## SCA10H-SAL

# Sleep Analysis Library

## Key features

- Output data for momentary and cumulative whole night applications
  - Overnight Recovery Analysis utilizing detected high and low frequency heart rate variability, respiration depth and respiration variability.
  - Automated Wakefulness, REM, Shallow and Deep Sleep scoring
  - Supports sleep quality index based on detected recovery, REM-, deep and total sleep times.
- Currently supported operating systems
  - Ubuntu 18.04 and newer
  - CentOS 6.0 and 7.0

## SW functionality

Input BCG data
23,55,15,84,47,2001,1,1063,0,0
24,55,17,81,24,2050,1,1089,0,0
25,55,17,85,19,2108,1,1059,0,0

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Sleep analysis

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Output data
Cumulative vector once/run
0.342 0.325 0.048 0.078 0.199 0.016 0.339 0.139 2.589 29.192
Output matrix at 1 Hz
1.12 1.03 66.88 10.07 5.12 4.66 0
1.12 1.03 66.88 10.07 5.12 4.66 0
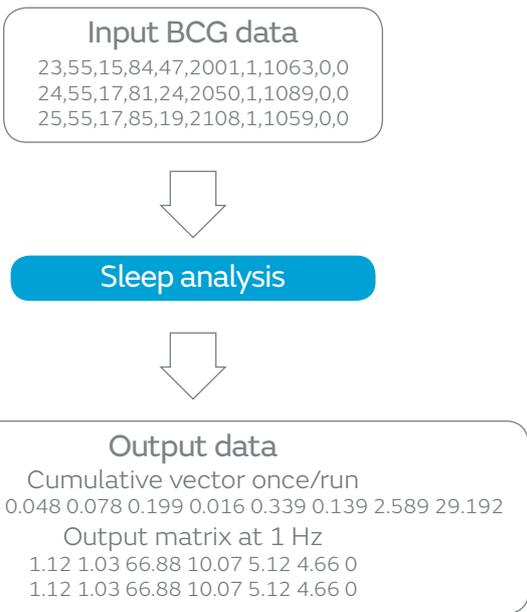
- Further in-depth information can be found in APP 2810 BCG-Based Sleep Analysis SW ENG (ID 75286), available on request.

## Detection characteristics*

| Sleep phase detection | Total sleep | REM sleep | Deep sleep |
|---|---|---|---|
| Detection sensitivity | > 90 % | > 60 % | > 60 % |
| PSG reference ** | $400\,^{+120}_{-240}$ min | $65\,^{+65}_{-50}$ min | $110\,^{+90}_{-110}$ min |
| PSG vs BCG *** | ± 45 min | ± 25 min | ± 45 min |

\* Clinical study at Turku University Sleep Research Centre and home test with ambulatory PSG by Finnish Institute of Occupational Health, Statistics of 45 overnight tests, age 24 – 65 years, 30 male, 15 female
\*\* Average reference value ± min/max deviation
\*\*\* 95% estimate

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## BCG-based sleep analysis

- Non-intrusive and user friendly measurements enabled by Murata SCA10H/11H BCG bed sensor.
- Measures the pumping activity of the heart influenced by the autonomous nervous system and the mechanical effect of respiration to detect sleep stages and the stress and recovery balance.
- Detection performance is enhanced by motion artefact and arrhythmia removal processing

## Evaluation tool

- Standalone PC-application with graphical user interface to post-process 1 Hz BCG-data
- Full algorithm, output restricted to cumulative results
- Requires free-of-charge 64-bit Matlab Runtime 9.5 (R2018b) installation. Can be downloaded from http://www.mathworks.com/products/compiler/mcr/index.html
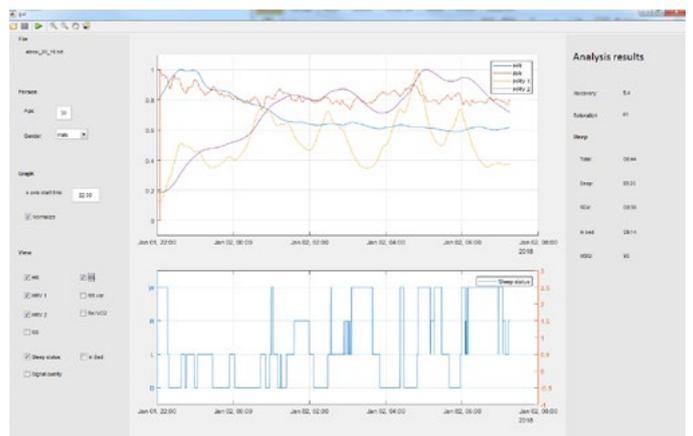


| Beat detection | Heart rate HR | Heart rate variability HFHRV/LFHRV |
|---|---|---|
| PSG vs BCG correlation R | 97 % | 78 % |