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 <b>MLF Experimental Report</b>	提出日 Date of Report 04/27/2014
課題番号 Project No. 2013B0137 実験課題名 Title of experiment Nondestructive study of Japanese iron artifacts using pulsed neutron imaging for evaluating crystallographic texture and microstructure 実験責任者名 Name of principal investigator Manako Tanaka 所属 Affiliation Tokyo University of the Arts	装置責任者 Name of responsible person Kenichi Oikawa 装置名 Name of Instrument/(BL No.) NOBORU (BL No.10) 実施日 Date of Experiment 02/20/2014-02/26/2014

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.
1. Japanese matchlock gun fabricated by Kunitomo manufacturer, Fe, solid, 101cm, 2kg  2. Japanese matchlock gun (unsigned), Fe, solid, 101.7cm, 2.5kg  3. Fragment of Japanese matchlock gun, Fe, solid, 1cm, 30g 4. Fragment of Japanese matchlock gun, Fe, solid, 1cm, 10g 5. Fragment of Japanese sword, Fe, solid, 12.2cm, 70g 6. Fragment of Japanese sword, Fe, solid, 23.5cm, 200g 7. Fragment of Japanese sword, Fe, solid, 23.3cm, 200g 8. Fragment of Japanese sword, Fe, solid, 26.7cm, 195g 9. Standard iron sample (very low carbon steel), Fe, solid, 2.4cm 10. Standard iron sample (low carbon steel, 0.25mass%C) , Fe, solid, 2cm 11. Standard iron sample (medium carbon steel, 0.5mass%C) , Fe, solid, 3.1cm 12. Standard iron sample (high carbon steel, 1.1mass%C) , Fe, solid, 1.3cm 13. Standard iron sample (high carbon steel, cast iron) , Fe, solid, 2cm

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.
<b>【Experimental method】</b> Experiment was carried out by pulsed neutron imaging using the time-of-flight (TOF) method. The layout of the experiment is shown in Fig. 1. We observed the incident neutron TOF spectra and the transmitted neutron

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

TOF spectra. The distortion of the incident spectrum was clearly observed in the transmitted spectrum due to the Bragg scattering. A 2D-PSD was used to get the spatial dependent TOF data. Measurements were performed at room temperature.

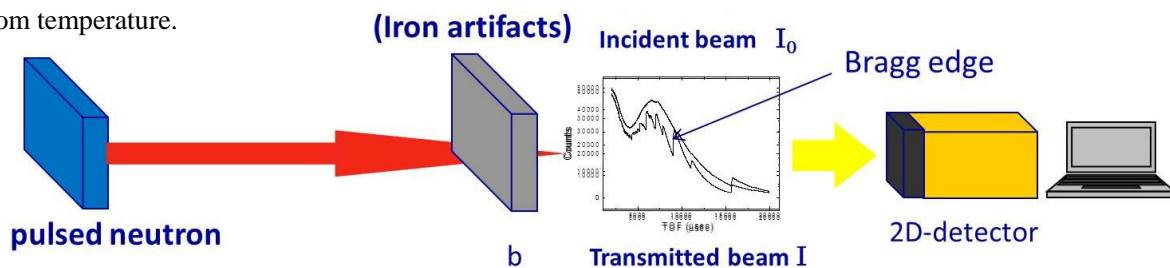


Fig.1 Experimental layout

### 【Results】

The experiment was conducted as planned. The parts of the results obtained are shown in Fig.2 and Fig.3. Now we are still analyzing the obtained data, the shape and the position of the Bragg edge of the samples cautiously. The information of the preferred orientation, the crystallite size, and crystal strain of the Japanese iron artifacts such as Japanese matchlock gun and fragment of Japanese sword will clarify the metallurgical characteristics of those iron artifacts and reveal the traditional Japanese iron making and forging techniques. The final goal of our study is to examine the differences of the metallurgical characteristics of those iron artifacts between the manufacturing technique, manufacturer, manufacturing area and manufacturing age.

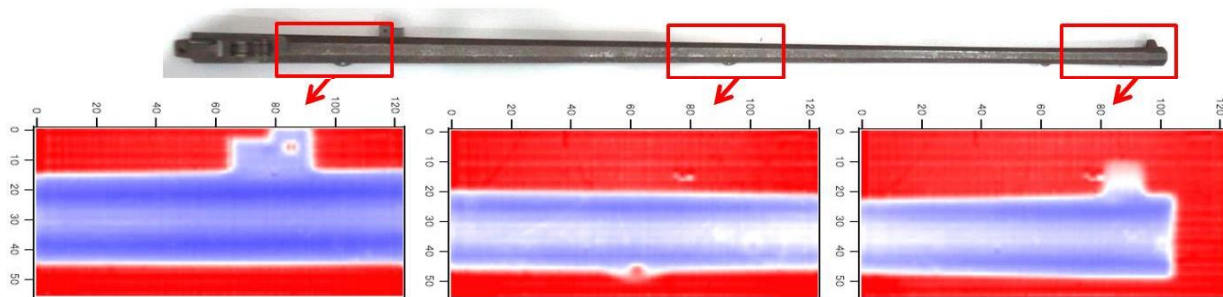


Fig.2 Neutron imaging of a Japanese matchlock gun fabricated by Kunitomo manufacturer.

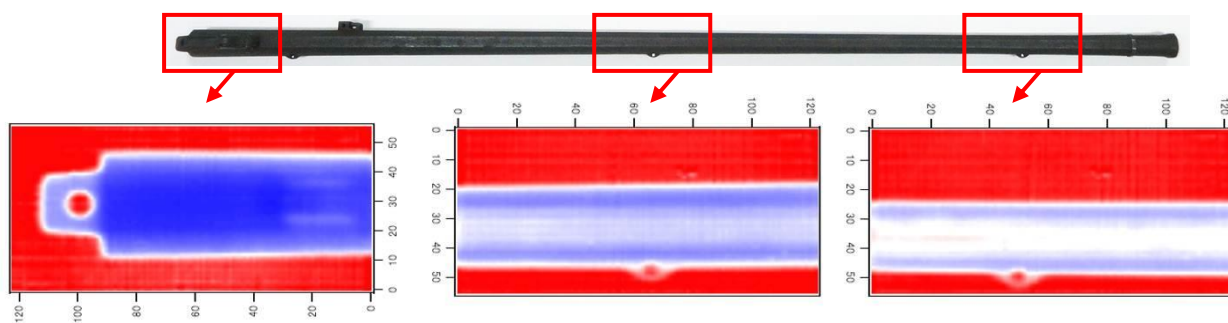


Fig.3 Neutron imaging of a Japanese matchlock gun (unsigned).