

Precision measurement of muonium hyperfine splitting at J-PARC

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Muonium is the bound state of a positive muon and an electron. In the standard model of particle physics, muonium is considered as the two-body system of structureless leptons. At J-PARC (Japan Proton Accelerator Research Complex), we are going to perform a precision measurement of muonium's ground state hyperfine splitting (MuHFS). MuHFS is the most precise probe for test of the bound state QED and determination of the ratio of muon's magnetic moment to proton's one. The experimental methodology is microwave spectroscopy of muonium. Figure 1 shows the conceptual overview of the experiment. Spectroscopy of the energy states can be performed by measurement of positron asymmetry from muonium decay. Precision of the latest experimental result [1] was mostly statistically limited (more than 90% of total uncertainty). Hence, higher statistics is essential to the higher precision of measurement. Our goal is more than 10 times accuracy with 200 times of statistics relative to the latest experiment. For improvement of precision, we use the J-PARC's highest intensity pulsed muon beam [2] and highly segmented positron detector with SiPM (Silicon PhotoMultiplier) [3]. For further improvement, we reduce systematic uncertainty by using a longer cavity, a high precision superconducting magnet, and online/offline beam profile monitor. In this presentation, we discuss the experimental overview and R&D status of each components.

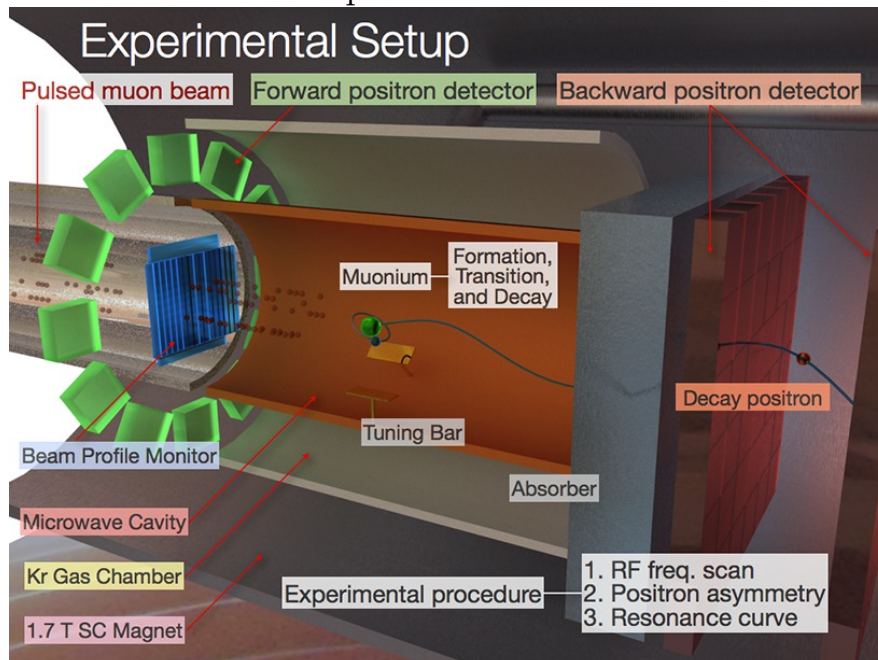


Figure 1: *Experimental Overview*

References

- [1] W. Liu et al., PRL. 82, 711 (1999).
- [2] A. Toyoda et al. J.Phys.Conf.Ser. 408 (2013) 012073
- [3] S. Kanda et al, KEK-MSL Progress Report 2012B0117 (2013)