Estimation of the beam-trip frequency of ADS accelerator based on the operational data of J-PARC Linac

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Frequent beam trips as experienced in existing high-power proton accelerators may cause thermal fatigue in Accelerator-Driven System (ADS) components, which may lead to degradation of their structural integrity and reduction of their lifetime. In the previous study [1], the thermal transient analyses were performed to investigate the effects of beam trips on the reactor components. In order to consider methods to reduce beam-trip frequency, we compared the acceptable beam-trip frequency with the performance of the ADS accelerator, which was estimated based on the operational data on existing accelerators, the Los Alamos Neutron Science Center (LANSCE) and the High Energy Accelerator Research Organization (KEK). The comparison showed that for beam trips with a duration of 10 s or less, the beam-trip frequency was acceptable. On the other hand, for beam trips with durations exceeding 10 s, beam-trip frequencies were about 6 to 35 times larger than acceptable values.

In the present study, the operational data on J-PARC Linac were newly analyzed and probability density functions (*pdf*) of beam trips for the ion source and the accelerator tube of the J-PARC Linac was obtained. Using the Monte Carlo method based on the beam-trip *pdf*, the beam-trip frequencies of the ADS accelerator were estimated. As the result of the estimation, it was found that the type of the beam-trip *pdf* was the initial failure type, *i.e.*, the beam-trip frequency for the ion source and the accelerator tube was larger at the beginning and decreased monotonously with the operation time. And the beam-trip frequency of the ADS accelerator with a duration of 10 s or less was acceptable, as same as the previous value. On the other hand, beam-trip frequencies with durations exceeding 10 s were less than the previous values, but about 3 to 10 times larger than acceptable values.

In the presentation, the reliability of the ion source and the accelerator tube to satisfy the acceptable beam-trip frequency will be mentioned.

References

[1] H.Takei, K. Nishihara, K. Tsujimoto, and H. Oigawa, J. Nucl. Sci. Technol. **49**, 384 (2012).