PZN outer layer structures (previously called “skin effects”)

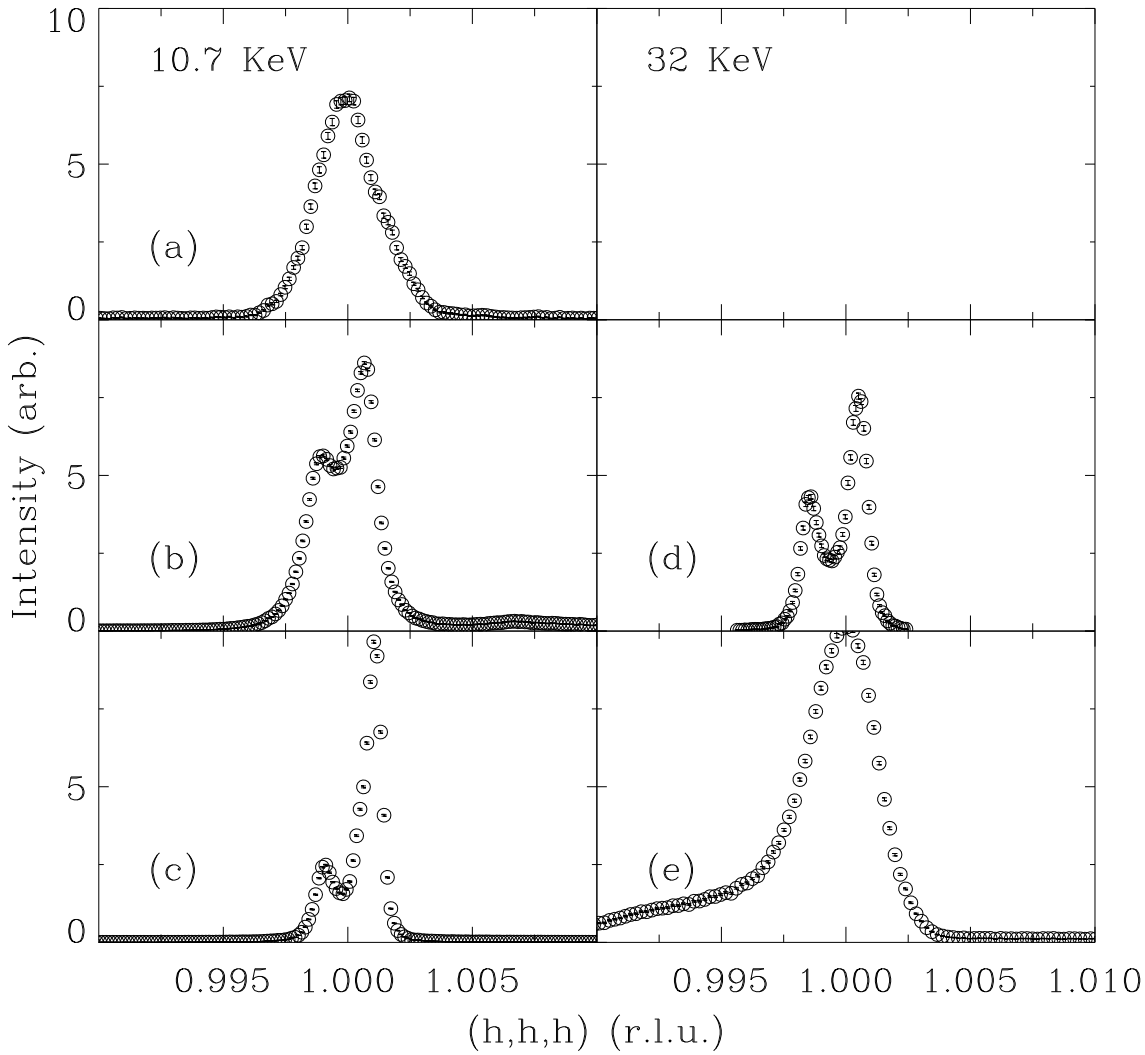

FIG. 1: (111) reflection measured by 10.7 keV (a,b,c) and 32.1 keV (d,e) x-rays. (a) is C. Stock’s measurement on the old PZN crystal (#11). (b) and (c) are results using the new crystals sent be Yonghong (#14 and #15) on X-22A from 2/16/03 to 2/18/03. (d) is C. Stock’s measurement on the old PZN crystal (#11) using 32 keV x-rays, and (e) is our recent (2/18-2/24) measurement on the same crystal using 32 keV x-rays.

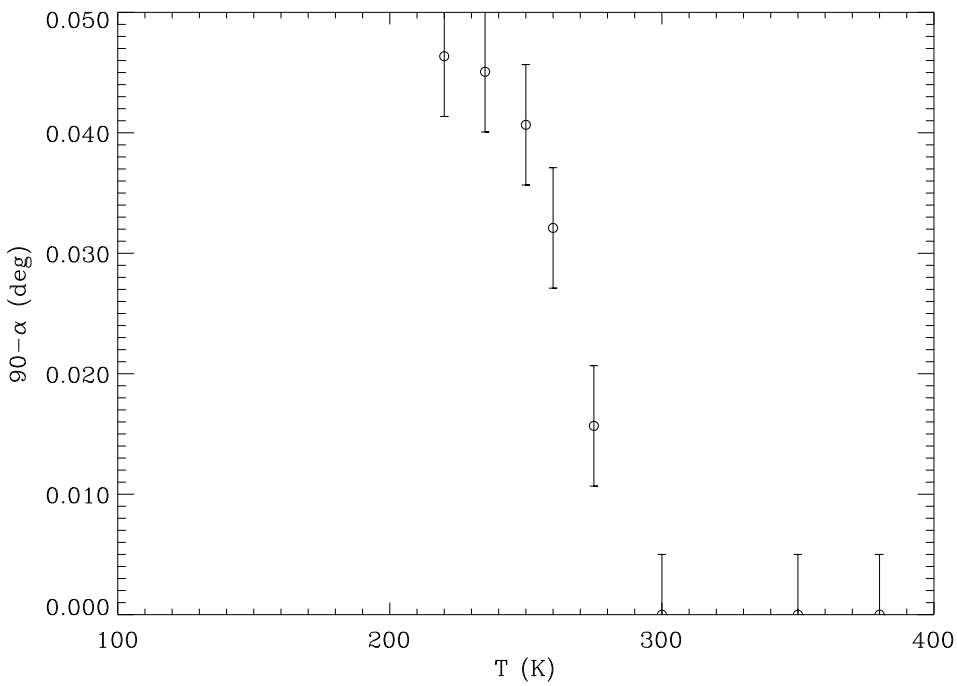

FIG. 2: Rhombohedral angle α vs temperature for the outer layer (measured on X-22A, using 10.7 keV x-rays).

From the combined results of both the previous and recent measurements on the PZN single crystals, we have the following info:

(1) The outer layer (skin) of the crystals behave very differently from the bulk. Both phase Y (R) and Z (broad (111) peak) have been observed under different conditions. Very little phase X component can be detected using 10.7 or 32 keV x-rays. This gives an estimate of outer layer thickness $\geq 50\mu$m.

(2) Our T-dep measurements on phase X using 67 keV x-rays give lattice parameter $a = 4.071 \pm 0.001$ through out the temperature range of 50 K to 400 K. Quite different from those previously obtained by other groups.

(3) T-dep measurements on the outer layer (using 10.7 keV x-rays) show the rhombohedral to cubic transition at 300 K to 350 K. This indicates that Lebon's results showing similar transitions could be coming from this outer layer.