Research and Developments on the PRISM-FFAG

A. Sato[1], M. Aoki[1], S. Araki[1], Y. Arimoto[1], T. Itahashi[1], Y. Iwashita[2], Y. Kuno[1], Y. Kuriyama[1], Y. Mori[3], H. Nakanishi[1], C. Ohmori[4], M. Yoshida[1]

[1]*Department of Physics, Osaka University, Toyonaka, Osaka 560-0043, Japan*

[2]*Institute for Chemical Research, Kyoto University, Gokasho, Uji, Kyoto, 611-0011, Japan*

[3]*Kyoto University Research Reactor Institute, Kumatori, Osaka, 590-0494, Japan*

[4]*KEK/J-PARC, Tsukuba, Ibaraki, 305-0801, Japan*

An Fixed Field Alternating Gradient (FFAG) ring has been build in the M-experimental-hall of RCNP to demonstrate the phase rotation for the PRISM project. The purpose of PRISM is provide a high intense, monochromatic low energy muon beam without pion contamination [1]. Such a muon beam Muon science can spring board the muon science, not only in the field of elementary particle physics but also material and their application. A search for the muon to electron conversion in a muonic atom, in particular, is a main target of the PRISM project. In this experiment, a mono-energetic and pure muon beam is indispensable to achieve a sensitivity of BR 10^{-18}. PRISM uses a FFAG ring to make a mono-energetic muon beam by adopting the phase rotation. In the ring, muons with higher energy are decelerated and that with lower energy are accelerated by an RF field with a high field gradient [2]. A momentum spread of 68MeV/c±20% at the injection time can be reduced to 68MeV/c±2% after 7 turns in the ring.

The experiments on the phase rotation will be performed by a FFAG ring with six PRISM-FFAG magnets and alpha particles, although the original PRISM-FFAG was designed with ten magnets for muons [3]. On the last week of September, the six magnets and their power supplies were installed into the M-experimantal hall. The ring was ready to start commissioning by the end of December, as shown in Fig. 1. Figure 2 shows the RF system of the ring. The cavity has 4 magnetic alloy cores, which are necessary to achieve a high field gradient sawtooth wave. The system were re-optimized for the demonstration, so that it produces a field gradient of 100kV/m at 2.1MHz. New detectors for alpha particles to measure their orbit, energy, and timing were also developed.

Now the ring is ready to operate. After some tuning, we will start studies on the ring performance and the phase-rotation.

References

[1] "The PRISM Project – A Muon Source of the World-Highest Brightness by Phase Rotation –", LOI for Nuclear and Particle Physics Experiments at the J-PARC (2003),

[2] C. Ohmori *et al.*, Nucl. Phys. Proc. Suppl. **149**, 280 (2005).

[3] A.Sato, S.Machida, "LATTICE DESIGN OF LARGE ACCEPTANCE FFAGS FOR THE PRISM PROJECT", EPAC'04, July 2004, Lucerne, p.1345.

Figure 1: PRISM-FFAG ring with six magnets in the M-experimental hall. Now the ring is ready to demonstrate the phase rotation.

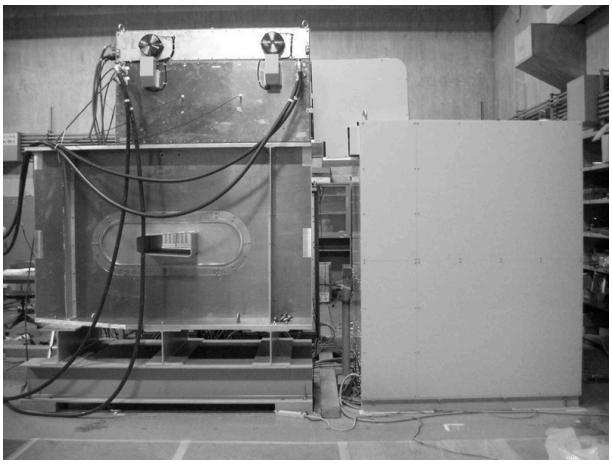

Figure 2: RF system of the PRISM-FFAG.