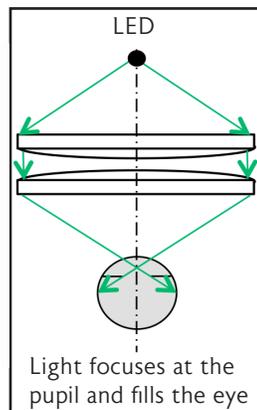


Phoenix Ganzfeld ERG

The Phoenix Ganzfeld ERG takes advantage of the Maxwellian view illumination technique to avoid the large size of the traditional bowl illumination approach. It is uniquely and specifically designed as a stand alone Ganzfeld for the rodent eye with the ability to test the S-cones, M-cones and rods of these small animals.

Maxwellian view illumination

The Maxwellian view illumination technique focuses the light from a single LED onto the plane of the eye's iris using a small f/number lens diverging the light to illuminate the entire retina. This approach, with its compact size and use of LEDs, requires only 50 cm of lab bench space.

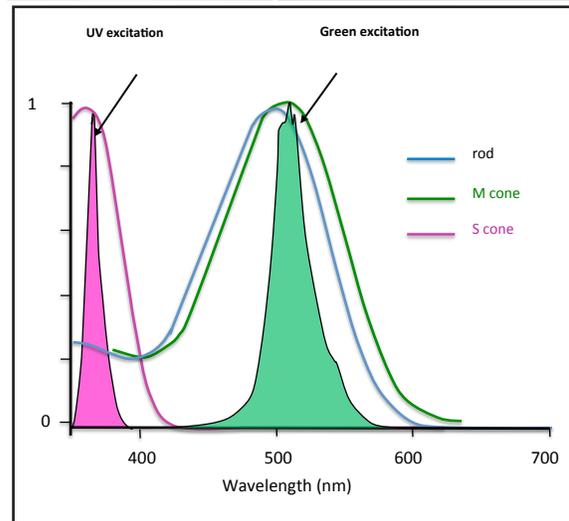


Illumination designed for the rodent eye

The Phoenix Ganzfeld ERG is not an ad hoc adaptation of a clinical instrument designed for the human eye. While the rodent eye is a useful analogue to the human eye there are substantial differences. As shown in the side bar there are only two classes of cones in rodents; S-cones sensitive to ultraviolet (UV) light and M-cones sensitive to green light. In addition, the rods are also sensitive to green but have UV sensitivity as well. A green LED emitting at 510 nm is used to excite the M-cones and rods while the UV LED emitting at 360 nm is used to excite the S-cones. To separate the rod and the cone response, the system is equipped with flicker and background capabilities.

The use of a single LED light source not only preserves bench space but provides extraordinary flexibility in separately testing each of these photoreceptor classes.

A near infrared (IR) LED at 850 nm is used for alignment. This is a wavelength where there is no response from the rodent retina, thereby the very best possible levels of scotopic adaptation are maintained.



The Phoenix Ganzfeld uniquely studies the rodent M and S cones and rods using narrow band illumination in the green and UV wavelengths.

This complete set of testing modalities is unique to the Phoenix Ganzfeld and is driven by a convenient software menu. The system is completed by an outstanding set of analysis, display, and data extraction routines.

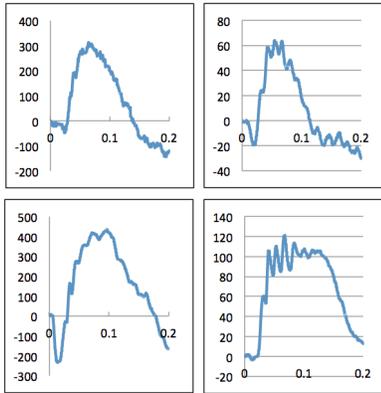
Configuration of the Maxwellian view Ganzfeld illumination

The Maxwellian view Ganzfeld approach makes changing the light source is easy. The system can easily host flash lamps and other sources via a fiber optic. The base LEDs in the body can be changed giving the research flexibility and convenient access to various wavelengths.

Unique electrode system

The Phoenix Ganzfeld ERG design features a unique corneal electrode design. It is integrated into a gold-tipped ring attached to the objective lens which couples with the small animal eye. Guidance using deep NIR illumination and an IR camera allows precise alignment of the eye to the light and electrode while maintaining scotopic adaptation.

ERG Ganzfeld recordings in UV and Green Light



Green and UV traces under different levels of energy, pulse length and dark adaptation illustrate the flexibility of the Phoenix Ganzfeld system to test S and M cones. To separate the rod and cone response, the system is configured to take advantage of the rod saturation by providing continuous background or by flickering the stimulus at a rate higher than the rods can respond.

Left side:

Both traces use 510 nm green light. The animal in the upper trace is photopic and the lower trace is scotopic. Saturation of the B and A wave has been seen in various recordings,

Right side:

These traces use 306 nm UV light. The upper trace is scotopic and a limited A wave is shown. The lower trace is photopic and a strong oscillatory potential (OP) signal is seen along with signs of B wave saturation.

SPECIFICATIONS

LED wavelength	aerial energy density from above 100 CD sec/m ² to below 0.01 Cd sec/m ² . Set levels over a range of 10 ⁶
LED light sources	360 nm, 504 nm, 850 nm, others by request
Temporal control	pulse length from 0.2 to 500 milliseconds
	pulse delay
	flicker
	continuous background
Dark lab technology	red monitor overlay 22"
	illuminate the eye for alignment at 850 nm
	laboratory illumination at 750 nm
Objective lenses	separate Phoenix Ganzfeld ERG objective lenses for mouse and rat included
Software and controls for reception and analysis (can be used with both the Ganzfeld and the Phoenix Image Guided Focal ERG)	averaging with screen based rejection of poor traces
	bandwidth
	digitization rate
	scan time
	analysis of implicit time and peaks in scan
	automatic generation of waterfall display
	export into convenient formats
Electrodes	tail (ground), reference (gold-plated bite bar), corneal (gold-plate on objective lens)
Heater	mouse and rat
Animal stage	2 degrees of rotation and 3 degrees of translation