Semi-custom platforms and method

From niche markets to consumer applications
OUTLINE

- About Pyxalis
- Full-Custom vs Semi-custom
- Examples of available platforms
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Pyxalis CMOS Image Sensors

LAUNCH
2010
CIS design house
10 people

NEW LOCATION
2014
In Moirans, France

NOW
ISO 9001: 2015 certified
28 people (and hiring)
Several product platform available
A few words on Pyxalis

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

- Turnover: 2,8M€

- Experience: 200 man-year experience in CMOS image sensors

- Located in Grenoble, France:
  700sqm offices, state of the art design center, full EO characterization
A solid Ecosystem

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Applications

- AEROSPACE
- VIDEO SURVEILLANCE
- MACHINE VISION
- BIOMETRICS
- MEDICAL IMAGING
- MULTI/HYPER SPECTRA
- CONSUMER
- AERIAL PHOTOGRAPHY
Examples of Sensors
What makes us unique?

- Advanced TCAD simulation capabilities
- Large scale devices
What makes us unique?

- Pixel / Analog / Digital / Algoritmic design under the same roof
  
  - 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
  - Image formatting
  
  - Defect correction
  - Automatic Black clamp/ calibration
  - Row and column FPN correction
  - Stitching artifact corrections
  - Binning subsampling,
  - Multi ROI,
  - Flip H&V and combined modes
  - High dynamic range reconstruction

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What makes us unique?

- Ultra Fast Custom camera prototyping with CreaPYX

Successfully demonstrated pixels from 1.4 to 100um
Demonstrated in:

Consumer, automotive, scientific, industrial application...

...But we will come back to that
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Where to find custom product?

Worldwide sales ($M)

- **security / industrial / Defence / Space**
- **Medical**
- **Automotive / Transport**
- **Computing**
- **Consumer**
- **Mobile Handset**

Source: Yole Development

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Where to find custom product?

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Custom sensors

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Where to find custom product?

Worldwide sales ($M)

Source: Yole Development

Custom sensors

Custom sensors!
Custom product examples

- 1.75um pixel
- 65nm process
- custom design
- 100ku -> 1.5Mu /y
- mobile, tablets, etc.

- 10um pixel
- 180nm process
- custom design
- 100ku/y
- Automotive market

- 100um pixel
- 130nm process
- custom design
- 10ku/y
- Medical market

- 20um pixel
- 130nm process
- custom design
- 1 u/y
- Space application
When to go for a full-custom?

- Best way to achieve unique design, State of the Art performances
- Best way to adapt the sensor to specific camera requirements
- Creates a premium camera product
When to go for a full-custom?

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But:

- It is an investment compared to COTS sensors
- One has to accommodate the design cycle in the Time to market.
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But:

- It is an investment compared to COTS sensors
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To solve those issues:

- Pyxalis offers a Semi-custom approach
Semi-custom Sensors

- What is it?

Development of a customizable platform by Pyxlais that can be derived in multiple different productions. Sometimes for very different market.
Platform example: HDPYX

- Platform designed to be flexible and quickly modified with limited effort
Platform example: HDPYX

- Platform designed to be flexible and quickly modified with limited effort

Multispectral application
With custom filters

In use

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Platform example: HDPYX

- Platform designed to be flexible and quickly modified with limited effort

Multispectral application
With custom filters

Direct Xray
With ultra thick EPI

Q2 2017

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Platform example: HDPYX

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Q2 2017

BSI for UV enhancement

In use

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NIR optimized for Security

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- NIR optimized for Security

- Larger 5MP version for microscopy for ex

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Platform example: HDPYX

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Space born app.
First flight 2018

Multispectral application
With custom filters
In use

Direct Xray
With ultra thick EPI
Q2 2017

BSI for UV enhancement

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Custom dicing for large scanning area

Larger 5MP version for microscopy for ex

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Semi-custom platforms

Semi-custom / Platform approach is a good way to:

- Reduce risk
- Reduce initial investments
- Reduce time to market

It comes with certain limitations due to platform seed.

But still a very good way to provide a differentiation factor on camera market.
OUTLINE

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Available platforms

• Pyxalis has a wide experience in terms of pixel design size and features
• The portfolio of available designs is large, and can be adapted to various readout platforms

- 3.0 µm GS low noise (2el)
- 4-5 µm RS+GS
- 10-13 µm for TDI (CT or DS)
- 6.5 µm RS Super low noise (<0.5el)
- 1.75 µm RS BSI
- 3.0 µm HDR
- 10 µm HDR
- -10 µm RS+GS HDR
- -10 µm ToF

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HDPYX: HDR platform

<table>
<thead>
<tr>
<th>Name</th>
<th>Resolution</th>
<th>Pixel pitch</th>
<th>Dynamic/noise</th>
<th>Frame rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDPYX</td>
<td>Baseline: 3MP</td>
<td>10um</td>
<td>120dB / 2,6 e⁻</td>
<td>Up to 45 FPS @ 20bits per pixel</td>
</tr>
<tr>
<td></td>
<td>Up to 5MP</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Available customization:

- multi./hyperspectral
- NIR, UV, direct Xray sensitivity
- Custom dicing & packaging
- Compatible with LETI/Pyxalis Owly Eye pixel: 0,45e⁻ noise
## HDPYX: HDR platform

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<tr>
<td>GigaPIX</td>
<td>Variable: from 30MP to 150MP</td>
<td>~4.5µm</td>
<td>#90dB / 3 e-</td>
<td>&gt;&gt;120fps in 35mm format</td>
</tr>
</tbody>
</table>

**PROJECT TIMELINE:**
- Specification phase started
- Prototypes available in 2018

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HDPYX: HDR platform

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<tbody>
<tr>
<td>nanoPIX</td>
<td>Variable: from VGA to 8MP</td>
<td>1,75µm</td>
<td>#70dB / 3 e-</td>
<td>Up to 100fps</td>
</tr>
</tbody>
</table>

Available customization:
- GS Low noise (2 e-) with adapted pixel size
- Variable resolution
- Interface type
- Data rate
- Color scheme, incl. RGB+NIR
- …
Last but not least: CREAPYX

Using our CreaPYX platform, Pyxalis can propose a custom Demonstration CAMERA based on CUSTOM Pixel design.

With ultra short time to market: around 6-7 months.

- Delivered with complete software
- USB connection to standard PC
- DLLs to interface with other software such as Matlab / Labview.
- Fully software parametrizable

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Last but not least: CREAPYX

A very flexible customizable platform:

• Compatible with:
  • Different pixel sizes (< 1μm up to > 500μm)
  • Different architectures (3T, 4T, 5T …)
  • Shared architectures
  • Ultra low noise pixel measurement
  • Backside illumination
  • High resistivity substrate
  • Negative voltage on pixel control line
  • Large range of power supply inputs
  • HDR pixel with multiple readout
  • Bulk biasing
  • TDI operation
  • TOF pixels
  • NMOS/PMOS pixel type
  • Non destructive readout
  • Post process options
  • CCD (charge transfer) concept

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  - **HDR** pixel with multiple readout
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  - **TDI** operation
  - **TOF** pixels
  - **NMOS/PMOS** pixel type
  - Non destructive readout
  - Post process options
  - **CCD** (charge transfer) concept

Come and see it on our booth!

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Pyxalis strongly believes that semi-custom platforms are:

- A good way to enhance time to market of Full Custom products
- A possibility to significantly reduce dev. Costs
- A opportunity to access advanced technology node by aggregating volumes

Pyxalis will continue to propose regularly new semicustom platform for different type of industries so…

Tell us what you need!
Thank You!