

Ablation des TV : quelles techniques choisir ?



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FRANCE

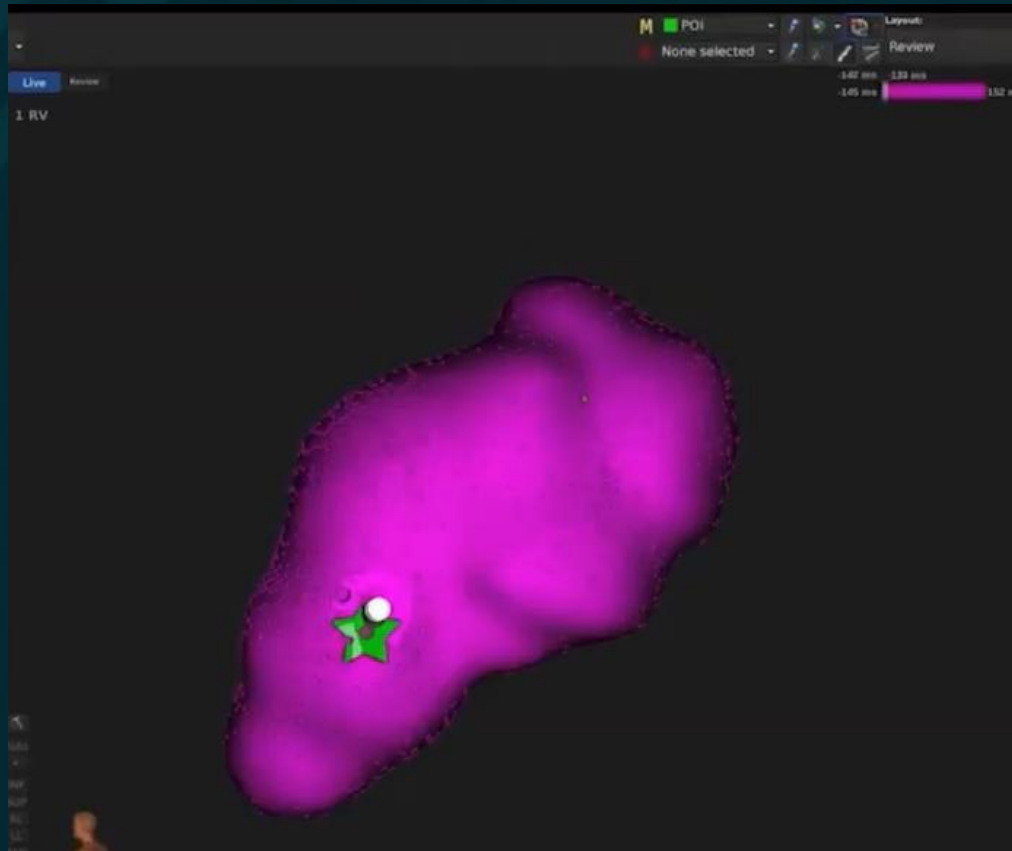
RELATIONSHIP WITH INDUSTRY

- **Speaking honorarium:** Biosense Webster, Boston Scientific, Medtronic, Abbott, Microport, Bayer Healthcare
- **Consulting fees:** Boston scientific, Bayer Healthcare, Inheart

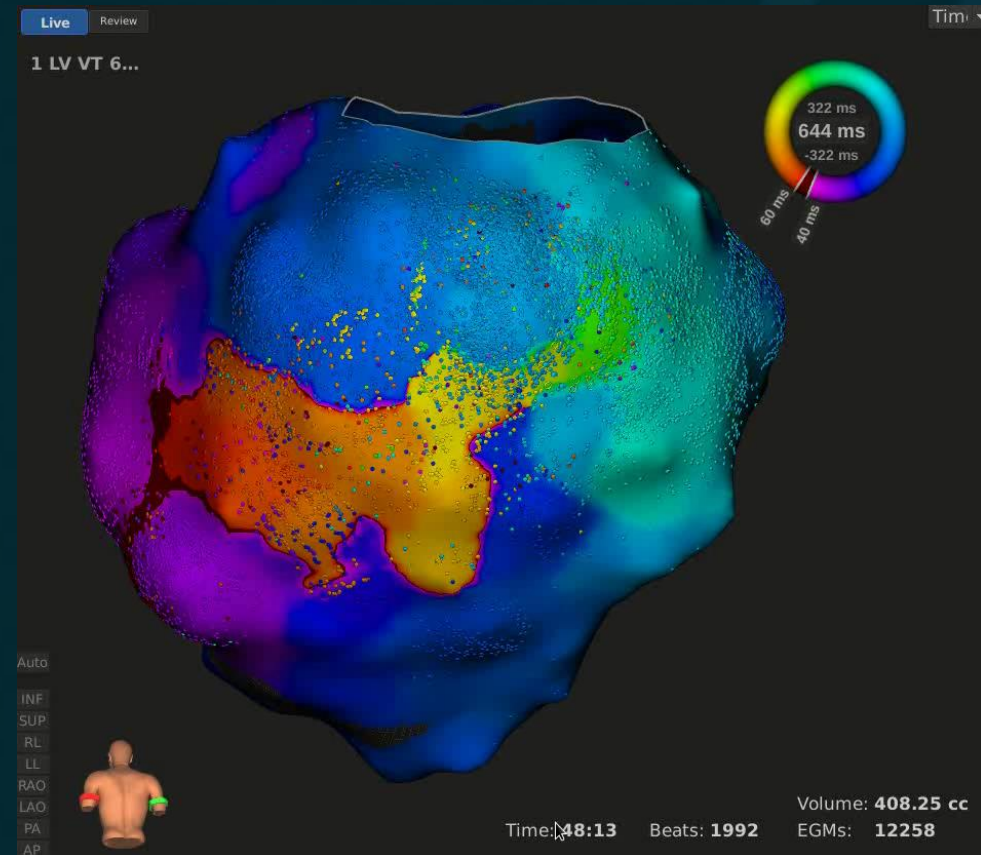
PLAN

- **Mécanismes Tachycardies Ventriculaires**
- **Repérer la zone = cartographie = mapping**
 - par catheter
 - par imagerie
- **Eliminer la zone = Ablation**
 - RF
 - PFA = electroporation
 - Point par point vs PFA large

MÉCANISMES DES TACHYCARDIES VENTRICULAIRES



Focal

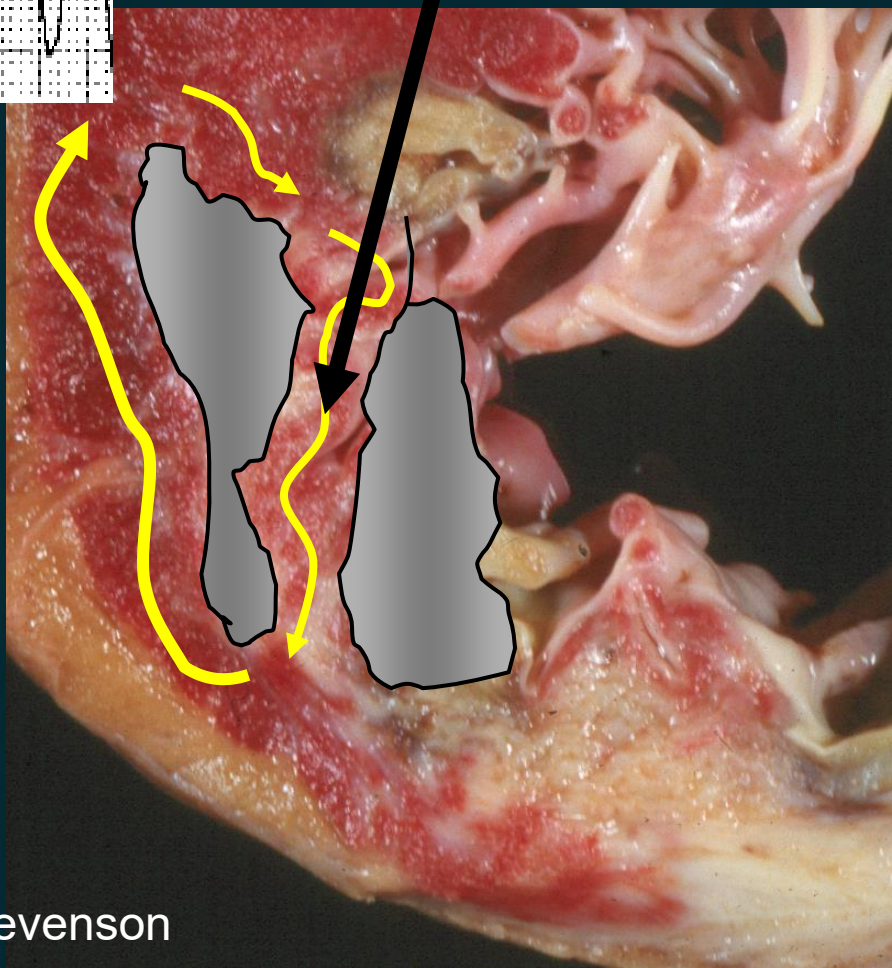


Ré-entrant

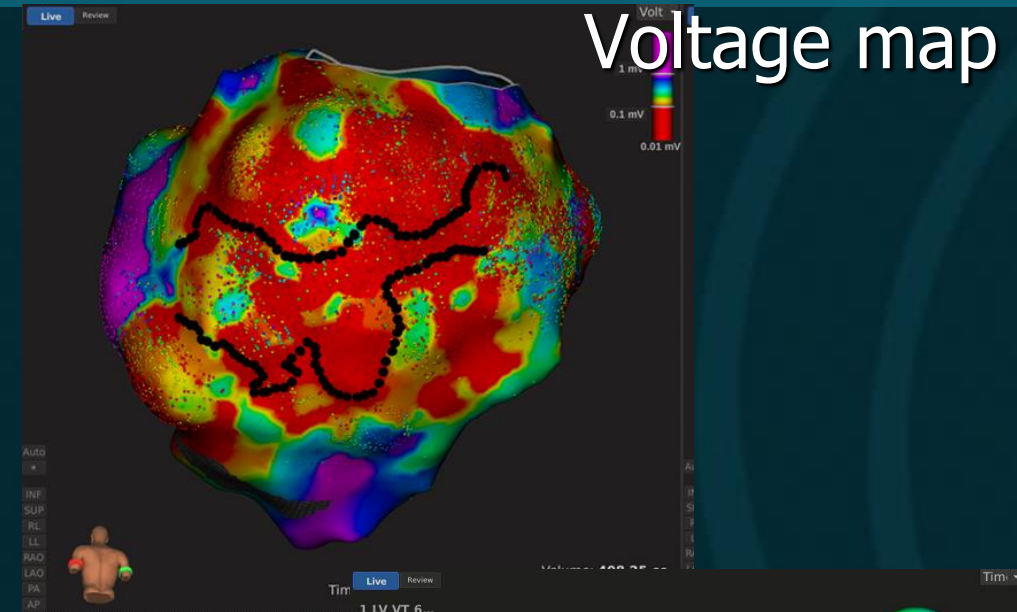
LES TV PAR RÉ-ENTRÉE SURVIENNENT SUR CICATRICE



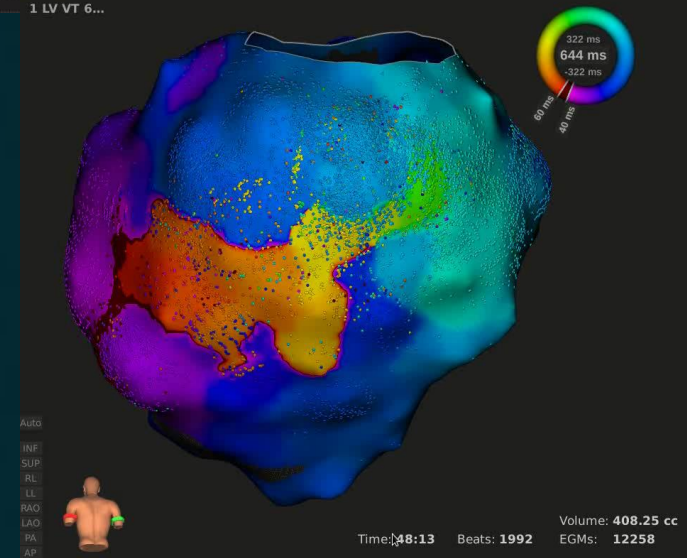
Channel / Isthmus



Voltage map



Activation map



CARTOGRAPHIE - MAPPING

Repérer la zone à traiter

Avec un cathéter dans le coeur

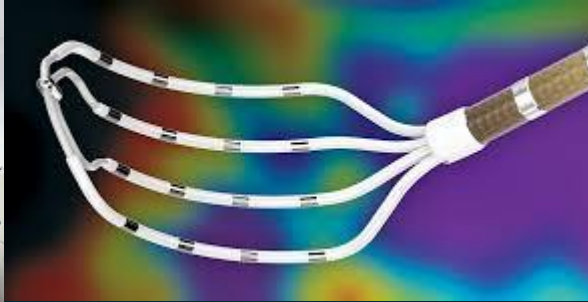
- Un catheter qui fait tout (catheter d'ablation)
- Un catheter dédié de haute densité (catheter de cartographie)

Avec l'imagerie

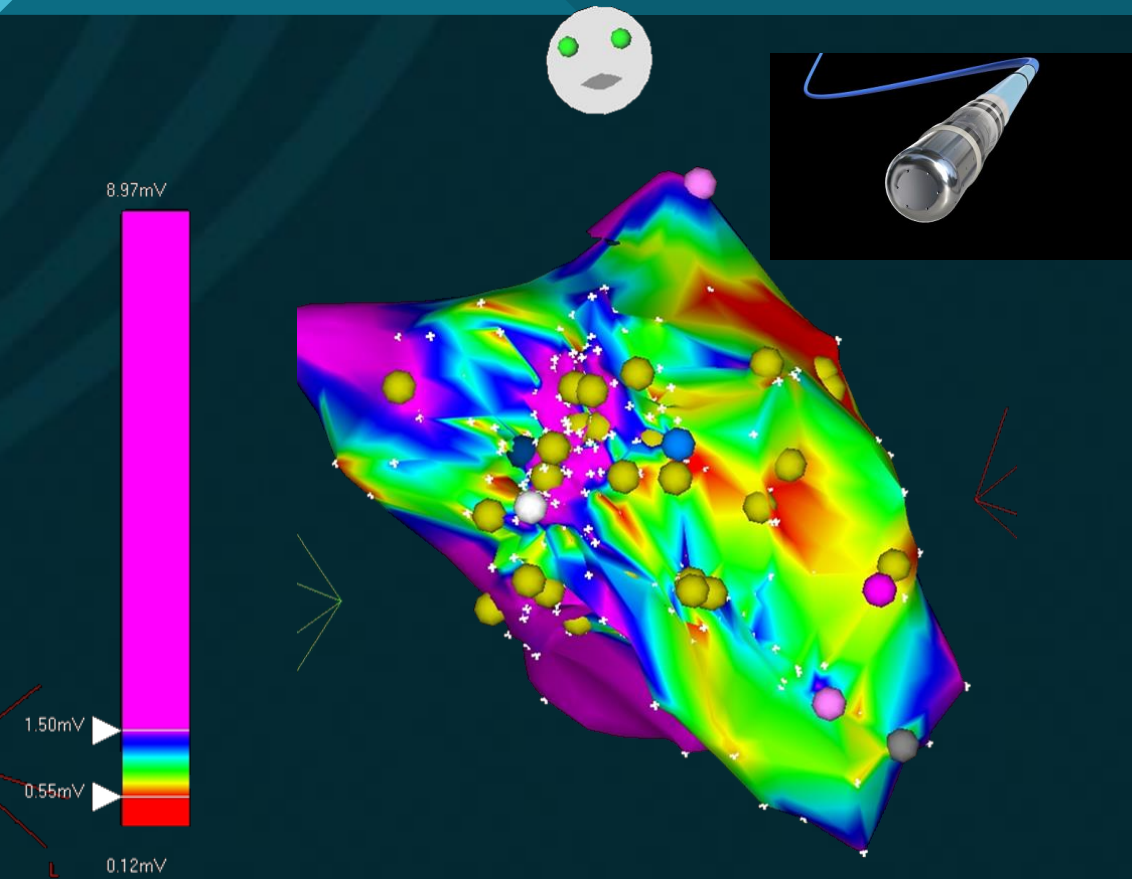
- À partir des images de scanner ou d'IRM
- Traitées avec un logiciel dédié (InHeart, ADAS)

CARTOGRAPHIE - MAPPING

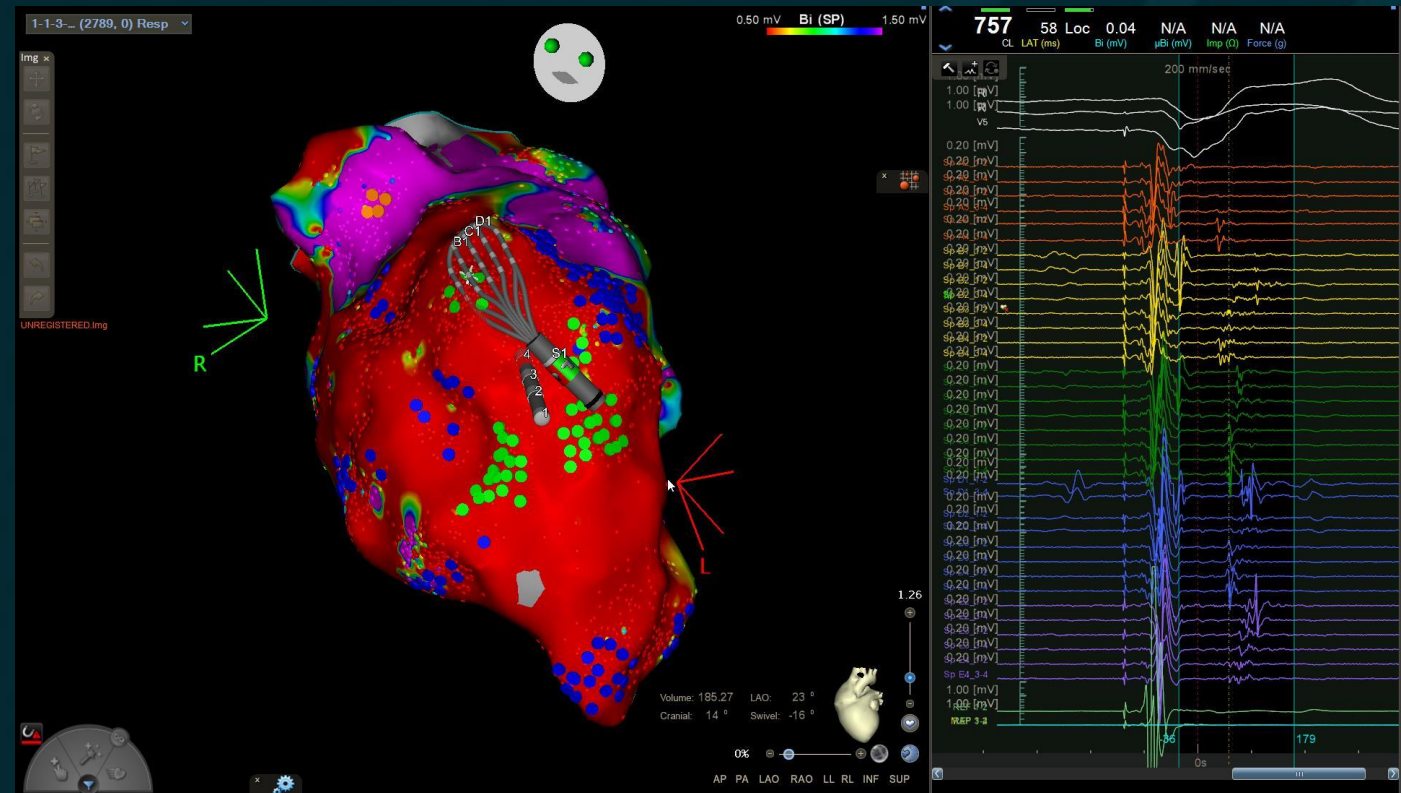
Avec un catheter dans le Coeur en TV



Avec un catheter dans le coeur



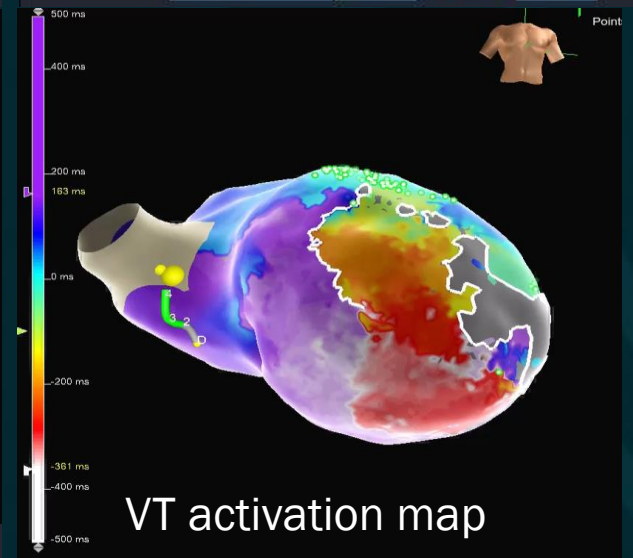
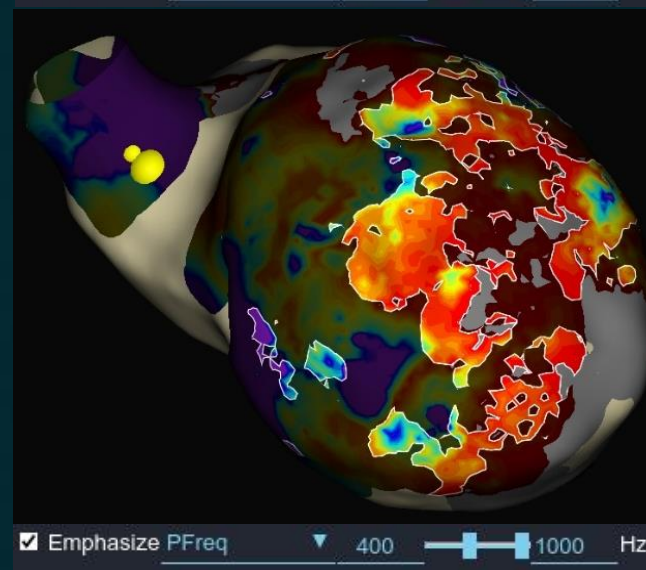
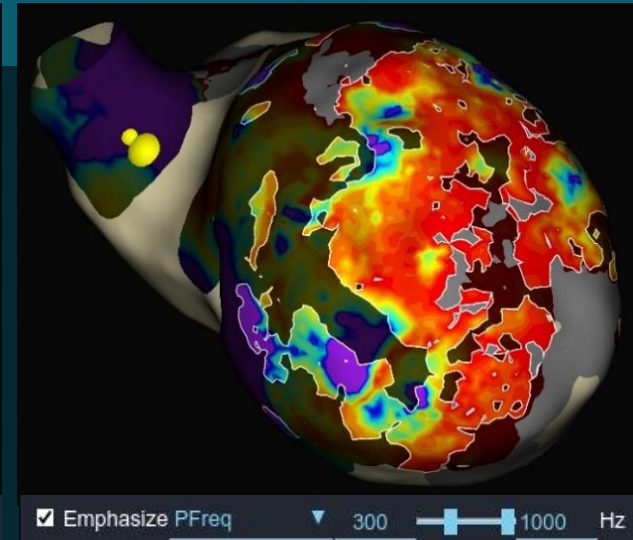
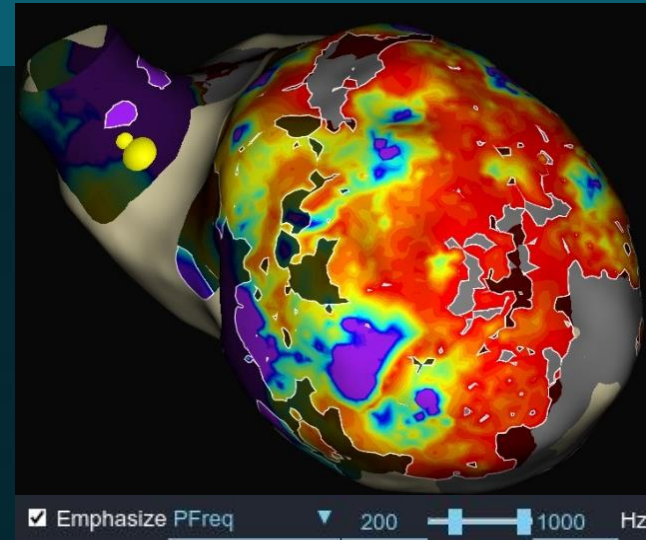
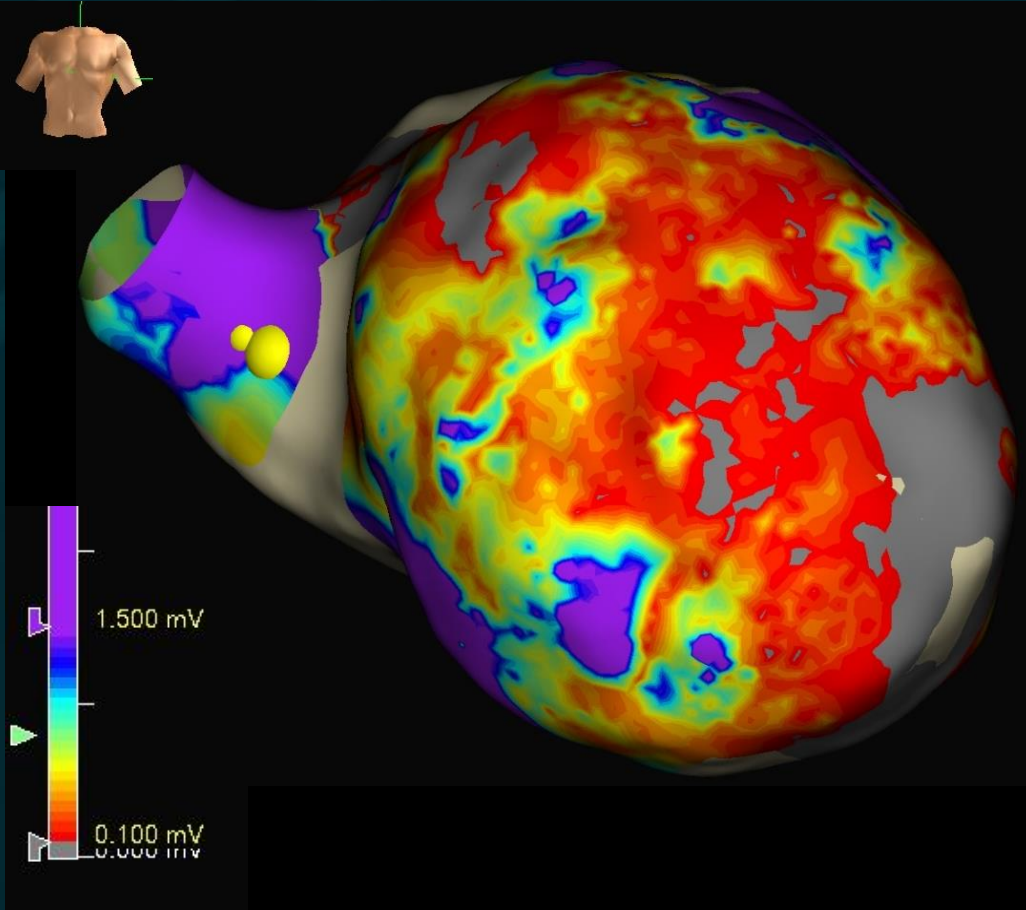
Carte avec Catheter d'ablation
1 heure 350 points



Carte avec Catheter de cartographie
haute densité
10 min 10000 points

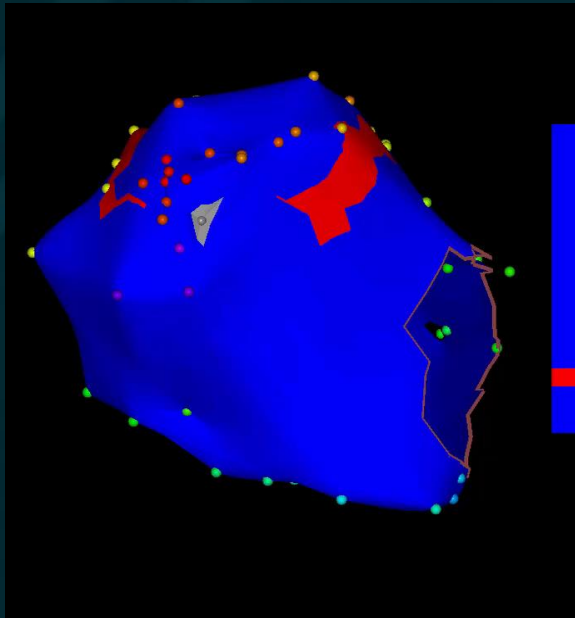
Mr C. 53 yo, Isch CMP

VOLTAGE MAP – PACED RHYTHM

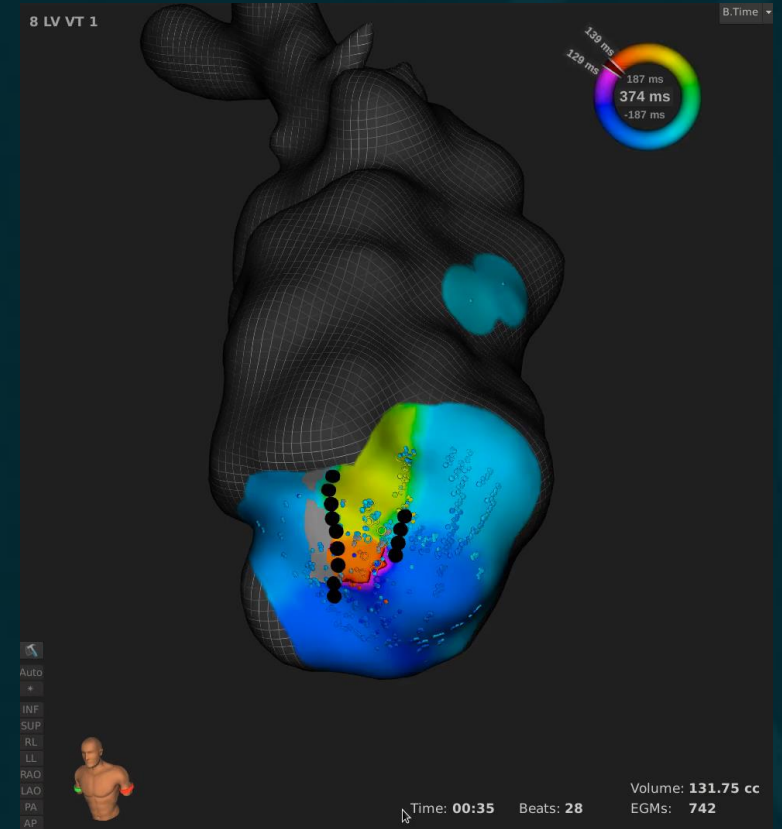
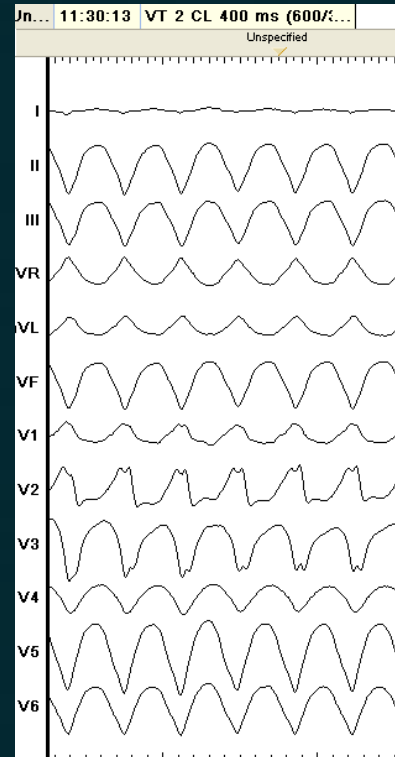


CARTOGRAPHIE - MAPPING

Avec un catheter dans le Coeur en TV



Carte avec Catheter d'ablation
100 pts en 10 min

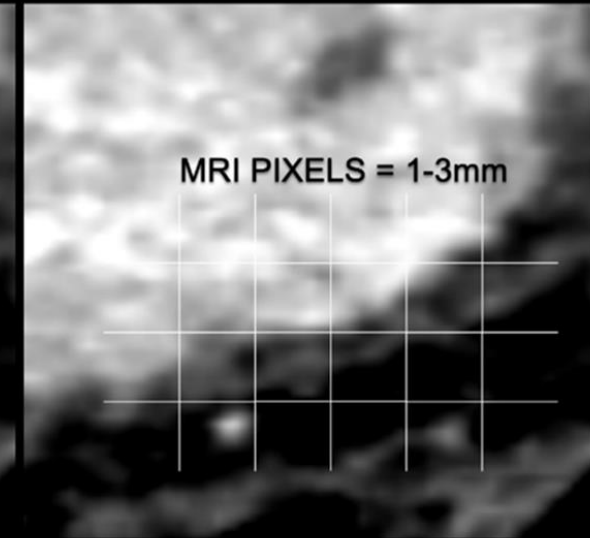
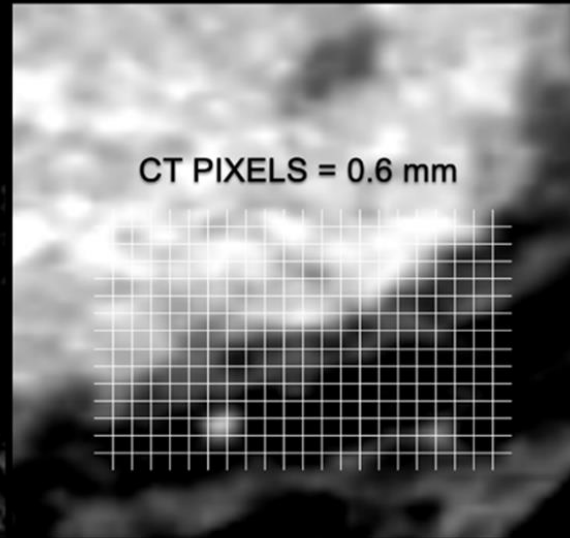
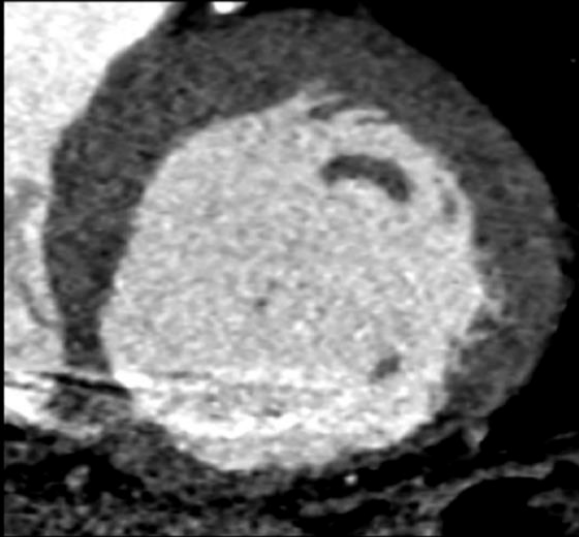


Carte avec Catheter de cartographie
haute densité
742 pts en 35 secondes

CARTOGRAPHIE - MAPPING

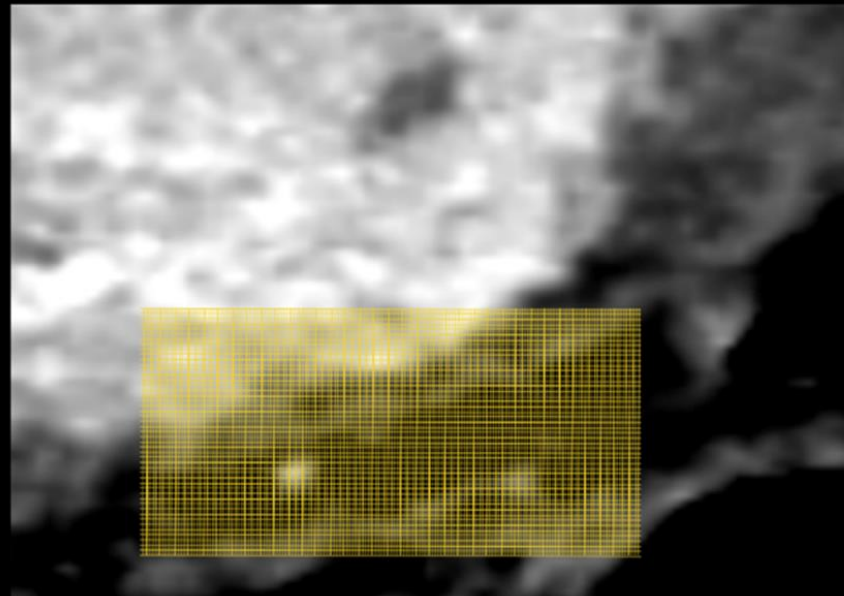
Avec l'imagerie

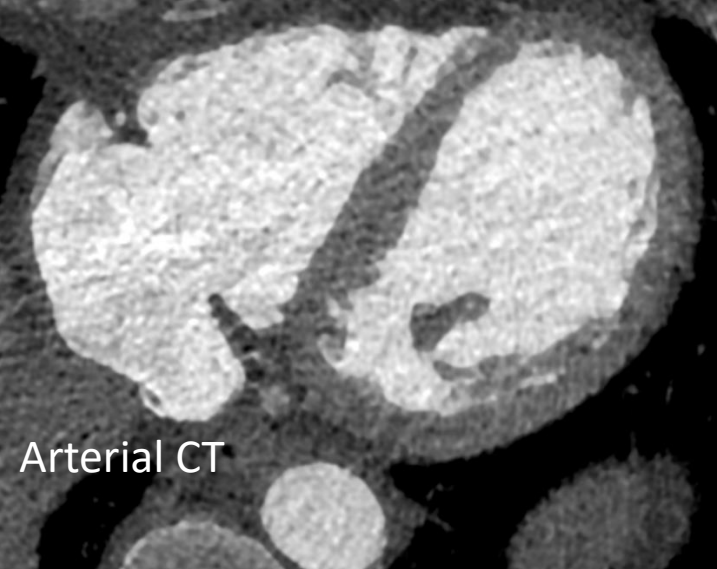
Scanner IRM



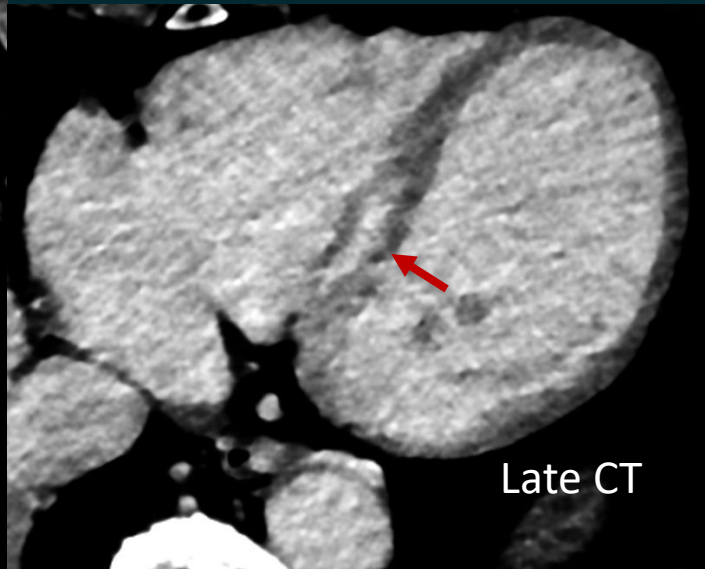
Scanner à comptage photonique:

- caractérisation tissulaire (comme IRM)
- Résolution spatiale ($\rightarrow 100\mu\text{m}$)

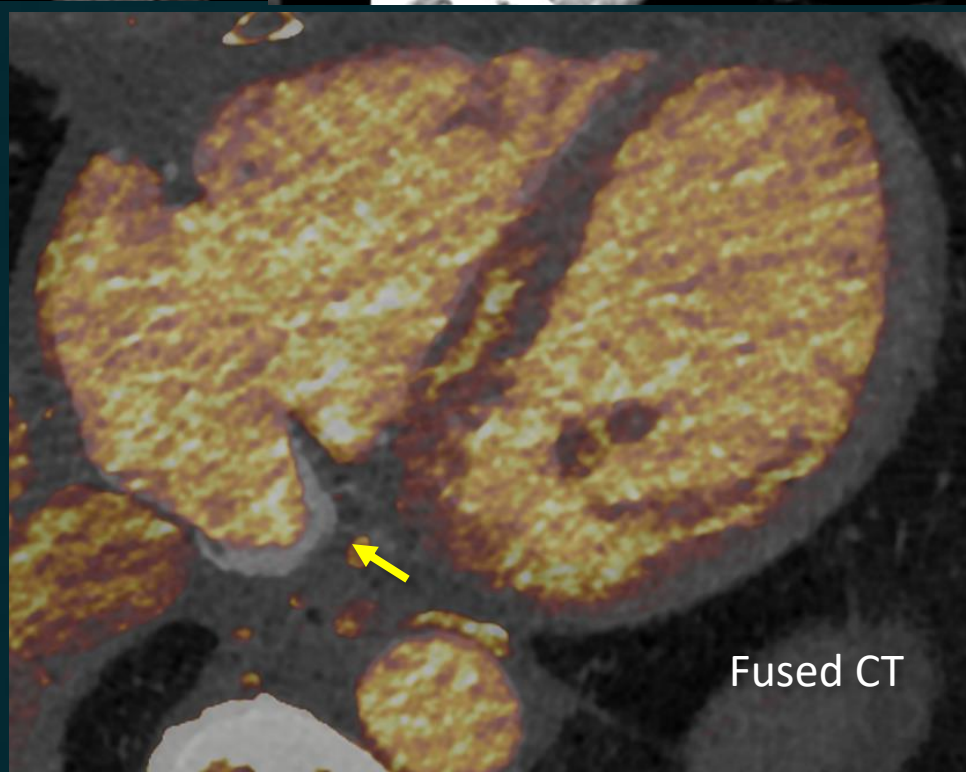




Arterial CT

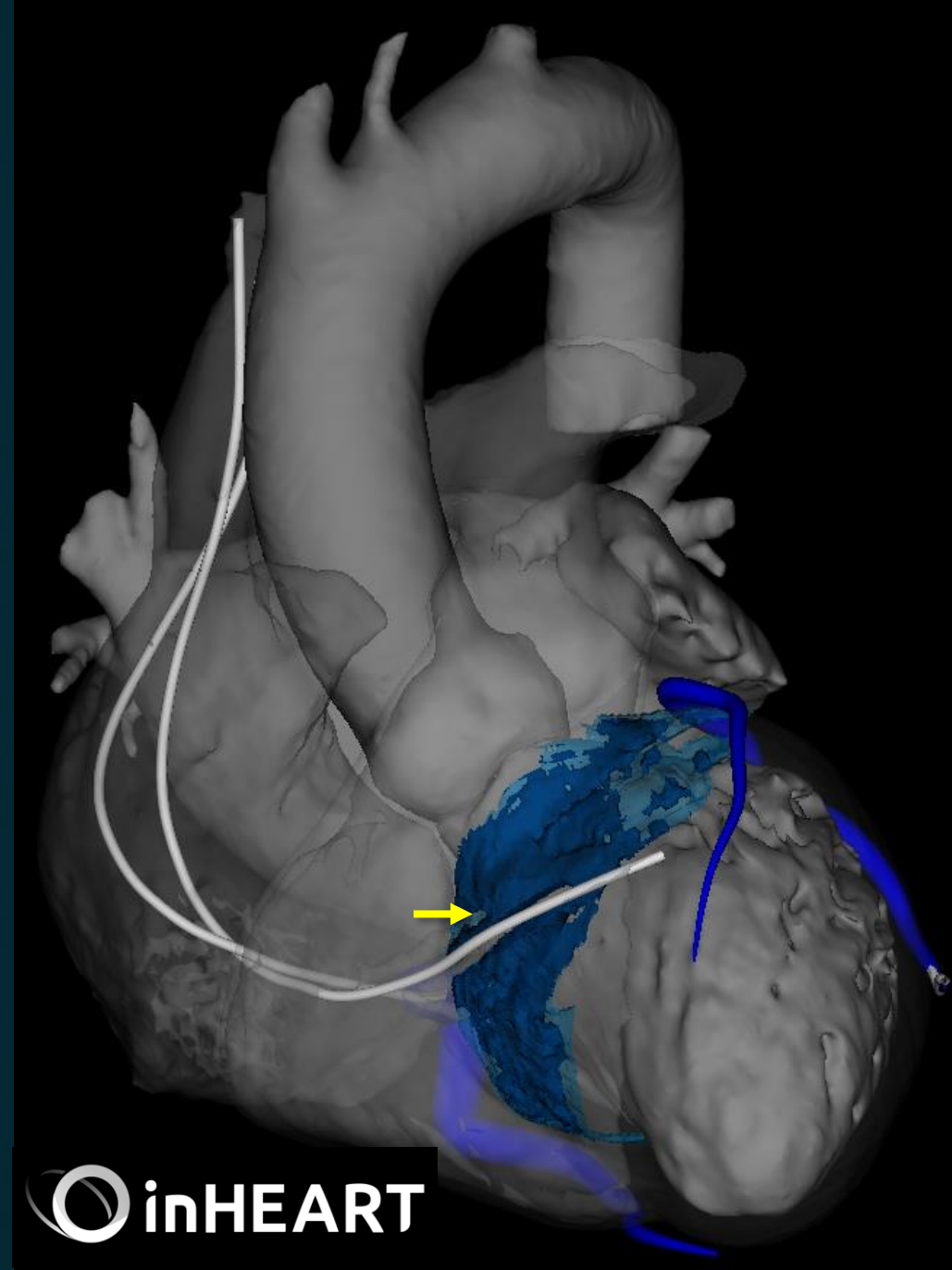


Late CT



Fused CT

CT scan



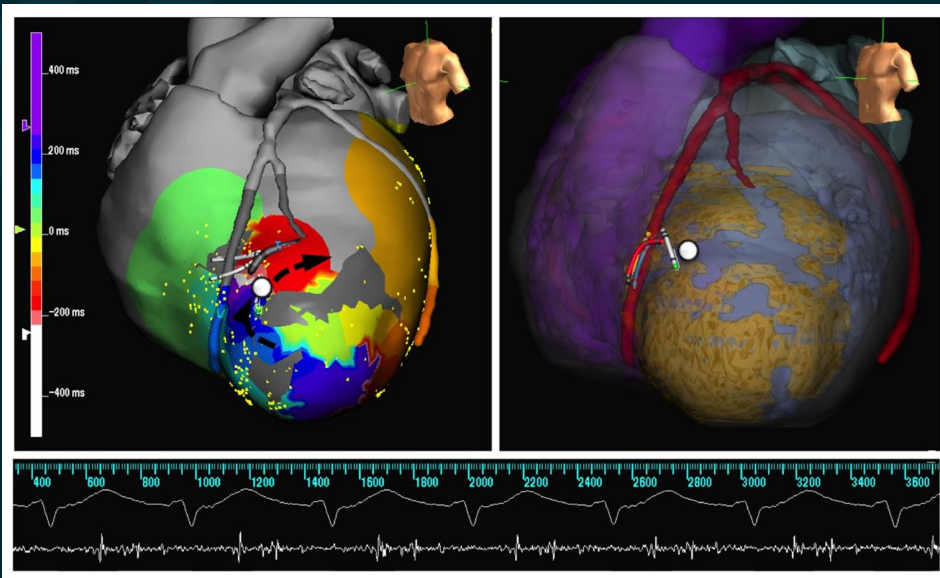
 **inHEART**

<https://www.inheartmedical.com/>

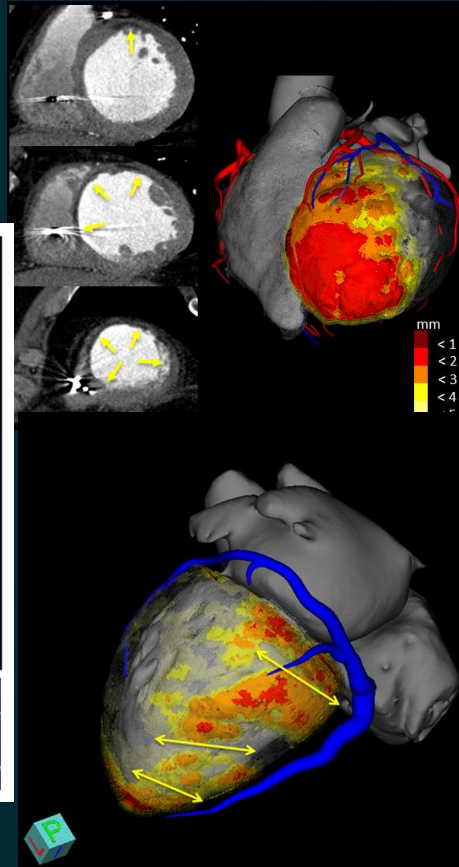
IMAGING FOR VT ABLATION TO GUIDE ABLATION

CT scan

Wall thickness

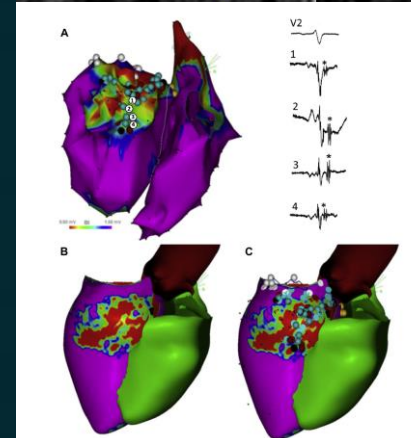
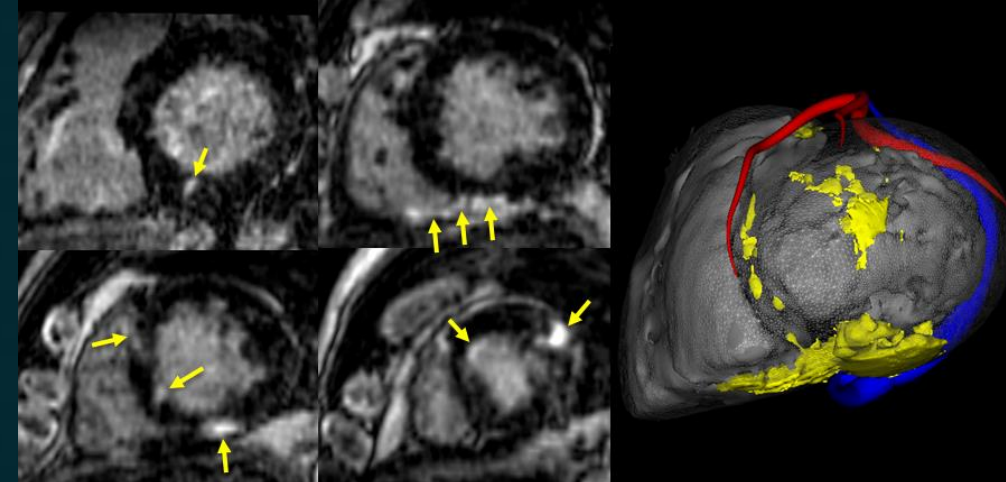


Komatsu Y et al. Circ A & E 2013



MRI

Signal Intensity



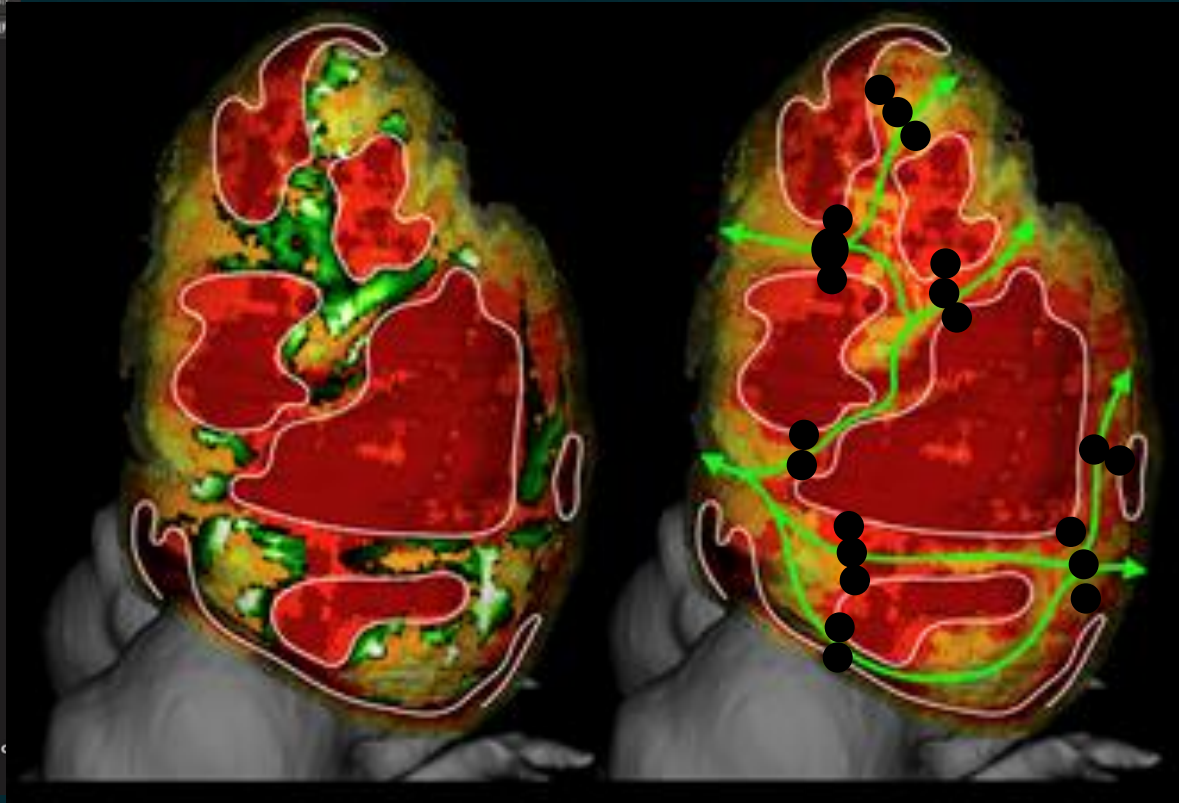
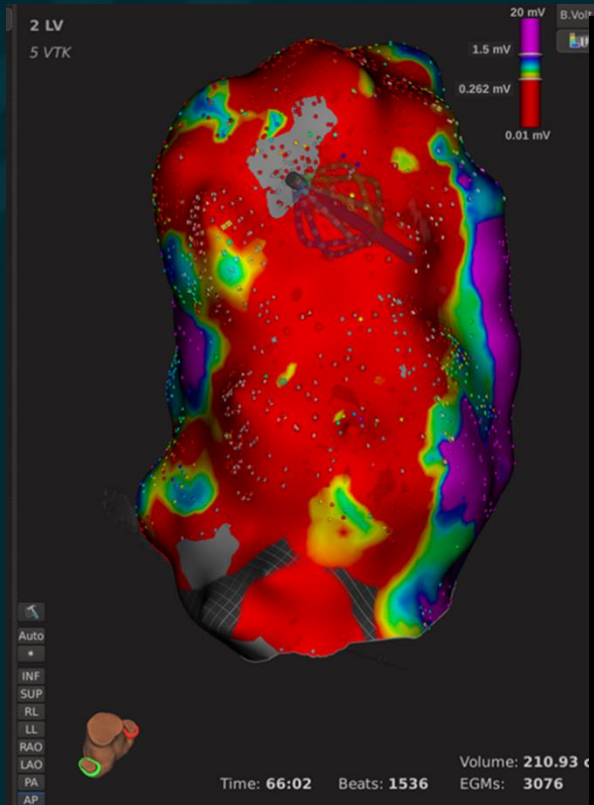
Andreu D. et al. HR 2017

■ ICE, MIBG, PET Scan...

INEURHEART

SUBSTRATE MAPPING AND ABLATION BASED ON CT SCAN IN ISCHEMIC CMP

HYPOTHESIS: CHANNELS DELIMITED BY WALL THICKNESS HETEROGENITY



■ **Strategy evaluated:**

- 1) Merge CT scan in 3D mapping
- 2) CT isthmus ablation
- 3) Induction
 - Non inducible: Stop
 - Inducible: VT mapping & ablation

Potential isthmii based on wall thickness heterogeneity identified on CT scan in a patient with inferior MI (INEURHEART). <https://www.inheartmedical.com/>

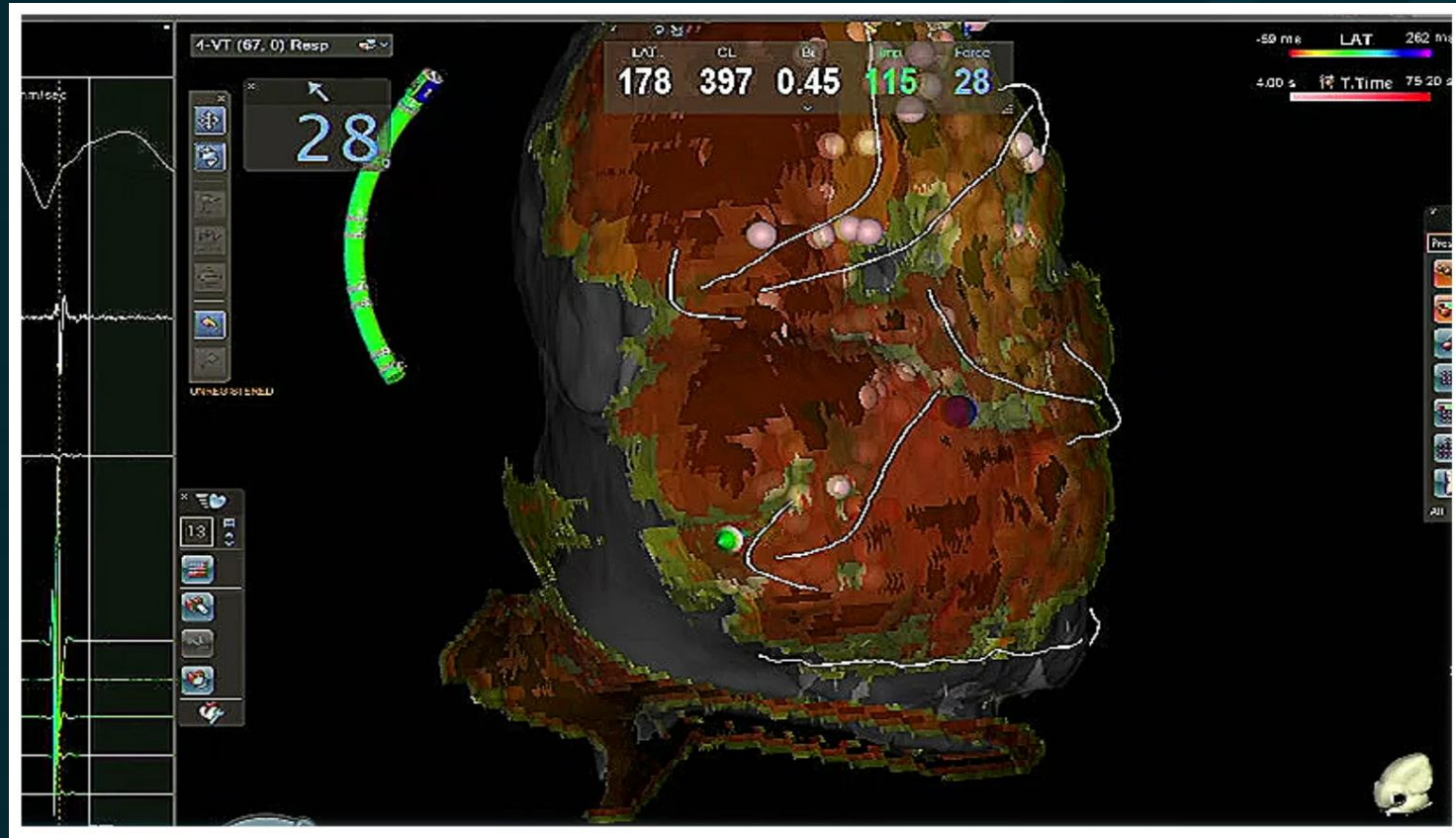
WORKFLOW

Ablation of the identified isthmus

- 40-50 Watts for 45-60 sec. sometimes more, depending on impedance drop, signal reduction, catheter position and contact force
- Block the isthmus or at least render them unexcitable (pacing a 10 mA and 2 ms)

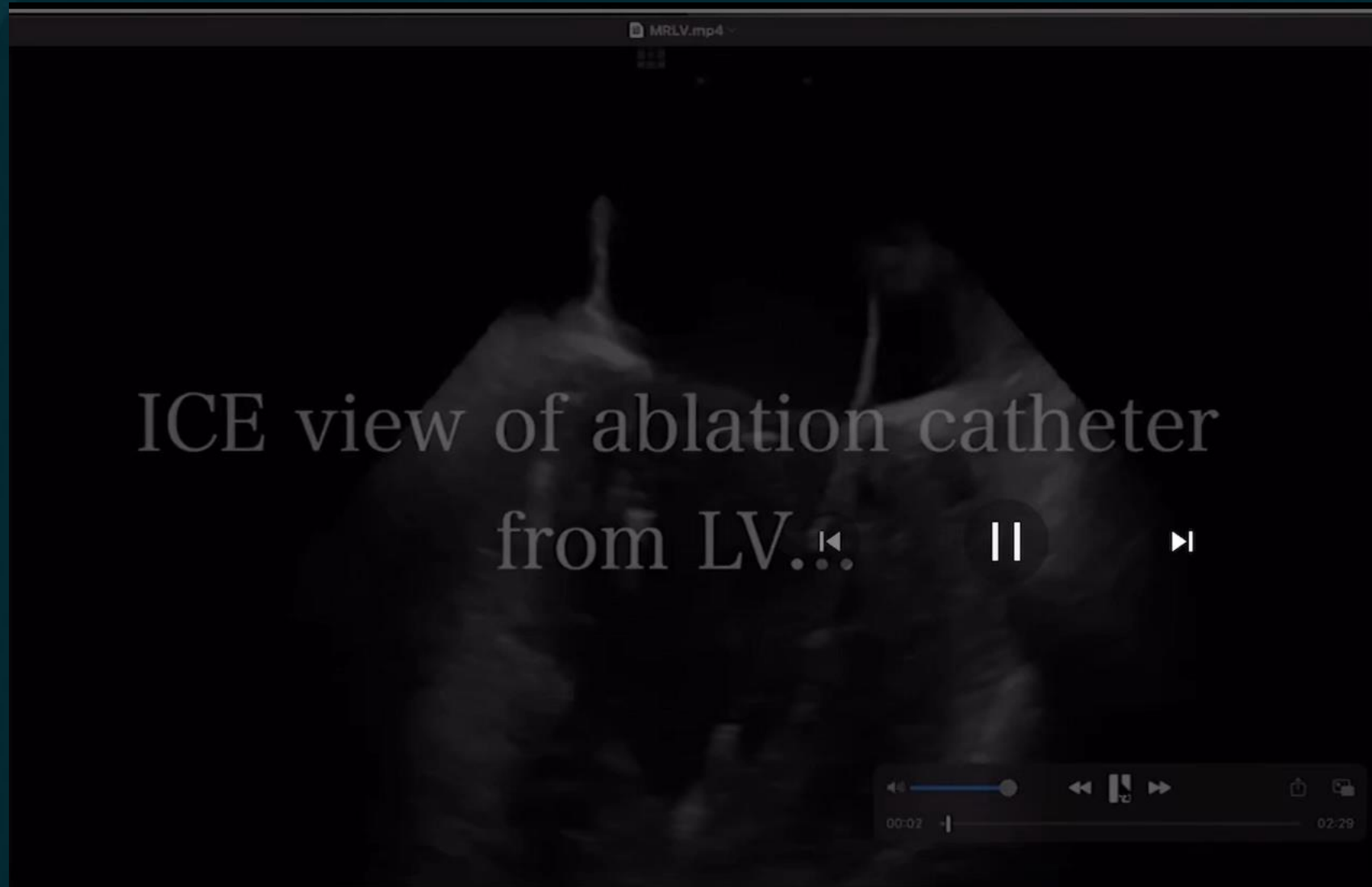
Inducibility

- If negative: stop there
- If positive: map and ablate the induced VT



CARTOGRAPHIE - MAPPING

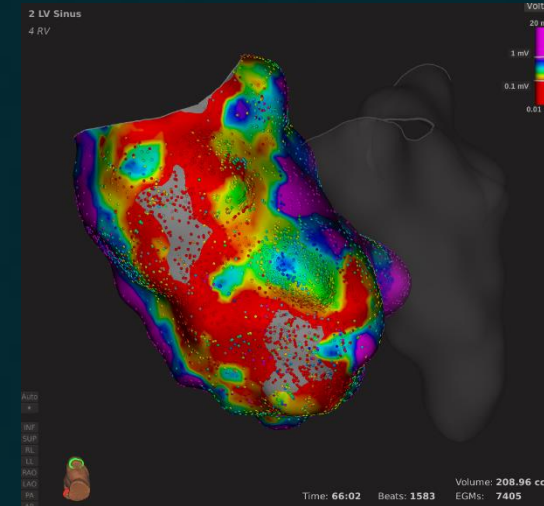
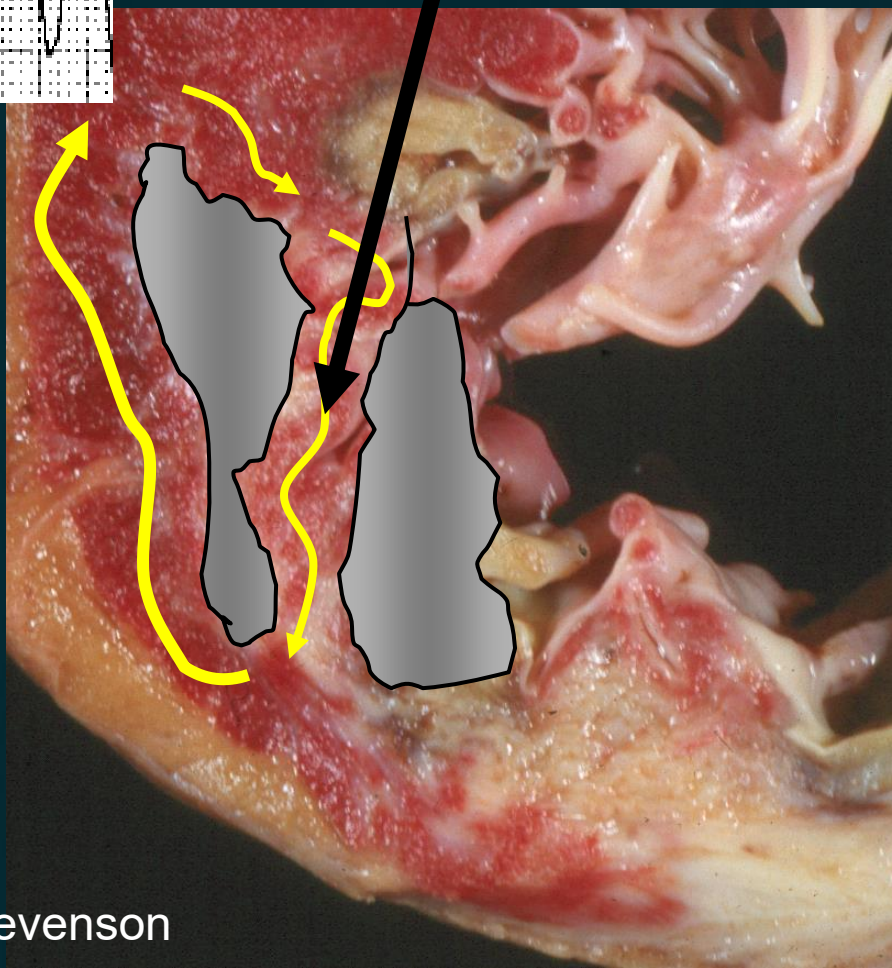
Avec l'imagerie - ICE



TAILLE ET PROFONDEUR DE LESIONS LIMITÉES AVEC LA RF

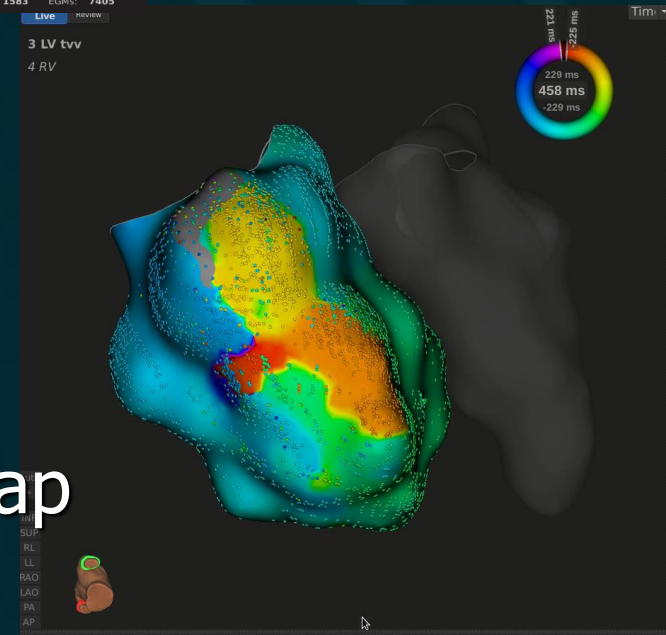


Channel / Isthmus



Voltage map

Activation map



ABLATION

Eliminer la zone responsable d'arythmie

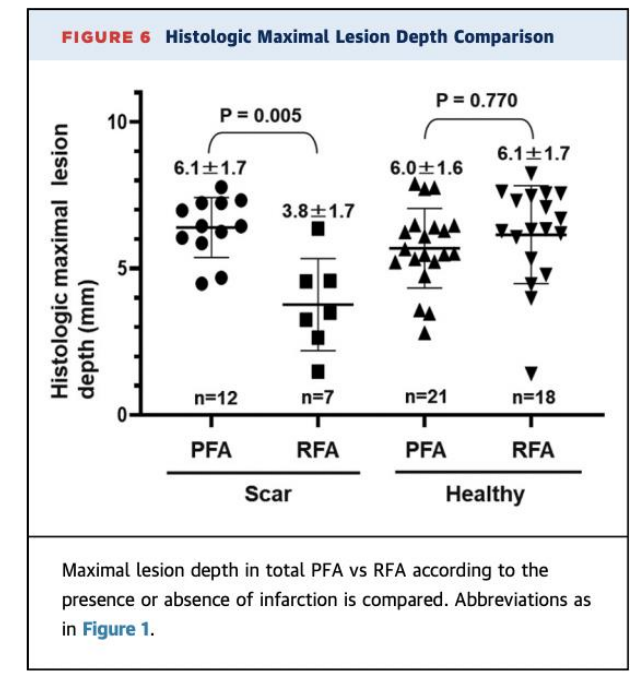
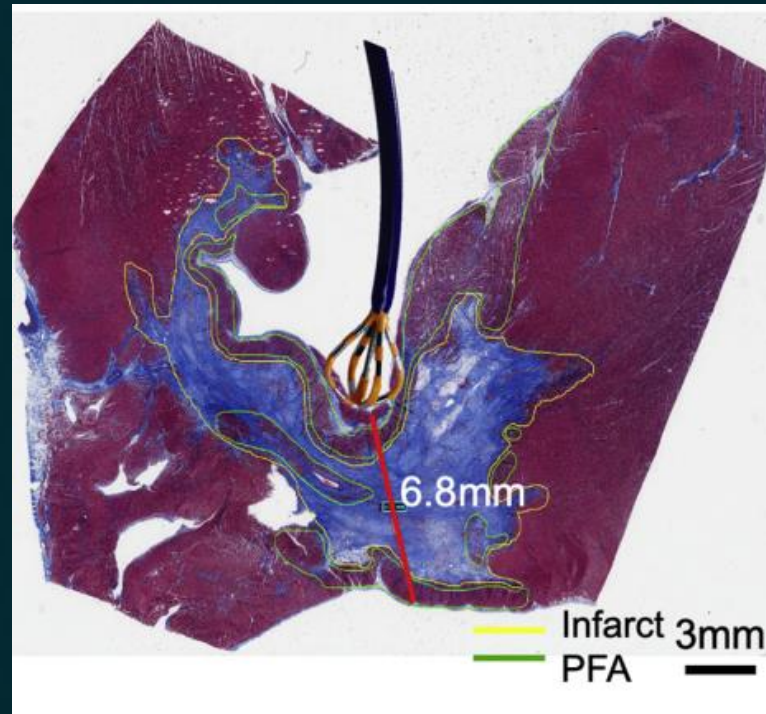
Radiofréquence

vs

Electroporation - PFA



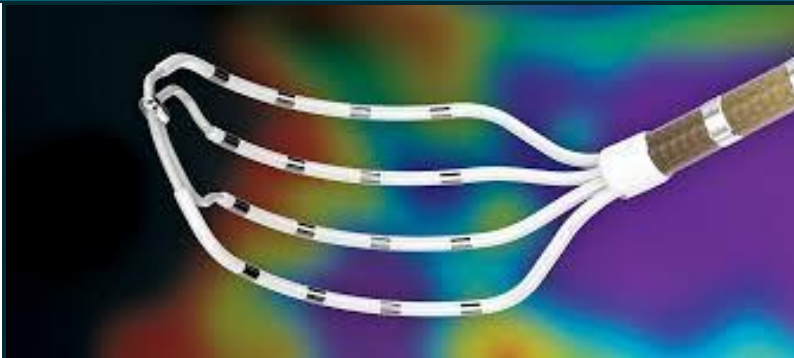
Lesion Thermique
Reproductible mais lésion de taille limitée surtout dans du tissu cicatriciel
Problème pour les zones à traiter étendues ou profondes



Im S et al. JACC CE 2022

Lésion par Champ Electrique
Energie passe mieux à travers la cicatrice

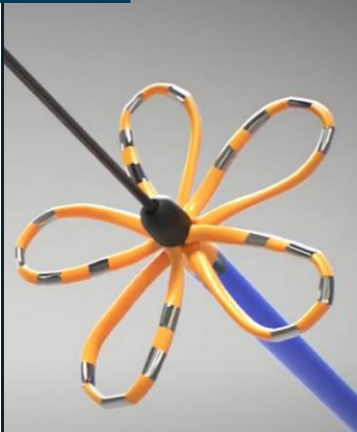
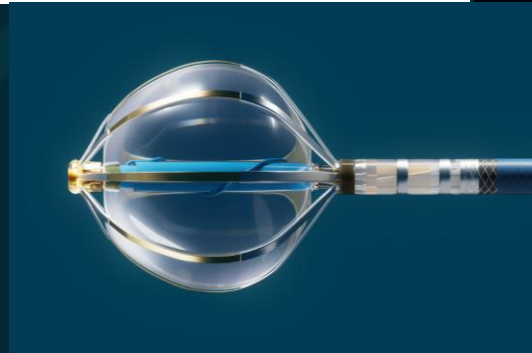
DEPENDING ON CATHETER



Comparison of efficiency of PFA catheter designs by computer modeling

Andres Belalcazar BSEE, PhD¹ | E. Kevin Heist MD, PhD²

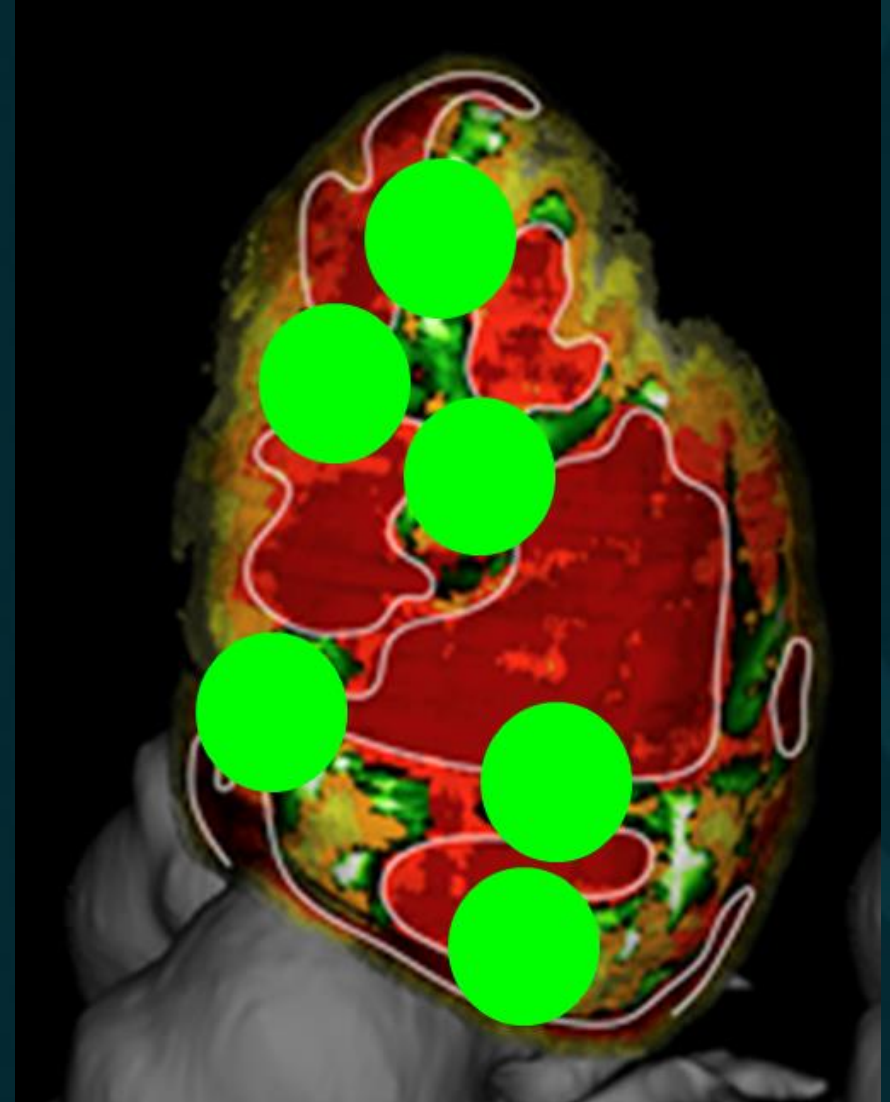
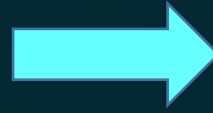
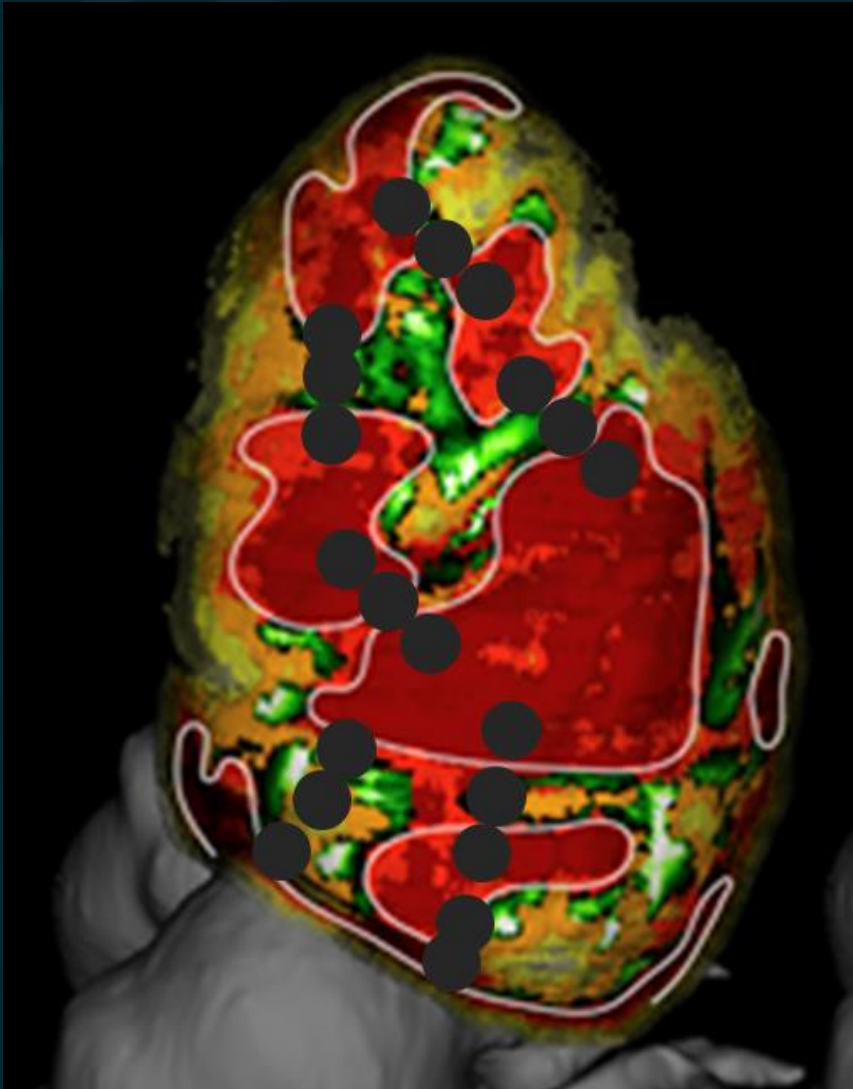
J. Cardiovasc. Electrophysiol. Sept 2024;35:2382–2393



Conclusion: Computer models demonstrated a remarkable range in efficiency among catheters studied. Those having less atrial blood exposure had the highest efficiencies, with factors of up to 13X more efficiency compared to exposed ones. Higher efficiency designs have less collateral current and are safer. Confirmatory in-vivo studies are required.

ABLATION

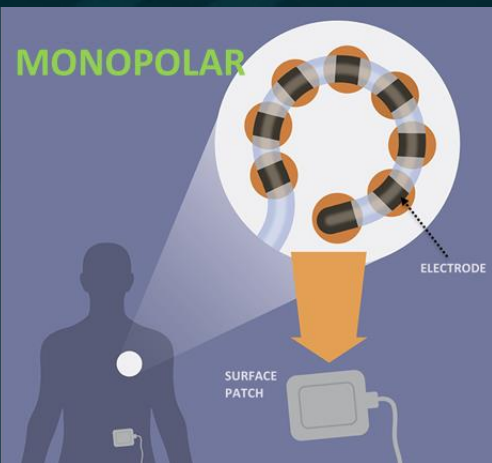
Eliminer la zone responsable d'arythmie



PFA DELIVERY PARAMETERS

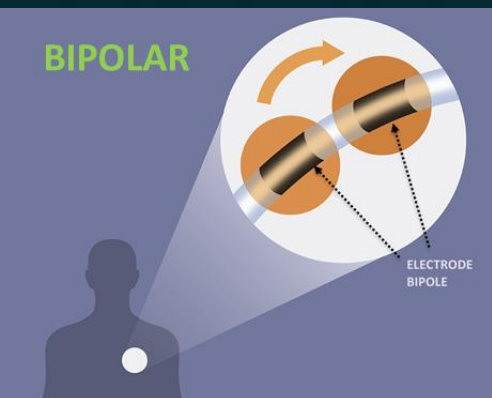
INFLUENCING ELECTRICAL FIELD

Effects of PFA are highly parameter-dependent



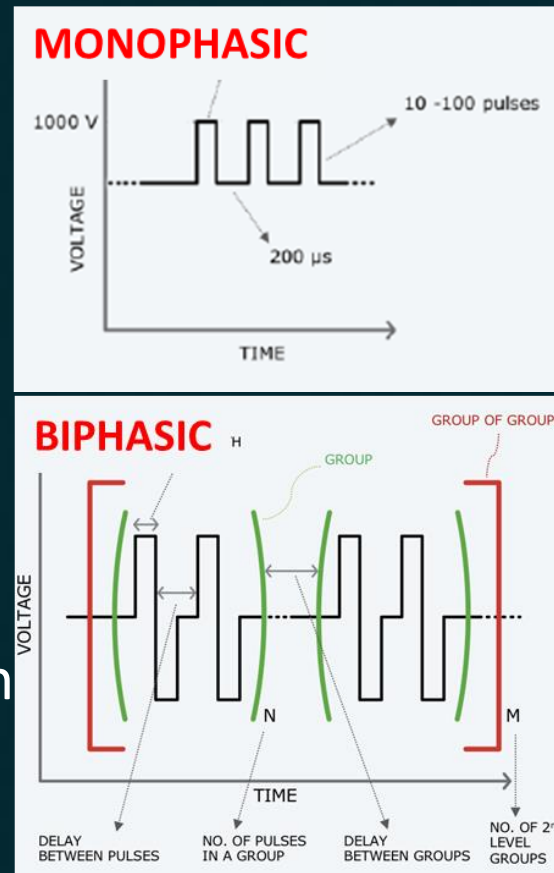
Catheter dependant

- Electrode geometry
- Electrode count
- Electrode spacing



Tissue dependant

- Target cell size
- Target cell orientation
- Target cell proximity
- Tissue resistivity

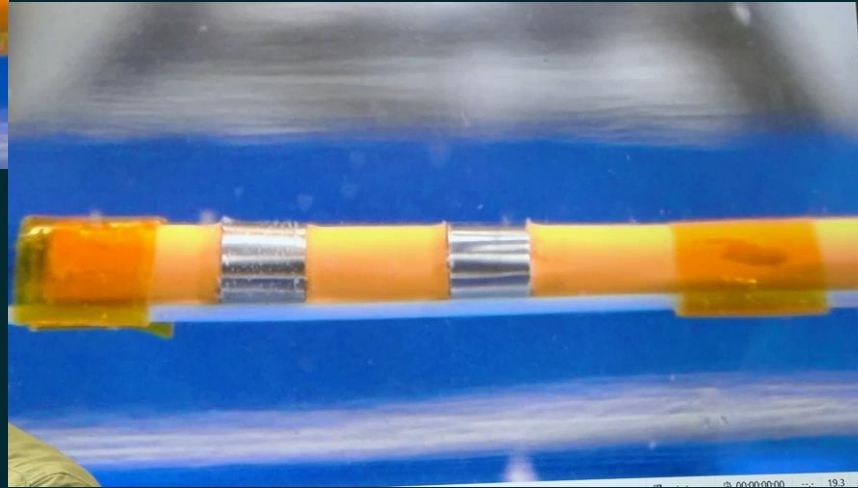
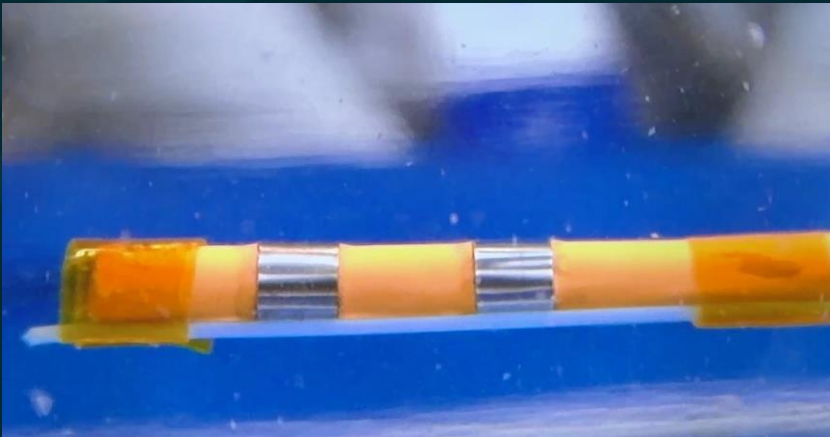


Electrical field dependant

- Mono vs biphasic
- Amplitude of the + phase
- Amplitude of the - phase
- Duration of the + phase
- Duration of the - phase
- Interphase delay
- Pulse repetition rate
- Burst repetition rate
- Number of pulses in burst
- Number of bursts

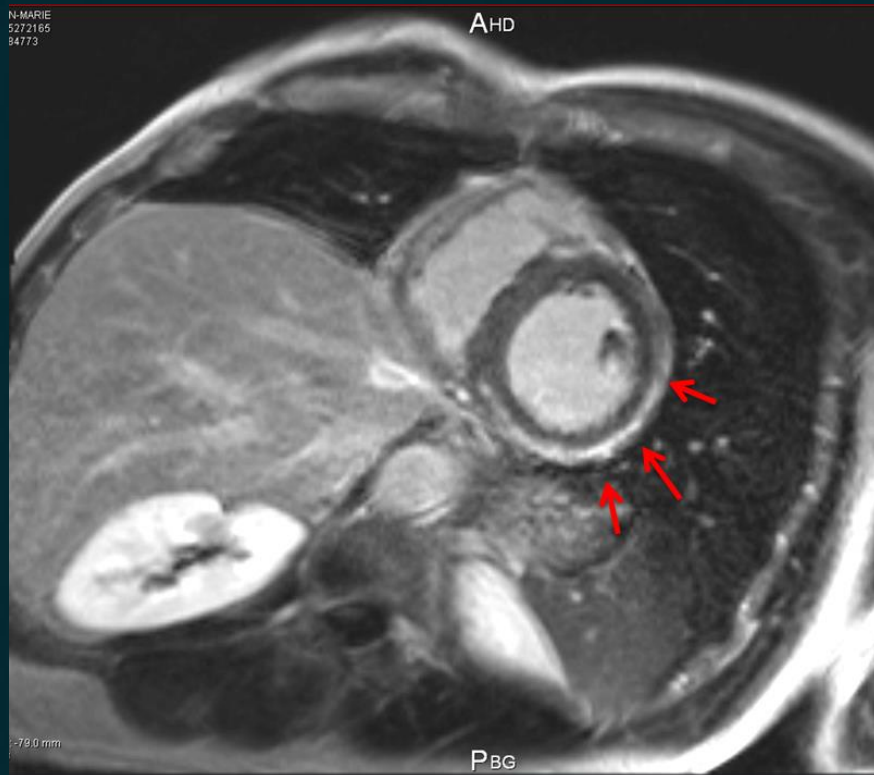
PFA DELIVERY PARAMETERS INFLUENCING ELECTRICAL FIELD

Effects of PFA are highly parameter-dependent

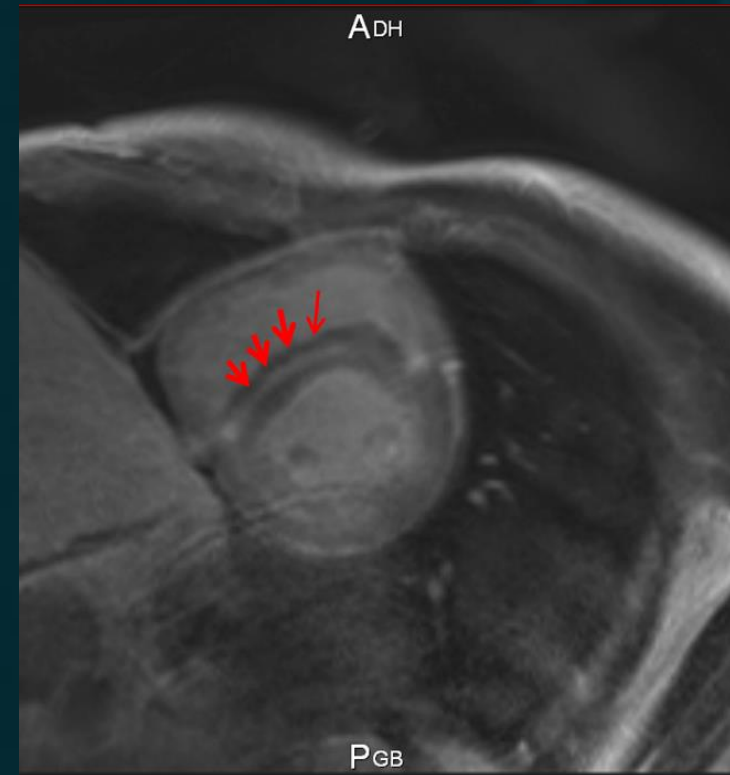


CHOIX PEUT ETRE GUIDE PAR LE SUBSTRAT

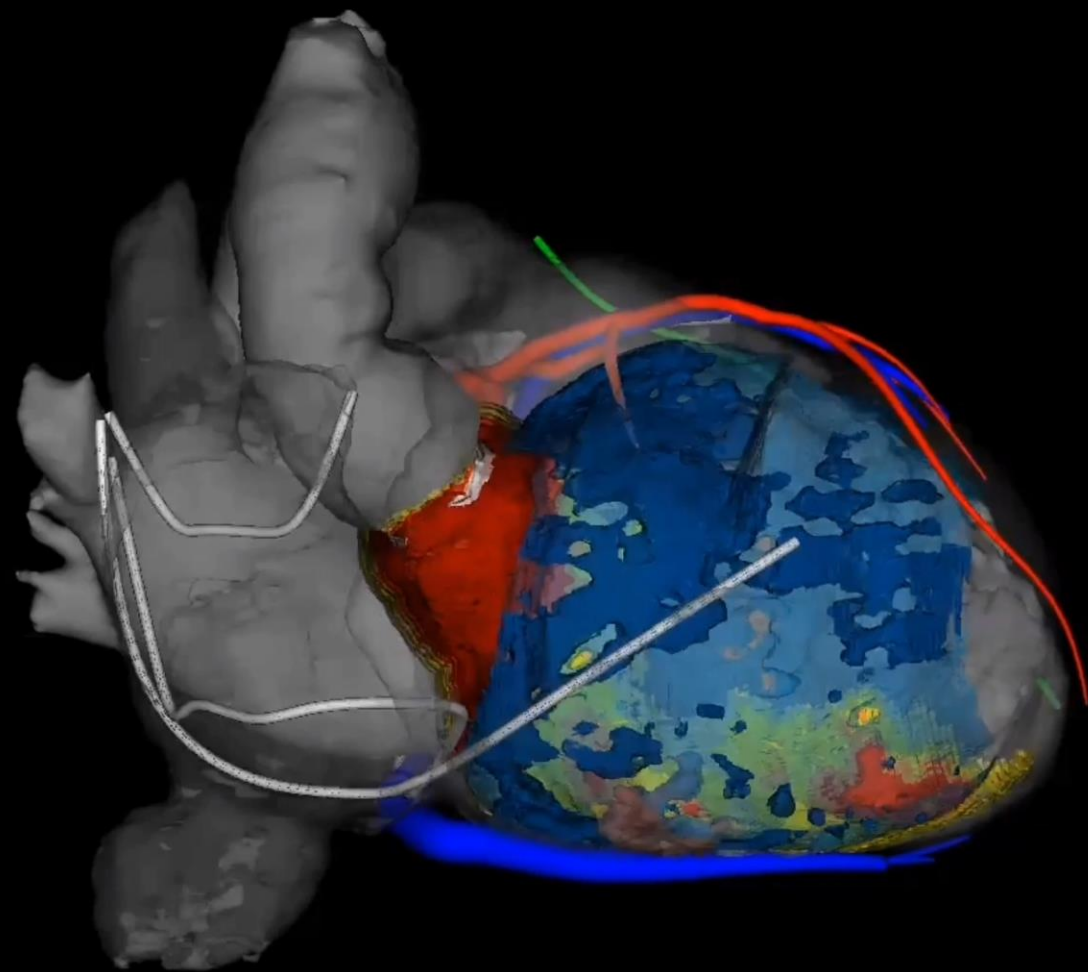
Identifying substrate



Epicardial Scar



Intramural septal Scar



+



C

CONCLUSION

<https://www.liryc-education.fr/frederic.sacher@chu-bordeaux.fr>
Linked in: Frederic Sacher

- Choisir un catheter de cartographie et d'ablation
 - Dépend du système en sa possession
 - Dépend du substrat à l'imagerie
- Certains systèmes sont plus versatiles que d'autres (FA +TV)
- Il n'y a pas une solution "PFA" comme une RF mais autant que de cathéters et de paramètres pour le champ électrique pulsé

MERCI

<https://www.liryc-education.fr/>
frederic.sacher@chu-bordeaux.fr
Linked in: Frederic Sacher

➤ Bordeaux EP team

- Romain Tixier, Josselin Duchateau, Nicolas Derval, Thomas Pambrun, Jan Charton, Benjamin Sacristan, Meleze Hocini, Michel Haissaguerre, Pierre Jais
- Fellows: Vlachos Konstantinos, John Fitzgerald, Francesco Notaristefano, Laurens Verhaege, Geoffroy Ditac, Nicolas Johner, Marianne Tétreault-Langlois
- Aurélie Fresselinat