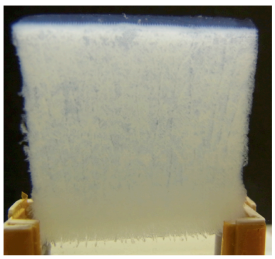
MLF Experimental Report	提出日 Date of Report
課題番号 Project No. 2013B0148 実験課題名 Title of experiment Measurement of muonium in vacuum from silica aerogel 実験責任者名 Name of principal investigator 三部 勉 所属 Affiliation 高エネルギー加速器研究機構 素粒子原子核研究所	装置責任者 Name of responsible person 三宅 康博 装置名 Name of Instrument/(BL No.) D2 ミュオン基礎科学実験装置 実施日 Date of Experiment 2014/3/6-2014/3/8

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 used the surface muon beam at the MUSE D2 area. Sub-surface muon at momentum 23.7 MeV/c was used. The muon beam was collimated by three collimators with a hole diameter of 16 mmϕ, 12 mmϕ, and 10 mmϕ, respectively. The collimated beam is stopped at the aerogel target. The beam momentum is tuned so that half of the muons are stopped in the target to maximize muon stopping density at the rear surface of the target.

After muon stops in the target, muon captures an electron to form muonium inside of silica granule with 52% probability. Muonium thermally diffuses through voids in between silica granules, and a fraction of them eventually reach to the tar- get surface to be ejected to vacuum region towards the downstream of the vacuum chamber. Positrons from muonium decay in the vacuum region are detected by the positron detector installed next to the target vacuum chamber. The positron detector consists of two layers of scintillation-fiber hodoscope (S1, S2) followed by a polyethylene absorber and 4x4 matrix of 20mm-thick scintillators (S3). The hit position of S1, S2, and S3 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.

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

The positron track-back distribution along the beam axis (z) is shown in Fig. 2 The distribution obtained with silica plate indicates the resolution of positron track-back with the detector hits. The mean position of the distribution moved to up- stream in the case of aerogel target. This is under- stood as the difference in muon stoping distribution as the thickness of the aerogel (7 mm) is much larger than that of silica plate. The time distribution of positron for three z regions are shown in Fig. 3. 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.

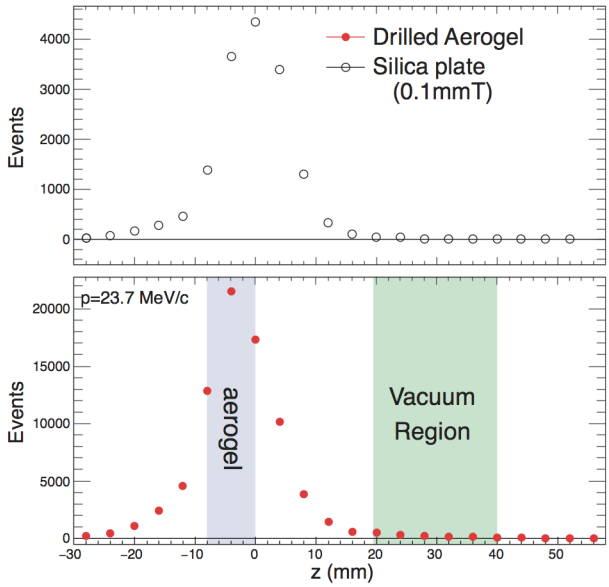


Fig. 2: Traced-backed positron distribution along the beam axis (z) for silica plate sample (top) and the laser-ablated aerogel sample (bottom).

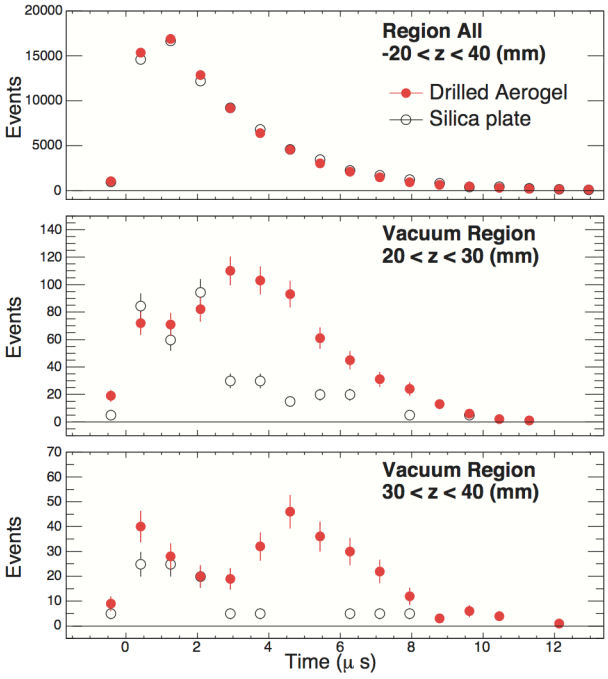


Fig. 3: Time distribution of positrons from three z regions for the Laser-ablated aerogel sample.