3-5 JAEA's Accelerator Chosen for ITER NBI
—Comparative Test of Accelerators for Neutral Beam Injector—

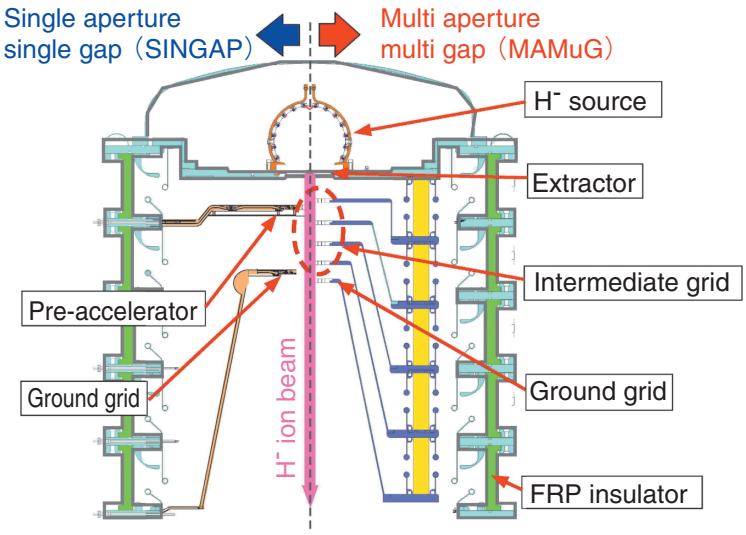

Fig.3-11 Comparison between SINGAP and MAMuG
The advantage of the SINGAP accelerator is its simplicity due to the absence of intermediate grids. However, electrons produced in the accelerator are accelerated to high energy. On the contrary, MAMuG has a complicated structure, but the electrons can be suppressed before acceleration to full energy by intermediate grids.

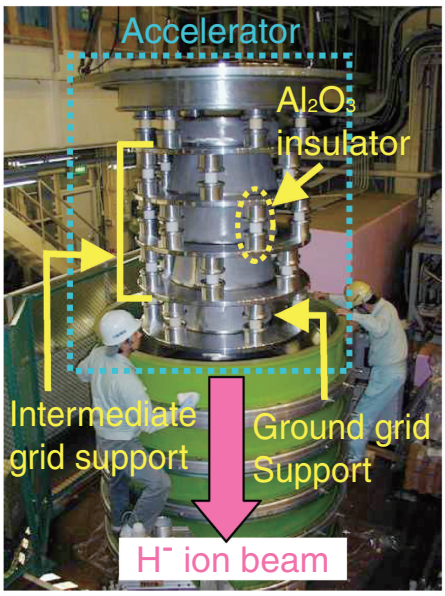

Fig.3-12 MAMuG accelerator developed at JAEA
Photograph of the MAMuG accelerator having four intermediate grids. Each grid is suspended from 1MV potential flanges supported by post insulators made of alumina.

The neutral beam injector (NBI) for ITER is required to inject 16.5MW of D^0 beams per injector. For this purpose, D^- beam current of 40A needs to be accelerated up to 1MeV by an accelerator. The required ion current is two orders of magnitude larger than conventional accelerators. To fulfill this requirement for the ITER accelerator, we have developed the "MeV accelerator" at the MeV test facility (MTF) in JAEA.

For the accelerator of the ITER NBI, two concepts have been proposed as shown in Fig.3-11. One is MAMuG (Multi-Aperture Multi-Grid) accelerator developed at JAEA (Fig.3-12) and the other is SINGAP (Single-Aperture Single-Gap) accelerator developed in EU. In order to choose the accelerator type for ITER, performance of the SINGAP and the MAMuG accelerator was tested and compared at the same test facility with the same diagnostics. For this purpose, the SINGAP accelerator was installed in JAEA's test facility and test was performed with participation of 7 scientists from EU. The results can be summarized as follows;

(1) The maximum voltage of the SINGAP was limited to 800kV, whereas the MAMuG could attain 1MV.
(2) The highest performance in the beam acceleration test of the SINGAP was 220mA at 672keV, while the MAMuG achieved 796keV, 320mA H^- ion acceleration.
(3) Co-accelerated electron current in the SINGAP was three times higher than the MAMuG, which will cause higher heat loads on beamline components.

From these results, it was concluded that the MAMuG has better performance than the SINGAP, and it has been decided to choose the MAMuG in the baseline design for the ITER NBI.

Reference

Taniguchi, M. et al., Development of 1 MeV H^- Accelerator at JAEA for ITER NB, AIP Conference Proceedings 1097, 2009, p.335-343.