

Phoenix Image-Guided Focal ERG

The Phoenix generation II Image-Guided Focal ERG is optimized for use with mice and rats. The unique design utilizes the new near infrared (NIR) imaging capability of the Micron IV to precisely select a location for focal testing. Testing of a selected specific region is valuable to differentiate segments of the retina as to functionality. Such a capability is ideal for applications for investigating retinal response where therapy is provided on a regional basis. The Generation II Phoenix Image-Guided Focal ERG attaches to the Micron IV and uses its imaging capability.

Scotopic testing with Generation II

The Micron IV, the next generation retinal imaging microscope, features a custom three-chip CCD with improved sensitivity and capability for imaging at 850 nm. The rodent retinal response is lower by 10^{-8} than at the peak in the green. This use of the 850 nm illumination allows guiding of the focal spot while also maintaining scotopic adaptation.

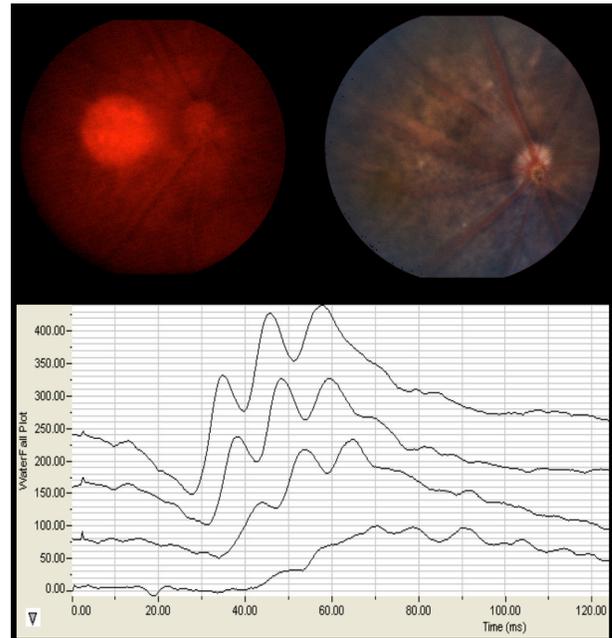
Controlling stimulus and reception

A low-noise microprocessor-based control system provides for illumination and reception through easy to use software screens. The LED light sources deliver aerial energy densities from well above the ISCEV high standard of 100 Cd sec/m^2 to well below the lower standard of 0.01 Cd sec/m^2 . A sophisticated software based system provides for illumination control over six orders of magnitude and pulse length control from 0.2 to 500 milliseconds, to separate cone from rod response, set backgrounds or deliver "flicker".

Unique electrode system

Contact lens electrodes can be challenging to use as they can easily disconnect from the tiny eyes of rodents. Additionally insertion must be accomplished in a dark laboratory if one is to conduct scotopic testing.

The Image-Guided Focal ERG design features a corneal electrode integrated into a gold-tipped ring at the end of the objective lens which couples with the small animal eye. Stimulus targeting is done under guidance from deep NIR illumination and an IR camera. With the animal eye coupled to the objective lens/electrode, the user knows with confidence that it will remain in place.



Phoenix Image-Guided Focal ERG stimulus is projected against a dim red fundus image for targeting (top left). Once the animal can be light adapted, corresponding bright field images can be captured (top right). Focal ERG traces from C57BL/6 mouse with increased brightness by a factor of two (bottom).



Phoenix Image-Guided Focal ERG nosepiece with integrated corneal electrode. As an attachment to the Micron IV the Image-Guided Focal ERG does not require additional laboratory bench space.

Dark Lab Technology

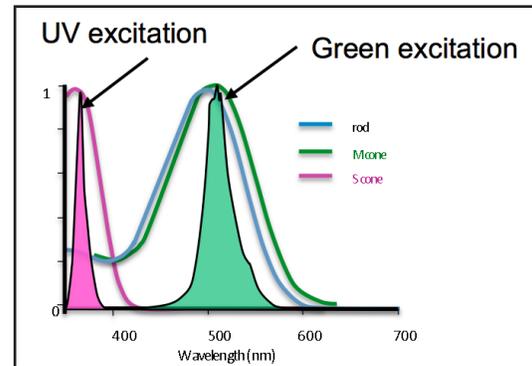
Absolute dark adaption is required for scotopic testing. The Image-Guided Focal ERG uses light at 850 nm to illuminate the retina for targeting. The laboratory is illuminated at 750 nm which the human eye can use for handling the equipment.

Animal Handling

The animal is provided with a calibrated heating pad which mains body temperature to within 1 deg C.

Testing S-cones and M-cones

The Phoenix Image-Guided Focal ERG provides for illumination at 360, 504 and 850 nm. This facilitates a unique capability to test the M and S cones. To access the rods, the system delivers the capability to establish a continuous background illumination and to provide flicker.



The Phoenix Generation Two Image-Guided Focal ERG provides LED based illumination optimized to study different classes of photoreceptors.

SPECIFICATIONS	
Stimulation	white light LED
	focal spot size diameters 0.25mm, 0.5mm, 0.75mm, 1mm, 1.5mm in mouse (doubled for rat)
	micrometer driven targeting
Additional stimulation	360 nm, 505 nm, 850 nm, others by request (in development)
Temporal control	pulse length 0.2 to 500 milliseconds
	pulse delay
	flicker
	continuous background
Range of intensity	10 ⁶ (100 Cd sec/m ² to 10 ⁻⁴ Cd sec/m ²)
Dark Lab technology	illuminate the eye for alignment at 850 nm
	laboratory illumination at 750 nm
	red screen monitor cover 22"
Electrodes	tail (ground), reference (gold-plated bite bar), corneal (gold-plate on objective lens)
Objective lenses	separate Phoenix Micron IV standard objective lenses for mouse and rat
	separate Phoenix Focal ERG objective lenses for mouse and rat
Software and controls for reception and analysis	averaging with user-selectable rejection of poor traces
	controllable bandwidth
	controllable digitization rate
	controllable scan time
	analysis of implicit time and peaks in scan
	automatic generation of waterfall display
	export into convenient formats
Heater	mouse and rat
Animal stage	2 degrees of rotation and 3 degrees of translation
Integrated with the Phoenix Micron Retinal Imaging Microscope and associated hardware	