

Clinical Application



Neuro-Monitoring-Analysis (NMA)®

A horizontal banner image. On the left, a blue-toned CT scan of a brain showing vascular structures. On the right, a close-up photograph of a human brain. A semi-transparent blue box with the text 'Neuromon bv' is overlaid on the right side of the banner.

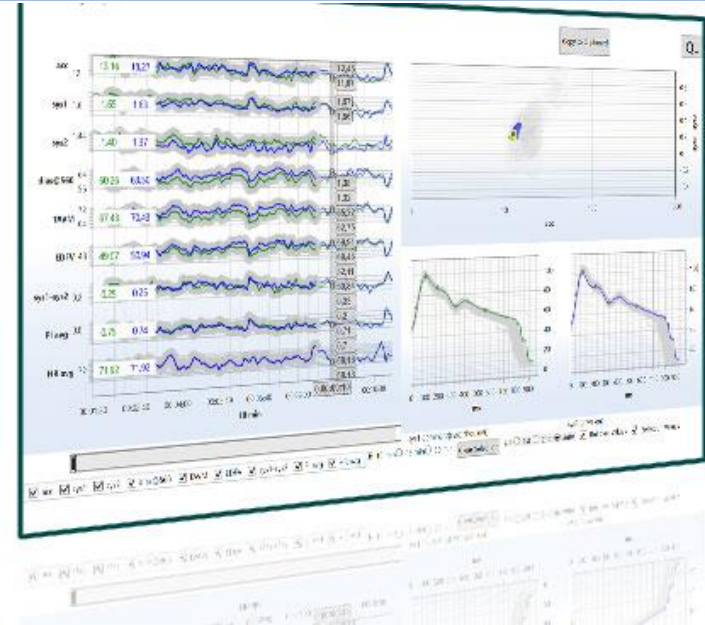
Neuromon bv

A new technique standing for a new philosophy
on cardiovascular physiology



Improved TCD waveform analysis with new parameters allowing
discrimination of pathology patients from normal controls.

Neuro-Monitoring-Analysis (NMA)®



- Surgery
- Anesthesia
- Intensive Care

Theory of arterial acceleration

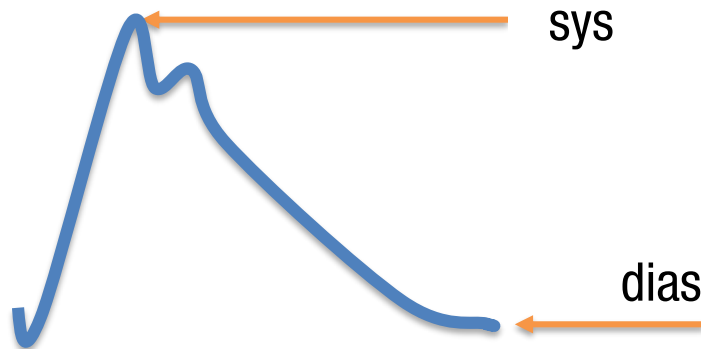
Arteries are not only passive conduction systems, but also bring energy into the pressure wave of the heart.

- ➔ At the beginning of a heartbeat a pressure wave is generated by myocardial contraction.
- ➔ This pressure wave is expanded within the smooth muscle cells of the arterial wall.
- ➔ This leads to a peristaltic wave spreading along the branches of the arterial tree.

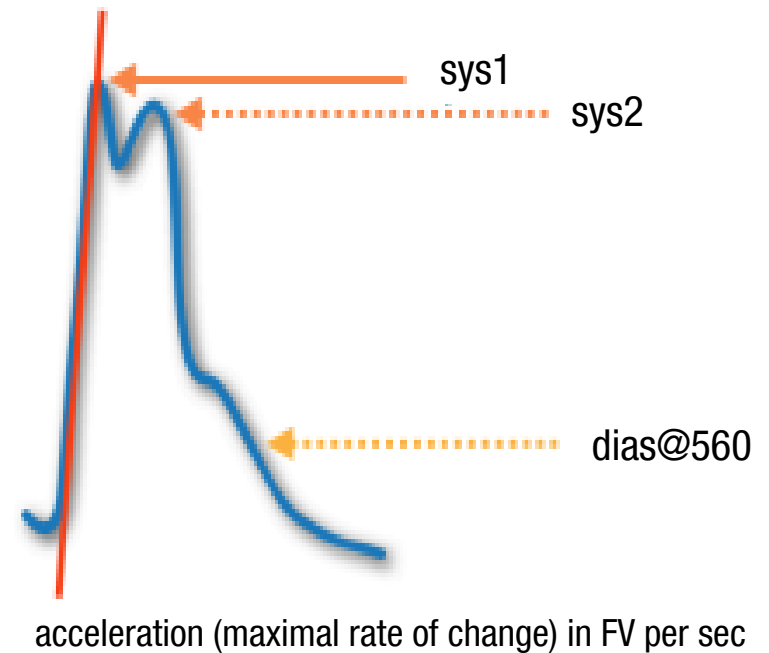


Introduction of “New” Parameters (Indices)

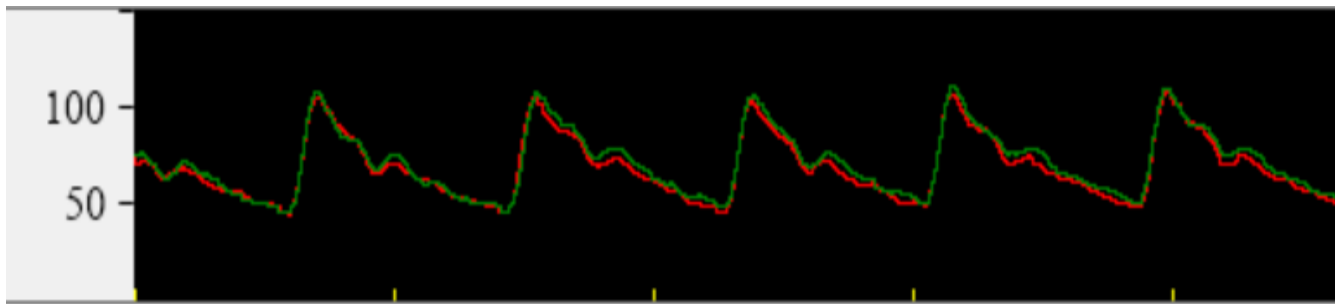
Common Indices



New Parameters (Indices)



Flow profile in an artery



Heart cycles

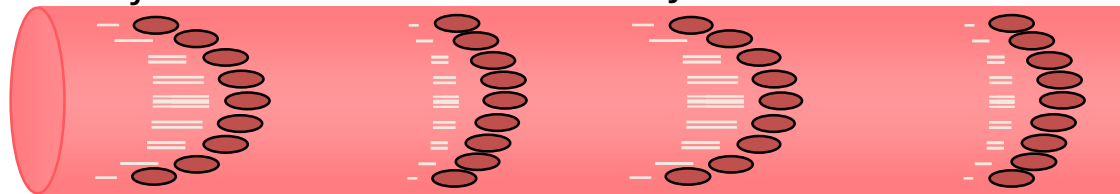
systole

diastole

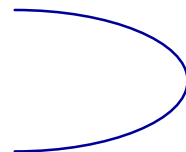
systole

diastole

Artery



Flow patterns



parabolic



flat

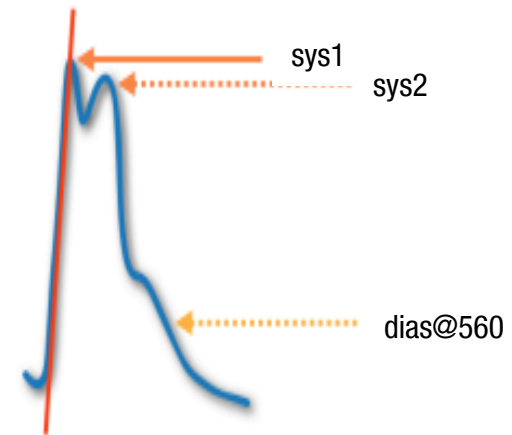


Various factors influence the flow profiles in the arteries

- Change in heart rhythm (flow velocity)
- Changes in respiration (e.g. CO₂ content)
- Changes in arterial blood pressure
- Changes in intracranial pressure
- Changes in blood values (e.g. haematocrit)
- Changes in posture (e.g. lying, standing)
- Changes to the activity (e.g. sport/sleep)
- Changes within age (e.g. stiffening)

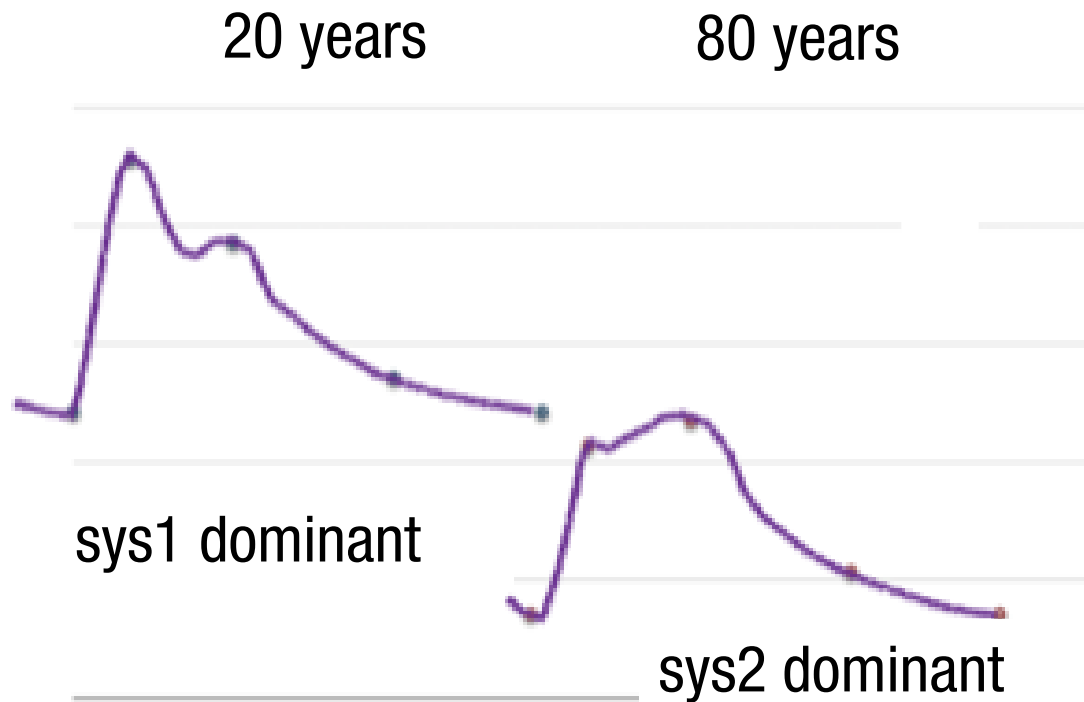
- Acc = acceleration, the maximal change in flow velocity at stroke onset, gradient of the line
- Sys1= the maximal flow velocity reached during early systole (first systole peak)
- Sys2= the maximal flow velocity reached during late systole (second systole peak)
- dias@560= the diastolic flow velocity fixed 560ms after stroke onset
- HR= mean heart rate over the 10 interval

parameter	origin	1st order dependence	2nd order dependence	3rd order dependence
acc (sys1)	phasic myogenic response	smooth muscle contractility		
		aorta pressure		
sys2	ventricular ejection	stroke volume	diastolic filling time	heart rate
			ventricular ejection fraction	heart contractility
		blood distribution	cerebro-vascular resistance	metabolic activity
			peripheral vascular resistance	sympathetic vasomotor tone metabolic activity
dias@560	aorta pressure	cardiac output	preload to the heart	venous capacity
				total blood volume
		aorta stiffness total vascular resistance		
HR	cardiac innervation	aorta and carotid baro-receptors	dynamic aorta pressure	heart contractility
				aorta pressure
				total vascular resistance
		atrial baro-receptors	venous pressure	venous capacity
				total blood volume
cardiac output				

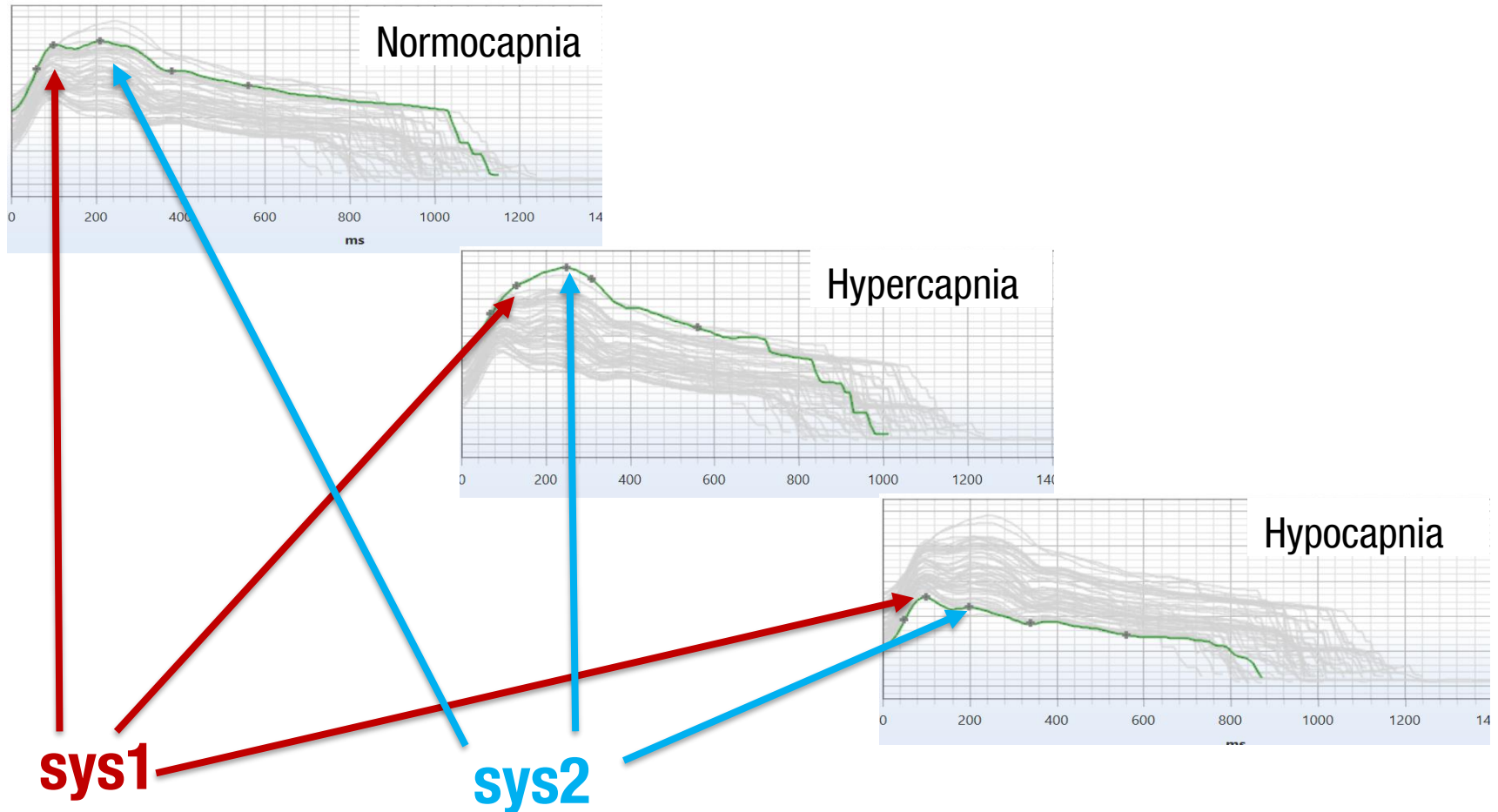


acceleration (maximal rate of change) in FV per sec

Changes within age



Changes in respiration

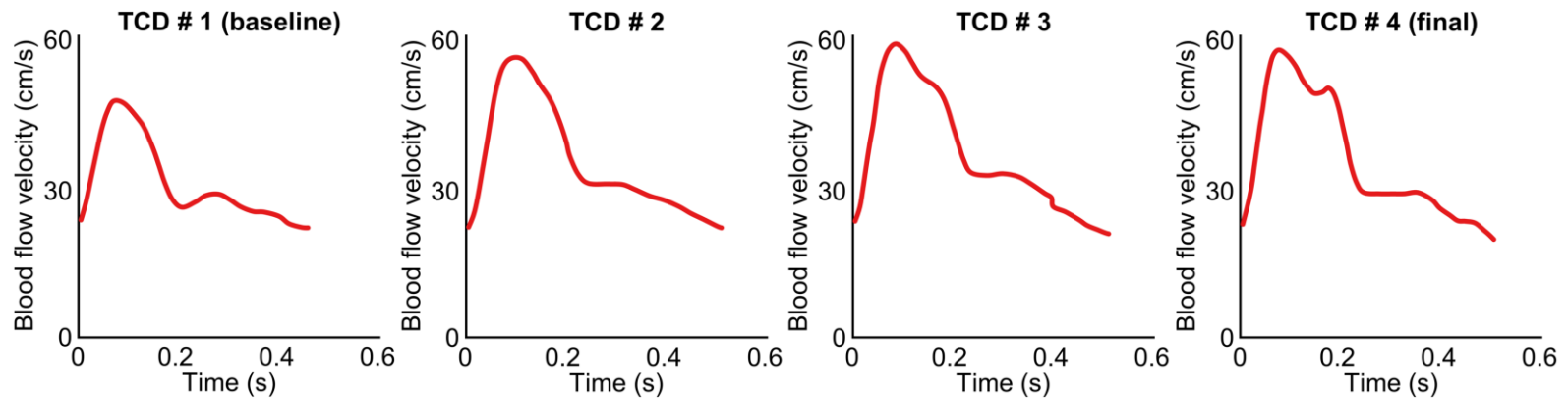


For the assessment of disease progression and as therapy control

e.g.:

- age-related changes in the vascular flow area
- Changes in blood circulation during therapeutic interventions, e.g. follow-up during drug treatment
- pre-, peri- and postoperative examination (before/after evaluation)

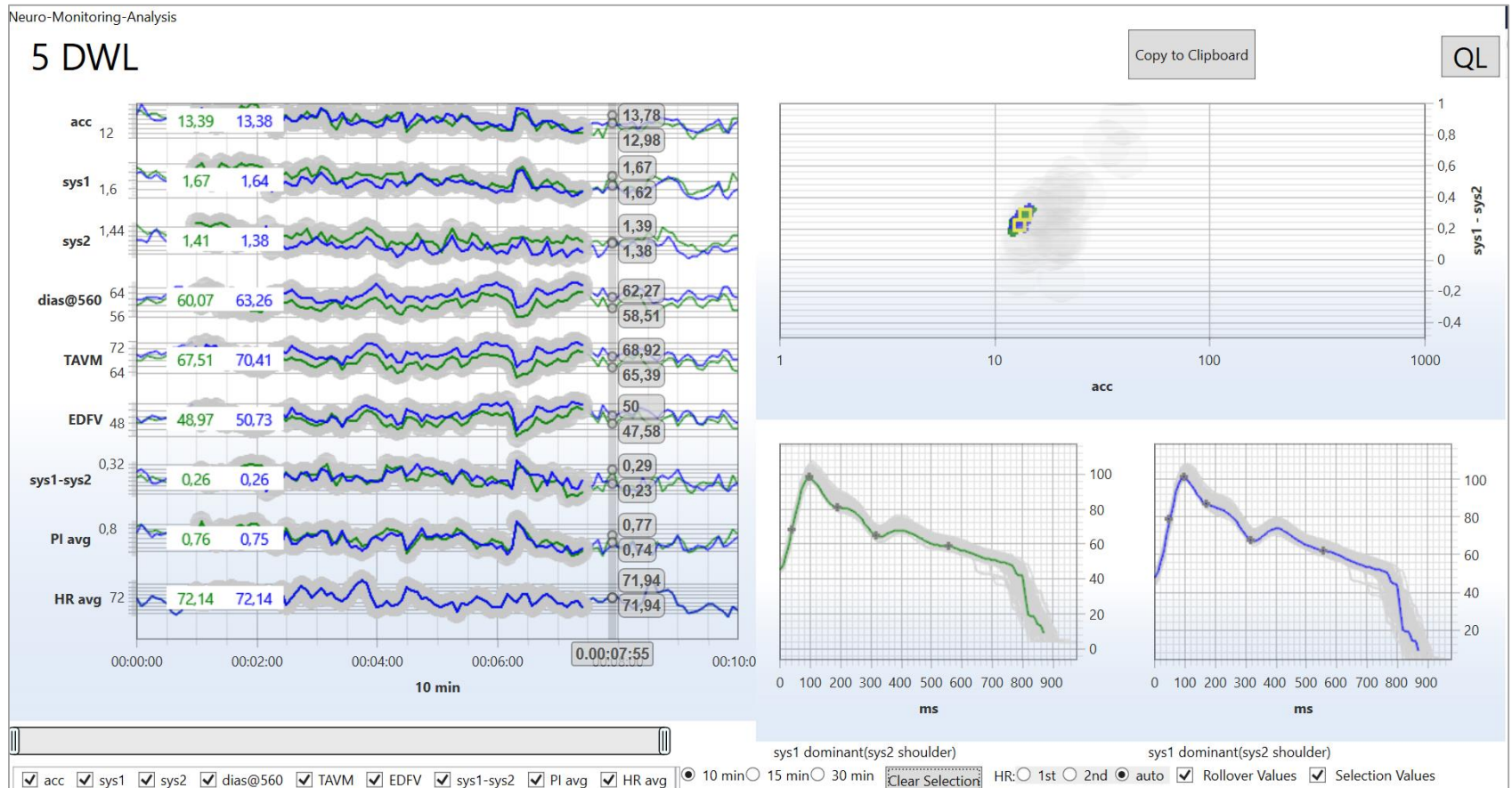
Change during medical treatment



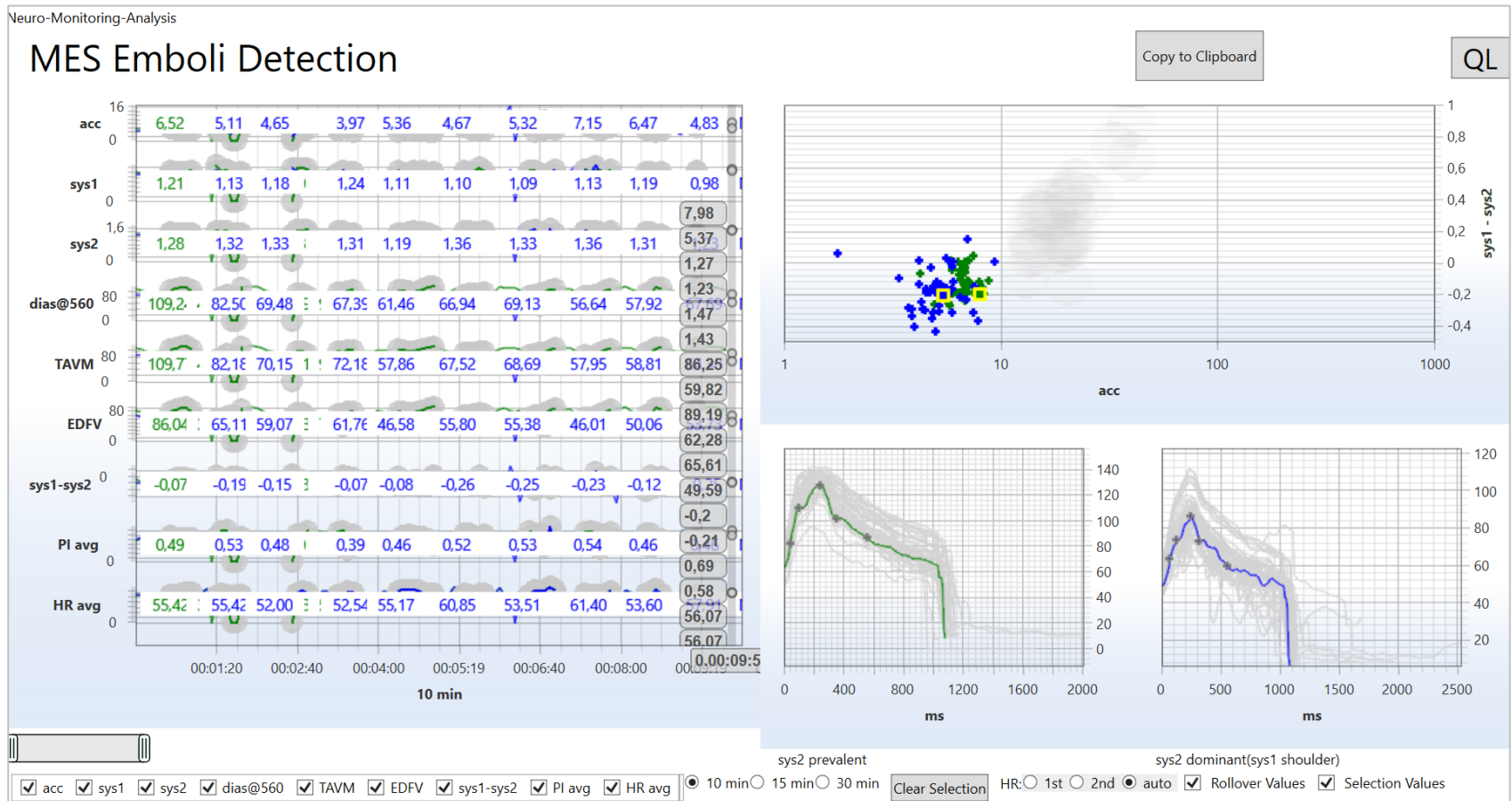
Successive injection of 500ml Colloid

Example patient with sepsis – sys2 missing

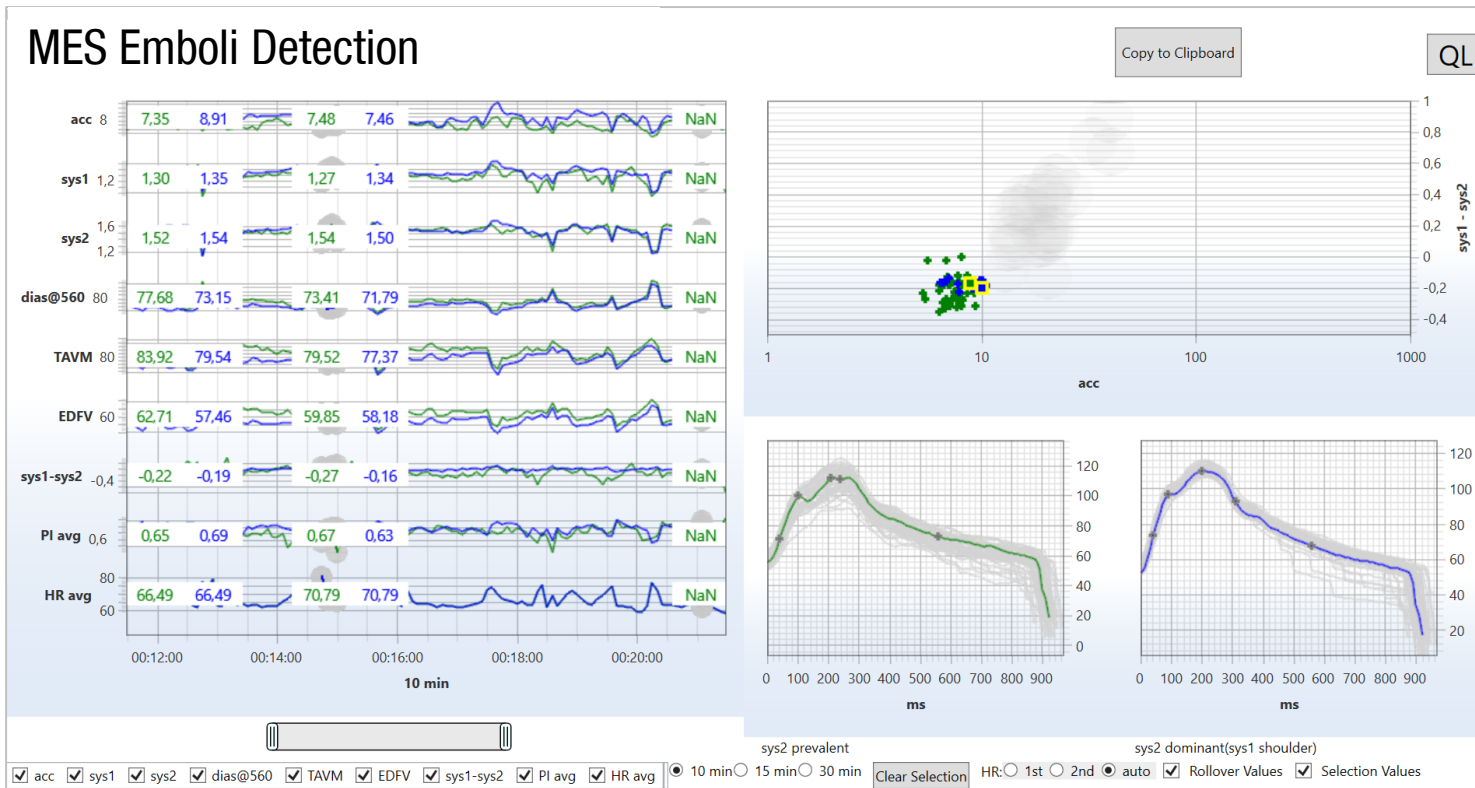
Woman, 30 years. Normal example



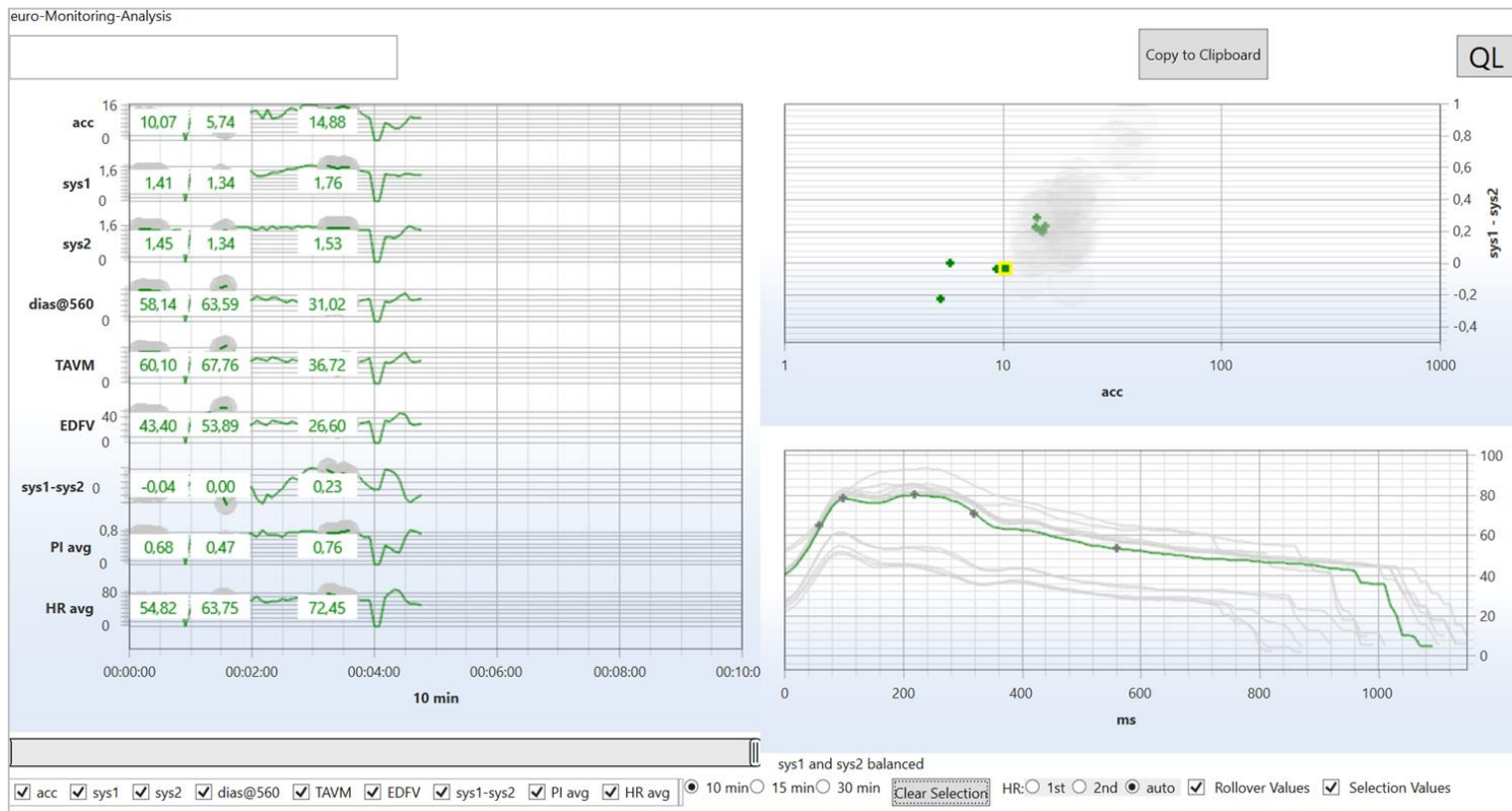
Man, 57 years. 70% ICA stenosis right praeoperative



Man, 57 years. 70% ICA stenosis right after surgery



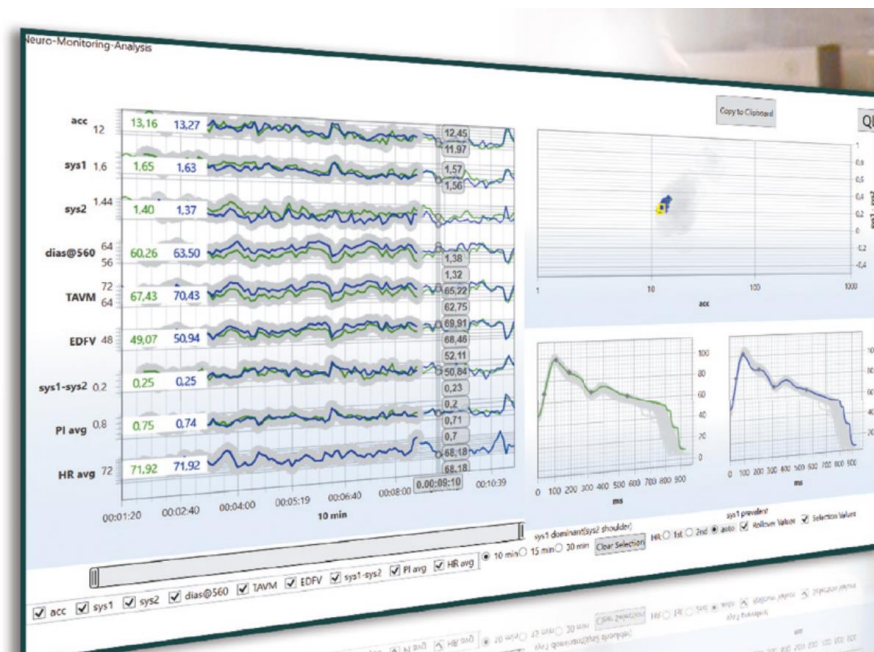
Woman, 50 years. Normal changes in respiration



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Beside “traditional” vascular neurology, TCD application of online monitoring techniques for surgery, anesthesia and intensive care are gaining popularity.



Literature, References:

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Artery Flow Velocity, 43(11), 2591-2600. <https://doi.org/10.1016/j.ultrasmedbio.2017.06.027>



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Neuromon bv

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