

GAS SYSTEMS OF PHENIX CENTRAL TRACKING DETECTORS

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The base of PHENIX Central Tracking Detectors (BNL,USA) is the Drift Chambers(DCs), Pad Chambers(PCs) and Time Expansion Chambers with Transition Radiation Detectors (TECs/TRDs). The DCs/PCs Gas System supplies Ar+50% Ethane mixture and TECs/TRDs Gas System - P10 (Ar+10%Methane). Basically, both Gas Systems have the same design and, therefore we are proposing to consider the version of DCs/PCs Gas System.

The primary purpose of the DCs/PCs Gas System (Fig.1) is to provide the pure mixture to the DCs and PCs at the correct temperature and pressure. The system operates nominally as a closed circuit gas system with the majority of mixture recirculating through the DCs, PCs and delivery system. During normal operation a small amount of fresh mixture (1-5 l/min) is added and an equivalent quantity of the existing mixture is vented. The gas system can be operated in an open system configuration for purging.

The mixture circulation rate through the compressor is 5000 l/hr and 2400-4000 l/hr through the DCs and PCs. The gas system contains two compressors (BC1, BC2), one active and one spare, each capable of 8000 l/hr at 100 mBar gauge pressure. The 100 mBar output pressure from the compressor is reduced to 10mBar by the pressure regulator (PCV1) and supported with the back pressure control valve (BPCV2). A water cooled heat exchanger (HE2) downstream of the compressors is used to remove the compression heat. The return gas manifold is maintained at 1.0mm WC above atmospheric pressure by a differential pressure transmitter (PT3) and pneumatic (PID) controller that operates a bypass valve. The bypass shunts flow from the compressor discharge line directly back to the compressor's inlet. A second bypass valve (MV3) is manually adjusted to enable the automatic control loop to be used within its optimum range.

The bypass line including the manual valve (MV8) and back pressure control valve (BPCV2) gives a possibility to the smooth gas system start and the rapid response on the increased or reduced Ethane content measured with the Ethane analyzer upstream of compressor. Also, it permits to prepare the mixture with a homogeneous Ethane content.












Two flow indicators (FI1 and FI8) will measure the recirculating flows: main and bypass. A difference between them is the flow through the DCs and PCs. The measurements of the fresh mixture (FM1, FM2) and flow through the flow indicator (FI2) give a possibility to estimate the detectors leakage.

The purity and composition of the mixture is monitored using oxygen, ethane and humidity analyzers. The small compressor SC is used to supply the analyzers and sample at the different points. Also, the monitoring chamber can be used for this too. A fraction of the recirculating mixture, measuring with FI1a, can be passed through a purifier and dryer to remove moisture and oxygen to 25 ppm level as needed.

It is imperative for the safety, that the detectors inside pressure typical preceding storms and hurricanes. To assure that the detectors follow a fast rise in atmospheric pressure, a relatively large flow of inert gas will be admitted into the vessels in the event that normal pressure controls fail to keep up with "falling" internal pressure. The vent lines and associated valves are sized to allow for rapid venting of the detector mixture to prevent a high internal pressure in the case of the fast barometric pressure fall.

A computer driven data acquisition/control system monitors all of the process variables. The computer flags quantities, which fall outside of predefined limits and initiates corrective action. A separate Alarm Interlock system prevents the detectors from operating under unsafe conditions.

DC/PC Gas System

-  - Check Valve
-  - Manual Valve
-  - Solenoid Valve
-  - Pressure Transmitter
-  - Bubbler
-  - Pressure Control Valve
-  - Flow Mass Controller
-  - Flow Indicator
-  - Temperature Transmitter
-  - Pressure Indicator
-  - Flow Direction Indicator

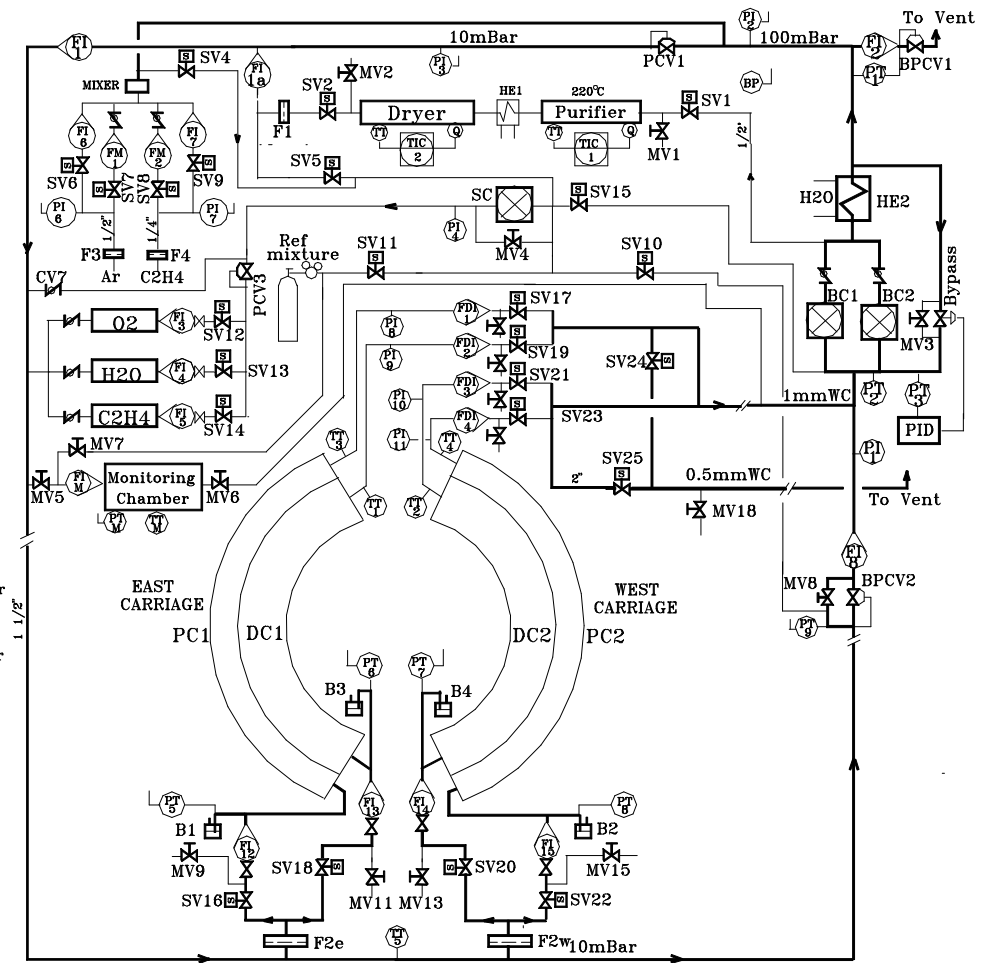


Fig.1. PHENIX DCs/PCs Gas System