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。）

J-PARC MLF Experimental Report

提出日 Date of Report

課題番号 Project No.
2016A0180

実験課題名 Title of experiment
Systematic studies on muonium production in vacuum from laser-ablated silica aerogel

実験責任者名 Name of principal investigator
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装置責任者 Name of responsible person

装置名 Name of Instrument/(BL No.)
D2 ミュオン基礎科学実験装置

実施日 Date of Experiment
2017/01/14-2017/01/16

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.

Laser ablated silica aerogel sheets were prepared (see right table). Muonium production data for samples with check marks were taken in this experiment.

Sample number	Sample Name	Hole diameter (um)	Nominal depth (mm)	Patterned area (mm x mm)	Size (mm x mm)
✔ 1	MSR12-3b-S1	250	1	30 x 30	50 x 50
2	MSR12-3b-S2	250	3	30 x 30	50 x 50
✔ 3	MSR12-2a-S3	250	3	30 x 30	50 x 50
✔ 4	MSR12-3b-S4	250	5	35 x 35	50 x 50
✔ 5	MSR12-3b-S5	250	through holes	30 x 30	50 x 50
6	MSR12-2a-S6	250	5	34 x 32	fit to the ho
✔ 7	MSR12-2a-S7	150	through holes	32 x 32	50 x 50
✔ 8	MSR12-2a-blank	-	-	-	50 x 50

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.

This experiment is a continuation of the experiment conducted in 2014 (2014A0193). The main difference is the use of new laser-ablated silica aerogel samples with different depth of holes.

The experiment used the surface muon beam at the MUSE D2 port where surface muon beam is available at the intensity 3×10^6 /sec (150 kW proton beam power) with a 5% momentum bite. Sub-surfacemuon at momentum 23.7 MeV/*c* was used. After muon stops in the target, muon captures an electron to form a muonium inside of silica granule with 52% probability. Muonium rapidly escapes the granule and thermally diffuses through voids in between silica granules, and a fraction of them eventually reach to the target surface to be ejected to vacuum region towards the downstream of the vacuum chamber.

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

The positron detector installed next to the target vacuum chamber detects positrons from muonium decay in the vacuum region. The positron detector consists of four layers of scintillation-fiber hodoscope followed by a polyethylene absorber and 4x4 matrix of 20 mm-thick scintillators. The hit positions of hodoscope determined the position and angles of the positron track from which the positron track was tracked-back to the beam axis to measure the decay position.

The time distributions of the decay positrons are shown in Fig. 1. Signal from muonium in vacuum observed as event excess over the silica plate data in the vacuum regions are clearly seen in the time region t > 2 μs. Figure 2 shows preliminary results on dependence of the vacuum Mu yield as a function of hole depth. Preliminary finding from these results is that there is no strong dependence of the vacuum Mu yield on the hole depth.

In summary, data taking for all planned sample were collected without any problem. Preliminary results on dependence on hole depth were obtained. We plan to continue the study at TRIUMF with new ablation patterns taking into account the results from this experiment.

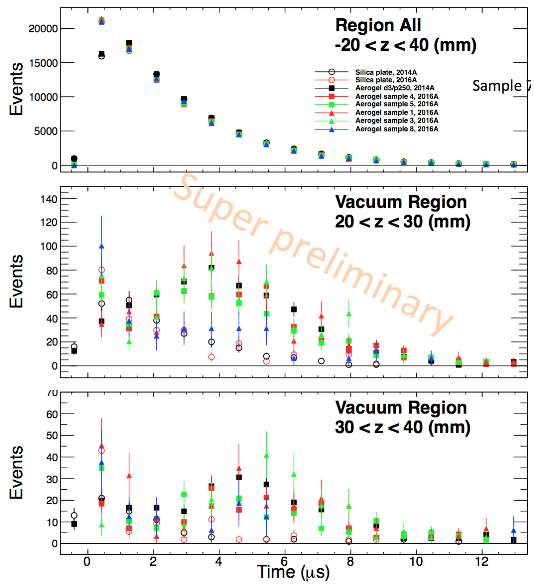

Figure 1 : Time distribution of positrons

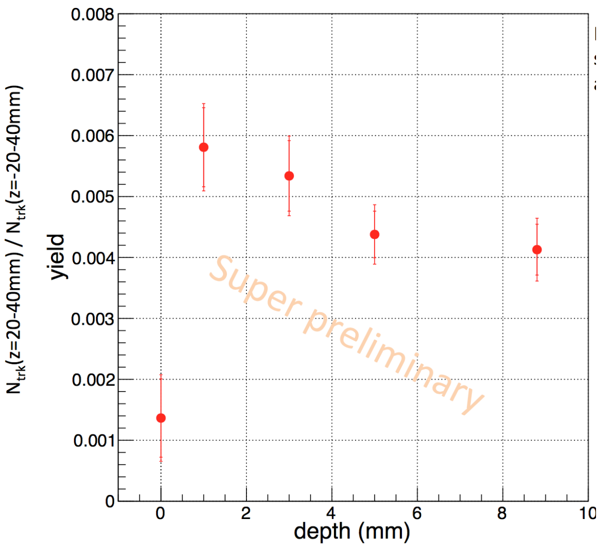

Figure 2 : Vacuum Mu yield vs hole depth