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## How to: Align Video Sequences

*Video Clarity, Inc.*

With the proliferation of new video compression options, Video Clarity has introduced new picture quality assessment techniques. The Clearview Video Analysis systems serve uncompressed video sequences, record the output of the processing unit, and calculate a mean-opinion-score (MOS).

### *Video Server*

The device-under-test (DUT), regardless of what type of processing, needs a video quality input signal. The processing includes:

- Compression – transmission – decompression
- Removal of artifacts

### *Example*

The video sequence on the left is the 720x486, NTSC source. It was imported as a Y'CbCr uncompressed file directly into ClearView. ClearView served this video sequence into a hardware MPEG-4 video encoder using SDI output.

The video encoder compressed and cropped the video sequence. The video sequence on the right was recorded from component input as 720x486, NTSC. The number of black lines at the top and bottom is not equal.

**Figure 1: Side-by-side Mode**

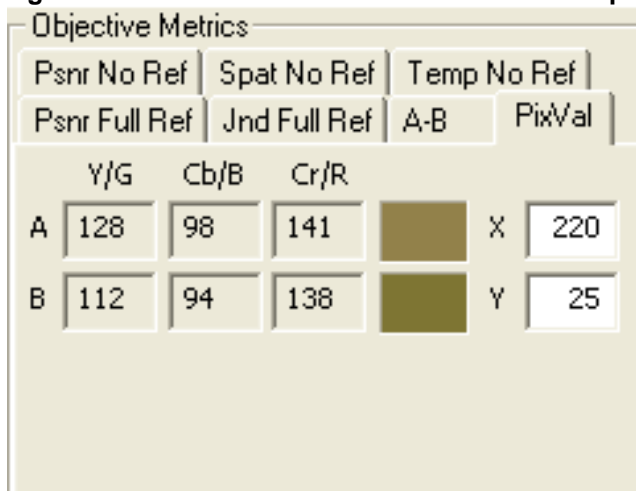


As a first step, a window will be drawn around both video sequences to crop the original video sequence. To get the box exactly right, the pixval tool will be used to find the first occurrence of non-black at the top and the first occurrence of black at the bottom of the video sequence on the right. With these Y offsets measured, a window can be drawn using the window command.

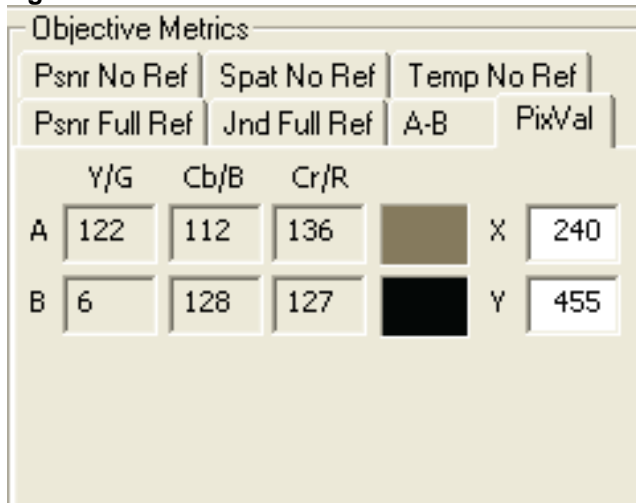
To use the pixval tool, select the pixval tab under the objective metrics pane. To begin point the mouse where black starts and press the right mouse button. The color and the X,Y cursor location will be displayed. Using the keyboard commands move the cursor up/down to find the boundary between

black and the real first color (default commands are ^w for up; ^s for down). It is easier to control the cursor using the keyboard commands as opposed to the mouse.

**Figure 2: PixVal Tool Finds first non Black at Top**

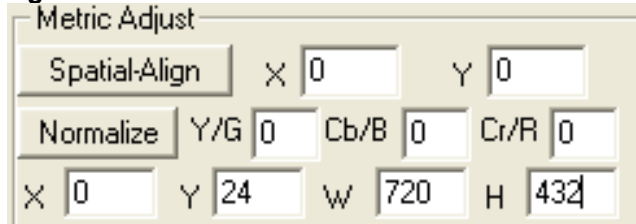


**Figure 3: PixVal Tool finds first Black frame at Bottom**



Now enter the X,Y, W, H parameters that were measured above into the window command under the Metric Adjust pane.

**Figure 4: Window is Created based on PixVal**



The video sequences are re-recorded using the Record ClearView Output controls. These are described in detail later in this document.

**Figure 5: Video Sequences after Cropping**



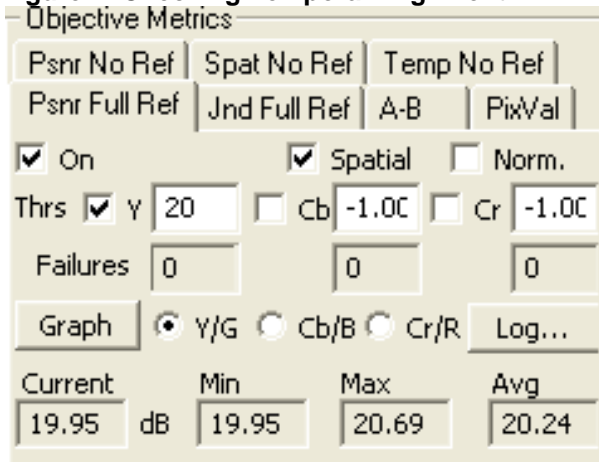
At this point the video sequences are now the same size, but they are not aligned. Using ClearView's spatial alignment, the video sequences were found to be off by  $x=-6$ ,  $y=-16$  (the video sequence on the right is higher and further to the left).

**Figure 6: Spatial-Align Metric Adjust**

Metric Adjust					
<input checked="" type="checkbox"/> Spatial-Align	X	<input type="text" value="-6"/>	Y	<input type="text" value="-16"/>	
<input type="checkbox"/> Normalize	Y/G	<input type="text" value="0"/>	Cb/B	<input type="text" value="0"/>	Cr/R <input type="text" value="0"/>
X	<input type="text" value="0"/>	Y	<input type="text" value="0"/>	W	<input type="text" value="720"/>
				H	<input type="text" value="486"/>

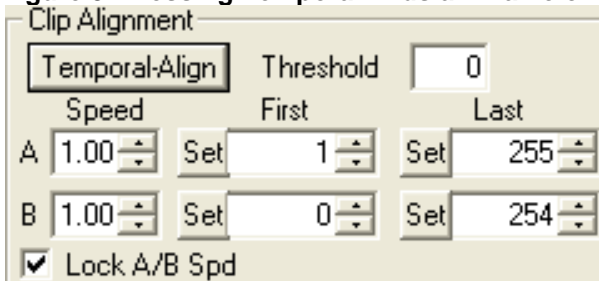
Temporally, the video sequences look close, but ClearView detected a 1 frame offset using the temporal alignment feature. Temporal alignment took the spatial alignment into consideration when performing the alignment. It does this, by using the PSNR metric pane as shown below. After temporal alignment is complete, the PSNR between the best fit match will be compared against the Y threshold. A value over this threshold will confirm the temporal alignment. Normally, this value should be set to 15-18, but for this test, it is set to 20.

**Figure 7: Checking Temporal Alignment**



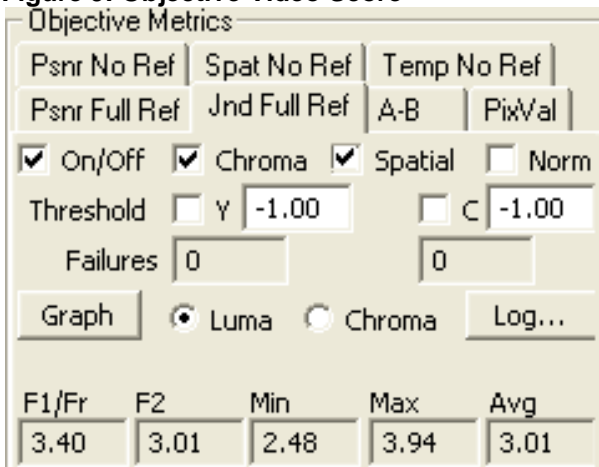
Current	Min	Max	Avg
19.95 dB	19.95	20.69	20.24

**Figure 8: Pressing Temporal finds a 1 frame offset**



The video sequences are aligned. Now, ClearView can calculate the objective video score using Sarnoff JND or PSNR. By checking the spatial check box, the JND/PSNR algorithm will automatically remove the spatial offset.

**Figure 9: Objective Video Score**



F1/Fr	F2	Min	Max	Avg
3.40	3.01	2.48	3.94	3.01

The score takes into account the spatial offset, but the display still shows the video sequences with the offset. To remove the offset, you can re-record the video sequences using the Record ClearView Output controls.

**Figure 10: Record ClearView Output**

Record

ClearView Output | Broadcast | DVI Input

To Disk  AOI  Use Metric Adjustments

Library: G:\NTSC YCbCr 8bit\

Sequence: OriginalWindowed SpatAdjust 2

Library: G:\NTSC YCbCr 8bit\

Sequence: ProcessedWindowed SpatAdjust 2

Frames: 0 Record Stop

Both video sequences are re-recorded with the Use Metric Adjust box checked. The video sequences are re-recorded to the \NTSC Y'CbCr 8-bit\ library on G: disk array. The final video sequences are shown below in seamless split mode. Alignment is complete.

**Figure 11: Seamless Split after Alignment**

