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ELECTROMYOGRAPHY EVOKED POTENTIALS

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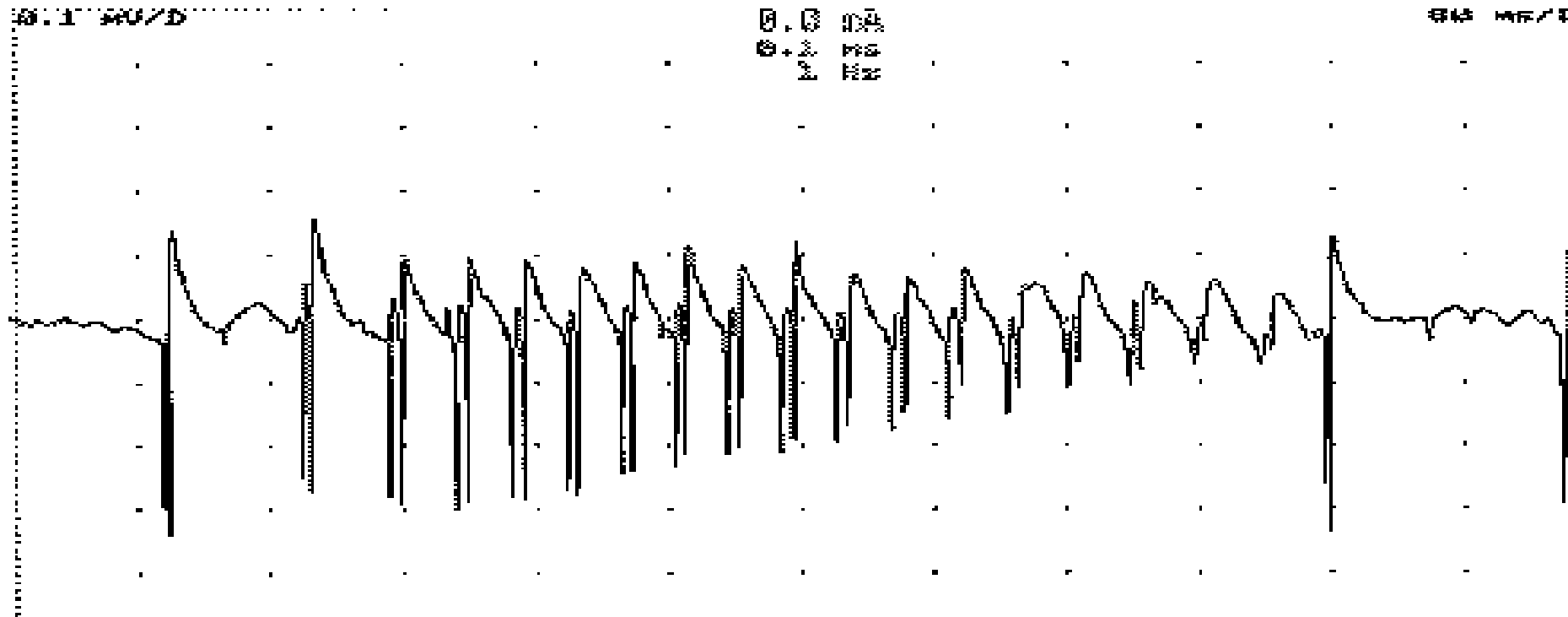
DEFINITION OF ELECTROMYOGRAPHY (EMG)

- EMG is an electrodiagnostic method aimed at the diagnosis of neuromuscular disorders (i.e., involvement of peripheral motor, sensory, and autonomic neurons, neuromuscular transmission and voluntary muscles).
- Methodologically it comprises two groups of techniques:
 - **Needle EMG** using needle recording electrodes for registration of bioelectrical potentials from voluntary muscles;
 - **Conduction studies** using artificial electrical stimulation of nerves and recording evoked responses from muscles or nerves with surface recording electrodes

NEEDLE EMG I

1. Insertion activity:

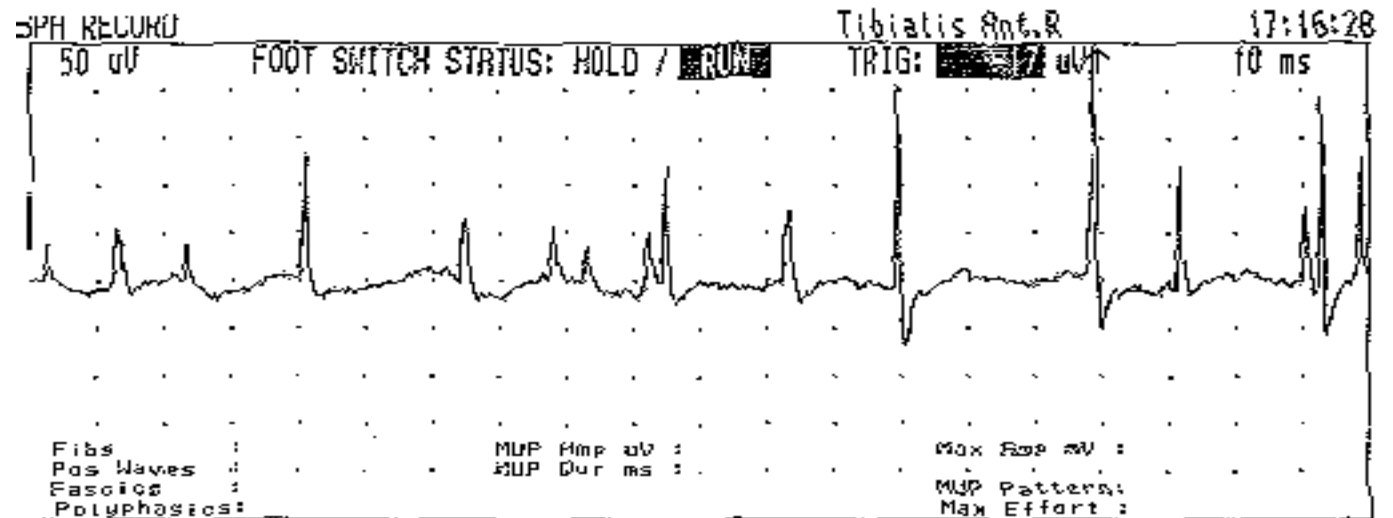
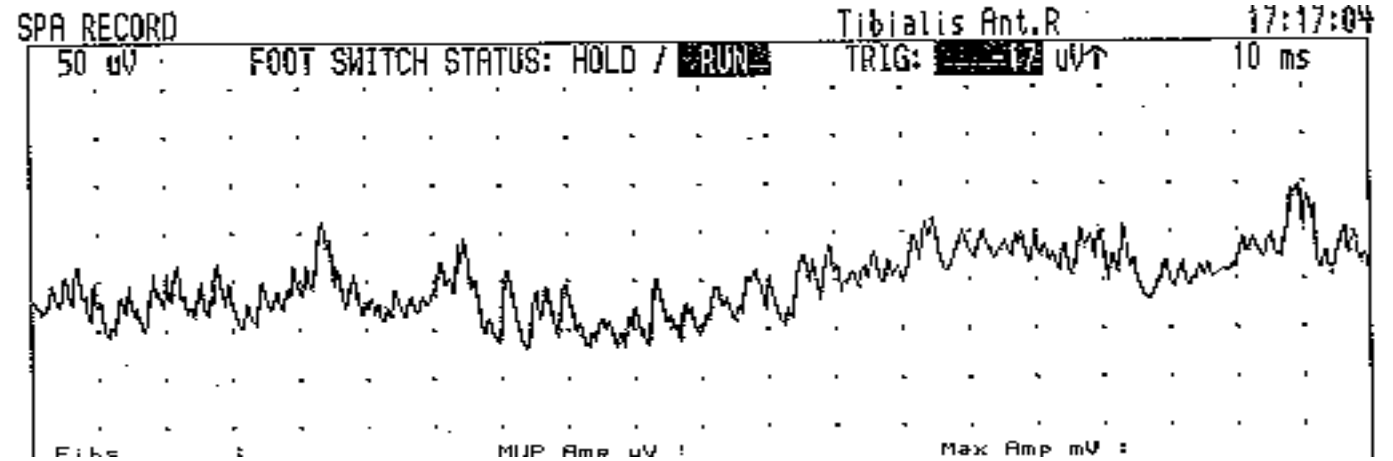
- Example of abnormal insertion activity: **myotonic discharges**



NEEDLE EMG II

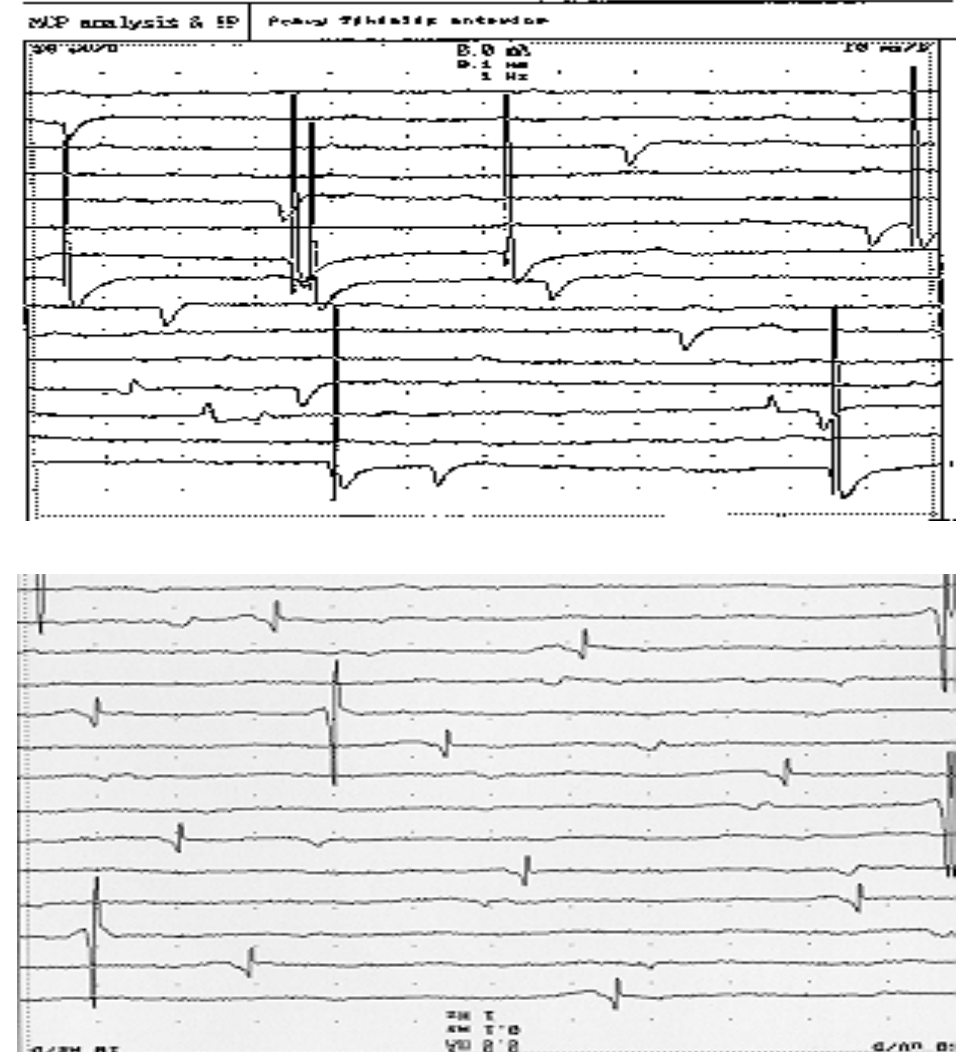
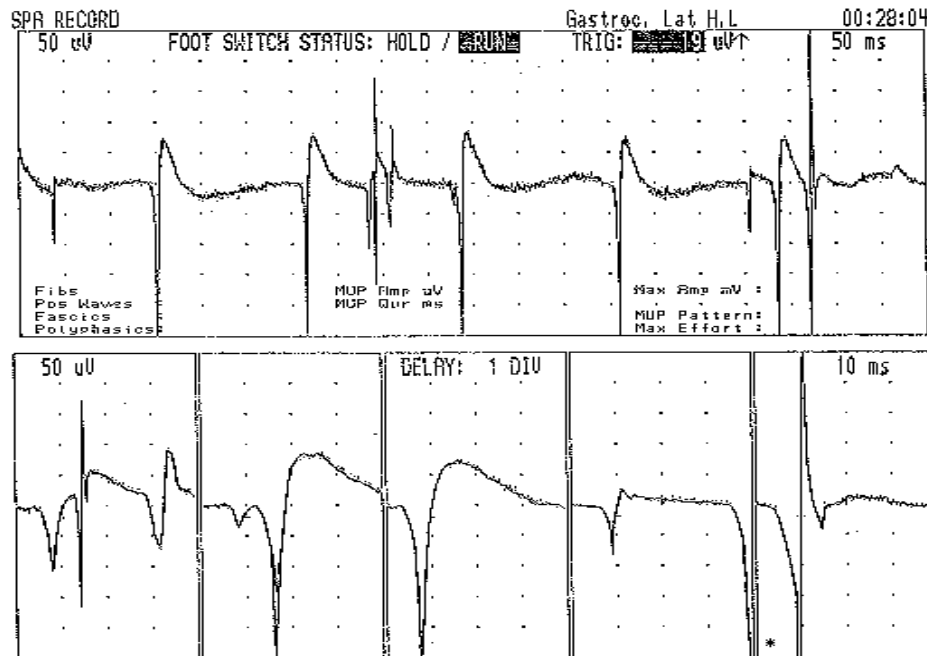
– („end-plate noise“)

– („end-plate spikes“)



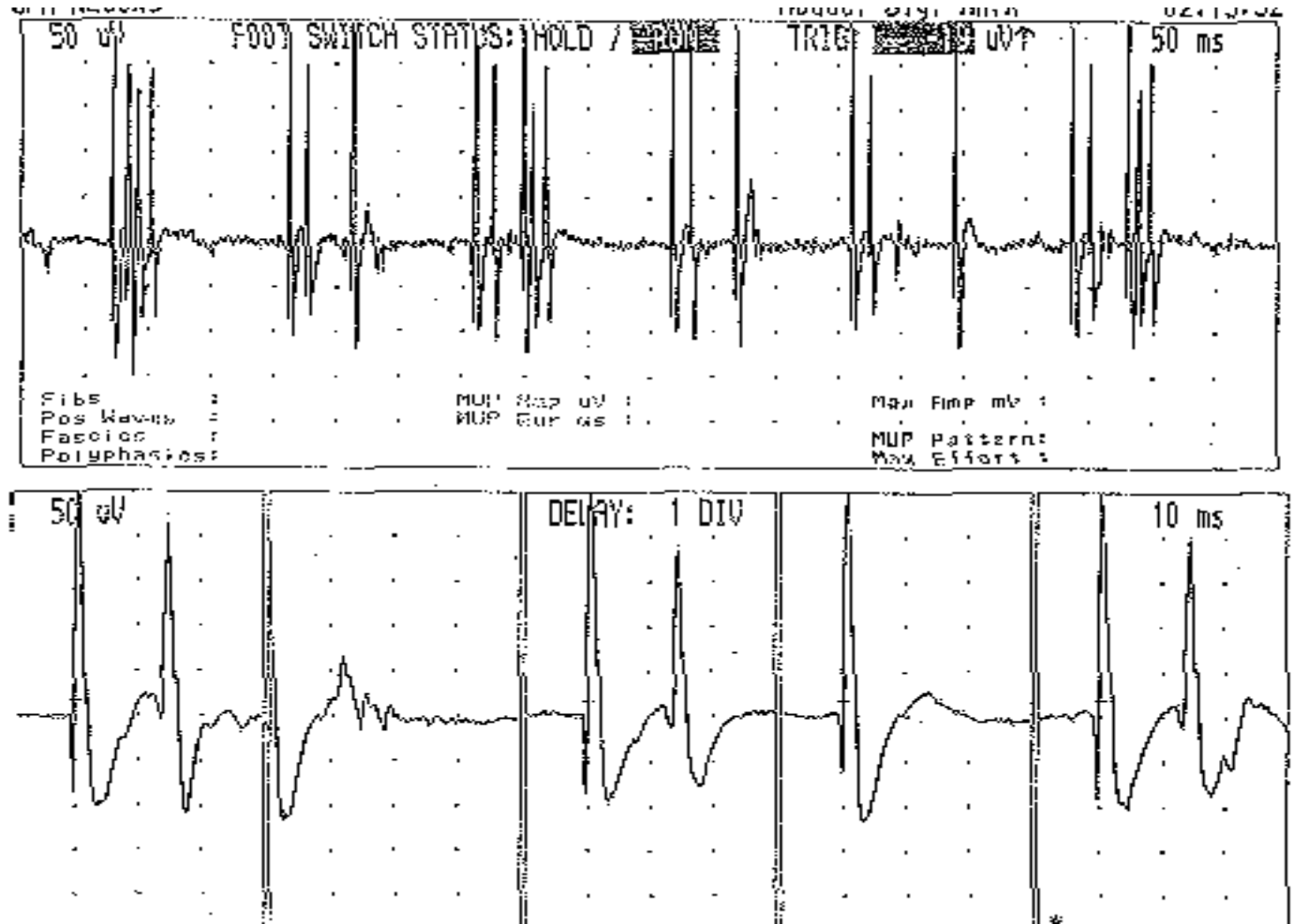
NEEDLE EMG III

- 2. Abnormal spontaneous activity:
- fibrillation potentials and positive sharp waves



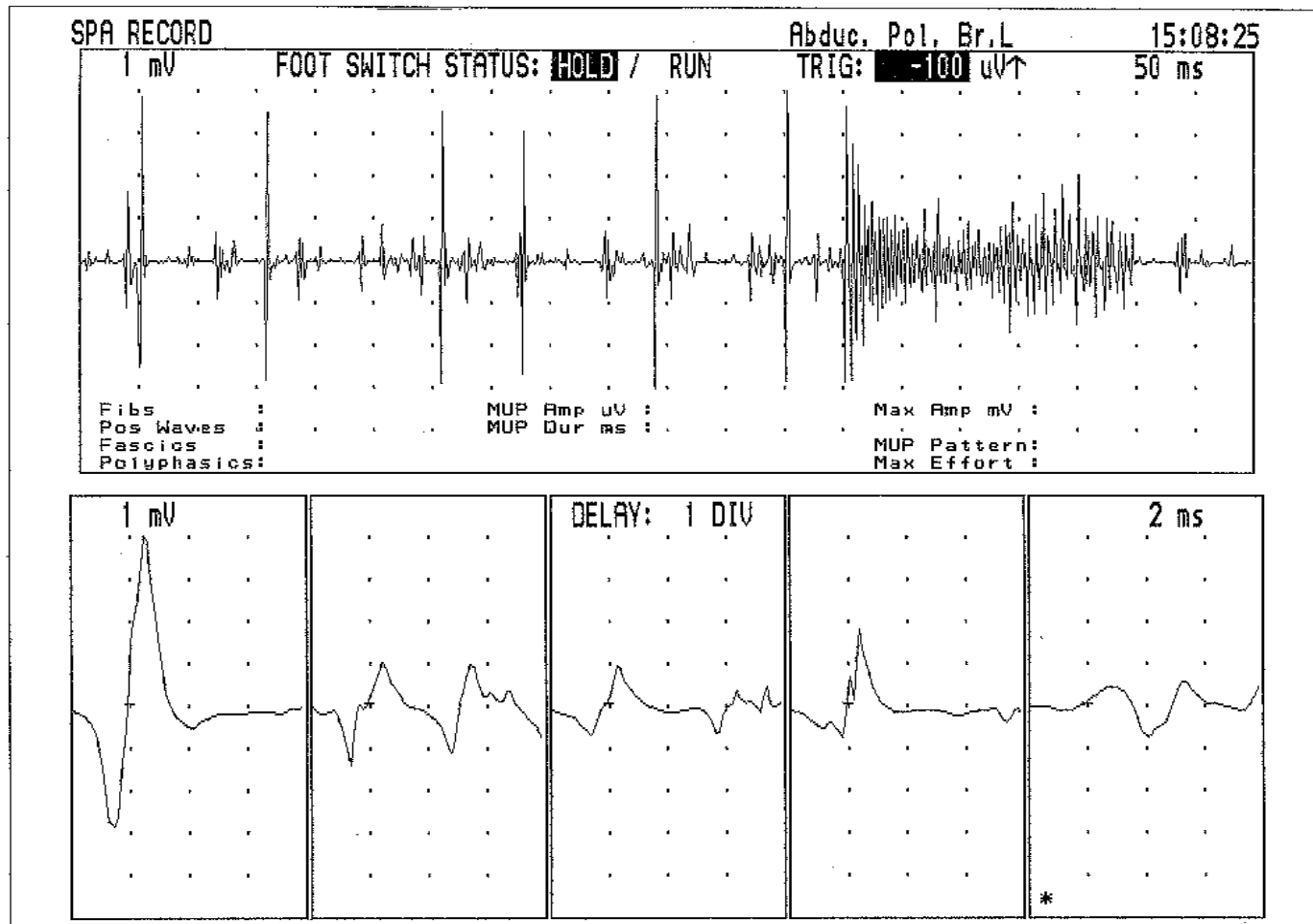
NEEDLE EMG IV

2. Abnormal spontaneous activity:
- tetanic discharges (doublets, triplets, multiplets)



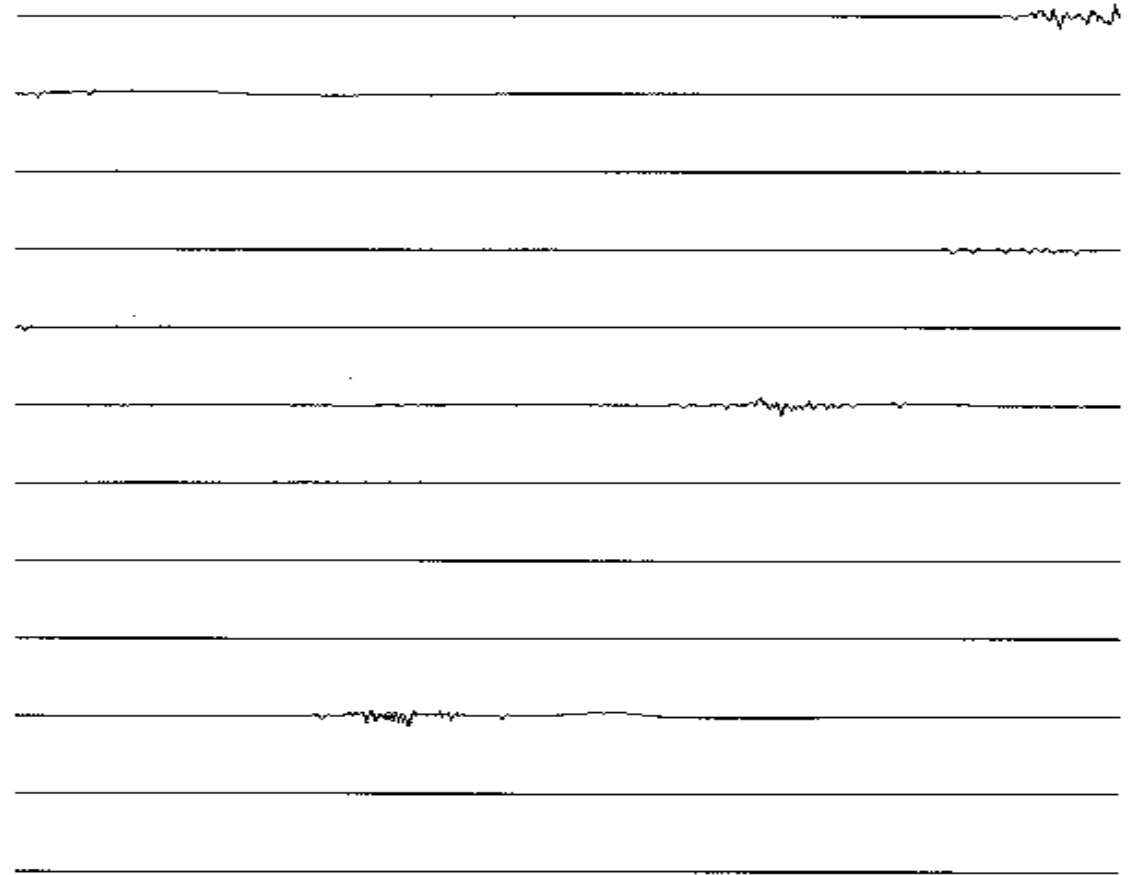
NEEDLE EMG V

2. Abnormal spontaneous activity: neuromyotonic discharges



NEEDLE EMG VI

3. Physiological activity at rest
(no potentials)



3 mV
20 ms

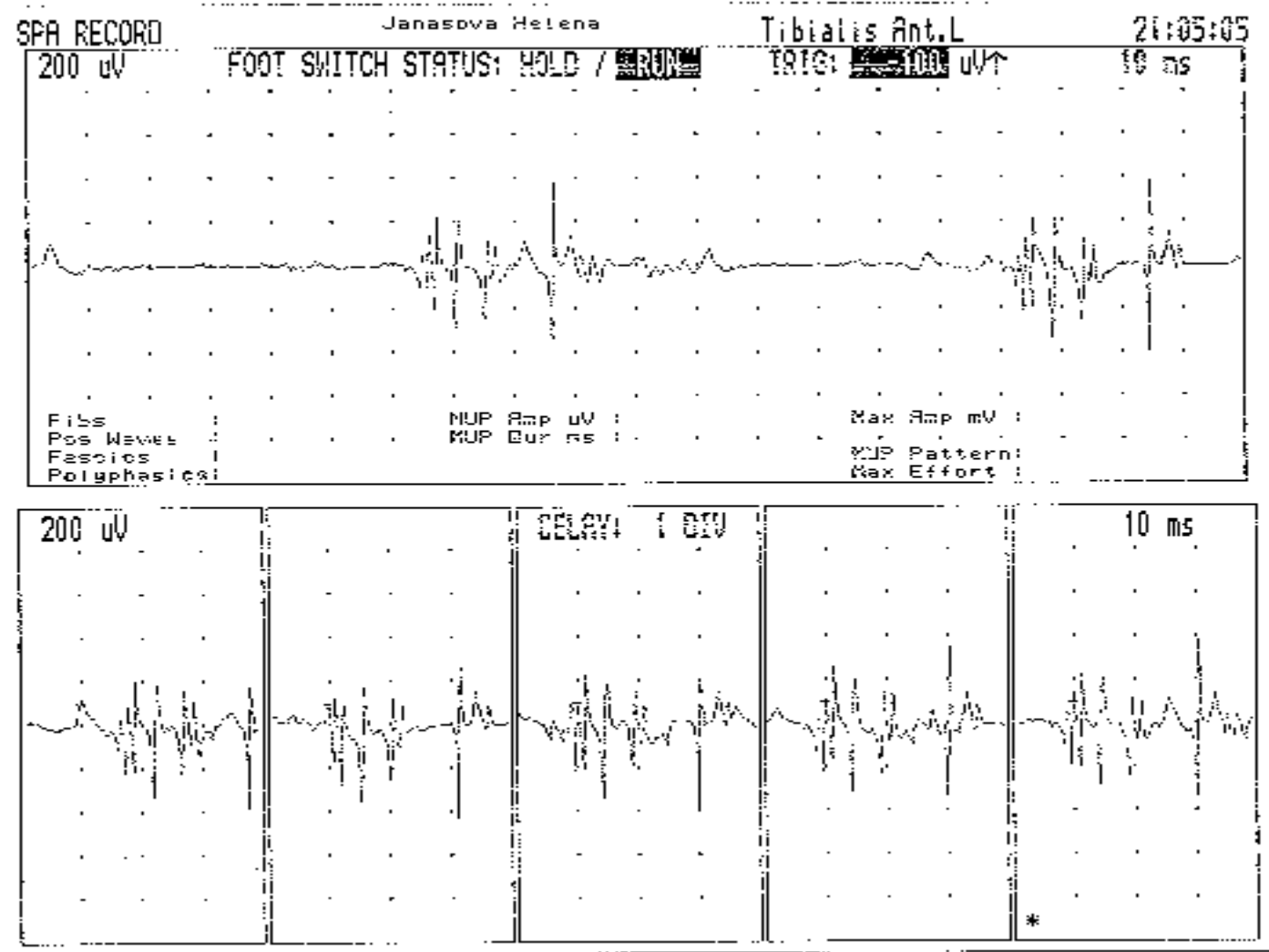
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NEEDLE EMG VII

3. Quantification of parameters of motor unit potentials (MUPs)

– indicator of microarchitecture of motor unit

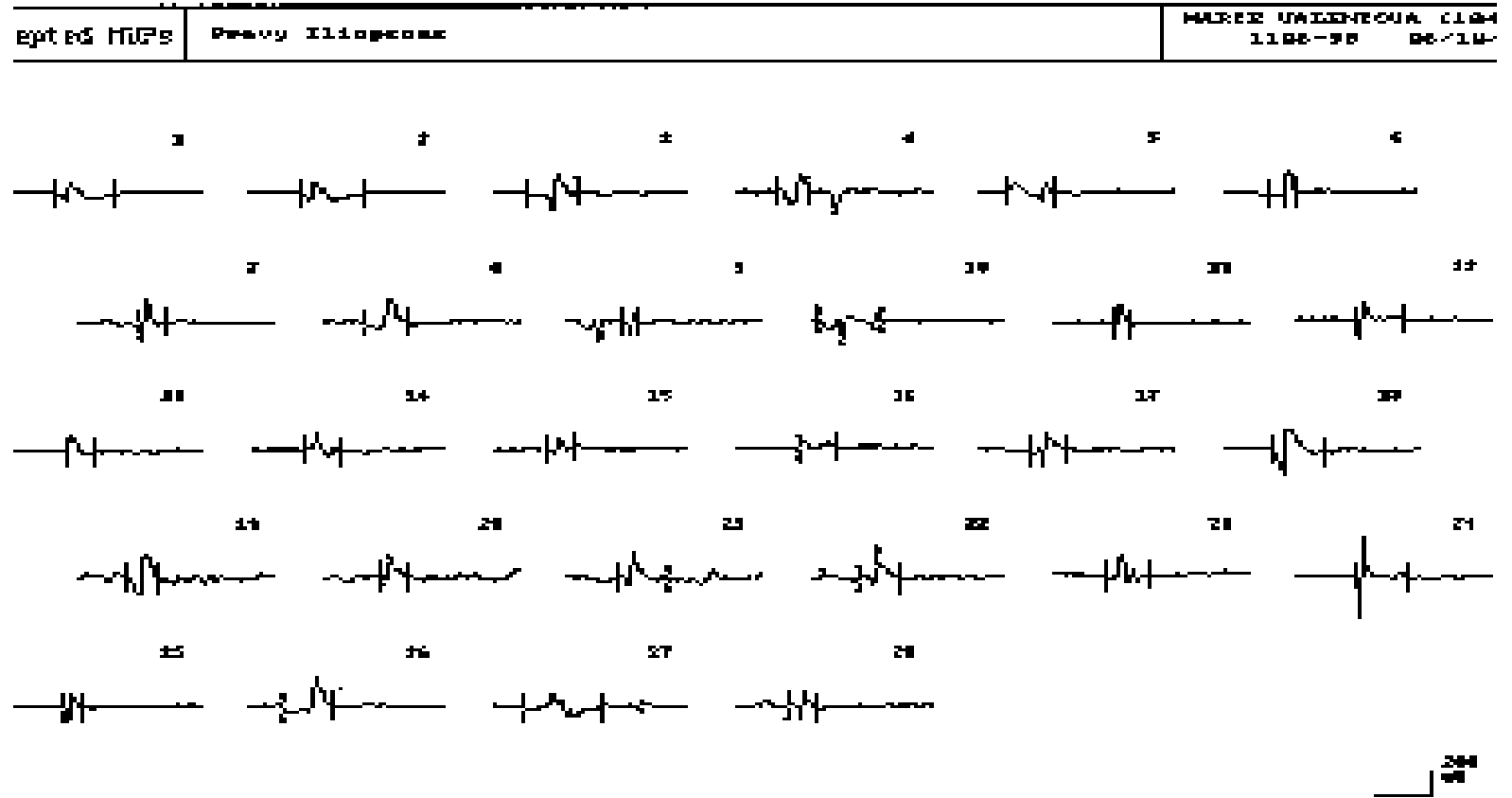
– → Signs of chronic re-innervation



NEEDLE EMG VIII

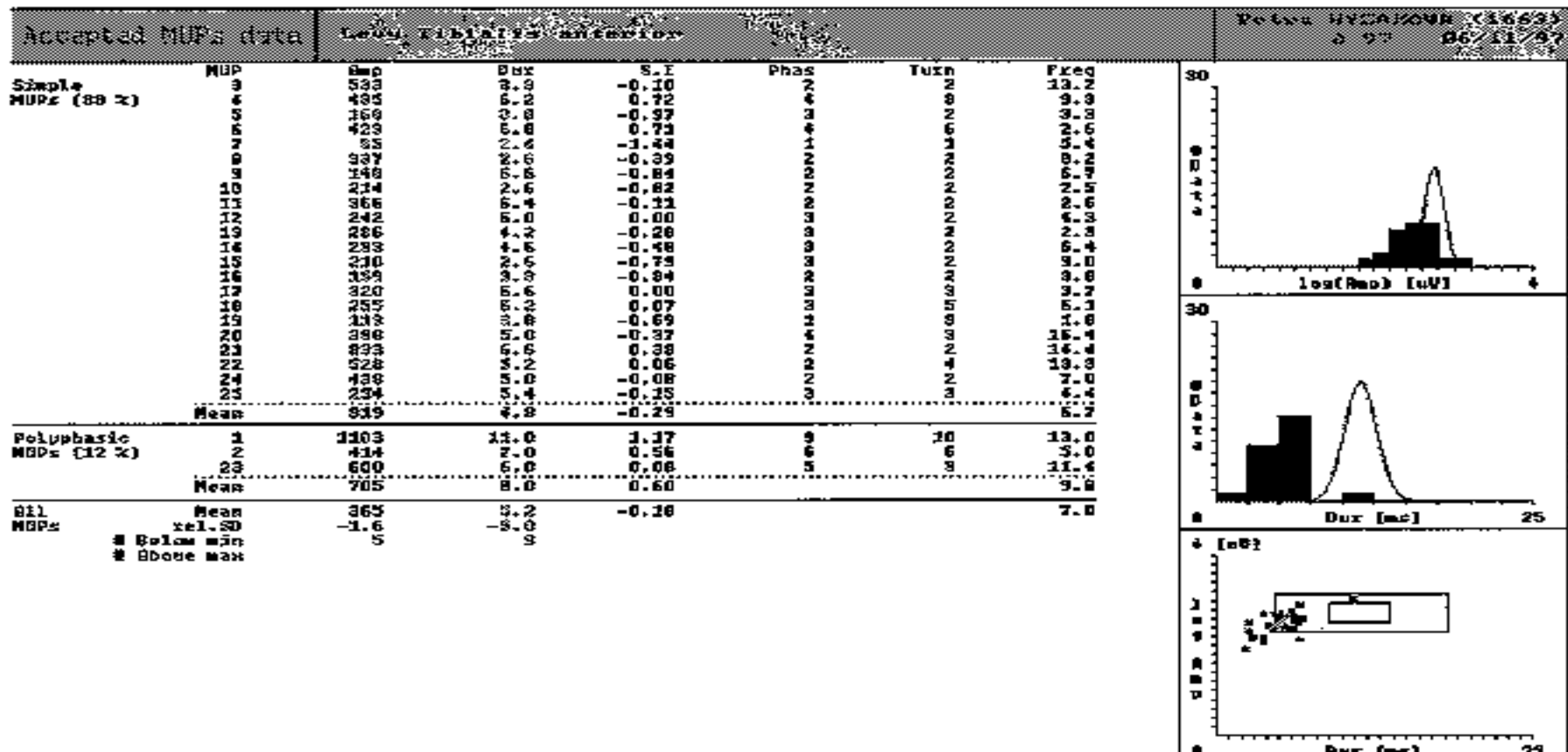
3. Quantification of parameters of motor unit potentials (MUPs)

- indicator of microarchitecture of motor unit
- → Signs of myogenic lesion (decreased number of muscle fibers)



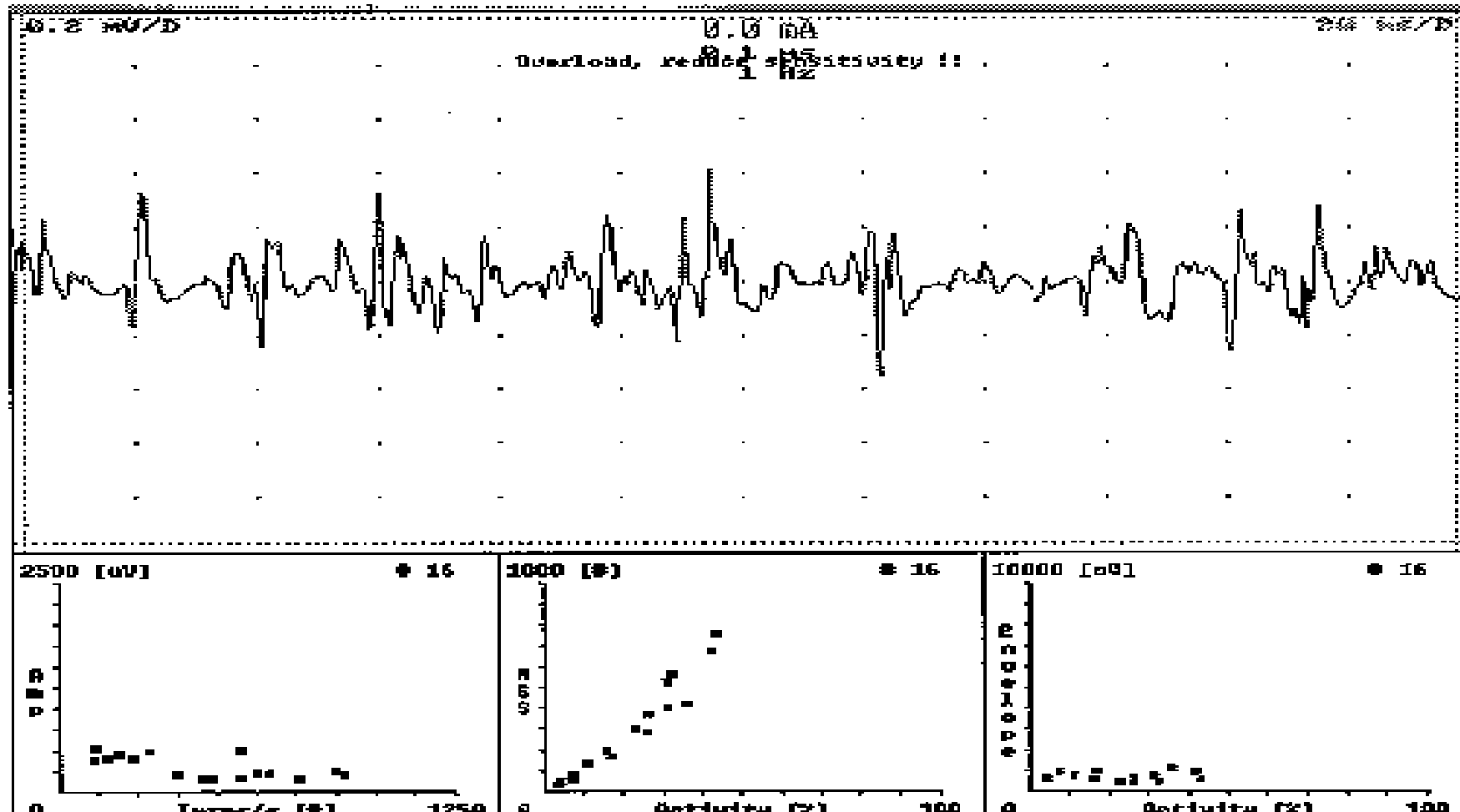
NEEDLE EMG IX

3. Quantification of parameters of motor unit potentials (MUPs) – indicator of microarchitecture of motor unit
 — → Signs of myogenenic lesion (decreased number of muscle fibers)



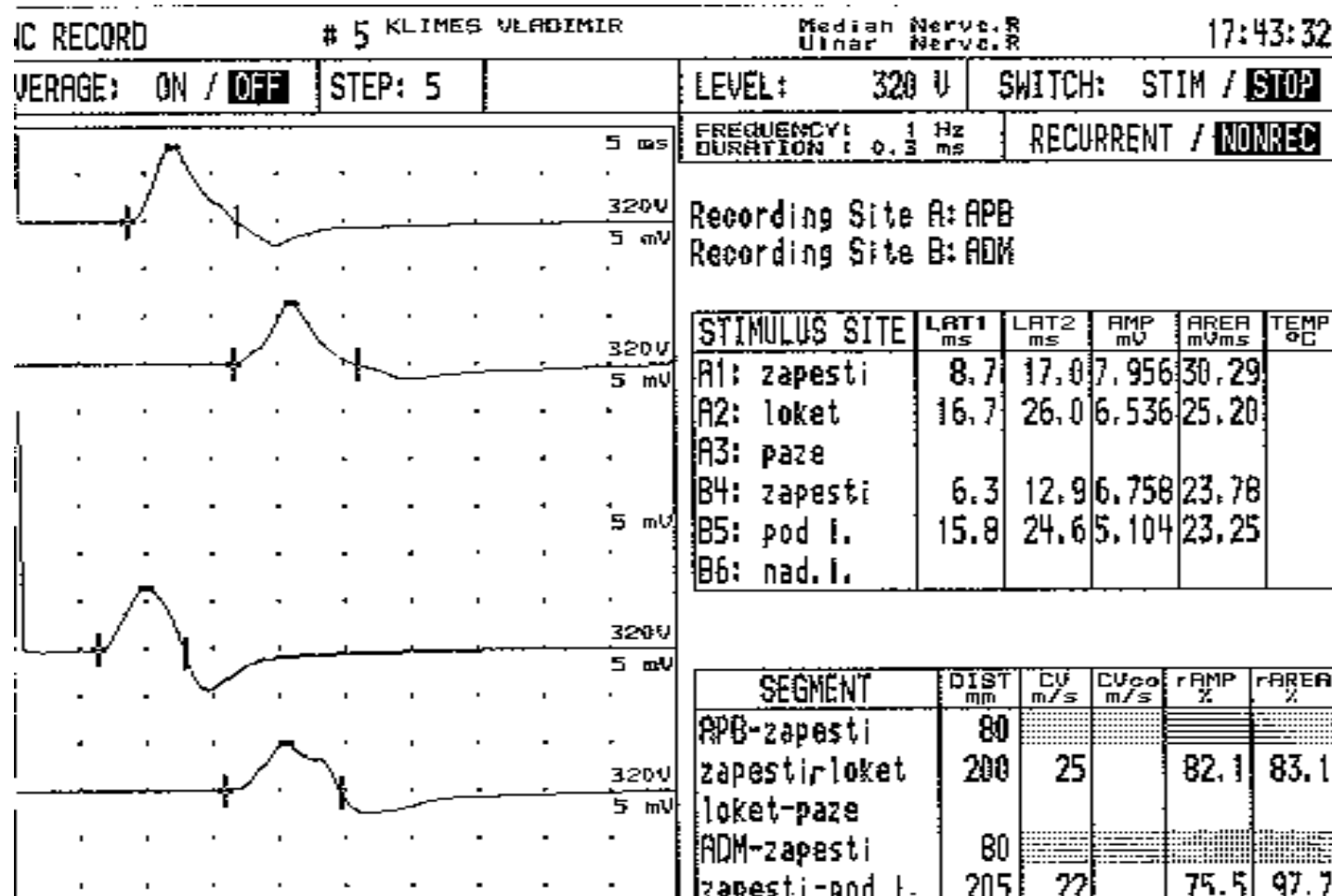
NEEDLE EMG X

4. Assessment of recruitment of motor units and interference pattern



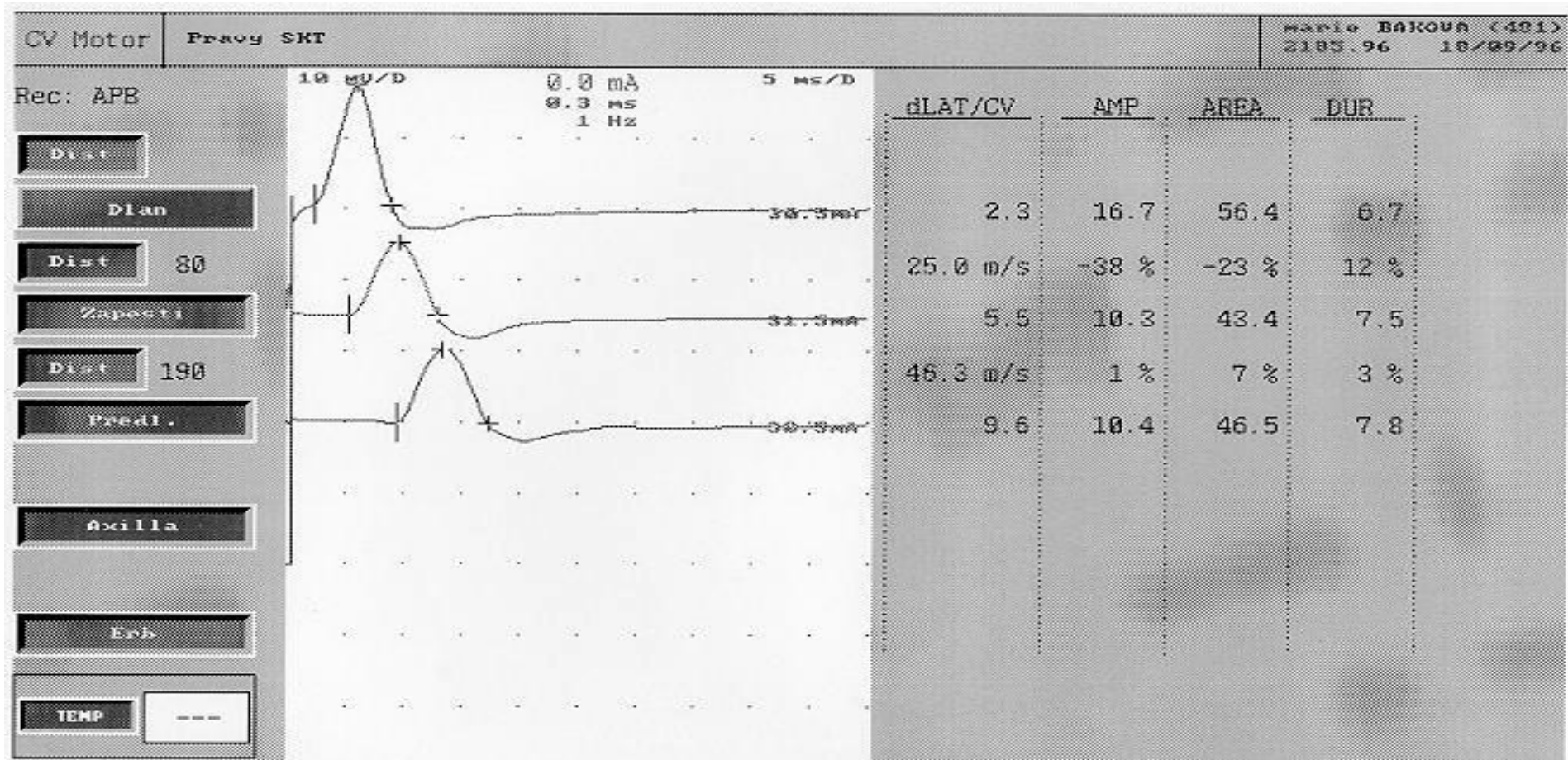
CONDUCTION STUDIES I

1. Motor conduction studies: diffuse conduction slowing



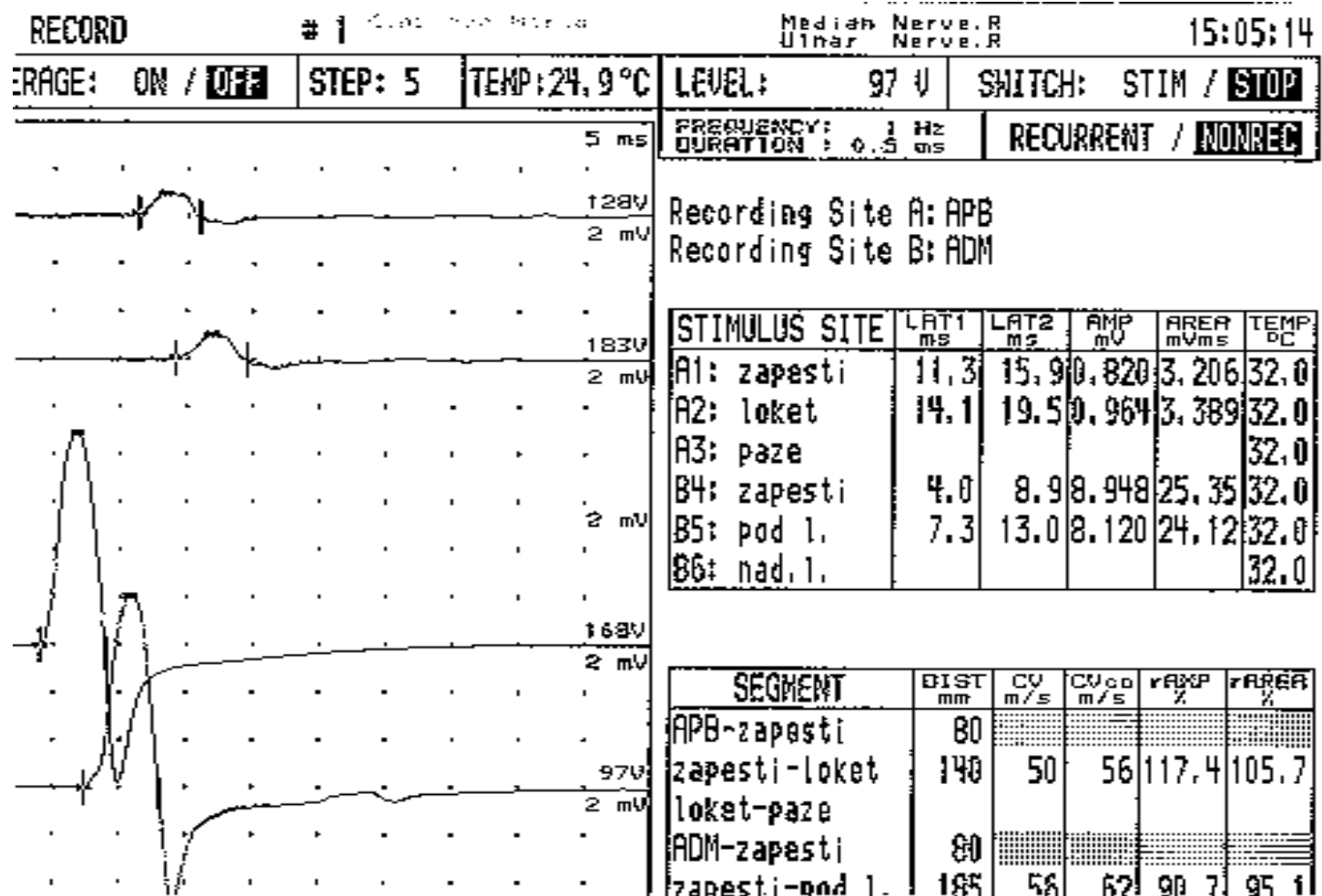
CONDUCTION STUDIES II

1. Motor conduction studies : focal conduction slowing + conduction block



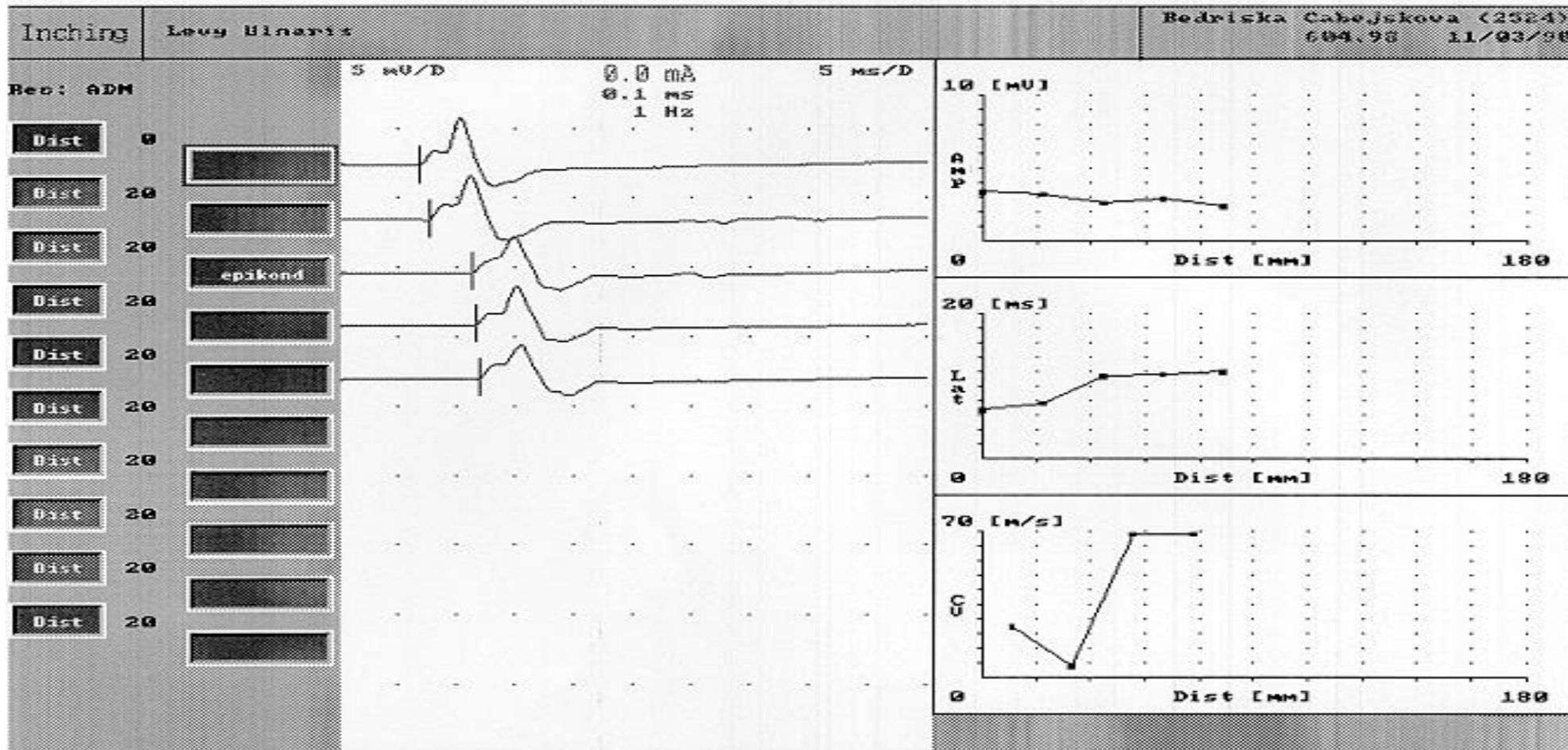
CONDUCTION STUDIES III

1. Motor conduction studies : focal conduction slowing + axonal loss



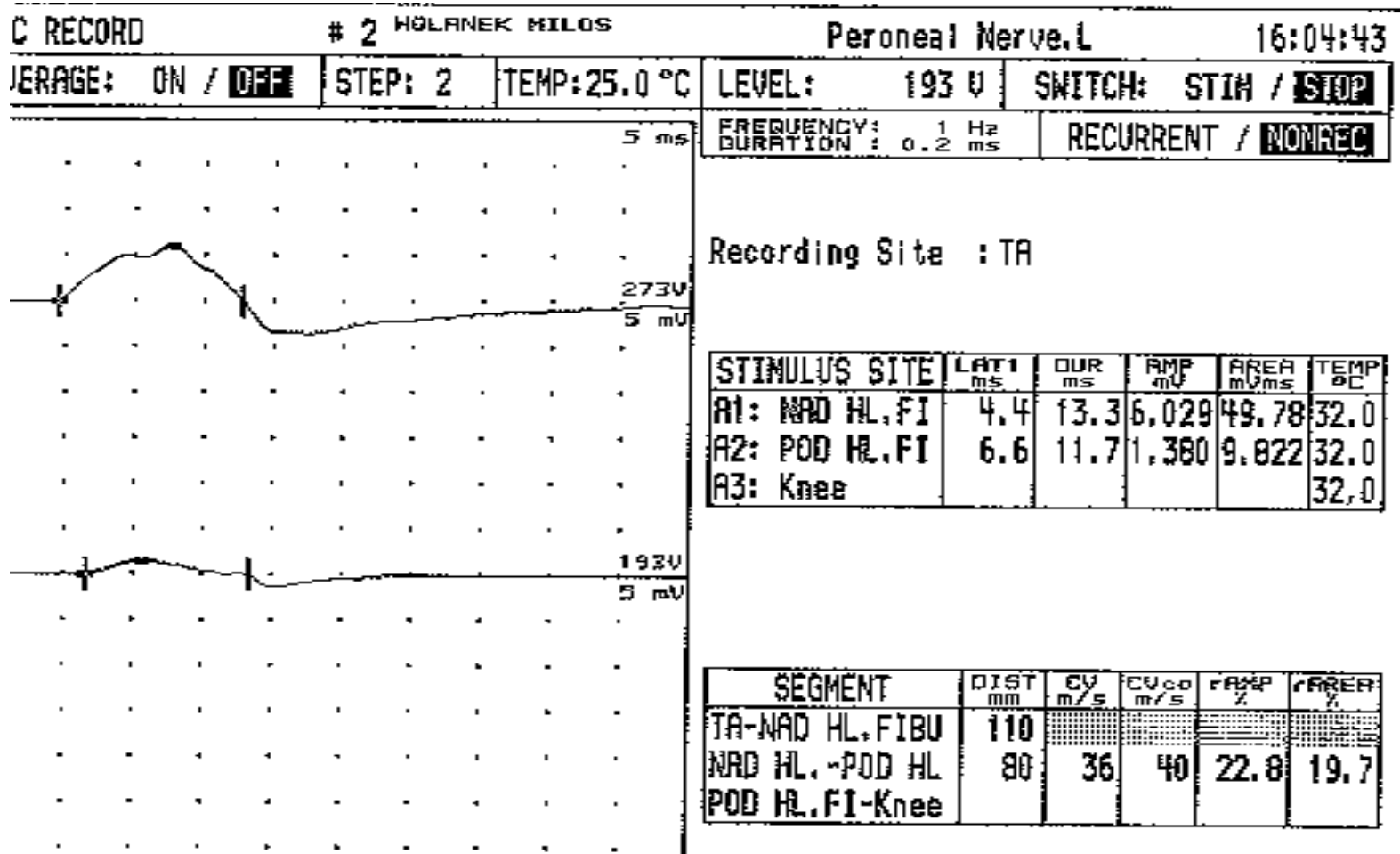
CONDUCTION STUDIES IV

1. Motor conduction studies : focal conduction slowing („inching“ technique)



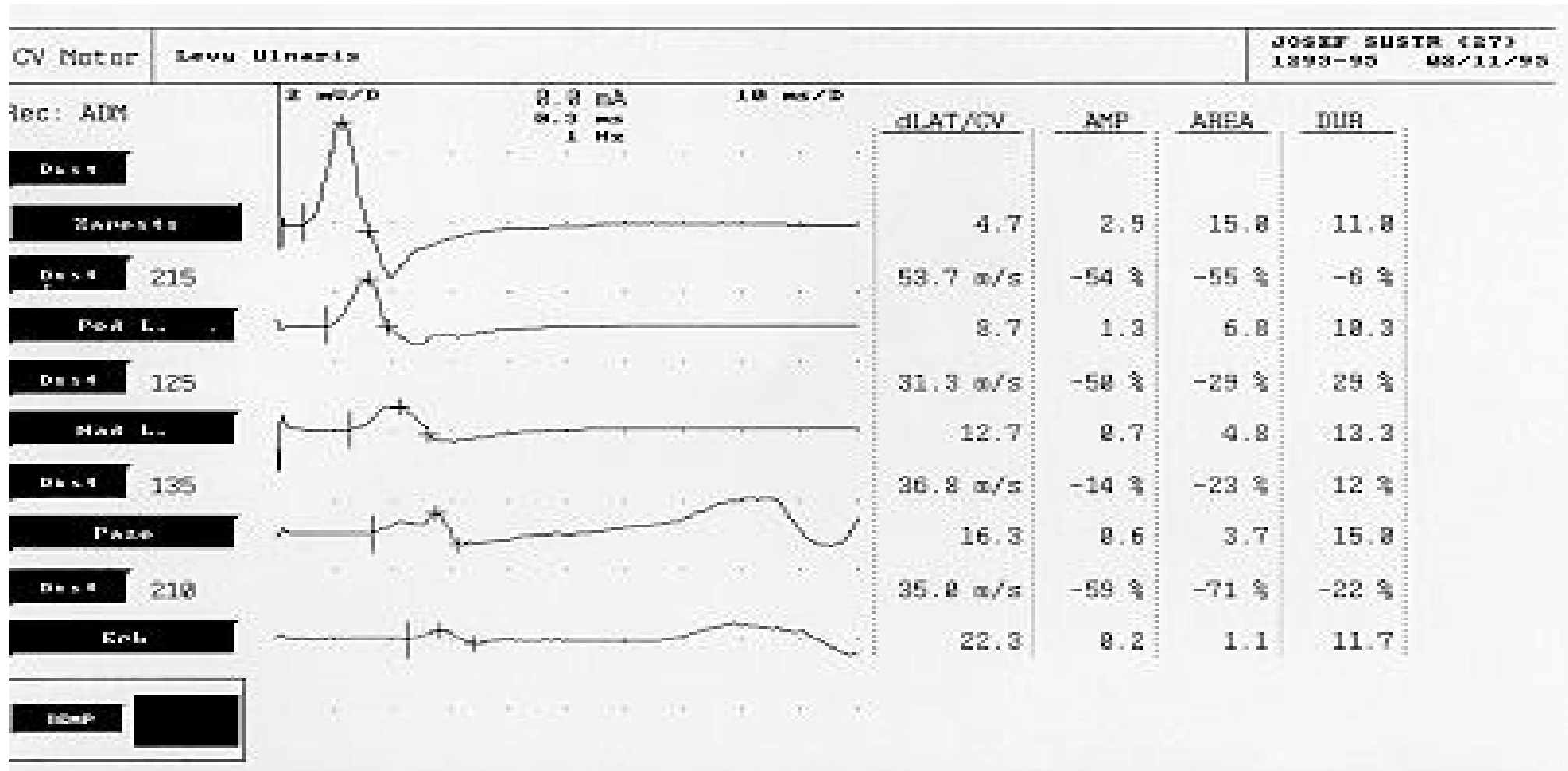
CONDUCTION STUDIES V

1. Motor conduction studies : focal partial conduction block



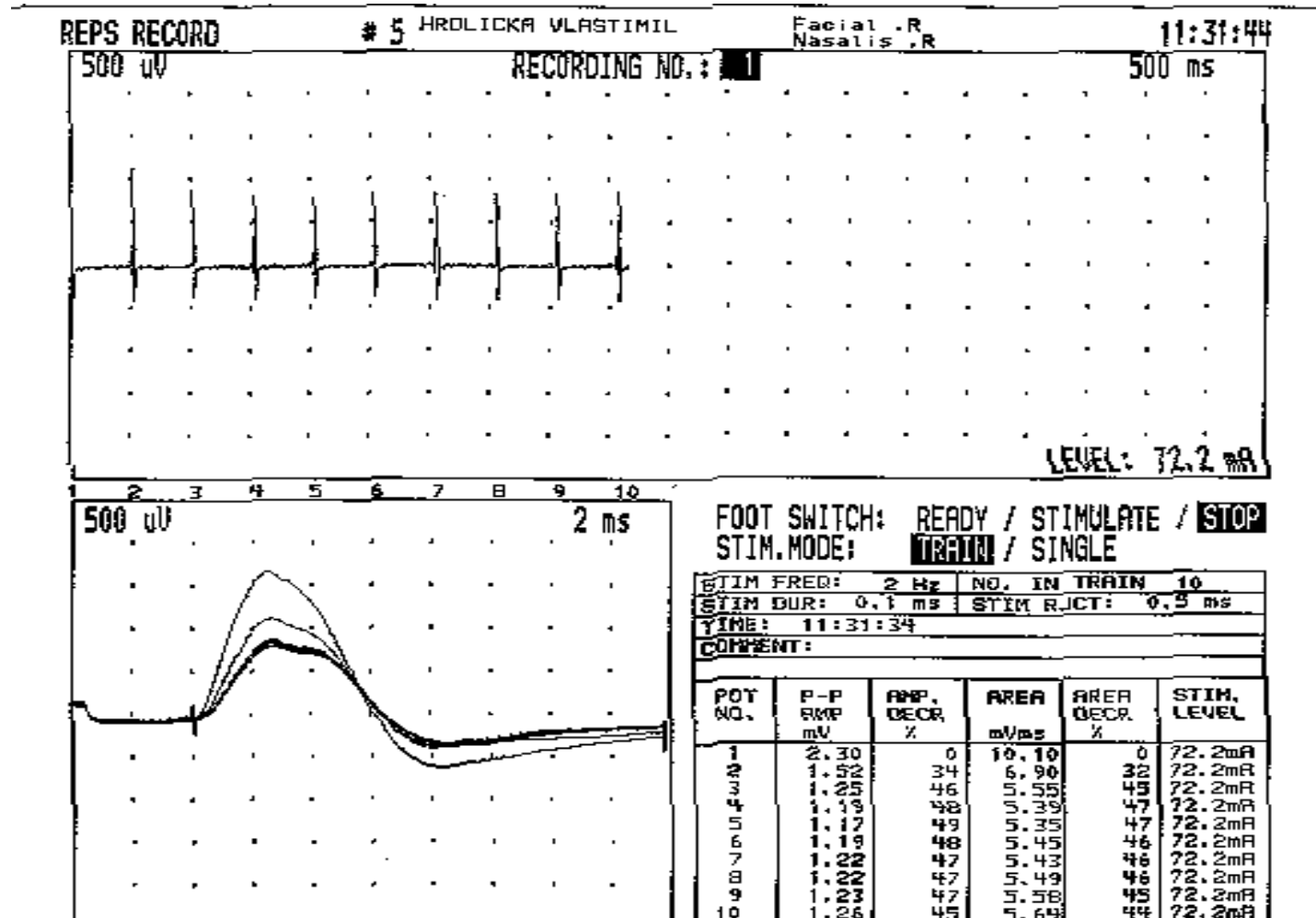
CONDUCTION STUDIES VI

1. Motor conduction studies : multifocal conduction slowing + conduction block



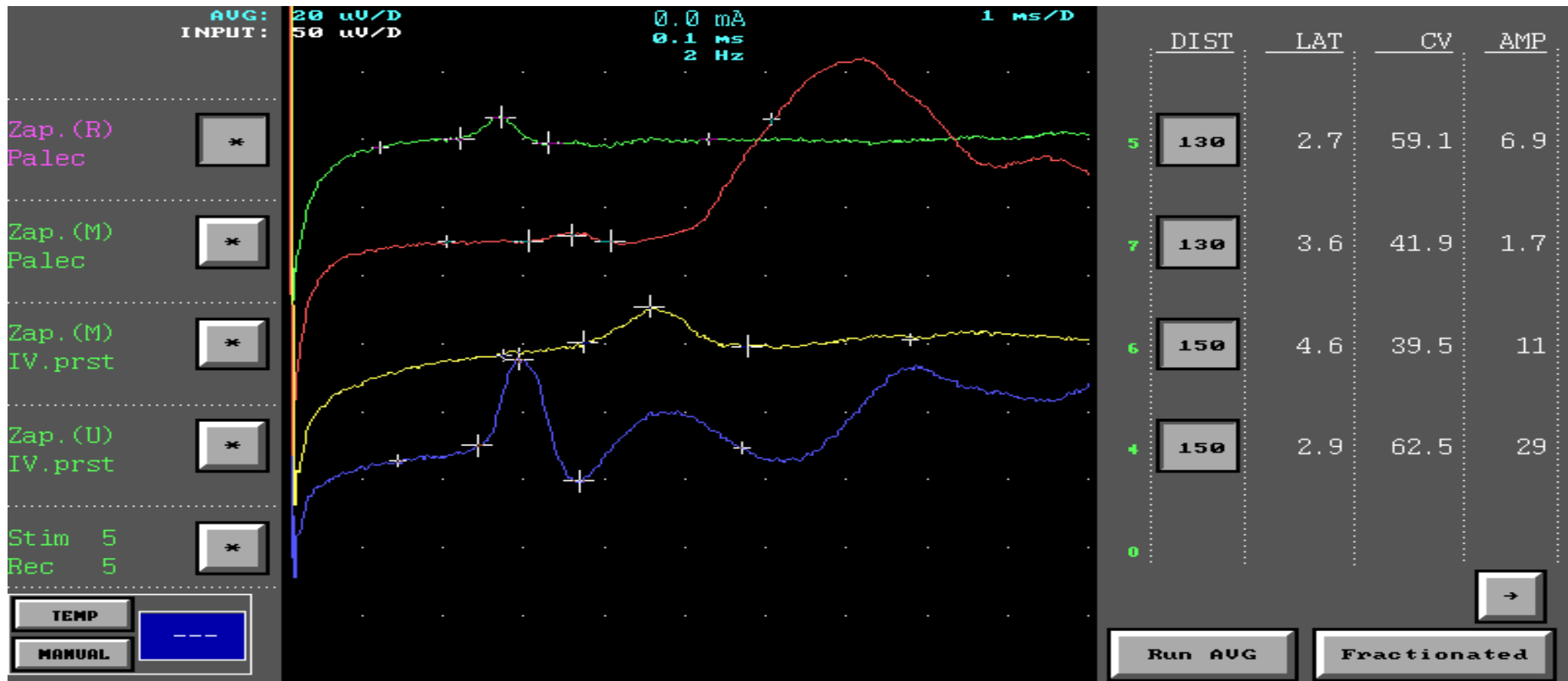
CONDUCTION STUDIES VII

1. Motor conduction studies : repetitive stimulation of motor nerve



CONDUCTION STUDIES VIII

2. Sensory conduction studies



EVOKED POTENTIALS (EP): DEFINITION

- Evoked potentials represents bioelectrical response of the brain (or spinal cord and peripheral nerves) to external stimuli (mostly of sensory character) – sensory EP.
- Evoked potentials (as a diagnostic method or tool) are electrodiagnostic methods that register and evaluate bioelectrical potentials triggered by visual (VEP), auditory (BAEP) and somatosensory stimuli (SEP).
- Motor evoked potentials (MEP) use magnetic (originally electrical) stimulation to excite motor cortex (transcranially) and to register response from a muscle.
- Endogenous or cognitive potentials are long-latency responses related to cognitive processes or initiation of voluntary movement; it is mostly research tool.

EVOKED POTENTIALS: TECHNICAL PRINCIPLE

Evoked potentials generated in the cortex or spinal cord and recorded over the scalp or the spine have the magnitude in order of microvolts (therefore lower than EEG or artifacts). Extraction of these EP „buried“ in other electrical activity at the recording areas is enabled by the „averaging“ method performed by a computer. EP appears in a constant time interval from the stimulus (in contrast to otherwise accidental other electrical activities).

EVOKED POTENTIALS: CLINICAL IMPORTANCE

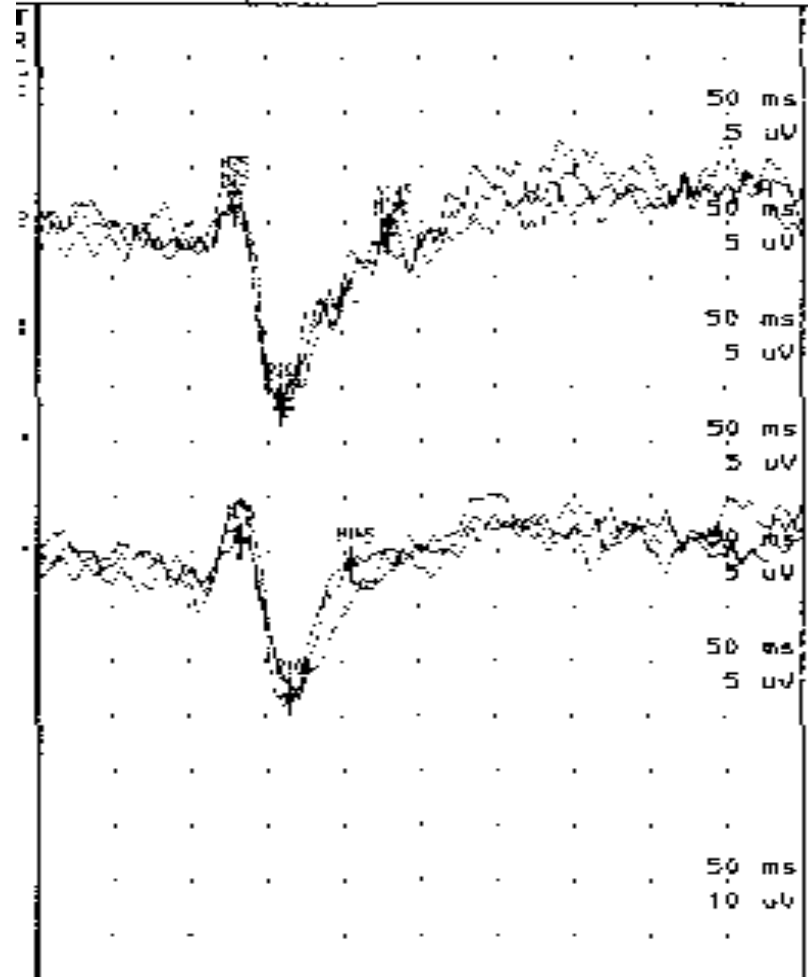
They:

- Objectify clinical data and offer quantitative information;
- Capture subclinical lesion or dysfunction
- Offer precision of localisation of the lesion;
- Could monitor function of the system or pathway during surgery

VISUAL EVOKED POTENTIALS

VEP # 1 ZOUHAROUR, Iana Pattern-Shift Visual 14:44:28
L & R Eyes/Full-Field

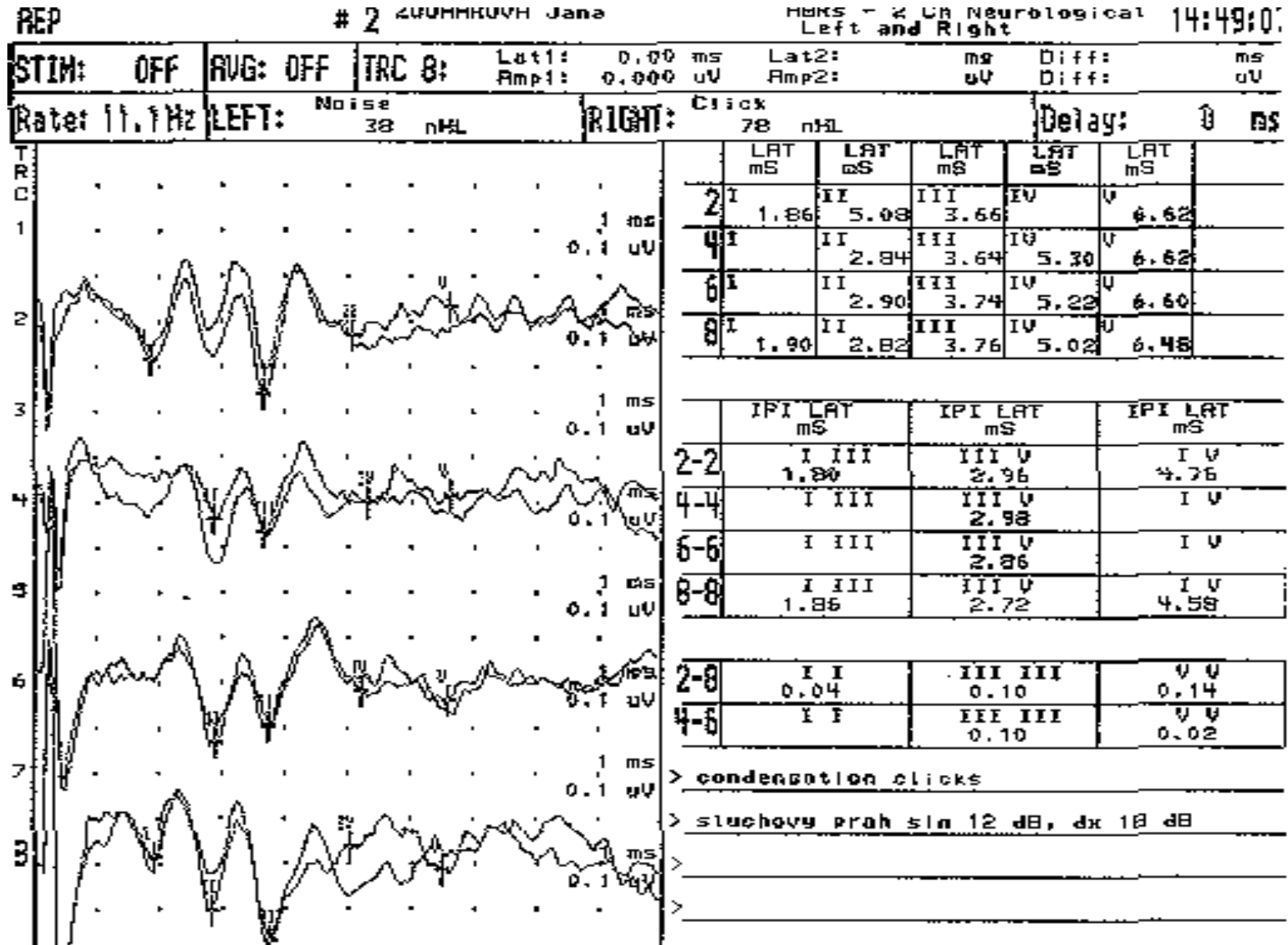
STIM: OFF AVG: OFF TRC 1: Lat1: 0 ms Lat2: ms Q.14: ms
Amp1: 0.595 uV Amp2: uV Q.14: uV
Rate: 1.1Hz Stimulator: 1015 Delay: 0 ms



	LAT ms	LAT ms	LAT ms	AMP uV	AMP uV
1	N75 128	P100 158	N145 228	19.66	15.65
2	N75 128	P100 159	N145 229	17.68	16.09
3	N75	P100	N145		
4	N75 132	P100 165	N145 204	14.29	12.09
5	N75	P100	N145		
6	N75	P100	N145		

	IPI ms	LAT ms	IPI ms	LAT ms	IPI ms	LAT ms
1-4	N75 4	N75	P100 7	P100	N145 24	N145
2-5	N75	N75	P100	P100	N145	N145
3-6	N75	N75	P100	P100	N145	N145
	AMP uV		AMP uV		AMP uV	
1-4	5.365		3.565			
2-5						
3-6						

BRAINSTEM AUDITORY EVOKED POTENTIALS



SOMATOSENSORY EVOKED POTENTIALS

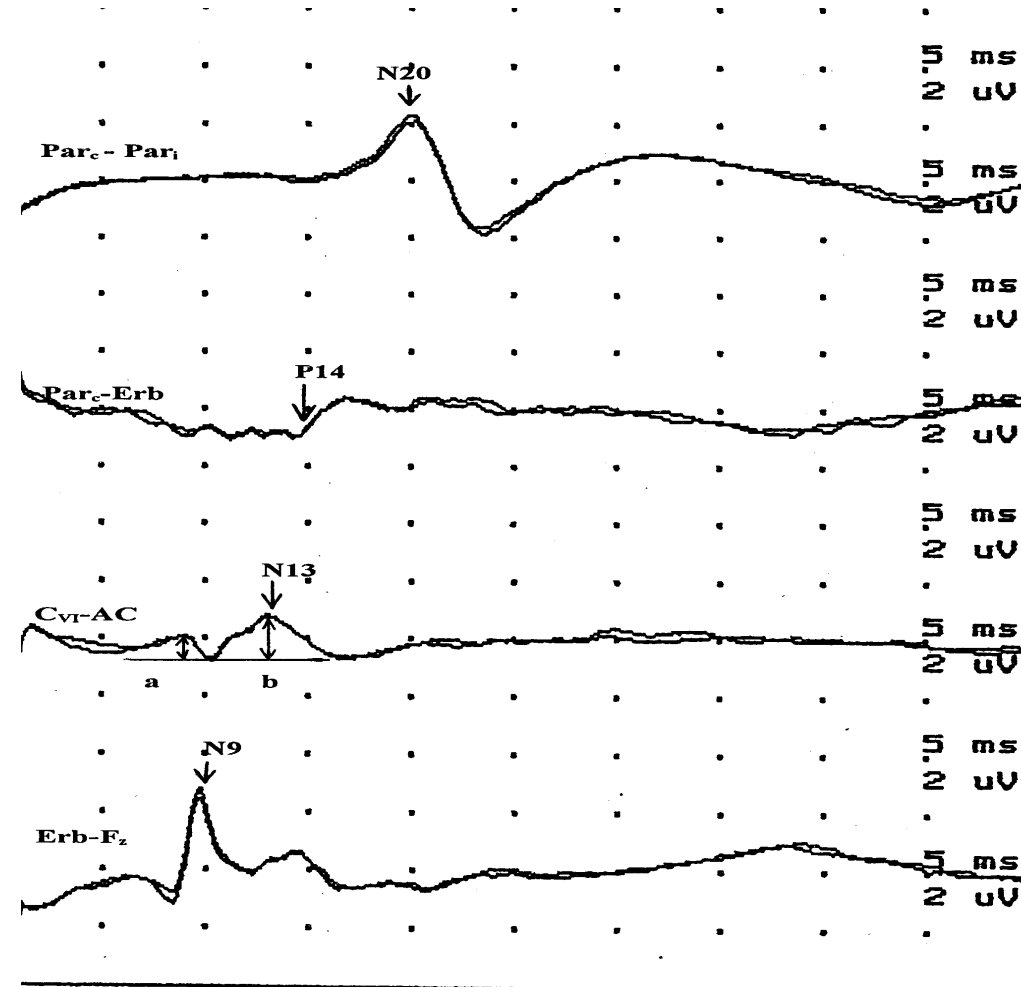
Electrical stimulation of the median nerve
at the wrist

Cortex

Cervico-medullar junction

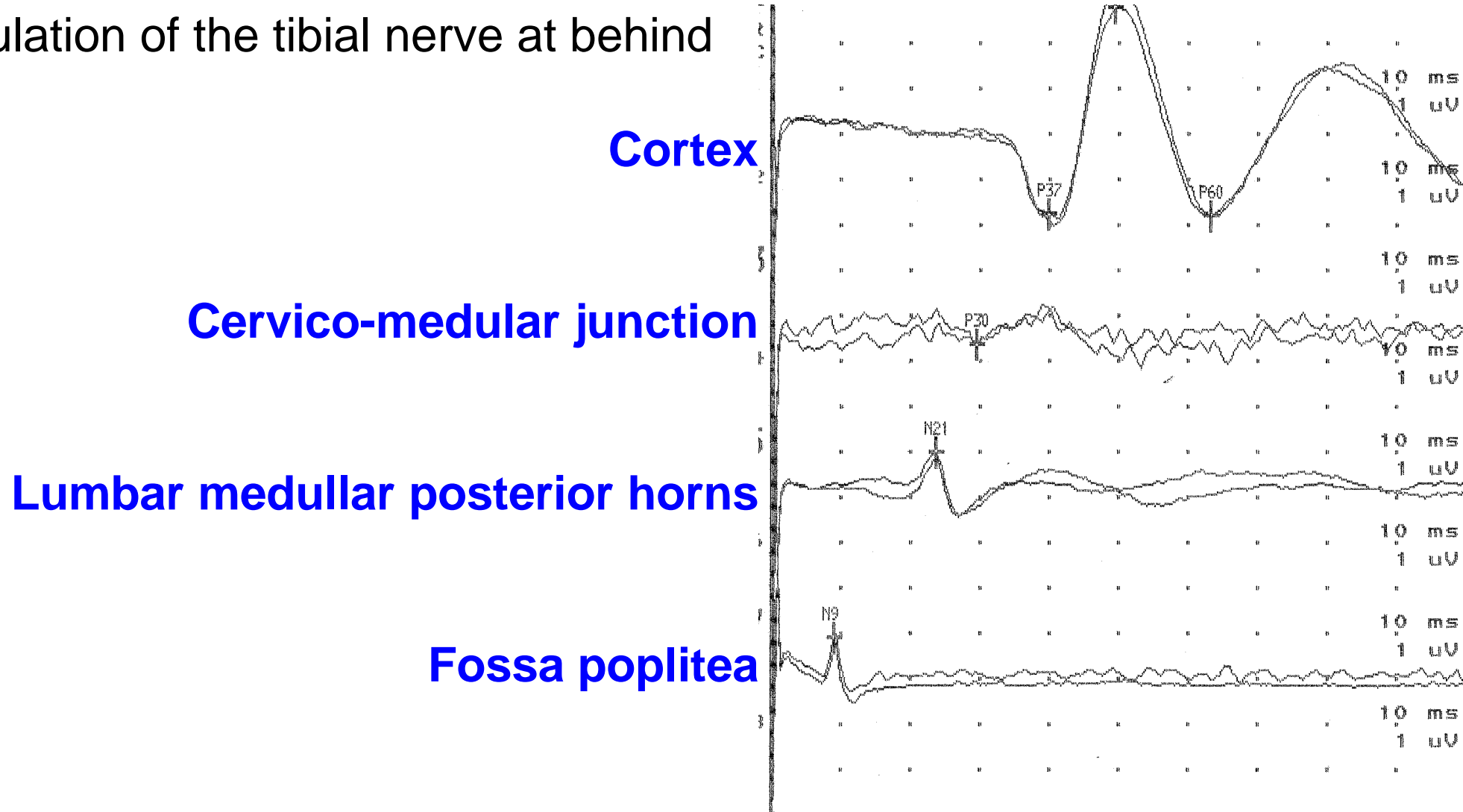
Cervical posterior horns

Erb's point



SOMATOSENSORY EVOKED POTENTIALS

Electrical stimulation of the tibial nerve at behind malleolus



MOTOR EVOKED POTENTIALS

Magnetic stimulation of the cervical or lumbar roots (RL) and cortex (CL)

