SONAS® Technology

SONAS® - Device Description

SONAS® is a portable ultrasound device with a quad-core ARM-based application processor running Linux, and a high-resolution four channel A2D converter. A transmit circuit includes high-performance amplifiers and a transformer section to achieve output amplitude. The entire unit is powered by eight replaceable "AA" batteries. The SONAS® system includes a headset with two ultrasound transducers positioned on each side of the head in the area of the temporal bone window. Each transducer assembly contains two individual transducers in a single mechanical package, including a transmit element and a receive element.

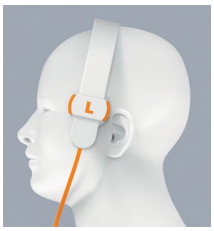
SONAS® - Signal Generation

For improved skull penetration, SONAS® transmits ultrasound at a low, sub MegaHertz frequency in an alternating fashion right vs. left. The transmissions on each side also invert the phase angle on an alternating basis, to enable application of pulse inversion in signal processing. Commercially available ultrasound contrast agents (microbubbles) are injected intravenously during the SONAS® test procedure. Microbubbles oscillate in the presence of the ultrasound excitation signal, producing harmonic frequencies at multiples of the transmit frequency. Microbubble excitation occurs in the Region of Interest, which is focused over the main supply area of the middle cerebral artery on both sides. When a SONAS® test is conducted, the transmit duty cycle is repeated for a total of 40 seconds after injection of the contrast agent.

SONAS® - Data Acquisition

Following microbubble excitation SONAS® detects the 4th, 5th, and 6th harmonic frequencies. SONAS® conditions the received signals first with filters and amplification in hardware, then applies Pulse Inversion in software to reduce the harmonic interference from the skull boundary.

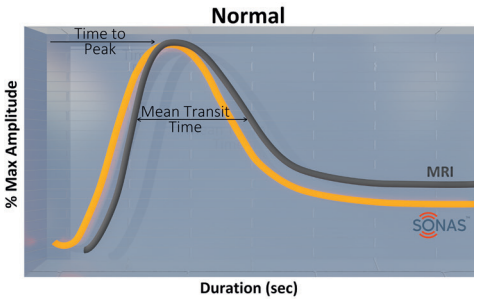
Next, time-boxes are applied to discern signals originating from the two hemispheres independently. Additional time-boxes are applied to ignore parts of the received signals that are not relevant (e.g. close to skull). Ipsilateral Data (transmit/receive on the same side of the head) as well as Contralateral Data (transmit/receive on the opposite side of the head) is acquired and used for further analysis.



SONAS® - Analytic Approach

SONAS® measures brain perfusion in both hemispheres using microbubbles as acoustic tracers. The analytic concept is based on Bolus Kinetic Modeling. Similar to MRI- or CT-Perfusion, the contrast agent is administered as a bolus injection. The change in microbubble related acoustic signal strength is monitored over time and displayed as bolus kinetic curves.

The proprietary analytic algorithm is based on the comparison of the bolus kinetic parameter Time to Signal Peak in a 1:1 comparison right vs. left hemisphere. Other kinetic parameters, such as Time to Arrival, Area Under Curve or Mean Transit Time as well as non-kinetic parameters, such as Acoustic Signal Amplitude, can be compared in the same fashion.



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