Conduction System Pacing Summer Summit Berlin

HOW TO SET UP YOUR LAB – WHAT IS ***NEEDED*** AND WHAT WOULD BE ***NICE TO HAVE***

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Heart and Lung Center

Meilahden sairaala

Meilahti Hospital

Helsinki, Finland

PRESENTER DISCLOSURE INFORMATION

Jarkko Karvonen

- has worked as a consultant for Abbott, Biotronik, Boston Scientific and Medtronic
- is a member of the Medtronic Micra EMEA Advisory Board
- is the primary investigator in PROTECT-HF, ABACUS, Abbott SyncAV PMT and Medtronic Enlighten studies at Helsinki University Hospital
- is a member of EHRA Scientific Initiatives Committee
- Is the chairman of the Finnish Cardiac Society's Working Group for Arrhythmias and Pacing
- has **no relation to any of the companies** mentioned in the lecture as examples of different technologies

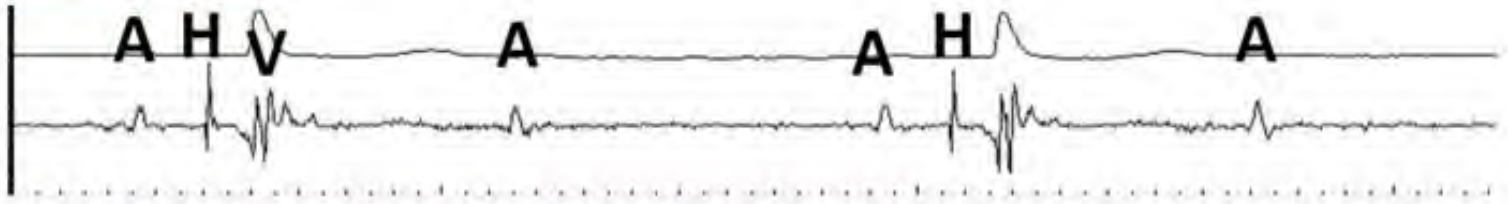
Must haves

Motivation to learn new things
Conduction system pacing requires a shift in mindset and continuous learning.

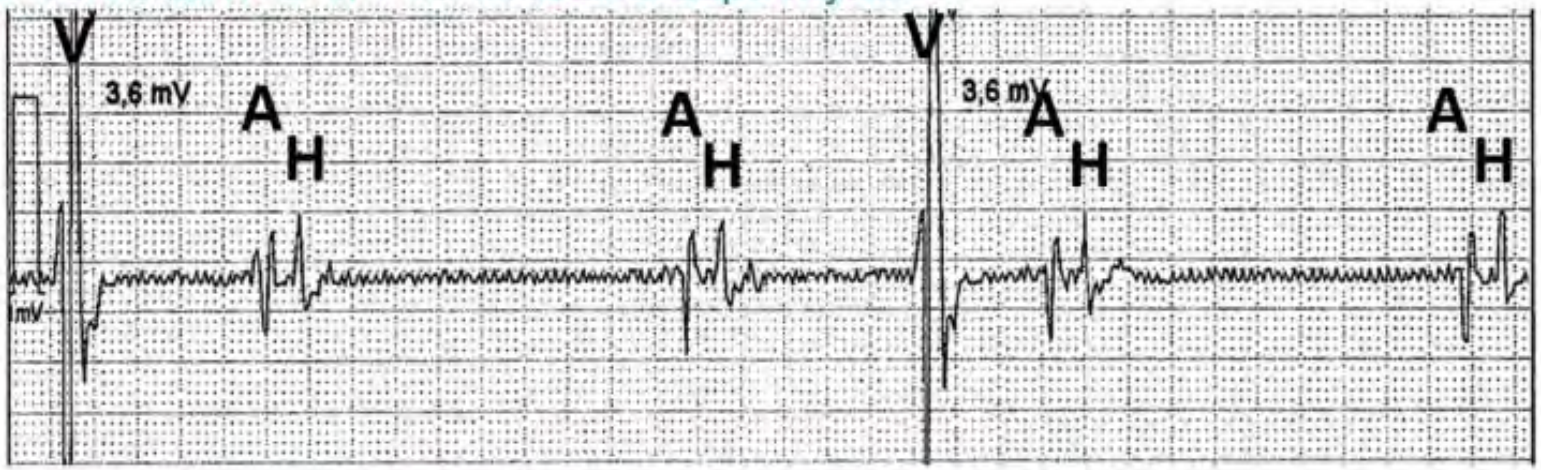
Well-trained operator and staff
Success doesn't come from equipment alone – it comes from the people using it.

Patience
There is a learning curve. Be ready to fail, reflect and improve.

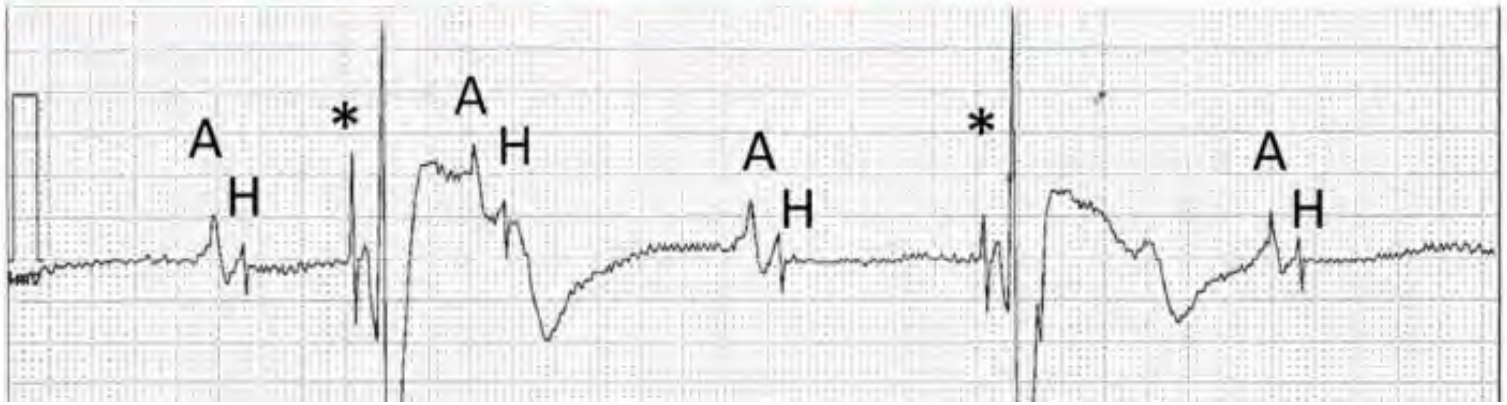
Nodal 2:1 AVB



Infra-nodal AVB III + ventricular escape rhythm



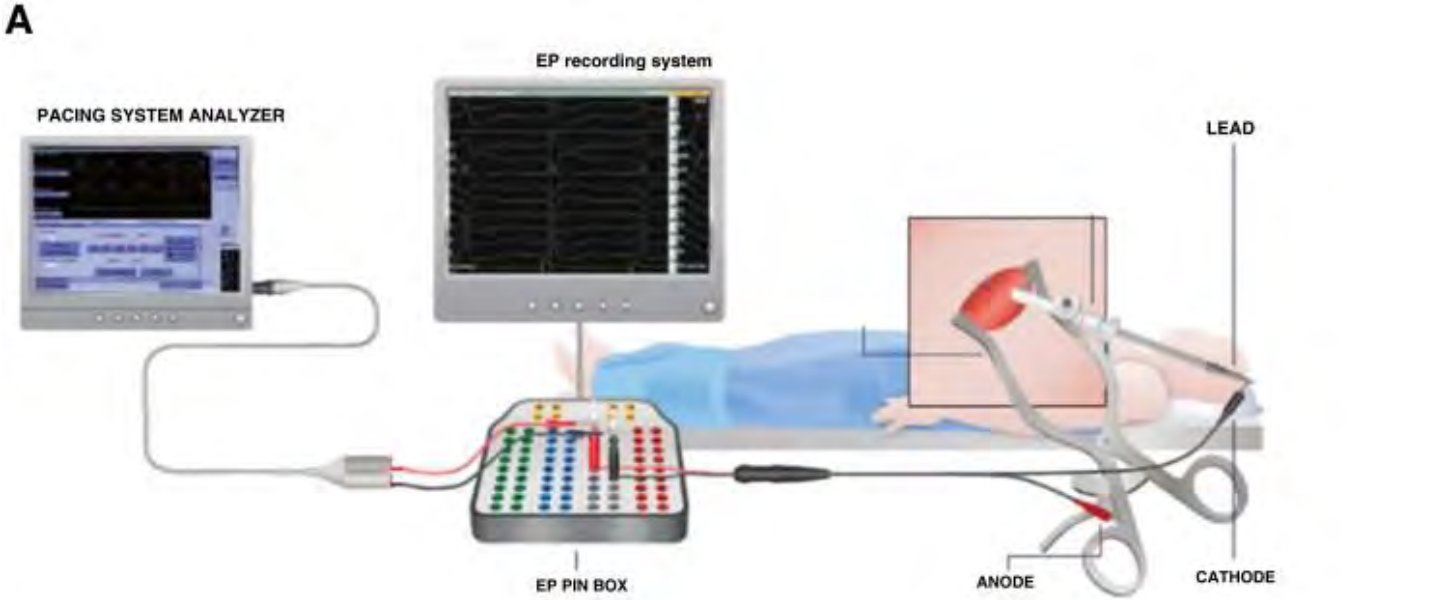
Infra-nodal AVB III + temporary ventricular pacing(*)



Strongly recommended:

The implanting physician should be familiar with basic electrophysiology of the conduction system, especially the know-how to interpret endocardial signals.

Europace (2023) 25, 1208–1236.



ESC European Society of Cardiology
Europace (2023) 25, 1208–1236
https://doi.org/10.1093/europace/euad043
EHRA DOCUMENT

EHRA clinical consensus statement on conduction system pacing implantation: endorsed by the Asia Pacific Heart Rhythm Society (APHRS), Canadian Heart Rhythm Society (CHRS), and Latin American Heart Rhythm Society (LAHRS)

Haran Burri [1]*, Marek Jastrzebski[2], Óscar Cano[3,4], Karol Čurila[5], Jan de Pooter[6], Weijian Huang[7], Carsten Israel[8], Jacqueline Joza[9], Jorge Romero[10], Kevin Vernooy[11], Pugazhendhi Vijayaraman[12], Zachary Whinnett[13], and Francesco Zanon[14]

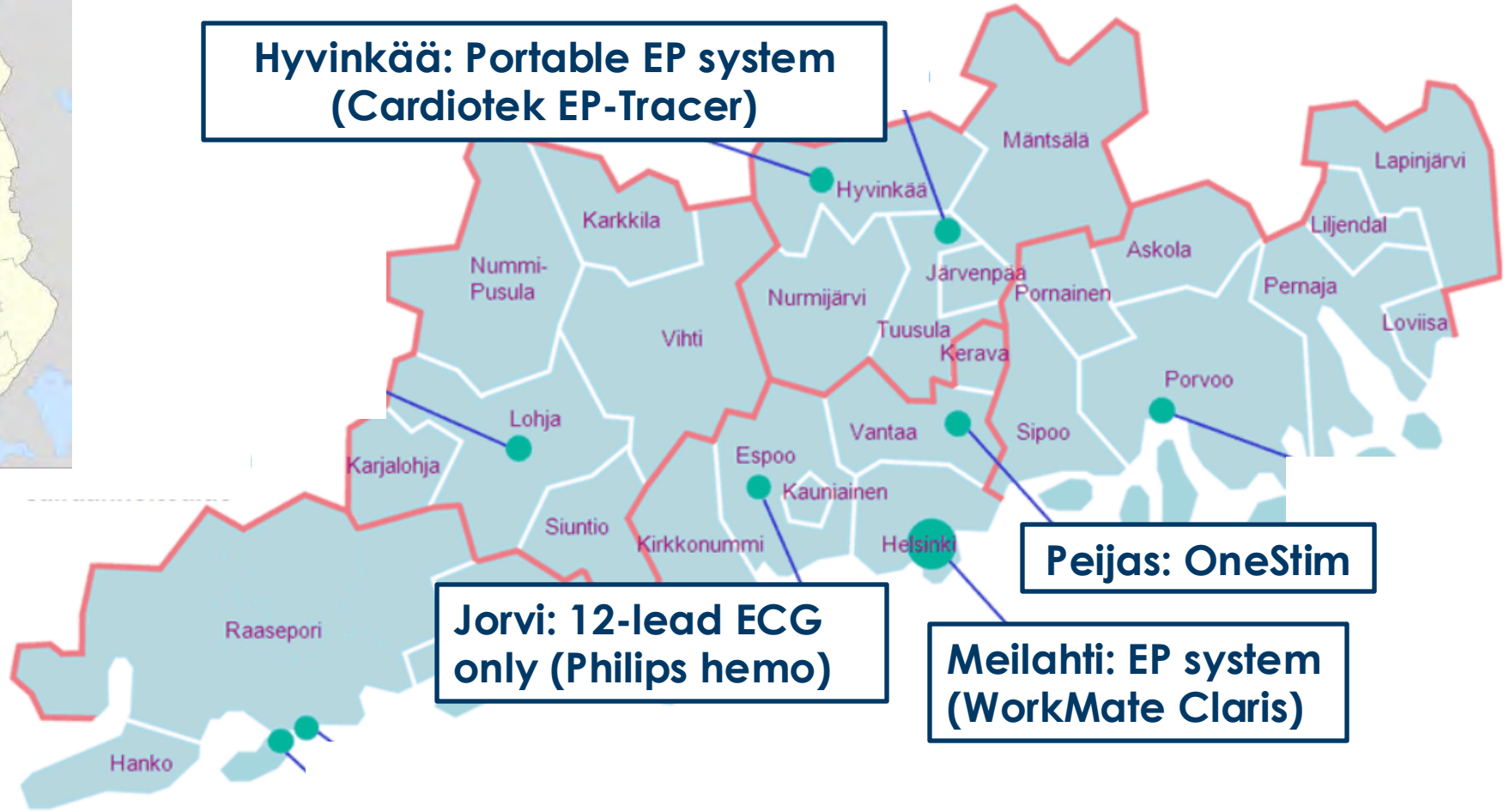
Figure 5 (A) Connection setup for CSP (modified, with permission, from Medtronic). (B) Screen setup with the **12-lead ECG** and intracardiac electrogram recorded at 100 mm/s sweep speed during LBBAP implantation, with a **filtered 30–500 Hz channel** (cyan) and **unfiltered 0.5–500 Hz channel** (green). V1 and V6 are coloured in yellow to be distinguished from the other leads to facilitate analysis in real time.

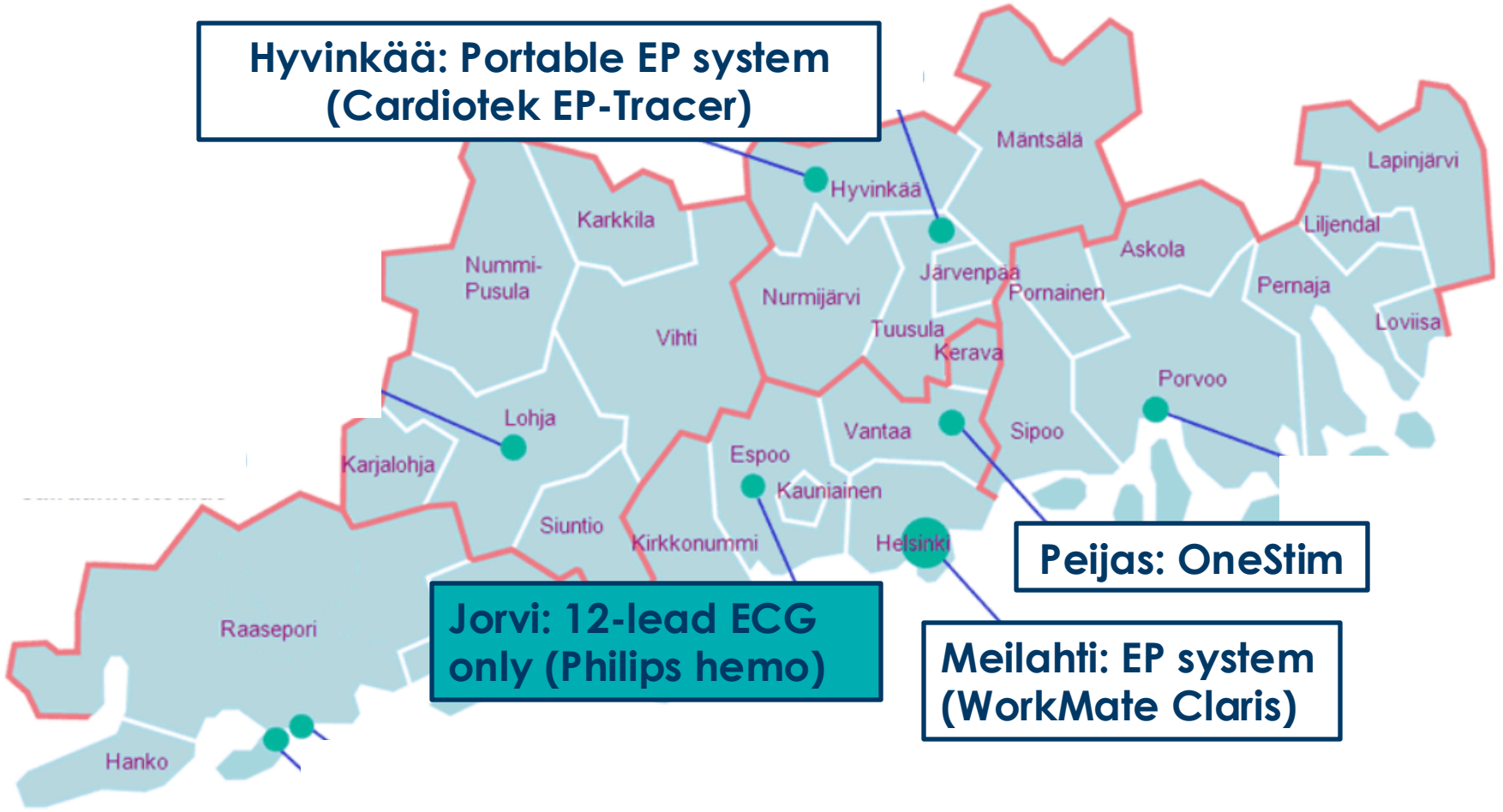
NEEDED! 12-LEAD ECG

- If an EP recording system is not available, endocardial signals may be displayed on a **PSA, at a 0.05 mV/mm gain**.

- **12-lead ECG** is necessary to confirm conduction tissue capture but does not have
  - continuous recording of signals for review
  - electronic callipers for precise measurement of timing intervals

UUSIMAA: 1.8 MILLION PEOPLE




Hyvinkää: Portable EP system (Cardiotek EP-Tracer)
Hyvinkää
Mäntsälä
Lapinjärvi
Karkkila
Liljendal
Askola
Nummi-Pusula
Järvenpää
Pornainen
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Nurmijärvi
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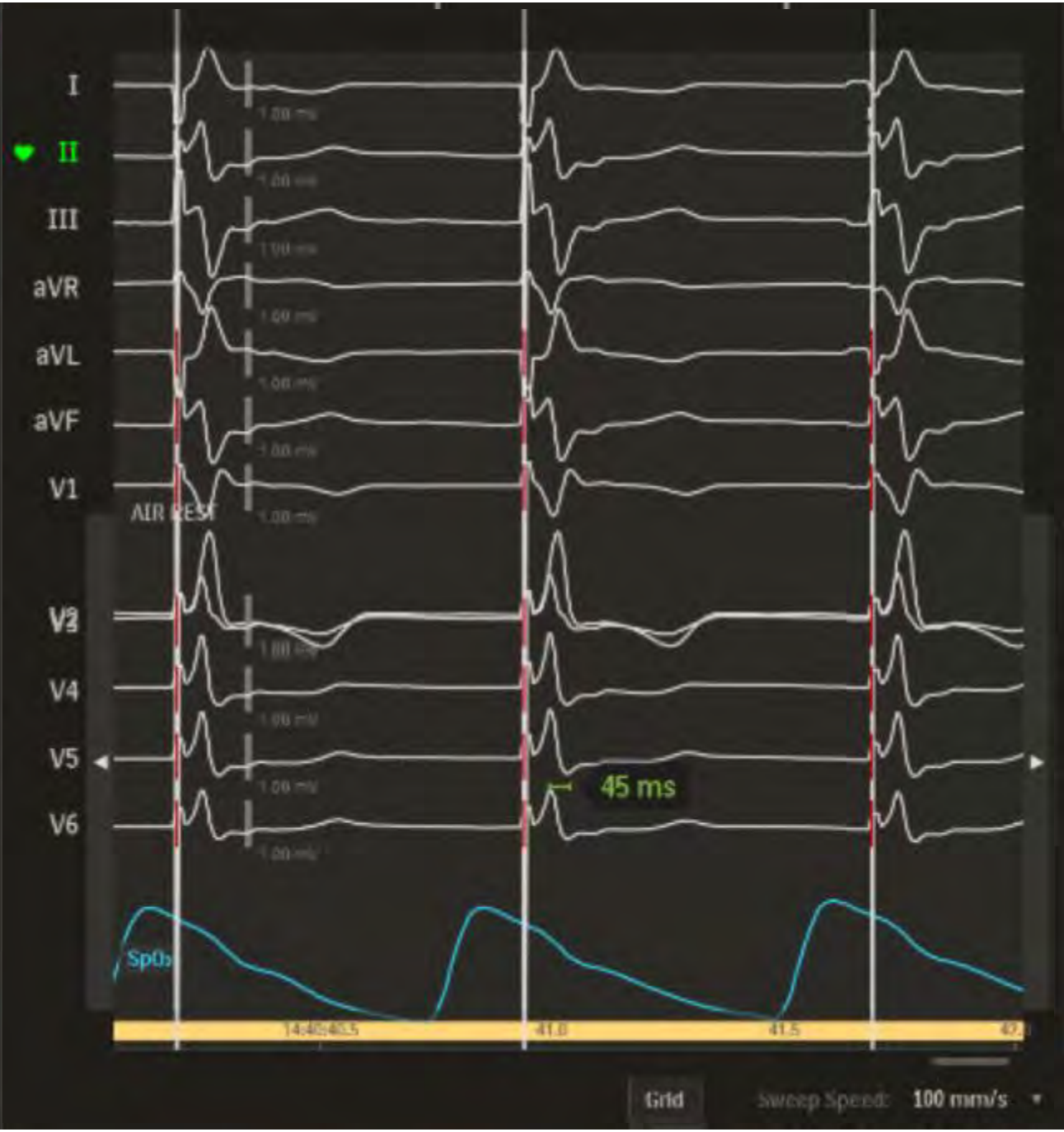
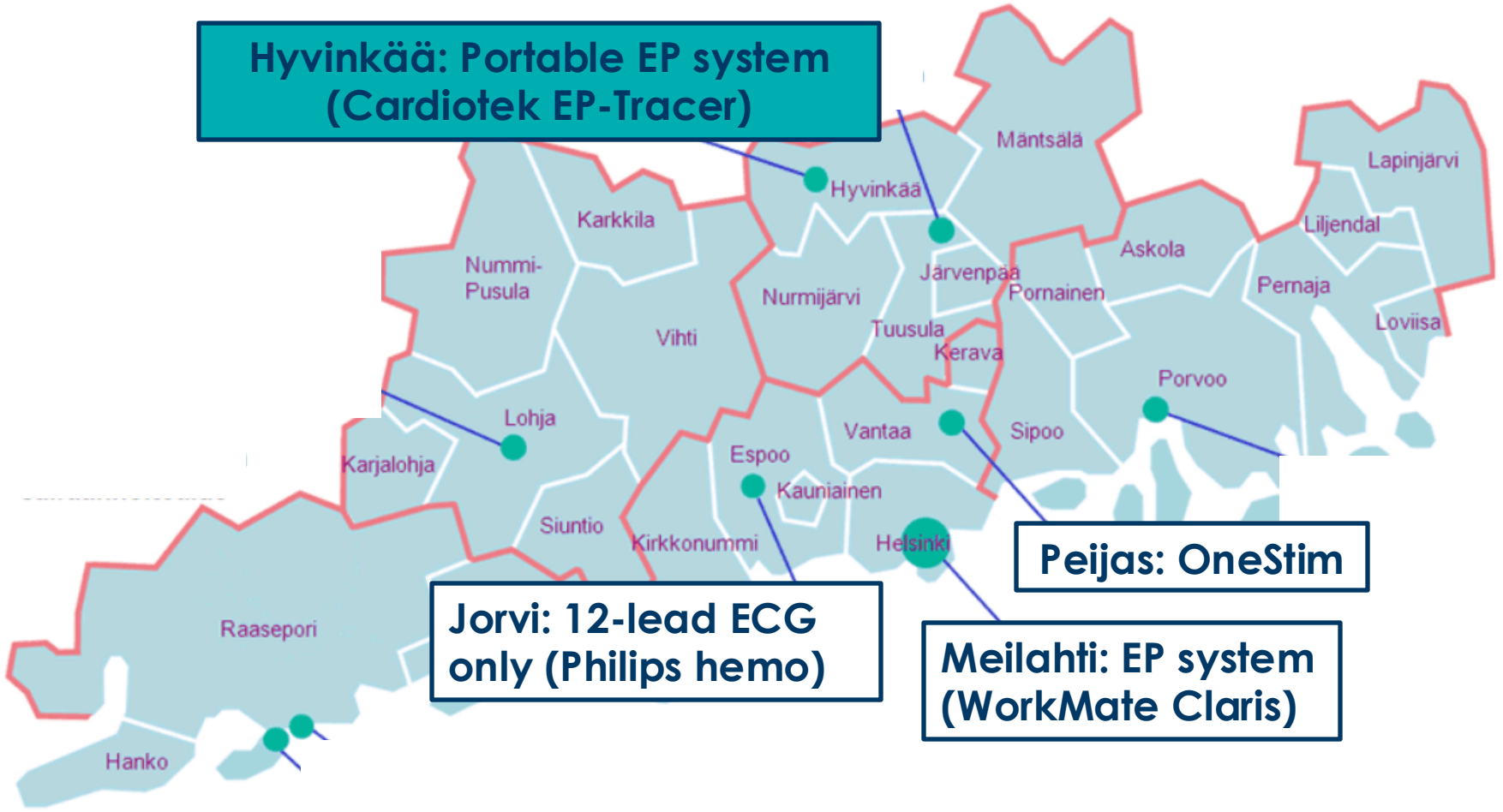
Espoo
Kauniainen
Siuntio
Kirkkonummi
Helsinki
Peijas: OneStim
Jorvi: 12-lead ECG only (Philips hemo)
Meilahti: EP system (WorkMate Claris)
Raasepori
Hanko


03:51:45
I
II
III
aVR
aVL
aVF
V1
A: ---
V: 50 bpm
ODO
V. EGM
(unfiltered)
Peak to Peak:
23,452 mV
20 mV
10 mV
0 mV
-10 mV
-20 mV
A. EGM
V. EGM
FILTER
00:44:46
Vitals Interval:
/:14
30 min
STAT
Sweep Speed:
100 mm/s


I
II
III
aVR
aVL
aVF
V1
V4
V5
V6
45 ms
SpO2
Grid
Sweep Speed:
100 mm/s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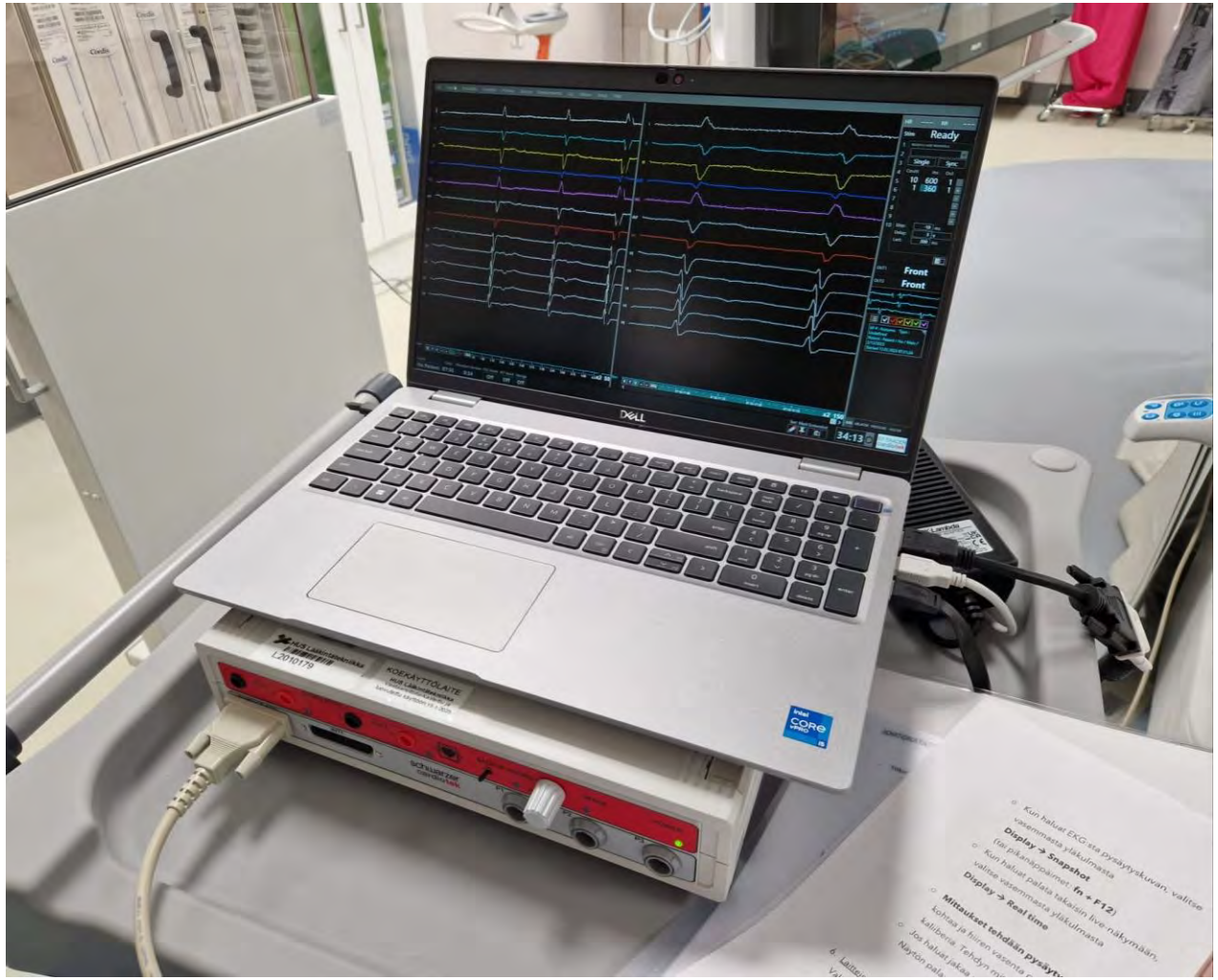
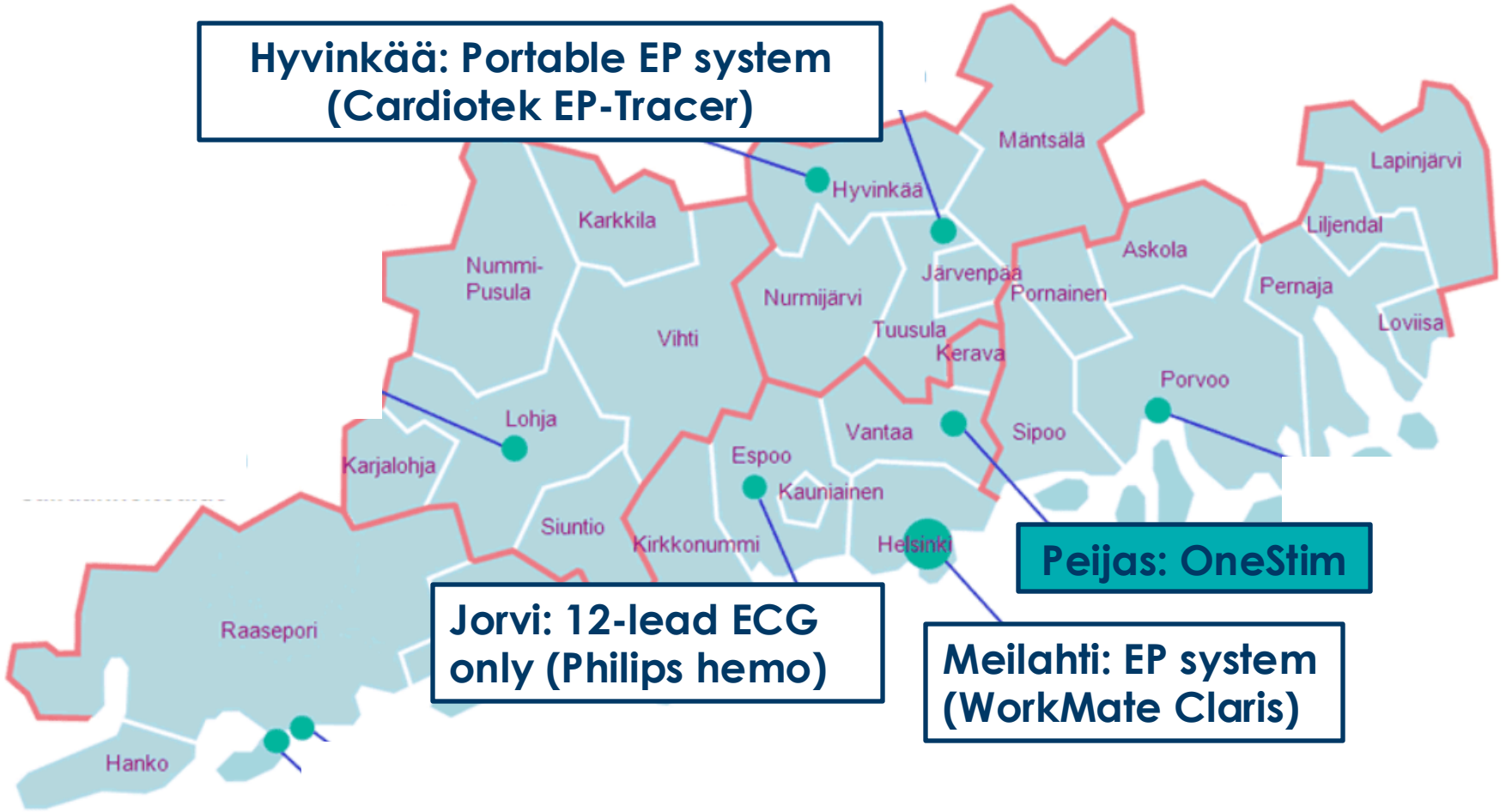
PORTABLE EP SYSTEM

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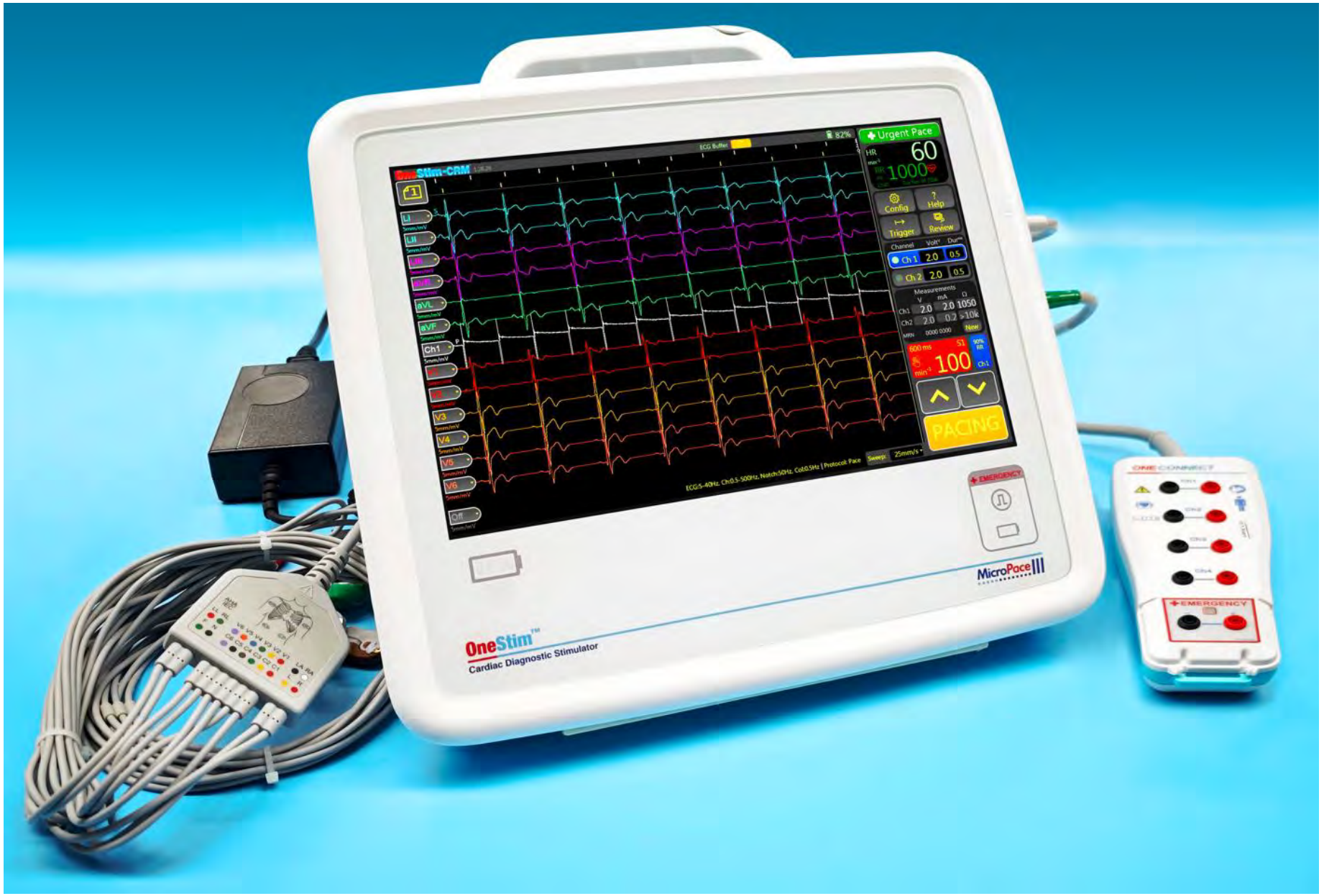
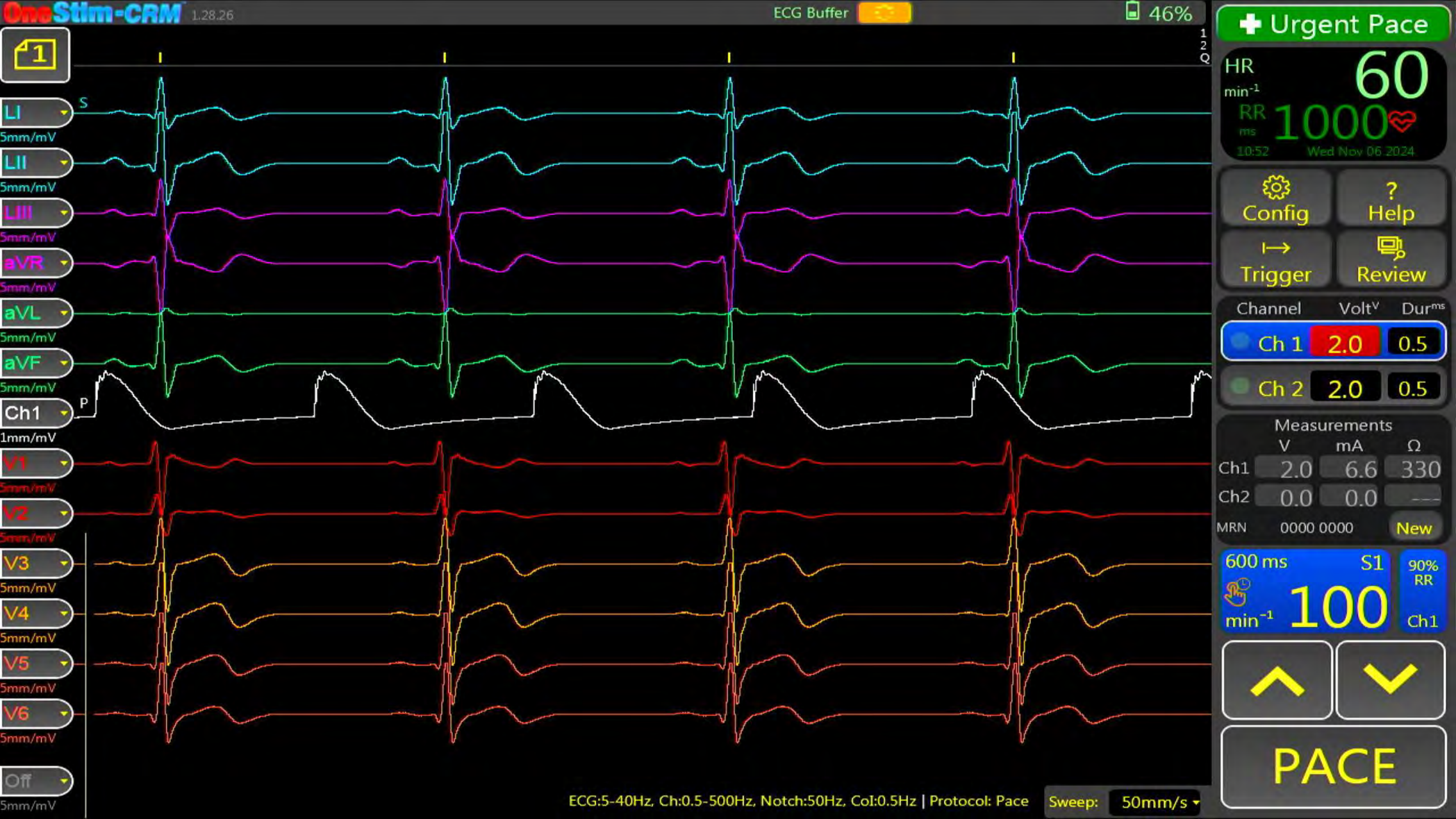
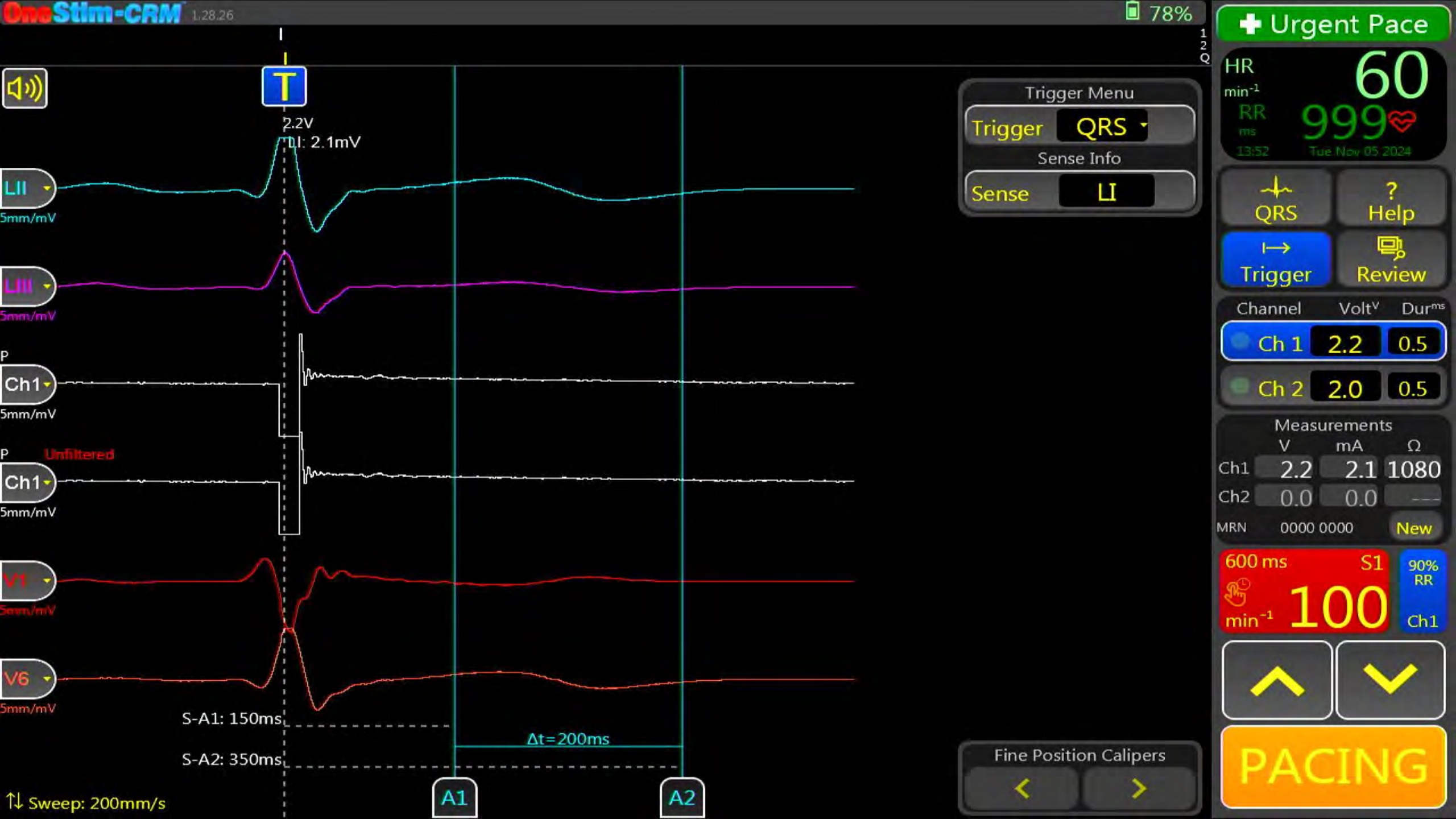
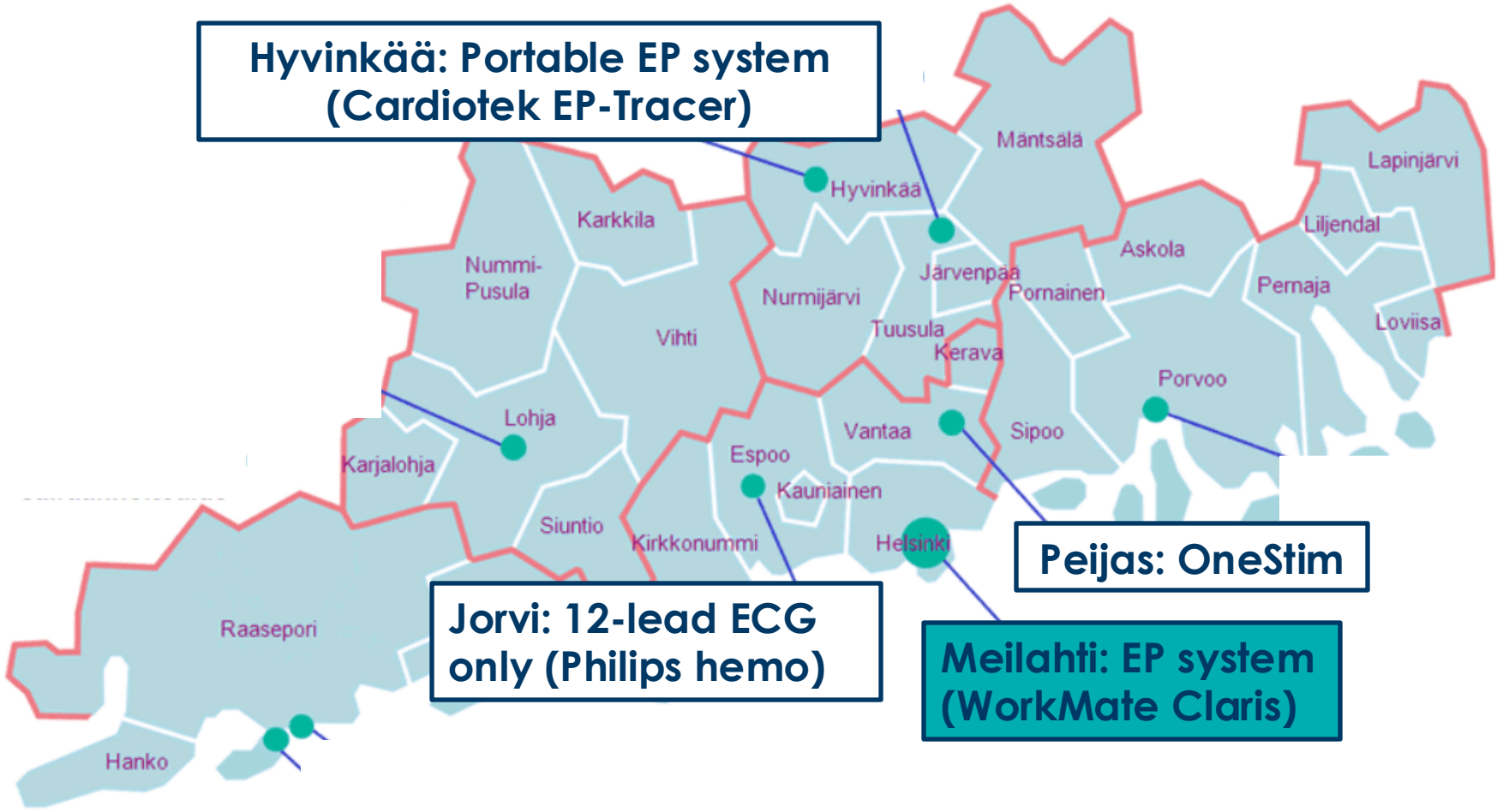

OneStim-CRM
Urgent Pace
HR
60
1000
Config
Help
Trigger
Review
Channel
Volt
Dur
Ch 1
2.0
0.5
Ch 2
2.0
0.5
Measurements
V
mA
Ω
Ch1
2.0
2.0
1050
Ch2
2.0
0.2
>10k
MFN
0000 0000
None
600 ms
S1
100
Ch1
PACING
EMERGENCY
MicroPace
OneStim™
Cardiac Diagnostic Stimulator
EMERGENCY


OneStim-CRM 1.28.26
ECG Buffer
46%
Urgent Pace
HR
min-1
60
RR
ms
1000
10:52
Wed Nov 06 2024
Config
Help
Trigger
Review
Channel
Volt V
Dur ms
Ch 1
2.0
0.5
Ch 2
2.0
0.5
Measurements
V
mA
Ω
Ch1
2.0
6.6
330
Ch2
0.0
0.0
MRN
0000 0000
New
600 ms
S1
min-1
100
90% RR
Ch1
PACE
LI
LII
LIII
aVR
aVL
aVF
Ch1
V1
V2
V3
V4
V5
V6
Off
5mm/mV
1mm/mV
ECG:5-40Hz, Ch:0.5-500Hz, Notch:50Hz, CoI:0.5Hz | Protocol: Pace
Sweep:
50mm/s


OneStim-CRM 1.28.26
78%
Urgent Pace
HR
min-1
60
RR
ms
999
13:52
Tue Nov 05 2024
Trigger Menu
Trigger
QRS
Sense Info
Sense
LI
QRS
Help
Trigger
Review
Channel
Volt V
Dur ms
Ch 1
2.2
0.5
Ch 2
2.0
0.5
Measurements
V
mA
Ω
Ch1
2.2
2.1
1080
Ch2
0.0
0.0
MRN
0000 0000
New
600 ms
S1
min-1
100
90% RR
Ch1
PACING
T
2.2V
LI: 2.1mV
LII
5mm/mV
LIII
5mm/mV
P
Ch1
5mm/mV
P
Unfiltered
Ch1
5mm/mV
V1
5mm/mV
V6
5mm/mV
S-A1: 150ms
S-A2: 350ms
Δt=200ms
A1
A2
Sweep: 200mm/s
Fine Position Calipers

HUS

Standing in front of the screen in Danderyd Hospital…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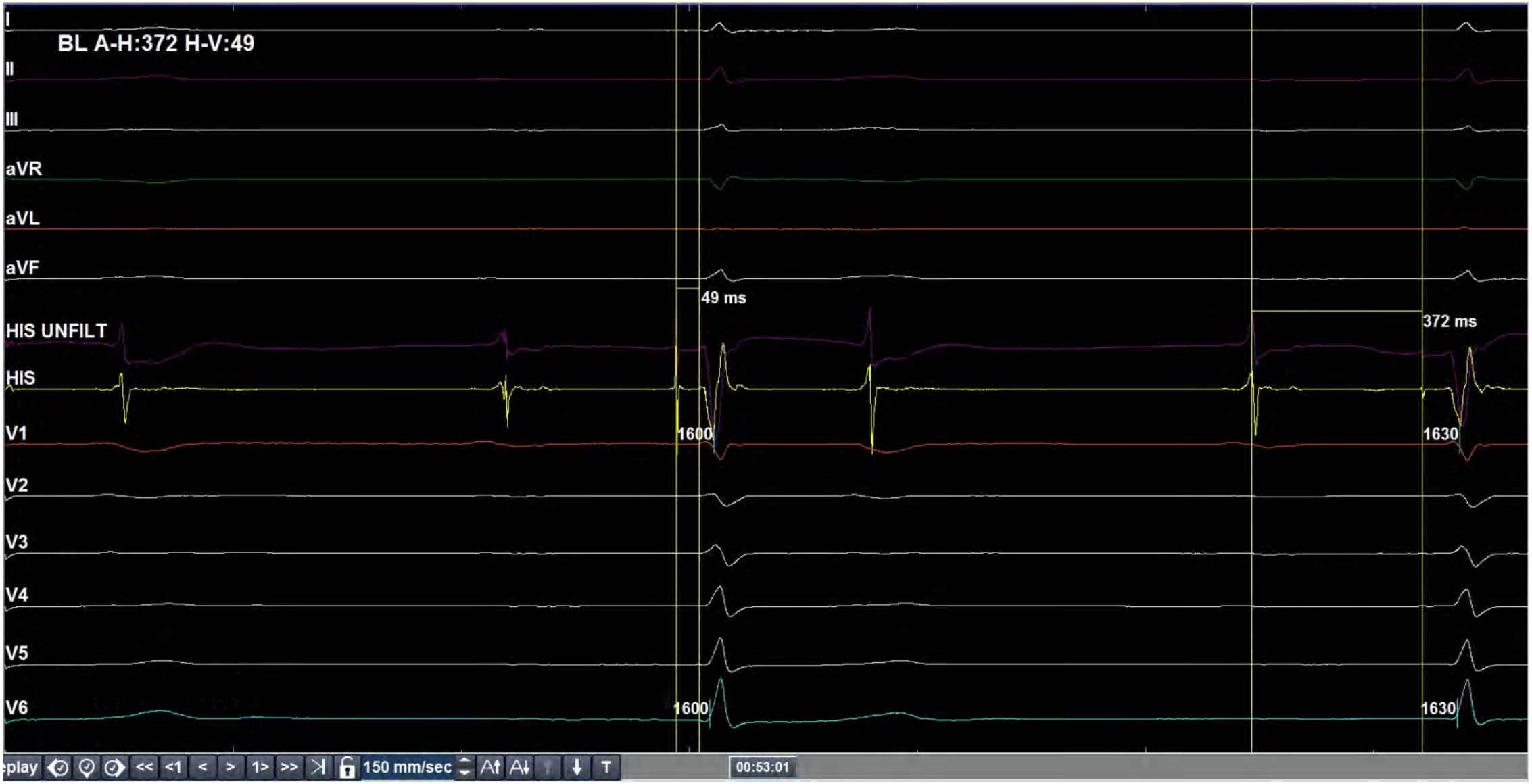
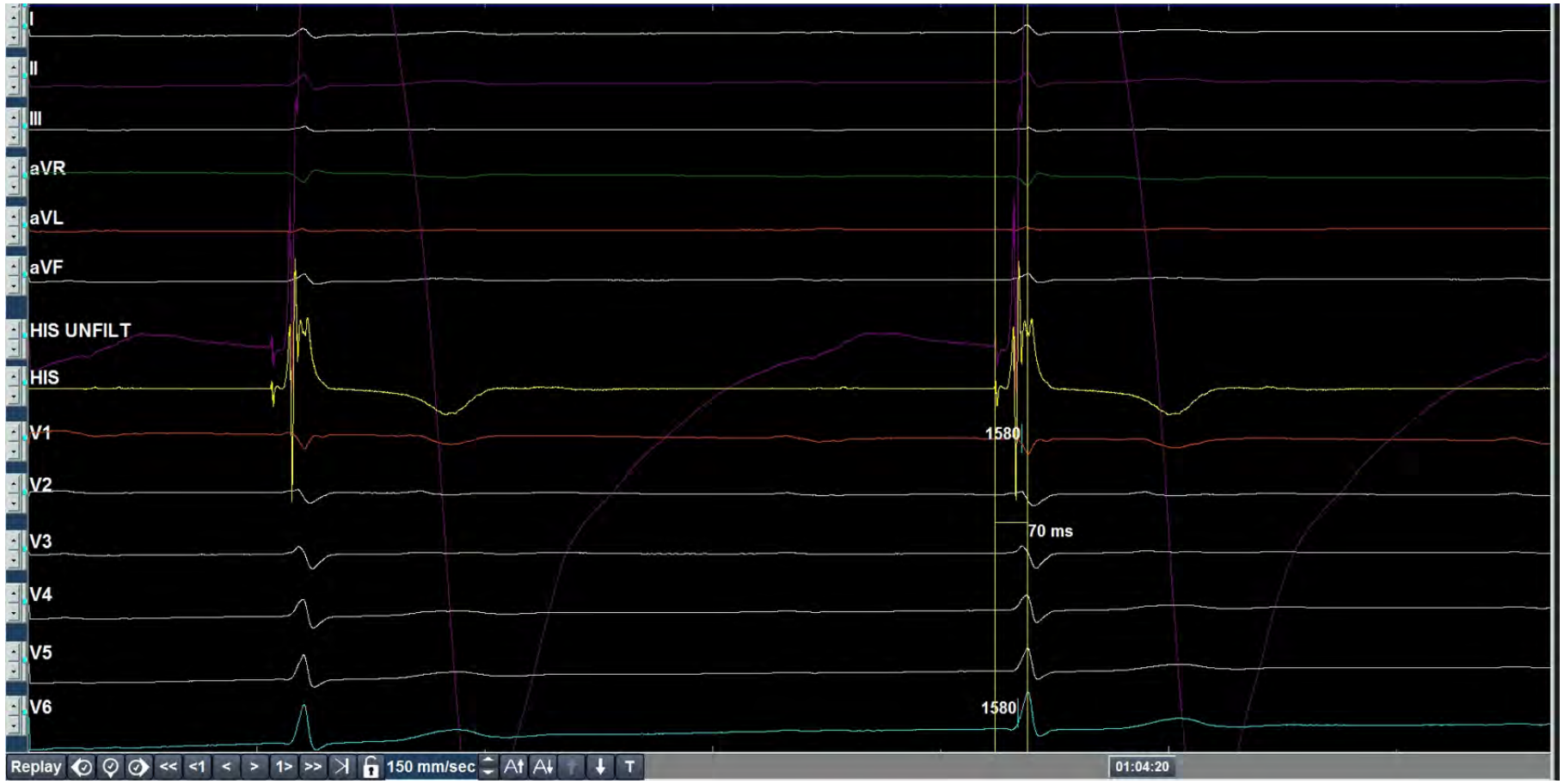
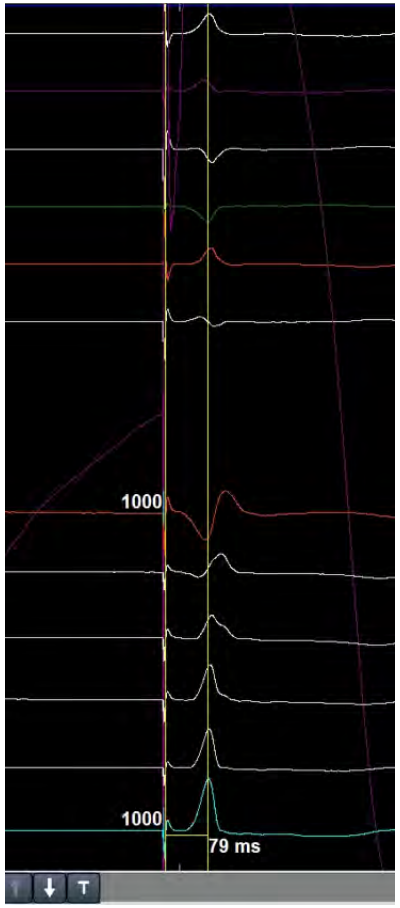
EP RECORDING SYSTEM



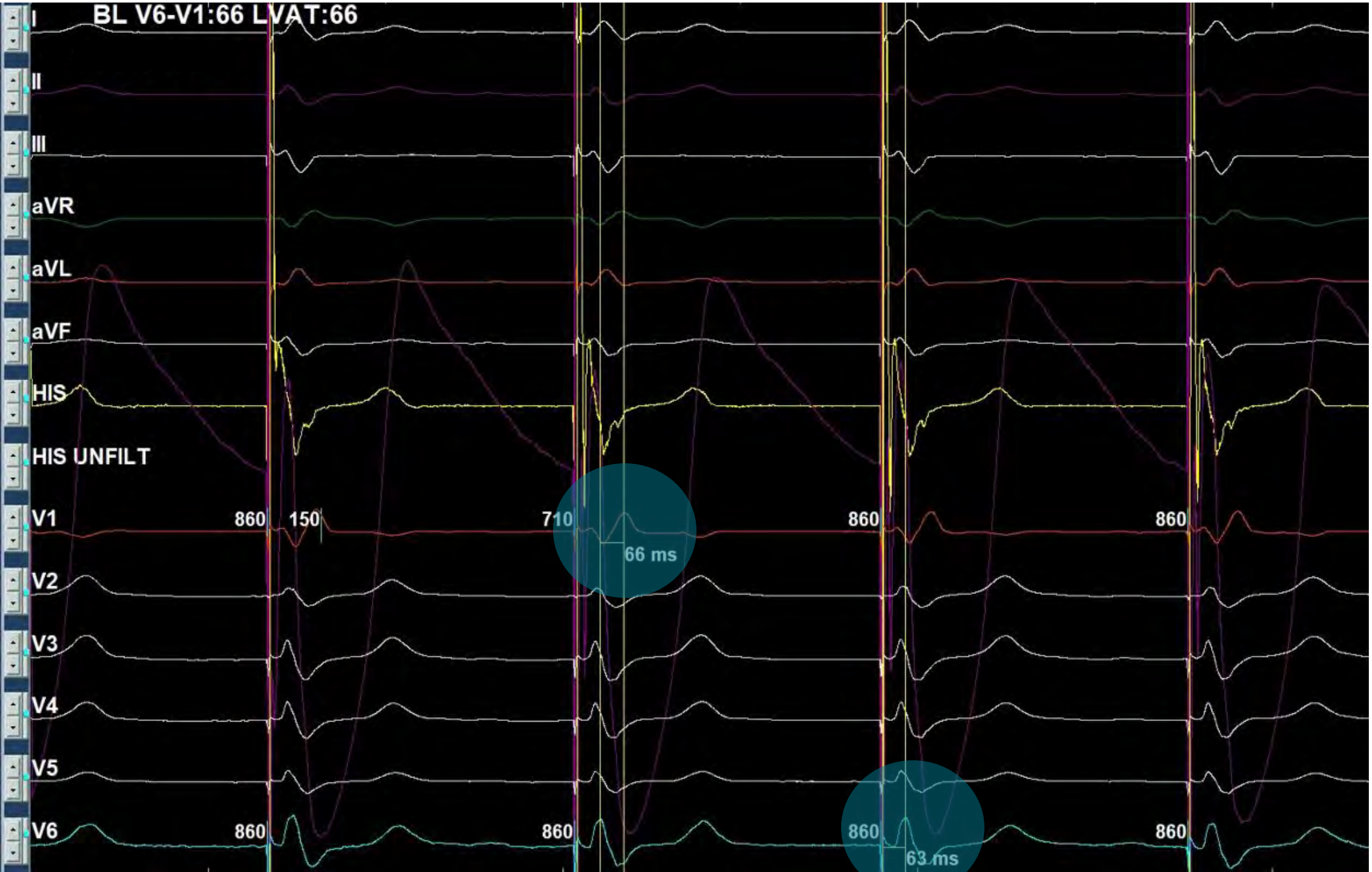
FASCICULAR POTENTIAL



Intrinsic beat



Paced beat


I
BL V6-V1:66 LVAT:66
II
III
aVR
aVL
aVF
HIS
HIS UNFILT
V1
860
150
710
66 ms
860
860
V2
V3
V4
V5
V6
860
860
860
63 ms
860

NICE TO HAVE

- **Classical music** √
- World's best chocolate √
- Coffee machine x

Journal of
Cardiovascular
Development and Disease

MDPI

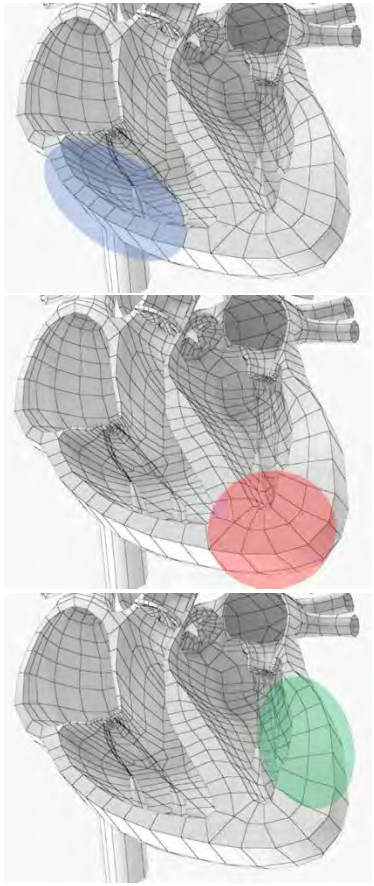
Review

Ultra-High-Frequency ECG in Cardiac Pacing and Cardiac Resynchronization Therapy: From Technical Concept to Clinical Application

Uyên Châu Nguyên [1,2,*,†], Jesse H. J. Rijks [1,†], Filip Plesinger [3], Leonard M. Rademakers [4], Justin Luermans [1], Karin C. Smits [2], Antonius M. W. van Stipdonk [1], Frits W. Prinzen [2], Kevin Vernooy [1], Josef Halamek [3], Karol Curila [5] and Pavel Jurak [3]

J. Cardiovasc. Dev. Dis. 2024, 11, 76.

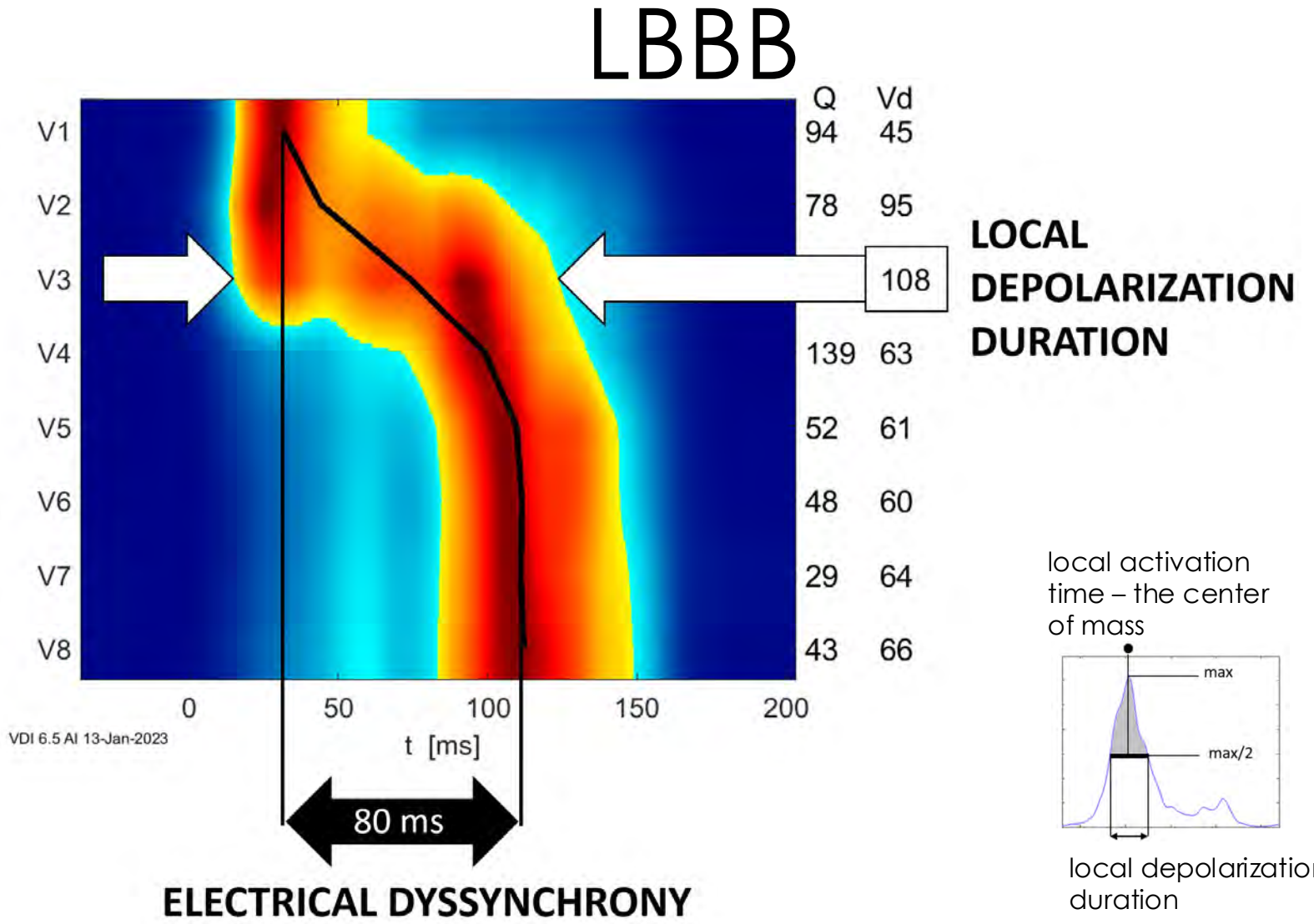
UHF-ECG activation map



Right ventricle + septum

Apex

Free wall of the left ventricle



local activation time – the center of mass

local depolarization duration

UHF-ECG activation map

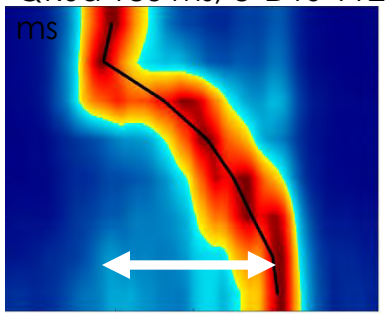
HEART FAILURE

VDI VENTRICULAR DYSSYNCHRONY IMAGING BY ULTRA-HIGH-FREQUENCY ECG TECHNOLOGIES

HUS

Left Bundle Branch Block

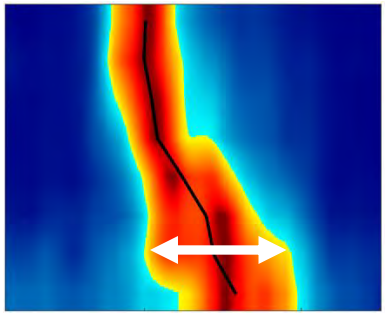
QRSd 185 ms, e-DYS 112 ms



LBBB – high electrical dyssynchrony.

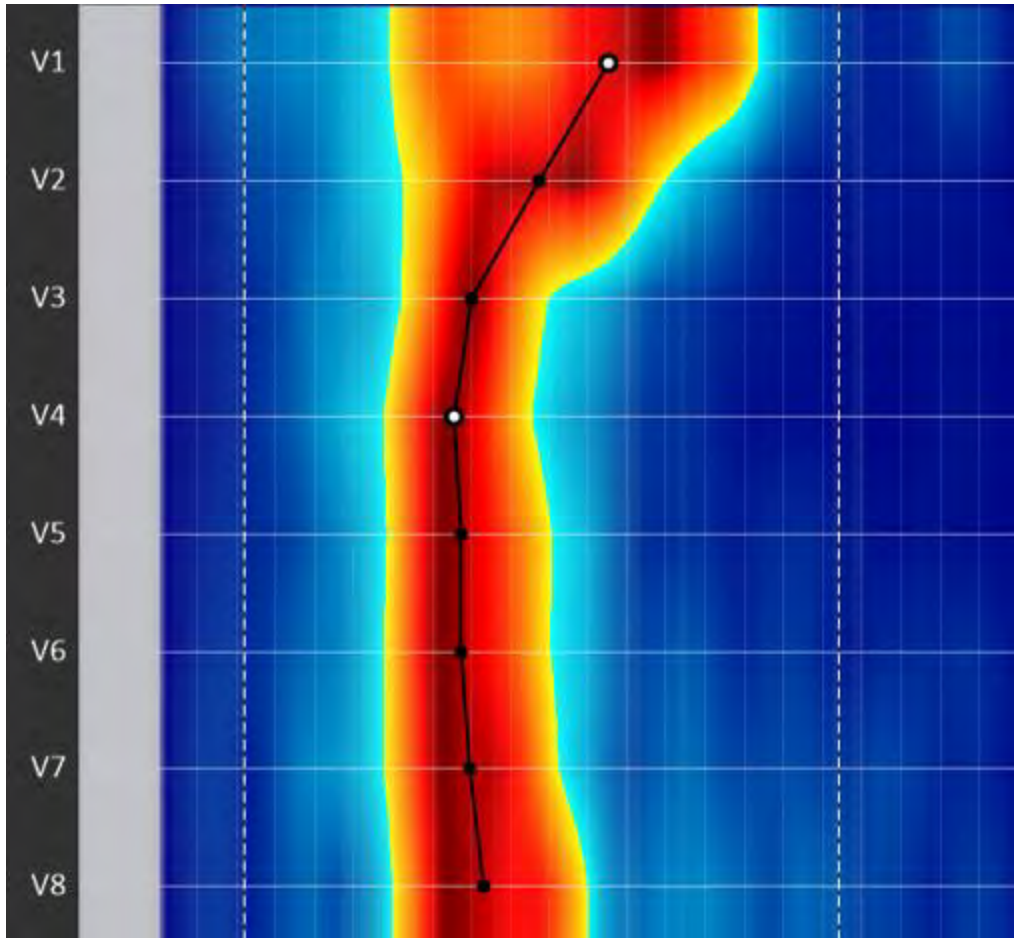
Intraventricular Conduction Delay

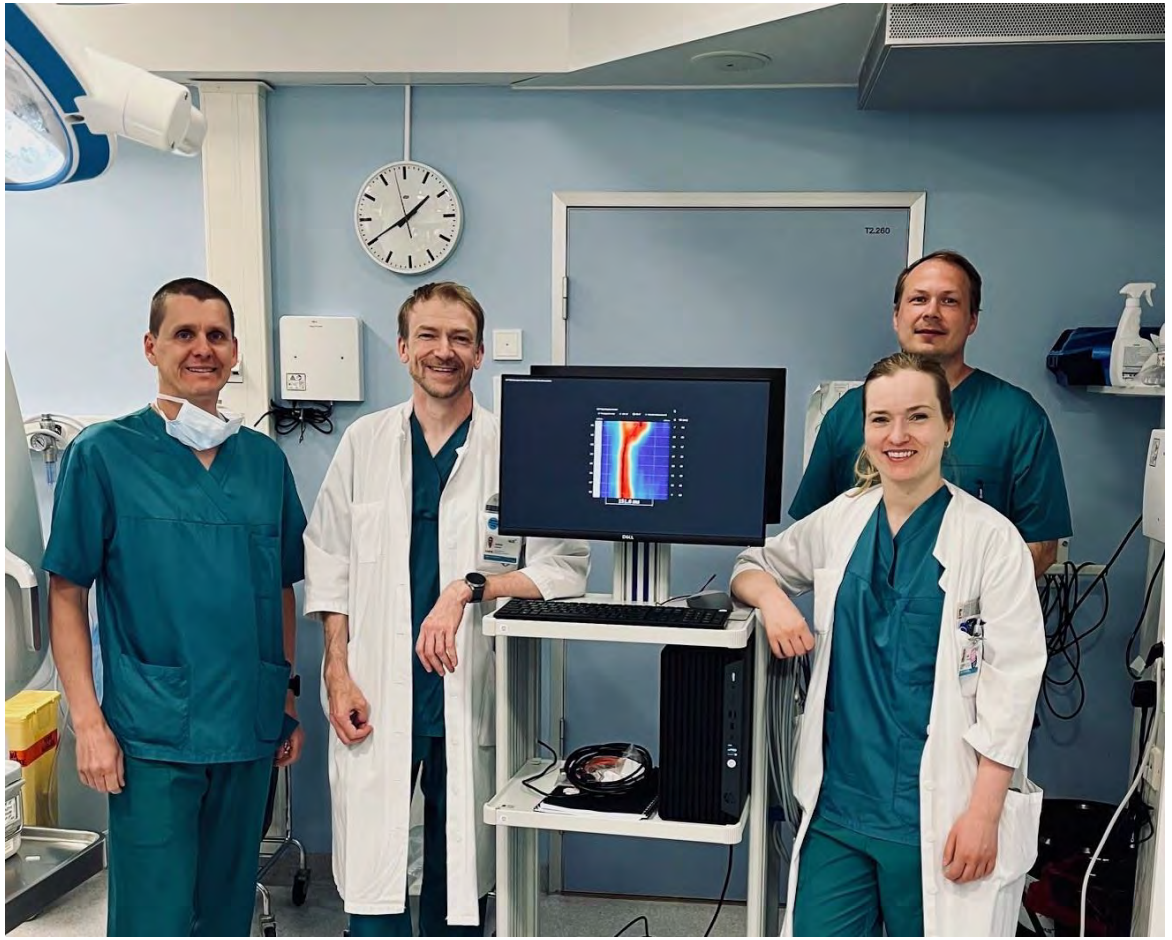
QRSd 166 ms, e-DYS 59 ms



IVCD – less electrical dyssynchrony and longer local depolarization

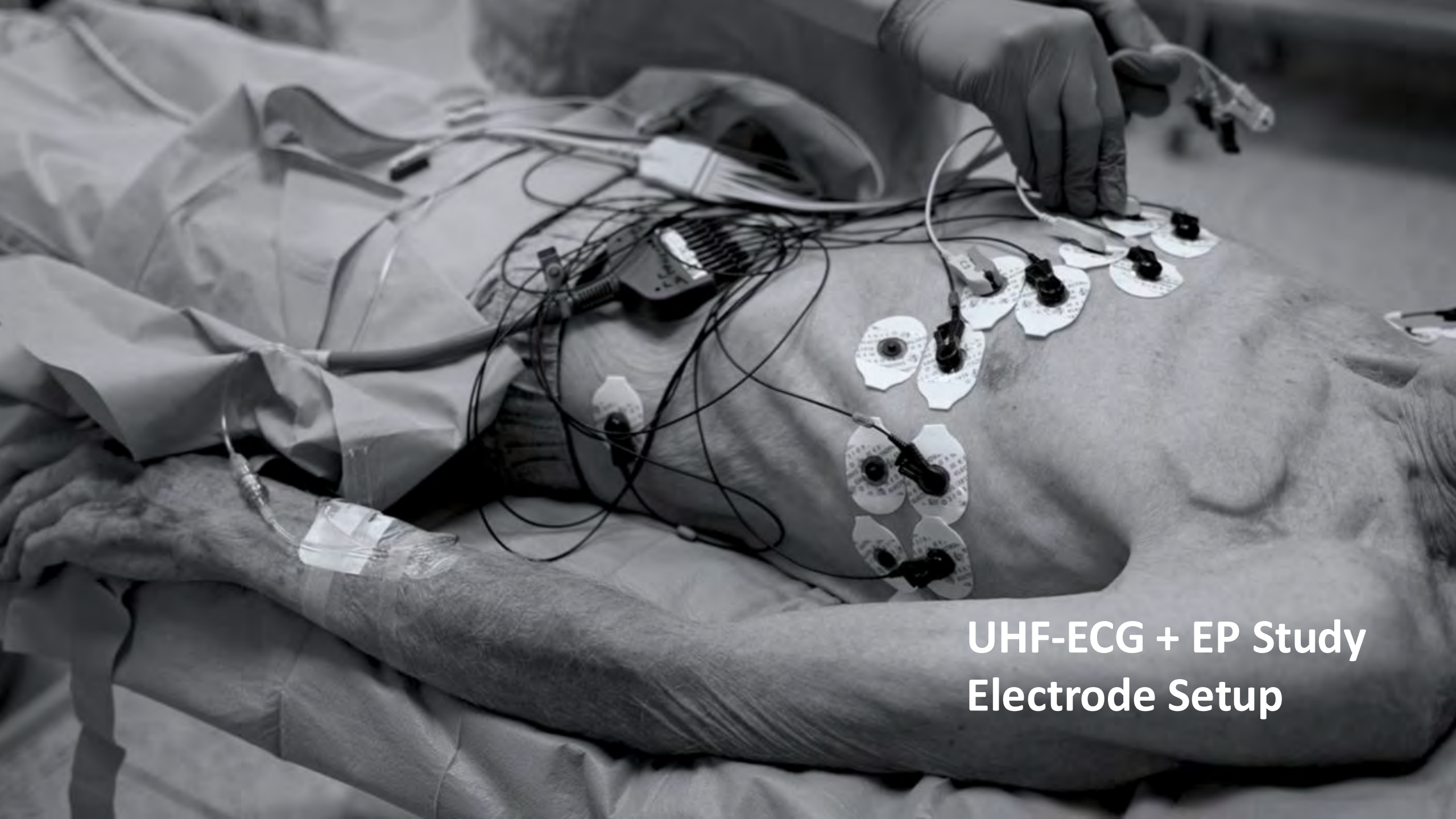
ULTRA-HIGH-FREQUENCY ECG





May 27, 2025


PHILIPS



UHF-ECG + EP Study
Electrode Setup

	Minimalistic	Standard	Tools for personalized medicine
100% of labs toolset	Fluoroscopy, Programmer, vital function monitoring, CSP leads portfolio		
Patient classification	Typical Brady with narrow, LBBB, RBBB		Complex septal anatomy; diffuse conduction disease, IVCDs
ECG	**12-lead ECG** - IC reading from the programmer	**EP Study with IC lead** - LBB, His RBB potentials	**EP Study** with top EP skills + procedural time
			UHF-ECG – precordial lead mapping
			ECGi – high res mapping
			Intracardiac Mapping Catheters
Other modalities			Echo, Arterial Pressure
VDI UHF-ECG device features (Swiss army knife for CSP and CRT)	12-lead	Running leads with optional IC mounting	UHF-ECG mapping

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KIITOS – THANKS – DANKE
JARKKO.KARVONEN@HUS.FI