

Report

Measurement: EDF - European Data Format 17.09.2016 22:28:14 Subject: Athlet Professional, 12.04.1996

Summary

Measurement quality

Measurement quality day: very good



Measurement quality night: well



Noticeable HRV parameters

HRV parameter out of range day: 8,96 %



HRV parameter out of range night: 2,99 %



Heart rate

Number of heartbeats: 92.198 beats in 24 h



Heart rate day: 84,04 [1/min.]



Heart rate night: 50,24 [1/min.]



Lowering of the nocturnal heart rate: 34 [1/min.]



Fluctuation index

Fluctuation index day: 2,6 xSD



Fluctuation index night: -0,8 xSD



Vegetative balance

Parasympathetic index day: 0,9 xSD



Parasympathetic index night: 1,1 xSD



Sympathetic index day: -0,2 xSD



Sympathetic index night: -1,3 xSD



Sleep

Sleep duration: 7,5 h



OSA score: 5,8



Recovery Index: 37,9 %



Functional HRV age

Functional HRV age: 20,0 a



Legend

unfavourable



still normal



normal



favourable



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Measurement quality

The basis of every HRV measurement is the best possible registration of the ECG signal. Before assessing the HRV, the quality of measurement should be considered first.

The duration of the measurement was 22:38:56 [hh:mm:ss]

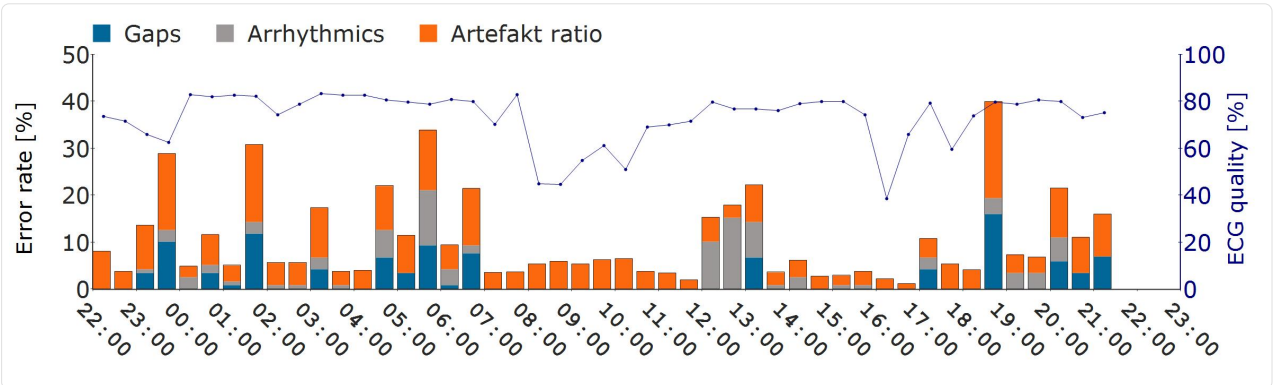


Diagram: Measurement quality over the entire measurement. The ECG quality is provided for every half hour as a blue curve.

Measurement quality day

very good



Measurement quality night

well



Abnormalities in heart rate variability

A good starting point for the HRV analysis is the overall consideration of whether it is a "normal" HRV measurement. "Normal" in this context means that most HRV parameters are in the normal range.

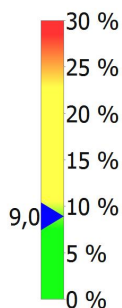
8,96%

The percentage of abnormal HRV parameters during the day was 8,96 [%]

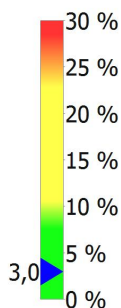
2,99%

The percentage of abnormal HRV parameters during the night was 2,99 [%]

Day



Night



Parameter out of range day

no particular abnormalities



Parameter out of range night

no particular abnormalities



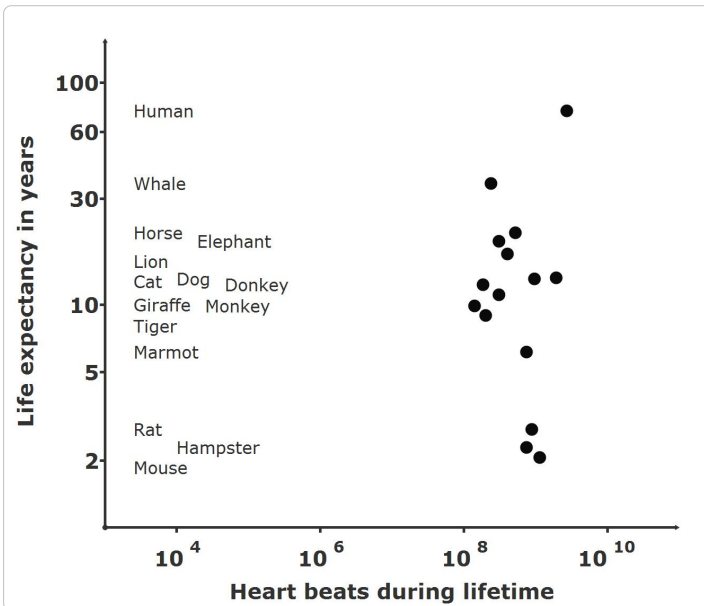
Explanation: A total of 67 parameters were evaluated to calculate the proportion of suspicious HRV parameters. Of these, 6 were raised on the day and 2 during the night.

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Number of heartbeats

Although mammals vary significantly in size and weight (mouse to whale weight: 1: 500000), the number of heartbeats throughout their lifespan is remarkably consistent. Behind this is probably a universal characteristic of the energy turnover of living tissue. Man has been able to increase his life expectancy through medical advances, but the number of heartbeats during his life remains the same order of magnitude.



In humans, the heart beats about 100,000 times a day. Of course, the human heart has not incorporated a counter, but the relationship between many heartbeats and higher risk of death has also been clearly demonstrated in humans in numerous studies. A calmly beating heart is therefore beneficial in terms of prevention.

Your heart has beaten during the measurement 87.008 times. This equals 92.198 beats in 24 h.

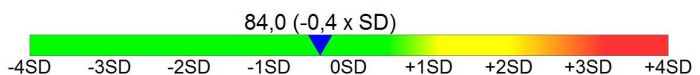


Number of heart beats per day was significantly lower than the average +

Heart rate

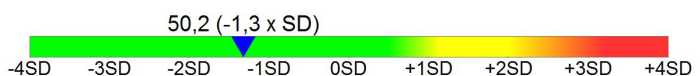
Heart rate is one of the best studied physiological parameters. A good parasympathetic tone, expressed by a low heart rate is healthy. For example, people with a heart rate > 90 / min have a multiple increased risk of mortality than people with a heart rate < 60 / min.

The average heart rate during the day was 84,04 [1/min.]



Your heart rate was within normal limits during the day ✓

The average heart rate during the night was 50,24 [1/min.]

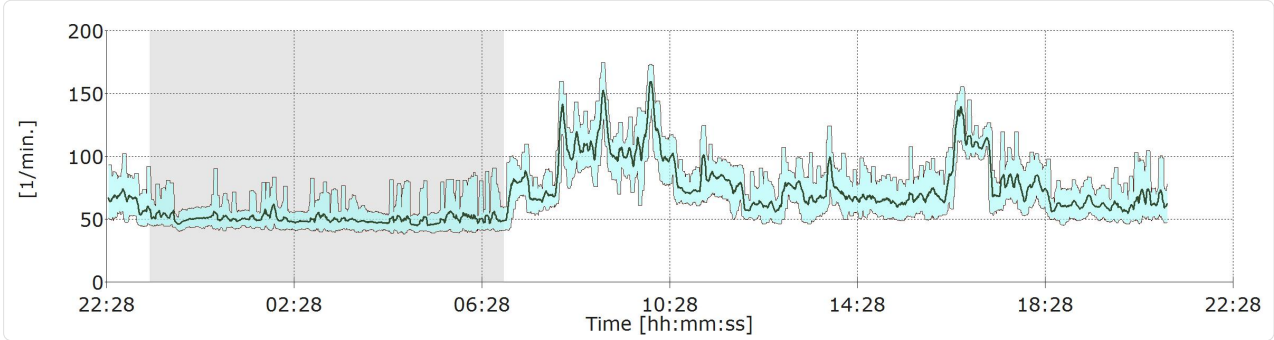


Your heart rate was moderately reduced during the night +

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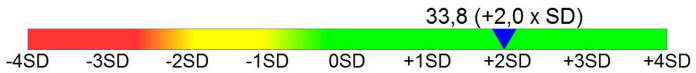
Heart rate history



Lowering of the nocturnal heart rate

The lowering of the heart rate from day to night is a sign of a shift of the autonomic nervous system in the direction of more parasympathetic activity and thus signs of increased regeneration at night.

The lowering of the heart rate from day to night was at 34 [1/min.]

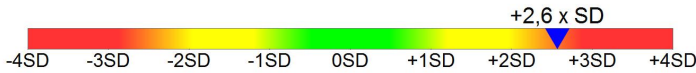


There was a marked drop in heart rate from day to night. +

Fluctuation index

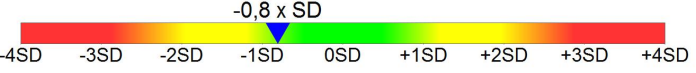
Stages of strain and relief usually alternate and are in a "healthy" relationship expressed by the fluctuation index. The fluctuation index quantifies how much the heart rate variability changes. A high fluctuation index during the day is found, for example, in athletes on training and competition days or in heavy occupational stress with cyclical loads. Important: A low fluctuation index is not synonymous with the absence of stress phases. A sustained sustained load, e.g. persistent psychosocial stress also leads to a low fluctuation index with high sympathetic activity.

The fluctuation index was 2,6 xSD during the day



The change of strain and recovery during the day was increased. There were increasingly many or strong changes in the HRV during the day. -

The fluctuation index was -0,8 xSD during the night



The change of strain and recovery during the night was normal. ✓

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Vegetative balance - specific performance indices for the sympathetic and parasympathetic system

The autonomic nervous system with its two counterparts sympathetic ("gas pedal") and parasympathetic ("brake") regulates all important body processes and ensures optimal adaptation to the respective situation. In most cases, the sympathetic and parasympathetic nervous system act in opposite directions. For example, the sympathetic increases our heart rate in a dangerous situation. When the danger is over, the parasympathetic nervous system ensures that our heart beats slower again. For a healthy interaction of sympathetic and parasympathetic, the activities of "accelerator" and "brake" should neither be too high or too low. To assess the autonomic balance, the HRV scanner calculates the autonomic nervous system performance indices separately for day and night.

**PNS Index (Parasympathetic Index)**

Expresses the activity of the parasympathetic part of the autonomic nervous system. The parasympathetic system is responsible for regeneration and relaxation.

0,9 xSD Your parasympathetic activity during the day was 0,9 xSD

Your parasympathetic activity during the day was slightly elevated.

1,1 xSD Your parasympathetic activity during the night was 1,1 xSD

Your parasympathetic activity at night was significantly increased

**SNS Index (Sympathetic Index)**

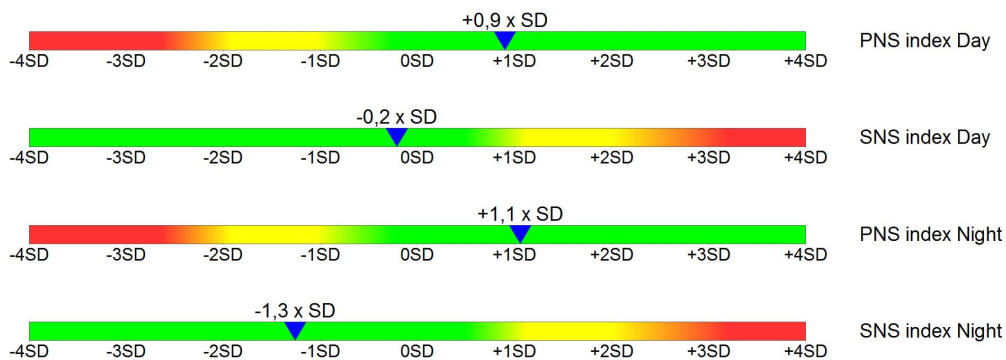
Expresses the activity of the sympathetic part of the autonomic nervous system. The sympathetic system is responsible for performance and activation.

-0,2 xSD Your sympathetic activity during the day was -0,2 xSD

Your sympathetic activity during the day was normal

-1,3 xSD Your sympathetic activity during the night was -1,3 xSD

Your sympathetic activity at night was significantly reduced



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Sleep

Insufficient sleep or sleep disturbances can cause serious health problems. A well-known example is the increase in cardiovascular risk when sleep apnoea occurs. There are many problems falling asleep and staying asleep, as a result of which the quality of sleep is reduced. The natural sequence of the various sleep phases is then usually disturbed. This also has an effect on the autonomic nervous system: The dominance of the parasympathetic system, which is important for recovery, is diminished or completely absent. The diagnosis of sleep disorders is complex and usually requires the registration of numerous different physiological parameters in the sleep laboratory (polysomnography). The HRV analysis can not replace this, but HRV analysis can sometimes provide valuable clues to the presence of a sleep disorder.

Sleep duration

7,5 h      The sleep time was 7,5 h.

Your sleep duration was normal.

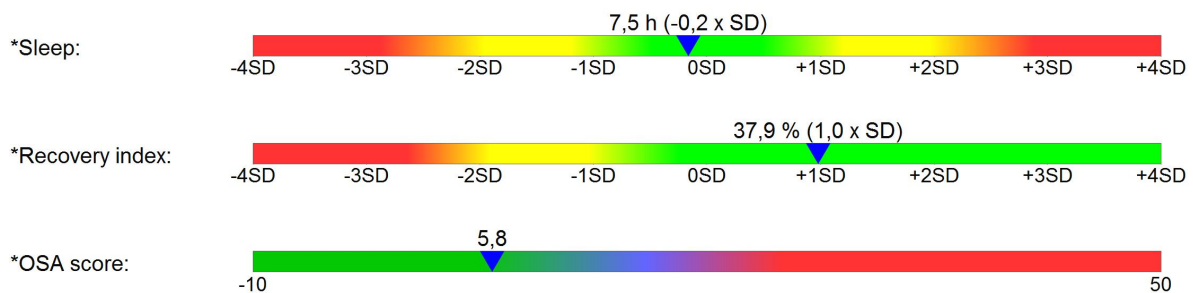


OSA-Score

The HRV-Scanner looks for respiratory, ECG and HRV patterns that are characteristic of sleep apnoea. The strength and frequency of these patterns are quantified in the form of "OSA score". The OSA score was developed using the SHHS study, which includes several thousand polysomnographic datasets. However, a high OSA score does not automatically mean that obstructive sleep apnea is certain. Incidentally, this applies to all screening examinations; a positive test result does not necessarily mean that a disease is present, even if this is often interpreted. The decisive factor is always the pretest probability, which depends on the frequency of the disease and on the presence of symptoms.

5,8      The OSA score was 5,8

The 24-hour analysis shows no indication of the presence of an OSA.



The OSA risk decreases from 3,2 % to 0% (LRp:1,3; LRn:0,1315)

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**Assessment of nocturnal rest**

A good nocturnal recovery is characterized by a reduction of the sympathetic activity and a clear activation of the parasympathetic nervous system. Heart rate and blood pressure decrease during sleep, and parasympathetic activity indicators increase.

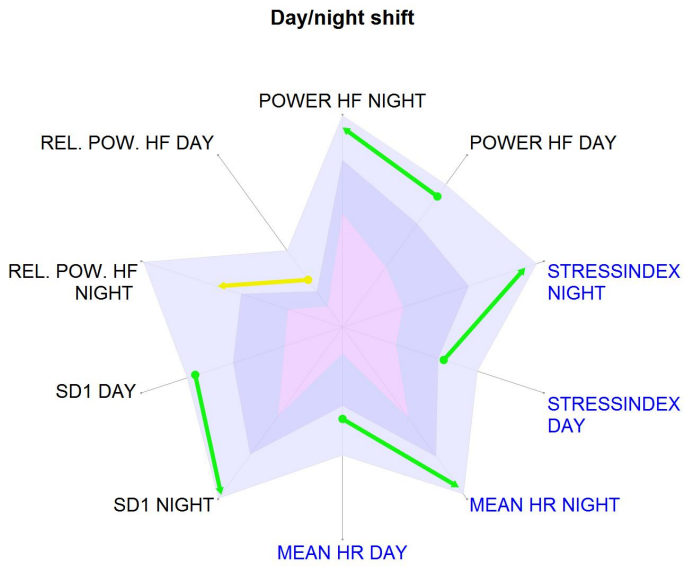
**Lowering of the nocturnal heart rate**

34 [1/min.]      Heart rate reduction from day to night was 34 [1/min.]

There was a marked drop in heart rate from day to night.



**Day / Night Shift**



The Spiderweb Diagram "Day / Night Shift" displays the day value for selected parameters and the corresponding night value immediately next to it (counterclockwise). The corresponding percentiles are also drawn. An arrow colored after the traffic light principle shows the change of day and night. If the absolute HRV value deteriorates, a red arrow is displayed. If the absolute HRV value and the percentiles improve, a green arrow will be displayed. Although the absolute HRV value improves, but the night value ranking falls by more than 5%, the arrow is yellow (still an improvement, but not optimal).

The average relative improvement in HRV parameters is also calculated as a numerical value and is available as recovery index.

**Recovery Index**

The Recovery Index expresses the average improvement in important HRV parameters during the night compared to the day. Are there hardly any stresses during the day, e.g. bed rest or long lay periods, the recovery index may be low, although the parasympathetic tone is high at night. To interpret the recovery, it is therefore advisable to take into account the stress during the day and the parasympathetic and sympathetic activity.

37,9 %      The recovery index was 37,9 %

The recovery index was slightly higher. ---

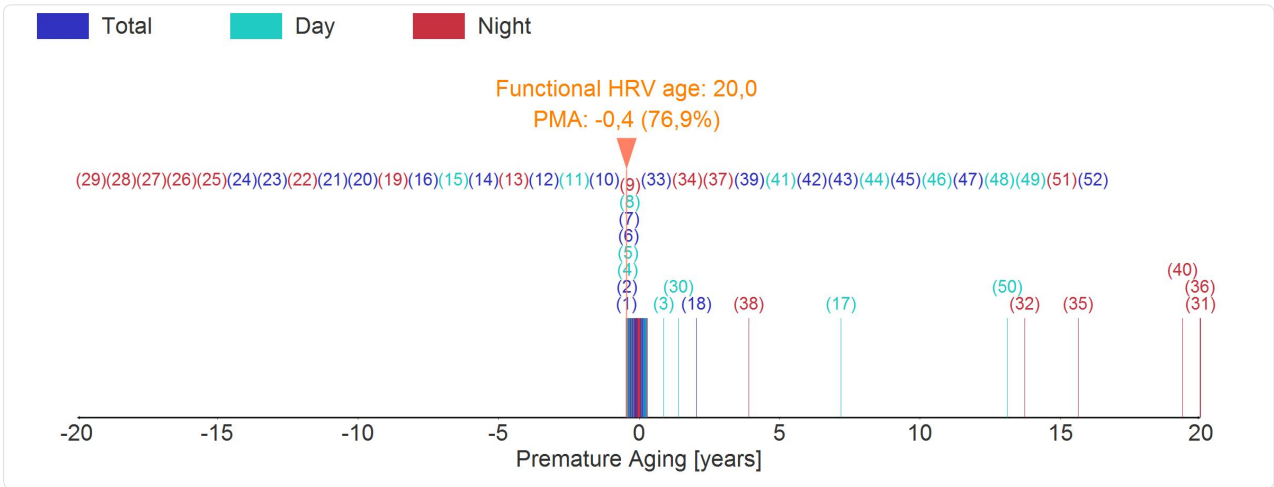


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### Functional HRV Age and "Premature Aging (PMA)"

Age is one of the most important risk factors for cardiovascular diseases. For example, the older we get, the more likely it is that a heart attack or stroke occurs. For this reason, age is usually included as an important factor in the calculation of risk scores. Reduced HRV may also indicate an increased cardiovascular risk. The extent of premature aging can be quantified by the functional HRV age. The difference between the functional HRV age and the actual age is the PMA value and indicates how many years the neurovegetative control system is older than the actual age. Negative PMA values indicate that the neurovegetative control system is younger than its age.



The functional HRV age and PMA value are calculated in the HRV scanner for 52 HRV parameters, which have in common that they correlate highly with age ( $r > 0.5$ ). The resulting functional HRV age is the median of the 52 individual values.

### Functional HRV age

20,0 a    Your functional HRV age calculated from this measurement was 20,0 years.

Your functional HRV age was about your age.

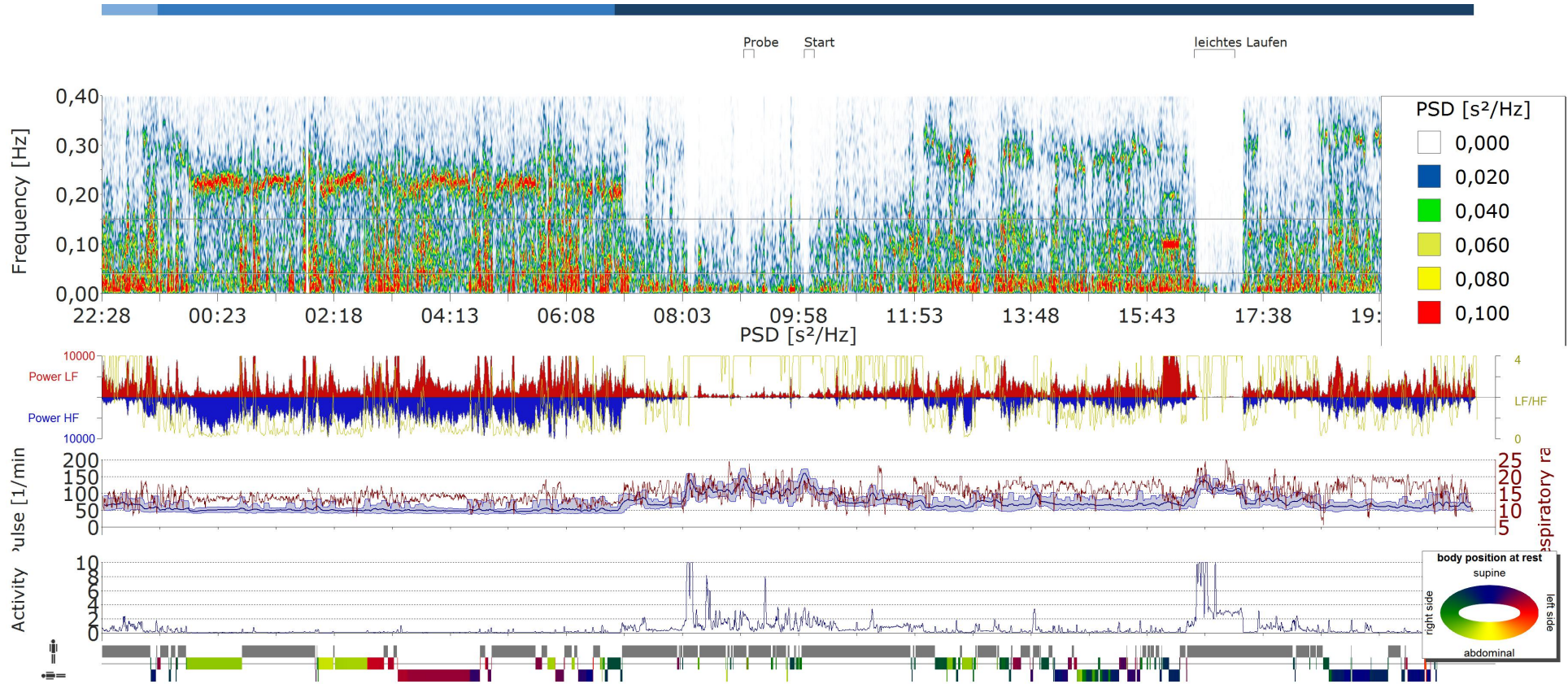
Functional HRV age and cardiovascular risk: We have investigated whether patients suffering from cardiovascular disease can be distinguished from healthy individuals based on the functional HRV age. For this purpose, the data of a healthy control group were compared with those of a patient group with angiographically proven CHD. Of all the 311 HRV parameters studied, the "functional HRV age" of an effect size of 1.896 was the parameter with the greatest effect size and thus the best discrimination between CHD patients and healthy individuals. Common HRV parameters such as SDNN (d: 0.872), SD1 (d: 0.654) or Power HF (d: 0.881) had significantly lower effect sizes. We therefore believe that a high functional HRV age indicate a higher cardiocascular risk.



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Color FFT (color-coded spectral analysis)



The spectral analysis allows the determination of the frequency components in the heart rate curve. This can be used to deduce the parasympathetic and sympathetic activity. Rapid changes in heart rate ( $> 0.15$  Hz) are indicative of parasympathetic activity. In the color FFT diagram, the activity in a particular frequency band is encoded by the color at a given time. The lower section shows the ratio LF / HF and Power LF / Power HF, the heart rate (mean HR, maximum and minimum heart rate) and the activity (measured from the motion sensor system).

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HRV during 24h

