Polarization of ILL Co/Ti supermirror Pi192

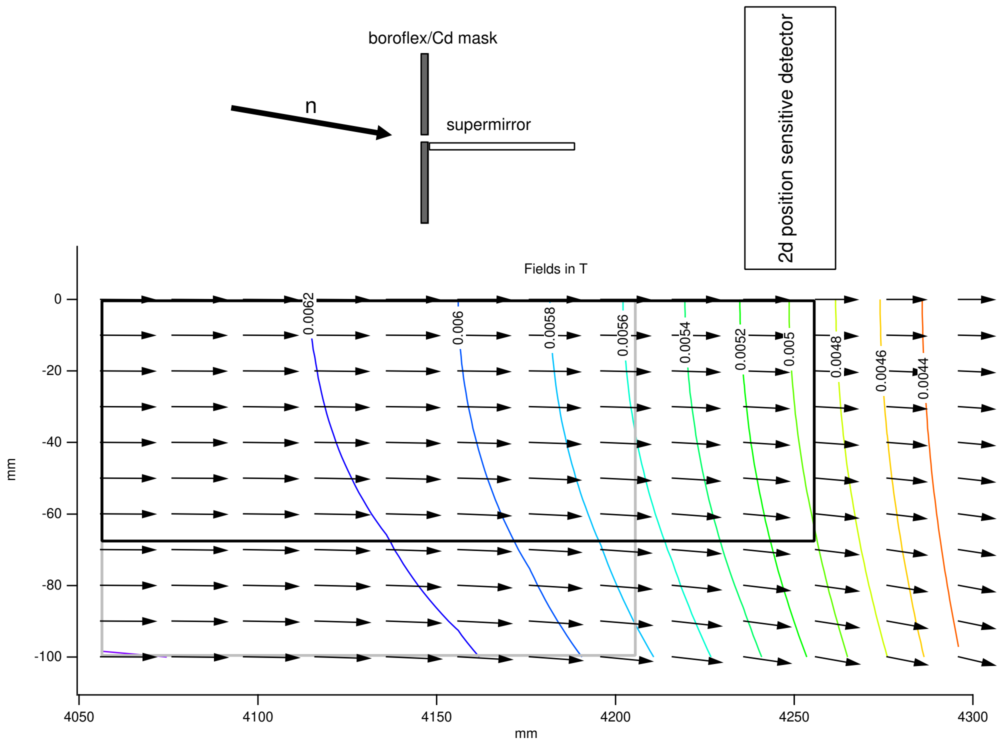

Figure 1: (top) Scheme for the measurement of the polarization using the Pi192 Co/Ti test piece. (bottom) Calculation of the magnetic field (in T) of the face of the supermirror test piece (solid rectangle) and a quadrant of a proposed supermirror plate for the full analyzer. The contour lines indicate the absolute magnitude of the field for a 10 A current, while the arrows indicate the direction of the field in the plane of the paper.

I installed the Pi192 Co/Ti supermirror test piece in place of the Fe/Si analyzer in the analyzer solenoid on the NSE. The test piece was positioned with its long axis (200 mm) along the field (and beam) direction and its short axis (64 mm) vertical. The leading edge of the test piece was located at the center of the coil (4056 mm from the sample position). A boroflex/Cd mask with a 4mm gap was placed against the leading edge of the test piece (see Fig. 1). For a 10 A current through the polarizer coil the field varied over the test piece from 62 G down to 49 G (see Fig. 1).

Our measurements were performed by momentarily raising the current to 48 A and then reducing it to 9.6 A. A measurement in the direct beam gave a polarization $P = 0.826(3)$ (see Fig. 2), which after 90 minutes was not significantly different $P = 0.820(2)$. With a current of 45 A in the analyzer coil (minimum field on sample is then 220 G), the measured polarization was 0.848(3).

The polarization was also measured to be $P = 0.901(1)$ at the edge of the main beam by moving the second arm of the detector by 3 cm from the beam center position (see Fig. 3), confirming my earlier analysis that the center of the main beam is contaminated by a low-divergence unpolarized component transmitted through the polarizer.

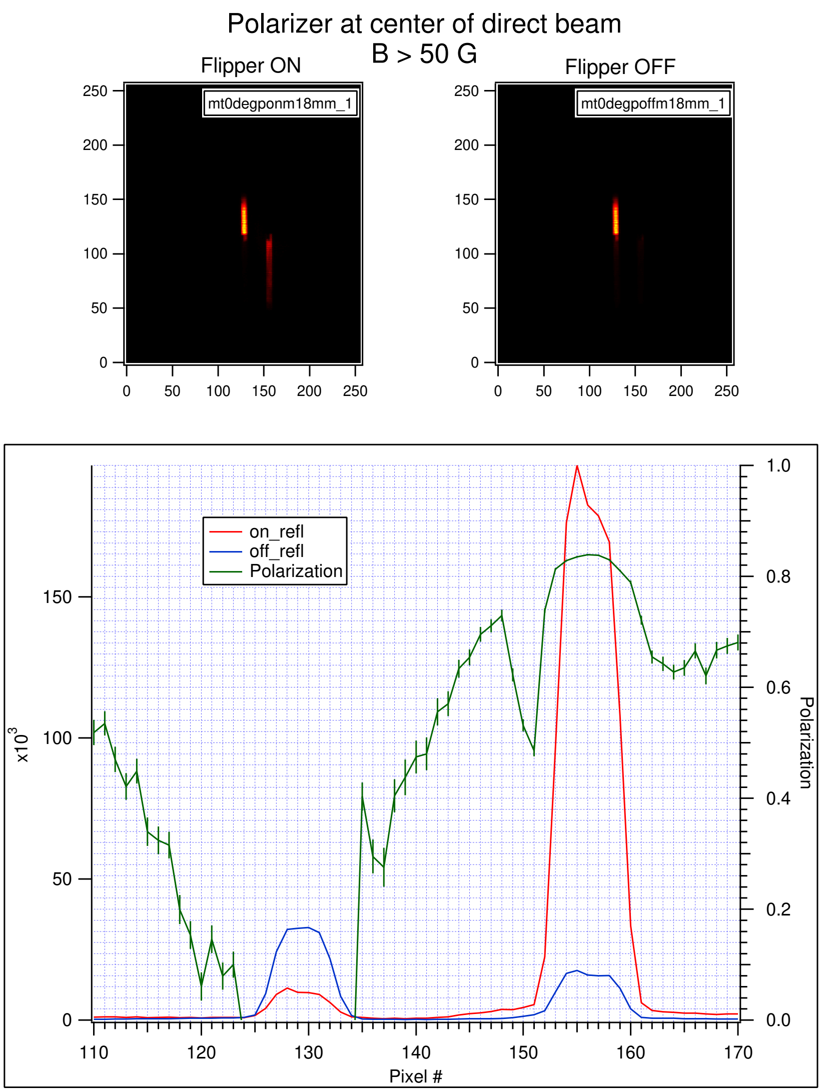

Figure 2: (top) Detector images of the center of the direct beam both above and at the position of the test supermirror piece, for both π-flipper on and off. (bottom) Integration of image along the vertical axis, as a function of the horizontal axis distance, for π-flipper on and off, and the resulting polarization. The integration along y is between pixels 43 and 94. (1 pixel = 0.85 mm)

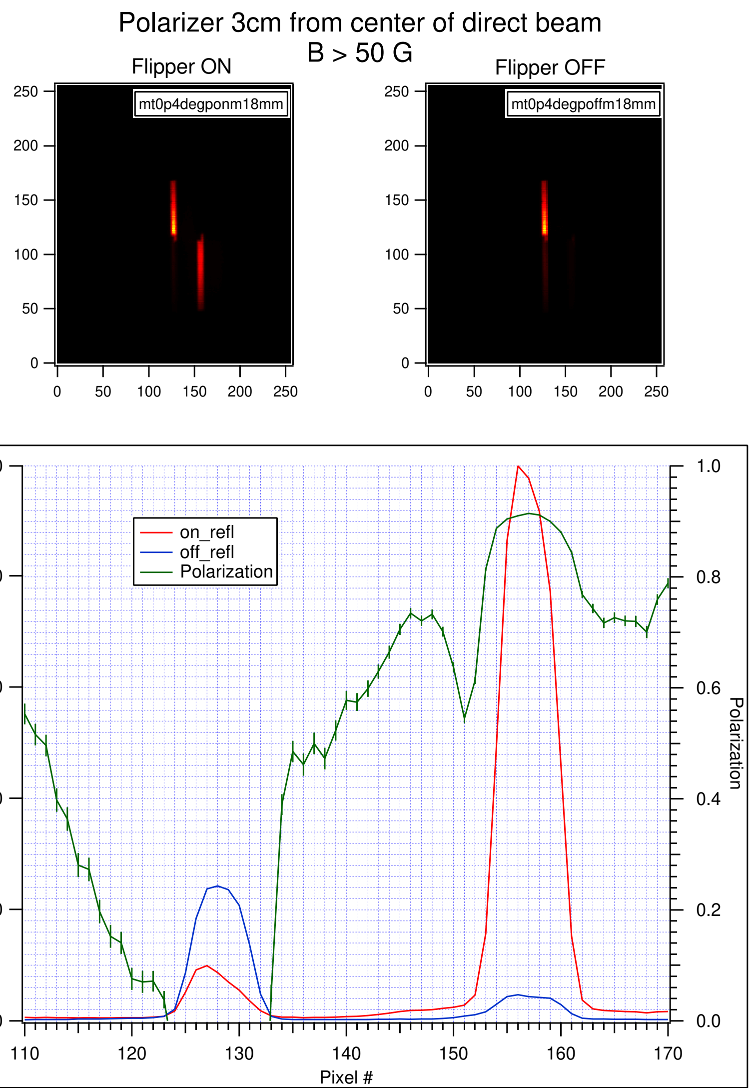

Figure 3: (top) Detector images of the edge of the direct beam (3 cm from the center) both above and at the position of the test supermirror piece, for π-flipper both on and off. (bottom) Integration of image along the vertical axis, as a function of the horizontal axis distance, for π-flipper on and off, and the resulting polarization. The integration along y is between pixels 43 and 94. (1 pixel = 0.85 mm)