**XXth Exercise**

**Filtered Backprojection**

1. Import *sinogram.mat*. The file includes two arrays. *sino* is an array containing a sinogram and *angs* an array containing the corresponding angles.
2. Write your own Matlab-function *fourierReconstruction.m* that resamples the unfiltered k-space of the object. It should take the sinogram and an array of the corresponding angles as input. The output of the function is the resampled k-space. Use the given function *fourierRotate.m* and make sure to read the documentation to know how to use it.  
   At which point do you use the Fourier Slice Theorem?  
   Show the result of the resampled k-space using *sino* and *angs* as input-arguments in your function. Then use the 2D-inverse-fourier-transform and show the reconstructed (unfiltered) object.  
   What’s the advantage of plotting the logarithm of the fourier space using *log()*?
3. What you should see in task 2 is a blurred version of the object. What is missing to get a sharp reconstructed object? According to your answer update your function *fourierReconstruction.m* and show the resampled k-space and the reconstructed object. Be careful to mind the center of the DFT which is at N/2+1 for an even N.
4. Look into the function *filteredBackprojection.m* and add a comment where it says to do so, to describe what the lines up to the next comment perform. Also, at the beginning of the function add a description. Use it to reconstruct the object from the sinogram and show the result.  
   Are there differences to the result in part 4? If there are, make assumptions what the reason for them is.  
   Find out about *zero padding* and describe in a few words why it can be used to reduce artefacts.
5. Import *data.mat*. Each two-dimensional array *data(:, :, n)* is a sinogram of one slice of a body-part. Use your function *fourierReconstruction.m* or the function *filteredBackprojection.m* to reconstruct each layer and store all the layers in a three-dimensional array.  
   Depending on your computer, it may take a while to reconstruct the volume. The algorithm of the filtered backprojection is the faster one of the two.

Open MATLABs Volume Viewer App and import your reconstructed volume. Be careful, the app only takes real numbers. Describe in a comment in your code what you can see.