Constructing and Testing the Limited Streamer Tube with Smaller Cross Section

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The PHENIX project proposed to use the limited streamer tubes (LST) as muon's detector. The collider's bunch time interval is about 112 ns, but the LST with 9 mm $\times$ 9 mm cross section has about 120 ns timing uncertainty. In order to meet the timing requirement, one approach is to use the LST with smaller cross section.

We constructed a 1 m long prototype LST. The tube is 5 mm $\times$ 5 mm in cross section, 24 units in each jacket. The extrusion was supplied by ORNL and the rest was made at the China Institute of Atomic Energy. The tube was strung with 50 μm diameter silver-plated copper beryllium wires at a tension of 125 g. We put a spacer in the middle of the tube to support the wires. The wires were open circuit at one end and joined together through 200 Ω terminating resistors to a high-voltage connection at the other end. The graphite painted extrusion electrode has a surface resistivity of 90 K$\Omega/\square$. The graphite paint was made in a Shanghai graphite paint factory. The paint was diluted with $(CH_3)_2CHCH$ $COCH_3$ and absolute alcohol. We painted the extrusion three times.

A mixture of argon and isobutane $Ar:C_4H_{10} = 1 : 3$ was used as a working gas at one atmospheric pressure. Over a period of about two weeks, the operating voltage was gradually raised. When the high voltage can be raised to 3500 V and the leakage current is less than 2 μA, we consider the tube a good one.

In July we performed a triple coincidence experiment to test the LST with cosmic ray. Figure 1 and Figure 2 show the experiment arrangement and the electronics. This experiment was performed with a Micro VAX data acquisition system.

We obtained the time and energy spectra (see Figures 3 and 4) at different high voltages for the LST working in a proportional mode. Results of the cosmic ray test are as follows:

1. When the high voltage was increased from 3300 V to 3400 V and from

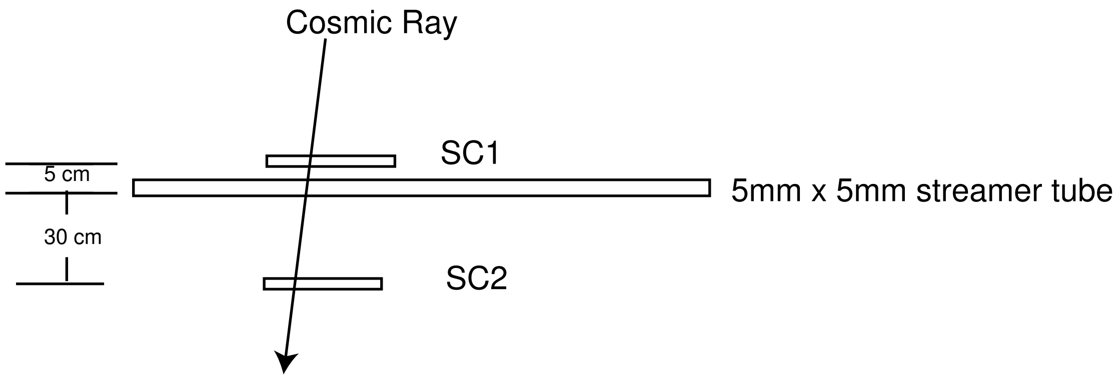

Figure 1: Sketch of the experiment arrangement.

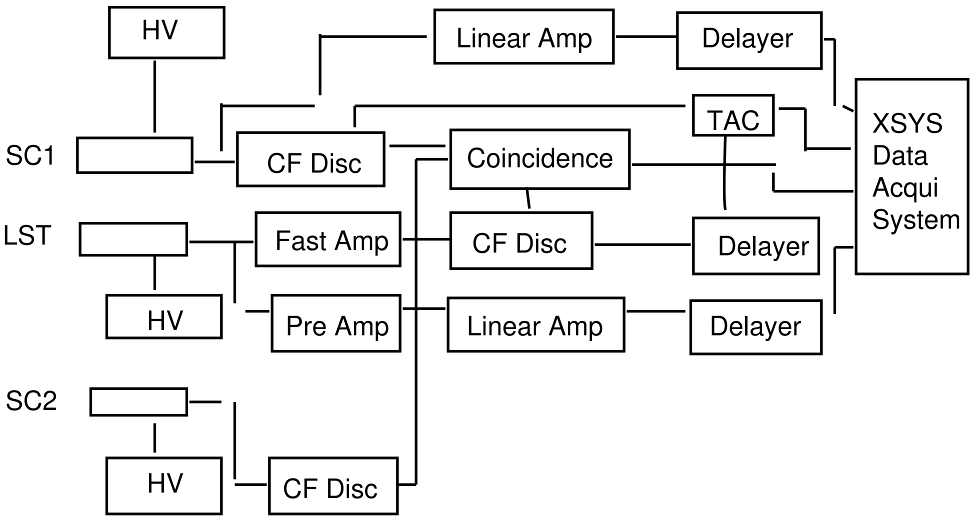

Figure 2: Electronics of the experiment.

3600 V to 3700 V, the pulse height increased obviously. In the region from 3500 V to 3600 V, the pulse height remained constant.

2. Although the shape of the time spectrum varied slightly at different high voltages, the timing uncertainty was constantly less than 50 ns. By staggering two layers of these kinds of prototyes, one can expect a timing uncertainty of less than 25 ns, which should meet the trigger requirement of the RHIC environment.

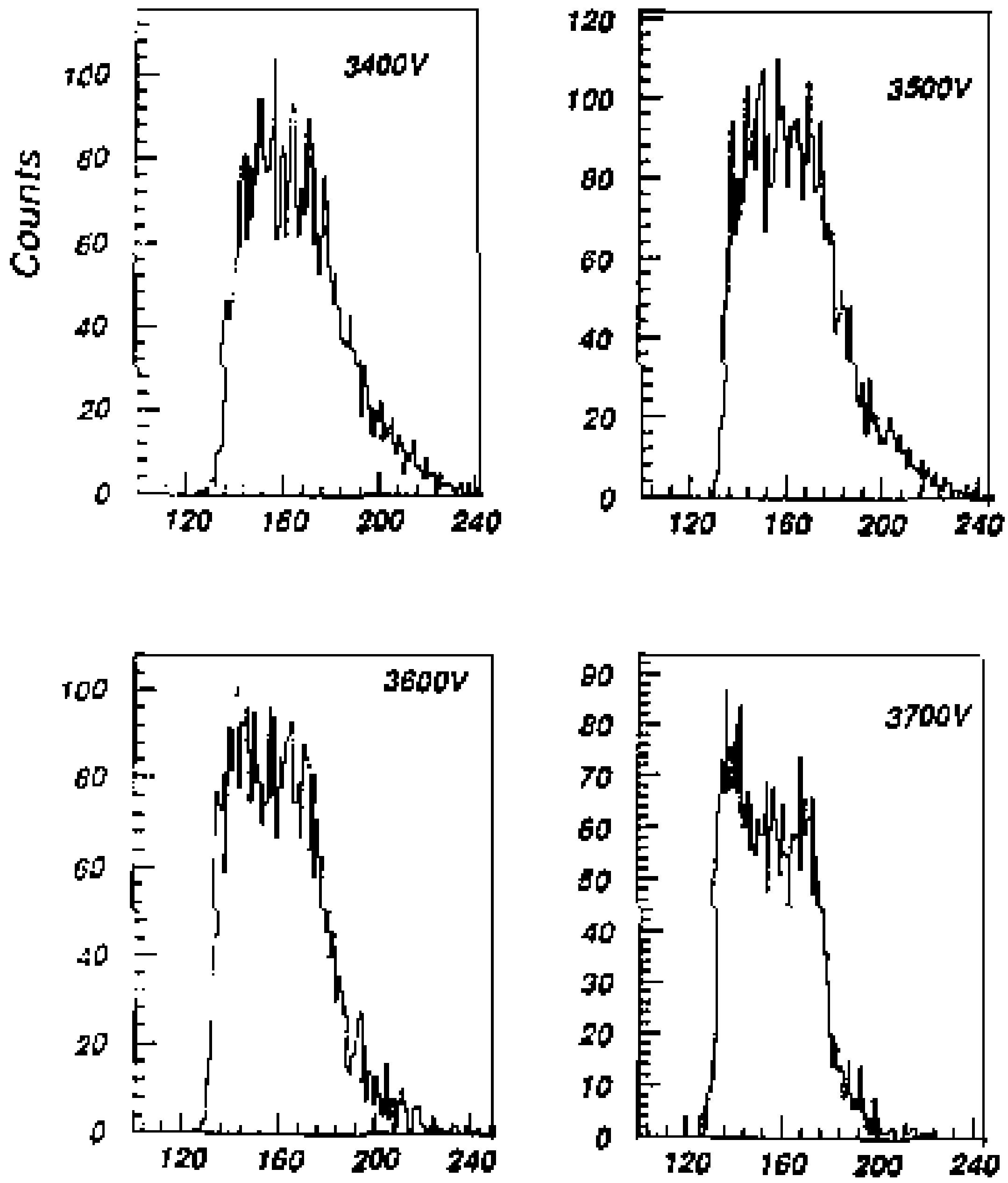

Figure 3: Time spectra at different HVs (Cosmic Ray)

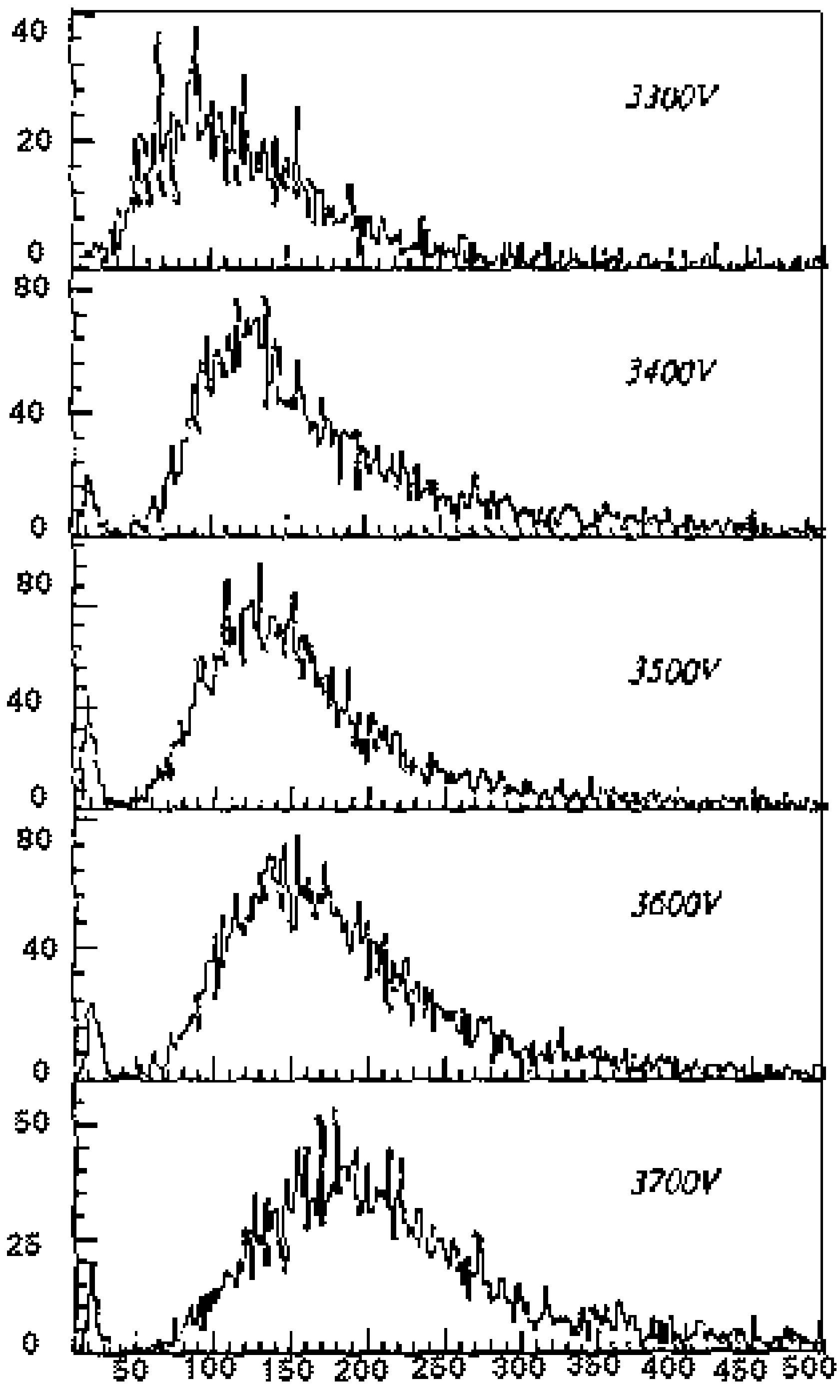

Figure 4: Energy spectra at different HVs (Cosmic Ray)