

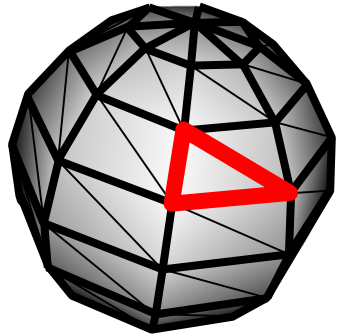
# Window to Viewport

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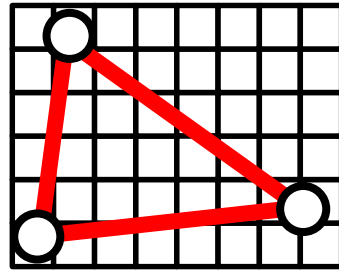
CS418 Computer Graphics

John C. Hart

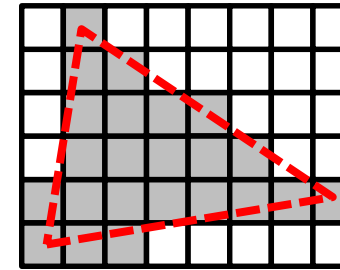
# Graphics Processing



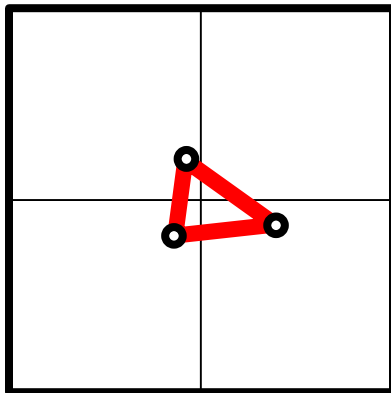
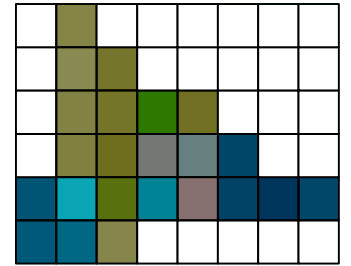
Vertex  
Shader



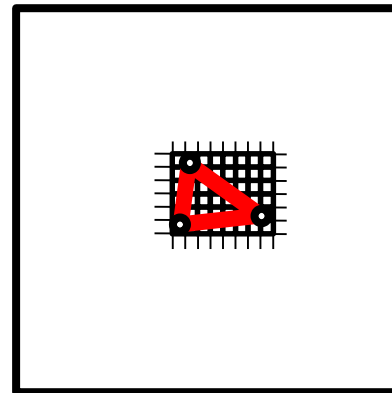
Scan  
Converter



Fragment  
Shader



Window  
to  
Viewport

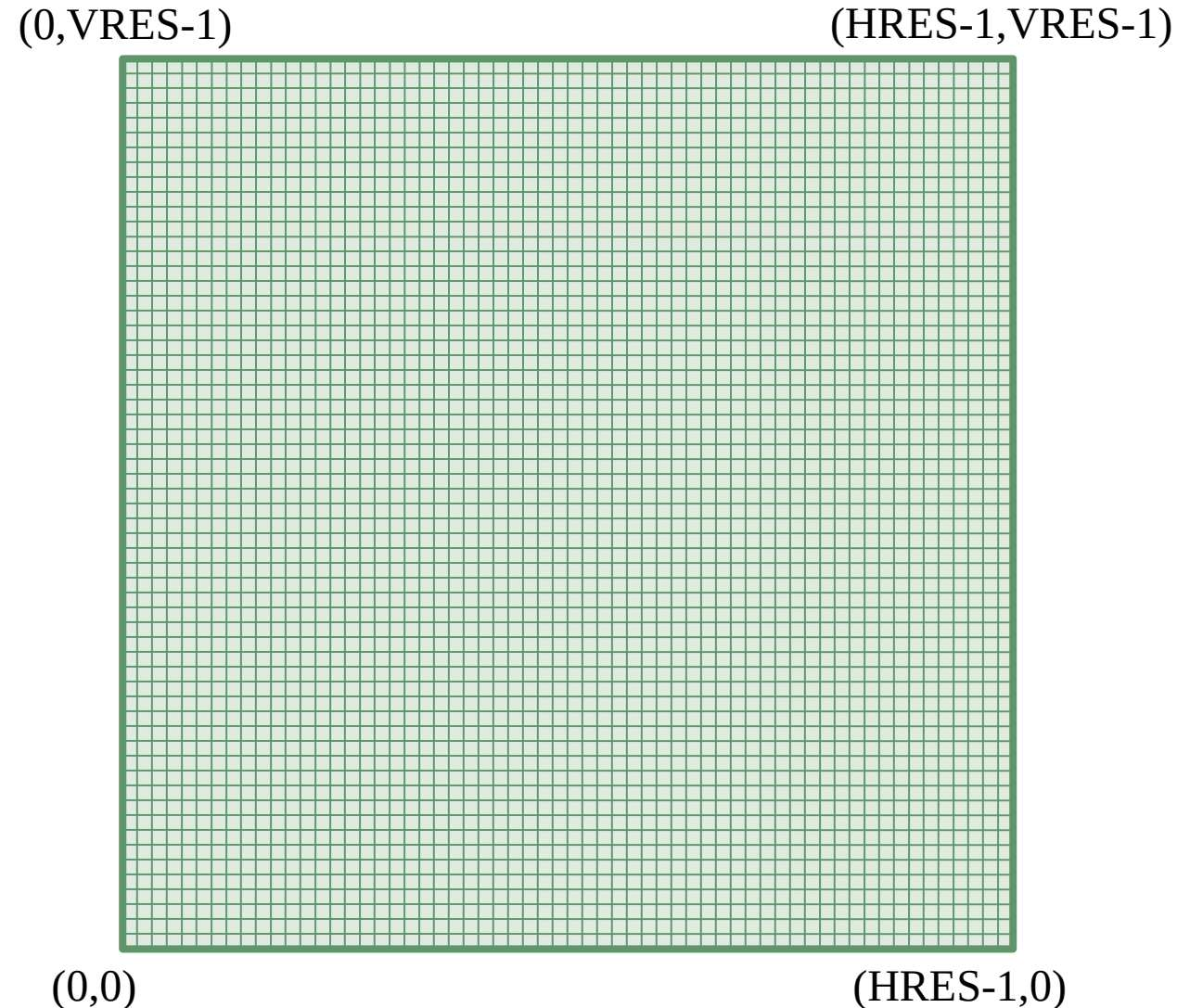


# Viewport Coordinates

- Physical per-pixel integer coordinates
- Also called screen or device coordinates

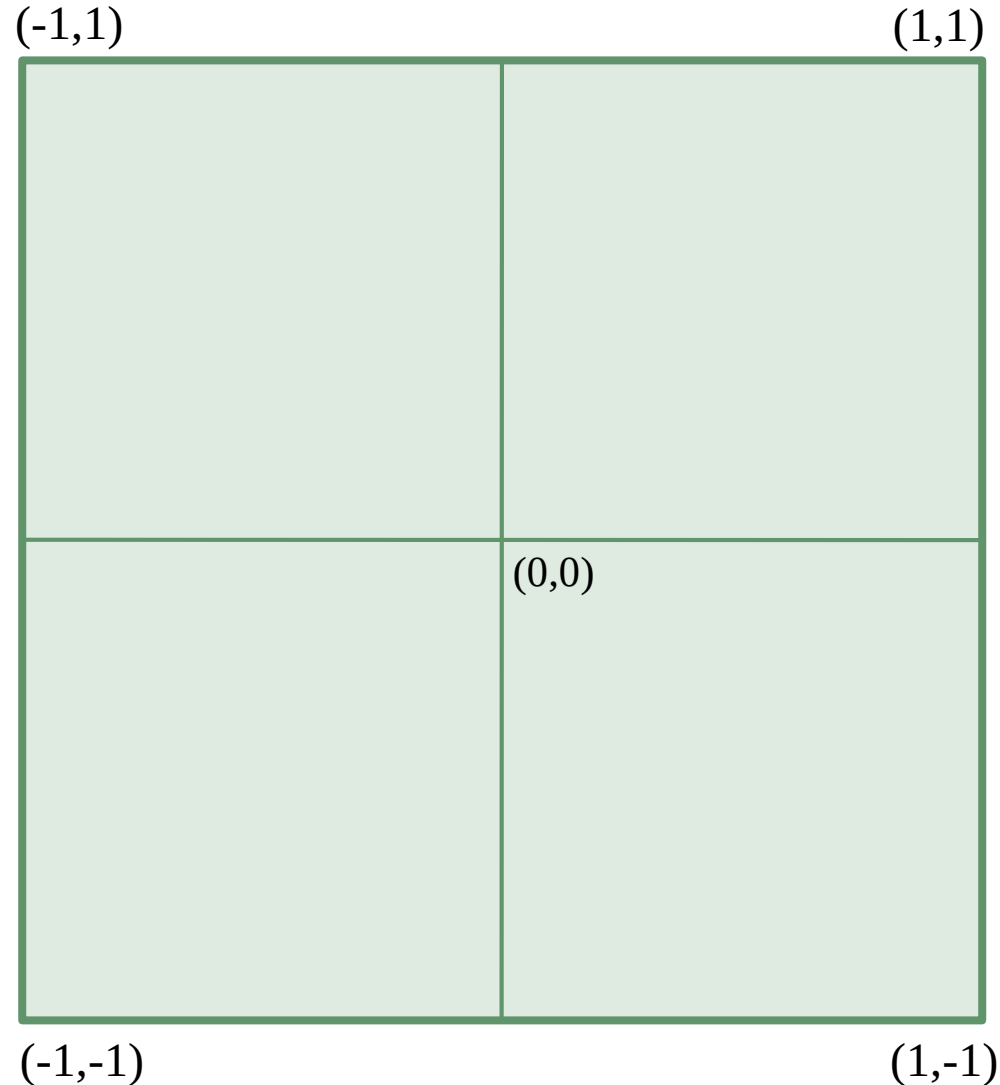
## **gl.viewport(x,y,w,h)**

- x,y – lower left pixel
- w – width
- h – height
- Sometimes (0,0) is in the upper left corner (e.g. for mouse input)



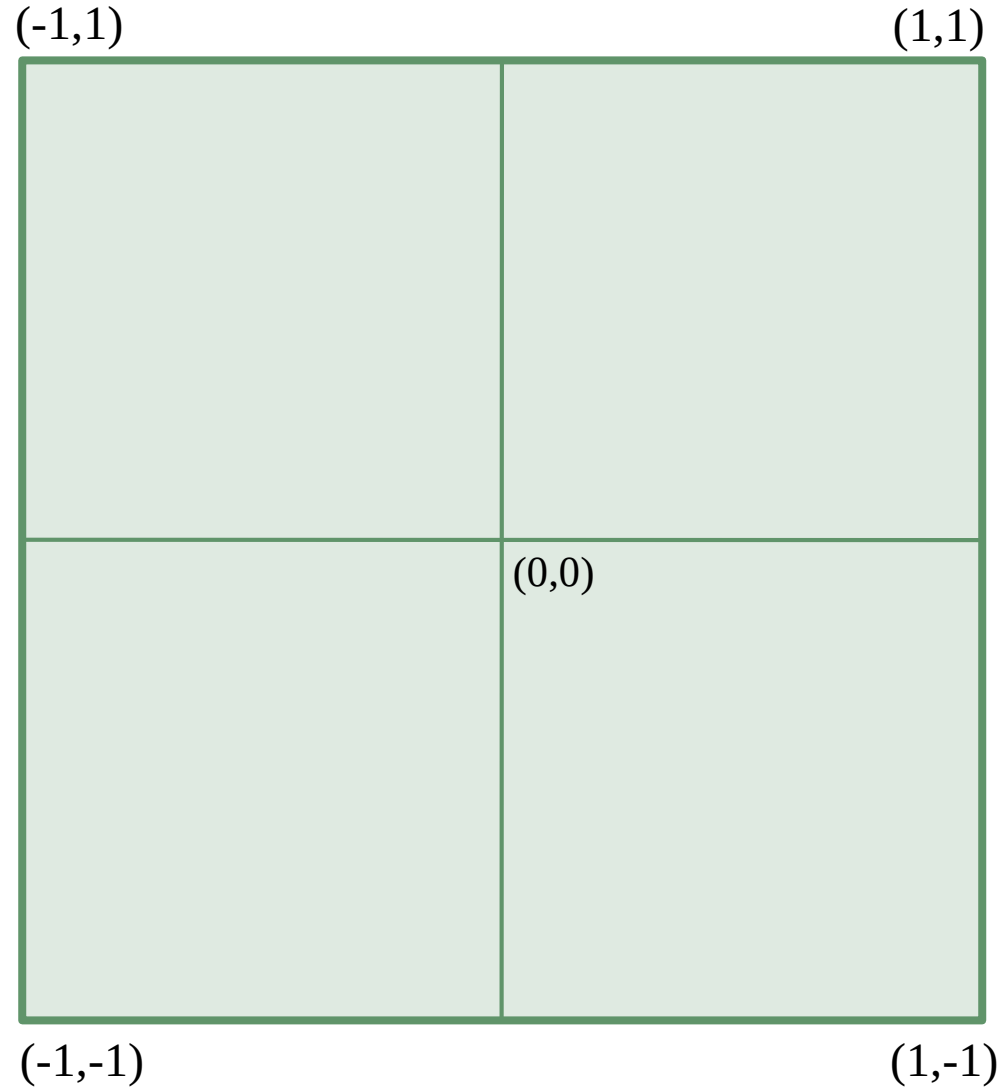
# Window Coordinates

- Logical, mathematical floating-point coordinates
- WebGL defaults to a window extending from  $(-1,-1)$  to  $(1,1)$
- This is the normalized coordinate system you would use to plot an equation
  - Origin at the middle
  - All four quadrants



# Window to Viewport

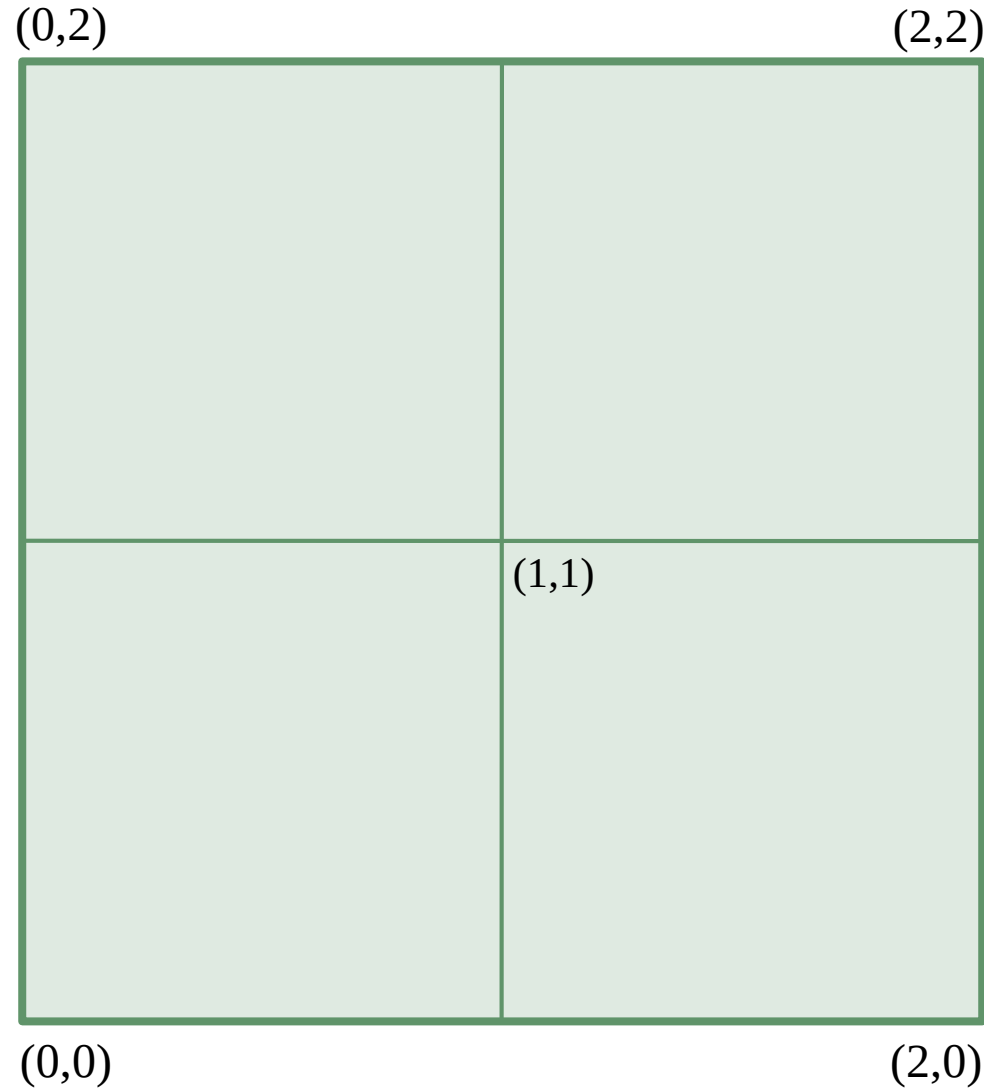
- Translate lower-left corner of window  $(-1,-1)$  to the lower-left corner of viewport  $(0,0)$



# Window to Viewport

- Translate lower-left corner of window  $(-1,-1)$  to the lower-left corner of viewport  $(0,0)$

$$\begin{bmatrix} 1 & & 1 \\ & 1 & 1 \\ & & 1 \end{bmatrix}$$



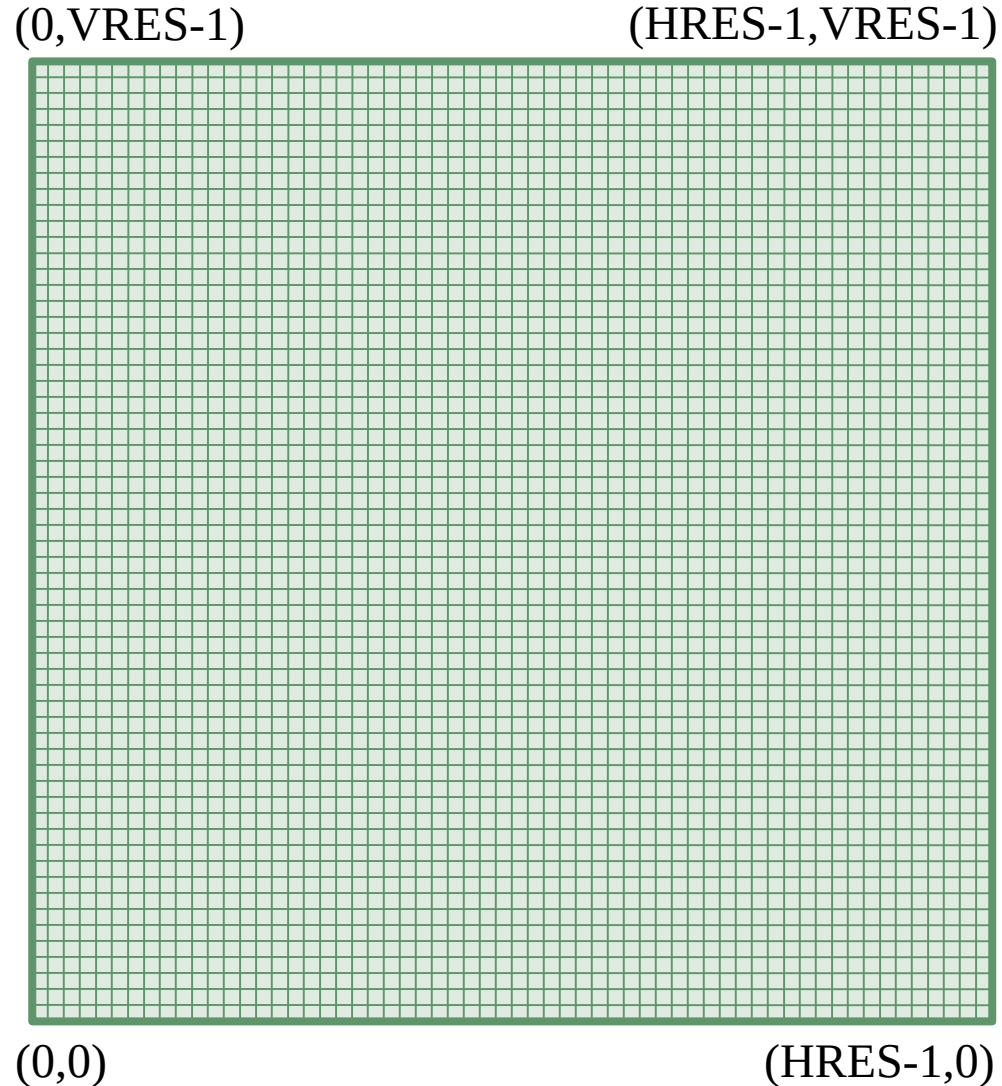
# Window to Viewport

- Translate lower-left corner of window  $(-1,-1)$  to the lower-left corner of viewport  $(0,0)$

$$\begin{bmatrix} 1 & & 1 \\ & 1 & 1 \\ & & 1 \end{bmatrix}$$

- Scale upper-right corner from  $(2,2)$  to upper-right corner of viewport

$$\begin{bmatrix} \frac{(HRES-1)}{2} & & \\ & \frac{(VRES-1)}{2} & \\ & & 1 \end{bmatrix}$$

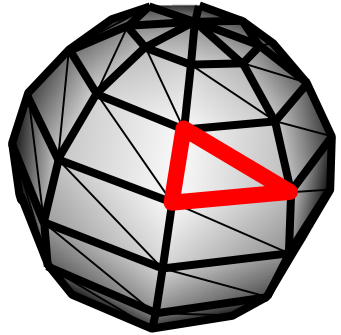


# Window to Viewport

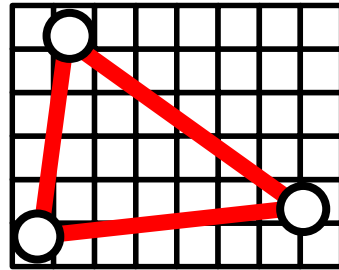
$$\begin{bmatrix} \frac{(HRES-1)}{2} & \frac{(VRES-1)}{2} & 1 \end{bmatrix} \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix} = \begin{bmatrix} \frac{(HRES-1)}{2} & \frac{(HRES-1)}{2} \\ \frac{(VRES-1)}{2} & \frac{(VRES-1)}{2} \\ 1 & 1 \end{bmatrix}$$



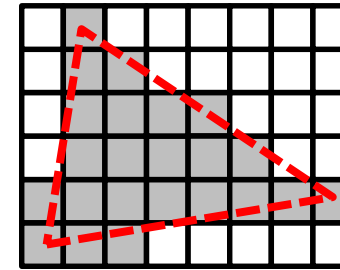
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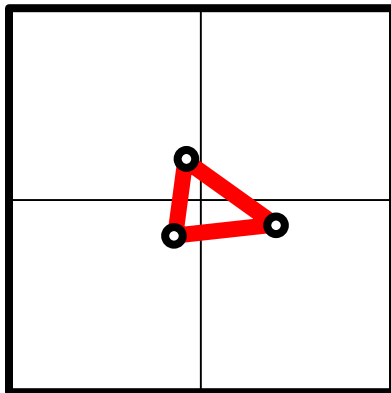
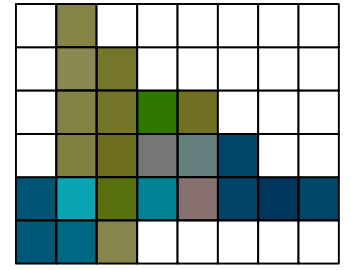
Vertex  
Shader



Scan  
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Fragment  
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$$\begin{bmatrix} \frac{(HRES-1)}{2} & \frac{(HRES-1)}{2} \\ \frac{(VRES-1)}{2} & \frac{(VRES-1)}{2} \\ 1 & 1 \end{bmatrix}$$

