The experimental results

It was found that initial gas (Fig.2) has the main impurity C_2H_4 (6% vol) and small amount of heavy hydrocarbons (0,1% vol) (Fig.3). The analysis results of pure gas are presented in Fig.4. The impurities of ethylene and heavy hydrocarbons at level $1 \cdot 10^{-2}$% vol were not found. By way of illustration the chromatogram of impurities concentrated in adsorber-1 is presented in Fig.5. From chromatogram it appears that heavy impurities including mercoptans has been absorbed in adsorber-1. At the same time only impurity ethane is concentrated in adsorber-2.

In conclusion it should be mentioned that goal set at the beginning has been achieved.The method was selected, the setup was fabricated and sampled that had permits to receive high-purity ethane for the drift chambers "PHENIX" and to supply the daily productivity of ethane 1 m^3.

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CRYOGENIC INTERNAL HYDROGEN GAS TARGET

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The internal gas targets are widely used at various storage rings of accelerators (atomic polarized hydrogen/deuterium gas target, HERMERS, DESY Hamburg and so on). The main aim of such type of targets (from technical point of view) is to create:

– the maximum possible density of the atomic or molecular gas on the way of the particles;

– to restrict the gas area as much as possible because the target vacuum is the same as storage ring vacuum (it is impossible to use any walls on the beam way).

For the electron storage ring at Novosibirsk Nuclear Physics institute the cryogenic hydrogen/deuterium gas target was designed and produced (see Fig.).

The target creates the cloud of the could hydrogen or deuterium gas with the average total density 10^{14} molecules/cm^2 (temperature 8 K – 30 K) on the electron beam way.

The storage gas cell has the 400 mm length along the beam direction and the 35 mm diameter. Gas cell is surrounded by the special gas volume for the heat exchange. The synchrotron radiation inside the cell introduces the heat power about 1.0 – 1.5 W. The heat goes through the heat exchanger volume to the liquid helium. The heat exchanger volume is filled by low pressure helium, and we can change the rate of the heat flow by varying the pressure (1 mbar – 10 mbar). For the precise temperature stabilization of the internal surface of the gas cell the electrical heaters are used. There are two temperature sensors TBO 1000K on the surface of the gas cell for temperature measurements. This structure

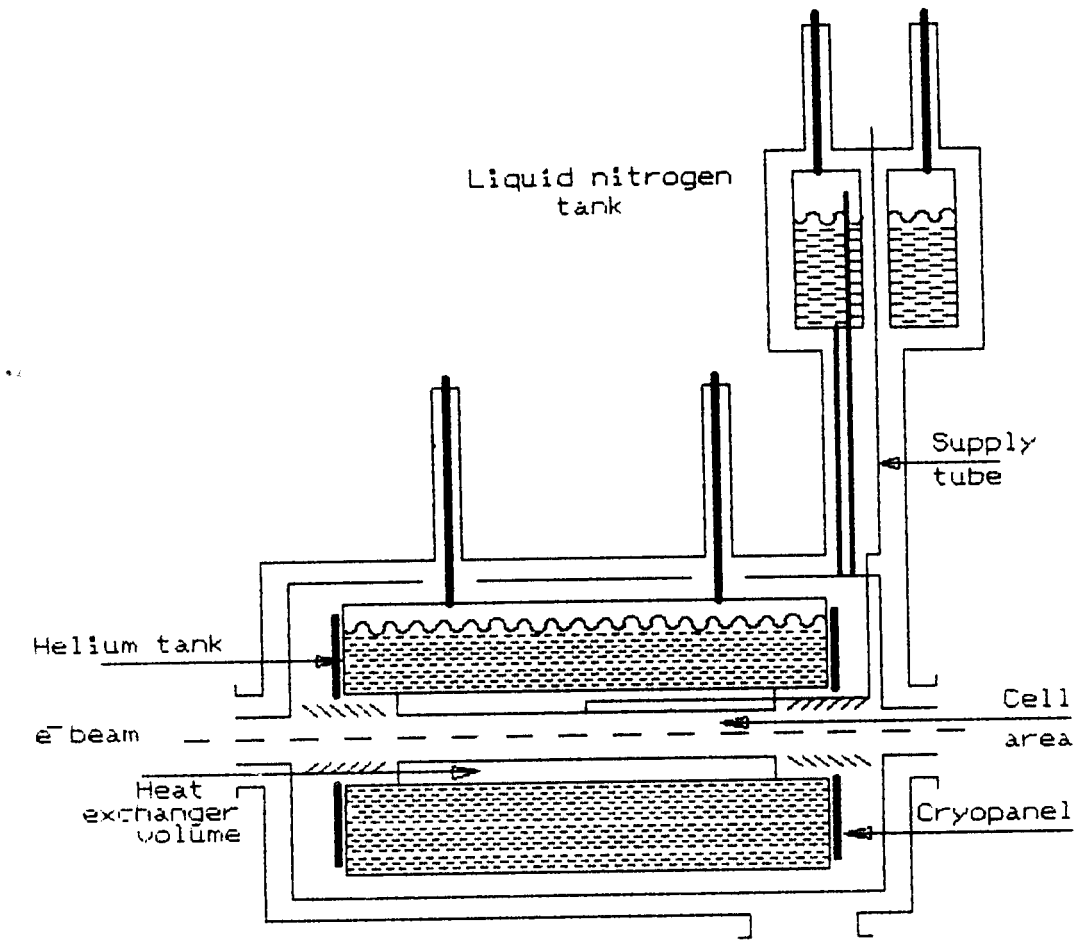

Fig. Cryogenic internal hydrogen gas target

with special controlling system gives a possibility to stabilize the gas cell temperature in the range 8 K - 30 K on the level ± 0.05 K. The gas supply tube connected to the central part of the gas cell. The flow of the hydrogen (deuterium) is introduced to the central part of the cell after thermalization on the cell surface. We used fine valve to arrange of the gas flow ($10^{16} - 10^{18}$ molecules/s). The fine valve is calibrated by the constant volumes method.

The cell and the heat exchanger volume are placed inside the helium tank. Such construction allows to use the helium tank for the cell cooling and for pumping of the gas outside the cell. Two cryopumping blocks are placed at the sides of the helium tank. Special elements form the gas flow and approximately 75% of the gas from the cell goes to the space between the liquid helium tank and the "nitrogen" radiation screen. After that gas is pumped by the cryopanels on the helium tank surface.

Controlling system:

- measures the temperature of the cell;
- stabilizes the cell temperature;
- changes the pressure in the heat exchanger volume and optimizes the liquid helium outlay.

The main advantages of the internal gas target are:

- It does not necessary to use the additional pumps for the target operation. The gas from the cell is pumped in to the same volume at the maximum density by internal cryopumps.
- The temperature of the gas is stabilized in wide region without changing the helium outlay. The helium density is changed in the heat exchanger volume and it is possible to decrease the electric power at the heaters to the level 0.3–0.4 W.

The main parameters of the internal gas target are:

- The average gas flow is $2 \cdot 10^{17}$ molecules/s.
- The hydrogen density on the way of the beam 10^{14} molecules/cm^2 (average flow, cell temperature 15 K).
- Vacuum in the target with the gas flow $2 \cdot 10^{17}$ molecules/s is 10^{-5} mbar.
- Working time without liquid helium refilling is 30 h.
- Working time without regeneration of cryopanels is about 2–3 weeks (for hydrogen).

KNOWLEDGE BASED CONTROL: METHOD AND APPLICATION

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The paper presents the results of last several years in the field of developing and implementation of software for real time control systems of sophisticated installations such as nuclear reactor, accelerator, large detector, etc. All of those installations are characterized with a huge number of parameters and complex control rules that, practically, can not be represented in a complete form. The approach presented combines the knowledge based technique (procedural knowledge representation [1]) with object oriented technology and