（ ※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. 2017A0426 実験課題名 Title of experiment Elucidating the oxygen-deficiency-induced new magnetic phase in iron-pnictide superconductor $Sr_4V_2O_6Fe_2As_2$ 実験責任者名 Naoki Murai 所属 Affiliation J-PARC, JAEA	装置責任者 Name of responsible person Dr. T. Ohtomo 装置名 Name of Instrument/（BL No.） BL21 NOVA 実施日 Date of Experiment 2017/5/30

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.

$Sr_4V_2O_6Fe_2As_2$ (power sample)

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.

High-T_c superconductivity in iron-based superconductors (FeSCs) emerges from parent compounds that show structural phase transition followed by an antiferromagnetic ordering at the Fe-site. This magneto-structurally ordered phase turned out to arise from the complex interplay of spin and orbital degrees of freedom, suggesting that spin and/or orbital fluctuations play an essential role in forming Cooper pairs. On the other hand, $Sr_4V_2O_6Fe_2As_2$, which has the blocking layer with a perovskite-type structure (see Fig.(a)), shows superconductivity with T_c of 37 K without chemical substitution and interestingly, a magneto-structurally ordered phase has not been observed so far. The absence of a magneto-structural phase in this material calls for re-visiting our current understanding of superconductivity mechanism in FeSCs.

Very recently, we revealed that the magnetically ordered phase is indeed present in proximity to the superconducting phase of $Sr_4V_2O_6Fe_2As_2$. Figure b shows the temperature dependence of magnetic susceptibility for oxygen-deficient $Sr_4V_2O_{6-\delta}Fe_2As_2$. Remarkably, a magnetic phase transition is observed at T = 100 K. This transition exhibits a hysteresis behavior, suggesting a coincident structural

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

phase transition. To the best of our knowledge, this is the first observation of magneto-structual transition in off-stoichiometric FeSCs compounds.

In the present beamtime, we performed powder neutron diffraction study at BL21 NOVA to determine the magnetic structure of the newly-discovered magnetic phase of oxygen-deficient $Sr_4V_2O_{6-\delta}Fe_2As_2$. Measurements were performed at T = 140 K, 100K, and 60K. Structure refinements were performed using FullProf software. Unfortunately, we could not observe any detectable magnetic Bragg peak at the low-temperature phase, probably due to a small ordered moment size. Therefore, it seems difficult to achieve the original goals of the present research proposal.

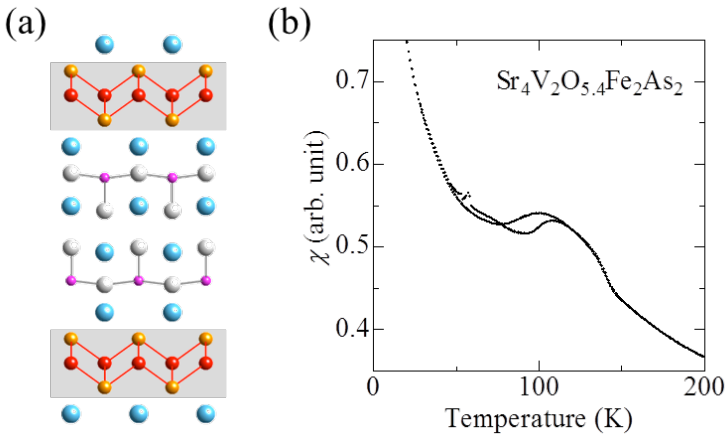

Fig.(a) Crystal structure of $Sr_4V_2O_6Fe_2As_2$. Shaded area represents FeAs layers.

Fig.(b) Temperature dependence of magnetic susceptibility for the compound with oxygen deficiency.