BOLEX LOG & WIDE GAMUT RGB

Version 1.0 | April 20, 2016

Version History

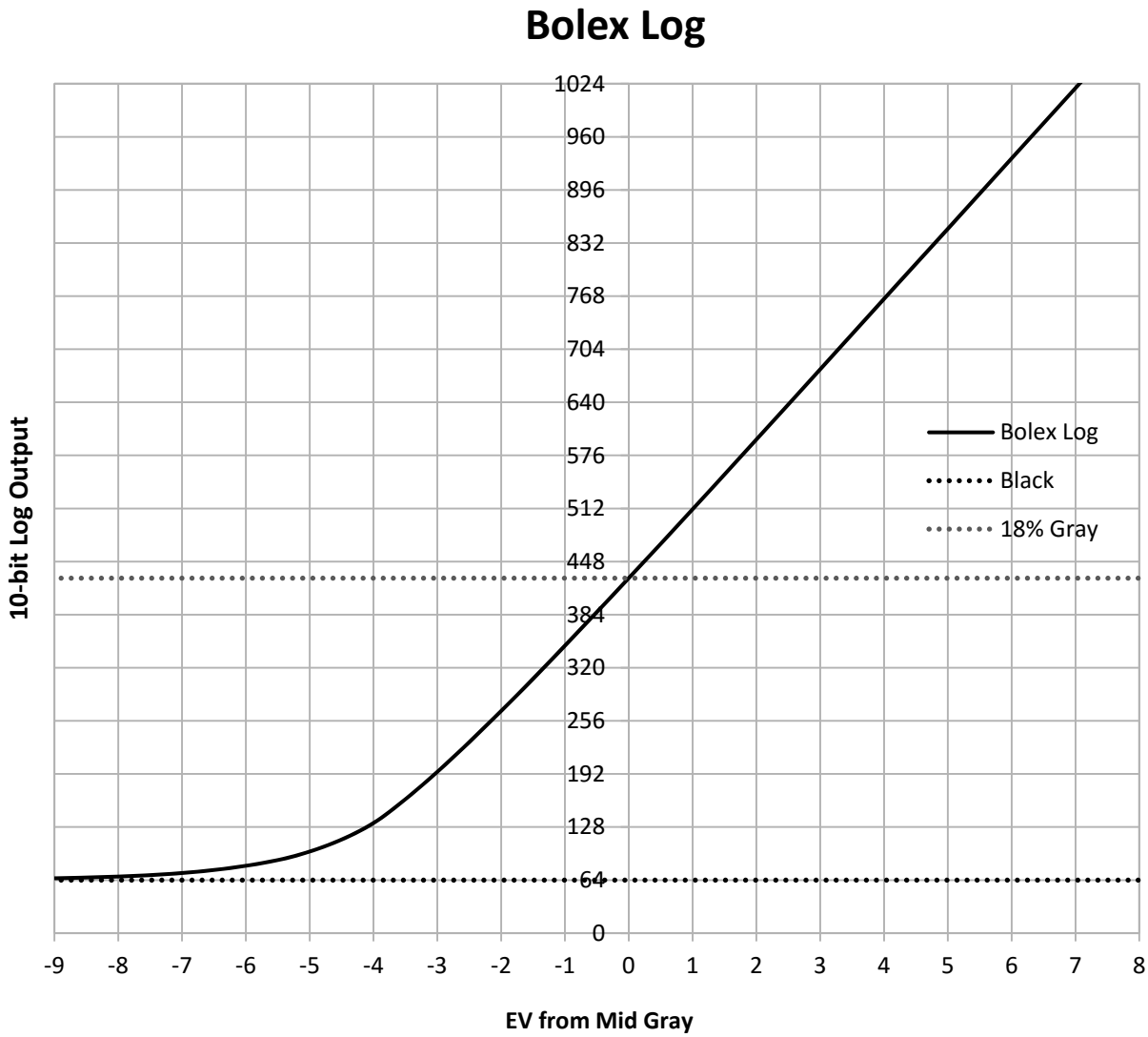
Version	Date	Author	Change Note
1.0	Apr 20, 2016	Edward Barton	Initial Draft

Introduction

This document provides the technical summary of the color space used for encoding D16 footage. The color space consists of the Bolex Wide Gamut RGB color gamut and the nonlinear Bolex Log transfer function. This color space was designed to emulate the film negative color grading workflow making the D16 more compatible with existing production pipelines.

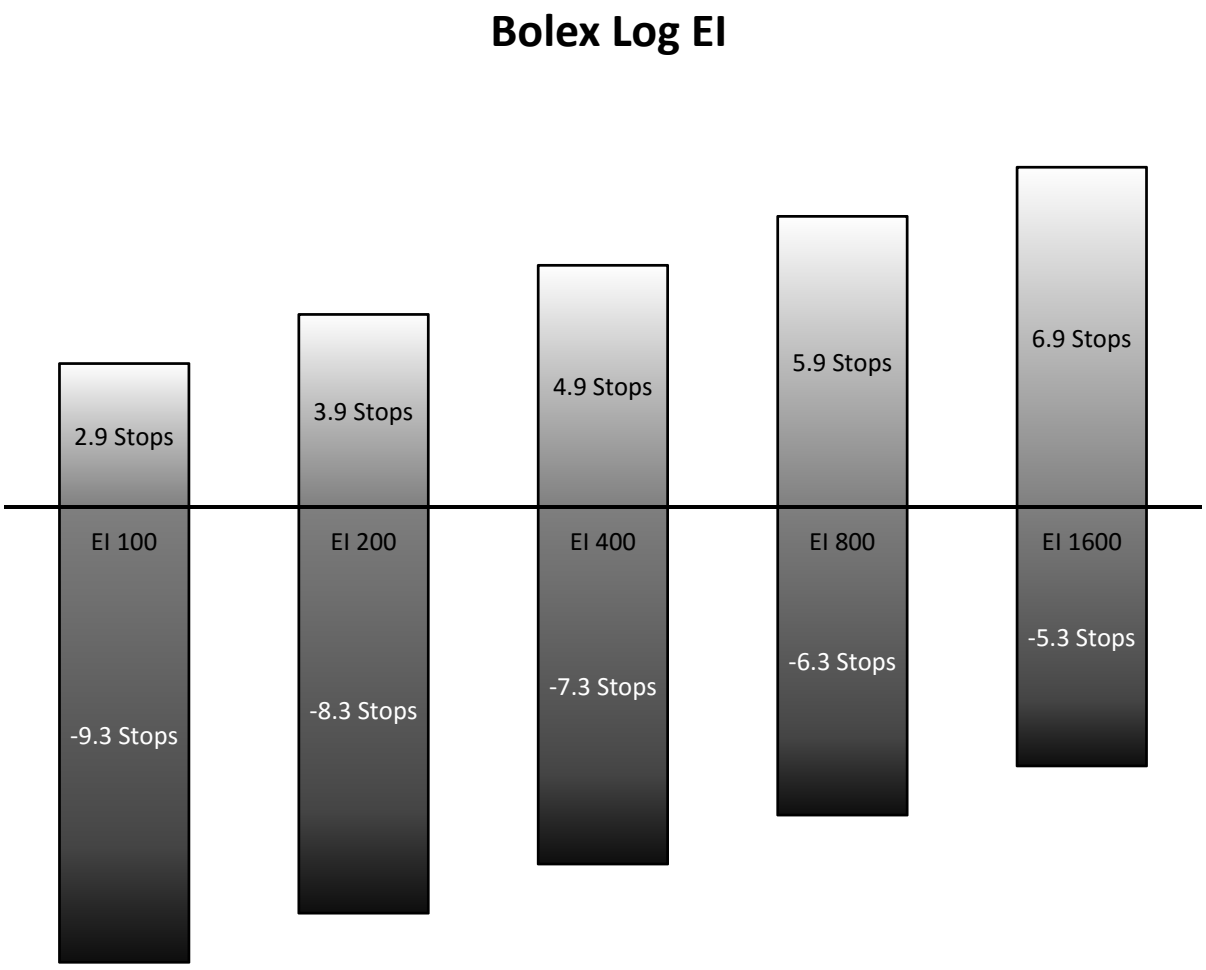
Bolex Wide Gamut was designed to optimally encode sensor data, producing accurate and pleasing hues. The gamut encloses DCI-P3 to provide room for grading. Bolex Log was designed such that any given stop of light has roughly the same amount of gradations as any other. This preserves detail across the entire exposure range of the camera.

Bolex Log Transfer Function



The Bolex Log transfer function covers a wide dynamic range to prevent clipping values that are captured by the D16. 18% gray is encoded at the code word 428/1023 and black level is fixed at 64/1023. The linear part of the above graph spans a 10 stop range and encodes the values with about 83 code words per stop in a 10-bit encoding.

The following graph shows how footage encoded to Bolex Log changes with EI. Changing the EI shifts the dynamic range of the image up or down around the middle gray point. With each increase in scene exposure values, there's an increase in the maximum clipping point along the transfer function.



The following function encodes scene referred linear values using the Bolex Log transform:

```
// Scene Referred Linear to Bolex Log
if (scene >= 0.0149480)
  out = 0.2756705 * log10(5.5555556 * scene + 0.0280665) + 0.4150634
else
  out = 5.9861078 * scene + 0.0625265
```

And the reverse function for decoding Bolex Log back to scene linear values:

```
// Bolex Log to Scene Referred Linear
if (BolexLog >= 0.1520070)
  out = 0.18 * (pow(10, (BolexLog - 0.4150634) / 0.2756705) - 0.0280665)
else
  out = (BolexLog - 0.0625265) / 5.9861078
```

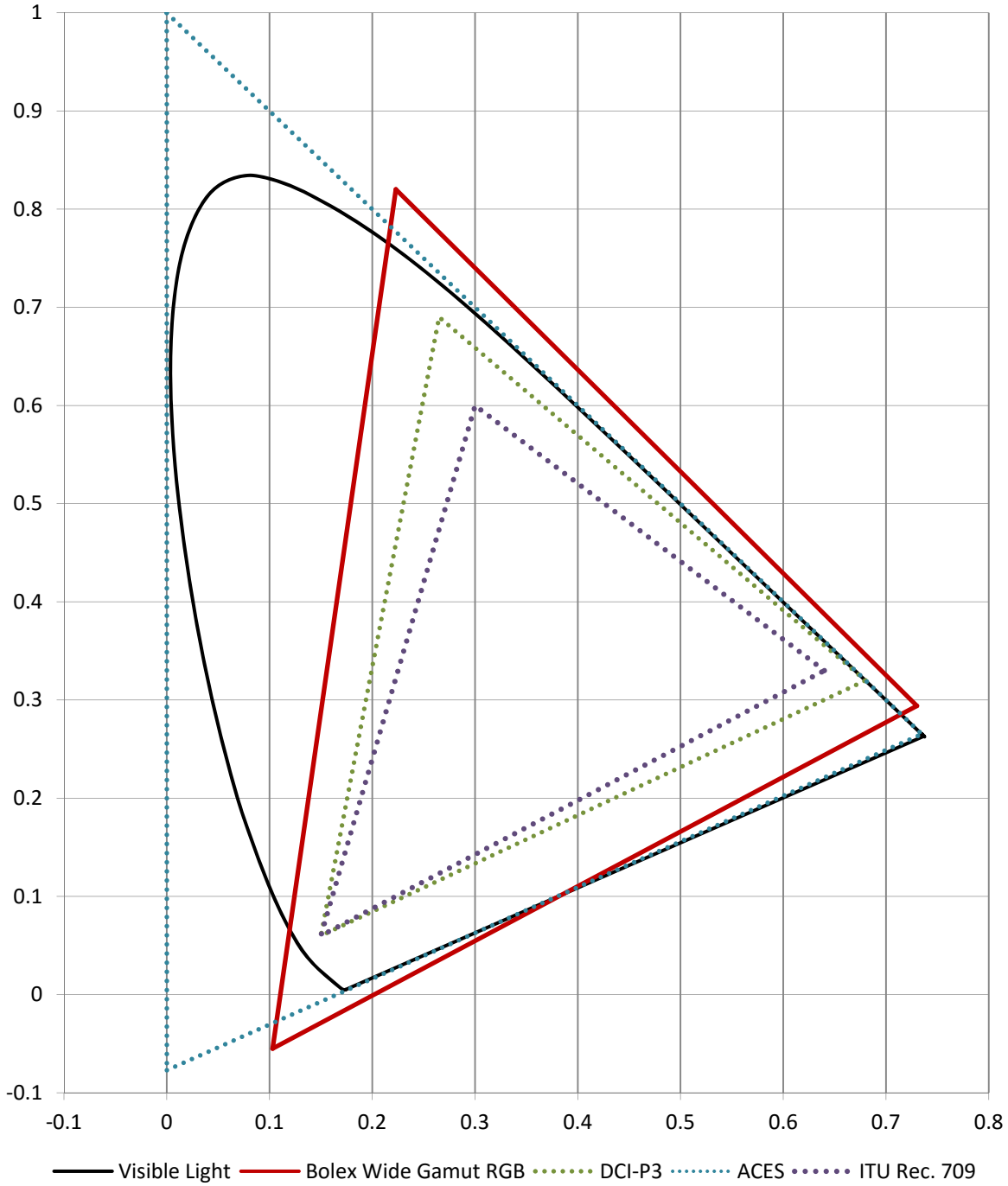
The following table lists the black level and clipping points for a user selected EI.

EI	Black	Clipping
100	64	612
125	64	639
160	64	670
200	64	697
250	64	724
320	64	754
400	64	782
500	64	809
640	64	839
800	64	866
1000	64	894
1280	64	924
1600	64	951
2000	64	978
2500	64	1006
3200	64	1023

Bolex Wide Gamut RGB

The Bolex Wide Gamut bounds are greater than the cinema specification, DCI-P3, giving the colorist room to grade the image into the smaller space. It will also serve users well for archiving footage where all possible color fidelity is needed in a digital intermediate codec.

Below is the chromaticity plot comparing Bolex Wide Gamut RGB to other standard color gamuts.



The following are the corresponding chromaticity values that create the vertices of the above color gamuts. Color matrices to convert between these color gamuts can be calculated from this table of values. Conversions must be applied only on linear footage. When converting Bolex Wide Gamut RGB to color gamuts with white points other than D65, it's recommended to use the Bradford transform for chromatic adaptation.

		x	y
Bolex Wide Gamut RGB	Red Primary	0.73000	0.29400
	Green Primary	0.22300	0.82000
	Blue Primary	0.10300	-0.05500
	White (D65)	0.31270	0.32900
DCI-P3	Red Primary	0.68000	0.32000
	Green Primary	0.26500	0.69000
	Blue Primary	0.15000	0.06000
	White (DCI)	0.31400	0.35100
ACES	Red Primary	0.73470	0.26530
	Green Primary	0.00000	1.00000
	Blue Primary	0.00010	-0.07700
	White (Approx. D60)	0.32168	0.33767
ITU Rec. 709	Red Primary	0.64000	0.33000
	Green Primary	0.30000	0.60000
	Blue Primary	0.15000	0.06000
	White(D65)	0.31270	0.32900

The Bolex Wide Gamut RGB to CIE 1931 XYZ conversion matrix is

```
 0.6016556  0.2241551  0.1246452
 0.2423106  0.8242476 -0.0665581
-0.0197805 -0.0432227  1.1520609
```

The inverse matrix that converts CIE 1931 XYZ to Bolex Wide Gamut RGB is

```
 1.8634534 -0.5189129 -0.2315923
-0.5468874  1.3692053  0.1382728
 0.0114768 -0.0424600  0.8692210
```

The Bolex Wide Gamut RGB to ACES RGB conversion matrix is

```
 0.6440546  0.2522830  0.1132824
 0.0327044  1.0102242 -0.0469101
 0.0028926  0.0370239  1.0491803
```