Development and Application of multivariate Methods of Time Series Analysis

EEG's with epileptic activity

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in collaboration with

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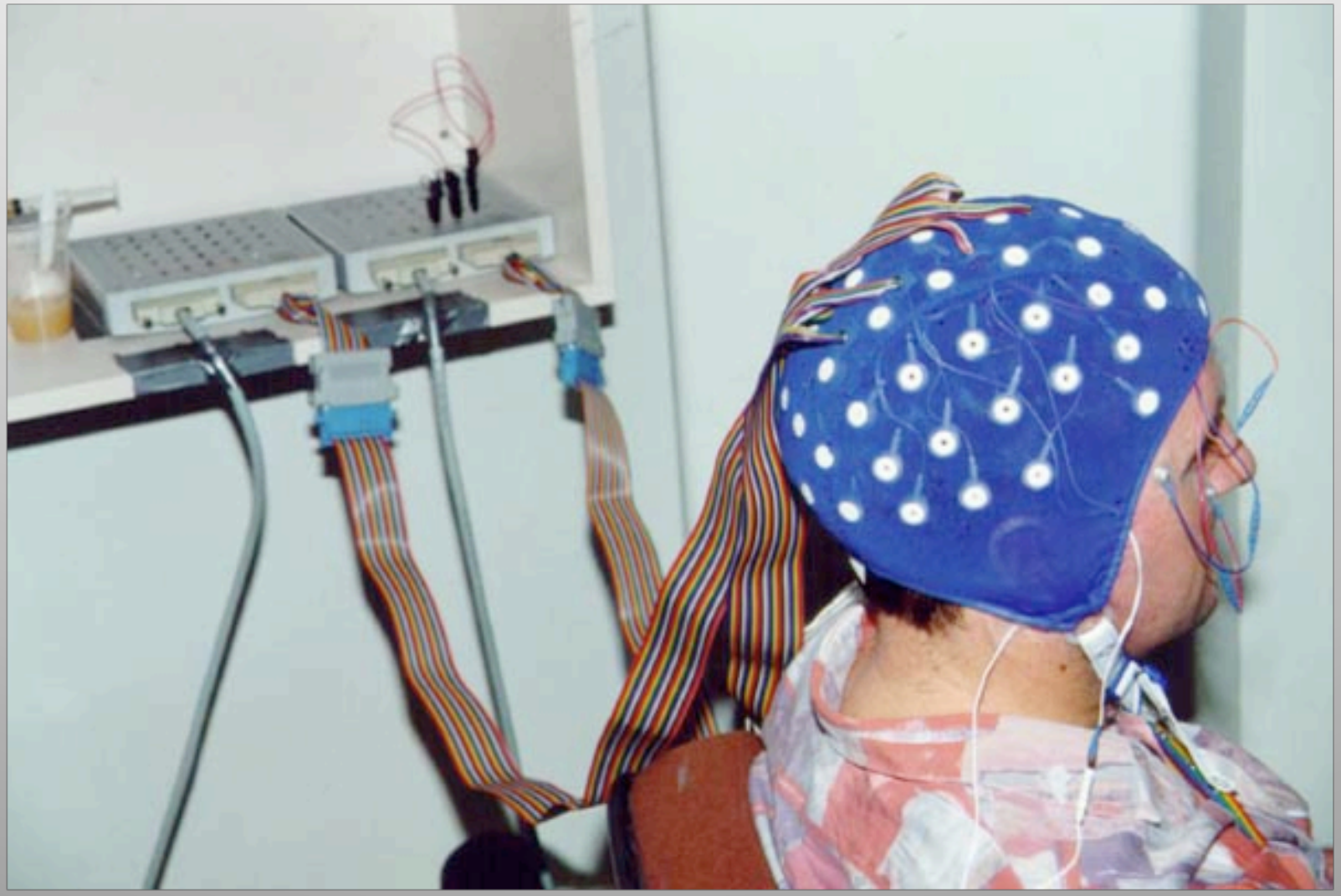
Christian Rummel (Inselspital Bern)
Kaspar Schindler (Inselspital Bern)

also
Gerold Baier (University of Manchester, UK)

Definition of the Problem



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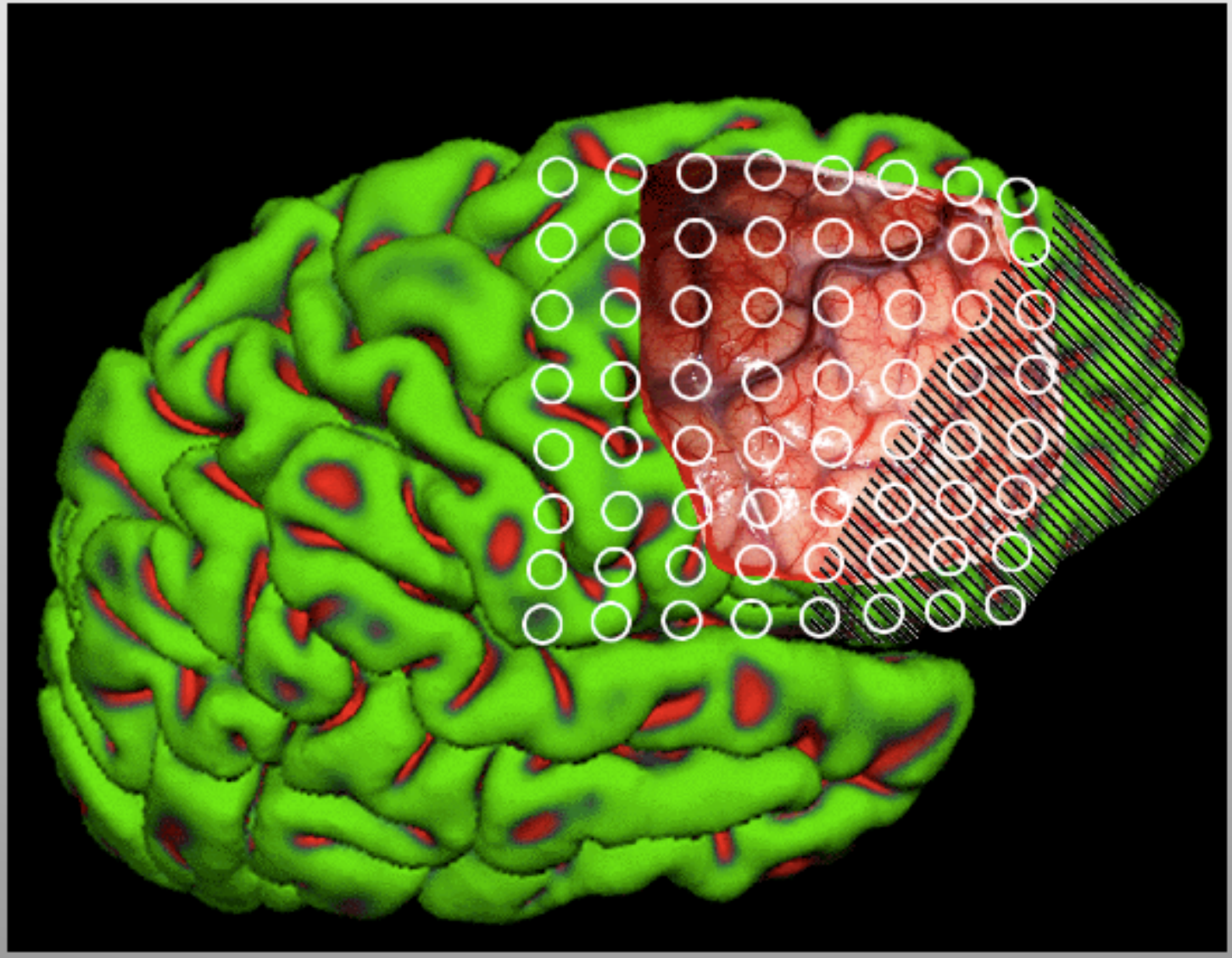

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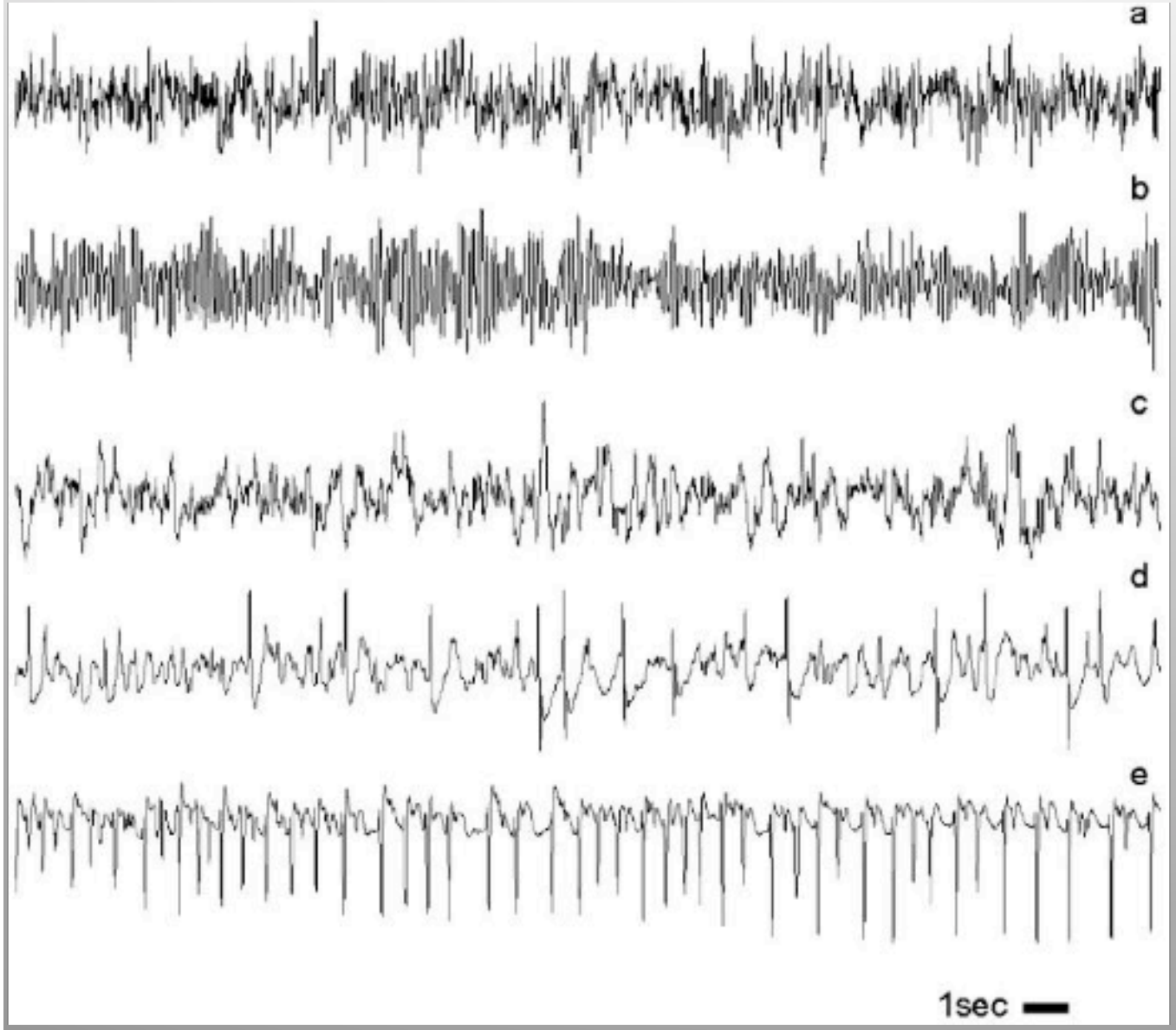


surface EEG,
at rest, eyes open

surface EEG,
at rest, eyes closed

intracranial EEG,
seizure free

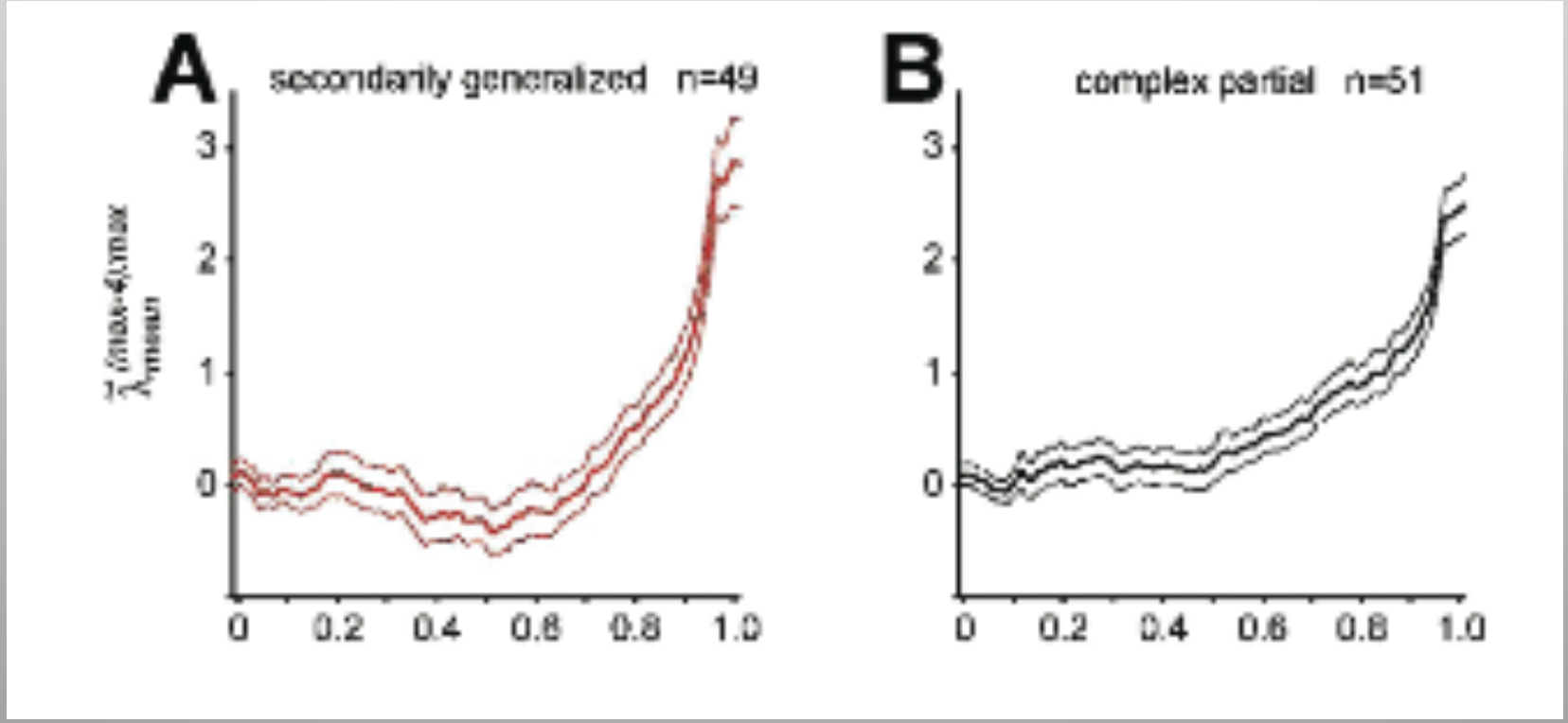
intracranial EEG,
epileptogenic zone

intracranial EEG,
epileptic seizure

The CCS-measure

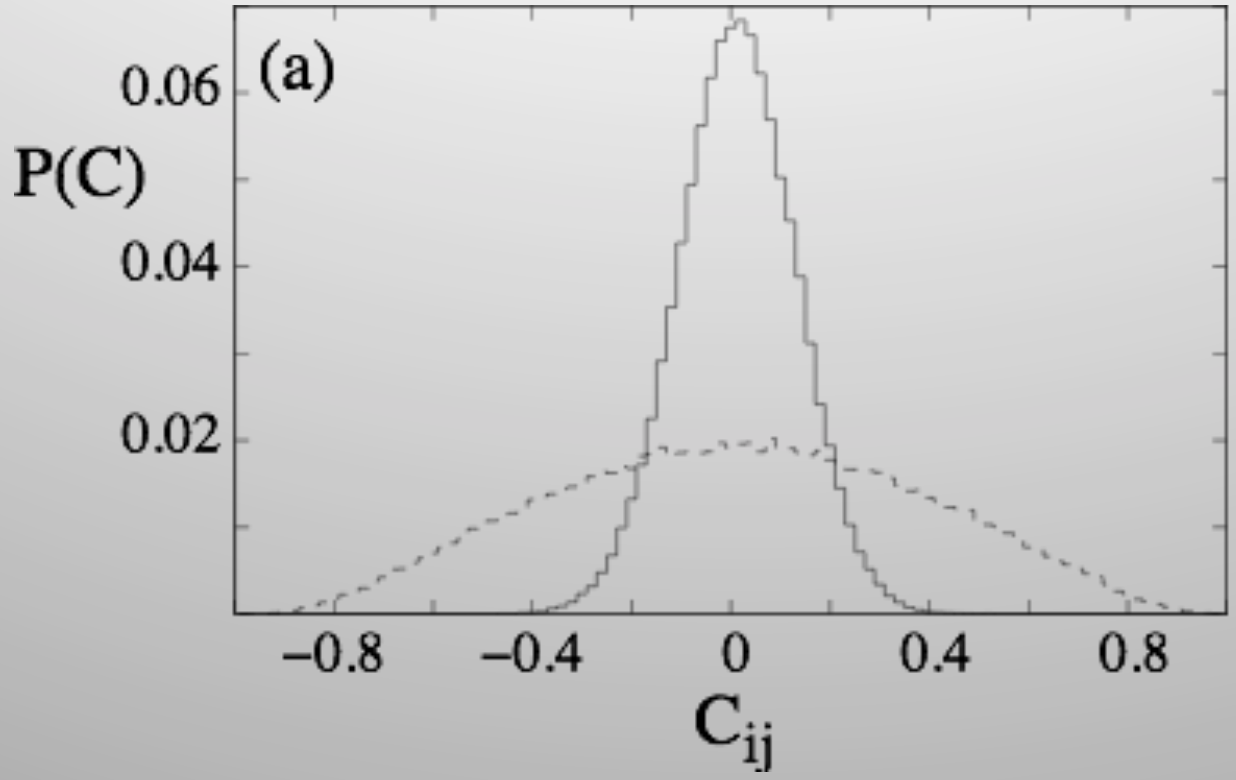
Application to focal onset seizures (Temporal Lobe Epilepsy):

Previous result (100 seizures, intracranial recordings)



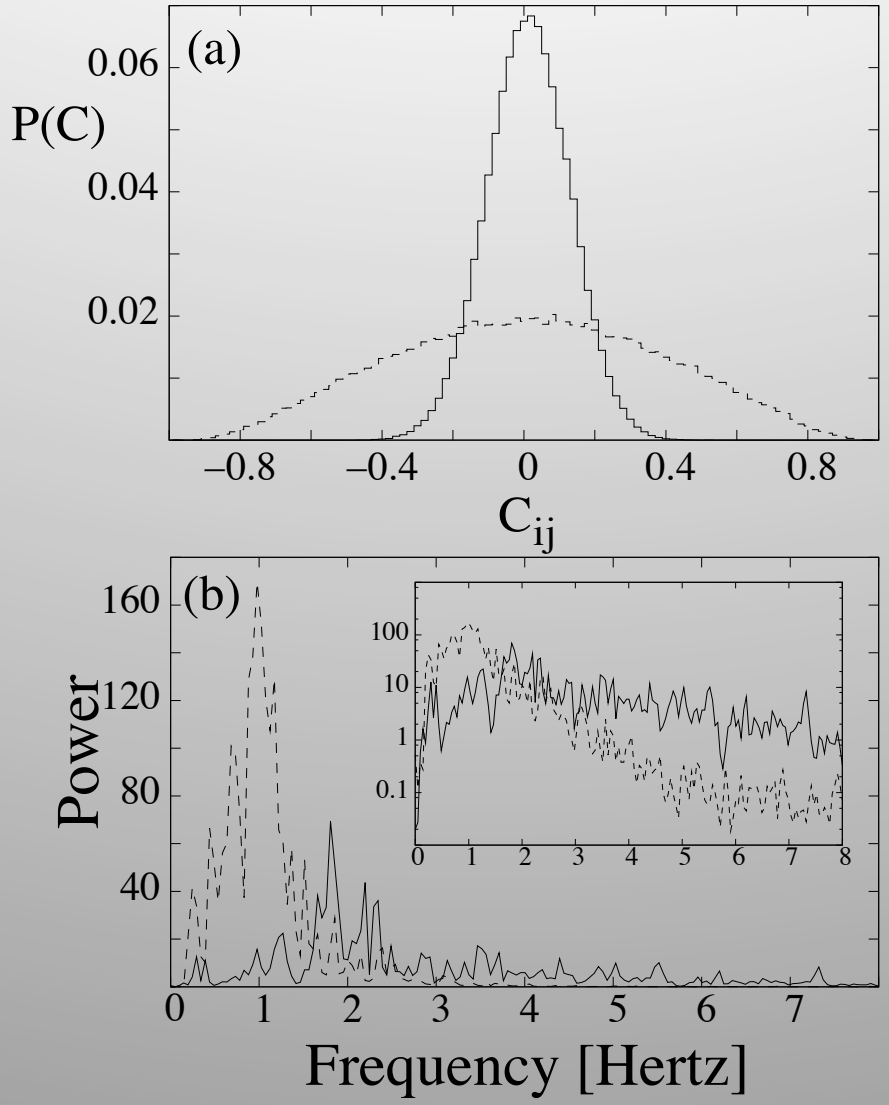
Schindler et al. Brain 130 (2007) 65

The equal-time cross-correlation matrix



Finite data segments might might have a crucial negative influence on the quantitative analysis!!!

The equal-time cross-correlation matrix

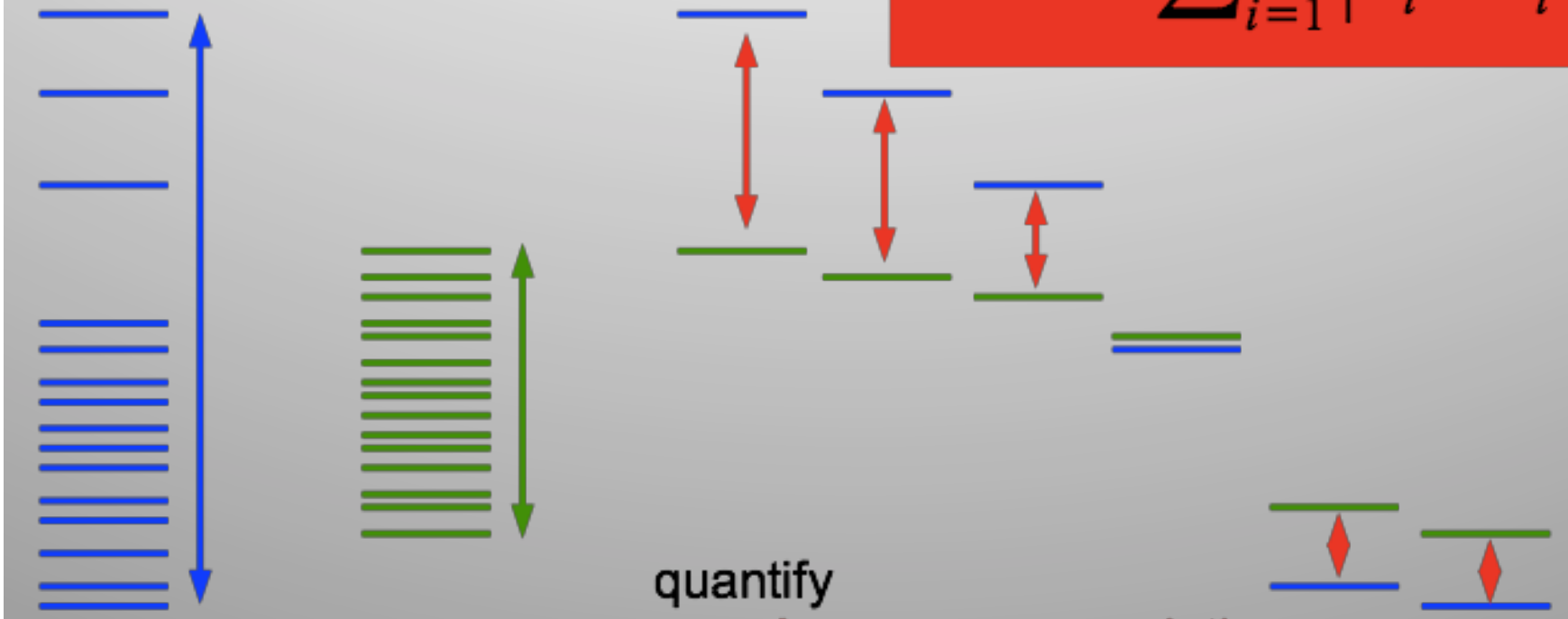


But also the variation of the power spectra!

The CCS-measure

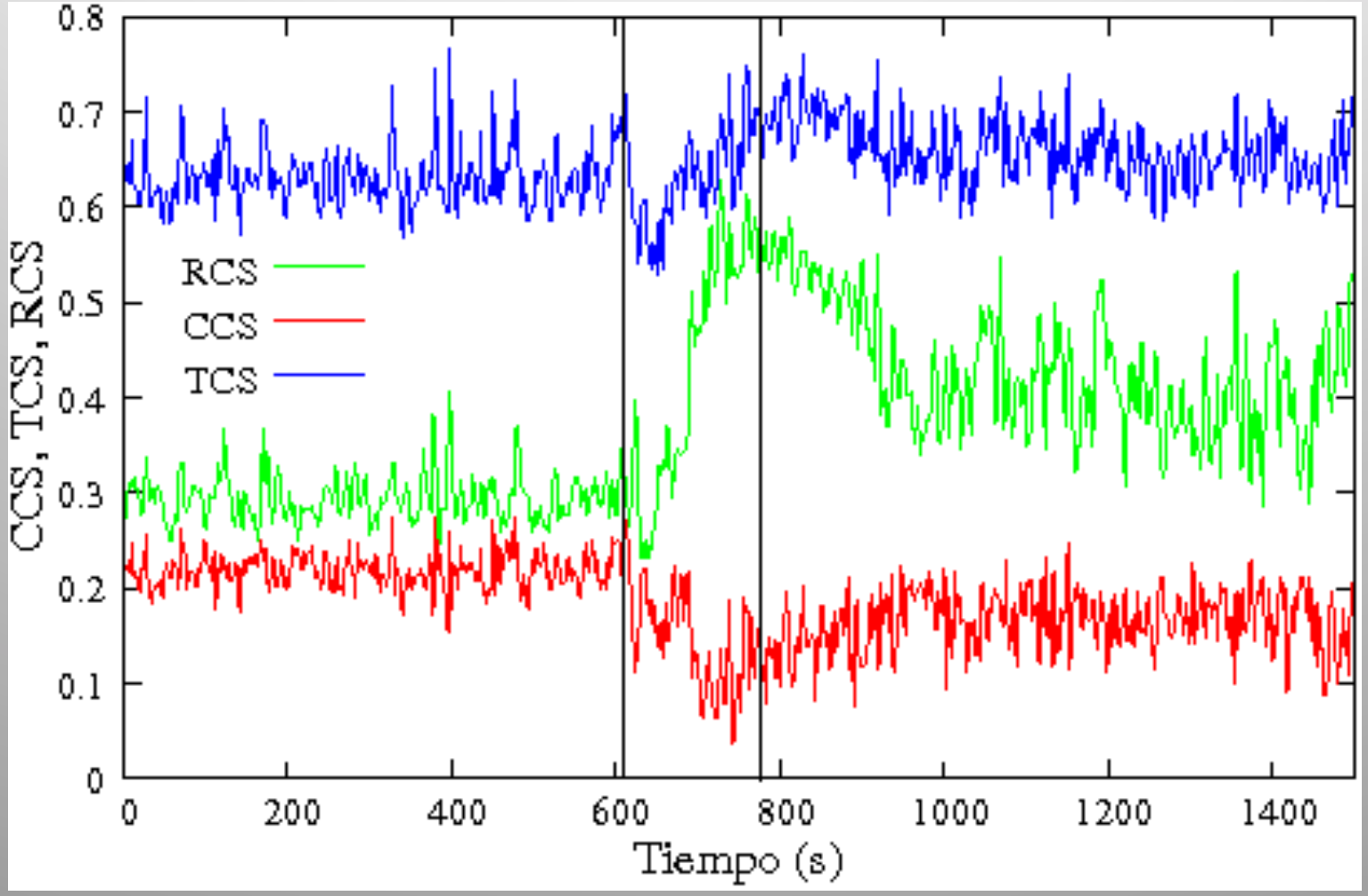
Is to possible to derive a measure to quantify the total amount of genuine cross-correlations?

$$CCS \sim \sum_{i=1}^{M} \left| \lambda_i - \lambda_i^{surr} \right|$$



The CCS-measure

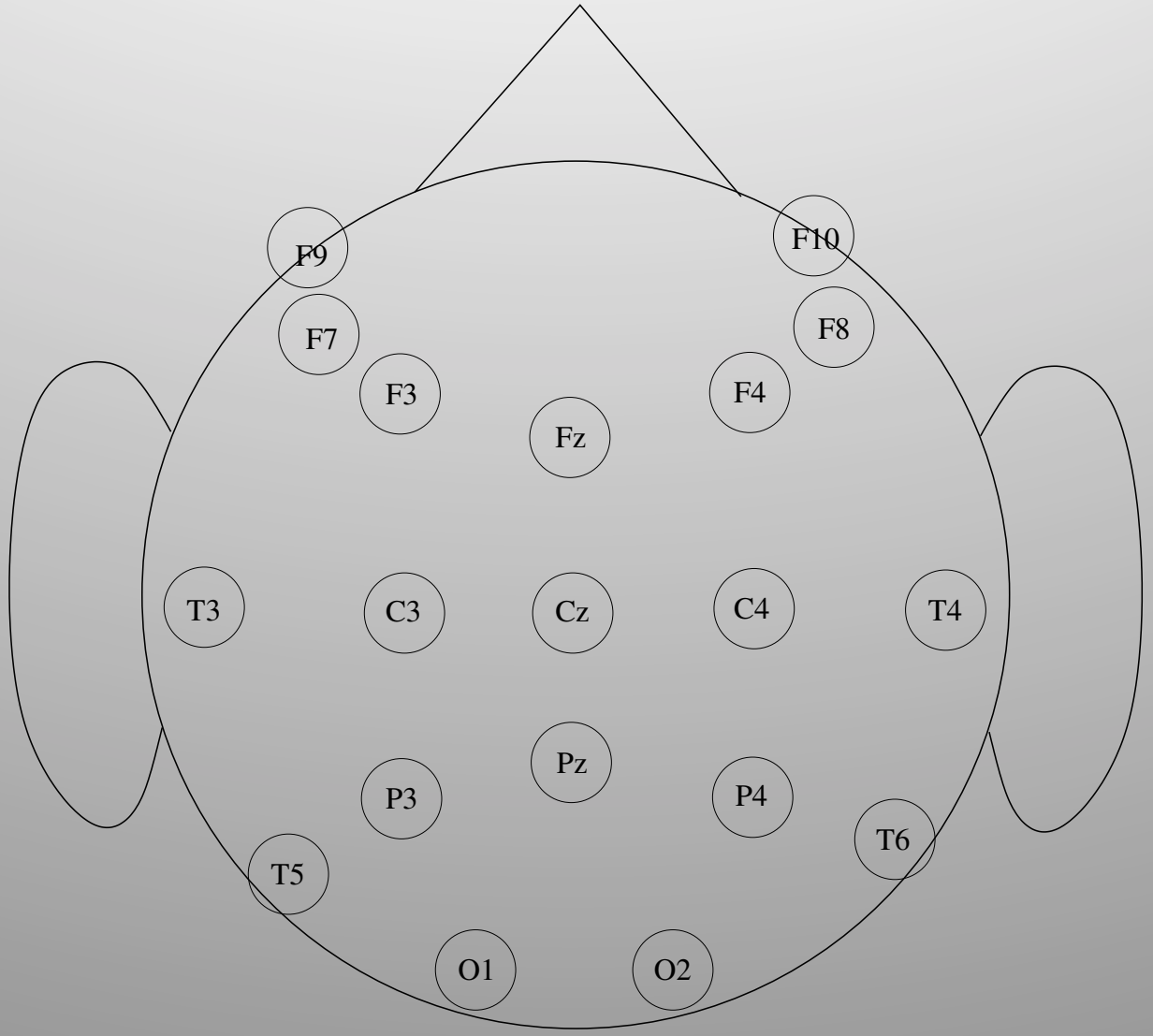
Application to focal onset seizures (Temporal Lobe Epilepsy):



M.M. et al. submitted to J. Clin. Neurophysiol.

The CCS-matrix

Preliminary results for focal onset seizures (extracranial recordings):



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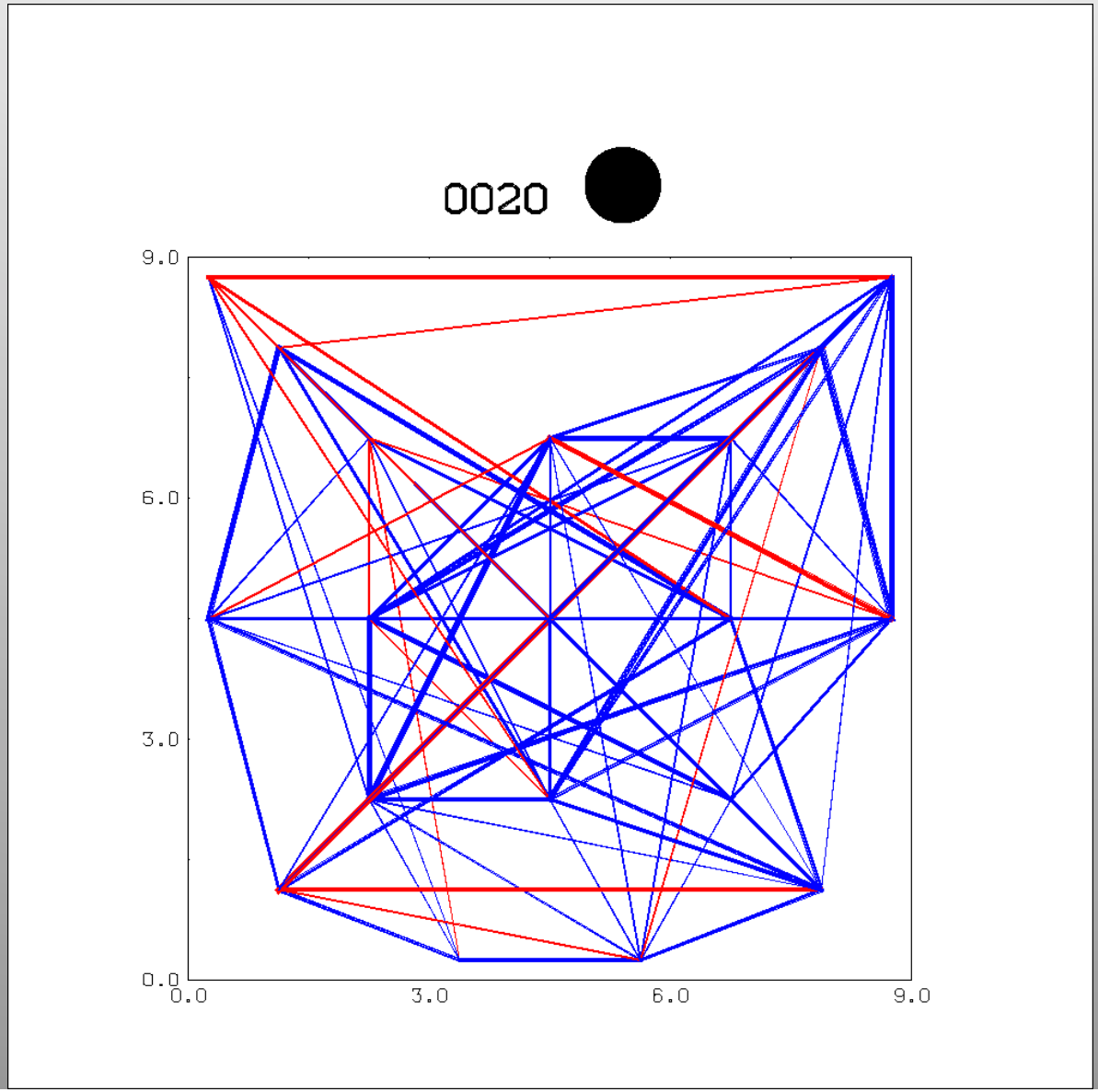

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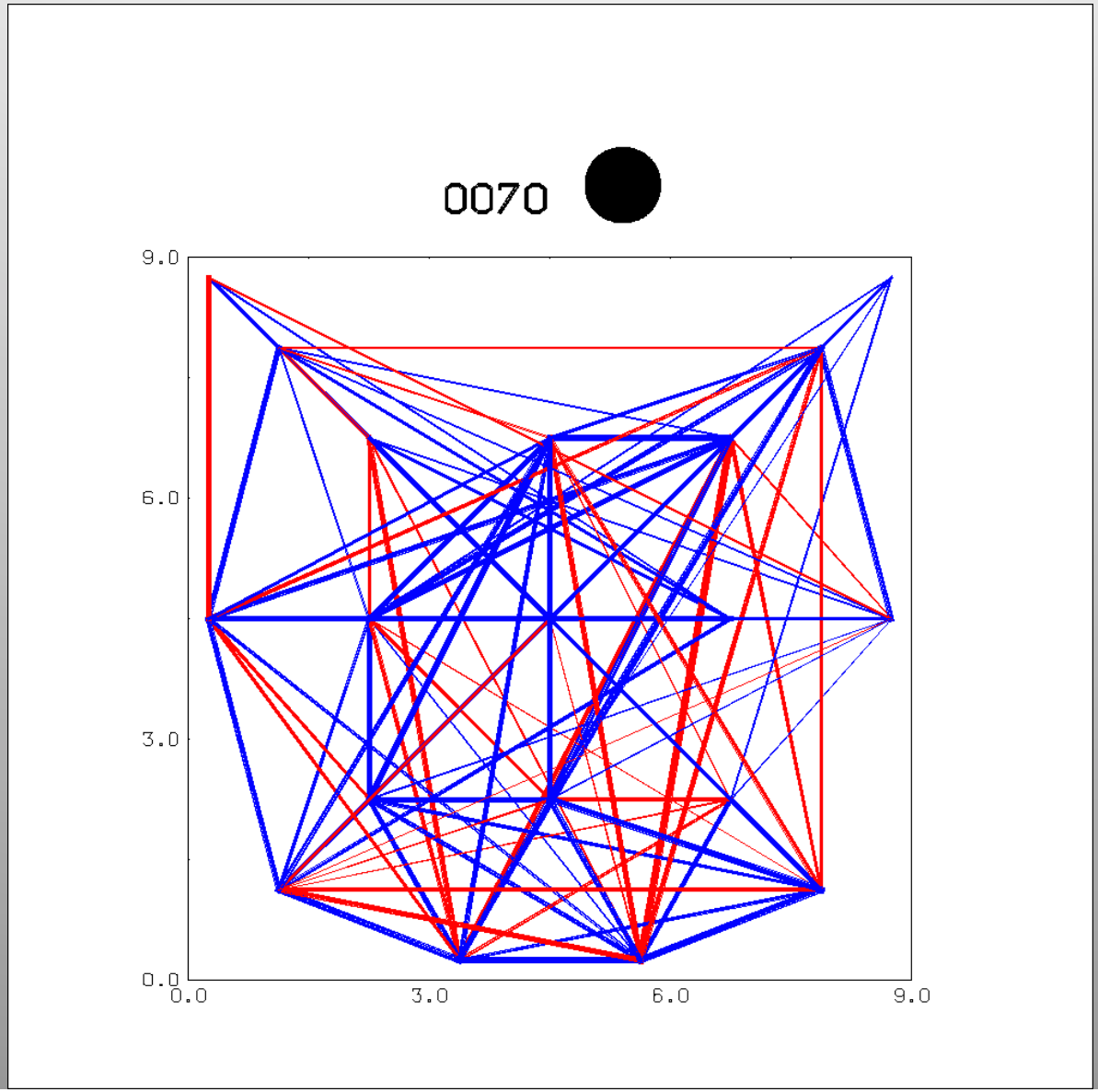

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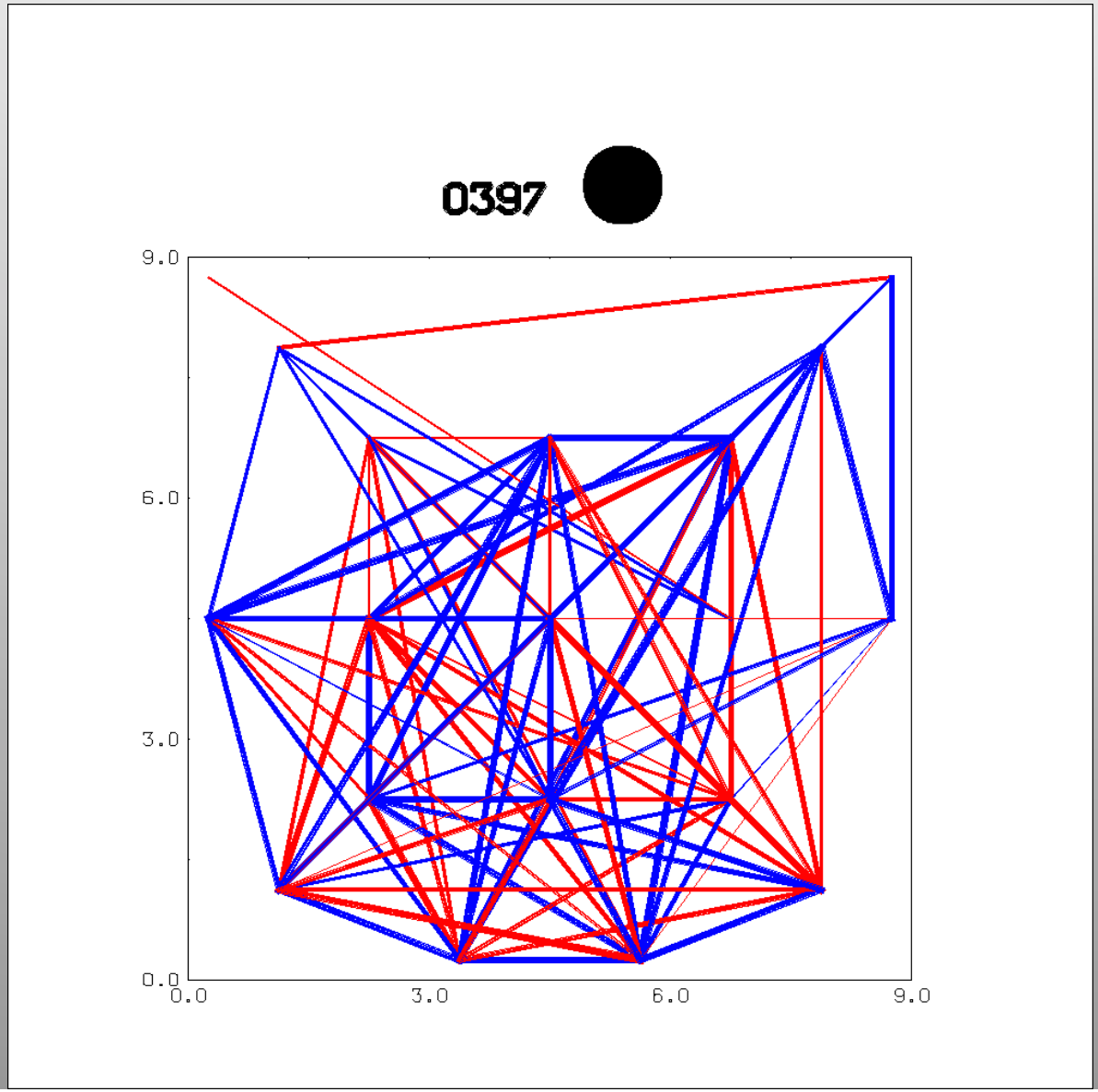

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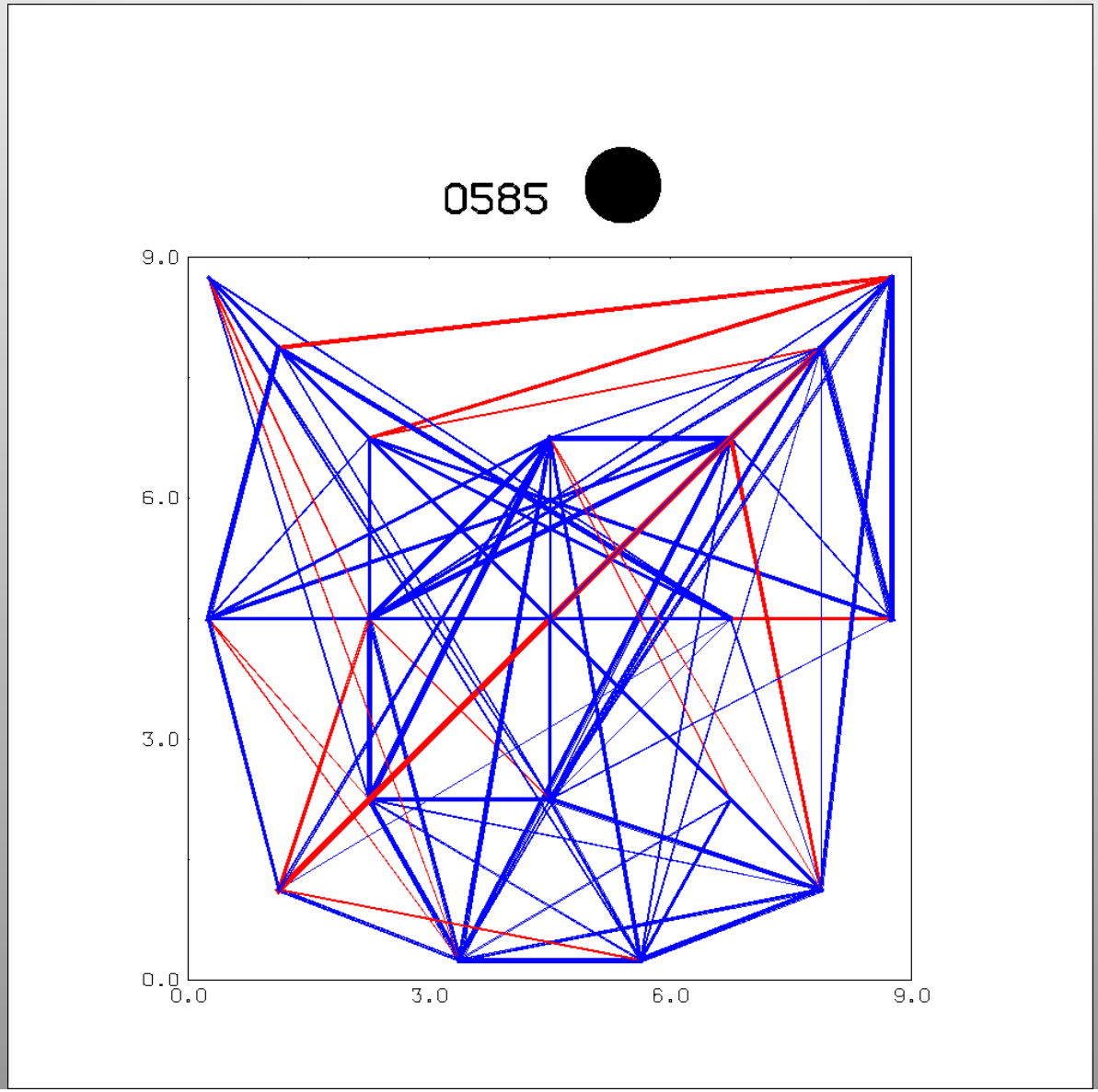

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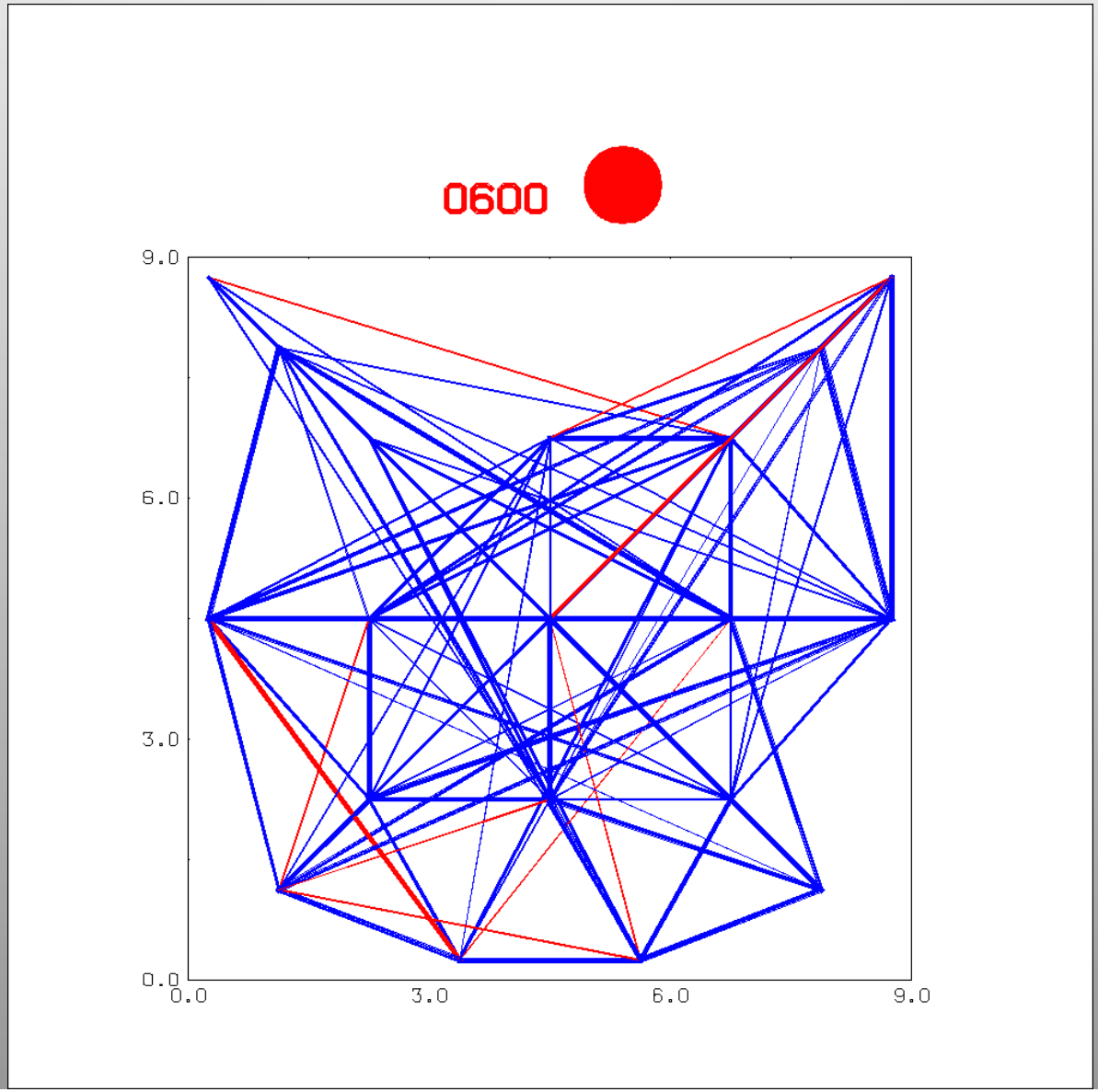

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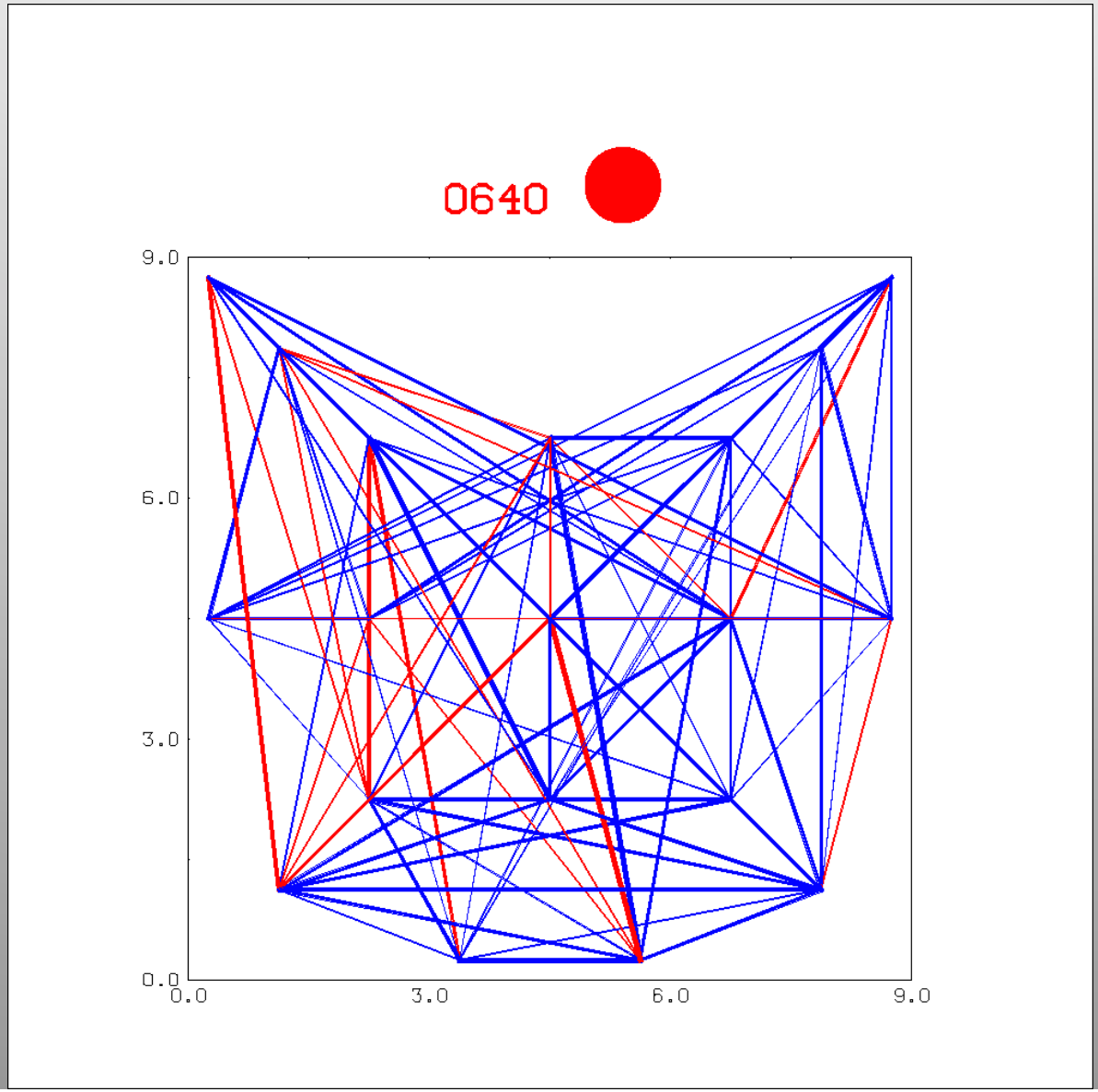

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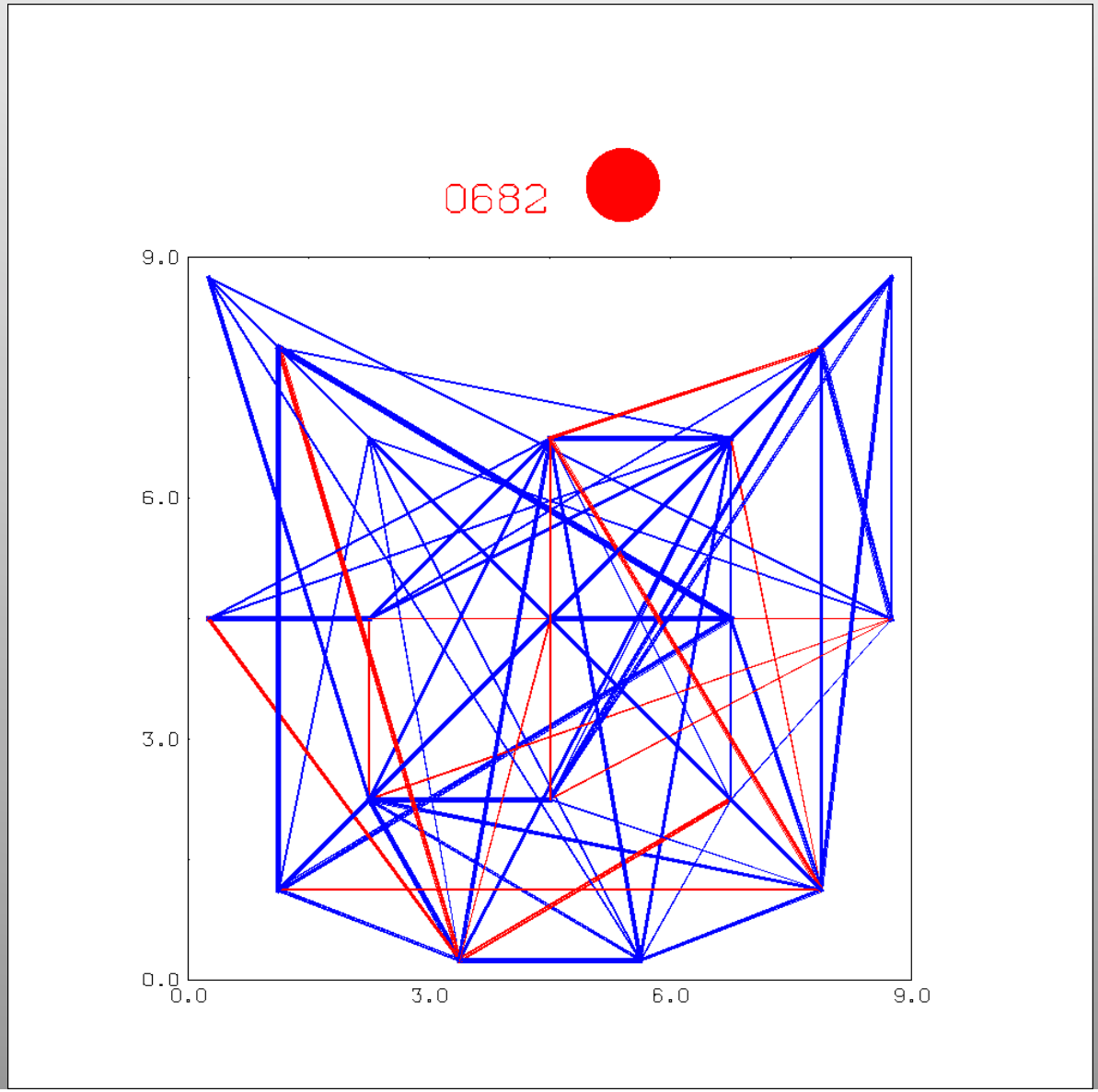

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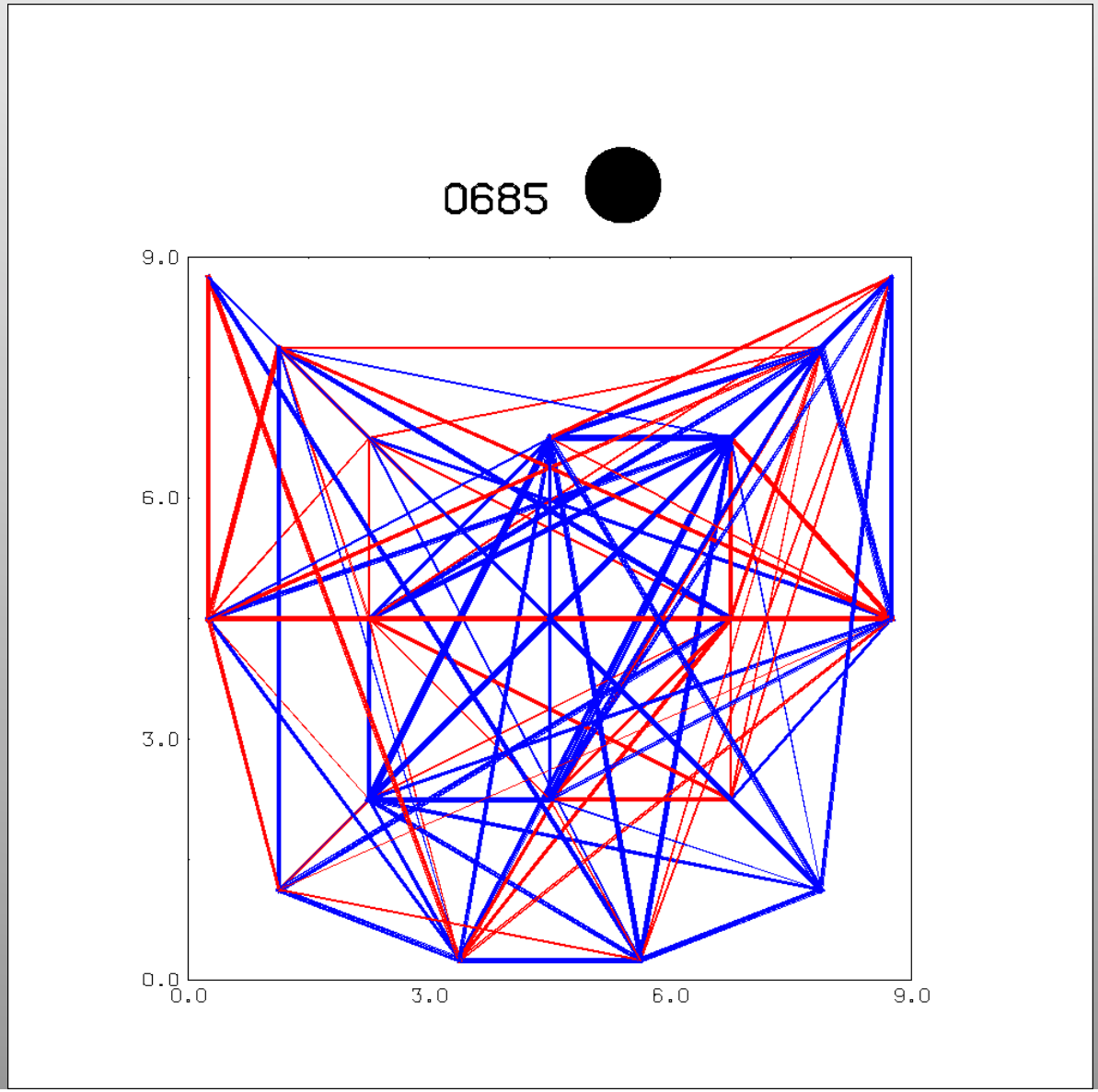

The CCS-matrix

Preliminary results for focal onset seizures (extracranial recordings):

Applying graph theoretical measures to the 12 EEG recordings we observe a simultaneous integration and segregation of the functional network of the cerebral dynamics

-Splitting in subgraphs

-Increase of genuine correlations within those subgraphs

Many thanks to my collaborators!

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And many thanks to YOU!!!