IMPROVEMENT OF THE 2T TRIPLE AXIS SPECTROMETER

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In order to improve the thermal neutron flux available on the french triple axis spectrometer and to get the opportunity to have a polarized neutron option on this spectrometer, the size of the neutron beam has been changed to get a 5x12 cm^2 surface at the monochromator site. This necessitated a change of the beam port inserted in the beam tube. The wish to keep the possibility to transform the channel 1 from a thermal beam to a cold one, as well as the need for a vertical accessibility of the sample table for the polarized neutron option, led to the decision to swap the french and german spectrometers. The german spectrometer, managed by the group of Karlsruhe, was thus transferred from 2T on 1T. A new design of the beam port of 2T was realized, tested and installed by the Orphee group, while the PG002 and Cu111 monochromators of previous 1T french triple axis spectrometer were enhanced and set up on a new changer, designed by AZ-Systems. A copy of the monochromator unit, mechanics and shielding, was done and adapted to receive the new Heusler monochromator, so to have the possibility to go easily from the non-polarized option to the polarized one. 18 pieces of Heusler single crystals of 1.5x7 cm^2 grown and tested at the ILL, were used to achieve a 13.5x14 cm^2 vertically focusing monochromator, maintained in a horizontal magnetic field of 1.5 kGauss to get a polarized thermal neutron beam in an energy range from 5 to 75 meV, which hopefully will be extended to 100 meV. The non-polarized neutron option was first undertaken. Modifications of the drum were needed to take a full advantage of the new beam size. The beam entrance had to be enlarged as well as the exit of the monochromatic beam. This implied a dismantling of the whole drum.

During this operation, the 35 years old needle bearings used for the 20 tons drum rotation went stuck! A lot of patience and skill from the technical staff was needed to get it fixed up…

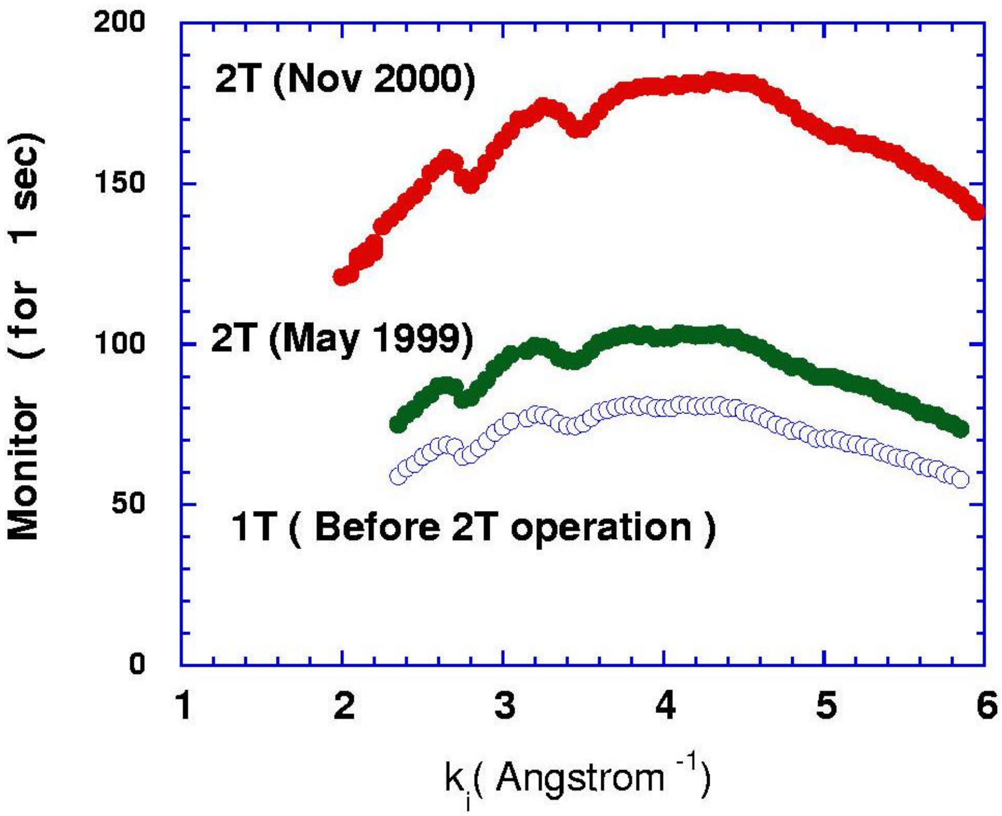

Figure 1 Monitor count evolution. May 1999: new beam port, old monochromator. Nov 2000: final state

Finally the spectrometer, in its new version, could be settled in. The improvement obtained on the thermal flux is illustrated on Figure 1 where the successive steps of the operation are reported. The gain is indeed about a factor 2.25 for the monitor count and nearly a factor 3 at constant time for a Vanadium measurement, which is even better than had been estimated initially. This is due to intrinsic differences between channels 1T and 2T: the distance between source and monochromator is slightly shorter on 2T, but it also appeared that the luminance of the beam is less on 1T, for yet unclear reason.

The completion of the polarized option is now nearly achieved. First tests have been undertaken, pointing out the need of a few modifications: a change in the curvature control of the vertical focusing of the monochromator and a modification of the guide field in the vicinity of the monochromator. On the other hand, a new shielding has been built up to allow the use of a new horizontally focusing polarizing Heusler analyzer. It will be installed during summer 2001 together with the above mentioned modifications. The polarized option on the 2T thermal beam will thus be fully operational at the end of 2001. The success obtained with the non polarized beam allows us to expect very good numbers for this new option.

To illustrate the current possibility of the non polarized thermal beam, we have reported on Figure 2 measurements performed on Molecular-Beam-Epitaxy-grown samples. Spin waves have been measured in pure MnTe, obtained in the cubic Blende structure because of the epitaxial growth, while otherwise it would have been of hexagonal structure. After a series of measurements on a 6 µm thick sample in the type III antiferromagnetic phase below ~ 65 K, where a complete spin wave spectrum has been obtained, we tried to look at the spin waves in a superlattice made of a stacking of blocks of MnTe (20 monolayers, with about 3.15 ? spacing) interspaced by block of non magnetic ZnTe layers (6 monolayers). Indeed this superlattice exhibits a surprisingly long range coherency of the same magnetic order as the pure material. On Figure 2 are superimposed results obtained on a 1 µm thick superlattice and those on the 6 µm thick MnTe. In both case the sample surface was ~ 2.5 cm^2. This illustrates the feasibility of this kind of measurements for a total sample volume of ~ 0.25 mm^3.

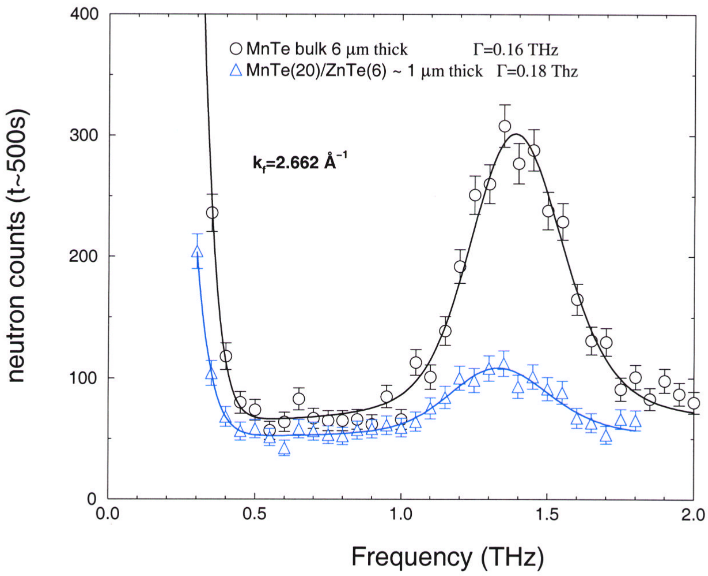

Figure 2: Zone boundary spin wave for MnTe (6 µm) and MnTe(20)/ZnTe(6) (1µm) at 13 K.
(ref : B.Hennion, W.Szuszkiewicz et al. to be published)