DETERMINATION OF THE ANODE WIRE POSITION IN A NEW TIPE OF STRAW USING VISIBLE LIGHT

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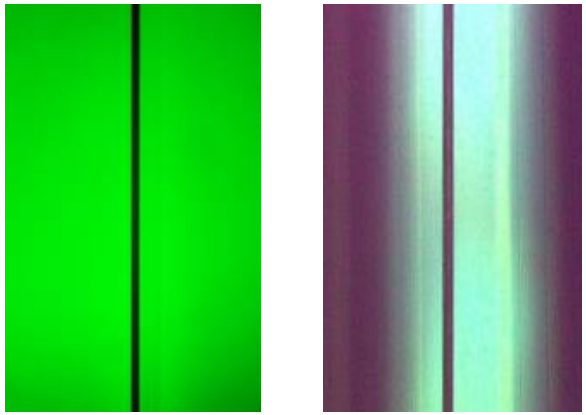


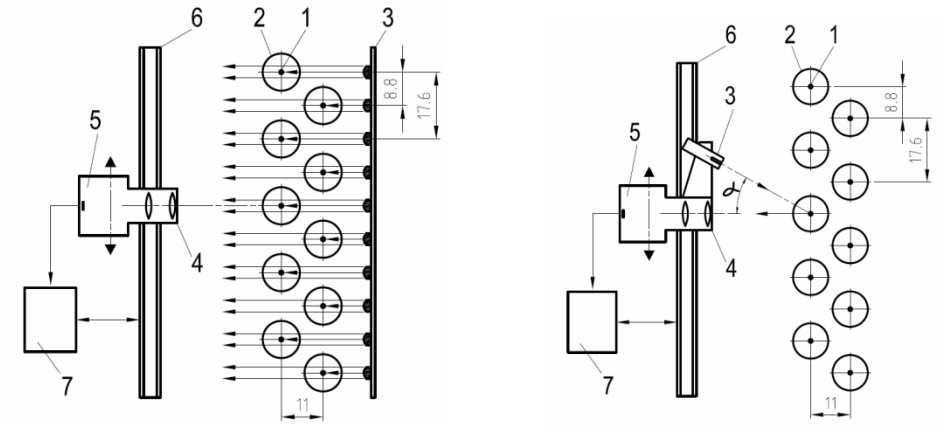
Anode wire (Ø 30 µm) in the tube under transmitted and reflected light .

Introduction

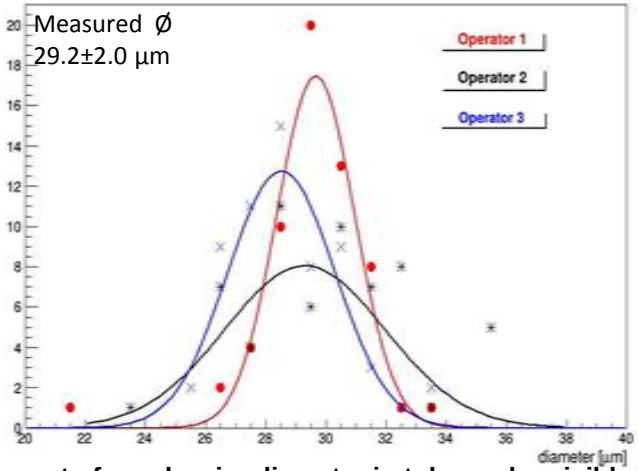
Spatial resolution of charged particle tracks in drift chamber experiments depends on several factors and among them, accuracy of anode wire positioning and spacing in the tubes is one of the significant. Therefore, it is important to measure the real position of anode wires in a chamber. When the anode wire cannot be seen, a radioactive or an X-ray source is used. Devices based on these methods are rather complicated.

We propose a simpler way to control the coordinates of the anode wires in a new type of the drift tubes used in the drift chambers operating in vacuum for the NA62 experiment (A total of 8000 tubes). These are made from the 36-mm Mylar film ultrasonic weld along the generatrix with 9.80 mm in diameter and covered with 0.05 µm of copper and 0.02 µm of gold from inside. The anode was a 30-µm wire of gilded tungsten.

The walls of these tubes turned out to be semitransparent. This fact allowed us to develop a simple method for measuring coordinates of anode wires in drift tubes. Positions of wires in tubes and consequently anode spacing can be directly measured under the microscope. Wires are observed under transmitted or reflected light. Here we describe the method for measuring coordinates of anode wires in tubes and present **tentative** results.



Setup for measuring the wire position under transmitted (a) reflected light (b). (1) Anode wire, (2) drift tube, (3)extended LED light source, (4) microscope, (5) electronic ocular, (6) optical bench, (7) control PC.



Measurement of anode wire diameter in tube under visible light

Measurements in trans mitted light

We performed series of measurements under **transparent light** using the **UIM-23** and the **MBS-10** microscopes. The actual measurement accuracy depends from the operators. The wire diameter measurements distributions see in Fig. The results of those measurements yielded the diameter value 29.2±2.0 μm, which we think to be quite acceptable.

The final results of measuring the anode spacing are summarized in Table 1 and 2. The accuracy of our wire position measurements is about ±5 to ±10 μm, which is quite sufficient in many practical cases.

Table 1

Top			Bottom		
Average	Sigma (σ)	MBC-10	Average	Sigma (σ)	MBC-10
UIM-23			UIM-1		
17.648	0.003	17.650	17.574	0.023	17.575
17.654	0.002	17.675	17.627	0.003	17.631
17.598	0.002	17.606	17.612	0.004	17.625
17.601	0.001	17.613	17.621	0.002	17.628
17.710	0.006	17.712	17.578	0.004	17.576
17.572	0.004	17.588	17.603	0.003	17.618
17.594	0.004	17.594	17.622	0.005	17.632
17.580	0.014	17.94	17.556	0.005	17.575

One row anode wires inter distance

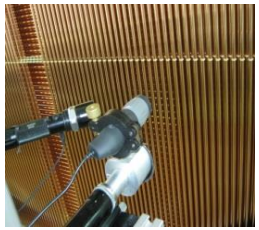
Table 2

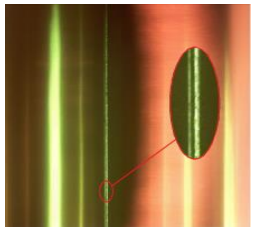
Top		Bottom		
Average	Sigma (σ)	Average	Sigma (σ)	
UIM-23		UIM-23		
8.903	0.013	8.890	0.016	
8.745	0.011	8.683	0.018	
8.966	0.013	8.894	0.018	
8.689	0.014	8.732	0.017	
8.884	0.012	8.879	0.021	
8.715	0.013	8.741	0.018	
8.879	0.014	8.881	0.014	
8.722	0.014	8.740	0.012	
8.859	0.014	8.816	0.016	
8.818	**0.003**	**8.806**	**0.016**	

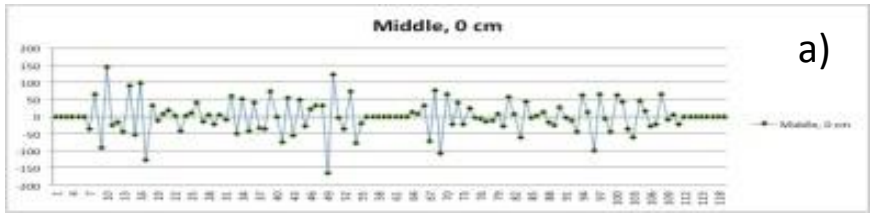
Two rows anode wires Inter dIstance

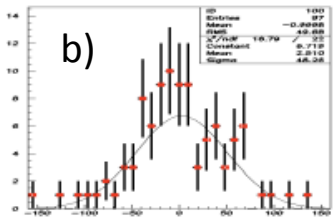
Measurements in reflected light

Figure 2b shows the scheme of setup we used for determining the position of the wires in the tubes under **reflected light.** The microscope and the light source are on the same side of the tube plane. These measurements were performed directly at a module of the chamber for the NA62 experiment. But only wires in the tubes of the first row were measured. The results of the measurements are presented plotted lower. Difference between actual and nominal wire position for 97 straws is shown in Fig. a. Deviation of anode wire distribution with σ= 48 μm are presented in Fig. 3b. Main part of wire deviation is inside ±100 μm corridor that satisfies requirements of NA62 Experiment.









Conclusion

It is shown that in the thin-wall tubes of the new type, which turned out to be semitransparent for visible light, the positions of the anode wires in the chamber can be measured under transmitted and reflected light with an accuracy of ±5 to ±10 μm using an optical microscope. It should be stressed that reflected-light measurements are performed with the microscope and the light source located on the same side of the tube plane, which is especially helpful when the tubes cannot be illuminated from the opposite side.

An electronic ocular and an image recognition program can allow the coordinates of the wire ends to be automatically read when the wire passes through the microscope cross hair. Almost the entire process can be automated except the referencing of the coordinates to the chamber body and the aiming of the microscope at the wire. This will help improve the measurement accuracy and eliminate systematic errors as the operator brings the microscope cross hair into coincidence with the wire edges.