HARDWARE AND SOFTWARE COMPLEX FOR MEASURING THE TENSION OF SIGNAL WIRES IN DRIFT PIPES.

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This work presents a software-hardware complex for measuring the tension of anode wires in drift tubes used in the straw tracker of the SPD experiment at the NICA collider. The tension of the anode wire is crucial for ensuring precise coordinate determination, as it affects the electrical stability and positioning of the wire under the influence of electrostatic and gravitational forces.

The developed system employs an electromagnetic measurement method, providing high-precision control over the tension in thin-walled Mylar tubes. The tension measurement is performed by analyzing the vibrations of the wire. The central component of the system is an STM32L4 microcontroller, which controls the delivery of electrical pulses and performs the measurements. The complex is characterized by ease of setup, a user-friendly interface, and high measurement speed, making it suitable for large-scale production. Testing demonstrated the high accuracy and efficiency of the device, indicating that the developed complex represents a significant advancement in the technology for assembling high-precision wire detectors.

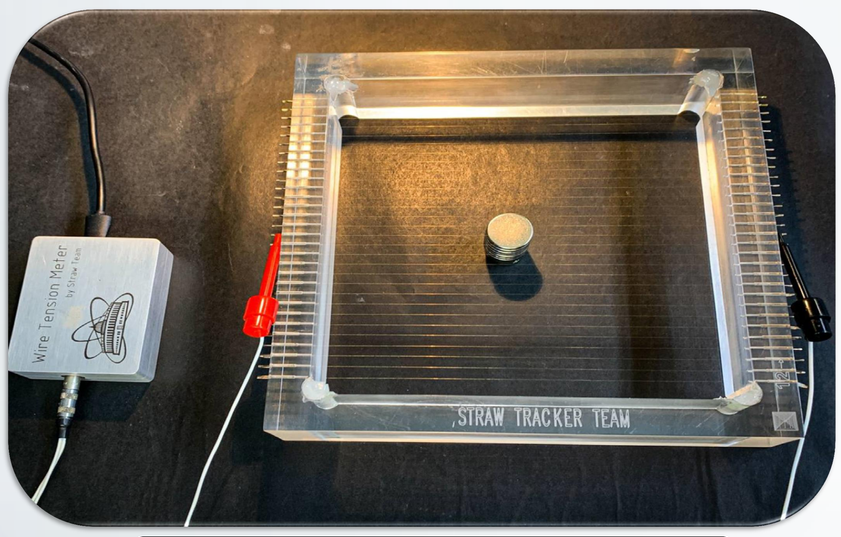

Fig.1. The process of measuring tension

Fig.2. The appearance of the experimental camera

Fig.3. Tension meter

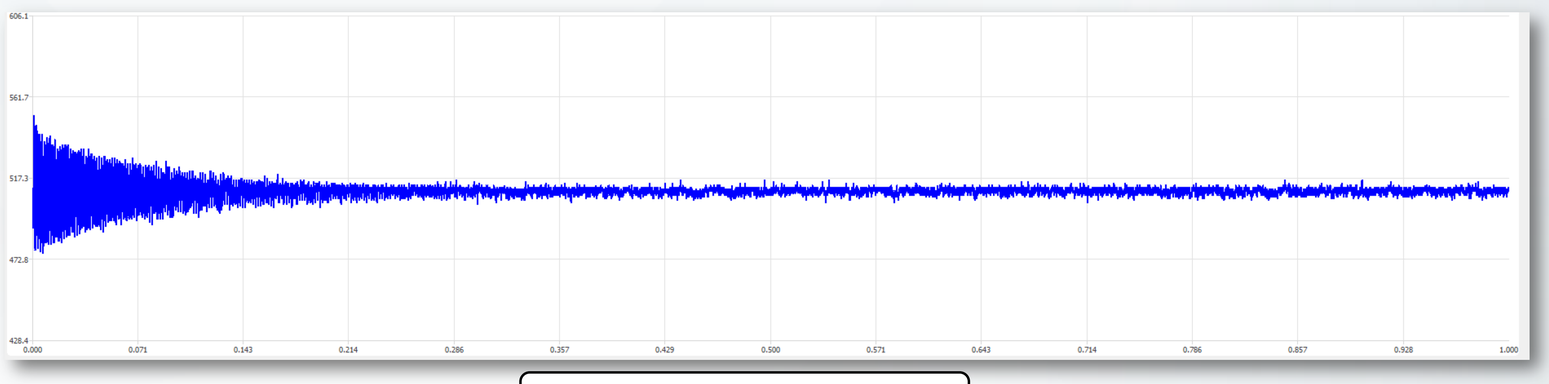

Fig.4. Pulse attenuation graph

An electric pulse is applied by the tensioner, generating a magnetic field due to the moving electric field. This magnetic field, interacting with the static magnetic field, induces vibrations in the string thread. The resulting oscillations are measured by the anode and cathode, which detect the oscillation frequency. The first graph represents the attenuation of the oscillations over time, while the second graph shows the oscillation frequency.

Fig.5. Graph frequency of oscillation of the thread

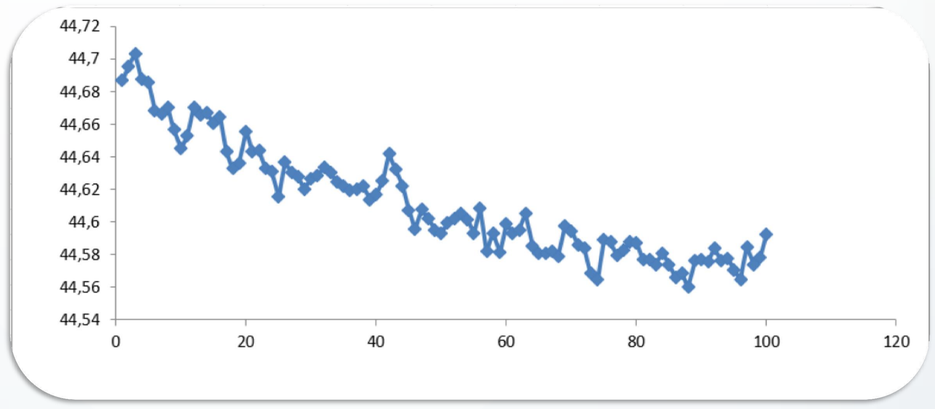

Fig.5. The result of repeated measurement of thread tension

The program automatically determines the points and approximates them using a Gaussian fit. Thus, by measuring the vibrations of the threads, the tension across the entire chamber can be determined.

Multiple measurements are required to evaluate the errors of the tension meter.

There is a temperature dependence, constant measurements warm the thread, the tension drops because the metal expands.

Results and Summary

During the research, a software-hardware complex was developed for measuring the tension of the anode wire in the drift tubes of the SPD straw tracker at the NICA superconducting collider. An electromagnetic non-contact measurement method was implemented, enabling high-precision determination of the tension in the signal wire. It was established that the developed system offers significant advantages, including a user-friendly interface, ease of setup and calibration, as well as the speed and accuracy of tension measurements in the drift tubes of the NICA collider.