（ ※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。 ）

MLF Experimental Report	提出日 Date of Report
課題番号 Project No. 2013B0133 実験課題名 Title of experiment Long periodical Chiral Helimagnetism in Inorganic Chiral Compounds: T1/3NbSe2 (T = Transition Metal) 実験責任者名 Name of principal investigator Y. Kousaka 所属 Affiliation Aoyama-Gakuin University	装置責任者 Name of responsible person T. Kamiyama 装置名 Name of Instrument/(BL No.) BL08 (Super HRPD) 実施日 Date of Experiment March/13/2014-March/18/2014 April/01/2014-April/06/2014

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.

$Cr_{1/3}NbSe_2$(powder)

$Mn_{1/3}NbS_2$(powder)

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.

Our aim for this experiment was to investigate long periodical helimagnetic ordering in chiral magnetic compounds $T_{1/3}NbX_2$ (T = Transition Metal, X = S and Se). These compounds are belonging to a chiral space group of $P6_322$, allowing Dzyaloshinskii-Moriya (DM) vector along the helical axis. Therefore, they are expected to form chiral helimagnetic ordering due to the competition between ferromagnetic exchange interaction and DM interaction, The pitch angle of the chiral helix is determined by the ratio of ferromagnetic exchange interaction and DM interaction. As a result, the period can be hundreds of angstroms. However, sometimes the angle resolution of thermal neutron diffraction experiments is not high enough to separate fundamental Bragg peaks and magnetic satellite peaks. As consequence, some compounds with chiral helimagnetic ordering may be easily misinterpreted as ferromagnetic ordering. In this sense, high Q resolution is the key to detect the long periodic helimagnetic satellite peaks.

In order to observe the mangetic satellite peaks, we performed super high-resolution powder neutron diffraction experiments at BL08 (Super HRPD) in the Materials and Life Science Experimental Facility (MLF) of J-PARC. We obtained powder diffractograms of the ferromagnetic $Mn_{1/3}NbS_2$ and $Cr_{1/3}NbSe_2$ in the

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

paramagnetic and magnetic ordered phase. We have already obtained data of $Mn_{1/3}NbS_2$ in the beamtime of 2012A. As shown in Figure 1 (a), we could not separate the Bragg and magnetic satellite peaks around the (1,0,2) reflection. Therefore, in this beamtime, we adopted the second frame mode of incident neutron and observed around the (0,0,2) reflection using backward bank in order to maximize the *Q* resolution. Figure 1 shows the scan profiles of $Mn_{1/3}NbS_2$ obtained in 2012A and 2013B. The both profiles could not observe the magnetic satellite peaks, but observe the increase of peak-width. If the increase is due to existence of magnetic satellite peaks, the period of the magnetic ordering can be 3000 angstroms.

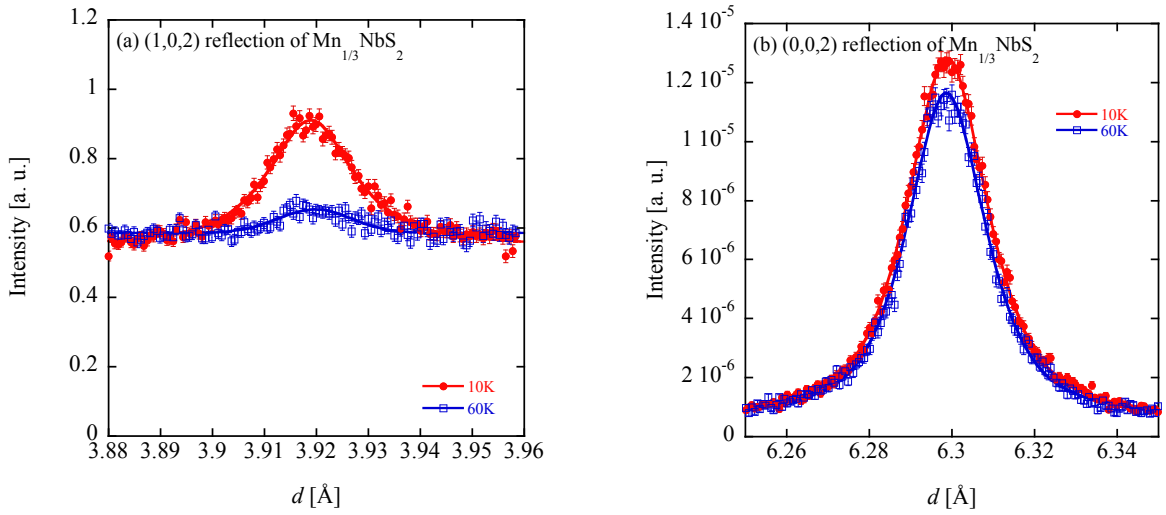

Figure 1 Scan profile of $Mn_{1/3}NbS_2$, obtained in (a) beamtime of 2012A and (b) beamtime of 2013B.

Figure 2 shows scan profile around (1,0,2) of $Cr_{1/3}NbSe_2$. While the magnetic peak-width of $Mn_{1/3}NbS_2$ was 2 times larger than the paramagnetic one, the magnetic peak-width of $Cr_{1/3}NbSe_2$ was same with the paramagnetic one. In this sense, $Cr_{1/3}NbSe_2$ forms ferromagnetic structure.

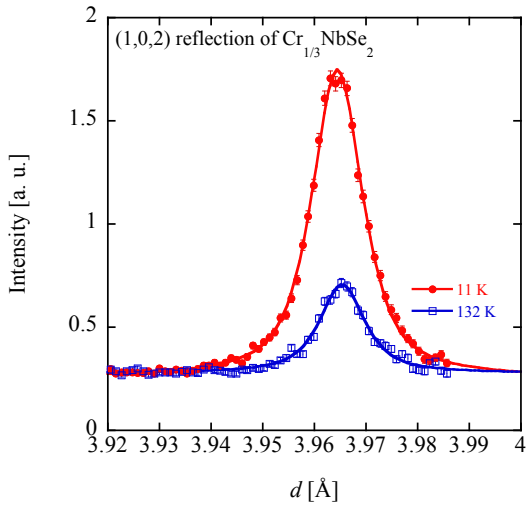

Figure 2 Scan profile of $Cr_{1/3}NbSe_2$.