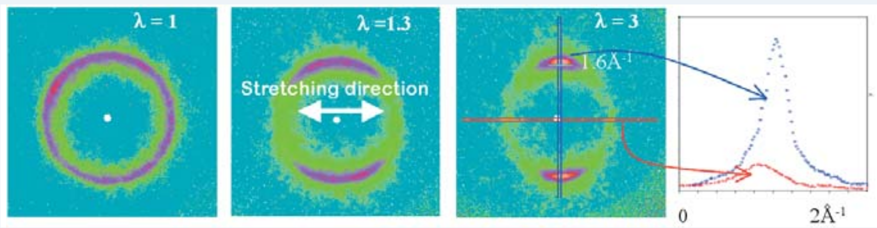
[C4. P. Baroni] New developments for 2D High Resolution Neutron Scattering Experiments. Application case and experimental evidences from crystals to polymer science.

We present here a new type of 2-dimensional neutron detector (CNRS CEA patent **WO2006095013** – publication date: 2006-09-14), allowing a high resolution investigation of the scattering space including both large to small angles.
This new system being almost insensitive to most radiations (γ, X radiation and visible light) except neutron radiation, is particularly adapted to the detection of neutron scattering or neutron diffraction, without exhibiting memory effects. Combining the advantages of the high resolution and of a 2 dimensional integrating readout, this new instrumental development appears as a reliable, efficient and evolutionary setup which could extend the possibilities of time-resolved experiments in this research field. An example of illustration of structural investigations carried out using this new system is displayed below. It is an original study at two-dimensions of the effect of an uniaxial mechanical deformation (elongational stress λ= L/L0 where L0 is the initial sample length) on the structure of a bulky sample of polytetrafluoroethylene (PTFE). The experiment points out different effects with respect to the stress, which can be interpreted by the uncorrelated contributions of the crystalline and of the amorphous parts respectively. The experimental conditions are: wavelength= 2.85Å, sample-detector distance: 53.5mm, exposure time: 5 min, beam diameter: 3mm, 16 bits data.

[P. Baroni and L. Noirez, LLB]

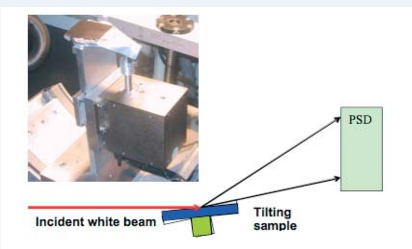


2D-Diffraction patterns displayed at 3 elongation rates (λ=1, 1.3 and 3) by the IV phase of the PTFE, observed from 0.05 to 2.2Å^{-1}. The fourth figure shows the vertical (blue points) and the horizontal (red points) profiles of the anisotropic scattering corresponding to the elongation rate (λ=3)

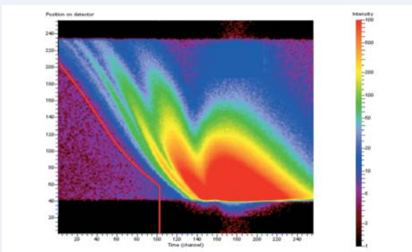
[C5. F. Ott] TilTof a high intensity space-time reflectometer

Being able to measure reflectivities down to 10^{-9} is the challenge of neutron reflectometers for the 21st century. The use of a periodic tilt of the sample, coupled with a position sensitive detector enables to perform specular reflectivity measurements on continuous neutron sources without any monochromator or chopper and thus allows intensity gains up to 10 compared to conventional reflectometers. The implementation consists in modulating the incidence angle of the beam by a periodic **Tilt** of the sample of a few degrees at a frequency of the order of 20 Hz. At each time, the sample reflects the neutron white beam at a different angle. The reflected beam arrives at a different position on the detector. The time of flight (**Tof**) from the sample allows wavelengths separation, and as a result, the full reflectivity curve is measured in each detector cell. The duty cycle of such a reflectometer is only limited by the velocity of the sample movements and may exceed 90%. We have performed the first measurements on a simplified setup (40% duty cycle) installed on the EROS reflectometer. Results show that the expected intensity gain has been obtained. However, mechanical instabilities conduct to poor resolution. In addition, off specular scattering from the sample gives a high unexpected background. A new version of Tiltof with less vibrations and equipped with a synchronized slit after the sample to cut background is under development to solve the two problems encountered.

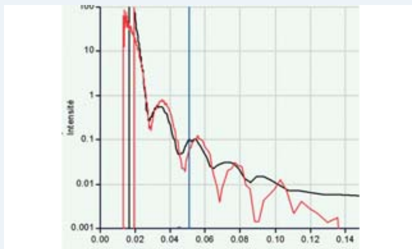
[F.Ott, A.Menelle, ICNS 2005]



Principle of TilTof and implementation on Eros



TilTof measurement of a Cu layer on silicon. X axis is time channels, Y axis is position on the detector.



Reflectivity obtained on Eros with Tiltof (black) or with the usual chopper configuration (red).