PINHOLE SHAPE - THE MORE CORNERS THE MORE EFFICIENT?

Rolf T Borlinghaus
Leica Microsystems CMS GmbH
Am Friedensplatz 3, 69165 Mannheim, Germany
E-mail: rolf.borlinghaus@leica-microsystems.com

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PINHOLE SHAPE AND SIZE. Optical sectioning by true confocal imaging requires a small aperture in a field-conjugated plane in the emission part of the beam path. In the simplest case, this aperture is circular, allowing transmission of a centered section of the Airy diffraction pattern that is illuminating the aperture. The size of the aperture should just transmit the inner disk of the pattern (the "Airy disk"). Consequently, the correct size of the aperture depends on the wavelength and numerical aperture of the objective lens, as these parameters also define the (magnified) diffraction pattern in the intermediate image plane.

To enable adaption to varying colors and resolution, the detection pinhole should be variable. For exact circular apertures, this means providing a set of apertures on a mechanical device that allows a change of size when needed. Most confocal microscopes use a tunable pinhole instead, which is usually a two-blade "iris". Hence, the aperture is not circular, but rectangular (square).

It has been suggested that a hexagonal pinhole (using three blades) would be more efficient in transmitting focal information, as it covers a larger fraction of a circle. [1, 2], although this topic was described earlier [3]. This contribution is to clarify how to compare pinholes in terms of shape and size in confocal microscopes. In addition, a separate consideration for spectral confocals is added [4].

REFERENCES