5 - 9 Low Temperature Monitor System for SSC/SFC Cryogenic Pumps

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The SSC/SFC cryogenic pumps are important equipment in HIRFL accelerator field which have some particularities and limitations. In order to improve the working efficiency and safety of the operator, a Low Temperature monitor system for Cryogenic Pumps is designed and realized by the slow control group and the vacuum engineering group in IMP 2012. This system can acquire all of the temperature data from the model 218 temperature monitor which is connected to several cryogenic pumps and transmit the data from RS232 port via self-designed RS232-TCP/IP protocol converter to the center control room. When the temperature is anomalous, the system can generate alarm signals. After practical running for more than one year, the system had shown its accuracy and reliability.

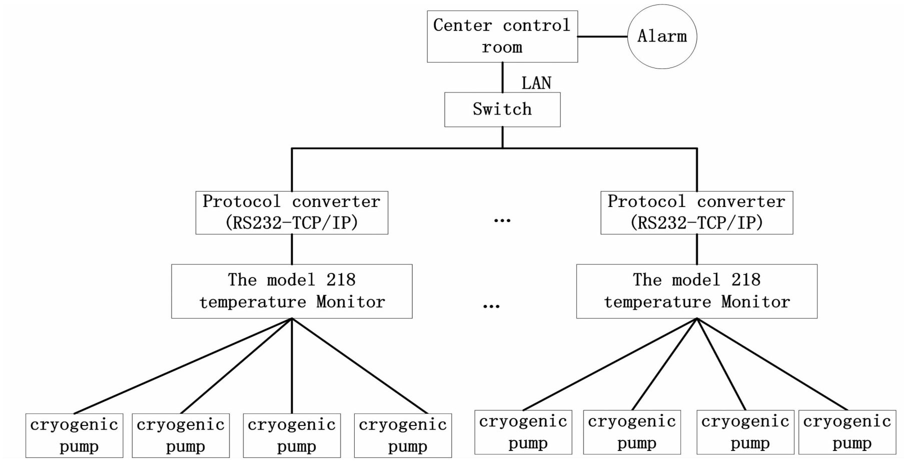

Fig. 1 The topology of the monitor system for SSC/SFC cryogenic pumps.

The topology of this system is shown in Fig. 1. The RS232-TCP/IP protocol converter is connected to the model 218 temperature monitor and converts the Serial signal from the model 218 temperature monitor to the network data, then the LAN switch transmits the temperature data to the background software in the center control room.

A model 218 temperature monitor in this system can connect 4 cryogenic pumps. Each cryogenic pump has 2 sensor connected. Several engineering site photos are shown in Fig. 2.

Fig. 2 Example photos of the system.

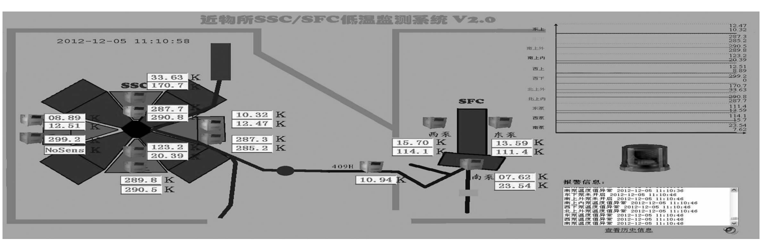

Fig. 3 Console GUI of the system.

The GUI software on console is shown in Fig. 3. When the temperature value detected by the software is not in threshold, the corresponding alarm light will blink with ringing to warn the on-duty person. At the same time, the message will be shown in the warning message column. The GUI software of this system also shows the real-time temperature curve at the top-right corner so as to observe the difference in one hour directly. The history temperature values and warning messages will be storied in the database so that we can inquire them at any time.

Up to now, totally 12 pumps had been monitored. The monitor system for the SSC/SFC cryogenic pumps can accurately record the history and real-time temperature data and guarantee the equipment running normally. Next step, more and more cryogenic pumps will be added in this system.

References

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[2] Self-designed Protocol Converter. pdf, IMP, China, 2009.

5 - 10 A Rotating Target Wheel for Thin Targets with Low Melting Temperature

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In these experiments of synthesizing super-heavy nuclei, the heavy ion beam intensities are restricted, as thin targets, especially those of low melting temperatures may be destroyed thermally. In order to reduce target temperatures and to increase the tolerable ion current density, we developed a rotating target wheel[1,2] for thin targets. The ion beam is pulsed by rotating wheel itself using a photo-electric system. The temperature of a thin target in a pulsed beam can be calculated as a function of time by using energy conservation. The formula is as follow[2]:

$$\frac{dE}{dt\Delta F} + 2\varepsilon\sigma T_u^4 = 2\varepsilon\sigma T^4(t) + c\rho d\frac{dT}{dt}$$

where c is the specific heat capacity of the target, ρ is the mass density and d the thickness of the target foil. The rotating target wheel system has been used in experiments $^{24}Mg + ^{208}Pb$ and $^{64}Ni + ^{208}Pb$, and it worked well.

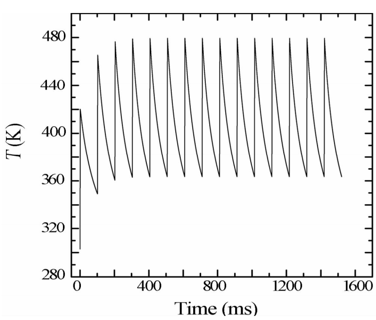

Fig. 1 Calculated temperature curve for rotating lead target in vacuum.

Fig. 1 shows the calculated temperature curve for rotating lead target in vacuum correspond to ^{64}Ni ion beam densities of 0.5 pμA. The targets have a thickness of 40-450-10 μg/cm^2 (C-Pb-C), the rotating target wheel frequency $\nu = 10\ s^{-1}$, and the wheel radius $R = 11.2$ cm. Fig. 2 is the picture of C covered Pb targets before irradiation and after bombardment with ^{24}Mg ions.

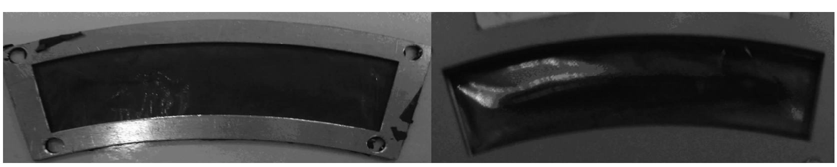

Fig. 2 Picture of C covered Pb targets before irradiation and after bombardment with ^{24}Mg ions.

References

[1] D. Marx, F. Nickel, G. Munzenberg, et. al., Nucl. Instr. and Meth., 163(1979)15.
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