

Comparison of multifocal ERG responses to luminance and contrast stimulations

Jacques Charlier

Metrovision, France

EVER 2016



Multifocal pattern ERG

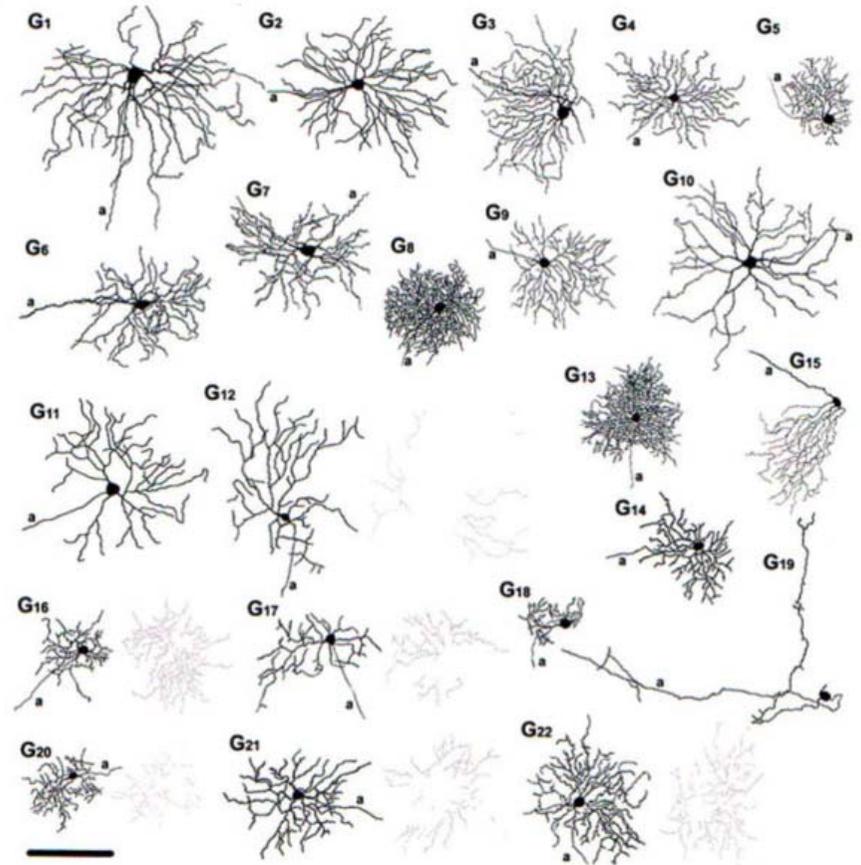
- Better understanding of retina functions in humans
- Clinical applications: glaucoma, optic neuritis, ...
- A technical challenge ...

Publications

- > 10 000 for multifocal flash ERG
- > 1 000 for multifocal VEP
- ~10 for multifocal pattern ERG

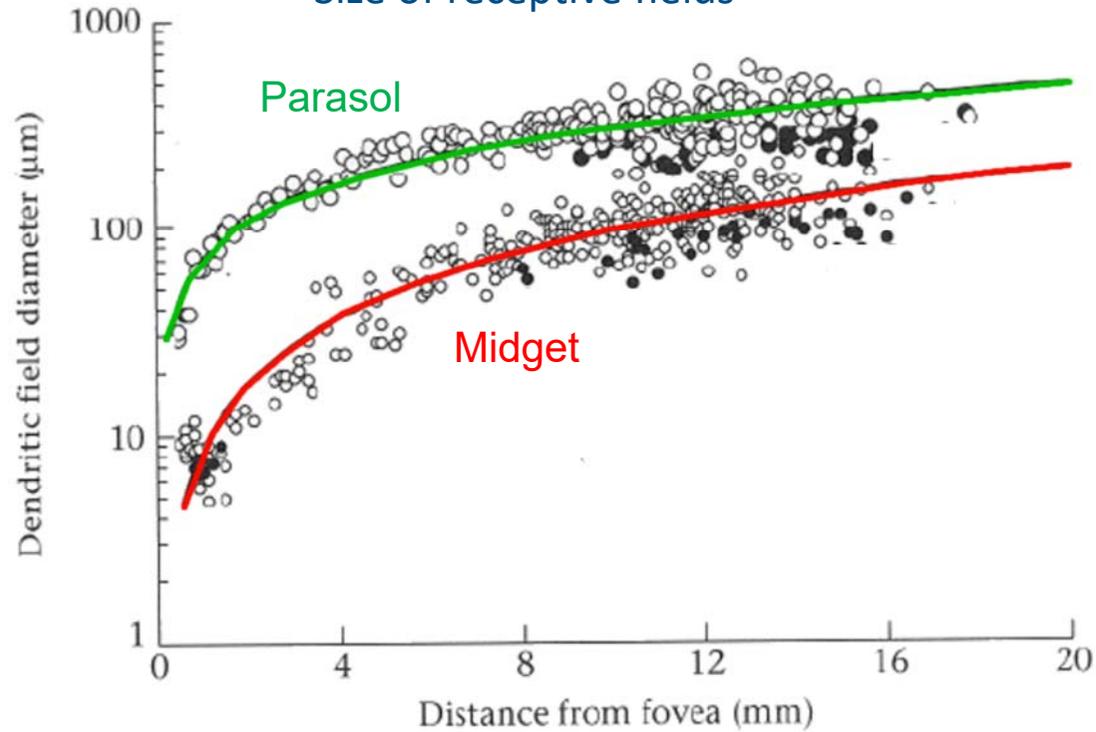
Ganglion cells

- > 18 different types in humans (Kolb, 2015)
- 80% midget
- 10% parasol

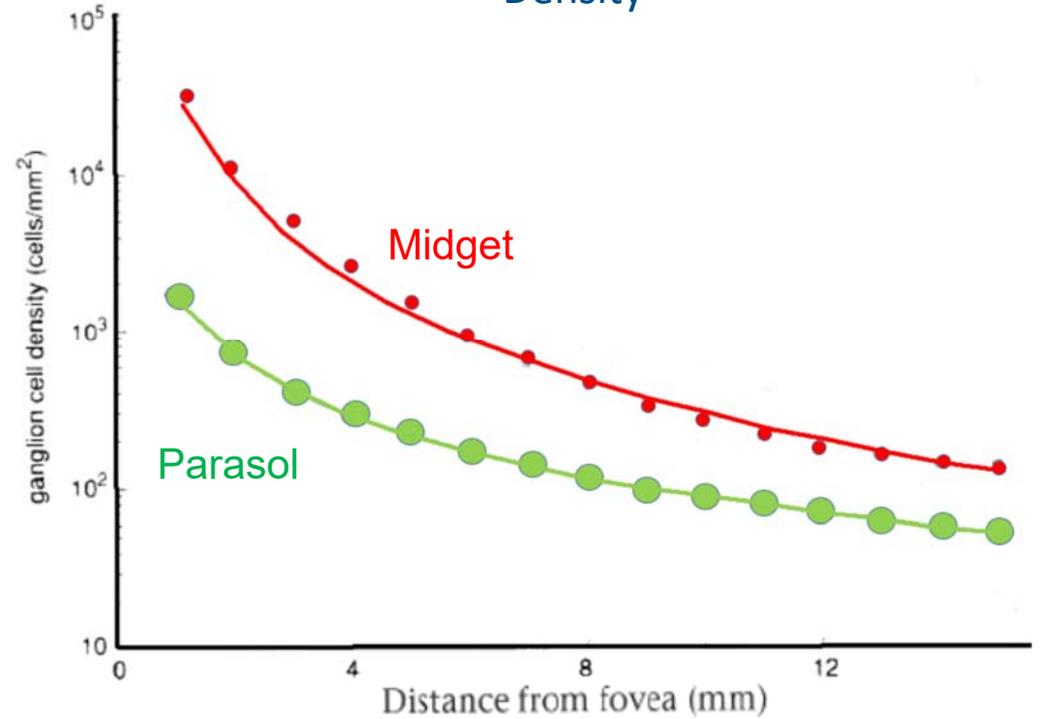


Ganglion cells

Size of receptive fields



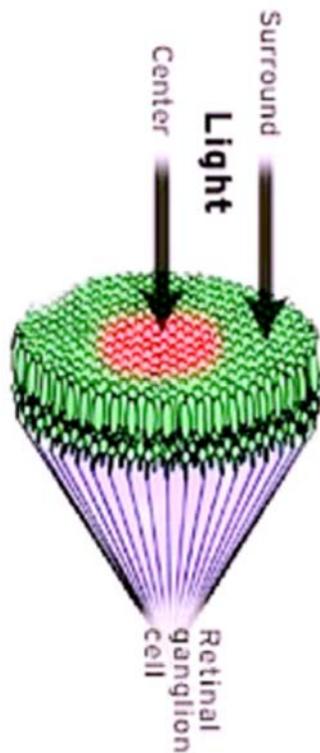
Density



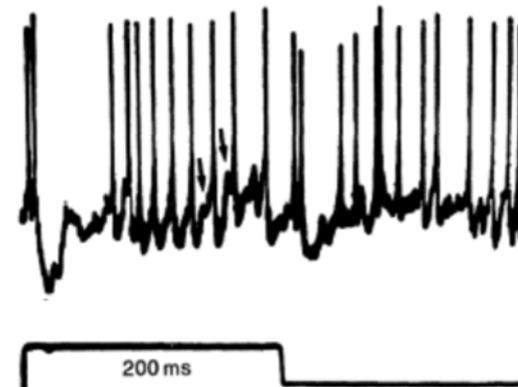
(Dacey, 1994)

Ganglion cells

- ❖ Receptive field



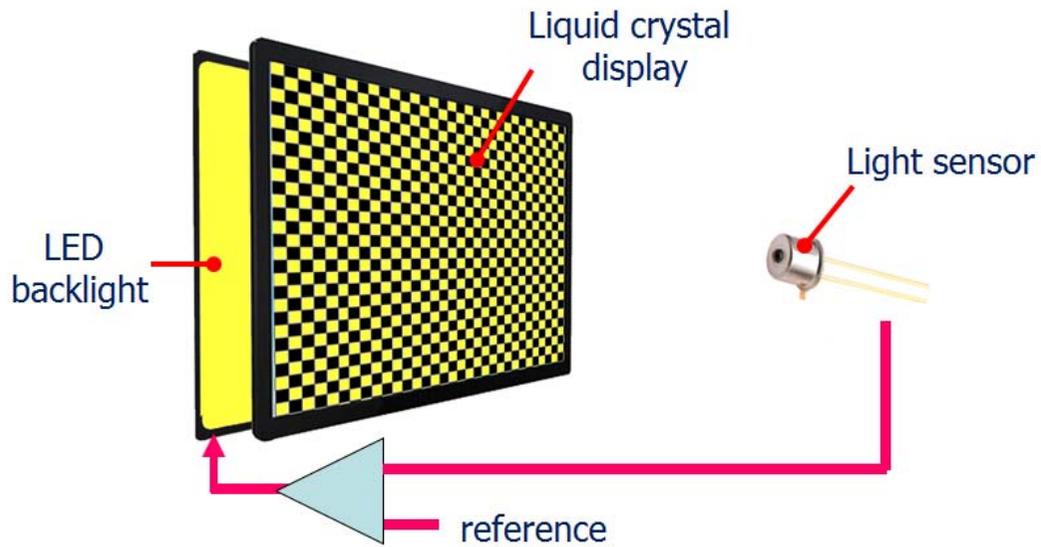
- ❖ First neurons of the retina that generate action potentials.
- ❖ Pulses with frequency up to 250 Hz



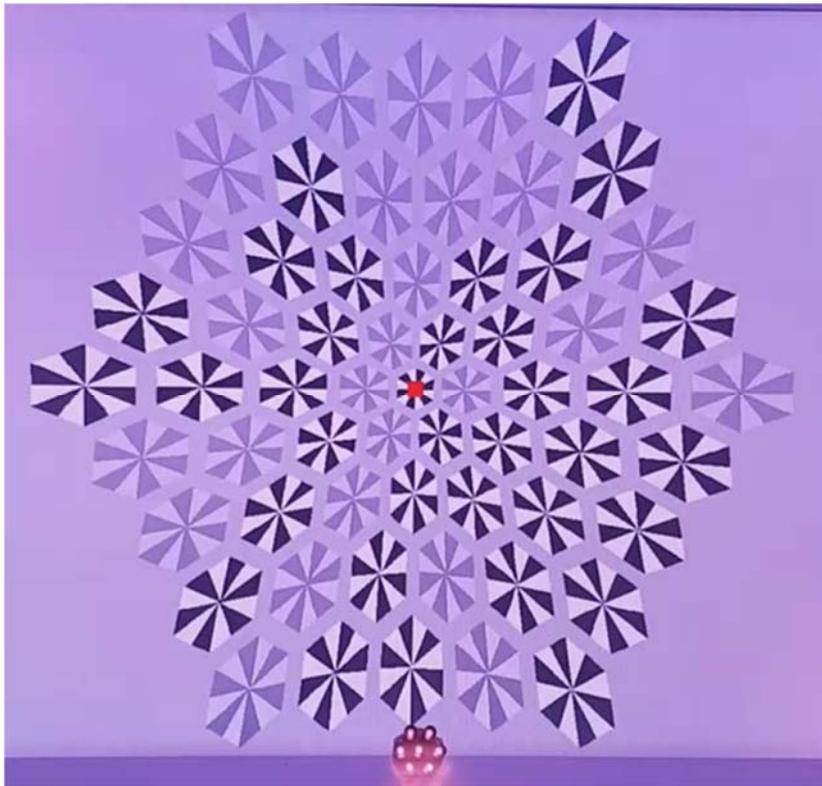
Multifocal pattern ERG technique



- ❖ MonPackONE stimulator with luminance control to avoid the luminance artifact of standard LCD monitors



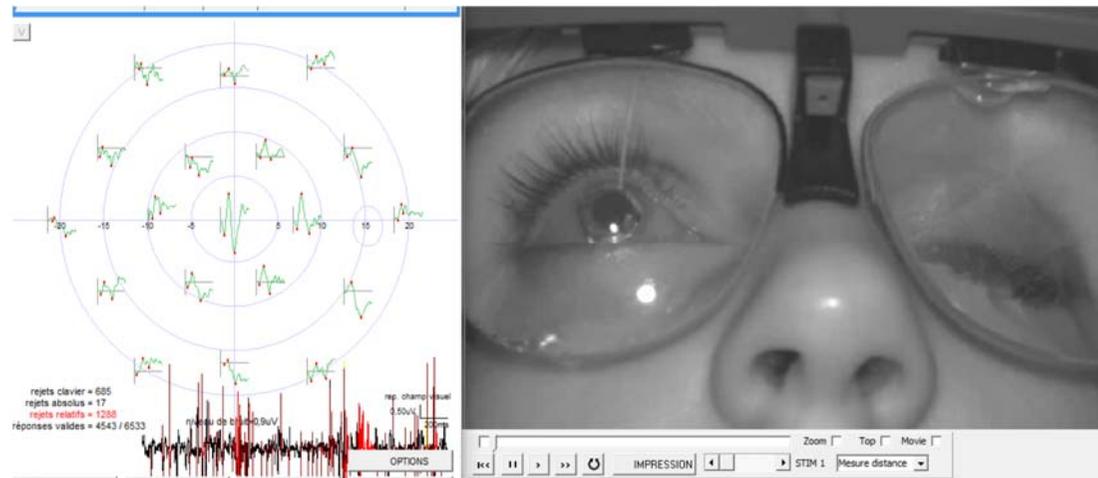
Multifocal pattern ERG technique



- ❖ 61 Local black & white patterns
- ❖ scaled with eccentricity
- ❖ 60 degrees field (up to 30 degrees)
- ❖ 15 contrast reversal per second
- ❖ Short m-sequences (512 elements)
- ❖ ERG jet electrode

Multifocal pattern ERG technique

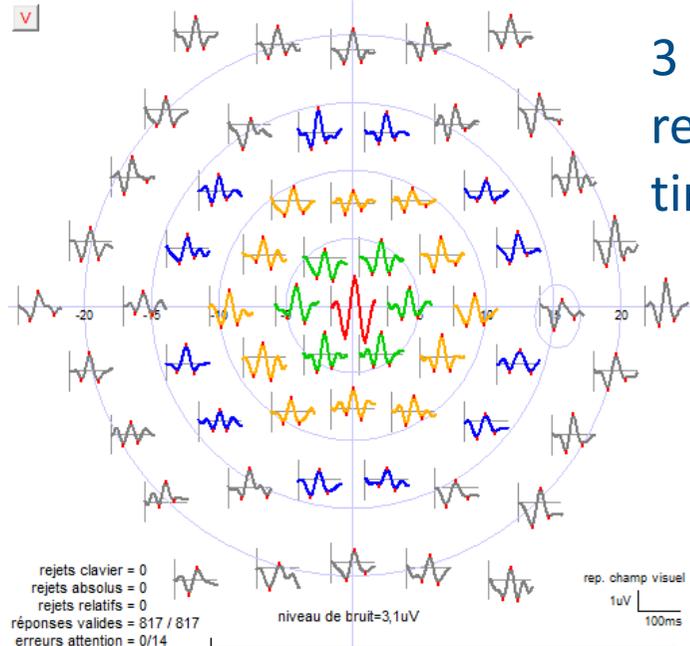
- ❖ Synchronized video recording



Responses to flash and pattern ERG 61 zones

FLASH

MERG61B	OD stimulé	enr377	1mn 2s
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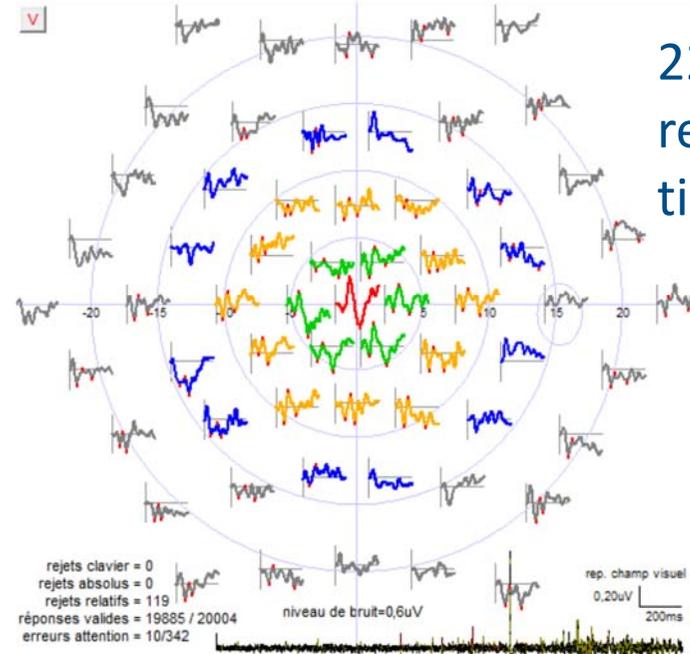


3 minutes
recording
time

1uV

PATTERN

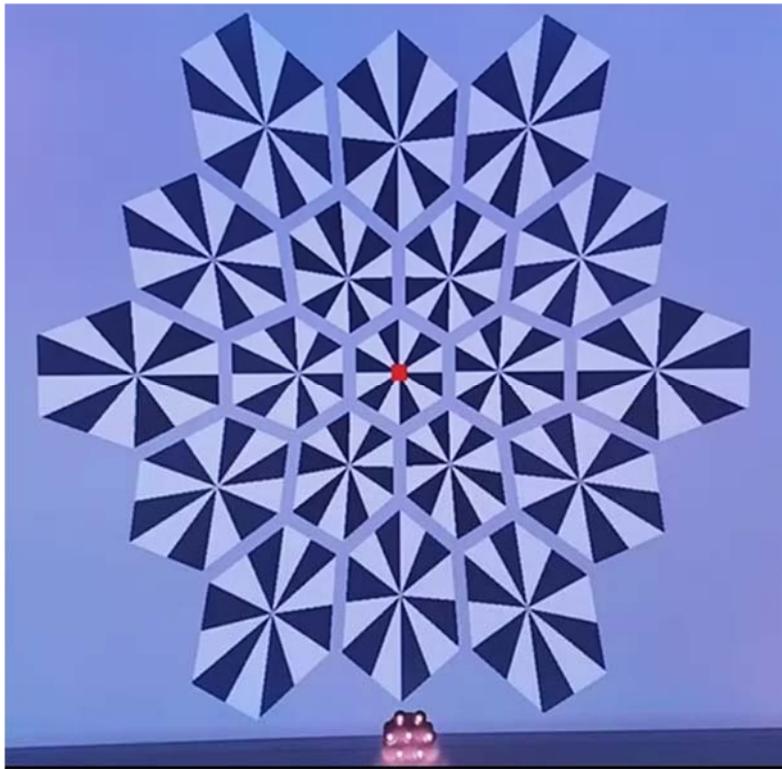
MPERG	OD stimulé	enr330	22mn 18s
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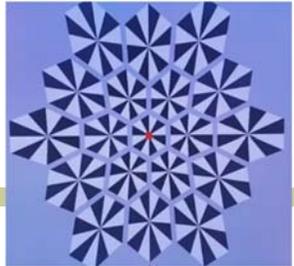
22 minutes
recording
time

0.2uV

Stimulation with 19 pattern zones

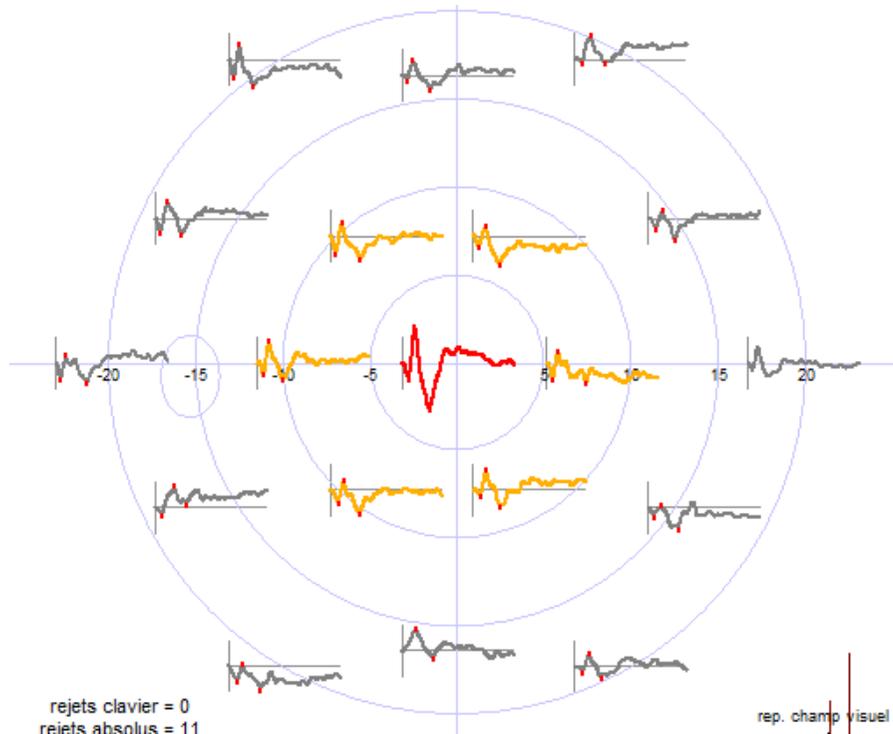


With larger pattern size
(surface area x 3.2)

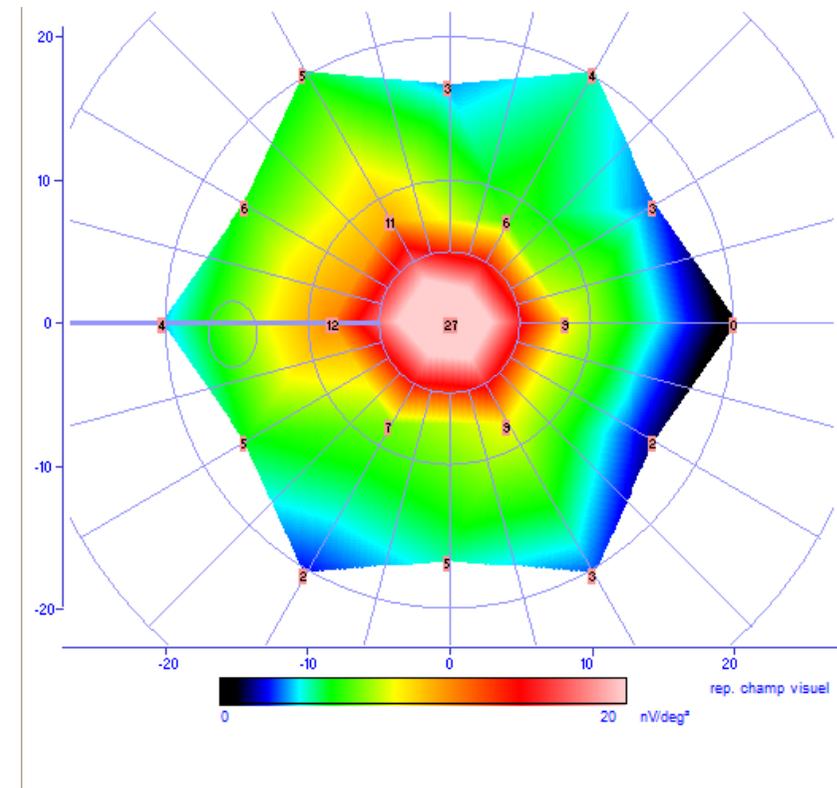


Responses to pattern ERG 19 zones

Local responses

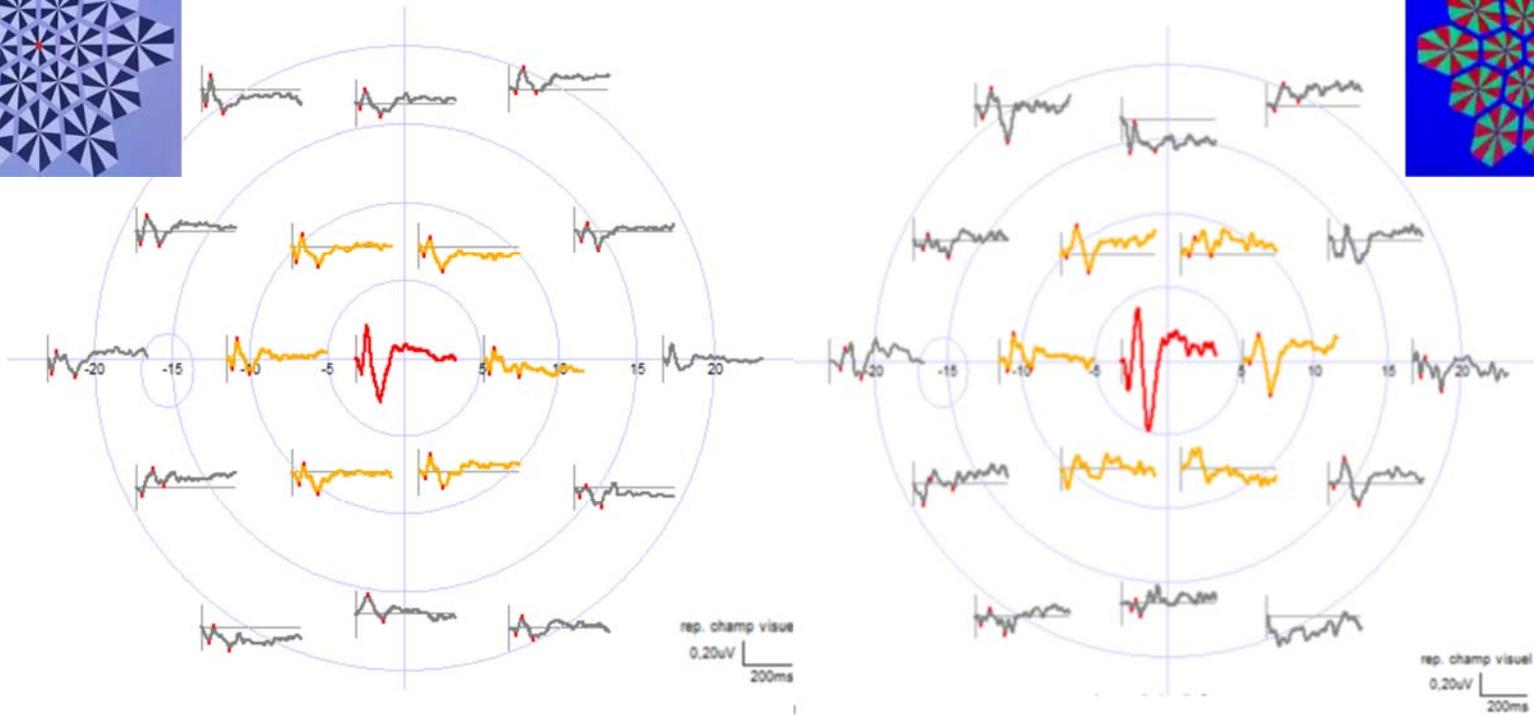
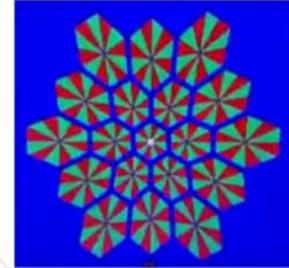
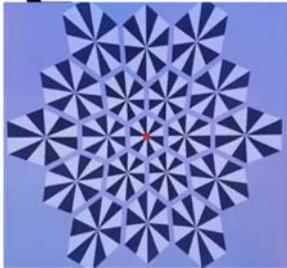


Density plot of P1 (nV/deg²)



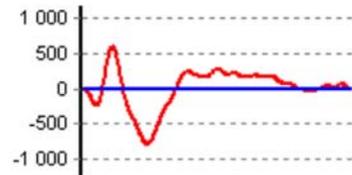
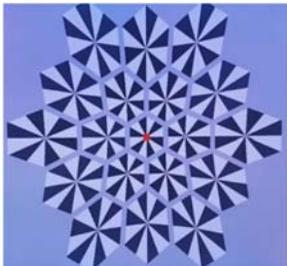
Responses to pattern ERG 19 zones

Local responses

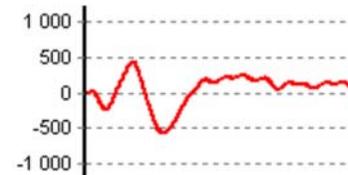


Responses to pattern ERG 19 zones

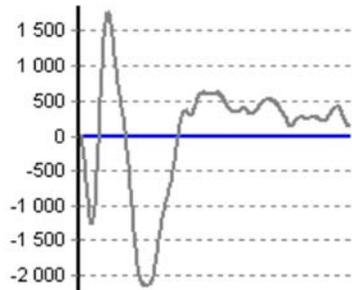
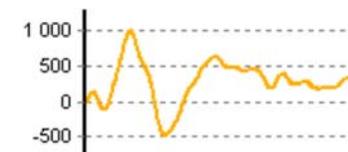
Sum of responses



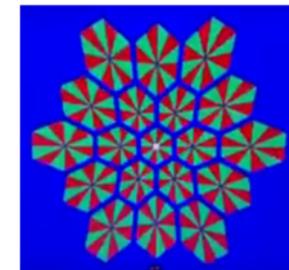
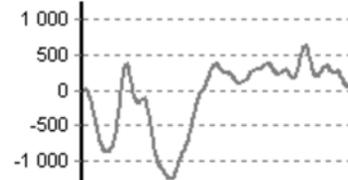
0-5 deg

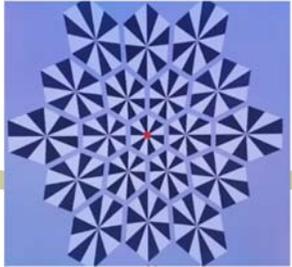


5-15 deg



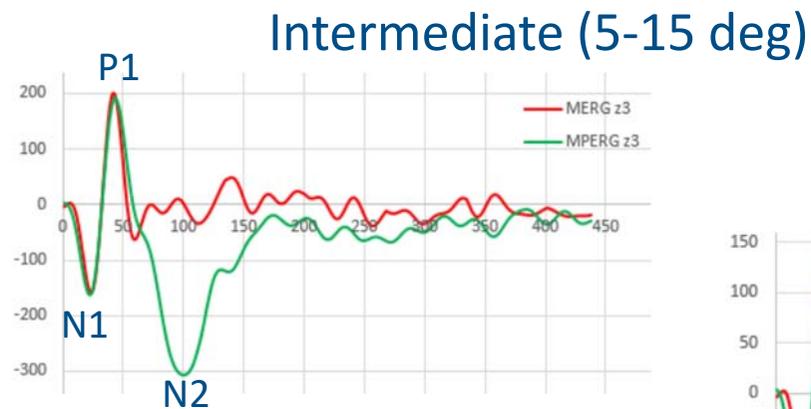
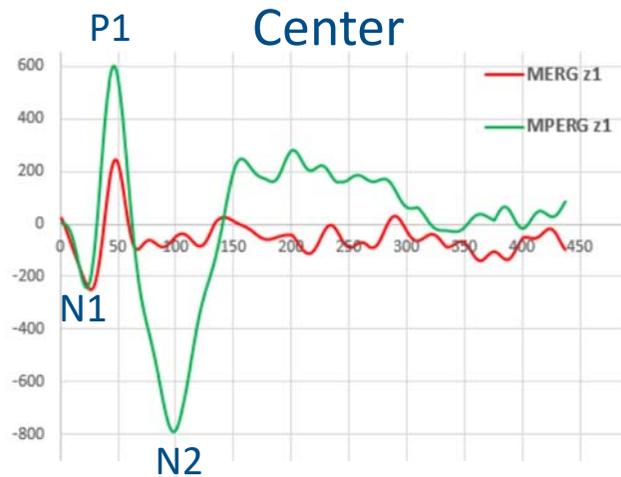
15-25 deg



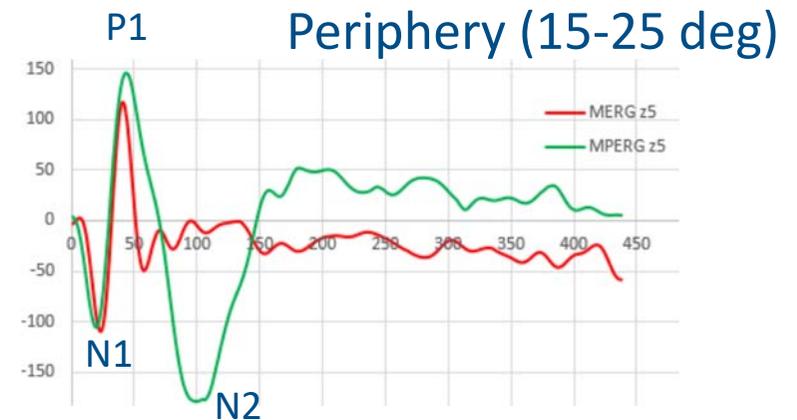


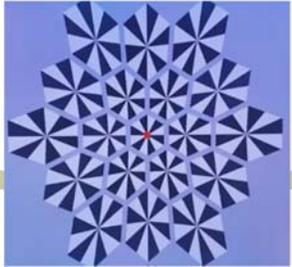
Comparison of flash and pattern multifocal ERG

- Normalized for N1
- Morphology of pattern responses is different from flash
- Responses are similar to the « classic » pattern ERG (N35 P50 N95 peaks)



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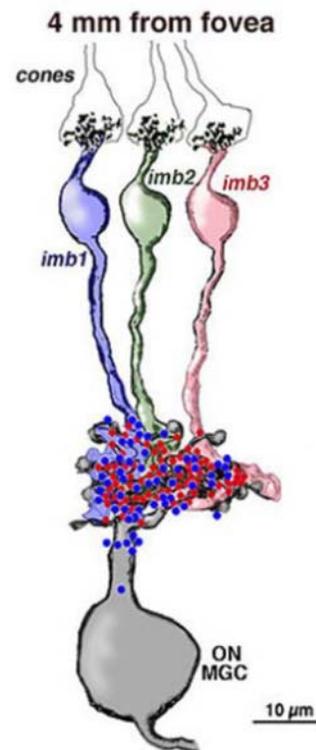
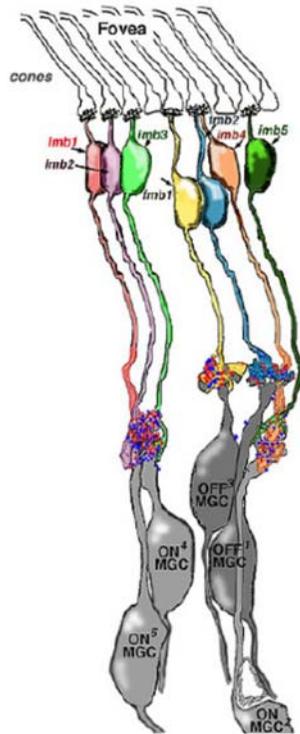
Comparison of amplitudes of P1

	FLASH	PATTERN	RATIO
0-5 deg	146 nV/deg ²	57 nV/deg ²	2.5
15-25 deg	43 nV/deg ²	3.2 nV/deg ²	13

- ❖ With eccentricity, the density of responses to pattern decreases much faster than the density of responses to cones.

Comparison with the distribution of cones and ganglion cells

Curcio, 1990; Kolb, 2012



❖ Center
1 cone
1-2 ganglion

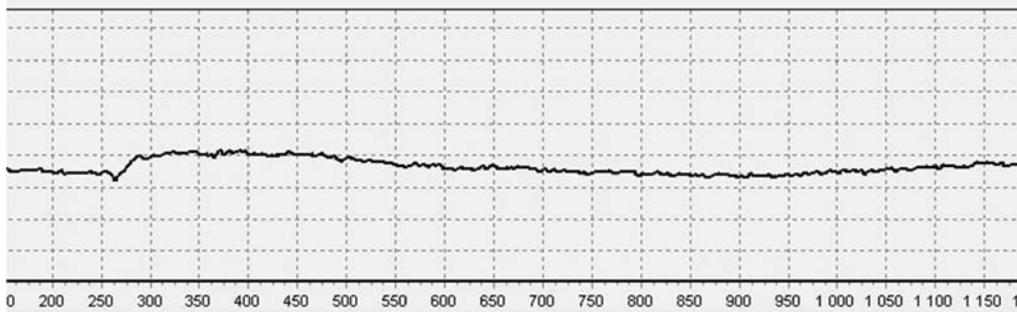
❖ Periphery (12 degrees)
3 cones
1 ganglion

Limits for clinical use

- ❖ Small signals for eccentric stimulations
- ❖ Examination duration: 10 to 20 minutes

Limits for clinical use

Blinks and micro eye movements



VIDEO



- ❖ Blinks
period ~3 seconds amplitude ~500 μV
- ❖ “Micro eye movements”
period ~800 ms amplitude ~50 μV
- ❖ Global response of pattern multifocal ERG
amplitude ~10 μV
- ❖ Global response of flash multifocal ERG
amplitude ~50 μV

Thank you!

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