

Mechanical Design of a High Power Coupler for the PIP-II 162.5 MHz RF Quadrupole O. Pronitchev, S. Kazakov.



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Abstract

PXIE is a prototype front end system [1] for the proposed PIP-II accelerator upgrade at Fermilab. An integral component of the front end is a 162.5 MHz, normal conducting, continuous wave (CW), radiofrequency quadrupole (RFQ) cavity. Two identical couplers will deliver approximately 100 kW total CW RF power to the RFQ. Fermilab has designed and procured main couplers for the CW RFQ accelerating cavity. The mechanical design of the coupler, along with production status, is presented below.



Difference between the couplers on the left and the right side of the RFQ



There are two types of the RFQ input couplers. They are differentiated by a 180 degree rotation of the coupling loop antenna relative to the water cooling loop. This design allows the RFQ input coupler water cooling connectors to face down on both sides of the RFQ, therefore avoiding interference with other RFQ cooling structures.

Antenna shaping



The vacuum part includes a loop-shaped antenna, which is brazed into a ceramic window. The window is connected to a copper outer conductor. On one side the conductor is attached to the RFQ by a rotatable flange. On the other side the conductor is connected to a T-junction with a 3 1/8 fixed coaxial flange. The copper hollow block of the loop-shaped antenna is connected to the inner conductor with two parallel copper pipes. The cooling air flows through these pipes. The loop is electrically isolated. The ceramic window is made from a alumina. A rotatable 316 stainless steel flange provides electrical connectivity to the RFQ using a beryllium copper RF seals. Vacuum is sealed with Viton rubber O-rings. The outer conductor has an additional water cooling loop, which is brazed to the outer surface in a close proximity to the location of the ceramic disk. Bended Loop shaped antenna Copper sleeves

It is difficult to provide consistent titanium nitride coating to the vacuum side of ceramic disk when antenna is in the final shape. Therefor the decision was made to first braze the non-bended antenna, outer conductor and ceramic disk together. Then to coat the vacuum side of the ceramic disk with titanium nitride followed by bending the antenna into its required shape.

CONCLUSIONS

The main couplers for PXIE RFQ are designed and in the final stages of fabrication. The start of RF tests is planned for the October 2015.