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Image Reconstruction of a Phantom Brain Model using parallel beam and fan beam technique

```
close all; clear all
```

Defining an phantom brain model in the x,y space

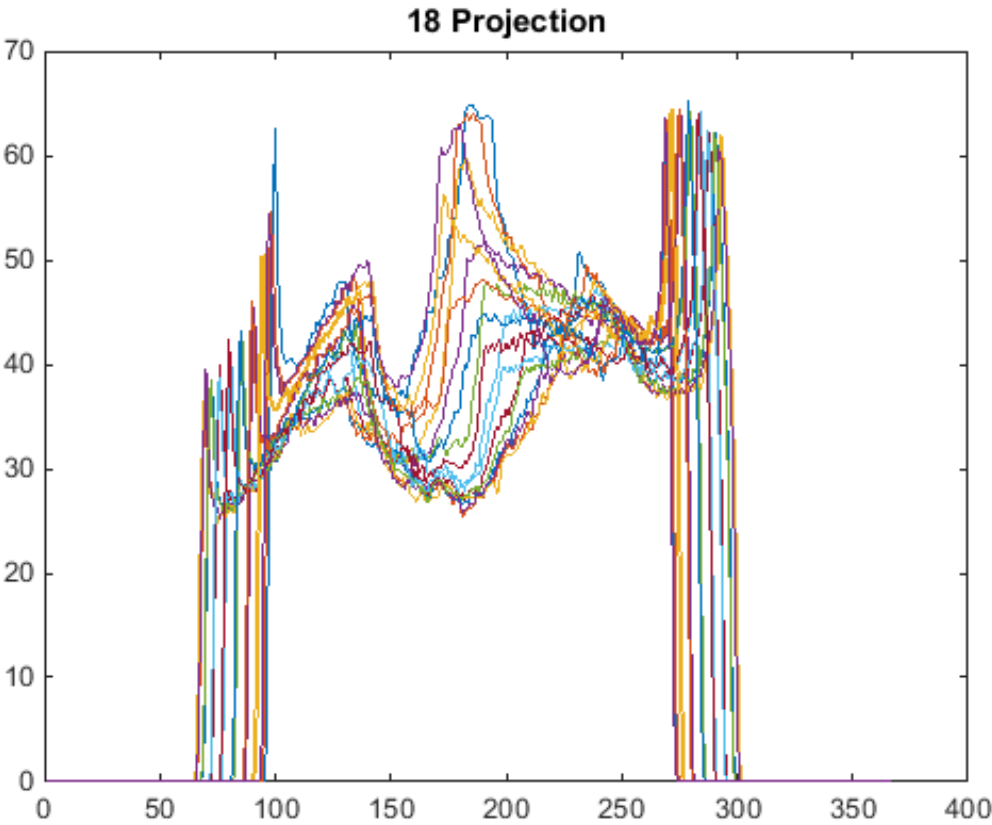
```
figure;  
I=phantom('Modified Shepp-Logan',256);  
imshow(I,[],'InitialMagnification','fit'), title('The phantom brain model in the x-y space')
```

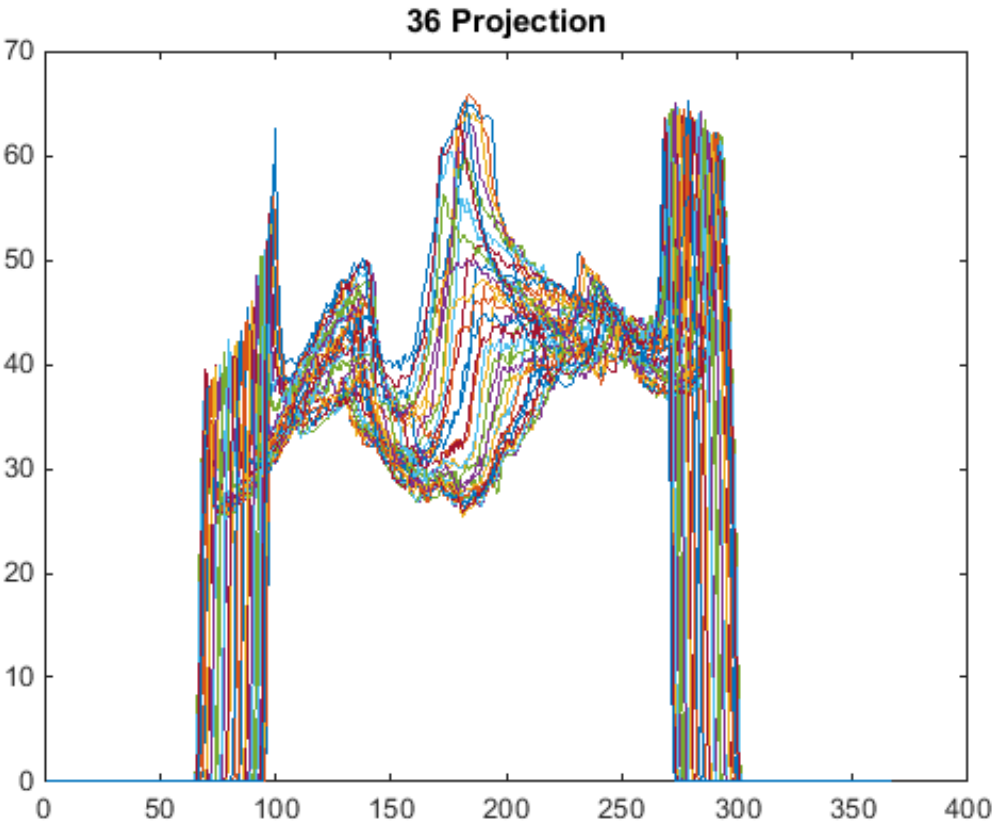
The phantom brain model in the x-y space

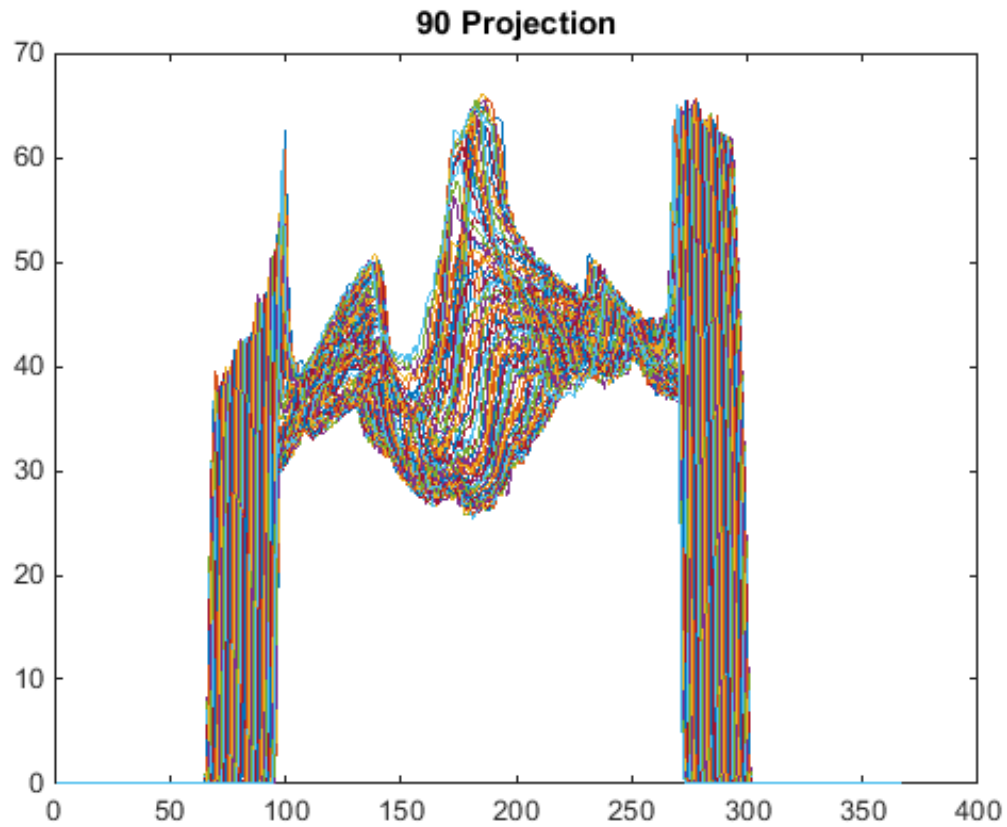


Parallel Projection of the brain model in the Radon Space

```
theta1=0:10:170;  
theta2=0:5:175;  
theta3=0:2:178;  
[p1,r]=radon(I, theta1);  
[p2,r]=radon(I, theta2);  
[p3,r]=radon(I, theta3);  
figure;plot(radon(I,theta1)),title('18 Projection');  
figure;plot(radon(I,theta2)),title('36 Projection');  
figure;plot(radon(I,theta3)),title('90 Projection');
```

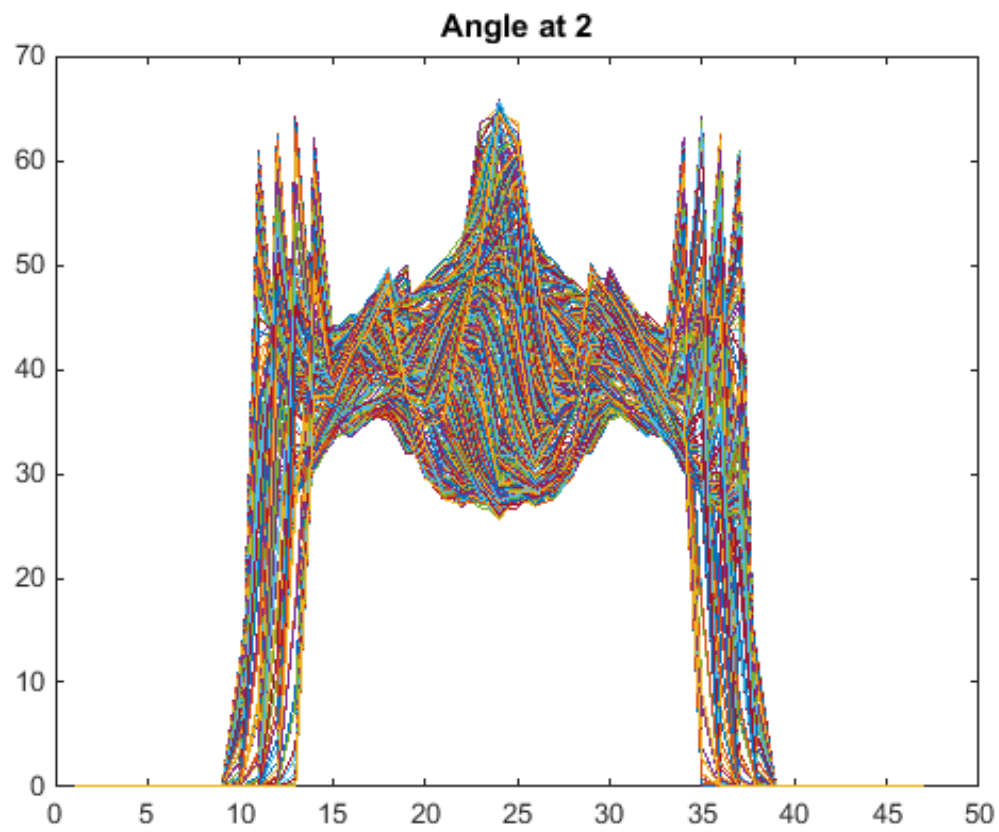


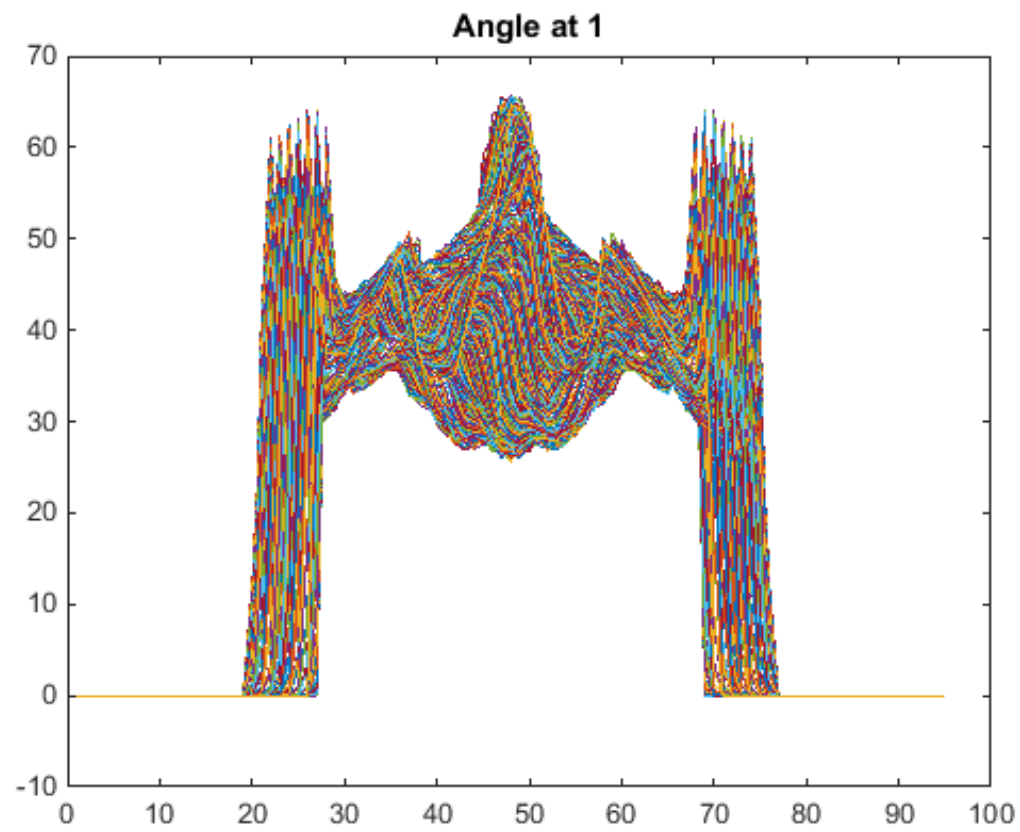


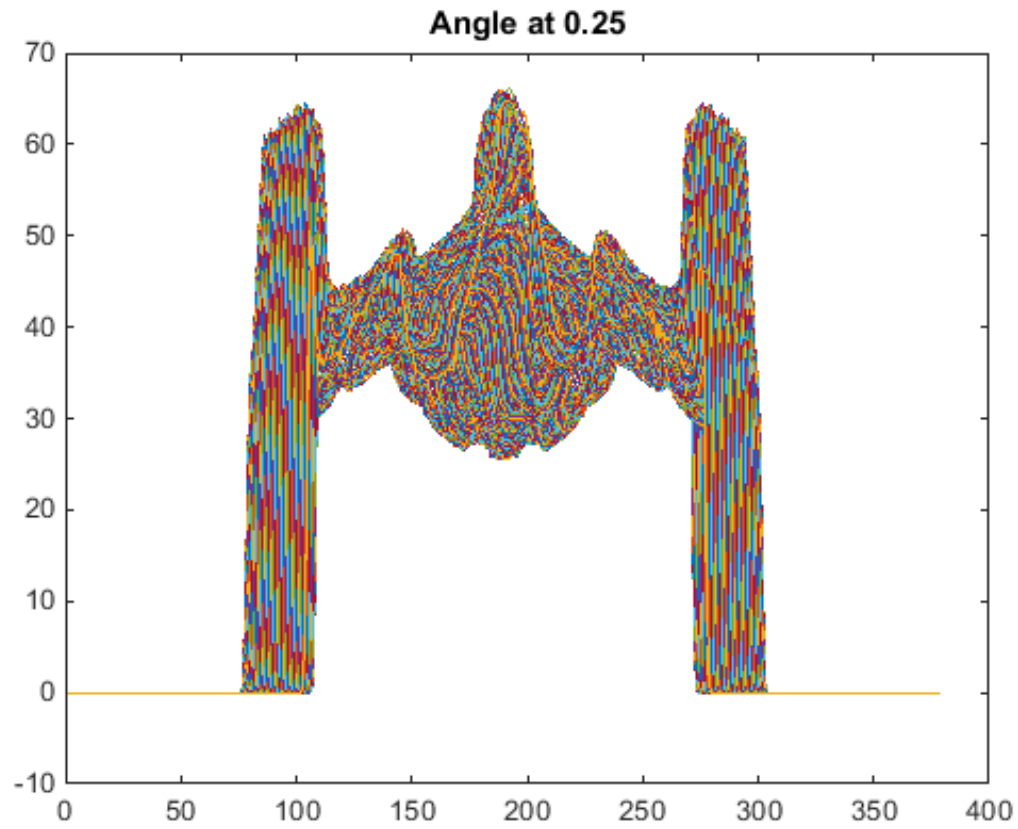


Fan Projection of the brain model in the Radon Space

```
D=250;
[g1,f_loc,f_angle1]=fanbeam(I,D,'FanSensorSpacing',2);
[g2,f_loc,f_angle2]=fanbeam(I,D,'FanSensorSpacing',1);
[g3,f_loc,f_angle3]=fanbeam(I,D,'FanSensorSpacing',0.25);
figure;plot(fanbeam(I,D,'FanSensorSpacing',2)),title('Angle at 2');
figure;plot(fanbeam(I,D,'FanSensorSpacing',1)),title('Angle at 1');
figure;plot(fanbeam(I,D,'FanSensorSpacing',0.25)),title('Angle at 0.25');
```

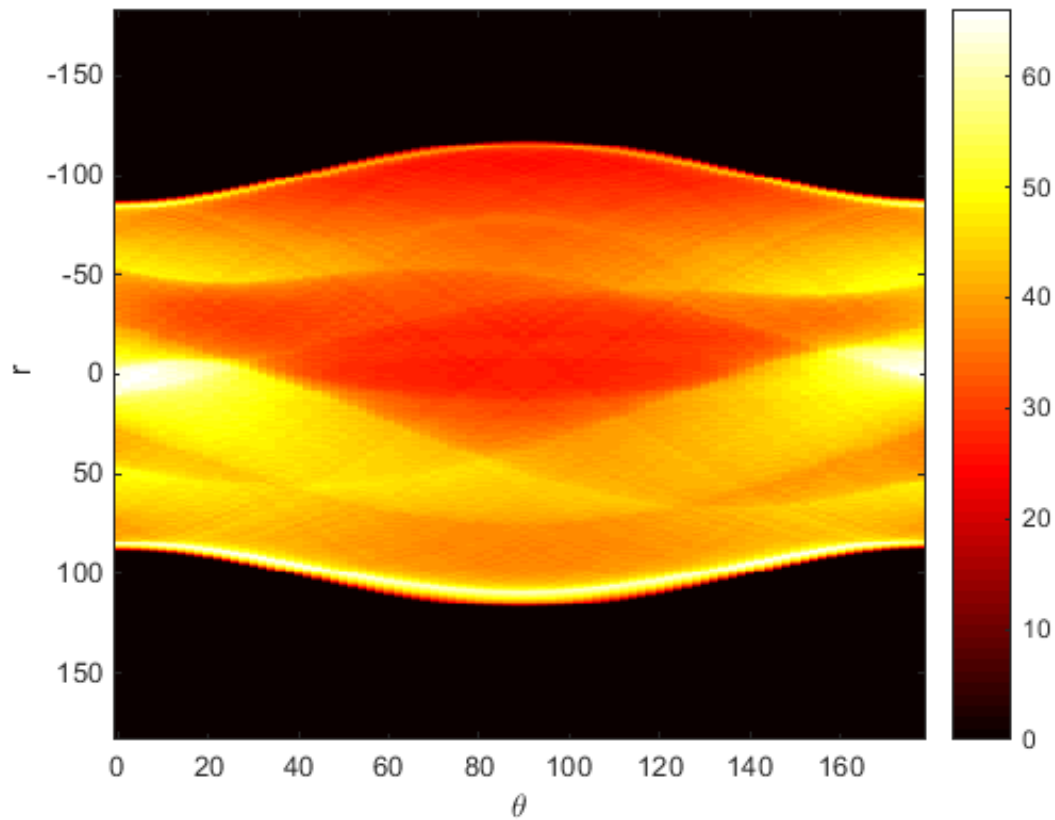






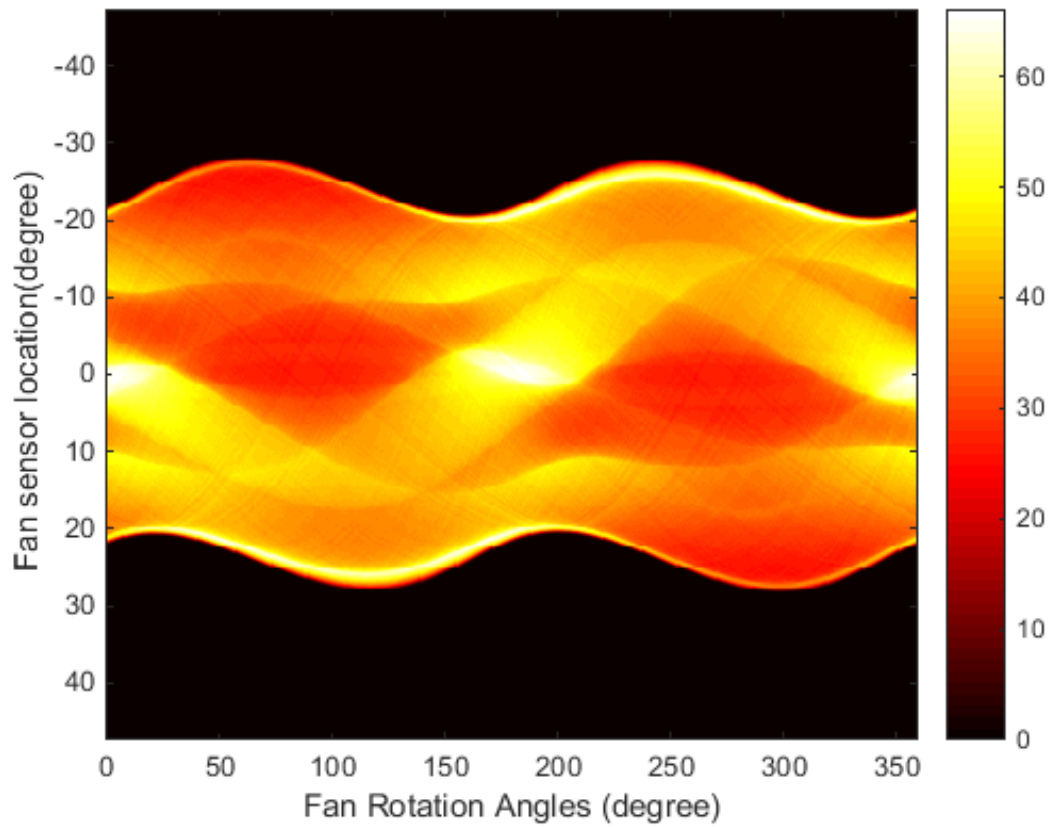
Sinogram for 90 parallel projections in Radon Space

```
figure,imagesc (theta3,r,p3);colormap(hot);colorbar  
xlabel('\theta'); ylabel('r');
```

Sinogram for fan rotation angle of 0.25 in Radon Space

```
figure,imagesc(f_angle3,f_loc,g3);colormap(hot);colorbar
xlabel('Fan Rotation Angles (degree)'); ylabel('Fan sensor location(degree)');
```

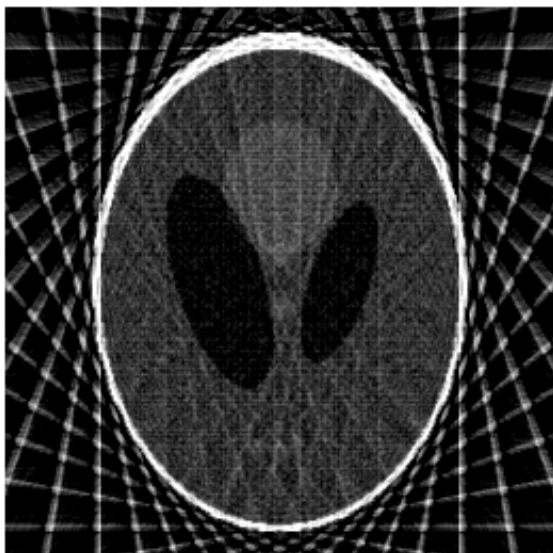


Back parallel-projection to the object space with filter

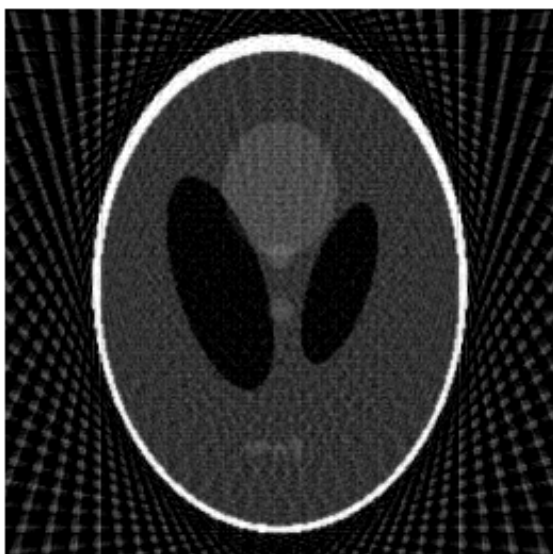
This returns raw back projection data

```
b1=iradon(p1,10);  
b2=iradon(p2,5);  
b3=iradon(p3,2);  
figure,imshow(b1),title('Back Projection at 18 angles');  
figure,imshow(b2),title('Back Projection at 36 angles');  
figure,imshow(b3),title('Back Projection at 90 angles');
```

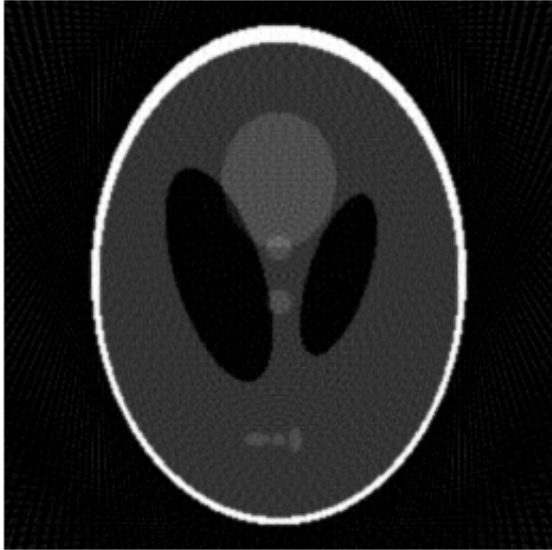
Back Projection at 18 angles



Back Projection at 36 angles



Back Projection at 90 angles



Back fan-projection to the object space with filter

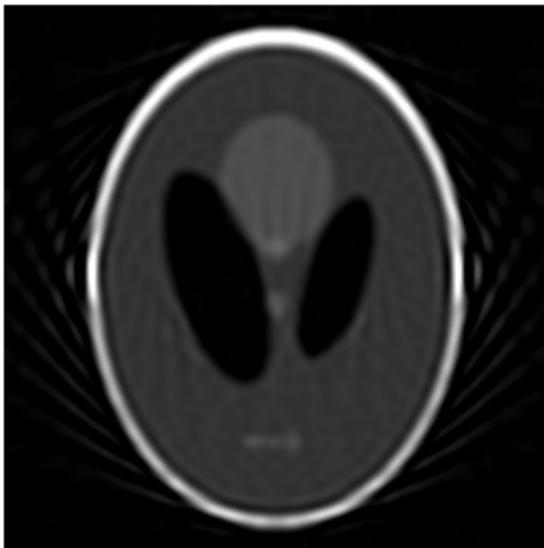
This returns raw back projection data

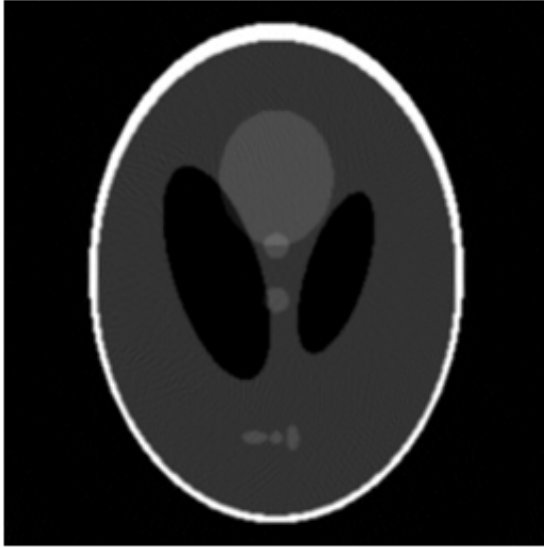
```
output_size=max(size(I));  
B1=ifanbeam(g1,D,'FanSensorSpacing',2,'OutputSize',output_size);  
figure;imshow(B1), title('Back Projection at fan angle of 2');  
B2=ifanbeam(g2,D,'FanSensorSpacing',1,'OutputSize',output_size);  
figure;imshow(B2), title('Back Projection at fan angle of 1');  
B3=ifanbeam(g3,D,'FanSensorSpacing',0.25,'OutputSize',output_size);  
figure;imshow(B3), title('Back Projection at fan angle of 0.25');
```

Back Projection at fan angle of 2



Back Projection at fan angle of 1



Back Projection at fan angle of 0.25

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