



ARCFA

Techniques Ablatives Ablation technologies



M3C

Brief history of catheter ablation in children

Early 90's



Surgical treatment

<1 year: life threatening arrhythmia

>1 year: medically refractory arrhythmia

Case et al, Am J Cardiol 1989

Crawford et al, J Thorac Cradiovasc Surg 1990

Direct current catheter ablation

Lemery et al, Circ 1992

Perry et al, Am J Cardiol 1992

Comparaison of catheter ablation using radiofrequency versus direct current energy

Huang et al, JACC 1991

Percutaneous Radiofrequency Catheter Ablation for supraventricular Arrhythmias in Children

Van Hare et al, JACC 1991

Brief history of catheter ablation in children

1992



Radiofrequency Catheter Ablation of Incessant, Medically Resistant Supraventricular Tachycardia in Infants and Small Children

Case et al, JACC 1992

7 pts

3.4 to 13 kg

Brief history of catheter ablation in children

Early 90's 92 1994



Radiofrequency catheter ablation in children and adolescents

Kugler et al, NEJM 1994

625 Patients / 725 procedures

20 centers

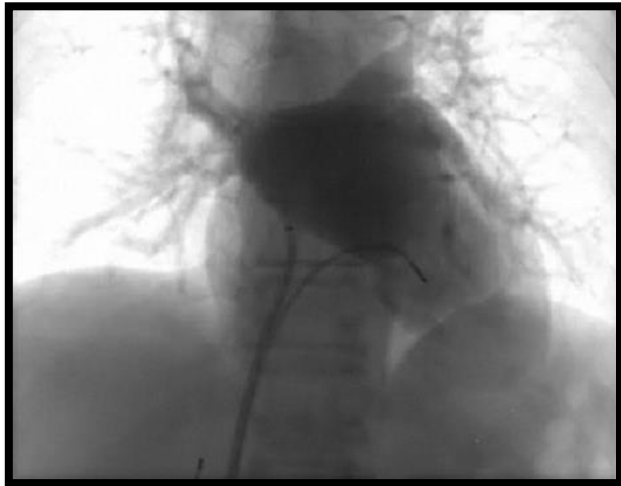
Brief history of catheter ablation in children

Early 90's 92 1994 1997

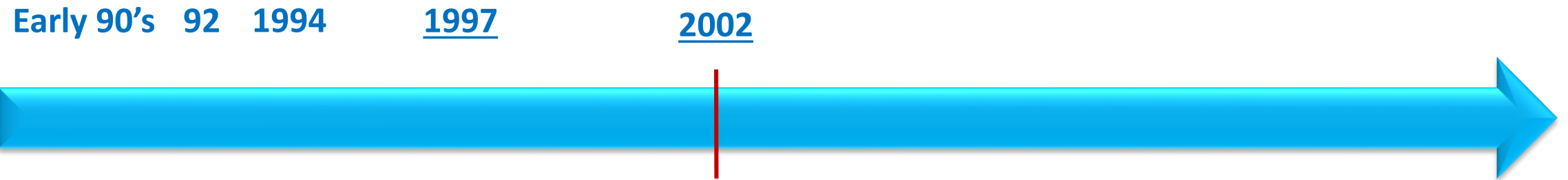


Indications for Radiofrequency Ablation in Pediatric Population

Van Hare, JCE 1997



Brief history of catheter ablation in children

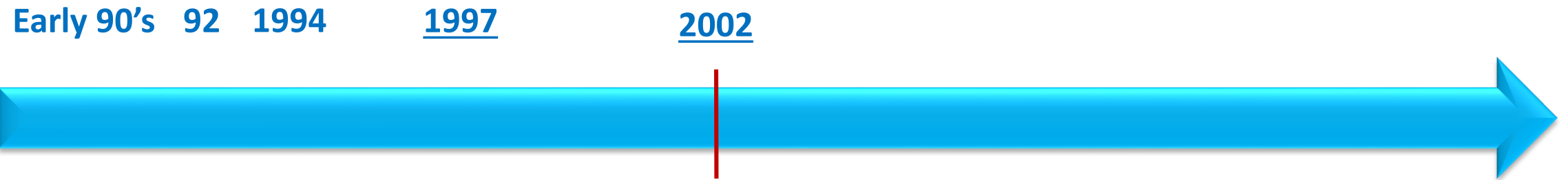


**Pediatric Radiofrequency Catheter Ablation Registry.
Success, Fluoroscopy Time, and Complication Rate for
Supraventricular Tachycardia**

Kugler et al, JCE 2002

7610 pts

Brief history of catheter ablation in children



NASPE Expert Consensus Conference
Friedman et al, PACE 2002

Brief history of catheter ablation in children

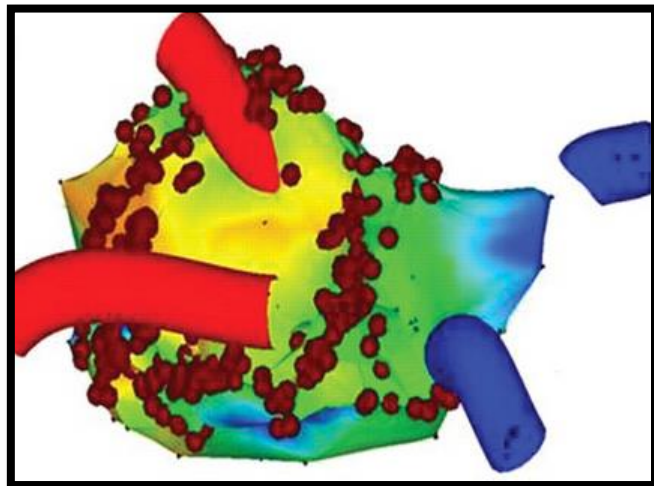
Early 90's

92

1994

1997

2002

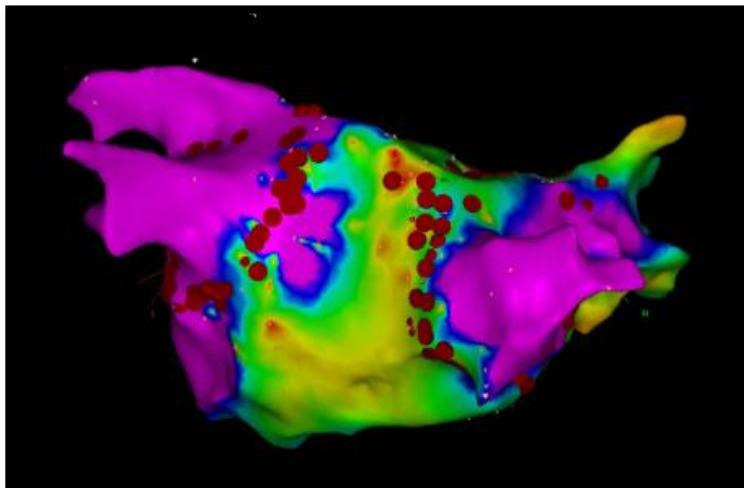


Technology Breakthroughs

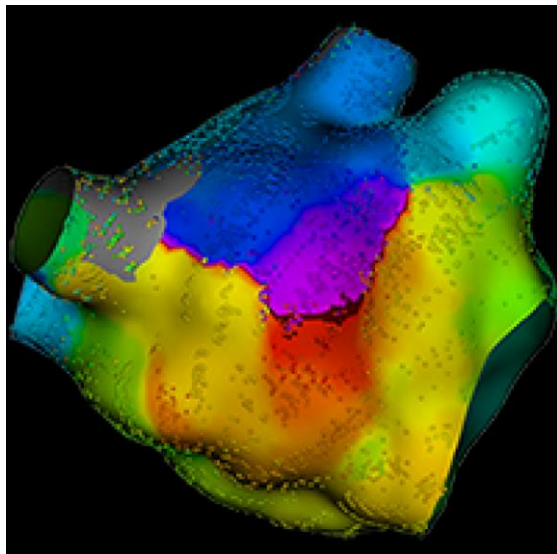
Brief history of catheter ablation in children



EHRA and AEPC-Arrhythmia Working Group joint consensus statement
Brugada et al, EUROPACE 2013



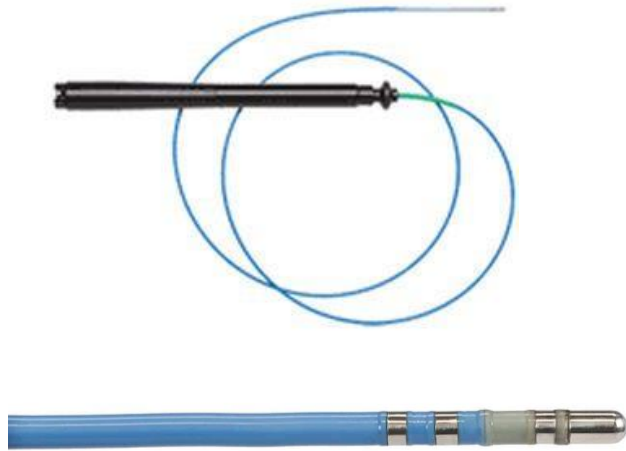
Brief history of catheter ablation in children



PACES/HRS expert consensus statement on the use of catheter ablation in children and patients with congenital heart disease
Saul et al, HR 2016

Energy

Radiofrequency



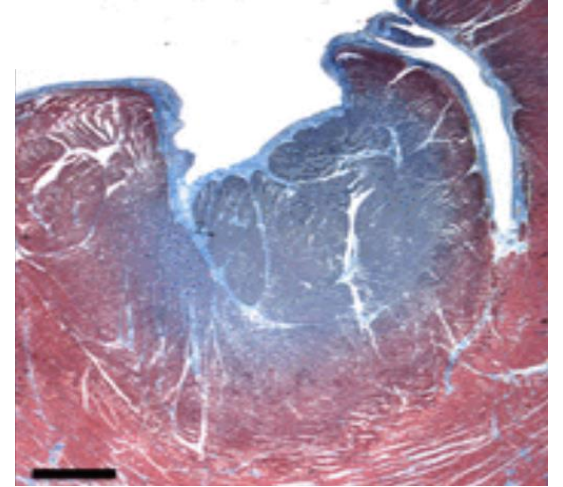
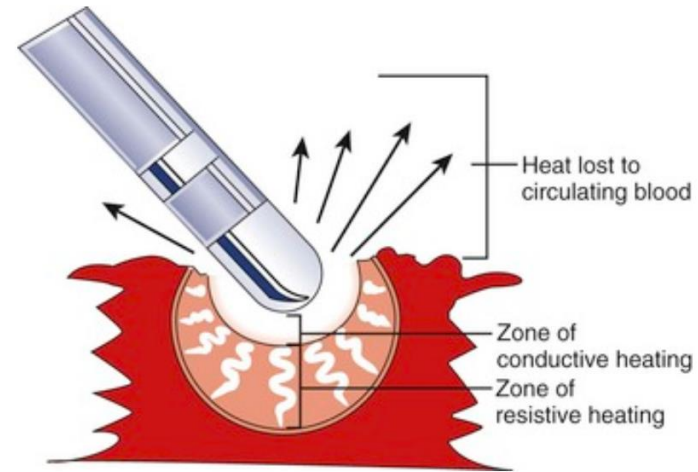
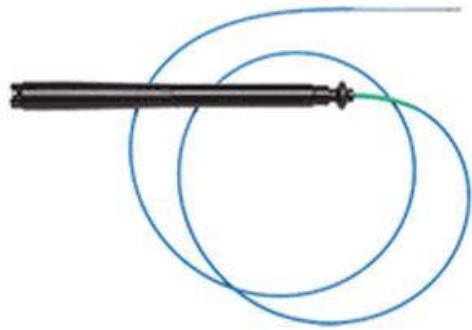
Lesion

- 5 to 6 mm in diameter
- 2 to 3 mm deep



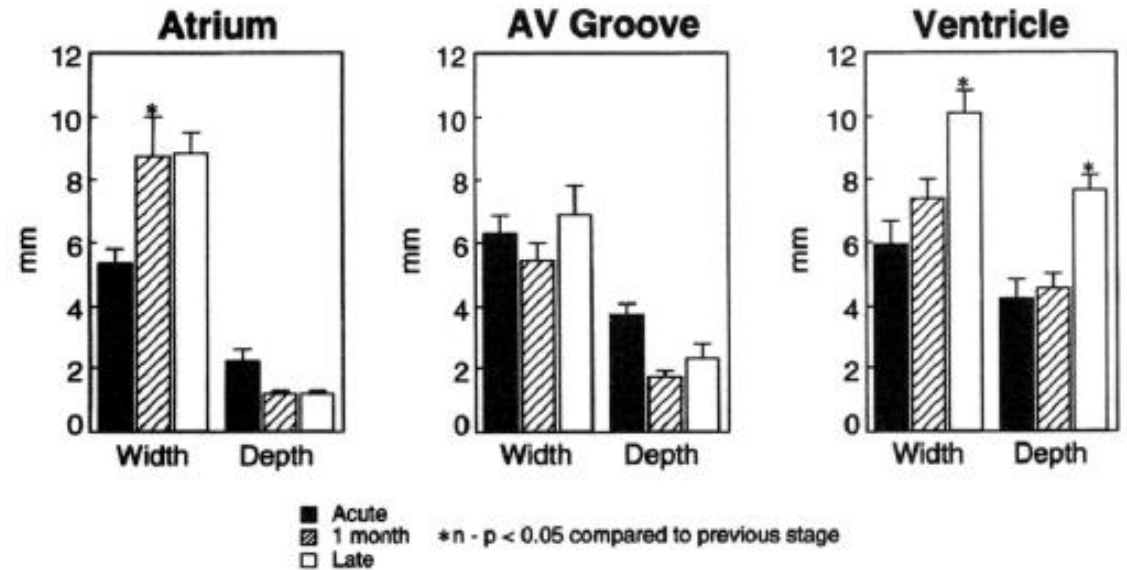
J.Lacotte ISCAT 2016

Radiofrequency

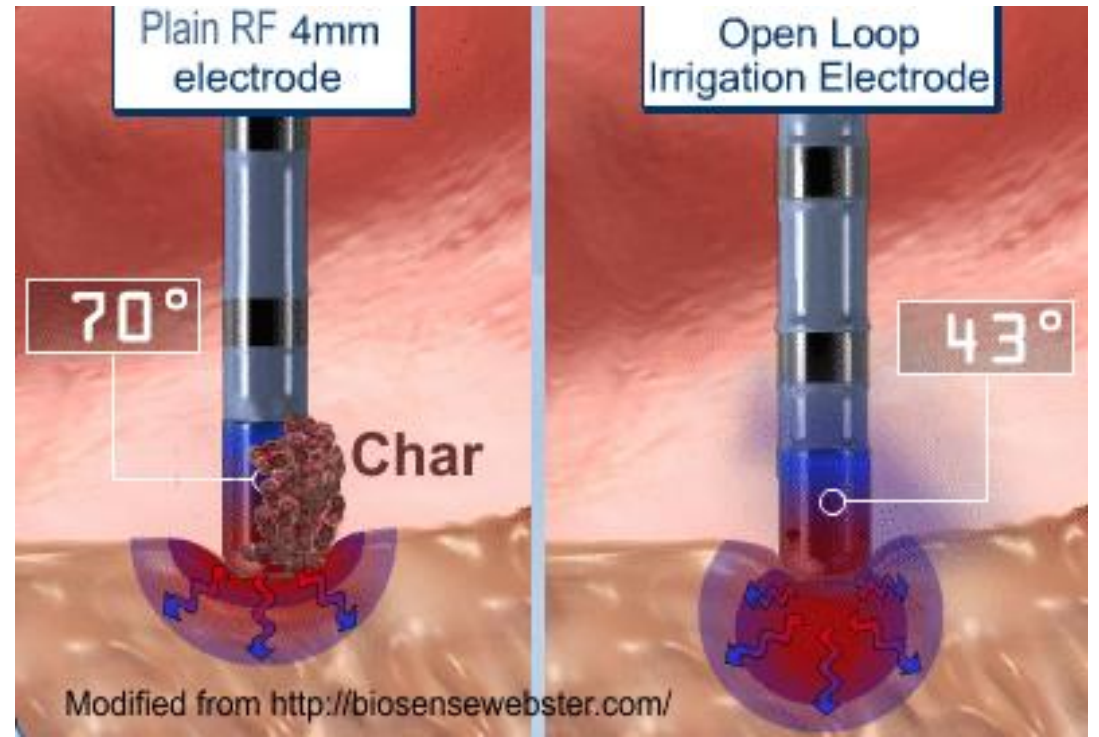


Efficacy

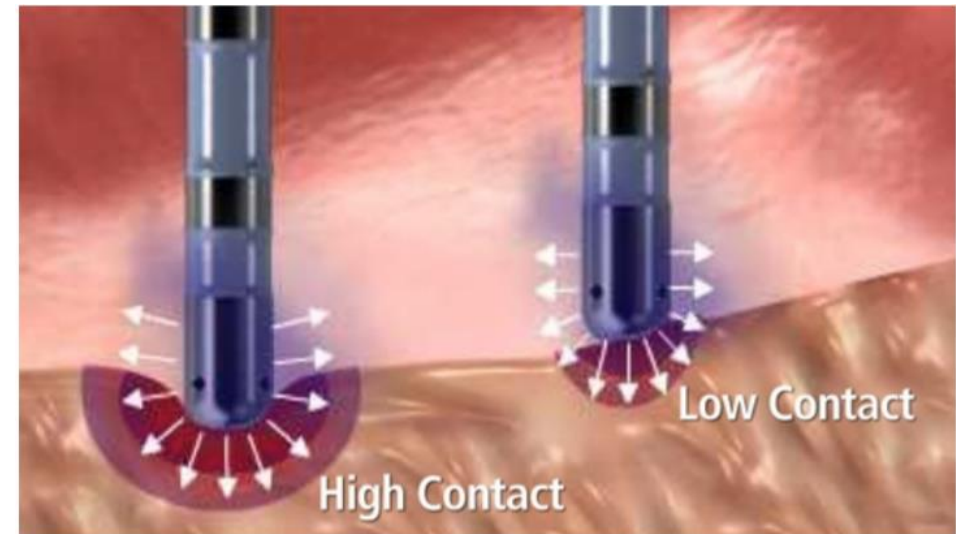
- Power delivered
- Tissue contact
- Tissue temperature reached
- Duration of delivery



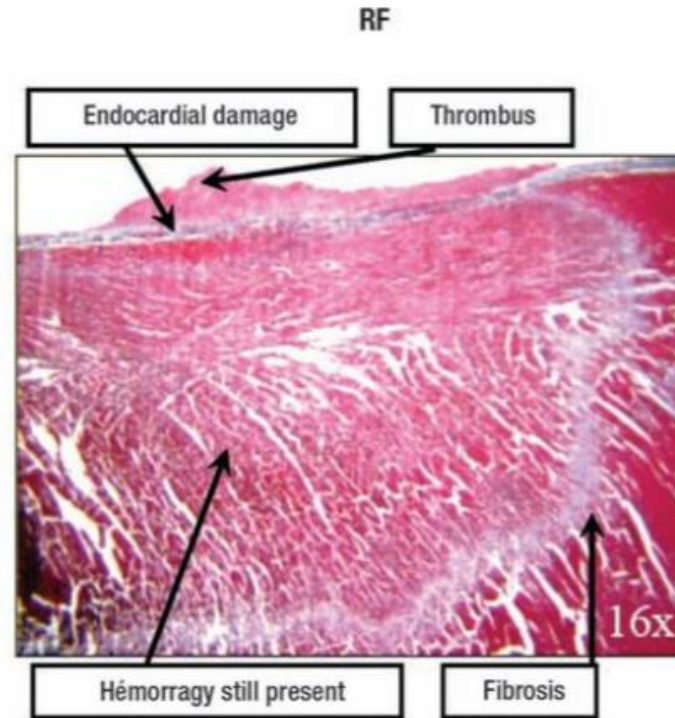
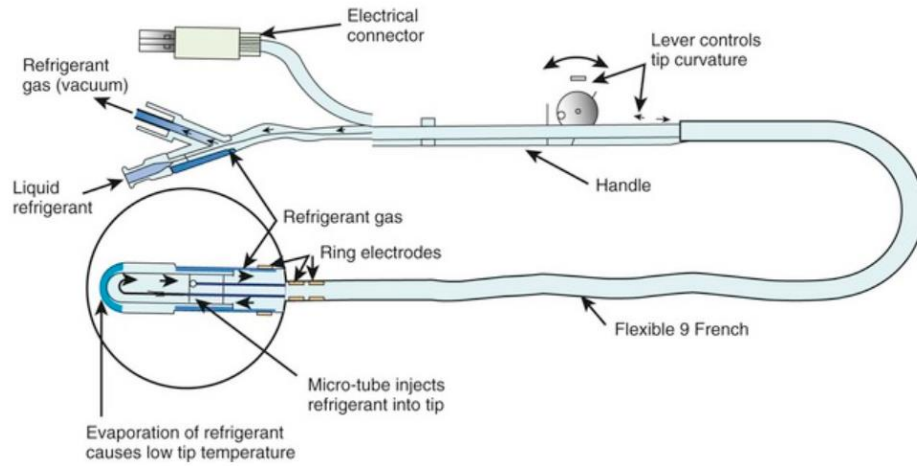
Radiofrequency



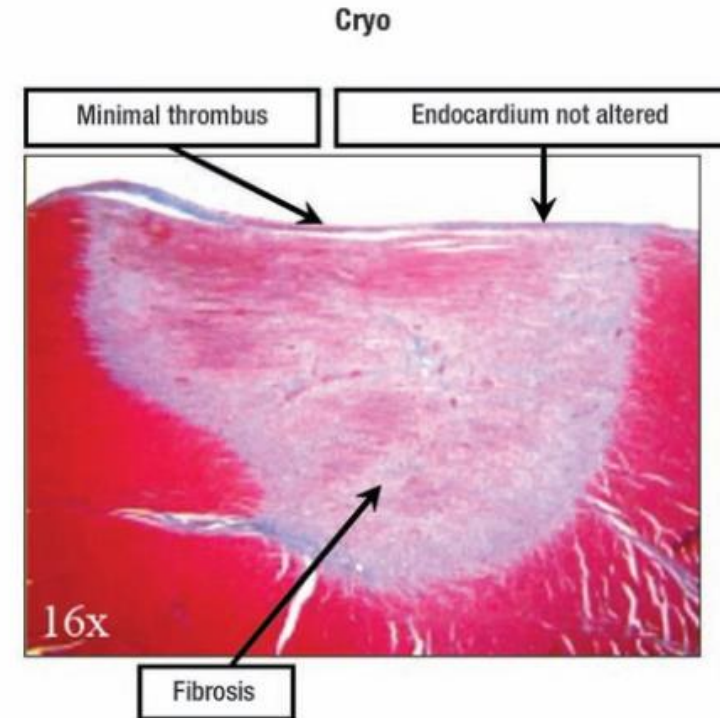
Lesion size X 3



Cryoablation



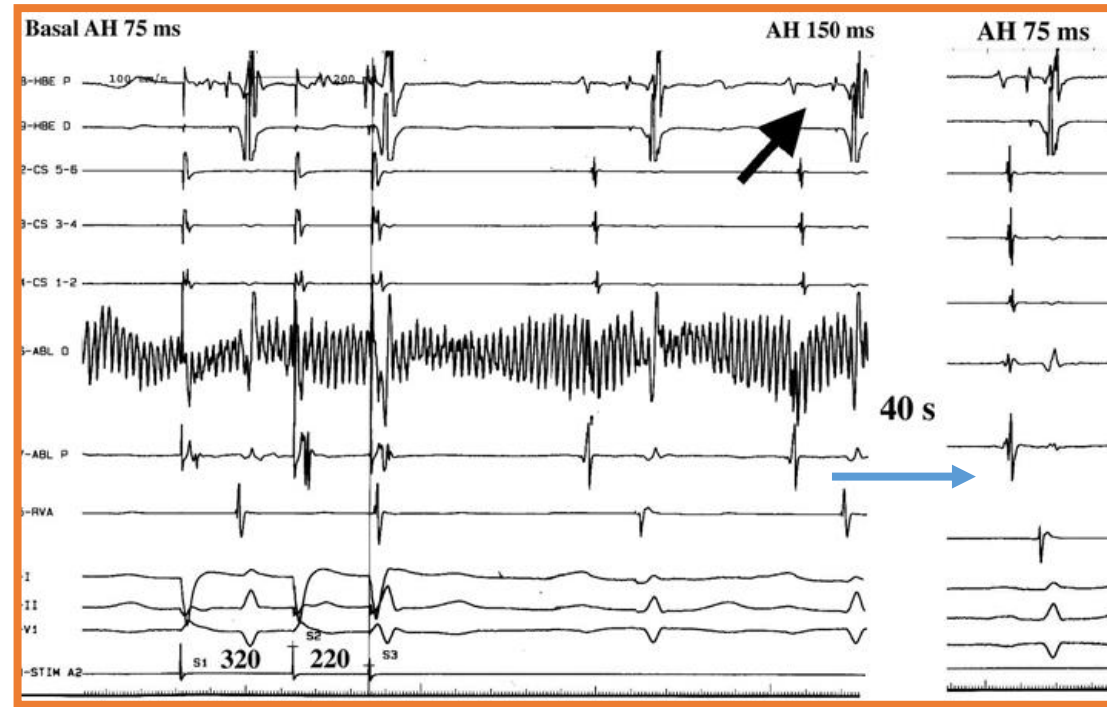
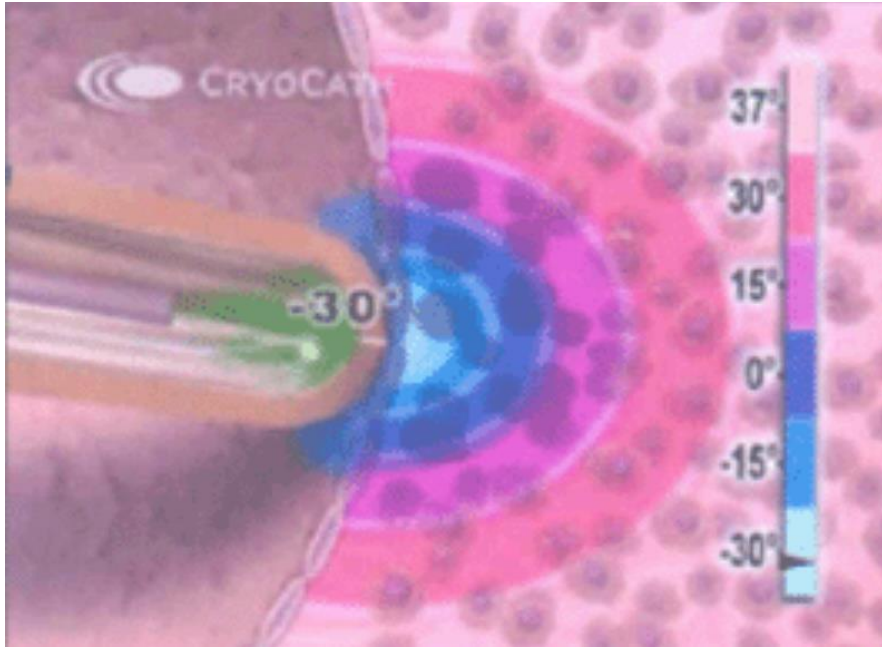
RF lesion at 1 week (dog)
+ 70°C 50 W 60 seconds



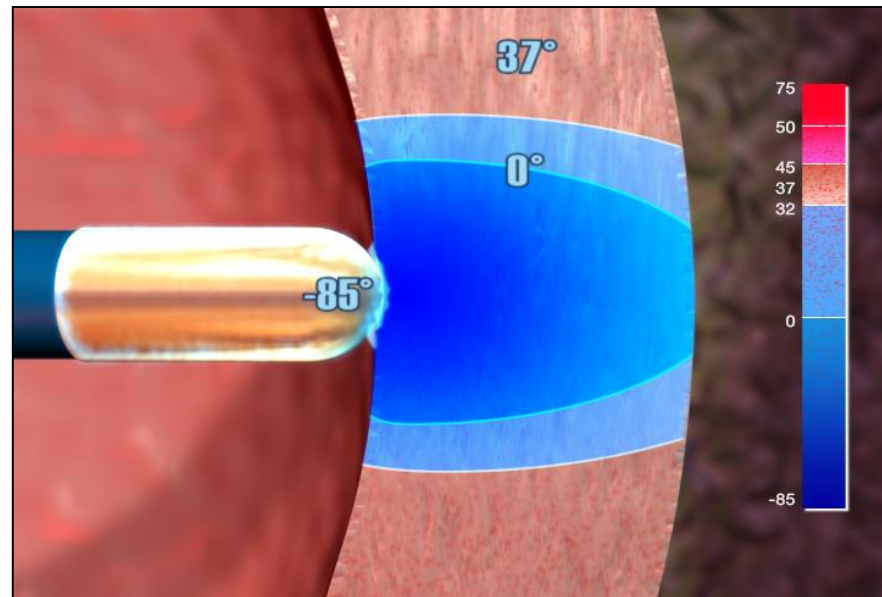
Cryolesion at 1 week (dog)
-75°C 1 x 4 minutes

Source: Khairy P, et al. Circulation 2003; 107:2045-2050

- Cryo mapping



- Cryo ablation



Riccardi et al, Ital Heart J 2003

RF vs Cryo



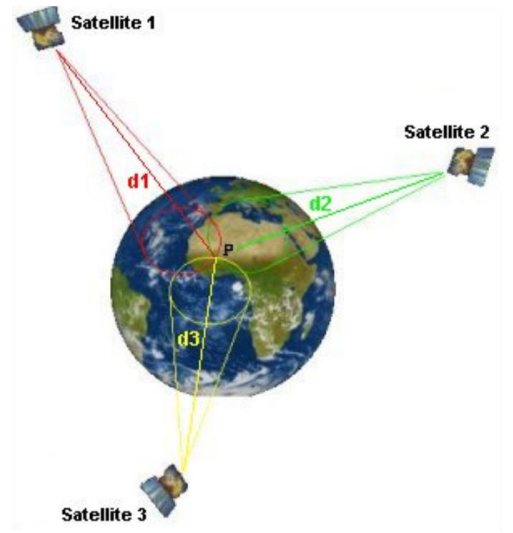
		RF	Cryo
Sucess rate	AVRT	92%	70 to 85%
	AVNRT	97%	80 to 97%
AV block		1 to 3%	0%
Recurrence		10%	7 to 45%

- With Cryo

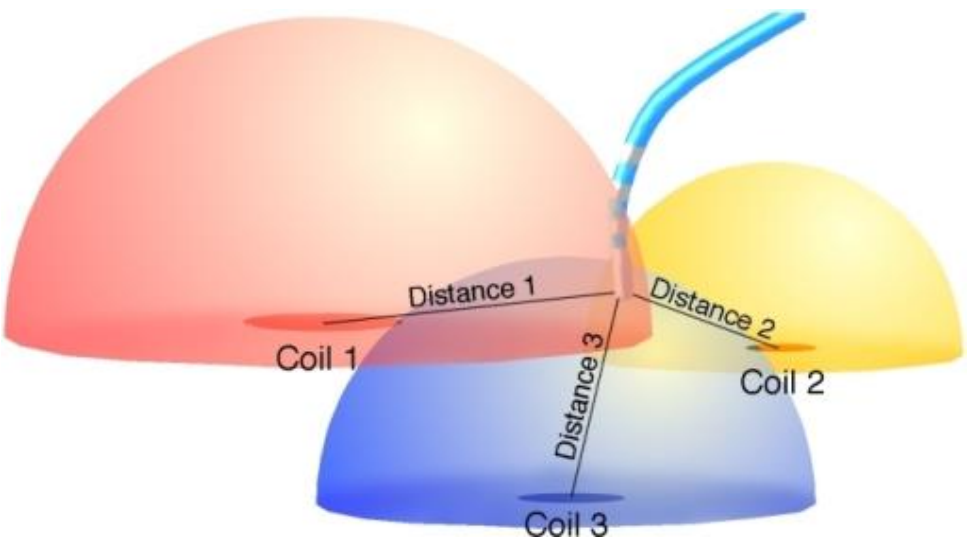
- Lower risk of coronary injury
- Less pain
- Lower fluoroscopy time
- Less local thrombus
- Lower operator stress

Triedman JK, J Cardiovasc electrophysiol. 2009
Drago et al, Pediatric Cardiol. 2006
Kriebel et al, J Cardiovasc electrophysiol. 2005
Bar-Cohen et al, H Rhythm. 2006

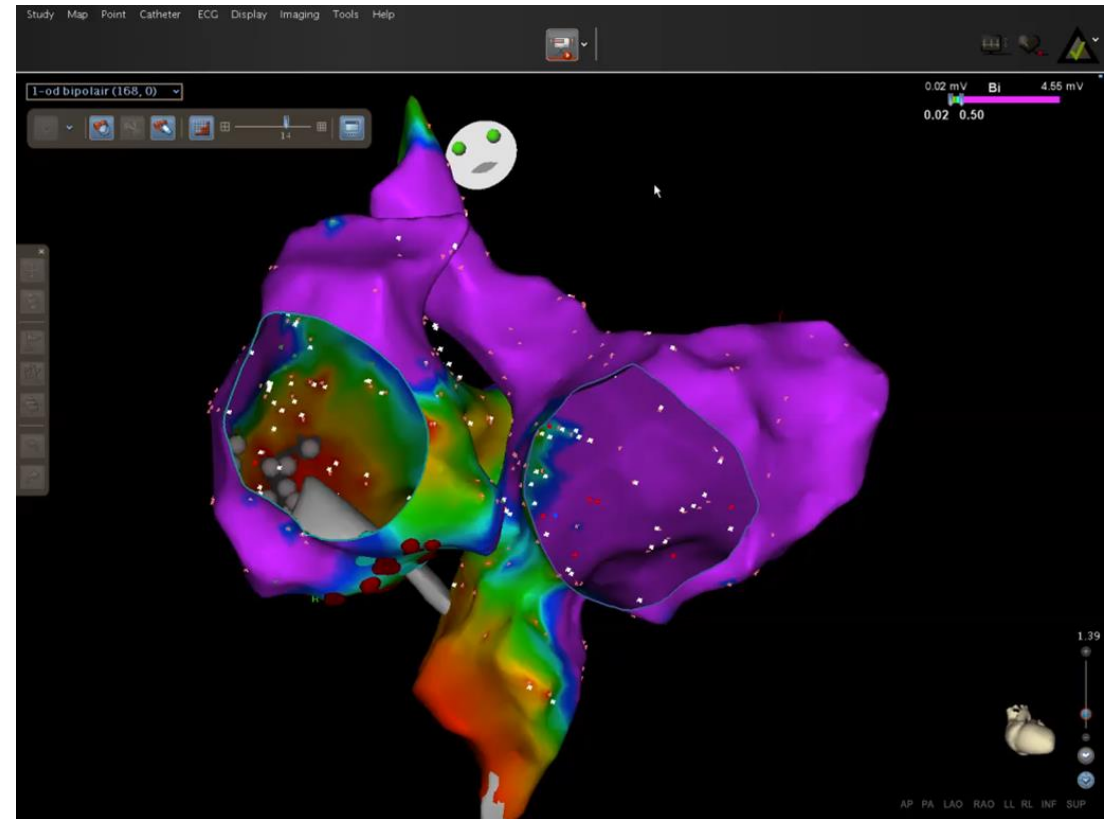
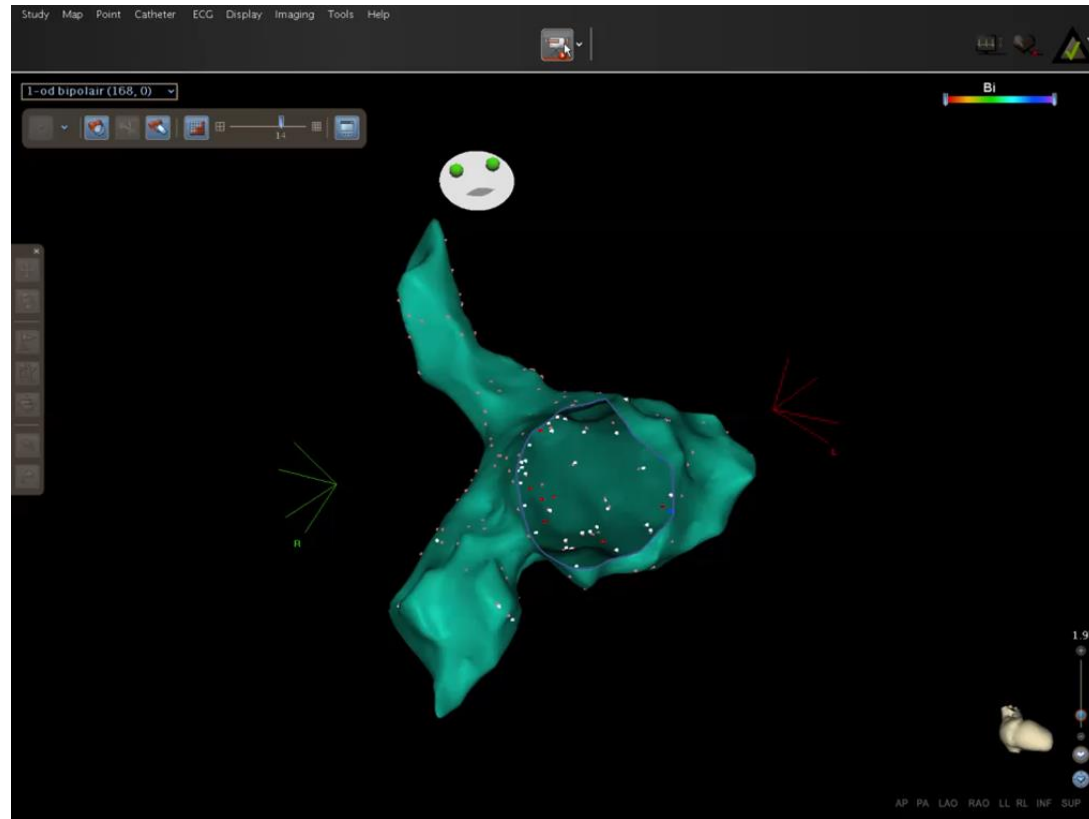
Nonfluoroscopic Electroanatomic mapping

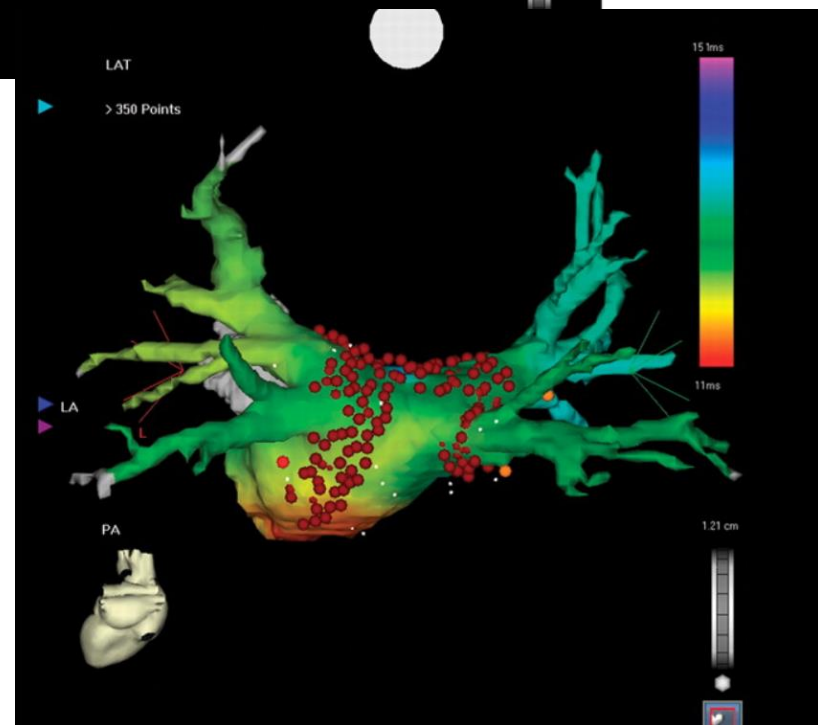
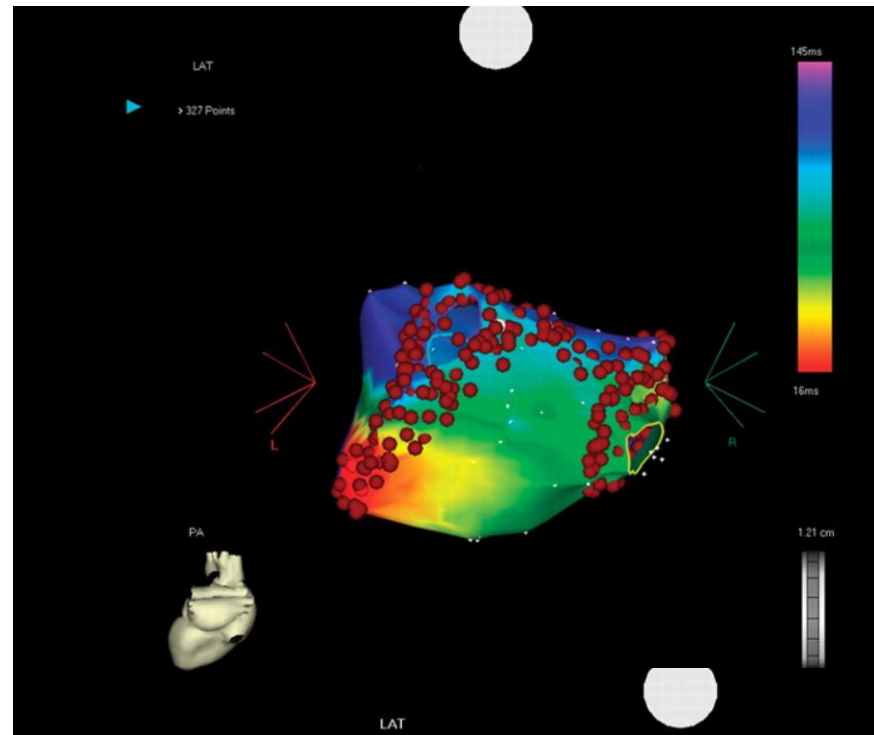
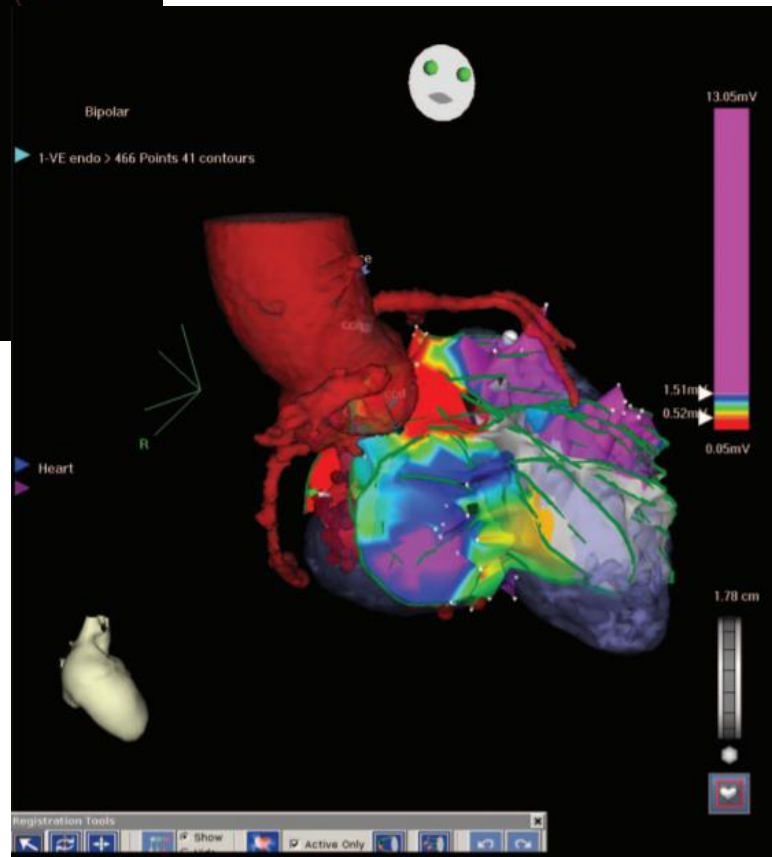
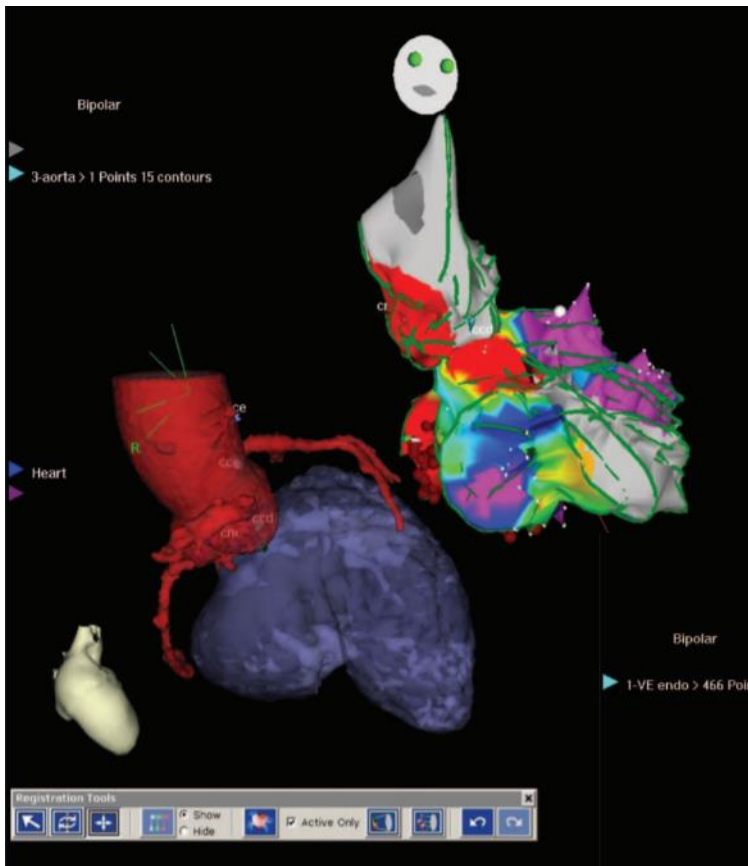


A screenshot of the CARTO3 software interface. The top menu bar includes options like Study, Map, Point, Catheter, ECG, Display, Imaging, Window, Tools, and Help. The main window shows a 3D model of a head with green eyes. Below it is a fluoroscopic image of the heart with catheters. The interface includes various toolbars and a status bar at the bottom with parameters like CL, LAT, BI, Imp, and Volume.



Complex anatomy and substrat





3D Carto + UNIVU

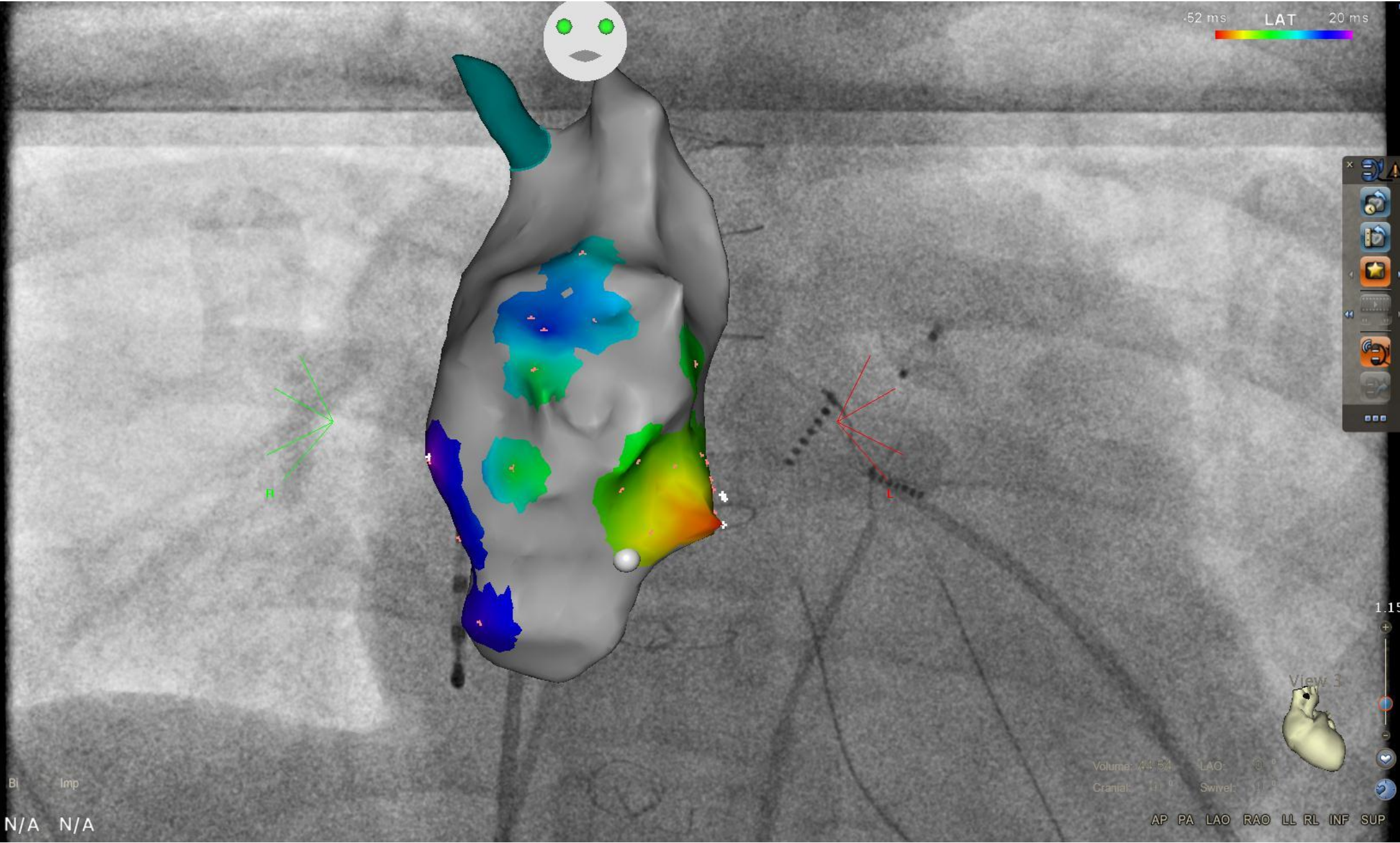
I-OD (34, 0)

.52 ms LAT 20 ms

orm Initialization of
of RF energy will be
fluoroscopy machine is
elines, and that the RF
hed on.

Initialize

15



Acquire

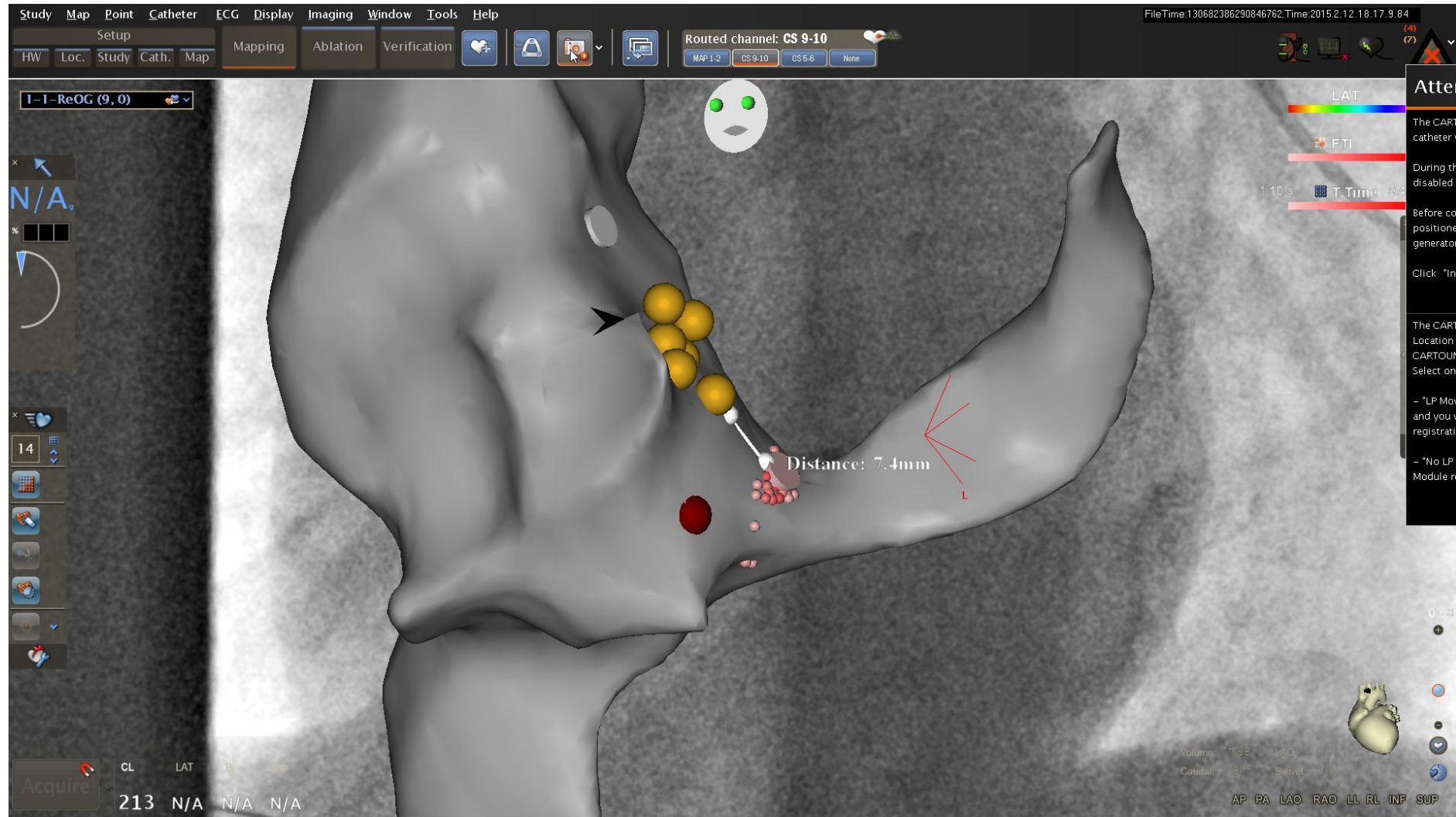
CL	LAT	BI	Imp
303	N/A	N/A	N/A

Volume: 44.54 LAO: 0°
 Cranial: 10° Swivel: 0°

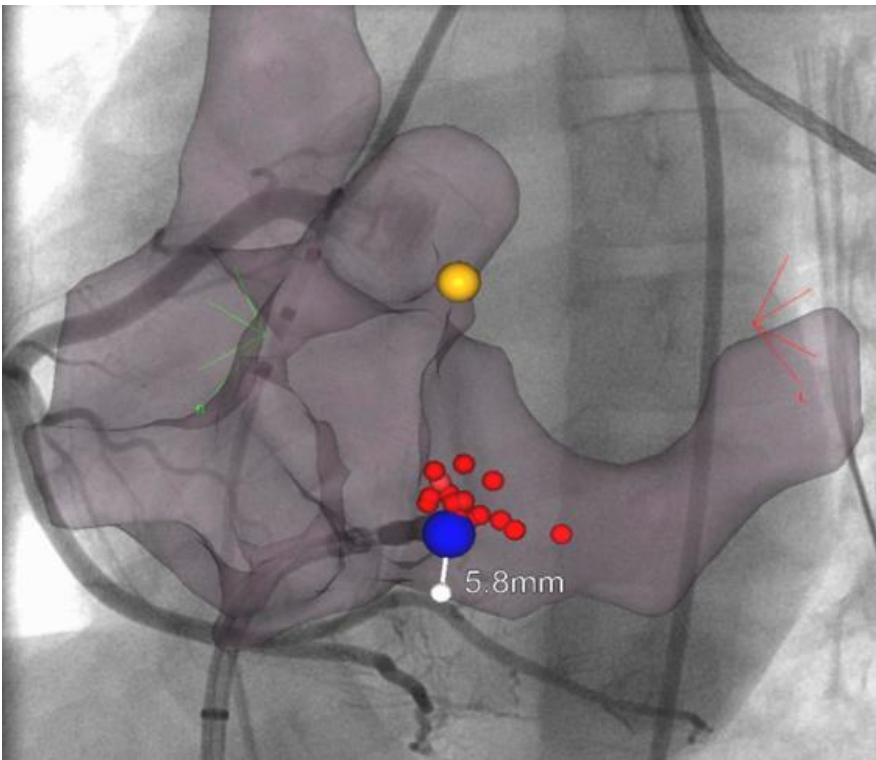
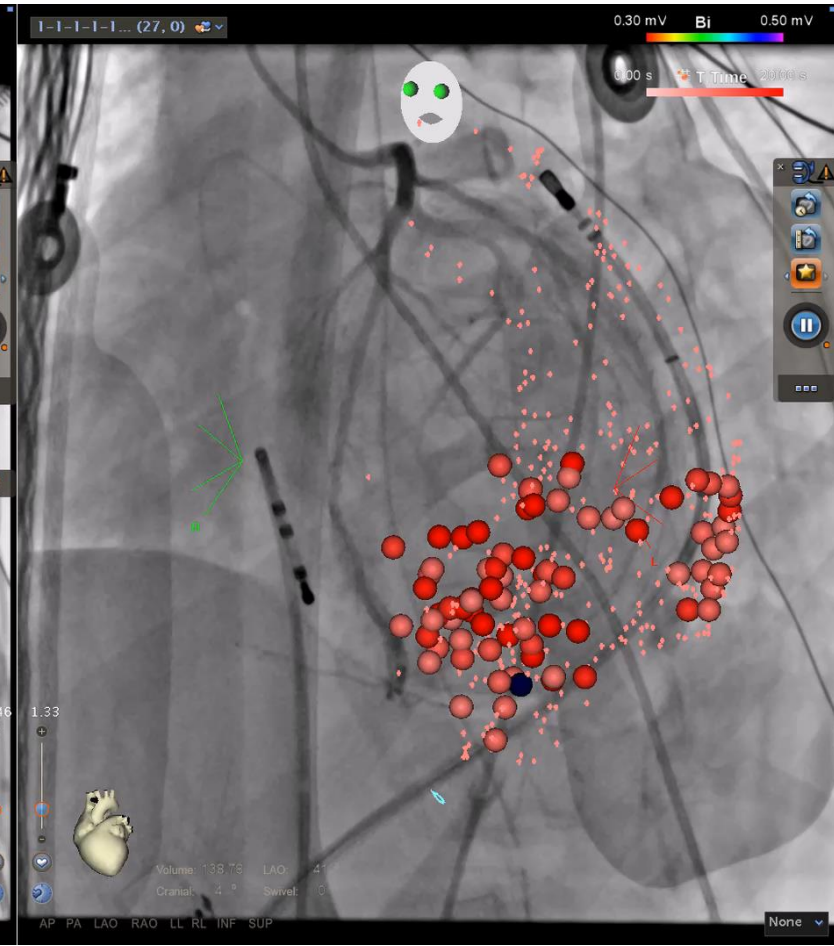
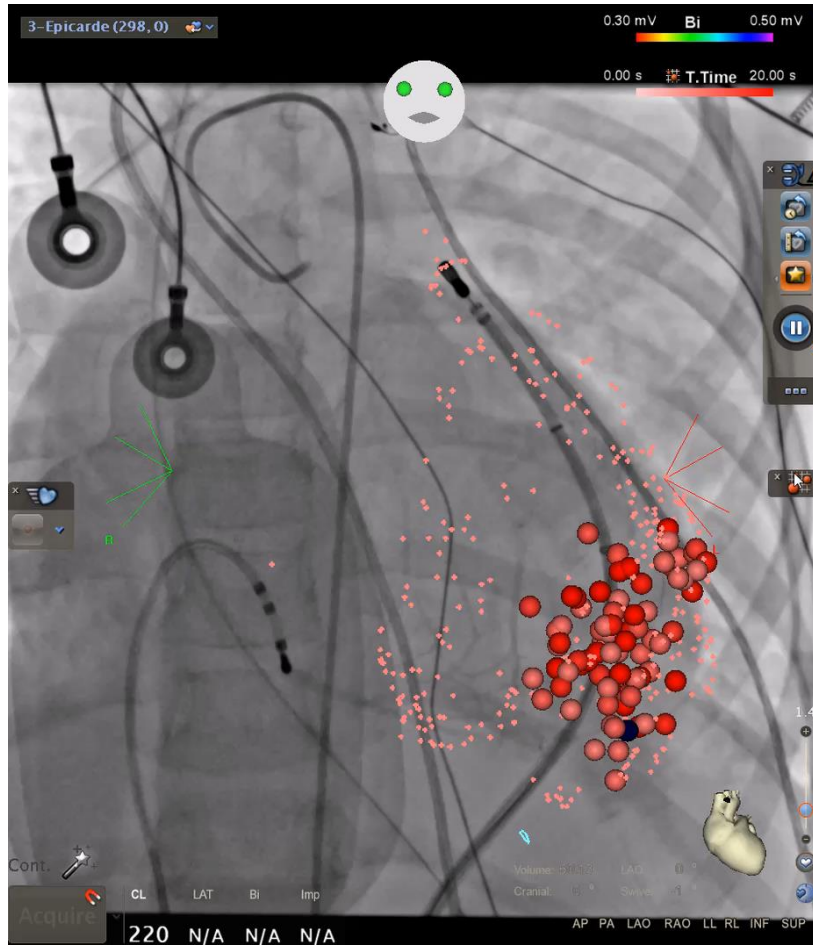
View 3

AP PA LAO RAO LL RL INF SUP

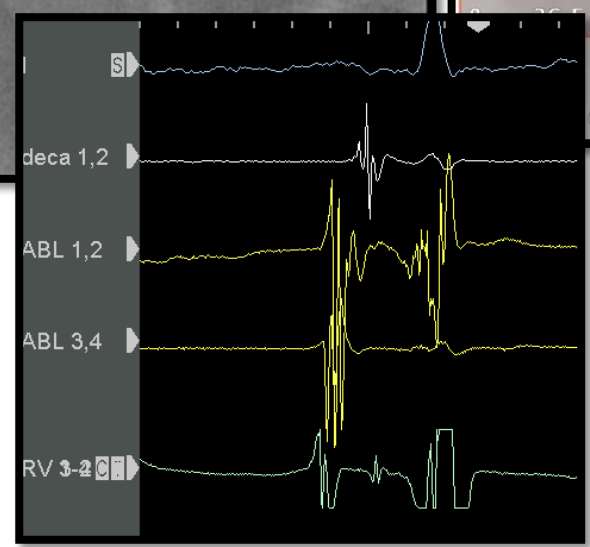
Safety margin



Safety margin

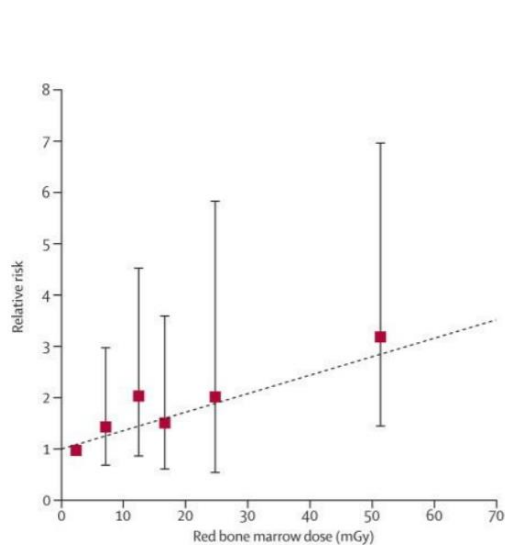


AVNRT

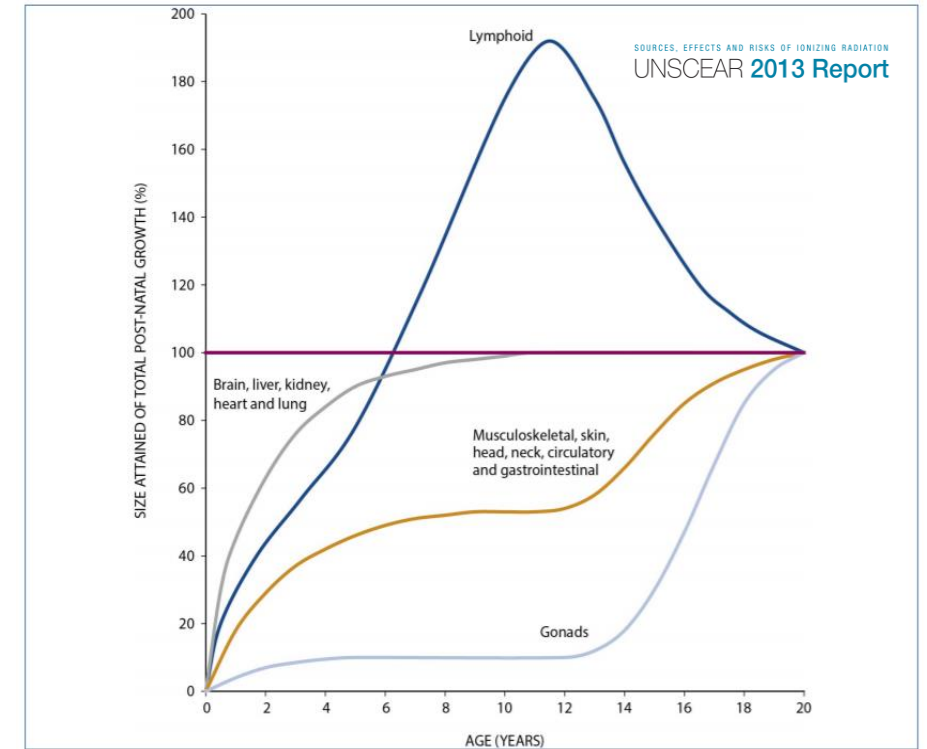
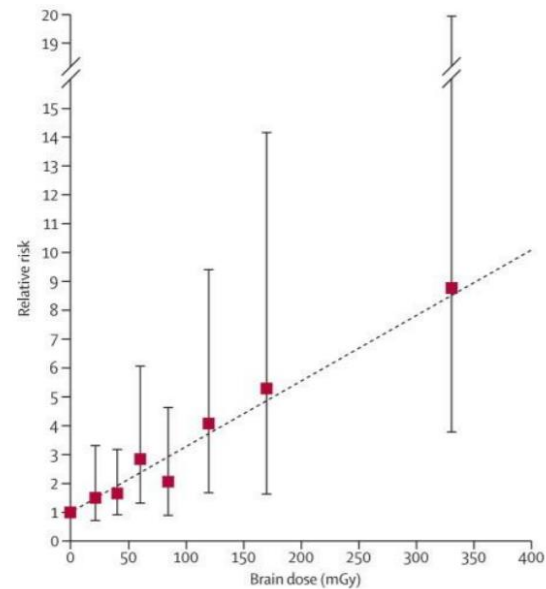


Radiation Exposure

- Risk of Leukaemia X3 for cumulative radiation dose > 30mGy
- Risk of Brain Tumor X2 for cumulative radiation dose > 60mGy

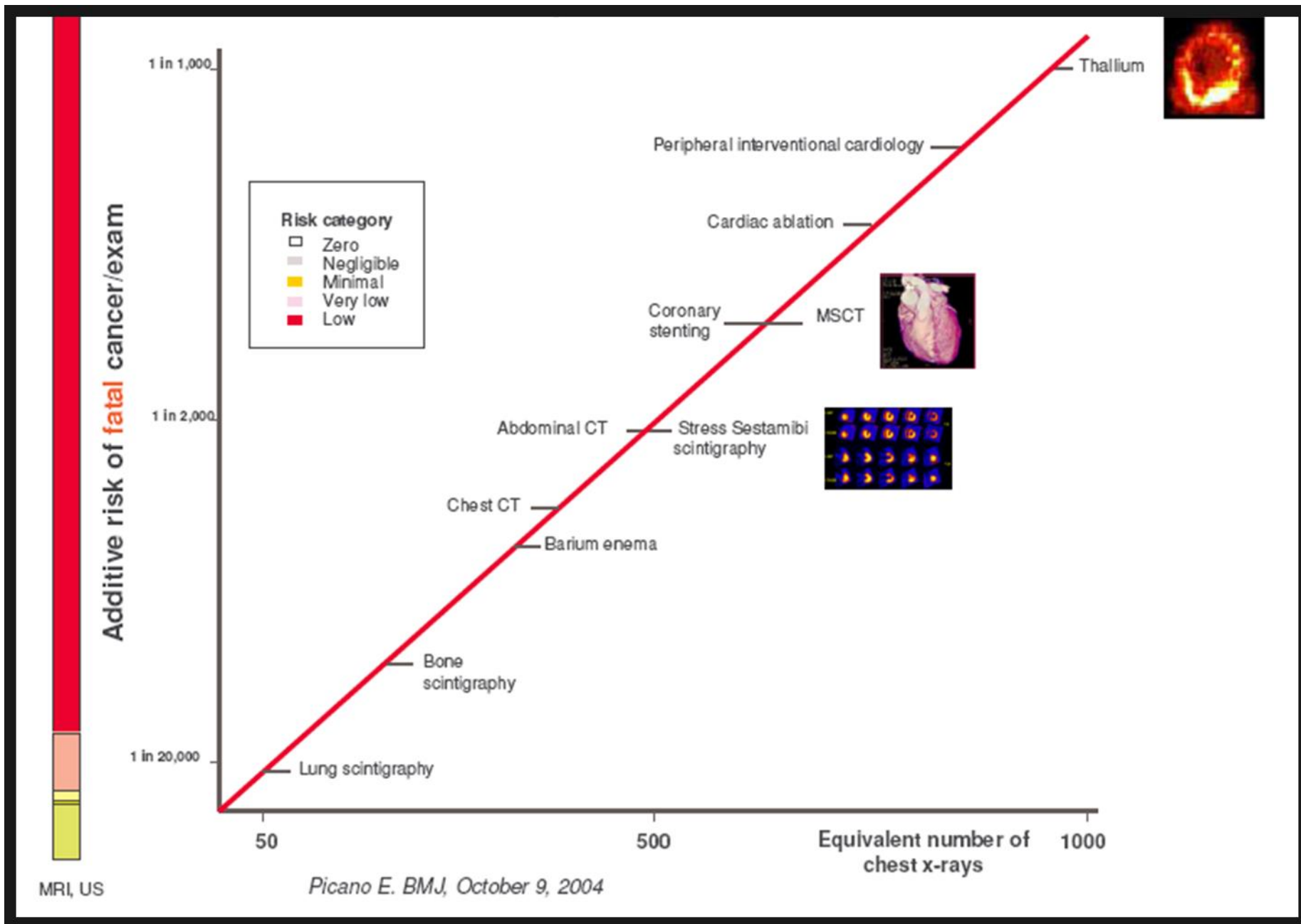


Pearce et al, Lancet 2012



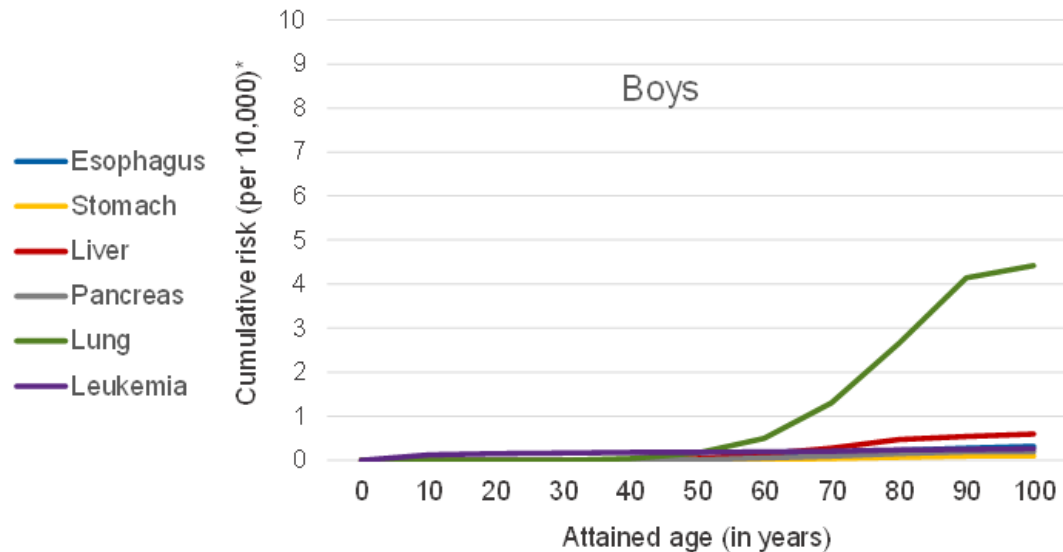
- Cancer incidence rate + 24% after CT scan exposure (4.5 mSv)

Mathews et al, BMJ 2012

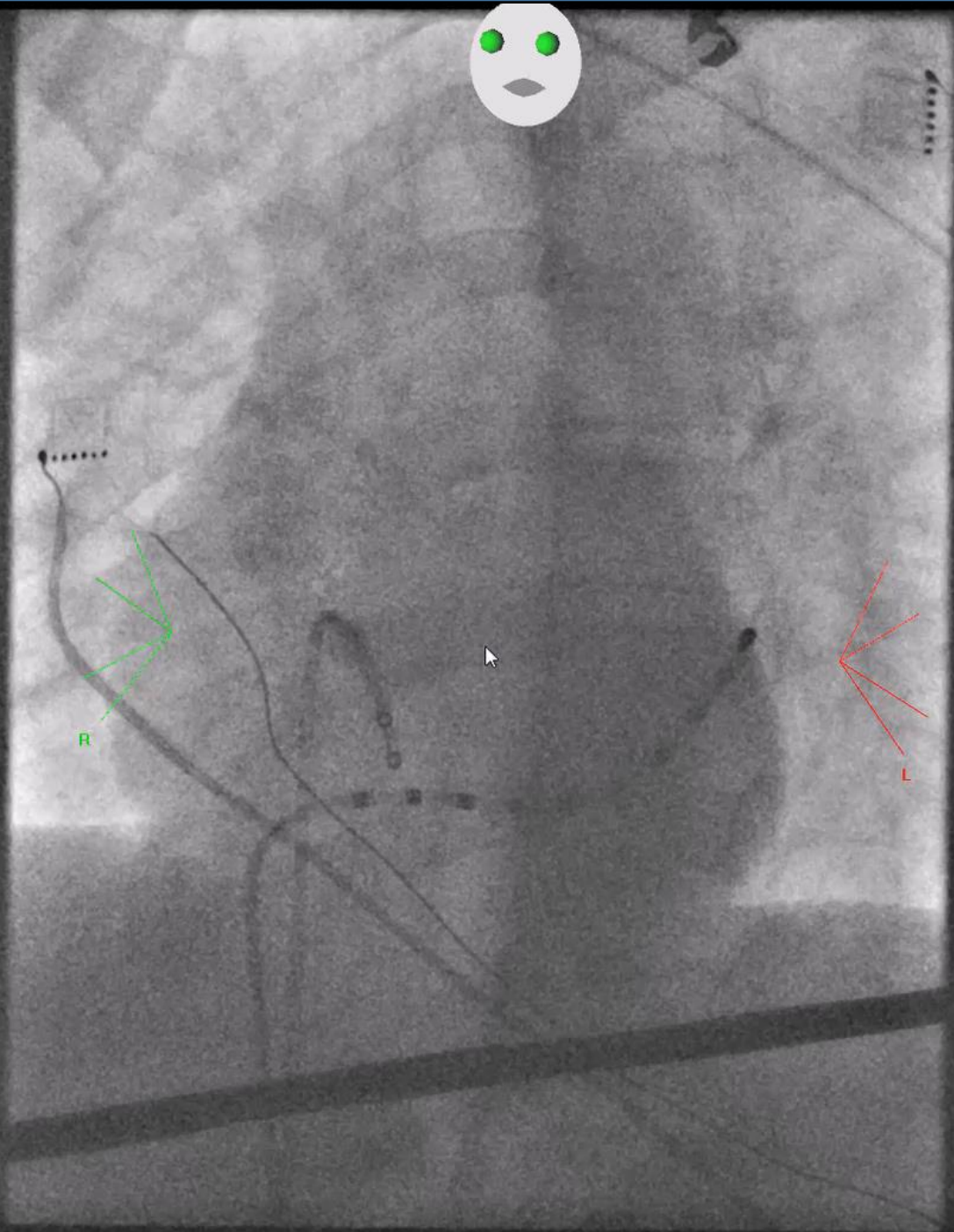


Risk of cancer after cardiac catheterization procedure in childhood

- Dose to lung and breast
 - 1 to 17 mSv
 - ASD or PDA closure
 - Pulmonary valvulation
- Lifetime attributable risk of cancer
 - 4.2 per 1000 in boys (lung)
 - 22.2 per 1000 in girls (breast)

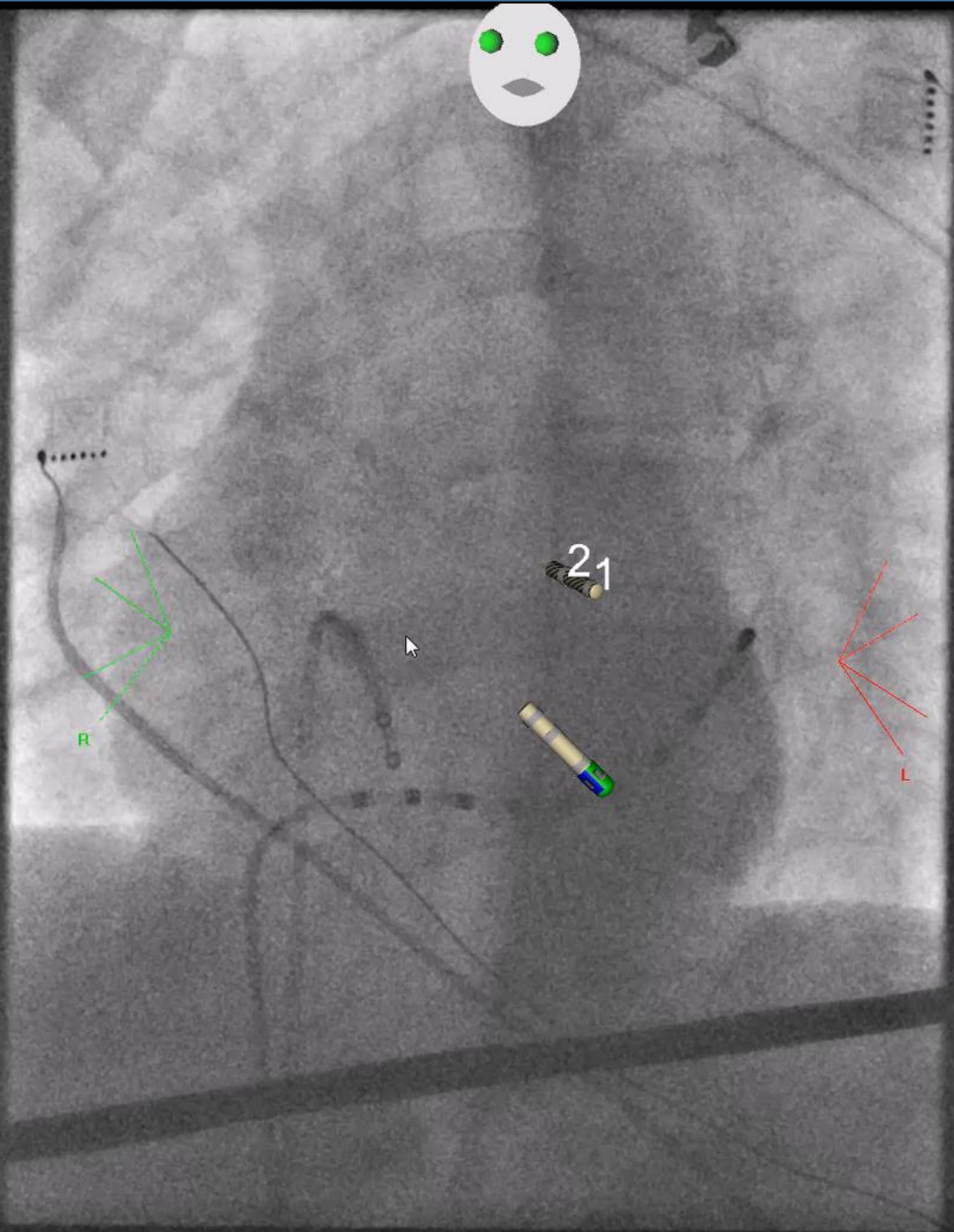


Journy et al. INSERM 1018
Under review



R

L

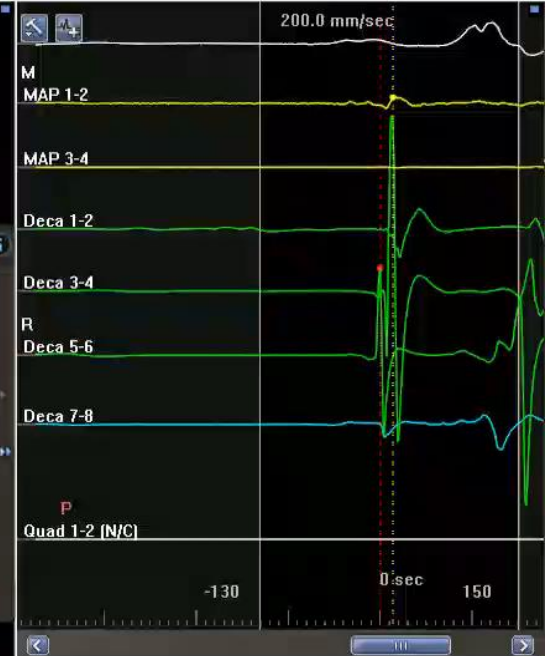
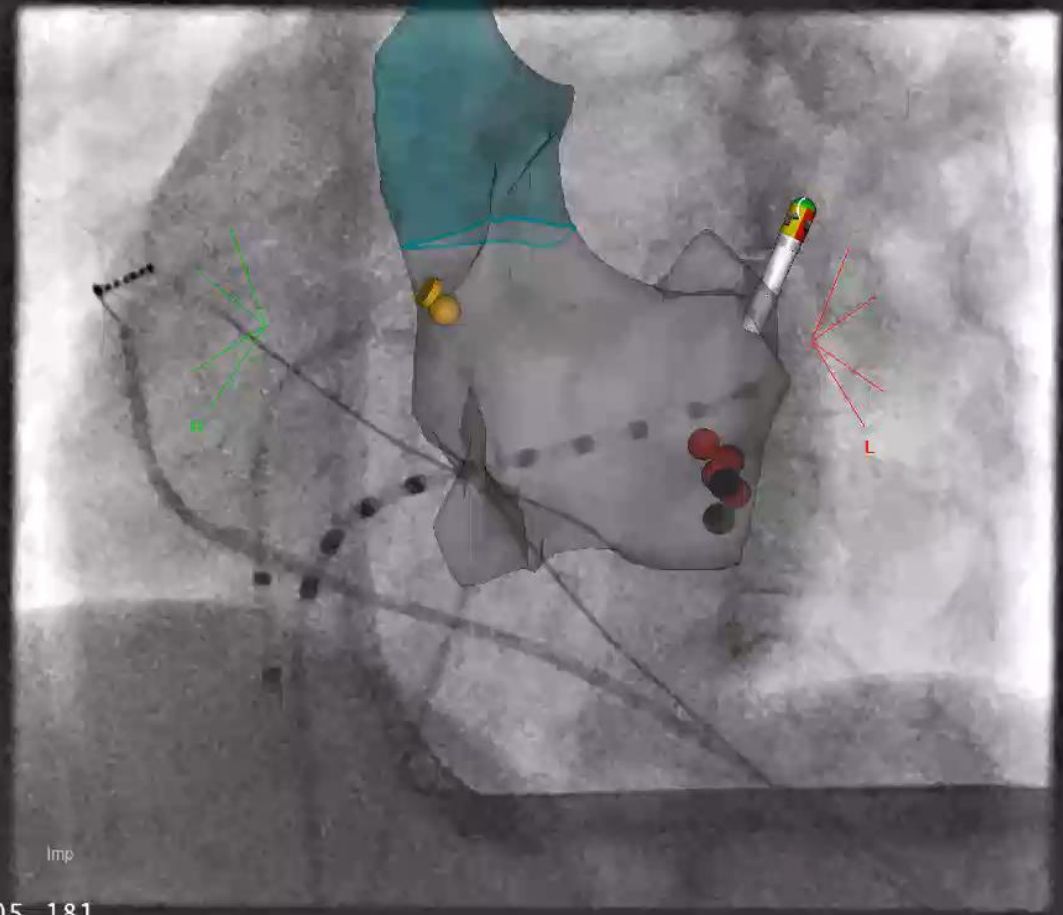
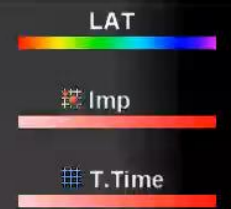


R

21

L

1-1-VG (8, 0)



#	LAT	Elect.	Frc	Tag	Typ
001	85	MAP 1-2	N/A	HIS	Loc
003	114	MAP 1-2	N/A	ABL	Loc
006	-32	MAP 1-2	N/A	ABL	Loc
007	-52	MAP 1-2	N/A	ABL	Loc
008	-107	MAP 1-2	N/A	ARR	Loc
009	-90	MAP 1-2	N/A	ABL	Loc
010	-113	MAP 1-2	N/A	ARR	Loc
011	77	MAP 1-2	N/A	ABL	Loc

12

Vertical toolbar with various icons

Acquire

CL	LAT	BI	Imp
741	14	0.05	181



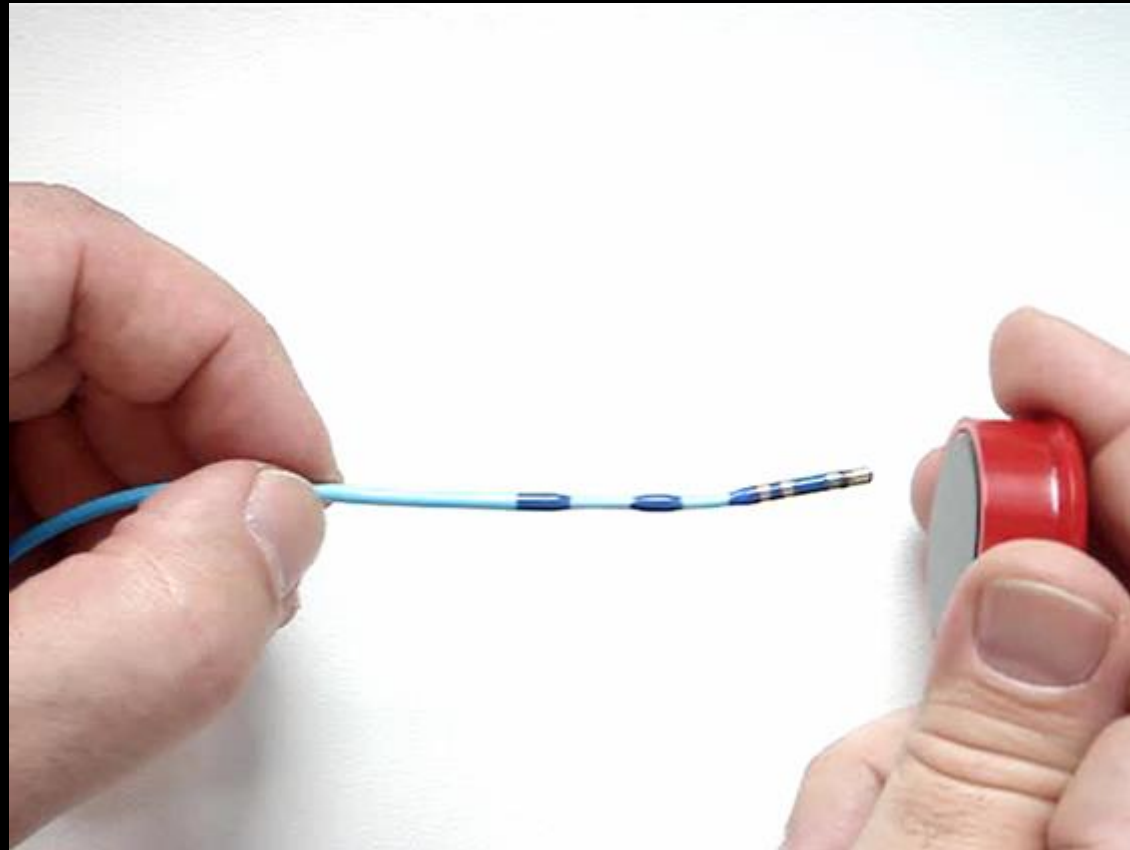
#	LAT	Elect.	Frc	Tag
002	141	MAP 1-2	N/A	LO
004	-34	MAP 1-2	N/A	ABL
005	100	MAP 1-2	N/A	ABL

AP PA LAO RAO LL RL INF SUP

Magnetic navigation

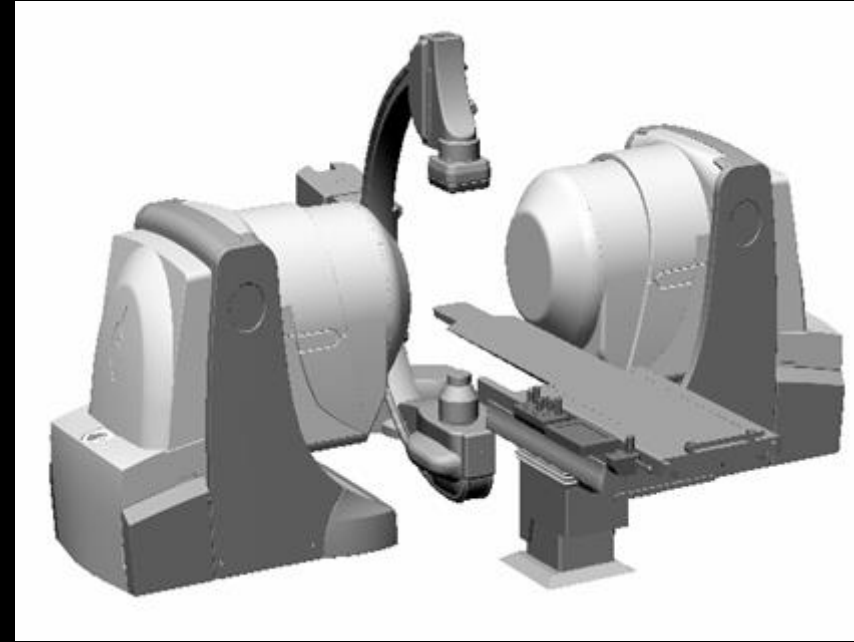
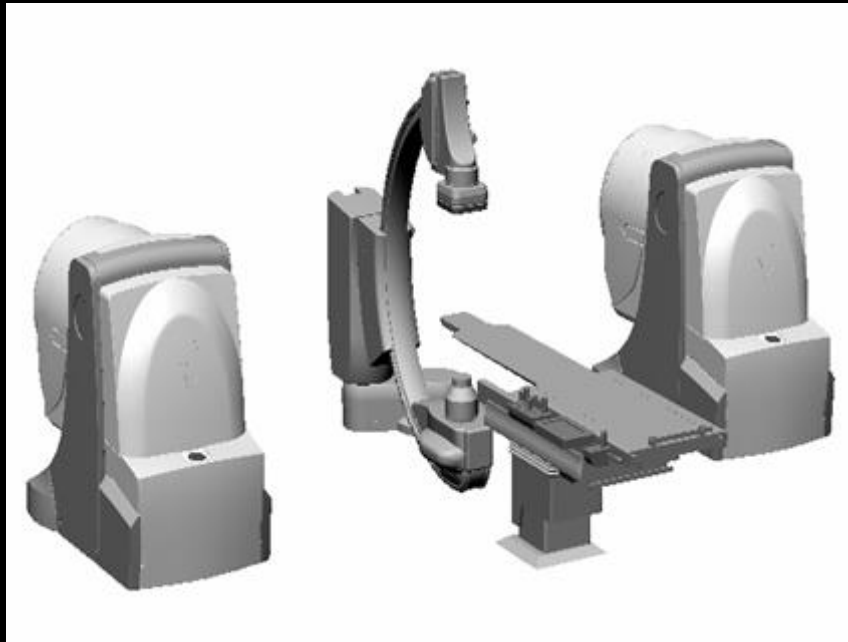
Magnetic Navigation

Small magnets in the tip of the catheter align parallel to magnetic field lines



Niobe – Magnetic positions

- Magnets are rotated away from the patient table
- 5 Gauss line for this position is marked on the floor



MAGNETIC FIELDS ARE ALWAYS ON!

Map Viewer

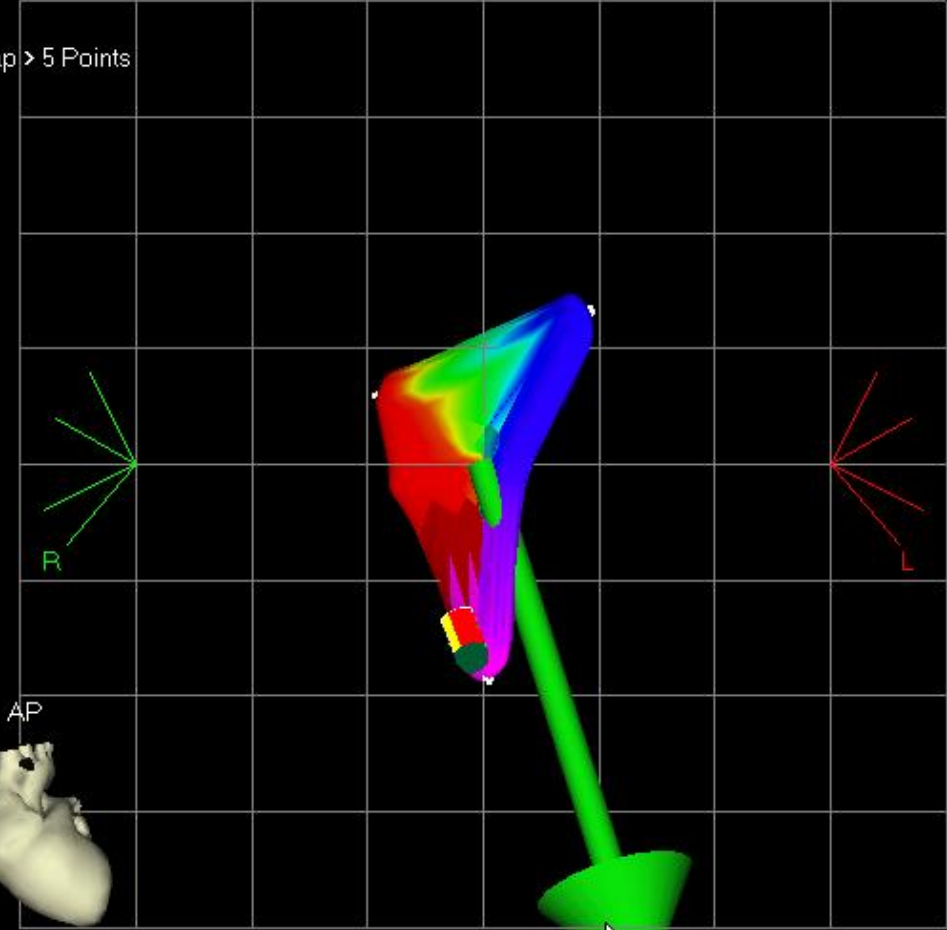


AP PA LAO RAO LL RL INF SUP



LAT

▶ 1-Map > 5 Points

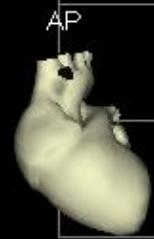


235ms



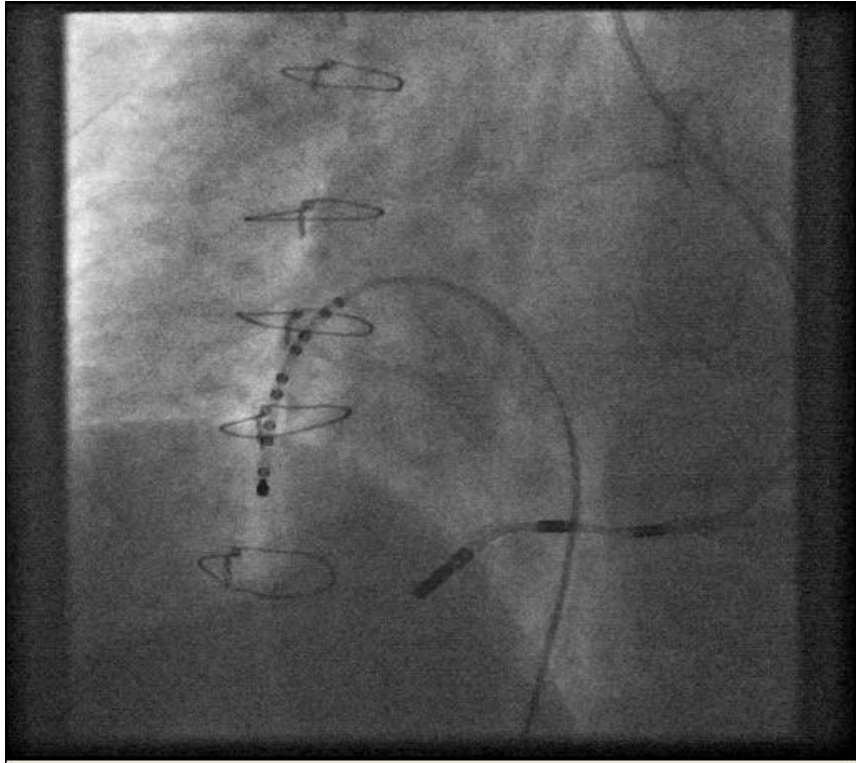
38ms

1.00 cm

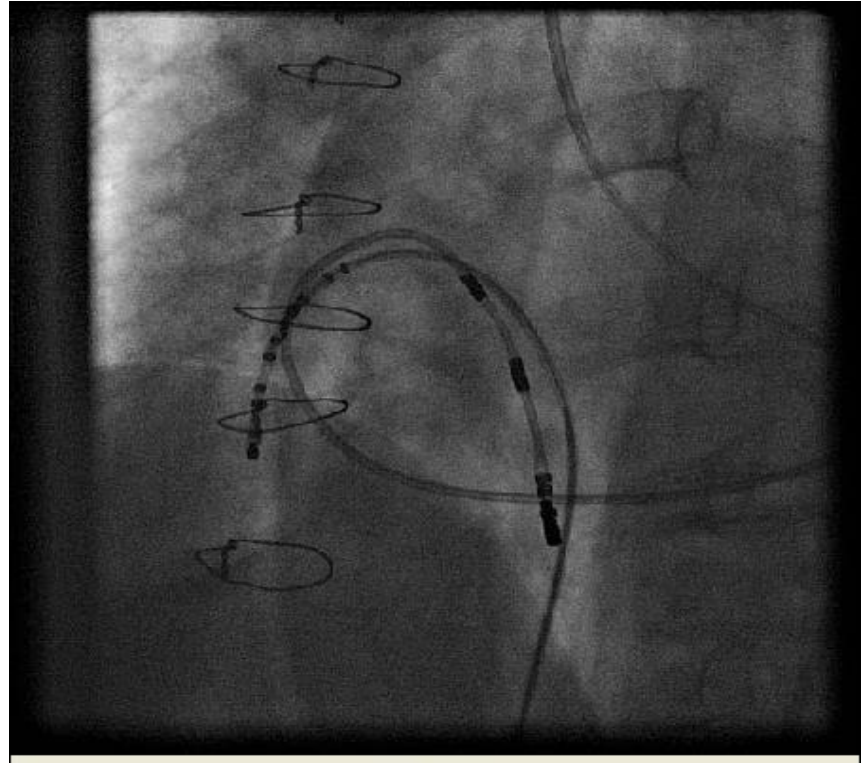


R

L

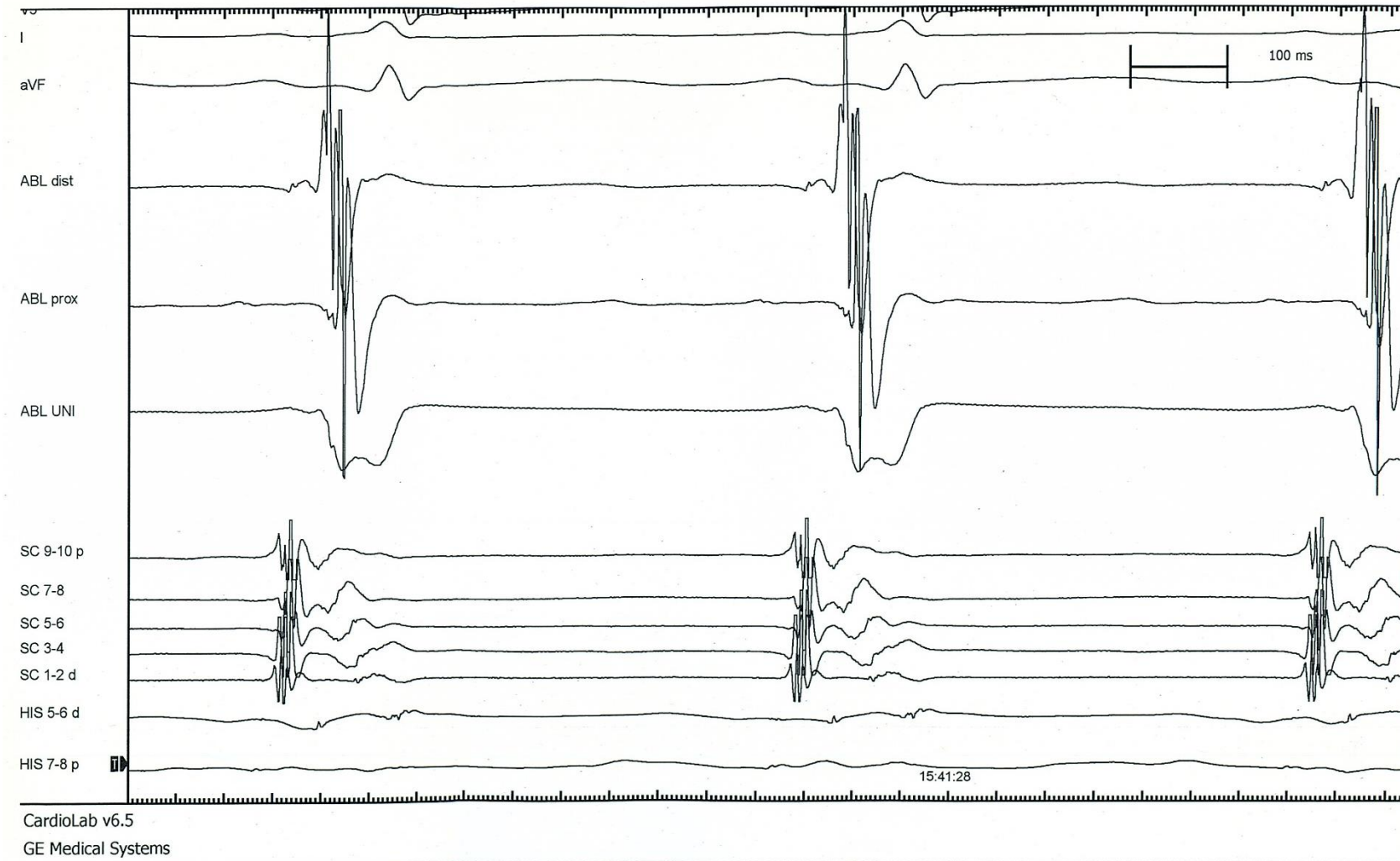


TCPC DILV 1



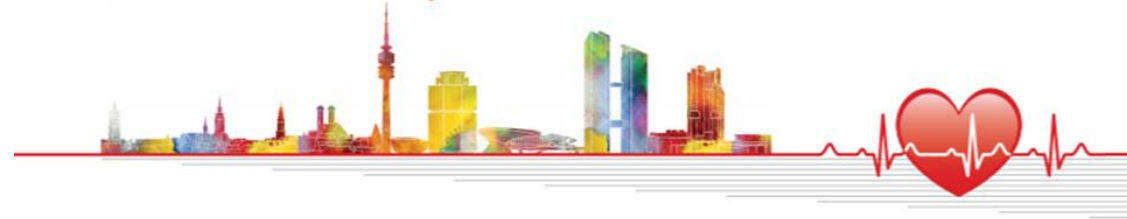
TCPC DILV 3

In conclusion



Save the date

Pedi*Rhythm* VIII



World Congress of Pediatric & Congenital Rhythm Disorders

2018 Special Focus

Arrhythmias in Adult Congenital Heart Disease

Save the date!

October 13-16 2018

Munich [Le Meridien, Munich, Germany]