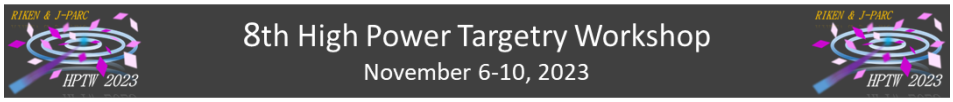

Contribution ID: **33** Type: **Contributed Oral**

Present status of cavitation damage mitigation techniques for the mercury target vessel at J-PARC pulsed spallation neutron source

Friday, 10 November 2023 15:00 (15 minutes)

A liquid mercury target system for the pulsed spallation neutron source is installed in the J-PARC. High-power proton beams of 3 GeV 25 Hz is injected to the liquid mercury to produce neutrons. A mercury target vessel made of 316L stainless steel is severely damaged by cavitation which is caused by the proton beam-induced pressure waves. The thickness of beam window is designed to 3 mm to reduce thermal stress. To mitigate the cavitation erosion, we adopted a double-walled structure with a narrow channel expects to disturb the growth of the cavitation bubbles due to the pressure gradient by the high-speed mercury flow.
In addition, gas microbubbles were injected into the mercury to suppress the pressure waves that induces cavitation.
During the beam operation, proton-beam induced acoustic vibration on the mercury target vessel is measured aiming to diagnose the effect of gas microbubble injection on pressure wave mitigation. Operational beam power for the J-PARC mercury target is gradually ramping-up to the 950~kW and achieved its stable operation on the effort of the cavitation damage mitigation techniques.
After the operational period, every year, cavitation erosion facing the mercury with gas microbubble injection and the narrow channel were observed by cutting out the beam window portion using an annular cutter with semi-dry cutting technique. The result showed that the obvious damage mitigation effect by injecting gas microbubble that is predicted through the acoustic measurement was observed. Based on the damage inspection, we are discussing to extend the operational period of target vessel from one year to two years.
In the workshop, present status of the cavitation damage mitigation will be discussed.

Themes for the contribution

7 Operation of targets and beam dumps:

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Session Classification: Topic7-2