Advanced sequence example: SMS-EPI fMRI

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Outline

Simultaneous multi-slice EPI

Idea:

- Excite multiple (N>1) slices at once
- Insert kz blips during EPI train $\rightarrow$ N-fold undersampling of ky-kz
- 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:

1. Download course content

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

2. Navigate to demo folder for this talk

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

3. Start MATLAB and run main.m

   ```
   >> main;
   ```

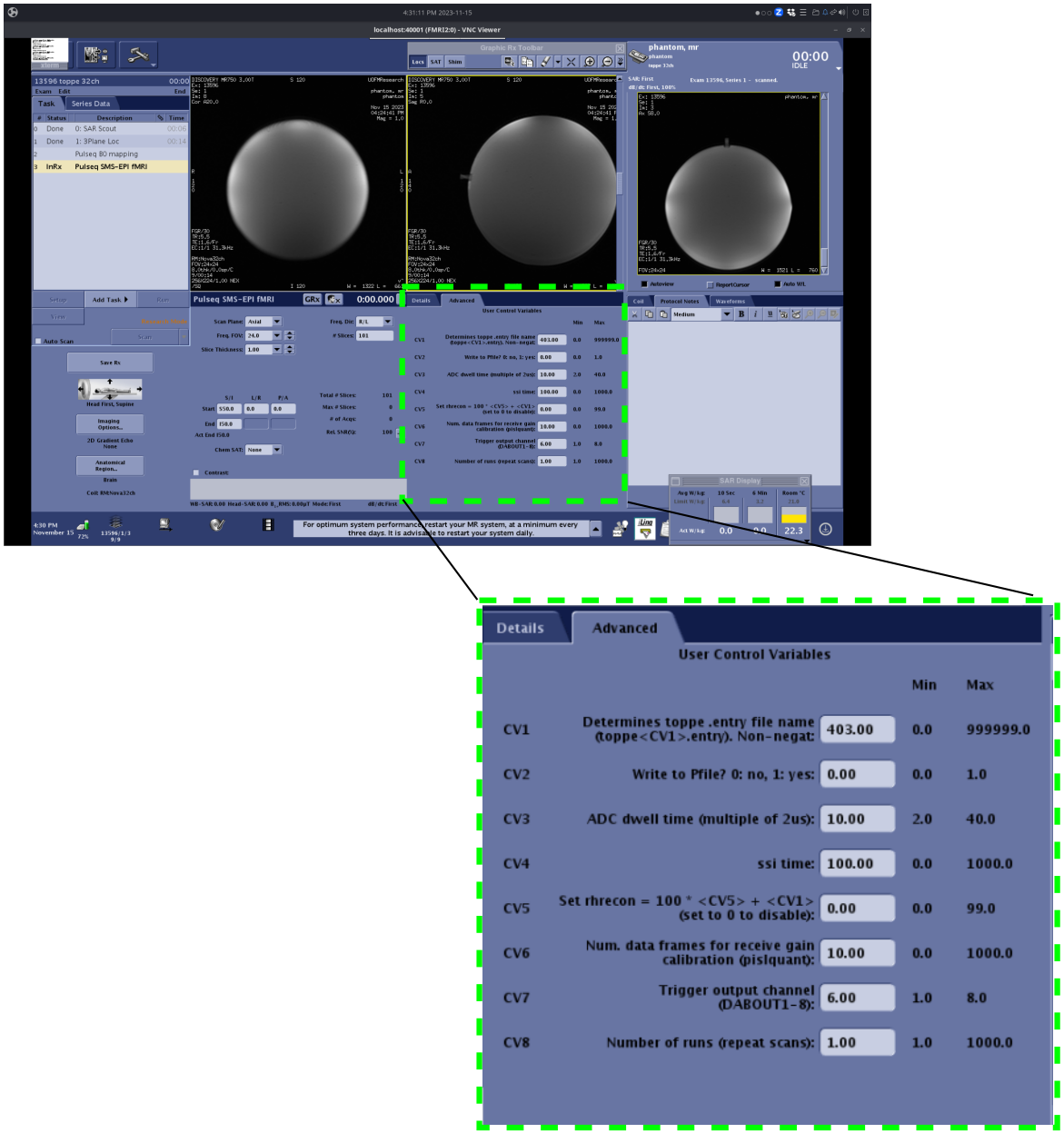
- Tested in Linux (Ubuntu). Requires git and python3.
- Not a toy example – state of the art SMS EPI fMRI sequence
- writeEPI.m can also create a 3D EPI fMRI sequence

Demo: Simulate sequence in Pulse Studio

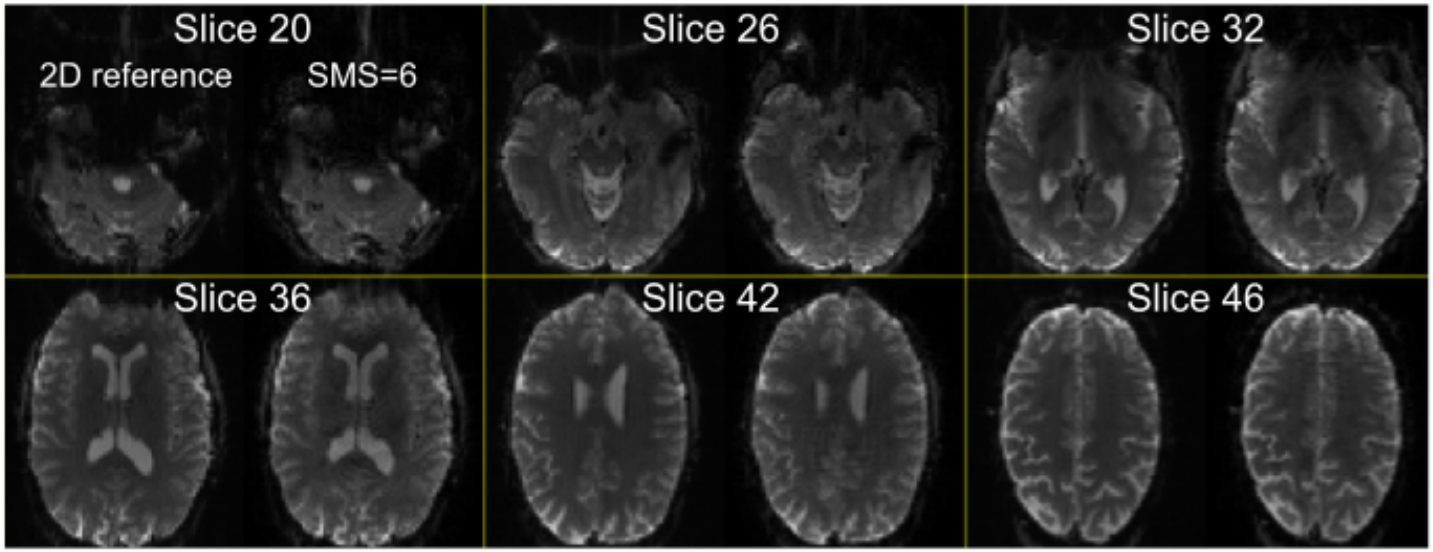
Simulate to verify that:

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

Sequence settings



Representative image quality



Functional analysis