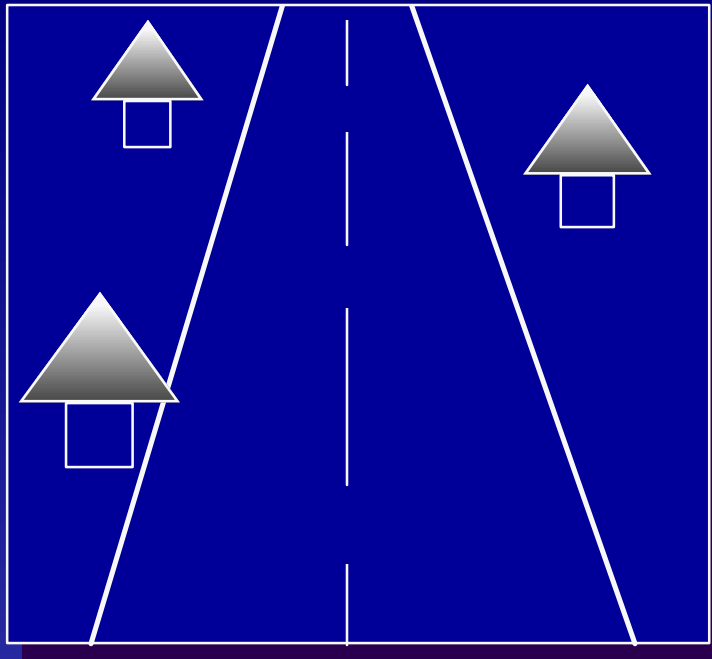


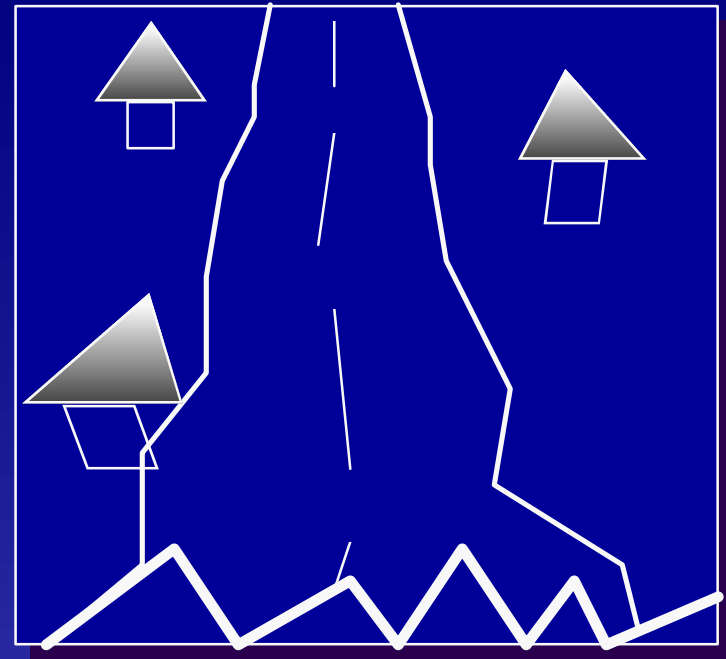
# *Methods for Speeding up Polygon Division*



# *Problems involved in displaying ground*



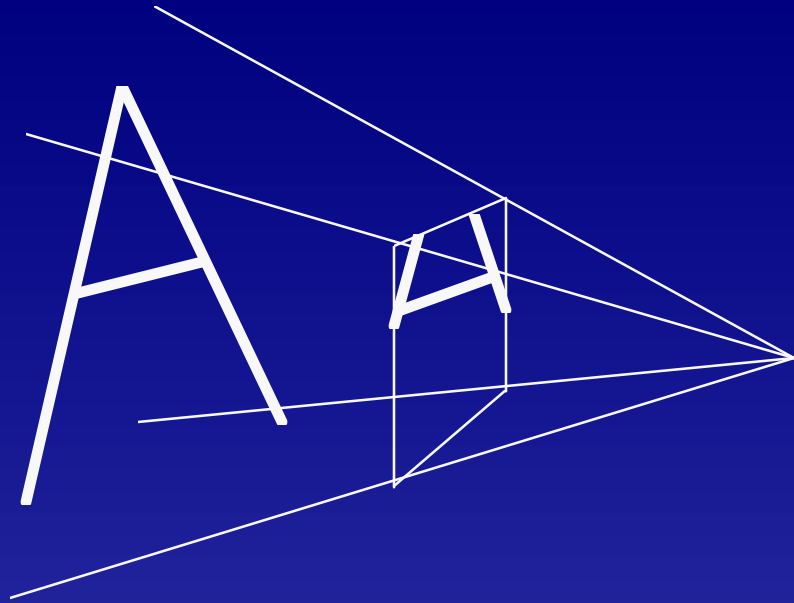
**Intended result**



**1. Warping of texture**

**2. Near clipping problems**

# *Solution using clipping*



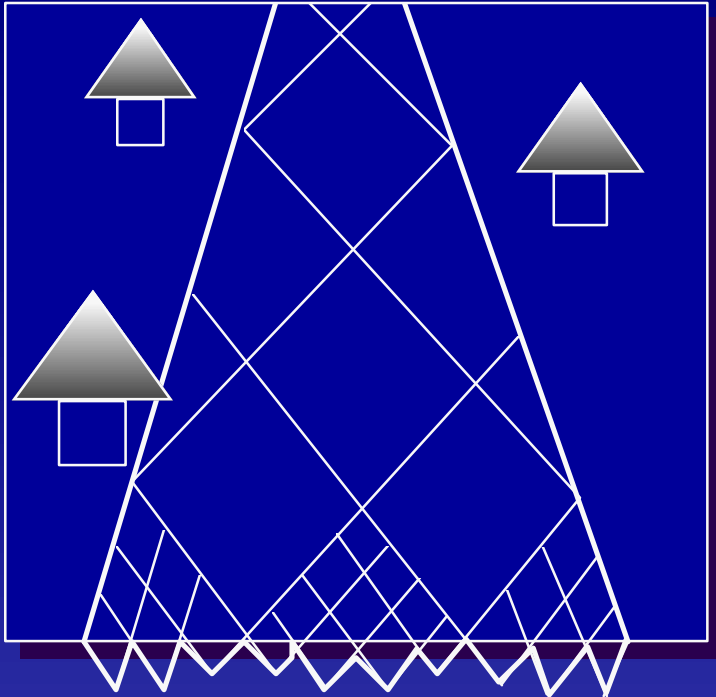
O allows more polygons to be used

X texture jumping

X texture warping

X calculations become more complex

# *Solution using division*

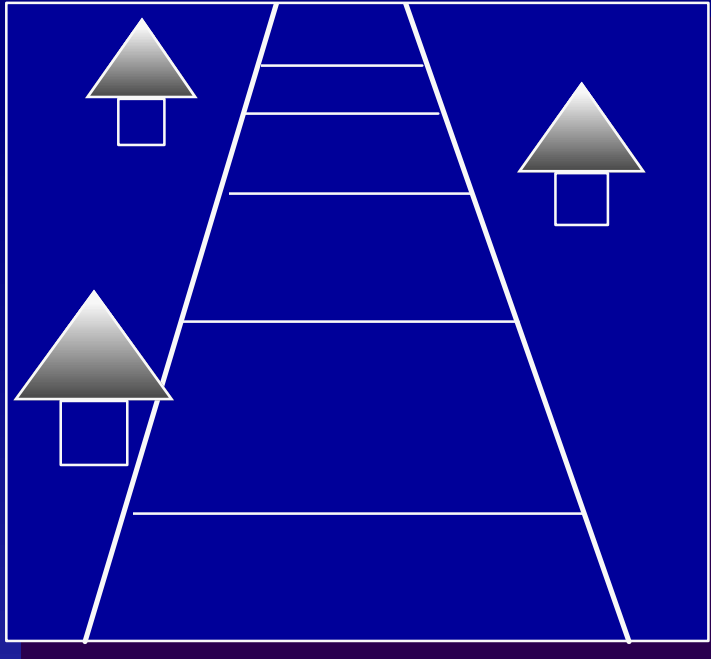


- less texture jumping
- texture warping is eliminated

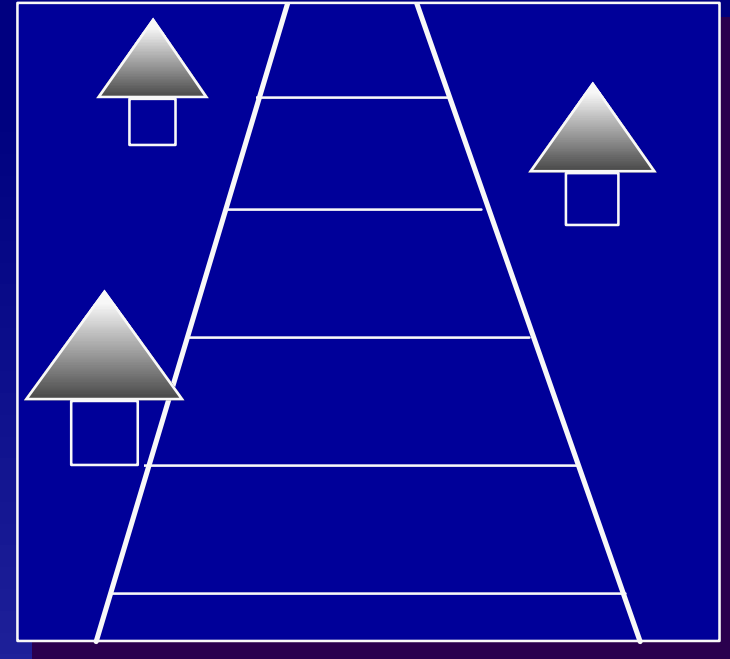
X the polygon count is increased

***Using the division method is better!***

# *Divide in 2 dimensions or 3 dimensions?*



3 dimensions

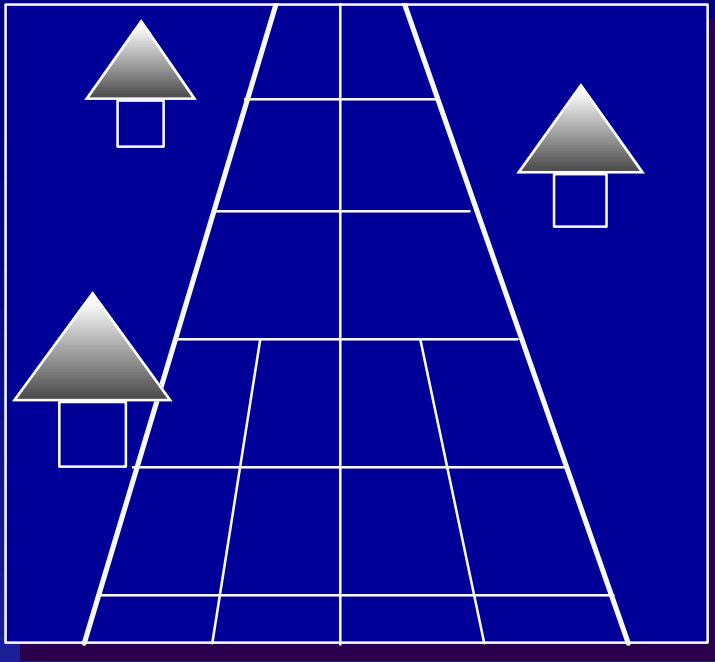


2 dimensions

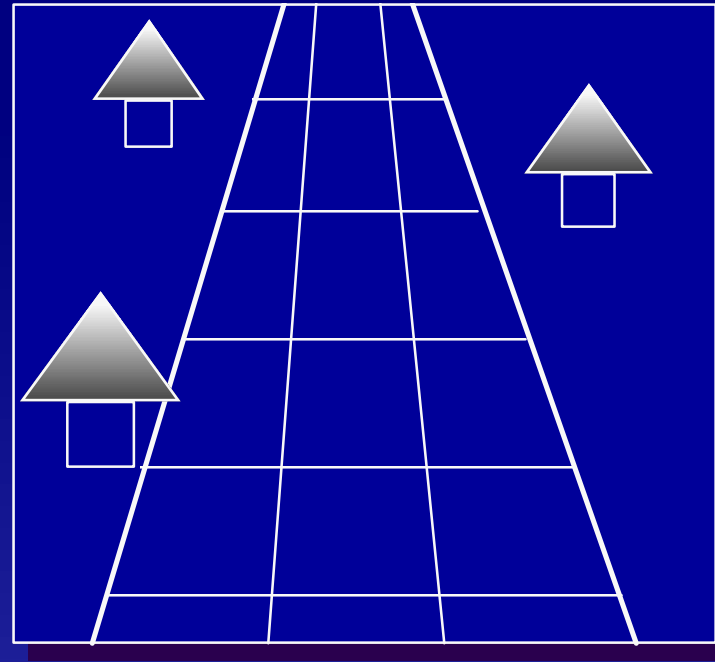
## Divide in three dimensions

- 3 dimensions provides more accuracy
- Because GTE calculations are performed at high speeds, there is no overhead with 3-dimensional division

# Active division or fixed division?



Active



Fixed

**Use active method**

## Advantages

1. Polygon count is decreased
2. Improves speed

## Disadvantages

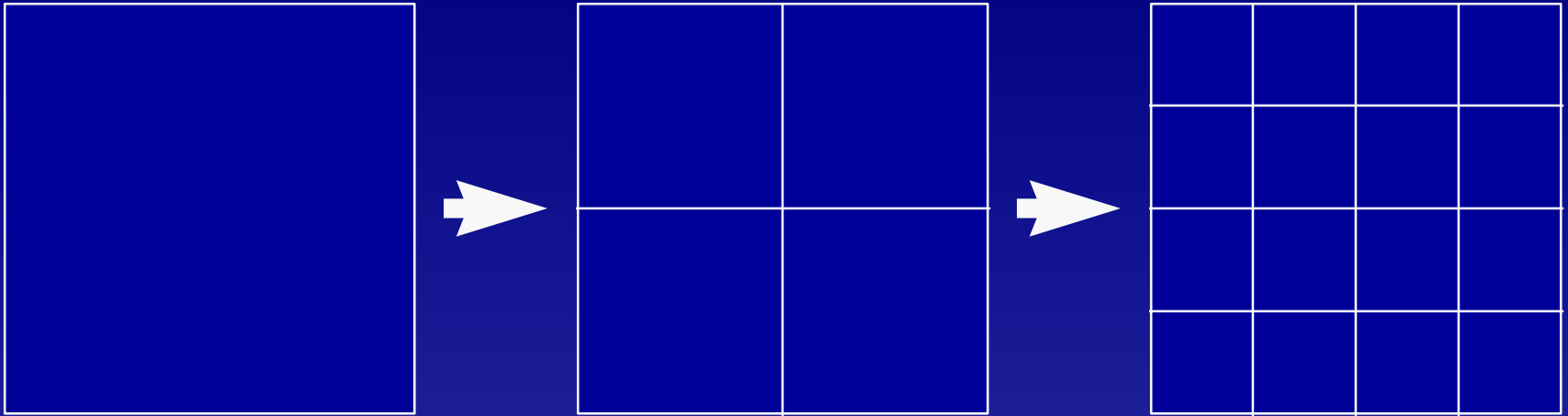
1. Gaps are generated
2. Textures become non-continuous

# *Actual programming*

## **Principle**

Display ground using active,  
3-dimensional division

# *Recursive call*



**2<sup>n</sup> division**



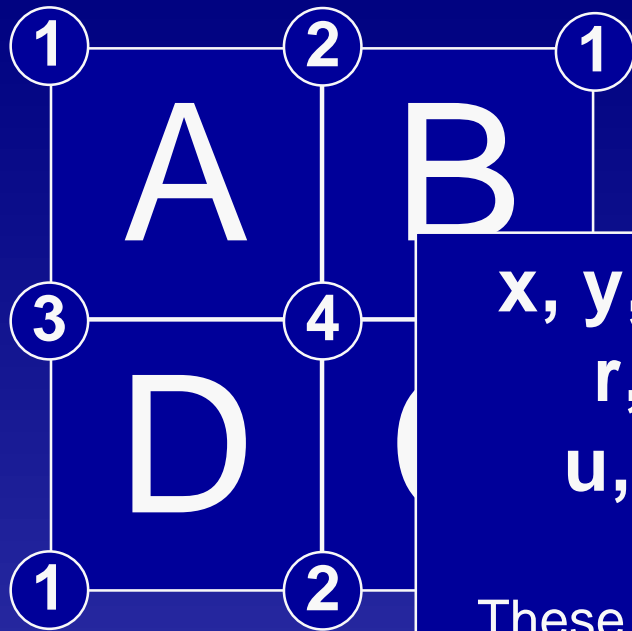
# *Conditions for stopping*

## <Polygon vertex distance>

### Reasons

- GPU rendering limit 1024x512
- Polygon warping is most noticeable with larger polygons
- Used together with Area Clipping

# 3-Dimensional $2n$ division



ordered as follows: A->B->C->D

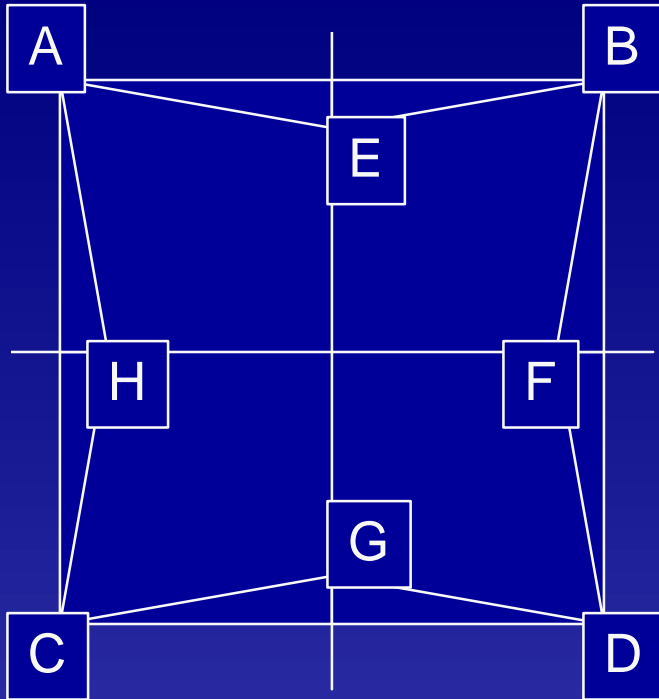
**x, y, z** coordinates

**r, g, b** color

**u, v** texture

These are all divided by two

# Fixing gaps



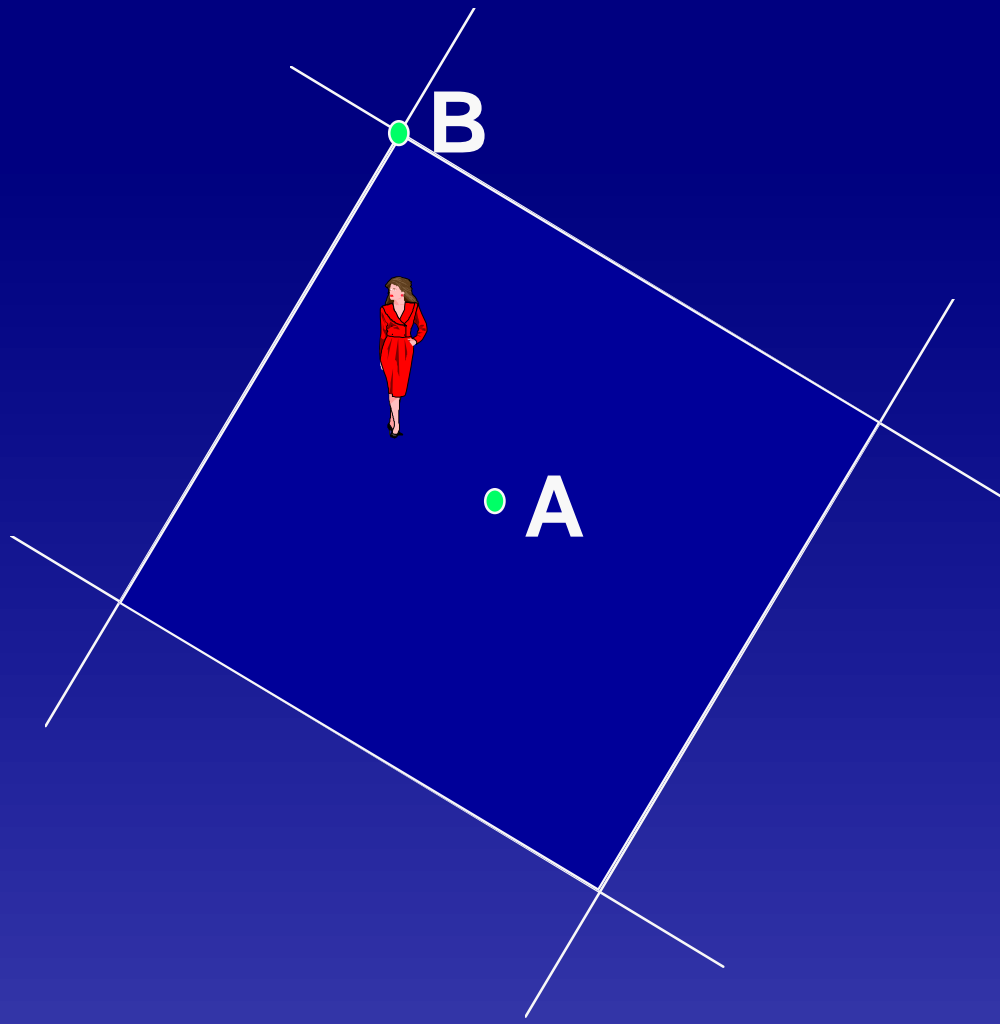
## Reason

Due to the margin of error, the center point does not necessary lie on the axis

## Solution

Draw a triangle for the gap as well  
However, Back Clip is necessary

# *Solving the Z-sort problem*

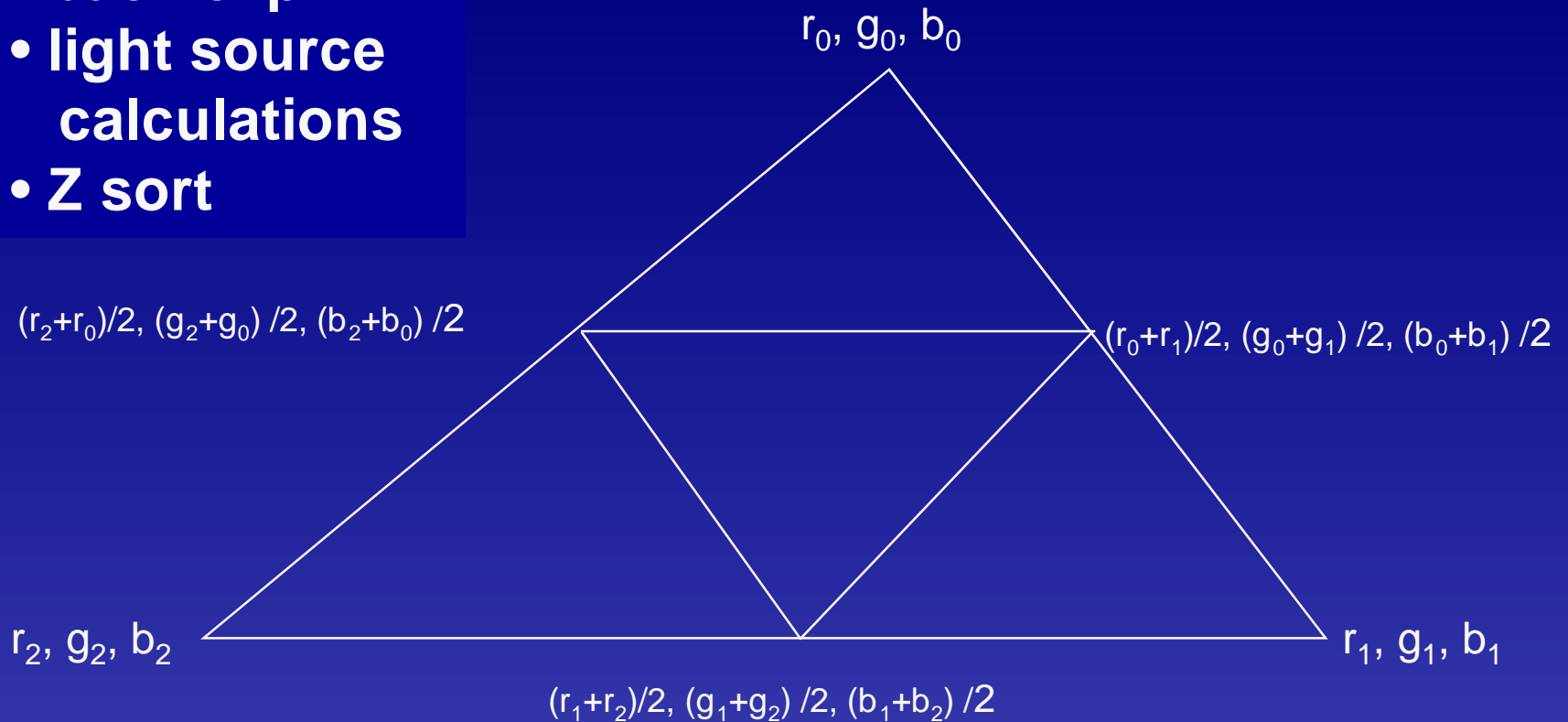


Set the Z-sort point to the furthest point (B) rather than the center of gravity (A)

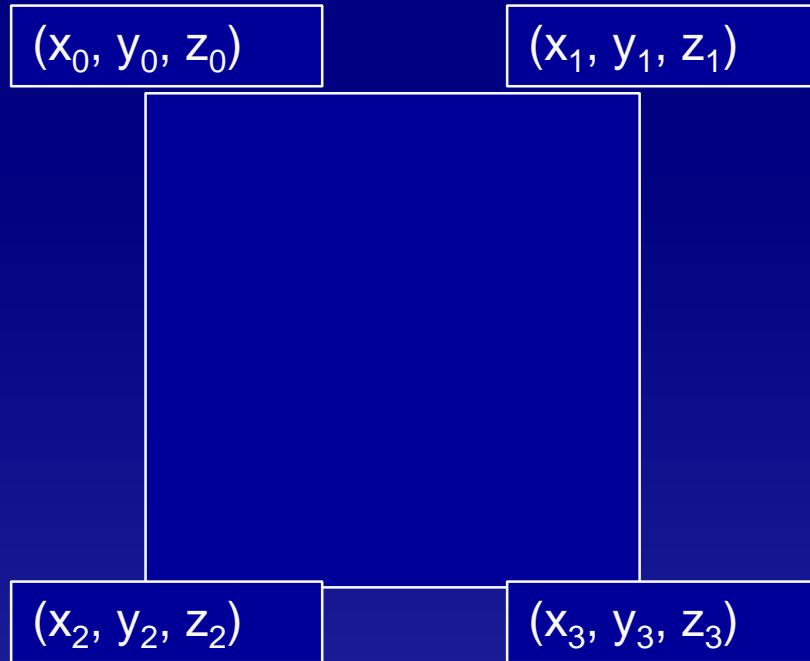
# Split processing for before and after division

Processing that is performed just once before division

- **back clip**
- **light source calculations**
- **Z sort**



# *READ modeling data*



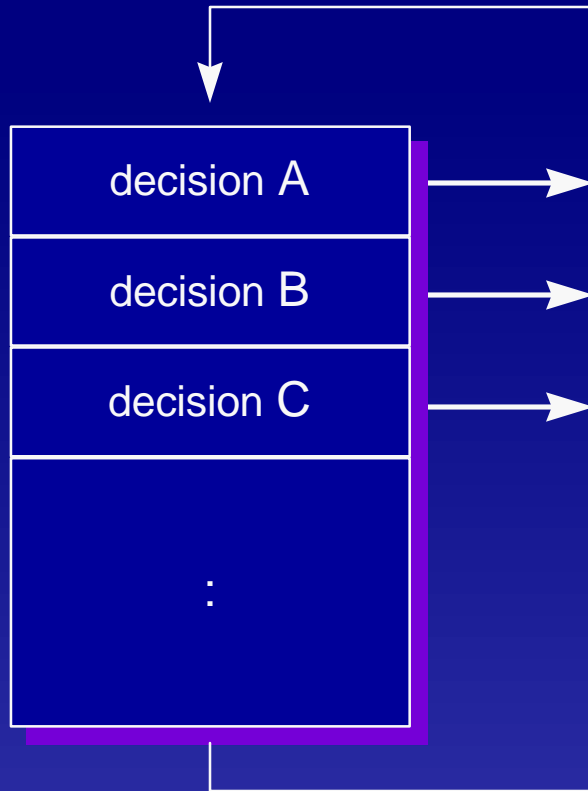
Reading 4 vertices, 12 words takes about 70 cycles



If the data can be expressed as w,h,d, about 7 words and 20 cycles can be saved

***Modeling data formats should take into consideration the fact that memory reads are very slow***

# *Polygons that will not be displayed should be rejected early on*



**MAIN LOOP**

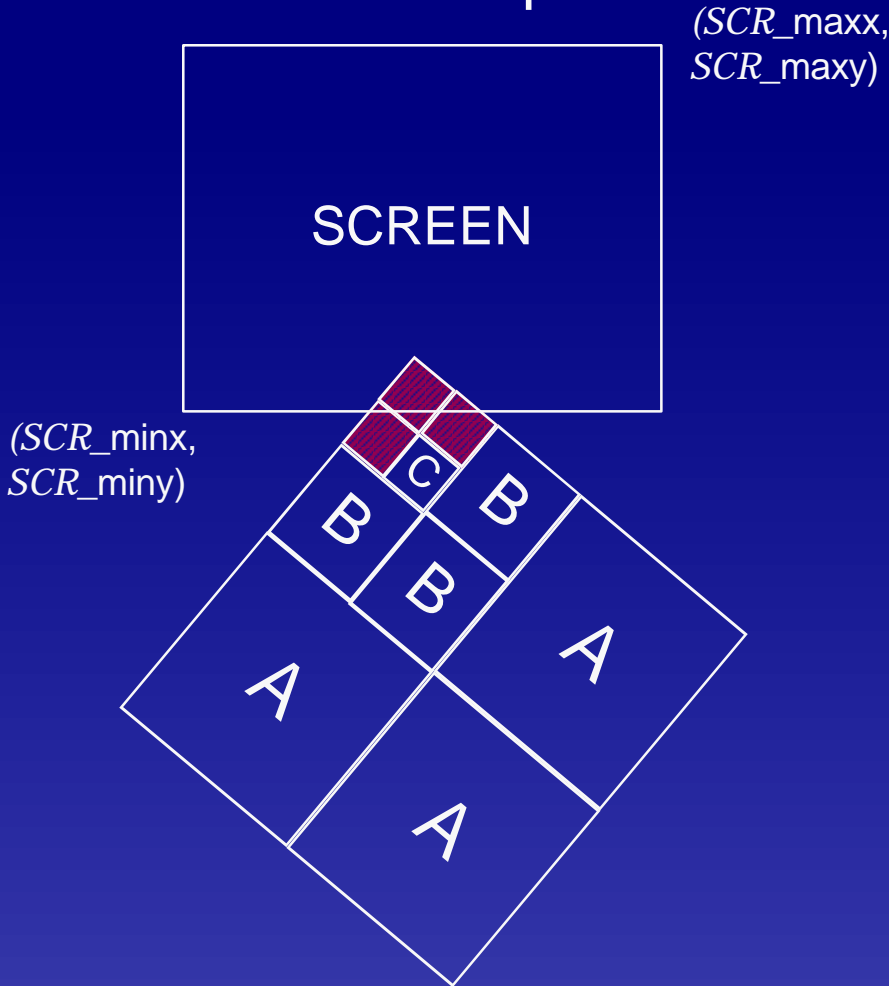
the rejection amount is

$$A > B > C$$

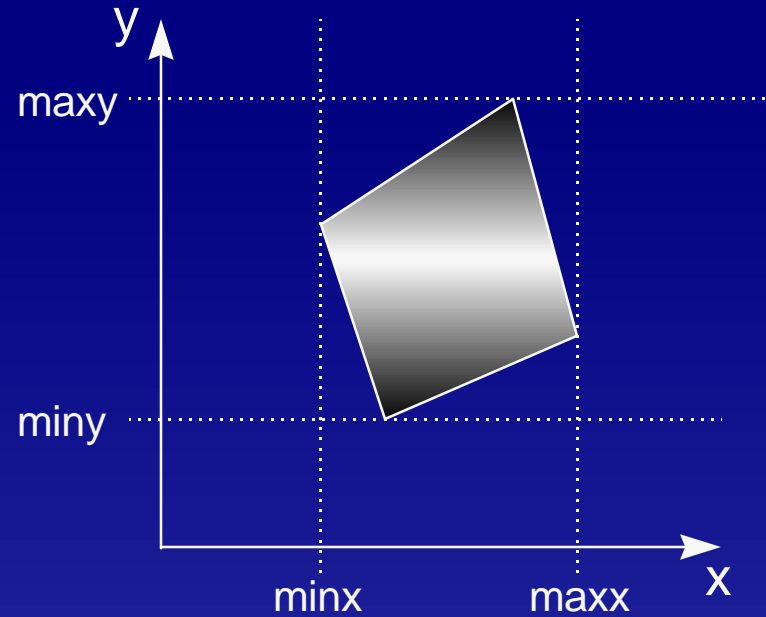
A is the GTE  
flag clip

# Clipping (1)

## HW clip



## 4-vertex min-max



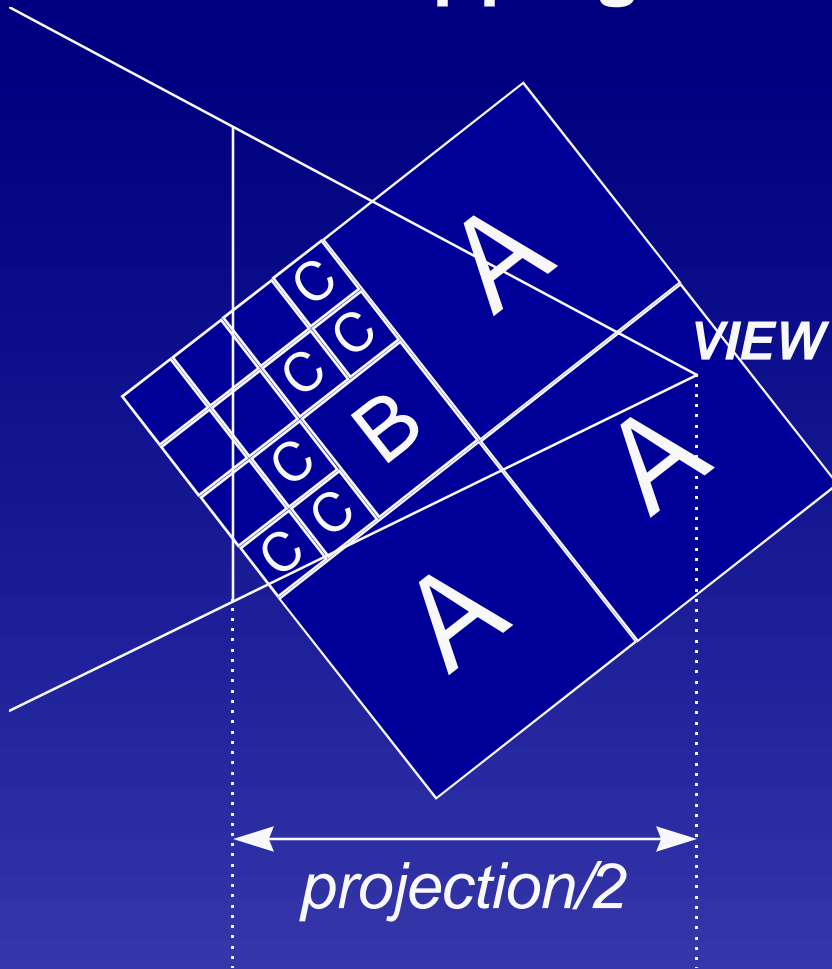
### Clip conditions

- $maxx > SCR\_minx$
- $maxy > SCR\_miny$
- $minx > SCR\_maxx$
- $miny > SCR\_maxy$



# Clipping (2)

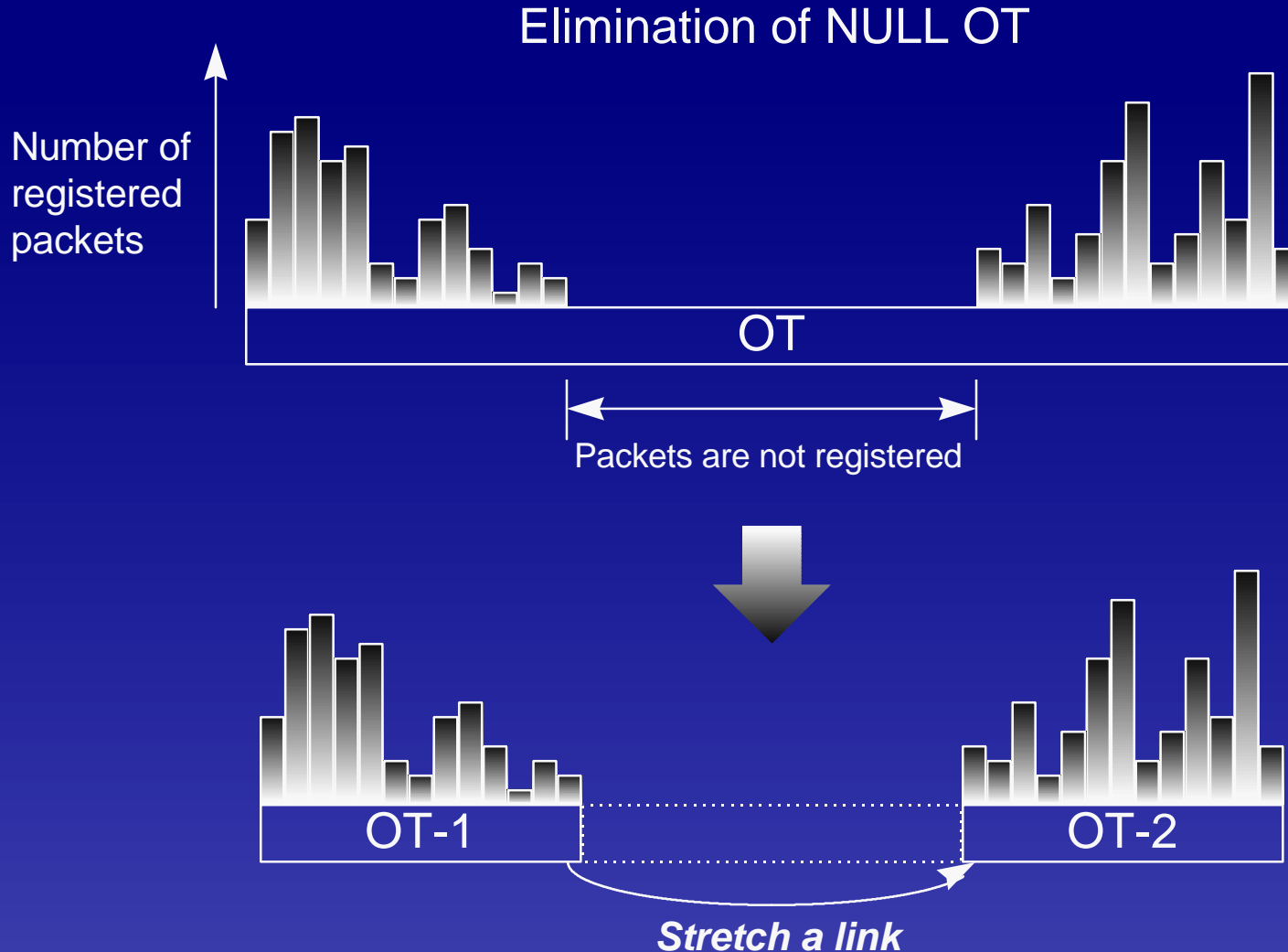
## NEAR Z clipping



## Clip conditions

**SZ0** < *projection/2*  
&  
**SZ1** < *projection/2*  
&  
**SZ2** < *projection/2*  
&  
**SZ3** < *projection/2*

# Eliminating useless OT



# *Conclusion*

## Rendering ground in 3-dimensions

1. Active 3-dimension divisions
2. Recursive call
3. On cache