



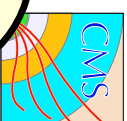
Test set-up for the CMS Resistive Plate Chambers

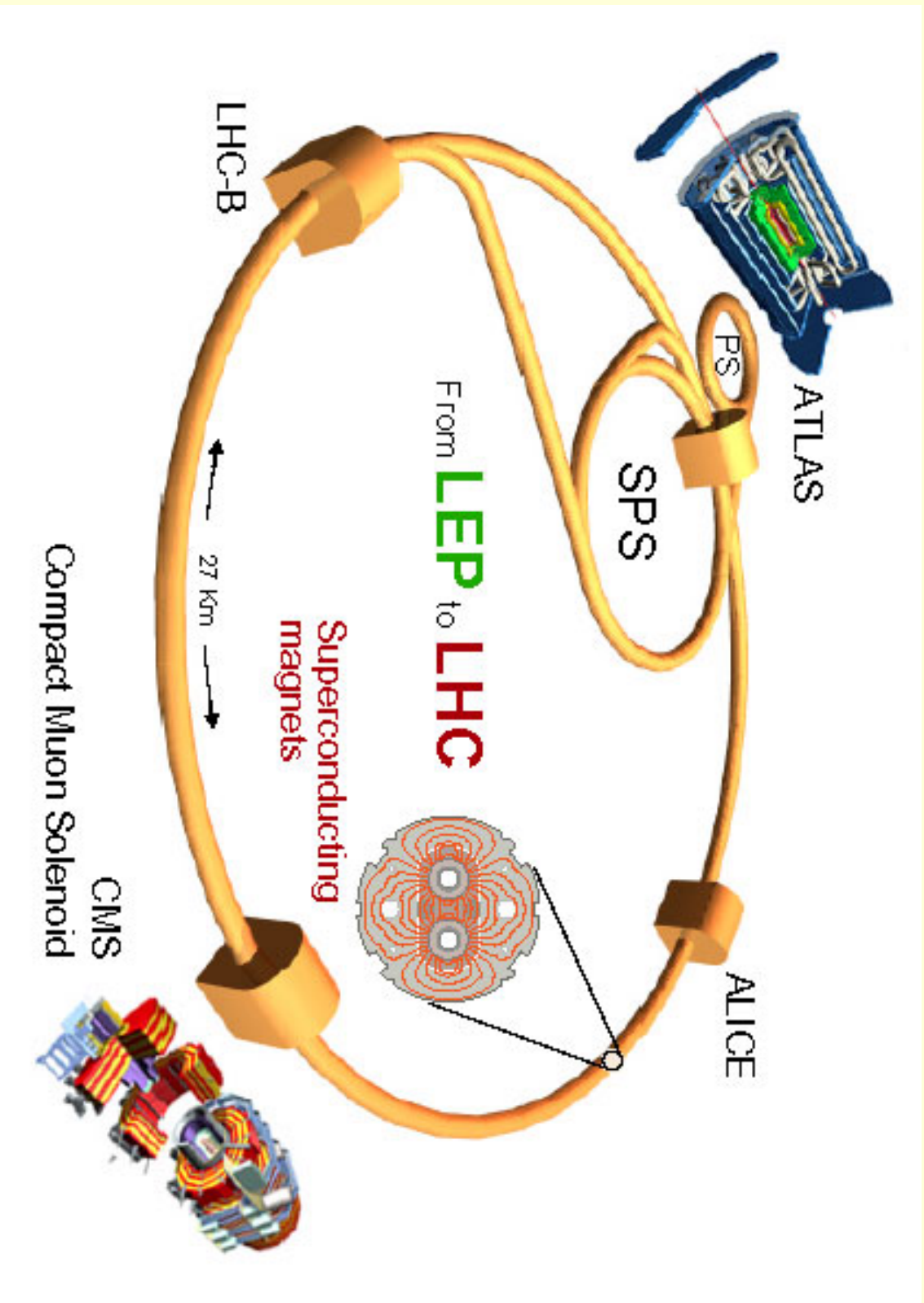
T. Angelov, I. Atanasov, V. Genchev, G. Georgiev, L. Litov,

B. Pavlov, I. Peev, P. Petkov, G. Sultanov

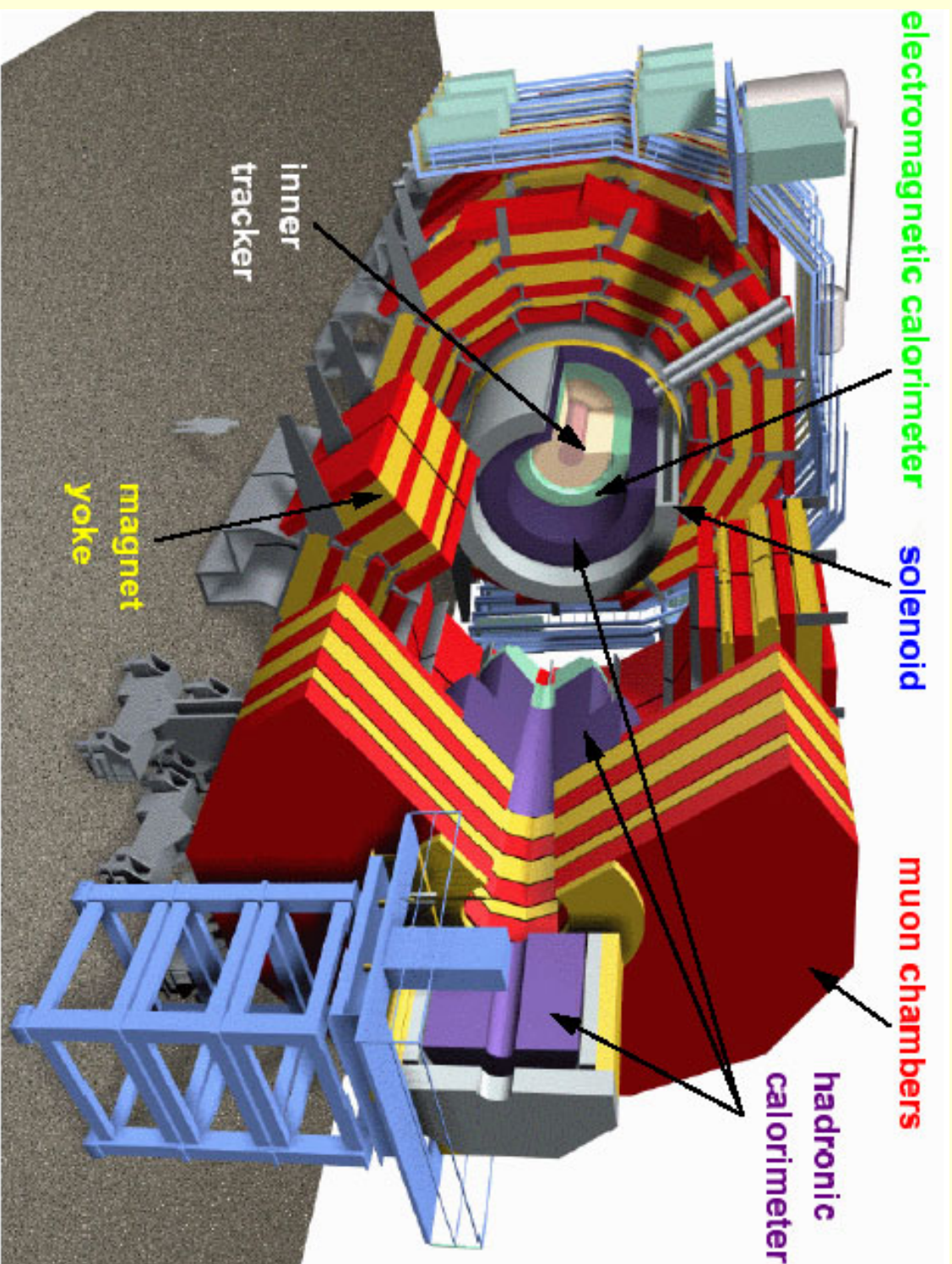
18.01.2002

Meetings in Physics at the University of Sofia

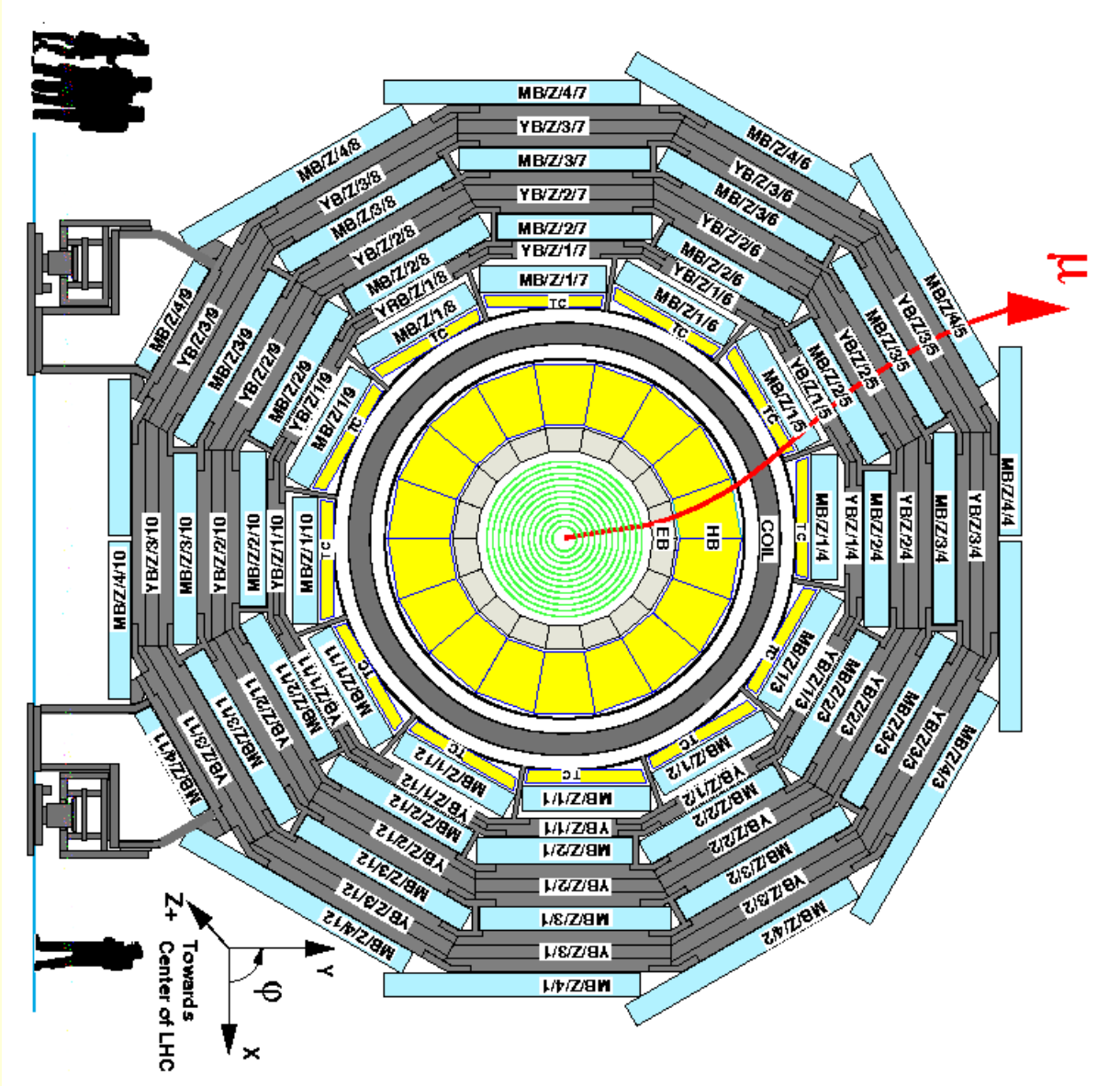




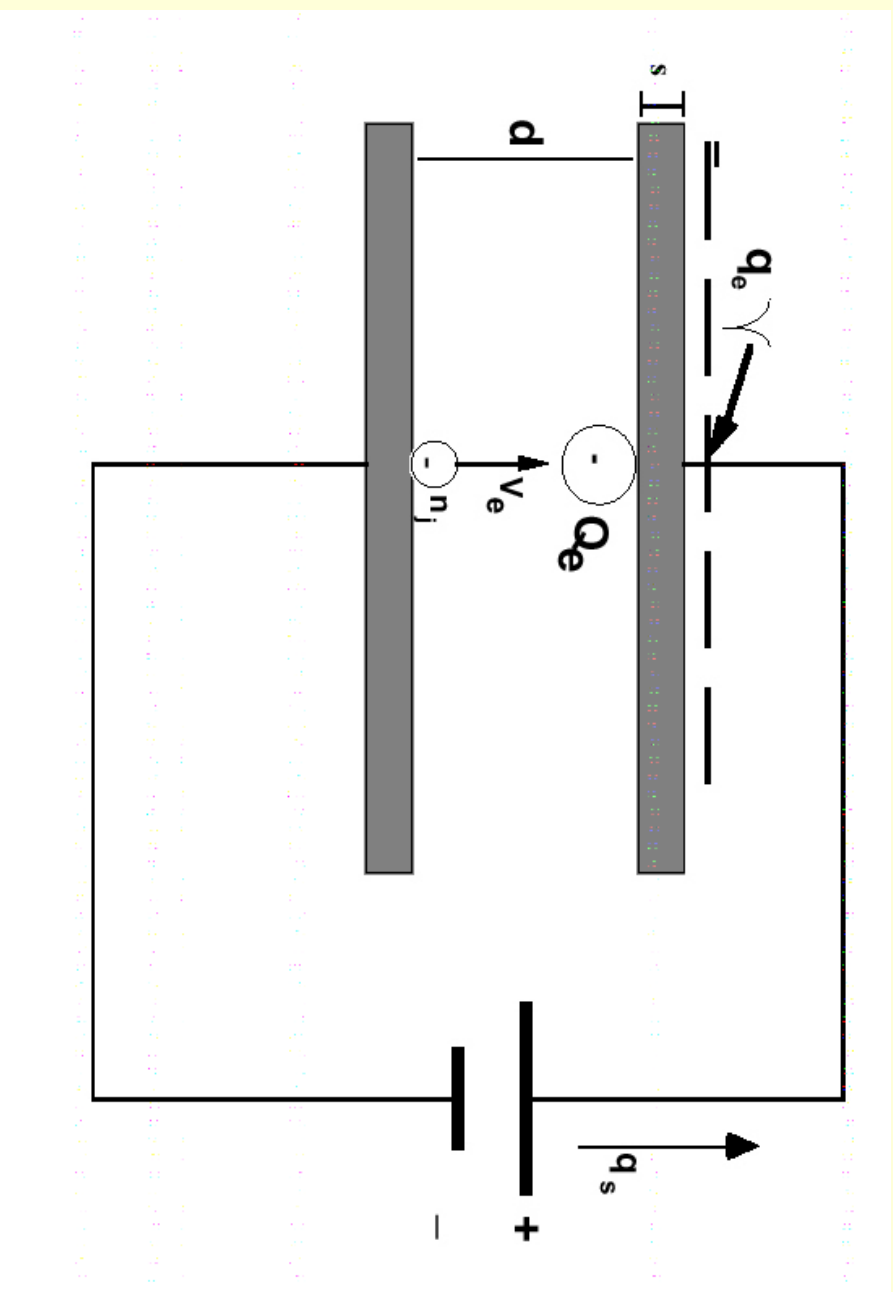
CMS Experiment



Muon System



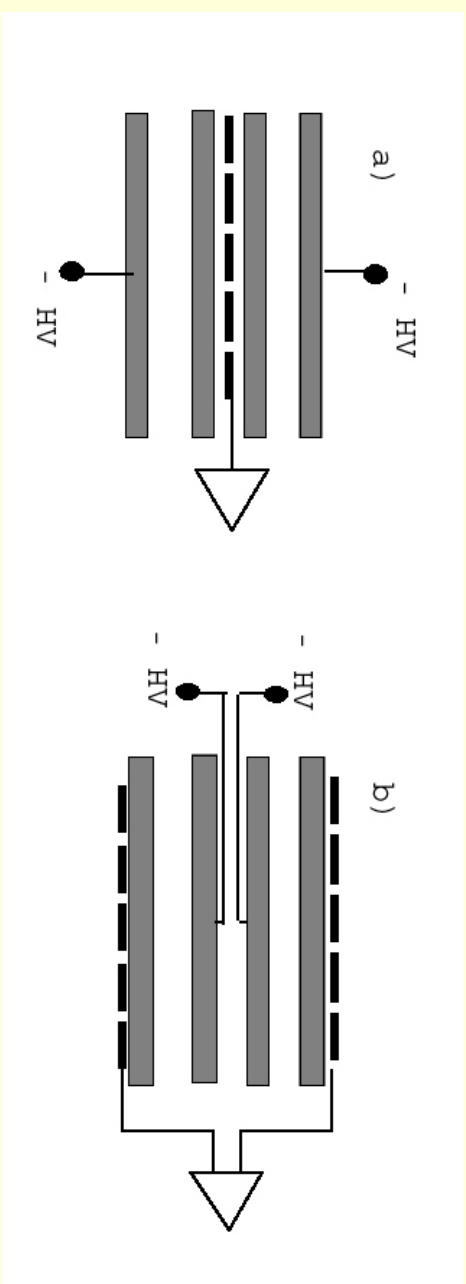
- ❖ Bulgaria is participating in barrel RPC design, production and assembly. In particular we are involved in:
 - Production of all mechanical parts for RB2, RB3, RB4 (375 chambers)
 - Production and full assembly of all RB3 (125 chambers)
 - Parameters measurement and testing of all RB3 chambers
 - Integration of RPC chambers in the CMS detector



Principle of action

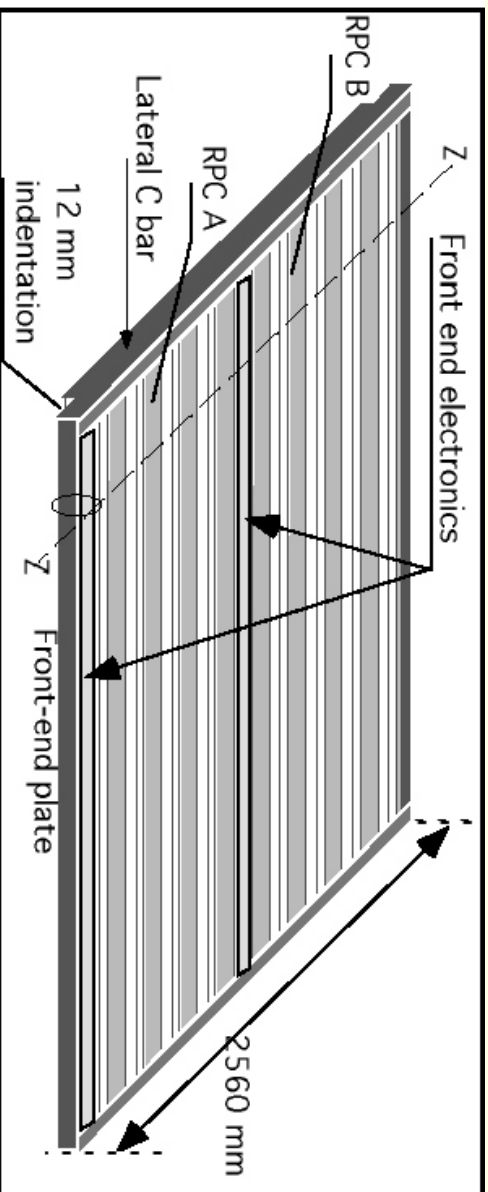


Double-Gap

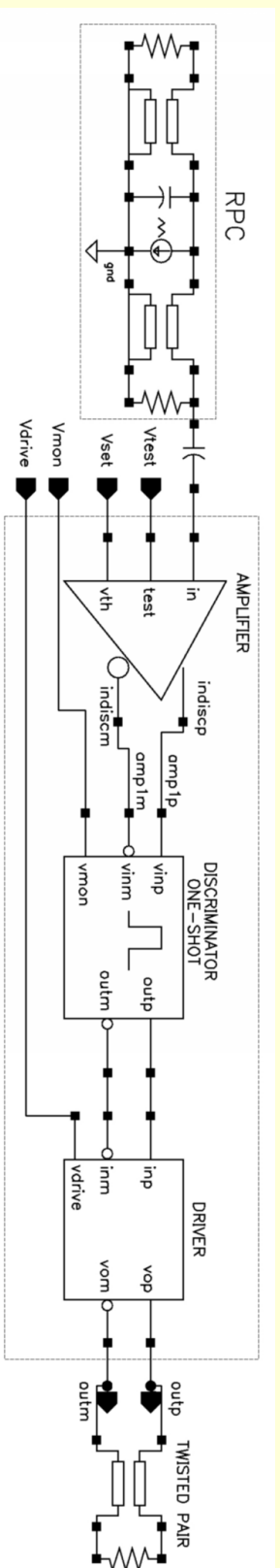


RPC Design and FE bord

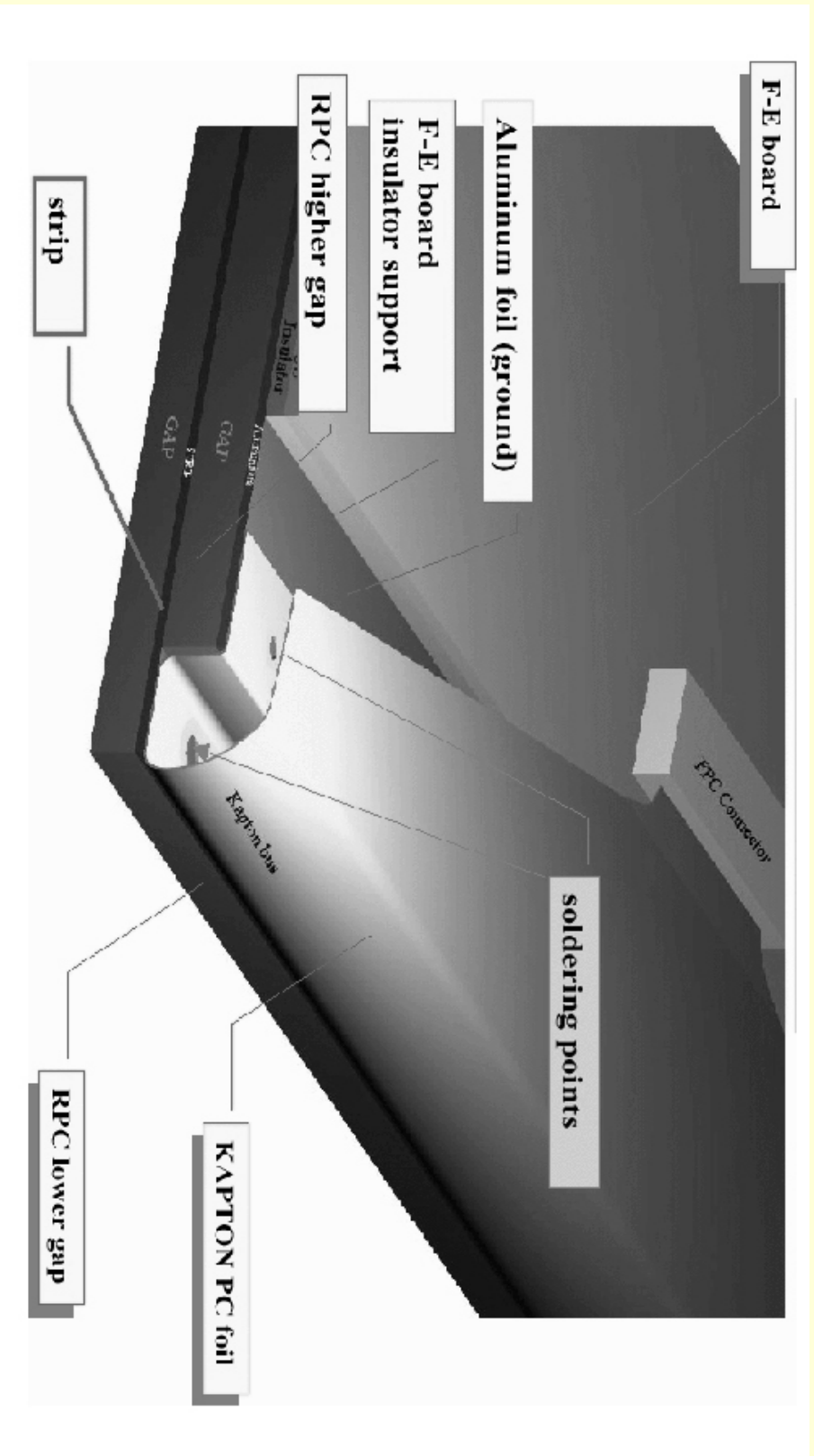
RPC Chamber



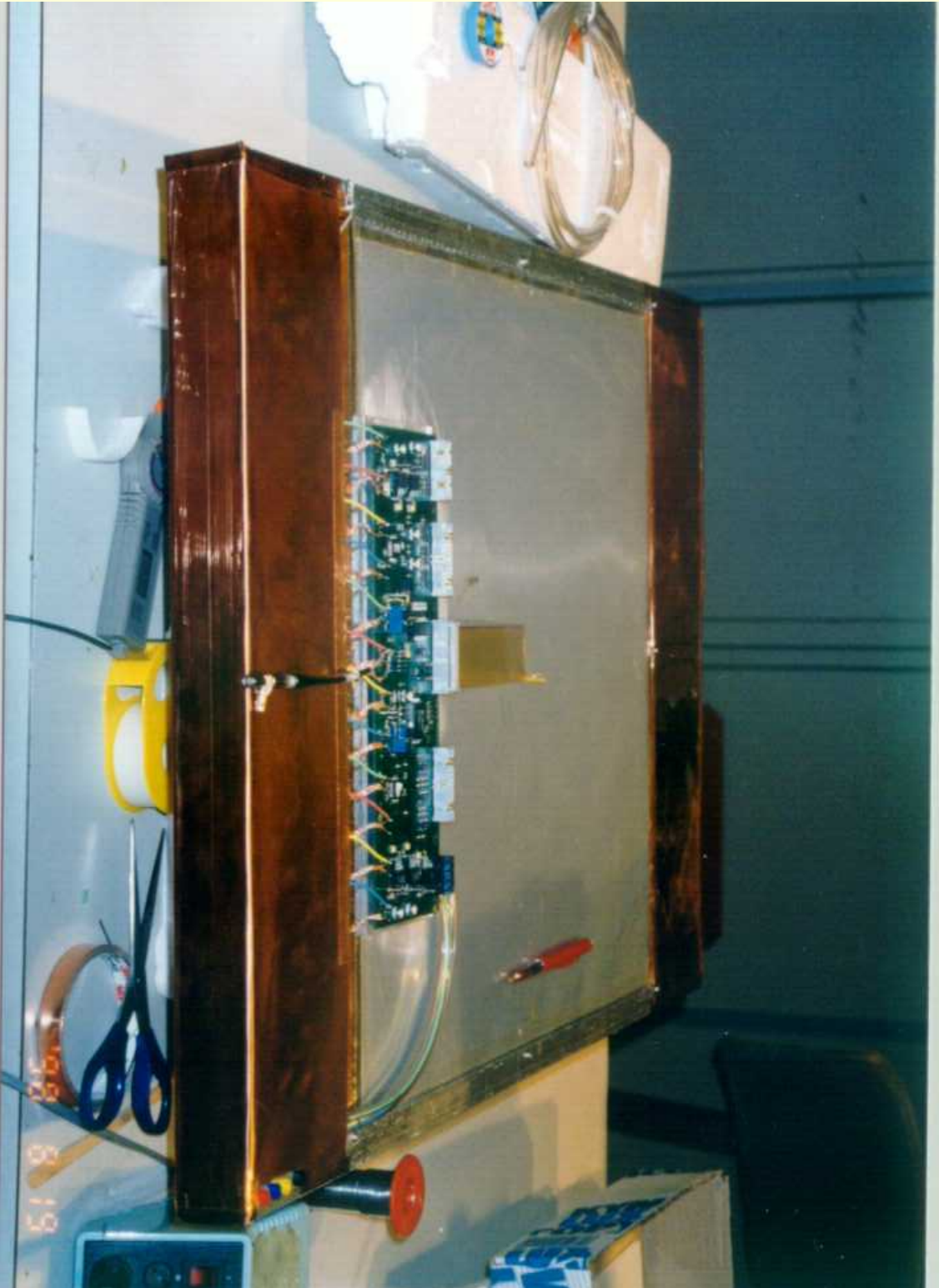
Front-End Board



RPC



RPC Prototype



Parameters and Requirements

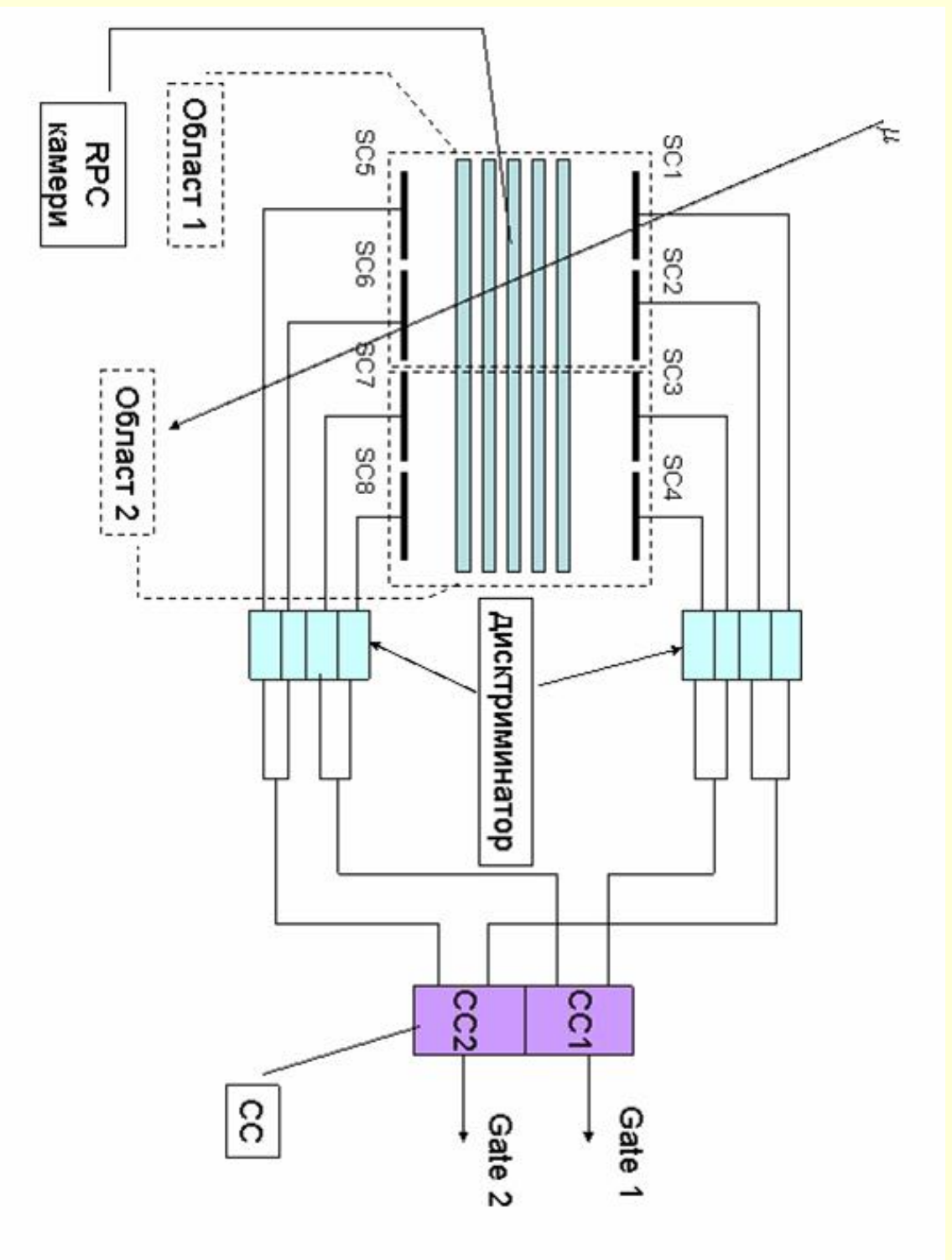
<p>Bakelite thickness Bakelite bulk resistivity Gap width Gas mixtures Operating High Voltage Number of Gaps</p>	<p>2mm $1-2 \times 10^{10} \Omega \text{cm}$ 2mm 95% $C_2H_2F_4$, 5% $i-C_4H_{10}$ 8.5 - 10.0 kV 2</p>
<p>Efficiency Time resolution Average cluster size Rate capability Power consumption Operation plateau Number of Streamers</p>	<p>>95% $\leq 1.8 \text{ ns}$ (98% within 20 ns) ≤ 2 strips $\geq 1 \text{ kHz/cm}^2$ $< 2-3 \text{ W/m}^2$ $> 300 \text{ V}$ $< 10\%$</p>

Aim of The Test Set-up

- ❖ **Working Voltage**
- ❖ **Noise Estimation**
- ❖ **Efficiency**

Test Set-up

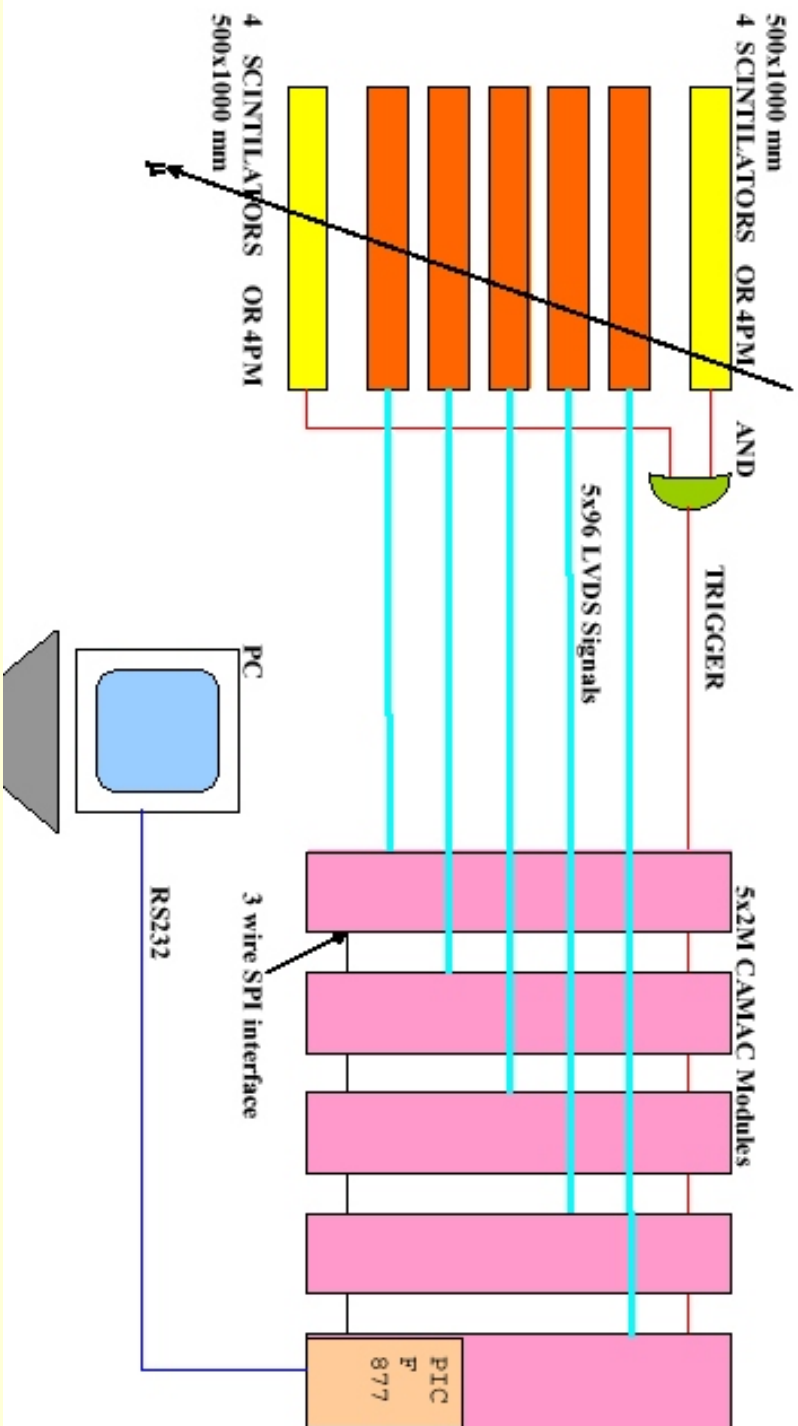
- ❖ **Trigger**
- ❖ **High Voltage System**
- ❖ **Data Acquisition System (DAQ)**
- ❖ **Gas System**
- ❖ **Cooling System**
- ❖ **Slow Control**



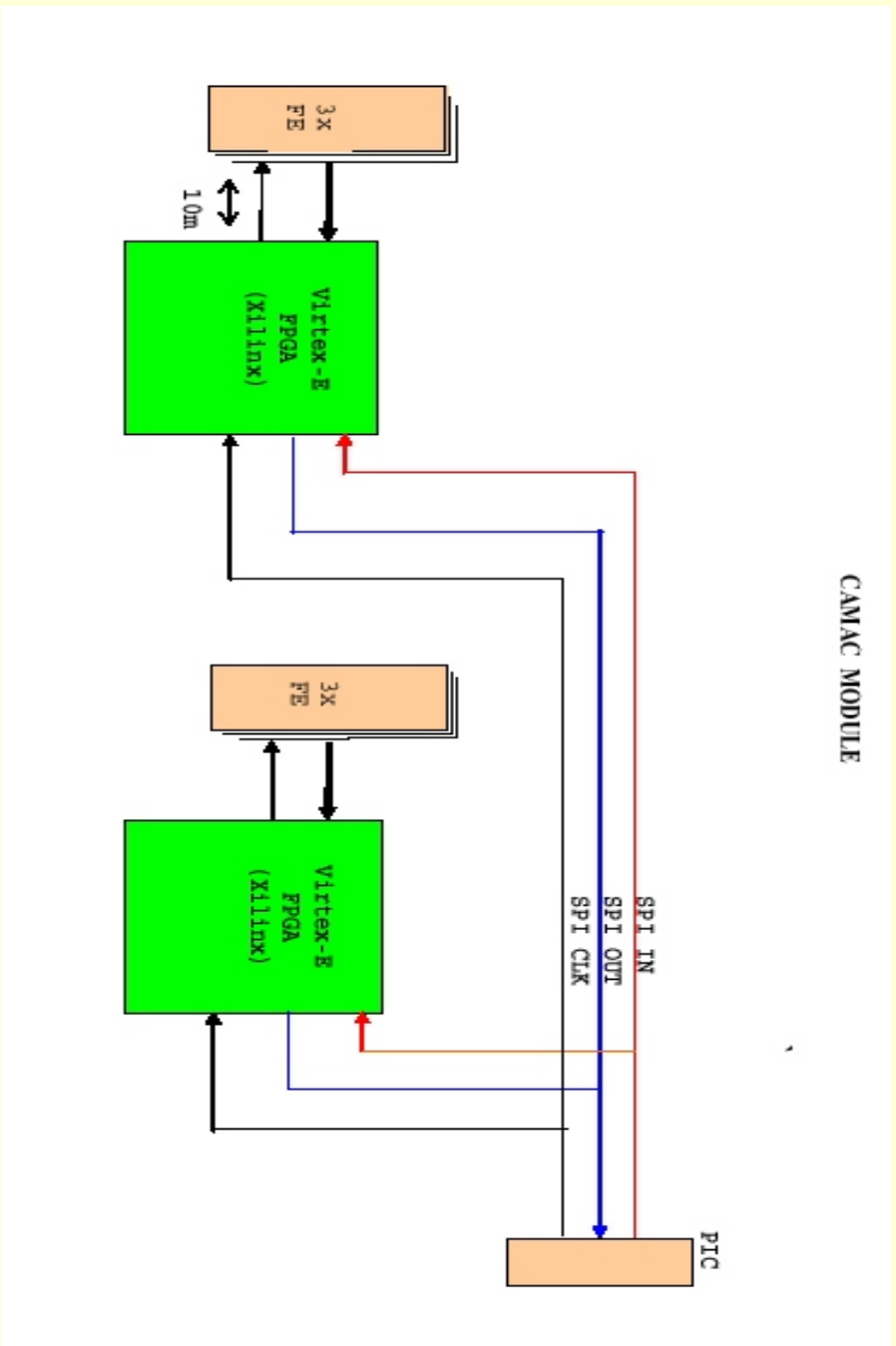
High Voltage System

- ❖ HV10-2N modules (we need 10 of them)
- ❖ Number of channels in the module : 2
- ❖ Output voltage : 0 - 10000 V
- ❖ Maximum output current : 150 μ A
- ❖ Steps of Regulation : 2.5 V
- ❖ Short-period stability : < 5 V
- ❖ Long-period stability : < 5 V
- ❖ Interface : CAMAC

DAQ for CMS RPC chambers test



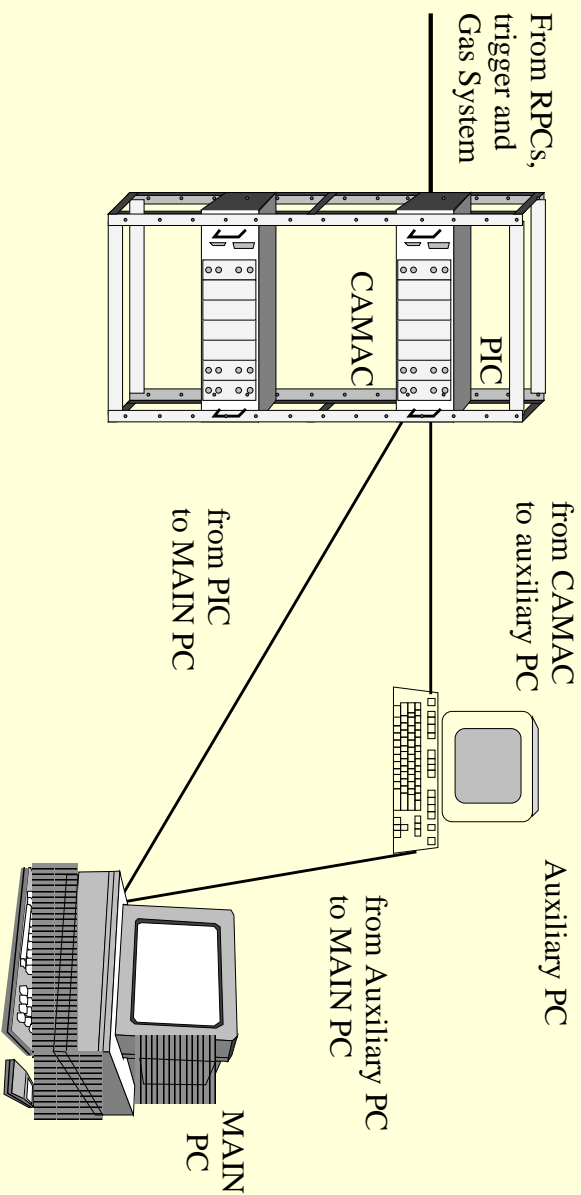
DAQ (FE-PIC)



DAQ Main Features

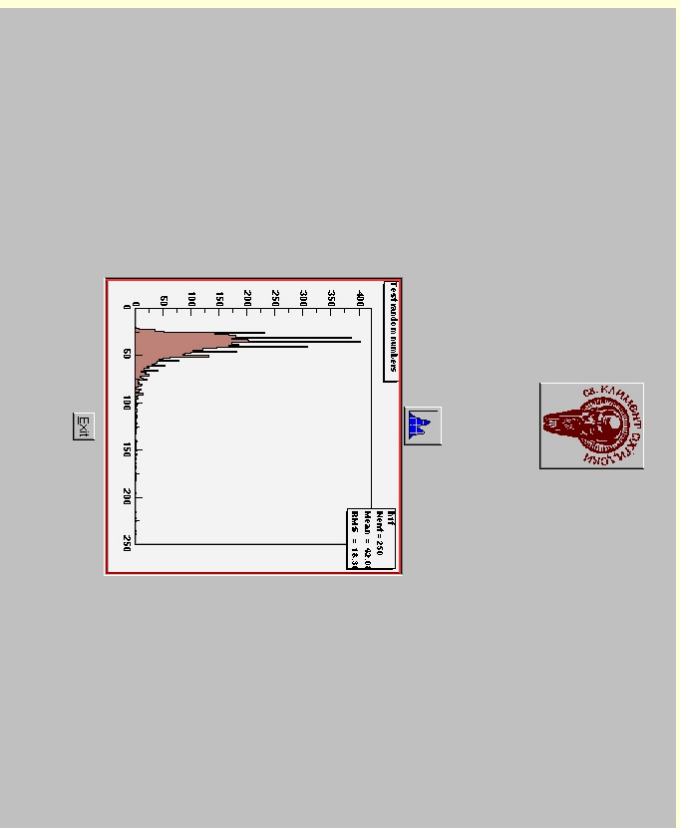
- ❖ **480 digital and 2 analogue channels**
- ❖ **Resolution 1 channel**
- ❖ **Noise resolution granularity 8 channels**
- ❖ **FPGA read out clock 1 to 4 MHz**
- ❖ **Trigger rate 240 Hz**
- ❖ **Expandable - up to 720 digital and 5 analogue channels**
- ❖ **Re-configurable, additional logic functions, various input level**
- ❖ **Output interface RS232C @ 115200 baud/sec.**

DAQ and Slow Control



- ❖ One auxiliary PC (monitoring and control of CAMAC crate via KK-009 crate controller)
- ❖ The DAQ PIC processor - responsible for DAQ and monitoring of Gas System
- ❖ Main PC

- ◆ Software for XILINX Virtex-E FPGA (Field Programmable Gate Arrays)
- ◆ C Software for PIC16F877 microcontroller
- ◆ C and C++ Software for Auxiliary and Main PC
- ◆ C++ Software for Visualisation using ROOT
- ◆ Possibility for remote monitoring via Internet



- ❖ Trigger is well studied
- ❖ High Voltage System is tested
- ❖ 500 channels flexible DAQ is developed
- ❖ DAQ and Visualisation are on-line
- ❖ Ready for production ...



