ESRF	**Experiment title:** Structure of the Pb(liq.)-Si(100) solid-liquid interface	**Experiment number**: SI-583
Beamline: ID15A	**Date of experiment**: from: 19.4.2000 to: 27.4.2000	**Date of report**: 29.8.2000
Shifts: 21	**Local contact(s)**: Veijo Honkimäki	*Received at ESRF:*

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Report:

For the experiment we have used the recently established method of grazing angle diffraction using the effect of total internal reflection at high photon energies, which we have successfully implemented at the high energy beamline ID15A in a previous beamtime (MI-339). There we have shown that the experimental setup we use is exactly matching the specifications for the proposed experiment.

In our previous experiments (MI-339, SI-504) we could use the large granite base plate of the three-axis spectrometer at ID15A for mounting a specially designed diffractometer and UHV-chamber supplied by the Max-Planck-Institut in Stuttgart. Using this setup we could achieve a positional stability better than 0.1μm/hour and an angular stability better then 3μrad/hour (incident beam stability relative to the sample position). Unfortunately, this base plate was not available for this beamtime. The ESRF has supplied a 0.5 ton concrete block as a base for our experimental setup. Using this setup we could not achieve the required stability for our experiment. The measured relative movement of the beam with respect to the sample was

>1μm/hour and >100μrad/hour. The resulting time interval was not long enough to get the Pb(liq.)-Si(100) solid-liquid interface aligned in the beam. This clearly demonstrates the needs for a stable mounting base for high precision experiments at ID15A. In the experiments we could, therefore, not demonstrate the anisotropic in-plane modulation of the (normally isotropic) structure factor of the liquid as proposed for this beamtime. In particular, we found it impossible to measure the inplane liquid structure factor as a function of the azimuthal with respect to solid substrate.

The second part of the experiment was concerned with the out-of-plane structure of the interfacial liquid layer. Due to the alignment problems as described above the measurement of the reflectivity from our deeply buried interface turned out to be difficult and time consuming. The Figure below shows a background corrected reflectivity curve taken at $T=T_m(Pb)+20K$. The measurements show that the roughness of the interface which is determined by the roughness of the solid Si substrate is still to large to achieve atomic resolution for the density profile. Roughness values vary from 5Å to 9Å for different Si substrates. The reflectivity curve also shows a modulation period which corresponds to a modified liquid density in a 20Å thin layer at the interface. Further analysis of the density profile of the liquid across the solid-liquid interface is underway.