MEDICAL APPLICATIONS

Spectral Hybrid Photon Counting detectors: A new era in X-ray imaging
Hybrid Photon Counting (HPC) technology is optimally suited for low-dose and multi-energy imaging in medical applications.

The single-photon counting mechanism as well as the absence of electronic noise lead to a tremendous reduction of patient dose. In addition to that, HPC detectors open the path to dual-energy and multi-energy (spectral) imaging with unsurpassed performance. Our technology goes beyond conventional dual-energy technology by enabling multi-energy imaging in a single shot and without kV switching or dual-source techniques. Spectral information comes on demand and can be retrospectively retrieved by the radiologist.

HPC detectors improve current medical imaging applications by enhancing soft tissue and bone discrimination in radiographs, separation of masses from tissue in mammography, extraction of digital subtraction angiographs from a single shot or separation of multiple contrast agents in contrast-enhanced CT.

Be inspired by this new era in X-ray imaging technology and contact us for your imaging application.

**Key Advantages**

- Noise free detection achieving the best signal-to-noise ratio at minimal dose
- Spectral imaging beyond classical dual energy technology
- High spatial resolution through direct detection
- High soft tissue contrast due to extreme dynamic range
- High frame rates
- Spectral imaging information can be retrieved retrospectively
Pre-Clinical and Medical Research

Pre-clinicians and medical researchers strongly benefit from our hybrid photon counting (HPC) detectors. Our revolutionary technology detects every single X-ray photon and guarantees highest sensitivity, best possible image quality, and lowest dose.

With a pixel size of 75 μm and a nearly ideal MTF offered by SANTIS 0804 detector, pre-clinical researchers are able to resolve finest details in radiographic or tomographic images. Furthermore, the ability of SANTIS 0804 to count single photons and sense their energy enables new imaging techniques such as single-shot dual energy imaging and material decomposition, leading to unsurpassed image contrast and tissue differentiation.

Preclinical contrast-enhanced CT of a mouse at 80 kVp to study respiratory dynamics. Left: Conventional coronal CT slice, Right: Spectral decomposition coronal CT slice, Green: bone, Red: contrast agent. Courtesy of C. Badea, Duke University
**Mammography and Digital Breast Tomosynthesis (DBT)**

HPC full field digital mammography (FFDM) of the accreditation phantom is clearly revealing the target objects (see picture below). These represent the different structures or malignancies found when imaging the breast.

HPC-DBT images (on the right) of a freshly ablated breast were acquired at ± 10° (21 angles) during a short scan. Clinical radiologist positively assessed the DBT results after comparing them with those from a conventional mammography flat panel detector.
Slice of a digital breast tomosynthesis scan (DBT) of a breast mastectomy (28 kVp, 0.5 mm Al filter). Top: visualization of a biopsy cavity and microcalcifications. Courtesy of TU Munich, Germany.
Angiography

Classical Digital Subtraction Angiography (DSA) requires the acquisition of multiple X-ray images, causing high patient dose and motion artifacts.

Taking advantage of the spectral imaging capability of DECTRIS’ HPC detectors, angiography can be performed in a single shot, enabling dynamic image acquisition, reducing motion artifacts and dose.

In combination with innovative material decomposition algorithms, quantitative iodine-only images are created which highlight the vascular structures for accurate diagnosis.

Coronary angiography of an excised pig heart with a HPC detector (90 kVp, 24 mAs, 4 mm Al filter, thresholds at 35, 48, 55, 68 keV). Material decomposition allows to separate the data into a conventional image (left) and an iodine only image (right). Courtesy of TU Munich, Germany.
Computed Tomography

HPC detectors from DECTRIS enable Spectral Computed Tomography (CT) which is an increasingly popular technique to reduce CT dose, enhance tissue differentiation and acquire quantitative maps of material densities or contrast agent concentrations.

Key Detector Features
- Increased CNR compared to conventional dual energy CT
- Higher dose efficiency (single exposure, 100% geometrical efficiency)
- Improves the resolution of CT beyond the premium high-resolution CT, with pixels below 500 μm
- Reduces beam hardening and streak artifacts
- No afterglow

Key Application Features
In addition, HPC provides true spectral information:
- Reducing patient dose and contrast agent concentration
- Multi-material and contrast agent decomposition
- Quantitative maps of tissue density, contrast agent concentration or atomic number

Spectral CT with Calcium and Iodine. Left: In conventional CT, attenuation coefficients (or HU) can be very similar. Middle, Right: Spectral CT allows to separate the two materials due to their difference in atomic number. Courtesy of TU Munich, Germany.
About DECTRIS

DECTRIS is the leader in X-ray photon counting detection technology. Our Hybrid Photon Counting technology has radically transformed basic research at synchrotron light sources and in X-ray laboratories during the past years. Over 1500 detector systems have been installed worldwide, proving the maturity of this technology. These detectors outperform the current integrating detectors used for the most advanced medical imaging systems in terms of quantum efficiency (DQE), sensitivity, spectral decomposition, resolution (MTF) and readout speed. DECTRIS’ latest detector generation is ready to provide photon-counting capability for low-dose X-ray medical imaging including CT, mammography, fluoroscopy and preclinical imaging.

To find out more about partnering with DECTRIS to transform your medical imaging capabilities, contact medical@dectris.com or visit dectris.com/medical.