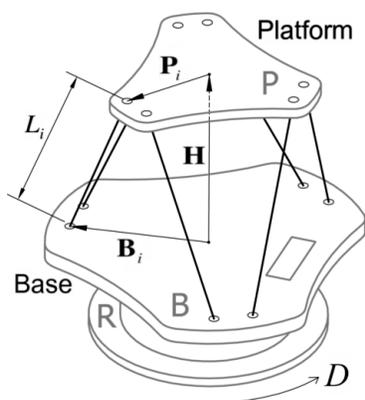


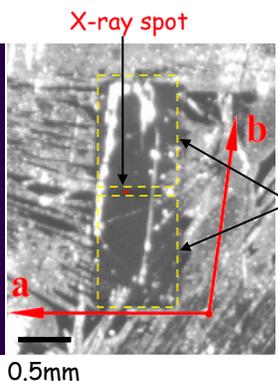
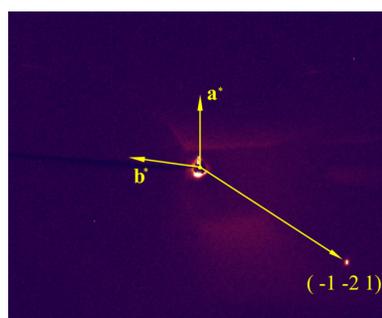
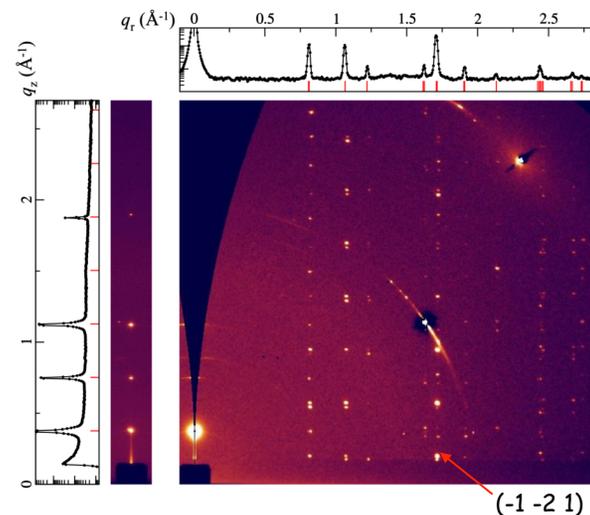
# Use of a hexapod for diffraction measurements

**Motivation:** Substrate-supported samples often contain ordered domains that share one common crystal plane that is parallel to the substrate. In highly ordered structures, such as organic semiconducting materials deposited on a substrate, the in-plane orientation of these ordered domains is not random and the crystal orientation with respect to the electrode arrangement may affect device performance. In situations like this, the sample needs to be rotated in a complex trajectory to access appropriate parts of the reciprocal space.



**Key result 1:** A commercial hexapod has been integrated into the beamline control software. The kinematic code in the motion controller was revised for X-ray diffraction experiments. The sample can be moved to a specified  $(x,y,z)$  position at the given pitch, roll, yaw angles with respect to a user-defined rotation center, which can be re-defined during experiments.

**Key result 2:** The lattice structure of the supported crystals can be found of a GID pattern collected during a full rotation of in-plane sample orientation while keeping the incident angle constant.



**Key result 3:** The local crystal orientation, in this case between two electrodes that are 0.1mm apart, was then found by programming the sample motion to exhaust all possible in-plane orientations so that a pre-selected Bragg peak appears on the detector when the actual in-plane orientation of the crystal is encountered in the scan. The lattice orientation can then be deduced from the position of the Bragg peak.

**Conclusions and significance:** The lattice structure of the crystal was determined and in-plane orientation of the crystal defined in diffraction measurements using a hexapod. This new method of performing diffraction measurements is well suited for measuring diffraction from supported crystals that contain numerous domains, such as films of organic semiconductors studied here and 2D membrane protein crystals.

*Use of a hexapod in diffraction measurements of substrate-supported crystals of organic semiconductors*

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