ESRF	**Experiment title:** Phase contrast-enhanced tomography of spiders mechano-sensors	**Experiment number**: LS 2295
Beamline: ID13	**Date of experiment**: from: 23.06.2012 to: 05.07.2014	**Date of report**: 27.02.2015
Shifts: 9	**Local contact(s)**: Britta Weinhausen	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

M. Erko*, C. Valverde Serrano*, H. Leemreize*, Y. Politi*
Laboratory MPI of Colloids & Interface Department of Biomaterials Wissenschaftspark Golm
D - 14424 POTSDAM

Report:

We investigated the structural design and fiber arrangement of the cuticular strain sensitive mechano-sensors in spiders. The specific function of these organs as filters and transducers of mechanical stimuli relate to the structural and mechanical materials properties of their main component.

The experiments were carried out at the beamline ID13. The operated energy was 15 keV. Overall nine samples were measured with sub-micron spacial resolution using a 200 nm - wide X-ray beam. Six samples contained the vibration sensitive slit-sensilla organs of the wandering spider *Cupiennius salei* in fully wet and in dry states. The collected scattering data allows to extract detailed structural and compositional information, such as the destribution of chitin and proteins in the organ, chitin fibrils alignment and their lattice ordering parameter. Figure 1 exemplarily shows the scattering intensity from (110) reflection of the chitin crystal mapped in one of the studied slit-sensilla samples. The data show non-homogeneous distribution of chitin within the cuticular organ. Since the observed signal intensity strongly depends on orientation of the chitin crystals, the data need further careful analysis taking into account perpendicular reflections. Figure 2 shows the orientation of chitin fibers within the same sample. Additionally, three samples containing airflow sensitive hair-like sensors were measured using the same experimental conditions. The hair samples are slightly thinner and so the scattering signal was weak compared to the signal from the slits slices discussed above. We aim at continuing the structural analysis of the hair-like sensilla within the upcoming beam time submission round. This time we plan to mount the samples on dedicated 1µm silicon nitride membrane (Norcada; NX5200F; 2 x 2mm window) in order to minimize background scattering from sample holder. This will largely increase the signal to noise ratio of our data.

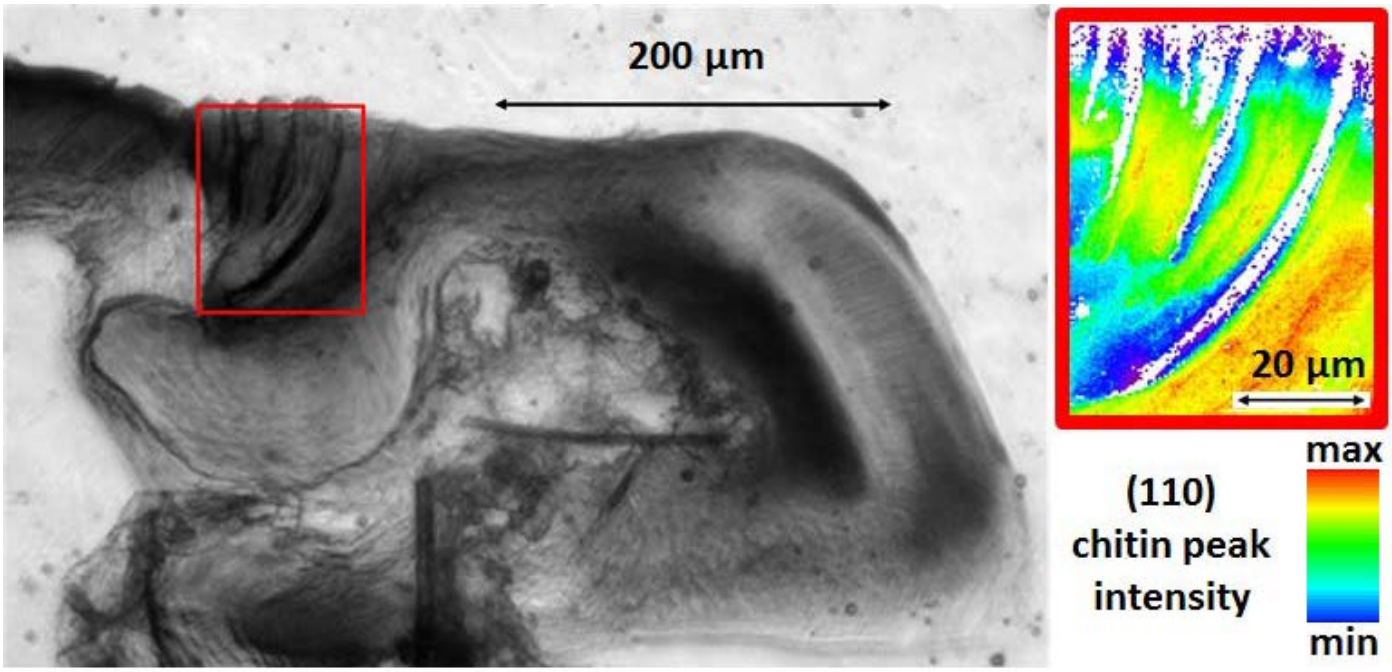

Figure 1: The left image is a light microscope image of a sagittal section (10 µm thickness) of the distal end of the metatarsus. It includes the cuticular pad pointing to the right (the contact region with the tarsus) and slit sensilla (red rectangle). The right image shows the distribution of the scattering intensity from (110) peak reflection from the chitin crystal in the studied region. Although strongly affected by orientation of the chitin fibrils, it qualitatively represents the distribution of chitin in the organ.

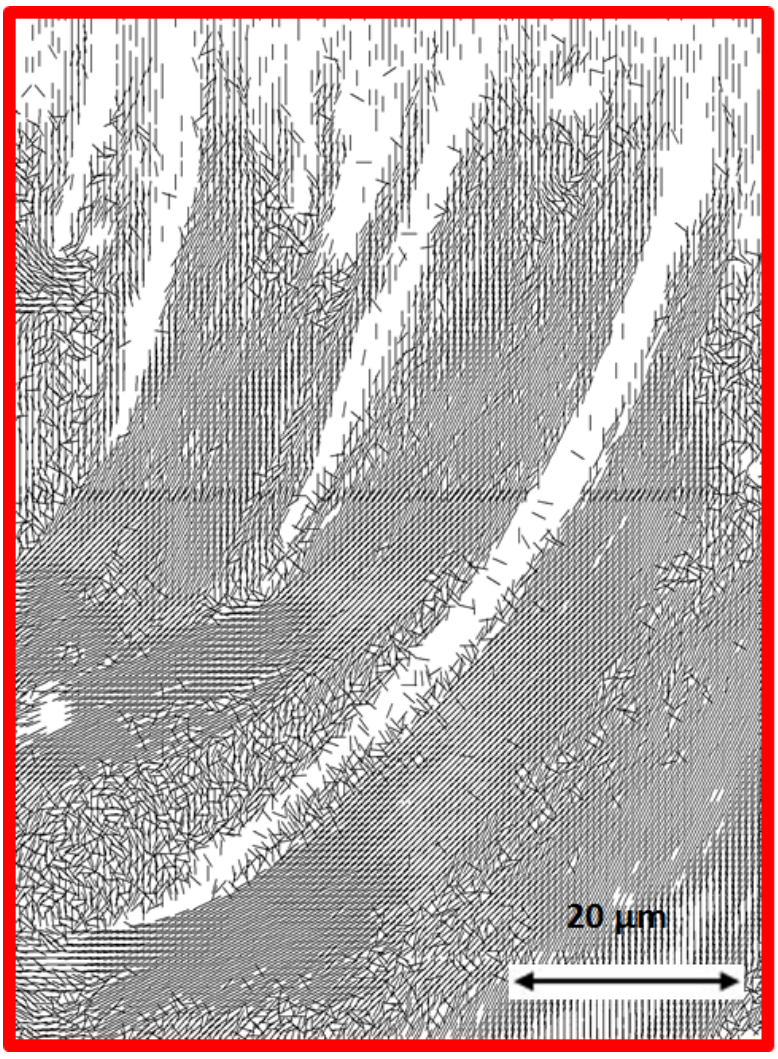

Figure 2: The main orientation of chitin fibrils in the same sample as shown in Figure 1.