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ABSTRACT PRESENTATION

Title: Darkcurrent corrections in broadcast imagers.
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Project name: Imagination
Funding group: Penta / ~~Xecs / Euripides / ECSEL / KDT~~
Abstract can be published on website: ☐ **YES** **X NO**

Provide abstract of 500 words maximum. Use font ARIAL, size 11.
If figures are used, the text plus figures must stay within this one page.

Introduction:

The change from CCD based cameras to CIS introduced a new era of imager corrections needed. Dark currents and blinking pixels must be corrected. A lot of research is being done to the nature of the dark current, RTS noise sources and analysis. In this presentation is focused on the corrections methods for dark current in broadcast cameras.

Design methodology:

First step is to minimize dark current and RTS with the best knowledge available during pixel design. This might take some iterations with test shuttles.

The silicon is evaluated and characterized for each shuttle, until an optimum is found, or a state-of-the-art level is met. Dark current sources (pd/fd) and their doubling factors are part of sensor characterization. The result is a dark current model which can later be used for the imager corrections.

As dark current is dependent on temperature a second step is to design a camera cooling system to keep the imager temperature low. In a broadcast camera the imager is cooled to a deltaT of 10-15°C above ambient. Camera environmental spec is -20° ..+45°C

Trades must be made to avoid condensation, and to avoid high power consumption elsewhere in the camera in case active cooling like peltiers are used. As in broadcast a colour beam splitter is used, three imagers are being positioned behind it. The mechanical requirements for positioning of the imagers is within u-meter range. Mechanical stress of the cooling system should not affect the positioning of the imagers during the lifetime of the camera.

Third step: Make use of imager corrections.

CIS dark current corrections:

These corrections are split in a mix of methods.

1. Mean dark current calibration: the average dark current for PD, MN, FD is measured and subtracted.
2. A circuit is built for correcting the dark current for temperature, based on the doubling factor found during characterization.
3. Blinking pixel correction: RTS noise might cause hot pixels to average out to the wrong level. Instead of a mean value, blinking pixels are captured using peak detection.
4. Finally, an adaptive algorithm is used to real time measure outliers. These outliers can be predicted using stdev of the noise level. A gamma curve is used to shape the noise level for shot noise, to have just one detection threshold over the full imager range.
5. For blinking/ hot pixels which are below the read noise, a recursive adaptive algorithm is used.
6. Care must be taken with the adaptive part of the algorithm. Therefor several mechanisms are implemented to find correlation between pixels, and a defect density count is used in case of led walls.

Conclusion:

Although during the design phase the intrinsic dark current is made as low as state-of-the-art technology allows CIS need additional corrections for dark current.

the presentation will give an overview of the design process and the used imager corrections for broadcast imagers to deal with dark current and RTS noise in CMOS imagers used for broadcast cameras.