

# Evaluation of quantitative indexes for the analysis of multifocal ERG

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-FRANCE-

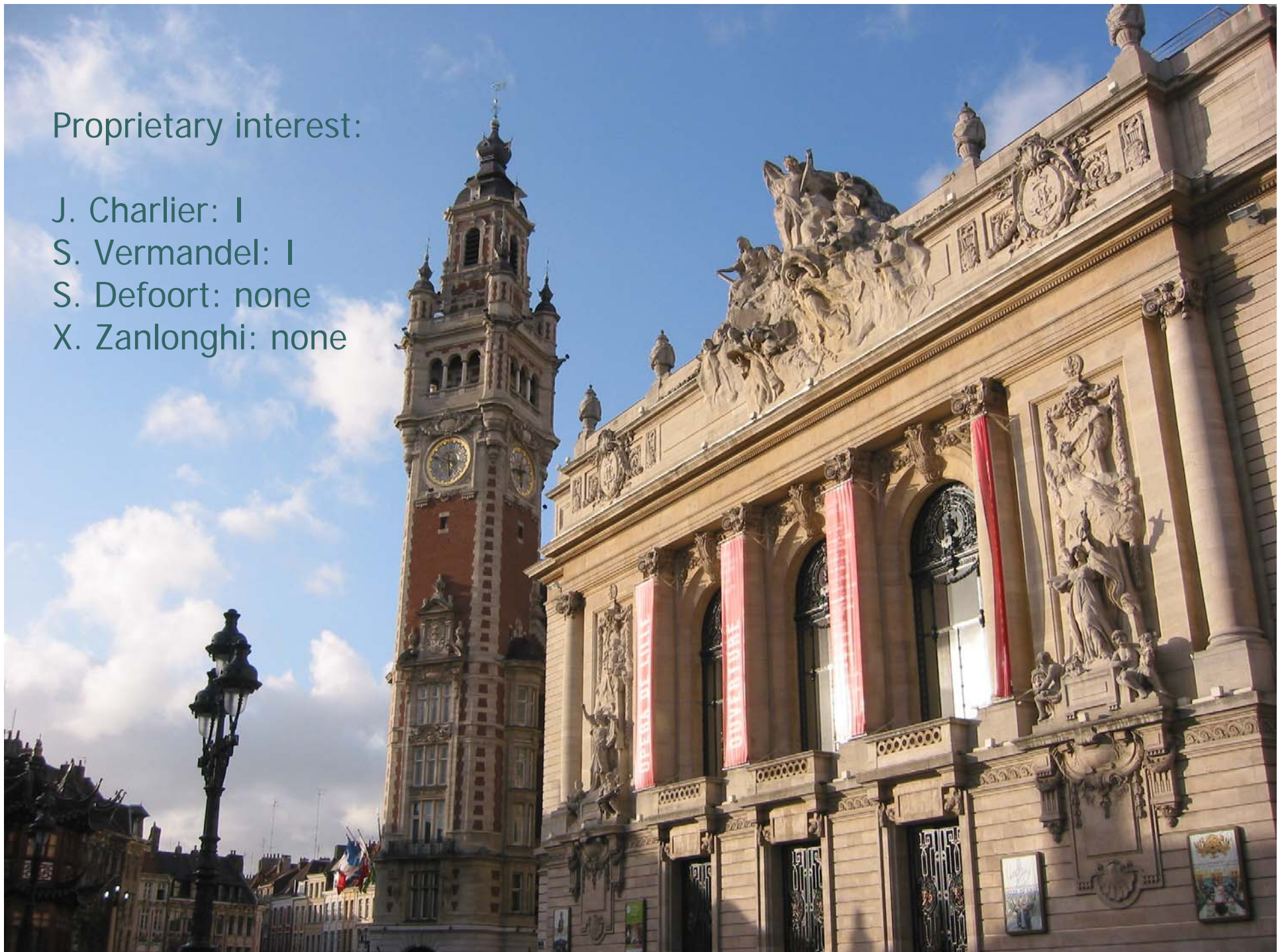
Proprietary interest:

J. Charlier: I

S. Vermandel: I

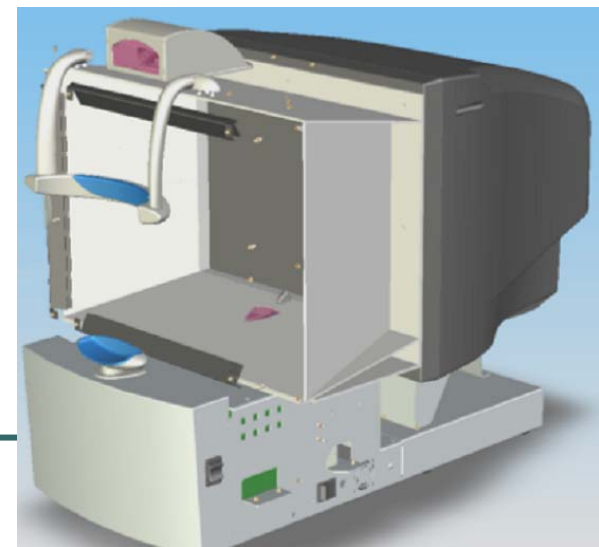
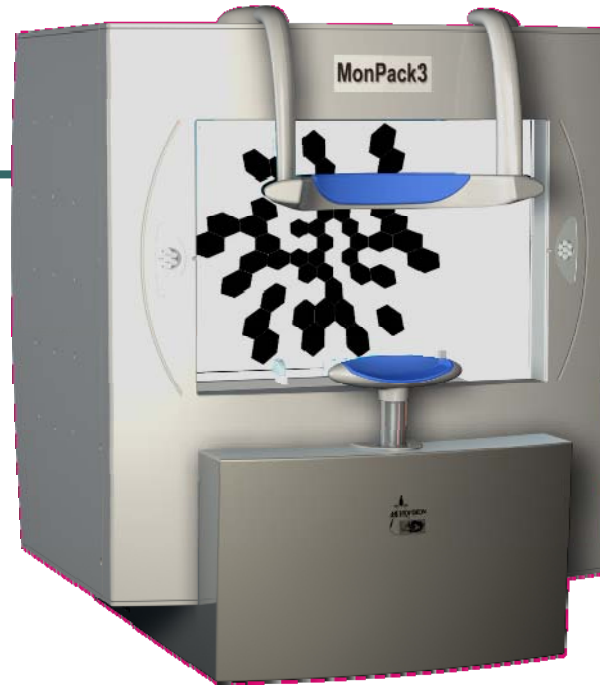
S. Defoort: none

X. Zanlonghi: none



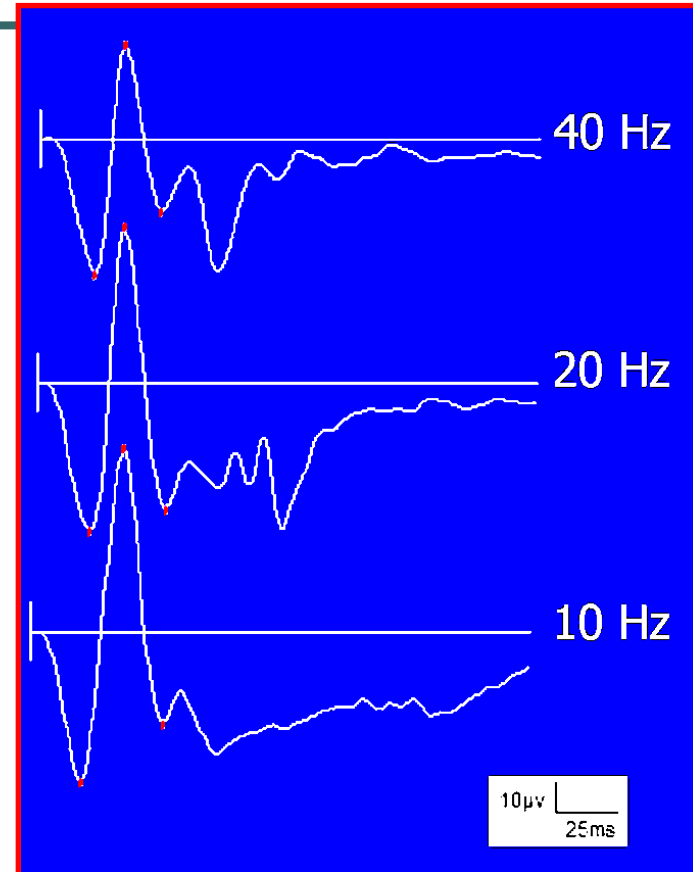
# Data base of normal subjects

- 71 subjects
- age 11 – 62 (medium = 39)
- 61 scaled hexagons covering the central 50 degrees
- 120 Hz frame frequency
- 200 cd/m<sup>2</sup>



# Methods

- slow 17 Hz stimulation
- short sequences ( $2^9$ )
- 30 cd/m<sup>2</sup> surrounding background





# Methods

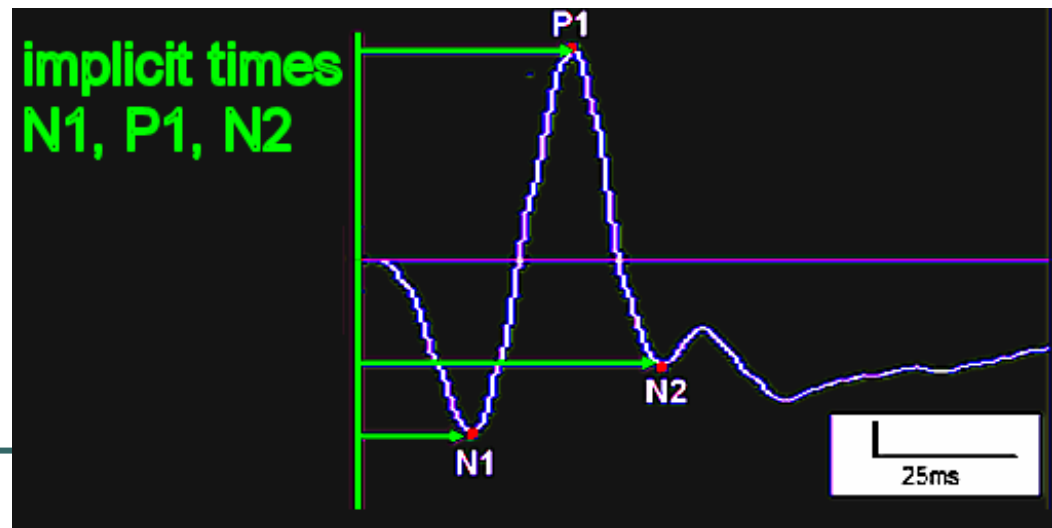
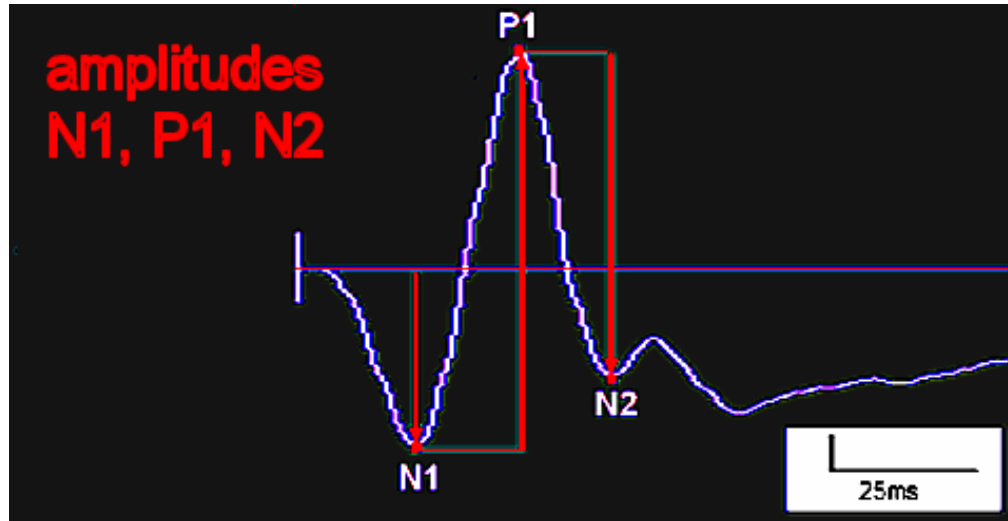
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## recording

- dilated pupils
- large field refractive lenses with correction for examination distance
- ERG jet electrodes
- data acquisition band pass:  
0.1 – 74 Hz
- post acquisition filter:  
10 – 45 Hz



## Quantitative analysis



## Large inter-individual variability of ERG amplitudes:

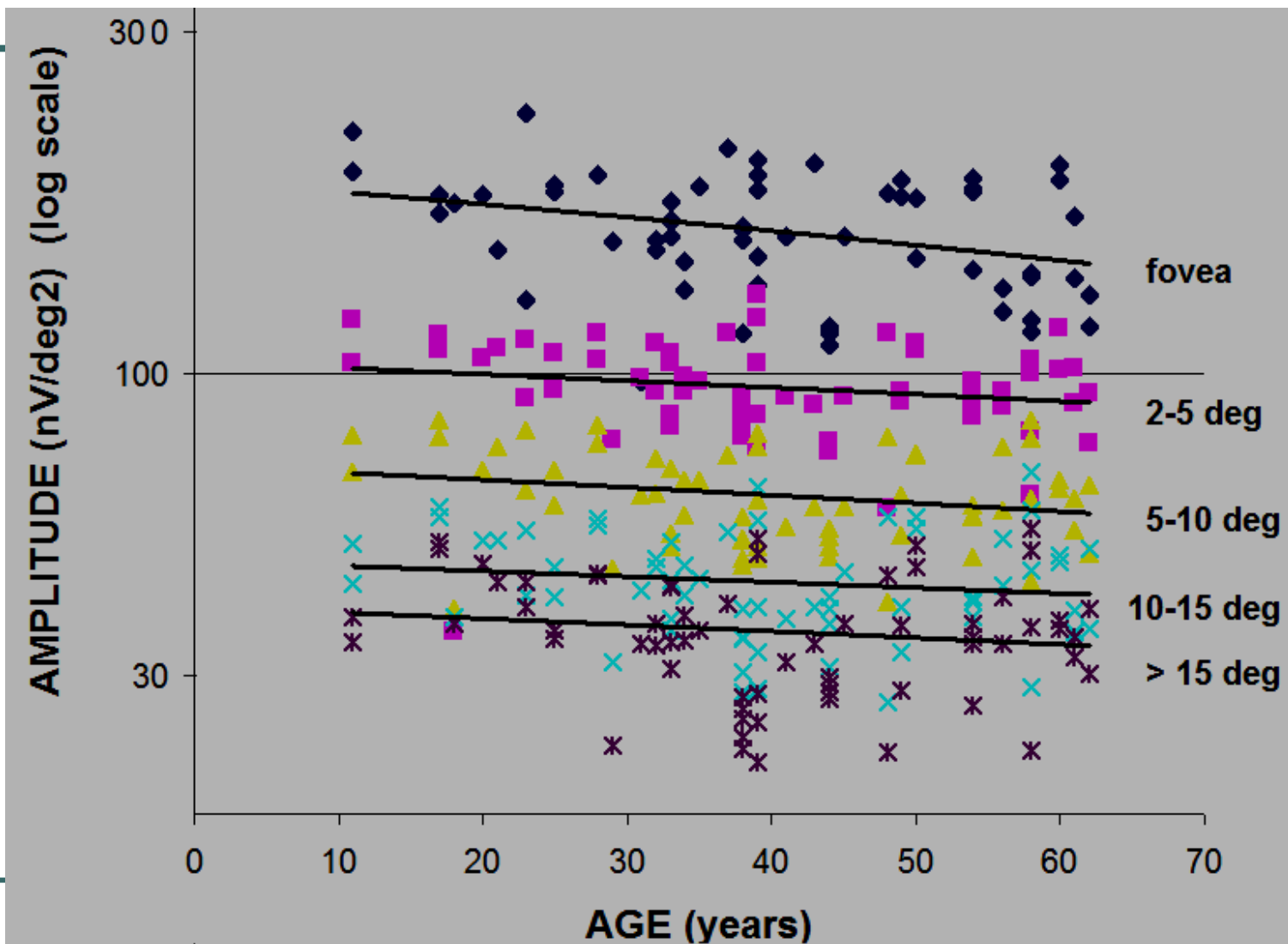
Coefficient of variation for P1 amplitude = 20.2%  
(average response of 5 - 10 degrees ring)

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- stimulus luminance
- dilation of the pupil
- optical properties of ocular media
  
- age
- previous exposure to light
- time of day, season
- coffee, ...
  
- length of the eye
- conductivity of tissues
- position of electrodes

# Amplitude of P1 as a function of age

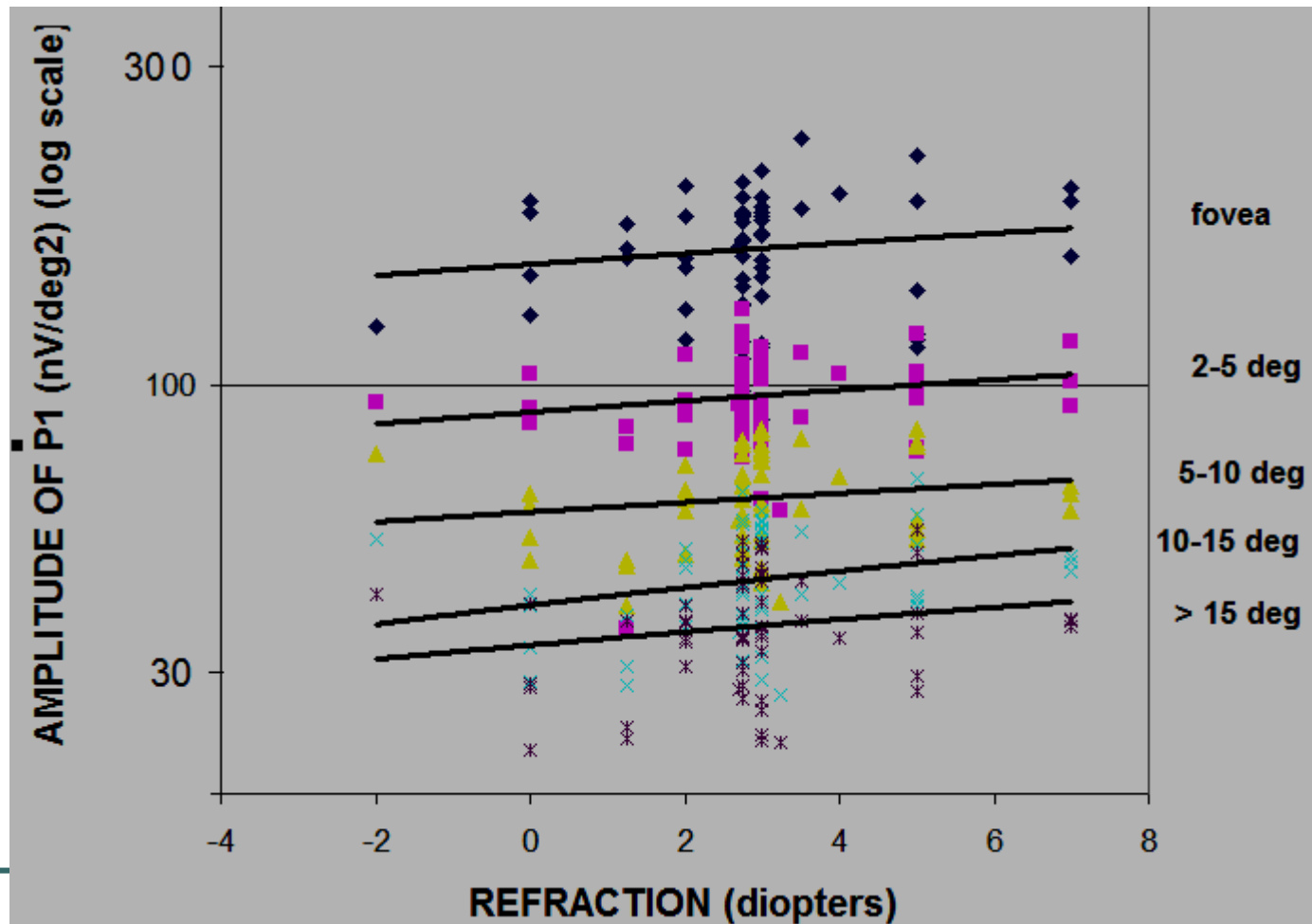
71 eyes





# Amplitude of P1 as a function of refraction

71 eyes



## Improve the detection of MfERG alterations ?

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Coefficient of variation for average response  
of 5 - 10 degrees ring:

amplitude of P1: 19%

" " after correction for age: 17%

" " after correction for age and refraction: 16%

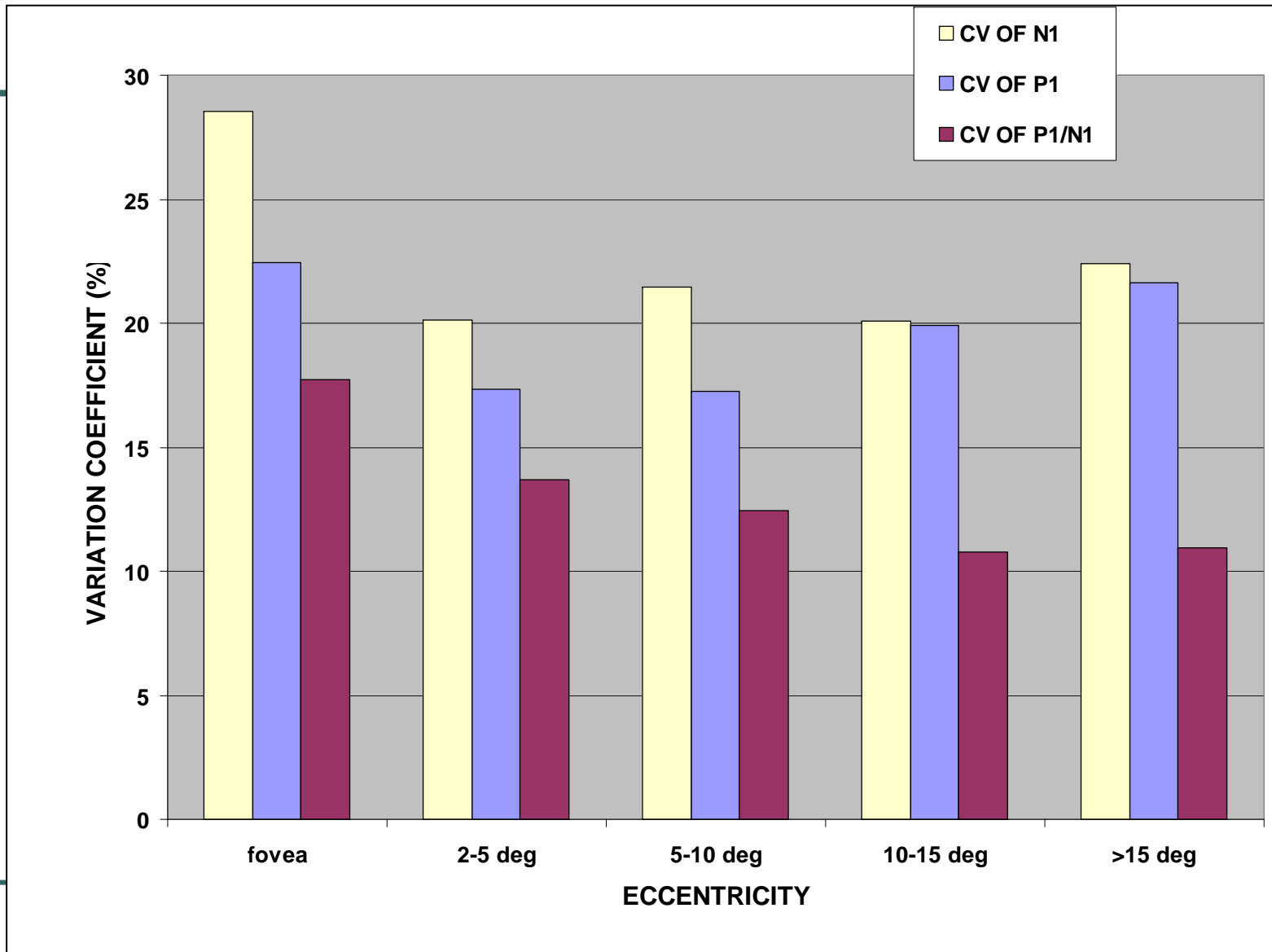
Improve the detection  
of MfERG alterations ?

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Use the patient's data as his/her own reference:

- periphery for pathologies of central retina
- N1 amplitude for pathologies of inner layers

# Improve the detection of MfERG alterations ?



Improve the detection  
of MfERG alterations ?

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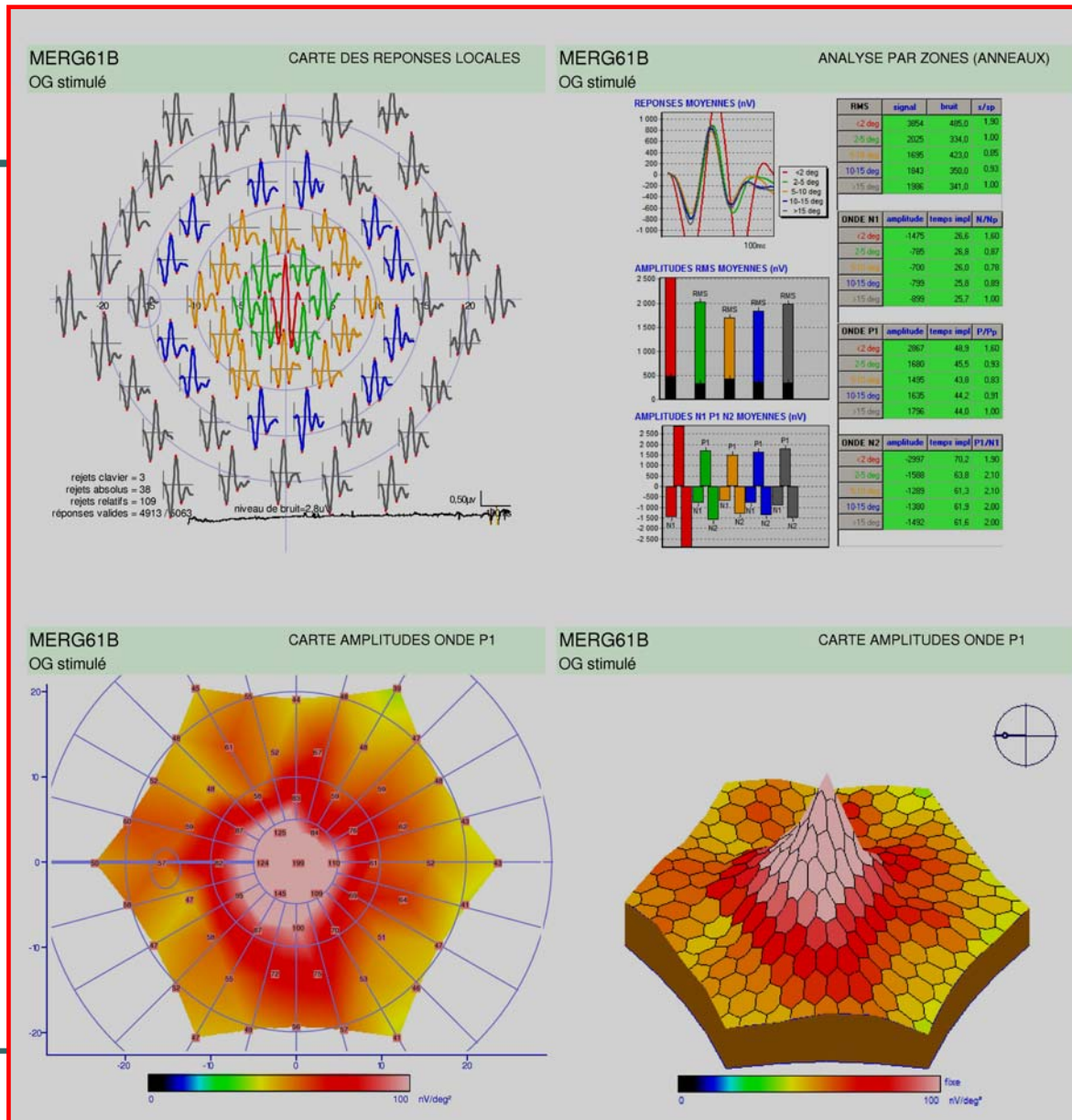
Coefficient of variation:  
(for average response of 5 - 10 degrees ring)

Amplitude of P1: 19%

Ratio to periphery: 11%

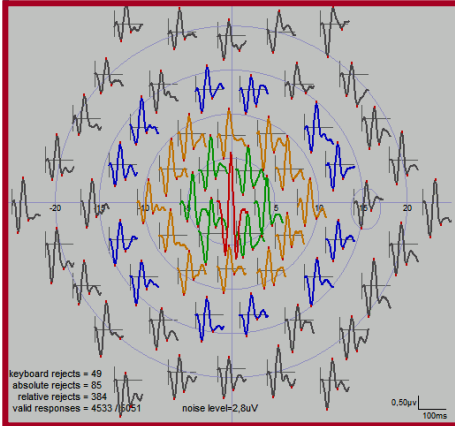
Ratio to N1: 12%

# Case n1: Normal subject

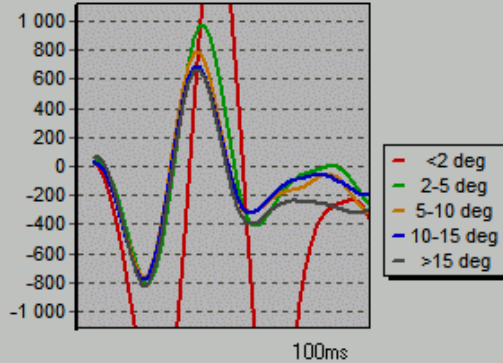




# Case n1: Normal subject



AVERAGE RESPONSES (nV)

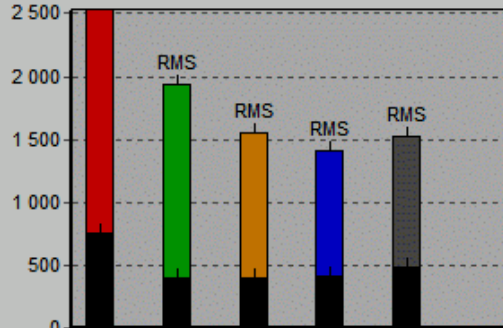


RMS	signal	noise
<2 deg	4537	760
2-5 deg	1942	402,0
5-10 deg	1548	399,0
10-15 deg	1412	407,0
>15 deg	1519	479,0

N1 WAVE	amplitude	impl.time	N/Np
<2 deg	-1811	27,3	2,20
2-5 deg	-814	23,7	0,98
5-10 deg	-768	23,7	0,92
10-15 deg	-783	23,7	0,94
>15 deg	-831	23,7	1,00

Ratio to periphery

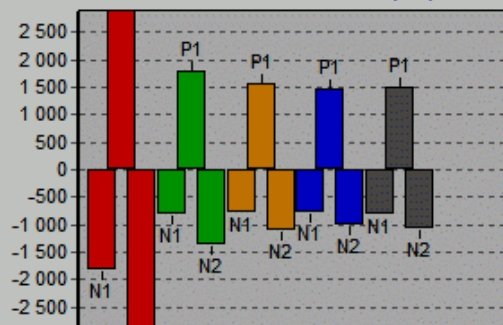
AVERAGE RMS AMPLITUDES (nV)



P1 WAVE	amplitude	impl.time	P/Pp
<2 deg	3518	47,4	2,30
2-5 deg	1789	43,7	1,20
5-10 deg	1556	41,9	1,00
10-15 deg	1472	41,9	0,98
>15 deg	1499	41,9	1,00

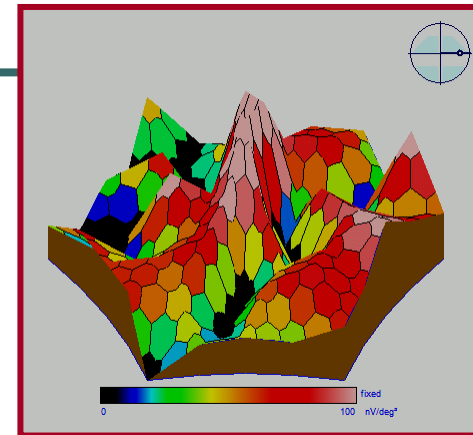
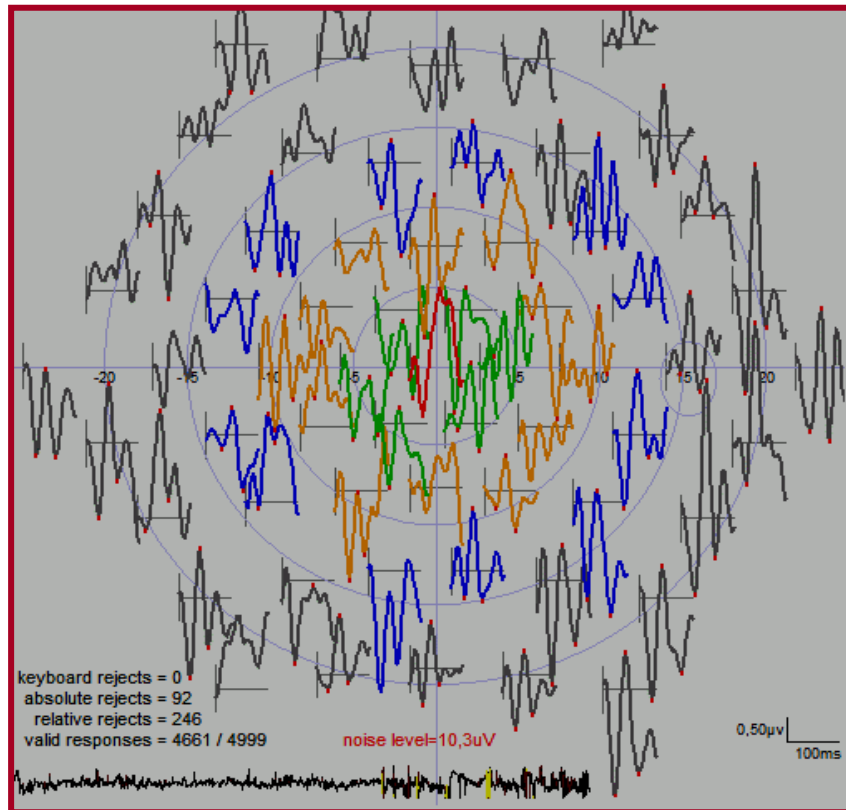
Ratio P1 / N1

AVERAGE N1 P1 N2 AMPLITUDES (nV)

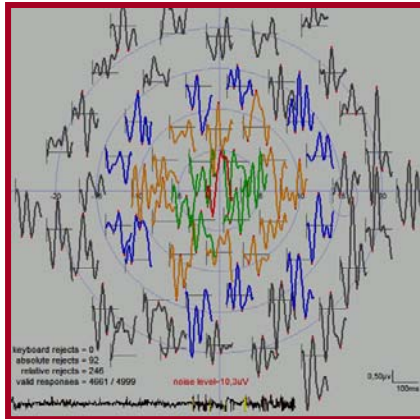


N2 WAVE	amplitude	impl.time	P1/N1
<2 deg	-3634	67,4	1,90
2-5 deg	-1381	62,0	2,20
5-10 deg	-1110	58,3	2,00
10-15 deg	-1013	58,3	1,90
>15 deg	-1069	60,2	1,80

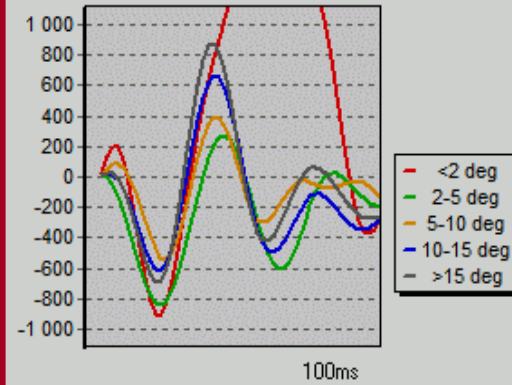
## Case n2



# Case n2



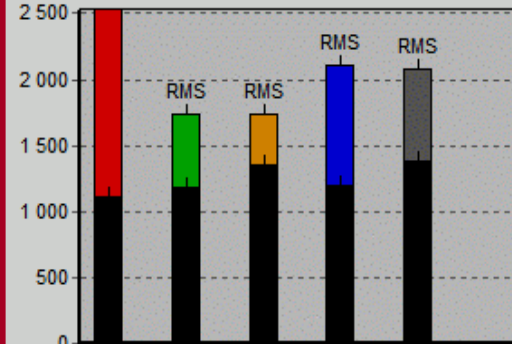
AVERAGE RESPONSES (nV)



RMS	signal	noise	s/sp
<2 deg	2795	1105	1,30
2-5 deg	1735	1182	0,83
5-10 deg	1738	1354	0,84
10-15 deg	2106	1200	1,00
>15 deg	2079	1380	1,00

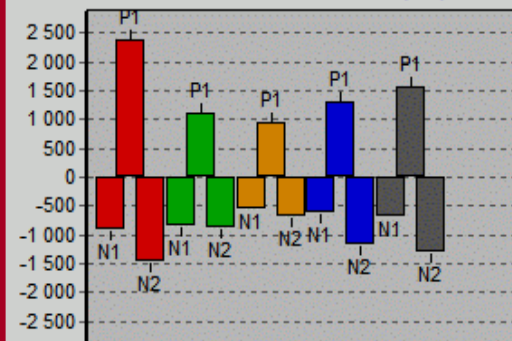
N1 WAVE	amplitude	impl.time	N/Np
<2 deg	-920	25,0	1,30
2-5 deg	-846	25,4	1,20
5-10 deg	-544	27,1	0,78
10-15 deg	-624	25,1	0,90
>15 deg	-697	24,6	1,00

AVERAGE RMS AMPLITUDES (nV)



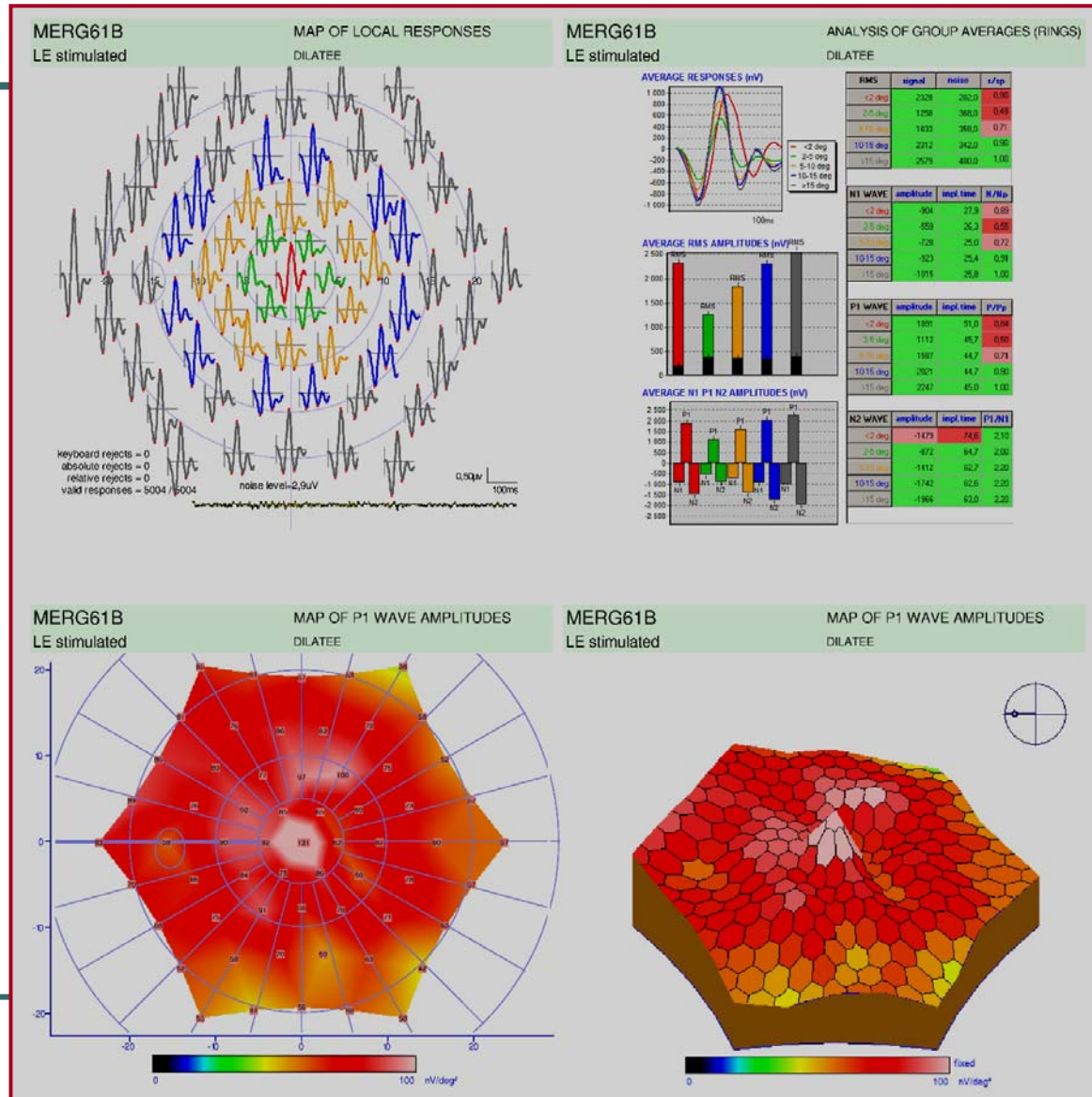
P1 WAVE	amplitude	impl.time	P/Pp
<2 deg	2393	57,0	1,50
2-5 deg	1120	47,1	0,71
5-10 deg	935	44,5	0,59
10-15 deg	1290	44,2	0,82
>15 deg	1575	43,2	1,00

AVERAGE N1 P1 N2 AMPLITUDES (nV)



N2 WAVE	amplitude	impl.time	P1/N1
<2 deg			2,60
2-5 deg	-880	66,1	1,30
5-10 deg	-691	60,1	1,70
10-15 deg	-1162	63,4	2,10
>15 deg	-1298	61,3	2,30

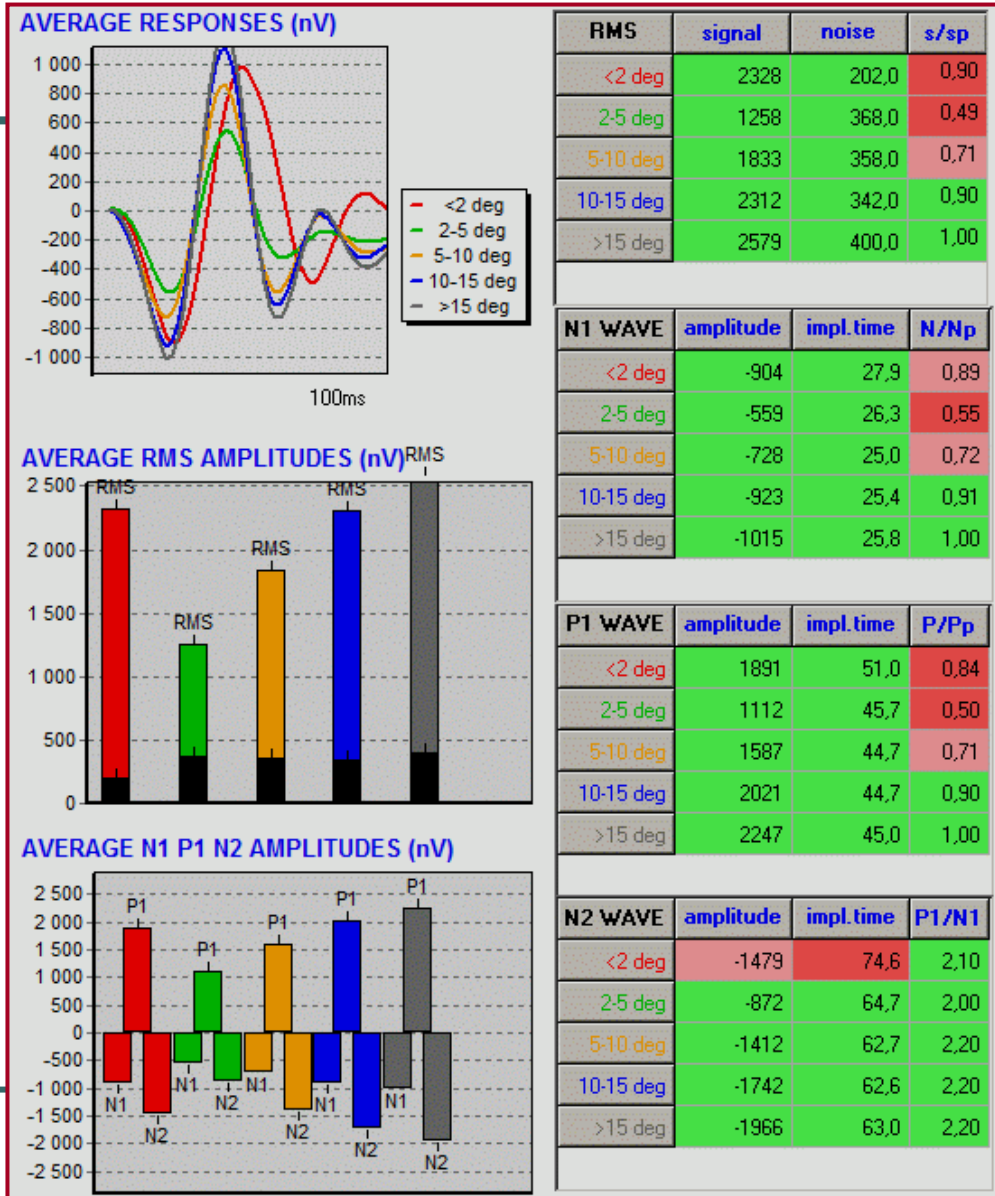
# Case n3: hydroxychloroquine



SM (Nantes)

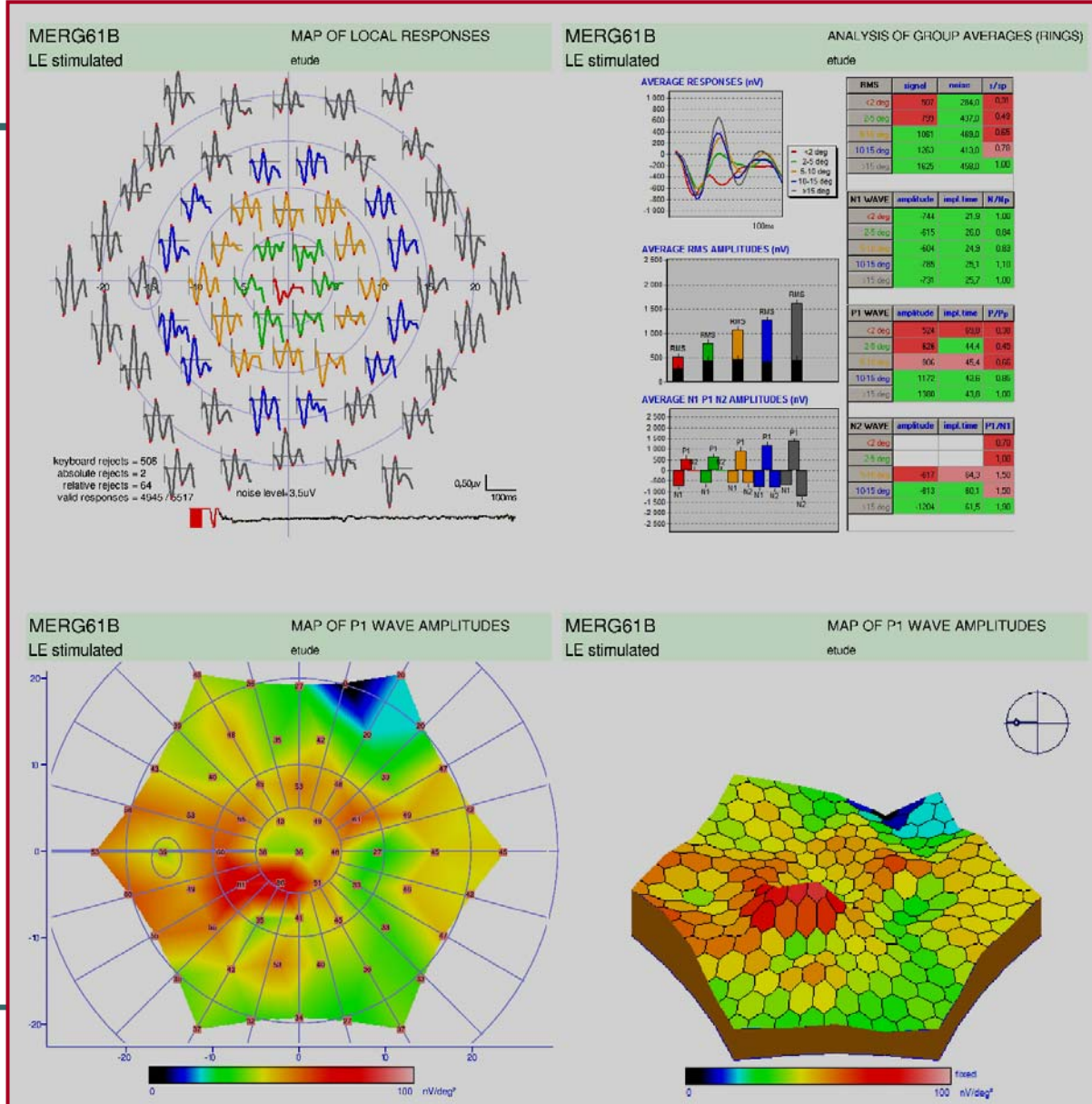


# Case n3: hydroxychloroquine



SM (Nantes)

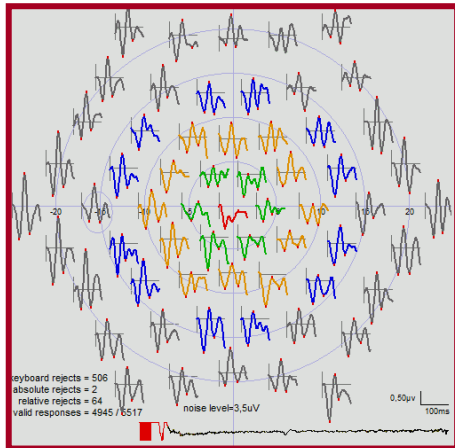
# Case n4: chorioretinopathy



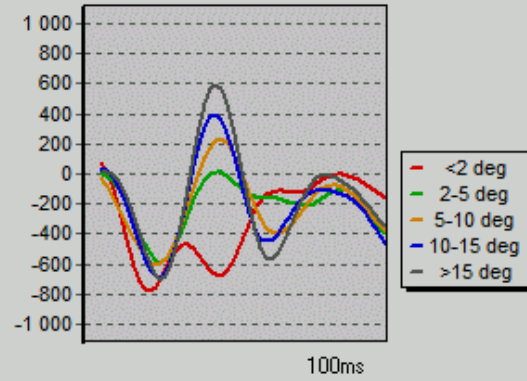
BS (Lille)



# Case n4: chorioretinopathy



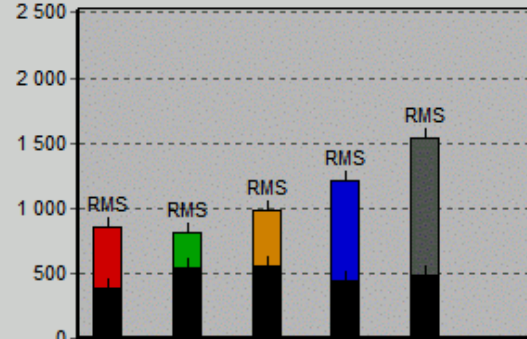
**AVERAGE RESPONSES (nV)**



RMS	signal	noise
<2 deg	861	390,0
2-5 deg	807	542
5-10 deg	989	548
10-15 deg	1214	448,0
>15 deg	1542	489,0

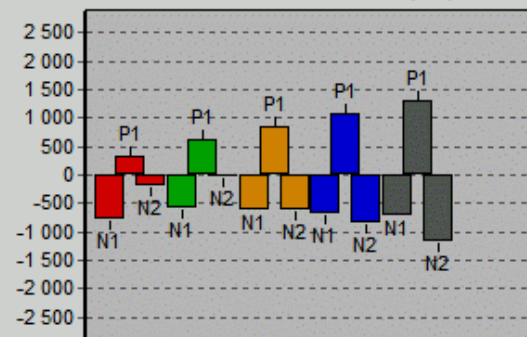
N1 WAVE	amplitude	impl.time	N/Np
<2 deg	-782	21,9	1,10
2-5 deg	-591	25,5	0,84
5-10 deg	-604	23,7	0,86
10-15 deg	-692	25,5	0,98
>15 deg	-704	25,5	1,00

**AVERAGE RMS AMPLITUDES (nV)**



P1 WAVE	amplitude	impl.time	P/Pp
<2 deg	310,0	34,6	0,24
2-5 deg	609	43,7	0,47
5-10 deg	834	45,6	0,64
10-15 deg	1089	43,7	0,84
>15 deg	1301	43,7	1,00

**AVERAGE N1 P1 N2 AMPLITUDES (nV)**



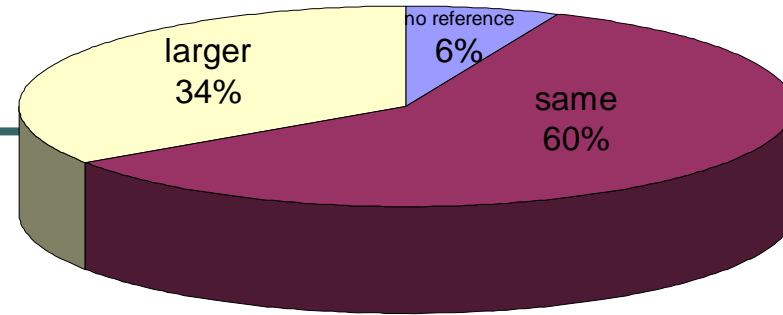
N2 WAVE	amplitude	impl.time	P1/N1
<2 deg	-202,0	45,6	0,40
2-5 deg			
5-10 deg	-630	63,8	1,40
10-15 deg	-848	60,2	1,60
>15 deg	-1161	62,0	1,80

BS (Lille)

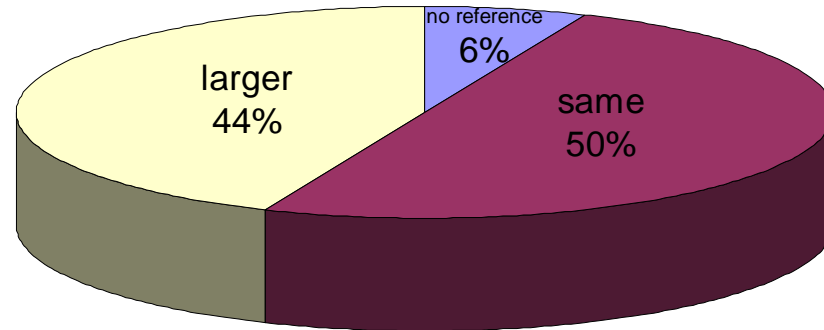
# Results

32 patients

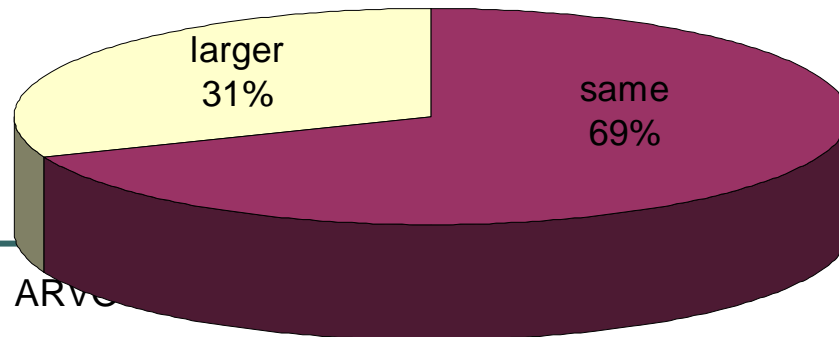
N/Nperiphery



P/Pperiphery



P1/N1



ARVC

## Conclusion

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### Quantitative indexes comparing

- central to peripheral amplitudes
- amplitudes of P1 to amplitudes of N1

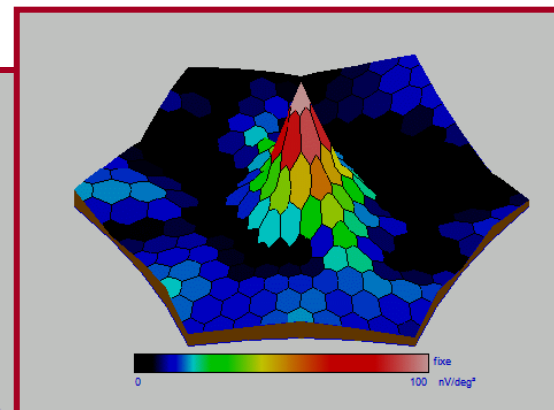
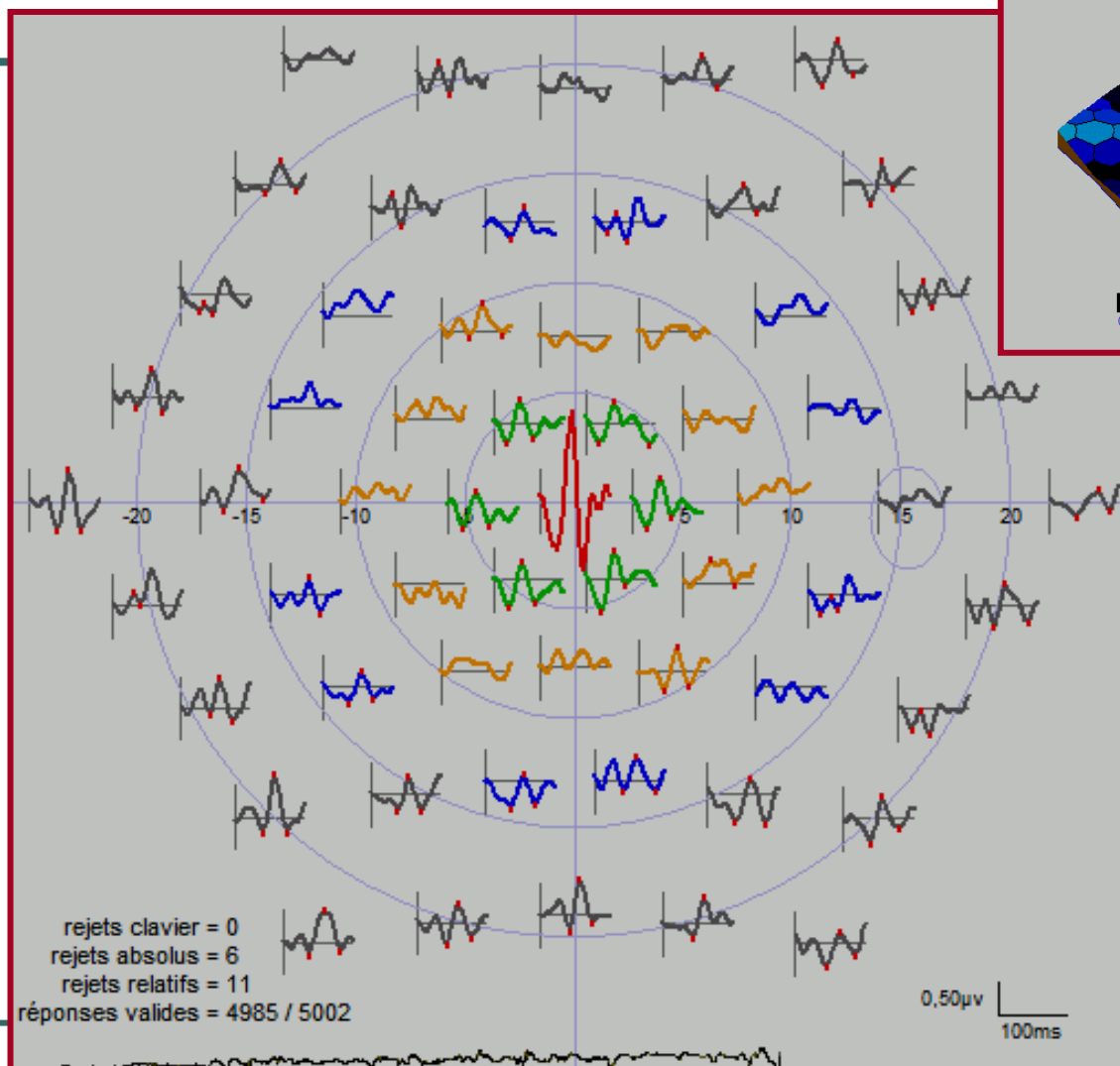
can significantly improve  
the detection and interpretation  
of alterations of MfERG results.

Thank you!



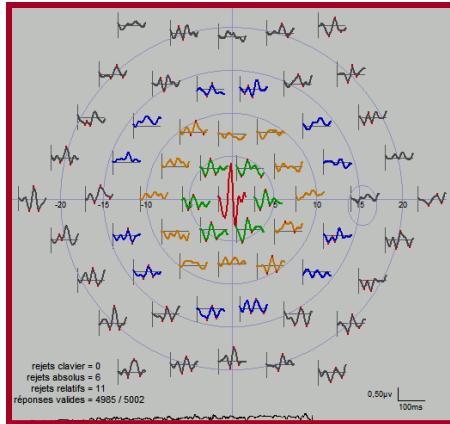


# Retinitis pigmentosa

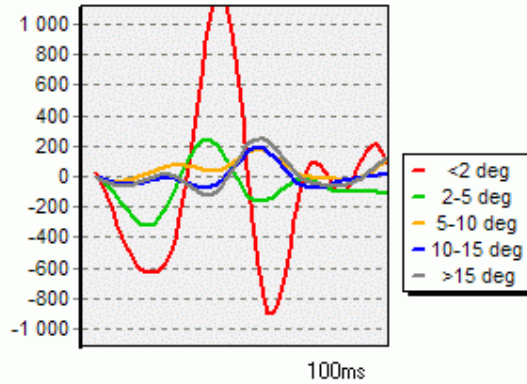


Rp (Lille)

# Retinitis pigmentosa



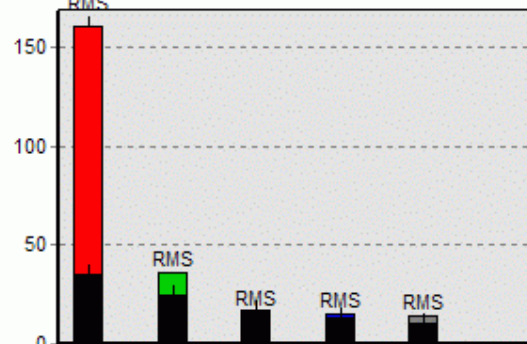
REPONSES MOYENNES (nV)



RMS	signal	bruit	s/sp
<2 deg	160,0	34,8	11,00
2-5 deg	36,3	24,6	2,50
5-10 deg	16,1	16,9	1,10
10-15 deg	14,8	12,9	1,00
>15 deg	14,3	10,2	1,00

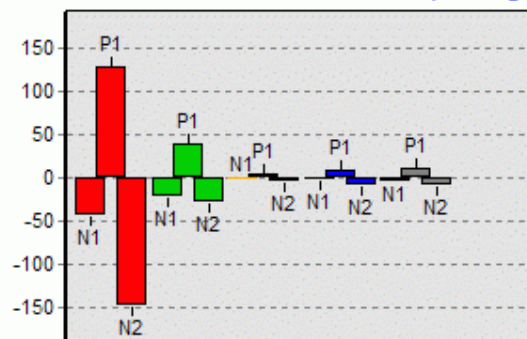
ONDE N1	amplitude	temps impl	N/Np
<2 deg	-43,9	23,6	13,00
2-5 deg	-21,9	21,9	6,50
5-10 deg			
10-15 deg	-2,6	40,5	0,76
>15 deg	-3,4	40,5	1,00

AMPLITUDES RMS MOYENNES (nV/deg2)



ONDE P1	amplitude	temps impl	P/Pp
<2 deg	129,0	45,6	13,00
2-5 deg	38,7	40,5	3,80
5-10 deg	3,9	32,1	0,38
10-15 deg	9,5	57,4	0,93
>15 deg	10,2	57,4	1,00

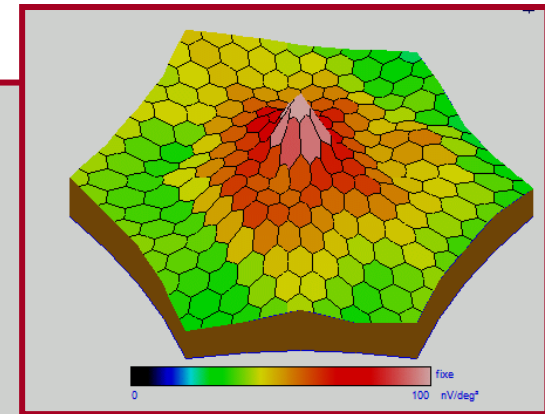
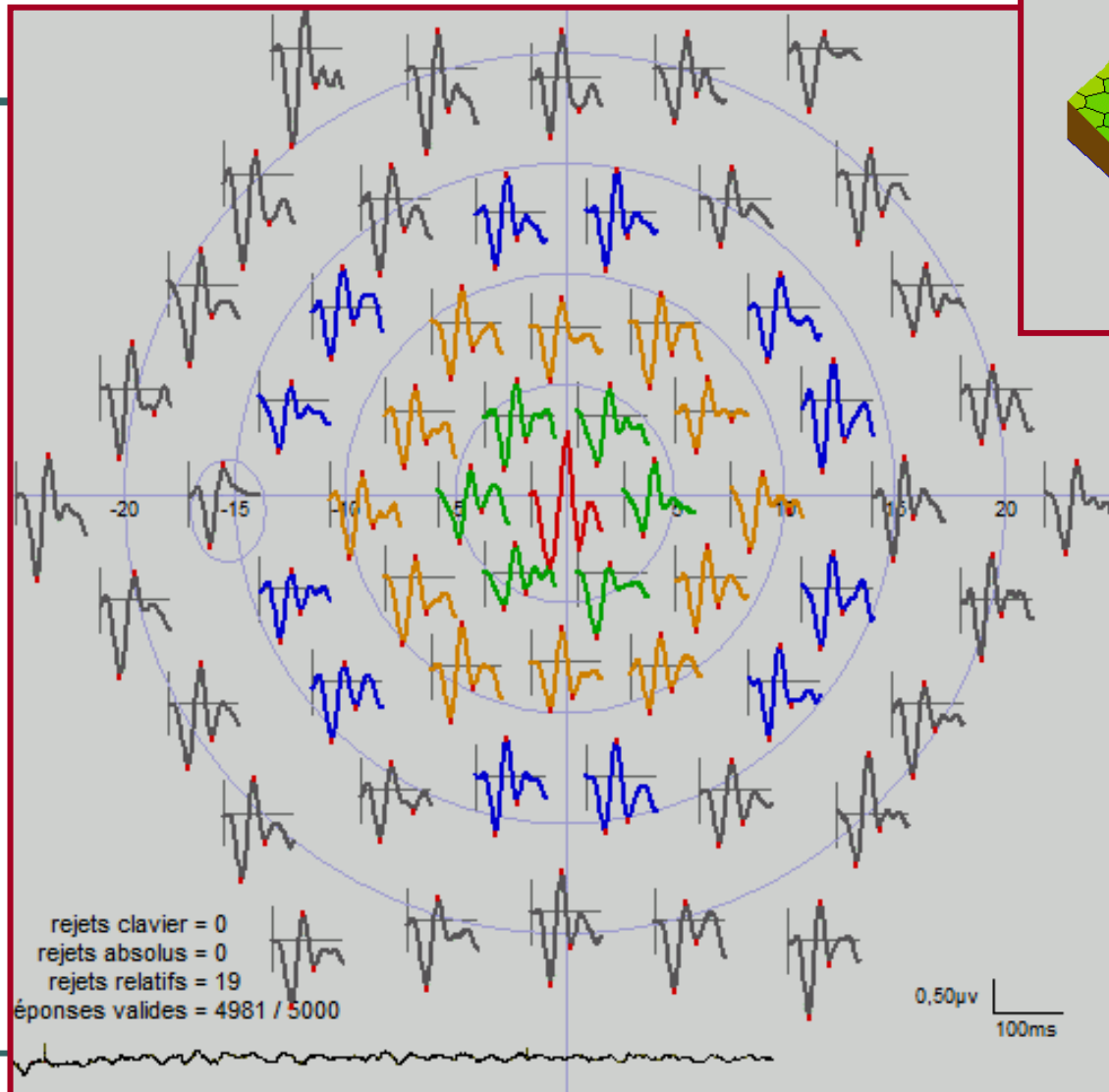
AMPLITUDES N1 P1 N2 MOYENNES (nV/deg2)



ONDE N2	amplitude	temps impl	P1/N1
<2 deg	-148,0	62,4	2,90
2-5 deg	-28,0	59,1	1,80
5-10 deg	-5,0	86,1	
10-15 deg	-9,7	75,9	3,70
>15 deg	-8,5	81,0	3,00



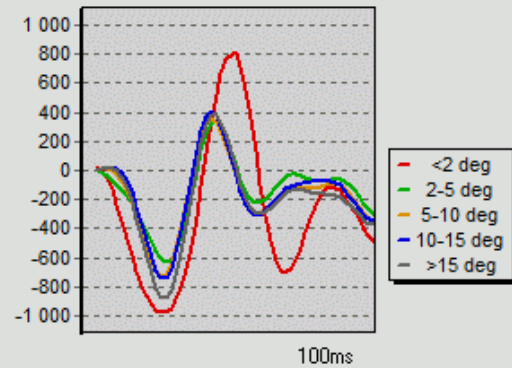
# Vigabatrin



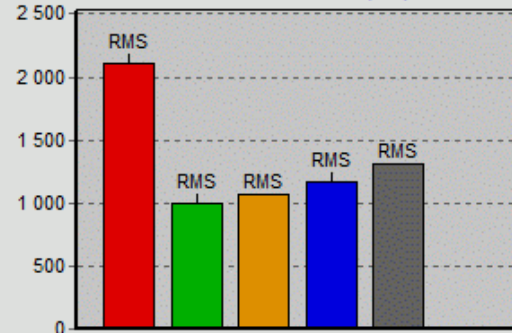
NM (Lille)

# Vigabatrin

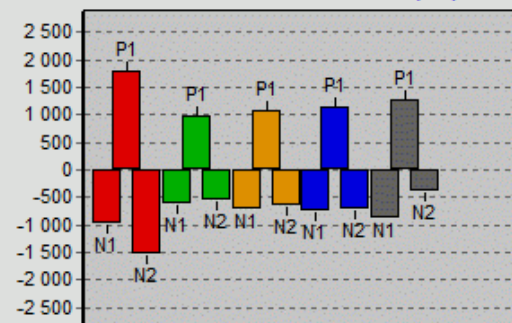
REPONSES MOYENNES (nV)



AMPLITUDES RMS MOYENNES (nV)



AMPLITUDES N1 P1 N2 MOYENNES (nV)

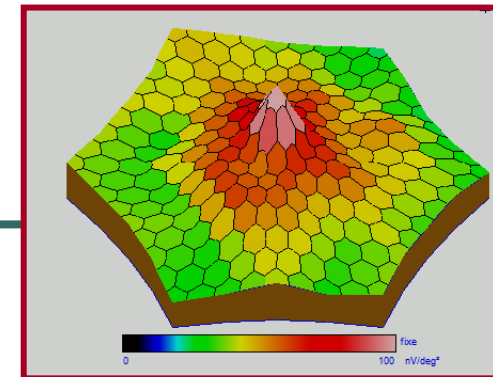


RMS	signal	bruit	s/sp
<2 deg	2103		1,60
2-5 deg	995		0,76
5-10 deg	1071		0,81
10-15 deg	1167		0,89
>15 deg	1317		1,00

ONDE N1	amplitude	temps impl	N/Np
<2 deg	-981	27,6	1,10
2-5 deg	-629	28,7	0,71
5-10 deg	-727	27,3	0,82
10-15 deg	-744	27,8	0,84
>15 deg	-883	28,0	1,00

ONDE P1	amplitude	temps impl	P/Pp
<2 deg	1793	51,8	1,40
2-5 deg	971	45,4	0,77
5-10 deg	1082	44,2	0,85
10-15 deg	1147	44,1	0,90
>15 deg	1268	45,0	1,00

ONDE N2	amplitude	temps impl	P1/N1
<2 deg	-1522	69,1	1,80
2-5 deg	-567	59,7	1,50
5-10 deg	-658	59,6	1,50
10-15 deg	-714	59,5	1,50
>15 deg			



- Alteration of N2 amplitude in the periphery

NM (Lille)