EEG INSTRUMENTATION

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CONTENTS

- EEG MACHINE
  - Acquisition Station
  - Reader Station
  - Scalp Electrode
  - Amplifiers
  - Montage Editor
  - Localization of potential in a bipolar montage
- Q/A

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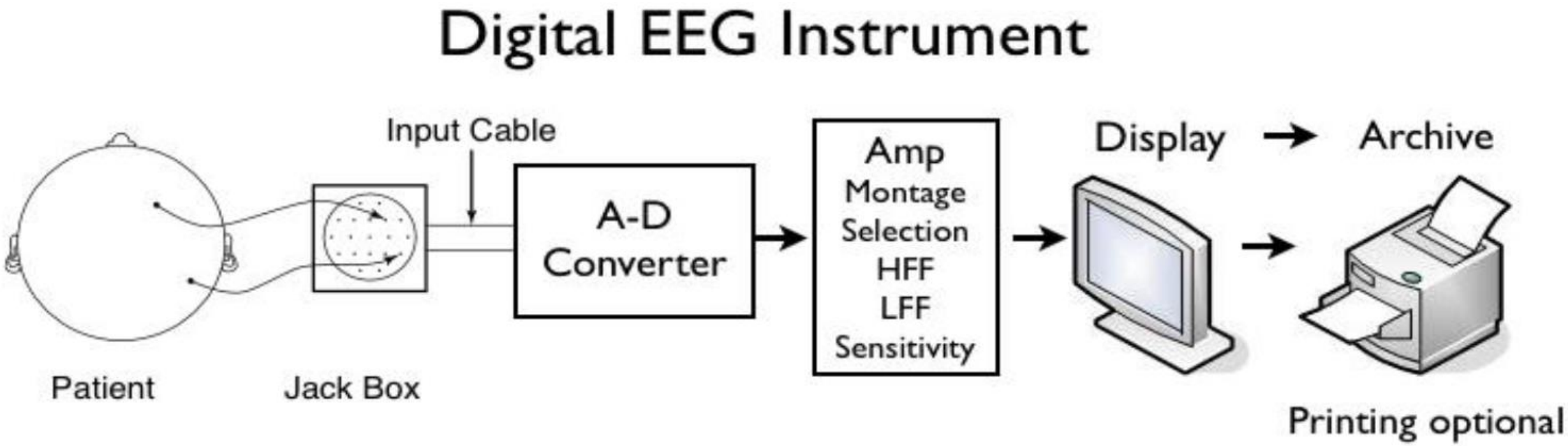
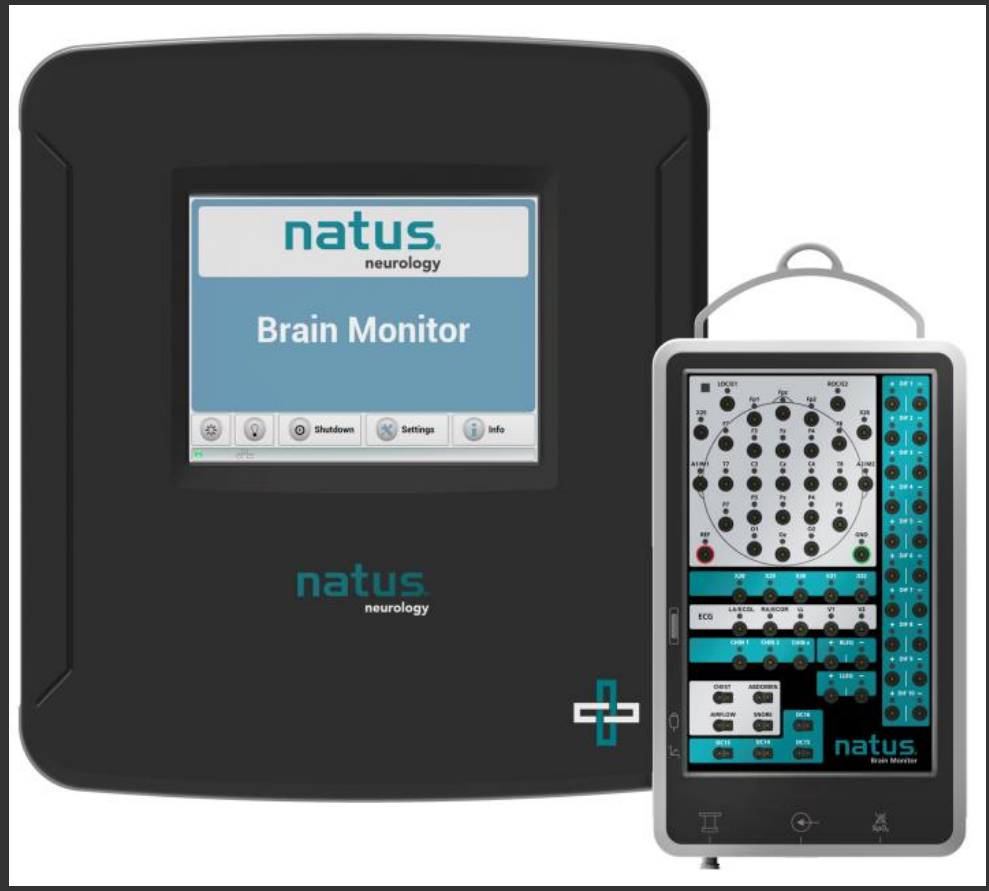
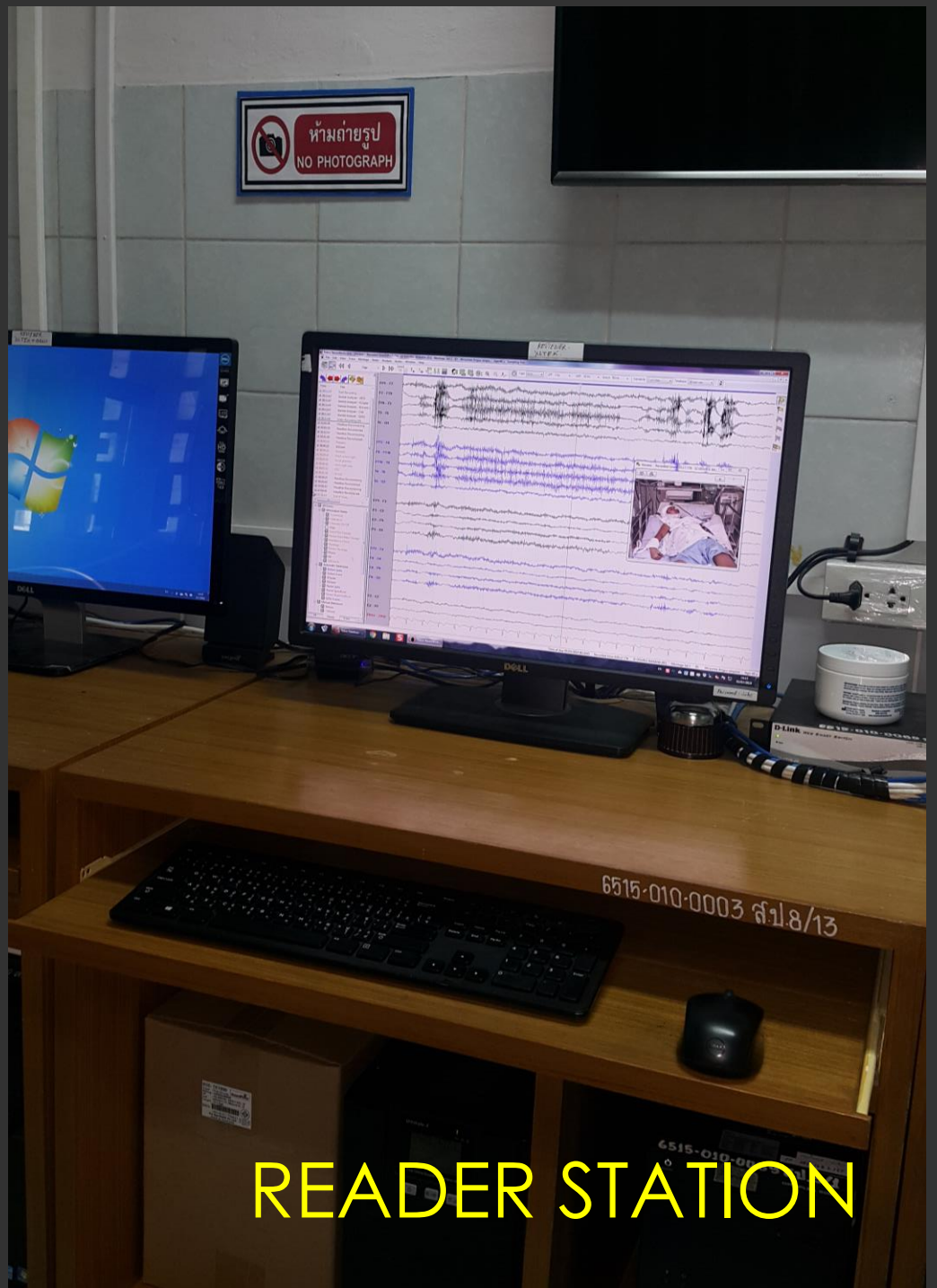
BLOCK DIAGRAM OF DIGITAL EEG INSTRUMENT



Natus Brain Monitor




ACQUISITION STATION


ห้ามถ่ายรูป
NO PHOTOGRAPH
READER STATION

10-20 scheme (according to new ACNS guidelines)

5-lead ECG

Head-cap

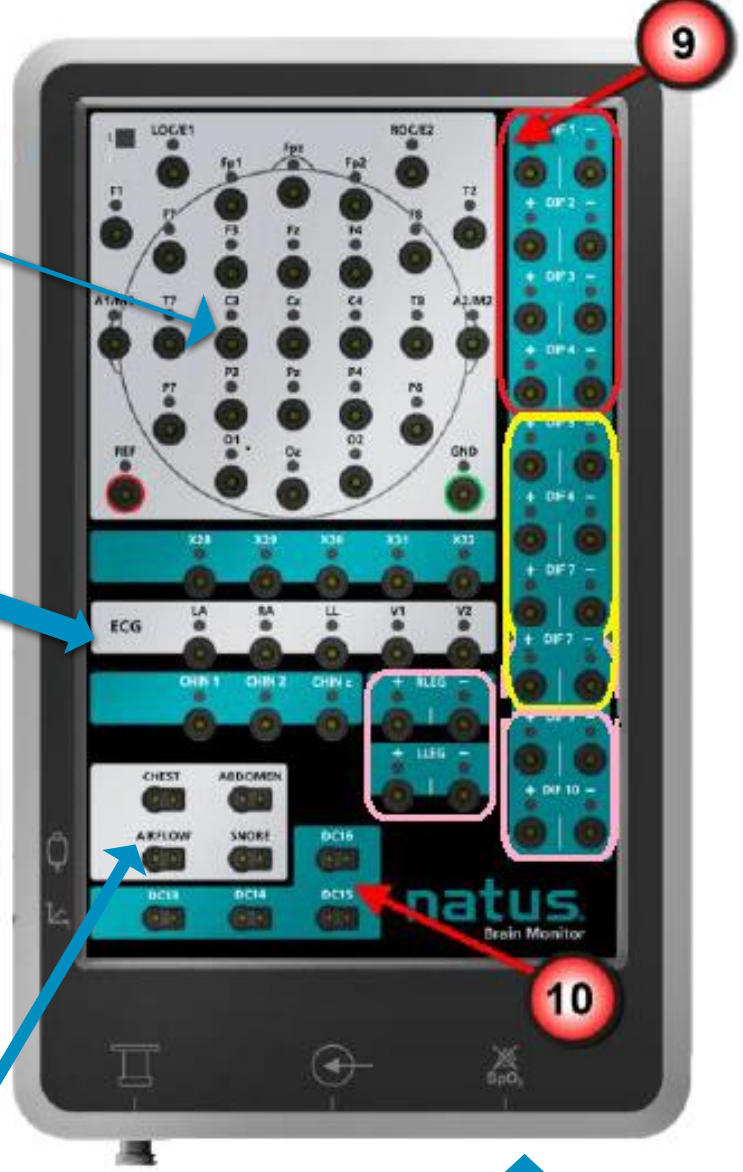
Event button

Body position

RIP effort belts and thermistor

Nasal Pressure

Oximetry sensor (finger probe)



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DIFFERENTIAL AMPLIFIER

- The differential amplifier amplifiers or magnifies differences in electrical potential while rejecting or canceling signals that are common at the two inputs.
- The characteristic of a differential amplifier to cancel like signals is called common mode rejection.

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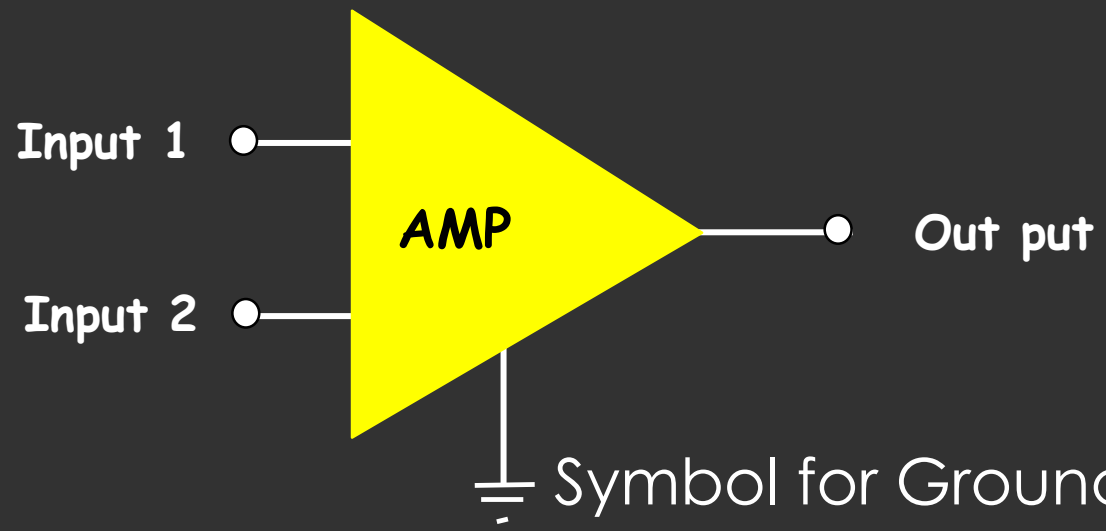
THIS IS THE SYMBOL FOR THE DIFFERENTIAL AMPLIFIER



Input 1 and Input 2 are often called
Grid 1
and
Grid 2

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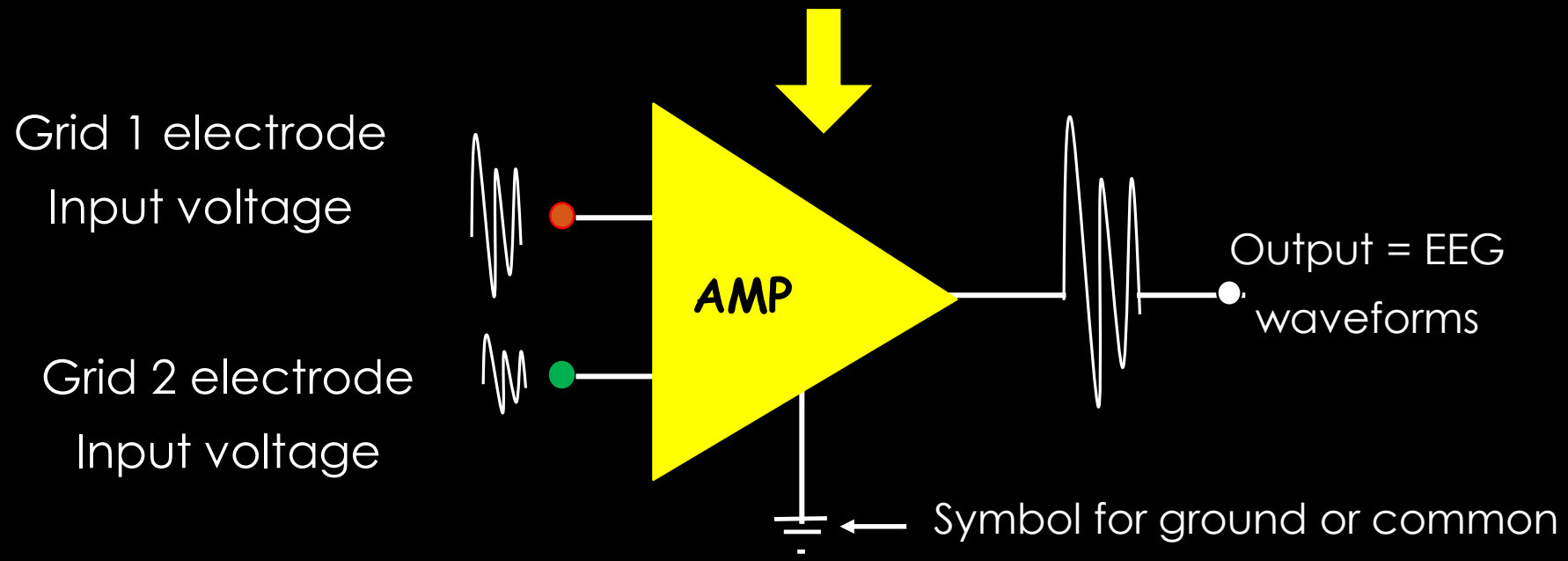
CHANNEL 1 IN EEG INSTRUMENT



A note about mathematics:
(Grid 1) – (Grid 2) = Output

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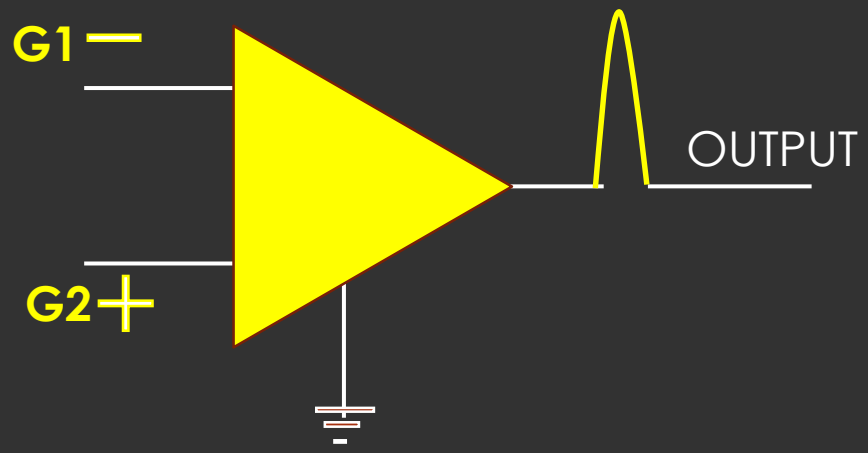
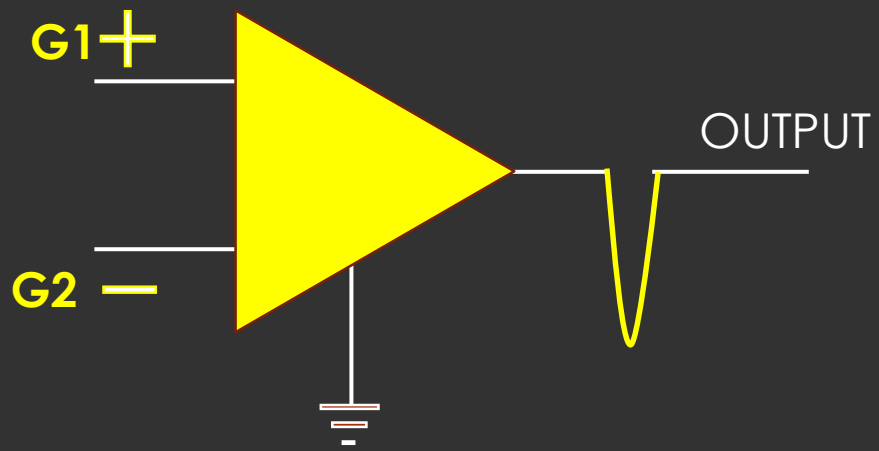
STANDARD POLARITY CONVENTION IN EEG



If Grid 1 is more negative
or less positive than Grid 2
then the deflection will be up



If Grid 2 is more negative
or less positive than Grid 1
then the deflection will be down

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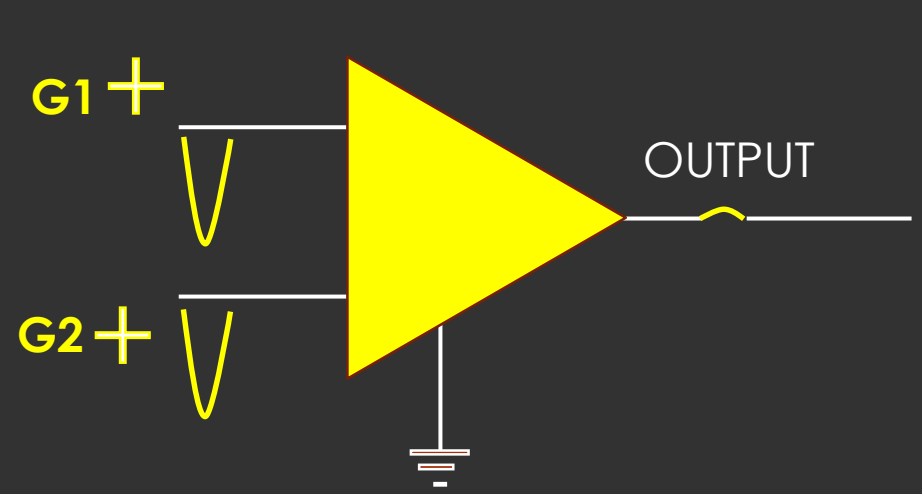
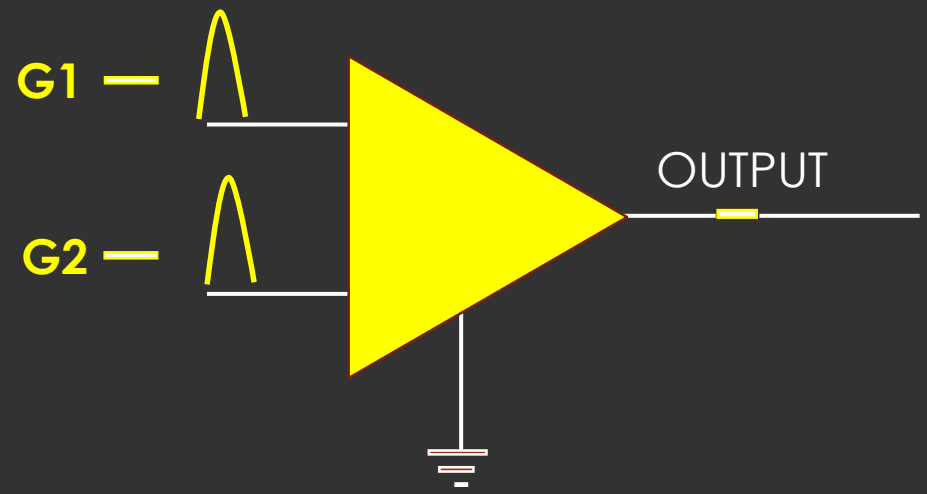
IN PHASE CANCELLATION





When the inputs are the same or close to the same, the output may be 0 or minimal. This is also sometimes called “equipotential” meaning equal to potential.

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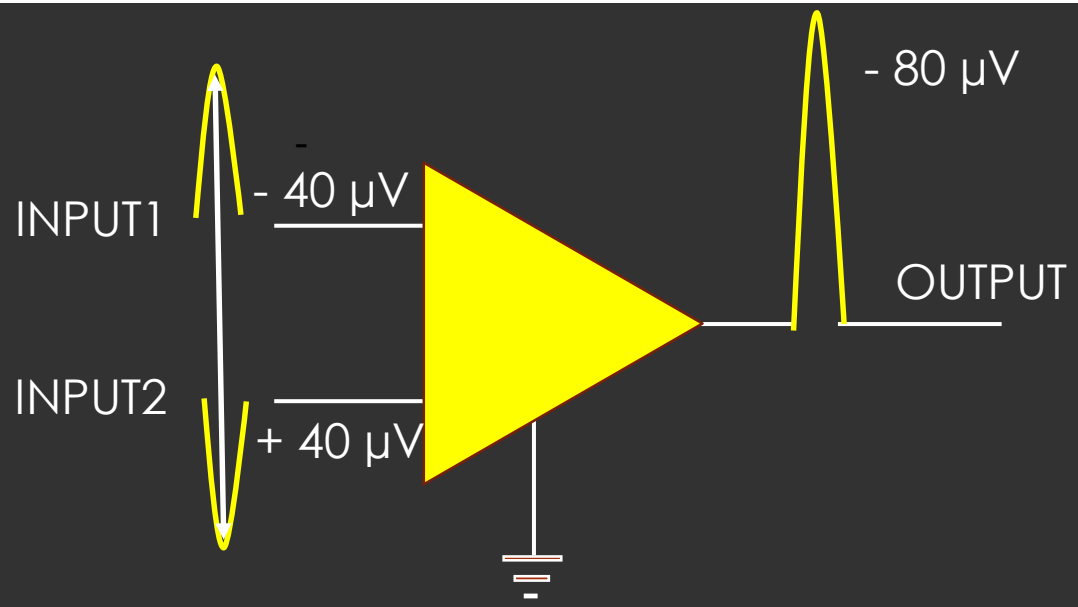
SUMMATION



When one input is positive and one negative or when the inputs are very difference.

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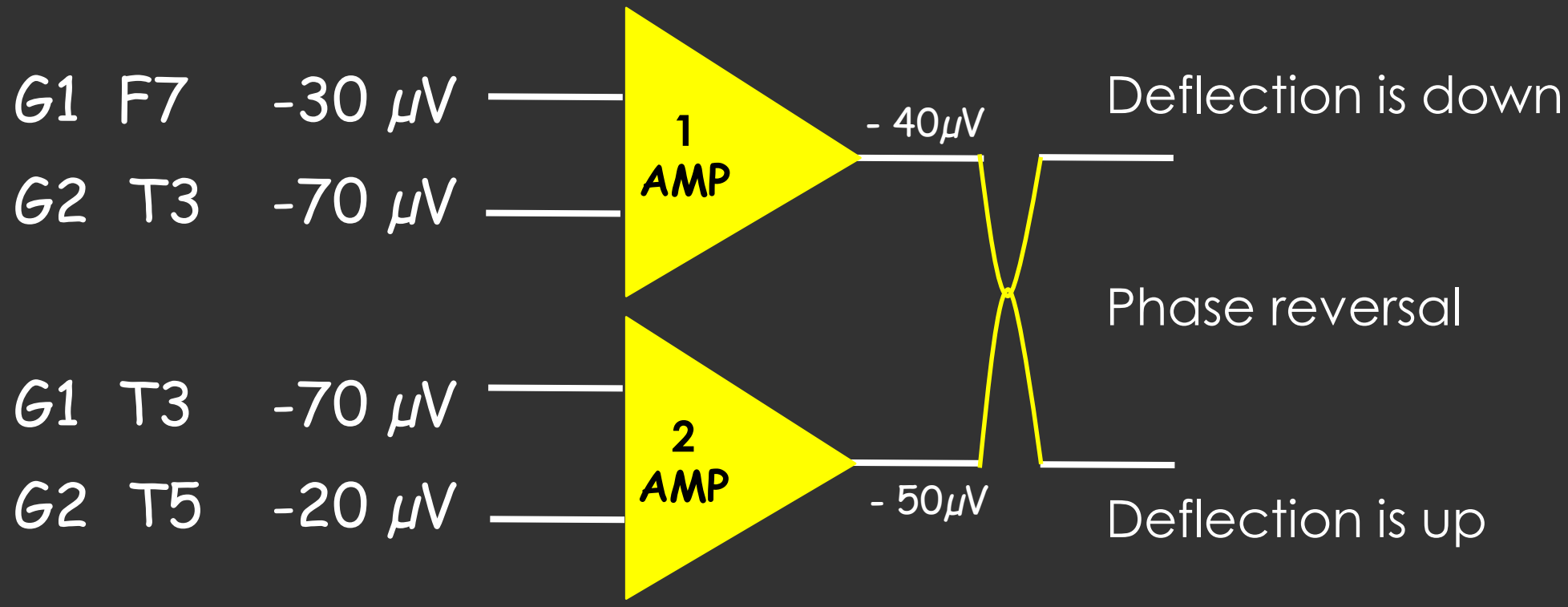
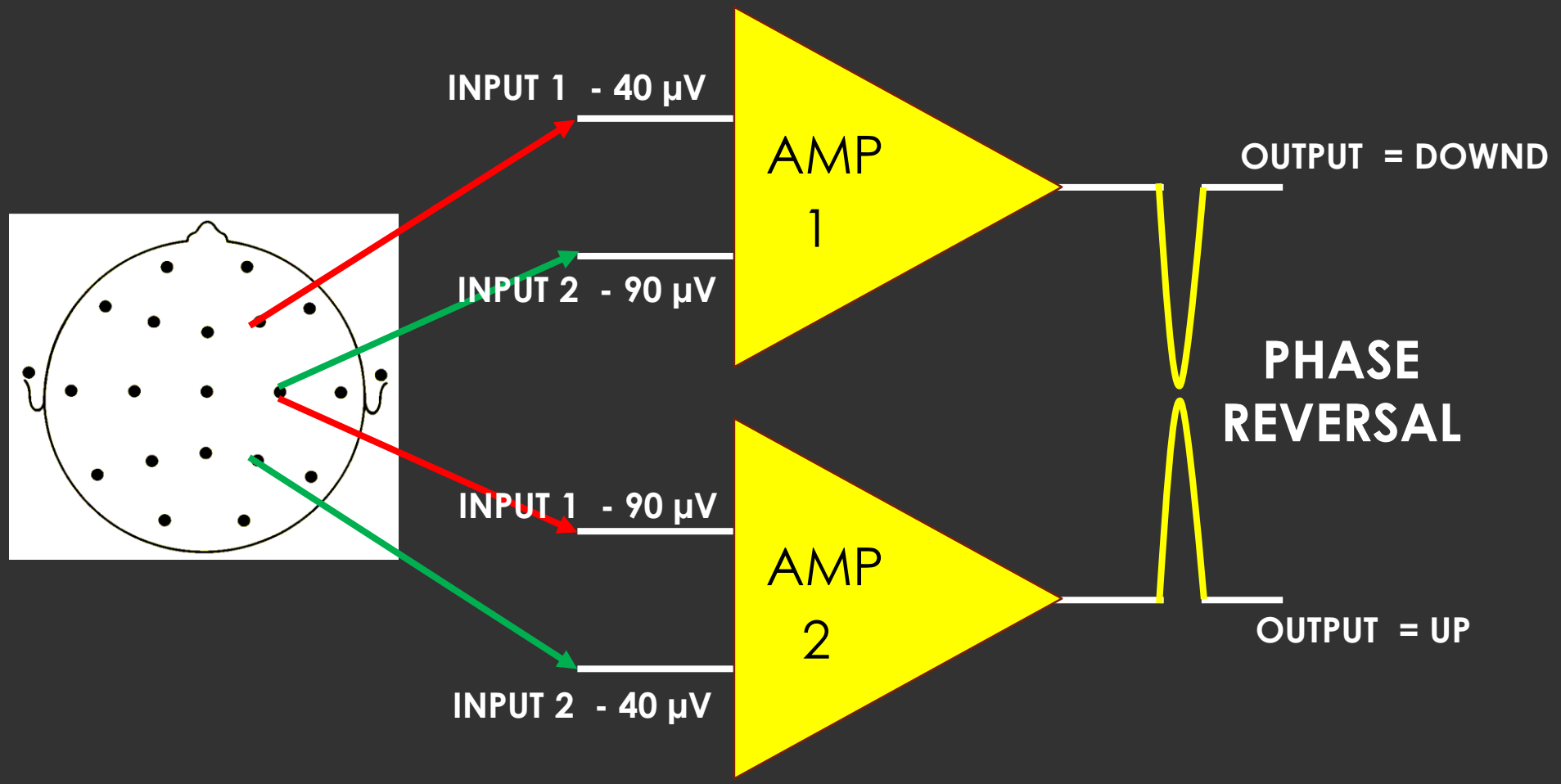
LOCALIZING USING - PHASE REVERSAL

IN THIS EXAMPLE, THE DEFLECTION IS DOWN IN THE FIRST CHANNEL BECAUSE GRID2 IS MORE NEGATIVE THAN GRID1.

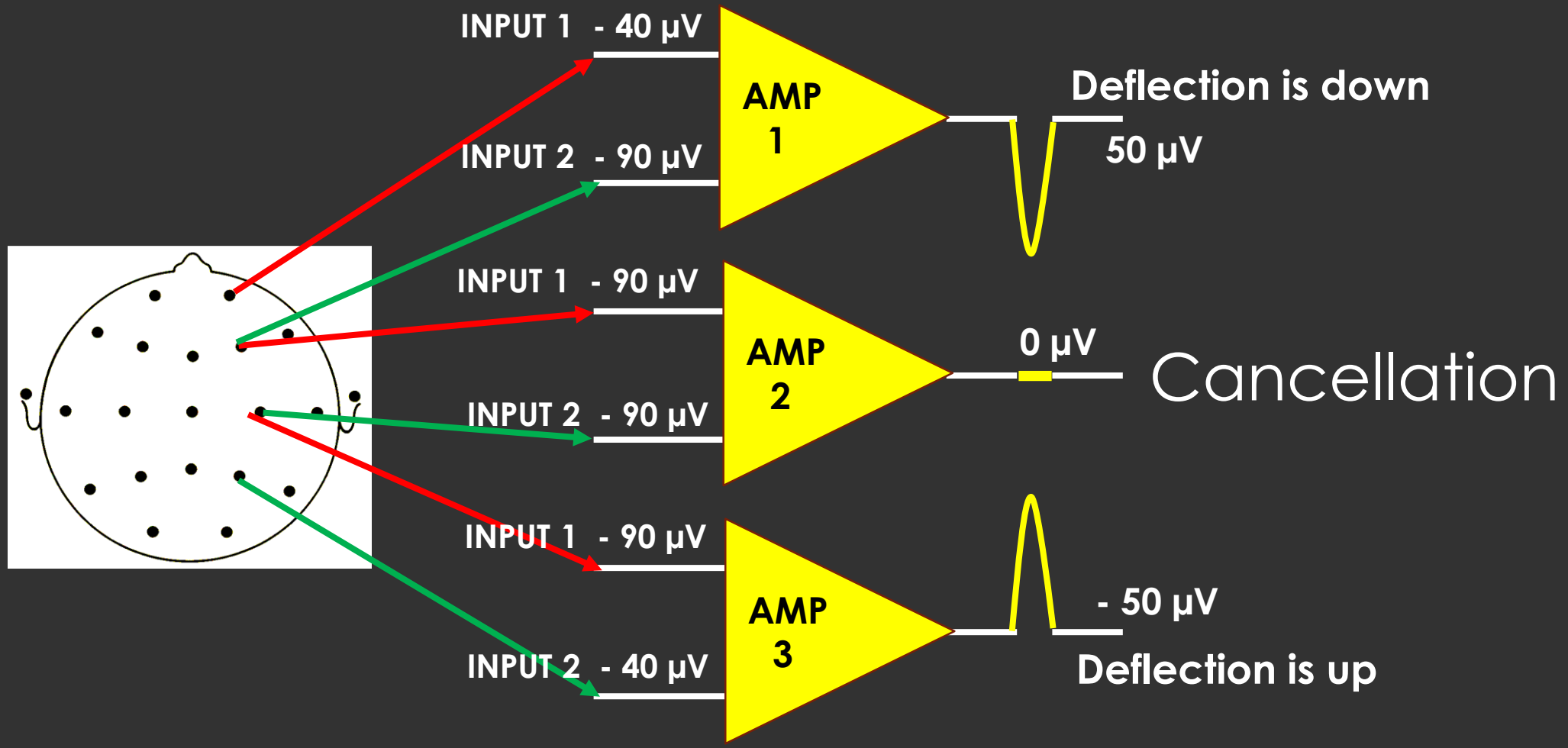


In the second channel, the deflection is up because Grid1 is more negative than Grid2.

BIPOLAR MONTAGES LOCALIZE ACTIVITY BY PHASE REVERSAL AND END OF CHAIN ACTIVITY

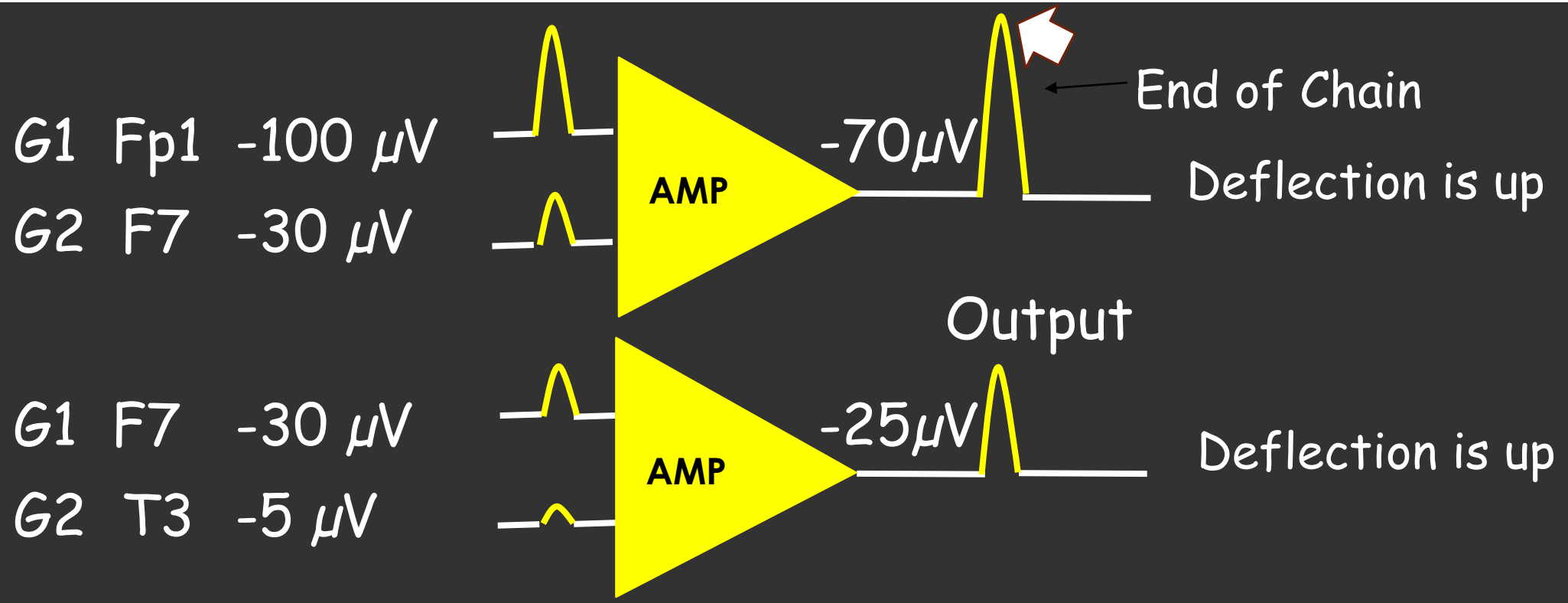


IN THIS EXAMPLE, THE DEFLECTION IS DOWN IN THE FIRST CHANNEL BECAUSE INPUT2 IS MORE NEGATIVE THAN INPUT1.
IN THE IN THE SECOND CHANNEL, INPUTS ARE THE SAME, THE OUTPUT IS 0.
THE THIRD CHANNEL, THE DEFLECTION IS UP BECAUSE INPUT1 IS MORE NEGATIVE THAN INPUT2.



LOCALIZING USING - "END OF CHAIN"

IN THIS EXAMPLE, THE DEFLECTION IS UP IN THE FIRST CHANNEL BECAUSE GRID1 IS MORE NEGATIVE THAN GRID2.



In the second channel, the deflection is up because Grid1 is more negative than Grid2.

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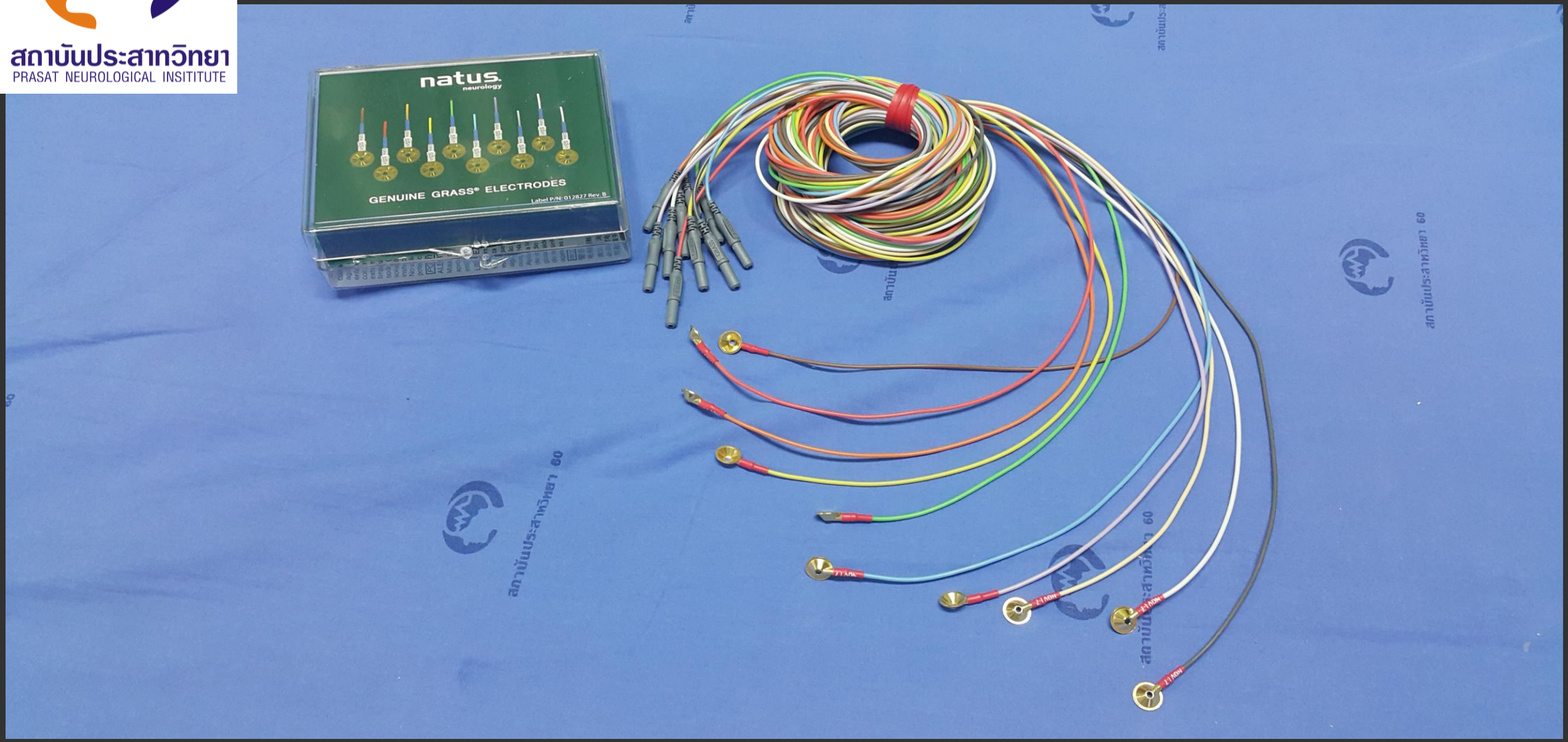
SCALP ELECTODE



Color Code	Left Hemisphere	Midline	Right Hemisphere
Brown	Fp1		Fp2
Red	F3	Fz	F4
Blue	F7		F8
White	FT9		FT10
Orange	C3	Cz	C4
Violet	T3		T4
Gray	T5		T6
Yellow	P3	Pz	P4
Green	O1		O2
Light Grey	A1		A2
Blue =	ECG L	=	ECG R
Green =	GND		
Light Grey =	REF	Brown =	REF
Light Grey =	EMG L	White =	EMG R

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MONTAGE EDITOR

Electrode Set

- All of Electrodes

Recording Montage

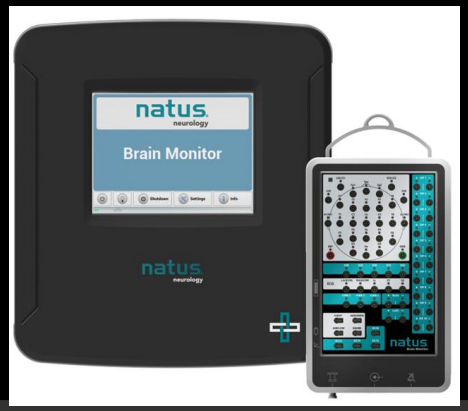
- Scalp EEG
- ECoG
- Physio

Display Montages

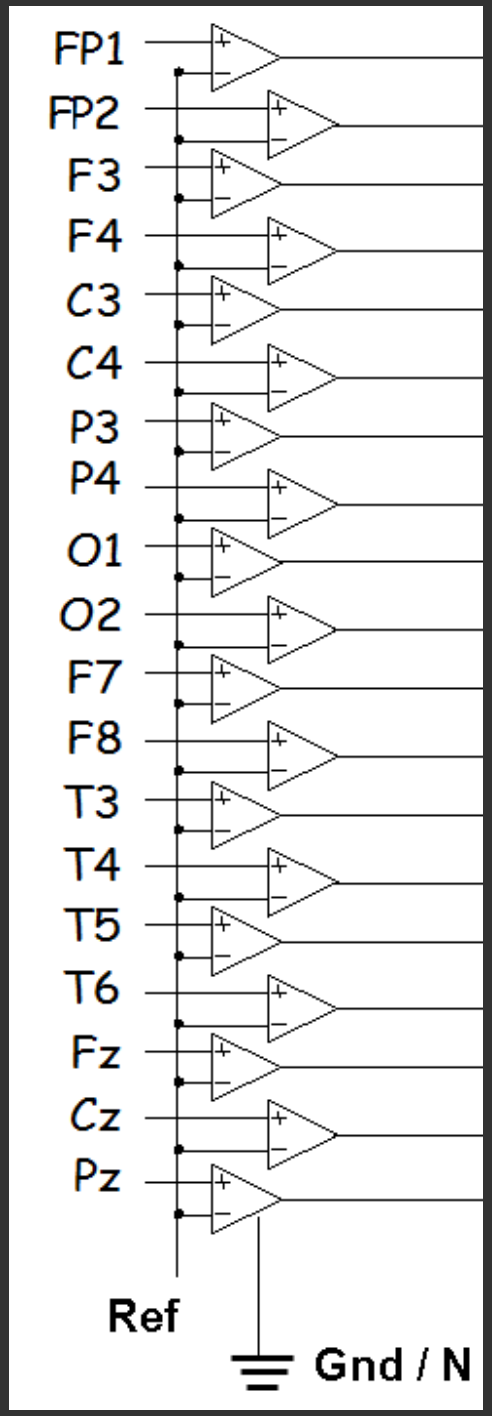
- Bipolar Montage
- Referential Montage

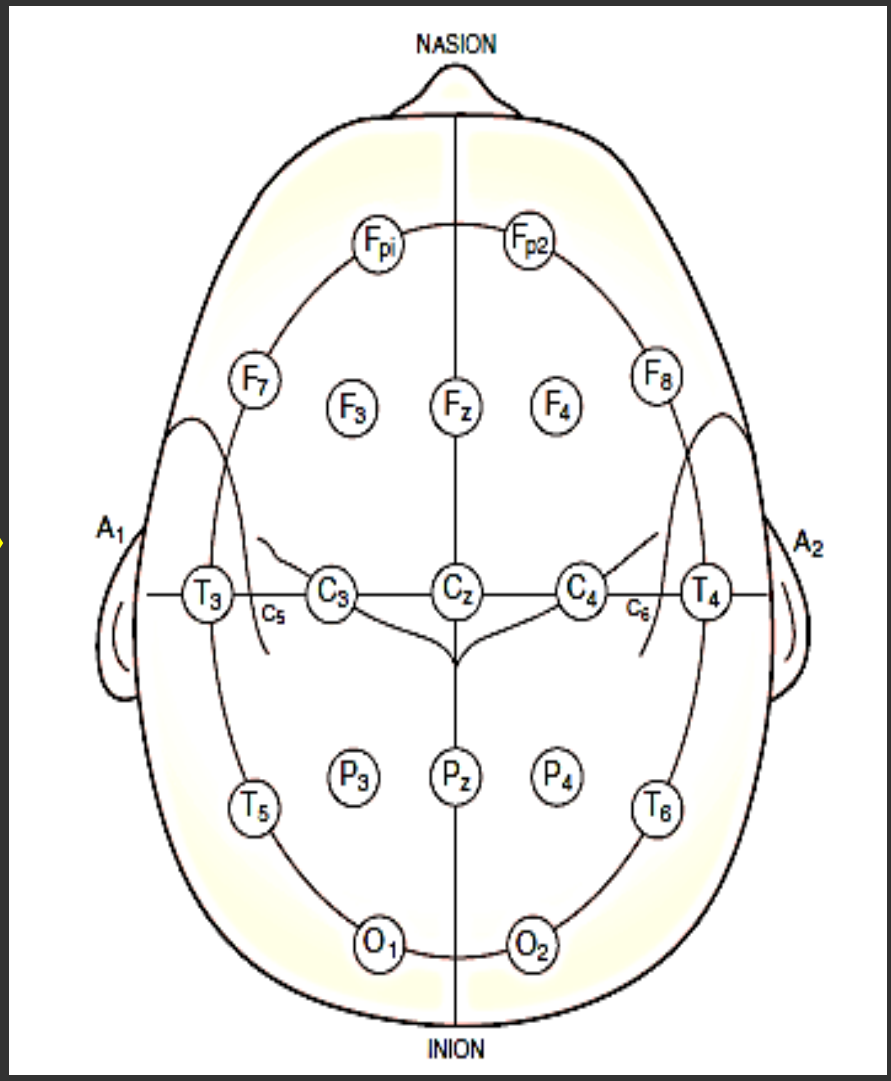
Electrode Set

EEG32U	Trex HD	Brain Monitor	EMU40EX	QUANTUM
EEG	EEG Sleep	EEG Sleep	EEG	EEG Sleep
32 CH	32 CH	64 CH	40 CH	128, 256 CH




9
10
natus
Brain Monitor


FP1
FP2
F3
F4
C3
C4
P3
P4
O1
O2
F7
F8
T3
T4
T5
T6
Fz
Cz
Pz
Ref
Gnd / N


NASION
INION
A1
A2
Fpi
Fp2
F7
F3
Fz
F4
F8
T3
C5
C3
Cz
C4
C6
T4
T5
P3
Pz
P4
T6
O1
O2

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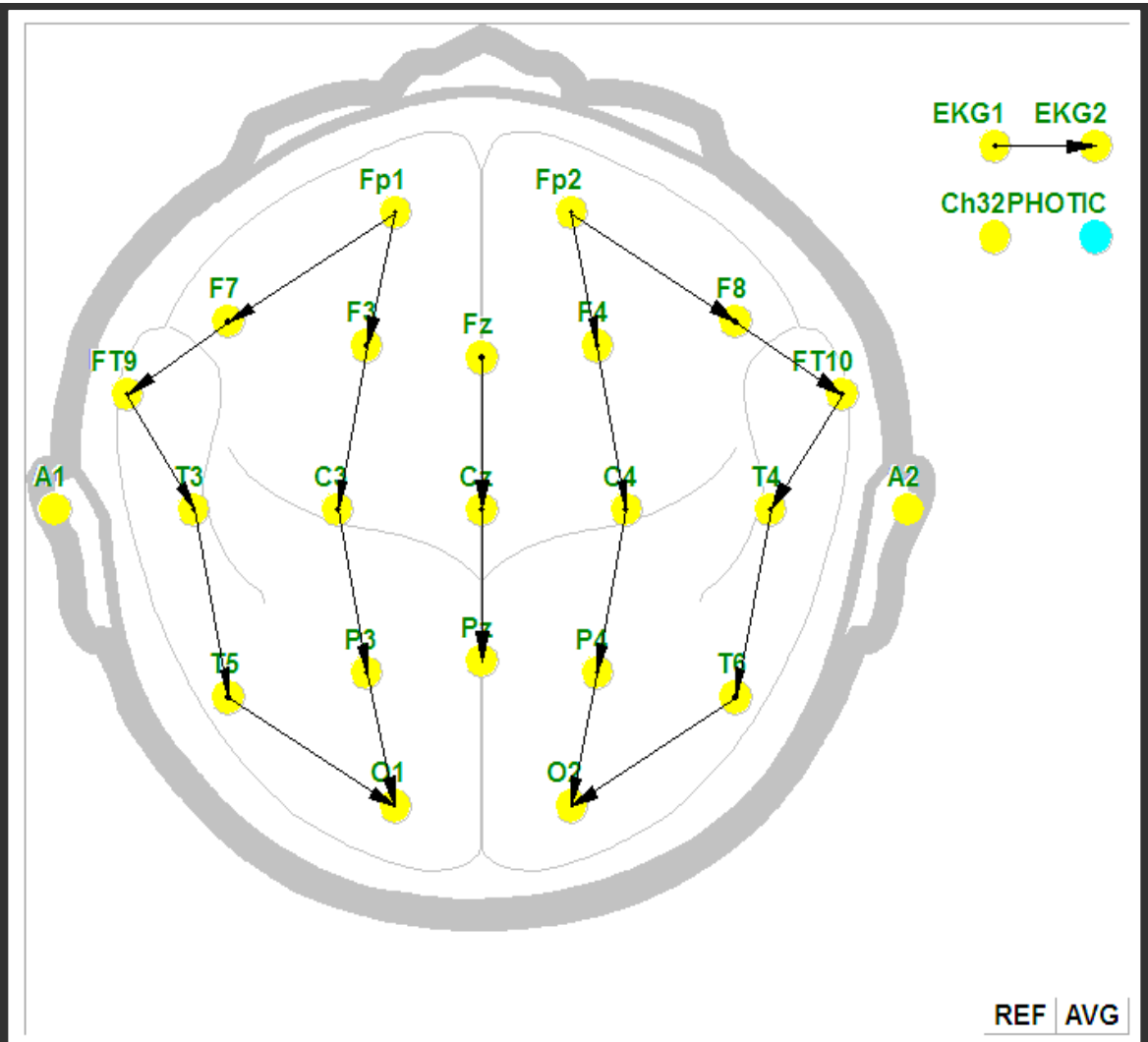
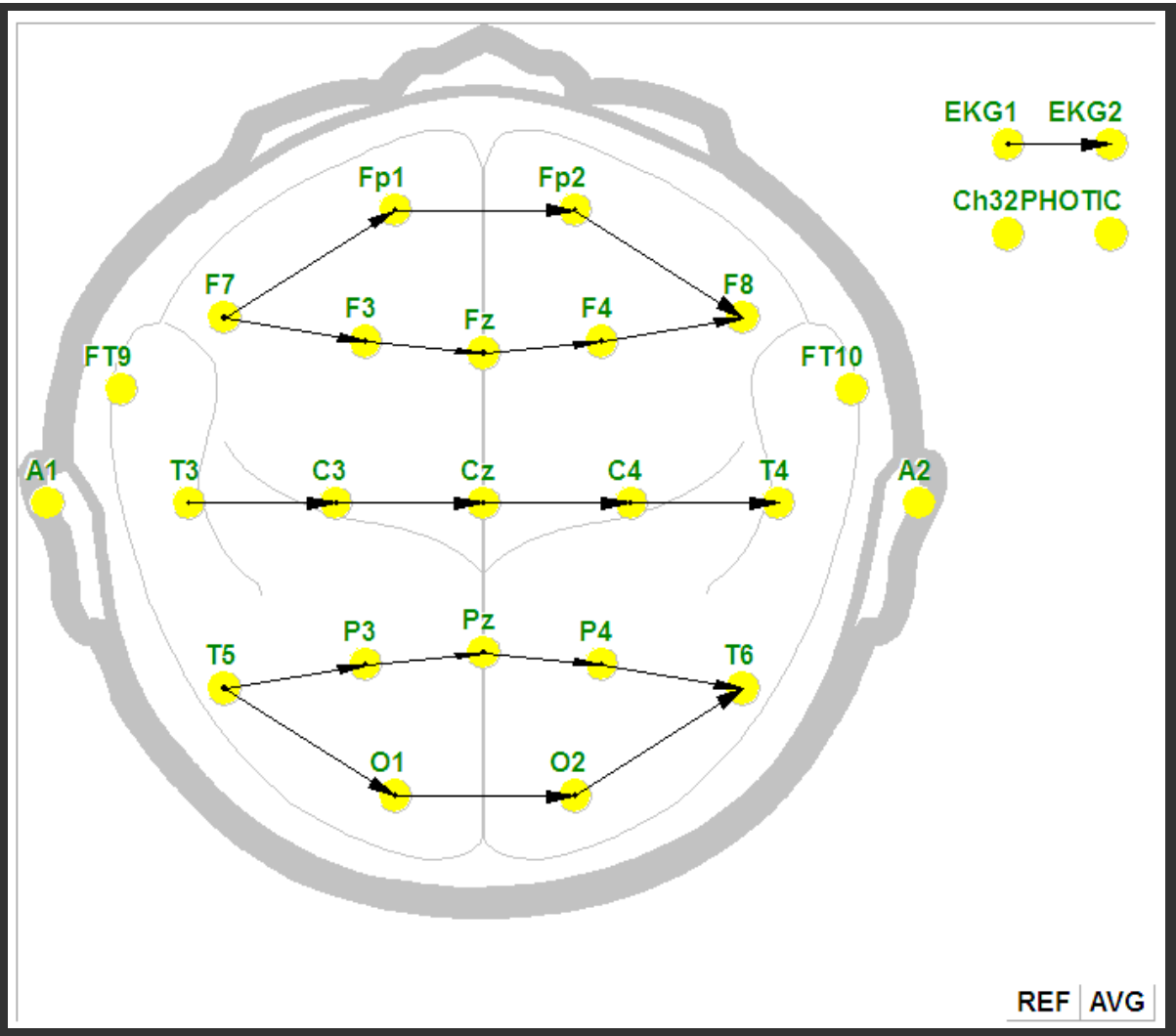
DISPLAY MONTAGES

- Bipolar Montages
  - Longitudinal Bipolar Montage
  - Transverse Bipolar Montage
  - Circumferential Bipolar Montage
- Referential Montages
  - Ipsilateral Ear Referential Montage
  - Contralateral Ear Referential Montage
  - Average Referential Montage

LONGITUDINAL BIPOLAR MONTAGE



TRANSVERSE BIPOLAR MONTAGE



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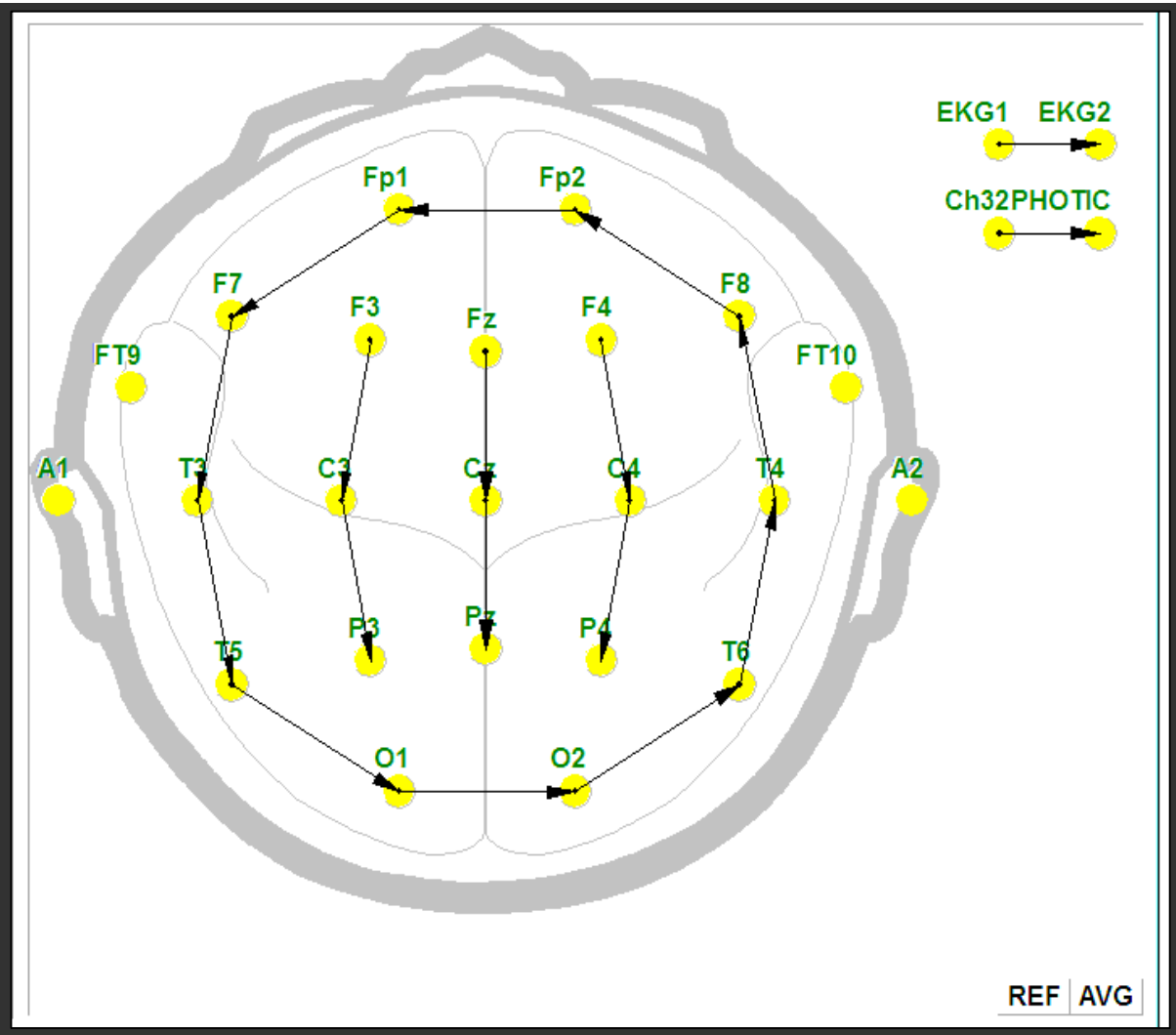
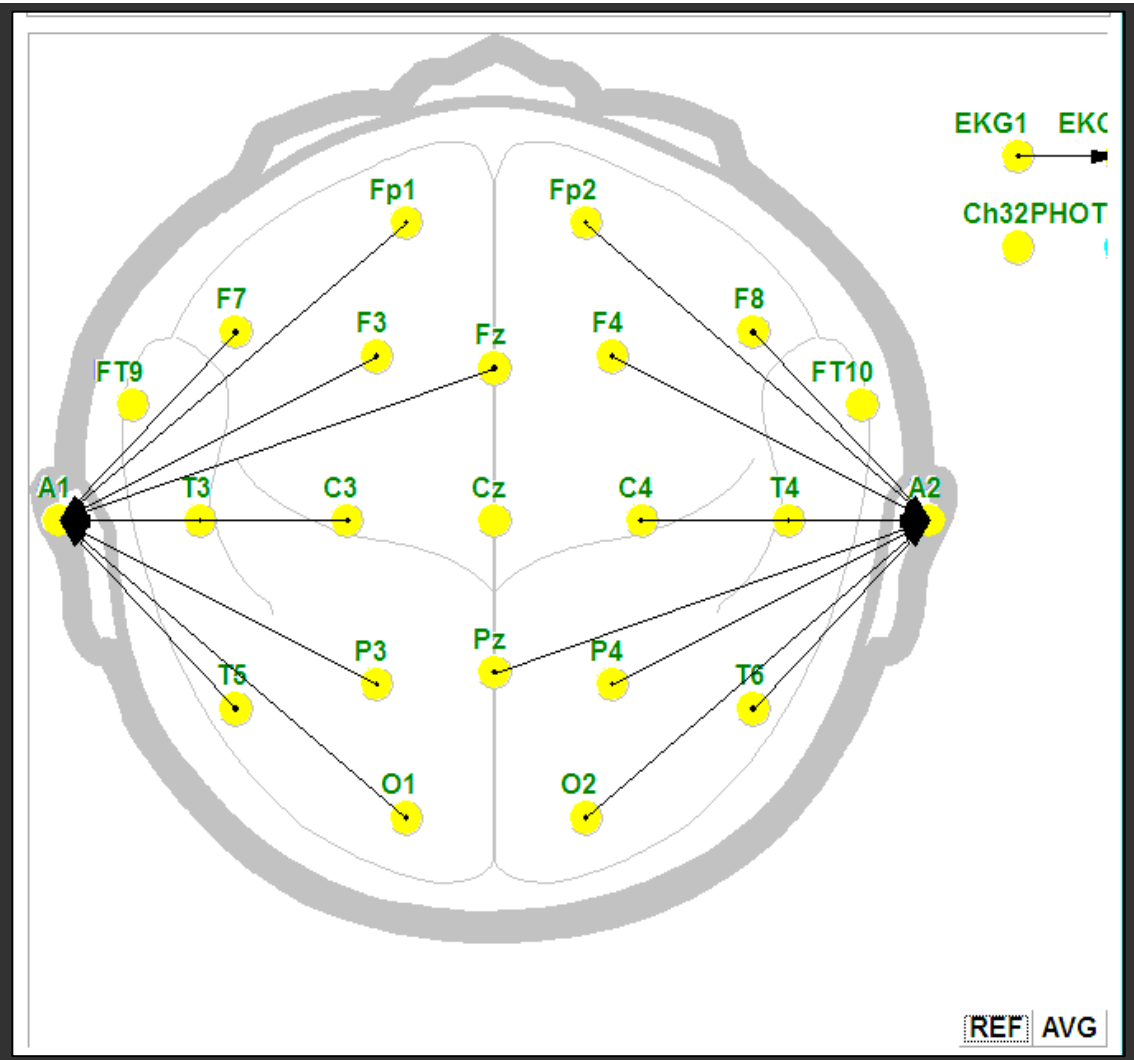
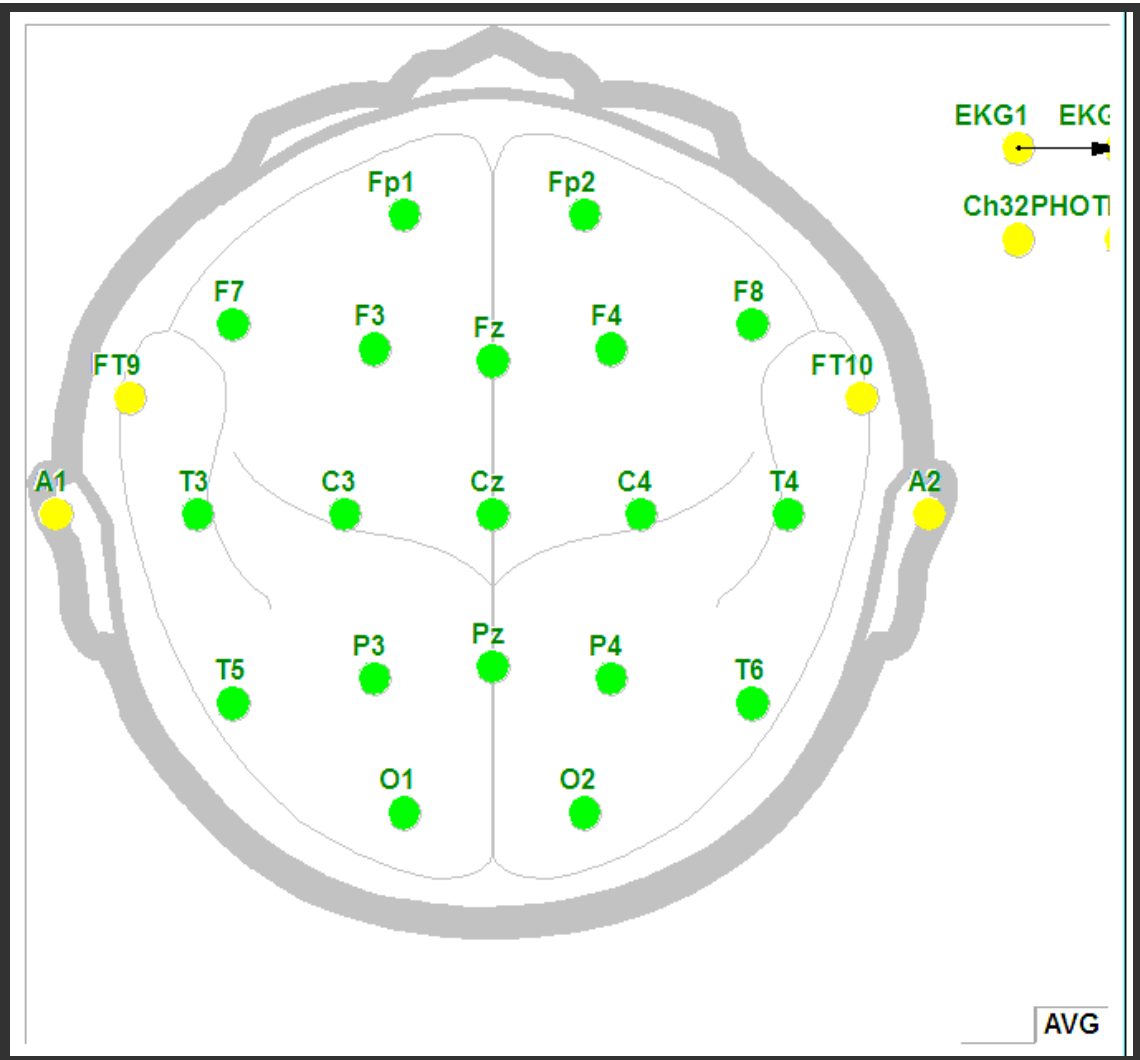
CIRCUMFERENTIAL BIPOLAR MONTAGE



IPSILATERAL EAR REFERENTIAL MONTAGE



AVERAGE REFERENTIAL MONTAGE



LOCALIZATION OF POTENTIAL IN A BIPOLAR MONTAGE

- In a bipolar montage localization is accomplished by identification of reversal polarity.
  - Potential is present in a single electrode
  - Potential present equally at two electrodes
  - Potential at two electrodes, unequally involved
  - Potential at the end of the chain
  - Potential at the end of the chain and adjacent electrode

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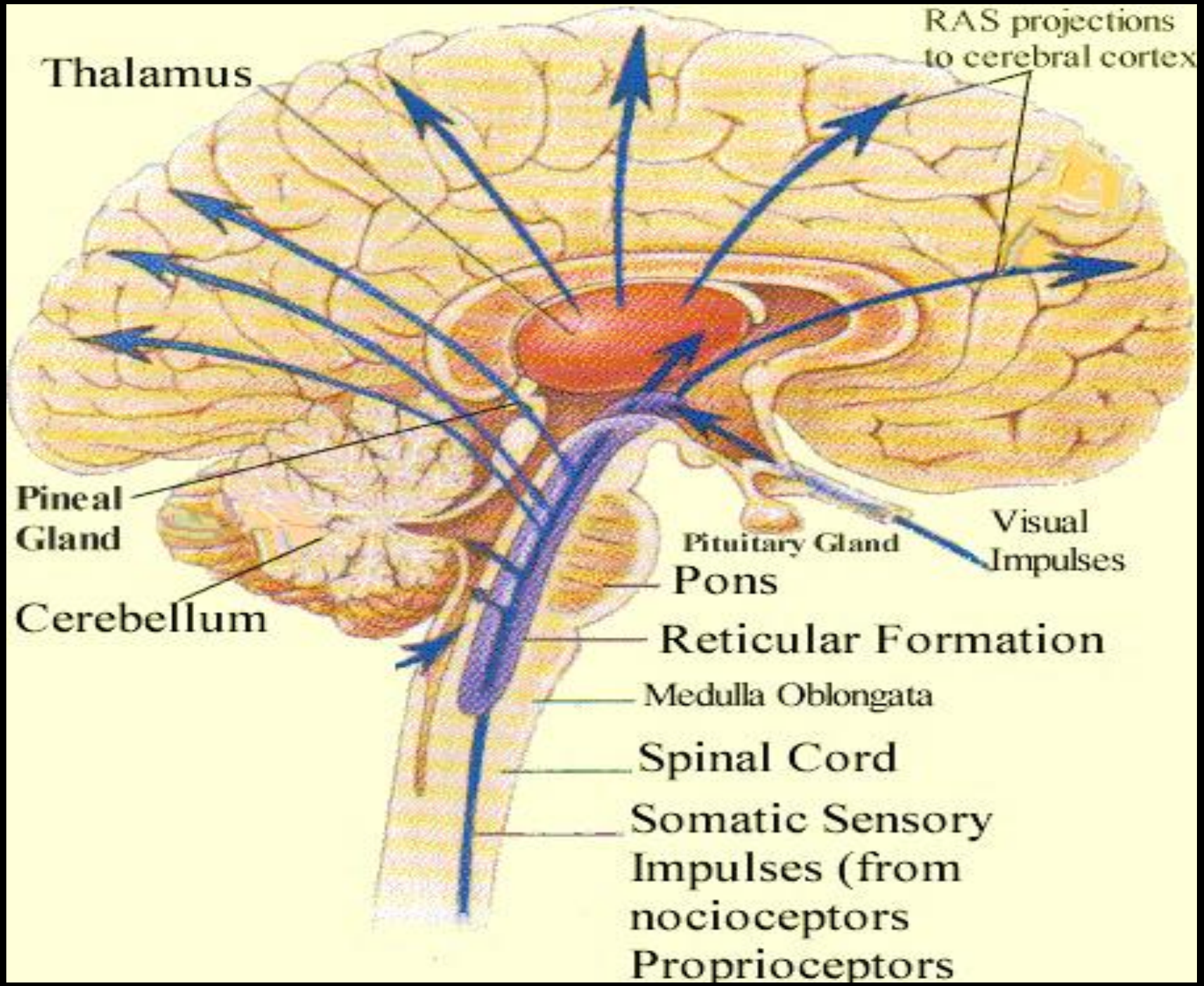
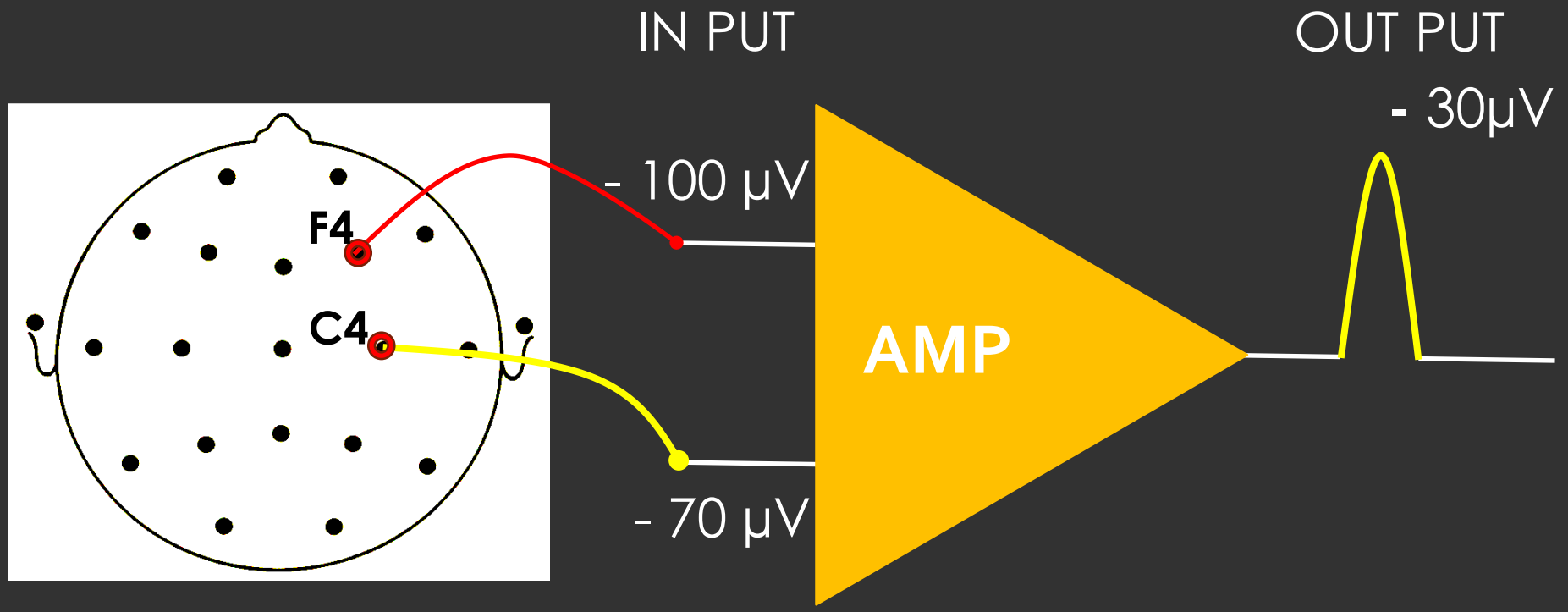
LOCALIZATION OF POTENTIAL IN A REFERENTIAL MONTAGE

- Localization in a referential montage is dependent on amplitude, assuming the presence of a neutral reference.
- The channel containing the highest amplitude will represent the location at the center of the field.


RAS projections
to cerebral cortex
Thalamus
Pineal
Gland
Cerebellum
Pituitary Gland
Visual
Impulses
Pons
Reticular Formation
Medulla Oblongata
Spinal Cord
Somatic Sensory
Impulses (from
nocioceptors
Proprioceptors

EEG IS SURFACE NEGATIVE



[Input1 – Input2] = Output
[(-100 μV) – (-70 μV)] = - 30 μV

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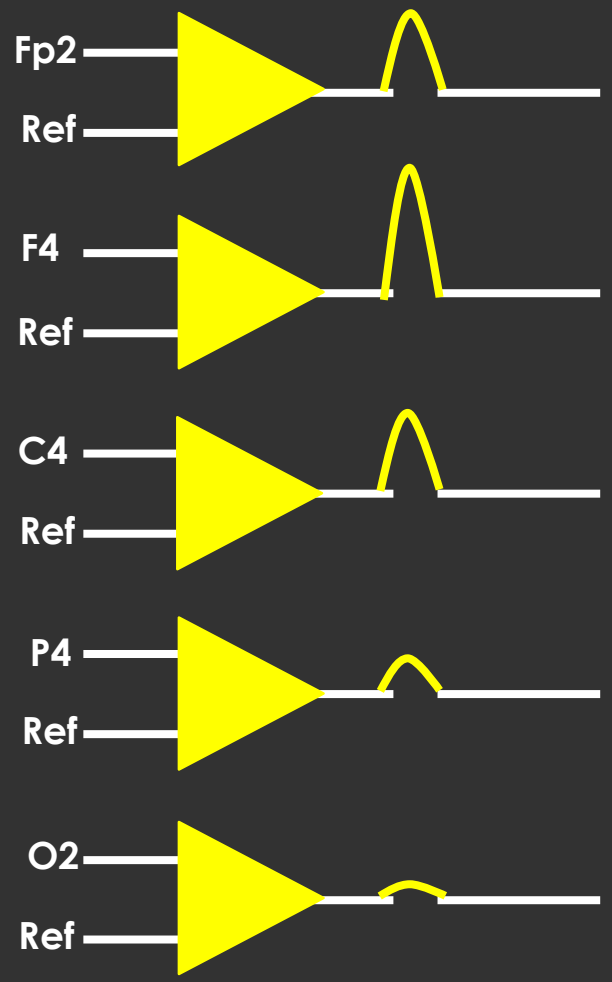
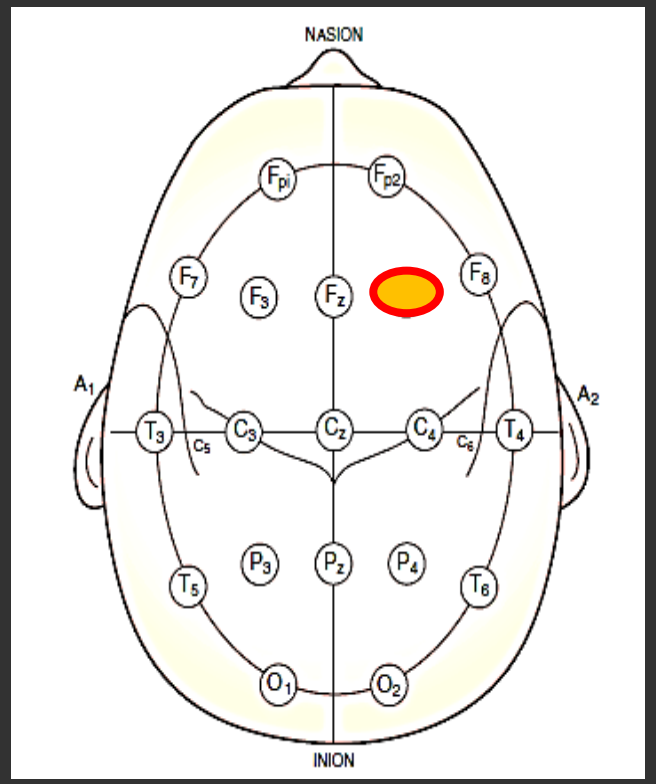
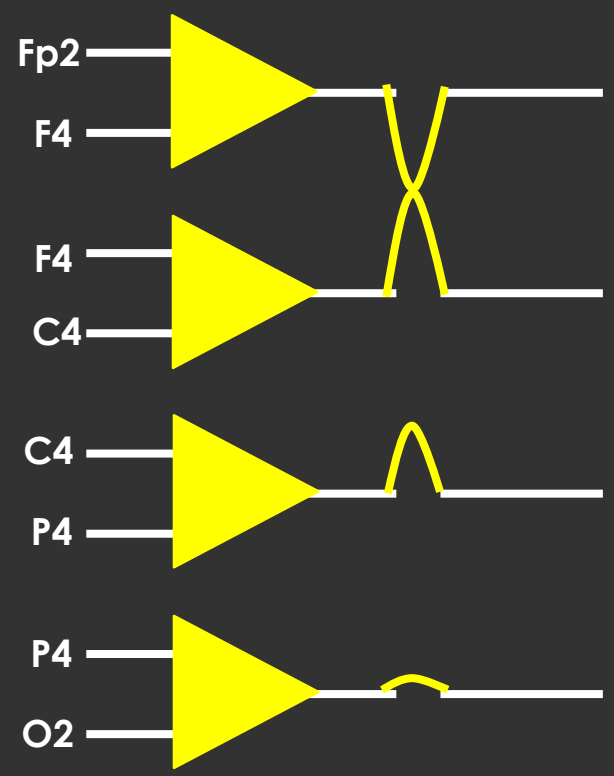
POTENTIAL IS PRESENT IN A SINGLE ELECTRODE







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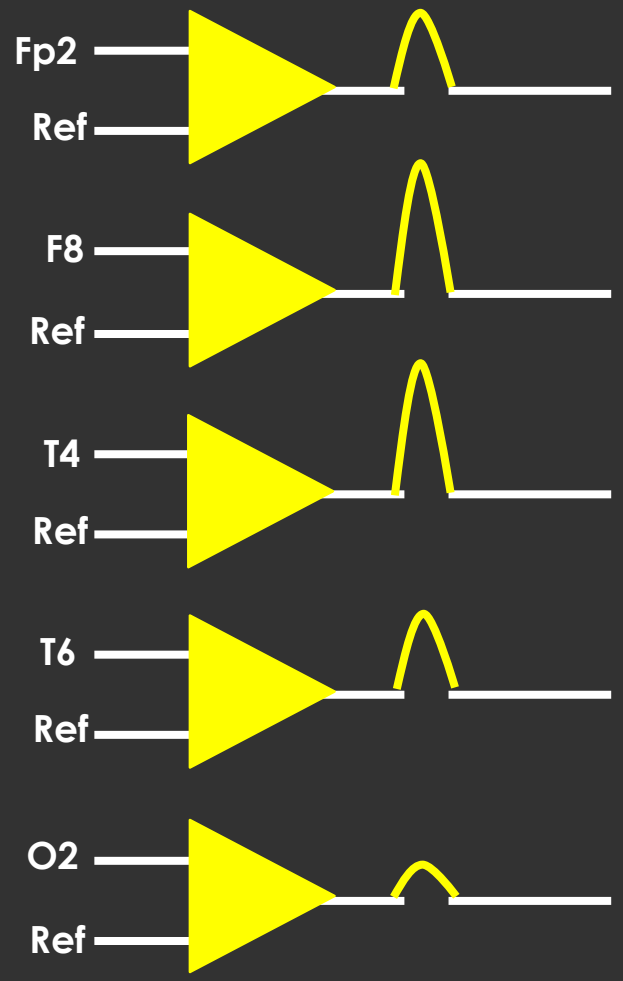
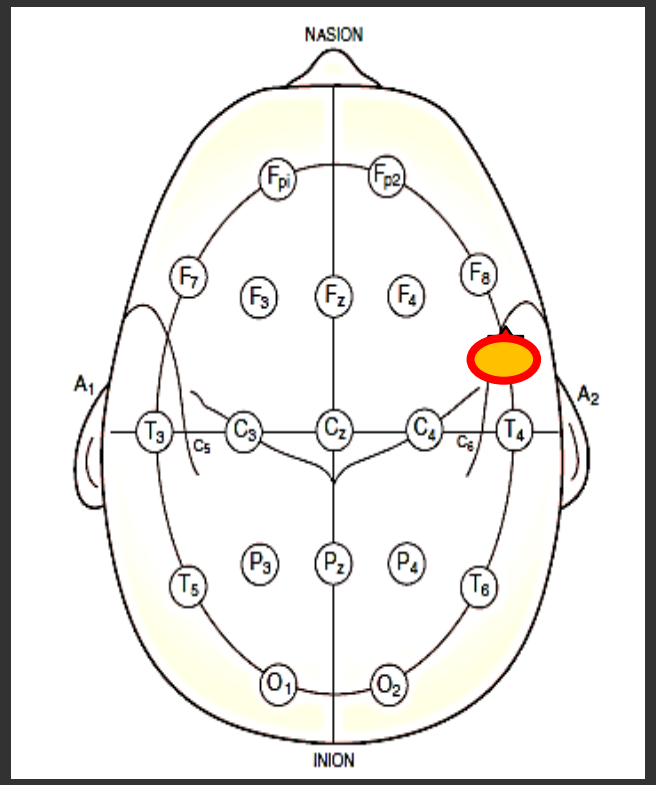
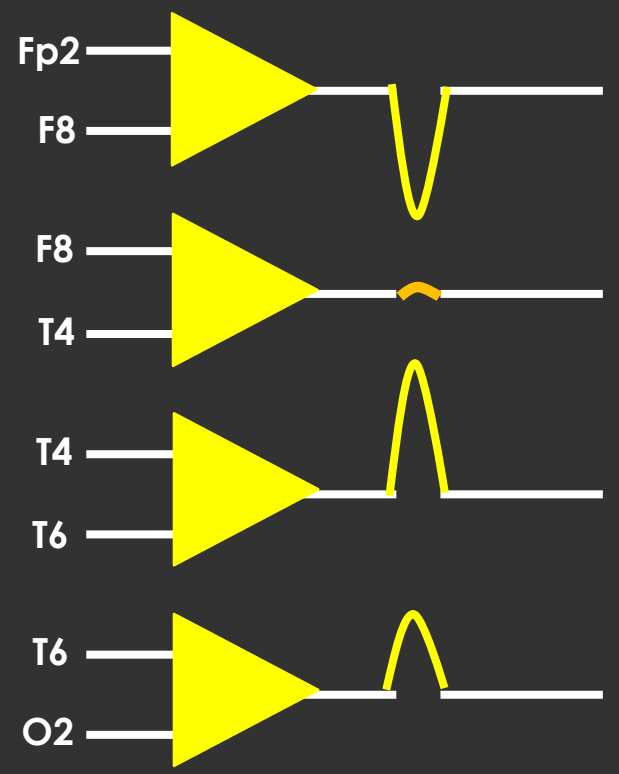
POTENTIAL PRESENT EQUALLY AT TWO ELECTRODES







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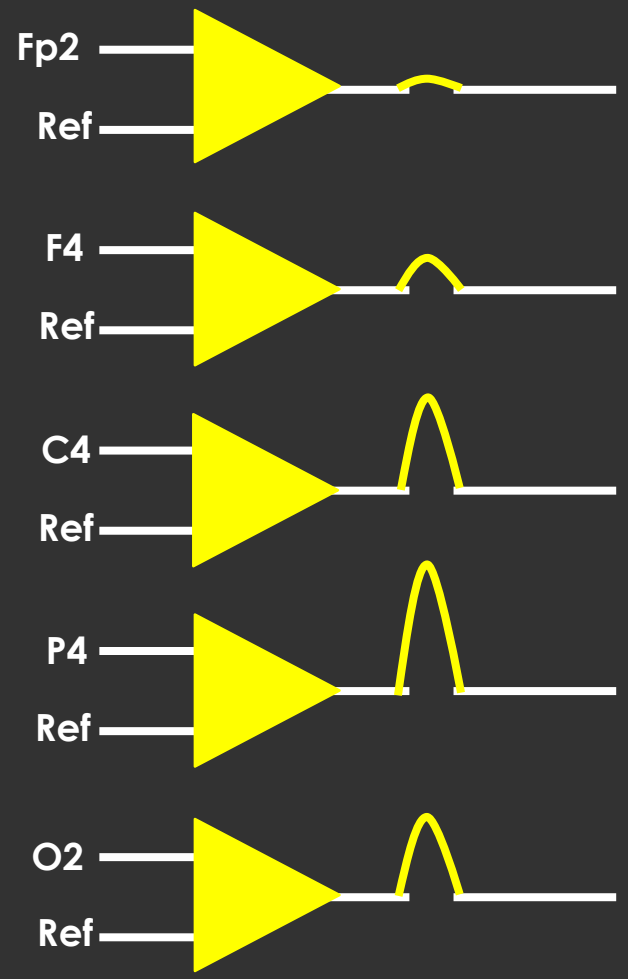
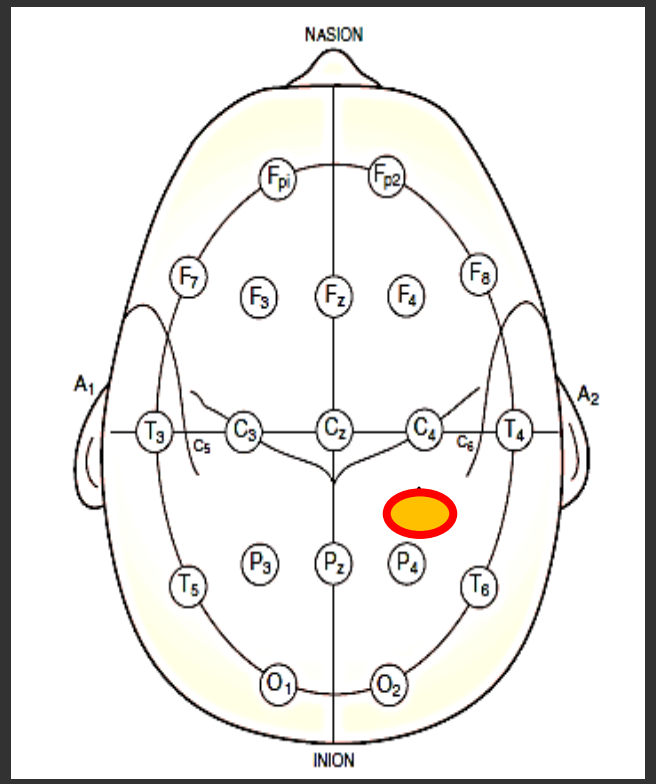
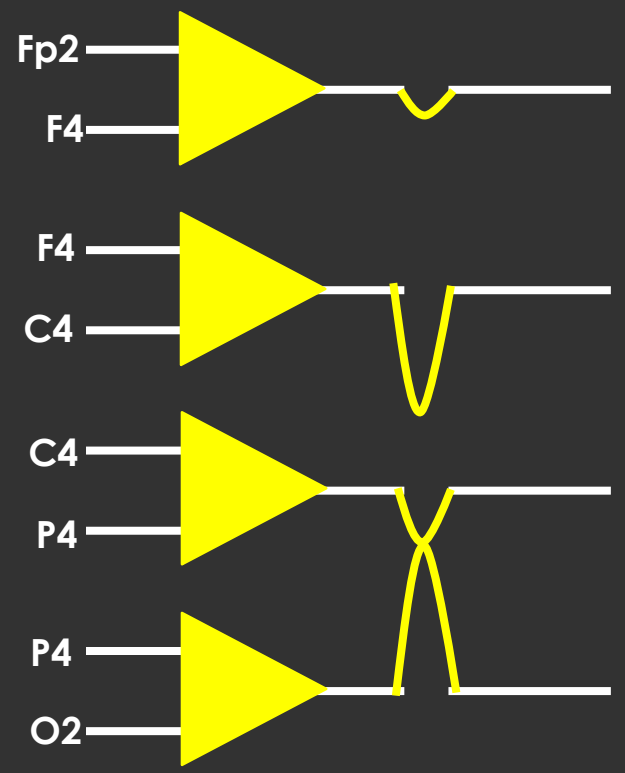
POTENTIAL AT TWO ELECTRODES, UNEQUALLY INVOLVED







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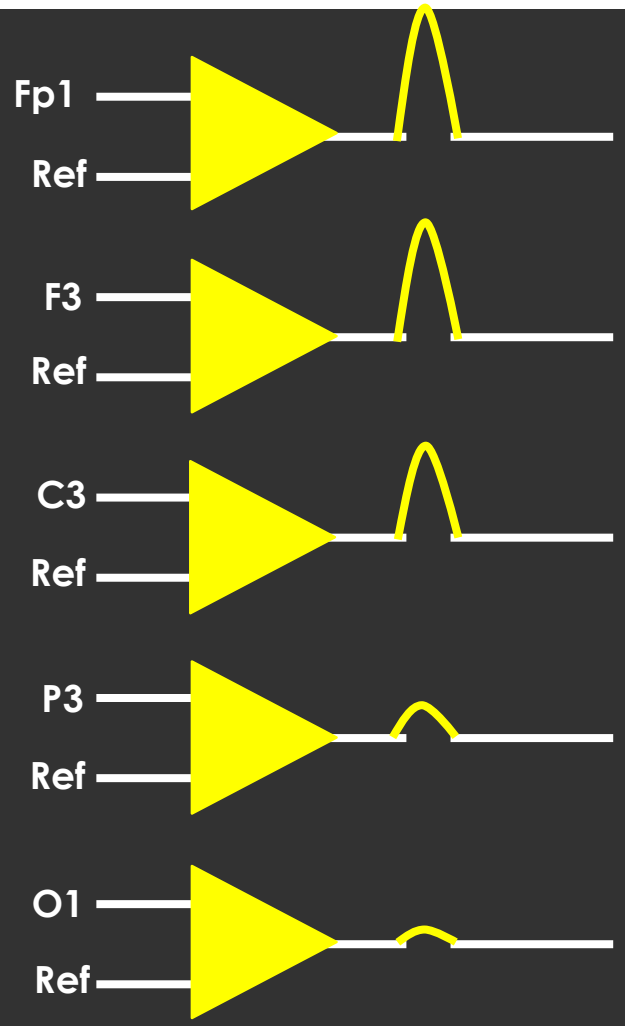
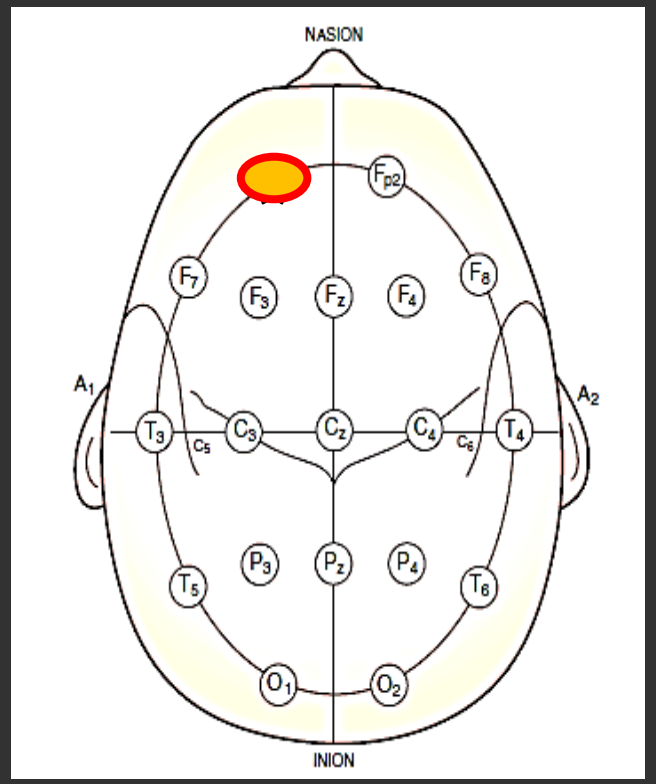
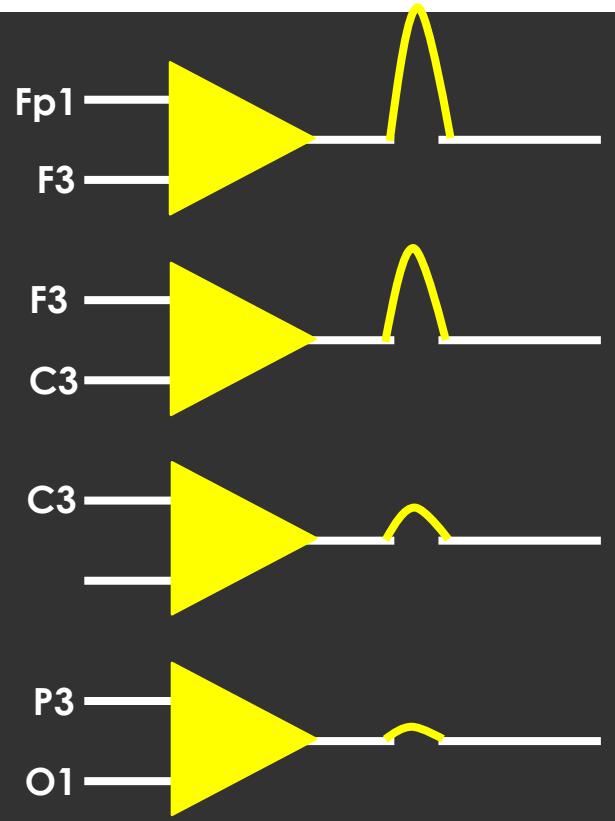
POTENTENTIAL AT THE END OF THE CHAIN







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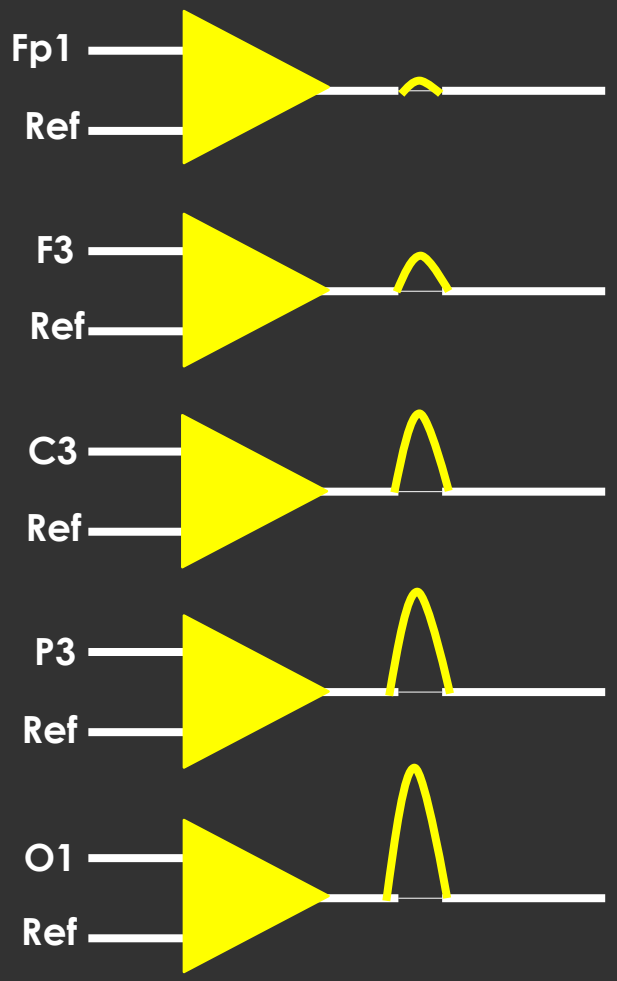
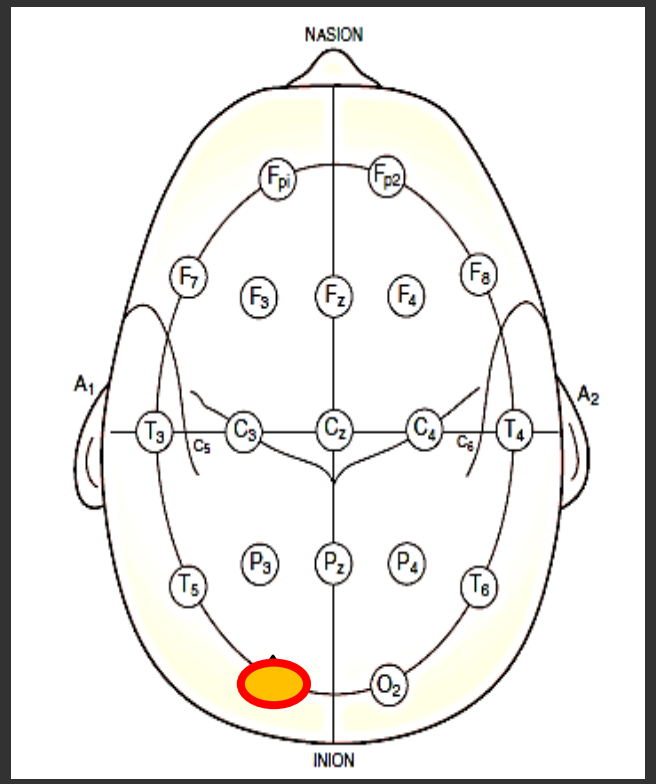
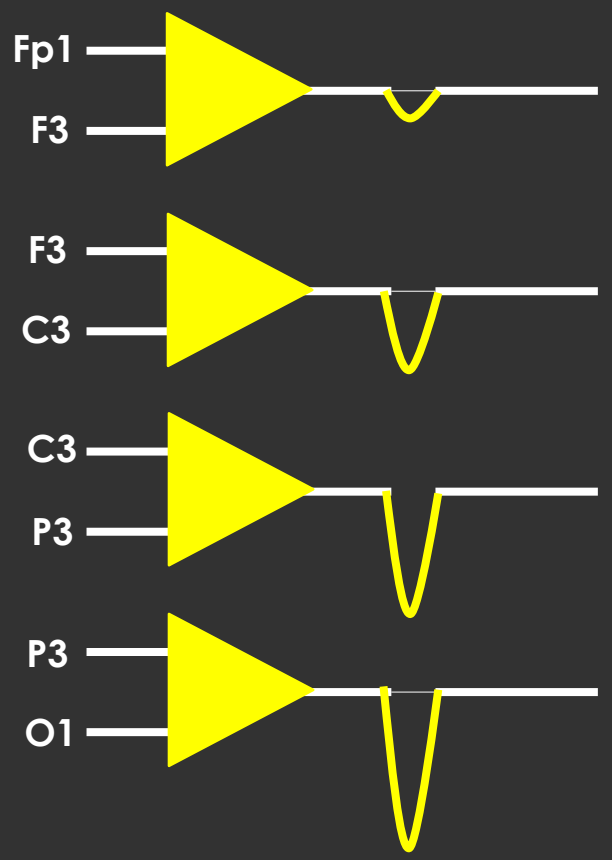
POTENTENTIAL AT THE END OF THE CHAIN







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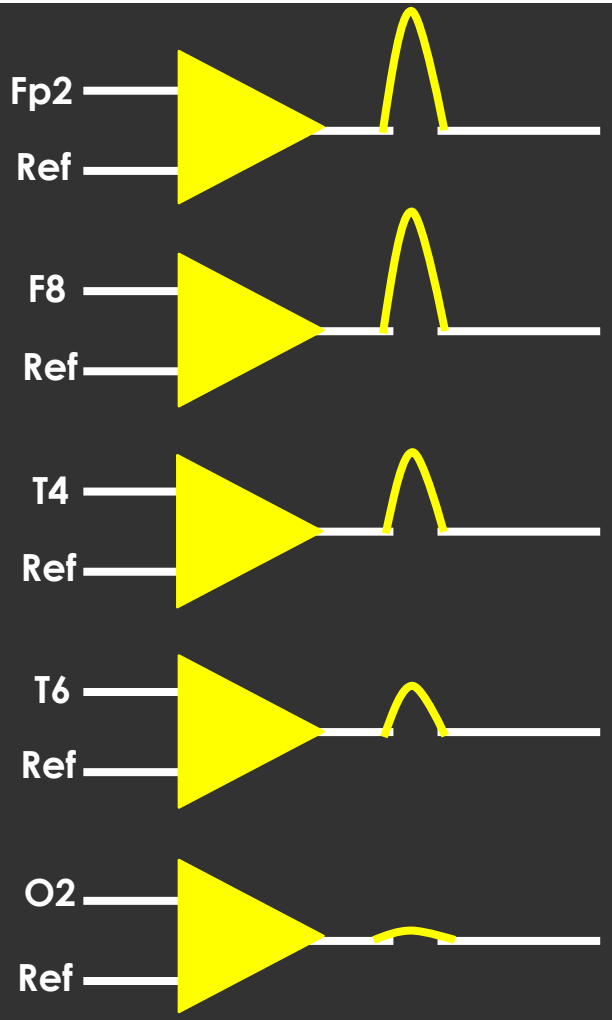
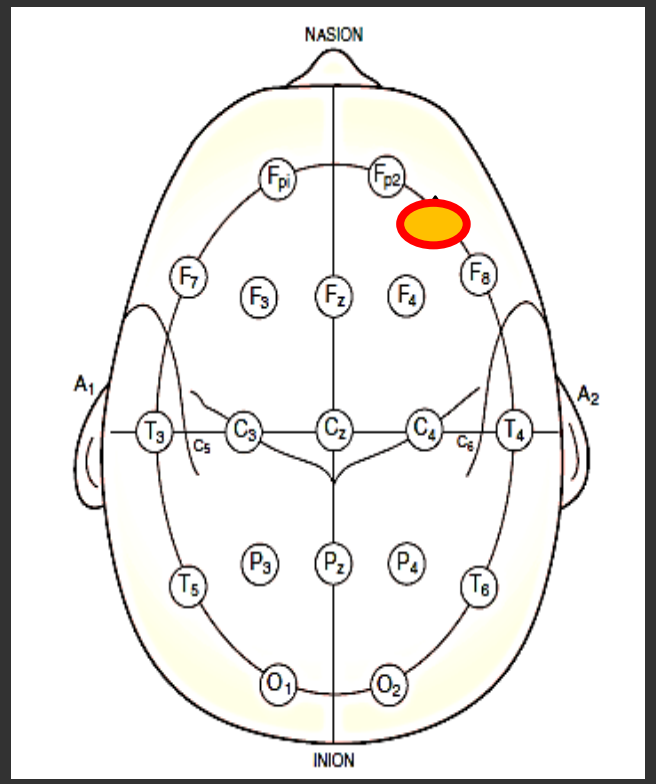
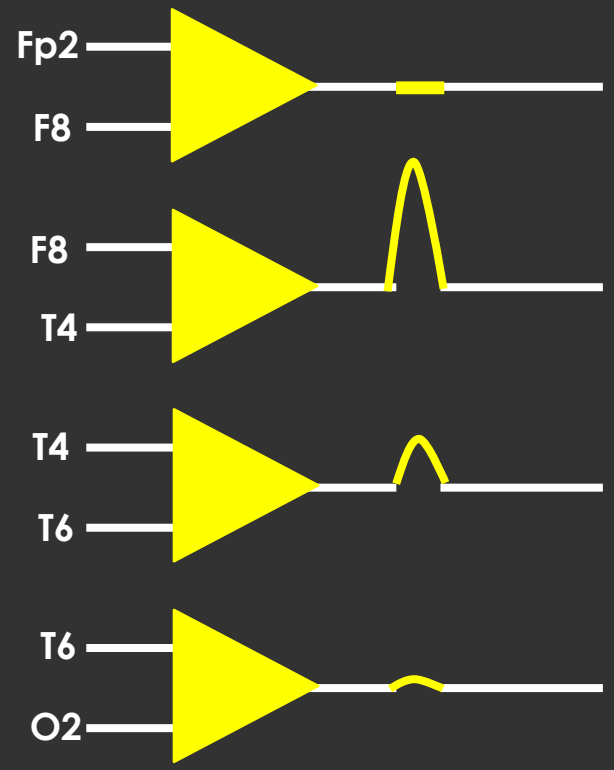
POTENTIAL AT THE END OF THE CHAIN AND ADJACENT ELECTRODE







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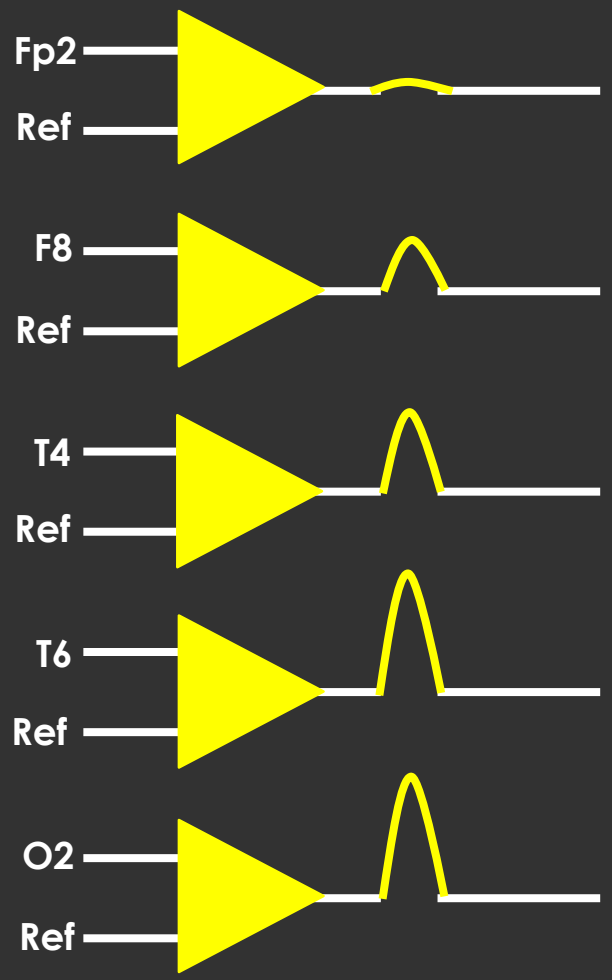
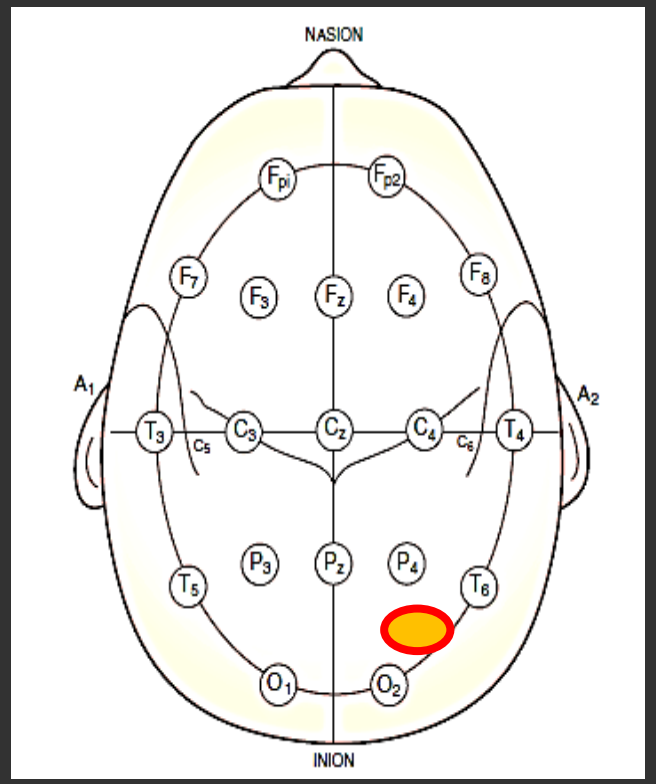
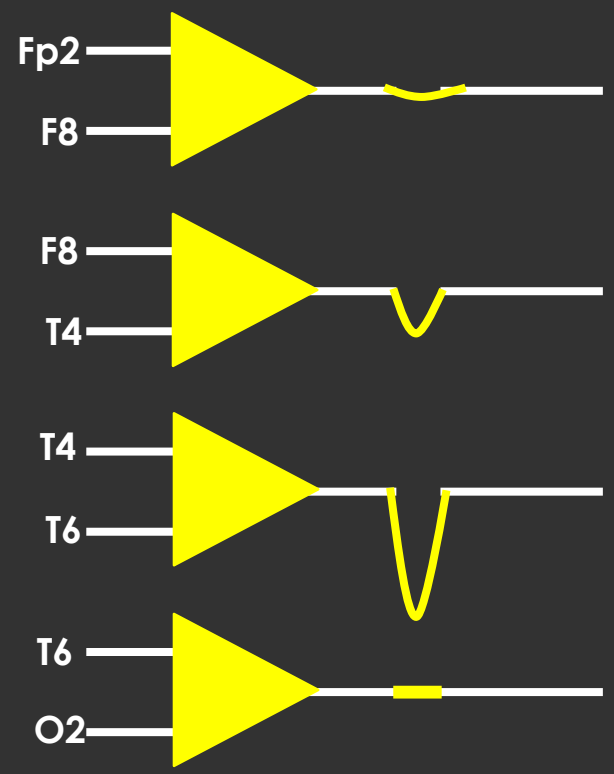
POTENTIAL AT THE END OF THE CHAIN AND ADJACENT ELECTRODE







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END OF PRESENTATION

Thank you for your attention.