Epilepsy course for Neurology residdent 2013

Presurgical Evaluation

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Goal

- To identify the **epileptogenic zone**, the cortical area generating seizures, whose complete removal or disconnection is necessary for seizure freedom.

Five Cortical Zones

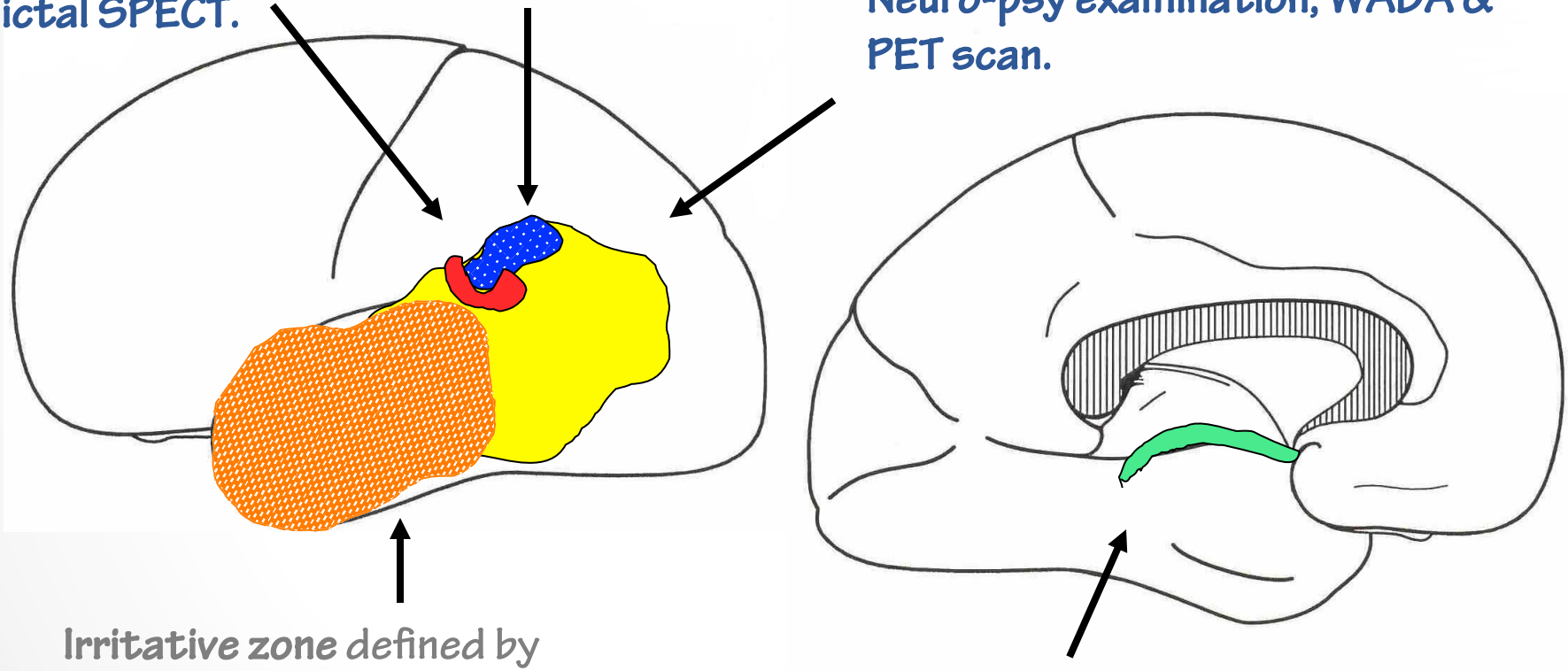
1. Ictal onset zone
2. Irritative zone
3. Symptomatogenic zone
4. Epileptogenic lesion
5. Functional deficit zone

Five Cortical Zones

Ictal onset zone defined by **Ictal EEG & ictal SPECT.**

Epileptogenic lesion defined by **MRI.**

Functional deficit zone defined by **Neuro-psy examination, WADA & PET scan.**



Irritative zone defined by **Interictal EEG & MEG.**

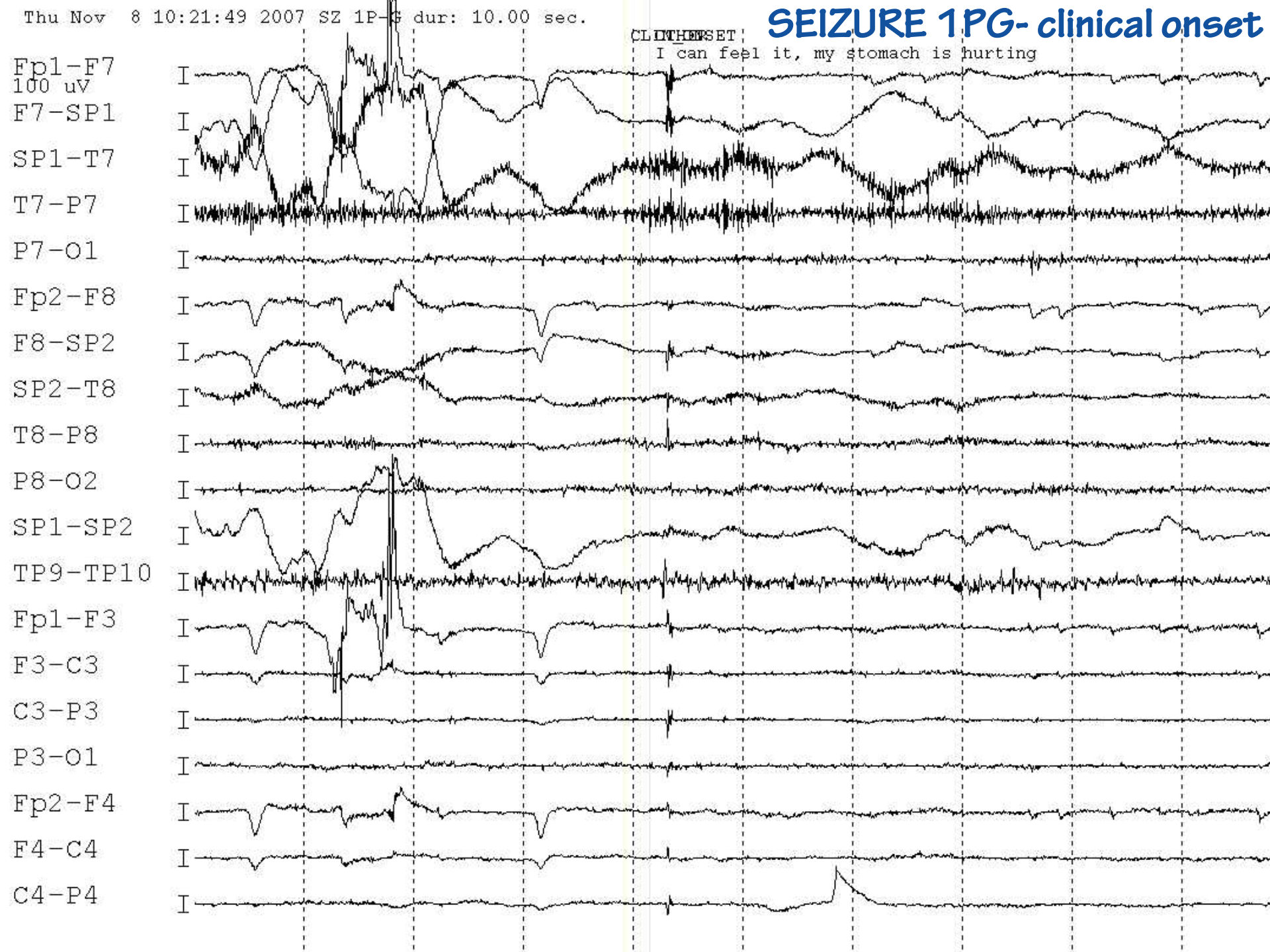
Symptomatogenic zone defined by **Seizure semiology.**

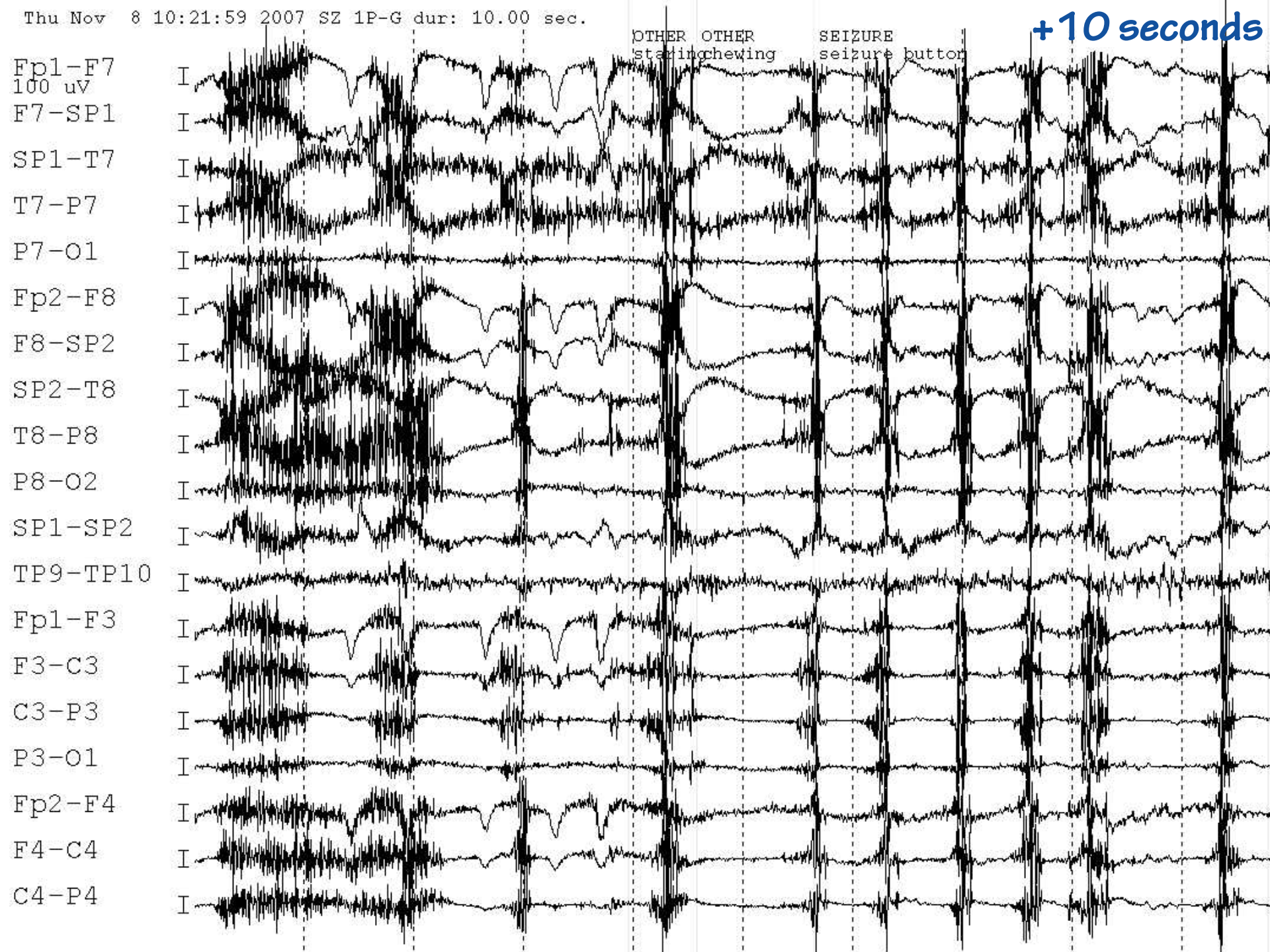
Figure from Foldvary N AES 2009.

Ictal Onset Zone

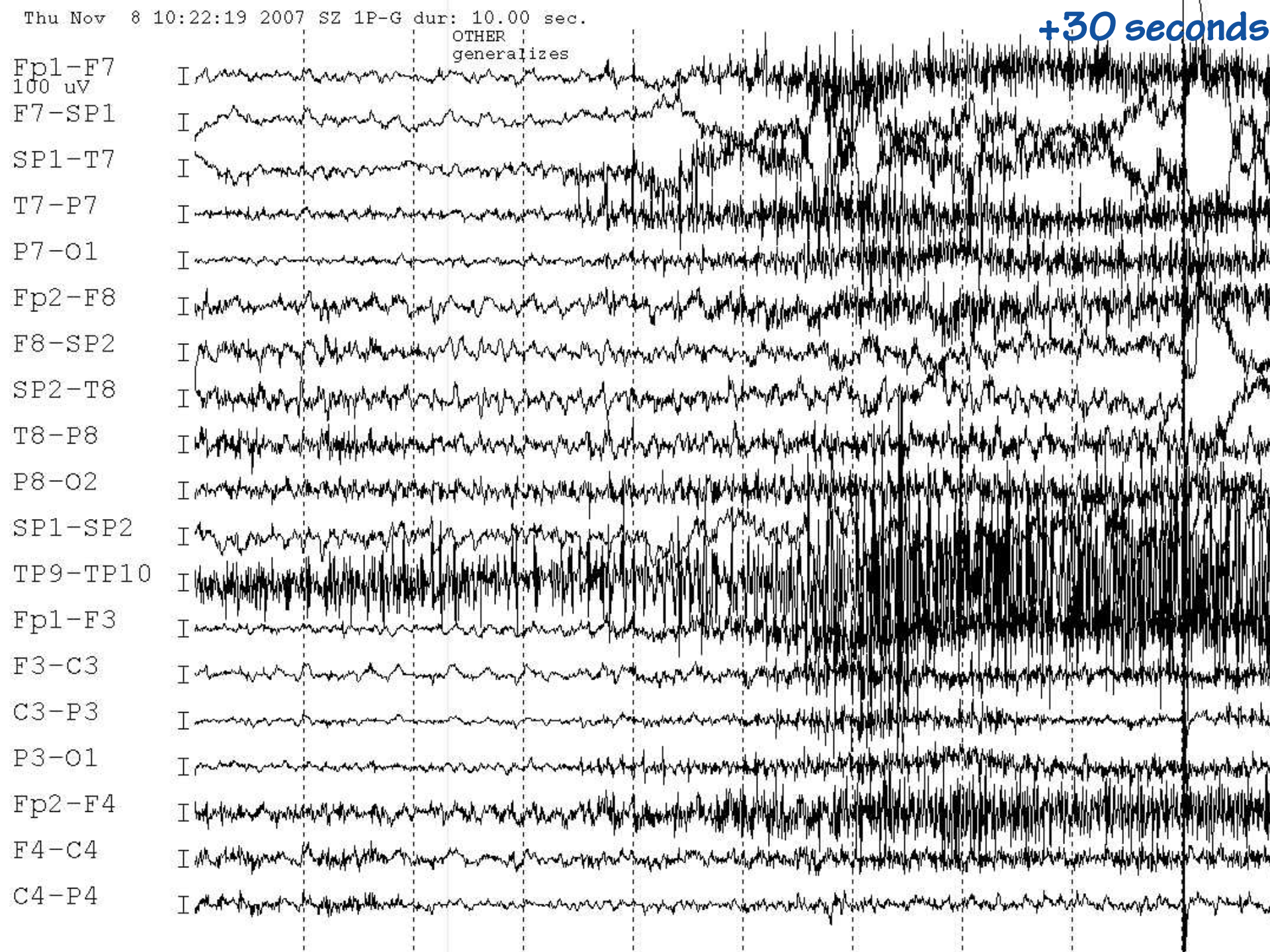
- The area from which ictal epileptic activities are generated.
- Defined by **ictal EEG** and **ictal SPECT**.
- When defined by **intracranial EEG**, is considered the best approximation of the epileptogenic zone.

SEIZURE 1PG- clinical onset

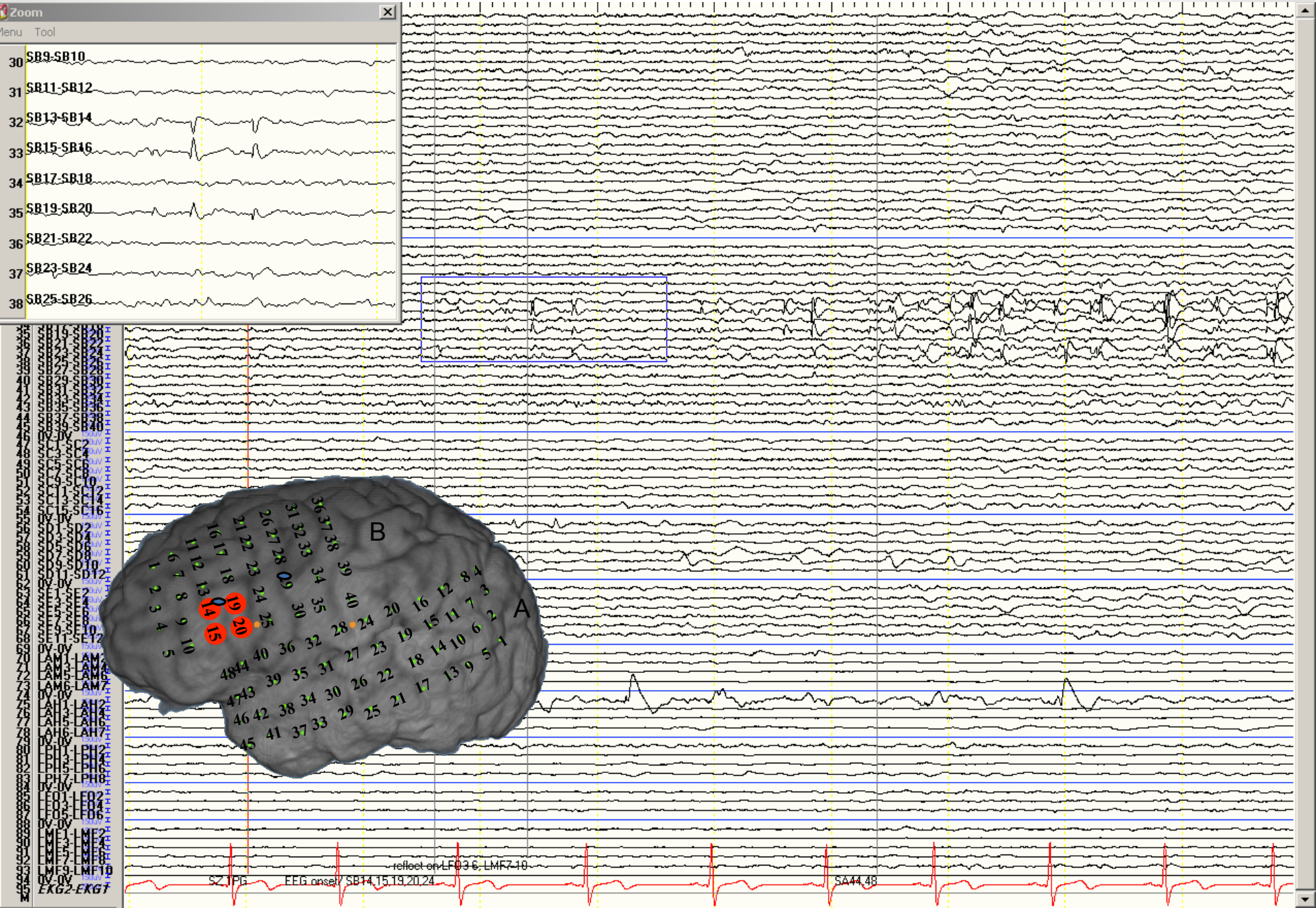



Thu Nov 8 10:21:59 2007 SZ 1P-G dur: 10.00 sec.
OTHER OTHER
starting chewing
SEIZURE
seizure button
+10 seconds
Fp1-F7
100 uV
F7-SP1
SP1-T7
T7-P7
P7-O1
Fp2-F8
F8-SP2
SP2-T8
T8-P8
P8-O2
SP1-SP2
TP9-TP10
Fp1-F3
F3-C3
C3-P3
P3-O1
Fp2-F4
F4-C4
C4-P4

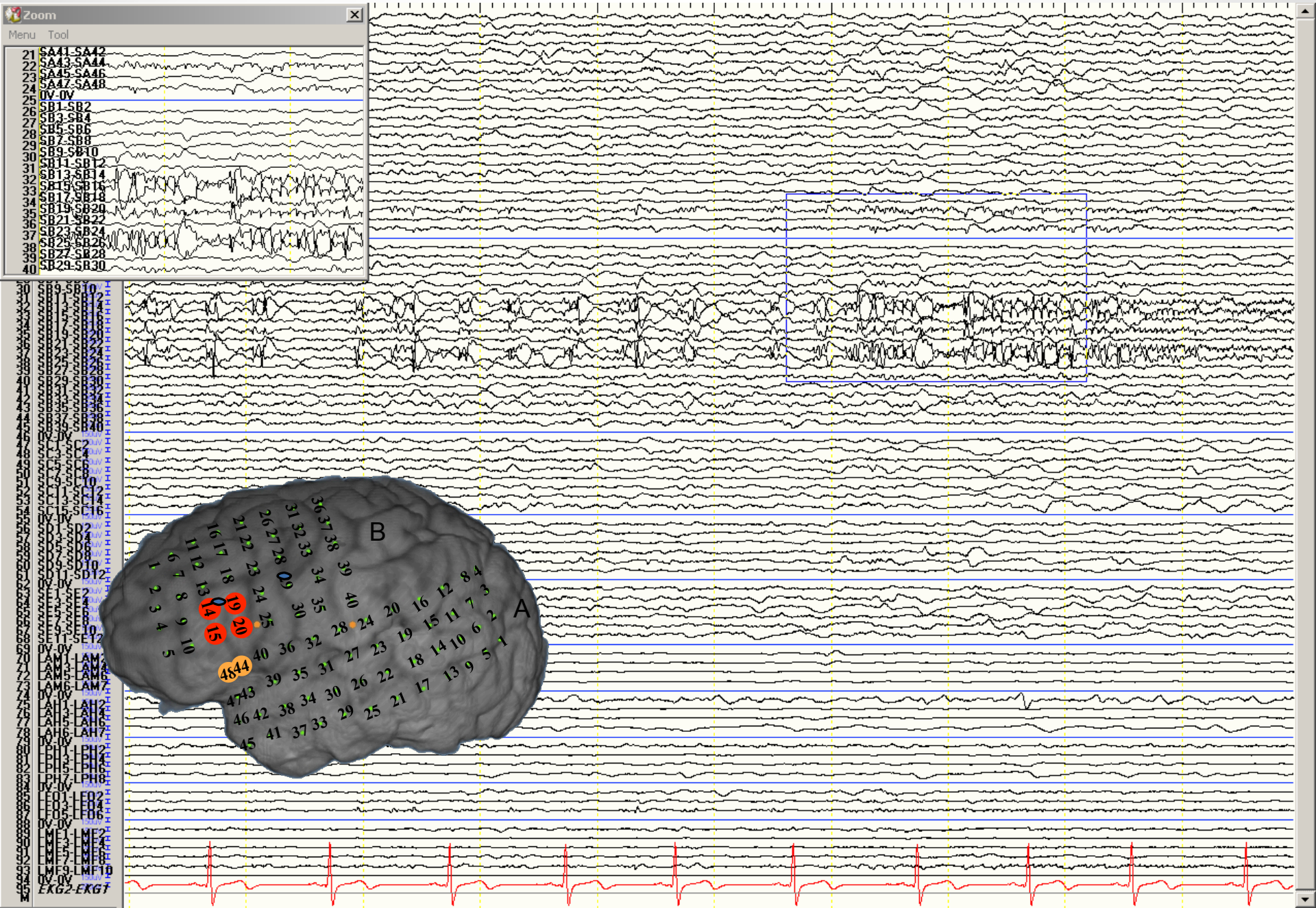

Thu Nov 8 10:22:09 2007 SZ 1P-G dur: 10.00 sec.
+20 seconds
OTHER OTHER
Sz-1P-G EEG onset- T8/sp2
OTHER
turns head to right
Fp1-F7
100 uV
F7-SP1
SP1-T7
T7-P7
P7-O1
Fp2-F8
F8-SP2
SP2-T8
T8-P8
P8-O2
SP1-SP2
TP9-TP10
Fp1-F3
F3-C3
C3-P3
P3-O1
Fp2-F4
F4-C4
C4-P4


Thu Nov 8 10:22:19 2007 SZ 1P-G dur: 10.00 sec.
OTHER
generalizes
+30 seconds
Fp1-F7
100 uV
F7-SP1
SP1-T7
T7-P7
P7-O1
Fp2-F8
F8-SP2
SP2-T8
T8-P8
P8-O2
SP1-SP2
TP9-TP10
Fp1-F3
F3-C3
C3-P3
P3-O1
Fp2-F4
F4-C4
C4-P4

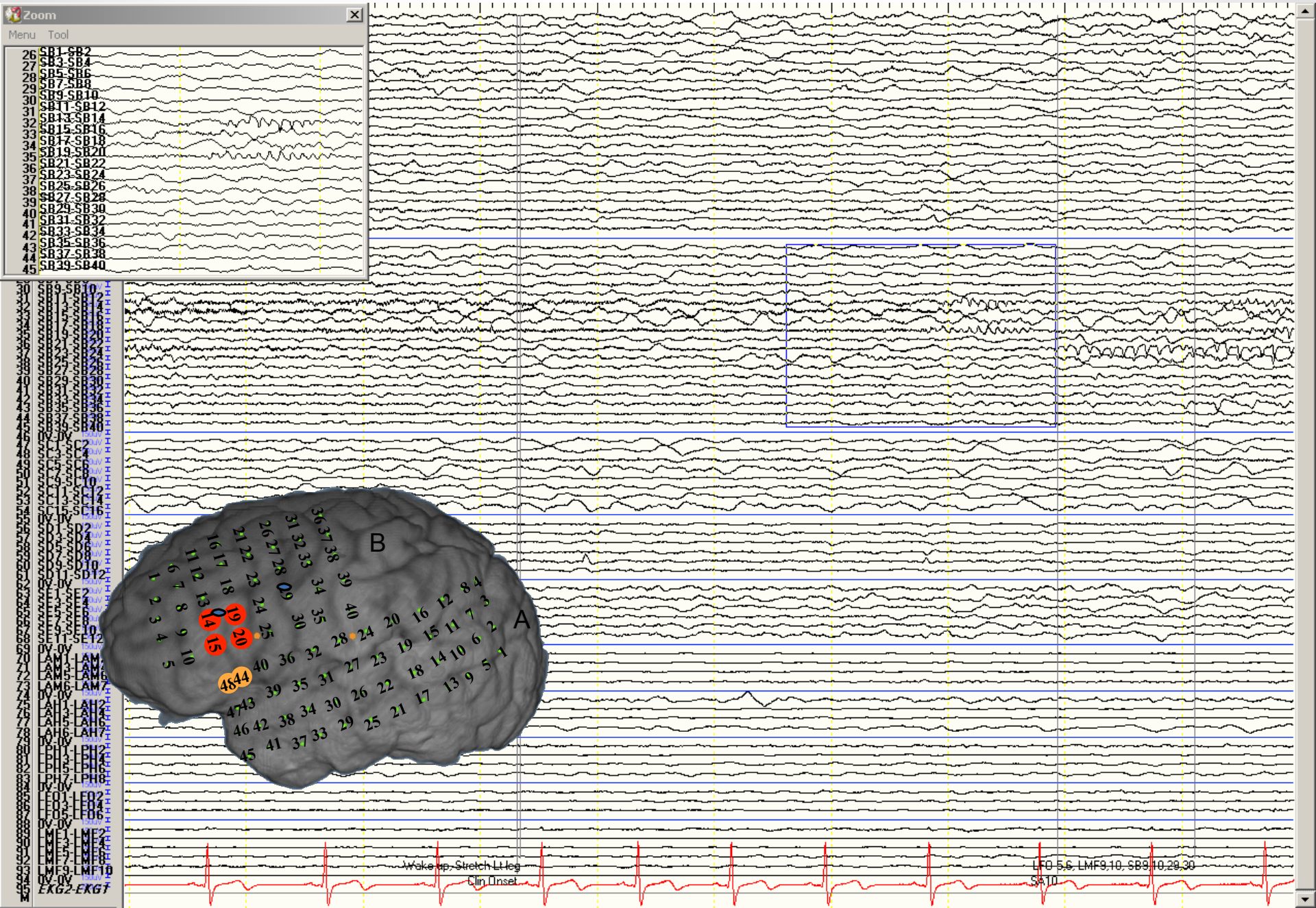
SEIZURE 1PG _ONSET- inferior frontal gyrus



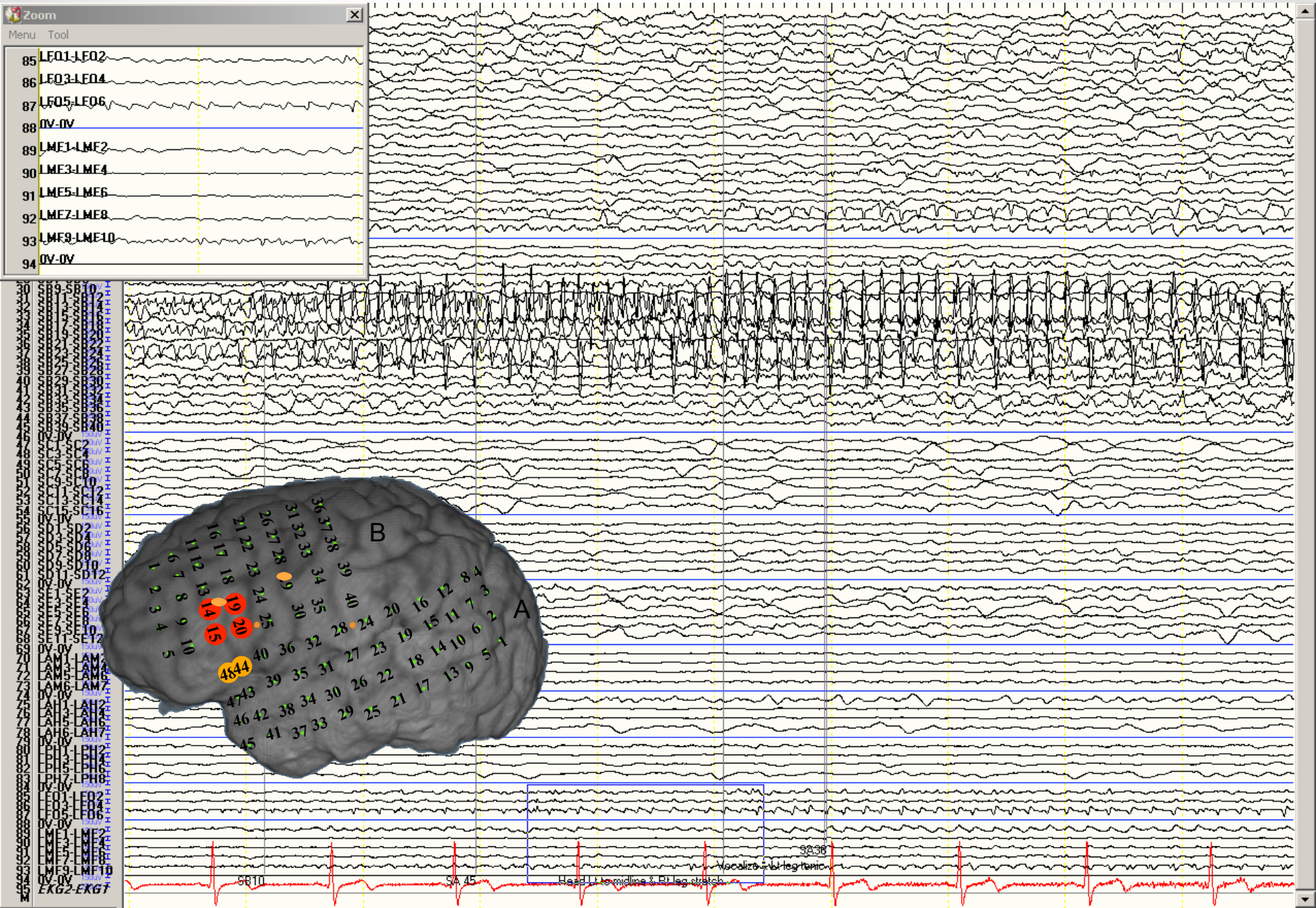
SEIZURE 1PG _+10 seconds

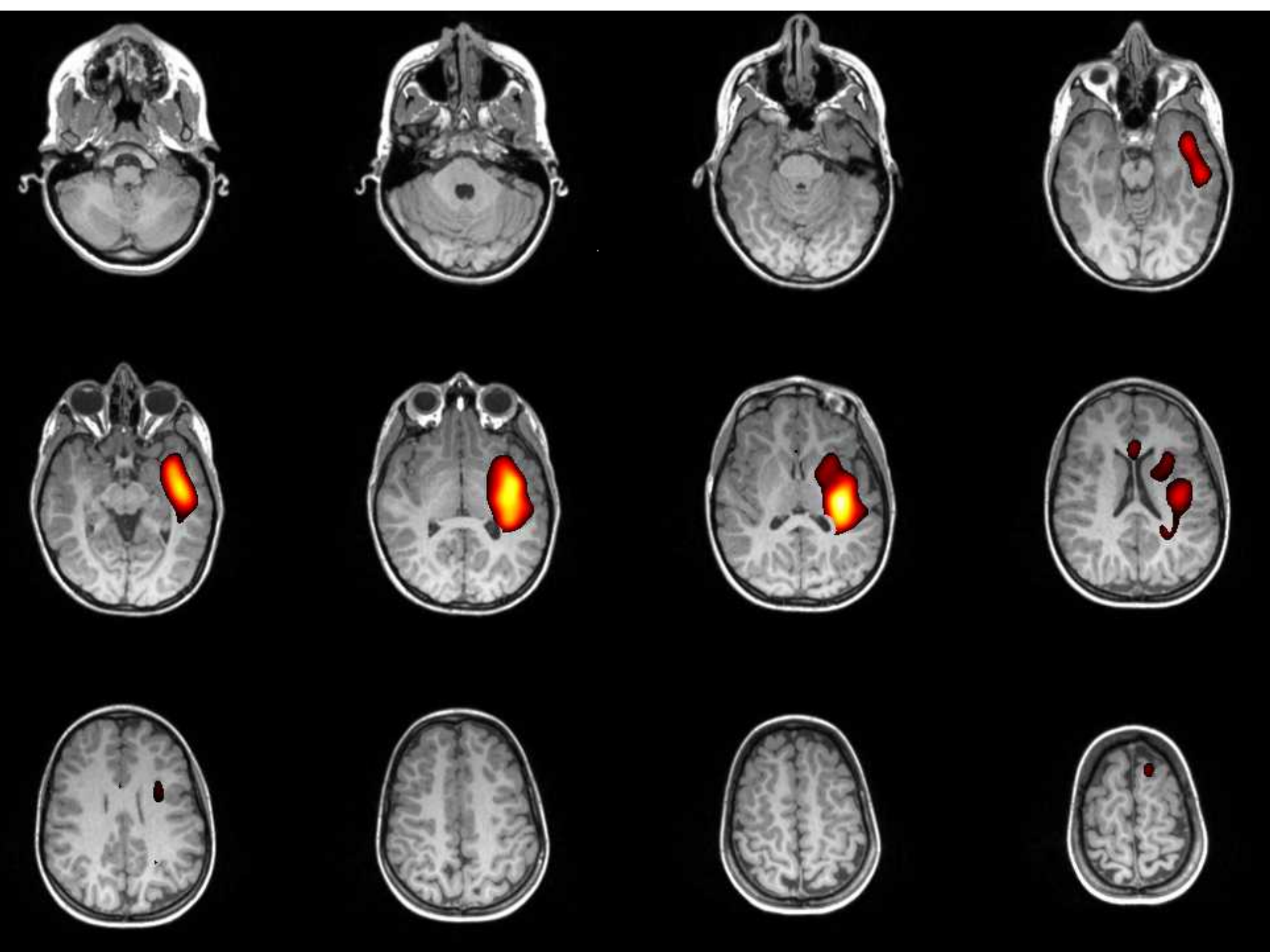


SEIZURE 1PG _+20 seconds



SEIZURE 1PG _+30 seconds

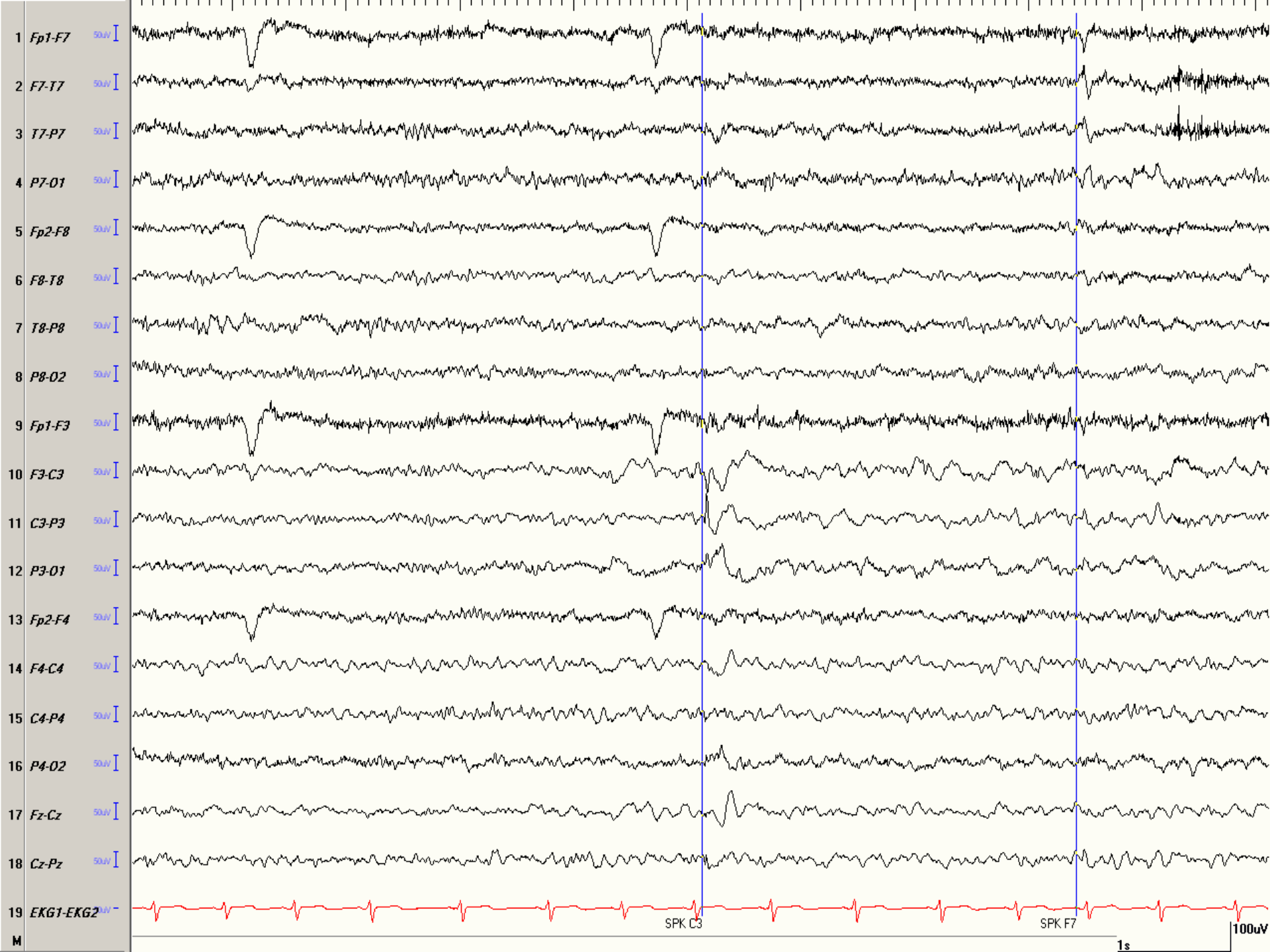




Irritative Zone

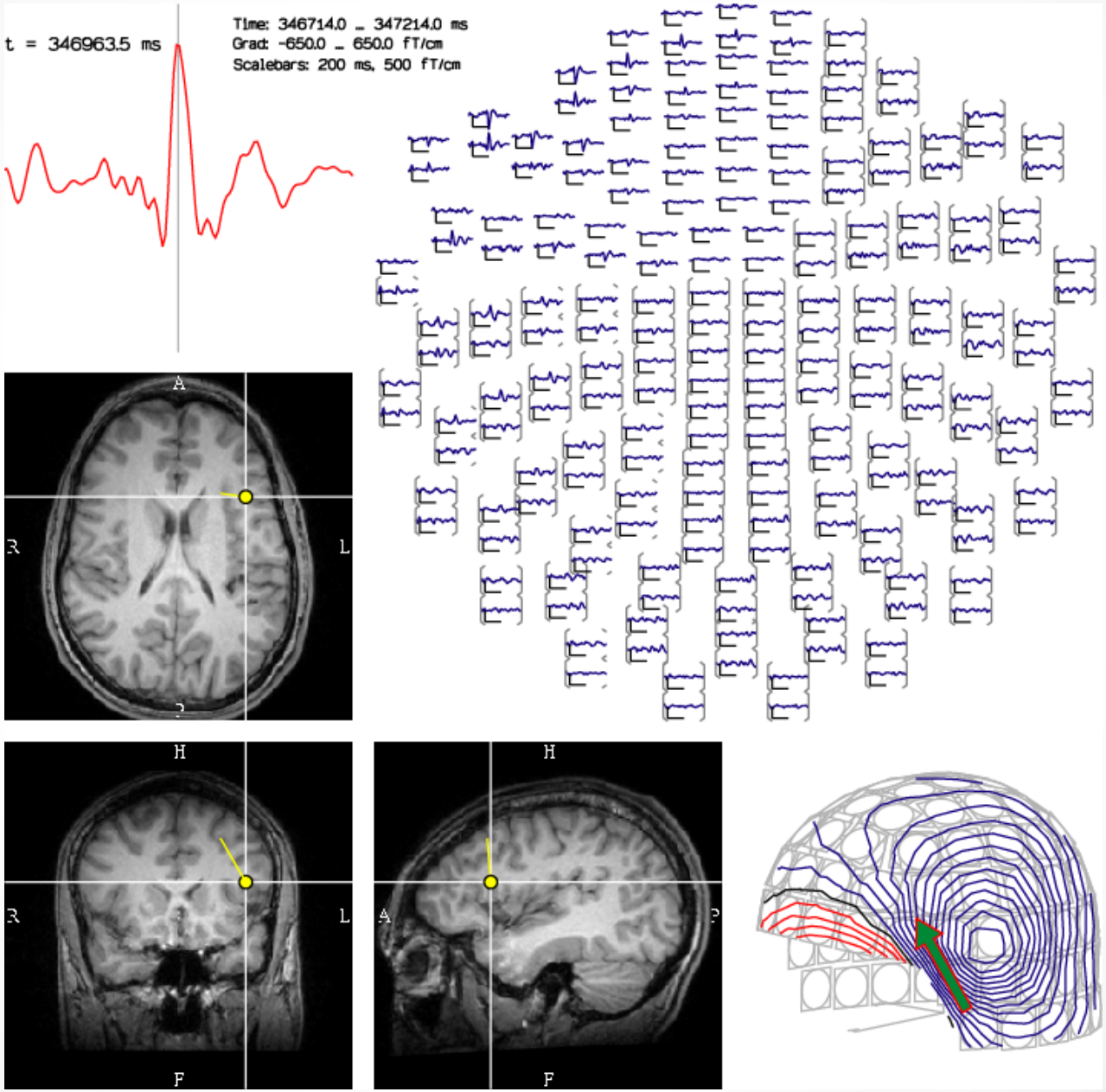
- The area, generating interictal epileptiform discharges (IEDs).

- Defined by interictal EEG & MEG.

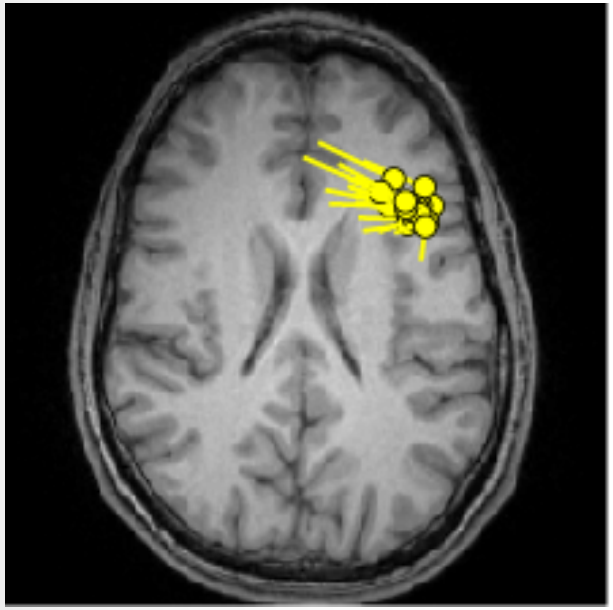

1 Fp1-F7
2 F7-T7
3 T7-P7
4 P7-O1
5 Fp2-F8
6 F8-T8
7 T8-P8
8 P8-O2
9 Fp1-F3
10 F3-C3
11 C3-P3
12 P3-O1
13 Fp2-F4
14 F4-C4
15 C4-P4
16 P4-O2
17 Fz-Cz
18 Cz-Pz
19 EKG1-EKG2
M
50uV
SPK C3
SPK F7
1s
100uV

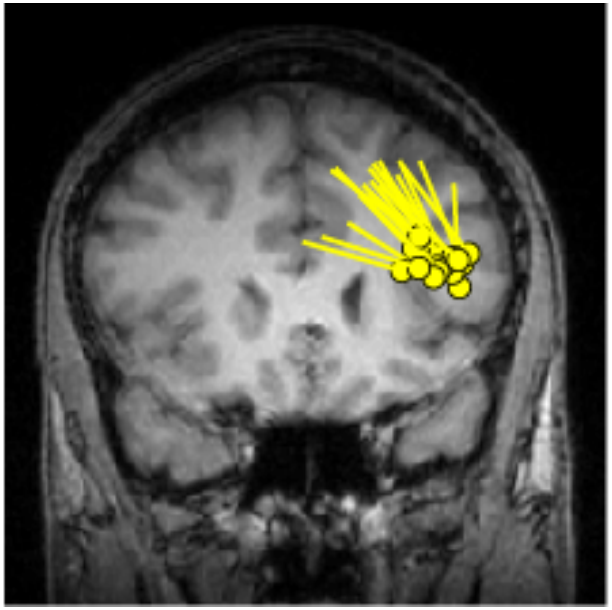
Map of Left Frontal Spike

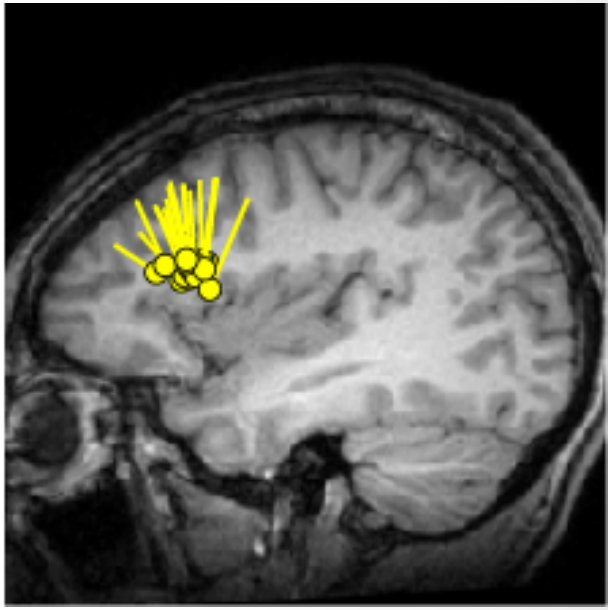
MEG



MEG







A very localized cluster of MEG dipole spikes in the left inferior frontal gyrus

Symptomatogenic Zone

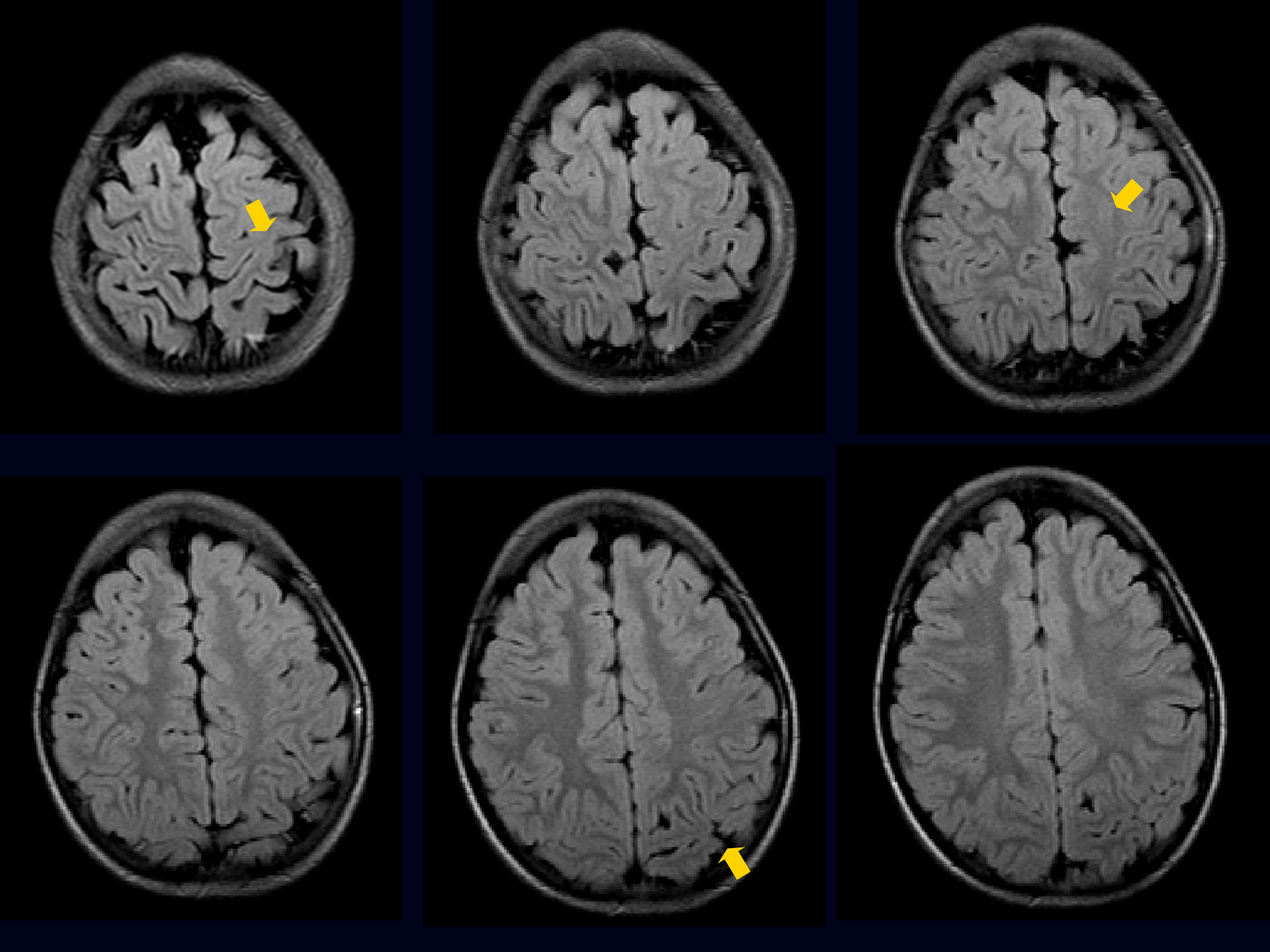
- The area when activated by epileptic activities, produces ictal symptoms.

- Defined by seizure history & Video-EEG.

Epileptogenic Lesions

- The imaging abnormality, responsible for seizures.

- Defined by anatomical imaging studies e.g., MRI.



Functional Deficit Zone

- The abnormal function area during the interictal period.

- Defined by Neurological examination, Neuropsychological test, WADA test, and PET scan.

Neuropsychological Testing

Wechsler Adult Intelligence Scale - Third Edition

Verbal Comprehension Index = 120, superior
Perceptual Organization Index = 116, high average
Working Memory Index = 108, average
Processing Speed Index = 96, average

Wechsler Memory Scale - Third Edition

Auditory Immediate Index = 97, average
Auditory Delayed Index = 83, low average
Delayed Auditory Recognition Index = 110, high average

Visual Immediate Index = 94, average
Visual Delayed Index = 103, average

WADA Test

- LEFT INJECTION

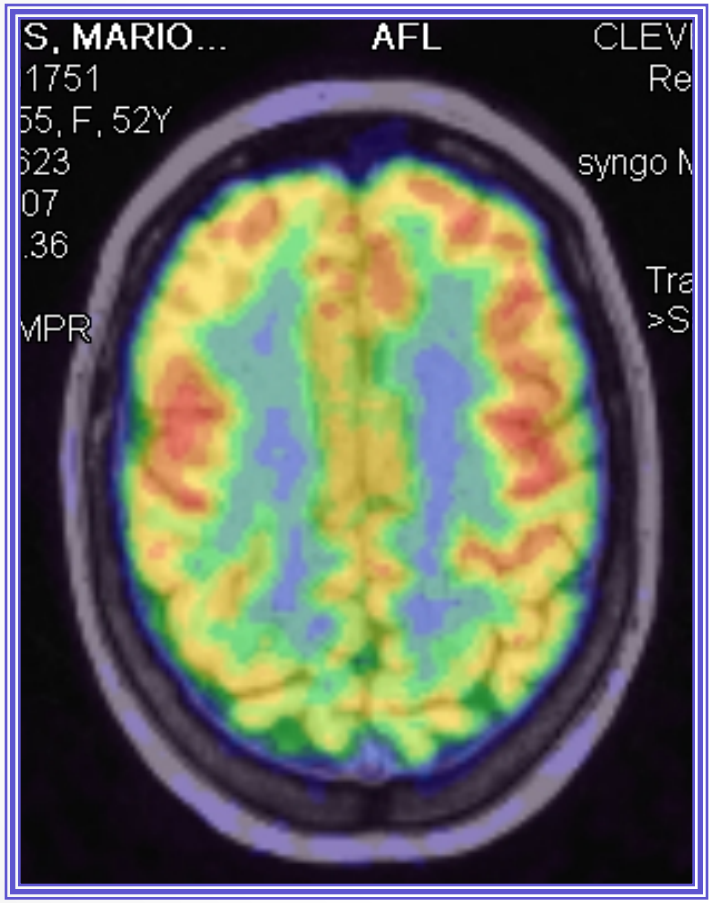
  Language testing

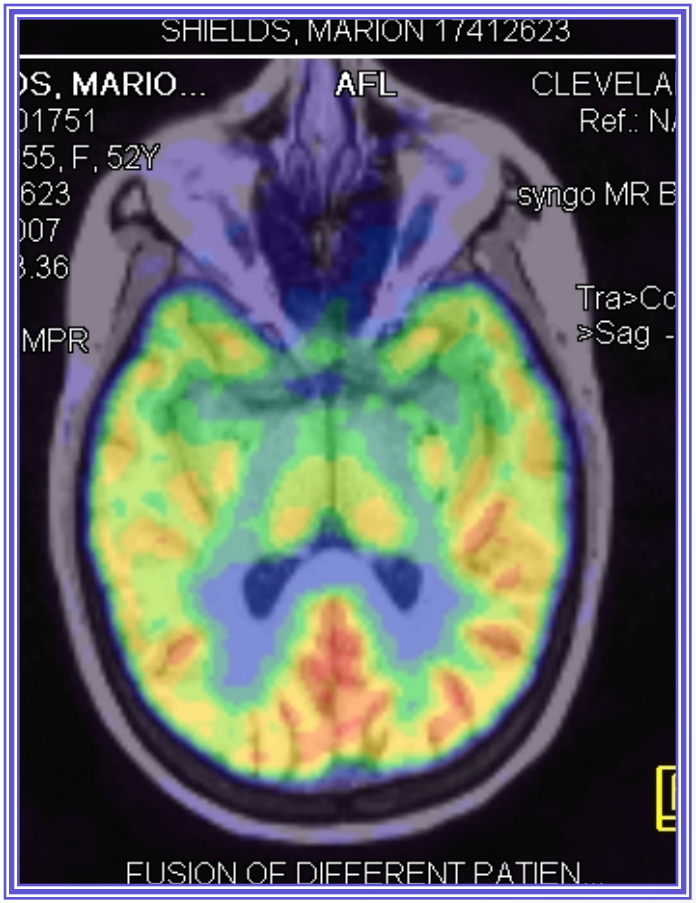
  12 / 12 items (100%) named while strength 0/0 to <5/5.

  Memory testing

  9 / 12 (75 %) items recalled or recognized after full recovery.

PET scan


S, MARIO...
AFL
CLEV
1751
55, F, 52Y
623
07
.36
MPR
syngo M
Tra
>S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55, F, 52Y
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Ref.: N
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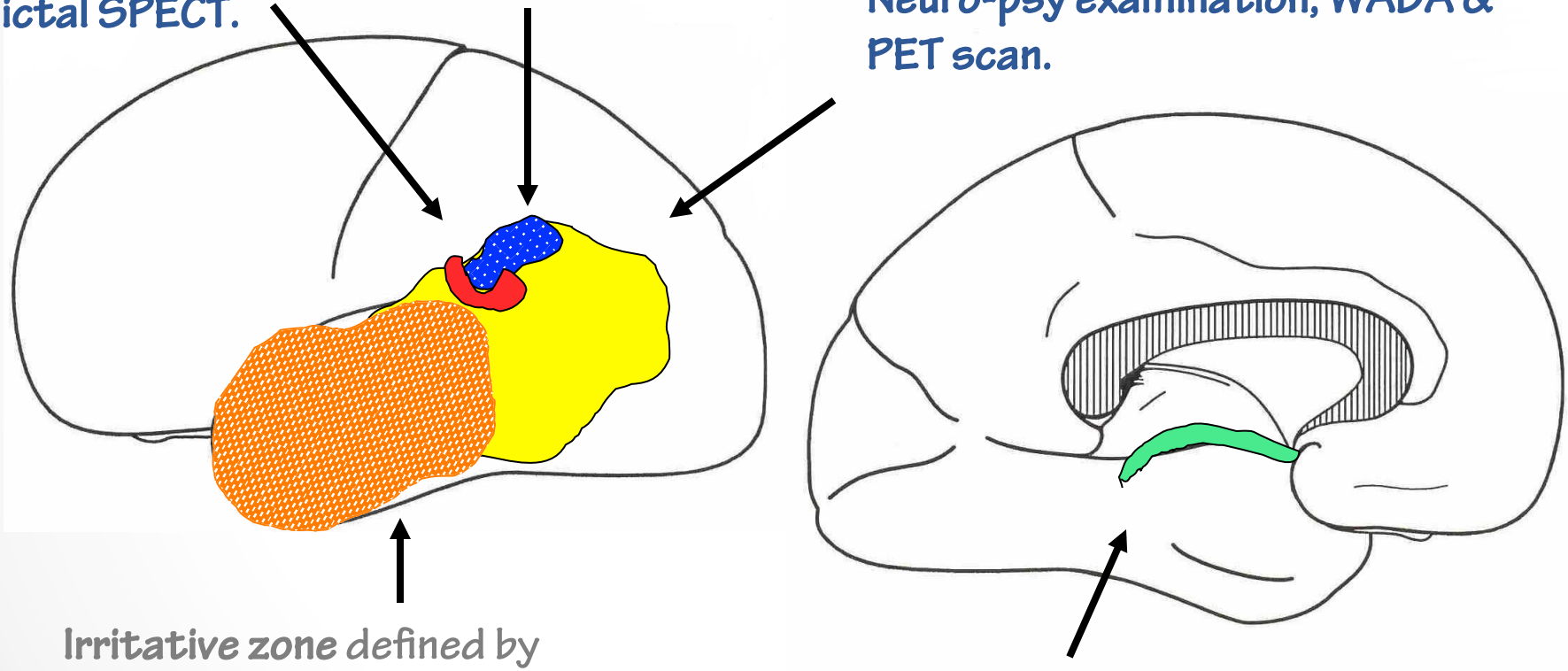
>Sag
FUSION OF DIFFERENT PATIEN

Five Cortical Zones

Ictal onset zone defined by **Ictal EEG & ictal SPECT.**

Epileptogenic lesion defined by **MRI.**

Functional deficit zone defined by **Neuro-psy examination, WADA & PET scan.**



Irritative zone defined by **Interictal EEG & MEG.**

Symptomatogenic zone defined by **Seizure semiology.**

Figure from Foldvary N AES 2009.

Case Scenario

Seizure history and evoluation

- A 53 year-old right-handed woman.
- Had a **gen. motor seizure** at age13 months.
- Was told she had "injured a vein on the **right side** of her brain".

- Developed recurrent afebrile seizures in childhood beginning with **nausea** often accompanied by **a sensation ascending into her neck** and a feeling of having a **"lump in her throat"**.

Case Scenario

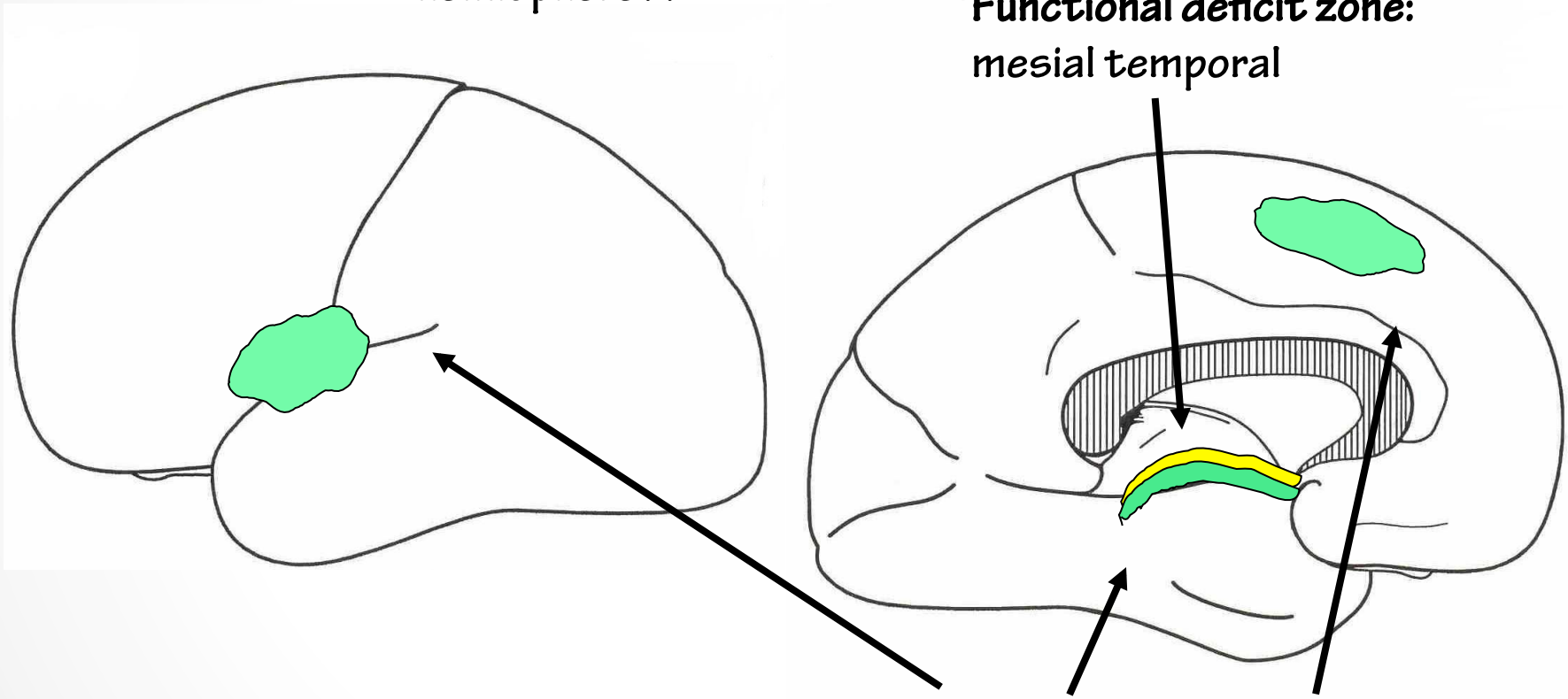
- This is followed by an arrest of activity with **unresponsiveness**, starring and **drawing up of the left arm**, occurring 15-20 times per month.

- Experienced 3 episodes of status epilepticus.
- Seizures proved resistant to a variety of AEDs.
- Employed part-time for a medical answering service.
- Examination revealed poor short-term memory, slow response time.

Five Cortical Zones

Epileptogenic lesion: Rt hemisphere??

Functional deficit zone: mesial temporal



Symptomatogenic zone: mesial temporal, insular, SSMA

Lateralize: right

Case Scenario

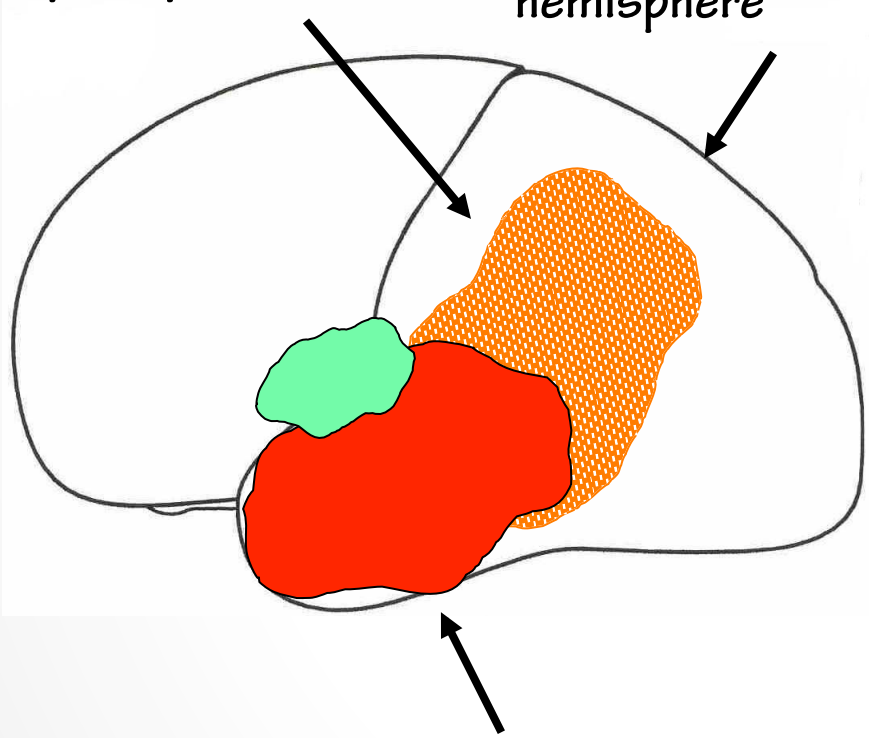
Scalp video-EEG monitoring

- The interictal EEG revealed sharp waves in the **right temporo-parietal** region.
- Two auras and three seizures were recorded.
- Auras were not accompanied by discernable EEG change. Seizures were accompanied by **right hemispheric** rhythmic delta, maximal in the **temporal** region, beginning 8 to 32 seconds after clinical onset.

Five Cortical Zones

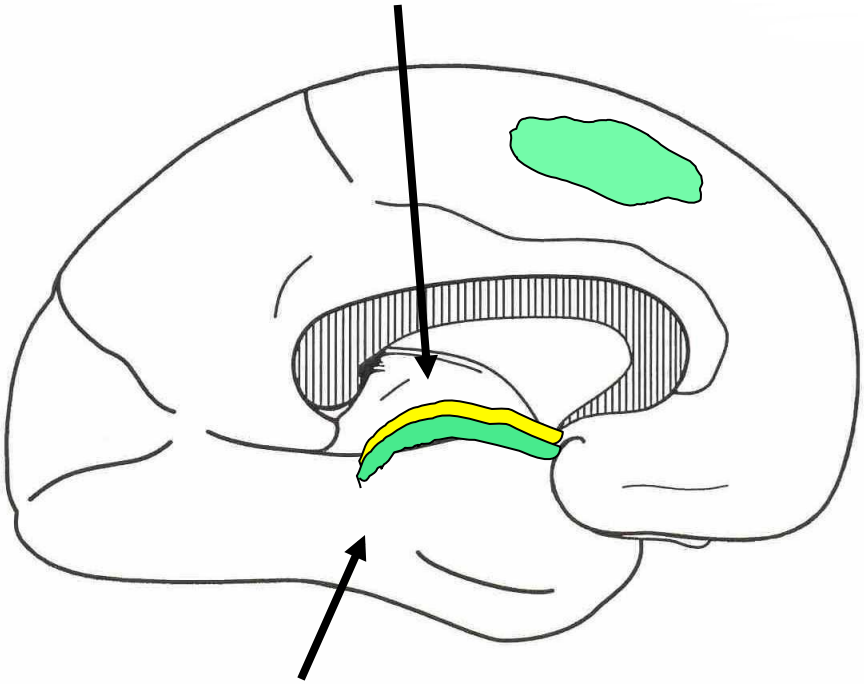
Irritative zone: temporo-parietal

Epileptogenic lesion: Rt hemisphere



Ictal onset zone: Rt hemisphere- temporal

Functional deficit zone: mesial temporal



Symptomatogenic zone: mesial temporal, insular, SSMA

Lateralize: right

Case Scenario

Neuroimaging

- Increased signal on the FLAIR sequence was observed in the body and tail of the **right hippocampal** formation.
- An area represent of prior hemorrhage or occult arterial venous malformation was observed in the **right parietal** region.

Case Scenario

Neuropsychological testing

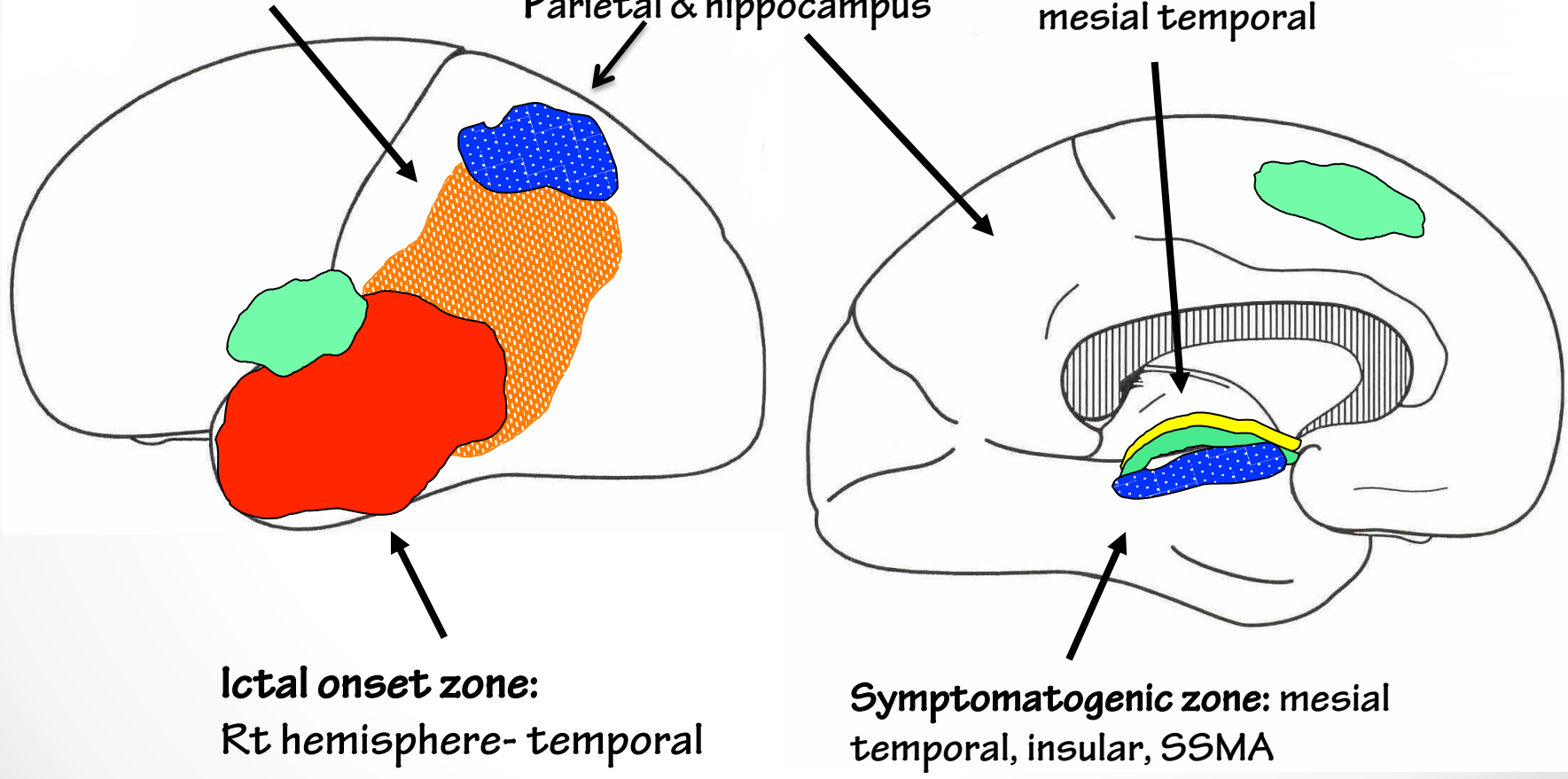
- Low average general intellectual functions.
- A significant 33-point discrepancy between her Auditory and Visual Delayed Memory Index scores (92 versus 59, respectively).

Five Cortical Zones

Irritative zone:
temporo-parietal

Epileptogenic lesion:
Parietal & hippocampus

Functional deficit zone:
mesial temporal



Ictal onset zone:
Rt hemisphere- temporal

Symptomatogenic zone: mesial temporal, insular, SSMA

Lateralize: right

Case Scenario

WADA test

- The first verbal response was 03:45 minutes following the left injection and 00:00 minutes following the right injection, supporting **left hemisphere language** representation.

- Retention score 44% after the left injection and retention score 69% after the right injection. Memory was impaired in the **right hemisphere**.

Case Scenario

- Do we have enough to plan surgery?
- If not, what do we need?

Case Scenario

Intracranial video EEG monitoring

- Interictal spikes were seen very frequently in the **mesial temporal** contacts.
- Low voltage repetitive spikes were seen nearly continuously in the anterior aspect of the **parietal** lesion.

Case Scenario

Intracranial video EEG monitoring

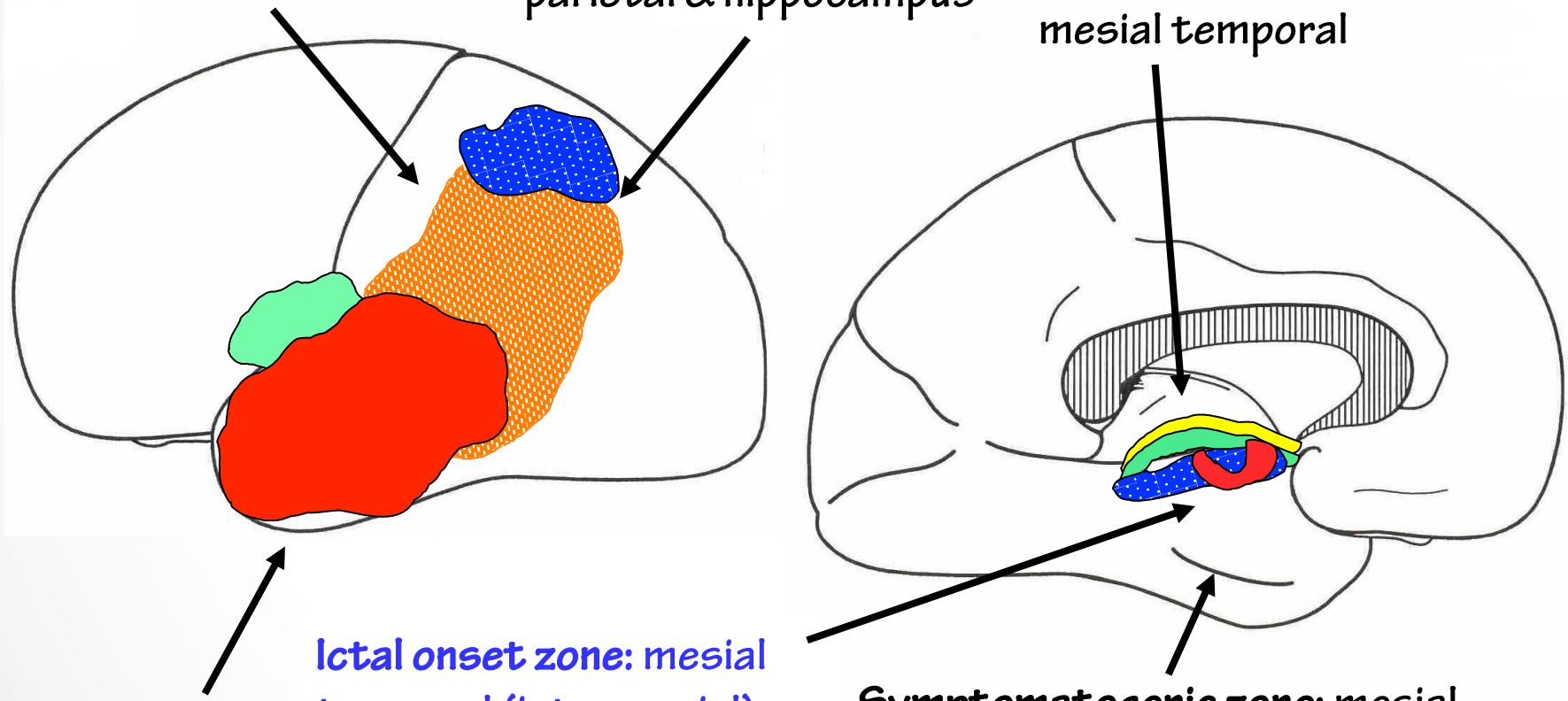
- Eleven auras and 13 seizures were recorded.
- EEG onset was characterized by low voltage fast activity appearing at the most **mesial temporal contacts**. This pattern gradually spread to adjacent electrodes on the infero-lateral temporal lobe.
- EEG onset preceded clinical onset by 10 to 76 seconds.

Five Cortical Zones

Irritative zone:
temporo-parietal

Epileptogenic lesion:
parietal & hippocampus

Functional deficit zone:
mesial temporal



Ictal onset zone: mesial temporal (intracranial)

Symptomatogenic zone: mesial temporal, insular, SSMA

Ictal onset zone:
Rt hemisphere- temporal

Lateralize: right

Case Scenario

Surgical procedure & outcome

- Right temporal lobectomy and resection of vascular lesion in the right parietal were done.

- The pathological findings demonstrated focal neuronal loss and gliosis consistent with **hippocampal sclerosis**.

- The parietal specimen is consistent with a **vascular malformation**.

Case Scenario

Surgical procedure & outcome

- During the first two years postoperatively, auras were reduced to approximately two per day and were less intense, although similar in character. She was otherwise seizure free.

สถาบันประสาทวิทยา

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