# Reduction and Resource Recycling of High-level Radioactive Wastes through Nuclear Transmutation (Accelerator Technology)
# (4) Study of MERIT (Mulitplex Energy Recovery Internal Target) on Intense Negative Muon Production for Muon Nuclear Transmutation

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Abstract

An intense negative muon source for muon nuclear transformation to mitigate the long lived fission products of nuclear wastes, which is based on MERIT (multiplex energy recovery internal target) ring is presented. Negative muon production of more than 1016 /s can be obtainable with this scheme.

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**Keywords:** LLFP, ERIT, nuclear transmutation, muon

**1. Introduction**

Reduction of nuclear wastes, especially long lived radioactive species such as long lived fission products (LLFPs) is one of the most important issues concerning energy production for society based on nuclear power plants. In muonic atom, the atomic nucleus absorbs a negative muon with large probability (95per cent), if the atomic number (Z) is more than 30 and then, it transforms to a stable nucleus by beta decay and the emission of several neutrons [1]. Long-lived cesium isotope,$^{135}$Cs (half-life:2.3 Myear), which is produced from the nuclear power plant in burning out one ton of enriched the nuclear fuel including 3per cent $^{235}$U can be transformed to non-radioactive xenon isotopes within about five years, if the yield of negative muon is $10^{16}\mu^-$/s.

**2. Production of negative muon**

In order to realize the negative muon yield of $10^{16}\mu^-$/s, the 800MeV(500MeV/u) proton(deuteron) beam current of more than 3A is necessary if a thin lithium target of 1cm in thickness or a 1atm deuterium gas target is used and recovery of the beam energy loss by re-acceleration and use of a thinner target, the so called energy recovery internal target (ERIT) scheme [2], is useful and convenient to overcome these difficulties. For negative pion/muon production, the ERIT ring providing with simultaneous beam acceleration and storage at the orbit where a wedge target is placed is most adequate. A new type of ERIT named MERIT (Multiplex Energy Recovery Internal Target) for negative muons has been proposed [3].

**3. Conclusion**

A new scheme with multiplex energy recovery internal target (MERIT) has been proposed for efficient production of negative muons to mitigate the long-lived fission products in the nuclear wastes from the nuclear power plant with muon nuclear transformation. In this scheme, it is expected that a muon yield of $10^{16}\mu^-$/s can be obtained with an 800MeV/(500MeV/u) proton(deuteron) beam.

**References**

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