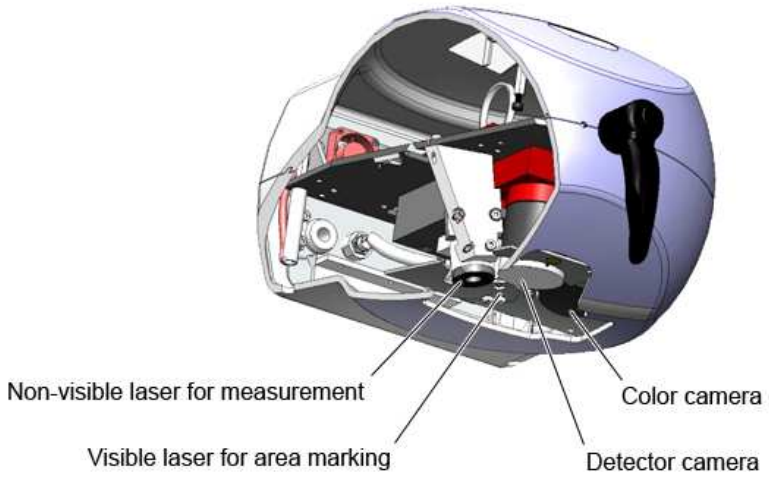
PeriCam PSI System Design Principle

The PeriCam PSI System is a real-time microcirculation imager based on the laser speckle technology. The PeriCam PSI System consists of four major parts:



Measurement laser

The PeriCam PSI System uses a 70 mW laser diode for blood perfusion measurements. The beam is spread over an area by a diffuser. The size of the illuminated area depends on the distance between the laser aperture in the head and the measurement object.

Indicator laser

A visible near infra red (NIR) indicator laser is used to indicate the maximum measurement area since the wavelength of the measurement laser is invisible to the human eye. To avoid interference with measurements the pattern laser is switched off during recording.

Detector camera

The blood perfusion in the scanned area is monitored using a 1388 x 1038 pixel CCD camera that can take images at a speed of up to ~100 per second.

Documentation camera

A color camera is used for documentation. The capture rate can be set at different speeds. The color photos provide an extra help when placing regions of interest (ROIs), assuring that the object has not moved during the recording and for understanding the obtained blood perfusion and intensity images.
To assure high quality data, the following properties have been implemented:

Measurement accuracy

The PeriCam PSI System will show an accuracy of ±10% (Motility Standard).To achieve this level of accuracy, the PeriCam PSI System has been implemented with a fixed focal length rather than a variable zoom. Varying the zoom will result in changes in the size of the speckles in the speckle pattern. The size of the speckles in the speckle pattern influences the blood perfusion values monitored. To control this non physiological factor, zooming is not possible with the PeriCam PSI System ensuring that all measurements are carried out with the same sized speckles. It also avoids the need for additional compensations in the algorithms.

Automatic background compensation

To compensate for changes in the background light during measurements, an automatic background compensation is carried out once every second. This ensures comparable results between identical experiments, regardless of environmental lighting variations.

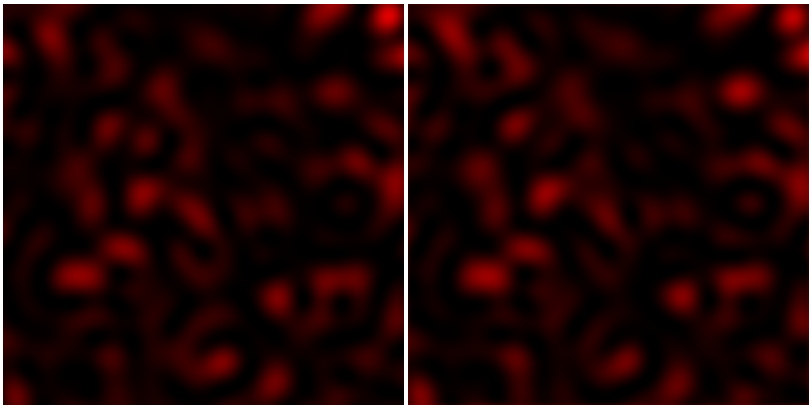
Laser Speckle Contrast Analysis (LASCA)

Laser Speckle Contrast Analysis (LASCA) is a method that visualizes tissue blood perfusion in the microcirculation instantaneously. It is an imaging technique that combines high resolution and speed.

When an object is illuminated by laser light, the backscattered light will form a random interference pattern consisting of dark and bright areas. This pattern is called a speckle pattern. If the illuminated object is static, the speckle pattern is stationary. When there is movement in the object, such as red blood cells in a tissue, the speckle pattern will change over time. In the PeriCam PSI System, a CCD camera will record these changes in the speckle pattern.

Depending on the degree of movement in the imaged area, the level of blurring will differ. The more movement there is in an image, the more blurred it will appear. The level of blurring is quantified by the speckle contrast. The contrast has been found to correlate with blood flow and this is how the LASCA technique can be implemented for blood perfusion measurements. The speckle contrast is defined as the ratio between the standard deviation of the intensity and the mean of the intensity. If there is a lot of movement, the blurring will increase and the standard deviation of the intensity will decrease, and consequently the speckle contrast will be lower. On the contrary, if there is no movement, the speckle contrast will be larger since the blurring will decrease and the standard deviation will increase. The mean intensity will remain unchanged.

The PeriCam PSI System records the blood perfusion using the arbitrary units, Perfusion Units (PU). In order to compare result accurately each instrument is factory calibrated. In addition, a Calibration Box is delivered with the PeriCam PSI System to allow for continuous control of calibration and adjustments.



Static speckle pattern. *Moving speckle pattern.*

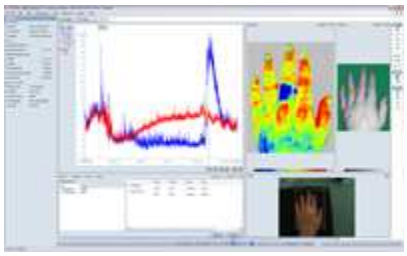
PIMSoft

Software for PeriCam PSI System

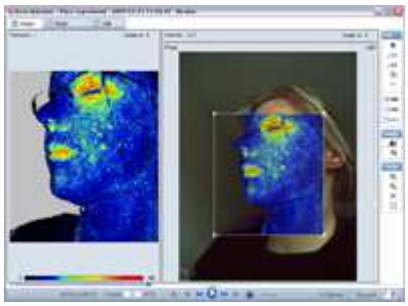
Video functionality
Images and real-time graphs
Simple and straightforward

PIMSoft

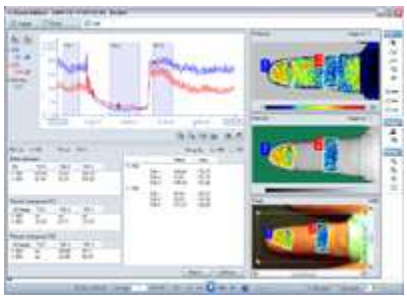
The PeriCam PSI System is operated using PIMSoft software. This software has been developed to create a user-friendly interface facilitating blood perfusion measurements and evaluations. Features include:



Blood perfusion is presented both as color-coded images and in graphical form, enhancing the possibilities for understanding and analyzing the microcirculatory data.



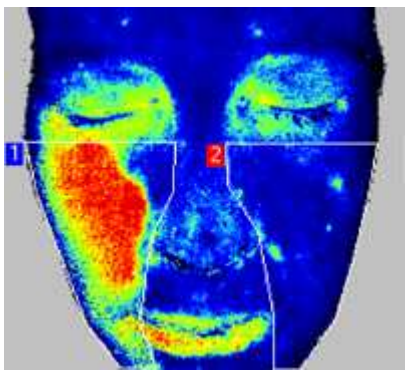
Perfusion images may be overlaid on the color photograph or the intensity image.



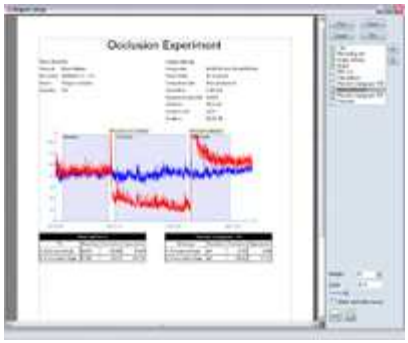
Specific regions of interest (ROIs) can be defined before, during or after a completed recording. In addition, ROIs may be implemented during sections of a run.

Time period Of Interest (TOIs) allow for evaluation of blood perfusion during specific time periods.

Event markers with comments may be added at any time.



Recordings can be directly viewed in video playback at ¼ - 64x original speed or exported as .avi files.



Automatically calculated values include mean, percentage change, number of measurement points, standard deviations and more. Selected data is conveniently exported as pdf reports or in .xml format for further processing.

Templates can be created for commonly used settings.

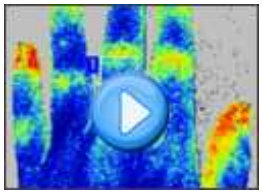
PeriCam PSI System

Real-time microcirculation imaging

Laser Speckle technology
Video speed, large areas
High resolution and normal resolution models

PeriCam PSI System

The PeriCam PSI System is a blood perfusion imager based on the Laser Speckle Contrast Analysis (LASCA) technology. It is a method that visualizes tissue blood perfusion in real-time. LASCA provides new means to study the microcirculation in ways that were not possible in the past. The PeriCam PSI System allows you to combine dynamic response and spatial resolution in one instrument, providing both real-time graphs and video recordings of the area of interest. To further enhance its usability, dedicated application software, PIMSoft , has been developed. The PeriCam PSI System is available in two versions, normal resolution, PeriCam PSI NR, and high resolution, PeriCam PSI HR.



Perfusion video gallery