TOKAI CROSS Experimental Report J-PARC	提出日 Date of Report 2013/05/14
課題番号 Project No. 2012B0130 実験課題名 Title of experiment “Average chalcogen height dependence of spin resonance intensity on single crystals of $FeTe_{1-x}Se_x$” 実験責任者名 Name of principal investigator Shin-ichi Shamoto 所属 Affiliation Japan Atomic Energy Agency	装置責任者 Name of responsible person Ryoichi Kajimoto 装置名 Name of Instrument/（BL No.） 4SEASONS/BL01 実施日時 Date and time of Experiment 2013/3/6 21:00 ～ 2013/3/12 11:00

試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。（適宜、図表添付のこと）
Please report your samples, experimental method and results, discussion and conclusions. Please add figures and tables for better explanation.

1. 試料 Name of sample(s) and chemical formula, or compositions including physical form.

Measured single crystal sample is $Fe_{1.0}Te_{0.5}Se_{0.5}$ (~11g) with T_c=13K and 50% superconducting volume fraction. Unfortunately, the other single crystals with different compositions had low superconducting shielding volume fractions such as 10-30%. Therefore, we measured only the best $Fe_{1.0}Te_{0.5}Se_{0.5}$ single crystal sample here.

2. 実験方法及び結果（実験がうまくいかなかった場合、その理由を記述してください。）
Experimental method and results. If you failed to conduct experiment as planned, please describe reasons.

Experimental conditions: *c*-axis of the $Fe_{1.0}Te_{0.5}Se_{0.5}$ crystal is aligned along the beam direction to observe (*hk*0)-plane. Experimental conditions are optimized at E_i=21.4 meV, which is one of the typical and standard setting parameters at BL01. The energy resolution is estimated to be 1.2 meV at E=0 meV. Measured temperatures range from 4 to 150 K.

Experimental results: Superconducting $Fe_{1.0}Te_{0.5}Se_{0.5}$ crystal shows spin excitation at (π, 0) position (unfolded Brillouin zone) as shown in Fig. 1. The spectral weight is transferred from low energy to high energy due to superconducting gap opening as the sample temperature is lowered below superconducting transition temperature T_c. This phenomenon is usually called as spin resonance. In this experiment, Q-dependence of the spectral weight shift is studied in detail as shown in Figs. 2 and 3. The $S(Q, E)$ intensity is integrated in the energy range of 1.2 meV. Although both of the top flat spin excitations are enhanced below T_c, the Q-dependence is very different from each other. At E=7 meV, only the intensity at (π, 0) is enhanced.

This characteristic single peak feature has been observed only at spin resonance energy, where the enhanced peak in energy appears.

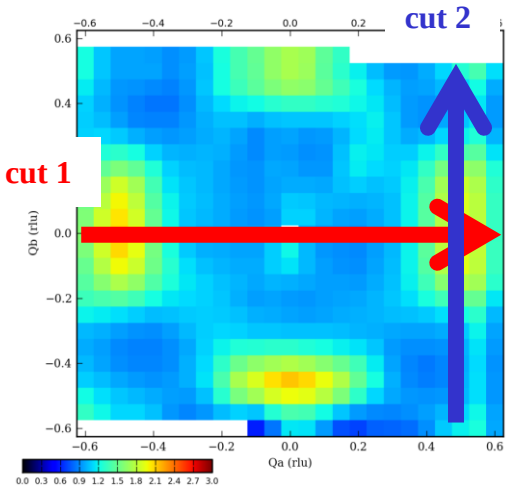

Fig. 1. 2D intensity map of inelastic spin excitation spectrum. Cut 1 crosses the Q=0 center along Q_a line from (-π, 0) to (π, 0). Cut 2 crosses (π, 0) along Q_b line from (π, -π) to (π, π).

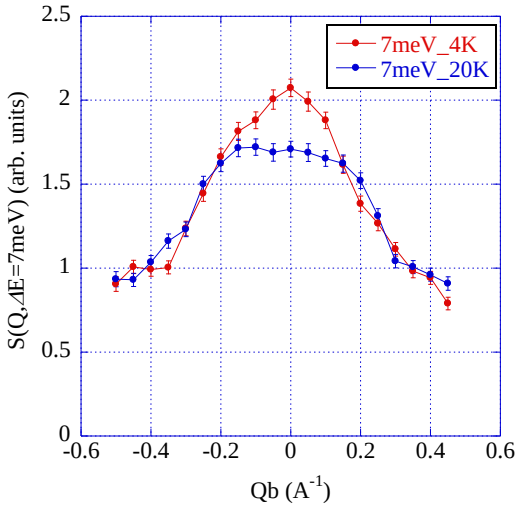

Fig. 2. Constant-E cuts of $S(Q, E)$ at E=7 meV along the cut 2(Red: 4 K, Blue: 20 K).

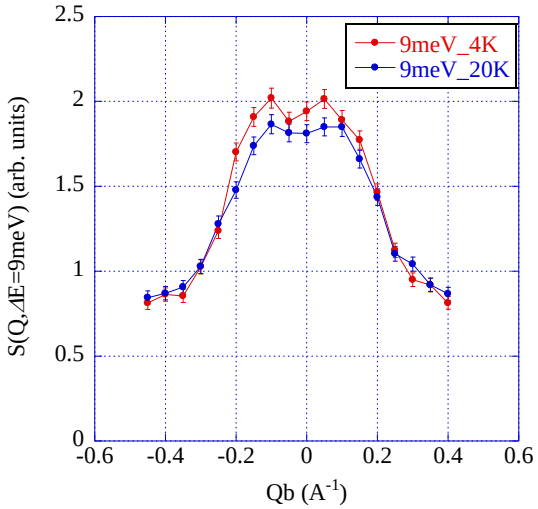

Fig. 3. Constant-E cuts of $S(Q, E)$ at E=9 meV along the cut 2(Red: 4 K, Blue: 20 K).