

A scientific HDR Multi-spectral imaging platform

B. Dupont, Pyxalis, France.



CONNECT

OUTLINE

- HDPYX HDR Scientific Sensor platform
- First usage as hyperspectral device by Resolution Spectra and CSUG
- Perspectives

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A few words on Pyxalis



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

A few figures:

- Founded in: 2010
- Team: 30 people
- Experience: 200 man-year experience in CMOS image sensors



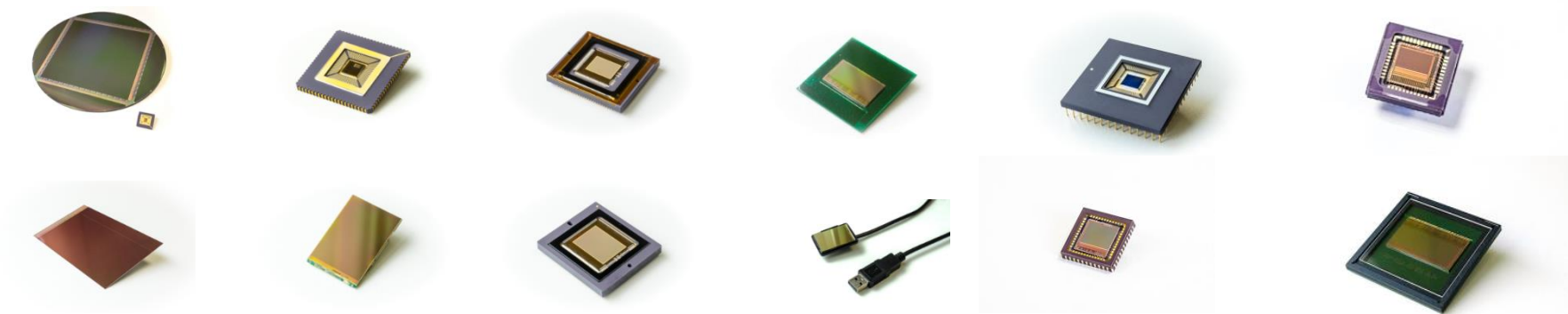
- Located in Grenoble, France:
700sqm offices, state of the art design center, full EO characterization

A few words on Pyxalis



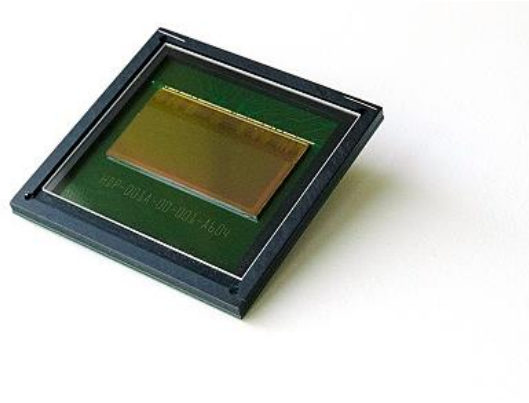
Pyxalis is a custom image sensor supplier in the field of:

- Medical
- Security
- Automotive
- Consumer
- Machine Vision
- Science
- Air and spaceborn applications



HDPYX: Sensor architecture

- A semi-custom sensor, designed as modular platform



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Space born app.

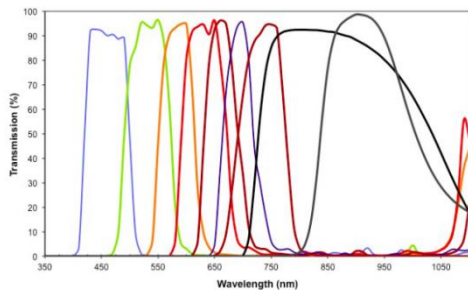
This Paper



Multi/hyperspectral
application

With custom filters

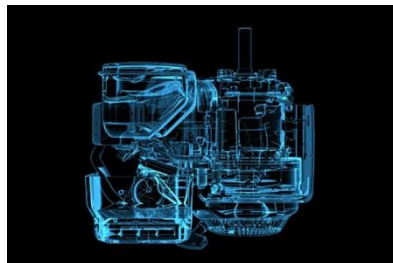
This paper



Direct Xray

With ultra thick EPI

Q2 2017



BSI for UV
enhancement

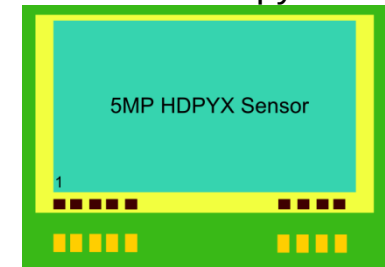
NIR optimized for
Security



Custom dicing for large
scanning area



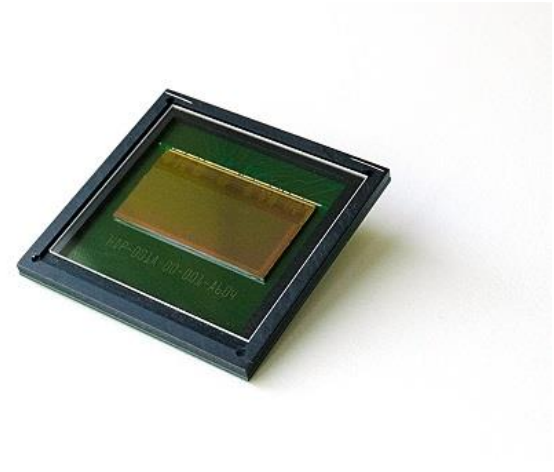
Larger 5MP version
for microscopy for ex



HDPYX: Sensor architecture

A few specifications:

- 2800x1088 actives pixels
- 10 μ m pixel pitch
- up to 100 FPS
- 20 bits per pixel parallel data
- Processor based, instrument driven operating modes:
 - Rolling shutter
 - Global shutter
 - Low noise global shutter
 - Global reset
 - Integrating while read out (RWI)
 - Triggered acquisition
 - Triggered read out

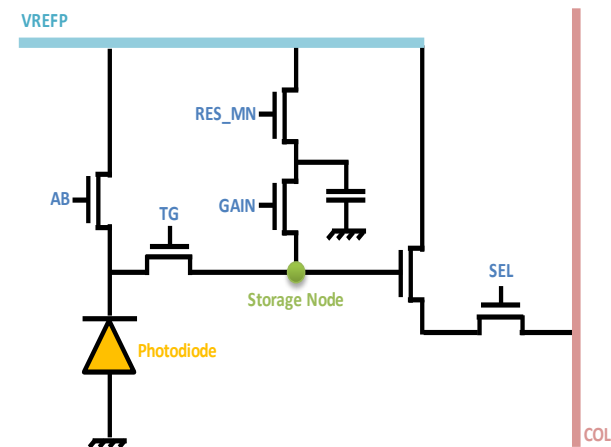


HDPYX: Sensor architecture



- Pixel design :
 - In pixel dual gain

- 6T pixel based
- Global or rolling shutter
- 2 gains in pixel

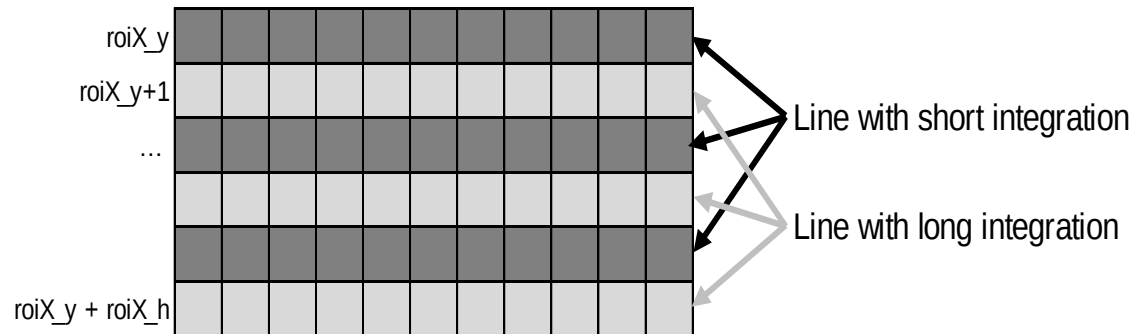


- Ensures charge conservation!
- Automatically switching gain during readout
- Single readout chain

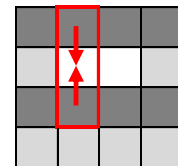
➔ 90dB linear dynamic range

HDPYX: HDR features

- Dynamic range extension:



- Exposure time is changed line by line in a single image capture
- Programmable integration time ratio
- Interpolation filter to correct saturated values
- Improves dynamic range up to 120dB

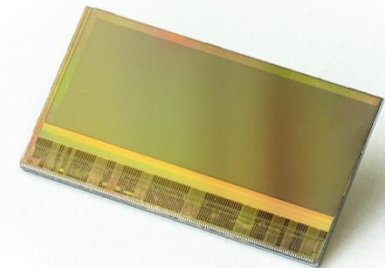


⇒ Single frame, single output, no post treatment required

Semicon 2016, Grenoble

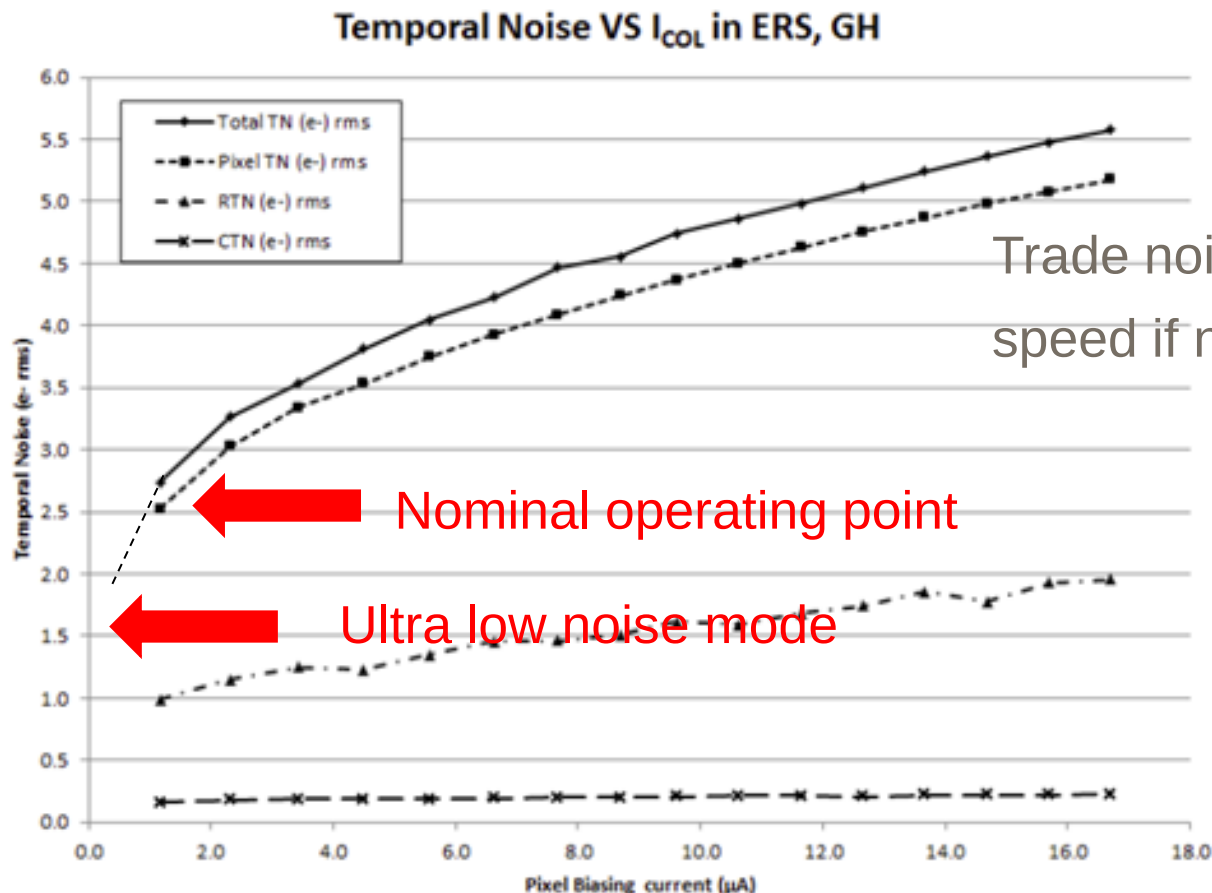
HDPYX: performances

Parameters	Low gain	High gain	Unit
Full well Capacity	85000	10500	e-
Temporal noise in darkness	25	2,6	e-rms
Conversion factor	12	125	$\mu\text{V}/\text{e-}$

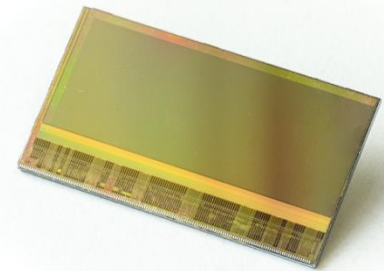


HDPYX: performances

- Noise (1/f limited at source follower) :

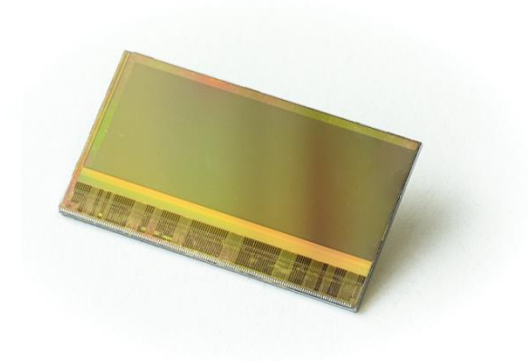
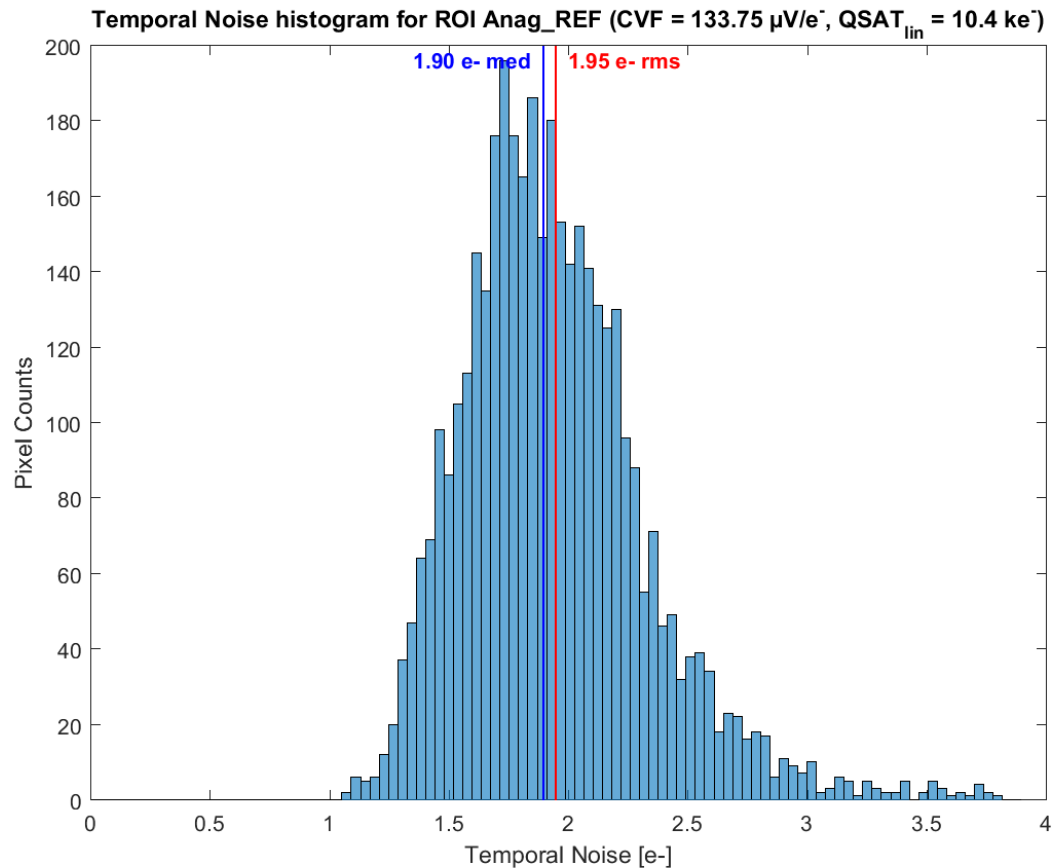


Trade noise for speed if needed



HDPYX: performances

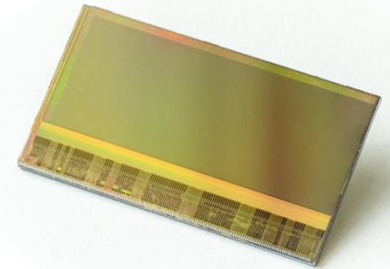
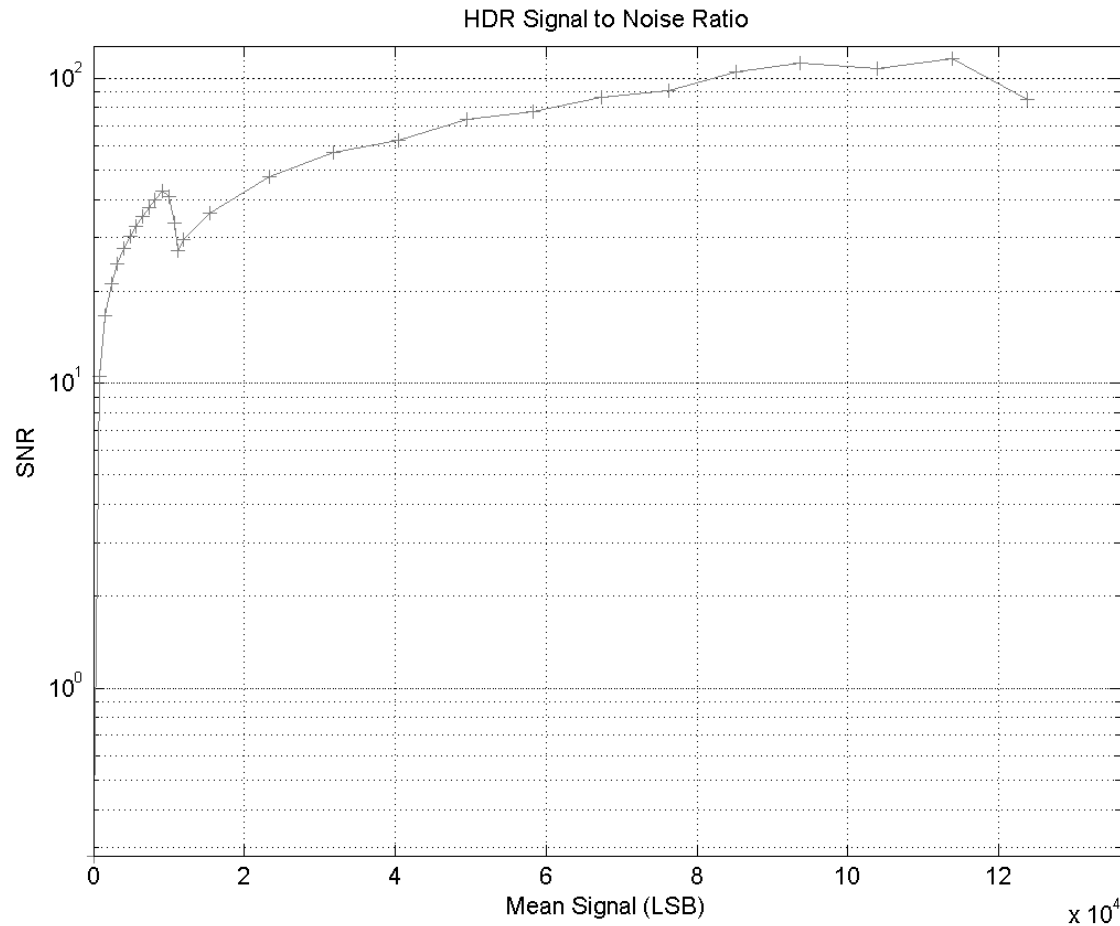
- Specific Ultra Low noise operating mode :



HDPYX: performances

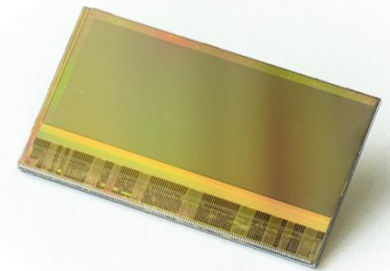
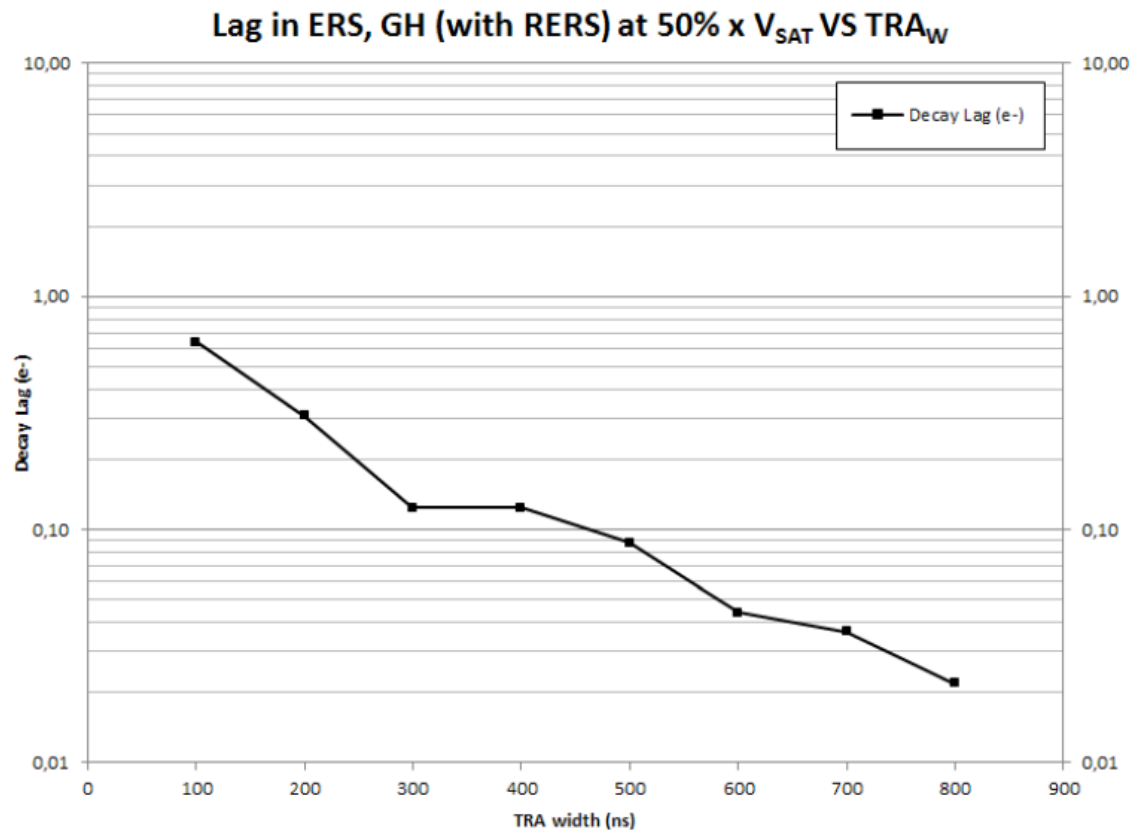


- SNR over single tinT: shot noise limited



HDPYX: performances

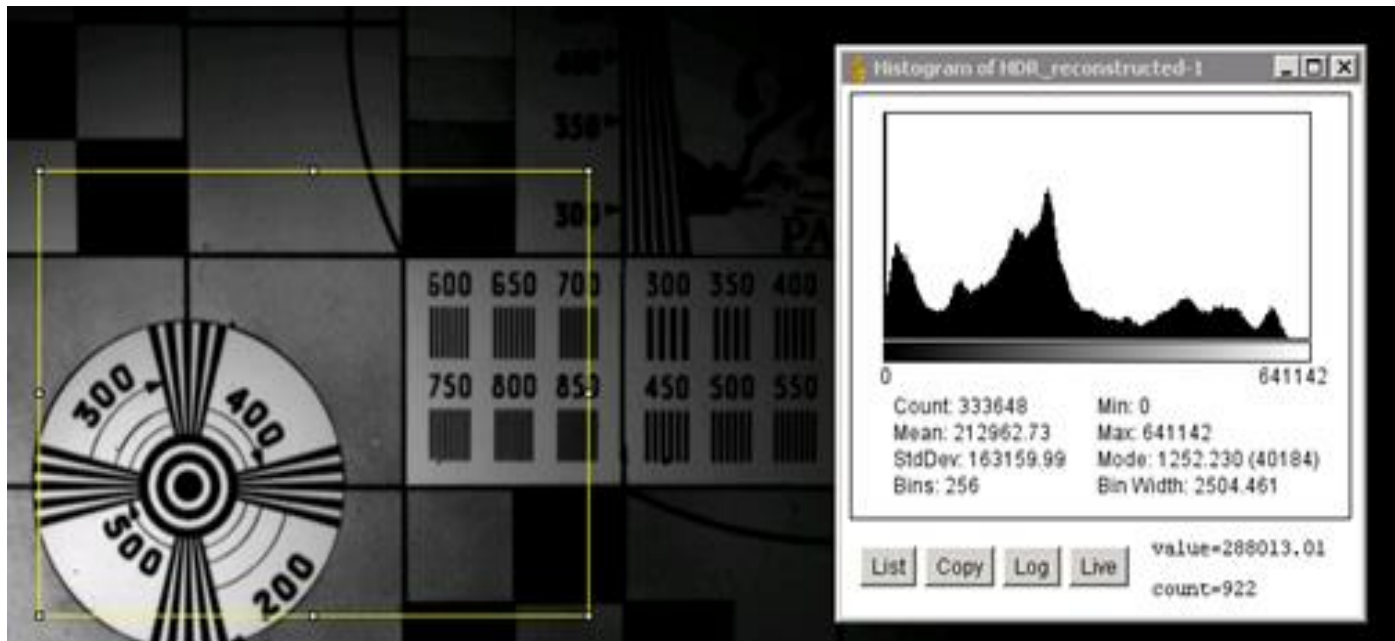
- Image lag : below 1 e⁻



HDPYX: HDR images



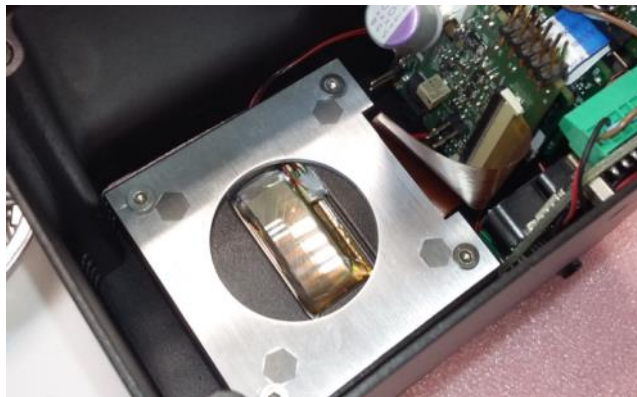
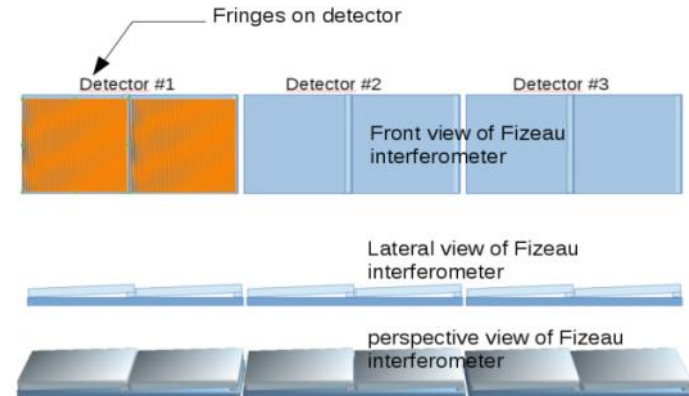
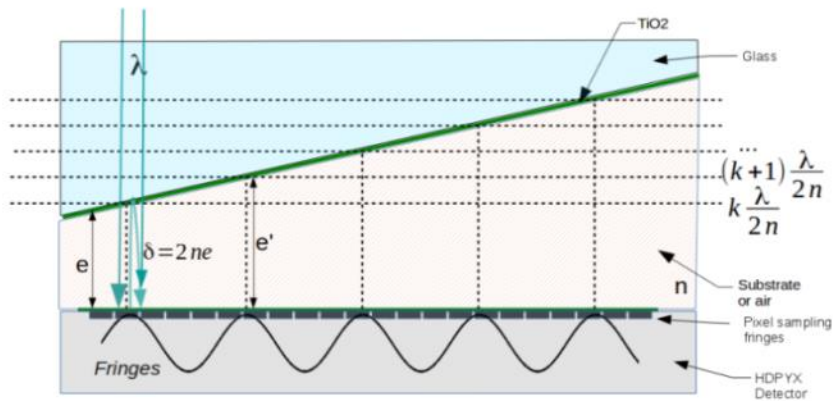
← Using only low gain



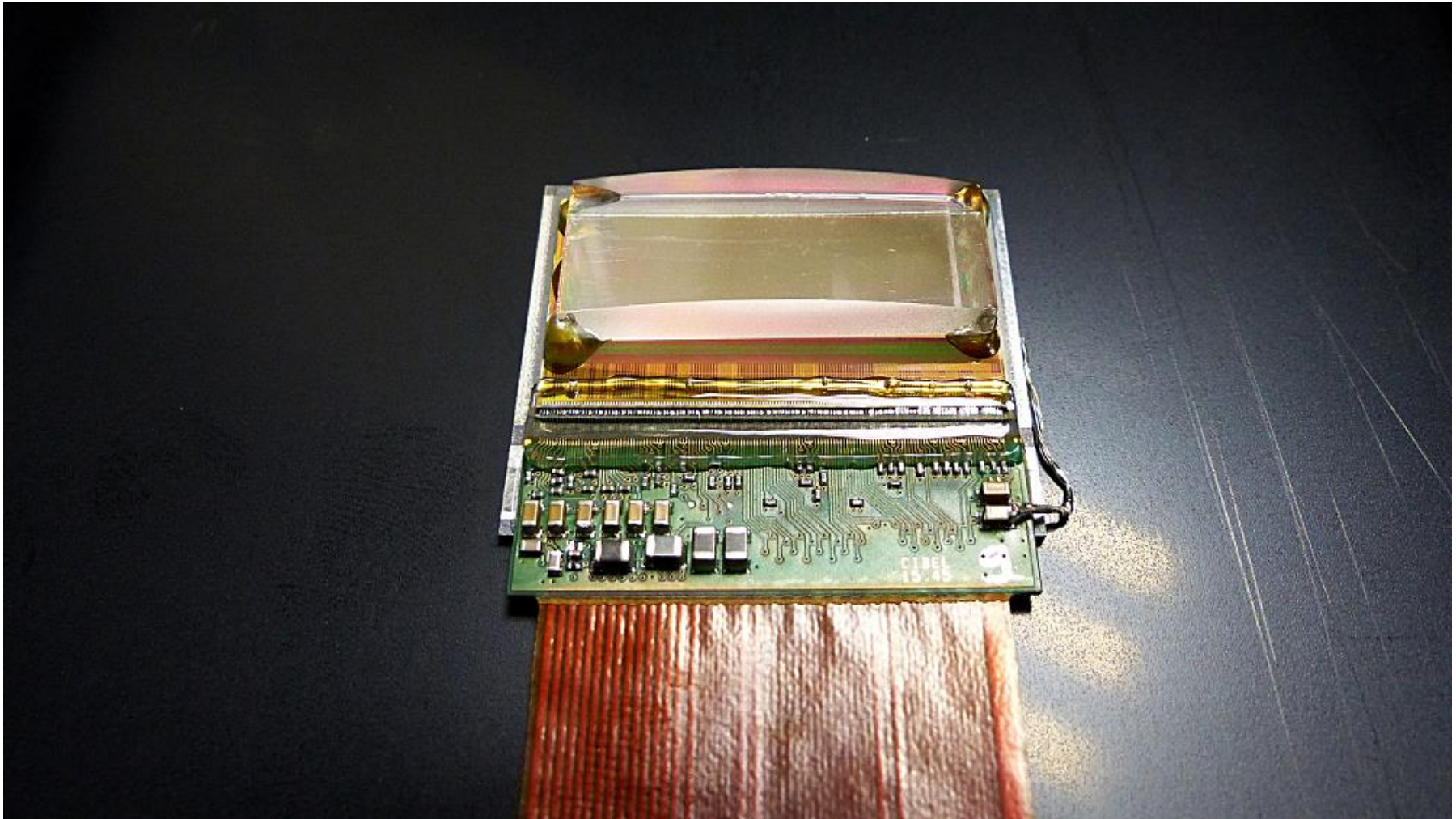
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Instrument design



Sensor Module



First products

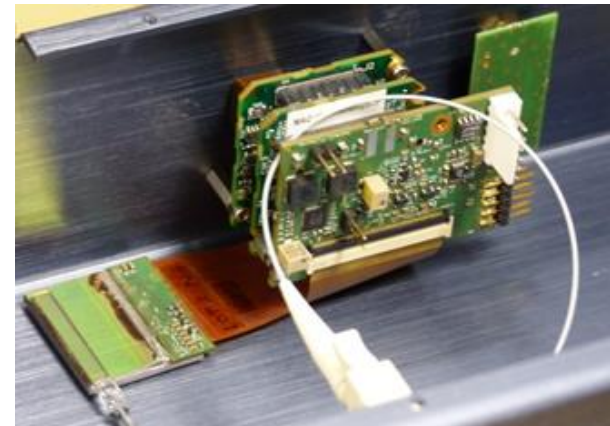
SWIFTS-LA



high-throughput high-resolution spectroscopy:

Raman spectroscopy for process control,
gas detection, hyperspectral imaging

ANAgRAM SWIFTS



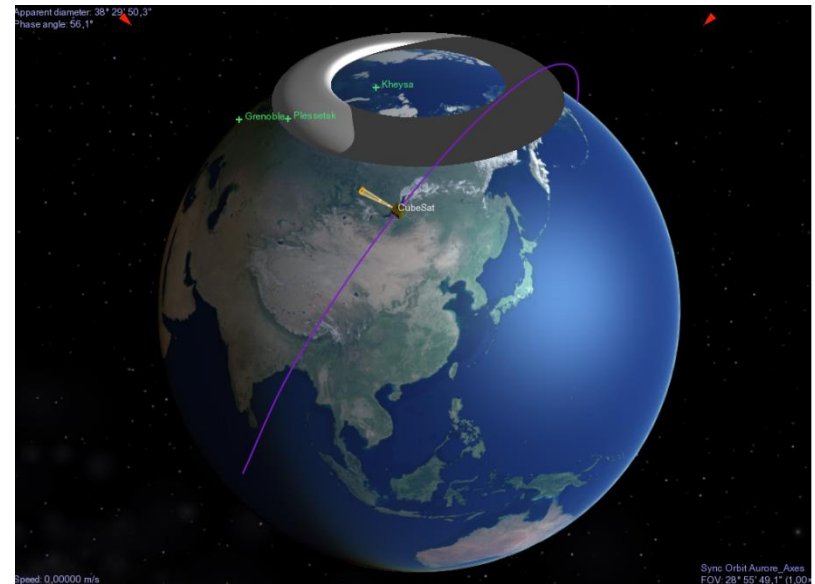
Ultra High-resolution spectroscopy:
typically 0.01 nm over 300 nm range
laser characterization

First Space mission

- ATISE:

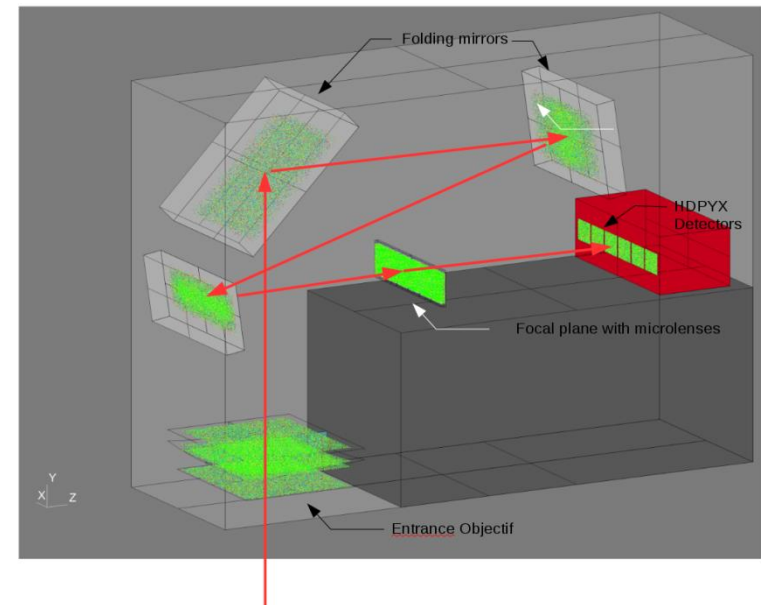
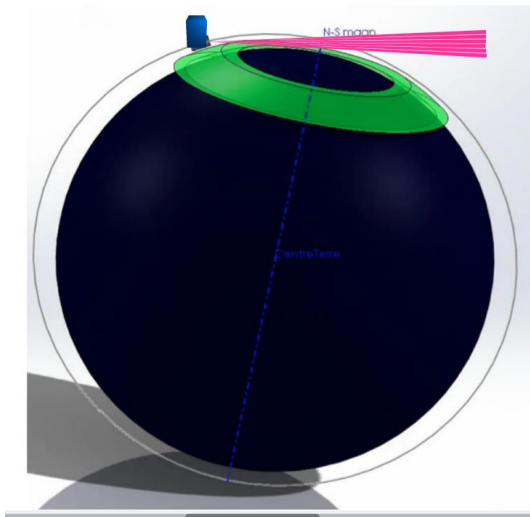
Auroral Thermospheric and Ionospheric Spectrometer Experiment

- Spectral analysis of the Auroral emissions
- Space weather
- In the visible light
- Prior Art:
Arizona Airglow GLO
experiment in UV range



ATISE Instrument

- 6U nanosat
- Instrument using 3 HDPYX with 6 Fizeau interferometer
- 6° by $1,5^\circ$ FOV
- In the visible range: 380 nm to 900 nm
- Using 3 HDPYX detectors



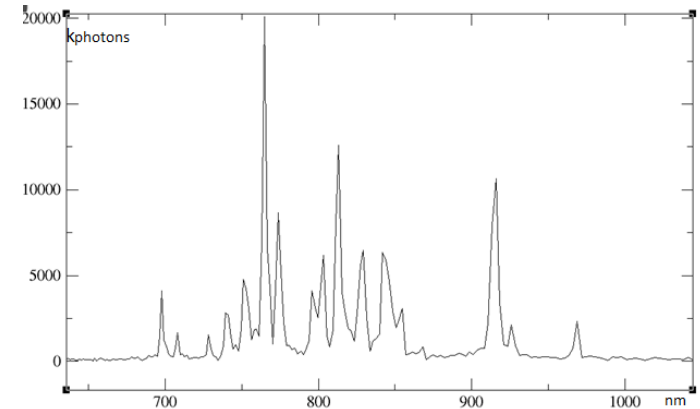
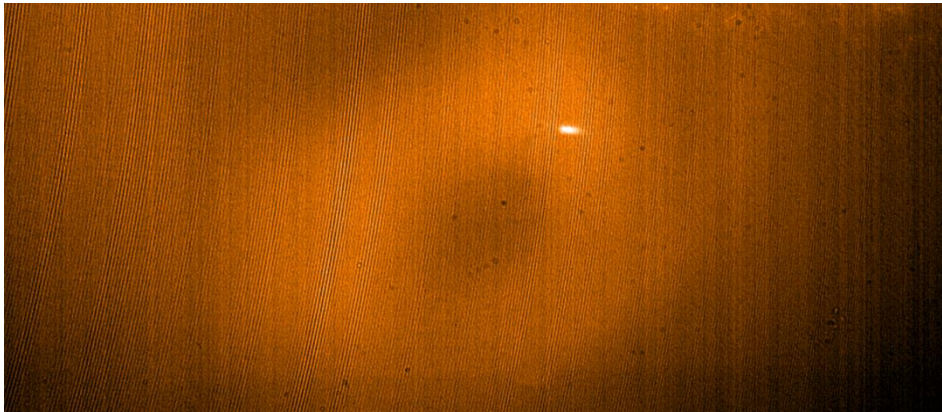
ATISE Instrument



- First results using Argon plasma signature

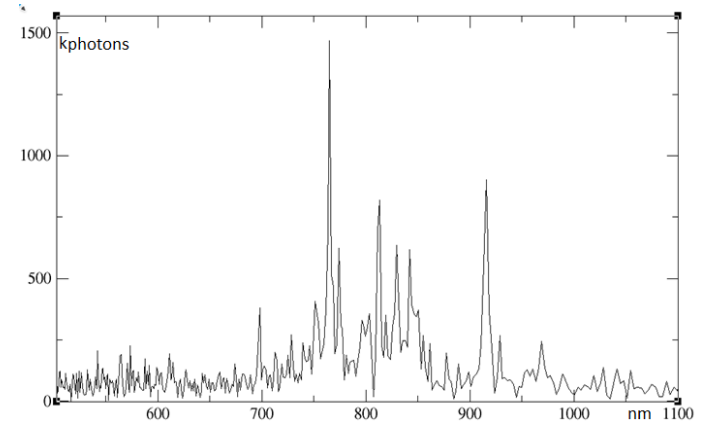
ATISE Instrument

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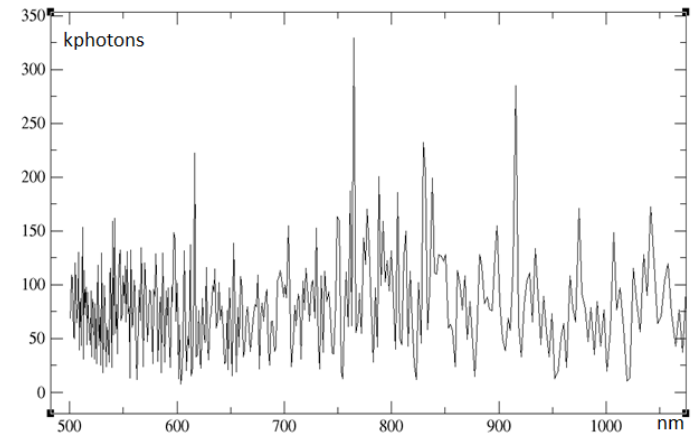
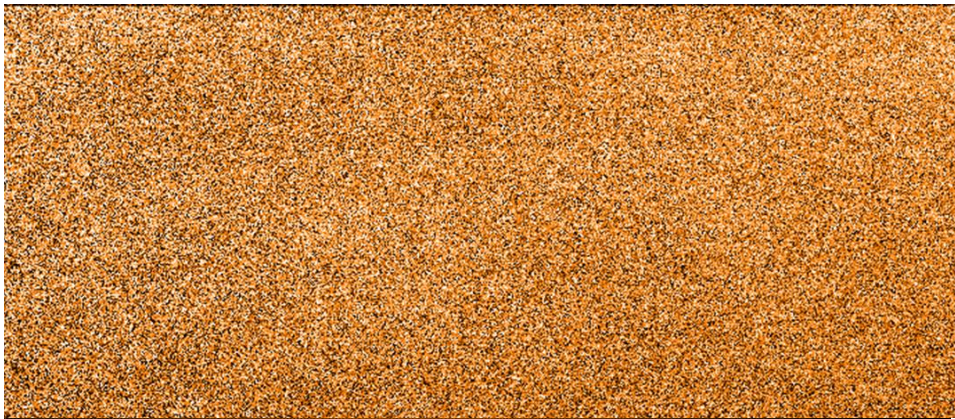
ATISE Instrument

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ATISE Instrument

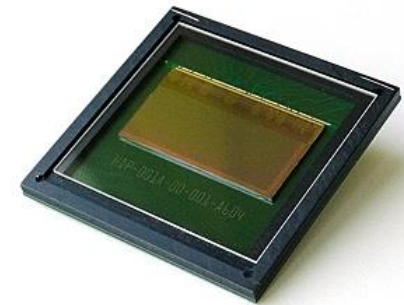
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- the instrument concept is valid and that sensor is suitable for production
- Sensor will be deployed in hyperspectral/multispectral systems
- From space applications:
 - Other missions with Cube sats are under discussions
- New variations around the detector for UV/NIR, Xray are under consideration



Thank you !
Come visit us on booth 1308 !

