Pixel Shape Doesn't Affect Picture Shape
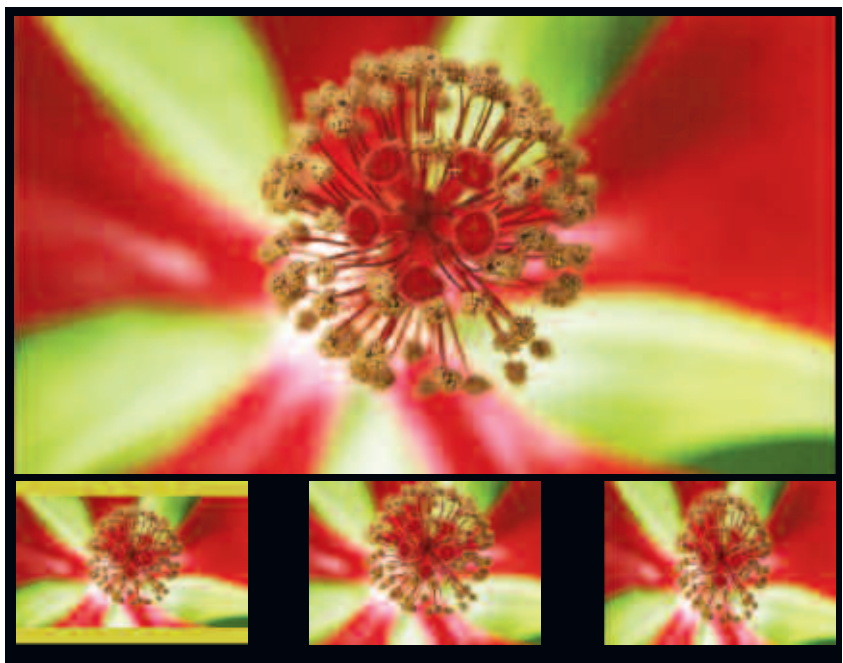
This month we look at pixels and formats in post. ■ By C.R. Caillouet

So pixel shape doesn't affect picture shape. Well, maybe—if the system processing the pictures knows what to expect. This "non-square pixel" thing can be confusing. It can be even more confusing when you attempt to mix footage recorded in more than one format with different pixel shapes.

Many formats aren't defined for direct interchange as digital video streams. Those that aren't must be handled as video data files. The commonly accepted method of moving digital video is called a serial digital interface (SDI). Standard definition (SD) SDI is defined for North American use by SMPTE 259M, and SD SDI streams consist of the 720 luma samples on each of 480 lines, so the pixels are non-symmetrical.

Recently, more SD programs have been shot in the widescreen 16:9 (1.78:1) aspect ratio, but moved around through the same paths as 4:3 programs, so there can be additional confusion about the shape of the pixels and the shape of the pictures. If the SDI stream doesn't carry aspect ratio information, or if the destination device can't distinguish between the shapes, then manual settings are required. The setting could be as simple as an aspect ratio button on the front of a monitor or a menu setting in an editor.

In the HD world, the potential problems are different. All HD SDI streams are defined around symmetrical luma samples. (The chroma samples are twice as wide as they are tall, but that's a different issue for a different time.) File-based storage systems, or systems that allow transfer of digital image data across data links, may keep samples in the original shape delivered by a camera, but as soon as that data is converted to HD SDI, it must be "resampled" to a standard format. Conversion to HD SDI may reduce confusion about the original format and allow standard capture methods, but also may increase stor-

The original "square pixel" HD image at the top, with three variations of down-conversion. The right two are converted with pixel aspect ratio correction, which keep the proportions of the content consistent, even though the overall image shape changes. The left image is converted from 1.778:1 to 1.333:1 without correction. The result is an anamorphic squeeze, which requires special processing in the display.

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age and processing requirements. Use of video data files from cameras with non-standard pixel shapes can reduce storage and processing needs, but requires that the processing device know about the original shape and convert it for processing and display.

When an HD SDI signal gets to an editing system, a related decision must be made. It either can be captured into a file with the standard, symmetrical pixels or compressed to another format. The difference in the amount of stored information can be significant because the compressed format usually represents a considerable size reduction compared to the standard or "uncompressed" version.

(I described the difference between uncompressed and de-compressed video in a previous column.)

The difference in disk storage speeds required to edit the two types of material could even determine whether you can afford to edit your own footage or not. There are several considerations that enter into the decision of which format to capture into the editor, but for now I'll stop with the pixel shape issues.

There also are several downstream processes that can be affected by the pixel shape:

• Monitoring HD video usually isn't a big problem on dedicated

video monitors because the HD SDI video signal presented will have been converted to a standard, and all HD standards use the 16:9 aspect ratio (1.78:1). Analog signals are okay because they conform to an analog standard, reconstructed to reflect the correct picture aspect ratio. But monitoring inside an editing system must take pixel shape into consideration. The internal file format could use either standard or original pixel shapes. For example, viewing a DVCProHD compressed image requires that the pixels be interpreted as 150% wider than the number of pixels and picture aspect ratio would imply.

• The format of images moved between systems depends on the method of transport. If you plan to move images in the HD SDI format, then the images must be decompressed and pixels adjusted to the standard shape. If the images will be moved as files across a data link, then the only requirement is that the destination device be able to understand the format.

• Some editing systems can handle subsampled image data and maintain the format through the editing process, but any such system must deal with the display and transport conversions in order to maintain proper display shape and legal interface over standard links. And any shape-related effects must compensate for the internal image shape.

• Most programming services today expect full-format recordings. These include D-5, HDCam SR and uncompressed video format files on hard drives. An exception is the original HDCam format, still accepted by many as an interchange format. Before a subsampled image can be exported to another image format, the conversion software must take into account the true image shape and compensate for the sample aspect ratio.

• Each delivery medium may be encoded in whatever delivery format that's readable by the receiver of the product, so closed-circuit channels are free to use subsampled formats, but open channels are limited to standard formats, most of which expect square pixels.

Of course, tomorrow, the rules may be different, so stay tuned. **HDVP**