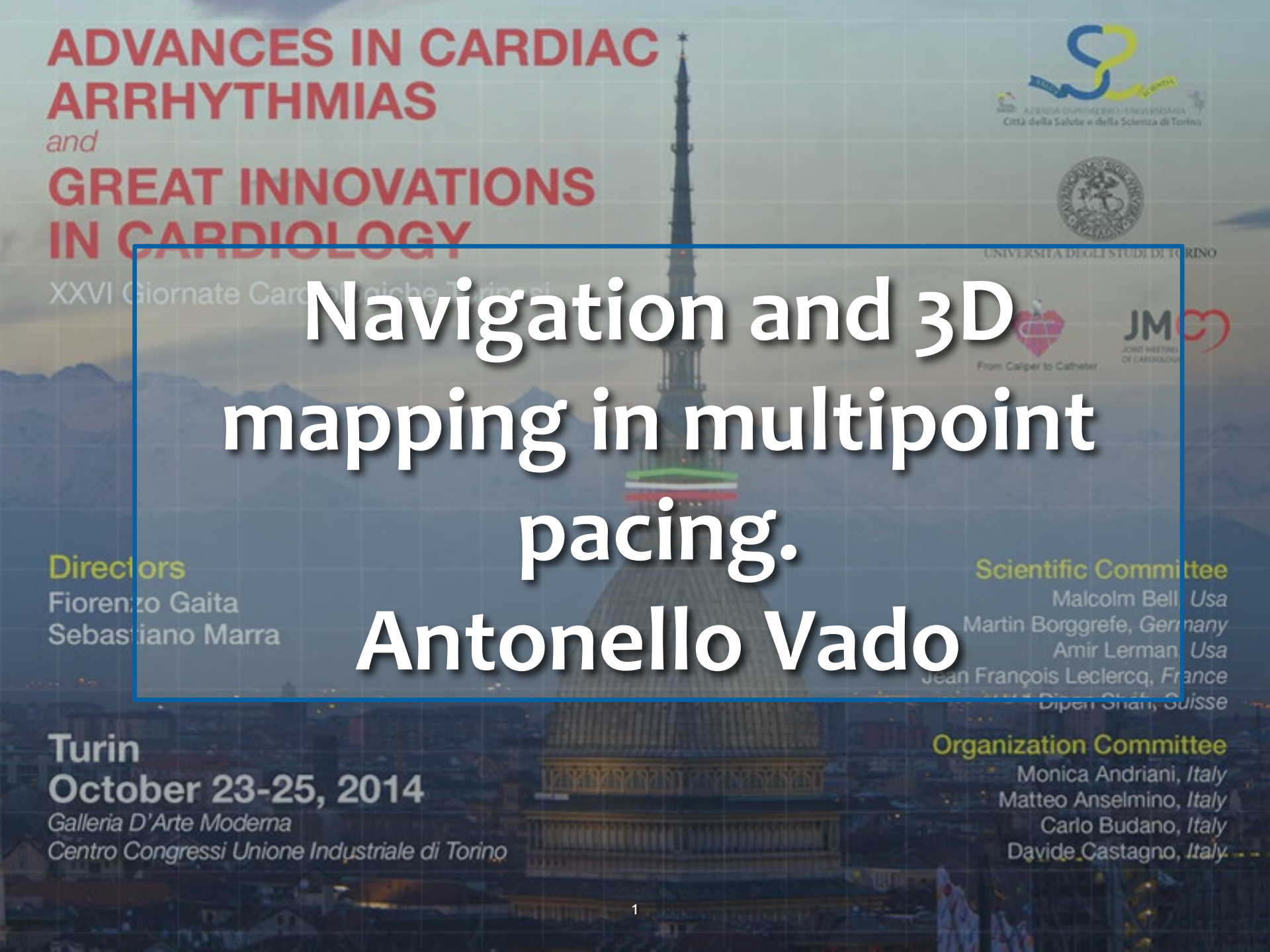
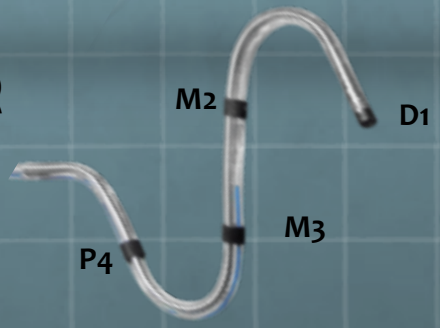


Navigation and 3D mapping in multipoint pacing.

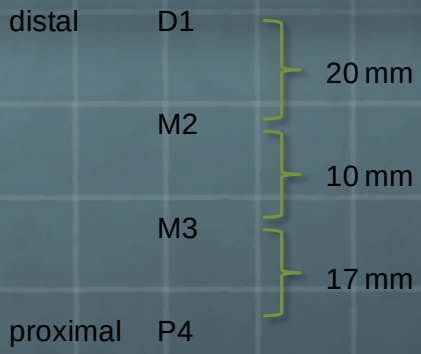
Antonello Vado

Quadripolar Pacing Technology – MultiPoint™ Pacing (MPP)

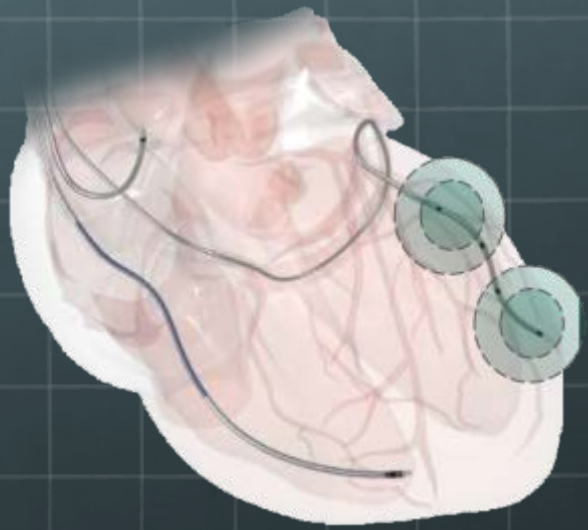
Quartet™ LV Lead 1458Q



Electrode naming and spacing



Ability to pace from **3 V sites** with **programmable delays**



***Two** VectSelect Quartet™ options*

LV1 LV2

\+ RV

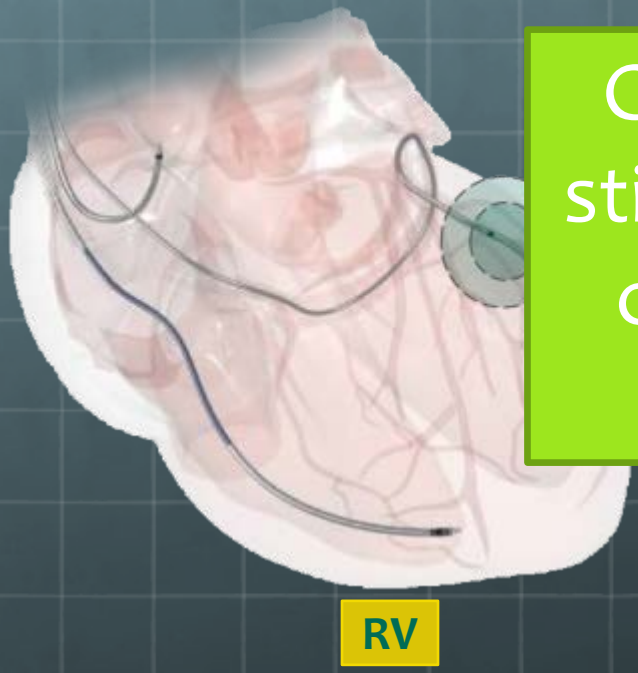
10 VectSelect Quartet™ Vectors

Vector	Cathode to Anode
1	D1 → M2
2	D1 → P4
3	D1 → RV Coil
4	M2 → P4
5	M2 → RV Coil
6	M3 → M2
7	M3 → P4
8	M3 → RV Coil
9	P4 → M2
10	P4 → RV Coil

MultiPoint™ Pacing

Programming Options

- Pacing Sequences and Delays

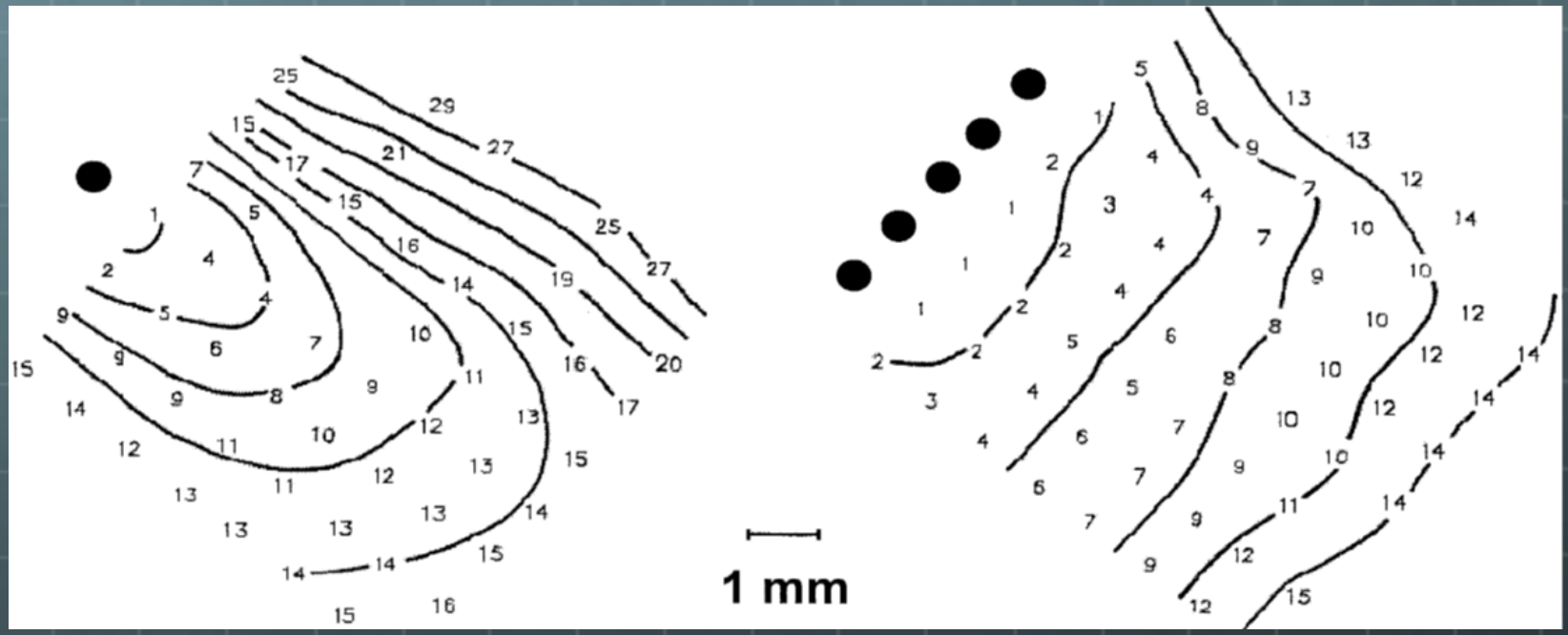


Configurazioni di stimolazione senza considerare AV : 23680

LV First	Delay 1 5-80 ms	Delay 2 5-50 ms
	LV2	RV
	LVp	RV
	LVd	RV
RV	LV1	LV2
RV	LVd	LVp
RV	LVp	LVd

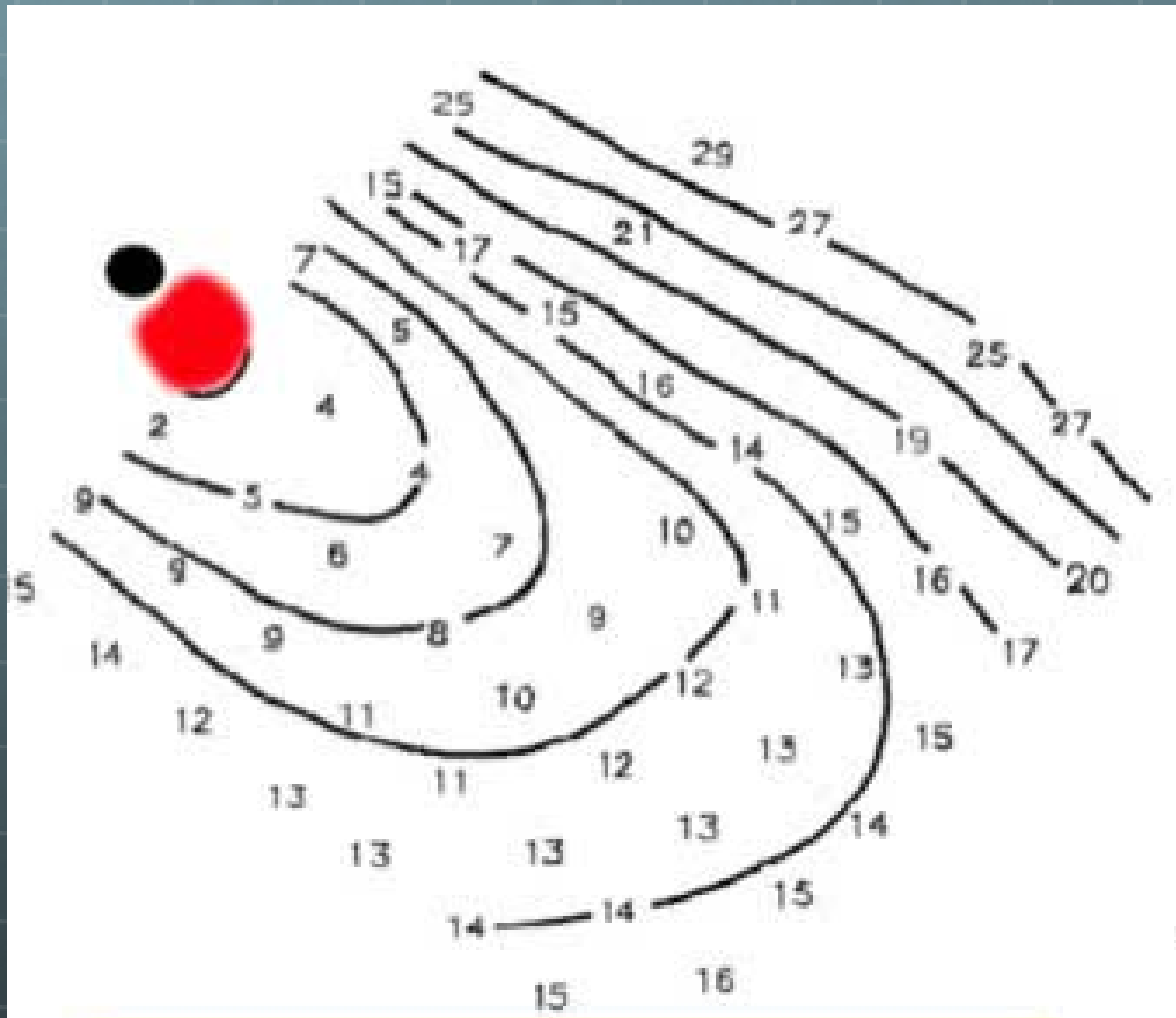
Advantages of MPP vs BIP

Propagation from single electrode versus from multiple electrodes

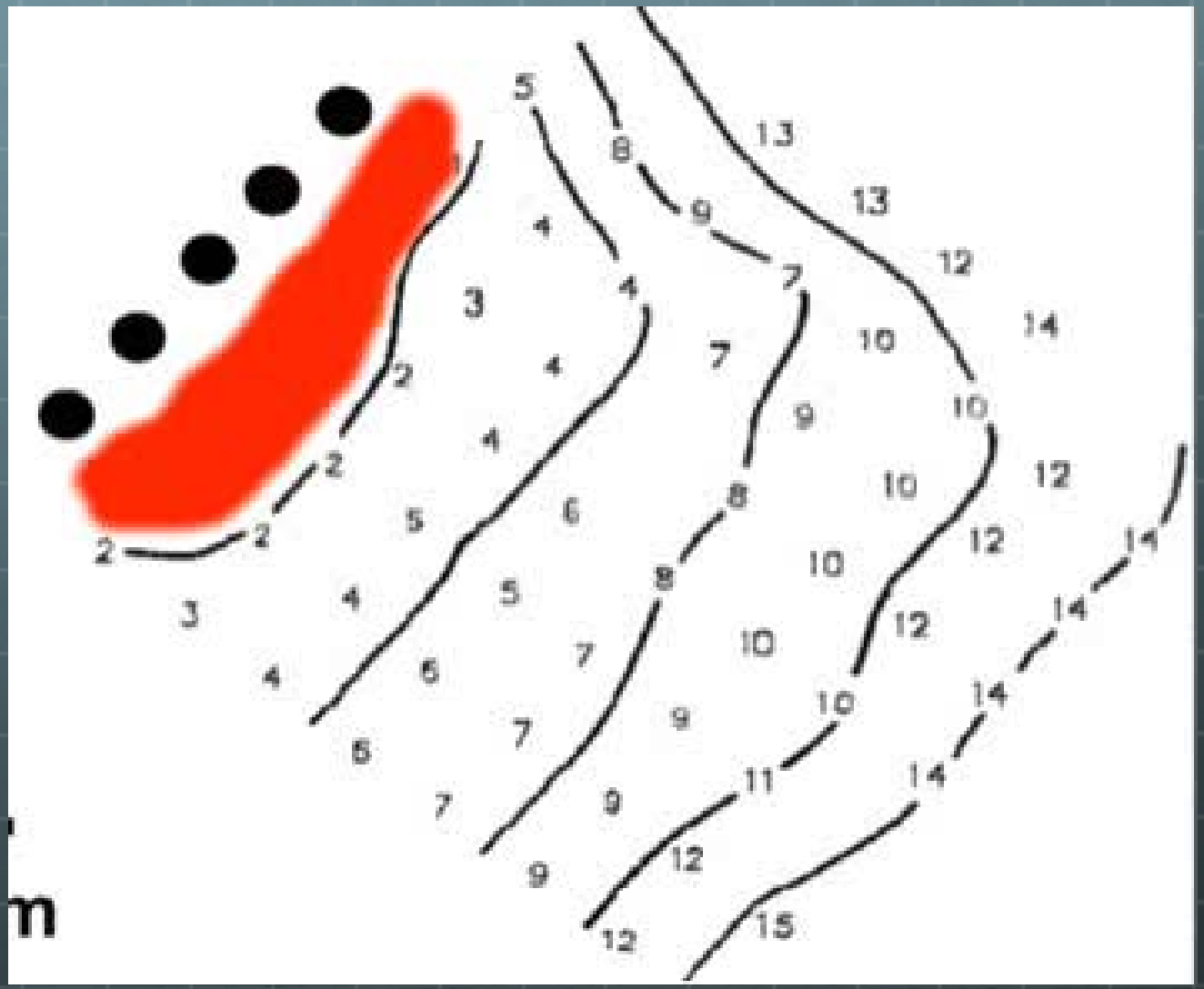


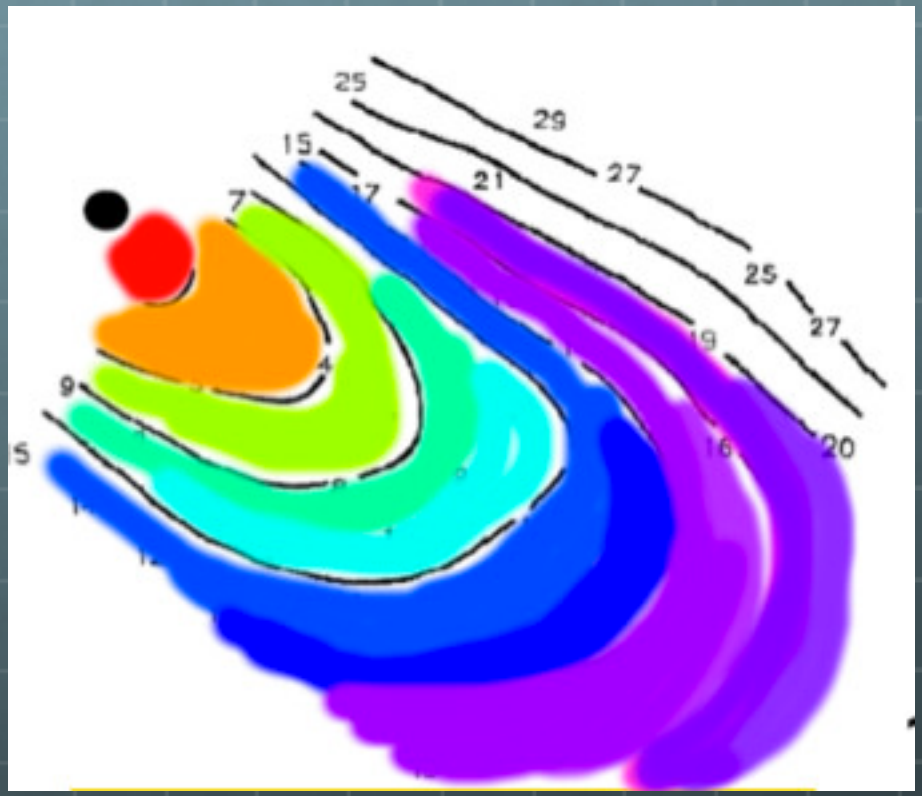
- Laser scanning optical maps showed that activation from single electrode induce an elliptical wavefront, whereas activation from linear array induce a flat wavefront

Role of wavefront curvature in propagation of cardiac impulse. Vladimir G. Fast , Andre´G. Kleber. Cardiovascular Research 33(1997)258–271



25
29
15
21
27
7
17
15
5
25
16
4
2
27
14
19
4
3
9
15
10
7
6
9
16
20
11
9
9
8
14
17
12
13
10
12
11
15
13
11
12
13
14
13
13
13
15
14
14
16
15


5
8
13
13
12
14
4
9
7
4
3
7
10
2
4
9
10
4
8
10
12
2
5
6
12
14
2
2
10
3
4
5
8
12
14
4
6
7
10
12
14
10
14
6
7
9
10
14
8
7
9
11
14
9
12
12
15


25
29
15
21
27
7
25
27
9
20


5
8
9
10
2
8
8
11

Contact mapping in MPP

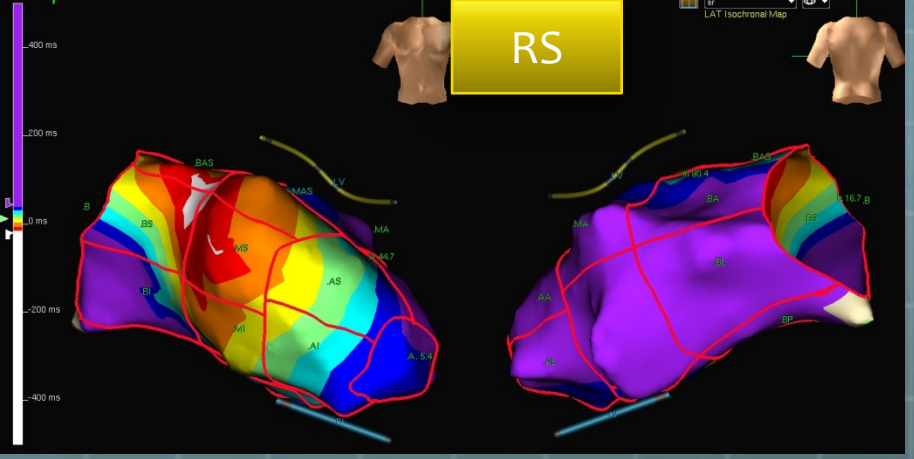
Study population:

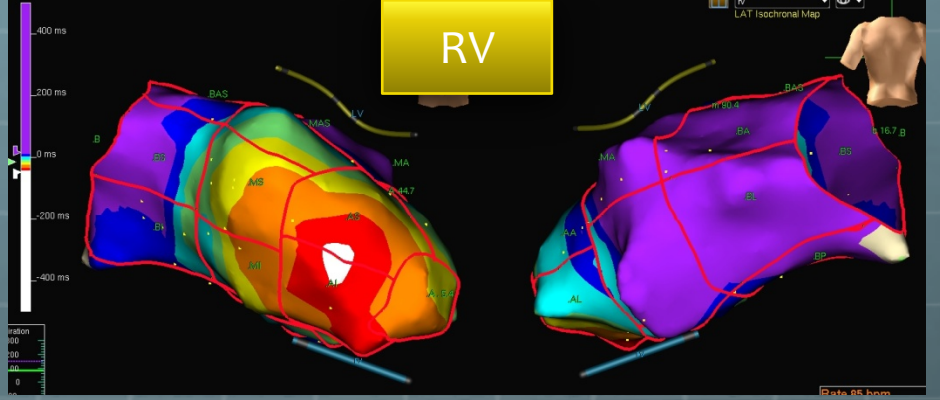
- ✓ Heart failure of non-ischemic etiology NYHA class II or III, EF ≤35%
- ✓ aspecific bundle branch block, typical left bundle branch block or IVCD
- ✓ sinus rhythm
- ✓ no or non-significant coronary lesions.

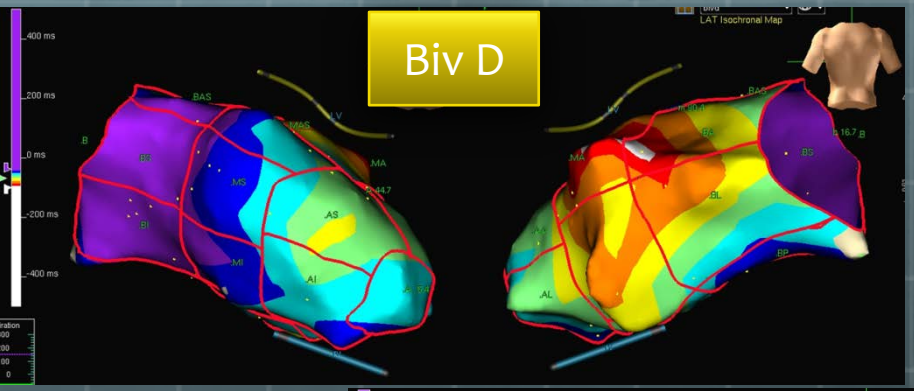
Contact mapping in MPP

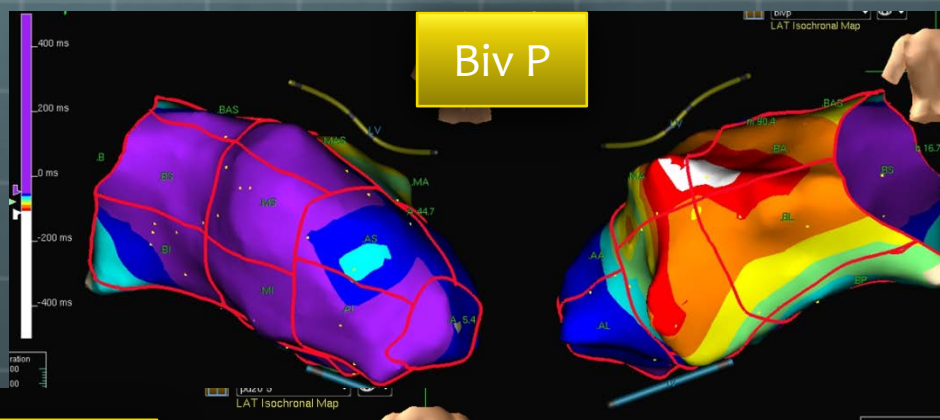
Protocol:

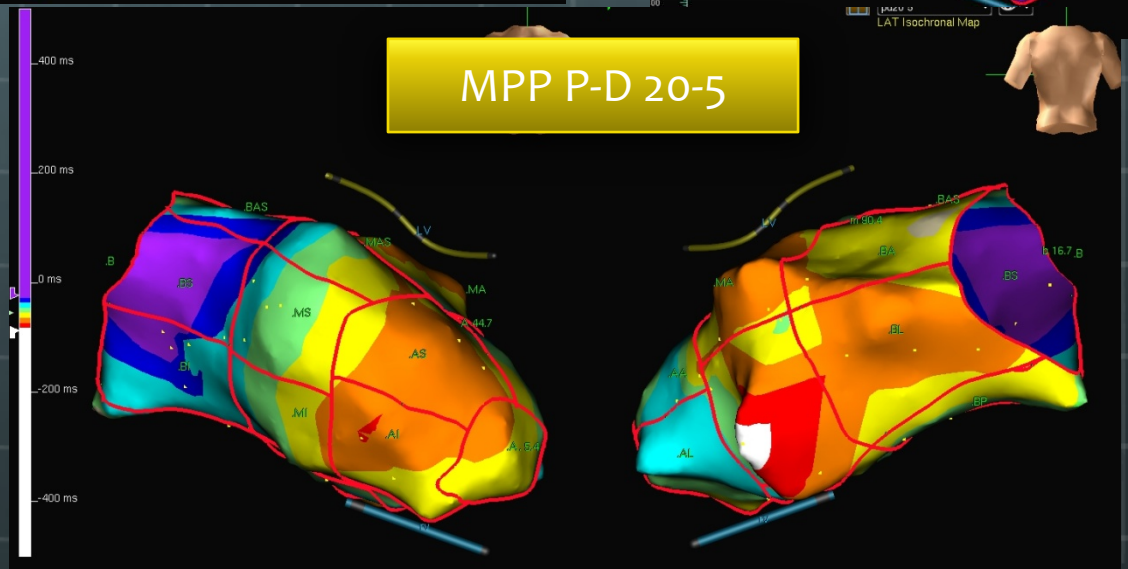
- ✓ Device Implantation (quadripolar lead + MPP device)
- ✓ Contact mapping
- ✓ dP/dT evaluation
- ✓ Up to 15 pacing interventions were tested by pacing at a rate of 10bpm above patient's spontaneous rhythm (AV delay was set to 130 ms in order to ensure ventricular capture)

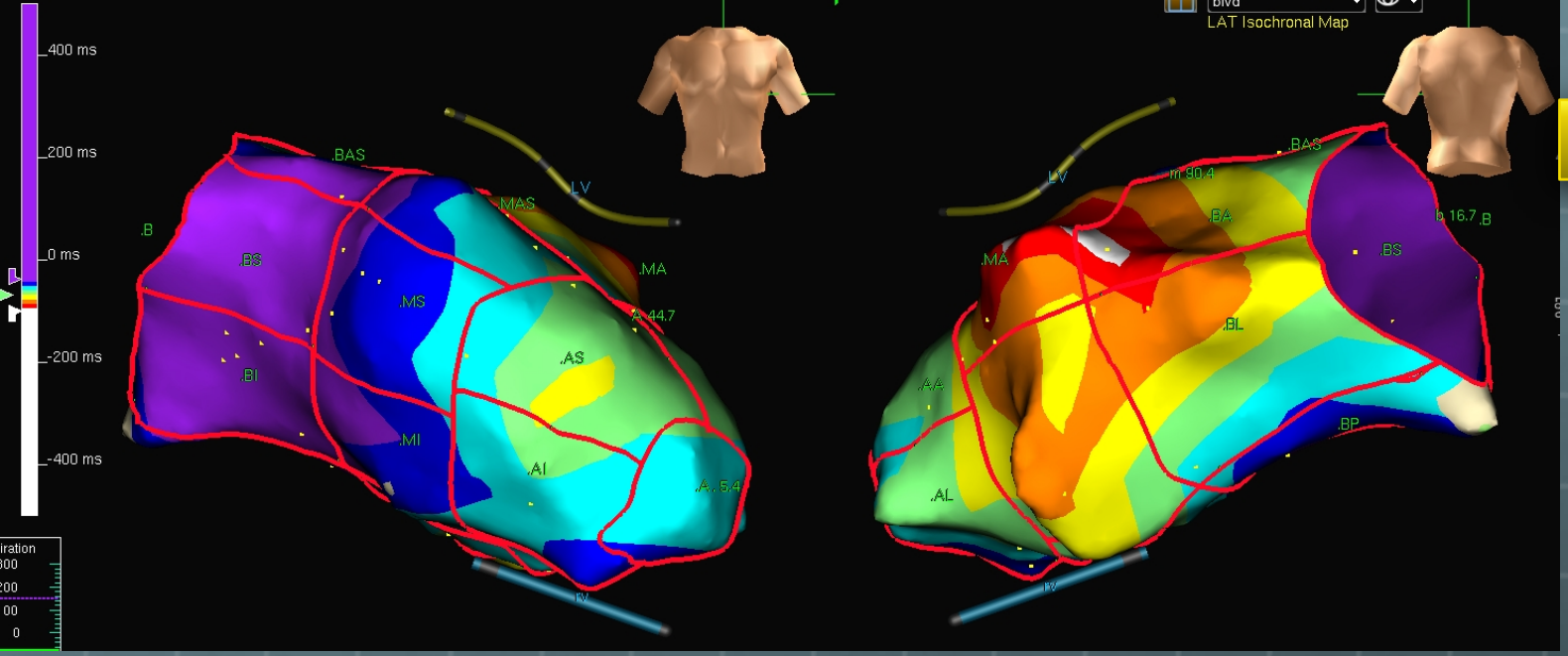

RS
LAT Isochronal Map
400 ms
200 ms
0 ms
-200 ms
-400 ms


RV
LAT Isochronal Map
400 ms
200 ms
0 ms
-200 ms
-400 ms

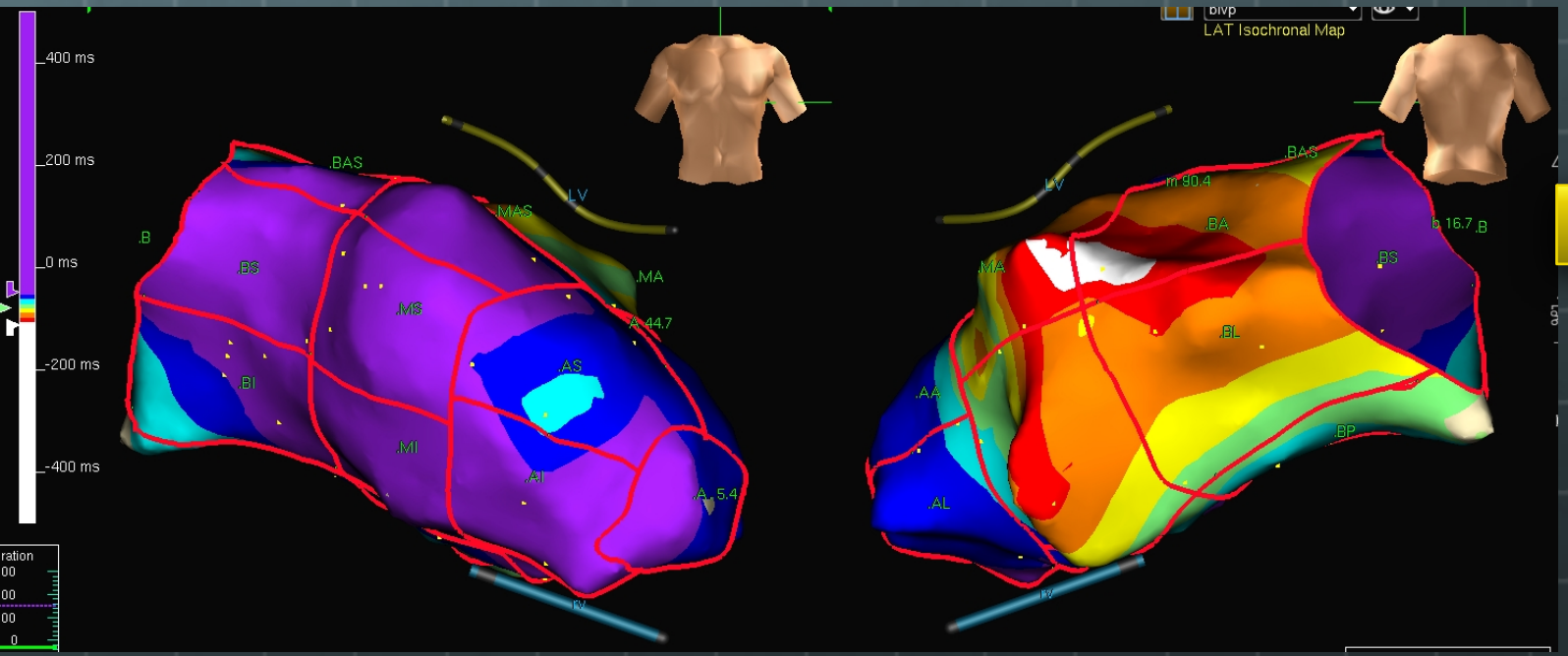

Biv D
LAT Isochronal Map
400 ms
200 ms
0 ms
-200 ms
-400 ms


Biv P
LAT Isochronal Map
400 ms
200 ms
0 ms
-200 ms
-400 ms


MPP P-D 20-5
400 ms
200 ms
0 ms
-200 ms
-400 ms



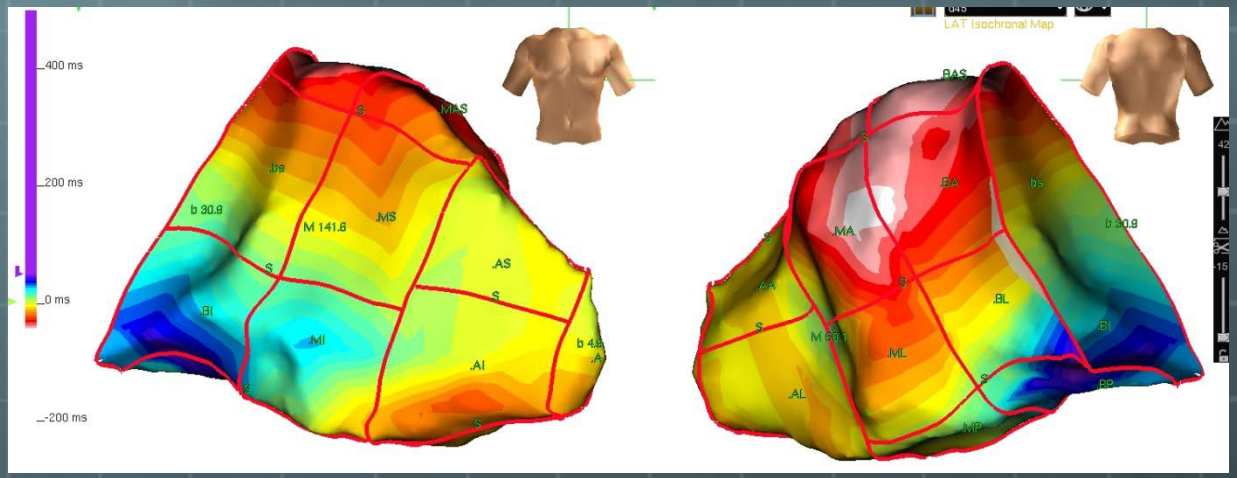
Distal BIV



Prox BIV

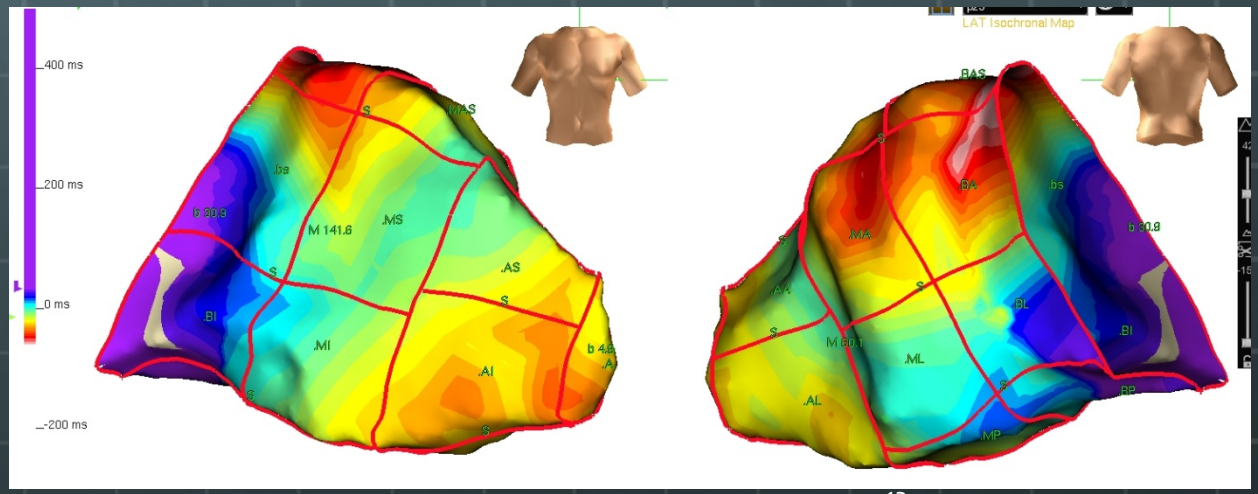
Contact mapping

DIST vs PROX



M2 –Coil RV / RV after 45 ms pacing:

- QRS_{stim} 120 ms
- Delta dp/dt 224 mmHg vs AAI (spontaneous conduction)

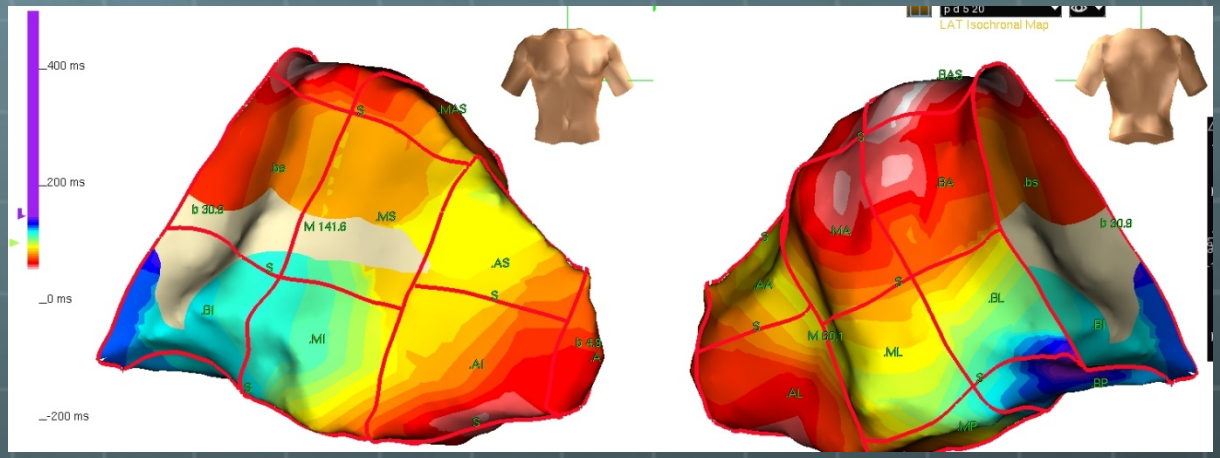


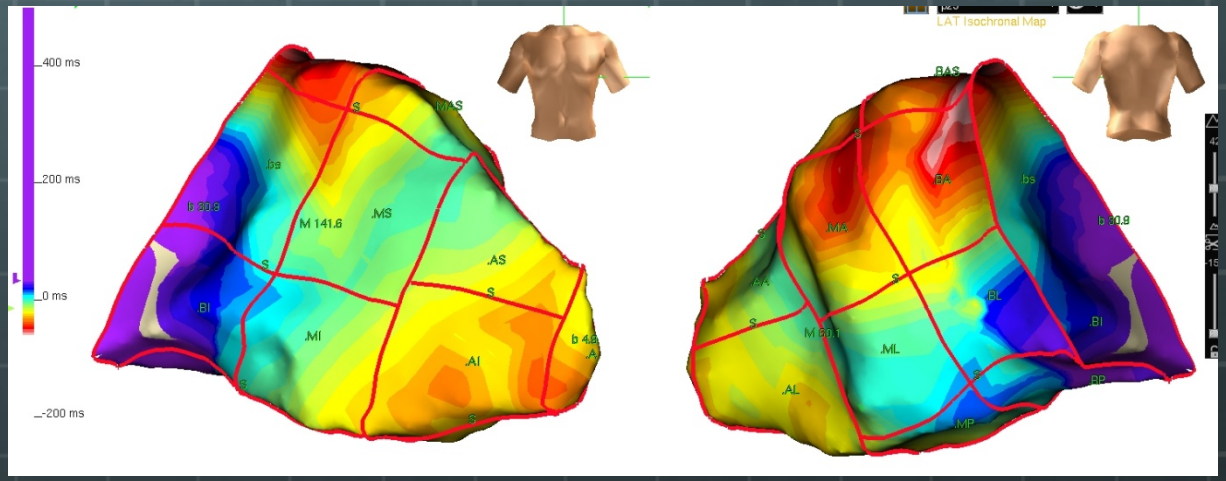
M3 –P4 / RV after 25 ms pacing:

- QRS_{stim} 122 ms
- Delta dp/dt 235 mmHg vs AAI (spontaneous conduction)
-

Contact mapping

MPP vs PROX



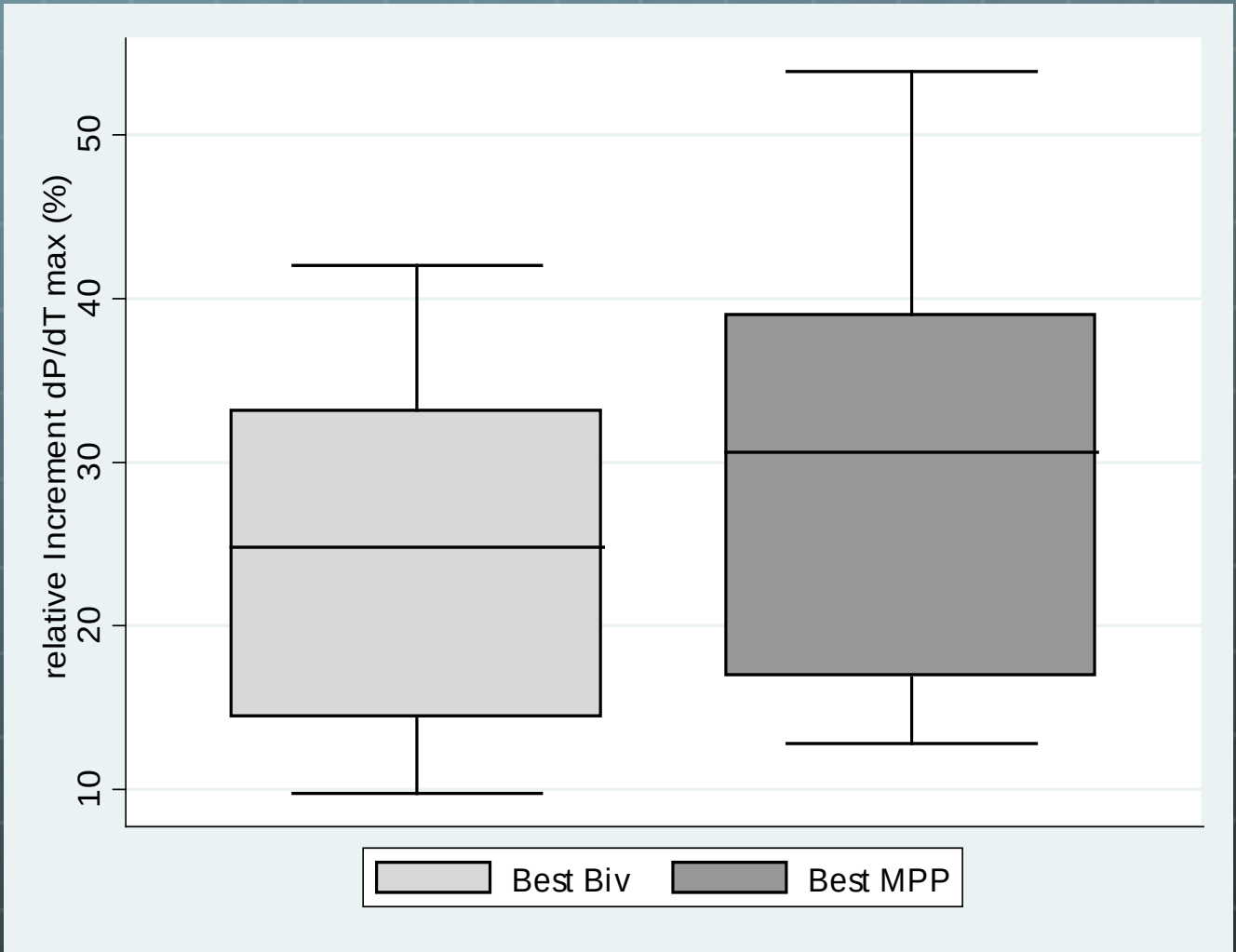


M3-P4 / M2-Coil RV after 5 ms / RV after 20 ms

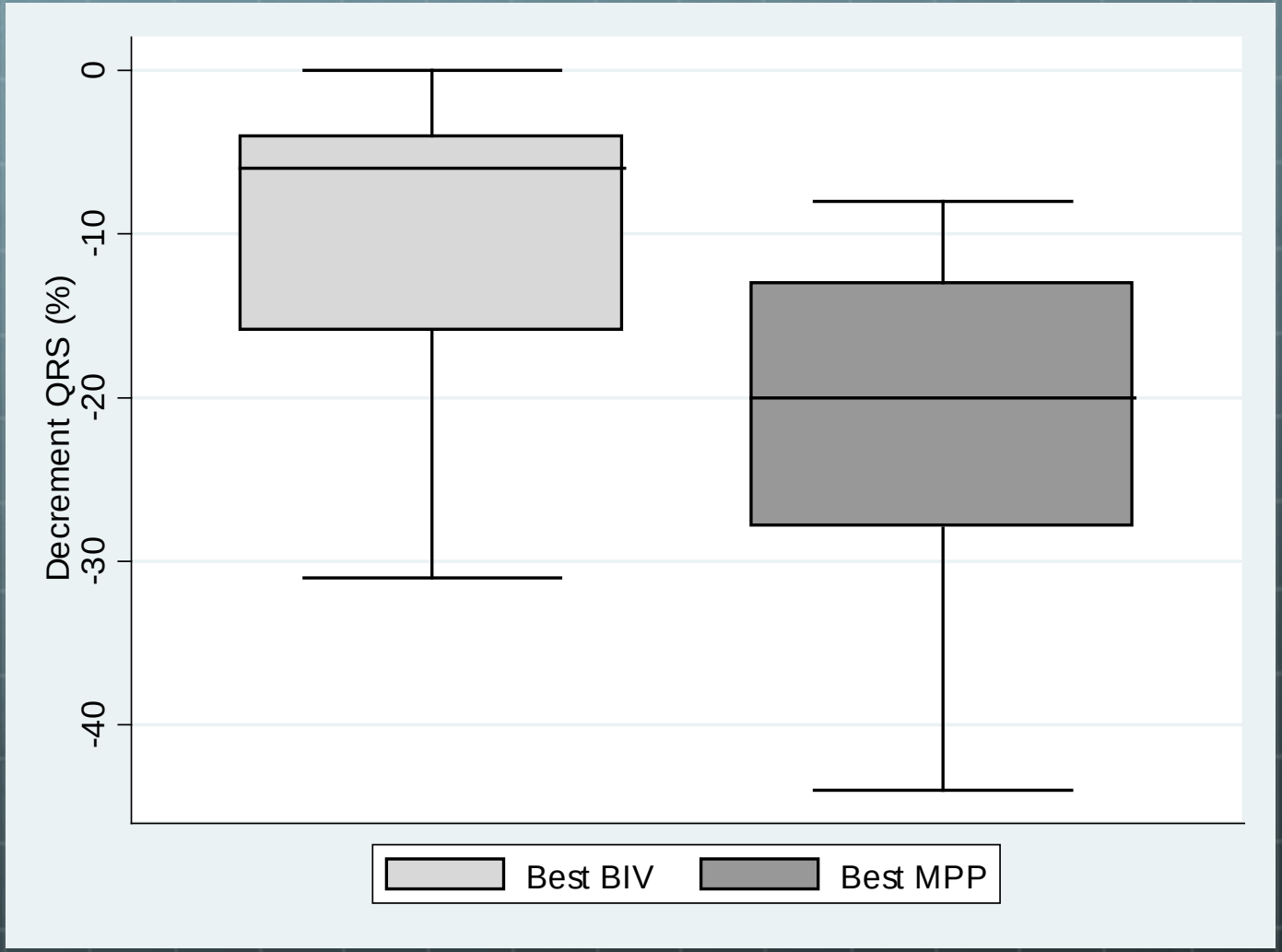
- **QRS_{stim} 101 ms**
- **Delta dp/dt 296 mmHg vs** AAI (spontaneous conduction)
-

M3 –P4 / RV after 25 ms pacing:

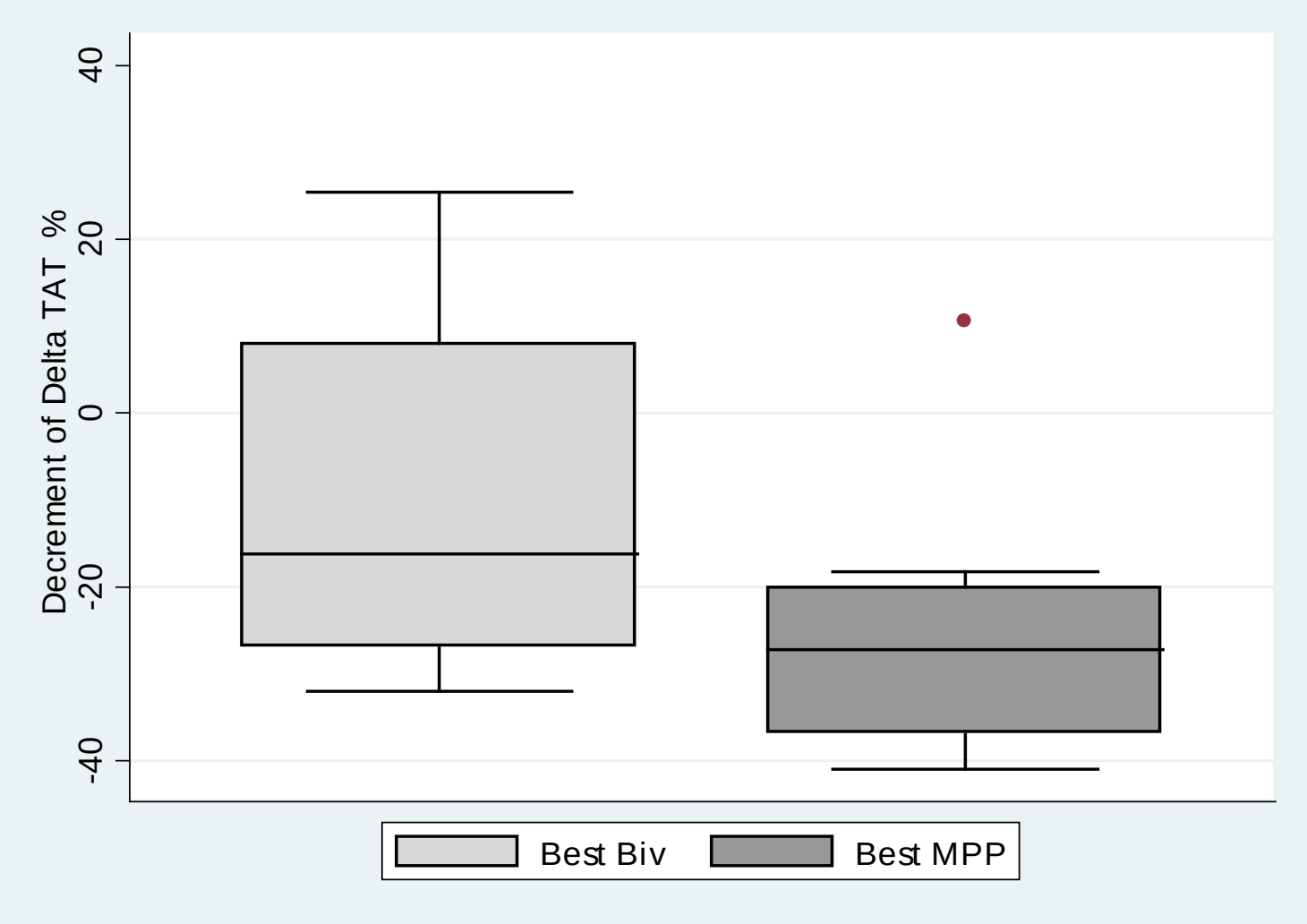
- QRS_{stim} 122 ms
- Delta dp/dt 235 mmHg vs AAI (spontaneous conduction)
-



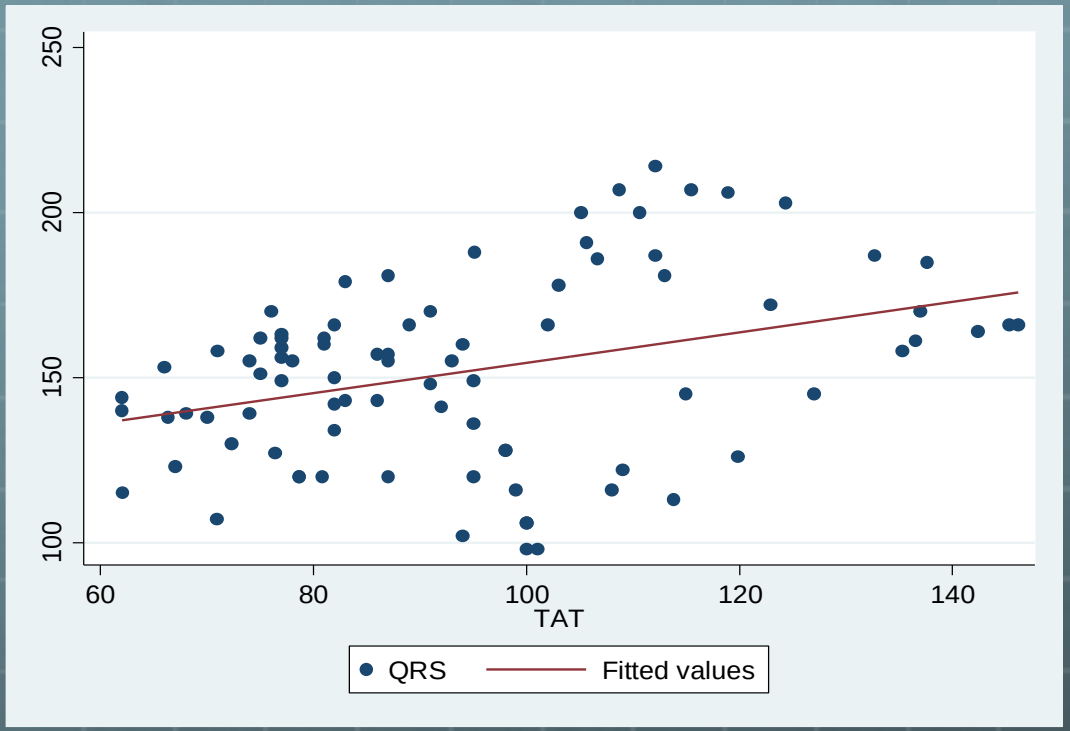
Relative increment of dP/dtmax in best BIV and best MPP configuration



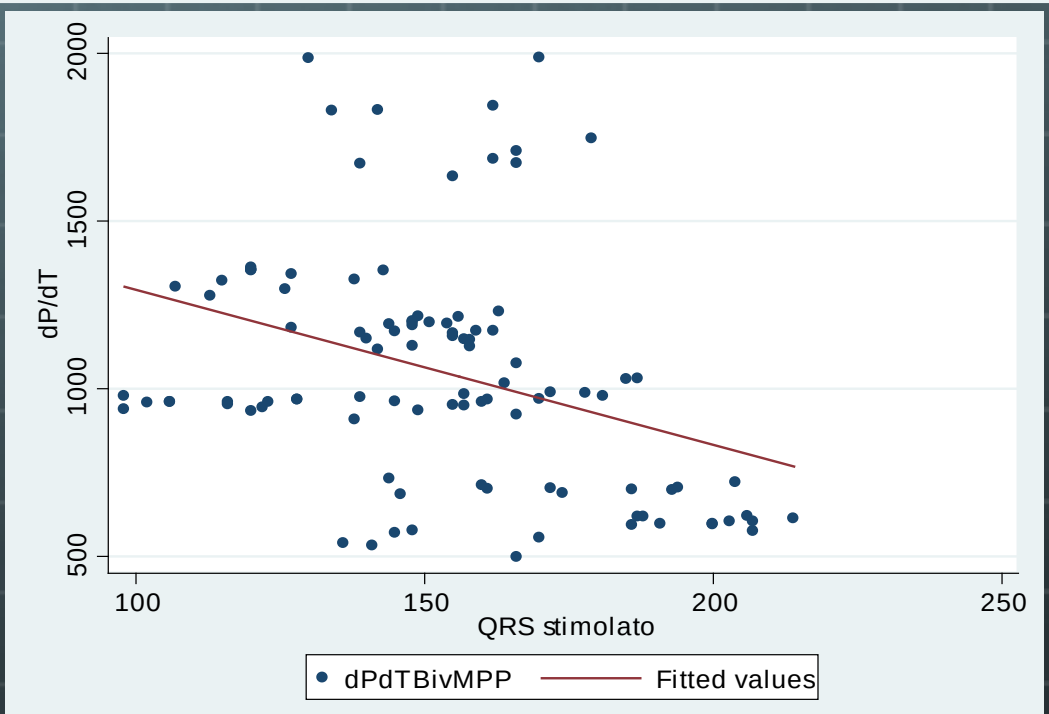
Relative decrement of QRS duration in best BIV and best MPP configuration



Relative decrement of Delta TAT % in best BIV and best MPP configuration



Linear correlation between QRSd and TAT

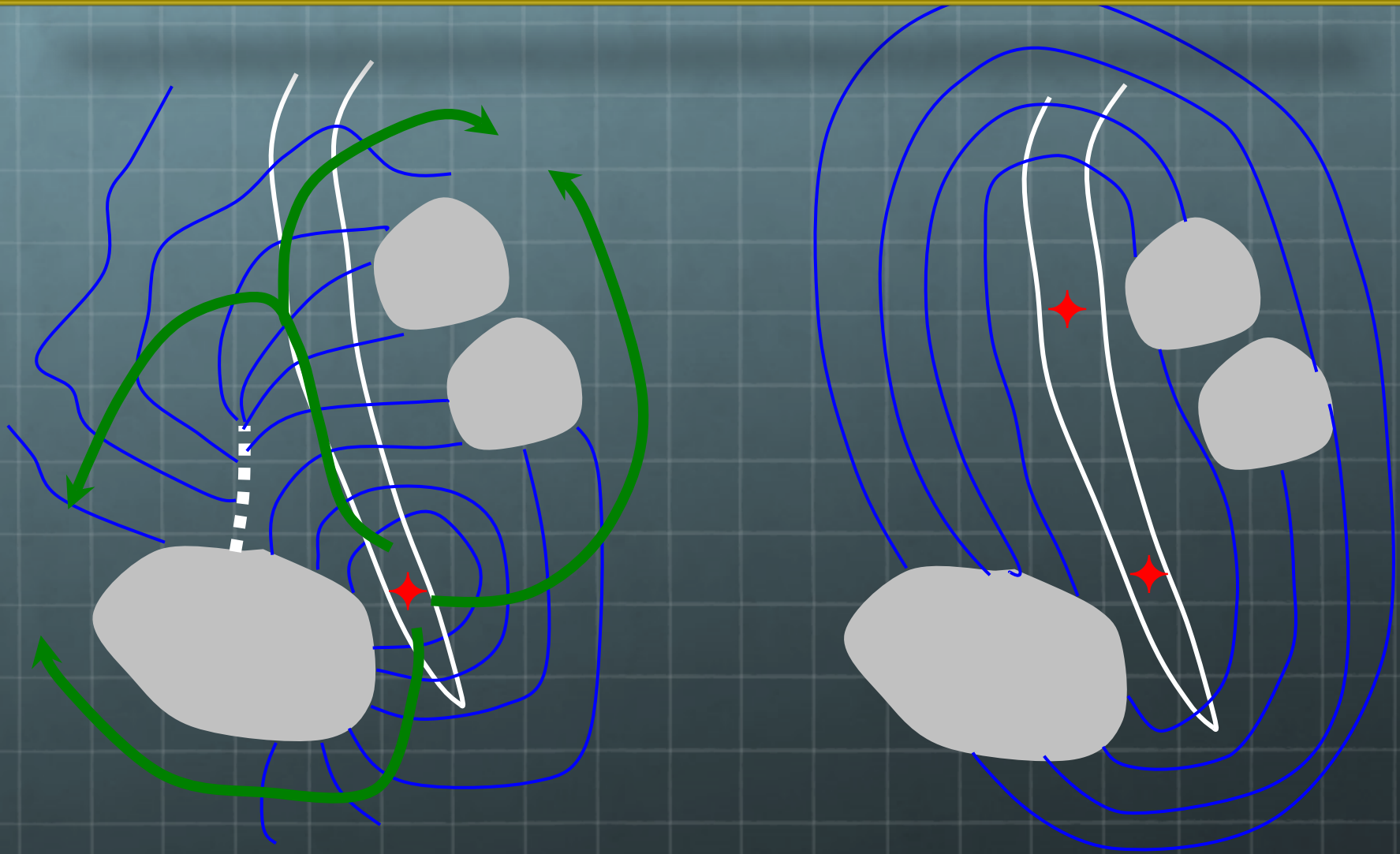


Linear correlation between QRSd and dP/dt

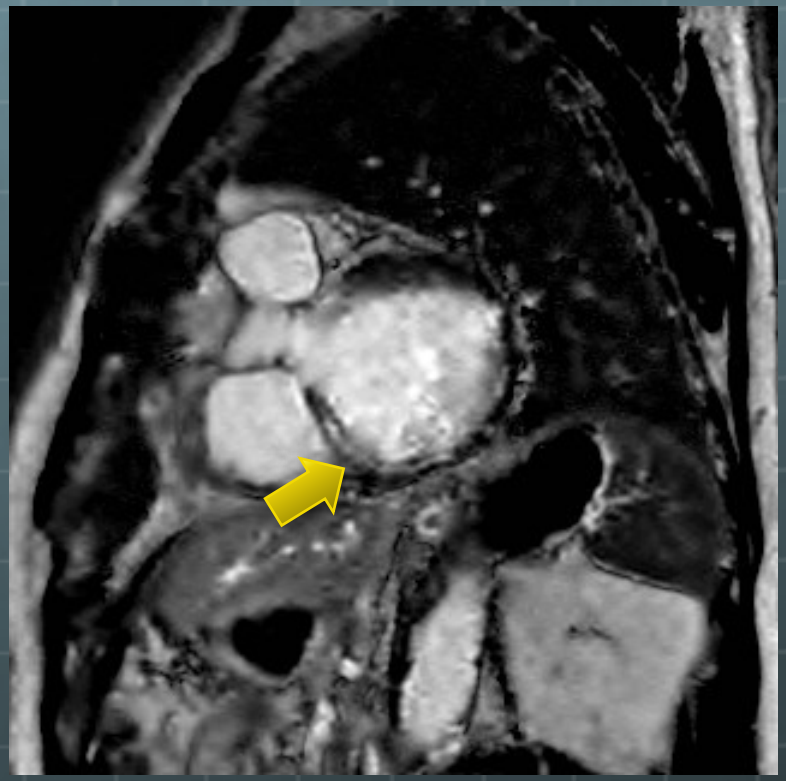
Results

	RS	Biv-d	Biv-p	Best MPP
QRS-D	173.5±24.8	160.1±28.3	164.6±27.2	136.5±29.4
Lv TAT	113.1±30.0	91.1±10.2	96.0±15.2	82.0±14.4
Δp/Δt	752.4±316.2	991.3±419.1	981.8±401.7	1054±520.7
%of LV activation after 50msec		60±23		78±27

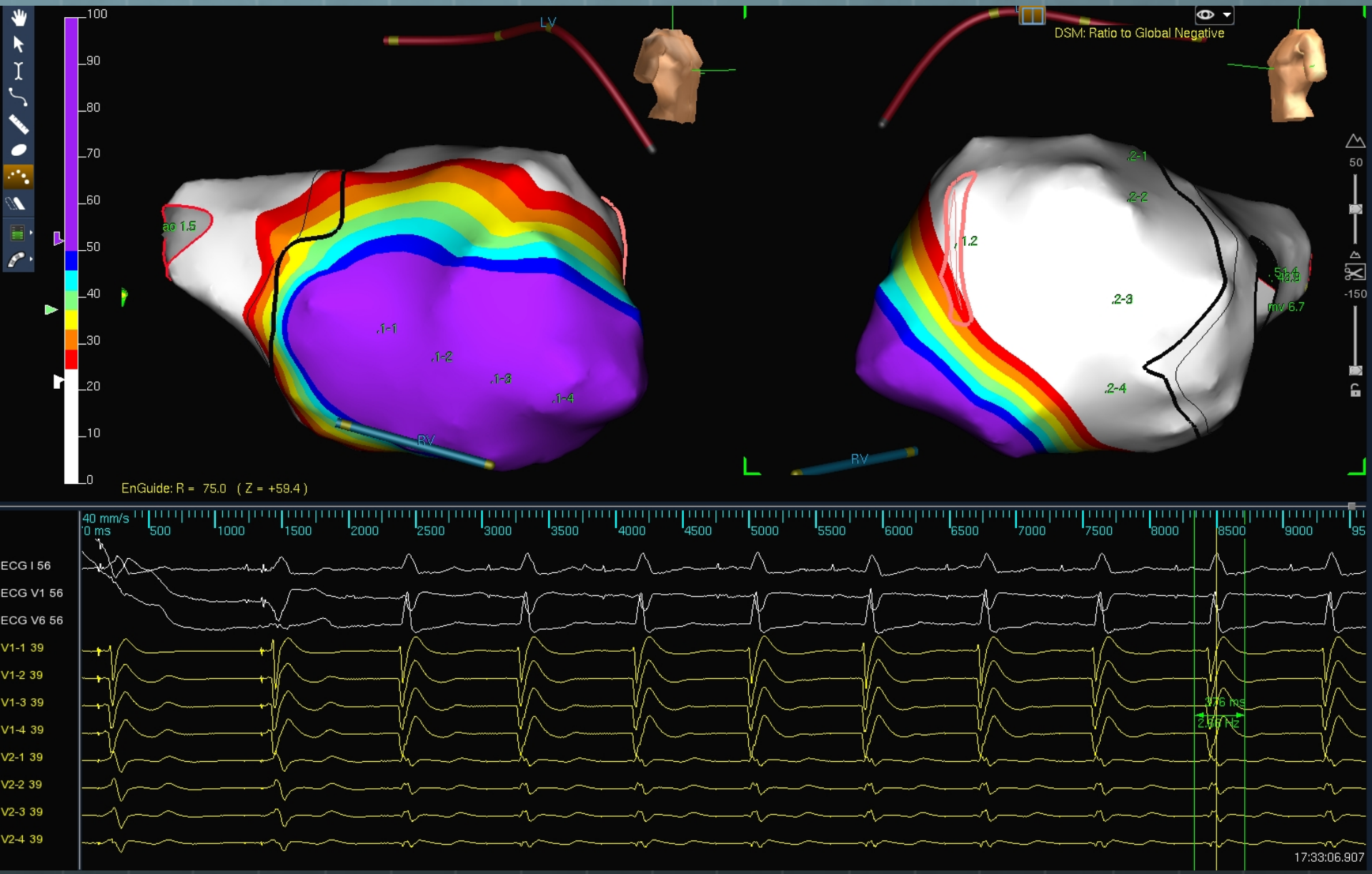
Possible Patterns of Wavefront Propagation* with conventional LV Pacing vs. MPP in HF, Scarred Heart

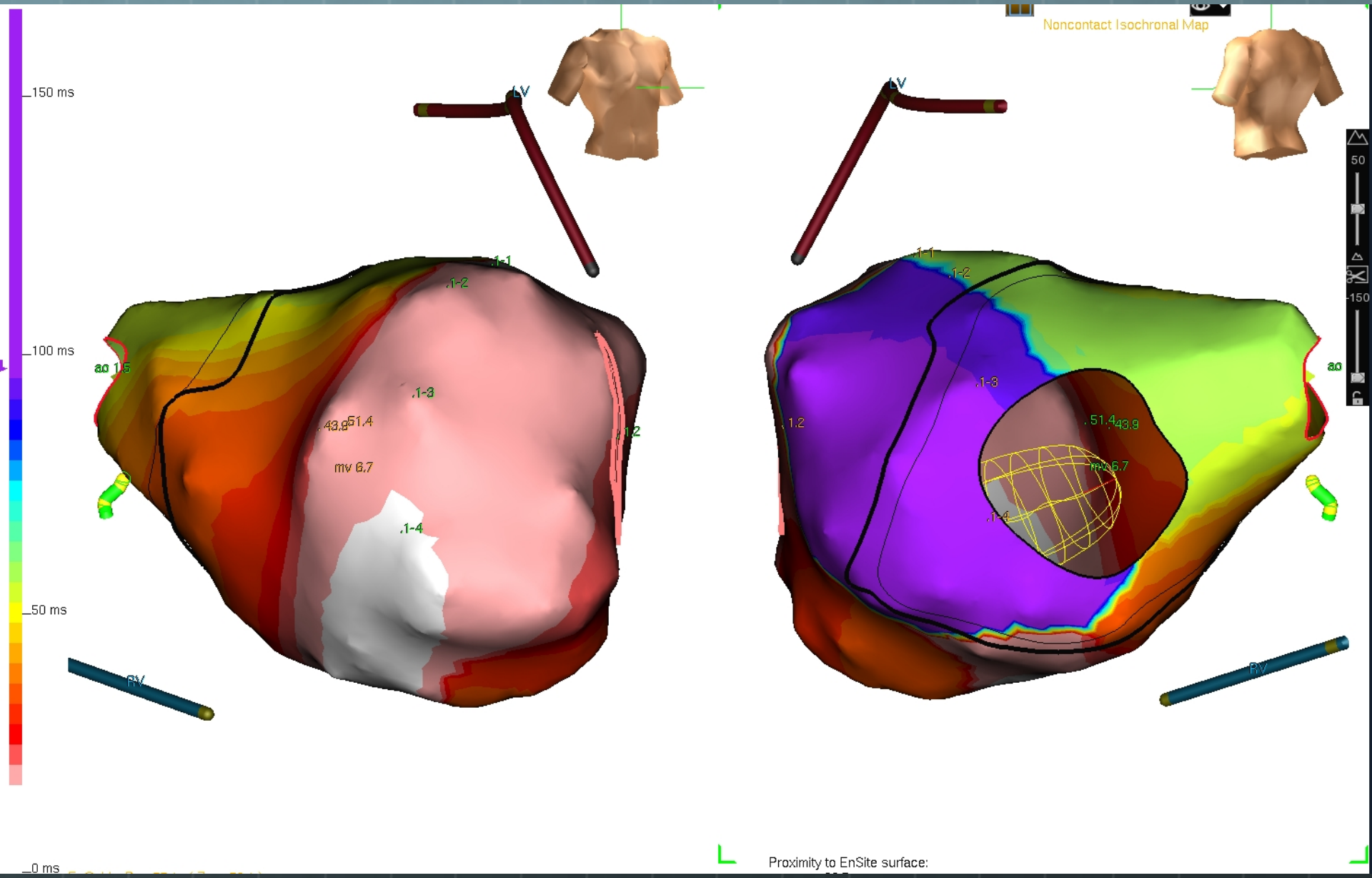


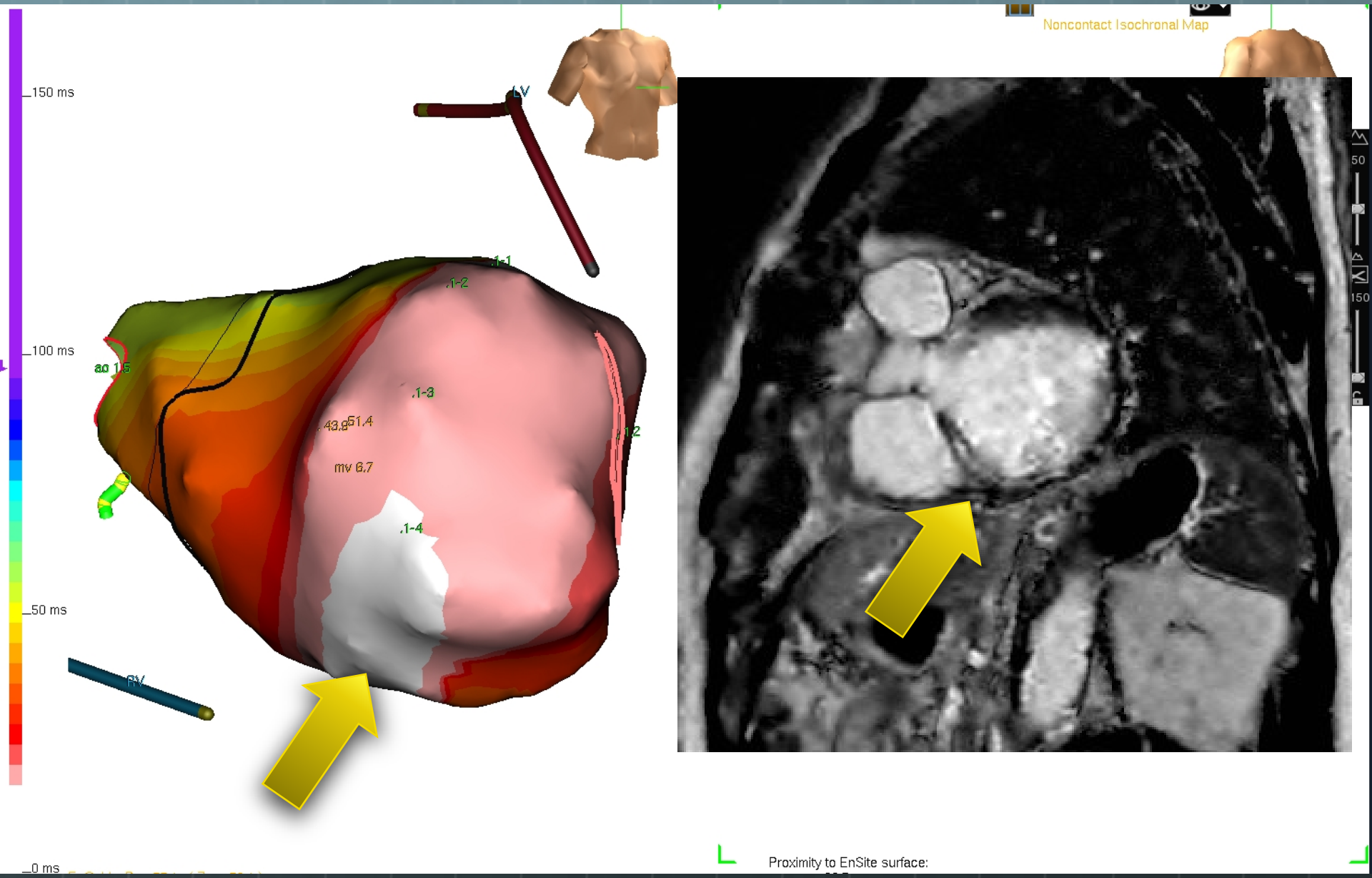
Contact mapping + MR




DSM: Ratio to Global Negative
ao 1.5
mv 6.7
EnGuide: R = 75.2 (Z = +59.9)
40 mm/s
0 ms
ECG I 56
ECG V1 56
ECG V6 56
V1-1 39
V1-2 39
V1-3 39
V1-4 39
V2-1 39
V2-2 39
V2-3 39
V2-4 39
375 ms
17:33:06.936


LV
RV
ao 1.5
.1-1
.1-2
.1-3
.1-4
EnGuide: R = 75.0 (Z = +59.4)
DSM: Ratio to Global Negative
.2-1
.2-2
.2-3
.2-4
mv 6.7
40 mm/s
0 ms
ECG I 56
ECG V1 56
ECG V6 56
V1-1 39
V1-2 39
V1-3 39
V1-4 39
V2-1 39
V2-2 39
V2-3 39
V2-4 39
17:33:06.907


Noncontact Isochronal Map
150 ms
100 ms
50 ms
0 ms
LV
RV
ao
.1-1
.1-2
.1-3
.1-4
mv 6.7
Proximity to EnSite surface:


150 ms
100 ms
50 ms
0 ms
LV
RV
ao 1.5
.1-1
.1-2
.1-3
.1-4
.1-2
43.8
51.4
mv 6.7
Noncontact Isochronal Map
50
150
Proximity to EnSite surface:

Conclusions

- Quadripolar lead technology represents a leap in CRT therapy.
  - More CRT position
  - No PNS
  - CRT delivery always effective
- MPP technology added to quadripolar epicardial LV leads improves the speed of LV activation in acute study assessed by no-Rx, 3D mapping.
- Long-term follow-up and the outcomes of these patients will help confirm these results.