Background on ADX Channel Gains
ADX encodes Academy Printing Density (APD) values as either 10-bit or 16-bit digital code values. APD values are printing densities defined by the spectral responsivities Π_{APD} which are defined for use with modern motion picture color negative and internegative film stocks. For more background see TB-2104-005.

In an optimal film system, the exposure of a spectrally nonselective (i.e. neutral color) object by a source for which the film has been balanced (e.g. 3200K) followed by nominal laboratory processing would ideally produce a negative with equal Red, Green and Blue printing densities. This means that exposure of the spectrally nonselective object would print through as a neutral onto the print film and appear as expected.

While historically present in systems that comply with the silver criterion, this ideal system behavior is not a characteristic of contemporary motion picture negative films stocks. In order to produce printing densities that were more equal, encoding gain factors were computed as a weighted average of gain factors necessary to make commonly used motion picture films be neutral. The gain factors of 1.00, 0.92, and 0.95 for Red, Green, and Blue channels, respectively, are intended to better center the point cloud of samples from films along the neutral axis (Figure 1).

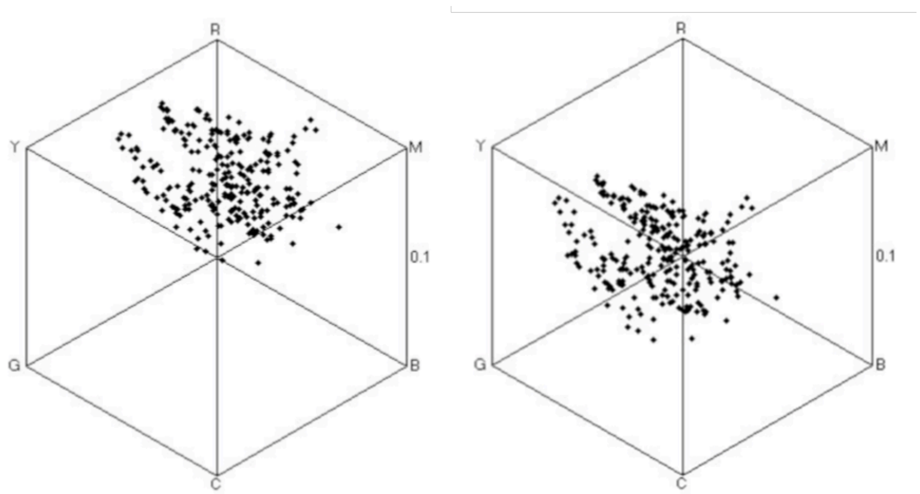

Figure 1. APD values of 17 films without (left) and with (right) encoding gain factors applied.

The gain factors are present to make objects that are intended to be neutral be more neutral. However, that theory relies on the assumption of using LAD as the anchor of the process, i.e. to set scanner calibration. In practice, scanner gains are almost always set using D_{min}. (This is due to the fact that LAD patches are rarely available, especially in restoration scans. So instead of balancing on LAD, scanner gains are most often set using D_{min}, which can be found in the head or tail segments of every piece of film.)

Because the gains are linear, the farther one moves away from the anchoring code value the more the lines diverge. Anchoring on D_{min} instead of LAD exacerbates the effect of the gain factors in the highlights. As seen in Figure 2, the deviation in highlights for values balanced at LAD can fit between the deviation between just the Red and Blue channels of the values balanced at D_{min}.

While originally well-intentioned, the channel gains seem to cause more issues than they solve, largely because practice varies from theory. Either the gains should be removed, or the use of LAD must be specified. As previously mentioned, even if use of LAD were specified, it is not always available, and so it is probably best to remove the channel gains or rescale them to work for D_{min} balancing.

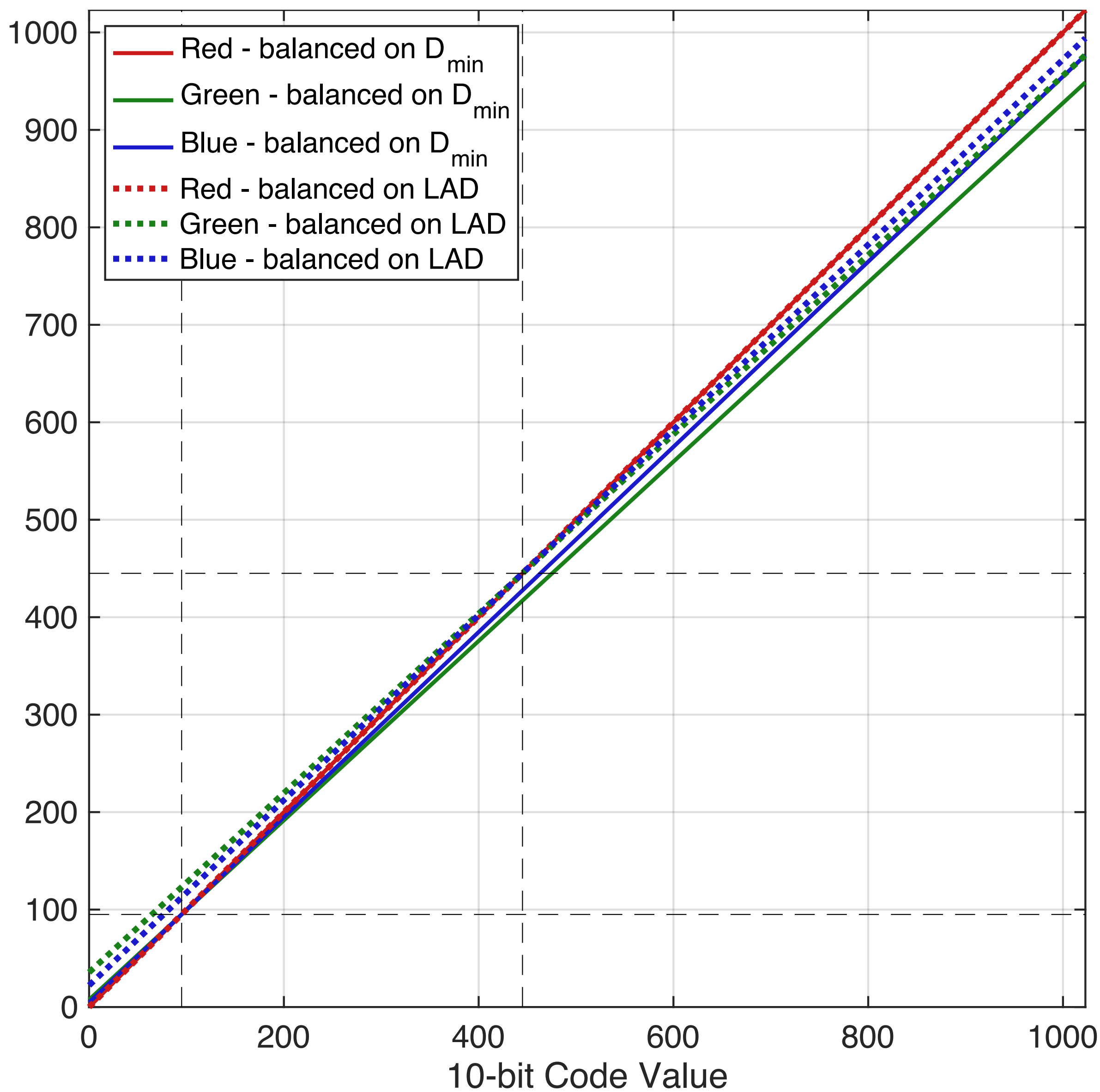

Figure 2. A comparison of click-balancing a scanner using D_{min} instead of using LAD.