

Conceptual Design of Vacuum Control System for ILSF



Iranian Light Source Facility

A. Khalilzadeh[†], M. Akbari, M. Jafarzadeh, J. Rahighi
Iranian Light Source Facility, IPM, P. O. Box 19395-5746, Tehran, Iran

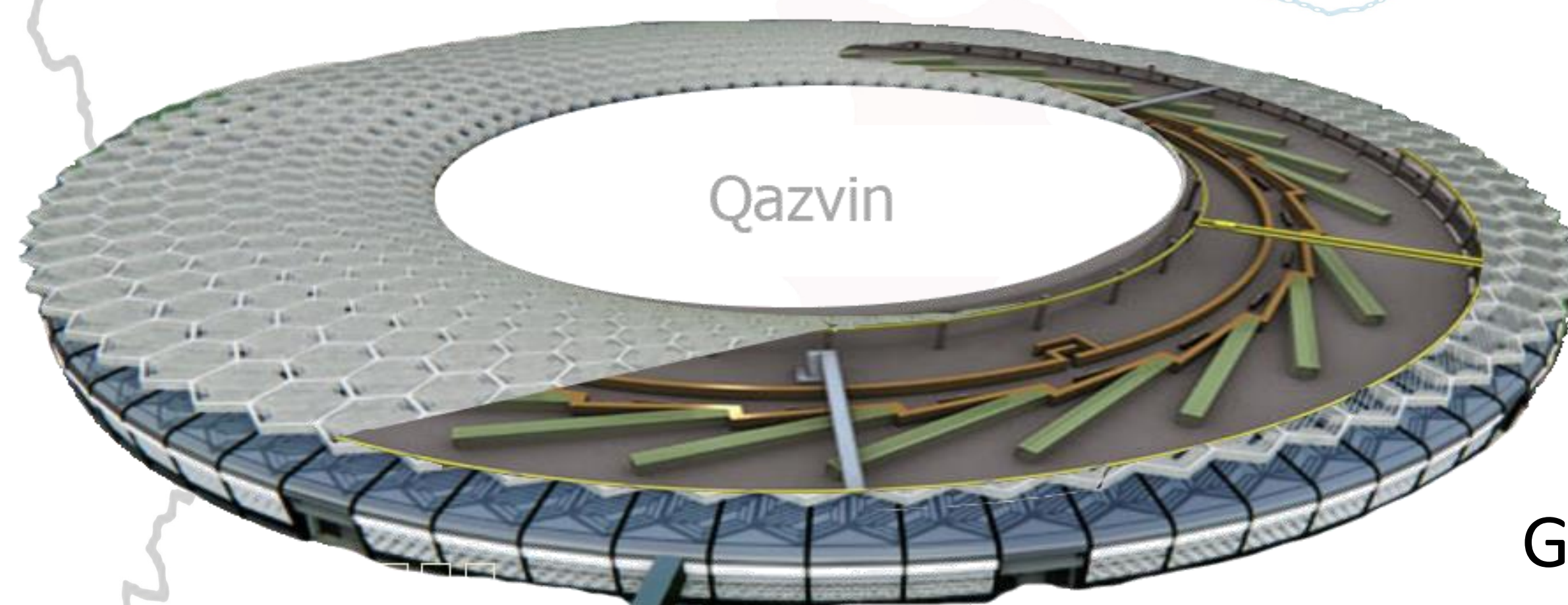


Abstract

Many The Iranian Light Source Facility (ILSF) is a new 3 GeV third generation synchrotron light source facility with circumference of 528 m, which is in the design stage. In this paper conceptual design of vacuum control systems presented. The control system architecture, Software toolkit and controller in device layer are discussed in this paper

Main parameters of the ILSF storage ring

Parameter	Unit	Value
Energy	GeV	3
Circumference	m	528
Emittance	nm-rad	275
Current	mA	400
Length of straight section	m	7
Number of straight section	-	20
RF frequency	MHz	100



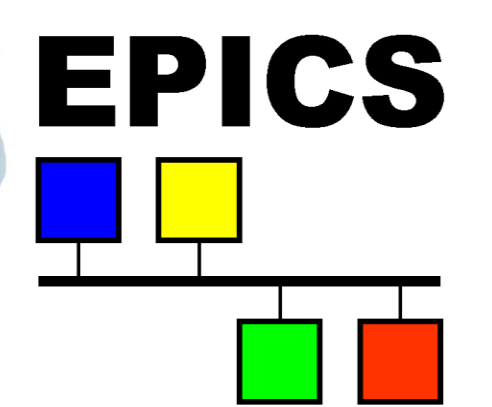
Storage ring vacuum

The vacuum chambers will be made of stainless steel and will be baked out before installation. 580 ion pumps, 180 TPS and 100 NEG pump have been foreseen for the storage ring

Calculations have shown that the maximum pressure in storage ring will be lower than 1.8×10^{-9} mbar during operation time.

One of important character of vacuum control system is the implementation of object oriented concept in vacuum PLC's. In this approach, equipment lays behind of virtual graphs which describe the dynamic behavior of the system. This character helps us to remove or add different components from and to the vacuum system easily and reduce the consequences of the required programming.

Monitoring level



control system toolkit

Open source and wide usage are the two main factors which have led us to choosing EPICS as a control system toolkit for ILSF.

PLC Controller

A PLC in associate with control network is used to stablish a complete controllable system for vacuum. The main duty of vacuum PLC is control rough pump, gate valve which work pneumatically and proper reaction against interlocks from controller by digital input output and large number of temperature sensors by analog modules. And finally send pressure to control room at the lower rate.

Data Base

Gauges controller

Controllers which drive pressure gauges must calculate the rate of pressure change to detect any leak in vacuum chamber and send interlock signal in case of detect any abnormal increase rate chamber pressure. Due to vacuum pressure break speed and the length of each section the rate of monitoring pressure must be less than 17 ms.

Ion Pump Controller

ion pump controller must have an intelligence behavior, i.e. it should set the voltage value of the ion pump based on its current which is related to the pressure on the local ion pump. In other words, voltage has a wave form with respect to local pressure.

Ethernet

Control level

In order to increase respond time and system reliability, and also to reduce network control traffic, the vacuum system is designed on the basis of distributed control system in which the process of control take place in each controller individually and the results of events or sensitive process variables are being sent to man-machine interface.

Field level

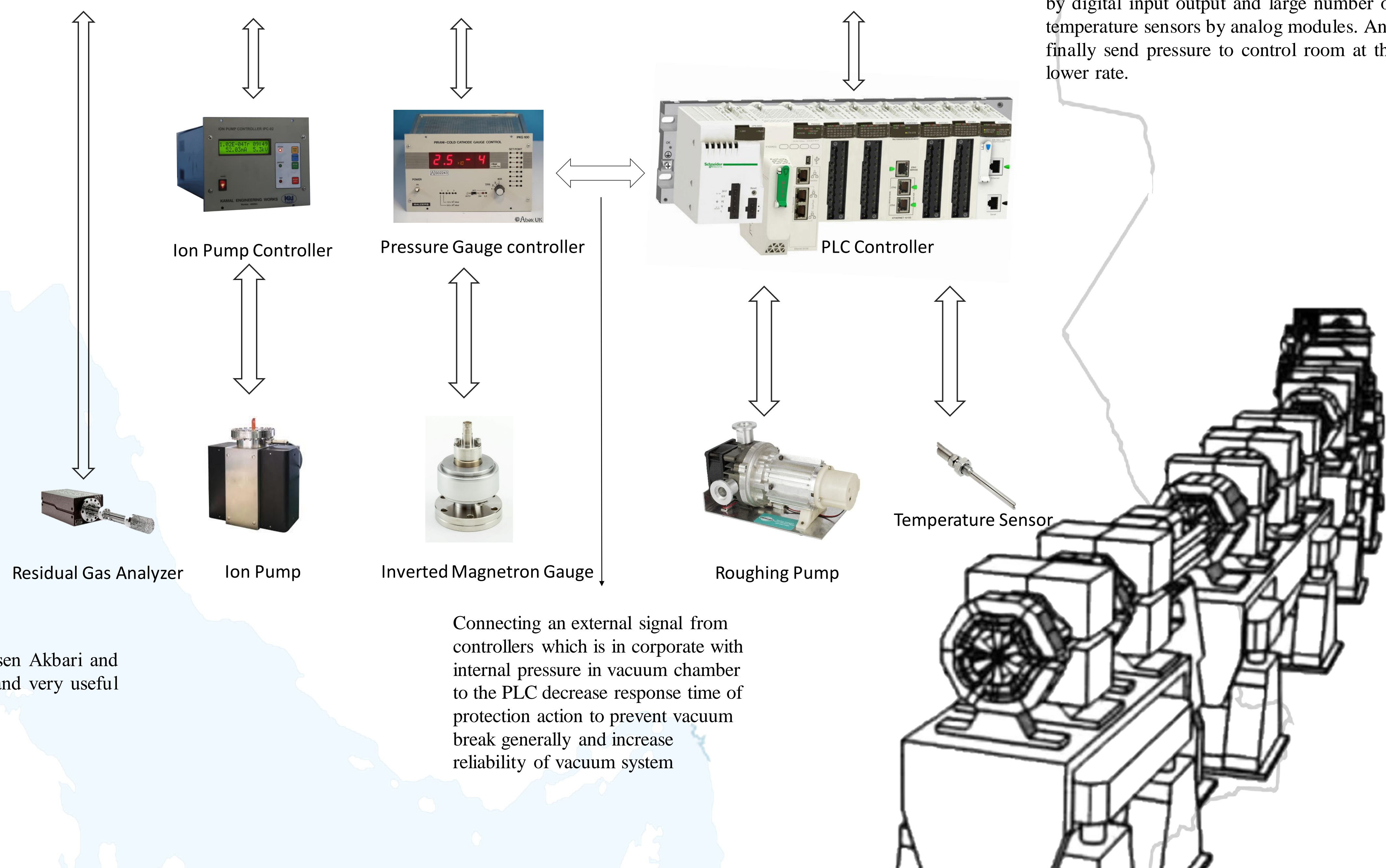
Acknowledgment

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Reference

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Connecting an external signal from controllers which is in corporate with internal pressure in vacuum chamber to the PLC decrease response time of protection action to prevent vacuum break generally and increase reliability of vacuum system