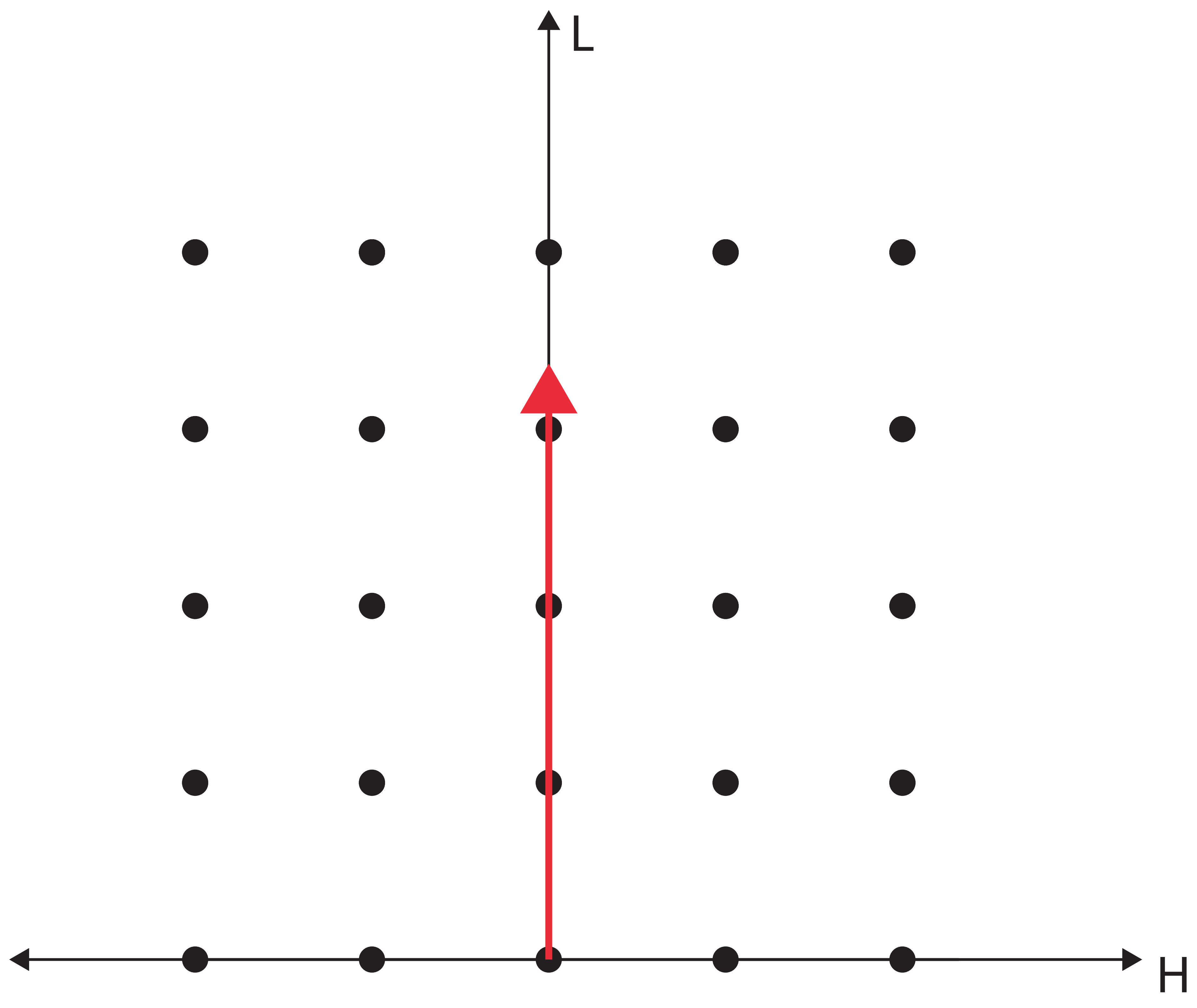
Pilatus ROI manipulation

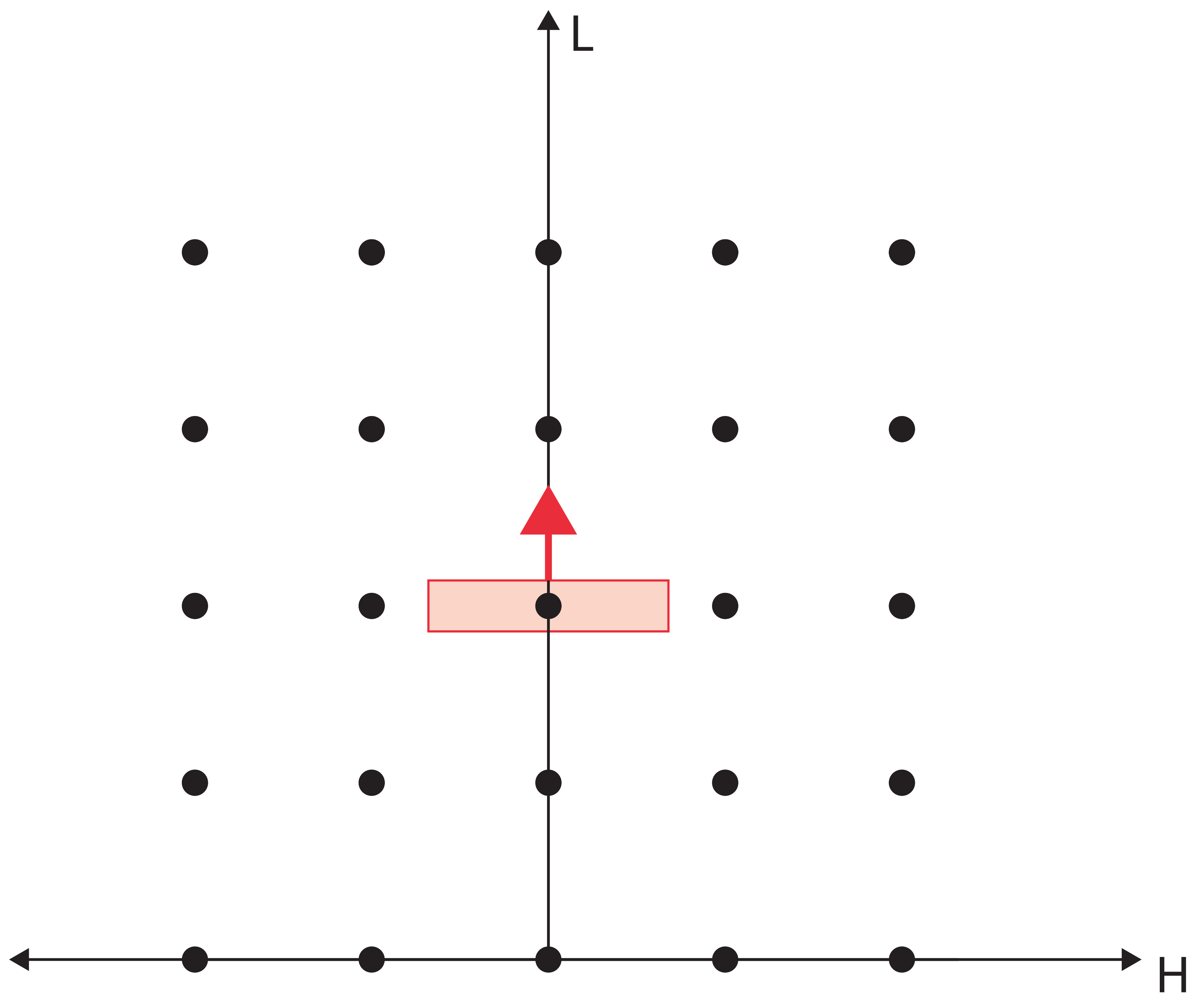
What is it?

- At SSRL beamlines 2-1 and 7-2 we use a Pilatus 100k area detector - an array of 487 x 195 pixels
- During alignment a “center pixel” is determined - this is the location of the direct beam on the detector
- Specific regions of interest must be selected from Pilatus detector in order to extract data

0D detector vs 2D detector

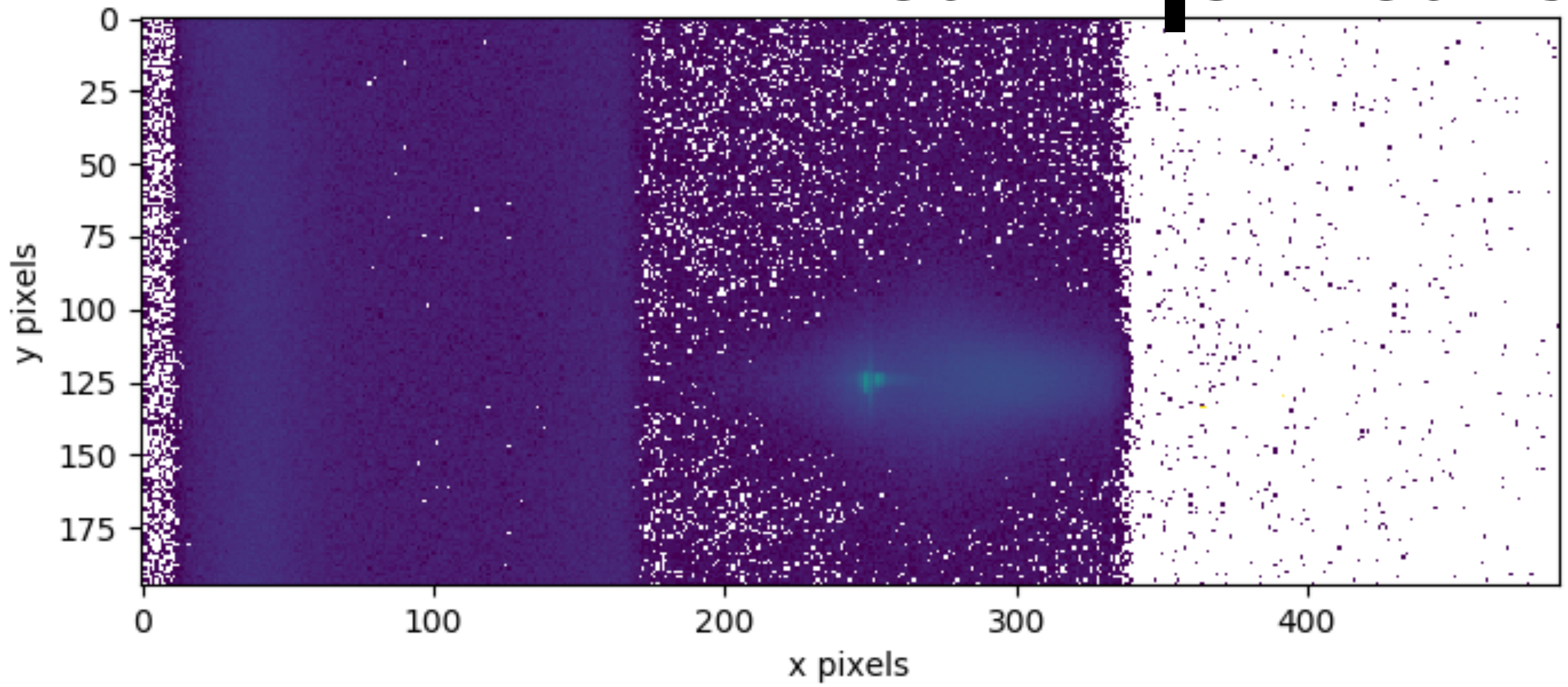


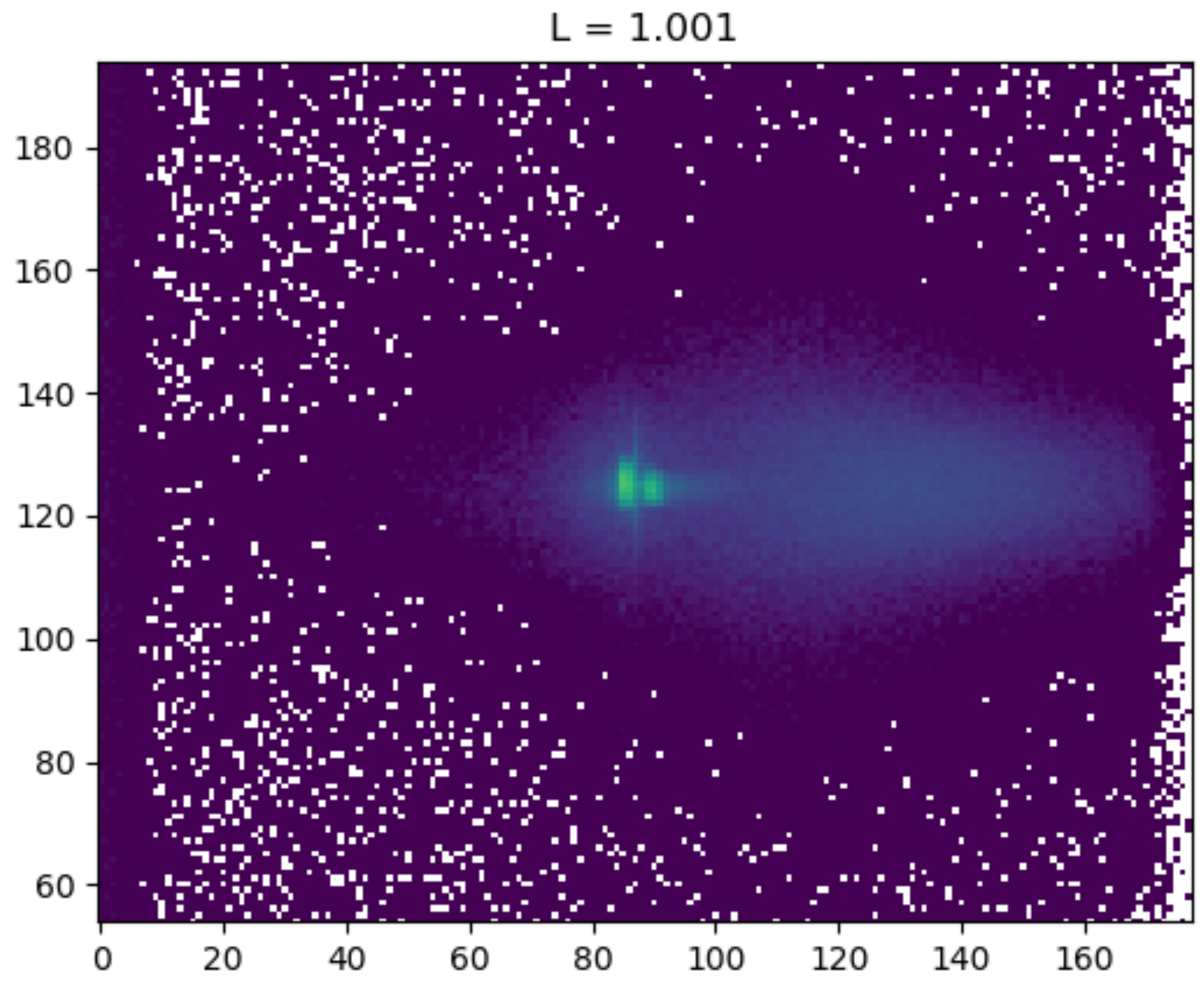
0D detector - Bruker



2D detector - SSRL BL 7-2

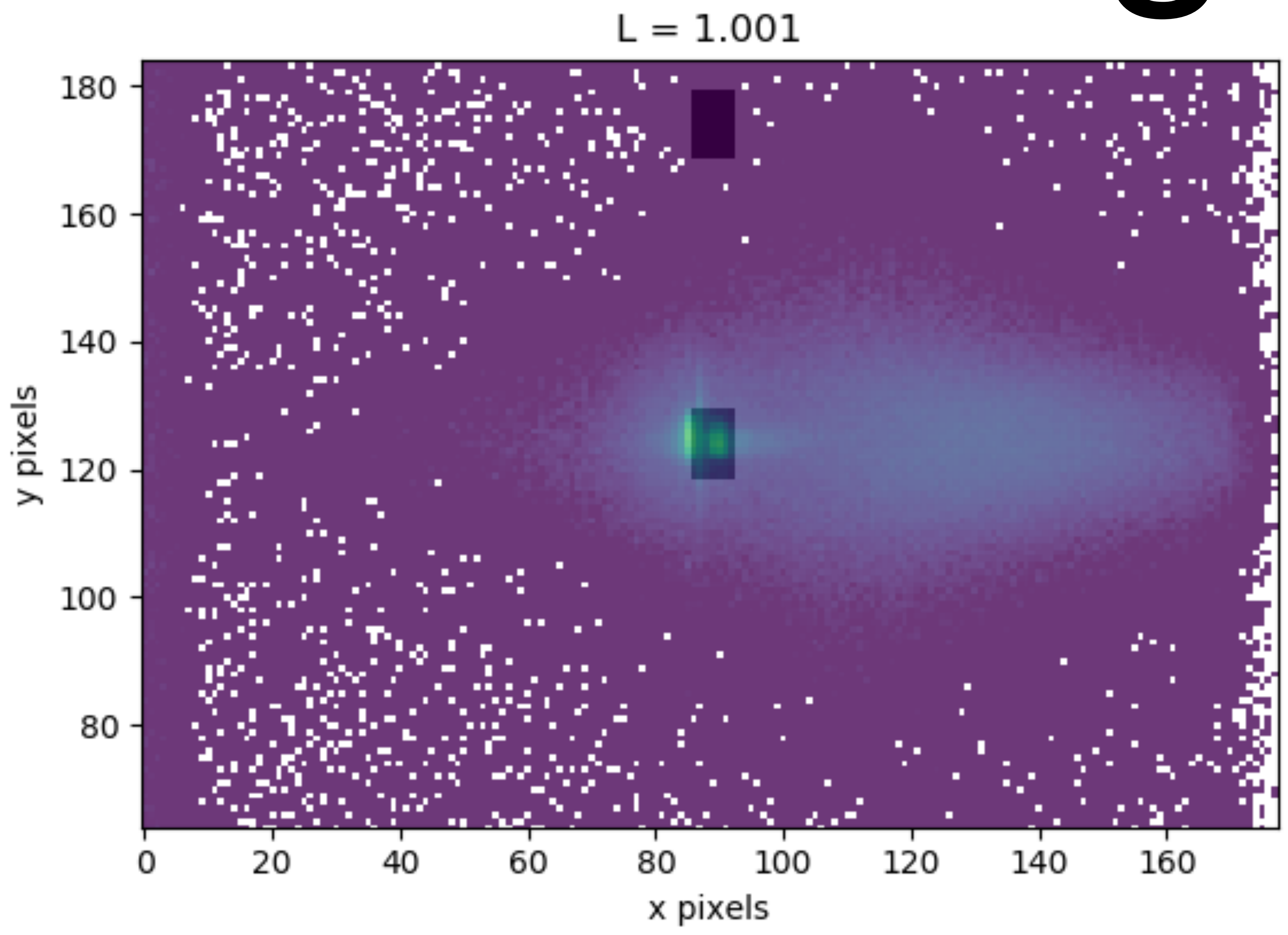
Raw pilatus data

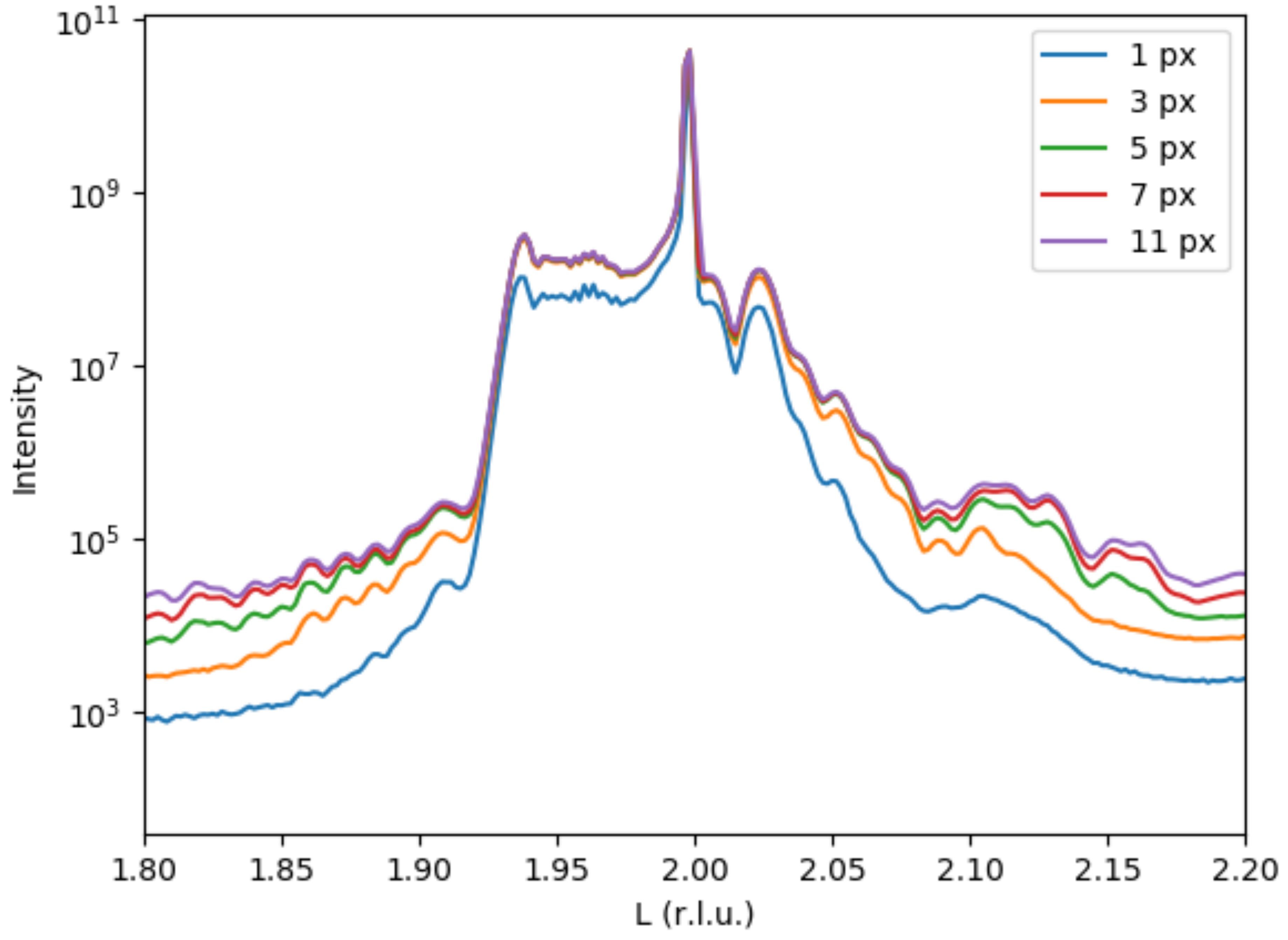




- First step - digitally crop regions defined by detector slits (v1gap and h1gap at BL)
- Apply proper normalization from filters

Extracting data from images

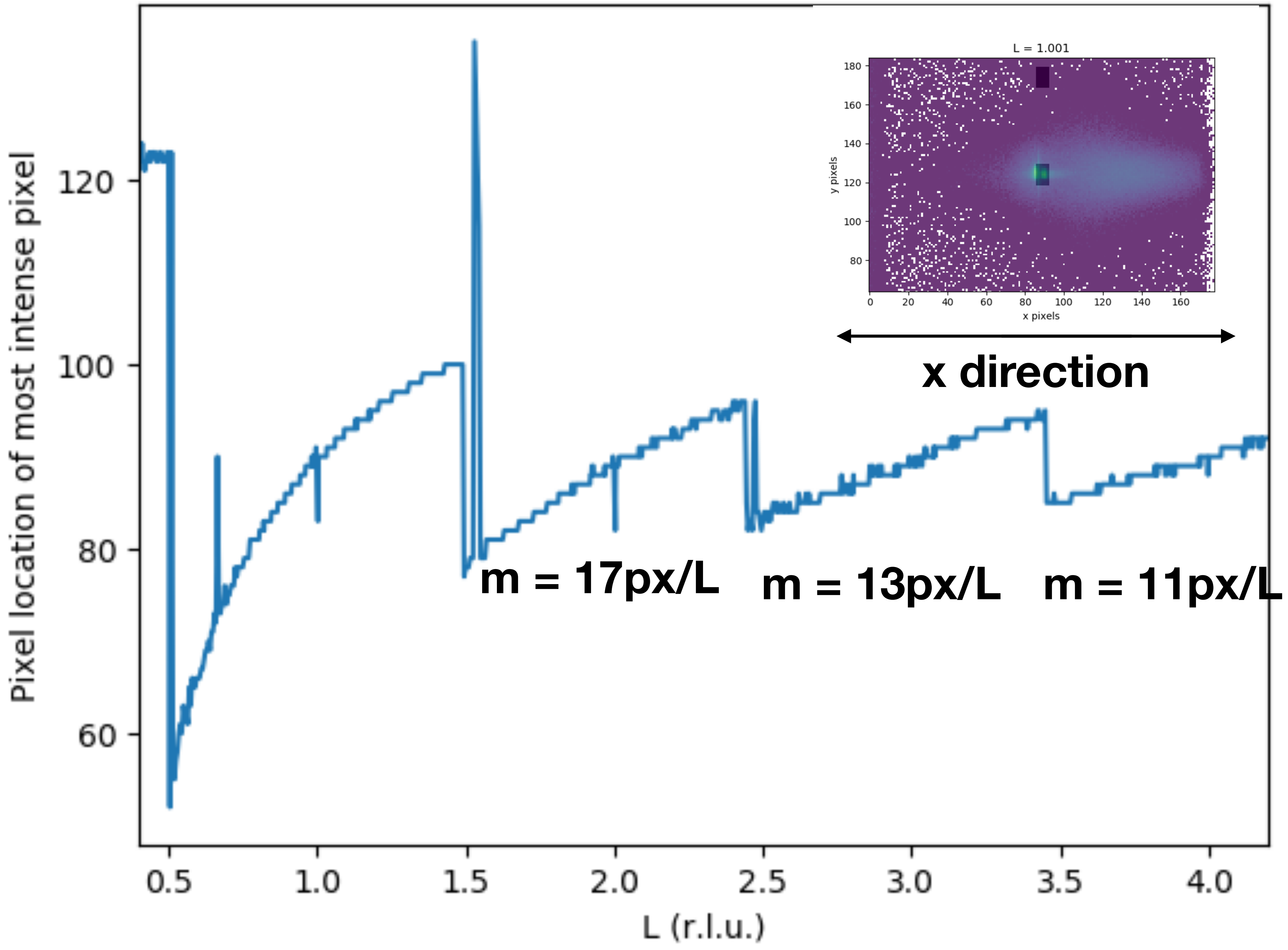




- Using a fixed ROI - smaller ROI widths lose thickness fringe information, but things like peak separation can get better

- The 00L rod actually moves in the “x” direction during the scan - we should TRACK IT

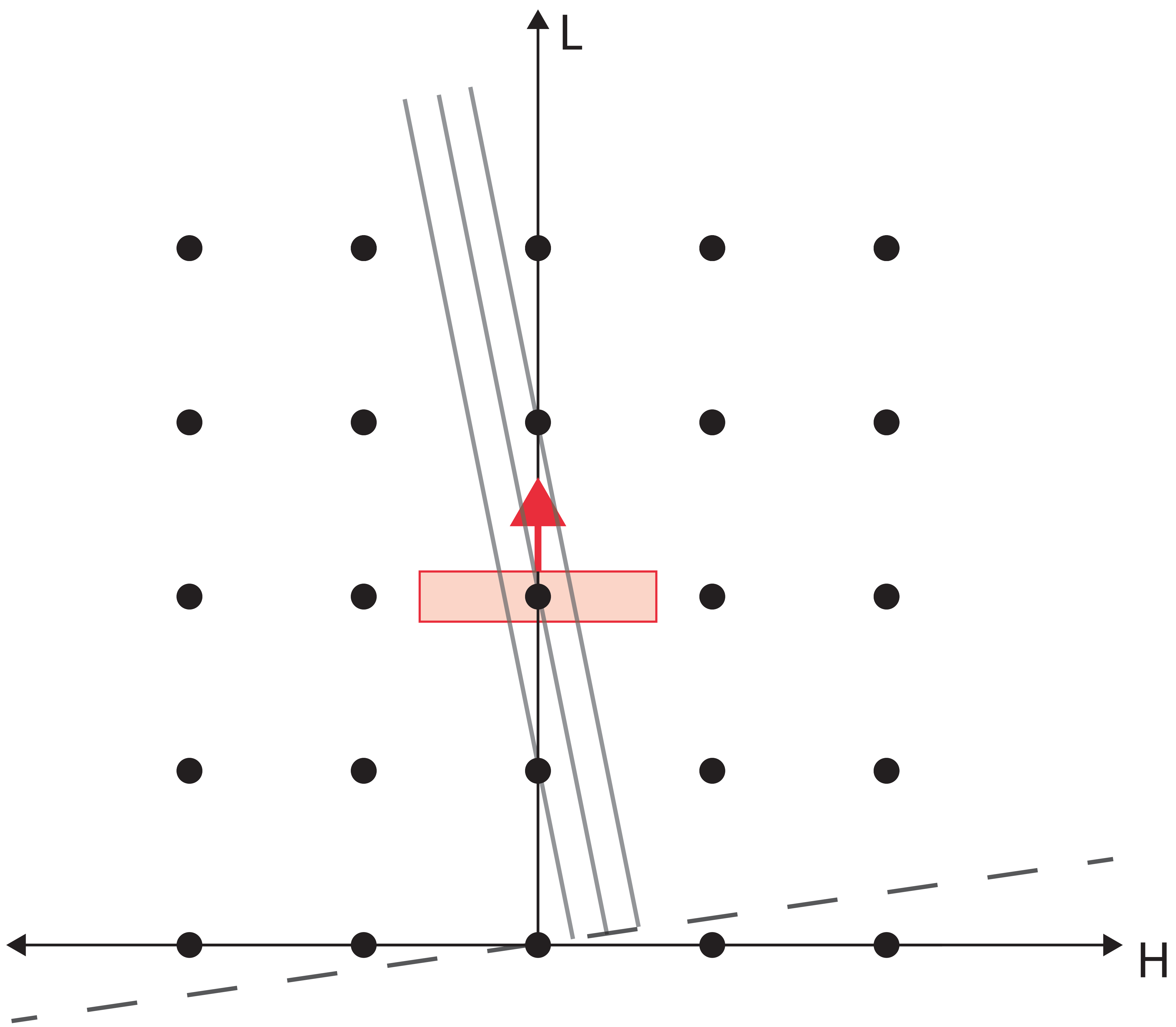
Tracking motion of central pixel



- Significant ‘x’ motion of central pixel as the l-scan progresses

- Why? Crystal Truncation Rods

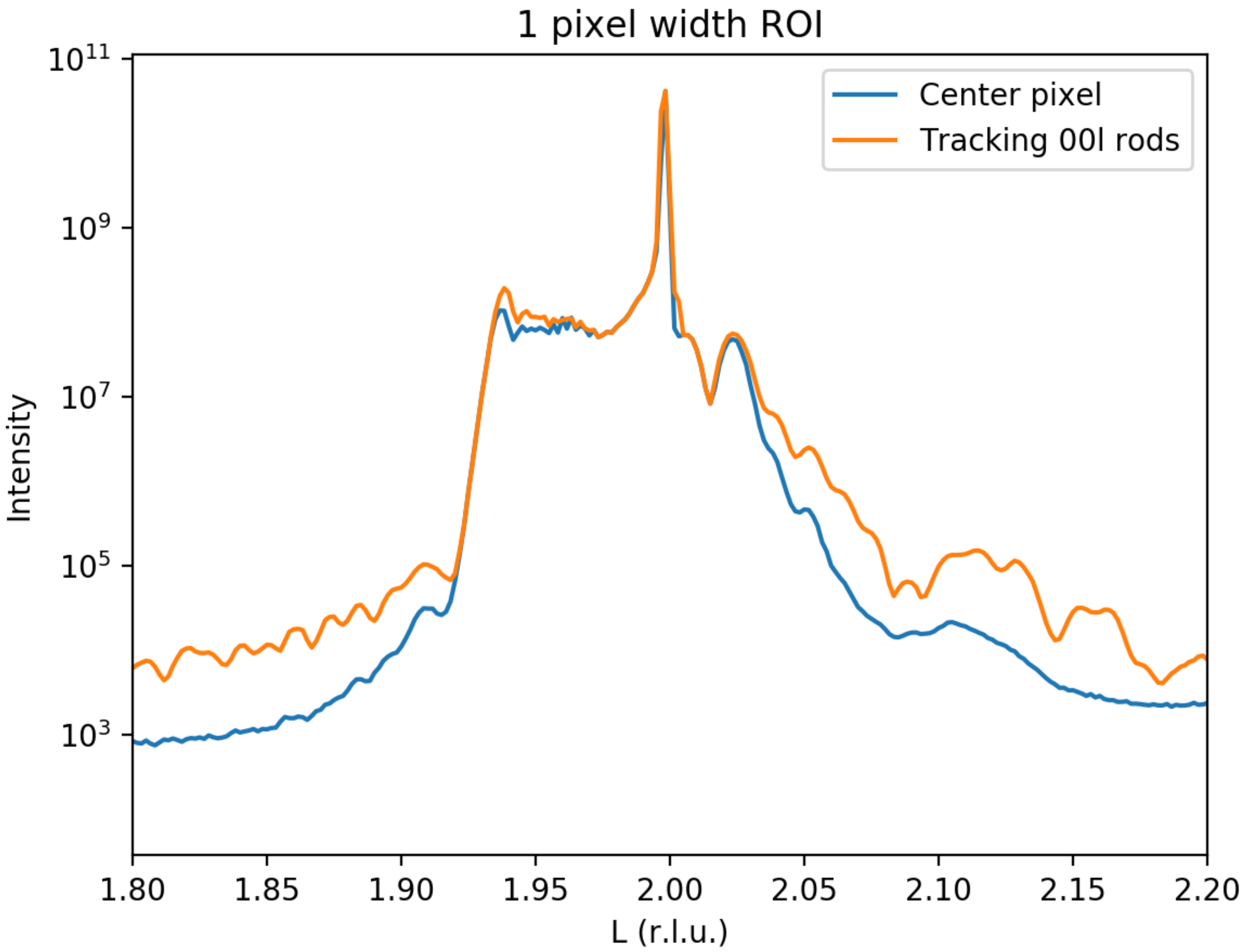
Crystal Truncation Rods



- A result of the finite dimensions of crystals

- Crystal surface slightly misaligned with crystal lattice - rods are always perpendicular to sample surface so they are slightly offset from reciprocal space directions

Tracking the central rod



- Tracking the central rod keeps prominent lattice fringes while also having good peak separation

Next steps

- Incorporate a conversion from pixel coordinates to reciprocal space coordinates. This will require knowledge of the sample orientation matrix (set during alignment at beamline), the location of the detector (from motor positions), angular offsets of the detector, distance from sample-detector, and the size of Pilatus pixels

- Track multiple CTR - these will give information about substrate miscut and surface roughness. If CTR analysis will be done, count for longer in between Bragg peaks