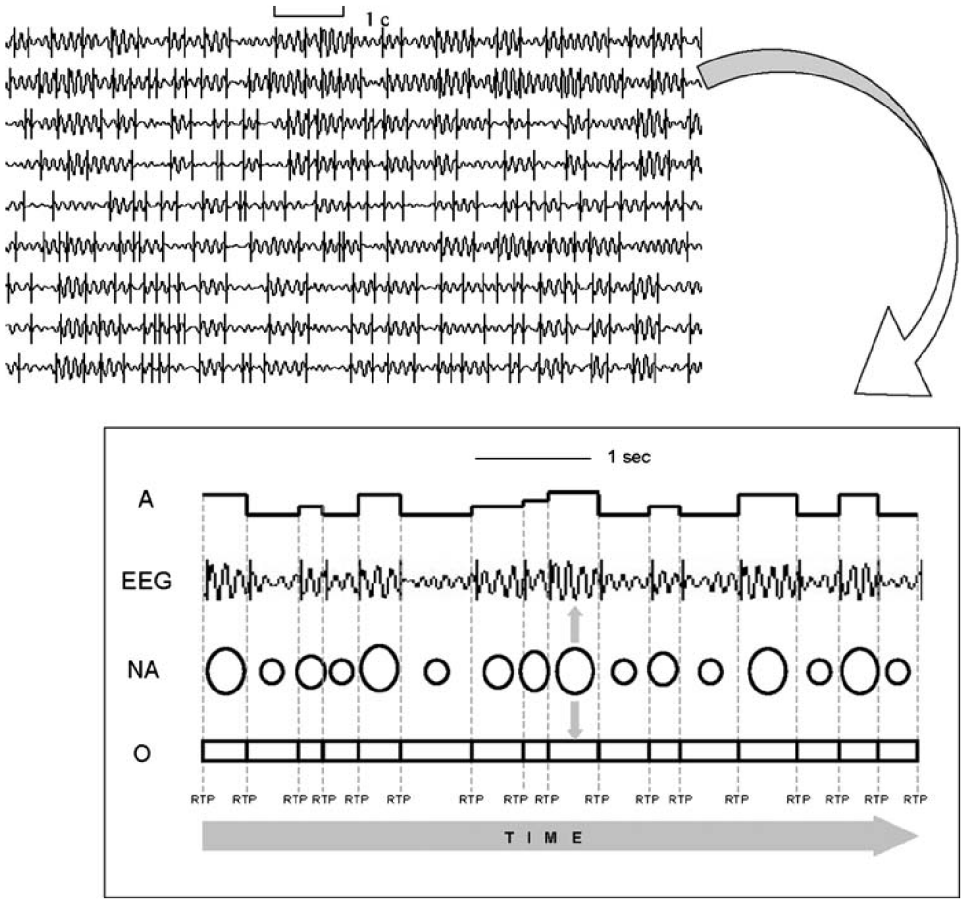

Fig. 2 Correspondence between neuronal assemblies and EEG segments. At the *top of the figure* nine EEG channels filtered in the alpha frequency band (7–13 Hz) are presented. At the *bottom of the figure* right occipital EEG channel is presented with corresponding characteristics. *A* Average amplitude of EEG segments across time-period *t*; *EEG* Electroencephalogram; *NA* Neuronal assemblies of different size; *O* Operations of different duration; *RTP* Rapid transition periods (boundaries between quasi-stationary EEG segments)

may relate to some other OM). The sketch of this general idea is presented in the Fig. 3.

A quantitative description (Kaplan et al. 2005) of this type of synchrony, also called *structural synchrony* (SS)[12], provides the means for a radically new insight into the co-operation of the brain's systems, and it offers a mechanism of how discrete brain operations are bound together into a unified complex cognitive operation/function (Fingelkurts and Fingelkurts 2003; Fingelkurts et al. 2005). Thus, the structural (or operational) synchrony measure enables researchers to detect periods with a more or less generalized stabilization (*metastable OMs*) in the dynamics of the spatial mosaic of segments of the brain electromagnetic field (Fingelkurts and Fingelkurts 2001, 2003). It was demonstrated experimentally that the OMs *transition* appears *abruptly*, when the set of brain areas which constitute an OM rapidly looses functional couplings with each other and establishes new couplings within another set of brain areas, thus demarcating a new OM in the space–time continuum, Fig. 4 (Fingelkurts 1998; Fingelkurts et al. 2003b; see also John 2002 for the possible mechanism; and Brown 1998 for a philosophical conceptualization). These distinctive jumps between OMs have the appearance of a spatio-temporal discontinuity revealed in the EEG global field (which is not to be confused with abrupt jumps in the local EEG fields—concatenated quasi-stationary segments). Therefore, the apparent EEG field discontinuity was adopted as the sign of a state transition in cortical (and subcortical) dynamics (Fingelkurts and Fingelkurts 2001; for similar ideas see also Bressler 1995; Freeman 2003; Freeman and Vitiello 2005). First substantial experimental support for this formulation was obtained within the framework of the brain microstates concept: Momentary cortical electric field distributions are abruptly upgraded and replaced constantly (Lehmann 1971; Lehmann et al. 1987),

[12] The index of structural synchrony (ISS) is estimated through synchronization of rapid transition processes (RTP)—boundaries between quasi-stationary segments—between different EEG channels. This procedure reveals the functional (operational) interrelationships between cortical sites as distinct from those measured using correlation, coherence and phase analysis (Kaplan et al. 2005).