



HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL

Ablation of Post PVI Flutter

Moussa Mansour, MD

Director, Atrial Fibrillation Program

Jeremy Ruskin and Dan Starks Endowed Chair in Cardiology

Associate Professor of Medicine, Harvard Medical School

Disclosures:

Consultant: Biosense-Webster, Abbott, Medical, Medtronic, Boston Scientific

Research Grants: Abbott, Biosense-Webster, Boston Scientific, Pfizer, Boehringer-Ingelheim

Equity: Newpace Ltd, EPD Solutions, Affera

December 7th, 2019



MASSACHUSETTS
GENERAL HOSPITAL

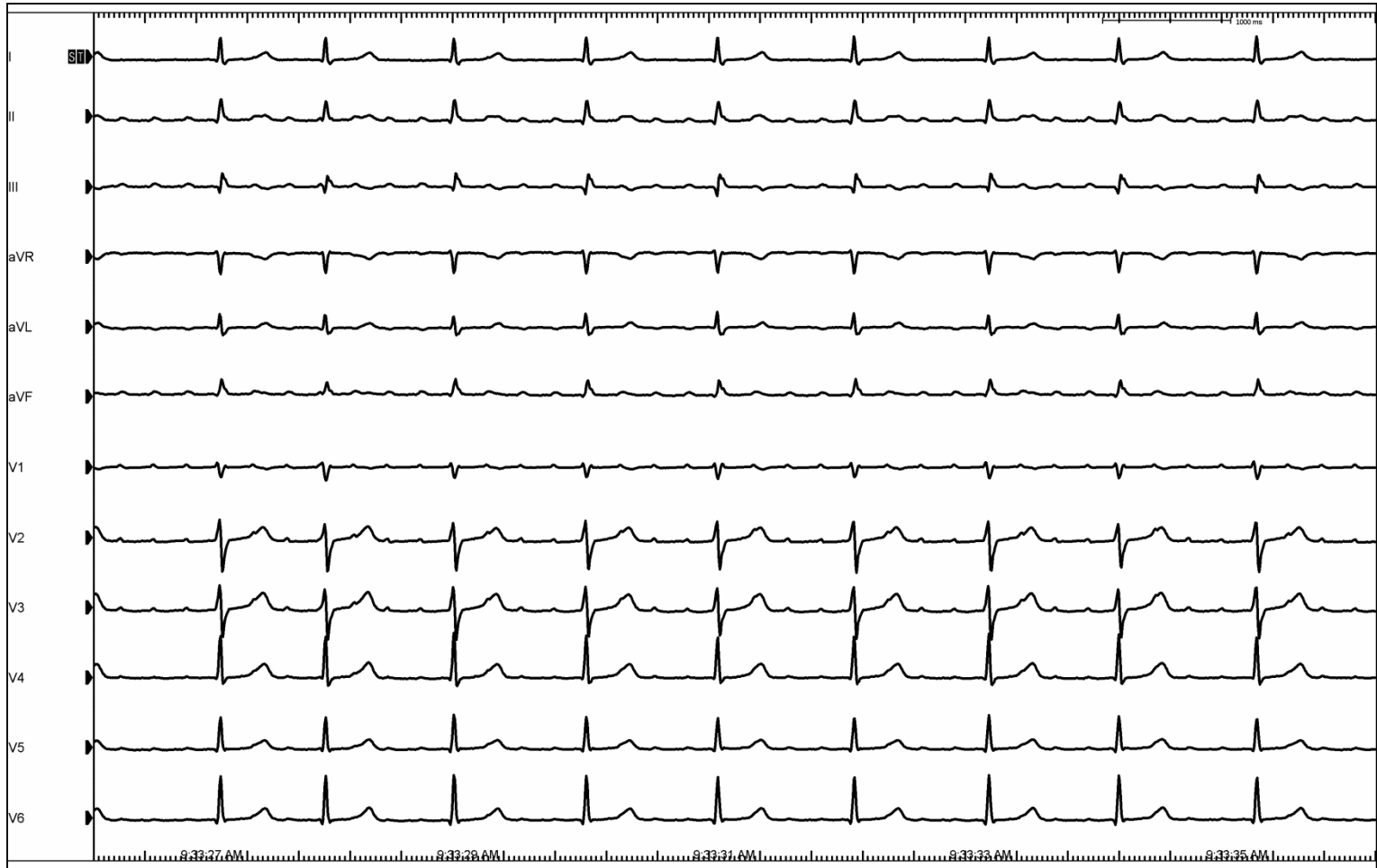
**CORRIGAN MINEHAN
HEART CENTER**

Patient

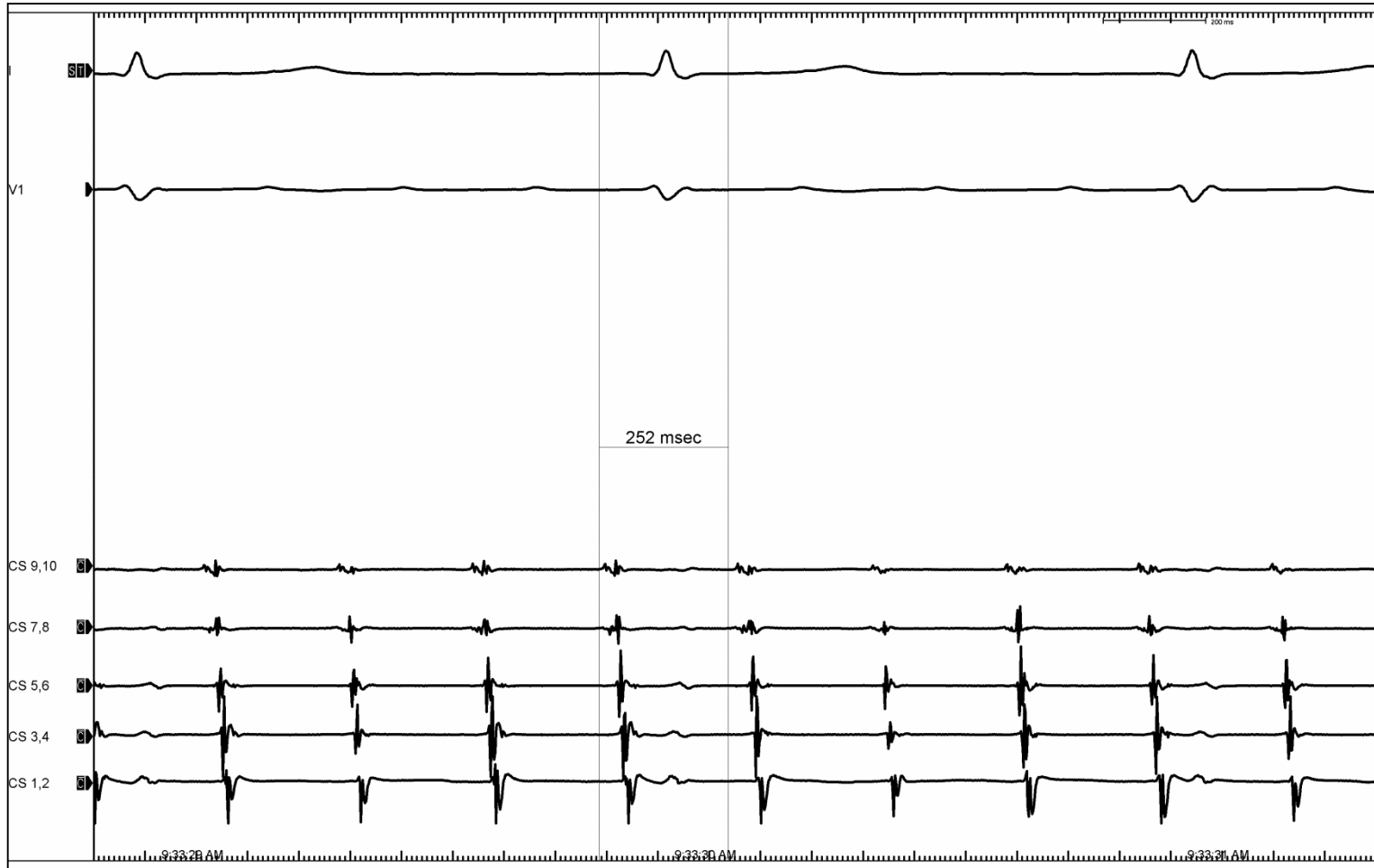
- 64 year-old with persistent AF
- Referred after 2 ablations 2 years prior :
 1. PVI
 2. Followed by re-isolation of the RPV, CTI flutter, MI flutter, and roof flutter 5 months after the first ablation
- Continues to have incessant atrial arrhythmias
- Failed multiple AA medications

- HTN
- CHADS score 1, CHADSVASC score 1
- Anticoagulation: warfarin
- EF: 60%
- Mild MR
- LA 48

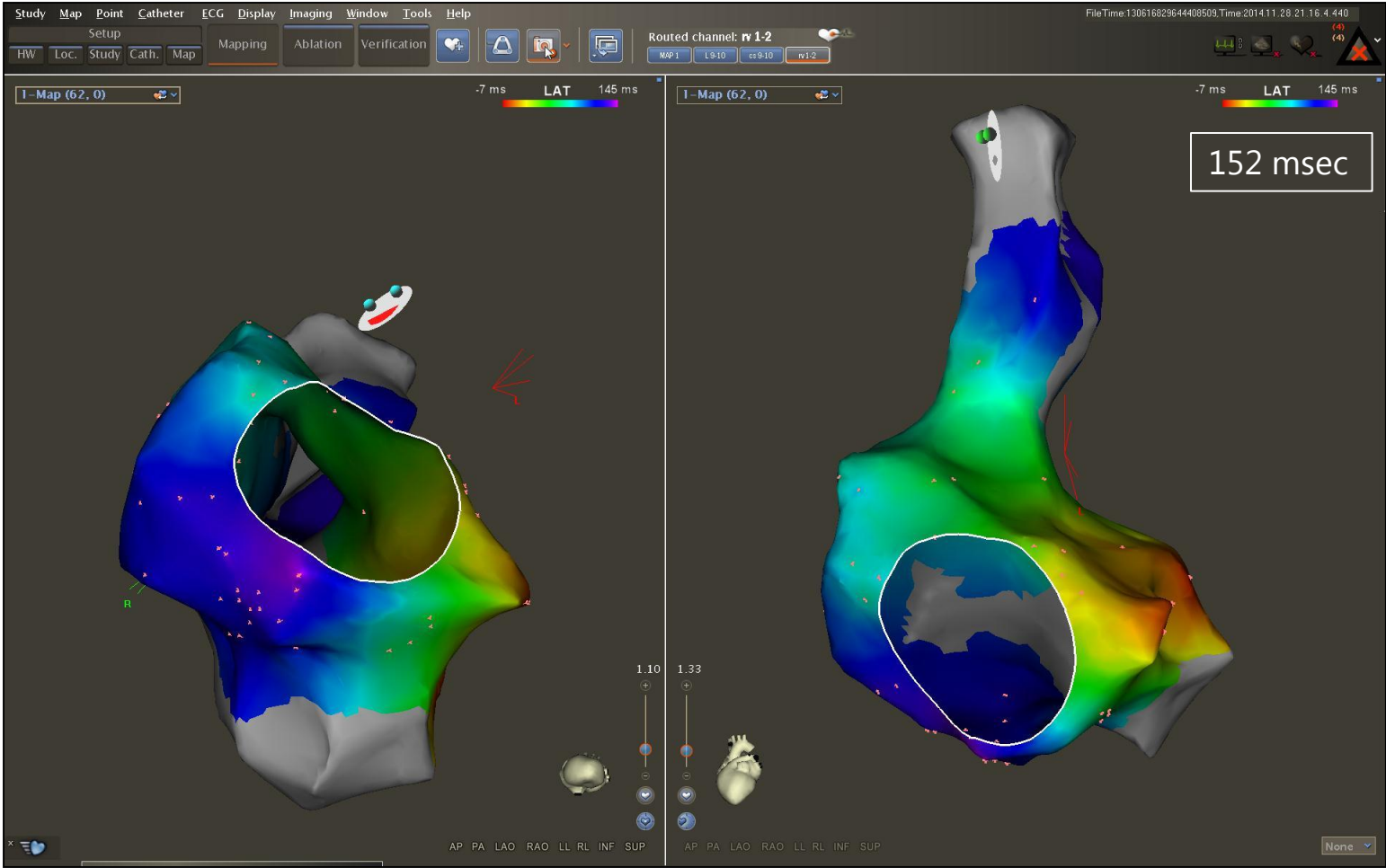
ECG on the Day of the Procedure



Intracardiac EG

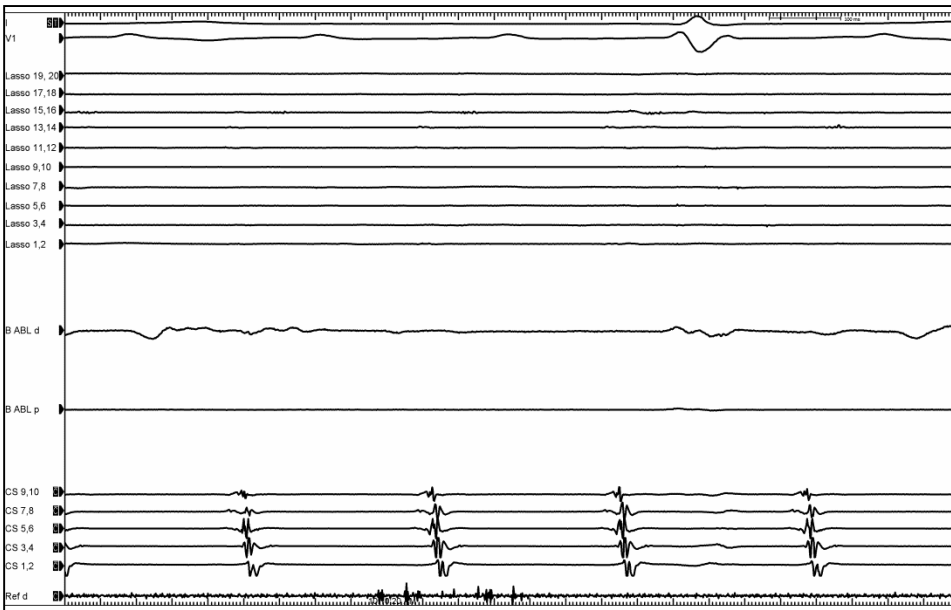


RA Map

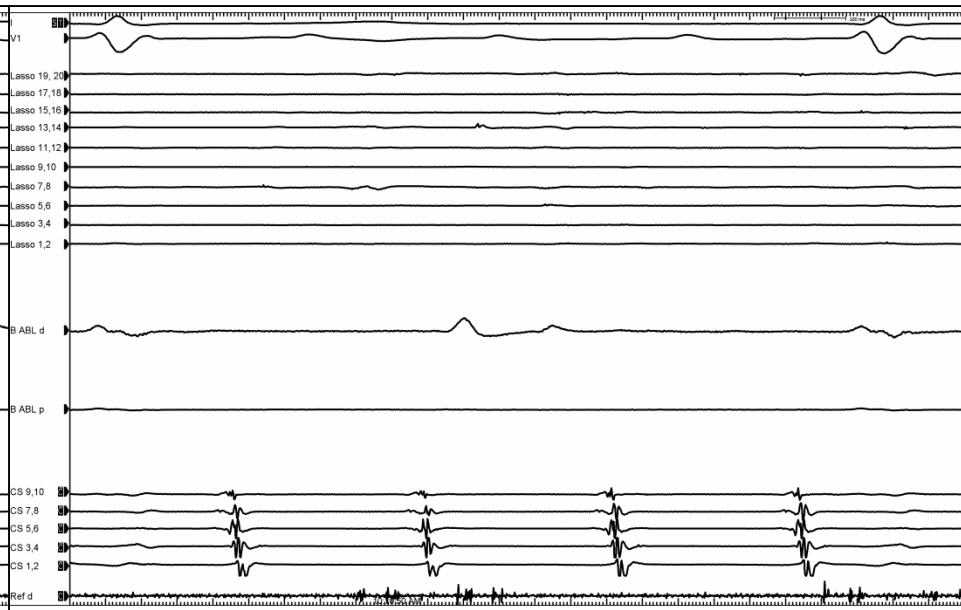


PV

LPV

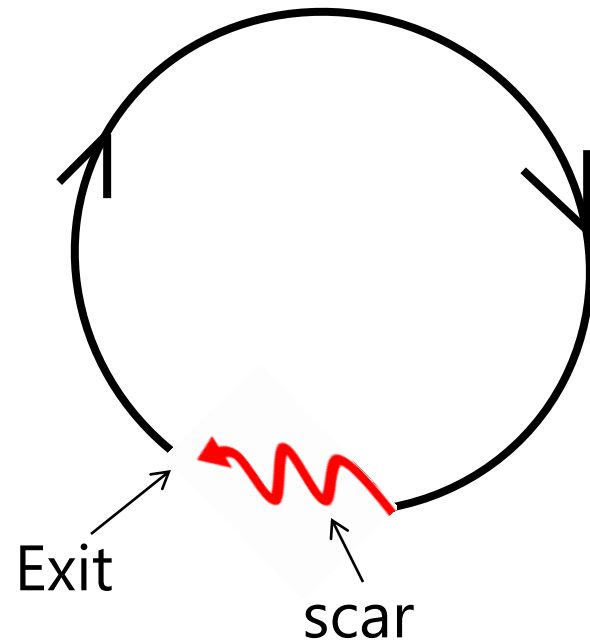


RPV

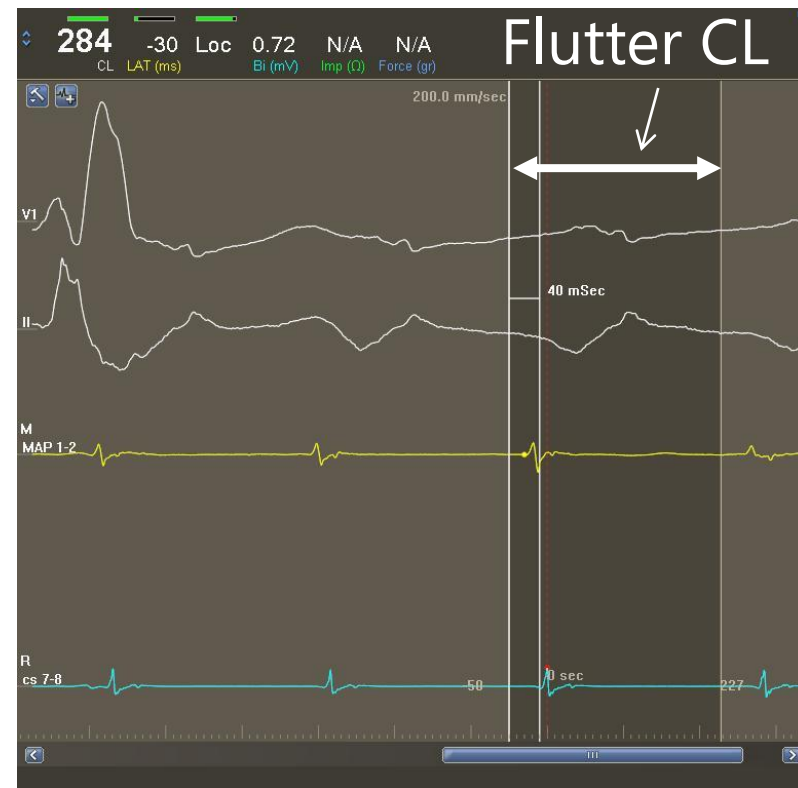
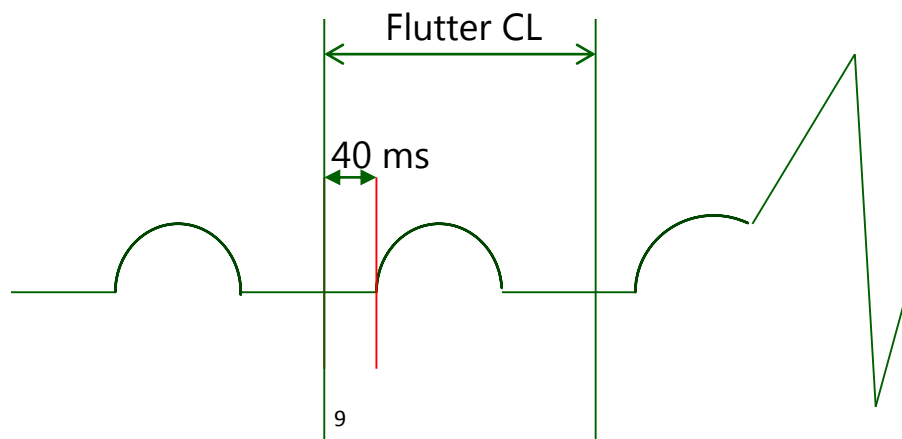


Mapping of Post PVI flutters

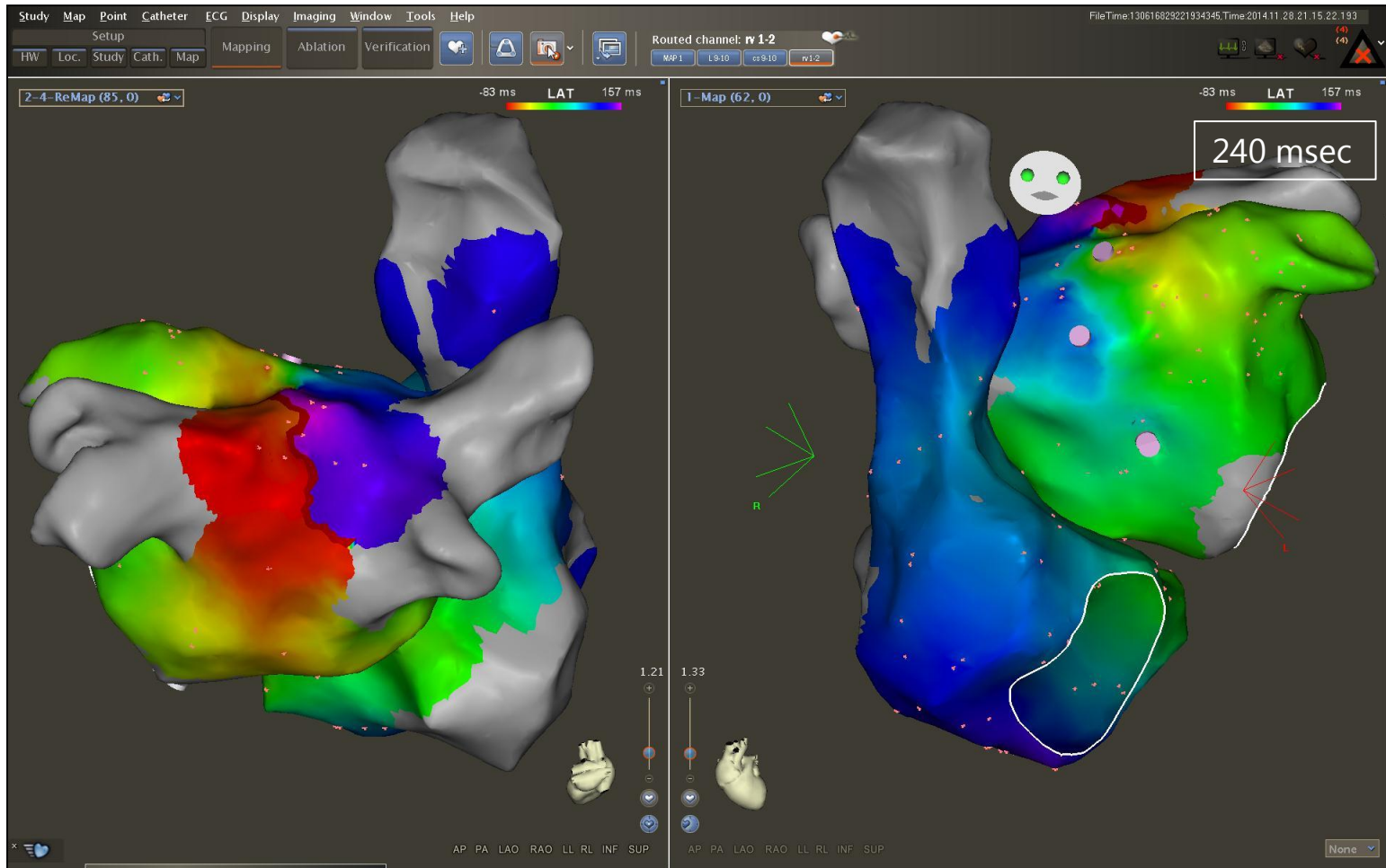
- Most are scar related
 - Involve an area of slow conduction
 - Commonly multiple flutters and unstable rendering entrainment challenging
- Similar mechanism to scar-related VT



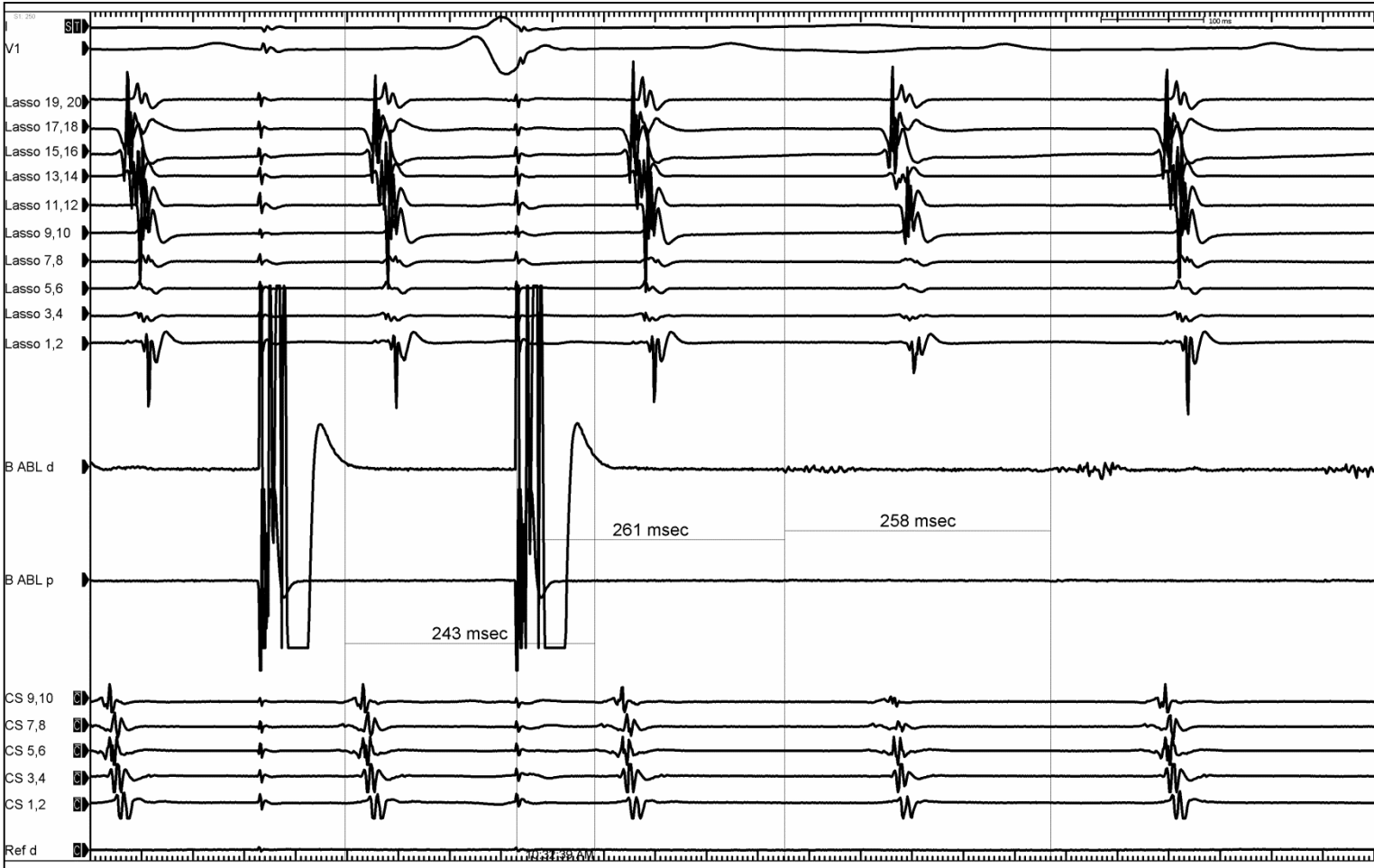
EAM Mapping Technique



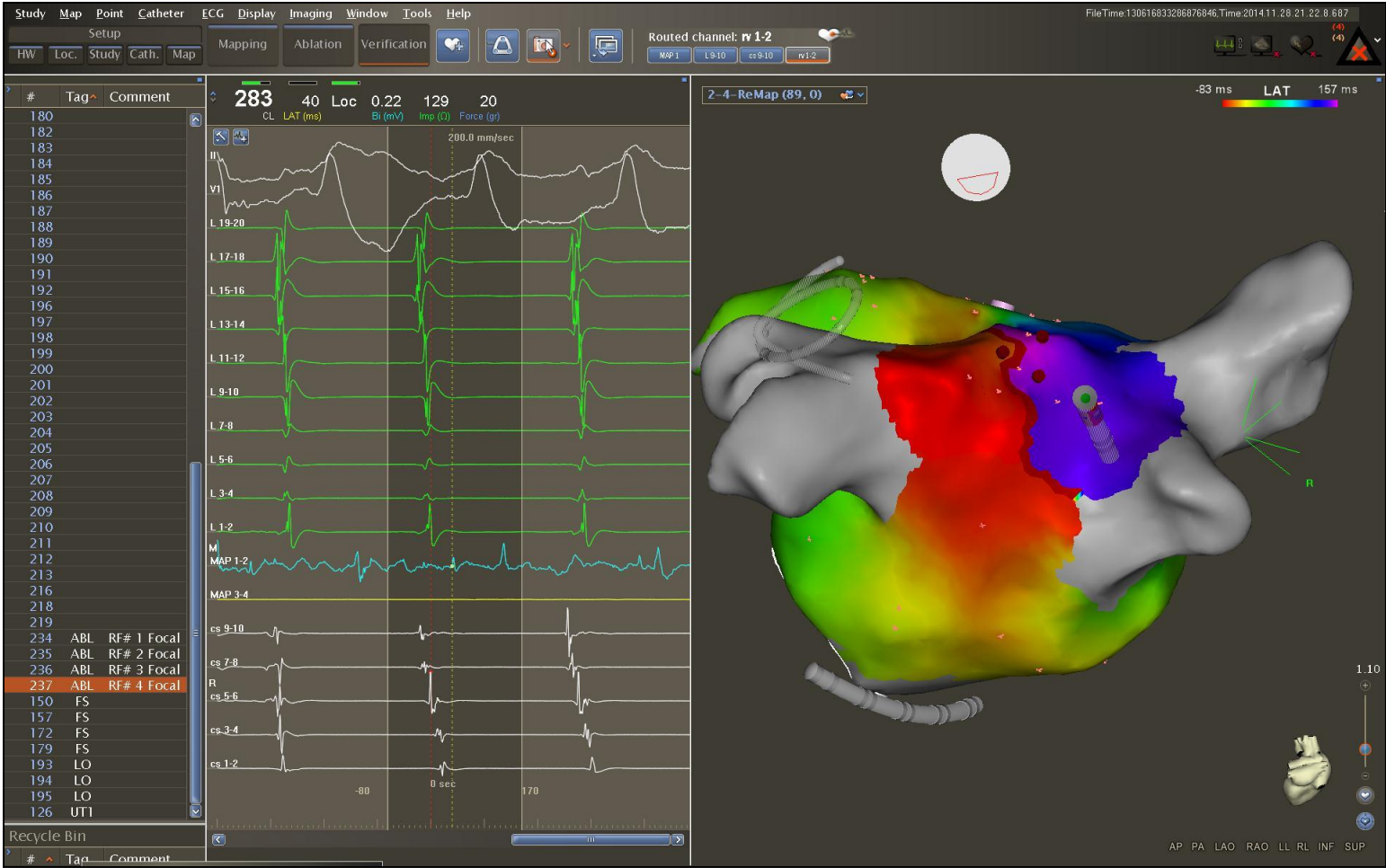
LA Map



Entrainment in the Posterior LA Wall



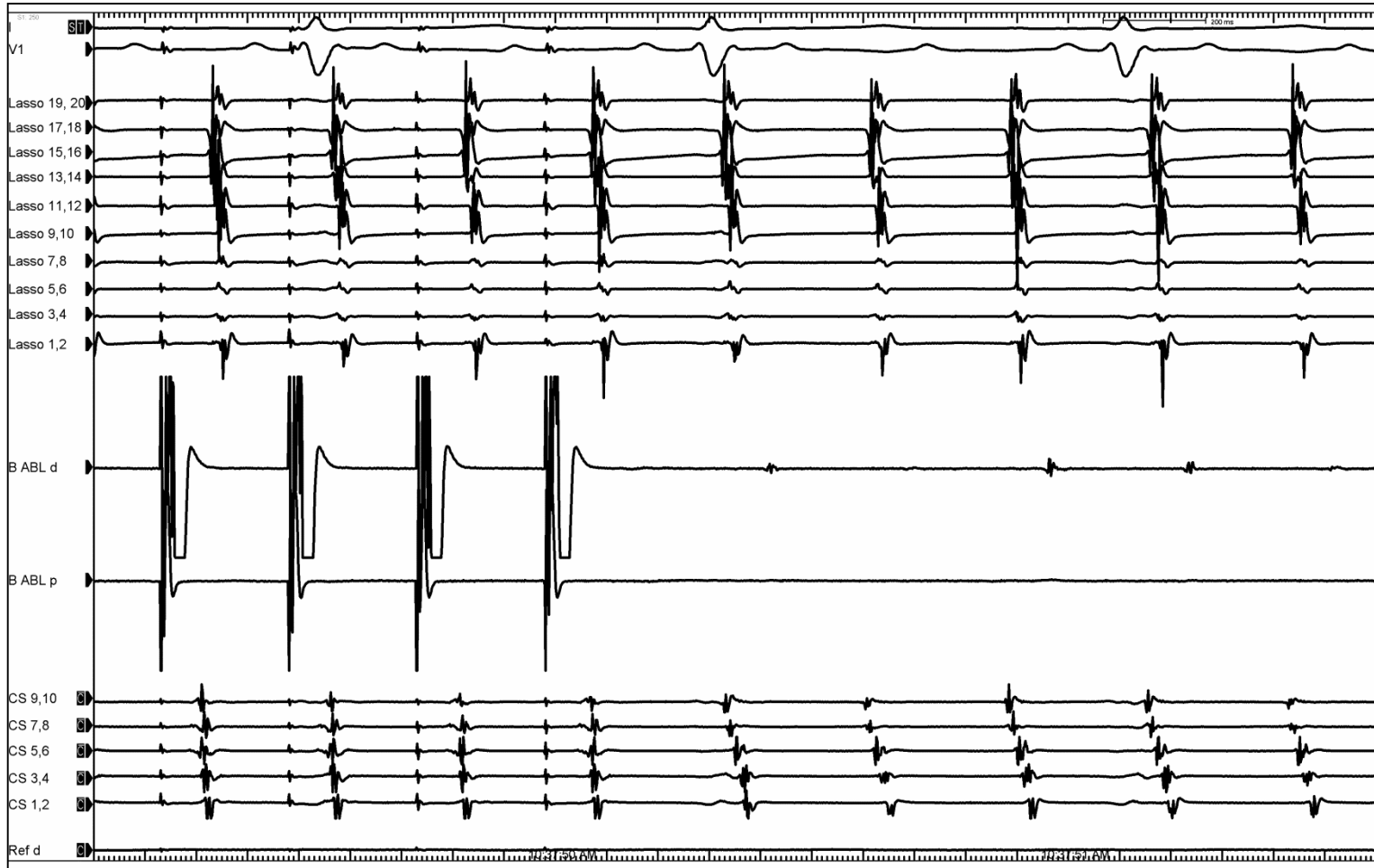
During Ablation



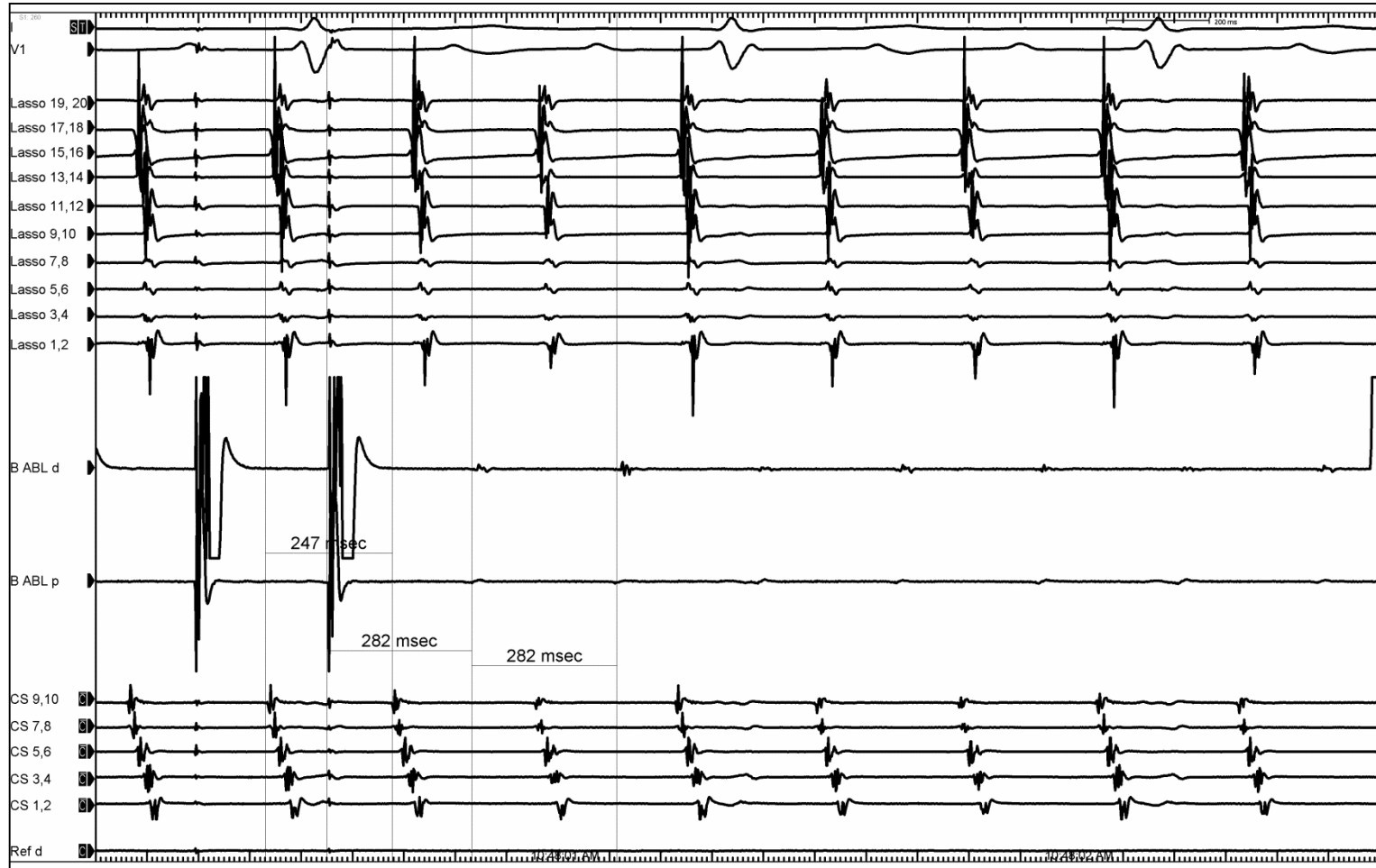
During Ablation



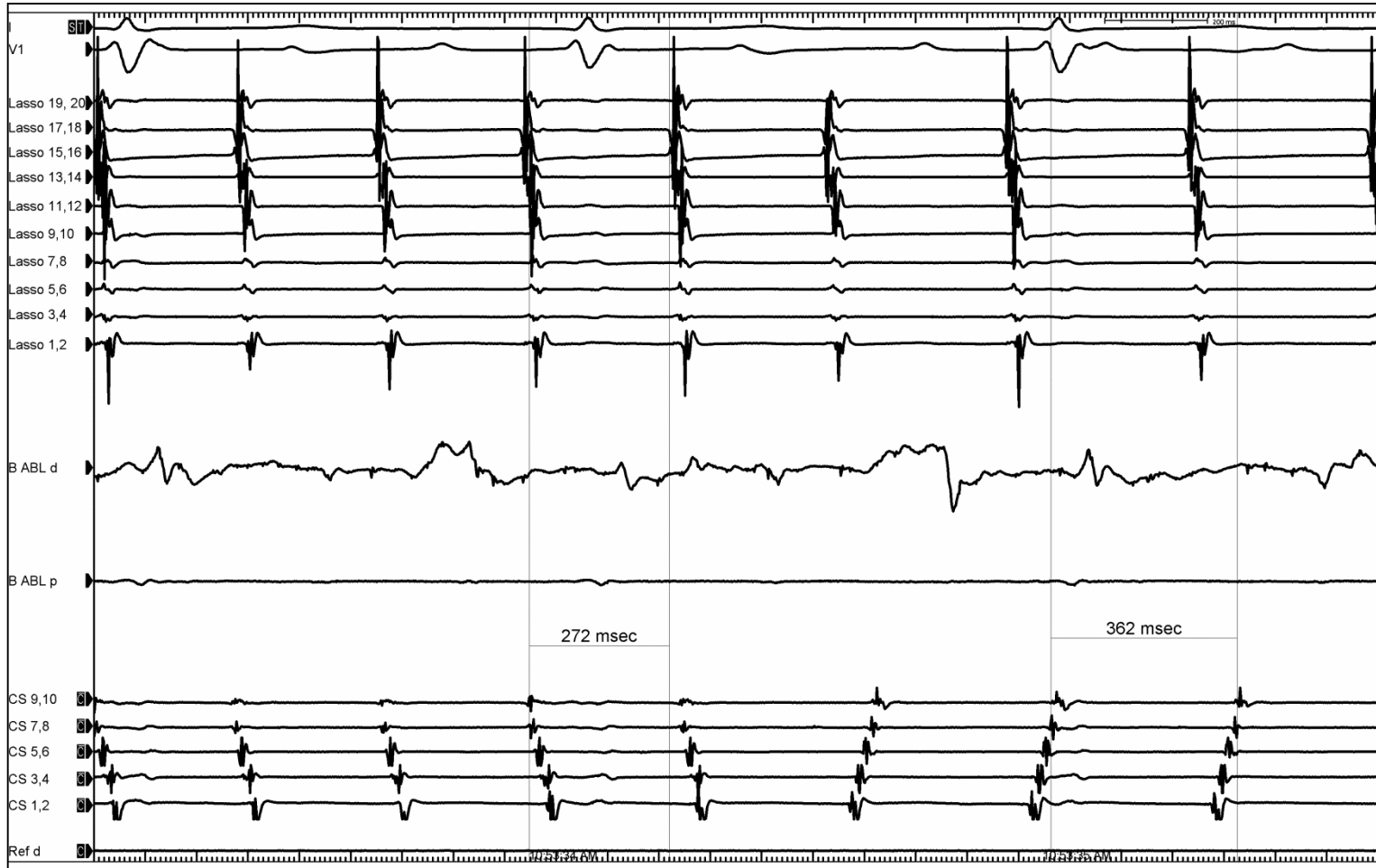
Entrainment from the Same Site that was in the Circuit earlier



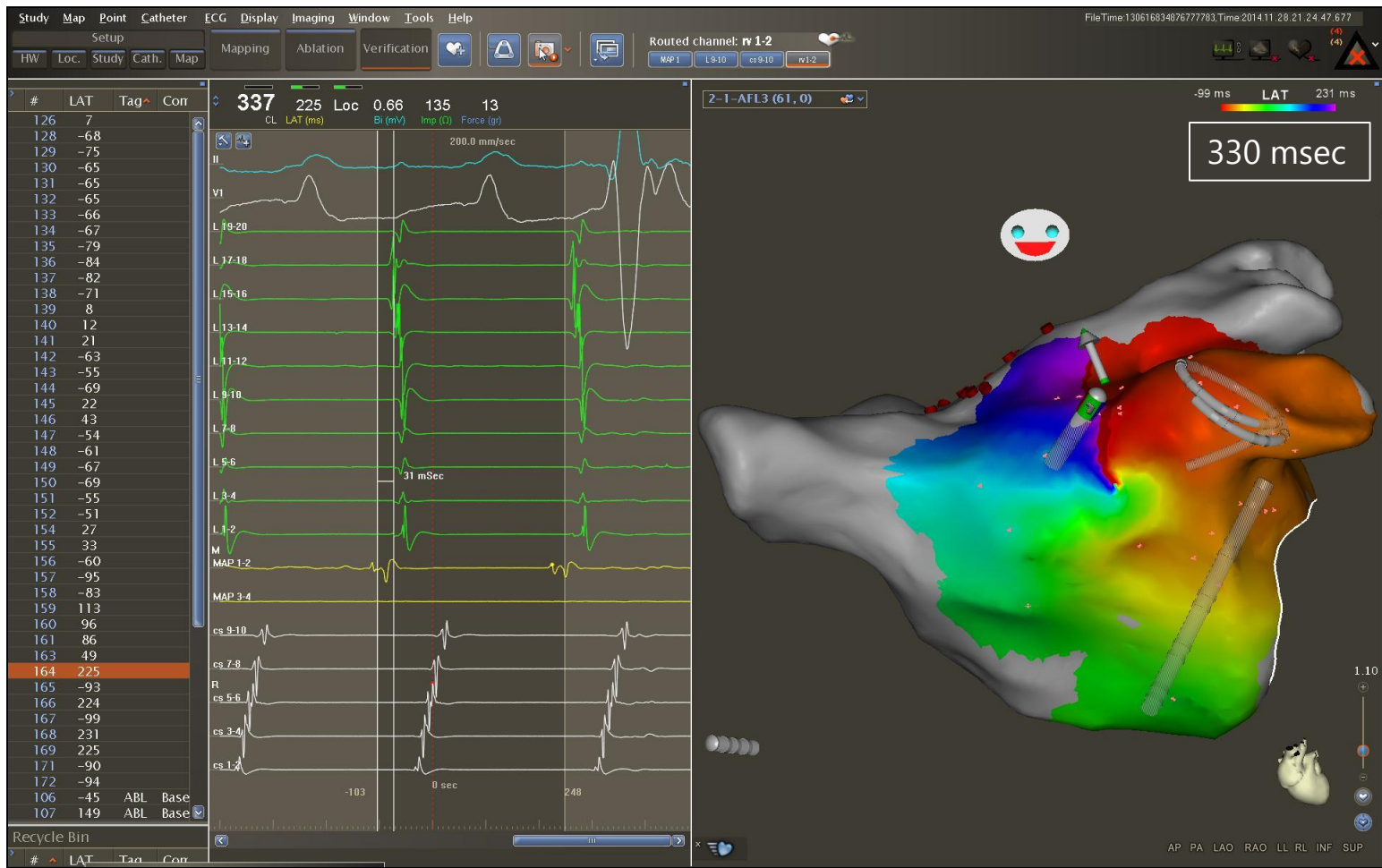
CTI Entrainment



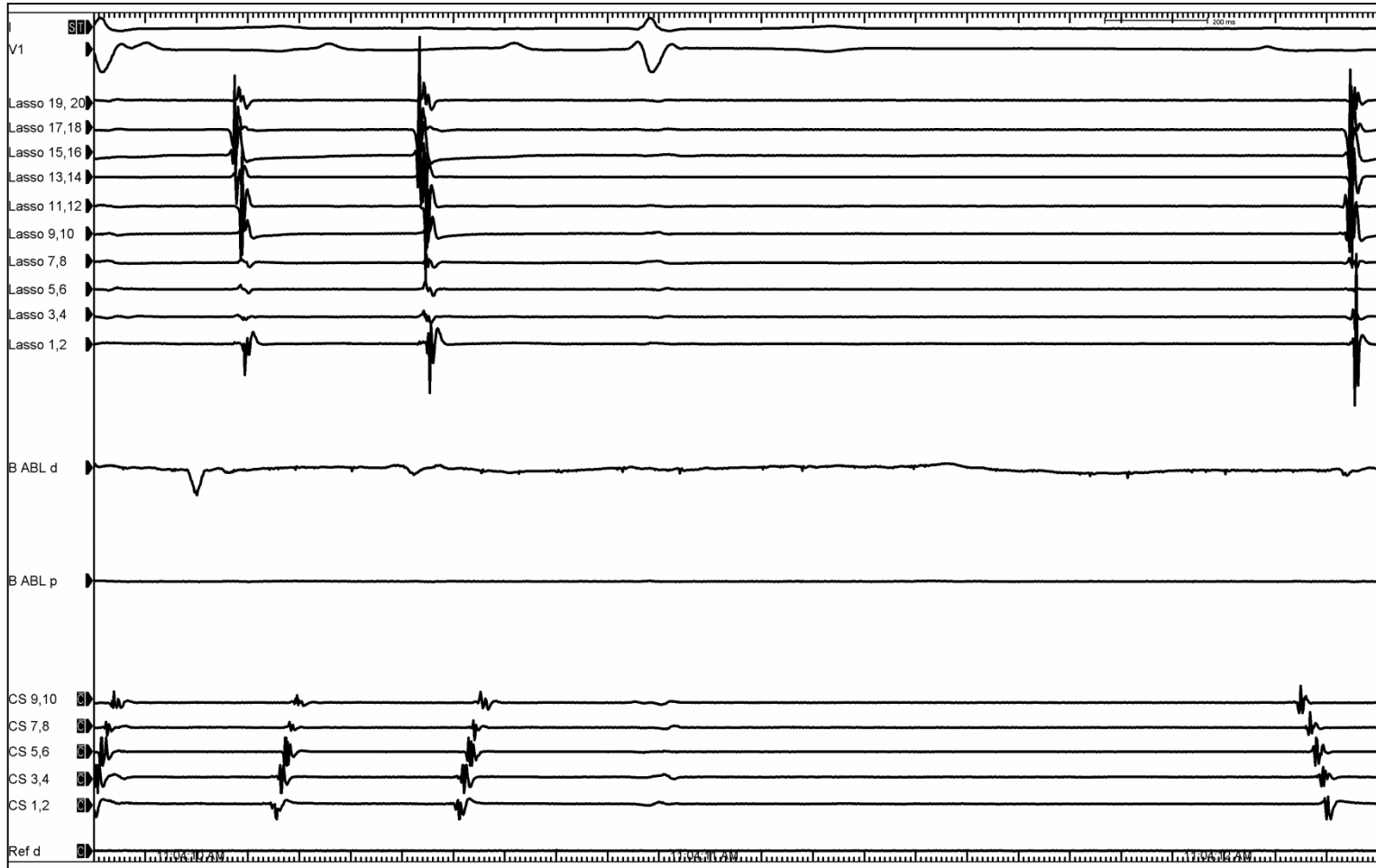
Ablation of Flutter 2 at CTI



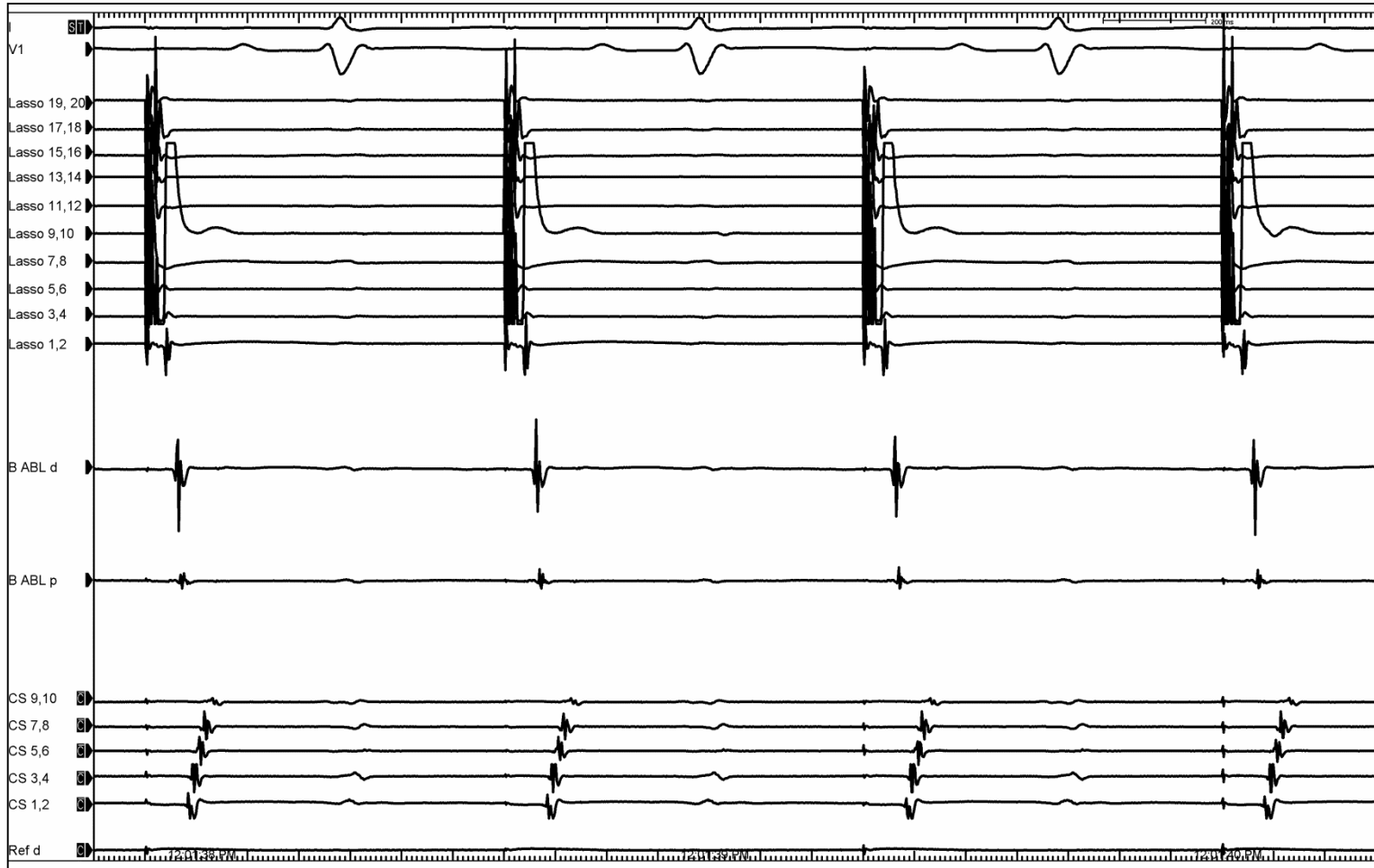
LA Map During Flutter 3



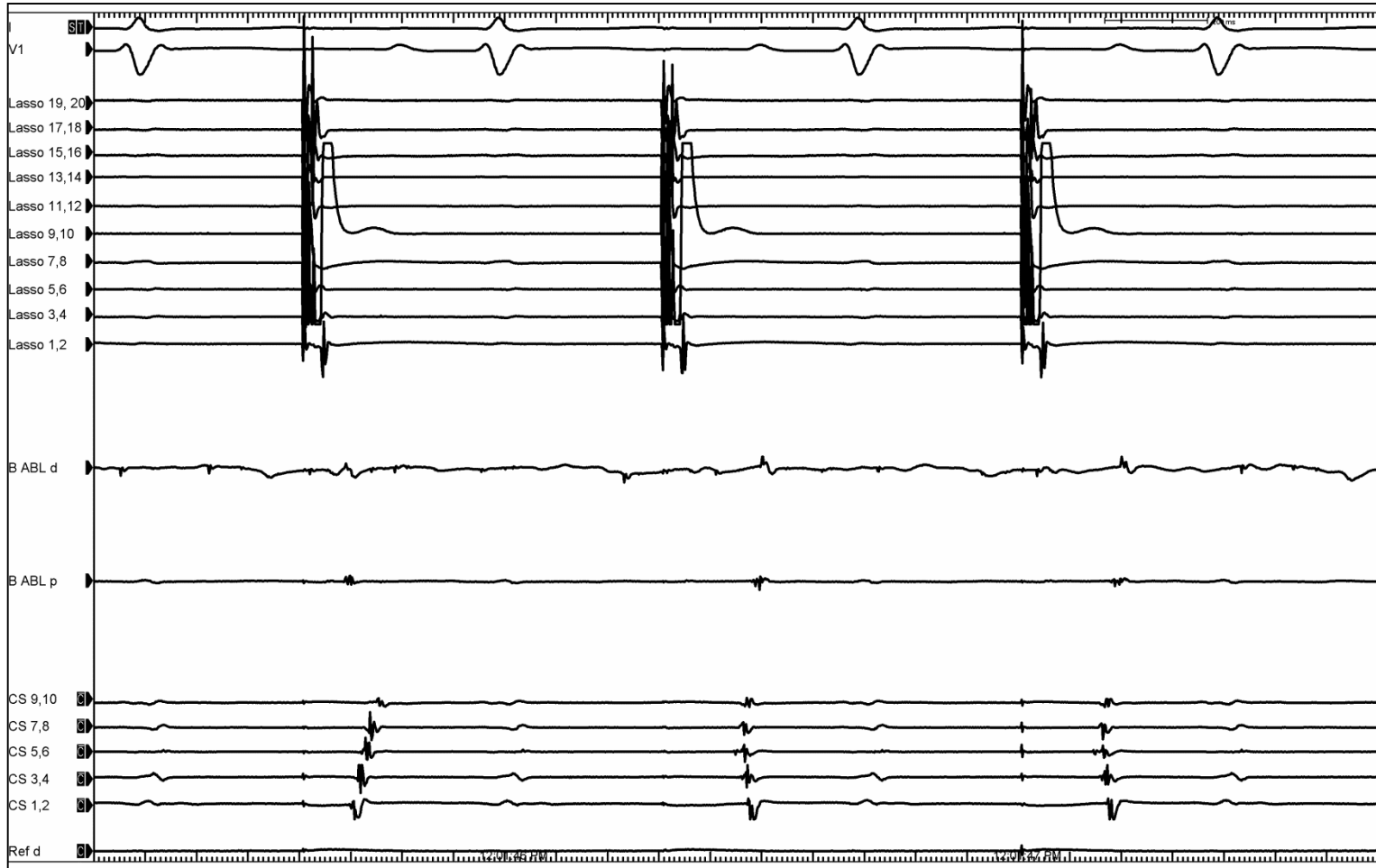
Ablation of Flutter 3



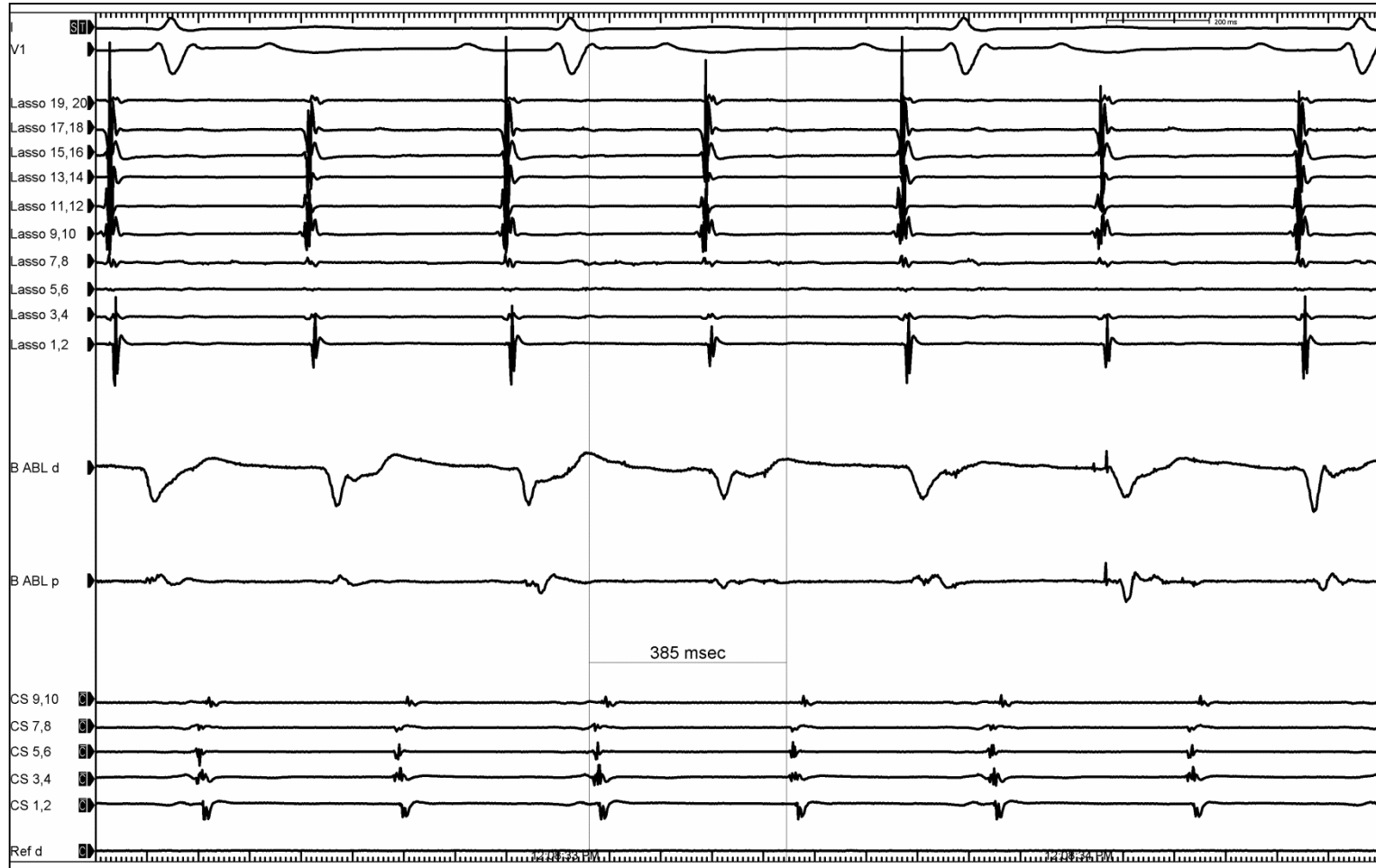
Mitral Isthmus Recovered from Prior Ablation



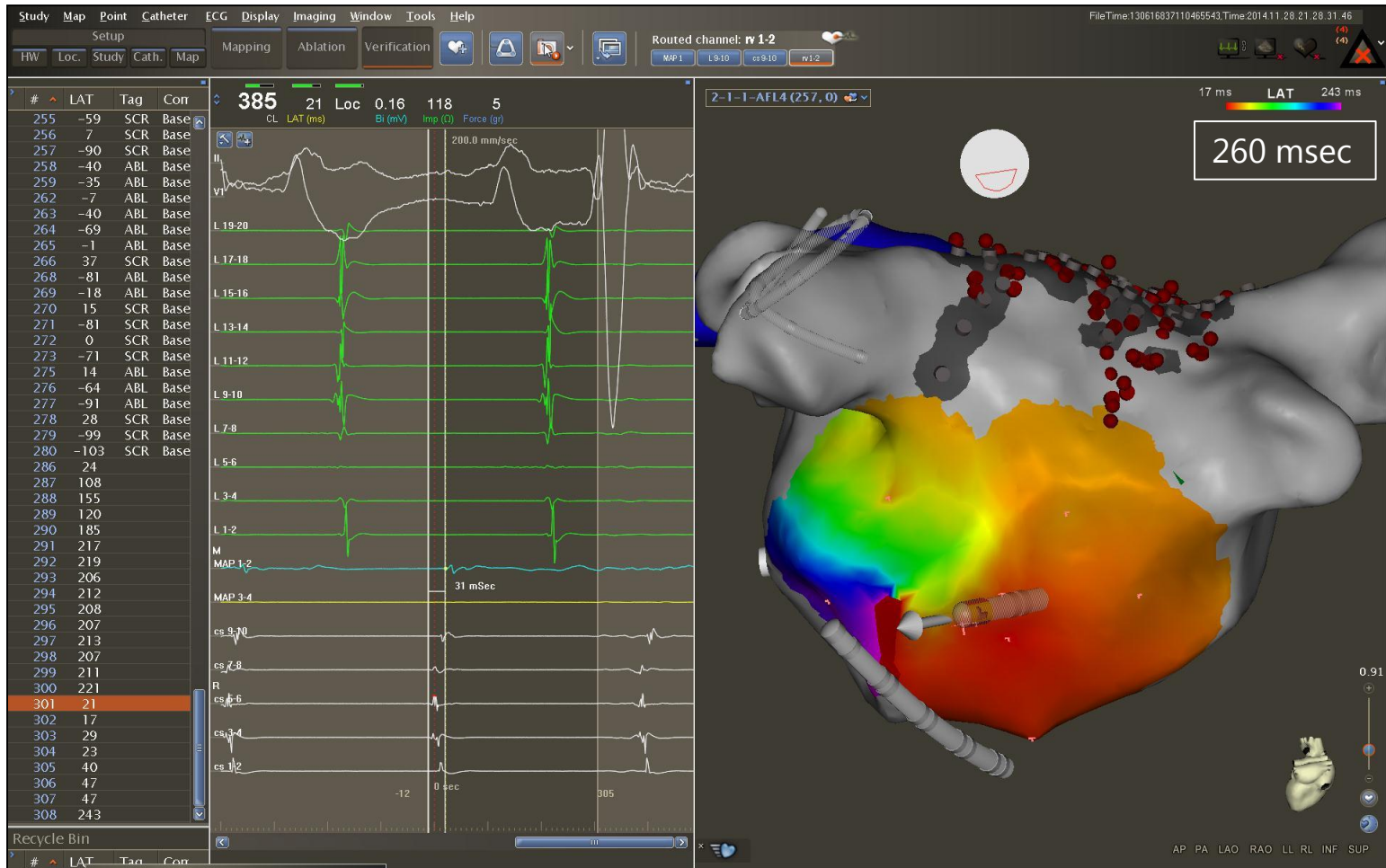
Ablation of the Mitral Isthmus



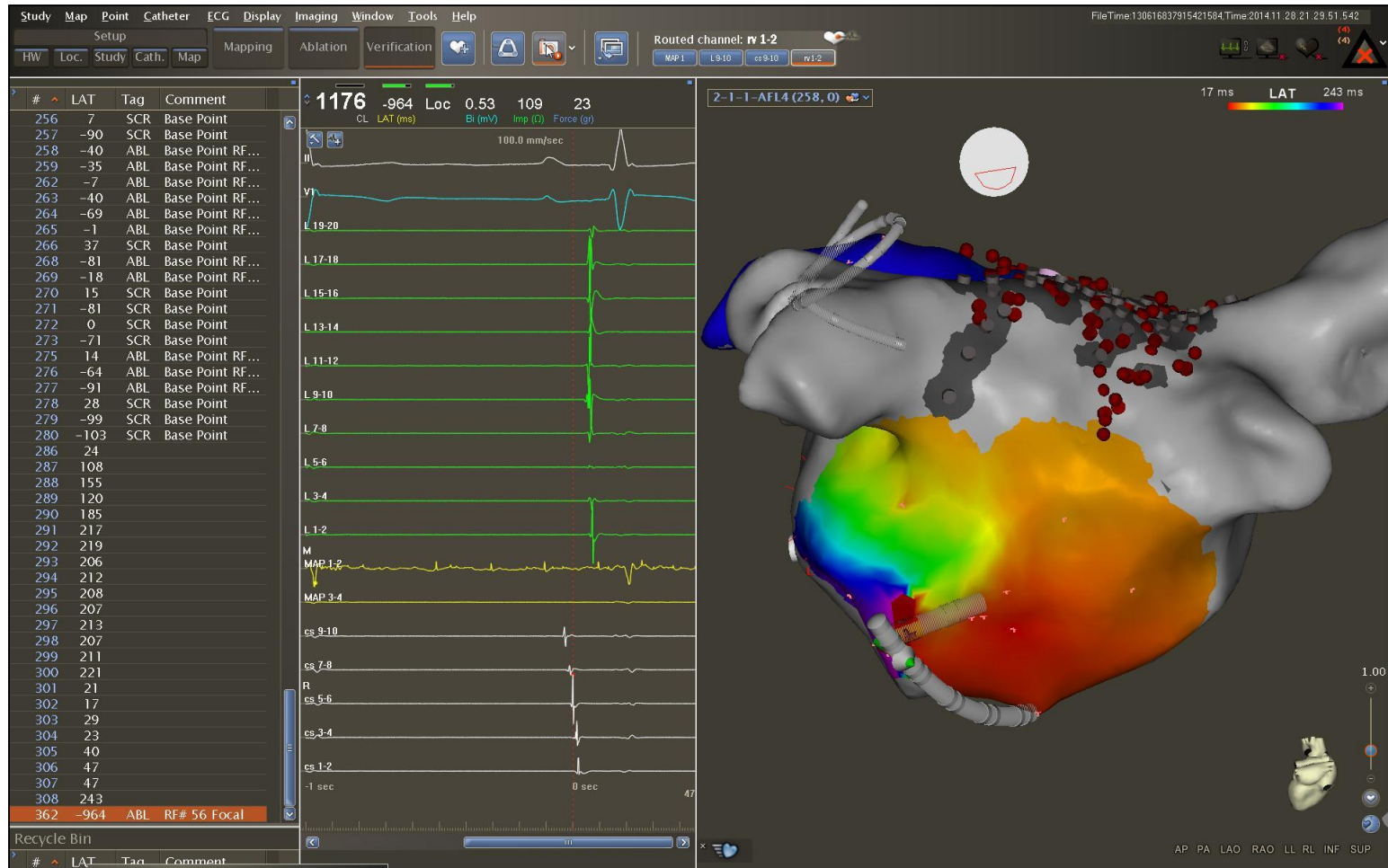
Flutter 4 Induced with Pacing



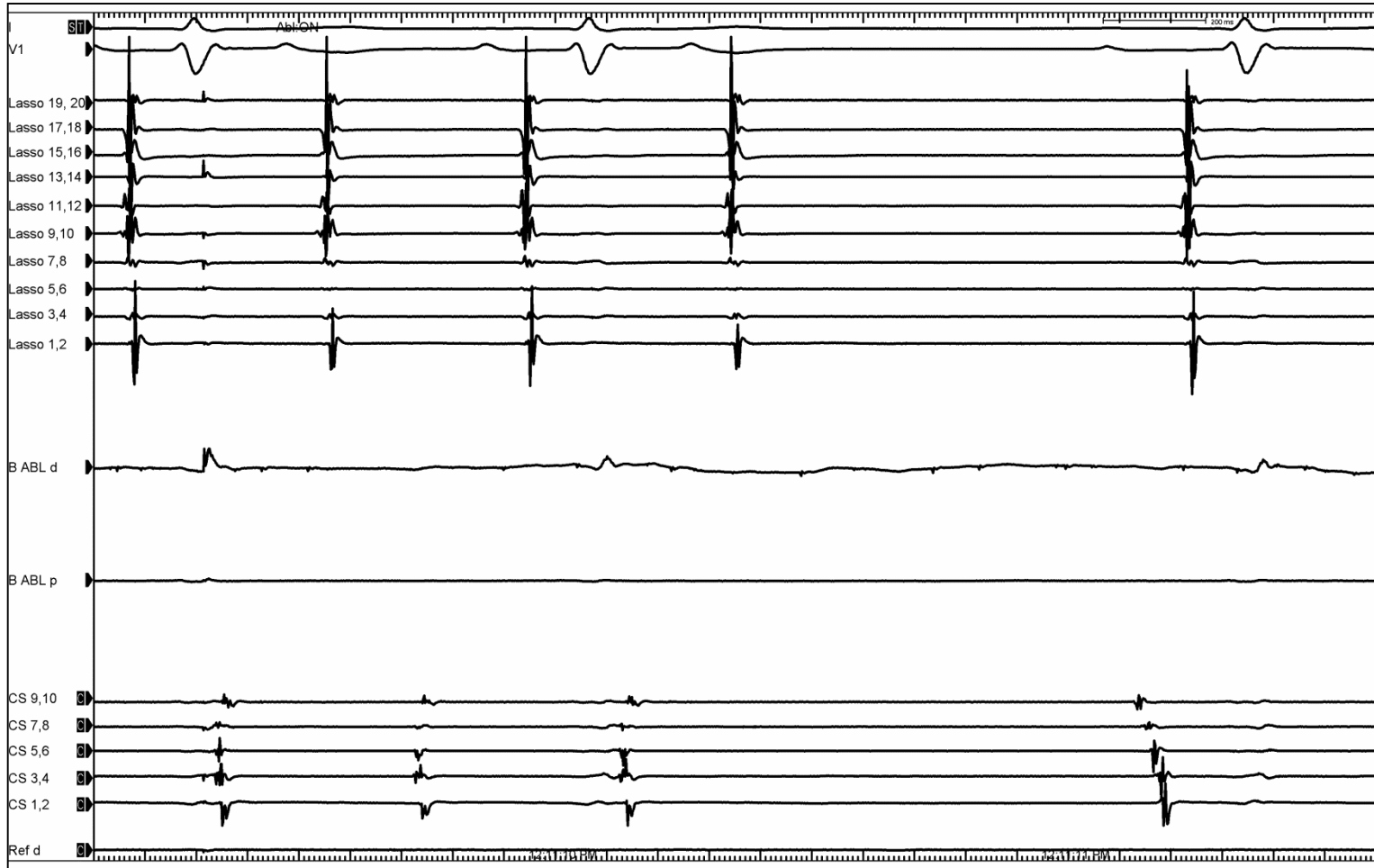
LA Map During Flutter 4



Ablation of Flutter 4



Ablation of Flutter 4



End of the Procedure

- No arrhythmia could be induced despite aggressive pacing and Isoproterenol
- Confirmation of the posterior LA wall ablation, MI, and CTI

Results of a Study

- 28 patients with prior catheter or surgical ablation
- Age 64 ± 10.7 years and 20/28 (71%) males
- EF $60.2 \pm 8\%$, LA 42.6 ± 5.4 mm
- 23/28 (82%) had persistent AF at the time of their first ablation
- In addition to PVI
 - Posterior wall isolation in 16/23 (69%)
 - Mitral isthmus ablation in 11/23 (48%)
 - CFAE ablation in 6/23 (26%)

Atrial Tachycardias

- 36 ATs in 28 patients (not including CTI flutters)
- ATs per patient: 1.3 ± 0.6 (range 1-3)
- The mean AT CL was 282 ± 60 ms
- Mitral isthmus flutter 13/36 (36%)
- Roof AT in 11/36 (30.5%)
- Other ATs were localized to the anterior, lateral and posterior LA walls (10/36, 28 %)
- A minority of the ATs originated from the RA (2/36, 5.5%)
- Map covered $94 \pm 6.5\%$ of the AT CL

Ablation

- Fractionated low amplitude EGM occurred at a mean distance of 1.8 ± 1.2 mm from the "early-meets-late" line
- Ablation at these sites resulted in termination of 34/36 AT's (94%)
- Mean number of RF ablations needed for AT termination was 6.2 ± 9.6

Entrainment

- In 10/36 AT's (28%) entrainment was not performed and RF energy was delivered at sites exhibiting pre-P wave fractionated electrograms near the "early-meets late" sites
- In 6/36 AT's (17 %) entrainment was not successful due to significant noise or inability to capture from site
- There was no difference in the rate of termination of ATs between the cases in which entrainment was performed and cases in which entrainment was not performed

Follow up

- Duration 15.1 ± 7.6 months
- One-month ambulatory monitors at 3, 6, and 12 months
- 22 /28 patients (79%) were free of atrial arrhythmias
- 6 patients with brief recurrences, the duration of the arrhythmia was short and no patient required a repeat ablation or change in medication

Conclusion

- The simple annotation is based on the similarities between the mechanisms of AT occurring after AF ablation and scar-related VT
- It allows the rapid identification of the critical isthmus of the arrhythmia using EAM and without reliance on entrainment
- Guided by this technique, the critical isthmus was easily identified and ablation terminated the tachycardia in 94% of the cases