BESA Program Suite:

Pipeline for LTM-EEG

Evaluation in Epilepsy

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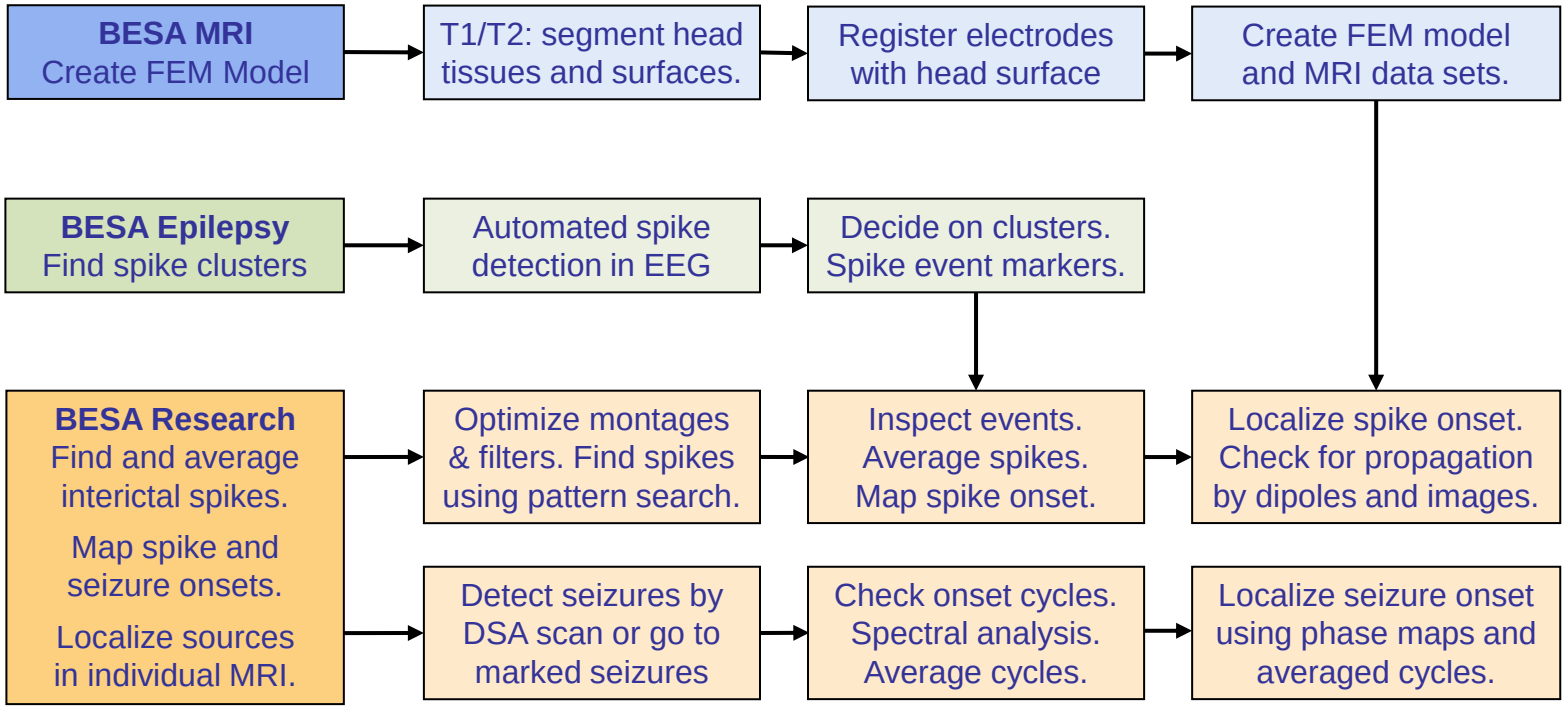
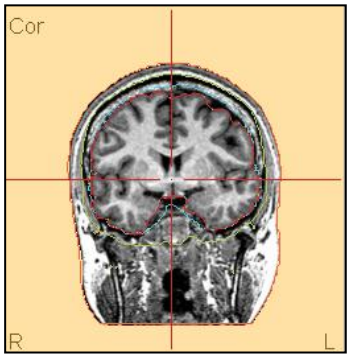
BESA: Reliable pipeline to analyze interictal spikes and seizure onset



Worksteps 1-2: Prepare MRI & FEM and detect spike hyperclusters

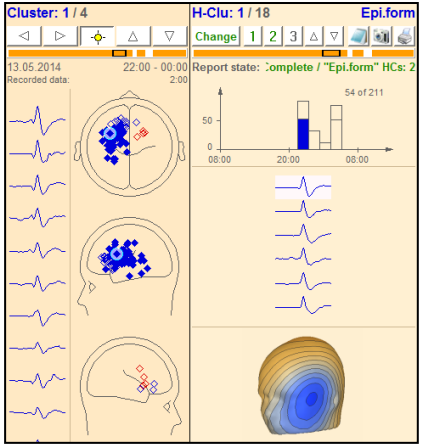
BESA MRI
Create FEM Model → T1/T2: segment head tissues and surfaces. → Obtain individual MRI project files

1

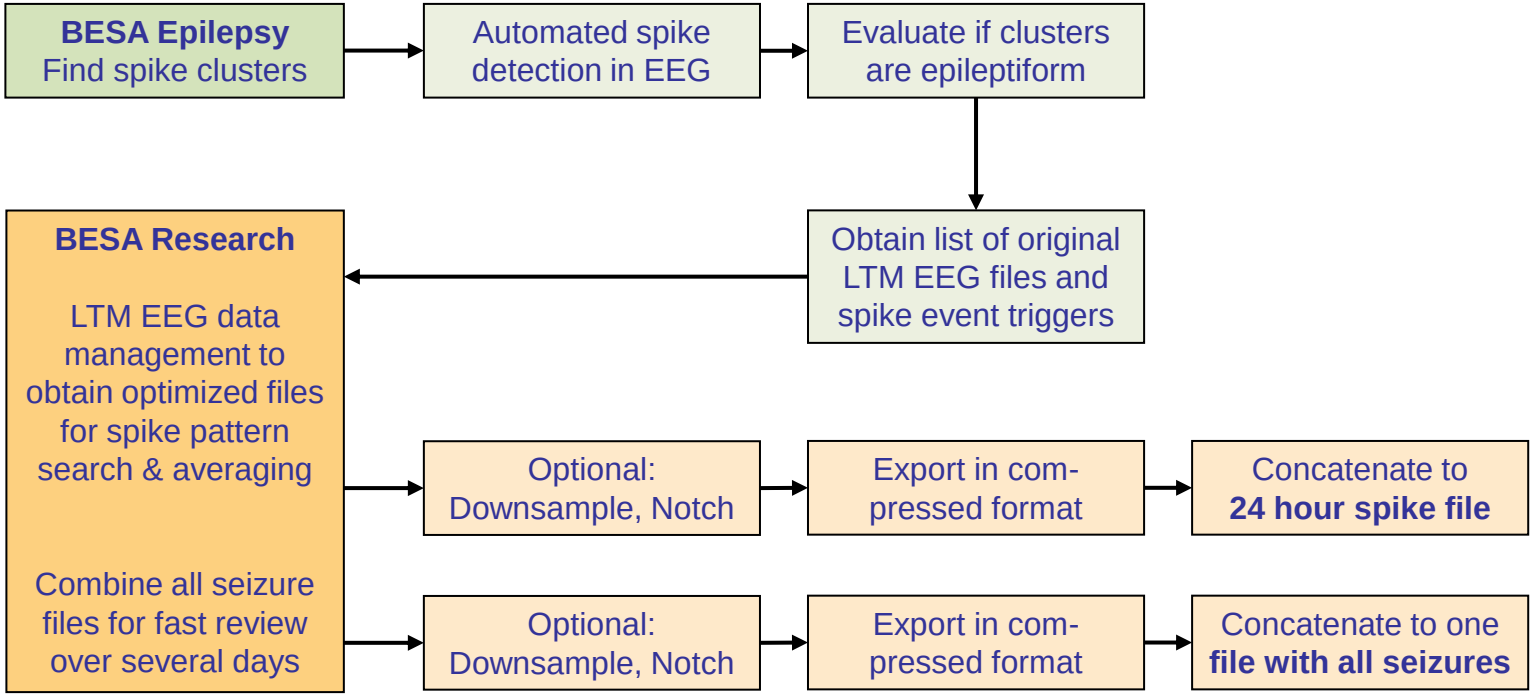


BESA Epilepsy
Find spike clusters → Automated spike detection in EEG → Evaluate if clusters are epileptiform

2



Workstep 3: Prepare concatenated files with spike events and seizures



3

Convenient batch functions are available for fast, automated export and concatenation with and without downsampling and/or notch filter.

Workstep 4: Register electrodes with MRI and calculate FEM model

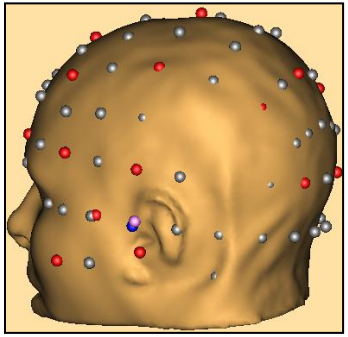
BESA MRI
Create FEM Model

Fit electrodes to the head surface

Check fiducials and adjust manually

Calculate FEM leadfields

Concatenated **spike / seizure file**



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Start registration of electrodes on the individual head.

Obtain all data required for fitting with MRI & FEM

Add 10-10 standard electrode positions for current electrodes

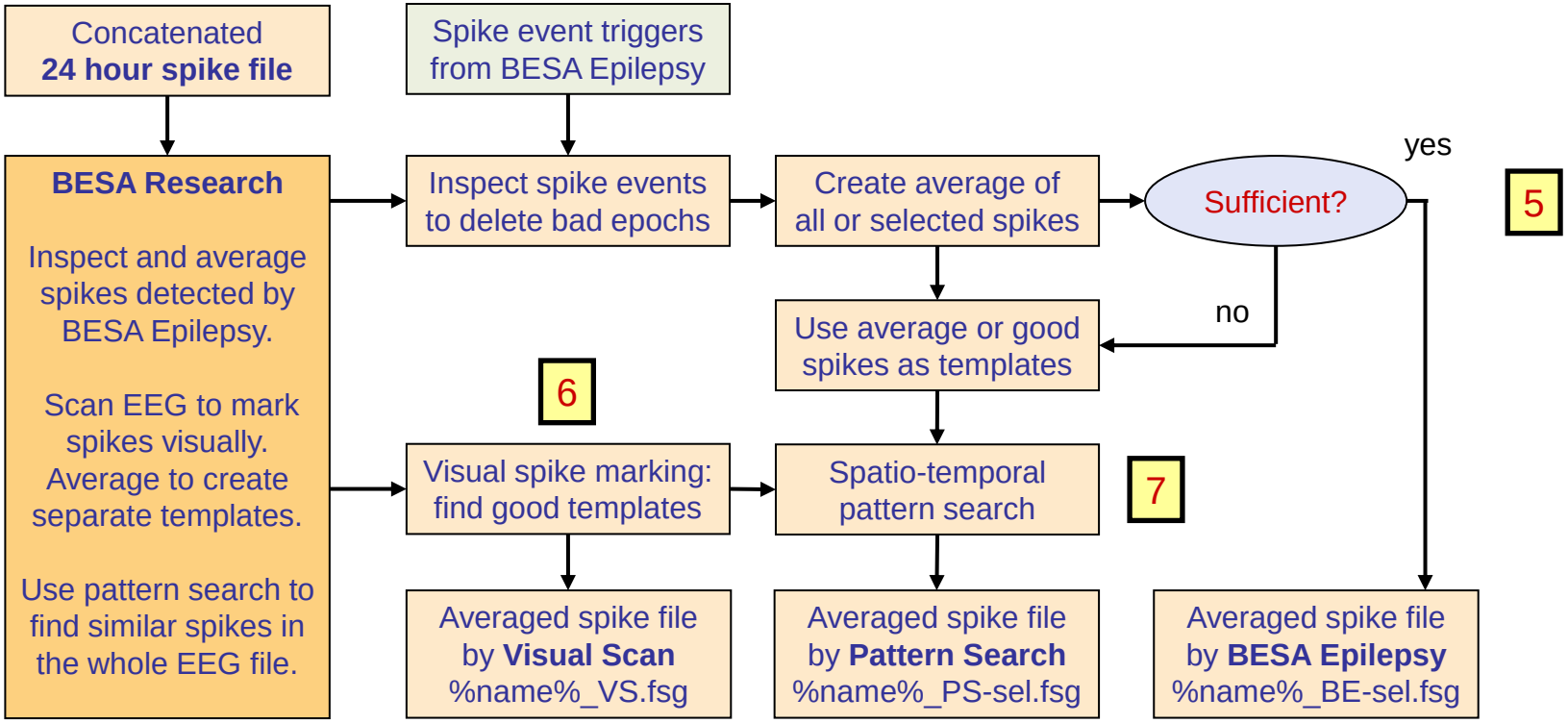
Obtain coordinates for all electrodes.

Obtain paths to MRI and FEM files

File: %name%.sfh

4

Worksteps 5-7: Create spike averages by BE events and pattern search



Convenient batch functions are available to obtain these averages.
The BESA artifact rejection tool is used to select spikes with clear baselines.

Workstep 8: Localize spike onset region visually by 3D voltage mapping

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Map spike peak and onset manually.

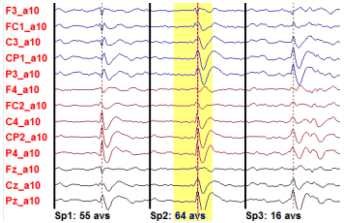
Averaged files open automatically with correct filtering when averaging batch terminates.

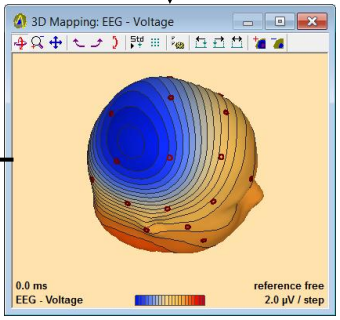
Open averaged file with segments Sp1…

Press F5 to set 5 Hz forward filter

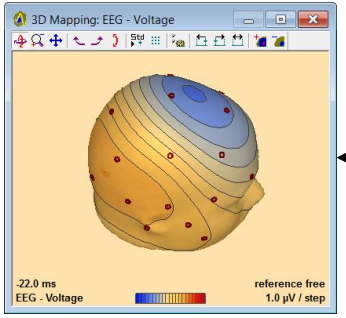
Click onto spike peaks to map

8





Use left / right arrow keys to find onset



Rules for visual localization of the center regions of the dipole field can be found in the document BESA-Quick Guide on 3D Maps.pdf

Workstep 9: Localize and image spike onset automatically with indiv. MRI

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Use batches for optimized, automated localization

Open averaged files with segments Sp1…

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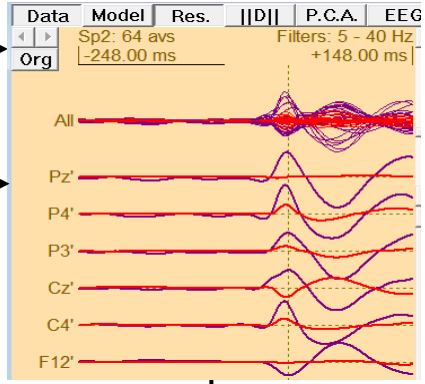
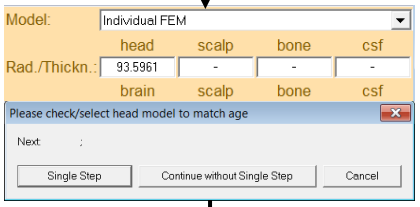
Press **F7** to load Sp1 into SA module

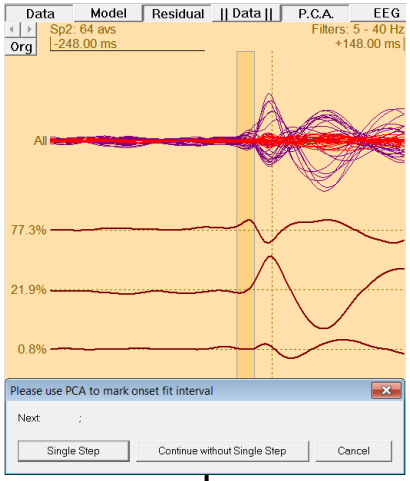
Type **R** to select fit batch for **Sp2**, Sp3,,,



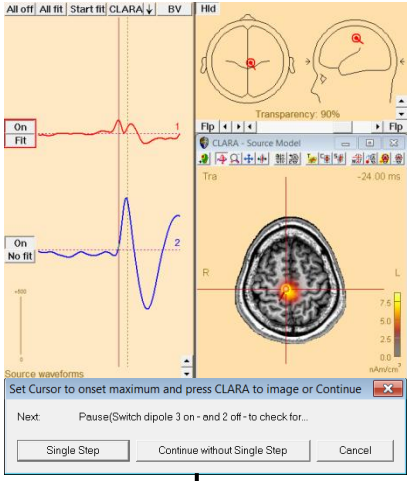
User interaction 1: Set Indiv. FEM model



In the batch control box press continue.



User interaction 2: Mark onset interval



User interaction 3: Image and interpret

Workstep 10: Find seizure onset and localize using phase maps

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Detect seizures by DSA / visual scan.

Use virtual and source montage to find onset oscillation

Use phase maps to localize

10

Navigate using DSA and marked events

F8: Narrow filters & optimized montage

Find earliest oscillation

no

FFT to map spectral power

clear peak?

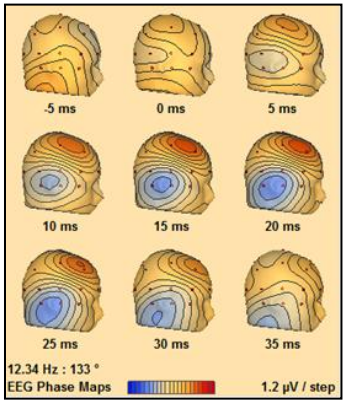
yes

no

Right click to obtain phase map

Detect seizures by DSA scan

Use voltage mapping rules to localize



Phase mapping impossible

Workstep 11: Mark seizure onset cycles, average & localize

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Use virtual / source montages to optimze perception of onset oscillation signal.

Mark clear seizure onset cycles and average.

Use F7 batch to localize average

11

Navigate using DSA & marked/det. events

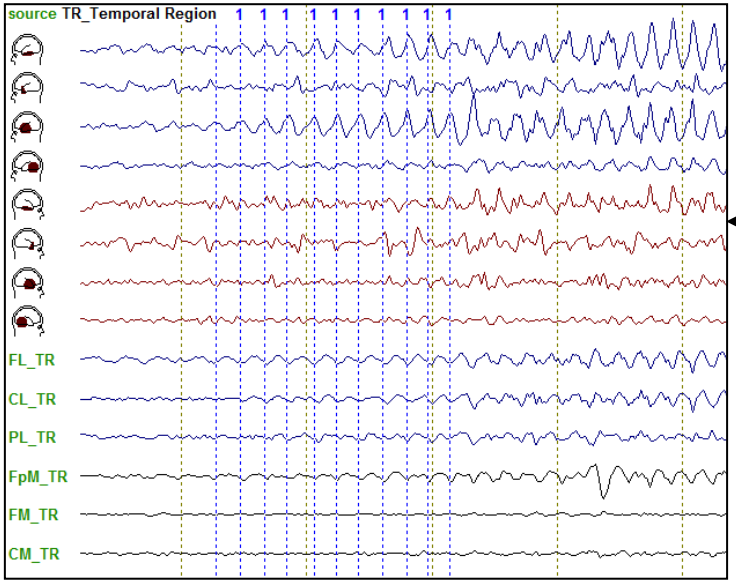
F8: Narrow filters & optimized montage

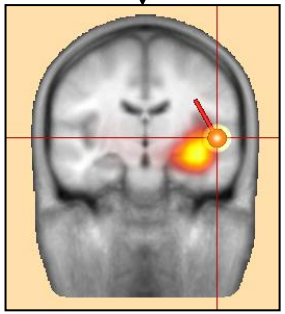
Set best montage to show onset oscillation

Use high low filter to enhance fast ascent

Right click to mark cycles (Pattern 1)

Press F6 to average, then F7 to localize





Caution: Few averages, large background activity, localization less reliable than spikes.

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