Real-time fMRI

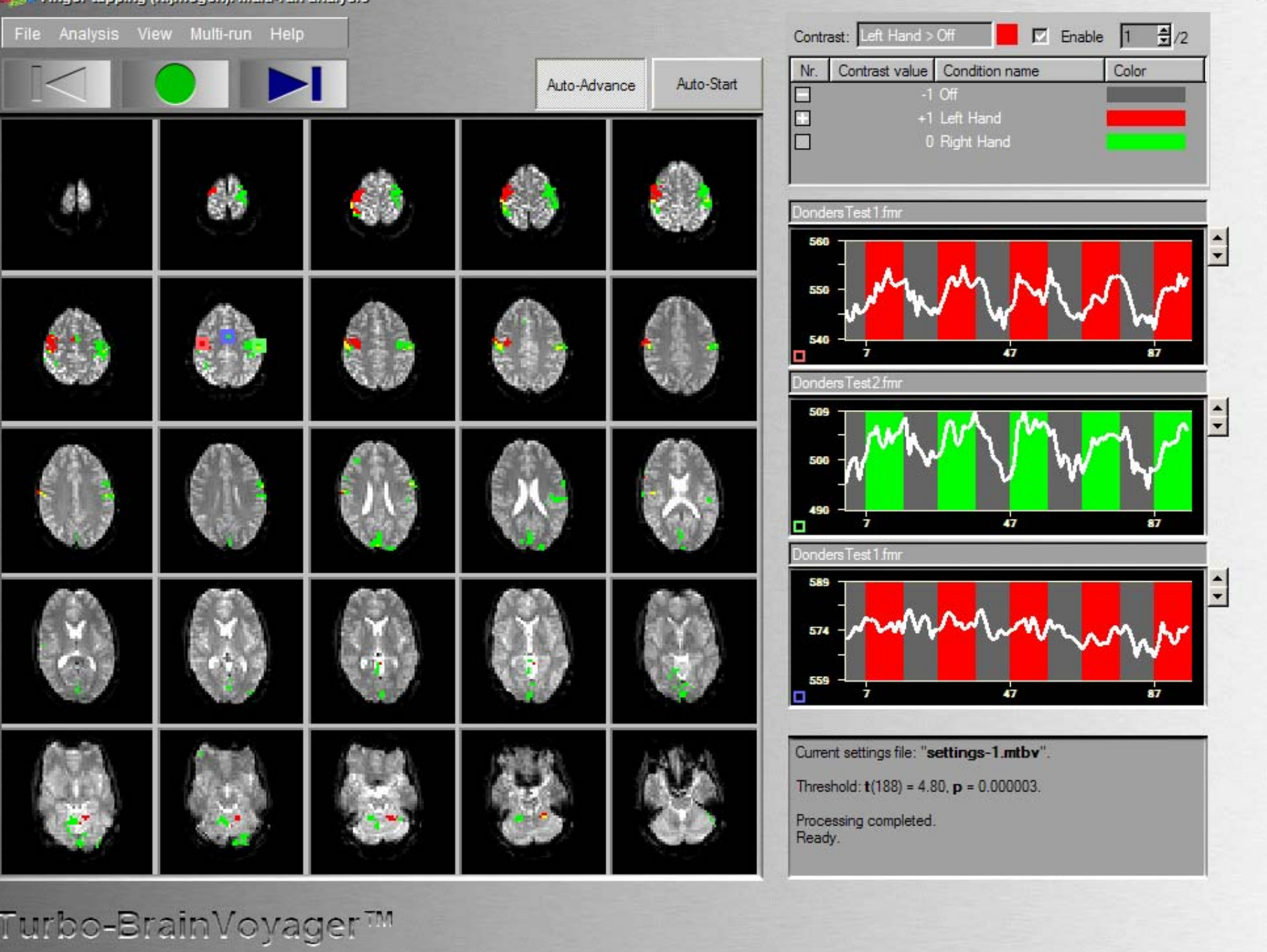
- Can be used to analyze fMRI data directly during image acquisition allowing “online” observation of the working brain
- Allows for quality assurance: Were the right locations scanned? How much head motion? Are statistical maps and time courses o.k.?
- Advanced applications such as bio-feedback and neurosurgical monitoring

Real-time fMRI

During the functional runs, the following computations are repeatedly performed in Turbo-BrainVoyager within the time window of ***one TR***:

- reading of EPI slices into working memory
- 3D motion correction
- incremental general linear model
- Incremental event-related averaging
- thresholding, clustering and color-coding of the resulting statistical maps
- visualization of the maps on the EPI images, on the intra- or extra-session 3D data set and on rendered cortical surfaces

Real-time fMRI – a movie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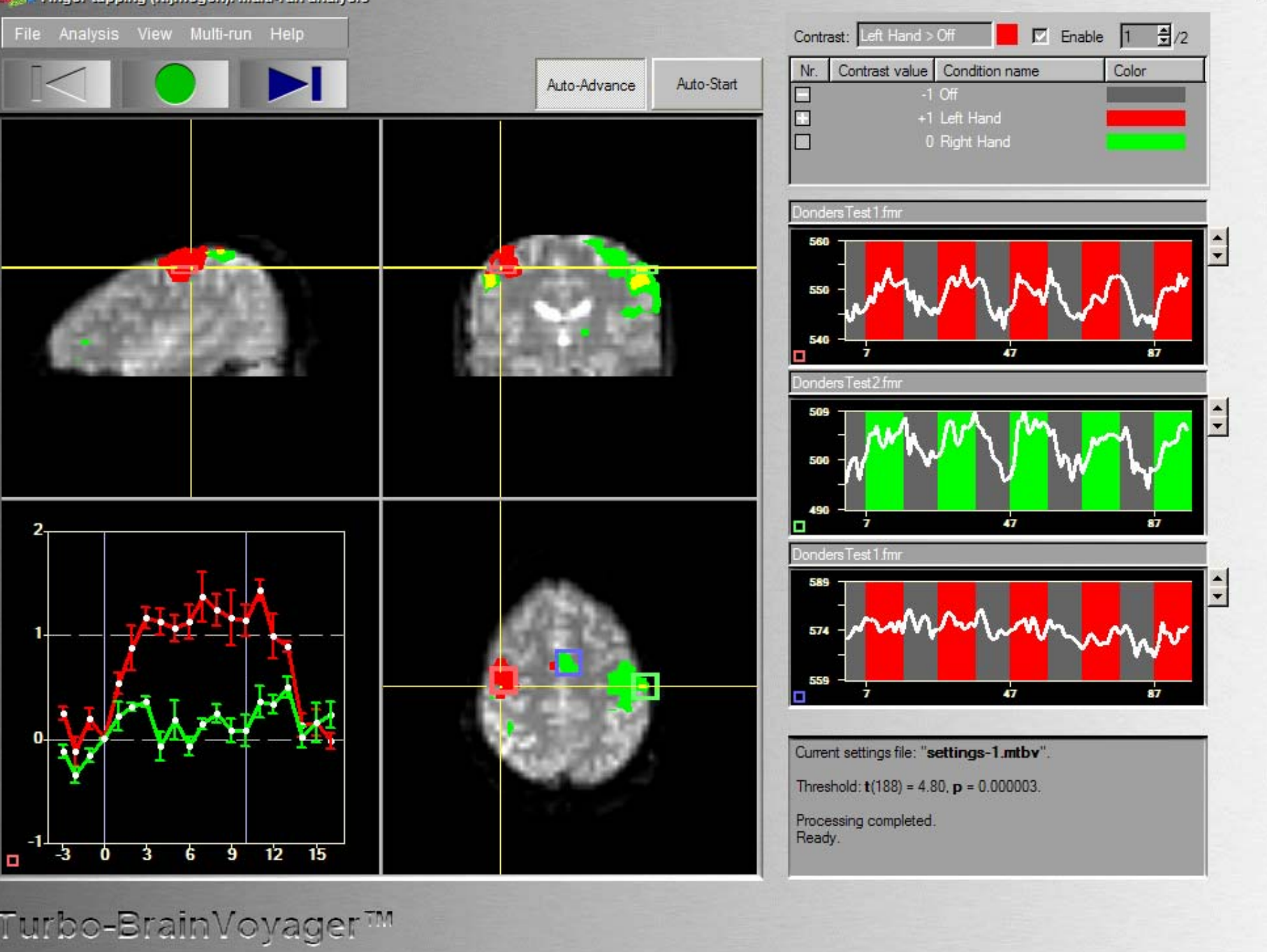
Ready.
Turbo-BrainVoyager™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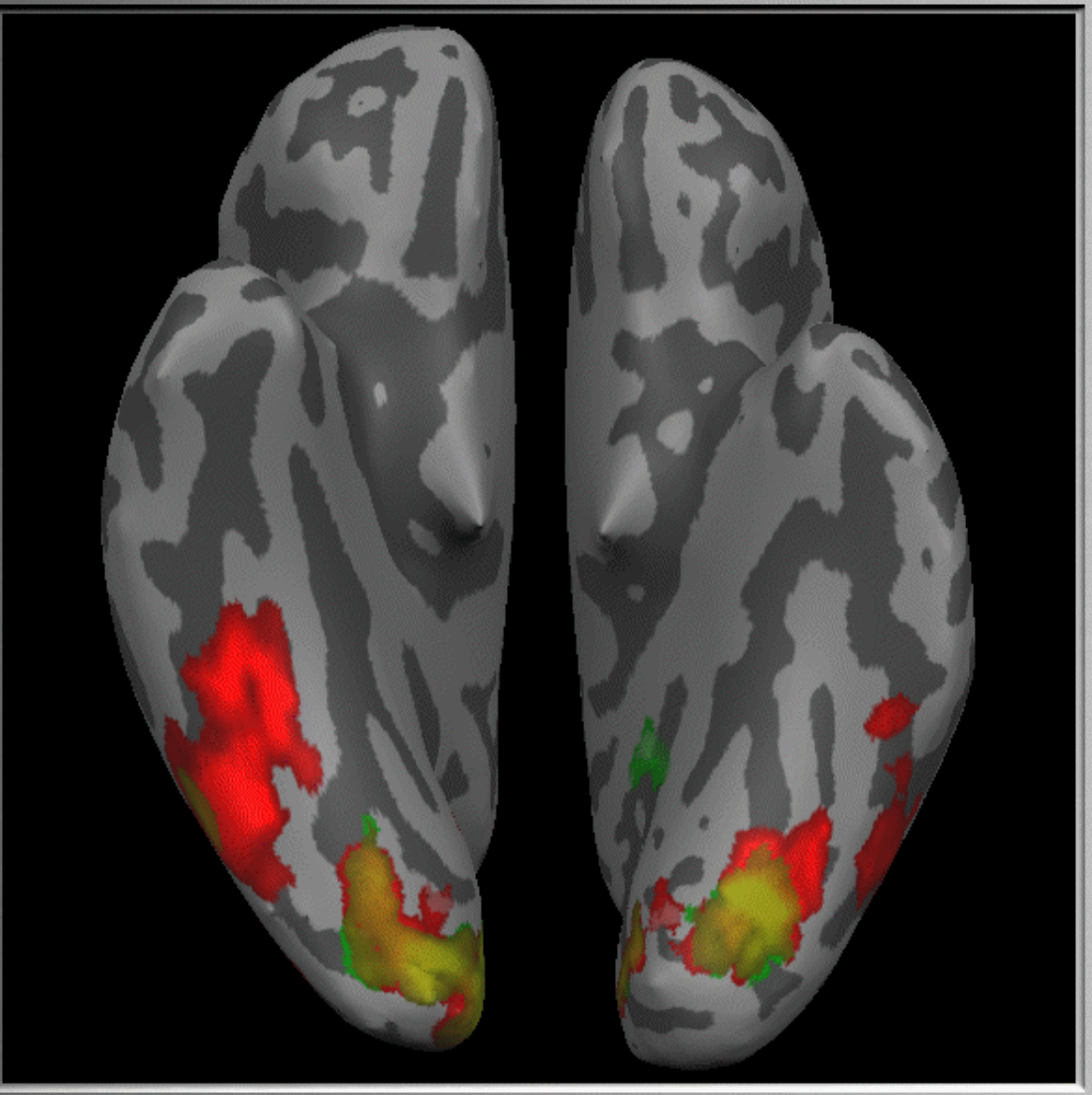
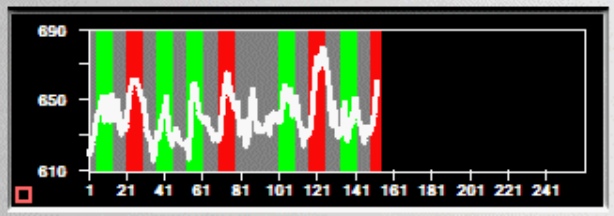
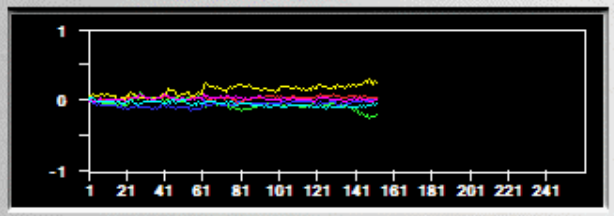
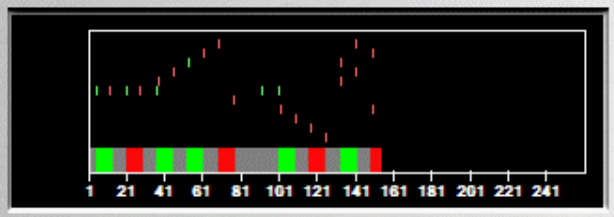
Turbo-BrainVoyager™









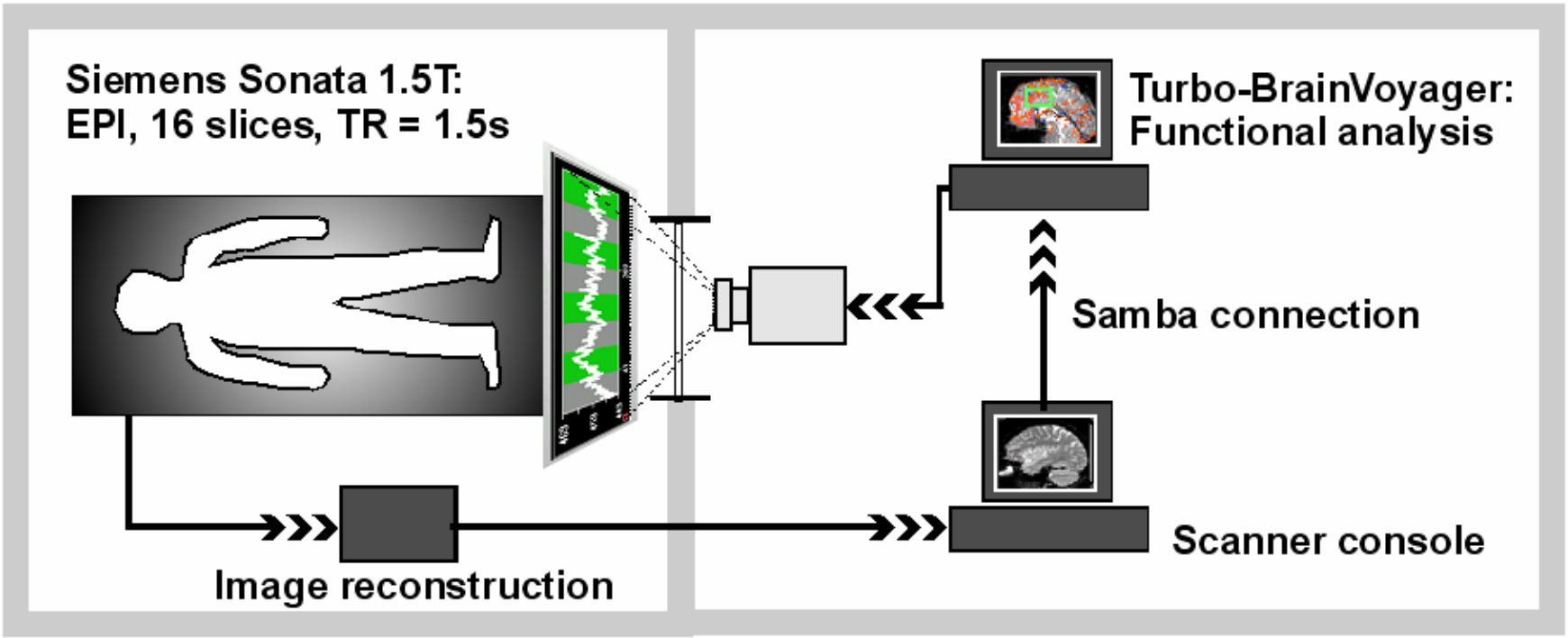
volume **153**, elapsed time: **157.1** secs, R > **0.25**

Turbo-BrainVoyager™

Current research projects:

fMRI-neurofeedback in collaboration with Prof. Bierbaumer's group

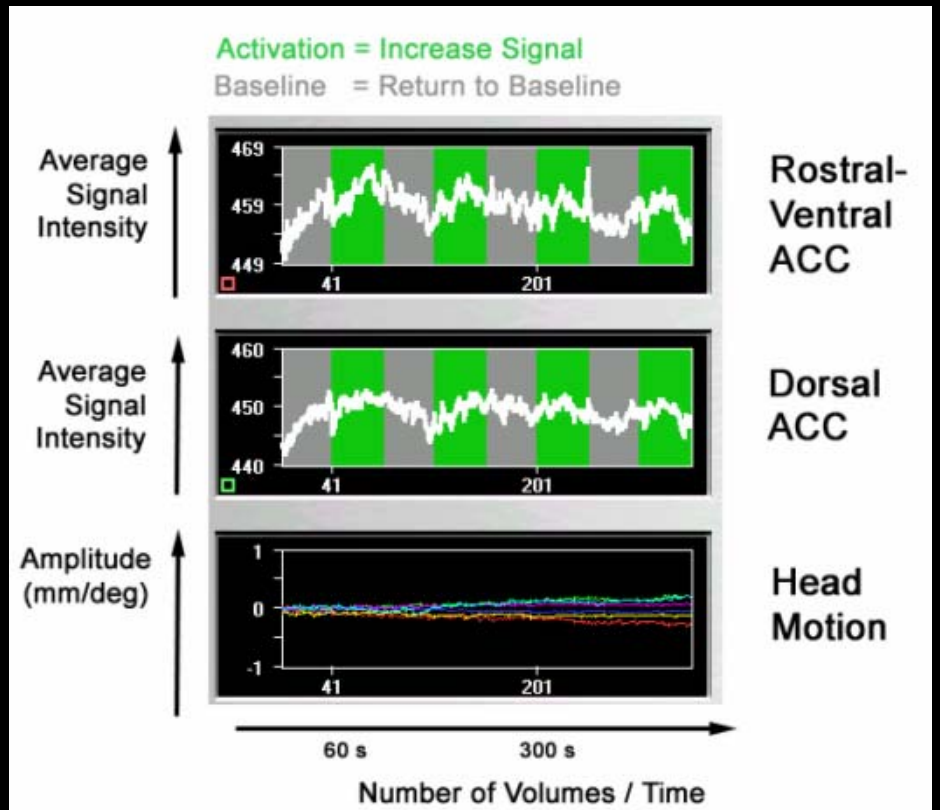
Experimental Setup and Data Flow

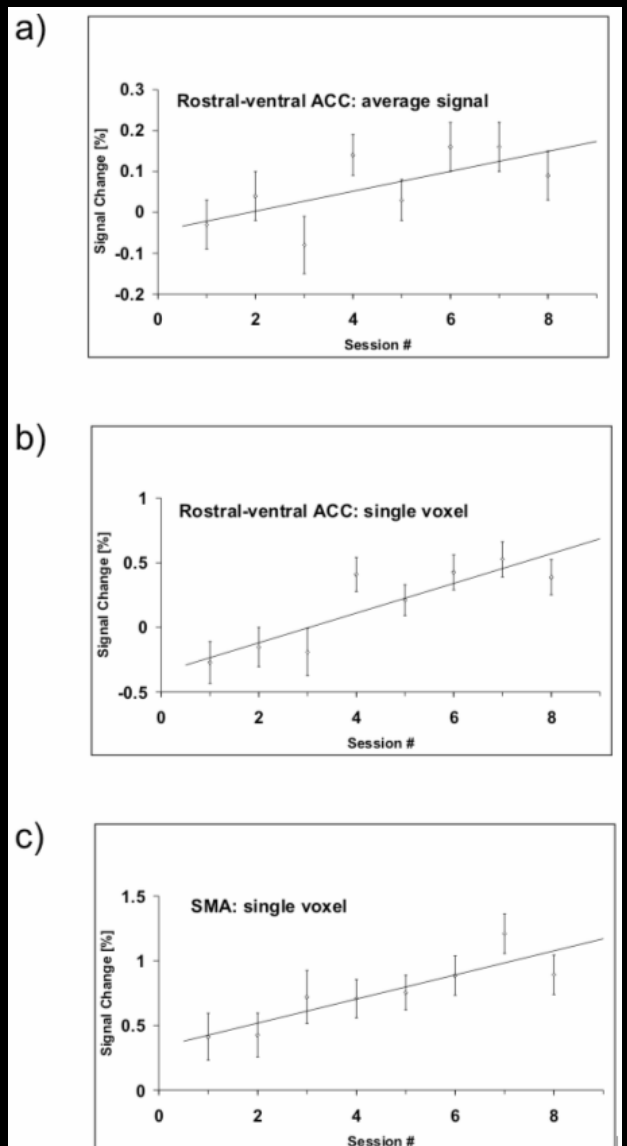


Processing time from acquisition to feedback < 2 s

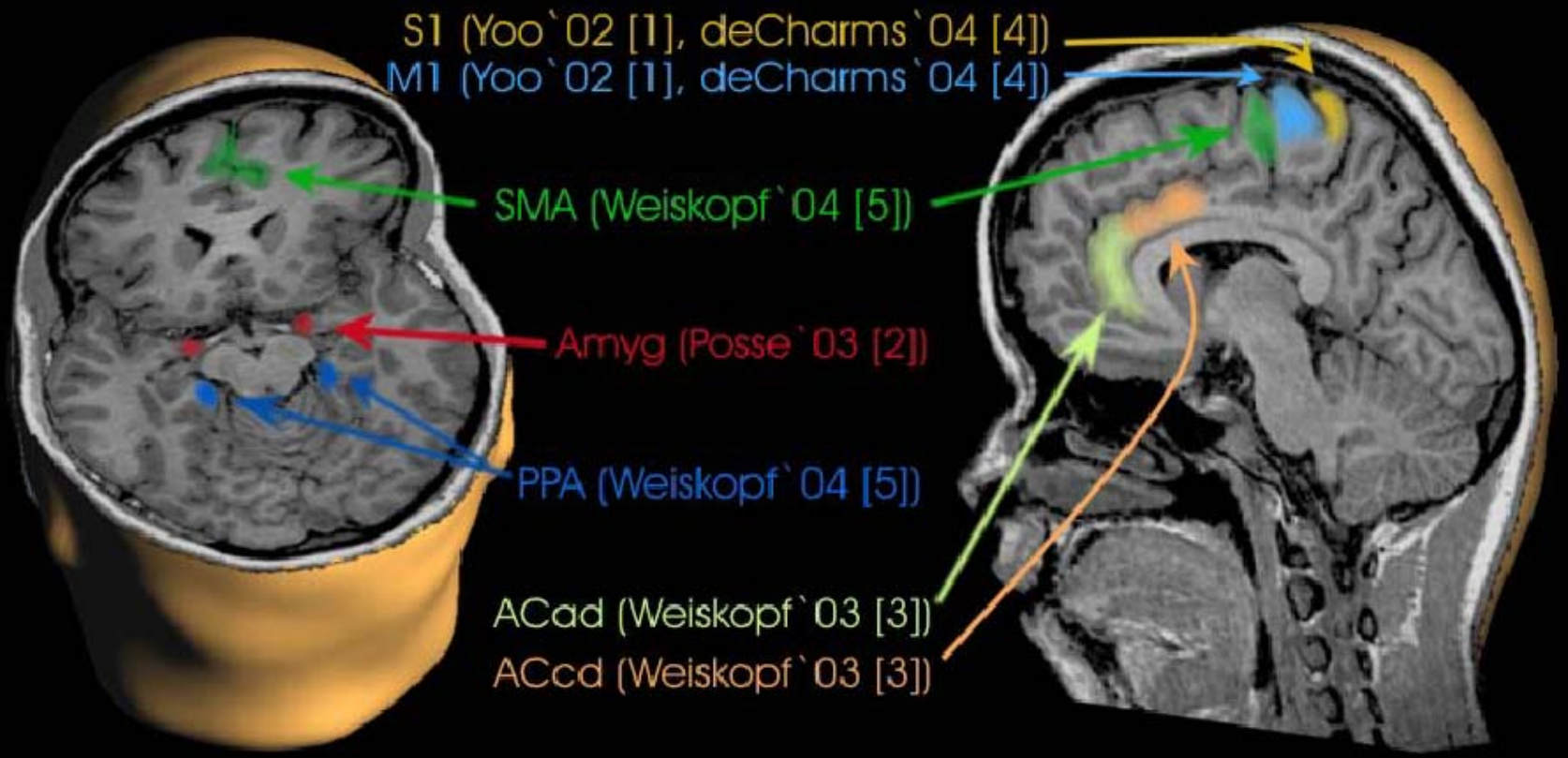
Neurofeedback in collaboration with Prof. Bierbaumer's group

Weiskopf, Veit, Erb, Mathiak, Grodd, Goebel, Birbaumer: "Physiological regulation and voluntary control of regional brain activity using real-time functional magnetic resonance imaging (fMRI)", *NeuroImage*.

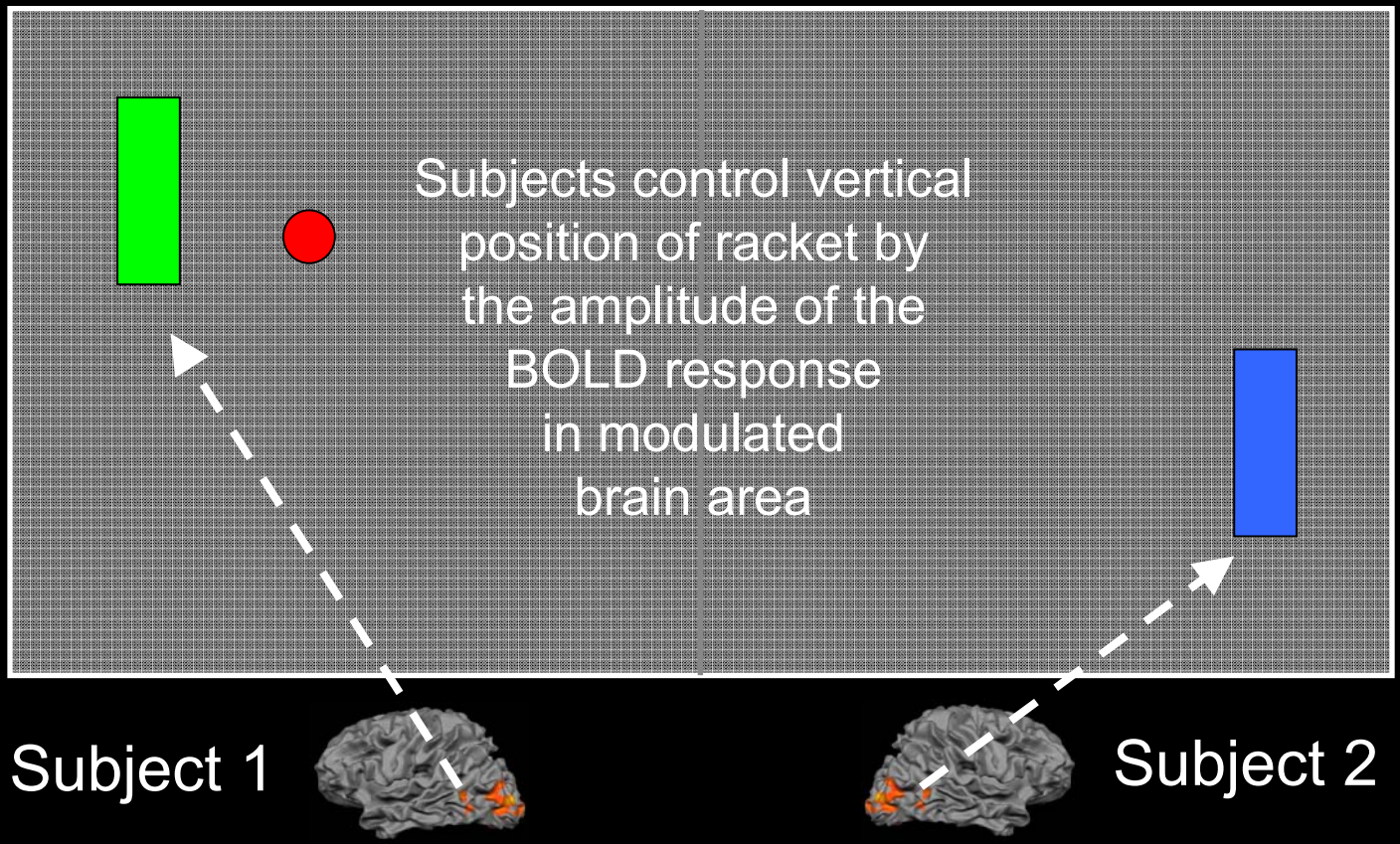




An overview of neurofeedback studies with fMRI



BOLD Brain Pong – Synchro-scanning two subjects



Experimental Questions

- Is it possible to couple *two* brains ?
  (Subject 1 sees brain response of subject 2 and vice versa; own neurofeedback takes into account the “actions” of the other subject)

- How much information can be reliably communicated using gradual differential feedback of multiple brain areas?

- How difficult is it to learn to handle the BOLD response delay? What limits does this delay impose on brain interactions?

- The study aims to establish the basis for routine “synchro scan” neurofeedback studies. Are there interesting applications of fMRI-based brain-brain interactions, i.e. “social fMRI” ?