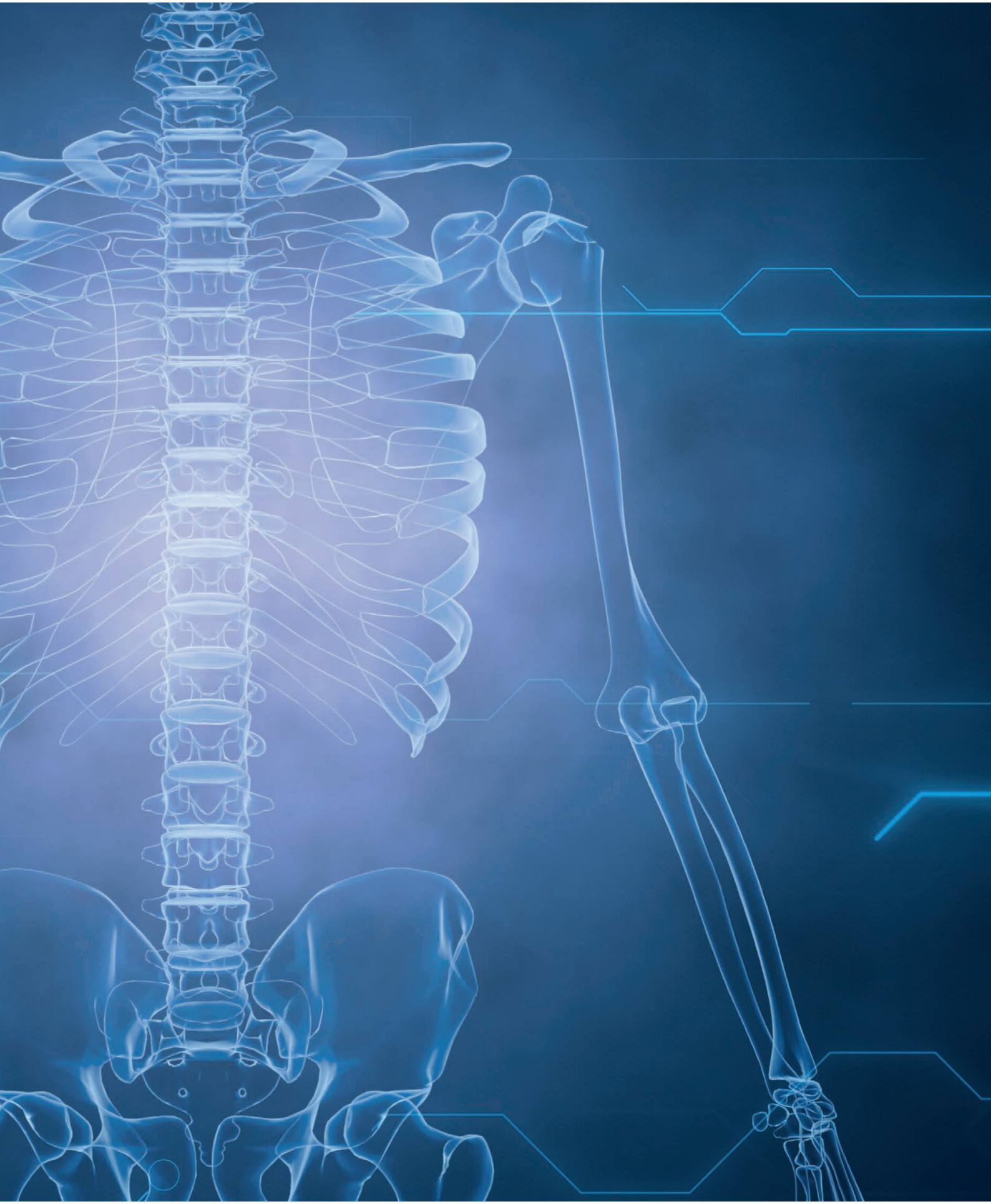

SCINTILLATOR TECHNOLOGY – GOING DIGITAL!

Evaporation solves the challenges for "thick" layer deposition to enable the latest large area digital scintillator technology for medical and industrial use. Evatec Product Manager **Kurt Flisch** tells us how.

FPD – A growing market in healthcare

Digital X-ray detectors used in Flat Panel Detectors (FPDs) convert X-rays into electronic data that a computer can process and convert to an image quickly. These FPDs first convert X-rays into visible light through a scintillating medium and this visible light is then converted into electrical charge by a photodiode or TFT. The most common digital scintillators are based on materials like Caesium Iodide (CsI) and Thallium Iodide (TlI).

FPD based systems are increasingly replacing the traditional analog and computed radiography (CR) systems used by the healthcare industry until now which have disadvantages of relatively high radiation exposure, poor image quality, long diagnosis time and the need for chemical processing. Some analysts expect that the FPD market in this sector will reach USD 1,700 Million dollars by 2021.

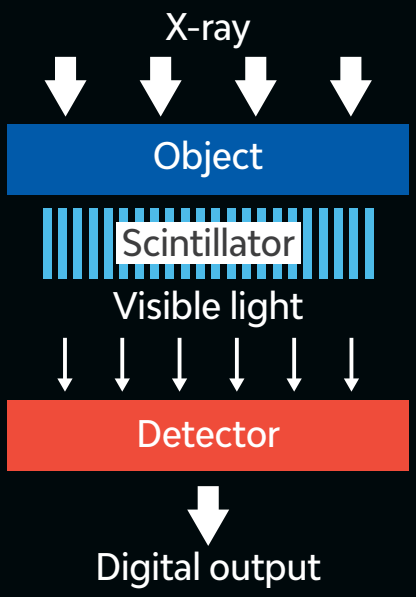

Figure 1: Scintillator Function

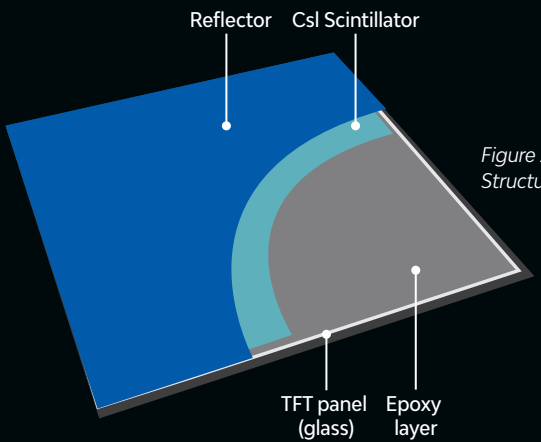

Figure 2: Structure

(source: www.abyzr.com/open_content/product/scintillator.php)

Controlled rates for CsI and TlI during the entire deposition of 7 hours

Evaporation solves the manufacturing challenges for CsI/TlI

Deposition of the layers required for the x-ray detector sets some interesting challenges to be solved

- The typical layers required are thalium doped CsI with typical doping rates of TlI of between 0.2% and 3.0%.
- A whole variety of panel sizes and shapes must be handled: square, rectangular up to a typical maximum of 17" x 17" (chest x-rays).
- The layer thicknesses required are much higher than in typical thin film deposition processes at 500 – 600 µm, and over 700 µm for moving image detectors.
- The typical substrate temperature must be kept below 150°C during the whole deposition time of 5 or more hours.

CsI and TlI exhibit unique non linear temperature gradation making control of source temperature during both ramp-up (shutter closed) and evaporation essential to maintain source stability during an extended process time. Accurate rate control of both materials during the entire evaporation process is also essential as scintillator performance is highly sensitive to small changes in TlI doping level.

Layer uniformity and doping levels must both be maintained across the large active substrate areas but uniformity shapers should be avoided by using a planetary tooling system to keep deposition rates high and maximise material material useage from the the large barrel sources required for such thick layers. Maintaining overall process stability and keeping substrate temperatures under control for extended process times is also a must.

On a practical level system uptime and throughput needs to be maximised by optimising pumping performance and simplifying shield changes and cleaning procedures.

Dedicated sources and process control are key

Evatec already has 10 years of experience in delivering dedicated scintillator systems. Custom evaporation sources, in-situ control of temperature rates during the entire process, as well as real-time process supervision and data logging are just a few of the features which are essential for successful scintillator manufacture.

Typical Evatec BAK1401 production tool for Scintillator

A growing market

The high quality scintillators produced by evaporation today are mainly used in x-ray detectors for medical devices – portable or heavy-static – such as dental and mammography but there are other growth opportunities too. Analog x-ray detection can also be replaced with its digital counterpart in areas like nondestructive material inspection, human and/or luggage screening and Evatec's BAK Evaporation system are ready.