

MRI Simulator Notes

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Tasks

- ▶ I computed the required parameters for the proper FOV and pixel size for the simulation.
- ▶ I ran the excitation simulation of 2019-12-04 on Supershop and tracked the resource usage.

Parameter requirements

Summary

- ▶ The ems are arranged in a grid, with the number of grid points in each dimension being $2r_{\text{grid}} + 1$, with r_{grid} an integer.
- ▶ The ems are placed at $x = [-x_{\text{lim}} : \Delta x : x_{\text{lim}}]$, where $\Delta x = x_{\text{lim}}/r_{\text{grid}}$ and similarly for y .
- ▶ The number of samples of k-space taken in the phase-encoding direction (y) is $2r_{\text{pe}} + 1$ and the number of samples taken in the frequency-encoding direction (x) is $2r_{\text{fe}} + 1$, with r_{pe} and r_{fe} integers.
- ▶ We require the field-of-view to satisfy $FOV_x \geq 2x_{\text{lim}}$ and $FOV_y \geq 2y_{\text{lim}}$.
- ▶ We require a pixel dimension of $\Delta x \times \Delta y$.

- For the field-of-view requirements, we use

$$FOV_x = \frac{1}{\Delta k_x},$$

where Δk_x is the spacing between k-space samples in the x direction, and similarly for y .

- For the pixel size requirements, we use

$$\delta_x \approx \frac{1}{2k_{x,max}},$$

where δ_x is the spatial resolution in x and $k_{x,max}$ is the maximum sample of k-space in the x direction, and similarly for y .

For the FOV requirements, I find

$$\frac{r_{\text{fe}}}{k_{x,\text{max}}} \geq 2x_{\text{lim}} , \quad \frac{r_{\text{pe}}}{k_{y,\text{max}}} \geq 2y_{\text{lim}} .$$

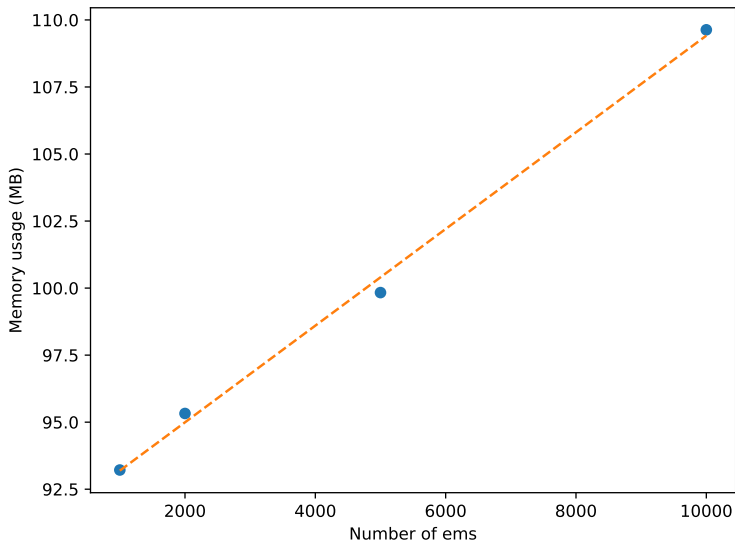
For the pixel size requirements, I find

$$\frac{x_{\text{lim}}}{r_{\text{grid}}} = \frac{1}{2k_{x,\text{max}}} , \quad \frac{y_{\text{lim}}}{r_{\text{grid}}} = \frac{1}{2k_{y,\text{max}}} .$$

Resource usage on Supershop

Summary

- ▶ The memory usage as a function of the number of ems is shown on the following slide.
- ▶ The CPU usage from `top` never exceeded 100%.



1.8 kB per em