



Digital Remote Focusing Microscopy

Context

Remote focusing in microscopy:

When environmental conditions do not allow to put hands into sample area, remote focusing enables focus adjustment with just easy-access button while viewing live image on video screen, it also helps eliminate repetitive motions, reduce user fatigue and improve productivity when proceeding with visual quality control. The remote control is usually achieved by using a stand-alone control box without computer connection. Smooth focus adjustment with quick response time, ease of implementation and cost are the main criteria for device selection.

Remote focusing is also required in microscopy automation, for image processing tasks such as 3D acquisition or Z depth measurement. The choice for a remote focusing device controlled by computer is largely determined by the scanning performance: range, speed, Z step accuracy and repeatability, software tools to control all these parameters.

Technologies Landscape & Current Limitations

Remote focusing is usually achieved by 3 main methods:

Motorized microscope:

As turnkey solutions, they offer full control of microscope features such as objective turret, stage, condenser, etc. at significant cost. The motorization of the Z axis on an existing microscope cannot be easily added afterwards, as being an expensive adaptation and dependent of the microscope stand.

Piezo objective / piezo stage:

They offer high precision Z steps with a trade-off between scanning range and scanning speed. When mounted on the objective turret, the scanning device can be used with a single objective,

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thus reducing the system flexibility. They are mainly used for automated imaging platforms comprising various equipments from different manufacturers.

Motorized focus knob (stepper motors):

Using stepper motor on the microscope focus axis is a cost effective solution at the expense of limited scanning performance in terms of speed and resolution. Custom mechanical adaptation for each microscope brand / model is required.

The above techniques do not provide straightforward solutions for users who simply want to add remote focusing capability on microscopy platforms without computer control. The current solutions include either expensive products with computer connection or basic stepper motor solutions with associated drawbacks such as mechanical adaptation requirement, slow response and lack of flexibility.

All these techniques rely on mechanical parts in movement, for the objective, stage or sample, which bring several limitations: the scanning speed is constrained by the mechanical means, the potential risks for damaging either the sample or the objective especially at high magnification where the working distance is small. In addition when using oil or water dipping lenses the focal plane is very shallow, any mis-adjustment of the mechanical focusing device may lead to loose contact between oil or water and the specimen,

Phaseview Digital Remote Focusing

Digital remote focusing is based on an active optical component comprising a variable focus lens (tunable lens) electronically driven to achieve different power and corrective optics to ensure optimal imaging performance. This remote focusing method enables easy focus control without objective or stage mechanical movement. The optical device does not require microscope adaptation or additional accessories as directly fitting either between the objective and microscope turret or between the microscope video port and the camera.

The optical device can be associated with an electronic unit with computer control for full control of the scanning parameters or for simple remote focusing application, a control box with smooth focus control and quick response time can be provided.

Thanks to this remote focusing method with no mechanical movement, the scanning can be performed without vibration during image acquisition, with no risk for the objective or the sample as staying in fixed, and in addition the scanning speed can be optimized according to application requirement.

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Value Added For Microscopy Applications

- Remote focusing without mechanical move
- Enabling optimized scanning speed without mechanical constraints
- Z scanning without vibration or risk of sample or objective damage
- Easy mounting, no microscope adaptation needed
- Smooth focusing control
- Maintenance free
- Smart packaging and cost effective

Technology Licensing

PhaseView offer licensing agreement opportunities including:

Standard or custom digital remote focusing devices: see PhaseView [3D Imaging Products](#)

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