

DUNE APA Wire Tension tension Relaxation

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October 2023

1 Introduction

For a proper, safe operation of APAs as a time projection chamber, the tension of the CuBe wires has to be maintained within certain well estimated limits. One factor that has to be taken into account for that estimation is the wire tension evolution with time (as the APA wire tension at installation and operation is of interest and not the one actually measured during construction).

Layers X and V of APA7 have been wound in June 2023 and all the corresponding wire tensions have been measured. APA7 has been laying in the same position, on the same winder (# 4) without ever being moved or shaken until October 2023. Therefore, it is ideal for studying the wire tension evolution as a function of time without required corrections for variations of other parameters (as frame orientations, effects of transport, temperature variations etc).

2 APA wire tension measurements

In June and October 2023, wires tensions of layers X and V of APA7 were measured. In both cases measurements were done with the same laser wire tension measurement system and with APA7 at the horizontal position. Both measurements were done with the APA7 on winder #4 of the DUNE factory at Daresbury Laboratory. With the same environmental conditions (20 °C and 50% relative humidity). For practical reasons (accessibility of X and V plane wires) only about 10% of the wires were measured.

Figures 1 and 2 show the measured tension distribution for the two data sets (June and October). Sides A and B are shown separately in order to verify that there is no systematic deviation between the two sides. The measurements are summarized in table 1

Layer	Side	June (N)	October (N)	Difference (N)	Mean Difference (N)
X	A	6.7	6.4	0.3	0.30
	B	6.7	6.4	0.3	
V	A	6.4	6.4	0.0	0.15
	B	6.2	5.9	0.3	

Table 1: Tension measurements in June 2023 and October 2023 of APA7, layers X and V. Mean values of measurements of the various data sets are shown.

3 Summary

Two sets of wire tension measurements were taken, under the same conditions three months apart. It can be concluded that within this time span the mean wire wire tension of layer X reduces by 0.30 N and that of layer V by 0.15 N

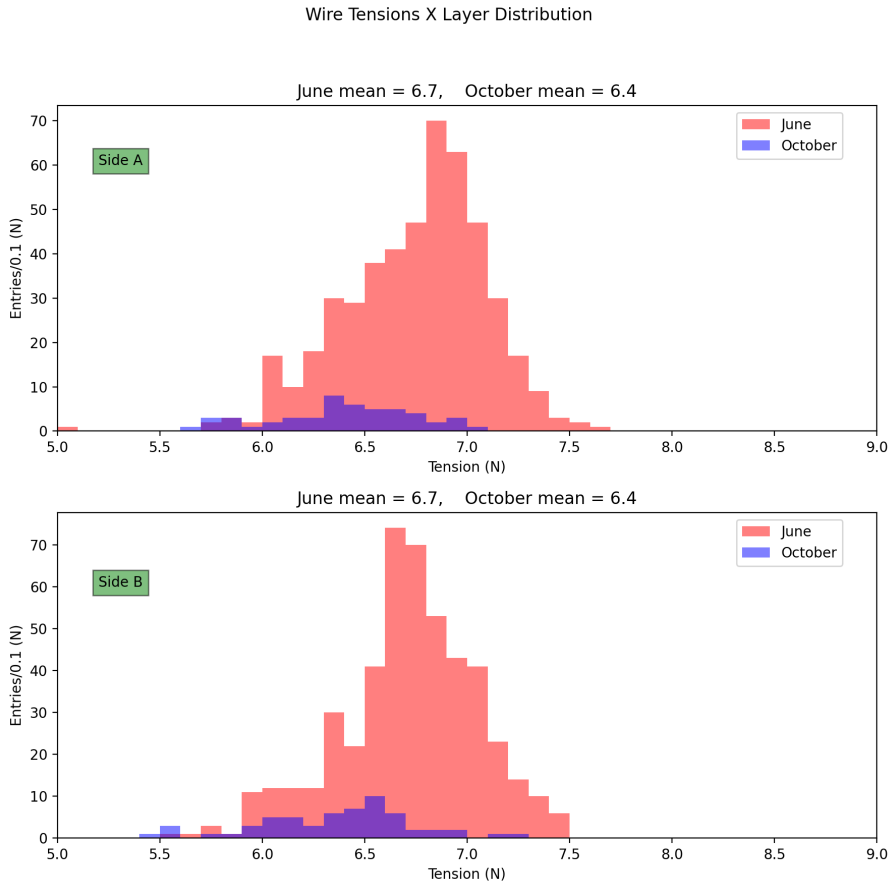


Figure 1: Wire tension distribution for side A and B of APA7, layer X

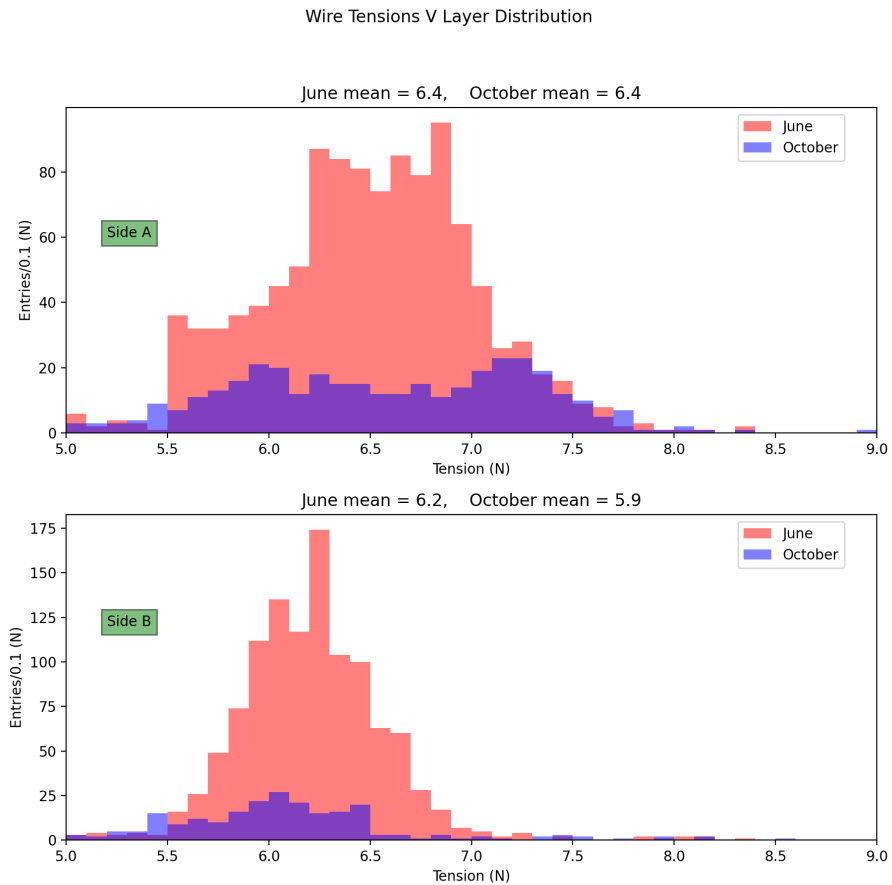


Figure 2: Wire tension distribution for side A and B of APA7, layer V