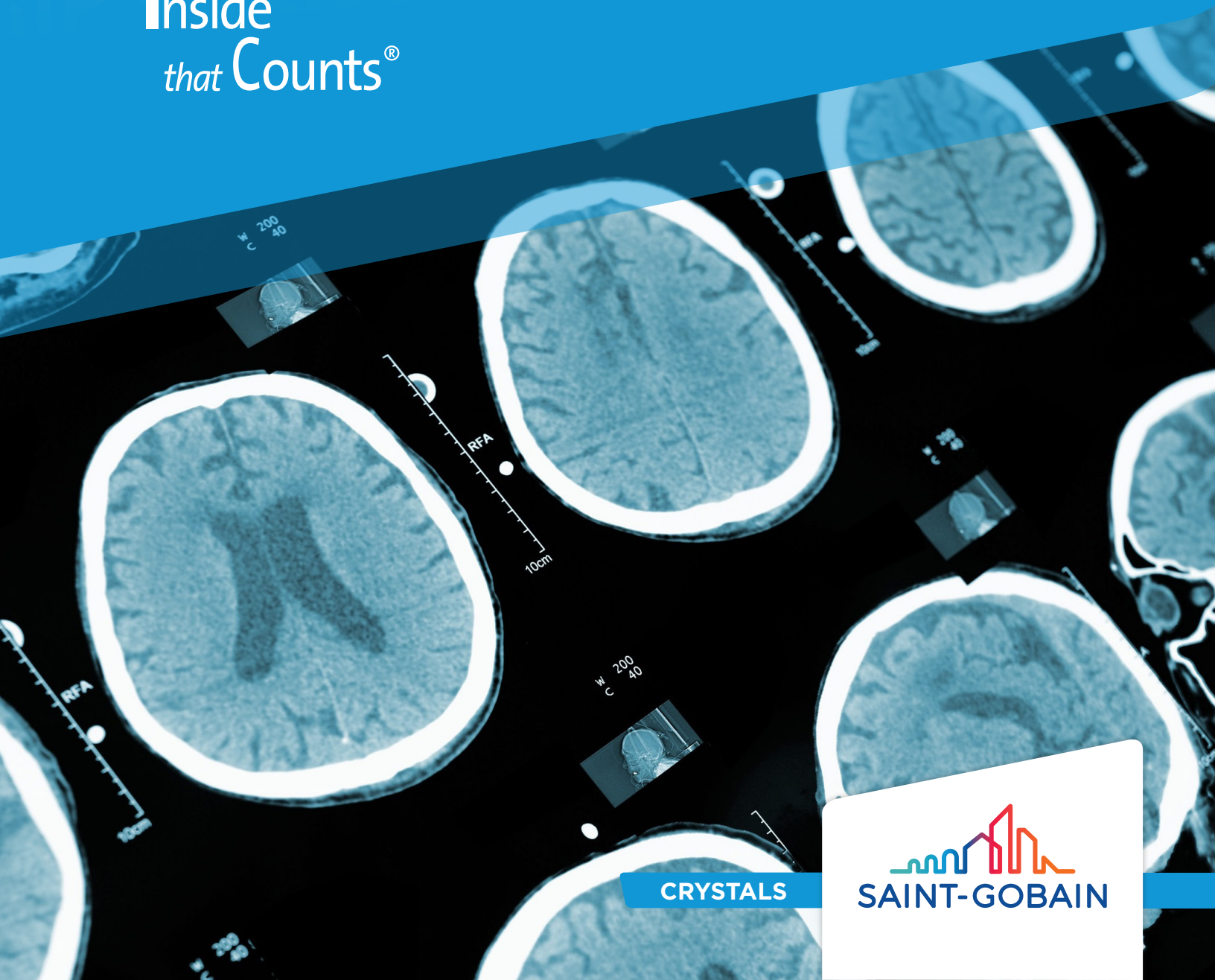
Medical Imaging Products

It's what's **Inside** *that* **Counts**®



CRYSTALS

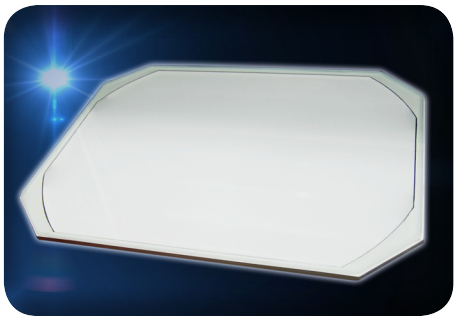
SAINT-GOBAIN

Products for Medical Applications

Radiation detectors play a major role in non-invasive clinical investigations. Such applications include: (1) nuclear medicine, requiring the injection of a radioisotope into the patient's body, includes modalities such as gamma cameras, PET scanners and surgical probes; (2) X-ray techniques, such as CT scanners, X-ray digital imaging and bone mass densitometry; and (3) analytical techniques, such as radioimmunoassay. This brochure is devoted to the medical imaging modalities.

LFOV SPECT –

Large NaI(Tl) crystals are used to detect the gamma rays emitted by the radiotracer injected into the patient. Two or more standard crystals with a 60cm by 45cm field of view are commonly used in one gamma camera system. Limits were pushed when a crystal prototype with a 86cm by 60cm field of view was manufactured.



The strength of our unique design comes from our product performance with superior energy resolution, light output level and detection homogeneity. In addition, with all manufacturing processes integrated in-house, we can assure reliability and reproducibility.

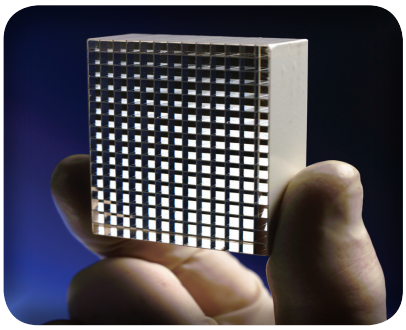
Organ Specific Imagers –

Many nuclear medicine developments are focusing on small field of view imagers for cardiac, breast or brain imaging. The fine spatial resolution needed in these applications can be achieved with a specifically designed array using CsI(Tl), BGO, $LaBr_3$ or LYSO crystals.

Several readout systems, such as flat panel PMTs, PSPMTs or photodiodes, can be directly coupled to the crystal to further improve the spatial resolution.

Positron Emission Tomography (PET) –

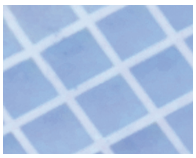
The high detection efficiency required by the PET application is traditionally achieved by using BGO arrays. BGO has the best stopping power known in commonly used scintillation crystals.



Research at Saint-Gobain Crystals with our key partners has resulted in new products. Saint-Gobain Crystals introduced the LYSO crystal in 2003. It has a shorter decay time which allows higher data rates, shorter scan times and TOF applications. Our $LaBr_3$(Ce) crystals also show good performance with a Coincidence Resolution Time as low as 220ps.

Computed Tomography –

Saint-Gobain Crystals has developed a technique to manufacture scintillator arrays with high precision, reliability and performance. These arrays are coupled to multichannel photodiodes.



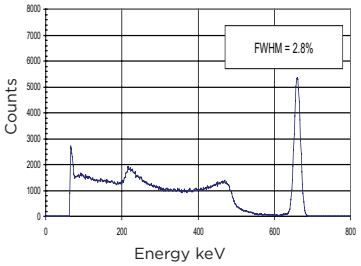
Close-up of $CdWO_4$ 2D array with diffuse reflector technology.

Applications Matrix –

The numbers in the applications chart below relate to the typical pixel size used (in mm).
Also listed for comparison are a few of the specific properties of each material.

	NaI(TL)	CsI(Tl)	CdWO4	BGO	LYSO	$LaBr_3$(Ce)
Materials Properties						
Density	3.67	4.51	8.0	7.13	7.1	5.08
R%@662 keV	7	8	15	9.7	7.1	2.8
Decay Time (µs)	0.25	1	14	0.3	0.041	0.016
Applications						
SPECT	NP	–	–	–	–	NP
Organ Specific Imagers	NP	1-4	–	1-4	1-4	NP
PET	NP	–	–	2-10	2-10	4-10
PET/SPECT	NP	–	–	–	–	5-8
CT	–	>0.35	0.6-1.5	–	–	–
X-ray	–	>0.35	–	–	–	–

NP: Non-pixellated



Pulse Height Resolution spectrum of 25x25mm $LaBr_3$(Ce) crystal

Technical Insight –

Time of flight (TOF) PET:

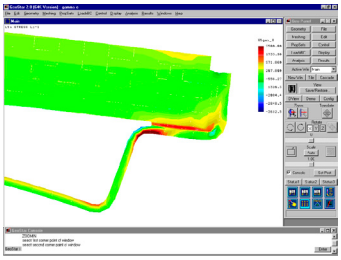
When using ultra-fast scintillators, time of flight becomes possible. In this technique, the difference between the moments of interaction of the two 511 keV photons is used to provide information on the position of the annihilation. This TOF information also allows the rejection of annihilation events outside a selected area and further improves the image contrast.

Depth of Interaction (DOI):

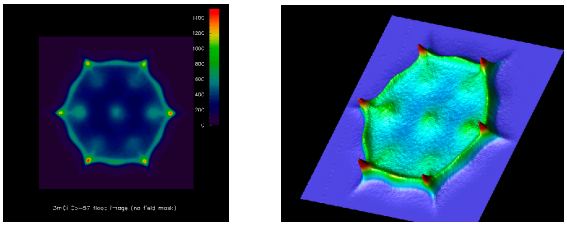
Penetration of 511 keV photons into the crystal ring blurs the measured position. This effect is known as parallax error and can be removed by measuring the depth of interaction. In practice, two different scintillators are used and their respective signals are sorted by either pulse shape discrimination or rise time discrimination.

Research and Development Capabilities –

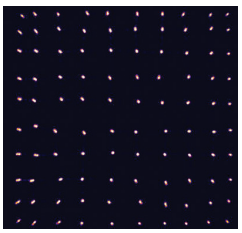
- Key partners with whom to develop new materials and new devices for existing or new applications
- Monte Carlo simulation software
- Finite Element Analysis (FEA)
- VME-based test equipment for flood imaging of full-scale or small proof-of-concept gamma cameras
- PET block testing capability
- Thermal cycling and testing of large assemblies
- Coincidence Resolving Time (CRT) measuring system



FEA analysis of a gamma camera hermetic seal.



Geometric patterns are routinely imaged in order to quantify detector spatial resolution while monitoring resultant distortions that may arise from different packaging technologies.



Example of a PSPMT flood image of a small pixel array. We can test for uniformity, spatial resolution and individual pixel energy resolution.

About Saint-Gobain

Saint-Gobain North America's market solutions span from construction to life science, aerospace to energy. From Earth to Mars, there is little territory we don't cover.

The Scintillation Products business is a combination of companies that have been prominent in crystal growth or in radiation detection and measurement. Notable names include: Bicron® and Crismatec (inorganic and organic scintillators and detectors); Gamma Laboratories and TGM Detectors (gas-filled radiation detectors).

For additional product literature or information, call customer service at any of our locations or access our website document library – www.crystals.saint-gobain.com. Other radiation detection products available from Saint-Gobain Crystals include:

- Inorganic scintillators including NaI(Tl), BGO, CsI, $CdWO_4$, $LaBr_3$ crystals and LYSO scintillator – configured as solids or arrays with or without an integrated photo readout device.
- Plastic scintillators available as rods, blocks, ingots, thick and thin sheets, tubing and spheres.
- Liquid scintillators as detectors or as bulk material.

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www.crystals.saint-gobain.com