

**Subject: Computer graphics**

**Topic : Color CRT**

**Name of Teacher: Simna v j**

**Academic year: 2020-2021**

# CRT color monitor

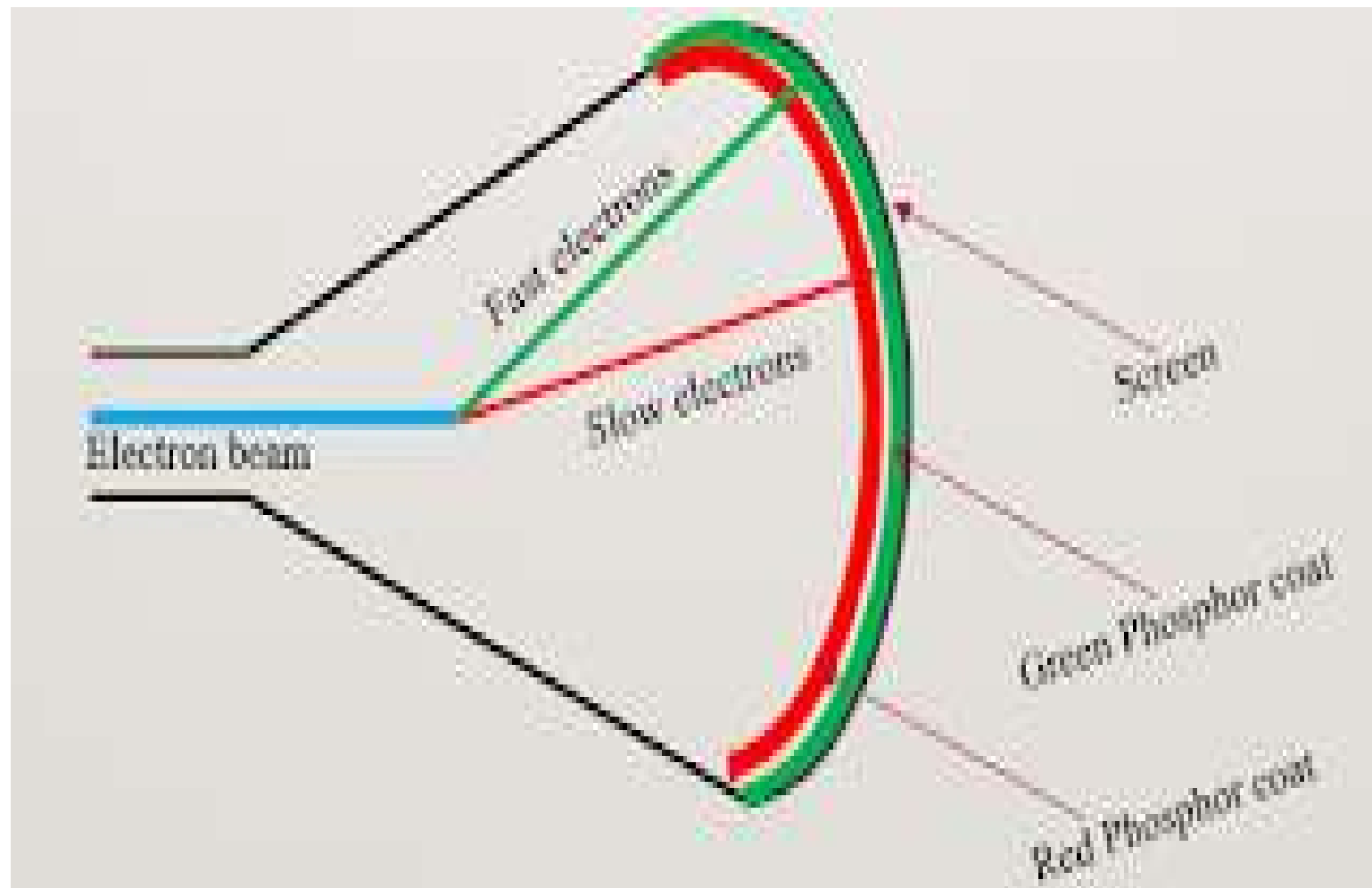
- A CRT monitor displays color pictures by using a combination of phosphors that emit different-colored light
- By combining the emitted light from the different phosphors, a range of colors can be generated

- The two basic techniques for producing color displays with a CRT are
  - **The beam-penetration method**
  - **The shadow-mask method**

# The beam-penetration method

- The beam-penetration method for displaying color pictures has been used with **random-scan monitors**
- Two layers of phosphor, usually **red and green**, are coated onto the inside of the CRT screen

- Displayed color depends on how far the electron beam penetrates into the phosphor layers.



- A beam of slow electrons excites only the outer red layer.
- A beam of very fast electrons penetrates through the red layer and excites the inner green layer.

- At intermediate beam speeds, combinations of red and green light are emitted to show two additional colors, orange and yellow.
- The speed of the electrons, and hence the screen color at any point, is controlled by the beam-acceleration voltage.



- Beam penetration has been an inexpensive way to produce color in random-scan monitors
- The quality of pictures is not as good as with other methods

# SHADOW MASK METHOD

- They are commonly used in raster scan systems (including color TV) because they produce a much wider range of colors than the beam- penetration method.
- A shadow-mask CRT has three phosphor color dots at each pixel position.
- One phosphor dot emits a red light, another emits a green light,
- and the third emits a blue light.

- This type of CRT has **three electron guns**, one for each color dot,
- and a **shadow-mask grid** which is pierced with small round holes
- in a triangular pattern just behind the phosphor-coated screen.
- 2 types of arrangements are possible
- **In-line Method** and **delta delta method(Triad arrangement)**

# Delta- Delta method

- Delta- Delta method is commonly used in **color CRT system**
- A *shadow mask* is often used to ensure that the electron beams from the guns fall on the correct phosphors
- The three electron beams are deflected and focused as a group onto the shadow mask

- When the three beams pass through a hole in the shadow mask, they activate a **dot triangle**, which appears as a small color spot on the screen.
- The phosphor dots in the triangles are arranged so that each electron beam can activate only its corresponding color dot when it passes through the shadow mask.
- Color variations in a shadow-mask CRT are obtained by varying the intensity levels of the three electron beams

- A white (or gray) area is the result of activating all three dots with equal intensity
- A black is produced with zero intensity of all colors
- Yellow=Red+ Green
- Magenta=Red+Blue
- Cyan= Blue +Green
- **This produce 8 colors**

# Inline arrangement

- 3 electron guns and the corresponding red-green-blue color dots on the screen, are aligned along one scan line rather than in a triangular pattern
- This inline arrangement of electron guns is easier to keep in alignment and is commonly used in **high-resolution color CRT's**

- In some low-cost systems, the electron beam can only be set to on or off, limiting displays to **eight colors**.
- More sophisticated systems can set intermediate intensity levels for the electron beams, allowing several million different colors to be generated



- Color CRTs in graphics systems are designed as **RGB monitors**.
- These monitors use **shadow mask method** and take the intensity level for each gun.
- A RGB color system with 24 bits of storage per pixel is known as **full color system or true color system**.

# Pros & Cons of shadow mask method

## Advantages

- Produce realistic images
- Million different colors to be generated
- Shadow scenes are possible

## Disadvantages

- low resolution
- expensive

# COMPARISON BETWEEN SHADOW MASK AND BEAM PENETRATION METHOD

	Beam Penetration method	Shadow Mask method
<b>Where Used</b>	It is used with Random Scan System to display color.	It is Used With Raster Scan System to display color.
<b>Colors</b>	It can displays Only four colors i.e. Red , Green, Orange and Yellow.	it can display Millions of colors.
<b>Color Dependency</b>	Less colors are available because the colors in Beam Penetration depends on the speed of the electron beam.	Millions of colors are available because the colors in Shadow Mask depends on the type of the ray.
<b>Cost</b>	It is Less Expensive as compared to Shadow Mask.	It is More Expensive than other methods.
<b>Picture Quality</b>	Quality of picture is not so good i.e. Poor with Beam Penetration Method.	Shadow Mask gives realism in picture with shadow effect and millions of color.
<b>Resolution</b>	It gives High Resolution.	It gives Low Resolution.
<b>Criteria</b>	In Beam Penetration method, Color display depends on how far electron excites outer Red layer and then Green layer.	In Shadow Mask Method, there are no such criteria for producing colors. It is used in computers, in color TV etc.