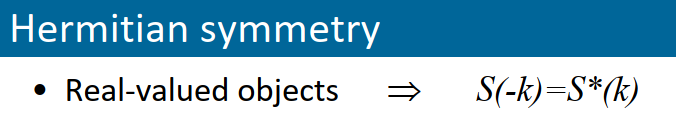
**Computational MR imaging**

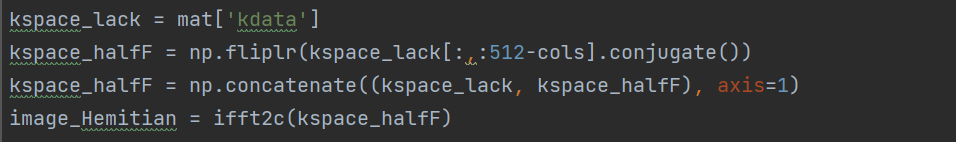
**Laboratory 3: Partial Fourier imaging**

**Nan Lan**

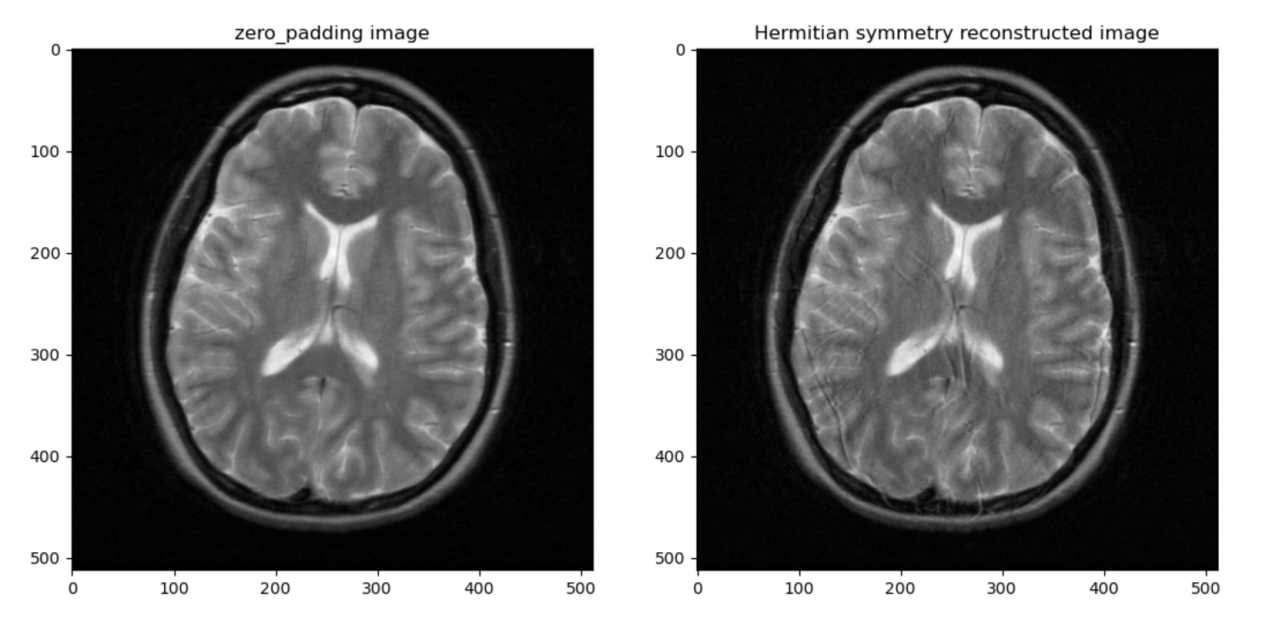
1. **Hermitian symmetry reconstructed image**

Use the Hermitian symmetry to estimate the zero\_padding part of original kspace.

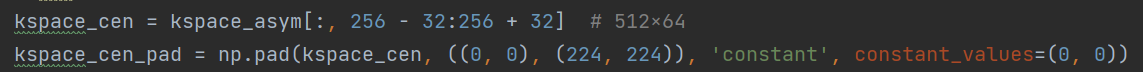




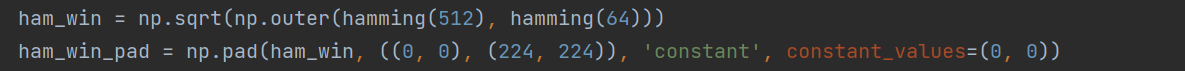
The result below shows the PatialFourier=9/16 image and the Hermitian symmetry reconstructed image. The right image is less blurry than the left one. But Hermitian symmetry reconstructed image has obvious ringing artifact at the edge and in the center. The reason is that the condition of Hermitian symmetry is value in the image ought to be pure real, which means there should have no phase errors. In fact, all image data sets contain some phase errors, and therefore the conjugate symmetry approximations are not perfect. The sources of these phase errors include the usual "posibilities": Bo inhomogeneity, susceptibility effects, eddy currents, physiologic motion and so on.



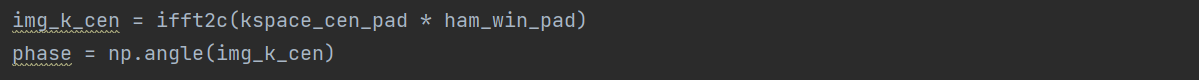
1. **Phase estimation from center kspace**
2. Crop the center kspace and zero pad

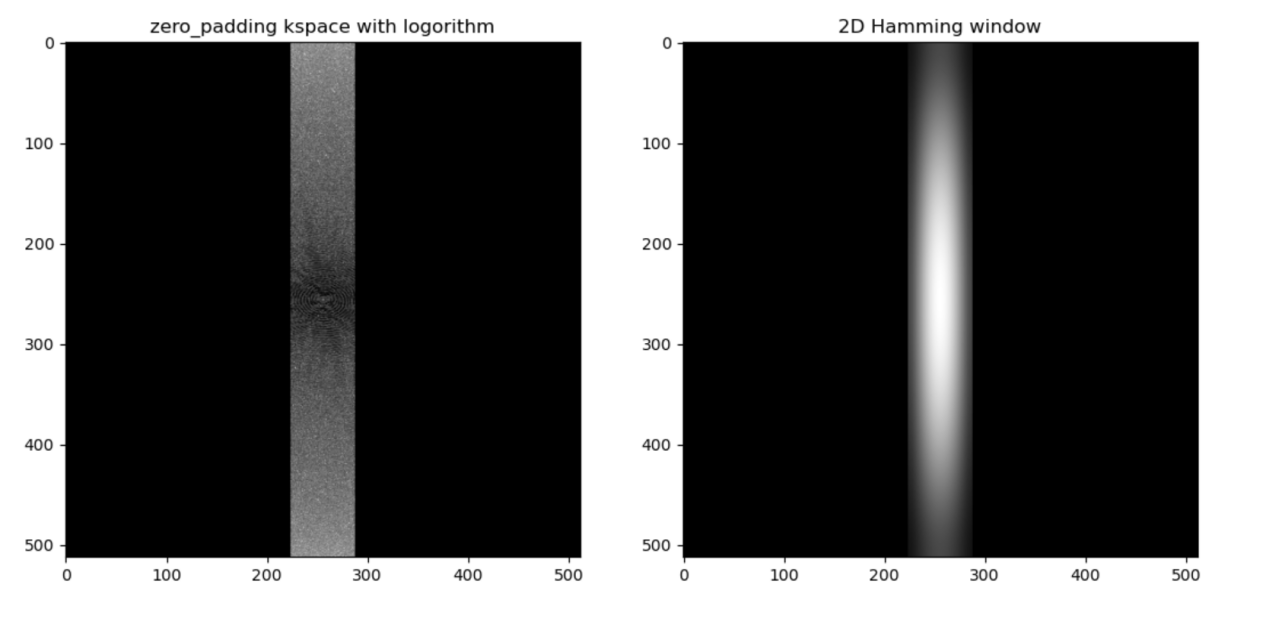


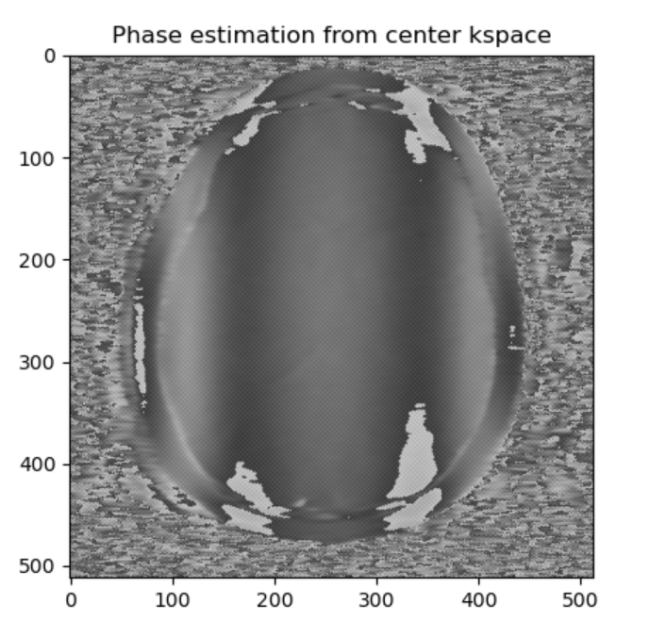
1. Create the hamming window and zero pad



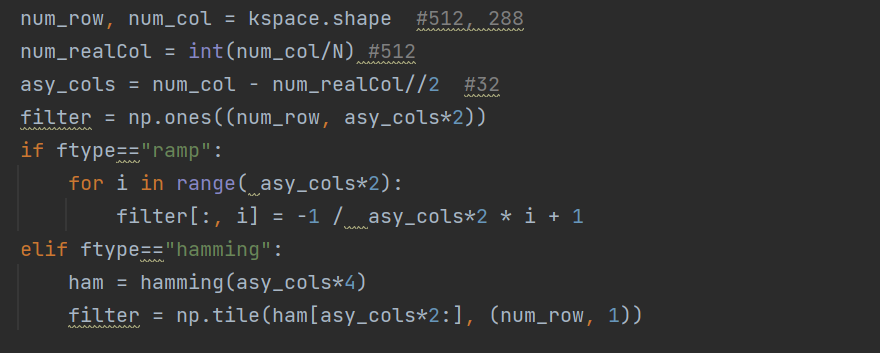
1. Use the filtered center space to estimate the phase



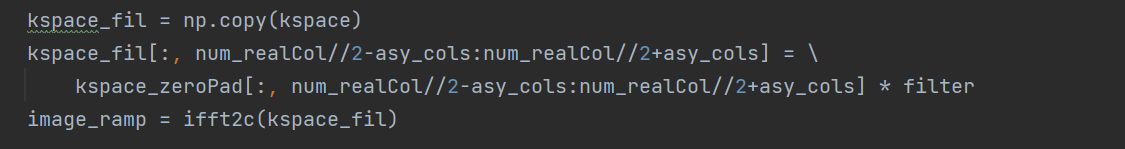




1. **Margosian method**
2. Create ramp filter with the size of (512,32)



1. Use ramp filter to smooth the transition between kspace and zero padding parts, so as to reduce gibbs ring artifact. Obtain I0(r) now.

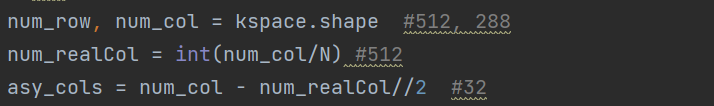


3) Reconstruct image with phase part and magnitude part based on Margosian method





1. **POCS method**
2. Initialize and use ifft to obtain the zero\_padding image





1. Reconstruct image with phase part and magnitude of zero\_padding image



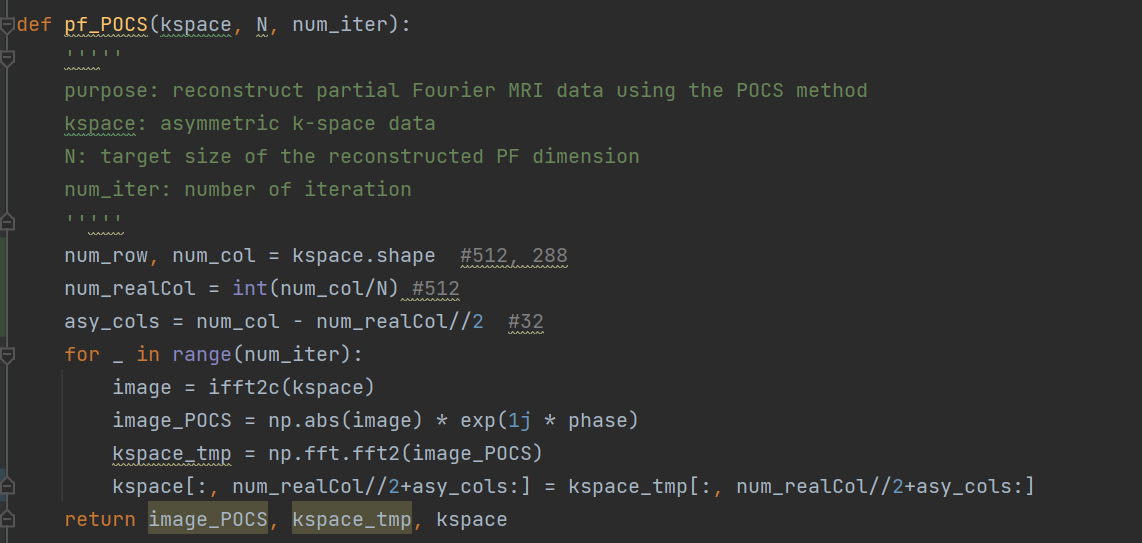
1. Use fft to obtain the new kspace



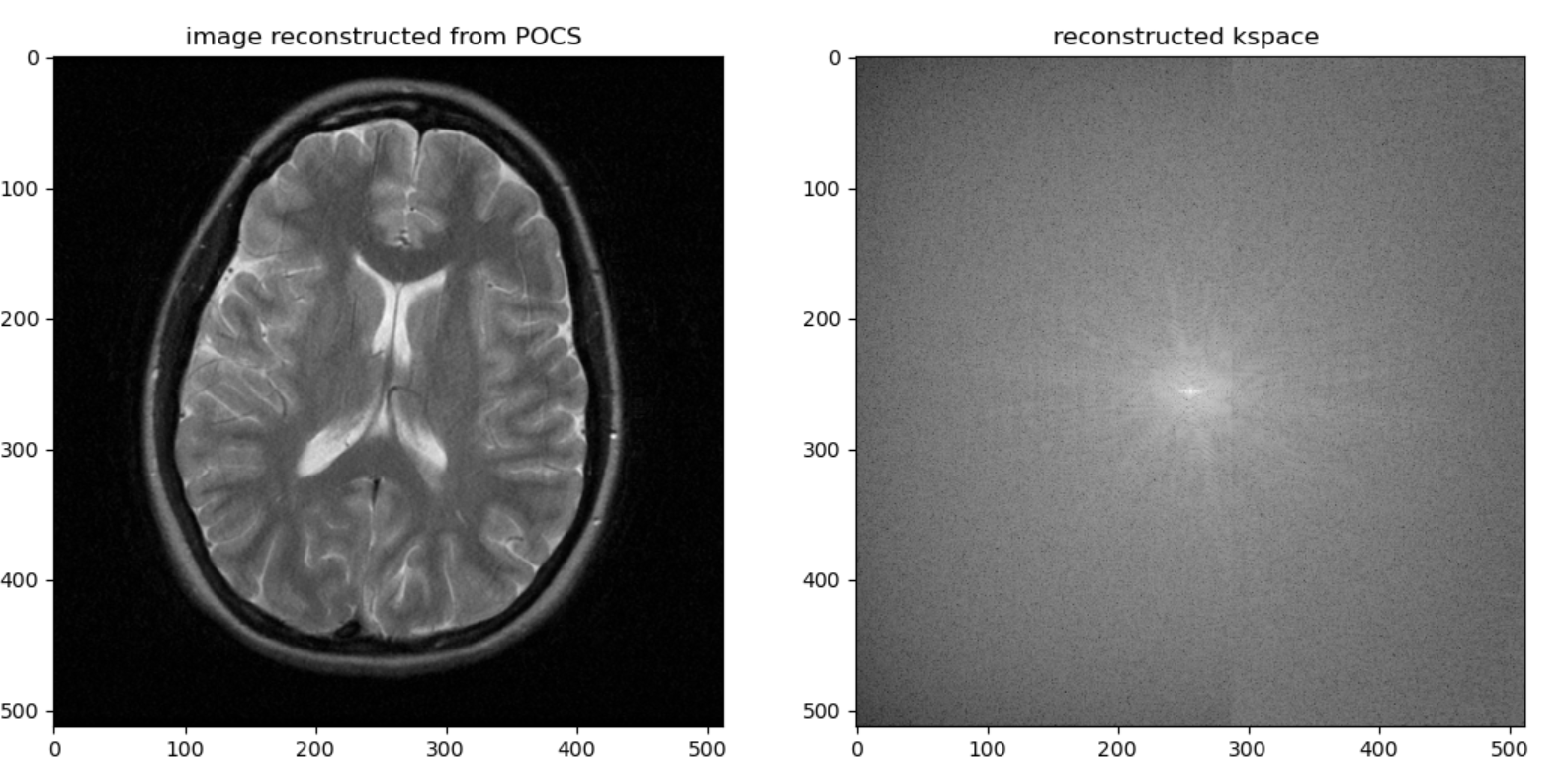
1. Fill the zero padding part in orignal kspace with the corresponding part of new kspace, and go to step1



The code below is the whole process:

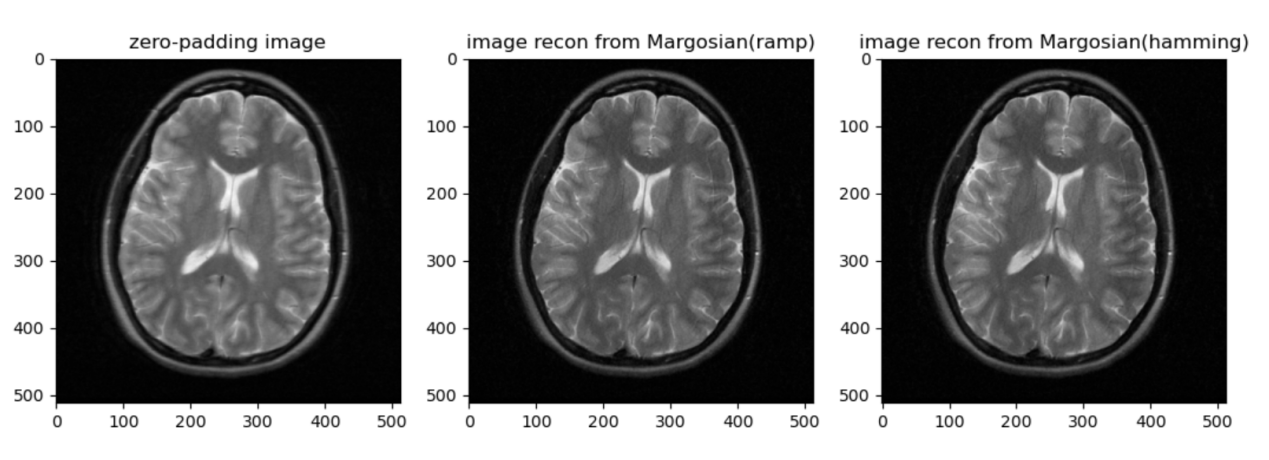


The picture below is the result.



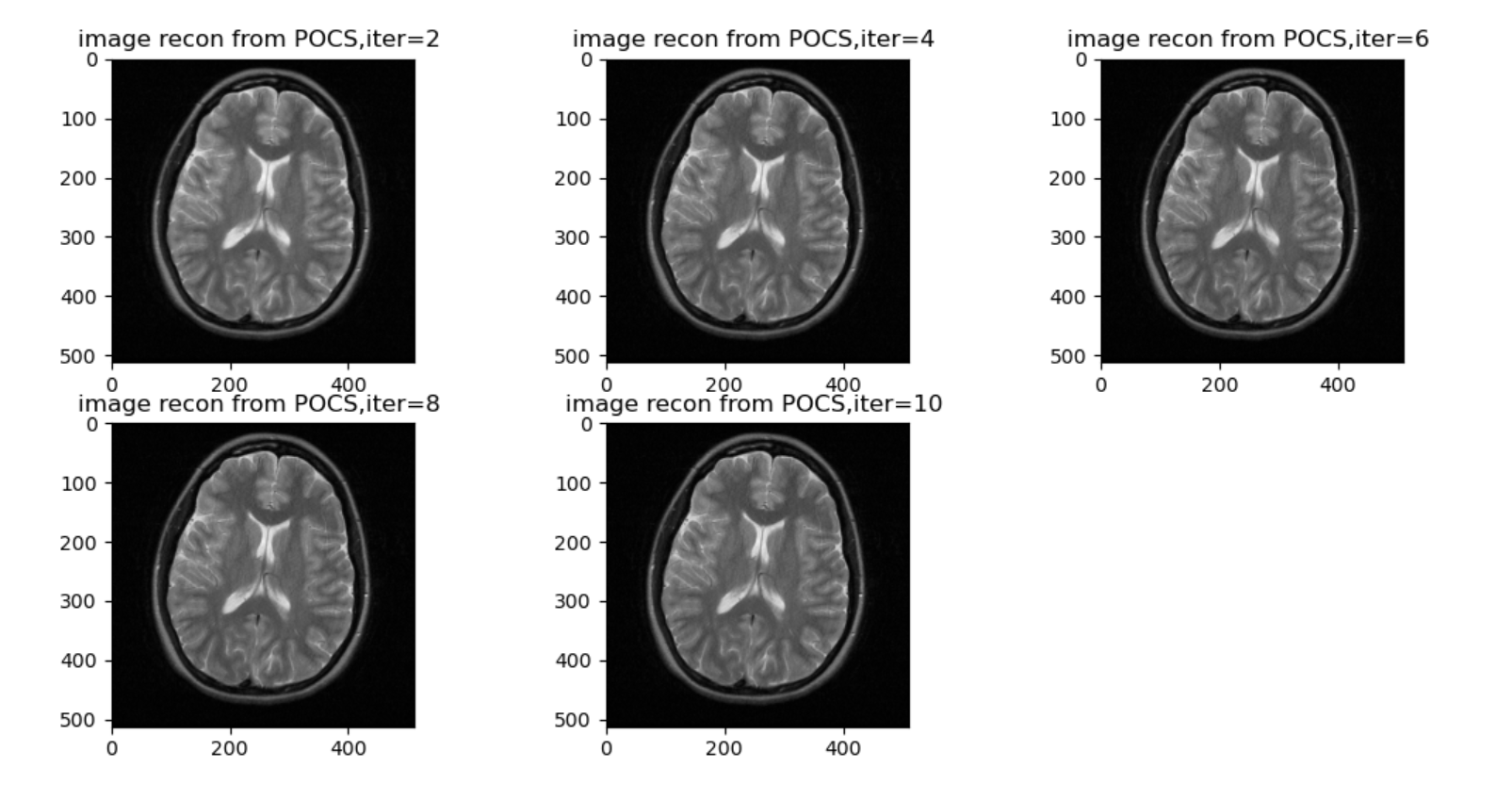
1. **Result of Margosian method**

There are no big different between Margosian(ramp) and Margosian(ramp)



1. **Different iteration of POCS Method**

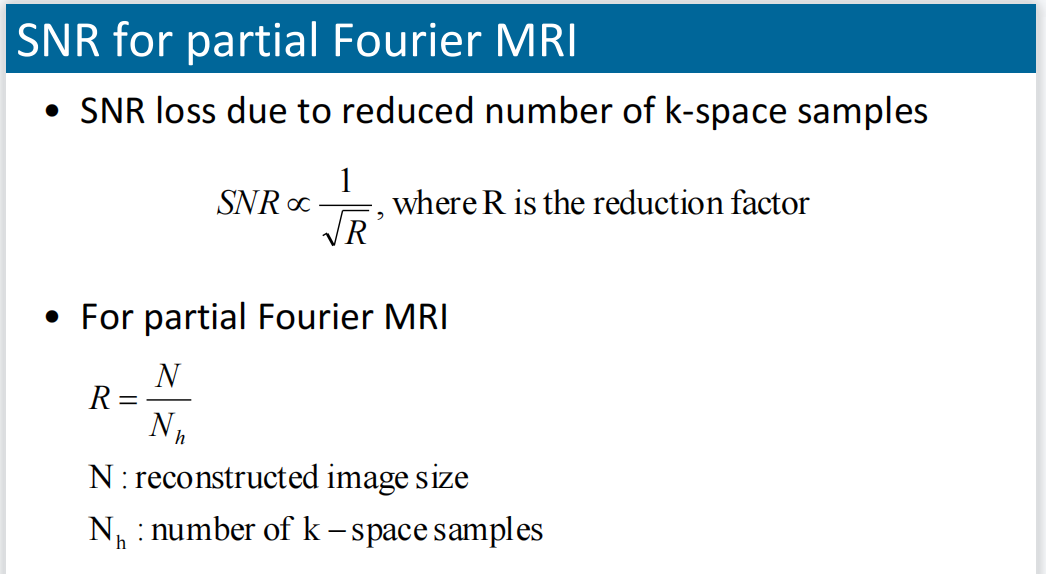
The result below shows Different iteration of POCS Method. The large the the iteration number is, the less blurry the reconstructed image is. When the iteration number reach 6, the the algorithm has converged, because the upcoming reconstructed image doesn’t change much.



1. **Hermitian, Margosian, POCS methods comparisom**

The result below shows the reconstruted image from Original, Hermitian, Margosian(ramp), Margosian(hamming), POCS methods.

**SNR**: The POCS and Margosian methods have lower SNR. Take the definition of SNR for partial Fourier MRI (refer to the image below). R = 16/9 in our example is larger than 1, so 1/sqrt(R) would be less than 1.



Source: computer MRI slice

**Spacial resolution**: The POCS and Margosian methods can get the better reconstructed image than Hermitian method. POCS method has higher spacial resolution than Margosian method, because it estimate the not only the phase but the zero part of kspace.

**Residual Artifact:** aaa??

**Ringing**: The POCS method and Margosian will lead to less gibbs ringing than Hermisian. POCS method can help to reduce the residual artifact.

