High density and automated mapping technology in VT

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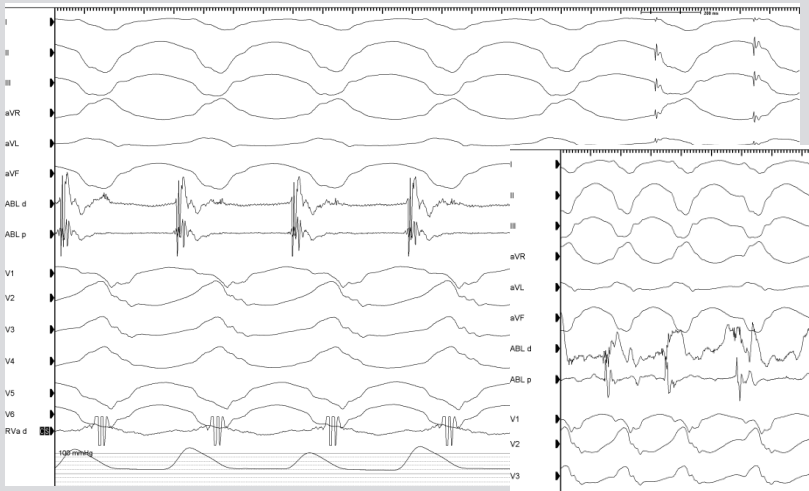
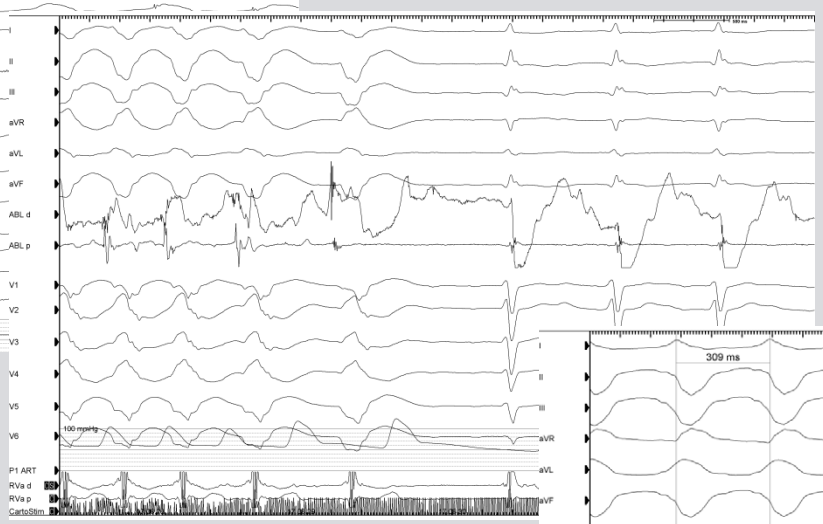
VT ablation: limitations of activation mapping

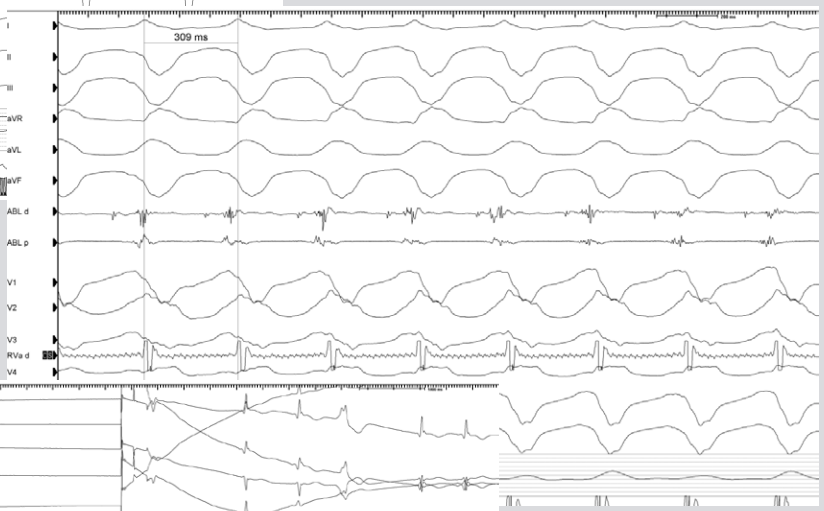
Post- MI VT RFCA



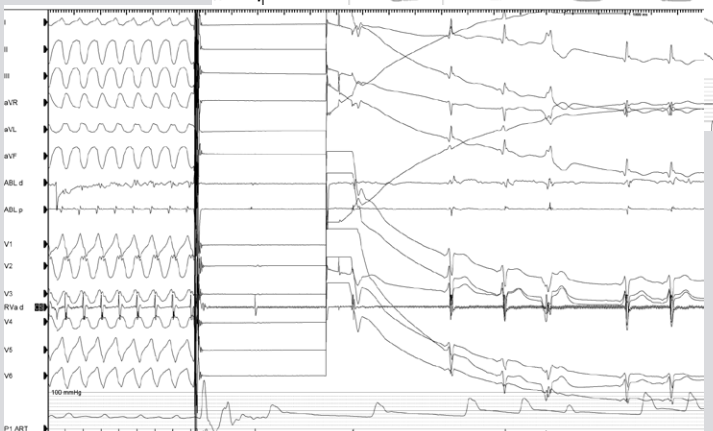
Tolerated VT cycle 390 ms. Activation mapping…



VT termination during RF…



A second , faster (310 ms) and poorly tolerated VT. Activation mapping. …



- Non tolerated VTs
- Multiple morphologies of VT inducible
- Morphology of the index spontaneous VT often not available
- Unpredictable VT inducibility at pre-ablation EP study

Concept of Substrate Modification

- Ablation is performed during sinus rhythm
- The aim is the identification and elimination of those sites related with the maintainance of VT circuits
- It is performed by mapping and elimination of specific targets:
  - *Late potentials*
  - *LAVA*

It relies on

- Reproducibility of specific targets
- Possibility to assess, objectively and reproducibly, the modification of the substrate after the ablation

Improved long term results of substrate modification as an additional endpoint to abolition of VT inducibility

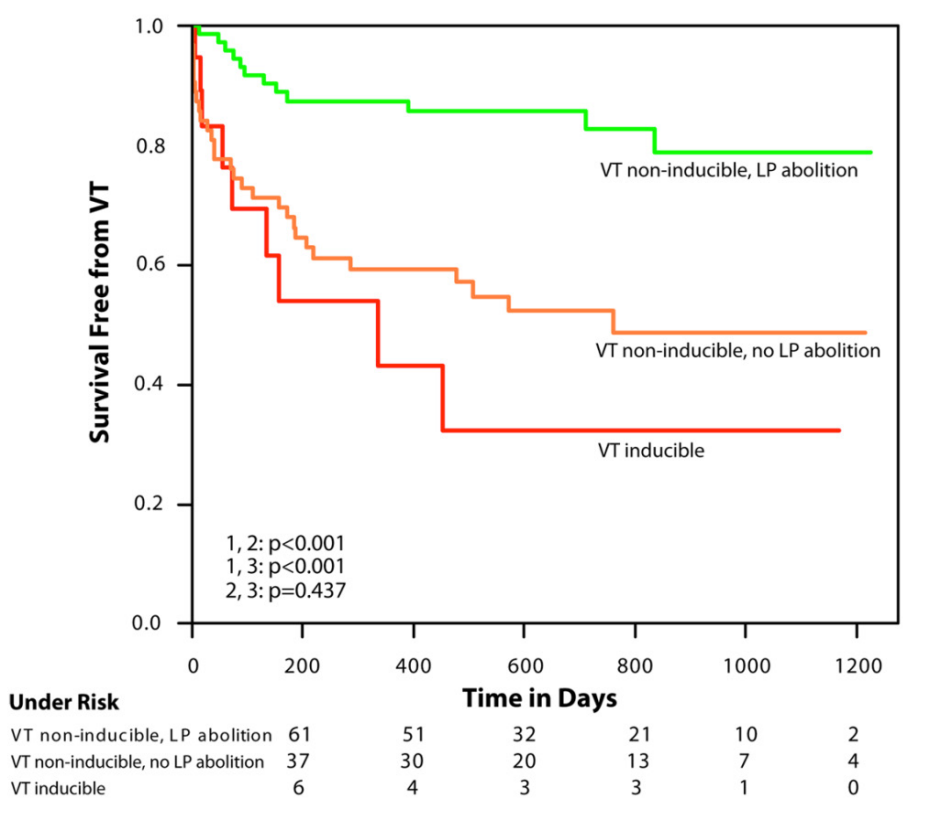
Study population: 155 pts with post-MI VT

Anterior: 35%, Inferior: 37%, inferolateral: 17%, multiple: 11%

Mean EF: 31±3,3%

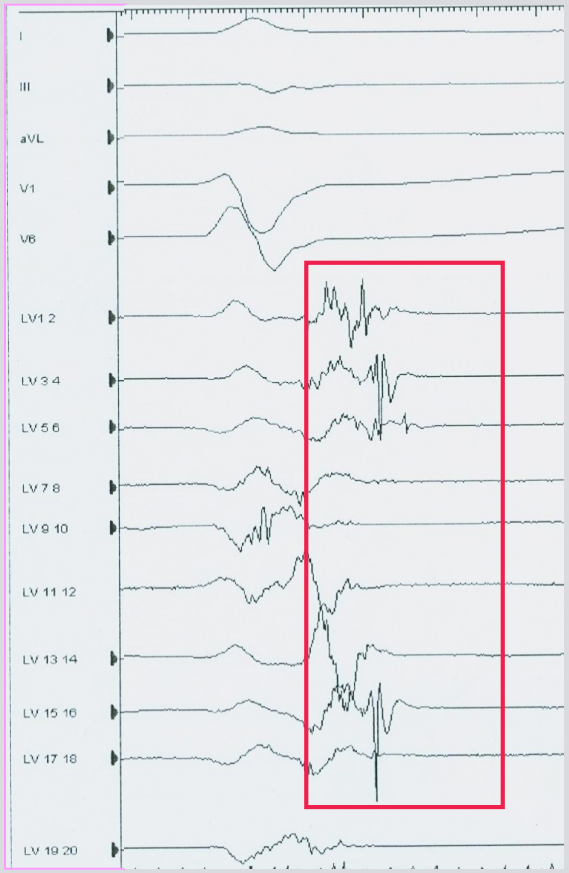
LPs in 103 pts (65%)

LPs successful ablation: 79/103 (76%)

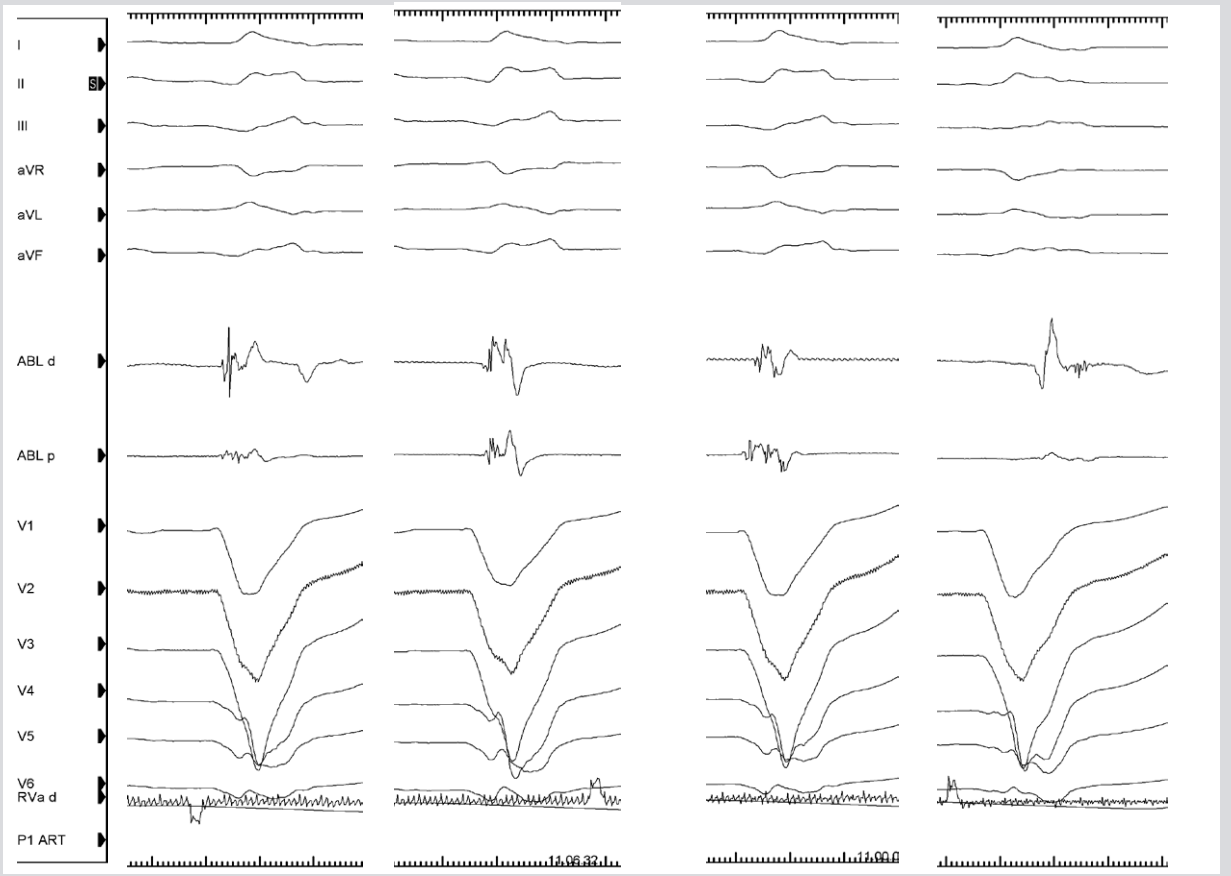


VT recurrence rate in the overall population

Targets for substrate modification



Late potentials occurring after QRS in SR

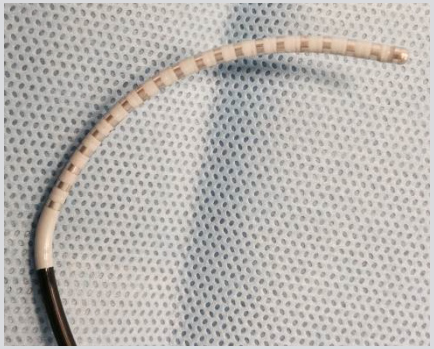


Low-amplitude, sharp, high frequency potentials occurring anytime during or after the far field ventricular EGM in SR

ADVANTAGES OF HIGH DENSITY MAPPING BY MULTIELECTRODE CATHETERS

- - High number of recording electrodes in a small surface
- - Small electrode size
- - Reduced interelectrode distance

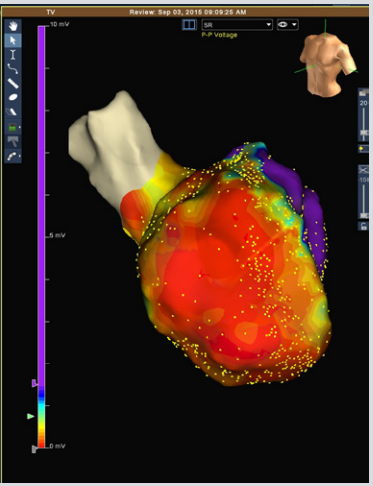
Enhanced discrimination of near –field from farfield electrical activity even in the setting of low amplitude and complex EGMs

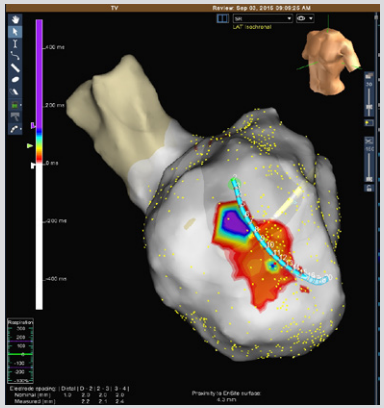


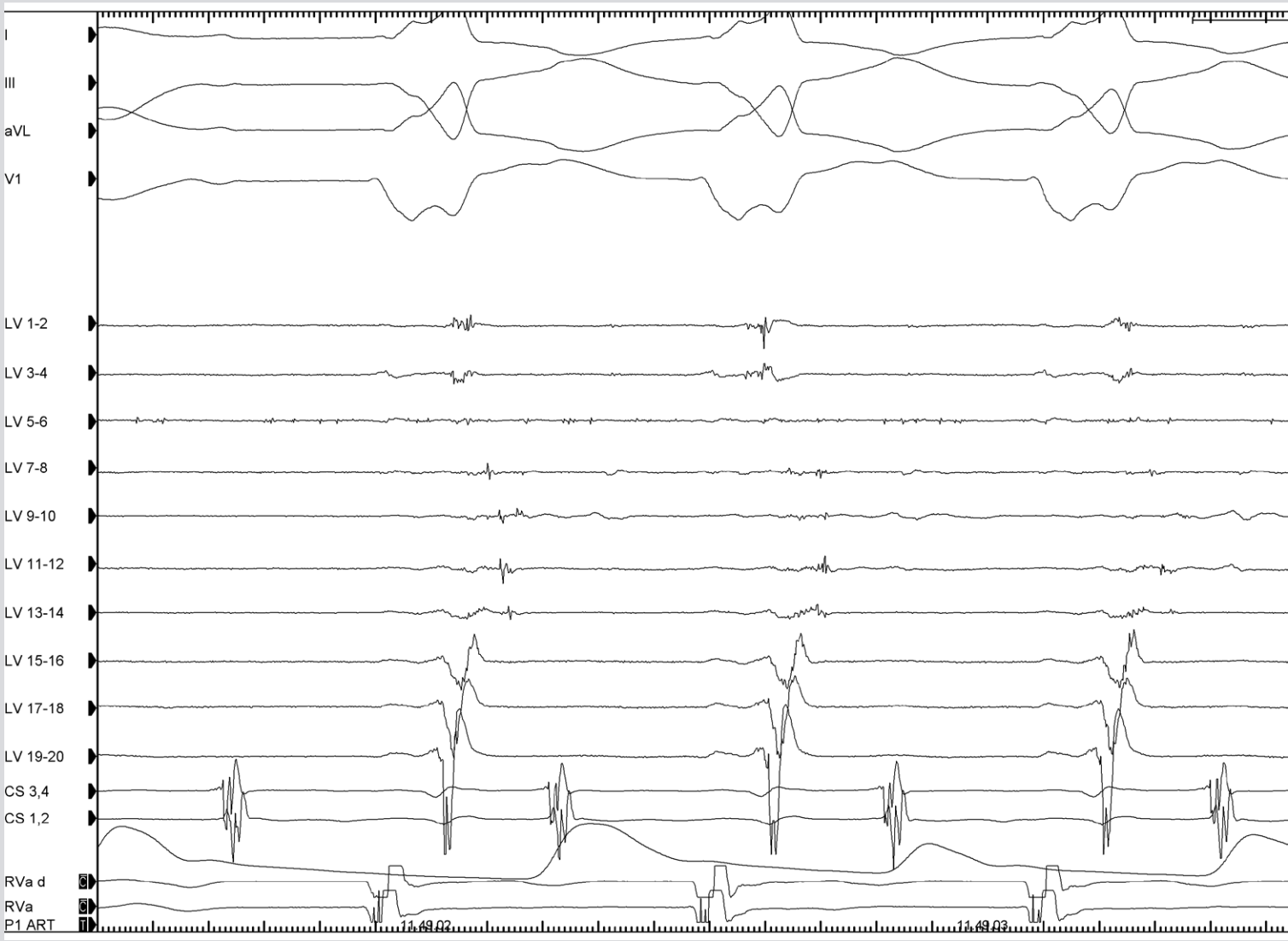
2-2-2 20 poles high density mapping catheter

- -More accurate evaluation of the arrhythmogenic substrate during sinus rhythm.
- -Improved activation mapping during VT:
- -Quicker and improved evaluation of substrate modification after ablation

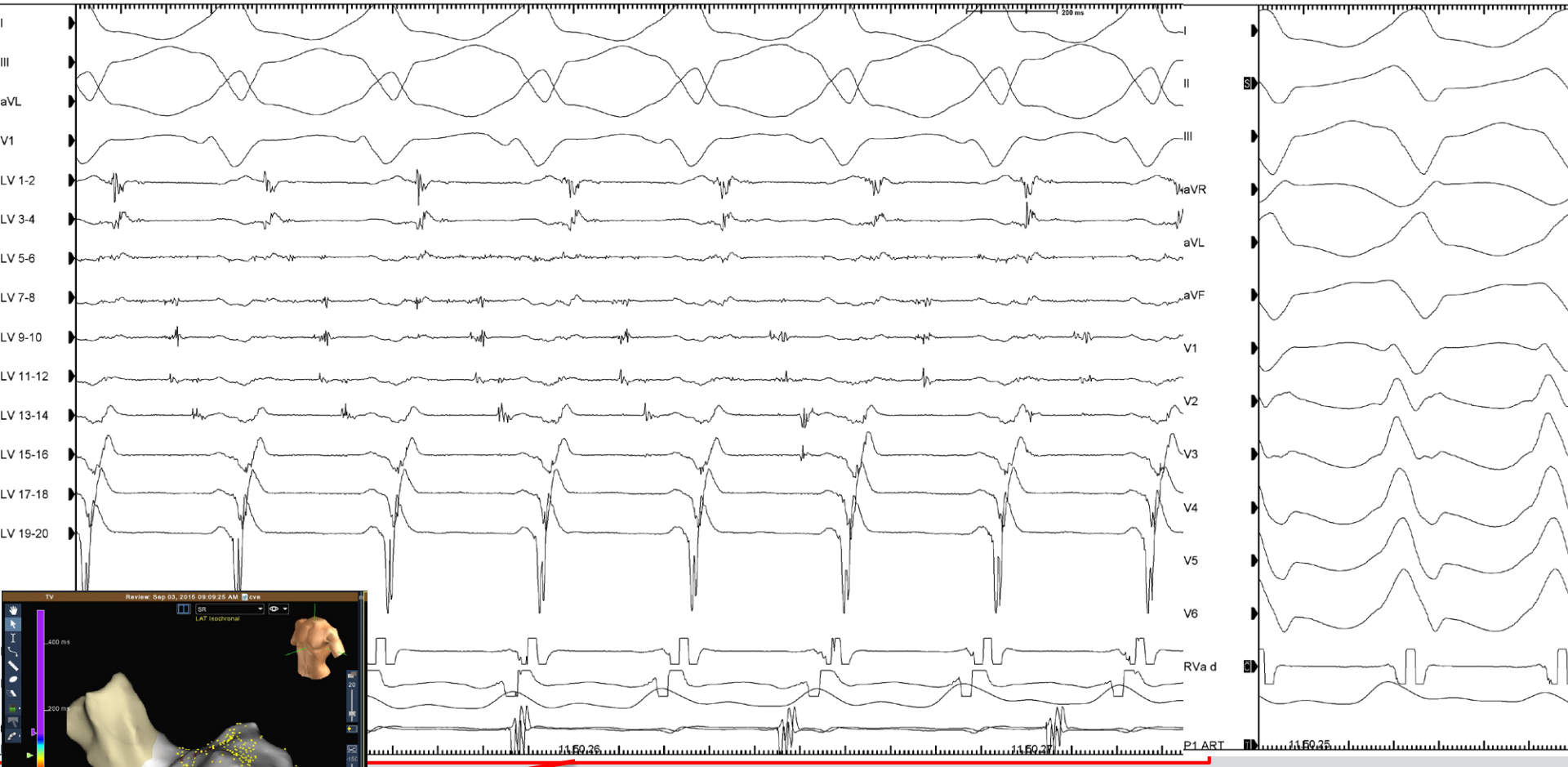
C.M. Post-MI VT ablation. Previous anterior MI- LVEF: 21%

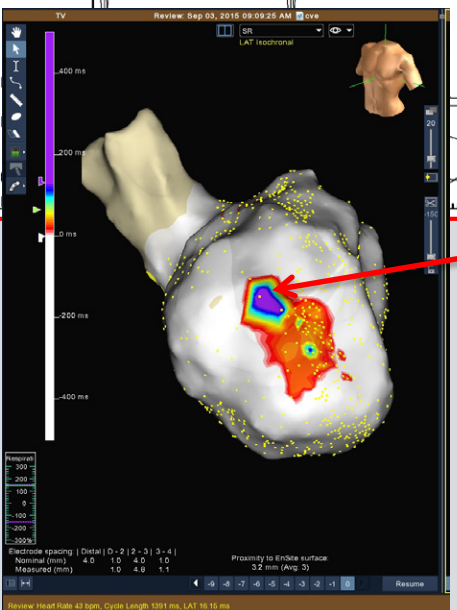




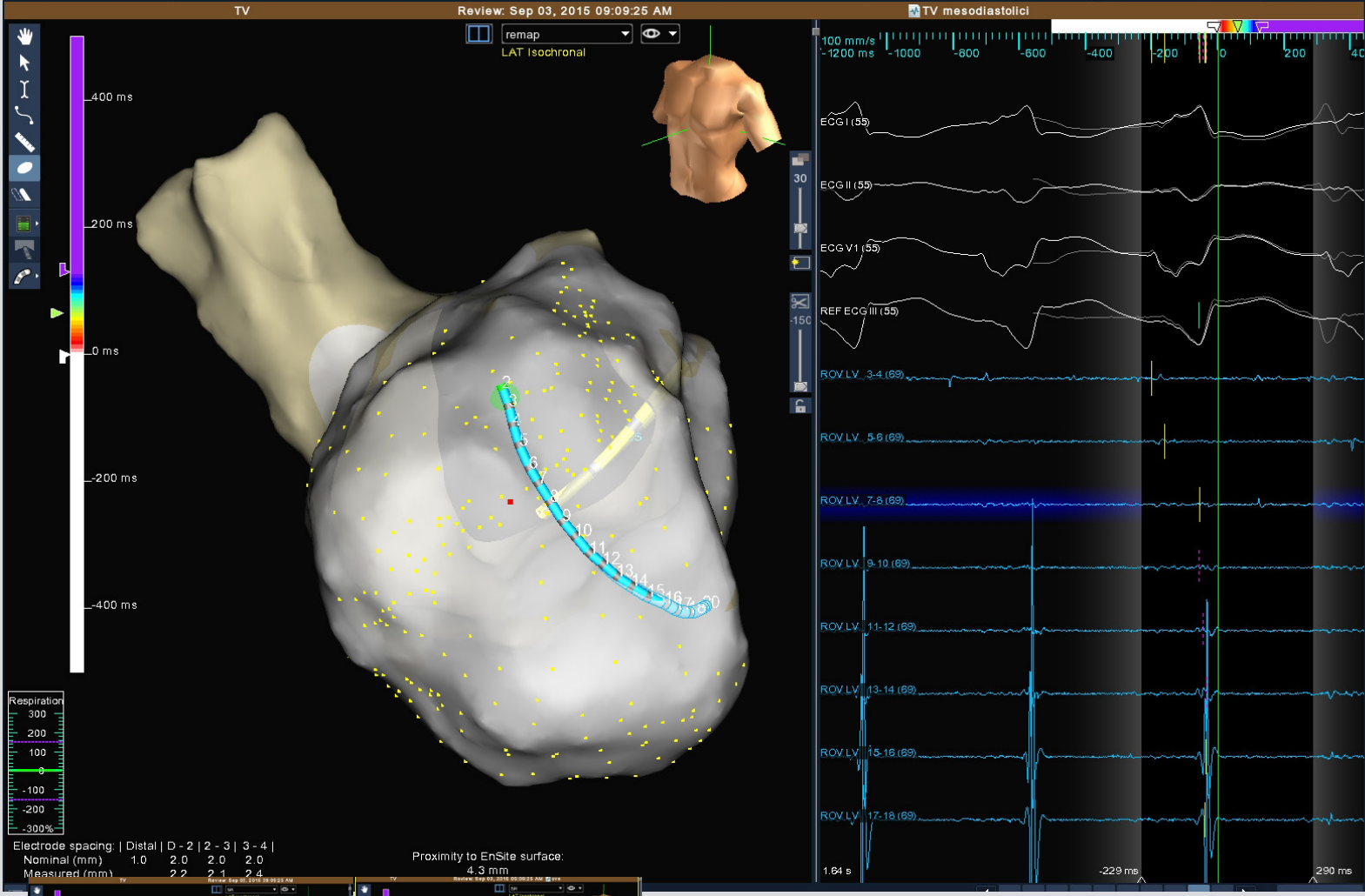


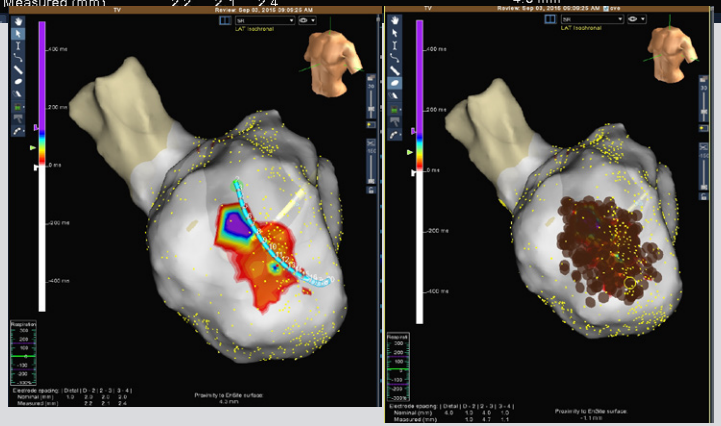
VT diastolic pathway recorded by multipolar catheter





Better accuracy of signal recording by multipolar with respect to Flexability ablation catheter





Remapping

Programmed ventricular stimulation: no VT inducible

VT substrate ablation

Tools for the currently used advanced mapping techniques

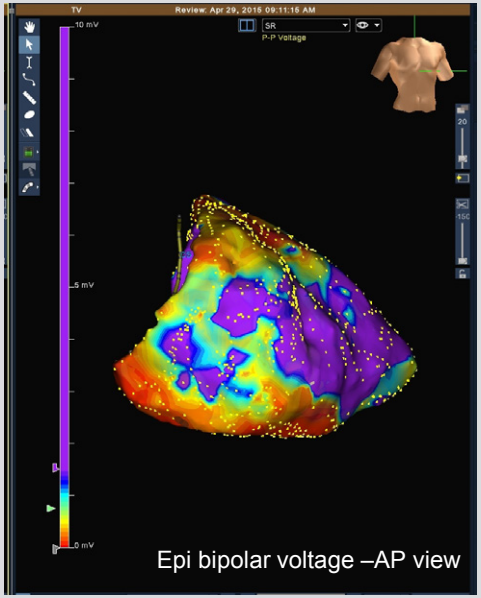
- Accurate reconstruction of the geometry of the endocardium and epicardium

- Evaluation of arrhythmogenic substrate during sinus rhythm:
  - Bipolar voltage map
  - Unipolar voltage map
  - Local activation map (Late potentials map)

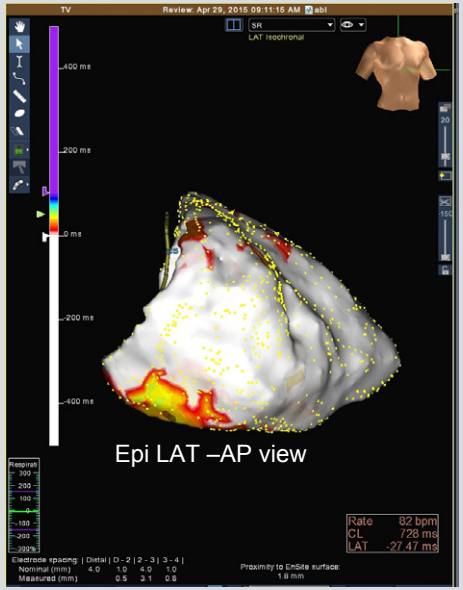
- Quick and accurate remapping to assess substrate modification after ablation

Automap: software to provide automated point collection and annotation by multielectrode catheters

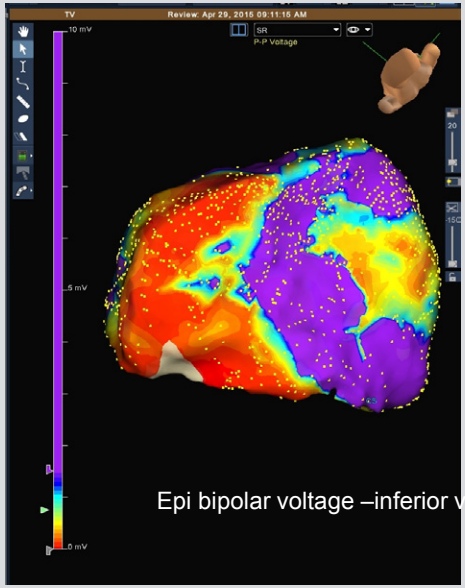
Epicardial VT RFCA - IDCM



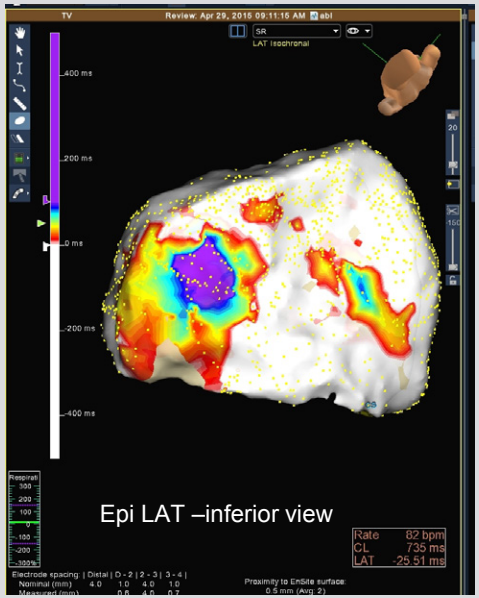
Epi bipolar voltage –AP view



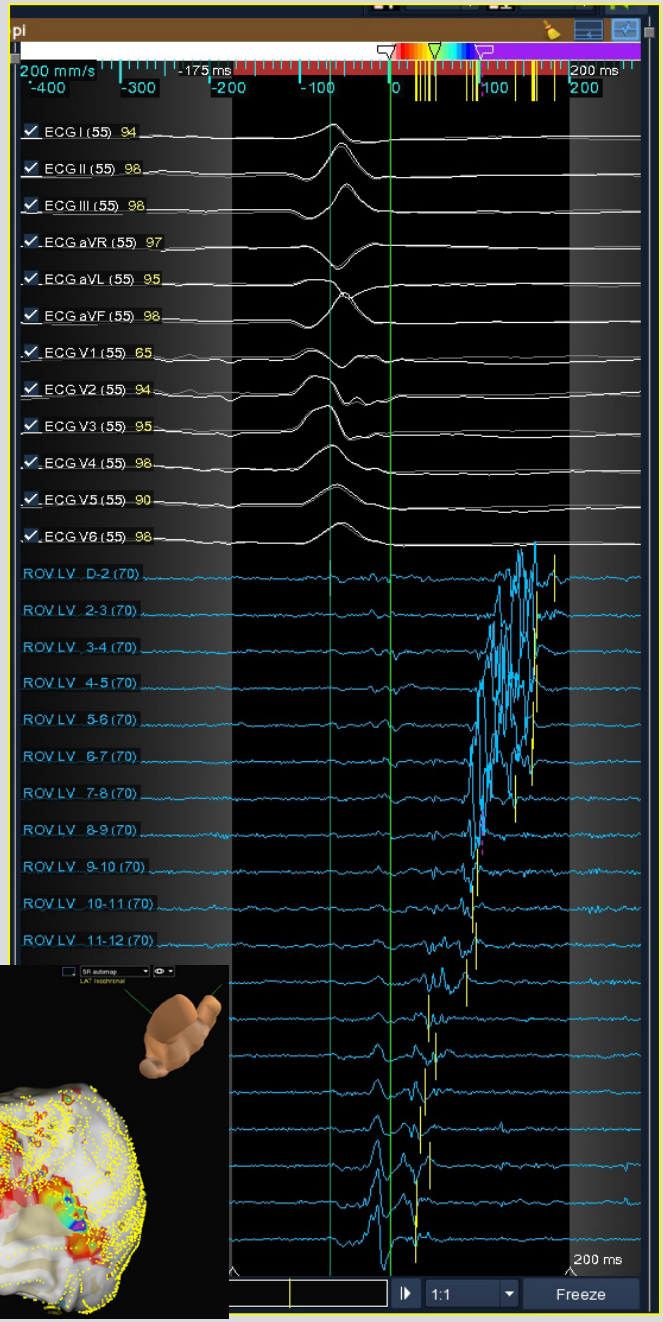
Epi LAT –AP view

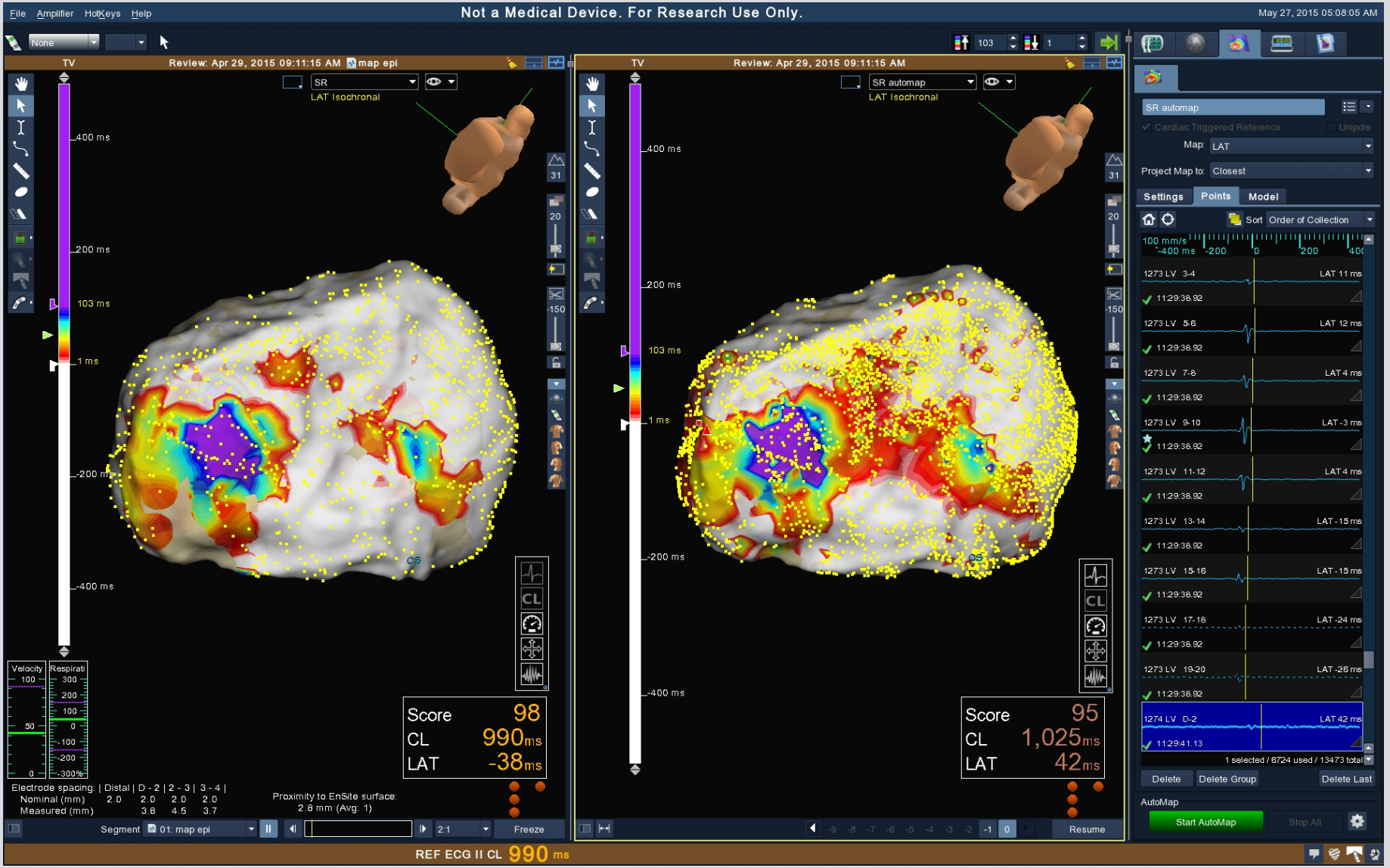


Epi bipolar voltage –inferior view

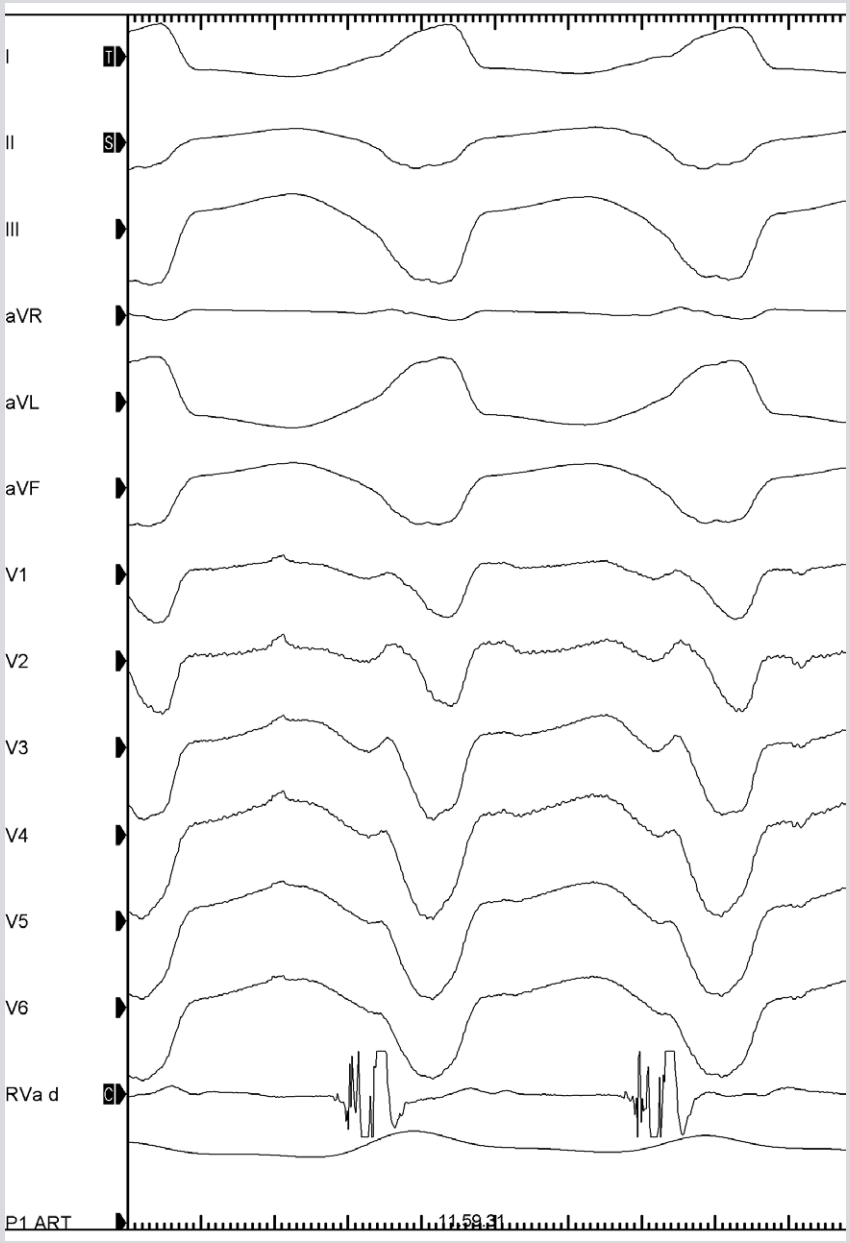


Epi LAT –inferior view

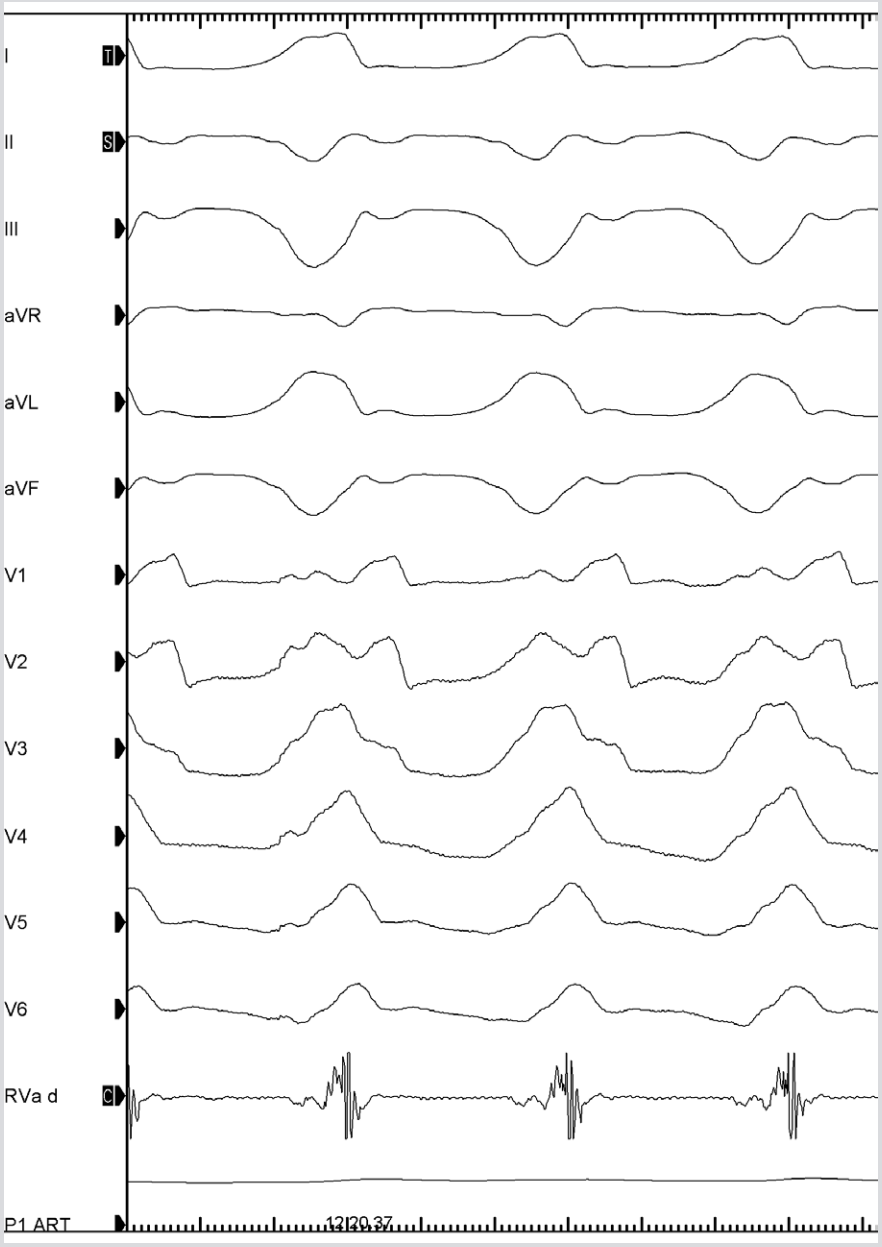




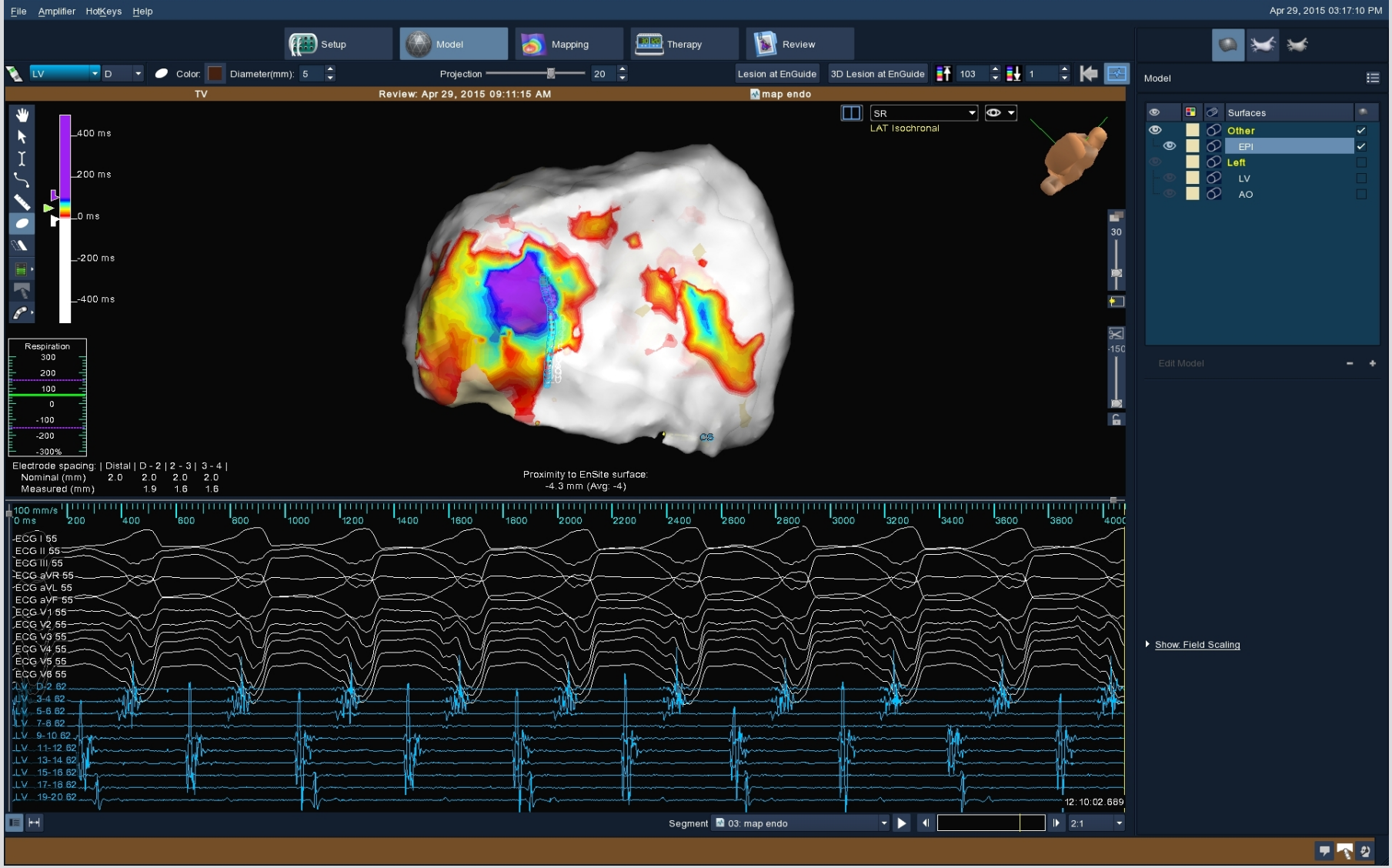
MANUALLY COLLECTED MAP (2336 POINTS) (LEFT) VS. AUTOMAP (6726 POINTS) (RIGHT)


I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
RVa d
P1 ART

VT1

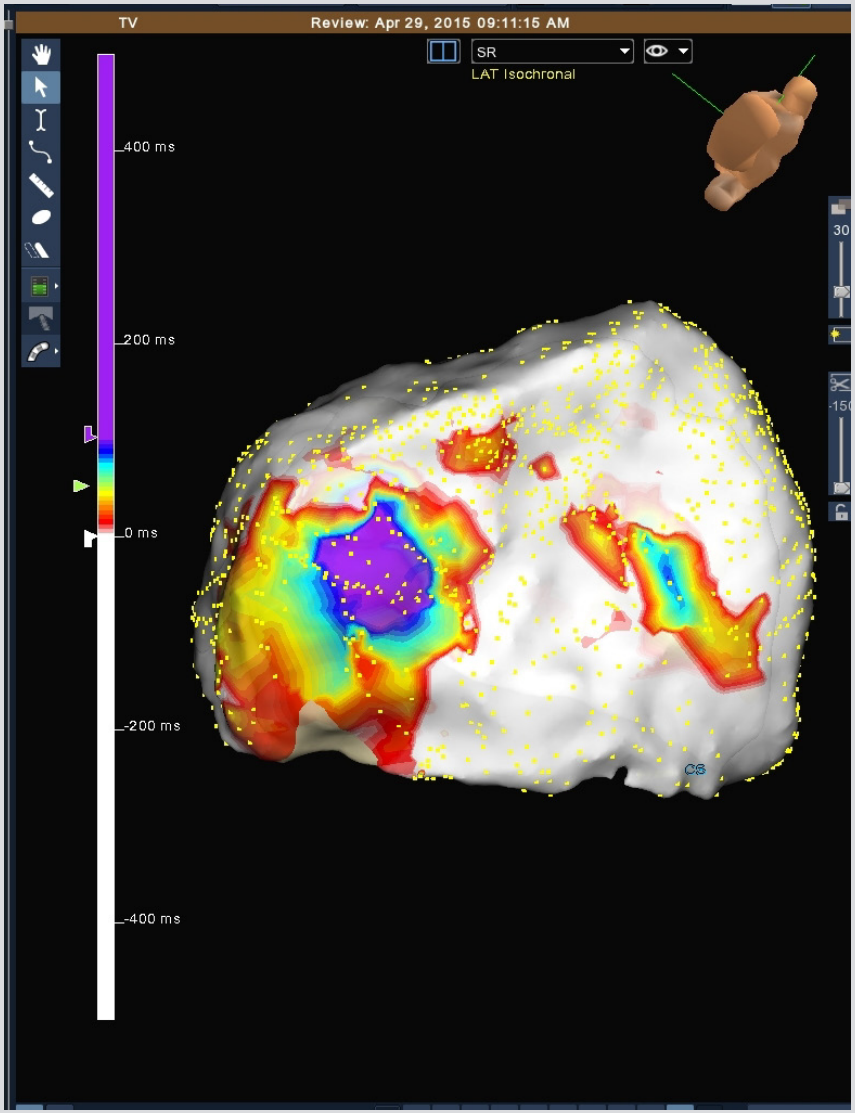

I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
RVa d
P1 ART

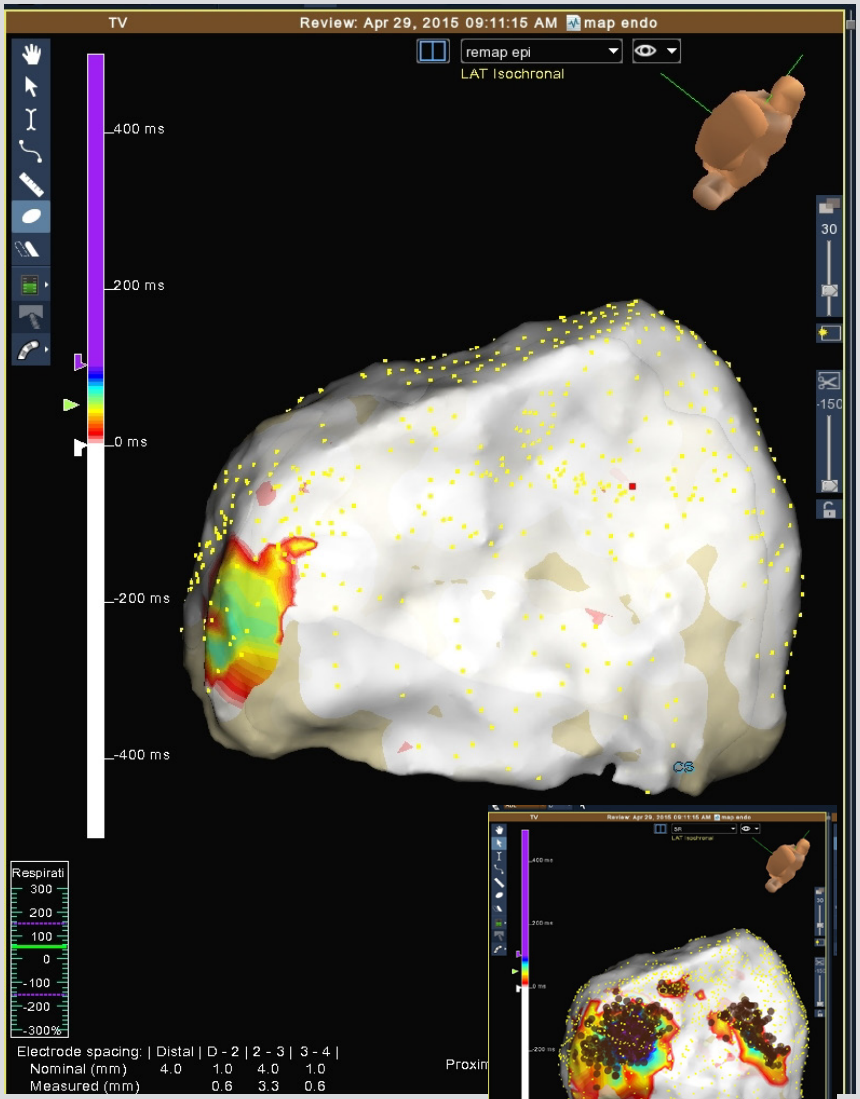
VT2



VT activation mapping (multipolar catheter)

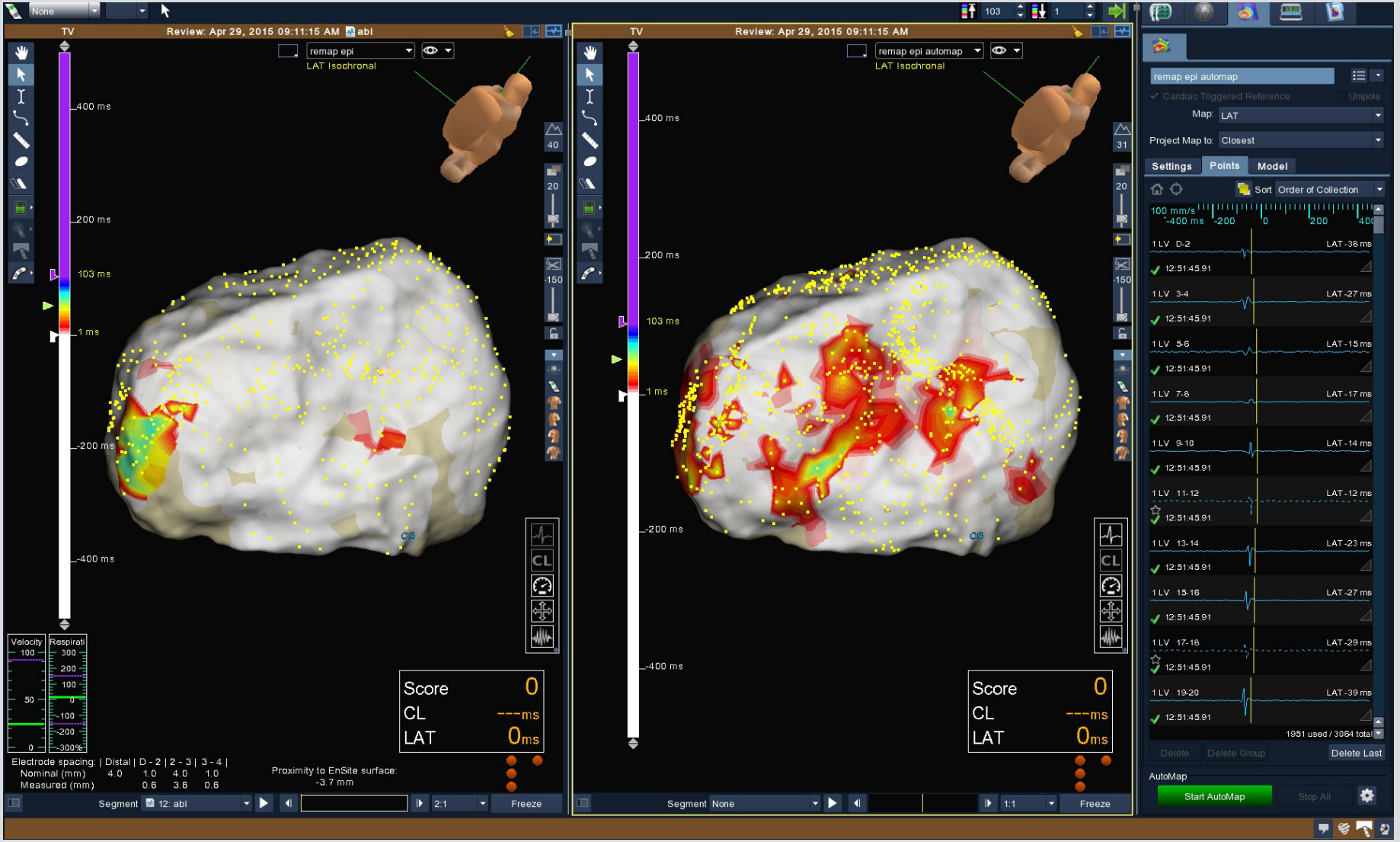
VT termination during RF delivery





Abolition of LPs demonstrated by remap (right panel)

Remap

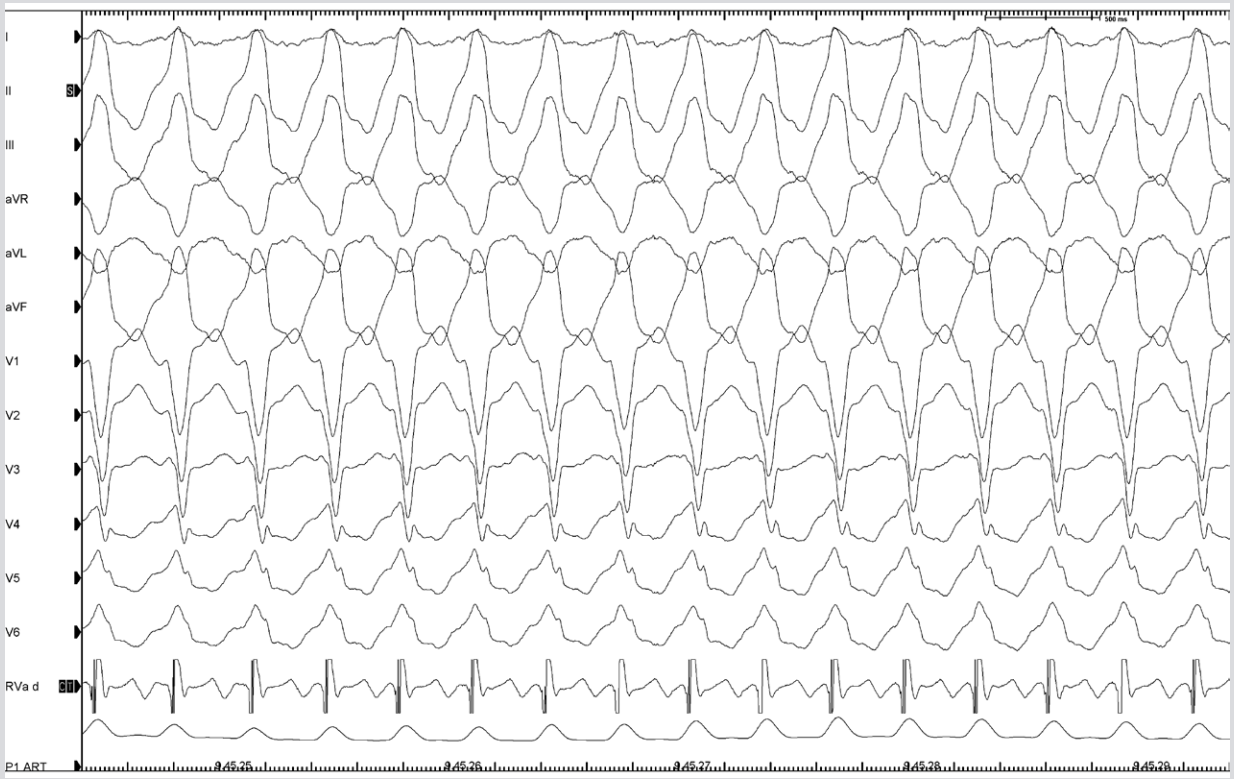


Manually collected Map (929 points) (left) vs. Automap (1951 points) (right)

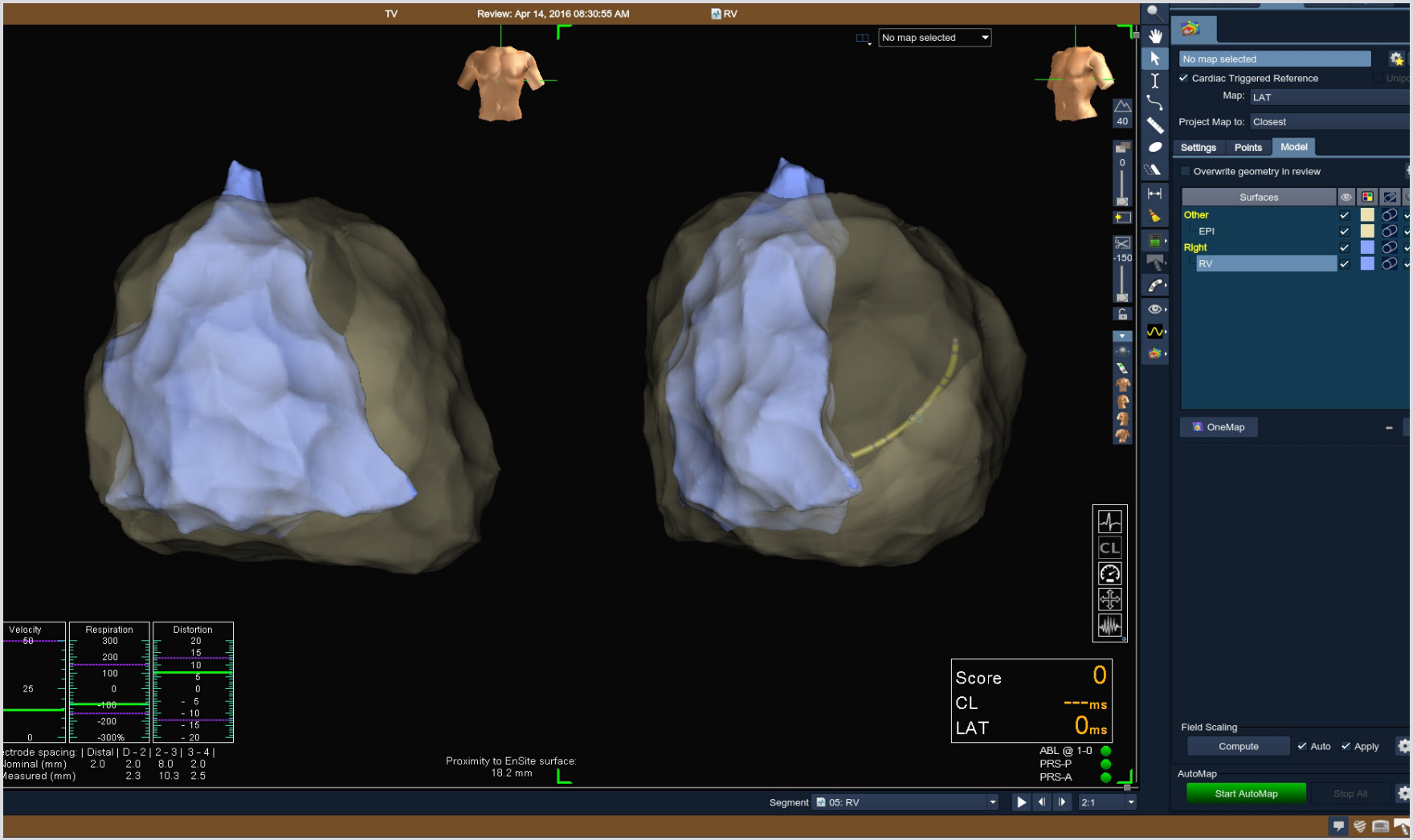
VT ablation in RVOT epicardium- «early» ARVD

F.A. , male 34 years
Episodes of LBBB-inferior axis VT related to physical effort
Previous documentation of T wave inversion in V1-3 lead during sinus rhythm in 12 lead ECG recorded 12 months before the ablation.
Normal pattern of repolarization at hospital admittance
Cardiac MRI: no abnormalities suggesting ARVD

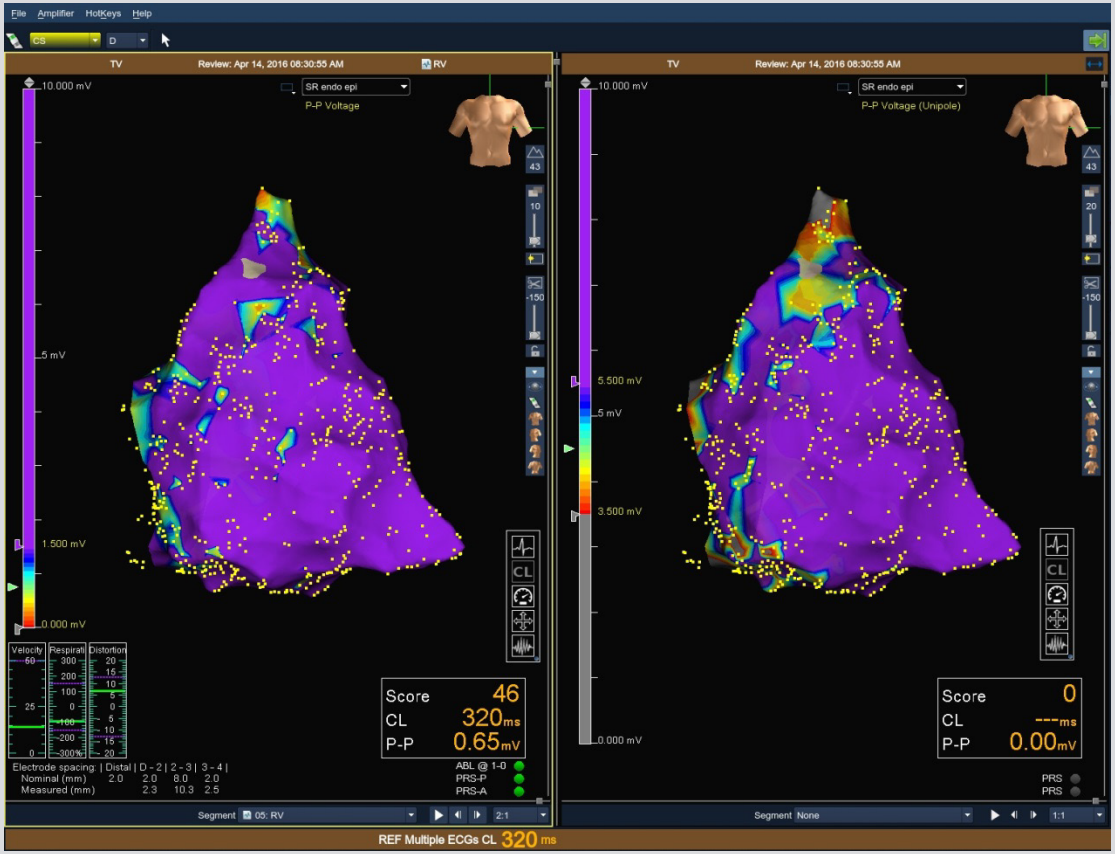
- Ensite Precision
- High density mapping catheter Livewire 20 poles 2-2-2
- Ablation catheter: Flexability SE



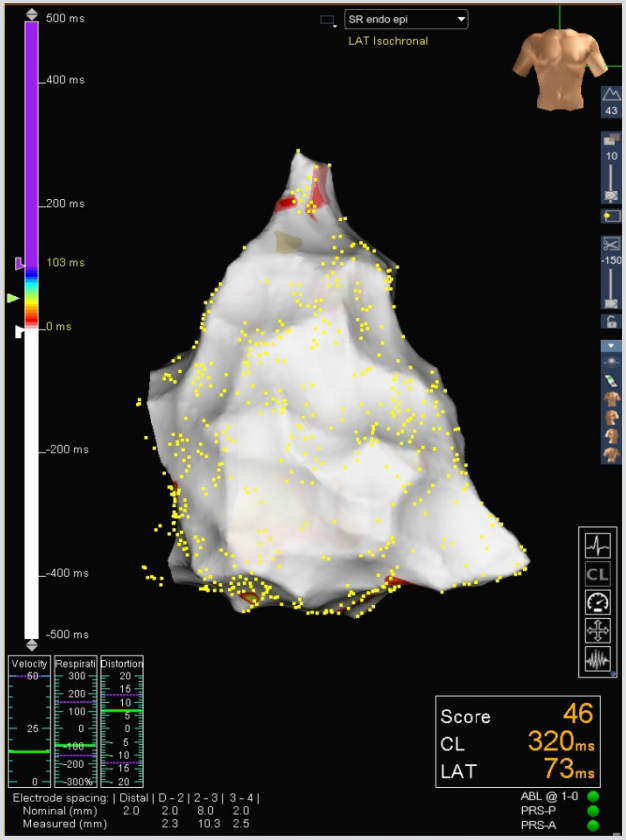
Clinical VT (spontaneous or induced by programmed stimulation from RVA)



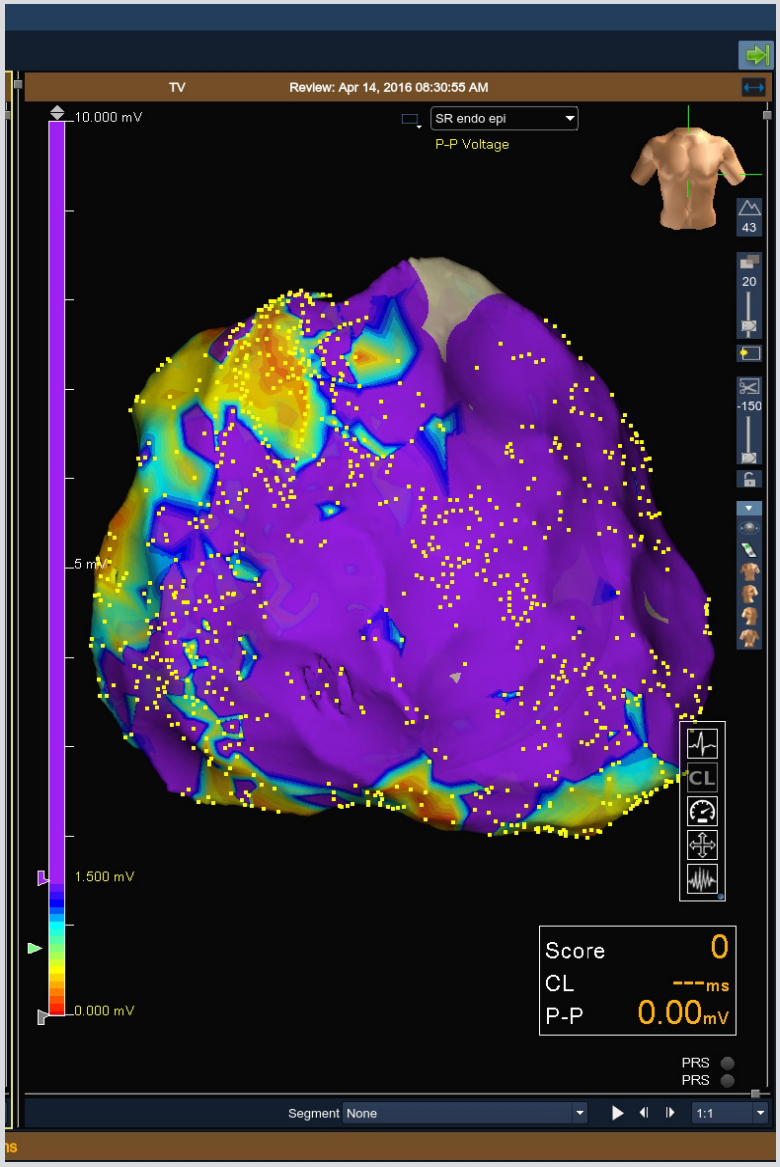
Geometry of the endocardium and epicardium of the right ventricle

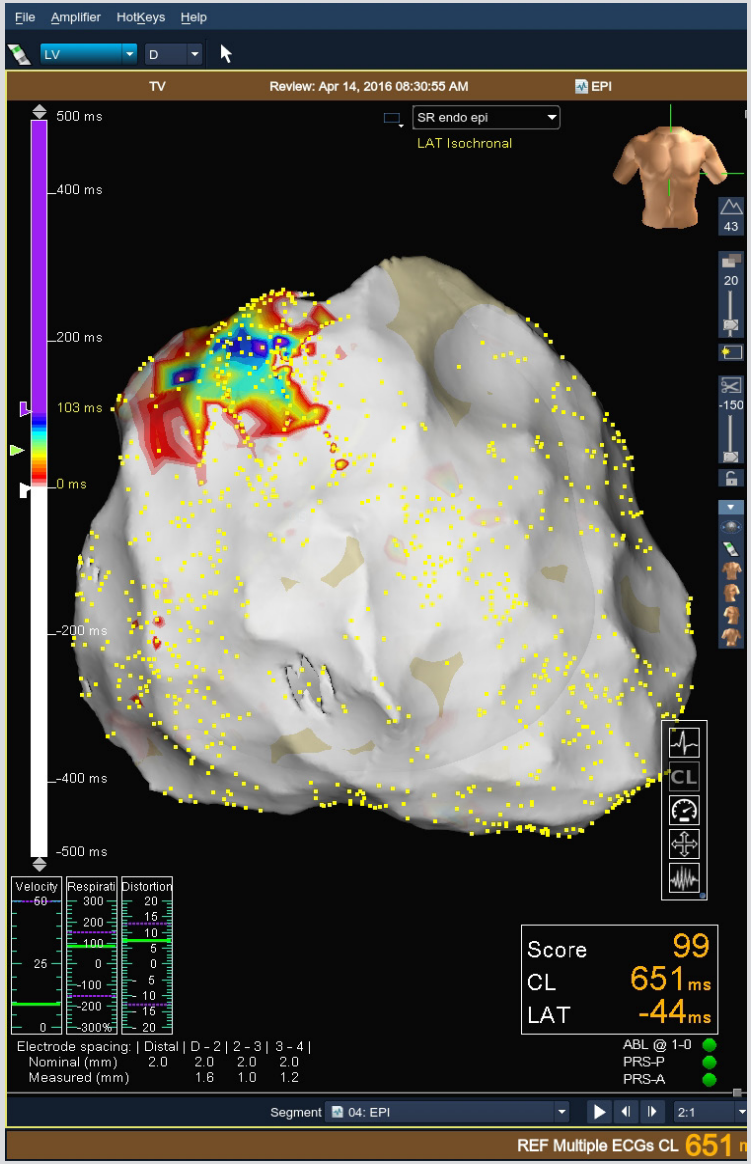


Unipolar (left) and bipolar (right) voltage map - endocardium

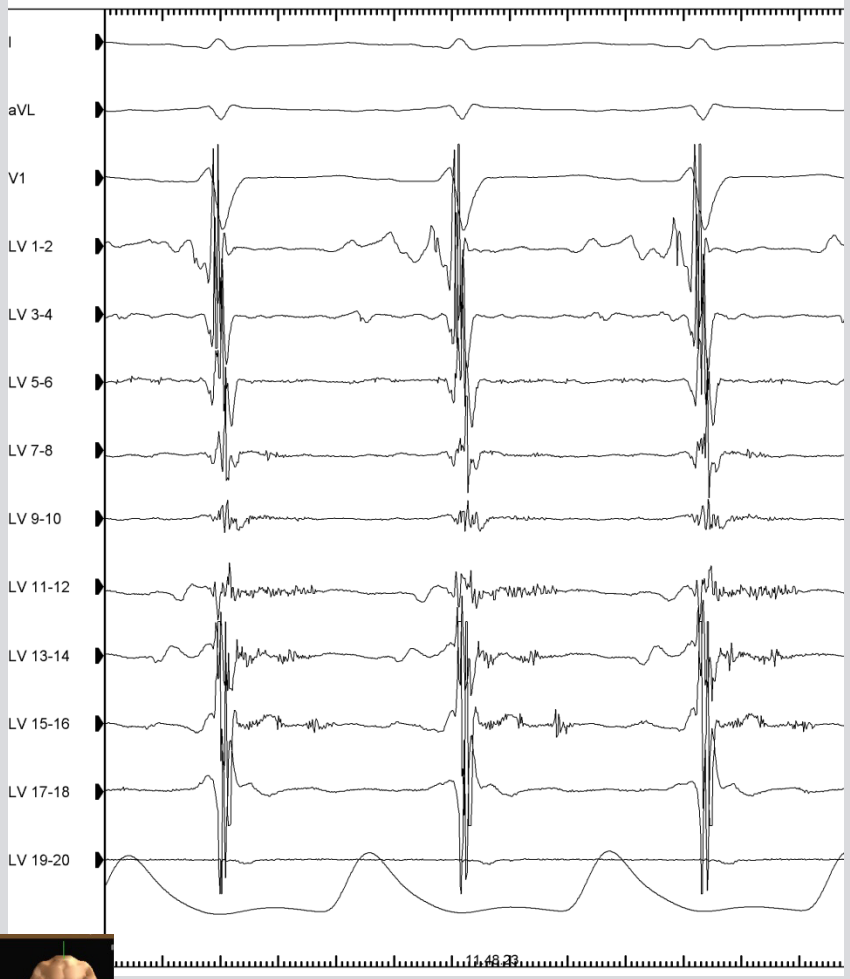


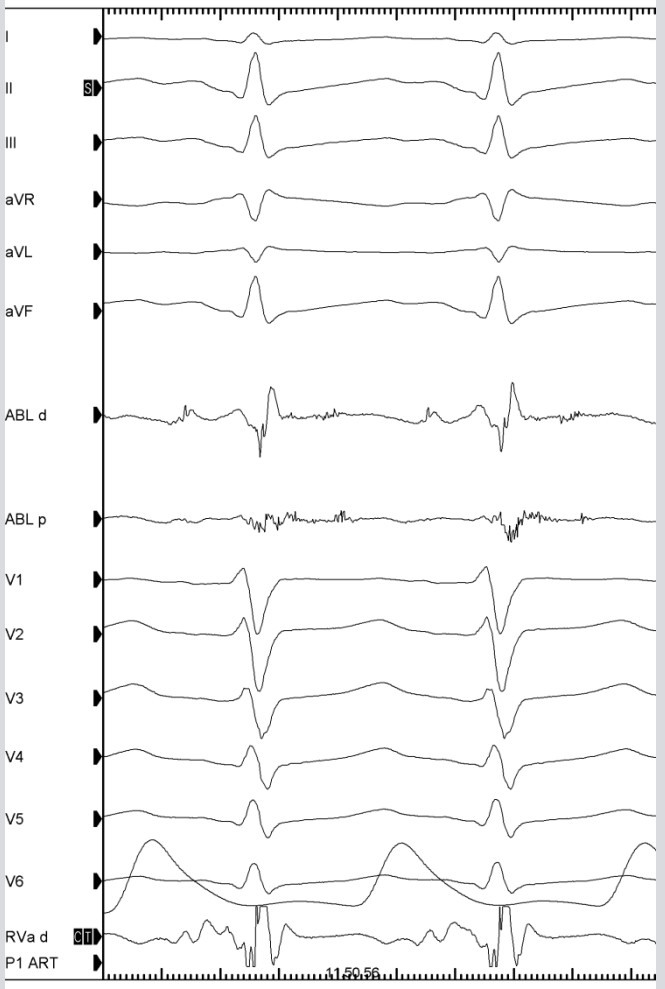
LAT map during sinus rhythm – endocardium

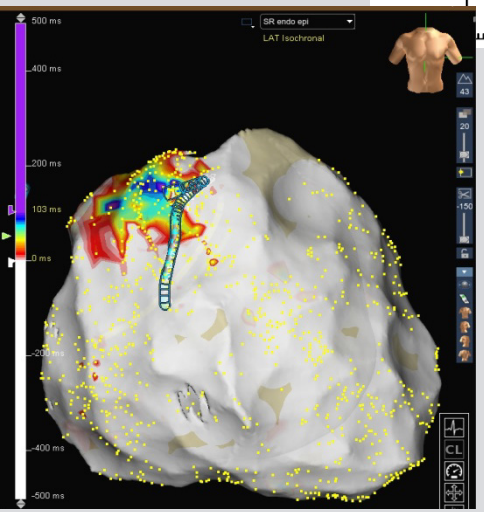




Bipolar voltage (right) voltage and LAT map – epicardium

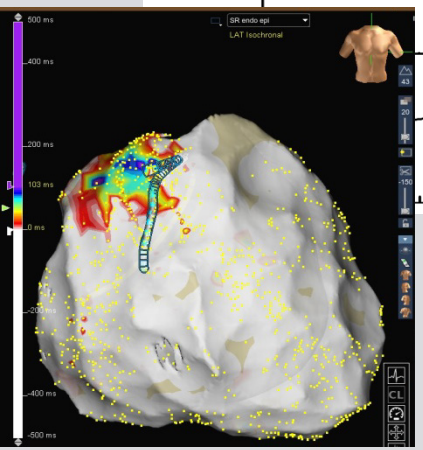




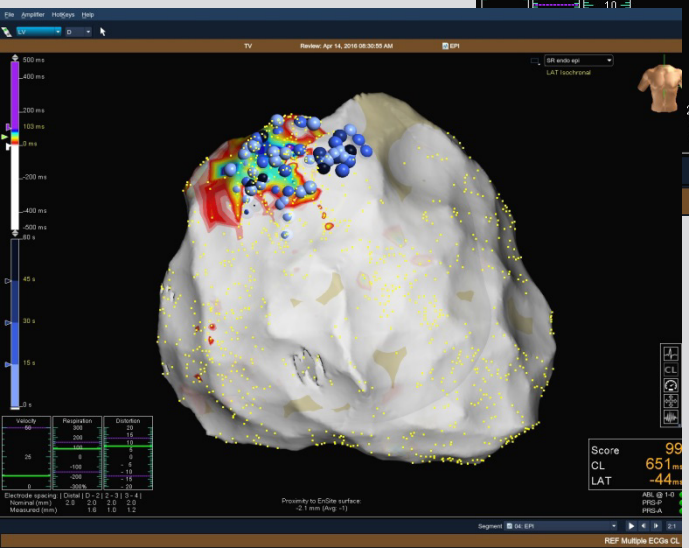


LPs – multipolar catheter

LPs – Flexability



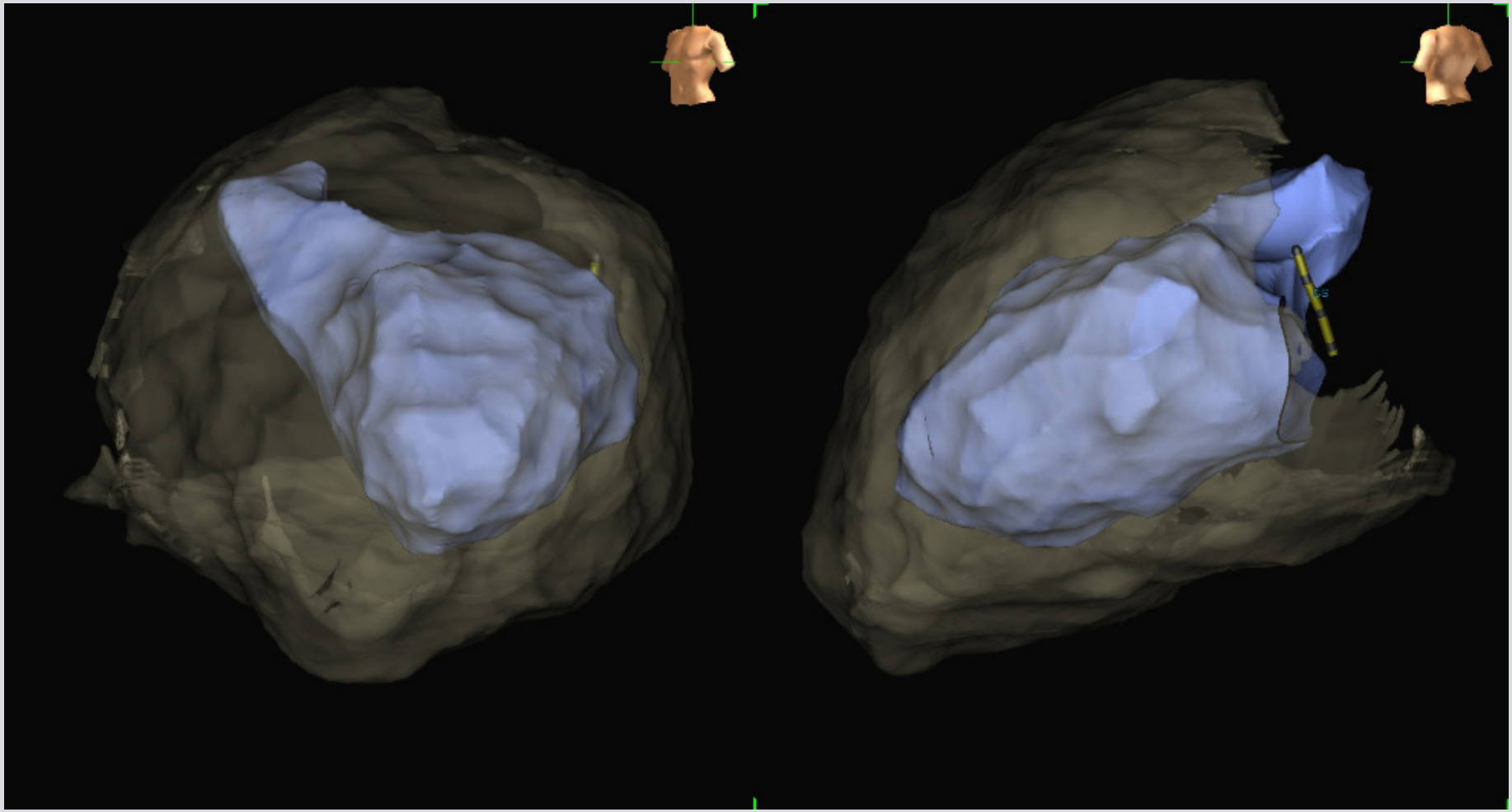
VT activation mapping – Multipolar catheter (left) and Flexability (right)



Remap: LPs abolition

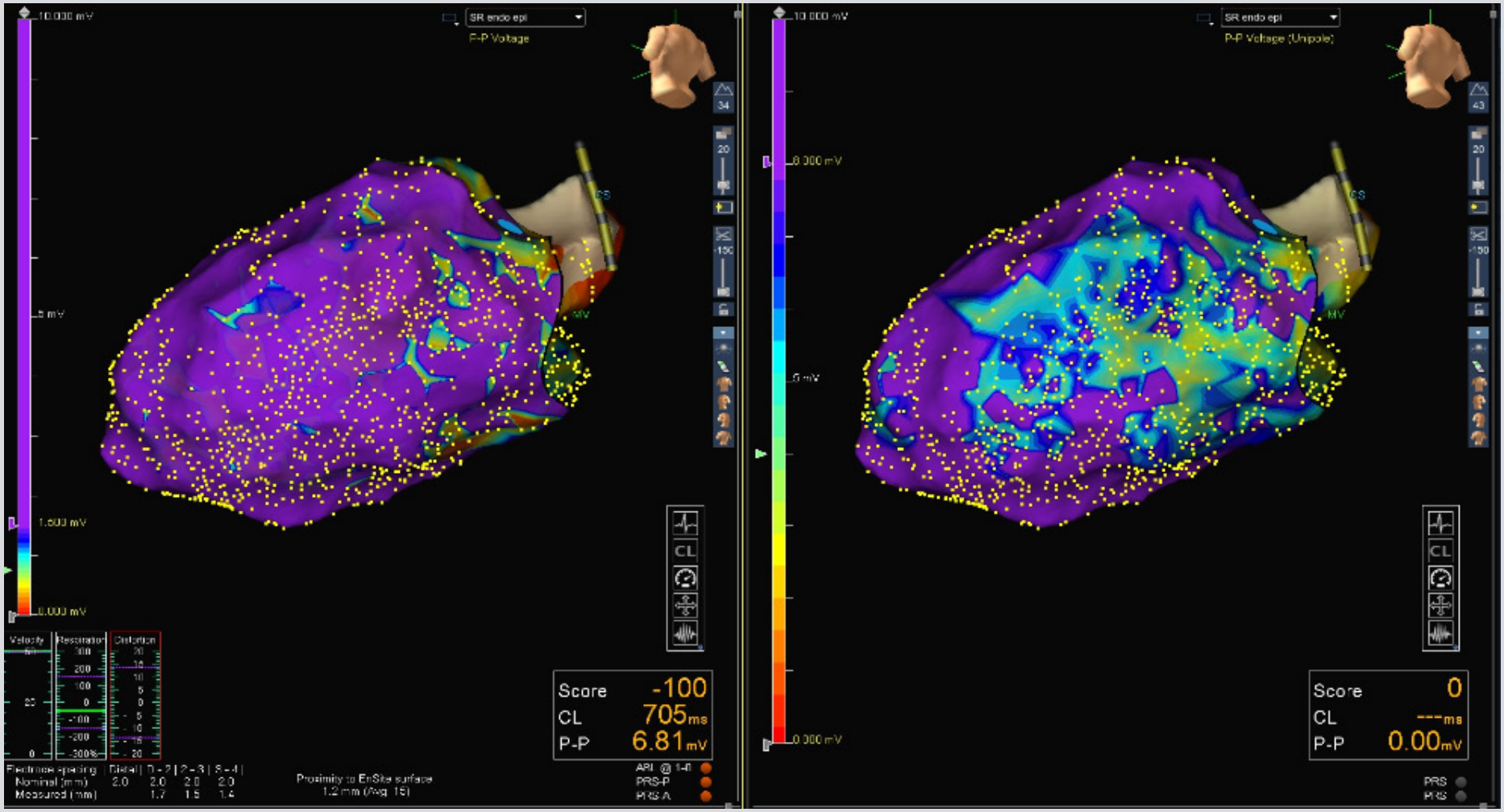
Post-procedure programmed ventricular stimulation (4 extrastimuli):
No VT inducible

Endo-epicardial VT ablation in a patient with IDCM

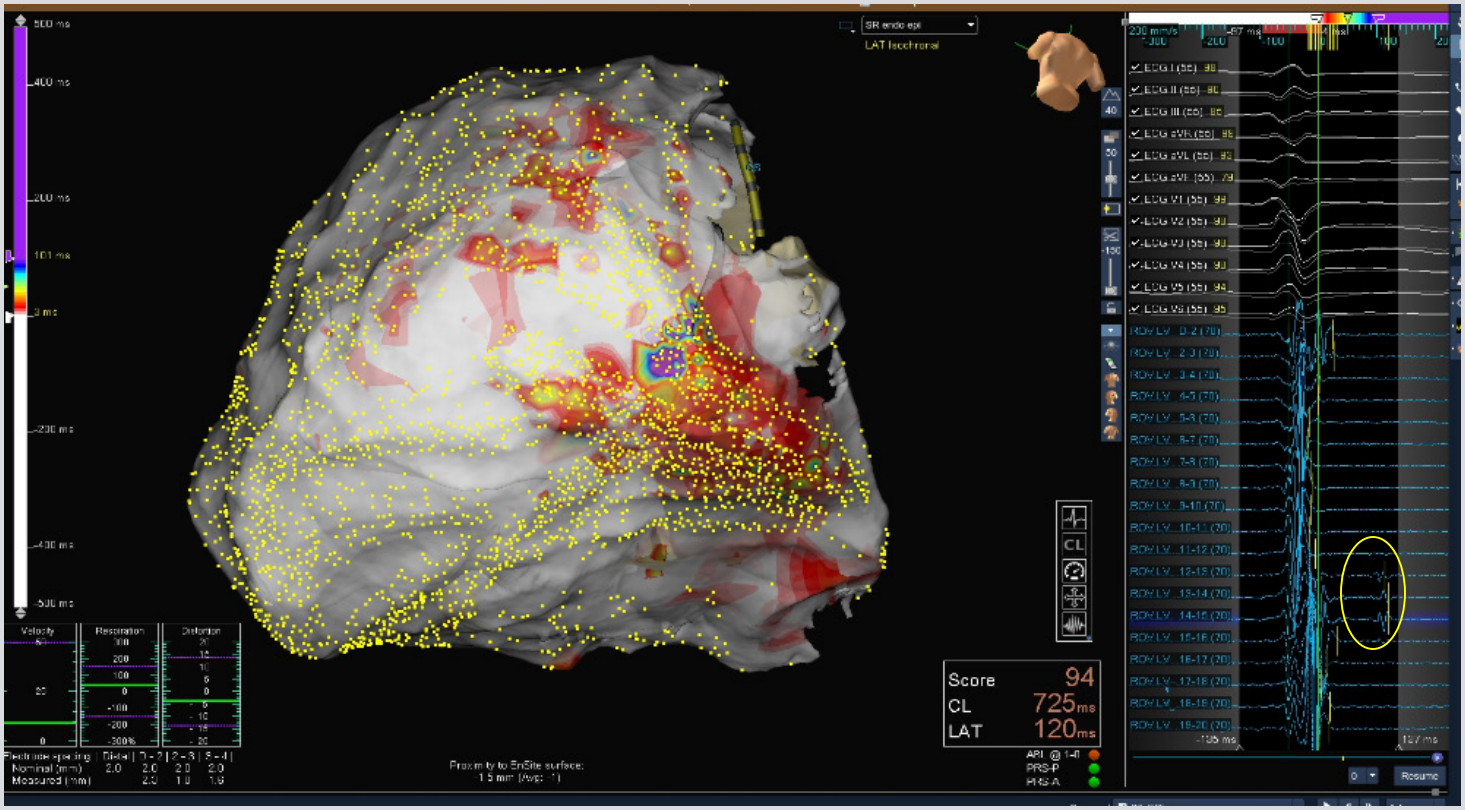


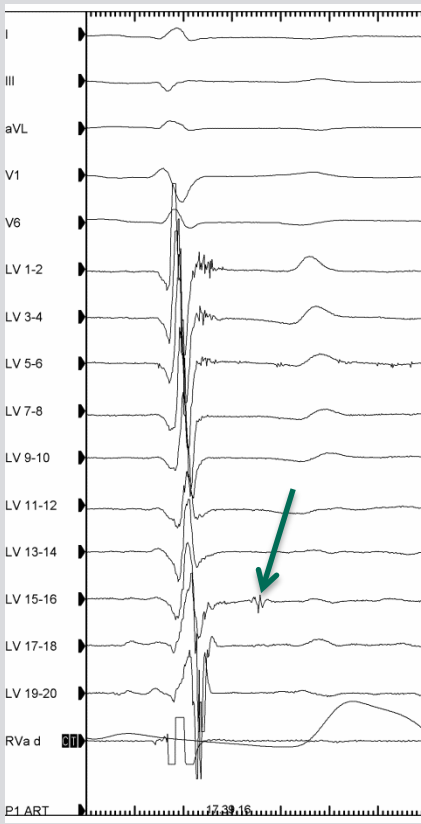
Reconstruction of the geometry of the left ventricle
(endocardium and epicardium)

Endocardial bipolar (left) and unipolar (right) voltage map: 1600 collected points



Mapping of epicardial late potentials by Automap software



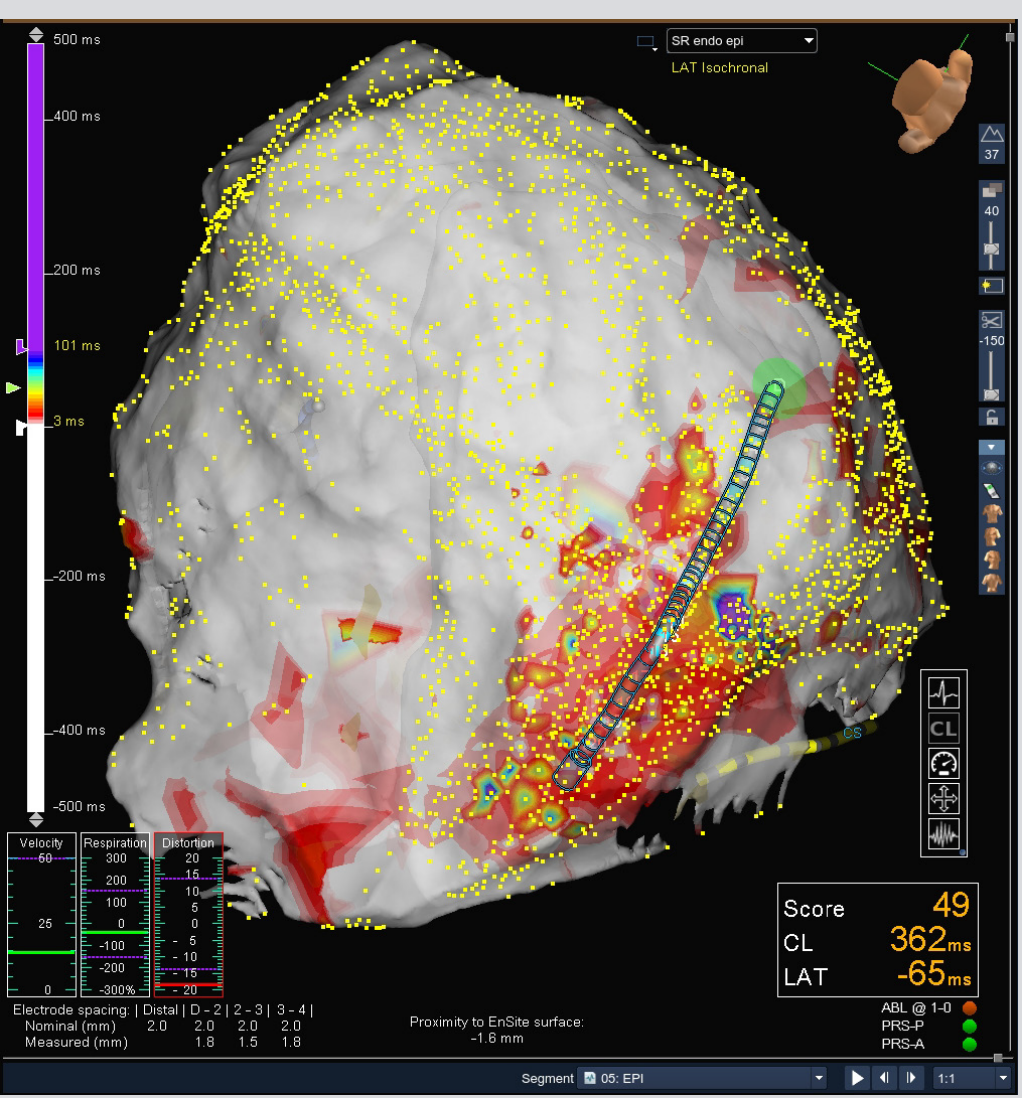


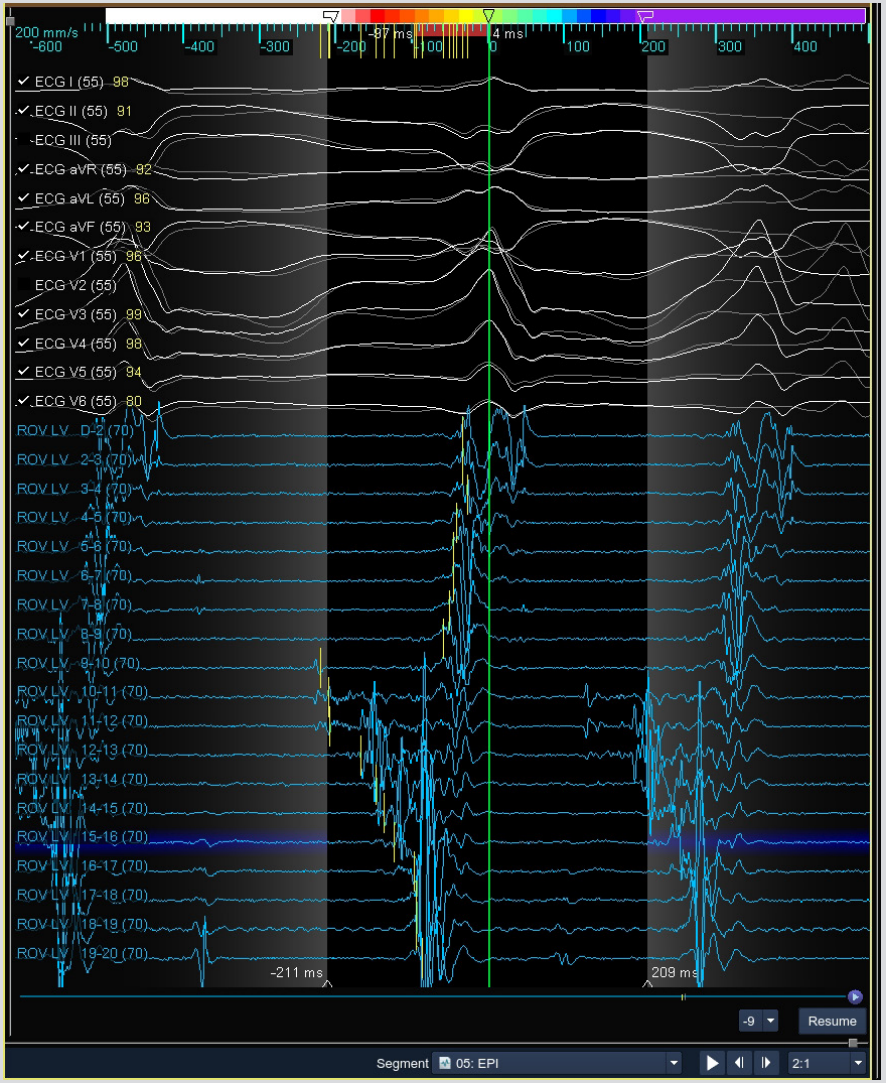
LPs correctly annotated by Automap


500 ms
I
II
S
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
RVa d
CT
P1 ART
16:21:30
16:21:31
16:21:32
16:21:33
16:21:34

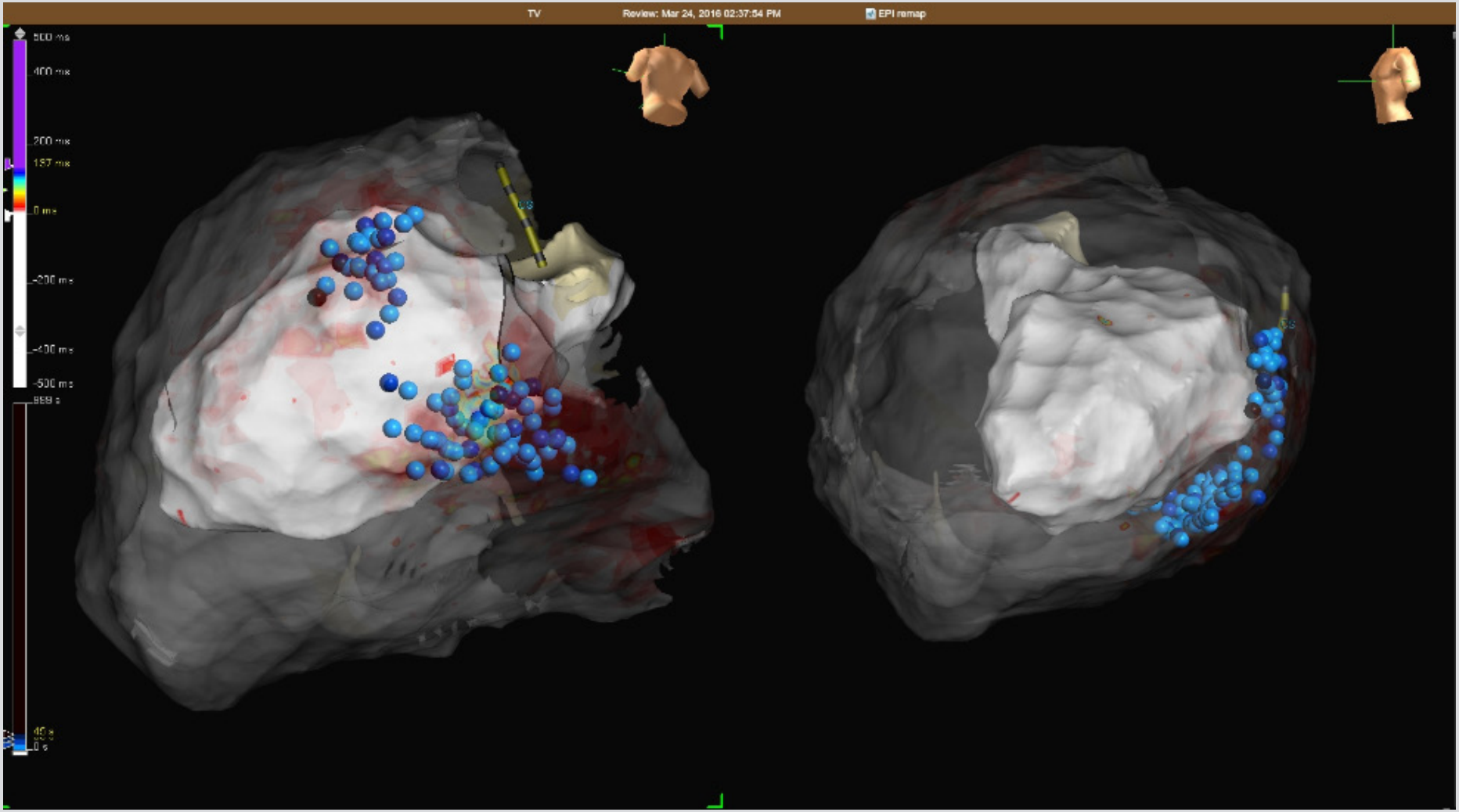
Clinical VT

Activation mapping during epicardial VD by high density mapping catheter (Livewire 2 2 2)

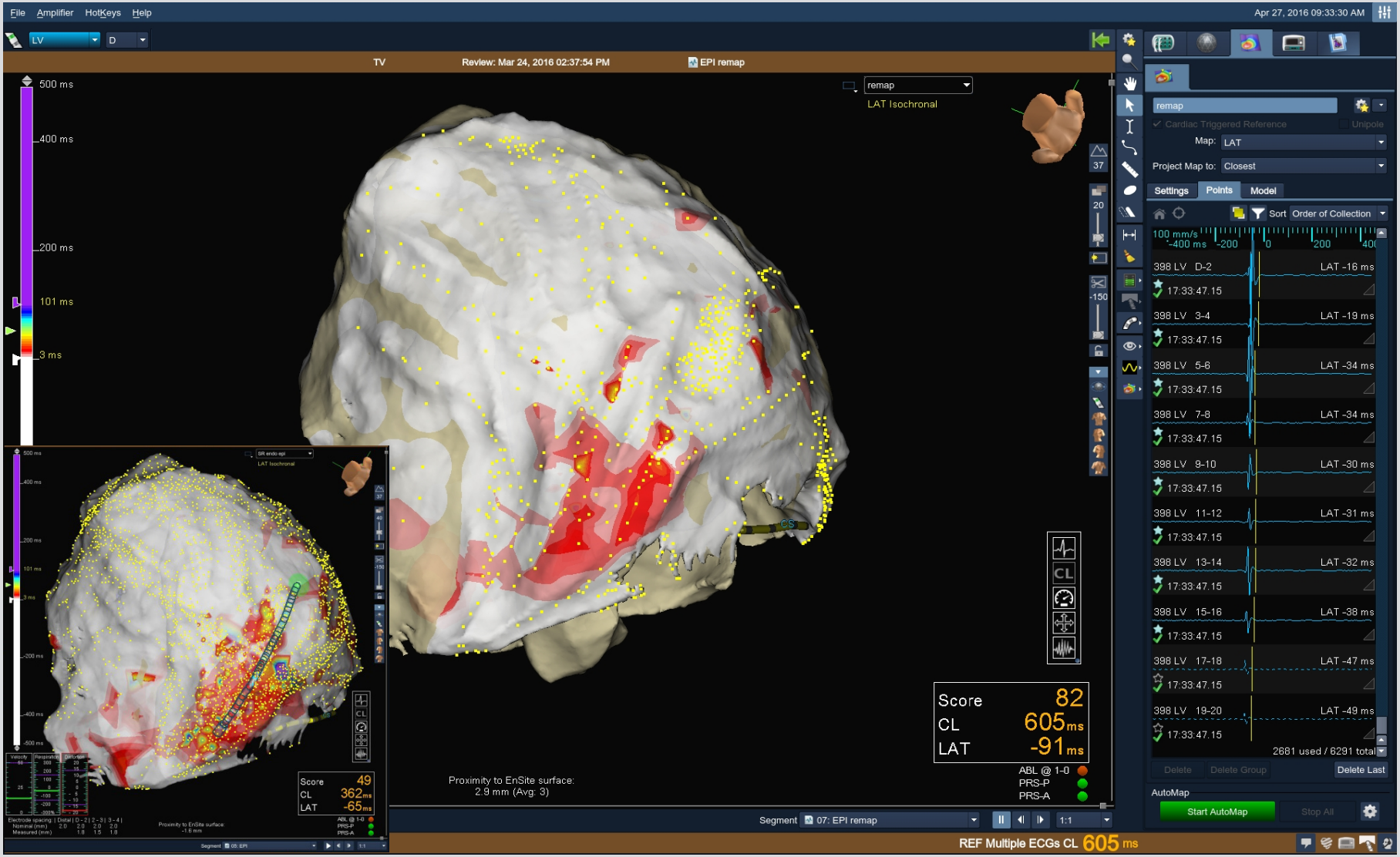




RF delivery in epicardium



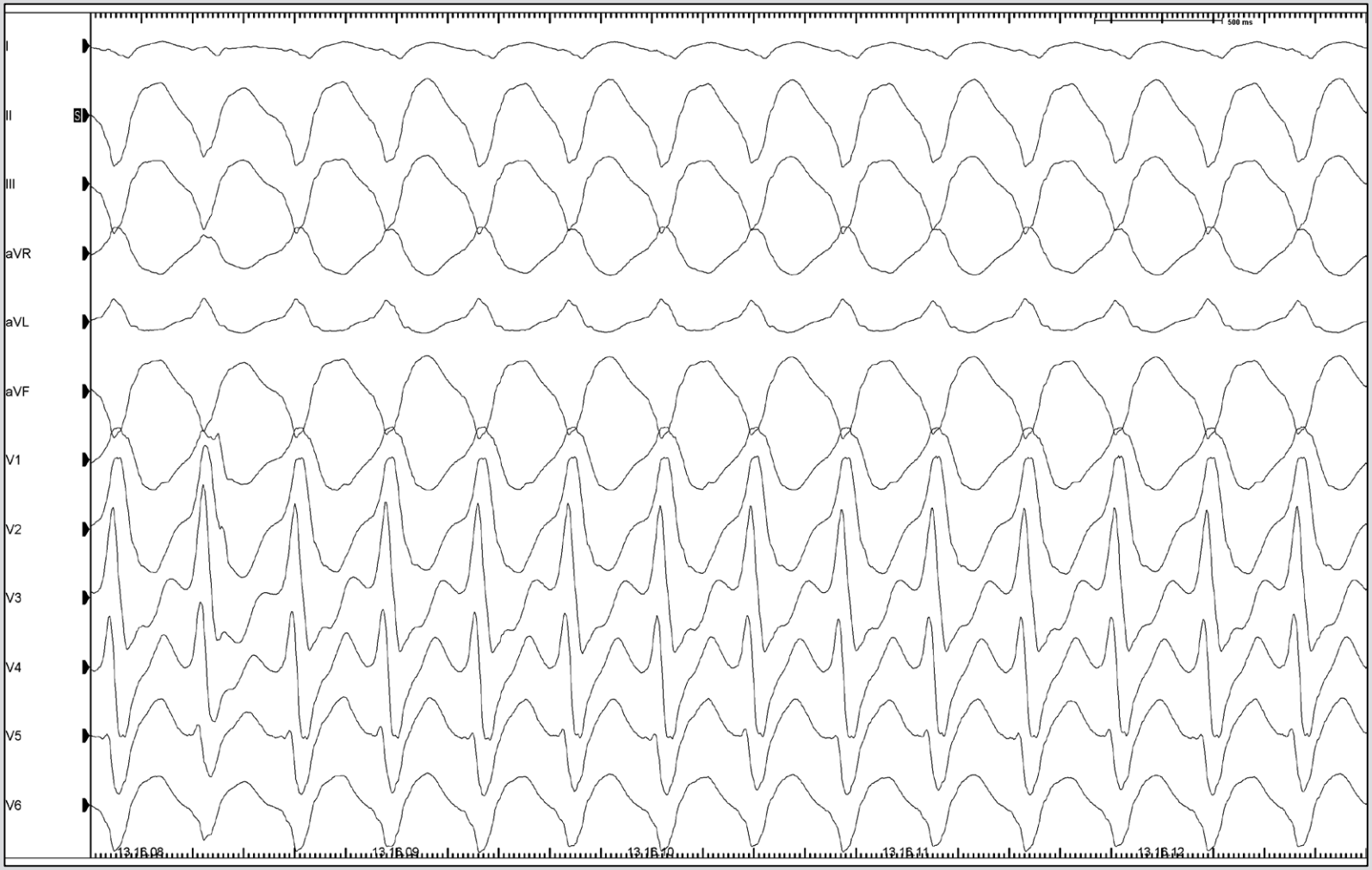
Remap


File Amplifier HotKeys Help
Apr 27, 2016 09:33:30 AM
TV
Review: Mar 24, 2016 02:37:54 PM
EPI remap
LAT Isochronal
500 ms
400 ms
200 ms
101 ms
3 ms
Score 82
CL 605 ms
LAT -91 ms
Proximity to EnSite surface:
2.9 mm (Avg: 3)
ABL @ 1-0
PRS-P
PRS-A
Segment 07: EPI remap
REF Multiple ECGs CL 605 ms
Map: LAT
Project Map to: Closest
Settings Points Model
Sort Order of Collection
398 LV D-2 LAT -16 ms
398 LV 3-4 LAT -19 ms
398 LV 5-6 LAT -34 ms
398 LV 7-8 LAT -34 ms
398 LV 9-10 LAT -30 ms
398 LV 11-12 LAT -31 ms
398 LV 13-14 LAT -32 ms
398 LV 15-16 LAT -38 ms
398 LV 17-18 LAT -47 ms
398 LV 19-20 LAT -49 ms
2681 used / 6291 total
Delete Delete Group Delete Last
AutoMap
Start AutoMap Stop All

VT case

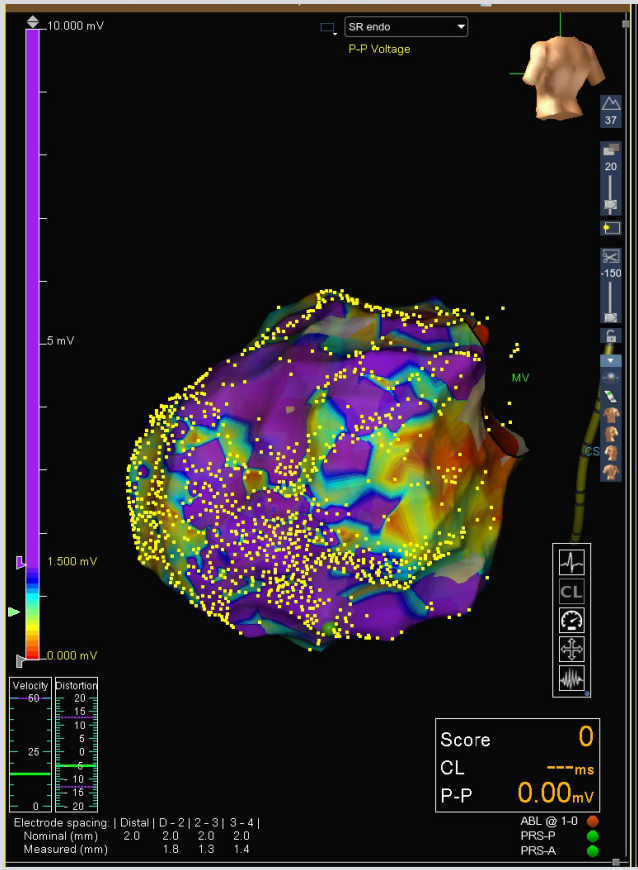
Male 48 yo, amateur cyclist. Previous AMI (2013). In 2015 secondary prevention ICD implantation.

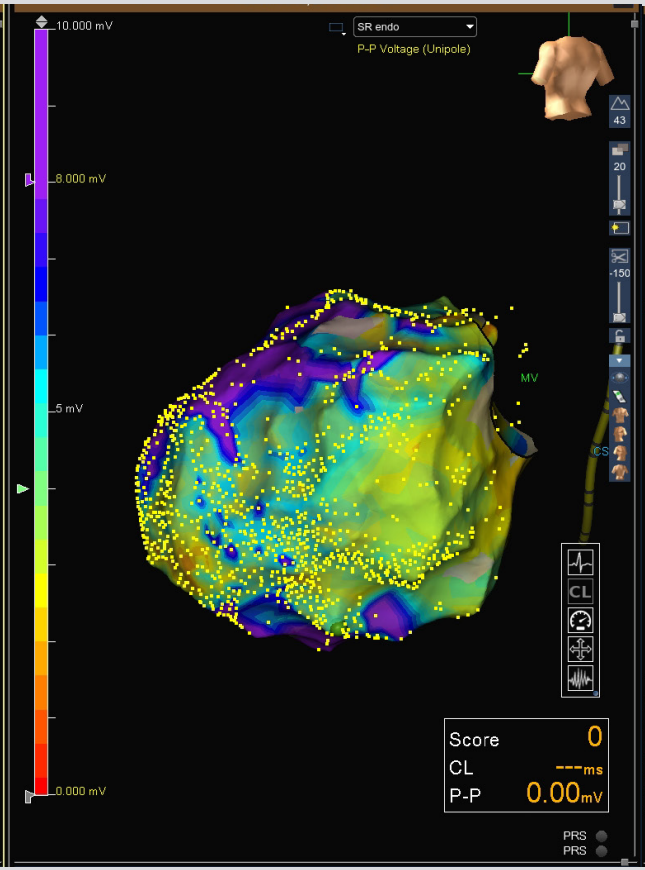
Cardiac MRI: scar in the infero-lateral wall of the LV

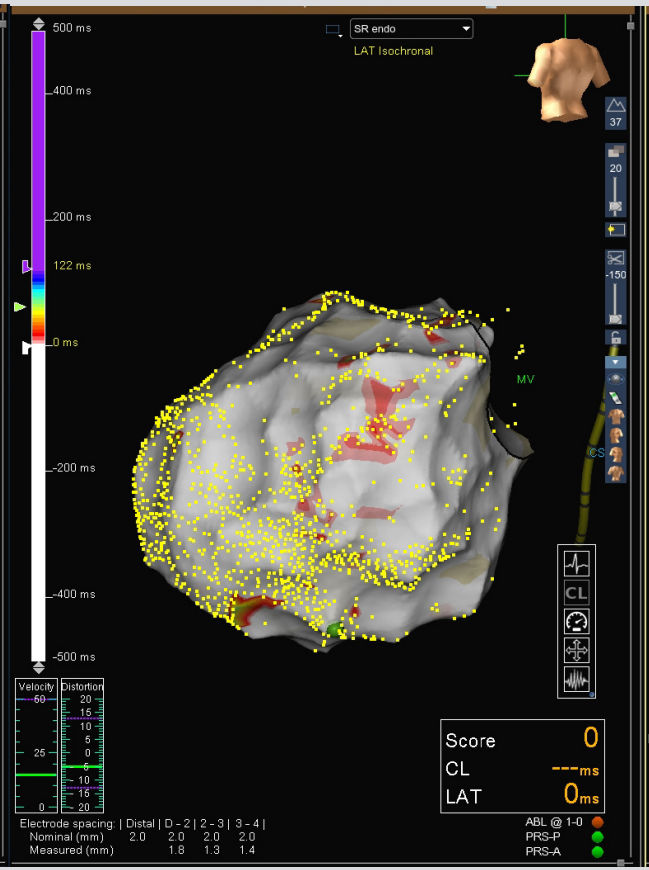


Clinical VT morphology

Left ventricle Endocardial map



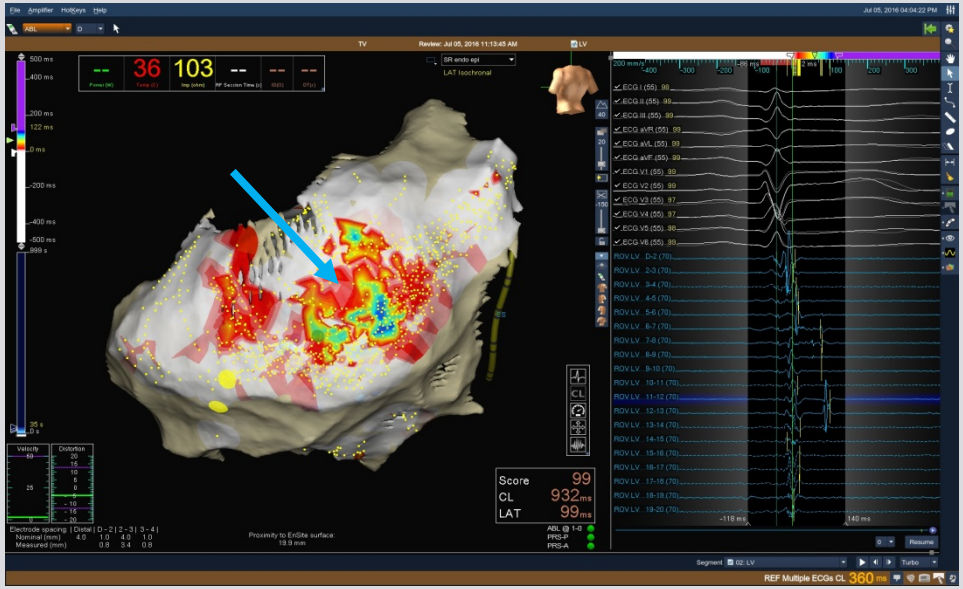


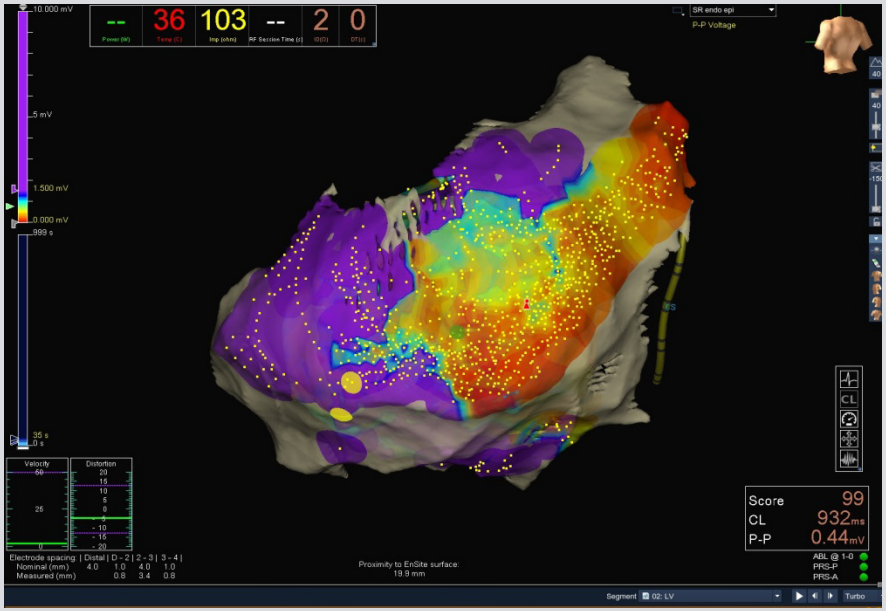


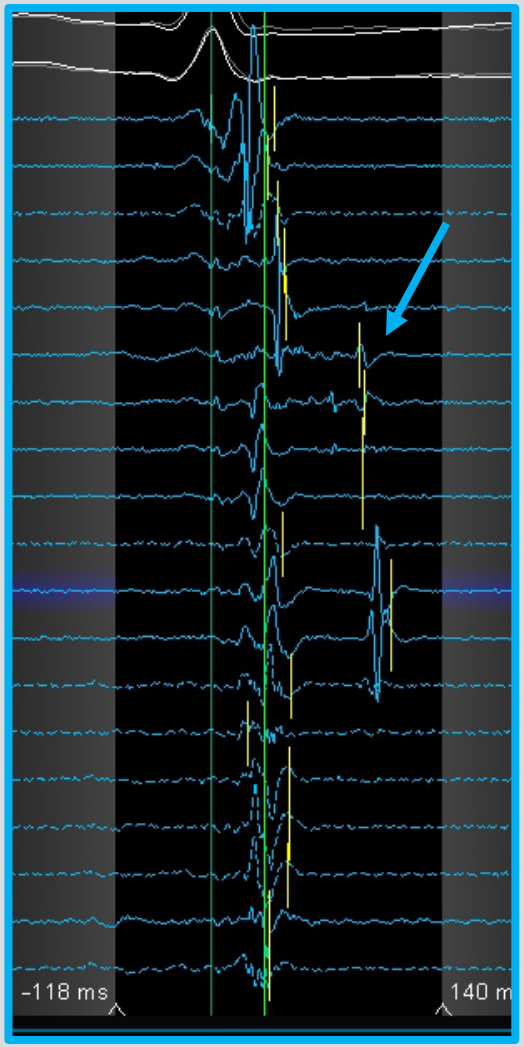
BIPOLAR AND UNIPOLAR, LATERAL WALL

LATE POTENTIAL MAP

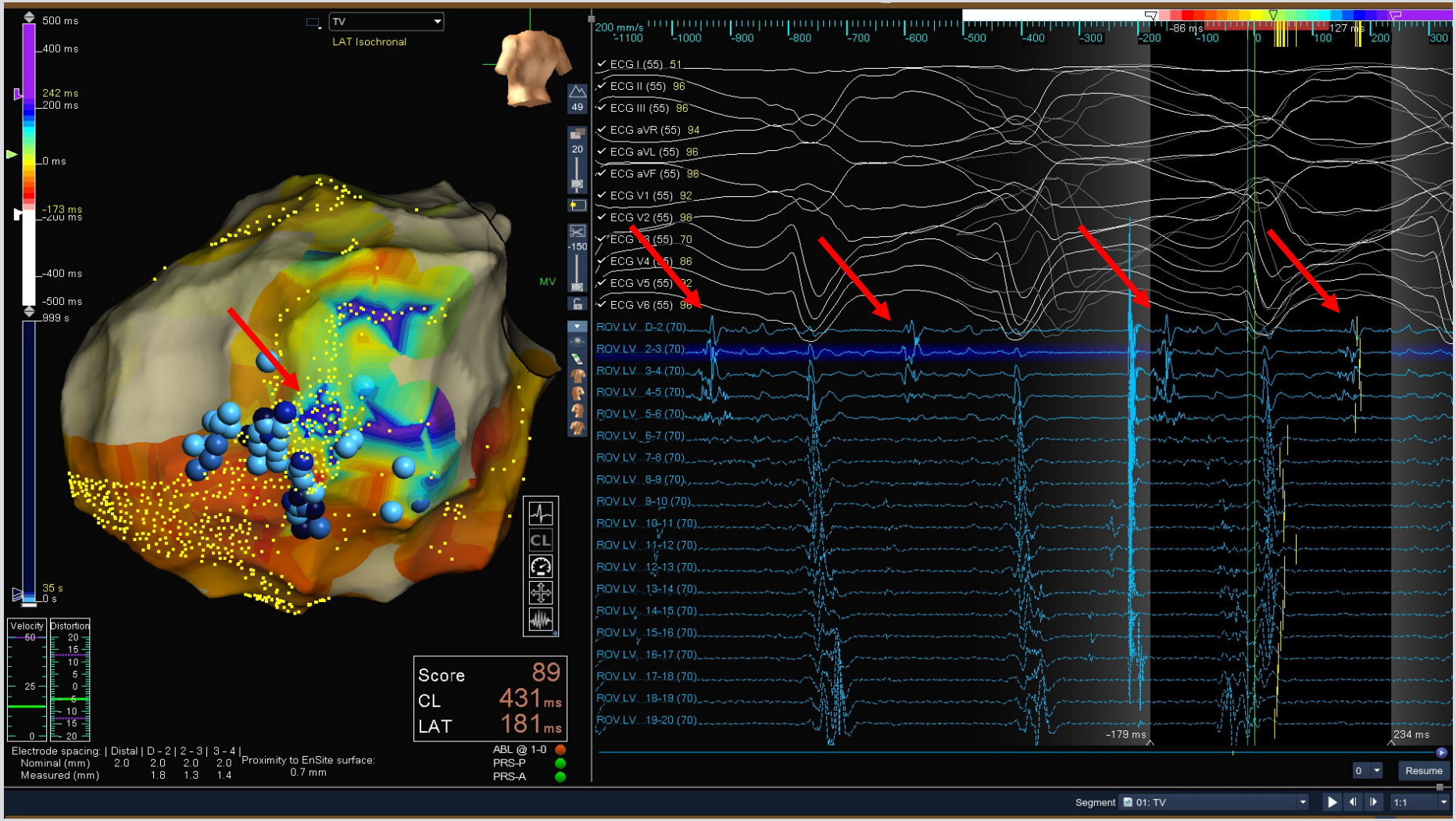
EPICARDIAL LAT AND BIPOLAR VOLTAGE: LPS



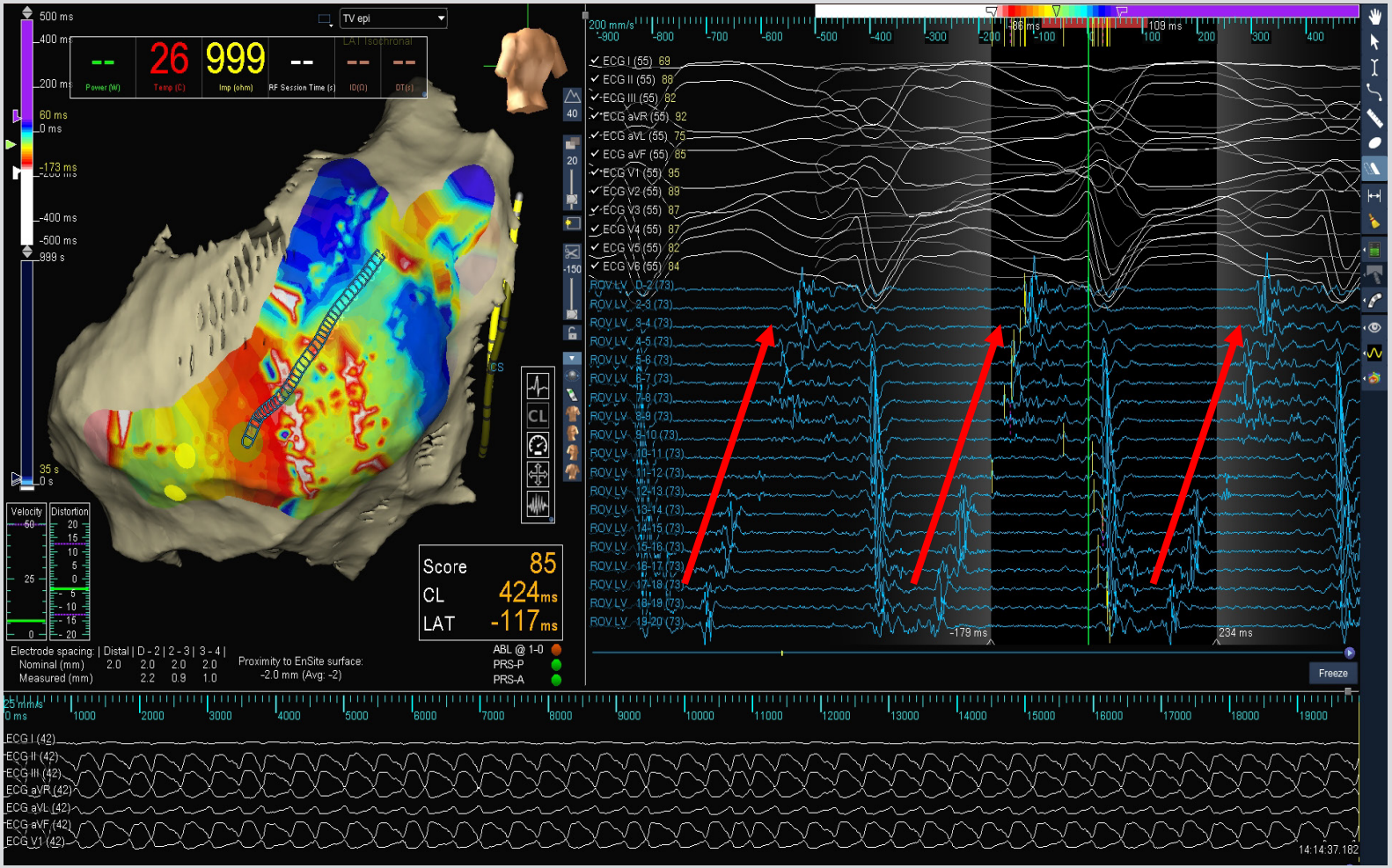




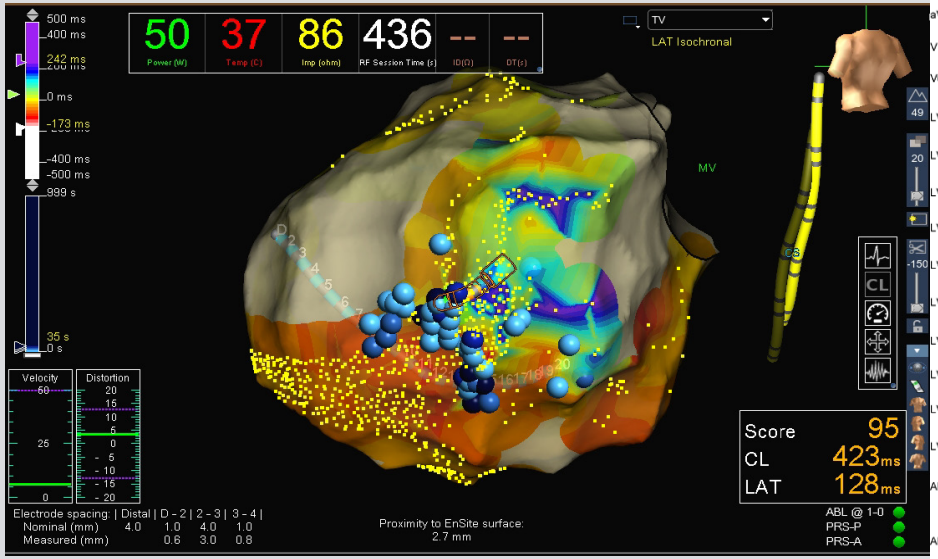
MID-DIASTOLIC PATTERN IN THE MID-LATERAL WALL

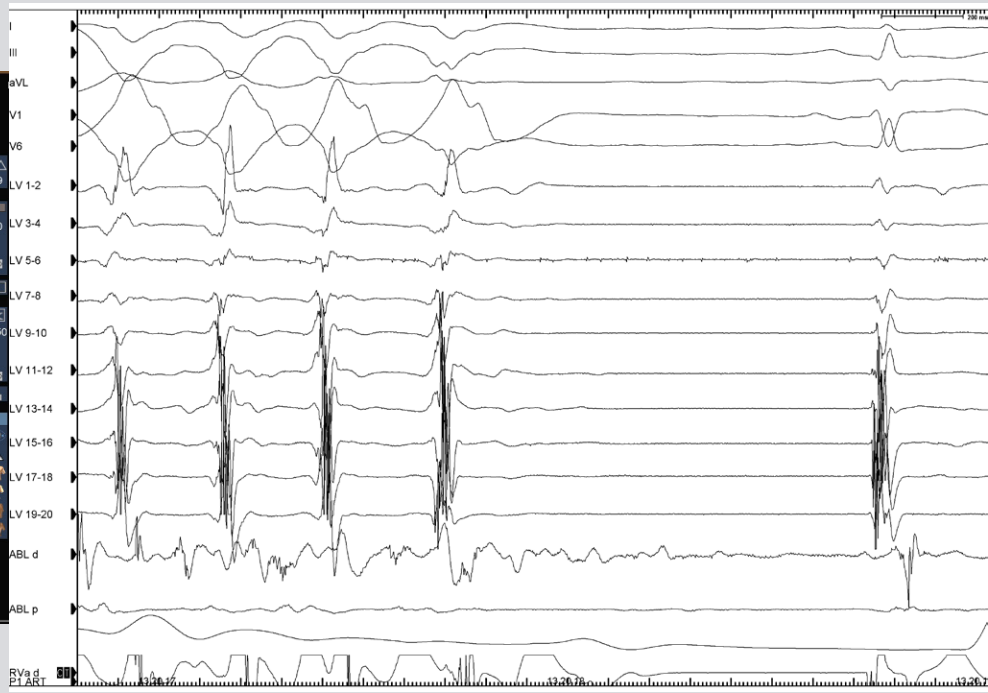


MID-DIASTOLIC PATTERN DURING VT

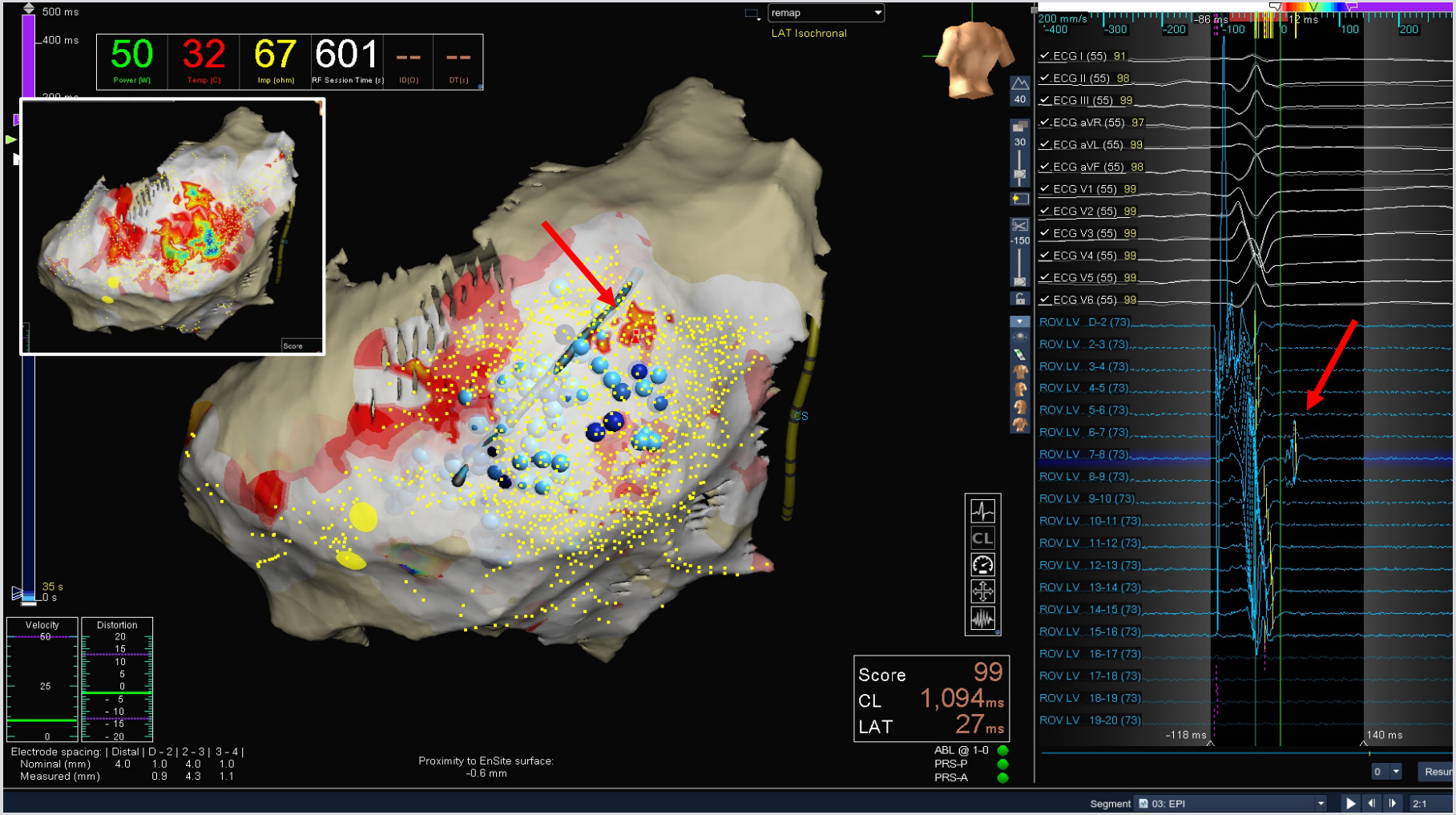


VT TERMINATION DURING RF AT 50W

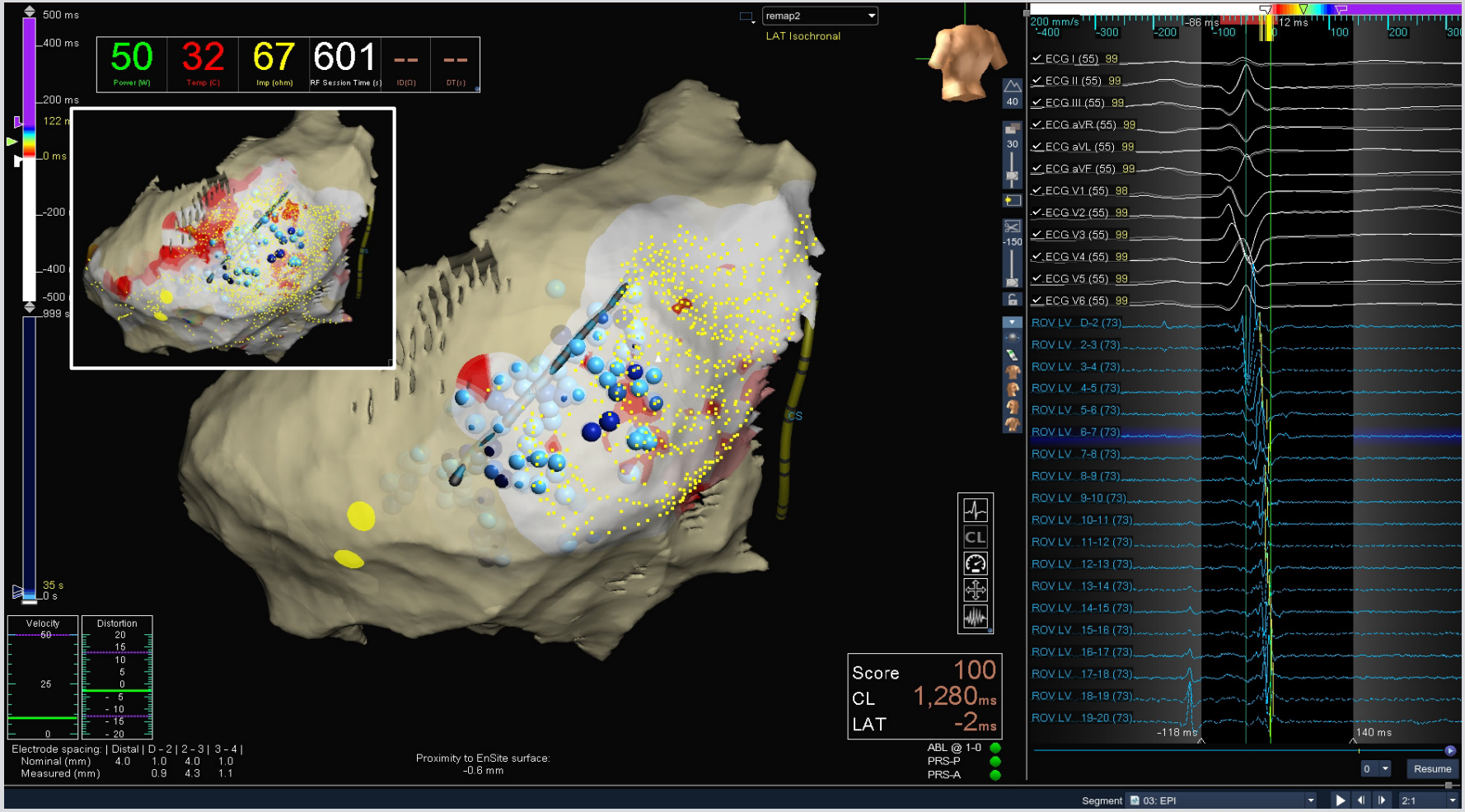




FIRST REMAP


remap
LAT Isochronal
50
32
67
601
Power (W)
Temp (C)
Imp (ohm)
RF Session Time (s)
Score
99
CL
1,094ms
LAT
27ms
ABL @ 1-0
PRS-P
PRS-A
Proximity to EnSite surface:
-0.6 mm
Electrode spacing: | Distal | D - 2 | 2 - 3 | 3 - 4 |
Nominal (mm) 4.0 1.0 4.0 1.0
Measured (mm) 0.9 4.3 1.1
Velocity
Distortion
ECG I (55) 91
ECG II (55) 98
ECG III (55) 99
ECG aVR (55) 97
ECG aVL (55) 99
ECG aVF (55) 98
ECG V1 (55) 99
ECG V2 (55) 99
ECG V3 (55) 99
ECG V4 (55) 99
ECG V5 (55) 99
ECG V6 (55) 99
-118 ms
140 ms
Segment 03: EPI

SECOND REMAP AFTER ANOTHER SET OF RF LESIONS



Conclusions

- Current features of the Precision software enable simultaneous acquisition from multielectrode catheters and the reconstruction of high density maps.

- Automatic annotation of the electrogram timing is provided by the Automap software signals from multielectrode cathaters, without the need for manual tagging.

- Better visualization of ablation parameters (including contact force) by Automark software

- Further improvement of accuracy in geometry reconstruction and catheter navigation by magnetic sensor.