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In-line examination of Si wafers & solar cells using high resolution X-ray imaging methods

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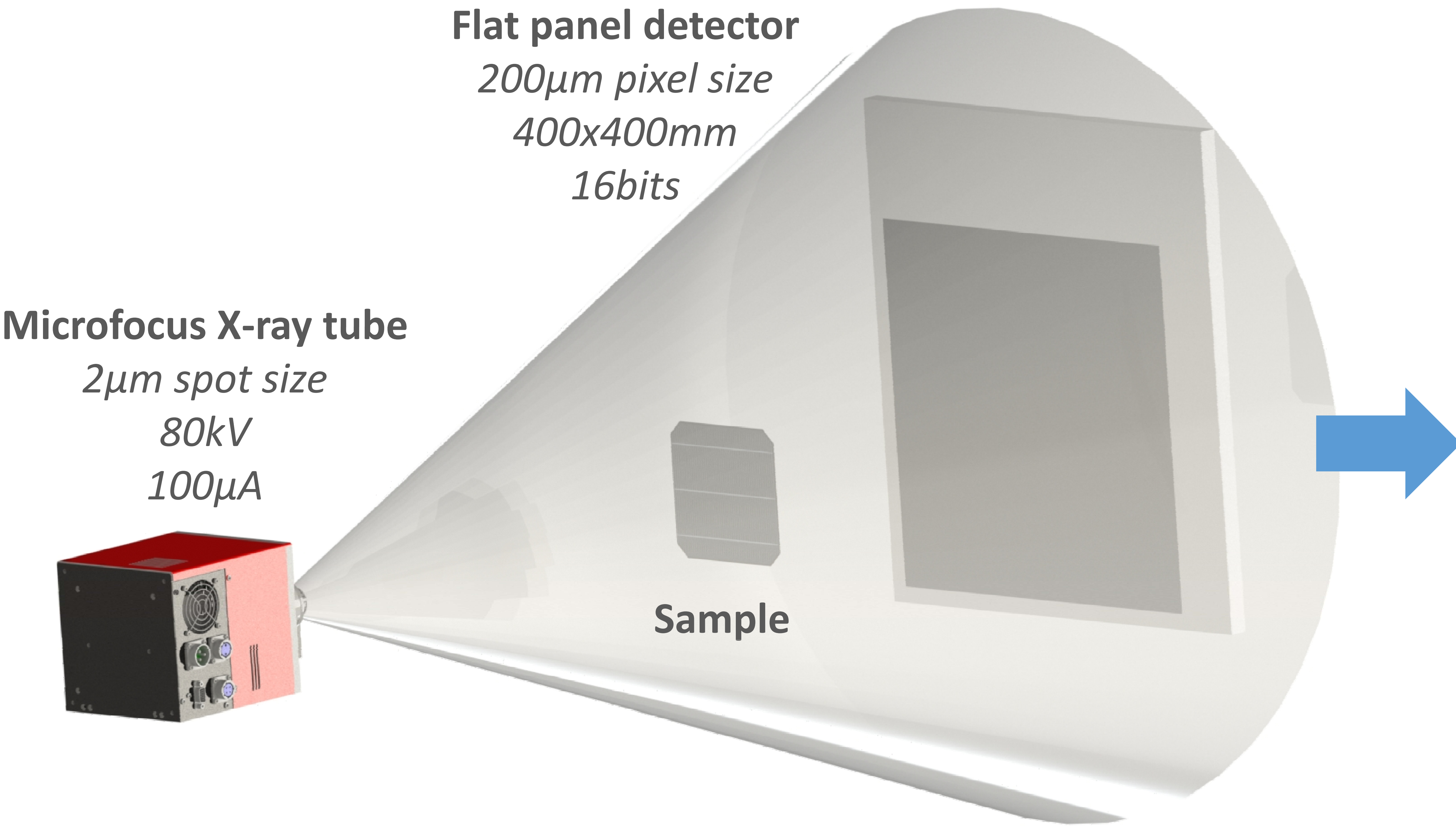
High-resolution X-ray radiography method

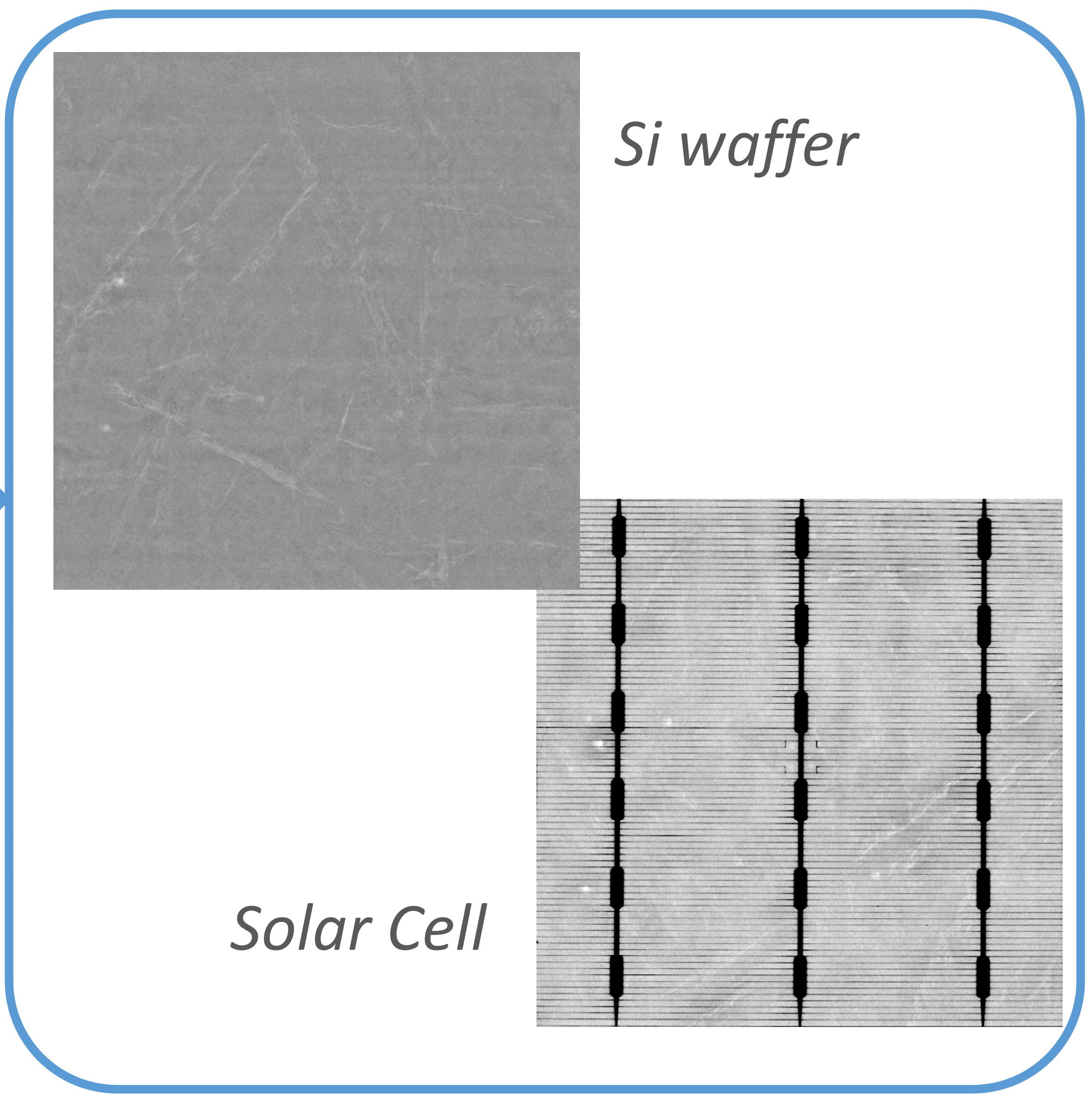


Flat panel detector
200µm pixel size
400x400mm
16bits

Microfocus X-ray tube
2µm spot size
80kV
100µA

Sample

Radiographic images



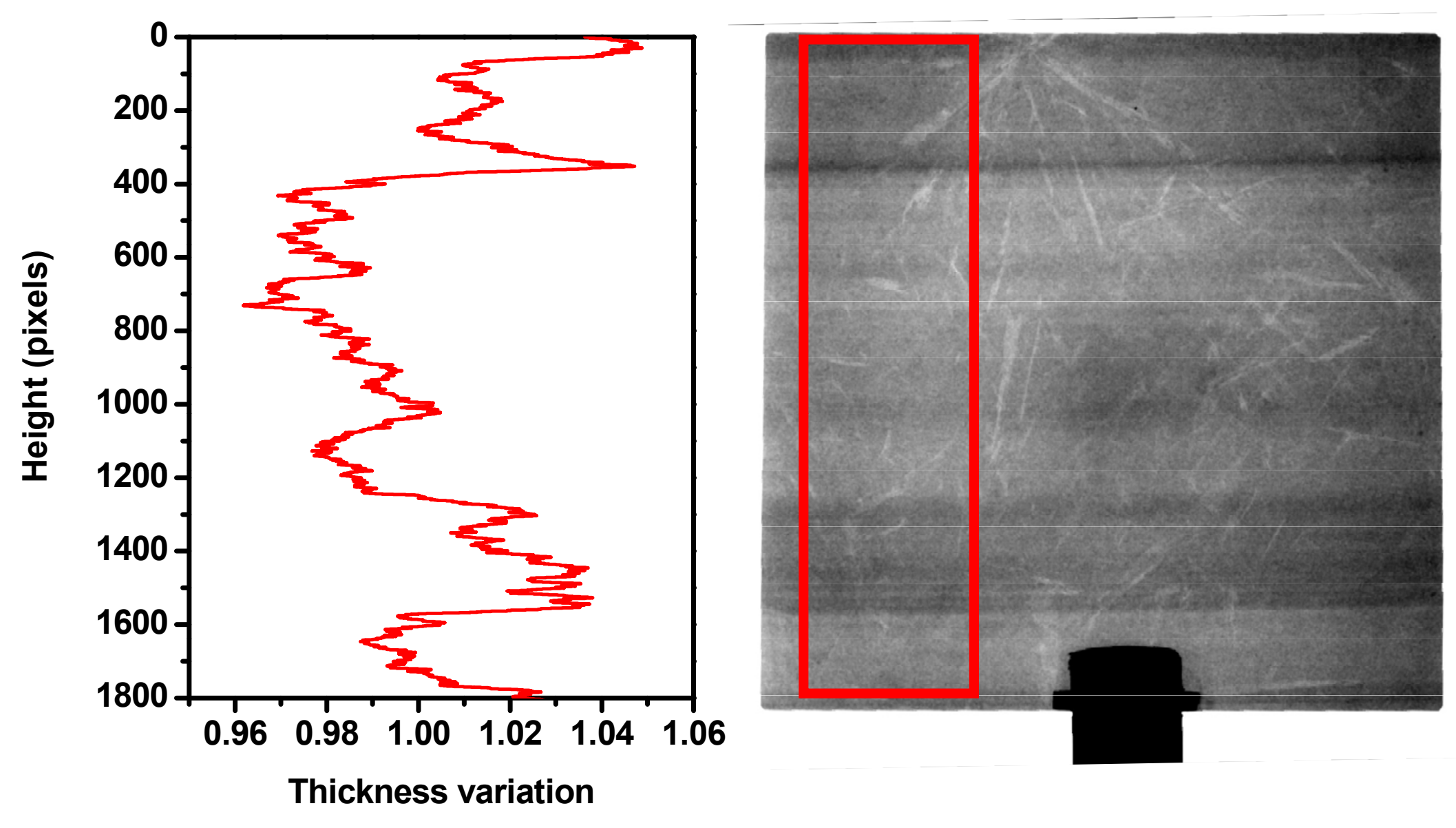
Si waffer

Solar Cell

Different information can be extracted from the obtained radiographies

Thickness homogeneity:

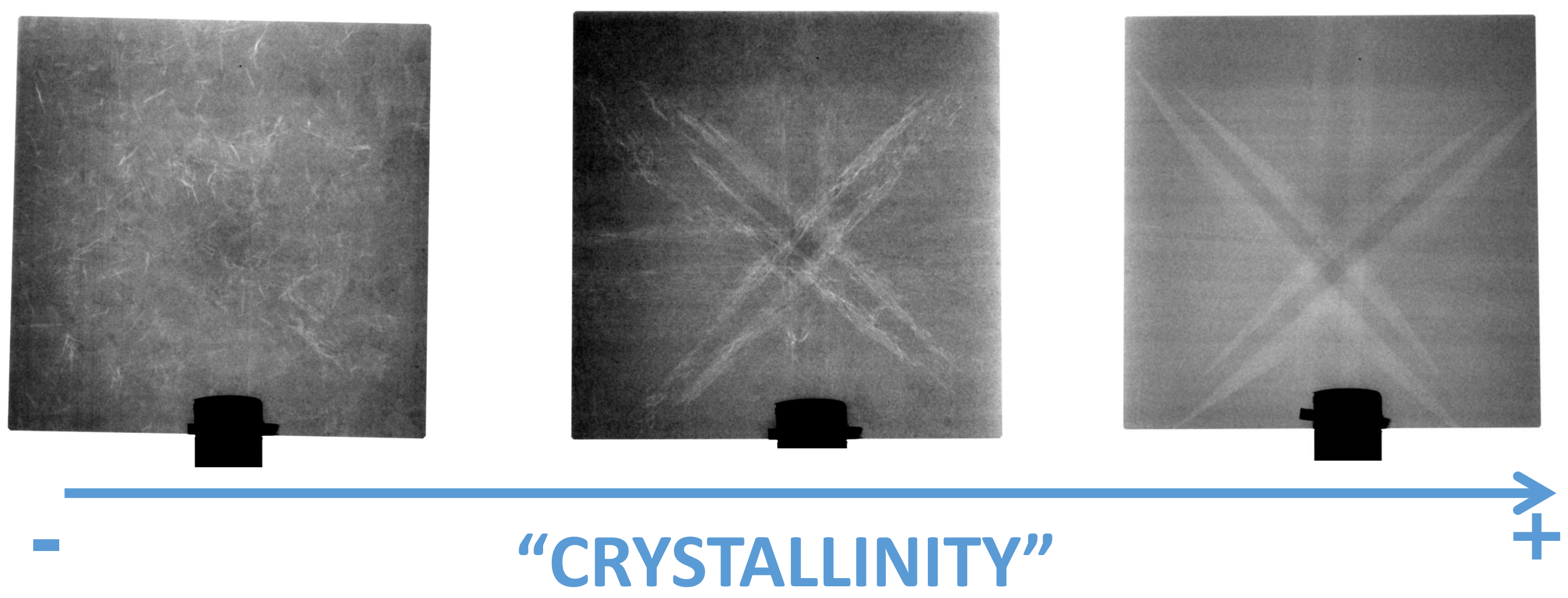
A thickness map of the complete cell/wafer based on Beer-Lambert equation and the determined special X-ray absorption in the radiography. As brick slicing might be sometimes problematic this technique offers the possibility of controlling the wafer thickness quality.



"Monocristalinity" grade:

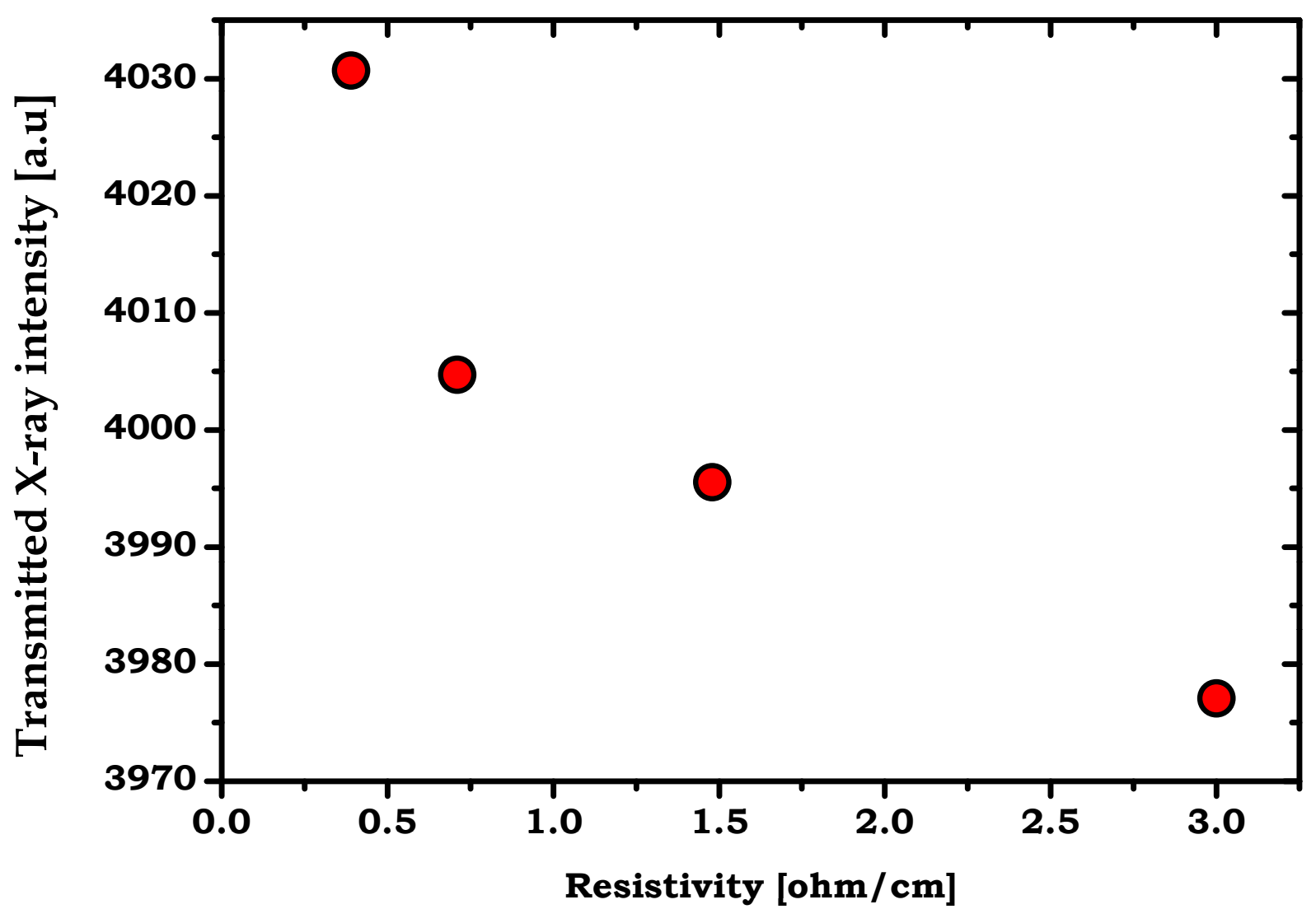
One of the most curious results is possibility of visualizing diffraction lines produced by a monolithic big surface in combination with a non-focused polychromatic X-ray beam. Therefore this pseudo-diffraction signal will strongly depend on the domains orientation. For samples with a single domain (monocrystalline) the diffraction response has spatial coherence forming well defined lines. This spatial coherence will progressively become reduces are regards the Si wafer contain domains with different cristallographic orientations.

Multicrystalline *Quasi-Monocrystalline* *MonoCrystalline*



Doping grade:

Variations in doping elements which later influence the cell/wafer electrical resistance can be also determined by X-ray absorption (radiographic) methods. Figure 3 shows a correlation graph (absorption VS resistivity) obtained for materials with a know resistivity value. Local variations and/or inhomogeneities of doping elements could be also identified.



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