

Future use of CXD at ID01

Ian Robinson

Ross Harder

Steven Leake

Marcus Newton

Hyunjung Kim

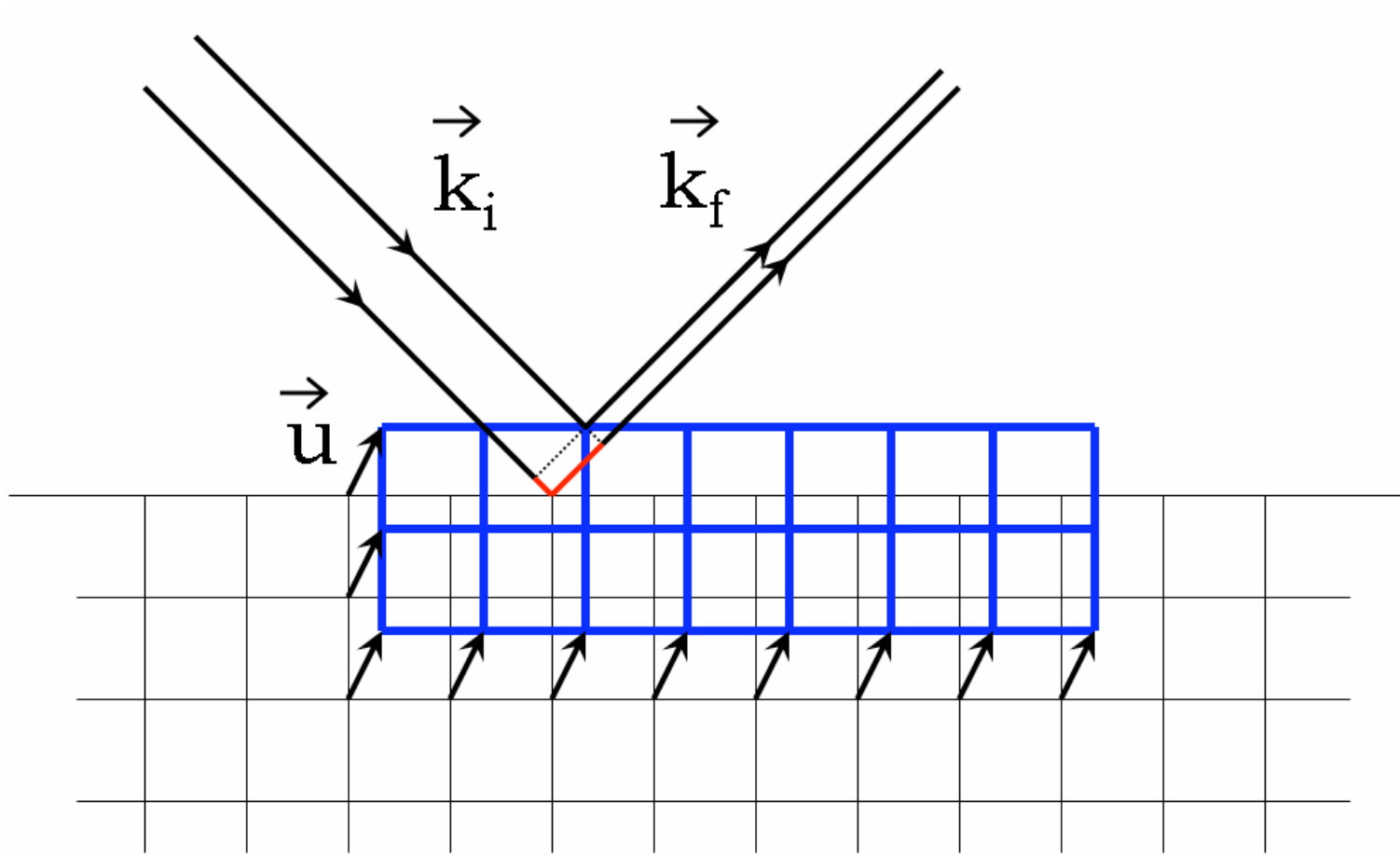
Wonsuk Cha

London Centre for Nanotechnology
Diamond Light Source

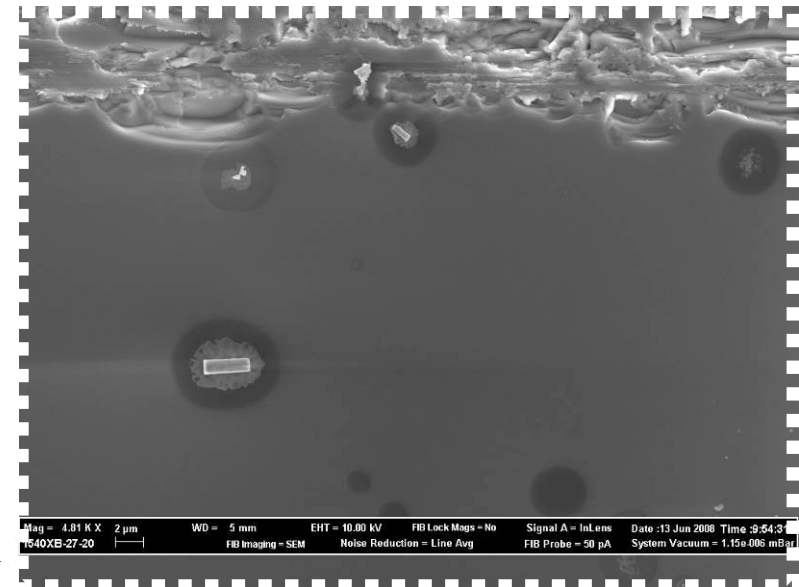
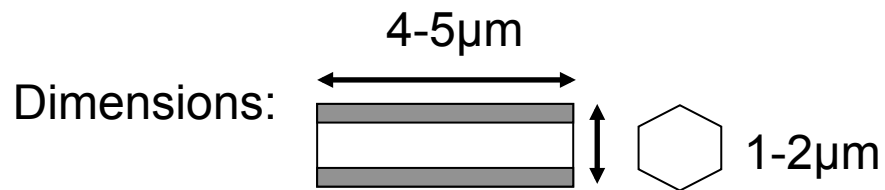
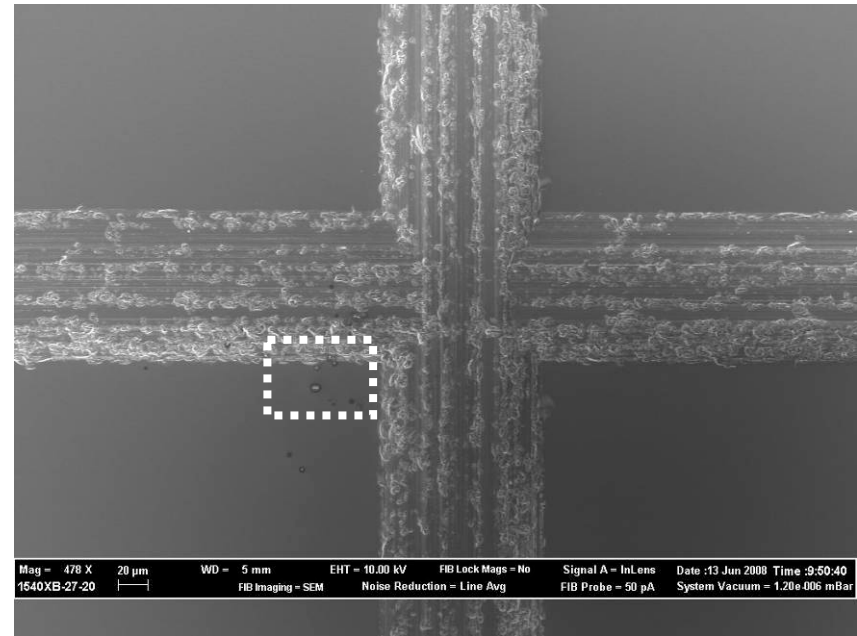
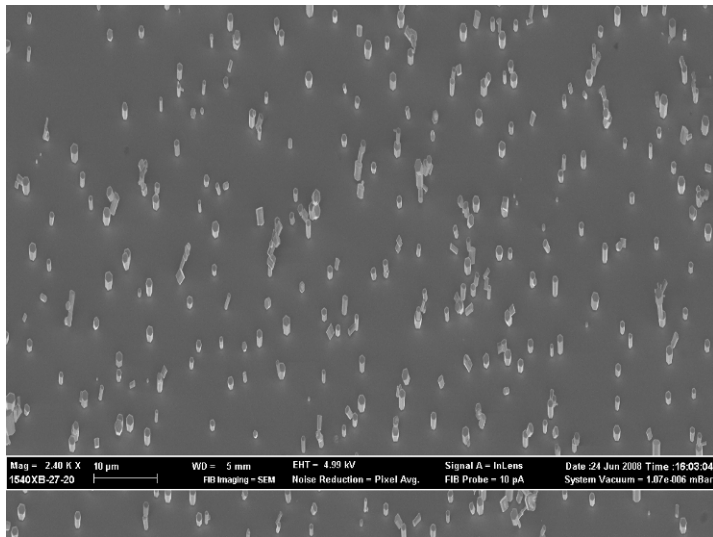
ID01 “brainstorming”
December 2008

Sensitivity to strain

$$\Delta\varphi = \mathbf{k}_f \cdot \mathbf{u} - \mathbf{k}_i \cdot \mathbf{u} = \mathbf{Q} \cdot \mathbf{u}$$

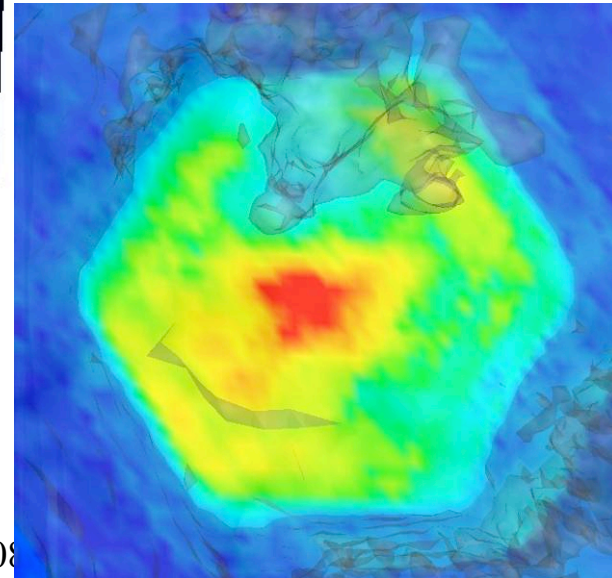
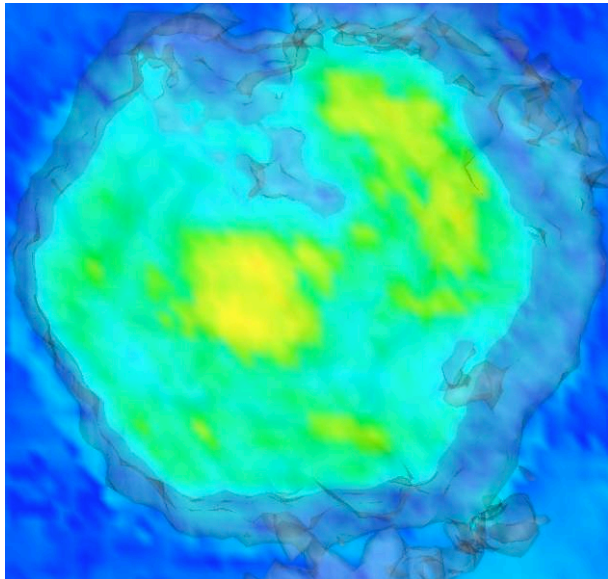
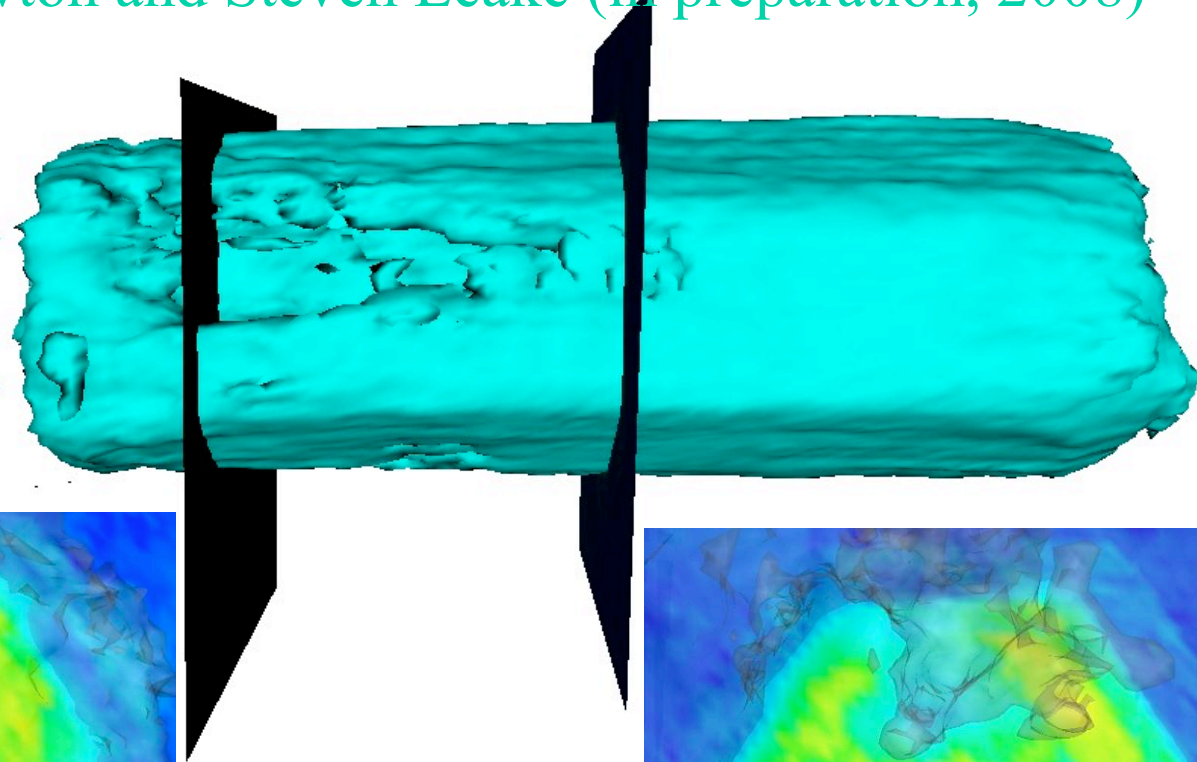


ZnO Sample Preparation



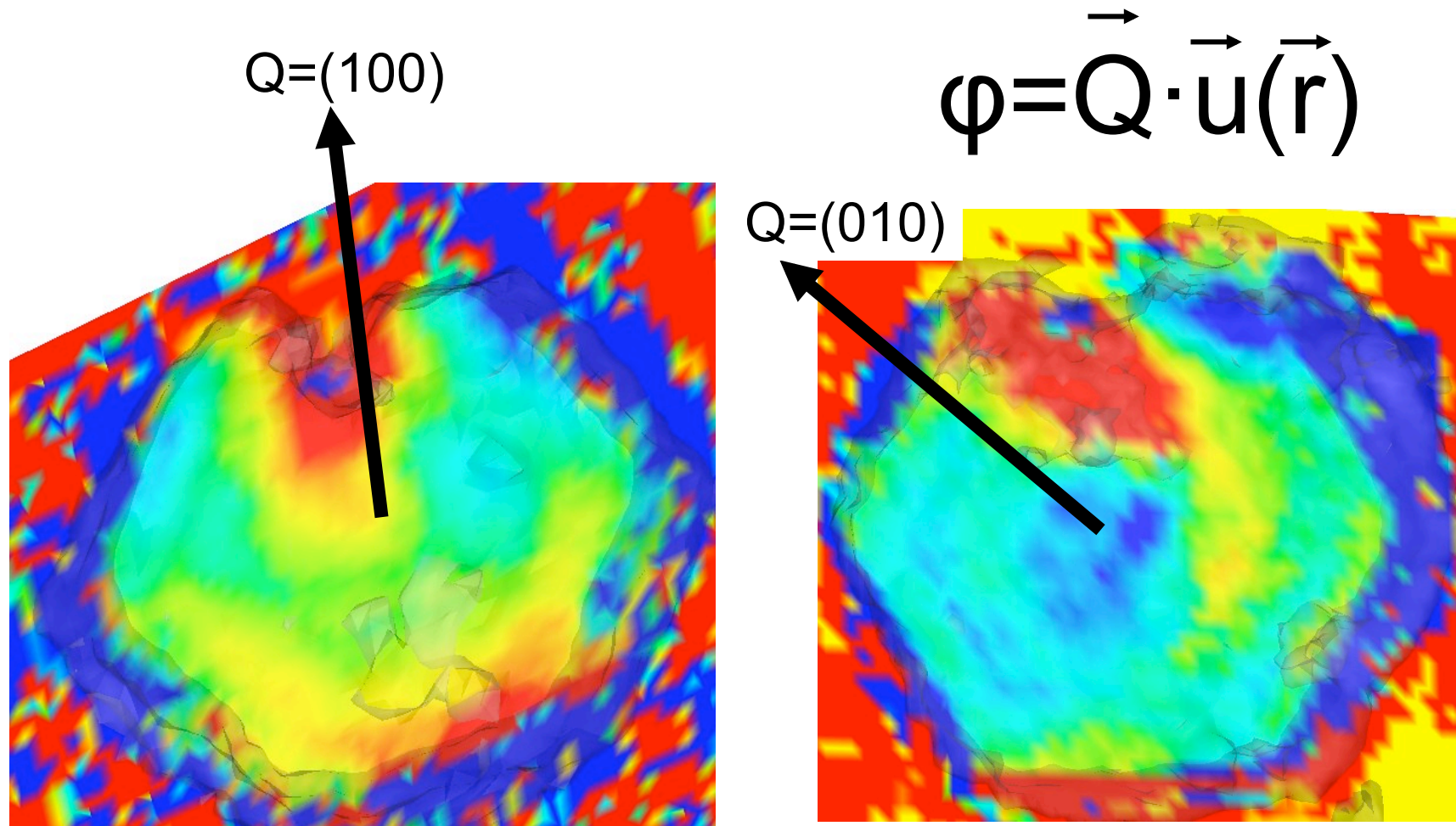
Density sections ZnO-39 (010)

Marcus Newton and Steven Leake (in preparation, 2008)

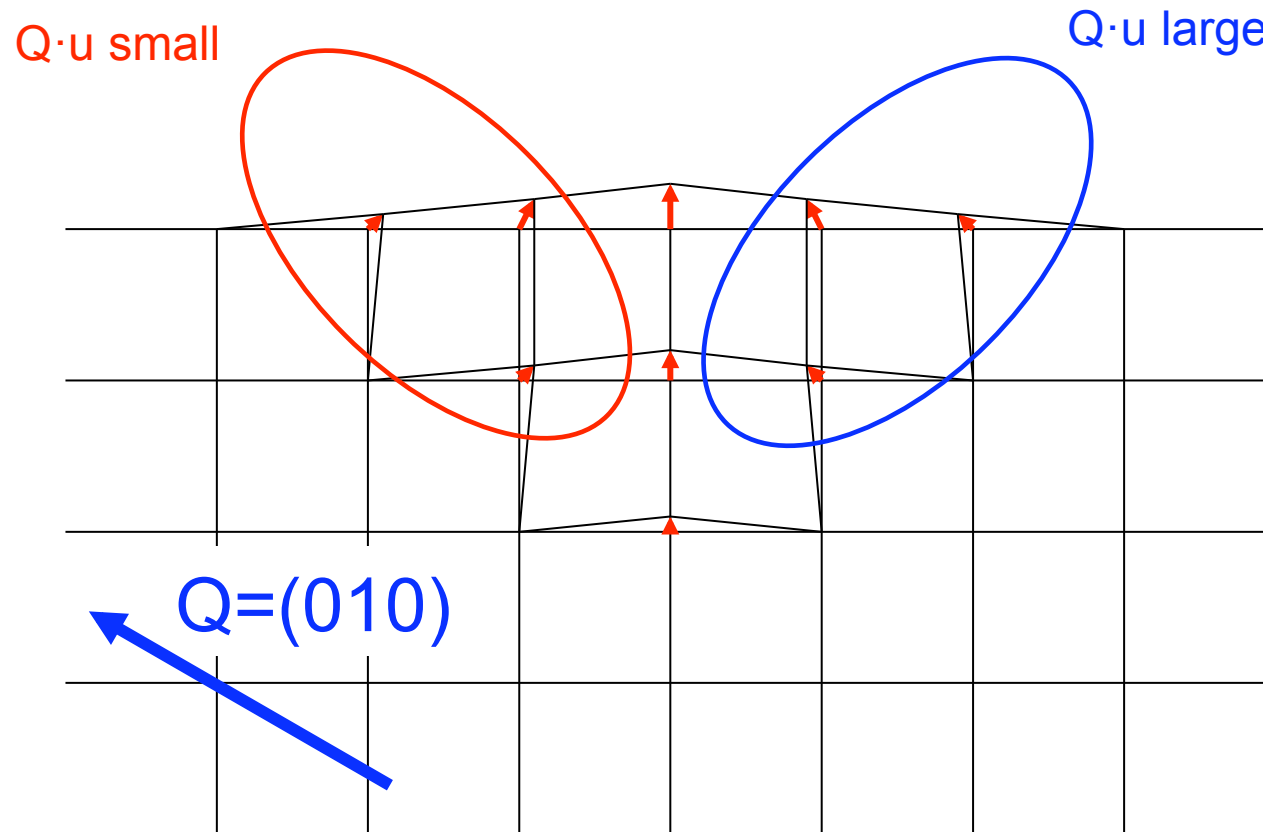


Phase maps from 2 Bragg peaks

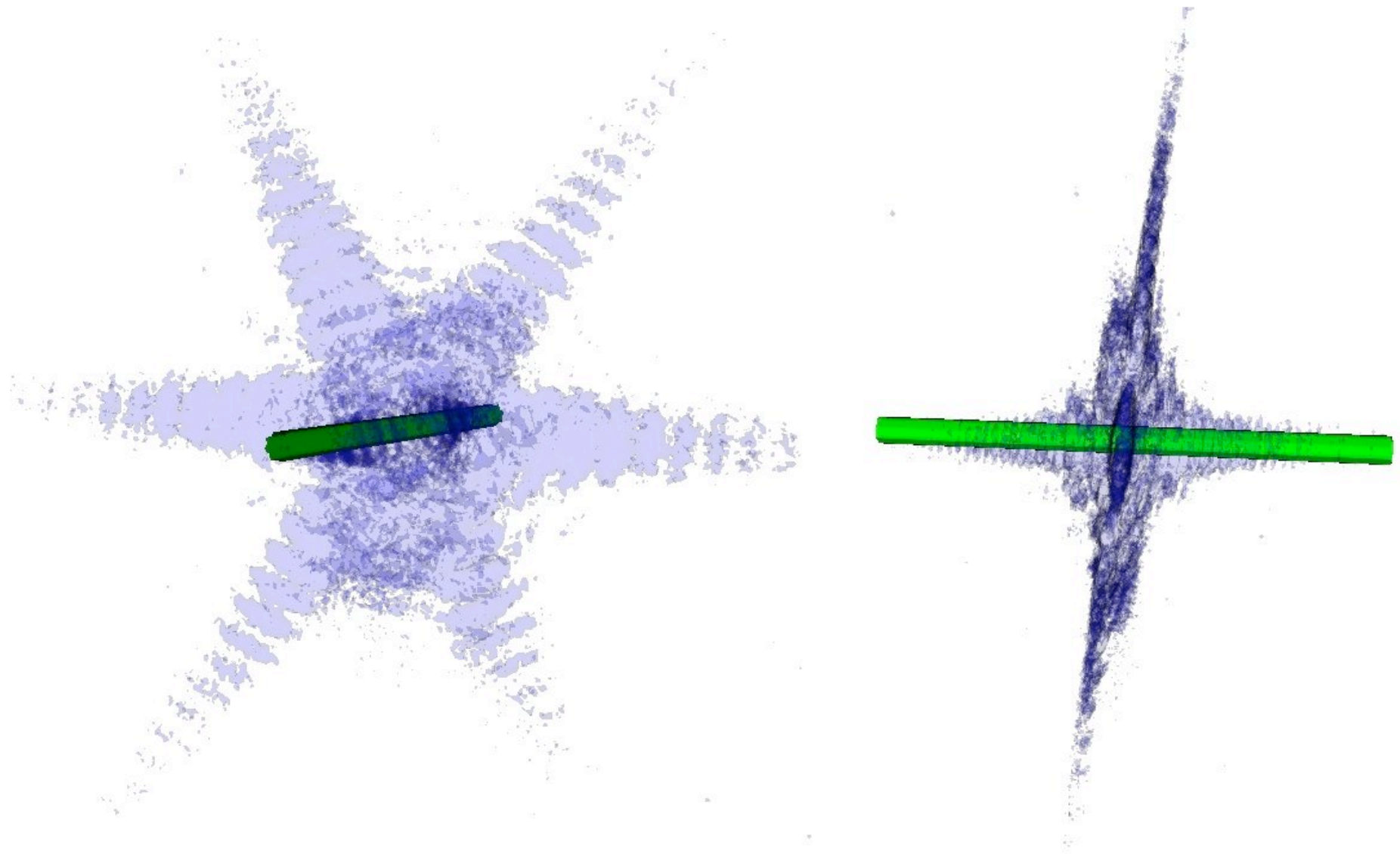
Blue-Red is +2 radians. Slice at -1500nm from centre ZnO-5 -39



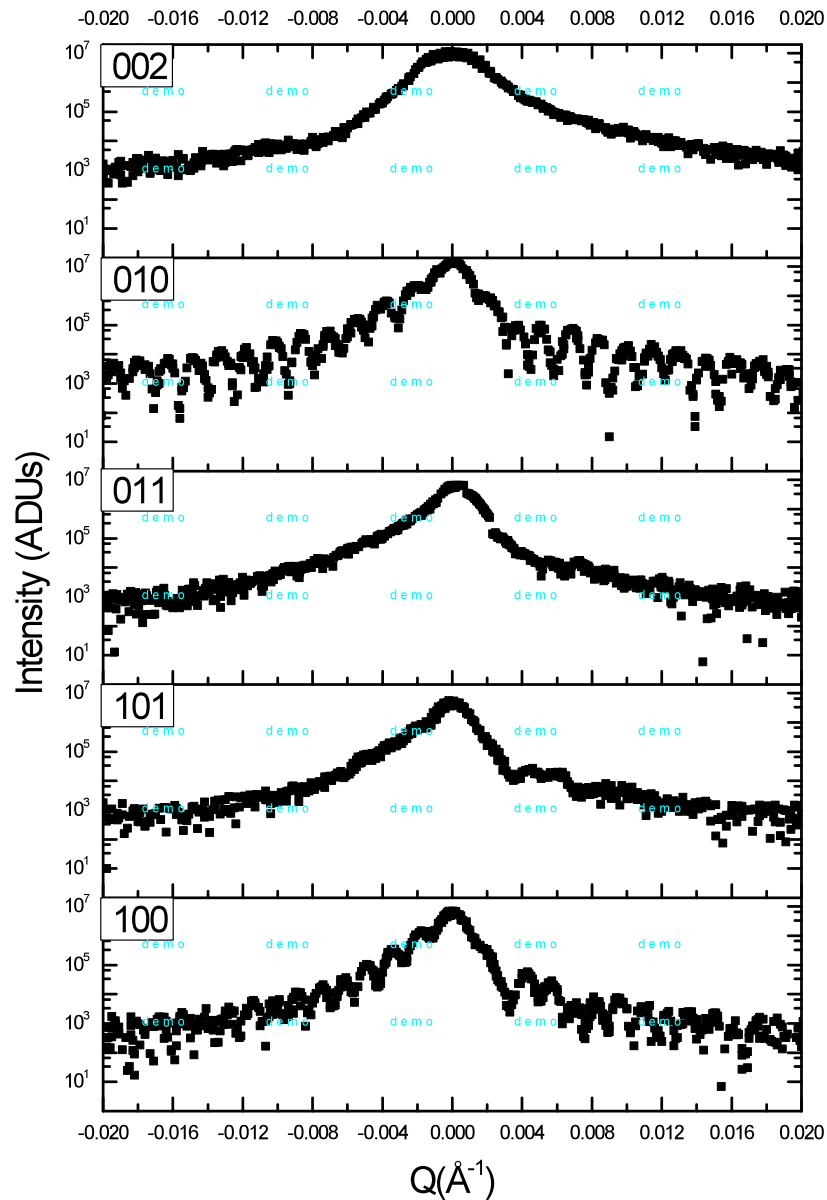
Typical displacement field



How to extract the contrast data



Five Bragg peaks



002 no fringe visibility

010 & 100 good fringe visibility

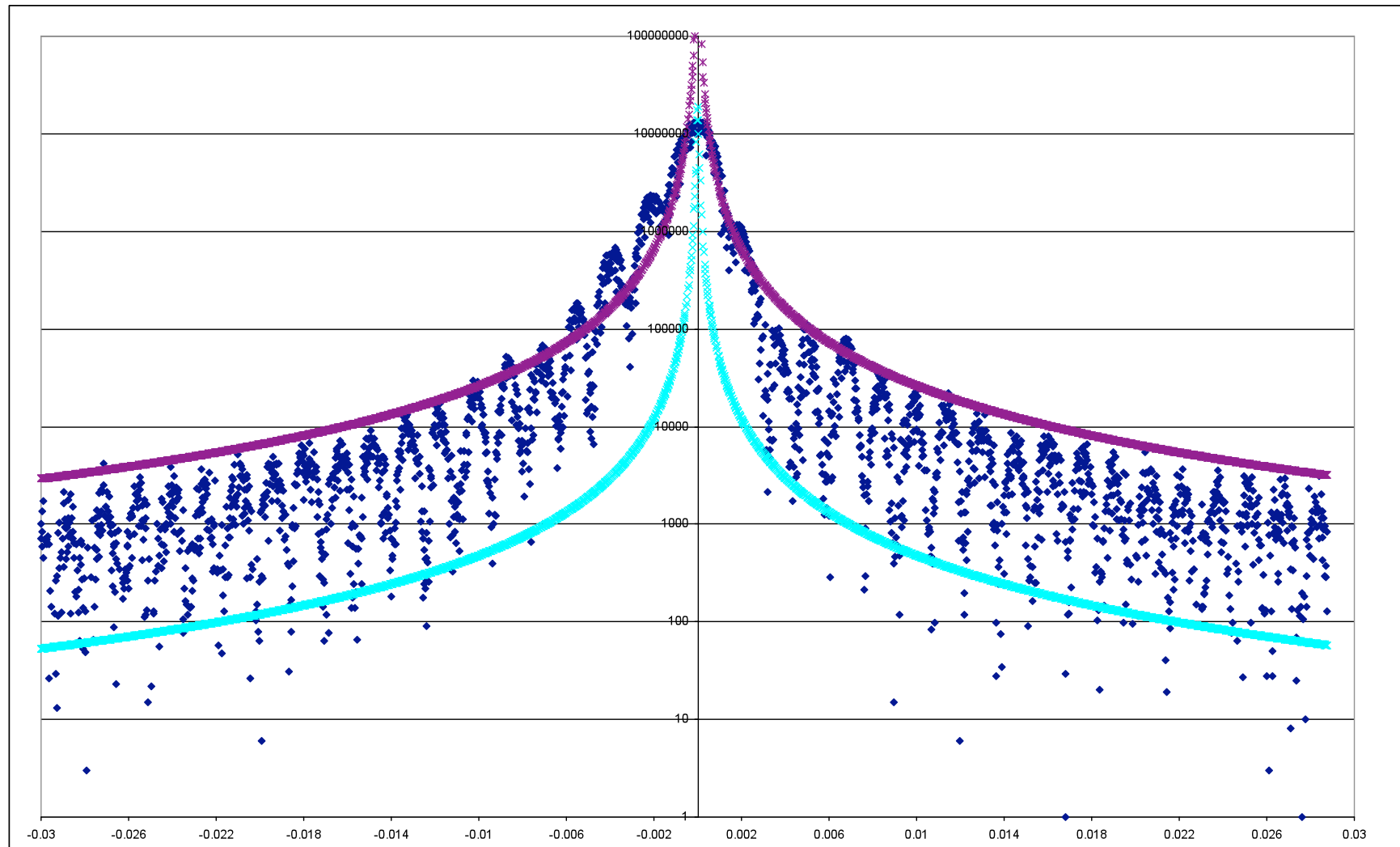
101 & 011 diminished fringe visibility
but fringes still evident

010:011 & 101:100
show complementary fringes
but not between each other

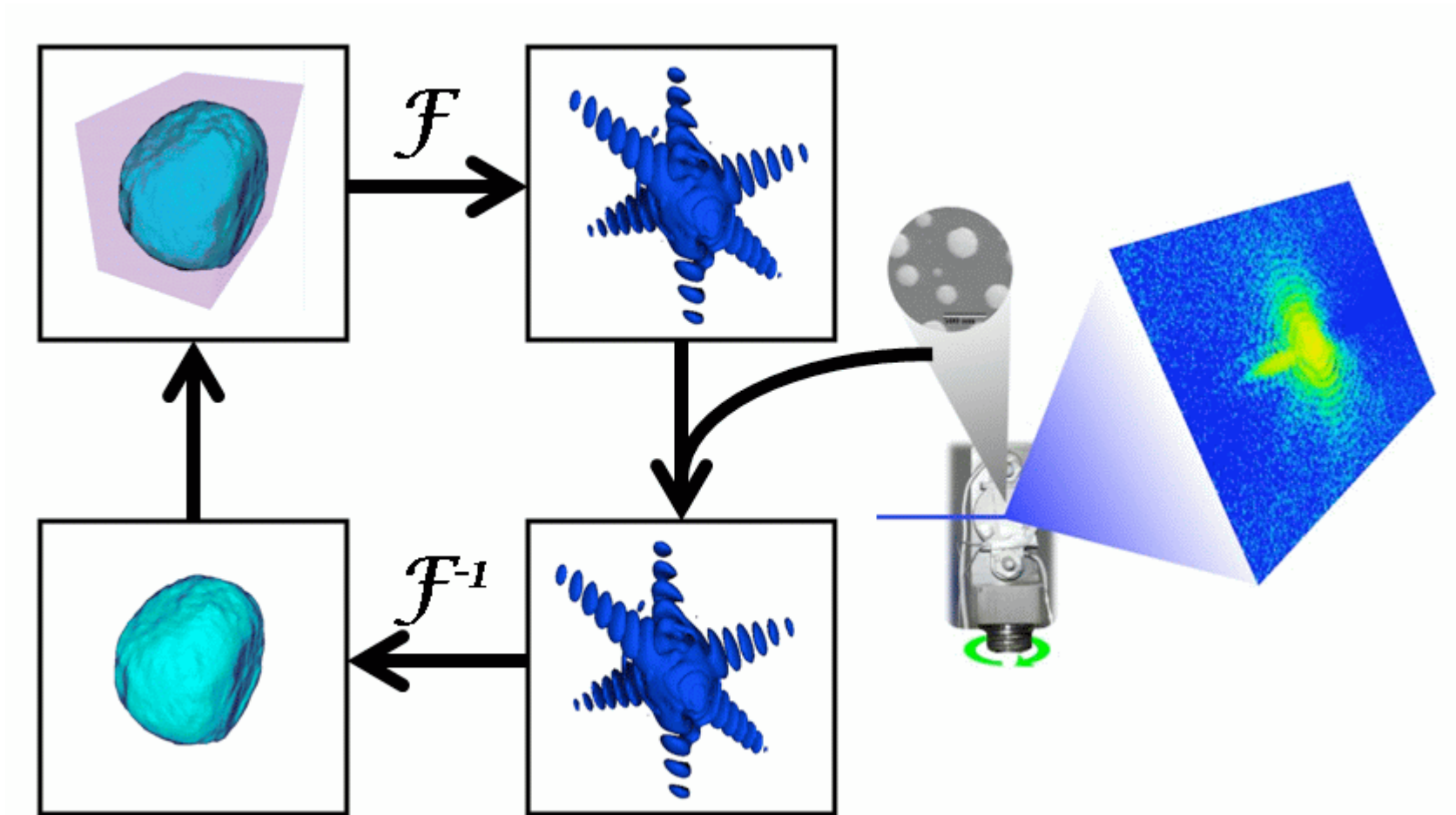
Error in coordinate transform ruled out

010 and 100 reflections fringe spacing
difference $\sim 20\%$

Fringe Visibility $96 \pm 2\%$ @010

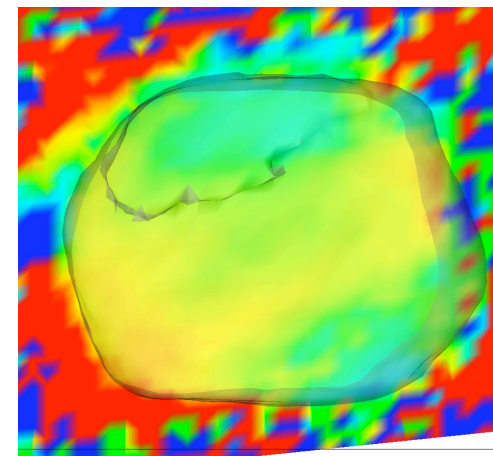
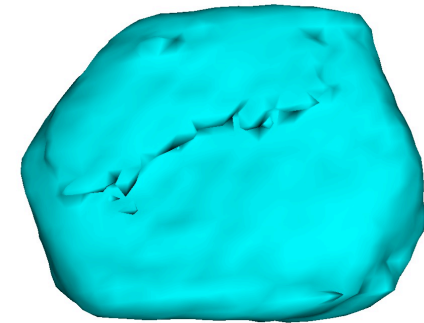
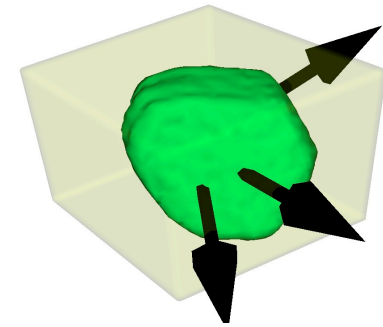
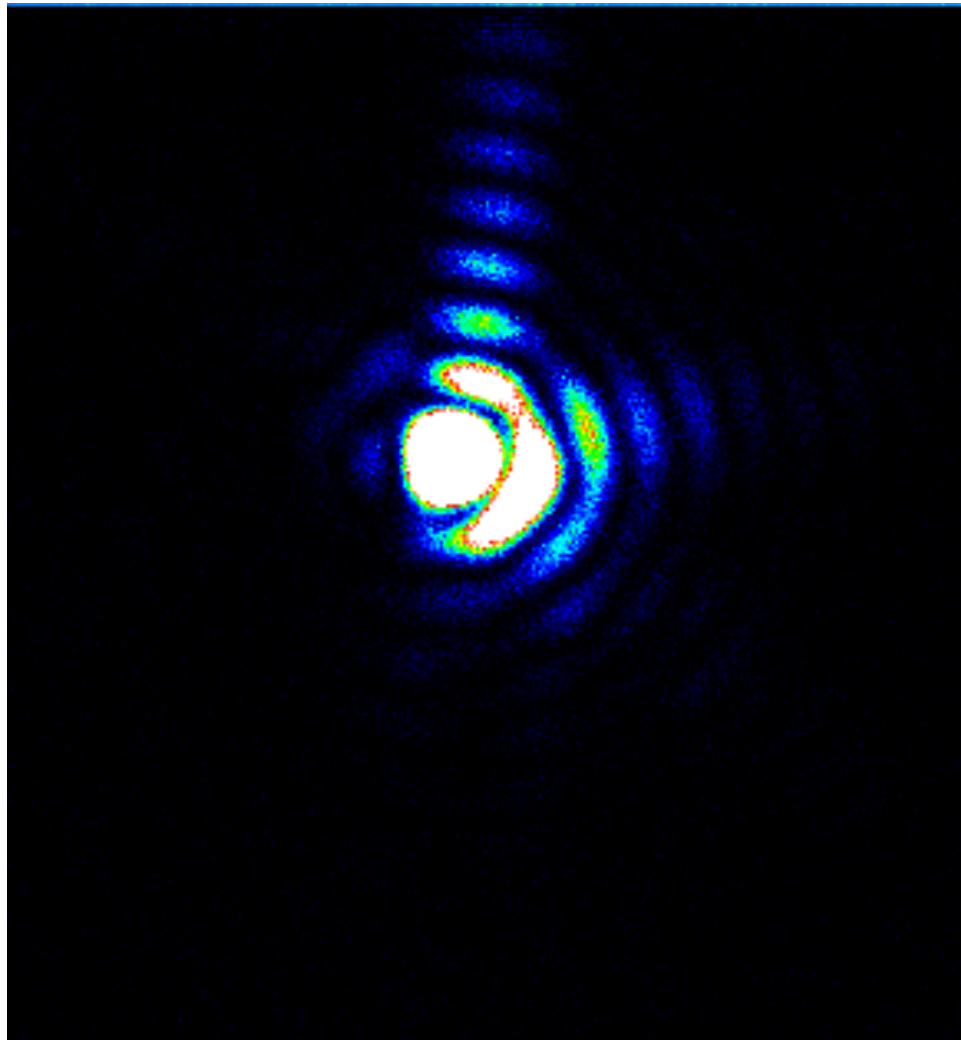


Generic “Error Reduction” method



J. R. Fienup Appl. Opt. 21 2758 (1982)

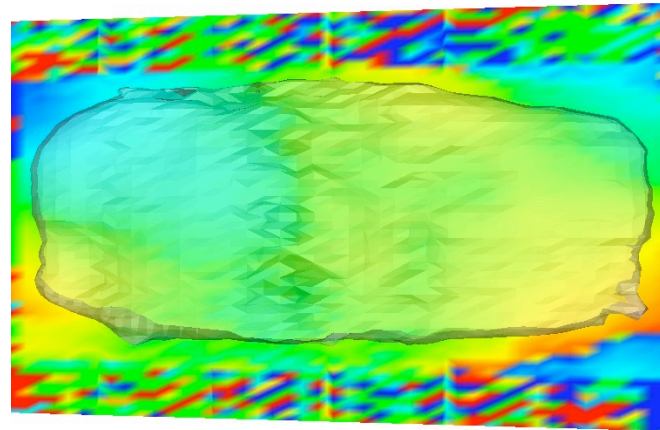
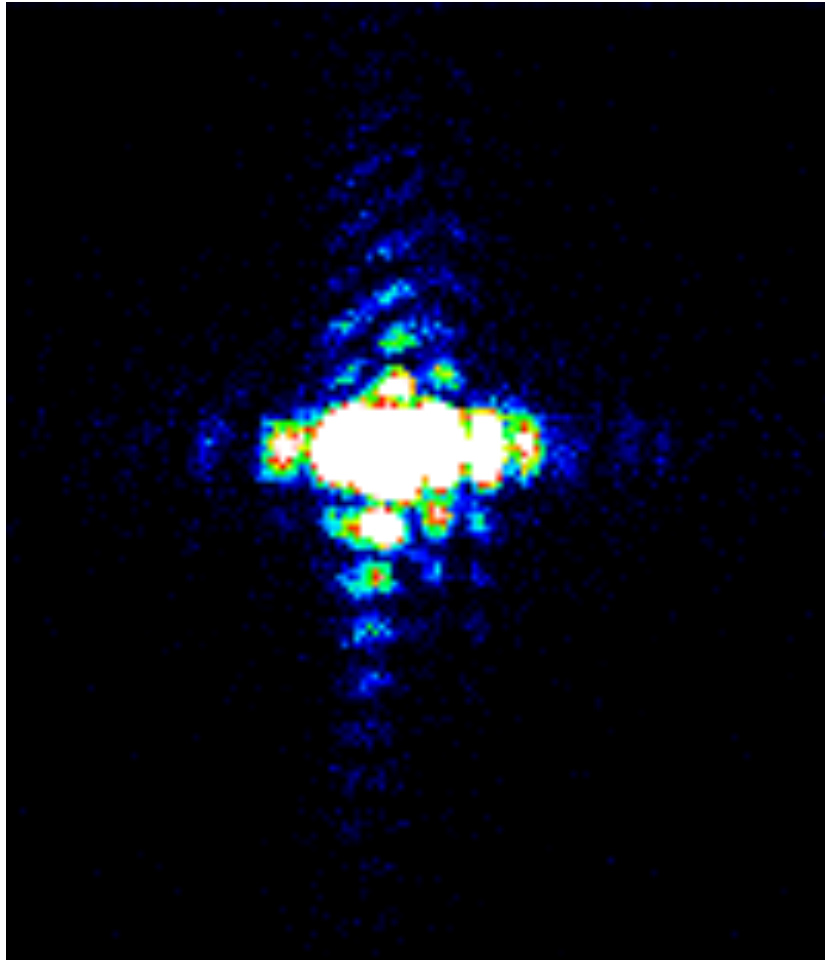
R. W. Gerchberg and W. O. Saxton Optik 35 237 (1972)



I. K. Robinson, ID01 Dec 2008

Still too hard to phase...

zeo1107-36 and -49B



CXD imaging at Bragg peaks

- Coherent x-ray diffraction of Au, ZnO
- “Support” based phasing works
- Strain has many applications
- Ptychography phasing “should” work
- Strong phase objects maybe soon?
- General phase problem still challenging