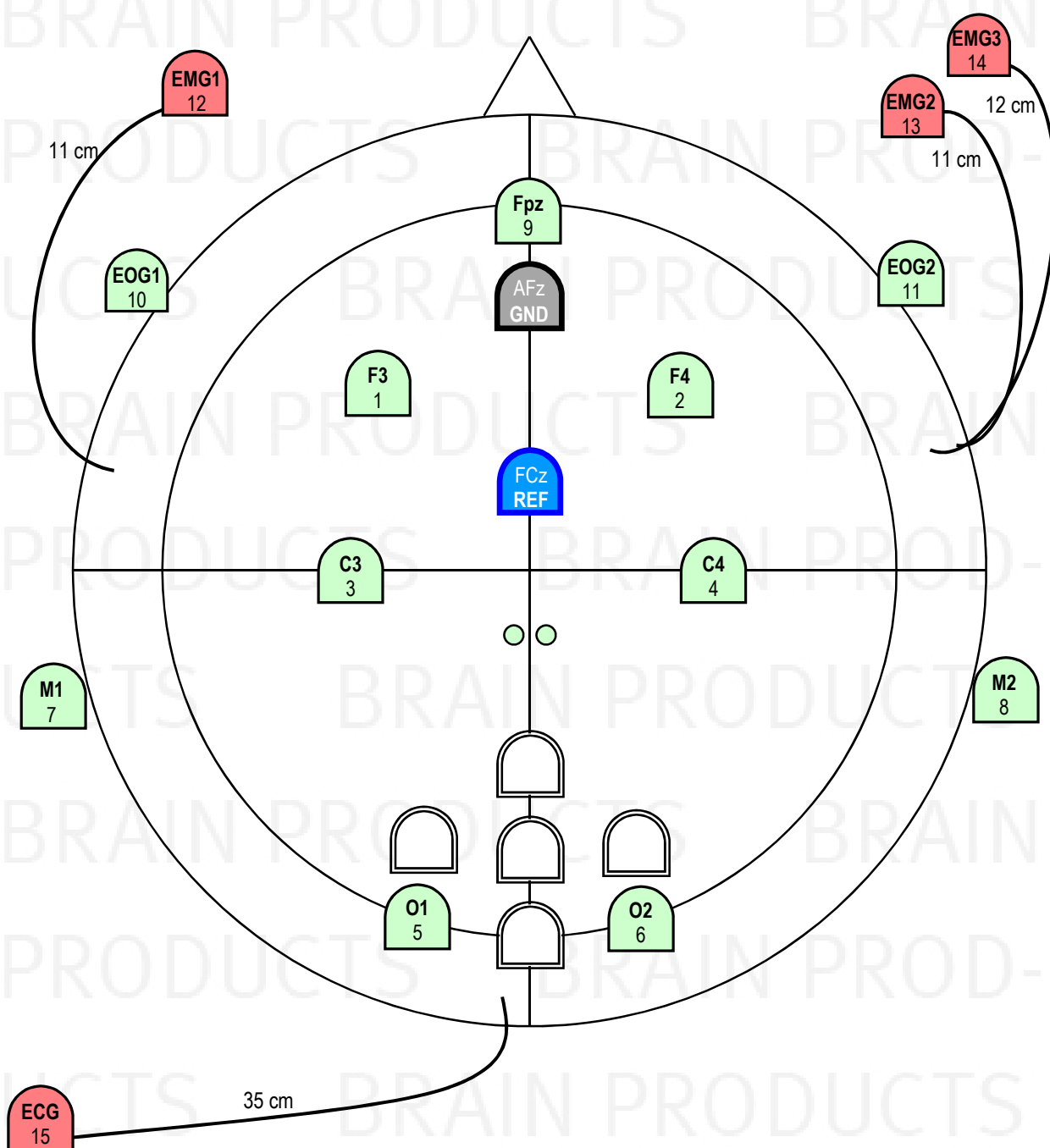


15Ch BrainCap MR for Sleep Recordings during fMRI

Layout according to American Academy of Sleep Medicine Guidelines 2007,
With EOG for reference to FPz

Electrode Layout and Channel Assignment



- M1 / M2 are approximately at mastoid positions (TP9' / TP10')
- FCz offers a reliable online recording reference; please reference offline to mastoid position e.g. M2
- EOG1/FPz and EOG2/FPz may be used for EOG, they are integrated in the cap for better signal quality
- Additional rings in occipital area offer higher comfort

Details for Users

Ordering Information

For ordering please give **Article Number, Cap Cut, and Size**
(e.g. *BC-MRS-15, Caucasian, 56*):

- Article Number: **BC-MRS-15**
- Cap Cut: **Caucasian** or **Asian**
- Size (given in cm head circumference):
 - Adult caps: **54, 56, 58, 60, 62, 64** (average male: 58, average female: 56)
 - Children caps: **50** (3-4 years), **52** (5-10 years), **54** (11-14 years)
 - Infant caps: **36** (newborn), **38, 40** (3 months), **42, 44** (7 month), **46, 48** (2 years)

The catalogue-number comprises the cap as described, serial number, and this document; all packed in a labelled cardboard box. For further information about accessories or consumables, please visit our website or contact our local distributor.

Cap

Standard: Sublnion Cap with integrated chin belt, white

Sizes 52 – 64 made from High Precision Fabric, Sizes 50 and smaller made from High Comfort Fabric

Options: *Caucasian* or *Asian*, *Size*

Electrodes

All electrodes are Multitrodes for MR with sintered Ag/AgCl sensors. They are buttoned directly into the cap (total height less than 3,5 mm) or can be attached to the skin with washers (= double-sided adhesive rings). In the parieto-occipital area, empty electrode housings (double border lines in the layout) provide more comfort.

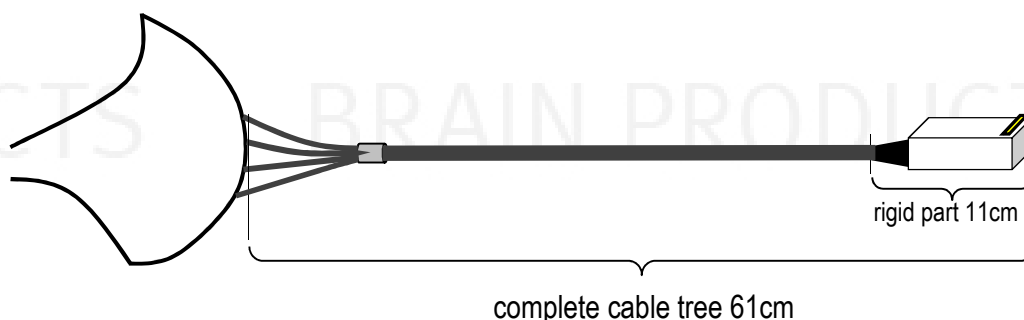
All electrodes in the cap are with 5 kOhm-resistors directly after the sensor. The drop-down electrodes (EMG for chin EMG, and ECG) are with 15 kOhm resistor.

Electrode housing colours are according to the above figure. All cables are white, except Ch 12-15 red, REF = blue cable, GND = black cable. All electrodes are name-labelled (F3, F4, ...) near sensor.

The drop-down electrode cable parts outside the cap are covered waterproof wherever possible in silicone - or if more suitable in spiral tube - to avoid direct contact to skin.

All cables go on the outside of the cap directly to the leaving point of the cable tree. Cables are fixed with double-T-nylon threads. The cables part from the cap in branches of approx. 8 cables. These branches leave radially from the area around CPz and straight/tight to a uniting point after approx. 5 cm. After the uniting point, one cable tree continues to the BrainCap-connector-box.

The length of the cable tree until the end of the connector box is approx. 61 cm.



Termination

The cable tree is led into a connector box. From here the caps are connected to BrainAmp-MR with 30 cm-flat-ribbon-cables. These flat ribbon cables come with the BrainAmps. They can be re-ordered from BrainProducts (Cat-No. BP-02400-NN) or from Easycap (Cat.-No. E80).

Inside the connector box there is another 5 kOhm-resistor on each channel, Ref, Gnd.

All unused channels are short-circuited to GND in the connector box.

The top side of the connector box is labelled "BrainCap-MR". The bottom side label states

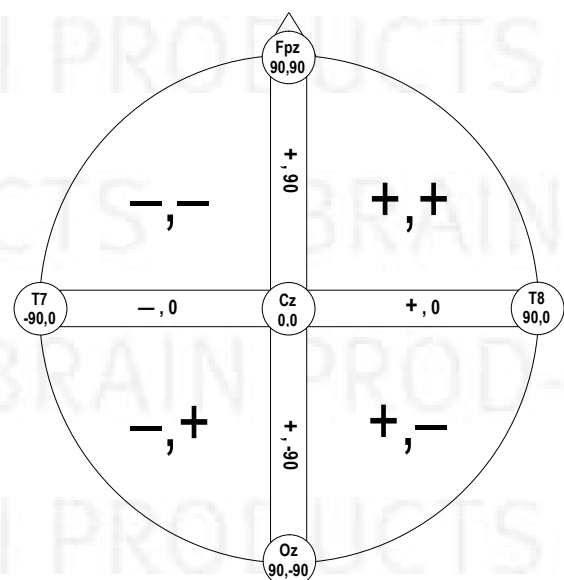
- 10k Ω in cap electrodes (5k Ω : tip + 5k Ω : box)
- 20k Ω at drop-down (15k Ω : tip + 5k Ω : box)

Theta/Phi Coordinates for BC-MRS-15

Channel-Number	Name	Theta	Phi
1	F3	-60	-51
2	F4	60	51
3	C3	-45	0
4	C4	45	0
5	O1	-90	72
6	O2	90	-72
7	M1 (TP9')	-121	18
8	M2 (TP10')	121	-18
9	Fpz	90	90
10	EOG1 (F9')	-121	-30
11	EOG2 (F10')	121	30
12	EMG1	-	-
13	EMG2	-	-
14	EMG3	-	-
15	ECG	-	-
Ref	FCz	23	90
Gnd	Afz	67	90

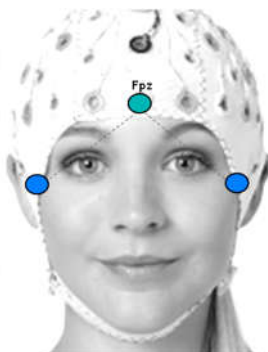
These values are standardized to a Theta of 90° for the plane through Fpz, T7, T8, Oz.

The signs follow this convention



EEG data can be referenced offline to mastoid position, e.g. M2, as recommended in AASM manual.

For EOG, please reference the "E1" and "E2" channel offline to Fpz, for EOG left/right:



Based on:

Iber C, Ancoli-Israel S, Chesson A and Quan SF
for the American Academy of Sleep Medicine.

The AASM Manual for the Scoring of Sleep and Associated Events:
Rules, Terminology and Technical Specifications, 1st. ed:
Westchester, IL: American Academy of Sleep Medicine, 2007.



This cap can be used inside MR if you follow these rules:

- **Scanner sequences**
The BrainCap MR with Multitrodes can be used for combined EEG & fMRI recordings. That is, the intended use is for "functional" studies, but NOT for anatomical studies.
GRE-EPI sequences are allowed.
MP Rage is allowed.
Localizer is allowed.

All other sequences e.g. FSE, TSE, FLAIR etc. are NOT allowed.
All sequences with more than one activation pulses (Multi Shot) or even inverted activation pulses other than "Single Shot GRE-EPI" are not allowed.
- **Positioning**
No cable loops are allowed. While recording, all wires must never create loops or similar (e.g. meander). Wires must never touch the subject's skin directly. If no plastic tubes are available, place towels or similar between wire and skin. This rule applies also to the cable tree(s).
- **Amplifiers safety**
Please never do phantom scanning with the cap connected to the amp without covering the whole phantom with electrolyte gel AND inserting gel into all electrodes. All electrodes must be shortened (electrically) to each other that way.
- All electrodes must have one fixed site. Flexible re-buttoning of electrodes into different sites is not allowed.
- All electrode sites must be in the cap, except one ECG electrode. If more drop-down electrodes are used, the cables must be inside a plastic tube. Quality of the MR-pictures may be degraded from dropdown electrodes. Cables may never touch the subject's skin. For polygraphic electrodes we recommend not to go through the cap. Instead, a BrainAmp-EXG with bipolar channels should be used.
- Total cable length from sensor tip to amplifier may not exceed 150 cm.
- **Repair**
The cap may not be altered by the customer himself. For any repair the cap must be sent to us.
- The BrainCap-MR and the BrainAmp-MR together constitute one system. Please also consult the chapter about safety measures in the BrainAmp-MR-Manual.

Beside the above any safety rules by the manufacturer of the MRI-Scanner must be followed