

Pixelated ceramic scintillators for large-area high-resolution X-ray and γ -ray detectors

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Introduction

Philips Healthcare together with Philips Research over the last decade developed various ceramic scintillator materials for medical imaging applications. Based on this, we propose a technology that provides strong energy absorption and high spatial resolution for pixelated scintillator detectors at a moderate price.

	Low resolution	High resolution
Low absorption		Si-strip, Si-pixel, Ge, ...
High absorption	PWO, BGO, CsI	New materials / designs

Current detector designs

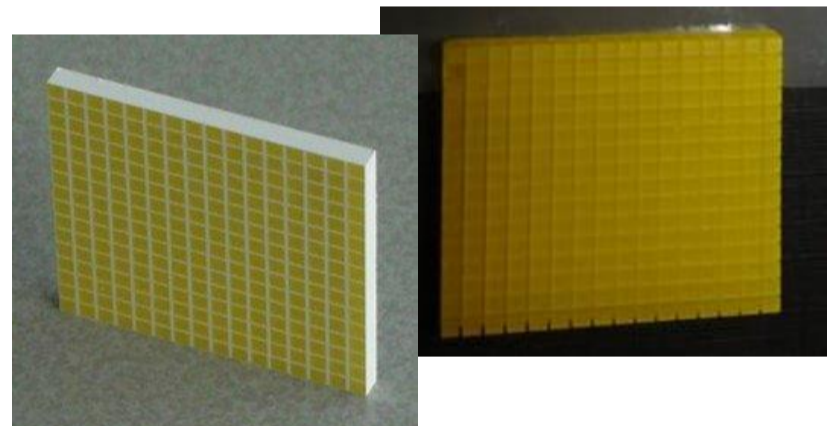
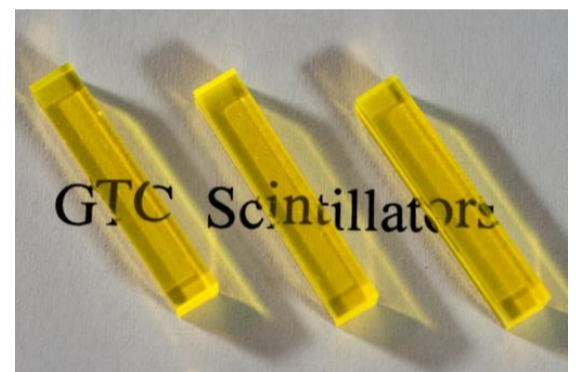
The Concept

Ceramic technology for gadolinium oxysulfides (GOS) and garnets (GGAG) has been developed at Philips.

Advantages compared to single crystal growth:

- larger flexibility to tailor the material composition to meet scintillator requirements.
- effective Z values up to 57,
- photon gain values approaching 50 - 60,000 photons/MeV,
- energy resolution on par with high-end PET scintillators such as LSO and LYSO,
- decay times much shorter than known for single-crystalline garnets
- optically transparent sticks up to 60mm length
- arrays of up to 100mm x 100mm size
- pixel size > 500 μ m

Building large-area arrays of scintillator sticks for medical imaging applications (CT and PET), including optical reflectors, is by now an established technology for Philips.



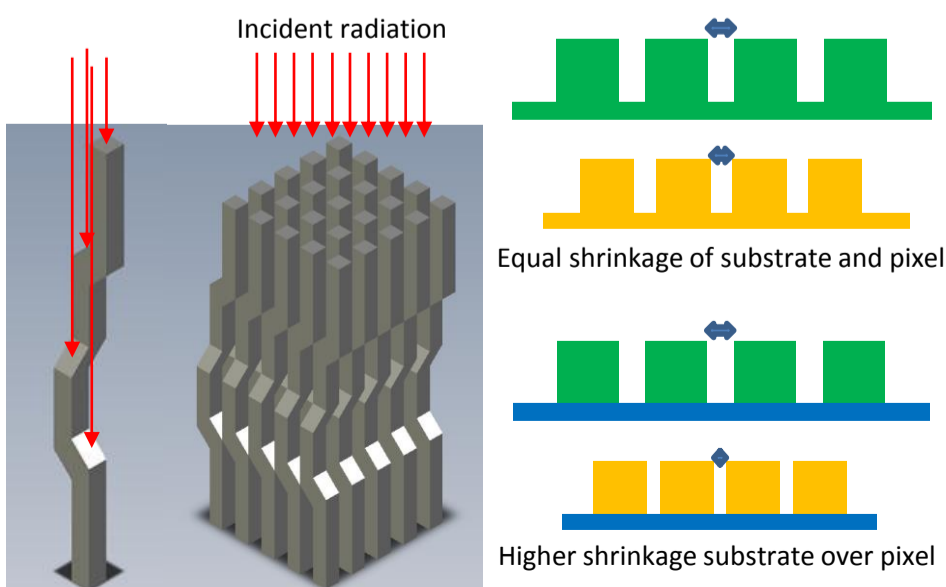
Technology options under investigation

Low-cost manufacturing of large-area structured ceramic scintillators

3D printing of scintillators

- good separation of pillars
- "100% fill factor"

Shrinking substrate to maintain / lower pixel gap



Offering

Customized high resolution large area detectors at low cost price.

Advantages:

- fine-tuned material composition
- advanced 3D shapes possible over large areas
- low cost price: avoid expensive crystal growth

Partnering in projects on

- Ceramic scintillator material development
- Additive manufacturing, e.g. 3D printing, of structured ceramic material
- Encapsulation and packaging
- Detector assembly and integration
- X-ray and gamma-ray imaging beyond medical applications

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