ESRF	**Experiment title:** *Momentum conservation and resonant inelastic X-ray scattering in Al3Ni*	**Experiment number**: *HE-793*
Beamline: ID-16	**Date of experiment**: *from: 26 April, 2000 to: 1 May, 2000*	**Date of report**: 1 Sept, 2000
Shifts: *15*	**Local contact(s)**: *Dr. Abhay SHUKLA (e-mail: shukla@esrf.fr)*	*Received at ESRF:*

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Report:

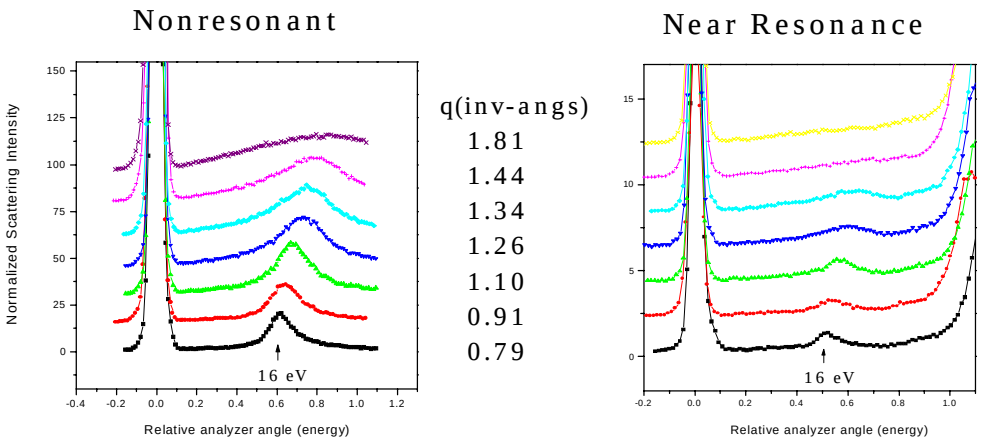
Resonant inelastic x-ray scattering (RIXS) is rapidly developing as a technique for probing elementary excitations in condensed matter and liquid systems. However, the utility of resonant inelastic scattering ultimately depends on whether it can be used to measure the momentum-resolved electronic excitation spectra in a straightforward manner. In order to check for momentum conservation near resonance, we have studied scattering in Al_3Ni on and off the Ni K-edge. Al_3Ni is a free-electron like system with the added attraction of having the Ni atom with an accessible K-edge at 8.333 keV. Al_3Ni have a fairly sharp plasmon near 16 eV at q~0. It is thus possible to measure the plasmon dispersion both on- and off-resonance. If the model for a dynamic correlation function proposed by Abbamonte et.al. [i] holds in general, these two measurements should show the same dispersion (once the resonance denominators are factored out). Our initial results obtained from the April beamtime (HE-793) at ESRF ID-16 suggest an identical dispersion pattern on and off-resonance within the level of resolution {Fig-1}. In addition to the q-dependent study we have performed the incident energy dependence (resonance profile) of the plasmon which shows an interesting behavior near resonance. We observed a dip in plasmon intensity right at the edge {Fig-2}. In order to establish the full resonance shape we need to fill up the curve by taking several more energy points both above and below the absorption edge as evident from the existing data. We are planning for such studies in future beamtimes at ESRF. Such a study would reveal the nature of this relatively new technique in probing the character of electronic excitations in systems with complex electronic groundstates.[ii]

[i] P. Abbamonte, C. Burns, E.D. Isaacs, P.M. Platzman, L.L. Miller, S.-W. Cheong, and M. Klein, *Phys. Rev. Lett.* **83**, 860 (1999).

[ii] M.Z. Hasan, E.D. Isaacs, Z.X. Shen, L.L. Miller, K. Tsutsui, T. Tohyama and S. Maekawa, *Science* **288**, 1811 (2000).

Fig-1 (Raw Data) :

q-dependence of plasmons on and off- Resonance (Ni K-edge) in Al3Ni (data from ESRF ID-16 Beamline). Dispersion, $E_{plasmon}(q)$, is identical(within the error bars) on and off resonance.



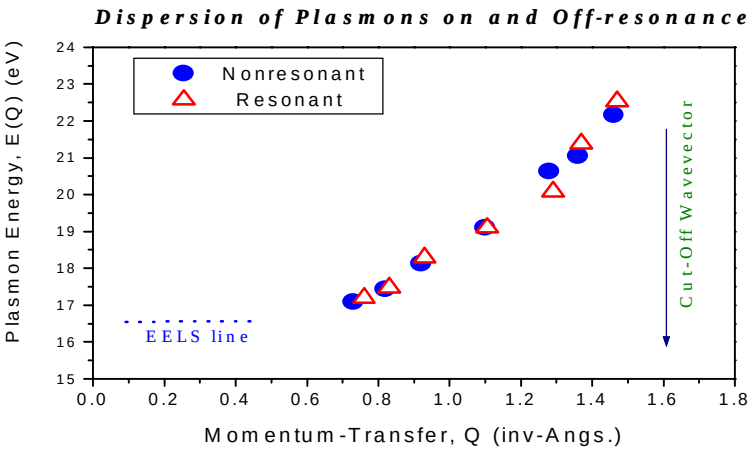


Fig-2 : Resonance Profile of Plasmons