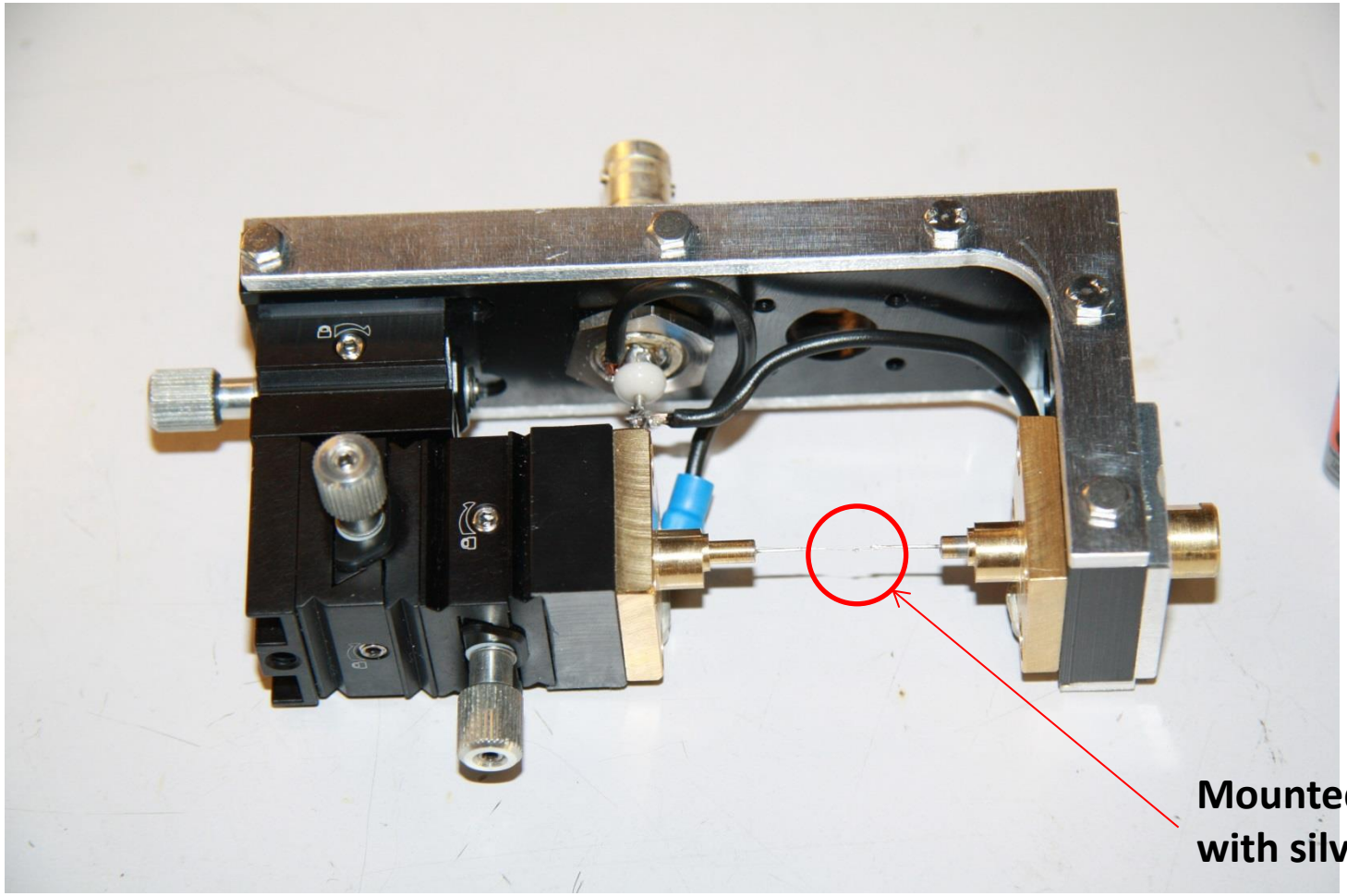
E-field experiment with PMN-33%PT single crystal

Swiss-Norwegian Beam Lines
at ESRF

BM01A 2014

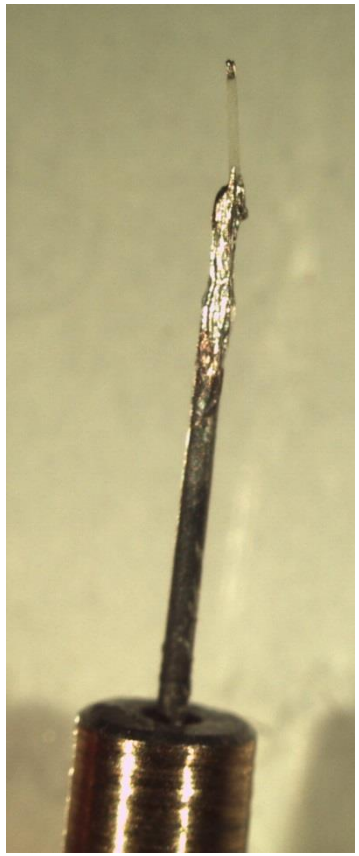
Dmitry Chernyshov, Tikhon Vergentev, Vadim Dyadkin

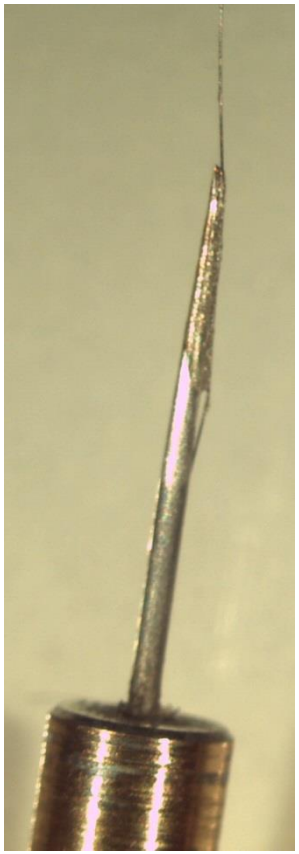
Sample cell



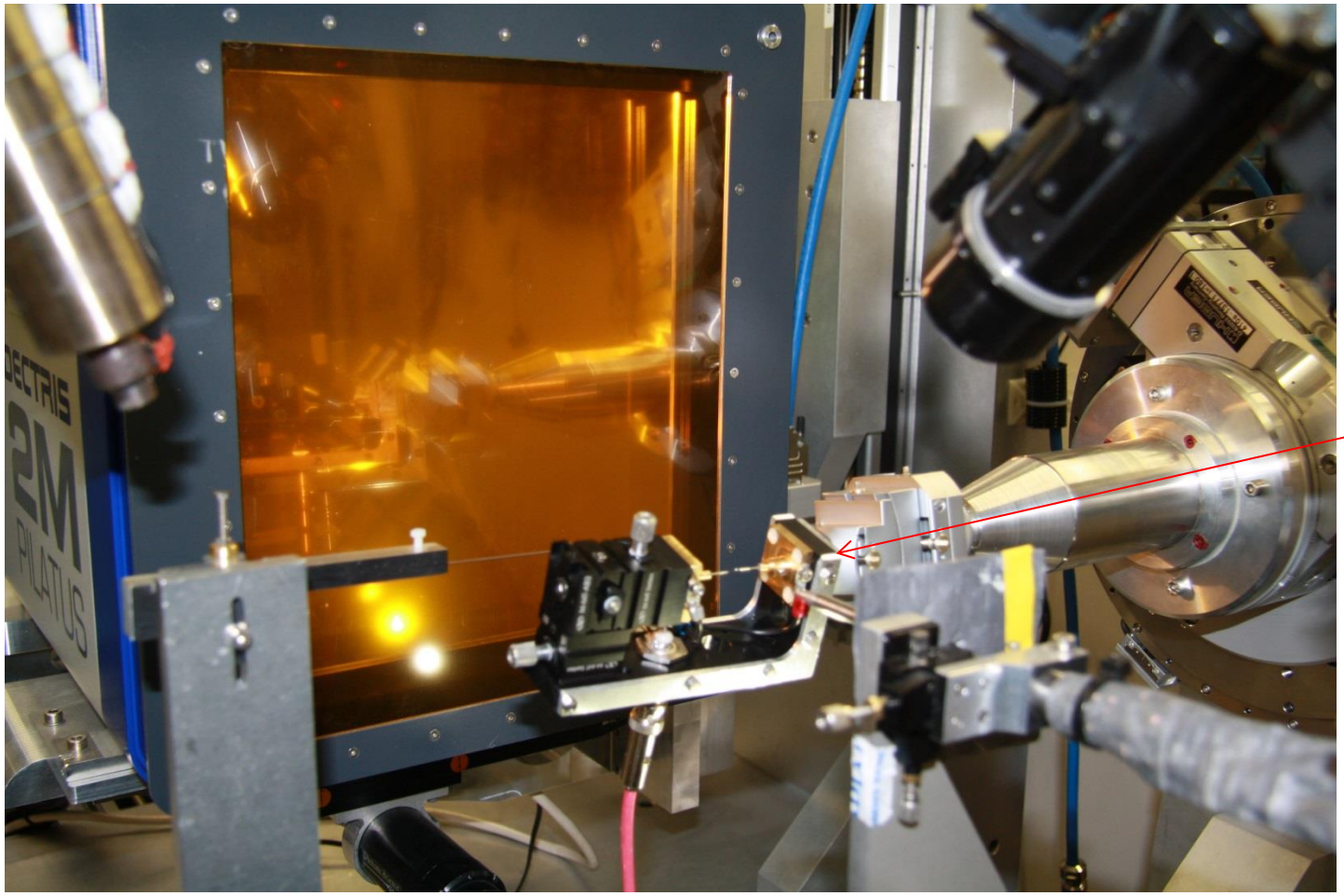
Distance between electrodes is about 0.7mm

Sample mounting



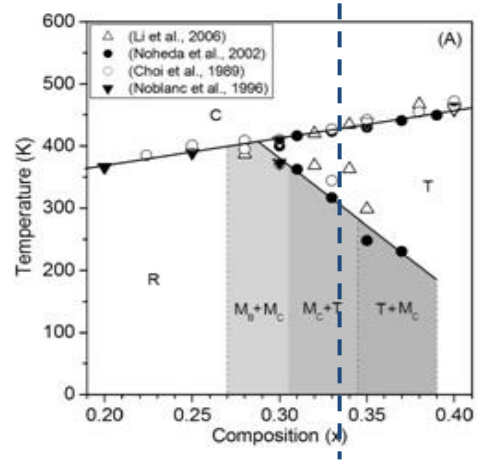


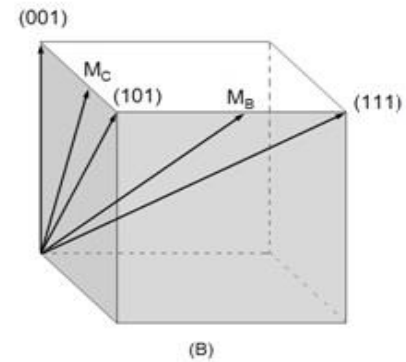
Sample cell on the position



$\Delta\omega=90^0$

Phase diagram PMN-xPT and d-spacing monoclinic and tetragonal structures





$$\left(\frac{2\sin\theta}{\lambda}\right)^2 = \frac{h^2+k^2+l^2}{a^2}$$

Cubic phase

$$\left(\frac{2\sin\theta}{\lambda}\right)^2 = \frac{h^2+k^2}{a^2} + \frac{l^2}{c^2}$$

Tetragonal phase

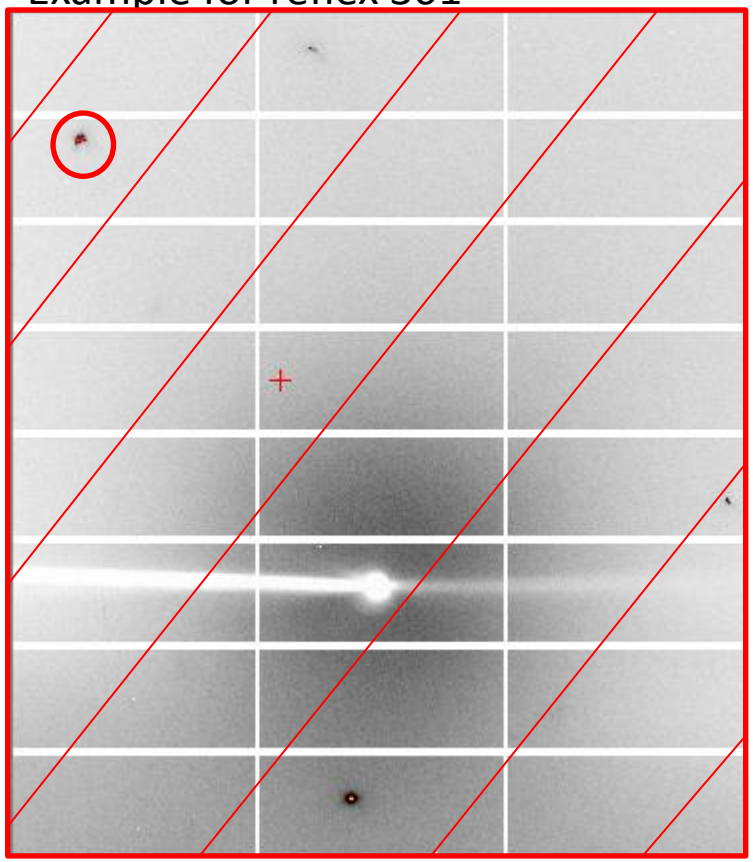
$$\left(\frac{2\sin\theta}{\lambda}\right)^2 = \frac{h^2}{a^2} + \frac{k^2}{b^2} + \frac{l^2}{c^2} + \frac{2hl}{ac}\cos\beta$$

Monoclinic phase

*Eudes Borges Araujo // Materials Science, Chapter 3, (2011)

Data Processing

Example for reflex 301



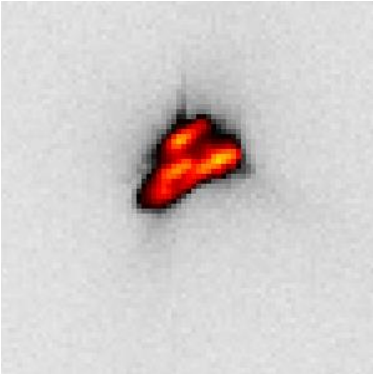
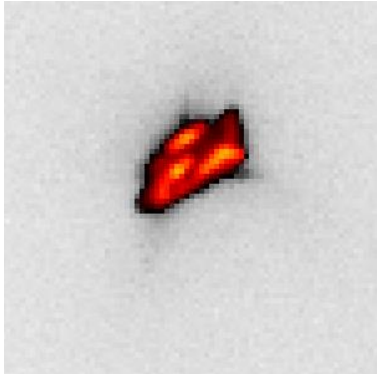
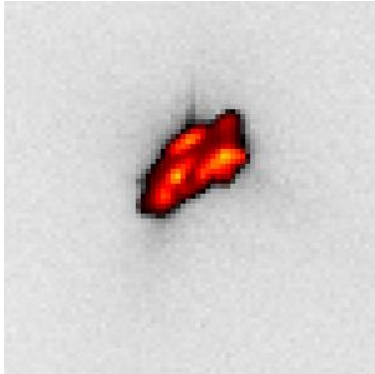
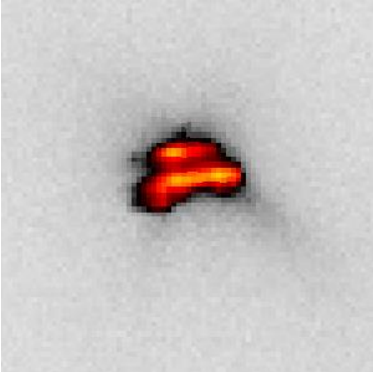
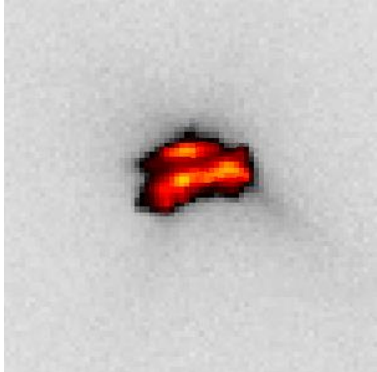
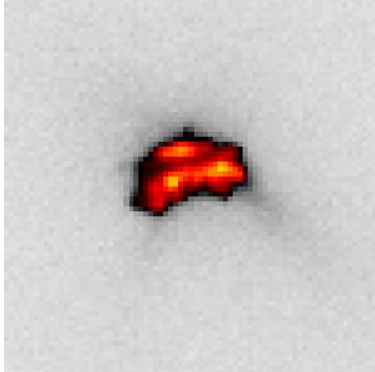
The data processing:

1. Binning of raw frames
2. "Cake" integration – transformation from pixel to angular space (Bragg angle – azimuth angle)
3. Powder-like integration – to get a pattern for numerical analysis

Steps:
- **Make a mask except interesting reflex**
- **Set threshold 0**
- **Integrate**

Fit2d parameters:
- **Wavelengths 0.69658 A**
- **Detector distance 294 mm**
- **Pixel size 172x172 mcm^2**
- **Beam position (537.61, 733.98) pixels**
- **3000 bins**

Evolution of cubic Bragg nodes 301 and 310 – pixel space

	0V	200V	300V
301			
310			

$Pb(In_{1/2}Nb_{1/2})O_3$-$Pb(Mg_{1/3}Nb_{2/3})O_3$-$PbTiO_3$ (PIN-PMN-PT)

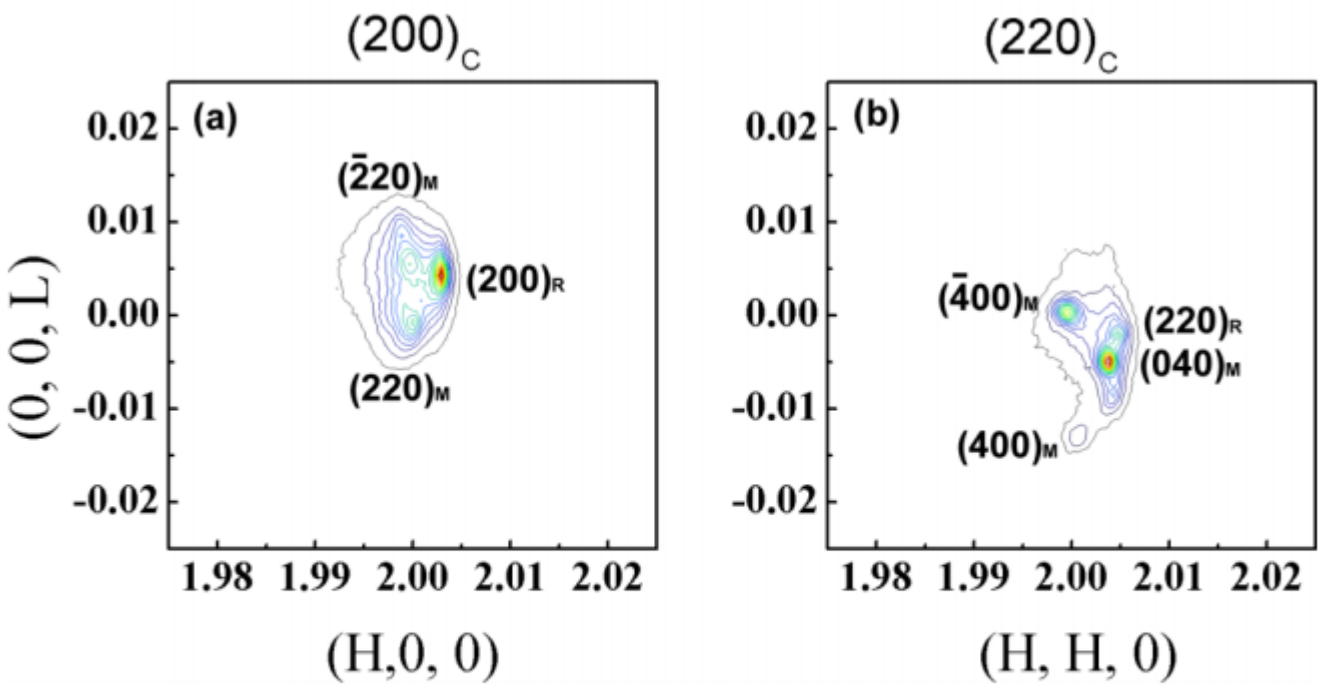
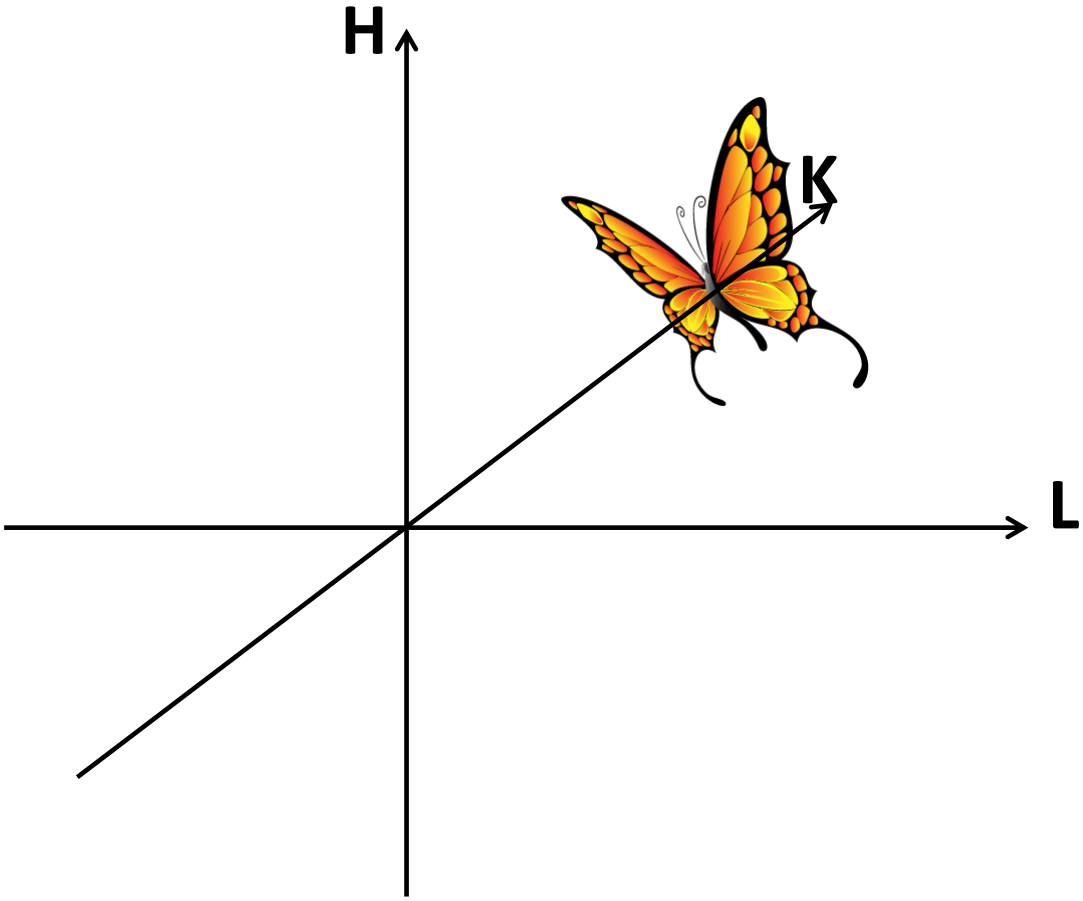


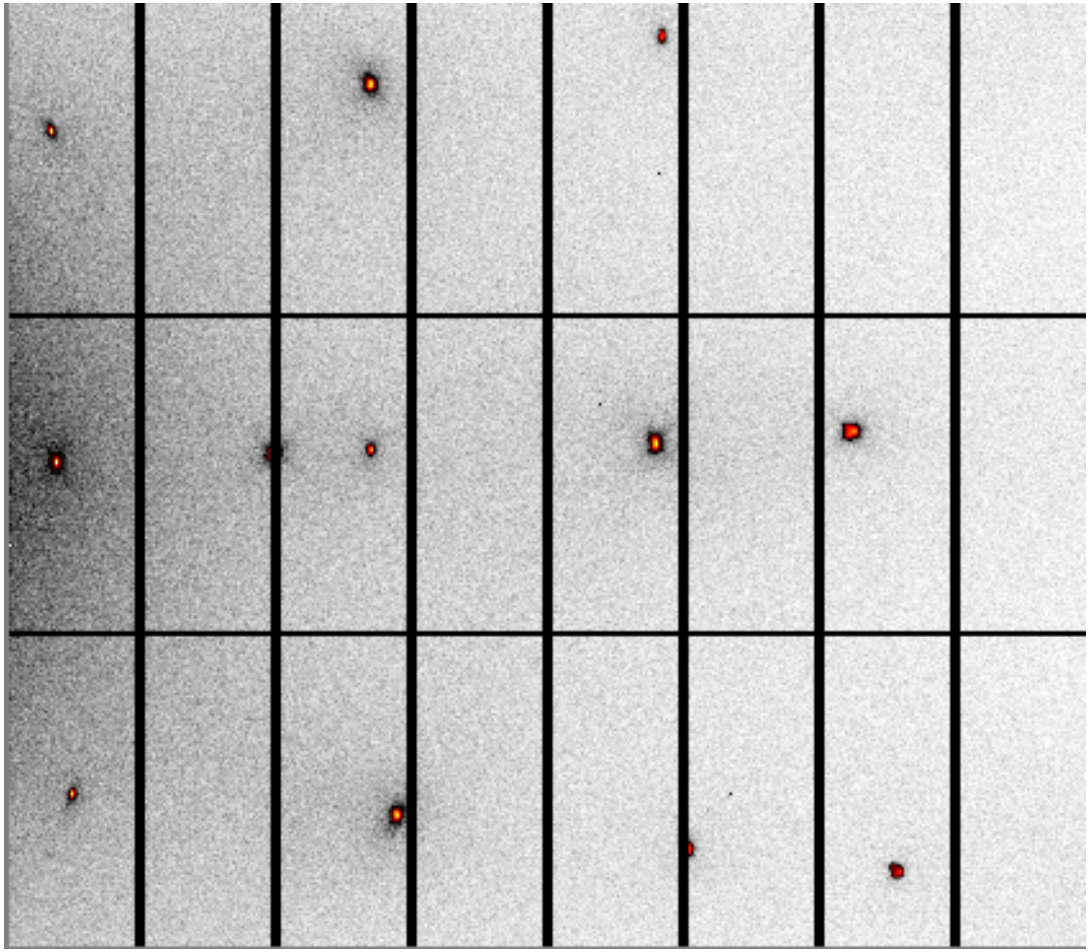
FIG. 12. (Color online) Reciprocal-space mesh scan around pseudocubic (200) and (220) zone with increasing E field to E = 2 kV/cm at fixed temperature of 100 °C.

Yaojin Wang, Zhiguang Wang, Wenwei Ge, Chengtao Luo, Jiefang Li, and D. Viehland M //PHYSICAL REVIEW B 90, 134107 (2014)

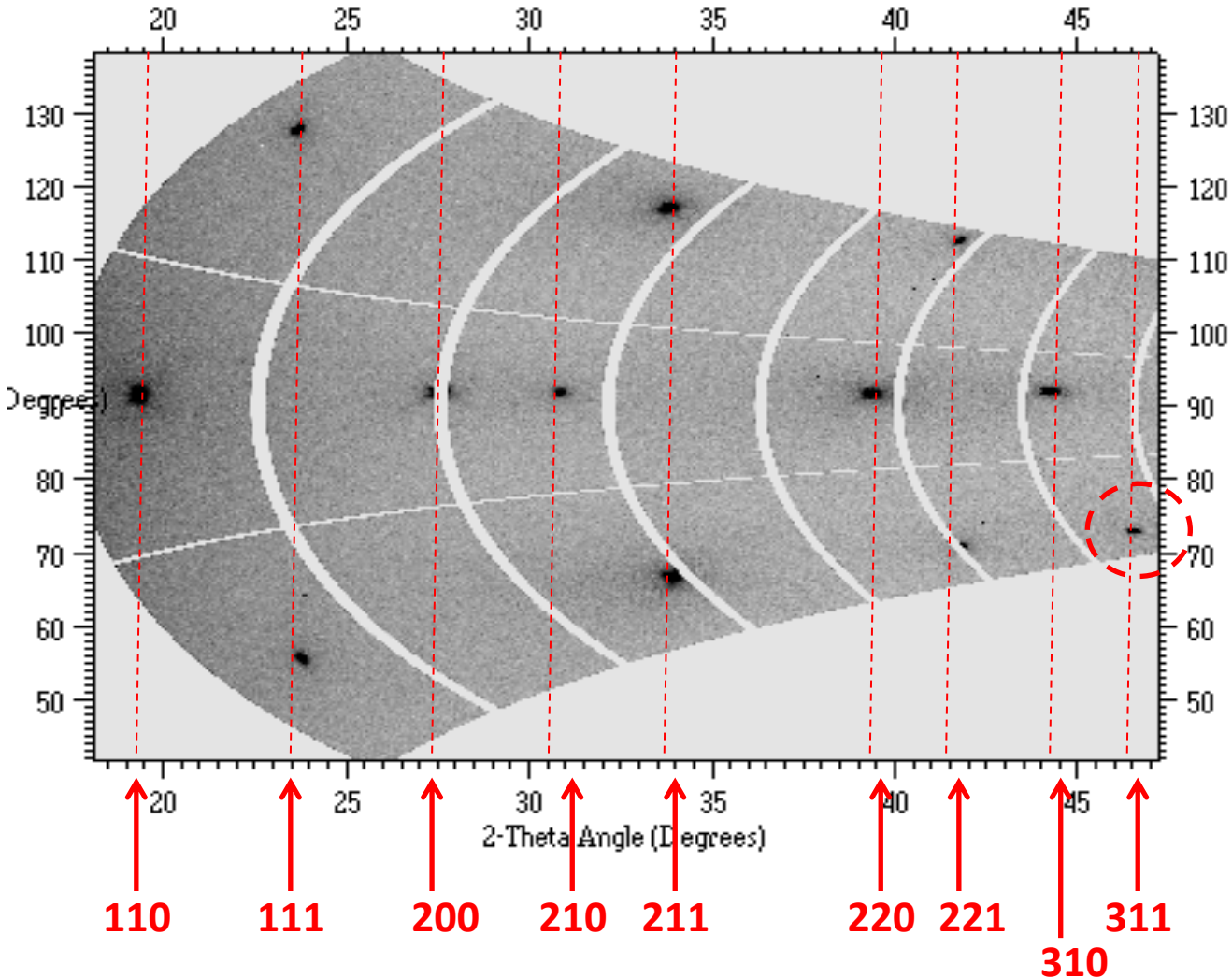
HKL planes sometimes lost information



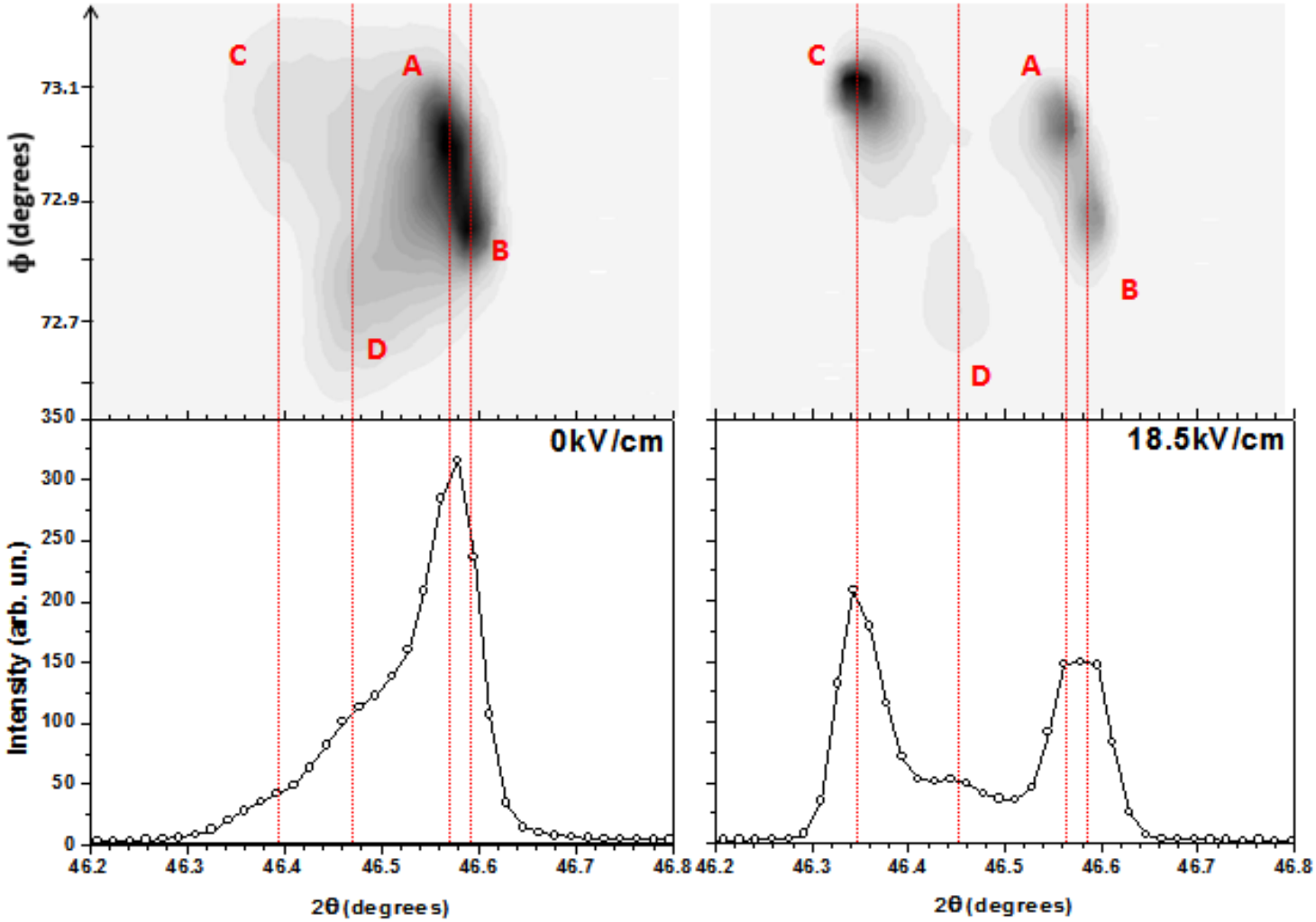
Integrated images of Pilatus detector



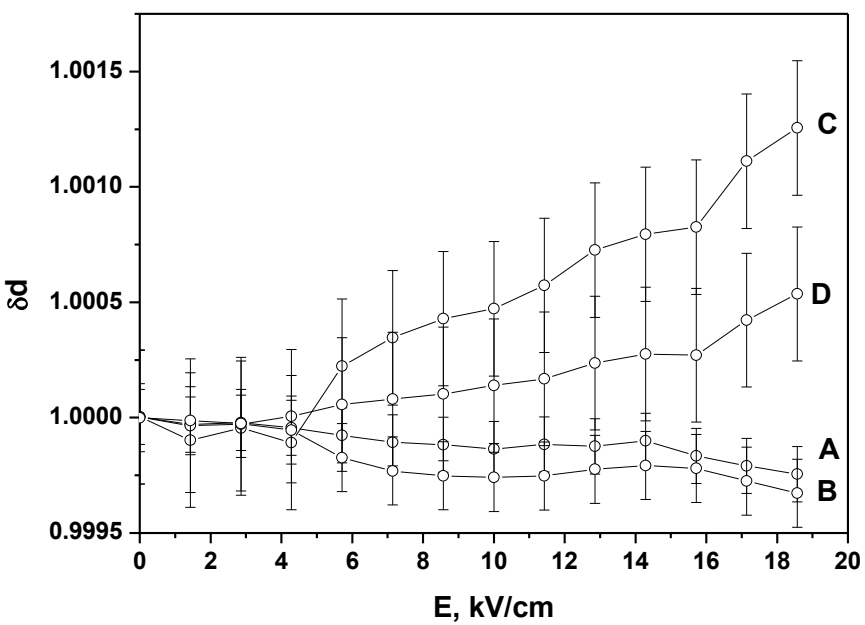
Azimuthal images

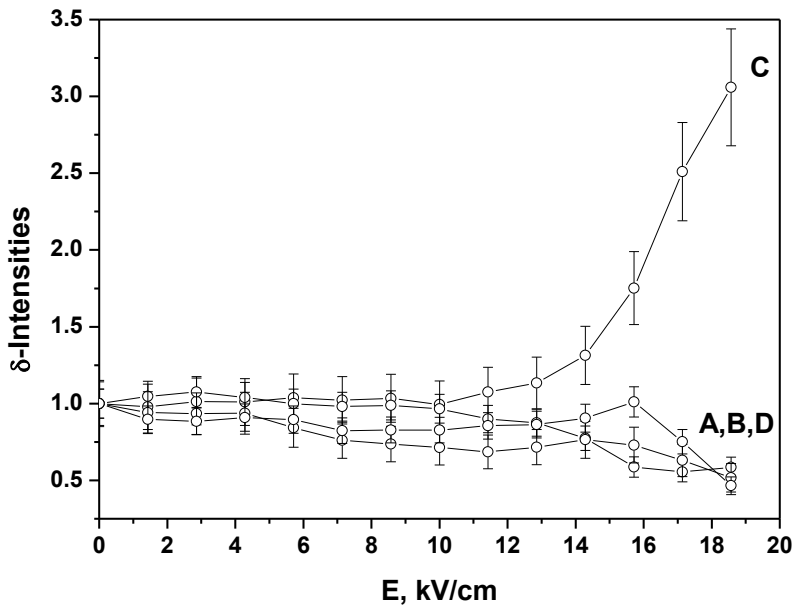


Pseudo cubic node ($\bar{1}31$) of PMN-33%PT

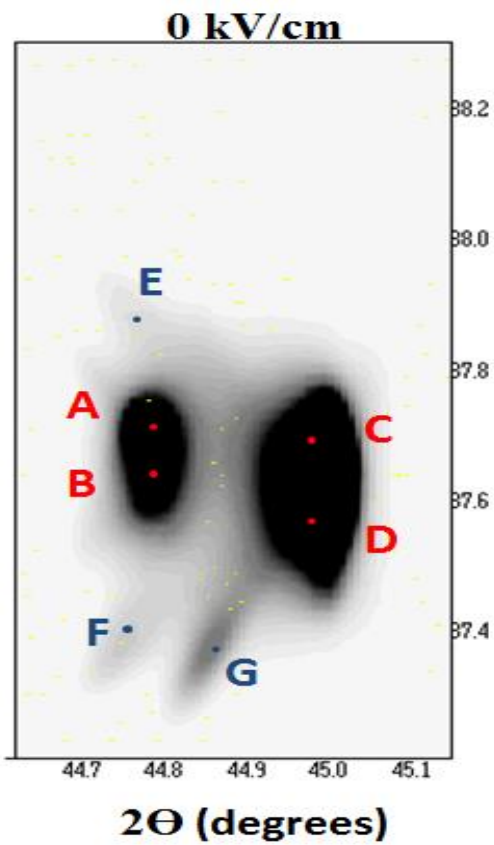


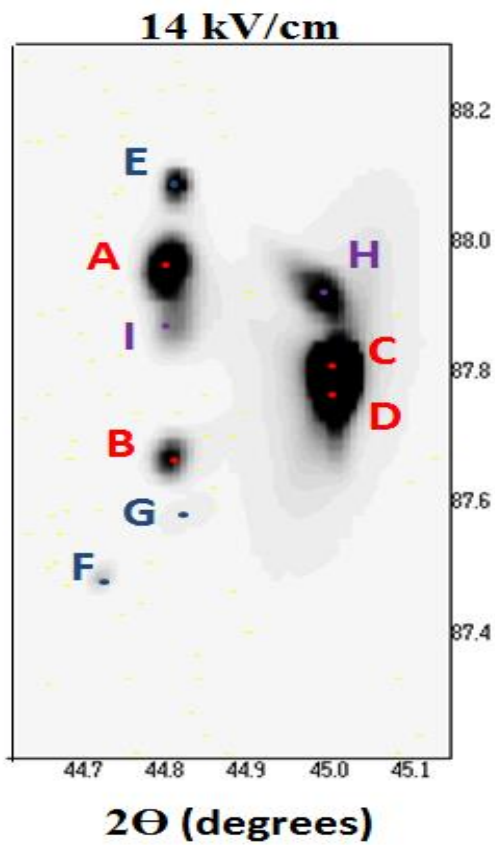
Pseudo cubic node $(\bar{1}31)$ of PMN-33%PT

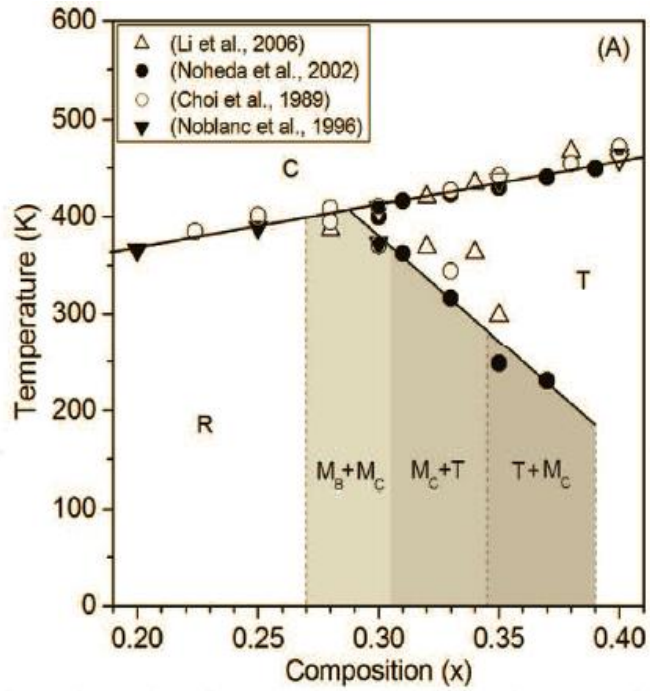




Pseudo-cubic node ($\bar{1}31$) of PMN-33%PT at high resolution







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