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Calculating Video Field of View (Video-FOV)

According to most sources, the majority of microscopes sold today have a video camera of some kind attached to them, either analog or digital. One major consideration is field of view (FOV). How much of the specimen or sample will be visible? For eyepieces, it is easy. Simply divide the field number or FN (field stop diameter in millimeters) by the objective magnification. For example, FN 25 eyepieces with a 10x objective would have a field of view with a 2.5mm diameter. It is almost as easy with video cameras, you just need to know the size of the camera sensor and consider the magnification of the video adapter.

Camera sensor, chip or CCD sizes are typically described as a fraction of an inch. This is an estimated size. The actual dimensions are listed in this chart.

Video Camera Sensor Sizes

Camera Sensor	Diagonal	Vertical	Horizontal
¼”	4.0mm	2.4mm	3.2mm
1/3”	6.0mm	3.6mm	4.8mm
½” (Coolpix-950)	8.0mm	4.8mm	6.4mm
2/3” (DXM1200)	11.0mm	6.6mm	8.8mm
1”	16.0mm	9.6mm	12.8mm
Nikon Coolpix-990 (1/1.8” or 5/9”)	14.1mm	8.5mm	11.3mm
Nikon D1	28.4mm	15.6mm	23.7mm
Kodak MegaPlus ES 1.0	12.9mm	9.2mm	9.1mm
35mm Film (for reference)	43.3mm	24mm	36mm

When using a video camera on a microscope an adapter is necessary. The adapter will have its own magnification. When calculating the field of view, this magnification needs to be multiplied with objective magnification, (sensor dimension) ÷ (objective mag. x adapter mag.). For example:

- The DXM1200 2/3” camera has a diagonal of 11mm
- the recommended adapter is 0.6x
- if used with a 10x microscope objective lens.
- the diagonal of the field of view would be 11mm ÷ (0.63 x 10) = 1.75mm.

How do you choose the right adapter for the camera? It is ideal to match the field of view of the camera with the field of view of the eyepiece. Also consider that using an adapter with too small of a magnification may result in a vignetted image. The *"Rule of Thumb*" is to convert the chip size fraction to a decimal, for example, 2/3" is approximately 0.6x.

To make it easier to calculate the field of view, the next chart has the sensor or chip dimension divided by the magnification of the recommended adapter. ***Simply divide the numbers below by the objective magnification to calculate the field of view.*** It also shows the relationship of various video camera sizes to one another and to 35mm film. Please note the diagonals are within a range of 16mm to 18mm (with the exception of the ¼" camera which should ideally use an adapter of 0.25x or less).

Relative Chip Size with Recommended Adapter

(Sensor Dimension ÷ Adapter Mag.)

Camera/Adapter Combo	Diagonal	Vertical	Horizontal
¼" with 0.35x	11.4mm	6.9mm	9.1mm
1/3"with 0.35x	17.1mm	10.3mm	13.7mm
½" with 0.45x	17.8mm	10.7mm	14.2mm
2/3" with 0.6x	18.3mm	11.0mm	14.7mm
DXM1200 with 0.63x	17.5mm	10.5mm	14.0mm
1" with 1x	16.0mm	9.6mm	12.8mm
Nikon D1 with 1.6x	17.8mm	9.8mm	14.8mm
Coolpix-990 with 0.33-0.93x*	47.0~15.2mm	28.3~9.1mm	37.7~12.2mm
35mm with 2.5x	17.3mm	9.6mm	14.4mm

*This range based on the Coolpix-990's 3:1 Zoom Lens and the MDC-A Relay Lens. There will be vignetting at the lower end of the zoom. Therefore 0.33x is not usable for most applications. Use the camera's zoom controls (marked "T" & "W") to fill the field of view.