3.2 X-Ray Sensor

4.1 As told before, the X-ray detector uses a sensor plate to make the image. Within Philips IGT all detectors use CsI (Cesium Iodide) scintillators to convert X-rays to visible light. 4.2. CsI crystals are grown on an aluminum substrate to get a “pillar” like structure (Figure 4). Due to this structure the light that is generated from the X-rays is reflected inside the pillars. CsI is a kind of “kitchen salt” and needs protection from moisture. The aluminum layer acts as reflector for light going in the wrong direction, so it increases the sensitivity and also blocks the moisture from reaching the CsI crystals.
This results in a relative sharp image (high MTF). Within Philips, DXR some detectors use GOS (Gadolinium Oxi Sulphide) or CaWO (Calcium Wolfram Oxide) scintillators. These are powders that are cheaper to make but result in a less sharp image (lower MTF) because the light gets more scattered when reflecting on the powder.

Under the scintillator is the sensor plate (Figure 5). This plate has amorphous silicon structures on it. Each pixel contains a small TFT (thin film transistor) and a large photo diode. Each gate of a TFT is connected to a “high voltage” Gate driver (Thalassa within Trixell) through gate lines while the source is connected to the photo diode and the drain connected to the read-out chip (MAPIX within Trixell detectors). The whole sensor is build-up in a matrix structure. To read out the sensor 1 gate line is made active such that all the photo diodes on that gate line get connected to the data lines and through the data lines to the read-out chips. When the read-out is done the next gate line is selected. Within Trixell detectors, the gate driver and read-out ICs cover each 120 rows/columns. These structures can sometimes be recognized in X-ray images.

EMC distortion to the sensor will because of the synchronous conversion per line lead to line structures in the image.

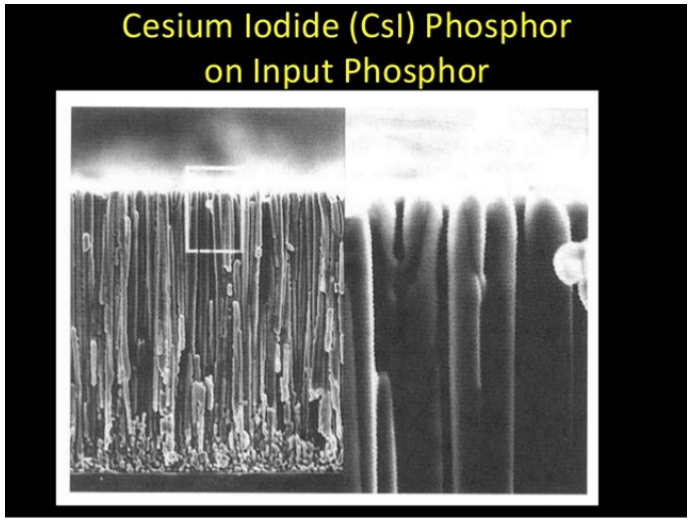

Figure 4 CsI pillars

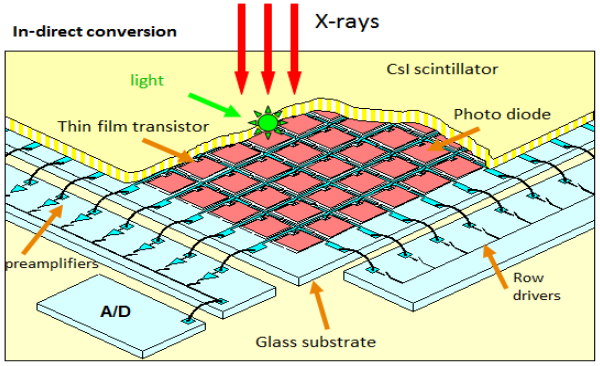

Figure 5 X-ray sensor stack

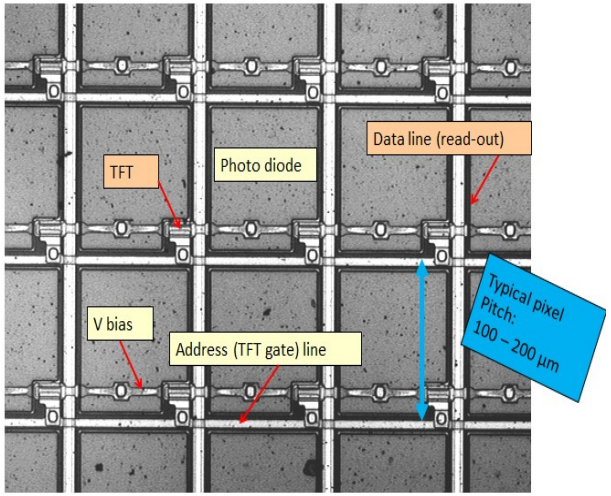

Figure 6 Sensor plate, close up