Slice Timing Correction

Slice Timing Correction: why

- Most of the time, fMRI data are acquired using sequential 2D imaging like single shot EPI. Since fMRI statistics are about analyzing the time course of the BOLD signal, exact timing with regard to the stimulus presentation is crucial.

- For instance, if you set a TR of 2 sec and acquire 30 slices, the acquisition time of 1 slice is ~66.66 ms (2000/30) and STC compensates for these sampling differences .

Sladky et al. (2011) NeuroImage, 58, 588-594.
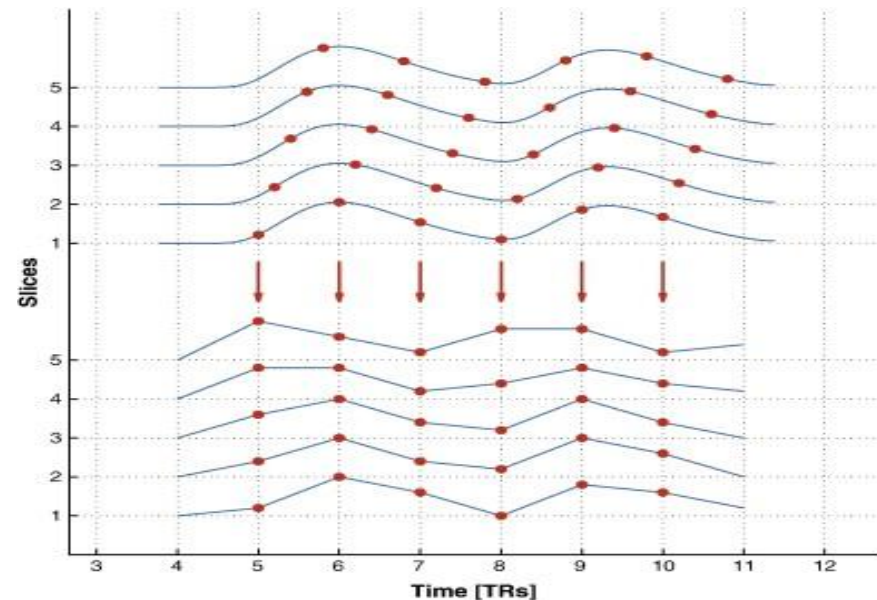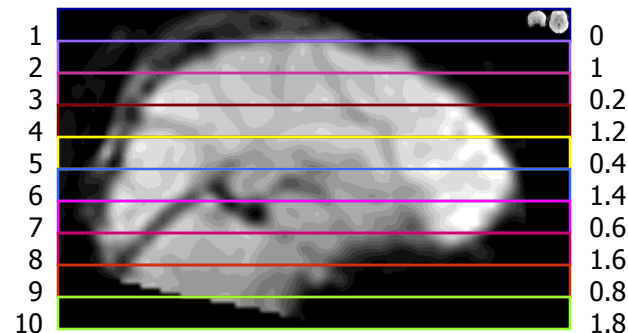
Slice Timing Correction: How

■ STC consists in shifting the signal phase by a given amount to temporally align data. It is therefore mandatory to select a reference slice. The reference slice is usually the slice acquired in the middle of the sequence (maximum interpolation of TR/2) but any slice can be used.

Data are acquired either in sequential or interleaved mode and the middle of the sequence **is not** the middle of the brain!
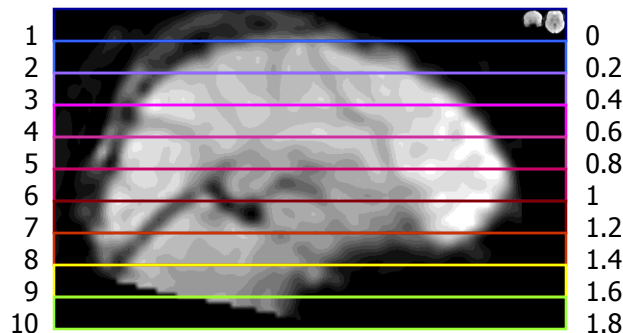
Sequential acquisition
Ref slice 6

Interleaved acquisition
Ref slice 2

Slice Timing Correction: How

■ TR of e.g. 2 sec with the middle temporal slice as reference is comparable to a dataset with a TR of 1 sec when the first (or last) slice acquired are used as a reference slice. This can be a reasonable practice, if the region of interest and putative activations are located near the first (or last) slice because it suppresses temporal interpolation effects in these areas.

Note that all regressors in the GLM also need to be adjusted for this shift in time according to the reference slice (e.g. TR / 2).

Sladky et al. (2011) NeuroImage, 58, 588-594.

Slice Timing Correction: Issues

■ Possible introduction of aliasing effects for signals at frequencies above the Nyquist sampling limit. Given a typical TR of 2 *s* (*f* = 0.25 *Hz*) a minimal inter-stimulus interval (ISI) of more than 4 *s* is recommended.

■ When using the slice acquired in the middle of the acquisition period (TR) as a reference slice, the signal needs to be shifted by TR / 2, therefore reducing the suggested minimal ISI to 2 *s*.

Sladky et al. (2011) NeuroImage, 58, 588-594.

Slice Timing Correction: Issues

■ It is sometimes advocated to not do the STC especially for TR<2 sec. However, Sladky et al. showed that is always beneficial. When not performed, the reduction of parameter estimates (effects) were more pronounced for long TRs, event-related designs and designs with shorter SOA (up to 63% !).

visual-motor task
versus rest condition
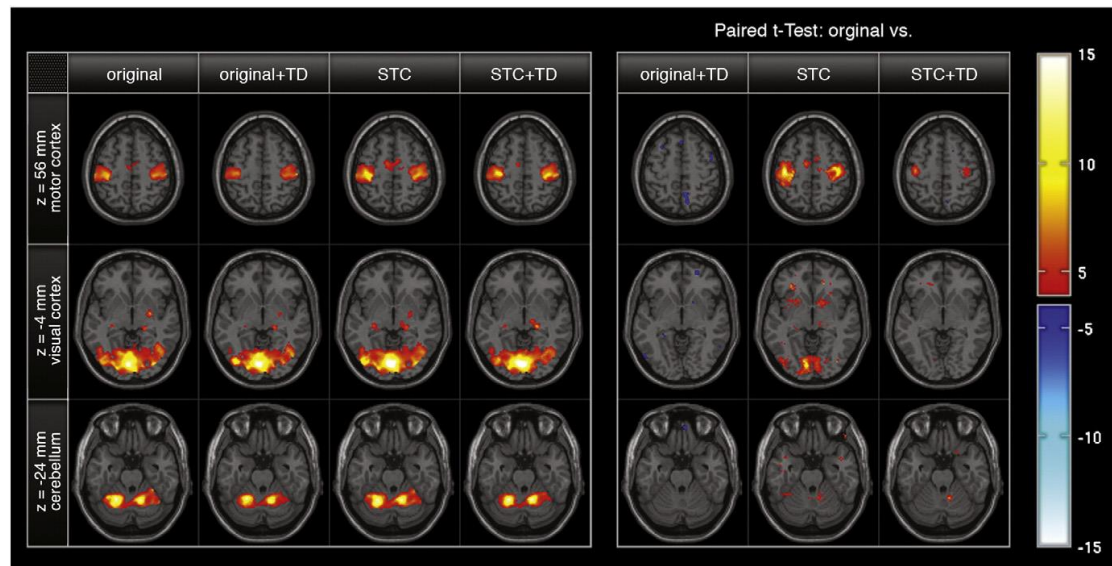
Slice Timing Correction in SPM
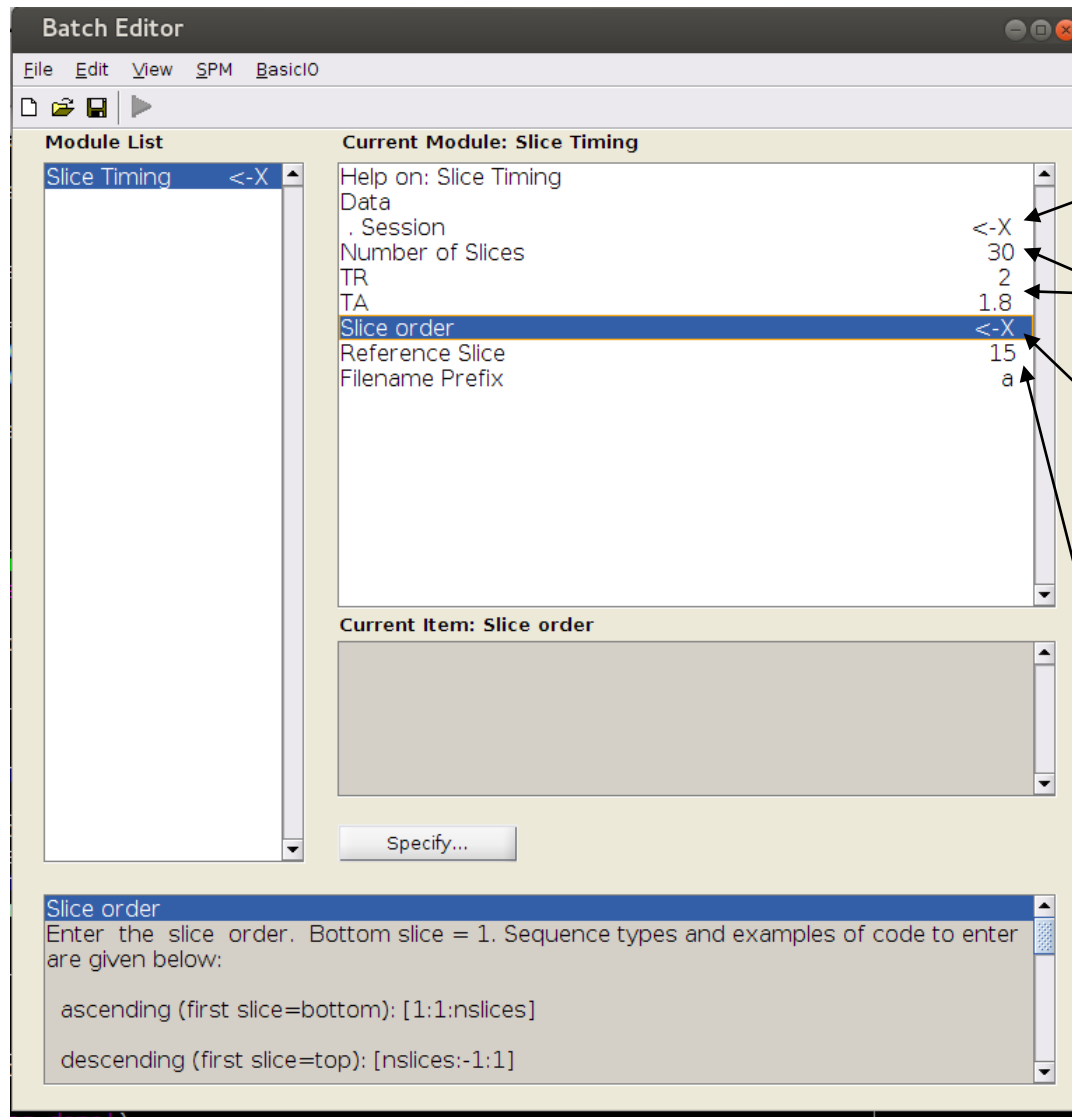
fMRI data

Number of slices and TR is from the scanner (you should know)

Slice order: either as numbers e.g. 1 3 5 7 9 .. 2 4 6 8 … or enter directly the time of acquisition e.g. [0, 0.11, 0.22, 0.33, …] which is the only way to input SMS data.

which slice to interpolate to

Questions?