

SEMICON[®]
Europa 2015



Digital integration: a path to lower system cost in imaging systems

*Benoit Dupont, Pyxalis,
booth 2042*



PYXALIS

in a few words...



PYXALIS

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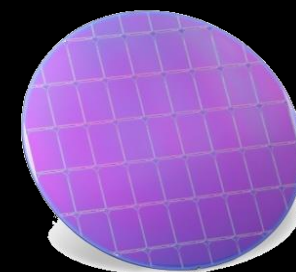
PYXALIS is a high-end CMOS Image Sensor supplier & Design house

A few figures:

- Founded in: 2010
- Team: 20 people
- Experience: >150 man-year experience in CMOS image sensors



- Located in **Grenoble**, France , in the «Imaging Vallée»:
700sqm offices, state of the art design center, full EO characterization

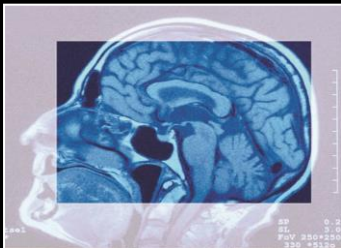




Pyxalis is a custom image sensor supplier in the field of:

- Medical
- Security
- Machine Vision
- Science
- Air and space born applications

With a strong emphasis on High performance SoCs

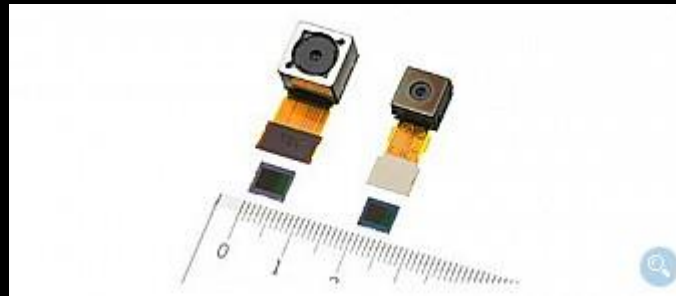


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Digital integration, a path to lower total system cost



In consumer image sensor industry, the trend towards more compact systems is undeniable...

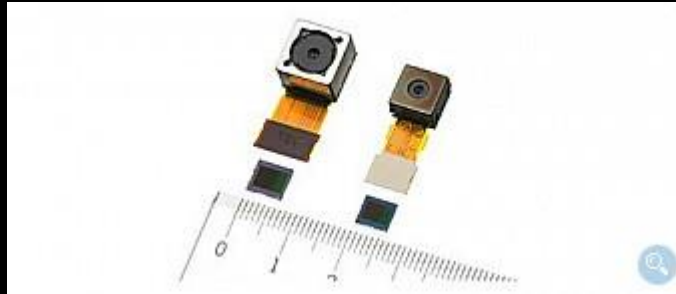


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Digital integration, a path to lower total system cost



In consumer image sensor industry, the trend towards more compact systems is undeniable...



What about industrial application ?

What about industrial application ?



« 1st » digital
camera

Kodak

1975



« 1st » centralized IP
Camera

Axis Com

1996



Today's industrial cameras



The trend is also there, slower of course, due to:

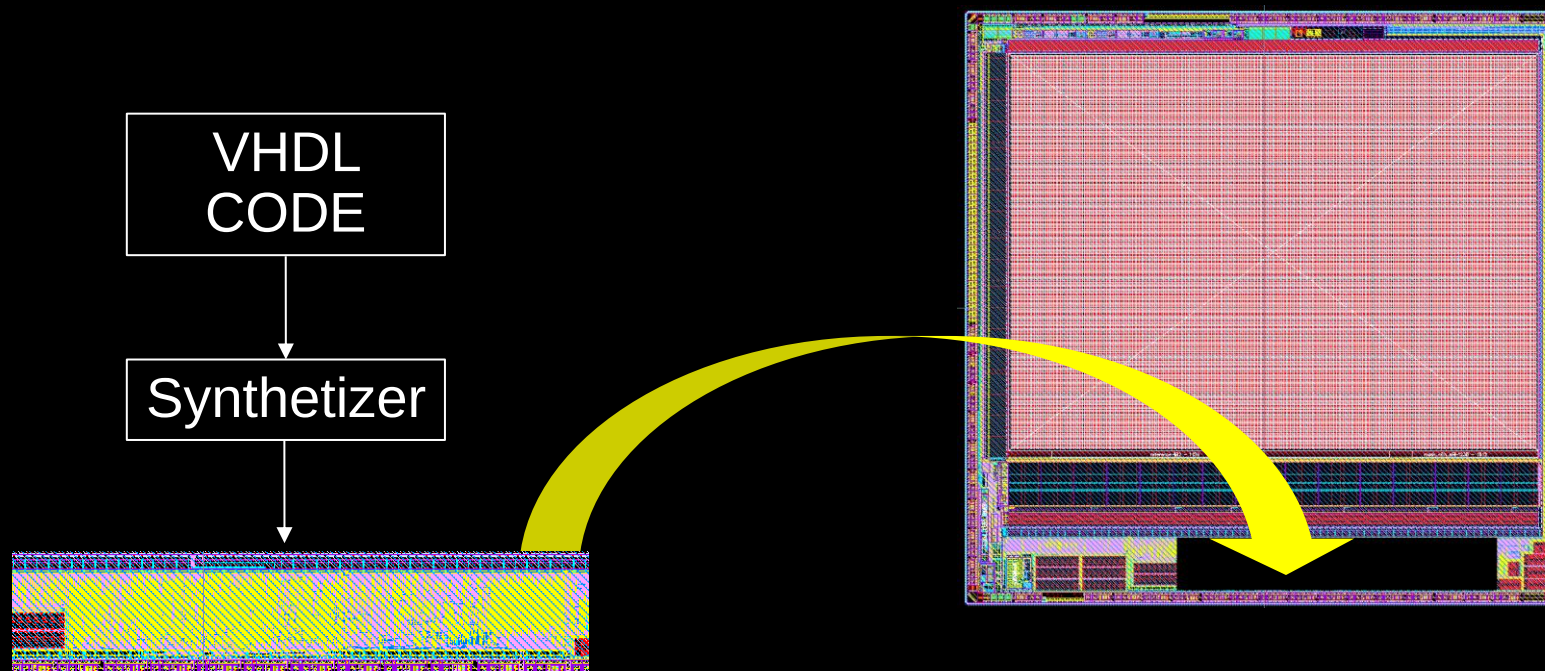
- Development cost pressure
- Performance requirements, optical formats, etc...

Yet, today a significant part of the camera functions can be performed by the imager itself:

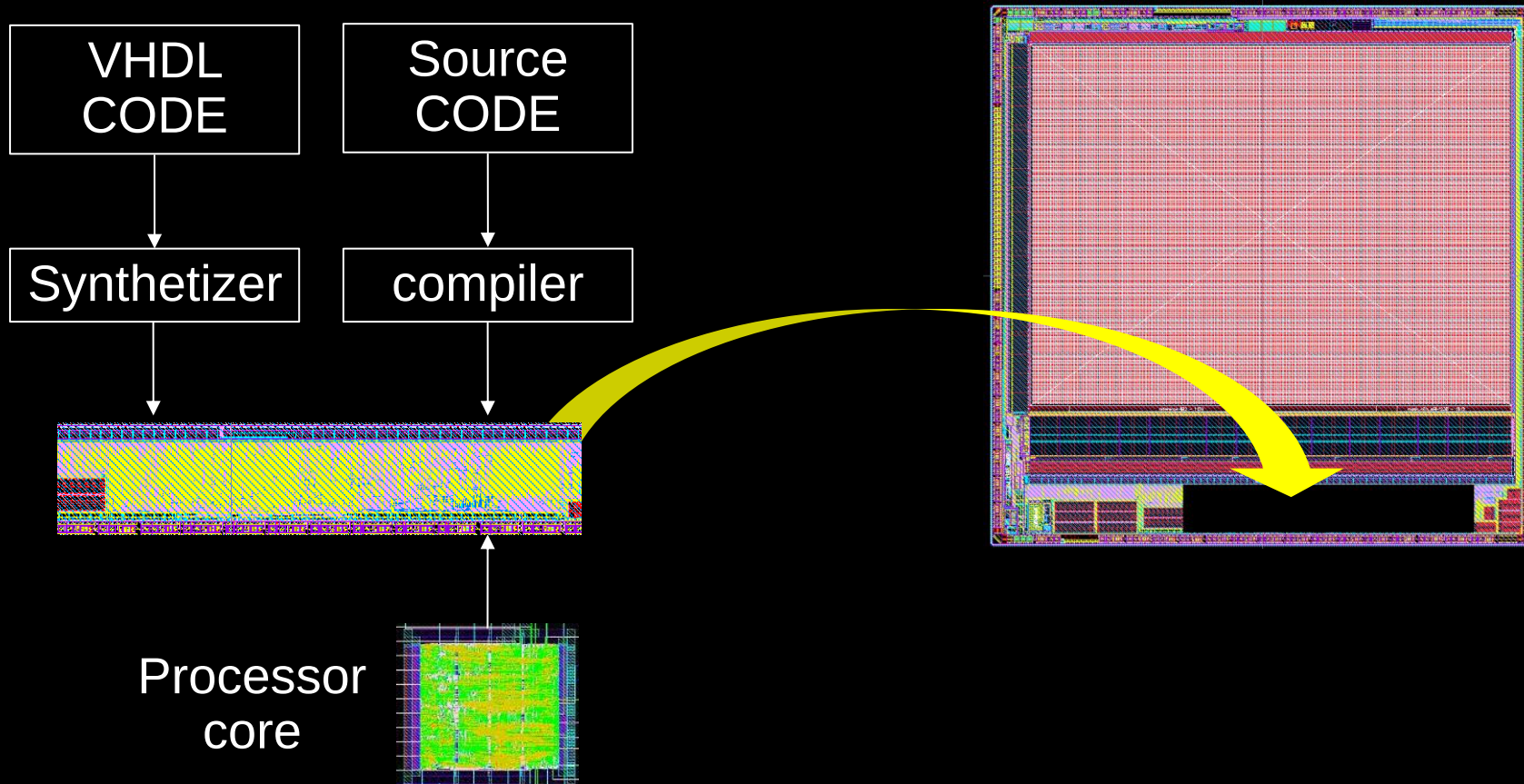
- Auto white balance (AWB)
- Auto exposure control (AEC)
- Auto gain control (AGC)
- Edge sharpness enhancement
- Lens vignetting correction
- Color interpolation
- Gamma correction
- RGB to YcrCb transformation
- Picture statistic
- Defect correction
- Automatic Black clamp/ calibration
- Row and column fixed pattern noise correction
- Stitching artifact corrections
- Binning subsampling,
- Multi ROI,
- Flip H&V and combined modes
- High dynamic range reconstruction
- Image formatting

➔ Smaller, cheaper FPGAs, smaller memories, etc...

Typically, on-chip sequencers are made using hard-coded synthesized logic:

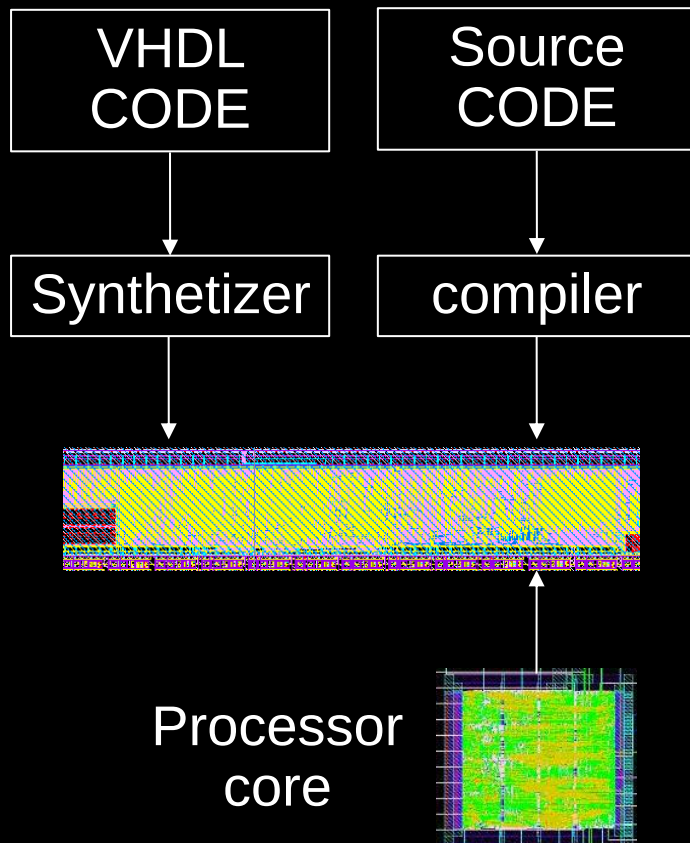


We propose a different approach: processor driven digital sequencing



We propose a different approach: processor driven digital sequencing

But Why?

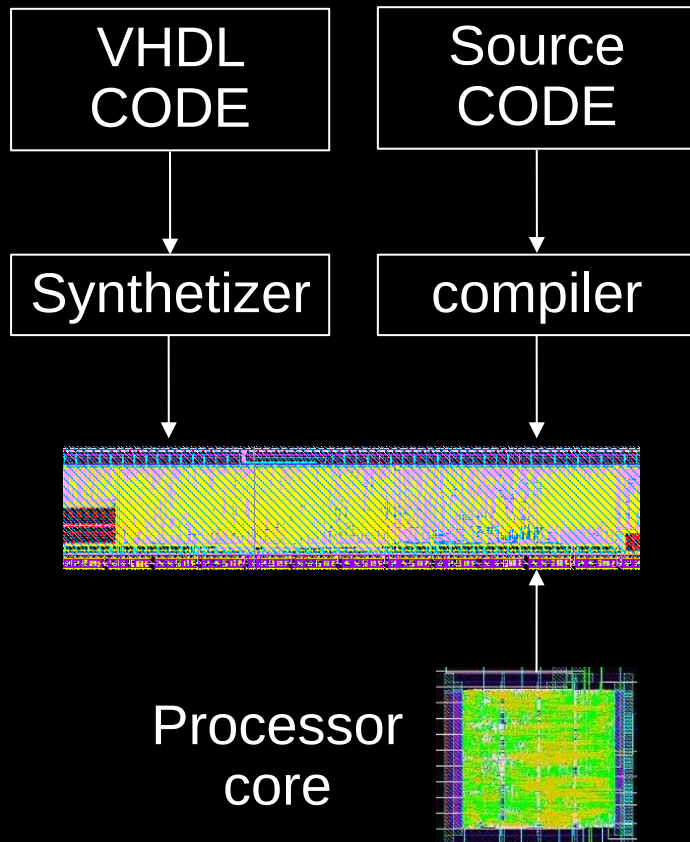


We propose a different approach: processor driven digital sequencing

But Why?

- Significant advantages for custom design:

- Great user flexibility
- Faster simulation cycles
- Easier debugging
- Easier to fix (if required)
- Easier reuse
- Overall shorter design cycles
- Lower design risks
- Take over more camera functions



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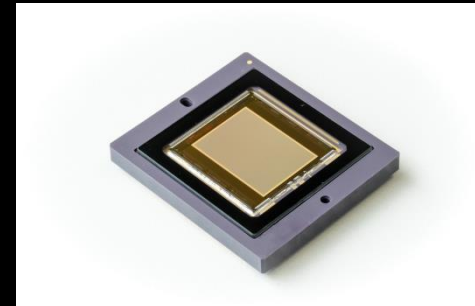
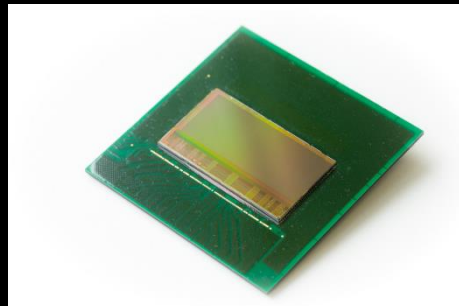
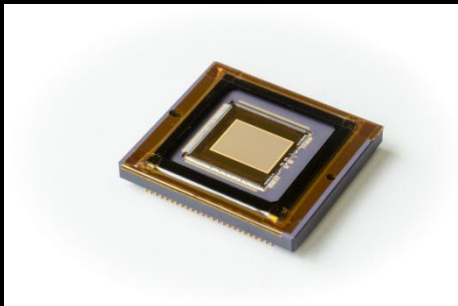
Digital integration, a path to lower total system cost



processor driven digital sequencing

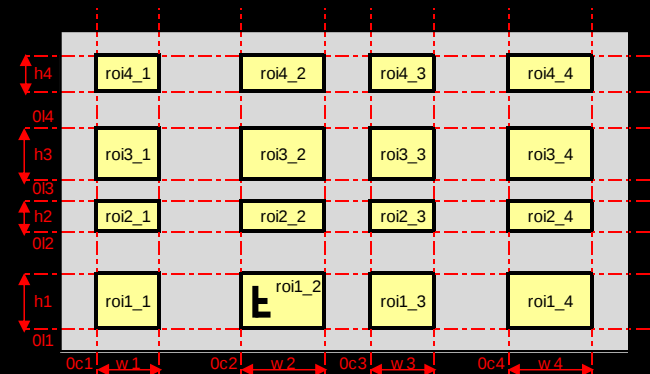
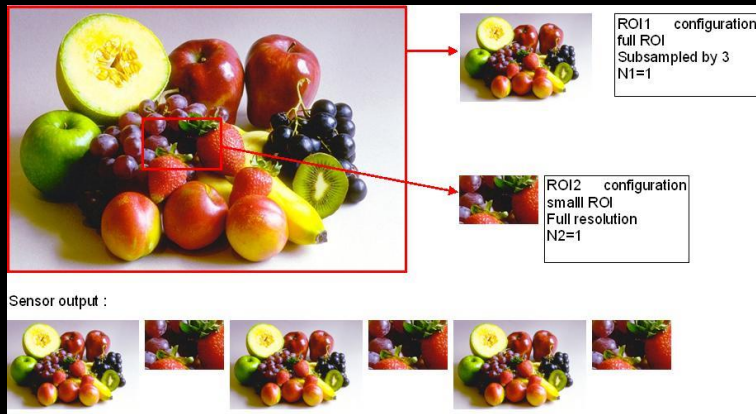
- 32bits APS on-chip for maximum flexibility:
- Windowing / subsampling
- Integration time and mode management (ERS, GS, Snapshot, RWI/Overlapp)
- Black level correction, fine digital gains, etc.

cortus



processor driven digital sequencing

- Oriented towards machine vision:



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Digital integration, a path to lower total system cost



Technology limited clock rate, but:

- Multiple cores
- Dedicated peripherals
- Application specific cores

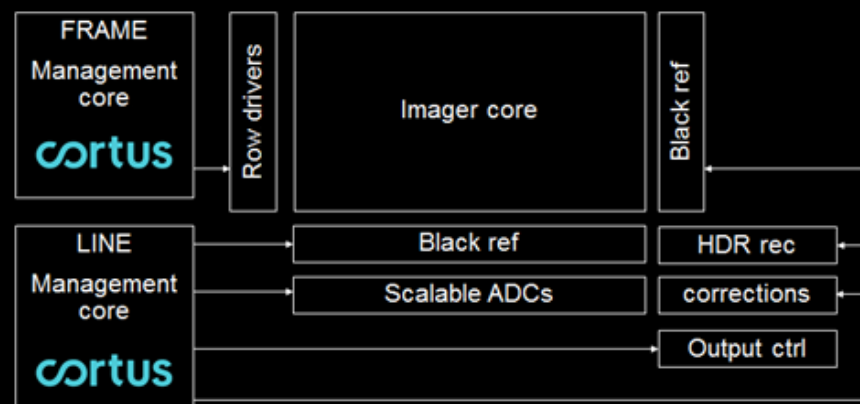
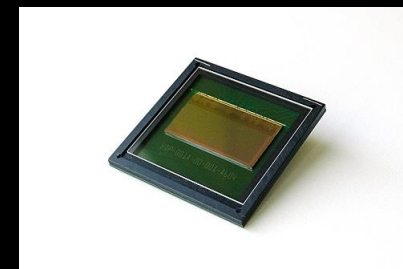
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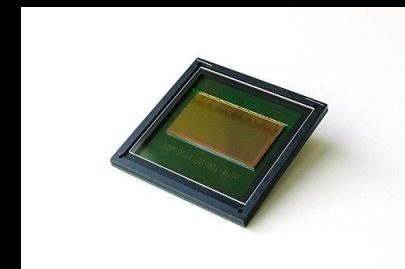
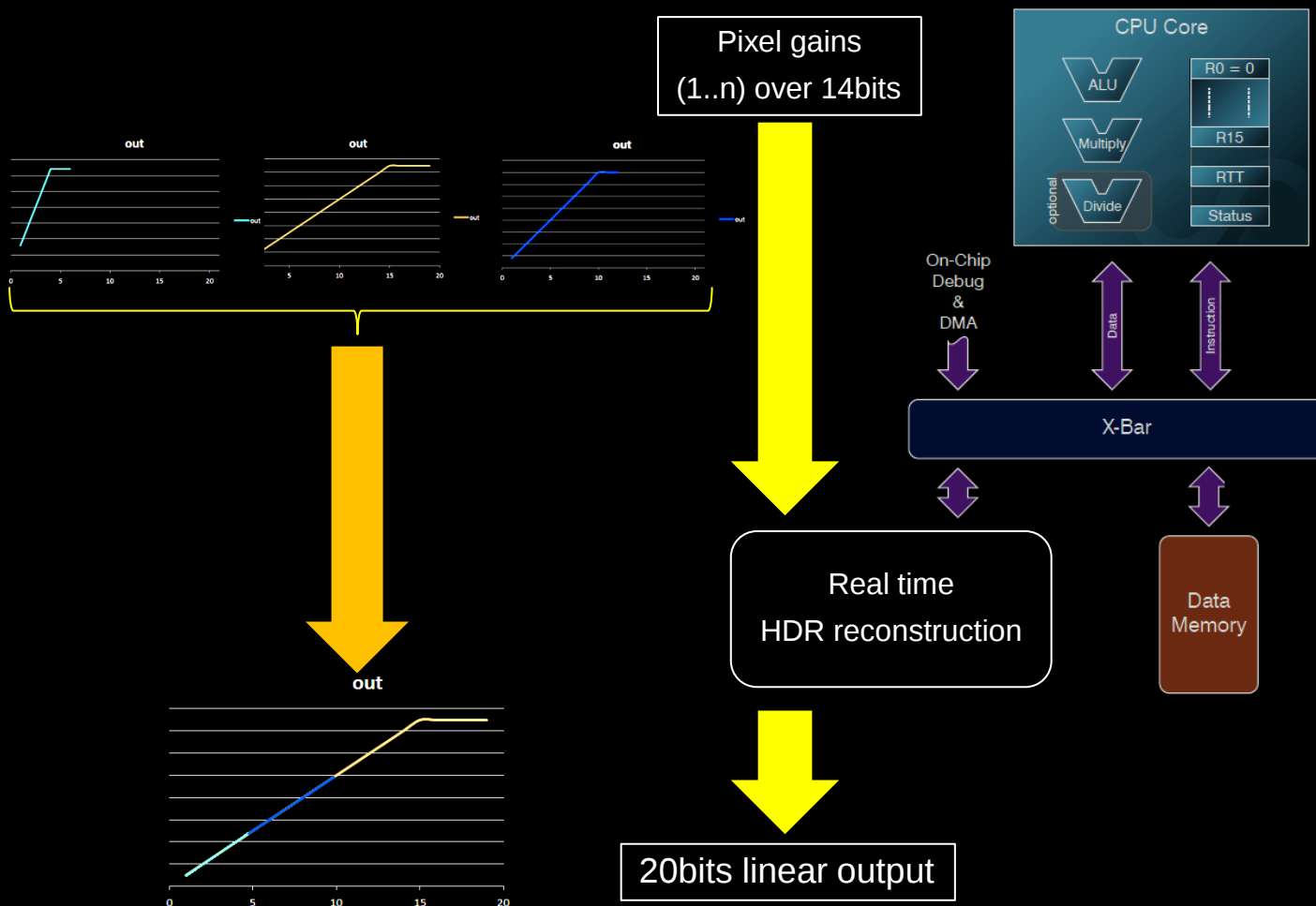


Example: Multiple cores

- To run different codes
- Branching and conditions sets by user with SPI
- ROIs, binning, subsampling, etc...

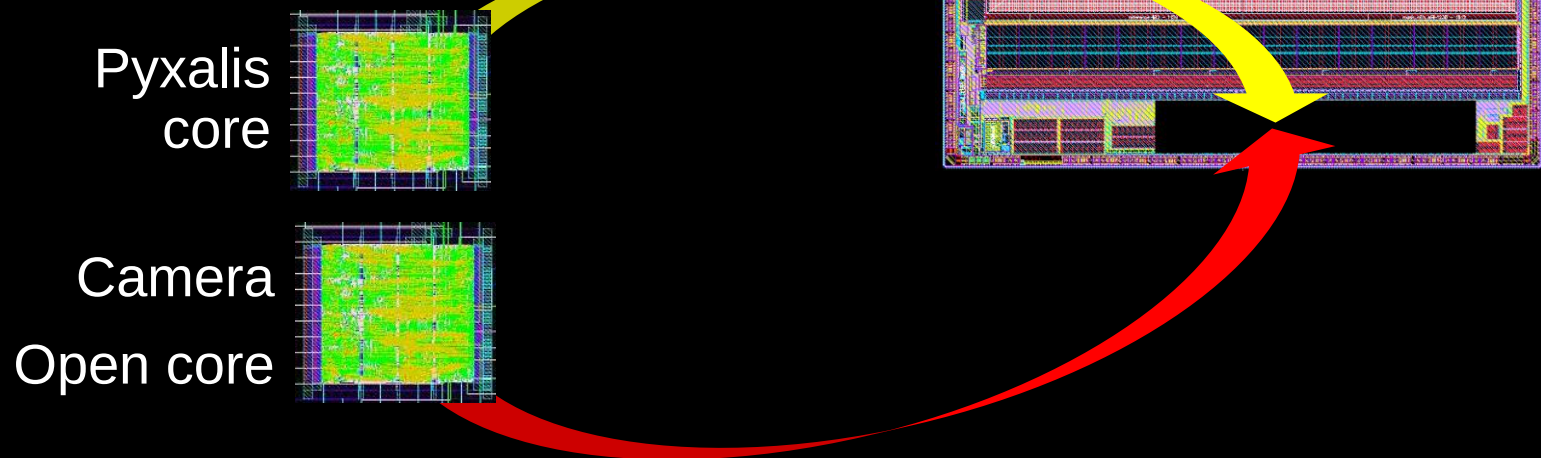


Example: Dedicated Peripherals: HDR reconstruction



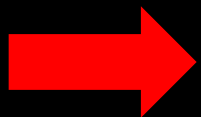
Example: in the future, application specific cores:

- Run, modify, update client specific functions
- Uploadable code (SPI, external Eeprom...)
- Allowing camera maker to add value to the camera



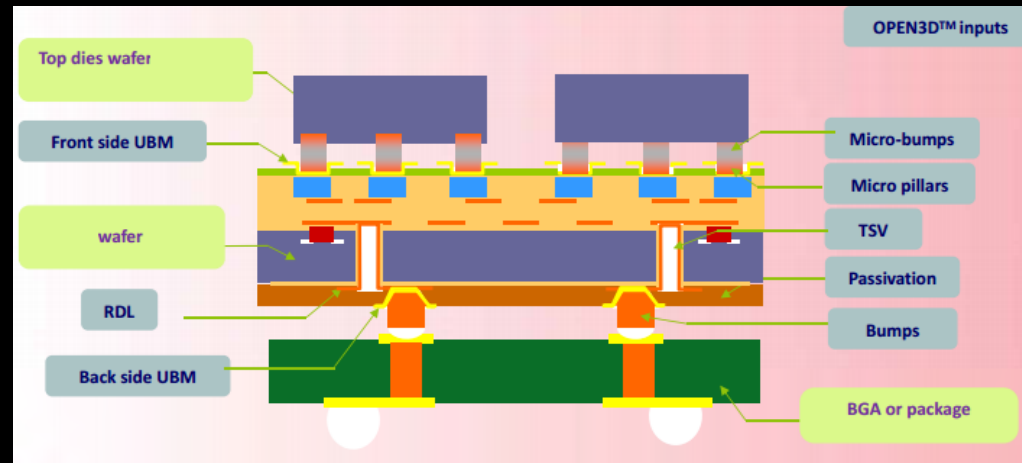
Where are the limits to this approach ?

- Imaging technology nodes are not state of the art in terms of digital performances
- Best is to combine:
 - an opto technology for the detection area
 - a digital technology node for processing



3D stacking

(Source LETI)



3D Stacking: doing it for the right reason

- Compactness ?
- Performance ?
- Cost ?
- Power ?
- Right trade-off with dual chips solution ?

Thank you!



Visit us on booth 2042 !