

# Accuracy of automated interictal high-density EEG source localisation

Hôpitaux Universitaires Genève

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### Rationale

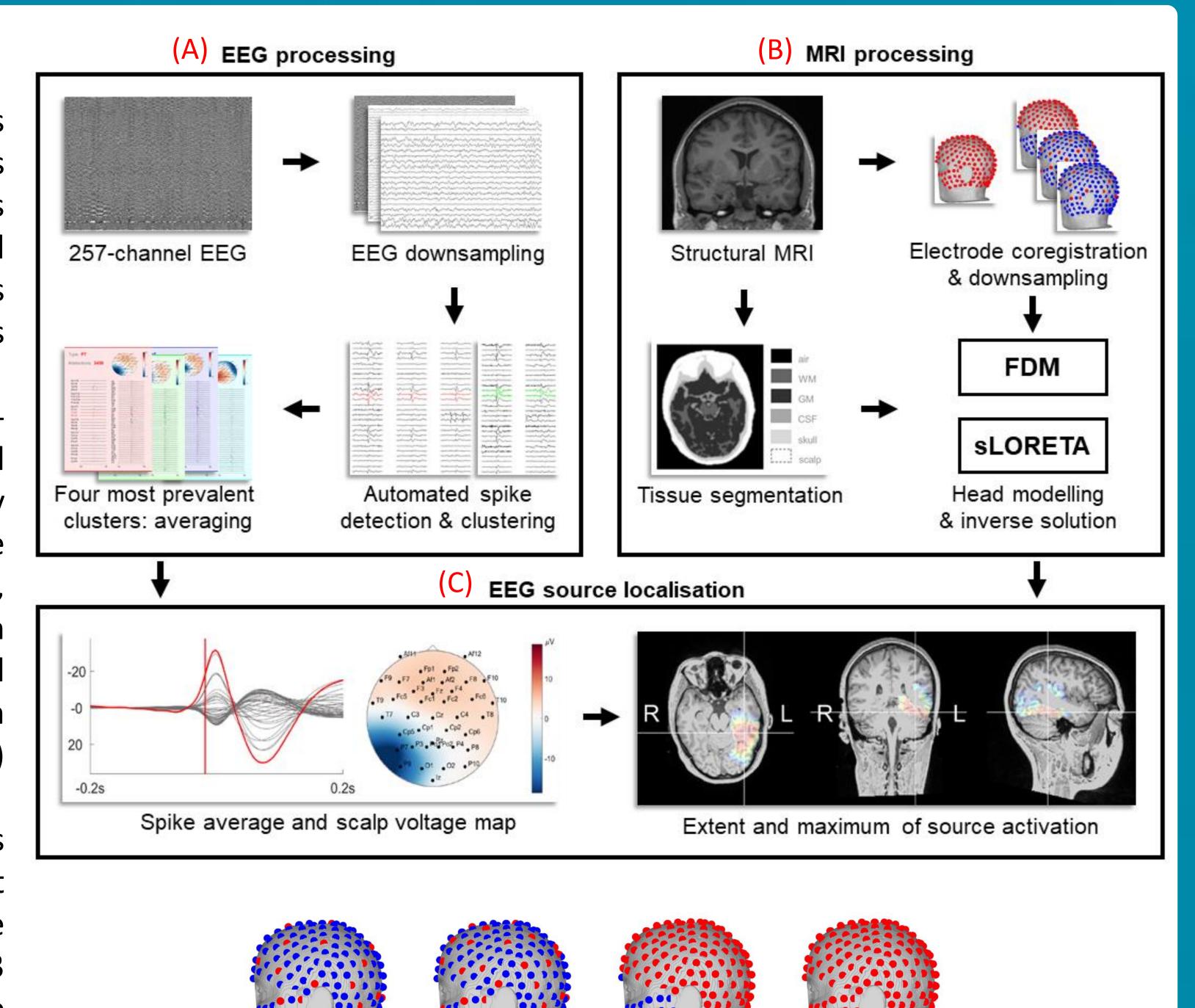
- EEG source localisation of interictal epileptic spikes is a valuable non-invasive tool for presurgical epilepsy evaluation,
- This solution is time consuming and needs expertise,
- Automated analysis has been validated on long-term low-density recordings.

#### Aim

We aimed at evaluating feasibility and accuracy of automated interictal EEG Source Imaging (ESI) based on presurgical high-density (HD) EEG and comparing different electrode setups.

## Methods

- (A) The full 257-channel EEG was downsampled to 25, 40, and 204 channels for comparison. For each EEG setup, spikes were automatically detected and clustered based on their topography. The 4 clusters with the highest numbers of single events were further evaluated.
- (B) The 257-channel EEG setup was coregistered to the structural 3D MRI and downsampled. The head was automatically segmented into 6 tissue layers (white matter, grey matter, cerebrospinal fluid, skull, scalp, and air) to generate an individual finite difference head model (FDM). The standardized low-resolution electromagnetic tomography (sLORETA) served as inverse solution.
- (C) For each spike cluster, at the average's onset, half-rise, and peak, both the extent and the maximum (crosshairs) of the source activation were visualised in the 3 orthogonal planes of the MRI. The source maximum of half-rising was later compared to the postsurgical MRI.

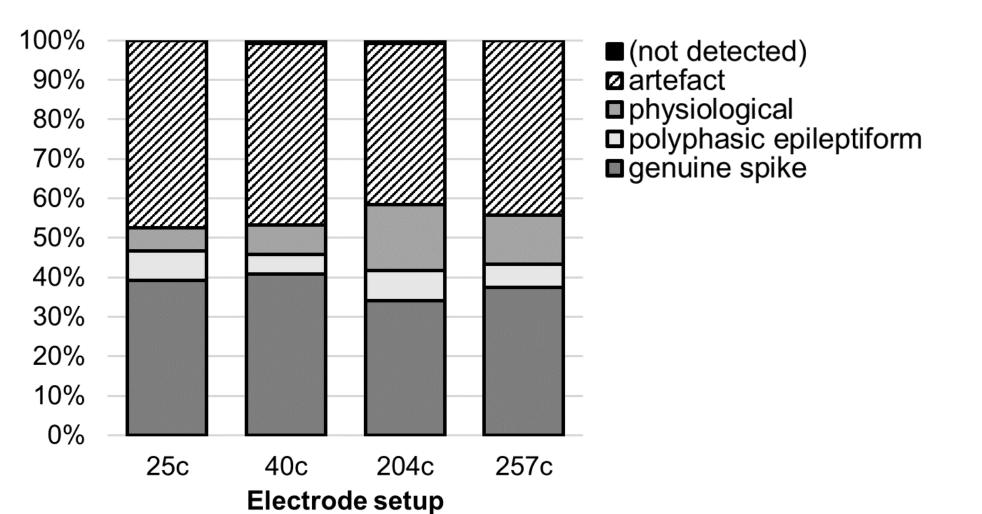


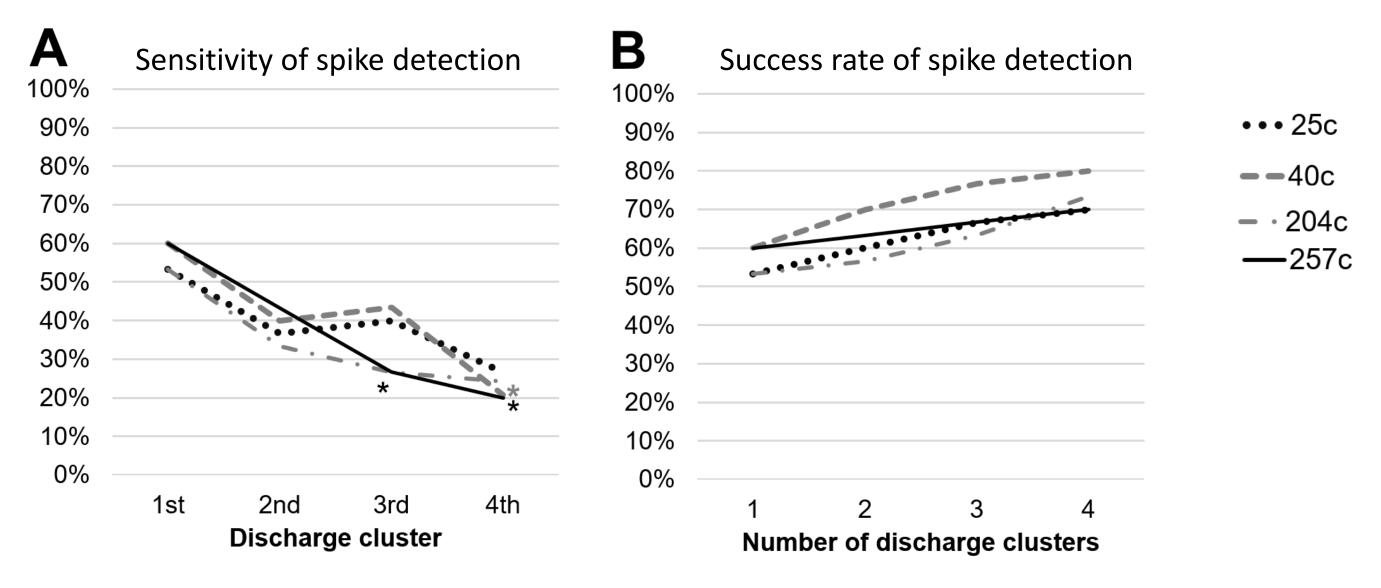
204 channels 257 channels

#### Results

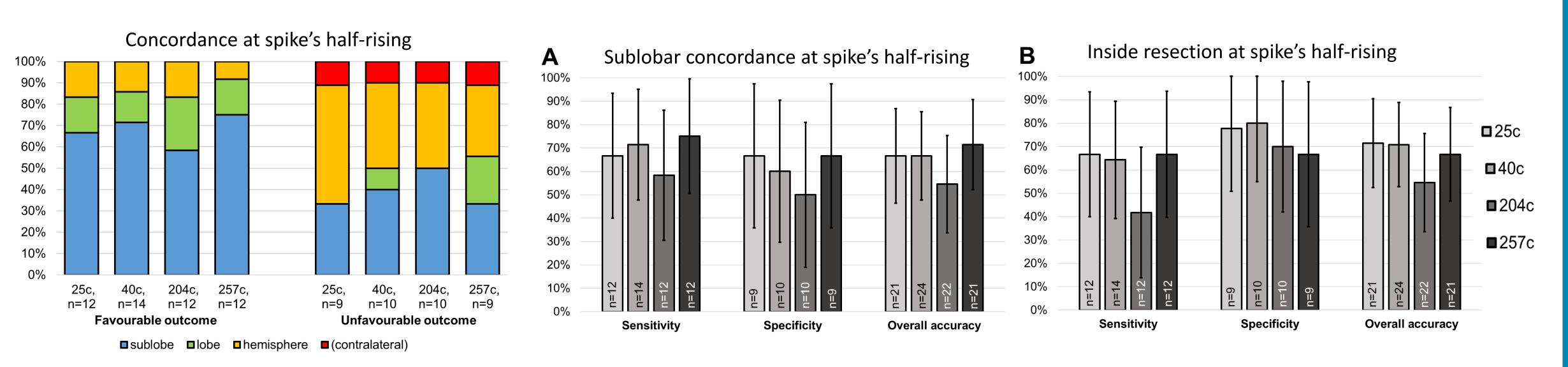
From 30 consecutive cases of this study, 21 patients had at least one spike cluster.

- N1 = 12 with favourable postsurgical outcome, ILAE 1+2;
- N2 = 9 with unfavourable outcome, ILAE 3-5.





- A) proportion of genuine spikes in the first, second, third, and fourth most prevalent discharge cluster,
- B) success rate of automated spike detection to detect at least one genuine spike cluster depending on the number of the most prevalent discharge clusters included.



- A) parameters based on sublobar concordance between source maximum and resected brain area at the most prevalent spike average's half-rise.
- B) parameters based on the source maximum located inside the resected brain area at the most prevalent spike average's half-rise. Error bars indicate 95%-confidence intervals.

## Conclusion

- Automated interictal source localisation from high-density EEG is feasible in the majority of patients, with EEG-expert review to discard false-positive patterns.
- Validated by site of resection and postsurgical seizure outcome, results of automated source localisation are fairly accurate but not significantly different from low-density EEG.

