# RSXS diffraction alignment

The goal is to align th, chi, and phi at two orientation of structural Bragg peaks. The approach will be different from one sample crystallographic symmetry to the other. Here is just an example with a cubic system and the out-of-plane (L) direction is normal to a sample surface and one of the in-plane (H or K) direction is set to the scattering plane.

Use following steps to prepare the instrument for diffraction scans:

1. Perform the sample alignment as described in “RSXS sample alignment” procedure.
2. All detectors can be used to detect structural Bragg peaks. The detector height position on the scattering plane and its relative tth distance can be viewed with **statDET**. For better visualization, the MCP 2D area detector is preferred (**umv detz 0** and tth offset (**set tth xxx + tth_offset of MCP**).
3. Input the lattice parameter info (**setlat**).
4. Normally we set the FOURC mode to chi and phi fixed (**setmode 2**).
5. Searching for the (00L) peak at higher energy:
    a. Calculate the motor position for a given 00L and energy (**ca 0 0 L**).
    b. Move to that calculated position (either **ubr** or **uan**).
    c. Monitoring the analog MCP 2D image by moving th about ±5° (**umvr th**) at every chi step of 3° (**umvr chi**) until finding a potential peak.
    d. Optimizing the peak by aligning th and tth (**lup th**, **lup tth**, and **th2th**).
    e. Set the th as half of tth (**set th**).
    f. Checking the HKL value at the peak position (**wh**). If needed, adjust the c lattice parameter (**setlat**) in order to match with the intended 00L.
    g. Input the th, tth, chi values for the first orientation (**setor0**).
6. Searching for the (H0L) peak at higher energy:
    a. Calculate the motor position for a given H0L and energy (**ca H 0 L**).
    b. Move to that calculated position (either **ubr** or **uan**).
    c. Monitoring the analog MCP 2D image by moving th about ±5° (**umvr th**) at every phi step of 3° (**umvr phi**) until finding a potential peak.
    d. Optimizing the peak by aligning th and tth (**lup th**, **lup tth**, and **th2th**).
    e. Checking the HKL value at the peak position (**wh**). If needed, adjust the a and b lattice parameter (**setlat**) in order to match with the intended H0L.
    f. Input the th, tth, chi, and phi values for the second orientation (**setor1**).
    g. Update also the phi value in the first orientation (**setor0**).
7. If chi and phi position are quite different from the normal chi and phi position at 90° and 0°, respectively, then it is good to verify x, y, and z position again.