実験報告書様式（一般利用課題・成果公開利用）

（ ※本報告書は英語で記述してください。ただし、産業利用課題として採択されている方は日本語で記述していただいても結構です。 ）

CROSS TOKAI **Experimental Report** J-PARC	承認日 Date of Approval 承認者 Approver 提出日 Date of Report 31.08.2016
課題番号 Project No. 2014B0320 実験課題名 Title of experiment Underlying mechanism of the magnetocaloric effect in $MnFe_4Si_3$ 実験責任者名 Name of principal investigator Jörg Voigt 所属 Affiliation Forschungszentrum Jülich GmbH	装置責任者 Name of Instrument scientist Dr. Ryoichi Kajimoto, Dr. Kazuki Iida 装置名 Name of Instrument/(BL No.) 4SEASONS (BL01) 実施日 Date of Experiment 16 – 20 June 2016

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.

$MnFe_4Si_3$ single crystal, hexagonal symmetry

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.

We have investigated magnetic and spin dynamics in the magnetocaloric compound $MnFe_4Si_3$ at the thermal time-of-flight spectrometer 4SEASONS (BL01). Single crystalline sample of ~0.3 cm^3 has been oriented with [0 0 1] and [1 1 0] hexagonal axis in the horizontal scattering plane. The measurements were carried out at T = 7 K and 360 K by rotating the crystal around vertical [1 −1 0]-axis in the range of 94.5^0 in order to get 4-dimensional momentum-energy map. The data have been recorded using the repetition rate multiplication mode, with set of incoming energies E_i = 80.08 meV, 36.60 meV, 20.88 meV, 13.48 meV, 9.42 meV (250 Hz frequency of Fermi chopper). The corresponding energy resolution (FWHM) at the elastic line was 5.52 meV, 1.89 meV, 0.92 meV, 0.56 meV and 0.36 meV, respectively.

During the experiment the data have been preliminary analyzed and visualized using the Utsusemi software [1]. Unfortunately, due to the presets in the path for data files we were not able to use it outside the J-Parc campus. Therefore, for the subsequent data treatment we use Horace program package [2].

Fig.1. and Fig.2 show the cuts of $S(Q,\omega)$ made using Horace at zero energy perpendicular to the axes of high symmetry (Fig.1) and energy cut (Fig.2). One can see that the quality of the single crystal is rather high, without any twins and satellites. However, the inelastic signal (see Fig.2) is very weak and its analysis requires more detailed and involved treatment.

2. 実験方法及び結果（つづき） Experimental method and results (continued)

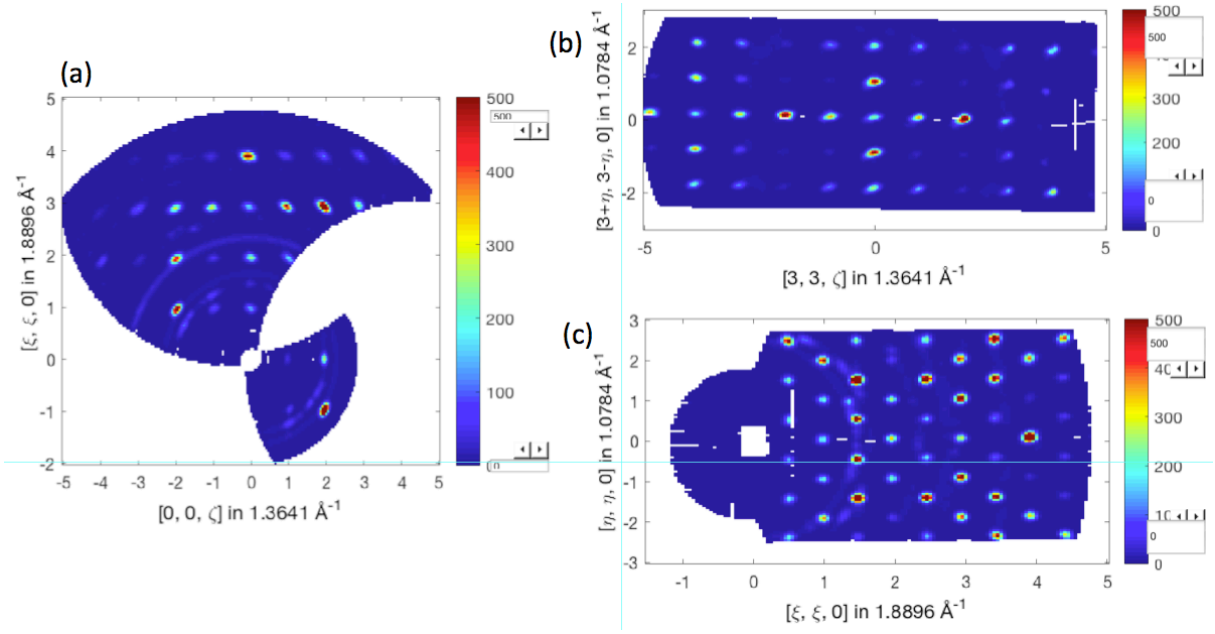

Fig.1. 2D-cuts of S(Q,ω) at E=0 (integrated over the range ±5meV).

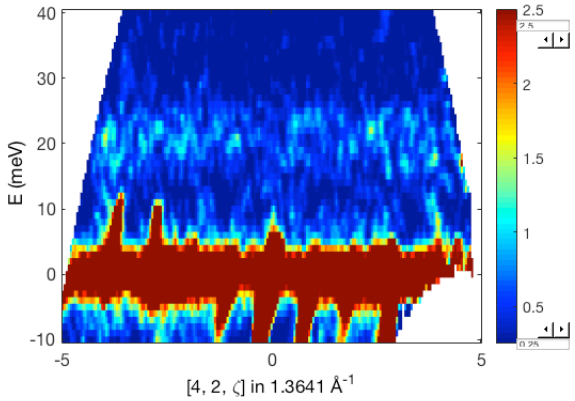

Fig.2. 2D map of S(Q,ω) in Q-E plane.

[1] Y. Inamura, T. Nakatani, J. Suzuki, T. Otomo, J. Phys. Soc. Jpn. **82** (2013) SA031.

[2] R. A. Ewings, A. Buts, M. D. Le, J. van Duijn, I. Bustinduy, T. G. Perring, Nucl. Instr. Meth. Phys. Res. A **834** (2016) 132.