

HMRC Technical Note of Kwan-Jin Jung, Ph.D.

Subject: Optimum RF angle and BOLD signal of Cortex

1. Optimum rf angle for GM (cortex)

- T_R : repetition time
- T_1 : longitudinal relaxation time (GM = 1209 ms)
- Optimum rf flip angle (radian): $\theta_{opt} = \cos^{-1}[\exp(-T_R/T_1)]$

2. MR signal at the optimum rf angle

TR	θ_{opt}	GM signal	Sampling gain	Total GM	WM signal	CSF signal	Slice numbers
0.25 s	35.6°						4
0.5 s	48.6°	0.4515	2.4495	1.1060	0.5665	0.2292	8
1.0 s	64.1°	0.6257	1.7321	1.0837	0.7642	0.3262	18
1.5 s	73.2°	0.7425	1.4142	1.0501	0.8749	0.4030	27
2.0 s	79.0°	0.8240	1.2247	1.0092	0.9356	0.4699	36
2.5 s	82.7°	0.8806	1.0954	0.9647	0.9677	0.5301	46
3.0 s	85.2°	0.9196	1.0000	0.9196	0.9840	0.5847	55

- Slice numbers were based on TE = 29 ms.
- Lower CSF signal at shorter TR could contribute to the reduced physiology noise that is caused from the pulsatile CSF flow.

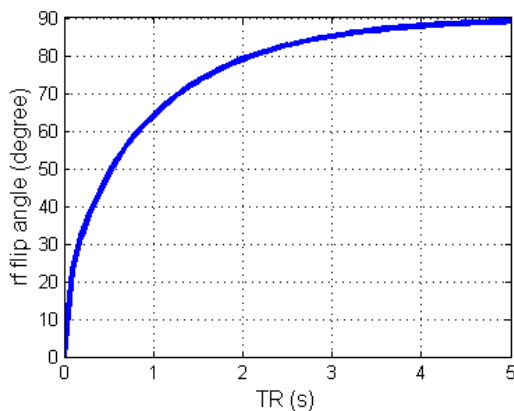


Fig. 1. Optimum rf angle

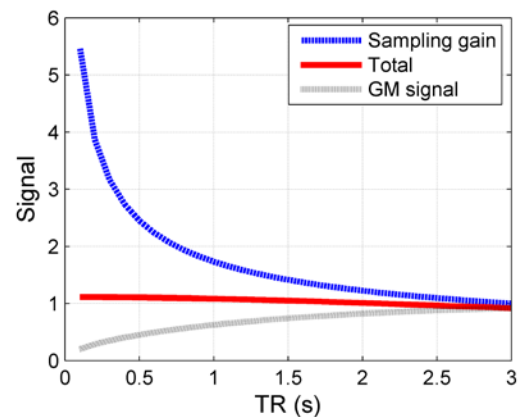


Fig. 2. BOLD signal vs TR

Reference: Jung KJ, Schneider W. (2007): Is the BOLD sensitivity reduced at a short TR in

fMRI? A theoretical study. *The Organization for Human Brain Mapping*: 271.