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R&D of Biperiodic DAW

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SHORT HISTORY OF THE R&D

V. G. Andreev reported the Disk-and-Washer structure as an efficient stable linac in high ß region in 1972 [1]. Early enthusiasm for this structure was dampened by the discovery of an overlap between a deflecting mode passband and the operating frequency. The first author reported that the biperiodic configuration can cure the problem at 1983 Particle Accelerator Conference at Santa Fe, New Mexico, USA[2], while he was staying at Los Alamos National Laboratory (LANL). He joined the PIGMI (Pion Generator for a Medical Irradiations) project [3] and other research project [4] for research and development of new RF cavities for a compact proton linac. In the report, the biperiodicity was introduced by the supports for the washers(see Fig. 1).

The newly considered structure with high performance was thought to be suitable for the former Kyoto University Meson Facility Project [5]. The R&D (Research and Development) of DAW for the project has been continued from 1985 at Keagé Laboratory, ICR [6,7,8,9]. Because the major part of such a linac system is a high *ß* section ($v = c\,ß$), it has to be firstly optimized in terms of the cost performance.

From 1986, construction of the 7 MeV proton linac was started. Because the initial low energy part is important and somewhat complex, it was suitable as the prototype for the project. The first 7 MeV proton beam was successfully accelerated in 1991. After that, biperiodic L-support geometry was found to be suitable for electron acceleration[10]. It can reduce a loss on support and have a shorter filling time.

In 1994, a proposal on building a biperiodic L-support DAW for electron acceleration was accepted and was funded partly by Grant-In-Aid for Scientific Research from Ministry of Education Science and Culture of Japan (06554003). This proposal aimed that a beam acceleration test can be performed with the in-house electron linac system [11].

It started from a rough cold model test that confirmed the consistency of the design procedure[12, 13, 14, 15]. During the research, a coaxial bridge coupler was developed, which is incorporated a choke structure(see Fig. 3)[16]. Because the support for the spool, which is a block of connected washers, is parallel to the electric field line, the perturbation was too large without the choke structure. The bridge coupler connects two 1.2m

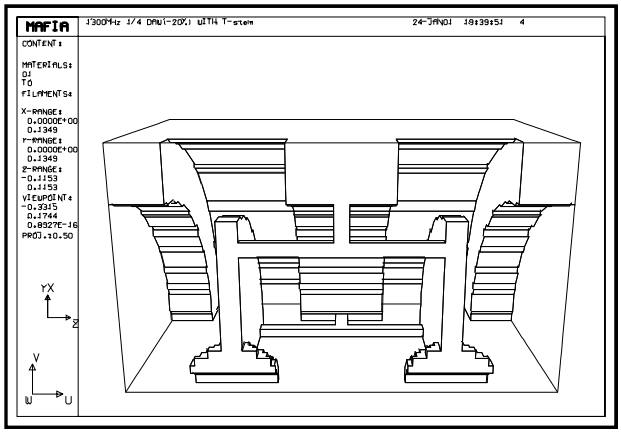

Fig. 1 Quarter cut view of DAW with biperiodic T-support. Two washers are supported by four T supports.

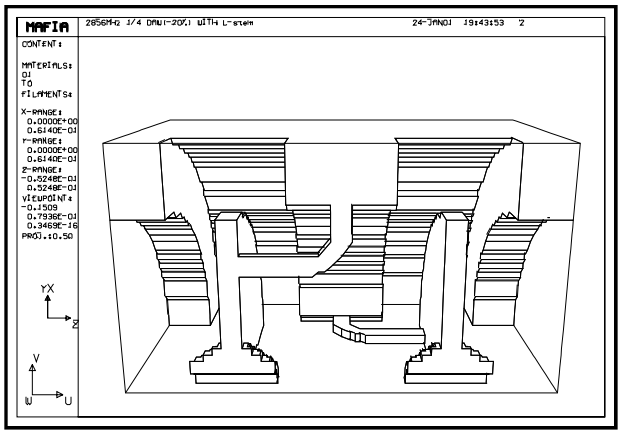

Fig. 2 Quarter cut view of DAW with biperiodic L-support. The L-support can be considered as a T-support without one branch.

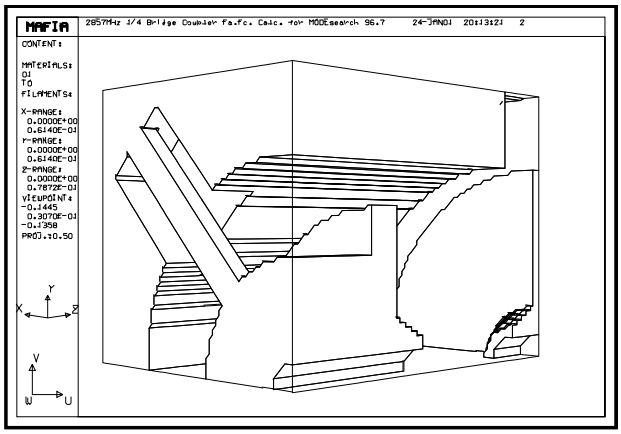

Fig. 3 Quarter cut view of the bridge coupler. The spool is supported by four supports. In order to reduce the perturbation, the support has a choke structure.

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accelerating tubes and has RF coupler, evacuation port and frequency tuners.

After the confirmation, several units of power model were constructed for fine machining adjustments, because the resonant frequency of the cavity has to be tuned within 10^{-4} accuracy[17, 18, 19, 20, 21, 22]. Some improvements have been made on the fabrication techniques, especially in the brazing process[23, 24].

The photograph on the front cover shows the overview of the power model of the Disk-and-Washer linear accelerator fabricated in collaboration with Mitsubishi Heavy Industries, Ltd. One cooling tube is connected to a washer through the water jacket and the cooling water comes from the washer into the jacket. By removing the endplate, the first washer in the linac can be seen (the back cover).

A high power feeding test and an acceleration test is expected after a final tune.

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