UNITED INTERNATIONAL UNIVERSITY

Department of Electrical and Electronics Engineering

EEE 4331: Biomedical Engineering

SUMMER 2023

Assignment – 03

[Lab on CT scan]

Submitted by

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Submitted To

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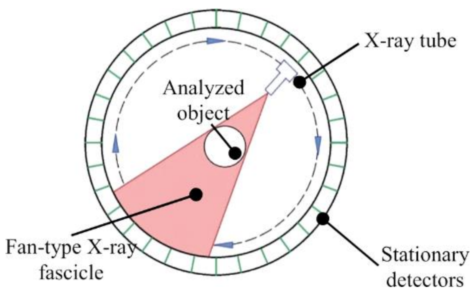
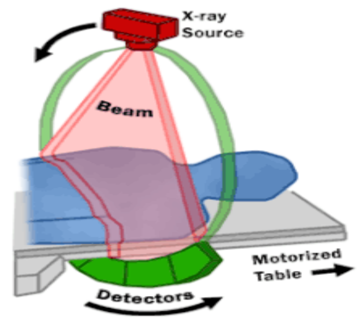
Professor
Department of Electrical & Electronics Engineering

Computed Tomography (CT)

Also known as CAT (Computer Assisted/Aided Tomography).

The idea is to resolve a single slice of an object using many X-ray projections.





[as the gantry rotates, the scanner collects 1-D x-ray at each angle]

Create Head Phantom

1.

Figure-1

2. The phantom image represents many qualities that are found in real-world tomographic imaging of human heads. The bright elliptical shell along the exterior is analogous to a skull and the many ellipses inside are analogous to brain features or tumors.

3.

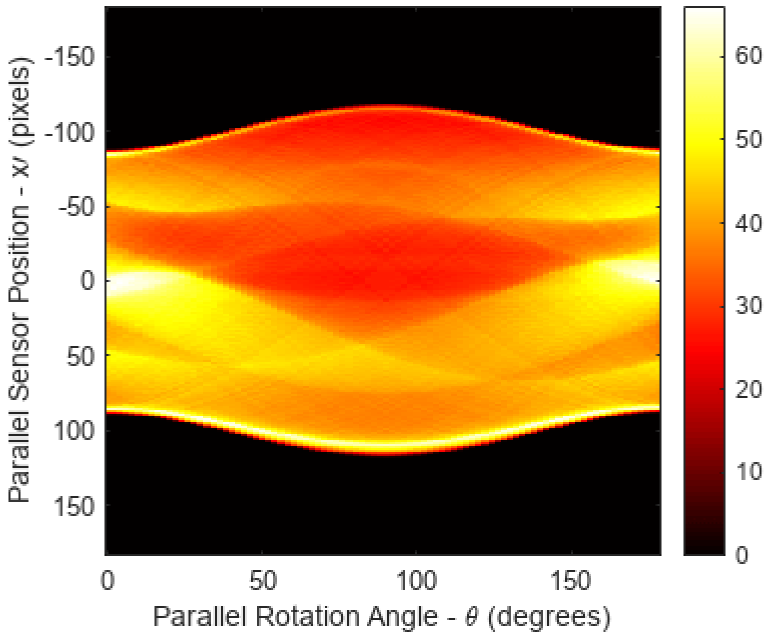


Figure-2: Radon Transformation

4. ‘xp’ represents the parallel sensor position in pixels.

5. absorption variation at ‘theta = 0’

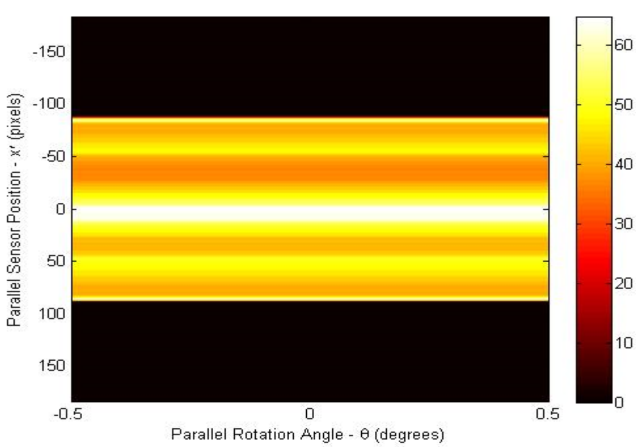


Figure-3

6. absorption variation at 'theta = 90'

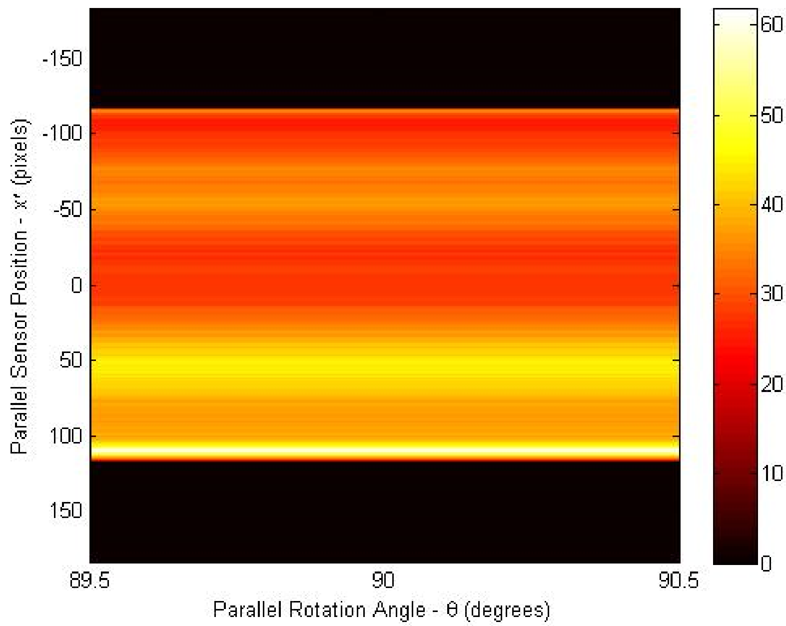


Figure-4

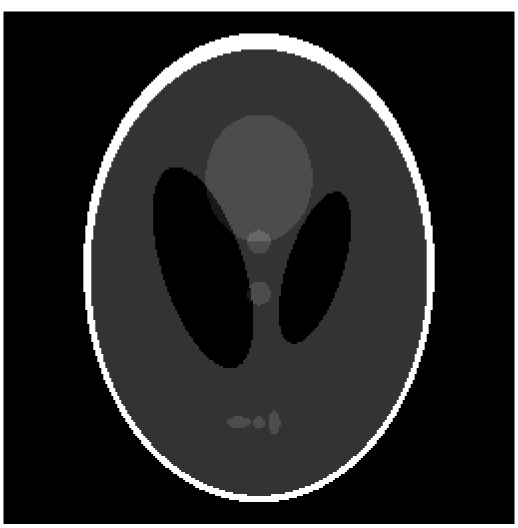
7. R1 represent the projection data. The first column of R1 corresponds to a projection at 0 degrees, which is integrating in the vertical direction. The centermost column corresponds to a projection at 90 degrees, which is integrating in the horizontal directions.

Parallel Beam - Reconstruct Head Phantom from Projection Data

8.

Figure-5

9.



Original image

Reconstructed image

10. The function iradon reconstructs an image from parallel-beam projections. In parallel-beam geometry, each projection is formed by combining a set of line integrals through an image at a specific angle. The function ifanbeam reconstructs an image from fan-beam projections, which have one emitter and multiple sensors.

12.

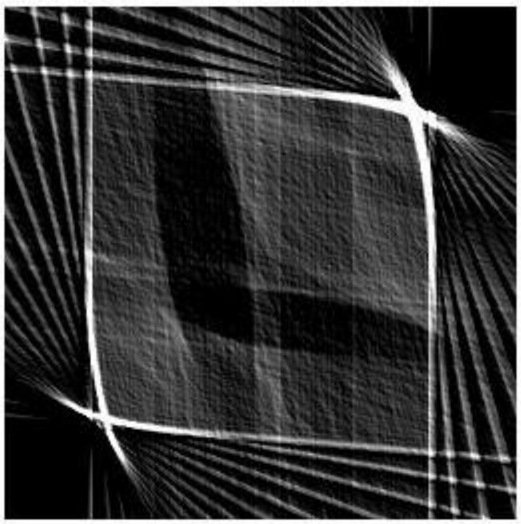


Figure-7
(dtheta = 5)

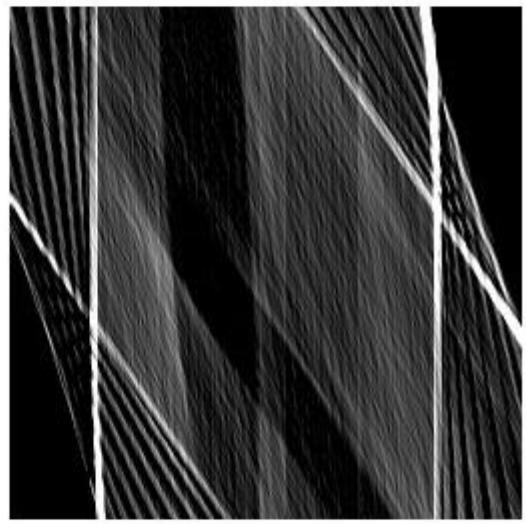
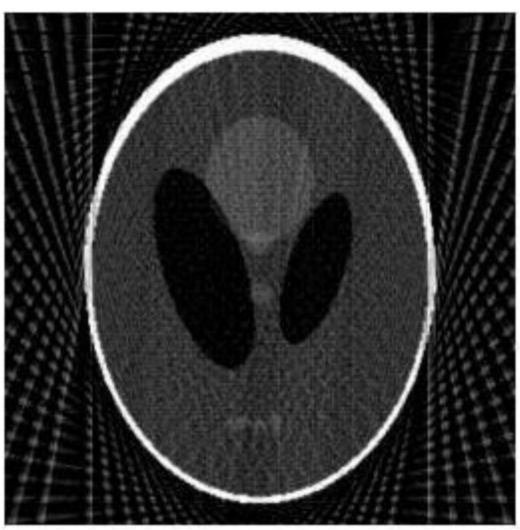
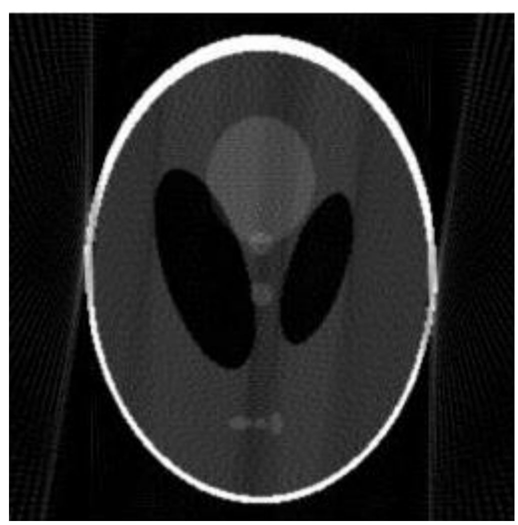


figure-8
(dtheta = 2)

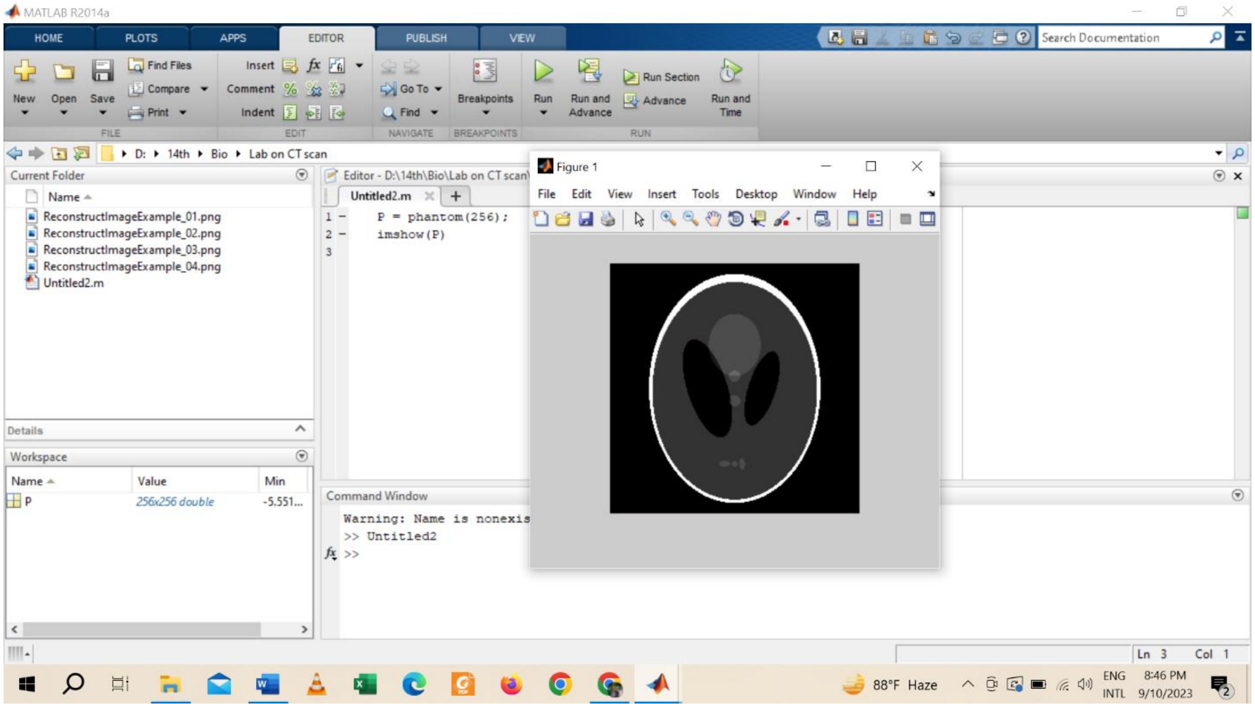


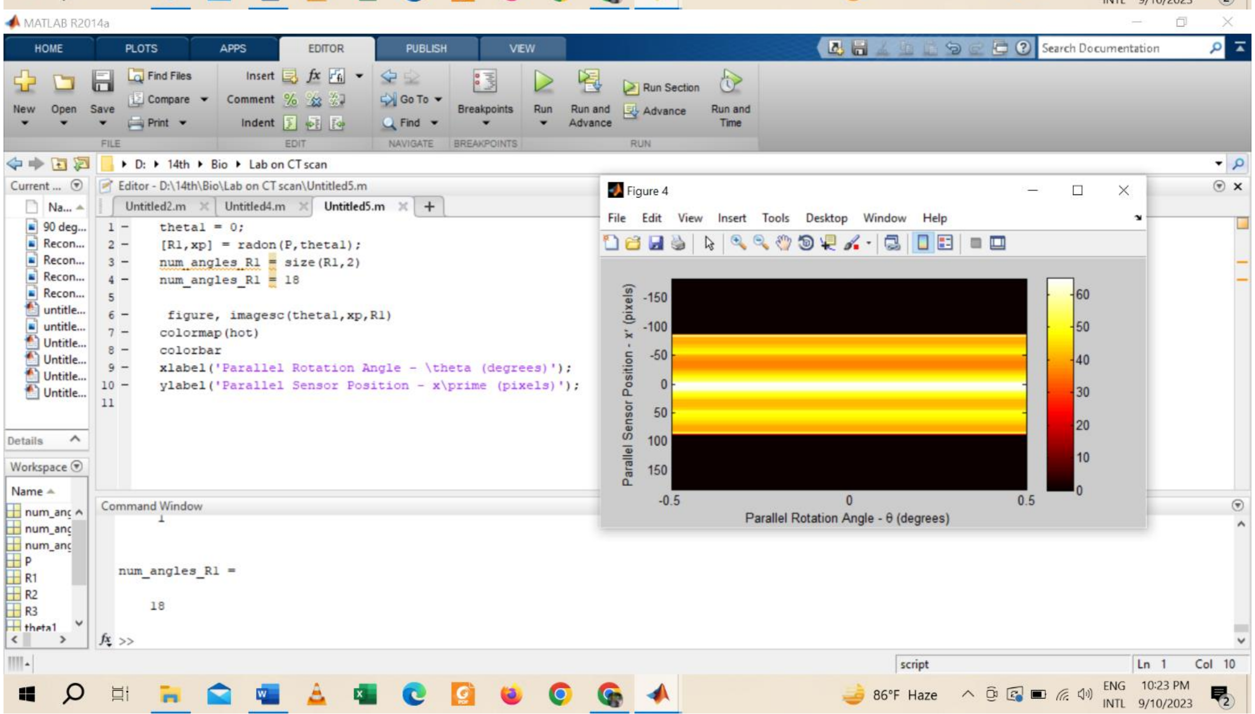
(`theta1 = 0:5:170;`)



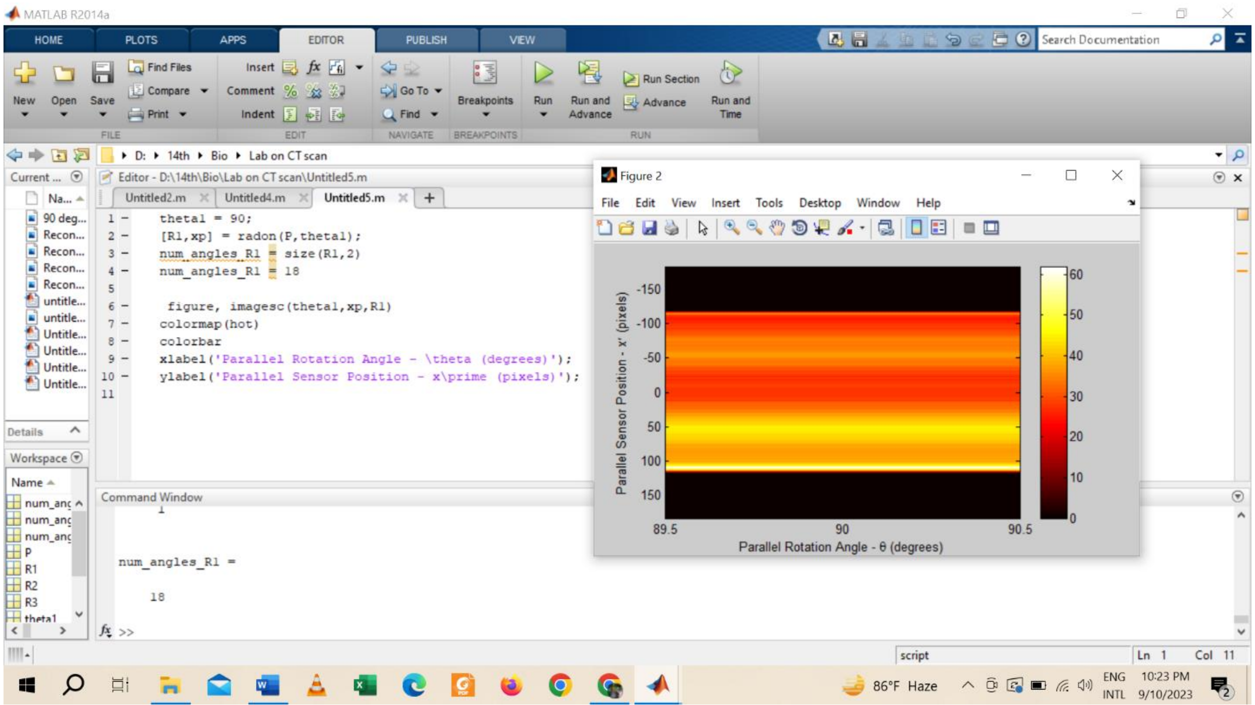
(`theta1 = 0:2:170;`)

MATLAB experiments:

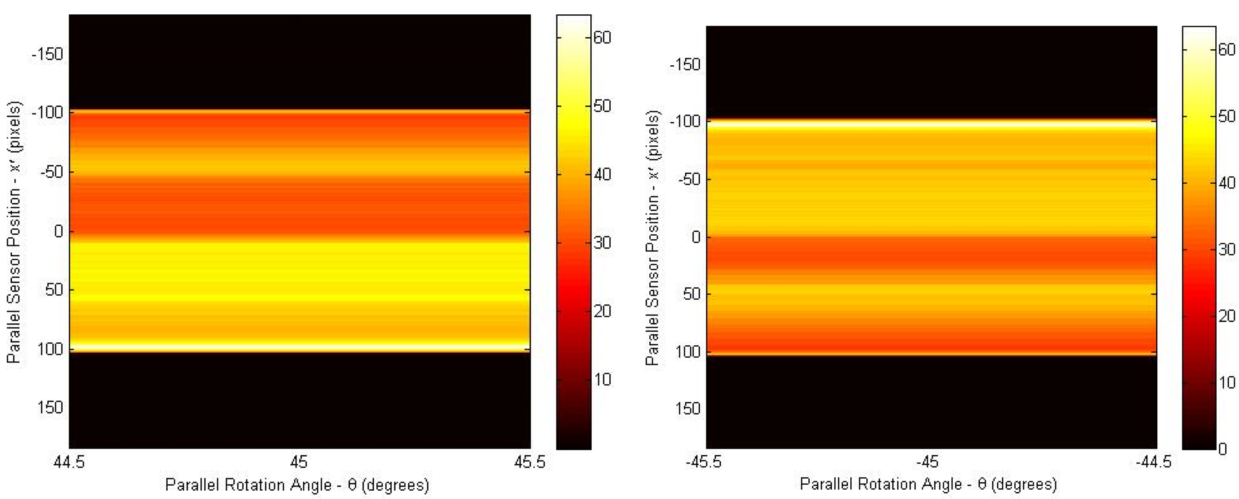




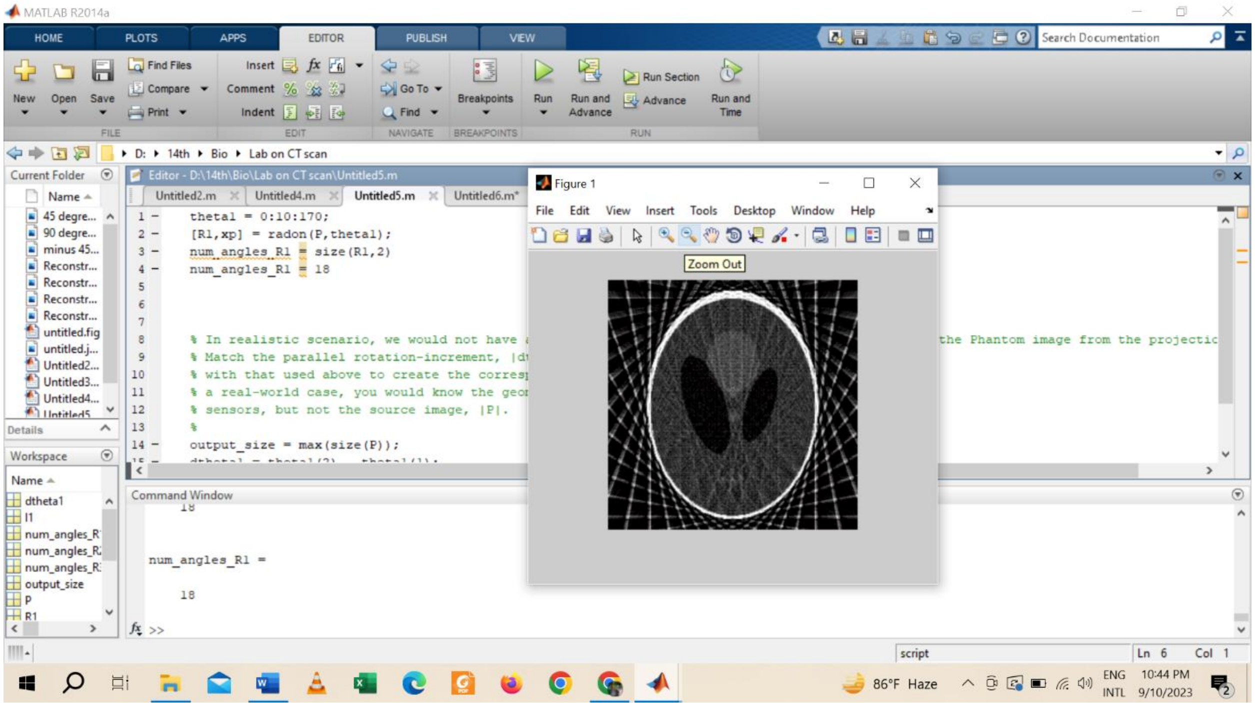
(Que-5: absorption variation ‘theta = 0 degree’)



(Que-6: absorption variation 'theta = 90 degree')



(The changes can be observed more accurately at theta = 45degee and theta = -45degree)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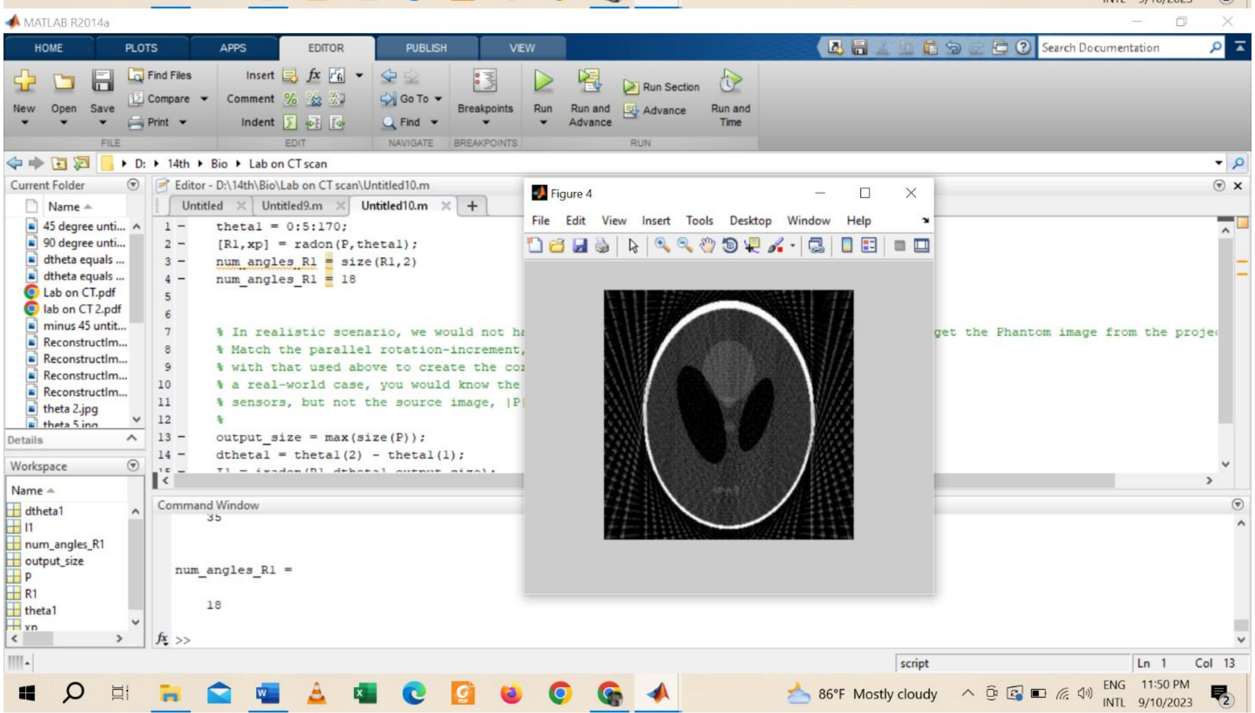
Untitled2.m
Untitled4.m
Untitled5.m
Untitled6.m*
thetal = 0:10:170;
[R1,xp] = radon(P,thetal);
num_angles_R1 = size(R1,2)
num_angles_R1 = 18
% In realistic scenario, we would not have
% Match the parallel rotation-increment,
% with that used above to create the corres
% a real-world case, you would know the geo
% sensors, but not the source image, |P|.
%
output_size = max(size(P));
the Phantom image from the projectio
Figure 1
File Edit View Insert Tools Desktop Window Help
Zoom Out
Workspace
dtheta1
I1
output_size
P
R1
Command Window
num_angles_R1 =
18
script
Ln 6 Col 1
86°F Haze
ENG INTL
10:44 PM
9/10/2023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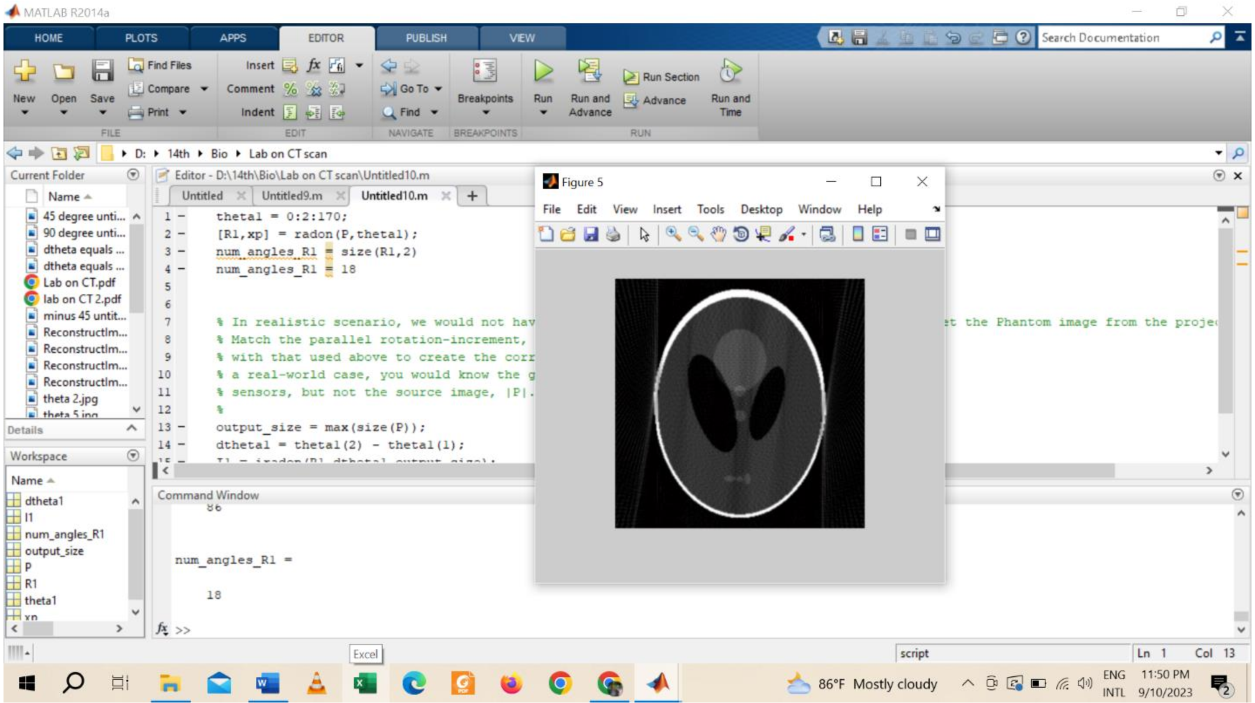
Untitled
Untitled9.m
Untitled10.m
45 degree unti...
90 degree unti...
dtheta equals ...
Lab on CT.pdf
lab on CT 2.pdf
minus 45 untit...
theta 2.jpg
thetal = 0:5:170;
[R1,xp] = radon(P,thetal);
num_angles_R1 = size(R1,2)
num_angles_R1 = 18
% In realistic scenario, we would not ha
% Match the parallel rotation-increment,
% with that used above to create the cor
% a real-world case, you would know the
% sensors, but not the source image, |P
%
output_size = max(size(P));
dthetal = thetal(2) - thetal(1);
get the Phantom image from the projec
Figure 4
File Edit View Insert Tools Desktop Window Help
Workspace
dtheta1
I1
num_angles_R1
output_size
P
R1
theta1
Command Window
35
num_angles_R1 =
18
script
Ln 1 Col 13
86°F Mostly cloudy
ENG INTL
11:50 PM
9/10/2023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Editor - D:\14th\Bio\Lab on CT scan\Untitled10.m
Untitled
Untitled9.m
Untitled10.m
thetal = 0:2:170;
[R1,xp] = radon(P,thetal);
num_angles_R1 = size(R1,2)
num_angles_R1 = 18
% In realistic scenario, we would not hav
% Match the parallel rotation-increment,
% with that used above to create the corr
% a real-world case, you would know the g
% sensors, but not the source image, |P|.
%
output_size = max(size(P));
dthetal = thetal(2) - thetal(1);
Figure 5
File
Edit
View
Insert
Tools
Desktop
Window
Help
Workspace
dtheta1
I1
num_angles_R1
output_size
P
R1
theta1
Command Window
num_angles_R1 =
18
86°F Mostly cloudy
11:50 PM
9/10/2023