実験報告書様式（一般利用課題・成果公開利用）

MLF Experimental Report

課題番号 Project No. 2014A0193	提出日 Date of Report
実験課題名 Title of experiment Systematic studies on muonium production in vacuum from structured silica aerogel	装置責任者 Name of responsible person 三宅 康博
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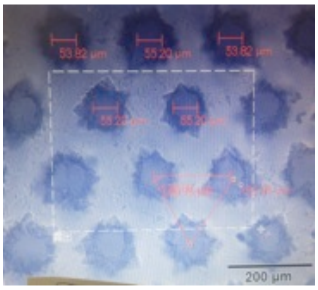
試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。（適宜、図表添付のこと）

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



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.

The experiment utilized the surface muon beam at the MUSE D2 port where surface muon beam is available at the intensity 6×10^{6} /sec (300 kW proton beam power) with a 5% momentum bite. The experimental setup is shown in Fig. 1. Sub-surface muon 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 [2]. 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.

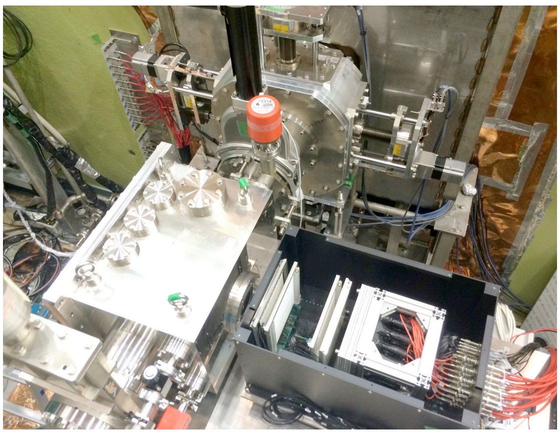


Figure 1: experimental setup

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 hodoscopes 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 distribution was measured in three regions of decay position. Very preliminary results on the positron time distribution are shown in Fig 2. 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. The muonium yield becomes large from 285 μm pitch to 185 μm pitch. There is only slight increase from 185 μm pitch to 115 μm pitch. The 115 μm pitch sample gave the highest yield among these samples. There is no significant difference between diameter/pitch = 55μm/115μm and 270μm/300μm. This could be due to shallower depth of holes in 55μm/115μm sample.

As a next step, we'd like to explore even smaller hole pitch and/or deeper hole depth to survey how muonium yield changes with these parameters. We have established the procedure to prepare laser-ablated aerogel with arbitrary patterns. The sample preparation should be straightforward.

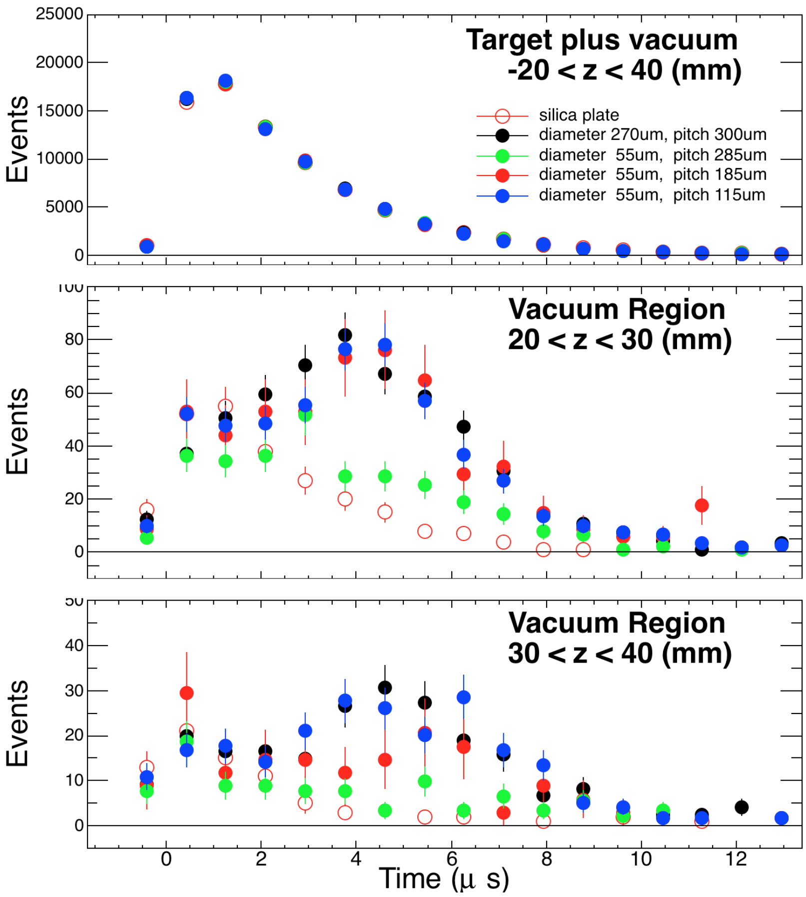


Figure 2：Time distribution of positron in three z regions