WESPER'S

# CHANNELS AND METRICS

Read on to understand how Wesper dervies different channels and metrics.

HOW WE DERIVE

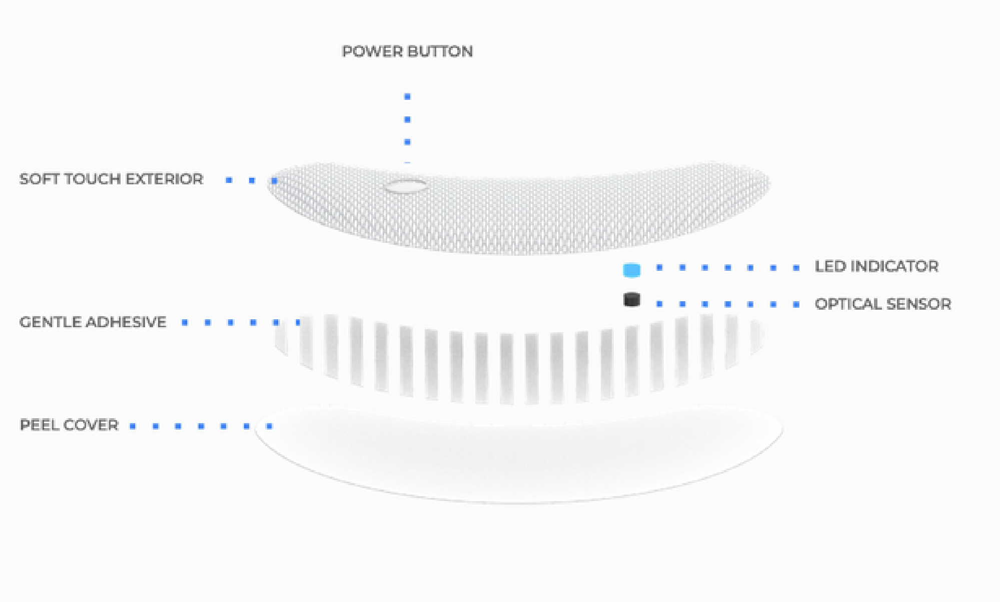
## RESPIRATORY EFFORT

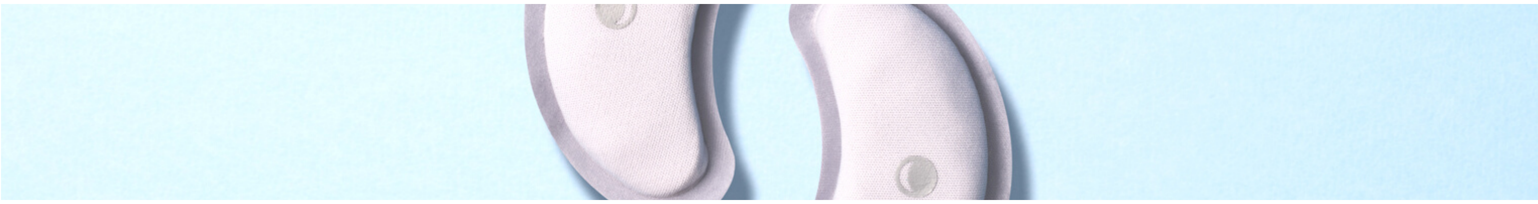
Wesper detects respiratory effort by way of patented optical proximity sensing.

Optical sensing is known to be extremely sensitive to motion. In this case, the resulting waveform is inscribed with the motion profile of the anatomical site on which it is placed. For Wesper, that would be the abdomen or thorax.

During near-motionless sleep, the primary component of thoracic/abdominal motion is induced by respiration. Therefore, this waveform would contain a strong respiratory component and other components, such as noise, cardiac activity, etc.

Wesper algorithms then extract respiration from raw waveform to produce a respiratory effort measurement.





HOW WE DERIVE
## AIRFLOW

Wesper measures airflow by employing a well-known principle, studied most famously by Konno and Mead, where an additive combination of respiratory effort signals from the thorax and abdomen results in a waveform which strongly correlates with a direct measurement of airflow. This principle has been proven through many academic and clinical studies, and is formally recognized by the AASM to be used in sleep studies as an alternative to standard nasal cannula measurements through the summation of RIP belt signals.

Based on results form its clinical work, Wesper is cleared by FDA to label this measurement as airflow.

HOW WE DERIVE
## PRESSURE

Wesper measures pressure by deriving it from the airflow, using Bernoulli's principle, which in its simplified form infers a square relationship between flow and pressure, specifically, that pressure is proportional to the square of the flow. Wesper algorithms perform that calculation to obtain the Pressure waveform.

Based on results form its clinical work, Wesper is cleared by FDA to label this measurement as pressure.

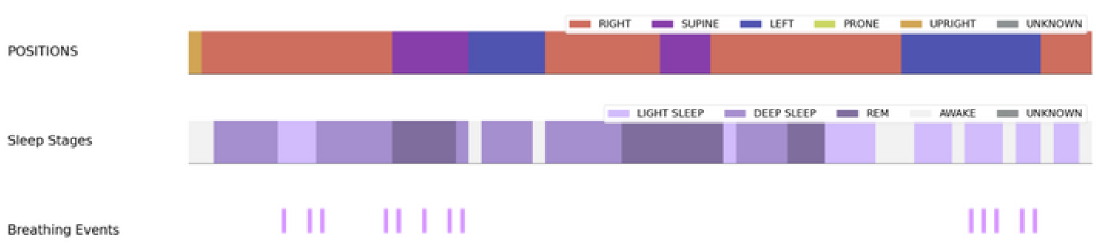
HOW WE DERIVE

## POSITIONAL

Wesper detects body positions by using collecting continuous measurements from an accelerometer located on the patch. The general process works by using High-frequency (10Hz) 3-dimensional accelerometer measurements collected throughout the night.

An algorithm is then applied to establish the coronal, transverse and median planes of the subject. Using that, the algorithm then automatically assigns each measurement one of 5 positions: Upright, Prone, Supine, Left or Right

Wesper has cleared its position algorithm with the FDA, after validating it both on the bench and in clinical settings.

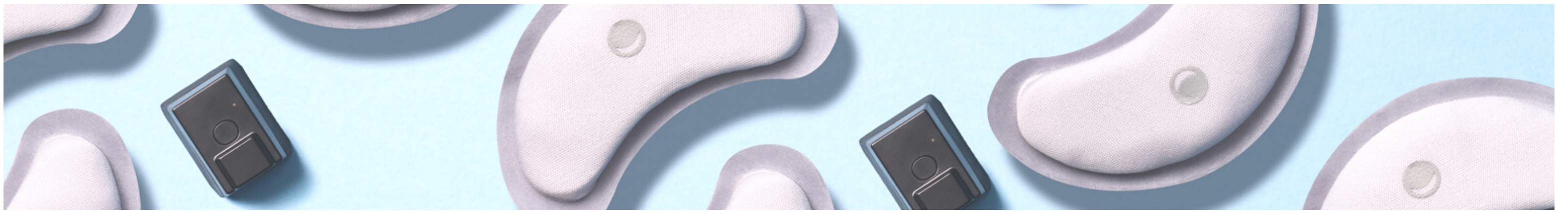



DID YOU KNOW?

## DATA VISUALIZATION

The wealth of information provided by Wesper across breathing, positional, sleep stages, snoring, temperature, and more is correlated visually to allow better diagnosis and ongoing care to move from understanding the "what" to understanding the "why".

# WESPER



HOW WE DERIVE

## TOTAL SLEEP TIME AND SLEEP STAGES

Wesper uses a collection of physiological signals collected during the night to establish the subject's sleep stage at standard, 30-second epoch segments, among them are respiratory rate, heart rate, motion, and more.

These inputs are provided to a machine learning model which has been trained using gold-standard reference PSG data. The model then assigns each epoch one of four sleep states.

Total Sleep Time is calculated as a tallying of all the non-Wake epochs. Wesper has validated its TST against gold-standard PSG data and has shown to have excellent, best-in-class performance in terms of its overall error and correlation when compared against EEG-based, manually annotated studies.

## THE FUTURE OF SLEEP MANAGEMENT

Wesper is the first longitudinal and wireless clinical-grade sleep testing platform designed to help the world sleep better.