# Unified protocol for resting-state fMRI

February 28, 2014

Note that setting parameters are below described in technical terms for Siemens scanners. We would like to ask users of GE or Philips scanner to find parameters that correspond to below parameters.

## 1） Resting-state fMRI

Please cover the entire brain including the cerebellum and minimize TR.

We will put emphasis on prefrontal regions that are related to psychiatric disorders.

- Coil: 8/12 ch. phased array coil （32 ch coil is acceptable）
- Sequence： ep2d_bold (Siemens)

  *Please find corresponding parameters for other venders.
- Series： T2*weighted image
- No motion correction
- No SENSE (GRAPPA)
- TR: 2.5 s
- TE: 30 ms
- Flip angle: 80 deg
- Phase encoding: P→A（emphasis on ）      * Note that A→P is unacceptable.
- Matrix: 64 x 64
- FOV: 212 mm
- In-plane resolution: 3.3 x 3.3 mm

  Reason: we sometimes find that prefrontal regions are elongated and included in FoV when the phase encoding is set at PA and the in-plane resolution is set at 3 x 3 mm.
- Slice Thickness: 3.2 mm
- Gap: 0.8 mm （25% of slice thickness）

  We recommend to set (Slice Thickness + Gap) at an integer value (4) to prevent reading error of SPM. Siemens users can set a slice gap as an integer value corresponding to percentage of slice thickness: Gap = Slice Thickness (3.2 mm) x 25% = 0.8 mm.

・N of slices: 40 slices（Ideal value）

Ideally, please maintain TR = 2.5 s and number of slices = 40. Slice positions should be set so that there is a considerable margin between the top slice and the top of the head. It is acceptable to let the bottom of the cerebellum go out of the FoV if the entire brain cannot be covered by FoV.

・Trans-axial

In principle, we do not recommend oblique slices but it is acceptable to optimize slice angles if it is necessary for a specific research purpose and scanner properties.

・Ascending acquisition（suitable for connectivity analysis）

・BW = minimum (1736 - 2500 Hz/Px)

You can increase number of slices by increasing this value due to decrease in scanning time. However, scanners may alert you to increase this value. It depends on your site policy about permission of the scanning modes other than the standard mode whether you can ignore the alert. If you can use only the standard mode, please reduce the number of slices.

・Number of scanning volume：240 volumes + 4 dummy volumes

Four dummy volumes at the beginning of each run

・Scanning time: 10 min.+ 10 s (dummy)

・Fat suppression ON

・Acquisition Time: Equidistant (= TR TR/N_slices)


2）B0 Field Map

Field map is necessary for correction of distortion of prefrontal regions（about 2 min.）

・Sequence：gre_field_mapping（Siemens）

*Please find corresponding parameters for the other venders（2D multi-slice is acceptable）

・Series：Field mapping

・Reconstruction (phase+magnitude)

・TR: 488 ms（Siemens）

・Flip angle: 60 deg.

・TE: 4.92 ms, 7.38ms

・Phase encoding: PA

・FOV: 212 mm

・Matrix: 64 x 64

・In-plane resolution: 3.3 x 3.3 mm

・Slice thickness: 3.2 mm

・Gap: 0.8 mm

・Ascending acquisition

・Fat suppression OFF

・Trans-axial

・N of slices: 40 slices (aligned to EPI)

・BW = minimum (〜260 Hz/Px)

　Please minimize this value as possible if you cannot set this value at 260 Hz.

・Phase encoding: fat shift (L)

### 3) Structure Image

・Parameters for structure images conform to those of J-ADNI2（high-speed mode : GRAPPA/No SENSE）

・1 x 1 x 1 mm$^3$ isovoxel（J-ADNI2 1 x 1 x 1.2 mm$^3$）

・No specification of slice numbers (in RL-direction) but please include the entire brain with considerable margin.

### 4) Instructions to participants and others

< Instructions >

・Please be relaxed and look at the fixation point

・Do not sleep

・Do not think particular things

・Do not move your body, especially the head and trunk

< Display Image >

・Presents a black cross that is covered by the fovea as a fixation point with the gray background that does not dazzle participants.

< Environment >

・Carefully fix the participant's head trunk.

・Lighting of the room: dim light

・Ear plug: Natural Beige UF Foam Ear Plugs (NRR 32) should be used

・Please also put the ear muff of head phone typeover the ear plugs.

・We would like to recommend to monitor heart respiration rates if possible.


< Debriefing >

・Evaluation of sleepiness by Stanford Sleepiness Scale

・Ask if participants followed the instructions（we will prepare the unified questionnaire sheet）