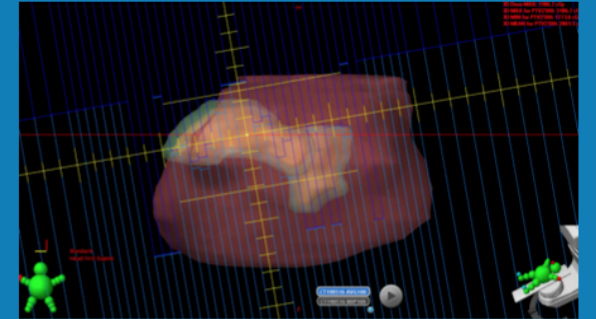


# Simplified Workflow to Improve the Precision of Non-invasive Radio-ablation of Ventricular Tachycardia Storm

**Gordon Ho, MD, FACC, FHRS\***



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## **Problem:**

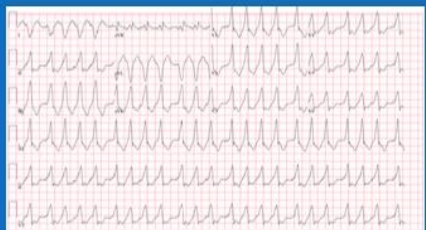
The radio-ablation workflow requires **multiple complex steps** to plan and deliver therapy by a **large multi-disciplinary team**.

## **Hypothesis:**

A simplified workflow utilizing **12-lead ECG mapping** and **respiratory gating** enables efficient and effective non-invasive VT therapy

# Methods: Simplified Workflow for Non-invasive Ablation

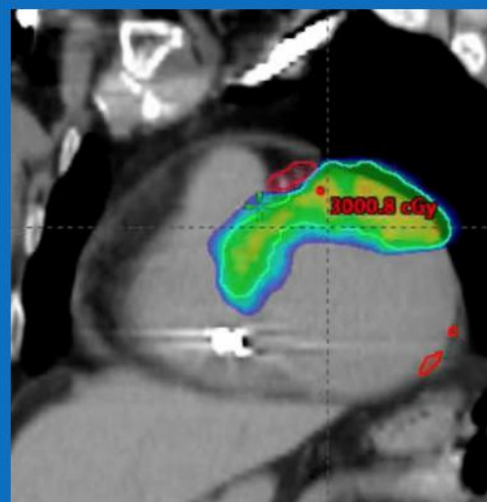
## 1) 12-Lead ECG Mapping



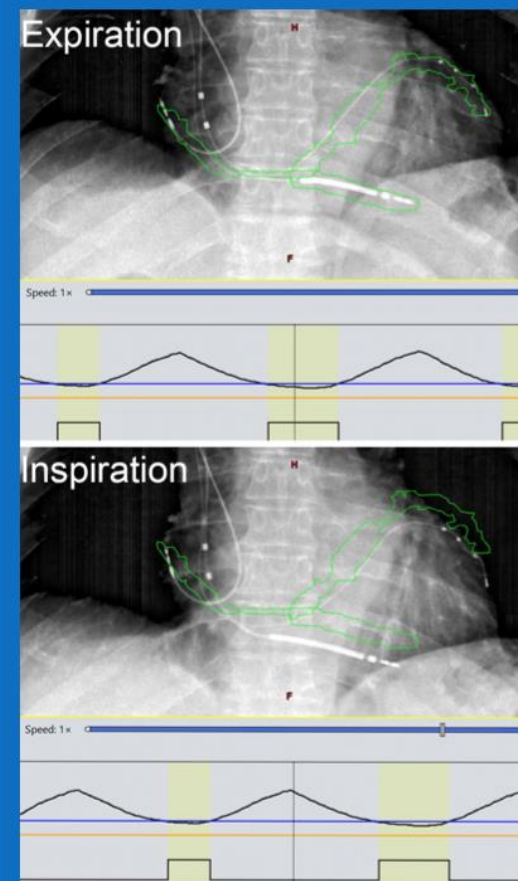
## 2) Cardiac CT Contouring



## 3) Simulation on Respiratory-Gated CT



## 4) Respiratory-Gated Radiotherapy Delivery







# Results

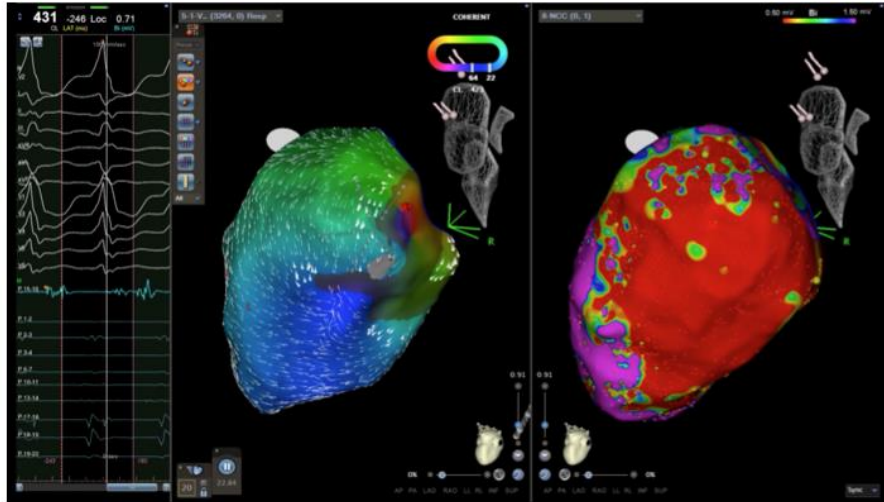
# Results: 12-lead ECG Mapping is More Efficient than Standard Invasive Mapping

## Standard Invasive Mapping

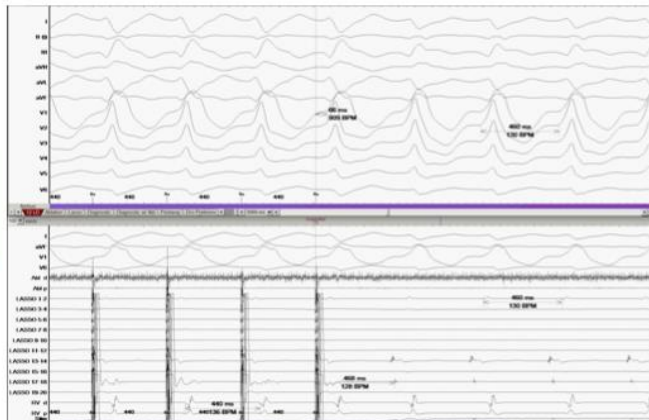
6-7 hours

Activation Mapping

Voltage Mapping



Entrainment Mapping

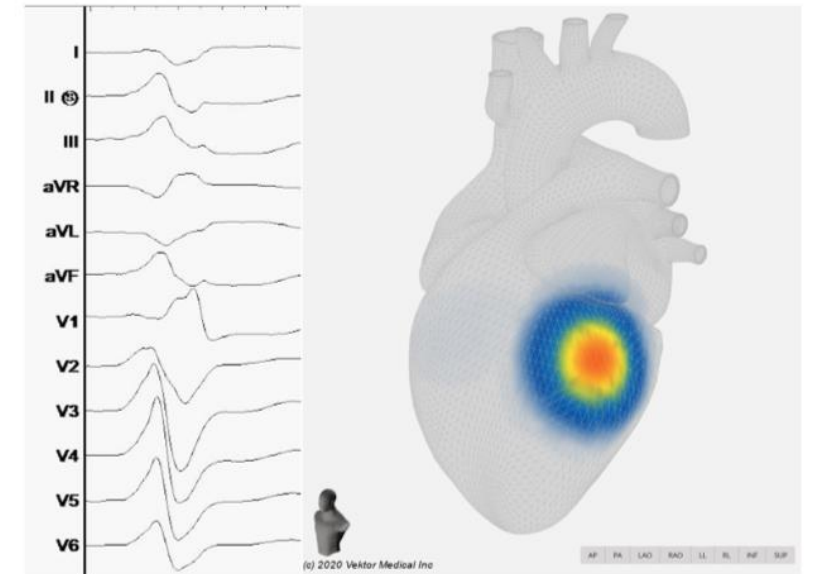


Example invasive ablation case

## Non-invasive 12-Lead ECG Mapping

30-40 min

ECG Mapping



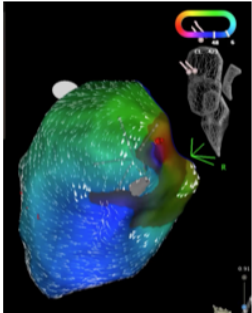
Patient 4



# Simplified 12-lead ECG Computerized Mapping

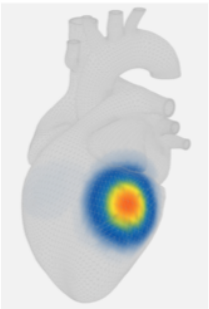
## Standard Invasive Mapping

Invasive Procedural Mapping Time: <b>392 ± 107 min</b>
Fluoroscopy Time (mean): <b>54 ± 28 min</b>
Invasive Access Sites (mean): <b>4.5 ± 0.7 sites</b>



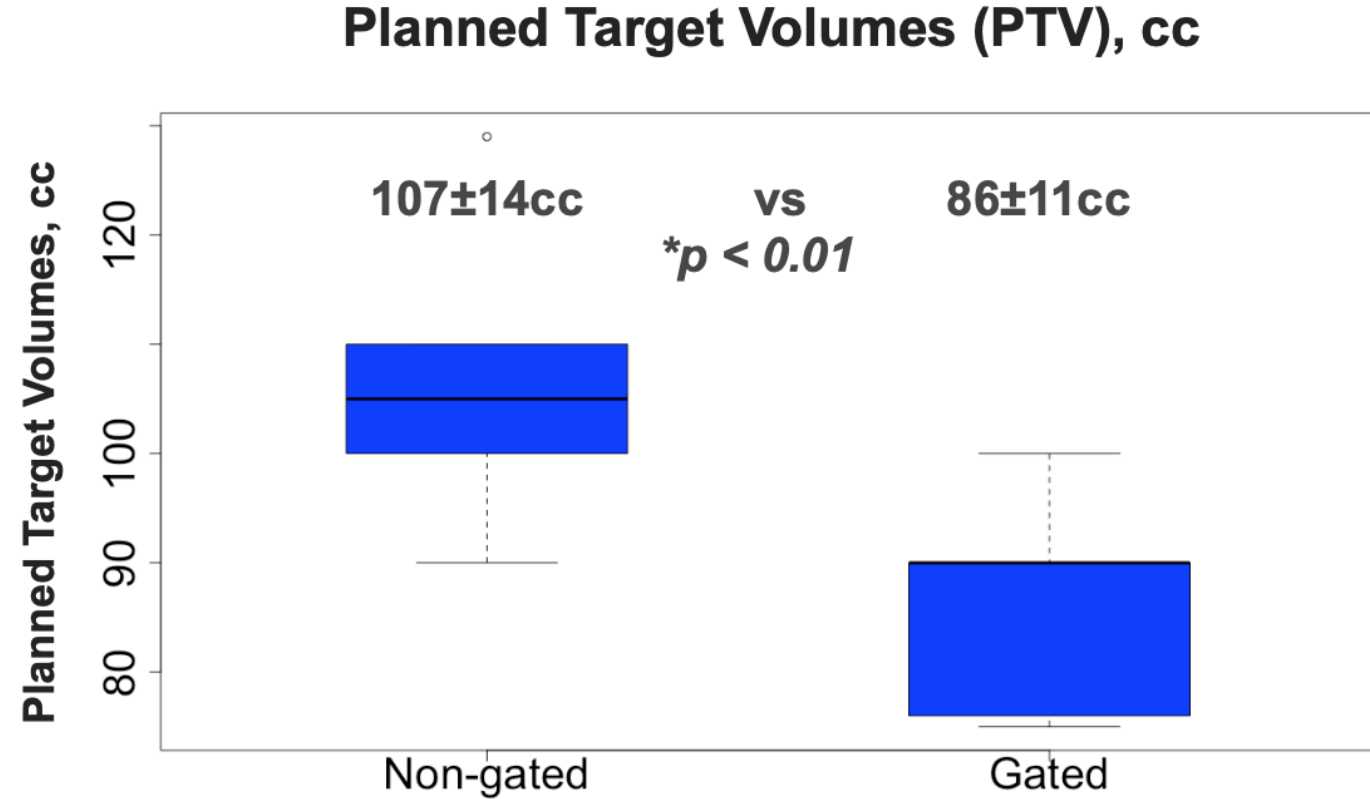
## Non-invasive 12-Lead ECG Mapping

Non-invasive Programmed Stimulation (NIPS) & 12-Lead ECG Mapping Time: <b>33 ± 13 min</b>	<b>p &lt; 0.01</b>
Fluoroscopy Time (mean): <b>0</b>	<b>p &lt; 0.01</b>
Invasive Access Sites (mean): <b>0</b>	<b>p &lt; 0.01</b>



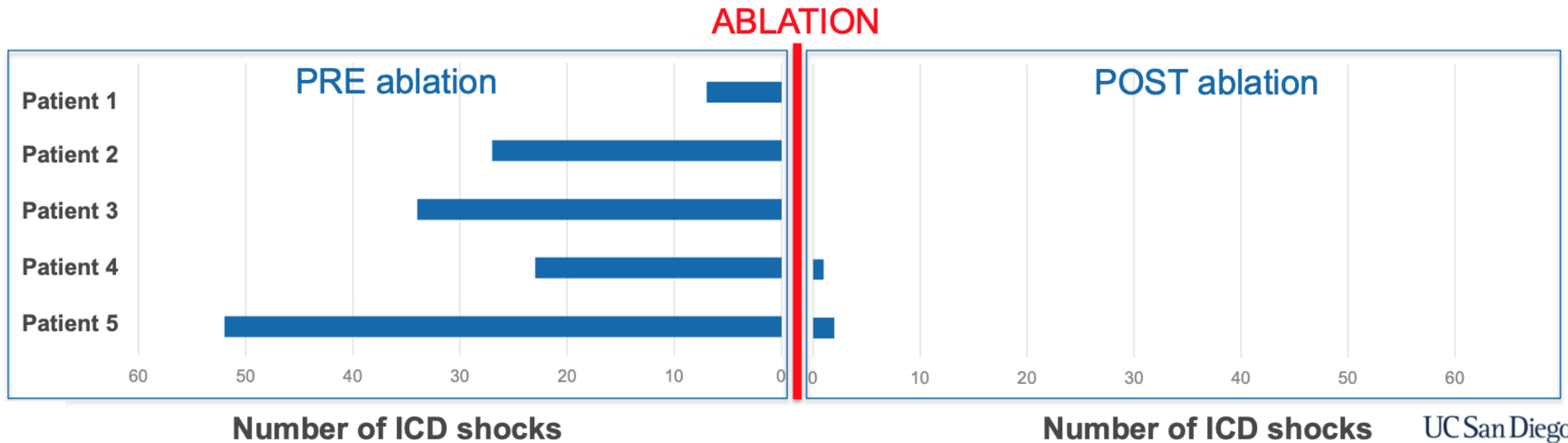
# Results: Respiratory-Gated Delivery May Improve Precision

- Calculated the target volume with and without respiratory gating.
- Respiratory gating may enable a smaller planned target volume (PTV).



# Results: Radio-ablation Decreased the Number of ICD Therapies

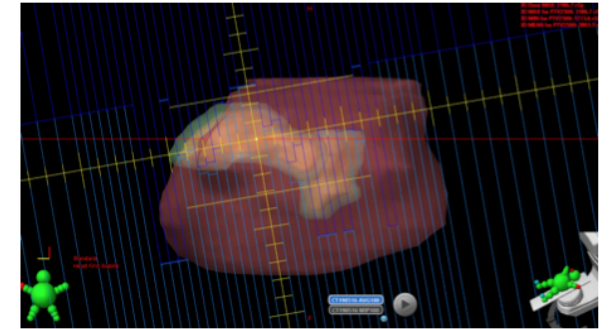
- ICD shocks were decreased after radio-ablation compared to before ( **$0.6 \pm 0.9$  vs  $29 \pm 16$  shocks,  $p < 0.02$** )
- No patients experienced adverse events related to the radiotherapy at  $6.4 \pm 3.4$  months follow-up.
- The 2 patients with inferior wall targets close to the stomach were treated with respiratory gating.
  - They did not experience adverse events such as pericardio-gastric fistula in close follow-up.





# Conclusions

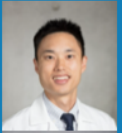
- A simplified, non-invasive workflow utilizing 12-lead ECG mapping, cardiac CT and respiratory gating improves:
  - Procedure time
  - Fluoroscopy time
  - Risks associated with invasive access
  - Size of planned target volume
- This workflow allows delivery of safe and effective non-invasive ablation without GI complications with a significant reduction in ICD shocks



*Patient 1*

# UCSD Non-Invasive Arrhythmia Mapping and Ablation Program

## Cardiac Electrophysiology



Gordon Ho, MD



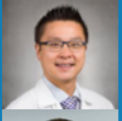
David E. Krummen, MD



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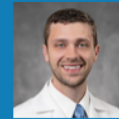


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## Bio-Engineering



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## Cardiac Imaging



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