ESRF	**Experimental title: Micro-Focus Diffraction Study of Domain-Wall Structure In Periodically Domain-Inverted $LiNb0_3$**	**Experiment number:** HS-112
Beamline: BLlO/D5	**Date of experiment:** from: 16-Oct-96 7:00 am to: 20-Oct-96, 7:00 am	**Date of report:** **26** Feb. 97
Shifts: 12	**Local contact(s):** Dr. A. Souvorov	*Received at ESRF:* 04 MAR 1997

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Report:

A periodically domain-inverted nonlinear optical crystal of $LiNbO_3$ has been investigated by phase-contrast imaging and micro-focus diffraction techniques. Periodic fluctuations in the intensity of the 006 rocking curves with a periodicity consistent with that patterned by a mask have been, for the first time, observed using the Bragg-Fresnel focus technique. The topographs taken with the 006 reflection clearly show interference fringes arising, it seems, from coherent diffraction from different parts of a single domain. In the phase-contrast imaging experiment, the coherent beams diffracted from the domain-inverted regions are split by lattice distortions rather than refractive index variations as in the usual case, and subsequently overlapped, which gives rise to interference between the coherently-related

diffracted waves. In the absence of lattice distortions, such contrast would not appear. The resulting patterns of interference therefore represent the underlying patterns of the lattice distortions generated via the domain-inversion processing.

By combining the phase-contrast imaging with the conventional multiple-crystal topography and diffraction-space mapping of the domain-inverted structure, we have established an interpretation of the origin of formation of the interference fringes. Our results clearly show that the phase-contrast imaging technique can be effectively exploited for the investigation of periodically domain-inverted structures in nonlinear optical materials.

An abstract mainly based on this experiment will be submitted to ECM-17 (Portugal, 97). A paper is being prepared for publication.