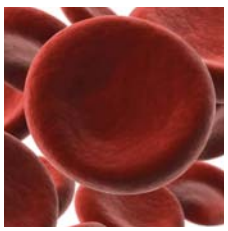
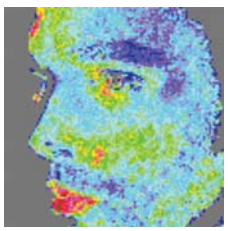
Full-field, video frame rate blood flow imaging

with moorFLPI™









moor instruments
laser Doppler blood flow assessment

moorFLPI – Capturing blood flow images in real time

This system is ideally suited to any application where the dynamic changes are too rapid for conventional laser Doppler imaging. This, coupled with superior spatial resolution opens many new and exciting research applications.

- **Non contact** images are obtained by illuminating the scan area with a low power, Class 1 laser.
- **Compact Design** increases mobility and convenience.
- **Easy Set-up;** USB and firewire connections link directly to the PC. Flexible support arm enables the scan head to be moved in or away from the field of view quickly and conveniently.
- **Manual Zoom & Focus** with real time feedback increases convenience when selecting the scan region.
- **High Spatial Resolution;** up to 1 million pixels per cm^2.
- **High Temporal Resolution;** up to 25 frames per second.
- **Measurement Software** allows the user to acquire simultaneously live video image, repeat images and single point traces (average flow in graphical form from a defined ROI).
- **Analysis Software** based on our advanced laser Doppler imaging software, refined through customer feedback for over 10 years.



moorFLPI with desktop stand/arm and PC

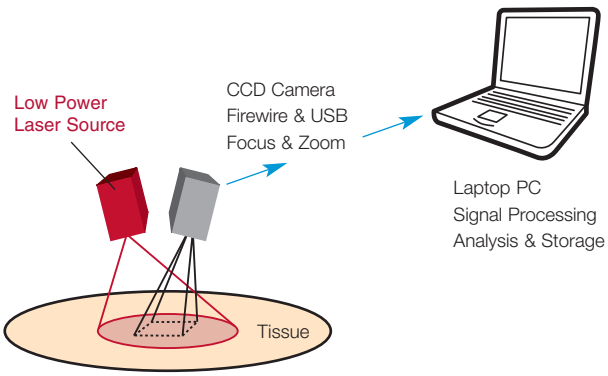
The laser Speckle technique

The full field laser technique is used to provide real time images of blood flow. The technique, known as laser speckle contrast imaging, exploits the fact that the random speckle pattern that is generated when tissue is illuminated by laser light, changes when blood cells move within the region of interest. When there is a high level of movement (fast flow) the changing pattern becomes more blurred and the contrast in that region reduces accordingly. Therefore low contrast is related to high flow, high contrast to low flow. The contrast image is processed to produce a colour-coded image that correlates with blood flow in the tissue.

Laser speckle imaging is based on a technique pioneered by Fercher and Briers at the University of Essen in Germany in the early nineteen-eighties.

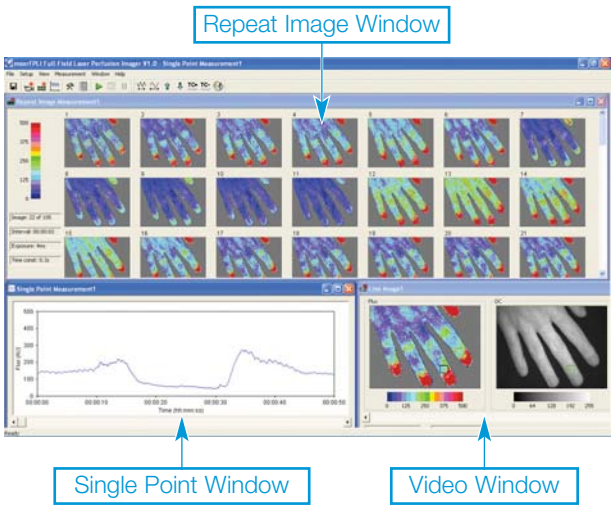
Originally called Single-Exposure Speckle Photography, it was a two-stage process involving photography under laser illumination followed by optical image processing (spatial filtering) to convert the contrast variations to intensity variations. The first digital version, called LASCA (LAser Speckle Contrast Analysis), was developed by Briers and co-workers at Kingston University in the early nineties; by-passing the photographic stage allowed a real-time technique to be realised. Many refinements, including a video capability, have since been added by our own team at Moor Instruments.

The strength of this technique is video frame rate blood flow images (25 per second). It enables the tracking of fast transient blood flow changes that could not be seen by conventional laser imaging techniques. It is possible to view pulsation in finger tips and spatial variations due to deep breath, occlusion, reactive hyperaemia and other stimuli.



moorFLPI Software Features

Unique measurement functions are provided by moorFLPI to take advantage of the high acquisition speeds of moorFLPI. Unlike conventional laser Doppler systems, moorFLPI can offer all these acquisition modes simultaneously. Analysis functions have been developed and refined for nearly 10 years following customer experience with moorLDI laser Doppler imaging. Although the moorFLPI is new – the software is well developed.



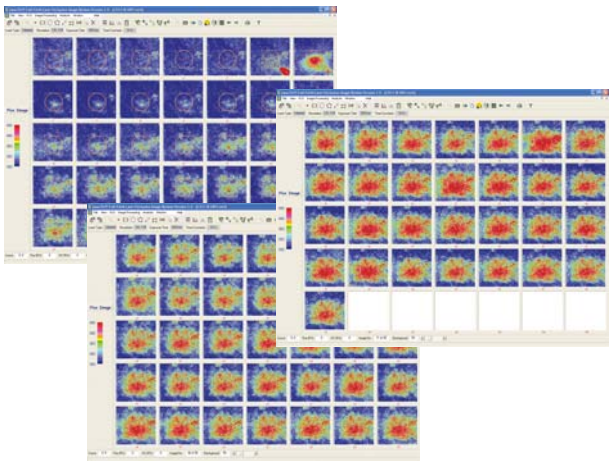
Video Mode

With frame rates of up to 25 images per second, the moorFLPI offers video speed blood flow imaging. This allows pulsation to be viewed in fingertips (in line with cardiac cycle), variations due to deep breath, occlusion and vasomotion. The system allows you to save 'AVI' video files, play, pause, fast forward and rewind. Single frame capture allows you to select from individual frames and build these into standard 'repeat' files for analysis.

moorFLPI Single Point Mode

Single Point Mode (SPM) is similar to single point laser Doppler monitor. A region of interest is defined (flexible size and location) and the mean flow in that region calculated and plotted in real time in the separate SPM window. The resultant trace can be analysed to compare flow changes before, during and after intervention.

moorFLPI Repeat Scan Mode



Repeat scanning allows you to 'grab' images at pre-set intervals – e.g. every second, 5 seconds, minute or minutes as required. This is useful for slower changes and is very useful to reduce the amount of data acquired. Analysis functions include the mean flow analysis of selected regions of interest, histogram mode and line profile mode.

moorFLPI Single Image Mode

Single Image Mode is useful when spatial variations in flow are of greater interest than time variations. Single images can also be combined later into repeat files to ease analysis of variations over time.

References

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David Briers.
Institute of Physics Publishing, Physiol. Meas. 22 (2001) R35-R66.

(2) Laser Speckle Imaging of Blood Flow in Microcirculation.
Haiying Cheng, Qingming Luo, Qian Liu, Qiang Lu, Hui Gong and Shaoqun Zeng.
Phys. Med. Biol. 49 (2004) 1347–1357.

(3) Laser Speckle Flowmetry for the Study of Cerebrovascular Physiology in Normal and Ischemic Cortex.
Cenk Ayata, Andrew K. Dunn, Yasemin Gürsoy-Özdemir, Zhihong Huang, David A. Boas, and Michael A. Moskowitz.
Journal of Cerebral Blood Flow & Metabolism 24:744–755
© 2004 The International Society for Cerebral Blood Flow and Metabolism.

About Moor Instruments

Moor Instruments, established in 1987, is a world leader in the design, manufacture and distribution of laser Doppler systems, used for the measurement and imaging of blood flow in the microvasculature.

First hand experience of laser Doppler research and development within Moor dates back to 1978 and with this we have the breadth of knowledge to help with your application and the enthusiasm to try to find answers to any of your questions.

By giving priority to performance, quality and service we strive to be our customers number one choice.

Our dedicated design team are involved with a number of development projects for other partners and manufacturers. Whatever your needs, as a researcher, clinician or manufacturer, Moor will work harder for you.



moorFLPI with laptop and optional MS3 mobile stand

Specifications:

Laser Source
Near Infra-Red laser diode: 785nm.
Class 1 per IEC 60825-1:2001.
(Safe to use without eye protection).



Scan Area
Variable zoom: 5mm x 7mm to 15cm x 20cm.

Working Distance
15cm to 45cm, between scan head and measurement site.

Image Resolution
Standard mode 50µm.
Temporal mode 10µm.
(moorFLPI-HR Standard mode 10µm).

CCD Camera
576 x 768 pixel resolution, 25 fps.

Image Acquisition Rate
Up to 25 images per second.

Acquisition Modes
Single point, single image, repeat image, video mode (all modes are available simultaneously if needed).

Lighting Conditions
Normal, ambient room lighting.

Software
Windows™ based control, processing and analysis.

Safety Standards
EN60601-1:1990 Safety of medical electrical equipment.
EN60601-1-2:2001 Electromagnetic compatibility.
IEC 60825-1:2001 Laser safety.
Complies with CFR 1040.10 and 1040.11 except for deviations.
pursuant to Laser Notice No. 50 dated July 26, 2001.
EU Medical devices directive classification: Class IIa.

Hardware Options
There are two supports available for the moorFLPI which include the MS3 (pictured above) and desktop stand. PC packages normally supplied by Moor Instruments or by authorised distributors.

Options include:
1. Laptop, with mobile stand mounting, and colour printer (pictured above).
2. Desktop PC with colour printer.

Minimum Computer Requirements
Pentium™ 4 2GHz or higher compatible CPU.
512MB RAM.
CD-ROM drive.
Super VGA monitor (1024 x 768 resolution or higher).
40GB of available hard disk space.
Windows™ XP or higher.
1 USB port and 1 Firewire (IEEE1394) port.

General
Universal voltage switch mode power supply.
Range 100 to 230V AC 50 to 60Hz.
Scan Head Dimensions: W H D cm 22 x 8 x 23, Weight < 2Kgs.
Operating Temperature: 15-30ºC.
Storage Temperature: 0-45ºC.

Moor Instruments reserves the right to change specifications without notice.

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