

# Advanced sequence example: SMS-EPI fMRI

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# Outline

- 1 SMS-EPI
- 2 Demo: Create .seq file
- 3 Demo: Simulate sequence in Pulse Studio
- 4 Running sequence on scanner, and example results

# Simultaneous multi-slice EPI

Idea:

- Excite multiple ( $N > 1$ ) slices at once
- Insert  $k_z$  blips during EPI train  $\rightarrow$   $N$ -fold undersampling of  $k_y$ - $k_z$
- Reconstruct all  $N$  slices from a single EPI train

Widely used for:

- Functional MRI (increase frame rate by factor  $N$ )
- Diffusion imaging (reduce scan time by factor  $N$ )

Our goal: A fully harmonized workflow for reproducible fMRI (NIH U24)

# Demo: Create sms-epi.seq

Create an SMS-EPI sequence and plot:

❶ Download course content

```
$ git clone git@github.com:pulseseq/ISMRM-Virtual-Meeting--November-15-17-2023.git
```

❷ Navigate to demo folder for this talk

```
$ cd ISMRM-Virtual-Meeting--November-15-17-2023/tutorials/day2_SMS-EPI/
```

❸ Start MATLAB and run main.m

```
>> main;
```

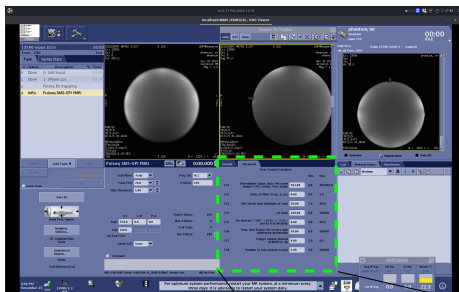
- Tested in Linux (Ubuntu). Requires git and python3.
- Not a toy example – state of the art SMS EPI fMRI sequence
- writeEPI.m can also create a 3D EPI fMRI sequence

# Demo: Simulate sequence in Pulse Studio

Simulate to verify that:

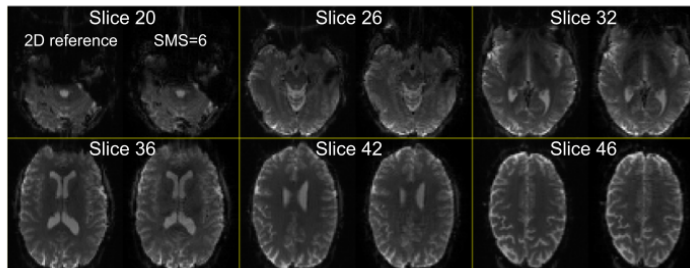
- You understand how to install the sequence files :)
- Scan is runnable
- Sequence timing is correct

# Sequence settings



User Control Variables		Min	Max
CV1	Determines toppre_entry file name (topre < CV1 >_entry). Non-negat:	403.00	999999.0
CV2	Write to Pfile? 0: no, 1: yes:	0.00	1.0
CV3	ADC dwell time (multiple of 2us):	10.00	40.0
CV4	ssi time:	100.00	1000.0
CV5	Set threcon = $100 * <CV5> + <CV1>$ (set to 0 to disable):	0.00	99.0
CV6	Num. data frames for receive gain calibration (qisquan0):	10.00	1000.0
CV7	Trigger output channel (@ABOUT1-B):	6.00	8.0
CV8	Number of runs (repeat scans):	1.00	1000.0

# Representative image quality



# Functional analysis

