Die neuen Augen der digitalen Ästhetik - ARRI's Kamera ALEXA

Franz Kraus
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Key Parameters For Image Quality: Sharpness & Resolution
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1000 Pixel

500 Pixel

Increased contrast due to low frequency detail
Key Parameters For Image Quality: Sharpness & Resolution

MTF with Heynacher Integral

$A_{\text{left}} < A_{\text{right}}$
Basics – Dynamic Range

**Dynamic Range / Simultaneous Contrast**
- Modulation for spatial frequencies < 1 Lp/mm
- Perception intuitive

**Sharpness**
- Integral/area under MTF curve for spatial frequencies < 20 Lp/mm
- More important
- Perception intuitive

**Resolution**
- Modulation for spatial frequencies > 30 Lp/mm
- Authenticity
- Perception needs time
Analog Postproduction

OCN = Original Camera Negative
IP = Intermediate Positive
IN = Intermediate Negative
P = Print
– = Generational Quality Loss

Cut

Light Regulation

Printing

(Wet) Printing

Bulk Printer

Cut Negativ

Printed

Cut Negativ

Corrected Printer Prints

Printer Lights

Animation Stand

Title
Dissolves
Slow Motion
optical effects

EDL

Optional Color Conversion

Special Photo-chemical Processes
Standard Analog Workflow

Original Camera Negative (OCN)  Intermediate Positive (IP)  Intermediate Negative (IN)  Print
Hybrid Workflow for Feature Film

**Broadcast:** (HD)TV

**DVD/Video:** (HD)DVD

**Blue Ray..**

**Video on Demand..:**

**Video over IP...**

**Digital Cinema Projection**

**ARRISCAN RGB/IR**
- 3k / 2k
- 6k / 4k
- 10 bit log
- 16 bit lin

**ARRILASER**
- Recording on intermediate color negative & BW for separation

**DCP**
- DCI-compliant distribution formats

**DCI-compliant**

**Data File 2K/4K**
- RETOUCHING
- CONFORMING
- COLOR TIMING
- VERSIONING

**POSTPRODUCTION**

**Digital FX**
- Visual effects
- CGI
- Compositing
- Titles

**Digital Archiving**

**HD-Master**
- Video with 3d LUT

**Archiving**
- YMC-Sep.
- Physical
- SAT optical

**Distribution Formats**
- Broadcast: (HD)TV
- DVD/Video: (HD)DVD
- Blue Ray...
- Video on Demand...
- Video over IP...

**Bulk Printer**

**One-light**

**Release prints**

**POSTPRODUCTION**
- RETOUCHING
- CONFORMING
- COLOR TIMING
- VERSIONING
Comparison: Film-Scan Workflow

Example: 2K / 4K - Resolution

2K, 4K Scan of Original Camera Negative
Comparison: Film-Scan Workflow

Film - Scan

2K

4K
Comparison: Film-Scan-Record Workflow

2K

4K

Film – Scan – Record
Basics – Dynamic Range

**Basics – Dynamic Range**

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**Heynacher Integral**

**MTF**

- 20 Lp/mm
- 33 Lp/mm
- 50 Lp/mm
- 80 Lp/mm
Basics – Dynamic Range

daylight: up to 20 f-stops

1:1 Mio

human eye:
fixed aperture: ~ 6 f-stops
var. aperture: ~24 f-stops *
*depending on angle of vision/ brightness surrounding and time to adapt

digital camera with linear characteristic curve:

\[10\text{bit} = 2^{10} = 1024 = \frac{1024}{1} \approx 1000 = 10\text{ f-stops}\]

\[12\text{bit} = 12\text{ f-stops}\]

modern film: 16 f-stops
ALEXA – Digital Camera System

Shoot > Edit

- Image Performance
- Versatile and Efficient Workflows
- ARRI Product Quality
- Open, Future-Proof Architecture
ALEXA – Key Facts

Shoot > Edit

- Sensitivity: 160 – 1.600 ASA
- Dynamic Range: 14 Stops
- Resolution: 3k > 2k | HD, 2880 x 1620
- Size: 329 x 158 x 153 mm
- Power Consumption: ~85 W
- Camera Body Weight: 6.26 kg
ALEXA – Key Components

- Pixel Pitch: 8.25 micron
- Frame Rate: 1-60 fps
- Connectivity: HDSDI, GB Ethernet
- Image Processing: FPGA
- El. Viewfinder: 1280 x 784; Elcos
ALEXA Sensor & Image Performance

The ALEXA 35 format ALEV III CMOS sensor is a custom design by ARRI, optimized for digital cinematography.

- Sensitivity: 160 – 1,600 ISO
- Dynamic Range: 14 Stops
- Resolution: 3k > 2k | HD
- Image area: Cine 35mm + 10%
ALEXA Comparison

![Graph showing OECF LOG comparison between Kodak Vision3 500T and ARRI ALEXA 400ASA]
ALEXA Comparison

OECF DARK cropout

Code Value [f/0dB]

Sensor/Film exposure [EV]

Kodak Vision3 500T
ARRI ALEXA 400ASA
ALEXA Comparison

Graph showing the OECF BRIGHT output with code values as a function of sensor/film exposure in EV (Electron Volts). Two lines are shown:
- Red line: Kodak Vision3 500T
- Blue line: ARRI ALEXA 400AS
ALEXA – Versatile Workflows

**ProRes**

**HD-SDI**

**ARRI RAW**

Max. Data Rate

- 2880 x 1620 ARRI RAW: 3 Gb/s
- 1920 x 1080 4:4:4 RGB: 3 Gb/s
- 1920 x 1080 4:2:2 YCbCr: 1.5 Gb/s
- 1920 x 1080 4:2:2 YCbCr: 1.5 Gb/s
- 1920 x 1080 ProRes 4444: 330 Mb/s
- 1920 x 1080 ProRes 422 HQ: 220 Mb/s
- 1920 x 1080 ProRes 422: 147 Mb/s
- 1920 x 1080 ProRes LT: 102 Mb/s
- 1920 x 1080 ProRes Proxy: 45 Mb/s

* At 30 frames per second
ALEXA – Workflows

- QuickTime/ProRes
- ARRIRAW or uncompressed HD

Flowchart:
1. QuickTime/ProRes
2. EDITING → COLOR CORRECTION → DISTRIBUTION
3. ARRIRAW or uncompressed HD
   - CONFORMING → COLOR CORRECTION → DISTRIBUTION
   - Edit Decision List
   - EDITING

Options:
- QuickTime/ProRes
- ARRIRAW or uncompressed HD
For ALEXA we have come up with a totally new thermal concept that is unique.

All of ALEXA’s electronics are contained in a sealed compartment while the heat is transferred via heat pipes to a radiator in the back.

Advantages
✓ Stays cool even in the sun
✓ Splash and dust proofed
✓ ALEXA is as silent as an ARRICAM
ALEXA – Future-Proof Architecture

The camera's software is designed in such a way that it can be quickly and easily upgraded.

Camera control electronics can be replaced with a future electronic with additional features.

SxS cards can be replaced with a future module in case another card technology proves more desirable.

The lens mount is exchangeable and we will offer mounts for Panavision, Canon and Nikon lenses.
Anonymous
Shoot at 800/1280 ASA
The Invention of Hugo Cabret
Filmbeispiele 1
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Example: 4k / 2k - Resolution

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0.012 mm eyelash = 2K resolution limit

0.006 mm eyelash = 4K resolution limit

4K Scan

2K Scan
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Key Parameters For Image Quality: Sharpness & Resolution
2k / 4k – UCI Wien

25 m
Filmbeispiele 2
4K