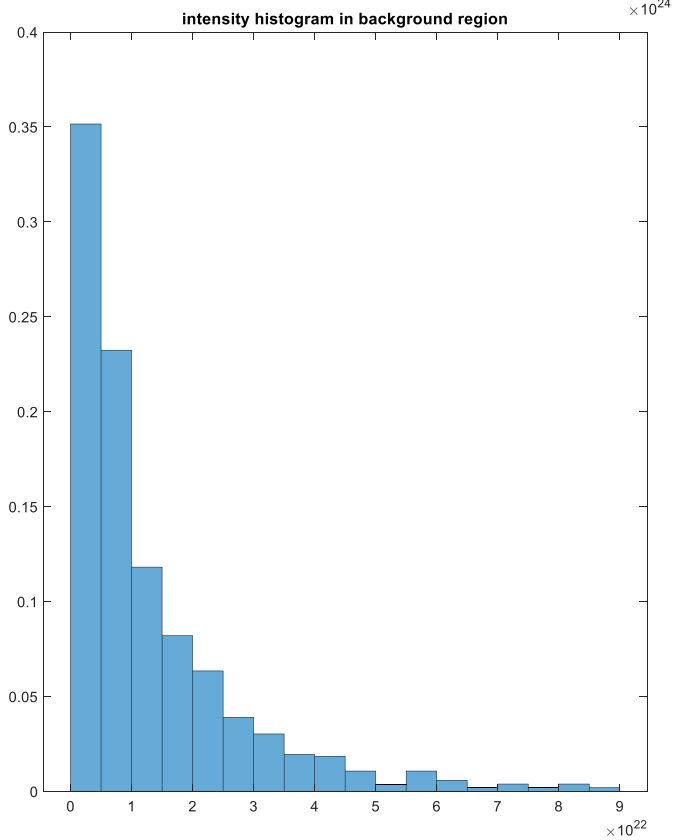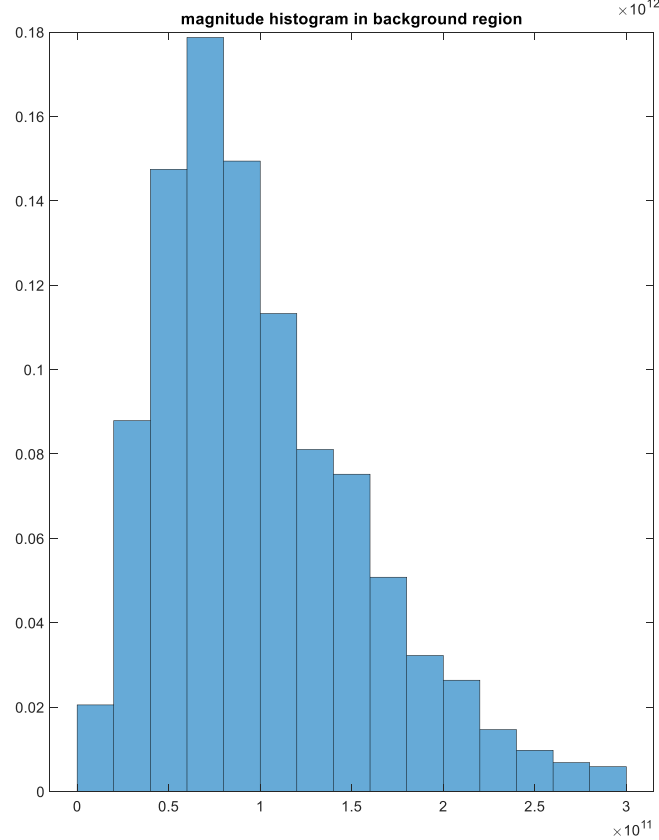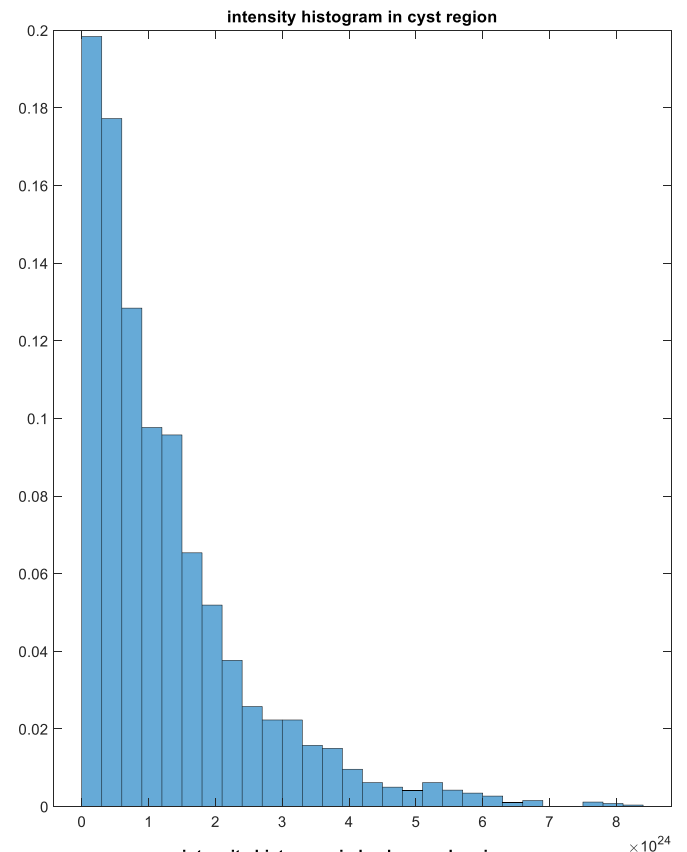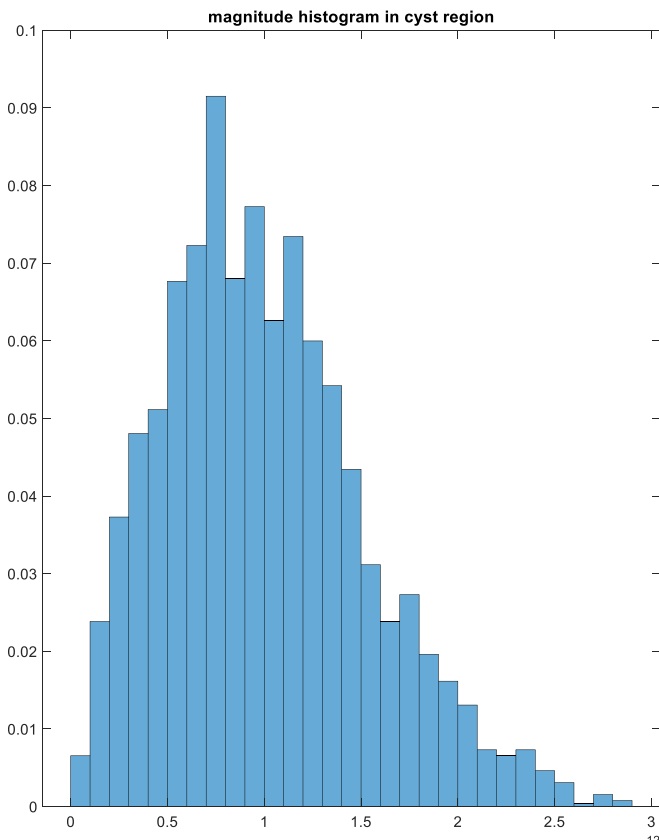a.

Both the histograms of magnitude in cyst and background follow Rayleigh distribution, and that of intensity follow exponential distribution.

b.

| cystdB	3	5	10	20	30	40
Cyst magnitude	1.9372	1.9372	1.9372	1.9372	1.9372	1.9372
Background magnitude	1.8099	1.8099	1.8099	1.8099	1.8099	1.8099
Theoretical value	1.91					
Cyst intensity	1.0186	1.0186	1.0186	1.0186	1.0186	1.0186
Background intensity	0.9021	0.9021	0.9021	0.9021	0.9021	0.9021
Theoretical value	1					

Since background has larger standard deviation and smaller average magnitude, the ratio of background is lower than that of cyst. But both are near the theoretical value. Moreover, the ratio is a constant which is independent of the contrast between cyst and background.

c.

Cyst	5.5280 dB
Background	5.3318 dB

It's an additive noise independing a little larger than the theoretical value 4.34 dB.
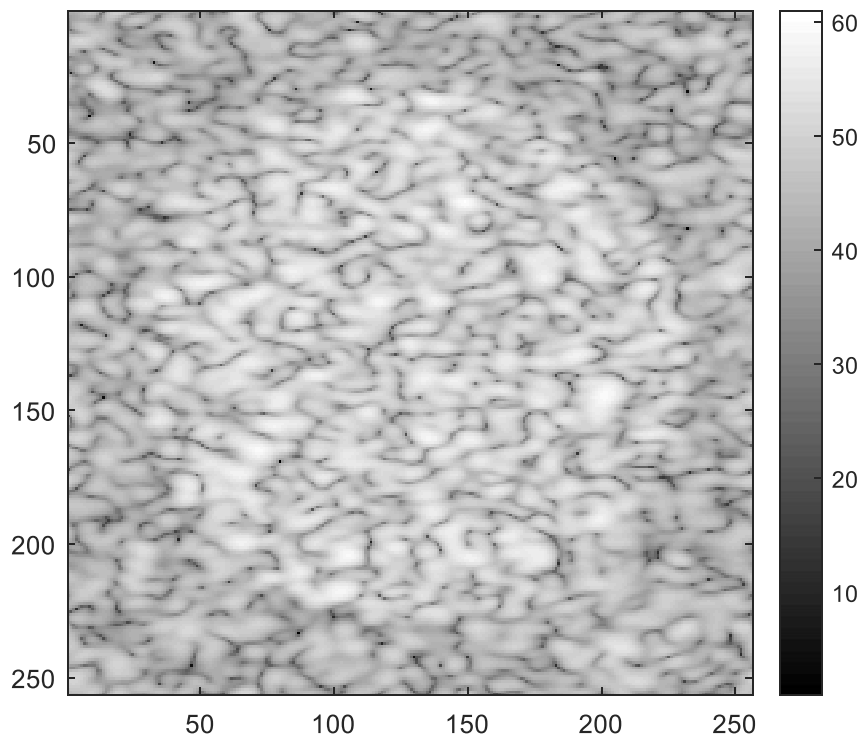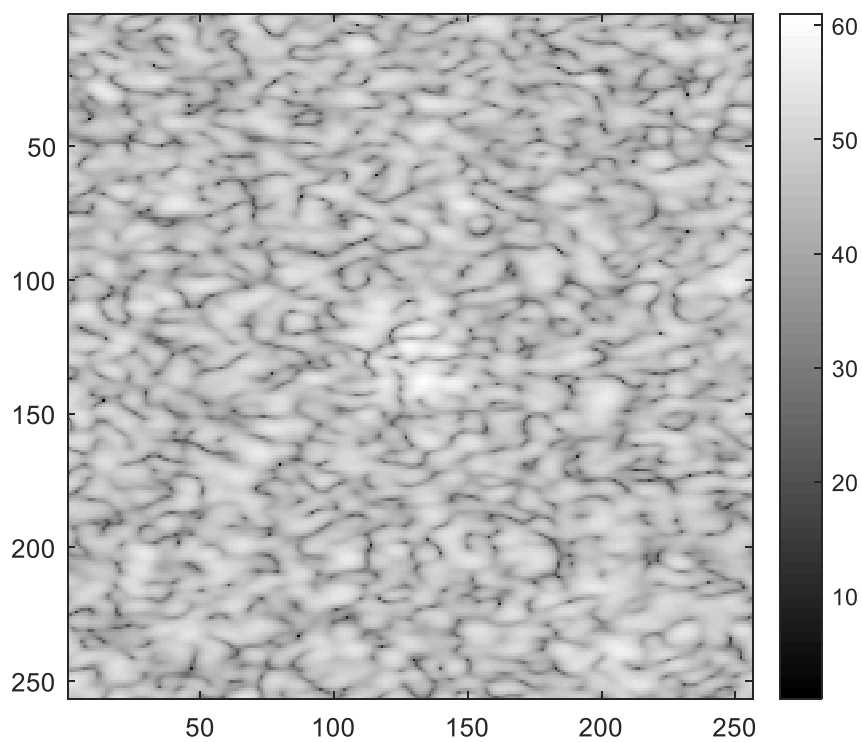
d.
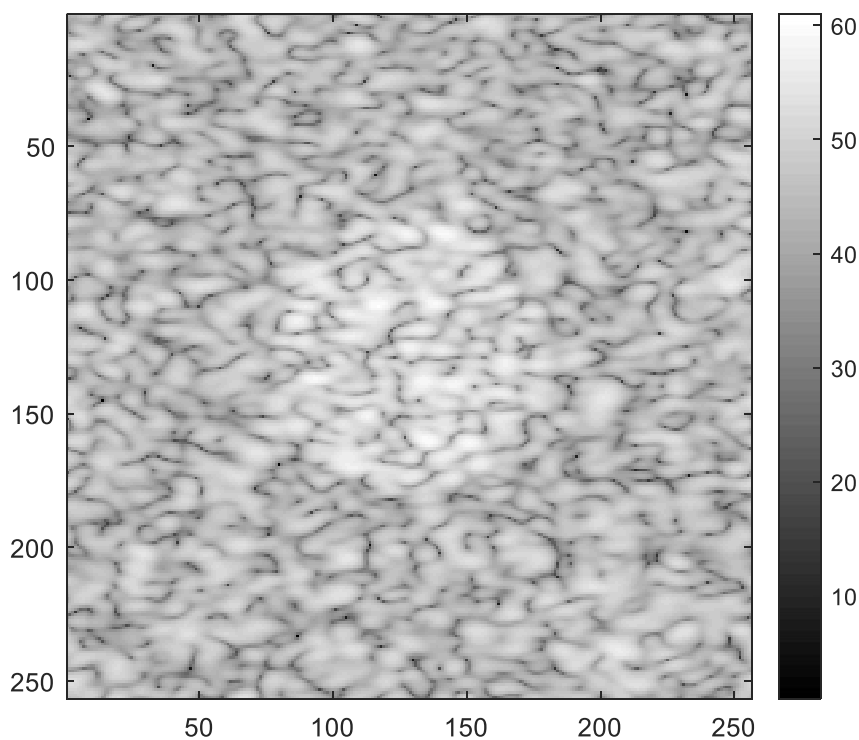
The true contrast is about 6 dB. It seems not to be detectable.

e.

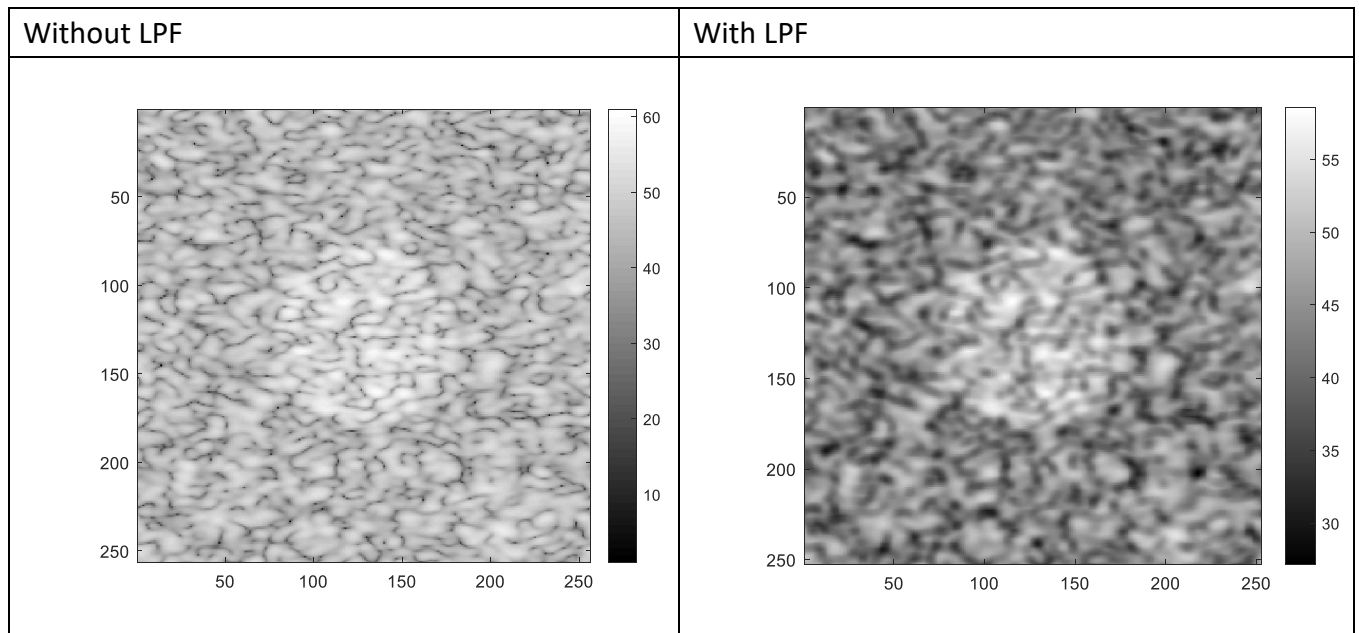It can't be further detected as the diameter of cyst increases or decreases.
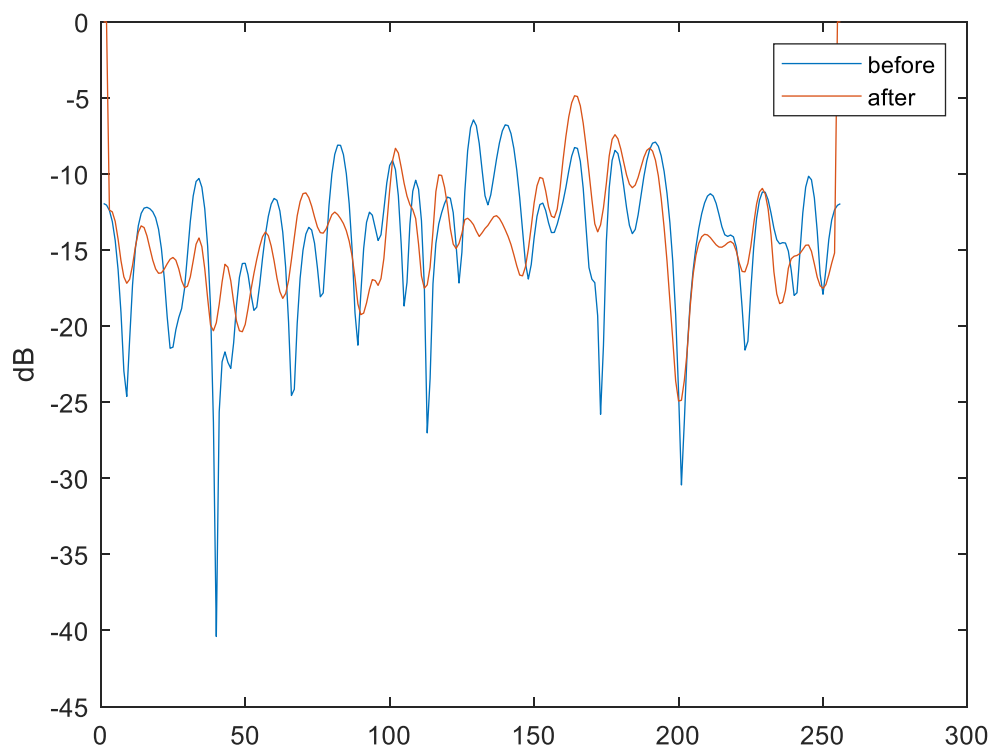

(R=60pixel)

(R=20pixel)

The cyst is detectable only the contrast beyond the scatter noise.
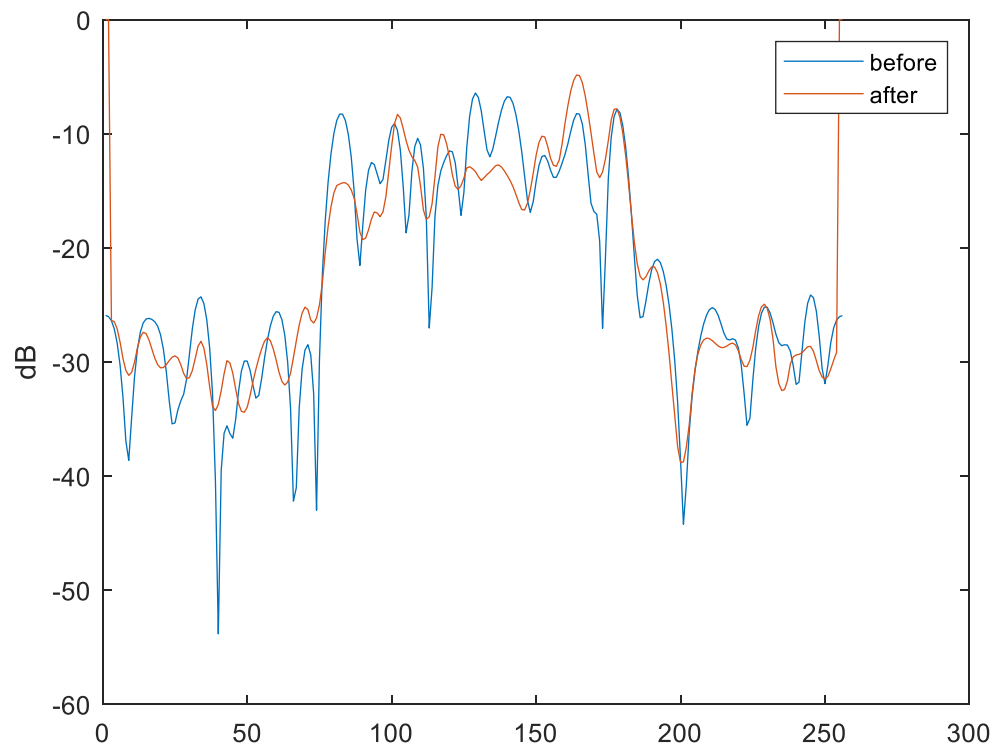
f.

Without LPF	With LPF

A lowpass filter enhances the contrast that we can see the cyst. although the contrast is still about 6 dB in (d). However, at the expense of spatial resolution, since a LPF smooth the edge that damages the spatial resolution and blurs image.

(6dB)

We can hardly see the significant cyst that suffers from scatter noise at 6 dB contrast.

(20dB)

If we alternatively increase the contrast to 20dB, the lateral profile obviously has a higher intensity in the center region. Due to the LPF, edges in the lateral profile are also smoothed.