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P4.154 Progress on reliability of remote maintenance concept for Japan's fusion DEMO reactor

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The banana-shaped segment transport using all vertical maintenance ports (BSAV scheme) was selected as the primary maintenance option on Japanese DEMO. Among various engineering issues on the BSAV scheme, recent progress on remote maintenance (RM) focuses on in-vessel transferring mechanism of the segment, support structure of the segment and pipe connection. In the BSAV scheme, cooperative operation and complex attitude control consistent with required installation accuracy and support structure of segment by full-remote operation are important issues on the maintenance. Therefore, the basic concept required for the RH device design is a simplified transferring mechanism for the blanket segment, that is, no rotation in vessel. Previous lift system was a cable crane, which catches the segment at the top of the segment. However, when one simply unilaterally supports or hoists the banana segment at the top of the segment, the segment tends to swing because its center-of-mass of the segment is away from the vertical axis directly beneath the supporting point. Updated RH equipment has a telescopic manipulator with a guide flame and the end effector for suppressing the swing. The segment attitude is kept by the end effector, which is sustained by the rigidity of the telescopic manipulator. The RH equipment is composed of the end effectors (grippers) for the banana segment, a power manipulator, a telescopic guide and a carrier. These components allow a three-axis attitude control of the banana segment in the vertical (Z), radial (R) and toroidal (f) directions. The role of the end effectors is to grip the segment at the top and bottom and to suppress the swing. The attitude control of RH equipment is made with a lift in the Z-direction, a link mechanism in the R-direction and a bogie in the f-direction, respectively.

Presenter: UTOH, Hiroyasu (National Institutes for Quantum and Radiological Science and Technology)

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