



# POST PROCESSING

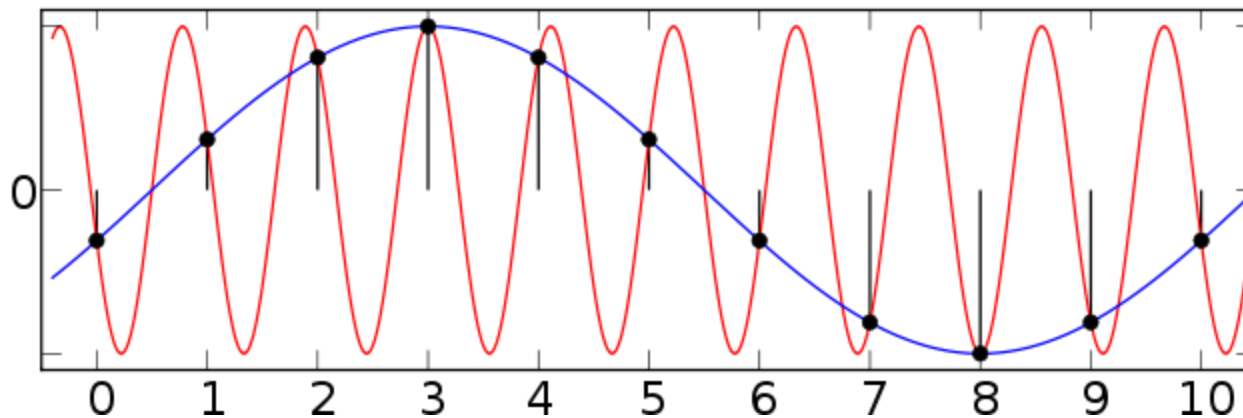
SEMINAR 7

Computer Graphics 2

# Aliasing

2

- Occurs when going from continuous to discrete
  - ▣ Such as from 3D space to pixels in image
- Sampling at low frequency can make two different signals indistinguishable



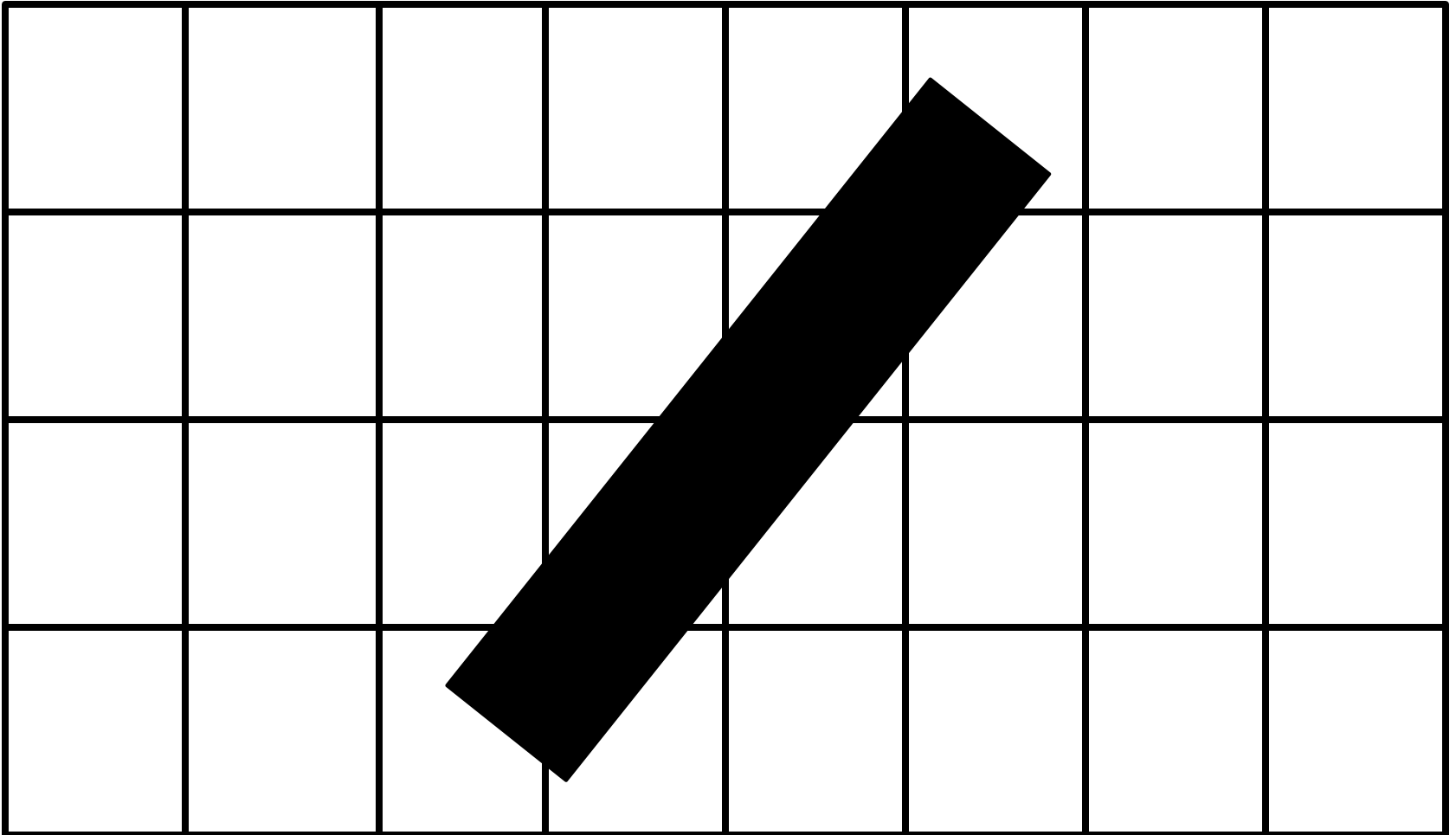
# Nyquist rate

3

- Twice the bandwidth of a bandlimited function
- Lower bound for sample rate of alias free sampling

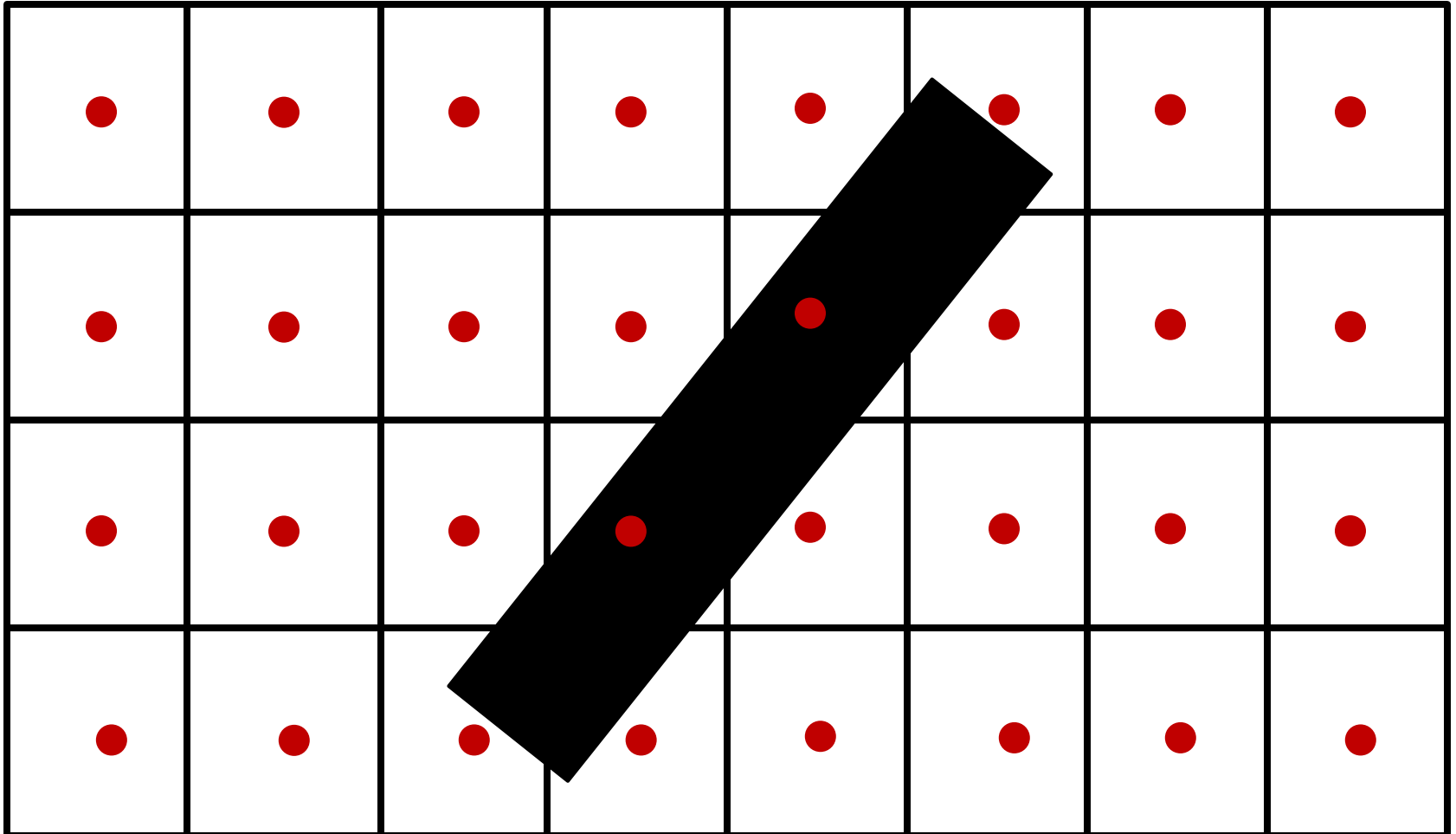
# Line in image

4



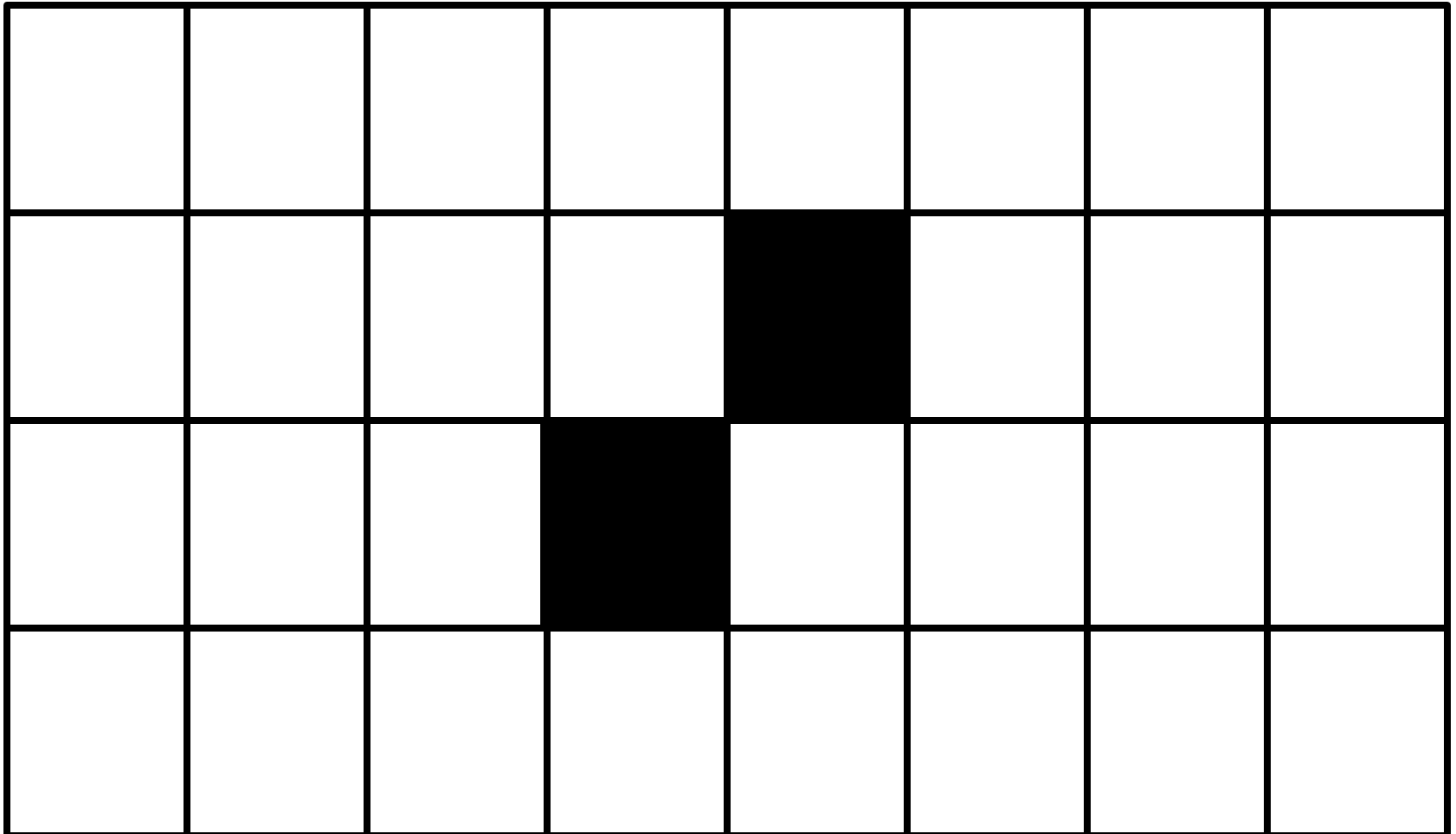
# Sampled image

5



# Rasterized line

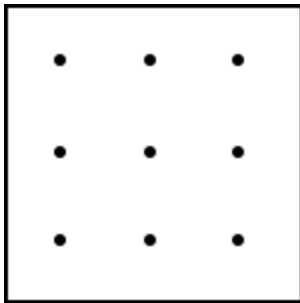
6



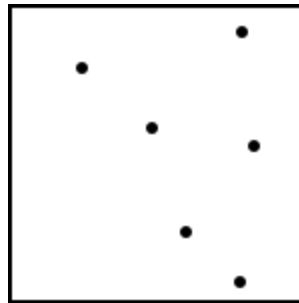
# FSAA

7

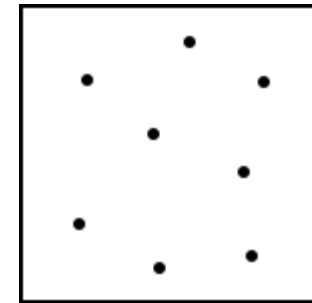
- Simplest approach to antialiasing
  - ▣ Render scene at higher resolution
    - More samples per pixel
  - ▣ Average samples in the same pixel



Grid spread



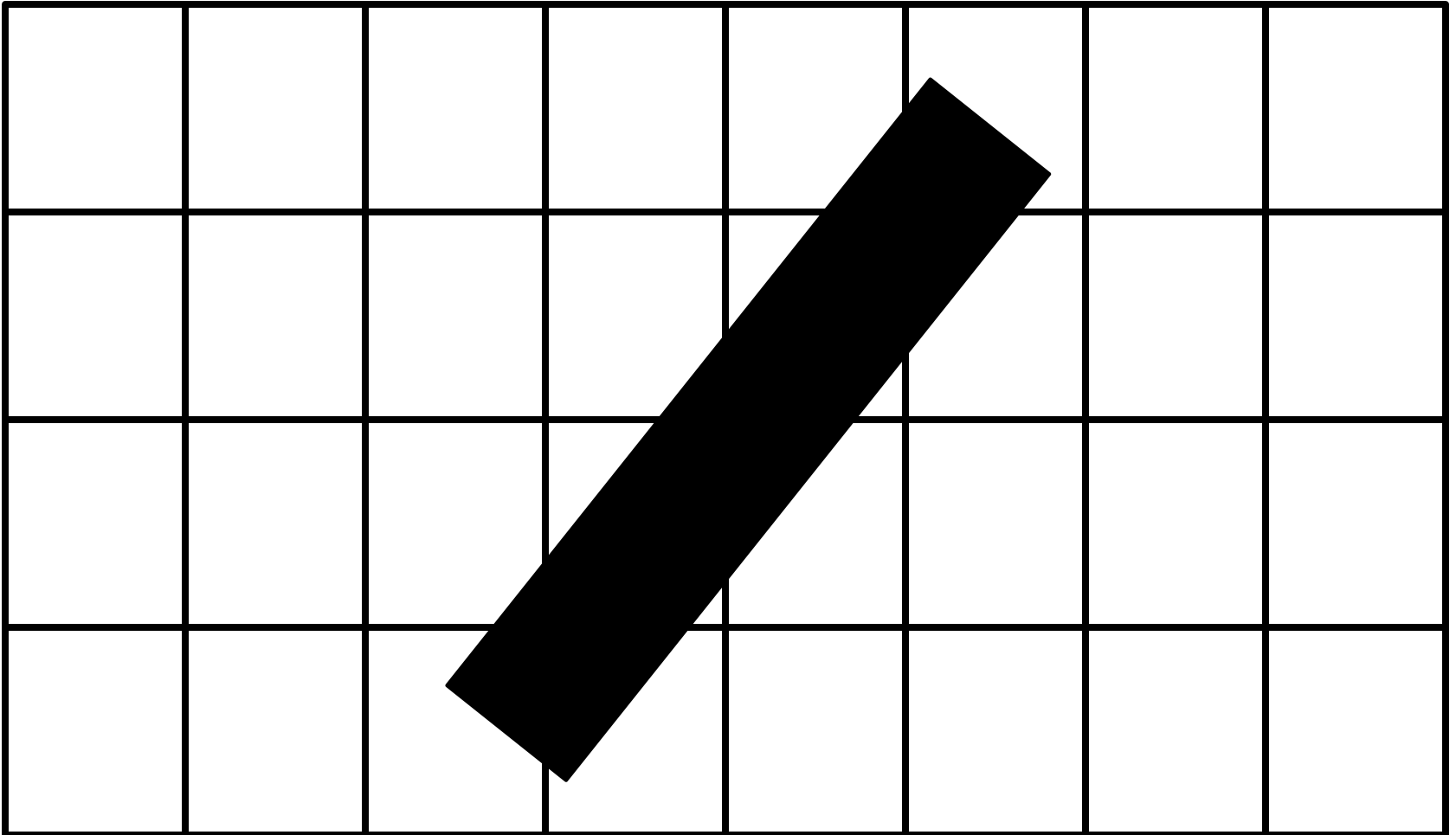
Random spread



Poisson spread

# FSAA line in image

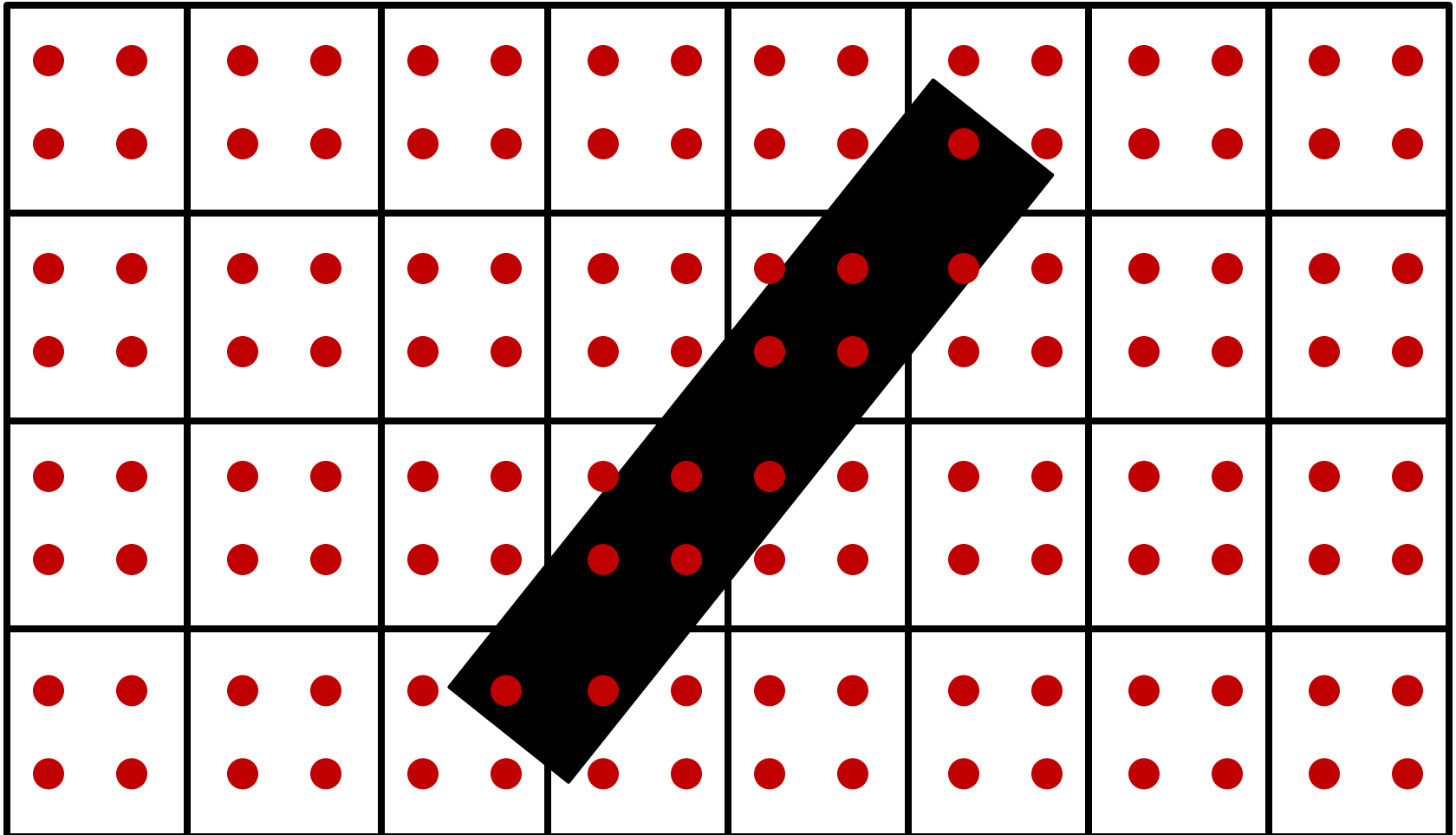
8





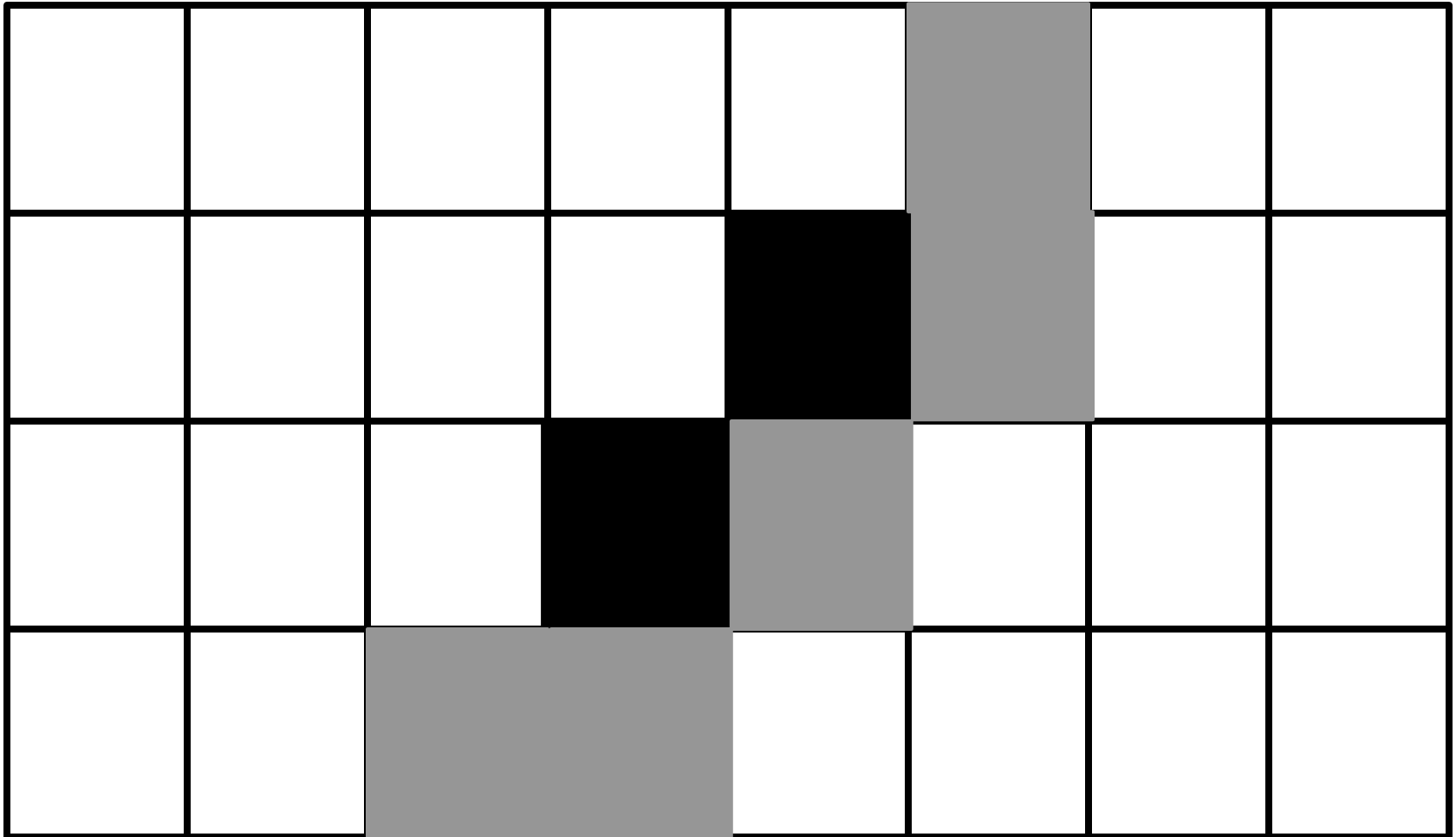
# FSAA image sampling

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# FSAA rasterized line

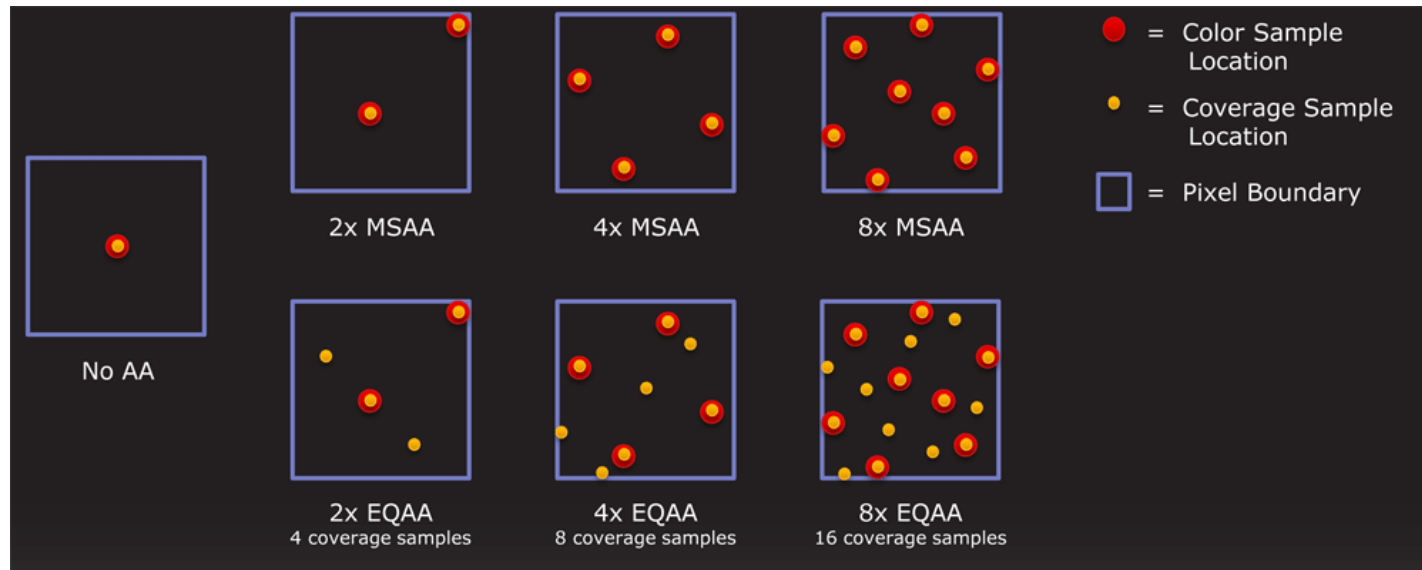
10



# MSAA

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- Less taxing than FSAA
- Does not render whole scene at higher resolution
- Renders multiple samples in each pixel
  - ▣ Resulting color is averaged over the samples



# Blur

12

- Gives idea of motion, focus, ...
- Uses a kernel to change color of image
- Kernel can be used to

- Blur image

- Detect edges

- ...

35	40	41	45	50
40	40	42	46	52
42	46	50	55	55
48	52	56	58	60
56	60	65	70	75

×

	0	1	0	
	0	0	0	
	0	0	0	

=

		42		



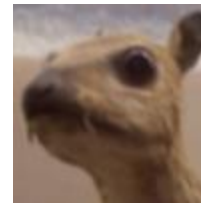
Identity



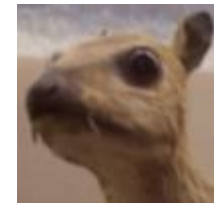
Edge



Sharpen



Blur

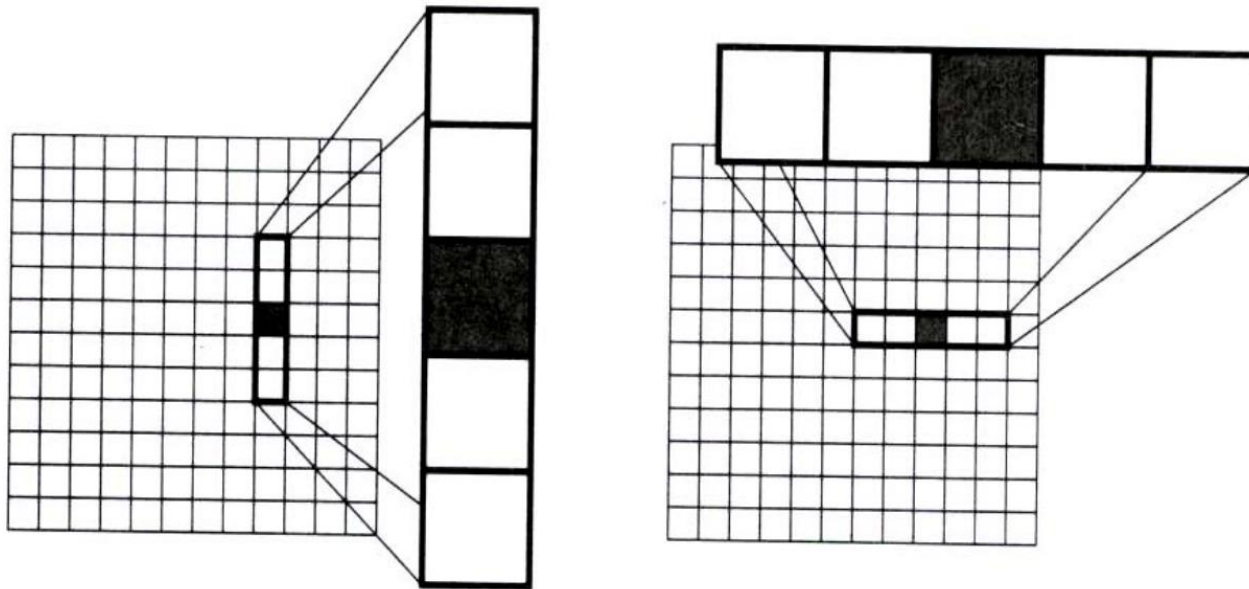


Gaussian

# Separable kernel

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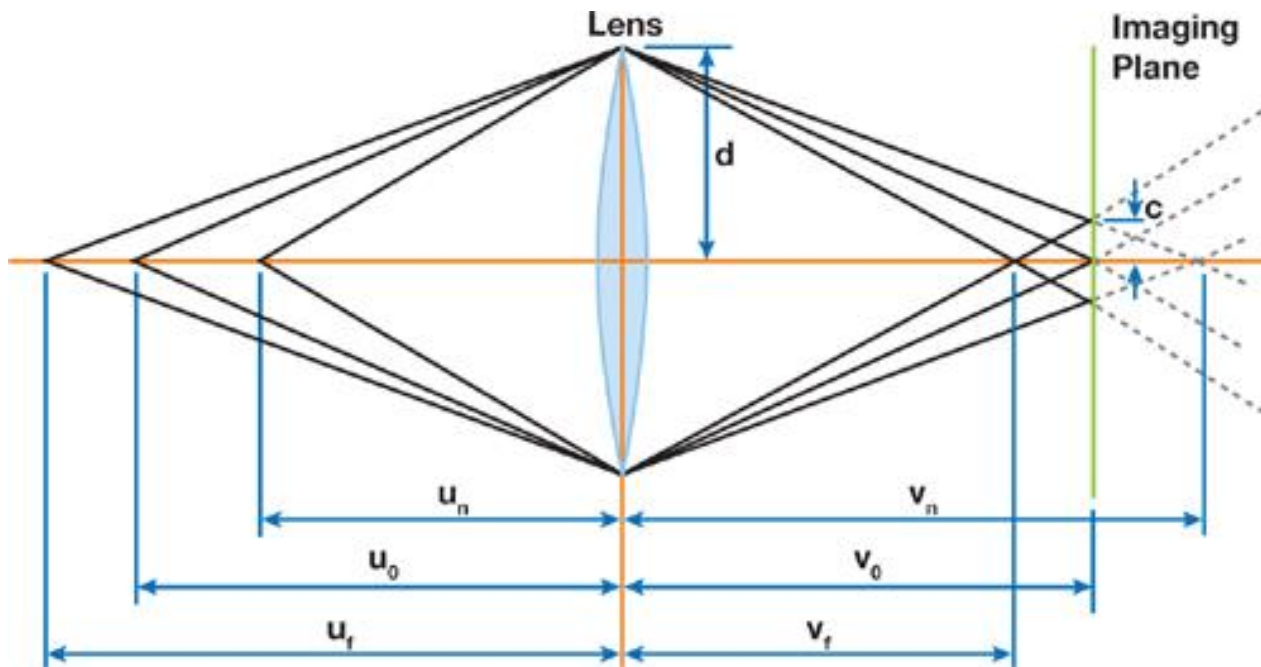
- Certain kernels can be separated
- $2m$  operations instead of  $m^2$  operations
- First apply kernel in x direction then in y direction



# Depth of field

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- Eyes focus on point in space rest is blurred
- In ray tracers usually implemented as lens before camera that refract rays
- Can be faked by blurring out of focus parts of image



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Questions?