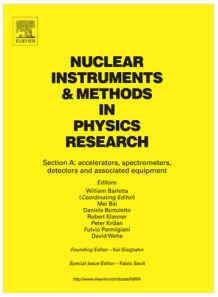
Accepted Manuscript



Development of a high-power X-band compact RF rotary joint

Jiayang Liu, Jiaru Shi, Jiaqi Qiu, Huaibi Chen, Xiaowei Wu

PII: S0168-9002(18)31007-6
DOI: https://doi.org/10.1016/j.nima.2018.08.049
Reference: NIMA 61090

To appear in: *Nuclear Inst. and Methods in Physics Research, A*

Received date : 9 April 2018; Revised date : 16 August 2018; Accepted date : 17 August 2018

Please cite this article as: J. Liu, et al., Development of a high-power X-band compact RF rotary joint, *Nuclear Inst. and Methods in Physics Research, A* (2018), https://doi.org/10.1016/j.nima.2018.08.049

Development of a high-power X-band compact RF rotary joint*

Jiayang Liu[1,2*] , Jiaru Shi[1,2†], Jiaqi Qiu[1,2], Huaibi Chen[1,2], Xiaowei Wu[1,2]

[1]*Department of Engineering Physics, Tsinghua University, Beijing CN-100084, China*

[2]*Key Laboratory of Particle and Radiation Imaging, Tsinghua University, Ministry of Education, Beijing CN-100084, China*

Abstract: A high-power X-band (9.3 GHz) compact RF rotary joint has been designed, fabricated and tested in Tsinghua University. Simulation results illustrated that RF parameters (the scattering matrix) of this rotary joint keep stable in different rotation angle. Cold measurement using Vector Network Analyzer confirmed the simulation results. The maximum reflection was below -25 dB, the insertion loss was less than 0.1 dB, and the variance of output phase shifts was below 0.2 degree while rotating the joint. High-power test under a 1.6 MW X-band magnetron also showed good results. The design, cold measurement and high-power test of the RF rotary joint are presented in this paper.

Keywords: RF rotary joint, X-band, Design, Stable transmitted characteristics, High-power test

I. Introduction

A radio-frequency (RF) rotary joint is a widely-used microwave device that can allow the independent movement between the RF power source and the accelerating tube in a linear accelerator (linac) system [1]. It plays an important role especially in industrial and medical applications, such as radar, non-destructive testing and electron/X-ray therapy. A great performance of RF rotary joints is characterized by high-power capability, low insertion loss and good impedance matching [2].

Various RF rotary joints have been reported in [1-9]. However, most of the commercial rotary joints are designed for radars, which focus on the average power rather than the peak power. An RF rotary joint working at high peak power is needed in application of particle accelerators. In recent years, CERN has developed an S-band high-power RF rotary joint for medical applications [3]. Compared to S- and C-band accelerators, X-band ones are expected to be more compact with higher gradient [10]. The position of the X-band accelerators can be controlled more easily and more accurately due to the obvious advantage on the mobility of the accelerator devices. Therefore, it is essential to develop a high-power X-band compact RF rotary joint.

† shij@mail.tsinghua.edu.cn