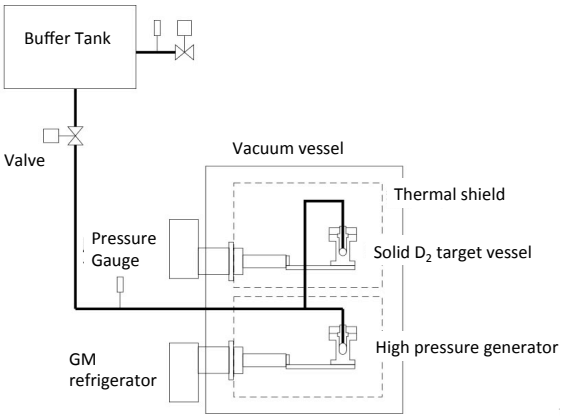
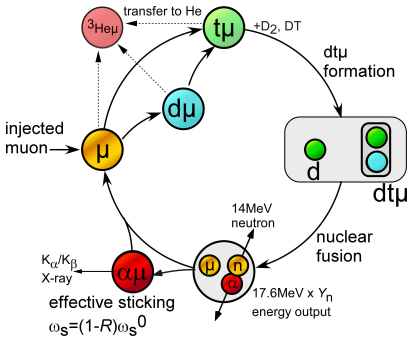
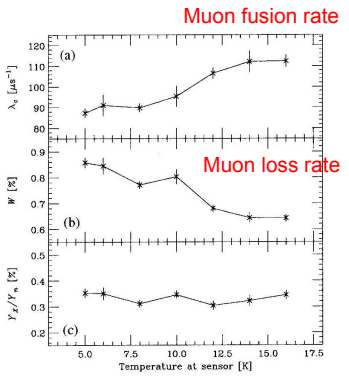
# High-pressure Solid Hydrogen Target for Muon Catalyzed Fusion

T. Matsuzaki, K. Ishida and M. Iwasaki
RIKEN Nishina Center, Wako, Saitama, 351-0198 Japan

Negative muon stops in deuterium and tritium mixture ($D_2$-$T_2$) to form mounic hydrogen atom $d\mu^-$ and $t\mu^-$ with small radius of 1/207 of the ordinary atomic radius. The $d\mu^-$ diffuses and converts to $t\mu^-$ by muon transfer. The $t\mu^-$ collides with $D_2$ molecule without any Coulomb repulsive force to resonantly form $dt\mu^-$ molecule. The d-t fusion reaction occurs in the $dt\mu^-$ molecule to produce α-particle and neutron. After the d-t fusion, the muon is liberated, and repeats the same process. In muon catalysed d-t fusion process, one negative muon produces 120 d-t fusions during its lifetime. The present fusion rate is 1 million d-t fusions per second and corresponding to 40% of scientific breakeven. We have also observed temperature dependence of fusion rate in solid $D_2$-$T_2$ targets. The d-t fusion rate increases by 20% from 5K to 17K in solid $D_2$-$T_2$, while the muon loss probability decreases[1]. As the first step, we have constructed a high-pressure solid $D_2$ target (1,000 bar, 30K) to study the temperature dependence of d-d fusion rate and the muon loss probability at higher temperature region of solid $D_2$ target, which is realized under high pressure up to 1,000 bar.




Upper: High-pressure solid hydrogen target

Right upper: Muon catalyzed fusion cycle

Right lower: Temperature dependence of d-t fusion rate and muon loss rate

Ref. 1) N. Kawamura et al, Phys. Rev. Lett. 90 (2003) 043401.