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High resolution X-ray imaging based on single crystal films

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In a high-resolution (micrometer spatial resolution) X-ray imaging detector [1], the Single Crystal Film (SCF) is the first element of the detection chain. Its role is crucial as its efficiency and thickness directly impacts the Detective Quantum Efficiency (DQE) of the detection system. The ideal SCF should possess high absorption efficiency, high light output, low afterglow, optical match with the detector and it should be grown on a substrate free from background luminescence [2]. SCFs are produced by the vertical Liquid Phase Epitaxy (LPE) technique in a thickness range from 1 μ m to 30 μ m with good optical quality. At the European Synchrotron Radiation Facility (ESRF), a LPE laboratory was built in order to produce common SCFs for synchrotron beam-lines, as well as to develop denser and more efficient SCFs for the future. The laboratory and its equipment will therefore be presented. Properties of common SCFs (GGG:Eu [2], GGG:Tb, LSO:Tb [3], [4], [5]) will be compared and the consequence of those properties on the detection system in terms of DQE will be highlighted. Finally the emphasis will be put on the coupling of the SCFs to the optics and CCD camera, in order to optimize the detection system as a whole.

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- [2] T. Martin and al., J. of Synchrotron Radiation, vol. 13, pp 180-194 (2006).
- [3] T. Martin and al., IEEE Transactions on Nuclear Science, vol. 56, pp 1412-1418 (2009).
- [4] P.-A. Douissard and al., J. of Synchrotron Radiation (2010).
- [5] www.scintax.eu/

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