

Users' support service: the vacuum system of EXOTIC beam line

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I. INTRODUCTION

The EXOTIC collaboration proposed to setup a relatively small and low cost facility for the production of light exotic beams [1]. The beam optics of the dedicated beam line was extensively described in a previous report [2]. During 2003 the facility was installed on the beam line at +10° in the Hall I of the Tandem-ALPI complex and the first tests started in October. Our service helped the EXOTIC collaboration to define specifications, design the vacuum control system, select and install the vacuum components.

II. THE VACUUM SYSTEM

The EXOTIC facility is separated by means of stainless steel gate valves manufactured by VAT (series 14) in four similar sections:

gas target chamber and first quadrupole triplet (Sect.1);

dipole bending magnet and suppression chamber (Sect.2);

Wien filter and second quadrupole triplet (Sect.3);

scattering chamber (Sect.4).

For a proper operation a pressure better than 5×10^{-6} mbar (hPa) is required. Then, UHV-CF and ISO-KF standard flanges and copper gasket and viton O-rings were used for vacuum connections and sealing purposes. Each section, having a volume of about 100 dm^3 and an internal surface of 200 dm^2 , includes:

- one Pfeiffer TMU521 turbo-drag pump;
- one dual gauge measuring system;
- one primary dry pump.

The turbo-drag pump has a DN160 CF connection flange and a pumping speed of 500 l/s for N_2 and 480 l/s for H_2 . It is a compact turbo-pump with the electronic driver integrated on the body, high compression ratios and relatively low weight. The pump is operated by means of a Display Control Unit (DCU) via RS-485 serial interface. Periodic maintenance and replacement of the ceramic ball bearings are possible on site without removing the pump from the system.

The dual gauge measuring system manufactured by Pfeiffer is composed of a TPG 262 dual gauge controller, a

PKR 251 full range gauge (cold cathode and Pirani gauges) and a TPR 265 Pirani gauge.

In order to provide a clean fore vacuum, dry pumps were used. Scroll pumps generally have higher pumping speed and better ultimate pressure than the diaphragm ones. These requirements are very important to reduce the waiting times in the fore and high-vacuum operations.

Sect.2 and Sect.3 were equipped with the Varian SH100 scroll pump having a pumping speed of $5 \text{ m}^3/\text{h}$ and an ultimate pressure of about 7×10^{-2} mbar (hPa). Sect.1 and Sect.4, where frequent vacuum and venting operations are expected, were equipped with Varian Triscroll 300 having a pumping speed of $12.5 \text{ m}^3/\text{h}$ and an ultimate pressure of about 1.3×10^{-2} mbar (hPa).

The vacuum system also includes:

eight DN 160 CF valves equipped with pneumatic actuator and two supplementary DN 40 KF ports on the bonnet;

eight DN 25 KF valves (IPV-PKA-Edwards in-line version and bellow sealed) installed on the fore-vacuum.

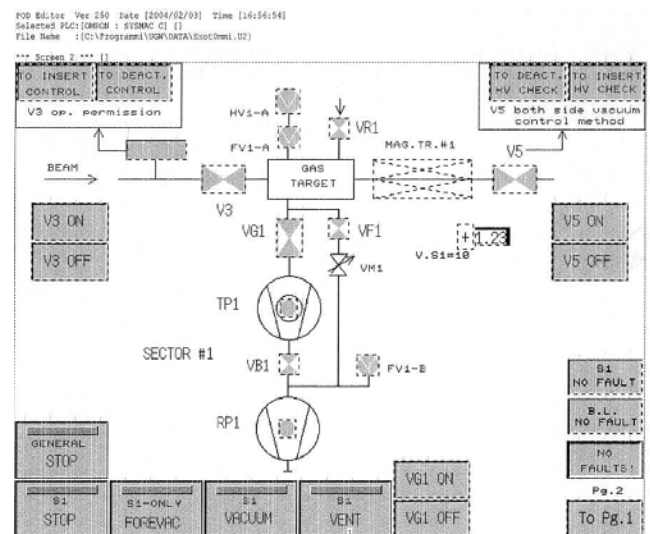


Fig.1: The vacuum control window of Sect. 1.

III. THE VACUUM CONTROL SYSTEM

An automatic control system for the vacuum and venting operations was installed in addition to the standard vacuum instrumentation. It is based on the CQM1H-

CPU51 Programmable Logic Controller (PLC) produced by Omron. The PLC was equipped with a MAB42 analog I/O board, a SCB41 serial communications board, four ID212 input units, three output units (two OC222 and one OC224, respectively). The ladder program has been developed by using the Omron Syswin 3.4 software tool, running on a PC under Windows '98.

switch is held down.

[1] M. Sandoli et al., LNL Annual Report 2001 pag.192

[2] V.Z.Maidikov et al., LNL Annual Report 2002 pag. 166

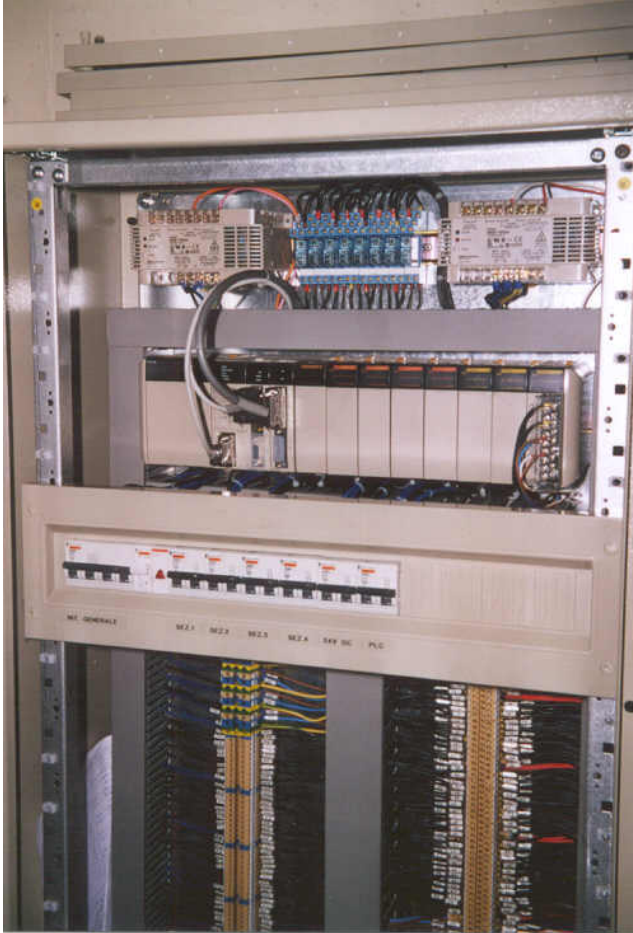


Fig.2: The vacuum control board including the CQM1- PLC .

Two programmable panels (Fuji UG420H-TC 10.4" TFT colors LCD touch screens), working as local and remote control stations, were connected by a serial line to the PLC for sending commands and receiving status signals.

By using the UG00S-CW2.50 software it is easy to build graphical windows displaying the status of valves, pumps and other devices. The window dedicated to the vacuum component control of the in Section 1 is shown in Fig.1 (the rectangular boxes are touch switches). The two panels were programmed in the same way; so they exhibit the same information and can perform the same operations. To avoid conflicts between the commands sent from the two panels only switches of momentary type were programmed: the bit transmitted is ON only when the