Microvision Application Note:

BeamView

VERSION 1.1

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About (Purpose of) this Document

The BeamView (BV) function was developed by Microvision for the investigation of beam profiles on shadow mask CRT's. Because most of the beam is hidden behind the mask, it is difficult to generate accurate beam profiles and perform the corresponding analysis on the beam such as line width or MTF measurements. Through the use of BV, the beam can be 'uncovered' from behind the mask and more detailed analysis can be made.

This document discusses the theory behind the BV function and provides information on using BV. This document assumes a working knowledge of SS200 series products.

System Requirements

- SS200 Series System
- BeamView Software Option
- UUT driven with separate Horizontal and Vertical Sync pulses

Theory of Operation

The purpose of BeamView (BV) is to 'uncover' or reveal the beam from behind the shadow mask so that a clear picture of the beam can be taken. The shadow mask only allows portions of the beam to be seen through the mask. If the beam were to be move slightly to a different position, then a new portion of the beam will be revealed. By continually moving the beam and saving the information from each location, the entire beam can eventually be uncovered and then reconstructed. Figures 1 and 2 show a sequence or horizontal beam movements. The beam is initially positioned behind the mask as shown by the first picture in the sequence. As it is moved, it can be seen that new portions of the beam become visible when positioned behind different shadow mask groupings. The last picture in the sequence shows the beam positioned behind a grouping similar to the first picture, revealing the same information. Thus it can be concluded that by sequentially moving the beam in the horizontal direction, the captured images can be used to reconstruct the beam. Because a single horizontal deflection will not unmask the entire beam, a vertical deflection will need to be introduced and then the horizontal movement repeated. (Note that slot and strip tubes do not require this vertical deflection because of the longer vertical mask geometry.)

The actual deflection of the beam is handled through a pulse delay circuit. The horizontal and vertical sync pulses are passed through a computer controlled delay circuit on the Microvision video board. The amount of the delay is programmed as required to move the beam in between each sample. The delay circuit accepts an 8 bit control word providing 256 positions. There are also 8 eight scales that can be set to adjust the resolution of the delay.
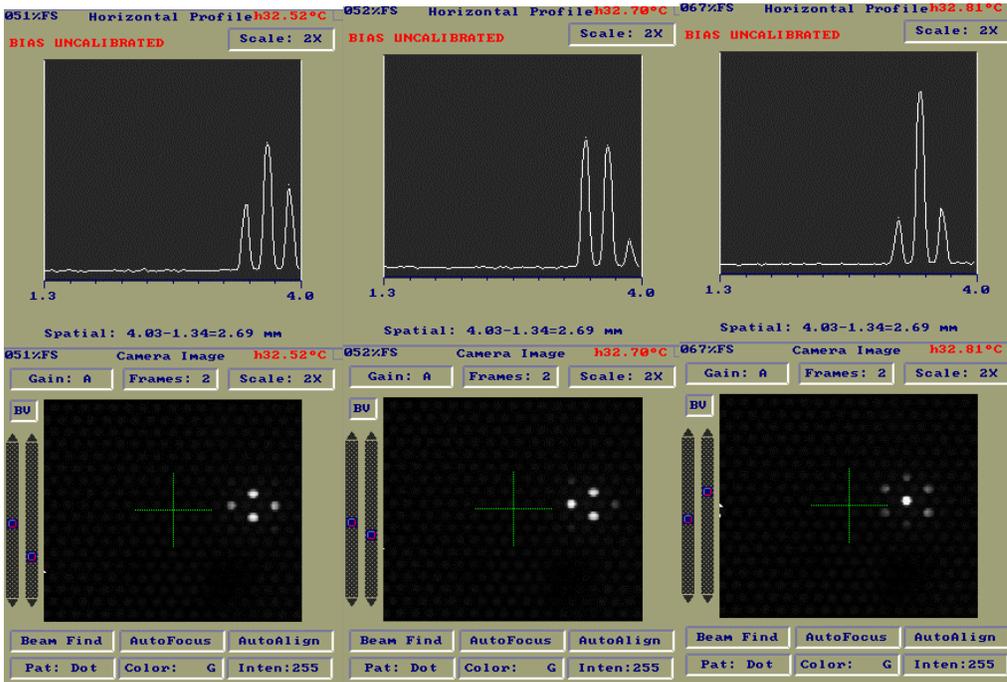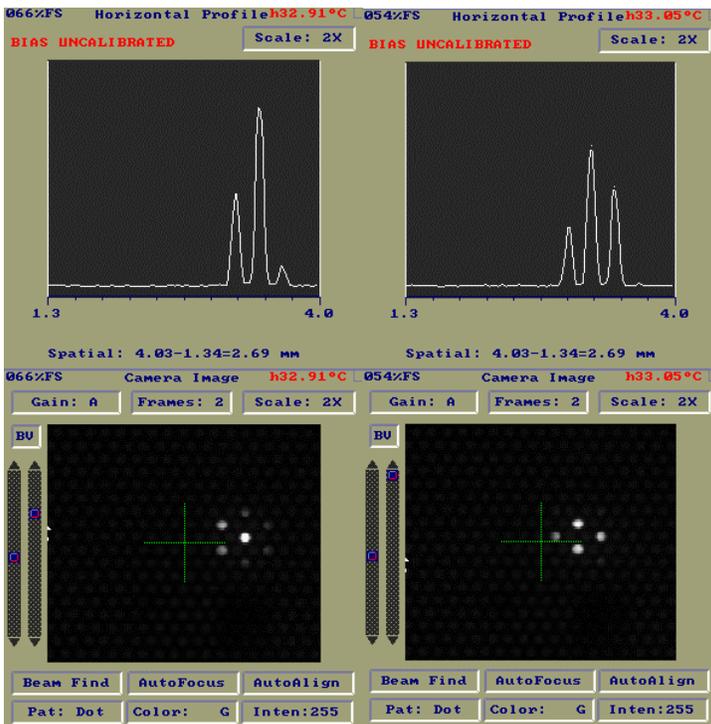
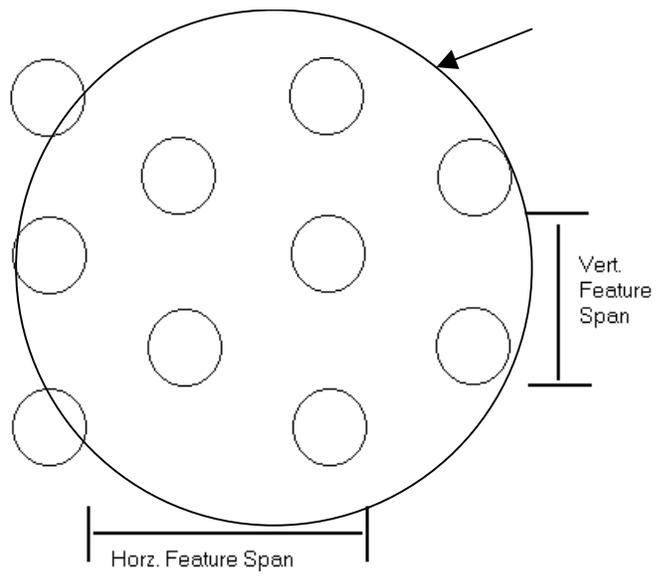**Figure 1 Beam Movement Images**

Figure 2

Vert.
Feature
Span

Horz. Feature Span

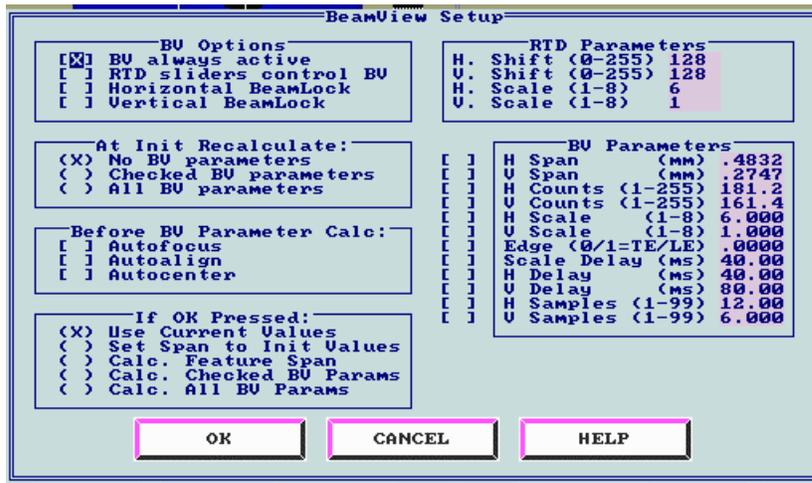**Figure 3**

Getting Started - BV Setup

Figure 4 BeamView Setup

Options

BV always active - enables or disables the BV circuitry in real time display.
RTD sliders control BV - In the real time display window (in Spot Analysis only), there are two vertical sliders that normally are used to set contrast levels. ('CC') When this item is checked, the vertical sliders are used to control the horizontal and vertical delay circuitry. ('BV") Referring back to figures 1 and 2, the sliders are located to the immediate left of the real time display windows. Note the position of the sliders in each of the pictures. It can be seen that with each movement of the right slider, the beam is displaced horizontally. The amount of horizontal movement per a slider increment is controlled by the H. scale setting. Similar control of the vertical can be accomplished with the left slider.
Beamlock - disables the ability to move the selected axis.

Before BV Parameter Calc.

Before a BV parameter calculation is run, (calibration) , the operator can select to perform any of the checked items.

Calibration

Before any BeamView data can be collected, the BeamView delay circuitry needs to be calibrated. This is necessary to establish the amount of physical movement on the face of the display per each increment of the delay circuit in both the horizontal and vertical directions. This is done by incrementally moving the beam with the delay circuit and monitoring the movement with the CCD camera. To initiate the calibration procedure, activate the BV dialog box by pressing the 'cc' or 'bv' button in the Real Time Display window. The dialog box as shown above will appear. The best approach is to let the system calculate all of the parameters. Check the 'Calc. All BV Params.' Check box and then click o.k. The system will automatically move the beam in both H and V directions to calibrate. The resluts of the calibration will be shown under 'BV Parameters '.

RTD Parameters

The horizontal and vertical shift amounts and scales can be manually entered here and then viewed in the real time display.

BeamView Parameters

This section will discuss the various BV parameters shown in the BV dialog box.

H,V Span - Horizontal/Vertical Feature span. This is the total distance that the beam must be moved in order to 'uncover' the beam completely. This value is then used to determine the amount of delay necessary in the h/v direction to move the beam. This is the minimum distance necessary to completely uncover the beam. This value is measured during initialization or when Calc. All BV Params. Is selected.

H,V Counts - The number of delay counts necessary to cover the H,V Span dimension. During calibration, the minimum resolvable distance is determined. (distance moved per single delay count). This minimum resolvable distance times the Count will equal the Span distance in H or V. The number of counts is in the range of 1 to 255.

H,V Scale - The scale adjusts the amount moved per a single delay count. There are 1-8 scale ranges and they are also set during Calc. All BV Params. The scale is like a gain range for the delay. The higher the scale, the higher the delay time per a count.

Edge - TE-trailing edge, LE-leading edge - sets the edge that is used for the delay reference.

Scale Delay - If H,V scales are changed, the system will wait this amount before acquiring more data. Provides for a settling time.

H,V delay - After each change in the H or V direction, a delay equal to this amount will be imposed before any more data is collected.

H,V Samples - The number of samples taken in the H/V directions. This number is based on the number of beam movements necessary to uncover the beam from behind the mask. See figure 5.

Span, counts, and scales - The *span* represents the distance necessary to deflect (delay h,v) the beam in order to completely uncover it. This applies horizontally and vertically. Movement of the beam is accomplished with delay circuitry that has 8 bit resolution or 256 steps. Each increment of the delay circuit is called a *count*. The total distance (delay) that the beam can be moved is 256 counts of the delay circuit. The BV circuitry also has the abilty to change *scales*. The scales control the total distance that can be moved. For example, on scale 1, it may be possible to move the beam .5mm as the counts are changed from 0 to 255. If scale 2 were twice that of scale 1, then changing the count values from 0 to 255 would move the beam 1mm.
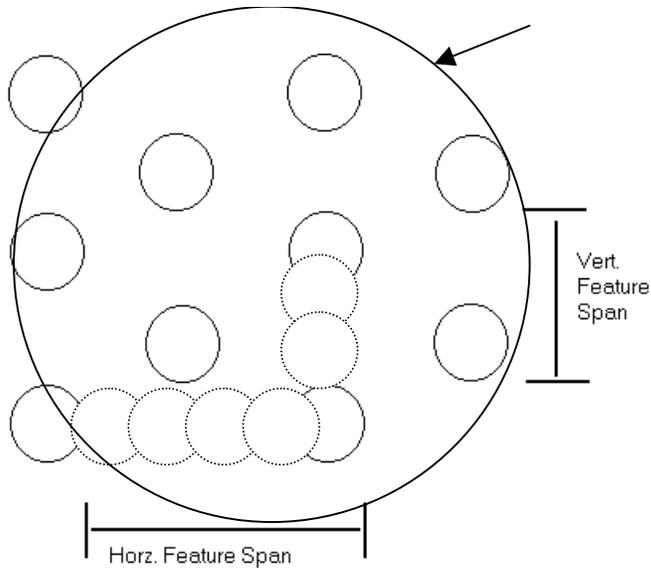
Figure 5 H/V Feature Span

The above figure shows a typical layout for a dot matrix shadow mask CRT. In the figure the dimension for the vertical and horizontal feature spans are shown. The solid circles represent the shadow mask and the dotted circles represent the apparent location of the mask after a delay is imposed. The large circle is the CRT beam. The minimum number of samples in either the horizontal or vertical direction is the number of dots necessary to fill the corresponding H or V feature span. The diagram shows that it takes 6 dots to span in the horizontal direction and 4 to span in the vertical direction. These are the bare minimum values. In practice these numbers will be doubled to ensure proper coverage. When the data is collected, the horizontal and/or vertical sync pulses will be delayed just enough to move the beam an amount equal to about 1/2 the diameter of the shadow mask dot. As the beam is delayed, new portions of the beam will be revealed and blended with previous images. Eventually through all the V/H delays, the entire beam will have been uncovered and blended together to form the complete image.
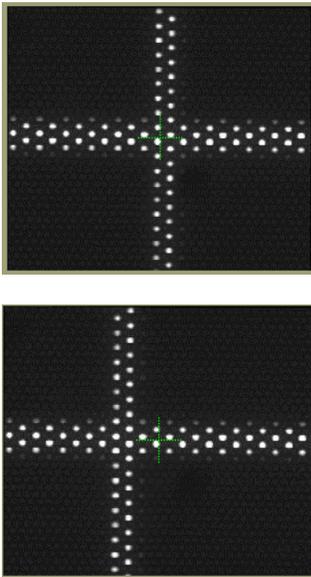
Figure 6 Scale/Count
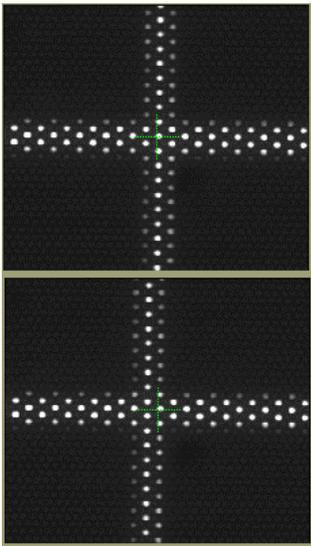
Horizontal Scale = 1 (1-8)
Horizontal Count = 1 (1-255)

Horizontal Scale = 1 (1-8)
Horizontal Count = 255 (1-255)

The above images show the effect of the BeamView circuit delay on the horizontal position. The images show the maximum amount of displacement possible on scale 1.

Figure 7

Horizontal Scale = 6 (1-8)
Horizontal Count = 1 (1-255)

 The above images show the effect of the BeamView circuit delay on the horizontal position. The images show the maximum amount of displacement possible on scale 6.

Running 'Collect'

After calibration, the system is now ready to collect BeamView information. Before starting, be sure that the camera is centered on the spot to be collected. When collect is pressed, the data collection process will begin. There will be several screen updates during the collection as each sample is collected. As more and more data is added top the display, the true shape of the beam will slowly become apparent.

Files

The data is saved into a file as shown in the option area. The name of this file can be changed prior to data collection by pressing the file name button. Entering the file name here can also retrieve previously collected files.

Sample Data Collection

The following pictures show a successful BV data collection.
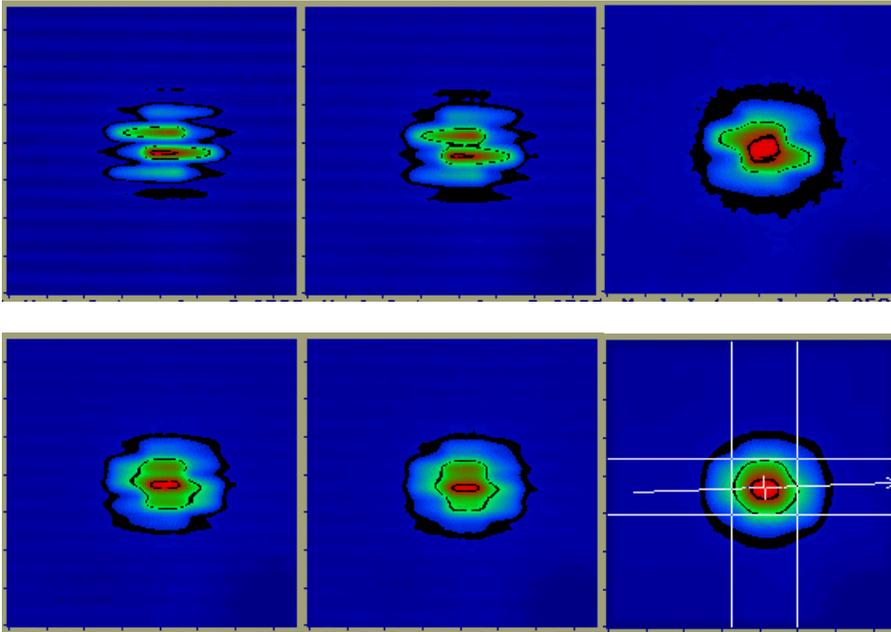

Figure 8 BeamView Data Collection Sample

The above sequence of pictures shows BV data collection from start to finish. Note how each successive picture gains more information about the beam (behind the mask) until the final reconstruction of the beam is made. This particular example required 6 horizontal passes to complete. Each horizontal pass was made after a new vertical position was set. The first picture in the sequence was the result of a single horizontal pass of the beam. The 'striping' of the individual phosphor dots can be seen. For the next image, the beam was moved vertically and then another horizontal pass was made. The process continues until the final pass was complete.

BeamView Data

BeamView data is saved in various files for later retrieval. The files created after a BV collection are: