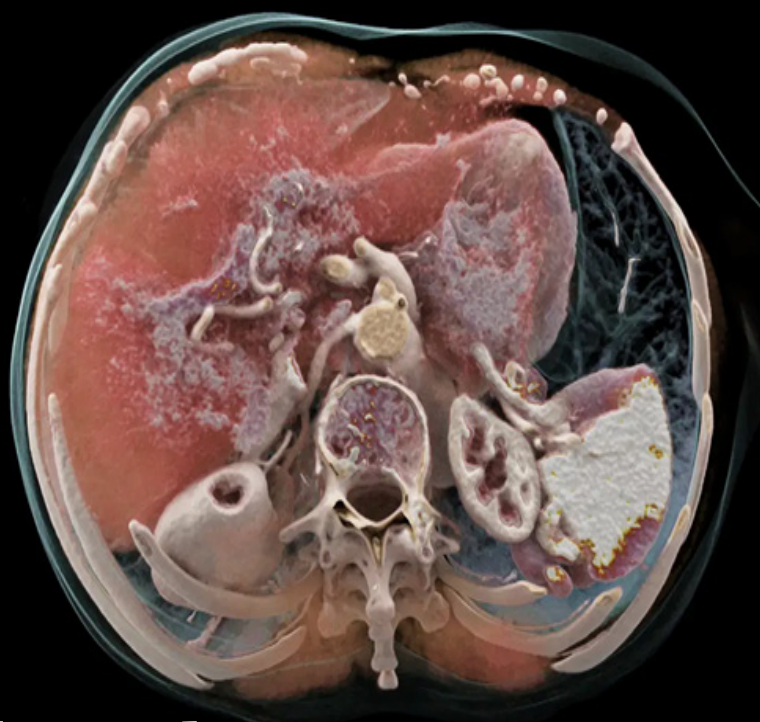


Photon Counting Computerised Tomography *-New era in imaging?*



News review
By CR Chandrasekar



Mr CR Chandrasekar
Orthopaedic Surgeon

First Photon counting CT is a reality in the UK, with the news of its availability at Oxford ⁽¹⁾

It is a significant development in CT scanning technology. After the introduction of CT scan in 1970, spiral CT in 1990, wide detector CT in 2004, Dual Source CT in 2005, and Dual Layer CT detectors in 2013, limitations remain for current CT technology.

Photon-counting CT, is a radically new technology with a new kind of detector that is substantially different from a standard energy integrating detector.

Figure 1 (2)

A, In conventional energy-integrating detector, an incident

x-ray photon is converted into a shower of visible light photons in a scintillator. Visible light hits an underlying light sensor, where it generates positive and negative electrical charges. B, In photon-counting detector, the x-ray photon is absorbed in a semiconductor material, where it generates positive and negative charges. Under the influence of a strong electric field, the positive and negative charges are pulled in opposite directions, generating an electrical signal.

These photon-counting detectors have the potential to overcome the limitations of current CT detectors, by providing CT data at very high spatial resolution, without electronic noise, with improved contrast-to-noise ratio, at lower radiation dose, and with intrinsic spectral information.

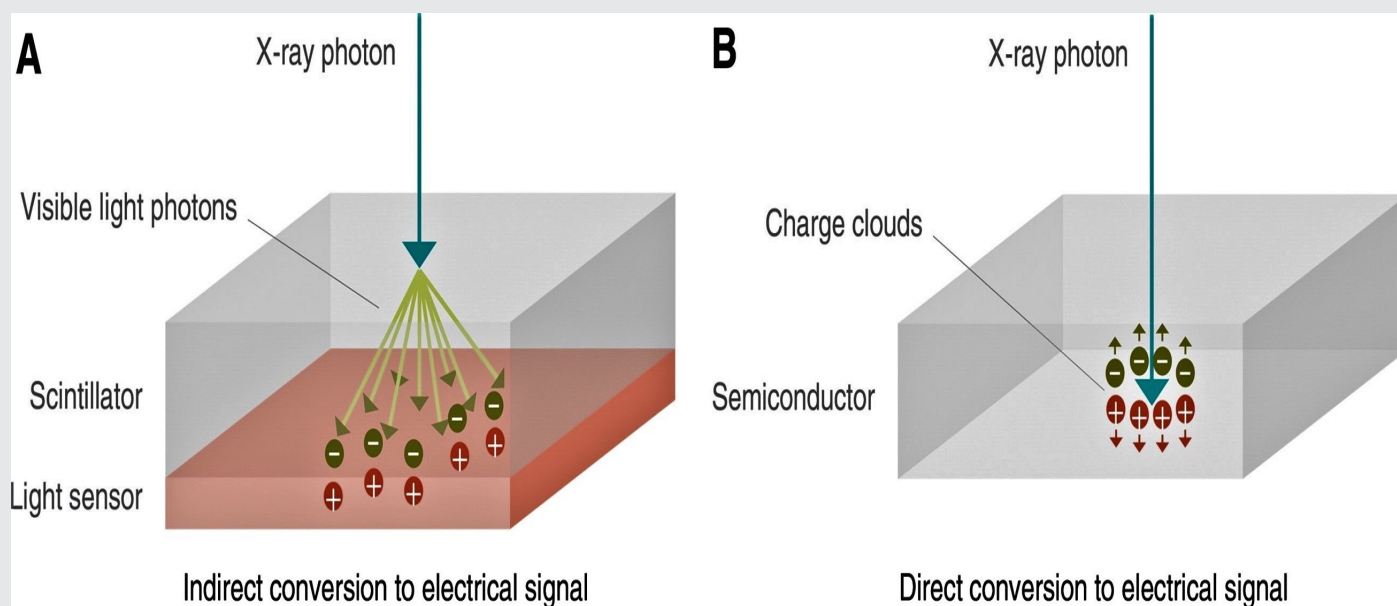




Figure 2 (3)

1. higher contrast-to-noise ratio,
2. improved spatial resolution, and
3. optimized spectral imaging.
4. Photon-counting CT can
5. reduce radiation exposure by about 45%
6. reconstruct images at a higher resolution,
7. correct beam-hardening artifacts,
8. optimize the use of contrast agents, and
9. create opportunities for quantitative imaging relative to current CT technology

Figure 2 (3) Above

Naeotom Alpha -Photon counting CT scanner designed by Siemens Healthineers

‘The introduction of photon-counting CT is a development that could be compared with the move from pixelated black-and-white images to HD colour’⁽¹⁾

Current possibilities in the UK.

With conventional CT imaging, the calcified arteries of these patients compromise image quality, often necessitating further, invasive investigations. The NAEOTOM Alpha allows the visualisation of coronary vessels by virtually removing the calcium, in order to clearly assess whether obstructions are present, helping to avoid unnecessary hospital admissions.

The combination of photon-counting CT and AI for the first time will also help to optimise heart attack diagnosis and prognosis ahead of adoption of the technology by the NHS.

The photon-counting CT scanner Alpha can act as a gatekeeper, reducing hospital admissions and scanning patients with

The system utilises cadmium telluride crystals, a new type of detector material, converting X-ray photons directly into electrical signals, overcoming the loss of information encountered in conventional CT. The better the input signals, the better the resulting images at the end of the processing chain that the radiologist can use for diagnosis. Equipped with highly-sensitive photon-counting detectors, the scanner can also achieve up to 45 percent dose reduction for ultra-high resolution, obtaining valuable new clinical information and supporting earlier diagnoses, whilst benefitting patients with lower radiation exposure. Photon-counting CT detectors count the number of incoming photons and measure photon energy. This technique results in

symptoms of a heart attack before they are admitted. It will be possible to identify patients who can undergo medical therapy as an outpatient or send patients directly for revascularisation procedures without the need for an invasive diagnostic angiogram.

References

1. <https://www.rdm.ox.ac.uk/news/uks-first-photon-counting-ct-scanner-arrives-at-avic>
2. <https://doi.org/10.1148/radiol.2018172656>
3. <https://www.siemens-healthineers.com/computed-tomography/technologies-and-innovations/photon-counting-ct>

Photon Counting CT

Uses cadmium telluride crystals
Reduces scanning time
Reduces radiation exposure
Better resolution
Better contrast
Reduces need for coronary angiograms
Triage tool for angina/chest pain
Potential for massive cost savings for the NHS when it is widely available
Will replace ageing CT/MRI scanners

Mr CR Chandrasekar is a Consultant Orthopaedic Oncology Surgeon at Royal Liverpool and Broadgreen University Hospitals NHS Trust with keen interest in raising sarcoma awareness.

