ESRF	**Experiment title:** Evolution of the electron-phonon cupling in superconducting Nb3Sn films probed by Inelastic x-ray scattering	**Experiment number**: **HE-1694**
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Report: We recently used nuclear inelastic scattering to probe phonons in superconducting Nb_3Sn films containing ^{119}Sn (see report HC1660). This provides the Sn partial phonon density of states (PDOS). Inelastic x-ray scattering (IXS) was used to obtain the full PDOS of these Nb_3Sn films and compare them with ab initio calculations. This provides a unique and quantitative insight into the respective role of phonons and electrons in the modification of the superconducting properties of Nb_3Sn. This experiment was the first attempt to study phonons in nanoscale superconductors with IXS.

Two Nb_3Sn thin films with thicknesses of 50nm and 5nm respectively, deposited on single cristaline MgO substrates, were investigated. These two thickness correspond to bulk like behaviour (50nm sample) and a confined geometry (5nm sample).
The samples were placed in grazing incidence geometry to avoid contributions from the substrate to the measured signal. The measurements were performed at room temperature.

The 50 nm sample was measured first. The experimental procedure was to record several inelastic x-ray spectra, on each of the nine analyzers, on the same sample at different momentum transfer values. The chosen values were: 45.61 nm^{-1}, 43.78 nm^{-1} , 35.80 nm^{-1} and 34.72 nm^{-1}. Thosevalues were chosen to avoid the signal from phonons coming from the susbtrate. During the alignment of a 20nm sample it was found that the sample consisted of two different phases. Since this might lead to complications with the interpretation of the data it was decided to measure the 5nm sample instead. The same procedure as for the 50nm sample was carried out. The momentum transfer values for this sample were: 45.60 nm^{-1} and 35.80 nm^{-1}.

The analysis of the recorded IXS spectra allowed us to extract the generalized phonon density of states (GPDOS) of the 50nm film. This allowed a comparision with the *ab-initio* calculation. Unfortunately the GPDOS for the 5 nm film could not be derived.

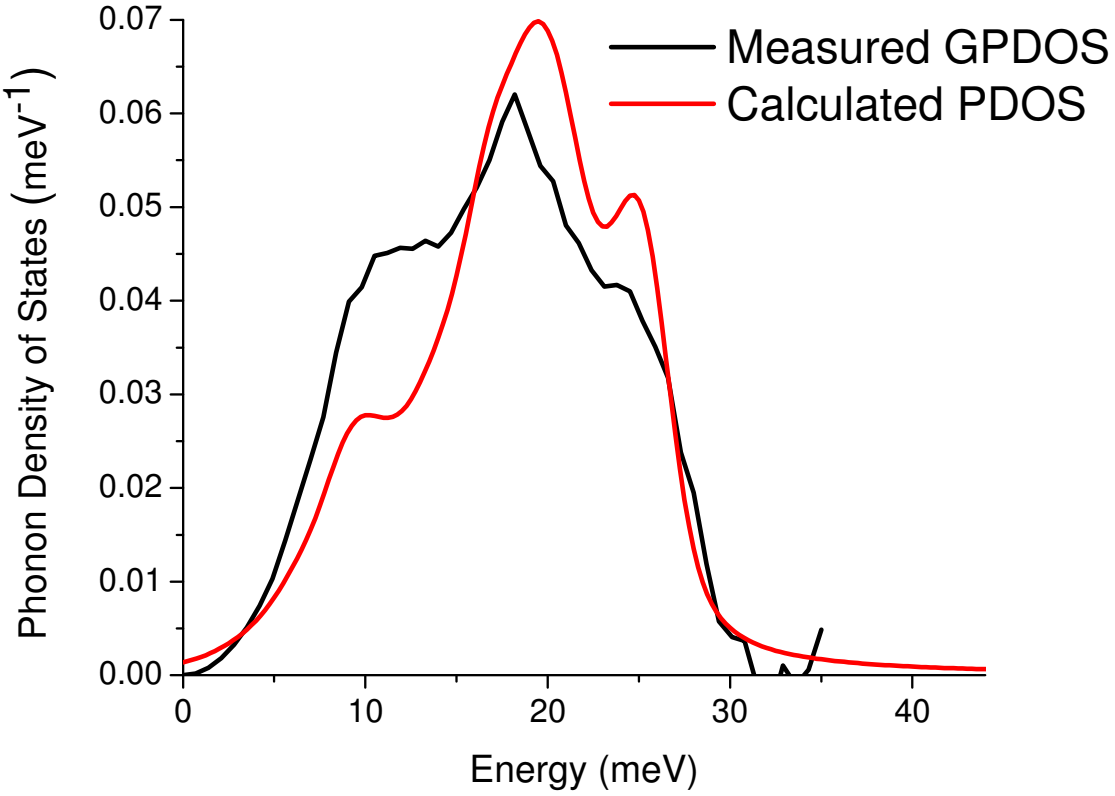

Figure 1: Phonon density of States of a Nb3Sn 50 nm film. We observer the features of the measured GPDOS at the same place ad the simulations. Also th position of the cut-off agreess with the simulation.

After convoluting the experimental resolution function of the 50nm sample with the calculated PDOS and comparing it with the *ab-initio* calculation, it can be seen that both curves show features at the same energies although with different intensities. This might be due to the presence of a second phase in the sample such as Nb_5Sn_6. Moreover, a correction function needs to be applied to the measured data in order to quantify the different masses and scattering cross sections of Nb and Sn.