

# NEW DETECTORS

**MINIPIX<sub>TPX3</sub>**



Miniaturized  
Array: 256x256

**ADVAPIX<sub>TPX3</sub>**



Event-by-event IO  
Array: 256x256

**WIDEPIX<sub>5x5</sub>**



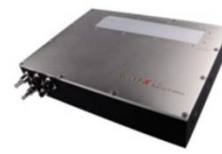
Large  
Array: 1280x1280

**WIDEPIX L<sub>1x5</sub>**



Scanning  
Array: 256x1280

**WIDEPIX L<sub>1x10</sub>**



Scanning  
Array: 256x2560

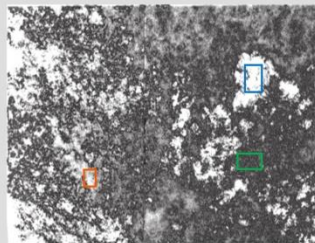
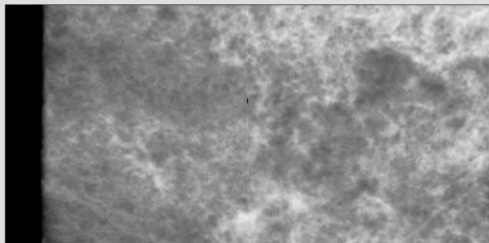
**WIDEPIX L<sub>1x15</sub>**



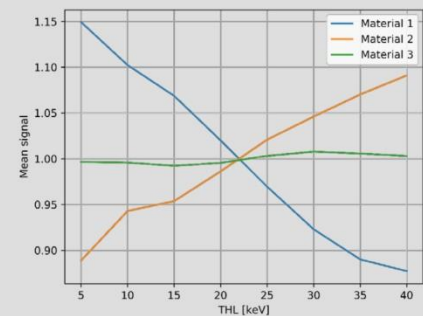
Scanning  
Array: 256x3840

## Medipix3 detectors: Multi-threshold imaging for material decomposition

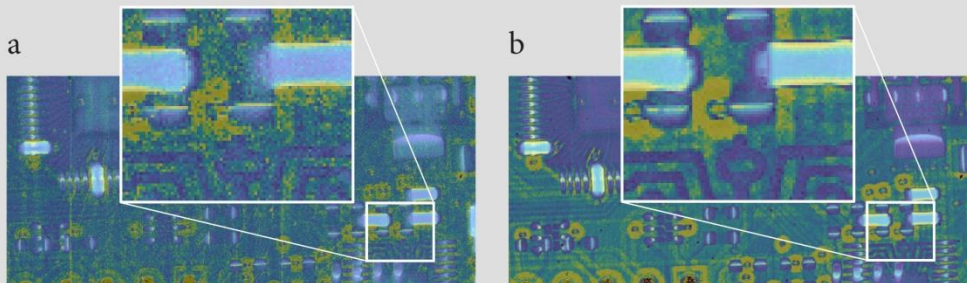
Various types of materials can be identified in the sample based on their response extracted from two or more images measured with different energy thresholds.



XRT image of rock slice after beam hardening correction, material variation and material response curves of three selected regions of the sample. Sample of Zn ore was by provided by Lovisagruvan mine.



X-rays of higher energies are needed for inspection of high-Z elements which is problematic from the detection efficiency point of view. One of the goals of this work was to study the benefits of the **Charge Summing Mode (CSM)** of Medipix3. The results verified that CSM provides better performance for spectral measurements.



Spectral images of PCB which represents well defined sample containing many elements. Different colors signify different material properties. Comparison of results measured with Medipix3 detector using:

- a | conventional approach of Single Pixel Mode
- b | Charge Summing Mode intended for spectral imaging

## Hybrid pixel detectors of the Medipix family

Single photon counting detectors of the Medipix family consist of a semiconductor sensor layer connected to the readout chip using the bump-bonding technology. The main advantages in comparison to the conventional X-ray imaging detectors are high contrast and spectral information of the radiation that allows material specific information to be displayed in colors. Pixel size is 55  $\mu\text{m}$  and sensitive area depends on detector type (e.g. 70  $\times$  70 mm in case of WidePIX 5 $\times$ 5).

Medipix3 operates in counting mode, however the spectral information can be measured using a threshold scan. Besides the classic Single Pixel Mode (SPM), the chip also implements **Charge Summing Mode (CSM)**. This feature suppresses the charge sharing effect and thus allows better imaging properties at higher energies. Several operation modes are available and the number of adjustable energy thresholds varies according to the selected mode. Modified „spectroscopic“ variant of the chip assembly with 110  $\mu\text{m}$  pixel pitch provides up to 8 thresholds.

Timepix3 chip can be operated in event-based mode, where all information about the interacting particle (position, time of arrival and energy) is recorded at the same time. This approach allows to get images for all spectral channels within one acquisition. Moreover, the unwanted effects can be suppressed and the original spectra can be reconstructed.