

COMMISSIONING OF THE INJECTOR II 150 MHz RF SYSTEM UPGRADE

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During shutdown 2003 the 150 MHz RF-system was upgraded according to the concept proposed in 2001 [1,2]. Since then it runs smoothly and has led to a better beam performance [3]. It is therefore intended to keep the system running for routine operation. This requires the replacement of the 50 kW amplifier.

INTRODUCTION

The basic idea of the upgrade is to provide more power to the two identical 150 MHz resonators of the Injector 2.

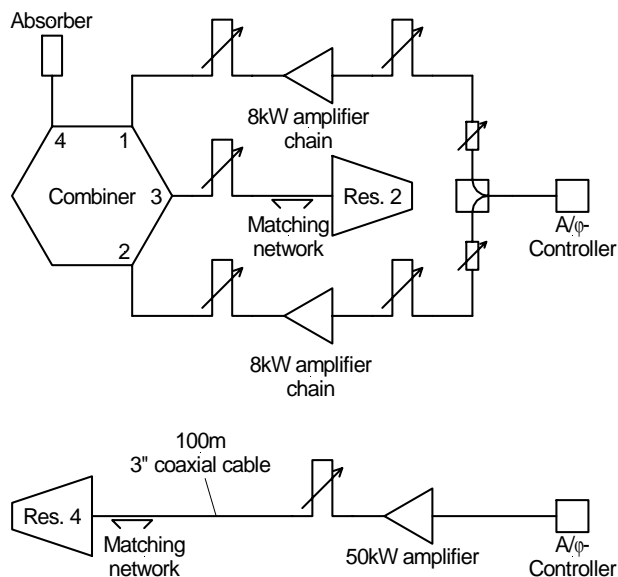


Fig. 1: Simplified layout of the 150 MHz RF system

This is accomplished by feeding the combined RF power of the two existing 8 kW amplifier chains to resonator 2 (Fig. 1). The power delivered to the resonator is 15 kW, which translates into a peak Voltage of 120 kV in the centre of the resonator.

A third amplifier chain, situated in the "Montagehalle", drives the second resonator. Due to the age of this amplifier the maintainability is not assured. The 3" coaxial cable limits the transferred power to 15 kW, assuming an SWR of 2.

The power increase necessitated replacing the water-cooled coupling loops in the two resonators. A matching network transforms the input impedance to 50 Ω with a beam current of 2 mA in the cyclotron.

RF POWER COMBINER

The simulation results [1] are in good agreement with the measurements and a mechanical fine-tuning was therefore not necessary. The RF characteristics of the combiner are [4]:

Isolation port 1/2	- 45.0 dB
Port 1 match	- 38.7 dB
Port 2 match	- 38.9 dB
Insertion loss port1/2	- 0.3 dB

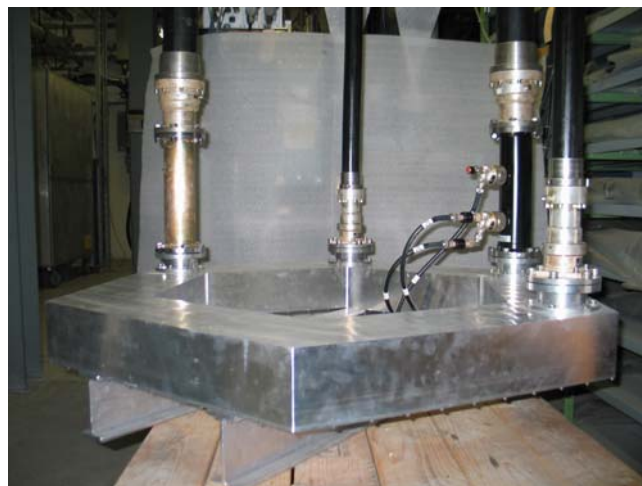


Fig. 1: Four port RF power combiner

COMMISSIONING

Amplitudes and phases in the combining circuit have to be adjusted carefully. We adopted the following procedure:

1. Using the trombones, the lengths of the two coaxial lines between the combiner and the 8 kW amplifiers are adjusted to a multiple of $\lambda/2$.
2. To avoid reflected waves, the resonator is replaced by a load. By adjusting the phases of the two branches the power into the load is minimized with a low drive level. Power balance is achieved by a proper setting of the gain of the branches.
3. The drive power is gradually increased and step 2 is repeated until a final power of 15 kW in the load is reached.

REFERENCES

- [1] W. Tron et al., *Experimental upgrade of the injector II 150 MHz RF system*, PSI Scientific and Technical Report, 2001, Vol. IV.
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- [4] S. Calic (Triumpf), *Power combiner for Injector 2/ Resonator 4 signal-level measurements*, RF internal report 27/5/2002.