GSENSE2020 channel merging description

REPORT

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HDR channel construction

The equation for construction of the HDR channel is as follows:

In case of GLOBAL SHUTTER (CHANNEL_BITDEPTH=10):

$$val_{HG}(x,y) = val_{HG\_SIG}(x,y) - val_{HG\_BLACK}(x,y) + BLACK\_OFFSET$$
$$val_{LG}(x,y) = val_{LG\_SIG}(x,y) - val_{LG\_BLACK}(x,y) + BLACK\_OFFSET$$

In case of ROLLING SHUTTER (CHANNEL_BITDEPTH=12):

$$val_{HG}(x,y) = val_{HG\_SIG}(x,y) - HG\_BLACK + BLACK\_OFFSET$$
$$val_{LG}(x,y) = val_{LG\_SIG}(x,y) - LG\_BLACK + BLACK\_OFFSET$$

For both cases:
$$if\ val_{HG}(x,y) < 0 => \ val_{HG}(x,y) = 0;$$
$$if\ val_{LG}(x,y) < 0 => \ val_{LG}(x,y) = 0;$$

$$val_{LG\_LFSR}(x,y) = 2^{17-CHANNEL\_BITDEPTH} * val_{LG}(x,y)\ |\ (LFSR\&(2^{17-CHANNEL\_BITDEPTH} - 1))$$

$$\alpha = \frac{GAIN\_RATIO}{2^{17-CHANNEL\_BITDEPTH}}$$

$$\beta = (GAIN\_RATIO - 1) * BLACK\_OFFSET$$

$$val_{LG\_SCALED}(x,y) = \alpha * val_{LG\_LFSR}(x,y) - \beta$$

$$\gamma(x,y) = 1 - val_{HG}(x,y)/(HG\_RANGE + BLACK\_OFFSET)$$

$$if\ \gamma(x,y) < 0 => \ \gamma(x,y) = 0;$$

$$val_{hdr}(x,y) = \gamma(x,y) * val_{HG}(x,y) + (1 - \gamma(x,y)) * val_{LG\_SCALED}(x,y)$$

$$\delta = \frac{2^{16} - 1}{GAIN\_RATIO * (BLACK\_OFFSET + LG\_RANGE) - \beta}$$

$$val_{hdr\_norm}(x,y) = val_{hdr}(x,y) * \delta$$

$$if\ val_{hdr\_norm}(x,y) > 2^{16} - 1 => \ val_{hdr\_norm}(x,y) = 2^{16} - 1$$

Calibrated parameters:

HG_BLACK   - black level of the high gain channel
LG_BLACK   - black level of the low gain channel
HG_RANGE   - valid range of the high gain channel (HG_SATURATION_VALUE - HG_BLACK)
LG_RANGE   - valid range of the high gain channel (LG_SATURATION_VALUE - LG_BLACK)
GAIN_RATIO   - ratio of the measured slopes of the response curves of high and low gain channels
BLACK_OFFSET - black level offset of the merged image (arbitrary constant)