**Analytic Reconstruction Codes (ARC) Phase I Version V1:4-16-16**

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This open-source software package is a response to the NIH/NIBIB Low-dose CT U01 community. The purpose is to share a standardized platform equipped with key analytic reconstruction methods for helical/spiral multi-slice/cone-beam CT assuming either a flat-panel detector or a curved detector array. To verify the codes, the users can download the whole folder and add this folder (with the subfolder) into your Matlab path.

For the flat-panel detector, the main file is: Helical\_Rec\_Flat.m

For the curved detector, the main file is: Helical\_Rec\_Curve.m

If your Matlab cannot identify the MEX file, you can re-compile the corresponding CPP files use the MEX command.

The functions to generate the linear attenuation coefficients are from the following webpage: <http://www.mathworks.com/matlabcentral/fileexchange/12092-photonattenuation-2>, and the copyright belongs to Jaroslaw Tuszynski. The image display graphic toolbox was developed by our late collaborator Dr. Shiying Zhao in 2004 for our collaboration. The public use of Dr. Zhao’s codes is a good way in memory of his dedication and contribution to our field.

**Frequently Asked Questions and Answers**

1. Q: How can I verify the correctness of the package?

A: You can run the “Helical\_Rec\_Flat.m” or “Helical\_Rec\_Curve.m” directly to perform numerical simulation with mathematical phantoms.

1. Q: How can I view reconstructed images?

A: You can use the command “imdisp” to show the results. Its format is “imdisp (image)”.

1. Q: How can I change the parameters in numerical simulation?

A: For a flat panel detector array, you can change the parameters in lines 13-42 in “Helical\_Rec\_Flat.m” to configure the system scanning geometry and specify a reconstructed image volume. For a curved detector array, you can change the parameters in lines 12-43 in “Helical\_Rec\_Curve.m”.

1. Q: How can I apply this package to reconstruct images from real projections?

A: Because most commercial clinical CT scanners use the curved-detector array, you can modify the example code in “Helical\_Rec\_Curve.m”. Particularly, you can set the parameters in lines 12-43 to those from a specific vendor. Also, you need to remove lines 50-51 that numerically synthesize projections, and include one line there to load real projections.

1. Q: How can I apply this package to reconstruct images from micro-CT?

A: Because most commercial micro-CT scanners use the flat-panel detector array, you can modify “Helical\_Rec\_Flat.m”. Particularly, you can set the parameters in lines 13-42 to those from a specific vendor. Meanwhile, you need to remove lines 49-50 that numerically synthesize projections, and include one line there to load real projections.

1. Q: How can I deal with large projections with limited memory?

A: You can divide projections into several segments, and add one additional loop to load projection segments. In each iteration, you can load one projection segment.

1. Q: How can I know the horizontal direction of real projections?

A: Various vendors have different definition for the horizontal direction. If you cannot reconstruct an image correctly using the default definition in this package, please flip the projections along the horizontal direction. Alternatively, you can change the sign of the local coordinate along the horizontal direction when you perform the backprojection.