

STIMULACE PŘEVODNÍHO SYSTÉMU Z OBLASTI LEVÉHO TAWAROVA SVAZKU POMOCÍ STYLET-DRIVEN ELEKTRODY: ROLE BMI

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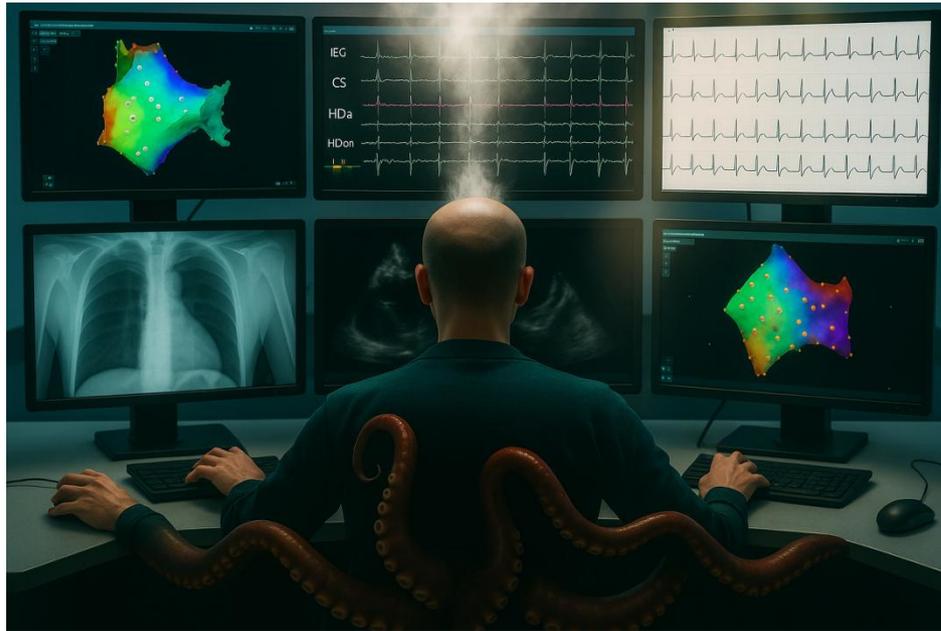
² *I. Interní klinika – kardiologická, Fakultní nemocnice Olomouc*

XXII. České a slovenské sympozium o arytmiích a kardiostimulaci
9. – 11. listopad 2025
Olomouc



BMI V EP LABU

2020



80 %



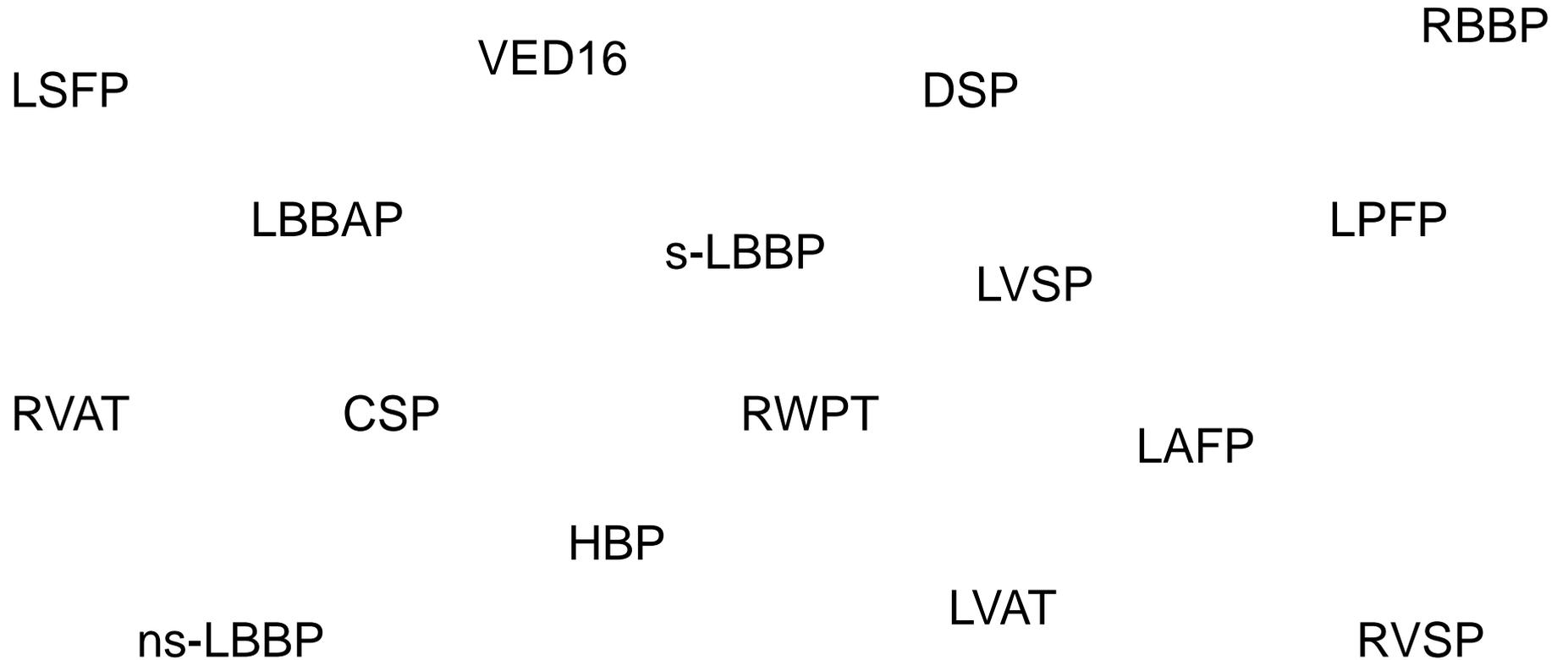
2025



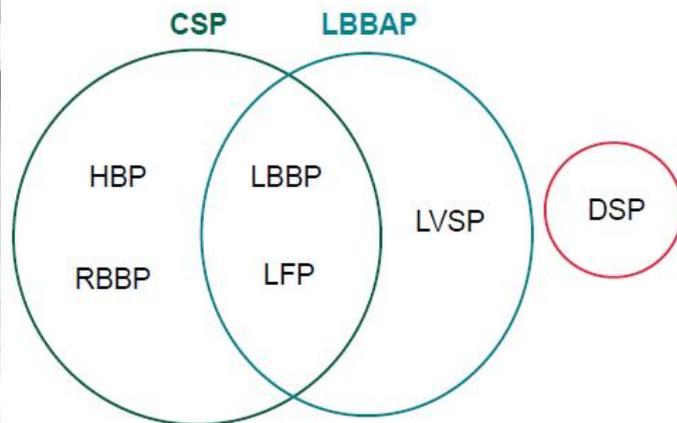
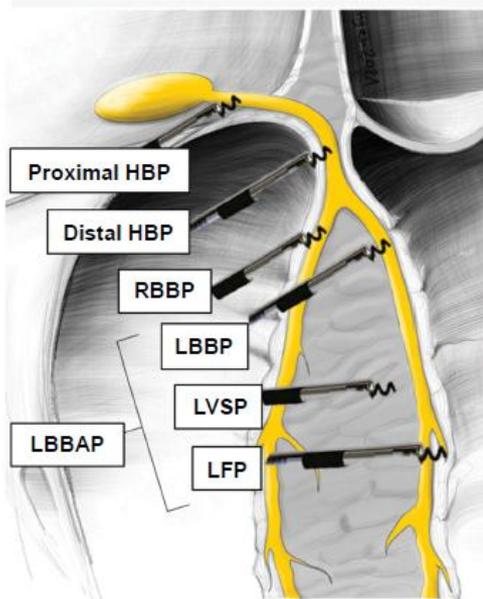
80 %



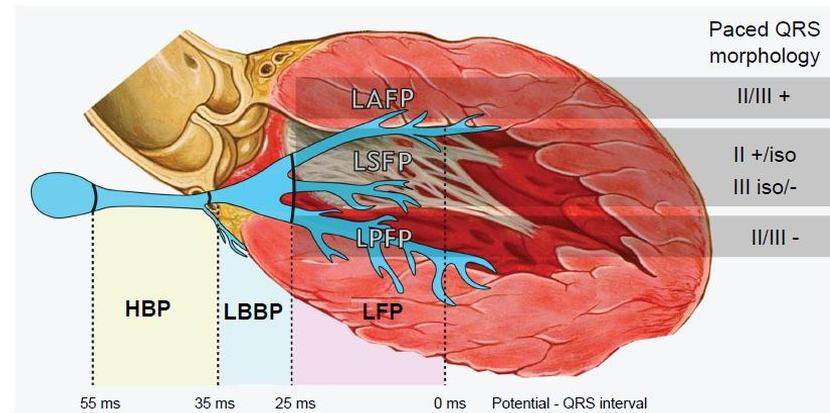
STIMULACE PŘEVODNÍHO SYSTÉMU



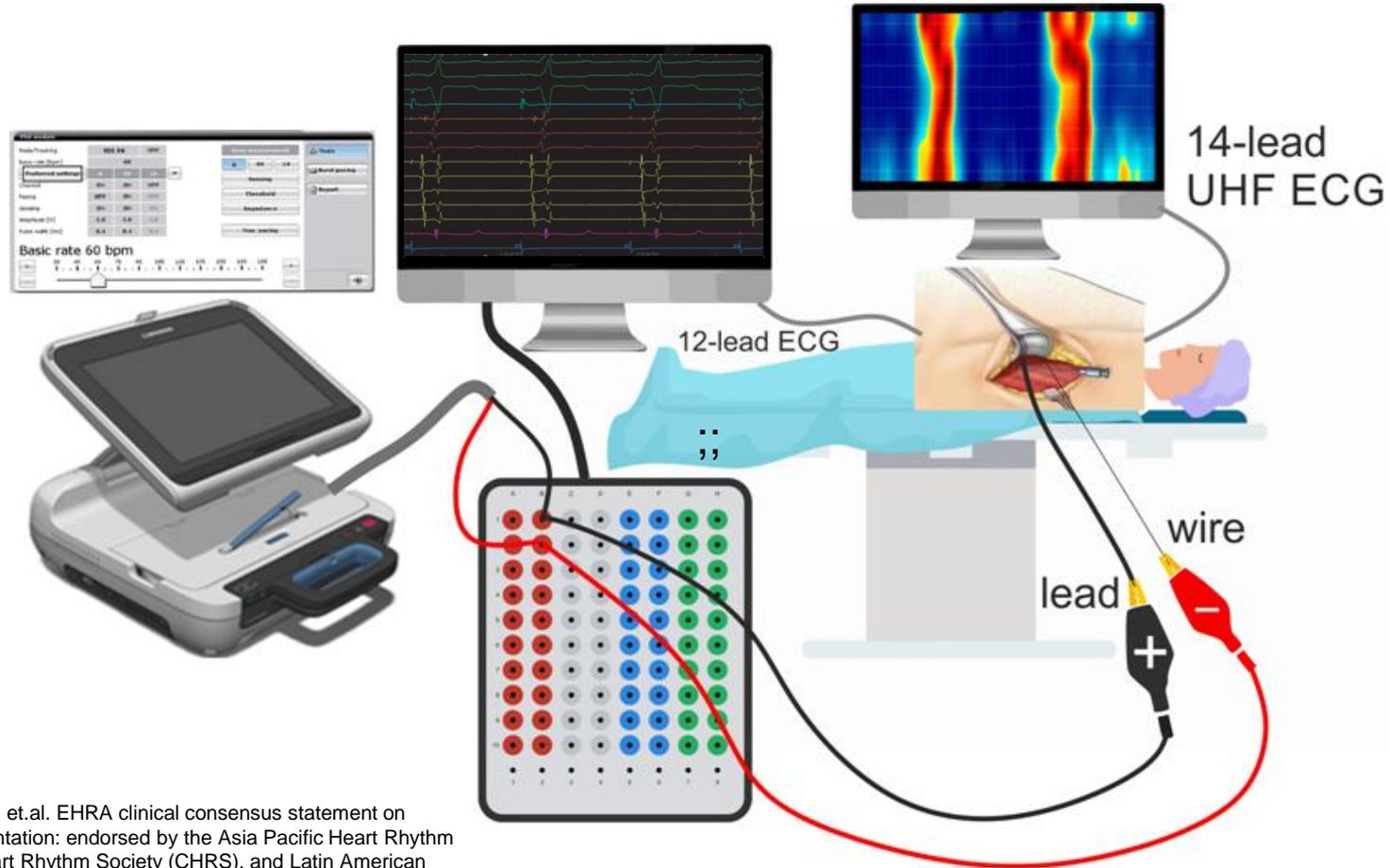
STIMULACE PŘEVODNÍHO SYSTÉMU



CSP: conduction system pacing; DSP: deep septal pacing; HBP: His bundle pacing
 LBBAP: left bundle branch area pacing; LBBP: left bundle branch pacing
 LFP: left fascicular pacing; RBBP: right bundle branch pacing

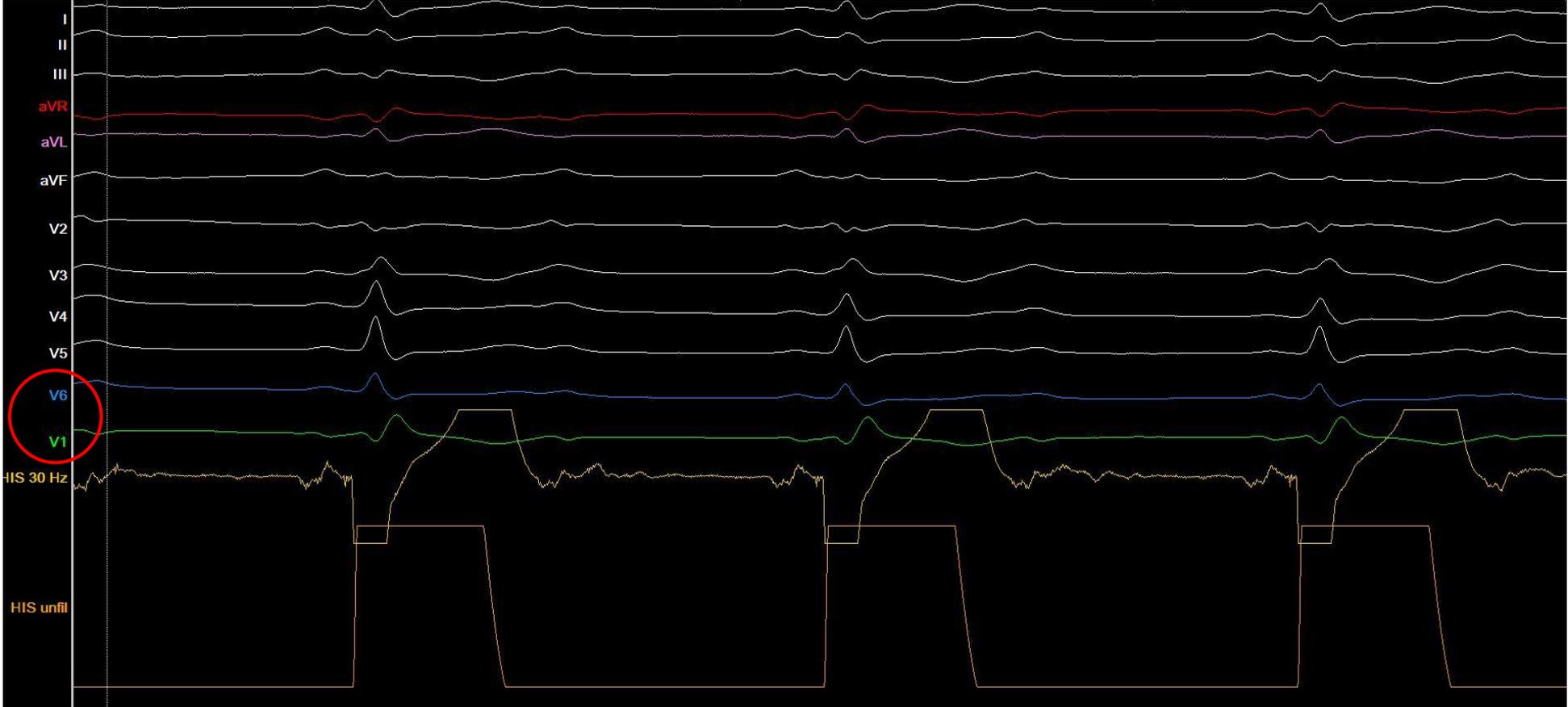


SETUP - HW



Převzato a upraveno z: Burri H, et.al. 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). Europace. 2023 Apr 15;25(4):1208-1236. doi: 10.1093/europace/euad043. PMID: 37061848; PMCID: PMC10105878.

SETUP - SW

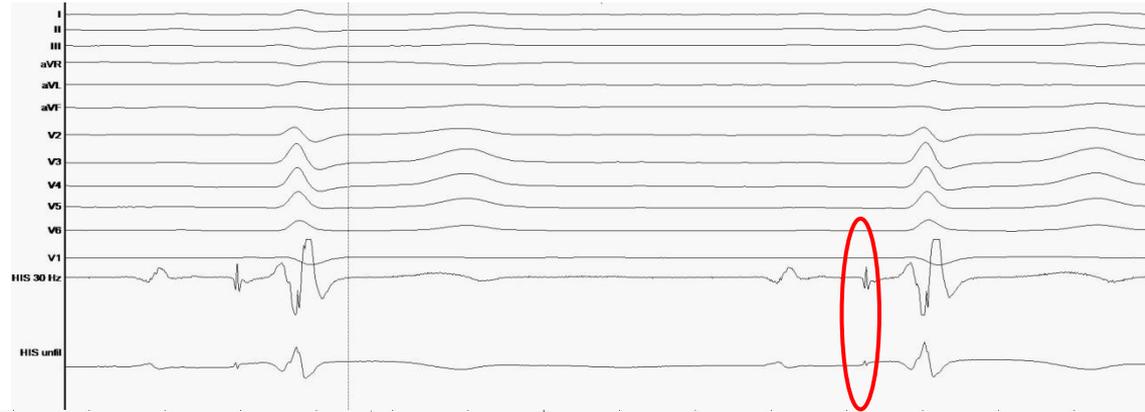


200 mm/s

SETUP - FILTRACE

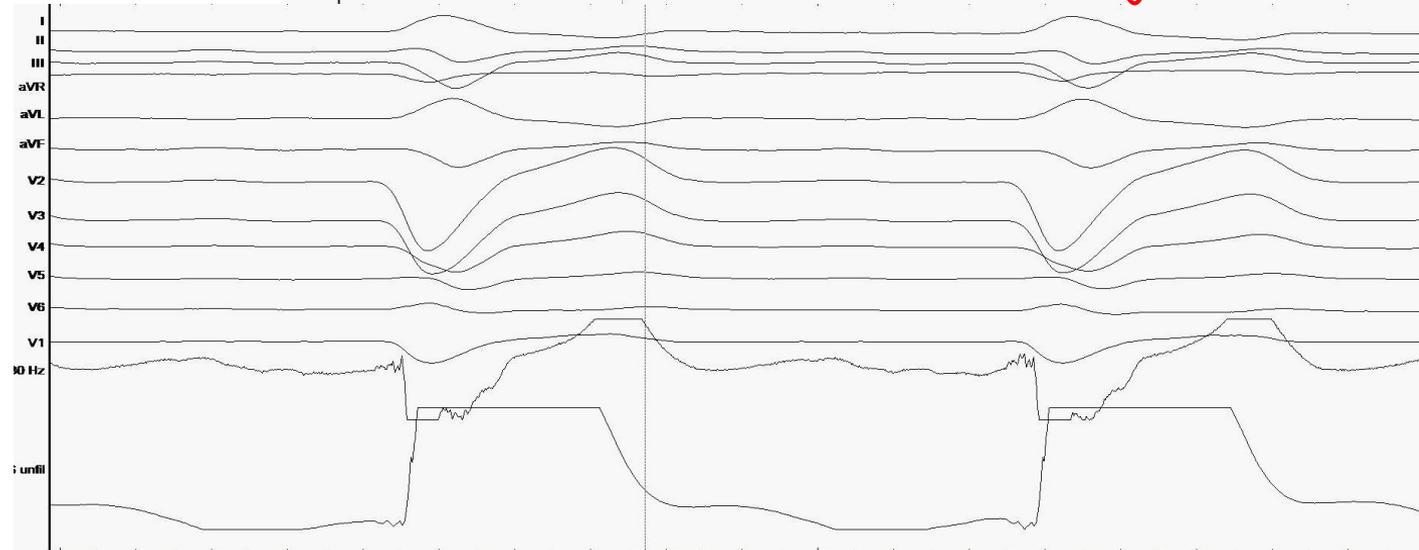
- **HIS 30 Hz**

- HPF 30 Hz
- LPF 250 Hz
- Notch 50 Hz vs. zeměnění/SNR



- **HIS unfil (COI)**

- HPF 0,05 Hz
- LPF 500 Hz
- Notch OFF
- Vzorkování !



SETUP - INSTRUMENT

- **SELECTRA 3D**

- 3 křivky – 40, 55 a 65 mm
- 2 délky – 39 a 42 cm
- CE pro LBBAP



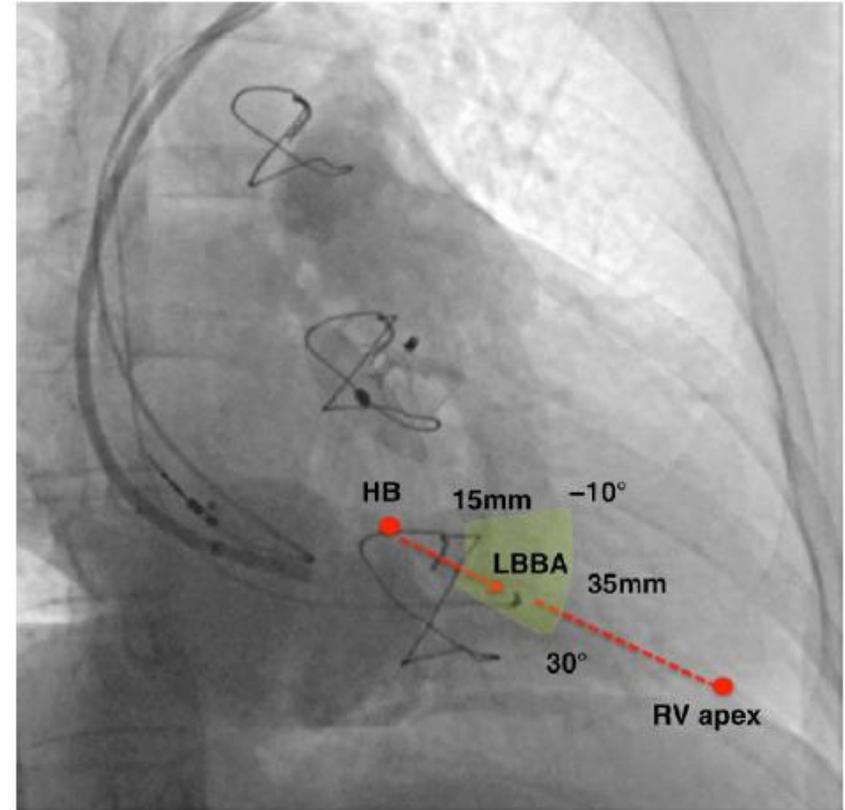
- **SOLIA CSP S 60**

- Fixní helix
- Double-cut sharp
- CE pro LBBAP



WORKFLOW

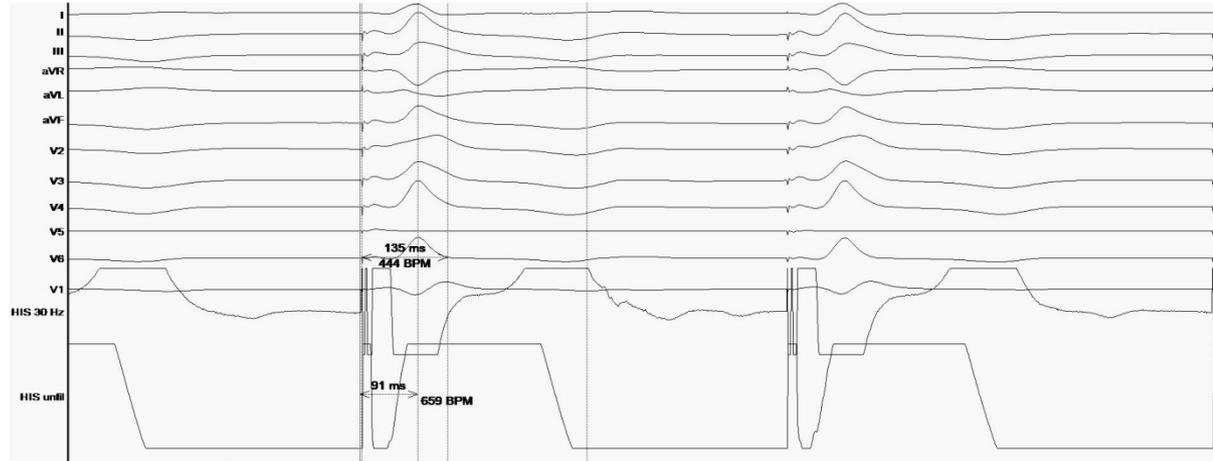
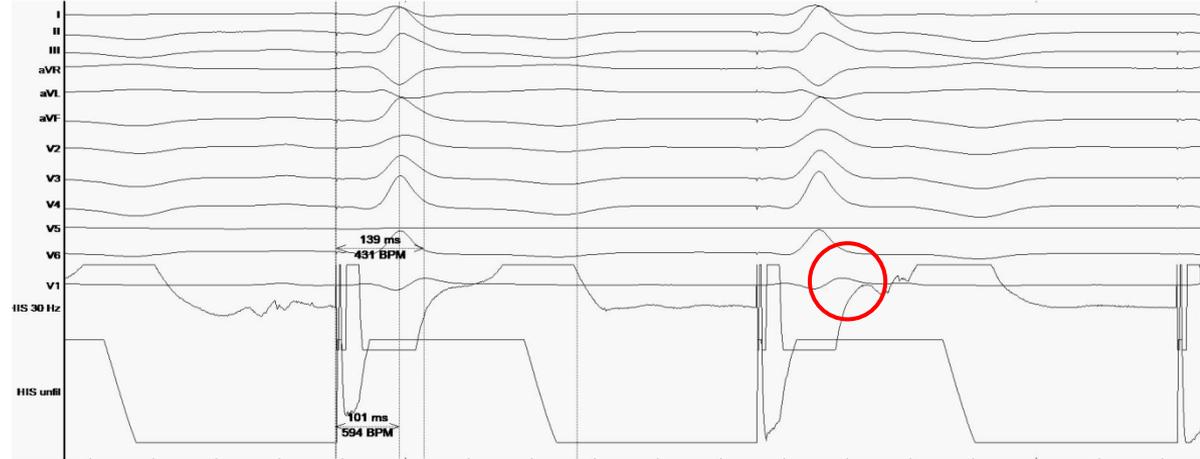
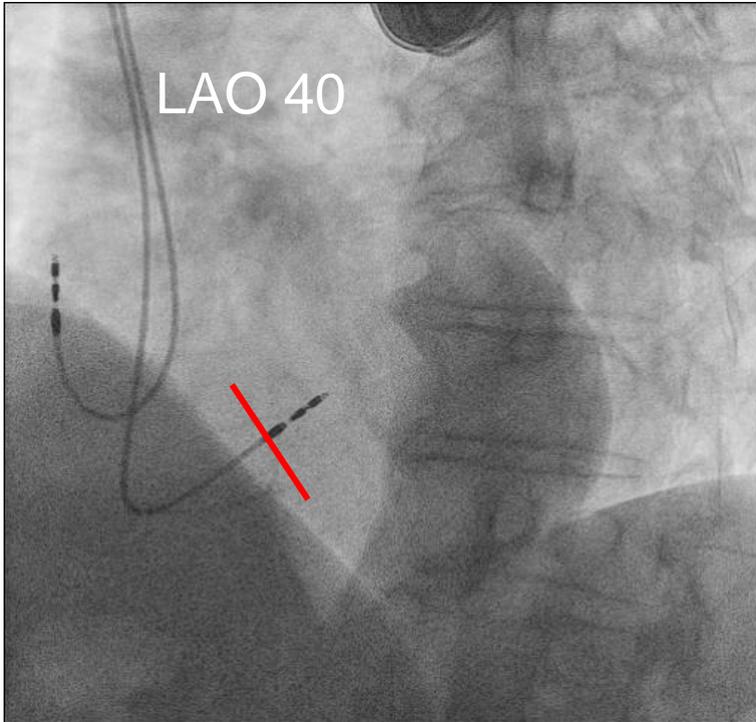
- **CW** rotace SELECTRA 3D do RV
- Kontrast
- **CCW** rotace na septum v **RAO 30**
- **LAO 40** kontrola pozice
 - kolmost
 - kontrast
- Stimulace **ON** + iniciální rychlé šroubování
- „**W**“ pattern ve **V1**
- **R** prime ve **V1**
- Vývoj impedance + **COI**



Burri H, et.al. 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). Europace. 2023 Apr 15;25(4):1208-1236. doi: 10.1093/europace/euad043. PMID: 37061848; PMCID: PMC10105878.

WORKFLOW

- Stop fixace
 - Tloušťka septa (kontrast)
 - Impedanční drop + pokles COI



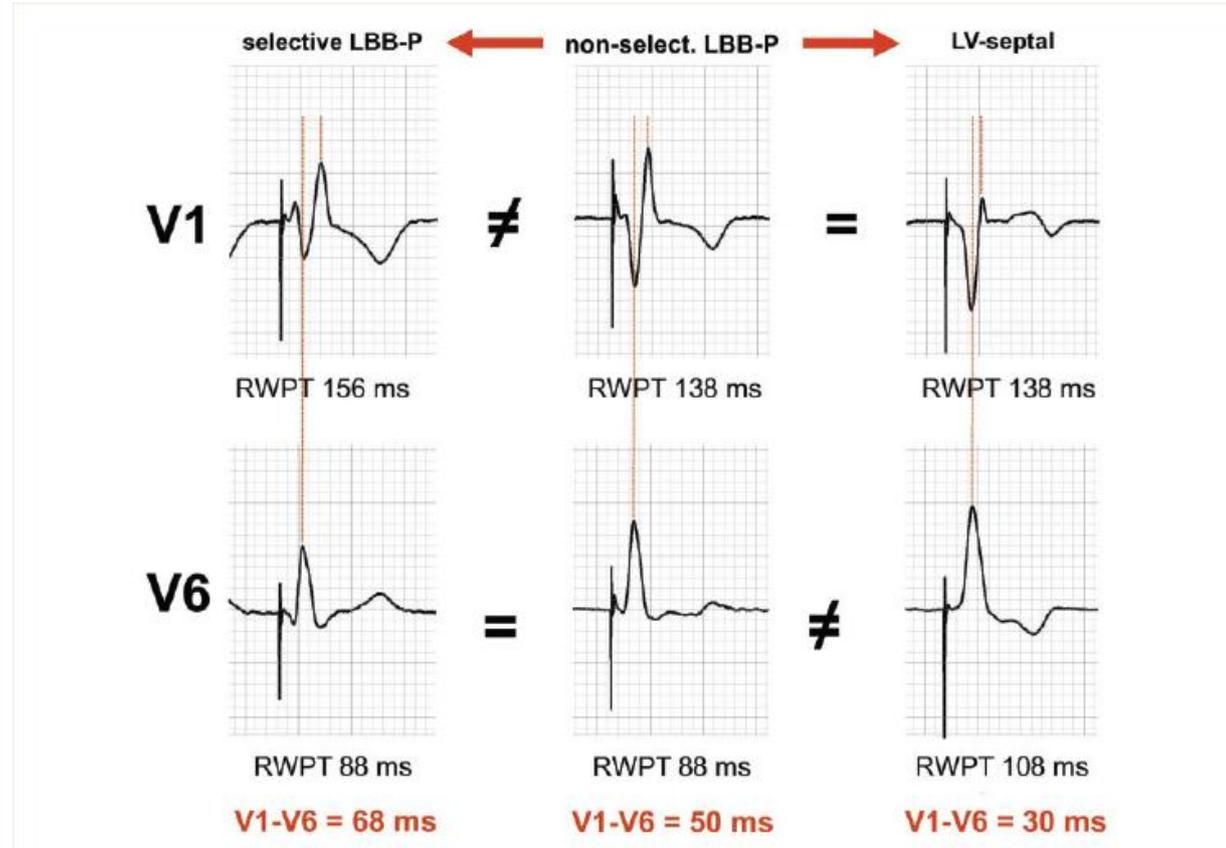
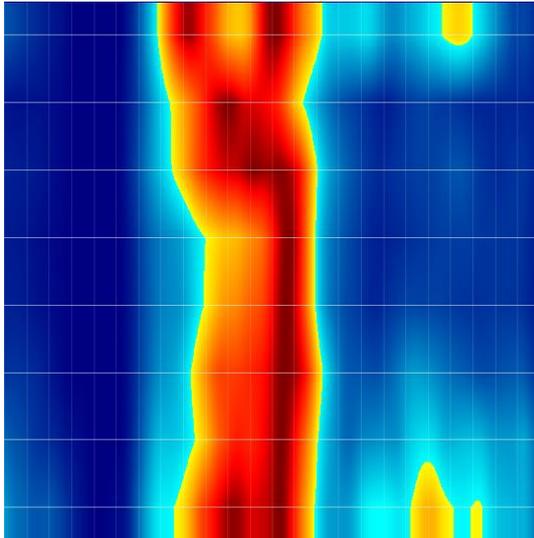
WORKFLOW

- Stop stimulance
 - LBB pot. vs. fascikli



WORKFLOW

- LVAT – RVAT
- Tranzice
- UHF ECG



Jastrzębski M, Burri H, Kielbasa G, Curila K, Moskal P, Bednarek A, Rajzer M, Vijayaraman P. The V6-V1 interpeak interval: a novel criterion for the diagnosis of left bundle branch capture. *Europace*. 2022 Jan 4;24(1):40-47. doi: 10.1093/europace/euab164. PMID: 34255038; PMCID: PMC8742628.

WORKFLOW – PROGRAMACE

- **UP** stimulace
- **ACC** OFF pro ns-LBBP, ON pro LVSP
- **BiV LBBAP** (DF1/IS1)
 - LV port = CSP el.
 - LV only pro non-dependentní pacienty, jinak BiV s LV first a VV delay 100 ms (max)
 - LV only nelze v Mode switch nebo DDI(R)
- **LOT CRTD** (DF1/IS4)
 - RV P/S = CSP el. – pouze BP stim (potvrzení capture LBB !!!)
- Optimalizace VV delay after Vp – role UHF ECG

LBBAP pro perzist. FiS

To allow recording:
1) Wait until data is saved

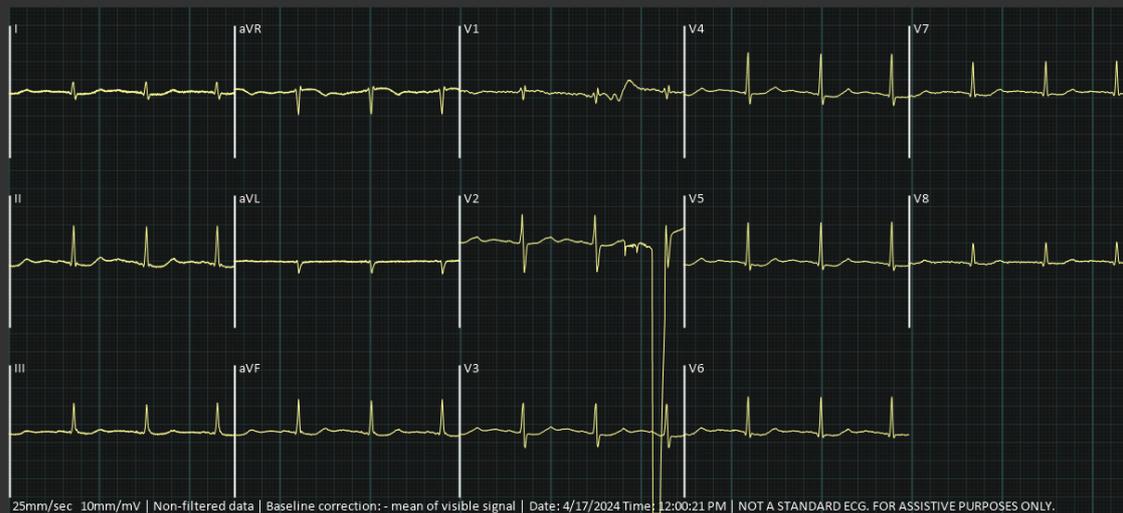
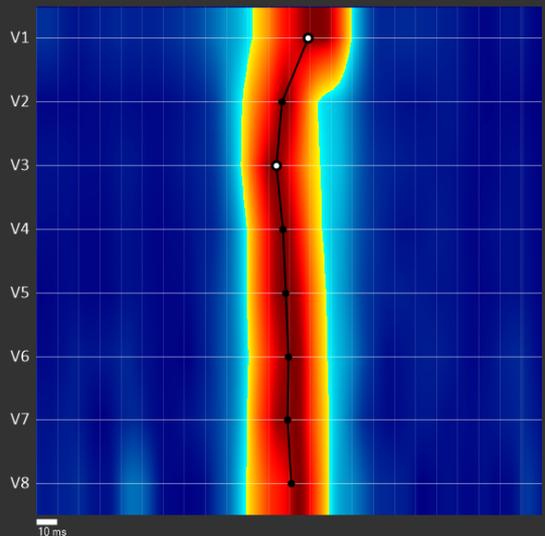
Recording length (s) **23 s** QRS total **24** Morphological groups **A** 95.2 %
4.8 % QRS in maj. group **20** Recording now...

Total groups: 2

R	L	F	C1	Noise levels			
C2	C3	C4	C5	C6	C7	C8	

Acquisition unit connected
Battery level
Min Max

Ventricular depolarization map, major QRS group, N=20, name A



- V1-V6
- V1-V8

VED16 (ms)

-15

Mean VD16 (ms)

39

Patient:

Operator (0 of 40 characters)

Measurement comment (5 of 200 characters)

bazal

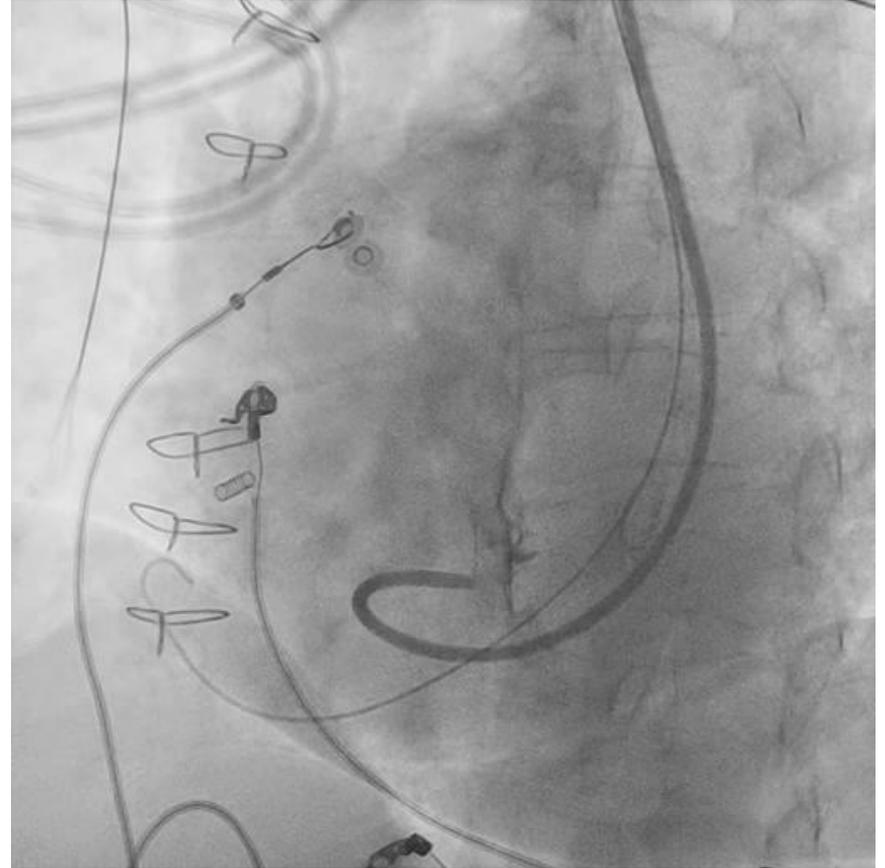
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(01)|(21)

Deploy ID: 1_NEMCB_CZ

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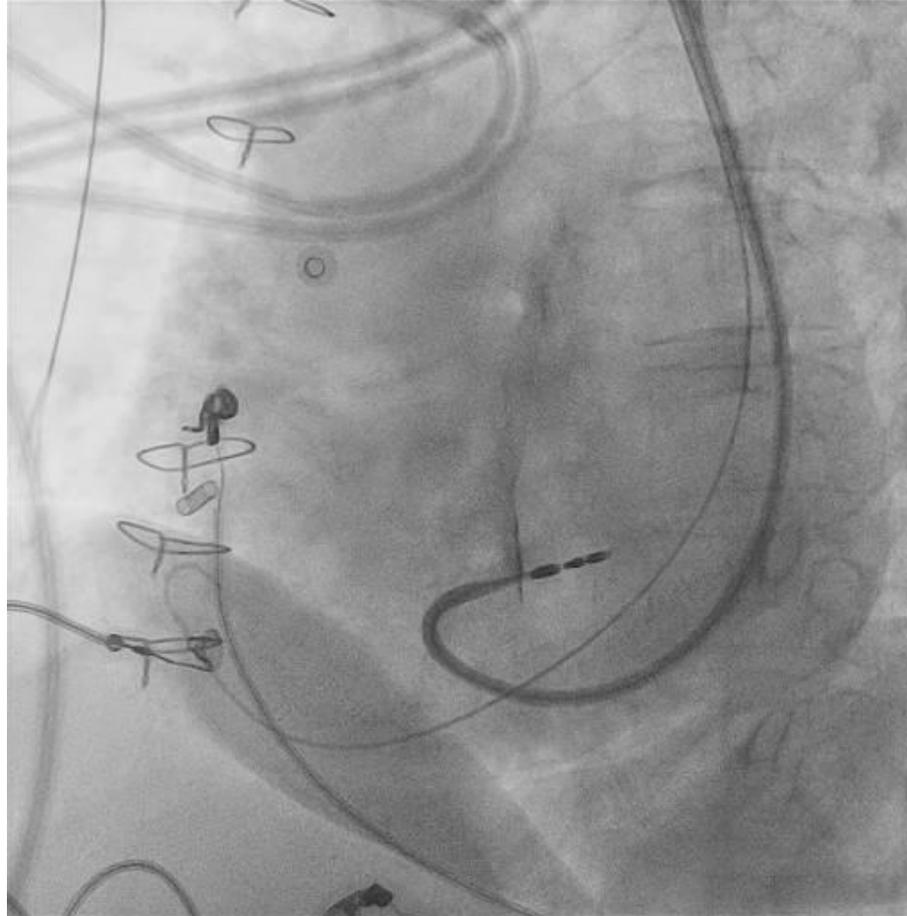


LBBAP via PLSVC

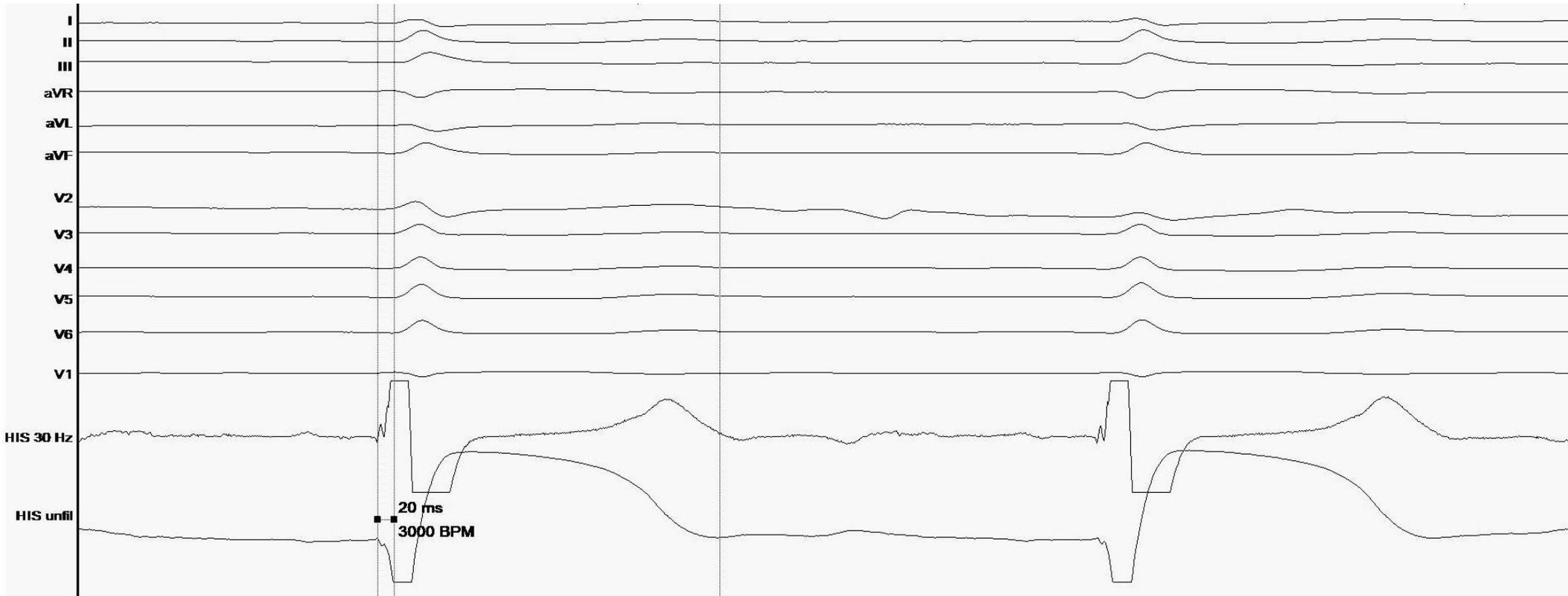


SELECTRA 3D 55-39

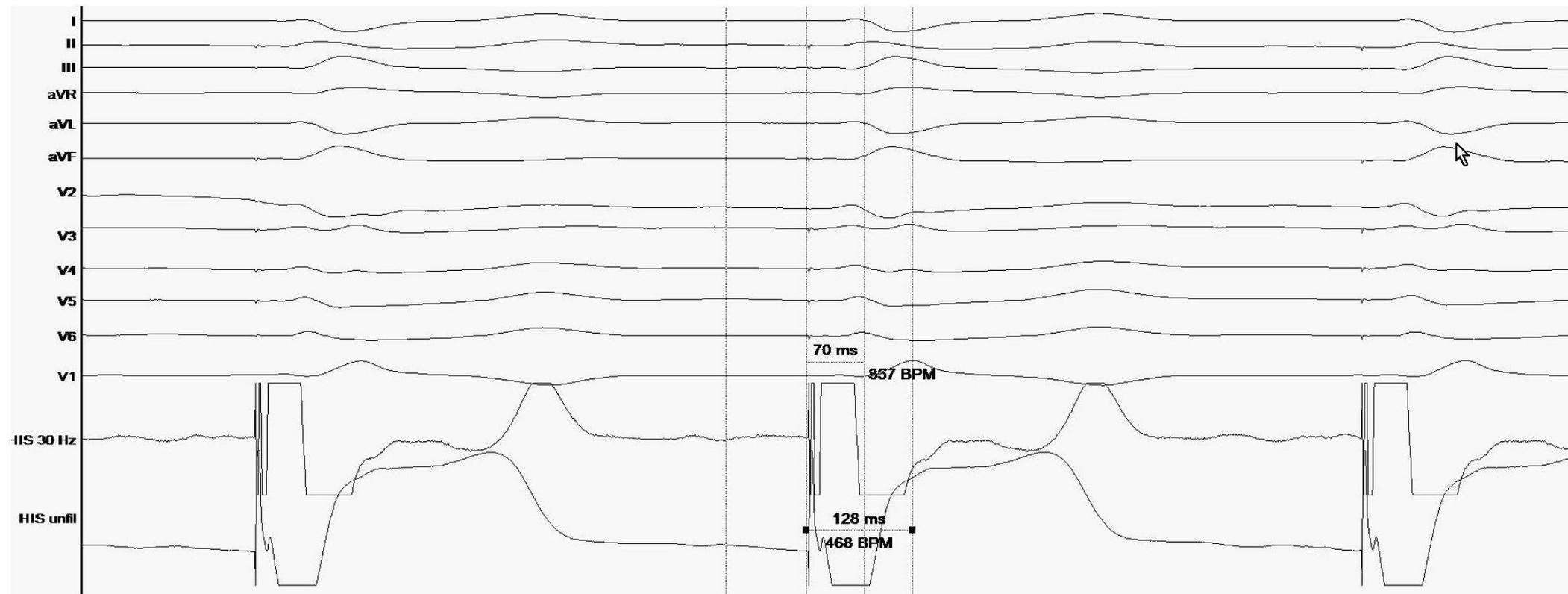
LBBAP via PLSVC



LBBAP via PLSVC



LBBAP via PLSVC



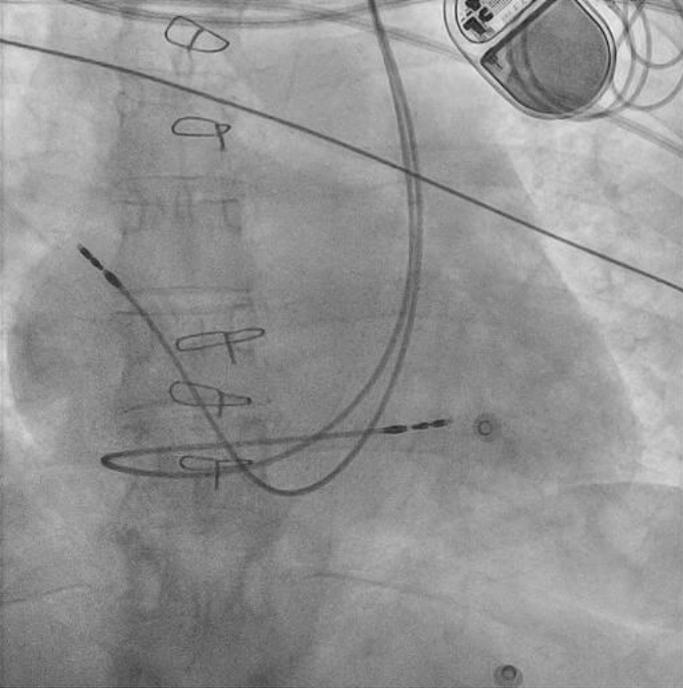
II, III +

LAFP

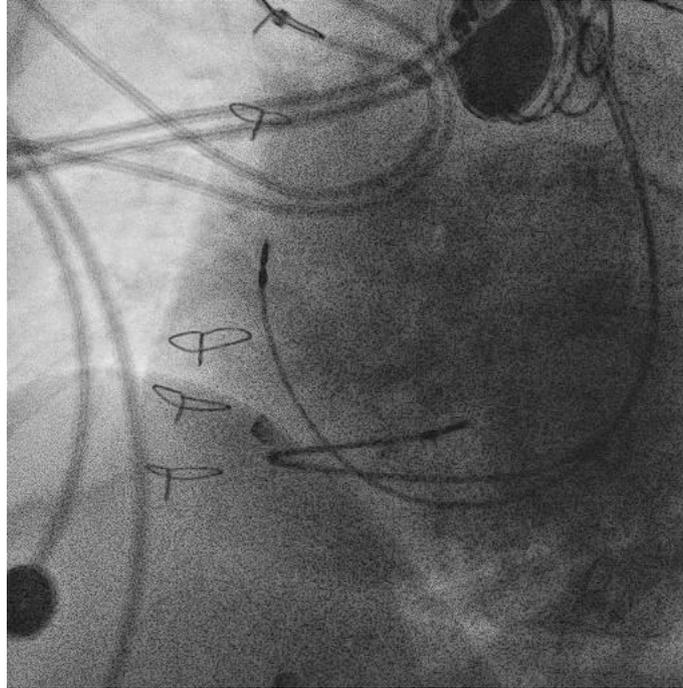
LBBAP via PLSVC



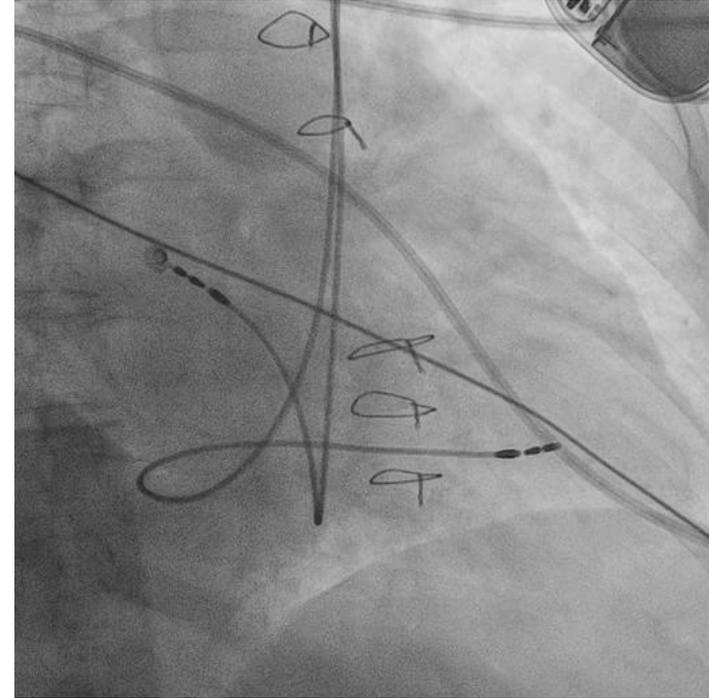
LBBAP via PLSVC



AP

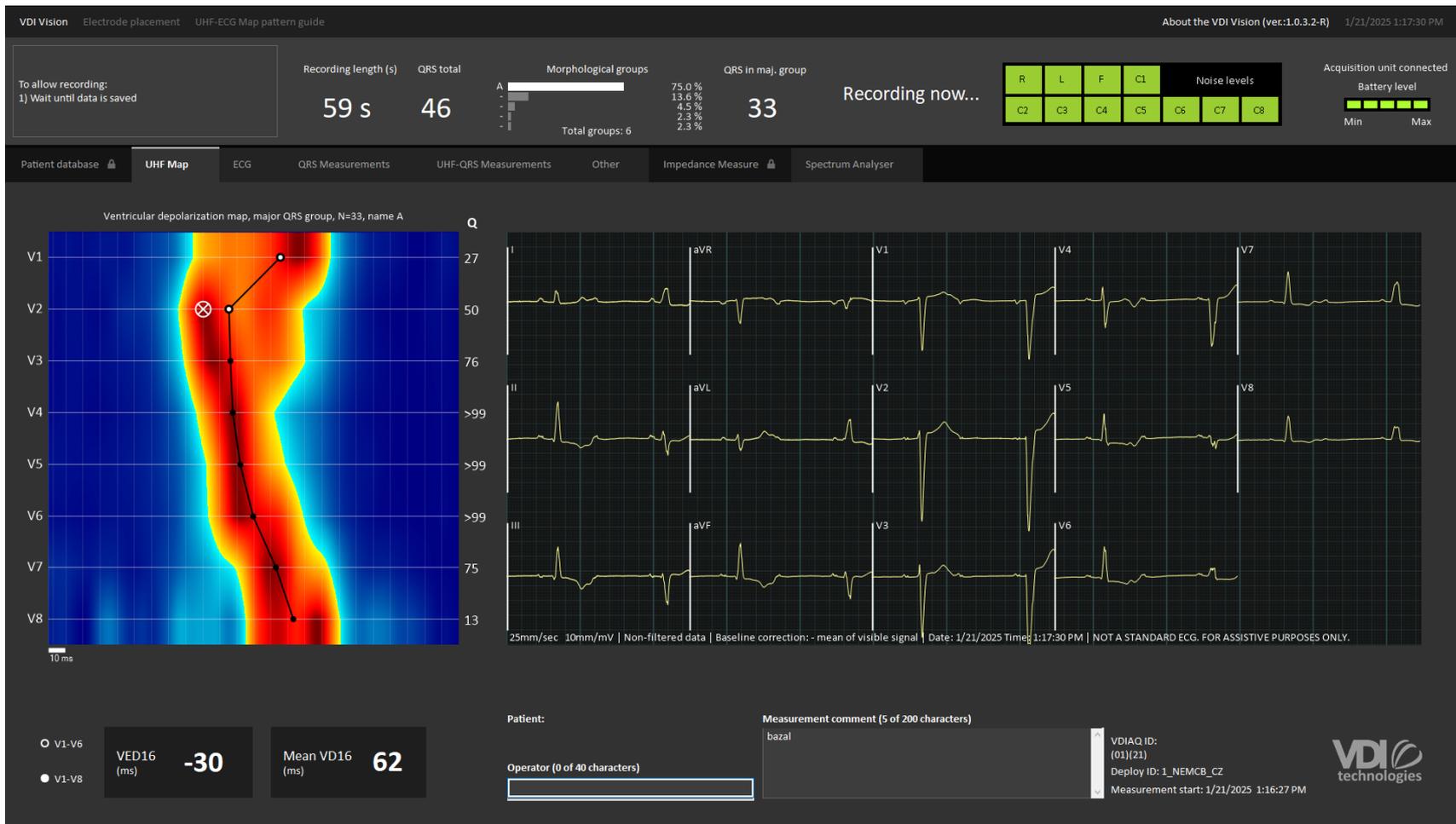


LAO 43

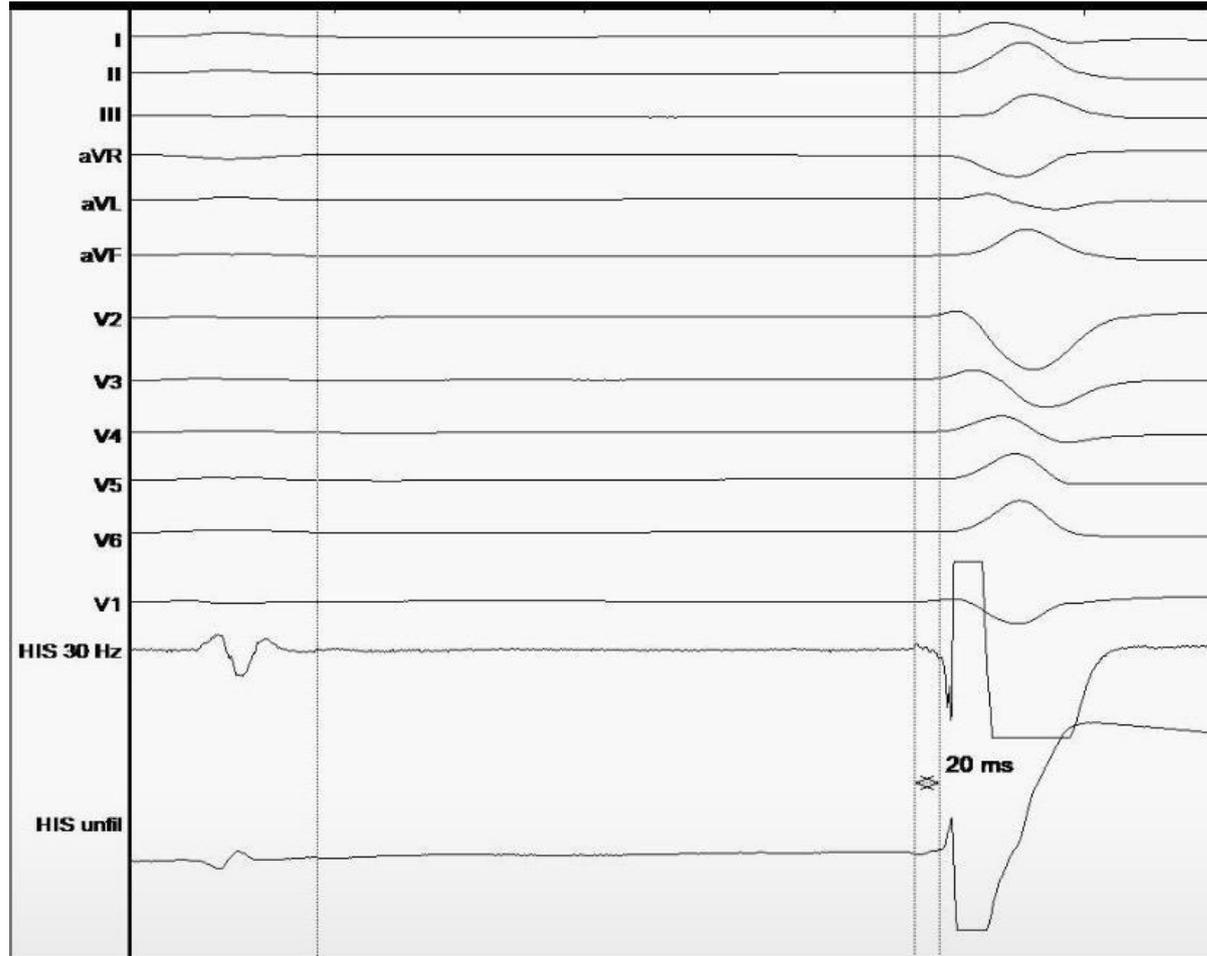


RAO 30

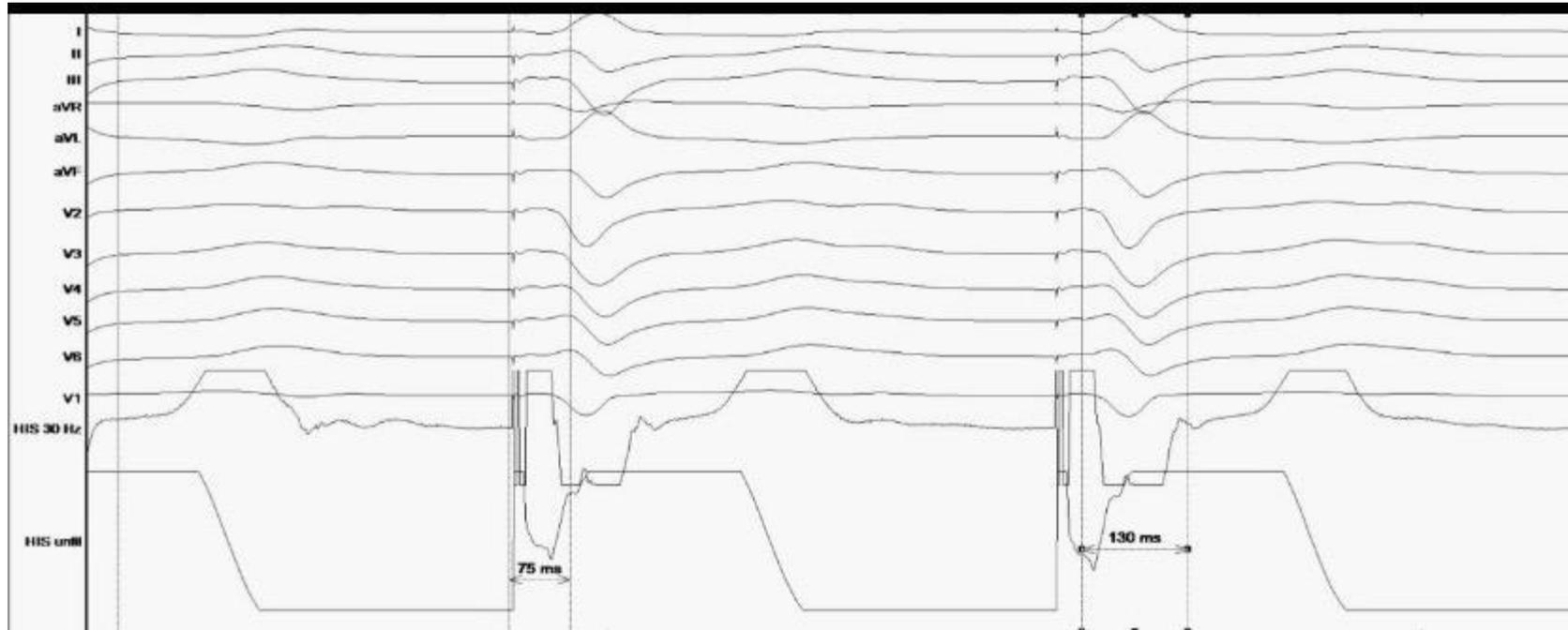
LOT CRT-P pro AVB



LOT CRT-P pro AVB



LOT CRT-P pro AVB



II, III -

LPFP

QRS 130 ms

LOT CRT-P pro AVB

VDI Vision Electrode placement UHF-ECG Map pattern guide About the VDI Vision (ver.:1.0.3.2-R) 1/21/2025 2:24:13 PM

Start recording (F5) Restart (CTRL+R)

Recording length (s) **46 s** QRS total **63** Morphological groups **100.0 %** QRS in maj. group **59**

Total groups: 1 Acquisition unit connected
Battery level
Min Max

Patient database **UHF Map** ECG QRS Measurements UHF-QRS Measurements Other Impedance Measure Spectrum Analyser

Ventricular depolarization map, major QRS group, N=59, name A

Q

25mm/sec 10mm/mV | Non-filtered data | Baseline correction: - mean of visible signal | Date: 1/21/2025 Time: 2:19:20 PM | NOT A STANDARD ECG. FOR ASSISTIVE PURPOSES ONLY.

○ V1-V6 **VED16 (ms) -41** Mean VD16 (ms) **53**

● V1-V8

Patient:

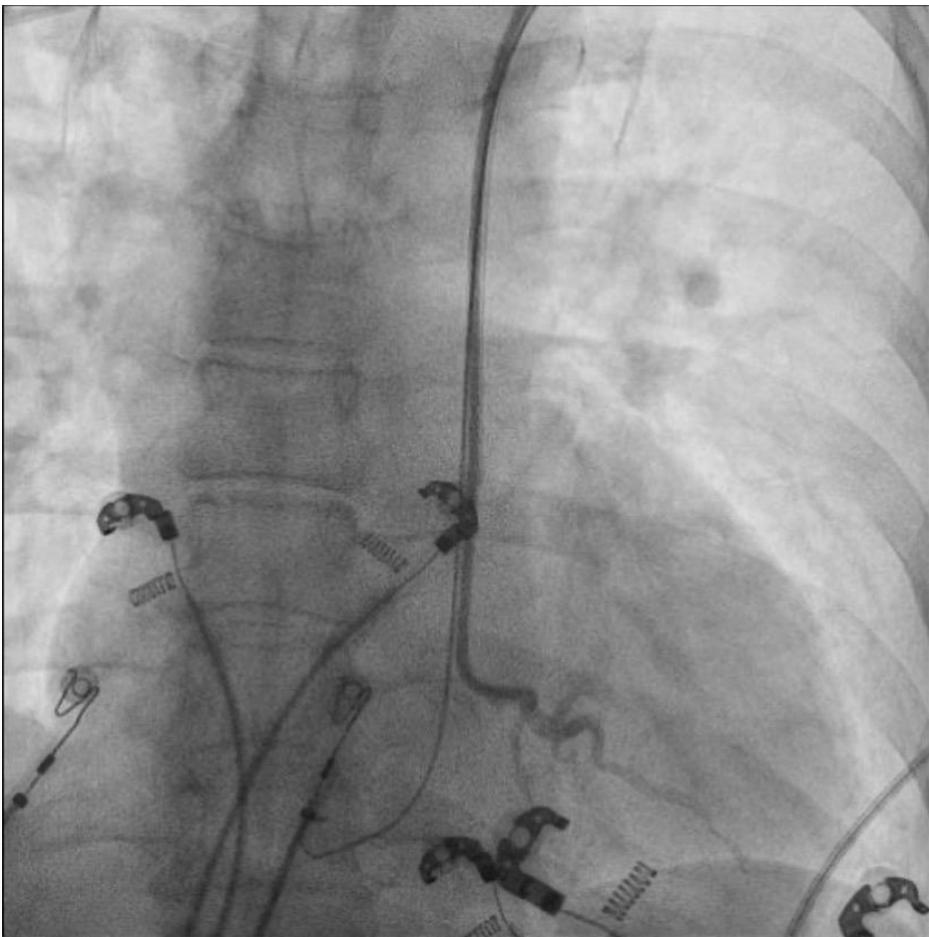
Operator (0 of 40 characters)

Measurement comment (13 of 200 characters)
3. pozice 5 V

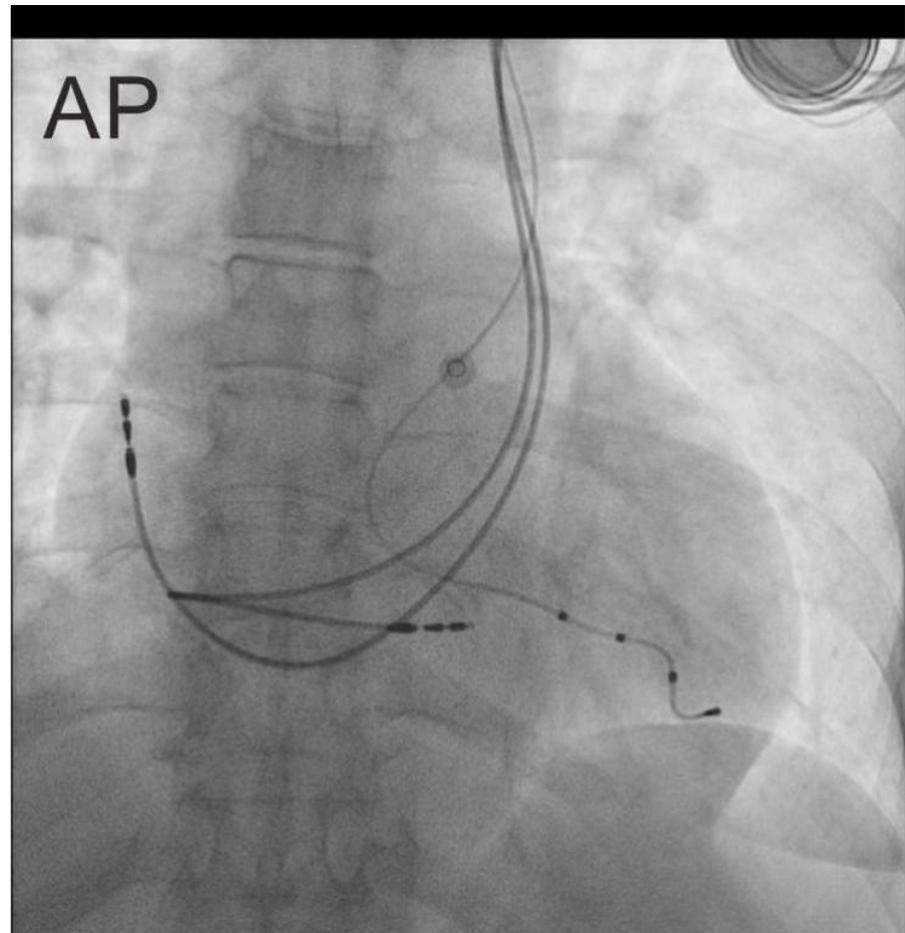
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Deploy ID: 1_NEMCB_CZ
Measurement start: 1/21/2025 2:18:32 PM

VDI technologies

LOT CRT-P via PLSVC



Selectra IC 90-59



LOT CRT-P via PLSVC

VDI Vision Electrode placement UHF-ECG Map pattern guide About the VDI Vision (ver:1.0.3.2-R) 1/21/2025 2:27:40 PM

To allow recording:
1) Wait until data is saved

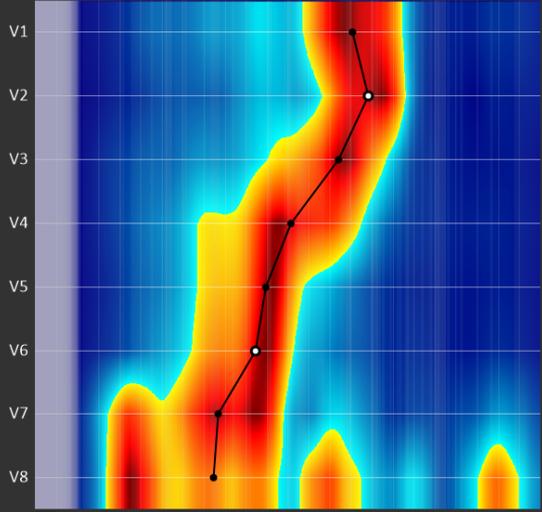
Recording length (s) **23 s** QRS total **30** Morphological groups **A** 88.9% 7.4% 3.7% QRS in maj. group **24** Recording now...

Total groups: 3

Acquisition unit connected
Battery level Min Max

Patient database **UHF Map** ECG QRS Measurements UHF-QRS Measurements Other Impedance Measure Spectrum Analyser

Ventricular depolarization map, major QRS group, N=24, name A



Q



5mm/sec 10mm/mV | Non-filtered data | Baseline correction: - mean of visible signal | Date: 1/21/2025 Time: 2:27:40 PM | NOT A STANDARD ECG. FOR ASSISTIVE PURPOSES ONLY.

10 ms

Patient:

Measurement comment (7 of 200 characters)
lv only

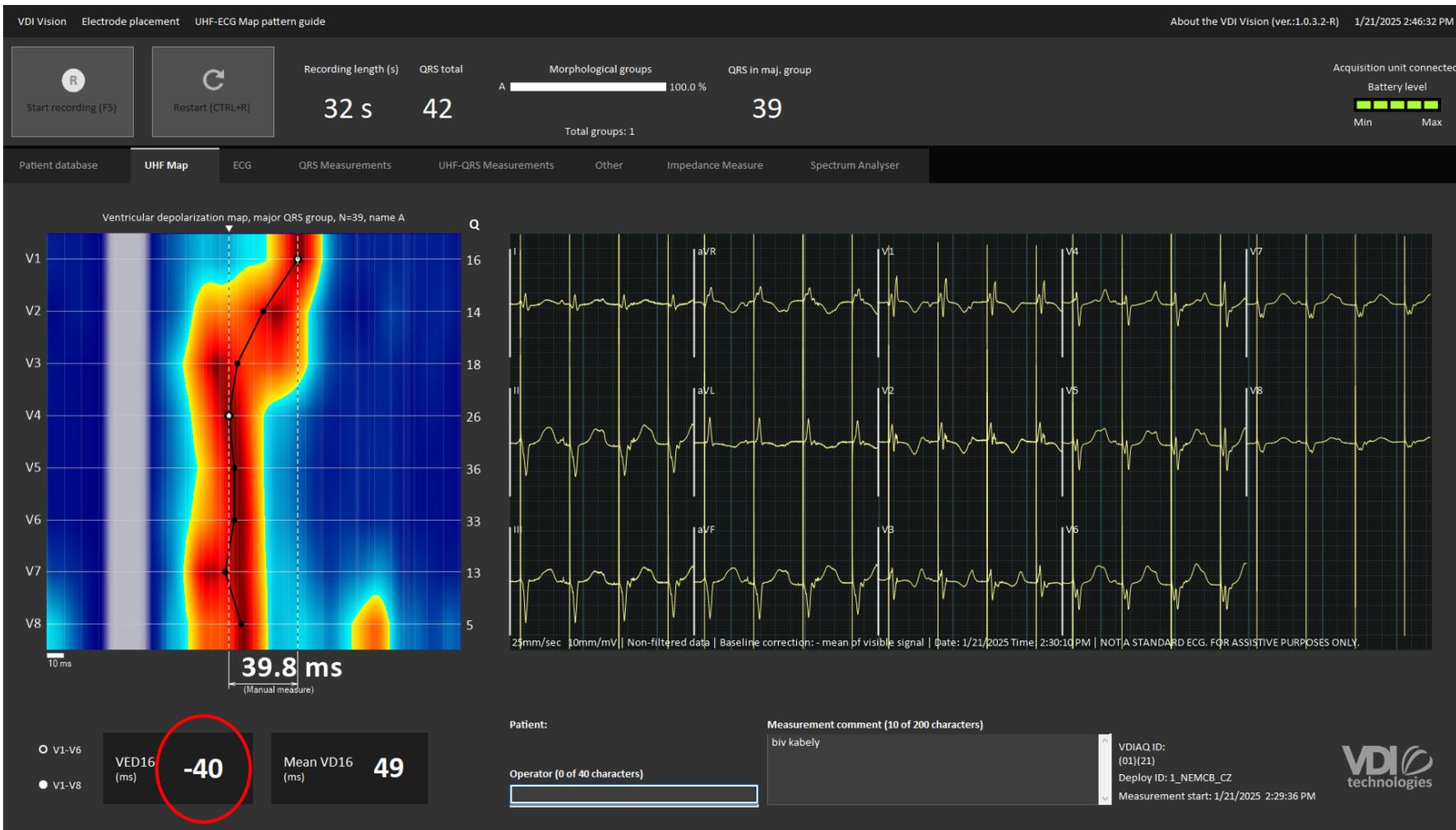
Operator (0 of 40 characters)

VDIAQ ID: (01)|21
Deploy ID: 1_NEMCB_CZ
Measurement start: 1/21/2025 2:27:14 PM

VDI technologies

V1-V6 VED16 (ms) **-54** Mean VD16 (ms) **53**
 V1-V8

LOT CRT-P via PLSVC



LOT CRT-P via PLSVC

VDI Vision Electrode placement UHF-ECG Map pattern guide

About the VDI Vision (ver.:1.0.3.2-R) 1/21/2025 2:48:47 PM

To allow recording:
1) Wait until data is saved

Recording length (s)

55 s

QRS total

71

Morphological groups



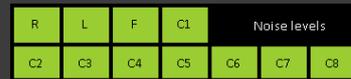
89.7 %
8.8 %
1.5 %

Total groups: 3

QRS in maj. group

61

Recording now...

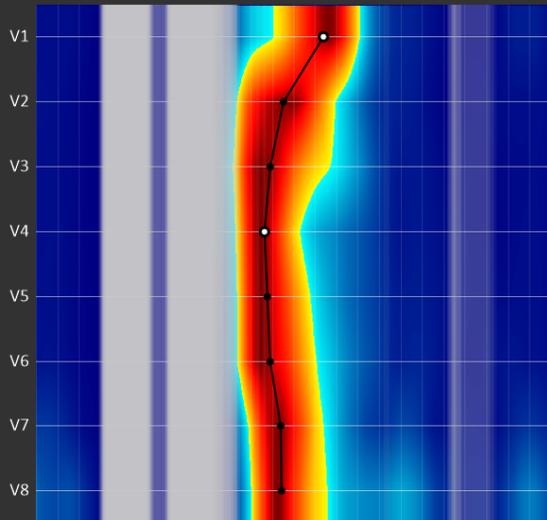


Acquisition unit connected



Patient database UHF Map ECG QRS Measurements UHF-QRS Measurements Other Impedance Measure Spectrum Analyser

Ventricular depolarization map, major QRS group, N=61, name A



Q



25mm/sec 10mm/mV | Non-filtered data | Baseline correction: - mean of visible signal | Date: 1/21/2025 Time: 2:48:47 PM | NOT A STANDARD ECG. FOR ASSISTIVE PURPOSES ONLY.

V1-V6

VED16 (ms)

-27

Mean VD16 (ms)

39

V1-V8

Patient:

Operator (0 of 40 characters)

Measurement comment (35 of 200 characters)

biv up amv ia rv first 30 ms pred lv

VDIAQ ID:

(01)(21)

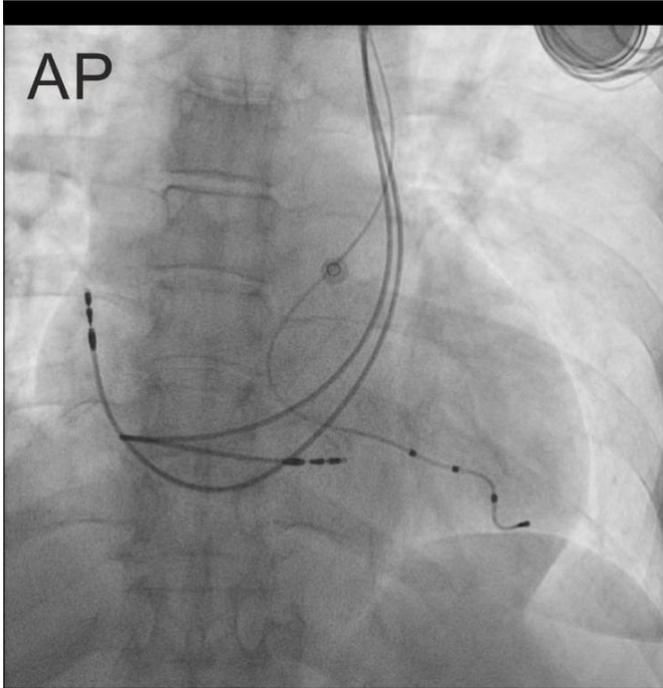
Deploy ID: 1_NEMCB_CZ

Measurement start: 1/21/2025 2:47:49 PM

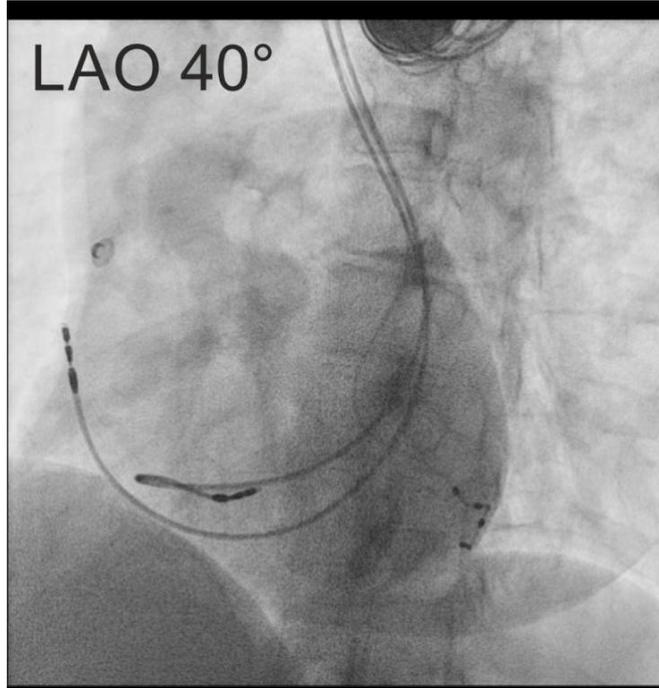


LOT CRT-P via PLSVC

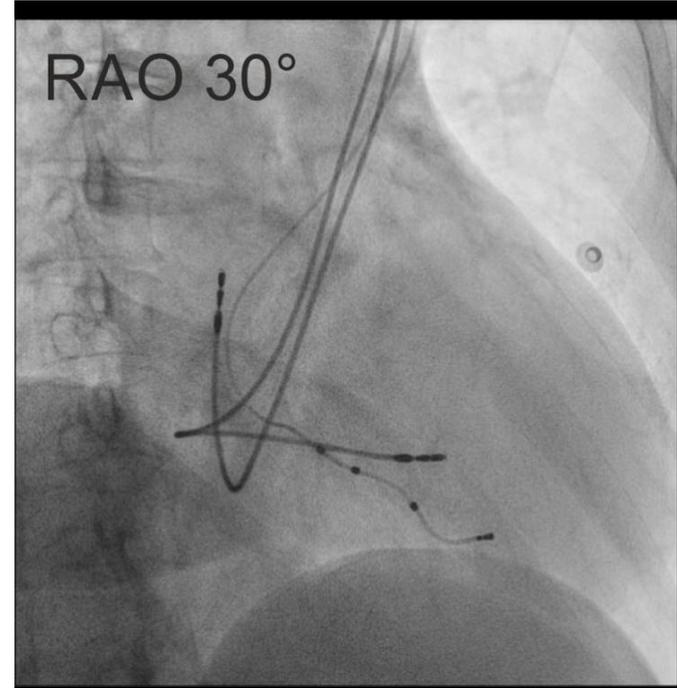
AP



LAO 40°



RAO 30°



DISKUZE

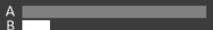
- **R** prime
 - Naložení svodů
 - BARD vs. UHF ECG
- **Tranzice** z ns-LBBP na s-LBBP
 - Perioperačně ano
 - Steroid – capture myokardu
- Výběr správné křivky **Selectra 3D**
 - Empiricky dle skiaskopie
 - Každý 10. pacient max – 2. křivka
 - CTAG + 3D tisk?
- Nastavení **filtrů** pro iEGM
 - SNR vs. HW
 - In-house recording system? UHF ECG vs. BARD



FÚZE NATIVNÍHO PŘEVODU S LBBAP

To allow recording:
1) Wait until data is saved

Recording length (s) **95 s**
QRS total **99**

Morphological groups
A  81.4 %
B  12.4 %
- 1.0 %
- 1.0 %
- 1.0 %
Total groups: 8

QRS in maj. group **79**

Recording now...

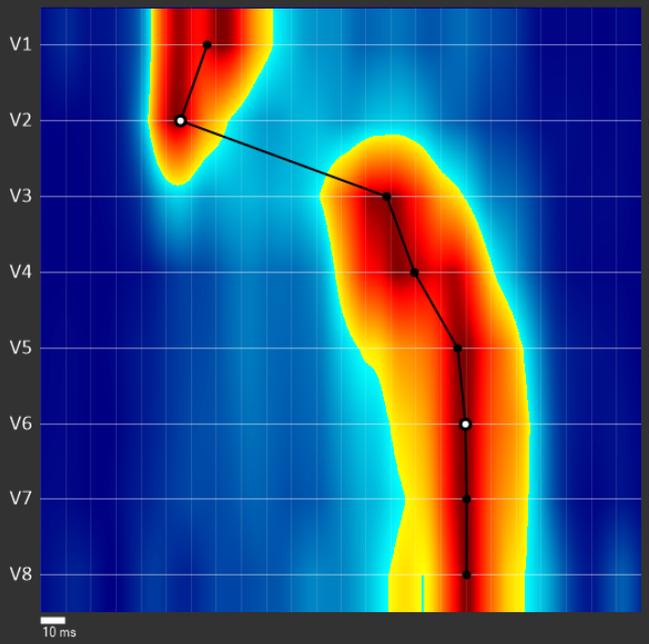
R	L	F	C1	Noise levels			
C2	C3	C4	C5	C6	C7	C8	

Acquisition unit connected
Battery level

Min Max

- Patient database
- UHF Map**
- ECG
- QRS Measurements
- UHF-QRS Measurements
- Other
- Impedance Measure
- Spectrum Analyser

Ventricular depolarization map, major QRS group, N=79, name A



Q



- V1-V6
- V1-V8

VED16 (ms) **114** Mean VD16 (ms) **54**

Patient:
Operator (0 of 40 characters)

Measurement comment (6 of 200 characters)
native

VDIAQ ID: (01)(21)
Deploy ID: 1_NEMCB_CZ
Measurement start: 6/19/2024 10:10:56 AM



To allow recording:
1) Wait until data is saved

Recording length (s)
30 s

QRS total
35

Morphological groups
A 
81.3 %
12.5 %
3.1 %
3.1 %
Total groups: 4

QRS in maj. group
26

Recording now...

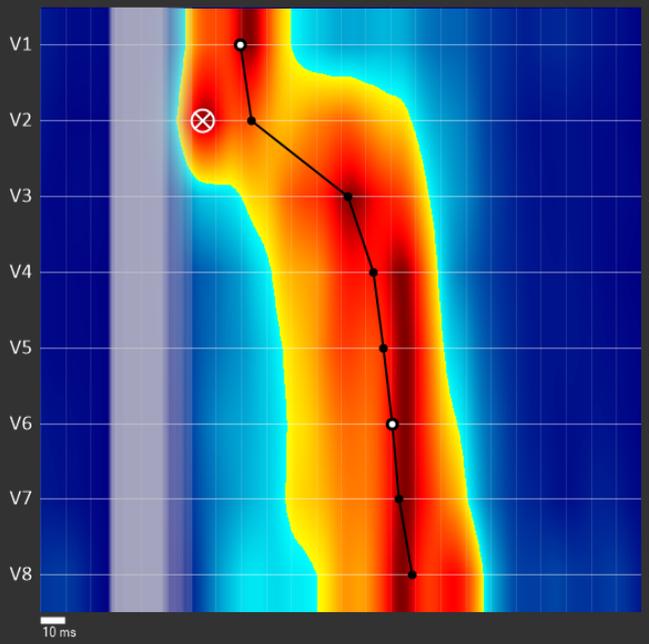
R	L	F	C1	Noise levels			
C2	C3	C4	C5	C6	C7	C8	

Acquisition unit connected
Battery level

Min Max

- Patient database
- UHF Map**
- ECG
- QRS Measurements
- UHF-QRS Measurements
- Other
- Impedance Measure
- Spectrum Analyser

Ventricular depolarization map, major QRS group, N=26, name A



Q



25mm/sec 10mm/mV | Non-filtered data | Baseline correction: - mean of visible signal | Date: 6/19/2024 Time: 10:52:01 AM | NOT A STANDARD ECG. FOR ASSISTIVE PURPOSES ONLY.

- V1-V6
- V1-V8

VED16 (ms) **60** Mean VD16 (ms) **68**

Patient:
Operator (0 of 40 characters)

Measurement comment (23 of 200 characters)
avd 120 ms bez R prime

VDIAQ ID:
(01)(21)
Deploy ID: 1_NEMCB_CZ
Measurement start: 6/19/2024 10:51:28 AM



R

Start recording (F5)

↺

Restart (CTRL+R)

Recording length (s)

63 s

QRS total

74

Morphological groups



QRS in maj. group

61

Total groups: 3

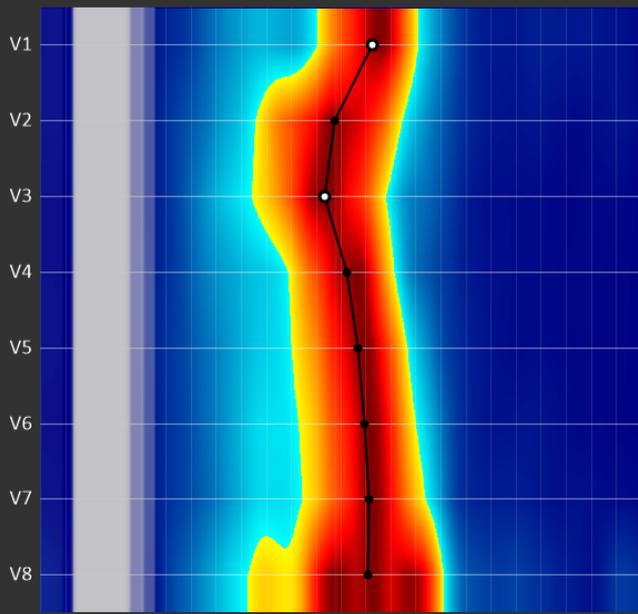
Acquisition unit connected

Battery level

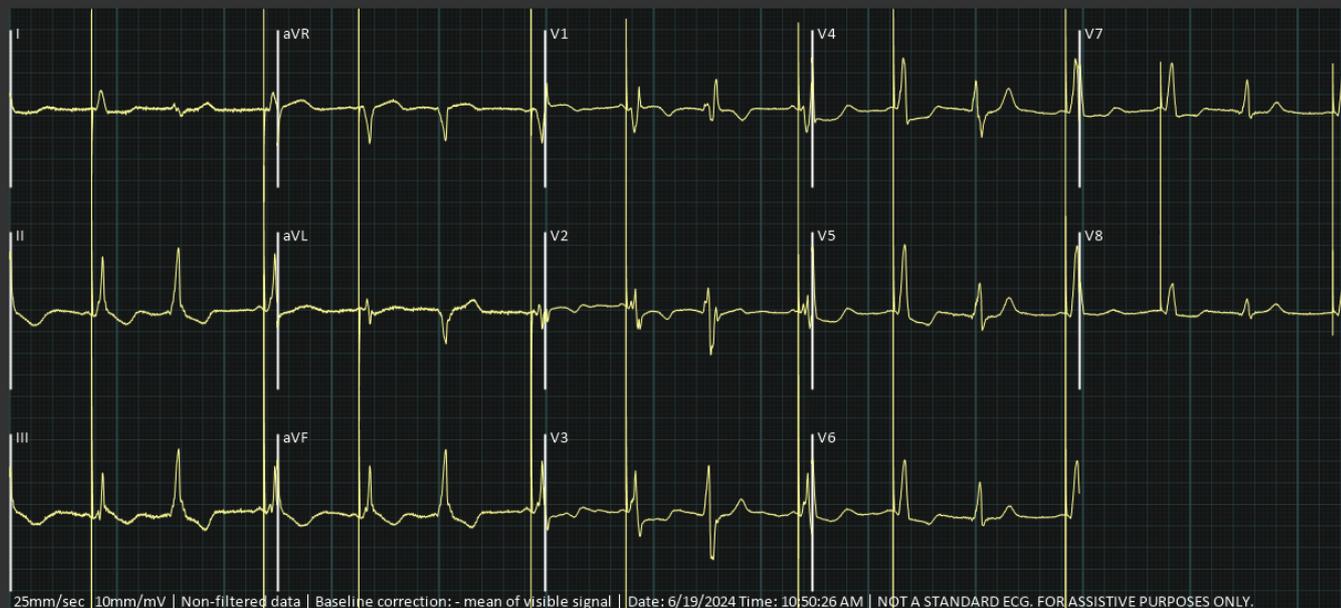


- Patient database
- UHF Map**
- ECG
- QRS Measurements
- UHF-QRS Measurements
- Other
- Impedance Measure
- Spectrum Analyser

Ventricular depolarization map, major QRS group, N=61, name A



Q



V1-V6

VED16 (ms)

-19

Mean VD16 (ms)

48

V1-V8

Patient:

Operator (0 of 40 characters)

Measurement comment (58 of 200 characters)

amvia up korektivni pacing 40 ms AVD jinak fuze s nativem

VDIAQ ID: (01)(21)

Deploy ID: 1_NEMCB_CZ

Measurement start: 6/19/2024 10:49:19 AM



LOT CRT + PROGRAMACE

R

Start recording (F5)

↺

Restart (CTRL+R)

Recording length (s)

58 s

QRS total

64

Morphological groups



QRS in maj. group

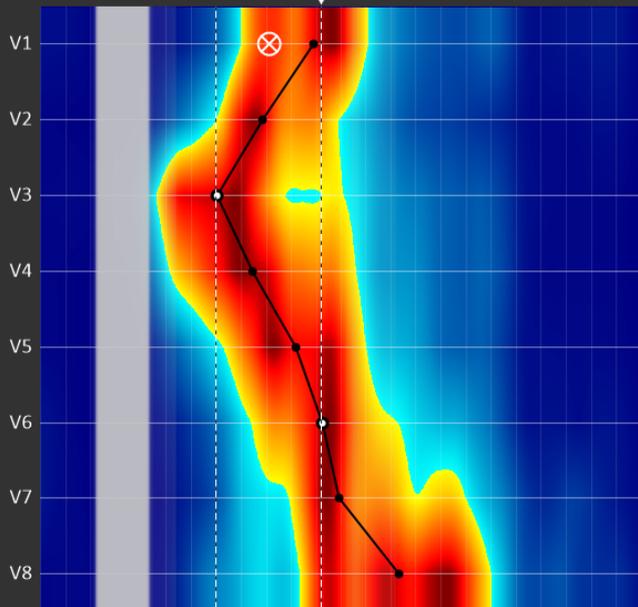
42

PICM, HFrEF, EF 27 %

Acquisition unit disconnected

- Patient database
- UHF Map**
- ECG
- QRS Measurements
- UHF-QRS Measurements
- Other
- Impedance Measure
- Spectrum Analyser

Ventricular depolarization map, major QRS group, N=42, name A



42.4 ms
(Manual measure)

Q



25mm/sec 10mm/mV | Non-filtered data | Baseline correction: - mean of visible signal | Date: 5/30/2024 Time: 10:20:01 AM | NOT A STANDARD ECG. FOR ASSISTIVE PURPOSES ONLY.

V1-V6

VED16 (ms)

42

V1-V8

Mean VD16 (ms)

58

Patient:

Operator (0 of 40 characters)

Measurement comment (5 of 200 characters)

2D PM

VDIAQ ID: (01)(21)

Deploy ID: 1_NEMCB_CZ

Measurement start: 5/30/2024 10:17:30 AM



To allow recording:
1) Wait until data is saved

Recording length (s)
29 s

QRS total
27

Morphological groups
A 100.0 %
Total groups: 1

QRS in maj. group
25

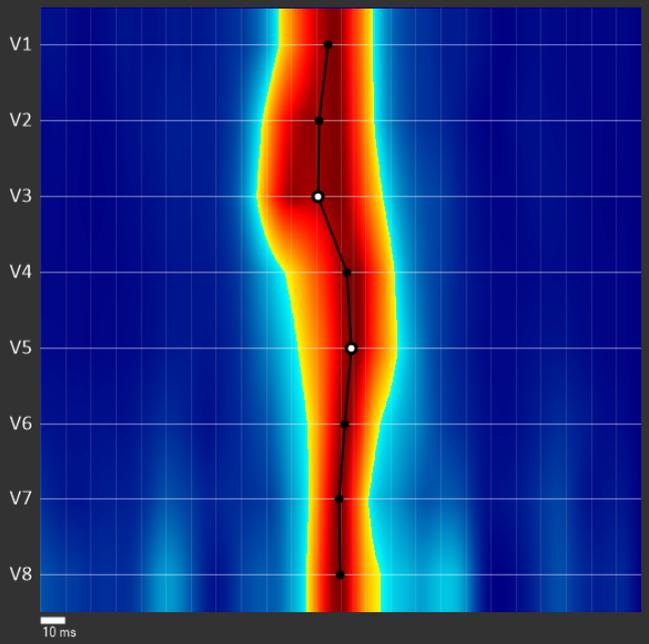
Recording now...

R	L	F	C1	Noise levels			
C2	C3	C4	C5	C6	C7	C8	

Acquisition unit connected
Battery level
 Min Max

- Patient database
- UHF Map**
- ECG
- QRS Measurements
- UHF-QRS Measurements
- Other
- Impedance Measure
- Spectrum Analyser

Ventricular depolarization map, major QRS group, N=25, name A



- V1-V6
- V1-V8

VED16 (ms)	13	Mean VD16 (ms)	41
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Patient:

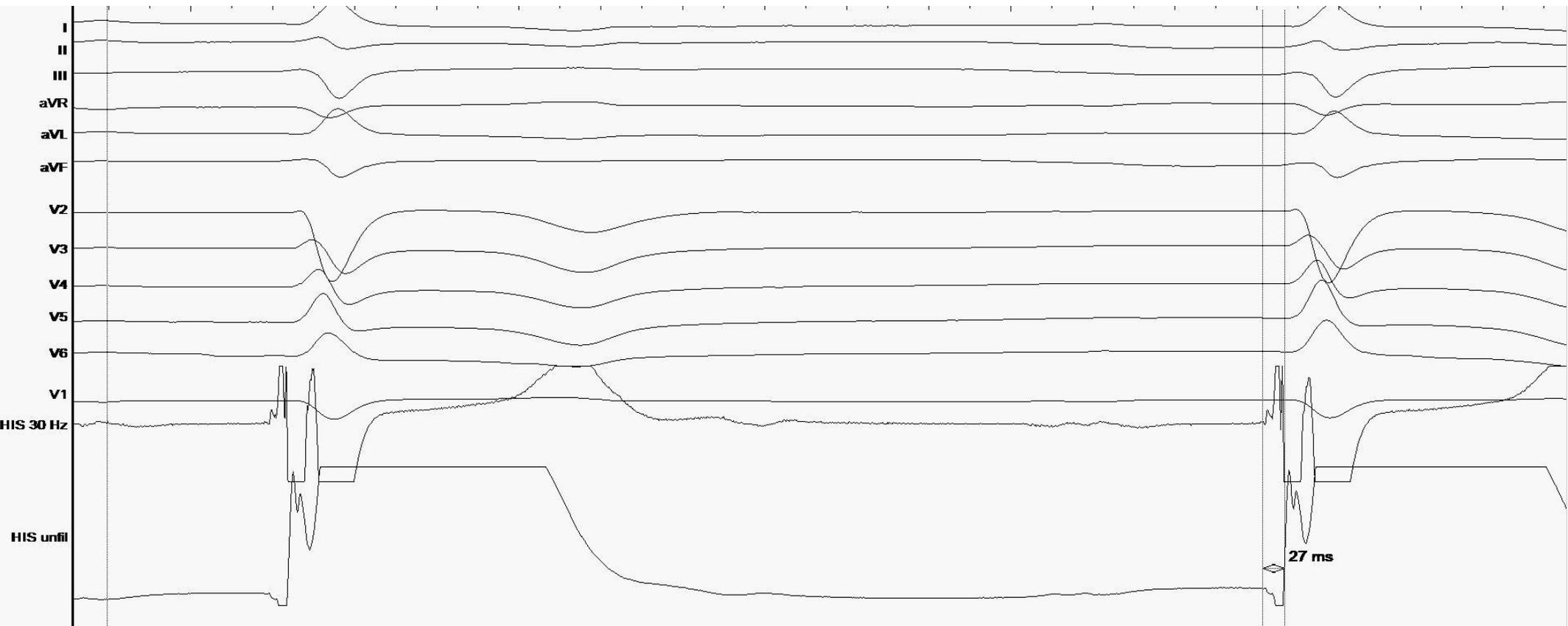
Operator (0 of 40 characters)

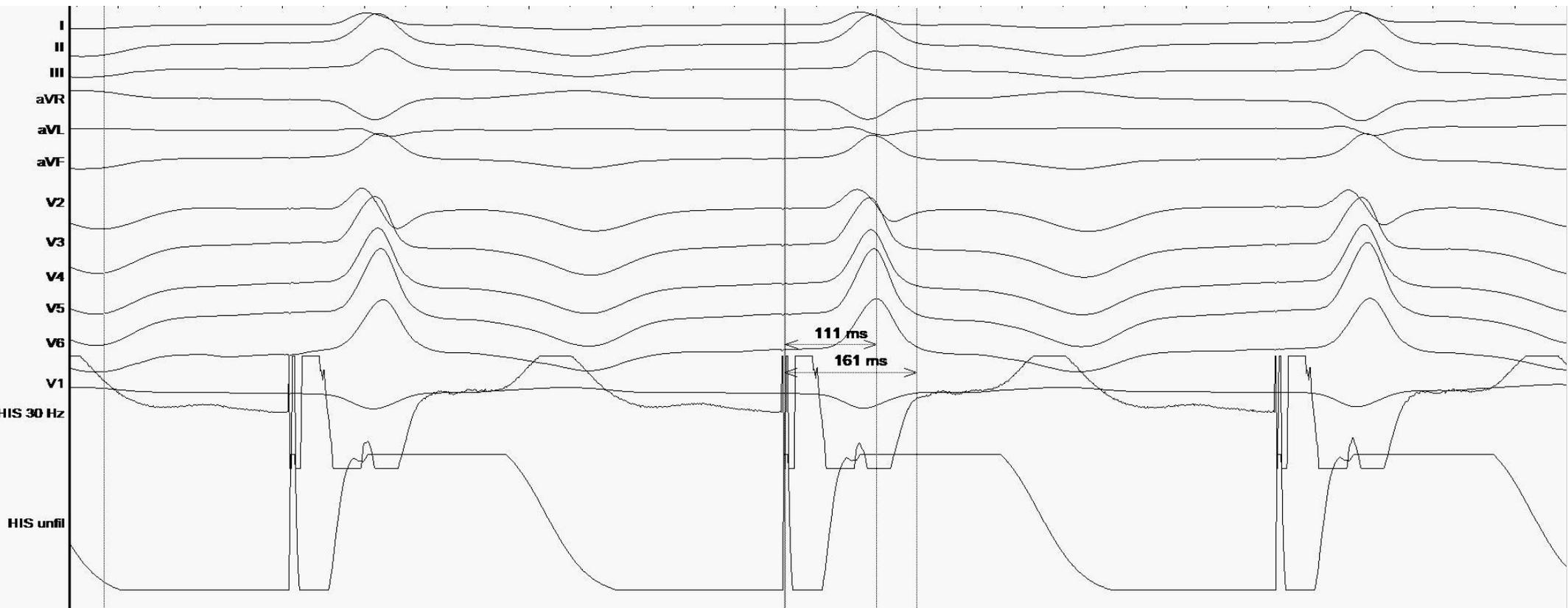
Measurement comment (6 of 200 characters)

NATIVE

VDIAQ ID:
(01)(21)
Deploy ID: 1_NEMCB_CZ
Measurement start: 5/30/2024 10:35:36 AM







To allow recording:
1) Wait until data is saved

Recording length (s)
26 s

QRS total
38

Morphological groups
A 100.0 %
Total groups: 1

QRS in maj. group
34

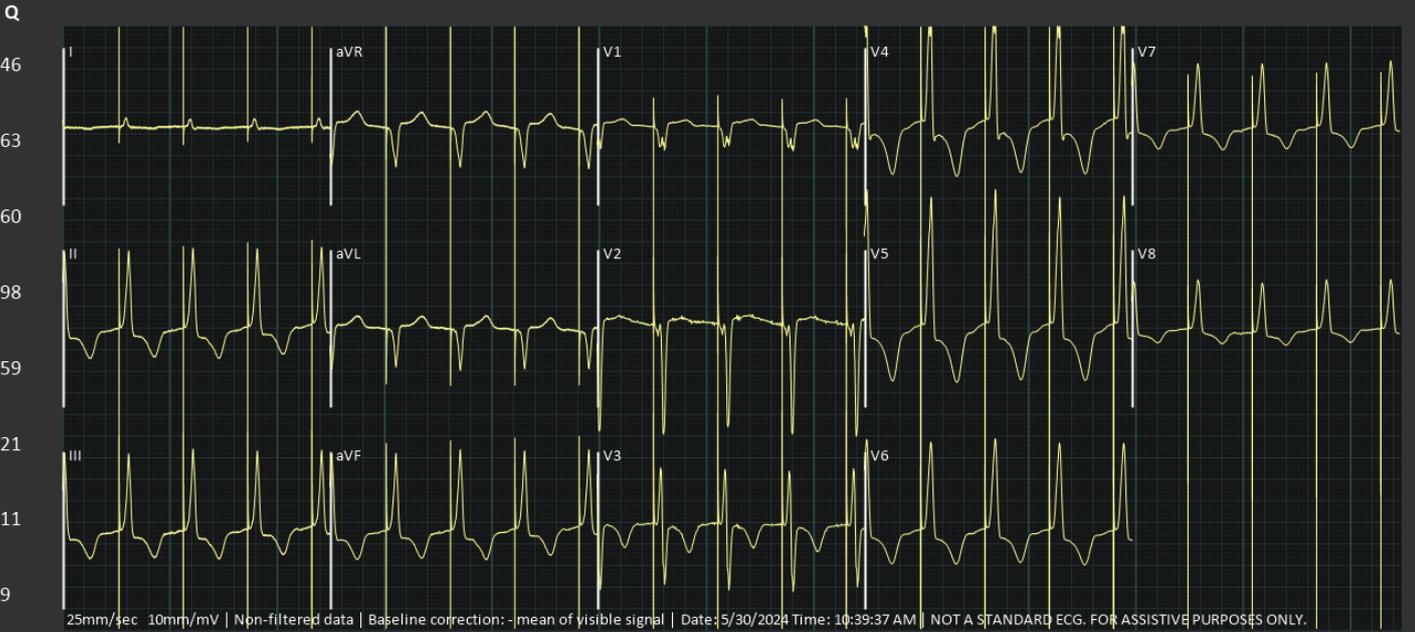
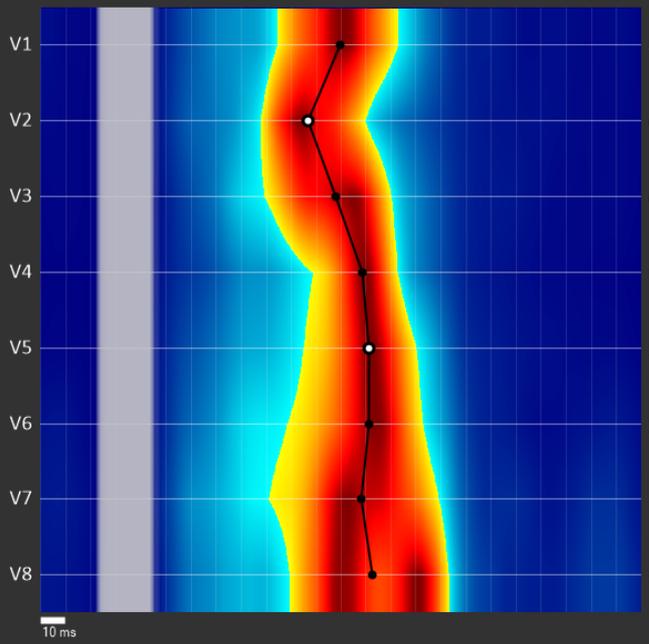
Recording now...

R	L	F	C1	Noise levels			
C2	C3	C4	C5	C6	C7	C8	

Acquisition unit connected
Battery level
 Min Max

- Patient database
- UHF Map**
- ECG
- QRS Measurements
- UHF-QRS Measurements
- Other
- Impedance Measure
- Spectrum Analyser

Ventricular depolarization map, major QRS group, N=34, name A



- V1-V6
- V1-V8

VED16 (ms) **24**

Mean VD16 (ms) **46**

Patient:
Operator (0 of 40 characters)

Measurement comment (20 of 200 characters)
lvsp 1/ POS NOT GOOD

VDIAQ ID: (01)(21)
Deploy ID: 1_NEMCB_CZ
Measurement start: 5/30/2024 10:39:08 AM



R
Start recording (F5)

↺
Restart (CTRL+R)

Recording length (s)

73 s

QRS total

94

Morphological groups



QRS in maj. group

91

Total groups: 1

Acquisition unit connected

Battery level

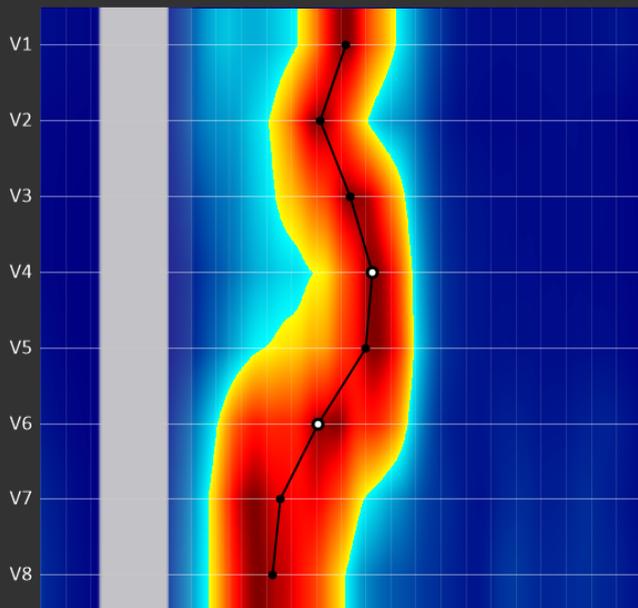


Min

Max

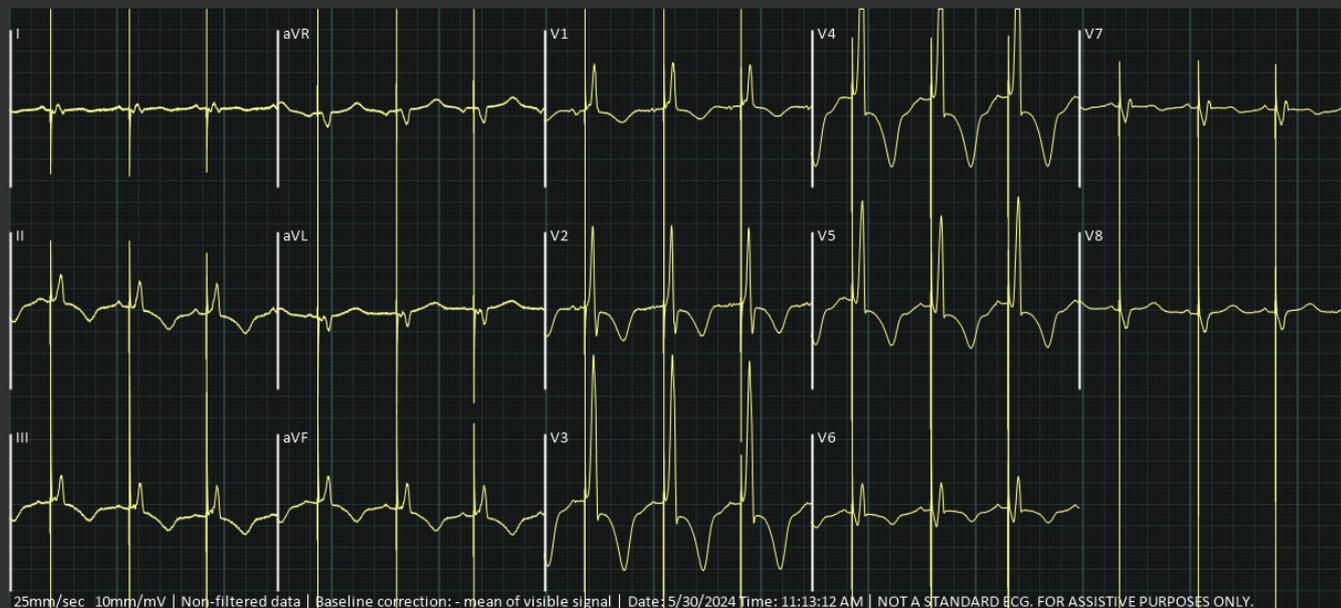
- Patient database
- UHF Map**
- ECG
- QRS Measurements
- UHF-QRS Measurements
- Other
- Impedance Measure
- Spectrum Analyser

Ventricular depolarization map, major QRS group, N=91, name A



10 ms

Q



25mm/sec 10mm/mV | Non-filtered data | Baseline correction: - mean of visible signal | Date: 5/30/2024 Time: 11:13:12 AM | NOT A STANDARD ECG. FOR ASSISTIVE PURPOSES ONLY.

V1-V6

VED16 (ms)

-22

Mean VD16 (ms)

51

V1-V8

Patient:

Operator (0 of 40 characters)

Measurement comment (22 of 200 characters)

biv lv1 lv2 plus LAFP

VDIAQ ID: (01)(21)

Deploy ID: 1_NEMCB_CZ

Measurement start: 5/30/2024 11:11:55 AM



R
Start recording (F5)

↻
Restart (CTRL+R)

Recording length (s)

61 s

QRS total

81

Morphological groups



QRS in maj. group

72

Total groups: 3

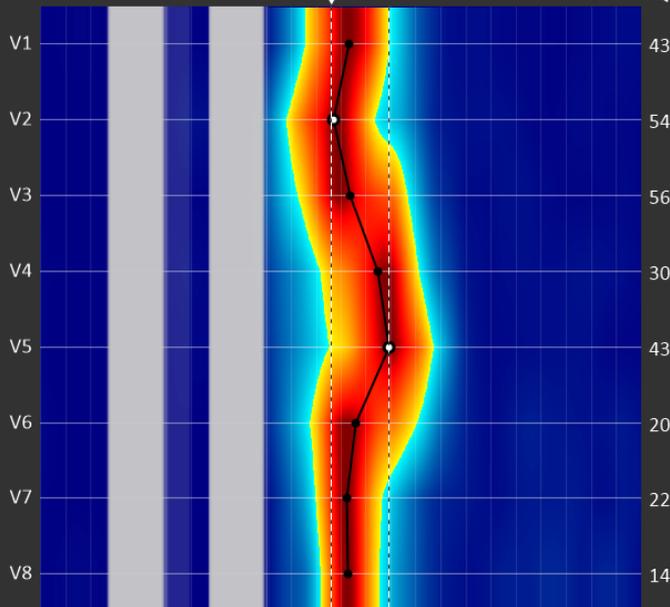
Acquisition unit connected

Battery level



- Patient database
- UHF Map**
- ECG
- QRS Measurements
- UHF-QRS Measurements
- Other
- Impedance Measure
- Spectrum Analyser

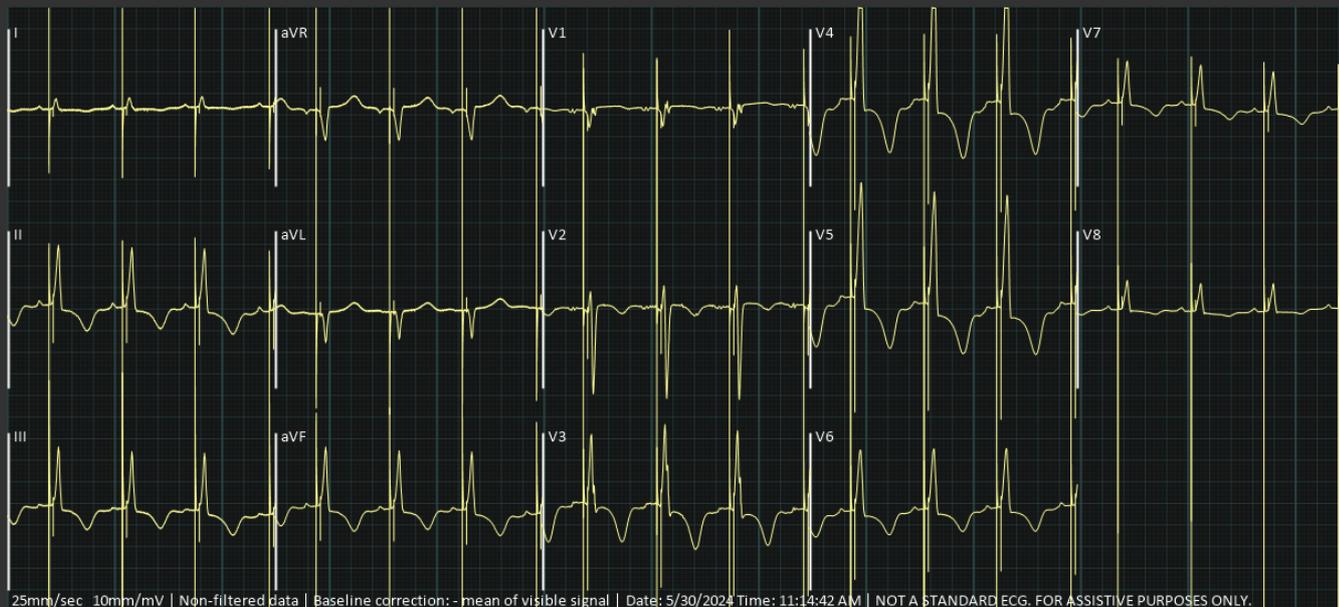
Ventricular depolarization map, major QRS group, N=72, name A



23.0 ms

(Manual measure)

Q



25mm/sec 10mm/mV | Non-filtered data | Baseline correction: - mean of visible signal | Date: 5/30/2024 Time: 11:14:42 AM | NOT A STANDARD ECG. FOR ASSISTIVE PURPOSES ONLY.

V1-V6

VED16 (ms)

22

Mean VD16 (ms)

39

V1-V8

Patient:

Operator (0 of 40 characters)

Measurement comment (36 of 200 characters)

biv LV1 LV2 plus LAFP, RV first 40ms

VDIAQ ID: (01)(21)

Deploy ID: 1_NEMCB_CZ

Measurement start: 5/30/2024 11:13:40 AM

