The Leading Investigator

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Leica MICROSYSTEMS

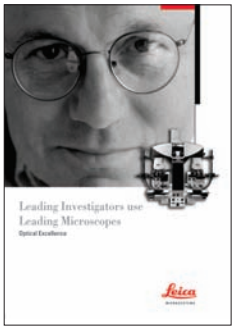
Welcome to the First Issue of *The Leading Investigator*

Leica Microsystems is pleased to sponsor the first issue of a new quarterly e-newsletter, *The Leading Investigator*, written by forensic scientists, for forensic scientists. The goal: To facilitate information sharing between forensic scientists, spread awareness of the latest microscopy techniques, and develop imaging expertise.

We contacted hundreds of criminalists and educators from an extensive range of forensic science specialties to find out how you feel about Leica sponsoring a forensic imaging e-newsletter and to ask for your article ideas and contributions. Your positive responses were overwhelming. This first issue is designed to give you a format overview and preview for the newsletter.

You are the key to success! Many of you have helpful microscopy tips and techniques and imaging application knowledge to share. The nature of your tips and techniques can range from improved workflow, better image documentation or specimen-specific aids. Please email: forensic.imaging@leica-microsystems.com to tell us about your areas of interest and to submit your articles and ideas.

Be a Leading Investigator: When you send an article or idea, we will send you a special thank you gift. If the article is used in *The Leading Investigator*, we will create a personal Leading Investigator Poster for you, featuring your likeness. Please see the example at the right.



I look forward to hearing from you.

Best regards,

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A Powerful Vision

Calculating Total Magnification

We all want to reproduce the same crisp images that we view under the microscope in our image documentation. Many of you have considered mounting a new camera on your microscope, and have asked yourself, "How can I get the same magnification of my images as I see through the microscope?"

"Total Magnification" is determined by calculating the product of the objective magnification, the intermediate magnification changer (if present), camera eyepiece lens, size of the detector, as well as the size of the final output device. The better question might be, "How do I get the same field-of-view from the camera as I get from the microscope eyepieces?"

First, consider what the camera detects. As the size of the detector (chip) gets smaller, the area of the sample that is detected also gets smaller. When this information is sent to the monitor (fixed in size), the resulting magnification increases. Like optics, as magnification increases, the field-of-view (FOV) decreases.

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A Powerful Vision

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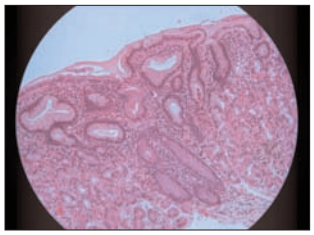

Figure 1: Image of sample with 0.33x mag changer

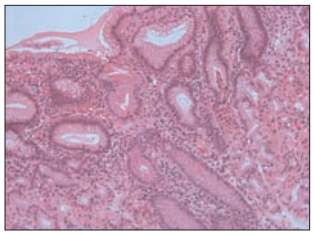

Figure 2: Image of sample with 0.5x mag changer

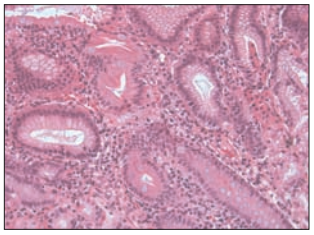

Figure 3: Image of sample with 0.63x mag changer

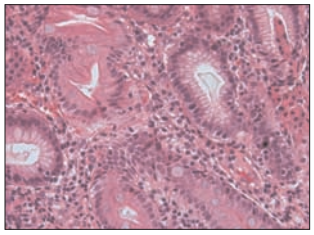

Figure 4: Image of sample with 1x mag changer

Figures 1-4 depict how a 0.35" diagonal chip sees an object depending on the magnification of the C-Mount adapter.

One obvious way to change the view of the chip is by changing the C-Mount adapter magnification. The C-Mount is a mechanical/optical adapter that provides a stable interface for the camera. A mount with no glass in it is referred to as a 1x adapter. There is no magnification factor. However, like an eyepiece, putting a magnification factor in the C-Mount can alter the magnification to the camera.

In the table below, the relative FOV of each camera adapter is given relative to the chip size. Many times it is convenient and desirable to match the FOV of the camera with that of the visual eyepiece. It is also important to consider the size of the object being viewed. So, it is possible to get the entire object in the FOV while using the maximum magnification and maximum optical resolution.

TV – Camera– Adapter	1/3" TV-camera	1/2" TV-camera	2/3" TV-camera	1" TV-camera
C-mount adapter HC 0,35x for 1/3"-TV-cameras	17.1	-	-	-
C-mount adapter HC 0,5x for 1/2"-TV-cameras	12.0	16.0	-	-
C-mount adapter HC 0.63x for 2/3"-TV-cameras	9.5	12.7	17.5	-
C-mount adapter HC 1x for 1"-TV-cameras	6.0	8.0	11.0	16
C-mount Vario-TV-adapter HC 0,33X-1,6X for 1/3" and 1/2" single and 3 CCD-TV-cameras (for 1/2"-TV-cameras starting with magnification = 0.42x)	18.0-3.8	19.0-5.0	-	-
B-mount Vario-TV-Adapter HC 0,5X-2,4X with ENG-mount for 1/2" single and 3 CCD-TV cameras	-	16.0-3.3	-	-

If the camera can see more of the sample than the eyepiece permits, the image in the camera will be an illuminated circle surrounded by a dark rectangle (Figure 1). This is an area of the chip that is not receiving any light. Typically the magnification of the sample is much lower that what is being viewed in the eyepiece and the FOV exceeds the chip area. In these cases the camera is not using its full potential in terms of resolution nor is the magnification optimized.

Although the FOV is regulated by the chip size and C-Mount magnification, the Total Magnification needs to take into account the size of the monitor. This is not as simple as taking the product of the objective, mag changer and eyepiece. Total Magnification can be calculated using the following formula:

Total Magnification = Objective Mag. x C-Mount Mag. x Video Mag.

$$\text{Video Mag.} = \frac{\text{Diagonal of the Monitor in mm}}{\text{Diagonal of the Detector in mm}}$$

Example:

This is the **Total Magnification** at the Monitor for a 10x objective. (0.5x C-Mount adapter with a .35" camera chip and a 17" Monitor.)

10 x 0.5 x 48.6 = 234

Tips and Tricks

Eyepiece Magic:

How do you determine the maximum magnification that can be used to view the entire specimen? You can calculate the maximum field-of-view (FOV) through the eyepiece by dividing the objective magnification by the FOV from the eyepiece. If an intermediate magnification factor is present then that factor should be calculated as well.

Objective Mag. = 10x

Eyepiece FOV number = 20mm

20 / 10 = 2mm

The largest object that could be viewed using the 10x objective would be 2mm.

It is possible to reverse this calculation and determine the actual magnification of the objective and intermediate magnification factors. If the FOV of the eyepiece is given at 20mm, and the sample that is viewed is 20mm across the diameter of the FOV, the magnification is:

FOV = 20mm

Eyepiece FOV number = 20

20 / 20 = 1x mag.

Industry News

The 36th Anniversary AFTE Training Seminar took place at the Adam's Mark Indianapolis Airport, in Indianapolis, Indiana from June 19 through 24, 2005. More information: **www.afte.org**

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"Gateway to the Forensic Frontier", the Midwestern Association of Forensic Scientists (MAFS) 34th Annual Meeting, will be held October 3-7, 2005 at the Adams Mark Hotel in St. Louis, MO. This year, MAFS offers a 50% Discount on workshops for MAFS members who register by September 7th. Keynote speaker is Dr. Richard Saferstein, former head of the New Jersey State Police Crime laboratory who has served as an expert witness over 1000 times in nearly 150 federal and state courts. Start putting your scientific papers and posters together to share what is going on in your lab at this meeting.

More information: **www.mafs.net**

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The Canadian Society of Forensic Science (CSFS) Annual Meeting will be held October 19-22, 2005 in Calgary, Alberta. The CSFS is a non-profit professional organization incorporated to maintain professional standards, and to promote the study and enhance the stature of forensic science. Membership is open internationally to forensic science professionals representing diverse areas of forensic examination: Anthropology, Medical, Odontology, Biology, Chemistry, Documents, Engineering, and Toxicology.

More Information: **www.csfs.ca**

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"Blueprint for Success: Leadership by Design," is the theme of the American Society of Crime Laboratory Directors (ASCLD) Annual Symposium on October 23-28, 2005. The ASCLD Annual Symposium stimulates, promotes, and develops excellence in forensic science management. The meeting will be held at the Pointe South Mountain Resort in Phoenix, Arizona. More information: **www.ascld.org**

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The 31st Annual Northeastern Association of Forensic Scientists (NEAFS) Meeting will be held at the Hyatt Regency in Newport, RI on November 8-13, 2005. If you want to present a paper in any of the program sessions: Toxicology, Drug Chemistry, Questioned Document, Poster, Criminalistics, and Biology, just download the "Call for Papers" form at the society website. The preliminary schedule and registration form are also available online. More information: **www.neafs.org**

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The AAFS 58th Annual Meeting will be held February 20-25, 2006 at the Washington State Convention & Trade Center in Seattle, Washington. The theme is "Mass Disasters: Natural and Man Made". More information: **www.aafs.org**

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Glossary

C Mount: Optical/Mechanical interface, designed to couple a digital/video camera to an optical system (e.g. microscope) using a one inch thread.

B Mount: Optical/Mechanical bayonet lens mounting system for cameras using the Sony ENG mounting format.

T Mount: Bayonet lens mounting systems for 35mm SLR cameras. Each T Mount is specific to a camera brand and occasionally, model specific.

F Mount: Bayonet lens mounting systems that are specific to Nikon camera formats.

Chip: Light sensitive solid-state semiconductor device used for image formation in digital and video cameras. Also referred to as a Charged Coupled Device (CCD) or Complementary Metal Oxide Semiconductor (CMOS), depending on the design parameters.

Detector: (see Chip)

Field of View (FOV): The amount of the specimen that can be viewed at one time through the eyepiece or imaging output device.

Total Magnification: The number of times by which the size of the microscope image exceeds the original object. Also stated as the optical image size divided by the actual object size.

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Note: We are interested in your comments and thoughts about the newsletter. Please feel free to email your comments to ***molly.lundberg@leica-microsystems.com.***