FOR IMMEDIATE RELEASE:

X-ray for medical, veterinary, industrial & security applications: new technologies reach the commercialization phase

LYON, France – July 9, 2019: “The X-ray detector market reached US$2 billion in 2018 driven by the medical segment,” announces Marjorie Villien, PhD. Technology & Market Analyst at Yole Développement (Yole). “The medical sector accounts for 75% of the global X-ray market, but the industrial and security market are step by step gaining share.”

With its new report, X-Ray Detectors for Medical, Industrial and Security Applications, the Life Sciences & Healthcare team from Yole, proposes a comprehensive overview of the X-ray technologies and related applications. This report provides a detailed overview of the X-ray imaging markets and technical landscapes at system and detector levels. Including accurate market data and forecasts, along with market share by application and by technology (aSi, aSe, CCD, CMOS, photodiodes, IGZO1) at the detector level. This x-ray report points out the business opportunities by presenting the different technologies, alternatives coming to market in the next few years and the possible new technologies currently in R&D.

Yole has followed the medical imaging market for years. With this new technology & market report, Yole’s analysts investigate today the veterinary, industrial, and security markets and offer you today a valuable picture of the X-ray world.

Today X-ray technology is gaining traction in the fields of industrial NDT2 and security.

The X-ray market was worth US$19 billion in 2018 at the system level. The medical market is by far the biggest, with US$16 billion revenues

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1 IGZO: Indium Gallium Zinc Oxide
2 NDT: Non-Destructive Testing
in 2018. The medical and dental segments are trusted by a few major players including Siemens, Philips, GE, and Canon. But smaller players with specific offers are gaining market share in areas like mammography, dental, and surgery.

In parallel, the security X-ray market is consolidated, with a few key players holding around 60% of overall market share in 2018. These players include OSI Systems, Smiths Detection, L3 Security & Detection Systems, and Analogic Corporation, along with Safeway System and Nuctech in China.

At the end, the industrial segment is split into many applications with very different needs and specifications. This explains the high number of small companies in this segment, compared to the medical segment where the main products are in the hands of 4 - 5 core players.

At the detector level, the X-ray market was worth US$2.0 billion in 2018 and is expected to grow with a 5.9% CAGR between 2018 and 2024 to reach US $2.8 billion in 2024.

“Today, X-ray imaging is almost exclusively based on solid-state sensors. Flat panel detectors using aSi and CMOS represent the biggest share of the market, being worth US$1.3 billion in 2018”, comments Jérôme Mouly, Senior Technology & Market Analyst and Business Developer at Yole. “They were followed by silicon photodiode array detectors, which were worth US$500 million in 2018. At Yole we expect IGZO flat panels to make a big entry into the market as soon as 2021 and to reach US$236 million in 2024.”

IGZO is directly competing with aSi and CMOS, but CMOS is still the reference technology for applications needing high resolution. However, the price erosion is slow with CMOS because the number of systems sold is still low in the X-ray field and the size of the flat panels is large.

“The only reason for price erosion is the competition with aSi,” explains Marjorie Villien from Yole. “That explains why the price difference between CMOS and aSi is decreasing, especially for smaller panels.”

Commercialization of IGZO flat panels for X-ray imaging began this year with Rayence, iRay and Varex presenting IGZO based products. Yole is expecting a rapid ramp-up of IGZO integration in new products as the technology is ready and the supply chain is almost ready too.

\[^3\text{aSi : amorphous Silicon}\]
Imaging system manufacturers are eager to use this new technology because it offers better image quality at an affordable cost. However, ramp-up will depend on how rapidly the technology is integrated into new products.

“Another very interesting development is single photon counting for spectral imaging,” adds Jérôme Mouly from Yole. “With the acquisition of MultiX by Detection Technology and with Varex buying Direct Conversion AB, photon counting is no longer just a promising technology. It will soon be available in products from the biggest detector manufacturers. System manufacturers’ interest in single photon counting and spectral imaging is focused on discrimination of materials in security and industrial applications and use of targeted contrast agents in medical applications.”

Yole is also seeing a growing trend towards 3D imaging that translates into more CT being sold into various medical, security and industrial applications.

X-ray line scan cameras are mainly used in industrial and security applications. The next trend in this field is the use of TDI cameras to enhance image quality. TDI cameras are already used for food sorting applications and non-destructive testing of microelectronics.

AI will be the next megatrend to follow in the field of imaging. This is especially true in X-ray, as spectral imaging requires processing of massive amounts of data.

A detailed description of the X-ray report as well as related reports such as Machine Vision for Industry and Automation, is available on i-micronews.com. Therefore, X-ray technologies for machine vision have been also deeply analyzed by Yole’s analysts.

“There is a silent revolution going on in factories,” comments Alexis Debray, PhD Technology & Market Analyst at Yole and author of the machine vision report. “The transformative forces we are facing are similar to what happened during the previous industrial revolutions. But this transformation isn’t about steam or electricity. Today’s trend is autonomous and on-demand processes, for humans and machines alike. Inside factories the transformation is about automation.”

Make sure to get a deep understanding of current and emerging X-ray-based solutions and discover right now the related technology & market reports from Yole on i-micronews.com.
ABOUT THE REPORT

**X-Ray Detectors for Medical, Industrial and Security Applications**

New technologies are finally arriving in the X-ray market and reshuffling the pack of players. – Performed by Yole Développement

Companies cited in this report:

About the authors:
- **As a Technology & Market Analyst, Medical Imaging & Biophotonics**, Marjorie Villien, PhD is member of the Life Sciences & Healthcare division at Yole Développement. She is a daily contributor to the development of medical technologies activities with a dedicated collection of market & technology reports as well as custom consulting projects. As an example, Marjorie was involved in a project focused on videoscopy for endoscopy application, to understand the benefits of the CCD/CMOS solution and identify business opportunities. In parallel, she performed an analysis of the PET detectors technology to evaluate the impact of innovative Solid-State technologies on the evolution of the nuclear medicine industry. After spending two years at Harvard, Marjorie served as a research scientist at INSERM in the field of medical imaging for the treatment of Alzheimer’s disease, stroke and cancers. She has spoken in numerous international conferences and has authored or co-authored 11 papers and 1 patent. Marjorie is daily exchanging with clinicians, researchers and industrial partners to understand technology issues and ensure the connection between R&D and applications. Marjorie Villien graduated from Grenoble INP and holds a PhD in physics & medical imaging.
- **Jérôme Mouly** serves as a Senior Technology & Market Analyst & Business Developer specialized in microtechnologies for inkjet & bioMEMS sensors at Yole Développement (Yole). Jérôme is supporting the development of strategic projects, following leading customers of the company, within the Life Sciences & Healthcare division. Since 2000, he is also engaged in more than 100 marketing and technological analyses for industrial groups, start-ups and institutes related to semiconductor & medical technologies industry, in the field of inkjet functional printing, wearable sensors and connected medical devices. Jérôme is also regularly involved in international conferences, giving presentations and delivering keynotes. Jérôme Mouly holds a Master of Physics from the University of Lyon (France).

Related reports:
- **Machine Vision for Industry and Automation 2018**
  Machine vision is at the heart of the automation revolution.
- **Status of the CMOS Image Sensor Industry 2018**
  Proliferation of cameras for imaging and sensing is driving CMOS image sensor (CIS) growth.
- **Ultrasound Sensing Technologies for Medical, Industrial and Consumer Applications 2018**
  New applications along with manufacturing capabilities and technological readiness are driving the takeoff of micro-machined ultrasonic transducers.
ABOUT YOLE DEVELOPPEMENT

Founded in 1998, Yole Développement has grown to become a group of companies providing marketing, technology and strategy consulting, media and corporate finance services, reverse engineering and reverse costing services and well as IP and patent analysis. With a strong focus on emerging applications using silicon and/or micro manufacturing, the Yole group of companies has expanded to include more than 80 collaborators worldwide covering MEMS and image sensors, Compound Semiconductors, RF Electronics, Solid-state lighting, Displays, software, Optoelectronics, Microfluidics & Medical, Advanced Packaging, Manufacturing, Nanomaterials, Power Electronics, Batteries & Energy Management and Memory.

The “More than Moore” market research, technology and strategy consulting company Yole Développement, along with its partners System Plus Consulting, PISEO and KnowMade, support industrial companies, investors and R&D organizations worldwide to help them understand markets and follow technology trends to grow their business.

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