Developments of the Palmer pickup tank for stochastic cooling in the CR

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Introduction

This report details the design and construction progress made on the Palmer pickup tank for the stochastic cooling system of the collector ring (CR) during 2014 at GSI. The CR is designed for the stochastic cooling of antiprotons and RIBs. For details of the complete stochastic cooling system including particle beam parameters see [1]. For the stochastic pre-cooling of RIBs, we use the Palmer method in combination with pickups of large acceptance to cool injected hot ion beams with large momentum spread. For this purpose Faltin type pickups have been designed and published previously [2]. The Faltin rail is a travelling wave pickup in the form of a rectangular coaxial structure with slots in the top which couple to the beam.

Drawing and Construction

Drawing work on the full tank began and finished 2014 as shown in figure 1, although work on the Faltin rails itself continues. To test the pickup designs prototypes were made. During 2014 drawing work on three different prototypes was completed. Construction and procurement of the prototypes was finished in December. The prototypes are shown in figure 2. The robustness of the assembly method was tested. Microwave measurements made on the prototypes which showed good agreement with simulations and are shown in figure 3.

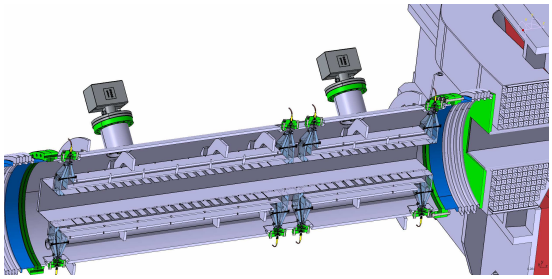

Figure 1: Cross sectional preliminary drawing of the full Palmer pickup tank(2 m installation length).

Simulations

Several unwanted modes which interfere with beam cooling were discovered and simulations with lossy ferrite material were conducted in order to damp these modes. Ferrite or some other lossy material will definitely be necessary within the pickup tank to maintain beam cooling performance. In 2014 a program was written which takes

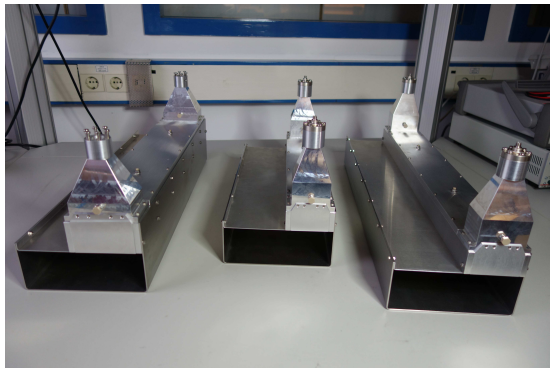

Figure 2: Three Faltin prototypes of one quarter of the pickup.

impedance and phase data of these waveguide pickups and adds signals from several of these pickups using delay lines of specific length to produce a flat impedance and linear phase over a desired band. This process was optimised using a genetic algorithm. This will be used for further optimisation of the pickup.

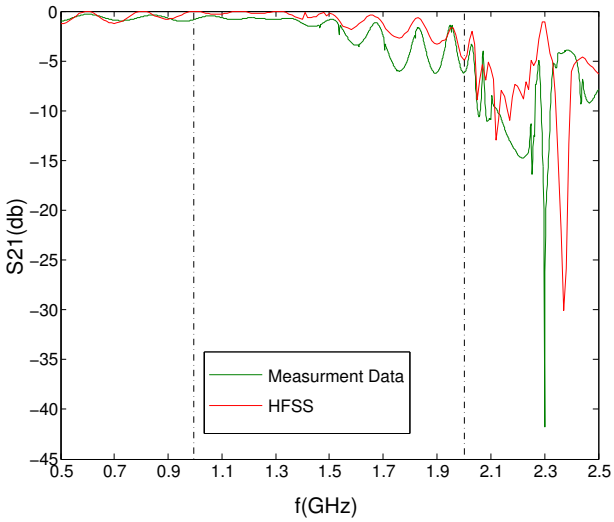

Figure 3: Comparison of measurements of S21 using a network analyser and S21 data from HFSS simulations.

References

[1] CR Technical Design Report 2014 and C.Dimopoulou et al., this report.

[2] D. Barker et al., JACoW Proc. COOL'13, WEPPO21.

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