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Centroiding Methods for Split Events in a Charge Coupled Device used for Resonant Inelastic X-ray Scattering

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When X-rays interact in the 'field free'region of a back illuminated Charge Coupled Device (CCD) they form clouds of electrons that diffuse outwards in a stochastic fashion. These electrons can diffuse into neighbouring pixels before being contained in the potential wells beneath the electrodes. This process leads to signal electrons from a single interaction event being spread across multiple pixels –a 'split event'.

At the Swiss Light Source (SLS), PolLux is a microscopy beamline capable of producing photons with energies from 200 eV to 1400 eV with a beam width down to 20 nm [1]. The beam can be scanned across back illuminated CCD pixels (˜15 μm square) to take images of split events where the position of interaction is known. This allows the dependence of position of interaction in a pixel on charge spreading and split event profiles to be studied. Centroiding algorithms can be applied to the split event profiles, inviting the comparison of the known and calculated positions to compare the accuracy of the methods to be investigated.

The Super Advanced X-ray Emission Spectrometer (SAXES), used for Resonant Inelastic X-ray Scattering on the ADRESS beamline at the SLS, has a resolution that is reported to be limited by the charge spreading in the CCD. By applying the centroiding techniques to these split events we aim to improve the spatial resolution of the CCD down to sub-pixel levels (<13.5 μm) from the currently reported 24 μm FWHM [2]. However, understanding the formation of split events and the errors associated with the centroiding algorithms is essential before these techniques can be fully applied to improve the resolution of SAXES.

[1] J. Raabe, et al., Rev. Sci. Instrum., vol. 79, 113704, 2008.
[2] G. Ghiringhelli, et al., Rev. Sci. Instrum., vol. 77, 113108, 2006.

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Poster

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