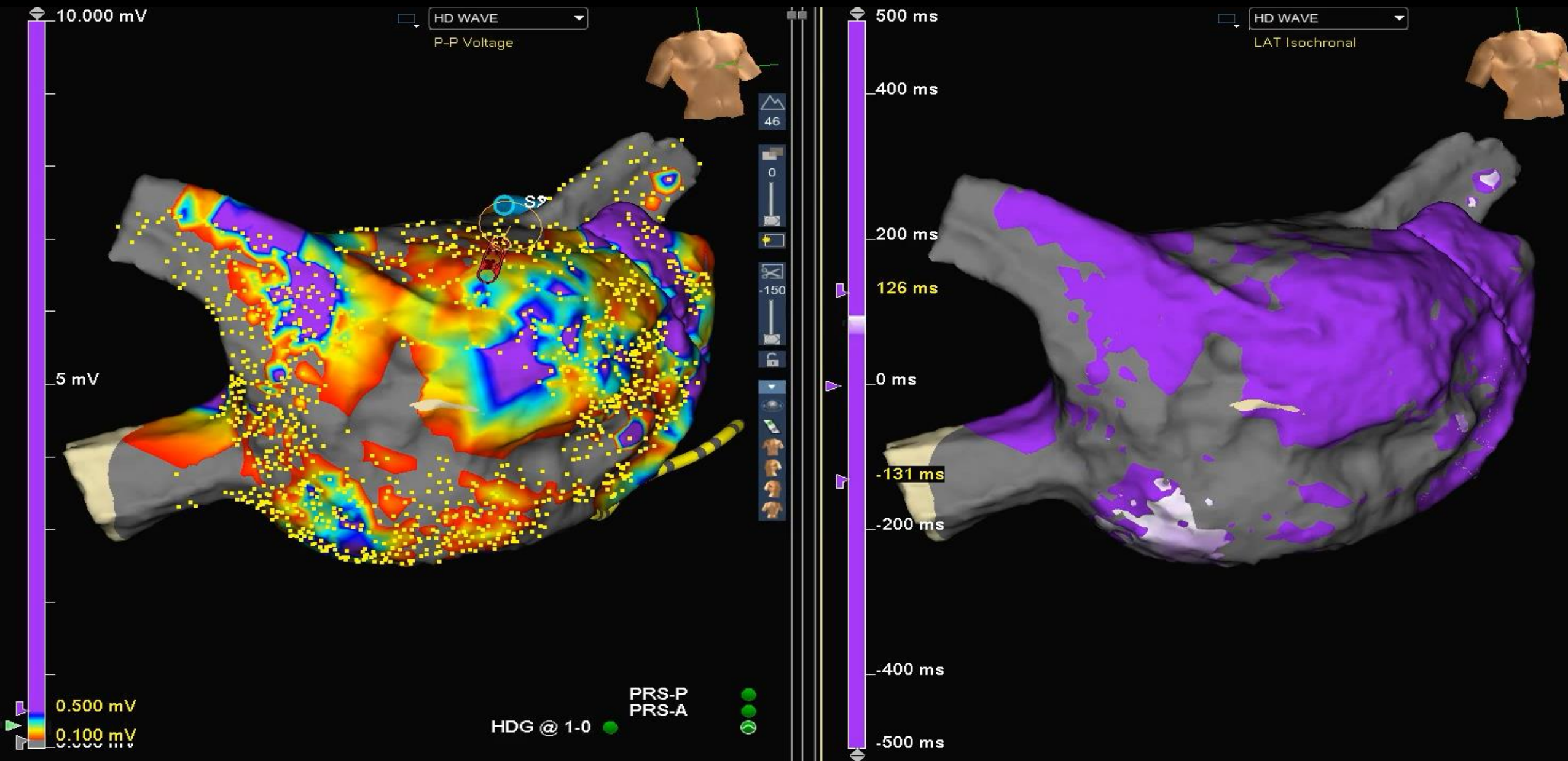
HD Grid: HD Wave Solution

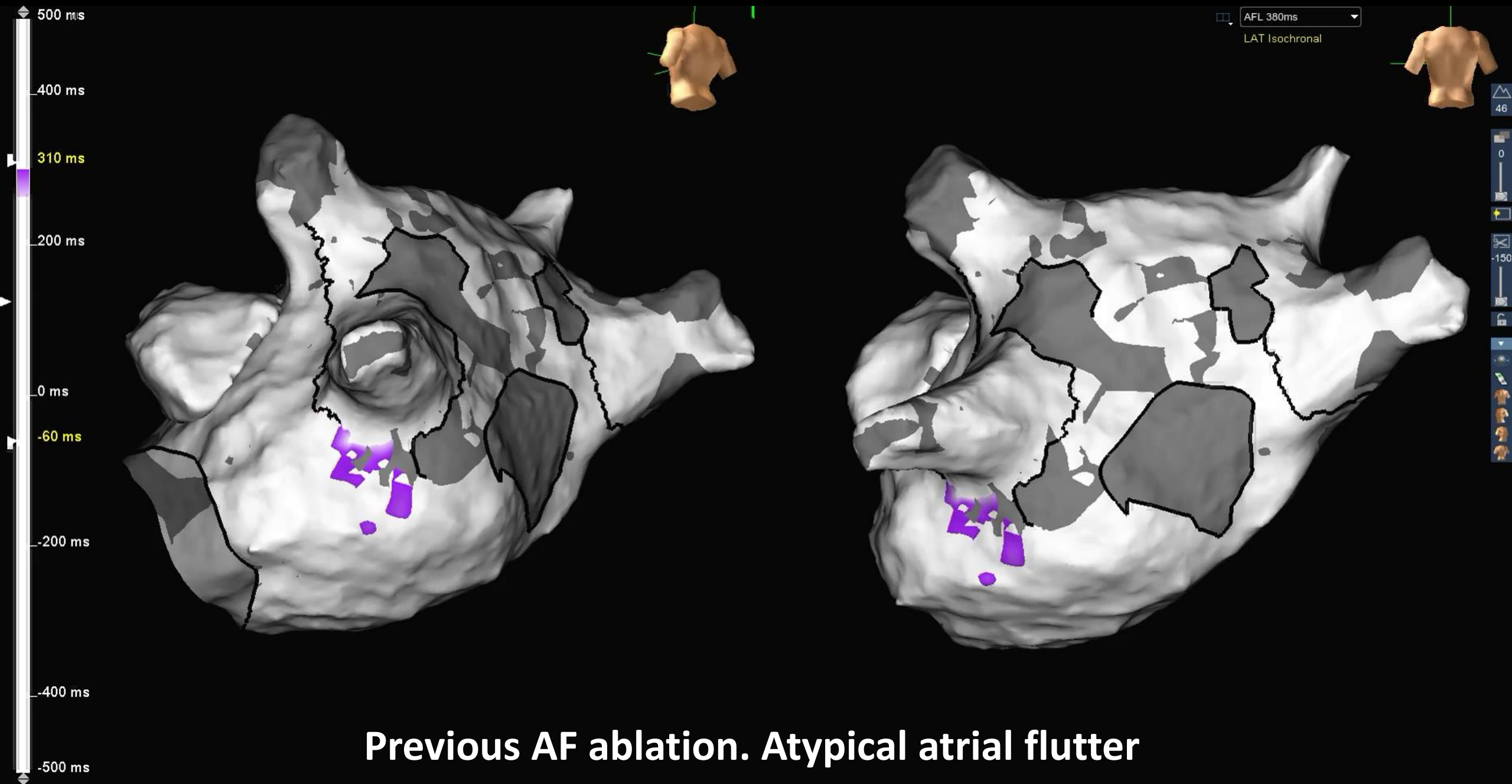


LVZ 18%



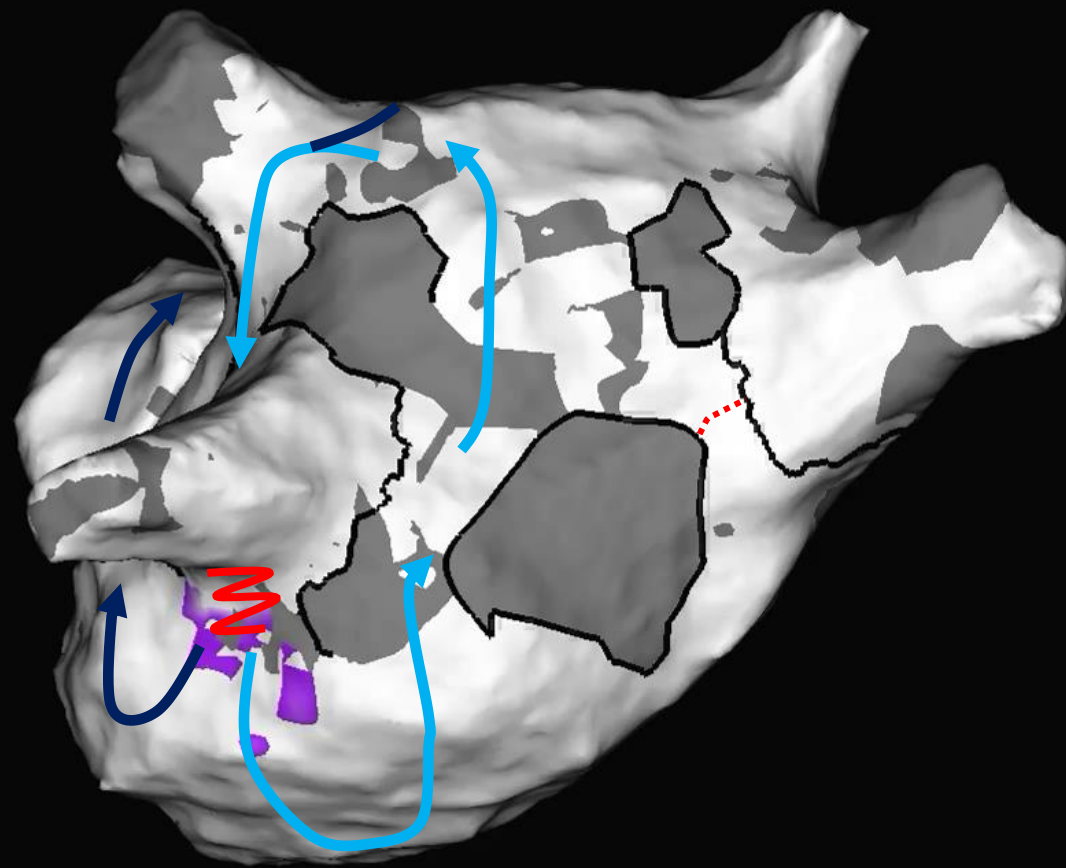
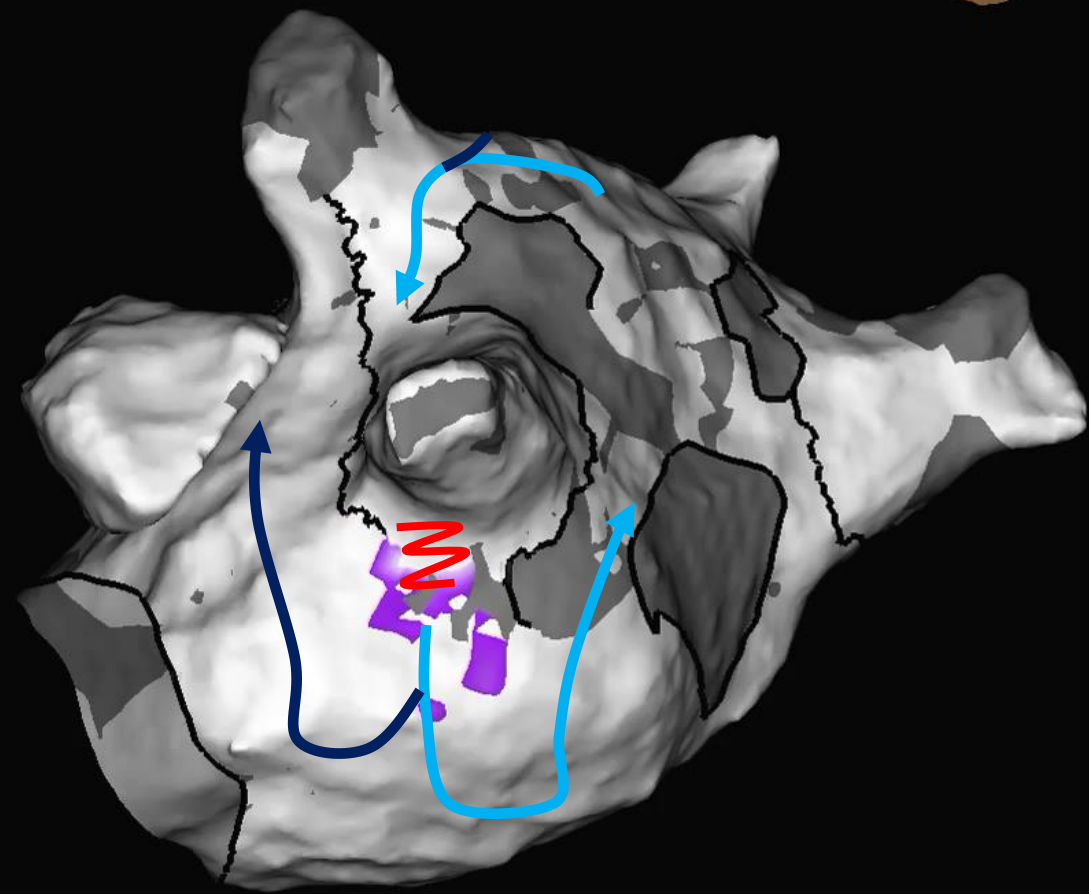
Assessing Pulmonary Vein Reconnection



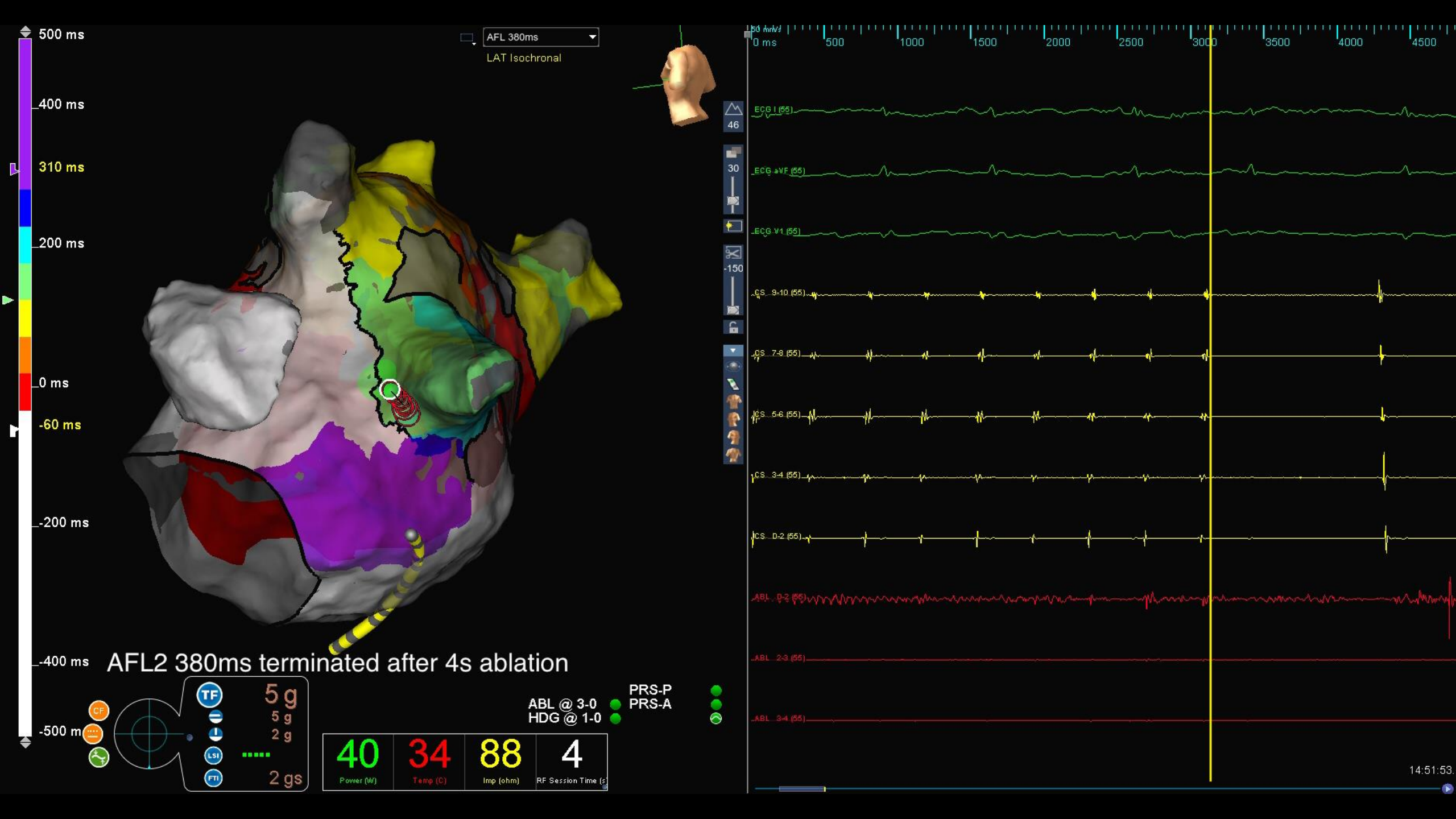


500 ms
400 ms
310 ms
200 ms
0 ms
-60 ms
-200 ms
-400 ms
-500 ms

AFL 380ms
LAT Isochronal



46
0
-150



Summary

RF ablation remains an important ablation technology for pAF and the main technology for persAF

Contemporary RF workflows incorporate:

- Contact force sensing coupled with automatic lesion annotation based on contact force, duration, stability, power ...
- High density mapping catheters – these are quickly supplanting traditional CMC

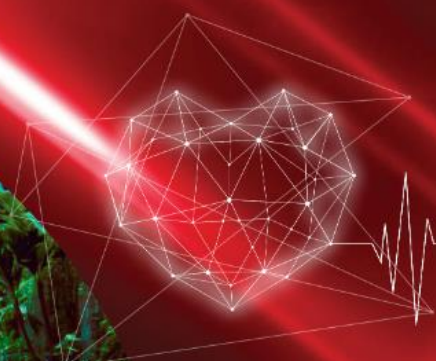
Incorporation of these techniques is likely to result in lower procedure times, lower fluoroscopy times, improved PV isolation durability and may result in improved clinical outcomes

APHRS 2022

Singapore

Save the date! November 18-20, 2022

See you soon!



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