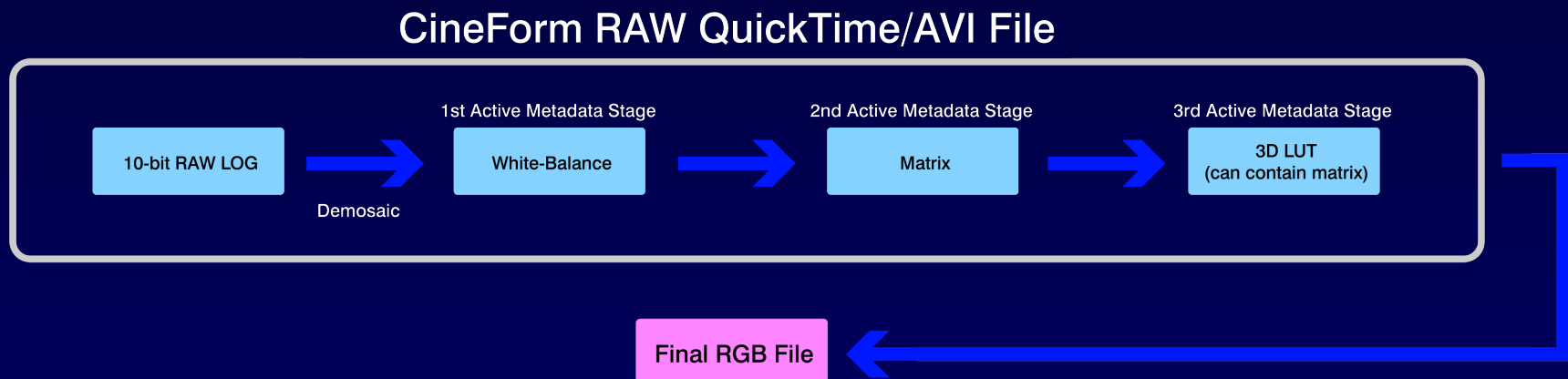


# **RAW WORKFLOWS:** CONVERSION PROCESSES

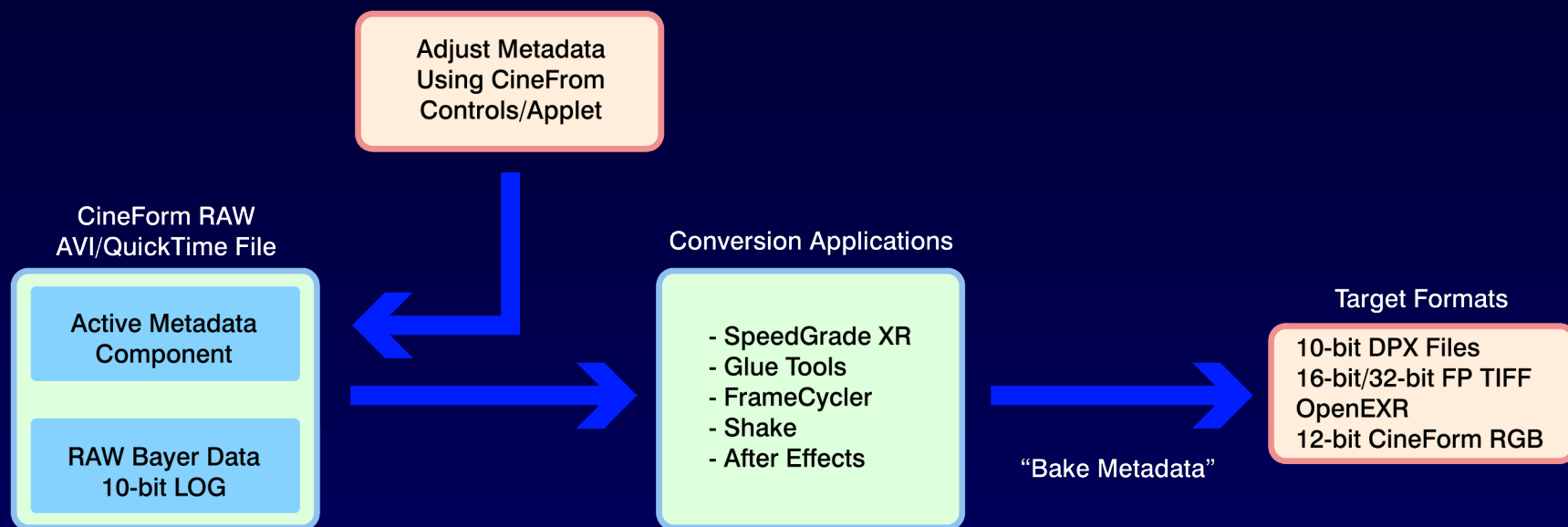
# CineForm RAW Pipeline

- Takes 10-bit RAW LOG file from camera and applies 3 different active metadata stages
  - White-balance
  - Matrix (optional stage . . . in SI-2K this is deactivated by default but is turned on with the “WhiteBalance + Matrix” setting in the CineForm SetActiveMetadata applet)
  - 3D LUT (typically this contains the matrix and allows non-destructive matrix operations in SpeedGrade)



# Converting from RAW to RGB

- Permanently “bakes-in” metadata information.
- Necessary for workflows that utilize applications that either do not support RAW files as well as QuickTime or AVI file wrappers
  - Scratch, Autodesk, Quantel, AVID DS|Nitris

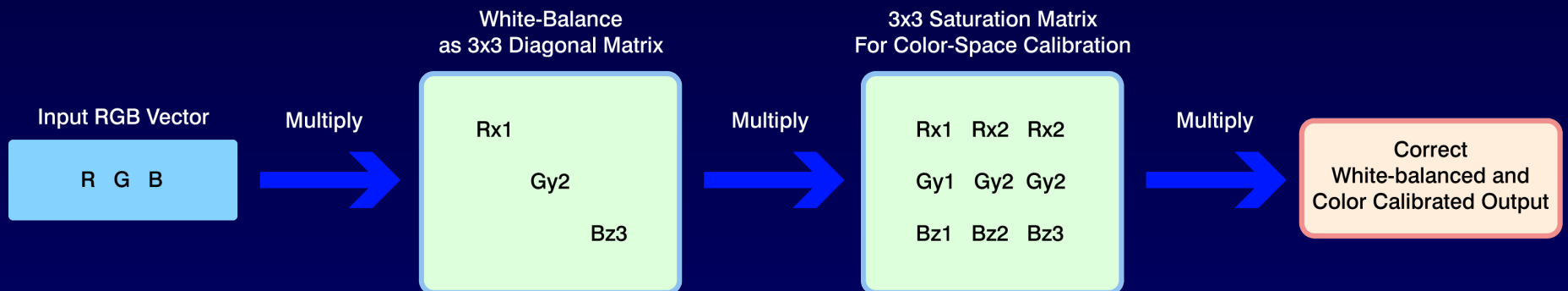


# Applying Metadata

- First step in conversion process is deciding what active metadata that you want “baked” into the image.
  - Pure “RAW”, or White Balance, Matrix, & 3D LUT?
  - Involves a fine balance between more flexibility later in post, but more work, or less flexibility but more accurate “starting point”
  - Difference between “one-light” and “best-light”
- Settings from .Look file are not compatible with 3rd-party applications, so need to re-create any custom “looks” using native controls in host-application
- 3D LUT can be used as a starting point by converting to native 3D LUT of the host-application, but 3D LUT's don't provide actual settings . . . they “bake-in” all the color-corrections settings into a single LUT.

# What is the Matrix?

- RGB color can be thought of as a 3-point vector (which defines a 3D-space . . . i.e., 3D LUT)
- 3x3 Matrices are ways of transforming from one vector-space to another
  - For color applications this means color-space transforms/calibration
  - Also used to apply saturation
- Matrix multiplication is not distributive ( $ABC \neq CBA$ ); must go in the correct processing order



# What is the Matrix?

- CineForm RAW files, and well as IRIDAS .Look files contain internal 3x3 matrix metadata that is applied to RAW footage from SI-2K in order to correctly color-calibrate and match REC709 color-space
  - Footage without matrix is very desaturated
- Saturation controls in color-correction applications are internally applying a 3x3 matrix transform, but are assuming corrected color-space for footage
  - Native RAW files from SI-2K are not in a “normal” color-space – need matrix for calibration
  - When applying 3x3 saturation transform on RAW data that is not calibrated, color-vectors will be in the wrong location on the vectorscope (what should be red would be orange, other colors “off”, etc.)

# Advantages/Disadvantages

- Advantages:
  - “Baking-in” color-calibration (white-balance and matrix) gives the colorist the proper color-space for images from the camera. Makes achieving accurate color possible depending on the host application tool-set
  - “Baking-in” 3D LUT gives colorist the desired “look” without them having to recreate it from scratch . . . work is faster, especially when time schedules are critical
    - The colorist also does not have to “guesstimate” settings for what the exact look was . . . they can simply refine current “look”, adjusting color and matching shots

# Advantages/Disadvantages

- Disadvantages:
  - Active metadata is not reversible when being baked into an integer-based file format (DPX, TIFF, etc.)
    - Reduces flexibility
    - To theoretically reverse any manipulation from active metadata, you would need to output a floating point pixel format (OpenEXR)
  - White-balance and Matrix operations are digital gains, and therefore add noise to an image
    - Noise reduces dynamic range which limits the ability to “stretch” the image in color-correction, although, if you were after a “color-accurate” look, this noise would be part of the color-correction process anyways because same transforms would need to be applied.



# Workflow Questions

- When going to target host applications that requires “baking” metadata information, ask yourself these questions before doing the conversion:
  - Does the processing pipeline of my target application expect pre-color-calibrated data?
  - If it does require color-calibrated data, does it provide the tools to calibrate data (proper re-linearization, white-balance, and matrix controls)?
  - How much work do I want to-do in post vs. having most of the “look” pre-set before color-correction
    - Color-correcting “best-light” vs. “one-light” approach
- Answers to these questions determine what metadata needs to be baked into the image

# Workflow Questions

- Does the processing pipeline of my target application expect pre-color-calibrated data?
  - YES: Choose the “White Balance + Matrix” option in the SetActiveMetadata applet
  - NO: Go to the next question
- Does the host app provide the tool set to properly calibrate RAW camera data (re-linearization, white-balance, and matrix controls)?
  - YES: Choose “Disabled all Active Metadata” in SetActiveMetadat applet and grade from RAW LOG
  - NO: Choose either “White Balance + Matrix” or “White Balance Only” in SetActiveMetadata applet
  - \*\*Note: White-balance must always come before matrix; you can't white-balance after a matrix.

# Workflow Questions

- How much work do you want to-do in post?
  - Depending on the amount of active metadata “Baked” into the exported images, colorists have either more or less work to-do, with associated gain or loss of flexibility.
    - For ultimate flexibility, do not bake-in any active metadata (RAW LOG file), but make sure color-correction app can deal with non-calibrated data properly
- Do you need color-accurate images?
  - YES: Use “White-Balance + Matrix”
  - NO: For “styistic effects”, you can either use “White-balance Only” or disable all active metadata and grade from the RAW LOG image

# “Gotchas” (Traps)

- Make sure your post-production pipeline maintains 10-bit precision or greater
  - You do not want to accidentally truncate to 8-bits anywhere in the pipeline
  - QuickTime conversion engine does not support greater than 8-bit formats; must use Compressor if wanting to export directly from Final Cut Pro in 32-bit
- Do not apply a matrix (“White-Balance + Matrix”) if the “No White-Balance” setting was used in camera.
  - White-Balance operation must happen before Matrix because matrix multiplication is not distributive.
  - If there was no white-balance in-camera, just use RAW LOG and apply white-balance later in post

# “Gotchas”

- Watch-out for gamma shifting when QuickTime is involved with non-native codec conversions
  - CineForm RAW → ProRES (in Compressor)
  - Apply a reverse gamma correction in color-correction application to fix this gamma offset
- Remember that with “White-Balance” only, or “White-Balance + Matrix”, you are grading on LOG images . . . you must apply a reverse LOG curve in color-correction application to get the correct contrast in the image.
  - LOG Base 90 curve, not Cineon Curve
  - Close approximation is gamma 1.7, black point 0, white-point 1023 depending on the Cineon converter
  - Not applying reverse curve can lead to excessive shadow noise

# “Gotchas”

- If you made your own .Look files, check for these things in the “Matrix and LUT” section of SpeedGrade:
  - Using the proper re-linearization LUT's (this will be required for the white-balance and matrix to work properly)
  - White-balance: did you start from a properly white-balanced image from the camera as a reference image, or did you apply the white-balance in SpeedGrade itself?
  - Matrix: did you add your own matrix, or is it even there? If not, you will probably not have accurate color if that is the desired end-goal.
- Accidentally “double-applying” the matrix
  - Creates very super-saturated images

# Conclusion

- The first step is to know your post-pipeline
  - If you're going to use SpeedGrade for DI work, then no conversion to DPX or other formats is necessary
  - If you are going to another application that does not support native CineForm RAW, you will need to know what the limitations of the toolset are
    - Can it apply white-balance, matrices, etc. to calibrate images?
    - Do you even need calibrated images, or is a stylistic effect desired (bleach-bypass “look”)?
- Depending on the capabilities of color-correction app, choose the correct amount of active metadata information to “bake” into the exported images
- Make sure your pipeline stays 10+ bits precision

# **RAW WORKFLOWS:** CONVERSION PROCESSES