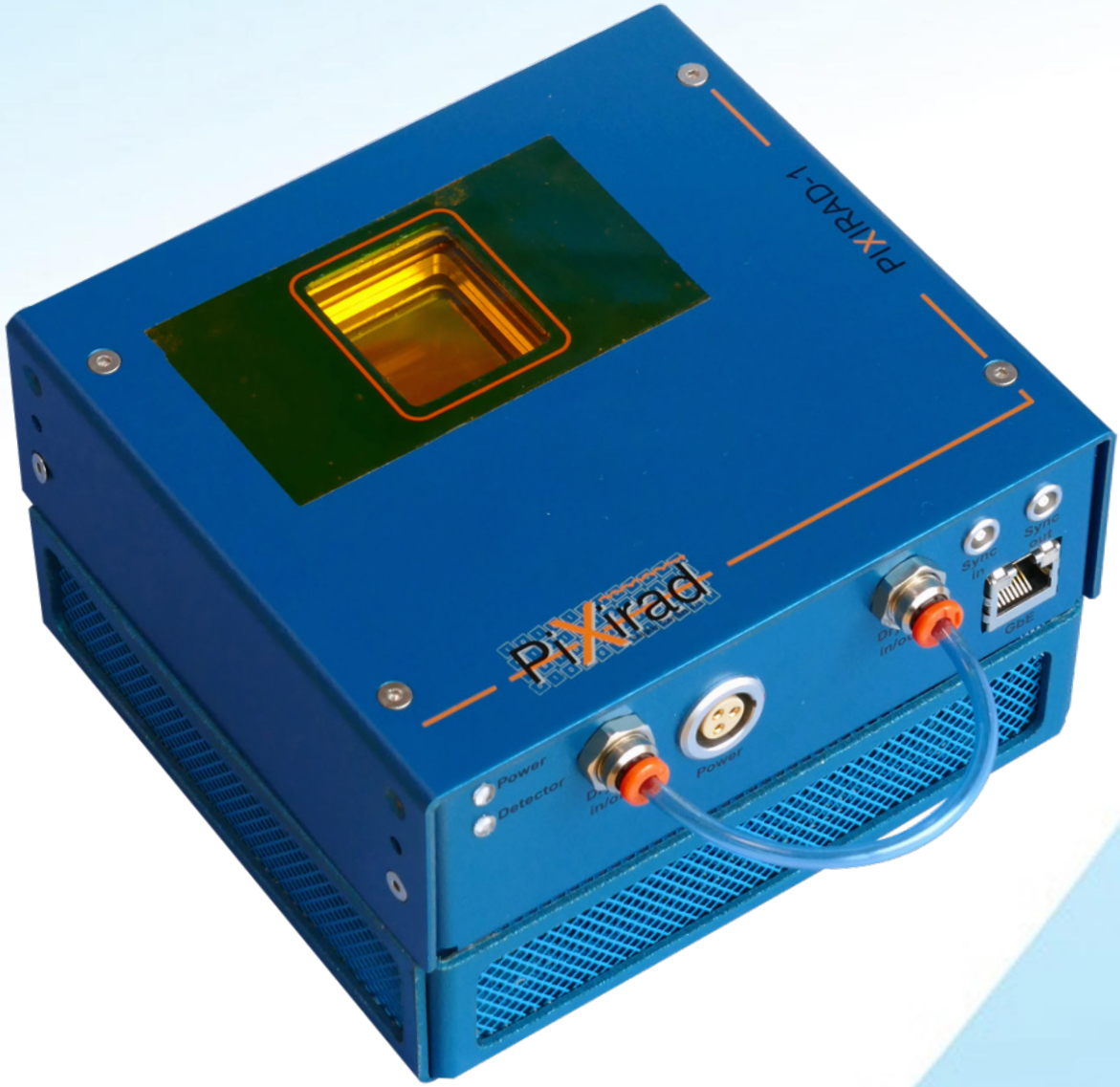
PiXirad
Imaging Counters s.r.l.
INFN Spin-off

CdTe2次元X線検出器



Chromatic Photon Counting

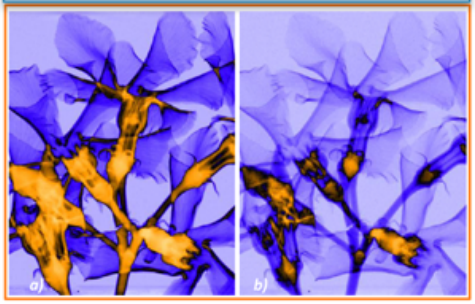
EMF
EMFジャパン株式会社

Pixirad-1 System

The **Pixirad-1 System** is the first commercial product of Pixirad Imaging Counters s.r.l.

The core of the X-ray imaging system is a new detector, based on chromatic photon counting, that has been realized coupling a pixelated large area ASIC, known as **Pixie-II**, to a matching pixelated sensor by flip-chip bonding technique. The Pixirad-1 System is able to deliver extremely clear and highly detailed images for medical, biological, industrial and scientific applications. .

Low Energy Sensitivity



Images of a very low contrast object, taken with

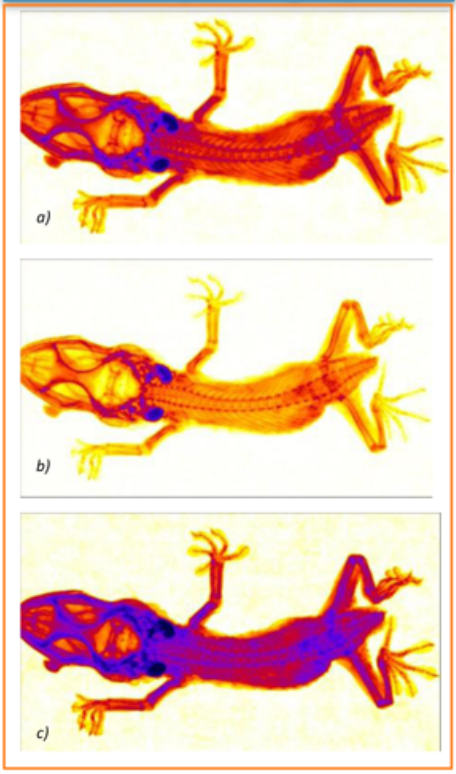
a) *200 electrons global threshold corresponding to 1 keV (LOW counter, all photons)*

b) at 6 keV threshold (1200 electrons). This image was taken in a single shot together with the previous one at 1 keV threshold

Due to its architecture the **Pixie-II** ASIC is able to count incident X-ray photons according to their energy in order to produce two 'color' images from a single exposure.

Chromatic Photon Counting

Three 'colors' from a single exposure



Images of a small dry animal obtained simultaneously by :
a) counting the X-ray photons with a low energy threshold (LOW COUNTER, all photons); b) counting the X-ray photons with an higher threshold (HIGH COUNTER, high energy photons); c) subtracting the previous pictures one from another (low energy photons)

Pixirad-1 Detector Module options

ASIC[1]:

- **Pixie-II read-out ASIC, 60 µm hexagonal arrangement**

Sensors:

- **650 µm thick CdTe crystal Schottky type**
- **750 µm thick CdTe crystal Ohmic type**
- **500 µm thick GaAs crystal**

[1] The Pixirad-1 Detector Module Unit is ready to use the new Pixie-III ASIC

Sensor specs:	CdTe, 650 µm, 31 x 25 mm² Schottky type diode Electron collection at pixel
Pixie-II ASIC + CdTe base block	512 x 476 pixels
Number of detector blocks	1
Global active area	31 x 25 mm²
Total number of pixels	243712
Total number of counters	487424
Pixel size	60 µm hexagonal arrangement
Pixel density	323 pixels/mm², equivalent to 55 µm on square arrangement
Pixel rate capability	10^6 counts/pixel/s (after dead-time correction)
Global rate capability	2.4 x 10^{11} counts/s
Pixel dead-time	300 ns
Position resolution	11 line pairs/mm at MTF 50%
Reading while taking data	Possible
Energy range	1-100 keV
Detection efficiency @10 keV, 25keV,50 keV	100%, 100%, 98%
Counters depth	15 bits
Read-out time@50 MHz clock	5ms/counter
Frame rate	160 readouts/s
Minimum applicable global threshold	200 electrons
Sensor bias voltage	200 ÷ 400 V
Leakage current density	5 nA/cm² at 400 V, -20°C
Typical number of defective pixels	a few per mil (typical)
Number of independent thresholds (colors)	2 set of two (swappable in real time)

Pixirad Imaging Counters srl
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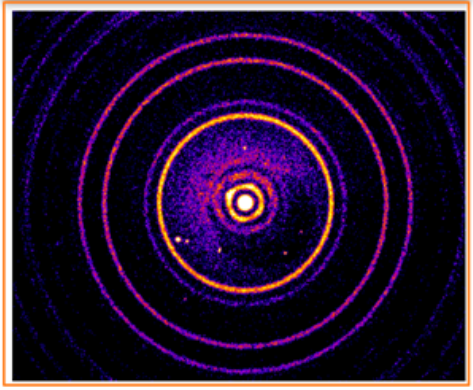
Pixirad-2 System

The new commercial product of Pixirad Imaging Counters s.r.l.

The **Pixirad-2** Detector Module Unit has 2 detector blocks (based on the **Pixie-II** ASIC) in a 2x1 pattern, with a global active area of 62 x 25 mm^2.

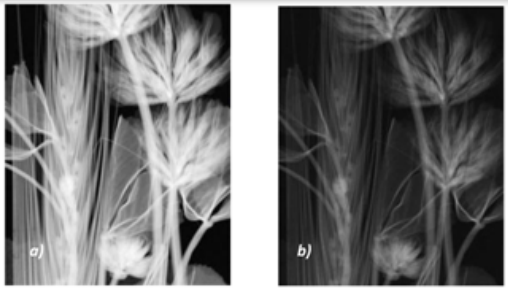
The Pixirad-2 System is able to deliver extremely clear and highly detailed images for medical, biological, industrial and scientific applications.

X-ray Diffraction



Attenuated Beam and diffraction rings from a Ce02 powder (obtained at the Cornell Synchrotron on a 40 keV beam line)

Ohmic CdTe: Low Energy Sensitivity



Images of a very low contrast object, taken: a) at 1 keV threshold (200 electrons, LOW counter, all photons); b) at 6 keV threshold (1200 electrons) in a single shot

Pixirad-2 Detector Module options

ASIC[1]:

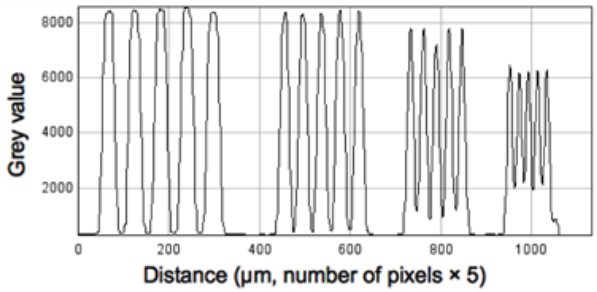
- **Pixie-II read-out ASIC, 60 µm hexagonal arrangement**

Sensors:

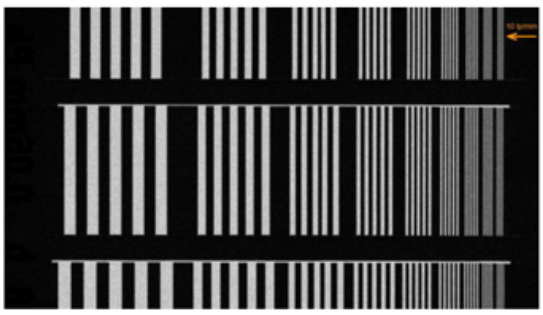
- **650 µm thick CdTe crystal Schottky type**
- **750 µm thick CdTe crystal Ohmic type**
- **500 µm thick GaAs crystal**

[1] The Pixirad-2 Detector Module Unit is ready to use the new Pixie-III ASIC

Resolving Power (Huttner Mask)



A profile across the mask below (Huttner mask, highest line density is 10 lp/mm)



Sensor specs:	CdTe, 650 µm, 31 x 25 mm^2 Schottky type diode Electron collection at pixel
Pixie-II ASIC + CdTe base block	512 x 476 pixels
Number of detector blocks	2
Global active area	62 x 25 mm^2
Total number of pixels	487424
Total number of counters	974848
Pixel size	60 µm hexagonal arrangement
Pixel density	323 pixels/mm^2, equivalent to 55 µm on square arrangement
Pixel rate capability	10^6 counts/pixel/s (after dead-time correction)
Global rate capability	4.8 x 10^{11} counts/s
Pixel dead-time	300 ns
Position resolution	11 line pairs/mm at MTF 50%
Reading while taking data	Possible
Energy range	1-100 keV
Detection efficiency @10 keV, 25keV,50 keV	100%, 100%, 98%
Counters depth	15 bits
Read-out time@50 MHz clock	5ms/counter
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Typical number of defective pixels	a few per mil (typical)
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Pixirad Systems

Pixirad System	Pixirad-1	Pixirad-2
Number of detector blocks	1 x 1	2 x 1
ASIC+sensor type	Pixie-II + CdTe Schottky Pixie-II + CdTe Ohmic Pixie-II + GaAs	
Global active area[1]	31 x 25 mm^2	62 x 25 mm^2
Total number of pixels	512 x 476 pixels	1024 x 476 pixels
Energy range	1-100 keV	
Frame rate	160 readouts/s	>100 readouts/s
Detector Module Unit		
Communication	TCP/IP socket over Gigabit Ethernet	
Size (WxLxH)	14.7 x 13.4 x 7.2 cm	9 x 13.4 x 13.5 cm
Weight	< 2 kg	2 kg
Power consumption	95W max	100W max
Voltage input	12V	24V
Detector cooling	water cooled / air cooled	
Power Supply Unit		
Size (WxLxH)	14.7 x 13.4 x 4.7 cm	14.7 x 13.4 x 4.7 cm
Weight	0.5 kg	
Power input	100-230V a.c. 50/60 Hz, 1.5A max	
Power output	12V, 16A max	24V, 8.3A max

[1] *Pixie-II + CdTe 60um*

Pixirad-4 (1M pixels) and Pixirad-8 (2M pixels) are also available (see our web page).

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