BASED ABLATION GUIDED BY ARTICIAL ITELLIGENCE

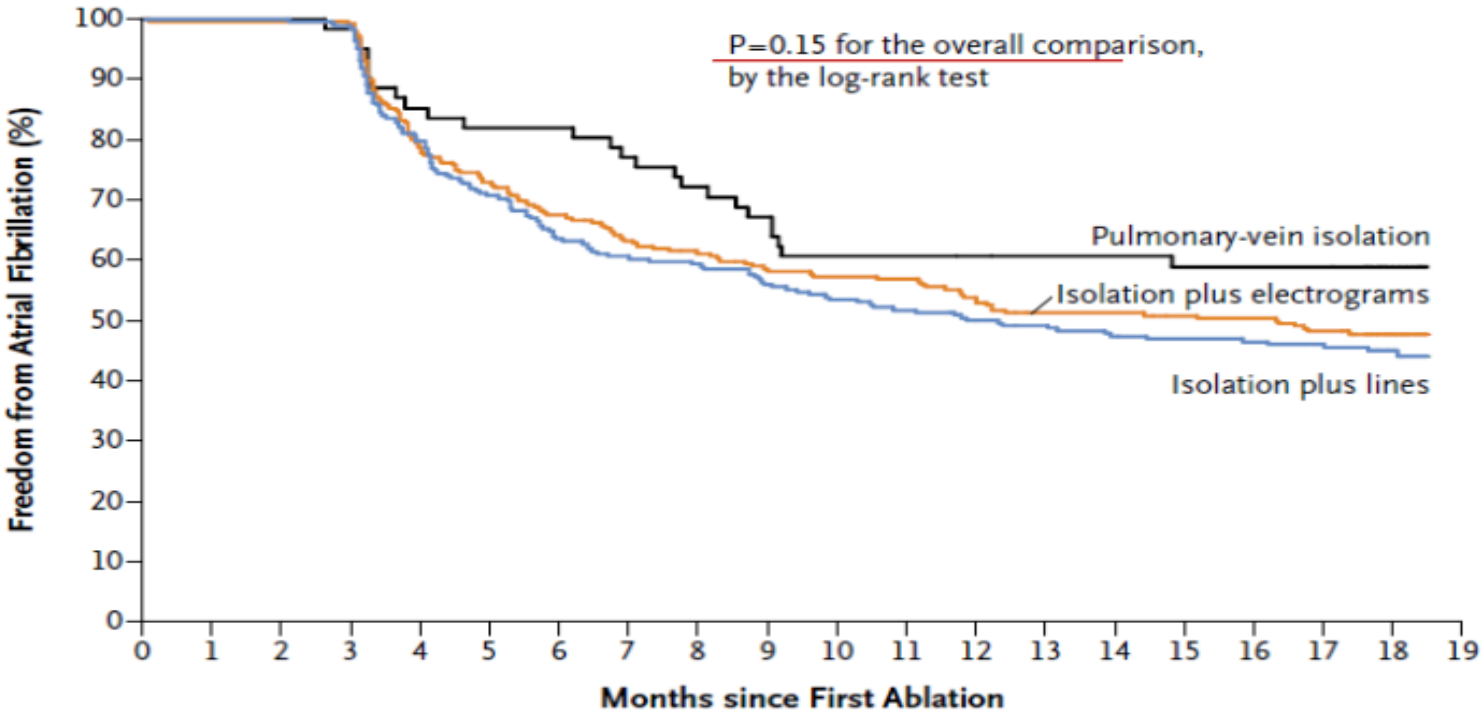
- Jean paul Albenque, *Département de rythmologie et de stimulation cardiaque*

CLINIQUE
Pasteur
TOULOUSE

Approaches to Catheter Ablation for Persistent Atrial Fibrillation

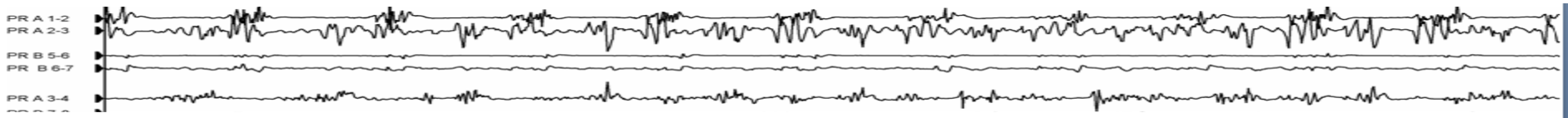
Atul Verma, M.D., Chen-yang Jiang, M.D., Timothy R. Betts, M.D., M.B., Ch.B., Jian Chen, M.D., Isabel Deisenhofer, M.D., Roberto Mantovan, M.D., Ph.D., Laurent Macle, M.D., Carlos A. Morillo, M.D., Wilhelm Haverkamp, M.D., Ph.D., Rukshen Weerasooriya, M.D., Jean-Paul Albenque, M.D., Stefano Nardi, M.D., Endrj Menardi, M.D., Paul Novak, M.D., and Prashanthan Sanders, M.B., B.S., Ph.D., for the STAR AF II Investigators*

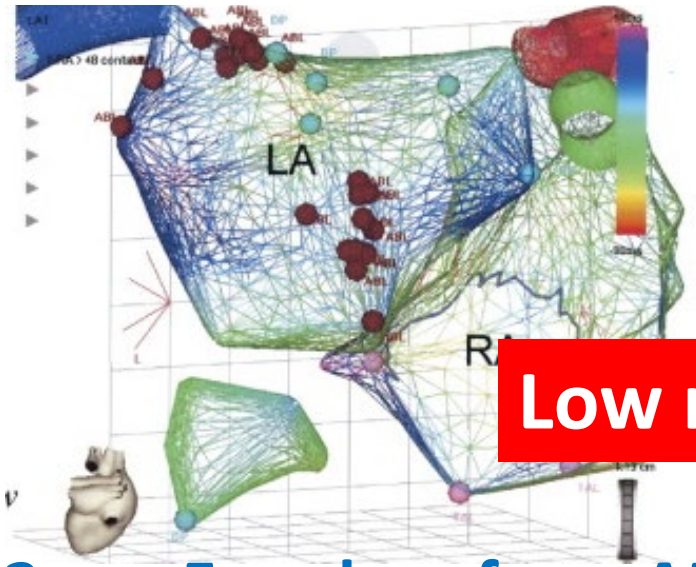
NEJM 2015

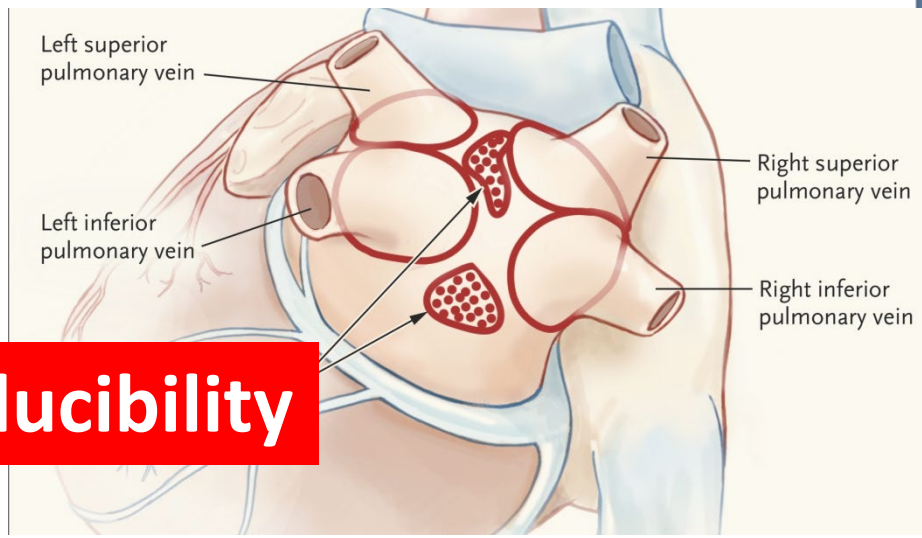


No. at Risk						
Pulmonary-vein isolation	61	60	50	41	36	23
Isolation plus electrograms	244	242	161	137	124	72
Isolation plus lines	244	240	152	133	115	57

EGM-based (CFAE) ablation?







Low reproducibility

12 mo-Freedom from AF/AT multiple procedures: 91%

EGMs selected visually

AF termination = 95%

Nademanee et al. JACC 2004

18 mo-Freedom from AF/AT multiple procedures: 50%

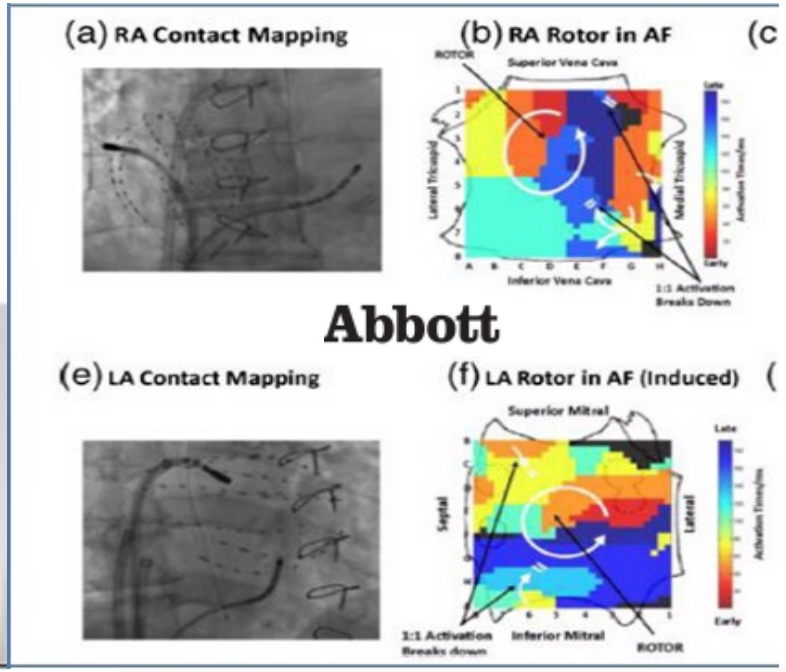
EGMs selected by CFAE software

AF termination = 45%

Verma et al. NEJM 2015

Anedoctic use of automated systems for the collection of AF DRIVERS

ECVUE™
SENSOR ARRAY
Multi-Electrode Mapping Vest



Topera

Ablation guided by artificial intelligence :a new way?

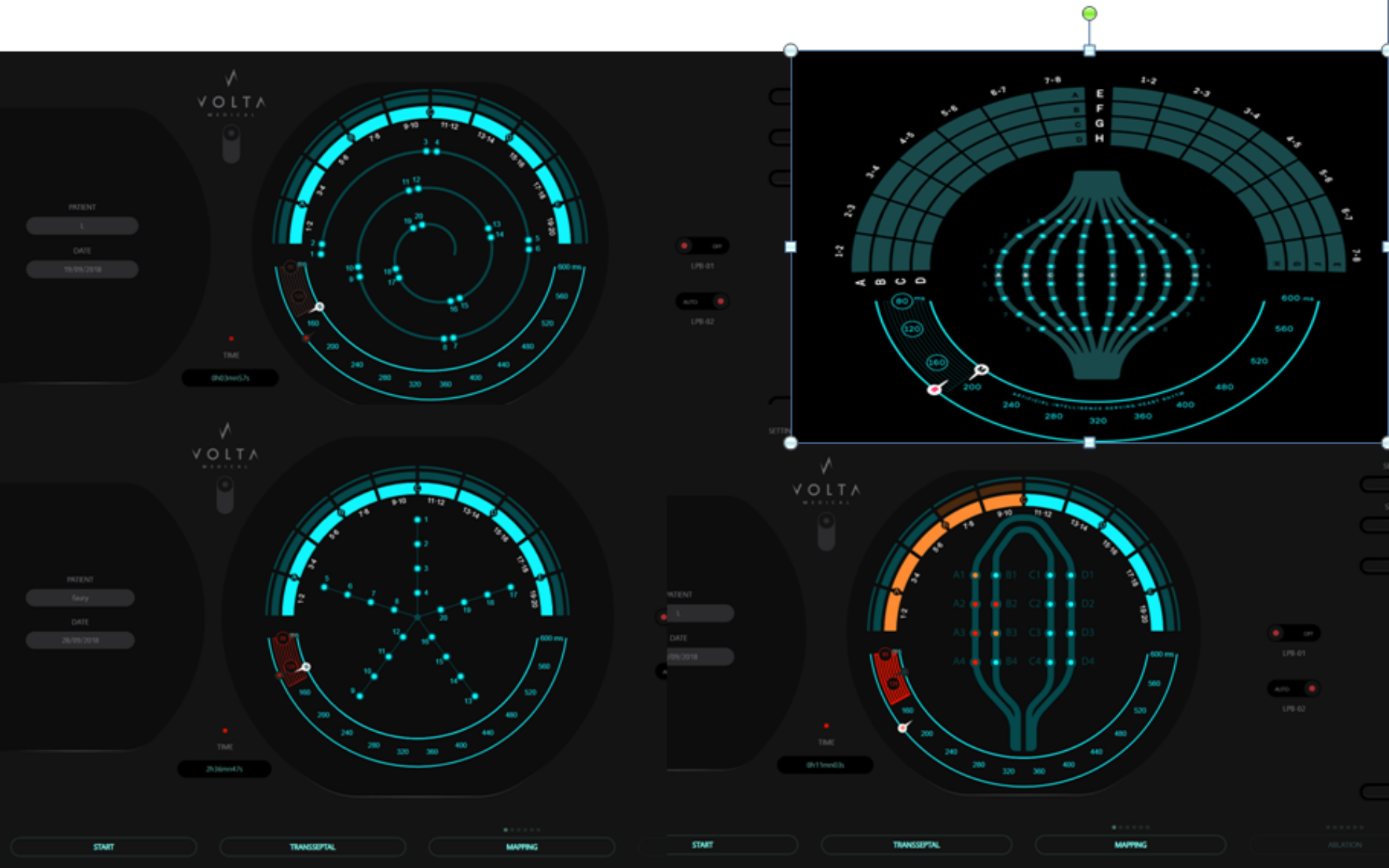
- Spatio-temporal dispersion seen to be a signal of AF Drivers
- Visual detection of spatial temporal dispersion remains challenging
- Did Volta system with automatic detection of spatial temporal dispersion improve ablation results ?

Preliminary clinical results

Ev-AIFib Study

AF module of Volta software

Needs multipolar endocardial AF signals

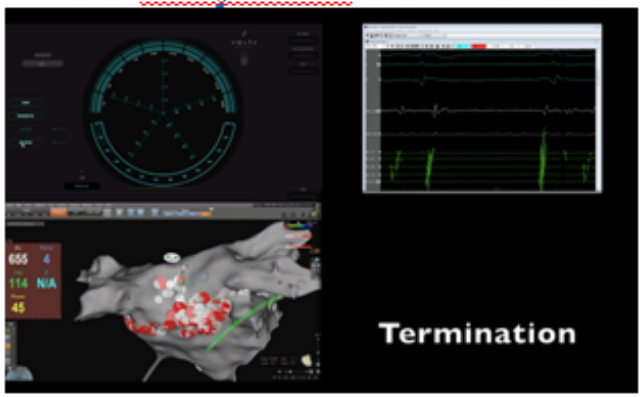


Ablation workflow

Ablation at Volta regions ± PVI (operator's choice)

Drivers' Ablation:

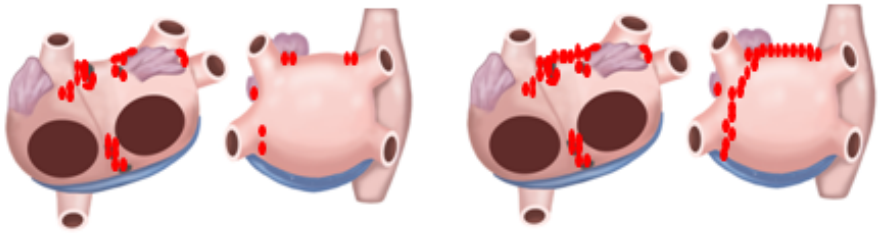
Sinus Rhythm conversion



- **Biatrial automatic Dispersion map**
- **High power ablation at dispersion regions:** 35-50W - Ablation index: 350-550*
- Complete "flattening" of the bipolar signal amplitude
- **Primary ablation endpoint : Sinus Rhythm conversion** (Remapping and re-ablation if needed)

Atrial locking:

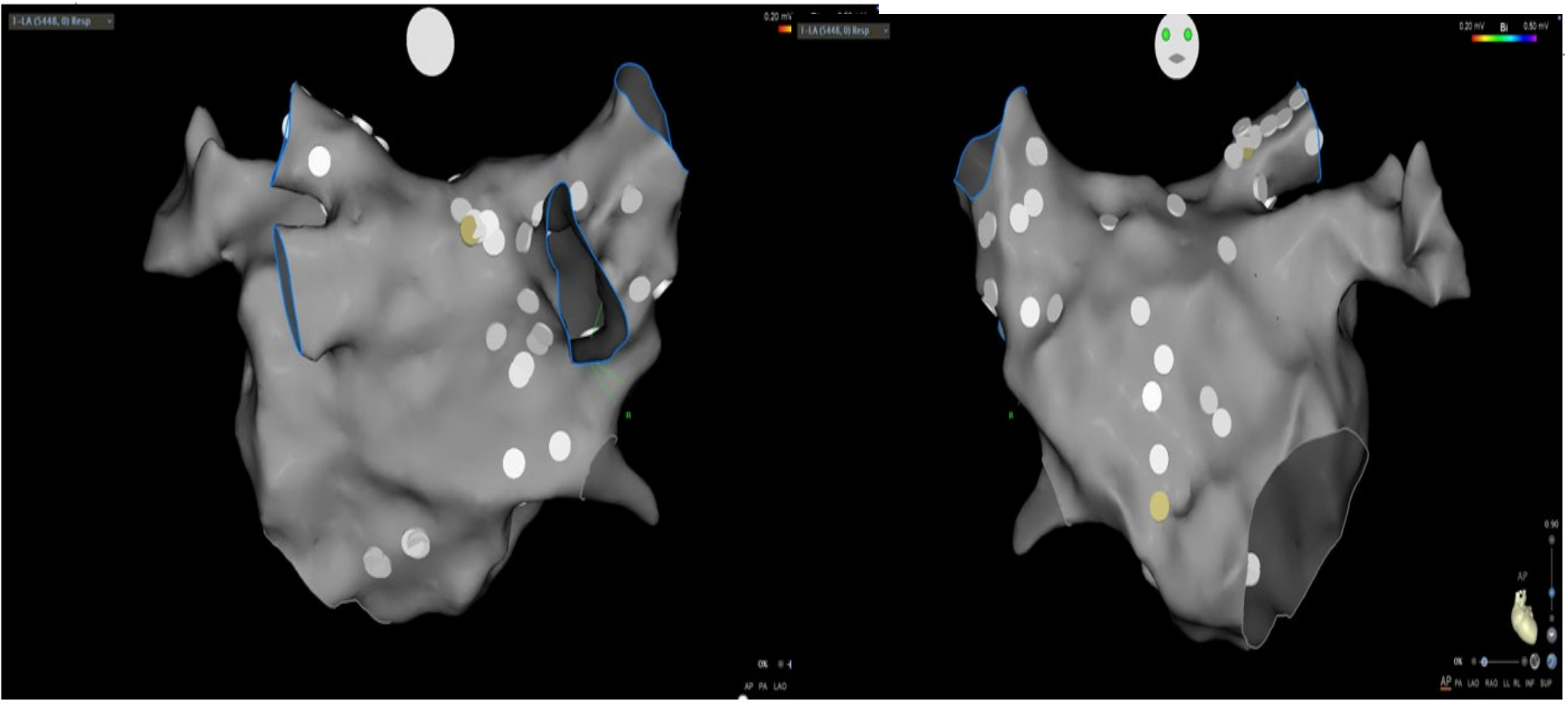
Completion of the ablation set

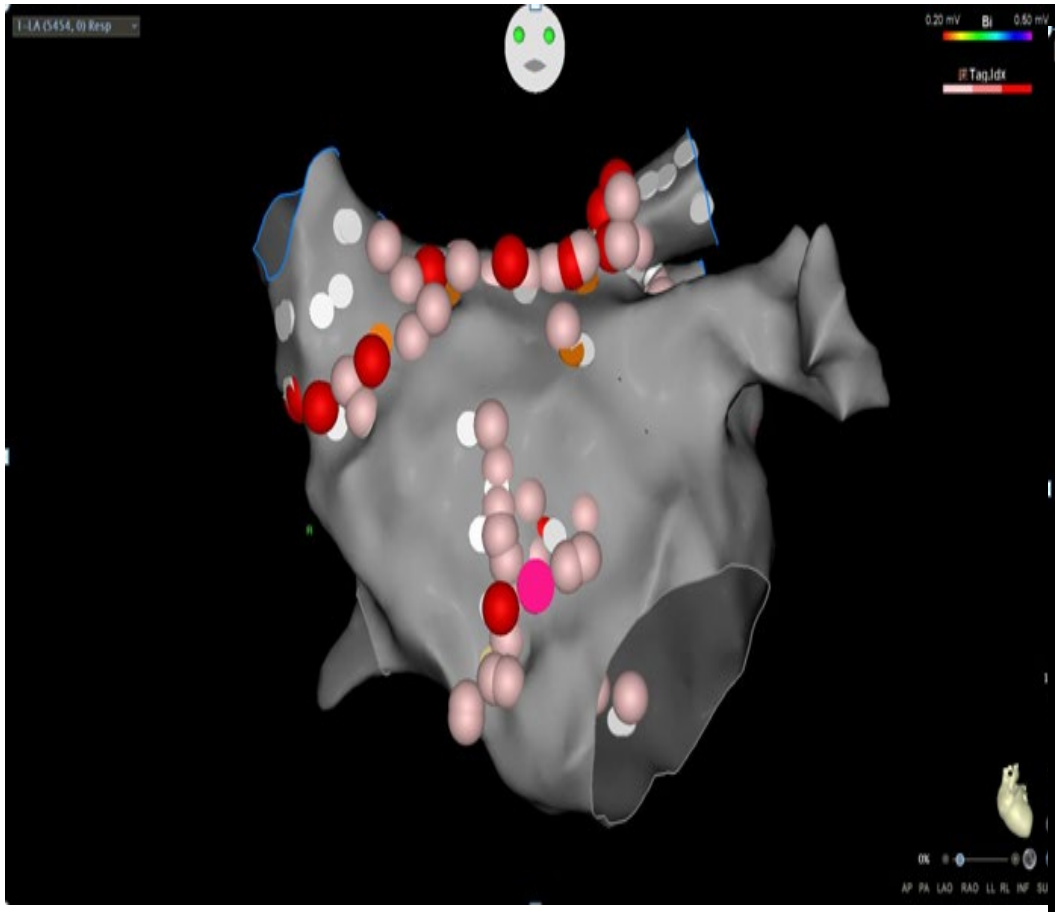


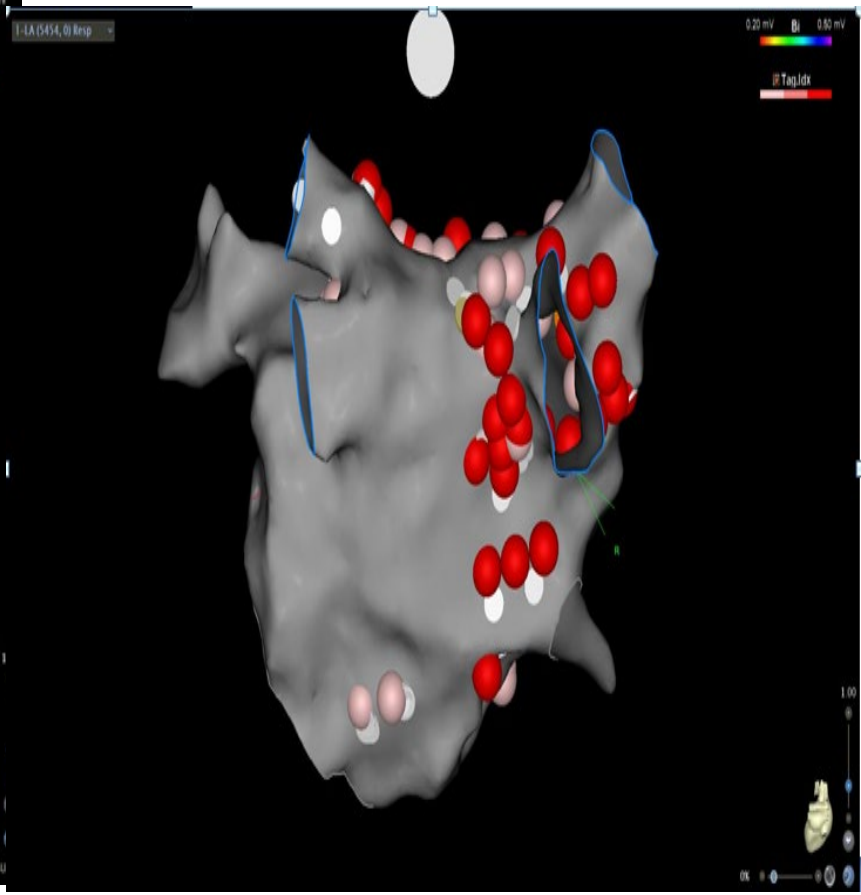
Ablation set for Sinus Rhythm conversion → Completion of the Ablation set

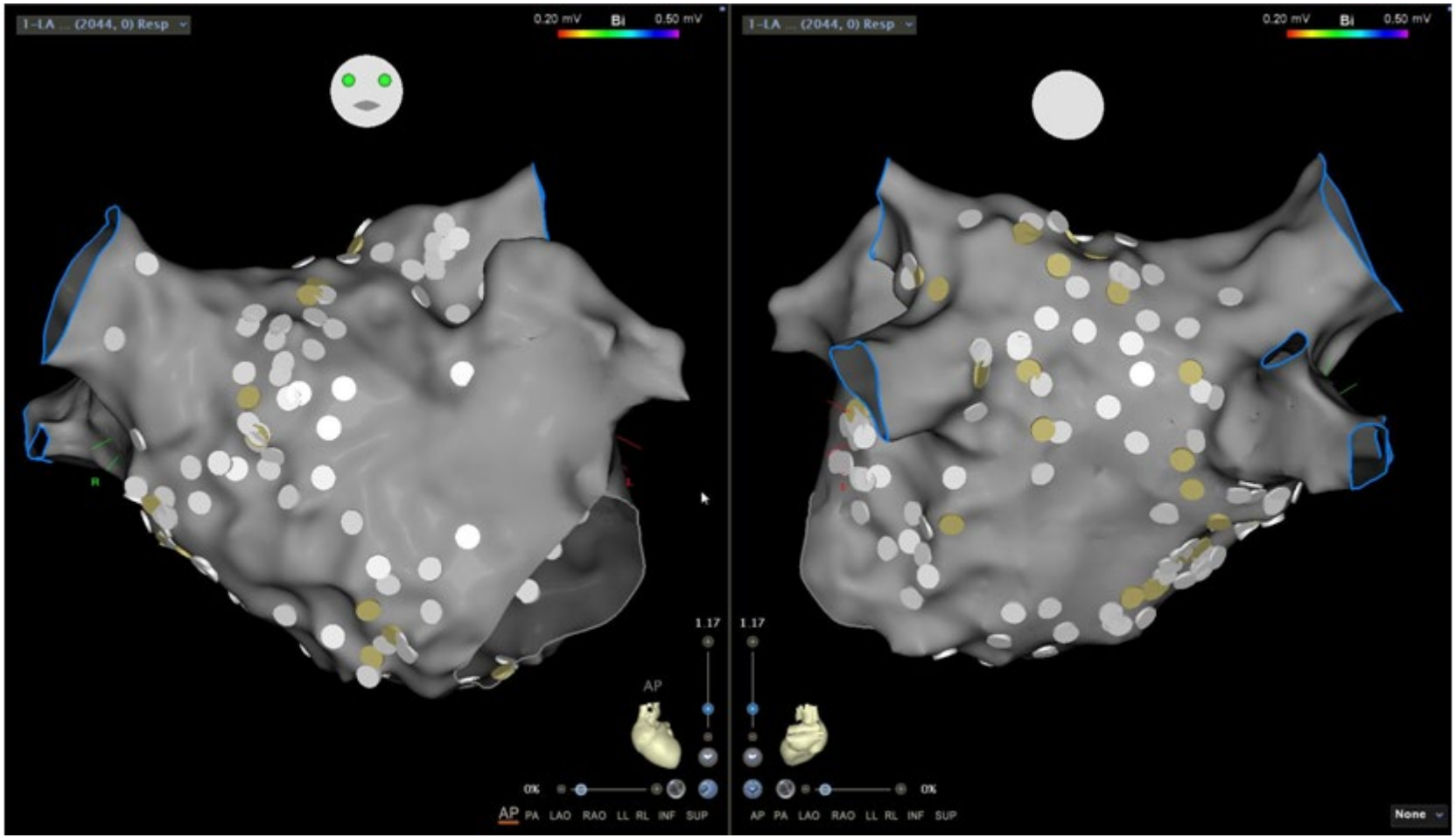
- **Connection of closed ablated areas**
- **Linear ablation to complete ablation at Dispersion regions** if needed (Mitral/ roof lines, PV encirclement)
- **Secondary enpoint: Lines validation**

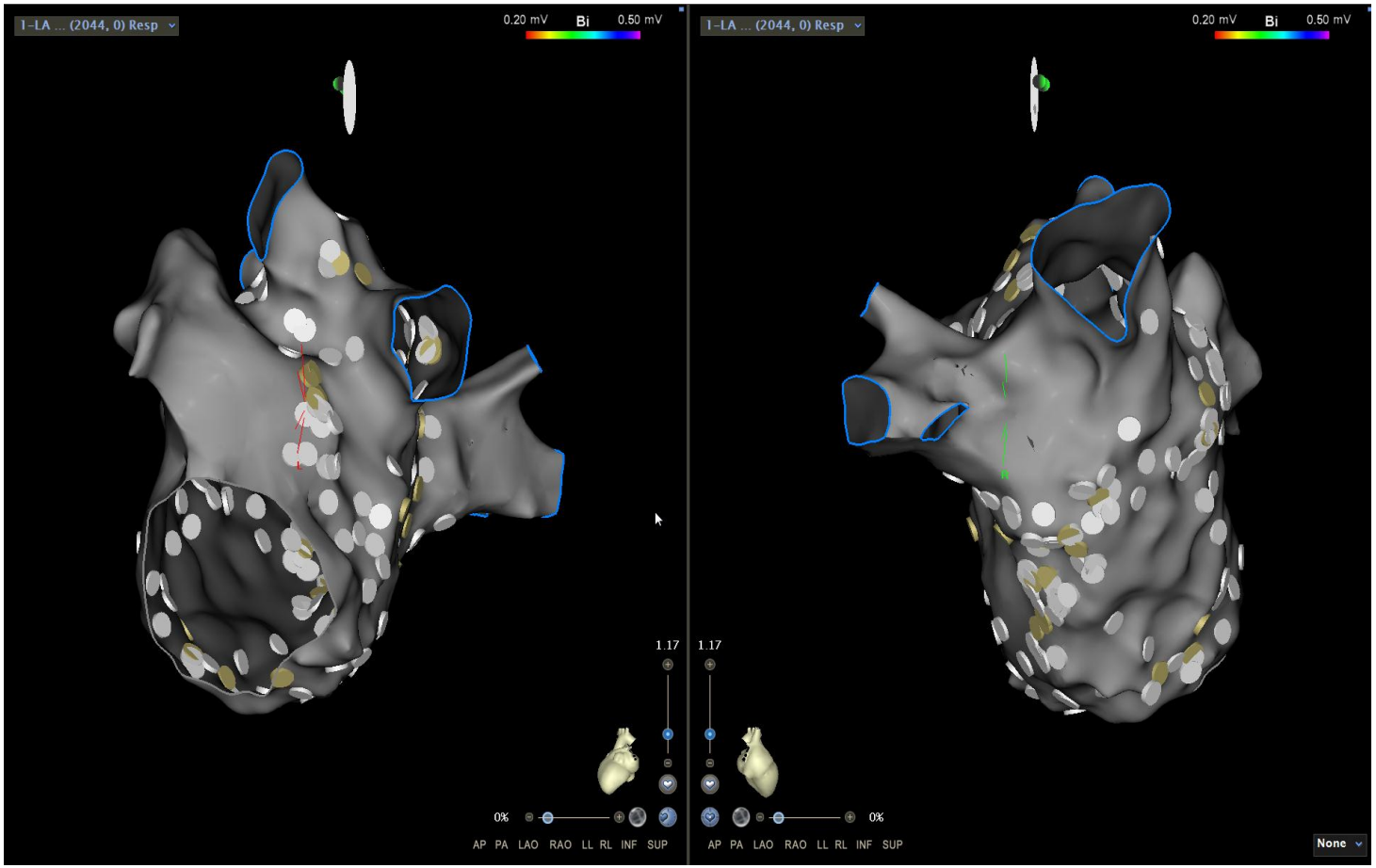
*Taghgi, Duytschaever et al. JACC EP 2017

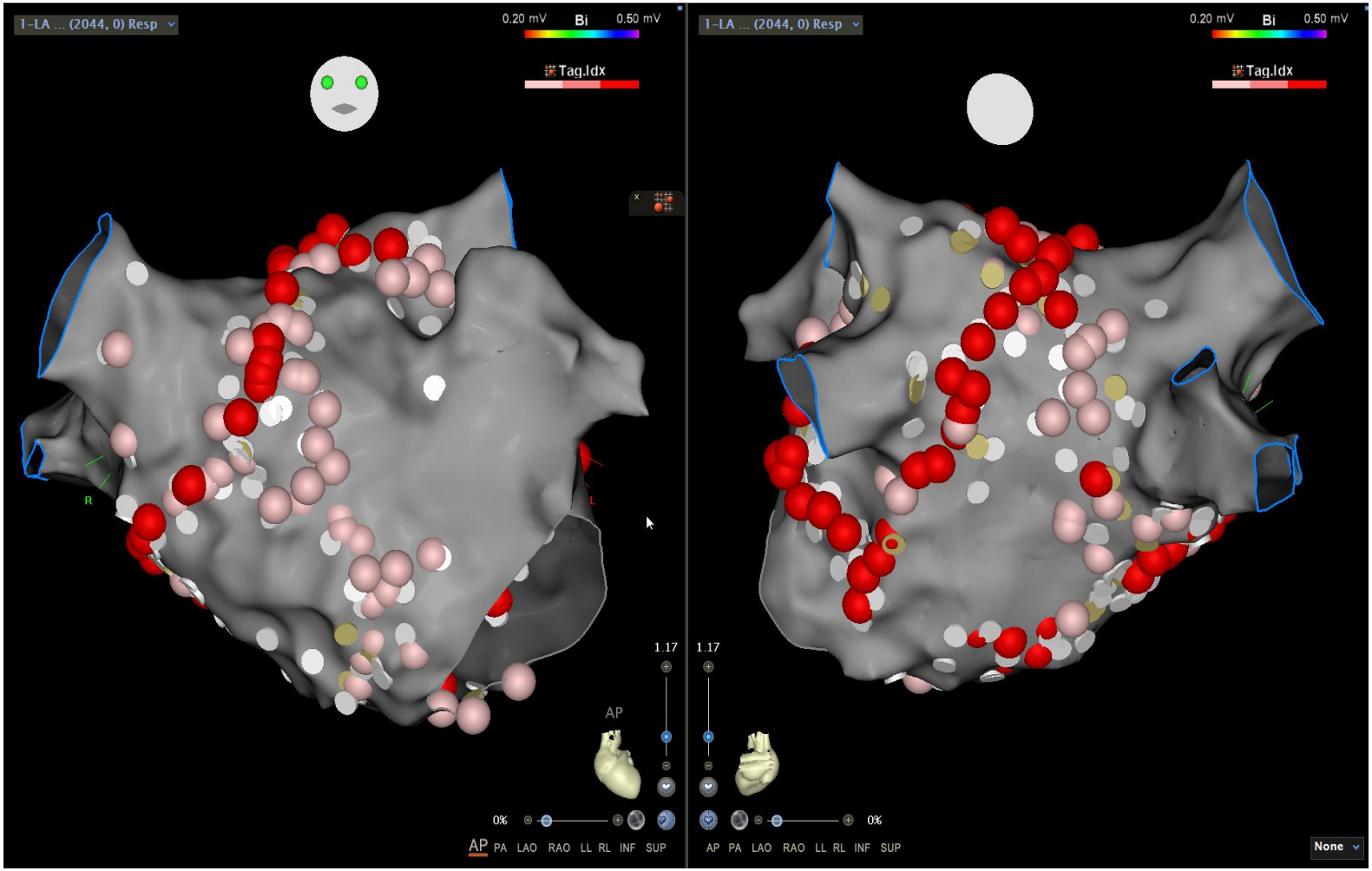

1 - LA (5448, 0) Resp
0.20 mV
1 - LA (5448, 0) Resp
AP PA LAO
0.20 mV
Bi
0.60 mV
AP
AP PA LAO RAO LL RL INF SUP

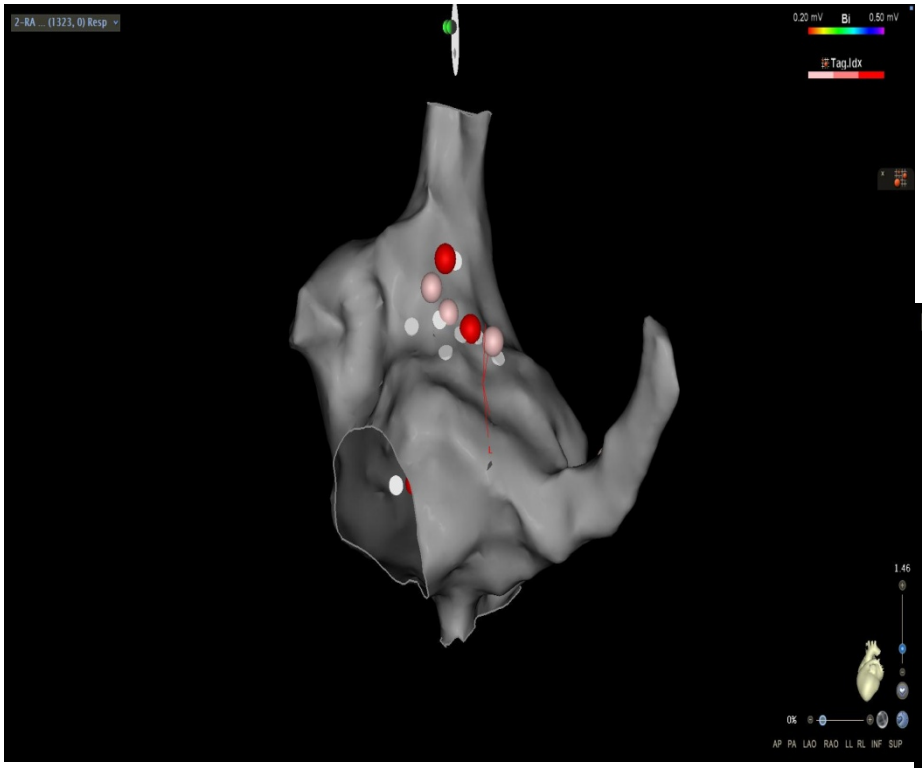

1 - LA (5454, 0) Resp
0.20 mV
Bi
0.60 mV
Tag Idx
AP PA LAO RAO LL RL INF SU

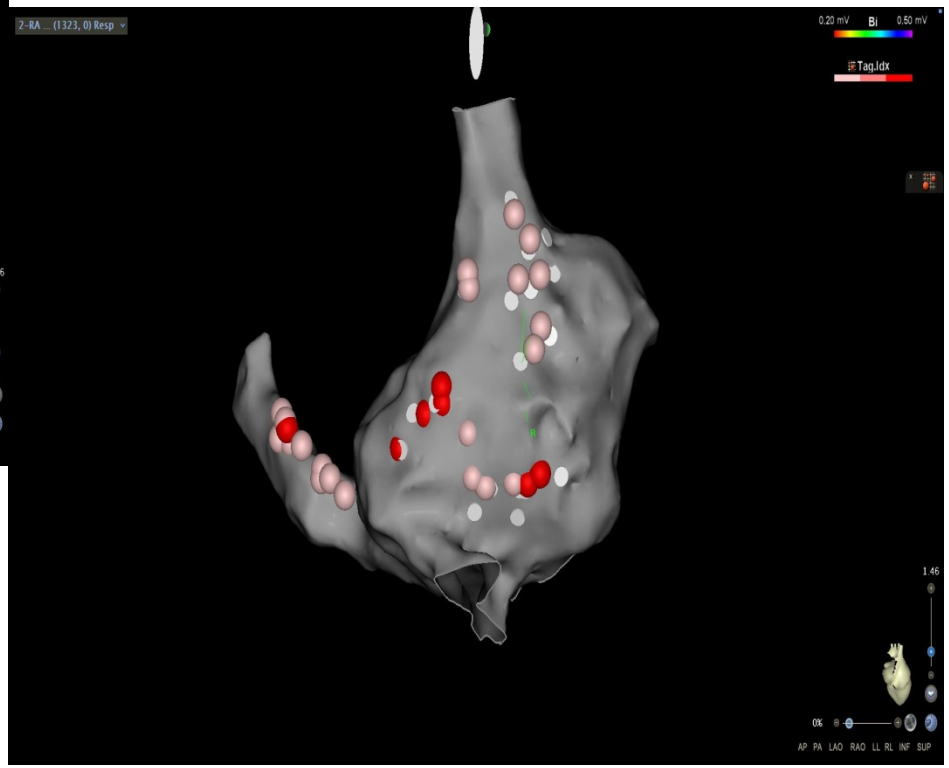

1 - LA (5454, 0) Resp
0.20 mV
Bi
0.60 mV
Tag Idx
1.00


1-LA ... (2044, 0) Resp
0.20 mV
Bi
0.50 mV
1.17
AP
0%
AP PA LAO RAO LL RL INF SUP
1-LA ... (2044, 0) Resp
0.20 mV
Bi
0.50 mV
1.17
0%
AP PA LAO RAO LL RL INF SUP
None


1-LA ... (2044, 0) Resp
0.20 mV
Bi
0.50 mV
1.17
0%
AP PA LAO RAO LL RL INF SUP
1-LA ... (2044, 0) Resp
0.20 mV
Bi
0.50 mV
1.17
0%
AP PA LAO RAO LL RL INF SUP
None


1-LA ... (2044, 0) Resp
0.20 mV
Bi
0.50 mV
Tag.Idx
R
L
1.17
AP
0%
AP PA LAO RAO LL RL INF SUP
1-LA ... (2044, 0) Resp
0.20 mV
Bi
0.50 mV
Tag.Idx
1.17
0%
AP PA LAO RAO LL RL INF SUP
None


2-RA ... (1323, 0) Resp
0.20 mV
Bi
0.50 mV
Tag.Idx
1.46
0%
AP PA LAO RAO LL RL INF SUP


2-RA ... (1323, 0) Resp
0.20 mV
Bi
0.50 mV
Tag.Idx
1.46
0%
AP PA LAO RAO LL RL INF SUP

ABLATION RESULTS

SOFTWARE REPRODUCTIBILITY

St Joseph Hospital

67 patients

- Paroxysmal patient -redos **8** (12%)
- Persistent patients **46** (69%)
- Long standing **13** (19%) persistent patients

1 Center

6 Electrophysiologists

Results

- **AF termination = 95 %**
- **SR conversion = 79 %**

Other centers

39 patients

- Paroxysmal patients **0** (0%)
- Persistent patients **28** (72%)
- Long standing **11** (28%) persistent patients

7 Centers

11 Electrophysiologists

Results

- **AF termination = 90 %**
- **SR conversion = 64 %**

ABLATION RESULTS

THE PROCEDURE

106 patients

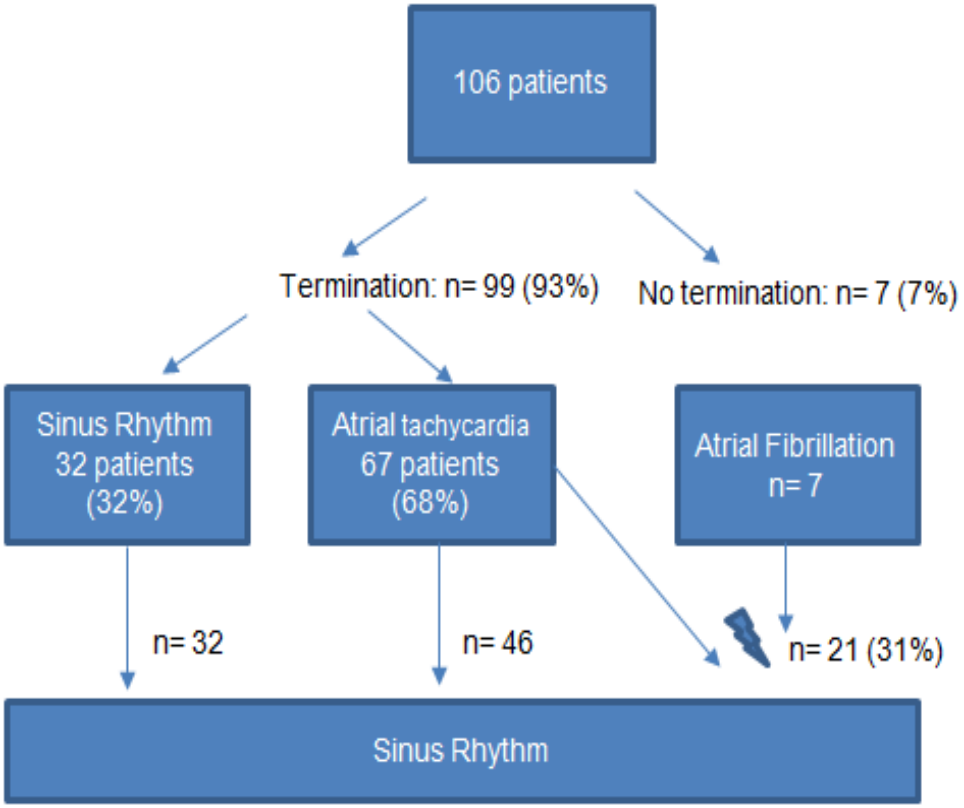
- Paroxysmal patients **8** (8%)
- Persistent patients **74** (70%)
- Long standing **24** (23%) persistent patients

8 Centers

17 Electrophysiologists

Results

- **AF termination = 93%**
- **SR conversion = 74%**



PASTEUR EXPERIENCE

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7	Patient 8	Patient 9	Patient 10	Moyenne	Ecart-type
Date procédure	29/01/2019	30/01/2019	30/01/2019	13/02/2019	13/02/2019	20/02/2019	20/02/2019	05/03/2019	05/03/2019	24/06/2019		
Temps RF (mn)	35	13	31	36	22	25,5	29	19	27	15,5	25	7,7
Temps procédure (mn)	160	80	220	230	140	180	150	150	160	180	165	42
Surface OG (cm2)	207	197	226	311	185	225	231	249	198	172	220	39
S dispersion OG (cm2)	39	10	56	50	33	45	48	82	13	14	39	22,4
%	19	5	25	16	18	20	21	33	6,5	8	17	
Surface OD (cm2)	218	Non fait	222	216	Non Fait	188	263	266	Non Fait	207	226	84
S dispersion OD (cm2)	0,2		13	13		11	5	17		37	10	11,6
%	0,09		6	6		6	2	6		18	5	
Temps scopie (mn)	4,11	7,15	11,28	15,46	17,12	17,1	11,33	14,17	12,13	23,02	13	5
Procédure	Converti en flutter. Arrêt paroi antérieur	Arrêt FA zone dispersion antérieure	4 TA Pas d'arrêt	4 TA Pas d'arrêt	Organisation flutter Arrêt ligne antérieure	Pas d'arrêt	Organisation 2 TA Arrêt sur crête	Organisation flutter toit arrêt	Organisation dispersion. Arrêt spontané	2 TA Pas d'arrêt		
Cardioversi	Non	Non	Oui	Oui	Non	Oui	Non	Non	Non	Oui		

PASTEUR EXPERIENCE

Age	Sexe	Contexte	Date ablation	Dr.	CEE	Reprise	Symptome FA	ECG 3mois	Anti arythmique
73 ans	Homme	FA pers malgré 2 CEE + cordarone	29/01/2019	SC	oui (2°mois)	oui (6°mois)	NON	TA / flutter	Cordarone
67 ans	Femme	FA pers	30/01/2019	JPA	non	non	NON	sinusal	Bisoprolol
64 ans	Femme	FA pers	30/01/2019	JPA	non	non	FA sur holter à 2mois	sinusal	Cordarone
64 ans	Homme	reprise FA ; déjà ablation FA puis	13/02/2019	JPA	non	non	NON	sinusal	NON
78 ans	Femme	FA pers (sinusale ac cordarone ms	13/02/2019	JPA	non	non	FA nuit post ablation + FA de 48h à 1mois	sinusal	Cordarone
64 ans	Femme	FA pers malgré CEE	20/02/2019	JPA	non	non	NON	sinusal	NON
65 ans	Homme	reprise FA ; deja ablation FA + flutter	20/02/2019	JPA	non	non	NON	sinusal	NON
68 ans	Femme	FA pers ; déjà 2 ablations flutter	06/03/2019	JPA	non	non	NON	sinusal	NON
64 ans	Homme	reprise FA	06/03/2019	JPA	non	non	NON	sinusal	Sotalol

CONCLUSION

- The use of artificial intelligence via the volta system looks promising.
- However like all new technologies it will be necessary to wait for the results of an internationnal multricentric study to validate this approach