ESRF	**Experiment title:** Investigation of contrast mechanism of inverted ferroelectric domains in lithium niobate crystals revealed by an applied electric field	**Experiment number**: ME-214
Beamline: ID19	**Date of experiment**: from: 28th August to: 1st September 2006	**Date of report**: 23rd February 09
Shifts: 9	**Local contact(s):** José Baruchel	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

Petra Pernot*,

P. Moretti*, *Université Claude Bernard Lyon I, Villeurbanne, F*

Report:

We intended to identify the contrast origin and mechanism allowing the domain observation under an applied external eletric field in lithium niobate periodically poled crystals. Periodically poled crystals contain periodic array of inverted ferroelectric domains. The coherent beam wavefront is distorted, when Bragg-diffracted, by the phase difference between the structure factors of adjacent domains. The phase shift produces contrast on the images recorded at various sample-to-detector distances. This contrast is low (at room temperature) when the sample-to-detector distance is "small" (< 20 cm). A dramatic increase of the periodic contrast, in the form of black lines, occurs even for short sample-to-detector distances when an external electric field is applied. The period of the contrast is the same as the one of the periodic domains.

We have performed a systematic study of the phenomenon by investigating, in transmission mode, using white beam section topography technique, periodically poled lithium niobate samples at the eletric fields with:

1) various magnitude and polarity
2) and recording the section topographs at several distances from the sample.

The effect appears and disappears in the inchanged manner when applying an electric field repetitevely. The contrast appears (and is more pronounced) even out of electroded area and clearly depends on the polarity of the applied electric field. The behaviour indicates a new origin of the contrast, which adds to the one produced by difference in structure factor phases of adjacent domains. The contrast mechanism seems to correspond to the inverted piezoelectric distortion between domains produced by the applied external field being in competition with the internal field present in these crystals.

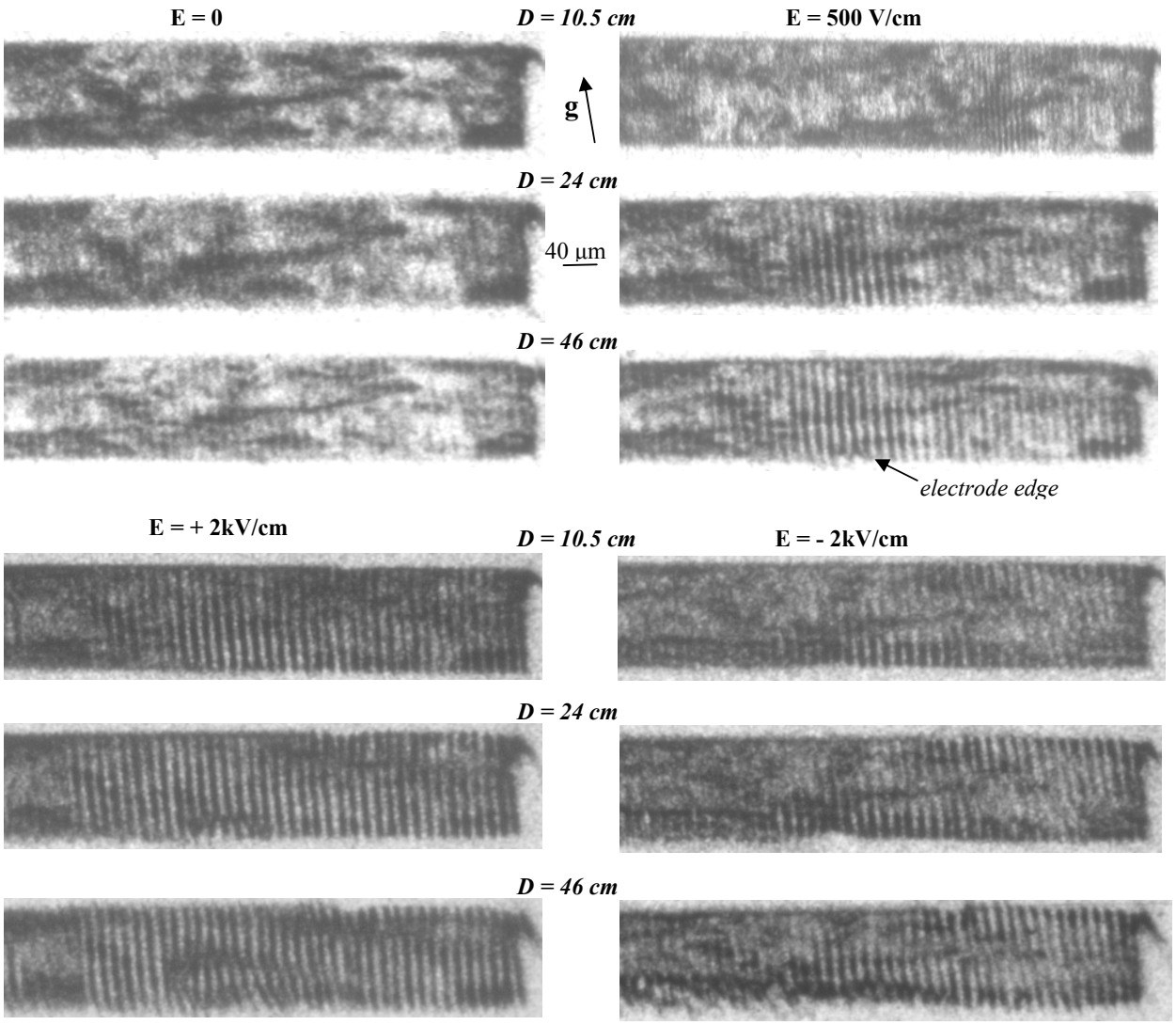

Figure shows a series of sections for the $\bar{1}\bar{3}\bar{1}$ reflection taken as a function of the sample-to-detector distance *D*, at various electrical fields E, λ = 0.497 Å, period of poling = 23 μm.

There is clearly a wealth of detail to be extracted from these systematic studies and we are looking forward to elucidate these phenomenon (and mecanism of the contrast) in near future.