

TEMPERATURE STABILIZATION OF RF- CAVITIES OF VEPP-4M ELECTRON-POSITRON FACILITY

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Abstract

Temperature variation of RF-cavities leads to a change of their geometrical sizes that provides undesirable cavity modes and to excitation of phase oscillations. It leads to decrease in luminosity and a beam life time.

Flowing water heaters with stabilization of temperature have been established for elimination of this disadvantage. Temperature probes LM335 were used with a sensitivity of 10 mV per degree centigrade. The power part is made on the controllable switches CPV240. The analysis of temperature of input and output temperatures of water is carried out by microcontroller ADAM connected to a computer by means of interface RS-485.

The temperature variation have been reduced from 5 to 0.2 degrees centigrade. That has led to decrease in probability of occurrence of parasitical phase oscillations more than in 100 times.

INTRODUCTION

VEPP-4M is the collider with the high energy beams of electrons and positrons [1]. The operating mode with two bunches of electrons and two bunches of positrons has been realized at VEPP-4M collider. Probability of occurrence of phase fluctuations of bunches was increased with the bunches number. Principal reason of occurrence of phase fluctuations it re-tuning RF cavities due to change of the geometrical sizes because of change of their temperature. Life time of a beam was decreased with increase of amplitude of phase fluctuations. Transversal beam size was increased too.

The method measurement of a level of phase fluctuations was described in paper (2). The precision measuring of temperature was described in paper (3, 4). The typical levels of phase fluctuations and luminosity are presented in Fig. 1 in case of absence of stabilization of RF cavity water cooling temperature. The temperature variation of water exceeded 2°C , that leads to increase in a level of phase fluctuations and to reduction of luminosity. Simultaneously big losses of particles are dangerous for the drift chamber of the detector the KEDR.

THE TEMPERATURE STABILIZATION SYSTEM

For stabilization of temperature of resonators the flowing heaters have been developed, allowing to keep the set temperature with accuracy of 0.05-0.1 degrees centigrade. Water flow rate is about 10 l/min.

The temperature of water is measured on an input and on an output of a heater by means of probes, and processor ADAM operates switches CPV240 to set required power of heating. The sensitivity of LM335 probes is about 10 mV per degree.

In figure 1 photograph of heater are present.



Figure 1: The photograph of heater.

In figure 2 photograph of ADAM controller and switches CPV240 are present.



Figure 2: ADAM controller and switches CPV240

In figure 3 the circuit of a heater is present.

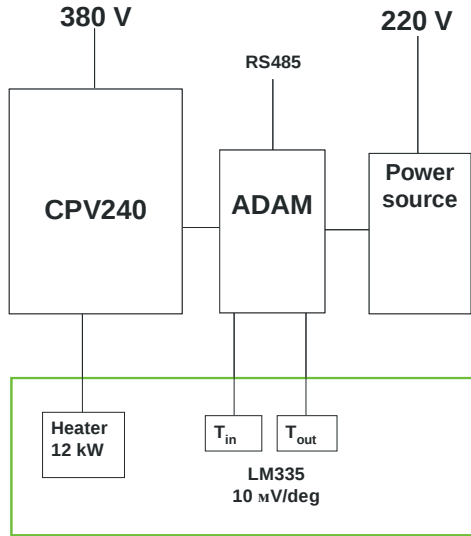


Figure 3: The circuit of a heater.

For connection ADAM with control room of VEPP-4M is used interface RS-485. The temperature variation have been reduced from 5 to 0.2 degrees centigrade. That has led to decrease in probability of occurrence of parasitical phase oscillations more than in 100 times

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